TSG-RAN Working Group1 meeting #20 R1(01)0520

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Agenda Item : **5**

Source : **Nortel Networks**

Title : **Discussion on rate matching for DSCH**

Document for : **Discussion and approval**

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1. Introduction

This paper discusses the rate matching on DSCH. In the 25.212 specification for Release 99 and Release 4, there is no difference between the rate matching for DCH and for DSCH. Our understanding is that there are some cases where it is not possible to apply the rate matching algorithm as it is defined, to the DSCH.

This paper details the issue, and proposes several solutions with their respective impact on L1 and L2/3 specifications. It recommends one solution, and CRs along the lines of the proposed solution are attached for Release 99 and for Release 4.

The objective is to discuss the possible solutions and come to an agreement among RAN WG1 delegates. Some discussions will also need to be initiated with RANWG2 in case there is an impact on the model or on the signalling.

2. Detail of the issue of rate matching for the DSCH

2.1.1. Characteristics of the current rate matching algorithm in downlink

Let us note Ndata the number of bits available on the physical resource for the CCTrCh. According to the TS 25.212, section 4.2.7.2, Ndata is given by the channelisation codes assigned by higher layers.

The downlink rate matching algorithm is based on the number of bits available for the CCTrCh, Ndata. Also, in downlink, the rate matching algorithm is done on a TTI per TTI basis and coordinated between the Transport Channels multiplexed in the CCTrCh. Therefore, all Transport Formats and all Transport Format Combinations of the Transport Format Combinations Set are taken into account in the rate matching calculations.

2.1.2. Case of CCTrCh other than DSCH

In the case of downlink CCTrCh other than DSCH, the Spreading Factor and the channelisation codes allocated to a CCTrCh do not vary dynamically. They can vary only upon reconfiguration by higher layers. In a given configuration, the Transport Formats Sets and Transport Format Combinations of a CCTrCh apply to the same physical resource.

2.1.3. Case of DSCH CCTrCh

In the case of DSCH, different sets of channelisation codes may be configured by higher layers for different Transport Format Combinations. Therefore a DSCH CCTrCH configuration may correspond to multiple Ndata values, each of which corresponding to a sub-set of the configured TFC (see companion document R1-01-xxxx). It should be noted that the signalling allows that one TFC may correspond to multiple Ndata values.

Our understanding of the specification is that the rate matching algorithm is already evaluated for each configured Ndata as indicated in the following sentence in section 4.2.7.2: "$N_{data,*}$ is given by the channelization code(s) assigned by higher layers". However this should probably be clarified if solution 2 is the retained solution.

However, for each Ndata, the whole TFCS of the CCTrCh is considered, even the TFCs not corresponding to the said Ndata. This leads to inconsistent values for the amount of rate matching. For instance, considering a TFC corresponding to a larger Ndata than the current one would lead to an inappropriate too big amount of puncturing. Therefore there is a need for modification of today's specifications.

3. Possible solutions

3.1.1. Solution 1

One solution would be to define, for each possible Ndata value for the CCTrCh, one Transport Format Set per Transport Channel, and one Transport Format Combinations Set. However, this changes both the L2/3 model and the signalling of the TFCS and channelisation codes for the DSCH. The impact is therefore very high.

3.1.2. Solution 2

Another solution is to modify the rate matching algorithm in case of DSCH, in the following way. Before performing the rate matching algorithm, the TFS and TFCS should be sorted in groups, each group applying to one Ndata. Then the rate matching algorithm should be performed for each Ndata, using the TFs and TFCs of the corresponding group.

This increases the complexity of the first step of the rate matching algorithm, but this enables not to modify the model and the signalling.

This also leads to more variables representing the rate matching amount, since there are cases where one Transport Format could apply to more than one Ndata. One possibility to reduce the number of these variables would be to restrict one Transport Format to be used with one Ndata only.

3.1.3. Recommendation

The recommended solution is solution 2, in order not to modify the DSCH model and signalling at this late point.

4. Conclusion

This document showed that the rate matching algorithm specified can not be applied as it is to the DSCH. The reason is that the TFCS of the DSCH CCTrCh covers altogether all the possibilities for the number of bits available for the DSCH CCTrCh. A solution modifying only the rate matching algorithm has been proposed.

We recommend that this solution be adopted to correct the rate matching algorithm in case of DSCH. Corresponding CRs on TS 25.212 for R99 and R4 are provided.

5. References

[1] 3GPP TS25.212 v3.5.0, Multiplexing and channel coding (FDD)

[2] 3GPP TS25.331 v3.6.0, RRC protocol specification