**3GPP TSG-RAN WG4 Meeting # 104-e R4-2214317**

**Electronic Meeting, 15 – 26 August 2022**

**Agenda item:** 9.18.6

**Source:** Moderator (Ericsson)

**Title:** Email discussion summary for [104-e][328] NR\_RedCap\_Demod

**Document for:** Information

# Introduction

This email discussion threads discusses the UE demodulation and CSI reporting requirements for RedCap. The target of the email discussion is summarized as follows:

* 1st round:
	+ Solve the remaining open issues
	+ Collect the simulation results
	+ Collect the comment to draft CRs
* 2nd round:
	+ Continue to solve the remaining open issues.
	+ Review the revised draft CRs.

It is appreciated that the delegates for this topic put their contact information in the table below.

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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)

# Topic #1: General topics for UE demodulation and CSI reporting requirements

## Companies’ contributions summary

### General (9.18.5)

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2213066 | Nokia, Nokia Shanghai Bell | **Proposal 1:** Specify RedCap operation for FR2-1 only.**Proposal 2:** Select MCS20 for 256QAM support for RedCap 1Rx UE.  |

### PDSCH/SDR requirements (9.19.5.1.1)

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2211831 | Apple | **Proposal 1:** Define an additional PDSCH demodulation requirement for 1Rx 256QAM RedCap UEs set at MCS20. |
| R4-2212892 | Ericsson | **Proposal 1:** Specify the UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands as well as 1Rx UE. The requirements with HD-FDD should be the same as the corresponding (full-duplex) FDD requirements. **Proposal 2:** RAN4 defines 256QAM demodulation requirements for 1Rx RedCap UE. **Proposal 3:** For 1Rx RedCap UE, set MCS20 for 256QAM demodulation requirements. |
| R4-2213067 | Nokia, Nokia Shanghai Bell | **Proposal 1:** Include PDSCH results for alignment and for requirements specification into the simulation summary. |
| R4-2213789 | Huawei, HiSilicon | **Observation 1:** 10ms delay only give BS 1ms to process reported CSI which may be very strict. Furthermore, in Rel-15 TDD PMI test, the time offset between CSI reporting and CSI application is 5ms.**Proposal 1:** Consider the following CSI feedback pattern:For CSI requirements, configure the following CSI feedback scheduling pattern applicable for both FD-FDD and HD-FDD* CQI reporting test in static/fading condition (periodic CSI reporting)
	+ CSI-RS periodicity and offset: 10/1
	+ CSI-Report periodicity and offset: 10/9
	+ CQI/RI/PMI delay: 14ms

PMI reporting tests (aperiodic CSI reporting)* CSI request: 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0.
	+ Reuse the FRC from Rel-15 PMI test (R.PDSCH 1-6.1 FDD).
* Aperiodic Report Slot Offset: 3 slots
* CQI/RI/PMI delay: 6ms

**Proposal 2:** Define 256QAM PDSCH performance requirements with 1RX UE with MCS22.**Proposal 3:** Don't introduce RI test.**Proposal 4:** Name the new section for RedCap performance requirements as “Minimum requirements for RedCap”. |
| R4-2213790 | Huawei, HiSilicon | Simulation results |
| R4-2213904 | MediaTek inc. | **Proposal 1:** Use MCS20 to define 1Rx 256QAM demodulation requirements for RedCap UE. |
| R4-2213964 | Qualcomm Incorporated | **Proposal 1:** According to the results of the alignment simulations, introduce 256QAM Demodulation requirements for RedCap UEs with 1RX using MCS 21 for FR1 FDD (15kHz).**Proposal 2:** According to the results of the alignment simulations, introduce 256QAM Demodulation requirements for RedCap UEs with 1RX using MCS 21 for FR1 TDD (30kHz). |
| R4-2212889 | Ericsson | Simulation results summary |
| R4-2211835 | Apple | Draft CR: PDSCH demodulation requirements |
| R4-2212890 | Ericsson | Draft CR: Applicability of UE demodulation requirements |
| R4-2213795 | Huawei, HiSilicon | Draft CR: Sustained downlink data rate provided by lower layers |

### PDCCH/PBCH requirements (9.19.5.1.2)

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2211832 | Apple | Simulation results |
| R4-2212893 | Ericsson | Simulation results |
| R4-2213068 | Nokia, Nokia Shanghai Bell | **Proposal 1:** Include PDCCH results for alignment and for requirements specification into the simulation summary. |
| R4-2213069 | Nokia, Nokia Shanghai Bell | **Proposal 1:** Include PBCH results for alignment and for requirements specification into the simulation summary. |
| R4-2213791 | Huawei, HiSilicon | Simulation results |
| R4-2213906 | MediaTek inc. | Not available |
| R4-2213926 | MediaTek inc. | Simulation results |
| R4-2213965 | Qualcomm Incorporated | Simulation results |
| R4-2213794 | Huawei, HiSilicon | Draft CR: PBCH demodulation requirements |
| R4-2213905 | MediaTek inc. | Draft CR: PDCCH demodulation requirements |

### CQI requirements (9.19.5.2.1)

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2211833 | Apple | **Proposal 1:** Introduce CQI/RI/PMI delay of 14ms, along with proposed Resource/Report configuration of [10/1] [10/9] respectively. Delay of 10ms or 14ms is indifferent to UE, implies equivalent performance**Proposal 2:** Introduce proposed Aperiodic Report Slot Offset 3 slots and CQI/RI/PMI delay of 6ms. |
| R4-2212894 | Ericsson | **Proposal 1:** For the wideband CQI reporting test with CQI table 1 in fading condition, set SNR=6/7dB for lower test points for RedCap 2Rx UE (both FDD 15kHz and TDD 30kHz). **Proposal 2:** For CQI reporting tests for HD-FDD SCS=15kHz in static/fading condition, configure the following CSI feedback scheduling pattern.* CSI-RS periodicity and offset: 10/5
* CSI-Report periodicity and offset: 10/9
* CQI/RI/PMI delay: 10ms
 |
| R4-2213070 | Nokia, Nokia Shanghai Bell | **Proposal 1:** Reuse existing CSI-RS configurations for CQI reporting tests for RedCap.**Proposal 2:** Reuse value 0 for the overhead parameter for TBS determination from existing CSI RMCs for CQI reporting under static condition.**Proposal 3:** Adopt new RMCs for CQI reporting under static condition in FR1 based on 52 and 51 RBs as depicted in the table below:**Proposal 4:** Reuse existing test for CQI reporting under static condition in clause 8.2.2.2.1 and corresponding CSI RMC for RedCap UE in FR2-1. **Proposal 5:** For the lower SNR test points for CQI reporting under fading condition, select the test points according to the majority view of contributing companies. |
| R4-2213071 | Nokia, Nokia Shanghai Bell | **Proposal 1:** Include CQI reporting results for alignment into the simulation summary. |
| R4-2213792 | Huawei, HiSilicon | Simulation results |
| R4-2213966 | Qualcomm Incorporated | **Proposal 1:** Regarding the tests points for CQI reporting test in fading condition for 2RX, support Option 2: SNR = 6/7 dB;**Proposal 2:** For CSI Requirements, support Option 1=10ms for CQI/RI/PMI delay;**Observation 1:** CQI reporting performances in static condition for the same SNR are expected to be similar for 1 RX/Rank=1 and 2 RX/Rank=2.**Observation 2:** The agreed static channel matrix H = [1 1]; proposed for CQI simulation alignment when using the codebookSubsetRestriction = 000001 results in 3dB SNR gain, summing (with the same phase) 2 TX ports at the TE outpit;**Observation 3:** The current agreements in [3] regarding the test points for CQI reporting test in static condition for RedCap UEs with 1Rx is not motivated by an expectation in performance but by the combination of choices for Channel Matrix and Codebook Index in the test setup;**Observation 4:** A careful choice for the Static propagation condition channel matrix for 1 RX UE $H\_{1RX}=\left[\begin{matrix}1&j\end{matrix}\right]$;, extracted from Channel matrix already included in 38.101-4, Annex B.1 results in no additional SNR gain with the typical CodebookSubsetRestriction value agreed;**Proposal 3:** For UE Receiver with 1 RX, define the static channel matrix in the frequency domain as $H\_{1RX}=\left[\begin{matrix}1&j\end{matrix}\right]$;**Proposal 4:** If $H\_{1RX}=\left[\begin{matrix}1&j\end{matrix}\right]$ is used, test points for CQI reporting test in static condition for RedCap UEs with 1 RX are introduced X=0 dB lower than 2 RX (same test point for 1 RX and 2 RX);**Proposal 5:** Define RI reporting requirements for RedCap 2 RX UEs, reusing test setup, metric and pass fail criteria from Rel.16 NR UEs where applicable;**Proposal 6:** For RI reporting requirements for RedCap 2 RX in TDD, reuse the same test configuration with the exception of CBW configured 20MHz; |
| R4-2212891 | Ericsson | Draft CR: Applicability of CSI reporting requirements |
| R4-2213072 | Nokia, Nokia Shanghai Bell | Draft CR: CQI reporting requirements under static condition |
| R4-2213797 | Huawei, HiSilicon | Draft CR: Introduction of static propagation condition |
| R4-2213968 | Qualcomm Incorporated | Draft CR: CQI reporting requirements under fading condition |

