**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
  + Option 2: 3.2dB (Intel)
* Recommended WF
  + TBA

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

* Proposals
  + Option 1: 2.8 dB
  + Option 2: 3.3 dB (Intel)
* Recommended WF
  + TBA

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

* Proposals
  + Option 1: 0.1 dB
  + Option 2: 0.6 dB (Intel)
* Recommended WF
  + TBA

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

* Proposals
  + Option 1: 0.2 dB
  + Option 2: 0.7dB (Intel)
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Based on our understanding, these values are average of impairments results. For UE requirements, 0.5 dB or 0.8 dB(for 256QAM) margin is usually added on top of average results from companies to take into account span in results. Therefore, we prefer to add 0.5 dB to values below and use for requirements definition. |
| QC | Agree with Intel’s comment of adding additional margin, following other demod requirement. |
| Apple | Thanks to Intel for reminding the procedure followed. We support the requirements proposed by Intel. |
| Huawei | Ok with option 2 for all cases. |
| Ericsson | We are OK with option 2 |
| QC | Following moderator suggestion, we checked our simulation results, no obvious issue found but we want to check further. We suggest to keep the exact SNR point TBD, come back next meeting to finalize it. |

### 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. |
| Intel: It is not clear why FRC should be coupled with UE capability. We don’t have such note for 256QAM modulation, |
| R4-2016107 | Moderator: Ericsson CR on requirements |
| Intel: “Maximum number of HARQ transmission = 1” should be specified in each table with test, because it is defined in General section equal to 4.  Configuration of “The number of slots between PDSCH and corresponding HARQ-ACK information” in Table 5.2.2.2.5-2 and Table 5.2.3.2.5-2: Probably it is better to add reference to table with K1 values, for example “Defined in Annex A.1.2 for TDD pattern FR1.30-1”. |
| [Huawei]: SNR value can be updated when it is available.  Reference channel can be updated based on CR R4-2016005 when it is available. |

## 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** |
|  | *Tentative agreements:*  Preliminary requirement values:  15kHz, 2RX: [3.2] dB  15kHz, 4RX: [3.3] dB  30kHz 2RX: [0.6] dB  30kHz, 4RX: [0.7] dB  *Recommendations for 2nd round:*  Agree these values and add to the CRs in square brackets.  Question to Qualcomm: The moderator comment impacts only the 30kHz, 4RX requirement. Would you be OK to agree the values in square brackets and also that they will be revised next meeting if new results change them (i.e. as the square brackets imply) ? |

*Recommendations on WF/LS assignment*

No WF/LS needed for this topic

### CRs/TPs

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

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| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2016004 | *Revise* |
| R4-2016107 | *Revise* |

## Discussion on 2nd round (if applicable)

For the second round, please continue to discuss the revised CRs. Please write comments here. CR authors please update drafts according to the comments.

When making a comment, please add your comment to the “comments” section in a new line.

CR author: When you resolve a comment, please mark the “Resolved” column with “Y”. If needed, add some explanation what you did below the comment. If after the resolution the commenting company is not satisfied with the resolution, please add you reason and remove the “Y” in the resolved column.

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| --- | --- | --- |
| **CR/TP number** | **Comments** | **Resolved ?** |
| Revision of R4-2016004 | Moderator: Intel CR on FRCs |  |
|  |  |
|  |  |
| Revision of R4-2016107 | Moderator: Ericsson CR on requirements |  |
|  |  |
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## 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

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| --- | --- | --- |
| **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, Ericsson, Apple, Intel)
  + Option 2: Do not use early pass/fail criteria
* Recommended WF
  + Agree option 1

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

* Proposals
  + Option 1:Yes (Qualcomm)
  + Option 2: No (Ericsson, Apple, Huawei, Intel)
* Recommended WF
  + Discuss in GTW

