**3GPP TSG-RAN WG4 Meeting #111 *R4-2410123***

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

**Agenda item:** 7.21.3

**Source:** Moderator (Ericsson)

**Title:** Topic summary for [111][330] NR\_redcap\_enh\_demod

**Document for:** Information

# Introduction

This topic summary lists open issues on Demodulation performance part for Rel-18 WI Enhanced support of reduced capability NR devices.

* 7.21.2.1: UE demodulation performance and CSI requirements [NR\_redcap\_enh-Perf]

# Topic #1: UE demodulation and CSI reporting requirements

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2407267 | Apple | Simulation results |
| R4-2407268 | Apple | Not found |
| R4-2408774 | Ericsson | **Proposal 1:** Set SNR=5/6dB and SNR=11/12dB for CQI reporting test in static condition for FDD/HD-FDD/TDD with 1Rx, same as Rel-17 RedCap CQI reporting test in static condition.**Proposal 2:** Set SNR=8/9dB and SNR=14/15dB for CQI reporting test in static condition for FDD/HD-FDD/TDD with 2Rx, same as Rel-17 RedCap CQI reporting test in static condition.**Proposal 3:** Set SNR=9/10dB and SNR=15/16dB for CQI reporting test in fading condition for FDD/HD-FDD/TDD with 1Rx, same as Rel-17 RedCap CQI reporting test in fading condition. **Proposal 4:** Set SNR=6/7dB for CQI reporting test in fading condition for FDD/HD-FDD/TDD with 2Rx, same as Rel-17 RedCap CQI reporting test in fading condition. **Proposal 5:** Apply the same requirements as Rel-17 RedCap UE CQI reporting test in fading condition.**Proposal 6:** Apply the same requirements as Rel-17 RedCap UE PMI reporting test for FDD/HD-FDD/TDD with 1Rx/2Rx. |
| R4-2408775 | Ericsson | Simulation results |
| R4-2408776 | Ericsson | Simulation results summary |
| R4-2409014 | Huawei, HiSilicon | **Observation 1:** For most SNR points of TDD, the throughput gain of follow CQI is quite limited and for some SNR points, the negative gain can be observed.**Proposal 1:** RAN4 to define CQI requirements under AWGN conditions and PMI requirements by reusing the Rel-17 RedCap test setup and test metric.**Proposal 2:** RAN4 shall not define CQI requirements under fading conditions. |
| R4-2409015 | Huawei, HiSilicon | Simulation results |
| R4-2409164 | Nokia, Nokia Shanghai Bell | Simulation results |

## Open issues summary

### Sub-topic 1-1 CSI reporting requirements

Background: RAN4#110bis agreed to investigate whether the Rel-17 RedCap CQI/PMI reporting requirements can be applicable for Rel-18 eRedCap with the following configuration:

|  |  |  |
| --- | --- | --- |
|  | **CQI reporting tests (static/fading)** | **PMI reporting test** |
| FDDCBW/SCS=10MHz/15kHz | BWP: 52 RBs CSI-RS: 24RBs (PRB 0 to 23)PDSCH:15 RBs (PRB 0 to 14)) | BWP: 52 RBs CSI-RS: 28RBs (PRB 0 to 27)PDSCH: 25RBs (PRB 0 to 24) |
| TDDCBW/SCS=20MHz/30kHz | BWP: 51 RBs CSI-RS: 24RBs (PRB 0 to 23)PDSCH: 7RBs (PRB 0 to 6) | BWP: 51 RBs CSI-RS: 24RBs (PRB 0 to 23)PDSCH: 12RBs (PRB 0 to 14) |
| Note: BWP size is same as the transmission bandwidth in TS38.101-1 5.3.2.  |