### PMI/RI requirements (9.19.5.2.2)

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2211834 | Apple | **Proposal 1:** Do not define additional RI reporting requirements for RedCap UE. |
| R4-2212895 | Ericsson | **Proposal 1:** For PMI reporting tests, configure the following CSI feedback scheduling pattern for HD-FDD SCS=15kHz.* CSI request: 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
	+ Reuse the FRC from Rel-15 PMI test (R.PDSCH.1-6.1 FDD), i.e., no PDSCH is scheduled where NZP-CSI-RS is transmitted.
* Aperiodic Report Slot Offset: 3 slots
* PMI delay: 6 ms

**Proposal 2:** If RAN4 define the RI test for 2Rx RedCap UE, defines only one test: throughput gain of follow RI over fix RI=2 in low correlation condition. In this case, apply the same requirements as the existing Rel-15 requirements, that is gamma1 > 1.05 with SNR=20dB. |
| R4-2213073 | Nokia, Nokia Shanghai Bell | **Observation 1:** MIMO operation is not one of the reduced capabilities of the RedCap UE.**Proposal 1:** Define RI reporting requirements for 2 Rx RedCap UEs.**Proposal 2:** Limit RI reporting tests to Test 2 for FR1 FDD/TDD and FR2 TDD.**Proposal 3:** Reuse the RMCs, defined for RedCap CQI reporting under static condition in FR1, for RI reporting in FR1. |
| R4-2213793 | Huawei, HiSilicon | **Observation 1:** For case with FDD 4T1R, the SNR @90% of max TP with follow PMI is 8.4dB. Gama=2.14**Observation 2:** For case with TDD 4T1R, the SNR @90% of max TP with follow PMI is 3.07 Db. Gama=3.4**Observation 3:** For case with TDD 4T2R, the SNR @90% of max TP with follow PMI is 4.9 dB. Gama=1.6 |
| R4-2213796 | Huawei, HiSilicon | Draft CR: PMI reporting requirements |
| R4-2213074 | Nokia, Nokia Shanghai Bell | Draft CR: RI reporting requirements |

## Open issues summary

### Sub-topic 1-1 Specification structure

**Issue 1-1-1: UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands**

Open issues and candidate options before e-meeting: FFS for the UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands

* Proposals (Ericsson)
	+ Specify the UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands as well as 1Rx UE.
	+ The requirements with HD-FDD should be the same as the corresponding (full-duplex) FDD requirements.
* Recommended WF
	+ Collect comments whether the proposal is acceptable or not.
	+ If this is acceptable, revise the draft CR in the 2nd round, if necessary.

**Issue 1-1-2: Section names for RedCap UE demodulation and CSI reporting requirements**

* Proposals (Huawei)
	+ Name the new section for RedCap performance requirements as “Minimum requirements for RedCap”.
* Recommended WF
	+ Collect comments whether the proposal is acceptable or not.
	+ If this is acceptable, revise the draft CR in the 2nd round, if necessary.

**Issue 1-1-3: Applicable FR2 bands for RedCap UE**

* Proposals (Nokia)
	+ Specify RedCap operation for FR2-1 only.
* Recommended WF
	+ Collect comments whether the proposal is acceptable or not.
	+ (Moderator) If this is acceptable, moderator don’t this any update is needed on the draft CR.

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| XXX | **Issue 1-1-1: UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands****Issue 1-1-2: Section names for RedCap UE demodulation and CSI reporting requirements****Issue 1-1-3: Applicable FR2 bands for RedCap UE** |
| Ericsson | **Issue 1-1-1: UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands**We support the proposal.From the specification point of view, for PDCCH, PBCH, SDR, CQI and PMI requirements, we can have the common requirements for FD-FDD and HD-FDD. For PDSCH we need two requirement tables: one for FD-FDD and another for HD-FDD because FD-FDD case reuses the Rel-15 FRC, as shown in our contribution R4-2212892. See also the applicability rule in R4-2212890 and R4-2212891. **Issue 1-1-2: Section names for RedCap UE demodulation and CSI reporting requirements**Generally we are fine with the proposal. Looking the requirements, we can add ‘for RedCap’ to PDSCH, PDCCH, CQI, and PMI requirements. We don’t need to add ‘for RedCap’ to SDR and PBCH requirements. **Issue 1-1-3: Applicable FR2 bands for RedCap UE**Since RedCap is Rel-17 WI and FR2-2 is also Rel-17 WI, we agree FR2-2 is excluded from the scope of RedCap FR2 UE demodulation requirements. Please also note that UE PC7 is applicable only for FR2 bands n257/258/261. As the moderator recommended, we don’t think this proposal affects to TS38.101-4.  |
| Huawei | **Issue 1-1-1: UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands**We prefer to follow the previous agreement that only defining HD-FDD requirements for 1RX UE.**Issue 1-1-2: Section names for RedCap UE demodulation and CSI reporting requirements**Support this proposal **Issue 1-1-3: Applicable FR2 bands for RedCap UE**OK with proposals from Nokia |
| MediaTek | **Issue 1-1-1: UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands**We prefer to only define HD-FDD requirements for 1RX UE.**Issue 1-1-2: Section names for RedCap UE demodulation and CSI reporting requirements**We are OK to the proposal.**Issue 1-1-3: Applicable FR2 bands for RedCap UE**OK with the proposal to specify RedCap operation for FR2-1 only. |
| Apple | **Issue 1-1-1: UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands**We support the proposal since a UE can support 1Rx or 2Rx in HD-FDD in FDD bands. If UE supports HD-FDD and 2RX, we should define requirements for that as well. During the previous meeting the discussion focused only on 1Rx requirements. These should be extended to 2Rx to have complete coverage.**Issue 1-1-2: Section names for RedCap UE demodulation and CSI reporting requirements**To avoid the excessive duplication of tables, we proposed in our draft CR to reuse the names already specified in 38.101-4. For 1RX requirements, the entire section needs to be created since no previous requirements had been agreed. For 2RX requirements, since the number of new tests is minimal, we propose to reuse existing sections and only add the incremental tests. The advantage of this is to produce minimum maintenance effort, since new RedCap tests can be unambiguously identified via Test Purpose tables and applicability rules.We respectfully propose the involved companies to review the draft CR in R4-2211835. **Issue 1-1-3: Applicable FR2 bands for RedCap UE**We support the proposal coming from Nokia |
| Nokia | **Issue 1-1-1: UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands**We support the proposals from Ericsson. HD-FDD for 2 Rx RedCap UE is not precluded in the WID and furthermore RAN4 has specified support for RRM for HD-FDD 2x RedCap UE.**Issue 1-1-2: Section names for RedCap UE demodulation and CSI reporting requirements**We support the proposal.**Issue 1-1-3: Applicable FR2 bands for RedCap UE**We support the proposal. |
| Qualcomm | **Issue 1-1-1: UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands**Based on the HD-FDD decision for 1Rx, we don’t see why RAN4 shouldn’t follow the same argument and introduce dedicated requirements for 2Rx UEs that only support HD-FDD;We support reusing the agreed applicability rule, and reusing the requirement from FD-FDD, with the same changes done for 1RX to the test setup for allocation and resources if necessary;**Issue 1-1-2: Section names for RedCap UE demodulation and CSI reporting requirements**@Apple: while we see the point in reducing the overhead, the proposal in R4-2211835 in our opinion does not clearly state that previous requirements do not apply to RedCap UEs, and it leads to having in the same table requirements for different type of devices with no overlap;For these reasons, we think that a separate section for RedCap that contains only the tests that apply to RedCap UEs would be the cleaner solution;**Issue 1-1-3: Applicable FR2 bands for RedCap UE**Support the proposal; |

### CRs/TPs comments collection

No CR to be revised.

