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Agenda item:

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Title: Proposed clarification to TR 25.926

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Introduction

The latest version of TR 25.926 does not fully describe the UE de-interleaver memory requirement. The parameter "Number of physical layer bits per 10 ms" as currently described addresses the demodulator processing requirement and per radio frame de-interleaver memory requirement. However the definition of this parameter fails to explicitly address the per TTI memory requirement.

Description

The physical layer specification, in particular TS 25.212, defines 10, 20, 40 and 80 ms interleaving lengths (or TTI). The TTI has a significant impact on the memory requirement as the UE has to store the soft-symbols for the whole TTI duration before it can process the information. Consequently the de-interleaver memory size is proportional not only to the inverse of the supported spreading factor but also to the maximum supported TTI.

The UE capability document, TR 25.926, defines the parameter "Number of physical layer bits per 10 ms" to describe both the de-interleaver memory size capability and the demodulator processing capability. However, as currently defined, the de-interleaver memory requirement is only based on the minimum supported SF but does not address the supported TTI. Those two aspects are related as the eventual memory requirement is proportional to (1/minSF) * maxTTI(when using minSF).

There are essentially two options to clarify the definition of the above mention UE capability parameter:

- clarify that for all the values, the UE should be able to support all TTIs.
- given the significant impact on UE memory requirement, define a rule which would constrain the UE TTI capability at the edge of its de-interleaver memory capability based on realistic configuration scenario.

The impact of the de-interleaver memory requirement on the terminal design is significant. It is therefore important to consider the benefits and likelihood of some specific configuration against their impact on the terminal design, in particular from the memory requirement point of view.

The different TTI values have been introduced in WCDMA at an early stage. At that point the first phase of WCDMA was not fully defined and many features have been included as a way to minimise the risks of not being in phase with the market. At this point in time, 3GPP members have a much clearer picture on how (i.e. which configurations) WCDMA is going to be used in the field, in particular based on the GSMA-ISG input and the coding and multiplexing examples described in TR 25.944.

Based on those inputs it is very clear that the TTI values of 10 ms (baseline), 20 ms (speech) and 40 ms (signalling) are going to be used in the field and should be supported by all terminals irrespective of other parameters. On the other hand none of the inputs received up to now suggest that 80 ms TTI is going to be used intensively in the field.

The initial claimed benefit of 80 ms TTI was related to the additional time diversity compared to other TTIs. Since then however many other diversity mechanisms have been included in WCDMA mitigating the potential gains which could be obtained by using 80 ms TTI instead of 40 ms TTI (these gains have moreover to be balanced with significant impact on delay). In addition, the initial inputs related to the evolution of WCDMA seems to indicate that the trend is towards the introduction of shorter frames with repetitions (ARQ) as a way to adapt (i.e. optimise) more rapidly to the channel condition and therefore minimise the impact on memory requirement.

Conclusion & Proposal

All in all, the overall benefit provided by 80 ms is not very clear, 80 ms TTI is not used in the typical radio configurations defined by the operators while its impact on memory requirement is very significant. Given these facts, we would like to propose that the UE de-interleaver memory requirement is constrained by the minimum supported SF and 40 ms TTI as described in the appended text proposal. The proposal does not prevent the use of 80 ms TTI as long as the UE does not operate at the edge of its de-interleaver memory capability.

This proposal puts a small additional constraint on the RRC algorithm, but it does not impact any other aspect of the physical channel structure nor does it impact any of the services supported by UTRAN. On the plus side, it allows manufactures to divide the de-interleaver memory requirement by two (the actual reduction factor may vary based on specific implementations, but this is the order of magnitude).

4.5.3 FDD Physical channel parameters in downlink

Maximum number of DPCH/PDSCH codes to be simultaneously received

Defines the number of codes the UE is capable of receiving in parallel. For DPCH in soft/softer handover, each DPCH is only calculated once in this capability. The capability does not include codes used for S-CCPCH.

Maximum number of physical channel bits received in any 10 ms interval (DPCH, PDSCH, S-CCPCH)

Defines the number of physical channel bits the UE is capable of receiving. For DPCH in soft/softer handover, each DPCH is only calculated once in this capability.

The number of DPCH channel bits indicates the capability for normal, un-compressed mode. The UE shall also be able to support compressed mode by SF reduction when operating at this value.

In addition, the maximum number of physical channel bits per 10 ms is based on a 40 ms TTI. Based on this parameter, the UE should support any CCTrCH combination if the normalised value

$$\sum_{CCTrCH} \frac{38400}{SF_i} \times N_i \times 2 \times \frac{TTI_i}{40\ \text{ms}}$$

, where *i* represents the CCTrCh index, and Ni the number of codes (multi-code),

does not exceed the maximum number of physical layer bits per 10 ms.