**3GPP TSG-RAN WG4 Meeting # 109 R4-23XXXXX**

**Chicago, USA, November 13 – November 17, 2023**

**Agenda item:** 8.29.5

**Source:** Moderator (Samsung)

**Title:** Topic summary for [109][327] 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:

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

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

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

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

This is the second meeting for Rel-18 MIMO WI demod part, moderator suggest to further discuss the test scope issues which are FFS and don’t have consistent agreements in last meeting firstly, and then try to reach agreements on the test setups and simulation assumptions:

* Topic #1 General performance scope
* Topic #2 Test set-up and simulation assumption for UE demodulation and CSI
* Topic #3 Test set-up and simulation assumption for BS demodulation

# Topic #1: General Scope

This topic focused to identify potential performance impact from both BS demodulation and UE demodulation/CSI perspective for Rel-18 WI objectives.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2318560 | MTK | **Proposal #1: We propose as one criteria of feasibility to be find test parameters where Config 1 (K=4, N4=4, Q=2, m=d=2) can outperform Config 3 (K=1, N4=1, Q=1, m=d=8).****Proposal #2: We propose that the impairments need to be carefully studied and modelled before the feasibility of channel prediction can be confirmed.****Proposal #3: We propose to discuss WI scope of network deployment if the same site with shared carrier reference clock can be assumed or not.****Proposal #4: We propose to define applicability rule to UE can skip the legacy case if UE has passed the case with the same configuration but using the new DMRS ports.****Proposal #17: We support Option 1 as a starting point.****Proposal #27: We support Option 1 as a starting point.** |
| R4-2318587 | Apple | ***Observation #1:*** *It is not feasible to define requirements with TDCP measurement report since there is no defined action at the gNB on how the report will be used.****Observation #2:*** *NW could use the TDCP report to change codebook or CSI configuration, but these are not feasible to test with CSI reporting requirements.***Proposal #1: Do not introduce CSI reporting requirements for TDCP measurement.****Proposal #2: Further evaluate performance and feasibility of introducing PMI reporting requirements with ‘typeII-Doppler-r18’ with the following assumptions:** **- Antenna configuration: 4x2 XP-High (N1,N2) = (2,1), 8x2 XP-High (N1,N2) = (4,1), 16x2 XP Medium (N1,N2) = (4,2)- Propagation channel: TDLA30-10, TDLA30-30, TDLA30-50- Codebook parameter combination: 2 (for 4TX), 3 (for 8TX), 6 (for 16TX with eType II), 7 (for 16TX with 'typeII-Doppler-r18')****Proposal #3: Use performance metric as TP gain compared to eTypeII codebook for feasibility evaluation.****Proposal #4: Further discuss suitable test metric, as random PMI with type II codebook is not feasible.** **DMRS Enhancements****Proposal 5: Introduce requirements with eDMRS for the following:- Rank 2 with 2RX- Rank 2, rank 4 with 4RX****Proposal 7: Introduce applicability rule as – UE supporting eDMRS can skip the corresponding test cases with R15 DMRS configuration.** |
| R4-2318795 | Nokia, Nokia Shanghai Bell | **Scope of UE demodulation performance and CSI requirements**Clarify if CSI requirements are needed for codebook enhancement for UE predicted PMI**Observation #1:** The existing metric of gamma can be considered as starting point as it is the same used for Rel 16 enhanced Type II. This latter can be extended for N4>1 PMIs.Proposal #1: Define CSI requirements are needed for codebook enhancement for UE predicted PMI using $γ=\frac{t\_{ue,follow1,follow2}}{t\_{rnd1,rnd2}}$ as the starting point with N4=4, and P-CSI-RS 5 slots and offset 1 slot, FFS adequate Doppler spread characteristics for the chosen propagation channel. Use speed of ~20km/h as starting point.Clarify if demodulation or CSI requirements are needed for TDCP**Observation #2:** A new type of CSI requirement would need to be introduced for accuracy reporting for Time Domain Channel Properties (TDCP). RRM is still discussing to introduce such requirement.Proposal #2: Keep decision on defining new testcase and requirements for TDCP accuracy reporting FFS pending outcome of RRM feasibility study.Clarify if CSI requirements are needed for codebook enhancement for CJT**Observation #3:** Using the already existing test metric defined as $γ=\frac{t\_{ue,follow1,follow2}}{t\_{rnd1,rnd2}}$ , where $t\_{ue,follow1,follow2}$ is TBD % of the maximum throughput obtained at $SNR\_{follow1,follow2}$ using the precoders configured according to the UE reports, and $t\_{rnd1,rnd2}$ is the throughput measured at $SNR\_{follow1,follow2}$ with random precoding, we see it feasible to introduce PMI reporting requirements with ‘typeII-CJT-r18’ (FR1 FDD only).Proposal #3: Introduce PMI reporting requirements with ‘typeII-CJT-r18’ (FR1 FDD only)Clarify if demodulation requirements are needed for increased number of orthogonal DMRS portsProposal #4: Reuse the following testcases from 38.101-4 section 5.2.3.1.1 as starting point:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Rank | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | 1 | R.PDSCH.1-1.1 FDD | 10 / 15 | QPSK, 0.30 | TDLB100-400 | 2x4, ULA Low | 70 | TBD |
| 2-1 | 2 | R.PDSCH.1-3.1 FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x4, ULA Low | 70 | TBD |
| 3-1 | 3 | R.PDSCH.1-2.3 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 4x4, ULA Low | 70 | TBD |
| 4-1 | 4 | R.PDSCH.1-2.4 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 4x4, ULA Low | 70 | TBD |

