TSG-RAN Working Group1 meeting #7 *TSGR1#7(99)a83*
***Hanover,* August 30th – September 3rd 1999**

Agenda Item :

Source : Nokia

Title : CCTrCH definition and multiplexing

Document for : Approval

1 Introduction

A definition for a Coded Composite Transport Channel (CCTrCH) is proposed to be added to TS 25.212. Also transport channel coding and multiplexing figures for common channels both for downlink and uplink are proposed to be added to TS 25.212. In following chapters more details and assumptions for multiplexing of common channels are presented. Several liaison needs to WG2 are also identified.

For RACH coding and multiplexing removal of 1st interleaving is proposed because the assumtion is that interleaving size will be fixed (10 ms), so only the 2nd interleaving is needed. A liaison about fixed interleaving length should be sent to WG2. Also a liaison statement to WG2 needs to be sent to inform that RACH rate matching values need to be specified for each possible SF.

It is FFS if in some RACH packet state transmission several TrCHs are allowed. Since in that case the assumtion is that transport formats can be signalled and agreed beforehand (by FACH). If this is possible then we should have 2nd multiplexing block in the figure 4-2.

For CPCH the assumption is that CPCH coding and multiplexing can have the same format as DCH coding and multiplexing. However, it is still FFS in WG2 whether there is a need to multiplex several CPCH transport channels (TS25.302 v3.0.0).

For DSCH associated with DCH it is proposed that the rate matching should be like in uplink: always filling up the frame since SF may change from frame to frame. If SF is changing from frame to frame then RM factor per TrCH can not be fixed for the whole connection, like usually in downlink. A liaison statement to WG2 needs to be sent to inform that several transport channels should be allowed, so that several packet bearers can be muxed together.

For BCH coding and multiplexing removal of 1st interleaving is proposed. The assumtion is that interleaving length is fixed, 10 ms, so only the 2nd interleaving is needed. A liaison about fixed interleaving length should be sent to WG2. The rate matching needs to be a fixed value. This value should be specified by WG2 (again a liaison needed).

For PCH and FACH coding and multiplexing following cases are identified: TrCHs can all be PCHs in one CCTrCH, TrCHs can all be FACHs in one CCTrCH and TrCHs can all be PCHs and FACHs in one CCTrCH. In case that TrCHs are reserved for PCH the 1st interleaving length is fixed to be 10 ms. This needs again a liaison to WG2.

Following reasons for the need of 2nd multiplexing are identified (N and M are number of TrCH's):

- we need 2nd multiplexing for N* PCH case, since then it is easier for the receiver to decode one PCH message from there.
- we need 2nd multiplexing for N*FACH case, since there might be several, different length transport blocks per frame
- we need 2nd multiplexing for N*PCH + M*FACH case, since they have also different length transport blocks per frame.

A liaison statement to WG2 needs to be sent to inform that this is the WG1 assumption of multiplexing PCH and FACH transport channels.

2 Text proposal for TS 25.212

4 Multiplexing, channel coding and interleaving

4.1 General

Data stream from/to MAC and higher layers (Transport block / Transport block set) is encoded/decoded to offer transport services over the radio transmission link. Channel coding scheme is a combination of error detection, error correcting, rate matching, interleaving and transport channels mapping onto/splitting from physical channels.

