**3GPP TSG-RAN WG4 Meeting #110bis R4-2405847**

**Changsha, China, 15 April – 19 April, 2024**

**Agenda item:** 6.19.5

**Source:** Moderator (Samsung)

**Title:** Topic summary for [110bis][328] NR\_MIMO\_evo\_DL\_UL\_demod

**Document for:** Information

# Introduction

This topic summary covers the contributions submitted under the following AI for demodulation performance requirements of Rel-18 NR MIMO evolution for downlink and uplink:

6.19 NR MIMO evolution for downlink and uplink [NR\_MIMO\_evo\_DL\_UL]

6.19.4 Demodulation performance requirements [NR\_MIMO\_evo\_DL\_UL-Perf]

6.19.4.1 UE demodulation performance and CSI requirements [NR\_MIMO\_evo\_DL\_UL-Perf]

6.19.4.2 BS demodulation performance requirements [NR\_MIMO\_evo\_DL\_UL-Perf]

This is the fourth meeting for Rel-18 MIMO WI demod part, in RAN4#108bis and RAN4#109 meetings companies agreed to do feasibility study of introducing PMI reporting requirements for typeII-Doppler-r18 and typeII-CJT-r18 codebooks for UE CSI reporting, and agreed to introduce UE and BS demodulation performance requirements for Rel-18 enhanced DMRS. In RAN4#110 meeting, the agreements about introducing PMI reporting requirements for typeII-Doppler-r18 and typeII-CJT-r18 codebooks for UE CSI reporting was achieved. In this meeting, let’s try to reach agreements on the open issues of test setups and simulation assumptions, and the definition of requirements:

* Topic #1 Open issues for UE demodulation and CSI

Sub-topic 1-1 Test setup and simulation assumptions for TypeII Doppler

Sub-topic 1-2 Test setup and simulation assumptions for TypeII for CJT

Sub-topic 1-3 Requirements for Rel-18 DMRS

* Topic #2 Open issues for BS demodulation

Sub-topic 2-1 Requirements for Rel-18 DMRS

# Topic #1: Open issues for UE demodulation and CSI

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2404240 | MediaTek Inc. | Proposals and observations of predicted PMI  **Observation #1: We do not see gains over Rel-16 reference in FDD in TDLA30-40 channel.**  **Observation #2: We see significant gains over Rel-16 reference in FDD in TDLA30-20 when N4=1.**  **Observation #3: We see reasonable gains over Rel-16 reference in FDD in TDLA30-30 when N4=1.**  **Observation #4: We see reasonable gains over Rel-16 reference in FDD in TDLA30-20 when N4=4.**  **Observation #5: We see minor gains over Rel-16 reference in FDD in TDLA30-30 when N4=4.**  **Observation #6: We see feasible gamma values in FDD in TDLA30-20 when with both N4=1 and N4=4.**  **Observation #7: We do not see gains over Rel-16 reference in TDD option 1 in TDLA30-40 channel.**  **Observation #8: We see some gain over Rel-16 reference in TDD option 2 in TDLA30-40 channel.**  **Observation #9: We see reasonable gains over Rel-16 reference in TDD in TDLA30-20 and TDLA30-30 channels in both timing options.**  **Observation #10: We see feasible gamma values in TDD in TDLA30-20 and TDLA30-30 channels in both timing options.**  **Proposal #1: We propose to use TDLA30-20 channel.**  **Proposal #2: We support Option 2: N4=1 and K=4 as the priority.**  **Proposal #3: We support Option 1: N4=4 and K=4 as the second priority, if needed in addition to Option 2.**  **Proposal #4: We support Option 2 to use 90% relative throughput test metric.**  **Proposal #5: We suggest checking all companies averages of agreed tests.**  **Proposal #6: We propose to use TDD timing of MTK TDD timing Option 2.**  **Proposal #7: We support Option 1 test setup for FDD timing.**  **Proposal #8: To fix the timing mismatch between the prediction reference and precoder usage in PDSCH transmission, we propose updating RAN1 specification with redefined delta parameter options.**  Proposals and observations of CJT  **Observation #11: We see higher gamma values on MCS13 compared to MCS20.**  **Observation #12: We see higher gamma values on Rank2 compared to Rank1.**  **Observation #13: We see test point SNR close or below 0dB in other than Rank2 MCS20 in 4Rx.**  **Observation #14: We see test point SNR clearly below 0dB in Rank1 MCS13.**  **Proposal #9: We support Option 1.**  **Proposal #10: We support using Rank2, meaning *typeII-CJT-RI Restriction-r18* set as 0010.**  **Proposal #11: We support using MCS20 at least in 4Rx test.**  **Proposal #12: We prefer using MCS20 also in 2Rx test but see that for 2Rx MCS13 would be also feasible.**  **Proposal #13: We suggest checking all companies averages of agreed tests.**  **Proposal #14: We prefer Option 2 assuming that is more practical configuration.**  **Proposal #15: We support Option 2 to use dual cluster beam steering for CJT.**  **Proposal #16: We propose to use DMRS antenna port 1000 for Rank1 and DMRS antenna ports 1000 and 1001 for Rank2.**  Proposals and observations of enhanced DMRS  **Observation #15: In our simulations we see maximum performance losses less than 0.3dB. Therefore, we see that reusing old values with possible additional margin is sufficient.**  **Proposal #17: We support Option 1 of reusing legacy values.** |
| R4-2404241 | MediaTek Inc. | Observations of predicted PMI  **Observation #1: We do not see gains over Rel-16 reference in FDD in TDLA30-40 channel.**  **Observation #2: We see significant gains over Rel-16 reference in FDD in TDLA30-20 when N4=1.**  **Observation #3: We see reasonable gains over Rel-16 reference in FDD in TDLA30-30 when N4=1.**  **Observation #4: We see reasonable gains over Rel-16 reference in FDD in TDLA30-20 when N4=4.**  **Observation #5: We see minor gains over Rel-16 reference in FDD in TDLA30-30 when N4=4.**  **Observation #6: We see feasible gamma values in FDD in TDLA30-20 when with both N4=1 and N4=4.**  **Observation #7: We do not see gains over Rel-16 reference in TDD MTK proposal 2a in TDLA30-40 channel.**  **Observation #8: We see some gain over Rel-16 reference in TDD MTK proposal 3a in TDLA30-40 channel.**  **Observation #9: We see reasonable gains over Rel-16 reference in TDD in TDLA30-20 and TDLA30-30 channels in both TDD MTK timing proposals.**  **Observation #10: We see feasible gamma values in TDD in TDLA30-20 and TDLA30-30 channels in both TDD MTK timing proposals.**  Observations of CJT  **Observation #11: We see higher gamma values on MCS13 compared to MCS20.**  **Observation #12: We see higher gamma values on Rank2 compared to Rank1.**  **Observation #13: We see test point SNR close or below 0dB in other than Rank2 MCS20 in 4Rx.**  **Observation #14: We see test point SNR clearly below 0dB in Rank1 MCS13.**  Observations of enhanced DMRS  **Observation #15: In our simulations we see maximum performance losses less than 0.3dB. Therefore, we see that reusing old values with possible additional margin is sufficient.** |
| R4-2404304 | Apple | **Type II Doppler Codebook**   1. N4=1 is baseline UE capability for R18 Type II Doppler. 2. With N4=4 it is more challenging to find a suitable Doppler that gives good performance 3. Define requirements with N4=1. 4. Define requirements for PMI reporting with Type II Doppler codebook with test metric at 90% of max TP.   **Type II CJT Codebook**   1. Set PCSI-RS=8 CSI-RS ports per TRP with (N1, N2) = (4, 1), (O1, O2) = (4, 1) for Rel-18 TypeII for CJT PMI test 2. Define requirements with 2 layers for Rel-18 TypeII for CJT PMI 3. Set RI restriction as 0010 for Rel-18 TypeII for CJT PMI test 4. Configure same TRS for both TRP for Rel-18 TypeII for CJT PMI test 5. Use dual cluster beam steering for Rel-18 TypeII for CJT PMI test   **DMRS Enhancements**   1. Define new requirements based on new simulation results for PDSCH demod with R18 eDMRS. 2. Introduce applicability rule that UE supporting enhanced DMRS needs to only be tested for new requirements for rank 2 with enhanced DMRS and can skip the corresponding tests for rank 2 with legacy DMRS configuration. |