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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|  | **Status summary**  |
| **Issue 1-1-1: UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands** | **Candidate options:*** Option 1 (Ericsson, Apple, Nokia, Qualcomm):
	+ Specify the UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands as well as 1Rx UE.
		- The requirements with HD-FDD should be the same as the corresponding (full-duplex) FDD requirements.
* Option 2 (Huawei, MediaTek):
	+ Not specify the UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands

**Tentative agreements:**Four companies support option 1, considering the test coverage for 2Rx RedCap UE **only supporting HD-FDD in FDD band**, and the consistency of requirements between 1Rx and 2Rx UEs. The moderator proposes to:* Specify the UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands as well as 1Rx UE.
	+ The requirements with HD-FDD are the same as the corresponding (full-duplex) FDD requirements.

**Recommendations for 2nd round:**Discuss if the tentative agreements are accepted. |
| **ue 1-1-2: Section names for RedCap UE demodulation and CSI reporting requirements** | **Candidate options:*** Name the new section for RedCap performance requirements as “Minimum requirements for RedCap”

**Tentative agreements:**The moderator observes this proposal is agreeable. Based on the discussion the moderator propose as follows: * If new section is added for for RedCap performance requirements, put ‘for RedCap’ (not ‘for RedCap UE’) for the section name.

**Recommendations for 2nd round**Review the revision of corresponding draft CRs. |
| **Issue 1-1-3: Applicable FR2 bands for RedCap UE** | **Agreements:*** In FR2 bands, specify RedCap UE demodulation and CSI reporting requirements for FR2-1 only.

**Recommendation for 2nd round:**No discussion |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round

### Open issues and companies views’ collection

**Issue 1-1-1: UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands**

* Proposals
	+ Specify the UE demodulation and CSI reporting requirements for 2Rx RedCap UE supporting HD-FDD in FDD bands as well as 1Rx UE.
		- The requirements with HD-FDD are the same as the corresponding (full-duplex) FDD requirements
* Recommended WF
	+ Discuss if proposals are agreed.
	+ Affected draft CRs if agreed:
		- Revision of R4-2211835 “Draft CR PDSCH demodulation requirements for RedCap”, Apple.
		- Revision of R4-2212890, “draft CR: Applicability of RedCap UE demodulation requirements”, Ericsson.
		- Revision of R4-2212891, “draft CR: Applicability of RedCap UE CSI reporting requirements”, Ericsson.

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| **Company** | **Comments** |
| MediaTek | We can compromise to define requirements for 2Rx UE supporting HD-FDD band. However, for CSI requirements, we just want to emphasize that we cannot use the existing configuration of 2Rx FD-FDD for 2Rx HD-FDD. Maybe we can apply CSI-RS periodicity and offset, CSI-Report periodicity and offset and CQI/RI/PMI delay of 1Rx HD-FDD to 2Rx HD-FDD. Also, interested companies can evaluated if the same requirements can be applied for both 2Rx HD-FDD and 2Rx FD-FDD. |
| Ericsson | We support the recommended WF. We agree to MediaTek, if necessary, the agreed CSI-RS periodicity and offset, CSI-Report periodicity and offset and CQI/RI/PMI delay of 1Rx HD-FDD should be set to 2Rx HD-FDD tests. We can work for CR drafting.We are fine to add ‘interested companies can evaluated if the same requirements can be applied for both 2Rx HD-FDD and 2Rx FD-FDD’ in the WF.  |
| Huawei | We don’t support this proposal and propose to respect the previous agreements. |

## Summary for 2nd round

# Topic #2: UE demodulation requirements

## Companies’ contributions summary

See 1.1

## Open issues summary

### Sub-topic 2-1 PDSCH demodulation requirements

**Issue 2-1-1: Define 256QAM demodulation requirements for 1Rx RedCap UE in FR1 or not. If defined, what is the MCS?**

* Proposals
	+ Option 1: Define 256QAM demodulation requirements for 1Rx RedCap UE in FR1
		- Option 1a (Nokia, Apple, Ericsson, MediaTek): MCS 20
		- Option 1b: (Qualcomm): MCS 21
		- Option 1c (Huawei): MCS 22
* Recommended WF
	+ Define 256QAM demodulation requirements for 1Rx RedCap UE in FR1.
	+ Most companies prefer to set MCS20. Moderator would like to ask if MCS20 is acceptable or not.

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| XXX | **Issue 2-1-1: Define 256QAM demodulation requirements for 1Rx RedCap UE in FR1 or not. If defined, what is the MCS?**  |
| Ericsson | **Issue 2-1-1: Define 256QAM demodulation requirements for 1Rx RedCap UE in FR1 or not. If defined, what is the MCS?** We support Option 1a, MCS20. If we look the companies simulation results, required SNR for MCS20 with 1Rx is close to the SNR with 2Rx 256QAM requirements. **Issue 2-1-1: Define 256QAM demodulation requirements for 1Rx RedCap UE in FR1 or not. If defined, what is the MCS?** We support option 1c but also can compromise to option 1a |
| MediaTek | **Issue 2-1-1: Define 256QAM demodulation requirements for 1Rx RedCap UE in FR1 or not. If defined, what is the MCS?** We share the same view as Ericsson and support Option 1a, MCS20. |
| Apple | **Issue 2-1-1: Define 256QAM demodulation requirements for 1Rx RedCap UE in FR1 or not. If defined, what is the MCS?** We maintain our position of using MCS20 for 1RX 256QAM demodulation requirement. We share the same observation by stated above by Ericsson. |
| Nokia | **Issue 2-1-1: Define 256QAM demodulation requirements for 1Rx RedCap UE in FR1 or not. If defined, what is the MCS?** We support option 1a and moderator’s suggestion on the recommended WF. |
| Qualcomm | We can compromise based on other companies’ views and go with the recommended WF; |

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| R4-2211835 (Apple) | **Title: Draft CR PDSCH demodulation requirements for RedCap** |
| Ericsson:Section name mismatch between 5.2.1.1.1 and 5.2.1.2.1. Maybe 5.2.1.1.1 should be “Minimum requirements for RedCap Ues”For 2Rx, according to WF R4-2210672, we suggest to create the dedicated sub-clauses for RedCap 2Rx Ues, e.g., 5.2.2.1.16 Minimum requirements for RedCap Ues (for FDD)5.2.2.2.17 Minimum requirements for RedCap Ues (for TDD)

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| 5.2  | PDSCH demodulation requirements  |   |
| 5.2.1  |   1RX requirements  |   |
| 5.2.1.1  | FDD  |   |
| 5.2.1.1.1  |       Minimum requirements for RedCap Ues  | New section  |
| 5.2.1.2  | TDD  |   |
| 5.2.1.2.1  |       Minimum requirements for RedCap Ues  | New section  |
| 5.2.2  |   2RX requirements  |   |
| 5.2.2.1  | FDD  |   |
| 5.2.2.1.X  |       Minimum requirements for RedCap Ues  | New section  |
| 5.2.2.2  | TDD  |   |
| 5.2.2.2.X  |       Minimum requirements for RedCap Ues  | New section  |

For FDD, we also need to define new FRCs corresponding to HD-FDD pattern DDDSU, according to the conclusion of Issue 1-1-1.  |
| Huawei: 1 May be the section 5.2.1.x is lost which is refer to FDD or TDD. 1. We propose to change name of 5.2.1.1.1 to be “Minimum requirements for RedCap”, change the name of 5.2.1.2.1 to be “Minimum requirements for RedCap ” rather than “Minimum requirements for RedCap UE”
2. For 2RX, we propose to change the section name “Minimum requirements for RedCap” rather than “Minimum requirements for RedCap UE”. We can create a new section for RedCap, we also propose to add “HD-FDD” in parameter table.

