**3GPP TSG-RAN WG4 Meeting # 99-e R4-21xxxxx**

**Online, May 19-27, 2021**

**Agenda item:** 6.1.7.1, 6.1.7.2, 6.1.7.3

**Source:** Qualcomm

**Title:** Email discussion summary for [99-e][321]

**Document for:** Information

# Introduction

List of candidate target of email discussion for 1st round and 2nd round

* 1st round: Agree on the issues pending from the last RAN4 meeting, discuss the final requirements based on the simulation results shared by the companies, review proposed draft CR;
* 2nd round: Keep discussing on issues pending from the 1st round;

# Topic #2: Demodulation Requirements (PDSCH and CQI)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2109352 | Apple | Proposal #1: Define requirements for Scenario A and C for 20MHz CBW. |
| R4-2109354 | Apple | Proposal #1: In slot 1 of FFP configure Aperiodic CSI report with aperiodic report slot offset of 6.  Proposal #2: Use same downlink transmission scheme as agreed for PDSCH demod requirements.  Proposal #3: Re-use the test parameters from CQI reporting tests in static channel for unlicensed carrier where applicable.  Proposal #4: Define CQI reporting requirements for NR-U with the same SNR pair as Test 1 for existing CQI reporting tests in static channel.  Proposal #5: Define minimum delta of median CQI of 2 for different transmission burst. |
| R4-2109588 | Ericsson | Issue 1-3: Requirement definition method for Scenario A and C.  Observation: The maximum bandwidth for PCell is 40MHz for n66 and 20MHz for n25 and n48.  Proposal 1: Configure TDD 20MHz for PCell in the test setup.  Observation: There is no statement for mandatory UE supported bandwidth.  Proposal 2: Define PDSCH requirements for {20, 40, 60, 80} MHz NR-U unlicensed cell. Only test the largest supported bandwidth for both Scenario A and C.  Issue 2: CQI report scheduling  Observation: Periodic CQI report could not fit in agreed burst transmission model.  Observation: The gap between aperiodic CSI report and its reference CSI-RS could be much smaller than periodic CSI report situation.  Proposal 3: Taking aperiodic CQI report for NR-U CQI report requirement test. |
| R4-2109591 | Ericsson | Proposal 1: Use aperiodic CQI report to fit for agreed burst transmission structure.  Proposal 2: Only define NR-U CQI report requirement for 2Rx.  Proposal 3: Consider following SNR configuration for CQI report requirement.  Option 1: Low SNR burst set [3, 4] dB, high SNR burst set [9, 10];  Option 2: Low SNR burst set [7, 8] dB, high SNR burst set [13, 14]; |
| R4-2110500 | Huawei | Observation 1: It is optional for a UE to support a specific bandwidth for a given band.  Proposal 1: Define the 20MHz for license band and define the requirements for 20MHz, 40MHz, 60MHz and 80MHz for unlicensed band with the following applicability rules:  - For scenario A: After selecting the largest NR-U supported CBW by the UE, configure NR PCell with 20 MHz CBW in combination with selected NR-U CBW;  - For scenario C: Only test the supported largest channel bandwidth. |
| R4-2110502 | Huawei | Proposal 1: Use CQI Table 2.  Proposal 2: Set SNR pair to [8, 9]dB without power level boost for 2RX and Set SNR pair to [5, 6]dB without power level boost for 4RX and set minimum delta CQI for transmission burst with different power level boost to 2  Proposal 3: Use periodic CQI reporting.  Proposal 4: Set CQI reporting periodicity and offset to 10 slots/ 9 slots and schedule PUCCH format 2 to transmit CQI information CQI in the first two symbols of last slot in each FFP.  Proposal 5: Reuse the codebook configuration of Rel-15 CQI testing.  Proposal 6: Change the S2 from {6, 9, 12, 14} to {14}.i.e. Always schedule full slots in the LBT burst transmission for NR-U CQI testing. |
| R4-2110718 | Qualcomm | Proposals 1: For NR-U CQI Performance tests, use CQI Table 2.  Proposals 2: For NR-U CQI Performance tests, use CodebookSubsetRestriction 010000.  Proposal 3: For NR-U CQI Performance tests, define requirements for 2RX using SNR [8, 9] dB, with the applicability rule that satisfying the requirement for one SNR point is sufficient.  Proposal 4: For NR-U CQI Performance tests, define requirements for 4RX using SNR [5, 6] dB, with the applicability rule that satisfying the requirement for one SNR point is sufficient.  Proposal 4: For NR-U CQI Performance tests, use the applicability rule to test UEs only for the largest supported number of RX.  Proposal 4: Regarding the passing criteria for NR-U CQI Performance tests, the Median CQI delta across reporting based on different power boost should be larger than 2, for both 2RX and 4RX. |
| R4-2110766 | Qualcomm | Observation 1: Previous agreements were to define NR-U PDSCH demodulation requirements for the unlicensed carrier for BW {20,40,60,80} MHz and test the largest supported BW only.  Observation 2: For operations in unlicensed bands, support for BW {20, 40, 60, 80} MHz is mandatory.  Observation 3: Impact of CBW on the SNR requirement is limited (<1dB difference among proposed CBW options).  Proposal 1: In line with current agreements, define and test NR-U UE PDSCH Performances requirements for 80MHz only.  Proposal 2: Same as NR-U PDSCH, NR-U UE CQI Performances requirements should be defined and tested for 80MHz only.  Proposal 3: For Scenario A, configure the NR PCell with CBW = 20MHz.  Proposal 4: According to the proposals in this contribution for defining a single requirement CBW (for both NR licensed CC and NR Unlicensed CC), test applicability rules for largest supported CBW in NR-U PDSCH Tests are not needed and should not be included.  Observation 4: The minimum gap between CSI-RS scheduling and Periodic CQI reporting is 8 slots for 30kHz SCS.  Observation 5: Periodic CQI reporting would constraint CSI-RS scheduling and CQI Reporting to Slot #0 and Slot #9 respectively, within each 5ms periodicity.  Observation 6: The minimum delay between CSI-RS scheduling and Aperiodic CSI reporting is 33 Symbols, which can fit within the 5ms periodicity, leaving the last slot completely idle.  Proposal 5: To keep last slot as idle and avoid conflicts with SSB slot, use CSI-RS scheduling with periodicity 10 slots and offset 1 slot and Aperiodic CSI Report type. |
| R4-2110947 | Intel | Observation 1: TD multiplexing of DRS with data can take place only if data has BW equal to 20MHz. Otherwise another LBT for data is required  Observation 2: DRS occupies first two slots, which overlaps with candidate positions for CSI-RS transmission.  Proposal 1: Define dedicated COT for DRS transmission equal to 1ms (i.e. no TD multiplexing of DRS with data)  Proposal 2: Define DRS periodicity equal to 40ms  Proposal 3: For periodic CQI reporting define CSI-RS periodicity and offset as 10 and 0 slots respectively  Proposal 4: For periodic CQI reporting define CSI-Report periodicity and offset as 10 and 8 slots respectively |
| R4-2109592 | Ericsson | CQI Simulation Results |
| R4-2110502 | Huawei | CQI Simulation Results |

## Open issues summary

The issues listed in this section address topics for discussions related to issue both general and specific for PDSCH performance testing.

### Sub-topic 1-1: DRS Configuration

**Issue 1-1-1: Whether to define a dedicated COT for DRS transmission**

* Proposals
  + Option 1: No, multiplex DRS and data in TD within the same COT, without multiplexing SSB and data in the same slot (Current WF);
  + Option 2: Yes, define dedicated COT for DRS equal to 1ms, without multiplexing in TD DRS and Data (Intel);
* Recommended WF:
  + TBA;

---------------GTW Note------------

Intel: multiplexing DRS and data with mixed BW is not supported in our view.

QC: We think no need to be aligned BW for DRS and data.

Intel: We need perform another LBT.

Agreement: Option 1.

