0 TSG-RAN Working Group 1 meeting #3 ***TSGR1#3(99)206***

1 Nynäshamn, Sweden

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Title: Flexible starting points of transport channels within a radio frame

Agenda Item:

Document for: Decision

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1 Introduction

From a system point view, it can be desirable to only use some transport format combinations. An example would be a radio link that carries both a variable rate speech and a variable rate packet service. By prohibiting simultaneous use of max bit rate on both the packet channel and speech channel, code resource can be saved.

This option exist in Editor, "3GPP RAN S2.02 v0.0.1, Services Provided by the Physical Layer". and has been identified in Ad Hoc 4 (Chair, WG1 Ad Hoc 4 study items, distributed via email March 4, 1999. item 5).

2 Implementation of restrictions on transport format combinations

The downlink-transport channel multiplexing scheme has been designed so that it enables simple blind rate detection (BRD). This means that the starting point of different transport channels (TrCHs) does not change from one radio frame to another. In order to preserve the positions of the TrCHs, discontinuous transmission (DTX) is used.

However, if the transport format combination with highest rate is prohibited, it is no longer possible to keep the positions of all TrCHs within the radio frame. The downlink transport channel multiplexing scheme should therefore enable both fix and flexible starting points of the TrCHs. This was one of the conclusions of Ad Hoc 4 Chair, 1st WG1 Ad Hoc 4 report distributed via email February 20, 1999., but the exact details have not been specified yet.

The benefit with BRD is that no TFCI need to be transmitted. The largest gain is obtained for low rate TrCHs since for high rates, the TFCI bits become negligible compared to the number of data bits. Hence, for most packet channels, TFCI is likely to be used. The benefits with not allowing some transport format combinations is expected to be largest with packet channels and consequently it is believed that it is sufficient to enable flexible starting points when TFCI is used. Further, when TFCI is used there is no need to use fix starting points of the TrCHs, and this does therefore not have to be mandatory for the basestation (since BRD only is mandatory in the UE).

The current downlink transport channel multiplexing scheme is shown in Figure 1 Chair, 1st WG1 Ad Hoc 4 report distributed via email February 20, 1999..

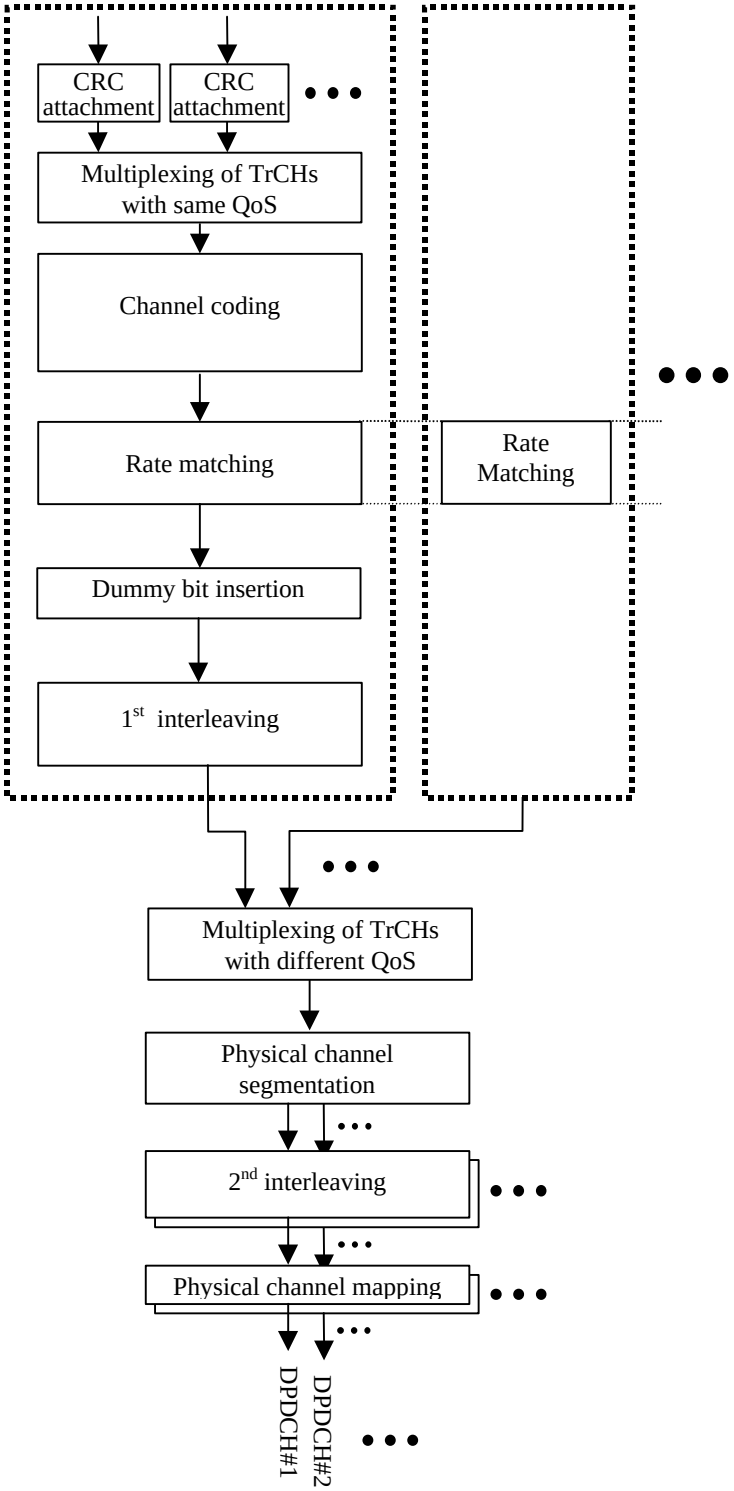


Figure 1: Transport channel multiplexing in downlink.

In Figure 1, the dummy bit insertion means that it is kept in mind (through the rest of the multiplexing scheme) what bit positions that discontinuous transmission should be applied on. This is needed for the case with fix starting points of the TrCHs. When TFCI is used there are two options:

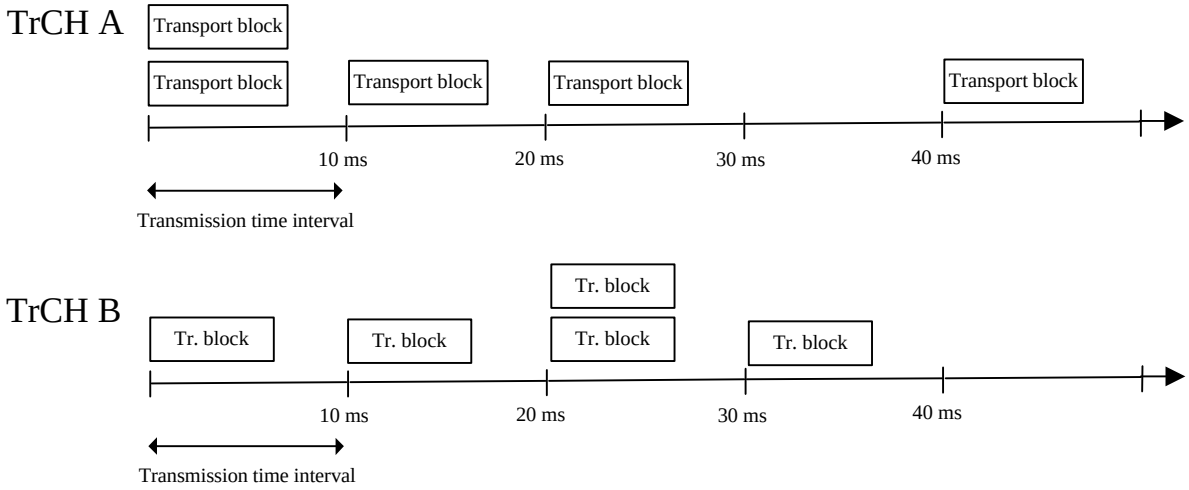
- 1) The number of inserted dummy bits is controlled so that the sum of the rates of the different TrCHs matches some physical channel rate. Note that for the case with restrictions on the transport format combinations, it means that the

whole interleaving matrix will not necessarily be filled with data and dummy bits (which is the case when fix starting points is used).

- 2) No dummy bits are inserted at this stage but instead added after multiplexing. The exact position of the DTX insertion should for this alternative be determined after decision on interleaving scheme. If FS-MIL is used, the dummy (DTX) bits should be inserted before the 2nd interleaving. FS-MIL always has 16 columns and hence the DTX will be divided equally between the different slots. If an optimized 1st interleaver is used, the 2nd interleaver will most likely be very simple and not necessarily have 16 columns. Consequently, for this case the dummy bits would be inserted when physical channel mapping is done, i.e. when the data is mapped to the slot structure.

In Figure 2, the case with fix positions and the two alternatives with flexible positions are illustrated. The highest rate is forbidden in the example, and consequently two transport blocks are never delivered to layer 1 simultaneously on the two TrCHs. Note that the position of the DTX in alternative 1 is only an example. Further, in the figure it is assumed that FS-MIL has been used for channel interleaving. If instead the 1st interleaver had been optimized, the DTX would be distributed over each TrCH in alternative 1 and in the fix position case. The alternatives would however be the same and a choice of flexible starting point scheme has to be made regardless of interleaving.

There are two benefits with the second alternative. No algorithm for the DTX division between different TrCHs needs to be designed (and standardized). Secondly, by inserting the DTX after multiplexing, it is possible to design an interleaving scheme that does not interleave the DTX bits. If the DTX bits are interleaved there is a risk that the DTX bits will not be inserted in pairs and consequently there is a risk that half QPSK symbols need to be transmitted. This might not be a serious problem but since there are no disadvantages with using alternative 2, it is proposed that alternative 2 is adopted as working assumption.



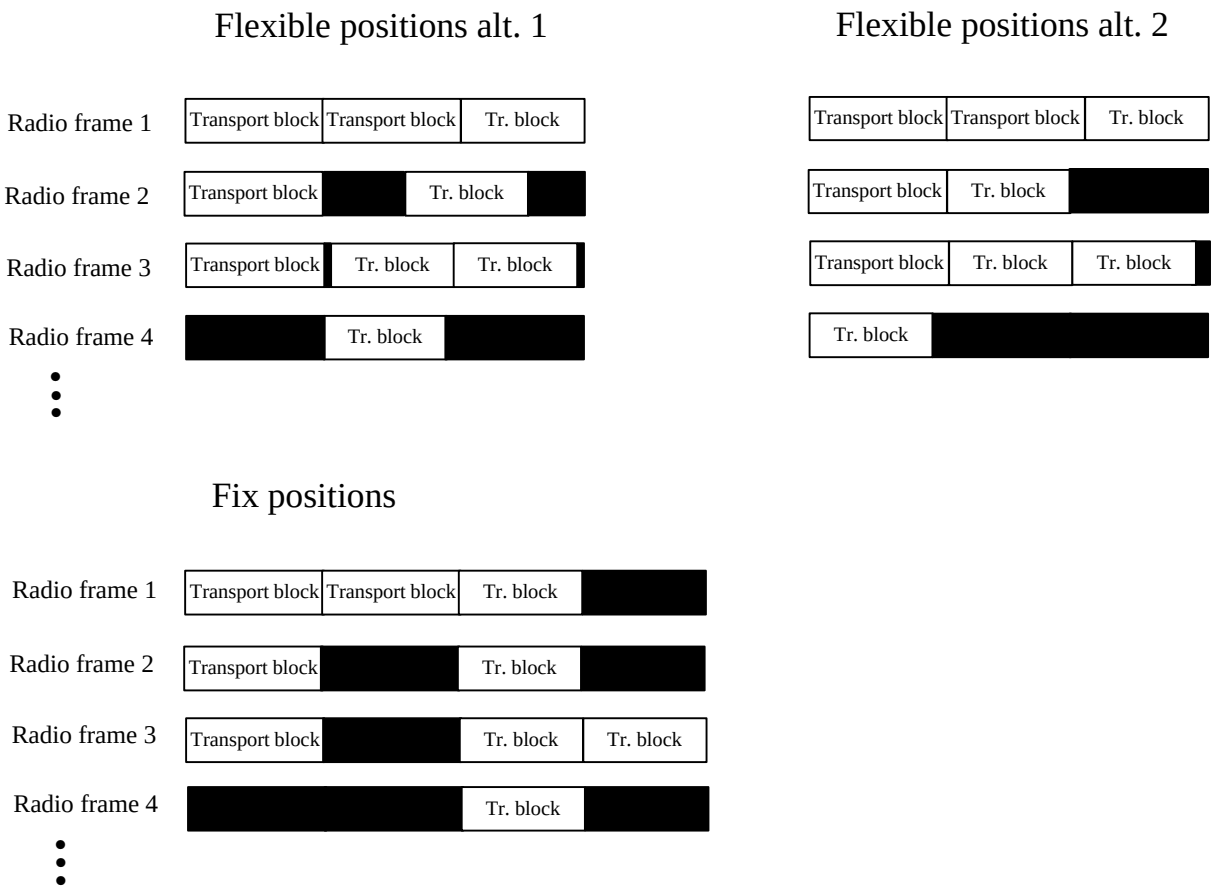


Figure 2: Position of DTX for fix and flexible positions of TrCHs. The figure illustrates the position of DTX after multiplexing but before 2nd interleaving.

3 Conclusion

It has been identified in Ad Hoc 4 that it should be possible to prohibit certain transport format combinations on higher layers. This requires that layer 1 enables flexible starting points of transport channels within a radio frame. It is proposed that the DTX should be placed in the end of each slot.

It is also proposed that fix starting points of the transport channels should not be mandatory in the basestation since it is only needed for blind rate detection, which is not mandatory in the basestation.

4 References

[1] Editor, “3GPP RAN S2.02 v0.0.1, Services Provided by the Physical Layer”.

[2] Chair, WG1 Ad Hoc 4 study items, distributed via email March 4, 1999.

[3] Chair, 1st WG1 Ad Hoc 4 report distributed via email February 20, 1999.