TSG-RAN Working Group 1 meeting #11 **TSGR1#11(00)0211**
San Diego, USA
February 29 – March 3, 2000

Agenda item:

Source: NEC

Title: CR 25.212-045: Editorial corrections

Document for: Approval

Following is a list of editorial corrections for TS 25.212 V3.1.0:

- p.12, Section 4.2.2.2:
  last 7th line: "≥" → ">"
  last line: "K_I" → "K_i"
- p.18, Section 4.2.4:
  2nd line: "4.1.6" → "4.2.7"
  8th line: "{0 | 1}" → "{0, 1}"
  11th line: "$N_i = \lfloor (E_i - 1)/F_i \rfloor + 1$" → "$N_i = \lceil E_i / F_i \rceil$" (same meaning)
- p.19, Section 4.2.5.2:
  4th line: "h_{ik}" → "g_{ik}"
- p.19 – p.20, Section 4.2.6:
  2nd line (p.19): "consecutive radio frames" → "consecutive F_i radio frames" (for clarification)
  4th line (p.20, 1st line): "Fi" → "F_i" (subscript)
  last 3rd – 2nd lines (p.20, 7th – 8th lines): remove these two lines, because x_{ik} and $y_{i,n_i k}$ are already defined in the text.
- p.20, Section 4.2.6.1:
  3rd line: "corresponding radio frame" → "corresponding to radio frame"
- p.20 – p.21, Section 4.2.7:
  13th line (p.20, last line), and 20th and 23rd lines (p.21, 7th and 10th lines): adjust indention
- p.27 – p.28, Section 4.2.7.2.2.2:
  last 4th line (p.28, 10th line): remove "N", because this is a mistake when applying CR 010r1.
- p.28 – p.29, Section 4.2.7.3:
  p.28, Figure 6: divide the box "Rate matching algorithm" into two for clarification
  Figures 6 and 7: add "in uplink" to the end of title
- p.30 – p.31, Section 4.2.7.4:
  p.31, Figure 8: divide the box "Rate matching algorithm" into two for clarification
  Figures 8 and 9: add "in downlink" to the end of title
- p.32, Section 4.2.7.5:
  2nd line: "X_i is the parameter given in sections 4.2.7.1 and 4.2.7.2." →
  "the sequence is defined in 4.2.7.3 for uplink or in 4.2.7.4 for downlink. Parameters X_i, e_{ini}, e_{plus}, and e_{minus} are given in 4.2.7.1 for uplink or in 4.2.7.2 for downlink." (for clarification)
- p.43, Section 4.4.1:
  Figure 13: "Slot # (N_{last} – 1)" → " Slot # (N_{last} + 1)"

3GPP TSG RAN WG1 Meeting #11
San Diego, USA, 29 Feb – 3 Mar 2000

Document ***R1-00-0211***
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**	**045**	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:	RAN #7	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	X	UTRAN / Radio	X	Core Network	

Source:	NEC	**Date:**	21 Feb 2000
Subject:	Editorial corrections		
Work item:			

Category:	F	Correction	X	**Release:**	Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature			Release 97	
shall be marked	C	Functional modification of feature			Release 98	
with an X)	D	Editorial modification			Release 99	X
					Release 00	

Reason for change:	Editorial corrections and clarifications
Clauses affected:	4.2.2.2, 4.2.4, 4.2.5.2, 4.2.6, 4.2.6.1, 4.2.7, 4.2.7.2.2.2, 4.2.7.3, 4.2.7.4, 4.2.7.5, 4.4.1

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:	

4.2.2.2 Code block segmentation

Segmentation of the bit sequence from transport block concatenation is performed if $X_i>Z$. The code blocks after segmentation are of the same size. The number of code blocks on TrCH i is denoted by C_i. If the number of bits input to the segmentation, X_i, is not a multiple of C_i, filler bits are added to the last block. The filler bits are transmitted and they are always set to 0. The maximum code block sizes are:

convolutional coding: $Z = 504$

turbo coding: $Z = 5114$

no channel coding: $Z = unlimited$

The bits output from code block segmentation are denoted by $o_{ir1}, o_{ir2}, o_{ir3}, \ldots, o_{irK_i}$, where i is the TrCH number, r is the code block number, and K_i is the number of bits.

