**3GPP TSG-RAN WG4 Meeting # 98-bis-e R4-2105986**

**Electronic Meeting, 12th – 20th April, 2021**

**Agenda item:** 5.1.4.1, 5.1.4.2, 5.1.4.3

**Source:** Qualcomm

**Title:** Email discussion summary for [98-bis-e][315]

**Document for:** Information

# Introduction

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

* 1st round: Agree on the updated workplan, discuss on the topics related to PDSCH and CQI testing, collect PDSCH simulation results summary;
* 2nd round: Keep discussing on issues pending from the 1st round;

# Topic #1: Updated Work Plan

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2106469 | Qualcomm | Proposal 1: Approve Work Item detailed in this contribution; |

## Open issues summary

### Sub-topic 1-1

*Proposed updated workplan*

* RAN4 #96-e (Aug 2020)
	+ Way forward on general framework;
* RAN4 #97-e (Oct 2020)
	+ Discussions on general framework;
* RAN4 #98-e (Feb 2021)
	+ Discussion on general framework;
	+ Baseline link simulation assumptions agreed for PDSCH;
* RAN4 #98-bis-e (Apr 2021)
	+ Remaining details on DL model and test setup agreed for PDSCH and CQI;
	+ Collection of ideal and impairment simulation results for PDSCH;
	+ Baseline link simulation assumptions agreed for CQI reporting;
* RAN4 #99-e (May 2021)
	+ Collection of ideal and impairment simulation results for PDSCH and CQI reporting;
	+ CRs agreed;

**Issue 1-1-1: Approve updated workplan as proposed**

* Proposals
	+ Option 1: Yes (Qualcomm)
* Recommended WF
	+ Update working plan according to the proposal.

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| **Company** | **Comments** |
| MediaTek | Support the recommended WF. |
| Apple | We support the recommended WF. |
| Ericsson | We support WF. But the plan for PDSCH and CQI report requirement is optimistic according to diversity of the discussion, especially for CQI report.  |
| Nokia | I understand that workplan is general for demod, including UE and BS. So I think it should be covering BS demod aspects. Here is a suggestion of text:* RAN4 #98-e (Feb 2021)
	+ Discussion on general framework;
	+ Baseline link simulation assumptions agreed for PDSCH;
	+ **Baseline link simulation assumptions agreed for PUSCH, PUCCH and PRACH;**
* RAN4 #98-bis-e (Apr 2021)
	+ Remaining details on DL model and test setup agreed for PDSCH and CQI;
	+ Collection of ideal and impairment simulation results for PDSCH;
	+ Baseline link simulation assumptions agreed for CQI reporting;
	+ **Remaining parameters for BS demod;**
	+ **Collection of ideal and impairment simulation results for PUSCH, PUCCH and PRACH**
	+ **First Draft CRs for 38.104, 38,141-1 and 38.141-2.**
* RAN4 #99-e (May 2021)
	+ Collection of ideal and impairment simulation results for PDSCH and CQI reporting;
	+ **Collection of ideal and impairment simulation results for PUSCH, PUCCH, PRACH, and CG-UCI;**
	+ CRs agreed;
 |
| Qualcomm | Agree with WF. @Ericsson: the proposed work plan fits the timeline according to the extension agreed during the plenary meeting;@Nokia: thanks for the comment. Yes, BS demod aspects should be introduced as well in the work plan, let’s wait for the comments from the moderator for that thread on the proposed text.  |
| Huawei | Although the proposed WP fits the current timeline, for UE demod, still some open issues left, we are not sure if all work can be done in next meeting considering short meeting cycle. |

## 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

## 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**  |
| **Updated Work Plan** | **Issue 1-1-1: Approve updated workplan**Updated proposal after discussion:* RAN4 #98-e (Feb 2021)
	+ Discussion on general framework;
	+ Baseline link simulation assumptions agreed for PDSCH;
	+ Baseline link simulation assumptions agreed for PUSCH, PUCCH and PRACH;
* RAN4 #98-bis-e (Apr 2021)
	+ Remaining details on DL model and test setup agreed for PDSCH and CQI;
	+ Collection of ideal and impairment simulation results for PDSCH;
	+ Baseline link simulation assumptions agreed for CQI reporting;
	+ Remaining parameters for BS demod;
	+ Collection of ideal and impairment simulation results for PUSCH, PUCCH and PRACH
	+ First Draft CRs for 38.104, 38,141-1 and 38.141-2.
* RAN4 #99-e (May 2021)
	+ Collection of ideal and impairment simulation results for PDSCH and CQI reporting;
	+ Collection of ideal and impairment simulation results for PUSCH, PUCCH, PRACH, and CG-UCI;
	+ CRs agreed;
* Recommended WF
	+ If no further comments are received, approve the work plan in this proposal.
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### CRs/TPs

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

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

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

## Discussion on 2nd round (if applicable)

# Topic #2: General and PDSCH Performance Requirements

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2104544 | Ericsson | **Issue 1-1: Requirement definition according to UE capability of supporting CSI-validation features**Observation: It is not reasonable to set different LBT failure probability and scheduling configuration for UE with and without CSI-validation capability. Observation: If UE without CSI-validation capability have to be tested, packing SSB and TRS together could be a solution.Observation: TRS won’t impact performance under typical NR-U scenario. Proposal: Define requirements only for UE with CSI-validation capability and no applicable test cases for UE without capability.Proposal: No TRS configuration for NR-U tests.Issue 1-2: Detailed test setup for scenario A and C.Observation: Same test setup is feasible for both Scenario A SCell and Scenario C PCell.Issue 1-3: Requirement definition method for Scenario A and C.Proposal: Reuse Rel-16 NR CA PDSCH requirements for Scenario A PCell. Define a single set of PDSCH requirements with {20, 40, 60, 80} MHz bandwidth for unlicensed cell in both Scenario A and C, and use applicability rule to reduce test effort for Scenario C. Observation: A single CQI report requirement will be enough to cover unlicensed carrier Scenario A and C.**Issue 2-1: Slot format**Observation: DL burst transmission slot could be up to 8.Observation: There is no enough resource for TRS or CSI-RS allocation when DL burst is 2 slots with less PDSCH symbols in the last slot.Proposal: Limit the minimum DL burst length to 1ms. The DL burst length could be described as: DL burst transmission slot length is {2, 4, 6, 7(8)}; the PDSCH symbols in the last slot is 14 for 2 slots DL burst transmission and {6, 9, 10, 12} for more than 2 slots DL burst transmission.Observation: NR-U RRM performance test configure dynamic TDD by DCI 1\_1 slot by slot.**Issue 3-1: LBT failure propability**Observation: Different LBT failure probability won’t impact on performance so much. Observation: Test time caused by 0.5 LBT failure probability won’t be an issue according to previous eLAA discussion. Proposal: Define LBT failure probability to 0.5. |
| R4-2106470 | Qualcomm | Proposal 1: Do not define additional requirements for UEs that do not support ‘csi-RS-ValidationWith-DCI’, and rely on Rel.15 tests (Option 1a in the WF);Proposal 2: During the test for Scenario A, verify only the PDSCH performance on the NR-U SCell, and do not define a requirement for the NR PCell.Proposal 3: Reuse PDSCH Demodulation requirement for Scenario A and C, and apply to the Unlicensed Cell only.Proposal 4: To configure the NR PCell for Scenario A, use the parameters in 38.101-4, Table 5.2-1, assuming CBW=20MHz and SCS=30kHz;Proposal 5: To reduce the overall test duration, use pLBT=0.25. Observation 1: The maximum burst duration requirement of 4ms in Japan regulation that was used as a design parameter for the test in the last meeting has been increased to 8ms, according to Article 49-20 in Radio Equipment Rule in Japanese Radio Law [8];Proposal 6: Increase Maximum COT to 4.5ms, leaving only the last slot idle (no DL/UL allocation) within the DL periodicity to satisfy dynamic channel access requirement;Proposal 7: If Maximum COT is extended to 4.5 ms, support Option 2 ({2,4,6,7} slots) in the WF [3] for the Downlink portion duration within the COT values;Proposal 8: Do not introduce a new TDD Pattern for NR-U, but use DCI-based Dynamic UL/DL detection (mandatory capability);Observation 2: According to Table 5.3-1 in [7], minimum PDSCH processing time for 30kHz numerology is 13 Symbols;Proposal 9: Reserve a slot for UL scheduling for HARQ Feedback, after 1 Guard Slot after the end of the last Slot with PDSCH allocation in the COT; |
| R4-2104545 | Ericsson |