| R4-2404533 | Nokia | **TypeII Doppler**  N4 and K configuration   1. N4=4 and K=4 (Option 1) and N4=1 and K=4 (option 2) are both feasible taking into account that tests are carried out with respect to a random Type I PMI. 2. N4=4 and K=4 (Option 1) will test both the prediction capabilities and the effect of the Time Domain/Doppler compression. 3. Define requirements for TypeII doppler using N4=4 and K=4 (Option 1) to cover both prediction as well as Time domain/Doppler compression.   X% of the maximum throughput in Test metric, MCS and Test metric values.   1. Based on the simulation results presented in the previous RAN4 #110 meeting it is at this time difficult to provide a final opinion on “X% of the maximum throughput in Test metric”. Further discussion will be needed when additional simulation results are made available.   Test setup for FR1 TDD case of TypeII-Doppler-r18 codebook   1. The inherent characteristics of TDD DL/UL switching might be an issue which affects the feasibility of Type II- Doppler Rel. 18 for TDD and the PMI requirement tests. Thus, it is required to determine if the proposed option 1 provides enough performance gain to justify PMI requirement for TDD.   Test setup for FR1 FDD case of TypeII-Doppler-r18 codebook   1. The delay compensation during tests can likely be neglected as the reference utilized is Type I random PMI. 2. Use option 1 as PMI requirements test setup for FR1 FDD case of TypeII-Doppler-r18 codebook.   **Test setup and simulation assumptions for TypeII for CJT**  N1, N2, O1, O2 and the number of CSI-RS ports   1. Configuring PCSI-RS=8 CSI-RS ports per TRP with (N1, N2) = (4, 1), (O1, O2) = (4, 1) provides a balanced trade-off between signaling overhead and channel estimation accuracy, ensuring effective utilization of CSI-RS resources in multi-TRP environments. 2. Adopt the agreement to PCSI-RS=8 CSI-RS ports per TRP with (N1, N2) = (4, 1), (O1, O2) = (4, 1) for Rel-18 TypeII for CJT PMI test.   RI restriction (typeII-CJT-RI Restriction-r18)   1. The selection of RI restriction (typeII-CJT-RI Restriction-r18) can be further discussed when more simulation results are available. 2. After simulation alignment, consider the RI restriction matching the highest gamma value as starting point.   MCS   1. The selection of MCS13 and/or MCS20 can be further discussed when more simulation results are available. 2. After simulation alignment, consider the MCS matching the highest gamma value as starting point.   TRS configuration in CJT   1. With the current agreement of co-located TRPs and no time/frequency offset between the TRPs, we see one TRS for both TRPs (option 1) as well as separate TRS for each TRP (option 2) as possible configurations. 2. RAN1 is currently discussing how to improve synchronization between two TRPs in Rel-19, hence at this time it is not fully agreed in RAN1 if there will be a need for separate TRS for each TRP. 3. Use one TRS for both TRPs (Option 1) as baseline. Consider using separate TRS for each TRP (Option 2) if RAN1 conclude it will be needed.   Beam steering modelling for TypeII-CJT-r18 PMI reporting requirements   1. Only two distinct clusters are needed for the CJT test setup. One from each TRxP. The principal beam direction specified in Annex B.2.3.2.3 will secure one distinct cluster for each TRxP and is sufficient to define PMI tests for CJT. 2. For beam steering modelling for TypeII CJT PMI reporting requirements, use the principal beam direction specified in TS38.101-4 Annex B.2.3.2.3.   **Test set-up and simulation assumptions for Rel-18 DMRS**   1. We see it preferable to define Rel-18 DMRS requirements based on simulation results assuming simulation alignment is achieved. 2. Define requirements using new values according to simulation results (option 2) |
| R4-2404752 | Samsung | **Proposal 1: Use scheduling option 1 for simulation assumption for TypeII-Doppler-r18 codebook.**  **Proposal 2: Use TDLA30-30 as the propagation channel for the test assumption of TypeII-Doppler-r18 codebook.**  **Proposal 3: Use N4 equal to 4 for the test assumption of TypeII-Doppler-r18 codebook.**  **Proposal 4: Use K equal to 4 for the test assumption of TypeII-Doppler-r18 codebook.**  **Proposal 5: Prefer to use 60% of the maximum throughput in Test metric for the test assumption of TypeII-Doppler-r18 codebook.**  **Proposal 6: For FR1 FDD, introduce PMI reporting requirements for TypeII-Doppler-r18 codebook with test metric**  **(using 60% of the maximum throughput) about 4.0 for 2Rx case, and 5.5 for 4Rx case, or with test metric**  **(using 90% of the maximum throughput) about 2.3 for 2Rx case, and 3.4 for 4Rx case.**  **Proposal 7: For FR1 TDD, introduce PMI reporting requirements for TypeII-Doppler-r18 codebook based on the simulation results based on configuration in Figure 2-4.**  **Proposal 8: Set PCSI-RS=8 CSI-RS ports per TRP with (N1, N2) = (4, 1), (O1, O2) = (4, 1) for Rel-18 TypeII for CJT PMI test.**  **Proposal 9: Set separate TRS for each TRP for Rel-18 TypeII for CJT PMI test, and introduce applicability rule which supporting requirements apply only when maxSimultaneousResourceSetsPerCC ≥ 2.**  **Proposal 10: dual cluster beams defined in Annex B.2.3.2.3A should be used for TypeII-CJT-r18 PMI reporting requirements.**  **Proposal 11: set RI restriction as 00000001 for Rel-18 TypeII for CJT PMI test.**  **Proposal 12: set MCS level as 13 for Rel-18 TypeII for CJT PMI test.**  **Proposal 13: Set the test metric**  **at 90% of the maximum TP as 3.0 for both 2Rx and 4Rx cases.**  Proposal 14: Prefer to define the minimum requirements by using the new value according simulation results for Rel-18 DMRS. |
| R4-2404753 | Samsung | **Observation 1: For the 2Rx PMI reporting performance simulation results on ‘typeII-Doppler-r18’ codebook vs Rel-16 Type II codebook, some benefit is observed for TDLA30 cases with Doppler 20Hz and 30Hz.**  **Observation 2: For the 2Rx PMI reporting performance simulation results on ‘typeII-Doppler-r18’ codebook vs Rel-16 Type II codebook, no obvious gain could be observed for TDLA30 cases with Doppler 40Hz.**  **Observation 3: For Doppler 30Hz case, both cases using ‘typeII-Doppler-r18’ codebook with N4=1 and N4=4 could outperform cases using Rel-16 Type II codebook, and the performance of ‘typeII-Doppler-r18’ codebook cases using N4=4 is better than N4=1.**  **Observation 4: For Doppler 20Hz, 30Hz case, the performance gain at the 60% and 70% of the maximum throughput point is higher than 90% of the maximum throughput point.**  **Observation 5: For Doppler 30Hz with MCS13 case, the 70% SNR working point of Rel-18 Doppler codebook could get about 0.6dB gain over Rel-16 codebook for 2Rx cases, and about 0.3dB gain for 4Rx cases.