[5G-ACIA] Email discussion

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Source: ZTE

Title: Views on URLLC features and simulation assumptions for 5G-ACIA evaluations

# Discussion

In the RAN#89-e meeting, RAN discussed the LS from 5G-ACIA on Rel-16 URLLC and IIoT performance evaluation [1], and approved a way forward in [2].

In this contribution, we provide our views on URLLC features and simulation assumptions for 5G-ACIA evaluation.

# URLLC features for evaluations

In Table 1, our views on possible Rel-16 URLLC features to be included in the evaluations are provided.

**Table 1 Rel-16 URLLC features for evaluations**

|  |  |
| --- | --- |
| **Rel-16 URLLC features** | **Impact on evaluations** |
| PDCCH enhancement | DCI format 1\_2/0\_2 can be used to achieve lower PDCCH overhead in the evaluations. |
| Multiple HARQ-ACK transmission in one slot | Sub-slot based HARQ-ACK feedback can be considered. This could reduce the latency if re-transmission is considered. |
| PUSCH repetition type B | Multiple PUSCH repetitions could be transmitted in one slot, and one PUSCH transmission can cross the slot boundary. The UL symbols a slot containing both DL and UL could be fully used. |
| Multiple SPS configurations/Shorter SPS periodicities | This could reduce the alignment delay for DL data transmission. |
| Multiple CG configurations | This could reduce the alignment delay for UL data transmission. |

***Proposal 1:*** *Consider Rel-16 URLLC features in Table 1 for 5G ACIA evaluations.*

# Simulation assumptions

During Rel-16 URLLC/IIoT SI phase, the baseline performance achievable with Rel-15 techniques was evaluated by SLS for four use cases, including factory automation, transport industry, electrical power distribution and Rel-15 enabled use case. The evaluation results are captured in TR 38.824. In [1], 5G-ACIA asks 3GPP to consider evaluation for use case examples pertaining to motion control (TS 22.104, clause A.2.2.1 [3]). Specifically, motion control use case #2 is selected. The performance requirements of selected motion control use case are specified in Table 5.2-1 in TS 22.104.

***Proposal 2:*** *Adopt motion control use case #2 in Table 5.2-1 in TS 22.104 for 5G ACIA evaluations.*

In Table 5.2-1, it’s not quite clear on the detailed requirements on user plan latency and packet reliability, which is more relevant to the evaluation in RAN1. The end-to-end latency is 1ms as specified in TS 22.104, and the CN induced latency can be negligible in this WI as noted in the LS. Therefore, 1ms user plan latency could be used for RAN1 evaluation.

As one of the suggested metric is percentage of UEs satisfying requirements, the reliability requirement for successful transmission of a packet needs also to be determined. In our view, 99.9999% packet reliability used in Rel-16 URLLC SI evaluation can be considered.

***Proposal 3:*** *1 ms user plan latency and 99.9999% packet reliability are considered.*

As for other simulation assumptions, our preference is listed in the following Table 2.

**Table 2 Simulation assumptions**

|  |  |
| --- | --- |
| Parameters | Values |
| Factory hall size | 120x50m |
| Room height | 10m |
| Inter-BS/TRP distance | 12 |
| BS/TRP antenna height | 1.5 m for InF-SL and InF-DL, 8m for InF-SH and InF-DH. |
| Layout – BS/TRP deploy-ment | The layout used in Rel-16 URLLC SI is shown as below. The BS/TRP is more uniformly located compared to the one suggested by 5G-ACIA. |
| Channel model | InF-DH |
| Carrier frequency and sim-ulation bandwidth | TDD  4 GHz: 100 MHz  30 GHz: 160 MHz |
| TDD DL-UL configuration | DDDSUDDSUU (S: 10D:2G:2U) for 4GHz and DDSU (S: 11D:3G:0U) for 30GHz |
| Number of UEs per service area | Up to 50 per service area, e.g., 10, 20, 40, and 50 |
| UE distribution | All UEs randomly distributed within the respective service area. |
| Message size | 48 bytes |
| DL traffic model | DL traffic arrival with option-1, i.e., all UEs’ DL messages arriving at NG-RAN node in the first transfer interval are uniformly random distributed within the TI time window. |
| UL traffic model | Same as UL traffic model, while the is traffic arrival is independent with DL. |
| CSA requirements | 99.9999% |
| Performance metrics | 1. CSA: single CDF of CSA distribution of all UEs in factory hall. Zero survival time could be the baseline.   2) Percentage of UEs satisfying requirements  3) Resource utilization |
| UE moving speed model | Linear movement |

***Proposal 4:*** *Consider the simulation assumptions in Table 2 for evaluation of motion control use case #2.*

# Conclusion

***Proposal 1:*** *Consider Rel-16 URLLC features in Table 1 for 5G ACIA evaluations.*

***Proposal 2:*** *Adopt motion control use case #2 in Table 5.2-1 in TS 22.104 for 5G ACIA evaluations.*

***Proposal 3:*** *1 ms user plan latency and 99.9999% packet reliability are considered.*

***Proposal 4:*** *Consider the simulation assumptions in Table 2 for evaluation of motion control use case #2.*

# Reference

1. 3GPP RAN1#102-e, R1-2006953, LS on 3GPP NR Rel-16 URLLC and IIoT performance evaluation, 5G ACIA.
2. 3GPP RAN#89-e, RP-202069, Way forward and RAN work for 5G ACIA requested simulations, Ericsson.
3. 3GPP TS 22.104, Service requirements for cyber-physical control applications in vertical domains.