## 3GPP TSG-RAN Meeting #15
## Jeju, Korea, 5 – 8, March, 2002

***RP-020059***

**Title:** **Agreed CRs (R99 and Rel-4 Category A) for the removal of channel coding option of "no coding"**

**Source:** **TSG-RAN WG1**

**Agenda item:** **7.1.2**

| No. | Spec | CR | Rev | R1 T-doc | Subject | Release | Cat | Workitem | V_old | V_new |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 25.201 | 009 | 1 | R1-02-0495 | Removal of channel coding option “no coding” for FDD and 3.84 Mcps TDD | R99 | F | TEI | 3.2.0 | 3.3.0 |
| 2 | 25.201 | 010 | - | R1-02-0495 | Removal of channel coding option “no coding” for FDD and 3.84 Mcps TDD | Rel-4 | A | TEI | 4.1.0 | 4.2.0 |
| 3 | 25.212 | 127 | 1 | R1-02-0308 | Removal of channel coding option “no coding” for FDD | R99 | F | TEI | 3.8.0 | 3.9.0 |
| 4 | 25.212 | 128 | 1 | R1-02-0308 | Removal of channel coding option “no coding” for FDD | Rel-4 | A | TEI | 4.3.0 | 4.4.0 |
| 5 | 25.215 | 110 | - | R1-02-0306 | Removal of channel coding option “no coding” for FDD | R99 | F | TEI | 3.9.0 | 3.10.0 |
| 6 | 25.215 | 111 | - | R1-02-0306 | Removal of channel coding option “no coding” for FDD | Rel-4 | A | TEI | 4.3.0 | 4.4.0 |
| 7 | 25.222 | 067 | 1 | R1-02-0309 | Removal of channel coding option “no coding” for 3.84 Mcps TDD | R99 | F | TEI | 3.7.0 | 3.8.0 |
| 8 | 25.222 | 068 | 1 | R1-02-0309 | Removal of channel coding option "no coding" for 3.84 Mcps TDD | Rel-4 | A | TEI | 4.2.0 | 4.3.0 |
| 9 | 25.225 | 044 | - | R1-02-0307 | Removal of channel coding option “no coding” 3.84 Mcps TDD | R99 | F | TEI | 3.9.0 | 3.10.0 |
| 10 | 25.225 | 045 | - | R1-02-0307 | Removal of channel coding option “no coding” for 3.84 Mcps TDD | Rel-4 | A | TEI | 4.3.0 | 4.4.0 |

***R1-02-0495***

*CR-Form-v5*

# CHANGE REQUEST

| | | | | | | |
|---|---|---|---|---|---|---|
| ⌘ | **25.201** | **CR** | **009** | ⌘ **rev** | **1** ⌘ | Current version: **3.2.0** ⌘ |

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

***Proposed change affects:*** ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [X] Core Network [ ]

| | | | |
|---|---|---|---|
| ***Title:*** ⌘ | Removal of channel coding option "no coding" for FDD and 3.84 Mcps TDD | | |
| ***Source:*** ⌘ | TSG RAN WG1 | | |
| ***Work item code:*** ⌘ | TEI | ***Date:*** ⌘ | 18.02.2002 |
| ***Category:*** ⌘ | F | ***Release:*** ⌘ | R99 |
| | *Use one of the following categories:*<br>***F*** *(correction)*<br>***A*** *(corresponds to a correction in an earlier release)*<br>***B*** *(addition of feature),*<br>***C*** *(functional modification of feature)*<br>***D*** *(editorial modification)*<br>Detailed explanations of the above categories can be found in 3GPP TR 21.900. | | *Use one of the following releases:*<br>*2 (GSM Phase 2)*<br>*R96 (Release 1996)*<br>*R97 (Release 1997)*<br>*R98 (Release 1998)*<br>*R99 (Release 1999)*<br>*REL-4 (Release 4)*<br>*REL-5 (Release 5)* |

| | |
|---|---|
| ***Reason for change:*** ⌘ | At the last joint AdHoc RAN1/RAN2 meeting it has been agreed to remove the channel coding option "no coding" for FDD and 3.84 Mcps TDD. For 1.28 Mcps TDD this option is still valid. |
| ***Summary of change:*** ⌘ | The channel coding option "no coding" has been removed in the IE "Type of channel coding".<br><br>**Isolated Impact Analysis**<br><br>This change affects the channel coding type.<br><br>It would not affect implementations behaving like indicated in the CR, it would affect implementations supporting the corrected functionality otherwise. |
| ***Consequences if not approved:*** ⌘ | An option that is not used by any Radio Bearer would be a mandatory feature for all UEs. |

| | | |
|---|---|---|
| ***Clauses affected:*** ⌘ | | |
| ***Other specs affected:*** ⌘ | [X] Other core specifications ⌘<br>[ ] Test specifications<br>[ ] O&M Specifications | 25.212, 25.222 |
| ***Other comments:*** ⌘ | | |

**How to create CRs using this form:**
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

## 4.2.2 Channel coding and interleaving

For the channel coding in UTRA ~~three~~ two options are supported:

- Convolutional coding.
- Turbo coding.
- ~~No coding.~~

Channel coding selection is indicated by higher layers. In order to randomise transmission errors, bit interleaving is performed further.

**3GPP TSG RAN Meeting #15**
**Jeju, Korea, 5 – 8, March, 2002**

***R1-02-0495***

*CR-Form-v5*

# CHANGE REQUEST

| | | | | | | |
|---|---|---|---|---|---|---|
| ⌘ | **25.201** | **CR 010** | ⌘ **rev** | **-** | ⌘ Current version: | **4.1.0** ⌘ |

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***Proposed change affects:*** ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [X] Core Network [ ]

| | | |
|---|---|---|
| ***Title:*** | ⌘ | Removal of channel coding option "no coding" for FDD and 3.84 Mcps TDD |
| ***Source:*** | ⌘ | TSG RAN WG1 |
| ***Work item code:*** | ⌘ | TEI |
| ***Date:*** | ⌘ | 18.02.2002 |
| ***Category:*** | ⌘ | A |
| ***Release:*** | ⌘ | REL-4 |

*Use one of the following categories:*
***F*** *(correction)*
***A*** *(corresponds to a correction in an earlier release)*
***B*** *(addition of feature),*
***C*** *(functional modification of feature)*
***D*** *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

*Use one of the following releases:*
*2 (GSM Phase 2)*
*R96 (Release 1996)*
*R97 (Release 1997)*
*R98 (Release 1998)*
*R99 (Release 1999)*
*REL-4 (Release 4)*
*REL-5 (Release 5)*

| | | |
|---|---|---|
| ***Reason for change:*** | ⌘ | At the last joint AdHoc RAN1/RAN2 meeting it has been agreed to remove the channel coding option "no coding" for FDD and 3.84 Mcps TDD. For 1.28 Mcps TDD this option is still valid. |
| ***Summary of change:*** | ⌘ | The channel coding option "no coding" has been removed in the IE "Type of channel coding".<br>**Isolated Impact Analysis**<br>This change affects the channel coding type.<br>It would not affect implementations behaving like indicated in the CR, it would affect implementations supporting the corrected functionality otherwise. |
| ***Consequences if not approved:*** | ⌘ | An option that is not used by any Radio Bearer would be a mandatory feature for all UEs. |

| | | | | |
|---|---|---|---|---|
| ***Clauses affected:*** | ⌘ | 4.2.2 | | |
| ***Other specs affected:*** | ⌘ | [X] | Other core specifications | ⌘ 25.212, 25.222 |
| | | [ ] | Test specifications | |
| | | [ ] | O&M Specifications | |
| ***Other comments:*** | ⌘ | | | |

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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

### 4.2.2 Channel coding and interleaving

For the channel coding in UTRA three options are supported:

- Convolutional coding.
- Turbo coding.
- No coding (only 1.28 Mcps TDD).

Channel coding selection is indicated by higher layers. In order to randomise transmission errors, bit interleaving is performed further.

**3GPP TSG RAN Meeting #15**
**Jeju, Korea, 5 – 8, March, 2002**

***R1-02-0308***

*CR-Form-v5*

# CHANGE REQUEST

⌘ **25.212 CR 127** ⌘ **rev 1** ⌘ Current version: **3.8.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

***Proposed change affects:*** ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [X] Core Network [ ]

| | | | |
|---|---|---|---|
| ***Title:*** ⌘ | Removal of channel coding option "no coding" for FDD | | |
| ***Source:*** ⌘ | TSG RAN WG1 | | |
| ***Work item code:*** ⌘ | TEI | ***Date:*** ⌘ | 18.02.2002 |
| ***Category:*** ⌘ | **F**<br>*Use one of the following categories:*<br>***F*** *(correction)*<br>***A*** *(corresponds to a correction in an earlier release)*<br>***B*** *(addition of feature),*<br>***C*** *(functional modification of feature)*<br>***D*** *(editorial modification)*<br>Detailed explanations of the above categories can be found in 3GPP TR 21.900. | ***Release:*** ⌘ | R99<br>*Use one of the following releases:*<br>*2 (GSM Phase 2)*<br>*R96 (Release 1996)*<br>*R97 (Release 1997)*<br>*R98 (Release 1998)*<br>*R99 (Release 1999)*<br>*REL-4 (Release 4)*<br>*REL-5 (Release 5)* |

| | |
|---|---|
| ***Reason for change:*** ⌘ | At the last joint AdHoc RAN1/RAN2 meeting it has been agreed to remove the channel coding option "no coding" for FDD and 3.84 Mcps TDD. For 1.28 Mcps TDD this option is still valid. |
| ***Summary of change:*** ⌘ | The channel coding option "no coding" has been removed in the IE "Type of channel coding".<br>**Isolated Impact Analysis**<br>This change affects the channel coding type.<br>It would not affect implementations behaving like indicated in the CR, it would affect implementations supporting the corrected functionality otherwise. |
| ***Consequences if not approved:*** ⌘ | An option that is not used by any Radio Bearer would be a mandatory feature for all UEs. |

| | | |
|---|---|---|
| ***Clauses affected:*** ⌘ | 4.2.2, 4.2.3, 4.2.7.1, 4.2.7.2, 4.2.7.3, 4.2.7.4 | |
| ***Other specs affected:*** ⌘ | [X] Other core specifications ⌘<br>[ ] Test specifications<br>[ ] O&M Specifications | 25.201, 25.215, 25.222, 25.225 |
| ***Other comments:*** ⌘ | | |

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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

## 4.2.2 Transport block concatenation and code block segmentation

All transport blocks in a TTI are serially concatenated. If the number of bits in a TTI is larger than $Z$, the maximum size of a code block in question, then code block segmentation is performed after the concatenation of the transport blocks. The maximum size of the code blocks depends on whether convolutional coding or ~~,~~ turbo coding ~~or no coding~~ is used for the TrCH.

### 4.2.2.1 Concatenation of transport blocks

The bits input to the transport block concatenation are denoted by $b_{im1}, b_{im2}, b_{im3}, \ldots, b_{imB_i}$ where $i$ is the TrCH number, $m$ is the transport block number, and $B_i$ is the number of bits in each block (including CRC). The number of transport blocks on TrCH $i$ is denoted by $M_i$. The bits after concatenation are denoted by $x_{i1}, x_{i2}, x_{i3}, \ldots, x_{iX_i}$, where $i$ is the TrCH number and $X_i = M_i B_i$. They are defined by the following relations:

$x_{ik} = b_{i1k}$ $k = 1, 2, \ldots, B_i$

$x_{ik} = b_{i,2,(k-B_i)}$ $k = B_i + 1, B_i + 2, \ldots, 2B_i$

$x_{ik} = b_{i,3,(k-2B_i)}$ $k = 2B_i + 1, 2B_i + 2, \ldots, 3B_i$

…

$x_{ik} = b_{i,M_i,(k-(M_i-1)B_i)}$ $k = (M_i - 1)B_i + 1, (M_i - 1)B_i + 2, \ldots, M_iB_i$

### 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 beginning of the first block. If turbo coding is selected and $X_i < 40$, filler bits are added to the beginning of the code 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, for $C_i \neq 0$, 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 per code block.

Number of code blocks:

$$_i = \lceil X_i / Z \rceil$$

~~$$C_i = \begin{cases} \lceil X_i / Z \rceil & \text{when } Z \neq \textit{unlimited} \\ 0 & \text{when } Z = \textit{unlimited} \text{ and } X_i = 0 \\ 1 & \text{when } Z = \textit{unlimited} \text{ and } X_i \neq 0 \end{cases}$$~~

Number of bits in each code block (applicable for $C_i \neq 0$ only):

if $X_i < 40$ and Turbo coding is used, then

$K_i = 40$

else

$K_i = \lceil X_i / C_i \rceil$

end if

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

for $k = 1$ to $Y_i$ -- Insertion of filler bits

$o_{i1k} = 0$

end for

for $k = Y_i+1$ to $K_i$

$o_{i1k} = x_{i,(k-Y_i)}$

end for

$r = 2$ -- Segmentation

while $r \leq C_i$

for $k = 1$ to $K_i$

$o_{irk} = x_{i,(k+(r-1)\cdot K_i - Y_i)}$

end for

$r = r+1$

end while

### 4.2.3 Channel coding

Code blocks are delivered to the channel coding block. They 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 in each code block. The number of code blocks on TrCH $i$ is denoted by $C_i$. After encoding the bits are denoted by $y_{ir1}, y_{ir2}, y_{ir3}, \ldots, y_{irY_i}$, where $Y_i$ is the number of encoded bits. The relation between $o_{irk}$ and $y_{irk}$ and between $K_i$ and $Y_i$ is dependent on the channel coding scheme.

The following channel coding schemes can be applied to TrCHs:

- convolutional coding;
- turbo coding;
- ~~no coding.~~

Usage of coding scheme and coding rate for the different types of TrCH is shown in table 1.