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| **Company** | **Comments** |
| Qualcomm | We identified two problems raised by Intel in their contribution regarding the current agreements on the DRS window, and it is our view that they do not motivate defining a dedicated COT for DRS.  The observations are:   1. *TD multiplexing of DRS with data can take place only if data has BW equal to 20MHz. Otherwise another LBT for data is required;*   We do not see an impediment in having the NB perform LBT after the end of the transmission of the SSB to continue with the PDSCH transmission as agreed over all the subbands, for tests with CBW larger than 20MHz.  For dynamic channel access these two separate transmission does not seem to pose a problem.  For semi-static channel access, according to 37.213, Section 4.3, multiple DL transmission bursts within the COT can be transmitted as long as the gNB performs LBT appropriately.   |  | | --- | | A channel occupancy initiated by a gNB and shared with UE(s) satisfies the following:  - The gNB shall transmit a DL transmission burst starting at the beginning of the channel occupancy time immediately after sensing the channel to be idle for at least a sensing slot duration Tsi=9us. If the channel is sensed to be busy, the gNB shall not perform any transmission during the current period.  - The gNB may transmit a DL transmission burst(s) within the channel occupancy time immediately after sensing the channel to be idle for at least a sensing slot duration Tsi=9us if the gap between the DL transmission burst(s) and any previous transmission burst is more than 16us. |  1. *DRS occupies first two slots, which overlaps with candidate positions for CSI-RS transmission*.   Unless there are other reasons why this should be avoided, this possibility seems to be contemplated and allowed according to the spec in 37.213, Section 4.0   |  | | --- | | A discovery burst refers to a DL transmission burst including a set of signal(s) and/or channel(s) confined within a window and associated with a duty cycle. The discovery burst can be any of the following:  - Transmission(s) initiated by an eNB that includes a primary synchronization signal (PSS), secondary synchronization signal (SSS) and cell-specific reference signal(s)(CRS) and may include non-zero power CSI reference signals (CSI-RS).  - Transmission(s) initiated by a gNB that includes at least an SS/PBCH block consisting of a primary synchronization signal (PSS), secondary synchronization signal (SSS), physical broadcast channel (PBCH) with associated demodulation reference signal (DM-RS) and may also include CORESET for PDCCH scheduling PDSCH with SIB1, and PDSCH carrying SIB1 and/or non-zero power CSI reference signals (CSI-RS). |   In conclusion, it’s our view that no modifications need to be done to the current DRS window assumption, so support option 1. |
| Huawei | We agree with QC and support Option 1 |
| Ericsson | We agree with Option 1. |
| Intel | Ok with Option 1 |

**Issue 1-1-2: DRS Duration, Periodicity**

* Proposals
  + Option 1: 1ms duration, 20ms periodicity (Current WF);
  + Option 2: 1ms duration, 40ms periodicity (Intel);
* Recommended WF:
  + TBA;

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| **Company** | **Comments** |
| Qualcomm | Option 1, keep current DRS agreements. |
| Apple | Option 1. We don’t see strong reason to change the DRS periodicity. |
| Huawei | Option 1 |
| Ericsson | Agree with Option 1. |
| Intel | Agree with Option 1. Option 2 was reasonable only if dedicated COT for DRS would be defined |

### Sub-topic 1-2: Bandwidth configuration

**Issue 1-2-1: Bandwidth to be used for PDSCH requirement definition, NR Unlicensed CC (Scenario A and C)**

* Proposals
  + Option 1: 20 MHz (Apple);
  + Option 2: 80 MHz (Qualcomm);
  + Option 2: Define requirements for {20, 40, 60, 80} and test the largest supported unlicensed CBW only (Current WF, Ericsson, Huawei);
* Recommended WF:
  + According to the current agreement in the WF and the observation from most of the companies, define requirements for {20, 40, 60, 80} and test the largest supported unlicensed CBW only.

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| **Company** | **Comments** |
| MediaTek | Support the WF. |
| Qualcomm | Support the WF |
| Apple | Option 1. The current WF agreement to define requirements/test for largest supported unlicensed CBW makes sense if we are testing CA requirements. We are configuring for CA in case of scenario A, but we don’t test the licensed carrier. This makes it like any other testcase we have defined since Rel-15 for PDSCH demod. We agreed to only define requirements for 15KHz/10MHz for FSS case, irrespective of what CBWs are supported by the UE. Why should it be different for unlicensed carrier? Hence, we proposed to introduce requirements only for 20MHz CBW which is the LBT BW. |
| Huawei | Support the WF |
| Ericsson | Agree with WF. |

-------GTW Note------

QC: We have only single Test, for NR we have several test cases. Test overhead should not be a concern since only single test can be applied.

Agreements:

PDSCH demod: Define requirements for {20, 40, 60, 80} and test the largest supported unlicensed CBW only

CSI: only 20MHz CHBW will be introduced

Define requirements configuring the NR PCell with CBW=20MHz (TDD) fpr scenario A.

**Issue 1-2-2: Bandwidth to be used for PDSCH requirement definition, NR PCell CC (Scenario A)**

* Proposals
  + Option 1: 20 MHz (Ericsson, Huawei, Qualcomm);
* Recommended WF:
  + Define requirements configuring the NR Pcell with CBW=20MHz (TDD);

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| **Company** | **Comments** |
| MediaTek | Support the WF. |
| Qualcomm | Support the WF |
| Apple | We support the WF. |
| Huawei | Support the WF |
| Ericsson | Agree with WF. |
| Intel | Agree with WF |

**Issue 1-2-3: Bandwidth to be used for CQI requirement definition (Scenario A and C)**

* Proposals
  + Option 1: 20 MHz (Huawei, from draftCR);
  + Option 2: Use the same BW and applicability rule as in the proposed WF for PDSCH (Qualcomm);
* Recommended WF:
  + TBA;

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| **Company** | **Comments** |
| MediaTek | Support Option 1. |
| Qualcomm | It is our view that the same discussion we had on PDSCH regarding on CBW support applies here. For this reason, it would make sense to define the CQI reporting test for BW ={20, 40, 60, 80}MHz and use the same applicability rule to test the largest CBW supported only.  This should not have a repercussion on the CQI requirements, which should be applied to all CBWs. |
| Apple | We propose to only define requirements for 20MHz case, same as PDSCH demod. |
| Huawei | Support the Option 1 |
| Ericsson | Agree with Option 1. |
| Intel | Agree with Option 1 |

### Sub-topic 1-3: PDSCH Performance Test Requirements

**Issue 1-3-1: SNR Requirement definition**

* Proposals
  + Option 1: TBA;
* Recommended WF

Based on the Impairment results collected, propose and discuss the PDSCH SNR Requirements

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| **Company** | **Comments** |
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### Sub-topic 1-4: Configuration for CQI Performance Tests

**Issue 1-4-1: Number of UE RX Antennas to define CQI requirements for**

* Proposals
  + Option 1: 2 RX (Ericsson);
  + Option 2: {2, 4} RX (Huawei);
  + Option 3: {2, 4} RX, with the applicability rule to test UEs only for the largest supported number of RX (Qualcomm);
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| MediaTek | Support Option 3 which follows CQI tests in Rel-15. |
| Qualcomm | Support Option 3. |
| Apple | Option 3 is fine, but do we have similar applicability rule for PDSCH demod as well? |
| Huawei | Now we prefer Option 1 since supporting 2RX is mandatory for band n46 and 4RX is optional. We think 2RX is enough |
| Ericsson | We can accept Option 3. NR-U band is higher than 5GHz, and 4Rx might be more typical. It would be better to align with Rel-15/16 applicability rule. There is no optional or mandatory difference in Rx applicability rule definition. In LTE Rel-8, 2Rx is mandatory but the same applicability rule is applied in the later release. Furthermore, we already agreed to define requirement for 2Rx and 4Rx for PDSCH, and CQI test could follow PDSCH. |
| Qualcomm | We share Ericsson’s opinion, in Rel.15 the applicability rule does not distinguish between mandatory and optional capabilities.  In conclusion, we propose to   * align CQI requirements with the agreed PDSCH requirements and define them for both 2 and 4 RX, and * For both PDSCH and CQI requirements, test only the largest supported number of RX |
| Intel | Agree with Option 3 with the same applicability rule for PDSCH and CQI requirements |

**---------------GTW Note---------------**

Huawei: For core spec, band n46, n96 ; 4Rx is optional. 2Rx is enough on band n46.

**Agreement:**

{2, 4} RX, with the applicability rule to test UEs only with applicable rules based on UE declared capability. Further work on the text into specifications.

**Issue 1-4-2: Periodic CSI-RS Resource Periodicity/Slot Offset**

* Proposals
  + Option 1: 10/1 Slots (Current WF);
  + Option 2: 10/0 Slots (Intel);
* Recommended WF:
  + TBA;

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| **Company** | **Comments** |
| Qualcomm | Support Option 1. |
| Apple | We might need to change it to aperiodic CSI-RS based on discussion in Issue 1-4-3? |
| Huawei | Support Option 1 |
| Intel | Need to consider aperiodic CSI-RS based on the discussion for Issue 1-4-3 |

**Issue 1-4-3: CSI Reporting Type and Periodicity and Slot Offset or Aperiodic Report Slot Offset**

* Proposals
  + Option 1: Aperiodic (Apple, Ericsson, Qualcomm)
    - Option 1a: Aperiodic Report Slot Offset 7 Slots (Apple);
  + Option 2: Periodic (Huawei, Intel)
    - Periodicity/Offset 10/9 Slots (Huawei);
    - Periodicity/Offset 10/8 Slots (Intel);
* Recommended WF:
  + TBA;

---------------------GTW Note ---------------

Apple: DCI 1-0, and aperiodic CSI –RS resource and reporting type should be used.   
QC: We share similar view as Apple. We don’t think SSB occsication in 2 slot without PDSCH scheduling have big impact on testing.

