

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

RP-020316

Title: Agreed CRs (Rel-5) for the WI of "High Speed Downlink Packet Access -- Physical Layer" (Part 1)

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	25.211	147	3	R1-02-0857	Specification of TX diversity for HSDPA	Rel-5	B	HSDPA-Phys	5.0.0	5.1.0
2	25.211	150	1	R1-02-0700	Adding section on HS-SCCH/HS-PDSCH timing relation	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
3	25.211	155	-	R1-02-0741	HSDPA subframe definition	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
4	25.211	157	1	R1-02-0812	Clarification for uplink HS-DPCCH/HS-PDSCH timing	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
5	25.212	130	5	R1-02-0856	Correction of errata noted by RAN1 delegates	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
6	25.212	131	2	R1-02-0768	Removal of inconsistencies and ambiguities in the HARQ description	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
7	25.212	132	-	R1-02-0605	Rate matching and channel coding for HS-SCCH	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
8	25.212	137	-	R1-02-0654	Basis sequences for HS-DPCCH channel quality information code	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
9	25.212	145	5	R1-02-0859	UE specific masking for HS-SCCH part1	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
10	25.213	050	-	R1-02-0402	Consistency of signal point constellation for QPSK and 16QAM	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
11	25.213	054	-	R1-02-0591	Clarification of uplink DTX handling and modulation	Rel-5	F	HSDPA-Phys	5.0.0	5.1.1
12	25.213	055	2	R1-02-0811	Removal of code mapping description over HS-SCCH	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
13	25.213	056	3	R1-02-0853	I/Q mapping of HS-DPCCH	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
14	25.213	057	-	R1-02-0800	Definition of the amplitude gain factor for HS-DPCCH	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
15	25.214	255	2	R1-02-0769	Correction on the operation of HSDPA during compressed mode	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
16	25.214	259	1	R1-02-0813	Clarification of UE transmission timing adjustment with HS-DPCCH	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
17	25.214	260	4	R1-02-0748	Definition of CQI reporting	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
18	25.214	266	-	R1-02-0801	Correction to the setting of DPCCH/HS-DPCCH power difference	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0
19	25.214	267	-	R1-02-0743	Inclusion of CQI table	Rel-5	F	HSDPA-Phys	5.0.0	5.1.0

CR-Form-v4	
CHANGE REQUEST	
z	25.211 CR 147 z rev 3 z Current version: 5.0.0 z

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

Title:	z	Specification of TX diversity for HSDPA	
Source:	z	TSG RAN WG1	
Work item code:	z	HSDPA-Phys	Date: z 15 May 2002
Category:	z	B	Release: z REL-5
		Use <u>one</u> of the following categories:	Use <u>one</u> of the following releases:
		F (correction)	2 (GSM Phase 2)
		A (corresponds to a correction in an earlier release)	R96 (Release 1996)
		B (addition of feature),	R97 (Release 1997)
		C (functional modification of feature)	R98 (Release 1998)
		D (editorial modification)	R99 (Release 1999)
		Detailed explanations of the above categories can be found in 3GPP TR 21.900 .	REL-4 (Release 4)
			REL-5 (Release 5)

Reason for change:	z	Complete the specification of HSDPA.
Summary of change:	z	The Tx diversity rules applicable to the HS-PDSCH, the associated DPCH and HS-SCCH are specified. Also channel bit encoding for 16QAM is specified for STTD.
Consequences if not approved:	z	TX diversity mode rules and encoding that apply to the physical channels of HSDPA are unknown.

Clauses affected:	z	5.3
Other specs affected:	z	<input checked="" type="checkbox"/> Other core specifications z 25.214 5.0.0 <input type="checkbox"/> Test specifications <input type="checkbox"/> 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.

5.3 Downlink physical channels

5.3.1 Downlink transmit diversity

Table 11 summarizes the possible application of open and closed loop transmit diversity modes on different downlink physical channel types. Simultaneous use of STTD and closed loop modes on the same physical channel is not allowed. In addition, if Tx diversity is applied on any of the downlink physical channels it shall also be applied on P-CCPCH and SCH. Regarding CPICH transmission in case of transmit diversity, see subclause 5.3.3.1.

With respect to the usage of Tx diversity on different radio links within an active set, the following rules apply:

- Different Tx diversity modes (STTD and closed loop) shall not be used on the radio links within one active set.
- No Tx diversity on one or more radio links shall not prevent UTRAN to use Tx diversity on other radio links within the same active set.
- If STTD is activated on one or several radio links in the active set, the UE shall operate STTD either on only those radio links where STTD has been activated or on all radio links in the active set.
- If closed loop TX diversity is activated on one or several radio links in the active set, the UE shall operate closed loop TX diversity either on only those radio links where closed loop TX diversity has been activated or on all radio links in the active set.

Furthermore, the transmit diversity mode used for a PDSCH frame shall be the same as the transmit diversity mode used for the DPCH associated with this PDSCH frame. The transmit diversity mode on the associated DPCH may not change during a PDSCH frame and within the slot prior to the PDSCH frame. This includes any change between no Tx diversity, open loop, closed loop mode 1 or closed loop mode 2.

Also, the transmit diversity mode used for a HS-SCCH and or a HS-PDSCH subframe shall be the same as the transmit diversity mode used for the DPCH associated with this HS-SCCH and or HS-PDSCH subframe. The transmit diversity mode on the associated DPCH may not change during a HS-SCCH and or HS-PDSCH subframe and within the slot prior to the HS-SCCH subframe. This includes any change between no Tx diversity, open loop, closed loop mode 1 or closed loop mode 2.

Table 11: Application of Tx diversity modes on downlink physical channel types
 "X" – can be applied, "-" – not applied, **"FFS" – for further study**

Physical channel type	Open loop mode		Closed loop Mode
	TSTD	STTD	
P-CCPCH	–	X	–
SCH	X	–	–
S-CCPCH	–	X	–
DPCH	–	X	X
PICH	–	X	–
PDSCH	–	X	X
<u>HS-PDSCH</u>	<u>–</u>	<u>X</u>	<u>FFS</u>
<u>HS-SCCH</u>	<u>–</u>	<u>X</u>	<u>FFS</u>
AICH	–	X	–
CSICH	–	X	–
AP-AICH	-	X	-
CD/CA-ICH	-	X	-
DL-DPCCH for CPCH	-	X	X

5.3.1.1 Open loop transmit diversity

5.3.1.1.1 Space time block coding based transmit antenna diversity (STTD)

The open loop downlink transmit diversity employs a space time block coding based transmit diversity (STTD).

The STTD encoding is optional in UTRAN. STTD support is mandatory at the UE.

If higher layers signal that neither P-CPICH nor S-CPICH can be used as phase reference for the downlink DPCH for a radio link in a cell, the UE shall assume that STTD is not used for the downlink DPCH (and the associated PDSCH if applicable) in that cell.

For QPSK, STTD encoding is applied on blocks of 4 consecutive channel bits. A block diagram of a generic STTD encoder for channel bits b_0, b_1, b_2, b_3 is shown in the figure 9 below.

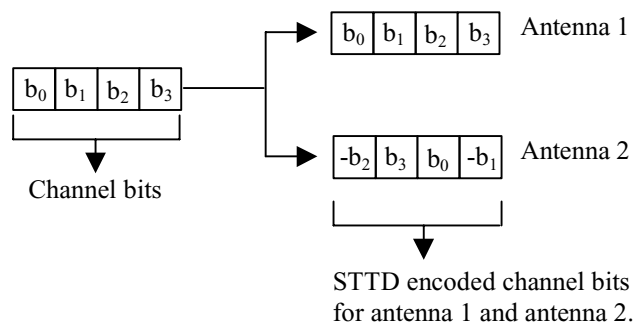


Figure 9: Generic block diagram of the STTD encoder for QPSK

For 16QAM, STTD operates on blocks of 8 consecutive symbols $b_0, b_1, b_2, b_3, b_4, b_5, b_6, b_7$ is shown in figure 10 below.

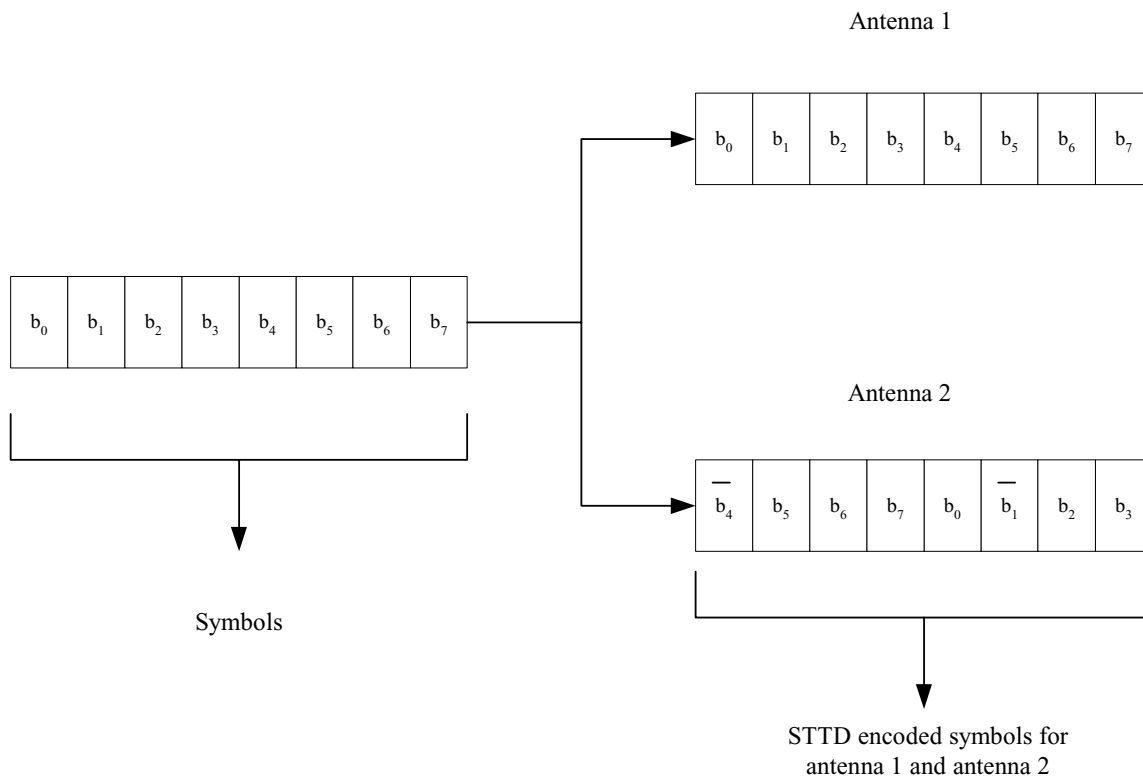


Figure 10: Generic block diagram of the STTD encoder for 16QAM

Channel coding, rate matching and interleaving is done as in the non-diversity mode. The bit b_i is real valued $\{0\}$ for DTX bits and $\{1, -1\}$ for all other channel bits.

CR-Form-v5			
CHANGE REQUEST			
z	25.211 CR 150	z rev 1	z Current version: 5.0.0 z

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

Title:	z	Adding section on HS-SCCH/HS-PDSCH timing relation	
Source:	z	TSG RAN WG1	
Work item code:	z	HSDPA-Phys	Date: z 8. May, 2002
Category:	z	F	Release: z REL-5
		Use <u>one</u> of the following categories:	Use <u>one</u> of the following releases:
		F (correction)	2 (GSM Phase 2)
		A (corresponds to a correction in an earlier release)	R96 (Release 1996)
		B (addition of feature),	R97 (Release 1997)
		C (functional modification of feature)	R98 (Release 1998)
		D (editorial modification)	R99 (Release 1999)
		Detailed explanations of the above categories can be found in 3GPP TR 21.900 .	REL-4 (Release 4)
			REL-5 (Release 5)

Reason for change:	z	The timing relation between the HS-SCCH and HS-DSCH was left out of the original CR adding the HSDPA feature to 25.211.
Summary of change:	z	Correcting an incorrect reference in 7.1. Adding new section 7.8 describing the timing relation.
Consequences if not approved:	z	The timing relation is essential for UE and RAN implementation.

Clauses affected:	z	7.1, 7.8
Other specs affected:	z	<input type="checkbox"/> Other core specifications z <input type="checkbox"/> Test specifications z <input type="checkbox"/> O&M Specifications z
Other comments:	z	

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Physical Signals**Physical Channels**

PRACH preamble part — Physical Random Access Channel (PRACH)

PCPCH access
preamble part
PCPCH CD/CA
preamble part
PCPCH power control
preamble part



Physical Common Packet Channel (PCPCH)

Figure 31: Physical channel and physical signal association

7 Timing relationship between physical channels

7.1 General

The P-CCPCH, on which the cell SFN is transmitted, is used as timing reference for all the physical channels, directly for downlink and indirectly for uplink.

Figure 32 below describes the frame timing of the downlink physical channels. For the AICH the access slot timing is included. Transmission timing for uplink physical channels is given by the received timing of downlink physical channels, as described in the following subclauses.

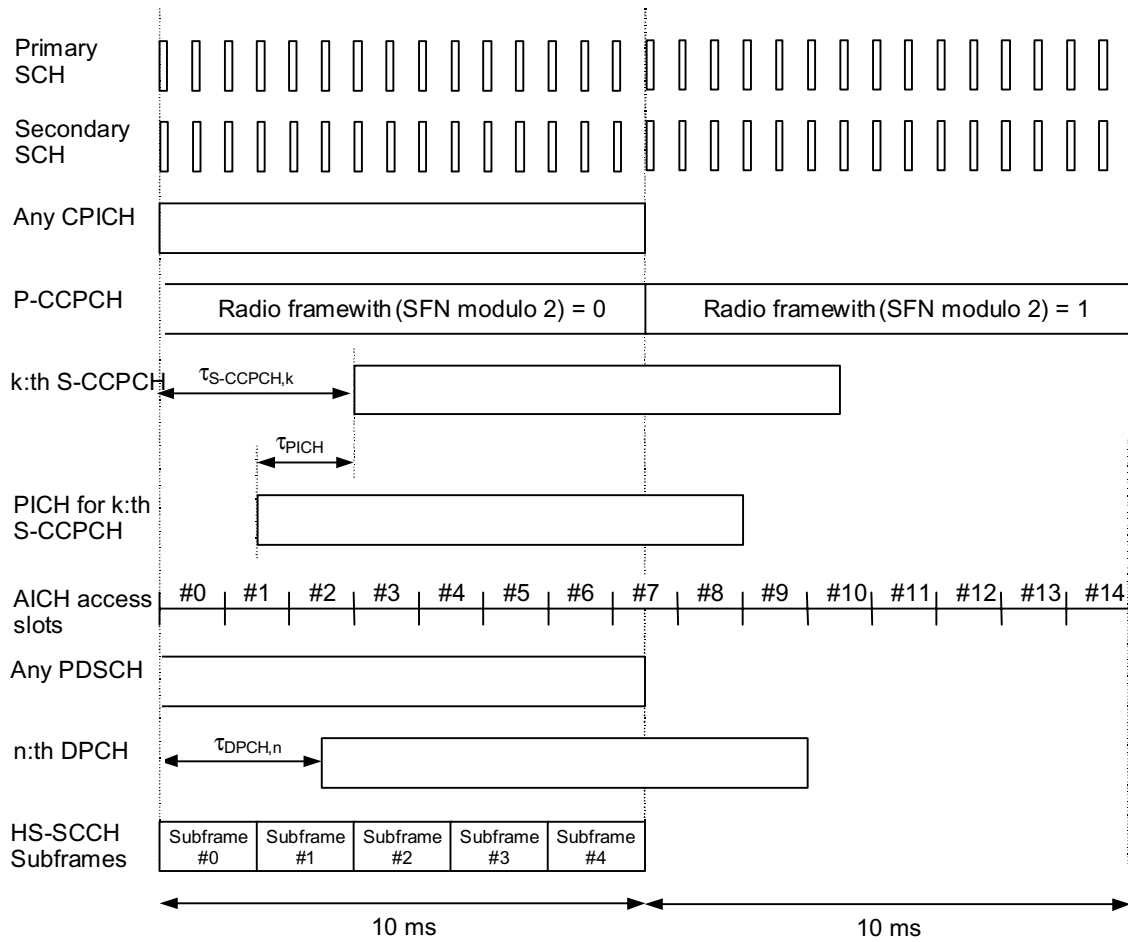


Figure 32: Radio frame timing and access slot timing of downlink physical channels

The following applies:

- SCH (primary and secondary), CPICH (primary and secondary), P-CCPCH, and PDSCH have identical frame timings.
- The S-CCPCH timing may be different for different S-CCPCHs, but the offset from the P-CCPCH frame timing is a multiple of 256 chips, i.e. $\tau_{S-CCPCH,k} = T_k \times 256 \text{ chip}$, $T_k \in \{0, 1, \dots, 149\}$.
- The PICH timing is $\tau_{PICH} = 7680 \text{ chips}$ prior to its corresponding S-CCPCH frame timing, i.e. the timing of the S-CCPCH carrying the PCH transport channel with the corresponding paging information, see also subclause 7.2.
- AICH access slots #0 starts the same time as P-CCPCH frames with $(\text{SFN modulo } 2) = 0$. The AICH/PRACH and AICH/PCPCH timing is described in subclauses 7.3 and 7.4 respectively.
- The relative timing of associated PDSCH and DPCH is described in subclause 7.5.
- The DPCH timing may be different for different DPCHs, but the offset from the P-CCPCH frame timing is a multiple of 256 chips, i.e. $\tau_{DPCH,n} = T_n \times 256 \text{ chip}$, $T_n \in \{0, 1, \dots, 149\}$. The DPCH (DPCCH/DPDCH) timing relation with uplink DPCCH/DPDCHs is described in subclause 7.6.
- The start of HS-SCCH subframe #0 is aligned with the start of the P-CCPCH frames. The relative timing between a HS-PDSCH and the corresponding HS-SCCH is described in subclause 7.87.

7.2 PICH/S-CCPCH timing relation

Figure 33 illustrates the timing between a PICH frame and its associated single S-CCPCH frame, i.e. the S-CCPCH frame that carries the paging information related to the paging indicators in the PICH frame. A paging indicator set in a PICH frame means that the paging message is transmitted on the PCH in the S-CCPCH frame starting τ_{PICH} chips after the transmitted PICH frame. τ_{PICH} is defined in subclause 7.1.

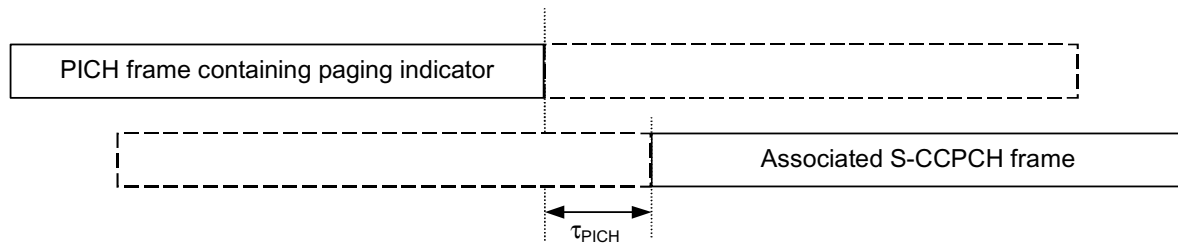


Figure 33: Timing relation between PICH frame and associated S-CCPCH frame

7.3 PRACH/AICH timing relation

The downlink AICH is divided into downlink access slots, each access slot is of length 5120 chips. The downlink access slots are time aligned with the P-CCPCH as described in subclause 7.1.

The uplink PRACH is divided into uplink access slots, each access slot is of length 5120 chips. Uplink access slot number n is transmitted from the UE $\tau_{\text{p-a}}$ chips prior to the reception of downlink access slot number n , $n = 0, 1, \dots, 14$.

Transmission of downlink acquisition indicators may only start at the beginning of a downlink access slot. Similarly, transmission of uplink RACH preambles and RACH message parts may only start at the beginning of an uplink access slot.

The PRACH/AICH timing relation is shown in figure 34.

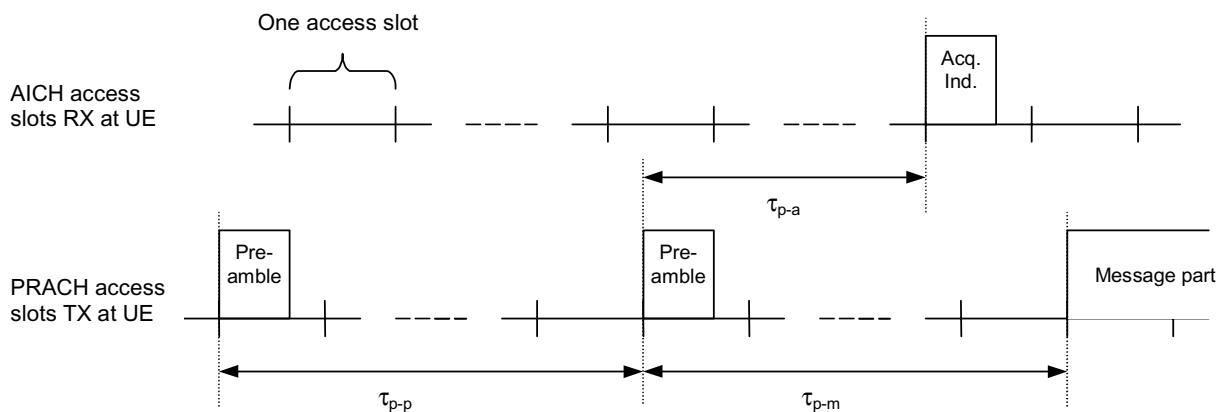


Figure 34: Timing relation between PRACH and AICH as seen at the UE

The preamble-to-preamble distance $\tau_{\text{p-p}}$ shall be larger than or equal to the minimum preamble-to-preamble distance $\tau_{\text{p-p,min}}$, i.e. $\tau_{\text{p-p}} \geq \tau_{\text{p-p,min}}$.

In addition to $\tau_{p-p,\min}$, the preamble-to-AI distance τ_{p-a} and preamble-to-message distance τ_{p-m} are defined as follows:

- when AICH_Transmission_Timing is set to 0, then

$$\tau_{p-p,\min} = 15360 \text{ chips (3 access slots)}$$

$$\tau_{p-a} = 7680 \text{ chips}$$

$$\tau_{p-m} = 15360 \text{ chips (3 access slots)}$$

- when AICH_Transmission_Timing is set to 1, then

$$\tau_{p-p,\min} = 20480 \text{ chips (4 access slots)}$$

$$\tau_{p-a} = 12800 \text{ chips}$$

$$\tau_{p-m} = 20480 \text{ chips (4 access slots)}$$

The parameter AICH_Transmission_Timing is signalled by higher layers.

7.4 PCPCH/AICH timing relation

The uplink PCPCH is divided into uplink access slots, each access slot is of length 5120 chips. Uplink access slot number n is transmitted from the UE τ_{p-a1} chips prior to the reception of downlink access slot number n , $n=0, 1, \dots, 14$.

The timing relationship between preambles, AICH, and the message is the same as PRACH/AICH. Note that the collision resolution preambles follow the access preambles in PCPCH/AICH. However, the timing relationships between CD-Preamble and CD/CA-ICH is identical to RACH Preamble and AICH. The timing relationship between CD/CA-ICH and the Power Control Preamble in CPCH is identical to AICH to message in RACH. The T_{cpch} timing parameter is identical to the PRACH/AICH transmission timing parameter. When T_{cpch} is set to zero or one, the following PCPCH/AICH timing values apply.

Note that a1 corresponds to AP-AICH and a2 corresponds to CD/CA-ICH.

τ_{p-p} = Time to next available access slot, between Access Preambles.

$$\text{Minimum time} = 15360 \text{ chips} + 5120 \text{ chips} \times T_{cpch}$$

$$\text{Maximum time} = 5120 \text{ chips} \times 12 = 61440 \text{ chips}$$

Actual time is time to next slot (which meets minimum time criterion) in allocated access slot subchannel group.

τ_{p-a1} = Time between Access Preamble and AP-AICH has two alternative values: 7680 chips or 12800 chips, depending on T_{cpch}

τ_{a1-cdp} = Time between receipt of AP-AICH and transmission of the CD Preamble τ_{a1-cdp} has a minimum value of $\tau_{a1-cdp,\min} = 7680$ chips.

τ_{p-cdp} = Time between the last AP and CD Preamble. τ_{p-cdp} has a minimum value of $\tau_{p-cdp,\min}$ which is either 3 or 4 access slots, depending on T_{cpch}

τ_{cdp-a2} = Time between the CD Preamble and the CD/CA-ICH has two alternative values: 7680 chips or 12800 chips, depending on T_{cpch}

$\tau_{cdp-pcp}$ = Time between CD Preamble and the start of the Power Control Preamble is either 3 or 4 access slots, depending on T_{cpch} .

The time between the start of the reception of DL-DPCCH slot at UE and the Power Control Preamble is T_0 chips, where T_0 is as in subclause 7.6.3.

The message transmission shall start 0 or 8 slots after the start of the power control preamble depending on the length of the power control preamble.

Figure 35 illustrates the PCPCH/AICH timing relationship when T_{cpch} is set to 0 and all access slot subchannels are available for PCPCH.

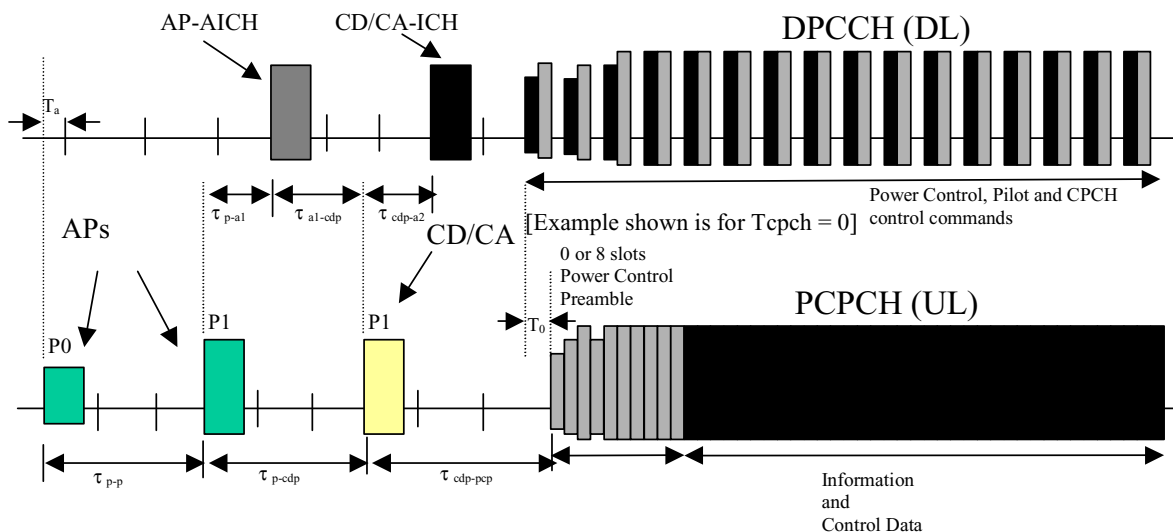


Figure 35: Timing of PCPCH and AICH transmission as seen by the UE, with $T_{cpch} = 0$

7.5 DPCH/PDSCH timing

The relative timing between a DPCH frame and the associated PDSCH frame is shown in figure 36.

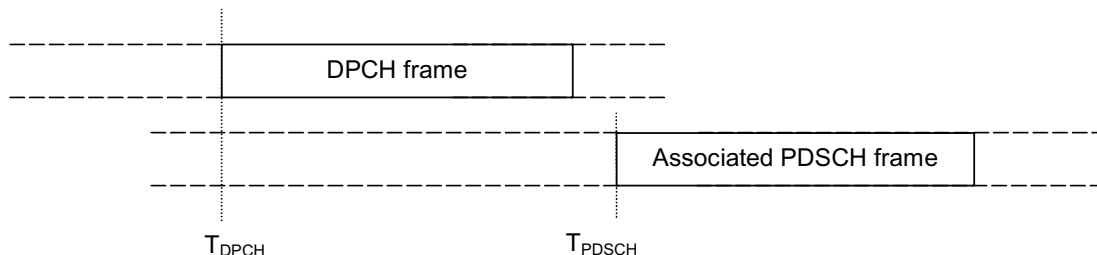


Figure 36: Timing relation between DPCH frame and associated PDSCH frame

The start of a DPCH frame is denoted T_{DPCH} and the start of the associated PDSCH frame is denoted T_{PDSCH} . Any DPCH frame is associated to one PDSCH frame through the relation $46080 \text{ chips} \leq T_{PDSCH} - T_{DPCH} < 84480 \text{ chips}$, i.e., the associated PDSCH frame starts between three slots after the end of the DPCH frame and 18 slots after the end of the DPCH frame, as described in subclause 7.1.

7.6 DPCCH/DPDCH timing relations

7.6.1 Uplink

In uplink the DPCCH and all the DPDCHs transmitted from one UE have the same frame timing.

7.6.2 Downlink

In downlink, the DPCCH and all the DPDCHs carrying CCTrCHs of dedicated type to one UE have the same frame timing.

Note: support of multiple CCTrCHs of dedicated type is not part of the current release.

7.6.3 Uplink/downlink timing at UE

At the UE, the uplink DPCCH/DPDCH frame transmission takes place approximately T_0 chips after the reception of the first detected path (in time) of the corresponding downlink DPCCH/DPDCH frame. T_0 is a constant defined to be 1024 chips. The first detected path (in time) is defined implicitly by the relevant tests in [14]. More information about the uplink/downlink timing relation and meaning of T_0 can be found in [5].

7.7 Uplink HS-DPCCH/HS-PDSCH timing

Figure 37 shows the timing offset between the downlink associated DPCH and the uplink HS-DPCCH. The code-multiplexed uplink HS-DPCCH starts $m \cdot 256$ chips after the start of the uplink DPCCH with m selected by the UE such that the ACK/NACK transmission starts within the first 0-255 chips after 7.5 slots following the end of the received HS-PDSCH.

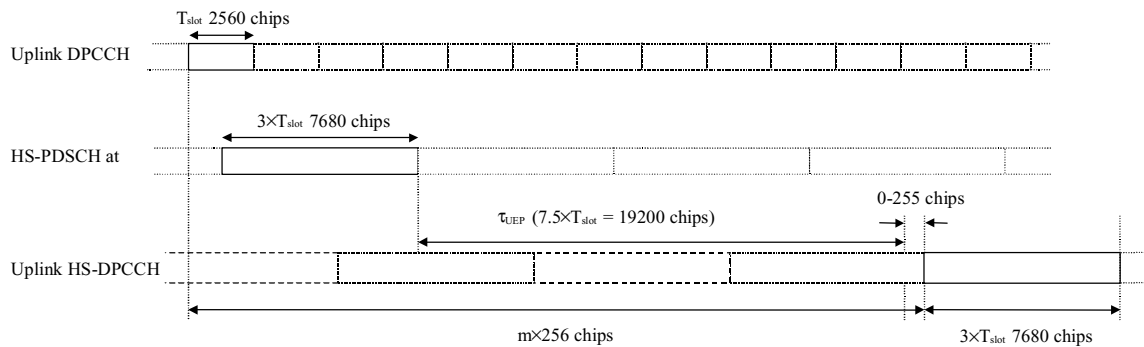


Figure 37: Timing structure at UE for UL HS-DPCCH control signalling

7.8 HS-SCCH/HS-PDSCH timing

Figure 38 shows the relative timing between the HS-SCCH and the associated HS-PDSCH for one HS-DSCH sub-frame. The HS-PDSCH starts $\tau_{HS-PDSCH} = 2 \times T_{slot} = 5120$ chips after the start of the HS-SCCH.

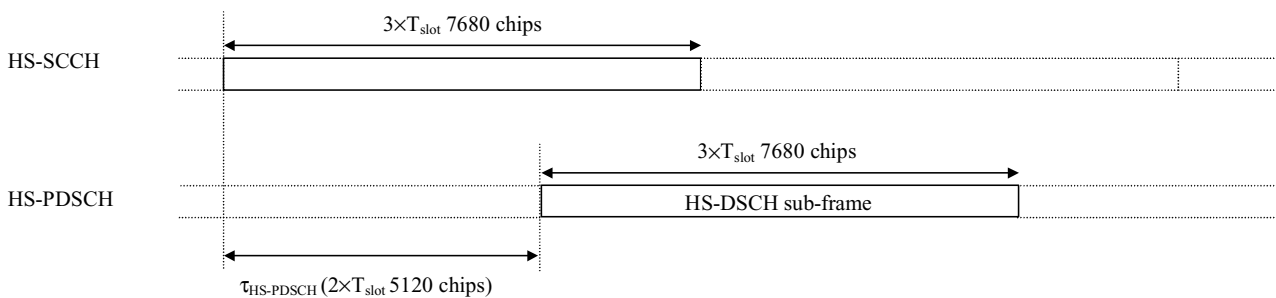


Figure 38: Timing relation between the HS-SCCH and the associated HS-PDSCH.

CHANGE REQUEST

z **25.211 CR 155** 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 Radio Access Network Core Network

Title:	z HSDPA subframe definition		
Source:	z TSG RAN WG1		
Work item code:	z HSDPA-Phys	Date:	z 2002-05-07
Category:	z F	Release:	z REL-5
	Use <u>one</u> of the following categories:		Use <u>one</u> of the following releases:
	F (correction)		2 (GSM Phase 2)
	A (corresponds to a correction in an earlier release)		R96 (Release 1996)
	B (addition of feature),		R97 (Release 1997)
	C (functional modification of feature)		R98 (Release 1998)
	D (editorial modification)		R99 (Release 1999)
	Detailed explanations of the above categories can be found in 3GPP TR 21.900 .		REL-4 (Release 4)
			REL-5 (Release 5)

Reason for change:	z	Although only the term “HS-DSCH sub-frame” is defined, the L1 specifications mention also HS-DPCCH subframes or HS-SCCH subframes. It may not always be clear what subframe is meant, e.g. on HS-DPCCH, when “HS-DSCH sub-frame” is used to address the corresponding slots of HS-DPCCH. Also, this use of terminology could cause confusion in other RAN WGs.
Summary of change:	z	Instead of HS-DSCH sub-frame, only the term sub-frame is defined. This allows the specifications to use “sub-frame” in connection with the intended physical or transport channel, i.e. HS-(P)DSCH, HS-SCCH or HS-DPCCH
Consequences if not approved:	z	Ambiguity about what subframe is meant when HS-DSCH sub-frame is used to address, e.g. HS-DPCCH “subframes”. Inconsistency of terminology within the RAN1 specifications.

Clauses affected:	z	5
Other specs affected:	z	<input type="checkbox"/> Other core specifications z <input type="checkbox"/> Test specifications z <input type="checkbox"/> O&M Specifications z
Other comments:	z	

5 Physical channels and physical signals

Physical channels are defined by a specific carrier frequency, scrambling code, channelization code (optional), time start & stop (giving a duration) and, on the uplink, relative phase (0 or $\pi/2$). Scrambling and channelization codes are specified in [4]. Time durations are defined by start and stop instants, measured in integer multiples of chips. Suitable multiples of chips also used in specification are:

- Radio frame: A radio frame is a processing duration which consists of 15 slots. The length of a radio frame corresponds to 38400 chips.
- Slot: A slot is a duration which consists of fields containing bits. The length of a slot corresponds to 2560 chips.
- ~~HS-DSCH-s~~Sub-frame: ~~The HS-DSCH-s~~A sub-frame is the basic time interval for HS-DSCH transmission and HS-DSCH-related signalling at the physical layer. The length of ~~the a HS-DSCH~~ sub-frame corresponds to 3 slots (7680 chips).

The default time duration for a physical channel is continuous from the instant when it is started to the instant when it is stopped. Physical channels that are not continuous will be explicitly described.

Transport channels are described (in more abstract higher layer models of the physical layer) as being capable of being mapped to physical channels. Within the physical layer itself the exact mapping is from a composite coded transport channel (CCTrCH) to the data part of a physical channel. In addition to data parts there also exist channel control parts and physical signals.

CR-Form-v5

CHANGE REQUEST

z **25.211 CR 157** 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 Radio Access Network Core Network

Title:	z Clarification for uplink HS-DPCCH/HS-PDSCH timing		
Source:	z TSG RAN WG1		
Work item code:	z HSDPA-Phys	Date:	z 15 th May, 2002
Category:	z F Use <u>one</u> 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 <u>one</u> 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 With current specification of uplink HS-DPCCH/HS-PDSCH timing, there is the possibility that the UE changes the start of the HS-DPCCH relative to the start of the UL DPCCH without the Node B having the possibility of doing the same change.		
Summary of change:	z Statement added clarifying that the UE shall only modify the start of HS-DPCCH relative to UI DPCCH when downlink signalling on timing adjustment takes place.		
Consequences if not approved:	z Node B risks losing slot synchronisation of HS-DPCCH.		

Clauses affected:	z 7.7		
Other specs affected:	z <input type="checkbox"/> Other core specifications	z <input type="checkbox"/>	
	<input type="checkbox"/> Test specifications		
	<input type="checkbox"/> 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/](http://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.

Uplink/downlink timing at UE

At the UE, the uplink DPCCH/DPDCH frame transmission takes place approximately T_0 chips after the reception of the first detected path (in time) of the corresponding downlink DPCCH/DPDCH frame. T_0 is a constant defined to be 1024 chips. The first detected path (in time) is defined implicitly by the relevant tests in [14]. More information about the uplink/downlink timing relation and meaning of T_0 can be found in [5].

7.7 Uplink DPCCH/HS-DPCCH/HS-PDSCH timing at the UE

Figure 37 shows the timing offset between the downlink associated uplink DPCCH, the HS-PDSCH and the uplink HS-DPCCH at the UE. The code-multiplexed uplink HS-DPCCH sub-frame starts $m \times 256 - m \times 256$ chips after the start of the uplink DPCCH slot with m selected by the UE such that the ACK/NACK transmission starts within the first 0-255 chips after 7.5 slots following the end of the received HS-PDSCH sub-frame. UE and Node B shall only update m in connection to UTRAN reconfiguration of downlink timing.

Note that due to autonomous adjustments of the DPDCH/DPCCH transmission time instant by the UE described in [5], the relationships described in this section may cease to be valid. More information about the uplink timing adjustments can be found in [5].

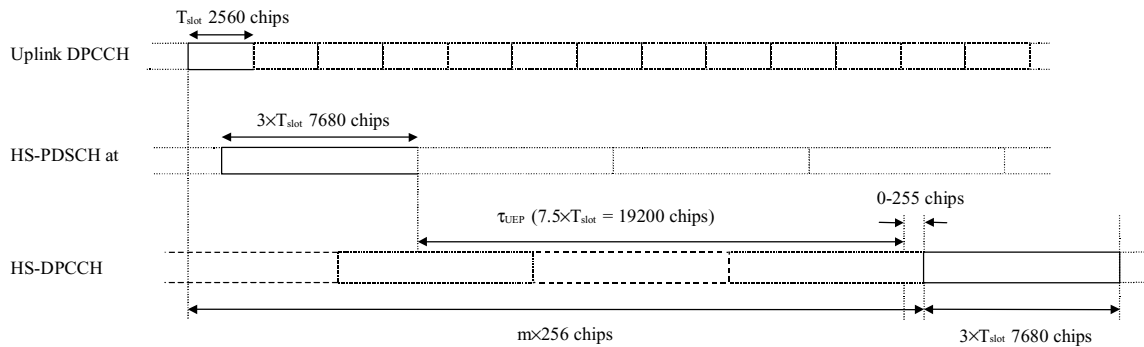


Figure 37: Timing structure at UE for UL HS-DPCCH control signalling

CHANGE REQUEST

z **25.212 CR 130** z rev **5** 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 Radio Access Network Core Network

Title:	z	Correction of Errata noted by RAN1 delegates	
Source:	z	TSG RAN WG1	
Work item code:	z	HSDPA-Phys	Date: z 21 May 2002
Category:	z	F	Release: z REL-5
		Use <u>one</u> of the following categories:	Use <u>one</u> of the following releases:
		F (correction)	2 (GSM Phase 2)
		A (corresponds to a correction in an earlier release)	R96 (Release 1996)
		B (addition of feature),	R97 (Release 1997)
		C (functional modification of feature)	R98 (Release 1998)
		D (editorial modification)	R99 (Release 1999)
		Detailed explanations of the above categories can be found in 3GPP TR 21.900 .	REL-4 (Release 4)
			REL-5 (Release 5)

Reason for change:	z	Correction of errata in specification.	
Summary of change:	z	(for constellation re-arrangement change) In section 4.5.4.4, read rows in the order 1, 2, 3, 4 instead of 1, 3, 2, 4. In section 4.5.6, write and read bits pair wise into parallel interleavers instead of bit wise. Corrections of indices in sections 4.5.6 and 4.5.8. Removal of I&Q indices in section 4.5.8 on constellation rearrangement.	
Consequences if not approved:	z	Specification text would not implement intended function. Isolated impact statement: The changes have no functional impact. No other specification would be altered as a result of this CR and no correct implementation affected.	

Clauses affected:	z	4.5, 4.5.1, 4.5.2, 4.5.4.4, 4.5.6, 4.5.7, 4.5.8, 4.6.2.1, 4.6.2.2, 4.6.2.3, 4.6.4, 4.6.5, 4.6.8, 4.7.1.2	
Other specs affected:	z	<input type="checkbox"/> Other core specifications <input type="checkbox"/> Test specifications <input type="checkbox"/> O&M Specifications	z
Other comments:	z		

4.5 Coding for HS-DSCH

Data arrives to the coding unit in form of a maximum of one transport block once every transmission time interval. The transmission time interval is 2 ms which is mapped to a radio sub-frame of 3 slots.

The following coding steps 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);
- physical channel segmentation (see subclause 4.5.5);
- interleaving for HS-DSCH (see subclause 4.5.6);
- ~~- mapping to physical channels (see subclause 4.5.7);~~
- constellation re-arrangement for 16 QAM (see subclause 4.5.~~7~~8).
- ~~- mapping to physical channels (see subclause 4.5.8);~~

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

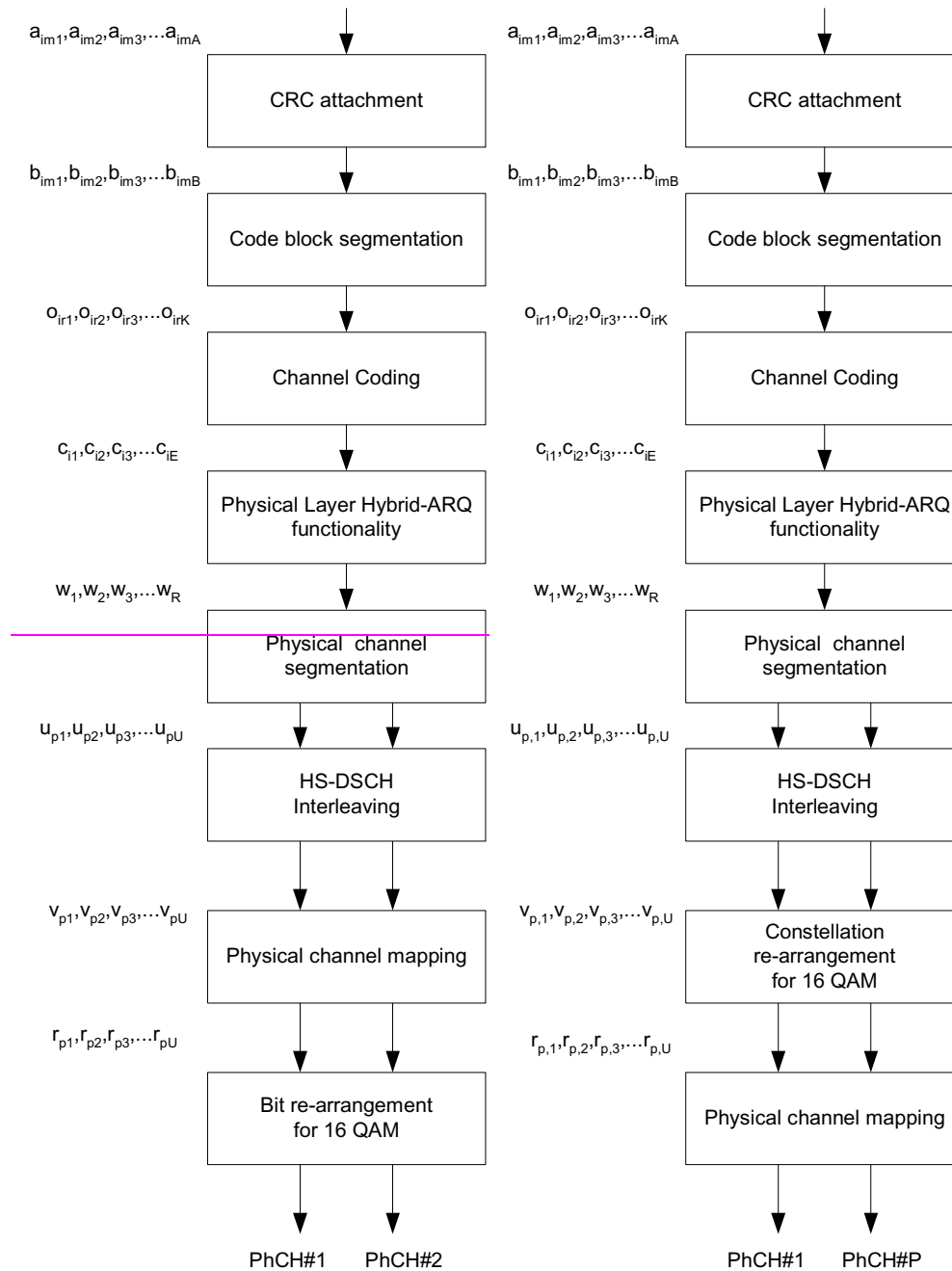


Figure 16: ~~Transport channel multiplexing structure~~Coding chain for HS-DSCH

In the following the number of transport blocks and the number of transport channels 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_1 may be written X).

4.5.1 CRC attachment for HS-DSCH

CRC attachment for the HS-DSCH transport channel shall be done using the general method described in 4.2.1 above with the following specific parameters.

There will be a maximum ~~to~~ of one transport block, $i=1$. The CRC length shall always be $L_1 = 24$ 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 be a maximum of one transport block, $i=1$. The bits $b_{im1}, b_{im2}, b_{im3}, \dots, b_{imB}$ input to the block are mapped to the bits $x_{i1}, x_{i2}, x_{i3}, \dots, x_{iXi}$ 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 $Q_{ir1}, Q_{ir2}, Q_{ir3}, \dots, Q_{irK}$.

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 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 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 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.

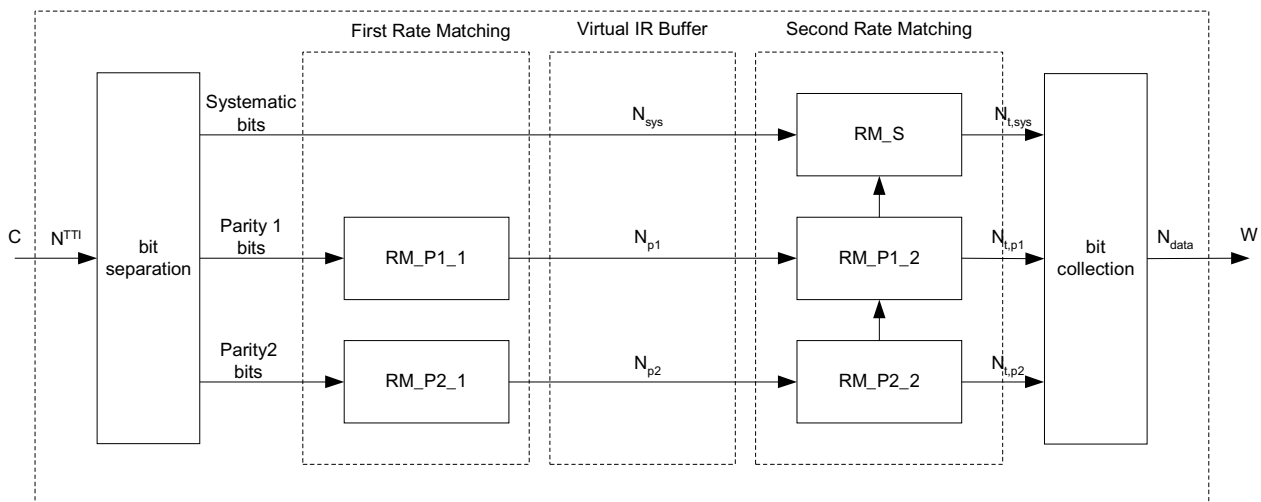


Figure 17: HS-DSCH hybrid ARQ functionality

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 4.2.7.4 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 4.2.7.2.2.3 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 4.2.7.2.2.3 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 4.2.7.5 above with the following specific parameters.

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 ($s = 1$) and non self-decodable ($s = 0$) transmissions. The parameter r (range 0 to r_{max}) changes the initial error variable e_{mi} in the case of puncturing. In case of repetition both parameters r and s change the initial error variable e_{mi} . The parameters X , e_{plus} and e_{minus} are calculated as per table 10 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 by P . N_{data} is the number of bits available to the CCTrCH in one radio frame and defined as $N_{data} = P \times 3 \times N_{data1}$, where N_{data1} is defined in [2]. The rate matching parameters are determined as follows.

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

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

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

Table 10 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 10: Parameters for HARQ second rate matching

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

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

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

and

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

Where $r \in \{0, 1, \dots, r_{max} - 1\}$ and r_{max} is the total number of redundancy versions allowed by varying r . Note that r_{max} varies depending on the modulation mode.

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

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:

$$N_{row} = \log_2(M)$$

$$N_{col} = F / N_{row}$$

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 $1 \dots N_r$.

Otherwise systematic bits are written into rows $1 \dots N_r+1$ in the first N_c columns and rows $1 \dots N_r$ 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, row 2, row 4** **row 1, row 2, row 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 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 $w_1, w_2, w_3, \dots, w_R$, 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 $u_{p1}, u_{p2}, u_{p3}, \dots, u_{pU}$, where p is PhCH number and U is the

number of bits in one radio sub-frame for each HS-PDSCH, i.e. $U = \frac{R}{P}$. The relation between w_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 .

Bits on first PhCH after physical channel segmentation:

$$u_{1,k} = w_k \quad k = 1, 2, \dots, U$$

Bits on second PhCH after physical channel segmentation:

$$u_{2,k} = w_{k+U} \quad k = 1, 2, \dots, U$$

...

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

$$u_{p,k} = w_{k+(p-1) \times U} \quad k = 1, 2, \dots, U$$

4.5.6 Interleaving for HS-DSCH

The interleaving for FDD is done as shown in figure 18 below, separately for each physical channel. The bits input to the block interleaver are denoted by $u_{p,1}, u_{p,2}, u_{p,3}, \dots, u_{p,U}$, where p is PhCH number and U is the number of bits in one TTI for one PhCH. For QPSK $U = 960$ and for 16QAM $U = 1920$. For QPSK the basic interleaver is the same as Rel99 the 2nd interleaver described in Section 4.2.11. The interleaver is of fixed size: R2=32 rows and C2=30 columns.

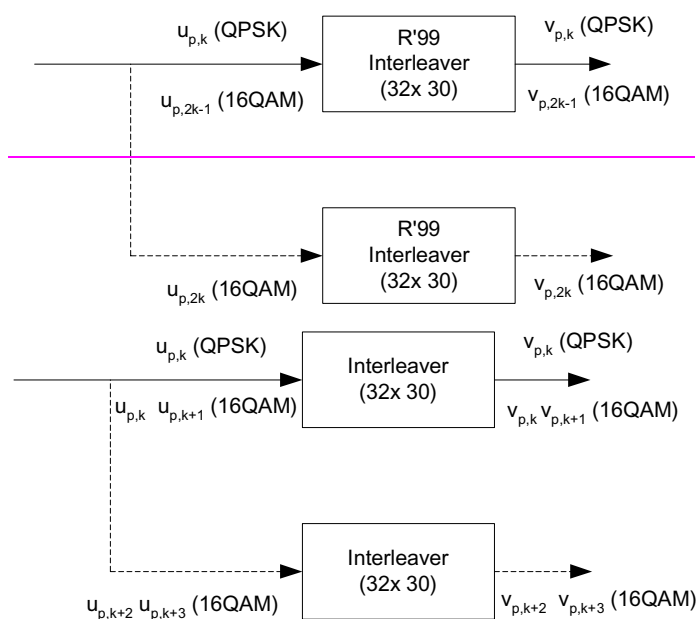


Figure 18: Interleaver structure for HS-DSCH

For 16QAM, there are two identical interleavers of the same fixed size $R2 \times C2 = 32 \times 30$. The output bits from the physical channel segmentation are divided two by two between the interleavers: all odd-numbered bits to interleaver one and all even-numbered bits to interleaver two; 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. Bits are collected two by two 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 $k \bmod 4 = 1$.

4.5.7 Physical channel mapping for HS-DSCH

The HS-PDSCH is defined in [2]. The bits input to the physical channel mapping are denoted by $v_{p1}, v_{p2}, \dots, v_{pU}$, where p is the physical channel number and U is the number of bits in one radio sub-frame 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 .

4.5.7 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 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 $k \bmod 4 = 0$.

Table 11: Constellation re-arrangement for 16 QAM

constellation version parameter b	Output bit sequence	Operation
0	$i_a q_a i_b q_b$ $v_{pk} v_{pk+1} v_{pk+2} v_{pk+3}$	None
1	$i_b q_b i_a q_a$ $v_{pk+2} v_{pk+3} v_{pk} v_{pk+1}$	Swapping MSBs with LSBs i_a with i_b and q_a with q_b
2	$i_a q_a i_b q_b$ $v_{pk} v_{pk+1} v_{pk+2} v_{pk+3}$	XOR with 0011 (equivalent to inversion of the logical values of LSBs i_b and q_b)
3	$i_b q_b i_a q_a$ $v_{pk+2} v_{pk+3} v_{pk} v_{pk+1}$	Swapping MSBs with LSBs i_a with i_b and q_a with q_b and inversion of logical values of LSBs 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 $k \bmod 4 = 0$.

4.5.8 Physical channel mapping for HS-DSCH

The HS-PDSCH is defined in [2]. The bits input to the physical channel mapping are denoted by $r_{p,1}, r_{p,2}, \dots, r_{p,U}$, where p is the physical channel number and U is the number of bits in one radio sub-frame for one HS-PDSCH. The bits $r_{p,k}$ are mapped to the PhCHs so that the bits for each PhCH are transmitted over the air in ascending order with respect to k .

4.6 Coding for HS-SCCH

The following information is transmitted by means of the HS-SCCH physical channel.

- Channelization-code-set information (7 bits): $x_{ccs,1}, x_{ccs,2}, \dots, x_{ccs,7}$
- Modulation scheme information (1 bit): $x_{ms,1}$
- Transport-block size information (6 bits): $x_{tbs,1}, x_{tbs,2}, \dots, x_{tbs,6}$
- Hybrid-ARQ process information (3 bits): $x_{hap,1}, x_{hap,2}, x_{hap,3}$
- Redundancy and constellation version (3 bits): $x_{rv,1}, x_{rv,2}, x_{rv,3}$
- New data indicator (1 bit): $x_{nd,1}$
- UE identity (10 bits): $x_{ue,1}, x_{ue,2}, \dots, x_{ue,10}$

4.6.1 Overview

Figure 19 below illustrates the overall coding chain for HS-SCCH.

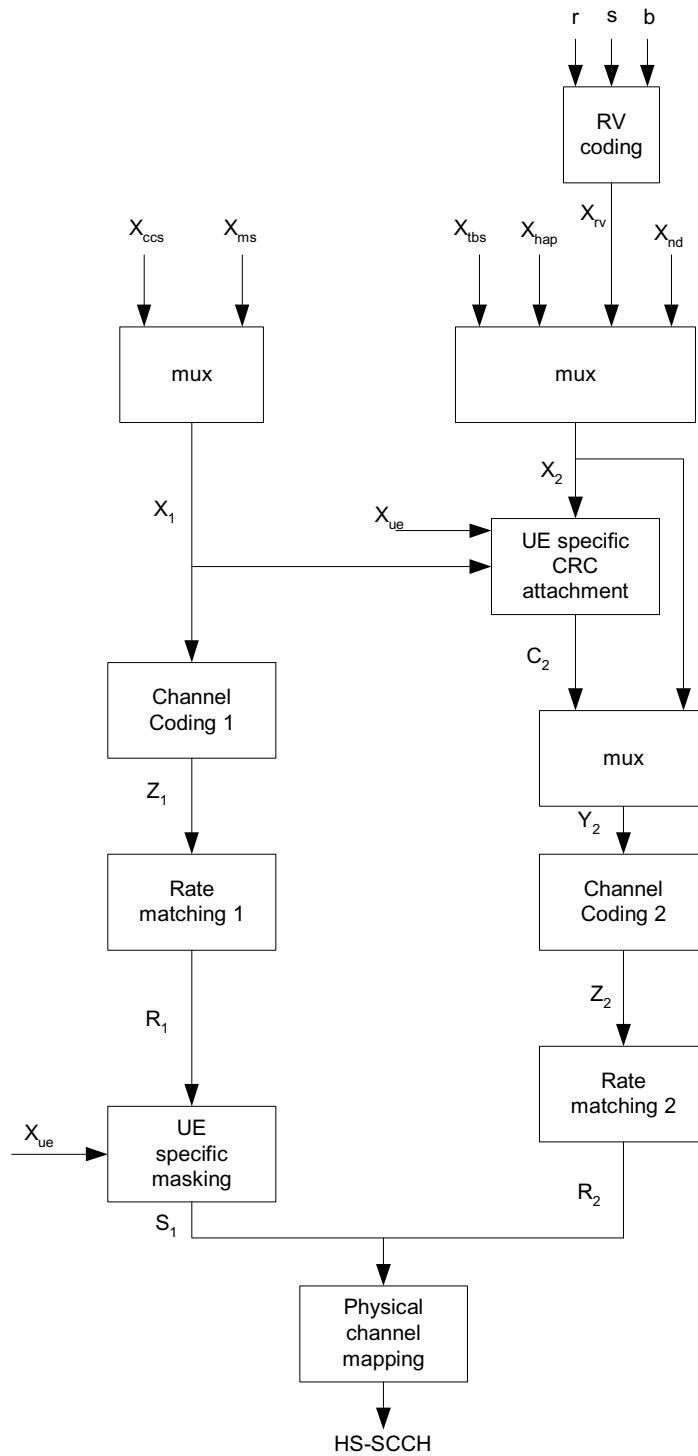


Figure 19: Coding chain for HS-SCCH

4.6.2 HS-SCCH information field mapping

4.6.2.1 Redundancy and constellation version coding

The redundancy version (RV) parameters r , s and constellation version parameter b are coded 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 coding 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 coding 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

4.6.2.2 Modulation scheme mapping

The value of $x_{ms,1}$ is derived from the modulation and given by the following:

$$x_{ms,1} = \begin{cases} 0 & \text{if } QPSK \\ 1 & \text{if } 16QAM \end{cases}$$

4.6.2.3 Channelization code-set mapping

The channelization code-set bits $x_{ccs,1}$, $x_{ccs,2}$, ..., $x_{ccs,7}$ are coded according to coded according to the following:

Given P (multi-)codes starting at code O calculate the information-field using the unsigned binary representation of integers calculated by the expressions,

for the first three bits (code group indicator):

$$x_{ccs,1}, x_{ccs,2}, x_{ccs,3} = \min(P-1, 15-P)$$

for the last four bits (code offset indicator):

$$x_{ccs,4}, x_{ccs,5}, x_{ccs,6}, x_{ccs,7} = \lfloor (O-1) \lfloor P/8 \rfloor * 15 \rfloor$$

The definitions of P and O are given in [3].

4.6.3 Multiplexing of HS-SCCH information

The channelization-code-set information $x_{ccs,1}, x_{ccs,2}, \dots, x_{ccs,7}$ and modulation-scheme information $x_{ms,1}$ are multiplexed together. This gives a sequence of bits $x_{1,1}, x_{1,2}, \dots, x_{1,8}$ where

$$x_{1,i} = x_{ccs,i} \quad i=1,2,\dots,7$$

$$x_{1,i} = x_{ms,i-7} \quad i=8$$

The transport-block-size information $x_{tbs,1}, x_{tbs,2}, \dots, x_{tbs,6}$, Hybrid-ARQ-process information $x_{hap,1}, x_{hap,2}, x_{hap,3}$, redundancy-version information $x_{rv,1}, x_{rv,2}, x_{rv,3}$ and new-data indicator $x_{nd,1}$ are multiplexed together. This gives a sequence of bits $x_{2,1}, x_{2,2}, \dots, x_{2,13}$ where

$$x_{2,i} = x_{tbs,i} \quad i=1,2,\dots,6$$

$$x_{2,i} = x_{hap,i-6} \quad i=7,8,9$$

$$x_{2,i} = x_{rv,i-9} \quad i=10,11,12$$

$$x_{2,i} = x_{nd,i-12} \quad i=13$$

4.6.4 CRC attachment for HS-SCCH

From the sequence of bits $x_{1,1}, x_{1,2}, \dots, x_{1,8}, x_{2,1}, x_{2,2}, \dots, x_{2,13}$ a 16 bits CRC is calculated according to Section 4.2.1.1.

This gives a sequence of bits c_1, c_2, \dots, c_{16} . This sequence of bits is then masked with the UE ID $x_{ue,1}, x_{ue,2}, \dots, x_{ue,16}$ and then appended to the sequence of bits $x_{2,1}, x_{2,2}, \dots, x_{2,13}$. This gives a sequence of bits y_1, y_2, \dots, y_{29} , where

$$y_i = x_{2,i} \quad i=1,2,\dots,13$$

$$y_i = c_{i-13} \oplus x_{ue,i-13} \pmod{2} \quad i=14,15,\dots,29$$

$$y_i = c_{i-13} \quad i=24,25,\dots,29$$

4.6.5 Channel coding for HS-SCCH

Rate $\frac{1}{2}$ convolutional coding, as described in Section 4.2.3.1, is applied to the sequence of bits $x_{1,1}, x_{1,2}, \dots, x_{1,8}$. This gives a sequence of bits $z_{1,1}, z_{1,2}, \dots, z_{1,32}$.

Rate $\frac{1}{2}$ convolutional coding, as described in Section 4.2.3.1, is applied to the sequence of bits y_1, y_2, \dots, y_{29} . This gives a sequence of bits $z_{2,1}, z_{2,2}, \dots, z_{2,73}$.

Note that the coded sequence lengths result from the termination of K=9 convolutional coding being fully applied.

4.6.6 Rate matching for HS-SCCH

Rate matching for HS-SCCH shall be done with the general method described in 4.2.7.5.

4.6.7 UE specific masking for HS-SCCH

The rate matched bits $r_{1,1}, r_{1,2}, \dots, r_{1,40}$ shall be masked in an UE specific way using the UE ID $x_{ue,1}, x_{ue,2}, \dots, x_{ue,10}$ to produce the bits $s_{1,1}, s_{1,2}, \dots, s_{1,40}$.

Define intermediate code word bits b_i by:

$$b_i = \sum_{n=0}^9 (x_{ue,n} \times M_{i,n}) \pmod{2}$$

where $i = 0, \dots, 31$ and the values of $M_{i,n}$ are taken from table 8.

The mask output bits are denoted by $r_k, k = 1, 2, \dots, 40$ and are calculated as follows:

$$r_k = b_{k-1} \quad \text{for } k = 1, 2, \dots, 40$$

$$r_k = b_{k-33} \quad \text{for } k = 33, 34 \dots 40$$

4.6.8 Physical channel mapping for HS-SCCH

The HS-SCCH sub-frame is described in[2].

The sequence of bits $s_{1,1}, s_{1,2}, \dots, s_{1,40}$ is mapped to the first slot of the HS-SCCH sub frame. The bits $s_{1,k}$ 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 sequence of bits $r_{2,1}, r_{2,2}, \dots, r_{2,80}$ is mapped to the second and third slot of the HS-SCCH sub frame. The bits $r_{2,k}$ are mapped to the PhCHs so that the bits for each PhCH are transmitted over the air in ascending order with respect to k .

Note that compressed mode is used for the HS-SCCH.

4.7 Coding for HS-DPCCH

Data arrives to the coding unit in form of indicators for measurement indication and HARQ acknowledgement.

The following coding/multiplexing steps can be identified:

- channel coding (see subclause 4.7.1);
- mapping to physical channels (see subclause 4.7.2).

The general coding flow is shown in the figure below. This is done in parallel for the HARQ-ACK and CQI as the flows are not directly multiplexed but are transmitted at different times.

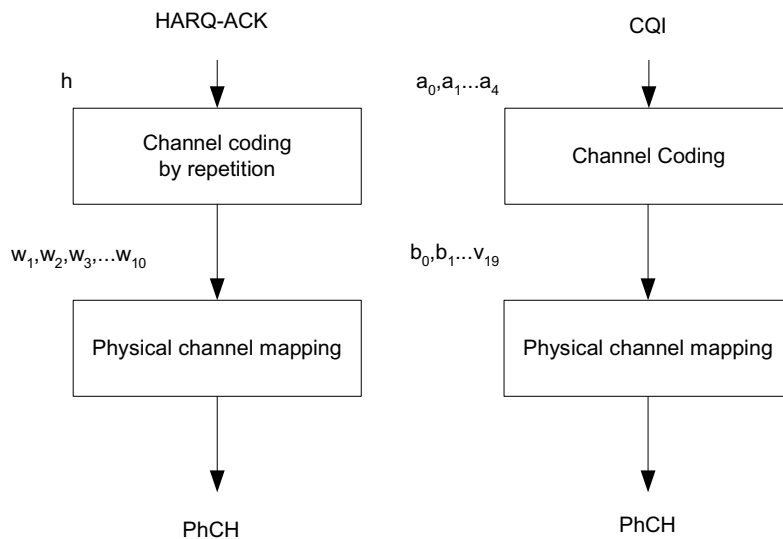


Figure 20: Coding for HS-DPCCH

4.7.1 Channel coding for HS-DPCCH

Two forms of channel coding are used, one for the channel quality information (CQI) and another for HARQ-ACK (acknowledgement).

4.7.1.1 Channel coding for HS-DPCCH HARQ-ACK

The 1 bit HARQ acknowledgement shall be repetition coded to 10 bits. The output is denoted w_1, w_2, \dots, w_{10} .

4.7.1.2 Channel coding for HS-DPCCH channel quality information

The channel quality information is coded using a (20,5) code. The code words of the (20,5) code are a linear combination of the 5 basis sequences denoted $M_{i,n}$ defined in the table below.

Table 14: Basis sequences for (20,5) code

i	$M_{i,0}$	$M_{i,1}$	$M_{i,2}$	$M_{i,3}$	$M_{i,4}$
0	1	0	0	0	1
1	0	1	0	0	1
2	1	1	0	0	1
3	0	0	1	0	1
4	1	0	1	0	1
5	0	1	1	0	1
6	1	1	1	0	1
7	0	0	0	1	1
8	1	0	0	1	1
9	0	1	0	1	1
10	1	1	0	1	1
11	0	0	1	1	1
12	1	0	1	1	1
13	0	1	1	1	1
14	1	1	1	1	1
15	0	0	0	0	1
16	0	0	0	0	1
17	0	0	0	0	1
18	0	0	0	0	1
19	0	0	0	1	0

The channel quality information bits are a_0, a_1, a_2, a_3, a_4 (where a_0 is LSB and a_4 is MSB). The output code word bits b_i are given by:

$$b_i = \sum_{n=0}^4 (a_n \times M_{i,n}) \bmod 2$$

where $i = 0, \dots, 19$.

4.7.2 Physical channel mapping for HS-DPCCH

The HS-DPCCH physical channel mapping function shall map the input bits w_k directly to physical channel bits in increasing order of k .

The HS-DPCCH physical channel mapping function shall map the input bits b_k directly to physical channel bits in increasing order of k .

CHANGE REQUEST

z **25.212 CR 131** z rev **2** z Current version: **5.0.0** z

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Proposed change affects: z (U)SIM ME/UE Radio Access Network 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	Release: z REL-5
		Use <u>one</u> of the following categories:	Use <u>one</u> of the following releases:
		F (correction)	2 (GSM Phase 2)
		A (corresponds to a correction in an earlier release)	R96 (Release 1996)
		B (addition of feature),	R97 (Release 1997)
		C (functional modification of feature)	R98 (Release 1998)
		D (editorial modification)	R99 (Release 1999)
		Detailed explanations of the above categories can be found in 3GPP TR 21.900 .	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	<ul style="list-style-type: none"> - 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 $0 \dots r_{max} - 1$ 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.
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Clauses affected:	z	4.5.4, 4.5.4.3, 4.5.4.4
Other specs affected:	z	<input type="checkbox"/> Other core specifications <input type="checkbox"/> Test specifications <input type="checkbox"/> O&M Specifications
Other comments:	z	

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- 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.

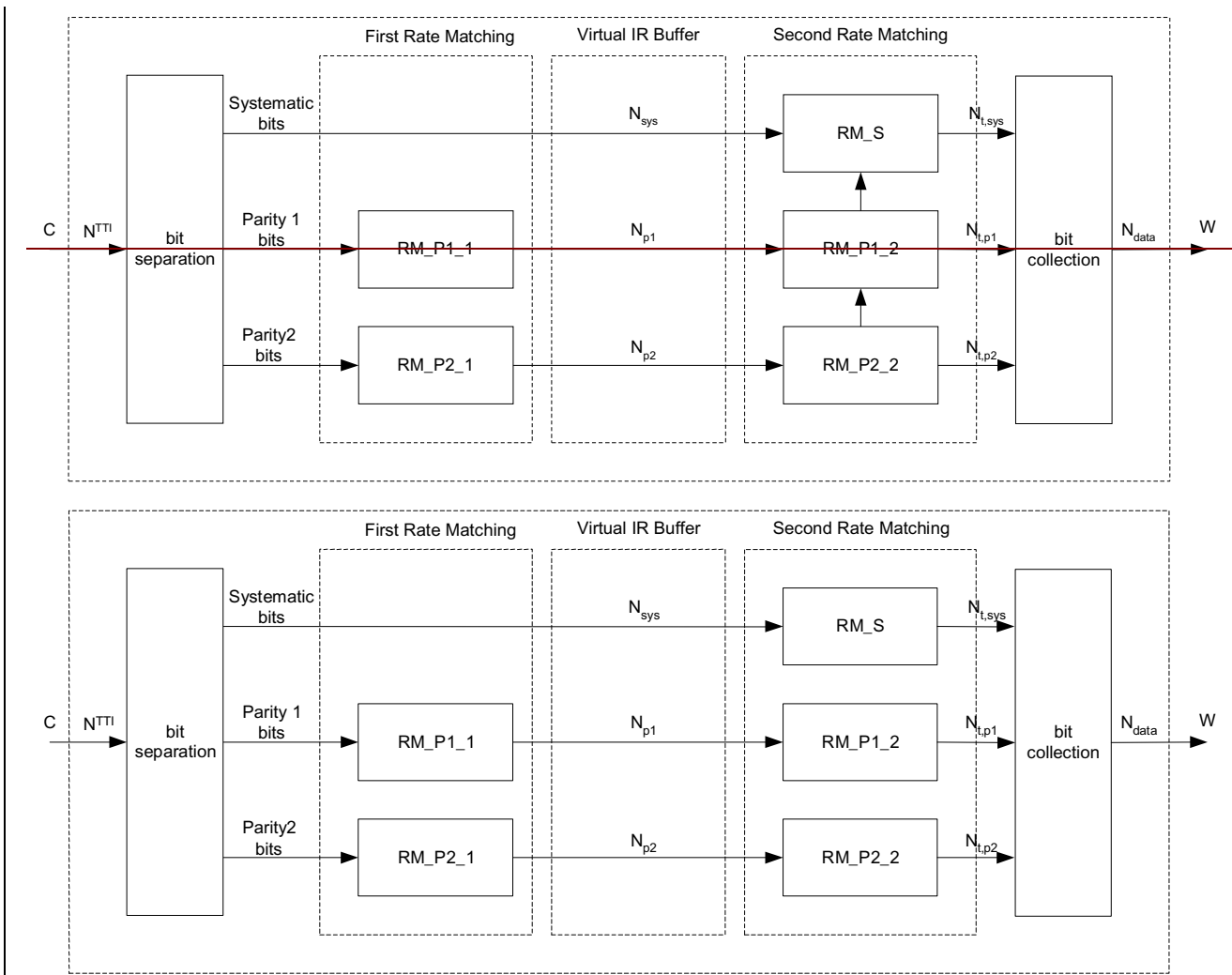


Figure 17: HS-DSCH hybrid ARQ functionality

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 4.2.7.4 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 4.2.7.2.2.3 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 4.2.7.2.3 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 4.2.7.5 above with the following specific parameters. Bits selected for puncturing which appear as δ in the algorithm in 4.2.7.5 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_s , e_{plus} and e_{minus} are calculated as per table 10 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 $N_{data} = P \times 3 \times N_{data1}$, where N_{data1} is defined in [2]. The rate matching parameters are determined as follows.

For $N_{data} \leq N_{sys} + N_{p1} + N_{p2}$, puncturing is performed in the second rate matching stage. The number of transmitted systematic bits in a ~~retransmission~~ is $N_{t,sys} = \min\{N_{sys}, N_{data}\}$ for a transmission that prioritises systematic bits of self-decodable type 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

$$N_{t,sys} = \left\lfloor N_{sys} \frac{N_{data}}{N_{sys} + 2N_{p2}} \right\rfloor \quad N_{t,sys} = \left\lfloor N_{sys} \frac{N_{data}}{N_{sys} + 2N_{p1}} \right\rfloor$$

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

Table 10 below summarizes the resulting parameter choice for the second rate matching stage. The parameter α in the table is chosen using $\alpha = 2$ for parity 1 and $\alpha = 1$ for parity 2.

Table 10: Parameters for HARQ second rate matching

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

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

$$e_{ini}(r) = \left\{ \left[X_i - \left(r \cdot e_{plus} / r_{max} \right) - 1 \right] \bmod e_{plus} \right\} + 1 \quad e_{ini}(r) = \left\{ \left(X_i - \left[r \cdot e_{plus} / r_{max} \right] - 1 \right) \bmod e_{plus} \right\} + 1$$

in the case of puncturing, i.e., $N_{data} \leq N_{sys} + N_{p1} + N_{p2}$, and

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

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

for repetition, i.e., $N_{data} > N_{sys} + N_{p1} + N_{p2}$.

Where $r \in \{0, 1, \dots, r_{max} - 1\}$ and r_{max} is the total number of redundancy versions allowed by varying r as defined in 4.6.2. 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 $(x \bmod y)$ is strictly in the range of 0 to $y-1$ (i.e. $-1 \bmod 10 = 9$).

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:

$$\frac{N_{row} = \log_2(M)}{N_{col} = F / N_{row}} \quad N_{row} = 4 \text{ for 16QAM and } N_{row} = 2 \text{ for QPSK}$$

$$N_{col} = N_{data} / N_{row}$$

where M is the modulation size and $F = N_{data}$ is used as defined in 4.5.4.3, 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:

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

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

Otherwise systematic bits are written into rows $1 \dots N_r + 1$ in the first N_c columns and, if $N_r > 0$, also into rows $1 \dots N_r$ 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.

CR-Form-v5	
CHANGE REQUEST	
z	25.212 CR 132 z rev - z Current version: 5.0.0 z

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

Title:	z Rate Matching and Channel Coding for HS-SCCH		
Source:	z TSG RAN WG1		
Work item code:	z HSDPA-Phys	Date:	z 10 APR 2002
Category:	z F	Release:	z REL-5
	Use <u>one</u> of the following categories:		Use <u>one</u> of the following releases:
	F (correction)		2 (GSM Phase 2)
	A (corresponds to a correction in an earlier release)		R96 (Release 1996)
	B (addition of feature),		R97 (Release 1997)
	C (functional modification of feature)		R98 (Release 1998)
	D (editorial modification)		R99 (Release 1999)
	Detailed explanations of the above categories can be found in 3GPP TR 21.900 .		REL-4 (Release 4)
			REL-5 (Release 5)

Reason for change:	z The details of the Rate Matching for HS-SCCH are missing.
Summary of change:	z The Rate Matching is described by the specific puncturing pattern. The code rate of the convolutional coder is changed to 1/3.
Consequences if not approved:	z The Rate Matching for the HS-SCCH would not work.

Clauses affected:	z 4.6.5, 4.6.6
Other specs affected:	z <input type="checkbox"/> Other core specifications z <input type="checkbox"/> Test specifications z <input type="checkbox"/> O&M Specifications
Other comments:	z Isolated impact: Only the Rate Matching and Coding for the HS-SCCH is impacted by this change. No other parts of the specification are affected.

How to create CRs using this form:

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- 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 for HS-SCCH

The following information is transmitted by means of the HS-SCCH physical channel.

- Channelization-code-set information (7 bits): $x_{ccs,1}, x_{ccs,2}, \dots, x_{ccs,7}$
- Modulation scheme information (1 bit): $x_{ms,1}$
- Transport-block size information (6 bits): $x_{tbs,1}, x_{tbs,2}, \dots, x_{tbs,6}$
- Hybrid-ARQ process information (3 bits): $x_{hap,1}, x_{hap,2}, x_{hap,3}$
- Redundancy and constellation version: r, s, b
- New data indicator (1 bit): $x_{nd,1}$
- UE identity (10 bits): $x_{ue,1}, x_{ue,2}, \dots, x_{ue,10}$

4.6.1 Overview

Figure 19 below illustrates the overall coding chain for HS-SCCH.

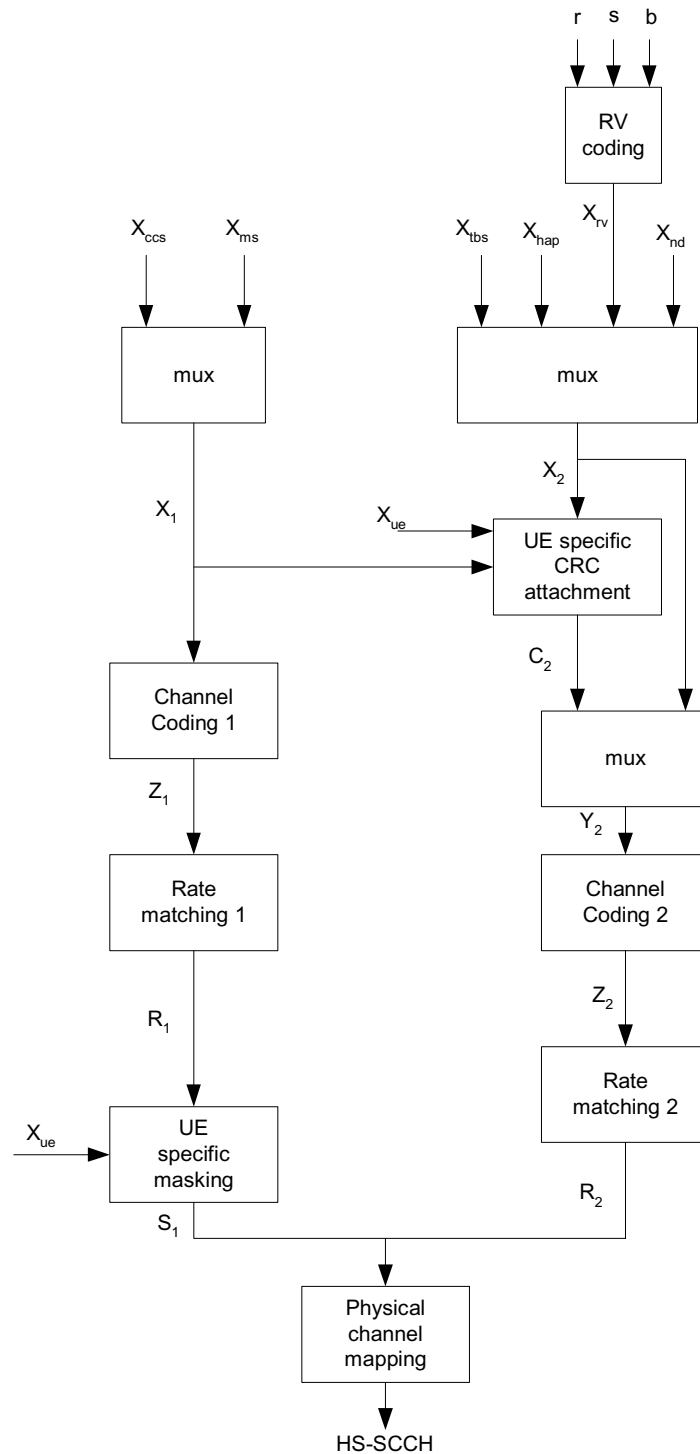


Figure 19: Coding chain for HS-SCCH

4.6.2 Redundancy and constellation version coding

The redundancy version (RV) parameters r , s and constellation version parameter b are coded 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 coding 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 coding 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

4.6.3 Multiplexing of HS-SCCH information

The channelization-code-set information $x_{ccs,1}, x_{ccs,2}, \dots, x_{ccs,7}$ and modulation-scheme information $x_{m,1}$ are multiplexed together. This gives a sequence of bits $x_{1,1}, x_{1,2}, \dots, x_{1,8}$ where

$$x_{1,i} = x_{ccs,i} \quad i=1,2,\dots,7$$

$$x_{1,i} = x_{ms,i-7} \quad i=8$$

The transport-block-size information $x_{tbs,1}, x_{tbs,2}, \dots, x_{tbs,6}$, Hybrid-ARQ-process information $x_{hap,1}, x_{hap,2}, x_{hap,3}$, redundancy-version information $x_{rv,1}, x_{rv,2}, x_{rv,3}$ and new-data indicator $x_{nd,1}$ are multiplexed together. This gives a sequence of bits $x_{2,1}, x_{2,2}, \dots, x_{2,13}$ where

$$x_{2,i} = x_{tbs,i} \quad i=1,2,\dots,6$$

$$x_{2,i} = x_{hap,i-6} \quad i=7,8,9$$

$$x_{2,i} = x_{rv,i-9} \quad i=10,11,12$$

$$x_{2,i} = x_{nd,i-12} \quad i=13$$

4.6.4 CRC attachment for HS-SCCH

From the sequence of bits $x_{1,1}, x_{1,2}, \dots, x_{1,8}, x_{2,1}, x_{2,2}, \dots, x_{2,13}$ a 16 bits CRC is calculated according to Section 4.2.1.1. This gives a sequence of bits c_1, c_2, \dots, c_{16} . This sequence of bits is then masked with the UE ID $x_{ue,1}, x_{ue,2}, \dots, x_{ue,10}$ and then appended to the sequence of bits $x_{2,1}, x_{2,2}, \dots, x_{2,13}$. This gives a sequence of bits y_1, y_2, \dots, y_{29} , where

$$y_i = x_{2,i} \quad i=1,2,\dots,13$$

$$y_i = c_{i-13} \wedge x_{ue,i-13} \quad i=14,15,\dots,23$$

$$y_i = c_{i-13} \quad i=24,25,\dots,29$$

4.6.5 Channel coding for HS-SCCH

Rate $\frac{1}{2}$ convolutional coding, as described in Section 4.2.3.1, is applied to the sequence of bits $x_{1,1}, x_{1,2}, \dots, x_{1,8}$. This gives a sequence of bits $z_{1,1}, z_{1,2}, \dots, z_{1,48}$.

Rate ~~$\frac{1}{2}$~~ $\frac{1}{3}$ convolutional coding, as described in Section 4.2.3.1, is applied to the sequence of bits y_1, y_2, \dots, y_{29} . This gives a sequence of bits $z_{2,1}, z_{2,2}, \dots, z_{2,111}$.

4.6.6 Rate matching for HS-SCCH

~~Rate matching for HS-SCCH shall be done with the general method described in 4.2.7.5. From the input sequence $z_{1,1}, z_{1,2}, \dots, z_{1,48}$ the bits $z_{1,1}, z_{1,2}, z_{1,4}, z_{1,8}, z_{1,12}, z_{1,16}, z_{1,20}, z_{1,24}, z_{1,28}, z_{1,32}, z_{1,36}, z_{1,40}, z_{1,44}, z_{1,48}$ are punctured to obtain the output sequence $r_{1,1}, r_{1,2}, \dots, r_{1,40}$.~~

~~From the input sequence $z_{2,1}, z_{2,2}, \dots, z_{2,111}$ the bits $z_{2,1}, z_{2,2}, z_{2,3}, z_{2,4}, z_{2,5}, z_{2,6}, z_{2,7}, z_{2,8}, z_{2,12}, z_{2,14}, z_{2,15}, z_{2,24}, z_{2,42}, z_{2,48}, z_{2,54}, z_{2,57}, z_{2,60}, z_{2,66}, z_{2,69}, z_{2,96}, z_{2,99}, z_{2,101}, z_{2,102}, z_{2,104}, z_{2,105}, z_{2,106}, z_{2,107}, z_{2,108}, z_{2,109}, z_{2,110}, z_{2,111}$ are punctured to obtain the output sequence $r_{2,1}, r_{2,2}, \dots, r_{2,80}$.~~

4.6.7 UE specific masking for HS-SCCH

The rate matched bits $r_{1,1}, r_{1,2}, \dots, r_{1,40}$ shall be masked in an UE specific way using the UE ID $x_{ue,1}, x_{ue,2}, \dots, x_{ue,10}$ to produce the bits $s_{1,1}, s_{1,2}, \dots, s_{1,40}$.

Define intermediate code word bits b_i by:

$$b_i = \sum_{n=0}^9 (x_{ue,n} \times M_{i,n}) \bmod 2$$

where $i = 0, \dots, 31$ and the values of $M_{i,n}$ are taken from table 8.

The mask output bits are denoted by $r_k, k = 1, 2, \dots, 40$ and are calculated as follows:

$$r_k = b_{k-1} \quad \text{for } k = 1, 2, \dots, 32$$

$$r_k = b_{k-33} \quad \text{for } k = 33, 34, \dots, 40$$

4.6.8 Physical channel mapping for HS-SCCH

The HS-SCCH sub-frame is described in [2].

The sequence of bits $s_{1,1}, s_{1,2}, \dots, s_{1,40}$ is mapped to the first slot of the HS-SCCH sub frame. The bits $s_{1,k}$ 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 sequence of bits $r_{2,1}, r_{2,2}, \dots, r_{2,80}$ is mapped to the second and third slot of the HS-SCCH sub frame. The bits $r_{2,k}$ are mapped to the PhCHs so that the bits for each PhCH are transmitted over the air in ascending order with respect to k .

Note that compressed mode is used for the HS-SCCH.

CR-Form-v5.1	
CHANGE REQUEST	
z	25.212 CR 137 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 Radio Access Network Core Network

Title:	z	Basis sequences for HS-DPCCH Channel Quality information code		
Source:	z	TSG RAN WG1		
Work item code:	z	HSDPA-Phys Date: z Apr 9th, 2002		
Category:	z	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> F Use <u>one</u> 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. </td> <td style="width: 50%; vertical-align: top;"> Release: z REL-5 Use <u>one</u> 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) </td> </tr> </table>	F Use <u>one</u> 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 <u>one</u> 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)
F Use <u>one</u> 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 <u>one</u> 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	Channel code for HS-DPCCH CQI is designed as (20,5) code with basis sequences that provide much protection on MSB of channel quality information. However, there exist basis sequences that show the better MSB protection capability so as to increase the HSDPA system throughput.
Summary of change:	z	In the last line of the table 14, two componets of basis sequences for (20,5) code are modified from 0 to 1 and 1 to 0.
Consequences if not approved:	z	This will clearly loose the opportunity to further increase the system throughput.

Clauses affected:	z	4.7.1.2						
Other specs affected:	z	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;"><input type="checkbox"/> Other core specifications</td> <td style="width: 50%;">z</td> </tr> <tr> <td><input type="checkbox"/> Test specifications</td> <td></td> </tr> <tr> <td><input type="checkbox"/> O&M Specifications</td> <td></td> </tr> </table>	<input type="checkbox"/> Other core specifications	z	<input type="checkbox"/> Test specifications		<input type="checkbox"/> O&M Specifications	
<input type="checkbox"/> Other core specifications	z							
<input type="checkbox"/> Test specifications								
<input type="checkbox"/> O&M Specifications								
Other comments:	z							

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- 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.

4.7.1.2 Channel coding for HS-DPCCH channel quality information

The channel quality information is coded using a (20,5) code. The code words of the (20,5) code are a linear combination of the 5 basis sequences denoted $M_{i,n}$ defined in the table below.

Table 14: Basis sequences for (20,5) code

i	$M_{i,0}$	$M_{i,1}$	$M_{i,2}$	$M_{i,3}$	$M_{i,4}$
0	1	0	0	0	1
1	0	1	0	0	1
2	1	1	0	0	1
3	0	0	1	0	1
4	1	0	1	0	1
5	0	1	1	0	1
6	1	1	1	0	1
7	0	0	0	1	1
8	1	0	0	1	1
9	0	1	0	1	1
10	1	1	0	1	1
11	0	0	1	1	1
12	1	0	1	1	1
13	0	1	1	1	1
14	1	1	1	1	1
15	0	0	0	0	1
16	0	0	0	0	1
17	0	0	0	0	1
18	0	0	0	0	1
19	0	0	0	1 0	0 1

The channel quality information bits are a_0, a_1, a_2, a_3, a_4 (where a_0 is LSB and a_4 is MSB). The output code word bits b_i are given by:

$$b_i = \sum_{n=0}^4 (a_n \times M_{i,n}) \bmod 2$$

where $i = 0, \dots, 19$.

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

R1-02-0859

CR-Form-v5

CHANGE REQUEST

z **25.212 CR 145** z rev **5** z Current version: **5.0.0** z

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

Title:	z	UE specific masking for HS-SCCH part1
Source:	z	TSG RAN WG1
Work item code:	z	HSDPA-Phys
		Date: z 5/16/2002
Category:	z	F
		Release: z REL-5
		Use <u>one</u> of the following categories:
		Use <u>one</u> of the following releases:
		F (correction) 2 (GSM Phase 2)
		A (corresponds to a correction in an earlier release) R96 (Release 1996)
		B (addition of feature), R97 (Release 1997)
		C (functional modification of feature) R98 (Release 1998)
		D (editorial modification) R99 (Release 1999)
		Detailed explanations of the above categories can be found in 3GPP TR 21.900 .
		REL-4 (Release 4)
		REL-5 (Release 5)

Reason for change:	z	The UE-ID has changed from 10 bits to 16 bits. A new mask generation scheme for HS-SCCH part 1 is required.
Summary of change:	z	HS-SCCH part 1 mask generation is changed. The reference to UE ID from higher layers was added. The 25.331 was added to the reference list.
Consequences if not approved:	z	Incomplete solution for the HS-SCCH

Clauses affected:	z	2, 4.6, 4.6.4, 4.6.7
Other specs affected:	z	<input type="checkbox"/> Other core specifications z <input type="checkbox"/> Test specifications z <input type="checkbox"/> O&M Specifications z
Other comments:	z	-

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

- [1] 3GPP TS 25.201: "Physical layer – General Description".
- [2] 3GPP TS 25.211: "Physical channels and mapping of transport channels onto physical channels (FDD)".
- [3] 3GPP TS 25.213: "Spreading and modulation (FDD)".
- [4] 3GPP TS 25.214: "Physical layer procedures (FDD)".
- [5] 3GPP TS 25.215: "Physical layer – Measurements (FDD)".
- [6] 3GPP TS 25.221: "Physical channels and mapping of transport channels onto physical channels (TDD)".
- [7] 3GPP TS 25.222: "Multiplexing and channel coding (TDD)".
- [8] 3GPP TS 25.223: "Spreading and modulation (TDD)".
- [9] 3GPP TS 25.224: "Physical layer procedures (TDD)".
- [10] 3GPP TS 25.225: "Physical layer – Measurements (TDD)".
- [11] 3GPP TS 25.302: "Services Provided by the Physical Layer".
- [12] 3GPP TS 25.402: "Synchronisation in UTRAN, Stage 2".
- [13] [3GPP TS 25.331: "Radio Resource Control \(RRC\); Protocol Specification".](#)

4.6 Coding for HS-SCCH

The following information is transmitted by means of the HS-SCCH physical channel.

- Channelization-code-set information (7 bits): $x_{ccs,1}, x_{ccs,2}, \dots, x_{ccs,7}$
- Modulation scheme information (1 bit): $x_{ms,1}$
- Transport-block size information (6 bits): $x_{tbs,1}, x_{tbs,2}, \dots, x_{tbs,6}$
- Hybrid-ARQ process information (3 bits): $x_{hap,1}, x_{hap,2}, x_{hap,3}$
- Redundancy and constellation version: r, s, b
- New data indicator (1 bit): $x_{nd,1}$
- UE identity (~~10~~16bits): $x_{ue,1}, x_{ue,2}, \dots, x_{ue,~~10~~16}$

4.6.1 Overview

Figure 19 below illustrates the overall coding chain for HS-SCCH.

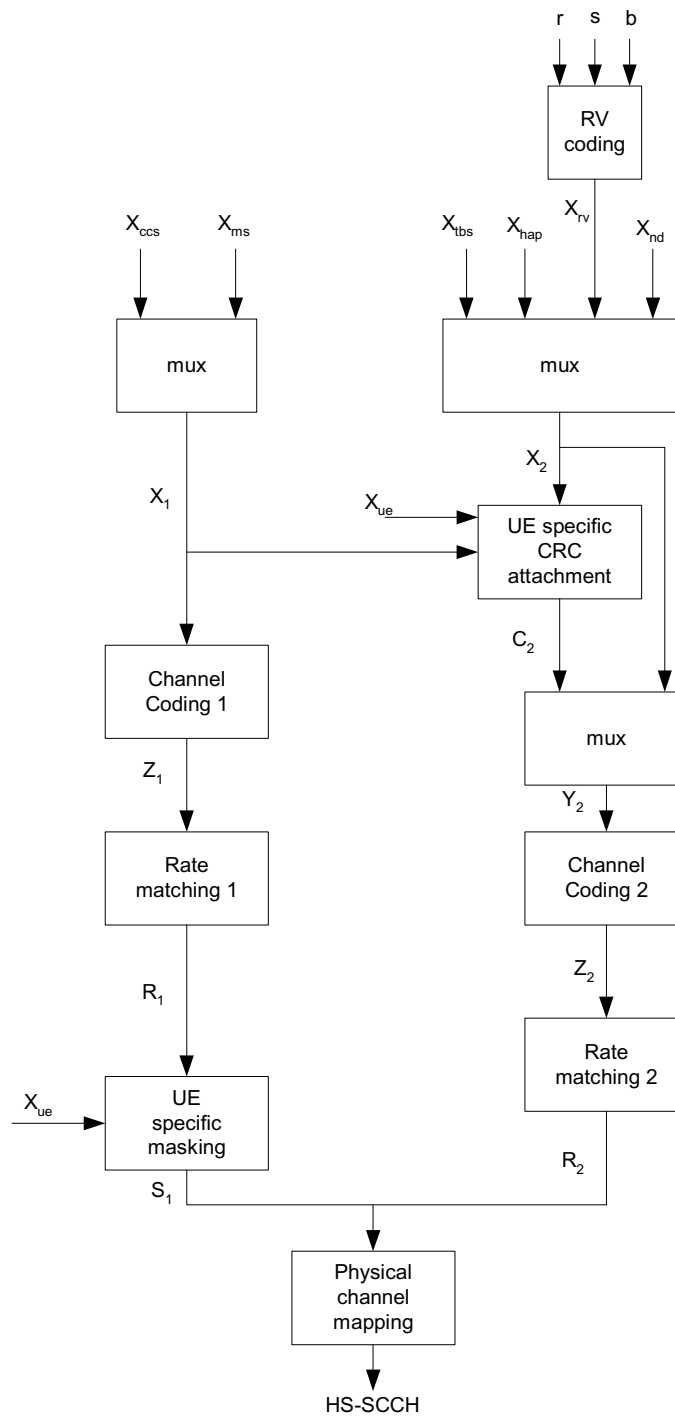


Figure 19: Coding chain for HS-SCCH

4.6.2 Redundancy and constellation version coding

The redundancy version (RV) parameters r , s and constellation version parameter b are coded 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 coding 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 coding 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

4.6.3 Multiplexing of HS-SCCH information

The channelization-code-set information $x_{ccs,1}, x_{ccs,2}, \dots, x_{ccs,7}$ and modulation-scheme information $x_{m,1}$ are multiplexed together. This gives a sequence of bits $x_{1,1}, x_{1,2}, \dots, x_{1,8}$ where

$$x_{1,i} = x_{ccs,i} \quad i=1,2,\dots,7$$

$$x_{1,i} = x_{ms,i-7} \quad i=8$$

The transport-block-size information $x_{tbs,1}, x_{tbs,2}, \dots, x_{tbs,6}$, Hybrid-ARQ-process information $x_{hap,1}, x_{hap,2}, x_{hap,3}$, redundancy-version information $x_{rv,1}, x_{rv,2}, x_{rv,3}$ and new-data indicator $x_{nd,1}$ are multiplexed together. This gives a sequence of bits $x_{2,1}, x_{2,2}, \dots, x_{2,13}$ where

$$x_{2,i} = x_{tbs,i} \quad i=1,2,\dots,6$$

$$x_{2,i} = x_{hap,i-6} \quad i=7,8,9$$

$$x_{2,i} = x_{rv,i-9} \quad i=10,11,12$$

$$x_{2,i} = x_{nd,i-12} \quad i=13$$

4.6.4 CRC attachment for HS-SCCH

From the sequence of bits $x_{1,1}, x_{1,2}, \dots, x_{1,8}, x_{2,1}, x_{2,2}, \dots, x_{2,13}$ a 16 bits CRC is calculated according to Section 4.2.1.1. This gives a sequence of bits c_1, c_2, \dots, c_{16} . This sequence of bits is then masked with the UE ID $x_{ue,1}, x_{ue,2}, \dots, x_{ue,10}$, where $x_{ue,1}$ is the MSB and $x_{ue,16}$ is the LSB of the UE ID, and then appended to the sequence of bits $x_{2,1}, x_{2,2}, \dots, x_{2,13}$. The UE ID corresponds to the HS-DSCH Radio Network Identifier (H-RNTI) as defined in [13], expressed in unsigned binary form. This-The mask CRC bits correspond to the give a sequence of bits y_1, y_2, \dots, y_{29} , where

$$y_i = x_{2,i} \quad i=1,2,\dots,13$$

$$y_i = c_{i-13} \wedge x_{ue,i-13} \quad i=14,15,\dots,23$$

$$y_i = c_{i-13} \quad i=24,25,\dots,29$$

4.6.5 Channel coding for HS-SCCH

Rate $\frac{1}{2}$ convolutional coding, as described in Section 4.2.3.1, is applied to the sequence of bits $x_{1,1}, x_{1,2}, \dots, x_{1,8}$. This gives a sequence of bits $z_{1,1}, z_{1,2}, \dots, z_{1,32}$.

Rate $\frac{1}{2}$ convolutional coding, as described in Section 4.2.3.1, is applied to the sequence of bits y_1, y_2, \dots, y_{29} . This gives a sequence of bits $z_{2,1}, z_{2,2}, \dots, z_{2,73}$.

4.6.6 Rate matching for HS-SCCH

Rate matching for HS-SCCH shall be done with the general method described in 4.2.7.5.

4.6.7 UE specific masking for HS-SCCH

The rate matched bits $r_{1,1}, r_{1,2}, \dots, r_{1,40}$ shall be masked in an UE specific way using the UE ID $x_{ue,1}, x_{ue,2}, \dots, x_{ue,16}$, where $x_{ue,1}$ is the MSB and $x_{ue,16}$ is the LSB of the UE ID, to produce the bits $s_{1,1}, s_{1,2}, \dots, s_{1,40}$. The UE ID corresponds to the HS-DSCH Radio Network Identifier (H-RNTI) as defined in [13], expressed in unsigned binary form.

Define i Intermediate code word bits $b_i, i=1,2,\dots,48$, are defined by: encoding the UE ID bits using the rate $\frac{1}{2}$ convolutional coding described in Section 4.2.3.1. Eight bits out of the resulting 48 convolutionally encoded bits are punctured using rate matching with the general method described in Section 4.2.7.5 where $X_i=48, e_{\text{ini}}=1, e_{\text{plus}}=96$ and $e_{\text{minus}}=16$. That is, from the input sequence b_1, b_2, \dots, b_{48} , the bits $b_1, b_7, b_{13}, b_{19}, b_{25}, b_{31}, b_{37}, b_{43}$ are punctured to obtain the 40 bit UE specific scrambling sequence c_1, c_2, \dots, c_{40} .

$$b_i = \sum_{n=0}^9 (x_{ue,n} \times M_{i,n}) \bmod 2$$

where $i=0, \dots, 31$ and the values of $M_{i,n}$ are taken from table 8.

The mask output bits $s_{1,1}, s_{1,2}, \dots, s_{1,40}$ are denoted by $r_k, k=1, 2, \dots, 40$ and are calculated as follows:

$$r_k = b_{k-1} \quad \text{for } k=1, 2, \dots, 32$$

$$r_k = b_{k-33} \quad \text{for } k=33, 34, \dots, 40$$

$$s_{1,k} = (r_{1,k} + c_k) \bmod 2 \quad \text{for } k=1, 2, \dots, 40$$

CHANGE REQUEST

z **25.213 CR 050** 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 Radio Access Network Core Network

Title:	z	Consistency of Signal Point Constellation for QPSK and 16QAM		
Source:	z	TSG RAN WG1		
Work item code:	z	HSDPA-Phys	Date:	z 4.4.2002
Category:	z	F	Release:	z REL-5
		Use <u>one</u> of the following categories:		Use <u>one</u> of the following releases:
		F (correction)	2	(GSM Phase 2)
		A (corresponds to a correction in an earlier release)	R96	(Release 1996)
		B (addition of feature),	R97	(Release 1997)
		C (functional modification of feature)	R98	(Release 1998)
		D (editorial modification)	R99	(Release 1999)
		Detailed explanations of the above categories can be found in 3GPP TR 21.900 .		REL-4 (Release 4)
			REL-5	(Release 5)

Reason for change:	z	Avoid mismatches of the physical channel power for different modulation schemes with HSDPA.		
Summary of change:	z	The modulation scheme for 16QAM is scaled by a factor of sqrt(2).		
Consequences if not approved:	z	Assuming some implementation specific constant factor between the internal representation of a transmit symbol and the transmit signal, the existing SPC would lead to different power offsets for the internal representation of the physical channel, depending on the modulation scheme.		

Clauses affected:	z	5.1		
Other specs affected:	z	<input type="checkbox"/> Other core specifications <input type="checkbox"/> Test specifications <input type="checkbox"/> O&M Specifications	z	
Other comments:	z			

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- 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 Downlink spreading and modulation

5.1 Spreading

Figure 8 illustrates the spreading operation for the physical channel except SCH. The behaviour of the modulation mapper is different between QPSK and 16QAM. The physical channel using QPSK are P-CCPCH, S-CCPCH, CPICH, AICH, AP-AICH, CSICH, CD/CA-ICH, PICH, PDSCH, HS-SCCH and downlink DPCH. The SCH consists of a sequence of real-valued symbols. The physical channel using both QPSK and 16 QAM is HS-DSCH. For all channels except the indicator channels using signatures (AICH, AP-AICH and CD/CA-ICH) and HS-PDSCH the symbols can take the three values +1, -1, and 0, where 0 indicates DTX. For the indicator channels using signatures, the symbol values depend on the exact combination of indicators to be transmitted, compare [2] Sections 5.3.3.7, 5.3.3.8 and 5.3.3.9.

For physical channel using QPSK each pair of two consecutive symbols is first serial-to-parallel converted and mapped to an I and Q branch. The behaviour of the modulation mapper is such that even and odd numbered symbols are mapped to the I and Q branch respectively. For all channels using QPSK except the indicator channels using signatures, symbol number zero is defined as the first symbol in each frame. For the indicator channels using signatures, symbol number zero is defined as the first symbol in each access slot. The I and Q branches are then both spread to the chip rate by the same real-valued channelisation code $C_{ch,SF,m}$. The channelisation code sequence shall be aligned in time with the symbol boundary. The sequences of real-valued chips on the I and Q branch are then treated as a single complex-valued sequence of chips. This sequence of chips is scrambled (complex chip-wise multiplication) by a complex-valued scrambling code $S_{dl,n}$. In case of P-CCPCH, the scrambling code is applied aligned with the P-CCPCH frame boundary, i.e. the first complex chip of the spread P-CCPCH frame is multiplied with chip number zero of the scrambling code. In case of other downlink channels, the scrambling code is applied aligned with the scrambling code applied to the P-CCPCH. In this case, the scrambling code is thus not necessarily applied aligned with the frame boundary of the physical channel to be scrambled.

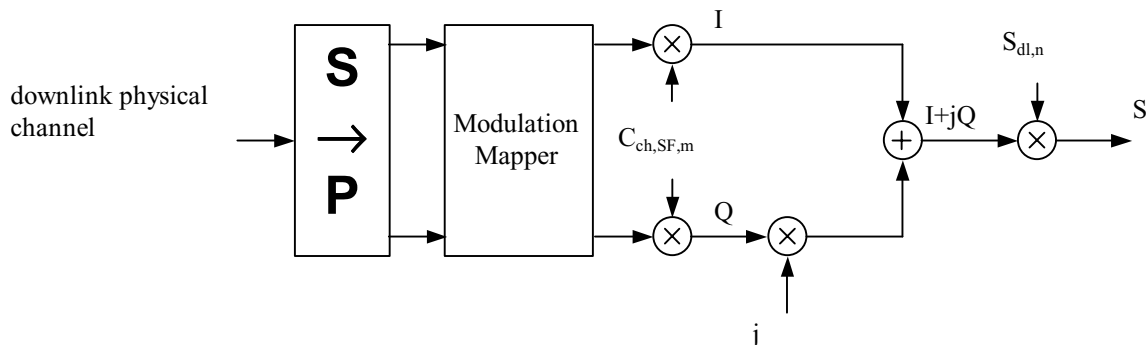


Figure 8: Spreading for all downlink physical channels except SCH

For physical channel using 16QAM, a set of consecutive symbols is serial-to-parallel converted and then mapped to 16QAM by Modulation mapper. The I and Q branches are then both spread to the chip rate by the same real-valued channelisation code $C_{ch,16,m}$. The channelisation code sequence shall be aligned in time with the symbol boundary. The sequences of real-valued chips on the I and Q branch are then treated as a single complex-valued sequence of chips. This sequence of chips from all multi-codes is summed and then scrambled (complex chip-wise multiplication) by a complex-valued scrambling code $S_{dl,n}$. The scrambling code is applied aligned with the scrambling code applied to the P-CCPCH.

The serial to parallel conversion uses four bits which result in index bits allocated to I and Q according to table 4. These index bits are mapped to the modulated constellation symbols as illustrated in figure 9xx.

Table 4: 16 QAM index bits

i	0	1	2	3
b(i)	i_1	q_1	i_2	q_2

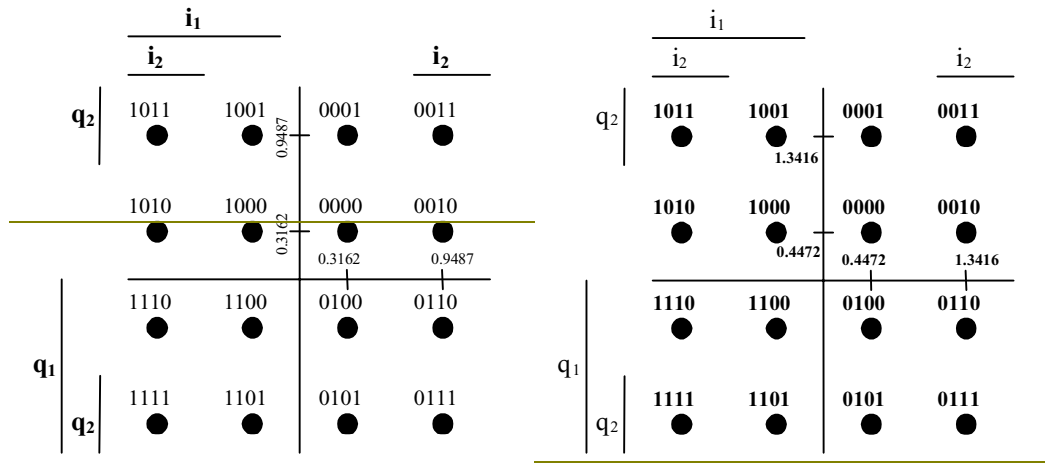


Figure 9: 16 QAM constellation

Figure 10 illustrates how different downlink channels are combined. Each complex-valued spread channel, corresponding to point S in Figure 8, is separately weighted by a weight factor G_i . The complex-valued P-SCH and S-SCH, as described in [2], section 5.3.3.4, are separately weighted by weight factors G_p and G_s . All downlink physical channels are then combined using complex addition.

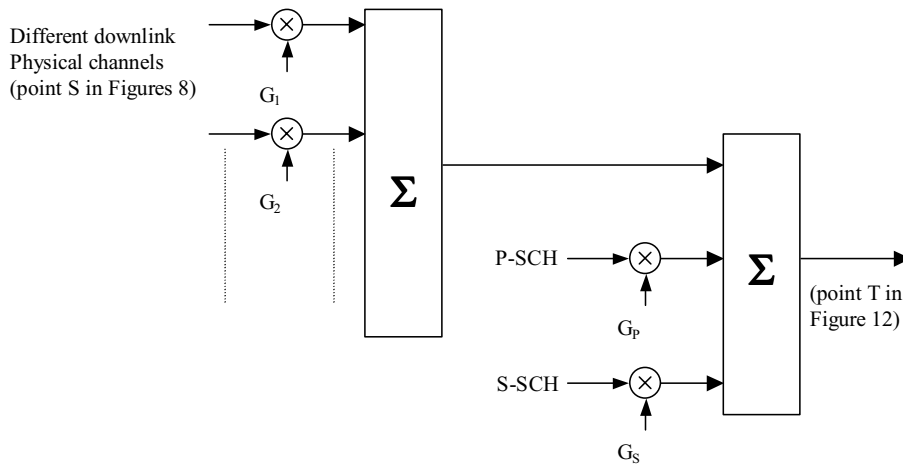


Figure 10: Spreading and modulation for SCH and P-CCPCH

CHANGE REQUEST

z **25.213 CR 054** 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 Radio Access Network Core Network

Title:	z	Clarification of uplink DTX handling and modulation		
Source:	z	TSG RAN WG1		
Work item code:	z	HSDPA-Phys	Date:	z 2002-04-08
Category:	z	F	Release:	z REL-5
		Use <u>one</u> of the following categories:		Use <u>one</u> of the following releases:
		F (correction)	2	(GSM Phase 2)
		A (corresponds to a correction in an earlier release)	R96	(Release 1996)
		B (addition of feature),	R97	(Release 1997)
		C (functional modification of feature)	R98	(Release 1998)
		D (editorial modification)	R99	(Release 1999)
		Detailed explanations of the above categories can be found in 3GPP TR 21.900 .		REL-4 (Release 4)
				REL-5 (Release 5)

Reason for change:	z	In uplink, DTX can occur on the HS-DPCCH. This is currently not covered by the specification. Modulation in downlink is only specified QPSK, although 16QAM may also be used for HS-PDSCH.
Summary of change:	z	Handling of DTX in uplink is included in the uplink spreading section. Modulation in uplink and downlink is described more general.
Consequences if not approved:	z	Unclear DTX handling in uplink. Ambiguous specification for downlink modulation in case of 16QAM.

Clauses affected:	z	4.2.1, 4.2.2, 5.3.2
Other specs affected:	z	<input type="checkbox"/> Other core specifications z <input type="checkbox"/> Test specifications <input type="checkbox"/> O&M Specifications
Other comments:	z	

4 Uplink spreading and modulation

4.1 Overview

Spreading is applied to the physical channels. It consists of two operations. The first is the channelisation operation, which transforms every data symbol into a number of chips, thus increasing the bandwidth of the signal. The number of chips per data symbol is called the Spreading Factor (SF). The second operation is the scrambling operation, where a scrambling code is applied to the spread signal.

With the channelisation, data symbols on so-called I- and Q-branches are independently multiplied with an OVSF code. With the scrambling operation, the resultant signals on the I- and Q-branches are further multiplied by complex-valued scrambling code, where I and Q denote real and imaginary parts, respectively.

4.2 Spreading

4.2.1 DPCCH/DPDCH/HS-DPCCH

Figure 1 illustrates the principle of the uplink spreading of DPCCH, DPDCHs and HS-DPCCH. The binary DPCCH, DPDCHs and HS-DPCCH to be spread are represented by real-valued sequences, i.e. the binary value "0" is mapped to the real value +1, ~~while the binary value "1" is mapped to the real value -1,~~ and the value "DTX" (HS-DPCCH only) is mapped to the real value 0. The DPCCH is spread to the chip rate by the channelisation code c_c . The n :th DPDCH called $DPDCH_n$ is spread to the chip rate by the channelisation code $c_{d,n}$. The HS-DPCCH is spread to the chip rate by the channelisation code C_{HS} . One DPCCH, up to six parallel DPDCHs, and one HS-DPCCH can be transmitted simultaneously, i.e. $1 \leq n \leq 6$.

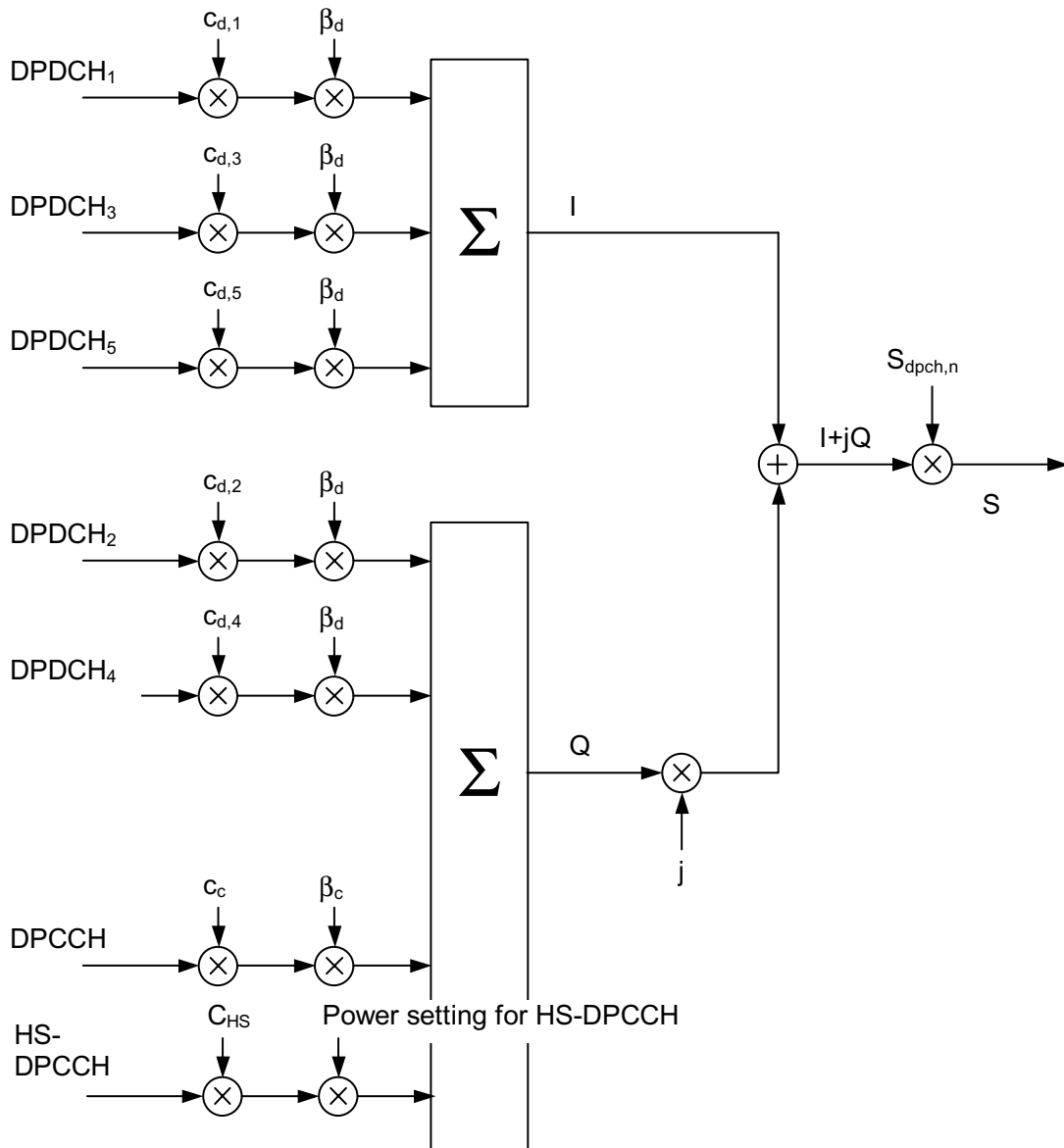


Figure 1: Spreading for uplink DPCCH and DPDCHs

After channelisation, the real-valued spread signals are weighted by gain factors, β_c for DPCCH and β_d for all DPDCHs.

At every instant in time, at least one of the values β_c and β_d has the amplitude 1.0. The β -values are quantized into 4 bit words. The quantization steps are given in table 1.

Table 1: The quantization of the gain parameters

Signalling values for β_c and β_d	Quantized amplitude ratios β_c and β_d
15	1.0
14	14/15
13	13/15
12	12/15
11	11/15
10	10/15
9	9/15
8	8/15
7	7/15
6	6/15
5	5/15
4	4/15
3	3/15
2	2/15
1	1/15
0	Switch off

After the weighting, the stream of real-valued chips on the I- and Q-branches are then summed and treated as a complex-valued stream of chips. This complex-valued signal is then scrambled by the complex-valued scrambling code $S_{dpch,n}$. The scrambling code is applied aligned with the radio frames, i.e. the first scrambling chip corresponds to the beginning of a radio frame. HS-DPCCH is mapped to Q branch.

4.4 Modulation

4.4.1 Modulating chip rate

The modulating chip rate is 3.84 Mcps.

4.4.2 Modulation

In the uplink, Modulation of the complex-valued chip sequence generated by the spreading process is QPSK modulated as shown in Figure 7 below:

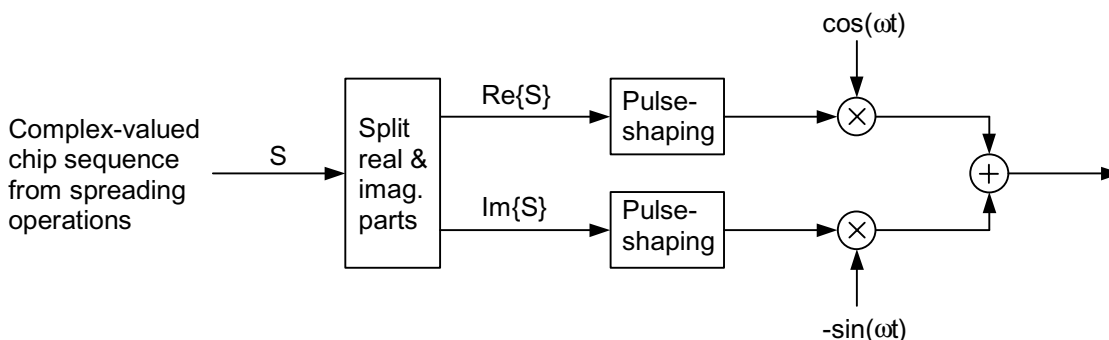


Figure 7: Uplink modulation

The pulse-shaping characteristics are described in [3].

5.3 Modulation

5.3.1 Modulating chip rate

The modulating chip rate is 3.84 Mcps.

5.3.2 Modulation

In the downlink, Modulation of the complex-valued chip sequence generated by the spreading process is QPSK modulated as shown in Figure 12 below.

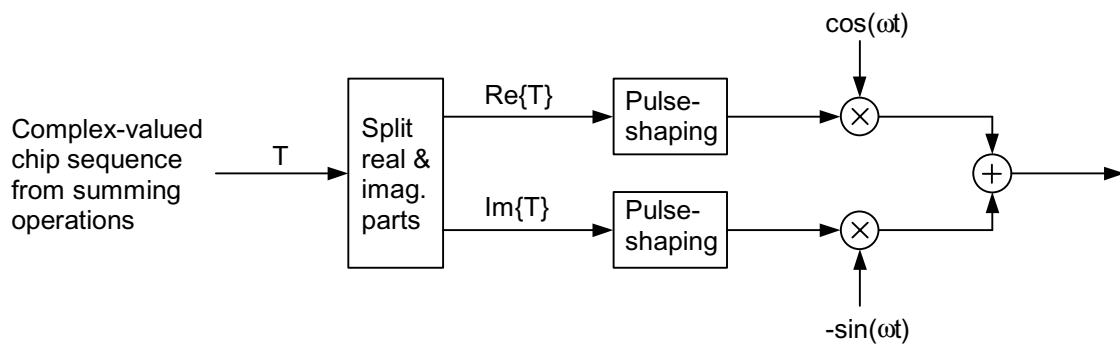


Figure 12: Downlink modulation

The pulse-shaping characteristics are described in [4].

CR-Form-v5	
CHANGE REQUEST	
z 25.213 CR 055	z rev 2 z Current version: 5.0.0 z

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

Title:	z	Removal of code mapping description over HS-SCCH	
Source:	z	TSG RAN WG1	
Work item code:	z	HSDPA-Phys	Date: z 2002-05-14
Category:	z	F	Release: z REL-5
		Use <u>one</u> of the following categories:	Use <u>one</u> of the following releases:
		F (correction)	2 (GSM Phase 2)
		A (corresponds to a correction in an earlier release)	R96 (Release 1996)
		B (addition of feature),	R97 (Release 1997)
		C (functional modification of feature)	R98 (Release 1998)
		D (editorial modification)	R99 (Release 1999)
		Detailed explanations of the above categories can be found in 3GPP TR 21.900 .	REL-4 (Release 4)
			REL-5 (Release 5)

Reason for change:	z	<p>The HS-SCCH information field mapping/encoding is collected in TS25.212 for good readability in 25.212CR130. Therefore, channelization code mapping for HS-DSCH is also moved to TS25.212.</p> <p>In addition, P is generally used in TS25.212 to indicate the number of physical channels within a CCTrCH. So To use P as the number of HS-PDSCHs in the HS-DSCH (i.e. number of codes) have good inconsistency with TS25.212. To use O as the offset is also proposed.</p>
Summary of change:	z	Channelization code mapping for HS-DSCH in 25.213 is removed. The "M" and "P" is also substituted each to "P" and "O".
Consequences if not approved:	z	Channelization code mapping for HS-DSCH is described in both 25.212 and 25.213. This would make confusion.

Clauses affected:	z	5.2.1
Other specs affected:	z	<input type="checkbox"/> Other core specifications <input type="checkbox"/> Test specifications <input type="checkbox"/> O&M Specifications
Other comments:	z	

5.2.1 Channelisation codes

The channelisation codes of figure 8 are the same codes as used in the uplink, namely Orthogonal Variable Spreading Factor (OVSF) codes that preserve the orthogonality between downlink channels of different rates and spreading factors. The OVSF codes are defined in figure 4 in section 4.3.1.

The channelisation code for the Primary CPICH is fixed to $C_{ch,256,0}$ and the channelisation code for the Primary CCPCH is fixed to $C_{ch,256,1}$. The channelisation codes for all other physical channels are assigned by UTRAN.

With the spreading factor 512 a specific restriction is applied. When the code word $C_{ch,512,n}$, with $n=0,2,4,\dots,510$, is used in soft handover, then the code word $C_{ch,512,n+1}$ is not allocated in the cells where timing adjustment is to be used. Respectively if $C_{ch,512,n}$, with $n=1,3,5,\dots,511$ is used, then the code word $C_{ch,512,n-1}$ is not allocated in the cells where timing adjustment is to be used. This restriction shall not apply in cases where timing adjustments in soft handover are not used with spreading factor 512.

When compressed mode is implemented by reducing the spreading factor by 2, the OVSF code used for compressed frames is:

- $C_{ch,SF/2,\lfloor n/2 \rfloor}$ if ordinary scrambling code is used.
- $C_{ch,SF/2,n \bmod SF/2}$ if alternative scrambling code is used (see section 5.2.2);

where $C_{ch,SF,n}$ is the channelisation code used for non-compressed frames.

In case the OVSF code on the PDSCH varies from frame to frame, the OVSF codes shall be allocated in such a way that the OVSF code(s) below the smallest spreading factor will be from the branch of the code tree pointed by the code with smallest spreading factor used for the connection which is called PDSCH root channelisation code. This means that all the codes for this UE for the PDSCH connection can be generated according to the OVSF code generation principle from the PDSCH root channelisation code i.e. the code with smallest spreading factor used by the UE on PDSCH.

In case of mapping the DSCH to multiple parallel PDSCHs, the same rule applies, but all of the branches identified by the multiple codes, corresponding to the smallest spreading factor, may be used for higher spreading factor allocation i.e. the multiple codes with smallest spreading factor can be considered as PDSCH root channelisation codes.

For HS-PDSCH, the spreading factor is always 16.

For HS-SCCH, the spreading factor is always 128.

Channelisation-code-set information over HS-SCCH is mapped in following manner: the OVSF codes shall be allocated in such a way that they are positioned in sequence in the code tree. That is, for PM multicode at offset OP the following codes are allocated:

$$C_{ch,16,OP,16} \dots C_{ch,16,OP+PM-1,16}$$

The number of multicode and the corresponding offset for HS-PDSCHs mapped from a given HS-DSCH is signalled by HS-SCCH on the HS-SCCH, where the following algorithm is used for the encoding using 7 information bits:

$$\text{Three first bits (Code group indicator): } [x_{ees,1}, x_{ees,2}, x_{ees,3}] = \min(M-1, 15-M)$$

$$\text{Four last bits (Code offset indicator): } [x_{ees,4}, x_{ees,5}, x_{ees,6}, x_{ees,7}] = \lfloor P-1 \lfloor M/8 \rfloor * 15 \rfloor$$

where $\lfloor \cdot \rfloor$ denotes rounding to nearest lower integer.

CHANGE REQUEST

z **25.213 CR 056** z rev **3** 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 Radio Access Network Core Network

Title:	z	I/Q mapping of HS-DPCCH	
Source:	z	TSG RAN WG1	
Work item code:	z	HSDPA-Phys	Date: z 15, MAY, 2002
Category:	z	F	Release: z REL-5
		Use <u>one</u> of the following categories:	Use <u>one</u> of the following releases:
		F (correction)	2 (GSM Phase 2)
		A (corresponds to a correction in an earlier release)	R96 (Release 1996)
		B (addition of feature),	R97 (Release 1997)
		C (functional modification of feature)	R98 (Release 1998)
		D (editorial modification)	R99 (Release 1999)
		Detailed explanations of the above categories can be found in 3GPP TR 21.900 .	REL-4 (Release 4)
			REL-5 (Release 5)

Reason for change:	z	I/Q mapping scheme of uplink HS-DPCCH in case of multi-codes is uncertain.
Summary of change:	z	<p>-The I/Q mapping of HS-DPCCH is specified. It depends on the maximum number of DPDCHs over all the TFCs in TFCS</p> <p>- Channelization codes of HS-DPCCH are specified. They depend on the maximum number of DPDCHs over all the TFCs in TFCS</p> <p>- The I/Q mapping of HS-DPCCH is not changed in case frame by frame TFCI change or temporary TFC restriction.</p>
Consequences if not approved:	z	I/Q mapping scheme of uplink HS-DPCCH in case of multi-code is uncertain. Furthermore the current assumption of $C_{ch,256,64}$ makes a collision in case of multi-code .

Clauses affected:	z	4.2.1 4.3.1.2
Other specs affected:	z	<input type="checkbox"/> Other core specifications z <input type="checkbox"/> Test specifications z <input type="checkbox"/> 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

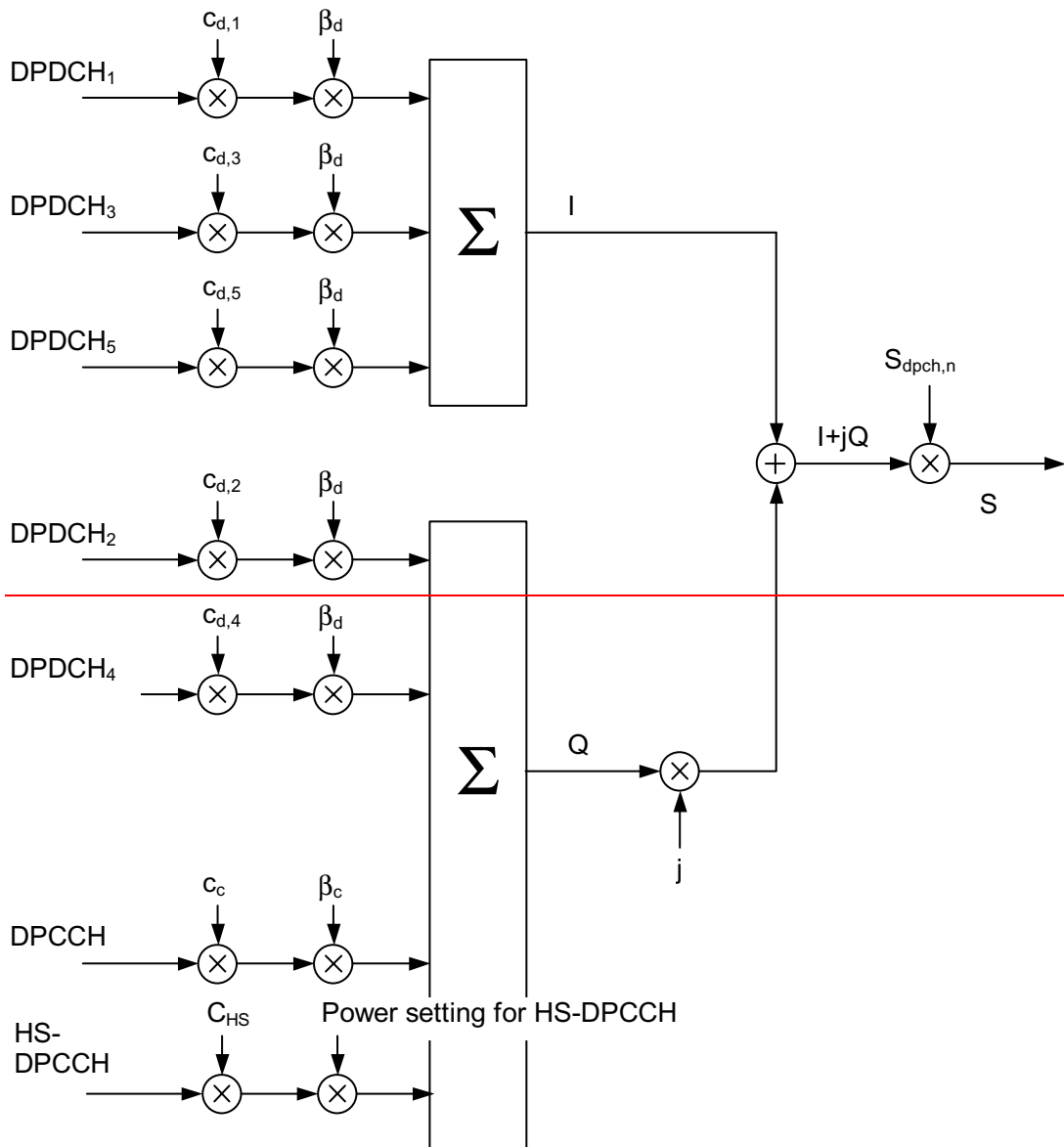
downloaded from the 3GPP server under <ftp://ftp.3gpp.org/specs/> For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

- 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.

4.2 Spreading

4.2.1 DPCCH/DPDCH/HS-DPCCH

Figure 1 illustrates the principle of the uplink spreading of DPCCH, DPDCHs and HS-DPCCH. The binary DPCCH, DPDCHs and HS-DPCCH to be spread are represented by real-valued sequences, i.e. the binary value "0" is mapped to the real value +1, while the binary value "1" is mapped to the real value -1. The DPCCH is spread to the chip rate by the channelisation code c_c . The n :th DPDCH called $DPDCH_n$ is spread to the chip rate by the channelisation code $c_{d,n}$. The HS-DPCCH is spread to the chip rate by the channelisation code C_{HS} . One DPCCH, up to six parallel DPDCHs, and one HS-DPCCH can be transmitted simultaneously, i.e. $1 \leq n \leq 6$.



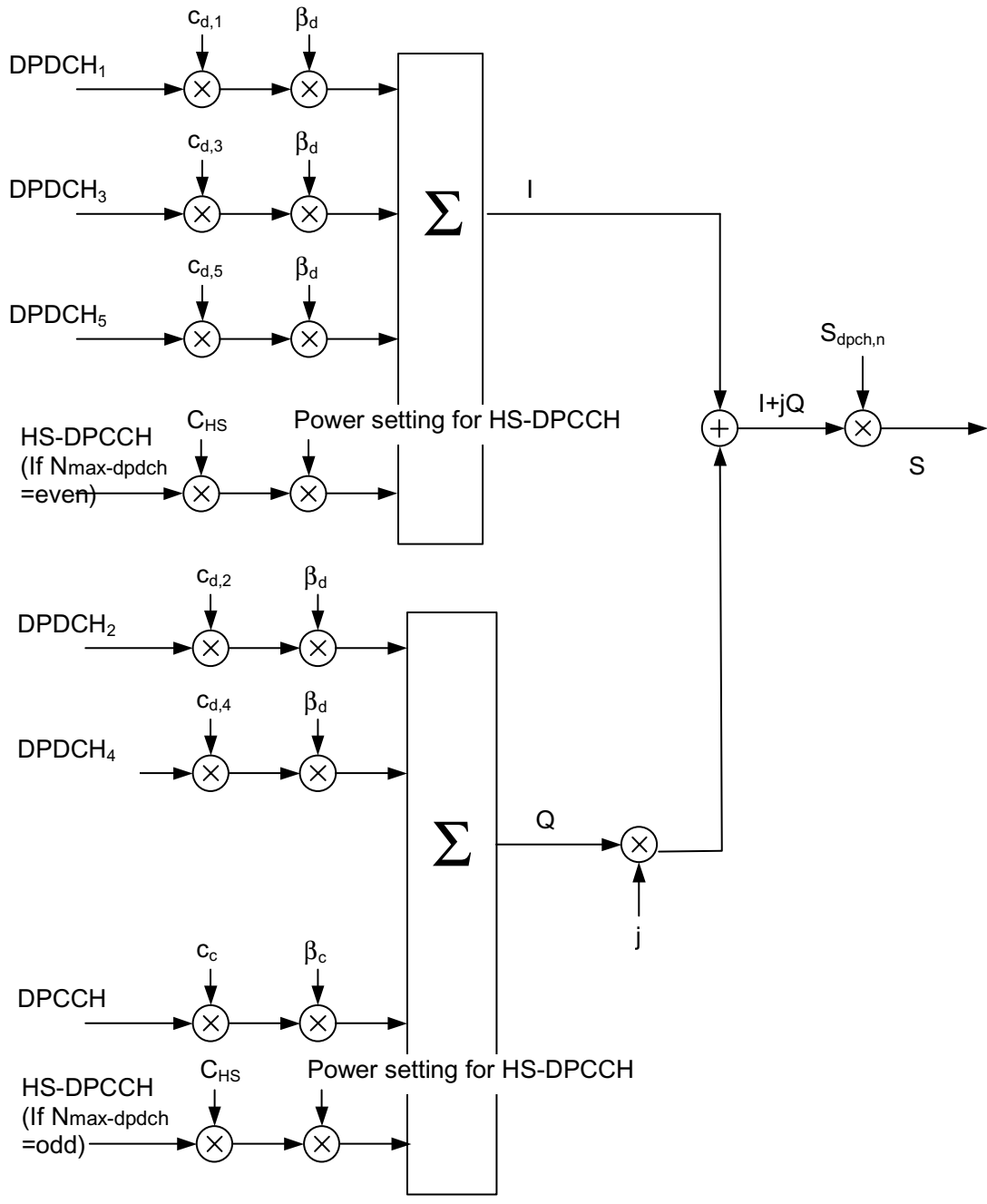


Figure 1: Spreading for uplink DPCCH and DPDCHs, DPDCHs and HS-DPCCH

After channelisation, the real-valued spread signals are weighted by gain factors, β_c for DPCCH and β_d for all DPDCHs. At every instant in time, at least one of the values β_c and β_d has the amplitude 1.0. The β -values are quantized into 4 bit words. The quantization steps are given in table 1.

Table 1: The quantization of the gain parameters

Signalling values for β_c and β_d	Quantized amplitude ratios β_c and β_d
15	1.0
14	14/15
13	13/15
12	12/15
11	11/15
10	10/15
9	9/15
8	8/15
7	7/15
6	6/15
5	5/15
4	4/15
3	3/15
2	2/15
1	1/15
0	Switch off

After the weighting, the stream of real-valued chips on the I- and Q-branches are then summed and treated as a complex-valued stream of chips. This complex-valued signal is then scrambled by the complex-valued scrambling code $S_{\text{dpcch},n}$. The scrambling code is applied aligned with the radio frames, i.e. the first scrambling chip corresponds to the beginning of a radio frame. ~~HS-DPCCH is mapped to Q branch.~~ HS-DPCCH is mapped to the I branch in case that the maximum number of DPDCH over all the TFCs in TFCS (defined as $N_{\text{max-dpdch}}$) is even, and mapped to the Q branch otherwise. The I/Q mapping of HS-DPCCH is not changed in case frame by frame TFCI change or temporary TFC restriction.

4.3 Code generation and allocation

4.3.1 Channelisation codes

4.3.1.1 Code definition

The channelisation codes of figure 1 are Orthogonal Variable Spreading Factor (OVSF) codes that preserve the orthogonality between a user's different physical channels. The OVSF codes can be defined using the code tree of figure 4.

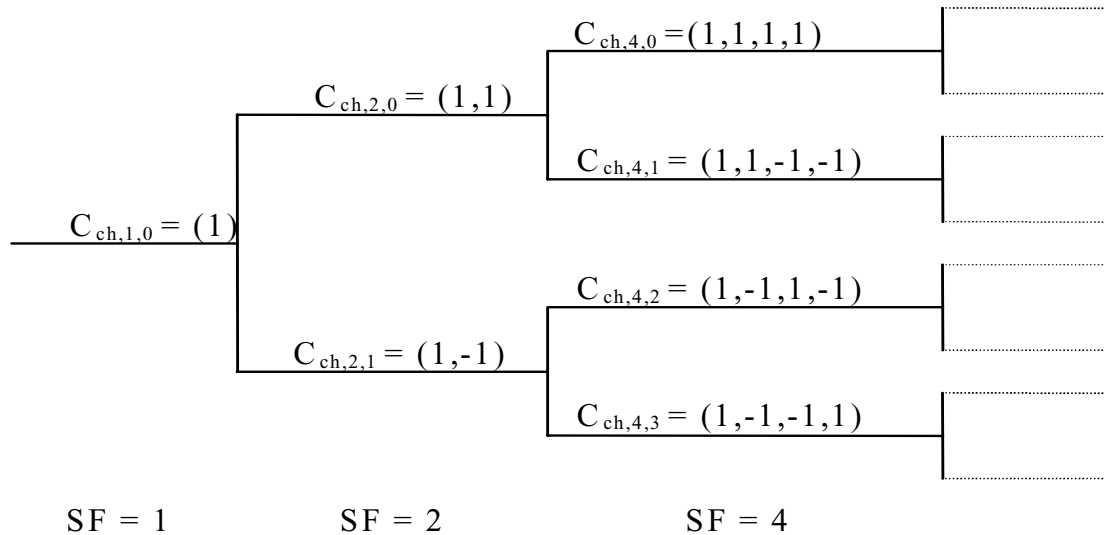


Figure 4: Code-tree for generation of Orthogonal Variable Spreading Factor (OVSF) codes

In figure 4, the channelisation codes are uniquely described as $C_{ch,SF,k}$, where SF is the spreading factor of the code and k is the code number, $0 \leq k \leq SF-1$.

Each level in the code tree defines channelisation codes of length SF, corresponding to a spreading factor of SF in figure 4.

The generation method for the channelisation code is defined as:

$$C_{ch,1,0} = 1,$$

$$\begin{bmatrix} C_{ch,2,0} \\ C_{ch,2,1} \end{bmatrix} = \begin{bmatrix} C_{ch,1,0} & C_{ch,1,0} \\ C_{ch,1,0} & -C_{ch,1,0} \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

$$\begin{bmatrix} C_{ch,2^{(n+1)},0} \\ C_{ch,2^{(n+1)},1} \\ C_{ch,2^{(n+1)},2} \\ C_{ch,2^{(n+1)},3} \\ \vdots \\ C_{ch,2^{(n+1)},2^{(n+1)}-2} \\ C_{ch,2^{(n+1)},2^{(n+1)}-1} \end{bmatrix} = \begin{bmatrix} C_{ch,2^n,0} & C_{ch,2^n,0} \\ C_{ch,2^n,0} & -C_{ch,2^n,0} \\ C_{ch,2^n,1} & C_{ch,2^n,1} \\ C_{ch,2^n,1} & -C_{ch,2^n,1} \\ \vdots & \vdots \\ C_{ch,2^n,2^n-1} & C_{ch,2^n,2^n-1} \\ C_{ch,2^n,2^n-1} & -C_{ch,2^n,2^n-1} \end{bmatrix}$$

The leftmost value in each channelisation code word corresponds to the chip transmitted first in time.

4.3.1.2 Code allocation for DPCCH/DPDCH/HS-DPCCH

For the DPCCH, DPDCHs and HS-DPCCH the following applies:

- The DPCCH is always spread by code $c_c = C_{ch,256,0}$.
- ~~The HS-DPCCH is spread by $c_c = C_{ch,256,64}$~~
- The HS-DPCCH is spread by code C_{ch} written in table x.

- **Table x: channelization code of HS-DPCCH**

<u>Nmax-dpdch (as defined in subclause 4.2.1)</u>	<u>Channelization code C_{ch}</u>
1	$C_{ch,256,64}$
2,4,6	$C_{ch,256,1}$
3,5	$C_{ch,256,32}$

- When only one DPDCH is to be transmitted, $DPDCH_1$ is spread by code $c_{d,1} = C_{ch,SF,k}$ where SF is the spreading factor of $DPDCH_1$ and $k = SF / 4$.
- When more than one DPDCH is to be transmitted, all DPDCHs have spreading factors equal to 4. $DPDCH_n$ is spread by the code $c_{d,n} = C_{ch,4,k}$, where $k = 1$ if $n \in \{1, 2\}$, $k = 3$ if $n \in \{3, 4\}$, and $k = 2$ if $n \in \{5, 6\}$.

If a power control preamble is used to initialise a DCH, the channelisation code for the DPCCH during the power control preamble shall be the same as that to be used afterwards.

CR-Form-v5.1

CHANGE REQUEST

z **25.213 CR 057** 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 Radio Access Network Core Network

Title:	z	Definition of the amplitude gain factor for HS-DPCCH	
Source:	z	TSG RAN WG1	
Work item code:	z	HSDPA-Phys	Date: z 2000-05-07
Category:	z	F	Release: z REL-5
		Use <u>one</u> of the following categories:	Use <u>one</u> of the following releases:
		F (correction)	2 (GSM Phase 2)
		A (corresponds to a correction in an earlier release)	R96 (Release 1996)
		B (addition of feature),	R97 (Release 1997)
		C (functional modification of feature)	R98 (Release 1998)
		D (editorial modification)	R99 (Release 1999)
		Detailed explanations of the above categories can be found in 3GPP TR 21.900 .	REL-4 (Release 4)
			REL-5 (Release 5)

Reason for change:	z	The amplitude gain factor for HS-DPCCH should be defined to keep the consistency with the definition of the UL DPCCH/DPDCH power difference. Especially, definition of the HS-DPCCH gain factor should not change the current definition of the UL DPCCH/DPDCH power difference.
Summary of change:	z	The amplitude gain factor for HS-DPCCH is defined.
Consequences if not approved:	z	HS-DPCCH power setting would be ambiguous.

Clauses affected:	z	2 References, 4.2.1 DPCCH/DPDCH/HS-DPCCH	
Other specs affected:	z	<input checked="" type="checkbox"/> Other core specifications	z 25.214
		<input type="checkbox"/> Test specifications	
		<input type="checkbox"/> O&M Specifications	
Other comments:	z		

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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.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TS 25.201: "Physical layer - general description".
- [2] 3GPP TS 25.211: "Physical channels and mapping of transport channels onto physical channels (FDD)."
- [3] 3GPP TS 25.101: "UE Radio transmission and Reception (FDD)".
- [4] 3GPP TS 25.104: "UTRA (BS) FDD; Radio transmission and Reception".
- [5] 3GPP TS 25.308: "UTRA High Speed Downlink Packet Access (HSDPA); Overall description".
- [6] [3GPP TS 25.214: "Physical layer procedures \(FDD\)".](#)
-

3 Symbols and abbreviations

3.1 Symbols

For the purposes of the present document, the following symbols apply:

$C_{ch,SF,n}$:	n :th channelisation code with spreading factor SF
$C_{pre,n,s}$:	PRACH preamble code for n :th preamble scrambling code and signature s
$C_{c-acc,n,s}$:	PCPCH access preamble code for n :th preamble scrambling code and signature s
$C_{c-cd,n,s}$:	PCPCH CD preamble code for n :th preamble scrambling code and signature s
$C_{sig,s}$:	PRACH/PCPCH signature code for signature s
$S_{dpch,n}$:	n :th DPCCH/DPDCH uplink scrambling code
$S_{r-pre,n}$:	n :th PRACH preamble scrambling code
$S_{r-msg,n}$:	n :th PRACH message scrambling code
S_{c-acc} :	n :th PCPCH access preamble scrambling code
S_{c-cd} :	n :th PCPCH CD preamble scrambling code
$S_{c-msg,n}$:	n :th PCPCH message scrambling code
$S_{dl,n}$:	DL scrambling code
C_{psc} :	PSC code
$C_{ssc,n}$:	n :th SSC code

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

16QAM	16 Quadrature Amplitude Modulation
AICH	Acquisition Indicator Channel
AP	Access Preamble

BCH	Broadcast Control Channel
CCPCH	Common Control Physical Channel
CD	Collision Detection
CPCH	Common Packet Channel
CPICH	Common Pilot Channel
DCH	Dedicated Channel
DPCH	Dedicated Physical Channel
DPCCH	Dedicated Physical Control Channel
DPDCH	Dedicated Physical Data Channel
FDD	Frequency Division Duplex
HS-DPCCH	Dedicated Physical Control Channel (uplink) for HS-DSCH
HS-DSCH	High Speed Downlink Shared Channel
HS-PDSCH	High Speed Physical Downlink Shared Channel
HS-SCCH	Shared Control Physical Channel for HS-DSCH
Mcps	Mega Chip Per Second
OVSF	Orthogonal Variable Spreading Factor (codes)
PDSCH	Physical Dedicated Shared Channel
PICH	Page Indication Channel
PRACH	Physical Random Access Channel
PSC	Primary Synchronisation Code
RACH	Random Access Channel
SCH	Synchronisation Channel
SSC	Secondary Synchronisation Code
SF	Spreading Factor
UE	User Equipment

4 Uplink spreading and modulation

4.1 Overview

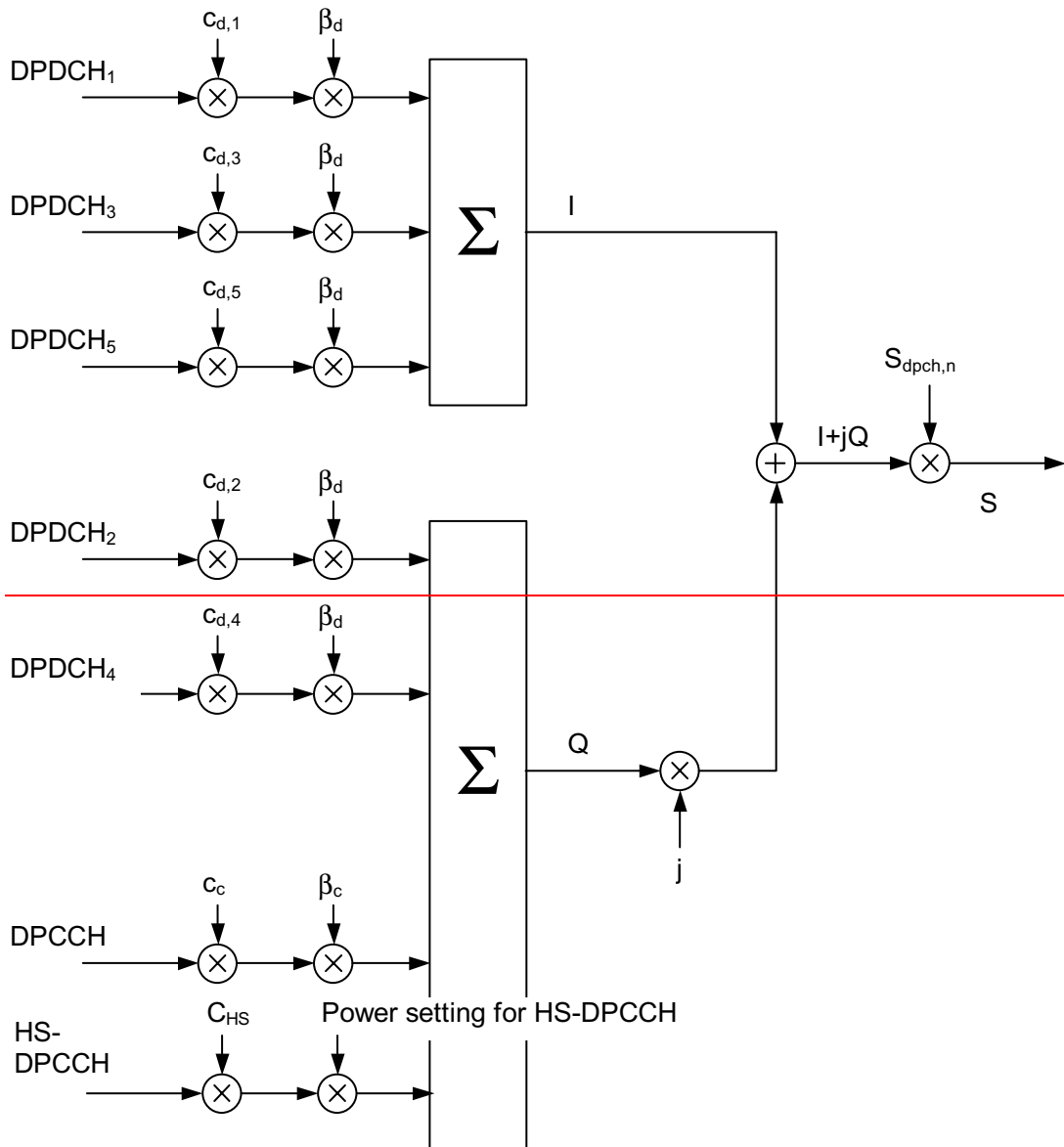
Spreading is applied to the physical channels. It consists of two operations. The first is the channelisation operation, which transforms every data symbol into a number of chips, thus increasing the bandwidth of the signal. The number of chips per data symbol is called the Spreading Factor (SF). The second operation is the scrambling operation, where a scrambling code is applied to the spread signal.

With the channelisation, data symbols on so-called I- and Q-branches are independently multiplied with an OVSF code. With the scrambling operation, the resultant signals on the I- and Q-branches are further multiplied by complex-valued scrambling code, where I and Q denote real and imaginary parts, respectively.

4.2 Spreading

4.2.1 DPCCH/DPDCH/HS-DPCCH

Figure 1 illustrates the principle of the uplink spreading of DPCCH, DPDCHs and HS-DPCCH. The binary DPCCH, DPDCHs and HS-DPCCH to be spread are represented by real-valued sequences, i.e. the binary value "0" is mapped to the real value +1, while the binary value "1" is mapped to the real value -1. The DPCCH is spread to the chip rate by the channelisation code c_c . The n -th DPDCH called $DPDCH_n$ is spread to the chip rate by the channelisation code $c_{d,n}$. The HS-DPCCH is spread to the chip rate by the channelisation code C_{HS} . One DPCCH, up to six parallel DPDCHs, and one HS-DPCCH can be transmitted simultaneously, i.e. $1 \leq n \leq 6$.



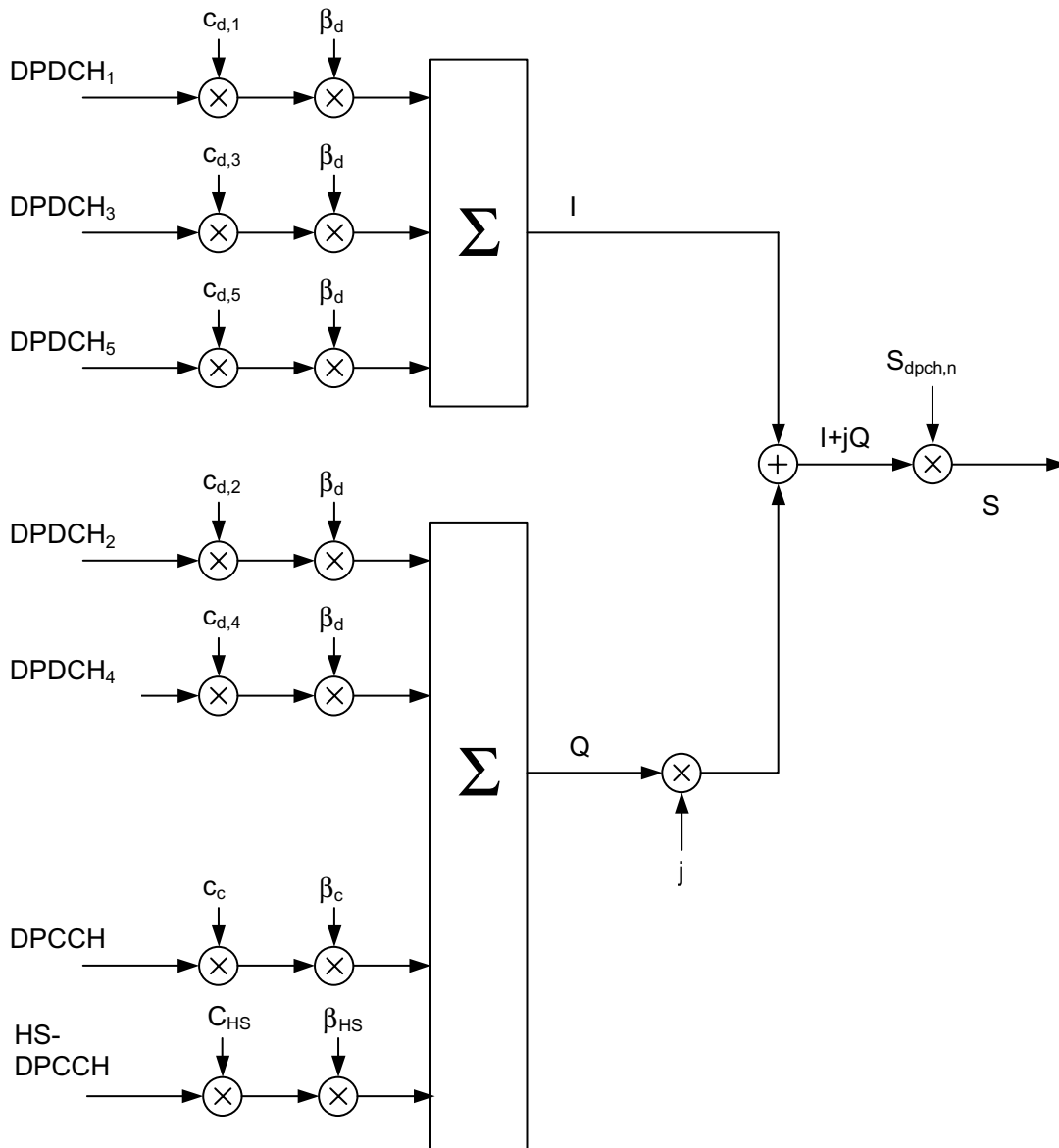


Figure 1: Spreading for uplink DPCCH, DPDCHs and HS-DPCCH

After channelisation, the real-valued spread signals are weighted by gain factors, β_c for DPCCH and β_d for all DPDCHs and β_{HS} for HS-DPCCH (if one is active).

The β_c and β_d values are signalled by higher layers or calculated as described in [6] 5.1.2.5. At every instant in time, at least one of the values β_c and β_d has the amplitude 1.0. The β_c and β_d values are quantized into 4 bit words. The quantization steps are given in table 1.

The β_{HS} value is derived from the power offset signalled by higher layers as described in [6] 5.1.2.6.

Table 1: The quantization of the gain parameters

Signalling values for β_c and β_d	Quantized amplitude ratios β_c and β_d
15	1.0
14	14/15
13	13/15
12	12/15
11	11/15
10	10/15
9	9/15
8	8/15
7	7/15
6	6/15
5	5/15
4	4/15
3	3/15
2	2/15
1	1/15
0	Switch off

After the weighting, the stream of real-valued chips on the I- and Q-branches are then summed and treated as a complex-valued stream of chips. This complex-valued signal is then scrambled by the complex-valued scrambling code $S_{\text{dpcch},n}$. The scrambling code is applied aligned with the radio frames, i.e. the first scrambling chip corresponds to the beginning of a radio frame. HS-DPCCH is mapped to Q branch.

CR-Form-v5	
CHANGE REQUEST	
z	25.214 CR 255 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 Radio Access Network Core Network

Title:	z	Correction on the operation of HSDPA during compressed mode.	
Source:	z	TSG RAN WG1	
Work item code:	z	HSDPA-Phys	Date: z 13 May 2002
Category:	z	F	Release: z REL-5
		Use <u>one</u> of the following categories:	Use <u>one</u> of the following releases:
		F (correction)	2 (GSM Phase 2)
		A (corresponds to a correction in an earlier release)	R96 (Release 1996)
		B (addition of feature),	R97 (Release 1997)
		C (functional modification of feature)	R98 (Release 1998)
		D (editorial modification)	R99 (Release 1999)
		Detailed explanations of the above categories can be found in 3GPP TR 21.900 .	REL-4 (Release 4)
			REL-5 (Release 5)

Reason for change:	z	Until now, the usage of compressed mode is not specified for the HSDPA channels.
Summary of change:	z	A description on the operation of HSDPA during compressed mode is added.
Consequences if not approved:	z	The operation of HSDPA during compressed mode would remain unclear.

Clauses affected:	z	7.2
Other specs affected:	z	<input type="checkbox"/> Other core specifications z <input type="checkbox"/> Test specifications z <input type="checkbox"/> O&M Specifications z
Other comments:	z	Isolated impact: The changes are only relevant for HSDPA during compressed mode. No other specifications are affected. Especially, no additional test case for testing the UE behaviour is needed with this CR.

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.

7 HS-DSCH-related procedures

7.1 General procedure

Scheduling and transport format selection is controlled by the MAC-hs sublayer in the Node B [9].

The following physical layer parameters are signalled to the UE and the Node B from higher layers:

- 1) HS-SCCH set to be monitored
- 2) Repetition factor of ACK/NACK: $N_{\text{acknack_transmit}}$
- 3) Channel Quality Indicator (CQI) feedback cycle k .
- 4) CQI feedback offset l .
- 5) Repetition factor of CQI: $N_{\text{cqi_transmit}}$

UE procedure for receiving HS-DSCH:

If the UE did not detect control information intended for this UE on any of the HS-SCCHs in the HS-SCCH set in the previous subframe, the UE shall monitor all HS-SCCHs in the HS-SCCH set. If the UE did detect control information intended for this UE in the previous subframe, it is sufficient to only monitor the same HS-SCCH used in the previous subframe.

If a UE detects that one of the monitored HS-SCCHs carries control information intended for this UE, the UE shall start receiving the HS-PDSCHs indicated by this control information.

After decoding the HS-PDSCH data, the UE shall transmit an hybrid ARQ ACK or NACK as determined by the MAC-hs based on the CRC check. The UE shall repeat the transmission of the ACK/NACK information over $N_{\text{acknack_transmit}}$ consecutive HS-DPCCH sub-frames, in the slots allocated to the HARQ-ACK as defined in [1]. When $N_{\text{acknack_transmit}}$ is greater than one, the UE shall not attempt to receive nor decode transport blocks from the HS-PDSCH in HS-DSCH sub-frames $n + 1$ to $n + (N_{\text{acknack_transmit}} - 1)$ where n is the number of the last HS-DSCH sub-frame in which a transport block has been received.

If control information is not detected on any of the HS-SCCHs in the HS-SCCH set, neither ACK, nor NACK, shall be transmitted in the corresponding subframe.

UE procedure for reporting channel quality indication (CQI):

- 1) The UE derives the CQI as defined in 7.2.1 from observations of the P-CPICH (alternatively S-CPICH in case of beamforming with S-CPICH is used).
- 2) The UE shall transmit the CQI on the HS-DPCCH sub frame which satisfies:

$$HSFN \bmod k = l$$

where HSFN is the sub frame counter version of SFN and defined as

$$HSFN = 5 * SFN + \text{HS-DPCCH sub frame}$$

- 3) The UE shall repeat the transmission of the CQI feedback information derived in 1) over $N_{\text{cqi_transmit}}$ consecutive HS-DPCCH sub frames in the slots respectively allocated to the CQI as defined in [1].
- 4) The UE shall not transmit the CQI in other subframes than those described in 2) and 3).

7.1.2 Channel quality indicator (CQI) definition

CQI reports one value at a time from the CQI report definition. CQI report definition is a table containing 32 values, each of which is defined with N parameters. These parameters shall consist of one or more of the following : [the transport block size, the coding rate, the number of HS-PDSCH codes, modulation, power offsets, $BLER_{\text{threshold}}$, P_{hs} =default power offset between HS-DSCH code channel and CPICH]

7.2 Operation during compressed mode on the associated DPCH

During compressed mode on the associated DPCH, the following applies for the UE for transmission of HS-DPCCH and reception of HS-SCCH and HS-PDSCH:

- The UE shall neglect a HS-SCCH or HS-PDSCH transmission, if a part of the HS-SCCH or a part of the corresponding HS-PDSCH overlaps with a downlink transmission gap on the associated DPCH. In this case, neither ACK, nor NACK shall be transmitted by the UE to respond to the corresponding downlink transmission.
- If a part of a HS-DPCCH slot allocated for ACK/NACK information overlaps with an uplink transmission gap on the associated DPCH, the UE shall not transmit ACK/NACK information in that slot.
- If in a HS-DPCCH sub-frame a part of the slots allocated for CQI information overlaps with an uplink transmission gap on the associated DPCH, the UE shall not transmit CQI information in that sub-frame.

CHANGE REQUEST

z **25.214 CR 259** 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 Radio Access Network Core Network

Title:	z	Clarification of UE transmission timing adjustment with HS-DPCCH	
Source:	z	TSG RAN WG1	
Work item code:	z	HSDPA-Phys	Date: z 06-05-2002
Category:	z	F	Release: z REL-5
		Use <u>one</u> of the following categories:	Use <u>one</u> of the following releases:
		F (correction)	2 (GSM Phase 2)
		A (corresponds to a correction in an earlier release)	R96 (Release 1996)
		B (addition of feature),	R97 (Release 1997)
		C (functional modification of feature)	R98 (Release 1998)
		D (editorial modification)	R99 (Release 1999)
		Detailed explanations of the above categories can be found in 3GPP TR 21.900 .	REL-4 (Release 4)
			REL-5 (Release 5)

Reason for change:	z	The UE is allowed to adjust its transmission time instant to maintain the reception of downlink DPCH from active set cells within a valid range. In release 99/release 4 the UE adjusts the transmission instant of DPCCH and DPDCH by the same amount so that they remain aligned. In release 5 when an HS-DPCCH is present it is not clear how this transmission time adjustment affects the HS-DPCCH transmission.
Summary of change:	z	It is clarified that when the UE adjusts the UL transmission timing autonomously i.e. independently of downlink timing reconfiguration controlled by the UTRAN it shall maintain the timing offset between DPCCH/DPDCH and HS-DPCCH constant.
Consequences if not approved:	z	Ambiguous specification of transmission timing adjustment leading to possible different implementations at the UE side and an impossibility for the node B to rely on the expected relative timing between UL DPCCH and HS-DPCCH.

Clauses affected:	z	4.3.4
Other specs affected:	z	<input type="checkbox"/> Other core specifications z <input type="checkbox"/> Test specifications <input type="checkbox"/> 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.

4.3.3 Radio link monitoring

4.3.3.1 Downlink radio link failure

The downlink radio links shall be monitored by the UE, to trigger radio link failure procedures. The downlink radio link failure criteria is specified in [5], and is based on the synchronisation status primitives CPHY-Sync-IND and CPHY-Out-of-Sync-IND, indicating in-sync and out-of-sync respectively.

4.3.3.2 Uplink radio link failure/restore

The uplink radio link sets are monitored by the Node B, to trigger radio link failure/restore procedures. Once the radio link sets have been established, they will be in the in-sync or out-of-sync states as shown in figure 1 in subclause 4.3.2.1. Transitions between those two states are described below.

The uplink radio link failure/restore criteria is based on the synchronisation status primitives CPHY-Sync-IND and CPHY-Out-of-Sync-IND, indicating in-sync and out-of-sync respectively. Note that only one synchronisation status indication shall be given per radio link set.

When the radio link set is in the in-sync state, Node B shall start timer T_RLFAILURE after receiving N_OUTSYNC_IND consecutive out-of-sync indications. Node B shall stop and reset timer T_RLFAILURE upon receiving successive N_INSYNC_IND in-sync indications. If T_RLFAILURE expires, Node B shall trigger the RL Failure procedure and indicate which radio link set is out-of-sync. When the RL Failure procedure is triggered, the state of the radio link set change to the out-of-sync state.

When the radio link set is in the out-of-sync state, after receiving N_INSYNC_IND successive in-sync indications Node B shall trigger the RL Restore procedure and indicate which radio link set has re-established synchronisation. When the RL Restore procedure is triggered, the state of the radio link set change to the in-sync state.

The specific parameter settings (values of T_RLFAILURE, N_OUTSYNC_IND, and N_INSYNC_IND) are configurable, see [6].

4.3.4 Transmission timing adjustments

During a connection the UE may adjust its DPDCH/DPCCH transmission time instant.

When the UE autonomously adjusts its DPDCH/DPCCH transmission time instant, it shall simultaneously adjust the HS-DPCCH transmission time instant by the same amount so that the relative timing between DPCCH/DPDCH and HS-DPCCH is kept constant.

If the receive timing for any downlink DPCCH/DPDCH in the current active set has drifted, so the time between reception of the downlink DPCCH/DPDCH in question and transmission of uplink DPCCH/DPDCH lies outside the valid range, L1 shall inform higher layers of this, so that the network can be informed of this and downlink timing can be adjusted by the network.

NOTE: The maximum rate of uplink TX time adjustment, and the valid range for the time between downlink DPCCH/DPDCH reception and uplink DPCCH/DPDCH transmission in the UE is to be specified by RAN WG4.

CHANGE REQUEST

z **25.214 CR 260** 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 Radio Access Network Core Network

Title:	z	Definition of CQI reporting	
Source:	z	TSG RAN WG1	
Work item code:	z	HSDPA-Phys	Date: z 2002-05-15
Category:	z	F	Release: z REL-5
		Use <u>one</u> of the following categories:	Use <u>one</u> of the following releases:
		F (correction)	2 (GSM Phase 2)
		A (corresponds to a correction in an earlier release)	R96 (Release 1996)
		B (addition of feature),	R97 (Release 1997)
		C (functional modification of feature)	R98 (Release 1998)
		D (editorial modification)	R99 (Release 1999)
		Detailed explanations of the above categories can be found in 3GPP TR 21.900 .	REL-4 (Release 4)
			REL-5 (Release 5)

Reason for change:	z	The term HSFN is not needed in L1 or higher layers. Instead of SFN, CFN would be the more appropriate reference, as CFN is typically used by higher layers for configurations of the L1. Section numbering in chapter 7 is not consistent. CQI is not actually transmitted by the UE, instead the CQI value is transmitted.
Summary of change:	z	HSFN is replaced with an expression using CFN instead of SFN. Clarify that CQI value is transmitted by the UE. Section numbering in chapter 7 is improved.
Consequences if not approved:	z	Unnecessary definition of HSFN. Inconsistent section numbering. Ambiguity about actual CQI transmission by the UE.

Clauses affected:	z	7.1, 7.1.2	
Other specs affected:	z	<input type="checkbox"/> Other core specifications	z
		<input type="checkbox"/> Test specifications	
		<input type="checkbox"/> O&M Specifications	
Other comments:	z		

7 HS-DSCH-related procedures

7.1 General procedure

Scheduling and transport format selection is controlled by the MAC-hs sublayer in the Node B [9].

The following physical layer parameters are signalled to the UE and the Node B from higher layers:

- 1) HS-SCCH set to be monitored
- 2) Repetition factor of ACK/NACK: $N_{\text{acknack_transmit}}$
- 3) Channel Quality Indicator (CQI) feedback cycle k .
- ~~4) CQI feedback offset l .~~
- ~~45) Repetition factor of CQI: $N_{\text{cqi_transmit}}$~~

7.1.1 UE procedure for receiving HS-DSCH:

If the UE did not detect control information intended for this UE on any of the HS-SCCHs in the HS-SCCH set in the previous subframe, the UE shall monitor all HS-SCCHs in the HS-SCCH set. If the UE did detect control information intended for this UE in the previous subframe, it is sufficient to only monitor the same HS-SCCH used in the previous subframe.

If a UE detects that one of the monitored HS-SCCHs carries control information intended for this UE, the UE shall start receiving the HS-PDSCHs indicated by this control information.

After decoding the HS-PDSCH data, the UE shall transmit an hybrid ARQ ACK or NACK as determined by the MAC-hs based on the CRC check. The UE shall repeat the transmission of the ACK/NACK information over $N_{\text{acknack_transmit}}$ consecutive HS-DPCCH sub-frames, in the slots allocated to the HARQ-ACK as defined in [1]. When $N_{\text{acknack_transmit}}$ is greater than one, the UE shall not attempt to receive nor decode transport blocks from the HS-PDSCH in HS-DSCH sub-frames $n + 1$ to $n + (N_{\text{acknack_transmit}} - 1)$ where n is the number of the last HS-DSCH sub-frame in which a transport block has been received.

If control information is not detected on any of the HS-SCCHs in the HS-SCCH set, neither ACK, nor NACK, shall be transmitted in the corresponding subframe.

7.1.2 UE procedure for reporting channel quality indication (CQI):

1) The UE derives the CQI value as defined in 7.2.1 ~~from observations of the P-CPICH (alternatively S-CPICH in case of beamforming with S-CPICH is used).~~

~~2) The UE shall transmit the CQI value on in the HS-DPCCH sub_frame which satisfies:~~

~~$$(5 \times \text{HSCFN} + i) \bmod k = l_0$$~~

~~2) The UE shall transmit the CQI value in each subframe that starts $n \times 256$ chips after the start of slot i on the associated uplink DPCCH with i simultaneously fulfilling~~

~~$$(5 \times \text{CFN} + \lceil (n \times 256 \text{ chip} + i \times 2560 \text{ chip}) / 7680 \text{ chip} \rceil) \bmod k = 0 \text{ and } i \bmod 3 = 0$$~~

~~where CFN denotes the connection frame number for the associated DPCH and n being the smallest m fulfilling the requirement described in subclause 7.7 in [1]. HSFN is the sub frame counter version of SFN and defined as~~

~~$$\text{HSFN} = 5 \times \text{SFN} + \text{HS-DPCCH sub frame}$$~~

- 3) The UE shall repeat the transmission of the CQI ~~value feedback information~~ derived in 1) over the next $(N_cqi_transmit - 1)$ consecutive HS-DPCCH sub frames in the slots respectively allocated to the CQI as defined in [1].
- 4) The UE shall not transmit the CQI in other subframes than those described in 2) and 3).

7.1.27.2 Channel quality indicator (CQI) definition

CQI reports one value at a time from the CQI report definition. CQI report definition is a table containing 32 values, each of which is defined with N parameters. These parameters shall consist of one or more of the following : [the transport block size, the coding rate, the number of HS-PDSCH codes, modulation, power offsets, $BLER_{threshold}$, P_{hs} =default power offset between HS-DSCH code channel and CPICH]

CHANGE REQUEST

z **25.214 CR 266** 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 Radio Access Network Core Network

Title:	z	Correction to the setting of DPCCH/HS-DPCCH power difference	
Source:	z	TSG RAN WG1	
Work item code:	z	HSDPA-Phys	Date: z 2000-05-07
Category:	z	F	Release: z REL-5
		Use <u>one</u> of the following categories:	Use <u>one</u> of the following releases:
		F (correction)	2 (GSM Phase 2)
		A (corresponds to a correction in an earlier release)	R96 (Release 1996)
		B (addition of feature),	R97 (Release 1997)
		C (functional modification of feature)	R98 (Release 1998)
		D (editorial modification)	R99 (Release 1999)
		Detailed explanations of the above categories can be found in 3GPP TR 21.900 .	REL-4 (Release 4)
			REL-5 (Release 5)

Reason for change:	z	DPCCH/HS-DPCCH power difference should be defined to keep the consistency with the definition of the UL DPCCH/DPDCH power difference. Especially, definition of the HS-DPCCH gain factor should not change the current definition of the UL DPCCH/DPDCH power difference.	
Summary of change:	z	The HS-DPCCH power offset is represented as an amplitude gain factor.	
Consequences if not approved:	z	There will be an ambiguity and an inconsistency among the definitions of the UL DPCCH, DPDCH and HS-DPCCH power differences.	

Clauses affected:	z	5.1.2.6	
Other specs affected:	z	<input checked="" type="checkbox"/> Other core specifications	z 25.213
		<input type="checkbox"/> Test specifications	
		<input type="checkbox"/> 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/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.

5.1.2.6 Setting of the uplink DPCCH/HS-DPCCH power difference

When an HS-DPCCH is active, the relative power offset $\Delta_{\text{HS-DPCCH}}$ between the DPCCH and the HS-DPCCH for each HS-DPCCH slot shall be set as follows.

For HS-DPCCH slots carrying HARQ Acknowledgement :

$\Delta_{\text{HS-DPCCH}} = \Delta_{\text{ACK}}$ if the corresponding HARQ Acknowledgement is equal to 1

$\Delta_{\text{HS-DPCCH}} = \Delta_{\text{NACK}}$ if the corresponding HARQ Acknowledgement is equal to 0

For HS-DPCCH slots carrying CQI :

$\Delta_{\text{HS-DPCCH}} = \Delta_{\text{CQI}}$

The values for Δ_{ACK} , Δ_{NACK} and Δ_{CQI} are set by higher layers.

The setting of the power difference between DPCCH and HS-DPCCH is independent of the inner loop power control.

Then, in non-compressed frames β_{HS} , which is the gain factor defined in [3] subclause 4.2.1, is calculated according to

$$\beta_{\text{HS}} = \beta_c \cdot 10^{\left(\frac{\Delta_{\text{HS-DPCCH}}}{20}\right)}$$

where β_c value is signalled by higher-layer or calculated as described in subclause 5.1.2.5.3 or 5.1.2.5.4.

When HS-DPCCH is transmitted in compressed frames, β_{HS} is calculated according to

$$\beta_{\text{HS}} = \beta_c \cdot 10^{\left(\frac{\Delta_{\text{HS-DPCCH}}}{20}\right)} \cdot \sqrt{\frac{N_{\text{pilot},N}}{N_{\text{pilot},C}}}$$

where $N_{\text{pilot},C}$ is the number of pilot bits per slot on the DPCCH in compressed frames, and $N_{\text{pilot},N}$ is the number of pilot bits per slot in non-compressed frames.

The gain factor β_{HS} may vary on slot basis depending on the current power offset $\Delta_{\text{HS-DPCCH}}$ and whether the compressed mode is used or not in UL DPCH. When the HS-DPCCH and the DPCCH are not slot aligned, the reference DPCCH power shall be the one used in the DPCCH slot being transmitted at the beginning i.e. slot boundary of the HS-DPCCH slot.

CR-Form-v5	
CHANGE REQUEST	
z	25.214 CR 267 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 Radio Access Network Core Network

Title:	z	Inclusion of CQI table	
Source:	z	TSG RAN WG1	
Work item code:	z	HSDPA-Phys	Date: z 2002-05-09
Category:	z	F	Release: z REL-5
		Use <u>one</u> of the following categories:	Use <u>one</u> of the following releases:
		F (correction)	2 (GSM Phase 2)
		A (corresponds to a correction in an earlier release)	R96 (Release 1996)
		B (addition of feature),	R97 (Release 1997)
		C (functional modification of feature)	R98 (Release 1998)
		D (editorial modification)	R99 (Release 1999)
		Detailed explanations of the above categories can be found in 3GPP TR 21.900 .	REL-4 (Release 4)
			REL-5 (Release 5)

Reason for change:	z	Version 5.0.0 of 25.214 does not specify the definition of the channel quality indicator (CQI).
Summary of change:	z	Definition of the basis for and the format of the CQI, including the necessary tables.
Consequences if not approved:	z	The CQI specification will be ambiguous and incomplete.

Clauses affected:	z	2, 7.1, 7.1.2
Other specs affected:	z	<input type="checkbox"/> Other core specifications z <input type="checkbox"/> Test specifications z <input type="checkbox"/> O&M Specifications z
Other comments:	z	

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
 - For a specific reference, subsequent revisions do not apply.
 - For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.
- [1] 3GPP TS 25.211: "Physical channels and mapping of transport channels onto physical channels (FDD)".
- [2] 3GPP TS 25.212: "Multiplexing and channel coding (FDD)".
- [3] 3GPP TS 25.213: "Spreading and modulation (FDD)".
- [4] 3GPP TS 25.215: "Physical layer – Measurements (FDD)".
- [5] 3GPP TS 25.331: "RRC Protocol Specification".
- [6] 3GPP TS 25.433: "UTRAN Iub Interface NBAP Signalling".
- [7] 3GPP TS 25.101: "UE Radio transmission and Reception (FDD)".
- [8] 3GPP TS 25.133: "Requirements for Support of Radio Resource Management (FDD)".
- [9] 3GPP TS 25.321: "MAC protocol specification".
- [10] [3GPP TS 25.306: "UE Radio Access Capabilities"](#).

7.1 General procedure

Scheduling and transport format selection is controlled by the MAC-hs sublayer in the Node B [9]. The following physical layer parameters are signalled to the UE and the Node B from higher layers:

- 1) HS-SCCH set to be monitored
- 2) Repetition factor of ACK/NACK: $N_{\text{acknack_transmit}}$
- 3) Channel Quality Indicator (CQI) feedback cycle k .
- 4) CQI feedback offset l .
- 5) Repetition factor of CQI: $N_{\text{cqi_transmit}}$
- 6) [Measurement power offset \$\Gamma\$](#)

UE procedure for receiving HS-DSCH:

If the UE did not detect control information intended for this UE on any of the HS-SCCHs in the HS-SCCH set in the previous subframe, the UE shall monitor all HS-SCCHs in the HS-SCCH set. If the UE did detect control information intended for this UE in the previous subframe, it is sufficient to only monitor the same HS-SCCH used in the previous subframe.

If a UE detects that one of the monitored HS-SCCHs carries control information intended for this UE, the UE shall start receiving the HS-PDSCHs indicated by this control information.

After decoding the HS-PDSCH data, the UE shall transmit an hybrid ARQ ACK or NACK as determined by the MAC-hs based on the CRC check. The UE shall repeat the transmission of the ACK/NACK information over $N_{acknack_transmit}$ consecutive HS-DPCCH sub-frames, in the slots allocated to the HARQ-ACK as defined in [1]. When $N_{acknack_transmit}$ is greater than one, the UE shall not attempt to receive nor decode transport blocks from the HS-PDSCH in HS-DSCH sub-frames $n + 1$ to $n + (N_{acknack_transmit} - 1)$ where n is the number of the last HS-DSCH sub-frame in which a transport block has been received.

If control information is not detected on any of the HS-SCCHs in the HS-SCCH set, neither ACK, nor NACK, shall be transmitted in the corresponding subframe.

UE procedure for reporting channel quality indication (CQI):

- 1) The UE derives the CQI as defined in 7.2.4 from observations of the P-CPICH (alternatively S-CPICH in case of beamforming with S-CPICH is used).
- 2) The UE shall transmit the CQI on the HS-DPCCH sub frame which satisfies:

$$HSFN \bmod k = l$$

where HSFN is the sub frame counter version of SFN and defined as

$$HSFN = 5 * SFN + HS-DPCCH \text{ sub frame}$$

- 3) The UE shall repeat the transmission of the CQI feedback information derived in 1) over $N_{cqi_transmit}$ consecutive HS-DPCCH sub frames in the slots respectively allocated to the CQI as defined in [1].
- 4) The UE shall not transmit the CQI in other subframes than those described in 2) and 3).

7.27.1.2 Channel quality indicator (CQI) definition

~~CQI reports one value at a time from the CQI report definition. CQI report definition is a table containing 32 values, each of which is defined with N parameters. These parameters shall consist of one or more of the following : [the transport block size, the coding rate, the number of HS PDSCH codes, modulation, power offsets, $BLER_{threshold}$, P_{hs} =default power offset between HS DSCH code channel and CPICH]~~

~~The UE shall report the highest tabulated CQI value such that, for the current radio conditions, the transport block error probability does not exceed 0.1 for a single transmission with a TFRC corresponding to the reported, or a lower, CQI value. Depending on the UE category as defined in [10], either Table 8, 9, 10, or 11 should be used. For the purpose of CQI reporting, the UE shall assume a total received HS-PDSCH power of $P_{HSPDSCH} = P_{CPICH} + \Gamma + \Delta$ in dB, where the measurement power offset Γ is signaled by higher layers and the reference power adjustment Δ is given by Table 8, 9, 10, or 11, depending on the UE category. If S-CPICH is used as a phase reference for HS-PDSCH demodulation, P_{CPICH} is the received power of the S-CPICH used by the UE, otherwise P_{CPICH} is the received power of the P-CPICH.~~

Table 8: CQI mapping table for UE categories 1 to 6.

CQI value	Transport Block Size	Number of HS-PDSCH	Modulation	Reference power adjustment Δ
0	N/A	out of range		
1	137	1	QPSK	0

<u>2</u>	<u>173</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>3</u>	<u>233</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>4</u>	<u>317</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>5</u>	<u>377</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>6</u>	<u>461</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>7</u>	<u>650</u>	<u>2</u>	<u>QPSK</u>	<u>0</u>
<u>8</u>	<u>792</u>	<u>2</u>	<u>QPSK</u>	<u>0</u>
<u>9</u>	<u>931</u>	<u>2</u>	<u>QPSK</u>	<u>0</u>
<u>10</u>	<u>1262</u>	<u>3</u>	<u>QPSK</u>	<u>0</u>
<u>11</u>	<u>1483</u>	<u>3</u>	<u>QPSK</u>	<u>0</u>
<u>12</u>	<u>1742</u>	<u>3</u>	<u>QPSK</u>	<u>0</u>
<u>13</u>	<u>2279</u>	<u>4</u>	<u>QPSK</u>	<u>0</u>
<u>14</u>	<u>2583</u>	<u>4</u>	<u>QPSK</u>	<u>0</u>
<u>15</u>	<u>3319</u>	<u>5</u>	<u>QPSK</u>	<u>0</u>
<u>16</u>	<u>3565</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>17</u>	<u>4189</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>18</u>	<u>4664</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>19</u>	<u>5287</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>20</u>	<u>5887</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>21</u>	<u>6554</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>22</u>	<u>7168</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>23</u>	<u>7168</u>	<u>5</u>	<u>16-QAM</u>	<u>-1</u>
<u>24</u>	<u>7168</u>	<u>5</u>	<u>16-QAM</u>	<u>-2</u>
<u>25</u>	<u>7168</u>	<u>5</u>	<u>16-QAM</u>	<u>-3</u>
<u>26</u>	<u>7168</u>	<u>5</u>	<u>16-QAM</u>	<u>-4</u>
<u>27</u>	<u>7168</u>	<u>5</u>	<u>16-QAM</u>	<u>-5</u>
<u>28</u>	<u>7168</u>	<u>5</u>	<u>16-QAM</u>	<u>-6</u>
<u>29</u>	<u>7168</u>	<u>5</u>	<u>16-QAM</u>	<u>-7</u>
<u>30</u>	<u>7168</u>	<u>5</u>	<u>16-QAM</u>	<u>-8</u>

Table 9: CQI mapping table for UE categories 7 and 8.

CQI value	Transport Block Size	Number of HS-PDSCH	Modulation	Reference power adjustment Δ
<u>0</u>	<u>N/A</u>	<u>out of range</u>		
<u>1</u>	<u>137</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>2</u>	<u>173</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>3</u>	<u>233</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>4</u>	<u>317</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>5</u>	<u>377</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>

<u>6</u>	<u>461</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>7</u>	<u>650</u>	<u>2</u>	<u>QPSK</u>	<u>0</u>
<u>8</u>	<u>792</u>	<u>2</u>	<u>QPSK</u>	<u>0</u>
<u>9</u>	<u>931</u>	<u>2</u>	<u>QPSK</u>	<u>0</u>
<u>10</u>	<u>1262</u>	<u>3</u>	<u>QPSK</u>	<u>0</u>
<u>11</u>	<u>1483</u>	<u>3</u>	<u>QPSK</u>	<u>0</u>
<u>12</u>	<u>1742</u>	<u>3</u>	<u>QPSK</u>	<u>0</u>
<u>13</u>	<u>2279</u>	<u>4</u>	<u>QPSK</u>	<u>0</u>
<u>14</u>	<u>2583</u>	<u>4</u>	<u>QPSK</u>	<u>0</u>
<u>15</u>	<u>3319</u>	<u>5</u>	<u>QPSK</u>	<u>0</u>
<u>16</u>	<u>3565</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>17</u>	<u>4189</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>18</u>	<u>4664</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>19</u>	<u>5287</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>20</u>	<u>5887</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>21</u>	<u>6554</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>22</u>	<u>7168</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>23</u>	<u>9719</u>	<u>7</u>	<u>16-QAM</u>	<u>0</u>
<u>24</u>	<u>11418</u>	<u>8</u>	<u>16-QAM</u>	<u>0</u>
<u>25</u>	<u>14411</u>	<u>10</u>	<u>16-QAM</u>	<u>0</u>
<u>26</u>	<u>14411</u>	<u>10</u>	<u>16-QAM</u>	<u>-1</u>
<u>27</u>	<u>14411</u>	<u>10</u>	<u>16-QAM</u>	<u>-2</u>
<u>28</u>	<u>14411</u>	<u>10</u>	<u>16-QAM</u>	<u>-3</u>
<u>29</u>	<u>14411</u>	<u>10</u>	<u>16-QAM</u>	<u>-4</u>
<u>30</u>	<u>14411</u>	<u>10</u>	<u>16-QAM</u>	<u>-5</u>

Table 10: CQI mapping table for UE category 9.

<u>CQI value</u>	<u>Transport Block Size</u>	<u>Number of HS-PDSCH</u>	<u>Modulation</u>	<u>Reference power adjustment Δ</u>
<u>0</u>	<u>N/A</u>	<u>out of range</u>		
<u>1</u>	<u>137</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>2</u>	<u>173</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>3</u>	<u>233</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>4</u>	<u>317</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>5</u>	<u>377</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>6</u>	<u>461</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>7</u>	<u>650</u>	<u>2</u>	<u>QPSK</u>	<u>0</u>
<u>8</u>	<u>792</u>	<u>2</u>	<u>QPSK</u>	<u>0</u>
<u>9</u>	<u>931</u>	<u>2</u>	<u>QPSK</u>	<u>0</u>

<u>10</u>	<u>1262</u>	<u>3</u>	<u>QPSK</u>	<u>0</u>
<u>11</u>	<u>1483</u>	<u>3</u>	<u>QPSK</u>	<u>0</u>
<u>12</u>	<u>1742</u>	<u>3</u>	<u>QPSK</u>	<u>0</u>
<u>13</u>	<u>2279</u>	<u>4</u>	<u>QPSK</u>	<u>0</u>
<u>14</u>	<u>2583</u>	<u>4</u>	<u>QPSK</u>	<u>0</u>
<u>15</u>	<u>3319</u>	<u>5</u>	<u>QPSK</u>	<u>0</u>
<u>16</u>	<u>3565</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>17</u>	<u>4189</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>18</u>	<u>4664</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>19</u>	<u>5287</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>20</u>	<u>5887</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>21</u>	<u>6554</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>22</u>	<u>7168</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>23</u>	<u>9719</u>	<u>7</u>	<u>16-QAM</u>	<u>0</u>
<u>24</u>	<u>11418</u>	<u>8</u>	<u>16-QAM</u>	<u>0</u>
<u>25</u>	<u>14411</u>	<u>10</u>	<u>16-QAM</u>	<u>0</u>
<u>26</u>	<u>17300</u>	<u>12</u>	<u>16-QAM</u>	<u>0</u>
<u>27</u>	<u>17300</u>	<u>12</u>	<u>16-QAM</u>	<u>-1</u>
<u>28</u>	<u>17300</u>	<u>12</u>	<u>16-QAM</u>	<u>-2</u>
<u>29</u>	<u>17300</u>	<u>12</u>	<u>16-QAM</u>	<u>-3</u>
<u>30</u>	<u>17300</u>	<u>12</u>	<u>16-QAM</u>	<u>-4</u>

Table 11: CQI mapping table for UE category 10.

<u>CQI value</u>	<u>Transport Block Size</u>	<u>Number of HS-PDSCH</u>	<u>Modulation</u>	<u>Reference power adjustment Δ</u>
<u>0</u>	<u>N/A</u>	<u>out of range</u>		
<u>1</u>	<u>137</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>2</u>	<u>173</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>3</u>	<u>233</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>4</u>	<u>317</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>5</u>	<u>377</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>6</u>	<u>461</u>	<u>1</u>	<u>QPSK</u>	<u>0</u>
<u>7</u>	<u>650</u>	<u>2</u>	<u>QPSK</u>	<u>0</u>
<u>8</u>	<u>792</u>	<u>2</u>	<u>QPSK</u>	<u>0</u>
<u>9</u>	<u>931</u>	<u>2</u>	<u>QPSK</u>	<u>0</u>
<u>10</u>	<u>1262</u>	<u>3</u>	<u>QPSK</u>	<u>0</u>
<u>11</u>	<u>1483</u>	<u>3</u>	<u>QPSK</u>	<u>0</u>
<u>12</u>	<u>1742</u>	<u>3</u>	<u>QPSK</u>	<u>0</u>
<u>13</u>	<u>2279</u>	<u>4</u>	<u>QPSK</u>	<u>0</u>

<u>14</u>	<u>2583</u>	<u>4</u>	<u>QPSK</u>	<u>0</u>
<u>15</u>	<u>3319</u>	<u>5</u>	<u>QPSK</u>	<u>0</u>
<u>16</u>	<u>3565</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>17</u>	<u>4189</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>18</u>	<u>4664</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>19</u>	<u>5287</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>20</u>	<u>5887</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>21</u>	<u>6554</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>22</u>	<u>7168</u>	<u>5</u>	<u>16-QAM</u>	<u>0</u>
<u>23</u>	<u>9719</u>	<u>7</u>	<u>16-QAM</u>	<u>0</u>
<u>24</u>	<u>11418</u>	<u>8</u>	<u>16-QAM</u>	<u>0</u>
<u>25</u>	<u>14411</u>	<u>10</u>	<u>16-QAM</u>	<u>0</u>
<u>26</u>	<u>17300</u>	<u>12</u>	<u>16-QAM</u>	<u>0</u>
<u>27</u>	<u>21754</u>	<u>15</u>	<u>16-QAM</u>	<u>0</u>
<u>28</u>	<u>23370</u>	<u>15</u>	<u>16-QAM</u>	<u>0</u>
<u>29</u>	<u>24222</u>	<u>15</u>	<u>16-QAM</u>	<u>0</u>
<u>30</u>	<u>25558</u>	<u>15</u>	<u>16-QAM</u>	<u>0</u>