**Observation #4:** Decision on introducing applicability rule for UE to skip legacy case(s) if UE has passed the case(s) with same configuration using the new DMRS ports can be done after simulation alignment is finalized.**Proposal 5: FFS: decision to introducing applicability rule for UE to skip legacy case(s) if UE has passed the case(s) with same configuration using the new DMRS ports.**Proposal 18: For PMI reporting tests with Type II codebook for predicted PMI, use the test metric defined as $γ=\frac{t\_{ue,follow1,follow2}}{t\_{rnd1,rnd2}}$ as the starting point, where $t\_{ue,follow1,follow2}$ is TBD % of the maximum throughput obtained at $SNR\_{follow1,follow2}$ using the precoders configured according to the UE reports, and $t\_{rnd1,rnd2}$ is the throughput measured at $SNR\_{follow1,follow2}$ with random precoding (option 1).Proposal 27: For PMI reporting test with Type II codebook for CJT use the already existing test metric defined as $γ=\frac{t\_{ue,follow1,follow2}}{t\_{rnd1,rnd2}}$ , where $t\_{ue,follow1,follow2}$ is TBD % of the maximum throughput obtained at $SNR\_{follow1,follow2}$ using the precoders configured according to the UE reports, and $t\_{rnd1,rnd2}$ is the throughput measured at $SNR\_{follow1,follow2}$ with random precoding (Option 1). |
| R4-2319336 | Samsung | **Observation 1: From 38.214 description, if UE has the capability to support ‘typeII-Doppler-r18’, it is assumed that this UE could support UE-side CSI prediction. Several potential processing in UE chipset may be introduced including perform channel estimation based on multiple CSI-RS resources, perform channel prediction for N4 occasions in the future, etc.****Observation 2: Due to the channel coherence time window restriction, current TDD PMI reporting test case for typeII-r16 codebook will get obvious performance degradation for medium/high UE speed with more than 100Hz maximum Doppler shift.****Observation 3: Due to the channel coherence time window duration and predicted PMI theory in TypeII-Doppler-r18 codebook definition, TDD PMI reporting test case for TypeII-Doppler-r18 codebook should get good performance for medium/high UE speed with more than 100Hz maximum Doppler shift.****Observation 4: From 38.214 description, if UE has the capability to support ‘typeII-CJT-r18’ which is based on the enhancement of Rel-16 TypeII codebook, it is assumed that this UE could support coherent joint precoding matrix estimation among multiple TRPs, which need different processing of multiple TRP with NCJT based on Type I single panel codebook.** **Proposal 7: For TypeII-Doppler-r18 test, use similar test metric with ‘typeII-r16' codebook, define the specified percentage value of the maximum throughput later when we have simulation results, and the** $ t\_{rnd1,rnd2}$ **based on Single Panel TypeI codebook.****Proposal 15: For TypeII-CJT-r18 test, use similar test metric with ‘typeII-r16' codebook, define the specified percentage value of the maximum throughput later when we have simulation results, and the** $ t\_{rnd1,rnd2}$ **based on Single Panel TypeI codebook.****Proposal 16: Do not define CSI requirements for TDCP measurement.****Proposal 20: Introduce applicability rule to define that UE can skip the legacy case if UE has passed the case with the same configuration but using the new DMRS ports.** |
| R4-2319747 | Ericsson | **Observation 1: No performance difference between Rel-15 and Rel-18 DMRS configurations as far as 1 or 2 DMRS ports share one resource element.****Proposal 2: Introduce applicability rule that UE can skip the legacy test cases if UE supporting ‘*dmrs-TypeEnh*’ passes the cases with the Rel-18 enhanced DMRS type 1 configuration.** **Observation 2: RAN4 RRM is discussing the feasibility of TDCP measurement accuracy requirements.** **Proposal 3: Not define TDCP reporting requirements in TS38.101-4.****Proposal 5: For PMI reporting tests with *typeII-Doppler-r18*, use the test metric defined as** $γ\_{1}=\frac{t\_{typeII-doppler}}{t\_{rnd}}$ **as the starting point, where** $t\_{typeII-doppler}$ **is X % (e.g. X=90) of the maximum throughput obtained at** $SNR\_{typeII-doppler}$ **using the precoders configured according to the UE reports, and** $t\_{rnd}$ **is the throughput measured at** $SNR\_{typeII-doppler}$ **with random precoding.****Proposal 6: For PMI reporting test with *typeII-Doppler-r18*, also consider another test metric defined as** $γ\_{2}=\frac{t\_{typeII-doppler}}{t\_{typeII-r16}}$**, where** $t\_{typeII-doppler}$ **is Y % (e.g., Y=90) of the maximum throughput obtained at** $SNR\_{typeII-doppler}$ **using the *typeII-Doppler-r18* precoders configured according to the UE reports, and** $t\_{typeII-r16}$ **is the throughput measured at** $SNR\_{typeII-doppler}$ **with using the *typeII-r16* precoders configured according to the UE reports.****Proposal 7: RAN4 define PMI reporting test with *typeII-Doppler-r18* only when the significant gain is observed with the test metric.****Proposal 9: For PMI reporting test with *typeII-CJT-r18*, the test metric is defined as** $γ\_{3}=\frac{t\_{typeII-CJT}}{t\_{rnd}}$**, where** $t\_{typeII-CJT}$ **is Z % (e.g., Z=90) of the maximum throughput obtained at** $SNR\_{typeII-CJT}$ **using the precoders configured according to the UE reports, and** $t\_{rnd}$ **is the throughput measured at** $SNR\_{typeII-CJT}$ **with random precoding.****Proposal 10: RAN4 define PMI reporting test with *typeII-CJT-r18* only when the significant gain is observed with the test metric.** |
| R4-2320231 | Huawei, HiSilicon | Proposal 1: Define PMI reporting requirements for the new Rel-16-based doppler measurement type-II codebook.Proposal 2: Do not define any CSI requirements for TRS-based TDCP reporting.Proposal 3: Define PMI reporting requirements for the new Rel-16-based CJT type-II codebook.Proposal 4: Only mandatory cases should be considered. The cases can be further down-selected as Table 2.1.4-1.Observation 1: There is negligible performance difference between the cases with different DMRS ports.Proposal 5: Define applicability rule that UE can skip the legacy case if UE has passed the case with the same configuration but using the new DMRS ports. |
| R4-2318054 | Nokia, Nokia Shanghai Bell | Observation 1: RAN4 will require a spatial channel model to define requirements for STxMP.Observation 2: RAN4 is unlikely to be able to agree a spatial channel model for STxMP within Rel-18.Proposal 1: RAN4 shall delay performance requirements for STxMP to a later release.Proposal 2: RAN4 shall define requirements for enhanced DMRS for Rel-18 MIMO |
| R4-2319312 | Ericsson | **Observation 2 The definition of TRP is not clear in RAN4 scope.****Observation 3 The OTA test cost for STxMP with SDM would be very high no matter how to interpret TRP.****Proposal 3 Introduce new BS declaration for increased DM-RS port configuration.****Proposal 4 Introduce new applicability rule for increased DM-RS port configuration to the section for normal PUSCH. Following text could be considered for further discussion.****Unless otherwise stated, PUSCH requirements with increased DM-RS port configuration shall apply only for a BS declaring support of enhanced DM-RS port type (see D.xxx in table 4.6-1). A BS that passes the tests with increased DM-RS port number can also consider the tests with legacy DM-RS port configuration passed.****Proposal 5 Do not consider FR2 STxMP demodulation requirements in Rel-18.** |
| R4-2319845 | Samsung | **Proposal 1: RAN4 introduce PUSCH demodulation requirement with new DMRS pattern with both Rank 1 and Rank 2.****Observation 1: For single-DCI based SDM scheme, the different layers LLR information from one PUSCH CW combination is required among two TRPs into one decoder for PUSCH demodulation.****Observation 2: For single-DCI based SFN scheme, the same PUSCH signal from each panel can be combined among two TRPs for PUSCH demodulation****Observation 3: For multi-DCI based scheme, the different PUSCH signal can be processed separately** **Observation 4: For single-DCI based SFN scheme, the same PUCCH signal from each panel can be combined among two TRPs for PUSCH demodulation****Proposal 2: From performance requirement aspect, PUSCH and PUCCH requirements with UE FR2 STxMP should be introduced.****Observation 5: How to handle the multiple TRPs reception for UL CoMP is transparent to UE, up to gNB implementation, without requirement for UL CoMP in 3GPP.****Observation 6: New test method is required for BS conformance test to support PUSCH and PUCCH requirements with UE FR2 STxMP.****Observation 7: No specific UE RF requirements with two UL beams simultaneously transmission introduced in RF session** **Proposal 3: Postpone the discussion on introduction BS demodulation requirement with UE FR2 STxMP to future release.** |
| R4-2320230 | Huawei, HiSilicon | Proposal 1: All CBW, all SCS and all PUSCH mapping type should be covered. For each combination of CBW, SCS and PUSCH mapping type, the cases can be further down-selected as Table 2.1.1-1.Table 2.1.1-1 Down-selected cases for each combination of CBW, SCS and PUSCH mapping type

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix | Fraction of maximum throughput | MCS | Additional DM-RS position |
| 1 | 2 | Normal | TDLC300-100 Low | 70 % | 16 | pos1 |
| 2 | 2 | Normal | TDLC300-100 Low | 70 % | 16 | pos1 |

Observation 1: There is negligible performance difference between the cases with different DMRS ports.Proposal 2: Do not define any demodulation performance requirements for simultaneous multi-panel UL transmission. |

## Open issues summary

### Sub-topic 1-1 scope of UE demodulation performance and CSI requirements

Open issues for requirements scope of UE demodulation performance and CSI requirements could be summarized as:

Issue 1-1-1: clarify criteria of feasibility for ‘typeII-Doppler-r18’ codebook

Issue 1-1-2: clarify test metric for PMI reporting requirements with ‘typeII-Doppler-r18’ codebook

Issue 1-1-3: clarify if CSI requirements are needed for TDCP

Issue 1-1-4: clarify if PMI reporting requirements are needed for ‘typeII-CJT-r18’ codebook

Issue 1-1-5: clarify if applicability rule are needed for demodulation requirements of Rel-18 DMRS ports

**Issue 1-1-1: clarify criteria of feasibility for ‘typeII-Doppler-r18’ codebook**

* Proposals
	+ Option 1: UE throughput with ‘typeII-Doppler-r18’ codebook could outperform Rel-16 Type II codebook with the same CSI-RS configurations and medium/high UE speed (MTK, Apple, Nokia, Samsung, Ericsson)
		- Config 1 (K=4, N4=4, Q=2, m=d=2) can outperform Config 3 (K=1, N4=1, Q=1, m=d=8). (MTK)
		- The impairments need to be carefully studied and modelled before the feasibility of channel prediction can be confirmed. (MTK)
		- N4=4, and P-CSI-RS 5 slots and offset 1 slot, FFS adequate Doppler spread characteristics for the chosen propagation channel. Use speed of ~20km/h as starting point. (Nokia)
		- TypeII-Doppler-r18 codebook should get good performance for medium/high UE speed with more than 100Hz maximum Doppler shift. (Samsung)
	+ Option 2: UE throughput with ‘typeII-Doppler-r18’ codebook could outperform random precoding based on Single Panel Type I codebook with the same CSI-RS configurations and medium/high UE speed (Ericsson)

Moderator Note: All companies share similar observation that ‘typeII-Doppler-r18’ codebook do have impact on baseband processing, and prefer to consider the criteria of feasibility as option 1 (UE throughput with ‘typeII-Doppler-r18’ codebook could outperform Rel-16 Type II codebook with the same CSI-RS configurations and medium/high UE speed).

* Recommended WF
	+ Use option 1 as the criteria of feasibility, encourage companies to further discuss and evaluate with proper simulation set-up. Introduce PMI reporting requirements with ‘typeII-Doppler-r18’ (FR1 only) if feasibility confirmed.

Tentative agreement:

Define PMI reporting requirements with ‘typeII-Doppler-r18’ using option 2 if both option 1 and option 2 could be fulfilled. Otherwise, if only option 1 is fulfilled, further discuss if feasible to define requirement using option 1 only.

Option 1: UE throughput with ‘typeII-Doppler-r18’ codebook could outperform Rel-16 Type II codebook with the same CSI-RS configurations and medium/high UE speed.

Option 2: UE throughput with ‘typeII-Doppler-r18’ codebook could outperform random precoding based on Single Panel Type I codebook with the same CSI-RS configurations and medium/high UE speed.

**Issue 1-1-2: clarify test metric for PMI reporting requirements with ‘typeII-Doppler-r18’ codebook**

* Proposals
	+ Option 1: test metric defined as $γ\_{1}=\frac{t\_{typeII-doppler}}{t\_{rnd}}$, where $t\_{typeII-doppler}$ is X % (e.g. X=90) of the maximum throughput obtained at $SNR\_{typeII-doppler}$ using the *typeII-Doppler-r18* precoders configured according to the UE reports, and $t\_{rnd}$ is the throughput measured at $SNR\_{typeII-doppler}$ with random precoding based on Single Panel Type I codebook. (MTK, Nokia, Samsung, Ericsson)
	+ Option 2: test metric defined as $γ\_{2}=\frac{t\_{typeII-doppler}}{t\_{typeII-r16}}$, where $t\_{typeII-doppler}$ is Y % (e.g., Y=90) of the maximum throughput obtained at $SNR\_{typeII-doppler}$ using the *typeII-Doppler-r18* precoders configured according to the UE reports, and $t\_{typeII-r16}$ is the throughput measured at $SNR\_{typeII-doppler}$ with using the *typeII-r16* precoders configured according to the UE reports. (Ericsson)
	+ Option 3: Further discuss suitable test metric, as random PMI with type II codebook is not feasible. (Apple)

Moderator Note: Option 1 is similar as the PMI reporting requirements of legacy type II codebook, which is based on the random precoding with Single Panel TypeI codebook.