**  **Observation 6: For Doppler 30Hz with MCS13 case, the test metric**  **on 70% SNR working point of Rel-18 Doppler codebook is about 3.2 for 2Rx case, and 4.5 for 4Rx case; the test metric**  **on 90% SNR working point of Rel-18 Doppler codebook is about 2.4 for 2Rx case, and 3.5 for 4Rx case.**  **Observation 7: Cases with MCS20 has higher gain (performance of following TypeII-CJT-r18 codebook vs random Type I codebook) than cases with MCS13. However, this higher gain comes from the lower performance throughput of random Type I codebook case.**  **Observation 8: For paramCombination-CJT-L-r18 = 7 and paramCombination-CJT-r18 = 4 with MCS13 and RI Restriction as 00000001, the test metric at 90% of the maximum TP is about 3.4 for 2 Rx, is about 3.8 for 4Rx.**  **Observation 9: For paramCombination-CJT-L-r18 = 7 and paramCombination-CJT-r18 = 4 with MCS13 and RI Restriction as 00000010, the test metric at 90% of the maximum TP is about 2.1 for 4Rx.**  **Observation 10: For the PDSCH demodulation performance, cases with Rel-18 enhanced DMRS have almost the same SNR point at 70% fraction of maximum throughput with Rel-15 DMRS cases.** |
| R4-2404900 | Qualcomm Incorporated | **Proposal1: For Rank4 cases, RAN4 to use new simulation results for R18 DMRS rank4 PDSCH demod. requirements.**  **Proposal2: For Rank2 cases, RAN4 to reuse requirements of Test 2-1 of Clause 5.2.2.1.1, 5.2.2.2.1.**  **Proposal3: RAN4 to discuss applicability rules for rank2 requirements.** |
| R4-2405087 | Ericsson | **Proposal 1: RAN4 define the new PDSCH demodulation requirements for enhanced DMRS rank 4 with {1000, 1001, 1008, 1009} by collecting the simulation results.**  **Proposal 2: RAN4 can reuse the existing PDSCH demodulation requirements for enhanced DMRS rank 2 with {1008, 1009}.**  **Proposal 3: For the PMI reporting requirements with typeII-CJT-r18, configure MCS20 and rank 2.**  **Proposal 4: For the PMI reporting requirements with typeII-CJT-r18, set the test metric to 1.8 for both 2Rx and 4Rx.**  **Proposal 5: For the PMI reporting requirements with typeII-CJT-r18, configure TRS per TRP; one for TCI state #1 and another for TCI state #2.**  **Proposal 6: For the FDD PMI reporting requirements with typeII-Doppler-r18, configure N4=4.**  **Proposal 7: For the FDD PMI reporting requirements with typeII-Doppler-r18, apply the reported PMI estimated for slot n to the PDSCH transmitted in slot n, i.e., slot offset = 4 (Option 2).**  **Proposal 8: For the FDD PMI reporting requirements with typeII-Doppler-r18, configure TDLA30-30.**  **Proposal 9: For the FDD PMI reporting requirements with typeII-Doppler-r18, SNR test point are set with 90% of the maximum throughput with follow PMI with typeII-Doppler-r18.**  **Observation 1: The CSI/PDSCH scheduling in the existing PMI reporting tests in TS38.101-4 is based on the periodicity of 20ms.**  **Proposal 10: Consider the following scheduling pattern for FDD SCS=15kHz with the periodicity of 20ms (20 slots):**   * **Non-CSI slots: scheduled in mod(i, 10) = {1,3,5,7,9}, i={0,1,2,…,19}** * **CSI slots: scheduled in mod(i, 10) = {2,4,6,8}, i={0,1,2,…,19}** * **SSB slots: i=0** * **TRS slots: i=10 and 11.**   **Proposal 11: Configure the following parameters for typeII-doppler-r18:**   |  |  |  | | --- | --- | --- | | Codebook type | FR1 FDD SCS=15kHz | FR1 TDD SCS=30kHz | | paramCombination-Doppler-r18 | 7 | 7 | | CSI-RS periodicity (slots) | 2 | 1 | | Number of CSI-RS resources (K) | 4 | 4 | | Number of PMIs reported (N4) | 4 | 4 | | Reported slot offset (δ) | 1 | 2 | | Spacing (in slots) between PMIs (d) | 2 | 1 |   **Proposal 12: Consider the following scheduling pattern for TDD SCS=30kHz with the periodicity of 20ms (20 slots):**   * **Non-CSI slots: scheduled in mod(i, 20) = {5,6}, i={0,1,2,…,39}** * **CSI slots: scheduled in mod(i, 20) = {10,11,12,13}, i={0,1,2,…,39}** * **SSB slots: i=0** * **TRS slots: i=20 and 21.**   **Proposal 13: For the TDD PMI reporting requirements with typeII-Doppler-r18, configure TDLA30-30.**  **Proposal 14: For the TDD PMI reporting requirements with typeII-Doppler-r18, SNR test point are set with 90% of the maximum throughput with follow PMI with typeII-Doppler-r18.** |
| R4-2405131 | Huawei, HiSilicon | 1. Select N4=1 for TypeII Doppler codebook to define the minimum performance requirements. 2. Select the test metric as X = 90% for the TypeII Doppler codebook. 3. Select the gamma as 1.2 for the TypeII Doppler codebook. 4. For TypeII-Doppler-r18 codebook, in case of N4=1 for TDD 30kHz SCS, CSI-RS is transmitted in slot#10n+{0, 1, 2, 3}, CSI report is transmitted in slot#10n+9 to estimate precoder in slot#10n+10, BS apply the estimated precoder in slot#10n+{15, 16}. 5. For TypeII-Doppler-r18 codebook, in case of N4>1 for TDD 30kHz SCS, CSI-RS is transmitted in slot#10n+{0, 2, 4, 6}, CSI report is transmitted in slot#10n+19 to estimate precoder in slot#10n+{20, 22, 24, 26}, BS apply the {2nd, 3rd ,4th} estimated precoder in slot#10n+{31, 33, 35} respectively. 6. For TypeII-Doppler-r18 codebook, in case of N4=1 for FDD 15kHz SCS, CSI-RS is transmitted in slot#8n+{0, 2, 4, 6}, CSI report is transmitted in slot#8n+10 to estimate precoder in slot#8n+11, BS apply the estimated precoder in slot#8n+{15, 17, 19, 21}. 7. For TypeII-Doppler-r18 codebook, in case of N4>1 for FDD 15kHz SCS, CSI-RS is transmitted in slot#8n+{0, 2, 4, 6}, CSI report is transmitted in slot#8n+13 to estimate precoder in slot#8n+{14, 16, 18, 20}, BS apply the {1st, 2nd, 3rd ,4th} estimated precoder in slot#8n+{21, 23, 25, 27} respectively. 8. Set PCSI-RS=8 CSI-RS ports per TRP with (N1, N2) = (4, 1), (O1, O2) = (4, 1) for Rel-18 TypeII for CJT PMI test. 9. Set RI restriction as 0001 for Rel-18 TypeII for CJT PMI test. 10. Select MCS 13 for Rel-18 TypeII for CJT PMI test. 11. Select the gamma as 1.8 for the TypeII CJT codebook. 12. One TRS for both TRPs for TRS configuration in CJT. 13. Select dual cluster beams defined in Annex B.2.3.2.3A for TypeII-CJT-r18 PMI reporting requirements 14. For TypeII-CJT-r18 codebook, in case of FDD 15kHz SCS, CSI-RS is transmitted in slot#5n+1, CSI report is transmitted in slot#5n+8, BS apply the corresponding precoder in slot#5n+{15, 17, 18, 19}, and PDSCH transmission in slot#20k should be skipped that is used for SSB transmission. 15. Reuse legacy value for increased number of orthogonal DMRS ports performance requirements. |
| R4-2405132 | Huawei, HiSilicon | 1. There is negligible performance difference between the cases using legacy DMRS ports and the new DMRS ports. |
| R4-2405770 | Nokia | This contribution contains Nokia’s simulation results with relation to MIMO Evolution. |