Number of code blocks: $C_i = \lceil X_i / Z \rceil$

Number of bits in each code block: $K_i = \lceil X_i / C_i \rceil$

Number of filler bits: $Y_i = C_i K_i - X_i$

If $X_i \leq Z$, then $o_{i1k} = x_{ik}$, and $K_i = X_i$.

If X_i ≥> Z, then

$o_{i1k} = x_{ik}$ $k = 1, 2, \ldots, K_i$

$o_{i2k} = x_{i,(k+K_i)}$ $k = 1, 2, \ldots, K_i$

$o_{i3k} = x_{i,(k+2K_i)}$ $k = 1, 2, \ldots, K_i$

…

$o_{iC_ik} = x_{i(k+(C_i-1)K_i)}$ $k = 1, 2, \ldots, K_i - Y_i$

$o_{iC_ik} = 0$ $k = (K_i - Y_i) + 1, (K_i - Y_i) + 2, \ldots, K_{1i}$

4.2.4 Radio frame size equalisation

Radio frame size equalisation is padding the input bit sequence in order to ensure that the output can be segmented in F_i data segments of same size as described in section ~~4.1.6~~4.2.7. Radio frame size equalisation is only performed in the UL (DL rate matching output block length is always an integer multiple of F_i)

The input bit sequence to the radio frame size equalisation is denoted by $c_{i1}, c_{i2}, c_{i3}, \ldots, c_{iE_i}$, where i is TrCH number and E_i the number of bits. The output bit sequence is denoted by $t_{i1}, t_{i2}, t_{i3}, \ldots, t_{iT_i}$, where T_i is the number of bits. The output bit sequence is derived as follows:

$t_{ik} = c_{ik}$, for k = 1… E_i and

$t_{ik} = \{0~~|~~, 1\}$ for k= E_i +1… T_i, if $E_i < T_i$

where

$T_i = F_i * N_i$ and

~~$N_i = \lfloor (E_i - 1)/F_i \rfloor + 1$~~ $N_i = \lceil E_i / F_i \rceil$ is the number of bits per segment after size equalisation.

4.2.5.2 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, $x_{ik} = h_{ik}$ and $X_i = F_i H_i$.

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, x_{ik} = ~~h~~g$_{ik}$ and $X_i = G_i$.

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.

4.2.6 Radio frame segmentation

When the transmission interval is longer than 10 ms, the input bit sequence is segmented and mapped onto consecutive F_i radio frames. Following rate matching in the DL and radio frame size equalisation in the UL the input bit sequence length is guaranteed to be an integer multiple of F_i.

The input bit sequence is denoted by $x_{i1}, x_{i2}, x_{i3}, \ldots, x_{iX_i}$ where i is the TrCH number and X_i is the number bits. The F~~i~~$_i$ output bit sequences per TTI are denoted by $y_{i,n_i 1}, y_{i,n_i 2}, y_{i,n_i 3}, \ldots, y_{i,n_i Y_i}$ where n_i is the radio frame number in current TTI and Y_i is the number of bits per radio frame for TrCH i. The output sequences are defined as follows:

$$y_{i,n_i k} = x_{i,((n_i-1)Y_i)+k}, \; n_i = 1 \ldots F_i, \; k = 1 \ldots Y_i$$

where

$Y_i = (X_i / F_i)$ is the number of bits per segment. ~~,~~

~~x_{ik} is the k^th bit of the input bit sequence and~~

~~$y_{i,n_i k}$ is the k^th bit of the output bit sequence corresponding to the n^th radio frame~~

The n_i -th segment is mapped to the n_i -th radio frame of the transmission time interval.

4.2.6.1 Relation between input and output of the radio frame segmentation block in uplink

The input bit sequence to the radio frame segmentation is denoted by $d_{i1}, d_{i2}, d_{i3}, \ldots, d_{iT_i}$, where i is the TrCH number and T_i the number of bits. Hence, $x_{ik} = d_{ik}$ and $X_i = T_i$.