* Recommended WF
	+ Use option 1 as the starting point.

**Issue 1-1-3: clarify if CSI requirements are needed for TDCP**

* Proposals
	+ Option 1: Do not introduce CSI requirements for TDCP measurement (Apple, Samsung, Ericsson, Huawei)
		- Observation ***#1:*** *It is not feasible to define requirements with TDCP measurement report since there is no defined action at the gNB on how the report will be used.*
		- Observation ***#2:*** *NW could use the TDCP report to change codebook or CSI configuration, but these are not feasible to test with CSI reporting requirements.*
	+ Option 2: Keep decision on defining new testcase and requirements for TDCP accuracy reporting FFS pending outcome of RRM feasibility study. (Nokia)
		- *Observation* ***#2:*** *A new type of CSI requirement would need to be introduced for accuracy reporting for Time Domain Channel Properties (TDCP). RRM is still discussing to introduce such requirement.*

Moderator Note: RRM session is discussing the feasibility of TDCP measurement accuracy requirements, it seems the fluctuation range of TDCP amplitude is large when the SNR is not high enough, i.e. lower than 20dB. Meanwhile, it is hard to define and test suitable NW switching algorithm(s) for specified TDCP amplitude reporting from CSI requirement point of view.

* Recommended WF
	+ Do not introduce CSI requirements for TDCP measurement

**Issue 1-1-4: clarify if PMI reporting requirements are needed for ‘typeII-CJT-r18’ codebook**

* Proposals
	+ Option 1: Yes (Nokia, Samsung, Huawei, Ericsson if the significant gain is observed with the test metric)
		- Test metric is defined as $γ\_{3}=\frac{t\_{typeII-CJT}}{t\_{rnd}}$, where $t\_{typeII-CJT}$ is Z % (e.g., Z=90) of the maximum throughput obtained at $SNR\_{typeII-CJT}$ using the precoders configured according to the UE reports, and $t\_{rnd}$ is the throughput measured at $SNR\_{typeII-CJT}$ with random precoding.
	+ Option 2: discuss WI scope of network deployment if the same site with shared carrier reference clock can be assumed or not. (MTK)

Moderator Note: All companies share similar observation that ‘typeII-CJT-r18’ codebook do have impact on UE baseband processing, majority companies prefer to introduce PMI reporting requirements for ‘typeII-CJT-r18’ codebook.

* Recommended WF
	+ Encourage companies further discuss, and provide simulation results on next meeting, based on the initial simulation assumption agreements in sub-topic 2-2 agreed on this meeting. Introduce PMI reporting requirements with ‘typeII-CJT-r18’ (FR1 FDD only) if performance gain could be observed.

**Issue 1-1-5: clarify if applicability rule are needed for demodulation requirements of Rel-18 DMRS ports**

* Proposals
	+ Option 1: Introducing applicability rule for UE to skip legacy case(s) if UE has passed the case(s) with same configuration using the Rel-18 DMRS ports. (MTK, Apple, Samsung, Ericsson, Huawei)
		- Observation: No performance difference between Rel-15 and Rel-18 DMRS configurations as far as 1 or 2 DMRS ports share one resource element. (Ericsson)
		- Observation: There is negligible performance difference between the cases with different DMRS ports. (Huawei)
	+ Option 2: FFS: decision to introducing applicability rule for UE to skip legacy case(s) if UE has passed the case(s) with same configuration using the new DMRS ports. (Nokia)
* Recommended WF
	+ Go with option 1.

### Sub-topic 1-2 scope of BS demodulation performance requirements

Open issues for requirements scope of BS demodulation performance requirements could be summarized as:

Issue 1-2-1: clarify the details of applicability rule for Rel-18 DMRS ports

Issue 1-2-2: clarify if BS demodulation requirements are needed for FR2 STxMP

**Issue 1-2-1: clarify the details of applicability rule for Rel-18 DMRS ports**

* Proposals
	+ Option 1: Introduce new applicability rule for increased DM-RS port configuration to the section for normal PUSCH. Following text could be considered for further discussion. (Ericsson)
		- Unless otherwise stated, PUSCH requirements with increased DM-RS port configuration shall apply only for a BS declaring support of enhanced DM-RS port type (see D.xxx in table 4.6-1). A BS that passes the tests with increased DM-RS port number can also consider the tests with legacy DM-RS port configuration passed.

|  |  |  |
| --- | --- | --- |
| D.xxx | PUSCH enhanced DM-RS port | Declaration of support PUSCH enhanced DM-RS port configuration enhanced-dmrs-Type\_r18.  |

* Recommended WF
	+ We already agreed to introduce applicability rule for Rel-18 DMRS ports in last meeting, about the further details, encourage feedback on option 1.

Tentative agreement:

Unless otherwise stated, PUSCH requirements with enhanced DM-RS port configuration shall apply only for a BS declaring support of enhanced DM-RS port type (see D.xxx in table 4.6-1).

|  |  |  |
| --- | --- | --- |
| D.xxx | PUSCH enhanced DM-RS port | Declaration of support PUSCH enhanced DM-RS port configuration enhanced-dmrs-Type\_r18.  |

[A BS that passes tests with enhanced DM-RS port can consider corresponding legacy PUSCH tests as passed. Definition of "corresponding" needs to be further specified.] FFS on specific wording.

**Issue 1-2-2: clarify if BS demodulation requirements are needed for FR2 STxMP**

* Proposals
	+ Option 1: Do not define FR2 STxMP demodulation requirements in Rel-18, postpone the discussion on introduction BS demodulation requirement with UE FR2 STxMP to future release. (Nokia, Ericsson, Samsung, Huawei)
		- RAN4 will require a spatial channel model to define requirements for STxMP. (Nokia)
		- RAN4 is unlikely to be able to agree a spatial channel model for STxMP within Rel-18. (Nokia)
		- The definition of TRP is not clear in RAN4 scope. (Ericsson)
		- The OTA test cost for STxMP with SDM would be very high no matter how to interpret TRP. (Ericsson)
		- For single-DCI based SDM scheme, the different layers LLR information from one PUSCH CW combination is required among two TRPs into one decoder for PUSCH demodulation. (Samsung)
		- For single-DCI based SFN scheme, the same PUSCH signal from each panel can be combined among two TRPs for PUSCH demodulation. (Samsung)
		- For multi-DCI based scheme, the different PUSCH signal can be processed separately. (Samsung)
		- For single-DCI based SFN scheme, the same PUCCH signal from each panel can be combined among two TRPs for PUSCH demodulation. (Samsung)
		- From performance requirement aspect, PUSCH and PUCCH requirements with UE FR2 STxMP should be introduced. (Samsung)
		- How to handle the multiple TRPs reception for UL CoMP is transparent to UE, up to gNB implementation, without requirement for UL CoMP in 3GPP. (Samsung)
		- New test method is required for BS conformance test to support PUSCH and PUCCH requirements with UE FR2 STxMP. (Samsung)
		- No specific UE RF requirements with two UL beams simultaneously transmission introduced in RF session. (Samsung)
* Recommended WF
	+ Following majority view, option 1?

Tentative agreement:

Do not define FR2 STxMP demodulation requirements in Rel-18, postpone the discussion on BS performance requirement introduction with UE FR2 STxMP to future release.

# Topic #2: Test set-up and simulation assumptions for UE demodulation performance and CSI

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2318560 | MTK | **Proposal #5: We need further study to find feasible test scenario.****Proposal #6: We support Option 1.****Proposal #7: We support Option 1.****Proposal #8: We support Option 1.****Proposal #9: We support Option 1.****Proposal #10: We support Option 1.****Proposal #11: We support Option 1.****Proposal #12: We support Option 1.****Proposal #13: We support Option 1.****Proposal #14: We support Option 1.****Proposal #15: We propose to study also aperiodic CSI-RS with 2 slot periodicity.****Proposal #16: We support Option 1.****Proposal #17: We support Option 1 as a starting point.****Proposal #18: We support Option 1.****Proposal #19: We support Option 1.****Proposal #20: We support Option 1.****Proposal #21: We propose to keep this open to give more time to study.****Proposal #22: We propose to keep this open to give more time to study.****Proposal #23: We support Option 1.****Proposal #24: We support Option 1 as a starting point.****Proposal #25: We propose to keep Mode1 as FFS until we will finish feasibility study with conclusions.****Proposal #26: We support Option 1.****Proposal #27: We support Option 1 as a starting point.****Proposal #28: We support Option 1.****Proposal #29: We support Option 1.****Proposal #30: We support Option 1.****Proposal #31: We propose to define one test for each Rank 1, 2, 3 and 4.****Proposal #32: We propose to use existing tests from Chapter 5.2.3.1.1 Minimum requirements for PDSCH Mapping Type A.****Proposal #33: We propose to use following existing tests as baseline for Rel-18 DMRS tests*** **Test 1-3 for Rank 1**
* **Test 2-1 for Rank 2**
* **Test 3-1 for Rank 3**
* **Test 4-1 for Rank 4**
 |
| R4-2318561 | MTK | **Observation #1: Performance of Config 2 and Config 3 is quite similar, meaning no gain from more frequent PMI reporting.****Observation #2: Performance of Config 1 is clearly worse than Config 3, meaning the legacy PMI reporting outperforms prediction codebook.****Observation #3: Conclusion from these simulations is that with these test parameters and used prediction method usage of new feature cannot be justified.** |
| R4-2318587 | Apple | **Proposal #5: Introduce requirements with eDMRS for the following:- Rank 2 with 2RX- Rank 2, rank 4 with 4RX****Proposal #6: Select the following test cases for introducing requirements with eDMRS: - 2RX: Test 2-1 in 5.2.2.1.1, 5.2.2.2.1 - 4RX: Test 2-1, 4-1 in 5.2.3.1.1, 5.2.3.2.1** |
| R4-2318795 | Nokia, Nokia Shanghai Bell | **Test set-up and simulation assumptions for UE demodulation performance and CSI**Propagation channel and correlation configurations**Observation 5:** TDLA30 with 100Hz seems more reasonable than 240Hz Doppler frequencies. Nonetheless, even smaller Doppler frequencies to enable P-CSI-RS with 10-20km/h are also reasonable to be considered.Proposal 6: Use 100Hz as the maximum Doppler frequency (Option 1). FFS if lower doppler values are to be considered.**Observation 6:** Considering that Rel 16 enhanced TypeII uses XP medium, Rel. 18 Doppler TypeII it seems reasonable to use similar configuration as starting point.Proposal 7: Use XP Medium as a starting point for Rel-18 TypeII Doppler PMI test (Option 1)CSI codebook configuration**Observation 7:** As a continuation of the PMI requirements for Rel 16 enhanced Type II, we see using 16 CSI-RS ports with (N1, N2) = (4, 2), (O1, O2) = (4, 4) as a good starting point. Proposal 8: Use the number of CSI-RS ports 16 with (N1, N2) = (4, 2), (O1, O2) = (4, 4) as a starting point for Rel-18 TypeII Doppler PMI test (Option 1)**Observation 8:** $L=4$ and $p\_{v}$ =1/4 and $β=1/2$ i.e., *paramCombination-Doppler-r18 =5*, is more compact in terms of bit overhead than the option proposed L=4, pυ=1/2, β=1/2 (*paramCombination-Doppler-r18 =7)* which according to our results gave just slightly better results while largely increasing the bit overhead.Proposal 9: Use $L=4$ and $p\_{v}$ =1/4 and $β=1/2$, paramCombination-Doppler-r18 =5**Observation 9:** Based on the fact that 0010 is the rank restriction for Rel. 16 enhanced Type II PMI tests, it is reasonable to use the same restriction for Rel. 18 TypeII Doppler Proposal 10: Set RI restriction as 0010 for Rel-18 TypeII Doppler PMI test (Option 1)**Observation 10:** For reasonable PMI tests in which the CSI prediction and compression are under test, a value of N4>1 is necessary.Proposal 11: Set N4=4 (Option 1)P/AP-CSI-RS Configuration**Observation 11:** From the discussions of RAN4#108bis is not clear if we may use AP-CSI-RS and/or P-CSI-RS. Based on this we may choose further the related parameters.**Observation 12:** We see P-CSI-RS as the best choice as it is more prone to be implemented in real deployments with cell specific resources and AP-CSI-RS have large radio overhead due to it requiring assignation of K CSI-RS resources for each triggered burst to each UE.Proposal 12: Focus on P-CSI-RS configuration for test setup and simulation assumptions.**Observation 13:** The selection of parameter *K* (number of NZP CSI-RS resources) depends on deciding if focus should be on AP-CSI-RS or P-CSI-RS.Proposal 13: FS the settings of parameter *K* (number of NZP CSI-RS resources) after deciding if focus should be on AP-CSI-RS or P-CSI-RS.**Observation 14:** The selection of parameters $m$ and $d$ depends on deciding if focus should be on AP-CSI-RS or P-CSI-RS. If we speak of AP-CSI-RS $m$ and $d$ as 2 seems a reasonable value. On the other hand, we are more inclined to focus on P-CSI-RS only.Proposal 14: FFS- further discuss the settings of these parameter after deciding if focus should be on AP-CSI\_RS or P-CSI-RS.**Observation 15: If the channel parametrization and Doppler spread in particular must be set in a way that with N4>1 predicted PMIs would bring reasonable performance results, we are fine with P-CSI-RS with 5 slots.**Proposal 15: For CSI-RS configuration use “Periodic with periodicity 5 slots and offset 1 slot” (option 1).MCS**Observation 16:** MCS20 has already been used as part of the legacy PMI requirements, hence we see it reasonable to use MCS 20 (64QAM, 0.55) as starting point.Proposal 16: Use MCS 20 (64QAM, 0.55)- (option 1) as the starting point. FFS: if other MCS are needed.Other parametersProposal 17: Use the following table (option 1):

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| Channel bandwidth and subcarrier spacing | For FDD, 10MHz/15kHzFor TDD, 40MHz/30kHz |
| TDD DL-UL configuration | FR1.30-1 as specified in 38.101-4 Annex A. |
| Number of UE receiver antennas | 2 and 4 |
| R (numberOfPMI-SubbandsPerCQI-Subband-Doppler-r18) | 1 |

Test metricProposal 18: For PMI reporting tests with Type II codebook for predicted PMI, use the test metric defined as $γ=\frac{t\_{ue,follow1,follow2}}{t\_{rnd1,rnd2}}$ as the starting point, where $t\_{ue,follow1,follow2}$ is TBD % of the maximum throughput obtained at $SNR\_{follow1,follow2}$ using the precoders configured according to the UE reports, and $t\_{rnd1,rnd2}$ is the throughput measured at $SNR\_{follow1,follow2}$ with random precoding (option 1).**Initial simulation assumptions for TypeII for CJT**Propagation channel and correlation configuration**Observation 17:** With reference to the existing requirements for Rel-17 NCJT PMI reporting, using TDLA30-10 with XP high as the propagation channel and correlation configuration is a reasonable starting point.Proposal 19: Use TDLA30-10 with XP high as the propagation channel and correlation configuration for Rel-18 TypeII for CJT test (option 1).K (numberOfCSI-RS-Resources), NTRP (Number of TRPs) and restrictedCMR-Selection**Observation 18:** As the UE may be configured with higher layer parameter *restrictedCMR-Selection*, setting K=2 CSI-RS resources, NTRP=2 TRPs and configure parameter *restrictedCMR-Selection* to restrict the number of selected CSI-RS resources is N=NTRP for Rel-18 TypeII for CJT PMI test (Option 1) is reasonable.Proposal 20: Set K=2 CSI-RS resources, NTRP=2 TRPs and configure parameter restrictedCMR-Selection to restrict the number of selected CSI-RS resources is N=NTRP for Rel-18 TypeII for CJT PMI test (Option 1). N1, N2, O1, O2 and the number of CSI-RS ports**Observation 19:** Rel-17 NCJT PMI tests are also based on 8 CSI-RS ports per TRP, hence setting 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 is a reasonable starting point.Proposal 21: Set PCSI-RS=8 CSI-RS ports per TRP with (N1, N2) = (4, 1), (O1, O2) = (4, 1) as a starting point for Rel-18 TypeII for CJT PMI test (Option 1).paramCombination-CJT-L-r18 and paramCombination-CJT-r18**Observation 20:** Our simulation results show better average UPT gain and better cell edge UPT gain for Ln = {4,4} (i.e., *paramCombination-CJT-L-r18* = 7) compared to Ln = {2,2} (i.e., *paramCombination-CJT-L-r18* = 4).Proposal 22: Set *paramCombination-CJT-L-r18* as 7 ({4, 4}) as a preliminary position for Rel-18 TypeII for CJT PMI test (Option 1- Issue 2-2-4).Proposal 23: Set *paramCombination-CJT-r18* as 4 ($p\_{ν}=\frac{1}{4}and\frac{1}{8}$,$ β=\frac{1}{2}$) or *paramCombination-CJT-r18* as 7 ($p\_{ν}=\frac{1}{2}and\frac{1}{2}$,$ β=\frac{1}{2}$) as a preliminary position for Rel-18 TypeII for CJT PMI test (Option 1- Issue 2-2-5).RI restriction (typeII-CJT-RI Restriction-r18)**Observation 21:** As a starting point, setting the RI restriction as 0001 for Rel-18 TypeII for CJT PMI test is reasonable and similar to the requirements assumption for Rel-17 NCJT PMI test.Proposal 24: Set RI restriction as 0001 for Rel-18 TypeII for CJT PMI test (Option 1). CodebookMode**Observation 22:** Setting *codebookMode* as Mode2 for Rel-18 TypeII for CJT test (Option 1) is preferred due to reduced bit overhead.Proposal 25: Set *codebookMode* as Mode2 for Rel-18 TypeII for CJT test (Option 1).other parameters**Observation 23:** Setting the number of UE receiver antennas as 2 and 4 and setting R (*numberOfPMI-SubbandsPerCQI-Subband-Doppler-r18*) as 1 is typical and reasonable.Proposal 26: Set 10MHz/15kHz as the channel bandwidth and subcarrier spacing for FDD respectively. For TDD DL-UL configuration, use FR1.15-1 as specified in 38.101-4 Annex A. Set the number of UE receiver antennas as 2 and 4. Set R (*numberOfPMI-SubbandsPerCQI-Subband-Doppler-r18*) as 1. (Option 1)Test metricProposal 27: For PMI reporting test with Type II codebook for CJT use the already existing test metric defined as $γ=\frac{t\_{ue,follow1,follow2}}{t\_{rnd1,rnd2}}$ , where $t\_{ue,follow1,follow2}$ is TBD % of the maximum throughput obtained at $SNR\_{follow1,follow2}$ using the precoders configured according to the UE reports, and $t\_{rnd1,rnd2}$ is the throughput measured at $SNR\_{follow1,follow2}$ with random precoding (Option 1).**Test set-up and simulation assumptions for Rel-18 DMRS**Proposal 28: Use Rel-18 DMRS configuration Type 1 with length 1. Use DMRS ports introduced by Rel-18 as:{1008} for Rank 1{1008, 1009} for Rank 2{1008-1010} for Rank 3{1008-1011} for Rank 4**Observation 24:** Limiting to low delay spread channels will also limit which legacy requirements can be re-used, hence higher delay spread channels should also be considered.Proposal 29: Consider TDLA30 and TDLB100 as starting point for propagation channel when defining requirements for Rel-18 DMRS. |
| R4-2319336 | Samsung | **Proposal 1: For both FDD and TDD cases with TypeII-Doppler-r18 codebook, use aperiodic CSI-RS resources configuration with settings as*** **The number of NZP CSI-RS resources K as 4**
* **Separation between two consecutive CSI-RS resources m as 1**
* **Slot associated with CSI report delta as 1**
* **The number of Doppler-/time domain (DD/TD) basis vectors N4 as 1**

**Proposal 2: For both FDD and TDD cases with TypeII-Doppler-r18 codebook propagation channel, use TDLA30-100, maximum Doppler shift as 100Hz.****Proposal 3: Use the number of CSI-RS ports 16 with (N1, N2) = (4, 2), (O1, O2) = (4, 4) as a starting point for TypeII-Doppler-r18 test.****Proposal 4: Set *paramCombination-Doppler-r18* as 7 (**$L=4$**,** $p\_{υ}=1/2$**,** $β=1/2$**) as a starting point for TypeII-Doppler-r18 test.****Proposal 5: For TypeII-Doppler-r18 test, use MCS13 (16QAM, 0.48).****Proposal 6: For TypeII-Doppler-r18 test, other parameters use below Table 3 as same as current test parameters of Rel-16 TypeII codebook in 38.101-4.****Table 3: other parameters**

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| **Channel bandwidth and subcarrier spacing** | **For FDD, 10MHz/15kHz****For TDD, 40MHz/30kHz** |
| **TDD DL-UL configuration** | **FR1.30-1 as specified in 38.101-4 Annex A.** |
| **Number of UE receiver antennas** | **2 and 4** |
| **R (numberOfPMI-SubbandsPerCQI-Subband-Doppler-r18)** | **1** |
| **RI restriction (typeII-Doppler-RI‑Restriction-r18)** | **0010** |
| **Other Test parameters** | **For FDD 2Rx, Table 6.3.2.1.6-1 in 38.101-4****For TDD 2Rx, Table 6.3.2.2.6-1 in 38.101-4****For FDD 4Rx, Table 6.3.3.1.6-1 in 38.101-4****For TDD 4Rx, Table 6.3.3.2.6-1 in 38.101-4** |

**Proposal 7: For TypeII-Doppler-r18 test, use similar test metric with ‘typeII-r16' codebook, define the specified percentage value of the maximum throughput later when we have simulation results, and the** $ t\_{rnd1,rnd2}$ **based on Single Panel TypeI codebook.****Proposal 8: Use TDLA30-10 with XP high as the propagation channel and correlation configuration for typeII-CJT-r18 test.****Proposal 9: Set K=2 CSI-RS resources, NTRP=2 TRPs and configure parameter *restrictedCMR-Selection* to restrict the number of selected CSI-RS resources is N=NTRP for** **typeII-CJT-r18 test.****Proposal 10: Set PCSI-RS=8 CSI-RS ports per TRP with (N1, N2) = (4, 1), (O1, O2) = (4, 1) as a starting point for typeII-CJT-r18 test.****Proposal 11: Set *paramCombination-CJT-L-r18* as 7 ({4, 4}) as a starting point for typeII-CJT-r18 test.****Proposal 12: Set *paramCombination-CJT-r18* as 4 (**$p\_{ν}=\frac{1}{4}and\frac{1}{8}$**,**$ β=\frac{1}{2}$**) or 7 (**$p\_{ν}=\frac{1}{2}and\frac{1}{2}$**,**$ β=\frac{1}{2}$**) as a starting point for typeII-CJT-r18 test.****Proposal 13: Set *codebookMode* as Mode2 for typeII-CJT-r18 test.****Proposal 14: For TypeII-CJT-r18 test, other parameters use below Table 5 as same as current test parameters of Rel-17 NCJT PMI reporting tests codebook in 38.101-4.****Table 5: other parameters**

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| **Channel bandwidth and subcarrier spacing** | **For FDD, 10MHz/15kHz** |
| **Number of UE receiver antennas** | **2 and 4** |
| **R (numberOfPMI-SubbandsPerCQI-Subband-Doppler-r18)** | **1** |
| **RI restriction (typeII-CJT-RI‑Restriction-r18)** | **0001** |
| **Other Test parameters** | **For FDD 2Rx, Table 6.3.2.1.7-1 in 38.101-4****For FDD 4Rx, Table 6.3.3.1.7-1 in 38.101-4** |

**Proposal 15: For TypeII-CJT-r18 test, use similar test metric with ‘typeII-r16' codebook, define the specified percentage value of the maximum throughput later when we have simulation results, and the** $ t\_{rnd1,rnd2}$ **based on Single Panel TypeI codebook.****Proposal 17: Introduce two PDSCH demodulation requirements test cases for Rel-18 enhanced DMRS with Rel-18 DMRS configuration Type 1 and length 1, for rank 2 and rank 4 separately.****Proposal 18: Use DMRS ports introduced by Rel-18, {1008, 1009} for Rank 2 case, {1008-1011} for Rank 4 case.****Proposal 19: select below cases for Rel-18 enhanced DMRS using the same test parameters except DMRS ports mentioned in Proposal 18:****For FDD**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value |
| Fraction of maximum throughput (%) | SNR (dB) |
| **2-1** | **R.PDSCH.1-3.1 FDD** | **10 / 15** | **64QAM, 0.50** | **TDLA30-10** | **2x2, ULA Low** | **70** | **[TBD]** |
| **4-1** | **R.PDSCH.1-2.4 FDD** | **10 / 15** | **16QAM, 0.48** | **TDLA30-10** | **4x4, ULA Low** | **70** | **[TBD]** |

**For TDD**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **TDD UL-DL pattern** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| **2-1** | **R.PDSCH.2-3.1 TDD** | **40 / 30** | **64QAM, 0.50** | **FR1.30-1** | **TDLA30-10** | **2x2, ULA Low** | **70** | **[TBD]** |
| **4-1** | **R.PDSCH.2-2.4 TDD** | **40 / 30** | **16QAM, 0.48** | **FR1.30-1** | **TDLA30-10** | **4x4, ULA Low** | **70** | **[TBD]** |

 |
| R4-2319747 | Ericsson | **Observation 1: No performance difference between Rel-15 and Rel-18 DMRS configurations as far as 1 or 2 DMRS ports share one resource element.****Proposal 1: Select the following test cases to specify UE demodulation requirements with Rel-18 enhanced DMRS type 1 configuration:*** FR1 Rank 1, QPSK 0.3 (Table 5.2.2.1.1-3 Test 1-2 for FR1 FDD 2Rx, Table 5.2.2.2.1-3 Test 2-1 for FR1 TDD 2Rx), DMRS ports = {1008}
* FR1 Rank 2, 64QAM 0.5 (Table 5.2.2.1.1-4 Test 2-1 for FR1 FDD 2Rx, Table 5.2.2.2.1-4 Test 2-1 for FR1 TDD 2Rx), DMRS ports = {1008, 1009}
* FR1 Rank 3, 16QAM 0.48 (Table 5.2.3.1.1-5 Test 3-1 for FR1 FDD 4Rx, Table 5.2.3.2.1-5 Test 3-1 for FR1 TDD 4Rx), DMRS ports = {1008, 1009, 1010}
* FR1 Rank 4, 16QAM 0.48 (Table 5.2.3.1.1-6 Test 4-1 for FR1 FDD 4Rx, Table 5.2.3.2.1-6 Test 4-1 for FR1 TDD 4Rx), DMRS ports = {1008, 1009, 1010, 1011}
* FR2-1 Rank 1, QPSK 0.3 (Table 7.2.2.2.1-3 Test 1-1 for FR2-1 TDD 2Rx), DMRS ports = {1008}
* FR2-1 Rank 2, QPSK 0.3 (Table 7.2.2.2.1-4 Test 2-1 for FR2-1 TDD 2Rx), DMRS ports = {1008, 1009}

**Proposal 4: For evaluation purpose of PMI reporting test with *typeII-Doppler-r18*, configure N4=1 and K=4. The detailed test PMI configurations are listed in Table 2 and Table 3.**Table 2 Codebook configuration for Type II codebook predicted PMI.

|  |  |  |
| --- | --- | --- |
| Parameters | Values | Notes |
| Codebook type | typeII-Doppler-r18 | Enhanced Type II codebook for predicted PMI |
| paramCombination-Doppler-r18 | 7 | $L=4$, $p\_{v}=1/2$, $β=1/2 $Same as Rel-16 eTypeII tests |
| CSI-RS configuration | Periodic  |  |
| CSI-RS periodicity and offset | 5/1 | Periodicity: 5 slotsOffset: 1 slot  |
| Number of CSI-RS resources (K)  | 4 | For an aperiodic CSI-RS resource set for channel measurement, the K ∈ {4,8,12} CSI-RS resources are triggered by the same triggering instance |
| Number of PMIs reported (N4) | 1 | N4 ∈ {1,2,4,8} |
| Reported slot offset (δ) | 1 | The earliest of the N4 slot intervals starts at slot *l*=*n*+δ, where *n* is the uplink slot in which the CSI is reported |
| Spacing (in slots) between PMIs (d) | N/A | Not configured for N4=1d ∈ {1,m} |
| numberOfPMI-SubbandsPerCQI-Subband-Doppler-r18 (R) | 1 | Same as Rel-16 eTypeII tests |
| (CodebookConfig-N1, CodebookConfig-N2) | (4, 2) | Same as Rel-16 eTypeII tests |
| (CodebookConfig-O1, CodebookConfig-O2) | (4, 4) | Same as Rel-16 eTypeII tests |

Table 3 Test setup for Type II codebook predicted PMI.

