3GPP TSG-RAN Meeting #16 *RP-020317*
Marco Island, FL, U.S.A., 4 – 7, June, 2002

Title: **Agreed CRs (Rel-5) for the WI of "High Speed Downlink Packet Access -- Physical Layer" (Part 2)**

Source: **TSG-RAN WG1**

Agenda item: **8.1.16**

No.	Spec	CR	Rev	R1 T-doc	Subject	Phase	Cat	Work Item	V_old	V_new
1	25.221	081	-	R1-02-0399	Tx diversity for HSDPA in TDD	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
2	25.222	078	2	R1-02-0768	Removal of inconsistencies and ambiguities in the HARQ description	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
3	25.222	079	4	R1-02-0841	Corrections to HS-DSCH coding	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
4	25.222	082	1	R1-02-0738	Corrections to HSDPA multiplexing and coding	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
5	25.222	084	-	R1-02-0840	Introduction of HS-SCCH cyclic sequence counter for TDD	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
6	25.223	031	-	R1-02-0403	Correction of SPC for 16QAM in TDD	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
7	25.224	089	-	R1-02-0399	Tx diversity for HSDPA in TDD	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
8	25.224	090	-	R1-02-0840	Correction to HS-SCCH power control (TDD)	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0

3GPP TSG RAN Meeting #16
Marco Island, FL, U.S.A., 4 – 7, June 2002

R1-02-0399

CR-Form-v5

CHANGE REQUEST

z **25.221**	**CR**	**081**	z **rev**	**-**	z Current version:	**5.0.0** z

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

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

Title:	z	TxDiversity for HSDPA in TDD		
Source:	z	TSG RAN WG1		
Work item code:	z	HSDPA-Phys	***Date:*** z	4.4.2002
Category:	z	**F**	***Release:*** z	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)*

Reason for change:	z	There is no need to restrict the applicability of the existing TxDiversity schemes to DPCH and PDSCH only.
Summary of change:	z	Text is extended to include the HS-PDSCH and HS-SCCH in the current sections on TxDiversity.
Consequences if not approved:	z	Unnecessary restriction with respect to the applicability of TxDiversity and loss of potential system benefits by this restriction.

Clauses affected:	z	5.4, 6.4	
Other specs affected:	z	[X] Other core specifications z	25.224
		[ ] Test specifications	
		[ ] O&M Specifications	
Other comments:	z		

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 z 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.

5.4 Transmit Diversity for DL Physical Channels

Table 9 summarizes the different transmit diversity schemes for different downlink physical channel types that are described in [9].

Table 9: Application of Tx diversity schemes on downlink physical channel types "X" – can be applied, "–" – must not be applied

Physical channel type	Open loop TxDiversity		Closed loop TxDiversity
	TSTD	SCTD	
P-CCPCH	–	X	–
SCH	X	–	–
DPCH	–	–	X
PDSCH	–	–	X
PICH	–	X	–
HS-SCCH	-	-	X
HS-PDSCH	-	-	X

6.4 Transmit Diversity for DL Physical Channels

Table 22 summarizes the different transmit diversity schemes for different downlink physical channel types in 1.28Mcps TDD that are described in [9].

Table 22: Application of Tx diversity schemes on downlink physical channel types in 1.28Mcps TDD "X" – can be applied, "–" – must not be applied

Physical channel type	Open loop TxDiversity		Closed loop TxDiversity
	TSTD	SCTD	
P-CCPCH	X	X	–
DwPCH	X	–	–
DPCH	X	–	X
PDSCH	X	–	X
HS-SCCH	-	-	X
HS-PDSCH	-	-	X

3GPP TSG RAN Meeting #16
Marco Island, FL, U.S.A., 4 – 7, June 2002

R1-02-0768

CR-Form-v5.1

CHANGE REQUEST

z	**25.222**	**CR**	**078**	z **rev**	**2**	z	Current version:	**5.0.0**	z

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

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

Title:	z	Removal of inconsistencies and ambiguities in the HARQ description		
Source:	z	TSG RAN WG1		
Work item code:	z	HSDPA-Phys	***Date:*** z	10 May 2002
Category:	z	**F** *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.	***Release:*** z	REL-5 *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: z Inconsistencies and ambiguities are present in the current description of HARQ.

Summary of change: z

- Figure 17: In the 2nd Rate Matching stage two arrows can be removed since they have no meaning.
- The range of r is corrected to 0 ... r_{max} –1 to be consistent with other parts of the specification. Also the value of r_{max} has been clarified.
- The wording for "self-decodable" and "non self-decodable" transmissions has been changed to "transmissions that prioritise systematic bits" and "transmissions that prioritise non systematic bits" in order to avoid confusion.
- The formula for the calculation of the transmitted systematic bits in case of repetition has been changed, since N_{p2} can be larger than N_{p1} from the first Rate Matching stage.
- Similar to the 1st Rate Matching stage a sentence is added for the 2nd Rate Matching stage that clarifies that δ bits are discarded.
- The parameter a in Table 10 has different values for parity 1 and parity 2 bits. This could be misunderstood when just looking on Table 10. Therefore, the values a = 1 for parity 2 and a = 2 for parity 1 are used in the table directly. The parameter a is no longer needed for this part of the specification.
- For the Rate Matching algorithm it is assumed that integer values are used for e_{ini}. Also it must be ensured that $e_{ini} \leq e_{plus}$. Therefore, in the formulas for calculation of e_{ini} rounding is introduced.
- The calculation of N_{row} and N_{col} is modified to avoid the usage of variables M and F. N_{data} is used instead of F to be consistent with section 4.5.4.3.
- The formula for calculating N_c is modified to avoid a division operation.
- Some ambiguities on writing into the bit collection interleaver have been removed. It is now clear that a parity 2 bit is written first when writing in alternating order into the interleaver.

		- In addition, some minor editorial changes (indices, references) are done.
Consequences if not approved:	z	Inconsistencies and ambiguities would remain in the specification. Vendors could build equipment with different implementations. Isolated impact: The enclosed changes do only have an impact to the changed section 4.5.4 itself. No other parts of the specifications are affected.

Clauses affected:	z	4.5.4, 4.5.4.3, 4.5.4.4		
Other specs affected:	z	[ ] Other core specifications [ ] Test specifications [ ] O&M Specifications	z	
Other comments:	z			

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 z 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.

4.5.4 Hybrid ARQ for HS-DSCH

The hybrid ARQ functionality matches the number of bits at the output of the channel coder to the total number of bits of the HS-PDSCH set to which the HS-DSCH is mapped. The hybrid ARQ functionality is controlled by the redundancy version (RV) parameters. The exact set of bits at the output of the hybrid ARQ functionality depends on the number of input bits, the number of output bits, and the RV parameters.

The hybrid ARQ functionality consists of two rate-matching stages and a virtual buffer as shown in the figure below.

The first rate matching stage matches the number of input bits to the virtual IR buffer, information about which is provided by higher layers. Note that, if the number of input bits does not exceed the virtual IR buffering capability, the first rate-matching stage is transparent.

The second rate matching stage matches the number of bits after first rate matching stage to the number of physical channel bits available in the HS-PDSCH set in the TTI.

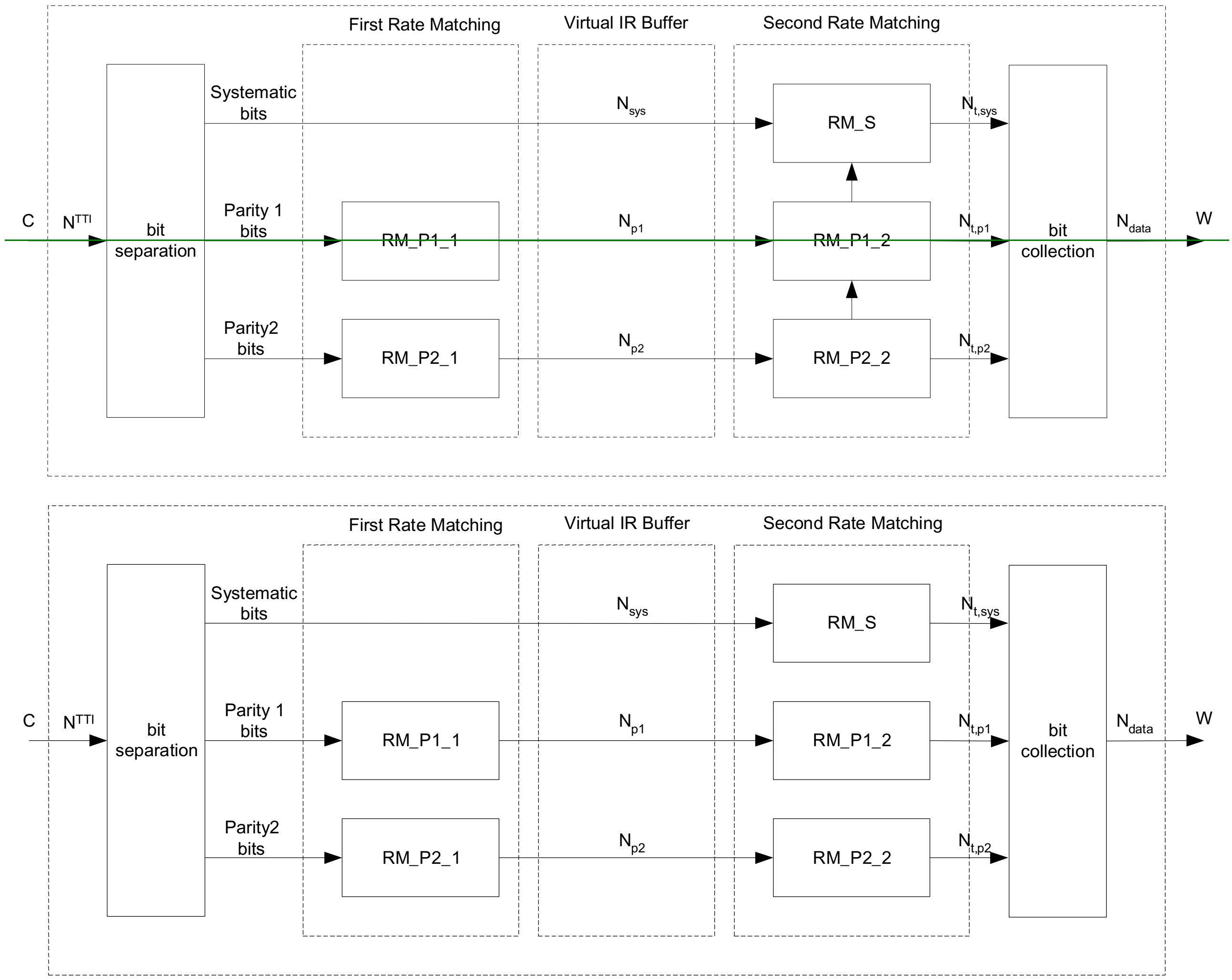


Figure 17: HS-DSCH hybrid ARQ functionality

4.5.4.1 HARQ bit separation

The HARQ bit separation function shall be performed in the same way as bit separation for turbo encoded TrCHs in 4.2.7.2 above.

4.5.4.2 HARQ First Rate Matching Stage

HARQ first stage rate matching for the HS-DSCH transport channel shall be done with the general method described in 4.2.7.1.2 above with the following specific parameters.

The maximum number of soft bits available in the virtual IR buffer is N_{IR} which is signalled from higher layers for each HARQ process. The number of coded bits in a TTI before rate matching is N^{TTI} this is deduced from information signalled from higher layers and parameters signalled on the HS-SCCH for each TTI. Note that HARQ processing and physical layer storage occurs independently for each HARQ process currently active.

If N_{IR} is greater than or equal to N^{TTI} (i.e. all coded bits of the corresponding TTI can be stored) the first rate matching stage shall be transparent. This can, for example, be achieved by setting $e_{minus} = 0$. Note that no repetition is performed.

If N_{IR} is smaller than N^{TTI} the parity bit streams are punctured as in 4.2.7.1.2 above by setting the rate matching parameter $\Delta N_{il}^{TTI} = N_{IR} - N^{TTI}$ where the subscripts i and l refer to transport channel and transport format in the referenced sub-clause. Note the negative value is expected when the rate matching implements puncturing. Bits selected for puncturing which appear as δ in the algorithm in 4.2.7 above shall be discarded and not counted in the totals for the streams through the virtual IR buffer.

4.5.4.3 HARQ Second Rate Matching Stage

HARQ second stage rate matching for the HS-DSCH transport channel shall be done with the general method described in 4.2.7.3 above with the following specific parameters. Bits selected for puncturing which appear as δ in the algorithm in 4.2.7.3 above shall be discarded and are not counted in the streams towards the bit collection.

The parameters of the second rate matching stage depend on the value of the RV parameters s and r. The parameter s can take the value 0 or 1 to distinguish ~~self-decodable~~ between transmissions that prioritise systematic bits (s = 1) and non ~~self-decodable~~ systematic bits (s = 0) ~~transmissions~~. The parameter r (range 0 to r_{max}-1) changes the initial error variable e_{ini} in the case of puncturing. In case of repetition both parameters *r* and *s* change the initial error variable e_{ini}. The parameters X_i, e_{plus} and e_{minus} are calculated as per table 15 below.

Denote the number of bits before second rate matching as N_{sys} for the systematic bits, N_{p1} for the parity 1 bits, and N_{p2} for the parity 2 bits, respectively. Denote the number of physical channels used for the ~~CCTrCH~~ HS-DSCH by *P*. N_{data} is the number of bits available to the ~~CCTrCH~~ HS-DSCH in one ~~radio frame~~ TTI and defined as $N_{data}=P\times N_{Data/Slot}$ ~~$3\times N_{data1}$~~, where ~~N_{data1}~~ $N_{Data/Slot}$ is defined in [7~~2~~]. The rate matching parameters are determined as follows.

For $N_{data} \le N_{sys} + N_{p1} + N_{p2}$, puncturing is performed in the second rate matching stage. The number of transmitted systematic bits in a ~~re~~transmission is $N_{t,sys} = \min\{N_{sys}, N_{data}\}$ for a transmission ~~of self-decodable type~~ that prioritises systematic bits and $N_{t,sys} = \max\{N_{data} - (N_{p1} + N_{p2}), 0\}$ ~~in the non self-decodable case~~for a transmission that prioritises non systematic bits.

For $N_{data} > N_{sys} + N_{p1} + N_{p2}$ repetition is performed in the second rate matching stage. A similar repetition rate in all bit streams is achieved by setting the number of transmitted systematic bits to

$$\cancel{N_{t,sys} = \left\lfloor N_{sys} \cdot \frac{N_{data}}{N_{sys} + 2N_{p2}} \right\rfloor} \; \underline{N_{t,sys} = \left\lfloor N_{sys} \cdot \frac{N_{data}}{N_{sys} + 2N_{p1}} \right\rfloor}.$$

The number of parity bits in a transmission is: $N_{t,p1} = \left\lfloor \frac{N_{data} - N_{t,sys}}{2} \right\rfloor$ and $N_{t,p2} = \left\lceil \frac{N_{data} - N_{t,sys}}{2} \right\rceil$ for the parity 1 and parity 2 bits, respectively.

Table 15 below summarizes the resulting parameter choice for the second rate matching stage. ~~The parameter *a* in the table is chosen using *a* = 2 for parity 1 and *a* = 1 for parity 2.~~

Table 15: Parameters for HARQ second rate matching

	X_i	e_{plus}	e_{minus}
Systematic RM S	N_{sys}	N_{sys}	$\lvert N_{sys} - N_{t,sys} \rvert$
Parity 1 RM P1_2	N_{p1}	$\cancel{a \cdot N_{p1}}$ $2 \cdot N_{p1}$	$\cancel{a \cdot \lvert N_{p1} - N_{t,p1} \rvert}$ $2 \cdot \lvert N_{p1} - N_{t,p1} \rvert$
Parity 2 RM P2_2	N_{p2}	$\cancel{a \cdot N_{p2}}$ N_{p2}	$\cancel{a \cdot \lvert N_{p2} - N_{t,p2} \rvert}$ $\lvert N_{p2} - N_{t,p2} \rvert$

The rate matching parameter e_{ini} is calculated for each bit stream according to the RV parameters r and s using

$\cancel{e_{ini}(r) = \{[X_i - (r \cdot e_{plus} / r_{\max}) - 1] \bmod e_{plus}\} + 1}$ $e_{ini}(r) = \{(X_i - \lfloor r \cdot e_{plus} / r_{\max} \rfloor - 1) \bmod e_{plus}\} + 1$ in the case of puncturing , i.e., $N_{data} \le N_{sys} + N_{p1} + N_{p2}$, and

$\cancel{e_{ini}(r) = \{[X_i - ((s + 2 \cdot r) \cdot e_{plus} / (2 \cdot r_{\max})) - 1] \bmod e_{plus}\} + 1}$

$e_{ini}(r) = \{(X_i - \lfloor (s + 2 \cdot r) \cdot e_{plus} / (2 \cdot r_{\max}) \rfloor - 1) \bmod e_{plus}\} + 1$ for repetition, i.e., $N_{data} > N_{sys} + N_{p1} + N_{p2}$.

Where $r \in \{0, 1, \cdots, r_{\max} - 1\}$ and $r_{\max}$ is the total number of redundancy versions allowed by varying r as defined in 4.6.1.4. Note that r_{max} varies depending on the modulation mode, i.e. for 16QAM r_{max} = 2 and for QPSK r_{max} = 4.

Note: For the modulo operation the following clarification is used: the value of (x mod y) is strictly in the range of 0 to y-1 (i.e. -1 mod 10 = 9).

4.5.4.4 HARQ bit collection

The HARQ bit collection is achieved using a rectangular interleaver of size $N_{row} \times N_{col}$.

The number of rows and columns are determined from:

$\cancel{N_{row} = \log_2(M)}$ $N_{row} = 4$ for 16QAM and $N_{row} = 2$ for QPSK

$\cancel{N_{col} = F / N_{row}}$ $N_{col} = N_{data} / N_{row}$

where N_{data} is used as defined in 4.5.4.3 above. ~~M is the modulation size and F is the number of coded and rate-matched bits to be transmitted.~~

Data is written into the interleaver column by column, and read out of the interleaver column by column.

$N_{t,sys}$ is the number of transmitted systematic bits. Intermediate values N_r and N_c are calculated using:

$N_r = \left\lfloor \frac{N_{t,sys}}{N_{col}} \right\rfloor$ and $\cancel{N_c = \left(\frac{N_{t,sys}}{N_{col}} - N_r\right) \cdot N_{col}}$ $N_c = N_{t,sys} - N_r \cdot N_{col}$.

If N_c=0, the systematic bits are written into rows 1…N_r.

Otherwise systematic bits are written into rows 1…N_r+1 in the first N_c columns and, if $N_r > 0$, also into rows 1…N_r in the remaining N_{col}-N_c columns.

The remaining space is filled with parity bits. The parity bits are written column wise into the remaining rows of the respective columns. Parity 1 and 2 bits are written in alternating order, starting with a parity 2 bit in the first available column with the lowest index number.

In the case of 16QAM for each column the bits are read out of the interleaver in the order row 1, row 3, row 2, row 4. In the case of QPSK for each column the bits are read out of the interleaver in the order row1, row2.

R1-02-0841

CR-Form-v5

CHANGE REQUEST

z	**25.222**	**CR**	**079**	z **rev**	**4**	z Current version:	**5.0.0** z

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

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

Title: z	Corrections to HS-DSCH coding		
Source: z	TSG RAN WG1		
Work item code: z	HSDPA-Phys	***Date:*** z	15 MAY 2002
Category: z	**F**	***Release:*** z	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)*

Reason for change: z	Correction of errata in specification. Most corrections follow FDD changes.
Summary of change: z	Physical channel numbering is defined Physical channel bit indexing is modified to reflect the fact that different physical channels may have different numbers of bits. Interleaver description is modified to reflect the fact that the physical channel payload is not fixed and to clarify that physical channel interleaving is intended. Constellation re-arrangement description is corrected to follow FDD Correction of typos and formatting
Consequences if not approved: z	Specification text would not implement intended function. Isolated impact statement: Only essential corrections are introduced. Since current specification is incomplete and contains errors, no working implementation can exist for the current specification.

Clauses affected: z	4.5, 4.5.1 – 4.5.3, 4.5.4.4, 4.5.6 – 4.5.9	
Other specs affected: z	[ ] Other core specifications [ ] Test specifications [ ] O&M Specifications	z
Other comments: z		

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 z 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 Coding for HS-DSCH

Figure 16 illustrates the overall concept of transport-channel coding and multiplexing for HS-DSCH. Data arrives to the coding/multiplexing unit in form of one transport block once every transmission time interval. The transmission time interval is 5 ms for 1.28Mcps TDD and 10ms for 3.84 Mcps TDD.

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

- add CRC to each transmission time interval (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);
- physical channel segmentation (see subclause 4.5.6);
- interleaving for HS-DSCH (see subclauses 4.5.7);
- ~~mapping to physical channels (see subclause 4.5.8);~~
- constellation re-arrangement for 16QAM (see subclause 4.5.8~~9~~).
- mapping to physical channels (see subclause 4.5.9);

The coding steps for HS-DSCH are shown in figure 16.

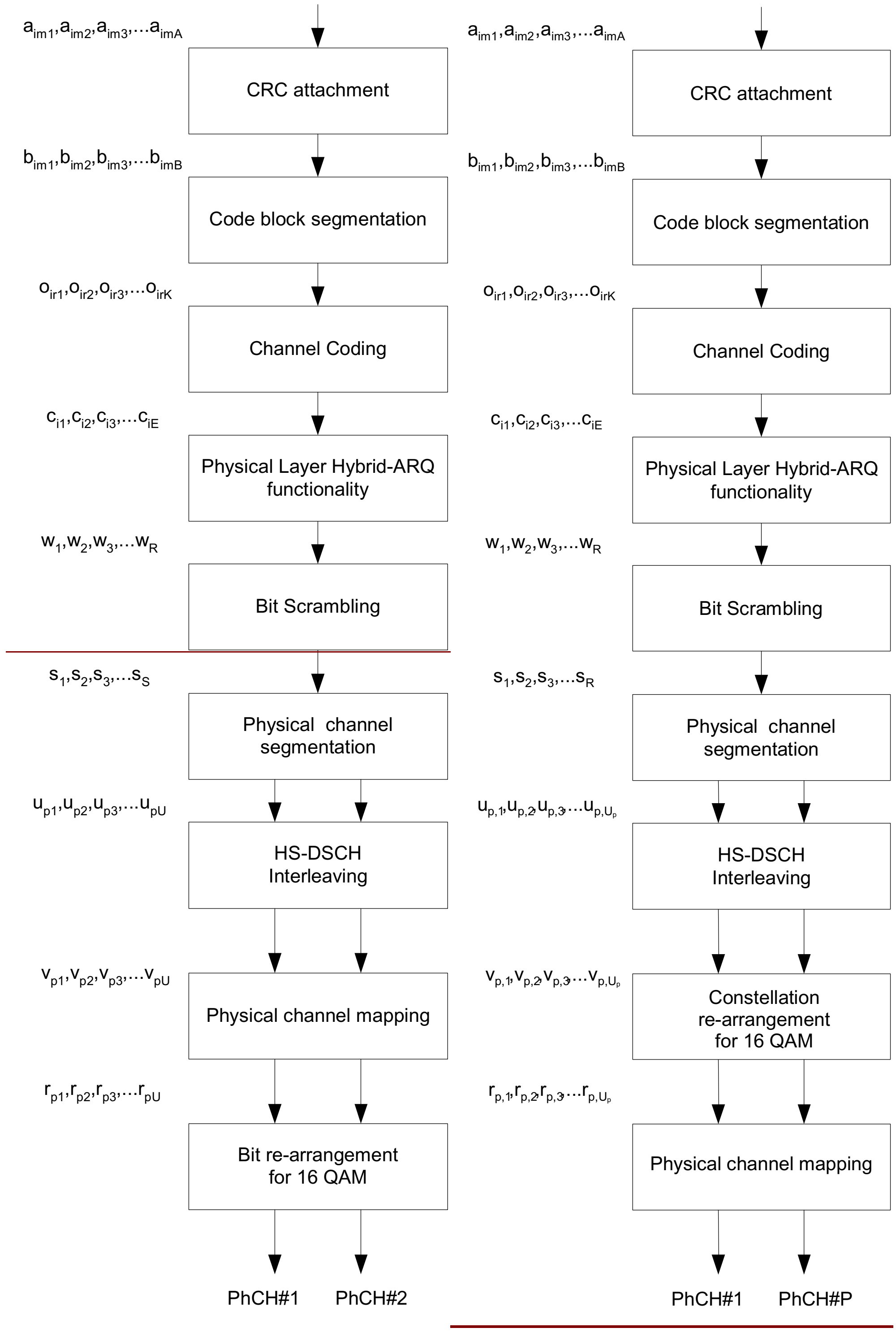


Figure 16. ~~Transport channel multiplexing structure~~ Coding chain for HS-DSCH

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).

4.5.1 CRC attachment for HS-DSCH

A CRC of size 24 bits is calculated and added per HS-DSCH TTI. The CRC polynomial is defined in 4.2.1.1 with the following specific parameters: $i = 1$, $L_1 = 24$ bits.

4.5.2 Code block segmentation for HS-DSCH

Code block segmentation for the HS-DSCH transport channel shall be done with the general method described in 4.2.2.2 above with the following specific parameters.

There will only be one transport block, $i = 1$. The bits $b_{im1}, b_{im2}, b_{im3},\ldots b_{imB}$ input to the block are mapped to the bits $x_{i1}, x_{i2}, x_{i3},\ldots x_{iX1i}$ directly. It follows that $X_1 = B$. Note that the bits x referenced here refer only to the internals of the code block segmentation function. The output bits from the code block segmentation function are $o_{ir1}, o_{ir2}, o_{ir3},\ldots o_{irK}$.

The value of Z = 5114 for turbo coding shall be used.

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.

4.5.4.4 HARQ bit collection

The HARQ bit collection is achieved using a rectangular interleaver of size $N_{row} \times N_{col}$.

The number of rows and columns are determined from:

$$N_{row} = \log_2(M)$$
$$N_{col} = F / N_{row}$$

where M is the modulation size and F is the number of coded and rate-matched bits to be transmitted.

Data is written into the interleaver column by column, and read out of the interleaver column by column.

$N_{t,sys}$ is the number of transmitted systematic bits. Intermediate values N_r and N_c are calculated using:

$$N_r = \left\lfloor \frac{N_{t,sys}}{N_{col}} \right\rfloor \text{ and } N_c = \left(\frac{N_{t,sys}}{N_{col}} - N_r \right) \cdot N_{col}.$$

If N_c=0, the systematic bits are written into rows $1 \ldots N_r$.

Otherwise systematic bits are written into rows $1 \ldots N_r+1$ in the first N_c columns and rows $1 \ldots N_r$ in the remaining N_c columns. The remaining space is filled with parity bits. The parity bits are written column wise into the remaining rows of the respective columns. Parity 1 and 2 bits are written in alternating order.

In the case of 16QAM for each column the bits are read out of the interleaver in the order row 1, row ~~3~~2, row ~~2~~3, row 4. In the case of QPSK for each column the bits are read out of the interleaver in the order row1, row2.

4.5.5 Bit scrambling

The bit scrambling for HS-DSCH shall be done with the general method described in subclause 4.2.9.

4.5.6 Physical channel segmentation for HS-DSCH

When more than one HS-PDSCH is used, physical channel segmentation divides the bits among the different physical channels. The bits input to the physical channel segmentation are denoted by ~~$w_1, w_2, w_3, \ldots w_R$~~$s_1, s_2, s_3, \ldots s_R$, where R is the number of bits input to the physical channel segmentation block. The number of PhCHs is denoted by P.

The bits after physical channel segmentation are denoted $u_{p1}, u_{p2}, \ldots, u_{pU_p}$ ~~$u_{p1}, u_{p2}, u_{p3}, \ldots, u_{pU}$~~, where p is PhCH number and U_p is the number of bits in one TTI for PhCH p, such that:

$$R = \sum_{p=1}^{P} U_p \quad \cancel{\text{each HS-PDSCH, i.e.}} \quad \cancel{U = \frac{R}{P}}$$

~~.~~PhCHs shall be numbered starting from 1 in ascending order of their timeslot number, such that PhCHs allocated to a lower numbered timeslot always have a lower PhCH number than those allocated to a higher numbered timeslot. If more than one PhCH is allocated in a given timeslot, then the PhCHs shall be numbered in ascending order of their channelisation code index (k). The relation between ~~w_k~~ s_k and u_{pk} is given below.

For all modes, some bits of the input flow are mapped to each code until the number of bits on the code is U_p.

Bits on first PhCH after physical channel segmentation:

$$u_{1,k} = s_k \quad \cancel{u_{1,k} = w_k} \quad k = 1, 2, \ldots, U_1$$

Bits on second PhCH after physical channel segmentation:

$$u_{2,k} = s_{k+U_1} \quad \cancel{u_{2,k} = w_{k+U}} \quad k = 1, 2, \ldots, U_2$$

…

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

$$u_{P,k} = s_{k+\sum_{p=1}^{P-1} U_p} \quad \cancel{u_{P,k} = w_{k+(P-1)\times U}} \quad k = 1, 2, \ldots, U_P$$

4.5.7 Interleaving for HS-DSCH

The interleaving for TDD is done as shown in figure 18 below, separately for each physical channel. The bits input to the block interleaver are denoted by $u_1, u_2, u_3, \ldots, u_U$, where U is the number of bits in one TTI. For QPSK the interleaver is the same as Rel99 2nd interleaver described in Section 4.2.11.1. The interleaver is of fixed size: R2=32 rows and C2=30 columns.

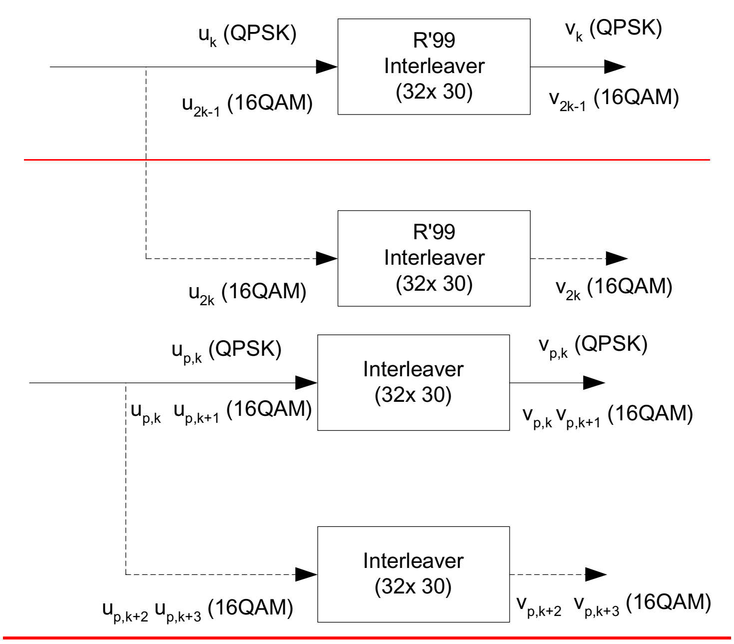


Figure 18: Interleaver structure for ~~HSDPA~~HS-DSCH

For 16QAM, there are two identical interleavers of the same fixed size R2×C2 = 32×30. The output bits from the physical channel segmentation are divided pairwise between the interleavers: bits $u_{p,k}$ and $u_{p,k+1}$ go to the first interleaver and bits $u_{p,k+2}$ and $u_{p,k+3}$ go to the second interleaver~~all odd numbered bits to interleaver one and all even numbered bits to interleaver two~~. Bits are collected pairwise from the interleavers: bits $v_{p,k}$ and $v_{p,k+1}$ are obtained from the first interleaver and bits $v_{p,k+2}$ and $v_{p,k+3}$ are obtained from the second interleaver, where k mod 4 = 1.

~~Note: the outputs of the interleavers will result in mapping to 16QAM symbols such that the output of first interleaver is mapped to the more reliable positions (i_1 and q_1) whereas the output of the second interleaver is mapped to the less reliable positions (i_2 and q_2).~~

~~4.5.8 Physical channel mapping for HS-DSCH~~

~~The HS-PDSCH is defined in [7]. The bits input to the physical channel mapping are denoted by~~ $\cancel{v_{p1}, v_{p2}, \ldots, v_{pU}}$~~, where p is the physical channel number and U is the number of bits in one TTI for one HS-PDSCH. The bits v_{pk} are mapped to the PhCHs so that the bits for each PhCH are transmitted over the air in ascending order with respect to k.~~

4.5.8~~9~~ 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 16 describes the operations that produce the different rearrangements.

The bits of the input sequence are mapped in groups of 4 so that $v_{p,k}$, $v_{p,k+1}$, $v_{p,k+2}$, $v_{p,k+3}$ are used~~map to $i_a i_b q_a q_b$~~, where k mod 4 = ~~0~~1.

Table 16: Constellation re-arrangement for 16 QAM

Constellation version parameter *b*	Output bit sequence	Operation
0	$\cancel{i_a q_a i_b q_b}$ $v_{p,k} v_{p,k+1} v_{p,k+2} v_{p,k+3}$	None
1	$\cancel{i_b q_b i_a q_a}$ $v_{p,k+2} v_{p,k+3} v_{p,k} v_{p,k+1}$	Swapping MSBs with LSBs~~i_a with i_b and q_a with q_b~~
2	$\cancel{i_a q_a \overline{i_b} \overline{q_b}}$ $v_{p,k} v_{p,k+1} \overline{v_{p,k+2}} \overline{v_{p,k+3}}$	~~XOR with 0011 (equivalent to I~~inversion of the logical values of LSBs~~i_b and q_b)~~
3	$\cancel{i_b q_b \overline{i_a} \overline{q_a}}$ $v_{p,k+2} v_{p,k+3} \overline{v_{p,k}} \overline{v_{p,k+1}}$	Swapping MSBs with LSBs, and inversion of the logical values of LSBs~~i_a with i_b and q_a with q_b and XOR with 0011~~

The output bit sequences from the table above map to the output bits in groups of 4, i.e. $r_{p,k}$, $r_{p,k+1}$, $r_{p,k+2}$, $r_{p,k+3}$, where k mod 4 = ~~0~~1.

4.5.9 Physical channel mapping for HS-DSCH

The HS-PDSCH is defined in [7]. The bits input to the physical channel mapping are denoted by $r_{p,1}, r_{p,2}, r_{p,3}, \ldots, r_{p,U_p}$, where p is the physical channel number and U_p is the number of bits in PhCH p in one TTI. The bits r_{pk} shall be mapped to the PhCHs such that the bits for PhCHs shall be transmitted over the air in ascending order with respect to the bit index k.

3GPP TSG RAN Meeting #16
Marco Island, FL, U.S.A., 4 – 7, June 2002

R1-02-0738

CR-Form-v5.1

CHANGE REQUEST

z	**25.222**	**CR**	**082**	z **rev**	**1**	z	Current version:	**5.0.0** z

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

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

Title:	z	Corrections to HSDPA Multiplexing and Coding	
Source:	z	TSG RAN WG1	
Work item code:	z	HSDPA-Phys	***Date:*** z 02 MAY 2002
Category:	z	**F** *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.	***Release:*** z REL-5 *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:	z	Some information concerning the coding and multiplexing of the HS-SCCH and HS-SICH channels was either incorrect, missing, misleading. Incorrect information was – UE Id is 16 bits rather than 10 bits Missing information was – Information field mappings for some HS-SCCH and HS-SICH fields Misleading information was – HS-SCCH interleaving was shown as occurring after physical channel segmentation, when in fact it occurs before. HS-SICH CQI field coding used misleading notation.
Summary of change:	z	Missing information is added. Misleading information is corrected.
Consequences if not approved:	z	HSDPA for TDD cannot be implemented due to incomplete specification. Isolated impact statement: Implementation details unaffected, other than the extension of UE id to 16 bits, which affects the CRC scrambling operation.

Clauses affected:	z	4.6, 4.6.1 – 4.6.8, 4.7, 4.7.1 – 4.7.5	
Other specs affected:	z	[ ] Other core specifications [ ] Test specifications [ ] O&M Specifications	z
Other comments:	z		

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 z 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.

4.6 Coding/Multiplexing for HS-SCCH

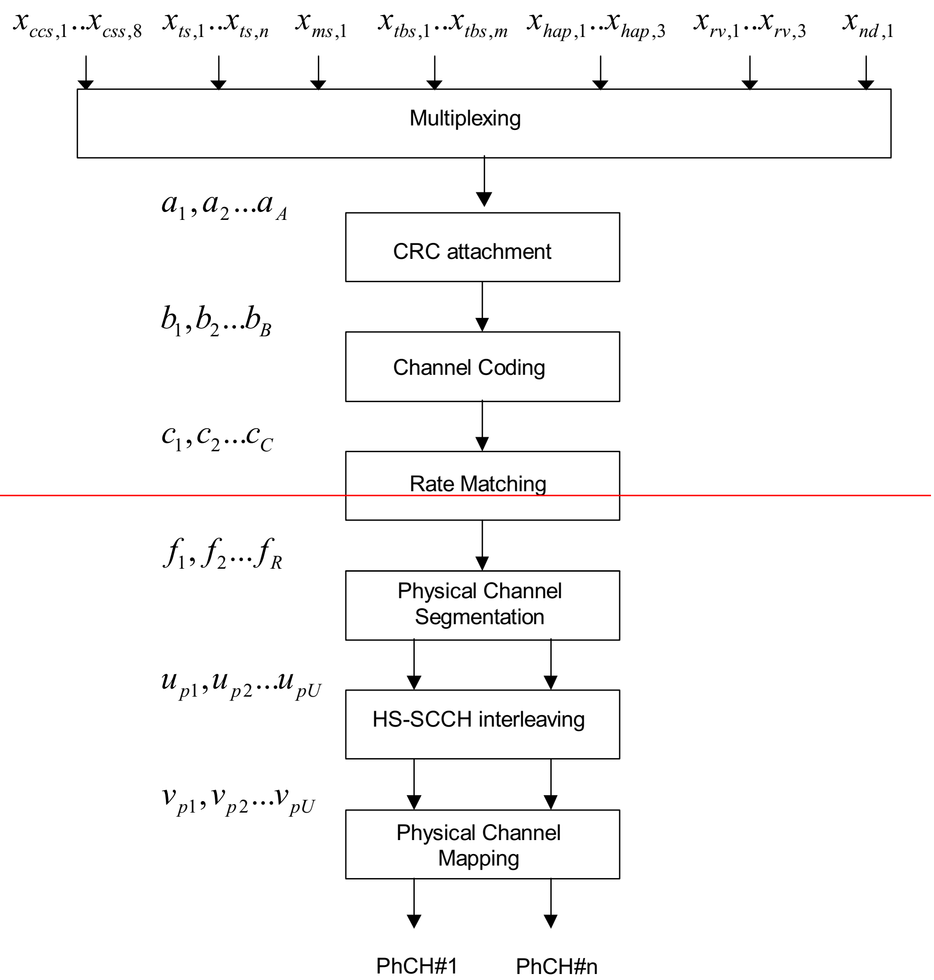
The following information, provided by higher layers, is transmitted by means of the HS-SCCH physical channel.

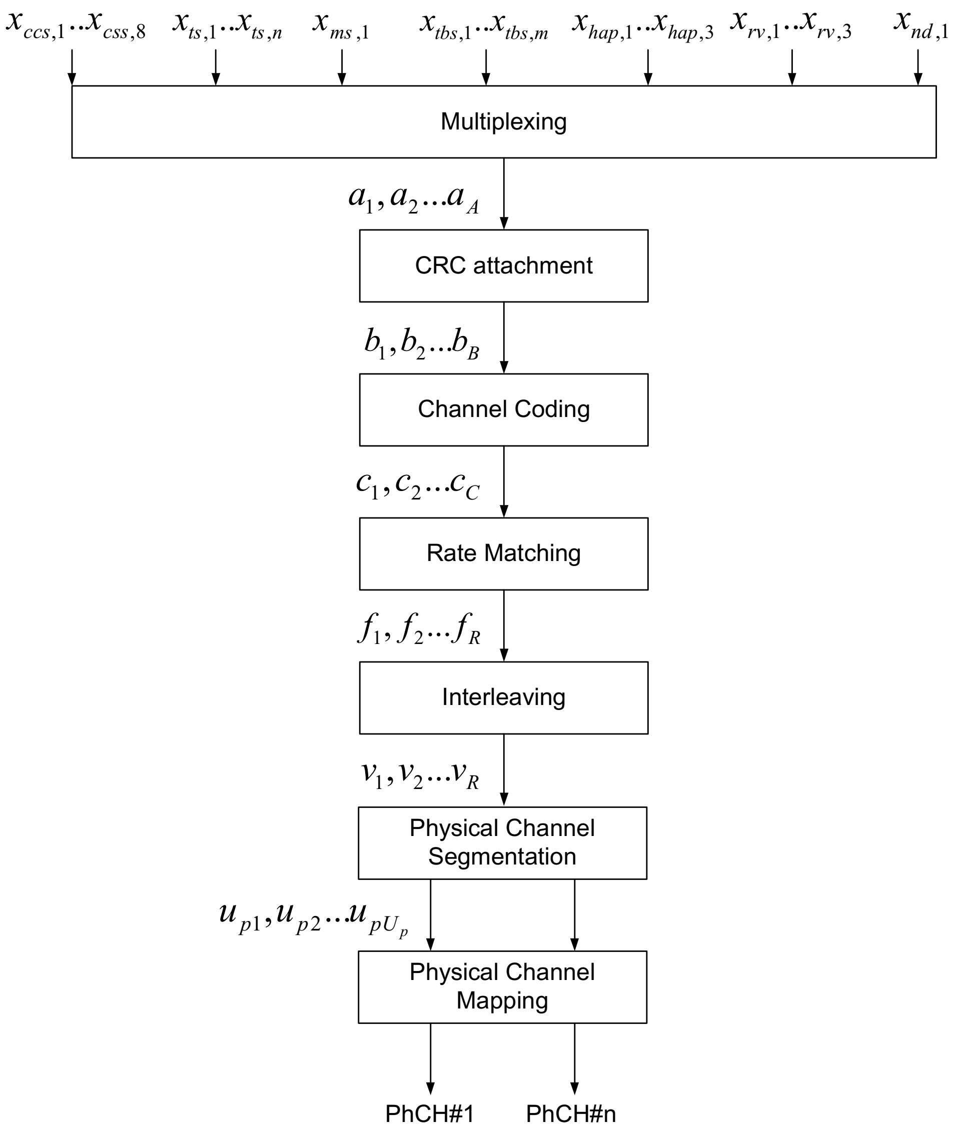
- Channelisation-code-set information (8 bits): $x_{ccs,1}$, $x_{ccs,2}$, …, $x_{ccs,8}$
- Time slot information (n bits where n = 5 for 1.28 Mcps TDD and n = 13 for 3.84 Mcps TDD): $x_{ts,1}$, $x_{ts,2}$, …, $x_{ts,n}$
- Modulation scheme information (1 bit): $x_{ms,1}$
- Transport-block size information (m bits where m = 6 for 1.28 Mcps TDD and m = 9 for 3.84 Mcps TDD): $x_{tbs,1}$, $x_{tbs,2}$, …, $x_{tbs,m}$
- Hybrid-ARQ process information (3 bits): $x_{hap,1}$, $x_{hap,2}$, $x_{hap,3}$
- Redundancy version information (3 bits): $x_{rv,1}$, $x_{rv,2}$,$x_{rv,3}$
- New data indicator (1 bit): $x_{nd,1}$
- UE identity (16~~0~~ bits): $x_{ue,1}$, $x_{ue,2}$, …, $x_{ue,16\cancel{0}}$

The following coding/multiplexing steps can be identified:

- multiplexing of HS-SCCH information (see subclause 4.6.2~~1~~)
- CRC attachment (see subclause 4.6.3~~2~~);
- channel coding (see subclause 4.6.4~~3~~);
- rate matching (see subclause 4.6.5~~4~~);
- interleaving for HS-SCCH (see subclause 4.6.6~~5~~);
- mapping to physical channels (see subclauses 4.6.7~~6~~ and 4.6.8).

The general coding/multiplexing flow is shown in the figure below.


$x_{ccs,1}..x_{css,8}$ $x_{ts,1}..x_{ts,n}$ $x_{ms,1}$ $x_{tbs,1}..x_{tbs,m}$ $x_{hap,1}..x_{hap,3}$ $x_{rv,1}..x_{rv,3}$ $x_{nd,1}$
Multiplexing
$a_1, a_2 ... a_A$
CRC attachment
$b_1, b_2 ... b_B$
Channel Coding
$c_1, c_2 ... c_C$
Rate Matching
$f_1, f_2 ... f_R$
Physical Channel Segmentation
$u_{p1}, u_{p2} ... u_{pU}$
HS-SCCH interleaving
$v_{p1}, v_{p2} ... v_{pU}$
Physical Channel Mapping
PhCH#1
PhCH#n



4.6.1 HS-SCCH information field mapping

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 X below applies.

Table X: 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.

4.6.1.2 Timeslot information mapping

4.6.1.2.1 1.28 Mcps TDD

For 1.28 Mcps, the timeslots to be used for HS-PDSCH resources are signalled by the bits $x_{ts,1}$, $x_{ts,2}$, …, $x_{ts,5}$, where bit $x_{ts,n}$ carries the information for timeslot n+1. Timeslots 0 and 1 cannot be used for HS-DSCH resources. If the signalling bit is set (i.e. equal to 1), then the corresponding timeslot shall be used for HS-PDSCH resources. Otherwise, the timeslot shall not be used. All used timeslots shall use the same channelisation code set, as signalled by the channelisation code set information bits.

4.6.1.2.2 3.84 Mcps TDD

For 3.84 Mcps, the timeslots to be used for HS-PDSCH resources are signalled by the bits $x_{ts,1}$, $x_{ts,2}$, …, $x_{ts,13}$, where bit $x_{ts,n}$ carries the information for the nth available timeslot for HS-PDSCH resources, where the order of the timeslots available for HS-PDSCH resources shall be signalled by higher layers. If the bit is set (i.e. equal to 1), then the corresponding timeslot shall be used for HS-PDSCH resources. Otherwise, the timeslot shall not be used. All used timeslots shall use the same channelisation code set, as signalled by the channelisation code set information bits.

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 Y shall apply.

Table Y: Modulation scheme information mapping

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

4.6.1.4 Redundancy and constellation version information mapping

The redundancy version (RV) parameters *r*, *s* and constellation version parameter *b* are mapped jointly to produce the value X_{rv}. X_{rv} is alternatively represented as the sequence $x_{rv,1}$, $x_{rv,2}$, $x_{rv,3}$ where $x_{rv,1}$ is the MSB. This is done according to the following tables according to the modulation mode used:

Table 12: RV mapping for 16 QAM

X_{rv} (value)	s	r	b
0	1	0	0
1	0	0	0
2	1	1	1
3	0	1	1
4	1	0	1
5	1	0	2
6	1	0	3
7	1	1	0

Table 13: RV mapping for QPSK

X_{rv} (value)	s	r
0	1	0
1	0	0
2	1	1
3	0	1
4	1	2
5	0	2
6	1	3
7	0	3

4.6.2~~1~~ Multiplexing of HS-SCCH information

The information carried on the HS-SCCH is multiplexed onto the bits $a_1, a_2, \ldots a_A$ according to the following rule :

$$a_1, a_2 \ldots a_8 = x_{ccs,1}, x_{css,2} \ldots x_{css,8}$$

$$a_9, a_{10} \ldots a_{9+n-1} = x_{ts,1}, x_{ts,2} \ldots x_{ts,n}$$

$$a_{9+n} = x_{ms,1}$$

$$a_{9+n+1}, a_{9+n+2} \ldots a_{9+n+m} = x_{tbs,1}, x_{tbs,2} \ldots x_{tbs,m}$$

$$a_{10+n+m}, a_{11+n+m}, a_{12+n+m} = x_{hap,1}, x_{hap,2}, x_{hap,3}$$

$$a_{13+n+m}, a_{14+n+m}, a_{15+n+m} = x_{rv,1}, x_{rv,2}, x_{rv,3}$$

$$a_{16+n+m} = x_{nd,1}$$

4.6.3~~2~~ CRC attachment for HS-SCCH

The bits b_1, ..., b_B are generated by adding the computed CRC of length 16 as described in the general section 4.2.1.1, and then scrambling the computed CRC by the modulo 2 addition of ~~an extended~~the UE identifier, $x_{ue,1}$, $x_{ue,2}$, …, $x_{ue,16}$. ~~The MSBs of the UE identifier shall be extended to 16 bits by zero padding.~~

4.6.4~~3~~ Channel coding for HS-SCCH

Channel coding for the HS-SCCH shall be done with the general method described in 4.2.3 with the following specific parameters:

The rate 1/3 convolutional coding shall be used for HS-SCCH.

4.6.5~~4~~ Rate matching for HS-SCCH

Rate matching for HS-SCCH shall be done with the general method described in 4.2.7.

~~4.6.5 Physical Channel Segmentation for HS-SCCH~~

~~Physical Channel Segmentation for HS-SCCH shall be done with the general method described in 4.2.10. For 1.28 Mcps TDD, the HS-SCCH consists of two physical channels HS-SCCH1 and HS-SCCH2; for 3.84 Mcps TDD the HS-SCCH only uses one physical channel, see [7].~~

4.6.6 Interleaving for HS-SCCH

Interleaving for HS-SCCH shall be done with the general method described in 4.2.11.1.

4.6.7 Physical Channel Segmentation for HS-SCCH

Physical channel segmentation for HS-SCCH shall be done with the general method described in 4.2.10. For 1.28 Mcps TDD, the HS-SCCH consists of two physical channels HS-SCCH1 and HS-SCCH2; for 3.84 Mcps TDD the HS-SCCH only uses one physical channel, see [7].

4.6.8~~7~~ Physical channel mapping for HS-SCCH

Physical channel mapping for the HS-SCCH shall be done with the general method described in subclause 4.2.13.

4.7 Coding for HS-SICH

The following information, provided by higher layers, is transmitted by means of the HS-SICH physical channel.

- Recommended Modulation Format (RMF) (1 bit): $x_{rmf,1}$
- Recommended Transport-block size (RTBS) (n bits where n = 6 for 1.28 Mcps TDD and n = 9 for 3.84 Mcps TDD): $x_{tbs,1}, x_{tbs,2}, \ldots, x_{tbs,n}$
- Hybrid-ARQ information ACK/NACK (1 bit): $x_{an,1}$

The following coding/multiplexing steps can be identified:

- separate coding of RMF, RTBS and ACK/NACK (see subclause 4.7.2~~1~~);
- multiplexing of HS-SICH information (4.7.3~~2~~);
- interleaving for HS-SICH (see subclause 4.7.4~~3~~);
- mapping to physical channels (see subclause 4.7.5~~4~~).

The general coding/multiplexing flow is shown in the figure 19.

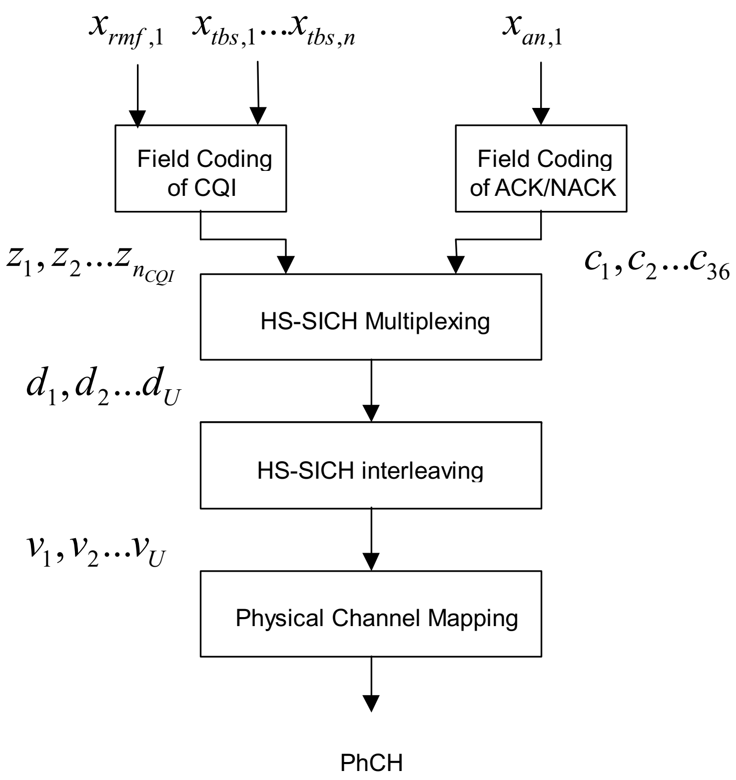


Figure 19 Coding and multiplexing for HS-SICH

4.7.1 HS-SICH information field mapping

4.7.1.1 RMF information mapping

The RMF information bit, $x_{rmf,1}$, shall be mapped according to the mapping specified in subclause 4.6.1.3.

4.7.1.2 RTBS information mapping

The RTBS information bits, $x_{tbs,1}$, $x_{tbs,2}$, …, $x_{tbs,n}$, shall be mapped according to the same mapping as is used for the transport block size information bits in subclause 4.6. This mapping is defined by higher layers [12].

4.7.1.3 ACK/NACK information mapping

The ACK/NACK information bit $x_{an,1}$ shall be mapped according to the mapping given in Table Z below.

Table Z: ACK/NACK information mapping

ACK/NACK	$x_{an,1}$
ACK	1
NACK	0

4.7.~~1~~2 Coding for HS-SICH

4.7.2~~1~~.1 Field Coding of ACK/NACK

The ACK/NACK ~~field~~ bit $x_{an,1}$ ~~of the HS-SICH is~~shall be repetition coded to 36 bits. The coded bits are defined as $c_1 \ldots c_{36}$

4.7.2~~1~~.2 Field Coding of CQI

4.7.2~~1~~.2.1 Field Coding of CQI for 1.28 Mcps TDD

The quality information consists of Recommended Transport Block Size (RTBS) and Recommended Modulation Format (RMF) fields. The 6 bits of the RTBS field are coded to 32 bits using a (32, 6) 1st order Reed-Muller code. The coding procedure is as shown in figure 20.

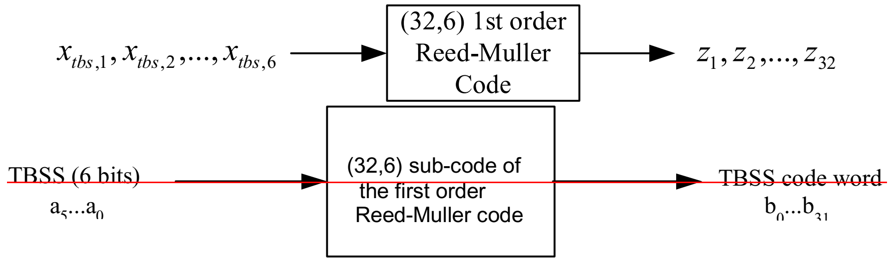


Figure 20 Field coding of RTBS information bits

The coding uses a subset basis sequences as the TFCI coder as described in subclause 4.3.1.1. The basis sequences that are used for RTBS coding are as follows in table 17.

Table 17: Basis sequences for (32,6) RTBS code

~~I~~i	$M_{i,0}$	$M_{i,1}$	$M_{i,2}$	$M_{i,3}$	~~M_i~~$M_{i,4}$	$M_{i,5}$
0	1	0	0	0	0	1
1	0	1	0	0	0	1
2	1	1	0	0	0	1
3	0	0	1	0	0	1
4	1	0	1	0	0	1
5	0	1	1	0	0	1
6	1	1	1	0	0	1
7	0	0	0	1	0	1
8	1	0	0	1	0	1
9	0	1	0	1	0	1
10	1	1	0	1	0	1
11	0	0	1	1	0	1
12	1	0	1	1	0	1
13	0	1	1	1	0	1
14	1	1	1	1	0	1
15	1	0	0	0	1	1
16	0	1	0	0	1	1
17	1	1	0	0	1	1
18	0	0	1	0	1	1
19	1	0	1	0	1	1
20	0	1	1	0	1	1
21	1	1	1	0	1	1
22	0	0	0	1	1	1
23	1	0	0	1	1	1
24	0	1	0	1	1	1
25	1	1	0	1	1	1
26	0	0	1	1	1	1
27	1	0	1	1	1	1
28	0	1	1	1	1	1
29	1	1	1	1	1	1
30	0	0	0	0	0	1
31	0	0	0	0	1	1

The output RTBS code word bits {~~b_i~~ z_i : i = 1, ... , 32} are given by:

$$\cancel{b_i = \sum_{n=0}^{5} (a_n \times M_{i,n}) \bmod 2} \quad z_i = \left(\sum_{n=1}^{6} x_{tbs,n} \cdot M_{i-1,n-1} \right) \bmod 2$$

~~where $i = 0,\ldots,31$. $N_{RTBS\ code\ word} = 32$.~~

The ~~1 bit of the~~ RMF bit $x_{rmf,1}$ is repetition coded to 16 bits to produce the bits ~~$b_{32}, b_{33} \ldots b_{47}$~~ $z_{33}, z_{34}, \ldots, z_{n_{CQI}}$ where $n_{CQI} = 48$.

~~The CQI is composed of the bits $z_1, z_2 \ldots z_{n_{CQI}}$ where :~~

$$\cancel{z_1, z_2 \ldots z_{n_{CQI}} = b_0, b_1 \ldots b_{47}}$$

4.7.1.2.2 Field Coding of CQI for 3.84 Mcps TDD

RTBS and RMF bits are multiplexed onto the bits $y_1, y_2 \ldots y_{10}$ according to the following rule :

$$y_1 = x_{rmf,1}$$

$$y_2, y_3 \ldots y_{10} = x_{tbs,1}, x_{tbs,2} \ldots x_{tbs,9}$$

The bits $y_1, y_2 \ldots y_{10}$ are coded to produce the CQI bits $z_1, z_2 \ldots z_{n_{CQI}}$ using a (32,10) sub-code of the second order Reed-Muller code as defined in subclause 4.3.1.1, where $n_{CQI} = 32$.

4.7.3~~2~~ Multiplexing of HS-SICH information fields

The CQI bits $z_1, z_2 \ldots z_{n_{CQI}}$ are multiplexed with the repetition coded ACK/NACK bits $c_1 \ldots c_{36}$ to produce the bits $d_1, d_2 \ldots d_U$ where U is the number of physical channel bits carried by HS-SICH, according to the following rule.:

$$d_1, d_2 \ldots d_{n_{CQI}} = z_{1,} z_2 \ldots z_{n_{CQI}}$$

$$d_{n_{CQI}+1}, d_{n_{CQI}+2} \ldots d_{n_{CQI}+36} = c_{1,} c_2 \ldots c_{36}$$

$$d_{n_{CQI}+37}, d_{n_{CQI}+38} \ldots d_U = 0,0 \ldots .0$$

4.7.4~~3~~ Interleaver for HS-SICH

Interleaver for HS-SICH shall be done with the general method described in 4.2.11.1.

4.7.5~~4~~ Physical channel mapping for HS-SICH

Physical channel mapping for HS-SICH shall be done with the general method described in 4.2.13.

3GPP TSG RAN Meeting #16 **R1-02-0840**
Marco Island, FL, U.S.A., 4 – 7, June 2002

CR-Form-v5.1

CHANGE REQUEST

z	**25.222**	**CR**	**084**	z **rev**	**-**	z	Current version:	**5.0.0**	z

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

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

Title:	z	Introduction of HS-SCCH Cyclic Sequence Counter for TDD		
Source:	z	TSG RAN WG1		
Work item code:	z	HSDPA-Phys	***Date:*** z	15 MAY 2002
Category:	z	**F** *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.	***Release:*** z	REL-5 *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:	z	HS-SCCH counter is required to support closed loop power control scheme
Summary of change:	z	A 3 bit counter field is added to the HS-SCCH payload.
Consequences if not approved:	z	New power control scheme for the HS-SCCH will not work. Isolated Impact Statement Changes required to higher layer signalling and UE implementation.

Clauses affected:	z	4.6, 4.6.1		
Other specs affected:	z	[X] Other core specifications [ ] Test specifications [ ] O&M Specifications	z	25.224
Other comments:	z			

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 z 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.

4.6 Coding/Multiplexing for HS-SCCH

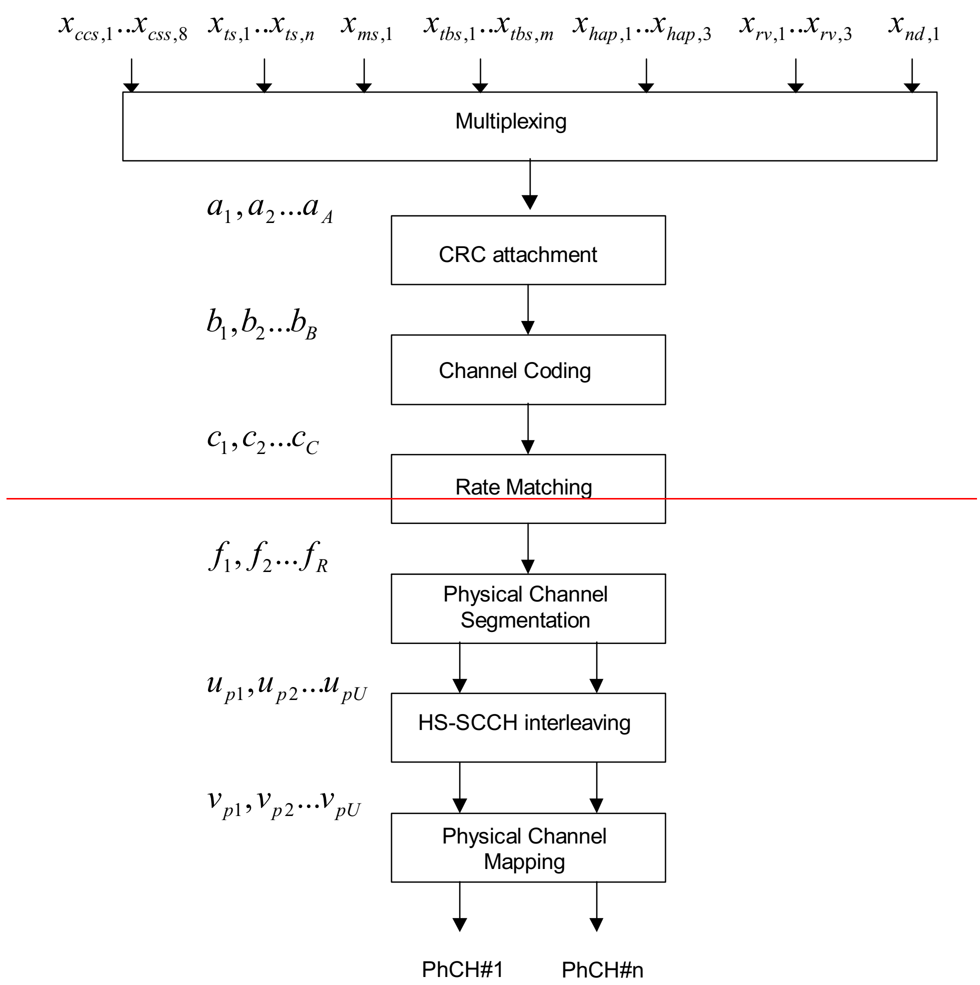
The following information, provided by higher layers, is transmitted by means of the HS-SCCH physical channel.

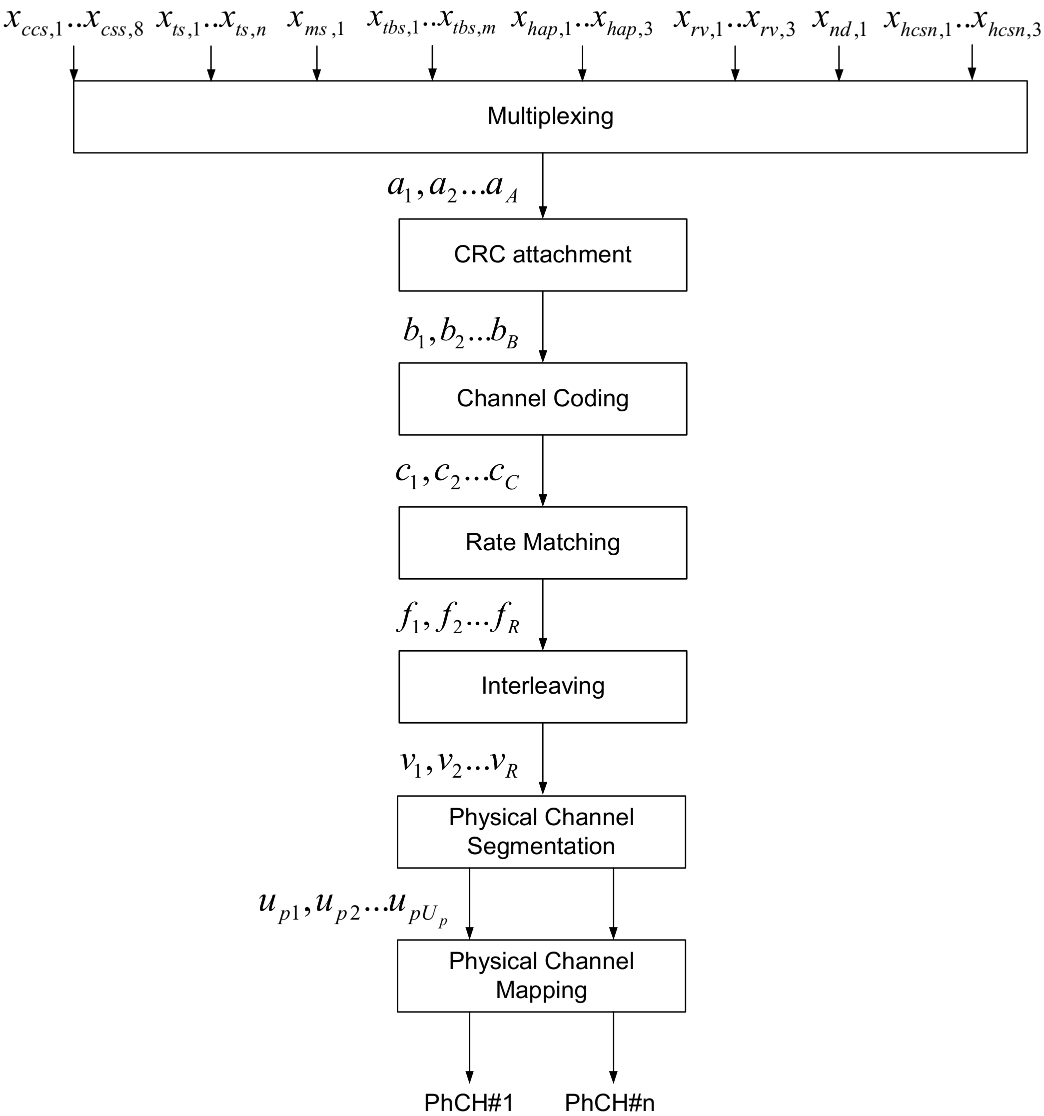
- Channelisation-code-set information (8 bits): $x_{ccs,1}, x_{ccs,2}, \ldots, x_{ccs,8}$
- Time slot information (n bits where n = 5 for 1.28 Mcps TDD and n = 13 for 3.84 Mcps TDD): $x_{ts,1}, x_{ts,2}, \ldots, x_{ts,n}$
- Modulation scheme information (1 bit): $x_{ms,1}$
- Transport-block size information (m bits where m = 6 for 1.28 Mcps TDD and m = 9 for 3.84 Mcps TDD): $x_{tbs,1}, x_{tbs,2}, \ldots, x_{tbs,m}$
- Hybrid-ARQ process information (3 bits): $x_{hap,1}, x_{hap,2}, x_{hap,3}$
- Redundancy version information (3 bits): $x_{rv,1}, x_{rv,2}, x_{rv,3}$
- New data indicator (1 bit): $x_{nd,1}$
- HS-SCCH cyclic sequence number (3 bits): $x_{hcsn,1}, x_{hcsn,2}, x_{hcsn,3}$
- UE identity (10 bits): $x_{ue,1}, x_{ue,2}, \ldots, x_{ue,10}$

The following coding/multiplexing steps can be identified:

- multiplexing of HS-SCCH information (see subclause 4.6.1)
- CRC attachment (see subclause 4.6.2);
- channel coding (see subclause 4.6.3);
- rate matching (see subclause 4.6.4);
- interleaving for HS-SCCH (see subclause 4.6.5);
- mapping to physical channels (see subclause 4.6.6).

The general coding/multiplexing flow is shown in the figure below.


$x_{ccs,1}..x_{css,8}$
$x_{ts,1}..x_{ts,n}$
$x_{ms,1}$
$x_{tbs,1}..x_{tbs,m}$
$x_{hap,1}..x_{hap,3}$
$x_{rv,1}..x_{rv,3}$
$x_{nd,1}$
Multiplexing
$a_1, a_2...a_A$
CRC attachment
$b_1, b_2...b_B$
Channel Coding
$c_1, c_2...c_C$
Rate Matching
$f_1, f_2...f_R$
Physical Channel Segmentation
$u_{p1}, u_{p2}...u_{pU}$
HS-SCCH interleaving
$v_{p1}, v_{p2}...v_{pU}$
Physical Channel Mapping
PhCH#1
PhCH#n



4.6.1 Multiplexing of HS-SCCH information

The information carried on the HS-SCCH is multiplexed onto the bits $a_1, a_2,...a_A$ according to the following rule :

$a_1, a_2...a_8 = x_{ccs,1}, x_{css,2}...x_{css,8}$

$a_9, a_{10}...a_{9+n-1} = x_{ts,1}, x_{ts,2}...x_{ts,n}$

$a_{9+n} = x_{ms,1}$

$a_{9+n+1}, a_{9+n+2}...a_{9+n+m} = x_{tbs,1}, x_{tbs,2}...x_{tbs,m}$

$a_{10+n+m}, a_{11+n+m}, a_{12+n+m} = x_{hap,1}, x_{hap,2}, x_{hap,3}$

$a_{13+n+m}, a_{14+n+m}, a_{15+n+m} = x_{rv,1}, x_{rv,2}, x_{rv,3}$

$a_{16+n+m} = x_{nd,1}$

$a_{17+n+m}, a_{18+n+m}, a_{19+n+m} = x_{hcsn,1}, x_{hcsn,2}, x_{hcsn,3}$

3GPP TSG RAN Meeting #16
Marco Island, FL, U.S.A., 4 – 7, June 2002

R1-02-0403

CR-Form-v5

CHANGE REQUEST

z	**25.223**	**CR**	**031**	z **rev**	**-**	z Current version:	**5.0.0** z

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

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

Title:	z	Correction of SPC for 16QAM in TDD		
Source:	z	TSG RAN WG1		
Work item code:	z	HSDPA-Phys	***Date:*** z	April 4th 2002
Category:	z	**F**	***Release:*** z	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)*

Reason for change:	z	The TDD constellation for 16QAM transmission signals should be derived from the 16QAM FDD symbol constellation in the same way as for the QPSK, i.e. by left hand rotating the FDD constellation by 45 degrees. This is currently not correct.
Summary of change:	z	The constellation points are corrected.
Consequences if not approved:	z	Inconsistencies between 16QAM and QPSK may lead to erroneous implementation.

Clauses affected:	z	5.2.2	
Other specs affected:	z	[ ] Other core specifications [ ] Test specifications [ ] O&M Specifications	z
Other comments:	z		

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 z contain pop-up help information about the field that they are closest to.

5.2.2 16QAM modulation

5.2.2.1 Mapping for burst type 1 and 2

The data modulation is performed to the bits from the output of the physical channel mapping procedure. In case of 16QAM, modulation 4 consecutive binary bits are represented by one complex valued data symbol. Each user burst has two data carrying parts, termed data blocks:

$$\underline{\mathbf{d}}^{(k,i)} = (\underline{d}_1^{(k,i)}, \underline{d}_2^{(k,i)}, \ldots, \underline{d}_{N_k}^{(k,i)})^{\mathrm{T}} \quad \mathrm{i} = 1, 2; \mathrm{k} = 1, \ldots, \mathrm{K}. \qquad (1)$$

N_k is the number of symbols per data field for the user k. This number is linked to the spreading factor Q_k.

Data block $\underline{\mathbf{d}}^{(k,1)}$ is transmitted before the midamble and data block $\underline{\mathbf{d}}^{(k,2)}$ after the midamble. Each of the N_k data symbols $\underline{d}_n^{(k,i)}$; i=1, 2; k=1,...,K; n=1,...,N_k; of equation 3 has the symbol duration $T_s^{(k)} = Q_k.T_c$ as already given.

The data modulation is 16QAM, thus the data symbols $\underline{d}_n^{(k,i)}$ are generated from 4 consecutive data bits from the output of the physical channel mapping procedure in [8]:

using the following mapping to complex symbols:

Consecutive binary bit pattern	complex symbol
$b_{1,n}^{(k,i)}\ b_{2,n}^{(k,i)}\ b_{3n}^{(k,i)}\ b_{4,n}^{(k,i)}$	$\cancel{\underline{d}_n^{(k,i)} \cdot e^{j\pi/4}}$ $\underline{\underline{d}_n^{(k,i)}}$
0000	$\cancel{\sqrt{1/10}+j\sqrt{1/10}}$ $\underline{j\frac{1}{\sqrt{5}}}$
0001	$\cancel{\sqrt{1/10}+j\sqrt{9/10}}$ $\underline{-\frac{1}{\sqrt{5}}+j\frac{2}{\sqrt{5}}}$
0010	$\cancel{\sqrt{9/10}+j\sqrt{1/10}}$ $\underline{\frac{1}{\sqrt{5}}+j\frac{2}{\sqrt{5}}}$
0011	$\cancel{\sqrt{9/10}+j\sqrt{9/10}}$ $\underline{j\frac{3}{\sqrt{5}}}$
0100	$\cancel{\sqrt{1/10}-j\sqrt{1/10}}$ $\underline{\sqrt{\frac{1}{5}}}$
0101	$\cancel{\sqrt{1/10}-j\sqrt{9/10}}$ $\underline{\frac{2}{\sqrt{5}}-j\frac{1}{\sqrt{5}}}$
0110	$\cancel{\sqrt{9/10}-j\sqrt{1/10}}$ $\underline{\frac{2}{\sqrt{5}}+j\frac{1}{\sqrt{5}}}$
0111	$\cancel{\sqrt{9/10}-j\sqrt{9/10}}$ $\underline{\frac{3}{\sqrt{5}}}$
1000	$\cancel{-\sqrt{1/10}+j\sqrt{1/10}}$ $\underline{-\frac{1}{\sqrt{5}}}$
1001	$\cancel{-\sqrt{1/10}+j\sqrt{9/10}}$ $\underline{-\frac{2}{\sqrt{5}}+j\frac{1}{\sqrt{5}}}$
1010	$\cancel{-\sqrt{9/10}+j\sqrt{1/10}}$ $\underline{-\frac{2}{\sqrt{5}}-j\frac{1}{\sqrt{5}}}$
1011	$\cancel{-\sqrt{9/10}+j\sqrt{9/10}}$ $\underline{-\frac{3}{\sqrt{5}}}$
1100	$\cancel{-\sqrt{1/10}-j\sqrt{1/10}}$ $\underline{-j\frac{1}{\sqrt{5}}}$
1101	$\cancel{-\sqrt{1/10}-j\sqrt{9/10}}$ $\underline{\frac{1}{\sqrt{5}}-j\frac{2}{\sqrt{5}}}$
1110	$\cancel{-\sqrt{9/10}-j\sqrt{1/10}}$ $\underline{-\frac{1}{\sqrt{5}}-j\frac{2}{\sqrt{5}}}$
1111	$\cancel{-\sqrt{9/10}-j\sqrt{9/10}}$ $\underline{-j\frac{3}{\sqrt{5}}}$

The mapping corresponds to a 16QAM modulation of the interleaved and encoded data bits $b_{l,n}^{(k,i)}$ of the table above and $\underline{d}_n^{(k,i)}$ of equation 3.

3GPP TSG RAN Meeting #16
Marco Island, FL, U.S.A., 4 – 7, June 2002

R1-02-0399

CR-Form-v5

CHANGE REQUEST

z	**25.224**	**CR**	**089**	z **rev**	**-**	z Current version:	**5.0.0** z

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

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

Title: z	TxDiversity for HSDPA in TDD			
Source: z	TSG RAN WG1			
Work item code: z	HSDPA-Phys		***Date:*** z	4.4.2002
Category: z	**F**		***Release:*** z	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)*

Reason for change: z	There is no need to restrict the applicability of the existing TxDiversity schemes to DPCH and PDSCH only.
Summary of change: z	Text is extended to include the HS-PDSCH and HS-SCCH in the current sections on TxDiversity.
Consequences if not approved: z	Unnecessary restriction with respect to the applicability of TxDiversity and loss of potential system benefits by this restriction.

Clauses affected: z	4.6, 5.5		
Other specs affected: z	**X**	Other core specifications z	25.221
		Test specifications	
		O&M Specifications	
Other comments: z			

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 z 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.

4.6 Downlink Transmit Diversity

Downlink transmit diversity for PDSCH, DPCH, P-CCPCH, HS-SCCH, HS-PDSCH, and SCH is optional in UTRAN. Its support is mandatory at the UE.

4.6.1 Transmit Diversity for PDSCH and DPCH

The transmitter structure to support transmit diversity for PDSCH, ~~and~~ DPCH, HS-SCCH, and HS-PDSCH transmission is shown in figure 1. Channel coding, interleaving and spreading are done as in non-diversity mode. The spread complex valued signal is fed to both TX antenna branches, and weighted with antenna specific weight factors w_1 and w_2. The weight factors are complex valued signals (i.e., $w_i = a_i + jb_i$), in general. These weight factors are calculated on a per slot and per user basis.

The weight factors are determined by the UTRAN. Examples of transmit diversity schemes are given in annex B.

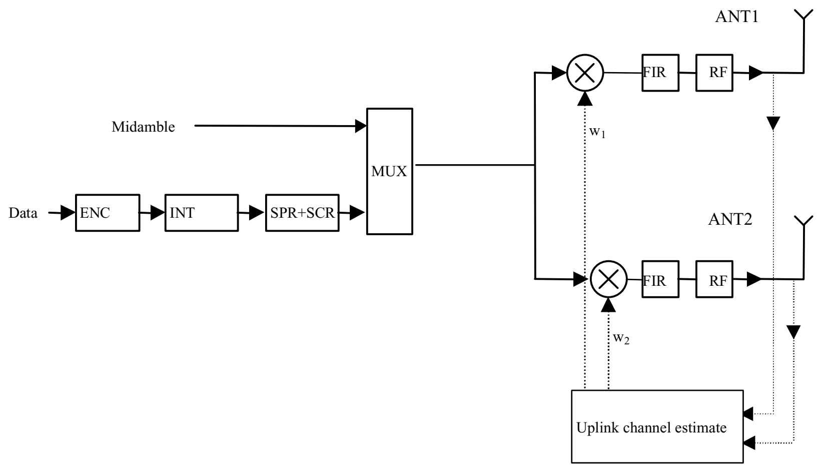


Figure 1: Downlink transmitter structure to support Transmit Diversity for PDSCH, ~~and~~ DPCH, HS-SCCH, and HS-PDSCH transmission (UTRAN Access Point)

5.5 Downlink Transmit Diversity

Downlink transmit diversity for DPCH, P-CCPCH, HS-SCCH, HS-PDSCH, and DwPTS is optional in UTRAN. Its support is mandatory at the UE.

5.5.1 Transmit Diversity for DPCH, HS-SCCH, and HS-PDSCH

~~Closed loop Transmit Diversity or~~ Time Switched Transmit Diversity (TSTD) may be employed as transmit diversity scheme for downlink DPCH. Closed loop Transmit Diversity may be employed as transmit diversity scheme for downlink DPCH, HS-SCCH, and HS-PDSCH

5.5.1.2 Closed Loop Tx Diversity for DPCH, HS-SCCH, and HS-PDSCH

The transmitter structure to support transmit diversity for DPCH, HS-SCCH, and HS-PDSCH transmission is shown in figure 9. Channel coding, interleaving and spreading are done as in non-diversity mode. The spread complex valued signal is fed to both TX antenna branches, and weighted with antenna specific weight factors w_1 and w_2. The weight factors are complex valued signals (i.e., $w_i = a_i + jb_i$), in general. These weight factors are calculated on a per slot and per user basis.

The weight factors are determined by the UTRAN.

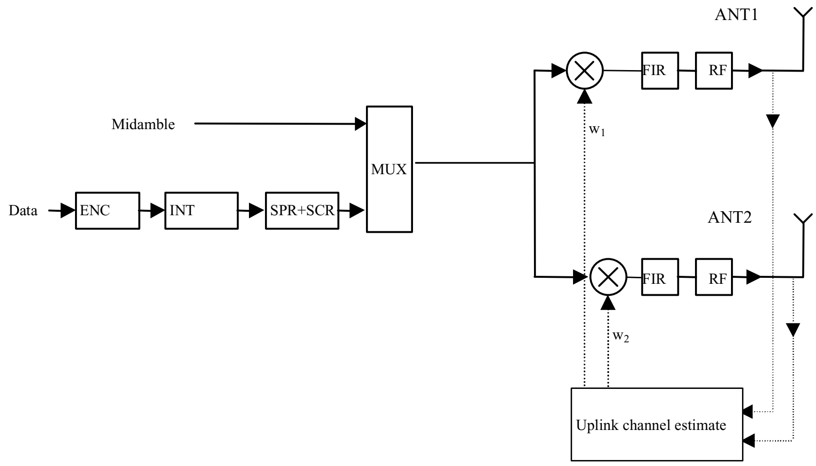


Figure 9: Downlink transmitter structure to support Transmit Diversity for DPCH, HS-SCCH, and HS-PDSCH transmission (UTRAN Access Point) in 1~~,~~.28 Mcps TDD

3GPP TSG RAN Meeting #16
Marco Island, FL, U.S.A., 4 – 7, June 2002

R1-02-0840

CR-Form-v5

CHANGE REQUEST

z **25.224**	**CR 090**	z **rev**	**-**	z Current version:	**5.0.0** z

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

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

Title: z	Correction to HS-SCCH Power Control (TDD)		
Source: z	TSG RAN WG1		
Work item code: z	HSDPA-Phys	***Date:*** z	15 MAY 2002
Category: z	**F**	***Release:*** z	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)*

Reason for change: z	Specified power control procedures for HS-SCCH in TDD are not correct.
Summary of change: z	HS-SCCH power control is procedure is corrected. Addition of procedures relating to HCSN sequence numbering indication on HS-SCCH. The current specification cannot guarantee that the UE will attain the specified BLER target for HS-SCCH. The procedure is modified such that the UE may take advantage of a new HCSN sequence number field signalled in HS-SCCH that enables the UE to correctly perform the specified TPC-based power control for HS-SCCH.
Consequences if not approved: z	Power control procedures as currently specified cannot guarantee correct BLER for the HS-SCCH. This has testing implications within WG4 and carries severe HS-SCCH capacity implications.

Clauses affected: z	4.2.3.7	
Other specs Affected: z	[X] Other core specifications z [ ] Test specifications [ ] O&M Specifications	25.222
Other comments: z		

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 z 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.

4.2.3.7 HS-SCCH

Higher layers shall indicate the initial transmit power of the HS-SCCH. How exactly this information is taken into account in the power setting is at the discretion of~~should be left to~~ the NodeB.
Following the initial transmission, the NodeB may optionally power control the HS-SCCH. This may be done using TPC commands sent by the UE in the HS-SICH.

The UE shall set the TPC commands in the HS-SICH in order to control the transmit power of the HS-SCCH. The TPC commands shall be set in order to meet the HS-SCCH target BLER.

The accuracy of the received HS-SCCH BLER estimate made by the UE may be enhanced by a suitable use of the HCSN field received within the HS-SCCH itself [9]. This field shall initially be set to zero and shall be incremented by the NodeB each time an HS-SCCH is transmitted to the UE.

1. ~~The UE shall be signalled a BLER target for the HS-SCCH by higher layers. The initial SIR target value shall be set autonomously by the UE.~~
2. ~~The UE shall not adapt its SIR target until it has detected an HS-SCCH transmission intended for it. Errors in HS-SCCH transmissions received before this first detected transmission shall not count towards the BLER target.~~
3. ~~Once the UE has detected this first HS-SCCH transmission, it may start to adapt its SIR target in order to meet the specified BLER target. For the purposes of BLER estimation, the UE shall assume that an HS-SCCH message is scheduled for it in every TTI following the first detected HS-SCCH transmission.~~
4. ~~If, following the detection of the first HS-SCCH transmission intended for the UE, a period of 8 TTIs elapses during which the UE does not detect any HS-SCCH transmissions intended for it, the UE shall reset its SIR target to the initial value and shall not start adapting it again until it has detected a subsequent HS-SCCH transmission intended for it. Errors in HS-SCCH transmissions received during this period (i.e. after the last detected HS-SCCH transmission intended for the UE but before the subsequent detected HS-SCCH transmission intended for the UE) shall not count towards the BLER target.~~