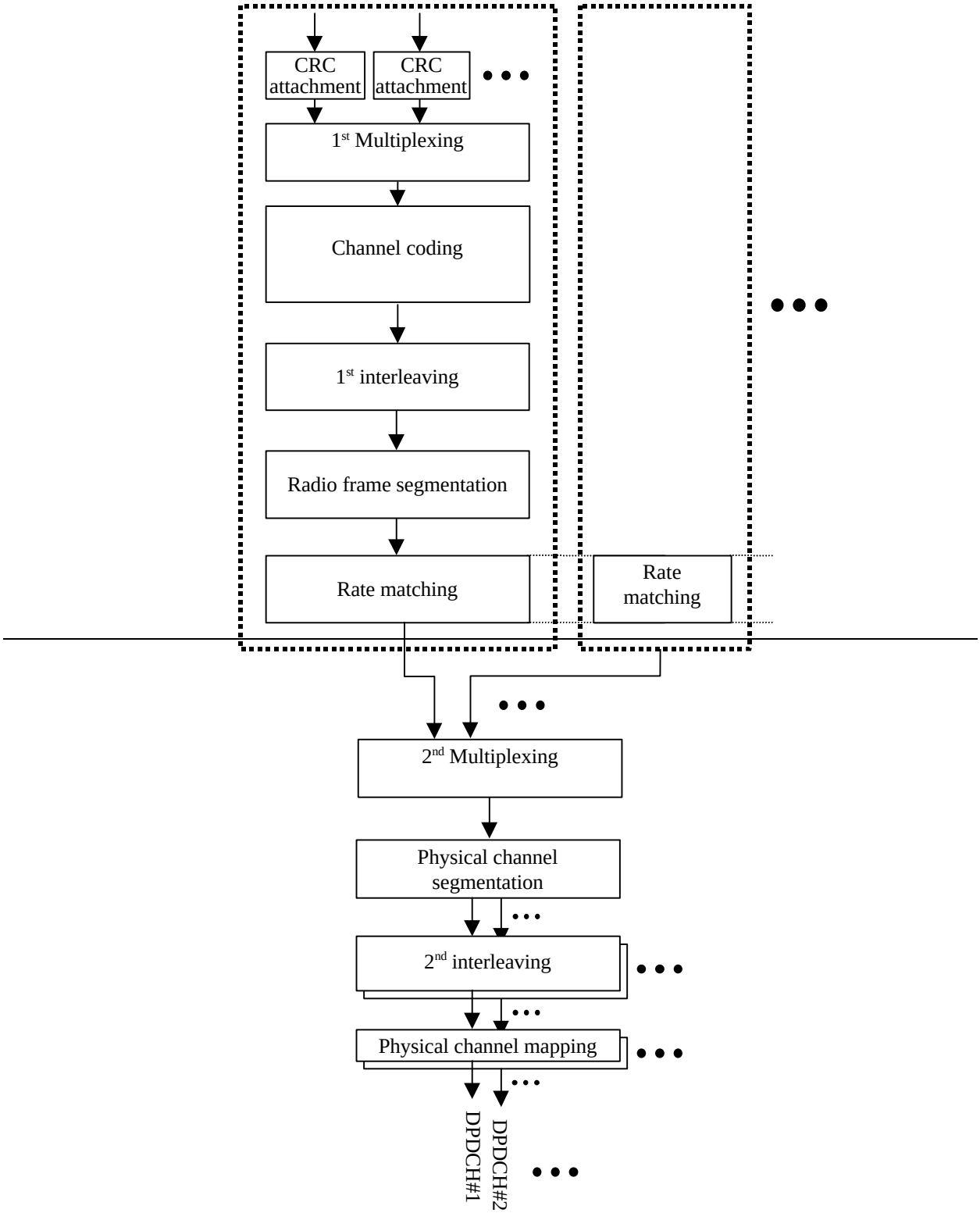
4.2 Transport-channel coding/multiplexing

Data arrives to the coding/multiplexing unit in form of transport block sets once every transmission time interval. The transmission time interval is transport-channel specific from the set {10 ms, 20 ms, 40 ms, 80 ms}.

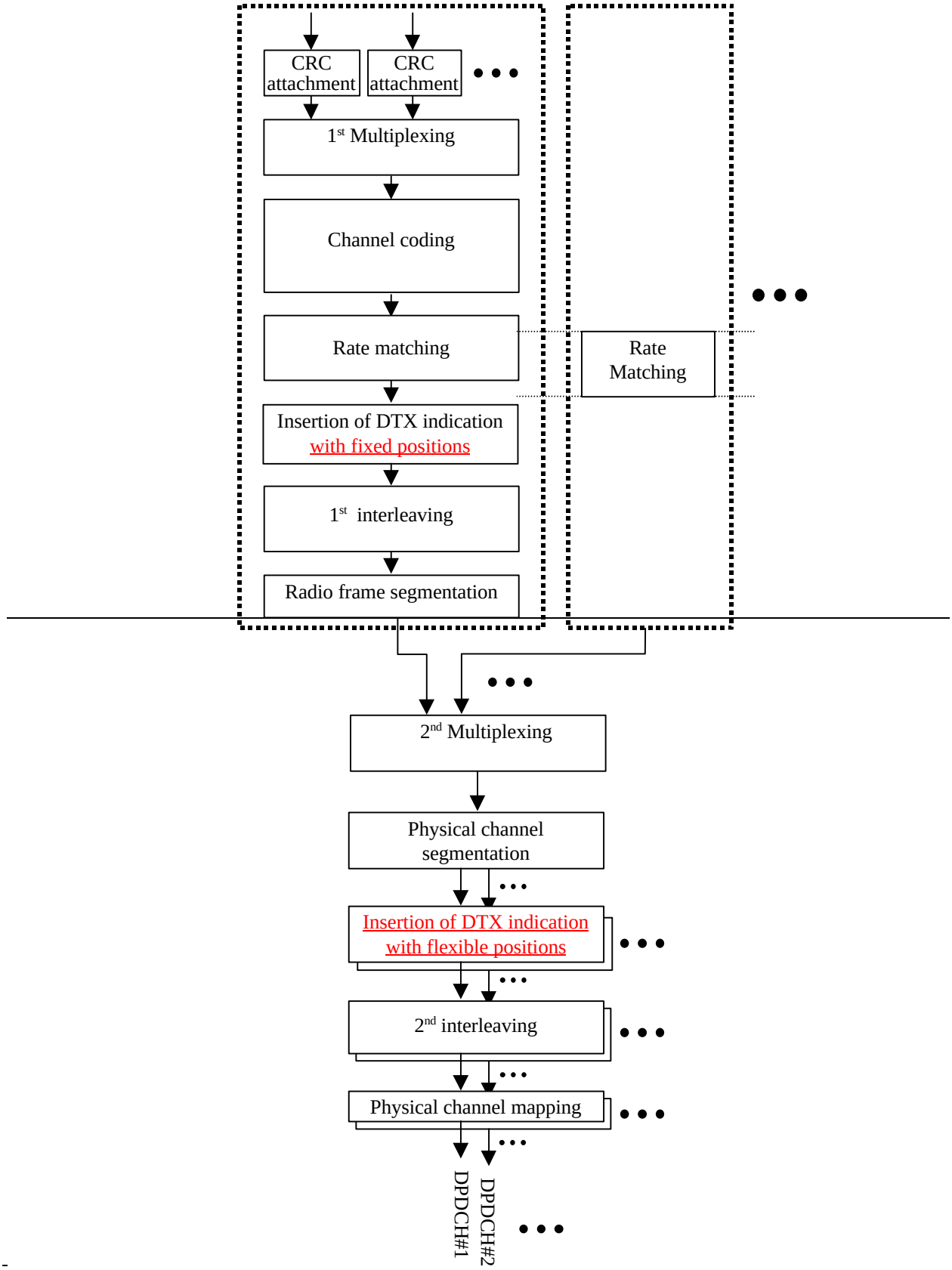
The following coding/multiplexing steps can be identified:

- Add CRC to each transport block (see Section 4.2.1)
- Channel coding (see Section 4.2.3)
- Rate matching (see Section 4.2.6)
- Insertion of discontinuous transmission (DTX) indication bits (see Section 4.2.7)
- Interleaving (two steps, see Section 4.2.4 and 4.2.10)
- Radio frame segmentation (see Section 4.2.5)
- Multiplexing of transport channels (two steps, see Section 4.2.2 and 4.2.8)
- Physical channel segmentation (see Section 4.2.9)
- Mapping to physical channels (see Section 4.2.11)

~~The coding/multiplexing steps for uplink and downlink are shown in Figure 1 and Figure 2 respectively.~~



~~Figure 1: Transport channel multiplexing structure for uplink~~



~~Figure 2: Transport channel multiplexing structure for downlink~~

The single output data stream from the "2nd multiplexing " unit (see sections 4.2.1.1 and 4.2.2.1) is denoted as *Coded Composite Transport Channel (CCTrCH)*. A CCTrCH can be mapped to one or several physical channels. Two different CCTrCHs cannot be mapped to the same physical channel.

The coding/multiplexing steps for uplink and for downlink are specified in section 4.2.1 and 4.2.2 respectively.

4.2.1 Transport channel coding and multiplexing for the uplink

4.2.1.1 Coding and multiplexing for the uplink Dedicated channels (DCHs)

Figure 4-1 illustrates the coding, multiplexing and mapping of different DCH transport channels of the dedicated type CCTrCH. The figure illustrates a particular example where the CCTrCH is mapped onto two DPDCH physical channels.

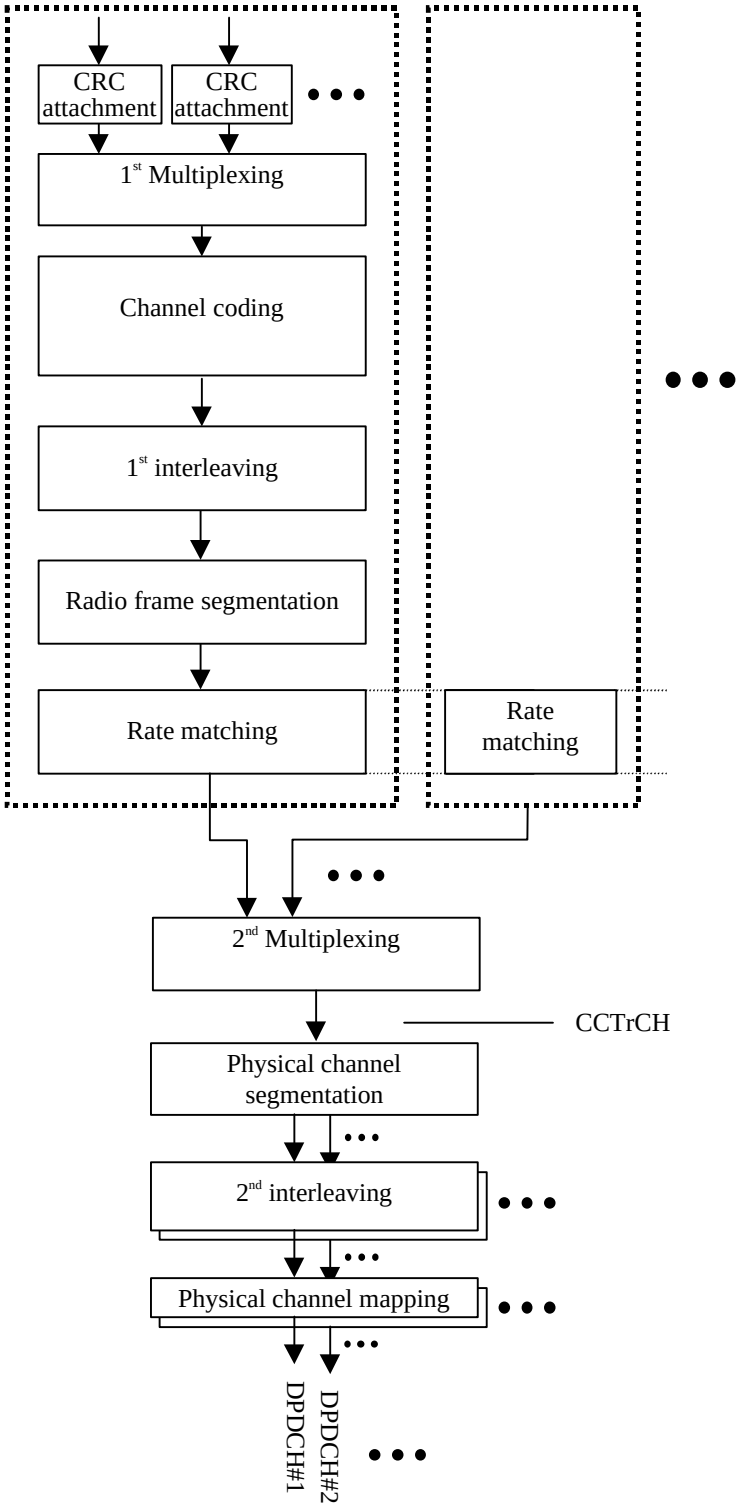


Figure 4-1. Transport channel multiplexing structure for uplink DCH's

4.2.1.2 Coding and multiplexing for the uplink Common channels

4.2.1.2.1 Coding and multiplexing for the RACH

Figure 4-2 illustrates the coding and multiplexing of RACH transport channels (common type CCTrCH) and mapping onto the PRACH physical channel.

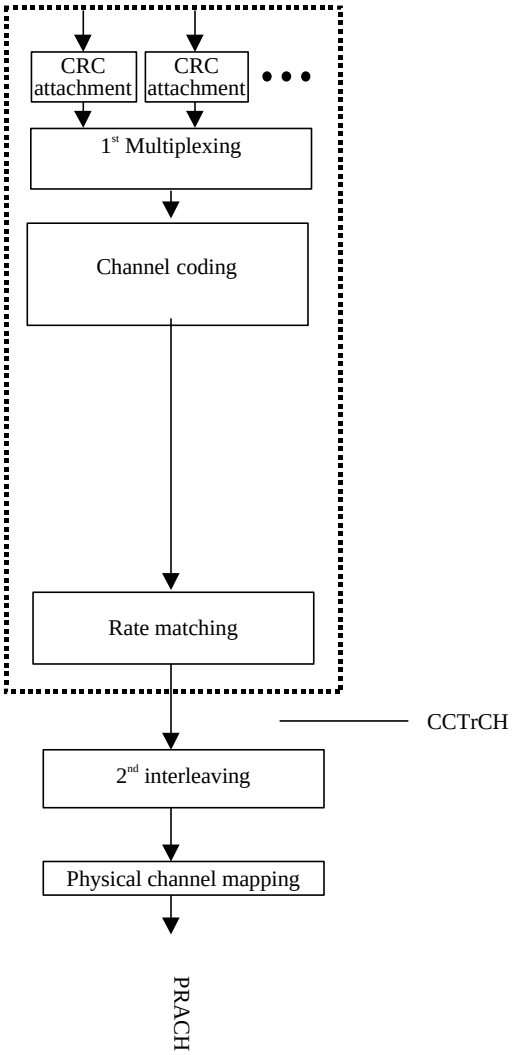


Figure 4-2. Transport channel multiplexing structure for RACH

In initial RACH transmission the rate matching needs to be a fixed value.
<Editor's note: this value should be specified in WG2.>

Rate matching values for each SF is FFS.
<Editor's note: a liaison is needed to WG2.>

4.2.1.2.2 Coding and multiplexing for the CPCH

Figure 4-3 illustrates the coding and multiplexing of CPCH transport channels (common type CCTrCH) and mapping onto the PCPCH physical channels. Only the data part of CPCH can be mapped onto multiple physical channels.

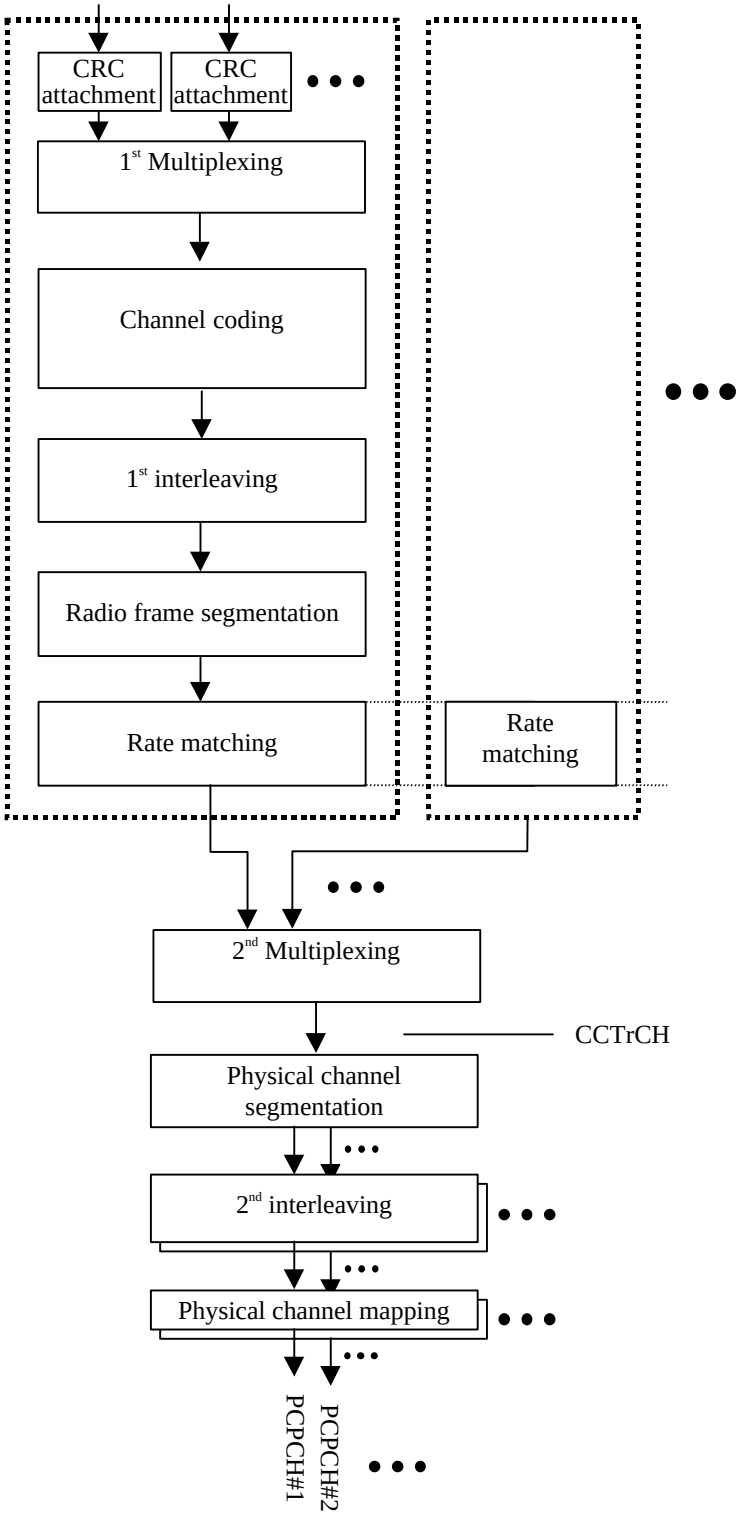


Figure 4-3. Transport channel coding and multiplexing structure for CPCH

4.2.2 Transport channel coding and multiplexing on the downlink

4.2.2.1 Coding and multiplexing for the downlink Dedicated channels (DCHs)

Figure 4-4 illustrates the coding, multiplexing and mapping of different DCH transport channels part of the same CCTrCH of dedicated type. The figure illustrates the case where the CCTrCH is mapped onto two DPDCHs.

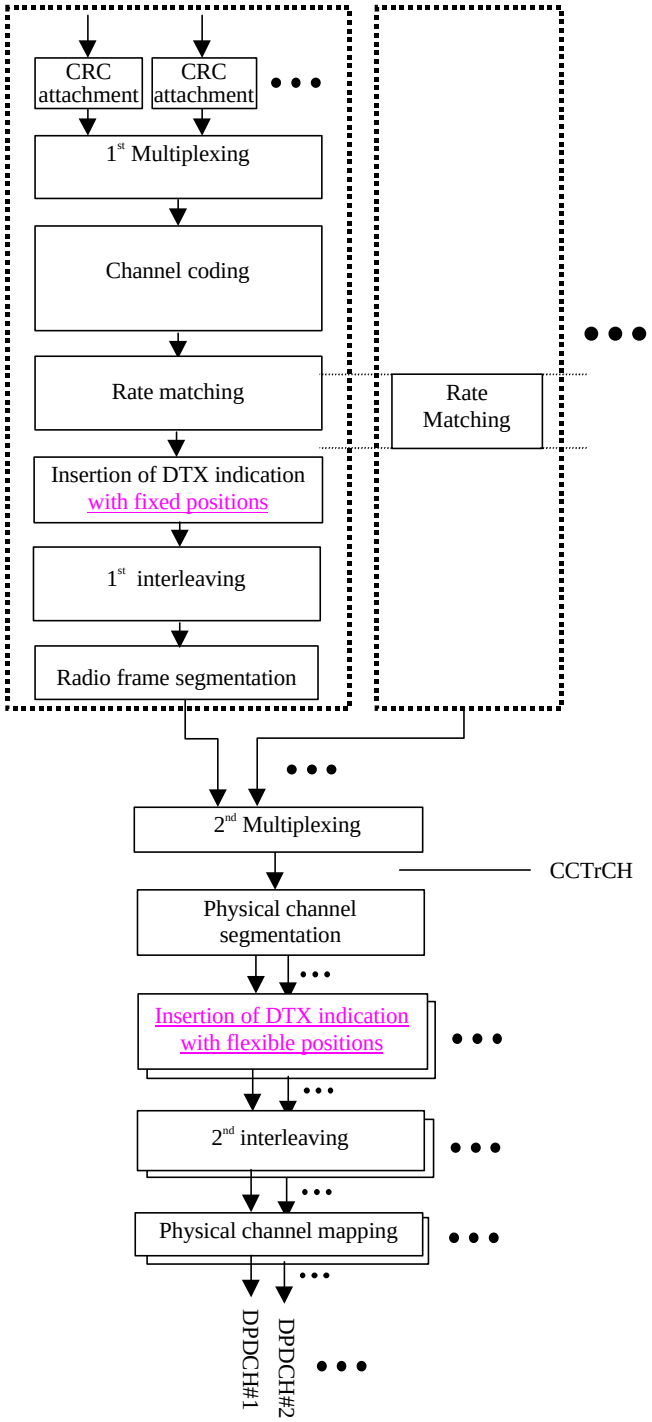


Figure 4-4. Transport channel multiplexing structure for downlink DCH's.

4.2.2.2 Coding and multiplexing for the DSCH associated with DCH

Figure 4-5 illustrates the coding, multiplexing and mapping of different DCH transport channels when the DSCH is associated with DCH. CCTrCH1 is dedicated type and CCTrCH2 is common type.