Apple:Our main concern while creating this draft CR was to avoid excessive overhead and duplication of tables. For 1RX requirements, the entire section is entirely new, but for 2RX requirements, we can reuse the sections by via Test Purpose tables and applicability rules.Ericsson2:To Apple, we understand the motivation. But we still want to add the dedicated section for 2Rx UE. For RedCap UE, test purpose and applicability table can identify which test cases are applicable for RedCap UE, as Apple commented. On the other hand, it is difficult to identify which tests are applicable **for** **non-RedCap Ues, e.g., Rel-15 Ues**.Moreover if RAN4 agree to define new demodulation requirements in Rel-18 RedCap, we can add new tests in this section.  |
| Apple2:Based on the received comments, we will provide a revised version of the draft CR for Round 2. |
| R4-2212890 (Ericsson) | **Title: draft CR: Applicability of RedCap UE demodulation requirements** |
| Ericsson: Update the clause numbers and test numbers.  |
| Huawei: We propose to change all “RedCap UE” to “”RedCap” |
|  |
| R4-2213795 (Huawei, HiSilicon) | **Title: draftCR for introduction on sustained downlink data rate provided by lower layers for RedCap** |
| Ericsson: This is the agreements from the last meeting: * For FR1, define SDR requirements with configuration 1T1R for UE supporting 1 layer and 2T2R for UE supporting 2 layers.
* For FR2, define SDR requirements for 2 layers only with configuration 2T2R

Based on the agreements, we prefer to add the antenna configuration in Tables as follows. **Table 5.5A-1: Common test parameters for FDD and TDD component carriers**

|  |  |  |
| --- | --- | --- |
| Propagation condition |  | Static propagation conditionNo external noise sources are applied |
| Antenna configuration | 1 layer CCs |  | 1x2 or 1x4 |
| 2 layers CCs |  | 2x2 or 2x4 |
| 4 layers CCs |  | 4x4 |
| Antenna configuration for RedCap UE | 1 layer |  | 1x1 |
| 2 layers |  | 2x2 |
| Physical signals, channels mapping and precoding |  | As specified in Annex B.4.1 |

**Table 7.5A.1-1: Test parameters for FR2 TDD**

|  |  |  |
| --- | --- | --- |
| Propagation condition |  | Static propagation conditionNo external noise sources are applied |
| Antenna configuration | 1 layer CCs |  | 1x2  |
| 2 layers CCs |  | 2x2  |
| Antenna configuration for RedCap UE | 1 layer  |  | 1x2 |
| 2 layers |  | 2x2 |
| Physical signals, channels mapping and precoding |  | As specified in Annex B.4.1 |

Then we can remove the following sentences:- ‘For RedCap, antenna configuration is 1x1 for UE supporting 1 layer and 2x2 for UE supporting 2 layers’ from 5.5.1- ‘For RedCap, antenna configuration is 2x2 for UE supporting 2 layers’ from 7.5.1. |
| Huawei: @Ericsson. In Rel-15 SDR test, MIMO layers can be different per band. For 2RX UE, MIMO layers are fixed to be 2 or depends on capability reporting per band? If MIMO layers is fixed to be 2, we propose to keep the current wording and add the following:”The MIMO layers is 2 for UE supporting 2 layers and 1 for UE supporting 1” since it is different from Rel-15 SDR test. If MIMO layers depends on capability per band, it is same as Rel-15 SDR test and we support your suggestion.Ericsson2: To Huawei.According to TS38.306 4.2.21.1,

|  |
| --- |
| For FR 1, 1 DL MIMO layer if 1 Rx branch is supported, and 2 DL MIMO layers if 2 Rx branches are supported; for FR2, either 1 or 2 DL MIMO layers can be supported, while 2 Rx branches are always supported. For FR1 and FR2, UE features and corresponding capabilities related to more than 2 UE Rx branches or more than 2 DL MIMO layers, as well as UE features and capabilities related to more than 2 UE Tx branches or more than 2 UL MIMO layers are not supported by RedCap Ues; |

From TS38.306, you’re right for FR1, we are ok to keep the sentence below. - For RedCap, antenna configuration is 1x1 for UE supporting 1 layer and 2x2 for UE supporting 2 layers. Regarding the additional sentence, maybe we can reuse the sentence from TS38.306: ‘DL MIMO layer is 2 if 2 Rx branches are supported, and 1 if 1 Rx branch are supported’.On the other hand, it looks number of DL MIMO layers for FR2 depends on the UE capability. So we propose our suggestion.  |
|  |
| R4-2213794 (Huawei, HiSilicon) | **Title: Draft CR Introduction of PBCH performamce requirements for RedCap** |
| Ericsson:‘Note 1: The test case is also applicable for RedCap’ is not necessary from Tables 5.4.2.1-2, 5.4.2.1-3, 7.4.2.2-2, and 7.4.2.2-3, because the applicable tests for RedCap are specified in Applicability rule in R4-2212890.  |
| Huawei: OK with Ericsson’s proposal |
| Apple: It seems CBW should be revised in Table 5.4.1.2-2 |
| R4-2213905 (MediaTek inc.) | **Title: Draft CR to TS38.101-4, addition of PDCCH requirements for RedCap Ues** |
| Ericsson: What is the difference between R.PDCCH.2-1.5 TDD and R.PDCCH.2-1.6 TDD? If both FRCs are same, we only need to define one FRC and it can be used from 1Rx and 2Rx requirements.  |
| MediaTek: Thanks for the comments from Ericsson. We agree that R.PDCCH.2-1.5 TDD can be used for both 1Rx and 2Rx requirements. We will modify it in the later revision. |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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| --- | --- |
|  | **Status summary**  |
| **Issue 2-1-1: Define 256QAM demodulation requirements for 1Rx RedCap UE in FR1 or not. If defined, what is the MCS?** | **Agreements:*** Define 256QAM demodulation requirements for 1Rx RedCap UE in FR1.
	+ Set MCS20

**Recommendation for 2nd round:**No discussionAdd this test case in the revision of draft CR R4-2211835. |

### CRs/TPs

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| R4-2211835 (Apple) | To be revised |
| R4-2212890 (Huawei, HiSilicon) | To be revised |
| R4-2213795 (Huawei, HiSilicon) | To be revised |
| R4-2213794 (Huawei, HiSilicon) | To be revised |
| R4-2213905 (MediaTek inc.) | To be revised |

## Discussion on 2nd round

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| Revision of R4-2211835, Apple | **Title: Draft CR PDSCH demodulation requirements for RedCap** |
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| Revision of R4-2212890, Ericsson | **Title: draft CR: Applicability of RedCap UE demodulation requirements** |
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| Revision of R4-2213795, Huawei, HiSilicon | **Title: draftCR for introduction on sustained downlink data rate provided by lower layers for RedCap** |
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| Revision of R4-2213794, Huawei, HiSilicon | **Title: Draft CR Introduction of PBCH performamce requirements for RedCap** |
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| Revision of R4-2213905, MediaTek inc. | **Title: Draft CR to TS38.101-4, addition of PDCCH requirements for RedCap Ues** |
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## Summary for 2nd round

# Topic #3: CSI reporting requirements

## Companies’ contributions summary

See 1.1

## Open issues summary

### Sub-topic 3-1 CQI reporting requirements

**Issue 3-1-1: CQI feedback scheduling pattern in static/fading condition (periodic CSI reporting) for both FD-FDD and HD-FDD**

* Proposals
	+ Option 1 (Huawei, Apple, Nokia):
		- CSI-RS periodicity and offset: **10/1**
		- CSI-Report periodicity and offset: 10/9
		- CQI/RI/PMI delay: **14ms**
	+ Option 2 (Qualcomm, Nokia):
		- CSI-RS periodicity and offset: **10/1**
		- CSI-Report periodicity and offset: 10/9
		- CQI/RI/PMI delay: **10ms**
	+ Option 3 (Ericsson):
		- CSI-RS periodicity and offset: **10/5**
		- CSI-Report periodicity and offset: 10/9
		- CQI/RI/PMI delay: **10ms**
* Recommended WF
	+ The differences among options are the slot offset of CSI-RS resource for CSI acquisition and CQI/RI/PMI delay.
	+ Three companies prefer Option 1. Moderator would like to ask companies if there any technical concern for **Option 1**.

**Issue 3-1-2: Lower test points for CQI reporting test in fading condition for 2Rx (FR1 FDD and TDD)**

* Proposals
	+ Option 1 (Ericsson, Qualcomm): SNR=6/7 dB
		- Option 1a (Nokia): select the test points according to the majority view
* Recommended WF
	+ Set SNR=6/7dB for lower test points for CQI reporting test in fading condition for 2Rx

**Issue 3-1-3: Static channel matrix used for 1Rx UE and SNR test points for CQI reporting tests**

**Agreement from the last meeting:** Define the codebookSubsetRestriction for 2T1R to avoid the equivalent channel matrix is 0. Set codebookSubsetRestriction to 000001 if H = [1 1] is used. Set test points for CQI reporting test in static condition for 1Rx is XdB lower than 2Rx case, where X=3dB.

* Proposals
	+ Option 1 (Qualcomm):
		- Set the static channel matrix in the frequency domain as $H\_{1RX}=\left[\begin{matrix}1&j\end{matrix}\right]$.
		- If $H\_{1RX}=\left[\begin{matrix}1&j\end{matrix}\right]$ is used, set the same SNR test points for 1Rx and 2Rx UE CQI reporting tests in static condition, that is X=0dB.
	+ Option 2 (Current assumption):
		- Set the static channel matrix in the frequency domain as $H\_{1RX}=\left[\begin{matrix}1&1\end{matrix}\right]$.
		- Keep X=3dB.
* Recommended WF
	+ Collect the companies view on the proposal by Qualcomm.

**Issue 3-1-4: Mapping of CQI index to information bit payload**

* Proposals (Nokia)
	+ FR1:
		- Reuse value 0 for the overhead parameter for TBS determination
		- Set 52RB for 10MHz/15kHz and 51RB for 20MHz/30kHz.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TBS Scheme | TBS.1-1 | TBS.1-2 | TBS.1-X1 | TBS.1-X2 | TBS.1-X3 | TBS.1-X4 |
| MCS table | 64QAM |
| Number of allocated PDSCH resource blocks | 66 | 66 | 52 | 52 | 51 | 51 |
| Number of consecutive PDSCH symbols | 12 | 12 | 12 | 12 | 12 | 12 |
| Number of PDSCH MIMO layers | 1 | 2 | 1 | 2 | 1 | 2 |
| Number of DMRS Res (Note 1) | 24 | 24 | 24 | 24 | 24 | 24 |
| Overhead for TBS determination | 6 | 6 | 0 | 0 | 0 | 0 |
| Available RE-s | 7590 | 7590 | 6240 | 6240 | 6120 | 6120 |
| CQI index | Spectral efficiency | MCS index | Modulation | Information Bit Payload per Slot |
| 0 | OOR | OOR | OOR | N/A | N/A | N/A | N/A | N/A | N/A |
| 1 | 0.2344 | 0 | QPSK | 1800 | 3624 | 1480 | 2976 | 1480 | 2856 |
| 2 | 0.2344 | 0 | 1800 | 3624 | 1480 | 2976 | 1480 | 2856 |
| 3 | 0.3770 | 2 | 2856 | 5640 | 2408 | 4744 | 2408 | 4616 |
| 4 | 0.6016 | 4 | 4480 | 8968 | 3752 | 7424 | 3752 | 7296 |
| 5 | 0.8770 | 6 | 6528 | 13064 | 5504 | 11016 | 5376 | 10760 |
| 6 | 1.1758 | 8 | 8712 | 17928 | 7296 | 14600 | 7168 | 14344 |
| 7 | 1.4766 | 11 | 16QAM | 11016 | 22032 | 9224 | 18432 | 8968 | 17928 |
| 8 | 1.9141 | 13 | 14344 | 28680 | 12040 | 24072 | 11784 | 23568 |
| 9 | 2.4063 | 15 | 17928 | 35856 | 15112 | 30216 | 14600 | 29192 |
| 10 | 2.7305 | 18 | 64QAM | 20496 | 40976 | 16896 | 33816 | 16896 | 33816 |
| 11 | 3.3223 | 20 | 25104 | 50184 | 20496 | 40976 | 20496 | 40976  |
| 12 | 3.9023 | 22 | 29192 | 58384 | 24576 | 49176 | 24072 | 48168 |
| 13 | 4.5234 | 24 | 33816 | 67584 | 28168 | 56368 | 27656 | 55304 |
| 14 | 5.1152 | 26 | 38936 | 77896 | 31752 | 63528 | 31240 | 62504 |
| 15 | 5.5547 | 28 | 42016 | 83976 | 34816 | 69672 | 33816 | 67584 |
| Note 1: Number of DMRS Res includes the overhead of the DM-RS CDM groups without dataNote 2: PDSCH is not scheduled on slots containing CSI-RS for tracking, CSI-RS for CSI acquisition and CSI-RS for beam refinement or slots which are not full DLNote 3: PDSCH is not scheduled on slots containing PBCH, i.e. slot#0 per 20ms periodicityNote 4: Spectral efficiency is based on MCS Table defined in Table 5.1.3.1-1 of TS 38.214 [12]Note 5: TBS.1-3, TBS.1-4, TBS.1-5 and TBS.1-6 are applicable to RedCap UE. |

* + FR2
		- Reuse existing test for CQI reporting under static condition in clause 8.2.2.2.1 and corresponding CSI RMC for RedCap UE in FR2-1
* Recommended WF
	+ Companies are encouraged to review the mapping of CQI index to information bit payload proposed by Nokia.

### Sub-topic 3-2 PMI reporting requirements

**Issue 3-2-1: PMI feedback scheduling pattern (aperiodic CSI reporting) for both FD-FDD and HD-FDD**

* Proposals (Huawei, Apple, Ericsson)
	+ CSI request: 1 in slots I, where mod(I, 5) = 1, otherwise it is equal to.
		- Reuse the FRC from Rel-15 PMI test (R.PDSCH 1-6.1 FDD)
	+ Aperiodic Report Slot Offset: 3 slots
	+ CQI/RI/PMI delay: 6ms
* Recommended WF
	+ Agree with the proposal

### Sub-topic 3-3 RI reporting requirements

**Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx uEs**

* Proposals
	+ Option 1: Define RI reporting requirements
		- Option 1a (Nokia, Ericsson): Apply Test 2 only.
		- Option 1b (Qualcomm): Apply 3 tests.
		- RI reporting is the mandatory capability for RedCap UE. It is necessary to verify 2 Rx RedCap UE reports the appropriate MIMO rank.
	+ Option 2 (Huawei, Apple): Not define RI reporting requirements
		- To reduce the testing burden on a low-complexity device.
		- RI reporting test is only applicable for 2Rx UE and 2 layers which is still subject to the reported UE capability.
		- Performance gain with following RI is limited according to the exiting RI requirements, and in some cases, the negative performance gain can be observed
* Recommended WF
	+ Collect views from companies. To avoid repeating the same discussion, the moderator would like to address the arguments above.
* Moderator: Conclusion of GTW discussion on August 18th.
	+ Agreement: Replace fading CQI test for 2 Rx UE (high SNR point) by RI test case (Test 2)
	+ Based on the agreement, no discussions are needed.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | **Issue 3-1-1: CQI feedback scheduling pattern in static/fading condition (periodic CSI reporting) for both FD-FDD and HD-FDD****Issue 3-1-2: Lower test points for CQI reporting test in fading condition for 2Rx (FR1 FDD and TDD)****Issue 3-1-3: Static channel matrix used for 1Rx UE and SNR test points for CQI reporting tests.** **Issue 3-1-4: Mapping of CQI index to information bit payload****Issue 3-2-1: PMI feedback scheduling pattern (aperiodic CSI reporting) for both FD-FDD and HD-FDD****Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx uEs** |
| Ericsson | **Issue 3-1-1: CQI feedback scheduling pattern in static/fading condition (periodic CSI reporting) for both FD-FDD and HD-FDD**We are ok with Option 1.**Issue 3-1-2: Lower test points for CQI reporting test in fading condition for 2Rx (FR1 FDD and TDD)**Support the recommended WF. **Issue 3-1-3: Static channel matrix used for 1Rx UE and SNR test points for CQI reporting tests.** The existing 2T2R channel matrix used for CQI reporting test is to provide the orthogonal channel suitable for reporting CQI index with rank 2. For 1Rx case, it only requires reporting CQI index with rank 1, we have no strong view either [1 1] or [1 j].We slight prefer to keep the original proposal (i.e., Option 2) to avoid to rerun the simulation to verify the performance. **Issue 3-1-4: Mapping of CQI index to information bit payload**We also have the same table. Support this table. **Issue 3-2-1: PMI feedback scheduling pattern (aperiodic CSI reporting) for both FD-FDD and HD-FDD**Support the recommended WF. **Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx uEs**We support Option 1a. We tend to agree the Rank 2 reporting functionality cannot be verified with PDSCH/SDR or CQI/PMI reporting tests, and RI reporting is the mandatory feature even for RedCap. On the other hand, we also understand the concern on the increase of the number of tests for RedCap uEs. Since the proponents of RI test are mainly interested in rank 2 reporting functionality, our compromised proposal is to reuse Test 2 (follow RI / fix RI=1 at high SNR test point) only.  |
| Huawei | **Issue 3-1-1: CQI feedback scheduling pattern in static/fading condition (periodic CSI reporting) for both FD-FDD and HD-FDD**Option 1**Issue 3-1-2: Lower test points for CQI reporting test in fading condition for 2Rx (FR1 FDD and TDD)**Option 1 is OK for us**Issue 3-1-3: Static channel matrix used for 1Rx UE and SNR test points for CQI reporting tests.** We prefer [1 1] to follow previous agreements.**Issue 3-1-4: Mapping of CQI index to information bit payload**OK with this table**Issue 3-2-1: PMI feedback scheduling pattern (aperiodic CSI reporting) for both FD-FDD and HD-FDD**Support the recommended WF.**Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx uEs**Option 2.  |
| MediaTek | **Issue 3-1-1: CQI feedback scheduling pattern in static/fading condition (periodic CSI reporting) for both FD-FDD and HD-FDD**Apple mentioned in the Todc “Delay of 10ms or 14ms is indifferent to UE, implies equivalent performance”. However, according to the simulation results provided by Ericsson, there is performance difference for delay of 14ms and 10 ms. Therefore, we propose that companies can provide simulations in the next meeting to check if the performance degradation can be acceptable and then determine the delay.**Issue 3-1-2: Lower test points for CQI reporting test in fading condition for 2Rx (FR1 FDD and TDD)**Support the recommended WF.**Issue 3-1-3: Static channel matrix used for 1Rx UE and SNR test points for CQI reporting tests.** We have no strong view for both Options. The proposal from Qualcomm is OK to us but we slightly prefer keeping the previous agreements to avoid rerunning the simulation. **Issue 3-1-4: Mapping of CQI index to information bit payload**OK with the proposed Table.**Issue 3-2-1: PMI feedback scheduling pattern (aperiodic CSI reporting) for both FD-FDD and HD-FDD**OK with the recommended WF.**Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx uEs**Prefer option 2 as RI reporting test is only applicable for 2Rx UE and 2 layers. |
| Apple | **Issue 3-1-1: CQI feedback scheduling pattern in static/fading condition (periodic CSI reporting) for both FD-FDD and HD-FDD**Our proposal is based on 10/1 and 10/9 as CSI Resource and Report Periodicity/Offset respectively. We support the majority view on 14ms of delay, Option 1, but we may also consider a 10ms delay. This, since the issue between 14ms or 10ms is only a slight performance difference of the test setup. This does not produce any actual burden to the UE. We want to note that the performance difference reported by Ericsson is rather minor, and that it also corresponds to a different CSI Resource Periodicity. **Issue 3-1-2: Lower test points for CQI reporting test in fading condition for 2Rx (FR1 FDD and TDD)**We support the recommended WF.**Issue 3-1-3: Static channel matrix used for 1Rx UE and SNR test points for CQI reporting tests.** We have no strong view on these options. It would be better to keep the previous agreement to avoid re-running simulations and avoid extending the discussion.**Issue 3-1-4: Mapping of CQI index to information bit payload**We support the table proposed by Nokia.**Issue 3-2-1: PMI feedback scheduling pattern (aperiodic CSI reporting) for both FD-FDD and HD-FDD**We agree with the recommended WF.**Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx uEs**We remain in our position of Option 2 of not defining RI reporting requirements. |
| Nokia | **Issue 3-1-1: CQI feedback scheduling pattern in static/fading condition (periodic CSI reporting) for both FD-FDD and HD-FDD**We are fine with Option 1 and support moderator’s suggested WF.**Issue 3-1-2: Lower test points for CQI reporting test in fading condition for 2Rx (FR1 FDD and TDD)**We are fine with the recommended WF.**Issue 3-1-3: Static channel matrix used for 1Rx UE and SNR test points for CQI reporting tests.** We understand the rationale in Qualcomm’s proposal. We have a slight preference for keeping current working assumption to avoid additional simulation efforts, but no strong view from our side.**Issue 3-1-4: Mapping of CQI index to information bit payload**We support the proposals.**Issue 3-2-1: PMI feedback scheduling pattern (aperiodic CSI reporting) for both FD-FDD and HD-FDD**We support the recommended WF.**Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx uEs**We support the GTW agreement. |
| Qualcomm | **Issue 3-1-1: CQI feedback scheduling pattern in static/fading condition (periodic CSI reporting) for both FD-FDD and HD-FDD**We are fine with option 1 as well;**Issue 3-1-2: Lower test points for CQI reporting test in fading condition for 2Rx (FR1 FDD and TDD)**Support WF**Issue 3-1-3: Static channel matrix used for 1Rx UE and SNR test points for CQI reporting tests**According to the comments received most companies would be okay with the change but would prefer to stick to the current agreements to avoid repeating simulations, and we understand this position considering the workload.Still, we’d like other companies to consider that the choice for this static channel matrix is not in line with the rest of the static matrixes used in the rest of the TS 38.101-4, and the +3dB SNR approach to the AWGN CQI testing we are using can be considered not transparent for readers that have not been exposed to this discussion. Can we further check in the second round whether we could collaborate on this correction?**Issue 3-1-4: Mapping of CQI index to information bit payload**Ok with the proposal;**Issue 3-2-1: PMI feedback scheduling pattern (aperiodic CSI reporting) for both FD-FDD and HD-FDD**Support WF; |

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2212891 (Ericsson) | **Title: draft CR: Applicability of RedCap UE CSI reporting requirements** |
| Ericsson: Update the clause numbers. |
|  |
|  |
| R4-2213072 (Nokia, Nokia Shanghai Bell) | **Title: Channel quality reporting for RedCap under static condition** |
| Ericsson: As it is proposed in WF R4-2210672, not use suffix ‘B’. We suggest to use the following section numbers for CQI reporting requirements in static condition.

|  |  |  |
| --- | --- | --- |
| 6.2.1  |   1RX requirements  |   |
|  | 6.2.1.1  FDD  |   |
| 6.2.1.1.1  |       CQI reporting definition under AWGN conditions |   |
| 6.2.1.1.1.1  |         Minimum requirement for periodic CQI reporting for RedCap  | New section  |
|  | 6.2.1.2  TDD  |   |
| 6.2.1.2.1  |       CQI reporting definition under AWGN conditions |   |
| 6.2.1.2.1.1  |         Minimum requirement for periodic CQI reporting for RedCap  | New section  |
| 6.2.2  |   2RX requirements  |   |
|  | 6.2.2.1  FDD  |   |
| 6.2.2.1.1  |       CQI reporting definition under AWGN conditions |   |
| 6.2.1.1.1.4 |         Minimum requirement for periodic CQI reporting for RedCap  | New section  |
|  | 6.2.2.2  TDD  |   |
| 6.2.2.2.1  |       CQI reporting definition under AWGN conditions |   |
| 6.2.2.2.1.5 |         Minimum requirement for periodic CQI reporting for RedCap  | New section  |

Regarding the HD-FDD, since we agreed to configure the common CSI reporting configurations for both full-duplex FDD and HD-FDD, one requirement (e.g., 6.2.1.1.1.1) can cover both FD-FDD and HD-FDD. See R4-2213968 as the example. Also we **don’t** need to define HD-FDD UL-DL pattern below. For example, if you look eMTC requirements in TS36.101, the requirements are set for both HD-FDD and FD-FDD, but no HD-FDD pattern is specified in the spec. The test parameters (e.g., CSI-RS periodicity/offset and CSI-Report periodicity/offset) are sufficient. See R4-2213796 also as another example. |
| Nokia: Thanks for the comments, we will update the draft CR accordingly. |
|  |
| R4-2213797 (Huawei, HiSilicon) | **Title: draftCR for introduction on static propagation condition** |
| Ericsson: It depends on the conclusion from Issue 3-1-3. |
|  |
|  |
| R4-2213968 (Qualcomm Incorporated) | **Title: draftCR for RedCapUE CQI Fading Reporting Requirements** |
| Ericsson: Regarding the section numbers, to align with other requirements, we suggest to changes as follows. <1Rx>6.2.1.1.2 CQI reporting under fading conditions ~~for RedCap uEs~~ 6.2.1.1.2.1 Minimum requirement for wideband CQI reporting for RedCap uEs6.2.1.2.2 CQI reporting under fading conditions ~~for RedCap uEs~~ 6.2.1.2.2.1 Minimum requirement for wideband CQI reporting for RedCap uEs<2Rx>~~6.2.2.1.3 CQI reporting under fading conditions for RedCap uEs~~6.2.2.1.1.4 Minimum requirement for wideband CQI reporting for RedCap uEs~~6.2.2.2.3 CQI reporting under fading conditions for RedCap uEs~~6.2.2.2.2.4 Minimum requirement for wideband CQI reporting for RedCap uEsSame comment as R4-2213072, we **don’t** need to define HD-FDD UL-DL pattern below.For example, if you look eMTC requirements in TS36.101, the requirements are set for both HD-FDD and FD-FDD, but no HD-FDD pattern is specified in the spec. The test parameters (e.g., CSI-RS periodicity/offset and CSI-Report periodicity/offset) are sufficient. See R4-2213796 also as another example. |
| Huawei: Please change “RedCap UE” to “RedCap”. |
| MediaTek: The CQI table is “Table 1”. Also, we might use 5/0 for CSI-Report periodicity and offset in Table 6.2.1.1.2.1-1 as we only consider HD-FDD for 1Rx UE now. |
| Ericsson2: According to the GTW conclusion, please remove ‘Test 2’ from 2Rx cases. |
| Qualcomm: We’ll provide a revised draft in the 2nd round based on the received comments and latest GTW agreements; |
| R4-2213796 (Huawei, HiSilicon) | **Title: draftCR for introduction on reporting of Precoding Matrix Indicator (PMI) for RedCap** |
| Ericsson:‘Test 1 is also applicable for RedCap.’ is not necessary from 6.3.2.1.1, because it is captured in the applicability rule in R4-2212891.‘Test 2 is also applicable for RedCap.’ is not necessary from 8.3.2.2.1, because it is captured in the applicability rule in R4-2212891.It looks many cells are empty in FRC R.PDSCH.2-8.4 TDD, e.g. information bits, code blocks, channel bits. Please fix it. |
| Huawei: Thanks, we will update it. |
| MediaTek: The antenna configuration for 1Rx is 4x1 ULA high. |
| R4-2213074 (Nokia, Nokia Shanghai Bell) | **Title: Rank Indicator reporting for RedCap** |
| Moderator: Depends on the conclusion on Issue 3-3-1. |
| Nokia: Based on GTW agreement to introduce RI reporting requirements, comments on the draft CR are invited. |
| Ericsson2: Same comment as R4-2213072. Not use the suffix ‘A’.Maybe we can specify the requirements under the following sections:6.4.2.1.1: Minimum requirements for RedCap6.4.2.2.1: Minimum requirements for RedCap |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Issue 3-1-1: CQI feedback scheduling pattern in static/fading condition (periodic CSI reporting) for both FD-FDD and HD-FDD** | **Candidate options:*** Option 1:
	+ CSI-RS periodicity and offset: 10/1
	+ CSI-Report periodicity and offset: 10/9
	+ CQI/RI/PMI delay: **14ms**
* Option 2:
	+ CSI-RS periodicity and offset: 10/1
	+ CSI-Report periodicity and offset: 10/9
	+ CQI/RI/PMI delay: **10ms**

**Tentative agreements:**The difference between Option 1 and Option 2 is the CQI/PMI/RI delay. Most companies accept Option 1, but some company has concern on the performance degradation (lower throughput gain) due to longer CQI delay compared with 10ms. The moderator proposes the following agreement:* Configure the following parameters for CQI feedback scheduling pattern in static/fading condition (periodic CSI reporting) for both FD-FDD and HD-FDD:
	+ CSI-RS periodicity and offset: 10/1
	+ CSI-Report periodicity and offset: 10/9
	+ CQI/RI/PMI delay: [14ms]
	+ Interested companies are encouraged to evaluate the performance difference between CQI delay 14ms and 10ms in RAN4#104-bis-e. If significant performance degradation is observed compared with CQI delay 10ms, RAN4 will revisit the CQI/RI/PMI delay.

**Recommendations for 2nd round:**Check the tentative agreement is accepted. |
| **Issue 3-1-2: Lower test points for CQI reporting test in fading condition for 2Rx (FR1 FDD and TDD)** | **Agreements:*** Set SNR=6/7dB for lower test points for CQI reporting test in fading condition for 2Rx

**Recommendations for 2nd round:**No discussion |
| **Issue 3-1-3: Static channel matrix used for 1Rx UE and SNR test points for CQI reporting tests** | **Candidate options:*** Option 1:
	+ Set the static channel matrix in the frequency domain as $H\_{1RX}=\left[\begin{matrix}1&j\end{matrix}\right]$
	+ X=0dB
* Option 2:
	+ Set the static channel matrix in the frequency domain as $H\_{1RX}=\left[\begin{matrix}1&1\end{matrix}\right]$
	+ X=3dB

**Tentative agreements:**Most companies prefer to keep the previous agreement (Option 2), but no strong view to use Option 1. The proponent of Option 1 wants to discuss more in the 2nd round. **Recommendations for 2nd round:**Discuss the following options for the static channel matrix and SNR test point offset applied for 1Rx UE CQI reporting tests. Set SNR test point X dB lower than 2Rx test case.* Option 1: Set the static channel matrix in the frequency domain as$H\_{1RX}=\left[\begin{matrix}1&j\end{matrix}\right]$. Set X=[0]dB.
	+ This channel matrix is aligned with TS38.101-4 B.1.
	+ May need to rerun the simulation to verify X=0dB with this channel matrix.
* Option 2: Keep the previous agreement on static channel matrix in the frequency domain, that is,$H\_{1RX}=\left[\begin{matrix}1&1\end{matrix}\right]$. Set X=3dB.
 |
| **Issue 3-1-4: Mapping of CQI index to information bit payload** | **Agreements:**For RedCap CSI reporting test using CQI table 1, apply the following configuration for mapping of CQI index to information bit payload:* FR1
	+ Reuse value 0 for the overhead parameter for TBS determination
	+ Set 52RB for 10MHz/15kHz and 51RB for 20MHz/30kHz

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| TBS Scheme | TBS.1-1 | TBS.1-2 | TBS.1-X1 | TBS.1-X2 | TBS.1-X3 | TBS.1-X4 |
| MCS table | 64QAM |
| Number of allocated PDSCH resource blocks | 66 | 66 | 52 | 52 | 51 | 51 |
| Number of consecutive PDSCH symbols | 12 | 12 | 12 | 12 | 12 | 12 |
| Number of PDSCH MIMO layers | 1 | 2 | 1 | 2 | 1 | 2 |
| Number of DMRS Res (Note 1) | 24 | 24 | 24 | 24 | 24 | 24 |
| Overhead for TBS determination | 6 | 6 | 0 | 0 | 0 | 0 |
| Available RE-s | 7590 | 7590 | 6240 | 6240 | 6120 | 6120 |
| CQI index | Spectral efficiency | MCS index | Modulation | Information Bit Payload per Slot |
| 0 | OOR | OOR | OOR | N/A | N/A | N/A | N/A | N/A | N/A |
| 1 | 0.2344 | 0 | QPSK | 1800 | 3624 | 1480 | 2976 | 1480 | 2856 |
| 2 | 0.2344 | 0 | 1800 | 3624 | 1480 | 2976 | 1480 | 2856 |
| 3 | 0.3770 | 2 | 2856 | 5640 | 2408 | 4744 | 2408 | 4616 |
| 4 | 0.6016 | 4 | 4480 | 8968 | 3752 | 7424 | 3752 | 7296 |
| 5 | 0.8770 | 6 | 6528 | 13064 | 5504 | 11016 | 5376 | 10760 |
| 6 | 1.1758 | 8 | 8712 | 17928 | 7296 | 14600 | 7168 | 14344 |
| 7 | 1.4766 | 11 | 16QAM | 11016 | 22032 | 9224 | 18432 | 8968 | 17928 |
| 8 | 1.9141 | 13 | 14344 | 28680 | 12040 | 24072 | 11784 | 23568 |
| 9 | 2.4063 | 15 | 17928 | 35856 | 15112 | 30216 | 14600 | 29192 |
| 10 | 2.7305 | 18 | 64QAM | 20496 | 40976 | 16896 | 33816 | 16896 | 33816 |
| 11 | 3.3223 | 20 | 25104 | 50184 | 20496 | 40976 | 20496 | 40976  |
| 12 | 3.9023 | 22 | 29192 | 58384 | 24576 | 49176 | 24072 | 48168 |
| 13 | 4.5234 | 24 | 33816 | 67584 | 28168 | 56368 | 27656 | 55304 |
| 14 | 5.1152 | 26 | 38936 | 77896 | 31752 | 63528 | 31240 | 62504 |
| 15 | 5.5547 | 28 | 42016 | 83976 | 34816 | 69672 | 33816 | 67584 |
| Note 1: Number of DMRS Res includes the overhead of the DM-RS CDM groups without dataNote 2: PDSCH is not scheduled on slots containing CSI-RS for tracking, CSI-RS for CSI acquisition and CSI-RS for beam refinement or slots which are not full DLNote 3: PDSCH is not scheduled on slots containing PBCH, i.e. slot#0 per 20ms periodicityNote 4: Spectral efficiency is based on MCS Table defined in Table 5.1.3.1-1 of TS 38.214 [12]Note 5: TBS.1-3, TBS.1-4, TBS.1-5 and TBS.1-6 are applicable to RedCap UE. |