The output bit sequence corresponding to radio frame n_i is denoted by $e_{i1}, e_{i2}, e_{i3}, \ldots, e_{iN_i}$, where i is the TrCH number and N_i is the number of bits. Hence, $e_{i,k} = y_{i,n_i k}$ and $N_i = Y_i$.

4.2.7 Rate matching

Rate matching means that bits on a transport channel are repeated or punctured. Higher layers assign a rate-matching attribute for each transport channel. This attribute is semi-static and can only be changed through higher layer signalling. The rate-matching attribute is used when the number of bits to be repeated or punctured is calculated.

The number of bits on a transport channel can vary between different transmission time intervals. In the downlink the transmission is interrupted if the number of bits is lower than maximum. When the number of bits between different transmission time intervals in uplink is changed, bits are repeated or punctured to ensure that the total bit rate after TrCH multiplexing is identical to the total channel bit rate of the allocated dedicated physical channels.

If no bits are input to the rate matching for all TrCHs within a CCTrCH, the rate matching shall output no bits for all TrCHs within the CCTrCH and no uplink DPDCH will be selected in the case of uplink rate matching.

Notation used in section 4.2.7 and subsections:

N_{ij}: For uplink: Number of bits in a radio frame before rate matching on TrCH *i* with transport format combination *j* .

For downlink : An intermediate calculation variable (not an integer but a multiple of 1/8).

N_{il}^{TTI} : Number of bits in a transmission time interval before rate matching on TrCH *i* with transport format *l*. Used in downlink only.

ΔN_{ij} : For uplink: If positive - number of bits that should be repeated in each radio frame on TrCH *i* with transport format combination *j*.

If negative - number of bits that should be punctured in each radio frame on TrCH *i* with transport format combination *j*.

For downlink : An intermediate calculation variable (not an integer but a multiple of 1/8).

ΔN^{TTI} : repeated in each transmission time interval on TrCH *i* with transport *j*.

If negative - number of bits to be punctured in each transmission time interval on *i* format *j*

Used in downlink only.

$_i$: *i*. Signalled from higher layers.

Puncturing limit for uplink. This value limits the amount of puncturing that can be applied in order to avoid

N_{data} : Total number of bits that are available for the combination *j*

I: TrCHs in the

Z_i : Intermediate calculation varia

F_i Number of radio frames in the of TrCH *i*.

$_i$: adio frame number in the transmission time interval of *i* 0 £ n_i F_i

q: Average puncturing or repetition distance (normalised to only show the remaining rate matc an integer number of repetitions). Used in uplink only.

I (n): The inverse interleaving function 1st identical to the interleaving function itself for the 1st

S(n): The shift of the puncturing or repetition pattern for radio frame $_i$. Used in uplink only.

$TF_i(j)$: Transport format of TrCH *i* for the transport format combination *j*.

TFS(i) The set of transport format indexes *l* for TrCH *i*.

TFCS The set of transport format combination indexes *j*.

e_{ini} Initial value of variable *e* in the rate matching pattern determination algorithm of section 4.2.7.5.

e_{plus} Increment of variable *e* in the rate matching pattern determination algorithm of section 4.2.7.5.

e_{minus} Decrement of variable *e* in the rate matching pattern determination algorithm of section 4.2.7.5.

b: Indicates systematic and parity bits

b=1: Systematic bit. *X(t)* in section 4.2.3.2.1.

b=2: 1st parity bit (from the upper Turbo constituent encoder). *Y(t)* in section 4.2.3.2.1.

b=3: 2nd parity bit (from the lower Turbo constituent encoder). *Y'(t)* in section 4.2.3.2.1.

