**3GPP TSG-RAN WG4 Meeting # 94-e-Bis R4-200XXXX**

**Electronic Meeting, 20 – 30 Apr., 2020**

**Agenda item:** 7.8.1.1

**Source:** Moderator (Ericsson)

**Title:** Email discussion summary for [97e][322] NR\_URLLC\_Demod\_Part1

**Document for:** Information

# Introduction

The scope of this e-mail discussion is the 0.001% BLER UE FMCS and CQI requirements and BS requirement.

For the UE FMCS, there are no open issues and simulation results and CRs are available.

For the CQI, further discussion and conclusions should first take place on how to structure the requirement and whether to define the requirement. When this is concluded, the CRs can be refined.

For the BS, most issues are resolved and CRs are available. Some requirement values are available, but for some bandwidths there are currently too few simulation results.

# Topic #1: UE demodulation requirements for ultra-low BLER

This topic covers the UE FMCS requirement

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2014241 | Apple | Simulation results |
| R4-2014541 | Intel | Simulation results |
| R4-2016105 | Ericsson | Simulation results |

## Open issues summary

### Sub-topic 1-1

Sub-topic description: Requirement values. The summary spreadsheet has been updated with the latest results. Please double check. In particular:

* Huawei impairment results are not present. Huawei please indicate impairment result
* Qualcomm: Please double check 4RX TDD result as it seems to deviate from expected ?

Open issues and candidate options before e-meeting:

**Issue 1-1: 15kHz, 2RX**

* Proposals
	+ Option 1: 2.7 dB
* Recommended WF
	+ TBA

**Issue 1-2: 30kHz, 2RX**

* Proposals
	+ Option 1: 2.8 dB
* Recommended WF
	+ TBA

**Issue 1-3: 15kHz, 4RX**

* Proposals
	+ Option 1: 0.1 dB
* Recommended WF
	+ TBA

**Issue 1-4: 30kHz, 4RX**

* Proposals
	+ Option 1: 0.2 dB
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1: Sub topic 1-2:….Others: |
| Ericsson | The values are OK for us |
| Apple | We are okay to capture these SNR requirements in square brackets. |
| Huawei | We are ok with these values. |

### CRs/TPs comments collection

*Major close-to-finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2015622 | Moderator: Huawei CR on applicability rules. Resubmission of previously endorsed draft CR. |
| This CR will be discussed in thread 323 |
|  |
| R4-2016004 | Moderator: Intel CR on FRCs |
| Ericsson: The SE table should be referred to as 64QAM-MCS-TableAlt to align to Huawei CRs and should be declared in a note below the table. |
|  |
| R4-2016107 | Moderator: Ericsson CR on requirements |
| Company A |
|  |

## 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:* |

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: CQI requirements

This topic covers UE CQI requirements.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2014542 | Intel | **Proposal 1: Define CQI requirements for CQI Table 3 verification only is case CL is lower than 98.6%.****Proposal 2: Inform RAN5 about RAN4 conclusion on feasible CQI testing methodology for CQI Table 3 verification.** |
| R4-2015615 | Huawei | **Proposal 1: The early pass/fail criterial should be introduced for the CQI test.** **Proposal 2: A lower confidence level for CQI test should be considered (e.g. 99%).****Proposal 3: No applicability rule for FMCS and CQI test.**  |
| R4-2015863 | Ericsson | **Proposal 1: For the (median CQI+1) and (median CQI) BLER, consider a confidence level down to 99% to reduce test time.****Proposal 2: Adopt the parameters in section 3 for the CQI test** |
| R4-2015864 | Ericsson | Simulation results |
| R4-2016445 | Qualcomm | **Proposal 1: Define a lower bound for median reported CQI in the CQI reporting tests for 99.999% reliability.****Observation 1: It is possible to have an applicability rule between CQI reporting test and fixed MCS test under AWGN.****Observation 2: Only one long test needs to be run for testing CQI reporting under AWGN condition for 1e-5 BLER with 99.999% confidence level.****Observation 3: SNR required to achieve 1e-5 BLER for different CQIs have enough difference that 0.5dB SNR difference to accommodate testability will not change reported CQI.****Observation 4: Similar to fixed MCS test for ultra-low BLER, long test duration for CQI reporting test can be reduced by using the same X dB relaxation as in fixed MCS test.****Proposal 2: Define CQI reporting test under AWGN condition with 99.999% confidence level.****Proposal 3: Define an applicability rule between CQI reporting test and FMCS test under AWGN to reduce the number of tests as below:**** If UE shows < 1e-5 BLER at the same SNR for an MCS greater than or equal to MCS in fixed MCS test, UE automatically passes the fixed MCS test.** ** If UE shows > 1e-5 BLER at the same SNR for an MCS less than or equal to MCS in fixed MCS test, UE automatically fails the fixed MCS test.****Observation 5: RAN5 never used early pass/fail criteria for CQI reporting tests because the test duration for existing CQI reporting tests is very small.****Observation 6: It is easy to apply early pass/fail criteria for CQI reporting tests when running the test for BLER criteria at median CQI and median+/-1 CQI similar to fixed MCS test cases.** |
|  |  |  |