MTK: Aperiodic CSI report and periodic CSI-RS.

Huawei: Test time will be increased for that case/

Ercisson: If we use aperiodic CSI-RS, and skip PDSCH in CSI-RS slots. Two step approach can be applied.

QC: only impact on 2 slots with SSB. 6% increased. Two step approach will no issue at all.

Apple: Use Downlink length of COT for PDSCH and CQI test cases, that’s the approach used in LAA.

Agreement:

Aperiodic for CSI reporting type

* Not include 2 slot DL transmission duration into COT pattern for CSI test cases
* FFS periodic CSI-RS resource or aperiodic CSI-RS resources

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| **Company** | **Comments** |
| MediaTek | There is a restriction for CQI test in Rel-15 that PDSCH is not scheduled on slots containing CSI-RS or slots which are not full DL.  Also, according to specification TS38.213, UE cancels the CSI-RS reception if UE does not detect a DCI format indicating a periodic CRS-RS reception or scheduling a PDSCH reception.   |  | | --- | | For operation with shared spectrum channel access, if a UE is provided *csi-RS-ValidationWith-DCI*, is not provided *CO-DurationsPerCell*, and is not provided *SlotFormatCombinationsPerCell*, and if the UE is configured by higher layers to receive a CSI-RS in a set of symbols of a slot, the UE cancels the CSI-RS reception in the set of symbols of the slot if the UE does not detect a DCI format indicating an **aperiodic CSI-RS reception or scheduling a PDSCH reception** in the set of symbols of the slot. |   If we do follow the restriction, UE will not be able to do CSI-RS validation as no PDCCH for scheduling PDSCH is transmitted. To valid the CRI-RS reception, we may use aperiodic CRI-RS reporting with DCI format 0-1. However, if we do not follow the restriction and allocate PDSCH in the same slot as CRI-RS, we think periodic reporting can be adopted.  We think this issue is related to issue 1-4-5 and we need to determine first whether to follow the restriction for CQI test in Rel-15. |
| Qualcomm | The problem raised by MediaTek in the previous comment is valid, but the specification states that UEs are supposed to validate scheduled Periodic CSI-RS when detecting a DCI format aperiodic CSI-RS reception.  So reviewing the current agreement in the WF for CSI-RS type and using aperiodic CSI-RS for CSI reporting scheduling would be a viable solution for this issue.  As a consequence, aperiodic CSI reporting should be used, so support option 1. |
| Apple | We support option 1a.  We brought up this issue in our contribution as well for UE not being validate CSI-RS since PDSCH is not transmitted.  ***Observation #1:*** *For CQI reporting requirements, we don’t transmit CSI-RS and PDSCH in the same slot. The UE will not be able to do CSI-RS validation with periodic CSI-RS transmitted with periodicity 10 slots and offset 1 since no PDCCH scheduling data is transmitted.*  Our understanding was that configuring PDCCH in the slot with aperiodic CSI report trigger would be sufficient. But if it should be aperiodic CSI-RS, then we would need to have to configure aperiodic CSI-RS as well and only aperiodic reporting will not be a valid test setup. |
| Huawei | We support option 2. From our understanding, compared periodic CQI reporting, aperiodic CQI reporting needs more complicated test procedures and DCI signalling overhead. As our purpose is to verify the UE's behaviour for NR-U CQI measurement rather than CQI type, we should simplify the test procedure while achieving the test purpose.  Meanwhile, we propose to schedule PDCCH/PDSCH in slot 1 to indicate UE to receive CSI-RS. Otherwise, there will be no PDSCH scheduling in transmission with SSB |
| Ericsson | According to specification delivered by MTK, it is a double negative sentence. We would translate it to a affirmative sentence. “the UE do the CSI-RS reception in the set of symbols of the slot if the UE ~~does not~~ detect a DCI format indicating an **aperiodic CSI-RS reception and scheduling a PDSCH reception** in the set of symbols of the slot.” That means aperiodic CSI-RS and PDSCH scheduling should be fulfilled at the same time, otherwise UE will cancel the CSI-RS reception. Is this a correct understanding?  If this is the case, we might have to use aperiodic CSI-RS and scheduling PDSCH at the same slot. It will violate the rule used in Rel-15. Otherwise, DCI 2-0 might be needed to inform UE *CO-DurationsPerCell and SlotFormatCombinationsPerCell.* Then periodic CSI-RS could be used.  As addressed in GTW, we don’t need to check UE behaviour of averaging CSI-RS between bursts if aperiodic CSI-RS would be used. The CQI report is limited to the closest CSI-RS resource measurement.  @Qualcomm: We have different understanding. Two preconditions: A= ap-CSI-RS not detected, B=PDSCH not detected. Once A or B is true, then UE will cancel CSI-RS reception.   |  |  |  | | --- | --- | --- | | Aperiodic CSI-RS DCI Format not detected | PDSCH DCI Format not detected | CSI-RS Reception | | Y | Y | Canceled | | Y | N | Canceled | | N | Y | Canceled | | N | N | Not canceled | |
| Qualcomm | We don’t agree with the interpretation of the spec provided by Ericsson.  The double negation can be indeed elided to get a clearer understanding, but in their interpretation the change in the phrasing of the condition for validation from ‘either/or’ to ‘and’ seems unjustified.  If we look at the potential cases, according to the original spec wording, we see:   |  |  |  | | --- | --- | --- | | Aperiodic CSI-RS DCI Format detected | PDSCH DCI Format detected | CSI-RS Reception | | Y | N | Not canceled | | N | Y | Not canceled | | Y | Y | Not canceled | | N | N | Canceled |   So the original spec can be also written as: [..] the UE *validates* CSI-RS in the set of symbols of the slot if the UE *detects* a DCI format indicating an **aperiodic CSI-RS reception or scheduling a PDSCH reception** in the set of symbols of the slot.  @Huawei: as included in your comment, the actual CSI resource configuration type is not the main focus of the test here.  Based on this, and taking into account that we fail to see a way in which we can configure periodic CSI-RS and still align with Rel.15 CQI assumptions, it seems evident that configuring aperiodic CSI-RS reception allows us to configure a test in line with Rel.15 CQI performance assumptions that also satisfies CSI-RS validation requirements and should be the option chosen.  We also fail to see the added overhead, since DCI information has to be sent to the UE and be processed in both cases, whether to validate periodic or aperiodic CSI-RS. |

**Issue 1-4-4: CSI Reporting UL Scheduling Type**

* Proposals
  + Option 1: PUCCH Format 2 (Huawei);
* Recommended WF:
  + TBA;

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| **Company** | **Comments** |
| Qualcomm | If aperiodic CSI reporting is chosen in issue 1-4-3, use PUSCH. |
| Apple | It would have to be PUSCH based on aperiodic reporting. |
| Huawei | As we discussed in our contribution, PUCCH format 2 only occupy 2 symbols and it left enough time for idle time. |

**Issue 1-4-5: Downlink Transmission Scheme for CQI requirements**

* Proposals
  + Option 1: Same Downlink model as agreed for PDSCH requirements (Apple, Current WF);
  + Option 2: Always schedule full slots in the LBT burst transmission for NR-U CQI testing (Huawei);
* Recommended WF:
  + For CQI requirements, used the same downlink model as agreed for PDSCH requirements

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| **Company** | **Comments** |
| MediaTek | There is a restriction for CQI test in Rel-15 that PDSCH is not scheduled on slots containing CSI-RS or slots which are not full DL.  If we do agree to follow the restriction, we cannot apply the current LBT burst transmission for PDSCH requirement for CQI testing. According the current WF, the resource for CSI-RS is allocated on slot 1 and there should be no PDSCH on slot 1, which violates the rule for the current downlink model for PDSCH. Besides, for DL Transmission duration larger than 2, the PDSCH allocation for the last slot should be full slot allocation, which also violates the rule for the current downlink model for PDSCH.  Hence, similar to issue 1-4-3, we think we need to determine first whether to follow the restriction for CQI test in Rel-15. |
| Qualcomm | On the comment from MediaTek, we do not see why the restriction used in Rel.15 CQI tests cannot be applied on top of the downlink model used for PDSCH tests.  A note can be added to the test assumption, that PDSCH is not scheduled on slots that contain CSI-RS or are not full DL. This implies that only when the last slot in the burst is full it will be scheduled with PDSCH.  Support option 1, adding the restrictions used in Rel.15 CQI tests. |
| Apple | Perhaps we need to schedule full slots for CQI test. The code rate would change if the number of symbols for PDSCH is different in the slot and we try to keep the same code rate in all slots for CQI tests. Also, we might need to make the minimum DL duration 3 slots. With 2 slot transmission, we would have PDSCH only in slot 1 and if that coincides with SSB transmission, that is also missed and there would be no PDSCH transmission. If we make it minimum of 3 slots we would always have PDSCH transmission when there is no LBT failure. |
| Huawei | We propose to add the note that not scheduling PDSCH for partial slot and needn’t modify the LBT model. |
| Intel | Agree with proposals from Qualcomm and Huawei made in the comments: PDSCH is not scheduled on slots that are not full DL. |

**Issue 1-4-6: CQI requirements Simulation Parameters**

* Proposals
  + Option 1: Reuse licensed test parameters from CQI reporting test in static channel where applicable (Apple);
* Recommended WF:
  + TBA

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| **Company** | **Comments** |
| Qualcomm | Support Option 1. |
| Apple | We support Option 1 |
| Huawei | Support Option 1 |

**Issue 1-4-7: CQI requirements parameters: CQI Table**

* Proposals
  + Option 1: Use CQI Table 2 (Huawei, Qualcomm)
* Recommended WF:
  + Use CQI Table 2.

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| **Company** | **Comments** |
| MediaTek | Support the WF. |
| Qualcomm | Support the WF. |
| Apple | We support the WF. |
| Huawei | We support the WF |
| Ericsson | Support WF. |

**Issue 1-4-8: CQI requirements parameters: Codebook Configuration**

* Proposals
  + Option 1: Reuse from Rel.15 CQI Tests (Huawei);
  + Option 2: CodebookSubsetRestriction = 010000 (Qualcomm, Ericsson)
* Recommended WF:
  + TBA

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| **Company** | **Comments** |
| MediaTek | Reuse CodebookSubsetRestriction = 010000 from Rel-15 CQI tests. |
| Qualcomm | Support Option 2 |
| Apple | Option 1 and 2 are the same. In Rel-15 the CodebookSubsetRestriction was 010000 for CQI tests in AWGN. |
| Huawei | Use CodebookSubSetRestriction=010000 |
| Ericsson | Agree with CodebookSubSetRestriction=010000 |

### Sub-topic 1-5: CQI Performance Tests Requirements

**Issue 1-5-1: SNR pair to be used for requirements (not including Transmission Power Level Boost), 2 RX**

* Proposals
  + Option 1: [8,9] dB (Huawei, Qualcomm, Apple);
    - Option 1a: Same SNR as Test 1 for existing CQI reporting tests in static channel (Apple);
  + Option 2: [3,4] dB (Ericsson);
  + Option 3: [7,8] dB (Ericsson);
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| Qualcomm | Support Option 1. |
| Apple | We support Option 1. |
| Huawei | We support Option 1 |

**Issue 1-5-2: SNR pair to be used for requirements (not including Transmission Power Level Boost), 4 RX**

* Proposals
  + Option 1: [5,6] dB (Huawei, Qualcomm, Apple);
    - Option 1b: Same SNR as Test 1 for existing CQI reporting tests in static channel (Apple);
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| Qualcomm | Support Option 1. |
| Apple | We support option1 |
| Huawei | If requirements for 4RX is defined, we support option 1 |

**Issue 1-5-3: Minimum difference between Median CQI reported** **for different power level boost to be included in the requirements**

* Proposals
  + Option 1: 2 (Huawei, Apple, Qualcomm);
* Recommended WF
  + Define the minimum difference between Median CQI reported for different power level boost requirement equal to 2.

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| **Company** | **Comments** |
| Qualcomm | Support the WF. |
| Apple | We support the WF. |
| Huawei | We support WF |

## Companies views’ collection for 1st round

### Open issues

*Companies are encouraged to comment in the dedicated comment section below each issue.*

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** | |
| **Company** | **Comment** |
| **R4-2110938, MediaTek**  CR for TS38.101-4, PDSCH requirements for standalone NR-U | *Apple* | 1. *We need not specify TRS config as its same as that in common parameters.* 2. *Need not specify TX EVM* 3. *Number of tests is still TBD* 4. Number of additional DMRS: 1 |
| Ericsson | Tx EVM is not needed. |
| Qualcomm | 1. Since the ‘number of slots set in a burst’ does not apply to PDSCH only, a dedicated section such as:  |  |  |  |  | | --- | --- | --- | --- | | Downlink Model Parameters | Downlink transmission duration values |  | {2,4,6,7} | | Occupied OFDM symbols in slot other than the last slot |  | 12 | | Occupied OFDM symbols in the last slot |  | {4,7,10,12} (Note 1) |  1. Rename the parameters to align with the draftCR for DL transmission model, according to the table above.   @Apple: we agreed to ‘pos1’ in the additional DMRS configuration to avoid issues with shorter slots, right? |
| Intel | 1. We do not operate with the term “burst”. Need to change “number of slots set in burst” to “Downlink transmission duration values”. 2. In the dedicated section proposed by Qualcomm need to add the parameters “Downlink period” and “pLBT”. 3. We might need to mention that “last slot” means last slot of the DL transmission. Suggest to change:   “Occupied OFDM symbols in slot other than the last slot”  to  “Occupied OFDM symbols in slot other than the last slot of the downlink duration”  and “Occupied OFDM symbols in the last slot”  to  “Occupied OFDM symbols in the last slot of the downlink duration” |
| Huawei | 1. We agree with QC and Intel to set a separate part for transmission burst model and remove LBT failure to this part. 2. Agree with Intel’s view for description of “last slot”. 3. In Table 5.2.3.2.15-3, the title “ Minimum performance for Rank 4” should be changed to “ Minimum performance for Rank 2” to keep align with simulation assumptions 4. “TX EVM” should be deleted. 5. Suggest to use “Operation on shared spectrum access” instead of “CCA” to keep align with core spec. 6. Should we create separate sub-clauses for scenario A and scenario C? The test setup and test applicability rules for scenario C and scenario A are also missing. 7. For applicability of requirements for different number of RX antenna ports specified in sub-clause 5.1.1.2, may be we need some modifications 8. For applicability of requirements for mandatory UE features with capability signaling, we suggest to add the UE feature” Supported UL channels for dynamic channel access mode (*ul-DynamicChAccess-r16* ) or UL channel access for semi-static channel access mode (ul-Semi-StaticChAccess-r16) or both” 9. In table 5.2.3.2.15-1, we suggest to remove the “When CSI-RS- ValidationWith-DCI-r16 is configured” to sub-clause 5.1.1.3 with some modifications |
| **R4-2109355, Apple**  Draft CR NRU CQI Scenario A-R16 | Ericsson | Suggest to use terminology like “under CCA” to replace “NR-U”. This is aligned with RRM terminology. And then use “PCell under CCA” for Scenario C and “SCell under CCA” for Scenario A. According to TS38.133 A.9 and A.11 |
| Qualcomm | 1. BW, CSI-RS reporting type, Physical channel for CSI report, Codebook subset restriction should be updated according to the latest agreements. 2. Shouldn’t be [8,9] SNR dB correspond to 2 different test, and not both Test1? 3. Downlink Model Parameters section is missing (see comments to the first CR in the table) |
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| **R4-2109590, Ericsson**  Draft CR for TS38101-4 introduction of PDSCH demodulation requirements for NR-U Scenario A (catB)\_pa1 | Apple | We don’t think the requirements should be specified under interworking requirements. Section 5 would be more appropriate.  Ericsson: Thanks for the comment. Section 5 is used for standalone scenario, so we think CA scenario would be better to be defined in another section. |
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| **R4-2110501, Huawei**  Draft CR for TS 38.101-4 Introduction of fixed reference channel of NR-U PDSCH | Apple | We should add a note that there is no UL transmission in slot 9 and is idle slot. |
| Ericsson | Suggest to use terminology like “under CCA” to replace “NR-U”. This is aligned with RRM terminology. And then use “PCell under CCA” for Scenario C and “SCell under CCA” for Scenario A. According to TS38.133 A.9 and A.11 |
| Intel | For Table A.1.2-2b: In Note 3 the range for “i" should be corrected from {0,…,10} to {0,…,9}  For Table A.3.2.2.2-18: mixing in one table different options of DL transmission duration with different options of number of symbols in last slot makes the table unreadable. Suggest to split the table into 4 tables – one for each option of DL transmission duration. |
| **R4-2110503, Huawei**  Draft CR for TS 38.101-4 Introduction of NR-U CQI requirements | Apple | The table for test parameters Table 6.1.2-1 is not from latest version of 38.101-4  We shouldn’t introduce new section for CQI reporting for unlicensed carrier. We should add requirements in section 6.2.  The requirements seem to cover both scenario A and scenario C. According to CR work split it should only be scenario C. We should have seprate sections for Scenario A and C  The wording in the section for requirements in Scenario C should be aligned with Scenario A.  Do we need a different measurement channel for unlicensed carrier? The CQI test is still for 1 layer as Rel-15 test.  These should be set as configured:  timeRestrictionForChannelMeasurements  timeRestrictionForInterferenceMeasurements |
| Ericsson | Suggest to use terminology like “under CCA” to replace “NR-U”. This is aligned with RRM terminology. And then use “PCell under CCA” for Scenario C and “SCell under CCA” for Scenario A. According to TS38.133 A.9 and A.11 |
| Qualcomm | Should the UE feature/capability entry in the table be aligned with draftCR R4-2110938? Ie. ‘*Verify PDSCH performance under CCA when CSI-RS-ValidationWith-DCI-r16 IE [17] is configured’;*  Downlink Model Parameters section is missing (see comments to the first CR in the table) |
| Intel | Table 6.1.2-1: for the “K1 value” the range for “i" should be corrected from {0,…,10} to {0,…,9} |
| **R4-2110719, Qualcomm**  DraftCR on NR-U UE Demodulation Downlink Transmission Model | Apple | Suggest using unlicensed carrier or shared spectrum access rather than NR-U in section title and text. |
| Ericsson | Suggest to use terminology like “under CCA” to replace “NR-U”. This is aligned with RRM terminology. And then use “PCell under CCA” for Scenario C and “SCell under CCA” for Scenario A. According to TS38.133 A.9 and A.11  Suggest to add full name for COT. It is really good if we can add definition for these terminologies, i.e. CCA, COT, at the beginning of the specification. |
| Qualcomm | Change ‘the set of possible duration of the last slot values’ to ‘Occupied OFDM symbols in the last slot’ to align with PDSCH requirements draftCR. |
|  |  |  |

## 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** |
| Sub-topic 1-1: DRS Configuration | ***Agreements:***  **Issue 1-1-1: Whether to define a dedicated COT for DRS transmission**  No, multiplex DRS and data in TD within the same COT, without multiplexing SSB and data in the same slot (Current WF);  **Issue 1-1-2: DRS Duration, Periodicity**  1ms duration, 20ms periodicity (Current WF); |
| Sub-topic 1-2: Bandwidth configuration | ***Agreements:***  **Issue 1-2-1: Bandwidth to be used for PDSCH requirement definition, NR Unlicensed CC (Scenario A and C)**  Define requirements for {20, 40, 60, 80} and test the largest supported unlicensed CBW only  **Issue 1-2-2: Bandwidth to be used for PDSCH requirement definition, NR PCell CC (Scenario A)**  Define requirements configuring the NR PCell with CBW=20MHz (TDD) for scenario A.  **Issue 1-2-3: Bandwidth to be used for CQI requirement definition (Scenario A and C)**  only 20MHz CHBW will be introduced |
| Sub-topic 1-3: PDSCH Performance Test Requirements | ***Recommendations for 2nd round:***  **Issue 1-3-1: SNR Requirement definition**   * Proposals   + Based on the impairment results provided in the simulation results collection, the following requirement is proposed for discussion. A margin 0.5 dB (for 16QAM) has been added to the average Impairment results. * Recommended WF   + Agree on the proposed requirements.  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Case** | **BW (MHz)** | **SCS (KHz)** | **Duplex** | **RX** | **Requirement** | | Test 1-1a | 20 | 30 | TDD | 2 | **14.3** | | Test 1-1b | 40 | 30 | TDD | 2 | **14.5** | | Test 1-1c | 60 | 30 | TDD | 2 | **14.7** | | Test 1-1d | 80 | 30 | TDD | 2 | **15.0** | | Test 2-1a | 20 | 30 | TDD | 4 | **9.3** | | Test 2-1b | 40 | 30 | TDD | 4 | **9.3** | | Test 2-1c | 60 | 30 | TDD | 4 | **9.5** | | Test 2-1d | 80 | 30 | TDD | 4 | **9.7** |     **Issue 1-3-2: Applicability Rule for PDSCH Tests based on UE declared capabilities**   * Proposals   + Option 1: As in Rel.15 test, UEs are tested only for the largest number of supported RX; * Recommended WF:   + Agree to the applicability rule in option 1. |
| Sub-topic 1-4: Configuration for CQI Performance Tests | ***Agreements:***  **Issue 1-4-1: Number of UE RX Antennas to define CQI requirements for**  {2, 4} RX, with the applicability rule to test UEs only with applicable rules based on UE declared capability. Further work on the text into specifications.  **Issue 1-4-3: CSI Reporting Type and Periodicity and Slot Offset or Aperiodic Report Slot Offset**  Aperiodic for CSI reporting type  **Issue 1-4-4: CSI Reporting UL Scheduling Type**  PUSCH, according to Aperiodic CSI Reporting.  **Issue 1-4-5: Downlink Transmission Scheme for CQI requirements**  Use the same Downlink Model as agreed for PDSCH, with the following modifications/notes:  Do not include 2 slot DL transmission duration into COT pattern for CSI test cases.  Do not schedule slots that are not fully allocated to DL.  **Issue 1-4-6: CQI requirements Simulation Parameters**  Reuse licensed test parameters from CQI reporting test in static channel where applicable.  **Issue 1-4-7: CQI requirements parameters: CQI Table**  Use CQI Table 2.  **Issue 1-4-8: CQI requirements parameters: Codebook Configuration**  Use CodebookSubsetRestriction = 010000.  ***Recommendations for 2nd round:***  **Issue 1-4-10: Whether to reuse the Rel.15 CQI performance test setup with no PDSCH scheduling in slots containing CSI-RS**   * Proposals   + Option 1: Yes (Qualcomm);   + Option 2: No (Huawei); * Recommended WF:   + TBA;     **Issue 1-4-11: CSI-RS Resource type and Periodicity/Slot Offset**  Continue the discussion on the feasibility to use periodic CSI-RS resource type in the 2nd round.   * Proposals   + Option 1: Periodic, 10/1 Slots (Current WF);   + Option 2: Periodic, 10/0 Slots (Intel);   + Option 3: Aperiodic, 10/1 Slots; * Recommended WF:   + Continue discussion in the 2nd round.   **Issue 1-4-12: Applicability Rule for CQI Tests based on UE declared capabilities**   * Proposals   + Option 1: As in Rel.15 test, UEs are tested only for the largest number of supported RX; * Recommended WF:   + Agree to the applicability rule in option 1   **Issue 1-4-13: Possible values for the length of the PDSCH allocation in the last slot in the downlink transmission duration for CQI performance Test**   * Proposals   + Option 1: {4, 6, 10, 12}, same as PDSCH;   + Option 2: {12}, always full DL allocation (Apple); * Recommended WF:   + TBA; |
| Sub-topic 1-5: CQI Performance Tests Requirements | ***Agreements:***  **Issue 1-5-2: SNR pair to be used for requirements (not including Transmission Power Level Boost), 4 RX**  Use SNR [5,6] dB.  **Issue 1-5-3: Minimum difference between Median CQI reported for different power level boost to be included in the requirements**  Define the minimum difference between Median CQI reported for different power level boost requirement equal to 2.  ***Recommendations for 2nd round:***  **Issue 1-5-1: SNR pair to be used for requirements (not including Transmission Power Level Boost), 2 RX**   * Proposals   + Option 1: [8,9] dB (Huawei, Qualcomm, Apple);   + Option 2: [3,4] dB (Ericsson);   + Option 3: [7,8] dB (Ericsson); * Recommended WF   + Can Ericsson agree to Option 1? |
| Sub-topic 1-6: Discussion on the draftCRs | ***Recommendations for 2nd round:***  **Issue 1-6-1: Terminology to use across all CRs:**   * Proposals   + Option 1: To align with RRM, “under CCA” for NR-U, “PCell under CCA” for Scenario C and “SCell under CCA” for Scenario A (Ericsson);   + Option 2: To align with core spec, “Operation on shared spectrum access” (Huawei); * Recommended WF   + TBA   **Issue 1-6-2: In R4-2110938, whether to add for the applicability of the requirements for mandatory UE features with capability signaling, the UE feature “Supported UL channels for dynamic channel access mode (ul-DynamicChAccess-r16 ) or UL channel access for semi-static channel access mode (ul-Semi-StaticChAccess-r16) or both”:**   * Proposals   + Yes (Huawei); * Recommended WF   + TBA   **Issue 1-6-3: In R4-2110938, Whether to move the “When CSI-RS- ValidationWith-DCI-r16 is configured” from table 5.2.3.2.15-1 to 5.1.1.3:**   * Proposals   + Yes (Huawei); * Recommended WF   + TBA   **Issue 1-6-4: In which section to introduce the PDSCH requirements for NR-U for Scenario A and Scenario C:**   * Proposals   + Option 1: Section 5, with separate sub-clauses for scenario A and C (Huawei, Apple);   + Option 2: Section 5 for scenario C and Section 9 for scenario A (Ericsson); * Recommended WF   + TBA   **Issue 1-6-5: Whether to split the fixed reference channel in 4 tables, one for each DL duration:**   * Proposals   + Option 1: Yes (Intel);   + Option 2: No (Huawei, from draftCR); * Recommended WF   + TBA   **Issue 1-6-6: Section in which to add CQI reporting requirements**   * Proposals   + Option 1: 6.2, separately for Scenario A and C (Apple);   + Option 2: 6.5 (Huawei, from draftCR); * Recommended WF   + TBA   **Issue 1-6-7: Whether we need a new measurement channel for unlicensed carrier**   * Proposals   + Option 1: No (Apple);   + Option 2: Yes (Huawei, from draftCR); * Recommended WF   + TBA   **Issue 1-6-8: Whether “…the last slot” should be replaced by “…the last slot in the downlink transmission duration” in all sentences where this change is applicable**   * Proposals   + Option 1: Yes (Intel, Huawei); * Recommended WF   + TBA |

### CRs/TPs

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| **R4-2110938, MediaTek**  CR for TS38.101-4, PDSCH requirements for standalone NR-U | To be revised according to the comments collected in the first round; |
| **R4-2109355, Apple**  Draft CR NRU CQI Scenario A-R16 | To be revised according to the comments collected in the first round; |
| **R4-2109590, Ericsson**  Draft CR for TS38101-4 introduction of PDSCH demodulation requirements for NR-U Scenario A (catB)\_pa1 | To be revised according to the comments collected in the first round; |
| **R4-2110501, Huawei**  Draft CR for TS 38.101-4 Introduction of fixed reference channel of NR-U PDSCH | To be revised according to the comments collected in the first round; |
| **R4-2110503, Huawei**  Draft CR for TS 38.101-4 Introduction of NR-U CQI requirements | To be revised according to the comments collected in the first round; |
| **R4-2110719, Qualcomm**  DraftCR on NR-U UE Demodulation Downlink Transmission Model | To be revised according to the comments collected in the first round; |

## Discussion on 2nd round (if applicable)

### Sub-topic 1-3: PDSCH Performance Test Requirements

**Issue 1-3-1: SNR Requirement definition**

* Proposals
  + Based on the impairment results provided in the simulation results collection, the following requirement is proposed for discussion.  
    A margin 0.5 dB (for 16QAM) has been added to the average Impairment results.
* Recommended WF
  + Agree on the proposed requirements.

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Agree on this corrected Table, with a margin of 0.5dB added to the average impairment results:  
(The previous table had the 0.5dB margin added twice)

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| **Case** | **BW (MHz)** | **SCS (KHz)** | **Duplex** | **RX** | **Requirement** |
| Test 1-1a | 20 | 30 | TDD | 2 | **13.8** |
| Test 1-1b | 40 | 30 | TDD | 2 | **14.1** |
| Test 1-1c | 60 | 30 | TDD | 2 | **14.2** |
| Test 1-1d | 80 | 30 | TDD | 2 | **14.5** |
| Test 2-1a | 20 | 30 | TDD | 4 | **8.7** |
| Test 2-1b | 40 | 30 | TDD | 4 | **8.7** |
| Test 2-1c | 60 | 30 | TDD | 4 | **8.9** |
| Test 2-1d | 80 | 30 | TDD | 4 | **9.1** |

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| **Company** | **Comments** |
| Ericsson | It seems 1dB is added to average impairment results showed in summary sheet. The impairment results for Huawei are not delivered, will Huawei deliver these results? |
| Qualcomm | Answering to Ericsson’s comment, yes, in the copy-pasting of the requirement there was a mistake. I have updated the proposed table with the correct computation, companies please express their support to the updated table. |
| Huawei | We have uploaded our impairment results |
| Qualcomm | The table has been updated to include Huawei’s impairment results. |

**Issue 1-3-2: Applicability Rule for PDSCH Tests based on UE declared capabilities**

* Proposals
  + Option 1: As in Rel.15 test, UEs are tested only for the largest number of supported RX;
* Recommended WF:
  + Agree to the applicability rule in option 1.

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| **Company** | **Comments** |
| Ericsson | Support WF. |
| Qualcomm | Support WF. |
| Apple | We support the WF. |
| MediaTek | Support WF. |
| Huawei | Support WF |

### Sub-topic 1-4: Configuration for CQI Performance Tests

**Issue 1-4-10: Whether to reuse the Rel.15 CQI performance test setup with no PDSCH scheduling in slots containing CSI-RS**

* Proposals
  + Option 1: Yes (Qualcomm);
  + Option 2: No (Huawei);
    - Option 2a: No, the slots containing CSI-RS are not used for BLER statistics.(Huawei)
* Recommended WF:
  + TBA;

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| **Company** | **Comments** |
| Ericsson | We can agree with Option 1 with aperiodic CSI-RS. We might also need to change configuration for PDSCH part as well if aperiodic CSI-RS is adopted for CQI report requirement to get alignment.  Is the intention of Option 2 to use periodic CSI-RS? If so, maybe the PDSCH scheduled within the same slot with CSI-RS is not suitable for PDSCH BLER statistic in CQI report test due to overhead caused by CSI-RS. But it would be more complex for test. |
| Qualcomm | Support Option 1, it would be preferred not to mix PDSCH and CSIRS scheduling to keep the coderate consistent, as done in Rel.15 CQI tests. |
| Apple | We support option1. We would have coder rate changes if we schedule PDSCH on the same slot as CSI-RS and that is not desirable in CQI reporting tests for the PDSCH BLER metric part of the test |
| MediaTek | OK with Option 1. |
| Huawei | We support Option 2. Our intention is to use P-CSI-RS to reduce the test complexity for UE. We think the overhead of CSI-RS is very small and it has not much effect on coding rate and BLER. If some companies concern about the effect on BLER metric caused by CSI-RS overhead, we propose to exclude the slots containing CSI-RS for BLER statistics. From the perspective of test time and demodulation performance, there is no difference between the case that no PDSCH is scheduled in CSI-RS transmission slot and the case that PDSCH is scheduled in CSI-RS transmission slots but not used for BLER statistics. |
| Qualcomm | @Huawei: It is unclear how we’re reducing test complexity by designing an ad-hoc PDSCH allocation to be then excluded for statistics collection, rather than using aperiodic CSI-RS instead of periodic CSI-RS. Most of the companies have expressed support for Option 1, can Huawei clarify where is the advantage in text complexity and why is it worth to change the assumption used for Rel.15 CQI test design for it? |

**Issue 1-4-11: CSI-RS Resource type and Periodicity/Slot Offset**

Continue the discussion on the feasibility to use periodic CSI-RS resource type in the 2nd round.

* Proposals
  + Option 1: Periodic, 10/1 Slots (Current WF);
  + Option 2: Periodic, 10/0 Slots (Intel);
  + Option 3: Aperiodic, 10/1 Slots;
* Recommended WF:
  + Continue discussion in the 2nd round.

