

Agenda item: 8.8.2
Source: Nokia, Alcatel-Lucent Shanghai Bell
Title: UCI transmission when UE configured to skip padding BSR
WID/SID: LTE_LATRED_L2-Core - Release 14
Document for: Discussion and Decision

1 Introduction

Whether UCI should be sent on PUCCH or PUSCH when the UE skips padding BSR was discussed in [1] in the previous RAN2 meeting [2]. In this contribution we provide our views on this issue.

2 Discussion

From MAC point of view, when the UE skips padding BSR, it does not generate any TB, it should be considered as no PUSCH transmission. However, from PHY point of view, it was stated in 36.213 that when simultaneous PUSCH and PUCCH is not configured, the UE shall transmit UCI on PUCCH when there is no PUSCH allocation in the subframe, otherwise on PUSCH. Note that it uses “PUSCH allocation” other than “PUSCH transmission” (same meaning before introduction of skipping padding BSR feature).

36.213

7.2 UE procedure for reporting Channel State Information (CSI)

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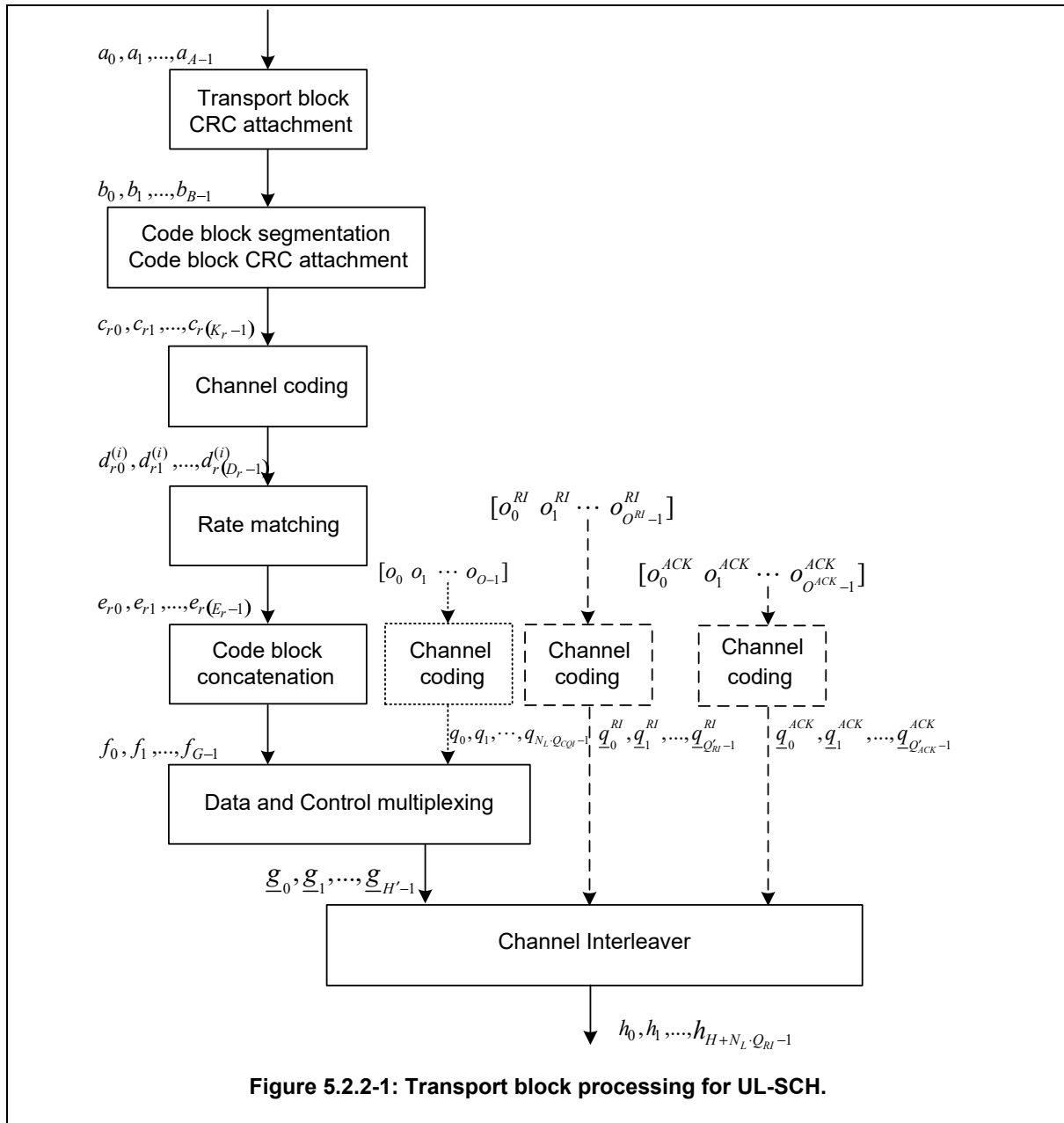
If a UE is not configured for simultaneous PUSCH and PUCCH transmission, it shall transmit periodic CSI reporting on PUCCH as defined hereafter in subframes with no PUSCH allocation.