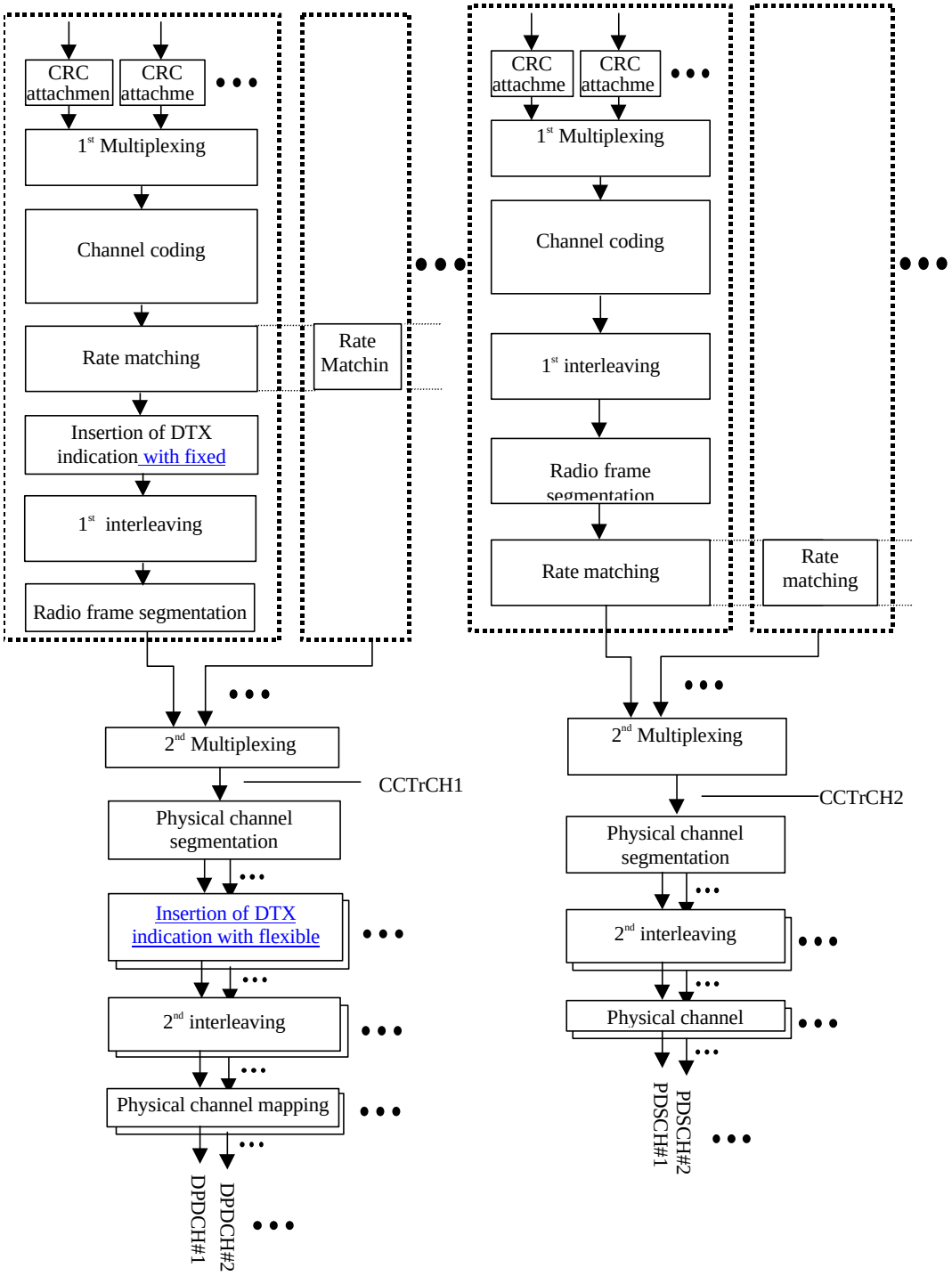


Figure 4-5. Transport channel multiplexing structure for DSCH associated with DCH.

<Editor's note: liaison statement to WG2 needs to be sent to inform that several transport channels should be allowed , so that several packet bearers can be muxed together.>

4.2.2.3 Coding and multiplexing for the downlink common transport channels and broadcast channels

4.2.2.2.1 Coding and multiplexing for the BCH

Figure 4-6 illustrates the coding and multiplexing of BCH transport channel (common type CCTrCH) and mapping onto the PCCPCH physical channel. Because the PCCPCH is a fixed rate channel the rate matching, if applied, must be also at fixed rate.

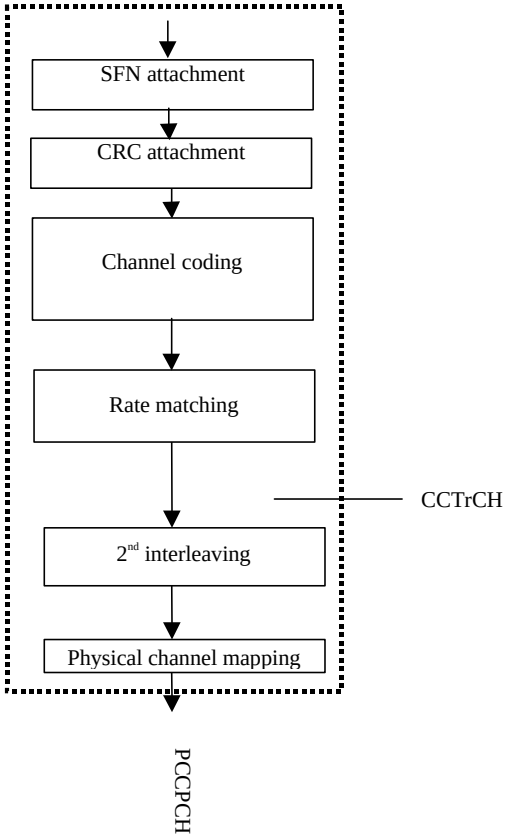


Figure 4-6. Transport channel multiplexing structure for BCH.

<Editor's note: a liaison about fixed interleaving length should be sent to WG2>

The rate matching needs to be a fixed value.
<Editor's note: this value should be specified by WG2.>

4.2.2.2.2 Coding and multiplexing for the PCH and FACH

Figure 4-7 illustrates the coding and multiplexing of both PCH transport channels and FACH transport channels (common type CCTrCH). Mapping shall be done onto the SCCPCH physical channel.