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| **Company** | **Comments** |
| Ericsson | We agree with Option 3. |
| Qualcomm | Agree with option 3. |
| Apple | We support option 3. |
| MediaTek | OK with Option 3. |
| Huawei | We support Option 1. Similar comments as Issue 1-4-10 |

**Issue 1-4-12: Applicability Rule for CQI Tests based on UE declared capabilities**

* Proposals
  + Option 1: As in Rel.15 test, UEs are tested only for the largest number of supported RX;
* Recommended WF:
  + Agree to the applicability rule in option 1

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| **Company** | **Comments** |
| Ericsson | We support WF. |
| Qualcomm | Support the WF |
| Apple | We support the WF. |
| MediaTek | Support the WF. |
| Huawei | Support the WF |

**Issue 1-4-13: Possible values for the length of the PDSCH allocation in the last slot in the downlink transmission duration for CQI performance Test**

* Proposals
  + Option 1: {4, 6, 10, 12}, same as PDSCH;
  + Option 2: {12}, always full DL allocation (Apple);
* Recommended WF:
  + TBA;

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| **Company** | **Comments** |
| Ericsson | We think Option 1 could be feasible but just cause longer test duration since PDSCH would not be scheduled on partial DL slot. It would be good to keep the similar setup as PDSCH part. |
| Qualcomm | Option 2 can speed up the test duration, and since the set of possible values for last slot in the downlink transmission is a test parameter and it could be configured differently in CQI tests without requiring a different Downlink Model, we can go with option 2, |
| Apple | We support option2. If we go with the assumption that PDSCH is not scheduled in partial slot, the DL slot duration is reduced 3 out of 4 times when last slot length is < 14. We need to have a a condition for slot length of 3 that 12 is always used. We think its simpler to assume that last slot is always full allocation. We don’t think there is any use of having random slot length for last slot, given that PDSCH would not be allocated in partial slots for CQI reporting tests. |
| Huawei | Support Option 2. Our purpose to verify the UE’s behavior for CQI calculation in NR-U mode and it is unnecessary to set different values for last slot duration. Also we already agreed only schedule PDSCH on full DL slots in the 1st round.  We also agree with QC that we don’t need to modify the LBT model by using variable “S2” instead of fixed value such as {6,9,12,14} in LBT model definition and we can configure different value for “S2” for PDSCH demodulation test and CQI test like did for LAA. |

### Sub-topic 1-5: CQI Performance Tests Requirements

**Issue 1-5-1: SNR pair to be used for requirements (not including Transmission Power Level Boost), 2 RX**

* Proposals
  + Option 1: [8,9] dB (Huawei, Qualcomm, Apple);
  + Option 2: [3,4] dB (Ericsson);
  + Option 3: [7,8] dB (Ericsson);
* Recommended WF
  + Can Ericsson agree to Option 1?

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| **Company** | **Comments** |
| Ericsson | Option 1 is OK for us. |
| Qualcomm | Option 1. |
| Apple | Option 1. Same as Rel15 CQI reporting. |
| Huawei | Option 1 is OK for us. |

### Sub-topic 1-6: Discussion on the draftCRs

**Issue 1-6-1: Terminology to use across all CRs:**

* Proposals
  + Option 1: To align with RRM, “under CCA” for NR-U, “PCell under CCA” for Scenario C and “Scell under CCA” for Scenario A (Ericsson);
  + Option 2: To align with core spec, “Operation on shared spectrum access” (Huawei);
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| Ericsson | We still prefer Option 1 since Option 2 is not so clear by using “operation”. CCA is one of the most important “operation” for NR-U and one of the biggest differences between normal NR and NR-U. Furthermore, there are no definition for Scenario A and C in core spec, so we think it might be better to get alignment in RAN4 specifications. |
| Qualcomm | Option 1 is ok. |
| Apple | We prefer option 1, to align with RRM spec. |
| MediaTek | Prefer Option 1. |
| Huawei | The reason that we propose Option 2 is to keep alignment with RAN1 core specification considering all features that demodulation performance requirements target to verify are from RAN1 core specification. |

**Issue 1-6-2: In R4-2110938, whether to add for the applicability of the requirements for mandatory UE features with capability signaling, the UE feature “Supported UL channels for dynamic channel access mode (ul-DynamicChAccess-r16 ) or UL channel access for semi-static channel access mode (ul-Semi-StaticChAccess-r16) or both”:**

* Proposals
  + Yes (Huawei);
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| Ericsson | We tend to agree with proposal but no strong opinion. |
| Qualcomm | We can agree with option 1 to align the CQI and PDSCH requirements wording. |
| Apple | We assume that this is for Scenario C only and these would be mandatory for Scenario C. |
| MediaTek | Agree with the proposal. |
| Huawei | Agree with the proposal to keep alignment with the existing test applicability rules for NR Rel-15 for those mandatory with capability features. |

**Issue 1-6-3: In R4-2110938, Whether to move the “When CSI-RS- ValidationWith-DCI-r16 is configured” from table 5.2.3.2.15-1 to 5.1.1.3:**

* Proposals
  + Yes (Huawei);
* Recommended WF
  + TBA

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | We agree with Huawei that CSI-RS- ValidationWith-DCI-r16 should be included in optional UE features table. |
| Qualcomm | We support adding the information to table 5.1.1.3, also it can be in both tables (no need to move) |
| Apple | UE capability for CSI-RS validation with DCI is indicated by: periodicAndSemi-PersistentCSI-RS-r16 ; this should be added in section 5.1.1.3 for applicability of requirements  For the test purpose in table 5.2.3.2.15-1, it could be more generic – CCA on Pcell or CCA on SCell, as there would be many more RRC parameters configured for NR-U in addition to CSI-RS- ValidationWith-DCI-r16 and all could possibly not be included. |
| MediaTek | Similar to the sentence in Table 5.2.2.1.9-1, “Verify PDSCH performance under 2 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when highSpeedDemodFlag-r16 IE [17] is configured”. We think “When CSI-RS-ValidationWith-DCI-r16 is configured” can be kept in table 5.2.3.2.15-1. Besides, as mentioned by Apple, we can add the corresponding capability “*periodicAndSemi-PersistentCSI-RS-r16*” in 5.1.1.3.  Table 5.1.1.3-1: Requirements applicability for optional UE features   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **UE feature/capability [14]** | **Test type** | **Test list** | **Applicability notes** | **UE feature/capability [14]** | | Validating P/SP-CSI-RS reception (*periodicAndSemi-PersistentCSI-RS-r16*) | FR1 TDD | PDSCH | Clause 5.2.2.2.15  Clause 5.2.3.2.15 |  | |
| Apple2 | The HST flag is in indication that its in HST deployment, and nothing else. But we don’t think CSI-RS-ValidationWith-DCI-r16 would be a good choice. Perhaps ChannelAccessConfig-r16 would be a more suitable RRC config parameter for NR-U. |
| Ericsson2 | We agree ChannelAccessConfig-r16 is necessary for NR-U scenarios, and CSI-RS-ValidationWith-DCI-r16 is also agreed as enhanced capability for NR-U UE requirements. So aybe these two parameters can be included. |
| Huawei | Based on our understanding, IE “***periodicAndSemi-PersistentCSI-RS-r16***” should be added in Table 5.1.1.3-1 for test applicability rules as proposed by MediaTek since it has been specified as mandatory features with capability signaling in TS 38.306:    For IE “*csi-RS-ValidationWith-DCI-r16*”, it should be moved to test parameters table and configured by TE during the test. |

**Issue 1-6-4: In which section to introduce the PDSCH requirements for NR-U for Scenario A and Scenario C:**

* Proposals
  + Option 1: Section 5, with separate sub-clauses for scenario A and C (Huawei, Apple);
  + Option 2: Section 5 for scenario C and Section 9 for scenario A (Ericsson);
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| Ericsson | We just think Scenario A is inter-band CA deployment which might be proper to be included in Section 9. We don’t have strong opinion since licensed cell is not tested. |
| Qualcomm | As Ericsson commented, the licensed Cell is not tested, so it could be ok to have Scenario A and C in the same section. |
| Apple | We think section 5.2 would be appropriate for both Scenario A and Scenario C. We don’t think Scenario A comes under not interworking requirements. In section 5 we have section 5.2A for CA requirements, but we are not testing CA requirements in Scenario A, only unlicensed SCell, so both should be included in section 5.2A. We could also double confirm with Haijie as he’s the spec rapporteur for 38.101-4. |
| Huawei | We prefer to create the new sub-clauses 5.2.2.2.15, 5.2.3.2.15 for Scenario C 2RX and 4RX separately and create new clause 5.2A.2.3, 5.2A.3.3 for Scenario A 2RX and 4RX separately by exactly following the current structure to avoid any possible confusion. |

**Issue 1-6-5: Whether to split the fixed reference channel in 4 tables, one for each DL duration:**

* Proposals
  + Option 1: Yes (Intel);
  + Option 2: No (Huawei, from draftCR);
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| Ericsson | We can accept Option 2 to include all FRC into one table. |
| Qualcomm | No strong preference |
| Apple | No strong reason to split it. To save effort we can combine them. |
| Huawei | We support Option 2 to reduce the effort and keep alignment with LAA |