If a UE is not configured for simultaneous PUSCH and PUCCH transmission, it shall transmit periodic CSI reporting on PUSCH of the serving cell with smallest *ServCellIndex* as defined hereafter in subframes **with a PUSCH allocation**, where the UE shall use the same PUCCH-based periodic CSI reporting format on PUSCH.

If to strictly follow the text in 36.213, UCI should be sent UCI on PUSCH as there is PUSCH allocation even if the UE skips the padding BSR. But that might be problematic as apart from the case of UL grant for CQI only, currently PHY assumes there is a TB to be multiplexed with CQI and interleaved with other UCIs when sending UCI together with data on PUSCH. As the SPS grant is not UL grant for CQI only, it cannot be used for sending UCI only. It follows the rule of multiplexing and interleaving CQI with data, as show in the figure from 36.212 below:

36.212:

5.2.2 Uplink shared channel



It is not clear how the multiplexing can be done when there is no input for TB from MAC. PHY might need to generate some dummy data then mute them. Or alternatively, the UL grant could be used to send UCI only following the description in 5.2.4 of 36.212, it requires double decoding at the eNB side for UCI only or UCI with data on PUSCH, as well as some changes in PHY is expected as CQI only grant has specific format.

Another option is to send UCI on PUCCH when MAC does not generate any TB. It would require double decoding at the eNB though for UCI on PUCCH or UCI with data on PUSCH depending on whether there is UL data to be transmitted. And some modification might be needed to 36.213 so that CQI on PUSCH or PUCCH should not be based on PUSCH allocation to allow it to be sent on PUCCH when MAC does not generate a TB.

Another option is to always require MAC to generate the TB even if only contains padding BSR when there is periodic CQI configured or aperiodic CQI requested (for dynamic scheduling only) in that subframe. With this, then there would be no impact to physical layer thus no need to send LS to RAN1.

Proposal 1: Discuss if we want to limit the impact only to RAN2, and if yes agree that for the SPS occasions configured with periodic CQI or aperiodic CQI requested, MAC should generate the TB even if it contains only padding BSR.

Proposal 2: If it is preferred MAC does not generate the TB when there is UCI but not data, the UCI should be sent on PUCCH. Send LS to RAN1 to request required specification modification.

3 Conclusion

The issue of UCI handling when the UE is configured to skip padding BSR is discussed in this contribution with the following proposal proposed:

Proposal 1: Discuss if we want to limit the impact only to RAN2, and if yes agree that for the SPS occasions configured with periodic CQI or aperiodic CQI requested, MAC should generate the TB even if it contains only padding BSR.

Proposal 2: If it is preferred MAC does not generate the TB when there is UCI but not data, the UCI should be sent on PUCCH. Send LS to RAN1 to request required specification modification.

References

- [1] [R2-162909](#), *Open issues for skipping UL grants*, QUALCOMM CDMA Technologies
- [2] [R2-163056](#), *Report from LTE Break-Out Session*, Vice-Chair (InterDigital)
- [3] [3GPP TS36.212](#), *Multiplexing and channel coding*
- [4] [3GPP TS36.213](#), *Physical layer procedures*