The values of $Y_i$ in connection with each coding scheme:

- convolutional coding with rate 1/2: $Y_i = 2*K_i + 16$; rate 1/3: $Y_i = 3*K_i + 24$;
- turbo coding with rate 1/3: $Y_i = 3*K_i + 12$;
- ~~no coding: $Y_i = K_i$.~~

**Table 1: Usage of channel coding scheme and coding rate**

| Type of TrCH | Coding scheme | Coding rate |
|---|---|---|
| BCH | Convolutional coding | 1/2 |
| PCH | | |
| RACH | | |
| CPCH, DCH, DSCH, FACH | | 1/3, 1/2 |
| | Turbo coding | 1/3 |
| | ~~No coding~~ | |

#### 4.2.7.1.2 Determination of parameters needed for calculating the rate matching pattern

The number of bits to be repeated or punctured, $\Delta N_{i,j}$, within one radio frame for each TrCH *i* is calculated with equation 1 for all possible transport format combinations *j* and selected every radio frame. $N_{data,j}$ is given from subclause 4.2.7.1.1.

In a compressed radio frame, $N_{data,j}$ is replaced by $N_{data,j}^{cm}$ in Equation 1. $N_{data,j}^{cm}$ is given as follows:

In a radio frame compressed by higher layer scheduling, $N_{data,j}^{cm}$ is obtained by executing the algorithm in subclause 4.2.7.1.1 but with the number of bits in one radio frame of one PhCH reduced to $\frac{N_{tr}}{15}$ of the value in normal mode.

$N_{tr}$ is the number of transmitted slots in a compressed radio frame and is defined by the following relation:

$$N_{tr} = \begin{cases} 15 - TGL, & \text{if } N_{first} + TGL \le 15 \\ N_{first}, & \text{in first frame if } N_{first} + TGL > 15 \\ 30 - TGL - N_{first}, & \text{in second frame if } N_{first} + TGL > 15 \end{cases}$$

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

In a radio frame compressed by spreading factor reduction, $N_{data,j}^{cm} = 2 \times \left(N_{data,j} - N_{TGL}\right)$, where

$$N_{TGL} = \frac{15 - N_{tr}}{15} \times N_{data,j}$$

If $\Delta N_{i,j} = 0$ then the output data of the rate matching is the same as the input data and the rate matching algorithm of subclause 4.2.7.5 does not need to be executed.

If $\Delta N_{i,j} \neq 0$ the parameters listed in subclauses 4.2.7.1.2.1 and 4.2.7.1.2.2 shall be used for determining $e_{ini}$, $e_{plus}$, and $e_{minus}$ (regardless if the radio frame is compressed or not).

##### 4.2.7.1.2.1 ~~Uncoded and c~~Convolutionally encoded TrCHs

$R = \Delta N_{i,j} \bmod N_{i,j}$ -- note: in this context $\Delta N_{i,j} \bmod N_{i,j}$ is in the range of 0 to $N_{ij}$-1 i.e. -1 mod 10 = 9.

if $R \neq 0$ and $2 \times R \leq N_{ij}$

then $q = \lceil N_{i,j} / R \rceil$

else

$q = \lceil N_{i,j} / (R - N_{i,j}) \rceil$

endif

-- note: q is a signed quantity.

if q is even

then $q' = q + \gcd(|q|, F_i)/F_i$ -- where $\gcd(|q|, F_i)$ means greatest common divisor of $|q|$ and $F_i$

-- note that q' is not an integer, but a multiple of 1/8

else

q' = q

endif

for $x = 0$ to $F_i - 1$

$S[\lfloor \lfloor x \times q' \rfloor \rfloor \bmod F_i] = (\lfloor \lfloor x \times q' \rfloor \rfloor \text{ div } F_i)$

end for

$\Delta N_i = \Delta N_{i,j}$

a = 2

For each radio frame, the rate-matching pattern is calculated with the algorithm in subclause 4.2.7.5, where :

$X_i = N_{i,j}$., and

$e_{ini} = (a \times S[P1_{Fi}(n_i)] \times |\Delta N_i| + 1) \bmod (a \cdot N_{ij})$.

$e_{\text{plus}} = a \times N_{i,j}$

$e_{\text{minus}} = a \times |\Delta N_i|$

puncturing for $\Delta N < 0$, repetition otherwise.

#### 4.2.7.2.1.3 Determination of rate matching parameters for ~~uncoded and~~ convolutionally encoded TrCHs

$\Delta N_i = \Delta N_{i,max}$

For compressed mode by puncturing, $\Delta N_i$ is defined as: $\Delta N_i = \Delta N_{i,\max}^{TTI,cm,m}$, instead of the previous relation.

$a$=2

$N_{max} = \max_{l \in TFS(i)} N_{il}^{TTI}$

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

$X_i = N_{il}^{TTI}$

$e_{ini} = 1$

$e_{plus} = a \times N_{max}$

$e_{\min us} = a \times |\Delta N_i|$

Puncturing if $\Delta N_i < 0$, repetition otherwise. The values of $\Delta N_{i,l}^{TTI}$ may be computed by counting repetitions or puncturing when the algorithm of subclause 4.2.7.5 is run. The resulting values of $\Delta N_{i,l}^{TTI}$ can be represented with following expression.

$$\Delta N_{i,l}^{TTI} = \left\lceil \frac{|\Delta N_i| \times X_i}{N_{max}} \right\rceil \times \mathrm{sgn}(\Delta N_i)$$

For compressed mode by puncturing, the above formula produces $\Delta N_{i,l}^{TTI,m}$ instead of $\Delta N_{i,l}^{TTI}$.

#### 4.2.7.2.1.4 Determination of rate matching parameters for Turbo encoded TrCHs

If repetition is to be performed on turbo encoded TrCHs, i.e. $\Delta N_{i,max} > 0$, the parameters in subclause 4.2.7.2.1.3 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.

$$\Delta N_i^b = \begin{cases} \lfloor \Delta N_{i,max}/2 \rfloor, & \text{for } b = 2 \\ \lceil \Delta N_{i,max}/2 \rceil, & \text{for } b = 3 \end{cases}$$

In Compressed Mode by puncturing, the following relations are used instead of the previous ones:

$\Delta N_i^b = \lfloor \Delta N_{i,\max}^{TTI,cm,m}/2 \rfloor$, for *b=2*

$\Delta N_{i\ I}^b = \lceil \Delta N_{i,\max}^{TTI,cm,m}/2 \rceil$, for *b=3*

$$N_{max} = \max_{l \in TFS(i)} (N_{il}^{TTI} / 3)$$

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

$$X_i = N_{il}^{TTI} / 3$$

$$e_{ini} = N_{max}$$

$$e_{plus} = a \times N_{max}$$

$$e_{minus} = a \times \left| \Delta N_i^b \right|$$

The values of $\Delta N_{i,l}^{TTI}$ may be computed by counting puncturing when the algorithm of subclause 4.2.7.5 is run. The resulting values of $\Delta N_{i,l}^{TTI}$ can be represented with following expression.

$$\Delta N_{i,l}^{TTI} = -\left\lfloor \frac{\left| \Delta N_i^2 \right| \times X_i}{N_{max}} + 0.5 \right\rfloor - \left\lfloor \frac{\left| \Delta N_i^3 \right| \times X_i}{N_{max}} \right\rfloor$$

In the above equation, the first term of the right hand side represents the amount of puncturing for *b*=2 and the second term represents the amount of puncturing for *b*=3.

For compressed mode by puncturing, the above formula produces $\Delta N_{i,l}^{TTI,m}$ instead of $\Delta N_{i,l}^{TTI}$ .

#### 4.2.7.2.2.2 Determination of rate matching parameters for ~~uncoded and~~ convolutionally encoded TrCHs

$$\Delta N_i = \Delta N_{il}^{TTI}$$

*a=2*

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

$$X_i = N_{il}^{TTI}$$

$$e_{ini} = 1$$

$$e_{plus} = a \times N_{il}^{TTI}$$

$$e_{\min us} = a \times \left| \Delta N_i \right|$$

puncturing for $\Delta N_i < 0$, repetition otherwise.

### 4.2.7.3 Bit separation and collection in uplink

The systematic bits of turbo encoded TrCHs shall not be punctured, the other bits may be punctured. The systematic bits, first parity bits, and second parity bits in the bit sequence input to the rate matching block are therefore separated into three sequences.

The first sequence contains:

- All of the systematic bits that are from turbo encoded TrCHs.
- From 0 to 2 first and/or second parity bits that are from turbo encoded TrCHs. These bits come into the first sequence when the total number of bits in a block after radio frame segmentation is not a multiple of three.
- Some of the systematic, first parity and second parity bits that are for trellis termination.

The second sequence contains:

- All of the first parity bits that are from turbo encoded TrCHs, except those that go into the first sequence when the total number of bits is not a multiple of three.
- Some of the systematic, first parity and second parity bits that are for trellis termination.

The third sequence contains:

- All of the second parity bits that are from turbo encoded TrCHs, except those that go into the first sequence when the total number of bits is not a multiple of three.
- Some of the systematic, first parity and second parity bits that are for trellis termination.

The second and third sequences shall be of equal length, whereas the first sequence can contain from 0 to 2 more bits. Puncturing is applied only to the second and third sequences.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 5 and 6.

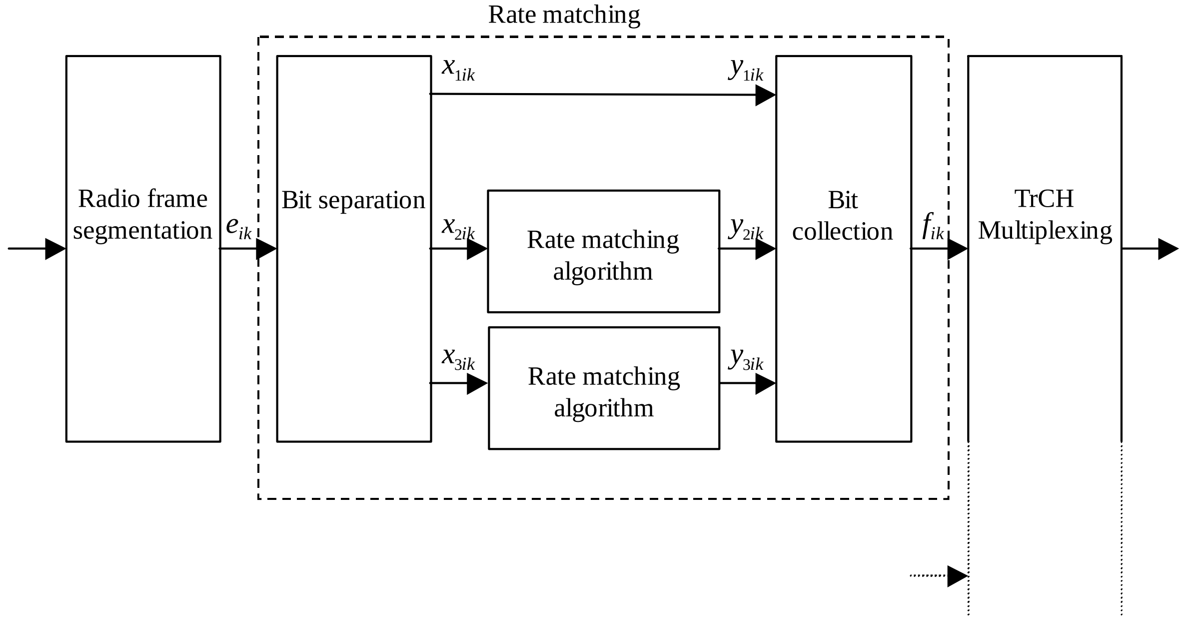


**Figure 5: Puncturing of turbo encoded TrCHs in uplink**

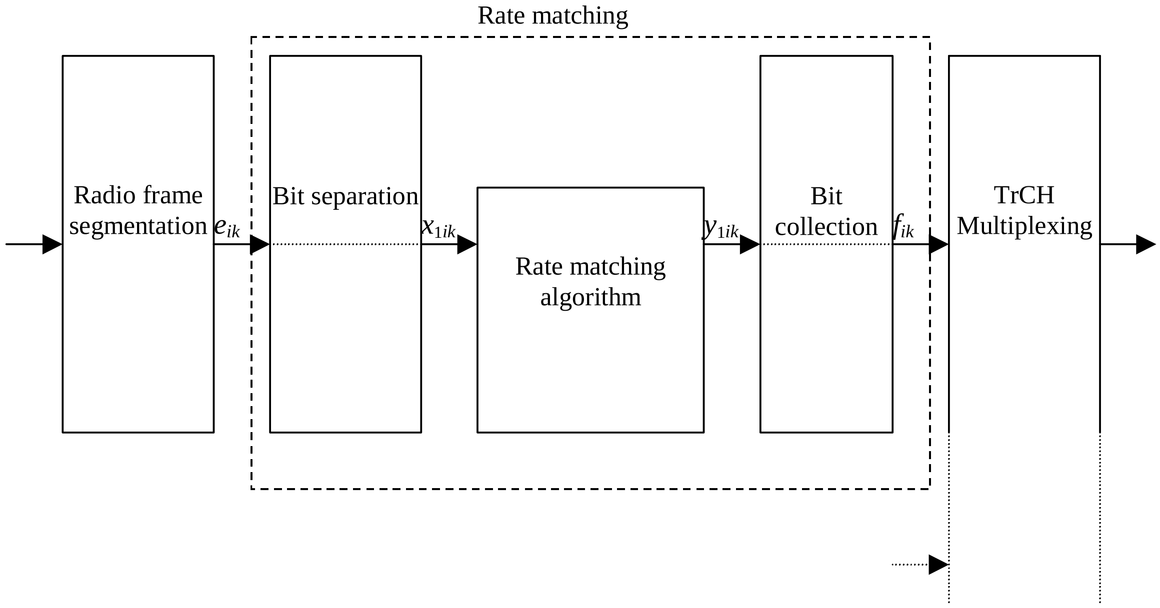


**Figure 6: Rate matching for ~~uncoded TrCHs,~~ convolutionally encoded TrCHs~~,~~ and for turbo encoded TrCHs with repetition in uplink**

The bit separation is dependent on the 1st interleaving and offsets are used to define the separation for different TTIs. *b* indicates the three sequences defined in this section, with *b*=1 indicating the first sequence, *b* = 2 the second one, and *b* = 3 the third one. The offsets $\alpha_b$ for these sequences are listed in table 5.

**Table 5: TTI dependent offset needed for bit separation**

| TTI (ms) | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ |
|---|---|---|---|
| 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 $\beta_{n_i}$ .