**Issue 1-1-1: CQI reporting test in fading condition**

* Observations:
	+ Ericsson: Simulation result shows we can keep the same accuracy requirements (i.e., α = 20%).
	+ Huawei: For most SNR points of TDD, the throughput gain of follow CQI is quite limited and for some SNR points, the negative gain can be observed.
* Proposals:
	+ Option 1 (Ericsson):
		- Set SNR=9/10dB and SNR=15/16dB for CQI reporting test in fading condition for FDD/HD-FDD/TDD with 1Rx, same as Rel-17 RedCap CQI reporting test in fading condition.
		- Set SNR=6/7dB for CQI reporting test in fading condition for FDD/HD-FDD/TDD with 2Rx, same as Rel-17 RedCap CQI reporting test in fading condition.
		- Apply the same requirements as Rel-17 RedCap UE CQI reporting test in fading condition:
			* A CQI index not in the set {median CQI - 1, median CQI, median CQI + 1} shall be reported at least α% of the time, where α = 20%.
			* Throughput ratio of follow CQI and fixed median CQI shall be ≥ γ, where γ = 1.05
			* Average BLER with follow CQI shall be greater than or equal to 0.02.
	+ Option 2 (Huawei):
		- RAN4 shall not define CQI requirements under fading conditions.
* Recommended WF
	+ Different observations from contributions.
	+ Discuss whether to define the CQI reporting requirements in fading condition for Rel-18 eRedCap.

**Issue 1-1-2: CQI reporting test in static condition**

* Proposal (Ericsson, Huawei):
	+ Define CQI reporting requirements under AWGN conditions by reusing the Rel-17 RedCap test setup and test metric.
		- Set SNR=5/6dB and SNR=11/12dB for CQI reporting test in static condition for FDD/HD-FDD/TDD with 1Rx, same as Rel-17 RedCap CQI reporting test in static condition.
		- Set SNR=8/9dB and SNR=14/15dB for CQI reporting test in static condition for FDD/HD-FDD/TDD with 2Rx, same as Rel-17 RedCap CQI reporting test in static condition.
* Recommended WF
	+ Reuse the same test setup and test metrics as Rel-17 RedCap CQI reporting requirements in static condition.

**Issue 1-1-3: PMI reporting tests**

* Proposals (Ericsson, Huawei)
	+ Define PMI reporting requirements by reusing the Rel-17 RedCap test setup and test metric.
		- Define the test metric as $γ=\frac{t\_{ue}}{t\_{rnd}}$ , where $t\_{ue}$ is 90 % of the maximum throughput obtained at $SNR\_{ue}$ using the precoders configured according to the UE reports, and $t\_{rnd}$ is the throughput measured at $SNR\_{ue}$ with random precoding based on type I Single Panel codebook.
		- Set γ=1.3.
* Recommended WF
	+ Reuse the same test setup and test metrics as Rel-17 RedCap PMI reporting requirements in static condition.

# Topic #2: CRs

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2407269 | Apple | Draft CR on PDSCH TDD Requirements for Enhanced Support of RedCap |
| R4-2407270 | Apple | Draft CR on SDR Requirements for Enhanced Support of RedCap |
| R4-2408038 | Qualcomm Incorporated | Draft CR on definition and requirements applicability |
| R4-2408777 | Ericsson | Draft CR on introduction of eRedCap FDD PDSCH demodulation requirements |
| R4-2409016 | Huawei, HiSilicon | Draft CR on introduction of PMI requirements for eRedCap |
| R4-2409163 | Nokia, Nokia Shanghai Bell | Draft CR of CQI reporting requirements for static/fading condition for RedCap enhancements |
| R4-2408778 | Ericsson | Big CR for 38.101-4: Introduction of eRedCap UE demodulation and CSI reporting requirements |

## Open issues summary

### Sub-topic 2-1 review draft CR

**Issue 2-1-1: Review draft CRs**

PDSCH demodulation requirements to be updated according to the simulation summary R4-2408776.

Companies are encouraged to give comments for draft CRs.

# Recommendation for Tdocs

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Suggested status** | **Comments** |
| R4-2407267 | Noted |  |
| R4-2407268 | Withdrawn? | Not found |
| R4-2408774 | Noted |  |
| R4-2408775 | Noted |  |
| R4-2408776 | Noted | Summary of simulation results |
| R4-2409014 | Noted |  |
| R4-2409015 | Noted |  |
| R4-2409164 | Noted |  |
| R4-2407269 | Revised | Draft CR |
| R4-2407270 | Revised | Draft CR |
| R4-2408038 | Revised | Draft CR |
| R4-2408777 | Revised | Draft CR |
| R4-2409016 | Revised | Draft CR |
| R4-2409163 | Revised | Draft CR |
| R4-2408778 | Email approval | Big CR |