**3GPP TSG-RAN WG4 Meeting # 102-e R4-2207451**

**Electronic Meeting, 21st February – 3rd March 2022**

**Agenda item:** 10.20.4

**Source:** Moderator (Ericsson)

**Title:** Email discussion summary for [102-e][331] 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
* 2nd round: Continue to solve the remaining open issues. Discuss the detailed simulation assumptions.

When updating this document, please remember to:

* At the beginning of the first round, the moderator shares the summary in /ftp/tsg\_ran/WG4\_Radio/TSGR4\_102-e/Inbox/Drafts/[102-e][331] NR\_RedCap\_Demod/Round 2/Summary\_331\_2nd\_v00.docx
* After update by company A: Summary\_331\_2nd\_v01\_companyA.docx
* After update by company B: Summary\_331\_2nd\_v02\_companyA\_companyB.docx
* After update by company C: Summary\_331\_2nd\_v03\_companyB\_companyC.docx

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

## Companies’ contributions summary

### General (10.20.4 and 10.20.4.1)

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2205001 | CMCC | **Proposal 1:** For RedCap UE with 1Rx, define following test cases:  FDD 15KHz FR1   * QPSK: Type A, Table 5.2.2.1.1-3 Test 1-1, QPSK 0.30, TDLB100-400, 2Tx, Rank 1, 70% max TP * 16QAM: Type A, Table 5.2.2.1.1-3 Test 1-4, 16QAM 0.48, TDLC300-100, 2Tx, Rank 1, 70% max TP * 64QAM: Type A, Table 5.2.2.1.1-4 Test 2-1, 64QAM 0.5, TDLA30-10, 2Tx, Rank 1, 70% max TP * 256QAM MCS24: Type A, Table 5.2.2.1.1-3 Test 1-3?, 256QAM 0.82, TDLA30-10, 2Tx, Rank 1, 70% max TP   TDD 30KHz FR1   * QPSK: Type A, Table 5.2.2.2.1-3 Test 1-1, QPSK 0.30, TDLB100-400, 2Tx, Rank 1, 70% max TP * 16QAM: Type A, Table 5.2.2.2.1-3 Test 1-4, 16QAM 0.48, TLDC300-100, 2Tx, Rank 1, 70% max TP * 64QAM: Type A, Table 5.2.2.2.1-4 Test 2-1, 64QAM 0.50, TLDA30-1, 2Tx, Rank 1, 70% max TP * 256QAM MCS24: Type A, Table 5.2.2.1.1-3 Test 1-3?, 256QAM 0.82, TDLA30-10, 2Tx, Rank 1, 70% max TP   For TDD 120KHz FR2   * QPSK: Type A, Table 7.2.2.2.1-3 Test 1-1, QPSK 0.30, TDLC60-300, 2Tx, Rank 1, 70% max TP * 16QAM: Type A, Table 7.2.2.2.1-4 Test 2-2, 16QAM 0.48, TDLA30-300, 2Tx, Rank 1, 70% max TP * 64QAM: Type A, Table 7.2.2.2.1-4 Test 2-6, 64QAM 0.42, TDLA30-75, 2Tx, Rank 1, 70% max TP * 256QAM MCS20: Type A, Table 7.2.2.2.1-3 Test 1-4?, 256QAM 0.76, TDLD30-75, 2Tx, Rank 1, 70% max TP   **Proposal 2:** For RedCap UE with 2Rx, define following test cases:  FDD 15KHz FR1   * QPSK: Type A, Table 5.2.2.1.1-3 Test 1-1, QPSK 0.30, TDLB100-400, 2Tx, Rank 1, 70% max TP (Reuse) * 16QAM: Type A, Table 5.2.2.1.1-3 Test 1-4, 16QAM 0.48, TDLC300-100, 2Tx, Rank 1, 70% max TP (New with 70% of max TP) * 64QAM: Type A, Table 5.2.2.1.1-4 Test 2-1, 64QAM 0.5, TDLA30-10, 2Tx, Rank 2, 70% max TP (Reuse) * 256QAM MCS24: Type A, Table 5.2.2.1.1-3 Test 1-3?, 256QAM 0.82, TDLA30-10, 2Tx, Rank 1, 70% max TP   TDD 30KHz FR1   * QPSK: Type A, Table 5.2.2.2.1-3 Test 1-1, QPSK 0.30, TDLB100-400, 2Tx, Rank 1, 70% max TP (New with CBW=20MHz) * 16QAM: Type A, Table 5.2.2.2.1-3 Test 1-4, 16QAM 0.48, TLDC300-100, 2Tx, Rank 1, 70% max TP (New with CBW=20MHz) * 64QAM: Type A, Table 5.2.2.2.1-4 Test 2-1, 64QAM 0.50, TLDA30-1, 2Tx, Rank 2, 70% max TP (New with CBW=20MHz) * 256QAM MCS24: Type A, Table 5.2.2.2.1-3 Test 1-3?, 256QAM 0.82, TDLA30-10, 2Tx, Rank 1, 70% max TP (New with CBW=20MHz)   For TDD 120KHz FR2   * QPSK: Type A, Table 7.2.2.2.1-3 Test 1-1, QPSK 0.30, TDLC60-300, 2Tx, Rank 1, 70% max TP (Reuse) * 16QAM: Type A, Table 7.2.2.2.1-4 Test 2-2, 16QAM 0.48, TDLA30-300, 2Tx, Rank 2, 70% max TP (Reuse) * 64QAM: Type A, Table 7.2.2.2.1-4 Test 2-6, 64QAM 0.42, TDLA30-75, 2Tx, Rank 2, 70% max TP (Reuse) * 256QAM MCS20: Type A, Table 7.2.2.2.1-3 Test 1-4?, 256QAM 0.76, TDLD30-75, 2Tx, Rank 1, 70% max TP (Reuse)   **Proposal 3:** For RedCap PDCCH, define requirements for AL 4, AL8 and AL16 for FDD 15KHz, TDD 30KHz and TDD 120KHz respectively  **Proposal 4:** For RedCap PBCH, define the case with SS/PBCH index is known for 1Rx UE  **Proposal 5:** Define SDR tests for RedCap 1Rx/2Rx UE.  **Proposal 6:** Define 2Rx tests for CQI table 1 and CQI table 2 (reuse existing requirements)  **Proposal 7:** Define PMI reporting for both 1Rx and 2Rx RedCap with 4Tx and 8Tx configuration.  **Proposal 8:** Define RI tests for 2Rx RedCap UE. |
| R4-2205094 | Ericsson | **Proposal 1:** Set CBW=10MHz for RedCap 1Rx UE demodulation and CSI reporting requirements with SCS 15kHz in FR1 FDD.  **Proposal 2:** Define UE demodulation and CSI reporting requirements for RedCap 1Rx UE based on half-duplex FDD scheduling by reusing the existing TDD pattern FR1.15.1 (i.e., DDDSU).  **Proposal 3:** RAN4 sets the applicability rule that   * RedCap UE capable of the half-duplex FDD operation type A only test with the half-duplex FDD mode, and * RedCap UE not capable of the half-duplex FDD operation type A only test with the full-duplex FDD mode.   **Proposal 4:** Define UE demodulation and CSI requirements with 2Rx only for FR2 RedCap UE. |
| R4-2205600 | ZTE Corporation | * We propose to define CRS-IM Performance Requirements for Redcap UE with single receiver in Rel-17 to ensure that Redcap UE could have the same capability to handle LTE CRS interference similar as normal NR UE. * If there is no time for Rel-17 Redcap UE demod to support the CRS-IM, then it should be included in Rel-18 Demod package. |
| R4-2206074 | Qualcomm Incorporated | **Proposal 1:** Support Option 1, CBW = 10MHz for 1RX Demodulation and CSI reporting requirements for FR1 FDD with SCS=15kHz.  **Proposal 2:** Support introducing PDSCH requirements for QPSK, 16, 64QAM each for FR1 15kHz FDD, FR1 30kHz TDD, FR2 120kHz TDD with the rank/metric/channel parameters listed in [3] (Option 1).  **Proposal 3:** To reduce the simulation load, keep FFS 256QAM PDSCH requirements (optional feature) for RedCap.  **Proposal 4:** Support introducing PDCCH requirements for AL4 and AL8 each for FR1 15kHz FDD, FR1 30kHz TDD, FR2 120kHz TDD as proposed in [3] (Option 2).  **Proposal 5:** Regarding PDCCH requirements with AL16, we are open to supporting the introduction if there is interest also from other companies.  **Proposal 6:** To reduce the simulation load, we support not introducing PBCH requirements for UEs with 1 RX and with known SS/PBCH block index (Option 2).  **Observation 1:** The introduction of reduced capabilities UEs does not directly imply that the capabilities supported should not be verified.  **Proposal 7:** Regarding SDR requirements, support Option 1 and extend SDR methodology to RedCap UEs.  **Proposal 8:** Regarding SDR requirements, further discuss MCS configuration for RedCap UEs if necessary.  **Proposal 9:** Regarding PMI requirements, we support the introduction for RedCap UEs. If PMI requirements are agreed, we support introducing them for both 1 and 2RX RedCap UEs, and we suggest choosing only one among the TX configurations discussed in the previous meeting to help reduce the load.  **Proposal 10:** Regarding RI Reporting requirements, we support the introduction if there is interest also from other companies. |