**Issue 1-6-6: Section in which to add CQI reporting requirements**

* Proposals
  + Option 1: 6.2, separately for Scenario A and C (Apple);
  + Option 2: 6.5 (Huawei, from draftCR);
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| Ericsson | We prefer using new section for NR-U requirements. |
| Qualcomm | PDSCH requirements are being added to the same section for licensed, we don’t see a reason not to do the same for CQI requirements (ie. below 6.2.2.2) |
| Apple | We prefer option 1 – same view as PDSCH demod requirements. Don’t see a reason to have a new section, for CQI reporting in NR-U. Again, might be good to double confirm with Haijie. |
| Huawei | We are also fine with Option 1 to keep alignment with PDSCH requirements |

**Issue 1-6-7: Whether we need a new measurement channel for unlicensed carrier**

* Proposals
  + Option 1: No (Apple);
  + Option 2: Yes (Huawei, from draftCR);
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| Qualcomm | We seem to need a new measurement channel for 30kHz/20MHz. Can Apple comment which existing measurement channel should be used otherwise? |
| Apple | Our comment was based on 40MHz CBW assumption. For 20MHz, we agree we need new RMC. We will correct it in our CR as well. But the current RMC table is for 2 layers. This needs to be updated for 1 layer. Also, TBS.2-7 exists in current spec. |
| Huawei | We support Option 2 to define new RMC for 20MHz CBW for CQI test |
|  |  |

**Issue 1-6-8: Whether “…the last slot” should be replaced by “…the last slot in the downlink transmission duration” in all sentences where this change is applicable**

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

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| **Company** | **Comments** |
| Ericsson | Maybe “the last downlink transmission slot” could be simpler? |
| Qualcomm | We are fine with Option 1 |
| Apple | OK with option 1. |
| MediaTek | OK with Option 1. |
| Huawei | OK with Option 1 |

### CRs/TPs Comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| **R4-2108713**  **(revision of R4-2110719), Qualcomm**  DraftCR on NR-U UE Demodulation Downlink Transmission Model | |  |  | | --- | --- | | **Company** | **Comments** | | Apple | For tests configured with the RRC Parameter *channelAccessMode*=’semiStatic’,🡪 This suggests that the DL transmission model is only for FBE devices, where as the agreement was that it was for both LBE and FBE devices. We don’t think we need to mention semiStatic channel access and FFP.  We could specify the full transmission last slot for slot length 2 in individual tests rather than here. Since we might not have 2 as option all the time. | | Qualcomm | The comment on the ‘SemiStatic’ channel access mode is useful to underline the fact that Downlink Duration equals Fixed Frame Period in those tests. We do not see this as suggesting that the model only applies to FBE devices, but in our v2 we added a comment specifying explicitly that the model applies to both FBE and LBE.  Regarding the full transmission 2 slot case, since that is indeed part of the LBT model and it must be valid for all tests, we think it’s definitely clearer to leave it explicitly as part of the model. If 2 it’s not an option, the model is still valid and there’s no possibility for confusion. | |  |  | |
| **R4-2108714**  **(revision of R4-2109590), Ericsson**  Draft CR for TS38101-4 introduction of PDSCH demodulation requirements for NR-U Scenario A (catB)\_pa1 | |  |  | | --- | --- | | **Company** | **Comments** | | Apple | Revised draftCR not available  Ericsson: revised draftCR has been uploaded, sorry for the late. | |  |  | |  |  | |
| **R4-2108715**  **(revision of R4-2110501), Huawei**  Draft CR for TS 38.101-4 Introduction of fixed reference channel of NR-U PDSCH | |  |  | | --- | --- | | **Company** | **Comments** | | Apple | Table title: Use CCA for consistency instead of shared spectrum channel access | | Ericsson | Use “under CCA” instead of “operation with shared spectrum channel access”. | |  |  | |
| **R4-2108716**  **(revision of R4-2110938), MediaTek**  CR for TS38.101-4, PDSCH requirements for standalone NR-U | |  |  | | --- | --- | | **Company** | **Comments** | | Apple | Section 5.2.2.2.15/5.2.3.2.15:  Test purpose should be based on a different RRC config param like ChannelAccessConfig-r16 to indicate unlicensed operation.  In Test parameters Physical Cell ID , SSB position in burst need not be specified – already captured in common parameters.  In Test parameters, Occupied OFDM symbols in the last slot of the downlink duration should be the total number of symbols rather than only PDSCH symbols.  Tentative requirements from Issue 1-3-1 can be captured in the requirements tables. | | Ericsson | Rev should be 1.  Test list in Table 5.1.1.3-1 and Table 5.1.1.4-1 should add “Clause 5.2.2.2.16 and Clause 5.2.3.2.16”  Standalone requirements would use “…PDSCH PCell under CCA” to differentiate from Scenario A requirement in the next sub-section.  Agree with Apple that Occupied OFDM symbols should base on 14os in total, and the “Unit” column should be filled as “symbol” | | Qualcomm | Change the test purpose to reflect Unlicensed Spectrum oeration. | |
| **R4-2108717**  **(revision of R4-2109355), Apple**  Draft CR NRU CQI Scenario A-R16 | |  |  | | --- | --- | | **Company** | **Comments** | | Ericsson | Downlink period should be 5ms.  6.2.3.2.1.3 don’t revised as 6.2.2.2.1.3 | | Qualcomm | ‘For each fixed frame period…’ should be changed into ‘For each Downlink Transmission Duration’ to align with DL model (and make sure the test is applicable to both channelAccessType configurations).  ‘Occupied OFDM symbols in the last slot of the downlink duration’ should be used in the test configuration where applicable  Is the CQI reporting configuration missing? | |  |  | |
| **R4-2108718**  **(revision of R4-2110503), Huawei**  Draft CR for TS 38.101-4 Introduction of NR-U CQI requirements | |  |  | | --- | --- | | **Company** | **Comments** | | Apple | Section numbers should be updated in applicability table  CQI reporting requirements:  DL transmission model parameters should be fully captured.  CSI reporting configuration is missing  Codebook subset restriction should be 010000  RMC:  CSI RMC table is for 2 layers. This needs to be updated for 1 layer. Also, TBS.2-7 exists in current spec. | | Ericsson | There is no definition for “Scenario A” and “Scenario C”. “SCell under CCA” and “PCell under CCA” could be used. | | Huawei | @Apple: Based on our understanding, the codebook subset restriction “010000” rank 2 rather than rank 1. We copy the corresponding description from TS 38.214 as follows:  C:\Users\l00502554\AppData\Roaming\eSpace_Desktop\UserData\l00502554\imagefiles\originalImgfiles\2F4E84F7-8843-4101-9F09-A3A2E69890FC.png  “a0~a3” indicates codebook for rank1 and “a4~a5” indicates codebook for rank2. So layer 2 should be defined rather than layer1in FRC. Is our understanding correct? | | Qualcomm | ‘For each fixed frame period…’ should be changed into ‘For each Downlink Transmission Duration’ to align with DL model (and make sure the test is applicable to both channelAccessType configurations).  In our view, 2 Layers is the correct understanding of the CodebookSubsetRestriction | |

# Topic #4: PDSCH Simulation Results

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2109353 | Apple | PDSCH Simulation Results |
| R4-2109589 | Ericsson | PDSCH Simulation Results |
| R4-2110499 | Huawei | PDSCH Simulation Results |
| R4-2110767 | Qualcomm | PDSCH Simulation Results |
| R4-2110937 | MediaTek | PDSCH Simulation Results |
| R4-2110948 | Intel | PDSCH Simulation Results |

## Open issues summary

### Sub-topic 2-1: Simulation results for alignment

**Issue 2-1-1: Simulation results summary**

* Recommended WF

Companies are encouraged to fill their results in the summary document which will be shared via mail during the meeting (please see below in Section 5, **‘Existing TDocs’**).

## Companies views’ collection for 1st round

### Open issues

*Companies are encouraged to comment in the dedicated comment section below each issue.*

## Summary for 1st round

### Open issues

### CRs/TPs

## Discussion on 2nd round (if applicable)

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| Big CR for the Introduction of NR-U UE Demodulation Requirements (PDSCH and CQI) | Qualcomm | Big CR to collect all the draftCRs presented in this meeting and be proposed for agreement. |
|  |  |  |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-2109351 | Summary of simulation results for NR-U UE Demod | Apple |  | Companies to fill their PDSCH results |
|  |  |  |  |  |
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Notes:

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

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |

Notes:

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