|  |  |  |
| --- | --- | --- |
| Parameters | Values | Notes |
| FDD/TDD, CBW/SCS | FR1 FDD 10MHz/15kHzFR1 TDD 40MHz/30kHz with FR1.30-1 | TDD pattern: 7D1S2U |
| Propagation channel | TDLC300-100 | Assuming ~30km/h |
| Antenna configuration per TRxP | XP medium 16 x 2XP medium 16 x 4 | Same as Rel-16 eTypeII tests |
| Beamforming model | As specified in Ts38.101-4 B.4.1 |  |
| CSI reporting type | Periodic |  |
| CSI-Report periodicity | 5 slots for FDD10 slots for TDD |  |
| timeRestrictionForChannelMeasurements | Not configured |  |
| timeRestrictionForInterferenceMeasurements | Not configured |  |
| cqi-FormatIndicator | Wideband |  |
| pmi-FormatIndicator | Subband | Same as Rel-16 eTypeII tests |
| CQI/RI/PMI delay | TBD |  |
| PDSCH MCS | MCS20 (64QAM, 0.55) | Same as Rel-16 eTypeII tests |
| PDSCH rank | Rank 2 |  |
| Maximum number of HARQ transmission | 4 |  |
| PDSCH DMRS | 1000/1001 |  |
| PDSCH DMRS configuration | 1+1 |  |

Proposal 8: For evaluation purpose of PMI reporting test with *typeII-CJT-r18*, configure the parameters as shown in Table 5 and Table 6.Table 5 Codebook configuration for *typeII-CJT-r18*.

|  |  |  |
| --- | --- | --- |
| Parameters | Values | Notes |
| Codebook type | typeII-CJT-r18 | Enhanced Type II codebook for CJT |
| (CodebookConfig-N1, CodebookConfig-N2) | (4, 1) | Same as TypeI tests for sDCI based SDM transmission scheme |
| (CodebookConfig-O1, CodebookConfig-O2) | (4, 1) | Same as TypeI tests for sDCI based SDM transmission scheme |
| paramCombination-CJT-L-r18(TS 38.214 Table 5.2.2.2.8-1) | 4 | $N\_{TRP}=2$, $L\_{1}=2$, $L\_{2}=2$L is same as Rel-15 TypeII tests |
| paramCombination-CJT-r18(TS 38.214 Table 5.2.2.2.8-2) | 1 | $p\_{v}=1/8$, $β=1/4 $Same as Rel-16 eTypeII tests |
| numberOfPMI-SubbandsPerCQI-Subband-CJT-r18 (R) | 1 | Same as Rel-16 eTypeII tests |
| codebookMode | mode2 | mode1: Per-TRP W­f reportingmode2: Common Wf reporting |

Table 6 Test setup for PMI reporting requirements with *typeII-CJT-r18*.

|  |  |  |
| --- | --- | --- |
| Parameters | Values | Notes |
| FDD/TDD, CBW/SCS | FR1 FDD 10MHz/15kHzFR1 TDD 40MHz/30kHz |  |
| Propagation channel | TDLA30-5 |  |
| Antenna configuration per TRxP | XP medium 8 x 2XP medium 8 x 4 | Same as TypeI tests for sDCI based SDM transmission scheme |
| Beamforming model | As specified in Ts38.101-4 B.4.1 |  |
| CSI reporting type | Aperiodic |  |
| timeRestrictionForChannelMeasurements | Not configured |  |
| timeRestrictionForInterferenceMeasurements | Not configured |  |
| cqi-FormatIndicator | Wideband |  |
| pmi-FormatIndicator | Wideband |  |
| CQI/RI/PMI delay | [8]ms for FDD 15kHz[6.5]ms for TDD 30kHz |  |
| PDSCH transmission scheme | sDCI-based SDM scheme (full overlapped) |  |
| PDSCH MCS | MCS13 (16QAM, 1/2) |  |
| PDSCH rank | Rank 1 per TRxP |  |
| Maximum number of HARQ transmission | 4 |  |
| PDSCH DMRS | 1000 for TRxP#11002 for TRxP#2 |  |
| PDSCH DMRS configuration | 1+1 |  |

 |
| R4-2320231 | Huawei, HiSilicon | Proposal4: Only mandatory cases should be considered. The cases can be further down-selected as Table 2.1.4-1.**Table 2.1.4-1 Down-selected cases**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Duplex** | **Rank** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** |
| 1 | 10 / 15 | QPSK, 0.30 | FDD | 1 | TDLB100-400 | 2x2, ULA Low | 70 |
| 2 | 40 / 30 | 64QAM, 0.50 | TDD FR1.30-1 | 2 | TDLA30-10 | 2x2, ULA Low | 70 |

 |
| R4- 2320892 | Qualcomm Incorporated | **For Increased DMRS orthogonal ports:****Proposal1: RAN4 to use Rel-18 DMRS configuration Type1 with length 1.** **Proposal2: RAN4 to reuse Test 4-1 of clause 5.2.3.2.1 of TS 38.101-4.**  **Proposal3: RAN4 to use DMRS ports {0,1,8,9} for the 4L case.** **Proposal4: RAN4 to consider low delay spread channels such as TDLA30-10 for PDSCH demodulation performance requirements.** **For TypeII Doppler:****Proposal5: RAN4 to use TDLA30-100 for TypeII doppler PMI requirements.** **Proposal6: RAN4 to use N4=1 for TypeII PMI Doppler requirements.** **For TypeII CJT:****Proposal7: RAN4 to set paramCombination-CJT-L-r18 as 4 ({2, 2}).** |

## Open issues summary

### Sub-topic 2-1 Initial simulation assumptions for TypeII Doppler

**Issue 2-1-1:** **Propagation channel**

* Proposals
	+ Option 1: TDLA30-100 (Nokia, Samsung, Qualcomm)
		- Use 100MHz, FFS if lower Doppler values are to be considered (Nokia)
	+ Option 2: need further study to find feasible test scenario (MTK)
	+ Option 3: TDLA30-10, TDLA30-30, TDLA30-50 (Apple)
	+ Option 4: TDLC300-100 (Ericsson)
* Recommended WF
	+ More discussion needed

**Issue 2-1-2:** **Correlation configurations**

* Proposals

For 16Tx:

* + Option 1: XP Medium as a starting point for Rel-18 TypeII Doppler PMI test. (MTK, Nokia, Samsung, Ericsson, Apple)

For 4Tx and 8Tx:

* + Option 1: XP-High (Apple)
* Recommended WF
	+ Option 1?

**Issue 2-1-3:** **N1, N2, O1, O2 and the number of CSI-RS ports**

* Proposals

For 16Tx:

* + Option 1: Use the number of CSI-RS ports 16 with (N1, N2) = (4, 2), (O1, O2) = (4, 4) as a starting point for Rel-18 TypeII Doppler PMI test. (MTK, Nokia, Samsung, Ericsson, Apple)

For 4Tx and 8Tx:

* + Option 1: 4Tx with (N1, N2) = (2, 1), 8Tx with (N1, N2) = (4, 1) (Apple)
* Recommended WF
	+ Option 1?

**Issue 2-1-4:** **paramCombination-Doppler-r18**

* Proposals

For 16Tx:

* + Option 1: Set paramCombination-Doppler-r18 as 7 (L=4, pυ=1/2, β=1/2) as a starting point (MTK, Apple, Samsung, Ericsson, Apple)
	+ Option 2: Set paramCombination-Doppler-r18 as 5 (L=4, pυ=1/4, β=1/2) (Nokia)

For 4Tx, 8Tx:

* + Option 1: Set paramCombination-Doppler-r18 as 2 for 4Tx, 3 for 8Tx (Apple)
* Recommended WF
	+ Option 1?

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

* Proposals
	+ Option 1: Set RI restriction as 0010 for Rel-18 TypeII Doppler PMI test. (MTK, Nokia, Samsung, Ericsson)
* Recommended WF
	+ Option 1?

**Issue 2-1-6:** **N4 configuration**

* Proposals
	+ Option 1: N4=4 (MTK, Nokia, Samsung)
		- For reasonable PMI tests in which the CSI prediction and compression are under test, a value of N4>1 is necessary. (Nokia)
	+ Option 2: N4=1 (Samsung, Ericsson, Qualcomm)
* Recommended WF
	+ More discussion needed

**Issue 2-1-7:** **CSI-RS configuration**

* Proposals
	+ Option 1: Periodic with periodicity 5 slots and offset 1 slot (Nokia, Ericsson)
		- If the channel parametrization and Doppler spread in particular must be set in a way that with N4>1 predicted PMIs would bring reasonable performance results, we are fine with P-CSI-RS with 5 slots. (Nokia)
	+ Option 2: Aperiodic CSI-RS with 2 slots separation (MTK, Samsung)
* Recommended WF
	+ TBA

**Issue 2-1-8:** **K (number of NZP CSI-RS resources)**

* Proposals
	+ Option 1: for Aperiodic CSI-RS, Set K=4 as a starting point for Rel-18 TypeII Doppler PMI test. (MTK, Samsung, Ericsson)
	+ Option 2: FFS the settings of parameter K (number of NZP CSI-RS resources) after deciding if focus should be on AP-CSI-RS or P-CSI-RS. (Nokia)
* Recommended WF
	+ Related to the feedback of Issue 2-1-7

**Issue 2-1-9:** **m (separation between two consecutive CSI-RS resources) and d (DD unit duration (in slots)**

* Proposals
	+ Option 1: for Aperiodic CSI-RS, Set m and d as 2 as a starting point for Rel-18 TypeII Doppler PMI test. (MTK, Nokia, Samsung)
	+ Option 2: FFS- further discuss the settings of these parameter after deciding if focus should be on AP-CSI\_RS or P-CSI-RS. (Nokia)
	+ Option 3: N/A, not configured for N4=1 (Ericsson)
* Recommended WF
	+ Related to the feedback of Issue 2-1-6 and Issue 2-1-7

**Issue 2-1-10:** **delta (slot associated with CSI report)**

* Proposals
	+ Option 1: Set delta as 1 as a starting point for Rel-18 TypeII Doppler PMI test. (MTK, Samsung, Ericsson)
* Recommended WF
	+ Option 1?