### Demodulation requirements (10.20.4.2, 10.20.4.2.1, and 10.20.4.2.2)

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2203780 | Apple | **Common**  **Proposal #1:** Define new requirements for 1RX RedCap UE in FDD with 15KHz SCS and 10MHz CBW.  **Proposal #2:** Define the same test cases for RedCap UE for 1RX and 2RX in FR1 FDD and FR2 TDD as well.  **Proposal #3:** Define applicability rule for requirements for RedCap UE – If RedCap UE supports 2RX, then only the 2RX requirements apply and the UE can skip the 1RX requirements.  **PDSCH Demod**  **Proposal #4:** Do not define requirements for RedCap with 256QAM.  **Proposal #5:** Define the following requirements for RedCap UE in FR1 FDD (15KHz /10MHz) with 1RX and 2RX:   * QPSK: Type A, Table 5.2.2.1.1-3 Test 1-1, QPSK 0.30, TDLB100-400, 2Tx, Rank 1, 70% max TP * 16QAM: Type A, Table 5.2.2.1.1-3 Test 1-4, 16QAM 0.48, TDLC300-100, 2Tx, Rank 1, 70% max TP * 64QAM: Type A, Table 5.2.2.1.1-4 Test 2-1, 64QAM 0.5, TDLA30-10, 2Tx, Rank 1, 70% max TP   **Proposal #6:** Define the following requirements for RedCap UE in FR1 TDD (30KHz /20MHz) with 1RX and 2RX:   * QPSK: Type A, Table 5.2.2.2.1-3 Test 1-1, QPSK 0.30, TDLB100-400, 2Tx, Rank 1, 70% max TP * 16QAM: Type A, Table 5.2.2.2.1-3 Test 1-4, 16QAM 0.48, TLDC300-100, 2Tx, Rank 1, 70% max TP * 64QAM: Type A, Table 5.2.2.2.1-4 Test 2-1, 64QAM 0.50, TLDA30-1, 2Tx, Rank 1, 70% max TP   **Proposal #7:** Define the following requirements for RedCap UE in FR2 TDD (120KHz /1000MHz) with 1RX and 2RX:   * QPSK: Type A, Table 7.2.2.2.1-3 Test 1-1, QPSK 0.30, TDLC60-300, 2Tx, Rank 1, 70% max TP * 16QAM: Type A, Table 7.2.2.2.1-4 Test 2-2, 16QAM 0.48, TDLA30-300, 2Tx, Rank 1, 70% max TP * 64QAM: Type A, Table 7.2.2.2.1-4 Test 2-6, 64QAM 0.42, TDLA30-75, 2Tx, Rank 1, 70% max TP   **SDR**  **Proposal #8:** Do not define SDR requirements for RedCap UE. |
| R4-2203781 | Apple | **Proposal #1:** Define the following test cases for PDCCH for RedCap for 1RX and 2RX:   * FDD 15KHz FR1   + AL: 4; Non-Interleaved; CORESET RB:48, CORESET Duration: 1, TDLA30-10, 1TX * TDD 30KHz FR1   + AL:8, Interleaved; CORESET RB:48, CORESET Duration: 1, TDLC300-100, 2TX * TDD 120KHz FR2   + AL:8; Interleaved; CORESET RB:60, CORESET Duration: 1, TDLA30-75, 2TX   **Proposal #2:** Do not define test case with known SSB index for 1RX UE. |
| R4-2204585 | Nokia, Nokia Shanghai Bell | **Concerning PDSCH**  **Observation 1:** 256 QAM is not a mandatory feature for RedCap UE.  **Proposal 1:** Do not use 256 QAM in all test cases.  **Concerning SDR test**  **Observation 2:** SDR test is configured based on the maximum data rate indicated by UE capabilities. Hence, we do no strong reason for not using SDR test for RedCap UEs.  **Proposal 2:** Use SDR test for RedCap UEs and for 1Rx use as much as possible from the MCS configuration and common test parameters used for 2Rx. |
| R4-2204586 | Nokia, Nokia Shanghai Bell | **Concerning PDCCH**  **Observation 1:** All AL were covered in test cases of 2Rx. and even more than one test case for the same AL was used in tables Table 5.3.2.1.1-1, Table 5.3.2.1.2-1, Table 5.3.2.2.1-1, Table 5.3.2.2.2-1, Table 7.3.2.2.1-1, Table 7.3.2.2.2-1.  **Observation 2:**  It is necessary to guarantee the performance of PDCCH of RedCap UE for all aggregation levels.  **Proposal 1:** Cover all AL levels in the new test cases. However one test case per AL is acceptable. In particular we propose to cover the AL16 in the case of 2Tx and 1 RX.  **Concerning PBCH**  **Observation 3:** It is necessary to guarantee the performance of PBCH of RedCap UEs in the same way we guarantee the performance of PBCH of non-RedCap UEs.  **Proposal 2:**  Support option 1: RAN4 define the case with SS/PBCH block index is known for 1Rx UE. |
| R4-2205095 | Ericsson | **Proposal 1:** Define the following PDSCH demodulation requirements for RedCap UE.  [Table omitted]  **Proposal 2:** Define SDR test for RedCap UE assuming 1Rx for FR1/FR2 and 2Rx for FR1. |
| R4-2205096 | Ericsson | **Proposal 1:** Define the following PDCCH demodulation requirements for RedCap UE.  [Table omitted]  **Proposal 2:** Define the following PBCH demodulation requirements for RedCap UE.  [Table omitted] |
| R4-2205804 | Huawei, HiSilicon | **Proposal 1:** Consider 20MHz bandwidth for 1RX UE.  **Proposal 2:** Only consider FDD and TDD.  **Proposal 2:** Not test SDR test.  **Proposal 3:** Use following configurations for PDSCH requirements definition:   * FDD 15 kHz FR1   + QPSK MCS4: Type A, Table 5.2.2.1.1-3 Test 1-2?, QPSK 0.3, TDLC300-100, 2Tx, Rank 1, 70% max TP   + 256QAM MCS24: Type A, Table 5.2.2.1.1-3 Test 1-3?, 256QAM 0.82, TDLA30-10, 2Tx, Rank 1, 70% max TP * TDD 30 kHz FR1   + 64QAM MCS19: Type A, Table 5.2.2.2.1-4 Test 2-1?, 64QAM 0.50, TLDA30-10, 2Tx, Rank 1, 70% max TP   + 256QAM MCS24: Type A, Table 5.2.2.1.1-3 Test 1-3?, 256QAM 0.82, TDLA30-10, 2Tx, Rank 1, 70% max TP * TDD 120 kHz FR2   + 64QAM MCS17: Type A, Table 7.2.2.2.1-4 Test 2-6?, 64QAM 0.42, TDLA30-75, 2Tx, Rank 1, 70% |
| R4-2205805 | Huawei, HiSilicon | **Proposal 1:** Consider following assumptions for RedCap UE PDCCH test:   * FDD 15 kHz FR1: AL8 only * TDD 30 kHz FR1: AL4 only * TDD 120 kHz FR2: AL16 only   **Proposal 2:** Use assumptions in Table 1 for RedCap PDCCH test.  [Table omitted]  **Proposal 3:** Define the case with SS/PBCH block index is known for 1Rx UE |
| R4-2205819 | Intel Corporation | **Proposal 1:** Define 1 Rx RedCap FDD requirements for 10 MHz CBW.  **Proposal 2:** Consider the following scope of PDSCH requirements for 1 Rx RedCap UEs   * FR1: QPSK Rank 1, 16QAM Rank 1, 64QAM Rank 1, 256QAM Rank 1 * FR2: QPSK Rank 1, 16QAM Rank 1, 64QAM Rank 1   **Proposal 3:** Consider the following scope of PDSCH requirements for 2 Rx RedCap UEs   * FR1: QPSK Rank 1, 16QAM Rank 1, 64QAM Rank 2, 256QAM Rank 1 * FR2: QPSK Rank 1, 16QAM Rank 2, 64QAM Rank 2   **Proposal 4:** Define RedCap PDCCH requirements for ALs 4, 8 and 16 based on simulation assumptions for the following tests:   * FR1 FDD: Table 5.3.2.1.1-1 (Test 3), Table 5.3.2.1.2-1 (Test 3), Table 5.3.2.1.1-1 (Test 5) * FR1 TDD: Table 5.3.2.2.1-1 (Test 2), Table 5.3.2.2.2-1 (Test 1), Table 5.3.2.2.1-1 (Test 3) * FR2: Table 7.3.2.2.1-1 (Test 1-2), Table 7.3.2.2.2-1 (Test 2-1), Table 7.3.2.2.2-1 (Test 2-2)   **Proposal 5:** Don’t define the 1 Rx PBCH requirements for scenario with SS block index is known.  **Proposal 6:** Define SDR requirements for RedCap UEs. |
| R4-2205907 | MediaTek inc. | **Proposal 1:** Consider defining PDSCH requirements for HST scenario.  **Proposal 2:** Consider defining PDSCH requirements for 256QAM.  **Proposal 3:** Considering that there are no quite new features introduced from the aspect of demodulation in RedCap and there might be more test cases introduced considering some essential scenarios, e.g., HST, we slightly prefer Option 2 for PDSCH test case to minimize the number of test cases for reducing test cost and workload. |

### CSI requirements (10.20.4.3, 10.20.4.3.1 and 10.20.4.3.2)

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2203782 | Apple | **Proposal #1:** Do not introduce CQI reporting requirements with 256QAM CQI table for RedCap.  **Observation #1:** We have agreement to define the same requirements for 1RX and 2RX for RedCap for TDD.  **Proposal #2:** Do not define PMI reporting requirements for RedCap UE for either 1RX or 2RX.  **Proposal #3:** Do not define RI reporting requirements for RedCap. |
| R4-2204587 | Nokia, Nokia Shanghai Bell | **Concerning CQI**  **Observation 1:** 256 QAM is not a mandatory feature for RedCap UE.  **Proposal 2:** Do not define test with CQI table 2 for Redcap UE supporting 256 QAM. |
| R4-2204588 | Nokia, Nokia Shanghai Bell | **Concerning PMI reporting requirements**  **Observation 2:** MIMO operation is not one of the reduced capabilities of the RedCap.  **Proposal 1:**  Use Option 3 Define only for 2Rx UE with the supported RedCap BW.  **Concerning PMI reporting requirements**  **[Moderator assumes this is the proposal for RI requirements]**  **Proposal 2:** Use Option 1 Define only for 2Rx UE with the supported RedCap BW. |
| R4-2205097 | Ericsson | **Proposal 1:** Define CQI reporting test with CQI table 1 (Test 1) for RedCap 2Rx UE in FR1 FDD. Define also CQI reporting test with CQI table 2 (Test 2) for RedCap 2Rx UE in FR1 FDD by reusing the existing requirements. If UE is capable of 256QAM, UE need to pass Test 2. Otherwise UE need to pass Test 1.  **Proposal 2:** Define the following CQI reporting tests for RedCap UE.  [Table omitted]  **Proposal 3:** For the static condition CQI reporting test with CQI table 1, set two SNR test points corresponding to CQI indexes of 16QAM and 64QAM for RedCap 1Rx and 2Rx UEs.  **Proposal 4:** For the static condition CQI reporting test with CQI table 1 for 2Rx UEs, set SNR=8/9dB and SNR=14/15dB as the starting point.  **Proposal 5:** For the wideband CQI reporting test with CQI table 1 in fading condition, set two SNR test points corresponding to CQI indexes of 16QAM and 64QAM for RedCap 1Rx and 2Rx UEs. |
| R4-2205098 | Ericsson | **Proposal 1:** Define the following PMI reporting tests for RedCap UE.  [Table omitted]  **Proposal 2:** Not define RI tests for RedCap. |
| R4-2205806 | Huawei, HiSilicon | **Proposal 1:** Not define CQI requirements for RedCap with CQI table 2.  **Proposal 2:** Not define PMI requirements for RedCap UE  **Proposal 3:** Not define RI test for RedCap UE |
| R4-2205820 | Intel Corporation | **Proposal 1:** Define FR1 FDD test with CQI table 2 for Redcap UE supporting 256 QAM with applicability rule that in case UE passes the test with CQI table 2, it is not needed to pass the tests with CQI Table 1.  **Proposal 2:** Define PMI requirements for 1 Rx and 2 Rx RedCap UEs.  **Proposal 3:** Use Single PMI test with Type I codebook and 8 Tx as reference for definition of PMI RedCap requirements.  **Proposal 4:** Define RI requirements for 2 Rx RedCap UEs. |

## Open issues summary

### Sub-topic 1-1 Configuration for UE demodulation and CSI reporting requirements

**Issue 1-1-1: RedCap 1Rx requirements in FR2**

Background (R4-2205094): RF main session agreed not to define 1Rx requirements for RedCap UE in FR2.

* Proposal (Ericsson)
  + Define UE demodulation and CSI requirements with 2Rx only for FR2 RedCap UE
* Recommended WF
  + Companies are encouraged to check with the agreements in the RF main session.
  + Discuss the proposal is acceptable or not from demodulation requirements point of view.

**Issue 1-1-2: Channel bandwidth for FR1 FDD with SCS=15kHz**

* Proposals
  + Option 1: (Ericsson, Qualcomm, Apple, Intel) 10MHz
  + Option 2: (Huawei) 20MHz
* Recommended WF
  + Collect more inputs

**Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE**

Background: Use Full Duplex FDD as the initial simulation assumption. RAN4 discuss further whether to define requirements (e.g., FRC) based on Half Duplex FDD or not. If HD-FDD is used, consider the existing TDD pattern FR1.15-1 (i.e., DDDSU)

* Proposals
  + Option 1: (Ericsson) Define UE demodulation and CSI reporting requirements for RedCap 1Rx UE based on half-duplex FDD scheduling by reusing the existing TDD pattern FR1.15.1, and RAN4 sets the applicability rule that:
    - RedCap UE capable of the half-duplex FDD operation type A only test with the half-duplex FDD mode, and
    - RedCap UE not capable of the half-duplex FDD operation type A only test with the full-duplex FDD mode.
  + Option 2: (Huawei) Only consider FDD and TDD.
* Recommended WF
  + Collect more inputs.

**Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE**

* Proposal (Apple)
  + Define applicability rule for requirements for RedCap UE
    - If RedCap UE supports 2RX, then only the 2RX requirements apply and the UE can skip the 1RX requirements.
* Recommended WF
  + Discuss the proposal

**Issue 1-1-5: Additional PDSCH demodulation requirements**

* Proposals
  + Proposal 1 (ZTE): Define CRS-IM Performance Requirements for Redcap UE with single receiver in Rel-17 to ensure that Redcap UE could have the same capability to handle LTE CRS interference similar as normal NR UE.
    - If there is no time for Rel-17 Redcap UE demod to support the CRS-IM, then it should be included in Rel-18 Demod package.
  + Proposal 2 (MediaTek): Define PDSCH requirements for HST scenario.
* Recommended WF
  + Collect comments on the additional requirements proposed by companies

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| XXX | Issue 1-1-1: RedCap 1Rx requirements in FR2  Issue 1-1-2: Channel bandwidth for FR1 FDD with SCS=15kHz  Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE  Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE  Issue 1-1-5: Additional PDSCH demodulation requirements  Others: |
| Ericsson | Issue 1-1-1: RedCap 1Rx requirements in FR2  We support to define RedCap FR2 UE demodulation and CSI requirements for 2 Rx UE only, i.e., not to define RedCap 1Rx requirements for FR2  For FR2, Noc (specified in TS38.101-4 4.5.3) is derived from REFSENS specified in TS38.101-2 7.3.2. If RF requirements does not specify REFSENS for FR2 1Rx UE, we cannot derive Noc. This is another reason we don’t propose to define 1Rx requirements.  Issue 1-1-2: Channel bandwidth for FR1 FDD with SCS=15kHz  Option 1. As many companies argued, RAN4 chose CBW=10MHz for FR1 because it is the channel bandwidth most FR1 bands support. We want to apply it for RedCap UE.  Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE  Option 1. As we discussed in our paper, both RF session and RRM session have already agreed to define the core requirements with HD-FDD even if it is optional feature. We think RAN4 should also define the corresponding demodulation performance requirements.  We don’t propose to define the dedicated requirements for HD-FDD, but propose to configure the common UL/DL scheduling applicable for both HD-FDD and FD-FDD. We believe this option does not increase the number of test cases and ensure the performance for HD-FDD capable UEs.  Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE  We are ok to define such an applicability rule.  Issue 1-1-5: Additional PDSCH demodulation requirements  RAN4 has introduced many demodulation and CSI reporting requirements including Mapping type B, HST, multi-TRP, URLLC in Rel-15/16. For Rel-17 RedCap, we think RAN4 should focus on the basic functionalities as discussed in Sub-topic 2-1. We don’t preclude to specify other requirements such as HST, but it should be discussed in the future release.  For the CRS-IM receiver requirements, this is Rel-17 WI and RAN4 is still discussing the test setup. We don’t think it is immature to consider this requirement for RedCap.  Others: |
| Apple | Issue 1-1-1: RedCap 1Rx requirements in FR2  We agree with the proposal. This is inline with agreements in RF and RRM session. Only define 2RX requirements in FR2 for RedCap  Issue 1-1-2: Channel bandwidth for FR1 FDD with SCS=15kHz  We support option 1. We don’t see the necessity to introduce requirements for 20MHz for FDD. It would be inline with 2RX requirements and same setup can be used for FDD with 2RX and 1RX.  Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE  In our understanding for HD-FDD the same requirements as FD\_FDD would be applicable. The change is in the FRC. If it is a new set of requirements, we prefer not to define it – firstly reduce the simulation effort involved given that there is a lot of simulation work to be done for demod for RedCap . Otherwise, same requirements with the applicability rule from Ericsson is okay.  Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE  We support the proposal on applicability rule.  Issue 1-1-5: Additional PDSCH demodulation requirements  We don’t support introducing requirements for RedCap for CRS-IM or HST. There are different use cases for redcap UEs and we don’t envision RedCap UEs supporting advanced receiver processing. We only should introduce requirements for a limited set of mandatory features for RedCap. This has been discussed in RF and RRM as well – it’s up to RedCap UE to support other features, but requirements will not be defined for all of them.  Others: |
| Huawei | **Issue 1-1-1: RedCap 1Rx requirements in FR2**  We share the same views with Ericsson and not introduce performance requirements for 1RX in FR2 as per RAN4 RF agreements.  **Issue 1-1-2: Channel bandwidth for FR1 FDD with SCS=15kHz**  We still think that it is necessary to test the max supported bandwidth for FDD. But to move forward, we can compromise to option 1.  **Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE**  We support Option 2. We think that HD-FDD just reflects the BS’s scheduling without any change of UE’s behavior.  **Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE**  Support the proposal from Apple  **Issue 1-1-5: Additional PDSCH demodulation requirements**  We don’t support define the requirements for HST scenario and CRS-IM receiver because this is the first release of RedCap UE and we should focus on basic requirements as defined in Rel-15. |
| Intel | **Issue 1-1-1: RedCap 1Rx requirements in FR2**  Support proposal from Ericsson.  **Issue 1-1-2: Channel bandwidth for FR1 FDD with SCS=15kHz**  Support Option 1 to cover different channel bandwidths for FDD and TDD  **Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE**  We suggest to focus on definition of FD FDD and TDD requirements. Once it is stable, we can come back to discussion on HD FDD.  **Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE**  We think that similar applicability rule as for 2 and 4 Rx Normal UEs:   * If UE supports 1 Rx, then 1Rx test only us executed * If UE supports 2 Rx, then 1Rx test only us executed * If UE supports both 1 and 2 Rx, then 2 Rx test is sufficient   **Issue 1-1-5: Additional PDSCH demodulation requirements**  We suggest to focus on definition of minimum set of requirements to verify the mandatory features. Once it is stable, we are fine to discuss the definition of other requirements.  As for CRS-IM, we think that it is better to wait the finalization of discussion on CRS-IM requirements for Normal UEs and, after that, we can just check which scenario we want to cover for RedCap UE. |
| Qualcomm | **Issue 1-1-1**  We support following RF agreement and exclude 1RX Demod Requirement for FR2 RedCap UEs;  **Issue 1-1-2**  Option 1;  **Issue 1-1-3**  We share other companies’ views that FDD scheduling does not have much impact on the demodulation performances.  Grom the point of view of the UE the applicability rule in Option 1 proposed by Ericsson means that HD-FDD capable UEs are not tested for FD-FDD which is the mandatory behaviour, so we prefer Option 2.  **Issue 1-1-4**  Support the proposed applicability rule, which reflects the 2/4 RX applicability rule for regular UEs;  **Issue 1-1-5**  We share other companies’ views that we should focus on a minimum set of requirements, without adding advanced receiver scenarios such as HST or CRS-IM (which is still under discussion for regular NR UEs), both due to the limited time of this release and the different scope of RedCap UEs. |
| ZTE | **Issue 1-1-5**  We could understand the importance of defining the basic functionality in Rel-17 for Redcap UE, for the support of CRS-IM on Redcap UE, since the workload is quite limited, if possible, we think that its very beneficial feature since LTE CRS interfering is widely exiting in the real field, otherwise after this practical implementation, more problem in filed would be identified. |
| NOKIA | Issue 1-1-1: RedCap 1Rx requirements in FR2  We agree with the proposal. Do not introduce performance requirements for 1RX in FR2.  Issue 1-1-2: Channel bandwidth for FR1 FDD with SCS=15kHz  Option 1.  Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE  HD-FDD UE (regardless if it is type A or Type B) can be seen as a TDD UE (with the exception that DL is using BW and UL is using another BW). Hence, we do not think that there is a need for test cases. We can add a note saying HD-FDD UE should have same performance requirements as TDD UE with same DL CBW (namely 10 MHz).  Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE  We are ok with the applicability rule.  Issue 1-1-5: Additional PDSCH demodulation requirements  We do not support the define PDSCH requirements for HST scenario nor for CRS-IM advanced receiver for the same reasons mentioned above by other companies.  Others: |
| MediaTek | **Issue 1-1-1**  Support the proposal not to define 1Rx requirements for RedCap UE in FR2.  **Issue 1-1-2**  Support Option 1.  **Issue 1-1-3**  We prefer Option 2 to define requirements only for FD-FDD and TDD. We think there is no impact to the UE demodulation performance in HD-FDD.  **Issue 1-1-4**  We are OK with the proposed applicability rule.  **Issue 1-1-5**  Just like we mentioned in our contribution, we think one of the use cases for RedCap devices is aimed for wearable devices, e.g., smart watches. It is highly possible that such RedCap devices will operate under the scenario of high-speed train. But we respect the views from other companies, we can focus on the mandatory features first. When it is stable for the mandatory features, we can then discuss other scenarios for RedCap. |
| CMCC | **Issue 1-1-1: RedCap 1Rx requirements in FR2**  Agree with the proposal  **Issue 1-1-2: Channel bandwidth for FR1 FDD with SCS=15kHz**  Option 1 is OK to us.  **Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE**  We are OK with option2 since in option 2 RedCap capable of HD-FDD will skip the FD-FDD mode.  **Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE**  OK with the applicability rule  **Issue 1-1-5: Additional PDSCH demodulation requirements**  CRS-IM for legacy UE haven’t been complete in Rel-17, we prefer to not consider this for RedCap in parallel.  HST RRM is not supported for RedCap, we prefer to consider HST as a whole feature. |

### CRs/TPs comments collection

Not applicable

## 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 1-1-1: RedCap 1Rx requirements in FR2** | **Candidate options:**   * Proposal 1: Define UE demodulation and CSI requirements with 2Rx only for FR2 RedCap UE (Ericsson, Apple, Huawei, Intel, Qualcomm, Nokia, MediaTek, CMCC)   **Tentative agreements:**  Define UE demodulation and CSI requirements with 2Rx only for FR2 RedCap UE  **Recommendations for 2nd round:**  No discussion. |
| **Issue 1-1-2: Channel bandwidth for FR1 FDD with SCS=15kHz** | **Candidate options:**  Option 1: 10MHz (Ericsson, Apple, Huawei, Intel, Qualcomm, Nokia, MediaTek, CMCC)  Option 2: 20MHz  **Tentative agreements:**  Set CBW 10MHz for FR1 FDD with SCS=15kHz  **Recommendations for 2nd round:**  Not discussion. |
| **Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE** | **Candidate options:**   * Option 1: Define UE demodulation and CSI reporting requirements for RedCap 1Rx UE based on half-duplex FDD scheduling by reusing the existing TDD pattern FR1.15.1, and RAN4 sets the applicability rule that: (Ericsson, Apple)   + Apply the same requirements for both HD-FDD and FD-FDD.   + RedCap UE capable of the half-duplex FDD operation type A only test with the half-duplex FDD mode, and   + RedCap UE not capable of the half-duplex FDD operation type A only test with the full-duplex FDD mode. * Option 2: Only consider FDD and TDD (MediaTek, CMCC)   + HD-FDD just reflects the BS’s scheduling without any change of UE’s behavior (Huawei)   + HD-FDD capable UEs are not tested for FD-FDD which is the mandatory behaviour (Qualcomm)   + We can add a note saying HD-FDD UE should have same performance requirements as TDD UE with same DL CBW (Nokia) * Option 3: Focus on definition of FD-FDD and TDD requirements for FR1 1Rx UE. Come back on HD-FDD once it is stable (Intel)   **Tentative agreements:**  This is the common understanding the UE requirements are same for both HD-FDD and FD-FDD. The moderator proposes to focus on the definition of FD-FDD and TDD, and come back how to capture the optional HD-FDD once it is stable.  Focus on definition of FD-FDD and TDD requirements for FR1 1Rx UE. RAN4 come back on HD-FDD once it is stable.  **Recommendations for 2nd round:**  Discuss the tentative agreements are acceptable. |
| **Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE** | **Candidate options:**   * Proposal 1: Define applicability rule for requirements for RedCap UE (Ericsson, Apple, Huawei, Qualcomm, Nokia, MediaTek, CMCC)   + If RedCap UE supports 2RX, then only the 2RX requirements apply and the UE can skip the 1RX requirements * Proposal 2: (Intel)   + If UE supports 1 Rx, then 1Rx test only us executed   + If UE supports 2 Rx, then 1Rx test only us executed   + If UE supports both 1 and 2 Rx, then 2 Rx test is sufficient   **Tentative agreements:**  Most companies support the proposal 1. Proposal 2 follows the Rel-15 applicability rule between 2Rx UE and 4Rx UE. The moderator will ask if the following applicability rule is accepted.  Define applicability rule for requirements for RedCap UE:   * If RedCap UE supports only 1 Rx, only 1Rx test is executed * If RedCap UE supports only 2 Rx, only 2Rx test is executed * If RedCap UE supports both 1 Rx and 2 Rx, only 2 Rx test is executed   **Recommendations for 2nd round:**  Discuss the tentative agreements are acceptable. |
| **Issue 1-1-5: Additional PDSCH demodulation requirements** | **Candidate options:**   * Proposal 1: Define CRS-IM Performance Requirements for Redcap UE with single receiver in Rel-17   + It very beneficial feature since LTE CRS interfering is widely exiting in the real field (ZTE) * Proposal 2: Define PDSCH requirements for HST scenario * Proposal 3: Not define PDSCH requirements for HST scenario nor for CRS-IM advanced receiver in for Rel-17 RedCap UE (Ericsson, Apple, Huawei, Qualcomm, Nokia, CMCC) * Proposal 4: Focus on definition of minimum set of requirements to verify the mandatory features. RAN4 discuss other requirements once it is stable (Intel, MediaTek)   **Tentative agreements:**  Most companies propose to focus on the minimum requirements. Some companies have concern especially for CRS-IM receiver because it is the ongoing Rel-17 WI and the discussion is ongoing. Considering the limited time, the moderator propose the following WF:  Focus on definition of minimum set of requirements, discussed in Topic #2, to verify the mandatory features. RAN4 discuss other requirements once it is stable, and the performance part TU is allowed.  **Recommendations for 2nd round:**  Discuss the tentative agreements are acceptable. |

### CRs/TPs

None

## Discussion on 2nd round

**Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE**

* Recommended WF
  + Focus on definition of FD-FDD and TDD requirements for FR1 1Rx UE. RAN4 come back on HD-FDD once it is stable.

**Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE**

* Recommended WF
  + Define applicability rule for requirements for RedCap UE
    - If RedCap UE supports only 1 Rx, only 1Rx test is executed
    - If RedCap UE supports only 2 Rx, only 2Rx test is executed
    - If RedCap UE supports both 1 Rx and 2 Rx, only 2 Rx test is executed

**Issue 1-1-5: Additional PDSCH demodulation requirements**

* Recommended WF
  + Focus on definition of minimum set of requirements, discussed in Topic #2, to verify the mandatory features. RAN4 discuss other requirements once it is stable, and the performance part TU is allowed.

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| **Company** | **Comments** |
| XXX | **Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE**  **Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE**  **Issue 1-1-5: Additional PDSCH demodulation requirements**  **Other comments:** |
| Apple | **Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE**  We are fine with the recommended WF.  **Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE**  We are fine with the recommended WF.  **Issue 1-1-5: Additional PDSCH demodulation requirements**  We are fine with the recommended WF.  **Other comments:** |
| Huawei | **Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE**  The wording of recommend WF is confusing. It seems that RAN 4 will define the requirements for HD-FDD anyway only after the work related to FD-FDD and TDD was completed. We still prefer only define requirements for FD-FDD and TDD for FR1 1Rx UE.  **Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE**  OK with recommended WF  **Issue 1-1-5: Additional PDSCH demodulation requirements**  Still prefer Option 2 in the 1st round: Not define PDSCH requirements for HST scenario nor for CRS-IM advanced receiver in for Rel-17 RedCap UE  We have similar understanding as Issue 1-1-3. It seems that RAN 4 will define the requirements for CRS-IM/HST anyway only after the work related to minimum set of PDSCH requirements was completed. As we commented in 1st round, we propose to not define the additional PDSCH demodulation requirements in Rel-17.  Also by following majority view in the 1st round discussion, Option 2 is preferred by most companies. |
| MediaTek | **Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE**  OK with the recommended WF.  **Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE**  OK with the recommended WF.  **Issue 1-1-5: Additional PDSCH demodulation requirements**  OK with the recommended WF. |
| NOKIA | **Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE**  The WF seems a little bit unclear and maybe a rewording is needed. We are fine with the message that we think it tries to convey about deprioritizing HD-FDD for the moment.  **Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE**  OK with recommended WF  **Issue 1-1-5: Additional PDSCH demodulation requirements**  OK with the recommended WF. We think it is OK not to take hard decision at this phase of work.  **Other comments:** |
| Ericsson | **Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE**  Support the recommend WF. We want to keep options to consider both HD-FDD and FD-FDD with applicability rule and UE capability. We understand the concern by Qualcomm in the first round, our original proposal cannot verify FD-FDD which is mandatory for RedCap UE. We need more time to find a good solution to verify HD-FDD feature without increasing the number of test cases.  **Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE**  Support the recommended WF.  **Issue 1-1-5: Additional PDSCH demodulation requirements**  Support the recommend WF. |

## Summary for 2nd round

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|  | **Status summary** |
| **Issue 1-1-3: UL/DL scheduling for FR1 FDD for 1Rx UE** | **Recommended WF:**   * Assume Full-duplex FDD to derive the requirements, e.g., SNR to achieve 70% of maximum throughput. * For the requirement specification,   + Option 1: Consider Full-duplex FDD only   + Option 2: Consider Full-duplex FDD and half-duplex FDD with applicability rule |
| **Issue 1-1-4: Applicability rule for RedCap UE demodulation and CSI reporting requirements between 1Rx UE and 2Rx UE** | **Agreements:**  Define applicability rule for requirements for RedCap UE:   * If RedCap UE supports only 1 Rx, only 1Rx test is executed * If RedCap UE supports only 2 Rx, only 2Rx test is executed * If RedCap UE supports both 1 Rx and 2 Rx, only 2 Rx test is executed |
| **Issue 1-1-5: Additional PDSCH demodulation requirements** | **Recommended WF:**   * Option 1: Focus on definition of minimum set of requirements, discussed in Topic #2, to verify the mandatory features. RAN4 discuss other requirements once it is stable, and the performance part TU is allowed. * Option 2: Not define the additional PDSCH demodulation requirements other than the candidates discussed in 2.1, in Rel-17 RedCap. |

# 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 or not**

Note: 256QAM is optional feature for RedCap UE (both 1Rx and 2Rx)

* Proposals
  + Option 1: (CMCC, MediaTek) Specify 256QAM demodulation requirements for both FR1 and FR2
  + Option 2: (Ericsson, Huawei, Intel) Specify 256QAM demodulation requirements for FR1 only
  + Option 3: (Apple, Nokia) Not to Specify 256QAM demodulation requirements
  + Option 4: (Qualcomm) Keep FFS to reduce the simulation load
* Recommended WF
  + Collect inputs

**Issue 2-1-2: PDSCH FR1 FDD SCS=15kHz test cases (except 256QAM scenarios)**

* Proposals: Define following test cases for 1Rx and 2Rx
  + Option 1: (CMCC, Ericsson, Qualcomm, Apple, Intel)
    - QPSK: Type A, Table 5.2.2.1.1-3 Test 1-1, QPSK 0.30, TDLB100-400, 2Tx, Rank 1, 70% max TP
    - 16QAM: Type A, Table 5.2.2.1.1-3 Test 1-4, 16QAM 0.48, TDLC300-100, 2Tx, Rank 1, 70% max TP
    - 64QAM: Type A, Table 5.2.2.1.1-4 Test 2-1, 64QAM 0.5, TDLA30-10, 2Tx, Rank 1, 70% max TP
  + Option 2: (Huawei, MediaTek)
    - QPSK MCS4: Type A, Table 5.2.2.1.1-3 Test 1-2?, QPSK 0.3, TDLC300-100, 2Tx, Rank 1, 70% max TP
* Recommended WF
  + Collect inputs

**Issue 2-1-3: PDSCH FR1 TDD SCS=30kHz test cases (except 256QAM scenarios)**

* Proposals: Define following test cases for 1Rx and 2Rx
  + Option 1: (CMCC, Ericsson, Qualcomm, Apple, Intel)
    - QPSK: Type A, Table 5.2.2.2.1-3 Test 1-1, QPSK 0.30, TDLB100-400, 2Tx, Rank 1, 70% max TP
    - 16QAM: Type A, Table 5.2.2.2.1-3 Test 1-4, 16QAM 0.48, TLDC300-100, 2Tx, Rank 1, 70% max TP
    - 64QAM: Type A, Table 5.2.2.2.1-4 Test 2-1, 64QAM 0.50, TLDA30-10, 2Tx, Rank 1, 70% max TP
  + Option 2: (Huawei, MediaTek)
    - 64QAM MCS19: Type A, Table 5.2.2.2.1-4 Test 2-1?, 64QAM 0.50, TLDA30-10, 2Tx, Rank 1, 70% max TP
* Recommended WF
  + Collect inputs

**Issue 2-1-4: PDSCH FR2 TDD SCS=120kHz test cases (except 256QAM scenarios)**

* Proposals: Define following test cases for 1Rx and 2Rx
  + Option 1: (CMCC, Ericsson, Qualcomm, Apple, Intel)
    - QPSK: Type A, Table 7.2.2.2.1-3 Test 1-1, QPSK 0.30, TDLC60-300, 2Tx, Rank 1, 70% max TP
    - 16QAM: Type A, Table 7.2.2.2.1-4 Test 2-2, 16QAM 0.48, TDLA30-300, 2Tx, Rank 1, 70% max TP
    - 64QAM: Type A, Table 7.2.2.2.1-4 Test 2-6, 64QAM 0.42, TDLA30-75, 2Tx, Rank 1, 70% max TP
  + Option 2: (Huawei, MediaTek)
    - 64QAM MCS17: Type A, Table 7.2.2.2.1-4 Test 2-6?, 64QAM 0.42, TDLA30-75, 2Tx, Rank 1, 70%
* Recommended WF
  + Collect inputs

### Sub-topic 2-2 SDR requirements

**Issue 2-2-1: Whether to define SDR requirements for RedCap UE or not (for FR1 FDD/TDD and FR2)**

* Proposals
  + Option 1: (CMCC, Qualcomm, Nokia, Ericsson, Intel) Define SDR tests for RedCap 1Rx/2Rx UEs
  + Option 2: (Apple, Huawei) Not define SDR tests for RedCap Ues (both 1Rx/2Rx Ues)
* Recommended WF
  + Collect inputs

### Sub-topic 2-3 PDCCH demodulation requirements

**Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)**

* Proposals
  + Option 1: (CMCC, Nokia, Ericsson, Intel) AL4, AL8, and AL16
  + Option 2: (Qualcomm) AL4 and AL8. Open for AL16.
  + Option 3: (Apple) AL4
  + Option 4: (Huawei) AL8
* Recommended WF
  + Collect inputs

**Issue 2-3-2: Aggregation level(s) for FR1 TDD SCS=30kHz test cases (1Rx and 2Rx)**

* Proposals
  + Option 1: (CMCC, Nokia, Ericsson, Intel) AL4, AL8, and AL16
  + Option 2: (Qualcomm) AL4 and AL8. Open for AL16.
  + Option 3: (Apple) AL8
  + Option 4: (Huawei) AL4
* Recommended WF
  + Collect inputs

**Issue 2-3-3: Aggregation level(s) for FR2 TDD SCS=120kHz test cases (1Rx and 2Rx)**

* Proposals
  + Option 1: (CMCC, Nokia, Ericsson, Intel) AL4, AL8, and AL16
  + Option 2: (Qualcomm) AL4 and AL8. Open for AL16.
  + Option 3: (Apple) AL8
  + Option 4: (Huawei) AL16
* Recommended WF
  + Collect inputs

### Sub-topic 2-4 PBCH demodulation requirements

Background: For 1Rx UE, RAN4 define PBCH demodulation requirements by reusing the existing PBCH test setup for 2Rx with SS/PBCH block index is unknown.

For the case with SS/PBCH block index is known,

* Option 1: RAN4 define the case with SS/PBCH block index is known for 1Rx UE
* Option 2: RAN4 don’t define the case with SS/PBCH block index is known for 1Rx UE

**Issue 2-4-1: Whether to define 1Rx PBCH demodulation requirements in the case SS/PBCH block index is known**

* Proposals
  + Option 1: (CMCC, Nokia, Huawei) Define the case with SS/PBCH block index is known (i.e., define both SS/PBCH block index is known and unknown).
  + Option 2: (Qualcomm, Apple, Ericsson, Intel) Not define the case with SS/PBCH block index is known (i.e., only define with the case SS/PBCH block index is NOT known)
* Recommended WF
  + Collect inputs