The * (star) notation is used to replace an index *x* when the indexed variable X_x does not depend on the index *x*. In the left wing of an assignment the meaning is that "$X_* = Y$" is equivalent to "**for all** <u>*x*</u> **do** $X_x = Y$ ". In the right wing of an assignment, the meaning is that "$Y = X_*$ " is equivalent to "**take any** <u>*x*</u> **and do** $Y = X_x$ "

The following relations, defined for all TFC *j*, are used when calculating the rate matching parameters:

$$Z_{0,j} = 0$$

$$Z_{ij} = \left\lfloor \frac{\sum_{m=1}^{i} RM_m \cdot N_{mj}}{\sum_{m=1}^{I} RM_m \cdot N_{mj}} \cdot N_{data,j} \right\rfloor \quad \text{for all } i = 1 \text{ .. I} \qquad (1)$$

$$\Delta N_{ij} = Z_{ij} - Z_{i-1,j} - N_{ij} \qquad \text{for all } i = 1 \text{ .. I}$$

4.2.7.2.2.2 Turbo encoded TrCHs

If repetition is to be performed on turbo encoded TrCHs, i.e. $\Delta N_{il}^{TTI} > 0$, the parameters in section 4.2.7.2.2.1 are used.

If puncturing is to be performed, the parameters below shall be used. Index *b* is used to indicate systematic (*b*=1), 1st parity (*b*=2), and 2nd parity bit (*b*=3).

a=2 when *b*=2

a=1 when *b*=3

The bits indicated by *b*=1 shall not be punctured.

$$\Delta N_i = \begin{cases} \lfloor \Delta N_{il}^{TTI} / 2 \rfloor, & b = 2 \\ \lceil \Delta N_{il}^{TTI} / 2 \rceil, & b = 3 \end{cases}$$

For each transmission time interval of TrCH *i* with TF *l*, the rate-matching pattern is calculated with the algorithm in section 4.2.7.5. The following parameters are used as input:

$X_i = N_{il}^{TTI} / 3$ ~~N~~,

$e_{ini} = X_i$,

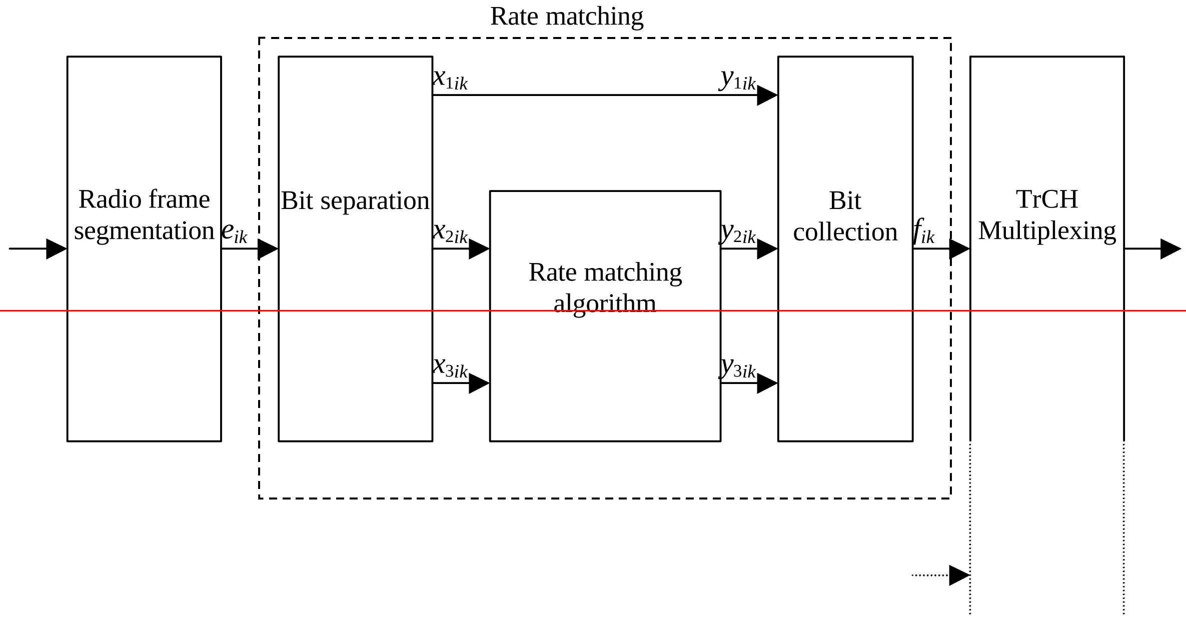
$e_{plus} = a \cdot X_i$

$e_{minus} = a \cdot |\Delta N_i|$

4.2.7.3 Bit separation and collection in uplink

The systematic bits (excluding bits for trellis termination) of turbo encoded TrCHs shall not be punctured. The systematic bit, first parity bit, and second parity bit in the bit sequence input to the rate matching block are therefore separated from each other. Puncturing is only applied to the parity bits and systematic bits used for trellis termination.