**Issue 2-1-11:** **MCS**

* Proposals
	+ Option 1: MCS20 (64QAM, 0.55) (MTK, Nokia, Ericsson)
		- Use MCS 20 (64QAM, 0.55)- (option 1) as the starting point. FFS: if other MCS are needed. (Nokia)
	+ Option 2: MCS13 (16QAM, 0.48) (Samsung)
* Recommended WF
	+ TBA

**Issue 2-1-12:** **other parameters**

* Proposals
	+ Option 1: follow below table (MTK, Nokia, Samsung, Ericsson)

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| Channel bandwidth and subcarrier spacing | For FDD, 10MHz/15kHzFor TDD, 40MHz/30kHz |
| TDD DL-UL configuration | FR1.30-1 as specified in 38.101-4 Annex A. |
| Number of UE receiver antennas | 2 and 4 |
| R (numberOfPMI-SubbandsPerCQI-Subband-Doppler-r18) | 1 |
| Other Test parameters not mentioned above | For FDD 2Rx, Table 6.3.2.1.6-1 in 38.101-4For TDD 2Rx, Table 6.3.2.2.6-1 in 38.101-4For FDD 4Rx, Table 6.3.3.1.6-1 in 38.101-4For TDD 4Rx, Table 6.3.3.2.6-1 in 38.101-4 |

* Recommended WF
	+ Option 1?

### Sub-topic 2-2 Initial simulation assumption for TypeII for CJT

**Issue 2-2-1: Propagation channel and correlation configuration**

* Proposals
	+ Option 1: Use TDLA30-10 with XP high as the propagation channel and correlation configuration for Rel-18 TypeII for CJT test. (MTK, Nokia, Samsung)
	+ Option 2: TDLA30-5 with XP medium(Ericsson)
* Recommended WF
	+ TBA

**Issue 2-2-2: K (numberOfCSI-RS-Resources), NTRP (Number of TRPs) and restrictedCMR-Selection**

* Proposals
	+ Option 1: Set K=2 CSI-RS resources, NTRP=2 TRPs and configure parameter *restrictedCMR-Selection* to restrict the number of selected CSI-RS resources is N=NTRP for Rel-18 TypeII for CJT PMI test. (MTK, Nokia, Samsung, Huawei)
* Recommended WF
	+ Option 1?

**Issue 2-2-3: 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) as a starting point for Rel-18 TypeII for CJT PMI test. (MTK, Nokia, Samsung, Huawei, Ericsson)
* Recommended WF
	+ Option 1?

**Issue 2-2-4: paramCombination-CJT-L-r18**

* Proposals
	+ Option 1: Set *paramCombination-CJT-L-r18* as 7 ({4, 4}) (Nokia, Samsung)
	+ Option 2: Set paramCombination-CJT-L-r18 as 4 ({2, 2}) (Ericsson, Qualcomm)
	+ Option 3: need more time to study (MTK)
* Recommended WF
	+ TBA

**Issue 2-2-5: paramCombination-CJT-r18**

* Proposals
	+ Option 1: Set *paramCombination-CJT-r18* as 4 ($p\_{ν}=\frac{1}{4}and\frac{1}{8}$,$ β=\frac{1}{2}$) or 7 ($p\_{ν}=\frac{1}{2}and\frac{1}{2}$,$ β=\frac{1}{2}$) for *paramCombination-CJT-L-r18* = 7 (Nokia, Samsung)
	+ Option 2: Set *paramCombination-CJT-r18* as 1 ($p\_{ν}=\frac{1}{8}$,$ β=\frac{1}{4}$) for *paramCombination-CJT-L-r18* = 4 (Ericsson)
	+ Option 3: need more time to study (MTK)
* Recommended WF
	+ TBA

**Issue 2-2-6: RI restriction (typeII-CJT-RI‑Restriction-r18)**

* Proposals
	+ Option 1: Set RI restriction as 0001 for Rel-18 TypeII for CJT PMI test. (MTK, Nokia, Samsung, Ericsson)
* Recommended WF
	+ Option 1?

**Issue 2-2-7: codebookMode**

* Proposals
	+ Option 1: Set *codebookMode* as Mode2 for Rel-18 TypeII for CJT test. (Nokia, Samsung, Huawei, Ericsson)
	+ Option 2: Set *codebookMode* as Mode2 as a starting point, keep Mode1 as FFS until finish feasibility study with conclusions.(MTK)
* Recommended WF
	+ Option 1?

**Issue 2-2-8:** **other parameters**

* Proposals
	+ Option 1: follow below table (MTK, Nokia, Samsung, Ericsson)

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| Channel bandwidth and subcarrier spacing | For FDD, 10MHz/15kHz |
| Number of UE receiver antennas | 2 and 4 |
| R (numberOfPMI-SubbandsPerCQI-Subband-Doppler-r18) | 1 |
| Other Test parameters not mentioned above | For FDD 2Rx, Table 6.3.2.1.7-1 in 38.101-4For FDD 4Rx, Table 6.3.3.1.7-1 in 38.101-4 |

* Recommended WF
	+ Option 1?

### Sub-topic 2-3 Test setup and simulation assumptions for Rel-18 DMRS

**Issue 2-3-1: DMRS configuration type and length**

* Proposals
	+ Option 1: Rel-18 DMRS configuration Type 1 with length 1 (MTK, Apple, Nokia, Samsung, Ericsson, Huawei, Qualcomm)
* Recommended WF
	+ Option 1?

**Issue 2-3-2: DMRS ports**

* Proposals
	+ Option 1: DMRS ports introduced by Rel-18 (MTK, Apple, Nokia, Samsung, Ericsson, Huawei)

{1008} if Rank 1 test is selected

{1008, 1009} if Rank 2 test is selected

{1008-1010} if Rank 3 test is selected

{1008-1011} if Rank 4 test is selected

* + Option 2: DMRS ports introduced by Rel-18 (Qualcomm)

{1008} if Rank 1 test is selected

{1008, 1009} if Rank 2 test is selected

{1008-1010} if Rank 3 test is selected

{1000, 1001, 1008, 1009} if Rank 4 test is selected

* Recommended WF
	+ TBD

**Issue 2-3-3: Duplex mode for tests need to be defined for Rel-18 DMRS**

* Proposals
	+ Option 1: both FDD and TDD (Apple, Samsung, Ericsson)
	+ Option 2: Only FDD (MTK, Nokia)
	+ Option 3: Only TDD (Qualcomm)
* Recommended WF
	+ TBA

**Issue 2-3-4: Number of Rx for tests need to be defined for Rel-18 DMRS**

* Proposals
	+ Option 1: both 2Rx and 4Rx (Apple, Samsung, Ericsson)
	+ Option 2: Only 4Rx (MTK, Nokia, Qualcomm)
	+ Option 3: Only 2Rx (Huawei)
* Recommended WF
	+ TBA

**Issue 2-3-5: Cases need to be defined for FR1 Rel-18 DMRS**

* Proposals
	+ Option 1: define one test for each Rank 1, 2, 3 and 4 with 4Rx (MTK, Nokia)
		- Option 1A: Use Test 1-3 for Rank 1, Test 2-1 for Rank 2, Test 3-1 for Rank 3, Test 4-1 for Rank 4 in Chapter 5.2.3.1.1 (MTK)
		- Option 1B: Use Test 1-1 for Rank 1, Test 2-1 for Rank 2, Test 3-1 for Rank 3, Test 4-1 for Rank 4 in Chapter 5.2.3.1.1 (Nokia)
	+ Option 2: define one test for Rank 2 with 2Rx, one test for each Rank 2, Rank 4 with 4Rx (Apple)
		- For 2Rx: Test 2-1 in Chapter 5.2.2.1.1, 5.2.2.2.1
		- For 4Rx: Test 2-1, 4-1 in Chapter 5.2.3.1.1, 5.2.3.2.1
	+ Option 3: define one test for Rank 2 with 2Rx, one test for Rank 4 with 4Rx (Samsung)
		- For 2Rx: Test 2-1 in Chapter 5.2.2.1.1, 5.2.2.2.1
		- For 4Rx: Test 4-1 in Chapter 5.2.3.1.1, 5.2.3.2.1
	+ Option 4: define one test for each Rank 1, Rank 2 with 2Rx, one test for each Rank 3, Rank 4 with 4Rx (Ericsson)
		- For Rank 1 with 2Rx, Test 1-2 in Chapter 5.2.2.1.1, 5.2.2.2.1
		- For Rank 2 with 2Rx, Test 2-1 in Chapter 5.2.2.1.1, 5.2.2.2.1
		- For Rank 3 with 4Rx, Test 3-1 in Chapter 5.2.3.1.1, 5.2.3.2.1
		- For Rank 4 with 4Rx, Test 4-1 in Chapter 5.2.3.1.1, 5.2.3.2.1
	+ Option 5: define one test for FDD Rank 1 with 2Rx, one test for TDD Rank 2 with 2Rx (Huawei)
		- For Rank 1 with 2Rx, Test 1-1 in Chapter 5.2.2.1.1
		- For Rank 2 with 2Rx, Test 2-1 in Chapter 5.2.2.2.1
	+ Option 6: define one test for TDD rank 4 with 4Rx (Qualcomm)
		- For rank 4 with 4 Rx, Test 4-1 in clause 5.2.3.2.1
* Recommended WF
	+ TBA