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 2-1-1: Define 256QAM demodulation requirements or not  Issue 2-1-2: PDSCH FR1 FDD SCS=15kHz test cases (except 256QAM scenarios)  Issue 2-1-3: PDSCH FR1 TDD SCS=30kHz test cases (except 256QAM scenarios)  Issue 2-1-4: PDSCH FR2 TDD SCS=120kHz test cases (except 256QAM scenarios)  Issue 2-2-1: Whether to define SDR requirements for RedCap UE or not (for FR1 FDD/TDD and FR2)  Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)  Issue 2-3-2: Aggregation level(s) for FR1 TDD SCS=30kHz test cases (1Rx and 2Rx)  Issue 2-3-3: Aggregation level(s) for FR2 TDD SCS=120kHz test cases (1Rx and 2Rx)  Issue 2-4-1: Whether to define 1Rx PBCH demodulation requirements in the case SS/PBCH block index is known  Others: |
| Ericsson | Issue 2-1-1: Define 256QAM demodulation requirements or not  Option 2. Although it is optional feature, we think it is important to ensure the higher throughput (e.g., 150Mbps DL as specified in WID) with the limited channel BW of 20MHz and single MIMO layer for 1Rx UE.  Issue 2-1-2: PDSCH FR1 FDD SCS=15kHz test cases (except 256QAM scenarios)  Option 1. This option ensures the good test coverage including MCS, rank, channel condition, TDD pattern.  We expect the supported bands for RedCap UE are limited compared with non-RedCap UE. For example, if RedCap UE only supports FDD bands only, Option 2 cannot verify higher order modulation (16QAM/64QAM). It is not preferable from test coverage point of view.  Issue 2-1-3: PDSCH FR1 TDD SCS=30kHz test cases (except 256QAM scenarios)  Option 1. This option can ensure the good test coverage including MCS, rank, channel condition, TDD pattern.  Issue 2-1-4: PDSCH FR2 TDD SCS=120kHz test cases (except 256QAM scenarios)  Option 1. This option can ensure the good test coverage including MCS, rank, channel condition, TDD pattern.  Issue 2-2-1: Whether to define SDR requirements for RedCap UE or not (for FR1 FDD/TDD and FR2)  Option 1.  Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)  Option 1.  We think verifying AL16 performance is imported because the RRM session agreed to configure AL16 for PDCCH transmission parameters of RLM Out-of-synch and beam failure detection for 1Rx UE to compensate the reduced received antenna.  As commented in PDSCH, we expect the supported bands for RedCap UE are limited compared with non-RedCap UE. For example, if RedCap UE supports FDD bands only, we think the test coverage of Options 3 or 4 is not sufficient. It is not preferable from test coverage point of view.  Issue 2-3-2: Aggregation level(s) for FR1 TDD SCS=30kHz test cases (1Rx and 2Rx)  Option 1.  Issue 2-3-3: Aggregation level(s) for FR2 TDD SCS=120kHz test cases (1Rx and 2Rx)  Option 1.  Issue 2-4-1: Whether to define 1Rx PBCH demodulation requirements in the case SS/PBCH block index is known  We support Option 2, although PBCH performance is not verified in the RAN5 conformance tests, to reduce the simulation work load. However we are also fine with Option 1 if companies want to define this scenario.  Others: |
| Apple | Issue 2-1-1: Define 256QAM demodulation requirements or not  To reduce the number of requirements and simulation effort, we prefer not to define requirements for 256QAM for RedCap UE since its an optional feature.  We don’t think RAN4 needs to define requirements to verify the peak DL data rate/ TP as specified in WID.  Issue 2-1-2: PDSCH FR1 FDD SCS=15kHz test cases (except 256QAM scenarios)  Option 1 gives us good coverage for PDSCH demod requirements across modulation, channel conditions. Its good to cover the same for FDD and TDD for PDSCH demod alone.  Issue 2-1-3: PDSCH FR1 TDD SCS=30kHz test cases (except 256QAM scenarios)  Option 1.  Issue 2-1-4: PDSCH FR2 TDD SCS=120kHz test cases (except 256QAM scenarios)  Option 1. But only 2 RX requirements.  Issue 2-2-1: Whether to define SDR requirements for RedCap UE or not (for FR1 FDD/TDD and FR2)  Our intention to support option 2 to mainly reduce the number of requirements. But we understand that SDR requirements are to test Layer 1 /2 function in a a sustained manner. We are fine with option 1.  Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)  We need not cover all AL in all duplex modes. Hence we suggest some down-selection as proposed in our test case list across different Duplex modes.  Issue 2-3-2: Aggregation level(s) for FR1 TDD SCS=30kHz test cases (1Rx and 2Rx)  We need not cover all AL in all duplex modes. Hence we suggest some down-selection as proposed in our test case list across different Duplex modes.  Issue 2-3-3: Aggregation level(s) for FR2 TDD SCS=120kHz test cases (1Rx and 2Rx)  Fine to select 1 AL.  Issue 2-4-1: Whether to define 1Rx PBCH demodulation requirements in the case SS/PBCH block index is known  Option 2. PBCH requirements for 1 RX with unknown SSB alone are sufficient.  Others: |
| Huawei | **Issue 2-1-1: Define 256QAM demodulation requirements or not**  We support Option 2. We think 256QAM is a very import feature related to demodulation processing and it should be verified. To reduce the test number, we think it is enough to verify it in FR1 only.  **Issue 2-1-2: PDSCH FR1 FDD SCS=15kHz test cases (except 256QAM scenarios)**  We still think it is unnecessary to cover all MCSs per duplex mode. To move forward, we can compromise to Option 1.  **Issue 2-1-3: PDSCH FR1 TDD SCS=30kHz test cases (except 256QAM scenarios)**  To move forward, we can compromise to Option 1.  **Issue 2-1-4: PDSCH FR1 TDD SCS=30kHz test cases (except 256QAM scenarios)**  To move forward, we can compromise to Option 1.  **Issue 2-2-1: Whether to define SDR requirements for RedCap UE or not (for FR1 FDD/TDD and FR2)**  We still think there is no need to define SDR test because RedCap UE is a low cost UE for reducing device size. But to verify the support of 150Mbps DL peak data rate as required from RAN1, we can compromise to Option 1.  **Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)**  Support Option 3 or Option 4. Our intention is try to cover all Als, but at the same time reduce the number of test case as many as possible and distribute them to different test cases. We think there are few Ues only supporting single duplex mode. Moreover, we can define the PDCCH requirements for AL16 in FR2 if some companies have strong views to cover it.  **Issue 2-4-1: Whether to define 1Rx PBCH demodulation requirements in the case SS/PBCH block index is known**  We supported Option 1 to keep align with 2RX/4RX, but if some companies concern the heavy simulation work, we can compromise to Option 2. |
| Intel | **Issue 2-1-1: Define 256QAM demodulation requirements or not**  We support definition of 256QAM requirements at least for FR1. Same time, we are also fine to keep FFS and come back once we stabilize the discussion on requirements for mandatory features  **Issue 2-1-2: PDSCH FR1 FDD SCS=15kHz test cases (except 256QAM scenarios)**  **Issue 2-1-3: PDSCH FR1 TDD SCS=30kHz test cases (except 256QAM scenarios)**  Support Option 1 for both FR1 issues to have sufficient test coverage to verify performance for different modulation schemes and propagation conditions.  Concerning Option 2, different modulation formats and channel models are considered for FDD and TDD. Therefore, in case UE supports only FDD or only TDD, only one scenario will be tested.  **Issue 2-1-4: PDSCH FR2 TDD SCS=120kHz test cases (except 256QAM scenarios)**  Support Option 1. Same comment as for FR1.  **Issue 2-2-1: Whether to define SDR requirements for RedCap UE or not (for FR1 FDD/TDD and FR2)**  Support definition of SDR requirements to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets.  **Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)**  **Issue 2-3-2: Aggregation level(s) for FR1 TDD SCS=30kHz test cases (1Rx and 2Rx)**  **Issue 2-3-3: Aggregation level(s) for FR2 TDD SCS=120kHz test cases (1Rx and 2Rx)**  Support Option 1 for all these issues to have sufficient test coverage. Same time, Option 2 is also fine for us.  **Issue 2-4-1: Whether to define 1Rx PBCH demodulation requirements in the case SS/PBCH block index is known**  To reduce the workload, we suggest to consider Option 2. Same time, Option 1 is also fine for us.  **Other**  In our paper we also have proposal to detailed simulation assumptions for PDCCH tests which can be reused from existing test cases. Probably, we can discuss it in the 2nd round:   * FR1 FDD: Table 5.3.2.1.1-1 (Test 3), Table 5.3.2.1.2-1 (Test 3), Table 5.3.2.1.1-1 (Test 5) * FR1 TDD: Table 5.3.2.2.1-1 (Test 2), Table 5.3.2.2.2-1 (Test 1), Table 5.3.2.2.1-1 (Test 3) * FR2: Table 7.3.2.2.1-1 (Test 1-2), Table 7.3.2.2.2-1 (Test 2-1), Table 7.3.2.2.2-1 (Test 2-2) |
| Qualcomm | **Issue 2-1-1**  Given that there is interest in this optional feature, we are ok with introducing 256QAM requirement and we prefer Option 2 (FR1 only), but to reduce the workload we can discuss these requirements after we have progressed the mandatory requirements;  **Issue 2-1-2/2-1-3**  Option 1;  **Issue 2-1-4**  Option 1, but for 2 RX only according to Issue 1-1-1;  **Issue 2-2-1**  Support Option 1;  **Issue 2-3-1/2-3-2/2-3-3**  We support Option 2 to have AL 4/8 coverage for RedCap Ues working in single duplex bands.  Even considering that there are RRM requirements based on AL16, we don’t see this as a necessary condition to introducing a dedicated requirement but we are open to Option 1 as well if there is sufficient interest;  **Issue 2-4-1**  Option 2, ignore the less indicative requirement of the two (also untestable) to reduce workload; |
| NOKIA | Issue 2-1-1: Define 256QAM demodulation requirements or not  Option 1.  To reduce the number of requirements and simulation effort, we prefer not to define requirements for 256QAM for RedCap UE since its an optional feature.  Issue 2-1-2: PDSCH FR1 FDD SCS=15kHz test cases (except 256QAM scenarios)  Issue 2-1-3: PDSCH FR1 TDD SCS=30kHz test cases (except 256QAM scenarios)  Option 1.  Issue 2-1-4: PDSCH FR2 TDD SCS=120kHz test cases (except 256QAM scenarios)  Option 1. But only 2 RX requirements.  Issue 2-2-1: Whether to define SDR requirements for RedCap UE or not (for FR1 FDD/TDD and FR2)  Option 1.  Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)  Issue 2-3-2: Aggregation level(s) for FR1 TDD SCS=30kHz test cases (1Rx and 2Rx)  Issue 2-3-3: Aggregation level(s) for FR2 TDD SCS=120kHz test cases (1Rx and 2Rx)  Option 1.  It is necessary to guarantee the performance of PDCCH, therefore, we propose to design for 1Rx test cases that are aligned with the ones defined for 2Rx which cover all the possible AL. We are aware that there are many cases and for that we propose to define new tables where only one test case per AL included. Hence, only chose one test case per AL when AL is repeated more than one time in rows of the tables Table 5.3.2.1.1-1, Table 5.3.2.1.2-1, Table 5.3.2.2.1-1, Table 5.3.2.2.2-1, Table 7.3.2.2.1-1, Table 7.3.2.2.2-1.  Additionally we think it is important for the UE for AL16 to respect minimum performance requirement in the case of 2Tx and 1 RX. because it might be asked by the serving cell to use this AL when it is at cell-edge. Hence, we propose to add a test case for AL16 to the new tables corresponding to 2Tx.  Issue 2-4-1: Whether to define 1Rx PBCH demodulation requirements in the case SS/PBCH block index is known  It is necessary to guarantee the performance of PBCH of RedCap Ues in the same way we guarantee the performance of PBCH of non-RedCap Ues. Hence, we support option 1. We can compromise to Option 2 to reduce the work load.  Others: |
| MediaTek | **Issue 2-1-1: Define 256QAM demodulation requirements or not**  We are OK to consider FR1 only. However, for the existing test cases for 256QAM, the operating SNR is around 24/25 dB for 2 Rx. If we consider 1 Rx UE with the same MCS, it will increase the operating SNR to a very high level. Hence, for the case of 1 Rx, we cannot leverage the existing MCS and need to use an MCS approaching similar operating SNR as the current existing 256QAM test cases.  **Issue 2-1-2: PDSCH FR1 FDD SCS=15kHz test cases (except 256QAM scenarios)**  We can compromise to Option 1.  **Issue 2-1-3: PDSCH FR1 TDD SCS=30kHz test cases (except 256QAM scenarios)**  We can compromise to Option 1  **Issue 2-1-4: PDSCH FR1 TDD SCS=30kHz test cases (except 256QAM scenarios)**  We can compromise to Option 1  **Issue 2-4-1: Whether to define 1Rx PBCH demodulation requirements in the case SS/PBCH block index is known**  We prefer Option 2. |
| CMCC | **Issue 2-1-1: Define 256QAM demodulation requirements or not**  We support option1. To make compromise, we can accept to option 2.  **Issue 2-1-2: PDSCH FR1 FDD SCS=15kHz test cases (except 256QAM scenarios)**  Option 1  **Issue 2-1-3: PDSCH FR1 TDD SCS=30kHz test cases (except 256QAM scenarios)**  Option 1  **Issue 2-1-4: PDSCH FR2 TDD SCS=120kHz test cases (except 256QAM scenarios)**  Option 1  **Issue 2-2-1: Whether to define SDR requirements for RedCap UE or not (for FR1 FDD/TDD and FR2)**  Option 1  **Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)**  **Issue 2-3-2: Aggregation level(s) for FR1 TDD SCS=30kHz test cases (1Rx and 2Rx)**  **Issue 2-3-3: Aggregation level(s) for FR2 TDD SCS=120kHz test cases (1Rx and 2Rx)**  Option 1.  **Issue 2-4-1: Whether to define 1Rx PBCH demodulation requirements in the case SS/PBCH block index is known**  We prefer option 1 to align with legacy 2Rx/4Rx requirements. To save the simulation efforts, we can compromise to option2. |

