TSG-RAN Working Group 1 meeting #11
San Diego, USA
February 29th – March 3rd, 2000

TSGR1#10(00)0218

Agenda item: AH 04 + AH 08

Source: Nokia

Title: CR 25.212-046: SF/2 method, DTX insertion after second interleaver

Document for: Decision

At the present, section 4.2.12, Physical channel mapping, in TS 25.212, defines that no bits are mapped to TGL consecutive slots in compressed mode. For example, if SF/2 method is used with TGL=7, it means that a 7-slot gap is created in the physical channel mapping section. The data, however, reserves only 7.5 slots when going to spreading factor SF/2. And for this reason, additional 0.5 slot of DTX has to be inserted in 2nd DTX insertion block.

Thus, if TGL=7 and SF/2 method is used with single frame method, the number of bits in the CCTrCH is not the same in normal mode and compressed mode. It is 0.5 slot bigger in compressed mode. For shorter TGL this disparity between CCTrCH in normal mode and compressed mode increases. Moreover, when TG extends over two frames there can be a case when there is only one empty slot in the first frame. In this case a total of 6.5 slots of extra DTX is needed in order to keep the number of bits in the CCTrCH constant.

Based on the assumption that the number of CCTrCH bits is the same in normal mode and in SF/2 method, the specification has to be modified so that additional 0.5-6.5 slots of DTX is created in the physical channel mapping section, and not inserted in 2nd DTX insertion. Also, with the number of CCTrCH bits remaining constant the buffer size for 2nd interleaver at the UE receiver does not have to be increased. With the present defition it would need to be almost doubled for TGL=1 case. At the UE receiver side the buffer size is further increased by the fact that values after RAKE combiner are represented as soft values of M (>>2) bits.

The benefit of this method is that every time SF/2 method is used, only physical channel mapping section needs to be reconfigured. With the present method, the total of four blocks have to be reconfigured in that case: 2nd DTX insertion, physical channel segmentation, 2nd interleaving and physical channel mapping.

It should be taken into account that there can be several compressed mode patterns running simultaneously. If the number of reconfiguring steps for multiplexing algorithms can be minimised in compressed mode, it simplifies the overall usage of several compressed mode patterns at the same time.

The attached CR proposes to add from 0.5 to 6.5 slots of DTX in physical channel mapping with SF/2 method, depending on the transmission gap length and location.

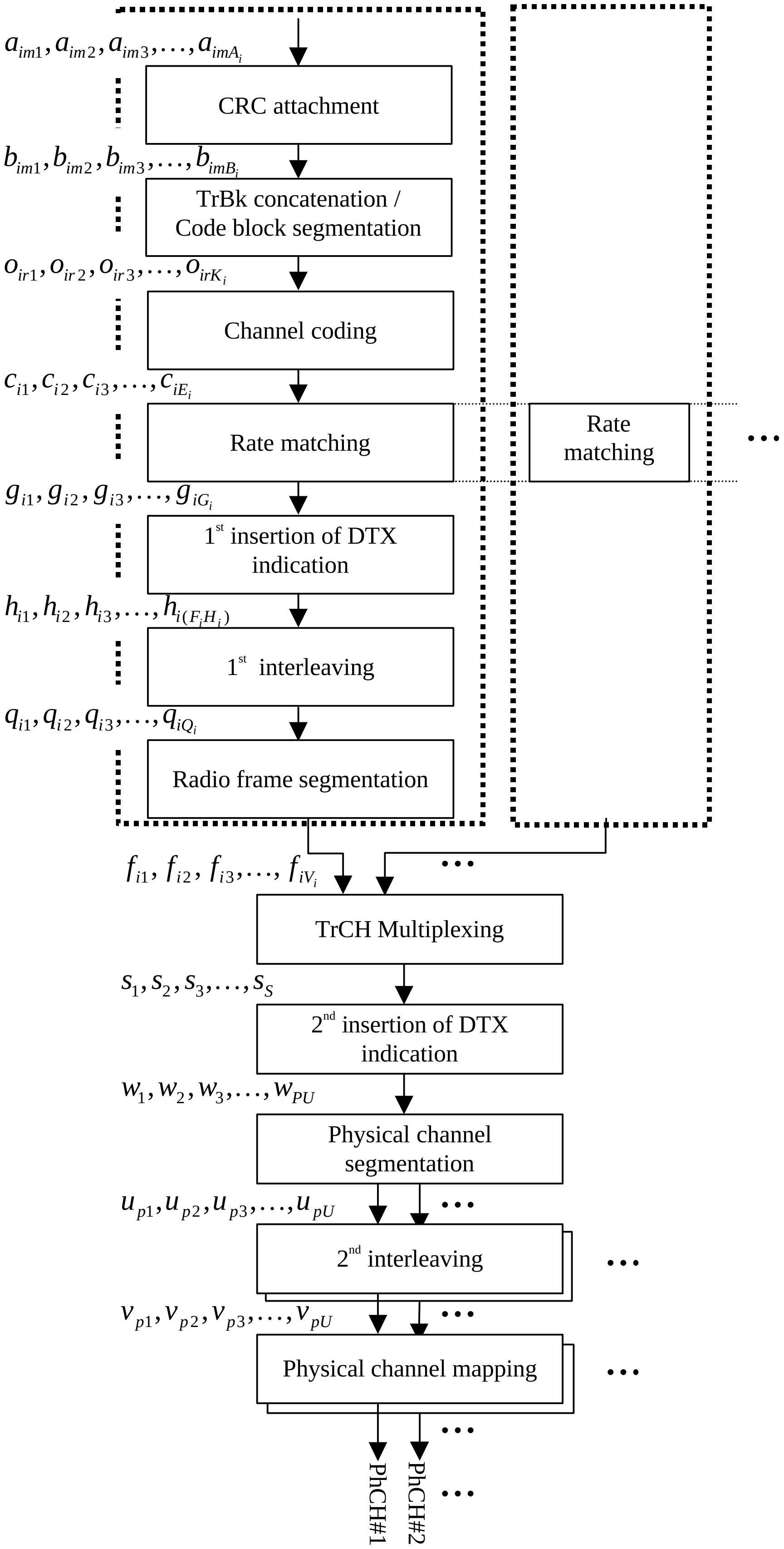

Figure 2: Transport channel multiplexing structure for downlink

3GPP/SMG Meeting RAN WG1 meeting #11
San Diego, USA, 29 Feb - 03 Mar 2000

Document R1-00-0218
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.212 CR 046 Current Version: 3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-RAN #7
list expected approval meeting # here ↑

for approval ☒
for information ☐

strategic ☐ *(for SMG*
non-strategic ☐ *use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: Nokia **Date:** Feb 17th 2000

Subject: SF/2 method: DTX insertion after 2nd interleaver

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction	☒
A	Corresponds to a correction in an earlier release	☐
B	Addition of feature	☐
C	Functional modification of feature	☐
D	Editorial modification	☐

Release:

Phase 2	☐
Release 96	☐
Release 97	☐
Release 98	☐
Release 99	☒
Release 00	☐

Reason for change: At the moment the number of CCTrCH bits is increased by 0.5-6.5 slots when going to SF/2. In this CR the sections 4.2.9.2 and 4.2.12 are changed so that the number of CCTrCH bits remains the same in SF/2 method as in normal mode.

Clauses affected:
4.2.9.2 2nd insertion of DTX indication bits
4.2.12 Physical channel mapping

Other specs affected:

Other 3G core specifications	☐	→ List of CRs:
Other GSM core specifications	☐	→ List of CRs:
MS test specifications	☐	→ List of CRs:
BSS test specifications	☐	→ List of CRs:
O&M specifications	☐	→ List of CRs:

Other comments:

The bits from rate matching are denoted by $g_{i1}, g_{i2}, g_{i3}, \ldots, g_{iG_i}$, where G_i is the number of bits in one TTI of TrCH *i*. Denote the number of bits in one radio frame of TrCH *i* by H_i. In normal or compressed mode by spreading factor reduction, H_i is constant and corresponds to the maximum number of bits from TrCH *i* in one radio frame for any transport format of TrCH *i*. In compressed mode by higher layer scheduling, only a subset of the TFC Set is allowed. From this subset it is possible to derive which TFs on each TrCH that are allowed. The maximum number of bits belonging to one TTI of TrCH *i* for the allowed TFs is denoted by X_i. H_i is then calculated as $H_i = \left\lceil \frac{X_i}{F_i} \right\rceil$, where F_i is the number of radio frames in a TTI of TrCH *i*. The bits output from the DTX insertion are denoted by $h_{i1}, h_{i2}, h_{i3}, \ldots, h_{i(F_i H_i)}$. Note that these bits are three valued. They are defined by the following relations:

$$h_{ik} = g_{ik} \quad k = 1, 2, 3, \ldots, G_i$$

$$h_{ik} = d \quad k = G_i+1, G_i+2, G_i+3, \ldots, F_i H_i$$

where DTX indication bits are denoted by d. Here $g_{ik} \in \{0, 1\}$ and $d \notin \{0, 1\}$.

4.2.9.2 2nd insertion of DTX indication bits

The DTX indication bits inserted in this step shall be placed at the end of the radio frame. Note that the DTX will be distributed over all slots after 2nd interleaving.

The bits input to the DTX insertion block are denoted by $s_1, s_2, s_3, \ldots, s_S$,where S is the number of bits from TrCH multiplexing. The number of PhCHs is denoted by P and the number of bits in one radio frame, including DTX indication bits, for each PhCH by U. In normal mode $U = \frac{N_{data,*}}{P} = 15N_{data1} + 15N_{data2}$ ~~The number of available bits on the PhCH is denoted by N_{data} and N_{data}=15N_{data1}+15N_{data2}~~, where N_{data1} and N_{data2} are defined in [2~~5.211~~].~~ In normal mode U=N_{data}.~~ In compressed mode, additional DTX shall be inserted if the transmission time reduction method does not exactly create a transmission gap of the desired TGL. The number of bits available to the CCTrCH in one radio frame in compressed mode is denoted by $N^{cm}_{data,*}$ and $U = \frac{N^{cm}_{data,*}}{P}$. ~~N_{data} is changed from the value in normal node.~~ The exact value of $N^{cm}_{data,*}$ ~~N_{data}~~ is dependent on the *TGL* and the transmission time reduction method, which are signalled from higher layers. For transmission time reduction by SF/2 method in compressed mode $N^{cm}_{data,*} = \frac{N'_{data,*}}{2}$, and for other methods it can be calculated as $N^{cm}_{data,*} = N'_{data,*} - N_{TGL}$. For every transmission time reduction method $N'_{data,*} = P(15N'_{data1} + 15N'_{data2})$, where N'_{data1} and N'_{data2} are the number of bits in the data fields of a slot for slot format A or B as defined in [2]. N_{TGL} is ~~T~~the number of bits that are located within the transmission gap ~~is denoted N_{TGL}~~ and defined as:

$$N_{TGL} = \begin{cases} \frac{TGL}{15} N'_{data}, \text{ if } N_{first} + TGL \le 15 \\ \frac{15 - N_{first}}{15} N'_{data}, \text{ in first frame if } N_{first} + TGL > 15 \\ \frac{TGL - (15 - N_{first})}{15} N'_{data}, \text{ in second frame if } N_{first} + TGL > 15 \end{cases}$$

N_{first} and *TGL* are defined in Section 4.4.

Note: In compressed mode by SF/2 method DTX is also added in physical channel mapping stage (section 4.2.12.2). During 2nd DTX insertion the number of CCTrCH bits is kept the same as in normal mode.

~~In compressed mode U=N_{data}-N_{TGL}.~~

The bits output from the DTX insertion block are denoted by $w_1, w_2, w_3, \ldots, w_{(PU)}$. Note that these bits are threevalued. They are defined by the following relations:

$w_k = s_k$ k = 1, 2, 3, …, S

$w_k = d$ k = S+1, S+2, S+3, …, PU

where DTX indication bits are denoted by *d*. Here $s_k \in \{0,1\}$ and $d \notin \{0,1\}$.

$$\begin{bmatrix} y_{p1} & y_{p,(R_2+1)} & y_{p,(2R_2+1)} & \cdots & y_{p,(29R_2+1)} \\ y_{p2} & y_{p,(R_2+2)} & y_{p,(2R_2+2)} & \cdots & y_{p,(29R_2+2)} \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ y_{pR_2} & y_{p,(2R_2)} & y_{p,(3R_2)} & \cdots & y_{p,(30R_2)} \end{bmatrix}$$

(5) The output of the 2nd interleaving is the bit sequence read out column by column from the inter-column permuted $R_2 \times C_2$ matrix. The output is pruned by deleting bits that were not present in the input bit sequence, i.e. bits y_{pk} that corresponds to bits u_{pk} with $k>U$ are removed from the output. The bits after 2nd interleaving are denoted by $v_{p1}, v_{p2}, \ldots, v_{pU}$, where v_{p1} corresponds to the bit y_{pk} with smallest index k after pruning, v_{p2} to the bit y_{pk} with second smallest index k after pruning, and so on.

Table 6

Number of column C_2	Inter-column permutation pattern
30	{0, 20, 10, 5, 15, 25, 3, 13, 23, 8, 18, 28, 1, 11, 21, 6, 16, 26, 4, 14, 24, 19, 9, 29, 12, 2, 7, 22, 27, 17}

4.2.12 Physical channel mapping

The PhCH for both uplink and downlink is defined in [2]. The bits input to the physical channel mapping are denoted by $v_{p1}, v_{p2}, \ldots, v_{pU}$, where p is the PhCH number and U is the number of bits in one radio frame for one PhCH. The bits v_{pk} are mapped to the PhCHs so that the bits for each PhCH are transmitted over the air in ascending order with respect to k.

In compressed mode, no bits are mapped to certain slots of the PhCH(s). If $N_{first} + TGL \le 15$, no bits are mapped to slots N_{first} to N_{last}. If $N_{first} + TGL > 15$, i.e. the transmission gap spans two consecutive radio frames, the mapping is as follows:

- In the first radio frame, no bits are mapped to slots N_{first}, $N_{first}+1$, $N_{first}+2$, …, 14.
- In the second radio frame, no bits are mapped to the slots 0, 1, 2, …, N_{last}.

TGL, N_{first}, and N_{last} are defined in section 4.4.

4.2.12.1 Uplink

In uplink, the PhCHs used during a radio frame are either completely filled with bits that are transmitted over the air or not used at all. The only exception is when the UE is in compressed mode. The transmission can then be turned off during consecutive slots of the radio frame.

4.2.12.2 Downlink

In downlink, the PhCHs do not need to be completely filled with bits that are transmitted over the air. Bits $v_{pk} \notin \{0, 1\}$ are not transmitted.

During compressed mode by reducing the spreading factor by 2, no bits are mapped to the DPDCH field as follows:

If $N_{first} + TGL \le 15$, i.e. the transmission gap spans one radio frame,

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if $N_{first} + 7 \le 14$
    no bits are mapped to slots $N_{first}, N_{first} + 1, N_{first} + 2, \ldots, N_{last} + (7 - TGL)$
    no bits are mapped to the first $(N_{Data1} + N_{Data2})/2$ bit positions of slot $N_{last} + (8 - TGL)$
else
    no bits are mapped to slots $N_{first}, N_{first} + 1, N_{first} + 2, \ldots, 14$
    no bits are mapped to slots $N_{first} - 1, N_{first} - 2, N_{first} - 3, \ldots, N_{first} - (7 - TGL - (14 - N_{last}))$
    no bits are mapped to the last $(N_{Data1} + N_{Data2})/2$ bit positions of slot $N_{first} - (8 - TGL - (14 - N_{last}))$
end if
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If $N_{first} + TGL > 15$, i.e. the transmission gap spans two consecutive radio frames,

In the first radio frame, no bits are mapped to last $(N_{Data1}+ N_{Data2})/2$ bit positions in slot 7 as well as to slots 8, 9, 10, ..., 14.

In the second radio frame, no bits are mapped to slots 0, 1, 2, ..., 6 as well as to first $(N_{Data1}+ N_{Data2})/2$ bit positions in slot 7.

N_{Data1} and N_{Data2} are defined in [2].

The following rules should be used for the selection of fixed or flexible positions of the TrCHs in the radio frame:

- For TrCHs not relying on TFCI for transport format detection (blind transport format detection), the positions of the transport channels within the radio frame should be fixed. In a limited number of cases, where there are a small number of transport format combinations, it is possible to allow flexible positions.
- For TrCHs relying on TFCI for transport format detection, higher layer signal whether the positions of the transport channels should be fixed or flexible.