* FR2
	+ Reuse existing test for CQI reporting under static condition in clause 8.2.2.2.1 and corresponding CSI RMC for RedCap UE in FR2-1

**Recommendations for 2nd round:**No discussion |
| **Issue 3-2-1: PMI feedback scheduling pattern (aperiodic CSI reporting) for both FD-FDD and HD-FDD** | **Agreements:**Configure the following parameters for PMI reporting tests for both FD-FDD and HD-FDD:* CSI request: 1 in slots I, where mod(i, 5) = 1, otherwise it is equal to.
	+ Reuse the FRC from Rel-15 PMI test (R.PDSCH 1-6.1 FDD)
* Aperiodic Report Slot Offset: 3 slots
* CQI/RI/PMI delay: 6ms

**Recommendations for 2nd round:**No discussion |
| **Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx uEs** | **Agreement in in GTW discussion 2022-08-18)** * Agreement: Replace fading CQI test for 2 Rx UE (high SNR point) by RI test case (Test 2)

**Recommendation for 2nd round:** Review the corresponding draft CR revisions |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| R4-2212891 (Ericsson) | To be revised  |
| R4-2213072 (Nokia, Nokia Shanghai Bell) | To be revised  |
| R4-2213797 (Huawei, HiSilicon) | To be revised (depending on the conclusion of Issue 3-1-2) |
| R4-2213968 (Qualcomm Incorporated) | To be revised  |
| R4-2213796 (Huawei, HiSilicon) | To be revised  |
| R4-2213074 (Nokia, Nokia Shanghai Bell) | To be revised  |

## Discussion on 2nd round

### Open issues Open issues and companies views’ collection

**Issue 3-1-1: CQI feedback scheduling pattern in static/fading condition (periodic CSI reporting) for both FD-FDD and HD-FDD**

* Proposals
	+ Configure the following parameters for CQI feedback scheduling pattern in static/fading condition (periodic CSI reporting) for both FD-FDD and HD-FDD:
		- CSI-RS periodicity and offset: 10/1
		- CSI-Report periodicity and offset: 10/9
		- CQI/RI/PMI delay: [14ms]
		- Interested companies are encouraged to evaluate the performance difference between CQI delay 14ms and 10ms in RAN4#104-bis-e. If significant performance degradation is observed compared with CQI delay 10ms, RAN4 will revisit the CQI/RI/PMI delay.
* Recommended WF
	+ Discuss if proposals are agreed.

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| **Company** | **Comments** |
| MediaTek | We are fine with the proposal to evaluate whether CQI/RI/PMI delay = 14 ms is acceptable. Also, we would like to confirm that if the above configurations are also applied for 2Rx HD-FDD (if agreed to introduce requirements). |
| Ericsson | We support the proposal. To MediaTek: your understanding is correct. The intention of this scheduling to apply the common configuration for both HD-FDD and FD-FDD tests, according to the WF R4-2210672 (RAN4#103-e):* Introduce demodulation/CSI requirements covering both FD-FDD and HD-FDD
	+ For CSI requirements, configure the following CSI feedback scheduling pattern applicable for both FD-FDD and HD-FDD

Note the configuration agreed in Issue 3-2-1 (for PMI test) can also apply to both FD-FDD and HD-FDD.  |
| Huawei | We are fine to check the performance with 14ms delay in next meeting. Additionally. If 10ms delay is used, we prefer to use the pattern introduced in R4-2212894 (Ericsson). Because the proposed pattern.I.e. CSI-RS periodicity and offset: 10/1, CSI-Report periodicity and offset: 10/9 only give BS 1 slot to process CSI which seems not practical.We prefer to check the performance with following cases:* Option 1:
	+ - CSI-RS periodicity and offset: **10/5**
		- CSI-Report periodicity and offset: 10/9
		- CQI/RI/PMI delay: **10ms**
* Option 2:
	+ - CSI-RS periodicity and offset: 10/1
		- CSI-Report periodicity and offset: 10/9
		- CQI/RI/PMI delay: 14

If large performance degradation for 14ms is observed, then we can go with option 1, otherwise we can go with option 2. |

**Issue 3-1-3: Static channel matrix used for 1Rx UE and SNR test points for CQI reporting tests**

* Proposals
	+ Option 1: Set the static channel matrix in the frequency domain as$H\_{1RX}=\left[\begin{matrix}1&j\end{matrix}\right]$. Set X=[0]dB:
		- This channel matrix is aligned with TS38.101-4 B.1.
		- May need to rerun the simulation to verify X=0dB with this channel matrix.
	+ Option 2: Keep the previous agreement on static channel matrix in the frequency domain, that is,$H\_{1RX}=\left[\begin{matrix}1&1\end{matrix}\right]$. Set X=3dB.
* Recommended WF
	+ Discuss the above options for the static channel matrix and SNR test point offset applied for 1Rx UE CQI reporting tests. Set SNR test point X dB lower than 2Rx test case.
	+ Since most companies prefer Option 2, the moderator suggests the proponent of Option 1 presents the technical benefit.

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| **Company** | **Comments** |
| Ericsson | We prefer Option 2, if no companies support Option 1 during the 2nd round.  |
| Huawei | We prefer option 2 to keep previous agreements. |

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| Revision of R4-2212891, Ericsson | **Title: draft CR: Applicability of RedCap UE CSI reporting requirements** |
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| Revision of R4-2213072, Nokia, Nokia Shanghai Bell | **Title: Channel quality reporting for RedCap under static condition** |
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| Revision of R4-2213797, Huawei, HiSilicon | **Title: draftCR for introduction on static propagation condition** |
| Moderator: It depends on the conclusion from Issue 3-1-3. |
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| Revision of R4-2213968, Qualcomm Incorporated | **Title: draftCR for RedCapUE CQI Fading Reporting Requirements** |
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| Revision of R4-2213796, Huawei, HiSilicon | **Title: draftCR for introduction on reporting of Precoding Matrix Indicator (PMI) for RedCap** |
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| Revision of R4-2213074, Nokia, Nokia Shanghai Bell | **Title: Rank Indicator reporting for RedCap** |
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## Summary for 2nd round

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
|  | WF on RedCap UE demodulation and CQI reporting requirements | Ericsson |  |
|  | Big CR to 38.101-4: Introduction of RedCap UE demodulation and CSI reporting requirements | Ericsson | For email approval |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-2211835 |  | Draft CR PDSCH demodulation requirements for RedCap | Apple | Revised |  |
| R4-2212890 |  | draft CR: Applicability of RedCap UE demodulation requirements | Ericsson | Revised |  |
| R4-2213795 |  | draftCR for introduction on sustained downlink data rate provided by lower layers for RedCap | Huawei, HiSilicon | Revised |  |
| R4-2213794 |  | Draft CR Introduction of PBCH performamce requirements for RedCap | Huawei, HiSilicon | Revised |  |
| R4-2213905 |  | Draft CR to TS38.101-4, addition of PDCCH requirements for RedCap UEs | MediaTek inc. | Revised |  |
| R4-2212891 |  | draft CR: Applicability of RedCap UE CSI reporting requirements | Ericsson | Revised |  |
| R4-2213072 |  | Channel quality reporting for RedCap under static condition | Nokia, Nokia Shanghai Bell | Revised |  |
| R4-2213797 |  | draftCR for introduction on static propagation condition | Huawei, HiSilicon | Revised | Depending on the conclusion of Issue 3-1-2 |
| R4-2213968 |  | draftCR for RedCapUE CQI Fading Reporting Requirements | Qualcomm Incorporated | Revised |  |
| R4-2213796 |  | draftCR for introduction on reporting of Precoding Matrix Indicator (PMI) for RedCap | Huawei, HiSilicon | Revised |  |
| R4-2213074 |  | Rank Indicator reporting for RedCap | Nokia, Nokia Shanghai Bell | Revised |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

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| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents