

Status and scope of the *URLLC* for *LTE* WI

Tdoc: RP-1800498

Source: Ericsson

Agenda Item: 10.2.4

Current situation



- RAN2 has progressed substantially the design of PDCP duplication
- At RAN1#90bis, RAN1 decided on 2 BLER & reliability targets to transmit a layer 2 PDU of 32B

| Latency bound | Error probability | Comment |
|---------------|-------------------|--------------------------|
| 1 ms | 1e-5 | IMT-2020 (ITU 5G target) |
| 10 ms | 1e-4 | |

- At RAN1#92, RAN1 decided on the targeted SINR for all physical channels

| | Q [dB] |
|----------------|--------|
| DL SINR | -2.6 |
| PUSCH | 2.5 |
| Subframe-PUCCH | -4.1 |
| Slot-PUCCH | -2.8 |
| Subslot-PUCCH | -1.7 |

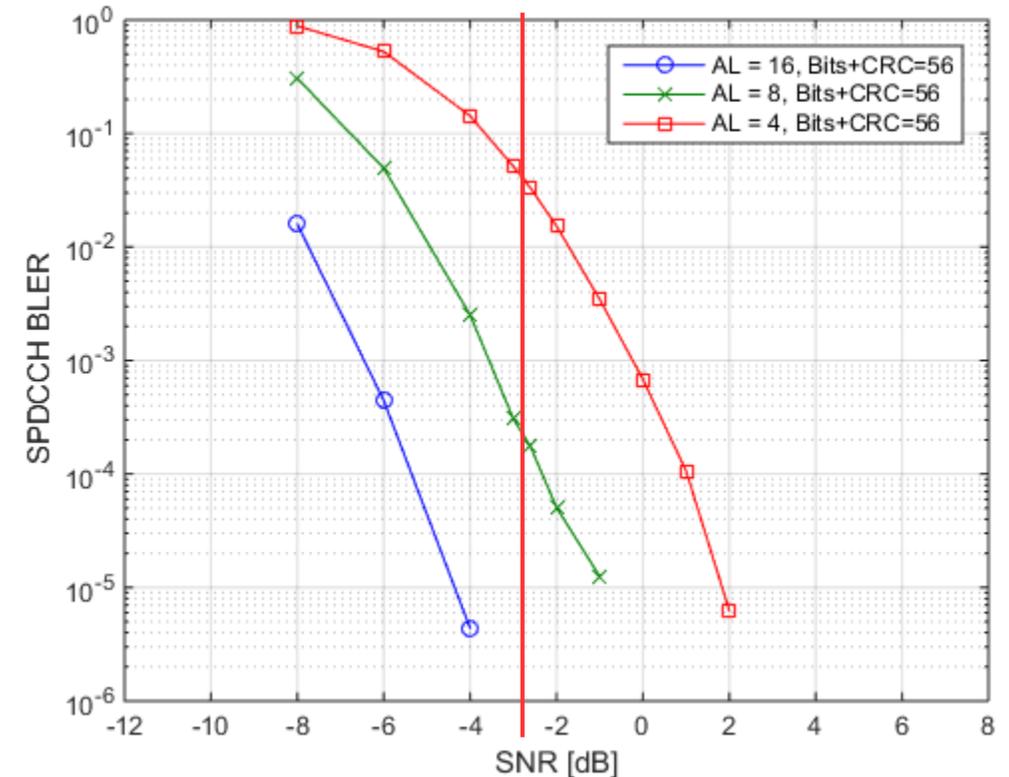
- At RAN1#92 RAN1 agreed on a list of candidate technical solutions for each physical channel

RAN1 has in its work not considered PDCP duplication, this document provide L1 performance doing so and possible WF

SPDCCH performance



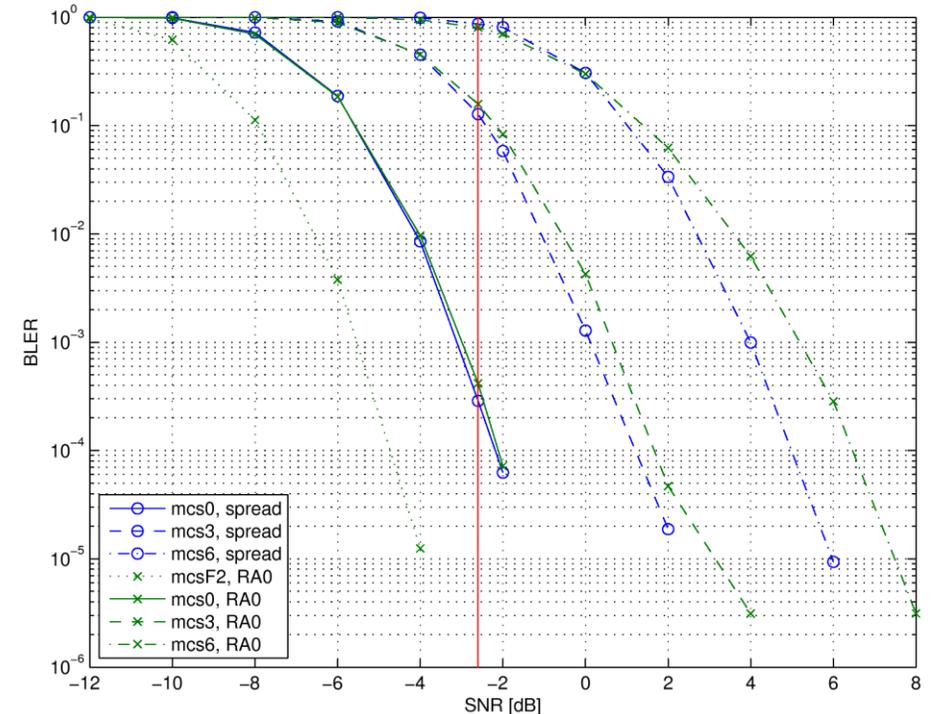
- Error probability of one-shot SPDCCH
 - $P_e = 2 \times 10^{-4}$ with AL8 at targeted SINR of -2.6dB
- With PDCP duplication, effective error probability
 - $P_e^2 = 4 \times 10^{-8}$
- **Observation:**
 - With PDCP duplication, 10^{-5} SPDCCH reliability requirement is met