## Open issues summary

### Sub-topic 2-1

Sub-topic description: Framework for the CQI requirement

Open issues and candidate options before e-meeting:

**Issue 2-1-1: Use of early pass/fail**

* Proposals
	+ Option 1: Use early pass/fail criteria for CQI test (Huawei)
	+ Option 2: Do not use early pass/fail criteria
* Recommended WF
	+ TBA

**Issue 2-1-1: Include X (0.5dB) in CQI test**

* Proposals
	+ Option 1:Yes (Qualcomm)
	+ Option 2: No
* Recommended WF
	+ TBA

**Issue 2-1-3: Confidence level**

* Proposals
	+ Option 1: 99.999% (Qualcomm)
	+ Option 2: 99%
	+ Option 3: 98.6%
	+ Option 4: 95%
	+ (Other options not precluded)
* Recommended WF
	+ TBA

**Issue 2-1-4: Lower bound for median CQI**

* Proposals
	+ Option 1: Define a lower bound for median CQI (Qualcomm)
	+ Option 2: No lower bound
* Recommended WF
	+ TBA

**Issue 2-1-5: Applicability rule with FMCS test**

* Proposals
	+ Option 1: Define an applicability rule (Qualcomm)
	+ Option 2: Do not define an applicability rule (Huawei)
* Recommended WF
	+ TBA

**Issue 2-1-6: Send an LS to RAN5**

* Proposals
	+ Option 1: Send an LS to RAN5 informing them of early termination & confidence level for CQI test (Intel)
	+ Option 2: No LS
* Recommended WF
	+ TBA

### Sub-topic 2-2

Sub-topic description: Detailed parameters

Open issues and candidate options before e-meeting:

**Issue 2-2-1: Detailed parameters**

* Proposals
	+ The following detailed parameters have been proposed. Please indicate alternative proposals for specific parameters as applicable

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **FDD** | **TDD** |
| Bandwidth | MHz | 10 | 40 |
| Number of allocated PDSCH resource blocks |  | 52 | 106 |
| Subcarrier spacing | kHz | 15 | 30 |
| MCS table |  | Table 3 |
| PDSCH starting symbol/length |  | 2/12 |
| Number of PDSCH MIMO layers |  | 1 |
| PDSCH mapping type |  | Type A |
| DMRS type |  | Type 1 |
| DMRS duration |  | single-symbol DMRS |
| Number of additional DMRS |  | 1 |
| Slot pattern |  | N/A | 7D1S2U, S=6D: 4G: 4U |
| Propagation channel |  | AWGN  |
| Antenna configuration |  | 1x2, ULA low​1x4, ULA low​ |
| Beamforming Model |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 1A |
| CDM Type |  | No CDM |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 2,4 |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 9 |
| CSI-RSperiodicity and offset | slot | 5/1 | 10/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 1 |
| CDM Type |  | No CDM |
| Density (ρ) |  | 3 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 1,(0,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 13 |
| NZP CSI-RS-timeConfigperiodicity and offset | slot | 5/1 | 10/1 |
| CSI-IM configuration | CSI-IM resource Type |  | Periodic |
| CSI-IM RE pattern |  | 0 |
| CSI-IM Resource Mapping(kCSI-IM,lCSI-IM) |  | (4, 9) |
| CSI-IM timeConfigperiodicity and offset | slot | 5/1 | 10/1 |
| ReportConfigType |  | Periodic |
| CQI-table |  | Table 3 |
| reportQuantity |  | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements |  | Not configured |
| timeRestrictionForInterferenceMeasurements |  | Not configured |
| cqi-FormatIndicator |  | Wideband |
| pmi-FormatIndicator |  | Wideband |
| Sub-band Size | RB | 8 | 16 |
| Csi-ReportingBand |  | 1111111 |
| CSI-Report periodicity and offset | slot | 5/0 | 10/9 |
| aperiodicTriggeringOffset |  | Not configured |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured |
| CodebookSubsetRestriction |  | 010000 |
| RI Restriction |  | 00000001 |
| Physical channel for CSI report |  | PUCCH |
| CQI/RI/PMI delay  | ms | 8 | 9.5 |
| Maximum number of HARQ transmission |  | 1 |
| Target BLER |  | 10^-5 |
| PBCH |  | slot#0 per 20ms periodicity |
| PT-RS |  | Disabled |
| PDSCH is not scheduled on slots containing CSI-RS or slots which are not full DL |