### CRs/TPs comments collection

Not applicable

## 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 2-1-1: Define 256QAM demodulation requirements or not** | **Candidate options:**   * Option 1: Specify 256QAM demodulation requirements for both FR1 and FR2 (CMCC) * Option 2: Specify 256QAM demodulation requirements for FR1 only (Ericsson, Huawei, Intel, Qualcomm, MediaTek, CMCC)   + For 1Rx, set lower MCS to keep the same SNR level as 2Rx requirements (MediaTek) * Option 3: Not to Specify 256QAM demodulation requirements (Apple, Nokia) * Option 4: Keep FFS to reduce the simulation load   + Discuss whether to specify the requirements once we stabilize the discussion on requirements for mandatory features (Intel, Qualcomm)   **Tentative agreements:**   * Option 1: Specify 256QAM demodulation requirements for FR1 only * Option 2: Not to specify 256QAM demodulation requirements. * Option 3: Discuss whether to specify the requirements for FR1 once we stabilize the discussion on requirements for mandatory features.   **Recommendations for 2nd round:**  Discuss the options further. |
| **Issue 2-1-2: PDSCH FR1 FDD SCS=15kHz test cases (except 256QAM scenarios)** | **Candidate options:**   * Option 1 (Ericsson, Apple, Huawei, Intel, Qualcomm, Nokia, MediaTek, CMCC)   + QPSK: Type A, Table 5.2.2.1.1-3 Test 1-1, QPSK 0.30, TDLB100-400, 2Tx, Rank 1, 70% max TP   + 16QAM: Type A, Table 5.2.2.1.1-3 Test 1-4, 16QAM 0.48, TDLC300-100, 2Tx, Rank 1, 70% max TP   + 64QAM: Type A, Table 5.2.2.1.1-4 Test 2-1, 64QAM 0.5, TDLA30-10, 2Tx, Rank 1, 70% max TP * Option 2:   + QPSK MCS4: Type A, Table 5.2.2.1.1-3 Test 1-2?, QPSK 0.3, TDLC300-100, 2Tx, Rank 1, 70% max TP   **Agreements:**  Option 1  **Recommendations for 2nd round:**  Discuss the detailed simulation assumption in WF. |
| **Issue 2-1-3: PDSCH FR1 TDD SCS=30kHz test cases (except 256QAM scenarios)** | **Candidate options:**   * Option 1: (Ericsson, Apple, Huawei, Intel, Qualcomm, Nokia, MediaTek, CMCC)   + QPSK: Type A, Table 5.2.2.2.1-3 Test 1-1, QPSK 0.30, TDLB100-400, 2Tx, Rank 1, 70% max TP   + 16QAM: Type A, Table 5.2.2.2.1-3 Test 1-4, 16QAM 0.48, TLDC300-100, 2Tx, Rank 1, 70% max TP   + 64QAM: Type A, Table 5.2.2.2.1-4 Test 2-1, 64QAM 0.50, TLDA30-10, 2Tx, Rank 1, 70% max TP * Option 2:   + 64QAM MCS19: Type A, Table 5.2.2.2.1-4 Test 2-1?, 64QAM 0.50, TLDA30-10, 2Tx, Rank 1, 70% max TP   **Agreements:**  Option 1  **Recommendations for 2nd round:**  Discuss the detailed simulation assumption in WF |
| **Issue 2-1-4: PDSCH FR2 TDD SCS=120kHz test cases (except 256QAM scenarios)** | **Candidate options:**   * Option 1: (Ericsson, Apple, Huawei, Intel, Qualcomm, Nokia, MediaTek, CMCC)   + QPSK: Type A, Table 7.2.2.2.1-3 Test 1-1, QPSK 0.30, TDLC60-300, 2Tx, Rank 1, 70% max TP   + 16QAM: Type A, Table 7.2.2.2.1-4 Test 2-2, 16QAM 0.48, TDLA30-300, 2Tx, Rank 1, 70% max TP   + 64QAM: Type A, Table 7.2.2.2.1-4 Test 2-6, 64QAM 0.42, TDLA30-75, 2Tx, Rank 1, 70% max TP * Option 2:   + 64QAM MCS17: Type A, Table 7.2.2.2.1-4 Test 2-6?, 64QAM 0.42, TDLA30-75, 2Tx, Rank 1, 70%   **Agreements:**  Option 1  Note: Define only 2Rx requirements according to 1-1-1.  **Recommendations for 2nd round:**  Discuss the detailed simulation assumption in WF |
| **Issue 2-2-1: Whether to define SDR requirements for RedCap UE or not (for FR1 FDD/TDD and FR2)** | **Candidate options:**   * Option 1: Define SDR tests for RedCap 1Rx/2Rx UE (Ericsson, Apple, Huawei, Intel, Qualcomm, Nokia, CMCC) * Option 2: Not define SDR tests for RedCap Ues for both 1Rx/2Rx Ues (Apple)   **Agreements:**  Option 1: Define SDR tests for RedCap 1Rx/2Rx UE  Note: Define only 2Rx requirements for FR2 according to 1-1-1.  **Recommendations for 2nd round:**  No discussion |
| **Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)** | **Candidate options:**   * Option 1: AL4, AL8, and AL16 (Ericsson, Intel, Nokia, CMCC) * Option 2: AL4 and AL8. Open for AL16. (Intel)   + Don’t see this as a necessary condition to introducing a dedicated requirement for AL16 even though it is considered for RRM (Qualcomm) * Option 3: AL4 (Huawei) * Option 4: AL8 (Huawei) * Option 5: No need to cover all AL in all duplex modes. Suggest down selection (Apple, Huawei)   **Tentative agreements:**  One comp want to define AL4, AL8, and AL16. On the other hand the other camp don’t think to cover all the aggregation levels, and some companies think AL16 may not need.  As a compromise, the moderator proposes to specify AL4 and AL8 only.   * Candidate test cases: Table 5.3.2.1.1-1 (Test 3), Table 5.3.2.1.2-1 (Test 3), Table 5.3.2.1.1-1 (Test 5)   **Recommendations for 2nd round:**  Discuss whether the moderator’s proposal is acceptable or not.  Also discuss the simulation assumption. |
| **Issue 2-3-2: Aggregation level(s) for FR1 TDD SCS=30kHz test cases (1Rx and 2Rx)** | **Candidate options:**   * Option 1: AL4, AL8, and AL16 (Ericsson, Intel, Nokia, CMCC) * Option 2: AL4 and AL8. Open for AL16. (Intel)   + Don’t see this as a necessary condition to introducing a dedicated requirement for AL16 even though it is considered for RRM (Qualcomm) * Option 3: AL8 (Huawei) * Option 4: AL4 (Huawei) * Option 5: No need to cover all AL in all duplex modes. Suggest down selection (Apple, Huawei)   **Tentative agreements:**  One camp want to define AL4, AL8, and AL16. On the other hand the other camp don’t think to cover all the aggregation levels, and some companies think AL16 may not need.  As a compromise, the moderator proposes to specify AL4 and AL8 only.   * Candidate test cases: Table 5.3.2.2.1-1 (Test 2), Table 5.3.2.2.2-1 (Test 1), Table 5.3.2.2.1-1 (Test 3)   **Recommendations for 2nd round:**  Discuss whether the moderator’s proposal is acceptable or not.  Also discuss the simulation assumption. |
| **Issue 2-3-3: Aggregation level(s) for FR2 TDD SCS=120kHz test cases (~~1Rx and~~ 2Rx)** | **Candidate options:**   * Option 1: AL4, AL8, and AL16 (Ericsson, Intel, Nokia, CMCC) * Option 2: AL4 and AL8. Open for AL16. (Intel)   + Don’t see this as a necessary condition to introducing a dedicated requirement for AL16 even though it is considered for RRM (Qualcomm) * Option 3: AL8 (Huawei) * Option 4: AL16 (Huawei) * Option 5: No need to cover all AL in all duplex modes. Select one AL only (Apple, Huawei)   **Tentative agreements:**  One comp want to define AL4, AL8, and AL16. On the other hand the other camp don’t think to cover all the aggregation levels, and some companies think AL16 may not need.  As a compromise, the moderator proposes to specify AL4 and AL8 only.   * Candidate test cases: Table 7.3.2.2.1-1 (Test 1-2), Table 7.3.2.2.2-1 (Test 2-1), Table 7.3.2.2.2-1 (Test 2-2)   Note: Define 2Rx requirements only according to 1-1-1. No new simulations are needed.  **Recommendations for 2nd round:**  Discuss whether the moderator’s proposal is acceptable or not.  Also discuss the applicable test cases. |
| **Issue 2-4-1: Whether to define 1Rx PBCH demodulation requirements in the case SS/PBCH block index is known** | **Candidate options:**   * Option 1: Yes (Ericsson, Huawei, Intel, Nokia, CMCC) * Option 2: No (Ericsson, Apple, Huawei, Intel, Qualcomm, Nokia, MediaTek, CMCC)   **Agreements:**  Not to define 1Rx PBCH demodulation requirements in the case SS/PBCH block index is known  Note: Define only 2Rx requirements for FR2 according to 1-1-1.  **Recommendations for 2nd round:**  Discuss the detailed simulation assumption in WF (the case with SS/PBCH block index is **unknown** only) |

### CRs/TPs

None

## Discussion on 2nd round

**Issue 2-1-1: Define 256QAM demodulation requirements or not**

* Proposals
  + Option 1: Specify 256QAM demodulation requirements for FR1 only
    - Option 1a: For 1Rx, set lower MCS to keep the same SNR level as 2Rx requirements
  + Option 2: Not to specify 256QAM demodulation requirements.
  + Option 3: Discuss whether to specify the requirements for FR1 once we stabilize the discussion on requirements for mandatory features
* Recommended WF
  + Discuss the options

**Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)**

* Proposals
  + Option 1: AL4, AL8, and AL16
  + Option 2: AL4 and AL8. Open for AL16.
    - Don’t see this as a necessary condition to introducing a dedicated requirement for AL16 even though it is considered for RRM
  + Option 3: No need to cover all AL in all duplex modes. Suggest down selection.
    - AL4 or AL8
* Recommended WF
  + Moderator proposes to specify AL4 and AL8 only.
    - Candidate test cases: Table 5.3.2.1.1-1 (Test 3), Table 5.3.2.1.2-1 (Test 3), Table 5.3.2.1.1-1 (Test 5)

**Issue 2-3-2: Aggregation level(s) for FR1 TDD SCS=30kHz test cases (1Rx and 2Rx)**

* Proposals
  + Option 1: AL4, AL8, and AL16
  + Option 2: AL4 and AL8. Open for AL16.
    - Don’t see this as a necessary condition to introducing a dedicated requirement for AL16 even though it is considered for RRM
  + Option 3: No need to cover all AL in all duplex modes. Suggest down selection.
    - AL4 or AL8
* Recommended WF
  + Moderator proposes to specify AL4 and AL8 only
    - Candidate test cases: Table 5.3.2.2.1-1 (Test 2), Table 5.3.2.2.2-1 (Test 1), Table 5.3.2.2.1-1 (Test 3)

**Issue 2-3-3: Aggregation level(s) for FR2 TDD SCS=120kHz test cases (2Rx only)**

* Proposals
  + Option 1: AL4, AL8, and AL16
  + Option 2: AL4 and AL8. Open for AL16.
    - Don’t see this as a necessary condition to introducing a dedicated requirement for AL16 even though it is considered for RRM
  + Option 3: No need to cover all AL in all duplex modes. Suggest down selection.
    - AL8 or AL16
* Recommended WF
  + Moderator proposes to specify AL4 and AL8 only
    - Candidate test cases: Table 7.3.2.2.1-1 (Test 1-2), Table 7.3.2.2.2-1 (Test 2-1), Table 7.3.2.2.2-1 (Test 2-2)

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| **Company** | **Comments** |
| XXX | **Issue 2-1-1: Define 256QAM demodulation requirements or not**  **Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)**  **Issue 2-3-2: Aggregation level(s) for FR1 TDD SCS=30kHz test cases (1Rx and 2Rx)**  **Issue 2-3-3: Aggregation level(s) for FR2 TDD SCS=120kHz test cases (2Rx only)**  **Other comments:** |
| Apple | **Issue 2-1-1: Define 256QAM demodulation requirements or not**  We prefer option 2, but are fine to consider once we have agreements on requirements for mandatory features.  **Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)**  We support option 3 to reduce number of test cases.  Suggest the following testcase: AL: 4; Non-Interleaved; CORESET RB:48, CORESET Duration: 1, TDLA30-10, 1TX (Table 5.3.2.1.1-1 Test 4 for 1TX)  If majority support is for AL4 and AL8, then we prefer Table 5.3.2.1.1-1 (Test 3), Table 5.3.2.1.2-1 (Test 3)  **Issue 2-3-2: Aggregation level(s) for FR1 TDD SCS=30kHz test cases (1Rx and 2Rx)**  We support option 3 to reduce number of tests.  Suggest the following testcase: AL:8, Interleaved; CORESET RB:48, CORESET Duration: 1, TDLC300-100, 2TX (Table 5.3.2.2.2-1 Test 1 for 2TX)  If majority support is for AL4 and AL8, then we prefer Table 5.3.2.2.1-1 (Test 2), Table 5.3.2.2.2-1 (Test 1),  **Issue 2-3-3: Aggregation level(s) for FR2 TDD SCS=120kHz test cases (2Rx only)**  We support option 3 to reduce number of tests.  Suggest the following testcase: AL:8; Interleaved; CORESET RB:60, CORESET Duration: 1, TDLA30-75, 2TX (Table 7.3.2.2.2-1 Test 1)  If majority support is for AL4 and AL8, then we prefer Table 7.3.2.2.1-1 (Test 1-2), Table 7.3.2.2.2-1 Test 1  **Other comments:** |
| Huawei | **Issue 2-1-1: Define 256QAM demodulation requirements or not**  We prefer Option 1. As we commented in 1st round. 256QAM is an important feature for demodulation processing which is necessary to be defined even it is optional.  **Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)**  Our preference is to only consider one AL per case but we can compromise to the recommended WF.  For the detailed simulation assumptions, we prefer the following:   * Table 5.3.2.1.1-1 (Test 3): 1Tx for AL4. * Table 5.3.2.1.2-1 (Test 3): 2Tx for AL8.   **Issue 2-3-2: Aggregation level(s) for FR1 TDD SCS=30kHz test cases (1Rx and 2Rx)**  Our preference is to only consider one AL per case but we can compromise to the recommended WF.  For the detailed simulation assumptions, we prefer the following:   * Table 5.3.2.2.1-1 (Test 2): 1Tx for AL4 with the following change: * Bandwidth: 40MHz -> 20MHz * CORESET RB: 102->48 * Table 5.3.2.2.2-1 (Test 1): 2Tx for AL8 with the following change * Bandwidth: 40MHz -> 20MHz * CORESET RB: 90->48   **Issue 2-3-3: Aggregation level(s) for FR2 TDD SCS=120kHz test cases (2Rx only)**  Our preference is to only consider one AL per case but we can compromise to the recommended WF.  For the detailed simulation assumptions, we prefer the following:   * Table 7.3.2.2.1-1 (Test 1-2): 1Tx for AL4. * Table 7.3.2.2.2-1 (Test 2-1) 2Tx for AL8. |
| MediaTek | **Issue 2-1-1: Define 256QAM demodulation requirements or not**  Option 1a. If the requirements for 256QAM is defined, we should consider the operating SNR for the case of 1Rx receiver.  **Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)**  We are OK to consider AL4 and AL 8 only.   * Table 5.3.2.1.1-1 (Test 3): 1Tx for AL4. * Table 5.3.2.1.2-1 (Test 3): 2Tx for AL8.   **Issue 2-3-2: Aggregation level(s) for FR1 TDD SCS=30kHz test cases (1Rx and 2Rx)**  We are OK to consider AL4 and AL 8 only.   * Table 5.3.2.2.1-1 (Test 2): 1Tx for AL4 considering 20 MHz. * Table 5.3.2.2.2-1 (Test 1): 2Tx for AL8 considering 20 MHz.   **Issue 2-3-3: Aggregation level(s) for FR2 TDD SCS=120kHz test cases (2Rx only)**  We are OK to consider AL4 and AL 8 only.   * Table 7.3.2.2.1-1 (Test 1-2): 1Tx for AL4. * Table 7.3.2.2.2-1 (Test 2-1): 2Tx for AL8. |
| NOKIA | **Issue 2-1-1: Define 256QAM demodulation requirements or not**  We agree with Apple. We prefer option 2, but we are fine to consider once we have agreements on requirements for mandatory features.  **Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)**  We agree with the recommended WF  **Issue 2-3-2: Aggregation level(s) for FR1 TDD SCS=30kHz test cases (1Rx and 2Rx)**  We agree with the recommended WF  **Issue 2-3-3: Aggregation level(s) for FR2 TDD SCS=120kHz test cases (2Rx only)**  We agree with the recommended WF  **Other comments:** |
| Ericsson | **Issue 2-1-1: Define 256QAM demodulation requirements or not**  We support Option 1, but we are also fine with Option 3.  **Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)**  We are ok to test with at least AL4 and AL8, from the test coverage. We are fine with the test cases proposed by MediaTek.  **Issue 2-3-2: Aggregation level(s) for FR1 TDD SCS=30kHz test cases (1Rx and 2Rx)**  We are ok to test with at least AL4 and AL8, from the test coverage. We are fine with the test cases proposed by MediaTek.  **Issue 2-3-3: Aggregation level(s) for FR2 TDD SCS=120kHz test cases (2Rx only)**  We are ok to test with at least AL4 and AL8, from the test coverage. We are fine with the test cases proposed by MediaTek. |

## Summary for 2nd round

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|  | **Status summary** |
| **Issue 2-1-1: Define 256QAM demodulation requirements or not** | **Candidate options:**   * Option 1: Specify 256QAM demodulation requirements for FR1 only (Huawei, MediaTek)   + Candidate test setup:     - TS38.101-4 5.2.2.1.1-3 Test 1-3 for FDD 15kHz     - TS38.101-4 5.2.2.2.1-3 Test 1-3 for TDD 30kHz   + FFS the MCS for 1Rx case * Option 2: Not to specify 256QAM demodulation requirements (Apple, Nokia) * Option 3: Discuss whether to specify the requirements for FR1 once we stabilize the discussion on requirements for mandatory features (Nokia, Ericsson)   **Recommended WF:**  Moderator proposes to keep three options open. |
| **Issue 2-3-1: Aggregation level(s) for FR1 FDD SCS=15kHz test cases (1Rx and 2Rx)** | **Candidate options:**   * Option 1: Specify PDCCH demodulation requirements with AL4 and AL8 (MediaTek, Nokia, Ericsson) * Option 2: Specify PDCCH demodulation requirements with AL4 or AL8 (Apple, Huawei) * Candidate test cases:   + AL4: Table 5.3.2.1.1-1 (Test 3)   + AL8: Table 5.3.2.1.2-1 (Test 3)   **Recommended WF:**  Moderator proposes to keep three options open. |
| **Issue 2-3-2: Aggregation level(s) for FR1 TDD SCS=30kHz test cases (1Rx and 2Rx)** | **Candidate options:**   * Option 1: Specify PDCCH demodulation requirements with AL4 and AL8 (MediaTek, Nokia, Ericsson) * Option 2: Specify PDCCH demodulation requirements with AL4 or AL8 (Apple, Huawei) * Candidate test cases:   + AL4: Table 5.3.2.2.1-1 (Test 2)   + AL8: Table 5.3.2.2.2-1 (Test 1)   **Recommended WF:**  Moderator proposes to keep two options open. |
| **Issue 2-3-3: Aggregation level(s) for FR2 TDD SCS=120kHz test cases (2Rx)** | **Candidate options:**   * Option 1: Specify PDCCH demodulation requirements with AL4 and AL8 (MediaTek, Nokia, Ericsson) * Option 2: Specify PDCCH demodulation requirements with AL4 or AL8 (Apple, Huawei) * Candidate test cases:   + AL4: Table 7.3.2.2.1-1 (Test 1-2)   + AL8: Table 7.3.2.2.2-1 (Test 2-1)   **Recommended WF:**  Moderator proposes to keep two options open. |

# Topic #3: CSI reporting requirements

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

See 1.1

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

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

Background: For 2Rx tests for FR1 FDD, define new 2Rx tests for FR1 FDD with CQI table 1. FFS whether to define test with CQI table 2 for Redcap UE supporting 256 QAM. If agreed, existing test requirements can be reused

**Issue 3-1-1: Whether to define CQI reporting test with CQI table 2 for RedCap 2Rx UE supporting 256QAM in FR1 FDD**

* Proposals
  + Option 1: (CMCC, Ericsson, Intel) Define 2Rx test with both CQI table 1 and CQI table 2 for FR1 FDD
    - Consider applicability rule that in case UE passes the test with CQI table 2, it is not needed to pass the tests with CQI Table 1
  + Option 2: (Apple, Nokia, Huawei) Define 2Rx test only with CQI table 1 for FR1 FDD
* Recommended WF
  + Collect inputs

**Issue 3-1-2: Test points for CQI reporting test with CQI table 1**

* Proposals (Ericsson)
  + Set two SNR test points corresponding to CQI indexes of 16QAM and 64QAM for RedCap 1Rx and 2Rx UEs
    - For the static condition CQI reporting test with CQI table 1 for 2Rx UEs, assume to set SNR=8/9dB and SNR=14/15dB as the starting point.
    - For the wideband CQI reporting test with CQI table 1 in fading condition, set two SNR test points corresponding to CQI indexes of 16QAM and 64QAM for RedCap 1Rx and 2Rx UEs.
* Recommended WF
  + Collect inputs

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

**Issue 3-2-1: Whether to define PMI reporting requirements for RedCap UEs**

* Proposals
  + Option 1: Define PMI reporting requirements for both 1Rx and 2Rx UEs
    - Option 1a: (CMCC) Define both 4Tx and 8Tx configurations (for 1Rx/2Rx)
    - Option 1b: (Qualcomm) Select one among the Tx configurations (for 1Rx/2Rx)
    - Option 1c: (Ericsson) Define 4Tx configuration for 1Rx and both 4Tx/8Tx configurations for 2Rx
    - Option 1d: (Intel) Define 8Tx configuration for 1Rx/2Rx.
  + Option 2: (Apple, Huawei) Not define PMI reporting requirements for RedCap UEs.
  + Option 3: (Nokia) Define PMI reporting requirements only for 2Rx UE.
* Recommended WF
  + Collect inputs

### Sub-topic 3-3 RI reporting requirements for 2Rx UE

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

* Proposals
  + Option 1: (CMCC, Qualcomm, Nokia, Intel) Define RI reporting requirements
  + Option 2: (Apple, Ericsson, Huawei) Not define RI reporting requirements
* Recommended WF
  + Collect inputs

## Companies views’ collection for 1st round

### Open issues

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| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 3-1-1: Whether to define CQI reporting test with CQI table 2 for RedCap 2Rx UE supporting 256QAM in FR1 FDD  Issue 3-1-2: Test points for CQI reporting test with CQI table  Issue 3-2-1: Whether to define PMI reporting requirements for RedCap UEs  Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx UEs  Others: |
| Ericsson | Issue 3-1-1: Whether to define CQI reporting test with CQI table 2 for RedCap 2Rx UE supporting 256QAM in FR1 FDD  Option 1. As we commented in Sub-topic 2-1, although it is optional feature, we think it is important to ensure the higher throughput (e.g., 150Mbps DL as specified in WID) with the limited channel BW of 20MHz and single MIMO layer.  Since it does not increase the simulation work and it is optional feature, we are fine to define CQI reporting test with CQI table 2 for RedCap 2Rx UE supporting 256QAM in FR1 FDD.  Issue 3-1-2: Test points for CQI reporting test with CQI table  Support to set 2 SNR test points covering CQI index corresponding to 16QAM and 64QAM. SNR=8/9dB and 14/15dB are good starting points.  Issue 3-2-1: Whether to define PMI reporting requirements for RedCap UEs  We support to define PMI reporting test for 1Rx/2Rx. To reduce the number of test cases, we are open to limit the test case with either 4Tx or 8Tx as proposed in options 1b or 1d, for both 1Rx and 2Rx UEs.  Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx UEs  We are open to define RI requirements if most companies support to define RI requirements for 2Rx UE.  Others: |
| Apple | Issue 3-1-1: Whether to define CQI reporting test with CQI table 2 for RedCap 2Rx UE supporting 256QAM in FR1 FDD  Do not define requirements with CQI table 2 for RedCap UE. It would save some simulation effort and also reduce number of requirements. We don’t have requirements for CQI table 1 and 2 in Rel-15 for the same reason.  We don’t think RAN4 needs to define requirements to ensure the peak data rate requirements specified in WID are met.  Issue 3-1-2: Test points for CQI reporting test with CQI table  Need to decide based on simulation results to cover SNR region with CQI report corresponding to 64QAM and QPSK or 16QAM. We can set SNR of 1RX 3dB higher than 2RX requirements.  Issue 3-2-1: Whether to define PMI reporting requirements for RedCap UEs  We proposed to de-prioritize PMI reporting for RedCap considering simulation and testing effort. But we also understand that it is important to cover the basic mandatory features for RedCap UEs, so we can support defining requirements, with the condition that either 4TX or 8TX are selected and we have applicability rule for number of RX (as proposed for demod requirements).  Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx UEs  While we see benefit of PMI reporting, RI reporting would only be for 2RX and given the use cases for RedCap UEs, we think RI reporting may not be very widely used for RedCap. Hence we can de-prioritize RI reporting requirements for RedCap with 2RX.  Others: |
| Huawei | **Issue 3-1-1: Whether to define CQI reporting test with CQI table 2 for RedCap 2Rx UE supporting 256QAM in FR1 FDD**  We support Option 2. Based on our understanding, if we choose the SNR point corresponding to up to 64QAM as did in Rel-15, there is no difference between CQI table 1 and CQI table 2. Therefore, we propose to not consider option 1. Also we think that it is enough to cover the support of 256QAM in PDSCH demodulation test as discussed in Issue 2-1-1.  **Issue 3-1-2: Test points for CQI reporting test with CQI table 1**  Considering the CQI table has been changed (NR Rel-15 CQI requirements are based on CQI table 2), we propose to reselect the SNR point based on the simulation results related to SNR from -6dB to 20dB.  **Issue 3-2-1: Whether to define PMI reporting requirements for RedCap UEs**  We proposed to not consider PMI reporting requirements, but if companies have strong views to introduce this requirement, we can compromise to only consider one TX configuration introduced for UE supporting different number of receiving antenna, i.e. Option 1b.  **Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx Ues**  We propose to not define the RI requirements since it is only applicable for 2RX UEs and we propose to keep the cases alignment between 2RX UEs and 1RX UEs as much as possible. Moreover, we should reduce the test number for RedCap UE to reduce the test cost. |
| Intel | **Issue 3-1-1: Whether to define CQI reporting test with CQI table 2 for RedCap 2Rx UE supporting 256QAM in FR1 FDD**  Taking into account that existing requirements can be reused for testing of CQI Table 2, and we just need to define the applicability rule without any simulation work load increase, we support Option 1.  **Issue 3-1-2: Test points for CQI reporting test with CQI table**  We are fine to consider two SNR test points corresponding different CQI indexes with different modulation formats. We need to double check whether QPSK and 64QAM or 16QAM and 64QAM should be covered. The final SNR points can be decided based on simulation results.  **Issue 3-2-1: Whether to define PMI reporting requirements for RedCap UEs**  We support the definition of PMI requirements only for one TX antenna configuration. Our original proposal is 8 Tx. But, taking into account that XPL antenna configuration is more typical for 8 Tx and we don’t have the correlation model for 1 Rx XPL case, probably it is better to use 4 Tx case for 1 Rx UE. And we are fine to consider 4 Tx for 2 Rx UE testing.  **Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx UEs**  Support definition of RI requirements to verify that all components of CSI framework work correctly. |
| Qualcomm | **Issue 3-1-1**  Is Option 1 proposing to extend the applicability of existing CQI requirements for this case only (2RX/FDD)? This would leave out 2RX/TDD and 1 RX/TDD&FDD  Similarly to our view on PDSCH requirements, we are ok with introducing requirements that cover the optional support to 256QAM, but we these can be discussed after we progress on mandatory requirements and their coverage should be align across duplex and RX;  **Issue 3-1-2**  Given that the CQI table will be different for 2RX UEs, we need to decide the SNR points based on simulation results.  We are ok with 2 SNR points targeting 16 and 64 QAM respectively.  **Issue 3-2-1**  We support Option 1b, the choice on TX configuration can be based on the feedback collected;  **Issue 3-3-1**  Given that the corresponding 1RX requirement would be meaningless, we don’t see any reason not to introduce this requirement for 2RX only, so we are okay with option 1; |
| Nokia | Issue 3-1-1: Whether to define CQI reporting test with CQI table 2 for RedCap 2Rx UE supporting 256QAM in FR1 FDD  Option 1.  Since 256 QAM is not a mandatory feature for RedCap UE and in order to reduce the number of test cases we proposed to define new 2Rx tests for FR1 FDD with CQI table 1  We think our proposal was wrongly captured and we are correcting that in our comment here  Issue 3-1-2: Test points for CQI reporting test with CQI table  We agree with the proposal as a starting point.  Issue 3-2-1: Whether to define PMI reporting requirements for RedCap UEs  We are ok with option 1. and we only proposed option 3 as a kind of comprise.  Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx UEs  Support definition of RI requirements to verify that all components of CSI framework work correctly.  Others: |
| MediaTek | **Issue 3-1-1: Whether to define CQI reporting test with CQI table 2 for RedCap 2Rx UE supporting 256QAM in FR1 FDD**  We prefer Option 2.  **Issue 3-1-2: Test points for CQI reporting test with CQI table**  We should determine the SNR test point based on the simulation results. |