## Open issues summary

### Sub-topic 1-1 Test setup and simulation assumptions for TypeII Doppler

**Issue 1-1-1:** **Propagation channel for both FDD and TDD cases**

* Proposals
  + Option 1: TDLA30-30 (Samsung, Ericsson)
  + Option 2: TDLA30-20 (MTK)
  + Option 3: Further discussion will be needed when additional simulation results are made available. (Nokia)
* Recommended WF
  + More discussion needed

**Issue 1-1-2:** **N4 and K configuration**

* Proposals
  + Option 1: N4=4 and K=4 (Nokia, Samsung, Ericsson, MTK as second priority)
  + Option 2: N4=1 and K=4 (Apple, Huawei, MTK as first priority)
* Recommended WF
  + More discussion needed

**Issue 1-1-3:** **X% of the maximum throughput in Test metric**

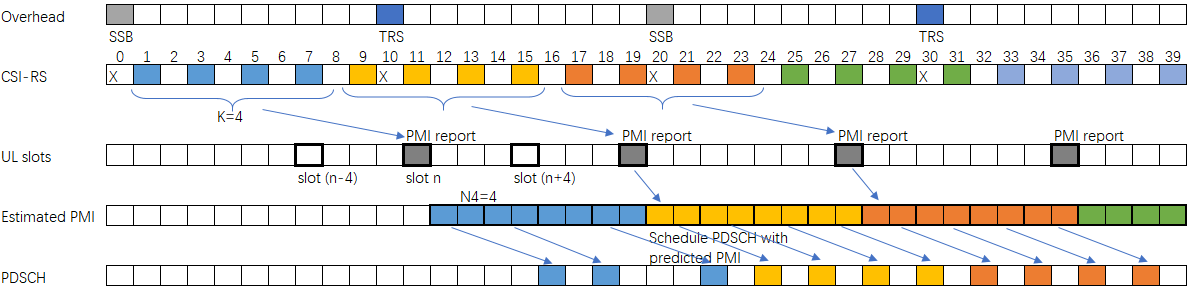
* Proposals
  + Option 1: 60% (Samsung)
  + Option 2: 90% (MTK, Apple, Ericsson, Huawei)
  + Option 3: Further discussion will be needed when additional simulation results are made available. (Nokia)
* Recommended WF
  + More discussion needed

**Issue 1-1-4:** **Test metric of TypeII-Doppler-r18 codebook**

* Proposals
  + Option 1: 2.3 for 2Rx case, and 3.4 for 4Rx case (Samsung)
  + Option 2: 1.2 (Huawei)
  + Option 3: checking all companies averages of agreed tests (MTK, Nokia)
* Recommended WF
  + More discussion needed

**Issue 1-1-5:** **Test setup for FR1 FDD case of TypeII-Doppler-r18 codebook**

* Proposals
  + Option 1: (MTK, Nokia, Samsung, Ericsson, Huawei)



* Option 1A: (Ericsson)

Scheduling pattern for FDD SCS=15kHz with the periodicity of 20ms (20 slots):

Non-CSI slots: scheduled in mod(i, 10) = {1,3,5,7,9}, i={0,1,2,…,19}

CSI slots: scheduled in mod(i, 10) = {2,4,6,8}, i={0,1,2,…,19}

SSB slots: i=0

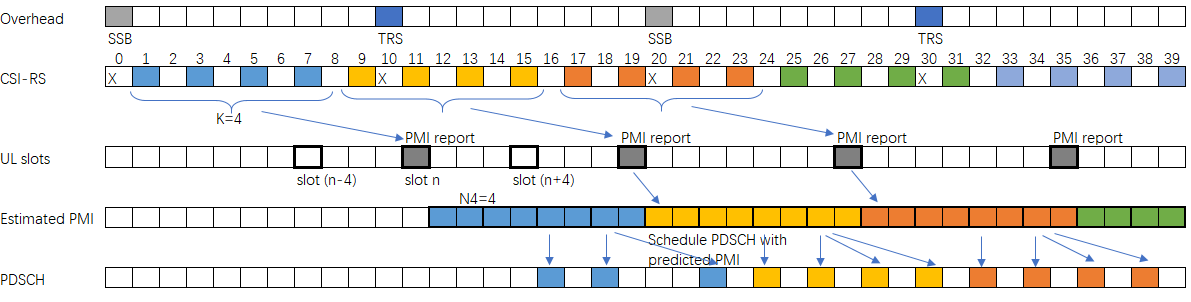
TRS slots: i=10 and 11.

* Option 1B: (Huawei)

For TypeII-Doppler-r18 codebook, in case of N4=1 for FDD 15kHz SCS, CSI-RS is transmitted in slot#8n+{0, 2, 4, 6}, CSI report is transmitted in slot#8n+10 to estimate precoder in slot#8n+11, BS apply the estimated precoder in slot#8n+{15, 17, 19, 21}.

For TypeII-Doppler-r18 codebook, in case of N4>1 for FDD 15kHz SCS, CSI-RS is transmitted in slot#8n+{0, 2, 4, 6}, CSI report is transmitted in slot#8n+13 to estimate precoder in slot#8n+{14, 16, 18, 20}, BS apply the {1st, 2nd, 3rd ,4th} estimated precoder in slot#8n+{21, 23, 25, 27} respectively.

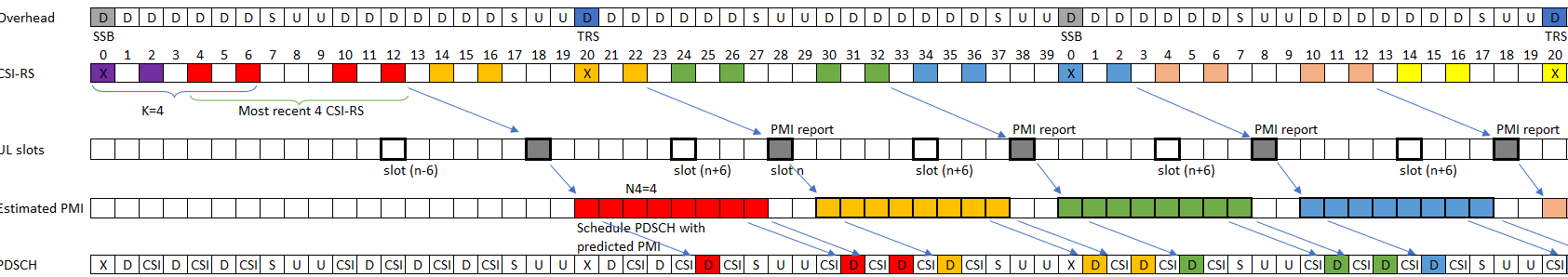
* + Option 2:



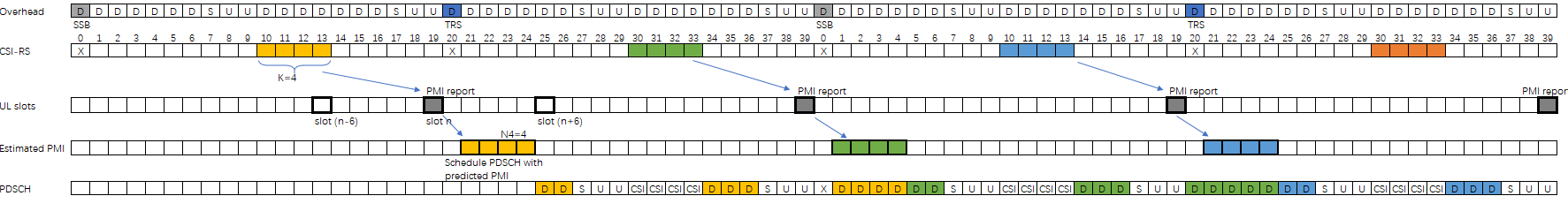
* Recommended WF
  + More discussion needed

**Issue 1-1-6:** **Test setup for FR1 TDD case of TypeII-Doppler-r18 codebook**

* Proposals
  + Option 1: (MTK)

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* + Option 2: (Samsung)



* + Option 3: (Ericsson)



* + Option 4: (Huawei)

For TypeII-Doppler-r18 codebook, in case of N4=1 for TDD 30kHz SCS, CSI-RS is transmitted in slot#10n+{0, 1, 2, 3}, CSI report is transmitted in slot#10n+9 to estimate precoder in slot#10n+10, BS apply the estimated precoder in slot#10n+{15, 16}.

For TypeII-Doppler-r18 codebook, in case of N4>1 for TDD 30kHz SCS, CSI-RS is transmitted in slot#10n+{0, 2, 4, 6}, CSI report is transmitted in slot#10n+19 to estimate precoder in slot#10n+{20, 22, 24, 26}, BS apply the {2nd, 3rd ,4th} estimated precoder in slot#10n+{31, 33, 35} respectively.

* Recommended WF
  + More discussion needed

**Issue 1-1-7: timing mismatch between the prediction reference and precoder usage in PDSCH transmission**

* Proposals
  + Option 1: updating RAN1 specification with redefined delta parameter options. (MTK)
* Recommended WF
  + More discussion needed

### Sub-topic 1-2 Test setup and simulation assumptions for TypeII for CJT

**Issue 1-2-1: N1, N2, O1, O2 and the number of CSI-RS ports**

* Proposals
  + Option 1:Set PCSI-RS=8 CSI-RS ports per TRP with (N1, N2) = (4, 1), (O1, O2) = (4, 1) for Rel-18 TypeII for CJT PMI test. (MTK, Apple, Nokia, Samsung, Huawei)
* Recommended WF
  + **Moderator expect this is agreeable without discussion:**
    - * Set PCSI-RS=8 CSI-RS ports per TRP with (N1, N2) = (4, 1), (O1, O2) = (4, 1) for Rel-18 TypeII for CJT PMI test

**Issue 1-2-2:** **Beam steering modelling for TypeII-CJT-r18 PMI reporting requirements**

* Proposals
  + Option 1: Apply dual cluster beams defined in Annex B.2.3.2.3A for TypeII-CJT-r18 PMI reporting requirements. (MTK, Apple, Samsung, Huawei)
  + Option 2: Apply the single cluster beam steering model per TRP as specified in TS 38.101-4 B.2.3.2.3. (Nokia)
* Recommended WF
  + More discussion needed

**Issue 1-2-3:** **TRS configuration in CJT**

* Proposals
  + Option 1: One TRS for both TRPs (Apple, Nokia, Huawei)
  + Option 2: separate TRS for each TRP (MTK, Samsung, Ericsson)
* Recommended WF
  + More discussion needed

**Issue 1-2-4:** **DMRS ports configuration in CJT**

* Proposals
  + Option 1: 1000 for Rank 1, 1000, 1001 for Rank 2 (MTK)
* Recommended WF
  + More discussion needed

**Issue 1-2-5: RI restriction (typeII-CJT-RI‑Restriction-r18)**

* Proposals
  + Option 1: Set RI restriction as 0001 for Rel-18 TypeII for CJT PMI test. (Samsung, Huawei)
  + Option 2: Set RI restriction as 0010 for Rel-18 TypeII for CJT PMI test. (MTK, Apple, Ericsson)
  + Option 3: After simulation alignment, consider the RI restriction matching the highest gamma value as starting point (Nokia)
* Recommended WF
  + More discussion needed

**Issue 1-2-6:** **MCS**

* Proposals
  + Option 1: MCS13 (16QAM, 0.48) (Samsung, Huawei)
  + Option 2: MCS20 (64QAM, 0.55) (MTK, Ericsson)
  + Option 3: After simulation alignment, consider the RI restriction matching the highest gamma value as starting point (Nokia)
* Recommended WF
  + More discussion needed

**Issue 2-2-9:** **Test metric of TypeII-CJT-r18 codebook**

* Proposals
  + Option 1: 1.8 for 2Rx and 4Rx case (Ericsson, Huawei)
  + Option 2: 3.0 for 2Rx and 4Rx case (Samsung)
  + Option 3: checking all companies averages of agreed tests (MTK)
* Recommended WF
  + More discussion needed

### Sub-topic 1-3 Requirements for Rel-18 DMRS

**Issue 1-3-1: Minimum requirements for tests need to be defined for Rel-18 DMRS**

* Proposals
  + Option 1: reuse legacy value because Rel-18 DMRS has almost same simulation results as Rel-15 DMRS cases (MTK, Huawei, Samsung)
  + Option 2: new value according simulation results (Apple, Nokia, Samsung)
  + Option 3: For Rank4 cases, RAN4 to use new simulation results for R18 DMRS. For Rank2 cases, RAN4 to reuse requirements of Test 2-1 of Clause 5.2.2.1.1, 5.2.2.2.1. (Qualcomm, Ericsson)
* Recommended WF
  + More discussion needed

**Issue 1-3-2: Applicability rule for Rel-18 DMRS**

* Proposals
  + Option 1: Introduce applicability rule that UE supporting enhanced DMRS needs to only be tested for new requirements for rank 2 with enhanced DMRS and can skip the corresponding tests for rank 2 with legacy DMRS configuration. (Apple)
* Recommended WF
  + More discussion needed

# Topic #2: Open issues for BS demodulation

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2404129 | Nokia | We have presented Nokia's results for eDMRS and BS demodulation performances with relation to MIMO evolution.  No observations or proposals were made. |
| R4-2404130 | Nokia | **Proposal 1: RAN4 shall add a new clause to TS 38.141-1 for the applicability of PUSCH with enhanced DMRS**  **Proposal 2: RAN4 shall assign the new clause to clause number 8.1.2.1.10**  **Proposal 3: RAN4 shall use the proposed wording within this contribution for the new clause.**  **Proposal 4: RAN4 shall add a new manufacturer declaration to Table 4.6-1 in TS 38.141-1**  **Proposal 5: RAN4 shall include the declaration description of “Declaration of support for enhanced DMRS as specified in TS 38.211 [17], i.e., type A, type B or both.” Within TS 38.141-1.** |
| R4-2405130 | Huawei, HiSilicon | In this contribution, we discuss on BS demodulation requirements for MIMO evolution. |
| R4-2405547 | Ericsson | [Proposal 1 Consider following applicability rule for PUSCH with enhanced DM-RS port demodulation requirements.](#_Toc163462303)  8.1.2.1.9 Applicability of PUSCH repetition type A requirements  Unless otherwise stated, PUSCH repetition type A requirements shall apply only for a BS declaring support of low spectral efficiency MCS index table 3 and PUSCH repetition type A (see D.121 and D.122 in table 4.6-1).  8.1.2.1.X Applicability of PUSCH DM-RS ports  Unless otherwise stated, a BS declare to support PUSCH *enhanced-dmrs-Type\_r18* (see D.xxx in table 4.6-1) and pass the requirement defined in 8.2.X, can also consider the tests defined in 8.2.1 with same configurations besides DM-RS ports as passed. |
| R4-2405548 | Ericsson | Simulation results for Rel18 DMRS of BS demodulation performances. |
| R4- 2405868 | Samsung | In this contribution, the initial simulation results are provided for alignment purpose. |

## Open issues summary

### Sub-topic 2-1 Requirements for Rel-18 DMRS

**Issue 3-1-1: Adding a new clause to TS 38.141-1 for the applicability of PUSCH with enhanced DMRS**

* Proposals
  + Option 1: RAN4 shall add a new clause to TS 38.141-1 for the applicability of PUSCH with enhanced DMRS, assign the new clause to clause number 8.1.2.1.10 and use the proposed wording within this contribution for the new clause. (Nokia, Ericsson)
* Option 1A: (Nokia)

|  |
| --- |
| Unless otherwise stated, PUSCH with enhanced DMRS mapping requirements shall apply only for a BS declaring support of enhanced DMRS.  Unless otherwise stated, PUSCH utilising enhanced DMRS mapping requirement tests shall apply only for the mapping type declared to be supported (see [D.XXX] in table 4.6-1). If both enhanced DMRS mapping type A and type B are declared to be supported, the tests shall be done for either type A or type B; the same chosen mapping type shall then be used for all tests except the requirement for PUSCH enhanced DMRS mapping Type B with 2 symbol length allocated. |

* Option 1B: (Ericsson)

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| --- |
| Unless otherwise stated, a BS declare to support PUSCH *enhanced-dmrs-Type\_r18* (see D.xxx in table 4.6-1) and pass the requirement defined in 8.2.X, can also consider the tests defined in 8.2.1 with same configurations besides DM-RS ports as passed. |

* Recommended WF
  + More discussion needed

**Issue 3-1-2: Adding a new manufacturer declaration to Table 4.6-1 in TS 38.141-1**

* Proposals
  + Option 1: RAN4 shall add a new manufacturer declaration to Table 4.6-1 in TS 38.141-1, include the declaration description of “Declaration of support for enhanced DMRS as specified in TS 38.211 [17], i.e., type A, type B or both.” Within TS 38.141-1. (Nokia)
* Recommended WF
  + More discussion needed

# Topic #3: Draft CRs

|  |  |  |
| --- | --- | --- |
| **Draft CR number** | **Source** | **Proposals / Observations** |
| R4-2404242 | MediaTek | Draft CR to 38.101-4: Applicability rules for PMI reporting requirements of typeII-doppler-r18 and typeII-CJT-r18 codebook |
| R4-2404305 | Apple | DraftCR for Applicability of requirements for MIMO Evo |
| R4-2404306 | Apple | DraftCR for FRCs for rank 4 requirements with eDMRS |
| R4-2404534 | Nokia | Draft CR for 38.101-4: PMI requirements and Measurement Channel for typeI-CJT-r18 for FR1 FDD |
| R4-2404754 | Samsung | Draft CR on combinations of channel model parameters (Table B.2.2-1: Channel model parameters for FR1) |
| R4-2405088 | Ericsson | Draft CR for 38.101-4: Reference measurement channels of typeII-doppler-r18 codebook tests |
| R4-2405133 | Huawei, HiSilicon | Draft CR on PMI reporting requirements of typeII-doppler-r18 for FR1 (TS38.101-4, Rel-18) |
| R4-2405349 | Qualcomm | Draft CR to 38.101-4, PDSCH Performance requirements of Rel-18 enhanced DMRS for FR1 FDD 2Rx and 4Rx |
| R4-2404131 | Nokia | [NR\_MIMO\_evo\_DL\_UL-Perf] Draft CR for TS 38.141-1 on PUSCH manufacturer declaration and test applicabilty |
| R4-2405135 | Huawei, HiSilicon | Draft CR on performance requirements for PUSCH with enhanced DMRS (TS38.141-2, Rel-18) |
| R4-2405866 | Samsung | Draft CR on PUSCH performance requirements with enhanced DMRS in 38.104 |

## Open issues

**Issue 3-1: Draft CR review**

* Companies to provide comments and response under e-mail thread [110bis] [328] NR\_MIMO\_evo\_DL\_UL\_demod – draft CR review.