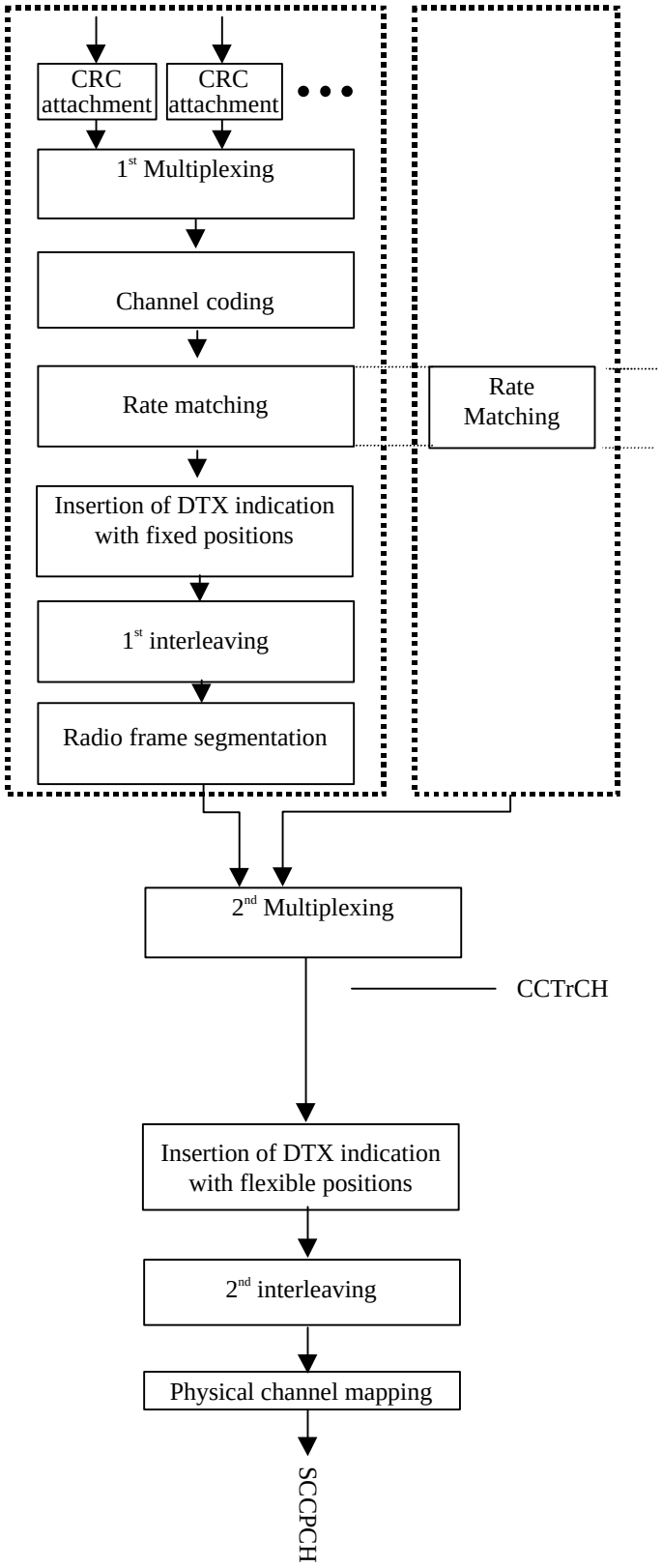


Figure 4-7. Transport channel multiplexing structure for PCH and FACH.

In case that TrCHs are reserved for PCH the 1st interleaving length is fixed to be 10 ms.
< Editor's note: This needs a liaison to WG2.>

~~*<Editor's note: Code multiplexing is not used in uplink as a working assumption in WG1..>*~~

~~Primarily, transport channels are multiplexed as described above, i.e. into one data stream mapped on one or several physical channels. However, an alternative way of multiplexing services is to use code multiplexing, which corresponds to having several parallel multiplexing chains as in Figure 4-1, resulting in several data stream, each mapped to one or several physical channels. This code multiplexing is used only for downlink DSCHs. For the other transport channels including downlink DCHs, the code multiplexing shall not be used.~~

~~4.2.1~~4.2.3 Error detection

Error detection is provided on transport blocks through a Cyclic Redundancy Check. The CRC is 16, 8 or 0 bits and it is signalled from higher layers what CRC length that should be used for each transport channel.

~~4.2.1.1~~4.2.3.1 CRC Calculation

The entire transport block is used to calculate the CRC parity bits for each transport block. The parity bits are generated by one of the following cyclic generator polynomials:

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