SPDCCH performance with 56 bit payload in TDL-C 30km/h, for AL 16, 8 and 4

Subslot-PDSCH performance

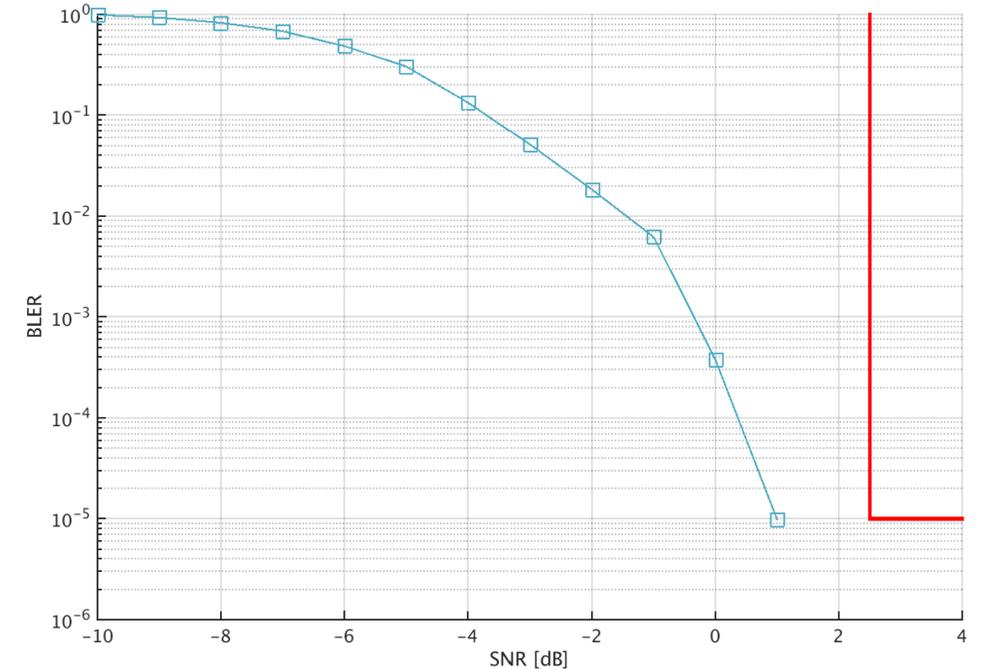
- Error probability of one-shot subslot-PDSCH, MCS-0
 - $P_e = 3 \times 10^{-4}$ with AL8 at targeted SINR of -2.6dB
- With PDCP duplication, effective error probability
 - $P_e^2 = 9 \times 10^{-8}$
- **Observation:**
 - With PDCP duplication, 10^{-5} subslot-PDSCH reliability requirement is met



Subslot PDSCH performance with TDL-C 30km/h, for MCS 0, 3, 6, and one lower MCS (mcsF2). RA0 and spread-out allocation.

Subslot-PUSCH, UL SPS

- A 32 B with subslot transmission using MCS-1 fulfils the target SINR (Q-value) of 2.5 dB even without PDCP duplication
- **Observation:**
 - Subslot-PUSCH can fulfil the target SINR with 10^{-5} with no repetition and without PDCP duplication



Subslot-SPUCCH



- For the 1 ms target requirement from ITU, there is no time for HARQ-based retransmissions and hence no improvements to the uplink control channel is required
- **Observation:**
 - Subslot-SPUCCH is not required for the 1ms ITU target requirement

Conclusion



- The defined reliability and latency targets from ITU (1ms, 10^{-5}) are met using PDCP duplication, subslot transmission and UL SPS.
- To allow DL operation also in single CC operation, improvements to DL operation should be prioritized

Proposal on new scope for LTE HRLLC WI



— Scope of WID (Alt 1)

- PCFICH reliability: Semi-static configuration of PDCCH duration to avoid PCFICH reliability impacting the overall DL reliability (RAN2 led)
- Define repetition for DL for PDSCH/sPDSCH (RAN1 led)
- Defined aggregation level greater than 8 for PDCCH/sPDCCH (RAN1 led)
- PDCP data duplication (RAN2)
- For the solutions above, introduce any necessary UE and base station core requirements (RAN4)

— Scope WID (Alt 2)

- PCFICH reliability: Semi-static configuration of PDCCH duration to avoid PCFICH reliability impacting the overall DL reliability (RAN2 led)
- PDCP data duplication (RAN2)
- For the solutions above, introduce any necessary UE and base station core requirements (RAN4)