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 2-1-1: We agree with option 1. It is important to use the early pass/fail criteria to reduce the test time as far as possibleIssue 2-1-2: In our understanding, it 0.5dB is added this could lead to some situations where the UE could fail the test requirement because CQI+1 could have BLER less than 1e-5 if 0.5dB is added during the test. So we support option 2.Issue 2-1-3: We prefer option 4 to minimize test time; we do not believe that high confidence is critical for the CQI testing. Options 2 and 3 could probably be OK too as they will reduce the test time, but potentially not by a large enough factor.Issue 2-1-4: We support option 1; it is preferable to define a minimum bound to avoid reporting the lowest CQI as outlined by Qualcomm.Issue 2-1-5: Assuming that the confidence level for the CQI test is different to the FMCS test, we do nt believe that an applicability rule should be applied.Issue 2-1-6: Since the CQI testing will differ to other requirements, we agree that there is a need to send an LS to RAN5. |
| Apple | Issue 2-1-1: We support option 1. Without early pass/fail criteria the test time could be very long. For static channel test, would there be a good reason not to use early pass/fail?Issue 2-1-2: We support option 2. Adding margin of 0.5 dB was necessary for FMCS test to have reasonable test time for the CL of 99.999% to achieve DUT BLER < 1e-5. Issue 2-1-3: We support option 3 or 4 to ensure small testing time. Based on Intel’s paper the run time is reasonable for overall CL < 98.6%Issue 2-1-4: We support option 1.Issue 2-1-5: We support option 2. We don’t think an applicability rule is possible given we have different CL and test methodology for CQI reporting and FMCS test.Issue 2-1-6: We support option 1 to send LS to RAN5 to capture the agreed test methodology for CQI reporting test. Issue 2-2-1: We need to discuss test parameters. Also, we propose to define only 1 Test (with 2 SNRs) for CQI reporting with Table 3.  |
| Huawei | Issue 2-1-2: Option 2. The intension of adding 0.5 dB is to reduce the test time but it may occur some uncertain situation. Issue 2-1-3: Option 3 or 4. With lower confidence level, the test time is reduced.Issue 2-1-4: Option 1.Issue 2-1-6: Option 1.  |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2015621 | Moderator: Huawei CR on applicability |
| Company B |
|  |
| R4-2016376 | Moderator: Apple CR on applicability |
| Moderator: Clashes with R4-2015621. Discuss R4-2015621 to follow work split. |
| Apple: We weren’t sure if applicability for CQI would also be covered by Huawei. Hence the duplicate CR. We are fine to go with agreed work split. |
| R4-2016375 | Moderator: Apple CR on CQI requirement |
| Ericsson: BLER should refer to 1e-5, not 0.1. Some of the parameters e.g. TX antenna configuration need to be discussed and agreed. |
| Apple: We will revise the CR as agreements are reached for CQI reporting tests. We agree to change BLER to 1e-5 from 0.1 in the requirements. |

## 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:* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### 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)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #3: BS requirements

This topic covers the BS 0.001% requirement.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2015094 | Nokia | Per step decision risks1. Making d\_early\_fail up to an order of magnitude stricter, does not meaningfully impact the testing time for marginal DUTs, and does not impact the testing time for good DUTs at all.
2. RAN4 to choose per step decision risks of d\_early\_fail = 2e-7 and d\_early\_pass = 1e-7, or d\_early\_fail = 4e-7 and d\_early\_pass = 1e-7 right now, and if necessary revise them, once further simulation results from several companies are available.

