

Agenda item: 6.3
Source: Nokia, Nokia Siemens Networks
Title: Number of HARQ processes for FDD
Document for: Discussion and Decision

1 Introduction

In RAN1#50, the following was decided for the number of HARQ-processes and processing times[1]:

- Set the maximum number of hybrid ARQ processes to 8 for FDD (max Nproc=8)
- A UE processing time of 3 ms minus the propagation roundtrip time ($TRx=3\text{ ms} - 2Tp$)

For the DL, due to the asynchronous HARQ, the two conditions are sufficient to define the timing relationships. The UE processing time sets the time between a PDSCH transmission and the associated transmission of ACK or NACK in the UL. The eNB is free to transmit a possible retransmission at any time after having received the ACK/NACK by using the HARQ-process signalling.

For the UL, synchronous HARQ means that there is a fixed time between retransmissions. Given the agreement of ~3 ms processing time for the UE, the time between the UL grant is sent on the PDCCH and the PUSCH transmission, this means deciding on the processing time for the eNB. In this contribution we discuss the processing times for eNB in order to close the issue.

2 eNB RX HARQ Loop Processing Time

The eNB RX processing time is the time it takes from the end of the sub-frame containing the data to the time when then ACK/NACK must be transmitted in the DL. Since the transmission time is aligned at the eNB, the propagation delay does not affect the eNB processing time.

Data rates in LTE are considerably higher than in WCDMA, E-DCH. Decoding requires most of the RX HARQ loop processing time in eNB and it is dependent of the data throughput. Scheduling is another task consuming RX HARQ loop processing time and its complexity depends on the number of UEs and bearers active, both of which are maximized in LTE.

Based on this, it is Nokia Siemens Networks' view that for a cost efficient implementation 3.0 ms of eNB processing time is needed. Together with the agreement from the Athens meeting, this means 8 ms between retransmissions and 8 HARQ processes for the UL.

3 Conclusion

Our recommendation is that the number of HARQ processes in the UL should be 8 with 8 ms between retransmissions.

References

- [1] R1-073871, *Maximum number of hybrid ARQ processes*, Ericsson, Qualcomm, Nokia, Nokia Siemens Networks, Samsung, Motorola, LG Electronics, Nortel, Philips, NXP Semiconductor

Appendix A: Timing Diagram

Figure 1 shows the uplink transmission timing diagram.

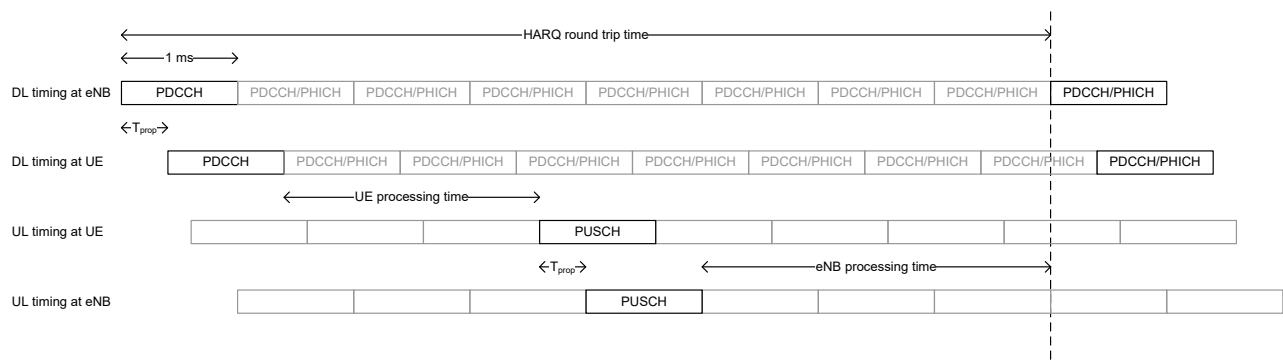


Figure 1 Uplink transmission timing diagram,