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

* Proposals
  + Option 1: 99.999% (Qualcomm)
  + Option 2: 99% (Ericsson)
  + Option 3: 98.6% (Ericsson, Apple, Huawei, Intel)
  + Option 4: 95% (Ericsson, Apple, Huawei, Intel)
  + (Other options not precluded)
* Recommended WF
  + Discuss in GTW

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

* Proposals
  + Option 1: Define a lower bound for median CQI (Qualcomm, Ericsson, Apple, Huawei)
  + Option 2: No lower bound (Intel)
* Recommended WF
  + Discuss in GTW

**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, Ericsson, Apple, Intel)
* Recommended WF
  + Discuss in GTW

**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, Apple, Huawei, Ericsson)
  + Option 2: No LS
* Recommended WF
  + Agree to send LS, drafted by Intel. Send this meeting if other issues agreed otherwise next meeting.

**Issue 2-1-7: Create CQI requirements at 2 SNR points**

* Proposals
  + Option 1: Create CQI requirements at 2 SNR points (Intel, Huawei)
  + Option 2: Create CQI requirements at 1 SNR point
* Recommended WF
  + Discuss in GTW

### 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-RS  periodicity 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-timeConfig  periodicity 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 timeConfig  periodicity 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 possible  Issue 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.Update 2020-11-04:  Issue 2-1-7: Regarding the 2 CQI points; we think that the CL needs to be resolved first to ensure that the test time is reasonable. For 2 CQI points, we should consider 95% CL to be sure test time is not too long.  In our opinion, the test is establishing that the CQI calculation is reasonable, whereas the FMCS test that the link is capable of performing ultra-low BLER with high confidence. That, combined with the fact that in real operation there are several reasons that the network can never be fully confident in the CQI (unpredictable future channel, interference..) justifies adopting a lower confidence level. |
| 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.  **--Update 11/03 8 PM PST---**  Issue 2-1-7: Not sure if 1 SNR point means 1 test with 1 SNR or 2 SNR separated by 1 dB. Our preference is to define 1 test for CQI reporting with 2 SNR points offset by 1dB – each for for 2RX/4RX; TDD/FDD |
| 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.  Updates on 4th:  Issue 2-1-7: Requirements with 2 SNRs are more reasonable. By using early pass/fail methodology, the test time can be reduced.  Issue 2-2-1: We are fine with the parameters in table and will submit simulation results in the next meeting. |
| Intel | **Issue 2-1-1: Use of early pass/fail**  Support Option 1, because it allows to reduce testing time.  **Issue 2-1-2: Include X (0.5dB) in CQI test**  Support Option 2, because in comparison to FMCS test, BLER for Med CQI is unclear and adding of certain SNR shift does not guaranty the reduction of CQI testing time.  **Issue 2-1-3: Confidence level**  Based on our analysis, for confidence level 98.6 % and lower, it can be expected that CQI testing time will be same as FMCS testing time. Therefore, we support Option 3 and 4.  **Issue 2-1-4: Lower bound for median CQI**  Support Option 2. It is not clear that is the benefits to introduce lower bound for median CQI. We don’t have such limitation for Normal CQI tests. CQI test will be defined for two SNR regions and, based on our understanding, it is impossible to pass the test in case the lowest CQI will be always reported.  **Issue 2-1-5: Applicability rule with FMCS test**  Support Option 2. It rather hard to guarantee that FMCS and CQI will be tested under same conditions (SNR, MCS). Therefore, introduction of complicated applicability rule is not required.  **Issue 2-1-6: Send an LS to RAN5**  Support Option 1. Similar to that we did in the previous meeting for FMCS test, we need to inform RAN5 about RAN4 assumptions on CQI testing to reach feasible testing time. |
| QC | **Issue 2-1-1: Use of early pass/fail**  We support option 1  **Issue 2-1-1: Include X (0.5dB) in CQI test**  We support option 1. The option 2 supporting companies all pointing to the uncertainty of test results by adding this 0.5dB. However, as we already demonstrated by our simulation results included in our contribution, at least 1.5dB gap are observed between consecutive CQI (with corresponding MCS) to achieve 1e-5 BLER. As long as channel estimation and CQI reporting function as expected, UE CQI reporting is kept the same with addition of 0.5dB. Given that test results are unaffected, and this can reduce testing time, we support option 1.   |  |  | | --- | --- | | **CQI/MCS** | **SNR in dB at 1e-5 BLER** | | CQI 7 (MCS 12) | -0.5 | | CQI 8 (MCS 14) | 1.0 | | CQI 9 (MCS 16) | 3.5 |   **Issue 2-1-3: Confidence level**  We support option 1. CQI reporting is a crucial function to ensure NW can transmit with correct MCS to achieve high reliability reception. Without verifying that UE reports CQI corresponding to the 1e-5 BLER level, on the field with link adaptation enabled, UE may not be able to achieve performance as verified in FMCS case. Therefore, we believe testing CQI reporting with 99.999% confidence level is important.  For concern of testing time, we propose including 0.5dB, applicability rule and early pass/fail to reduce it. With these proposals as a package, total URLLC testing time can still maintain in a reasonable range.  **Issue 2-1-4: Lower bound for median CQI**  Support option 1.  **Issue 2-1-5: Applicability rule with FMCS test**  We support option 1. It seems like the supporter for option 2 mainly concern the different CL, we suggest to discuss 2-1-3 and 2-1-5 as a package. |

### 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 |
| Intel: We prefer to have separate fields for different features like it was done in Apple’s paper R4-2016376. Such procedure is aligned with principle which was used for Rel-15 requirements. |
| Apple: Same comment as Intel.  [Huawei]: We will update when the CR is revised.  [Huawei]: Wrong cover sheet version used. Should be V12.1. |
| 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.  **--Update 11/03 8 PM PST---**  We prefer to define tests with 1 SNR pair to avoid multiple tests with longer test-time that other CQI reporting tests. |
| Intel: All Normal NR CQI requirements are defined for two tests (two different SNR regions) to ensure proper CQI reporting under different SNR conditions. Therefore, we would like to clarify why it is proposed to define CQI Table 3 requirements only for one SNR region?  [Huawei]: Parameters should be updated based on Issue 2-2-1 when it has an agreement.  Wrong cover sheet version used. Should be V12.1 for all CRs. |

## Summary for 1st round

### Open issues

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

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| --- | --- |
|  | **Status summary** |
| **Sub-topic#1, 2** | *Tentative agreements:*  LS to be sent to RAN5; this meeting if other agreements reached otherwise next meeting  *Agreed during GTW session:*  Use early pass/fail criteria for CQI test  *Recommendations for 2nd round:*  Issue 2-1-2. Include 0.5dB in CQI test & Issue 2-1-3. Confidence level:  To be discussed further in the 2nd round. Guidance from GTW:  Candidate options for further discussion in this meeting:  Op1: 98.6% Confidence level with X = 0 dB  Op2: 99% Confidence level with X = 0 dB  Op3: 99.999% Confidence level with X = [0.5] dB  Op4: NO test cases for CQI table 3 with ultra-BLER  Issue 2-1-4: Lower CQI bound.  To be discussed further in 2nd round. From GTW session: Further discuss the SNR test points to see if any lower bound needs to be defined.  Issue 2-1-5: Applicability rule with FMCS test: Discuss further in 2nd round  Issue 2-1-7: Create CQI requirement at 2 SNR points: Discuss further in 2nd round  Issue 2-2-1: Detailed parameters: Discuss further in 2nd round |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | WF on ultra-low BLER requirements | Moderator |
| #2 | Updated UE simulation summary | Moderator |
| #3 | LS to RAN5 on CQI reporting for URLLC | Intel |

### 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** |
| R4-2015621 | *Revise* |
| R4-2016375 | *Revise* |

## Discussion on 2nd round (if applicable)

Issue 1 Confidence level and X:

* Op1: 98.6% Confidence level with X = 0 dB
* Op2: 99% Confidence level with X = 0 dB
* Op3: 99.999% Confidence level with X = [0.5] dB
* Op4: NO test cases for CQI table 3 with ultra-BLER

Please discuss your preferred option and explain why you prefer the option (and issues with other options):

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |

Issue 2: CQI Lower bound and number of SNR test points

* Option 1: Lower bound, 2 SNR test points
* Option 2: No lower bound, 2 SNR test points
* Option 3: Lower bound, 1 SNR test point
* Option 4: No lower bound, 1 SNR test point

Please discuss your preferred option and explain why you prefer the option (and issues with other options):

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |

Issue 3: Applicability rule for FMCS and CQI

* Option 1: Define applicability rule
* Option 2: No applicability rule

Please discuss your preferred option and explain why you prefer the option (and issues with other options):

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| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |

Issue 4: Detailed parameters

Please discuss your views on the detailed parameters.

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| --- | --- |
| **Company** | **Comment** |
|  |  |
|  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **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-RS  periodicity 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-timeConfig  periodicity 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 timeConfig  periodicity 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 | | | | | | |

CRs discussion:

For the second round, please continue to discuss the revised CRs. Please write comments here. CR authors please update drafts according to the comments.

When making a comment, please add your comment to the “comments” section in a new line.

CR author: When you resolve a comment, please mark the “Resolved” column with “Y”. If needed, add some explanation what you did below the comment. If after the resolution the commenting company is not satisfied with the resolution, please add you reason and remove the “Y” in the resolved column.

|  |  |  |
| --- | --- | --- |
| **CR/TP number** | **Comments** | **Resolved ?** |
| Revision of R4-2015621 | Moderator: Huawei CR on applicability |  |
|  |  |
|  |  |
| Revision of R4-2016375 | Moderator: Apple CR on CQI requriement |  |
|  |  |
|  |  |

## 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 risks   1. 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-ordinates  The 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 (Ericsson, Samsung, Huawei, Nokia, Intel)
  + 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, Ericsson, Samsung, Huawei, Intel)
* 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, Ericsson, Samsung, Huawei, Intel)
* Recommended WF
  + TBA

**Issue 3-1-4: Minimum number of samples**

* Proposals
  + Option 1: Changing the note 4: “An ideal DUT passes after 1074532 samples. The maximum test time is 52171625 samples. A DUT passes, if the maximum number of samples is reached and it did not fail before.” (Nokia, Intel, Huawei)
  + Option 2: Remove the “The maximum test time… and it did not pass” part from note 4 and align the test method (X.1.1) with T 25.141 Annex C.1.2: “Stop the test at a stop criterion which is minimum test time or an early pass or an early fail event.”
  + Option 3: Do not “fix” the situation.
* 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.

