TSG-RAN Working Group1 meeting #12 TSGR1#12(00)539

Seoul, Korea, April, 10 – April 13, 2000

Agenda Item : **AH04**

Source : **Nortel Networks**

Title : **Editorial modifications of 25.212**

Document for : **Decision**

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1. Introduction

This CR proposes to correct minor editorial mistakes in the first interleaver, rate matching, 1st DTX indication bits insertion and physical channel segmentation sections:

4.2 Transport-channel coding/multiplexing:
In Figure 2: Transport channel multiplexing structure for downlink, replace F_iH_i by D_i to index sequence h_i since D_i has been defined for this purpose in section 4.2.9.1 1st insertion of DTX indication bits.

4.2.5.3: Relation between input and output of 1st interleaving in uplink:
Replace "$\boldsymbol{X_i} = T_i$" by "$\mathbf{Z_i} = T_i$," since now it is sequence z_i which is used at this stage.

4.2.5.4: Relation between input and output of 1st interleaving in downlink:
Replace "$X_i = F_i * H_i - Np^{TTI,m}_{i,max}$ in case of compressed by puncturing and $X_i = F_i * H_i$ in other cases", by "$X_i = D_i$" since D_i has been defined for this purpose in 1st DTX insertion section.

4.2.7.2 Determination of rate matching parameters in downlink:
Replace :
"The number of bits corresponding to the gap for TrCh i, in each radio frame of its TTI is calculated using the number of bits to remove on **each** Physical Channel $N_{TGL}[k]$,"
by:
"The number of bits corresponding to the gap for TrCh i, in each radio frame of its TTI is calculated using the number of bits to remove on **all** Physical Channels $N_{TGL}[k]$,"
since $N_{TGL}[k]$ is the number of bits for the gap on all Physical Channel associated to the CCTrCh.

4.2.9.1 1st insertion of DTX indication bits:

Replace "$D_i = F_i * H_{i,*} + DN^{TTI}_{cm,i,max}$" by "$D_i = F_i * H_{i,*} - Np^{TTI,m}_{i,max}$" since now $Np^{TTI,m}_{i,max}$ is used to indicate the number of bits p to be introduced in first interleaver section

4.2.10 Physical channel segmentation:

There was a **V** notation left over instead of **U**.

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Document R1-00539
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**	**068**	Current Version:	3.2.0

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

For submission to:	WG1 # 12	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

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: *(at least one should be marked with an X)*

(U)SIM	ME	UTRAN / Radio	Core Network
	X	X	

Source:	Nortel Networks	**Date:**	
Subject:	Editorial modifications of 25.212		
Work item:	TS 25.212		

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

F	Correction		**Release:** Phase 2	
A	Corresponds to a correction in an earlier release		Release 96	
B	Addition of feature		Release 97	
C	Functional modification of feature		Release 98	
D	Editorial modification	X	Release 99	X
			Release 00	

Reason for change: Editorial modifications correcting small mistakes left in change request 25.212-042-r5 (Downlink compressed mode by puncturing)

Clauses affected: 4.2, 4.2.5.3, 4.2.5.4, 4.2.7.2, 4.2.9.1, 4.2.10

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:

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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 subclause 4.2.1);
- transport block concatenation and code block segmentation (see subclause 4.2.2);
- channel coding (see subclause 4.2.3);
- rate matching (see subclause 4.2.7);
- insertion of discontinuous transmission (DTX) indication bits (see subclause 4.2.9);
- interleaving (two steps, see subclauses 4.2.4 and 4.2.11);
- radio frame segmentation (see subclause 4.2.6);
- multiplexing of transport channels (see subclause 4.2.8);
- physical channel segmentation (see subclause 4.2.10);
- mapping to physical channels (see subclause 4.2.12).

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

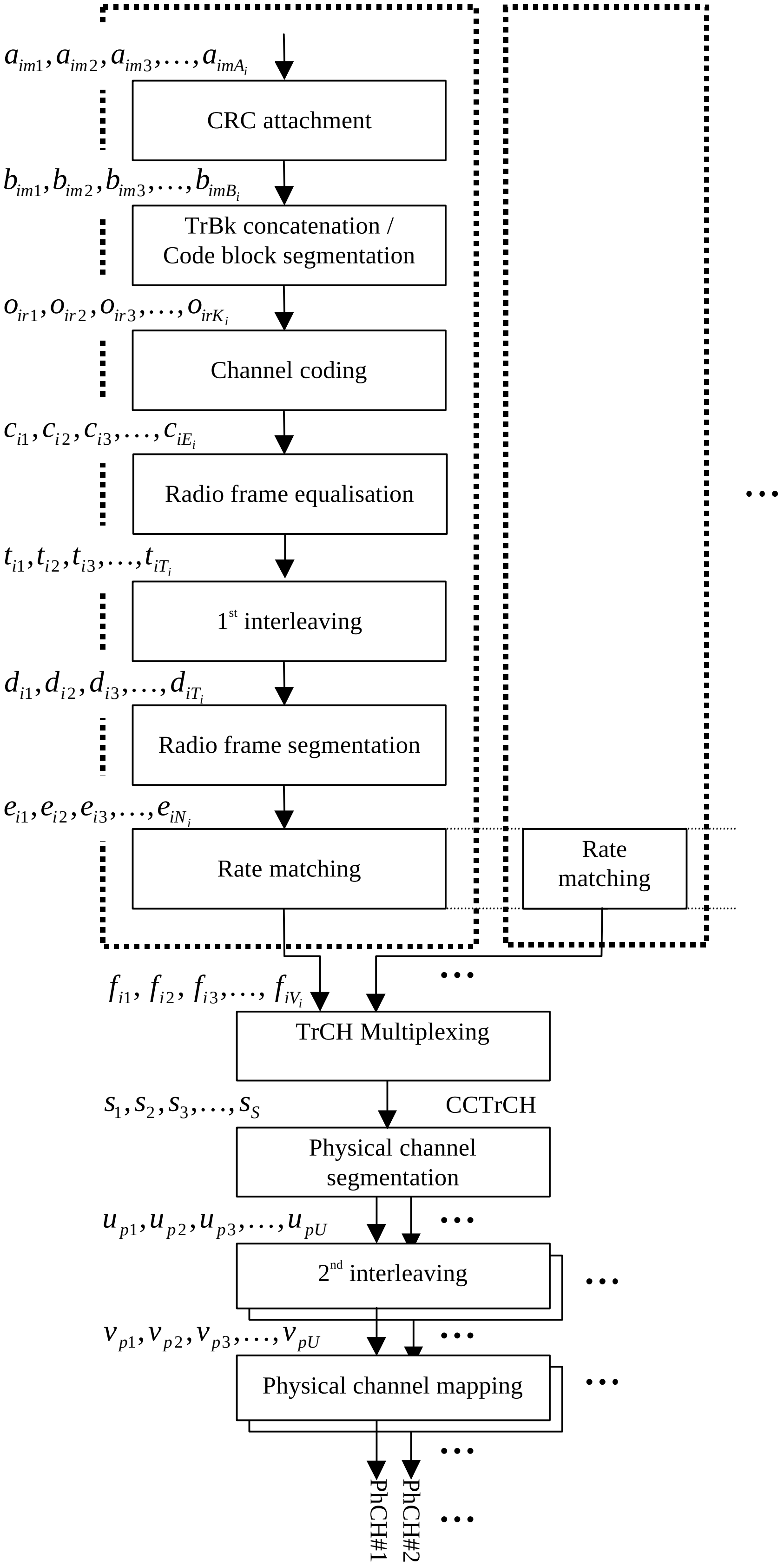
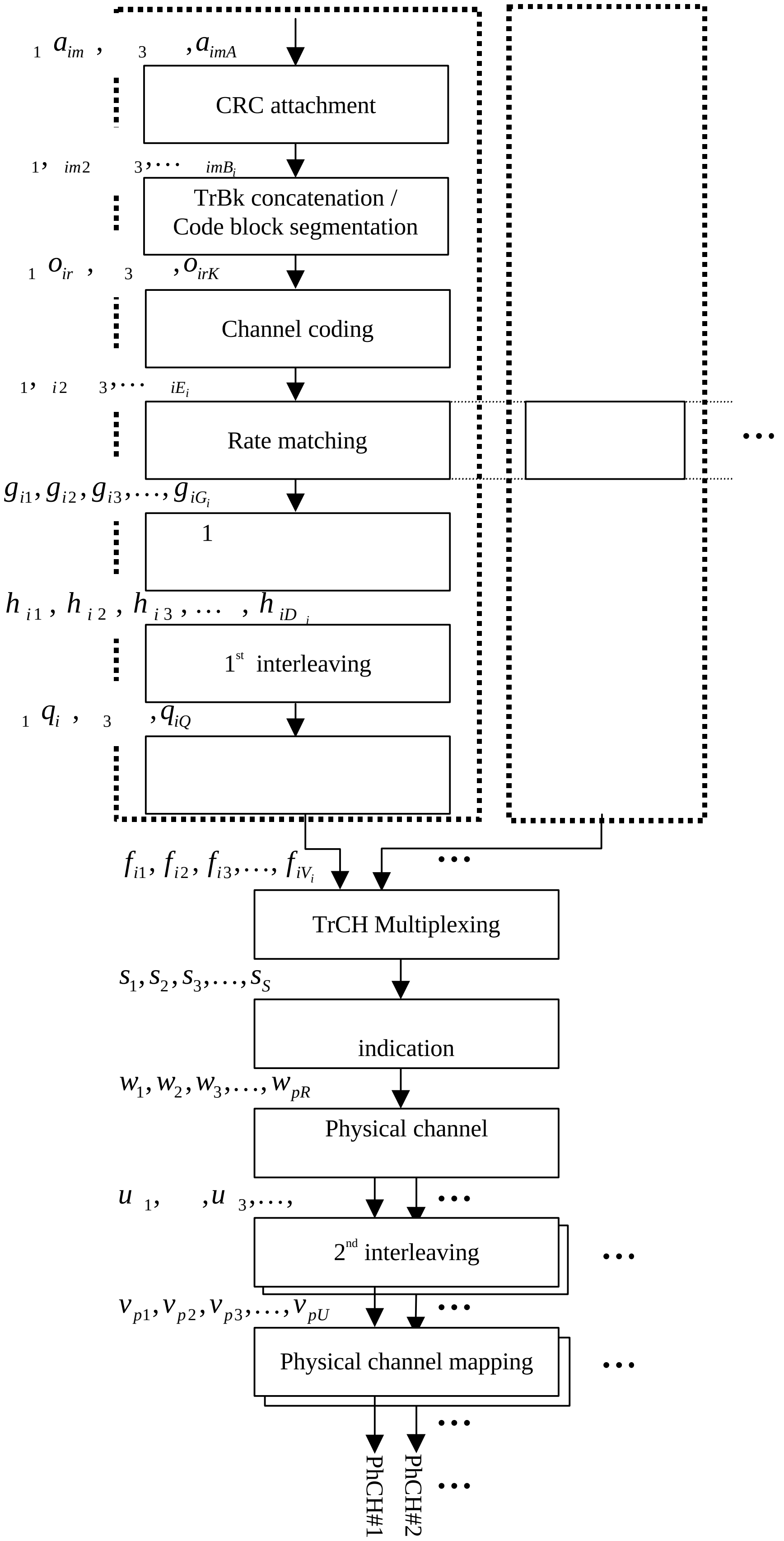


Figure 1: Transport channel multiplexing structure for uplink


CRC attachment
TrBk concatenation /
Code block segmentation
Channel coding
Rate matching
1st interleaving
TrCH Multiplexing
indication
Physical channel
2nd interleaving
Physical channel mapping
PhCH#1
PhCH#2

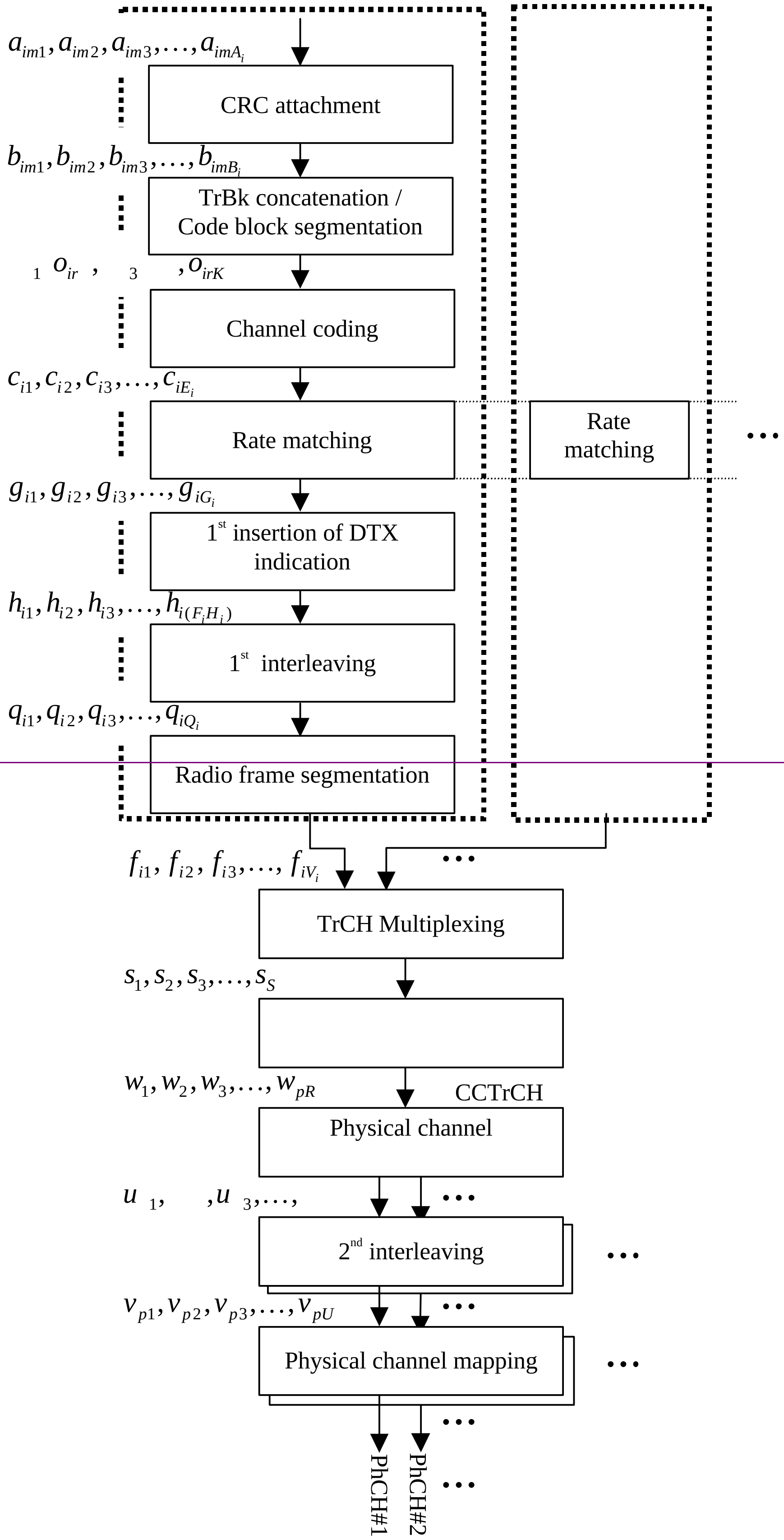


Figure 2: Transport channel multiplexing structure for downlink

The single output data stream from the TrCH multiplexing, including DTX indication bits in downlink, is denoted *Coded Composite Transport Channel (CCTrCH)*. A CCTrCH can be mapped to one or several physical channels.

4.2.5 1st interleaving

In Compressed Mode by puncturing, bits marked with a fourth value on top of {0, 1, δ} and noted p, are introduced in the radio frames to be compressed, in positions corresponding to the first bits of the radio frames. They will be removed in a later stage of the multiplexing chain to create the actual gap. Additional puncturing has been performed in the rate matching step, over the TTI containing the compressed radio frame, to create room for these p-bits. The following subclause describes this feature.

4.2.5.1 Insertion of marked bits in the sequence to be input in first interleaver

In normal mode, compressed mode by higher layer scheduling, and compressed mode by spreading factor reduction:

$x_{ik} = z_{ik}$ and $X_i = Z_i$.

In case of compressed mode by puncturing and fixed positions, sequence $x_{i,k}$ which will be input to first interleaver for TrCh *i* and TTI *m* within largest TTI, is built from bits $z_{i,k}$, $k=1, ..Z_i$, plus $Np^{TTI,m}_{i,max}$ bits marked p and $X_i = Z_i + Np^{TTI,m}_{i,max}$, as is described thereafter.

$Np^{TTI,m}_{i,max}$ is defined in the Rate Matching subclause 4.2.7.

$P_{Fi}[x]$ defines the inter column permutation function for a TTI of length Fi *10ms, as defined in Table 3 above. $P_{Fi}[x]$ is the Bit Reversal function of x on $\log_2(Fi)$ bits.

NOTE 1: C[x], x= 0 to Fi – 1, the number of bits p which have to be inserted in each of the Fi segments of the TTI, i.e. in each column of the first interleaver. C[x] is equal to $Np^{x}_{i,max}$ for x equal 0 to Fi –1 for fixed positions . It is noted Np^{x}_{i} in the following initialisation step.

NOTE 2: cbi[x], x=0 to Fi – 1, the counter of the number of bits p inserted in each of the Fi segments of the TTI, i.e. in each column of the first interleaver.

col = 0

while col < F_i **do**

C[col] = Np^{col}_{i} -- initialisation of number of bits p to be inserted in each of the Fi segments of the TTI

cbi[col] = 0 -- initialisation of counter of number of bits p inserted in each of the Fi segments of the TTI

end do

n = 0, m = 0

while n < X_i **do**

col = *n* mod F_i

if cbi[col] < C[P_{Fi}(col)] **do**

$x_{i,n}$ = p -- insert one p bit

cbi[col] = cbi[col]+1 -- update counter of number of bits p inserted

else -- no more p bit to insert in this segment

$x_{i,n} = z_{i,m}$

m = m+1

endif

n = n +1

end do

4.2.5.2 1st interleaver operation

The 1st interleaving is a block interleaver with inter-column permutations. The input bit sequence to the 1st interleaver is denoted by $x_{i1}, x_{i2}, x_{i3}, \ldots, x_{iX_i}$, where i is TrCH number and X_i the number of bits (at this stage X_i is assumed and guaranteed to be an integer multiple of TTI). The output bit sequence is derived as follows:

(1) Select the number of columns C_I from table 3.

(2) Determine the number of rows R_I defined as:

$R_I = X_i/C_I$

(3) Write the input bit sequence into the $R_I \times C_I$ rectangular matrix row by row starting with bit $x_{i,1}$ in the first column of the first row and ending with bit $x_{i,(R_I C_I)}$ in column C_I of row R_I:

$$\begin{bmatrix} x_{i1} & x_{i2} & x_{i3} & \ldots & x_{iC_I} \\ x_{i,(C_I+1)} & x_{i,(C_I+2)} & x_{i,(C_I+3)} & \ldots & x_{i,(2C_I)} \\ \vdots & \vdots & \vdots & \ldots & \vdots \\ x_{i,((R_I-1)C_I+1)} & x_{i,((R_I-1)C_I+2)} & x_{i,((R_I-1)C_I+3)} & \ldots & x_{i,(R_I C_I)} \end{bmatrix}$$

(4) Perform the inter-column permutation based on the pattern $\{P_1(j)\}$ (j=0,1, ..., C-1) shown in table 3, where $P_1(j)$ is the original column position of the j-th permuted column. After permutation of the columns, the bits are denoted by y_{ik}:

$$\begin{bmatrix} y_{i1} & y_{i,(R_I+1)} & y_{i,(2R_I+1)} & \ldots & y_{i,((C_I-1)R_I+1)} \\ y_{i2} & y_{i,(R_I+2)} & y_{i,(2R_I+2)} & \ldots & y_{i,((C_I-1)R_I+2)} \\ \vdots & \vdots & \vdots & \ldots & \vdots \\ y_{iR_I} & y_{i,(2R_I)} & y_{i,(3R_I)} & \ldots & y_{i,(C_I R_I)} \end{bmatrix}$$

(5) Read the output bit sequence $y_{i1}, y_{i2}, y_{i3}, \ldots, y_{i,(C_I R_I)}$ of the 1st interleaving column by column from the inter-column permuted $R_I \times C_I$ matrix. Bit $y_{i,1}$ corresponds to the first row of the first column and bit $y_{i,(R_I C_I)}$ corresponds to row R_I of column C_I.

Table 3

TTI	Number of columns C_I	Inter-column permutation patterns
10 ms	1	{0}
20 ms	2	{0,1}
40 ms	4	{0,2,1,3}
80 ms	8	{0,4,2,6,1,5,3,7}

4.2.5.3 Relation between input and output of 1st interleaving in uplink

The bits input to the 1st interleaving are denoted by $t_{i1}, t_{i2}, t_{i3}, \ldots, t_{iT_i}$, where i is the TrCH number and T_i the number of bits. Hence, $z_{ik} = t_{ik}$ and Z~~X~~$_i$ = T_i.

The bits output from the 1st interleaving are denoted by $d_{i1}, d_{i2}, d_{i3}, \ldots, d_{iT_i}$, and $d_{ik} = y_{ik}$.

4.2.5.4 Relation between input and output of 1st interleaving in downlink

If fixed positions of the TrCHs in a radio frame is used then the bits input to the 1st interleaving are denoted by $h_{i1}, h_{i2}, h_{i3}, \ldots, h_{i(F_i H_i)}$, where i is the TrCH number. Hence, $z_{ik} = h_{ik}$ and Z_i = D_i ~~$F_i * H_i - Np^{TTI,m}_{i,max}$ in compressed mode by puncturing, and $Z_i = F_i H_i$ otherwise~~.

If flexible positions of the TrCHs in a radio frame is used then the bits input to the 1st interleaving are denoted by $g_{i1}, g_{i2}, g_{i3}, \ldots, g_{iG_i}$, where i is the TrCH number. Hence, $z_{ik} = g_{ik}$ and $Z_i = G_i$.

The bits output from the 1st interleaving are denoted by $q_{i1}, q_{i2}, q_{i3}, \ldots, q_{iQ_i}$, where i is the TrCH number and Q_i is the number of bits. Hence, $q_{ik} = y_{ik}$, $Q_i = F_i H_i$ if fixed positions are used, and $Q_i = G_i$ if flexible positions are used.

4.2.7.2 Determination of rate matching parameters in downlink

For downlink $N_{data,j}$ does not depend on the transport format combination j. $N_{data,*}$ is given by the channelization code(s) assigned by higher layers. Denote the number of physical channels used for the CCTrCH by P. $N_{data,*}$ is the number of bits available to the CCTrCH in one radio frame and defined as $N_{data,*}=P(15N_{data1}+15N_{data2})$, where N_{data1} and N_{data2} are defined in [2]. Note that contrary to the uplink, the same rate matching patterns are used in normal and compressed mode by spreading factor reduction or higher layer scheduling.

In the following, the total amount of puncturing or repetition for the TTI is calculated.

Additional calculations for compressed mode by puncturing in case of fixed positions are performed to determine this total amount of rate matching needed.

For compressed mode by puncturing, in TTIs where some compressed radio frames occur, the puncturing is increased or the repetition is decreased compared to what is calculated according to the rate matching parameters provided by higher layers. This allows to create room for later insertion of marked bits, noted p-bits, which will identify the positions of the gaps in the compressed radio frames.

The amount of additional puncturing corresponds to the number of bits to create the gap in the TTI for TrCh $_i$. In case of fixed positions, it is calculated in addition to the amount of rate matching indicated by higher layers. It is noted $Np^{TTI,\,m}{}_{i,max}$.

In fixed positions case, to obtain the total rate matching $\Delta N_{i,\max}^{TTI,cm,m}$ to be performed on the TTI m, $Np^{TTI,\,m}{}_{i,max}$ is sub-stracted from $DN^{TTI,\,m}{}_{i,max}$ (calculated based on higher layers RM parameters as for normal rate matching). This allows to create room for the $Np^{TTI,\,m}{}_{i,max}$ bits p to be inserted later. If the result is null, i.e. the amount of repetition matches exactly the amount of additional puncturing needed, then no rate matching is necessary.

In case of compressed mode by puncturing and fixed positions, for some calculations, $N'_{data,*}$ is used for radio frames with gap instead of $N_{data,*}$, where $N'_{data,*}=P(15N'_{data1}+15N'_{data2})$. N'_{data1} and N'_{data2} are the number of bits in the data fields of the slot format used for the current compressed mode, i.e. slot format A or B as defined in [2] corresponding to the Spreading Factor and the number of transmitted slots in use.

The number of bits corresponding to the gap for TrCh i, in each radio frame of its TTI is calculated using the number of bits to remove on ~~each~~ all Physical Channels $N_{TGL}[k]$, where k is the radio frame number in the TTI.

For each radio frame k of the TTI, $N_{TGL}[k]$ is given by the relation:

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

N_{first} and TGL are defined in subclause 4.4.

Note that $N_{TGL}[k]=0$ if radio frame k is not compressed.

4.2.9.1 1st insertion of DTX indication bits

This step of inserting DTX indication bits is used only if the positions of the TrCHs in the radio frame are fixed. With fixed position scheme a fixed number of bits is reserved for each TrCH in the radio frame.

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. Denote D_i the number of bits output of the first DTX insertion block.

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. and $D_i = F_i * H_i$.

In compressed mode by puncturing, additional puncturing is performed in the rate matching block. The empty positions resulting from the additional puncturing are used to insert p-bits in the first interleaving block, the DTX insertion is therefore limited to allow for later insertion of p-bits. Thus DTX bits are inserted until the total number of bits is Di where $D_i = F_i * H_{i,*}$ $- Np^{TTI,m}_{i,max}$ ~~$+ DN^{TTI}_{cm,i,max}$~~, and $H_i = N_{i,*} + DN_{i,*}$.

The bits output from the DTX insertion are denoted by $h_{i1}, h_{i2}, h_{i3}, \ldots, h_{iDi}$ Note that these bits are three valued. They are defined by the following relations:

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

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

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

4.2.10 Physical channel segmentation

When more than one PhCH is used, physical channel segmentation divides the bits among the different PhCHs. The bits input to the physical channel segmentation are denoted by $x_1, x_2, x_3, \ldots, x_Y$, where Y is the number of bits input to the physical channel segmentation block. The number of PhCHs is denoted by P.

The bits after physical channel segmentation are denoted $u_{p1}, u_{p2}, u_{p3}, \ldots, u_{pU}$, where p is PhCH number and U is the number of bits in one radio frame for each PhCH, i.e. $U = (Y - N_{TGL}) / P$ for compressed mode by puncturing, and $U = \frac{Y}{P}$ otherwise. The relation between x_k and u_{pk} is given below.

For all modes, some bits of the input flow are mapped to each code until the number of bits on the code is ~~Y~~U. For modes other than compressed mode by puncturing, all bits of the input flow are taken to be mapped to the codes. For compressed mode by puncturing, only the bits of the input flow not corresponding to bits p are taken to be mapped to the codes, each bit p is removed to ensure creation the gap required by the compressed mode, as described below.

Bits on first PhCH after physical channel segmentation:

$u_{1,k} = x_{i,f(k)}$ $k = 1, 2, \ldots, U$

Bits on second PhCH after physical channel segmentation:

$u_{2,k} = x_{i,f(k+U)}$ $k = 1, 2, \ldots, U$

…

Bits on the P^{th} PhCH after physical channel segmentation:

$u_{P,k} = x_{i,f(k+(P-1)U)}$ $k = 1, 2, \ldots, U$

where f is such that :

- for modes other than compressed mode by puncturing, $x_{i,f(k)} = x_{i,k}$, i.e. $f(k) = k$, for all k.
- for compressed mode by puncturing, bit $u_{1,1}$ corresponds to the bit $x_{i,k}$ with smallest index k when the bits p are not counted, bit $u_{1,2}$ corresponds to the bit $x_{i,k}$ with second smallest index k when the bits p are not counted, and so on for bits $u_{1,3}, \ldots$ $u_{1,}$~~Y~~U, $u_{2,1}, u_{2,2}, \ldots u_{2,}$ ~~Y~~U, $\ldots u_{P,1}, u_{P,2}, \ldots u_{P,}$ ~~Y~~U,

4.2.10.1 Relation between input and output of the physical segmentation block in uplink

The bits input to the physical segmentation are denoted by $s_1, s_2, s_3, \ldots, s_S$. Hence, $x_k = s_k$ and $Y = S$.

4.2.10.2 Relation between input and output of the physical segmentation block in downlink

The bits input to the physical segmentation are denoted by $w_1, w_2, w_3, \ldots, w_{(PU)}$. Hence, $x_k = w_k$ and $Y = PU$.