**Table 6: Radio frame dependent offset needed for bit separation**

| TTI (ms) | $\beta_0$ | $\beta_1$ | $\beta_2$ | $\beta_3$ | $\beta_4$ | $\beta_5$ | $\beta_6$ | $\beta_7$ |
|---|---|---|---|---|---|---|---|---|
| 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 |

### 4.2.7.3.1 Bit separation

The bits input to the rate matching are 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 input to the rate matching block. Note that the transport format combination number *j* for simplicity has been left out in the bit numbering, i.e. $N_i$=$N_{ij}$. The bits after separation are denoted by $x_{bi1}, x_{bi2}, x_{bi3}, \ldots, x_{biX_i}$ . For turbo encoded TrCHs with puncturing, *b* indicates the three sequences defined in section 4.2.7.3, with *b*=1 indicating the first sequence, and so forth. For all other cases *b* is defined to be 1. $X_i$ is the number of bits in each separated bit sequence. The relation between $e_{ik}$ and $x_{bik}$ is given below.

For turbo encoded TrCHs with puncturing:

$$x_{1,i,k} = e_{i,3(k-1)+1+(\alpha_1+\beta_{n_i}) \bmod 3} \qquad k = 1, 2, 3, \ldots, X_i \qquad X_i = \lfloor N_i / 3 \rfloor$$

$x_{1,i,\lfloor N_i/3 \rfloor + k} = e_{i,3\lfloor N_i/3 \rfloor + k}$ $k$ = 1, …, $N_i$ mod 3 Note: When ($N_i$ mod 3) = 0 this row is not needed.

$x_{2,i,k} = e_{i,3(k-1)+1+(\alpha_2+\beta_{n_i}) \bmod 3}$ $k$ = 1, 2, 3, …, $X_i$ $X_i = \lfloor N_i/3 \rfloor$

$x_{3,i,k} = e_{i,3(k-1)+1+(\alpha_3+\beta_{n_i}) \bmod 3}$ $k$ = 1, 2, 3, …, $X_i$ $X_i = \lfloor N_i/3 \rfloor$

For ~~uncoded TrCHs,~~ convolutionally encoded TrCHs~~,~~ and turbo encoded TrCHs with repetition:

$x_{1,i,k} = e_{i,k}$ $k$ = 1, 2, 3, …, $X_i$ $X_i = N_i$

### 4.2.7.3.2 Bit collection

The bits $x_{bik}$ are input to the rate matching algorithm described in subclause 4.2.7.5. The bits output from the rate matching algorithm are denoted $y_{bi1}, y_{bi2}, y_{bi3}, \ldots, y_{biY_i}$.

Bit collection is the inverse function of the separation. The bits after collection are denoted by $z_{bi1}, z_{bi2}, z_{bi3}, \ldots, z_{biY_i}$. After bit collection, the bits indicated as punctured are removed and the bits are then denoted by $f_{i1}, f_{i2}, f_{i3}, \ldots, f_{iV_i}$, where $i$ is the TrCH number and $V_i = N_{ij} + \Delta N_{ij}$. The relations between $y_{bik}$, $z_{bik}$, and $f_{ik}$ are given below.

For turbo encoded TrCHs with puncturing ($Y_i$=$X_i$):

$z_{i,3(k-1)+1+(\alpha_1+\beta_{n_i}) \bmod 3} = y_{1,i,k}$ $k$ = 1, 2, 3, …, $Y_i$

$z_{i,3\lfloor N_i/3 \rfloor + k} = y_{1,i,\lfloor N_i/3 \rfloor + k}$ $k$ = 1, …, $N_i$ mod 3 Note: When ($N_i$ mod 3) = 0 this row is not needed.

$z_{i,3(k-1)+1+(\alpha_2+\beta_{n_i}) \bmod 3} = y_{2,i,k}$ $k$ = 1, 2, 3, …, $Y_i$

$z_{i,3(k-1)+1+(\alpha_3+\beta_{n_i}) \bmod 3} = y_{3,i,k}$ $k$ = 1, 2, 3, …, $Y_i$

After the bit collection, bits $z_{i,k}$ with value $\delta$, where $\delta \notin \{0, 1\}$, are removed from the bit sequence. Bit $f_{i,1}$ corresponds to the bit $z_{i,k}$ with smallest index $k$ after puncturing, bit $f_{i,2}$ corresponds to the bit $z_{i,k}$ with second smallest index $k$ after puncturing, and so on.

For ~~uncoded TrCHs,~~ convolutionally encoded TrCHs~~,~~ and turbo encoded TrCHs with repetition:

$z_{i,k} = y_{1,i,k}$ $k$ = 1, 2, 3, …, $Y_i$

When repetition is used, $f_{i,k}$=$z_{i,k}$ and $Y_i$=$V_i$.

When puncturing is used, $Y_i$=$X_i$ and bits $z_{i,k}$ with value $\delta$, where $\delta \notin \{0, 1\}$, are removed from the bit sequence. Bit $f_{i,1}$ corresponds to the bit $z_{i,k}$ with smallest index $k$ after puncturing, bit $f_{i,2}$ corresponds to the bit $z_{i,k}$ with second smallest index $k$ after puncturing, and so on.

## 4.2.7.4 Bit separation and collection in downlink

The systematic bits of turbo encoded TrCHs shall not be punctured, the other bits may be punctured.

The systematic bits, first parity bits and second parity bits in the bit sequence input to the rate matching block are therefore separated into three sequences of equal lengths.

The first sequence contains :

- All of the systematic bits that are from turbo encoded TrCHs.
- Some of the systematic, first parity and second parity bits that are for trellis termination.

The second sequence contains:

- All of the first parity bits that are from turbo encoded TrCHs.
- Some of the systematic, first parity and second parity bits that are for trellis termination.

The third sequence contains:

- All of the second parity bits that are from turbo encoded TrCHs.
- Some of the systematic, first parity and second parity bits that are for trellis termination.

Puncturing is applied only to the second and third sequences.

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 7 and 8.

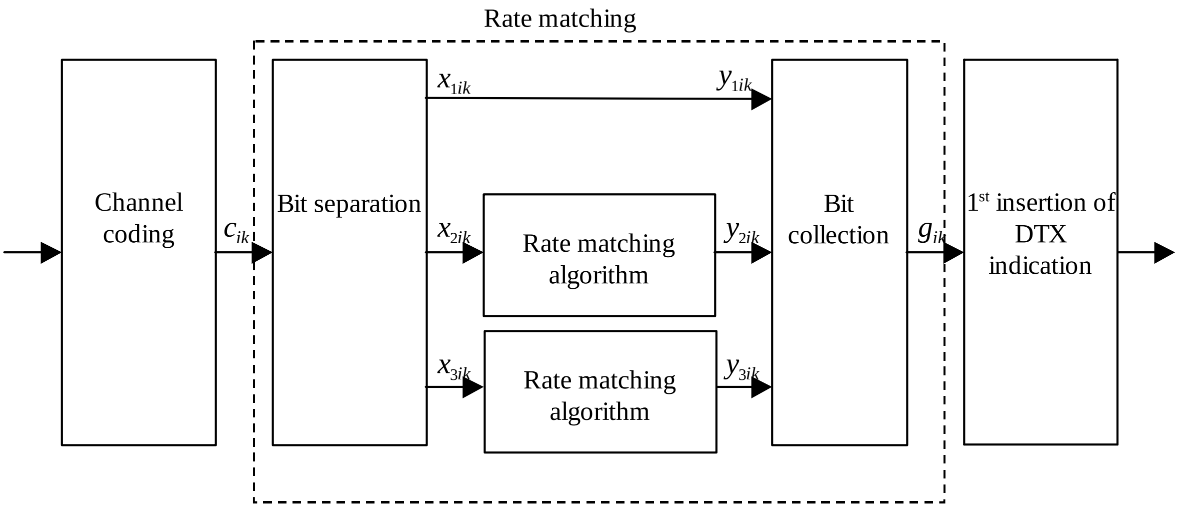


**Figure 7: Puncturing of turbo encoded TrCHs in downlink**

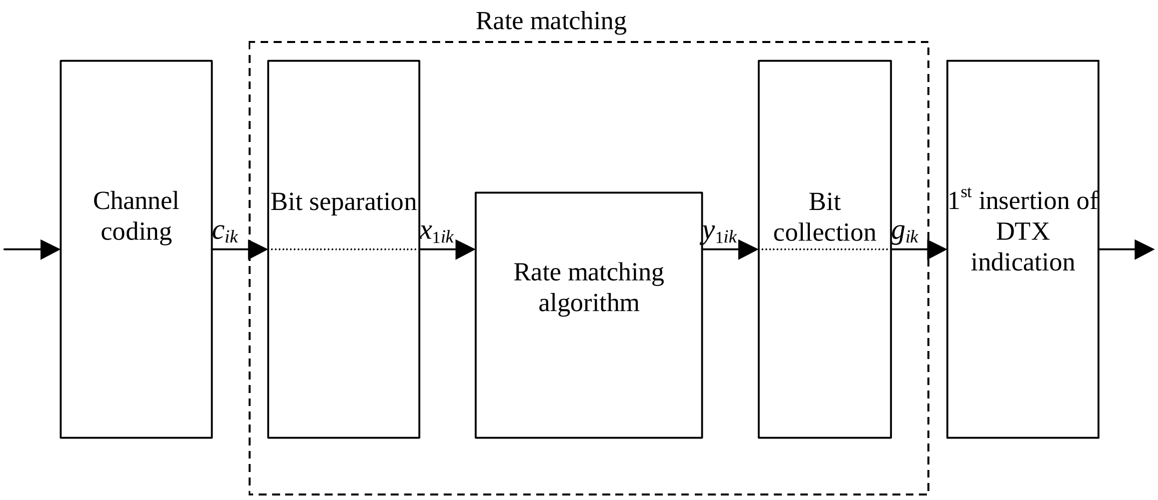


**Figure 8: Rate matching for ~~uncoded TrCHs,~~ convolutionally encoded TrCHs~~,~~ and for turbo encoded TrCHs with repetition in downlink**

#### 4.2.7.4.1 Bit separation

The bits input to the rate matching are denoted by $c_{i1}, c_{i2}, c_{i3}, \ldots, c_{iE_i}$ , where $i$ is the TrCH number and $E_i$ is the number of bits input to the rate matching block. Note that $E_i$ is a multiple of 3 for turbo encoded TrCHs and that the transport format $l$ for simplicity has been left out in the bit numbering, i.e. $E_i = N_{il}^{TTI}$ . The bits after separation are denoted by $x_{bi1}, x_{bi2}, x_{bi3}, \ldots, x_{biX_i}$ . For turbo encoded TrCHs with puncturing, *b* indicates the three sequences defined in section 4.2.7.4, with b=1 indicating the first sequence, and so forth. For all other cases *b* is defined to be 1. $X_i$ is the number of bits in each separated bit sequence. The relation between $c_{ik}$ and $x_{bik}$ is given below.

For turbo encoded TrCHs with puncturing:

$x_{1,i,k} = c_{i,3(k-1)+1}$ $k$ = 1, 2, 3, …, $X_i$ $X_i = E_i /3$

$x_{2,i,k} = c_{i,3(k-1)+2}$ $k$ = 1, 2, 3, …, $X_i$ $X_i = E_i /3$

$x_{3,i,k} = c_{i,3(k-1)+3}$ $k$ = 1, 2, 3, …, $X_i$ $X_i = E_i /3$

For ~~uncoded TrCHs,~~ convolutionally encoded TrCHs~~,~~ and turbo encoded TrCHs with repetition:

$x_{1,i,k} = c_{i,k}$ $k$ = 1, 2, 3, …, $X_i$ $X_i = E_i$

### 4.2.7.4.2 Bit collection

The bits $x_{bik}$ are input to the rate matching algorithm described in subclause 4.2.7.5. The bits output from the rate matching algorithm are denoted $y_{bi1}, y_{bi2}, y_{bi3}, \ldots, y_{biY_i}$ .

Bit collection is the inverse function of the separation. The bits after collection are denoted by $z_{bi1}, z_{bi2}, z_{bi3}, \ldots, z_{biY_i}$ . After bit collection, the bits indicated as punctured are removed and the bits are then denoted by $g_{i1}, g_{i2}, g_{i3}, \ldots, g_{iG_i}$ , where *i* is the TrCH number and $G_i = N_{il}^{TTI} + \Delta N_{il}^{TTI}$ . The relations between $y_{bik}$, $z_{bik}$, and $g_{ik}$ are given below.

For turbo encoded TrCHs with puncturing ($Y_i$=$X_i$):

$z_{i,3(k-1)+1} = y_{1,i,k}$ $k$ = 1, 2, 3, …, $Y_i$

$z_{i,3(k-1)+2} = y_{2,i,k}$ $k$ = 1, 2, 3, …, $Y_i$

$z_{i,3(k-1)+3} = y_{3,i,k}$ $k$ = 1, 2, 3, …, $Y_i$

After the bit collection, bits $z_{i,k}$ with value $\delta$, where $\delta \notin \{0, 1\}$, are removed from the bit sequence. Bit $g_{i,1}$ corresponds to the bit $z_{i,k}$ with smallest index *k* after puncturing, bit $g_{i,2}$ corresponds to the bit $z_{i,k}$ with second smallest index *k* after puncturing, and so on.

For ~~uncoded TrCHs,~~ convolutionally encoded TrCHs~~,~~ and turbo encoded TrCHs with repetition:

$z_{i,k} = y_{1,i,k}$ $k$ = 1, 2, 3, …, $Y_i$

When repetition is used, $g_{i,k}$=$z_{i,k}$ and $Y_i$=$G_i$.

When puncturing is used, $Y_i$=$X_i$ and bits $z_{i,k}$ with value $\delta$, where $\delta \notin \{0, 1\}$, are removed from the bit sequence. Bit $g_{i,1}$ corresponds to the bit $z_{i,k}$ with smallest index *k* after puncturing, bit $g_{i,2}$ corresponds to the bit $z_{i,k}$ with second smallest index *k* after puncturing, and so on.

3GPP TSG RAN Meeting #15
Jeju, Korea, 5 – 8, March, 2002

***R1-02-0308***

*CR-Form-v5*

# CHANGE REQUEST

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ⌘ | **25.212** | **CR** | **128** | ⌘ **rev** | **1** | ⌘ Current version: | **4.3.0** ⌘ |

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

***Proposed change affects:*** ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [X] Core Network [ ]

| | | | | |
|---|---|---|---|---|
| ***Title:*** | ⌘ Removal of channel coding option “no coding” for FDD | | | |
| ***Source:*** | ⌘ TSG RAN WG1 | | | |
| ***Work item code:*** | ⌘ TEI | | ***Date:*** ⌘ | 18.02.2002 |
| ***Category:*** | ⌘ **A** | | ***Release:*** ⌘ | REL-4 |
| | *Use one of the following categories:*<br>***F*** *(correction)*<br>***A*** *(corresponds to a correction in an earlier release)*<br>***B*** *(addition of feature),*<br>***C*** *(functional modification of feature)*<br>***D*** *(editorial modification)*<br>Detailed explanations of the above categories can be found in 3GPP TR 21.900. | | *Use one of the following releases:*<br>*2 (GSM Phase 2)*<br>*R96 (Release 1996)*<br>*R97 (Release 1997)*<br>*R98 (Release 1998)*<br>*R99 (Release 1999)*<br>*REL-4 (Release 4)*<br>*REL-5 (Release 5)* | |

| | |
|---|---|
| ***Reason for change:*** ⌘ | At the last joint AdHoc RAN1/RAN2 meeting it has been agreed to remove the channel coding option “no coding” for FDD and 3.84 Mcps TDD. For 1.28 Mcps TDD this option is still valid. |
| ***Summary of change:*** ⌘ | The channel coding option “no coding” has been removed in the IE “Type of channel coding”.<br><br>**Isolated Impact Analysis**<br><br>This change affects the channel coding type.<br><br>It would not affect implementations behaving like indicated in the CR, it would affect implementations supporting the corrected functionality otherwise. |
| ***Consequences if not approved:*** ⌘ | An option that is not used by any Radio Bearer would be a mandatory feature for all UEs. |

| | | |
|---|---|---|
| ***Clauses affected:*** ⌘ | 4.2.2, 4.2.3, 4.2.7.1, 4.2.7.2, 4.2.7.3, 4.2.7.4 | |
| ***Other specs affected:*** ⌘ | [X] Other core specifications ⌘<br>[ ] Test specifications<br>[ ] O&M Specifications | 25.201, 25.215, 25.222, 25.225 |
| ***Other comments:*** ⌘ | | |

## How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

## 4.2.2 Transport block concatenation and code block segmentation

All transport blocks in a TTI are serially concatenated. If the number of bits in a TTI is larger than $Z$, the maximum size of a code block in question, then code block segmentation is performed after the concatenation of the transport blocks. The maximum size of the code blocks depends on whether convolutional coding or ~~,~~ turbo coding ~~or no coding~~ is used for the TrCH.

### 4.2.2.1 Concatenation of transport blocks

The bits input to the transport block concatenation are denoted by $b_{im1}, b_{im2}, b_{im3}, \ldots, b_{imB_i}$ where $i$ is the TrCH number, $m$ is the transport block number, and $B_i$ is the number of bits in each block (including CRC). The number of transport blocks on TrCH $i$ is denoted by $M_i$. The bits after concatenation are denoted by $x_{i1}, x_{i2}, x_{i3}, \ldots, x_{iX_i}$, where $i$ is the TrCH number and $X_i=M_iB_i$. They are defined by the following relations:

$x_{ik} = b_{i1k}$ $k = 1, 2, \ldots, B_i$

$x_{ik} = b_{i,2,(k-B_i)}$ $k = B_i + 1, B_i + 2, \ldots, 2B_i$

$x_{ik} = b_{i,3,(k-2B_i)}$ $k = 2B_i + 1, 2B_i + 2, \ldots, 3B_i$

$\ldots$

$x_{ik} = b_{i,M_i,(k-(M_i-1)B_i)}$ $k = (M_i - 1)B_i + 1, (M_i - 1)B_i + 2, \ldots, M_iB_i$

### 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 beginning of the first block. If turbo coding is selected and $X_i < 40$, filler bits are added to the beginning of the code 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, for $C_i \neq 0$, 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 per code block.

Number of code blocks:

$${}_i = \lceil X_i/Z \rceil$$

$$C_i = \begin{cases} \lceil X_i/Z \rceil & \text{when } Z \neq unlimited \\ 0 & \text{when } Z = unlimited \text{ and } X_i = 0 \\ 1 & \text{when } Z = unlimited \text{ and } X_i \neq 0 \end{cases}$$

Number of bits in each code block (applicable for $C_i \neq 0$ only):

if $X_i < 40$ and Turbo coding is used, then

$K_i = 40$

else

$K_i = \lceil X_i / C_i \rceil$

end if

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

for $k$ = 1 to $Y_i$ -- Insertion of filler bits

$o_{i1k} = 0$

end for

for $k = Y_i+1$ to $K_i$

$o_{i1k} = x_{i,(k-Y_i)}$

end for

$r$ = 2 -- Segmentation

while $r \le C_i$

for $k$ = 1 to $K_i$

$o_{irk} = x_{i,(k+(r-1)\cdot K_i - Y_i)}$

end for

$r = r+1$

end while

## 4.2.3 Channel coding

Code blocks are delivered to the channel coding block. They 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 in each code block. The number of code blocks on TrCH $i$ is denoted by $C_i$. After encoding the bits are denoted by $y_{ir1}, y_{ir2}, y_{ir3}, \ldots, y_{irY_i}$, where $Y_i$ is the number of encoded bits. The relation between $o_{irk}$ and $y_{irk}$ and between $K_i$ and $Y_i$ is dependent on the channel coding scheme.

The following channel coding schemes can be applied to TrCHs:

- convolutional coding;
- turbo coding;
- ~~no coding.~~

Usage of coding scheme and coding rate for the different types of TrCH is shown in table 1.

The values of $Y_i$ in connection with each coding scheme:

- convolutional coding with rate 1/2: $Y_i = 2*K_i + 16$; rate 1/3: $Y_i = 3*K_i + 24$;
- turbo coding with rate 1/3: $Y_i = 3*K_i + 12$;
- ~~no coding: $Y_i = K_i$.~~

**Table 1: Usage of channel coding scheme and coding rate**

| Type of TrCH | Coding scheme | Coding rate |
|---|---|---|
| BCH | Convolutional coding | 1/2 |
| PCH | | |
| RACH | | |
| CPCH, DCH, DSCH, FACH | | 1/3, 1/2 |
| | Turbo coding | 1/3 |
| | ~~No coding~~ | |

#### 4.2.7.1.2 Determination of parameters needed for calculating the rate matching pattern

The number of bits to be repeated or punctured, $\Delta N_{i,j}$, within one radio frame for each TrCH $i$ is calculated with equation 1 for all possible transport format combinations $j$ and selected every radio frame. $N_{data,j}$ is given from subclause 4.2.7.1.1.

In a compressed radio frame, $N_{data,j}$ is replaced by $N_{data,j}^{cm}$ in Equation 1. $N_{data,j}^{cm}$ is given as follows:

In a radio frame compressed by higher layer scheduling, $N_{data,j}^{cm}$ is obtained by executing the algorithm in subclause 4.2.7.1.1 but with the number of bits in one radio frame of one PhCH reduced to $\frac{N_{tr}}{15}$ of the value in normal mode.

$N_{tr}$ is the number of transmitted slots in a compressed radio frame and is defined by the following relation:

$$N_{tr} = \begin{cases} 15 - TGL, & \text{if } N_{first} + TGL \le 15 \\ N_{first}, & \text{in first frame if } N_{first} + TGL > 15 \\ 30 - TGL - N_{first}, & \text{in second frame if } N_{first} + TGL > 15 \end{cases}$$

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

In a radio frame compressed by spreading factor reduction, $N_{data,j}^{cm} = 2 \times \left(N_{data,j} - N_{TGL}\right)$, where

$$N_{TGL} = \frac{15 - N_{tr}}{15} \times N_{data,j}$$

If $\Delta N_{i,j} = 0$ then the output data of the rate matching is the same as the input data and the rate matching algorithm of subclause 4.2.7.5 does not need to be executed.

If $\Delta N_{i,j} \neq 0$ the parameters listed in subclauses 4.2.7.1.2.1 and 4.2.7.1.2.2 shall be used for determining $e_{ini}$, $e_{plus}$, and $e_{minus}$ (regardless if the radio frame is compressed or not).

##### 4.2.7.1.2.1 ~~Uncoded and c~~Convolutionally encoded TrCHs

$R = \Delta N_{i,j}$ mod $N_{i,j}$ -- note: in this context $\Delta N_{i,j}$ mod $N_{i,j}$ is in the range of 0 to $N_{ij}$-1 i.e. -1 mod 10 = 9.

if $R \neq 0$ and $2 \times R \le N_{ij}$

then q = $\lceil N_{i,j} / R \rceil$

else

q = $\lceil N_{i,j} / (R - N_{i,j}) \rceil$

endif

-- note: q is a signed quantity.

if q is even

then q' = q + gcd($|q|$, $F_i$)/ $F_i$ -- where gcd ($|q|$, $F_i$) means greatest common divisor of $|q|$ and $F_i$

-- note that q' is not an integer, but a multiple of 1/8

else

q' = q

endif

for $x$ = 0 to $F_i$ - 1

$S[\lfloor \lfloor x \times q' \rfloor \rfloor \bmod F_i] = (\lfloor \lfloor x \times q' \rfloor \rfloor \text{ div } F_i)$

end for

$\Delta N_i = \Delta N_{i,j}$

a = 2

For each radio frame, the rate-matching pattern is calculated with the algorithm in subclause 4.2.7.5, where :

$X_i = N_{i,j}$., and

$e_{ini} = (a \times S[P1_{Fi}(n_i)] \times |\Delta N_i| + 1) \bmod (a \cdot N_{ij})$.

$e_{plus} = a \times N_{i,j}$

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

puncturing for $\Delta N$ <0, repetition otherwise.

#### 4.2.7.2.1.3 Determination of rate matching parameters for ~~uncoded and~~ convolutionally encoded TrCHs

$$\Delta N_i = \Delta N_{i,max}$$

For compressed mode by puncturing, $\Delta N_i$ is defined as: $\Delta N_i$ = $\Delta N_{i,\max}^{TTI,cm,m}$, instead of the previous relation.

$a$=2

$$N_{max} = \max_{l \in TFS(i)} N_{il}^{TTI}$$

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

$$X_i = N_{il}^{TTI}$$

$$e_{ini} = 1$$

$$e_{plus} = a \times N_{max}$$

$$e_{\min us} = a \times |\Delta N_i|$$

Puncturing if $\Delta N_i < 0$, repetition otherwise. The values of $\Delta N_{i,l}^{TTI}$ may be computed by counting repetitions or puncturing when the algorithm of subclause 4.2.7.5 is run. The resulting values of $\Delta N_{i,l}^{TTI}$ can be represented with following expression.

$$\Delta N_{i,l}^{TTI} = \left\lceil \frac{|\Delta N_i| \times X_i}{N_{max}} \right\rceil \times \text{sgn}(\Delta N_i)$$

For compressed mode by puncturing, the above formula produces $\Delta N_{i,l}^{TTI,m}$ instead of $\Delta N_{i,l}^{TTI}$.

#### 4.2.7.2.2.2 Determination of rate matching parameters for ~~uncoded and~~ convolutionally encoded TrCHs

$$\Delta N_i = \Delta N_{il}^{TTI}$$

$a=2$

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

$$X_i = N_{il}^{TTI}$$

$$e_{ini} = 1$$

$$e_{plus} = a \times N_{il}^{TTI}$$

$$e_{minus} = a \times \left| \Delta N_i \right|$$

puncturing for $\Delta N_i < 0$, repetition otherwise.

### 4.2.7.3 Bit separation and collection in uplink

The systematic bits of turbo encoded TrCHs shall not be punctured, the other bits may be punctured. The systematic bits, first parity bits, and second parity bits in the bit sequence input to the rate matching block are therefore separated into three sequences.

The first sequence contains:

- All of the systematic bits that are from turbo encoded TrCHs.
- From 0 to 2 first and/or second parity bits that are from turbo encoded TrCHs. These bits come into the first sequence when the total number of bits in a block after radio frame segmentation is not a multiple of three.
- Some of the systematic, first parity and second parity bits that are for trellis termination.

The second sequence contains:

- All of the first parity bits that are from turbo encoded TrCHs, except those that go into the first sequence when the total number of bits is not a multiple of three.
- Some of the systematic, first parity and second parity bits that are for trellis termination.

The third sequence contains:

- All of the second parity bits that are from turbo encoded TrCHs, except those that go into the first sequence when the total number of bits is not a multiple of three.
- Some of the systematic, first parity and second parity bits that are for trellis termination.

The second and third sequences shall be of equal length, whereas the first sequence can contain from 0 to 2 more bits. Puncturing is applied only to the second and third sequences.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 5 and 6.

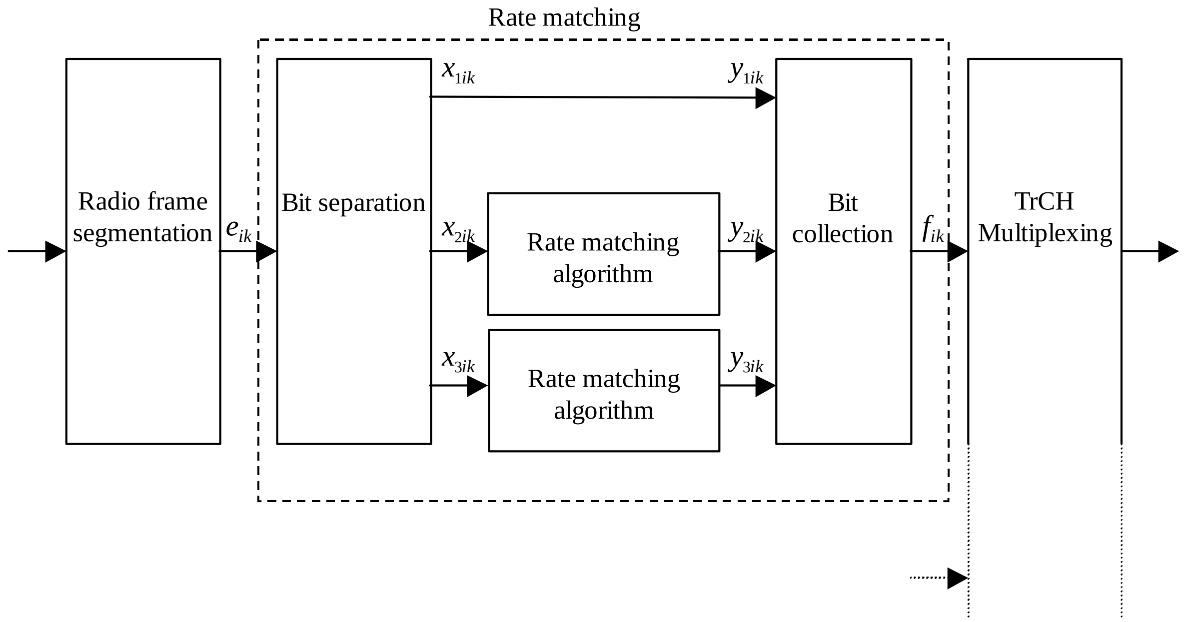


**Figure 5: Puncturing of turbo encoded TrCHs in uplink**

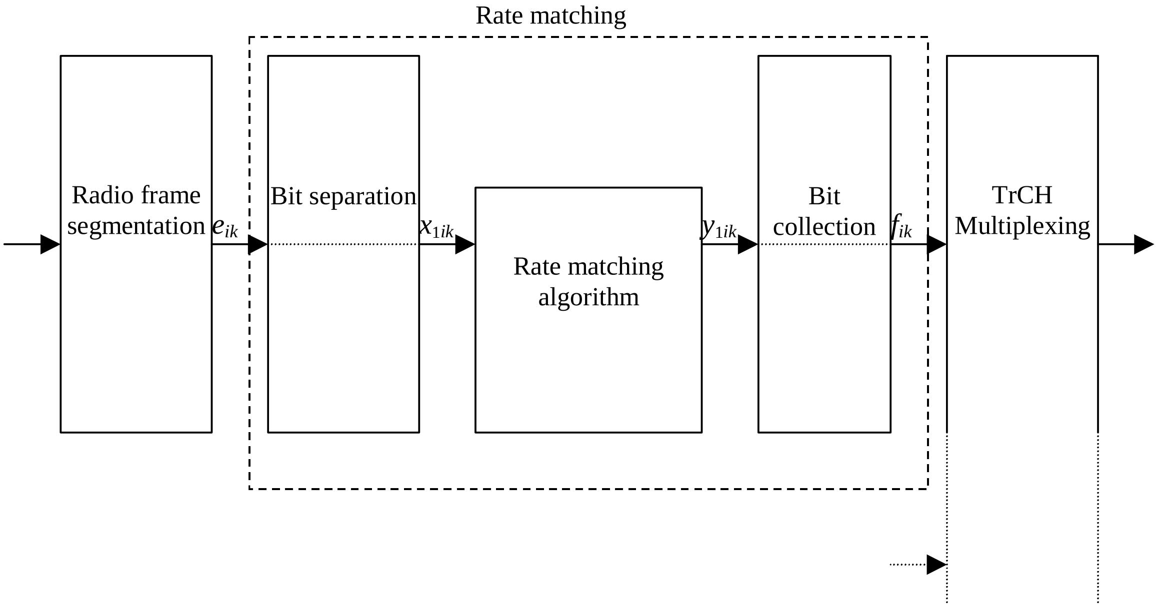


**Figure 6: Rate matching for ~~uncoded TrCHs,~~ convolutionally encoded TrCHs~~,~~ and for turbo encoded TrCHs with repetition in uplink**

The bit separation is dependent on the 1st interleaving and offsets are used to define the separation for different TTIs. *b* indicates the three sequences defined in this section, with *b*=1 indicating the first sequence, *b* = 2 the second one, and *b* = 3 the third one. The offsets $\alpha_b$ for these sequences are listed in table 5.

**Table 5: TTI dependent offset needed for bit separation**

| TTI (ms) | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ |
|---|---|---|---|
| 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 $\beta_{n_i}$ .

**Table 6: Radio frame dependent offset needed for bit separation**

| TTI (ms) | $\beta_0$ | $\beta_1$ | $\beta_2$ | $\beta_3$ | $\beta_4$ | $\beta_5$ | $\beta_6$ | $\beta_7$ |
|---|---|---|---|---|---|---|---|---|
| 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 |

### 4.2.7.3.1 Bit separation

The bits input to the rate matching are 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 input to the rate matching block. Note that the transport format combination number *j* for simplicity has been left out in the bit numbering, i.e. $N_i$=$N_{ij}$. The bits after separation are denoted by $x_{bi1}, x_{bi2}, x_{bi3}, \ldots, x_{biX_i}$ . For turbo encoded TrCHs with puncturing, *b* indicates the three sequences defined in section 4.2.7.3, with *b*=1 indicating the first sequence, and so forth. For all other cases *b* is defined to be 1. $X_i$ is the number of bits in each separated bit sequence. The relation between $e_{ik}$ and $x_{bik}$ is given below.

For turbo encoded TrCHs with puncturing:

$$x_{1,i,k} = e_{i,3(k-1)+1+(\alpha_1+\beta_{n_i}) \bmod 3} \qquad k = 1, 2, 3, \ldots, X_i \qquad X_i = \lfloor N_i / 3 \rfloor$$

$x_{1,i,\lfloor N_i/3 \rfloor+k} = e_{i,3\lfloor N_i/3 \rfloor+k}$ $k$ = 1, …, $N_i$ mod 3 Note: When ($N_i$ mod 3) = 0 this row is not needed.

$x_{2,i,k} = e_{i,3(k-1)+1+(\alpha_2+\beta_{n_i}) \bmod 3}$ $k$ = 1, 2, 3, …, $X_i$ $X_i = \lfloor N_i/3 \rfloor$

$x_{3,i,k} = e_{i,3(k-1)+1+(\alpha_3+\beta_{n_i}) \bmod 3}$ $k$ = 1, 2, 3, …, $X_i$ $X_i = \lfloor N_i/3 \rfloor$

For ~~uncoded TrCHs,~~ convolutionally encoded TrCHs~~,~~ and turbo encoded TrCHs with repetition:

$x_{1,i,k} = e_{i,k}$ $k$ = 1, 2, 3, …, $X_i$ $X_i = N_i$

#### 4.2.7.3.2 Bit collection

The bits $x_{bik}$ are input to the rate matching algorithm described in subclause 4.2.7.5. The bits output from the rate matching algorithm are denoted $y_{bi1}, y_{bi2}, y_{bi3}, \ldots, y_{biY_i}$.

Bit collection is the inverse function of the separation. The bits after collection are denoted by $z_{bi1}, z_{bi2}, z_{bi3}, \ldots, z_{biY_i}$. After bit collection, the bits indicated as punctured are removed and the bits are then denoted by $f_{i1}, f_{i2}, f_{i3}, \ldots, f_{iV_i}$, where $i$ is the TrCH number and $V_i = N_{ij} + \Delta N_{ij}$. The relations between $y_{bik}$, $z_{bik}$, and $f_{ik}$ are given below.

For turbo encoded TrCHs with puncturing ($Y_i = X_i$):

$z_{i,3(k-1)+1+(\alpha_1+\beta_{n_i}) \bmod 3} = y_{1,i,k}$ $k$ = 1, 2, 3, …, $Y_i$

$z_{i,3\lfloor N_i/3 \rfloor+k} = y_{1,i,\lfloor N_i/3 \rfloor+k}$ $k$ = 1, …, $N_i$ mod 3 Note: When ($N_i$ mod 3) = 0 this row is not needed.

$z_{i,3(k-1)+1+(\alpha_2+\beta_{n_i}) \bmod 3} = y_{2,i,k}$ $k$ = 1, 2, 3, …, $Y_i$

$z_{i,3(k-1)+1+(\alpha_3+\beta_{n_i}) \bmod 3} = y_{3,i,k}$ $k$ = 1, 2, 3, …, $Y_i$

After the bit collection, bits $z_{i,k}$ with value $\delta$, where $\delta \notin \{0, 1\}$, are removed from the bit sequence. Bit $f_{i,1}$ corresponds to the bit $z_{i,k}$ with smallest index $k$ after puncturing, bit $f_{i,2}$ corresponds to the bit $z_{i,k}$ with second smallest index $k$ after puncturing, and so on.

For ~~uncoded TrCHs,~~ convolutionally encoded TrCHs~~,~~ and turbo encoded TrCHs with repetition:

$z_{i,k} = y_{1,i,k}$ $k$ = 1, 2, 3, …, $Y_i$

When repetition is used, $f_{i,k} = z_{i,k}$ and $Y_i = V_i$.

When puncturing is used, $Y_i = X_i$ and bits $z_{i,k}$ with value $\delta$, where $\delta \notin \{0, 1\}$, are removed from the bit sequence. Bit $f_{i,1}$ corresponds to the bit $z_{i,k}$ with smallest index $k$ after puncturing, bit $f_{i,2}$ corresponds to the bit $z_{i,k}$ with second smallest index $k$ after puncturing, and so on.

### 4.2.7.4 Bit separation and collection in downlink

The systematic bits of turbo encoded TrCHs shall not be punctured, the other bits may be punctured.

The systematic bits, first parity bits and second parity bits in the bit sequence input to the rate matching block are therefore separated into three sequences of equal lengths.

The first sequence contains :

- All of the systematic bits that are from turbo encoded TrCHs.
- Some of the systematic, first parity and second parity bits that are for trellis termination.

The second sequence contains:

- All of the first parity bits that are from turbo encoded TrCHs.
- Some of the systematic, first parity and second parity bits that are for trellis termination.

The third sequence contains:

- All of the second parity bits that are from turbo encoded TrCHs.
- Some of the systematic, first parity and second parity bits that are for trellis termination.

Puncturing is applied only to the second and third sequences.

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 7 and 8.

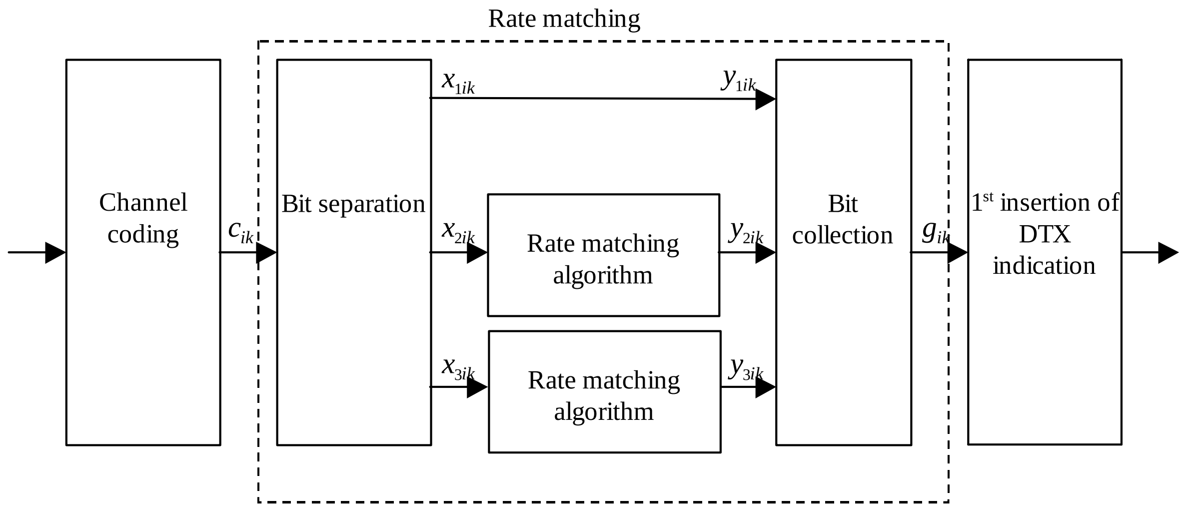


**Figure 7: Puncturing of turbo encoded TrCHs in downlink**

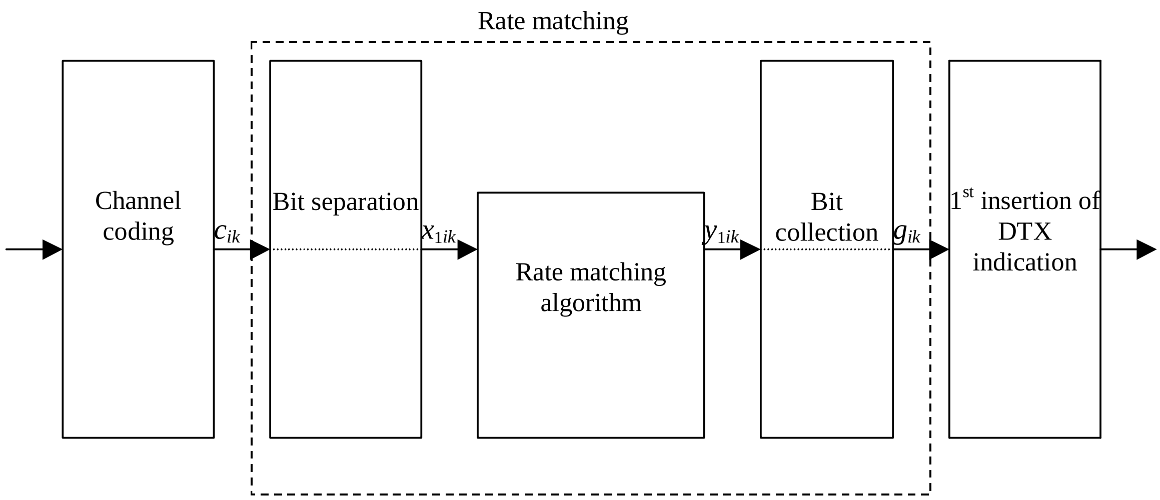


**Figure 8: Rate matching for ~~uncoded TrCHs,~~ convolutionally encoded TrCHs~~,~~ and for turbo encoded TrCHs with repetition in downlink**

### 4.2.7.4.1 Bit separation

The bits input to the rate matching are denoted by $c_{i1}, c_{i2}, c_{i3}, \ldots, c_{iE_i}$, where *i* is the TrCH number and $E_i$ is the number of bits input to the rate matching block. Note that $E_i$ is a multiple of 3 for turbo encoded TrCHs and that the transport format *l* for simplicity has been left out in the bit numbering, i.e. $E_i = N_{il}^{TTI}$. The bits after separation are denoted by $x_{bi1}, x_{bi2}, x_{bi3}, \ldots, x_{biX_i}$ . For turbo encoded TrCHs with puncturing, *b* indicates the three sequences defined in section 4.2.7.4, with b=1 indicating the first sequence, and so forth. For all other cases *b* is defined to be 1. $X_i$ is the number of bits in each separated bit sequence. The relation between $c_{ik}$ and $x_{bik}$ is given below.

For turbo encoded TrCHs with puncturing:

$x_{1,i,k} = c_{i,3(k-1)+1}$ $k = 1, 2, 3, \ldots, X_i$ $X_i = E_i/3$

$x_{2,i,k} = c_{i,3(k-1)+2}$ $k = 1, 2, 3, \ldots, X_i$ $X_i = E_i/3$

$x_{3,i,k} = c_{i,3(k-1)+3}$ $k = 1, 2, 3, \ldots, X_i$ $X_i = E_i/3$

For ~~uncoded TrCHs,~~ convolutionally encoded TrCHs~~,~~ and turbo encoded TrCHs with repetition:

$x_{1,i,k} = c_{i,k}$ $k = 1, 2, 3, \ldots, X_i$ $X_i = E_i$

### 4.2.7.4.2 Bit collection

The bits $x_{bik}$ are input to the rate matching algorithm described in subclause 4.2.7.5. The bits output from the rate matching algorithm are denoted $y_{bi1}, y_{bi2}, y_{bi3}, \ldots, y_{biY_i}$ .

Bit collection is the inverse function of the separation. The bits after collection are denoted by $z_{bi1}, z_{bi2}, z_{bi3}, \ldots, z_{biY_i}$ . After bit collection, the bits indicated as punctured are removed and the bits are then denoted by $g_{i1}, g_{i2}, g_{i3}, \ldots, g_{iG_i}$ , where *i* is the TrCH number and $G_i = N_{il}^{TTI} + \Delta N_{il}^{TTI}$ . The relations between $y_{bik}$, $z_{bik}$, and $g_{ik}$ are given below.

For turbo encoded TrCHs with puncturing ($Y_i=X_i$):

$z_{i,3(k-1)+1} = y_{1,i,k}$ $k = 1, 2, 3, \ldots, Y_i$

$z_{i,3(k-1)+2} = y_{2,i,k}$ $k = 1, 2, 3, \ldots, Y_i$

$z_{i,3(k-1)+3} = y_{3,i,k}$ $k = 1, 2, 3, \ldots, Y_i$

After the bit collection, bits $z_{i,k}$ with value $\delta$, where $\delta \notin \{0, 1\}$, are removed from the bit sequence. Bit $g_{i,1}$ corresponds to the bit $z_{i,k}$ with smallest index *k* after puncturing, bit $g_{i,2}$ corresponds to the bit $z_{i,k}$ with second smallest index *k* after puncturing, and so on.

For ~~uncoded TrCHs,~~ convolutionally encoded TrCHs, and turbo encoded TrCHs with repetition:

$z_{i,k} = y_{1,i,k}$ $k = 1, 2, 3, \ldots, Y_i$

When repetition is used, $g_{i,k}=z_{i,k}$ and $Y_i=G_i$.

When puncturing is used, $Y_i=X_i$ and bits $z_{i,k}$ with value $\delta$, where $\delta \notin \{0, 1\}$, are removed from the bit sequence. Bit $g_{i,1}$ corresponds to the bit $z_{i,k}$ with smallest index *k* after puncturing, bit $g_{i,2}$ corresponds to the bit $z_{i,k}$ with second smallest index *k* after puncturing, and so on.

CR-Form-v5

# CHANGE REQUEST

| ⌘ | **25.215** | **CR** | **110** | ⌘ **rev** | **-** | ⌘ | Current version: | **3.9.0** | ⌘ |
|---|---|---|---|---|---|---|---|---|---|

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***Proposed change affects:*** ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [X] Core Network [ ]

| | | | |
|---|---|---|---|
| ***Title:*** ⌘ | Removal of channel coding option "no coding" for FDD | | |
| ***Source:*** ⌘ | TSG RAN WG1 | | |
| ***Work item code:*** ⌘ | TEI | ***Date:*** ⌘ | 18.02.2002 |
| ***Category:*** ⌘ | F | ***Release:*** ⌘ | R99 |
| | *Use one of the following categories:*<br>***F*** *(correction)*<br>***A*** *(corresponds to a correction in an earlier release)*<br>***B*** *(addition of feature),*<br>***C*** *(functional modification of feature)*<br>***D*** *(editorial modification)*<br>Detailed explanations of the above categories can be found in 3GPP TR 21.900. | | *Use one of the following releases:*<br>*2 (GSM Phase 2)*<br>*R96 (Release 1996)*<br>*R97 (Release 1997)*<br>*R98 (Release 1998)*<br>*R99 (Release 1999)*<br>*REL-4 (Release 4)*<br>*REL-5 (Release 5)* |

| | |
|---|---|
| ***Reason for change:*** ⌘ | At the last joint AdHoc RAN1/RAN2 meeting it has been agreed to remove the channel coding option "no coding" for FDD and 3.84 Mcps TDD. For 1.28 Mcps TDD this option is still valid. |
| ***Summary of change:*** ⌘ | The channel coding option "no coding" has been removed in the IE "Type of channel coding".<br><br>**Isolated Impact Analysis**<br><br>This change affects the channel coding type.<br><br>It would not affect implementations behaving like indicated in the CR, it would affect implementations supporting the corrected functionality otherwise. |
| ***Consequences if not approved:*** ⌘ | An option that is not used by any Radio Bearer would be a mandatory feature for all UEs. |

| | | | |
|---|---|---|---|
| ***Clauses affected:*** ⌘ | 5.2.6 | | |
| ***Other specs affected:*** ⌘ | [X] Other core specifications<br>[ ] Test specifications<br>[ ] O&M Specifications | ⌘ | 25.201, 25.212, 25.222, 25.225 |
| ***Other comments:*** ⌘ | | | |

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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

## 5.2.6 Transport channel BER

| | |
|---|---|
| **Definition** | The transport channel BER is an estimation of the average bit error rate (BER) of the DPDCH data of a Radio Link Set. The transport channel (TrCH) BER is measured from the data considering only non-punctured bits at the input of the channel decoder in Node B. It shall be possible to report an estimate of the transport channel BER for a TrCH after the end of each TTI of the TrCH. The reported TrCH BER shall be an estimate of the BER during the latest TTI for that TrCH. ~~Transport channel BER is only required to be reported for TrCHs that are channel coded.~~ |

**3GPP TSG RAN Meeting #15**
**Jeju, Korea, 5 – 8, March, 2002**

***R1-02-0306***

*CR-Form-v5*

# CHANGE REQUEST

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ⌘ | **25.215** | **CR** | **111** | ⌘ **rev** | **-** | ⌘ | Current version: | **4.3.0** ⌘ |

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***Proposed change affects:*** ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [X] Core Network [ ]

| | | | | |
|---|---|---|---|---|
| ***Title:*** ⌘ | Removal of channel coding option “no coding” for FDD | | | |
| ***Source:*** ⌘ | TSG RAN WG1 | | | |
| ***Work item code:*** ⌘ | TEI | | ***Date:*** ⌘ | 18.02.2002 |
| ***Category:*** ⌘ | A<br>*Use one of the following categories:*<br>***F*** *(correction)*<br>***A*** *(corresponds to a correction in an earlier release)*<br>***B*** *(addition of feature),*<br>***C*** *(functional modification of feature)*<br>***D*** *(editorial modification)*<br>Detailed explanations of the above categories can be found in 3GPP TR 21.900. | | ***Release:*** ⌘ | REL-4<br>*Use one of the following releases:*<br>*2 (GSM Phase 2)*<br>*R96 (Release 1996)*<br>*R97 (Release 1997)*<br>*R98 (Release 1998)*<br>*R99 (Release 1999)*<br>*REL-4 (Release 4)*<br>*REL-5 (Release 5)* |

| | |
|---|---|
| ***Reason for change:*** ⌘ | At the last joint AdHoc RAN1/RAN2 meeting it has been agreed to remove the channel coding option “no coding” for FDD and 3.84 Mcps TDD. For 1.28 Mcps TDD this option is still valid. |
| ***Summary of change:*** ⌘ | The channel coding option “no coding” has been removed in the IE “Type of channel coding”.<br>**Isolated Impact Analysis**<br>This change affects the channel coding type.<br>It would not affect implementations behaving like indicated in the CR, it would affect implementations supporting the corrected functionality otherwise. |
| ***Consequences if not approved:*** ⌘ | An option that is not used by any Radio Bearer would be a mandatory feature for all UEs. |

| | | |
|---|---|---|
| ***Clauses affected:*** ⌘ | 5.2.6 | |
| ***Other specs affected:*** ⌘ | [X] Other core specifications ⌘<br>[ ] Test specifications<br>[ ] O&M Specifications | 25.201, 25.212, 25.222, 25.225 |
| ***Other comments:*** ⌘ | | |

**How to create CRs using this form:**
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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

## 5.2.6 Transport channel BER

| | |
|---|---|
| **Definition** | The transport channel BER is an estimation of the average bit error rate (BER) of the DPDCH data of a Radio Link Set. The transport channel (TrCH) BER is measured from the data considering only non-punctured bits at the input of the channel decoder in Node B. It shall be possible to report an estimate of the transport channel BER for a TrCH after the end of each TTI of the TrCH. The reported TrCH BER shall be an estimate of the BER during the latest TTI for that TrCH. ~~Transport channel BER is only required to be reported for TrCHs that are channel coded.~~ |

**3GPP TSG RAN Meeting #15**
**Jeju, Korea, 5 – 8, March, 2002**

***R1-02-0309***

*CR-Form-v5*

# CHANGE REQUEST

| | | | | | | |
|---|---|---|---|---|---|---|
| ⌘ **25.222** | **CR** **067** | ⌘ **rev** | **1** | ⌘ | Current version: **3.7.0** | ⌘ |

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***Proposed change affects:*** ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [X] Core Network [ ]

| | | | |
|---|---|---|---|
| ***Title:*** ⌘ | Removal of channel coding option “no coding” for 3.84 Mcps TDD | | |
| ***Source:*** ⌘ | TSG RAN WG1 | | |
| ***Work item code:*** ⌘ | TEI | ***Date:*** ⌘ | 18.02.2002 |
| ***Category:*** ⌘ | **F** | ***Release:*** ⌘ | R99 |
| | *Use one of the following categories:*<br>***F*** *(correction)*<br>***A*** *(corresponds to a correction in an earlier release)*<br>***B*** *(addition of feature),*<br>***C*** *(functional modification of feature)*<br>***D*** *(editorial modification)*<br>Detailed explanations of the above categories can be found in 3GPP TR 21.900. | | *Use one of the following releases:*<br>*2 (GSM Phase 2)*<br>*R96 (Release 1996)*<br>*R97 (Release 1997)*<br>*R98 (Release 1998)*<br>*R99 (Release 1999)*<br>*REL-4 (Release 4)*<br>*REL-5 (Release 5)* |

| | |
|---|---|
| ***Reason for change:*** ⌘ | At the last joint AdHoc RAN1/RAN2 meeting it has been agreed to remove the channel coding option “no coding” for FDD and 3.84 Mcps TDD. For 1.28 Mcps TDD this option is still valid. |
| ***Summary of change:*** ⌘ | The channel coding option “no coding” has been removed in the IE “Type of channel coding”.<br><br>**Isolated Impact Analysis**<br><br>This change affects the channel coding type.<br><br>It would not affect implementations behaving like indicated in the CR, it would affect implementations supporting the corrected functionality otherwise. |
| ***Consequences if not approved:*** ⌘ | An option that is not used by any Radio Bearer would be a mandatory feature for all UEs. |

| | | |
|---|---|---|
| ***Clauses affected:*** ⌘ | 4.2.2, 4.2.3, 4.2.7.1, 4.2.7.2 | |
| ***Other specs affected:*** ⌘ | [X] Other core specifications ⌘<br>[ ] Test specifications<br>[ ] O&M Specifications | 25.201, 25.212, 25.215, 25.225 |
| ***Other comments:*** ⌘ | | |

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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

## 4.2.2 Transport block concatenation and code block segmentation

All transport blocks in a TTI are serially concatenated. If the number of bits in a TTI is larger than the maximum size of a code block, then code block segmentation is performed after the concatenation of the transport blocks. The maximum size of the code blocks depends on whether convolutional or ~~,~~ turbo coding ~~or no coding~~ is used for the TrCH.

### 4.2.2.1 Concatenation of transport blocks

The bits input to the transport block concatenation are denoted by $b_{im1}, b_{im2}, b_{im3}, \ldots, b_{imB_i}$ where $i$ is the TrCH number, $m$ is the transport block number, and $B_i$ is the number of bits in each block (including CRC). The number of transport blocks on TrCH $i$ is denoted by $M_i$. The bits after concatenation are denoted by $x_{i1}, x_{i2}, x_{i3}, \ldots, x_{iX_i}$, where $i$ is the TrCH number and $X_i=M_iB_i$. They are defined by the following relations:

$$x_{ik} = b_{i1k} \quad k = 1, 2, \ldots, B_i$$

$$x_{ik} = b_{i,2,(k-B_i)} \quad k = B_i + 1, B_i + 2, \ldots, 2B_i$$

$$x_{ik} = b_{i,3,(k-2B_i)} \quad k = 2B_i + 1, 2B_i + 2, \ldots, 3B_i$$

$$\ldots$$

$$x_{ik} = b_{i,M_i,(k-(M_i-1)B_i)} \quad k = (M_i - 1)B_i + 1, (M_i - 1)B_i + 2, \ldots, M_iB_i$$

### 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 beginning of the first block. If turbo coding is selected and $X_i < 40$, filler bits are added to the beginning of the code 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, for $C_i \neq 0$, 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 per code block.

Number of code blocks:

$$_i = \lceil X_i / Z \rceil$$

$$C_i = \begin{cases} \lceil X_i / Z \rceil & \text{when } Z \neq unlimited \\ 0 & \text{when } Z = unlimited \text{ and } X_i = 0 \\ 1 & \text{when } Z = unlimited \text{ and } X_i \neq 0 \end{cases}$$

Number of bits in each code block (applicable for $C_i \neq 0$ only):

if $X_i < 40$ and Turbo coding is used, then

$K_i = 40$

else

$K_i = \lceil X_i / C_i \rceil$

end if

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

for $k = 1$ to $Y_i$ -- Insertion of filler bits

$o_{i1k} = 0$

end for

for $k = Y_i+1$ to $K_i$

$o_{i1k} = x_{i,(k-Y_i)}$

end for

$r = 2$ -- Segmentation

while $r \le C_i$

for $k = 1$ to $K_i$

$o_{irk} = x_{i,(k+(r-1)\cdot K_i - Y_i)}$

end for

r = r+1

end while

## 4.2.3 Channel coding

Code blocks are delivered to the channel coding block. They 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 in each code block. The number of code blocks on TrCH $i$ is denoted by $C_i$. After encoding the bits are denoted by $y_{ir1}, y_{ir2}, y_{ir3}, \ldots, y_{irY_i}$, where $Y_i$ is the number of encoded bits. The relation between $o_{irk}$ and $y_{irk}$ and between $K_i$ and $Y_i$ is dependent on the channel coding scheme.

The following channel coding schemes can be applied to transport channels:

- convolutional coding;
- turbo coding;
- ~~no coding.~~

Usage of coding scheme and coding rate for the different types of TrCH is shown in table 1. The values of $Y_i$ in connection with each coding scheme:

- convolutional coding with rate 1/2: $Y_i = 2*K_i + 16$; rate 1/3: $Y_i = 3*K_i + 24$;
- turbo coding with rate 1/3: $Y_i = 3*K_i + 12$;
- ~~no coding: $Y_i = K_i$.~~

**Table 1: Usage of channel coding scheme and coding rate**

| Type of TrCH | Coding scheme | Coding rate |
|---|---|---|
| BCH | Convolutional coding | 1/2 |
| PCH | | |
| RACH | | |
| DCH, DSCH, FACH, USCH | | 1/3, 1/2 |
| | Turbo coding | 1/3 |
| | ~~No coding~~ | |

#### 4.2.7.1.1 ~~Uncoded and c~~Convolutionally encoded TrCHs

a = 2

$\Delta N_i = \Delta N_{i,j}$

$X_i = N_{i,j}$

R = $\Delta N_{i,j}$ mod $N_{i,j}$ -- note: in this context $\Delta N_{i,j}$ mod $N_{i,j}$ is in the range of 0 to $N_{i,j}$-1 i.e. -1 mod 10 = 9.

if R ≠ 0 and 2×R ≤ $N_{i,j}$

then q = $\lceil N_{i,j} / R \rceil$

else

q = $\lceil N_{i,j} / (R - N_{i,j}) \rceil$

endif

NOTE 1: q is a signed quantity.

If q is even

then q' = q + gcd($|q|$, $F_i$) / $F_i$ -- where gcd ($|q|$, $F_i$) means greatest common divisor of $|q|$ and $F_i$

NOTE 2: q' is not an integer, but a multiple of 1/8.

else

q' = q

endif

for x = 0 to $F_i$-1

S[$|\lfloor x \times q' \rfloor|$ mod $F_i$] = ($|\lfloor x * q' \rfloor|$ div $F_i$)

end for

$e_{ini} = (a \times S[P1_{F_i}(n_i)] \times |\Delta N_i| + 1) \bmod (a \times N_{i,j})$

$e_{plus} = a \times X_i$

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

puncturing for $\Delta N_i$ <0, repetition otherwise.

### 4.2.7.2 Bit separation and collection for rate matching

The systematic bits of turbo encoded TrCHs shall not be punctured, the other bits may be punctured. The systematic bits, first parity bits, and second parity bits in the bit sequence input to the rate matching block are therefore separated into three sequences.

The first sequence contains:

- All of the systematic bits that are from turbo encoded TrCHs.
- From 0 to 2 first and/or second parity bits that are from turbo encoded TrCHs. These bits come into the first sequence when the total number of bits in a block after radio frame segmentation is not a multiple of three.
- Some of the systematic, first parity and second parity bits that are for trellis termination.

The second sequence contains:

- All of the first parity bits that are from turbo encoded TrCHs, except those that go into the first sequence when the total number of bits is not a multiple of three.
- Some of the systematic, first parity and second parity bits that are for trellis termination.

The third sequence contains:

- All of the second parity bits that are from turbo encoded TrCHs, except those that go into the first sequence when the total number of bits is not a multiple of three.
- Some of the systematic, first parity and second parity bits that are for trellis termination.

The second and third sequences shall be of equal length, whereas the first sequence can contain from 0 to 2 more bits. Puncturing is applied only to the second and third sequences.

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 4 and 5.

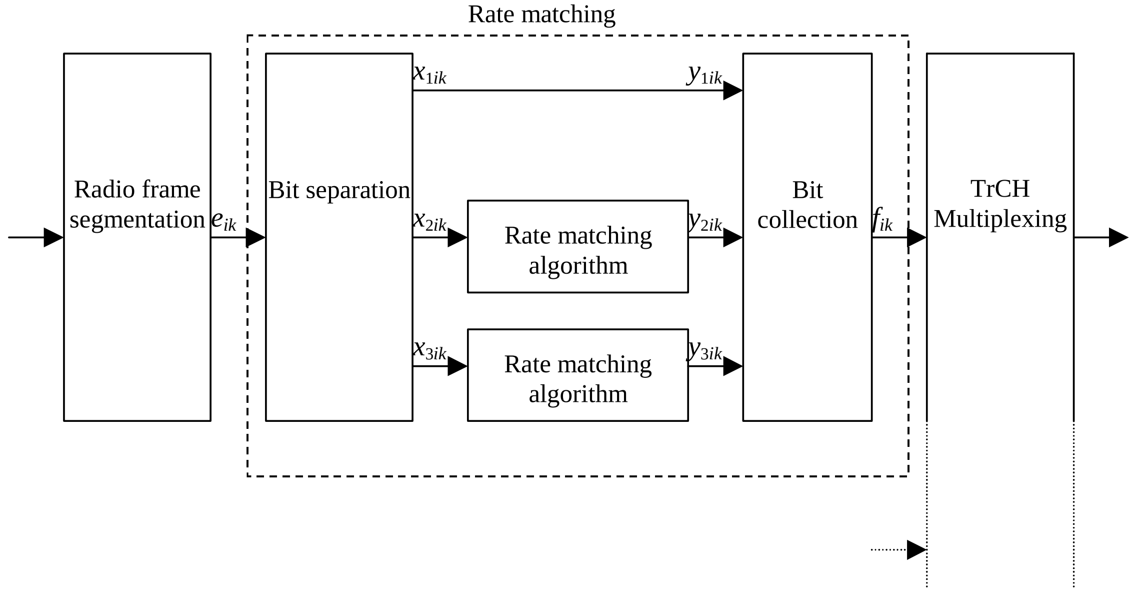


**Figure 4: Puncturing of turbo encoded TrCHs**

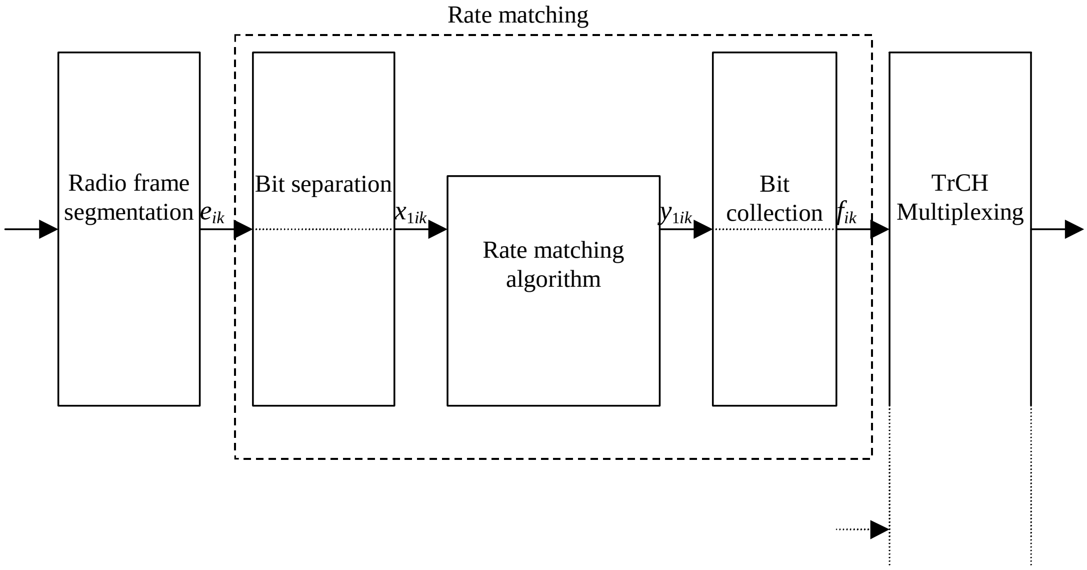


**Figure 5: Rate matching for ~~uncoded TrCHs,~~ convolutionally encoded TrCHs~~,~~ and for turbo encoded TrCHs with repetition**

The bit separation is dependent on the 1st interleaving and offsets are used to define the separation for different TTIs. *b* indicates the three sequences defined in this section, with *b*=1 indicating the first sequence, *b* = 2 the second one, and *b* = 3 the third one.

The offsets $\alpha_b$ for these sequences are listed in table 5.

**Table 5: TTI dependent offset needed for bit separation**

| TTI (ms) | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ |
|---|---|---|---|
| 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 $\beta_{n_i}$ .

**Table 6: Radio frame dependent offset needed for bit separation**

| TTI (ms) | $\beta_0$ | $\beta_1$ | $\beta_2$ | $\beta_3$ | $\beta_4$ | $\beta_5$ | $\beta_6$ | $\beta_7$ |
|---|---|---|---|---|---|---|---|---|
| 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 |

### 4.2.7.2.1 Bit separation

The bits input to the rate matching are denoted by $e_{i,1}, e_{i,2}, e_{i,3}, \ldots, e_{i,N_i}$ , where *i* is the TrCH number and $N_i$ is the number of bits input to the rate matching block. Note that the transport format combination number *j* for simplicity has been left out in the bit numbering, i.e. $N_i=N_{ij}$. The bits after separation are denoted by $x_{b,i,1}, x_{b,i,2}, x_{b,i,3}, \ldots, x_{b,i,X_i}$ . For turbo encoded TrCHs with puncturing, *b* indicates the three sequences defined in section 4.2.7.2, with *b*=1 indicating the first sequence, and so forth. For all other cases *b* is defined to be 1. $X_i$ is the number of bits in each separated bit sequence. The relation between $e_{i,k}$ and $x_{b,i,k}$ is given below.

For turbo encoded TrCHs with puncturing:

$$x_{1,i,k} = e_{i,3(k-1)+1+(\alpha_1+\beta_{n_i}) \bmod 3} \qquad k = 1, 2, 3, \ldots, X_i \qquad X_i = \lfloor N_i / 3 \rfloor$$

$x_{1,i,\lfloor N_i/3 \rfloor+k} = e_{i,3\lfloor N_i/3 \rfloor+k}$ $k$ = 1, …, $N_i$ mod 3 Note: When ($N_i$ mod 3) = 0 this row is not needed.

$x_{2,i,k} = e_{i,3(k-1)+1+(\alpha_2+\beta_{n_i}) \bmod 3}$ $k$ = 1, 2, 3, …, $X_i$ $X_i = \lfloor N_i/3 \rfloor$

$x_{3,i,k} = e_{i,3(k-1)+1+(\alpha_3+\beta_{n_i}) \bmod 3}$ $k$ = 1, 2, 3, …, $X_i$ $X_i = \lfloor N_i/3 \rfloor$

For ~~uncoded TrCHs,~~ convolutionally encoded TrCHs~~,~~ and turbo encoded TrCHs with repetition:

$x_{1,i,k} = e_{i,k}$ $k$ = 1, 2, 3, …, $X_i$ $X_i = N_i$

### 4.2.7.2.2 Bit collection

The bits $x_{b,i,k}$ are input to the rate matching algorithm described in subclause 4.2.7.3. The bits output from the rate matching algorithm are denoted $y_{b,i,1}, y_{b,i,2}, y_{b,i,3}, \ldots, y_{b,i,Y_i}$.

Bit collection is the inverse function of the separation. The bits after collection are denoted by $z_{b,i,1}, z_{b,i,2}, z_{b,i,3}, \ldots, z_{b,i,Y_i}$. After bit collection, the bits indicated as punctured are removed and the bits are then denoted by $f_{i,1}, f_{i,2}, f_{i,3}, \ldots, f_{i,V_i}$, where $i$ is the TrCH number and $V_i = N_{i,j}+\Delta N_{i,j}$. The relations between $y_{b,i,k}$, $z_{b,i,k}$, and $f_{i,k}$ are given below.

For turbo encoded TrCHs with puncturing ($Y_i$=$X_i$):

$z_{i,3(k-1)+1+(\alpha_1+\beta_{n_i}) \bmod 3} = y_{1,i,k}$ $k$ = 1, 2, 3, …, $Y_I$

$z_{i,3\lfloor N_i/3 \rfloor+k} = y_{1,i,\lfloor N_i/3 \rfloor+k}$ $k$ = 1, …, $N_i$ mod 3 Note: When ($N_i$ mod 3) = 0 this row is not needed.

$z_{i,3(k-1)+1+(\alpha_2+\beta_{n_i}) \bmod 3} = y_{2,i,k}$ $k$ = 1, 2, 3, …, $Y_i$

$z_{i,3(k-1)+1+(\alpha_3+\beta_{n_i}) \bmod 3} = y_{3,i,k}$ $k$ = 1, 2, 3, …, $Y_i$

After the bit collection, bits $z_{i,k}$ with value $\delta$, where $\delta \notin \{0, 1\}$, are removed from the bit sequence. Bit $f_{i,1}$ corresponds to the bit $z_{i,k}$ with smallest index $k$ after puncturing, bit $f_{i,2}$ corresponds to the bit $z_{i,k}$ with second smallest index $k$ after puncturing, and so on.

For ~~uncoded TrCHs,~~ convolutionally encoded TrCHs~~,~~ and turbo encoded TrCHs with repetition:

$z_{i,k} = y_{1,i,k}$ $k$ = 1, 2, 3, …, $Y_i$

When repetition is used, $f_{i,k}$=$z_{i,k}$ and $Y_i$=$V_i$.

When puncturing is used, $Y_i$=$X_i$ and bits $z_{i,k}$ with value $\delta$, where $\delta \notin \{0, 1\}$, are removed from the bit sequence. Bit $f_{i,1}$ corresponds to the bit $z_{i,k}$ with smallest index $k$ after puncturing, bit $f_{i,2}$ corresponds to the bit $z_{i,k}$ with second smallest index $k$ after puncturing, and so on.

***R1-02-0309***

*CR-Form-v5*

# CHANGE REQUEST

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ⌘ | **25.222** | **CR** | **068** | ⌘ **rev** | **1** | ⌘ | Current version: | **4.2.0** ⌘ |

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***Proposed change affects:*** ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [X] Core Network [ ]

| | | | | |
|---|---|---|---|---|
| ***Title:*** ⌘ | Removal of channel coding option "no coding" for 3.84 Mcps TDD | | | |
| ***Source:*** ⌘ | TSG RAN WG1 | | | |
| ***Work item code:*** ⌘ | TEI | | ***Date:*** ⌘ | 18.02.2002 |
| ***Category:*** ⌘ | **A** | | ***Release:*** ⌘ | REL-4 |
| | *Use one of the following categories:*<br>***F*** *(correction)*<br>***A*** *(corresponds to a correction in an earlier release)*<br>***B*** *(addition of feature),*<br>***C*** *(functional modification of feature)*<br>***D*** *(editorial modification)*<br>Detailed explanations of the above categories can be found in 3GPP TR 21.900. | | | *Use one of the following releases:*<br>*2 (GSM Phase 2)*<br>*R96 (Release 1996)*<br>*R97 (Release 1997)*<br>*R98 (Release 1998)*<br>*R99 (Release 1999)*<br>*REL-4 (Release 4)*<br>*REL-5 (Release 5)* |

| | |
|---|---|
| ***Reason for change:*** ⌘ | At the last joint AdHoc RAN1/RAN2 meeting it has been agreed to remove the channel coding option "no coding" for FDD and 3.84 Mcps TDD. For 1.28 Mcps TDD this option is still valid. |
| ***Summary of change:*** ⌘ | The channel coding option "no coding" has been removed in the IE "Type of channel coding".<br><br>**Isolated Impact Analysis**<br><br>This change affects the channel coding type.<br><br>It would not affect implementations behaving like indicated in the CR, it would affect implementations supporting the corrected functionality otherwise. |
| ***Consequences if not approved:*** ⌘ | An option that is not used by any Radio Bearer would be a mandatory feature for all UEs. |

| | | | |
|---|---|---|---|
| ***Clauses affected:*** ⌘ | 4.2.2, 4.2.3 | | |
| ***Other specs affected:*** ⌘ | [X] | Other core specifications ⌘ | 25.201, 25.212, 25.215, 25.225 |
| | [ ] | Test specifications | |
| | [ ] | O&M Specifications | |
| ***Other comments:*** ⌘ | | | |

**How to create CRs using this form:**
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

## 4.2.2 Transport block concatenation and code block segmentation

All transport blocks in a TTI are serially concatenated. If the number of bits in a TTI is larger than the maximum size of a code block, then code block segmentation is performed after the concatenation of the transport blocks. The maximum size of the code blocks depends on whether convolutional or, turbo coding ~~or no coding~~ is used for the TrCH. For 1.28 Mcps TDD also “no coding” is supported.

### 4.2.2.1 Concatenation of transport blocks

The bits input to the transport block concatenation are denoted by $b_{im1}, b_{im2}, b_{im3}, \ldots, b_{imB_i}$ where $i$ is the TrCH number, $m$ is the transport block number, and $B_i$ is the number of bits in each block (including CRC). The number of transport blocks on TrCH $i$ is denoted by $M_i$. The bits after concatenation are denoted by $x_{i1}, x_{i2}, x_{i3}, \ldots, x_{iX_i}$, where $i$ is the TrCH number and $X_i=M_iB_i$. They are defined by the following relations:

$x_{ik} = b_{i1k}$ $k$ = 1, 2, …, $B_i$

$x_{ik} = b_{i,2,(k-B_i)}$ $k = B_i + 1, B_i + 2, \ldots, 2B_i$

$x_{ik} = b_{i,3,(k-2B_i)}$ $k = 2B_i + 1, 2B_i + 2, \ldots, 3B_i$

…

$x_{ik} = b_{i,M_i,(k-(M_i-1)B_i)}$ $k = (M_i - 1)B_i + 1, (M_i - 1)B_i + 2, \ldots, M_iB_i$

### 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 beginning of the first block. If turbo coding is selected and $X_i < 40$, filler bits are added to the beginning of the code 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 (only for 1.28 Mcps TDD) : $Z$ = *unlimited*.

The bits output from code block segmentation, for $C_i \neq 0$, 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 per code block.

Number of code blocks:

$$C_i = \begin{cases} \lceil X_i / Z \rceil & \text{when } Z \neq \textit{unlimited} \\ 0 & \text{when } Z = \textit{unlimited} \text{ and } X_i = 0 \\ 1 & \text{when } Z = \textit{unlimited} \text{ and } X_i \neq 0 \end{cases}$$

Number of bits in each code block (applicable for $C_i \neq 0$ only):

if $X_i < 40$ and Turbo coding is used, then

$K_i = 40$

else

$K_i = \lceil X_i / C_i \rceil$

end if

Number of filler bits: $Y_i = C_iK_i - X_i$

for $k$ = 1 to $Y_i$ -- Insertion of filler bits

$$o_{i1k} = 0$$

end for

for $k = Y_i+1$ to $K_i$

$$o_{i1k} = x_{i,(k-Y_i)}$$

end for

$r$ = 2 -- Segmentation

while $r \le C_i$

for $k$ = 1 to $K_i$

$$o_{irk} = x_{i,(k+(r-1)\cdot K_i - Y_i)}$$

end for

r = r+1

end while

## 4.2.3 Channel coding

Code blocks are delivered to the channel coding block. They 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 in each code block. The number of code blocks on TrCH $i$ is denoted by $C_i$. After encoding the bits are denoted by $y_{ir1}, y_{ir2}, y_{ir3}, \ldots, y_{irY_i}$ , where $Y_i$ is the number of encoded bits. The relation between $o_{irk}$ and $y_{irk}$ and between $K_i$ and $Y_i$ is dependent on the channel coding scheme.

The following channel coding schemes can be applied to transport channels:

- convolutional coding;
- turbo coding;
- no coding (only for 1.28 Mcps TDD).

Usage of coding scheme and coding rate for the different types of TrCH is shown in tables 1 and 2. The values of $Y_i$ in connection with each coding scheme:

- convolutional coding with rate 1/2: $Y_i = 2*K_i + 16$; rate 1/3: $Y_i = 3*K_i + 24$;
- turbo coding with rate 1/3: $Y_i = 3*K_i + 12$;
- no coding: $Y_i = K_i$ (only for 1.28 Mcps TDD).

**Table 1: Usage of channel coding scheme and coding rate for 3.84Mcps TDD**

| Type of TrCH | Coding scheme | Coding rate |
|---|---|---|
| BCH | Convolutional coding | 1/2 |
| PCH | | |
| RACH | | |
| DCH, DSCH, FACH, USCH | | 1/3, 1/2 |
| | Turbo coding | 1/3 |
| | ~~No coding~~ | |

**Table 2: Usage of channel coding scheme and coding rate for 1.28Mcps TDD**

<table>
<tr><th>Type of TrCH</th><th>Coding scheme</th><th>Coding rate</th></tr>
<tr><td>BCH</td><td rowspan="4">Convolutional coding</td><td>1/3</td></tr>
<tr><td>PCH</td><td>1/3, 1/2</td></tr>
<tr><td>RACH</td><td>1/2</td></tr>
<tr><td rowspan="3">DCH, DSCH, FACH, USCH</td><td>1/3, 1/2</td></tr>
<tr><td>Turbo coding</td><td>1/3</td></tr>
<tr><td colspan="2">No coding</td></tr>
</table>

***R1-02-0307***

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# CHANGE REQUEST

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ⌘ | **25.225** | **CR** | **044** | ⌘ **rev** | **-** | ⌘ Current version: | **3.9.0** ⌘ |

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***Proposed change affects:*** ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [X] Core Network [ ]

| | | | | |
|---|---|---|---|---|
| ***Title:*** ⌘ | Removal of channel coding option “no coding” 3.84 Mcps TDD | | | |
| ***Source:*** ⌘ | TSG RAN WG1 | | | |
| ***Work item code:*** ⌘ | TEI | | ***Date:*** ⌘ | 18.02.2002 |
| ***Category:*** ⌘ | F | | ***Release:*** ⌘ | R99 |
| | *Use one of the following categories:*<br>***F*** *(correction)*<br>***A*** *(corresponds to a correction in an earlier release)*<br>***B*** *(addition of feature),*<br>***C*** *(functional modification of feature)*<br>***D*** *(editorial modification)*<br>Detailed explanations of the above categories can be found in 3GPP TR 21.900. | | | *Use one of the following releases:*<br>*2 (GSM Phase 2)*<br>*R96 (Release 1996)*<br>*R97 (Release 1997)*<br>*R98 (Release 1998)*<br>*R99 (Release 1999)*<br>*REL-4 (Release 4)*<br>*REL-5 (Release 5)* |

| | |
|---|---|
| ***Reason for change:*** ⌘ | At the last joint AdHoc RAN1/RAN2 meeting it has been agreed to remove the channel coding option “no coding” for FDD and 3.84 Mcps TDD. For 1.28 Mcps TDD this option is still valid. |
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| ***Consequences if not approved:*** ⌘ | An option that is not used by any Radio Bearer would be a mandatory feature for all UEs. |

| | | |
|---|---|---|
| ***Clauses affected:*** ⌘ | 5.2.5 | |
| ***Other specs affected:*** ⌘ | [X] Other core specifications ⌘<br>[ ] Test specifications<br>[ ] O&M Specifications | 25.201, 25.212, 25.215, 25.222 |
| ***Other comments:*** ⌘ | | |

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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

### 5.2.5 Transport channel BER

| | |
|---|---|
| **Definition** | The transport channel BER is an estimation of the average bit error rate (BER) of DCH or USCH data. The transport channel (TrCH) BER is measured from the data considering only non-punctured bits at the input of the channel decoder in Node B.<br>It shall be possible to report an estimate of the transport channel BER for a TrCH after the end of each TTI of the TrCH. The reported TrCH BER shall be an estimate of the BER during the latest TTI for that TrCH. ~~Transport channel BER is only required to be reported for TrCHs that are channel coded.~~ |

**3GPP TSG RAN Meeting #15**
**Jeju, Korea, 5 – 8, March, 2002**

***R1-02-0307***

*CR-Form-v5*

# CHANGE REQUEST

| | | | | | | |
|---|---|---|---|---|---|---|
| ⌘ | **25.225** | **CR 045** | ⌘ **rev** | **-** | ⌘ Current version: | **4.3.0** ⌘ |

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***Proposed change affects:*** ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [X] Core Network [ ]

| | | | |
|---|---|---|---|
| ***Title:*** ⌘ | Removal of channel coding option "no coding" for 3.84 Mcps TDD | | |
| ***Source:*** ⌘ | TSG RAN WG1 | | |
| ***Work item code:*** ⌘ | TEI | ***Date:*** ⌘ | 18.02.2002 |
| ***Category:*** ⌘ | A | ***Release:*** ⌘ | REL-4 |
| | *Use one of the following categories:*<br>***F*** *(correction)*<br>***A*** *(corresponds to a correction in an earlier release)*<br>***B*** *(addition of feature),*<br>***C*** *(functional modification of feature)*<br>***D*** *(editorial modification)*<br>Detailed explanations of the above categories can be found in 3GPP TR 21.900. | | *Use one of the following releases:*<br>*2 (GSM Phase 2)*<br>*R96 (Release 1996)*<br>*R97 (Release 1997)*<br>*R98 (Release 1998)*<br>*R99 (Release 1999)*<br>*REL-4 (Release 4)*<br>*REL-5 (Release 5)* |

| | |
|---|---|
| ***Reason for change:*** ⌘ | At the last joint AdHoc RAN1/RAN2 meeting it has been agreed to remove the channel coding option "no coding" for FDD and 3.84 Mcps TDD. For 1.28 Mcps TDD this option is still valid. |
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| ***Consequences if not approved:*** ⌘ | An option that is not used by any Radio Bearer would be a mandatory feature for all UEs. |

| | | |
|---|---|---|
| ***Clauses affected:*** ⌘ | 5.2.5 | |
| ***Other specs affected:*** ⌘ | [X] Other core specifications ⌘<br>[ ] Test specifications<br>[ ] O&M Specifications | 25.201, 25.212, 25.215, 25.222 |
| ***Other comments:*** ⌘ | | |

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### 5.2.5 Transport channel BER

| | |
|---|---|
| **Definition** | The transport channel BER is an estimation of the average bit error rate (BER) of DCH or USCH data. The transport channel (TrCH) BER is measured from the data considering only non-punctured bits at the input of the channel decoder in Node B.<br>It shall be possible to report an estimate of the transport channel BER for a TrCH after the end of each TTI of the TrCH. The reported TrCH BER shall be an estimate of the BER during the latest TTI for that TrCH.<br><br>For 1.28 Mcps TDD: Transport channel BER is only required to be reported for TrCHs that are channel coded. |