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| Slot Pattern  |   | According to DL Transmission Model |
| LBT failure probability |   | 0.5 |
| Common serving cell parameters | Physical Cell ID |   | 0 |
| SSB position in burst |   | The first SSB |
| SSB Q factor |   | 8 |
| PDCCH configuration | TCI state |  | TCI state #0  |
| CSI-RS for tracking | Not configured  |

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| DL Transmission Model | Maximum DL COT Duration  | ms | 4 |
| DL Transmission Model Period/Fixed Frame Period (Note 1) | ms | 5 |
| Probability of LBT Failure pLBT |  | ***0.5***  |
| **UL COT start time within each FFP** | **ms** | **Option 1: 4 for maximum DL burst length <=7 slots****Option 2: 4.5 for maximum DL burst length is 8 slots** |
| **UL COT duration**  | **ms** | **Option 1: 0.9 for maximum DL burst length <=7 slots****Option 2: 0.4 for maximum DL burst length is 8 slots** |
| **Idle Time after UL COT**  | **ms** | **0.1** |
| Number of slots between PDSCH and corresponding HARQ-ACK information  |  | **8 if mod(i,10)=0****7 if mod(i,10)=1****6 if mod(i,10)=2****5 if mod(i,10)=3****4 if mod(i,10)=4****3 if mod(i,10)=5****2 if mod(i,10)=6** |
| Duration of the Downlink burst  | Slots | **Option 1: {2, 4, 6, 7}** **Option 2: {2, 4 ,6, 8}** |
| PDSCH Allocation in the last Slot of the Downlink burst | Symbols | **14 for 2 DL slots** **{6, 9, 12, 14} for more than 2 DL slots**  |
| Notes:1. The Fixed Frame Period denomination applies only for *ChannelAccessType-r16 = ‘semistatic’.* For *ChannelAccessType-r16 = ‘dynamic’* this parameter is identified only as DL Transmission Model Period.
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| R4-2104838 | Apple | Test SetupProposal #1: Use one generic LBT model for all test cases, irrespective of UE capability of supporting CSI-RS validation.Observation #1: Requirement SNR based on 70% max TP would be similar with or without LBT failure.Proposal #2: Use probability of LBT failure as 0 for UEs that don’t support CSI-RS validation.Downlink Transmission ModelProposal #3: Use TDD pattern 6DS3U for NR-U demod requirements.Observation #2: With duration of DL portion of COT of 7 slots, it is not possible to accommodate an ‘S’ and ‘U’ slot within 8 slots for Max COT.Proposal #4: For NR-U demodulation requirements use randomly selected downlink portion of COT from set {2,3,5,6} slots.Proposal #5: For NR-U demodulation requirements use randomly selected partial ending slot length from {6,9,12,14} symbols.LBT ParametersObservation #3: With PLBT of 0.25 and 0.5, SNR @ 70% of Max TP is comparable. Proposal #6: Define NR-U UE demod requirements with PLBT of 0.25. |
| R4-2106784 | Huawei, HiSilicon | Proposal 1: Define one LBT transmission model and one requirements/test setup for UE supporting CSI-validation features with following additional conditions:* For UE not supporting CSI-validation, set probability of LBT failure to 0.
* Set TRS periodicity to 40 slots and offset to 20/21 slots for TRS resource 1 and 2 /3 and 4.i.e. Reuse the configuration of Rel-15 PDSCH test.

Proposal 2: The test set-up should be the same for scenario A and scenario C except for where HARQ feedback is transmitted and further discuss the time error and frequency offset of unlicensed CC to licensed CCProposal 3: Use TDD pattern 7D1S2UObservation 1: DL duration has negligible affection on the performance.Observation 2: DL duration {2, 4, 6, 7} doesn’t violate the Japan regulation.Proposal 4 Use DL duration {2, 4, 6, 7}Proposal 5: Use {6, 9, 12, 14} for PDSCH allocation in the last slot in the Downlink portion of the COT in Symbols.Proposal 6: Set number of additional DMRS is 0 when PDSCH allocation in the last slot is less than 8 and 1 otherwise. Proposal 7: Set LBT failure probability to 0.5 for UE supporting CSI-validation features. |
| R4-2107091 | Discussion on PDSCH requirements for NR-U | Proposal 1: Do not define test cases for UE which does not support CSI-validation features.Proposal 2: COT duration is randomly chosen with equal probability from the set {2, 3, 5, 6} slots.Proposal 3: Symbol length for the last slot in the COT is randomly chosen with equal probability from the set {6, 9, 12, 14} symbols. Proposal 4: Define LBT failure probability as 0.25. Proposal 5: The RB number of CSI-RS for tracking should be 48. |

## 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 2-1: Requirement definition according to UE capability of supporting CSI-validation features

**Issue 2-1-1: How to define requirements based on UEs capabilities related to CSI-RS validation**

* Proposals
	+ Option 1: Define requirements for UE supporting *‘csi-RS-validationWith-DCI’* only and no applicable test is defined for UE that do not support this capability (Ericsson, MediaTek, Qualcomm);
	+ Option 2: Use pLBT=0 for UEs that do not support *‘csi-RS-validationWith-DCI’* (Apple, Huawei);
* Recommended WF:
	+ TBA;

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| **Company** | **Comments** |
| MediaTek | We support Option 1. Considering the realistic deployment of NR-U, we think pLBT=0 is too artificial and unrealistic. |
| Apple | We proposed option 2 to have coverage for UE that don’t support CSI-RS validation feature. But we are okay to compromise to option 1 if that is majority view. |
| Ericsson | Support Option 1. We should not use impractical setup for UE without capability. |
| Qualcomm | Support Option 1, no LBT failure is not a realistic scenario and does provide guarantees on performances. |
| Huawei | We can compromise to option 1 |
| Intel | Slightly prefer Option 2 to be able to test UEs with different capabilities. We are also ok with Option 1 to avoid additional requirements in CQI testing. |

------------GTW Discussion -----------------

Huawei: We are fine with option1.

Apple: We also fine with option 1.

Agreement: Option 1: Define requirements for UE supporting *‘csi-RS-validationWith-DCI’* only and no applicable test is defined for UE that do not support this capability

**Issue 2-1-2: Whether to define a different LBT Model for UEs that do not support CSI-RS validation**

* Proposals
	+ Option 1: No (Apple, Huawei);
* Recommended WF
	+ Define a single LBT model for NR-U Demod tests, regardless of UE capabilities.

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| **Company** | **Comments** |
| MediaTek | We support Option 1. To be more precisely, we support not to define test cases for UE does not support CSI-RS validation. |
| Apple | We support the recommended WF.  |
| Ericsson | Support Option 1 and agree with the clarification from MTK.  |
| Qualcomm | Support recommended WF; |
| Huawei  | Support the recommended WF. |
| Intel | Support recommended WF |

* + 1. Sub-topic 2-2: Details of the Downlink Transmission Model

**Issue 2-2-1: Possible value of the random downlink duration within the COT;**

* Proposals
	+ Option 1: {2,3,5,6} Slots (Apple, MediaTek);
	+ Option 2a: {2,4,6,7} Slots (Ericsson, Huawei);
	+ Option 2b: {2,4,6,7} Slots, extending the maximum COT to 4.5ms (Qualcomm);
	+ Option 3: {2,4,6,8} Slots (Ericsson);
* Recommended WF
	+ TBA

-----------------GTW discussion --------------

Agreement: Option 2b: {2,4,6,7} Slots, extending the maximum COT to 4.5ms

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| **Company** | **Comments** |
| MediaTek | We can compromise to {2, 4, 6, 7} and extend the maximum COT to 4.5ms if it does not violate the regional regulation.  |
| Apple | Our proposal with option 1 was mainly based on the agreement in last meeting of max COT of 4ms. If max COT can be expended to 4.5ms and its majority view to have {2,4,6,7}, we are also fine to compromise to option 2b.  |
| Ericsson | We propose not use COT here. The definition of COT is for the situation when gap between DL and UL is equal or less than 25us (CAT1 or CAT 2 LBT). It seems not suitable to apply here since we would add a lager gap between DL and UL bursts. After checking the document Article 49-20 delivered by Qualcomm, we also believe that the burst length regulation in Japan has been extended to 8ms. Then we could double baseline DL model duration, such as FFP= 10ms, DL burst = {4, 8, 12, 16} slot. UL burst and Idle can take the last 3 slots of FFP. This will avoid discussion of lacking resource allocation for TRS in 2 slot transmission and should not impact the simulation results we have based on above options. If companies don’t want to extend the FFP, then we think Option 2a or 3 are OK for us.We just need to consider DL burst length here since 4ms is no longer a regulation. The last slot is idle would be OK and the second last slot should be fixed for UL feedback.  |
| Qualcomm | @Ericsson: FFP/DL duration has been already agreed to 5ms and we don’t see the value in rediscussing it.Support Option 2a/2b. The comment regarding extending the maximum COT to 4.5ms refers to said parameter in the Downlink model, to avoid the contradiction between the agreements for 4ms maximum COT and the overall duration when using Option 2a/b (7 Slots + 1 Guard + 1 Uplink)=4.5ms, see also Issue 2-2-2 |
| Huawei | We support option 2a: {2, 4, 6, 7} |
| Intel | We are ok with Option 2b |

**Issue 2-2-2: Maximum COT duration within the DL Periodicity**

* Proposals
	+ Option 1: 4ms (Agreement in WF);
	+ Option 2: 4.5 ms, only last slot in the DL periodicity is idle (Qualcomm);
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| MediaTek | We can agree on Option 2. |
| Apple | Based on response to Issue 2-2-1, we are okay with option 2.  |
| Ericsson | Since 4ms burst length regulation is not an issue, then this topic could be skipped.  |
| Qualcomm | Support option 2 to align with extended durations for downlink compared to the agreement in the WF. |
| Huawei | Option 2 is fine for us. |
| Intel | We are ok with Option 2 |

**Issue 2-2-3: Whether to limit the minimum DL duration to 1ms;**

* Proposals
	+ Option 1: Yes (Ericsson);
* Recommended WF:
	+ Minimum DL duration is already agreed to be at least 2 slots (=1 ms) due to the DRS window duration (1ms), and both options under consideration in the next issue do not include 1 slot, so agree on this proposal.

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| **Company** | **Comments** |
| MediaTek | Support the recommended WF.  |
| Apple | We support the recommended WF. We already have agreement on this with min DL duration of 2 slots.  |
| Ericsson | Support WF.  |
| Qualcomm | Support WF |
| Huawei | Support WF |
| Intel | We support the recommended WF. |

**Issue 2-2-4: Overall duration of the last slot in the COT:**

* Proposals
	+ Option 1: {6,9,12,14} Symbols (Apple, Huawei, MediaTek);
		- Option 1a: (Huawei) Use {6, 9, 12, 14} Symbols for PDSCH normal performance requirements. While for CQI test, to ensure all CSI-RS resource allocated within PDSCH resource allocation with 2 slots duration: configure the CSI-RS resource as per the smallest number of 6 symbols PDSCH length or configure 14 symbols length for PDSCH.
	+ Option 2: {2-14} Symbols;
	+ Option 3: 14 Symbols if DL duration equals 2 Slots, {6,9,12,14} Symbols otherwise (Ericsson);
* Recommended WF
	+ Agree on {6,9,12,14} Symbols, Companies are encouraged to comment on the proposal from Ericsson regarding the last slot duration when DL duration equals 2 Slots;

-----------------GTW discussion ------------

E///: Minimum DL is 1ms. Option 3 aligned with previous agreements. We want to ensure enough locations for TRS/CSI-RS transmission as minimum DL transmission.

Huawei: We share same observation as E///, we already agreed to 2 slots as minimum DL. Support option 3.

Apple: For CQI it’s critical. For 1ms as DL transmission, if not schedule 14 symbols then will be less than that value. We are ok with option 3.

QC: For FBE, COT should not shorten than DRS. Meanwhile we didn’t see strong technical issue to have specific 2 slot DL duration.

Agreements: Option 3: 14 Symbols if DL duration equals 2 Slots, {6,9,12,14} Symbols otherwise

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| **Company** | **Comments** |
| MediaTek | Support Option 3. We share the same view as Ericsson that there is no enough resource allocation for TRS or CSI-RS when the number of symbols is randomly chosen as 6, 9, or 12 from the set {6, 9 ,12, 14}. |
| Apple | We support option 3. We agree with Ericsson’s observation.  |
| Ericsson | Support Option 3.  |
| Qualcomm | We do not see an issue if the PDSCH allocation does not fit CSI-RS for tracking, since the UE behaviour in this case is covered by spec (UEs supporting *‘csi-RS-validationWith-DCI’* will be aware of the reduced duration and should discard partial TRS) and could potentially happen in a real deployment.Given this, we support option 1, for a more straightforward DL transmission model implementation. |
| Huawei | For PSDCH requirements, we share the same views with QC.For CQI test, if the PDSCH allocation cannot fit in configured CSI-RS resources for CQI measurement, it will lead to the situation that there is no CQI reporting (Full CSI-RS resources is not in PSDCH allocation) or inaccurate CQI reporting (Partial CSI-RS is not in PDSCH allocation) for some transmission bursts. As we discussed in our paper, the test purpose is to verify the behavior that UE doesn’t average the CQI across the bursts, so missing CQI reporting will increase the test time and inaccurate CQI reportingwillaffect the median CQI difference between two bursts with different power level, i.e. delta value. Therefore we think it would be better to allocate enough PDSCH allocation for CSI-RS resource by feasible CSI-RS configuration during CQI test. We give further Proposal 1a about CQI. |
| Intel  | Support Option 3 to guarantee DL duration not less than 1ms |

**Issue 2-2-5: TDD Pattern to be used in DL demodulation Tests**

* Proposals
	+ Option 1: Fixed TDD Pattern
		- Option 1a: 6D-1S-3U (Apple);
		- Option 1b: 7D-1S-2U (Huawei);
	+ Option 2: Do not specify a fixed pattern, use DCI-based Dynamic UL/DL detection instead (Qualcomm);
* Recommended WF
	+ TBA

-----------------GTW discussion-----------------

Huawei: For dynamic vs fixed TDD pattern, fixed TDD pattern can serve test purpose and simplify test set-up.

E///: Fixed TDD pattern used in LAA, dynamic more like in SA scenario. From demodulation perspective, no difference and we prefer to choose fixed one as simple test set-up.

Apple: Share similar view as Huawei, introducing dynamic TDD pattern, additional test effort and test set-up work required. And from demod requirements aspect, fixed TDD pattern works well. We think no issue for ACK/NACK with fixed TDD pattern for FBE device.

Intel: We see difference among LBE and FBE, and we agreed to define same requirements for FBE and LBE. With fixed TDD pattern, we have UL and DL COT, and FBE, no UL COT. Fixed TDD pattern not applicable for FBE.

MTK: Share similar view as Huawei and Apple, with Fixed TDD pattern we can simplify the test.

QC: Dynamic TDD is mandatory feature and more likely scenario. No additional test complexity issue. And we can use this to align between LBE and FBE.

Huawei: We should focus on major features introduced for NR-U, and dynamic TDD feature already verified by existing Rel-15 UE demod requirements.

QC: This not aims to verify dynamic TDD pattern, just to have a unify test set-up. We may have CQI reporting issue.

Apple: We suggest to have fixed pattern for demodulation test cases and further discuss for CSI test cases.

Conclusion:

Further discuss and split different test set-up for demodulation test cases and CSI test cases are not precluded.

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| **Company** | **Comments** |
| MediaTek | Support Option 1. If the random DL duration is determined as {2,3,5,6}, we go for Option 1a. If the random DL duration is determined as {2,4,6,7}, we go for Option 1b.Beside, we think this issue is related to Issue 3-2-2, where the CQI reporting is periodic or aperiodic. If the fixed pattern for TDD is adopted, CQI can be reported periodically in the uplink slot. |
| Apple | We support option 1a if we use {2,3,5,6} for DL transmission duration, otherwise option 1b for {2,4,6,7} as DL duration. Without specifying fixed duration how do we ensure that we have a UL slot in the COT duration to avoid cross COT HARQ-ACK? |
| Ericsson | It is agreed in RRM performance test that DCI-based dynamic slot by slot, but then the UL burst will be decided by DCI either. Then UL feedback will be impacted by DL LBT. It is contradicting with our previous agreement. For HARQ-ACK, dynamic TDD would be OK since no necessary to feedback if no PDSCH is transmitted due to LBT failure. For CSI report, dynamic TDD could be an issue if there is no enough delay time for feedback during one burst. In that case, CSI report will be delayed to the next LBT successful burst. That would cause more complex than fixed pattern. Aperiodic CSI-RS would be needed but it is still increase the complexity and test duration. In our understanding, dynamic TDD might fit for Scenario C situation while fixed pattern fits for Scenario A. But it won’t be no difference from demodulation point of view. We prefer Option 1b to simplify the simulation and test.  |
| Qualcomm | @Ericsson: Which previous agreement are you referring? We agreed not to consider UL LBT failure, but in our understanding that does not mean that UL feedback is not impacted by DL LBT. In fact, it is our understanding that in static channel access, UE won’t be able to transmit UL if the gNB experiences DL LBT failure at the beginning of the FFP.This does not have an impact in PDSCH simulations since without DL allocation there is no PDSCH HARQ feedback to report, but it can create a misalignment between dynamic and static channel access devices in the simulation setup for CQI.Using DCI-based allocation, we can make sure that the setup are aligned, so support Option 2.  |
| Huawei | Support option 1bAs we discussed in our contribution, 7D1S2U can guarantee that DL transmission burst consists of multiple consecutive DL slots without UL slots and hence additional LBT can be avoided. Moreover, more DL slots can reduce the test time. At the same time, no new TDD pattern is introduced. Dynamic TDD can increase the test complexity. |
| Intel | During the previous meetings we agreed to define the same requirements for LBE and FBE. In case of FBE only gNB can be COT initiator in Rel-16, so UL and DL should happen within the same COT. We also agreed to define random COT duration, so the position of UL cannot be fixed and fixed TDD pattern cannot be applied.We support Option 2.The issue of gap>25us between UL and DL can be resolved by filling it with OCNG. |

**Issue 2-2-6: UL scheduling with fixed TDD Pattern**

* Proposals
	+ Option 1: UL allocation, within each FFP, start at {4, 4.5} ms and duration {0.9, 0.4} ms, for DL duration {<=7, 8} Slots respectively (Ericsson);
	+ Option 2: UL allocation, within each FFP, starts at 4ms and lasts for 1 slot(=0.5ms). The last slot (=0.5ms) is idle.
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| MediaTek | We think this issue is related to Issue 2-2-5 and Issue 2-2-7. We can determine first whether to use fixed TDD pattern or not. If the fixed TDD pattern is determined, we prefer to start with 4.5ms and duration is 0.5ms. |
| Apple | The UL slot should be within the 4 or 4.5 max COT duration. We should choose a TDD pattern to ensure this. We should also have a fixed UL slot. The last 1ms or 0.5ms is left as Idle, we don’t think we can have UL transmission in it. |
| Ericsson | It is related to Issue 2-2-5. We can accept DL burst slot pattern {2, 4, 6, 7}, 1 UL burst slot start from 4ms and 1 idle slot from 4.5ms.  |
| Qualcomm | If Option 1 is agreed in Issue 2-2-5, support option 2. |
| Huawei | We share the same views with Ericsson. Support option 2 |
| Intel | Prefer to use DCI-based Dynamic UL/DL |

**Issue 2-2-7: UL scheduling when using DCI-based Dynamic UL/DL detection**

* Proposals
	+ Option 1: Reserve 1 slot for UL scheduling of the UE HARQ feedback, after 1 Guard Slot following the end of the last slot with PDSCH allocation in the COT (Qualcomm);
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| MediaTek | We think this issue is related to Issue 2-2-5 and 2-2-6, which are all about uplink scheduling. We think Issue 2-2-5 should be resolved first. If it is agreed to have fixed TDD pattern and then ACK/NACK/CQI are transmitted in the uplink slot in the corresponding TDD pattern. If the DCI-based dynamic uplink scheduling is adopted, we can agree the proposal to use 1 slot for uplink scheduling after 1 guard slot following the end of the last slot with PDSCH allocation. |
| Apple | We support using a fixed TDD pattern and fixed UL slot for HARQ-ACK transmission. |
| Ericsson | Agree with MTK and we need to fix issue 2-2-5 at first. |
| Qualcomm | If Option 2 is agreed in 2-2-5, support Option 1. |
| Huawei | We support to use fixed TDD pattern, dynamic TDD is complex. |
| Intel | Support Option 1 |

* + 1. Sub-topic 2-3: Details of the LBT Model

**Issue 2-3-1: LBT Probabilities (PLBT)to be used in the tests for Scenario A and C**

* Proposals
	+ Option 1: 0.5 (Ericsson, Huawei);
	+ Option 2: 0.25 (Apple, MediaTek, Qualcomm);
* Recommended WF
	+ TBA

----------------------GTW Discussion ----------

E///: 0.5 used in LAA, test duration no problem. Any specific consideration for 0.25 ?

QC: We have fixed transmission periodcity in NR.

Huawei: Share view as E///. In LAA, much short transmission chance can be used.

E///: We can comprise to option 2.

Tentative agreement: Option 2: 0.25 (pending on further check by Huawei)

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| **Company** | **Comments** |
| MediaTek | We prefer Option 2 to reduce the testing time. |
| Apple | We support option 2 to reduce testing time.  |
| Ericsson | If 0.5 probability is not problem in LTE eLAA test, we don’t know why it is the case for NR-U.  |
| Qualcomm  | Simulation results do not seem to show too much dependence on LBT failure probability and a still significant but lower LBT probability failure will reduce the test duration. Support Option 2. |
| Huawei | Share same views with Ericsson.  |
| Intel | Support Option 2. Since there is no difference in simulation results, we prefer to reduce the testing time |

### Sub-topic 2-4: Details of NR-U PDSCH Performance Tests

**Issue 2-4-1: Define a single set of PDSCH Requirements for the unlicensed cell for both Scenario A and C.**

* Proposals
	+ Option 1: Yes (Ericsson, Qualcomm);
	+ Option 1a: Yes (only HARQ feedback transmission differs), and further discuss time and frequency offset errors of unlicensed to licensed CC (Huawei);
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| Apple | We support option 1 in principle. Our understanding is that for scenario A we will define requirements for multiple BWs and for Scenario C it would only be for 40MHz CBW.  |
| Ericsson | We can accept Option 1a to further discuss the time and frequency error.  |
| Qualcomm | We propose not test the licensed CC in Scenario A, so we do not see the no need to discuss time and frequency offset between licensed and unlicensed CC. |
| Huawei | We support option 1a. For option1a, we propose to reuse the assumptions of LAA:  |
| Intel | Support Option 1 with different HARQ feedback transmission in the tests. |

**Issue 2-4-2: Whether to define PDSCH requirements for the licensed cell performances in Scenario A**

* Proposals
	+ Option 1: In Scenario A, verify only PDSCH performances on the unlicensed cell (no requirement on the NR Pcell) (Qualcomm);
	+ Option 2: Reuse Rel-16 NR CA PDSCH requirements for Scenario A Pcell (Agreement in the WF, Ericsson);
* Recommended WF
	+ TBA

-----------------GTW discussion -------------

Huawei: There are two issues, issue 1: whether to test Pcell under Scenario A, issue 2 whether to test CA requirements (CA between licensed and unlicensed, CA between unlicensed CCs).

Apple: Scenario A: Pcell configuration can be defined, during test we only test unlicensed carrier with Pcell configured.

 We didn’t discuss the cases for CA between unlicensed CCs.

 Huawei: For CA between unlicensed CCs, we maybe need to further check RF requirements covered scenarios.

QC: We share same view for Apple. For scenario A, we only focus on CA between licensed and unlicensed.

Huawei: During LAA discussion, we have requirements for both cases of CA scenarios. We need to test UE supporting largest CHBWs under CA scenarios. If we follow the approach proposed by QC, then we can’t verify that point.

Agreements:

For scenario A: Pcell configuration will be specified and during test, only PDSCH performances on the unlicensed carrier will be verified.

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| **Company** | **Comments** |
| Apple | It would be incomplete not to define requirements for Pcell for scenario A. We could re-use any single carrier test already defined for Pcell. We don’t see the necessity to go with CA PDSCH test.  |
| Ericsson | Support Option 2. |
| Qualcomm | If a single requirement is designed for Scenario A and C according to issue 2-4-1, the best option in our view would be to test the unlicensed carrier only, without CA test or re-using single carrier tests, so support Option 1. |
| Huawei | Support Option 2, it would be better to follow the Rel-15 CA test.Without CA test, we cannot test the largest aggregated bandwidth supported by UE. |
| Intel | Support Option 1. Licensed carrier will be already tested in Rel-15 PDSCH tests. Why do we need to test it twice?  |

**Issue 2-4-3: How to configure NR PCell in Scenario A PDSCH Demodulation test setup**

* Proposals
	+ Option 1: Use the parameters in 38.101-4, Table 5.2-1, with CBW = 20MHz and SCS = 30kHz (Qualcomm);
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| Apple | We are fine with option 1. We should re-use an existing requirement for PCell in our understanding.  |
| Qualcomm | Support option 1, @Apple: the issues relates to NR PCell configuration only, not to PCell requirements. |
| Huawei | Either only configure NR PCell or reusing the existing requirements for NR PCell, 40MHz CBW/30kHz SCS is preferred. |
| Intel | We are fine with Option 1. |

**Issue 2-4-4: Bandwidth to be used for the PDSCH Requirements for Scenario C**

* Proposals
	+ Option 1: 20 MHz (Agreement in the WF);
	+ Option 2: {20,40,60,80} MHz with applicability rule if Scenario A unlicensed requirements can be applied for Scenario C. (Ericsson);
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| MediaTek | Support Option 1 to keep the previous agreement. |
| Apple | Option1. We support to keep the agreement in WF. |
| Ericsson | We don’t want to increase the effort. We might need to define {20, 40, 60, 80}MHz requirement for Scenario A. If these requirements could be applied for Scenario C, then Scenario C can have all these bandwidth requirements. If not, then only 20MHz is necessary.  |
| Qualcomm | If a single requirement is defined for Scenario A and Scenario C, we do not see why the BW cannot be extended to cover both, with the same applicability rule to test the largest supported BW only, so support option 2. |
| Huawei | This depends on agreement for Issue 2-4-5**.** If finally one single set of requirements agreed to define for both Scenario A and C, the performance requirements for{20, 40, 60, 80}MHz agreed for Scenario A can be applied for Scenario C unlicensed CC, but as QC suggested, the corresponding test applicability rule should be defined: only the largest supported BW should be tested. |
| Intel | Agree with Option 2 |

* + 1. Sub-topic 2-5: Configuration details for PDSCH Tests

**Issue 2-5-1: Whether to reduce the number of additional DMRS in PDSCH**

* Proposal
	+ Set the number of additional DMRS to 0 when the PDSCH allocation in the last slot is less than 8 symbols, otherwise set it to 1 (Huawei);
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| MediaTek | According to the table 7.4.1.1.2-3 in TS38.211, the position of additional DMRS depends on *ld*, the duration between the first OFDM symbol of the slot and the last OFDM symbol of the scheduled PDSCH resources in the slot. As the information of *ld* can be obtained by DCI, UE is aware of the existence of additional DMRS.If it is not clear for the simulation assumption or test cases, we can modify the PDSCH DMRS configuration in current simulation assumption table with parameter *“dmrs-AdditionalPosition”* as *pos1*.  |
| Apple | We don’t think the additional parameter setting is needed as it can be derived based on number of PDSCH symbols. When number of symbols is less than 8, there would be no additional DMRS. |
| Ericsson | We agree with MTK and Apple. |
| Qualcomm | Agree with MTK and Apple, UE can derive based on PDSCH allocation. Agree with the update proposed by MTK to the simulation assumption table. |
| Huawei | We agree with MTK’s view that modify the PDSCH DMRS configuration with *“dmrs-AdditionalPosition”* as *pos1*. |
| Intel | Agree with the update proposed by MTK to the simulation assumption table. |

**Issue 2-5-2: Whether to configure CSI-RS for tracking**

* Proposal
	+ Option 1: No (Ericsson);
	+ Option 2: Yes, with the same configuration as in Rel.15 PDSCH tests. (20ms=40 slots periodicity and offset 10ms=20/21 slots for Res.1-2/3-4) (Huawei);
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| MediaTek | We are OK to Option 2. |
| Apple | We support option 2. |
| Ericsson | If it is the consensus that the minimum DL burst is full 2 slots, then there is no problem to configure TRS. Then Option 2 can be accepted.  |
| Qualcomm | Option 2, as agreed in the baseline simulation assumptions; |
| Huawei  | Support option 2 |
| Intel | Ok with Option 2 |

**Issue 2-5-3: CSI-RS for tracking configuration: RB size**

* Proposal
	+ 48 RBs (MediaTek);
* Recommended WF
	+ TBA

*Moderator comment: Can MediaTek please elaborate on this proposal? Does it apply to 20 MHz only or to all CBWs?*

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| **Company** | **Comments** |
| MediaTek |

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| - if carrier $N\_{grid}^{size,μ}=52$, $N\_{BWP,i}^{size}=52$, $μ=0$ and the carrier is configured in paired spectrum, the bandwidth of the CSI-RS resource, as given by the higher layer parameter *freqBand* configured by *CSI-RS-ResourceMapping*, is *X* resource blocks, where $X \geq 28$ resources if the UE indicates *trs-AddBW-Set1* for the *trs-AdditionalBandwidth* capability and $X \geq 32$ if the UE indicates *trs-AddBW-Set2* for the *AdditionalBandwidth* capability; in these cases, if the UE is configured with CSI-RS comprising X<52 resource blocks, the UE does not expect that the total number of PRBs allocated for DL transmissions but not overlapped with the PRBs carrying CSI-RS for tracking is more than 4, where all CSI-RS resource configurations shall span the same set of resource blocks; otherwise, the bandwidth of the CSI-RS resource, as given by the higher layer parameter *freqBand* configured by *CSI-RS-ResourceMapping*, is the minimum of 52 and $N\_{BWP,i}^{size}$ resource blocks, or is equal to $N\_{BWP,i}^{size}$ resource blocks. For operation with shared spectrum channel access, *freqBand* configured by *CSI-RS-ResourceMapping*, is the minimum of 48 and $N\_{BWP,i}^{size}$ resource blocks, or is equal to $N\_{BWP,i}^{size}$ resource blocks.- the UE is not expected to be configured with the periodicity of  slots if the bandwidth of CSI-RS resource is larger than 52 resource blocks. |

The restriction of CSI-RS for tracking is captured in TS 38.214 section 5.1.6.1.1. For operation with shared spectrum channel access, it is not clear when to apply “minimum of 48 and $N\_{BWP,i}^{size}$ resource blocks” or “or is equal to $N\_{BWP,i}^{size}$ resource blocks”.We would like to hear the views from other companies. |
| Apple | This is our understanding – if periodicity of TRS is 10ms, we cannot have larger than 52PRBs for TRS. Assuming that TRS periodicity is 20ms for unlicensed carrier, TRS BW could be either min(48,$ N\_{BWP,i}^{size}$ ) or $N\_{BWP,i}^{size}$. We could have TRS BW set as $N\_{BWP,i}^{size}$ for all CBW and need not restrict to 48 PRBs. In Rel-15 TDD testcases we restricted the TRS BW to 52 PRBs for tests with TRS periodicity set as 10ms.  |
| Qualcomm | We have the same understanding as Apple. For periodicity larger than 10ms, the TRS BW can be min(48, $N\_{BWP,i}^{size}$ ) or $N\_{BWP,i}^{size}$. Since we’re assuming 20ms periodicity for TRS, we do not see a reason to reduce TRS RB Size and we support using RB size = $N\_{BWP,i}^{size}.$ |
| Huawei | We share the same views with apple and QC, there is no restriction for TRS RB size since we agree use 20ms TRS periodicity. |
| Intel | Agree with the comments from Apple, Qualcomm and Huawei. The 20ms periodicity is expected to be agreed in Issue 2-5-2 |

## 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

Agreements finalized during the GTW session on April 14th are highlighted in green. Tentative agreements also discussed during the GTW are highlighted in yellow.

### Open issues

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| --- | --- |
|  | **Status summary**  |
| Sub-topic 2-1: Requirement definition according to UE capability of supporting CSI-validation features | ***Agreements on Proposed WF:*****Issue 2-1-1: How to define requirements based on UEs capabilities related to CSI-RS validation**Agreement: Option 1: Define requirements for UE supporting *‘csi-RS-validationWith-DCI’* only and no applicable test is defined for UE that do not support this capability**Issue 2-1-2: Whether to define a different LBT Model for UEs that do not support CSI-RS validation**Define a single LBT model for NR-U Demod tests, regardless of UE capabilities.***Tentative agreements:******Recommendations for 2nd round:*** |
| Sub-topic 2-2: Details of the Downlink Transmission Model | ***Agreements on Proposed WF:*****Issue 2-2-1: Possible value of the random downlink duration within the COT;**Agreement: Option 2b: {2,4,6,7} Slots, extending the maximum COT to 4.5ms**Issue 2-2-2: Maximum COT duration within the DL Periodicity**4.5 ms, only last slot in the DL periodicity is idle (Qualcomm);**Issue 2-2-3: Whether to limit the minimum DL duration to 1ms;**Minimum DL duration is already agreed to be at least 2 slots (=1 ms) due to the DRS window duration (1ms), and both options under consideration in the next issue do not include 1 slot, so agree on this proposal.**Issue 2-2-4: Overall duration of the last slot in the COT:**Agreements: Option 3: 14 Symbols if DL duration equals 2 Slots, {6,9,12,14} Symbols otherwise***Recommendations for 2nd round:*****Issue 2-2-5: TDD Pattern to be used in DL demodulation Tests*** Proposals
	+ Option 1: Fixed TDD Pattern, 7D-1S-2U (Huawei, MediaTek, Apple, Ericsson);
	+ Option 2: Do not specify a fixed pattern, use DCI-based Dynamic UL/DL detection instead (Qualcomm, Intel);
	+ Option 3: Split TDD pattern choice for Demodulation tests and CQI reporting tests;
* Recommended WF
	+ Discuss in the second round;

**Issue 2-2-6: UL scheduling with fixed TDD Pattern*** Proposals
	+ Option 1: UL allocation, within each FFP, start at {4, 4.5} ms and duration {0.9, 0.4} ms, for DL duration {<=7, 8} Slots respectively ();
	+ Option 2: UL allocation, within each FFP, starts at 4ms and lasts for 1 slot(=0.5ms). The last slot (=0.5ms) is idle (Qualcomm, Apple, Ericsson, Huawei);
	+ Option 3: UL allocation starts at 4.5ms and lasts 0.5ms (MediaTek);
* Recommended WF
	+ Keep discussing along with Issue 2-2-5;

**Issue 2-2-7: UL scheduling when using DCI-based Dynamic UL/DL detection*** Proposals
	+ Option 1: Reserve 1 slot for UL scheduling of the UE HARQ feedback, after 1 Guard Slot following the end of the last slot with PDSCH allocation in the COT (Qualcomm, MediaTek, Ericsson, Intel);
* Recommended WF
	+ Keep discussing along with Issue 2-2-5;
 |
| Sub-topic 2-3: Details of the LBT Model | ***Tentative agreements:*****Issue 2-3-1: LBT Probabilities (PLBT)to be used in the tests for Scenario A and C**Tentative agreement: Option 2: 0.25 (pending on further check by Huawei) |
| Sub-topic 2-4: Details of NR-U PDSCH Performance Tests | ***Agreements on Proposed WF:*****Issue 2-4-1: Define a single set of PDSCH Requirements for the unlicensed cell for both Scenario A and C.** Define a single set of PDSCH Requirements for the unlicensed cell.**Issue 2-4-2: Whether to define PDSCH requirements for the licensed cell performances in Scenario A** Agreements: For scenario A: Pcell configuration will be specified and during test, only PDSCH performances on the unlicensed carrier will be verified. ***Tentative agreements:******Recommendations for 2nd round:*****Issue 2-4-3: How to configure NR PCell in Scenario A PDSCH Demodulation test setup*** Proposals
	+ Option 1: Use the parameters in 38.101-4, Table 5.2-1, with CBW = 20MHz and SCS = 30kHz (Qualcomm, Apple, Intel);
	+ Option 2: Use the parameters in 38.101-4, Table 5.2-1, with CBW = 40MHz and SCS = 30kHz (Huawei);
* Recommended WF
	+ Discuss in the second round;

**Issue 2-4-4: Bandwidth to be used for the PDSCH Requirements for Scenario C*** Proposals
	+ Option 1: 20 MHz (Agreement in the WF, MediaTek, Apple);
	+ Option 2: {20,40,60,80} MHz with applicability rule (largest supported bandwidth) if Scenario A unlicensed requirements can be applied for Scenario C. (Ericsson, Qualcomm, Huawei, Intel);
* Recommended WF
	+ Discuss in the second round;

**NEW: Issue 2-4-5: Discuss time and frequency offset errors of unlicensed to licensed CC** * Proposals:
	+ Reuse Timing and Frequency error relative to PCell from LAA (Huawei);
* Recommended WF
	+ Discuss in the second round;
 |
| Sub-topic 2-5: Configuration details for PDSCH Tests | ***Agreements on Proposed WF:*****Issue 2-5-1: Whether to reduce the number of additional DMRS in PDSCH** Modify the PDSCH DMRS configuration in the current simulation assumption table, setting the parameter “dmrs-AdditionalPosition” = ‘*pos1*’.**Issue 2-5-2: Whether to configure CSI-RS for tracking**Yes, with the same configuration as in Rel.15 PDSCH tests. (20ms=40 slots periodicity and offset 10ms=20/21 slots for Res.1-2/3-4);**Issue 2-5-3: CSI-RS for tracking configuration: RB size**RB size = $N\_{BWP,i}^{size}.$***Tentative agreements:******Recommendations for 2nd round:*** |

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Topic #3: CQI Reporting Requirements

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2104547 | Ericsson | Issue 1: Do we need to check how UE measure CSI-RS?Observation: It is not practical to check UE CSI measurement behaviour under CQI report demodulation setup.Proposal: Only consider the option that two different runs with different SNR values.Issue 2: CQI report methodProposal: Use periodic CQI report configuration |
| R4-2104841 | Apple | Proposal #1: For NR-U introduce CQI reporting requirements with aperiodic CSI reporting.Proposal #2: Introduce tests with 2 SNR levels to verify CQI reporting.Proposal #3: PDSCH BLER measurement for CQI reporting need not be subject to LBT failure. |
| R4-2106472 | Qualcomm Incorporated | Proposal 1: For NR-U CQI Reporting test, reuse the DL Transmission Model already defined and agreed for NR-U PDSCH Demodulation tests;Observation 1: With proper scheduling, aperiodic CSI Reporting can fit within the constraints of the DL Model as defined for PDSCH tests in [3];Proposal 2: Use Aperiodic CSI Reporting in the NR-U CQI reporting test;Proposal 3: For the test setup details of CQI performance test, support Option 1 in the WF, designing the test using two sets of burst transmissions, each with distinct transmission power level boost and keeping the interference level constant during the test;Proposal 4: Use [0dB, +6dB], random with equal probability, as Transmission Power boost level for each DL Period;Proposal 5: Collect PDSCH and CQI reporting results separately per each transmission power level boost;Proposal 6: Determine PDSCH transport format for each transmission power level boost independently, according to the transmission power level boost applied to the resources measured by the UE to produce the CQI reports received;Proposal 7: Requirement for CQI reporting should include CQI reporting statistics and PDSCH BLER statistics, with each set of statistics collected separately per each transmission power level boost, and a minimum difference in median CQI between set collected per each transmission power level boost as described in this contribution;Proposal 8: To define CQI Reporting tests for NR-U, use AWGN channel only;Proposal 9: To define CQI Reporting tests for NR-U, agree on one SNR pair, with the condition that satisfying the requirement on one SNR is sufficient to pass the test;Proposal 10: For the next meeting, companies should be encouraged to presents results for alignment including: SNR pair to be used in the simulation, minimum delta across CQIs for different transmission power level boost; |
| R4-2106785 | Huawei, HiSilicon | Proposal 1: Use periodic CSI reporting and set periodicity of CSI-RS transmission and CSI reporting to FFP and set the offset of CSI-RS transmission less than minimal transmission duration (i.e. 2 slots) to collect CQI from every burst transmission.Proposal 2: For information, use following test set-up:* CSI-RS periodicity/offset: 10/1 slots
* CSI-RS reporting periodicity/offset: 10/8 slots
* TDD pattern: 7D1S2U

Proposal 3: Use option 1 as CQI Performance Test Design: -> with power boost Proposal 4: Use CQI distribute criterion and BLER criterion. |
| R4-2107090 | MediaTek inc. | Proposal 1: Define CQI requirements only for UEs supporting optional capabilities related to CSI-RS validation.Proposal 2: For the type of CSI reporting, we support periodic CSI with CSI-RS validation.Proposal 3: During the CQI test, there are two sets of burst transmissions, each with distinct transmission power level and keeping the interference level constant. |

## Open issues summary

The issues listed in this section address topics for discussions related to issues specific to CQI Reporting performance testing.

### Sub-topic 3-1: NR-U CQI Reporting test

**Issue 3-1-1: Requirement definition according to UE capability of supporting CSI-validation features**

* Proposals
	+ Option 1: Define CQI requirements only for UEs supporting optional capabilities related to CSI-RS validation (MediaTek);
	+ Option 2: The decisions on the CQI Requirements definition for UEs not supporting optional capabilities will follow the agreements reached on the same issue related to PDSCH Requirements (Agreement in WF);
* Recommended WF
	+ Discuss PDSCH and CQI requirements definition together in Topic #2 as per previous agreements;

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| **Company** | **Comments** |
| Apple | We could stick to agreement in WF to use the same agreement as PDSCH demod tests.  |
| Ericsson  | We support WF and also agree Option 1 that only define requirements for UE with CSI-validation capability.  |
| Qualcomm | We agree with recommended WF. How to define requirement should be discussed in 2-1-1 for PDSCH and the same decisions should apply here. |
| Huawei | Support Option 1 to only define the requirements for UE with CSI- validation capability. |
| Intel | We support the recommended WF |

**Issue 3-1-2: CQI Test Setup Details**

* Proposals
	+ Option 1: TE to transmit randomly in each DL periodicity with one of two different power level boost, with constant interference level during the test (Huawei, Qualcomm, MediaTek);
	+ Option 2: Two different runs with different SNR values (Ericsson, Apple);
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| MediaTek | We support Option 1 to validate that the UE does not average the channel measurement across different COTs. |
| Apple | We don’t see a strong motivation to introduce this complexity in the testcase – both for setup and metric/results collection. It would not be in the best interest of the UE to be averaging over different bursts/ transmissions in the first place for NR-U. We support option 2 to have same test setup as CQI reporting for licensed carrier. |
| Ericsson | We can accept Option 1 to follow LTE eLAA.  |
| Qualcomm | Support option 1. |
|  Huawei | Support option 1. @Apple: what’s the test purpose for option 2? From our understanding, there is no difference for algorithm and UE behavior between normal mode and NR-U if option 2 is considered. |
| Intel | Support Option 1.  |

**Issue 3-1-3: CQI Test Metrics Details**

* Proposals
	+ Option 1: CQI distribution criterion and BLER criterion (Huawei);
	+ Option 2: Include CQI distribution statistics, PDSCH BLER, minimum difference in median CQI between sets collected per each transmission power level boost (Qualcomm);
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| Apple | We support Option 1 since we don’t support to introduce tests with different power level for DL bursts.  |
| Ericsson | We support Option 1. |
| Qualcomm | The difference in median CQI across power level boost was used in LAA and if we do not use this metric we do not see the advantage of introducing the power level boost approach in Issue 3-1-2.Support Option 2. |
| Huawei | According to our test design in our paper, CQI distribution criterion includes the metric that minimum difference of median CQI between sets collected per each transmission power level boost. So we support option 2. |
| Intel | Support Option 2. |

**Issue 3-1-4: Power boost for CQI Test Setup with two transmission power level boosts**

* Proposals
	+ Option 1: Use randomly per each DL period [0, +6]dB with equal probability (Qualcomm);
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| MediaTek | We are OK to Option 1. |
| Qualcomm | Support Option 1 |
| Huawei | Support option 1. |
| Intel | Support Option 1 |

**Issue 3-1-5: Scheduling details for CQI Test Setup with two transmission power level boosts**

* Proposals
	+ Option 1: Determine PDSCH transport format for each transmission power level boost independently, depending on the boost applied to the resources measured by the UE to produce the CQI reports received (Qualcomm);
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| Qualcomm | To reasonably allocate PDSCH transport format, the reference CQI should be the one received by the TE based on UE measurements for the same power level boost used for said PDSCH transmission.Support Option 1. |
| Huawei | Support option 1 |
|  |  |

**Issue 3-1-6: Test metric collection for CQI Test Setup with two transmission power level boosts**

* Proposals
	+ Option 1: Collect PDSCH and CQI reporting results separately per each transmission power level boost (Qualcomm);
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| Qualcomm | For power level boost setup, Support Option 1. |
| Huawei | Support Option 1 |
| Intel | Ok with Option 1 |

### Sub-topic 3-2: Configuration details for CQI Reporting test

**Issue 3-2-1: LBT setup in CQI test**

* Proposals
	+ Option 1: Reuse the DL model as agreed for PDSCH (Qualcomm);
	+ Option 2: Do not consider LBT failure in PDSCH BLER measurement for CQI Reporting tests (Apple);
* Recommended WF
	+ TBA

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | For the first part of the test where CQI is measured and reported, we would have prob LBT failure, random DL transmission duration, random partial ending slot modeled/configured. For PDSCH BLER measurement with different MCS/CQI we don’t see the necessity to have LBT failure or DL transmission model enabled. It would nopt serve the purpose of verifying CQI reporting in anyway but only increase testing time.  |
| Ericsson | We support Option 1. If no LBT failure, we don’t see difference from licensed test.  |
| Qualcomm | We support Option 1, it seems more reasonable to test PDSCH in the same conditions in which the CQI is reported, so including LBT failure |
| Huawei | Support option 1, we think it is better to unify the test setup. Different LBT failure probability may increase the test complexity. |
| Intel | Support Option 1 |

**Issue 3-2-2: Type of CQI Reporting**

* Proposals
	+ Option 1: Aperiodic (Apple, Qualcomm)
	+ Option 2: Periodic (Ericsson, MediaTek, Huawei);
* Recommended WF
	+ TBA

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| --- | --- |
| **Company** | **Comments** |
| MediaTek | Support Option 2. If the fixed TDD pattern is adopted, we think it is nature to use periodic reporting. |
| Apple | We support option 1. We think Aperiodic reporting is more practical in NR-U. For many Rel-15 tests in TDD we still use aperiodic reporting fixed TDD pattern.  |
| Ericsson | Support Option 2. For Scenario A, periodic CQI reporting is typical. For Scenario C, aperiodic CQI report could be typical due to UL LBT failure. But as we agreed before, we should not consider UL LBT failure for both PDSCH and CQI report tests. Then periodic CQI report would be a better choice to avoid complexity.  |
| Qualcomm | We support option 1. It allows us to schedule CQI reporting within the COT (shorter delay for reporting) and it can work with both fixed TDD and dynamic DCI-based scheduling. |
| Huawei | We think it is better to set periodic CSI-RS resource and CSI reporting to FFP and set the offset of CSI-RS resource less than the minimal transmission duration (i.e. 2 slots), by this configuration every burst’s CQI can be collected within the FFP. |
| Intel | Option 1 to support dynamic burst structure |

**Issue 3-2-3: Scheduling of CSI-RS transmission and reporting for CQI Tests**

* Proposals
	+ Option 1 (Huawei):
		- CSI-RS resource periodicity/offset: 10/1 slots
		- CSI reporting periodicity/offset: 10/8 slots
		- TDD pattern: 7D1S2U
	+ Option 2 (Qualcomm):
		- CSI-RS Periodicity/offset: 10/1 slots
* Recommended WF
	+ TBA

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MediaTek | We are OK to Option 1. |
| Apple | We propose to use the same TDD pattern as PDSCH demod.We propose to use aperiodic CSI-RS and reporting |
| Ericsson | Support Option 1. If the requirements will be only defined for UE with CSI-RS validation capability, then periodic CSI-RS might also be practical. It will be more efficiency and flexible than aperiodic CSI-RS. In that case, less resource for DCI could be used and UE can be scheduled to feedback by periodic or aperiodic according to situation. If there is no much performance difference, we prefer using periodic CSI-RS to simplify the test.  |
| Qualcomm | CSI Reporting and TDD pattern should be discussed in the respective separate issues.Periodic CSI-RS can be used along with UE DCI-based validation, so we propose Option 2: 10/1 slots for CSI-RS scheduling |
| Huawei | Support option 1. |
| Intel | Support Option 2 |

**Issue 3-2-4: Channel Model for CQI Tests**

* Proposals
	+ Option 1: Use AWGN channel only (Qualcomm);
* Recommended WF
	+ TBA

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| --- | --- |
| **Company** | **Comments** |
| MediaTek | Support Option 1. |
| Apple | We support option 1.  |
| Ericsson | Support Option 1. |
| Qualcomm | Support Option 1. |
| Huawei  | Support Option 1 |
| Intel | Support Option 1  |

**Issue 3-2-5: SNR for CQI Test**

* Proposals
	+ Option 1: Agree on one SNR pair, with the condition that satisfying the requirement on one SNR is sufficient to pass successfully the test (Qualcomm);
* Recommended WF
	+ TBA

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| --- | --- |
| **Company** | **Comments** |
| Apple | We support option 1. Similar requirement as other CQI reporting tests.  |
| Qualcomm | Support option 1 |
| Huawei | Support Option 1. To save simulation efforts, maybe we can start as SNR [8,14]dB and [9,15]dB. |
| Intel | Support option 1 |

**Issue 3-2-6: Simulation results**

* Proposals
	+ Option 1: Encourage companies to present alignment results including at least: SNR pair for the simulation, minimum delta across CQI for different transmission power level boost (Qualcomm);
* Recommended WF
	+ TBA

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | We can decide/ discuss further based on agreements for other issues.  |
| Qualcomm | Support option 1; |
| Huawei | Support Option 1. By referring to LAA, the SNR value can be 6dB difference for bursts with different power level and minimum delta across CQI is 2. |

## 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

*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**  |
| Sub-topic 3-1: NR-U CQI Reporting test | ***Agreements on Proposed WF:*****Issue 3-1-1: Requirement definition according to UE capability of supporting CSI-validation features** Discuss PDSCH and CQI requirements definition together in Topic #2 as per previous agreements;**Issue 3-1-4: Power boost for CQI Test Setup with two transmission power level boosts**Use randomly per each DL period [0, +6]dB with equal probability;**Issue 3-1-5: Scheduling details for CQI Test Setup with two transmission power level boosts**Determine PDSCH transport format for each transmission power level boost independently, depending on the boost applied to the resources measured by the UE to produce the CQI reports received;**Issue 3-1-6: Test metric collection for CQI Test Setup with two transmission power level boosts**Collect PDSCH and CQI reporting results separately per each transmission power level boost;***Tentative agreements:******Recommendations for 2nd round:*****Issue 3-1-2: CQI Test Setup Details*** Proposals
	+ Option 1: TE to transmit randomly in each DL periodicity with one of two different power level boost, with constant interference level during the test (Huawei, Qualcomm, MediaTek, Ericsson, Intel);
	+ Option 2: Two different runs with different SNR values (Apple);
* Recommended WF
	+ Can Apple agree to Option 1?

**Issue 3-1-3: CQI Test Metrics Details*** Proposals
	+ Option 1: CQI distribution criterion and BLER criterion (Apple, Ericsson);
	+ Option 2: Include CQI distribution statistics, PDSCH BLER, minimum difference in median CQI between sets collected per each transmission power level boost (Qualcomm, Huawei, Intel);
* Recommended WF
	+ Align views in the second round, according to the decision made on Issue 3-1-2;
 |
| Sub-topic 3-2: Configuration details for CQI Reporting test | ***Agreements on Proposed WF:*****Issue 3-2-4: Channel Model for CQI Tests**Use AWGN channel only;**Issue 3-2-5: SNR for CQI Test**Agree on one SNR pair, with the condition that satisfying the requirement on one SNR is sufficient to pass successfully the test. SNR points can include but are not limited to [8,9] dB, not including the power boost [+0,+6]dB.***Tentative agreements:*****Issue 3-2-3: Scheduling of CSI-RS transmission and reporting for CQI Tests**All companies agreed on periodic CSI-RS resource periodicity/offset: 10/1 slots. 1 company did not express an opinion.***Recommendations for 2nd round:*****Issue 3-2-1: LBT setup in CQI test** * Proposals
	+ Option 1: Reuse the DL model as agreed for PDSCH (Qualcomm, Ericsson, Huawei, Intel);
	+ Option 2: Do not consider LBT failure in PDSCH BLER measurement for CQI Reporting tests (Apple);
* Recommended WF
	+ Can Apple agree to Option 1?

**Issue 3-2-7: Type of CQI Reporting*** Proposals
	+ Option 1: Aperiodic (Apple, Qualcomm, Intel)
	+ Option 2: Periodic (Ericsson, MediaTek, Huawei);
* Recommended WF
	+ Discuss in the second round, according to the output of the discussion for Issue 2-2-5 (TDD pattern)

**Issue 3-2-6: Simulation results*** Proposals
	+ Option 1: Encourage companies to present alignment results including at least: SNR pair for the simulation, minimum delta across CQI for different transmission power level boost (Qualcomm, Huawei);
* Recommended WF
	+ Can be agreed, pending decision on the Test configuration.
 |

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Topic #4: Simulation Results

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2104546 | Ericsson | Simulations Results for Alignment |
| R4-2104839 | Apple | Simulation Results for Alignment |
| R4-2106471 | Qualcomm Incorporated | Simulation Results for Alignment |
| R4-2106507 | Intel Corporation | Simulation Results for Alignment |
| R4-2106783 | Huawei, HiSilicon | Simulation Results for Alignment |

## Open issues summary

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

**Issue 3-2-8: Simulation results summary**

* Recommended WF

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | We have uploaded our results |
| Qualcomm | We included our results in the summary table provided by Apple. |
|  |  |

## 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

*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**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| Way Forward on NR-U UE demodulation requirements | Qualcomm |  |
| Updated Work Plan for NR-U Demodulation Performance Requirements | Qualcomm  |  |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-2104840 | Summary of simulation results for NR-U UE Demod | Apple |  |  |
|  |  |  |  |  |
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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