Low error count decision co-ordinatesThe inverse cumulative function of the negative binomial distribution is not defined for 0 error/success events. 1. RAN4 to adopt the approach of letting DUTs pass with zero error event, if the number of samples of the next valid sample count is reached (i.e., the next highest non-N/A entry).
2. RAN4 to replace sample counts of <1000 samples, with the next highest non-N/A entry.
 |

## Open issues summary

### Sub-topic 3-1

Sub-topic description: Early pass/fail methodology

Open issues and candidate options before e-meeting:

**Issue 3-1-1: Per step decision risks (Note: Decision from this meeting can be updated later based on further simulation results)**

* Proposals
	+ Option 1: d\_early\_fail = 2e-7, d\_early\_pass = 1e-7
	+ Option 2: d\_early\_fail = 4e-7, d\_early\_pass=1e-7
* Recommended WF
	+ TBA

**Issue 3-1-2: Zero error DUTs**

* Proposals
	+ Option 1: RAN4 to adopt the approach of letting DUTs pass with zero error event, if the number of samples of the next valid sample count is reached (i.e., the next highest non-N/A entry) (Nokia)
* Recommended WF
	+ TBA

**Issue 3-1-3: Minimum number of samples**

* Proposals
	+ Option 1: RAN4 to replace sample counts of <1000 samples, with the next highest non-N/A entry (Nokia)
* Recommended WF
	+ TBA

### Sub-topic 3-2

Sub-topic description: Requirement values

The following proposals are based on the available results in the results summary. There are however some issues with the results summary:

* Impairment values are missing for Huawei – Huawei requested to suggest values
* There are insufficient results for 5MHz/15k SCS and 10MHz/40k SCS. If companies have further results, they are requested to add them to the spreadsheet

**Issue 3-2-1: Summary of requirement based on available results in spreadsheet**

* Proposals

|  |  |
| --- | --- |
| 15kHz, 5MHz Bandwidth, Type A mapping |  |
| 15kHz, 10MHz Bandwidth, Type A mapping | -5.8 dB |
| 30kHz, 10MHz Bandwidth, Type A mapping |  |
| 30kHz, 40MHz Bandwidth, Type A mapping | -6.2 dB |
| 15kHz, 5MHz Bandwidth, Type B mapping |  |
| 15kHz, 10MHz Bandwidth, Type B mapping | -5.8 dB |
| 30kHz, 10MHz Bandwidth, Type B mapping |  |
| 30kHz, 40MHz Bandwidth, Type B mapping | -6.2 dB |

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 3-1-1: We prefer option 1 as simulation results up to now suggest that this provides closer to the target confidence level for both early pass and fail. We are OK to write the specification on this basis in this meeting, but due to long simulation times it could be good to agree to double check this if further results become available by next meeting.Issue 3-1-2: We support option 1, since DUTs with zero or extremely low error rate should not be penalized.Issue 3-1-3: We are OK with option 1; it will not substantially impact test time and provides some additional statistical safety. |
| Samsung | **Issue 3-1-1: Per step decision risks (Note: Decision from this meeting can be updated later based on further simulation results)**Ok with option1**Issue 3-1-2: Zero error DUTs**OK with option 1**Issue 3-1-3: Minimum number of samples**OK with option 1**Issue 3-2-1: Summary of requirement based on available results in spreadsheet**We will update our result during this meeting. Suggest to add [] for SNR value in this meeting, and remove the [] in the next meeting if no more results updated or no technical issue identified. |
| Huawei | Issue 3-1-1: We are fine with option 1.Issue 3-1-2: Option 1.Issue 3-1-3: Option 1.Issue 3-2-1: We will update the simulation results. |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2015024 | Moderator: Ericsson CR on Test requirements for 38.141-1 |
| Company B |
|  |
| R4-201525 | Moderator: Ericsson CR on introduction of requirement for 38.141-2 |
| Company B |
|  |
| R4-2015096 | Moderator: Nokia CR introducing requirement to 38.104 |
| Company B |
|  |
| R4-2015098 | Moderator: Nokia, Intel, Huawei, Ericsson CR introducing statistical annex to 38.141-1 |
| Company B |
|  |
| R4-2015099 | Moderator: Nokia, Intel, Huawei, Ericsson CR introducing statistical annex to 38.141-2 |
| Company B |
|  |
| R4-2015625 | Moderator: Huawei CR on test applicability |
| Discuss under thread 323 |
|  |
| R4-2015627 | Moderator: Huawei CR on FRCs |
| Company B |
|  |

## Summary for 1st round

### Open issues

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

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### 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)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |