3GPP TSG RAN Meeting #19 **RP-030139**
Birmingham, United Kingdom, 11 - 14 March 2003

Title: **CRs (Rel-5) to TS 25.222**

Source: **TSG-RAN WG1**

Agenda item: **8.1.5**

TS 25.222 **(RP-030139)**

Doc-1st-	Doc-2nd-	Spec	CR	Rev	Subject	Phase	Ca	Versio	Versio	Workitem
RP-030139	R1-030204	25.222	108	1	HSDPA corrections	Rel-5	F	5.3.0	5.4.0	HSDPA-Phys
RP-030139	(R1-030374	25.222	109	3	Miscellaneous Corrections	Rel-5	F	5.3.0	5.4.0	TEI-5

3GPP TSG-RAN1 Meeting #31
Tokyo, Japan, 18-21 February 2003

Tdoc ⌘R1-030204

CR-Form-v7

CHANGE REQUEST

⌘ **25.222**	**CR 108**	⌘ **rev**	**1**	⌘ Current version:	**5.3.0** ⌘

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

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [X] Core Network [ ]

Title: ⌘	HSDPA corrections		
Source: ⌘	TSG RAN WG1		
Work item code: ⌘	HSDPA-Phys	***Date:*** ⌘	23/12/2002
Category: ⌘	**F**	***Release:*** ⌘	Rel-5
	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)* *Rel-6 (Release 6)*

Reason for change: ⌘	Incorrect reference in section 4.5.3 means that code block concatenation is unspecified. Incorrect matrix dimension in section 4.5.6 leads to misleading specification.
Summary of change: ⌘	Code block concatenation is included by referring to section 4.2.3 rather than section 4.2.3.2. This correction aligns TS25.222 with TS25.212. In section 4.5.6, the matrix dimensions are consistently defined as R2 x 30.
Consequences if not approved: ⌘	Incomplete and misleading specification.

Clauses affected: ⌘	4.5.3, 4.5.6			
	Y	**N**		
Other specs affected: ⌘		**X**	Other core specifications	⌘
		X	Test specifications	
		X	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/specs/CR.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.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

4.5.3 Channel coding for HS-DSCH

Channel coding for the HS-DSCH transport channel shall be done with the general method described in 4.2.3~~.2~~ above with the following specific parameters.

There will be a maximum of one transport block, *i* = 1. The rate 1/3 turbo coding shall be used.

4.5.6 Interleaving for HS-DSCH

The interleaving for TDD is done over all bits in the TTI, as shown in figure 17 when QPSK modulation is being used for the HS-DSCH, and figure 18 when 16-QAM modulation is being used. The bits input to the block interleaver are denoted by $s_1, s_2, s_3, ..., s_R$, where R is the number of bits in one TTI.

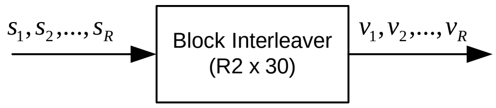

Figure 17: Interleaver structure for HS-DSCH with QPSK modulation

For QPSK, the interleaver is a block interleaver and consists of bits input to a matrix with padding, the inter-column permutation for the matrix and bits output from the matrix with pruning. The output bit sequence from the block interleaver is derived as follows:

(1) The number of columns of the matrix is 30. The columns of the matrix are numbered 0, 1, 2, …, 29 from left to right.

(2) Determine the number of rows of the matrix, $R2$, by finding minimum integer $R2$ such that $R \le 30 \times R2$. The rows of rectangular matrix are numbered 0, 1, 2, …, $R2 - 1$ from top to bottom.

(3) Write the input bit sequence $s_1, s_2, s_3, ..., s_R$ into the $R2 \times 30$ matrix row by row starting with bit y_1 in column 0 of row 0:

$$\begin{bmatrix} y_1 & y_2 & y_3 & \cdots & y_{30} \\ y_{31} & y_{32} & y_{33} & \cdots & y_{60} \\ \vdots & \vdots & \vdots & & \vdots \\ y_{30\cdot(R2-1)+1} & y_{30\cdot(R2-1)+2} & y_{30\cdot(R2-1)+3} & \cdots & y_{30\cdot R2} \end{bmatrix}$$

where $y_k = s_k$ for k = 1, 2, …, R and, if $R < 30\times R2$, dummy bits are inserted for $k = R+1, R+2, …, 30\times R2$. These dummy bits are pruned away from the output of the matrix after the inter-column permutation.

(4) Perform the inter-column permutation for the matrix based on the pattern $\langle P2(j)\rangle_{j\in\{0,1,...,29\}}$ that is shown in Table 7, where P2(j) is the original column position of the j-th permuted column. After permutation of the columns, the bits are denoted by y'_k.

$$\begin{bmatrix} y'_1 & y'_{R2+1} & y'_{2\cdot R2+1} & \cdots & y'_{29\cdot R2+1} \\ y'_2 & y'_{R2+2} & y'_{2\cdot R2+2} & \cdots & y'_{29\cdot R2+2} \\ \vdots & \vdots & \vdots & & \vdots \\ y'_{R2} & y'_{2\cdot R2} & y'_{3\cdot R2} & \cdots & y'_{30\cdot R2} \end{bmatrix}$$

(5) The output of the block interleaver is the bit sequence read out column by column from the inter-column permuted $R2\times30$~~$30\times R2$~~ matrix. The output is pruned by deleting dummy bits that were padded to the input of the matrix before the inter-column permutation, i.e. bits y'_k that corresponds to bits y_k with $k > R$ are removed from the output. The bits after interleaving are denoted by $v_1, v_2, v_3, ..., v_R$, where v_1 corresponds to the bit y'_k with smallest index k after pruning, v_2 to the bit y'_k with second smallest index k after pruning, and so on.

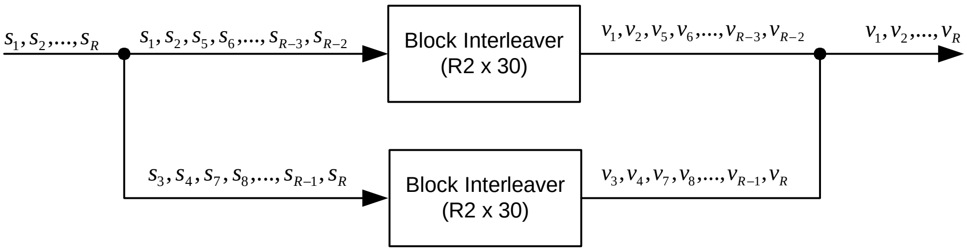

Figure 18: Interleaver structure for HS-DSCH with 16-QAM modulation

For 16QAM, a second identical interleaver operates in parallel to the first. For both interleavers, *R2* is chosen to be the minimum integer that satisfies $R \leq 60 \times R2$. The output bits from the bit scrambling operation are divided pairwise between the interleavers: bits s_k and s_{k+1} go to the first interleaver and bits s_{k+2} and s_{k+3} go to the second interleaver, where k mod 4 = 1. Bits are collected pairwise from the interleavers: bits v_k and v_{k+1} are obtained from the first interleaver and bits v_{k+2} and v_{k+3} are obtained from the second interleaver, where again k mod 4 = 1.

3GPP TSG-RAN1 Meeting #31
Tokyo, Japan, 18-21 February 2003

Tdoc ⌘R1-030374

CR-Form-v7

CHANGE REQUEST

⌘	**25.222**	**CR**	**109**	⌘ **rev**	**3**	⌘	Current version: **5.3.0**	⌘

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

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [X] Core Network [ ]

Title:	⌘	Miscellaneous Corrections	
Source:	⌘	TSG RAN WG1	
Work item code:	⌘	TEI-5	***Date:*** ⌘ 06/03/2003
Category:	⌘	**F**	***Release:*** ⌘ Rel-5
		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)* *Rel-6 (Release 6)*

Reason for change:	⌘	To correct the editorial mistakes
Summary of change:	⌘	Correction to some wrong references, wrong implementation of a previous CR (RAN_18 RP-020852, CR 107), and typing mistakes
Consequences if not approved:	⌘	Confusion, misunderstanding, and unreadability of the spec

Clauses affected:	⌘	4.2, 4.2.3.2.3, 4.2.7, 4.2.12.1, 4.5, 4.5.7, 4.6.1.1, 4.6.1.3				
		Y	**N**			
Other specs affected:	⌘		**N**	Other core specifications	⌘	
			N	Test specifications		
			N	O&M Specifications		
Other comments:	⌘					

4.2 General coding/multiplexing of TrCHs

This section only applies to the transport channels: DCH, RACH, DSCH, USCH, BCH, FACH and PCH. Other transport channels which do not use the general method are described separately below.

Figure 1 illustrates the overall concept of transport-channel coding and multiplexing. Data arrives to the coding/multiplexing unit in form of transport block sets, once every transmission time interval. The transmission time interval is transport-channel specific from the set {5 ms(*1), 10 ms, 20 ms, 40 ms, 80 ms}.

Note: (*1) may be applied for PRACH for 1.28 Mcps TDD

The following coding/multiplexing steps can be identified:

- add CRC to each transport block (see subclause 4.2.1);
- TrBk concatenation / Code block segmentation (see subclause 4.2.2);
- channel coding (see subclause 4.2.3) ;
- radio frame size equalization (see subclause 4.2.4);
- interleaving (two steps, see subclauses 4.2.5 and 4.2.11 ~~4.2.10~~);
- radio frame segmentation (see subclause 4.2.6);
- rate matching (see subclause 4.2.7);
- multiplexing of transport channels (see subclause 4.2.8);
- bit scrambling (see subclause 4.2.9);
- physical channel segmentation (see subclause 4.2.10);
- sub-frame segmentation(see subclause 4.2.11A only for 1.28Mcps TDD)
- mapping to physical channels (see subclause 4.2.12).

The coding/multiplexing steps for uplink and downlink are shown in figures 1 and 1A.

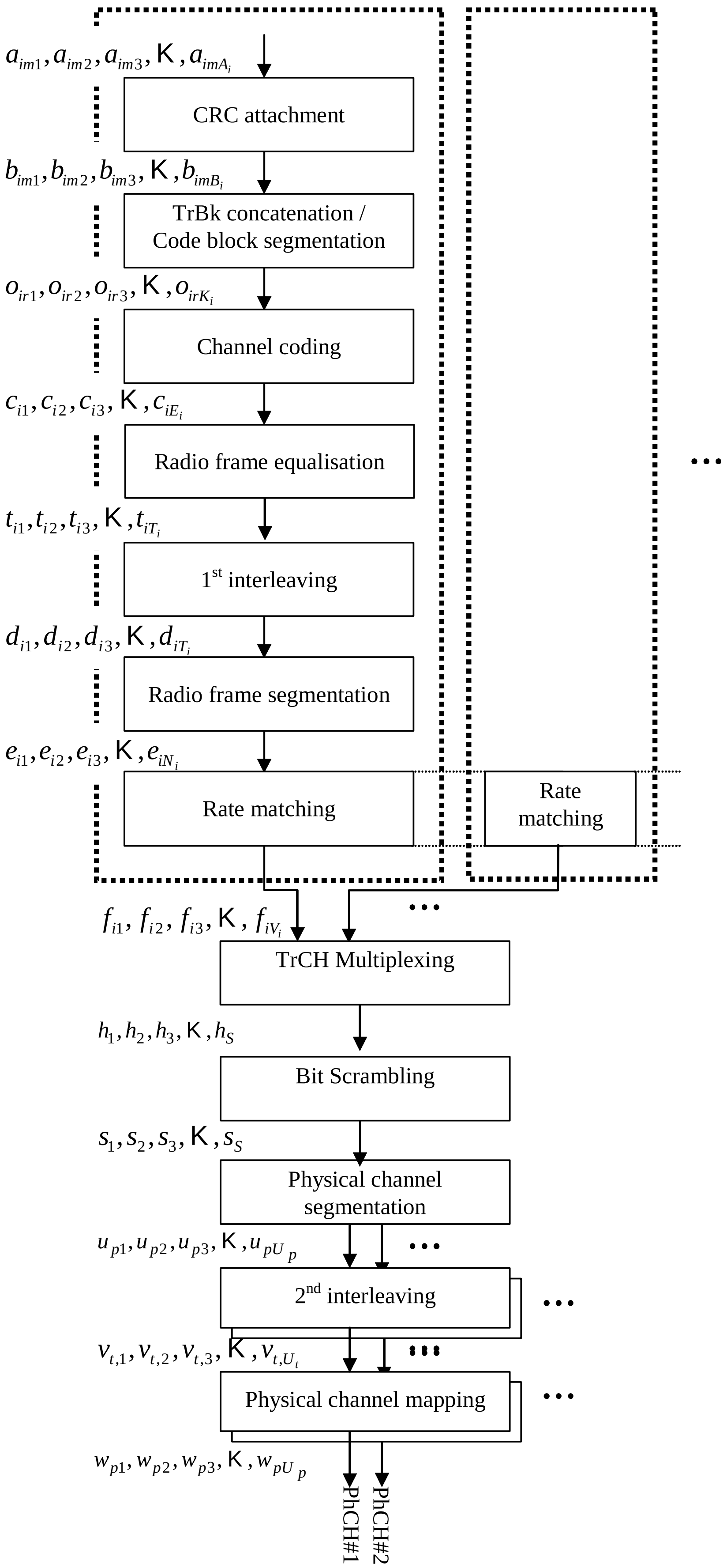

Figure 1: Transport channel multiplexing structure for uplink and downlink for 3.84Mcps TDD

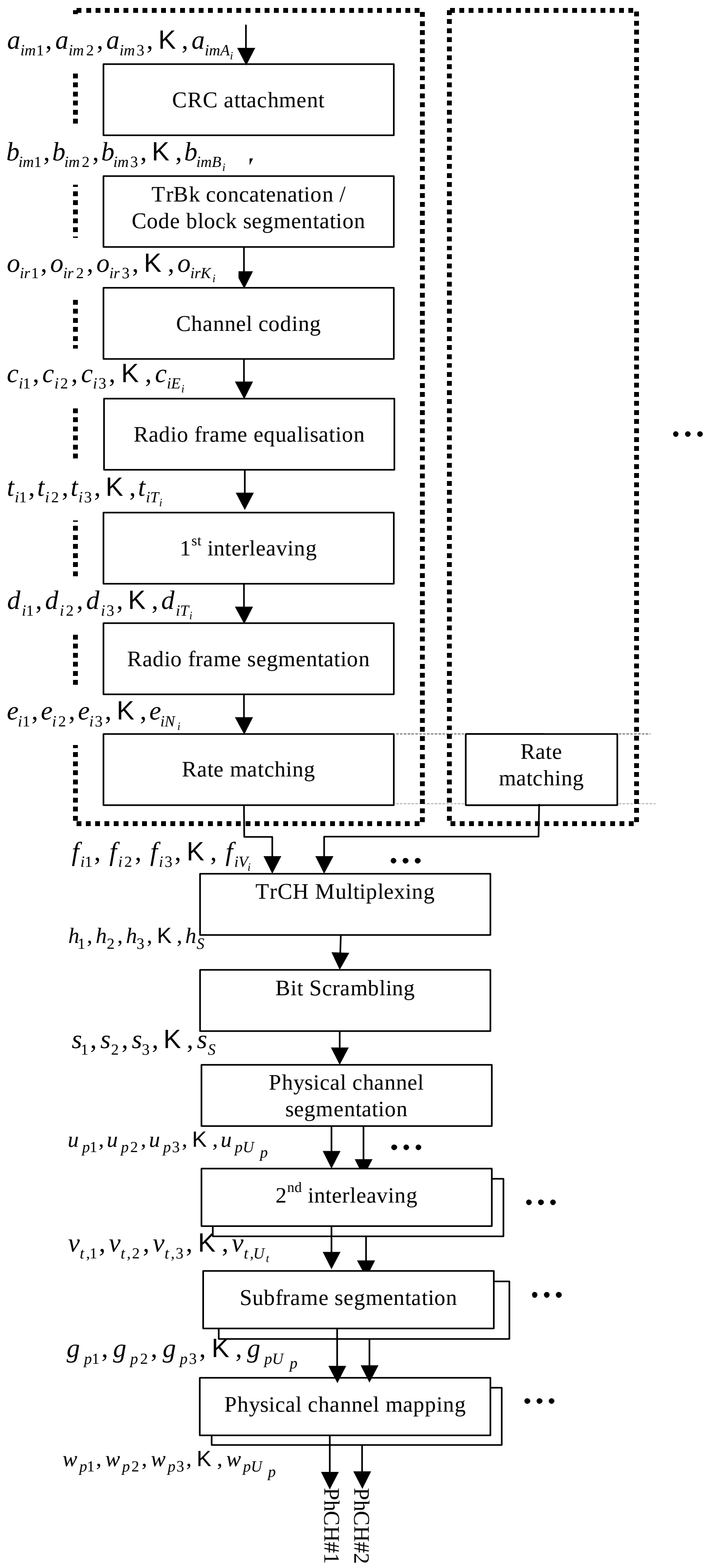

Figure 1A: Transport channel multiplexing structure for uplink and downlink of 1.28Mcps TDD

Primarily, transport channels are multiplexed as described above, i.e. into one data stream mapped on one or several physical channels. However, an alternative way of multiplexing services is to use multiple CCTrCHs (Coded Composite Transport Channels), which corresponds to having several parallel multiplexing chains as in figures 1 and 1A, resulting in several data streams, each mapped to one or several physical channels.

4.2.3.2.3 Turbo code internal interleaver

The Turbo code internal interleaver consists of bits-input to a rectangular matrix with padding, intra-row and inter-row permutations of the rectangular matrix, and bits-output from the rectangular matrix with pruning. The bits input to the Turbo code internal interleaver are denoted by $x_1, x_2, x_3, \ldots, x_K$, where K is the integer number of the bits and takes one value of $40 \le K \le 5114$. The relation between the bits input to the Turbo code internal interleaver and the bits input to the channel coding is defined by $x_k = o_{irk}$ and $K = K_i$.

The following subclause specific symbols are used in subclauses 4.2.3.2.3.1 to 4.2.3.2.3.3 ~~4.2.3.4.3.3~~:

K	Number of bits input to Turbo code internal interleaver
R	Number of rows of rectangular matrix
C	Number of columns of rectangular matrix
p	Prime number
v	Primitive root
$\langle s(j) \rangle_{j \in \{0,1,\ldots,p-2\}}$	Base sequence for intra-row permutation
q_i	Minimum prime integers
r_i	Permuted prime integers
$\langle T(i) \rangle_{i \in \{0,1,\ldots,R-1\}}$	Inter-row permutation pattern
$\langle U_i(j) \rangle_{j \in \{0,1,\ldots,C-1\}}$	Intra-row permutation pattern of i-th row
i	Index of row number of rectangular matrix
j	Index of column number of rectangular matrix
k	Index of bit sequence

4.2.7 Rate matching

Rate matching means that bits on a TrCH are repeated or punctured. Higher layers assign a rate-matching attribute for each TrCH. 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 TrCH can vary between different transmission time intervals. When the number of bits between different transmission time intervals is changed, bits are repeated to ensure that the total bit rate after TrCH multiplexing is identical to the total channel bit rate of the allocated 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.

Notation used in subclause 4.2.7 and subclauses:

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

$\Delta N_{i,j}$: If positive – number of bits to be repeated in each radio frame on TrCH *i* with transport format combination j.

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

RM_i : Semi-static rate matching attribute for TrCH *i*. Signalled from higher layers.

PL : Puncturing limit. This value limits the amount of puncturing that can be applied in order to minimise the number of physical channels. Signalled from higher layers. The allowed puncturing in % is actually equal to (1-PL)*100.

$N_{data,j}$: Total number of bits that are available for a CCTrCH in a radio frame with transport format combination j.

P : number of physical channels used in the current frame.

P_{max} : maximum number of physical channels allocated for a CCTrCH.

U_p : Number of data bits in the physical channel p with p = 1...P.

I : Number of TrCHs in a CCTrCH.

Z_{ij} : Intermediate calculation variable.

F_i : Number of radio frames in the transmission time interval of TrCH *i*.

n_i : Radio frame number in the transmission time interval of TrCH *i* ($0 \le n_i < F_i$).

q : Average puncturing or repetition distance(normalised to only show the remaining rate matching on top of an integer number of repetitions).

$P1_F(n_i)$: The column permutation function of the 1st interleaver, $P1_F(x)$ is the original position of column with number x after permutation. P1 is defined on table 4 of section 4.2.5 (note that $P1_F$ self-inverse).

S[n] : The shift of the puncturing or repetition pattern for radio frame n_i when $n = P1_{F_i}(n_i)$.

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

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

e_{ini} : Initial value of variable e in the rate matching pattern determination algorithm of subclause 4.2.7.3.

e_{plus} : Increment of variable *e* in the rate matching pattern determination algorithm of subclause 4.2.7.3.

e_{minus} : Decrement of variable *e* in the rate matching pattern determination algorithm of subclause 4.2.7.3.

b : Indicates systematic and parity bits.

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

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

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

4.2.12.1 Physical channel mapping for the 3.84 Mcps option

The PhCH for both uplink and downlink is defined in [76]. The bits after physical channel mapping are denoted by $w_{p,1}, w_{p,2}, \ldots, w_{p,U_p}$, where *p* is the PhCH number corresponding to the sequence number $1 \le p \le P$ of this physical channel as detailed below, U_p is the number of bits in one radio frame for the respective PhCH, and $P \le P_{max}$. The bits $w_{p,k}$ are mapped to the PhCHs so that the bits for each PhCH are transmitted over the air in ascending order with respect to *k*.

The physical layer shall assign the physical channel sequence number *p* to the physical channels of the CCTrCH in the respective radio frame, treating each allocated timeslot in ascending order. If within a timeslot there are multiple physical channels they shall first be ordered in ascending order of the spreading factor (*Q*) and subsequently by channelisation code index (*k*), as shown in [9].

The mapping of the bits $v_{t,1}, v_{t,2}, \ldots, v_{t,U_t}$ is performed like block interleaving, writing the bits into columns, but a PhCH with an odd number is filled in forward order, whereas a PhCH with an even number is filled in reverse order.

The mapping scheme, as described in the following subclause, shall be applied individually for each timeslot *t* used in the current frame. Therefore, the bits $v_{t,1}, v_{t,2}, \ldots, v_{t,U_t}$ are assigned to the bits of the physical channels $w_{t,1,1 \ldots U_{t1}}, w_{t,2,1 \ldots U_{t2}}, \ldots, w_{t,P_t,1 \ldots U_{tP_t}}$ in each timeslot.

In uplink there are at most two codes allocated (P≤2). If there is only one code, the same mapping as for downlink is applied. Denote SF1 and SF2 the spreading factors used for code 1 and 2, respectively. For the number of consecutive bits to assign per code bs_k the following rule is applied:

if

SF1 >= SF2 then $bs_1 = 1$; $bs_2 =$ SF1/SF2 ;

else

SF2 > SF1 then $bs_1 =$ SF2/SF1; $bs_2 = 1$;

end if

In the downlink case bs_p is 1 for all physical channels.

4.5 Coding for HS-DSCH

Figure 15 illustrates the overall concept of transport-channel coding for HS-DSCH. Data arrives at the coding unit in the form of one transport block once every TTI. The TTI is 5 ms for 1.28 Mcps TDD and 10 ms for 3.84 Mcps TDD.

The following coding steps for HS-DSCH can be identified:

- add CRC to each transport block (see subclause 4.5.1);
- code block segmentation (see subclause 4.5.2);
- channel coding (see subclause 4.5.3);
- hybrid ARQ (see subclause 4.5.4);
- bit scrambling (see subclause 4.5.5);
- interleaving for HS-DSCH (see subclause 4.5.6);
- constellation re-arrangement for 16QAM (see subclause 4.5.7);
- mapping to physical channels (see subclause 4.5.8).

The coding steps for HS-DSCH are shown in figure 15.

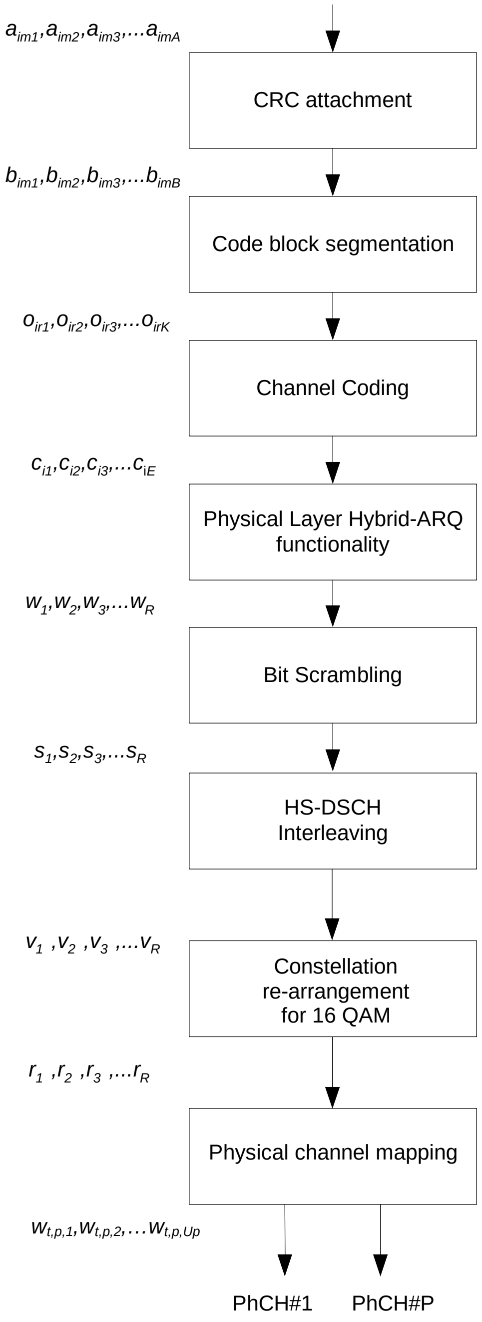

Figure 15. Coding chain for HS-DSCH

In the following the number of transport blocks is always one. When referencing non HS-DSCH formulae which are used in correspondence with HS-DSCH formulae the convention is used that transport block subscripts may be omitted (e.g. X_i when i is always 1 may be written X).

4.5.7 Constellation re-arrangement for 16 QAM

This function only applies to 16 QAM modulated bits. In case of QPSK it is transparent.

The following table 15 describes the operations that produce the different rearrangements.

The bits of the input sequence are mapped in groups of 4 so that v_k, v_{k+1}, v_{k+2}, v_{k+3} are used, where k mod 4 = 1.

Table 15: Constellation re-arrangement for 16 QAM

Constellation version parameter *b*	**Output bit sequence**	**Operation**
0	$v_k v_{k+1} v_{k+2} v_{k+3}$	None
1	$v_{k+2} v_{k+3} v_k v_{k+1}$	Swapping MSBs with LSBs
2	$v_k v_{k+1} \overline{v_{k+2}}\,\overline{v_{k+3}}$	Inversion of the logical values of LSBs
3	$v_{k+2} v_{k+3} \overline{v_k}\,\overline{v_{k+1}}$	Swapping MSBs with LSBs, and inversion of the logical values of LSBs

The output bit sequences from the table above map to the output bits in groups of 4, i.e. r_k, r_{k+1}, r_{k+2}, r_{k+3}, where k mod 4 = 1.

4.6.1.1 Channelisation code set information mapping

HS-PDSCH channelisation codes are allocated contiguously from a signalled start code to a signalled stop code, and the allocation includes both the start and stop code. The start code k_{start} is signalled by the bits $x_{ccs,1}$, $x_{ccs,2,}$ $x_{ccs,3}$, $x_{ccs,4}$ and the stop code k_{stop} by the bits $x_{ccs,5}$, $x_{ccs,6,}$ $x_{ccs,7}$, $x_{ccs,8}$. The mapping in Table 16 below applies.

Table 16: Channelisation code set information mapping

k_{start}	$x_{ccs,1}$	$x_{ccs,2}$	$x_{ccs,3}$	$x_{ccs,4}$	k_{stop}	$x_{ccs,5}$	$x_{ccs,6}$	$x_{ccs,7}$	$x_{ccs,8}$
1	0	0	0	0	1	0	0	0	0
2	0	0	0	1	2	0	0	0	1
3	0	0	1	0	3	0	0	1	0
4	0	0	1	1	4	0	0	1	1
5	0	1	0	0	5	0	1	0	0
6	0	1	0	1	6	0	1	0	1
7	0	1	1	0	7	0	1	1	0
8	0	1	1	1	8	0	1	1	1
9	1	0	0	0	9	1	0	0	0
10	1	0	0	1	10	1	0	0	1
11	1	0	1	0	11	1	0	1	0
12	1	0	1	1	12	1	0	1	1
13	1	1	0	0	13	1	1	0	0
14	1	1	0	1	14	1	1	0	1
15	1	1	1	0	15	1	1	1	0
16	1	1	1	1	16	1	1	1	1

If a value of k_{start} = 16 and k_{stop} = 1 is signalled, a spreading factor of SF=1 shall be used for the HS-PDSCH resources. Other than this case, $k_{start} > k_{stop}$ shall be treated as an error by the UE.

4.6.1.3 Modulation scheme information mapping

The modulation scheme to be used by the HS-PDSCH resources shall be signalled by bit $x_{ms,1}$. The mapping scheme in Table 17 shall apply.

Table 17: Modulation scheme information mapping

$x_{ms,1}$	Modulation Scheme
0	QPSK
1	16-QAM