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Gain Factors for TDD Mode

Introduction

After finalisation of Gain Factors for the FDD Mode (cf. R1-99j91, R1-00-0761), this contribution proposes equivalent application of Gain Factors for the TDD Mode. Resulting from discussions started at WG1 meeting #10, the presented scheme is as similar to FDD as possible.

Outline of TDD solution

In order to align the TDD standards with FDD, it is proposed to introduce a gain factor for uplink transmission in TDD. This gain factor can be used to compensate for the rate matching and the spreading. As with FDD, the gain factors may be signalled from higher layers or calculated from a signalled reference.

Where TDD differs from FDD, however, is the fact that in FDD there is distinction between DPCCH and DPDCH, whereas TDD has only DPDCH. Therefore, where FDD signals 2 gain factors, TDD should only signal one. Another difference is the fact that in TDD uplink different Spreading Factors may be used for different channels. This has to be taken into account additionally.

If not signalled by higher layers, this gain factor may be calculated using the rate matching attributes. Section below shows how to derive these ‘Computed Gain Factors’ in case of TDD Mode.

Computed Gain Factors

The gain factor b_j may also be computed for certain TFCs, based on the signalled settings for a reference TFC:

Let b_{ref} denote the signalled gain factor for the reference TFC. Further, let b_j denote the gain factor used for the j-th TFC.

Define the variable: $K_{ref} = \sum_i RM_i \cdot N_i$

where RM_i is the semi-static rate matching attribute for transport channel i, N_i is the number of bits output from the radio frame segmentation block for transport channel i and the sum is taken over all the transport channels i in the reference TFC.

Similarly, define the variable $K_j = \sum_i RM_i \cdot N_i$

where the sum is taken over all the transport channels i in the j-th TFC.

Moreover, define the variable $L_{ref} = \sum_i SF_i$

where SF_i is the spreading factor of DPCH i and the sum is taken over all DPCH i used in the reference TFC.

Similarly, define the variable $L_j = \sum_i SF_i$

where the sum is taken over all DPCH i used in the j-th TFC.

Then the variable A_j, called the nominal power relation for TFC j, is computed as:

$$A_j = \sqrt{\frac{L_j}{L_{ref}}} \times \sqrt{\frac{K_{ref}}{K_j}}$$

The gain factors b_j for the j-th TFC are then computed as follows:

- If $A_j > 1$, then b_j is the largest quantized b-value, for which the condition $b_j \leq 1 / A_j$ holds.

- If $A_j \leq 1$, then b_j is the smallest quantized b-value, for which the condition $b_j \geq 1 / A_j$ holds.

The quantized β-values are introduced into TS 25.223.

Signalled Gain Factors

When the gain factor b_j is signalled by higher layers for a certain TFC, the signalled values are used directly for weighting DPCH(s).

Conclusion

We propose to adopt the usage of Gain Factors for TDD by approving the corresponding CRs 25.223-007 and 25.224-019.