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

* Proposals

|  |  |
| --- | --- |
| 15kHz, 5MHz Bandwidth, Type A mapping | -5.0 dB |
| 15kHz, 10MHz Bandwidth, Type A mapping | -5.8 dB |
| 30kHz, 10MHz Bandwidth, Type A mapping | -5.2 dB |
| 30kHz, 40MHz Bandwidth, Type A mapping | -6.1 dB |
| 15kHz, 5MHz Bandwidth, Type B mapping | -5.1 dB |
| 15kHz, 10MHz Bandwidth, Type B mapping | -5.8 dB |
| 30kHz, 10MHz Bandwidth, Type B mapping | -5.3 dB |
| 30kHz, 40MHz Bandwidth, Type B mapping | -6.1 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.Update 2020-11-04:  Issue 3-1-4: This scenario is extremely low probability (That so many errors occur, and the device is marginal enough to land in this range). Of course, having run the test for so long, it is nice to presume pass rather than fail. In reality the device would be very marginal and since the aim of the requirement is to support ultra-reliability, it may not be good practice to assume pass by default rather than fail. Also, since the 1dB is added to the test metric to achieve an early pass, it may be rather dubious whether such a marginal device really meets the core SNR requirement.  That said, this scenario is very improbable and not worth to spend time over, so we do not oppose option 1 if other companies consensus is for that. |
| 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.  Updates on 4th:  Issue 3-1-4: We support Nokia’s proposal. |
| Nokia, Nokia Shanghai Bell | Issue 3-1-1: Per step decision risks  Option 1 seems to be the most secure choice, at almost no practical cost.  Issue 3-1-2: Zero error DUTs  We proposed option 1 and see currently no reason to change.  Issue 3-1-3: Minimum number of samples  We proposed option 1 and see currently no reason to change.  Other: Statistical annex - ultimate test termination  Concerning the shared CRs to introduce the statistical annex [R4-2015098, R4-2015099], we have made a very recent observation regarding the ultimate test termination in “Note 4”.  Maybe it coincides one of Intel’s previous observations.  It is possible to show via example that DUTs cannot pass at all with ne=642, due to the current formulation of note 4. Reminder: “NOTE 4: an ideal DUT passes after 1074532 samples. The maximum test time is 52171624 samples. A DUT fails, if the maximum number of samples is reached and it did not pass.”  Example   |  |  |  | | --- | --- | --- | | 641 | 52098123 | 52078809 | | 642 | 52171624 | 52168811 |  * ns=52098123 when ne=641 occurs, then ne=642 occurs exactly at ns=52168810 => DUT fails due to Note 4 * ns=52098123 when ne=641 occurs, then ne=642 occurs exactly at ns=52172624 => DUT fails due to Note 4 * ns=52098123 when ne=641 occurs, then no more error occurs till ns=52172624 => DUT fails due to Note 4   At least the last scenario should have passed.  First analysis finds the issue here to be caused by our decision to check decision coordinates when an error happens. We included an exception for “perfect DUT”, i.e.., when no error happens at all, but not for the case where the “last possible error” never happens. In practise, a test should never run for this long and a test engineer might not want to pass any device that “rides the limit” this close.  If found to be required, this situation could be remedied by either  a) Changing the note 4: “An ideal DUT passes after 1074532 samples. The maximum test time is 52171625 samples. A DUT passes, if the maximum number of samples is reached and it did not fail before.”  or  b) Remove the “The maximum test time… and it did not pass” part from note 4 and align the test method (X.1.1) with T 25.141 Annex C.1.2: “Stop the test at a stop criterion which is minimum test time or an early pass or an early fail event.”  Alternative (c) would be to not “fix” the situation.  Nokia slightly prefers (a) at this point, but we can agree to any of the options. |
| Intel | **Issue 3-1-1: Per step decision risks (Note: Decision from this meeting can be updated later based on further simulation results)**  At current stage, our analysis shows that in case of d\_early\_fail = 2e-7 and d\_early\_pass = 1e-7 the following CL can be reached: 99.9989% for limited DUT and 99.9995% for marginal DUT. In case, d\_early\_fail = 4e-7 and d\_early\_pass = 1e-7, CL is 99.9981% for limited DUT and 99.9998% for marginal DUT. So, option 1 is preferable for us  **Issue 3-1-2: Zero error DUTs**  Support Option 1  **Issue 3-1-3: Minimum number of samples**  Support Option 1  **Other: Statistical annex - ultimate test termination**  We support option (a) from Nokia’s proposal above. |

### 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 |
| [Huawei] SNR values can be updated when they are available. The CR can be revised. |
|  |
| R4-2015025 | Moderator: Ericsson CR on introduction of requirement for 38.141-2 |
| [Huawei] SNR values can be updated when they are available. The CR can be revised. |
|  |
| R4-2015096 | Moderator: Nokia CR introducing requirement to 38.104 |
| Intel: Based on our calculation, payload for G-FR1-A3A-4 in Table A.3A-1 should be 2976 (not 2960). |
|  |
| 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 |
| [Huawei]: Wrong cover sheet version used. This CR should be revised. |
|  |

## Summary for 1st round

### Open issues

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

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1, 2** | *Tentative agreements:*  *For the test methodology:* d\_early\_fail = 2e-7, d\_early\_pass = 1e-7. This may be revisited later based on further simulation results  *Zero error DUTs:* 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)  *Minimium number of samples:* RAN4 to replace sample counts of <1000 samples, with the next highest non-N/A entry  *Note in decision co-ordinates table:* Changing the note 4: “An ideal DUT passes after 1074532 samples. The maximum test time is 52171625 samples. A DUT passes, if the maximum number of samples is reached and it did not fail before.”  The BS core spec requirement values are agreed as follows (conformance spec requirements are core + TT + 1dB):   |  |  | | --- | --- | | 15kHz, 5MHz Bandwidth, Type A mapping | -5.0 dB | | 15kHz, 10MHz Bandwidth, Type A mapping | -5.8 dB | | 30kHz, 10MHz Bandwidth, Type A mapping | -5.2 dB | | 30kHz, 40MHz Bandwidth, Type A mapping | -6.1 dB | | 15kHz, 5MHz Bandwidth, Type B mapping | -5.1 dB | | 15kHz, 10MHz Bandwidth, Type B mapping | -5.8 dB | | 30kHz, 10MHz Bandwidth, Type B mapping | -5.3 dB | | 30kHz, 40MHz Bandwidth, Type B mapping | -6.1 dB |   *Recommendations for 2nd round:*  No discussion needed; just CR drafting |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | Updated BS simulation summary | Moderator |

### CRs/TPs

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

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2015024 | *Revise* |
| R4-2015025 | *Revise* |
| R4-2015096 | *Revise* |
| R4-2015098 | *Revise* |
| R4-2015099 | *Revise* |
| R4-2015627 | *Revise* |

## Discussion on 2nd round (if applicable)

CRs discussion:

For the second round, please continue to discuss the revised CRs. Please write comments here. CR authors please update drafts according to the comments.

When making a comment, please add your comment to the “comments” section in a new line.

CR author: When you resolve a comment, please mark the “Resolved” column with “Y”. If needed, add some explanation what you did below the comment. If after the resolution the commenting company is not satisfied with the resolution, please add you reason and remove the “Y” in the resolved column.

|  |  |  |
| --- | --- | --- |
| **CR/TP number** | **Comments** | **Resolved ?** |
| Revision of R4-201024 | Moderator: Ericsson CR on Test requirements for 38.141-1 |  |
|  |  |
|  |  |
| Revision of R4-2015025 | Moderator: Ericsson CR on introduction of requirement for 38.141-2 |  |
|  |  |
|  |  |
| Revision of R4-2015096 | Moderator: Nokia CR introducing requirement to 38.104 |  |
| Nokia: Intel previously commented that “Based on our calculation, payload for G-FR1-A3A-4 in Table A.3A-1 should be 2976 (not 2960).” Could Intel re-check their calculation? We think the payload should be 2960 and CB size including CRC should be 2976. Maybe there is a simple row name issue? Nokia’s proposal is currently aligned with G-FR1-A3A-4 in [R4-2015023 > R4-2017518] from [97e][323] NR\_L1enh\_URLLC\_Demod\_Part2, which has no comments in the 323 thread. | Needed? |
|  |  |
| Revision of R4-2015098 | Moderator: Nokia, Intel, Huawei, Ericsson CR introducing statistical annex to 38.141-1 |  |
| Nokia: Modified note 4 according to above agreement. | Y |
|  |  |
| Revision of R4-2015099 | Moderator: Nokia, Intel, Huawei, Ericsson CR introducing statistical annex to 38.141-2 |  |
| Nokia: Modified note 4 according to above agreement. | Y |
|  |  |
| Revision of R4-2015627 | Moderator: Huawei CR on FRCs |  |
| Nokia: The payload size of G-FR1-A3A-4 is currently 2976, while the CB size including CRC is 2960. This seems impossible.  (Nokia has these two values inverted in our CR.) |  |
|  |  |

## 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”* |