3GPP RAN 5G-ACIA Evaluations Week 1

October 12th – 16th 2020

Source: Moderator (Ericsson)

Title: Updated proposals on URLLC features and simulation assumptions

Document for: Discussion, Decision

# 1 Introduction

AT RAN#89, the following was agreed in [RP-202069](https://protect2.fireeye.com/v1/url?k=41a5db26-1f051960-41a59bbd-86fc6812c361-73f443258ff773bf&q=1&e=bc078f84-983d-45f3-ab31-19e60d911036&u=https%3A%2F%2Fwww.3gpp.org%2Fftp%2Ftsg_ran%2FTSG_RAN%2FTSGR_89e%2FDocs%2FRP-202069.zip) on providing evaluations for 5G-ACIA:

* Start an offline email-based activity to provide evaluation results for 5G-ACIA
* One company volunteers as moderator
  + Proposes a work plan to follow
  + Ericsson is willing do this
* Discussions are on the RAN1\_NR reflector
  + Email activity only during short periods (< week) distributed across the time allocated to the activity
  + No email activity in weeks before/during/after RAN1 meetings or RAN defined inactive periods
  + All companies should strive to limit email activity as much as possible
  + Outcome of the offline discussion will directly go to RAN without need for discussion in RAN1 nor need for LS from RAN1 to RAN
* Target completion by RAN#91
* At RAN#91, RAN will decide on a response LS to 5G-ACIA

The moderator made the following proposal on a timeline:

1. 12-16 October 2020
   * Discussion on which URLLC features to include in the evaluations and simulation assumptions
2. 14-18 December 2020
   * First round of simulation results
3. 22-26 February 2021
   * Second round of simulation results
4. 8-12 March 2021
   * Finalization of the report to RAN#91

A summary of the inputs provided by companies with first proposals for agreements was provided with companies adding their proposals[9].

In this contribution updated proposals are made based on companies’ comments to the initial proposals.

# 2 Simulation assumptions

## 2.1 Updated proposal

Based on the first round of discussions, the proposals for each parameter is listed in the table.

|  |  |  |
| --- | --- | --- |
| Parameters | 5G-ACIA LS | **Proposal for agreement** |
| Factory hall size | 120x50 m | As in 5G-ACIA LS |
| Room height | 10 m | As in 5G-ACIA LS |
| Inter-BS/TRP distance | Depending on the number of TRPs, which are evenly deployed in the factory hall. Simulation company should provide the number of BSs/TRPs used in the simulation. | According to proposed layout below |
| BS/TRP antenna height | 1.5 m for InF-SL and InF-DL 8m for InF-SH and InF-DH | As in 5G-ACIA LS |
| Layout – BS/TRP deployment | Depending on the number of TRPs | 12 TRPs within area with the same 2D placement as in TR 38.901 and TR 38.824. |
| Channel model | UC-2: InF-DH > InD-DL > InF-SH > InF-SL | Mandatory: InF-DH  Optional: InD-DL, InF-SH, InF-SL |
| Carrier frequency and simulation bandwidth | TDD 4 GHz: 100 MHz 30 GHz: 160 MHz | As in 5G-ACIA LS |
| TDD DL-UL configuration | Simulation company should report the used DL-UL configuration. | Companies should report the used DL-UL configuration. 1:1 DL-UL configuration is recommended. |
| Number of UEs per service area | Up to 50 per service area, e.g., 10, 20, 40, and 50 | As in 5G-ACIA LS |
| UE distribution | All UEs randomly distributed within the respective service area. | As in 5G-ACIA LS |
| Message size | 48 bytes | 48 bytes |
| DL traffic model | DL traffic arrival with option-1, option-2, and option-3. | 5G-ACIA Option 1 is mandatory |
| UL traffic model | UL traffic is symmetric with DL, and DL-UL traffic arrival time relationship with option-1 and option-2 | As in 5G-ACIA LS with Option 1 as mandatory |
| CSA requirements | UC-#2: 99.9999% | UC-#2: 99.9999% |
| Performance metrics | 1) CSA: single CDF of CSA distribution of all UEs in factory hall 2) Latency: single CDF of latency distribution of all UEs in factory hall 3) Percentage of UEs satisfying requirements  4) resource utilization | As in 5G-ACIA LS with 3) and 4) as low priority  Note: Clarification of metric 2) to be discussed |
| E2E latency & air interface latency | E2E latency: 1 ms for UC#2  Air interface latency: 1ms | As in 5G-ACIA LS |
| UE speed | Linear movement | Linear movement: 75 km/h  No explicit UE mobility (nor handovers) are modeled in the evaluations. |
| BS antenna mount |  | Option 1 (1 sector per BS) from 38.824 is used |
| Handover margin |  | 1 dB |

1. Agree on the proposals for simulation assumptions given in the table
2. Additional simulation parameters are taken from TR 38.824.

Intel raised a need for clarifying performance metric 2). The different alternatives are:

1. a packet transmission can be performed after the latency deadline. The collected statistics can exceed the latency requirement.
2. a packet transmission cannot be performed after the latency deadline. The collected statistics cannot exceed the latency requirement. The packets exceeding the deadline are visible in the UE packet error statistics

Companies are to give input on which alternative is preferred.

## 2.2 Companies comments to proposals

Companies can add comments on the proposals in the table.

|  |  |
| --- | --- |
| Company | View |
| Qualcomm | Regarding Proposal 1, companies should have the flexibility to choose what handover margin to use since this is implementation-dependent. Therefore, we suggest not to fix the value of the margin.  Regarding Proposal 2, we prefer Alternative 2. |
| Intel | Based on further clarifications, we are fine with most of the proposals.  Given that 5G-ACIA highlights that CN latency can be ignored, we can consider E2E latency = air interface latency. However, further agreement is needed here: 5G-ACIA indicates that E2E latency < Transmission Interval. Given that UC#2 uses 1ms TI and TS, then E2E needs to be taken less than 1 ms. We prefer to take either 0.9 ms value, or any other alternative < 1 ms.  We also confirm our own proposal on handover margin to be fixed. It is crucial to have aligned results between companies since it impacts basic geometry SINR distribution.  Between the mentioned latency options, we see reasonable Alt. 2, which however makes the metric #2 (latency CDF) less valuable.  The CDF of latency in this case still needs attention. For each point in the CDF, it could be either each packet latency, or a function of each UE packets latencies (max, avg, mean, X% tail, etc.). Given that it is just the first round of discussion, we suggest companies to comeback to this issue together with the initial results. |
| ZTE | For Proposal 1, we share with Qualcomm that the handover margin could leave to companies’ report based on their implementation.  In addition, we think the following aspects are important to be clarified.  **BLER requirement**  We support the proposed 99.9999%CSA requirement. But it is also important to clarify the packet BLER target used in air interface, which would make a big difference on the evaluation results. As discussed in the second round, there could be multiple options here.   * Option 1: Assume the same value for transfer interval and survival time, and packet errors are uncorrelated. In such case, we agree with Ericsson that 1e-3 BLER can be assumed. * Option 2: Assume the same value for transfer interval and survival time, and packet errors are correlated. In such case, a lower BLER target than 1e-3 BLER should be assumed. * Option 3: Assume zero survival time. In such case, the packet reliability is the same as CSA requirement, i.e., 1e-5 BLER. This is the same as the evaluation conducted in TR 38.824.   Clearly, Option 1 offers a much less stringent requirement than other options.  **DL traffic model**  If the traffic from different UEs is not coordinated, Option 1 should be taken, and the offset should be random to reflect the real traffic arrival. On the other hand, if the traffic arrival among different UEs could be synchronized in one or two groups, Option 3 is the more realistic model. Thus, we are fine to also consider Option 3 here. In such case, gNB can have a better arrangement on the traffic arrival based on TDD configuration and the number of UEs in the service area. Thus, we suggest to consider both Option 1 and Option 3, or leave this to companies report.  Regarding the performance metric, we prefer Alt 2. |
| vivo | Regarding proposal 1, for TDD DL-UL configuration, to make fair comparison across companies, we still think URLLC transmission schemes should be further clarified. According to the conclusions in TR 38.824, only a single-shot transmission can meet 1ms latency requirement for SCS=30KHz considering Rel-15 timing capability, re-transmission cannot be completed within 1ms. While if we adopt Rel-16 shorter periodicity DL SPS, and don’t consider PDCCH/PDSCH alignment delay, re-transmission can be completed within 1ms. Therefore, we would like to make the following modification.  *Companies should report the used DL-UL configuration and URLLC transmission schemes, i.e. HARQ-based retransmission or repetition-based transmission or one-shot transmission. If HARQ-based retransmission is used, what are the gNB’s/UE’s processing time and whether/how the DL/UL alignment delay is taken into account.*  In addition, for handover margin, we can leave it to company report.  Regarding proposal 2, Alt 2 is preferred. |

# 3 Features to include in simulations

## 3.1 Updated proposals

Based on the initial discussion the proposals are updated.

For the Rel-15 baseline, the following is proposed:

1. Rel-15 URLLC features included in the baseline are

* UE Processing capability 2
* UL Configured grant
* DL Semi-persistent scheduling

Regarding Rel-16 features, it is proposed to leave it up to each individual company which features to include in addition to the baseline. This can be revisited after the first round of simulations have been provided in December.

1. It is up to each to decide on which Rel-16 features to provide simulations results for in addition to the Rel-15 baseline. This can be revisited after the first round of simulations have been provided in December.

Again, companies are as always free to submit additional results that they find relevant to the evaluations.

## 3.2 Companies comments to proposals

Companies can add comments on the proposals in the table.

|  |  |
| --- | --- |
| Company | View |
| ZTE | Fine with the proposals. |
| vivo | Fine with the proposals. |

# 4 Conclusions

This document provided a summary of the input on 5G-ACIA simulation assumptions and features. The following proposals are made:

Proposal 1 Agree on the proposals for simulation assumptions given in the table

Proposal 2 Additional simulation parameters are taken from TR 38.824.

Proposal 3 Rel-15 URLLC features included in the baseline are

 UE Processing capability 2

 UL Configured grant

 DL Semi-persistent scheduling

Proposal 4 It is up to each to decide on which Rel-16 features to provide simulations results for in addition to the Rel-15 baseline. This can be revisited after the first round of simulations have been provided in December.

# References

1. [RP‑201279](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_88e/Docs/RP-201279.zip), “LS on 3GPP NR Rel-16 URLLC and IIoT performance evaluation”, 5G-ACIA
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3. “[Simulation Assumptions and URLLC Features for 5G-ACIA Performance Evaluation](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_90e/Inbox/Drafts/5G-ACIA%20October/Company%20Inputs/Ericsson%205G-ACIA%20URLLC%20simulation%20assumptions%20%26%20features.docx)”, Ericsson
4. “[Discussion on URLLC and IIoT features for performance evaluation in response to 5G-ACIA”,](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_90e/Inbox/Drafts/5G-ACIA%20October/Company%20Inputs/HWHiSi%20-%205G%20ACIA%20URLLC%20simulation%20assumptions%20and%20features.docx) Huawei, HiSilicon
5. “[5G-ACIA LS – Phase 1 input](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_90e/Inbox/Drafts/5G-ACIA%20October/Company%20Inputs/INTEL%20-%205G-ACIA%20LS%20-%20Phase%201%20inputs.docx)”, Intel Corporation
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7. “[Features and simulation assumption for 5G ACIA URLLC LS response](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_90e/Inbox/Drafts/5G-ACIA%20October/Company%20Inputs/QUALCOMM-5G-ACIA%20URLLC%20features%20and%20simulation%20assumptions%20.docx)”, Qualcomm CDMA Technologies
8. “[Views on URLLC features and simulation assumptions for 5G-ACIA evaluations](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_90e/Inbox/Drafts/5G-ACIA%20October/Company%20Inputs/ZTE-Views%20on%20URLLC%20features%20and%20simulation%20assumptions%20for%205G-ACIA%20evaluations.docx)”, ZTE
9. “[5G-ACIA URLLC features and simulation assumptions](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_90e/Inbox/Drafts/5G-ACIA%20October/Company%20Inputs/vivo-5G-ACIA%20URLLC%20features%20and%20simulation%20assumptions.docx)”, vivo
10. “[Summary of company inputs on URLLC features and simulation assumptions v6](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_90e/Inbox/Drafts/5G-ACIA%20October/First%20summary%20and%20proposals/Summary%205G-ACIA%20evaluations%20v006_Nokia_Moderator.docx)”, Moderator(Ericsson)