**Issue 2-3-6: Cases need to be defined for FR2-1 Rel-18 DMRS**

* Proposals
	+ Option 1: define one test for each Rank 1, 2 with 2Rx (Ericsson)
		- Option 1A: Use Test 1-1 for Rank 1, Test 2-1 for Rank 2 in Chapter 7.2.2.2.1 (Ericsson)
* Recommended WF
	+ TBA

**Issue 2-3-7: Minimum requirements for tests need to be defined for Rel-18 DMRS**

* Proposals
	+ Option 1: reuse legacy value (Samsung, Ericsson, Huawei)
		- No performance difference between Rel-15 and Rel-18 DMRS configurations as far as 1 or 2 DMRS ports share one resource element. (Ericsson)
		- There is negligible performance difference between the cases with different DMRS ports. (Huawei)
	+ Option 2: new value according simulation results (Nokia, [MTK])
* Recommended WF
	+ TBA

# Topic #3: Test set-up and simulation assumptions for BS demodulation performance

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2318054 | Nokia, Nokia Shanghai Bell | **Observation 3:** The proposed DMRS port allocation of Rank 1 = {8} and Rank 2 = {8,9} are sensible DMRS port allocations.**Proposal 3: RAN4 shall use a DMRS port allocation of Rank 1 = {8} and Rank 2 = {8,9}.****Proposal 4: RAN 4 shall use 15 KHz SCS with 5 MHz BW and 30 KHz SCS with 10 MHz BW for defining requirements.****Proposal 5: RAN4 shall use both 1T2R and 2T2R for defining requirements.****Proposal 6: RAN4 shall use MCS for initial alignment of requirements at RAN4#110****Observation 4:** The MCS choice may chance depending upon testability based on other parameters.**Proposal 7: RAN4 shall use TDLC300-100 for defining performance requirements.****Proposal 8: RAN4 shall use Mapping Type A for defining performance requirements.****Proposal 9: RAN4 shall use additional DMRS positions for defining performance requirements.****Proposal 10: RAN4 shall use CP-OFDM for defining performance requirements.** |
| R4-2319312 | Ericsson | **Proposal 1 Only consider normal PUSCH requirements with CP-OFDM for increased DM-RS ports demodulation requirements.****Proposal 2 Add enhanced DM-RS port configuration in parameters table and apply same requirements value for both legacy DM-RS ports and enhanced DM-RS ports for 1Tx and 2Tx configurations.****Proposal 3 Introduce new BS declaration for increased DM-RS port configuration.** |
| R4-2319845 | Samsung | **Proposal 1: RAN4 introduce PUSCH demodulation requirement with new DMRS pattern with both Rank 1 and Rank 2.****Proposal 4: The following simulation assumption can be considered for PUSCH requirement with DMRS enhancement if agreed to introduced** * **SCS&CBW**
	+ **15KHz SCS ,5MHz**
	+ **30KHz SCS, 10MHz**
* **Antenna configuration: 1Tx2Rx, 2Tx2Rx**
* **MCS: MCS 16**
* **Channel Model: TDLC300-100**
* **Mapping type: Type A and Type B**
* **Number of DMRS symbol: 2**
* **DM-RS port:**
	+ **{8} for 1Tx, {8, 9} for 2Tx**
* **Waveform: CP-OFDM**

|  |  |
| --- | --- |
| Parameter | Value |
| **Transform precoding** | **Disabled** |
| **Default TDD UL-DL pattern (Note 1)** | **15 kHz SCS:****3D1S1U, S=10D:2G:2U****30 kHz SCS:****7D1S2U, S=6D:4G:4U** |
| **HARQ** | **Maximum number of HARQ transmissions** | **4** |
|  | **RV sequence** | **0, 2, 3, 1** |
| **DM-RS** | **DM-RS configuration type** | **1** |
| **DM-RS duration** | **single-symbol DM-RS** |
| **Additional DM-RS position** | **pos1** |
| **Number of DM-RS CDM group(s) without data** | **2** |
| **Ratio of PUSCH EPRE to DM-RS EPRE** | **-3 dB** |
| **DM-RS port** | **{8}, {8,9}** |
| **DM-RS sequence generation** | **NID0=0, nSCID =0** |
| **DM-RS type**  | ***enhanced-dmrs-Type\_r18*** |
| **Time domain** | **PUSCH mapping type** | **A and B** |
| **resource** | **Start symbol** | **0**  |
| **assignment** | **Allocation length** | **14**  |
| **Frequency domain resource** | **RB assignment** | **Full applicable test bandwidth** |
| **assignment** | **Frequency hopping** | **Disabled** |
| **TPMI index for 2Tx two-layer spatial multiplexing transmission**  | **0** |
| **TPMI index for 4Tx four-layer spatial multiplexing transmission**  | **0** |
| **Code block group based PUSCH transmission** | **Disabled** |
| **NOTE 1: The same requirements are applicable to FDD and TDD with different UL-DL pattern.** |

**Observation 8: Similar performance can be achieved with Rel-15 DMRS port and Rel-18 DMRS port for 1 DMRS port****Observation 9: Minor performance degradation with Rel-18 DMRS port in large delay channel condition TDLC300-100 with small CBW condition for 2 DMRS ports.** |
| R4-2320230 | Huawei, HiSilicon | Proposal 1: All CBW, all SCS and all PUSCH mapping type should be covered. For each combination of CBW, SCS and PUSCH mapping type, the cases can be further down-selected as Table 2.1.1-1.Table 2.1.1-1 Down-selected cases for each combination of CBW, SCS and PUSCH mapping type

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix | Fraction of maximum throughput | MCS | Additional DM-RS position |
| 1 | 2 | Normal | TDLC300-100 Low | 70 % | 16 | pos1 |
| 2 | 2 | Normal | TDLC300-100 Low | 70 % | 16 | pos1 |

Observation 1: There is negligible performance difference between the cases with different DMRS ports. |

## Open issues summary

### Sub-topic 3-1 Test set-up and simulation assumptions for Rel-18 DMRS

**Issue 3-1-1: DMRS ports**

* Proposals
	+ Option 1: Rank 1 for 1Tx {8}, Rank 2 for 2Tx {8,9}. (Nokia, Ericsson, Samsung, Huawei)
* Recommended WF
	+ Option 1

Tentative agreement:

Option 1

**Issue 3-1-2: other parameters**

* Proposals
	+ Option 1: (Nokia, Ericsson, Samsung, Huawei)
		- SCS&CBW:
		- 15KHz SCS, 5MHz;
		- 30KHz SCS, 10MHz
		- Antenna configuration: 1Tx2Rx, 2Tx2Rx
		- MCS: MCS 16
		- Channel Model: TDLC300-100
		- Mapping type: Type A
		- Number of DMRS symbol: 2
		- Waveform: CP-OFDM

|  |  |
| --- | --- |
| Parameter | Value |
| Transform precoding | Disabled |
| Default TDD UL-DL pattern (Note 1) | 15 kHz SCS:3D1S1U, S=10D:2G:2U30 kHz SCS:7D1S2U, S=6D:4G:4U |
| HARQ | Maximum number of HARQ transmissions | 4 |
|  | RV sequence | 0, 2, 3, 1 |
| DM-RS | DM-RS configuration type | 1 |
| DM-RS duration | single-symbol DM-RS |
| Additional DM-RS position | pos1 |
| Number of DM-RS CDM group(s) without data | 2 |
| Ratio of PUSCH EPRE to DM-RS EPRE | -3 dB |
| DM-RS port | {8}, {8, 9} |
| DM-RS sequence generation | NID0=0, nSCID =0 |
| DM-RS type  | *enhanced-dmrs-Type\_r18* |
| Time domain | PUSCH mapping type | A |
| resource | Start symbol | 0  |
| assignment | Allocation length | 14  |
| Frequency domain resource | RB assignment | Full applicable test bandwidth |
| assignment | Frequency hopping | Disabled |
| TPMI index for 2Tx two-layer spatial multiplexing transmission  | 0 |
| Code block group based PUSCH transmission | Disabled |
| NOTE 1: The same requirements are applicable to FDD and TDD with different UL-DL pattern. |

* Recommended WF
	+ Option 1

Tentative agreement:

Option 1 except the CBW, Huawei propose to estimate the performance of maximum CBW.

**Issue 3-1-3: PUSCH mapping type B included or not**

* Proposals
	+ Option 1: Yes (Samsung, Huawei)
* Recommended WF
	+ TBA

Tentative agreement:

Option 1

**Issue 3-1-4: PUSCH demodulation cases need to be defined for Rel-18 DMRS**

* Proposals
	+ Option 1: All CBW, all SCS and all PUSCH mapping type should be covered. For each combination of CBW, SCS and PUSCH mapping type, the cases can be further down-selected as Table 2.1.1-1. (Huawei)
		- There is negligible performance difference between the cases with different DMRS ports.( Huawei)
		- Similar performance can be achieved with Rel-15 DMRS port and Rel-18 DMRS port for 1 DMRS port. (Samsung)
		- Minor performance degradation with Rel-18 DMRS port in large delay channel condition TDLC300-100 with small CBW condition for 2 DMRS ports. (Samsung)

Table 2.1.1-1 Down-selected cases for each combination of CBW, SCS and PUSCH mapping type

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix | Fraction of maximum throughput | MCS | Additional DM-RS position |
| 1 | 2 | Normal | TDLC300-100 Low | 70 % | 16 | pos1 |
| 2 | 2 | Normal | TDLC300-100 Low | 70 % | 16 | pos1 |

* Recommended WF
	+ TBA

Tentative agreement:

Cases for selected combination of CBW, SCS and PUSCH mapping type

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix | Fraction of maximum throughput | MCS | Additional DM-RS position |
| 1 | 2 | Normal | TDLC300-100 Low | 70 % | 16 or 21 (64QAM) | pos1 |
| 2 | 2 | Normal | TDLC300-100 Low | 70 % | 16 or 21 (64QAM) | pos1 |