The bit separation function is transparent for uncoded TrCHs, convolutionally encoded TrCHs, and for turbo encoded TrCHs with repetition. The bit separation and bit collection are illustrated in figures 6 and 7.



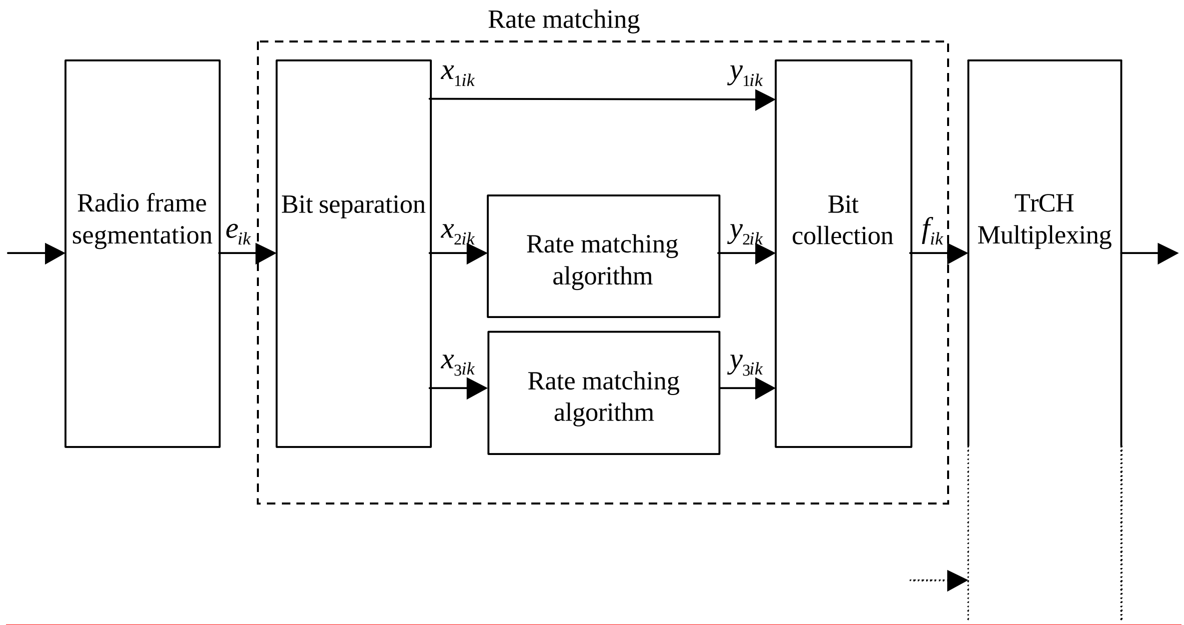


Figure 6: Puncturing of turbo encoded TrCHs in uplink

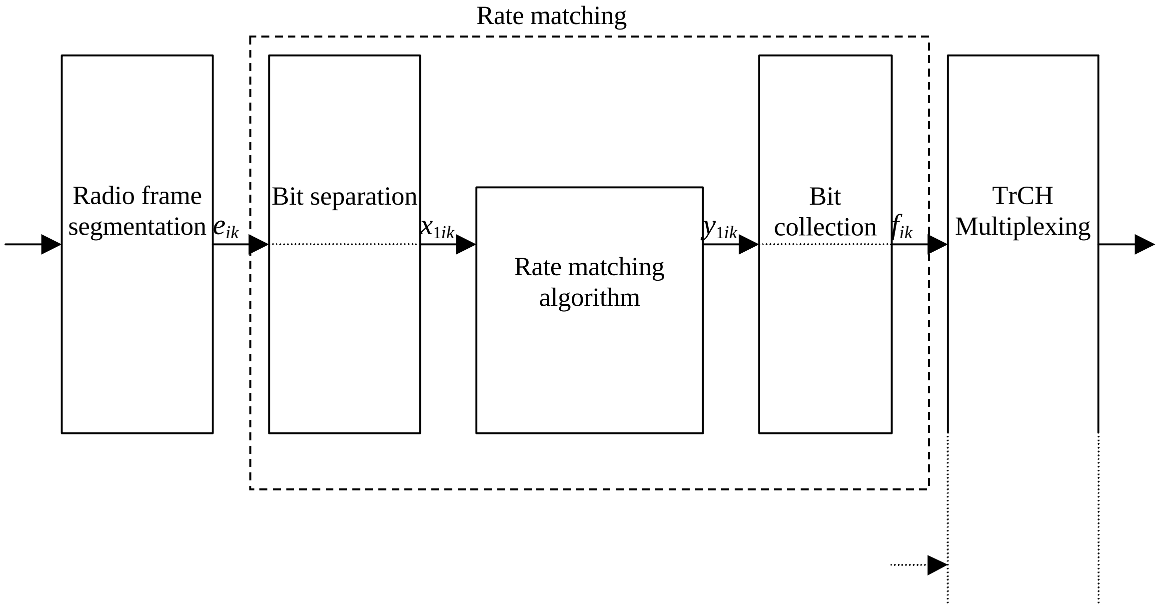


Figure 7: Rate matching for uncoded TrCHs, convolutionally encoded TrCHs, and for turbo encoded TrCHs with repetition in uplink.

The bit separation is dependent on the 1st interleaving and offsets are used to define the separation for different TTIs. The offsets a_b for the systematic (b=1) and parity bits ($b \in \{2, 3\}$) are listed in table 4.

Table 4: TTI dependent offset needed for bit separation

TTI (ms)	a_1	a_2	a_3
10, 40	0	1	2
20, 80	0	2	1

The bit separation is different for different radio frames in the TTI. A second offset is therefore needed. The radio frame number for TrCH i is denoted by n_i. and the offset by b_{n_i} .

Table 5: Radio frame dependent offset needed for bit separation

TTI (ms)	b_0	b_1	b_2	b_3	b_4	b_5	b_6	b_7
10	0	NA	NA	NA	NA	NA	NA	NA
20	0	1	NA	NA	NA	NA	NA	NA
40	0	1	2	0	NA	NA	NA	NA
80	0	1	2	0	1	2	0	1

4.2.7.4 Bit separation and collection in downlink

The systematic bits (excluding bits for trellis termination) of turbo encoded TrCHs shall not be punctured. The systematic bit, first parity bit, and second parity bit in the bit sequence input to the rate matching block are therefore separated from each other. Puncturing is only applied to the parity bits and systematic bits used for trellis termination.

The bit separation function is transparent for uncoded TrCHs, convolutionally encoded TrCHs, and for turbo encoded TrCHs with repetition. The bit separation and bit collection are illustrated in figures 8 and 9.

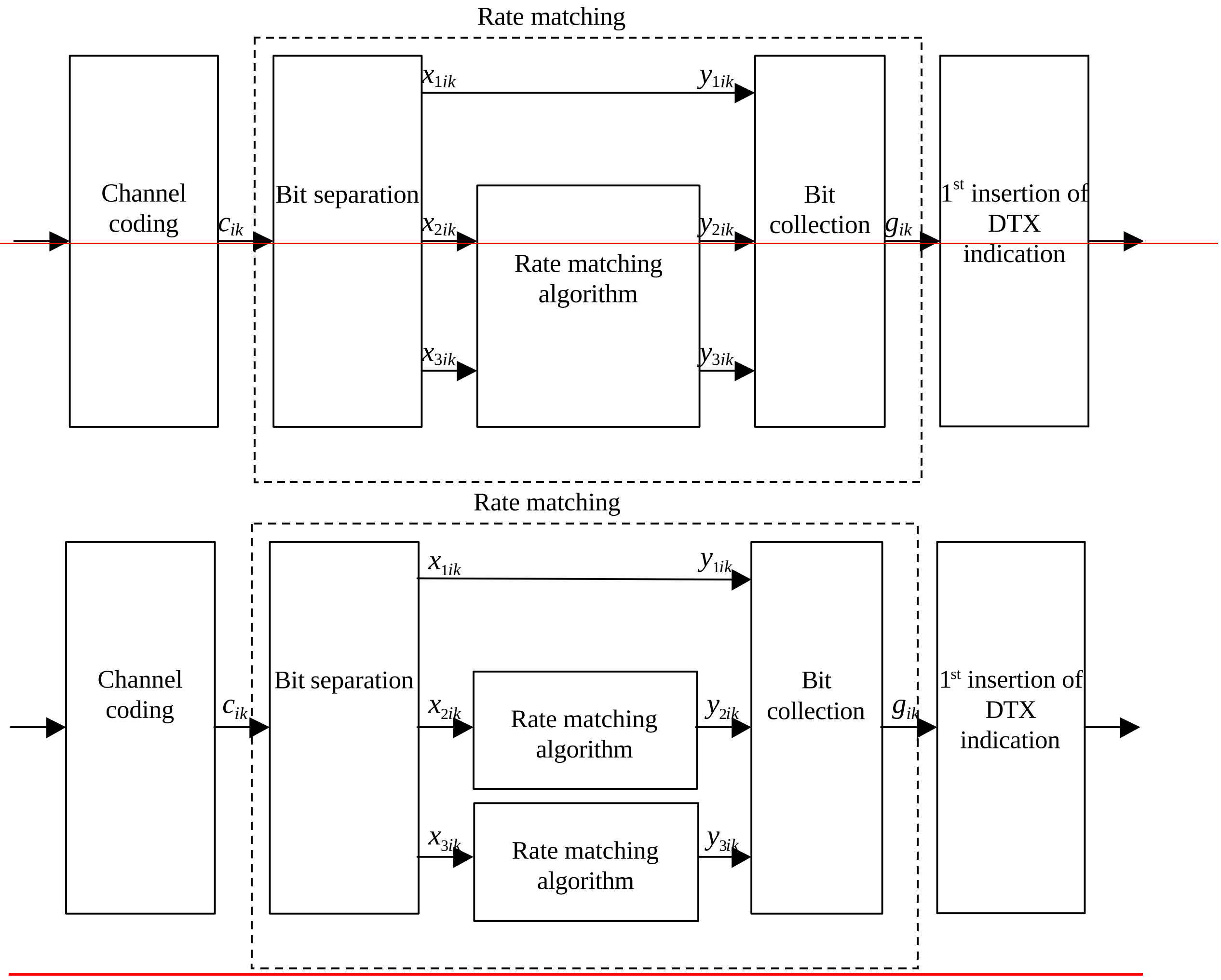


Figure 8: Puncturing of turbo encoded TrCHs in downlink

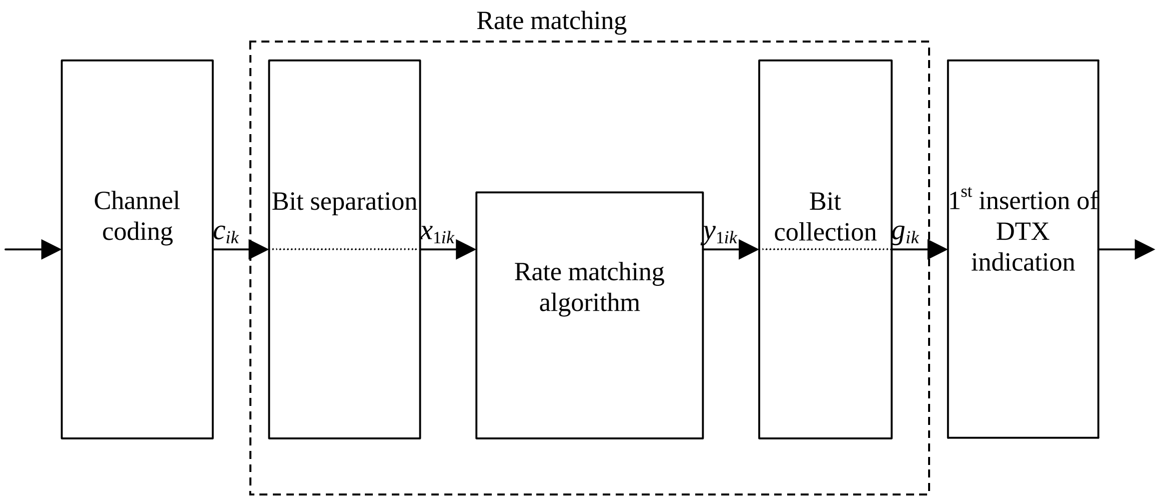


Figure 9: Rate matching for uncoded TrCHs, convolutionally encoded TrCHs, and for turbo encoded TrCHs with repetition in downlink.

4.2.7.5 Rate matching pattern determination

Denote the bits before rate matching by:

$x_{i1}, x_{i2}, x_{i3}, \ldots, x_{iX_i}$, where *i* is the TrCH number and the sequence is defined in 4.2.7.3 for uplink or in 4.2.7.4 for downlink. Parameters X_i, e_{ini}, e_{plus}, and e_{minus} ~~is the parameter given in sections 4.2.7.1 and 4.2.7.2~~are given in 4.2.7.1 for uplink or in 4.2.7.2 for downlink.

The rate matching rule is as follows:

```
if puncturing is to be performed
    e = e_ini        -- initial error between current and desired puncturing ratio
    m = 1            -- index of current bit
    do while m <= X_i
        e = e – e_minus        -- update error
        if e <= 0 then         -- check if bit number m should be punctured
            set bit x_i,m to d where d Ï {0, 1}
            e = e + e_plus   -- update error
        end if
        m = m + 1              --  next bit
    end do
else
    e = e_ini            -- initial error between current and desired puncturing ratio
    m = 1                -- index of current bit
    do while m <= X_i
        e = e – e_minus        -- update error
        do while e <= 0        -- check if bit number m should be repeated
            repeat bit x_i,m
            e = e + e_plus   -- update error
        end do
        m = m + 1                 --  next bit
    end do
end if
```

A repeated bit is placed directly after the original one.

4.4.1 Frame structure in the uplink

The frame structure for uplink compressed mode is illustrated in figure 13.

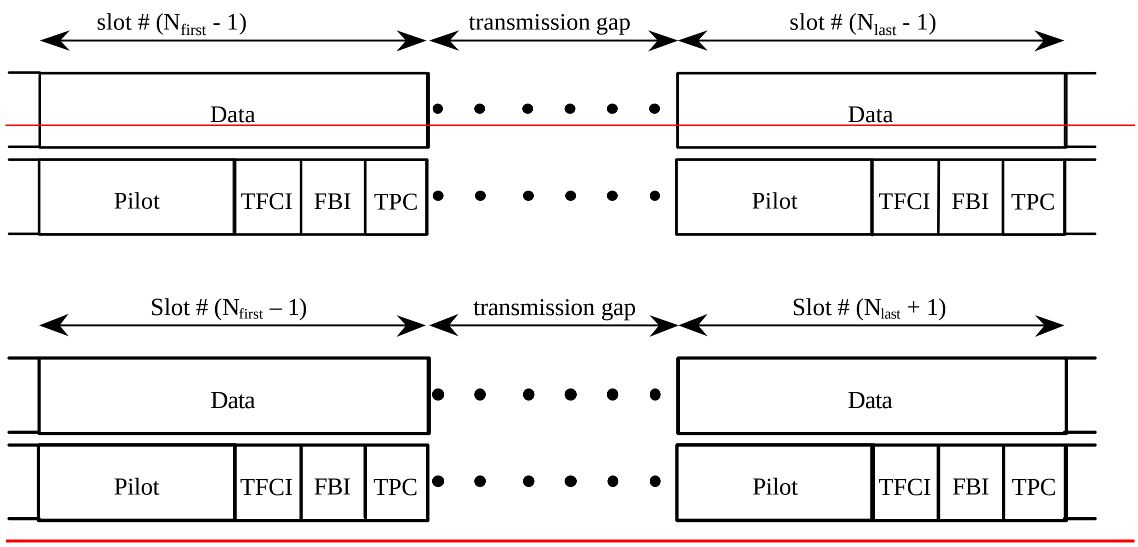


Figure 13: Frame structure in uplink compressed transmission