### CRs/TPs comments collection

Not applicable

## 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 3-1-1: Whether to define CQI reporting test with CQI table 2 for RedCap 2Rx UE supporting 256QAM in FR1 FDD** | **Candidate options:**  For FR1 FDD 2Rx UE:   * Option 1: Define with both CQI table 1 and with CQI table 2 (Ericsson, Intel, Qualcomm)   + Possible to define the applicability rule without any simulation work load increase * Option 2: Define only with CQI table 1 (Apple, Huawei, Nokia, MediaTek)   + If we choose the SNR point corresponding to up to 64QAM as did in Rel-15, there is no difference between CQI table 1 and CQI table 2.   **Tentative agreements:**  Option 1: Define test with both CQI table 1 and table 2 with applicability of 256QAM support.  Option 2: Define test with only CQI table 1.  **Recommendations for 2nd round:**  Continue the discussion considering the comments:   * For Option 1, RAN4 does not required additional simulation work. * For Option 2, there is no difference between CQI table 1 and CQI table 2 if RAN4 choose SNR test points corresponding up to 64QAM. |
| **Issue 3-1-2: Test points for CQI reporting test with CQI table 1** | **Candidate options:**   * Option 1: (Ericsson, Nokia)   + Set two SNR test points corresponding to CQI indexes of 16QAM and 64QAM for RedCap 1Rx and 2Rx UEs     - For the static condition CQI reporting test with CQI table 1 for 2Rx UEs, assume to set SNR=8/9dB and SNR=14/15dB as the starting point.     - For the wideband CQI reporting test with CQI table 1 in fading condition, set two SNR test points corresponding to CQI indexes of 16QAM and 64QAM for RedCap 1Rx and 2Rx UEs. * Option 2: (Apple, Intel, Qualcomm)   + Set two SNR test points based on simulation results to cover SNR region with CQI report corresponding to 64QAM and QPSK or 16QAM * Option 3: (Huawei, MediaTek)   + Select the SNR point based on the simulation results     - SNR range from -6dB to 20dB (Huawei)   **Tentative agreements:**  Set two SNR test points based on simulation results to cover SNR region with CQI report corresponding to 64QAM and QPSK or 16QAM  **Recommendations for 2nd round:**  Discuss the tentative agreements, and simulation assumption for both static case and fading cases in WF |
| **Issue 3-2-1: Whether to define PMI reporting requirements for RedCap UEs** | **Candidate options:**   * Option 1: Define PMI reporting requirements for both 1Rx and 2Rx UEs (Nokia)   + Option 1a: Define both 4Tx and 8Tx configurations (for 1Rx/2Rx)   + Option 1b: Select one among the Tx configurations (for 1Rx/2Rx) (Ericsson, Apple, Huawei, Qualcomm)   + Option 1c: Define 4Tx configuration for 1Rx and both 4Tx/8Tx configurations for 2Rx   + Option 1d: Define only 8Tx configuration for 1Rx/2Rx. (Ericsson, Apple, Huawei)   + Option 1e: Define only 4Tx configuration for 1Rx/2Rx. (Ericsson, Apple, Huawei, Intel)     - For 1Rx UE, it is better to use 4Tx case because no antenna correlation model for 1Rx. * Option 2: Not define PMI reporting requirements for RedCap UEs. * Option 3: Define PMI reporting requirements only for 2Rx UE. (Nokia)   **Tentative agreements:**  Companies support to define PMI reporting test for 1Rx/2Rx by selecting one among the Tx configurations. According to the comment by Intel, 4Tx case seems most reasonable for 1Rx UE. Moderator propose to define PMI test with 4Tx.  Define PMI reporting requirements with 4Tx configuration for both 1Rx and 2Rx UEs  **Recommendations for 2nd round:**  Discuss the tentative agreements, and simulation assumption in WF. |
| **Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx UEs** | **Candidate options:**   * Option 1: Yes (Ericsson. Intel, Qualcomm, Nokia) * Option 2: No (Ericsson, Apple, Huawei)   **Tentative agreements:**  There are still two different views.  Option 1: Define RI reporting tests for RedCap 2Rx UE.  Option 2: Not to define RI reporting tests for RedCap 2Rx UE.  **Recommendations for 2nd round:**  Continue the discussion on two options. |

### CRs/TPs

None

## Discussion on 2nd round

**Issue 3-1-1: Whether to define CQI reporting test with CQI table 2 for RedCap 2Rx UE supporting 256QAM in FR1 FDD**

* Proposals
  + Option 1: Define test with both CQI table 1 and table 2 with applicability of 256QAM support.
    - RAN4 does not required additional simulation work
  + Option 2: Define test with only CQI table 1.
    - No requirement difference between CQI table 1 and CQI table 2 if RAN4 choose SNR test points corresponding up to 64QAM
* Recommended WF
  + Discuss the options

**Issue 3-1-2: Test points for CQI reporting test with CQI table 1**

* Recommended WF
  + Set two SNR test points based on simulation results to cover SNR region with CQI report corresponding to:
    - 64QAM
    - QPSK or 16QAM

**Issue 3-2-1: Whether to define PMI reporting requirements for RedCap UEs**

* Recommended WF
  + Define PMI reporting requirements with 4Tx configuration for both 1Rx and 2Rx UEs.

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

* Proposals
  + Option 1: Define RI reporting tests for RedCap 2Rx UE.
  + Option 2: Not to define RI reporting tests for RedCap 2Rx UE.
* Recommended WF
  + Discuss the options.

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| **Company** | **Comments** |
| XXX | **Issue 3-1-1: Whether to define CQI reporting test with CQI table 2 for RedCap 2Rx UE supporting 256QAM in FR1 FDD**  **Issue 3-1-2: Test points for CQI reporting test with CQI table 1**  **Issue 3-2-1: Whether to define PMI reporting requirements for RedCap UEs**  **Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx UEs**  **Other comments:** |
| Apple | **Issue 3-1-1: Whether to define CQI reporting test with CQI table 2 for RedCap 2Rx UE supporting 256QAM in FR1 FDD**  Support option 2. If we decide to introduce requirements for DSCH demod with 256QAM (at later stage), we can use approach in option 1 for CQI reporting requirements.  **Issue 3-1-2: Test points for CQI reporting test with CQI table 1**  Choose SNR points corresponding to 64QAM and QPSK region  **Issue 3-2-1: Whether to define PMI reporting requirements for RedCap UEs**  Fine with recommended WF.  **Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx UEs**  Option 2. Do not introduce requirements for RI reporting for RedCap UEs with 2RX.  **Other comments:** |
| Huawei | **Issue 3-1-1: Whether to define CQI reporting test with CQI table 2 for RedCap 2Rx UE supporting 256QAM in FR1 FDD**  Option 2. Unlike demodulation part, CQI table doesn’t have impact on CQI calculation if SNR corresponding up to 64QAM is selected. What’s more, if we agree to define CQI reporting test with CQI table 2 for 2RX UE, it is reasonable that we also need to define the same test case for 1RX UE, but this will bring additional simulation burden.  **Issue 3-1-2: Test points for CQI reporting test with CQI table 1**  No strong view. It can be discussed in next meeting based on the simulation results from companies.  **Issue 3-2-1: Whether to define PMI reporting requirements for RedCap UEs**  For FR1, we support only define PMI requirements for 4TX.  However, for FR2, we prefer to only consider 2TX to be aligned with Rel-15.  For detailed assumptions, we propose the following:   * FR1 FDD: Table 6.3.2.1.1-1 * FR1 TDD: Table 6.3.2.2.1-1 * FR2 TDD: Table 8.3.2.2.1-1   **Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx UEs**  Option 2. Same views with Apple, don’t introduce the requirements for RI reporting for RedCap UEs with 2RX |
| NOKIA | **Issue 3-1-1: Whether to define CQI reporting test with CQI table 2 for RedCap 2Rx UE supporting 256QAM in FR1 FDD**  Support option 2.  **Issue 3-1-2: Test points for CQI reporting test with CQI table 1**  We support the WF.  **Issue 3-2-1: Whether to define PMI reporting requirements for RedCap UEs**  We are fine with the WF.  **Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx UEs**  We prefer option 1. RedCap UE should be tested if it declares that it supports RI reporting in MIMO framework. However, for the sake of advance of work we are ok to deprioritizes RI reporting and focus on the already high number of test cases we have as a start.  **Other comments:** |
| Ericsson | **Issue 3-1-2: Test points for CQI reporting test with CQI table 1**  Support the recommended WF. We want to check the median CQI index per SNR.  **Issue 3-2-1: Whether to define PMI reporting requirements for RedCap UEs**  Support the recommended WF. For the test cases, we agree with Huawei’s proposal.  For FR1, we also propose to change the antenna configuration to 4x1 **ULA** for instead of **XP**, as pointed by Intel in the first round.  **Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx UEs**  We support Option 2. Same view as Apple and Huawei. |

## Summary for 2nd round

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|  | **Status summary** |
| **Issue 3-1-1: Whether to define CQI reporting test with CQI table 2 for RedCap 2Rx UE supporting 256QAM in FR1 FDD** | **Candidate options:**  For FR1 FDD 2Rx UE:   * Option 1: Define test with both CQI table 1 and table 2 with applicability of 256QAM support * Option 2: Define test with only CQI table 1 (Apple, Huawei, Nokia)   Since no companies support Option 1, the moderator recommends Option 2 as the agreement.  **Recommended WF:**  Define test with only CQI table 1. |
| **Issue 3-1-2: Test points for CQI reporting test with CQI table 1** | **Agreements:**   * Set two SNR test points based on simulation results to cover SNR region with CQI report corresponding to:   + 64QAM   + QPSK or 16QAM |
| **Issue 3-2-1: Whether to define PMI reporting requirements for RedCap UEs** | **Agreements:**   * Define PMI reporting requirements with 4Tx configuration for FR1 for both 1Rx and 2Rx UEs * Define PMI reporting requirements with 2Tx configuration for FR2 for 2Rx UE |
| **Issue 3-3-1: Whether to define RI reporting requirements for RedCap 2Rx UEs** | **Candidate options:**   * Option 1: Yes (Nokia) * Option 2: No (Ericsson, Apple, Huawei)   **Recommended WF:**  Moderator proposes to keep two options open. |

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on RedCap UE demodulation and CQI reporting requirements | Ericsson | Capture the agreements and provide the simulation assumption if possible. |

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-2107451 | WF on RedCap UE demodulation and CQI reporting requirements | Ericsson | Agreeable |  |

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

# Annex

Contact information

|  |  |  |
| --- | --- | --- |
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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)