TSG-RAN Meeting #7
Madrid, Spain, 13 – 15 March 2000

RP-000060

Title: **Agreed CRs to TS 25.211**

Source: **TSG-RAN WG1**

Agenda item: **6.1.3**

No.	Doc #	Spec	CR	Rev	Subject	Cat	Versio	Versio
1	R1-000265	25.211	013	6	Addition of a downlink channel indicating CPCH	B	3.1.1	3.2.0
2	R1-000449	25.211	023	6	CPCH-related editorial changes, technical	F	3.1.1	3.2.0
3	R1-000130	25.211	024	1	Additional description of TX diversity for PDSCH	B	3.1.1	3.2.0
4	R1-000118	25.211	025	1	Consistent numbering of scrambling code groups	F	3.1.1	3.2.0
5	R1-000038	25.211	026	-	Minor corrections to timing section	F	3.1.1	3.2.0
6	R1-000239	25.211	028	1	Timing of PDSCH	C	3.1.1	3.2.0
7	R1-000216	25.211	029	1	Modifications to STTD text	D	3.1.1	3.2.0
8	R1-000429	25.211	031	4	CD/CA-ICH for dual mode CPCH	B	3.1.1	3.2.0
9	R1-000234	25.211	033	-	Clarification of frame synchronization word and its	D	3.1.1	3.2.0
10	R1-000450	25.211	034	1	Editorial updates to 25.211	D	3.1.1	3.2.0
11	R1-000270	25.211	036	-	PDSCH multi-code transmission	C	3.1.1	3.2.0
12	R1-000275	25.211	037	-	Clarification of pilot bit patterns for CPCH and slot	D	3.1.1	3.2.0
13	R1-000296	25.211	039	-	Further restrictions on the application of the Tx	C	3.1.1	3.2.0
14	R1-000297	25.211	040	-	Clarification of downlink pilot bit patterns	F	3.1.1	3.2.0
15	R1-000315	25.211	041	-	Clarification of DCH initialisation	C	3.1.1	3.2.0
16	R1-000409	25.211	044	2	Emergency Stop of CPCH transmission and Start	B	3.1.1	3.2.0
17	R1-000422	25.211	046	-	Clean up of USTS related specifications	F	3.1.1	3.2.0

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document R1-00-0265
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.211 CR 013r6 Current Version: 3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-RAN #7 for approval ☒ Strategic ☐ *(for SMG*
list expected approval meeting # here ↑ for information ☐ non-strategic ☐ *Use only)*

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: TSG RAN WG1 **Date:** 2000-02-22

Subject: Addition of a downlink channel indicating CPCH status

Work item:

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

Reason for change: Broadcast of status information significantly improves performance of CPCH

Clauses affected: 3, 5.3.1, 5.3.3.6, 5.3.3.8, 6

Other specs affected:	Other 3G core specifications	☐	→ List of CRs:	
	Other GSM core specifications	☐	→ List of CRs:	
	MS test specifications	☐	→ List of CRs:	
	BSS test specifications	☐	→ List of CRs:	
	O&M specifications	☐	→ List of CRs:	

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

3 Abbreviations

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

AI	Acquisition Indicator
AICH	Acquisition Indicator Channel
AP	Access Preamble
BCH	Broadcast Channel
CCPCH	Common Control Physical Channel
CCTrCH	Coded Composite Transport Channel
CD	Collision Detection
CPCH	Common Packet Channel
CPICH	Common Pilot Channel
CSICH	CPCH Status Indicator Channel
DCH	Dedicated Channel
DPCCH	Dedicated Physical Control Channel
DPCH	Dedicated Physical Channel
DPDCH	Dedicated Physical Data Channel
DSCH	Downlink Shared Channel
DTX	Discontinuous Transmission
FACH	Forward Access Channel
FBI	Feedback Information
MUI	Mobile User Identifier
PCH	Paging Channel
P-CCPCH	Primary Common Control Physical Channel
PCPCH	Physical Common Packet Channel
PDSCH	Physical Downlink Shared Channel
PI	Page Indicator
PICH	Page Indicator Channel
PRACH	Physical Random Access Channel
PSC	Primary Synchronisation Code
RACH	Random Access Channel
RNC	Radio Network Controller
S-CCPCH	Secondary Common Control Physical Channel
SCH	Synchronisation Channel
SF	Spreading Factor
SFN	System Frame Number
SI	Status Indicator
SSC	Secondary Synchronisation Code
STTD	Space Time Transmit Diversity
TFCI	Transport Format Combination Indicator
TSTD	Time Switched Transmit Diversity
TPC	Transmit Power Control
UE	User Equipment
UTRAN	UMTS Terrestrial Radio Access Network

5.3.1 Downlink Transmit Diversity

Table 10 summarizes the possible application of open and closed loop Transmit diversity modes on different downlink physical channels. Simultaneous use of STTD and closed loop modes on DPCH and PDSCH is not allowed.

Table 10: Application of Tx diversity modes on downlink physical channels "X" – can be applied, "–" – not applied

Channel	Open loop mode		Closed loop Mode
	TSTD	STTD	
P-CCPCH	–	X	–
SCH	X	–	–
S-CCPCH	–	X	–
DPCH	–	X	X
PICH	–	X	–
PDSCH (associated with DPCH)	–	X	X
AICH	–	X	–
CSICH	–	X	–

5.3.3.6 Acquisition Indicator Channel (AICH)

The Acquisition Indicator channel (AICH) is a physical channel used to carry Acquisition Indicators (AI). Acquisition Indicator AI_s corresponds to signature s on the PRACH or PCPCH. Note that for PCPCH, the AICH either corresponds to an access preamble or a CD preamble. The AICH corresponding to the access preamble is an AP-AICH and the AICH corresponding to the CD preamble is a CD-AICH. The AP-AICH and CD-AICH use different channelization codes, see further[4], Section 4.3.3.2.

Figure 19 illustrates the structure of the AICH. The AICH consists of a repeated sequence of 15 con~~c~~secutive *access slots* (AS), each of length 40 bit intervals. Each access slot consists of two parts, an *Acquisition-Indicator* (AI) part consisting of 32 real-valued symbols a_0, …, a_{31} and a~~n unused~~ part of duration 1024 chips with no transmission ~~consisting of 8 real-valued symbols a_{32}, …, a_{39}~~.

The phase reference for the AICH is the Primary CPICH.

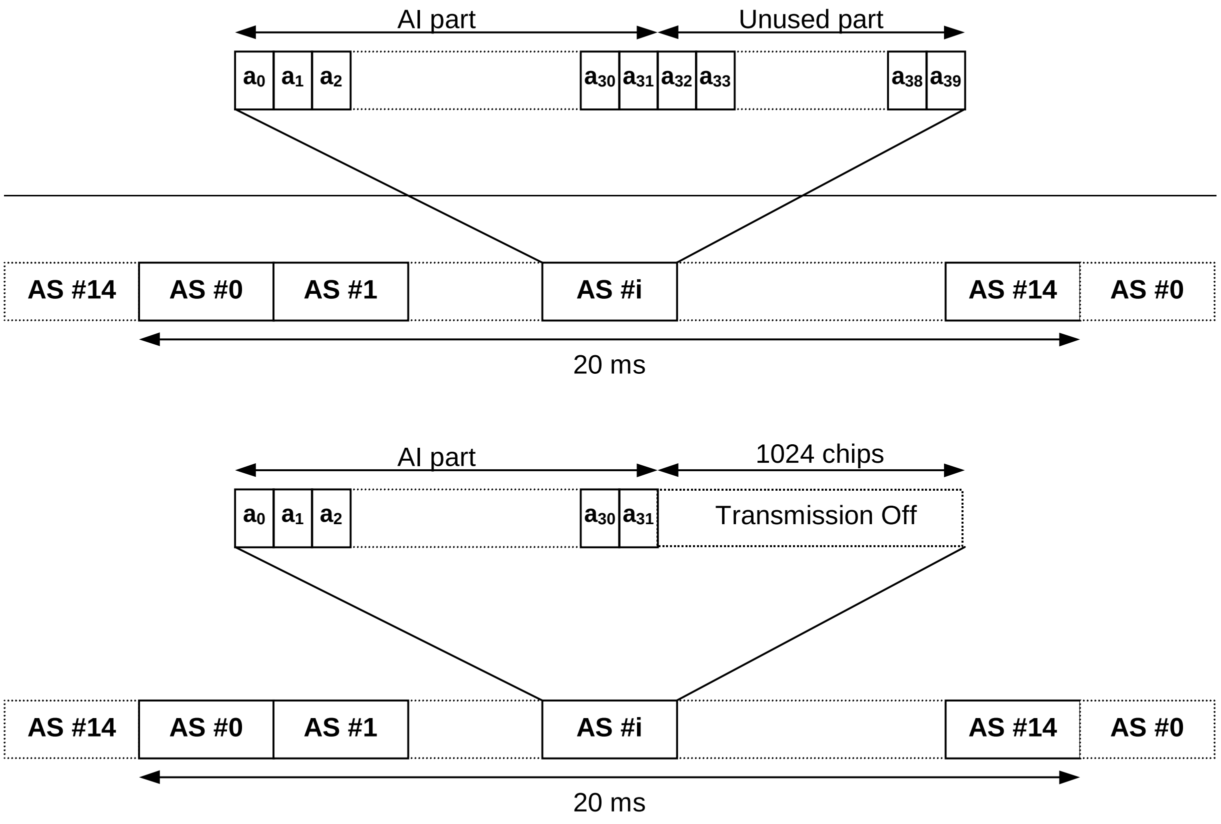


Figure 19: Structure of Acquisition Indicator Channel (AICH)

The real-valued symbols a_0, a_1, …, a_{31} in Figure 19 are given by

$$a_j = \sum_{s=0}^{15} AI_s b_{s,j}$$

where AI_s, taking the values +1, -1, and 0, is the acquisition indicator corresponding to signature s and the sequence $b_{s,0}$, …, $b_{s,31}$ is given by Table 20.

~~The real-valued symbols a_{32}, a_{33}, …, a_{39} in Figure 19 are undefined.~~

In case STTD-based open-loop transmit diversity is applied to AICH, STTD encoding according to section 5.3.1.1.1 is applied to each sequence $b_{s,0}$, $b_{s,1}$, ..., $b_{s,31}$ separately before the sequences are combined into AICH symbols a_0, …, a_{31}.

Table 20: AICH signature patterns

s	$b_{s,0}, b_{s,1}\ldots, b_{s,31}$
0	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1	1 1 -1 -1 1 1 -1 -1 1 1 -1 -1 1 1 -1 -1 1 1 -1 -1 1 1 -1 -1 1 1 -1 -1 1 1 -1 -1
2	1 1 1 1 -1 -1 -1 -1 1 1 1 1 -1 -1 -1 -1 1 1 1 1 -1 -1 -1 -1 1 1 1 1 -1 -1 -1 -1
3	1 1 -1 -1 -1 -1 1 1 1 1 -1 -1 -1 -1 1 1 1 1 -1 -1 -1 -1 1 1 1 1 -1 -1 -1 -1 1 1
4	1 1 1 1 1 1 1 1 -1 -1 -1 -1 -1 -1 -1 -1 1 1 1 1 1 1 1 1 -1 -1 -1 -1 -1 -1 -1 -1
5	1 1 -1 -1 1 1 -1 -1 -1 -1 1 1 -1 -1 1 1 1 1 -1 -1 1 1 -1 -1 -1 -1 1 1 -1 -1 1 1
6	1 1 1 1 -1 -1 -1 -1 -1 -1 -1 -1 1 1 1 1 1 1 1 1 -1 -1 -1 -1 -1 -1 -1 -1 1 1 1 1
7	1 1 -1 -1 -1 -1 1 1 -1 -1 1 1 1 1 -1 -1 1 1 -1 -1 -1 -1 1 1 -1 -1 1 1 1 1 -1 -1
8	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
9	1 1 -1 -1 1 1 -1 -1 1 1 -1 -1 1 1 -1 -1 -1 -1 1 1 -1 -1 1 1 -1 -1 1 1 -1 -1 1 1
10	1 1 1 1 -1 -1 -1 -1 1 1 1 1 -1 -1 -1 -1 -1 -1 -1 -1 1 1 1 1 -1 -1 -1 -1 1 1 1 1
11	1 1 -1 -1 -1 -1 1 1 1 1 -1 -1 -1 -1 1 1 -1 -1 1 1 1 1 -1 -1 -1 -1 1 1 1 1 -1 -1
12	1 1 1 1 1 1 1 1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 1 1 1 1 1 1 1 1
13	1 1 -1 -1 1 1 -1 -1 -1 -1 1 1 -1 -1 1 1 -1 -1 1 1 -1 -1 1 1 1 1 -1 -1 1 1 -1 -1
14	1 1 1 1 -1 -1 -1 -1 -1 -1 -1 -1 1 1 1 1 -1 -1 -1 -1 1 1 1 1 1 1 1 1 -1 -1 -1 -1
15	1 1 -1 -1 -1 -1 1 1 -1 -1 1 1 1 1 -1 -1 -1 -1 1 1 1 1 -1 -1 1 1 -1 -1 -1 -1 1 1

5.3.3.8 CPCH Status Indicator Channel (CSICH)

The CPCH Status Indicator Channel (CSICH) is a fixed rate (SF=256) physical channel used to carry CPCH status information.

A CSICH is always associated with a physical channel used for transmission of CPCH AP-AICH and uses the same channelization and scrambling codes. Figure 23 illustrates the frame structure of the CSICH. The CSICH frame consists of 15 consecutive access slots (AS) each of length 40 bits. Each access slot consists of two parts, a part of duration 4096 chips with no transmission, and a Status Indicator (SI) part consisting of 8 bits $b_{8i}, \ldots. b_{8i+7}$, where i is the access slot number. The modulation used by the CSICH is the same as for the PICH. The phase reference for the CSICH is the Primary CPICH.

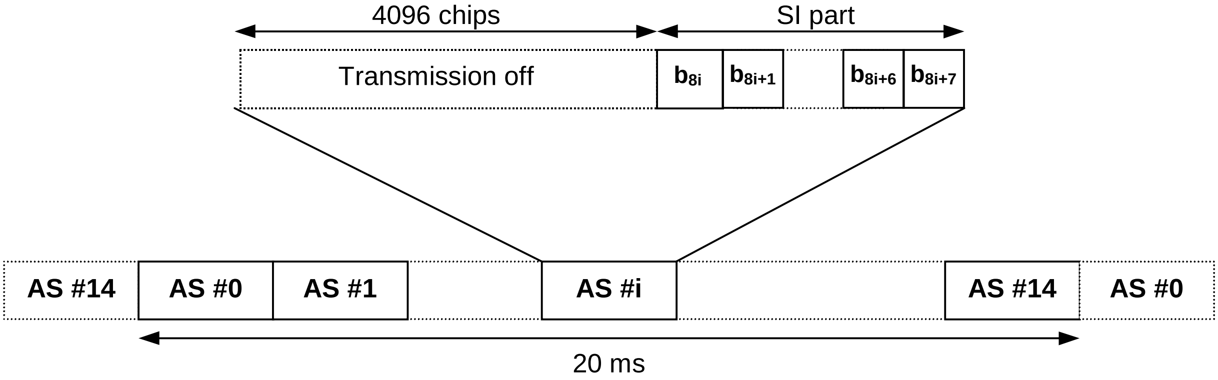


Figure 23: Structure of CPCH Status Indicator Channel (CSICH)

N Status Indicators $\{SI_0, \ldots, SI_{N-1}\}$ shall be transmitted in each CSICH frame. The mapping from $\{SI_0, \ldots, SI_{N-1}\}$ to the CSICH bits $\{b_0, \ldots, b_{119}\}$ is according to table 22. The Status Indicators shall be transmitted in all the access slots of the CSICH frame, even if some signatures and/or access slots are shared between CPCH and RACH.

Table 22: Mapping of Status Indicators (SI) to CSICH bits

Number of SI per frame (N)	$SI_n = 1$	$SI_n = 0$
N=1	$\{b_0, \ldots, b_{119}\} = \{1,1,\ldots,1\}$	$\{b_0, \ldots, b_{119}\} = \{0,0,\ldots,0\}$
N=3	$\{b_{40n}, \ldots, b_{40n+39}\} = \{1,1,\ldots,1\}$	$\{b_{40n}, \ldots, b_{40n+39}\} = \{0,0,\ldots,0\}$
N=5	$\{b_{24n}, \ldots, b_{24n+23}\} = \{1,1,\ldots,1\}$	$\{b_{24n}, \ldots, b_{24n+23}\} = \{0,0,\ldots,0\}$
N=15	$\{b_{8n}, \ldots, b_{8n+7}\} = \{1,1,\ldots,1\}$	$\{b_{8n}, \ldots, b_{8n+7}\} = \{0,0,\ldots,0\}$
N=30	$\{b_{4n}, \ldots, b_{4n+3}\} = \{1, 1, 1, 1\}$	$\{b_{4n}, \ldots, b_{4n+3}\} = \{0, 0, 0, 0\}$
N=60	$\{b_{2n}, b_{2n+1}\} = \{1,1\}$	$\{b_{2n}, b_{2n+1}\} = \{0,0\}$

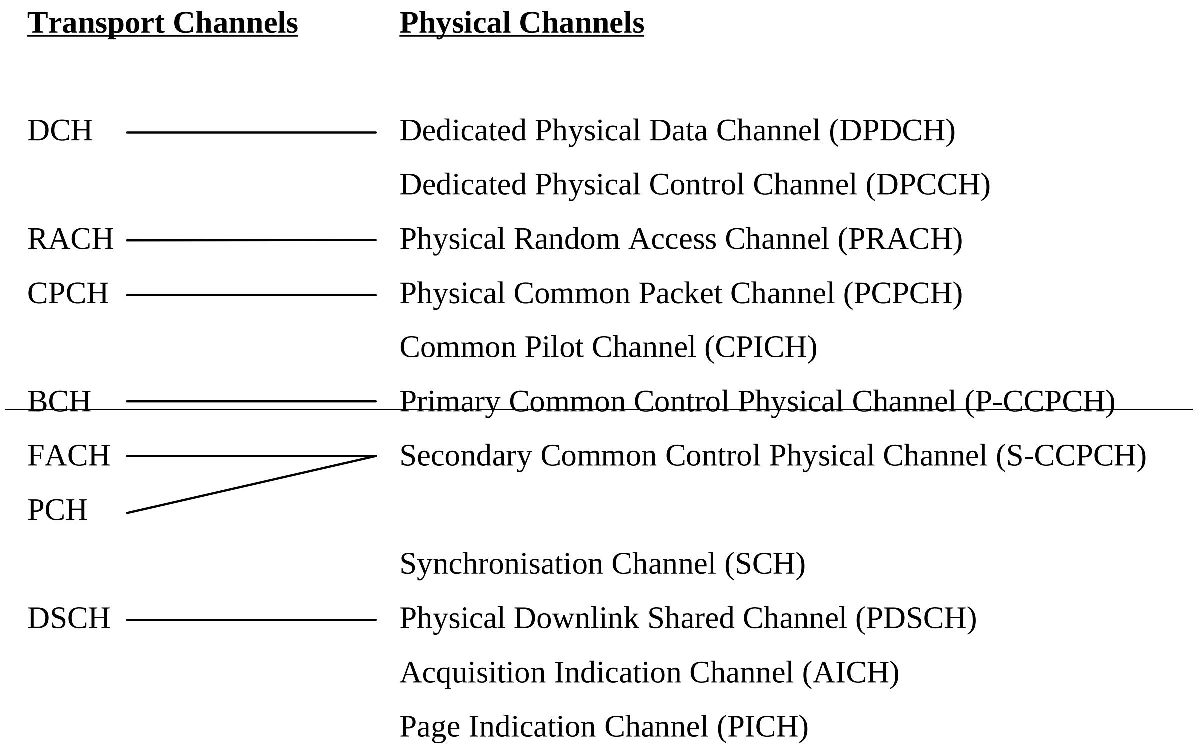
When transmit diversity is employed for the CSICH, STTD encoding is used on the CSICH bits as described in section 5.3.1.1.1.

At the UTRAN the values of the Status Indicators are set by higher layers.

At the UE the number of status indicators per frame is a higher layer parameter. The higher layers shall provide Layer 1 with the mapping between the values of the Status Indicators and the availability of CPCH resources .

6 Mapping of transport channels onto physical channels

Figure 21 summarises the mapping of transport channels onto physical channels.



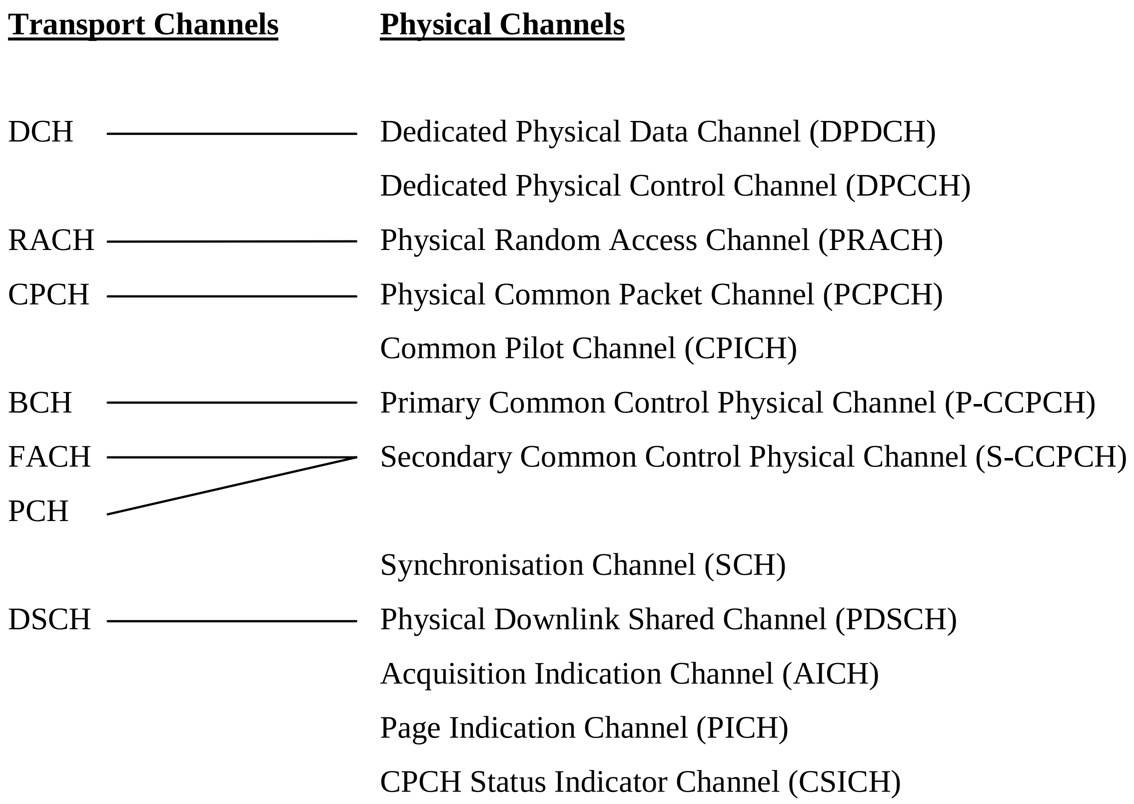


Figure 21: Transport-channel to physical-channel mapping

The DCHs are coded and multiplexed as described in [3] , and the resulting data stream is mapped sequentially (first-in-first-mapped) directly to the physical channel(s). The mapping of BCH and FACH/PCH is equally straightforward, where the data stream after coding and interleaving is mapped sequentially to the Primary and Secondary CCPCH respectively. Also for the RACH, the coded and interleaved bits are sequentially mapped to the physical channel, in this case the message part of the random access burst on the PRACH.

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document ***R1-000449***
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.211 **CR** **023r6.0** Current Version: 3.1.1

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ ↑ *CR number as allocated by MCC support team*

For submission to: RAN#7
list expected approval meeting # here
↑

for approval ☒
for information ☐

strategic ☐
non-strategic ☐
(for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM ☐ ME ☐ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: TSG RAN WG1 **Date:** Mar 2, 2000

Subject: **CPCH-related editorial changes, technical changes and additions to 25.211 and some clarifications to 7.4 PCPCH/AICH timing relation.**

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction	☒
A	Corresponds to a correction in an earlier release	☐
B	Addition of feature	☐
C	Functional modification of feature	☐
D	Editorial modification	☐

Release:

Phase 2	☐
Release 96	☐
Release 97	☐
Release 98	☐
Release 99	☒
Release 00	☐

Reason for change:
1. Some editorial changes
2. Correction to section 7.4

Clauses affected: 3.3, 5.2.2.2.1, 5.2.2.2.4, 5.2.2.2.5, 5.3.2.3, 7.4

Other specs affected:

Other 3G core specifications	☐	→ List of CRs:
Other GSM core specifications	☐	→ List of CRs:
MS test specifications	☐	→ List of CRs:
BSS test specifications	☐	→ List of CRs:
O&M specifications	☐	→ List of CRs:

Other comments:

3 Abbreviations

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

AI	Acquisition Indicator
AICH	Acquisition Indicator Channel
AP	Access Preamble
BCH	Broadcast Channel
CCPCH	Common Control Physical Channel
CCTrCH	Coded Composite Transport Channel
CD	Collision Detection
CPCH	Common Packet Channel
CPICH	Common Pilot Channel
DCH	Dedicated Channel
DPCCH	Dedicated Physical Control Channel
DPCH	Dedicated Physical Channel
DPDCH	Dedicated Physical Data Channel
DSCH	Downlink Shared Channel
DSMA-CD	Digital Sense Multiple Access – Collison Detection
DTX	Discontinuous Transmission
FACH	Forward Access Channel
FBI	Feedback Information
MUI	Mobile User Identifier
PCH	Paging Channel
P-CCPCH	Primary Common Control Physical Channel
PCPCH	Physical Common Packet Channel
PDSCH	Physical Downlink Shared Channel
PI	Page Indicator
PICH	Page Indicator Channel
PRACH	Physical Random Access Channel
PSC	Primary Synchronisation Code
RACH	Random Access Channel
RNC	Radio Network Controller
S-CCPCH	Secondary Common Control Physical Channel
SCH	Synchronisation Channel
SF	Spreading Factor
SFN	System Frame Number
SSC	Secondary Synchronisation Code
STTD	Space Time Transmit Diversity
TFCI	Transport Format Combination Indicator
TSTD	Time Switched Transmit Diversity
TPC	Transmit Power Control
UE	User Equipment
UTRAN	UMTS Terrestrial Radio Access Network

5.2.2.2.1 CPCH transmission

The CPCH transmission is based on DSMA-CD approach with fast acquisition indication. The UE can start transmission at the beginning of a number of well-defined time-intervals, relative to the frame boundary of the received BCH of the current cell. The access slot timing and structure is identical to RACH in section 5.2.2.1.1. The structure of the CPCH ~~random~~ access transmission is shown in figure 6. The PCPCH ~~random~~ access transmission consists of one or several Access Preambles [A-P] of length 4096 chips, one Collision Detection Preamble (CD-P) of length 4096 chips, a DPCCH Power Control Preamble (PC-P) which is either 0 slots or 8 slots in length, and a message of variable length Nx10 ms.

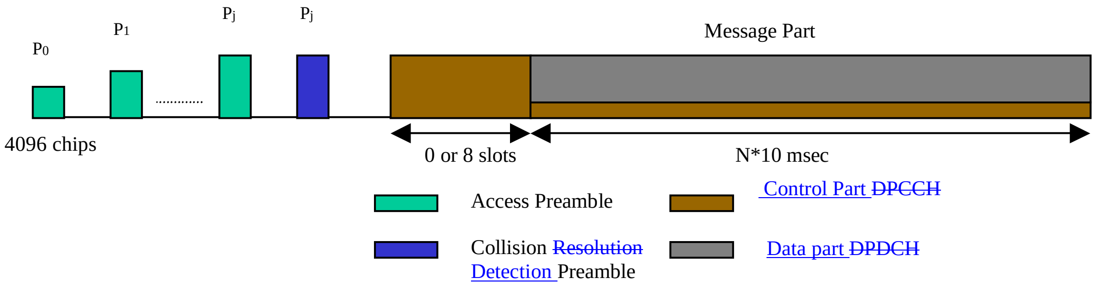


Figure 6: Structure of the CPCH ~~random~~ access transmission

5.2.2.2.4 CPCH power control preamble part

The power control preamble segment is called the ~~a~~ ~~DPCCH~~ CPCH Power Control Preamble (PC-P) part. The following table 9 is identical to Rows 2 and 4 of table 2 in section 5.2.1. Table 9 defines the DPCCH fields which only include Pilot, FBI and TPC bits. The Power Control Preamble length is a parameter which shall take the values 0 or 8 slots, as set by the higher layers.

Table 9: DPCCH fields for CPCH power control preamble segment

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{pilot}	N_{TFCI}	N_{FBI}	N_{TPC}
0	15	15	256	150	10	8	0	0	2
1	15	15	256	150	10	7	0	1	2

5.2.2.2.5 CPCH message part

Figure 1in section 5.2.1 shows the structure of the CPCH message part. Each message consists of up to N_Max_frames 10 ms frames. N_Max_frames is a higher layer parameter. Each 10 ms frame is split into 15 slots, each of length T_{slot} = 2560 chips. Each slot consists of two parts, a data part that carries higher layer information and a control part that carries Layer 1 control information. The data and control parts are transmitted in parallel.

Figure xxx shows the frame structure of the uplink common packet physical channel. Each frame of length 10 ms is split into 15 slots, each of length T_{slot} = 2560 chips, corresponding to one power-control period.

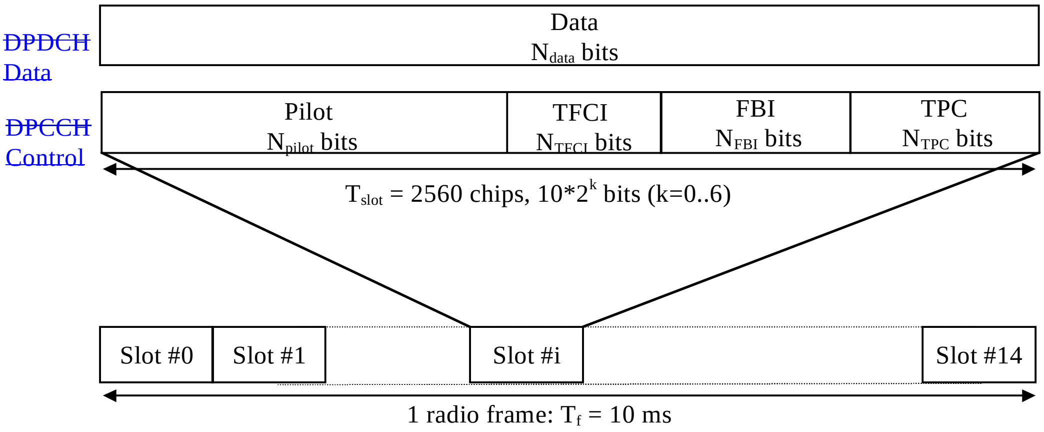


Figure xxx: Frame structure for uplink Data and Control Parts Associated with PCPCH

The data part consists of $10*2^k$ bits, where k = 0, 1, 2, 3, 4, 5, 6, corresponding to spreading factors of 256, 128, 64, 32, 16, 8, 4 respectively. ~~Note that various rates might be mapped to different signature sequences.~~

~~The spreading factor for the UL-DPCCHmessage control part is 256. The entries in table 1 corresponding to spreading factors of 256 and below and table 2 [both in section 5.2.1] apply to the DPDCH and DPCCH fields respectively for theCPCH message~~ part.

The entries of table 1 in section 5.2.1 apply to the data part of the CPCH message part. The spreading factor for the control part of the CPCH message part shall be 256. The slot format of the control part of CPCH message part shall be the same as the control part of CPCH PC-P. The pilot bit patterns of table 3 and 4 in section 5.2.1 shall be used for pilot bit patterns of the CPCH message part.

5.3.2.3 DL-DPCCH for CPCH

The spreading factor for the PCPCH message control part ~~UL-DPCCH (message control part)~~ is 256. The spreading factor for the DL-DPCCH (message control part) is 512. The following table 15 shows the DL-DPCCH fields (message control part) which are identical to the first row of table 11 in section 5.3.2.

Table 15: DPDCH and DPCCH fields for CPCH message transmission

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/Frame			Bits/ Slot	DPDCH Bits/Slot		DPCCH Bits/Slot		
				DPDCH	DPCCH	TOT		N_{Data1}	N_{Data2}	N_{TFCI}	N_{TPC}	N_{Pilot}
0	15	7.5	512	60	90	150	10	~~2~~0	~~2~~4	0	2	4

7.4 PCPCH/AICH timing relation

~~Transmission of random access bursts on the PCPCH is aligned with access slot times. The timing of the access slots is derived from the received Primary CCPCH timing The transmit timing of access slot n starts n×20/15 ms after the frame boundary of the received Primary CCPCH, where n = 0, 1, …,14. In addition, transmission of access preambles in PCPCH is limited to the allocated access slot subchannel group which is assigned by higher layer signalling to each CPCH set. Twelve access slot subchannels are defined and PCPCH may be allocated all subchannel slots or any subset of the twelve subchannel slots. The access slot subchannel identification is identical to that for the RACH and is described in table 6 of section 6.1 of [5]. Everything in the previous section [PRACH/AICH] applies to this section as well.~~ 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-~~A~~ICH is identical to RACH Preamble and AICH. The timing relationship between CD-~~A~~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-~~A~~ICH.

$\tau_{p\text{-}p}$ = Time to next available access slot, between Access Preambles.

Minimum time = 15360 chips + 5120 chips X Tcpch

Maximum time = 5120 chips X 12 = 61440 chips

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

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

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

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

$\tau_{cdp\text{-}a2}$ = Time between the CD Preamble and the CD-~~A~~ICH has two alternative values: 7680 chips or 12800 chips, depending on T_{cpch}

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

The 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 25 illustrates the PCPCH/AICH timing relationship whenT_{cpch} is set to 0 and all access slot subchannels are available for PCPCH.

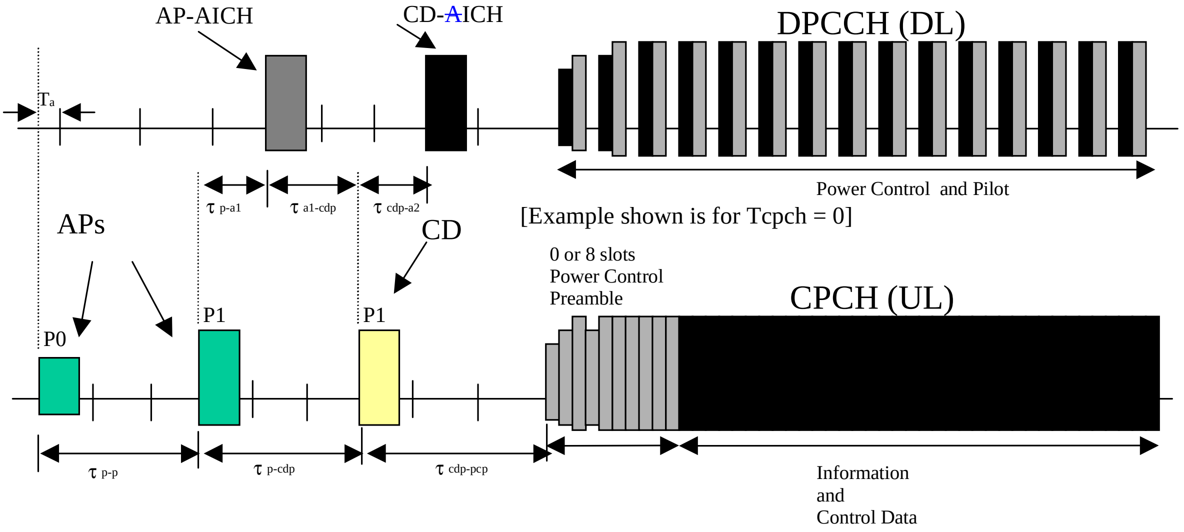


Figure 25: Timing of PCPCH and AICH transmission as seen by the UE, with T_{cpch}= 0

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document R1-00-0130
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.211 CR 024r1 Current Version: 3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-RAN #7	for approval	☒	strategic	☐	(for SMG use only)
list expected approval meeting # here ↑	for information	☐	non-strategic	☐	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: TSG RAN WG1 **Date:** 2000-01-11

Subject: Additional description of TX diversity for PDSCH

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction	☐	**Release:**	Phase 2	☐
A	Corresponds to a correction in an earlier release	☐		Release 96	☐
B	Addition of feature	☒		Release 97	☐
C	Functional modification of feature	☐		Release 98	☐
D	Editorial modification	☐		Release 99	☒
				Release 00	☐

Reason for change: The Change Request clarifies that associated PDSCH and DPCH must use the same TX diversity scheme.

Clauses affected: 5.3.1

Other specs affected:

Other 3G core specifications	☒	→ List of CRs:	25.214 CR 047
Other GSM core specifications	☐	→ List of CRs:	
MS test specifications	☐	→ List of CRs:	
BSS test specifications	☐	→ List of CRs:	
O&M specifications	☐	→ List of CRs:	

Other comments:

5.3.1 Downlink Transmit Diversity

Table 10 summarizes the possible application of open and closed loop t~~T~~ransmit diversity modes on different downlink physical channels. Simultaneous use of STTD and closed loop modes on DPCH and PDSCH is not allowed. 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. During the duration of the PDSCH frame, and within the slot prior to the PDSCH frame, the transmit diversity mode (open loop or closed loop) on the associated DPCH may not change. However, changing from closed loop mode 1 to mode 2 or vice versa, is allowed.

Table 10: Application of Tx diversity modes on downlink physical channels "X" – can be applied, "–" – not applied

Channel	Open loop mode		Closed loop Mode
	TSTD	STTD	
P-CCPCH	–	X	–
SCH	X	–	–
S-CCPCH	–	X	–
DPCH	–	X	X
PICH	–	X	–
PDSCH (associated with DPCH)	–	X	X
AICH	–	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. A block diagram of a generic STTD encoder for channel bits b_0, b_1, b_2, b_3 is shown in the figure 7 below. 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.

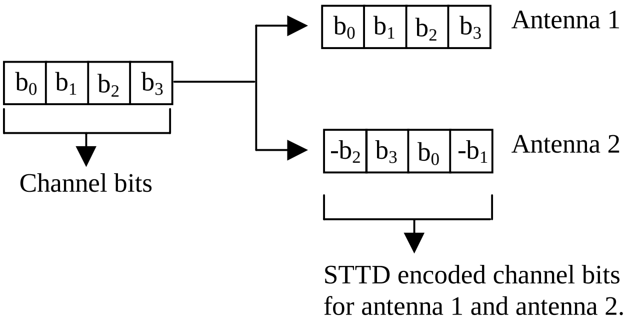


Figure 7: Generic block diagram of the STTD encoder

5.3.1.1.2 Time Switched Transmit Diversity for SCH (TSTD)

Transmit diversity, in the form of Time Switched Transmit Diversity (TSTD), can be applied to the SCH. TSTD for the SCH is optional in UTRAN, while TSTD support is mandatory in the UE. TSTD for the SCH is described in sub-clause 5.3.3.4.1.

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document R1-00-0118
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.211 CR 025r1 Current Version: 3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-RAN #7	for approval	☒	strategic	☐	*(for SMG use only)*
list expected approval meeting # here ↑	for information	☐	non-strategic	☐	

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: TSG RAN WG1 **Date:** 2000-01-18

Subject: Consistent numbering of scrambling code groups

Work item:

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

Reason for change: The numbering of scrambling code groups (from 1 to 64) in section 5.3.3.4 is not consistent with the numbering used in TS 25.213 (from 0 to 63).

In the last paragraph of 5.3.3.4, figure 16 should be referred to instead of figure 17.

Clauses affected: 5.3.3.4

Other specs affected:	Other 3G core specifications	☐	→ List of CRs:
	Other GSM core specifications	☐	→ List of CRs:
	MS test specifications	☐	→ List of CRs:
	BSS test specifications	☐	→ List of CRs:
	O&M specifications	☐	→ List of CRs:

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR

5.3.3.4 Synchronisation Channel (SCH)

The Synchronisation Channel (SCH) is a downlink signal used for cell search. The SCH consists of two sub channels, the Primary and Secondary SCH. The 10 ms radio frames of the Primary and Secondary SCH are divided into 15 slots, each of length 2560 chips. Figure 16 illustrates the structure of the SCH radio frame.

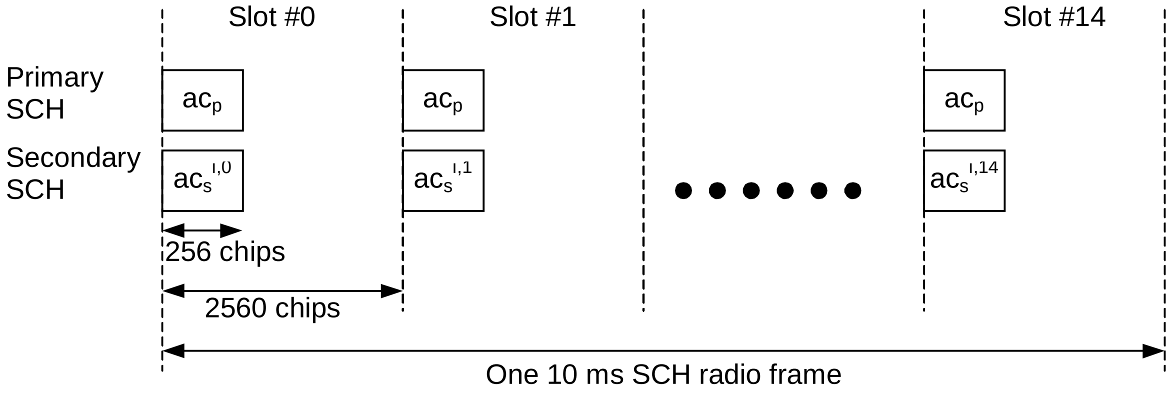


Figure 16: Structure of Synchronisation Channel (SCH)

The Primary SCH consists of a modulated code of length 256 chips, the Primary Synchronisation Code (PSC) denoted c_p in figure 16, transmitted once every slot. The PSC is the same for every cell in the system.

The Secondary SCH consists of repeatedly transmitting a length 15 sequence of modulated codes of length 256 chips, the Secondary Synchronisation Codes (SSC), transmitted in parallel with the Primary SCH. The SSC is denoted $c_s^{i,k}$ in figure 17, where i = ~~1~~0, ~~2~~1, …, ~~64~~ 63 is the number of the scrambling code group, and k = 0, 1, …, 14 is the slot number. Each SSC is chosen from a set of 16 different codes of length 256. This sequence on the Secondary SCH indicates which of the code groups the cell's downlink scrambling code belongs to.

The primary and secondary synchronization codes are modulated by the symbol *a* shown in figure ~~17~~16, which indicates the presence/ absence of STTD encoding on the P-CCPCH and is given by the following table:

P-CCPCH STTD encoded	a = +1
P-CCPCH not STTD encoded	a = -1

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document ***R1-00-0038***
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.211 CR 026 Current Version: 3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-RAN #7
list expected approval meeting # here ↑

for approval	☒	strategic	☐
for information	☐	non-strategic	☐

(for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: TSG RAN WG1 **Date:** 2000-01-12

Subject: Minor corrections to timing section

Work item:

Category:
(only one category shall be marked with an X)

F	Correction	☒	
A	Corresponds to a correction in an earlier release	☐	
B	Addition of feature	☐	
C	Functional modification of feature	☐	
D	Editorial modification	☐	

Release:

Phase 2	☐
Release 96	☐
Release 97	☐
Release 98	☐
Release 99	☒
Release 00	☐

Reason for change:

- In section 7.1, in figure 23, it says "PICH for n:th S-CCPCH". Since the corresponding S-CCPCH is called "k:th S-CCPCH", it is more correct to write "PICH for k:th S-CCPCH".
- In section 7.3, the preamble-to-message distance is incorrectly denoted $\tau_{p\text{-}a}$. The correct notation is $\tau_{p\text{-}m}$.

Clauses affected: 7.1, 7.3

Other specs affected:

Other 3G core specifications	☐	→ List of CRs:
Other GSM core specifications	☐	→ List of CRs:
MS test specifications	☐	→ List of CRs:
BSS test specifications	☐	→ List of CRs:
O&M specifications	☐	→ List of CRs:

Other comments:

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 22 below describes the frame timing of the downlink physical channels. For the AICH the access slot timing is included. Timing for uplink physical channels is given by the downlink timing, as described in the following sections.

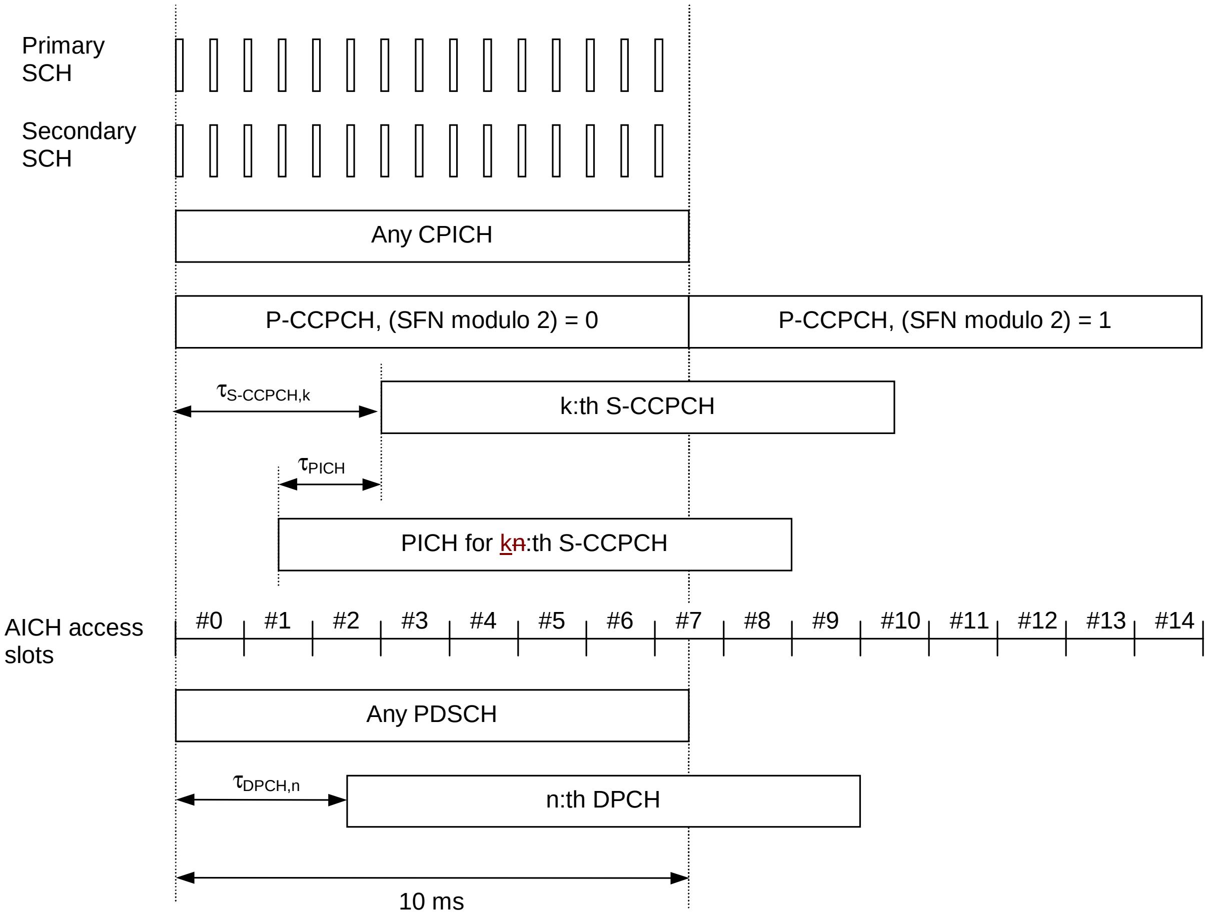


Figure 22: Frame timing and access slot timing of downlink physical channels

In figure 22 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. $\tau_{S\text{-}CCPCH,k} = T_k \times 256$ chip, $T_k \in \{0, 1, \ldots, 149\}$.
- The PICH timing is τ_{PICH} = 7680 chips prior to its corresponding S-CCPCH frame timing. The PICH timing relation to the S-CCPCH is described more in section 7.2.
- The AICH access slot #0 starts the same time as a P-CCPCH frame with (SFN modulo 2) = 0. The AICH/PRACH and AICH/PCPCH timing is described in sections 7.3 and 7.4 respectively.
- The PDSCH timing relative the DPCH timing is described in section 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. $\tau_{DPCH,n} = T_n \times 256$ chip, $T_n \in \{0, 1, \ldots, 149\}$. The DPCH (DPCCH/DPDCH) timing relation with uplink DPCCH/DPDCHs is described in section 7.6.

7.2 PICH/S-CCPCH timing relation

Figure 23 illustrates the timing between a PICH frame and its associated S-CCPCH 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 section 7.1.

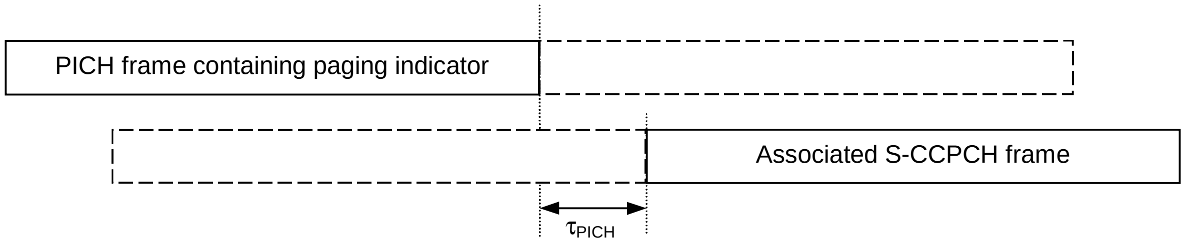


Figure 23: Timing relation between PICH frame and associated S-CCPCH frame

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 section 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 τ_{p-a} chips prior to the reception of downlink access slot number *n*, *n* = 0, 1, …, 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 24.

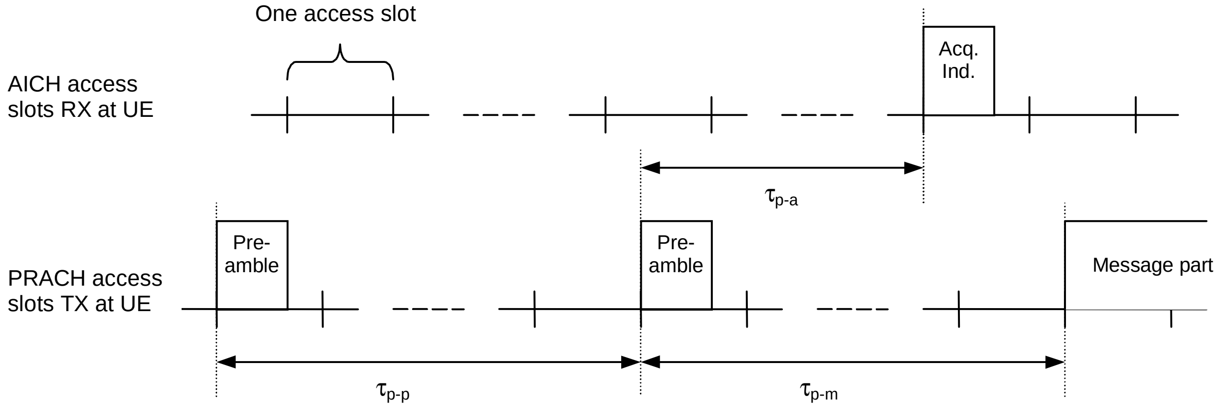


Figure 24: Timing relation between PRACH and AICH as seen at the UE

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

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

- when AICH_Transmission_Timing is set to 0, then

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

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

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

- when AICH_Transmission_Timing is set to 1, then

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

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

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

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document ***R1-00-0239***
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.211 **CR** **028r1** Current Version: 3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-RAN #7
list expected approval meeting # here ↑

for approval ☒
for information ☐

strategic ☐
non-strategic ☐
(for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: TSG RAN WG1 **Date:** 2000-02-21

Subject: Timing of PDSCH

Work item:

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

Reason for change: The relative timing between the start of a DPCH frame and the associated PDSCH frame should be increased in order to lower the complexity of the terminal.

Clauses affected: 7.5

Other specs affected:	Other 3G core specifications	☐	→ List of CRs:
	Other GSM core specifications	☐	→ List of CRs:
	MS test specifications	☐	→ List of CRs:
	BSS test specifications	☐	→ List of CRs:
	O&M specifications	☐	→ List of CRs:

Other comments:

7.5 DPCH/PDSCH timing

The relative timing between a DPCH frame and the associated PDSCH frame is shown in figure 28.

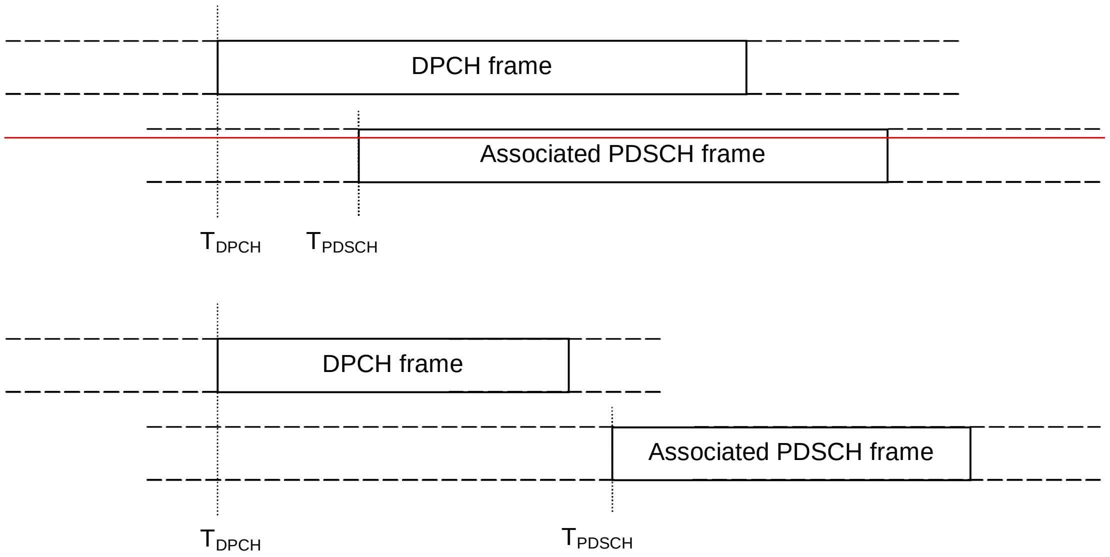


Figure 28: Timing relation between DPCH frame and associated PDSCH frame

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~~ -35840 chips < T_{DPCH} – T_{PDSCH} ≤ 2560 chips~~ 46080 chips ≤ T_{PDSCH} - T_{DPCH} < 84480 chips, i.e. the associated PDSCH frame starts anywhere between three slot after the end of the DPCH frame~~1 slot before or~~ up to 18~~4~~ slots behind the end of the DPCH frame.

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document ***R1-00-0216***
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.211 **CR** **029r1** Current Version: V 3.1.1

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: WG1 # 11
list expected approval meeting # here ↑

for approval ☒
for information ☐

strategic ☐
non-strategic ☐
(for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM ☐ ME ☐ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: TSG RAN WG1 **Date:** 24 Feb 2000

Subject: Modifications to STTD text

Work item: TS 25.211

Category:
(only one category shall be marked with an X)

F Correction ☐
A Corresponds to a correction in an earlier release ☐
B Addition of feature ☐
C Functional modification of feature ☐
D Editorial modification ☒

Release:

Phase 2 ☐
Release 96 ☐
Release 97 ☐
Release 98 ☐
Release 99 ☒
Release 00 ☐

Reason for change: Better readability and notation for STTD description

Clauses affected: 5.3.2.1

Other specs affected:

Other 3G core specifications ☐ → List of CRs:
Other GSM core specifications ☐ → List of CRs:
MS test specifications ☐ → List of CRs:
BSS test specifications ☐ → List of CRs:
O&M specifications ☐ → List of CRs:

Other comments:

<--------- double-click here for help and instructions on how to create a CR.

5.3.2.1 STTD for DPCH

The pilot bit pattern for the DPCH channel transmitted on the diversity antenna is given in table 14. ~~The shadowed part indicates pilot bits that are STTD encoded from the corresponding (shadowed) bits in Table 12. For the SF=256 DPCH, if there are only two dedicated pilot bits (N_{pilot} = 2 in Tables 12 and 14), they are STTD encoded together with the last two bits (data or DTX) of the second data field (data2) of the slot.~~

- For N_{pilot} = 8, 16 the shadowed part indicates pilot bits that are obtained by STTD encoding the corresponding (shadowed) bits in Table 12. The non-shadowed pilot bit pattern is orthogonal to the corresponding (non-shadowed) pilot bit pattern in table 12.

- For N_{pilot} = 4, the diversity antenna pilot bit pattern is obtained by STTD encoding both the shadowed and non-shadowed pilot bits in table 12.

- For N_{pilot} = 2, the diversity antenna pilot pattern is obtained by STTD encoding the two pilot bits in table 12 with the last two bits (data or DTX) of the second data field (data2) of the slot. Thus for N_{pilot} = 2 case, the last two bits of the second data field (data 2) after STTD encoding, follow the diversity antenna pilot bits in Table 14.

STTD encoding for the DPDCH, TPC, and TFCI fields is done as described in section 5.3.1.1.1. For the SF=512 DPCH, the first two bits in each slot, i.e. TPC bits, are not STTD encoded and the same bits are transmitted with equal power from the two antennas. The ~~following~~ remaining four bits are STTD encoded.

Table 14: Pilot pattern of the DPCH channel for the diversity antenna using STTD

	N_{pilot} = 2	N_{pilot} = 4		N_{pilot} = 8				N_{pilot} = 16							
Symbol #	0	0	1	0	1	2	3	0	1	2	3	4	5	6	7
Slot #0	01	01	10	11	00	00	10	11	00	00	10	11	00	00	10
1	10	10	10	11	00	00	01	11	00	00	01	11	10	00	10
2	11	11	10	11	11	00	00	11	11	00	00	11	10	00	11
3	10	10	10	11	10	00	01	11	10	00	01	11	00	00	00
4	00	00	10	11	11	00	11	11	11	00	11	11	01	00	10
5	01	01	10	11	00	00	10	11	00	00	10	11	11	00	00
6	01	01	10	11	10	00	10	11	10	00	10	11	01	00	11
7	00	00	10	11	10	00	11	11	10	00	11	11	10	00	11
8	11	11	10	11	00	00	00	11	00	00	00	11	01	00	01
9	01	01	10	11	01	00	10	11	01	00	10	11	01	00	01
10	11	11	10	11	11	00	00	11	11	00	00	11	00	00	10
11	00	00	10	11	01	00	11	11	01	00	11	11	00	00	01
12	00	00	10	11	10	00	11	11	10	00	11	11	11	00	00
13	10	10	10	11	01	00	01	11	01	00	01	11	10	00	01
14	10	10	10	11	01	00	01	11	01	00	01	11	11	00	11

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document ***R1-00-0429***
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.211 **CR** **031r4** Current Version: 3.1.1

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-RAN #7
list expected approval meeting # here ↑

for approval	☒	strategic	☐	*(for SMG use only)*
for information	☐	non-strategic	☐	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: TSG RAN WG1 **Date:** 28-Feb-2000

Subject: CD/CA-ICH for dual mode CPCH

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction	☐
A	Corresponds to a correction in an earlier release	☐
B	Addition of feature	☒
C	Functional modification of feature	☐
D	Editorial modification	☐

Release:

Phase 2	☐
Release 96	☐
Release 97	☐
Release 98	☐
Release 99	☒
Release 00	☐

Reason for change: For dual mode CPCH, the CD/CA-ICH is used instead of CD-ICH. In UE channel selection method, only the CD indicator is transmitted by CD/CA-ICH. On the other hand, both of the CD and CA indicators are transmitted by CD/CA-ICH for channel assignment method.

Clauses affected: 3, 5.3.3.6 ~ 5.3.3.9 of TS25.211

Other specs affected:

Other 3G core specifications	☐	→ List of CRs:	
Other GSM core specifications	☐	→ List of CRs:	
MS test specifications	☐	→ List of CRs:	
BSS test specifications	☐	→ List of CRs:	
O&M specifications	☐	→ List of CRs:	

Other comments:

<--------- double-click here for help and instructions on how to create a CR.

1 Scope

The present document describes the characteristics of the Layer 1 transport channels and physicals channels in the FDD mode of UTRA. The main objectives of the document are to be a part of the full description of the UTRA Layer 1, and to serve as a basis for the drafting of the actual technical specification (TS).

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] 3G TS 25.201: "Physical layer - general description"

[2] 3G TS 25.211: "Physical channels and mapping of transport channels onto physical channels (FDD)"

[3] 3G TS 25.212: "Multiplexing and channel coding (FDD)"

[4] 3G TS 25.213: "Spreading and modulation (FDD)"

[5] 3G TS 25.214: "Physical layer procedures (FDD)"

[6] 3G TS 25.221: "Transport channels and physical channels (TDD)"

[7] 3G TS 25.222: "Multiplexing and channel coding (TDD)"

[8] 3G TS 25.223: "Spreading and modulation (TDD)"

[9] 3G TS 25.224: "Physical layer procedures (TDD)"

[10] 3G TS 25.231: "Measurements"

[11] 3G TS 25.301: "Radio Interface Protocol Architecture"

[12] 3G TS 25.302: "Services Provided by the Physical Layer"

[13] 3G TS 25.401: "UTRAN Overall Description"

3 Abbreviations

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

AI	Acquisition Indicator
AICH	Acquisition Indicator Channel
AP	Access Preamble
AP-AICH	Access Preamble Acquisition Indicator Channel
API	Access Preamble Indicator
BCH	Broadcast Channel
CA	Channel Assignment
CAI	Channel Assignment Indicator
CCPCH	Common Control Physical Channel
CCTrCH	Coded Composite Transport Channel
CD	Collision Detection

CD/CA-ICH	Collision Detection/Channel Assignment Indicator Channel
CDI	Collision Detection Indicator
CPCH	Common Packet Channel
CPICH	Common Pilot Channel
DCH	Dedicated Channel
DPCCH	Dedicated Physical Control Channel
DPCH	Dedicated Physical Channel
DPDCH	Dedicated Physical Data Channel
DSCH	Downlink Shared Channel
DTX	Discontinuous Transmission
FACH	Forward Access Channel
FBI	Feedback Information
MUI	Mobile User Identifier
PCH	Paging Channel
P-CCPCH	Primary Common Control Physical Channel
PCPCH	Physical Common Packet Channel
PDSCH	Physical Downlink Shared Channel
PI	Page Indicator
PICH	Page Indicator Channel
PRACH	Physical Random Access Channel
PSC	Primary Synchronisation Code
RACH	Random Access Channel
RNC	Radio Network Controller
S-CCPCH	Secondary Common Control Physical Channel
SCH	Synchronisation Channel
SF	Spreading Factor
SFN	System Frame Number
SSC	Secondary Synchronisation Code
STTD	Space Time Transmit Diversity
TFCI	Transport Format Combination Indicator
TSTD	Time Switched Transmit Diversity
TPC	Transmit Power Control
UE	User Equipment
UTRAN	UMTS Terrestrial Radio Access Network

A DSCH may be mapped to multiple parallel PDSCHs as well, as negotiated at higher layer prior to starting data transmission. In such a case the parallel PDSCHs shall be operated with frame synchronization between each other.

Table 19: PDSCH fields

Slot format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{data}
0	30	15	256	300	20	20
1	60	30	128	600	40	40
2	120	60	64	1200	80	80
3	240	120	32	2400	160	160
4	480	240	16	4800	320	320
5	960	480	8	9600	640	640
6	1920	960	4	19200	1280	1280

When transmit diversity is employed for the PDSCH, STTD encoding is used on the data bits as described in section 5.3.1.1.1.

5.3.3.6 Acquisition Indicator Channel (AICH)

The Acquisition Indicator channel (AICH) is a physical channel used to carry Acquisition Indicators (AI). Acquisition Indicator AI_s corresponds to signature s on the PRACH.~~ or PCPCH. Note that for PCPCH, the AICH either corresponds to an access preamble or a CD preamble. The AICH corresponding to the access preamble is an AP-AICH and the AICH corresponding to the CD preamble is a CD-AICH. The AP-AICH and CD-AICH use different channelization codes, see further[4], Section 4.3.3.2.~~

Figure 19 illustrates the structure of the AICH. The AICH consists of a repeated sequence of 15 concecutive *access slots* (AS), each of length 40 bit intervals. Each access slot consists of two parts, an *Acquisition-Indicator* (AI) part consisting of 32 real-valued symbols a_0, …, a_{31} and an unused part consisting of 8 real-valued symbols a_{32}, …, a_{39}.

The phase reference for the AICH is the Primary CPICH.

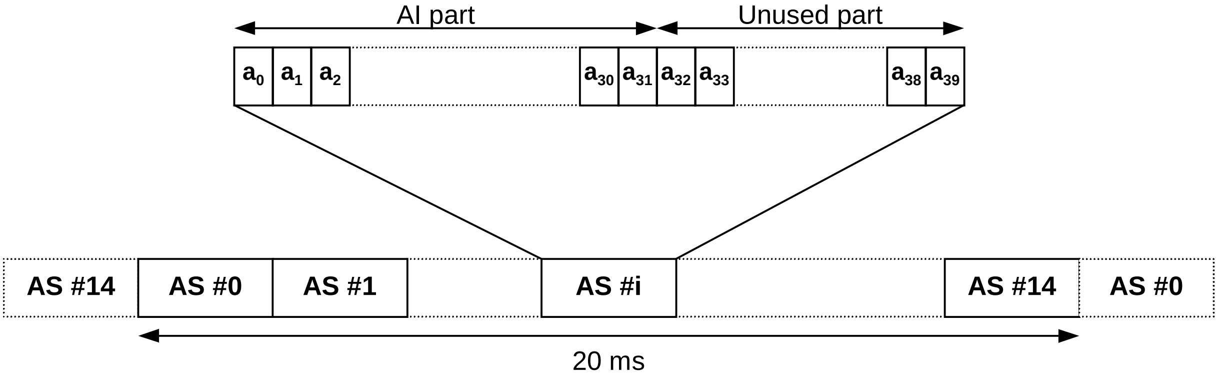


Figure 19: Structure of Acquisition Indicator Channel (AICH)

The real-valued symbols a_0, a_1, …, a_{31} in Figure 19 are given by

$$a_j = \sum_{s=0}^{15} AI_s \times b_{s,j}$$

where AI_s, taking the values +1, -1, and 0, is the acquisition indicator corresponding to signature s and the sequence $b_{s,0}$, …, $b_{s,31}$ is given by Table 20.

The real-valued symbols a_{32}, a_{33}, …, a_{39} in Figure 19 are undefined.

In case STTD-based open-loop transmit diversity is applied to AICH, STTD encoding according to section 5.3.1.1.1 is applied to each sequence $b_{s,0}$, $b_{s,1}$, ..., $b_{s,31}$ separately before the sequences are combined into AICH symbols a_0, …, a_{31}.

Table 20: AICH signature patterns

s	$b_{s,0}$, $b_{s,1}$…, $b_{s,31}$																														
0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1
2	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1
3	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1
4	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1
5	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1
6	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1
7	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
9	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1
10	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1
11	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1
12	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1
13	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1
14	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	1	1	1	1	-1	-1	-1	-1
15	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1

5.3.3.7 CPCH Access Preamble Acquisition Indicator Channel (AP-AICH)

The Access Preamble Acquisition Indicator channel (AP-AICH) is a physical channel used to carry AP acquisition indicators (API) of CPCH. AP acquisition indicator API corresponds to AP signature *s* transmitted by UE.

AP-AICH and AICH may use the same or different channelisation codes. The phase reference for the AP-AICH is the Primary CPICH. Figure 20 illustrates the structure of AP-AICH. The AP-AICH has a part of duration of 4096chips where the AP acquisition indicator (API) is transmitted, followed by a part of duration 1024chips with no transmission.

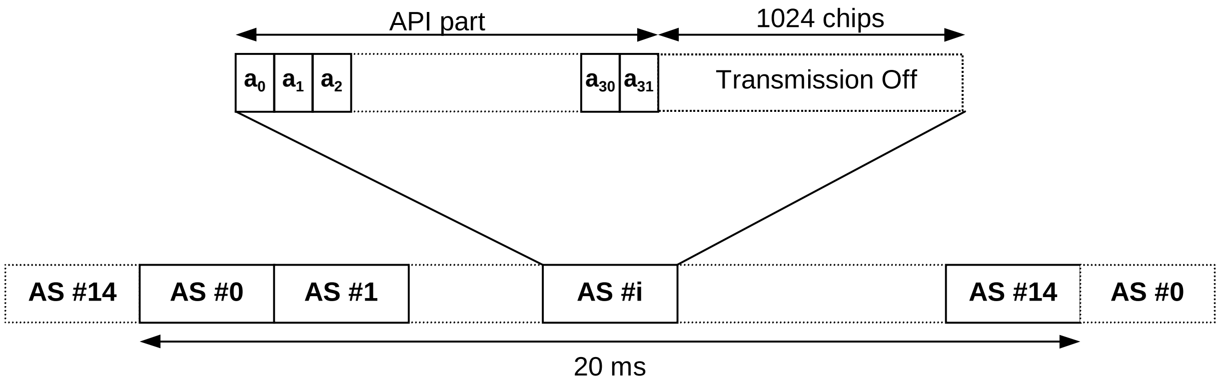


Figure 20: Structure of AP Acquisition Indicator Channel (AP-AICH)

The real-valued symbols a_0, a_1, …, a_{31} in Figure 20 are given by

$$a_j = \sum_{s=0}^{15} API_s \times b_{s,j}$$

where API_s, taking the values +1, -1, and 0, is the AP acquisition indicator corresponding to Access Preamble signature s transmitted by UE and the sequence $b_{s,0}$, …, $b_{s,31}$ is given in Table 20.

In case STTD-based open-loop transmit diversity is applied to AP-AICH, STTD encoding according to section 5.3.1.1.1 is applied to each sequence $b_{s,0}$, $b_{s,1}$, ..., $b_{s,31}$ separately before the sequences are combined into AP-AICH symbols a_0, …, a_{31}.

5.3.3.8 CPCH Collision Detection/Channel Assignment Indicator Channel (CD/CA-ICH)

The Collision Detection Channel Assignment Indicator channel (CD/CA-ICH) is a physical channel used to carry CD Indicator (CDI) only if the CA is not active, or CD Indicator/CA Indicator (CDI/CAI) at the same time if the CA is active. The structure of CD/CA-ICH is shown in Figure 21. CD/CA-ICH and AP-AICH may use the same or different channelisation codes.

The CD/CA-ICH has a part of duration of 4096chips where the CDI/CAI is transmitted, followed by a part of duration 1024chips with no transmission.

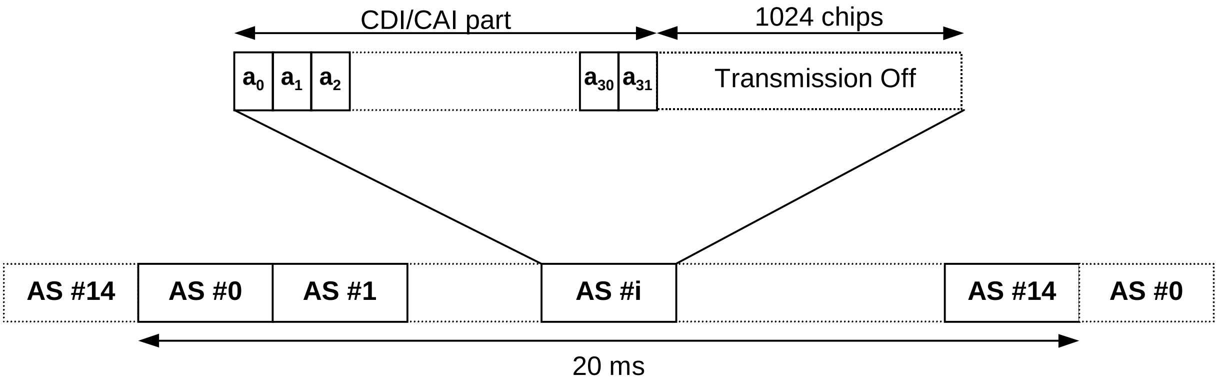


Figure 21: Structure of CD/CA Indicator Channel (CD/CA-ICH)

In case STTD-based open-loop transmit diversity is applied to AP-AICH, STTD encoding according to section 5.3.1.1.1 is applied to each sequence $b_{s,0}$, $b_{s,1}$, ..., $b_{s,31}$ separately before the sequences are combined into CD/CA-ICH symbols a_0, …, a_{31}.

In case CA is not active, the real-valued symbols a_0, a_1, …, a_{31} in Figure 21 are given by

$$a_j = \sum_{s=0}^{15} \mathrm{CDI}_s \times b_{s,j}$$

where CDI_s, taking the values +1, and 0, is the CD indicator corresponding to CD preamble signature *s* transmitted by UE and the sequence $b_{s,0}$, …, $b_{s,31}$ is given in Table 20.

In case CA is active, the real-valued symbols a_0, a_1, …, a_{31} in Figure 21 are given by

$$a_j = \sum_{i=0}^{15} \mathrm{CDI}_i \times b_{s_i,j} + \sum_{k=0}^{15} \mathrm{CAI}_k \times b_{s_k,j}$$

where the subscript s_i, s_k depend on the indexes *i*, *k* according to Table 21, respectively, and indicate the signature number *s* in Table 20. The sequence $b_{s,0}$, …, $b_{s,31}$ is given in Table 20. CDI_i, taking the values +1/0 or -1/0, is the CD indicator corresponding to the CD preamble *i* transmitted by the UE, and CAI_k, taking the values +1/0 or -1/0, is the CA indicator corresponding to the assigned channel index *k* as given in table 21.

Table 21. Generation of CDI_i/CAI_k

UE transmitted CD Preamble *i*	**CDI_i**	**signature s_i**	**Channel Assignment Index *k***	**CAI_k**	**signature s_k**
0	+1/0	1	0	+1/0	0
1	-1/0		1	-1/0	
2	+1/0	3	2	+1/0	8
3	-1/0		3	-1/0	
4	+1/0	5	4	+1/0	4

5	-1/0		5	-1/0	
6	+1/0	7	6	+1/0	12
7	-1/0		7	-1/0	
8	+1/0	9	8	+1/0	2
9	-1/0		9	-1/0	
10	+1/0	11	10	+1/0	6
11	-1/0		11	-1/0	
12	+1/0	13	12	+1/0	10
13	-1/0		13	-1/0	
14	+1/0	15	14	+1/0	14
15	-1/0		15	-1/0	

5.3.3.~~7~~9 Page Indicator Channel (PICH)

The Page Indicator Channel (PICH) is a fixed rate (SF=256) physical channel used to carry the Page Indicators (PI). The PICH is always associated with an S-CCPCH to which a PCH transport channel is mapped.

Figure ~~20~~ 22 illustrates the frame structure of the PICH. One PICH frame of length 10 ms consists of 300 bits (b_0, b_1, …, b_{299}). Of these, 288 bits (b_0, b_1, …, b_{287}) are used to carry Page Indicators. The remaining 12 bits (b_{288}, b_{289}, …, b_{299}) are undefined.

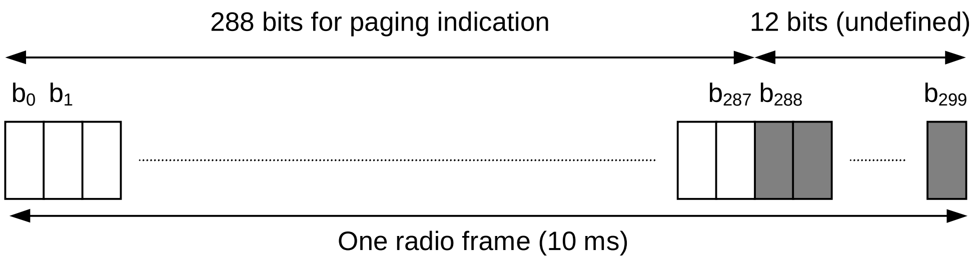


Figure 22~~0~~: Structure of Page Indicator Channel (PICH)

N Page Indicators {PI_0, …, PI_{N-1}} are transmitted in each PICH frame, where N=18, 36, 72, or 144.

The PI calculated by higher layers for use for a certain UE, is mapped to the paging indicator PI_p, where *p* is computed as a function of the PI computed by higher layers, the SFN of the P-CCPCH radio frame during which the start of the PICH radio frame occurs, and the number of paging indicators per frame (N):

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document R1-00-0234
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.211 CR 033 Current Version: V3.1.1

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG RAN #7
list expected approval meeting # here ↑

for approval	☒	strategic	☐	*(for SMG use only)*
for information	☐	non-strategic	☐	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: TSG RAN WG1 **Date:** 2000-2-29

Subject: Clarification of frame synchronization word and its usage

Work item:

Category:
(only one category Shall be marked With an X)

F	Correction	☐
A	Corresponds to a correction in an earlier release	☐
B	Addition of feature	☐
C	Functional modification of feature	☐
D	Editorial modification	☒

Release:

Phase 2	☐
Release 96	☐
Release 97	☐
Release 98	☐
Release 99	☒
Release 00	☐

Reason for change: TS25.211 does not exactly define the frame synchronization words. And it is not clear what it should be used for. This CR corrects these ambiguous sentences related to FSWs and pilot bit patterns based on R1-00-0232. The number of bits per slot for slot format 9B of table 11 is corrected.

Clauses affected: 3, 5.2.1, 5.3.2

Other specs Affected:

Other 3G core specifications	☐	→ List of CRs:
Other GSM core specifications	☐	→ List of CRs:
MS test specifications	☐	→ List of CRs:
BSS test specifications	☐	→ List of CRs:
O&M specifications	☐	→ List of CRs:

Other comments:

3 Abbreviations

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

AI	Acquisition Indicator
AICH	Acquisition Indicator Channel
AP	Access Preamble
BCH	Broadcast Channel
CCPCH	Common Control Physical Channel
CCTrCH	Coded Composite Transport Channel
CD	Collision Detection
CPCH	Common Packet Channel
CPICH	Common Pilot Channel
DCH	Dedicated Channel
DPCCH	Dedicated Physical Control Channel
DPCH	Dedicated Physical Channel
DPDCH	Dedicated Physical Data Channel
DSCH	Downlink Shared Channel
DTX	Discontinuous Transmission
FACH	Forward Access Channel
FBI	Feedback Information
FSW	Frame Synchronization Word
MUI	Mobile User Identifier
PCH	Paging Channel
P-CCPCH	Primary Common Control Physical Channel
PCPCH	Physical Common Packet Channel
PDSCH	Physical Downlink Shared Channel
PI	Page Indicator
PICH	Page Indicator Channel
PRACH	Physical Random Access Channel
PSC	Primary Synchronisation Code
RACH	Random Access Channel
RNC	Radio Network Controller
S-CCPCH	Secondary Common Control Physical Channel
SCH	Synchronisation Channel
SF	Spreading Factor
SFN	System Frame Number
SSC	Secondary Synchronisation Code
STTD	Space Time Transmit Diversity
TFCI	Transport Format Combination Indicator
TSTD	Time Switched Transmit Diversity
TPC	Transmit Power Control
UE	User Equipment
UTRAN	UMTS Terrestrial Radio Access Network

5.2.1 Dedicated uplink physical channels

There are two types of uplink dedicated physical channels, the uplink Dedicated Physical Data Channel (uplink DPDCH) and the uplink Dedicated Physical Control Channel (uplink DPCCH).

The DPDCH and the DPCCH are I/Q code multiplexed within each radio frame (see [4]).

The uplink DPDCH is used to carry dedicated data generated at Layer 2 and above, i.e. the dedicated transport channel (DCH). There may be zero, one, or several uplink DPDCHs on each Layer 1 connection.

The uplink DPCCH is used to carry control information generated at Layer 1. The Layer 1 control information consists of known pilot bits to support channel estimation for coherent detection, transmit power-control (TPC) commands, feedback information (FBI), and an optional transport-format combination indicator (TFCI). The transport-format combination indicator informs the receiver about the instantaneous parameters of the different transport channels multiplexed on the uplink DPDCH, and corresponds to the data transmitted in the same frame. It is the UTRAN that determines if a TFCI should be transmitted, hence making it mandatory for all UEs to support the use of TFCI in the uplink. There is one and only one uplink DPCCH on each Layer 1 connection.

Figure 1 shows the frame structure of the uplink dedicated physical channels. Each frame of length 10 ms is split into 15 slots, each of length T_{slot} = 2560 chips, corresponding to one power-control period

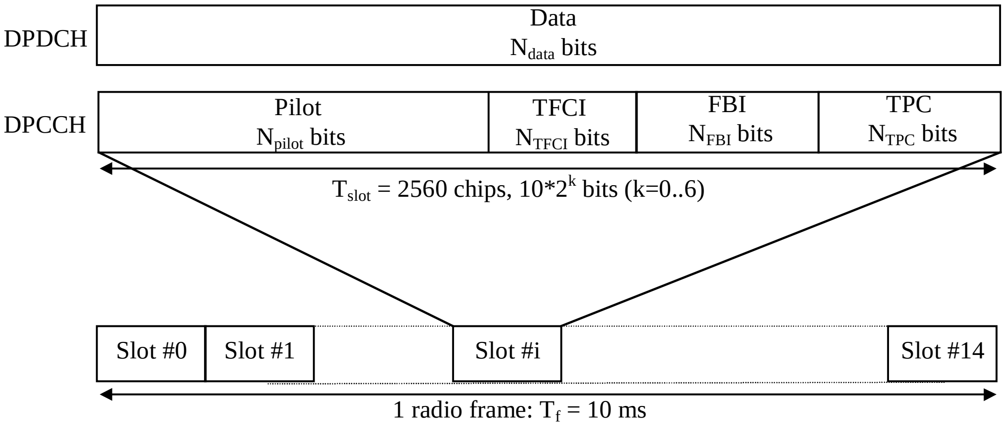


Figure 1: Frame structure for uplink DPDCH/DPCCH

The parameter k in figure 1 determines the number of bits per uplink DPDCH/DPCCH slot. It is related to the spreading factor SF of the physical channel as SF = $256/2^k$. The DPDCH spreading factor may thus range from 256 down to 4. Note that an uplink DPDCH and uplink DPCCH on the same Layer 1 connection generally are of different rates, i.e. have different spreading factors and different values of k.

The exact number of bits of the different uplink DPCCH fields (N_{pilot}, N_{TFCI}, N_{FBI}, and N_{TPC}) is determined in table 2. The field order and total number of bits/slot are fixed, though the number of bits per field may vary during a connection. The values for the number of bits per field are given in table 1 and table 2. The channel bit and symbol rates given in table 1 are the rates immediately before spreading. The pilot patterns are given in table 3 and table 4, the TPC bit pattern is given in table 5.

The N_{FBI} bits are used to support techniques requiring feedback between the UE and the UTRAN Access Point (=cell transceiver), including closed loop mode transmit diversity and site selection diversity (SSDT). The exact details of the FBI field are shown in figure 2 and described below.

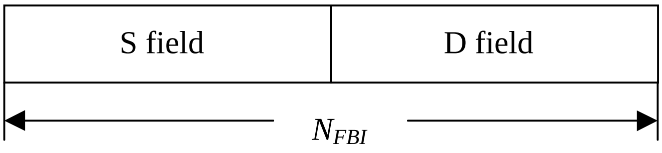


Figure 2: Details of FBI field

The S field is used for SSDT signalling, while the D field is used for Closed Loop Mode Transmit Diversity Signalling. The S field can be of length 0, 1 or 2. The D field can be of length 0 or 1. The total FBI field size N_{FBI} is according to table 2 (DPCCH fields). Simultaneous use of SSDT power control and Closed Loop Mode Transmit Diversity requires that the S field is of length 1. The use of these FBI fields is described in [5].

Table 1: DPDCH fields

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{data}
0	15	15	256	150	10	10
1	30	30	128	300	20	20
2	60	60	64	600	40	40
3	120	120	32	1200	80	80
4	240	240	16	2400	160	160
5	480	480	8	4800	320	320
6	960	960	4	9600	640	640

There are two types of Uplink Dedicated Physical Channels; those that include TFCI(e.g. for several simultaneous services) and those that do not include TFCI(e.g. for fixed-rate services). These types are reflected by the duplicated rows of table 2. In compressed mode, DPCCH slot formats with TFCI fields are changed. There are two possible compressed slot formats for each normal slot format. They are labelled A and B and the selection between them is dependent on the number of slots that are transmitted in each frame in compressed mode. The channel bit and symbol rates given in table 2 are the rates immediately before spreading.

Table 2: DPCCH fields

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{pilot}	N_{TPC}	N_{TFCI}	N_{FBI}	Transmitted slots per radio frame
0	15	15	256	150	10	6	2	2	0	15
0A	15	15	256	150	10	5	2	3	0	10-14
0B	15	15	256	150	10	4	2	4	0	8-9
1	15	15	256	150	10	8	2	0	0	8-15
2	15	15	256	150	10	5	2	2	1	15
2A	15	15	256	150	10	4	2	3	1	10-14
2B	15	15	256	150	10	3	2	4	1	8-9
3	15	15	256	150	10	7	2	0	1	8-15
4	15	15	256	150	10	6	2	0	2	8-15
5	15	15	256	150	10	5	1	2	2	15
5A	15	15	256	150	10	4	1	3	2	10-14
5B	15	15	256	150	10	3	1	4	2	8-9

The pilot bit patterns ~~is~~are described in table 3 and table 4. The shadowed column part of pilot bit pattern is defined as FSW and FSWs can be used to confirm frame synchronization. ~~The shadowed part can be used as frame synchronization words.~~ (The value of the pilot bit pattern other than ~~the frame synchronization word~~ FSWs shall be "1".)

Table 3: Pilot bit patterns for uplink DPCCH with N_{pilot} = 3, 4, 5 and 6

	N_{pilot} = 3			N_{pilot} = 4				N_{pilot} = 5					N_{pilot} = 6					
Bit #	0	1	2	0	1	2	3	0	1	2	3	4	0	1	2	3	4	5
Slot #0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0
1	0	0	1	1	0	0	1	0	0	1	1	0	1	0	0	1	1	0
2	0	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1
3	0	0	1	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0
4	1	0	1	1	1	0	1	1	0	1	0	1	1	1	0	1	0	1
5	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0
6	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0
7	1	0	1	1	1	0	1	1	0	1	0	0	1	1	0	1	0	0
8	0	1	1	1	0	1	1	0	1	1	1	0	1	0	1	1	1	0
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	0	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1
11	1	0	1	1	1	0	1	1	0	1	1	1	1	1	0	1	1	1
12	1	0	1	1	1	0	1	1	0	1	0	0	1	1	0	1	0	0
13	0	0	1	1	0	0	1	0	0	1	1	1	1	0	0	1	1	1
14	0	0	1	1	0	0	1	0	0	1	1	1	1	0	0	1	1	1

Table 4: Pilot bit patterns for uplink DPCCH with N_{pilot} = 7 and 8

	N_{pilot} = 7							N_{pilot} = 8							
Bit #	0	1	2	3	4	5	6	0	1	2	3	4	5	6	7
Slot #0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0
1	1	0	0	1	1	0	1	1	0	1	0	1	1	1	0
2	1	0	1	1	0	1	1	1	0	1	1	1	0	1	1
3	1	0	0	1	0	0	1	1	0	1	0	1	0	1	0
4	1	1	0	1	0	1	1	1	1	1	0	1	0	1	1
5	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0
6	1	1	1	1	0	0	1	1	1	1	1	1	0	1	0
7	1	1	0	1	0	0	1	1	1	1	0	1	0	1	0
8	1	0	1	1	1	0	1	1	0	1	1	1	1	1	0
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	1	0	1	1	0	1	1	1	0	1	1	1	0	1	1
11	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1
12	1	1	0	1	0	0	1	1	1	1	0	1	0	1	0
13	1	0	0	1	1	1	1	1	0	1	0	1	1	1	1
14	1	0	0	1	1	1	1	1	0	1	0	1	1	1	1

The relationship between the TPC bit pattern and transmitter power control command is presented in table 5.

Table 5: TPC Bit Pattern

TPC Bit Pattern		Transmitter power control command
N_{TPC} = 1	N_{TPC} = 2	
1	11	1
0	00	0

For slot formats using TFCI, the TFCI value in each radio frame corresponds to a certain combination of bit rates of the DCHs currently in use. This correspondence is (re-)negotiated at each DCH addition/removal. The mapping of the TFCI bits onto slots is described in [3].

Multi-code operation is possible for the uplink dedicated physical channels. When multi-code transmission is used, several parallel DPDCH are transmitted using different channelization codes, see [4]. However, there is only one DPCCH per connection.

5.3.2 Dedicated downlink physical channels

There is only one type of downlink dedicated physical channel, the Downlink Dedicated Physical Channel (downlink DPCH).

Within one downlink DPCH, dedicated data generated at Layer 2 and above, i.e. the dedicated transport channel (DCH), is transmitted in time-multiplex with control information generated at Layer 1 (known pilot bits, TPC commands, and an optional TFCI). The downlink DPCH can thus be seen as a time multiplex of a downlink DPDCH and a downlink DPCCH, compare section 5.2.1. It is the UTRAN that determines if a TFCI should be transmitted, hence making it is mandatory for all UEs to support the use of TFCI in the downlink. In case of USTS, the TPC bits in slot #14 in frames with CFN mod 2 = 0 are replaced by Time Alignment Bits (TABs) as described in section 9.3 of [5]

Figure 8 shows the frame structure of the downlink DPCH. Each frame of length 10 ms is split into 15 slots, each of length T_{slot} = 2560 chips, corresponding to one power-control period.

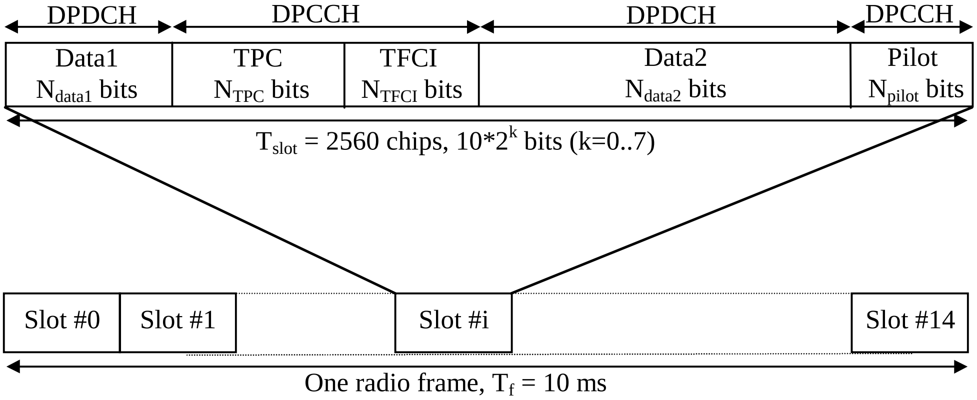


Figure 8: Frame structure for downlink DPCH

The parameter k in figure 8 determines the total number of bits per downlink DPCH slot. It is related to the spreading factor SF of the physical channel as SF = $512/2^k$. The spreading factor may thus range from 512 down to 4.

The exact number of bits of the different downlink DPCH fields (N_{pilot}, N_{TPC}, N_{TFCI}, N_{data1} and N_{data2}) is determined in table 11.The overhead due to the DPCCH transmission has to be negotiated at the connection set-up and can be re-negotiated during the communication, in order to match particular propagation conditions.

There are basically two types of downlink Dedicated Physical Channels; those that include TFCI (e.g. for several simultaneous services) and those that do not include TFCI(e.g. for fixed-rate services). These types are reflected by the duplicated rows of table 11. In compressed mode, a different slot format is used compared to normal mode. There are two possible compressed slot formats that are labelled A and B. Format B is used for compressed mode by spreading factor reduction and format A is used for all other transmission time reduction methods. The channel bit and symbol rates given in table 11 are the rates immediately before spreading.

Table 11: DPDCH and DPCCH fields

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Slot	DPDCH Bits/Slot		DPCCH Bits/Slot			Transmitted slots per radio frame N_{Tr}
					N_{Data1}	N_{Data2}	N_{TPC}	N_{TFCI}	N_{Pilot}	
0	15	7.5	512	10	0	4	2	0	4	15
0A	15	7.5	512	10	0	4	2	0	4	8-14
0B	30	15	256	20	0	8	4	0	8	8-14
1	15	7.5	512	10	0	2	2	2	4	15
1B	30	15	256	20	0	4	4	4	8	8-14
2	30	15	256	20	2	14	2	0	2	15
2A	30	15	256	20	2	14	2	0	2	8-14
2B	60	30	128	40	4	28	4	0	4	8-14
3	30	15	256	20	2	12	2	2	2	15
3A	30	15	256	20	2	10	2	4	2	8-14
3B	60	30	128	40	4	24	4	4	4	8-14
4	30	15	256	20	2	12	2	0	4	15
4A	30	15	256	20	2	12	2	0	4	8-14
4B	60	30	128	40	4	24	4	0	8	8-14
5	30	15	256	20	2	10	2	2	4	15
5A	30	15	256	20	2	8	2	4	4	8-14
5B	60	30	128	40	4	20	4	4	8	8-14
6	30	15	256	20	2	8	2	0	8	15
6A	30	15	256	20	2	8	2	0	8	8-14
6B	60	30	128	40	4	16	4	0	16	8-14
7	30	15	256	20	2	6	2	2	8	15
7A	30	15	256	20	2	4	2	4	8	8-14
7B	60	30	128	40	4	12	4	4	16	8-14
8	60	30	128	40	6	28	2	0	4	15
8A	60	30	128	40	6	28	2	0	4	8-14
8B	120	60	64	80	12	56	4	0	8	8-14
9	60	30	128	40	6	26	2	2	4	15
9A	60	30	128	40	6	24	2	4	4	8-14
9B	120	60	64	80~~40~~	12	52	4	4	8	8-14
10	60	30	128	40	6	24	2	0	8	15
10A	60	30	128	40	6	24	2	0	8	8-14
10B	120	60	64	80	12	48	4	0	16	8-14
11	60	30	128	40	6	22	2	2	8	15
11A	60	30	128	40	6	20	2	4	8	8-14
11B	120	60	64	80	12	44	4	4	16	8-14
12	120	60	64	80	12	48	4	8*	8	15
12A	120	60	64	80	12	40	4	16*	8	8-14
12B	240	120	32	160	24	96	8	16*	16	8-14
13	240	120	32	160	28	112	4	8*	8	15
13A	240	120	32	160	28	104	4	16*	8	8-14
13B	480	240	16	320	56	224	8	16*	16	8-14
14	480	240	16	320	56	232	8	8*	16	15
14A	480	240	16	320	56	224	8	16*	16	8-14
14B	960	480	8	640	112	464	16	16*	32	8-14
15	960	480	8	640	120	488	8	8*	16	15
15A	960	480	8	640	120	480	8	16*	16	8-14
15B	1920	960	4	1280	240	976	16	16*	32	8-14
16	1920	960	4	1280	248	1000	8	8*	16	15
16A	1920	960	4	1280	248	992	8	16*	16	8-14

* If TFCI bits are not used, then DTX shall be used in TFCI field.

NOTE1: Compressed mode is only supported through spreading factor reduction for SF=512 with TFCI.

NOTE2: Compressed mode by spreading factor reduction is not supported for SF=4.

The pilot bits~~symbol~~ patterns are~~is~~ described in table 12. The shadowed column part of pilot bit pattern is defined as

FSW and FSWs can be used to confirm frame synchronization. (The value of the pilot bit pattern other than FSWs shall be "11".)~~The shadowed part can be used as frame synchronization words. (The symbol pattern of the pilot symbols other than the frame synchronization word shall be "11".)~~ In table 12, the transmission order is from left to right. (Each two-bit pair represents an I/Q pair of QPSK modulation.)

In downlink compressed mode through spreading factor reduction, the number of bits in the TPC and Pilot fields are doubled. Symbol repetition is used to fill up the fields. Denote the bits in one of these fields in normal mode by x_1, x_2, x_3, …, x_X. In compressed mode the following bit sequence is sent in corresponding field: x_1, x_2, x_1, x_2, x_3, x_4, x_3, x_4,…, x_X,.

Table 12: Pilot bit~~Symbol P~~patterns for downlink DPCCH with N_{pilot} = 2, 4, 8 and 16

	N_{pilot} = 2	N_{pilot} = 4		N_{pilot} = 8				N_{pilot} = 16							
Symbol #	0	0	1	0	1	2	3	0	1	2	3	4	5	6	7
Slot #0	11	11	11	11	11	11	10	11	11	11	10	11	11	11	10
1	00	11	00	11	00	11	10	11	00	11	10	11	11	11	00
2	01	11	01	11	01	11	01	11	01	11	01	11	10	11	00
3	00	11	00	11	00	11	00	11	00	11	00	11	01	11	10
4	10	11	10	11	10	11	01	11	10	11	01	11	11	11	11
5	11	11	11	11	11	11	10	11	11	11	10	11	01	11	01
6	11	11	11	11	11	11	00	11	11	11	00	11	10	11	11
7	10	11	10	11	10	11	00	11	10	11	00	11	10	11	00
8	01	11	01	11	01	11	10	11	01	11	10	11	00	11	11
9	11	11	11	11	11	11	11	11	11	11	11	11	00	11	11
10	01	11	01	11	01	11	01	11	01	11	01	11	11	11	10
11	10	11	10	11	10	11	11	11	10	11	11	11	00	11	10
12	10	11	10	11	10	11	00	11	10	11	00	11	01	11	01
13	00	11	00	11	00	11	11	11	00	11	11	11	00	11	00
14	00	11	00	11	00	11	11	11	00	11	11	11	10	11	01

NOTE: In compressed mode through spreading factor reduction, symbol repetition is applied to the symbol patterns described in table 12.

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document R1-00-0450
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.211 CR 034r1 Current Version: 3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑   *↑ CR number as allocated by MCC support team*

For submission to: TSG-RAN #7
list expected approval meeting # here ↑

for approval	☒	strategic	☐	*(for SMG use only)*
for information	☐	non-strategic	☐	

Form: CR cover sheet, version 2 for 3GPP and SMG   The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: TSG RAN WG1   **Date:** 2000-02-21

Subject: Editorial updates to 25.211

Work item:

Category:
(only one category shall be marked with an X)

F	Correction	☐	**Release:**	Phase 2	☐
A	Corresponds to a correction in an earlier release	☐		Release 96	☐
B	Addition of feature	☐		Release 97	☐
C	Functional modification of feature	☐		Release 98	☐
D	Editorial modification	☒		Release 99	☒
				Release 00	☐

Reason for change:

Clauses affected: Many

Other specs affected:

Other 3G core specifications	☐	→ List of CRs:	
Other GSM core specifications	☐	→ List of CRs:	
MS test specifications	☐	→ List of CRs:	
BSS test specifications	☐	→ List of CRs:	
O&M specifications	☐	→ List of CRs:	

Other comments:

Foreword

This Technical Specification has been produced by the 3GPP.

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of this TS, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version 3.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 Indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the specification;

4 Transport channels

Transport channels are the services offered by Layer 1 to the higher layers. General concepts about transport channels are described in [12].

A transport channel is defined by how and with what characteristics data is transferred over the air interface. A general classification of transport channels is into two groups:

- Dedicated ~~C~~channels, using inherent addressing of UE
- Common ~~C~~channels, using explicit addressing of UE if addressing is needed

4.1 Dedicated transport channels

There exists only one type of dedicated transport channel, the Dedicated Channel (DCH).

4.1.1 DCH – Dedicated Channel

The Dedicated Channel (DCH) is a downlink or uplink transport channel. The DCH is transmitted over the entire cell or over only a part of the cell using e.g. beam-forming antennas.~~ The Dedicated Channel (DCH) is characterized by the possibility of fast rate change (every 10ms), fast power control and inherent addressing of UEs~~.

4.2 Common transport channels

There are six types of common transport channels: BCH, FACH, PCH, RACH, CPCH and DSCH.

4.2.1 BCH – Broadcast Channel

The Broadcast Channel (BCH) is a downlink transport channel that is used to broadcast system- and cell-specific information. The BCH is always transmitted over the entire cell and has a single transport format~~with a low fixed bit rate~~.

4.2.2 FACH – Forward Access Channel

The Forward Access Channel (FACH) is a downlink transport channel. The FACH is transmitted over the entire cell or over only a part of the cell using e.g. beam-forming antennas. The FACH can be transmitted using~~uses~~ slow power control.

4.2.3 PCH – Paging Channel

The Paging Channel (PCH) is a downlink transport channel. The PCH is always transmitted over the entire cell. The transmission of the PCH is associated with the transmission of ~~a ~~physical ~~-~~layer generated~~signal, the~~ Paging Indicators, to support efficient sleep-mode procedures.

4.2.4 RACH – Random Access Channel

The Random Access Channel (RACH) is an uplink transport channel. The RACH is always received from the entire cell. The RACH is characterized by~~ a limited size data field,~~ a collision risk and by being transmitted~~the ~~ using~~e~~ ~~of ~~open loop power control.

4.2.5 CPCH – Common Packet Channel

The Common Packet Channel (CPCH) is an uplink transport channel. ~~The CPCH is a contention based random access channel used for transmission of bursty data traffic.~~ CPCH is associated with a dedicated channel on the downlink which provides power control for the uplink CPCH. The CPCH is characterised by initial collision risk and by being transmitted using inner loop power control.

4.2.6 DSCH – Downlink Shared Channel

The D~~d~~ownlink S~~s~~hared C~~c~~hannel (DSCH) is a downlink transport channel shared by several UEs The DSCH is associated with one or several downlink~~a~~ DCH. The DSCH is transmitted over the entire cell or over only a part of the cell using e.g. beam-forming antennas.

---

5 Physical channels

Physical channels typically consist of a layered structure of radio frames and time slots, although this is not true for all physical channels. Depending on the channel bit~~symbol~~ rate of the physical channel, the configuration of ~~radio frames or time~~ slots varies.

Radio frame: A r~~R~~adio frame is a processing unit which consists of 15 ~~time~~ slots. The length of a radio frame corresponds to 38400 chips.

~~Time s~~Slot: A ~~Time~~ slot is a unit which consists of fields containing bits. The length of a slot corresponds to 2560 chips. The number of bits per ~~time~~ slot may be different for different physical channels and may, in some cases, vary in time~~depends on the physical channel~~.

5.1 The physical resource

The basic physical resource is the code/frequency plane. In addition, on the uplink, different information streams may be transmitted on the I and Q branch. Consequently, a physical channel corresponds to a specific carrier frequency, code, and, on the uplink, relative phase (0 or $\pi/2$).

5.2 Uplink physical channels

5.2.1 Dedicated uplink physical channels

There are two types of uplink dedicated physical channels, the uplink Dedicated Physical Data Channel (uplink DPDCH) and the uplink Dedicated Physical Control Channel (uplink DPCCH).

The DPDCH and the DPCCH are I/Q code multiplexed within each radio frame (see [4]).

The uplink DPDCH is used to carry the DCH transport channel~~dedicated data generated at Layer 2 and above, i.e. the dedicated transport channel (DCH)~~. There may be zero, one, or several uplink DPDCHs on each radio link~~Layer 1 connection~~.

The uplink DPCCH is used to carry control information generated at Layer 1. The Layer 1 control information consists of known pilot bits to support channel estimation for coherent detection, transmit power-control (TPC) commands, feedback information (FBI), and an optional transport-format combination indicator (TFCI). The transport-format combination indicator informs the receiver about the instantaneous transport format combination ~~parameters~~ of the ~~different~~ transport channels mapped to~~multiplexed on~~ the simultaneously transmitted uplink DPDCH radio frame~~, and corresponds to the data transmitted in the same frame~~. ~~It is the UTRAN that determines if a TFCI should be transmitted, hence making it mandatory for all UEs to support the use of TFCI in the uplink.~~ There is one and only one uplink DPCCH on each radio link~~Layer 1 connection~~.

Figure 1 shows the frame structure of the uplink dedicated physical channels. Each radio frame of length 10 ms is split into 15 slots, each of length T_{slot} = 2560 chips, corresponding to one power-control period.

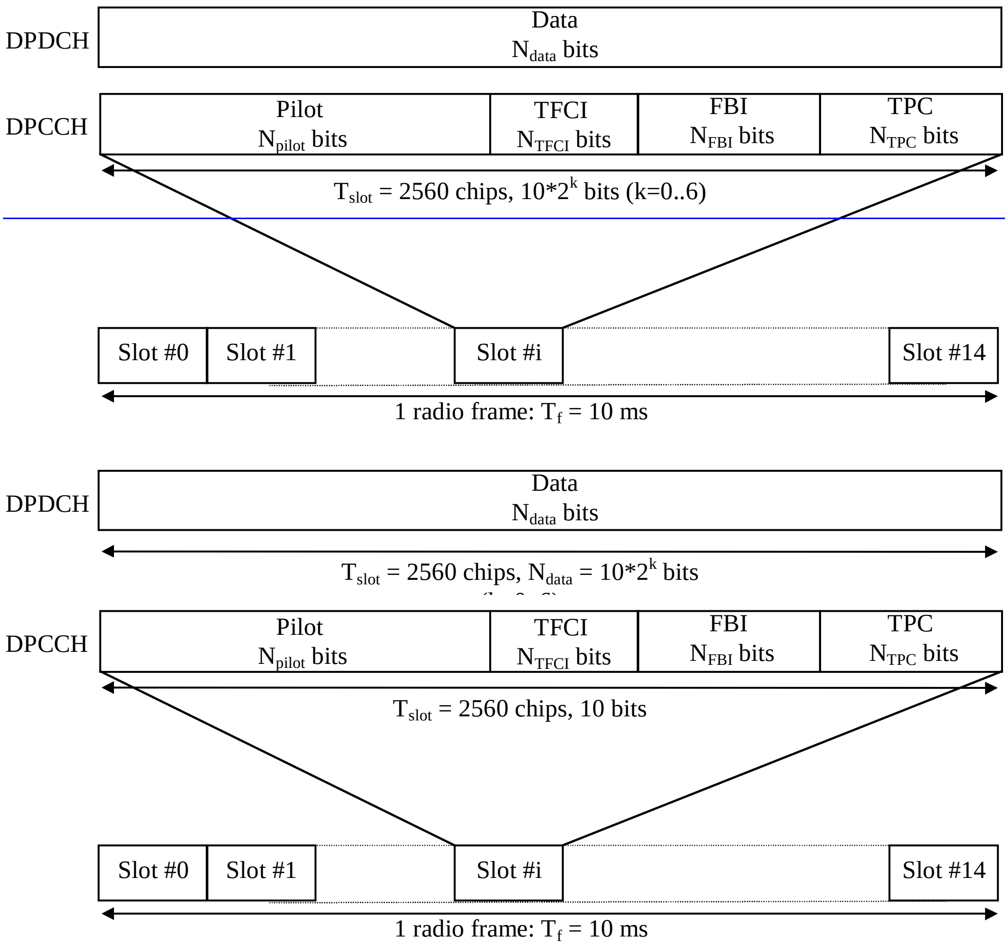


Figure 1: Frame structure for uplink DPDCH/DPCCH

The parameter k in figure 1 determines the number of bits per uplink DPDCH~~/DPCCH~~ slot. It is related to the spreading factor SF of the DPDCH~~physical channel~~ as SF = 256/2^k. The DPDCH spreading factor may ~~thus~~ range from 256 down to 4. ~~Note that an uplink DPDCH and uplink DPCCH on the same Layer 1 connection generally are of different rates, i.e. have different spreading factors and different values of k.~~The spreading factor of the uplink DPCCH is always equal to 256, i.e. there are 10 bits per uplink DPCCH slot.

The exact number of bits of the uplink DPDCH and the different uplink DPCCH fields (N_{pilot}, N_{TFCI}, N_{FBI}, and N_{TPC}) is given by~~determined in~~ table 1 and table 2. What slot format to use is configured by higher layers.~~The field order and total number of bits/slot are fixed, though the number of bits per field may vary during a connection.~~

~~The values for the number of bits per field are given in table 1 and table 2.~~The channel bit and symbol rates given in table 1 and table 2 are the rates immediately before spreading. The pilot patterns are given in table 3 and table 4, the TPC bit pattern is given in table 5.

The FBI~~N_{FBI}~~ bits are used to support techniques requiring feedback from~~between~~ the UE to~~and~~ the UTRAN Access Point~~ (=cell transceiver)~~, including closed loop mode transmit diversity and site selection diversity transmission (SSDT). The structure~~exact details~~ of the FBI field is~~are~~ shown in figure 2 and described below.

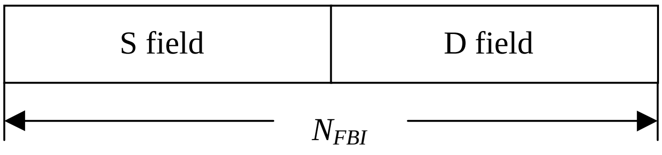


Figure 2: Details of FBI field

The S field is used for SSDT signalling, while the D field is used for ~~C~~closed l~~L~~oop m~~M~~ode t~~T~~ransmit d~~D~~iversity s~~S~~ignalling. The S field consists~~an be~~ of~~ length~~ 0, 1 or 2 bits. The D field consists~~an be~~ of~~ length~~ 0 or 1 bit. The total FBI field size N_{FBI} is given by~~according to~~ table 2~~ (DPCCH fields)~~. Simultaneous use of SSDT power control and c~~C~~losed l~~L~~oop m~~M~~ode t~~T~~ransmit d~~D~~iversity requires that the S field consists of ~~length~~ 1 bit. The use of the~~se~~ FBI fields is described in detail in [5].

Table 1: DPDCH fields

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{data}
0	15	15	256	150	10	10
1	30	30	128	300	20	20
2	60	60	64	600	40	40
3	120	120	32	1200	80	80
4	240	240	16	2400	160	160
5	480	480	8	4800	320	320
6	960	960	4	9600	640	640

There are two types of ~~U~~uplink ~~D~~dedicated ~~P~~physical ~~C~~channels; those that include TFCI (e.g. for several simultaneous services) and those that do not include TFCI (e.g. for fixed-rate services). These types are reflected by the duplicated rows of table 2. It is the UTRAN that determines if a TFCI should be transmitted and it is mandatory for all UEs to support the use of TFCI in the uplink. The mapping of TFCI bits onto slots is described in [3].

In compressed mode, DPCCH slot formats with TFCI fields are changed. There are two possible compressed slot formats for each normal slot format. They are labelled A and B and the selection between them is dependent on the number of slots that are transmitted in each frame in compressed mode~~. The channel bit and symbol rates given in table 2 are the rates immediately before spreading.~~

Table 2: DPCCH fields

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{pilot}	N_{TPC}	N_{TFCI}	N_{FBI}	Transmitted slots per radio frame
0	15	15	256	150	10	6	2	2	0	15
0A	15	15	256	150	10	5	2	3	0	10-14
0B	15	15	256	150	10	4	2	4	0	8-9
1	15	15	256	150	10	8	2	0	0	8-15
2	15	15	256	150	10	5	2	2	1	15
2A	15	15	256	150	10	4	2	3	1	10-14
2B	15	15	256	150	10	3	2	4	1	8-9
3	15	15	256	150	10	7	2	0	1	8-15
4	15	15	256	150	10	6	2	0	2	8-15
5	15	15	256	150	10	5	1	2	2	15
5A	15	15	256	150	10	4	1	3	2	10-14
5B	15	15	256	150	10	3	1	4	2	8-9

The pilot bit pattern is described in table 3 and table 4. The shadowed part can be used as frame synchronization words. (The value of the pilot bit other than the frame synchronization word shall be "1".)

Table 3: Pilot bit patterns for uplink DPCCH with N_{pilot} = 3, 4, 5 and 6

	N_{pilot} = 3			N_{pilot} = 4				N_{pilot} = 5					N_{pilot} = 6					
Bit #	0	1	2	0	1	2	3	0	1	2	3	4	0	1	2	3	4	5
Slot #0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0
1	0	0	1	1	0	0	1	0	0	1	1	0	1	0	0	1	1	0
2	0	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1
3	0	0	1	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0
4	1	0	1	1	1	0	1	1	0	1	0	1	1	1	0	1	0	1
5	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0
6	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0
7	1	0	1	1	1	0	1	1	0	1	0	0	1	1	0	1	0	0
8	0	1	1	1	0	1	1	0	1	1	1	0	1	0	1	1	1	0
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	0	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1
11	1	0	1	1	1	0	1	1	0	1	1	1	1	1	0	1	1	1
12	1	0	1	1	1	0	1	1	0	1	0	0	1	1	0	1	0	0
13	0	0	1	1	0	0	1	0	0	1	1	1	1	0	0	1	1	1
14	0	0	1	1	0	0	1	0	0	1	1	1	1	0	0	1	1	1

Table 4: Pilot bit patterns for uplink DPCCH with N_{pilot} = 7 and 8

	N_{pilot} = 7							N_{pilot} = 8							
Bit #	0	1	2	3	4	5	6	0	1	2	3	4	5	6	7
Slot #0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0
1	1	0	0	1	1	0	1	1	0	1	0	1	1	1	0
2	1	0	1	1	0	1	1	1	0	1	1	1	0	1	1
3	1	0	0	1	0	0	1	1	0	1	0	1	0	1	0
4	1	1	0	1	0	1	1	1	1	1	0	1	0	1	1
5	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0
6	1	1	1	1	0	0	1	1	1	1	1	1	0	1	0
7	1	1	0	1	0	0	1	1	1	1	0	1	0	1	0
8	1	0	1	1	1	0	1	1	0	1	1	1	1	1	0
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	1	0	1	1	0	1	1	1	0	1	1	1	0	1	1
11	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1
12	1	1	0	1	0	0	1	1	1	1	0	1	0	1	0
13	1	0	0	1	1	1	1	1	0	1	0	1	1	1	1
14	1	0	0	1	1	1	1	1	0	1	0	1	1	1	1

The relationship between the TPC bit pattern and transmitter power control command is presented in table 5.

Table 5: TPC Bit Pattern

TPC Bit Pattern		Transmitter power control command
N_{TPC} = 1	N_{TPC} = 2	
1 0	11 00	1 0

~~For slot formats using TFCI, the TFCI value in each radio frame corresponds to a certain combination of bit rates of the DCHs currently in use. This correspondence is (re-)negotiated at each DCH addition/removal. The mapping of the TFCI bits onto slots is described in [3].~~

Multi-code operation is possible for the uplink dedicated physical channels. When multi-code transmission is used, several parallel DPDCH are transmitted using different channelization codes, see [4]. However, there is only one DPCCH per radio link~~connection~~.

5.2.2 Common uplink physical channels

5.2.2.1 Physical Random Access Channel (PRACH)

The Physical Random Access Channel (PRACH) is used to carry the RACH.

5.2.2.1.1 Overall structure of random-access~~RACH~~ transmission

The random-access transmission is based on a Slotted ALOHA approach with fast acquisition indication. The UE can start the random-access transmission at the beginning of a number of well-defined time intervals~~-offsets~~, denoted *access slots*. There are 15 access slots per two frames and they are spaced 5120 chips apart, see figure 3. The timing ~~information~~ of~~n~~ the access slots and the acquisition indication is described~~given~~ in section 7.3. ~~Figure 3 shows the access slot numbers and their spacing to each other.~~ Information on what access slots are available for random-access transmission~~in the current cell~~ is given by higher layers.

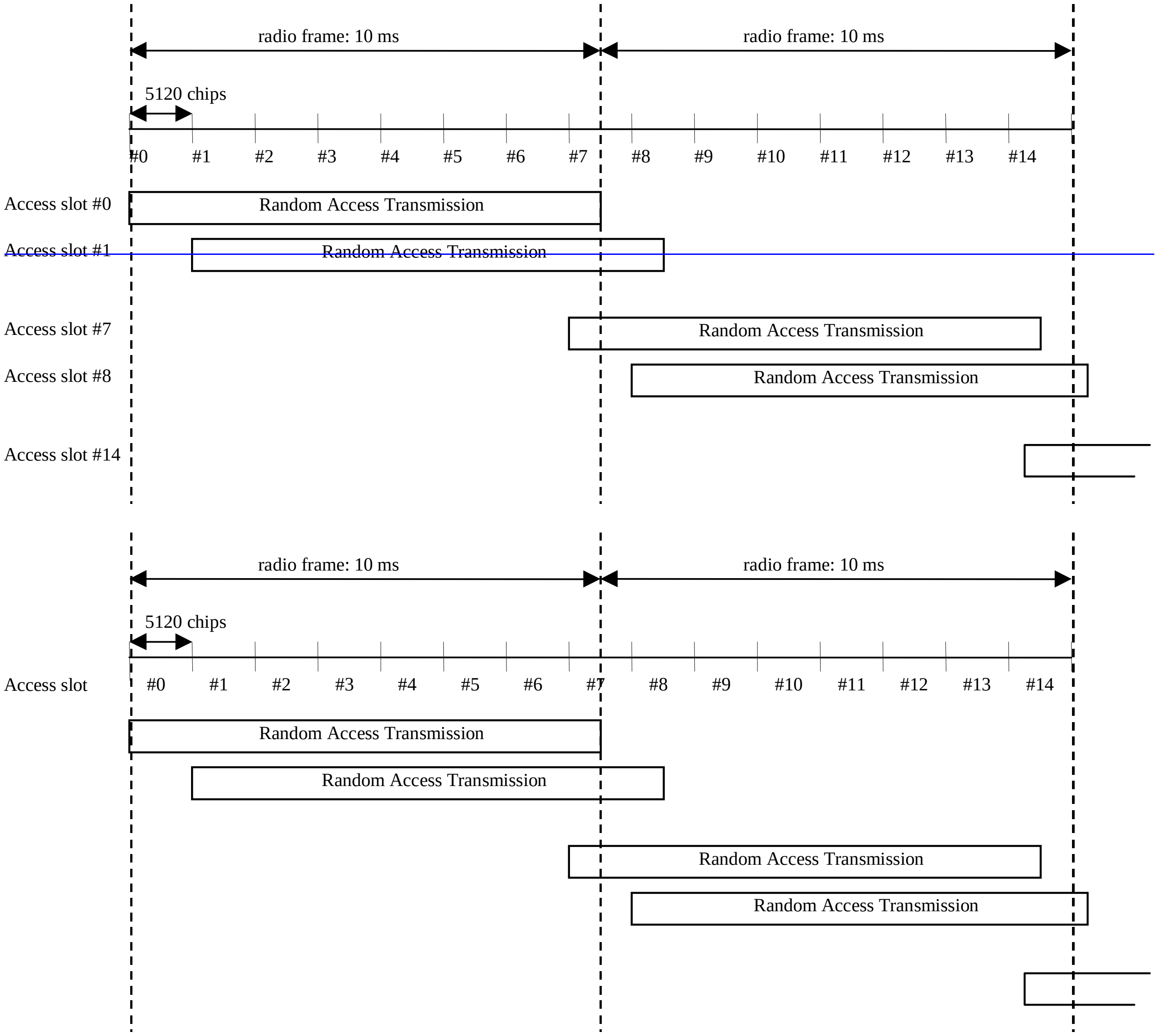


Figure 3: RACH access slot numbers and their spacing

The structure of the random-access transmission is shown in figure 4. The random-access transmission consists of one or several *preambles* of length 4096 chips and a *message* of length 10 ms or 20 ms. ~~The UE indicates the length of the message part to the network by using specific signatures and/or access slots. The assignment, which signatures and/or access slots are used for which message length, is performed by higher layers.~~

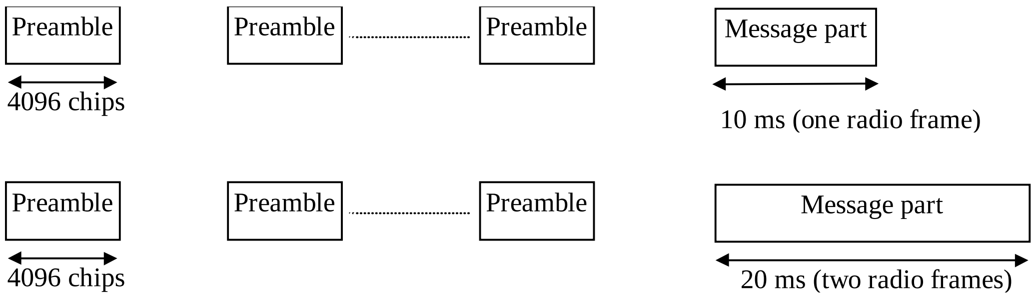


Figure 4: Structure of the random-access transmission

5.2.2.1.2 RACH preamble part

~~The~~Each preamble is of length 4096 chips and ~~part of the random-access burst~~ consists of 256 repetitions of a signature of length 16 chips. There are a maximum~~total~~ of 16 available~~different~~ signatures, ~~based on the Hadamard code set of length 16 (~~see [4] for more details~~)~~.

5.2.2.1.3 RACH message part

Figure 5 shows the structure of the r~~R~~andom-access message part radio frame. The 10 ms message part radio frame is split into 15 slots, each of length T_{slot} = 2560 chips. Each slot consists of two parts, a data part to which the~~that carries~~ RACH transport channel is mapped~~Layer 2 information~~ and a control part that carries Layer 1 control information. The data and control parts are transmitted in parallel. A 10 ms message part consists of one message part radio frame, while a 20 ms~~ long~~ message part consists of two consecutive 10 ms message part radio frames. The message part length can be determined from the used signature and/or access slot, as configured by higher layers.

The data part consists of $10*2^k$ bits, where k=0,1,2,3. This corresponds to a spreading factor of 256, 128, 64, and 32 respectively for the message data part.

The control part consists of 8 known pilot bits to support channel estimation for coherent detection and 2 TFCI bits. This corresponds to a spreading factor of 256 for the message control part. The pilot bit pattern is described in table 8. The total number of TFCI bits in the random-access message is 15*2 = 30. The TFCI of a radio frame indicates the transport format of the RACH transport channel mapped to the simultaneously transmitted message part radio frame. In case of a 20 ms PRACH message part, the TFCI is repeated in the second radio frame~~value corresponds to a certain transport format of the current Random-access message~~.

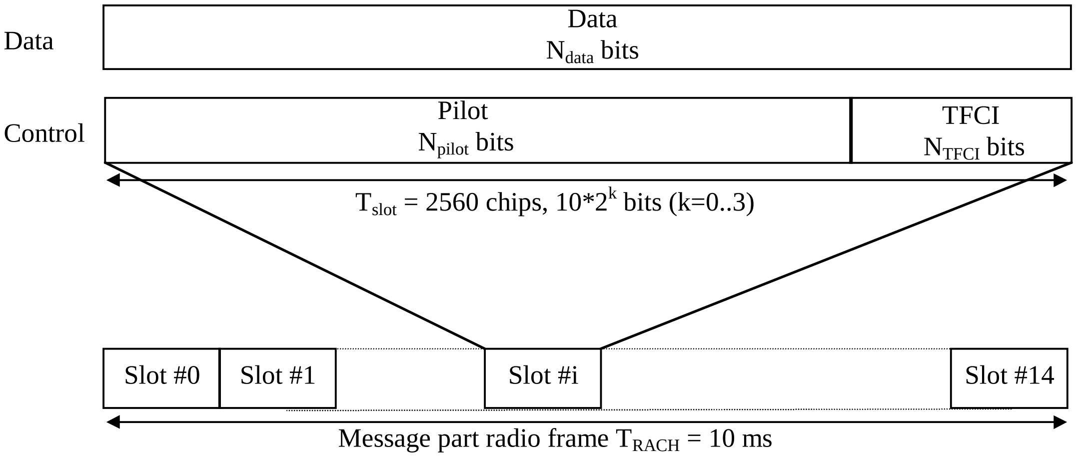


Figure 5: Structure of the random-access message part radio frame

Table 6: Random-access message data fields

Slot Format #i	**Channel Bit Rate (kbps)**	**Channel Symbol Rate (ksps)**	**SF**	**Bits/ Frame**	**Bits/ Slot**	**N_{data}**
0	15	15	256	150	10	10
1	30	30	128	300	20	20
2	60	60	64	600	40	40
3	120	120	32	1200	80	80

Table 7: Random-access message control fields

Slot Format #i	**Channel Bit Rate (kbps)**	**Channel Symbol Rate (ksps)**	**SF**	**Bits/ Frame**	**Bits/ Slot**	**N_{pilot}**	**N_{TFCI}**
0	15	15	256	150	10	8	2

Table 8: Pilot bit patterns for RACH message part with N_{pilot} = 8

	N_{pilot} = 8							
Bit #	0	1	2	3	4	5	6	7
Slot #0	1	1	1	1	1	1	1	0
1	1	0	1	0	1	1	1	0
2	1	0	1	1	1	0	1	1
3	1	0	1	0	1	0	1	0
4	1	1	1	0	1	0	1	1
5	1	1	1	1	1	1	1	0
6	1	1	1	1	1	0	1	0
7	1	1	1	0	1	0	1	0
8	1	0	1	1	1	1	1	0
9	1	1	1	1	1	1	1	1
10	1	0	1	1	1	0	1	1
11	1	1	1	0	1	1	1	1
12	1	1	1	0	1	0	1	0
13	1	0	1	0	1	1	1	1
14	1	0	1	0	1	1	1	1

5.2.2.2 Physical Common Packet Channel (PCPCH)

The Physical Common Packet Channel (PCPCH) is used to carry the CPCH.

5.2.2.2.1 CPCH transmission

The CPCH transmission is based on DSMA-CD approach with fast acquisition indication. The UE can start transmission at a number of well-defined time-offsets, relative to the frame boundary of the received BCH of the current cell. The access slot timing and structure is identical to RACH in section 5.2.2.1.1. The structure of the CPCH random access transmission is shown in figure 6. The CPCH random access transmission consists of one or several Access Preambles [A-P] of length 4096 chips, one Collision Detection Preamble (CD-P) of length 4096 chips, a DPCCH Power Control Preamble (PC-P) which is either 0 slots or 8 slots in length, and a message of variable length Nx10 ms.

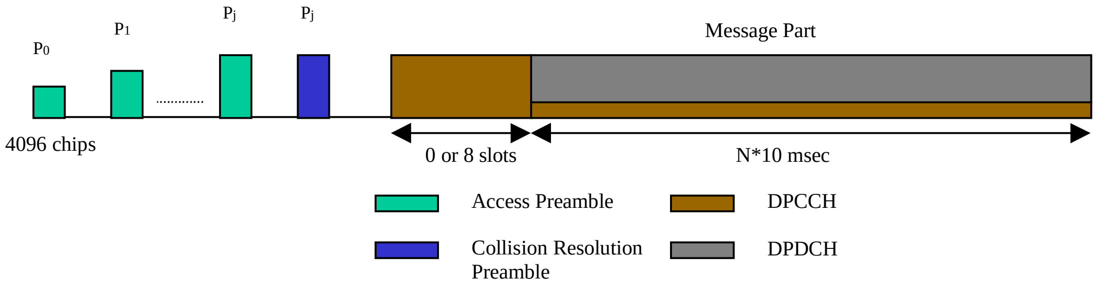


Figure 6: Structure of the CPCH random access transmission

5.2.2.2.2 CPCH access preamble part

Similar to 5.2.2.1.2 (RACH preamble part). The RACH preamble signature sequences are used. The number of sequences used could be less than the ones used in the RACH preamble. The scrambling code could either be chosen to be a different code segment of the Gold code used to form the scrambling code of the RACH preambles (see [4] for more details) or could be the same scrambling code in case the signature set is shared.

5.2.2.2.3 CPCH collision detection preamble part

Similar to 5.2.2.1.2 (RACH preamble part). The RACH preamble signature sequences are used. The scrambling code is chosen to be a different code segment of the Gold code used to form the scrambling code for the RACH and CPCH preambles (see [4] for more details).

5.2.2.2.4 CPCH power control preamble part

The power control preamble segment is a DPCCH Power Control Preamble (PC-P). The following table 9 is identical to Rows 2 and 4 of table 2 in section 5.2.1. Table 9 defines the DPCCH fields which only include Pilot, FBI and TPC bits. The Power Control Preamble length is a parameter which shall take the values 0 or 8 slots, as set by the higher layers.

Table 9: DPCCH fields for CPCH power control preamble segment

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{pilot}	N_{TFCI}	N_{FBI}	N_{TPC}
0	15	15	256	150	10	8	0	0	2
1	15	15	256	150	10	7	0	1	2

5.2.2.2.5 CPCH message part

Figure 1 in section 5.2.1 shows the structure of the CPCH message part. Each message consists of up to N_Max_frames 10 ms frames. N_Max_frames is a higher layer parameter. Each 10 ms frame is split into 15 slots, each of length T_{slot} = 2560 chips. Each slot consists of two parts, a data part that carries higher layer information and a control part that carries Layer 1 control information. The data and control parts are transmitted in parallel.

The data part consists of $10*2^k$ bits, where k = 0, 1, 2, 3, 4, 5, 6, corresponding to spreading factors of 256, 128, 64, 32, 16, 8, 4 respectively. Note that various rates might be mapped to different signature sequences.

The spreading factor for the UL-DPCCH (message control part) is 256. The entries in table 1 corresponding to spreading factors of 256 and below and table 2 [both in section 5.2.1] apply to the DPDCH and DPCCH fields respectively for the CPCH message part.

5.3 Downlink physical channels

5.3.1 Downlink t~~T~~ransmit d~~D~~iversity

Table 10 summarizes the possible application of open and closed loop t~~T~~ransmit diversity modes on different downlink physical channel types. Simultaneous use of STTD and closed loop modes on the same physical channel~~DPCH and PDSCH~~ is not allowed. Regarding CPICH transmission in case of transmit diversity, see section 5.3.3.1.

Table 10: Application of Tx diversity modes on downlink physical channel types
"X" – can be applied, "–" – not applied

Physical ~~C~~channel type	Open loop mode		Closed loop M~~M~~ode
	TSTD	STTD	
P-CCPCH	–	X	–
SCH	X	–	–
S-CCPCH	–	X	–
DPCH	–	X	X
PICH	–	X	–
PDSCH~~ (associated with DPCH)~~	–	X	X
AICH	–	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. 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 7 below. 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.

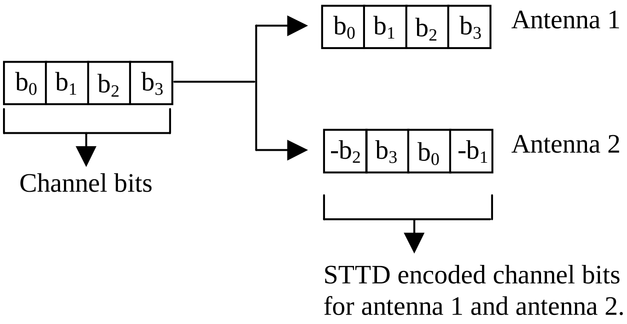


Figure 7: Generic block diagram of the STTD encoder

5.3.1.1.2 Time Switched Transmit Diversity for SCH (TSTD)

Transmit diversity, in the form of Time Switched Transmit Diversity (TSTD), can be applied to the SCH. TSTD for the SCH is optional in UTRAN, while TSTD support is mandatory in the UE. TSTD for the SCH is described in sub-clause 5.3.3.4.1.

5.3.1.2 Closed loop transmit diversity

Closed loop transmit diversity is described in [5].

5.3.2 Dedicated downlink physical channels

There is only one type of downlink dedicated physical channel, the Downlink Dedicated Physical Channel (downlink DPCH).

Within one downlink DPCH, dedicated data generated at Layer 2 and above, i.e. the dedicated transport channel (DCH), is transmitted in time-multiplex with control information generated at Layer 1 (known pilot bits, TPC commands, and an optional TFCI). The downlink DPCH can thus be seen as a time multiplex of a downlink DPDCH and a downlink DPCCH, compare section 5.2.1. ~~It is the UTRAN that determines if a TFCI should be transmitted, hence making it is mandatory for all UEs to support the use of TFCI in the downlink.~~ ~~In case of USTS, the TPC bits in slot #14 in frames with CFN mod 2 = 0 are replaced by Time Alignment Bits (TABs) as described in section 9.3 of [5]~~

Figure 8 shows the frame structure of the downlink DPCH. Each frame of length 10 ms is split into 15 slots, each of length T_{slot} = 2560 chips, corresponding to one power-control period.

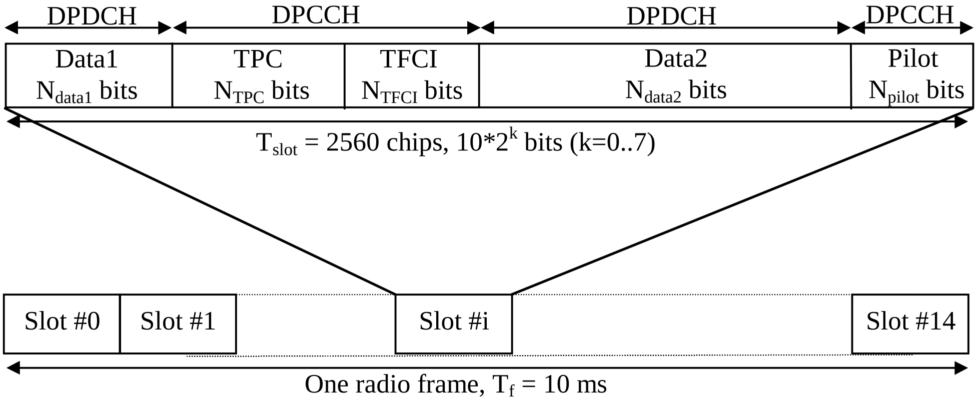


Figure 8: Frame structure for downlink DPCH

The parameter k in figure 8 determines the total number of bits per downlink DPCH slot. It is related to the spreading factor SF of the physical channel as SF = $512/2^k$. The spreading factor may thus range from 512 down to 4.

The exact number of bits of the different downlink DPCH fields (N_{pilot}, N_{TPC}, N_{TFCI}, N_{data1} and N_{data2}) is given~~determined~~ in table 11. What slot format to use is configured by higher layers and can also be reconfigured by higher layers~~The overhead due to the DPCCH transmission has to be negotiated at the connection set-up and can be re-negotiated during the communication, in order to match particular propagation conditions~~.

There are basically two types of downlink Dedicated Physical Channels; those that include TFCI (e.g. for several simultaneous services) and those that do not include TFCI(e.g. for fixed-rate services). These types are reflected by the duplicated rows of table 11. It is the UTRAN that determines if a TFCI should be transmitted and it is mandatory for all UEs to support the use of TFCI in the downlink. The mapping of TFCI bits onto slots is described in [3].

In compressed mode, a different slot format is used compared to normal mode. There are two possible compressed slot formats that are labelled A and B. Format B is used for compressed mode by spreading factor reduction and format A is used for all other transmission time reduction methods. The channel bit and symbol rates given in table 11 are the rates immediately before spreading.

Table 11: DPDCH and DPCCH fields

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Slot	DPDCH Bits/Slot		DPCCH Bits/Slot			Transmitted slots per radio frame N_{Tr}
					N_{Data1}	N_{Data2}	N_{TPC}	N_{TFCI}	N_{Pilot}	
0	15	7.5	512	10	0	4	2	0	4	15
0A	15	7.5	512	10	0	4	2	0	4	8-14
0B	30	15	256	20	0	8	4	0	8	8-14
1	15	7.5	512	10	0	2	2	2	4	15
1B	30	15	256	20	0	4	4	4	8	8-14
2	30	15	256	20	2	14	2	0	2	15
2A	30	15	256	20	2	14	2	0	2	8-14
2B	60	30	128	40	4	28	4	0	4	8-14
3	30	15	256	20	2	12	2	2	2	15
3A	30	15	256	20	2	10	2	4	2	8-14
3B	60	30	128	40	4	24	4	4	4	8-14
4	30	15	256	20	2	12	2	0	4	15
4A	30	15	256	20	2	12	2	0	4	8-14
4B	60	30	128	40	4	24	4	0	8	8-14
5	30	15	256	20	2	10	2	2	4	15
5A	30	15	256	20	2	8	2	4	4	8-14
5B	60	30	128	40	4	20	4	4	8	8-14
6	30	15	256	20	2	8	2	0	8	15
6A	30	15	256	20	2	8	2	0	8	8-14
6B	60	30	128	40	4	16	4	0	16	8-14
7	30	15	256	20	2	6	2	2	8	15
7A	30	15	256	20	2	4	2	4	8	8-14
7B	60	30	128	40	4	12	4	4	16	8-14
8	60	30	128	40	6	28	2	0	4	15
8A	60	30	128	40	6	28	2	0	4	8-14
8B	120	60	64	80	12	56	4	0	8	8-14
9	60	30	128	40	6	26	2	2	4	15
9A	60	30	128	40	6	24	2	4	4	8-14
9B	120	60	64	8~~4~~0	12	52	4	4	8	8-14
10	60	30	128	40	6	24	2	0	8	15
10A	60	30	128	40	6	24	2	0	8	8-14
10B	120	60	64	80	12	48	4	0	16	8-14
11	60	30	128	40	6	22	2	2	8	15
11A	60	30	128	40	6	20	2	4	8	8-14
11B	120	60	64	80	12	44	4	4	16	8-14
12	120	60	64	80	12	48	4	8*	8	15
12A	120	60	64	80	12	40	4	16*	8	8-14
12B	240	120	32	160	24	96	8	16*	16	8-14
13	240	120	32	160	28	112	4	8*	8	15
13A	240	120	32	160	28	104	4	16*	8	8-14
13B	480	240	16	320	56	224	8	16*	16	8-14
14	480	240	16	320	56	232	8	8*	16	15
14A	480	240	16	320	56	224	8	16*	16	8-14
14B	960	480	8	640	112	464	16	16*	32	8-14
15	960	480	8	640	120	488	8	8*	16	15
15A	960	480	8	640	120	480	8	16*	16	8-14
15B	1920	960	4	1280	240	976	16	16*	32	8-14
16	1920	960	4	1280	248	1000	8	8*	16	15
16A	1920	960	4	1280	248	992	8	16*	16	8-14

* If TFCI bits are not used, then DTX shall be used in TFCI field.

NOTE1: Compressed mode is only supported through spreading factor reduction for SF=512 with TFCI.

NOTE2: Compressed mode by spreading factor reduction is not supported for SF=4.

The pilot symbol pattern is described in table 12. The shadowed part can be used as frame synchronization words. (The symbol pattern of the pilot symbols other than the frame synchronization word shall be "11".) In table 12, the transmission order is from left to right.~~ (Each two-bit pair represents an I/Q pair of QPSK modulation.)~~

In downlink compressed mode through spreading factor reduction, the number of bits in the TPC and Pilot fields are doubled. Symbol repetition is used to fill up the fields. Denote the bits in one of these fields in normal mode by x_1, x_2, x_3, …, x_X. In compressed mode the following bit sequence is sent in corresponding field: x_1, x_2, x_1, x_2, x_3, x_4, x_3, x_4,…, $x_{X,}$.

Table 12: Pilot Symbol Pattern

	N_{pilot} = 2	**N_{pilot} = 4**		**N_{pilot} = 8**				**N_{pilot} = 16**							
Symbol #	0	0	1	0	1	2	3	0	1	2	3	4	5	6	7
Slot #0	11	11	11	11	11	11	10	11	11	11	10	11	11	11	10
1	00	11	00	11	00	11	10	11	00	11	10	11	11	11	00
2	01	11	01	11	01	11	01	11	01	11	01	11	10	11	00
3	00	11	00	11	00	11	00	11	00	11	00	11	01	11	10
4	10	11	10	11	10	11	01	11	10	11	01	11	11	11	11
5	11	11	11	11	11	11	10	11	11	11	10	11	01	11	01
6	11	11	11	11	11	11	00	11	11	11	00	11	10	11	11
7	10	11	10	11	10	11	00	11	10	11	00	11	10	11	00
8	01	11	01	11	01	11	10	11	01	11	10	11	00	11	11
9	11	11	11	11	11	11	11	11	11	11	11	11	00	11	11
10	01	11	01	11	01	11	01	11	01	11	01	11	11	11	10
11	10	11	10	11	10	11	11	11	10	11	11	11	00	11	10
12	10	11	10	11	10	11	00	11	10	11	00	11	01	11	01
13	00	11	00	11	00	11	11	11	00	11	11	11	00	11	00
14	00	11	00	11	00	11	11	11	00	11	11	11	10	11	01

The relationship between the TPC symbol and the transmitter power control command is presented in table 13.

Table 13: TPC Bit Pattern

TPC Bit Pattern			**Transmitter power control command**
N_{TPC} = 2	N_{TPC} = 4	N_{TPC} = 8	
11	1111	11111111	1
00	0000	00000000	0

~~For slot formats using TFCI, the TFCI wordvalue in each radio frame informs the receiver about the instantaneous transport format combination of the transport channels simultaneously mapped to the DPCH radio frame corresponds to a certain combination of bit rates of the DCHs currently in use. This correspondence is (re-)negotiated at each DCH addition/removal. The mapping of the TFCI bits onto slots is described in [3].~~

~~When the total bit rate to be transmitted on one downlink CCTrCH exceeds the maximum bit rate for a downlink physical channel, m~~Multicode transmission may be ~~is~~ employed in the downlink, i.e. the CCTrCH (see [3]) is mapped onto several parallel downlink DPCHs~~ are transmitted for one CCTrCH~~ using the same spreading factor. In this case, the Layer 1 control information is transmitted~~put on~~ only on the first downlink DPCH. DTX bits are transmitted during the corresponding time period for t~~T~~he additional downlink DPCHs~~ belonging to the CCTrCH do not transmit any data during the corresponding time period~~, see figure 9.

In ~~the~~ case there are ~~of~~ several CCTrCHs mapped to different DPCHs transmitted to the same UE~~of dedicated type for one UE~~ different spreading factors can be used on DPCHs to which different ~~for each~~ CCTrCHs are mapped. Also in this case, Layer 1 control information is only transmitted on the first DPCH while DTX bits are transmitted during the corresponding time period for the additional DPCHs~~and only one DPCCH would be transmitted for them in the downlink~~.

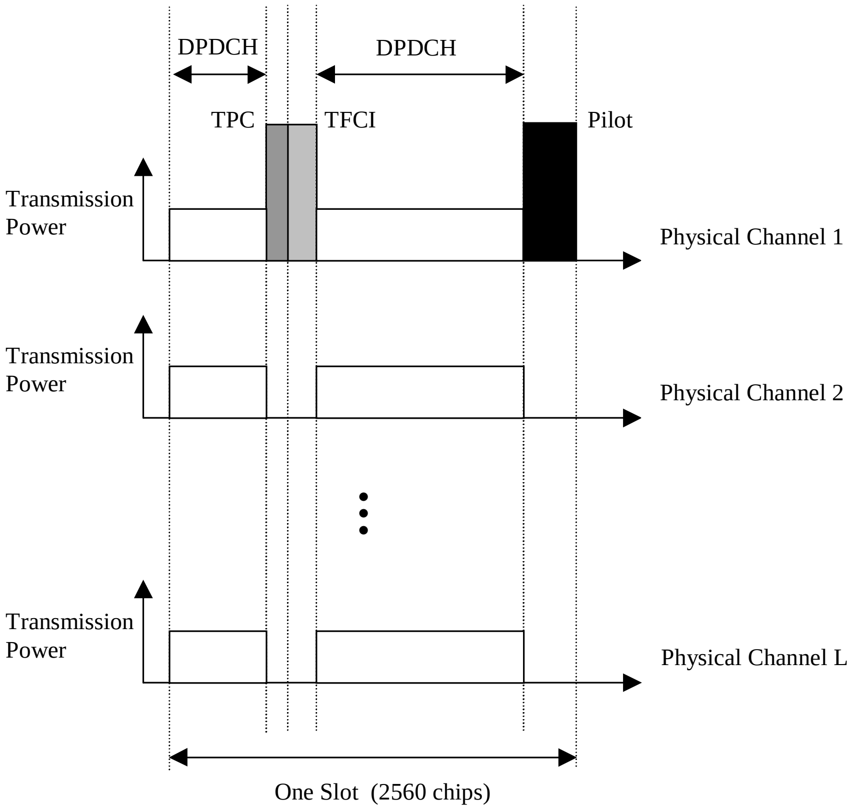


Figure 9: Downlink slot format in case of multi-code transmission

5.3.2.1 STTD for DPCH

The pilot bit pattern for the DPCH channel transmitted on ~~the diversity~~ antenna 2 is given in table 14. The shadowed part indicates pilot bits that are STTD encoded from the corresponding (shadowed) bits in Table 12. For the SF=256 DPCH, if there are only two dedicated pilot bits (N_{pilot} = 2 in Tables 12 and 14), they are STTD encoded together with the last two bits (data or DTX) of the second data field (data2) of the slot. STTD encoding for the DPDCH, TPC, and TFCI fields is done as described in section 5.3.1.1.1. For the SF=512 DPCH , the first two bits in each slot, i.e. TPC bits, are not STTD encoded and the same bits are transmitted with equal power from the two antennas. The following four bits are STTD encoded.

Table 14: Pilot pattern of the DPCH channel for ~~the diversity~~ antenna 2 using STTD

	Npilot = 2	Npilot = 4		Npilot = 8				Npilot = 16							
Symbol #	0	0	1	0	1	2	3	0	1	2	3	4	5	6	7
Slot #0	01	01	10	11	00	00	10	11	00	00	10	11	00	00	10
1	10	10	10	11	00	00	01	11	00	00	01	11	10	00	10
2	11	11	10	11	11	00	00	11	11	00	00	11	10	00	11
3	10	10	10	11	10	00	01	11	10	00	01	11	00	00	00
4	00	00	10	11	11	00	11	11	11	00	11	11	01	00	10
5	01	01	10	11	00	00	10	11	00	00	10	11	11	00	00
6	01	01	10	11	10	00	10	11	10	00	10	11	01	00	11
7	00	00	10	11	10	00	11	11	10	00	11	11	10	00	11
8	11	11	10	11	00	00	00	11	00	00	00	11	01	00	01
9	01	01	10	11	01	00	10	11	01	00	10	11	01	00	01
10	11	11	10	11	11	00	00	11	11	00	00	11	00	00	10
11	00	00	10	11	01	00	11	11	01	00	11	11	00	00	01
12	00	00	10	11	10	00	11	11	10	00	11	11	11	00	00
13	10	10	10	11	01	00	01	11	01	00	01	11	10	00	01
14	10	10	10	11	01	00	01	11	01	00	01	11	11	00	11

5.3.2.2 Dedicated channel pilots with closed loop mode transmit diversity

In closed loop mode 1 orthogonal pilot patterns are used between the transmit antennas. Pilot patterns defined in the table 12 will be used on ~~the non-diversity~~ antenna 1 and pilot patterns defined in the table 14 on ~~the diversity~~ antenna 2. This is illustrated in the figure 10 a which indicates the difference in the pilot patterns with different shading.

In closed loop mode 2 same pilot pattern is used on both of the antennas (see figure 10 b). The pattern to be used is according to the table 12.

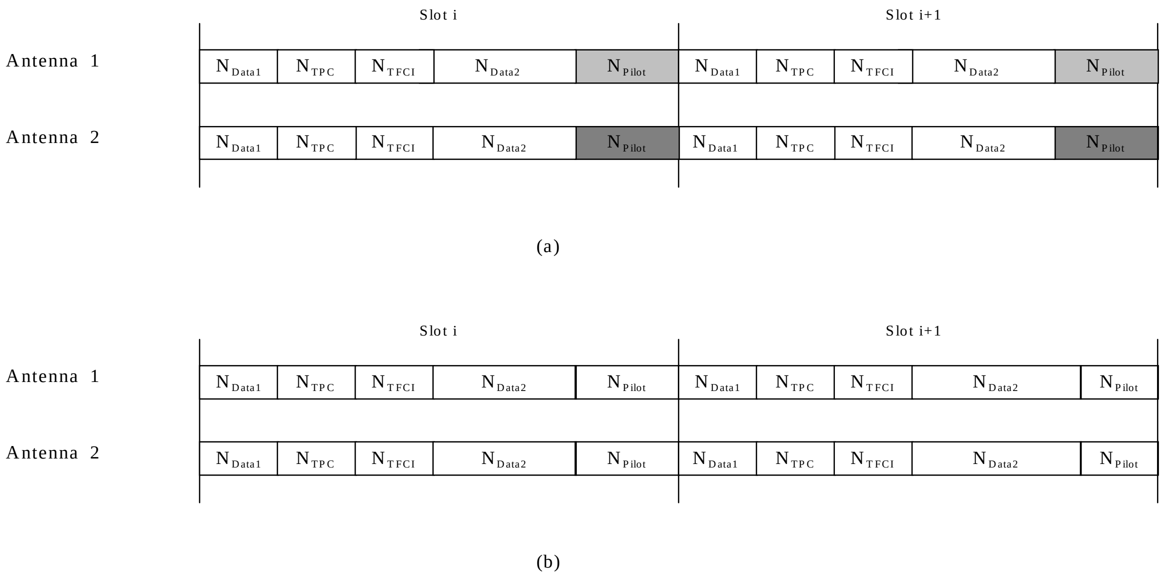


Figure 10: Slot structures for downlink dedicated physical channel diversity transmission. Structure (a) is used in closed loop mode 1. Structure (b) is used in closed loop mode 2. Different shading of the pilots indicate orthogonality of the patterns

5.3.2.3 DL-DPCCH for CPCH

The spreading factor for the UL-DPCCH (message control part) is 256. The spreading factor for the DL-DPCCH (message control part) is 512. The following table 15 shows the DL-DPCCH fields (message control part) which are identical to the first row of table 11 in section 5.3.2.

Table 15: DPDCH and DPCCH fields for CPCH message transmission

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/Frame			Bits/ Slot	DPDCH Bits/Slot		DPCCH Bits/Slot		
				DPDCH	DPCCH	TOT		NData1	NData2	NTFCI	NTPC	NPilot
0	15	7.5	512	60	90	150	10	2	2	0	2	4

5.3.3 Common downlink physical channels

5.3.3.1 Common Pilot Channel (CPICH)

The CPICH is a fixed rate (30 kbps, SF=256) downlink physical channel that carries a pre-defined bit/symbol sequence. Figure 11 shows the frame structure of the CPICH.

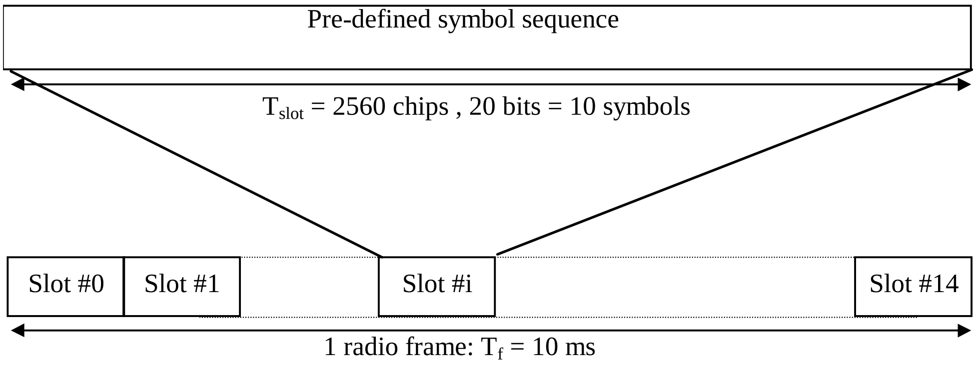


Figure 11: Frame structure for Common Pilot Channel

In case ~~of T~~transmit ~~D~~diversity (open or closed loop) is used on any downlink channel in the cell, the CPICH shall be transmitted from both antennas using the same channelization and scrambling code. In this case, the pre-defined symbol sequence of the CPICH is different for Antenna 1 and Antenna 2, see figure 12. In case of no t~~T~~ransmit d~~D~~iversity, the symbol sequence of Antenna 1 in figure 12 is used.

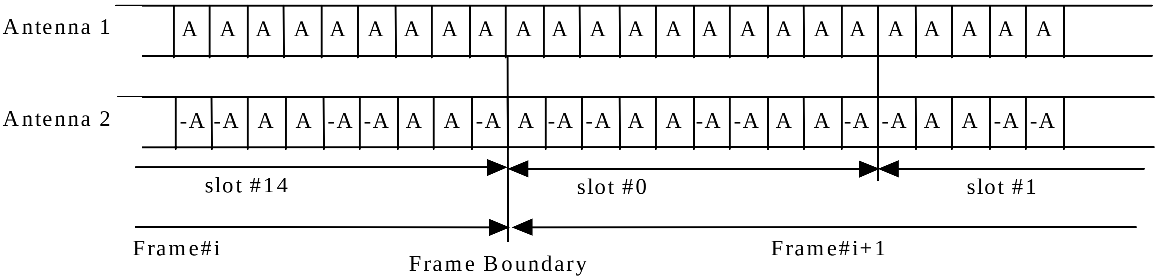


Figure 12: Modulation pattern for Common Pilot Channel (with A = 1+j)

There are two types of Common pilot channels, the Primary and Secondary CPICH. They differ in their use and the limitations placed on their physical features.

5.3.3.1.1 Primary Common Pilot Channel (P-CPICH)

The Primary Common Pilot Channel (P-CPICH) has the following characteristics:

- The same channelization code is always used for the P-CPICH~~this channel~~, see [4]
- The P-CPICH is ~~S~~scrambled by the primary scrambling code, see [4]
- There is one and only o~~O~~ne P-CPICH per cell
- The P-CPICH is ~~B~~broadcast over the entire cell

The Primary CPICH is the phase reference for the following downlink channels: SCH, Primary CCPCH, AICH, PICH. The Primary CPICH is also the *default* phase reference for all other downlink physical channels.

5.3.3.1.2 Secondary Common Pilot Channel (S-CPICH)

A Secondary Common Pilot Channel (S-CPICH) has the following characteristics:

- A~~Can use a~~n arbitrary channelization code of -SF=256 is used for the S-CPICH, see [4]
- A S-CPICH is ~~S~~scrambled by either the primary or a secondary scrambling code, see [4]
- There may be ~~Z~~zero, one, or several S-CPICH per cell
- A S-CPICH ~~M~~may be transmitted over the entire cell or only over a part of the cell
- A Secondary CPICH may be the reference for the Secondary CCPCH and the downlink DPCH. If this is the case, the UE is informed about this by higher-layer signalling.

5.3.3.2 Primary Common Control Physical Channel (P-CCPCH)

The Primary CCPCH is a fixed rate (30 kbps, SF=256) downlink physical channels used to carry the BCH transport channel.

Figure 13 shows the frame structure of the Primary CCPCH. The frame structure differs from the downlink DPCH in that no TPC commands, no TFCI and no pilot bits are transmitted. The Primary CCPCH is not transmitted during the first 256 chips of each slot. Instead, Primary SCH and Secondary SCH are transmitted during this period (see section 5.3.3.4).

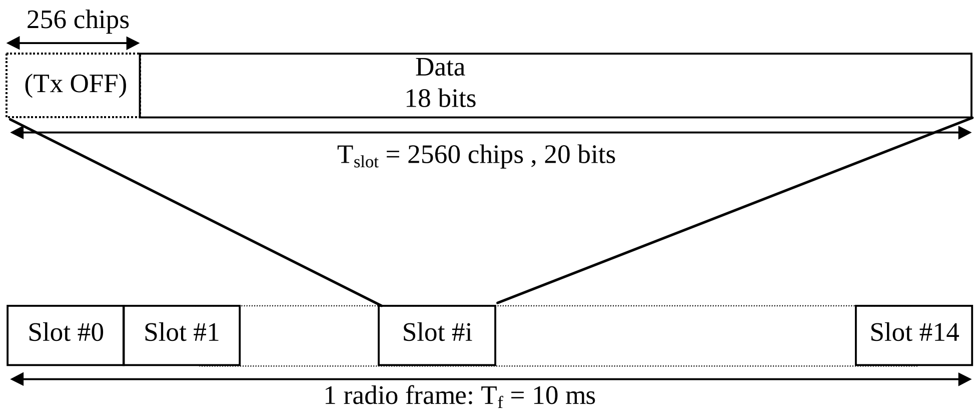


Figure 13: Frame structure for Primary Common Control Physical Channel

5.3.3.2.1 Primary CCPCH structure with STTD encoding

In case the diversity antenna is present in UTRAN and the P-CCPCH is to be transmitted using open loop transmit diversity, the data bits of the P-CCPCH are STTD encoded as given in section 5.3.1.1.1. The last two data bits in even numbered slots are STTD encoded together with the first two data bits in the following slot, except for slot #14 where the two last data bits are not STTD encoded and instead transmitted with equal power from both the antennas, see figure 14. Higher layers signal whether STTD encoding is used for the P-CCPCH or not. In addition~~, higher layer signalling indicates~~ the presence/absence of STTD encoding on P-CCPCH is indicated~~,~~ by modulating the SCH, see 5.3.3.4. During power on and hand over between cells the UE can determine~~s~~ the presence of STTD encoding on the P-CCPCH, by either receiving the higher layer message, by demodulating the SCH channel, or by a combination of the above two schemes.

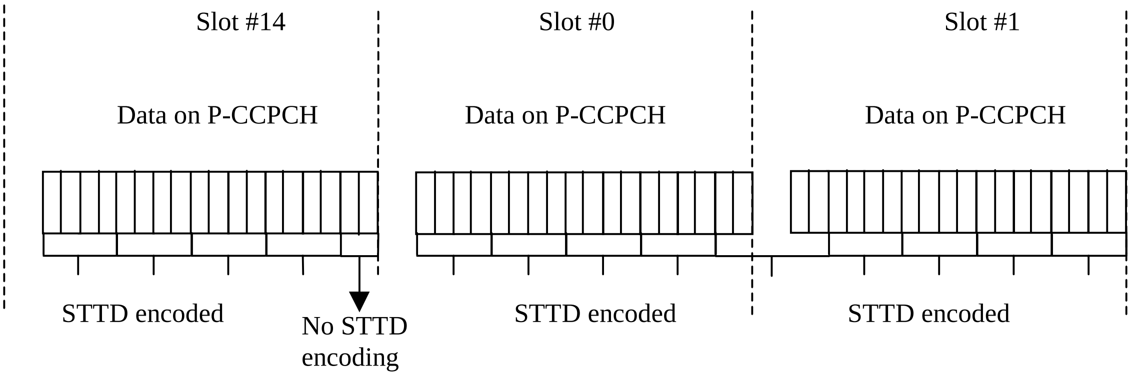


Figure 14: STTD encoding for the data bits of the P-CCPCH

5.3.3.3 Secondary Common Control Physical Channel (S-CCPCH)

The Secondary CCPCH is used to carry the FACH and PCH. There are two types of Secondary CCPCH: those that include TFCI and those that do not include TFCI. It is the UTRAN that determines if a TFCI should be transmitted, hence making it mandatory for all UEs to support the use of TFCI. The set of possible rates for the Secondary CCPCH is the same as for the downlink DPCH, see section 5.3.2. The frame structure of the Secondary CCPCH is shown in figure 15.

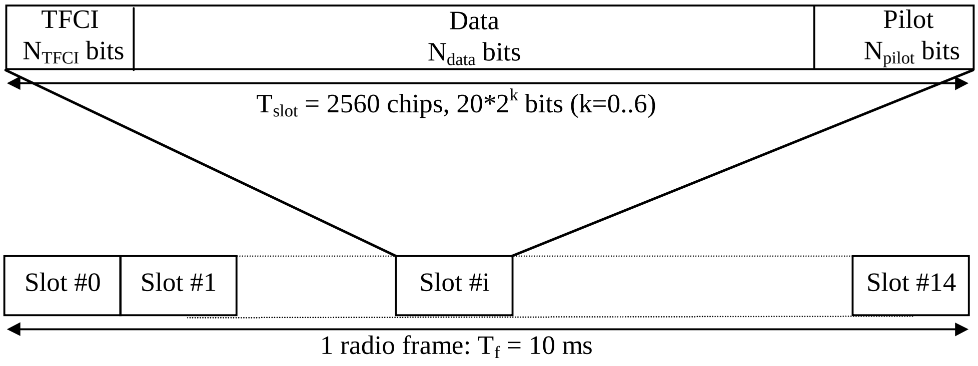


Figure 15: Frame structure for Secondary Common Control Physical Channel

The parameter k in figure 15 determines the total number of bits per downlink Secondary CCPCH slot. It is related to the spreading factor SF of the physical channel as SF = $256/2^k$. The spreading factor range is from 256 down to 4.

The values for the number of bits per field are given in table 16. The channel bit and symbol rates given in table 16 are the rates immediately before spreading. The pilot patterns are given in table 17.

The FACH and PCH can be mapped to the same or to separate Secondary CCPCHs. If FACH and PCH are mapped to the same Secondary CCPCH, they can be mapped to the same frame. The main difference between a CCPCH and a downlink dedicated physical channel is that a CCPCH is not inner-loop power controlled. The main difference between the Primary and Secondary CCPCH is that the transport channel mapped to the Primary CCPCH (BCH) can only have ~~has~~ a fixed predefined transport format combination,~~rate~~ while the Secondary CCPCH ~~can~~ support multiple transport format combinations using~~variable rate with the help of the~~ TFCI~~ field included~~. Furthermore, a Primary CCPCH is ~~continuously~~ transmitted over the entire cell while a Secondary CCPCH ~~is only transmitted when there is data available and~~ may be transmitted in a narrow lobe in the same way as a dedicated physical channel (only valid for a Secondary CCPCH carrying the FACH).

Table 16: Secondary CCPCH fields

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{data}	N_{pilot}	N_{TFCI}
0	30	15	256	300	20	20	0	0
1	30	15	256	300	20	12	8	0
2	30	15	256	300	20	18	0	2
3	30	15	256	300	20	10	8	2
4	60	30	128	600	40	40	0	0
5	60	30	128	600	40	32	8	0
6	60	30	128	600	40	38	0	2
7	60	30	128	600	40	30	8	2
8	120	60	64	1200	80	72	0	8*
9	120	60	64	1200	80	64	8	8*
10	240	120	32	2400	160	152	0	8*
11	240	120	32	2400	160	144	8	8*
12	480	240	16	4800	320	312	0	8*
13	480	240	16	4800	320	296	16	8*
14	960	480	8	9600	640	632	0	8*
15	960	480	8	9600	640	616	16	8*
16	1920	960	4	19200	1280	1272	0	8*
17	1920	960	4	19200	1280	1256	16	8*

* If TFCI bits are not used, then DTX shall be used in TFCI field.

The pilot symbol pattern is described in table 17. The shadowed part can be used as frame synchronization words. (The symbol pattern of pilot symbols other than the frame synchronization word shall be "11"). In table 17, the transmission order is from left to right. (Each two-bit pair represents an I/Q pair of QPSK modulation.)

Table 17: Pilot Symbol Pattern

	$N_{pilot} = 8$				$N_{pilot} = 16$							
Symbol #	0	1	2	3	0	1	2	3	4	5	6	7
Slot #0	11	11	11	10	11	11	11	10	11	11	11	10
1	11	00	11	10	11	00	11	10	11	11	11	00
2	11	01	11	01	11	01	11	01	11	10	11	00
3	11	00	11	00	11	00	11	00	11	01	11	10
4	11	10	11	01	11	10	11	01	11	11	11	11
5	11	11	11	10	11	11	11	10	11	01	11	01
6	11	11	11	00	11	11	11	00	11	10	11	11
7	11	10	11	00	11	10	11	00	11	10	11	00
8	11	01	11	10	11	01	11	10	11	00	11	11
9	11	11	11	11	11	11	11	11	11	00	11	11
10	11	01	11	01	11	01	11	01	11	11	11	10
11	11	10	11	11	11	10	11	11	11	00	11	10
12	11	10	11	00	11	10	11	00	11	01	11	01
13	11	00	11	11	11	00	11	11	11	00	11	00
14	11	00	11	11	11	00	11	11	11	10	11	01

For slot formats using TFCI, the TFCI value in each radio frame corresponds to a certain transport format combination of the FACHs and/or PCHs currently in use. This correspondence is (re-)negotiated at each FACH/PCH addition/removal. The mapping of the TFCI bits onto slots is described in [3].

5.3.3.3.1 Secondary CCPCH structure with STTD encoding

In case the diversity antenna is present in UTRAN and the S-CCPCH is to be transmitted using open loop transmit diversity, the data symbols of the S-CCPCH are STTD encoded as given in Section 5.3.1.1.1. The ~~diversity antenna~~ pilot symbol pattern for antenna 2 for the S-CCPCH is given in table 18 below.

Table 18: Pilot symbol pattern for ~~the diversity~~ antenna 2 when STTD encoding is used on the S-CCPCH

	$N_{pilot} = 8$				$N_{pilot} = 16$							
Symbol #	0	1	2	3	0	1	2	3	4	5	6	7
Slot #0	11	00	00	10	11	00	00	10	11	00	00	10
1	11	00	00	01	11	00	00	01	11	10	00	10
2	11	11	00	00	11	11	00	00	11	10	00	11
3	11	10	00	01	11	10	00	01	11	00	00	00
4	11	11	00	11	11	11	00	11	11	01	00	10
5	11	00	00	10	11	00	00	10	11	11	00	00
6	11	10	00	10	11	10	00	10	11	01	00	11
7	11	10	00	11	11	10	00	11	11	10	00	11
8	11	00	00	00	11	00	00	00	11	01	00	01
9	11	01	00	10	11	01	00	10	11	01	00	01
10	11	11	00	00	11	11	00	00	11	00	00	10
11	11	01	00	11	11	01	00	11	11	00	00	01
12	11	10	00	11	11	10	00	11	11	11	00	00
13	11	01	00	01	11	01	00	01	11	10	00	01
14	11	01	00	01	11	01	00	01	11	11	00	11

5.3.3.4 Synchronisation Channel (SCH)

The Synchronisation Channel (SCH) is a downlink signal used for cell search. The SCH consists of two sub channels, the Primary and Secondary SCH. The 10 ms radio frames of the Primary and Secondary SCH are divided into 15 slots, each of length 2560 chips. Figure 16 illustrates the structure of the SCH radio frame.

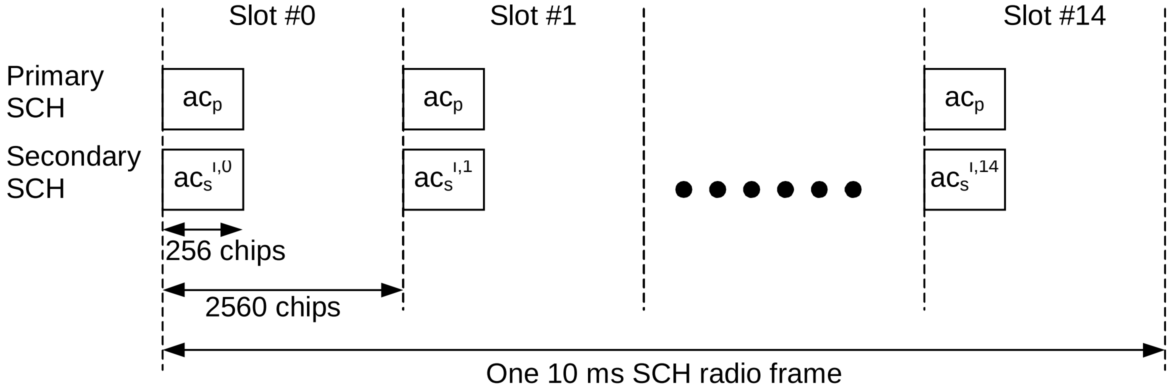


Figure 16: Structure of Synchronisation Channel (SCH)

The Primary SCH consists of a modulated code of length 256 chips, the Primary Synchronisation Code (PSC) denoted c_p in figure 16, transmitted once every slot. The PSC is the same for every cell in the system.

The Secondary SCH consists of repeatedly transmitting a length 15 sequence of modulated codes of length 256 chips, the Secondary Synchronisation Codes (SSC), transmitted in parallel with the Primary SCH. The SSC is denoted $c_s^{i,k}$ in figure 17, where $i = 1, 2, \ldots, 64$ is the number of the scrambling code group, and $k = 0, 1, \ldots, 14$ is the slot number. Each SSC is chosen from a set of 16 different codes of length 256. This sequence on the Secondary SCH indicates which of the code groups the cell's downlink scrambling code belongs to.

The primary and secondary synchronization codes are modulated by the symbol a shown in figure 17, which indicates the presence/ absence of STTD encoding on the P-CCPCH and is given by the following table:

P-CCPCH STTD encoded	a = +1
P-CCPCH not STTD encoded	a = -1

5.3.3.4.1 SCH transmitted by TSTD

Figure 17 illustrates the structure of the SCH transmitted by the TSTD scheme. In even numbered slots both PSC and SSC are transmitted on antenna 1, and in odd numbered slots both PSC and SSC are transmitted on antenna 2.

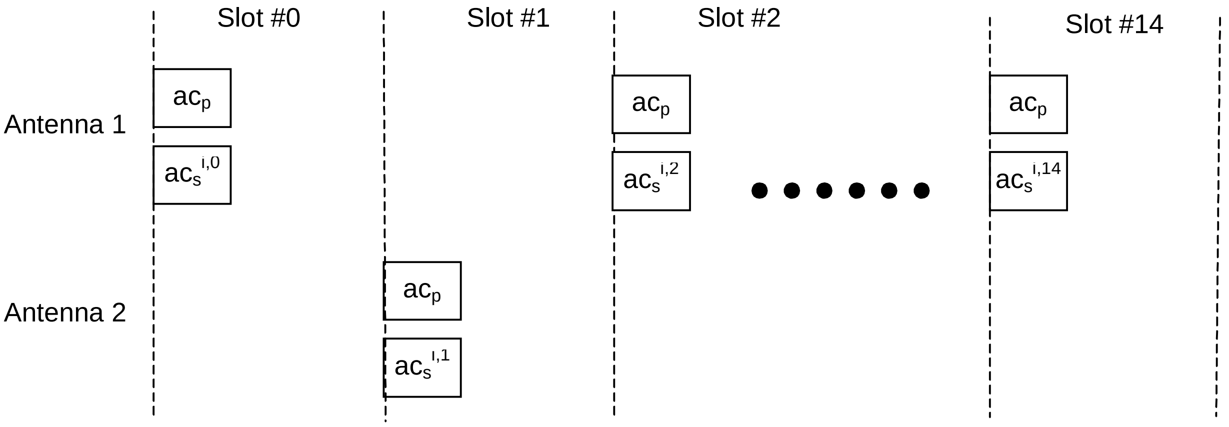


Figure 17: Structure of SCH transmitted by TSTD scheme

5.3.3.5 Physical Downlink Shared Channel (PDSCH)

The Physical Downlink Shared Channel (PDSCH), used to carry the Downlink Shared Channel (DSCH) transport channel, is shared by users based on code multiplexing. As the DSCH is always associated with one or several DCHs, the PDSCH is always associated with one or several downlink DPCHs. More exactly, each PDSCH radio frame is associated with one downlink DPCH.

The frame and slot structure of the PDSCH are shown on figure 18.

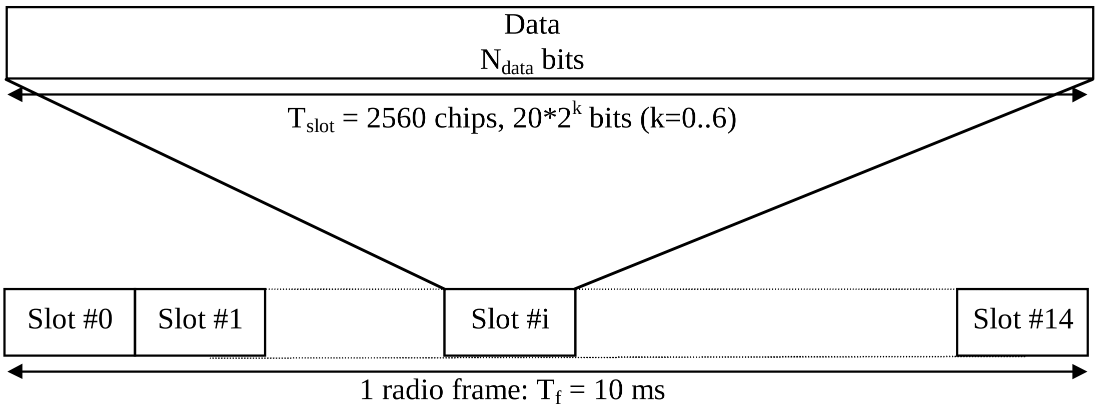


Figure 18: Frame structure for the PDSCH

To indicate for UE that there is data to decode on the DSCH, two signalling methods are possible, either using the TFCI field, or higher layer signalling.

The PDSCH transmission with associated DPCH is a special case of multi-code transmission. The PDSCH and DPCH do not have necessary the same spreading factors. Furthermore, the ~~and for~~ PDSCH ~~the~~ spreading factor may vary from frame to frame. All~~The~~ relevant Layer 1 control information is transmitted on the DPCCH part of the associated DPCH, i.e. the PDSCH does not carry~~ontain~~ physical layer information. The channel bit rates and symbol rates for PDSCH are given in table 19.

For PDSCH the allowed spreading factors may vary from 256 to 4.

If the spreading factor and other physical layer parameters can vary on a frame-by-frame basis, the TFCI shall be used to inform the UE what are the instantaneous parameters of PDSCH including the channelisation code from the PDSCH OVSF code tree.

A DSCH may be mapped to multiple parallel PDSCHs.~~ as well, as negotiated at higher layer prior to starting data transmission. In such a case the parallel PDSCHs shall be operated with frame synchronization between each other.~~

Table 19: PDSCH fields

Slot format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{data}
0	30	15	256	300	20	20
1	60	30	128	600	40	40
2	120	60	64	1200	80	80
3	240	120	32	2400	160	160
4	480	240	16	4800	320	320
5	960	480	8	9600	640	640
6	1920	960	4	19200	1280	1280

When open loop transmit diversity is employed for the PDSCH, STTD encoding is used on the data bits as described in section 5.3.1.1.1.

5.3.3.6 Acquisition Indicator Channel (AICH)

The Acquisition Indicator channel (AICH) is a physical channel used to carry Acquisition Indicators (AI). Acquisition Indicator AI_s corresponds to signature s on the PRACH or PCPCH. Note that for PCPCH, the AICH either corresponds to an access preamble or a CD preamble. The AICH corresponding to the access preamble is an AP-AICH and the

AICH corresponding to the CD preamble is a CD-AICH. The AP-AICH and CD-AICH use different channelization codes, see further[4], Section 4.3.3.2.

Figure 19 illustrates the structure of the AICH. The AICH consists of a repeated sequence of 15 concecutive *access slots* (AS), each of length 40 bit intervals. Each access slot consists of two parts, an *Acquisition-Indicator* (AI) part consisting of 32 real-valued symbols a_0, …, a_{31} and an unused part consisting of 8 real-valued symbols a_{32}, …, a_{39}.

The phase reference for the AICH is the Primary CPICH.

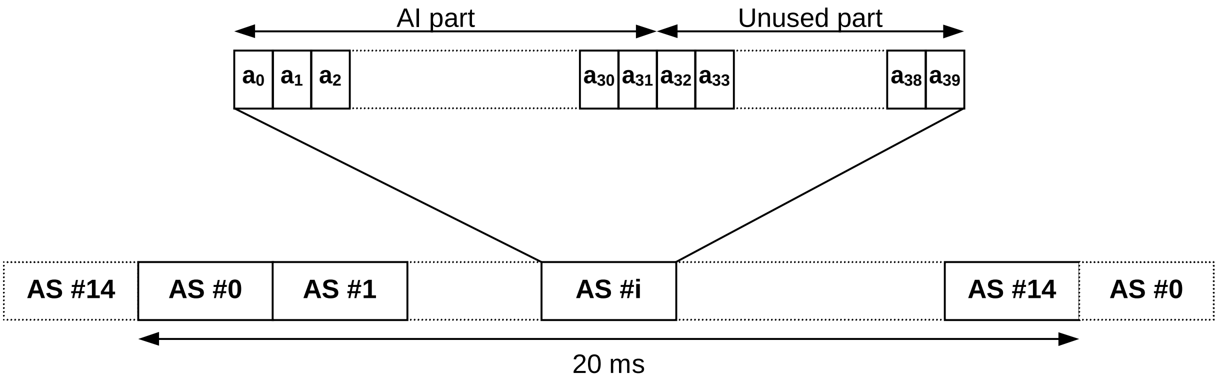


Figure 19: Structure of Acquisition Indicator Channel (AICH)

The real-valued symbols a_0, a_1, …, a_{31} in Figure 19 are given by

$$a_j = \sum_{s=0}^{15} \mathrm{AI}_s b_{s,j}$$

where AI_s, taking the values +1, -1, and 0, is the acquisition indicator corresponding to signature s and the sequence $b_{s,0}$, …, $b_{s,31}$ is given by Table 20.

The real-valued symbols a_{32}, a_{33}, …, a_{39} in Figure 19 are undefined.

In case STTD-based open-loop transmit diversity is applied to AICH, STTD encoding according to section 5.3.1.1.1 is applied to each sequence $b_{s,0}$, $b_{s,1}$, ..., $b_{s,31}$ separately before the sequences are combined into AICH symbols a_0, …, a_{31}.

Table 20: AICH signature patterns

s	$b_{s,0}$, $b_{s,1}$…, $b_{s,31}$																															
0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1
2	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1
3	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1
4	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1
5	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1
6	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1
7	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
9	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1
10	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1
11	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1
12	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1
13	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1
14	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	1	1	1	1	-1	-1	-1	-1
15	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1

5.3.3.7 Paging~~e~~ Indicator Channel (PICH)

The Paging~~e~~ Indicator Channel (PICH) is a fixed rate (SF=256) physical channel used to carry the Paging~~e~~ Indicators (PI). The PICH is always associated with an S-CCPCH to which a PCH transport channel is mapped.

Figure 20 illustrates the frame structure of the PICH. One PICH radio frame of length 10 ms consists of 300 bits (b_0, b_1, …, b_{299}). Of these, 288 bits (b_0, b_1, …, b_{287}) are used to carry Paging~~e~~ Indicators. The remaining 12 bits (b_{288}, b_{289}, …, b_{299}) are undefined.

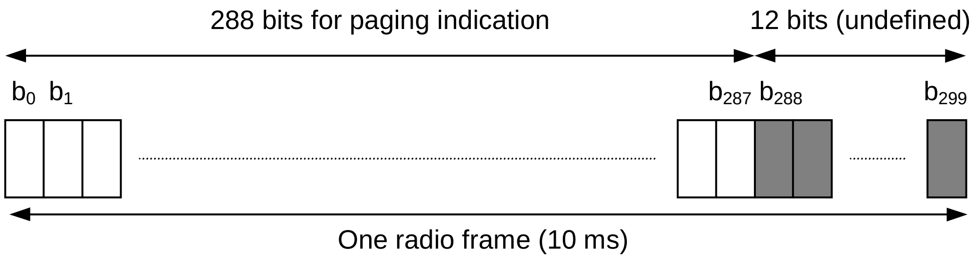


Figure 20: Structure of Paging~~e~~ Indicator Channel (PICH)

N Paging~~e~~ Indicators {PI_0, …, PI_{N-1}} are transmitted in each PICH frame, where N=18, 36, 72, or 144.

The PI calculated by higher layers for use for a certain UE, is mapped to the paging indicator PI_p, where p is computed as a function of the PI computed by higher layers, the SFN of the P-CCPCH radio frame during which the start of the PICH radio frame occurs, and the number of paging indicators per frame (N):

$$p = \left(PI + \left\lfloor \left(\left(18 \times \left(SFN + \lfloor SFN/8 \rfloor + \lfloor SFN/64 \rfloor + \lfloor SFN/512 \rfloor \right) \right) \bmod 144 \right) \times \frac{N}{144} \right\rfloor \right) \bmod N .$$

The mapping from {PI_0, …, PI_{N-1}} to the PICH bits {b_0, …, b_{287}} are according to table 21.

Table 21: Mapping of Paging~~e~~ Indicators (PI) to PICH bits

Number of PI per frame (N)	$PI_p = 1$	$PI_p = 0$
N=18	{b_{16p}, …, b_{16p+15}} = {1,1,…,1}	{b_{16p}, …, b_{16p+15}} = {0,0,…,0}
N=36	{b_{8p}, …, b_{8p+7}} = {1,1,…,1}	{b_{8p}, …, b_{8p+7}} = {0,0,…,0}
N=72	{b_{4p}, …, b_{4p+3}} = {1, 1,…,1}	{b_{4p}, …, b_{4p+3}} = {0, 0,…,0}
N=144	{b_{2p}, b_{2p+1}} = {1,1}	{b_{2p}, b_{2p+1}} = {0,0}

If a Paging Indicator in a certain frame is set to "1" it is an indication that UEs associated with this Paging~~e~~ Indicator should read the corresponding frame of the associated S-CCPCH.

When transmit diversity is employed for the PICH, STTD encoding is used on the PICH bits as described in section 5.3.1.1.1.

6 Mapping of transport channels onto physical channels

Figure 21 summarises the mapping of transport channels onto physical channels.

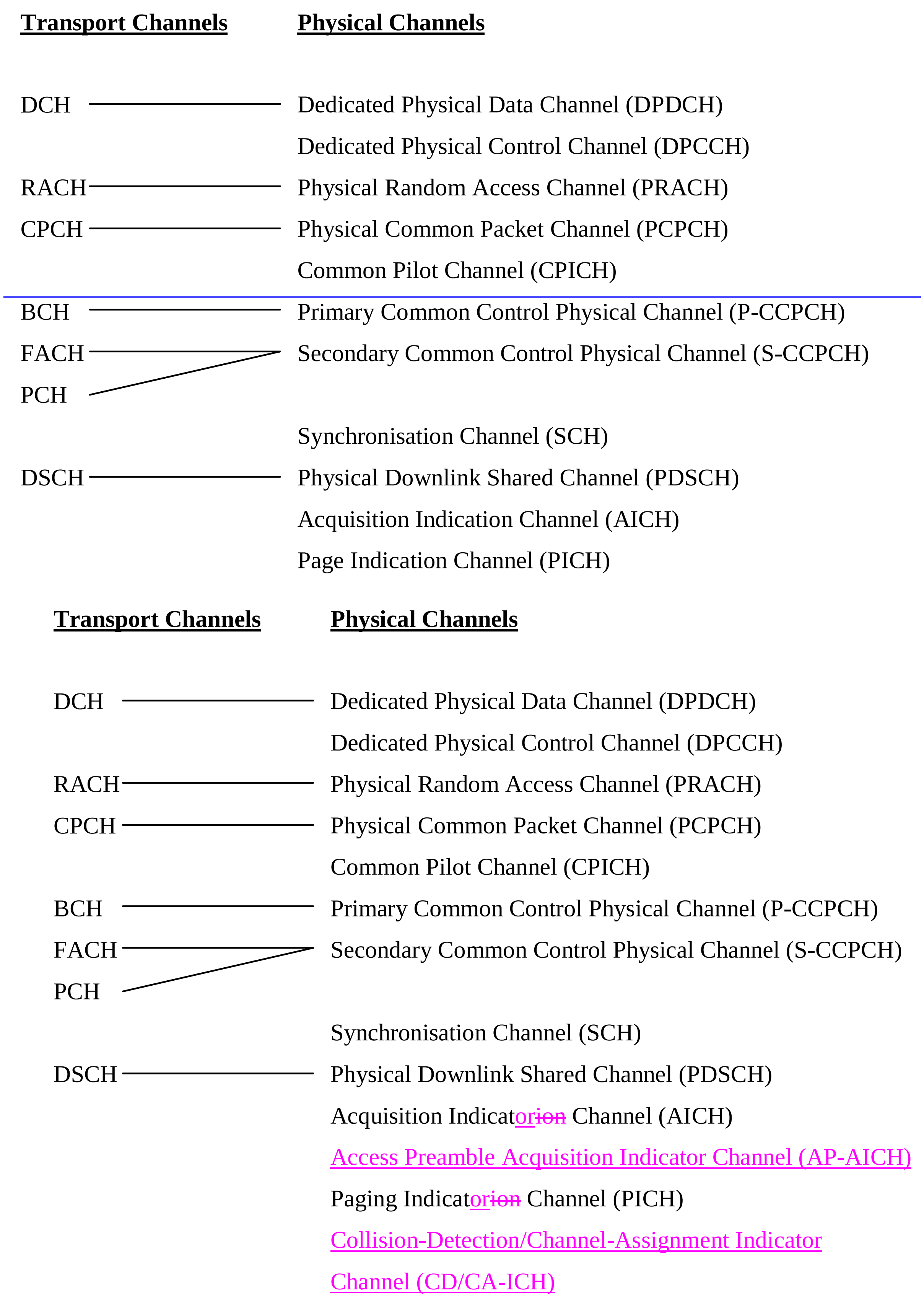


Figure 21: Transport-channel to physical-channel mapping

The DCHs are coded and multiplexed as described in [3] , and the resulting data stream is mapped sequentially (first-in-first-mapped) directly to the physical channel(s). The mapping of BCH and FACH/PCH is equally straightforward, where the data stream after coding and interleaving is mapped sequentially to the Primary and Secondary CCPCH respectively. Also for the RACH, the coded and interleaved bits are sequentially mapped to the physical channel, in this case the message part of ~~the random access burst on~~ the PRACH.

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 22 below describes the frame timing of the downlink physical channels. For the AICH the access slot timing is included. Transmission ~~T~~timing for uplink physical channels is given by the received timing of downlink physical channels~~timing~~, as described in the following sections.

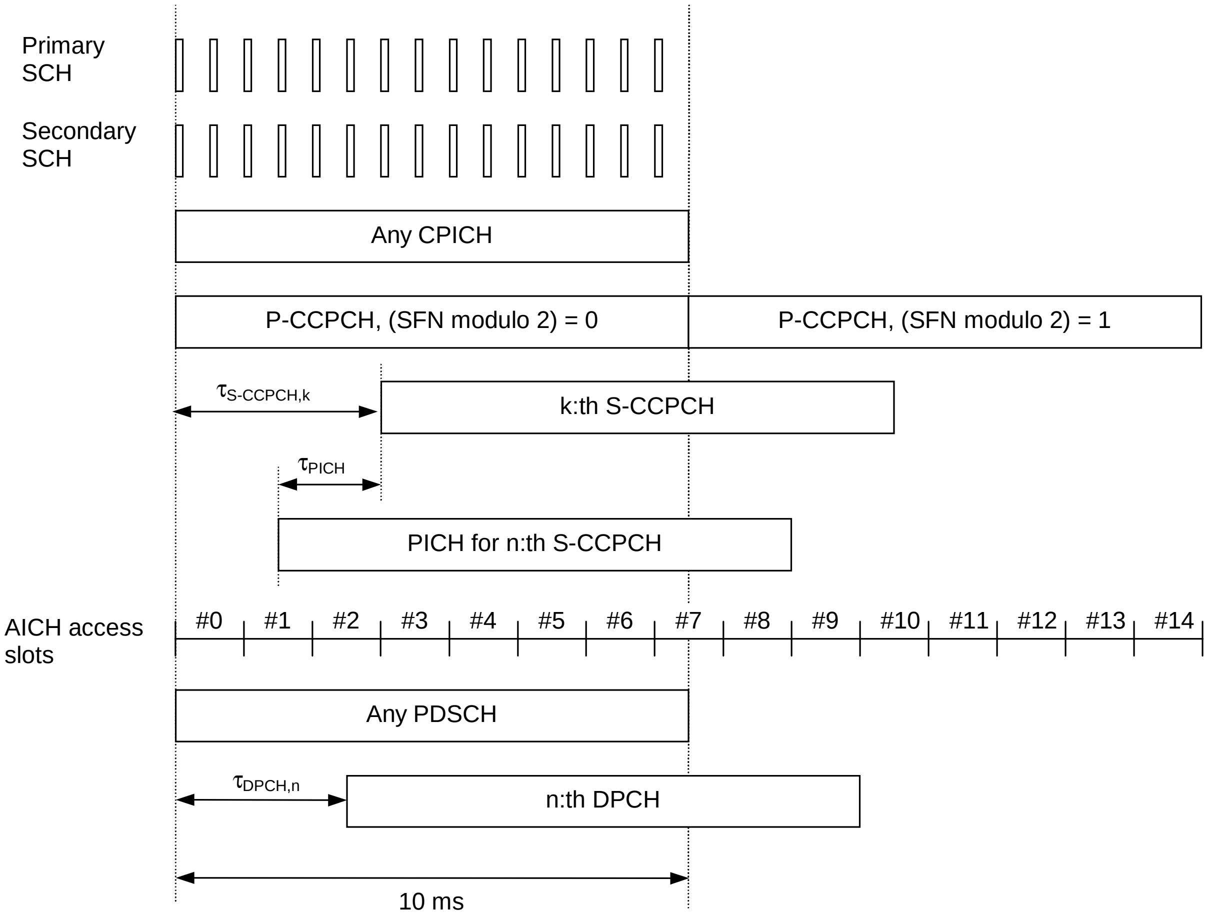


Figure 22: Frame timing and access slot timing of downlink physical channels

~~In figure 22 t~~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. $\tau_{S-CCPCH,k} = T_k \times 256$ chip, $T_k \in \{0, 1, …, 149\}$.

- The PICH timing is τ_{PICH} = 7680 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~~. The PICH timing relation to the S-CCPCH is described more in~~ section 7.2.
- ~~The~~ AICH access slots #0 starts the same time as ~~a~~ P-CCPCH frames with (SFN modulo 2) = 0. The AICH/PRACH and AICH/PCPCH timing is described in sections 7.3 and 7.4 respectively.
- The relative timing of associated PDSCH ~~timing relative the~~and DPCH ~~timing~~ is described in section 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. $\tau_{DPCH,n} = T_n \times 256$ chip, $T_n \in \{0, 1, \ldots, 149\}$. The DPCH (DPCCH/DPDCH) timing relation with uplink DPCCH/DPDCHs is described in section 7.6.

7.2 PICH/S-CCPCH timing relation

Figure 23 illustrates the timing between a PICH frame and its associated 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 section 7.1.

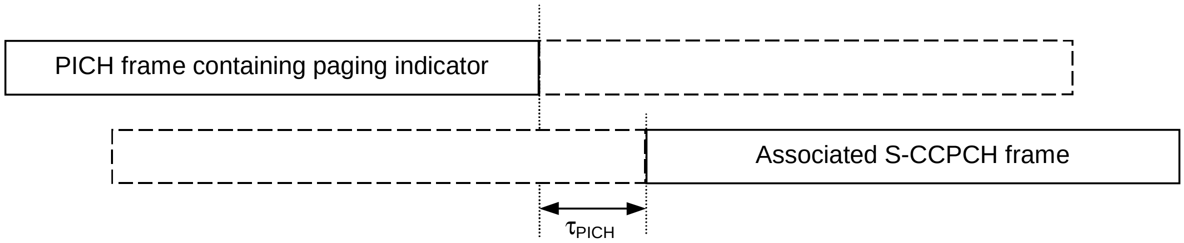


Figure 23: Timing relation between PICH frame and associated S-CCPCH frame

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 section 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 $\tau_{p\text{-}a}$ chips prior to the reception of downlink access slot number n, $n = 0, 1, \ldots, 14$.

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 24.

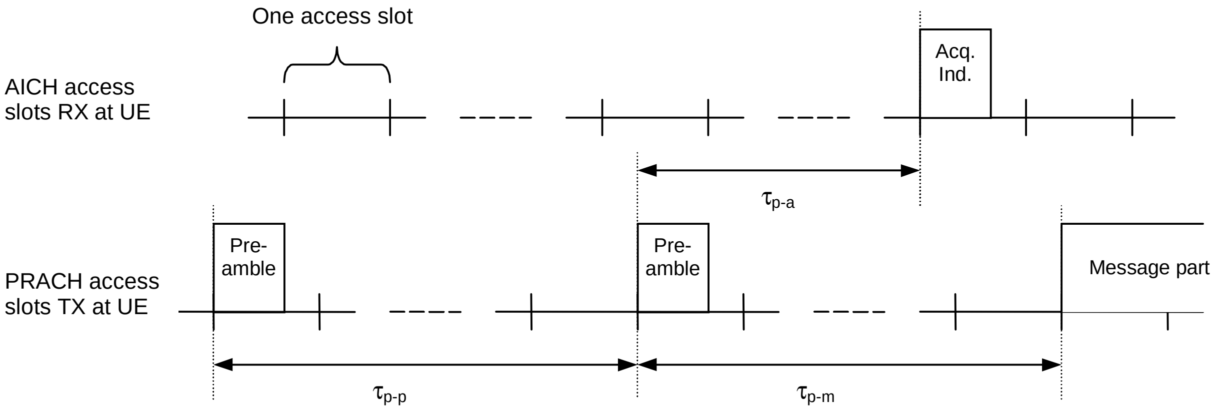


Figure 24: Timing relation between PRACH and AICH as seen at the UE

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

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

- when AICH_Transmission_Timing is set to 0, then

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

  τ_{p-a} = 7680 chips

  τ_{p-m} = 15360 chips (3 access slots)

- when AICH_Transmission_Timing is set to 1, then

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

  τ_{p-a} = 12800 chips

  τ_{p-m} = 20480 chips (4 access slots)

The parameter AICH_Transmission_Timing is signalled by higher layers.

7.4 PCPCH/AICH timing relation

Transmission of random access bursts on the PCPCH is aligned with access slot times. The timing of the access slots is derived from the received Primary CCPCH timing The transmit timing of access slot n starts n×20/15 ms after the frame boundary of the received Primary CCPCH, where n = 0, 1, …,14. In addition, transmission of access preambles in PCPCH is limited to the allocated access slot subchannel group which is assigned by higher layer signalling to each CPCH set. Twelve access slot subchannels are defined and PCPCH may be allocated all subchannel slots or any subset of the twelve subchannel slots. The access slot subchannel identification is identical to that for the RACH and is described in table 6 of section 6.1 of [5].

Everything in the previous section [PRACH/AICH] applies to this section as well. 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-AICH is identical to RACH Preamble and AICH. The timing relationship between CD-AICH 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-AICH.

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

Minimum time = 15360 chips + 5120 chips X Tcpch

Maximum time = 5120 chips X 12 = 61440 chips

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

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

$\tau_{a1\text{-}cdp}$ = Time between receipt of AP-AICH and transmission of the CD Preamble has one value: 7680 chips.

$\tau_{p\text{-}cdp}$ = Time between the last AP and CD Preamble. is either 3 or 4 access slots, depending on T_{cpch}

$\tau_{cdp\text{-}a2}$ = Time between the CD Preamble and the CD-AICH has two alternative values: 7680 chips or 12800 chips, depending on T_{cpch}

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

Figure 25 illustrates the PCPCH/AICH timing relationship whenT_{cpch} is set to 0 and all access slot subchannels are available for PCPCH.

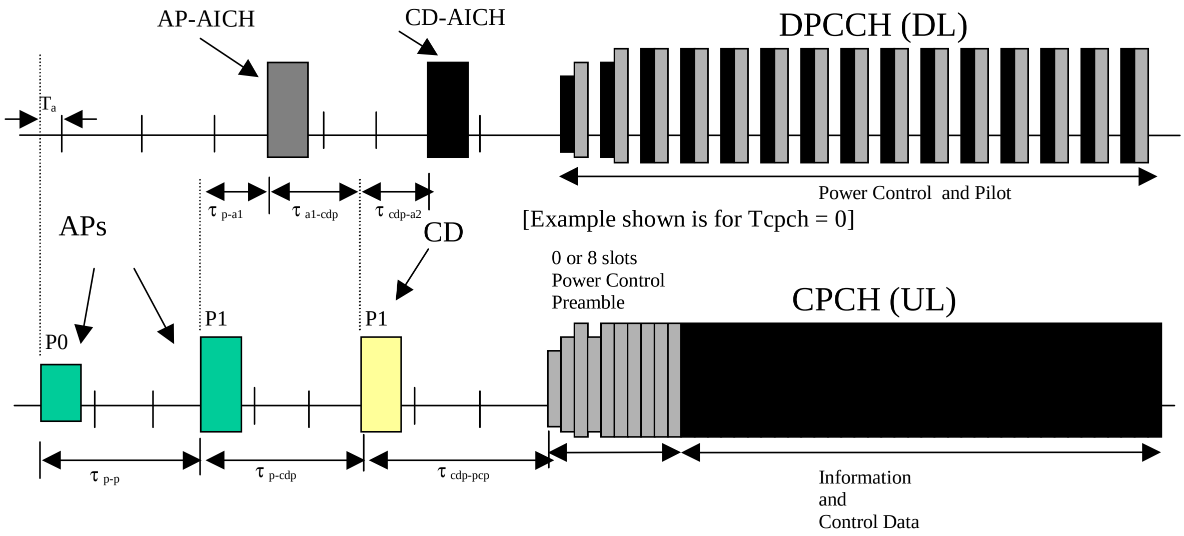


Figure 25: Timing of PCPCH and AICH transmission as seen by the UE, with T_{cpch}= 0

7.5 DPCH/PDSCH timing

The relative timing between a DPCH frame and the associated PDSCH frame is shown in figure 26.

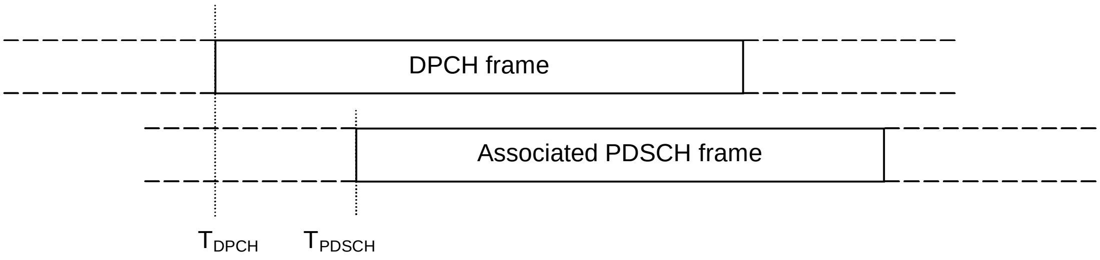


Figure 26: Timing relation between DPCH frame and associated PDSCH frame

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 -35840 chips < $T_{DPCH} - T_{PDSCH} \leq 2560$ chips, i.e. the associated PDSCH frame starts anywhere between 1 slot before or up to 14 slots behind the DPCH.

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.

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 significant path of the corresponding downlink DPCCH/DPDCH frame. T_0 is a constant defined to be 1024 chips. More information about the uplink/downlink timing relation and meaning of T_0 can be found in [5].

In case of USTS, the uplink DPCCH/DPDCH frame transmission for Initial synchronization takes place T_0+T_{INIT_SYNC} after the reception of the first significant path of the corresponding downlink DPCCH/DPDCH frame where T_{INIT_SYNC} is Initial synchronization time delivered by UTRAN. However the uplink DPCCH/DPDCH frame transmission for Tracking of USTS takes place approximately $T_0+T_{INIT\_SYNC}\pm\delta T$ after the reception of the first significant path of the corresponding downlink DPCCH/DPDCH frame where δT is the resultant timing adjustment due to the timing control by TAB command bits. More information on T_{INIT_SYNC} and δT can be found in section 9.2 and 9.3 of [5]

7.7 Timing relations for initialisation of channels

Figure 27 shows the timing relationships between the physical channels involved in the initialisation of a DCH.

The maximum time permitted for the UE to decode the relevant FACH frame before the first frame of the DPCCH is received shall be $T_{B\text{-}min}$ = 38400 chips (i.e.15 slots).

The downlink DPCCH shall commence at a time T_B after the end of the relevant FACH frame, where $T_B \geq T_{B\text{-}min}$ according to the following equation:

$$T_B = (T_n - T_k)\times 256 - N_{pcp}\times 2560 + N_{offset\_1}\times 38400 \text{ chips},$$ where:

N_{pcp} is a higher layer parameter set by the network, and represents the length (in slots) of the power control preamble (see [5], section 5.1.2.4).

N_{offset_1} is a parameter derived from the activation time set by higher layers. In order that $T_B \geq T_{B\text{-}min}$, N_{offset_1} shall be an integer number of frames such that:

$$N_{offset\_1} \geq \begin{cases} 1 \text{ when } T_n - T_k \geq \dfrac{T_{B-\min}}{256} + 10N_{pcp} - 150 \\[2ex] 2 \text{ when } \dfrac{T_{B-\min}}{256} + 10N_{pcp} - 300 \leq T_n - T_k < \dfrac{T_{B-\min}}{256} + 10N_{pcp} - 150 \\[2ex] 3 \text{ when } T_n - T_k < \dfrac{T_{B-\min}}{256} + 10N_{pcp} - 300 \end{cases}$$

T_n and T_k are parameters defining the timing of the frame boundaries on the DL DPCCH and S-CCPCH respectively (see section 7.1). These parameters are provided by higher layers.

The uplink DPCCH shall commence at a time T_C after the end of the relevant FACH frame, where

$T_C = T_B + T_0 + N_{offset\_2} \times 38400 \text{ chips}$, where T_0 is as in section 7.6.3 and N_{offset_2} is a UE-specific higher-layer parameter which shall be an integer number of frames greater than or equal to zero.

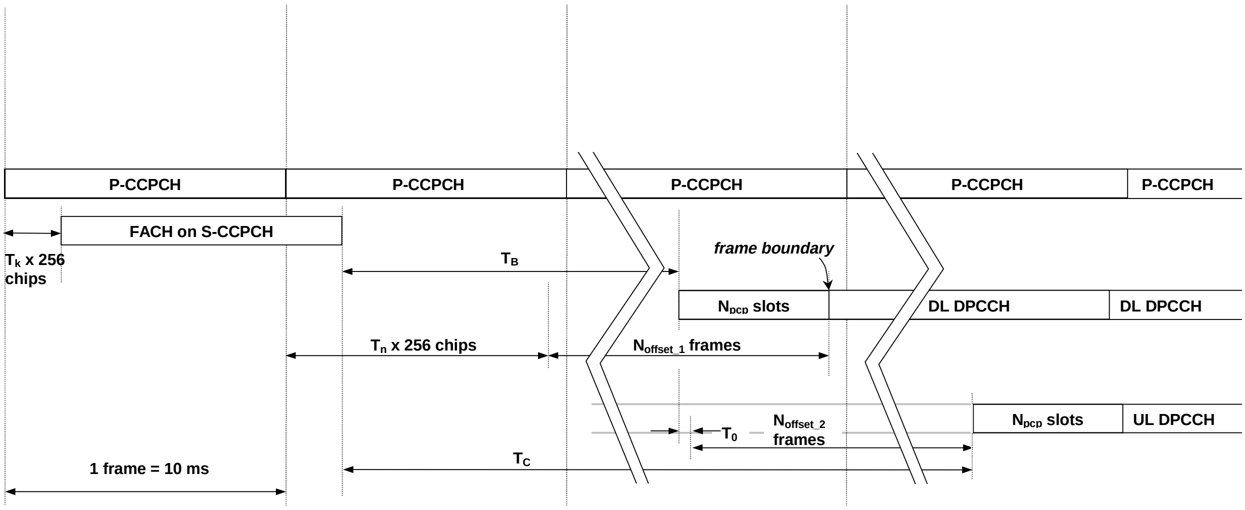


Figure 27: Timing for initialisation of DCH.

The data channels shall not commence before the end of the power control preamble.

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document ***R1-00-0270***
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.211 CR 036 Current Version: 3.1.1

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	TSG-RAN#7	for approval	X	strategic	*(for SMG*
list expected approval meeting # here ↑		for information		non-strategic	*use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from:* ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: TSG RAN WG1 **Date:** 28 Feb 2000

Subject: PDSCH multi-code transmission

Work item:

Category:
(only one category shall be marked with an X)

F	Correction	☐	
A	Corresponds to a correction in an earlier release	☐	
B	Addition of feature	☐	
C	Functional modification of feature	☒	
D	Editorial modification	☐	

Release:

Phase 2	☐
Release 96	☐
Release 97	☐
Release 98	☐
Release 99	☒
Release 00	☐

Reason for change: Clarification that where multi-code PDSCH transmission is used the spreading factor of each code will be the same.

Clauses affected: 5.3.3.5

Other specs affected:

Other 3G core specifications	☒	→ List of CRs:	25.331, 25.433, 25.435
Other GSM core specifications	☐	→ List of CRs:	
MS test specifications	☐	→ List of CRs:	
	☐	→ List of CRs:	
O&M specifications	☐	→ List of CRs:	

Other comments:

help.doc

<---------- double-click here for help and instructions on how to create a CR.

5.3.3.5 Physical Downlink Shared Channel (PDSCH)

The Physical Downlink Shared Channel (PDSCH), used to carry the Downlink Shared Channel (DSCH), is shared by users based on code multiplexing. As the DSCH is always associated with a DCH, the PDSCH is always associated with a downlink DPCH.

The frame and slot structure of the PDSCH are shown on figure 18.

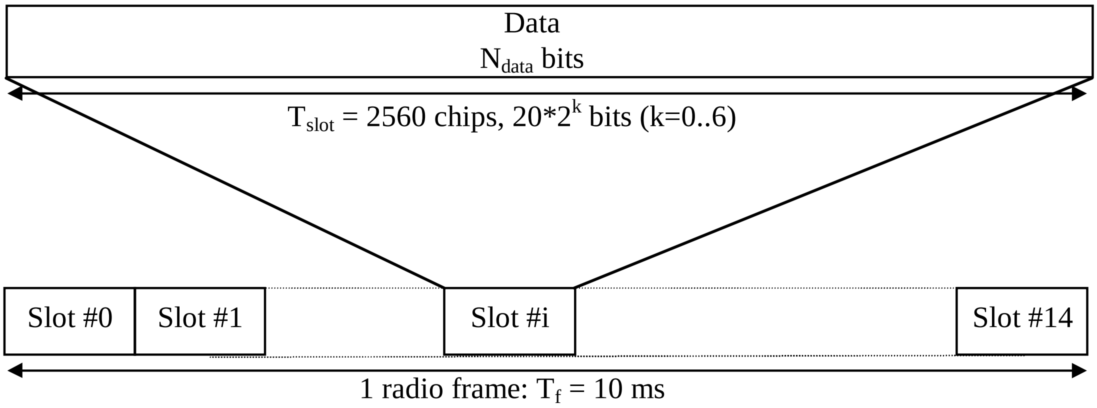


Figure 18: Frame structure for the PDSCH

To indicate for UE that there is data to decode on the DSCH, two signalling methods are possible, either using the TFCI field, or higher layer signalling.

The PDSCH transmission with associated DPCH is a special case of multicode transmission. The PDSCH and DPCH do not have necessary the same spreading factors and for PDSCH the spreading factor may vary from frame to frame. The relevant Layer 1 control information is transmitted on the DPCCH part of the associated DPCH, the PDSCH does not contain physical layer information. The channel bit and symbol rates for PDSCH are given in table 19.

For PDSCH the allowed spreading factors may vary from 256 to 4.

If the spreading factor and other physical layer parameters can vary on a frame-by-frame basis, the TFCI shall be used to inform the UE what are the instantaneous parameters of PDSCH including the channelisation code from the PDSCH OVSF code tree.

A DSCH may be mapped to multiple parallel PDSCHs as well, as negotiated at higher layer prior to starting data transmission. In such a case the parallel PDSCHs shall be operated with frame synchronization between each other and the spreading factor of all PDSCH codes will be the same.

Table 19: PDSCH fields

Slot format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{data}
0	30	15	256	300	20	20
1	60	30	128	600	40	40
2	120	60	64	1200	80	80
3	240	120	32	2400	160	160
4	480	240	16	4800	320	320
5	960	480	8	9600	640	640
6	1920	960	4	19200	1280	1280

When transmit diversity is employed for the PDSCH, STTD encoding is used on the data bits as described in section 5.3.1.1.1.

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document R1-00-0275
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.211 CR 037 Current Version: V3.1.1

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG RAN #7	for approval	☒	strategic	☐	(for SMG
list expected approval meeting # here ↑	for information	☐	non-strategic	☐	use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: TSG RAN WG1 **Date:** 2000-2-29

Subject: Clarification of pilot bit patterns for CPCH and slot formats for CPCH PC-P and message part.

Work item:

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

Reason for change: TS25.211 does not exactly define pilot bit patterns for CPCH PC-P and message part. This CR clears this ambiguity. This CR also specifies the same slot formats CPCH message part and PC-P to ensure the same numbers of pilot bits and FBI bits.

Clauses affected: 5.2.2.2

Other specs Affected:	Other 3G core specifications	☐	→ List of CRs:
	Other GSM core specifications	☐	→ List of CRs:
	MS test specifications	☐	→ List of CRs:
	BSS test specifications	☐	→ List of CRs:
	O&M specifications	☐	→ List of CRs:

Other comments:

5.2.2.2 Physical Common Packet Channel (PCPCH)

The Physical Common Packet Channel (PCPCH) is used to carry the CPCH.

5.2.2.2.1 CPCH transmission

The CPCH transmission is based on DSMA-CD approach with fast acquisition indication. The UE can start transmission at a number of well-defined time-offsets, relative to the frame boundary of the received BCH of the current cell. The access slot timing and structure is identical to RACH in section 5.2.2.1.1. The structure of the CPCH random access transmission is shown in figure 6. The CPCH random access transmission consists of one or several Access Preambles [A-P] of length 4096 chips, one Collision Detection Preamble (CD-P) of length 4096 chips, a DPCCH Power Control Preamble (PC-P) which is either 0 slots or 8 slots in length, and a message of variable length Nx10 ms.

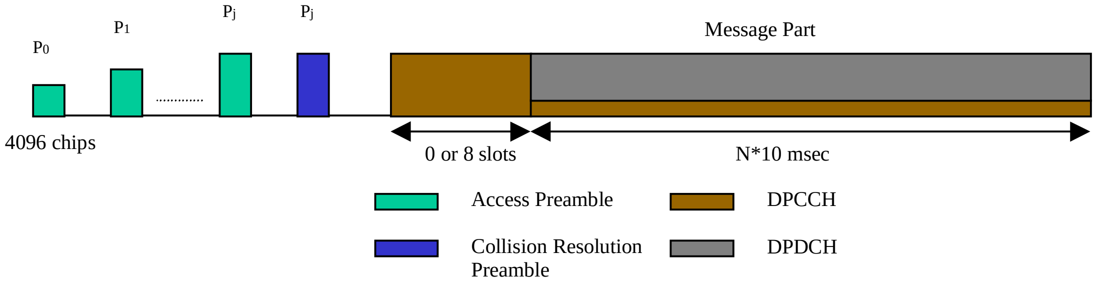


Figure 6: Structure of the CPCH random access transmission

5.2.2.2.2 CPCH access preamble part

Similar to 5.2.2.1.2 (RACH preamble part). The RACH preamble signature sequences are used. The number of sequences used could be less than the ones used in the RACH preamble. The scrambling code could either be chosen to be a different code segment of the Gold code used to form the scrambling code of the RACH preambles (see [4] for more details) or could be the same scrambling code in case the signature set is shared.

5.2.2.2.3 CPCH collision detection preamble part

Similar to 5.2.2.1.2 (RACH preamble part). The RACH preamble signature sequences are used. The scrambling code is chosen to be a different code segment of the Gold code used to form the scrambling code for the RACH and CPCH preambles (see [4] for more details).

5.2.2.2.4 CPCH power control preamble part

The power control preamble segment is a DPCCH Power Control Preamble (PC-P). ~~The following table 9 is identical to Rows 2 and 4 of table 2 in section 5.2.1.~~ Table 9 defines the DPCCH fields for CPCH PC-P part and this is identical to slot formats 0, 1, 2, 3, 4, and 5 of table 2 in section 5.2.1. ~~which only include Pilot, FBI and TPC bits.~~ The Power Control Preamble length is a parameter which shall take the values 0 or 8 slots, as set by the higher layers. The pilot bit patterns from slot #0 to slot #7 of table 3 and 4 in section 5.2.1 shall be used for CPCH PC-P pilot bit patterns when the power control preamble length is set to 8 slots.

Table 9: DPCCH fields for CPCH power control preamble segment

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{pilot}	~~N_{TFCI}~~ N_{TPC}	~~N_{FBI}~~ N_{TFCI}	~~N_{TPC}~~ N_{FBI}
0	15	15	256	150	10	6~~8~~	2~~0~~	2~~0~~	0~~2~~
1	15	15	256	150	10	8~~7~~	2~~0~~	0~~1~~	0~~2~~
2	15	15	256	150	10	5	2	2	1
3	15	15	256	150	10	7	2	0	1
4	15	15	256	150	10	6	2	0	2
5	15	15	256	150	10	5	1	2	2

5.2.2.2.5 CPCH message part

Figure 1 in section 5.2.1 shows the structure of the CPCH message part. Each message consists of up to N_Max_frames 10 ms frames. N_Max_frames is a higher layer parameter. Each 10 ms frame is split into 15 slots, each of length T_{slot} = 2560 chips. Each slot consists of two parts, a data part that carries higher layer information and a control part that carries Layer 1 control information. The data and control parts are transmitted in parallel.

The data part consists of $10*2^k$ bits, where k = 0, 1, 2, 3, 4, 5, 6, corresponding to spreading factors of 256, 128, 64, 32, 16, 8, 4 respectively. Note that various rates might be mapped to different signature sequences.

~~The spreading factor for the UL-DPCCH (message control part) is 256. The entries in table 1 corresponding to spreading factors of 256 and below and table 2 [both in section 5.2.1] apply to the DPDCH and DPCCH fields respectively for the CPCH message part.~~

The entries of table 1 in section 5.2.1 apply to the data part of the CPCH message part. The spreading factor for the control part of the CPCH message part shall be 256. The slot format of the control part of CPCH message part shall be the same as the control part of CPCH PC-P. The pilot bit patterns of table 3 and 4 in section 5.2.1 shall be used for pilot bit patterns of the CPCH message part.

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document R1-00-0296

CHANGE REQUEST

25.211 CR 039

Current Version:

For submission to: TSG RAN #7	for approval	☒	strategic	☐	(for SMG use only)
	for information	☐	non-strategic	☐	

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐

Source: TSG RAN WG1

Date: 29th, Feb., 2000

Subject: Further restrictions on the application of the Tx diversity modes in DL

Work item:

Category:	F Correction	☐	**Release:**	Phase 2	☐
	A Corresponds to a correction in an earlier release	☐		Release 96	☐
	B Addition of feature	☐		Release 97	☐
	C Functional modification of feature	☒		Release 98	☐
	D Editorial modification	☐		Release 99	☒
				Release 00	☐

Reason for change: For CPICH measurement purposes it is necessary for UE to know if CPICH is sent from 1 or 2 antennas. That information will be easily available to UE if the proposed modifications are adopted.

Clauses affected: 5.3.1

Other specs affected:	Other 3G core specifications	☐	→ List of CRs:	
	Other GSM core specifications	☐	→ List of CRs:	
	MS test specifications	☐	→ List of CRs:	
	BSS test specifications	☐	→ List of CRs:	
	O&M specifications	☐	→ List of CRs:	

Other comments:

5.3 Downlink physical channels

5.3.1 Downlink Transmit Diversity

Table 10 summarizes the possible application of open and closed loop Transmit diversity modes on different downlink physical channels. Simultaneous use of STTD and closed loop modes on DPCH and PDSCH 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.

Table 10: Application of Tx diversity modes on downlink physical channels
"X" – can be applied, "–" – not applied

Channel	**Open loop mode**		**Closed loop Mode**
	TSTD	**STTD**	
P-CCPCH	–	X	–
SCH	X	–	–
S-CCPCH	–	X	–
DPCH	–	X	X
PICH	–	X	–
PDSCH (associated with DPCH)	–	X	X
AICH	–	X	–

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document ***R1-00-0297***

e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.211 **CR** **040** Current Version: 3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG RAN #7 *list expected approval meeting # here ↑*	for approval	☒	Strategic	☐	*(for SMG use only)*
	for information	☐	Non-strategic	☐	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: TSG RAN WG1 **Date:** 24 Feb 2000

Subject: Clarification of downlink pilot bit patterns

Work item:

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

Reason for change: To clarify pilot bit patterns when compressed mode is achieved through spreading factor reduction.

Clauses affected: 5.3.2, 5.3.2.1

Other specs affected:	Other 3G core specifications	☐	→ List of CRs:	
	Other GSM core specifications	☐	→ List of CRs:	
	MS test specifications	☐	→ List of CRs:	
	BSS test specifications	☐	→ List of CRs:	
	O&M specifications	☐	→ List of CRs:	

Other comments: This CR does not supersede CR 029r1, CR 033, and CR 034.

5.3.2 Dedicated downlink physical channels

There is only one type of downlink dedicated physical channel, the Downlink Dedicated Physical Channel (downlink DPCH).

Within one downlink DPCH, dedicated data generated at Layer 2 and above, i.e. the dedicated transport channel (DCH), is transmitted in time-multiplex with control information generated at Layer 1 (known pilot bits, TPC commands, and an optional TFCI). The downlink DPCH can thus be seen as a time multiplex of a downlink DPDCH and a downlink DPCCH, compare section 5.2.1. It is the UTRAN that determines if a TFCI should be transmitted, hence making it is mandatory for all UEs to support the use of TFCI in the downlink. In case of USTS, the TPC bits in slot #14 in frames with CFN mod 2 = 0 are replaced by Time Alignment Bits (TABs) as described in section 9.3 of [5]

Figure 8 shows the frame structure of the downlink DPCH. Each frame of length 10 ms is split into 15 slots, each of length T_{slot} = 2560 chips, corresponding to one power-control period.

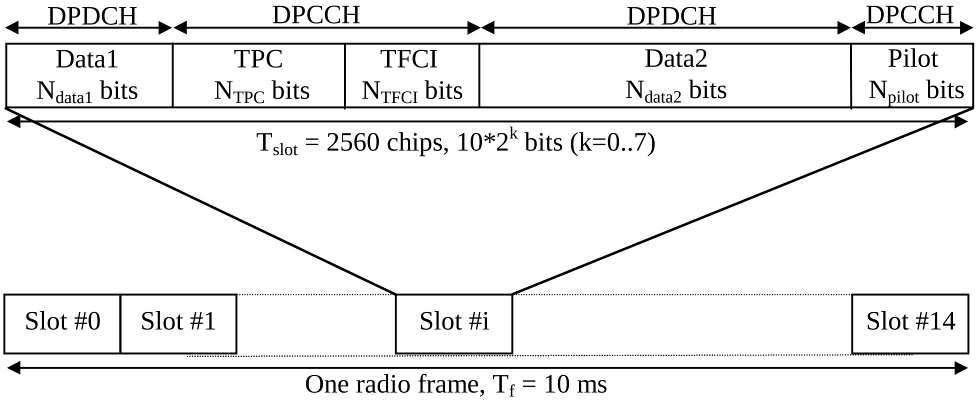


Figure 8: Frame structure for downlink DPCH

The parameter k in figure 8 determines the total number of bits per downlink DPCH slot. It is related to the spreading factor SF of the physical channel as SF = $512/2^k$. The spreading factor may thus range from 512 down to 4.

The exact number of bits of the different downlink DPCH fields (N_{pilot}, N_{TPC}, N_{TFCI}, N_{data1} and N_{data2}) is determined in table 11. The overhead due to the DPCCH transmission has to be negotiated at the connection set-up and can be re-negotiated during the communication, in order to match particular propagation conditions.

There are basically two types of downlink Dedicated Physical Channels; those that include TFCI (e.g. for several simultaneous services) and those that do not include TFCI (e.g. for fixed-rate services). These types are reflected by the duplicated rows of table 11. In compressed mode, a different slot format is used compared to normal mode. There are two possible compressed slot formats that are labelled A and B. Format B is used for compressed mode by spreading factor reduction and format A is used for all other transmission time reduction methods. The channel bit and symbol rates given in table 11 are the rates immediately before spreading.

Table 11: DPDCH and DPCCH fields

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Slot	DPDCH Bits/Slot		DPCCH Bits/Slot			Transmitted slots per radio frame N_{Tr}
					N_{Data1}	N_{Data2}	N_{TPC}	N_{TFCI}	N_{Pilot}	
0	15	7.5	512	10	0	4	2	0	4	15
0A	15	7.5	512	10	0	4	2	0	4	8-14
0B	30	15	256	20	0	8	4	0	8	8-14
1	15	7.5	512	10	0	2	2	2	4	15
1B	30	15	256	20	0	4	4	4	8	8-14
2	30	15	256	20	2	14	2	0	2	15
2A	30	15	256	20	2	14	2	0	2	8-14
2B	60	30	128	40	4	28	4	0	4	8-14
3	30	15	256	20	2	12	2	2	2	15
3A	30	15	256	20	2	10	2	4	2	8-14
3B	60	30	128	40	4	24	4	4	4	8-14
4	30	15	256	20	2	12	2	0	4	15
4A	30	15	256	20	2	12	2	0	4	8-14
4B	60	30	128	40	4	24	4	0	8	8-14
5	30	15	256	20	2	10	2	2	4	15
5A	30	15	256	20	2	8	2	4	4	8-14
5B	60	30	128	40	4	20	4	4	8	8-14
6	30	15	256	20	2	8	2	0	8	15
6A	30	15	256	20	2	8	2	0	8	8-14
6B	60	30	128	40	4	16	4	0	16	8-14
7	30	15	256	20	2	6	2	2	8	15
7A	30	15	256	20	2	4	2	4	8	8-14
7B	60	30	128	40	4	12	4	4	16	8-14
8	60	30	128	40	6	28	2	0	4	15
8A	60	30	128	40	6	28	2	0	4	8-14
8B	120	60	64	80	12	56	4	0	8	8-14
9	60	30	128	40	6	26	2	2	4	15
9A	60	30	128	40	6	24	2	4	4	8-14
9B	120	60	64	~~4~~80	12	52	4	4	8	8-14
10	60	30	128	40	6	24	2	0	8	15
10A	60	30	128	40	6	24	2	0	8	8-14
10B	120	60	64	80	12	48	4	0	16	8-14
11	60	30	128	40	6	22	2	2	8	15
11A	60	30	128	40	6	20	2	4	8	8-14
11B	120	60	64	80	12	44	4	4	16	8-14
12	120	60	64	80	12	48	4	8*	8	15
12A	120	60	64	80	12	40	4	16*	8	8-14
12B	240	120	32	160	24	96	8	16*	16	8-14
13	240	120	32	160	28	112	4	8*	8	15
13A	240	120	32	160	28	104	4	16*	8	8-14
13B	480	240	16	320	56	224	8	16*	16	8-14
14	480	240	16	320	56	232	8	8*	16	15
14A	480	240	16	320	56	224	8	16*	16	8-14
14B	960	480	8	640	112	464	16	16*	32	8-14
15	960	480	8	640	120	488	8	8*	16	15
15A	960	480	8	640	120	480	8	16*	16	8-14
15B	1920	960	4	1280	240	976	16	16*	32	8-14
16	1920	960	4	1280	248	1000	8	8*	16	15
16A	1920	960	4	1280	248	992	8	16*	16	8-14

* If TFCI bits are not used, then DTX shall be used in TFCI field.

NOTE1: Compressed mode is only supported through spreading factor reduction for SF=512 with TFCI.

NOTE2: Compressed mode by spreading factor reduction is not supported for SF=4.

The pilot ~~symbol~~bit patterns ~~is~~are described in table 12. The shadowed part can be used as frame synchronization words. (The symbol pattern of the pilot ~~symbol~~bits other than the frame synchronization word shall be "11".) In table 12, the transmission order is from left to right. (Each two-bit pair represents an I/Q pair of QPSK modulation.)

In downlink compressed mode through spreading factor reduction, the number of bits in the TPC and Pilot fields are doubled. Symbol repetition is used to fill up the fields. Denote the bits in one of these fields in normal mode by x_1, x_2, x_3, …, x_X. In compressed mode the following bit sequence is sent in corresponding field: x_1, x_2, x_1, x_2, x_3, x_4, x_3, x_4,…, x_X,.

Table 12: Pilot ~~Symbol~~bit ~~P~~patterns for downlink DPCCH

	N_{pilot}~~Npilot~~ = 2	N_{pilot}~~Npilot~~ = 4 (*1)		N_{pilot}~~Npilot~~ = 8 (*2)				N_{pilot}~~Npilot~~ = 16 (*3)							
Symbol #	0	0	1	0	1	2	3	0	1	2	3	4	5	6	7
Slot #0	11	11	11	11	11	11	10	11	11	11	10	11	11	11	10
1	00	11	00	11	00	11	10	11	00	11	10	11	11	11	00
2	01	11	01	11	01	11	01	11	01	11	01	11	10	11	00
3	00	11	00	11	00	11	00	11	00	11	00	11	01	11	10
4	10	11	10	11	10	11	01	11	10	11	01	11	11	11	11
5	11	11	11	11	11	11	10	11	11	11	10	11	01	11	01
6	11	11	11	11	11	11	00	11	11	11	00	11	10	11	11
7	10	11	10	11	10	11	00	11	10	11	00	11	10	11	00
8	01	11	01	11	01	11	10	11	01	11	10	11	00	11	11
9	11	11	11	11	11	11	11	11	11	11	11	11	00	11	11
10	01	11	01	11	01	11	01	11	01	11	01	11	11	11	10
11	10	11	10	11	10	11	11	11	10	11	11	11	00	11	10
12	10	11	10	11	10	11	00	11	10	11	00	11	01	11	01
13	00	11	00	11	00	11	11	11	00	11	11	11	00	11	00
14	00	11	00	11	00	11	11	11	00	11	11	11	10	11	01

Note *1: This pattern is used except slot formats 2B and 3B.

Note *2: This pattern is used except slot formats 0B, 1B, 4B, 5B, 8B, and 9B.

Note *3: This pattern is used except slot formats 6B, 7B, 10B, 11B, 12B, and 13B.

Note: For the other slot formats, symbol repetition shall be applied to the pilot bit pattern with the half size.

The relationship between the TPC symbol and the transmitter power control command is presented in table 13.

Table 13: TPC Bit Pattern

TPC Bit Pattern			**Transmitter power control command**
N_{TPC} = 2	N_{TPC} = 4	N_{TPC} = 8	
11	1111	11111111	1
00	0000	00000000	0

For slot formats using TFCI, the TFCI value in each radio frame corresponds to a certain combination of bit rates of the DCHs currently in use. This correspondence is (re-)negotiated at each DCH addition/removal. The mapping of the TFCI bits onto slots is described in [3].

When the total bit rate to be transmitted on one downlink CCTrCH exceeds the maximum bit rate for a downlink physical channel, multicode transmission is employed, i.e. several parallel downlink DPCHs are transmitted for one CCTrCH using the same spreading factor. In this case, the Layer 1 control information is put on only the first downlink DPCH. The additional downlink DPCHs belonging to the CCTrCH do not transmit any data during the corresponding time period, see figure 9.

In the case of several CCTrCHs of dedicated type for one UE different spreading factors can be used for each CCTrCH and only one DPCCH would be transmitted for them in the downlink.

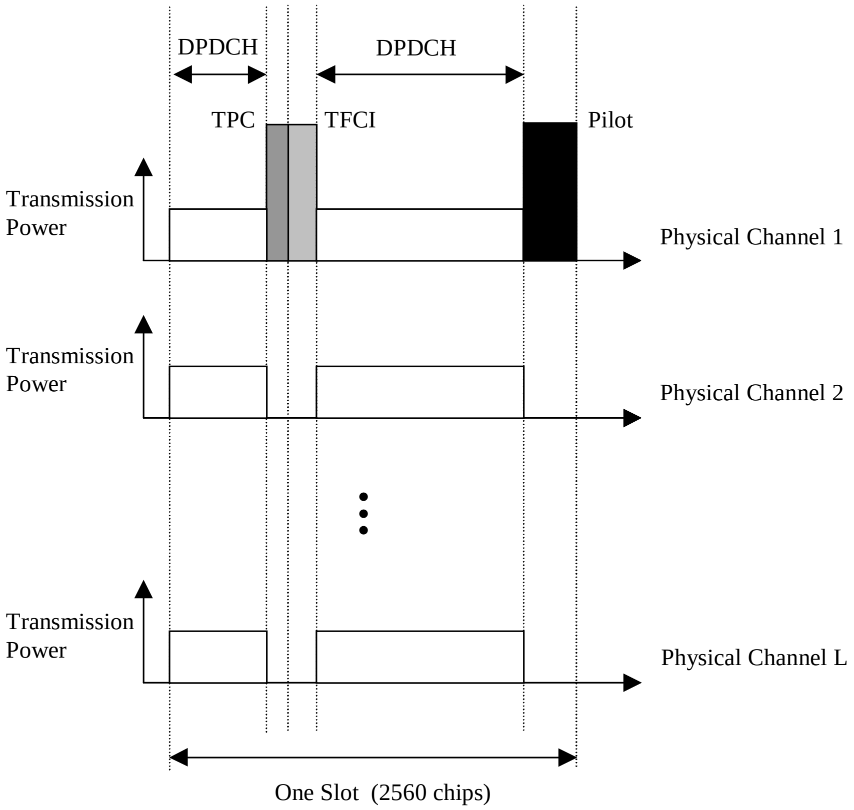


Figure 9: Downlink slot format in case of multi-code transmission

5.3.2.1 STTD for DPCH

The pilot bit pattern for the DPCH channel transmitted on ~~the diversity~~ antenna 2 is given in table 14. The shadowed part indicates pilot bits that are STTD encoded from the corresponding (shadowed) bits in Table 12. For the SF=256 DPCH, if there are only two dedicated pilot bits (N_{pilot} = 2 in Tables 12 and 14), they are STTD encoded together with the last two bits (data or DTX) of the second data field (data2) of the slot. STTD encoding for the DPDCH, TPC, and TFCI fields is done as described in section 5.3.1.1.1. For the SF=512 DPCH , the first two bits in each slot, i.e. TPC bits, are not STTD encoded and the same bits are transmitted with equal power from the two antennas. The following four bits are STTD encoded.

For compressed mode through spreading factor reduction and for N_{pilot} > 4, symbol repetition shall be applied to the pilot bit patterns of table 14, in the same manner as described in 5.3.2. For slot formats 2B and 3B, i.e. compressed mode through spreading factor reduction and N_{pilot} = 4, the pilot bits on antenna 1 are STTD encoded, and thus the pilot bit pattern is as shown in the most right set of table 14.

Table 14: Pilot bit patterns of ~~the~~downlink DPCCH~~ channel~~ for ~~the diversity~~ antenna 2 using STTD

	~~N_{pilot} = 2~~	~~N_{pilot} = 4~~		~~N_{pilot} = 8~~				~~N_{pilot} = 16~~							
~~Symbol #~~	~~0~~	~~0~~	~~1~~	~~0~~	~~1~~	~~2~~	~~3~~	~~0~~	~~1~~	~~2~~	~~3~~	~~4~~	~~5~~	~~6~~	~~7~~
~~Slot #0~~	~~01~~	~~01~~	~~10~~	~~11~~	~~00~~	~~00~~	~~10~~	~~11~~	~~00~~	~~00~~	~~10~~	~~11~~	~~00~~	~~00~~	~~10~~
~~1~~	~~10~~	~~10~~	~~10~~	~~11~~	~~00~~	~~00~~	~~01~~	~~11~~	~~00~~	~~00~~	~~01~~	~~11~~	~~10~~	~~00~~	~~10~~
~~2~~	~~11~~	~~11~~	~~10~~	~~11~~	~~11~~	~~00~~	~~00~~	~~11~~	~~11~~	~~00~~	~~00~~	~~11~~	~~10~~	~~00~~	~~11~~
~~3~~	~~10~~	~~10~~	~~10~~	~~11~~	~~10~~	~~00~~	~~01~~	~~11~~	~~10~~	~~00~~	~~01~~	~~11~~	~~00~~	~~00~~	~~00~~
~~4~~	~~00~~	~~00~~	~~10~~	~~11~~	~~11~~	~~00~~	~~11~~	~~11~~	~~11~~	~~00~~	~~11~~	~~11~~	~~01~~	~~00~~	~~10~~
~~5~~	~~01~~	~~01~~	~~10~~	~~11~~	~~00~~	~~00~~	~~10~~	~~11~~	~~00~~	~~00~~	~~10~~	~~11~~	~~11~~	~~00~~	~~00~~
~~6~~	~~01~~	~~01~~	~~10~~	~~11~~	~~10~~	~~00~~	~~10~~	~~11~~	~~10~~	~~00~~	~~10~~	~~11~~	~~01~~	~~00~~	~~11~~
~~7~~	~~00~~	~~00~~	~~10~~	~~11~~	~~10~~	~~00~~	~~11~~	~~11~~	~~10~~	~~00~~	~~11~~	~~11~~	~~10~~	~~00~~	~~11~~
~~8~~	~~11~~	~~11~~	~~10~~	~~11~~	~~00~~	~~00~~	~~00~~	~~11~~	~~00~~	~~00~~	~~00~~	~~11~~	~~01~~	~~00~~	~~01~~
~~9~~	~~01~~	~~01~~	~~10~~	~~11~~	~~01~~	~~00~~	~~10~~	~~11~~	~~01~~	~~00~~	~~10~~	~~11~~	~~01~~	~~00~~	~~01~~
~~10~~	~~11~~	~~11~~	~~10~~	~~11~~	~~11~~	~~00~~	~~00~~	~~11~~	~~11~~	~~00~~	~~00~~	~~11~~	~~00~~	~~00~~	~~10~~
~~11~~	~~00~~	~~00~~	~~10~~	~~11~~	~~01~~	~~00~~	~~11~~	~~11~~	~~01~~	~~00~~	~~11~~	~~11~~	~~00~~	~~00~~	~~01~~
~~12~~	~~00~~	~~00~~	~~10~~	~~11~~	~~10~~	~~00~~	~~11~~	~~11~~	~~10~~	~~00~~	~~11~~	~~11~~	~~11~~	~~00~~	~~00~~
~~13~~	~~10~~	~~10~~	~~10~~	~~11~~	~~01~~	~~00~~	~~01~~	~~11~~	~~01~~	~~00~~	~~01~~	~~11~~	~~10~~	~~00~~	~~01~~
~~14~~	~~10~~	~~10~~	~~10~~	~~11~~	~~01~~	~~00~~	~~01~~	~~11~~	~~01~~	~~00~~	~~01~~	~~11~~	~~11~~	~~00~~	~~11~~

	N_{pilot} = 2 (*1)	N_{pilot} = 4 (*2)		N_{pilot} = 8 (*3)				N_{pilot} = 16 (*4)								N_{pilot} = 4 (*5)	
Symbol #	0	0	1	0	1	2	3	0	1	2	3	4	5	6	7	0	1
Slot #0	01	01	10	11	00	00	10	11	00	00	10	11	00	00	10	01	10
1	10	10	10	11	00	00	01	11	00	00	01	11	10	00	10	10	01
2	11	11	10	11	11	00	00	11	11	00	00	11	10	00	11	11	00
3	10	10	10	11	10	00	01	11	10	00	01	11	00	00	00	10	01
4	00	00	10	11	11	00	11	11	11	00	11	11	01	00	10	00	11
5	01	01	10	11	00	00	10	11	00	00	10	11	11	00	00	01	10
6	01	01	10	11	10	00	10	11	10	00	10	11	01	00	11	01	10
7	00	00	10	11	10	00	11	11	10	00	11	11	10	00	11	00	11
8	11	11	10	11	00	00	00	11	00	00	00	11	01	00	01	11	00
9	01	01	10	11	01	00	10	11	01	00	10	11	01	00	01	01	10
10	11	11	10	11	11	00	00	11	11	00	00	11	00	00	10	11	00
11	00	00	10	11	01	00	11	11	01	00	11	11	00	00	01	00	11
12	00	00	10	11	10	00	11	11	10	00	11	11	11	00	00	00	11
13	10	10	10	11	01	00	01	11	01	00	01	11	10	00	01	10	01
14	10	10	10	11	01	00	01	11	01	00	01	11	11	00	11	10	01

Note *1: The pilot bits precede the last two bits of the data2 field.

Note *2: This pattern is used except slot formats 2B and 3B.

Note *3: This pattern is used except slot formats 0B, 1B, 4B, 5B, 8B, and 9B.

Note *4: This pattern is used except slot formats 6B, 7B, 10B, 11B, 12B, and 13B.

Note *5: This pattern is used for slot formats 2B and 3B.

Note: For the other slot formats, symbol repetition shall be applied to the pilot bit pattern with the half size.

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document R1-00-0315
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.211 CR 041   Current Version: 3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑   *↑ CR number as allocated by MCC support team*

For submission to: TSG-RAN #7
list expected approval meeting # here ↑

for approval	☒	strategic	☐	*(for SMG use only)*
for information	☐	non-strategic	☐	

Form: CR cover sheet, version 2 for 3GPP and SMG   The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: TSG RAN WG1   **Date:** 2000-02-24

Subject: Clarification of DCH initialisation

Work item:

Category:
(only one category shall be marked with an X)

F	Correction	☐	**Release:**	Phase 2	☐
A	Corresponds to a correction in an earlier release	☐		Release 96	☐
B	Addition of feature	☐		Release 97	☐
C	Functional modification of feature	☒		Release 98	☐
D	Editorial modification	☐		Release 99	☒
				Release 00	☐

Reason for change: DCH initialisation should be consistent with defined higher layer parameters and Layer 1 synchronisation procedure in TS 25.214 4.3.2

Clauses affected: 7.7

Other specs affected:

Other 3G core specifications	☐	→ List of CRs:	
Other GSM core specifications	☐	→ List of CRs:	
MS test specifications	☐	→ List of CRs:	
BSS test specifications	☐	→ List of CRs:	
O&M specifications	☐	→ List of CRs:	

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

7.7 Timing relations for initialisation of channels

Figure 27 shows the timing relationships between the physical channels involved in the initialisation of a DCH.

The maximum time permitted for the UE to decode the relevant FACH frame before the first frame of the DPCCH is received shall be $T_{B\text{-min}}$ = 38400 chips (i.e.15 slots).

The downlink DPCCH shall commence at a time T_B after the end of the relevant FACH frame, where $T_B \geq T_{B\text{-min}}$ according to the following equation:

$$T_B = (T_n - T_k) \times 256 - N_{pcp} \times 2560 + N_{offset\_1} \times 38400 \text{ chips}, \text{ where:}$$

N_{pcp} is a higher layer parameter set by the network, and represents the length (in slots) of the power control preamble (see [5], section 5.1.2.4).

N_{offset_1} is a parameter set by higher layers and derived from the activation time -if one is specified~~set by higher layers~~. In order that $T_B \geq T_{B\text{-min}}$, N_{offset_1} shall be an integer number of frames such that:

$$N_{offset\_1} \geq \begin{cases} 1 \text{ when } T_n - T_k \geq \dfrac{T_{B-\min}}{256} + 10N_{pcp} - 150 \\ 2 \text{ when } \dfrac{T_{B-\min}}{256} + 10N_{pcp} - 300 \leq T_n - T_k < \dfrac{T_{B-\min}}{256} + 10N_{pcp} - 150 \\ 3 \text{ when } T_n - T_k < \dfrac{T_{B-\min}}{256} + 10N_{pcp} - 300 \end{cases}$$

T_n and T_k are parameters defining the timing of the frame boundaries on the DL DPCCH and S-CCPCH respectively (see section 7.1). These parameters are provided by higher layers.

The uplink DPCCH shall commence at a time T_C after the end of the relevant FACH frame, where

$T_C = T_B + T_0 + N_{offset\_2} \times 38400 \text{ chips}$, where T_0 is as in section 7.6.3 . If an activation time for the uplink DPCCH is specified, then N_{offset_2} shall be set to zero. Otherwise the stating time of the uplink DPCCH shall be determined by higher layers according to the procedure in TS 25.214 sub clause 4.3.2, subject to the constraint that ~~and~~ N_{offset_2} ~~is a UE-specific higher-layer parameter which~~ shall be an integer number of frames greater than or equal to zero~~.~~

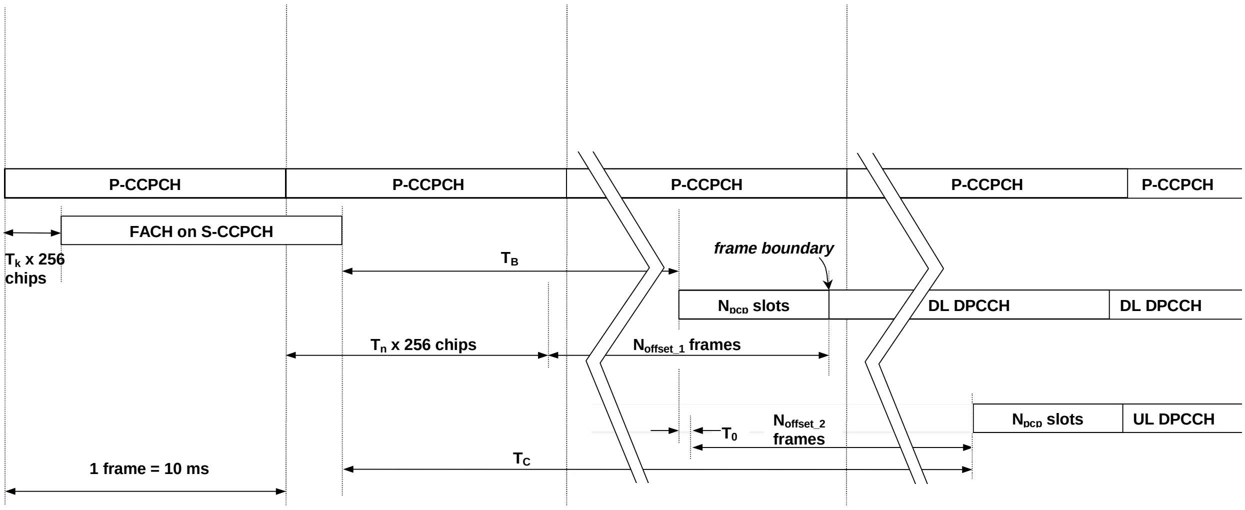


Figure 27: Timing for initialisation of DCH.

The data channels shall not commence before the end of the power control preamble.

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document R1-00-0409
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.211 CR 044r2 Current Version: 3.1.1

GSM (AA.BB) or 3G (AA.BBB) specification number ↑
↑ CR number as allocated by MCC support team

For submission to: TSG-RAN #7
list expected approval meeting # here
↑

for approval ☒
for information ☐

strategic ☐
non-strategic ☐
(for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: TSG RAN WG1 **Date:** 2000-03-02

Subject: Emergency Stop of CPCH transmission and Start of Message Indicator

Work item:

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

Reason for change:
1. Current Emergency Stop of CPCH transmission is not explicit, so that it should be changed into new explicit feature.
2. Start of Message Indictor solves the false mobile problem.

Clauses affected:
3
4.2.5
5.3.2.3
7.4

Other specs affected:	Other 3G core specifications	☐	→ List of CRs:	
	Other GSM core specifications	☐	→ List of CRs:	
	MS test specifications	☐	→ List of CRs:	
	BSS test specifications	☐	→ List of CRs:	
	O&M specifications	☐	→ List of CRs:	

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

3 Abbreviations

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

AI	Acquisition Indicator
AICH	Acquisition Indicator Channel
AP	Access Preamble
BCH	Broadcast Channel
CCC	CPCH Control Command
CCPCH	Common Control Physical Channel
CCTrCH	Coded Composite Transport Channel
CD	Collision Detection
CPCH	Common Packet Channel
CPICH	Common Pilot Channel
DCH	Dedicated Channel
DPCCH	Dedicated Physical Control Channel
DPCH	Dedicated Physical Channel
DPDCH	Dedicated Physical Data Channel
DSCH	Downlink Shared Channel
DTX	Discontinuous Transmission
FACH	Forward Access Channel
FBI	Feedback Information
MUI	Mobile User Identifier
PCH	Paging Channel
P-CCPCH	Primary Common Control Physical Channel
PCPCH	Physical Common Packet Channel
PDSCH	Physical Downlink Shared Channel
PI	Page Indicator
PICH	Page Indicator Channel
PRACH	Physical Random Access Channel
PSC	Primary Synchronisation Code
RACH	Random Access Channel
RNC	Radio Network Controller
S-CCPCH	Secondary Common Control Physical Channel
SCH	Synchronisation Channel
SF	Spreading Factor
SFN	System Frame Number
SSC	Secondary Synchronisation Code
STTD	Space Time Transmit Diversity
TFCI	Transport Format Combination Indicator
TSTD	Time Switched Transmit Diversity
TPC	Transmit Power Control
UE	User Equipment
UTRAN	UMTS Terrestrial Radio Access Network

4 Transport channels

Transport channels are the services offered by Layer 1 to the higher layers. General concepts about transport channels are described in [12].

A transport channel is defined by how and with what characteristics data is transferred over the air interface. A general classification of transport channels is into two groups:

- Dedicated Channels
- Common Channels

4.1 Dedicated transport channels

There exists only one type of dedicated transport channel, the Dedicated Channel (DCH).

4.1.1 DCH – Dedicated Channel

The Dedicated Channel (DCH) is a downlink or uplink transport channel. The DCH is transmitted over the entire cell or over only a part of the cell using beam-forming antennas. The Dedicated Channel (DCH) is characterized by the possibility of fast rate change (every 10ms), fast power control and inherent addressing of UEs.

4.2 Common transport channels

There are six types of common transport channels: BCH, FACH, PCH, RACH, CPCH and DSCH.

4.2.1 BCH – Broadcast Channel

The Broadcast Channel (BCH) is a downlink transport channel that is used to broadcast system- and cell-specific information. The BCH is always transmitted over the entire cell with a low fixed bit rate.

4.2.2 FACH – Forward Access Channel

The Forward Access Channel (FACH) is a downlink transport channel. The FACH is transmitted over the entire cell or over only a part of the cell using beam-forming antennas. The FACH uses slow power control.

4.2.3 PCH – Paging Channel

The Paging Channel (PCH) is a downlink transport channel. The PCH is always transmitted over the entire cell. The transmission of the PCH is associated with the transmission of a physical layer signal, the Paging Indicator, to support efficient sleep-mode procedures.

4.2.4 RACH – Random Access Channel

The Random Access Channel (RACH) is an uplink transport channel. The RACH is always received from the entire cell. The RACH is characterized by a limited size data field, a collision risk and by the use of open loop power control.

4.2.5 CPCH – Common Packet Channel

The Common Packet Channel (CPCH) is an uplink transport channel. The CPCH is a contention based random access channel used for transmission of bursty data traffic. CPCH is associated with a dedicated channel on the downlink which provides power control and CPCH Control Commands (e.g. Emergency Stop) for the uplink CPCH.

4.2.6 DSCH – Downlink Shared Channel

The downlink shared channel (DSCH) is a downlink transport channel shared by several UEs The DSCH is associated with a DCH.

5.3.2.3 DL-DPCCH for CPCH

The downlink DPCCH for CPCH is a special case of downlink dedicated physical channel of the slot format #0 in table 11. ~~The spreading factor for the UL-DPCCH (message control part) is 256.~~ The spreading factor for the DL-DPCCH ~~(message control part)~~ is 512. Figure 11 shows the frame structure of DL-DPCCH for CPCH.

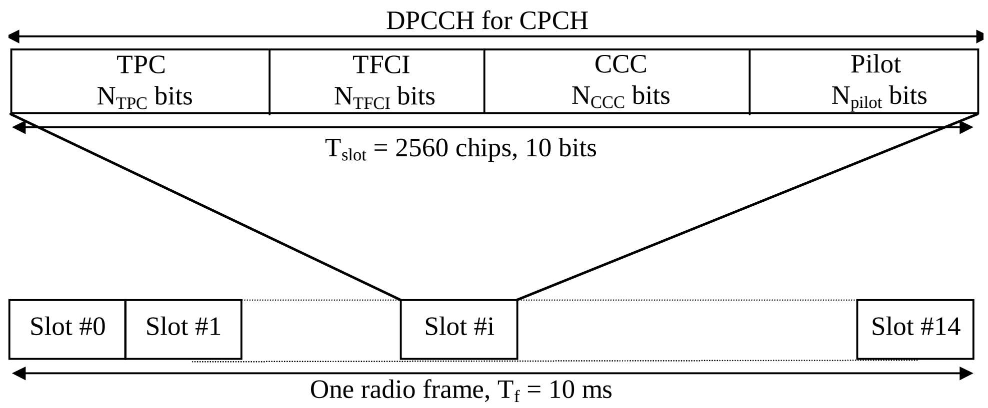


Figure 11: Frame structure for downlink DPCCH for CPCH

DL-DPCCH for CPCH consists of known pilot bits, TFCI, TPC commands and CPCH Control Commands (CCC). CPCH control commands are used to support CPCH signalling. There are two types of CPCH control commands: Layer 1 control command such as Start of Message Indicator, and higher layer control command such as Emergency Stop command. The exact number of bits of DL DPCCH fields (N_{pilot}, N_{TFCI}, N_{CCC} and N_{TPC}) is determined in table 15. The pilot bit pattern for N_{pilot}=4 of table 12 is used for DPCCH for CPCH.~~The following table 15 shows the DL-DPCCH fields (message control part) which are identical to the first row of table 11 in section 5.3.2.~~

Table 15: ~~DPDCH and~~ DPCCH fields for CPCH message transmission

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Slot	DPCCH Bits/Slot				Transmitted slots per radio frame N_{Tr}
					N_{TPC}	N_{TFCI}	N_{CCC}	N_{Pilot}	
0	15	7.5	512	10	2	0	4	4	15

~~Slot Format #I~~	~~Channel Bit Rate (kbps)~~	~~Channel Symbol Rate (ksps)~~	~~SF~~	~~Bits/Frame~~			~~Bits/ Slot~~	~~DPDCH Bits/Slot~~		~~DPCCH Bits/Slot~~		
				~~DPDCH~~	~~DPCCH~~	~~TOT~~		~~N_{data1}~~	~~N_{Data2}~~	~~N_{TFCI}~~	~~N_{TPC}~~	~~N_{Pilot}~~
~~0~~	~~15~~	~~7.5~~	~~512~~	~~60~~	~~90~~	~~150~~	~~10~~	~~2~~	~~2~~	~~0~~	~~2~~	~~4~~

CCC field in figure 11 is used for the transmission of CPCH control command. On CPCH control command transmission request from higher layer, a certain pattern is mapped onto CCC field, otherwise nothing is transmitted in CCC field. There is one to one mapping between the CPCH control command and the pattern. In case of Emergency Stop of CPCH transmission, [1111] pattern is mapped onto CCC field. The Emergency Stop command shall not be transmitted during the first $N_{Start\_Message}$ frames of DL DPCCH after Power Control preamble.

Start of Message Indicator shall be transmitted during the first $N_{Start\_Message}$ frames of DL DPCCH after Power Control preamble. [1010] pattern is mapped onto CCC field for Start of Message Indicator. The value of $N_{Start\_Message}$ shall be provided by higher layers.

7.4 PCPCH/AICH timing relation

Transmission of random access bursts on the PCPCH is aligned with access slot times. The timing of the access slots is derived from the received Primary CCPCH timing The transmit timing of access slot n starts n×20/15 ms after the frame boundary of the received Primary CCPCH, where n = 0, 1, …,14. In addition, transmission of access preambles in PCPCH is limited to the allocated access slot subchannel group which is assigned by higher layer signalling to each CPCH set. Twelve access slot subchannels are defined and PCPCH may be allocated all subchannel slots or any subset of the twelve subchannel slots. The access slot subchannel identification is identical to that for the RACH and is described in table 6 of section 6.1 of [5].

Everything in the previous section [PRACH/AICH] applies to this section as well. 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-AICH is identical to RACH Preamble and AICH. The timing relationship between CD-AICH 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-AICH.

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

Minimum time = 15360 chips + 5120 chips X Tcpch

Maximum time = 5120 chips X 12 = 61440 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 has one value: 7680 chips.

τ_{p-cdp} = Time between the last AP and CD Preamble. is either 3 or 4 access slots, depending on T_{cpch}

τ_{cdp-a2} = Time between the CD Preamble and the CD-AICH 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 $T_{cpch.}$

Figure 25 illustrates the PCPCH/AICH timing relationship whenT_{cpch} is set to 0 and all access slot subchannels are available for PCPCH.

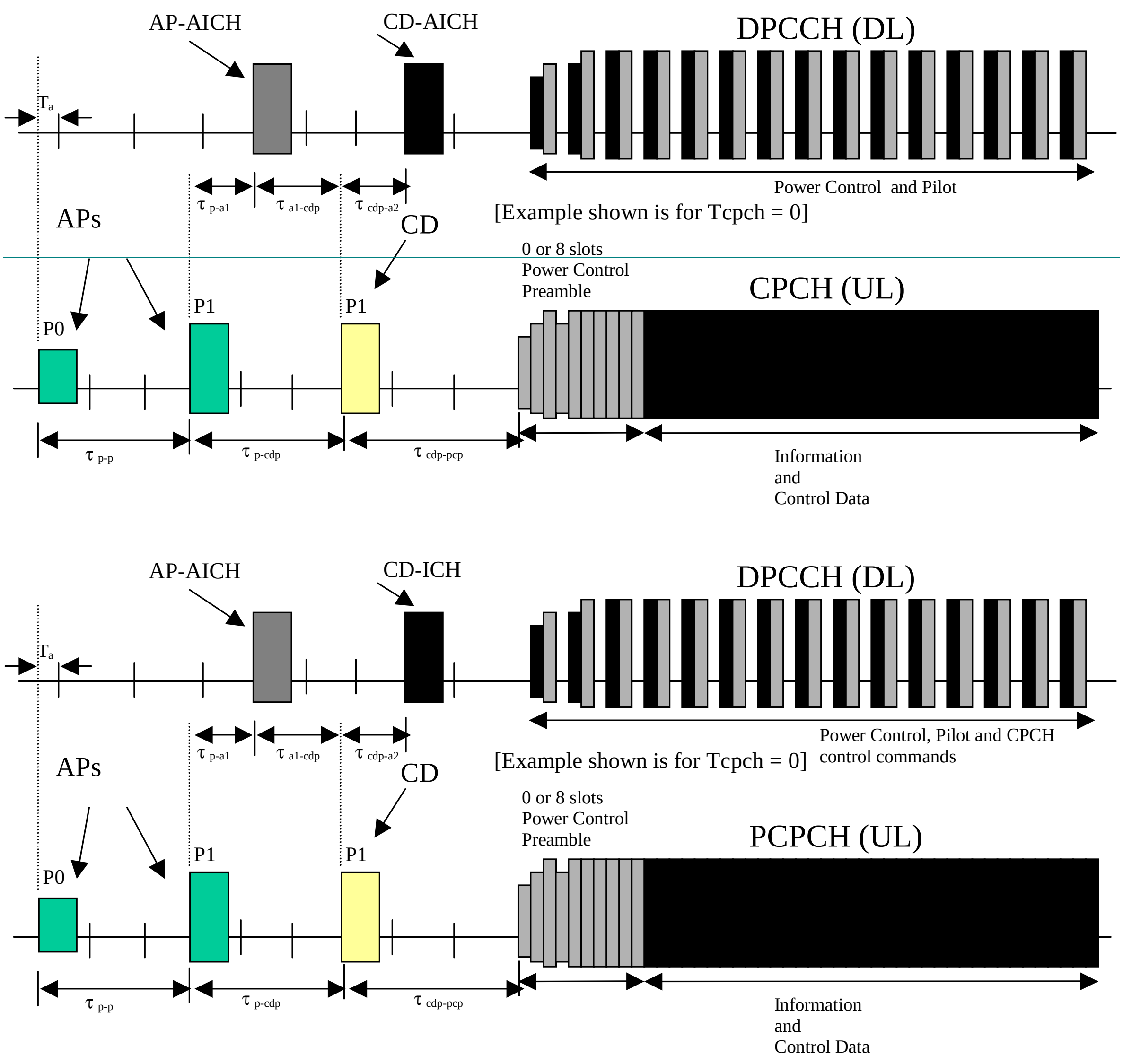


Figure 25: Timing of PCPCH and AICH transmission as seen by the UE, with T_{cpch}= 0

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

Document R1-00-0409
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.214 CR 082r2 Current Version: 3.1.1

GSM (AA.BB) or 3G (AA.BBB) specification number ↑
↑ CR number as allocated by MCC support team

For submission to: TSG-RAN #7
list expected approval meeting # here ↑

for approval ☒
for information ☐

strategic ☐
non-strategic ☐
(for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source: LGIC, GBT, Samsung, Lucent **Date:** 2000-03-02

Subject: Emergency Stop of CPCH transmission and Start of Message Indicator

Work item:

Category:
(only one category shall be marked with an X)

F	Correction	☐
A	Corresponds to a correction in an earlier release	☐
B	Addition of feature	☒
C	Functional modification of feature	☐
D	Editorial modification	☐

Release:

Phase 2	☐
Release 96	☐
Release 97	☐
Release 98	☐
Release 99	☒
Release 00	☐

Reason for change:
1. Current Emergency Stop of CPCH transmission is not explicit, so that it should be changed into new explicit feature.
2. Start of Message Indictor solves the false mobile problem.

Clauses affected: 6.2

Other specs affected:

Other 3G core specifications	☐	→ List of CRs:
Other GSM core specifications	☐	→ List of CRs:
MS test specifications	☐	→ List of CRs:
BSS test specifications	☐	→ List of CRs:
O&M specifications	☐	→ List of CRs:

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

6.2 CPCH Access Procedures

For each CPCH physical channel in a CPCH set allocated to a cell the following physical layer parameters are included in the System Information message:

- UL Access Preamble (AP) scrambling code.
- UL Access Preamble signature set
- The Access preamble slot sub-channels group
- AP- AICH preamble channelization code.
- UL Collision Detection(CD) preamble scrambling code.
- CD Preamble signature set
- CD preamble slot sub-channels group
- CD-AICH preamble channelization code.
- CPCH UL scrambling code.
- CPCH UL channelization code. (variable, data rate dependant)
- DPCCH DL channelization code.([512] chip)

NOTE: There may be some overlap between the AP signature set and CD signature set if they correspond to the same scrambling code.

The following are access, collision detection/resolution and CPCH data transmission parameters:

Power ramp-up, Access and Timing parameters (Physical layer parameters)

1) N_AP_retrans_max = Maximum Number of allowed consecutive access attempts (retransmitted preambles) if there is no AICH response. This is a CPCH parameter and is equivalent to Preamble_Retrans_Max in RACH.

2) $P_{RACH} = P_{CPCH}$ = Initial open loop power level for the first CPCH access preamble sent by the UE.

   [RACH/CPCH parameter]

3) ΔP_0 = Power step size for each successive CPCH access preamble.

   [RACH/CPCH parameter]

4) ΔP_1 = Power step size for each successive RACH/CPCH access preamble in case of negative AICH. A timer is set upon receipt of a negative AICH. This timer is used to determine the period after receipt of a negative AICH when ΔP_1 is used in place of ΔP_0.

   [RACH/CPCH parameter]

5) T_{cpch} = CPCH transmission timing parameter: This parameter is identical to PRACH/AICH transmission timing parameter.

   [RACH/CPCH parameter]

6) $L_{pc\text{-}preamble}$ = Length of power control preamble (0 or 8 slots)

   [CPCH parameter]

7) $N_{Start\_Message}$ = Number of frames for the transmission of Start of Message Indicator in DL-DPCCH for CPCH

NOTE: It is FFS if ΔP_0 for the CPCH access may be different from ΔP_0 for the RACH access as defined in section 6.1.

The CPCH -access procedure in the physical layer is:

1) The UE MAC function selects a CPCH transport channel from the channels available in the assigned CPCH set The CPCH channel selection includes a dynamic persistence algorithm (similar to RACH) for the selected CPCH channel.

2) The UE MAC function builds a transport block set for the next TTI using transport formats which are assigned to the logical channel with data to transmit. The UE MAC funtion sends this transport block set to the UE PHY function for CPCH access and uplink transmission on the selected CPCH transport channel.

3) The UE sets the preamble transmit power to the value $P_{CPCH\_}$ which is supplied by the MAC layer for initial power level for this CPCH access attempt.

4) The UE sets the AP Retransmission Counter to N_AP_Retrans_Max (value TBD).

5) The UE randomly selects a CPCH-AP signature from the signature set for this selected CPCH channel. The random function is TBD.

6) The UE Derives the available CPCH-AP access slots in the next two frames, defined by SFN and SFN+1 in the AP access slot sub-channel group with the help of SFN and table 7 in section 6.1. The UE randomly selects one access slot from the available access slots in the next frame, defined by SFN, if there is one available. If there is no access slot available in the next frame, defined by SFN then, randomly selects one access slot from the available access slots in the following frame, defined by SFN+1. Random function is TBD

7) The UE transmits the AP using the MAC supplied uplink access slot, signature, and initial preamble transmission power.

8) If the UE does not detect the positive or negative acquisition indicator corresponding to the selected signature in the downlink access slot corresponding to the selected uplink access slot, the UE:

    a) Selects the next uplink access slot from among the access slots in the CPCH-AP sub-channel group, as selected in 4.1. There must be a minimum distance of three or four access slots from the uplink access slot in which the last preamble was transmitted depending on the CPCH/AICH transmission timing parameter. [NOTE: Use of random function here to select access slot is FFS for RACH and CPCH.].

    b) Increases the preamble transmission power with the specified offset ΔP . Power offset ΔP_0 s is used unless the negative AICH timer is running, in which case ΔP_1 is used instead..

    c) Decrease the Preamble Retransmission Counter by one.

    d) If the Preamble Retransmission Counter < 0, the UE aborts the access attempt and sends a failure message to the MAC layer.

9) If the UE detects the AP-AICH_nak (negative acquisition indicator) corresponding to the selected signature in the downlink access slot corresponding to the selected uplink access slot, the UE aborts the access attempt and sends a failure message to the MAC layer. The UE sets the negative AICH timer to indicate use of ΔP_1 use as the preamble power offset until timer expiry

10) Upon reception of AP-AICH, the access segment ends and the contention resolution segment begins. In this segment, the UE randomly selects a CD signautre from the signature set and also select one-CD access slot sub-channel from the CD sub-channel group supported in the cell.and transmits a CD Preamble, then waits for a CD-AICH from the Node B.

11) If the UE does not receive a CD-AICH in the designated slot, the UE aborts the access attempt and sends a failure message to the MAC layer.

12) If the UE receives a CD-AICH in the designated slot with a signature that does not match the signature used in the CD Preamble, the UE aborts the access attempt and sends a failure message to the MAC layer.

13) If the UE receives a CD-AICH with a matching signature, the UE transmits the power control preamble $\tau_{cd-p-pc-p}$ ms later as measured from initiation of the CD Preamble. . The transmission of the message portion of the burst starts immediately after the power control preamble.

14) The UE shall test the value of Start of Message Indicator received from DL-DPCCH for CPCH during the first $N_{Start\_Message}$ frames after Power Control preamble. Start of Message Indicator is a known sequence repeated on a frame by frame basis. The value of $N_{Start\_Message}$ shall be provided by the higher layers.

15) If the UE does not detect Start of Message Indicator in the first $N_{Start\_Message}$ frames of DL-DPCCH for CPCH after Power Control preamble, the UE aborts the access attempt and sends a failure message to the MAC layer. Otherwise, UE continuously transmits the packet data.

~~14~~16) During CPCH Packet Data transmission, the UE and UTRAN perform inner-loop power control on both the CPCH UL and the DPCCH DL.

~~15)~~ 17) After the first $N_{Start\_Message}$ frames after Power Control preamble, upon the detection of an Emergency Stop command sent by UTRAN, the UE halts CPCH UL transmission, aborts the access attempt and sends a failure message to the MAC layer.

~~15)~~ 18) If the UE detects loss of DPCCH DL during transmission of the power control preamble or the packet data, the UE halts CPCH UL transmission, aborts the access attempt and sends a failure message to the MAC layer.

~~16~~19) If the UE completes the transmission of the packet data, the UE sends a success message to the MAC layer.

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

Document R1-00-0422
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.211 CR 046 Current Version: 3.1.1

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-RAN #7
list expected approval meeting # here
↑

for approval ☒
for information ☐

strategic ☐
non-strategic ☐
(for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM ☐ ME ☒ UTRAN / Radio ☒ Core Network ☐
(at least one should be marked with an X)

Source:	TSG RAN WG1	**Date:**	2000-03-03
Subject:	Clean up of USTS related specifications		
Work item:			

Category:
(only one category shall be marked with an X)

F	Correction	☒
A	Corresponds to a correction in an earlier release	☐
B	Addition of feature	☐
C	Functional modification of feature	☐
D	Editorial modification	☐

Release:

Phase 2	☐
Release 96	☐
Release 97	☐
Release 98	☐
Release 99	☒
Release 00	☐

Reason for change: USTS is Release-00 item. Therefore USTS related specifications shall be removed in Release-99.

Clauses affected: 5.3.2
7.6.3

Other specs affected:

Other 3G core specifications	☐	→ List of CRs:
Other GSM core specifications	☐	→ List of CRs:
MS test specifications	☐	→ List of CRs:
BSS test specifications	☐	→ List of CRs:
O&M specifications	☐	→ List of CRs:

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

5.3.2 Dedicated downlink physical channels

There is only one type of downlink dedicated physical channel, the Downlink Dedicated Physical Channel (downlink DPCH).

Within one downlink DPCH, dedicated data generated at Layer 2 and above, i.e. the dedicated transport channel (DCH), is transmitted in time-multiplex with control information generated at Layer 1 (known pilot bits, TPC commands, and an optional TFCI). The downlink DPCH can thus be seen as a time multiplex of a downlink DPDCH and a downlink DPCCH, compare section 5.2.1. It is the UTRAN that determines if a TFCI should be transmitted, hence making it is mandatory for all UEs to support the use of TFCI in the downlink. ~~In case of USTS, the TPC bits in slot #14 in frames with CFN mod 2 = 0 are replaced by Time Alignment Bits (TABs) as described in section 9.3 of [5]~~

Figure 8 shows the frame structure of the downlink DPCH. Each frame of length 10 ms is split into 15 slots, each of length T_{slot} = 2560 chips, corresponding to one power-control period.

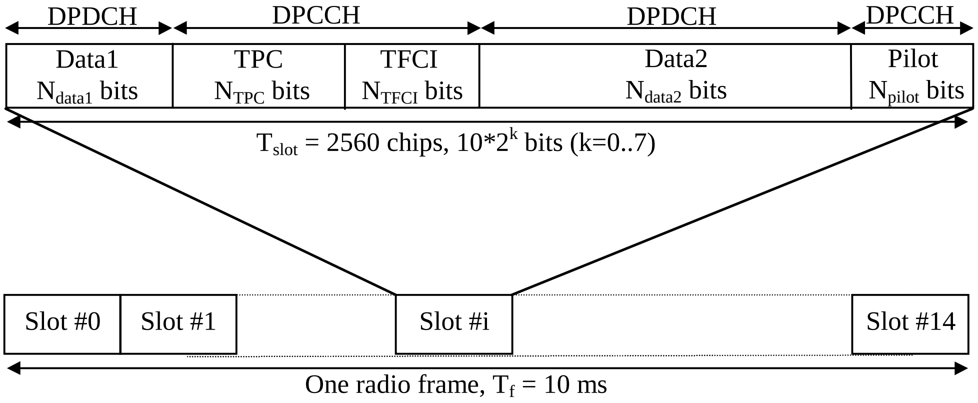


Figure 8: Frame structure for downlink DPCH

The parameter k in figure 8 determines the total number of bits per downlink DPCH slot. It is related to the spreading factor SF of the physical channel as SF = $512/2^k$. The spreading factor may thus range from 512 down to 4.

The exact number of bits of the different downlink DPCH fields (N_{pilot}, N_{TPC}, N_{TFCI}, N_{data1} and N_{data2}) is determined in table 11.The overhead due to the DPCCH transmission has to be negotiated at the connection set-up and can be re-negotiated during the communication, in order to match particular propagation conditions.

There are basically two types of downlink Dedicated Physical Channels; those that include TFCI (e.g. for several simultaneous services) and those that do not include TFCI(e.g. for fixed-rate services). These types are reflected by the duplicated rows of table 11. In compressed mode, a different slot format is used compared to normal mode. There are two possible compressed slot formats that are labelled A and B. Format B is used for compressed mode by spreading factor reduction and format A is used for all other transmission time reduction methods. The channel bit and symbol rates given in table 11 are the rates immediately before spreading.

Table 11: DPDCH and DPCCH fields

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Slot	DPDCH Bits/Slot		DPCCH Bits/Slot			Transmitted slots per radio frame N_{Tr}
					N_{Data1}	N_{Data2}	N_{TPC}	N_{TFCI}	N_{Pilot}	
0	15	7.5	512	10	0	4	2	0	4	15
0A	15	7.5	512	10	0	4	2	0	4	8-14
0B	30	15	256	20	0	8	4	0	8	8-14
1	15	7.5	512	10	0	2	2	2	4	15
1B	30	15	256	20	0	4	4	4	8	8-14
2	30	15	256	20	2	14	2	0	2	15
2A	30	15	256	20	2	14	2	0	2	8-14
2B	60	30	128	40	4	28	4	0	4	8-14
3	30	15	256	20	2	12	2	2	2	15
3A	30	15	256	20	2	10	2	4	2	8-14
3B	60	30	128	40	4	24	4	4	4	8-14
4	30	15	256	20	2	12	2	0	4	15
4A	30	15	256	20	2	12	2	0	4	8-14
4B	60	30	128	40	4	24	4	0	8	8-14
5	30	15	256	20	2	10	2	2	4	15
5A	30	15	256	20	2	8	2	4	4	8-14
5B	60	30	128	40	4	20	4	4	8	8-14
6	30	15	256	20	2	8	2	0	8	15
6A	30	15	256	20	2	8	2	0	8	8-14
6B	60	30	128	40	4	16	4	0	16	8-14
7	30	15	256	20	2	6	2	2	8	15
7A	30	15	256	20	2	4	2	4	8	8-14
7B	60	30	128	40	4	12	4	4	16	8-14
8	60	30	128	40	6	28	2	0	4	15
8A	60	30	128	40	6	28	2	0	4	8-14
8B	120	60	64	80	12	56	4	0	8	8-14
9	60	30	128	40	6	26	2	2	4	15
9A	60	30	128	40	6	24	2	4	4	8-14
9B	120	60	64	40	12	52	4	4	8	8-14
10	60	30	128	40	6	24	2	0	8	15
10A	60	30	128	40	6	24	2	0	8	8-14
10B	120	60	64	80	12	48	4	0	16	8-14
11	60	30	128	40	6	22	2	2	8	15
11A	60	30	128	40	6	20	2	4	8	8-14
11B	120	60	64	80	12	44	4	4	16	8-14
12	120	60	64	80	12	48	4	8*	8	15
12A	120	60	64	80	12	40	4	16*	8	8-14
12B	240	120	32	160	24	96	8	16*	16	8-14
13	240	120	32	160	28	112	4	8*	8	15
13A	240	120	32	160	28	104	4	16*	8	8-14
13B	480	240	16	320	56	224	8	16*	16	8-14
14	480	240	16	320	56	232	8	8*	16	15
14A	480	240	16	320	56	224	8	16*	16	8-14
14B	960	480	8	640	112	464	16	16*	32	8-14
15	960	480	8	640	120	488	8	8*	16	15
15A	960	480	8	640	120	480	8	16*	16	8-14
15B	1920	960	4	1280	240	976	16	16*	32	8-14
16	1920	960	4	1280	248	1000	8	8*	16	15
16A	1920	960	4	1280	248	992	8	16*	16	8-14

* If TFCI bits are not used, then DTX shall be used in TFCI field.

NOTE1: Compressed mode is only supported through spreading factor reduction for SF=512 with TFCI.

NOTE2: Compressed mode by spreading factor reduction is not supported for SF=4.

The pilot symbol pattern is described in table 12. The shadowed part can be used as frame synchronization words. (The symbol pattern of the pilot symbols other than the frame synchronization word shall be "11".) In table 12, the transmission order is from left to right. (Each two-bit pair represents an I/Q pair of QPSK modulation.)

In downlink compressed mode through spreading factor reduction, the number of bits in the TPC and Pilot fields are doubled. Symbol repetition is used to fill up the fields. Denote the bits in one of these fields in normal mode by x_1, x_2, x_3, …, x_X. In compressed mode the following bit sequence is sent in corresponding field: x_1, x_2, x_1, x_2, x_3, x_4, x_3, x_4,…, x_X,.

Table 12: Pilot Symbol Pattern

	N_{pilot} = 2	**N_{pilot} = 4**		**N_{pilot} = 8**				**N_{pilot} = 16**							
Symbol #	0	0	1	0	1	2	3	0	1	2	3	4	5	6	7
Slot #0	11	11	11	11	11	11	10	11	11	11	10	11	11	11	10
1	00	11	00	11	00	11	10	11	00	11	10	11	11	11	00
2	01	11	01	11	01	11	01	11	01	11	01	11	10	11	00
3	00	11	00	11	00	11	00	11	00	11	00	11	01	11	10
4	10	11	10	11	10	11	01	11	10	11	01	11	11	11	11
5	11	11	11	11	11	11	10	11	11	11	10	11	01	11	01
6	11	11	11	11	11	11	00	11	11	11	00	11	10	11	11
7	10	11	10	11	10	11	00	11	10	11	00	11	10	11	00
8	01	11	01	11	01	11	10	11	01	11	10	11	00	11	11
9	11	11	11	11	11	11	11	11	11	11	11	11	00	11	11
10	01	11	01	11	01	11	01	11	01	11	01	11	11	11	10
11	10	11	10	11	10	11	11	11	10	11	11	11	00	11	10
12	10	11	10	11	10	11	00	11	10	11	00	11	01	11	01
13	00	11	00	11	00	11	11	11	00	11	11	11	00	11	00
14	00	11	00	11	00	11	11	11	00	11	11	11	10	11	01

The relationship between the TPC symbol and the transmitter power control command is presented in table 13.

Table 13: TPC Bit Pattern

TPC Bit Pattern			**Transmitter power control command**
N_{TPC} = 2	N_{TPC} = 4	N_{TPC} = 8	
11	1111	11111111	1
00	0000	00000000	0

For slot formats using TFCI, the TFCI value in each radio frame corresponds to a certain combination of bit rates of the DCHs currently in use. This correspondence is (re-)negotiated at each DCH addition/removal. The mapping of the TFCI bits onto slots is described in [3].

When the total bit rate to be transmitted on one downlink CCTrCH exceeds the maximum bit rate for a downlink physical channel, multicode transmission is employed, i.e. several parallel downlink DPCHs are transmitted for one CCTrCH using the same spreading factor. In this case, the Layer 1 control information is put on only the first downlink DPCH. The additional downlink DPCHs belonging to the CCTrCH do not transmit any data during the corresponding time period, see figure 9.

In the case of several CCTrCHs of dedicated type for one UE different spreading factors can be used for each CCTrCH and only one DPCCH would be transmitted for them in the downlink.

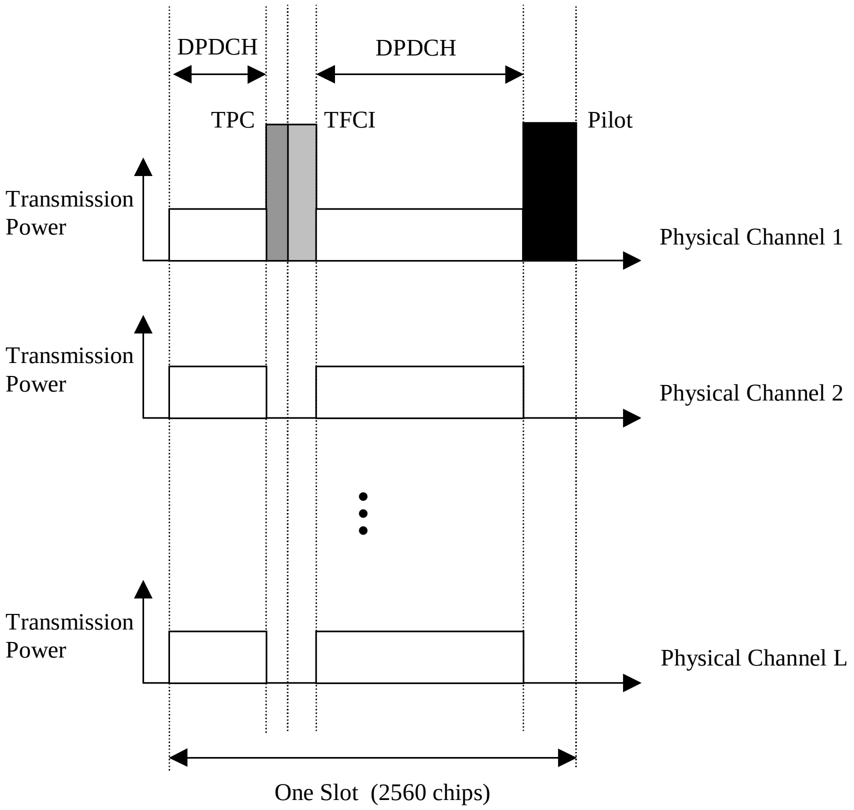


Figure 9: Downlink slot format in case of multi-code transmission

5.3.2.1 STTD for DPCH

The pilot bit pattern for the DPCH channel transmitted on the diversity antenna is given in table 14. The shadowed part indicates pilot bits that are STTD encoded from the corresponding (shadowed) bits in Table 12. For the SF=256 DPCH, if there are only two dedicated pilot bits (N_{pilot} = 2 in Tables 12 and 14), they are STTD encoded together with the last two bits (data or DTX) of the second data field (data2) of the slot. STTD encoding for the DPDCH, TPC, and TFCI fields is done as described in section 5.3.1.1.1. For the SF=512 DPCH , the first two bits in each slot, i.e. TPC bits, are not STTD encoded and the same bits are transmitted with equal power from the two antennas. The following four bits are STTD encoded.

Table 14: Pilot pattern of the DPCH channel for the diversity antenna using STTD

	Npilot = 2	Npilot = 4		Npilot = 8				Npilot = 16							
Symbol #	0	0	1	0	1	2	3	0	1	2	3	4	5	6	7
Slot #0	01	01	10	11	00	00	10	11	00	00	10	11	00	00	10
1	10	10	10	11	00	00	01	11	00	00	01	11	10	00	10
2	11	11	10	11	11	00	00	11	11	00	00	11	10	00	11
3	10	10	10	11	10	00	01	11	10	00	01	11	00	00	00
4	00	00	10	11	11	00	11	11	11	00	11	11	01	00	10
5	01	01	10	11	00	00	10	11	00	00	10	11	11	00	00
6	01	01	10	11	10	00	10	11	10	00	10	11	01	00	11
7	00	00	10	11	10	00	11	11	10	00	11	11	10	00	11
8	11	11	10	11	00	00	00	11	00	00	00	11	01	00	01
9	01	01	10	11	01	00	10	11	01	00	10	11	01	00	01
10	11	11	10	11	11	00	00	11	11	00	00	11	00	00	10
11	00	00	10	11	01	00	11	11	01	00	11	11	00	00	01
12	00	00	10	11	10	00	11	11	10	00	11	11	11	00	00
13	10	10	10	11	01	00	01	11	01	00	01	11	10	00	01
14	10	10	10	11	01	00	01	11	01	00	01	11	11	00	11

5.3.2.2 Dedicated channel pilots with closed loop mode transmit diversity

In closed loop mode 1 orthogonal pilot patterns are used between the transmit antennas. Pilot patterns defined in the table 12 will be used on the non-diversity antenna and pilot patterns defined in the table 14 on the diversity antenna. This is illustrated in the figure 10 a which indicates the difference in the pilot patterns with different shading.

In closed loop mode 2 same pilot pattern is used on both of the antennas (see figure 10 b). The pattern to be used is according to the table 12.

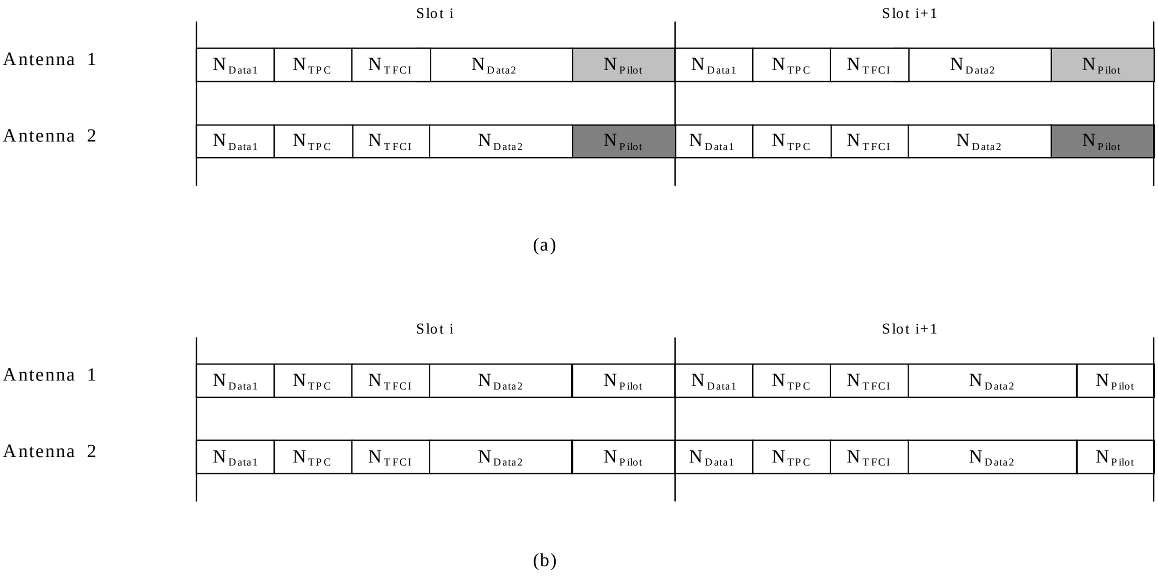


Figure 10: Slot structures for downlink dedicated physical channel diversity transmission. Structure (a) is used in closed loop mode 1. Structure (b) is used in closed loop mode 2. Different shading of the pilots indicate orthogonality of the patterns

5.3.2.3 DL-DPCCH for CPCH

The spreading factor for the UL-DPCCH (message control part) is 256. The spreading factor for the DL-DPCCH (message control part) is 512. The following table 15 shows the DL-DPCCH fields (message control part) which are identical to the first row of table 11 in section 5.3.2.

Table 15: DPDCH and DPCCH fields for CPCH message transmission

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/Frame			Bits/ Slot	DPDCH Bits/Slot		DPCCH Bits/Slot		
				DPDCH	DPCCH	TOT		N_{Data1}	N_{Data2}	N_{TFCI}	N_{TPC}	N_{Pilot}
0	15	7.5	512	60	90	150	10	2	2	0	2	4

5.3.3 Common downlink physical channels

5.3.3.1 Common Pilot Channel (CPICH)

The CPICH is a fixed rate (30 kbps, SF=256) downlink physical channel that carries a pre-defined bit/symbol sequence. Figure 11 shows the frame structure of the CPICH.

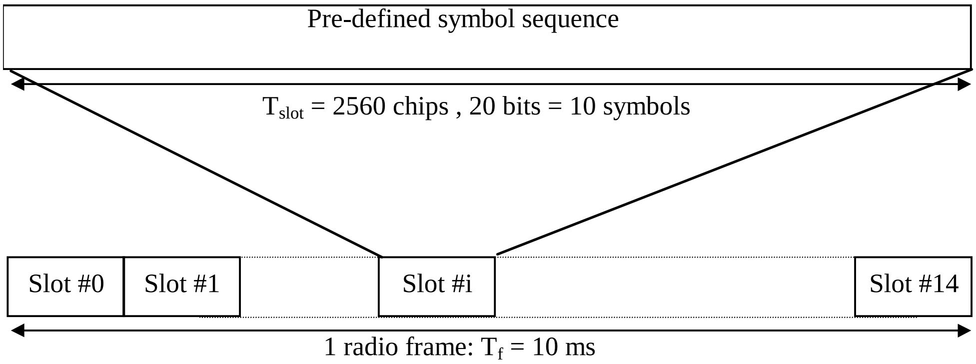


Figure 11: Frame structure for Common Pilot Channel

In case of Transmit Diversity (open or closed loop), the CPICH shall be transmitted from both antennas using the same channelization and scrambling code. In this case, the pre-defined symbol sequence of the CPICH is different for Antenna 1 and Antenna 2, see figure 12. In case of no Transmit Diversity, the symbol sequence of Antenna 1 in figure 12 is used.

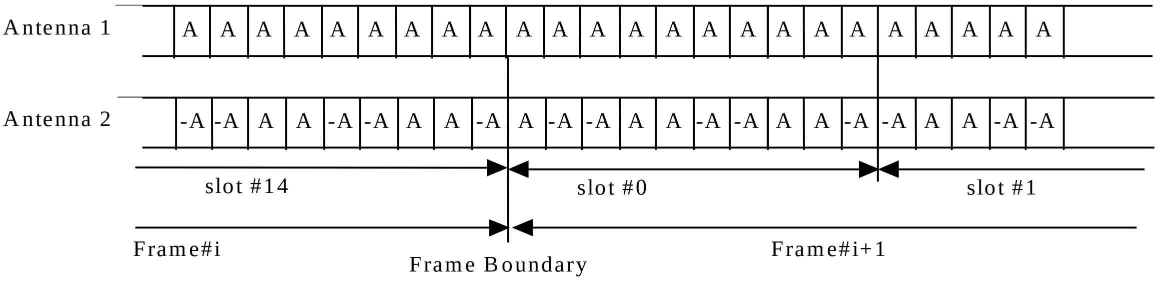


Figure 12: Modulation pattern for Common Pilot Channel (with A = 1+j)

There are two types of Common pilot channels, the Primary and Secondary CPICH. They differ in their use and the limitations placed on their physical features.

5.3.3.1.1 Primary Common Pilot Channel

The Primary Common Pilot Channel has the following characteristics:

- The same channelization code is always used for this channel, see [4]

- Scrambled by the primary scrambling code, see [4]
- One per cell
- Broadcast over the entire cell

The Primary CPICH is the phase reference for the following downlink channels: SCH, Primary CCPCH, AICH, PICH. The Primary CPICH is also the *default* phase reference for all other downlink physical channels.

5.3.3.1.2 Secondary Common Pilot Channel

A Secondary Common Pilot Channel the following characteristics:

- Can use an arbitrary channelization code of SF=256, see [4]
- Scrambled by either the primary or a secondary scrambling code, see [4]
- Zero, one, or several per cell
- May be transmitted over only a part of the cell
- A Secondary CPICH may be the reference for the Secondary CCPCH and the downlink DPCH. If this is the case, the UE is informed about this by higher-layer signalling.

5.3.3.2 Primary Common Control Physical Channel (P-CCPCH)

The Primary CCPCH is a fixed rate (30 kbps, SF=256) downlink physical channels used to carry the BCH.

Figure 13 shows the frame structure of the Primary CCPCH. The frame structure differs from the downlink DPCH in that no TPC commands, no TFCI and no pilot bits are transmitted. The Primary CCPCH is not transmitted during the first 256 chips of each slot. Instead, Primary SCH and Secondary SCH are transmitted during this period (see section 5.3.3.4).

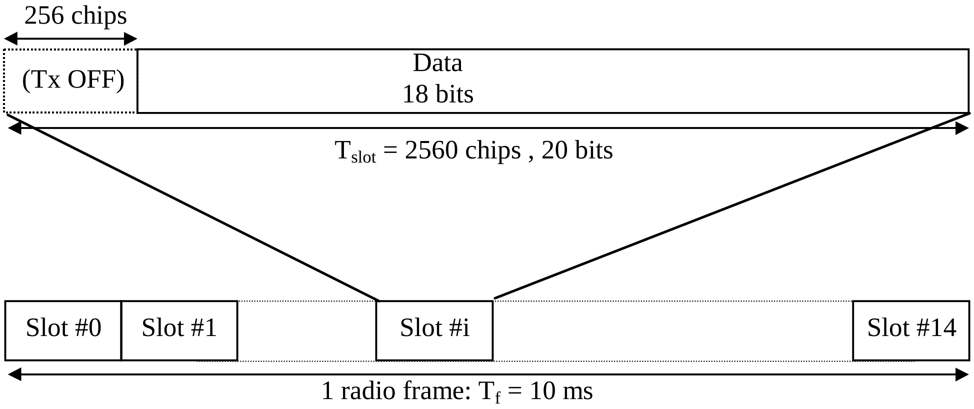


Figure 13: Frame structure for Primary Common Control Physical Channel

5.3.3.2.1 Primary CCPCH structure with STTD encoding

In case the diversity antenna is present in UTRAN and the P-CCPCH is to be transmitted using open loop transmit diversity, the data bits of the P-CCPCH are STTD encoded as given in section 5.3.1.1.1. The last two data bits in even numbered slots are STTD encoded together with the first two data bits in the following slot, except for slot #14 where the two last data bits are not STTD encoded and instead transmitted with equal power from both the antennas, see figure 14. Higher layers signal whether STTD encoding is used for the P-CCPCH or not. In addition, higher layer signalling indicates the presence/absence of STTD encoding on P-CCPCH, by modulating the SCH. During power on and hand over between cells the UE determines the presence of STTD encoding on the P-CCPCH, by either receiving the higher layer message, by demodulating the SCH channel or by a combination of the above two schemes.

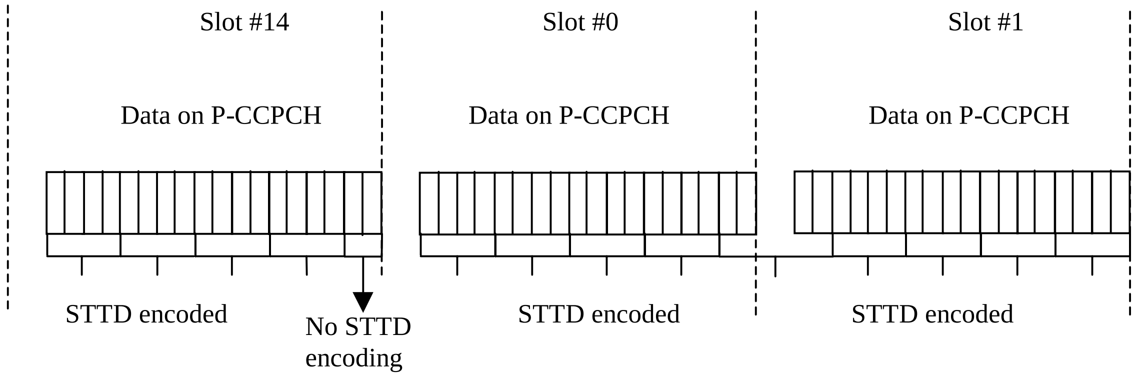


Figure 14: STTD encoding for the data bits of the P-CCPCH

5.3.3.3 Secondary Common Control Physical Channel (S-CCPCH)

The Secondary CCPCH is used to carry the FACH and PCH. There are two types of Secondary CCPCH: those that include TFCI and those that do not include TFCI. It is the UTRAN that determines if a TFCI should be transmitted, hence making it mandatory for all UEs to support the use of TFCI. The set of possible rates is the same as for the downlink DPCH, see section 5.3.2. The frame structure of the Secondary CCPCH is shown in figure 15.

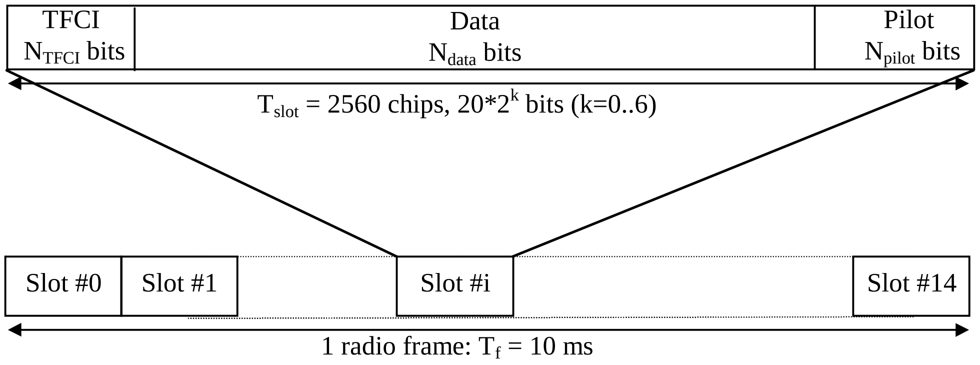


Figure 15: Frame structure for Secondary Common Control Physical Channel

The parameter k in figure 15 determines the total number of bits per downlink Secondary CCPCH slot. It is related to the spreading factor SF of the physical channel as $SF = 256/2^k$. The spreading factor range is from 256 down to 4.

The values for the number of bits per field are given in table 16. The channel bit and symbol rates given in table 16 are the rates immediately before spreading. The pilot patterns are given in table 17.

The FACH and PCH can be mapped to the same or to separate Secondary CCPCHs. If FACH and PCH are mapped to the same Secondary CCPCH, they can be mapped to the same frame. The main difference between a CCPCH and a downlink dedicated physical channel is that a CCPCH is not inner-loop power controlled. The main difference between the Primary and Secondary CCPCH is that the Primary CCPCH has a fixed predefined rate while the Secondary CCPCH can support variable rate with the help of the TFCI field included. Furthermore, a Primary CCPCH is continuously transmitted over the entire cell while a Secondary CCPCH is only transmitted when there is data available and may be transmitted in a narrow lobe in the same way as a dedicated physical channel (only valid for a Secondary CCPCH carrying the FACH).

Table 16: Secondary CCPCH fields

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{data}	N_{pilot}	N_{TFCI}
0	30	15	256	300	20	20	0	0
1	30	15	256	300	20	12	8	0
2	30	15	256	300	20	18	0	2
3	30	15	256	300	20	10	8	2
4	60	30	128	600	40	40	0	0
5	60	30	128	600	40	32	8	0
6	60	30	128	600	40	38	0	2
7	60	30	128	600	40	30	8	2
8	120	60	64	1200	80	72	0	8*
9	120	60	64	1200	80	64	8	8*
10	240	120	32	2400	160	152	0	8*
11	240	120	32	2400	160	144	8	8*
12	480	240	16	4800	320	312	0	8*
13	480	240	16	4800	320	296	16	8*
14	960	480	8	9600	640	632	0	8*
15	960	480	8	9600	640	616	16	8*
16	1920	960	4	19200	1280	1272	0	8*
17	1920	960	4	19200	1280	1256	16	8*

* If TFCI bits are not used, then DTX shall be used in TFCI field.

The pilot symbol pattern is described in table 17. The shadowed part can be used as frame synchronization words. (The symbol pattern of pilot symbols other than the frame synchronization word shall be "11"). In table 17, the transmission order is from left to right. (Each two-bit pair represents an I/Q pair of QPSK modulation.)

Table 17: Pilot Symbol Pattern

	$N_{pilot} = 8$				$N_{pilot} = 16$							
Symbol #	0	1	2	3	0	1	2	3	4	5	6	7
Slot #0	11	11	11	10	11	11	11	10	11	11	11	10
1	11	00	11	10	11	00	11	10	11	11	11	00
2	11	01	11	01	11	01	11	01	11	10	11	00
3	11	00	11	00	11	00	11	00	11	01	11	10
4	11	10	11	01	11	10	11	01	11	11	11	11
5	11	11	11	10	11	11	11	10	11	01	11	01
6	11	11	11	00	11	11	11	00	11	10	11	11
7	11	10	11	00	11	10	11	00	11	10	11	00
8	11	01	11	10	11	01	11	10	11	00	11	11
9	11	11	11	11	11	11	11	11	11	00	11	11
10	11	01	11	01	11	01	11	01	11	11	11	10
11	11	10	11	11	11	10	11	11	11	00	11	10
12	11	10	11	00	11	10	11	00	11	01	11	01
13	11	00	11	11	11	00	11	11	11	00	11	00
14	11	00	11	11	11	00	11	11	11	10	11	01

For slot formats using TFCI, the TFCI value in each radio frame corresponds to a certain transport format combination of the FACHs and/or PCHs currently in use. This correspondence is (re-)negotiated at each FACH/PCH addition/removal. The mapping of the TFCI bits onto slots is described in [3].

5.3.3.3.1 Secondary CCPCH structure with STTD encoding

In case the diversity antenna is present in UTRAN and the S-CCPCH is to be transmitted using open loop transmit diversity, the data symbols of the S-CCPCH are STTD encoded as given in Section 5.3.1.1.1. The diversity antenna pilot symbol pattern for the S-CCPCH is given in table 18 below.

Table 18: Pilot symbol pattern for the diversity antenna when STTD encoding is used on the S-CCPCH

	$N_{pilot} = 8$				$N_{pilot} = 16$							
Symbol #	0	1	2	3	0	1	2	3	4	5	6	7
Slot #0	11	00	00	10	11	00	00	10	11	00	00	10
1	11	00	00	01	11	00	00	01	11	10	00	10
2	11	11	00	00	11	11	00	00	11	10	00	11
3	11	10	00	01	11	10	00	01	11	00	00	00
4	11	11	00	11	11	11	00	11	11	01	00	10
5	11	00	00	10	11	00	00	10	11	11	00	00
6	11	10	00	10	11	10	00	10	11	01	00	11
7	11	10	00	11	11	10	00	11	11	10	00	11
8	11	00	00	00	11	00	00	00	11	01	00	01
9	11	01	00	10	11	01	00	10	11	01	00	01
10	11	11	00	00	11	11	00	00	11	00	00	10
11	11	01	00	11	11	01	00	11	11	00	00	01
12	11	10	00	11	11	10	00	11	11	11	00	00
13	11	01	00	01	11	01	00	01	11	10	00	01
14	11	01	00	01	11	01	00	01	11	11	00	11

5.3.3.4 Synchronisation Channel (SCH)

The Synchronisation Channel (SCH) is a downlink signal used for cell search. The SCH consists of two sub channels, the Primary and Secondary SCH. The 10 ms radio frames of the Primary and Secondary SCH are divided into 15 slots, each of length 2560 chips. Figure 16 illustrates the structure of the SCH radio frame.

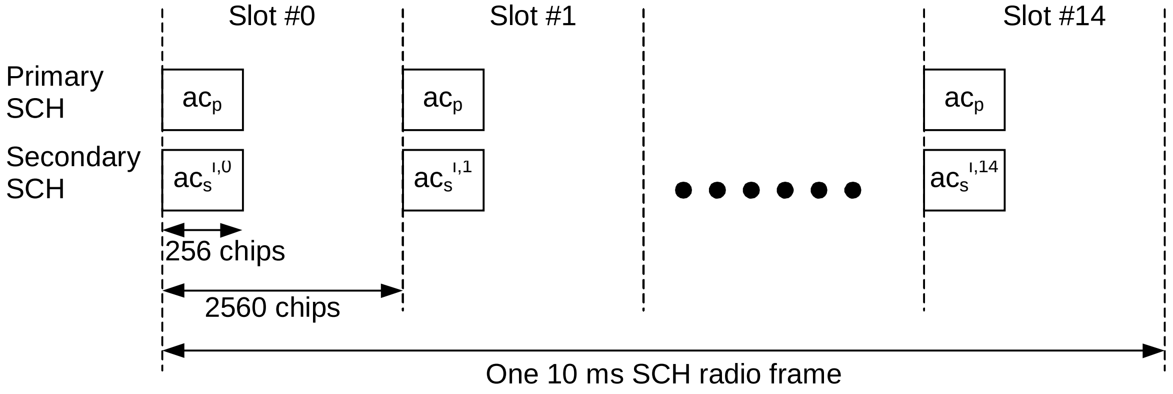


Figure 16: Structure of Synchronisation Channel (SCH)

The Primary SCH consists of a modulated code of length 256 chips, the Primary Synchronisation Code (PSC) denoted c_p in figure 16, transmitted once every slot. The PSC is the same for every cell in the system.

The Secondary SCH consists of repeatedly transmitting a length 15 sequence of modulated codes of length 256 chips, the Secondary Synchronisation Codes (SSC), transmitted in parallel with the Primary SCH. The SSC is denoted $c_s^{i,k}$ in figure 17, where $i = 1, 2, \ldots, 64$ is the number of the scrambling code group, and $k = 0, 1, \ldots, 14$ is the slot number. Each SSC is chosen from a set of 16 different codes of length 256. This sequence on the Secondary SCH indicates which of the code groups the cell's downlink scrambling code belongs to.

The primary and secondary synchronization codes are modulated by the symbol *a* shown in figure 17, which indicates the presence/ absence of STTD encoding on the P-CCPCH and is given by the following table:

P-CCPCH STTD encoded	a = +1
P-CCPCH not STTD encoded	a = -1

5.3.3.4.1 SCH transmitted by TSTD

Figure 17 illustrates the structure of the SCH transmitted by the TSTD scheme. In even numbered slots both PSC and SSC are transmitted on antenna 1, and in odd numbered slots both PSC and SSC are transmitted on antenna 2.

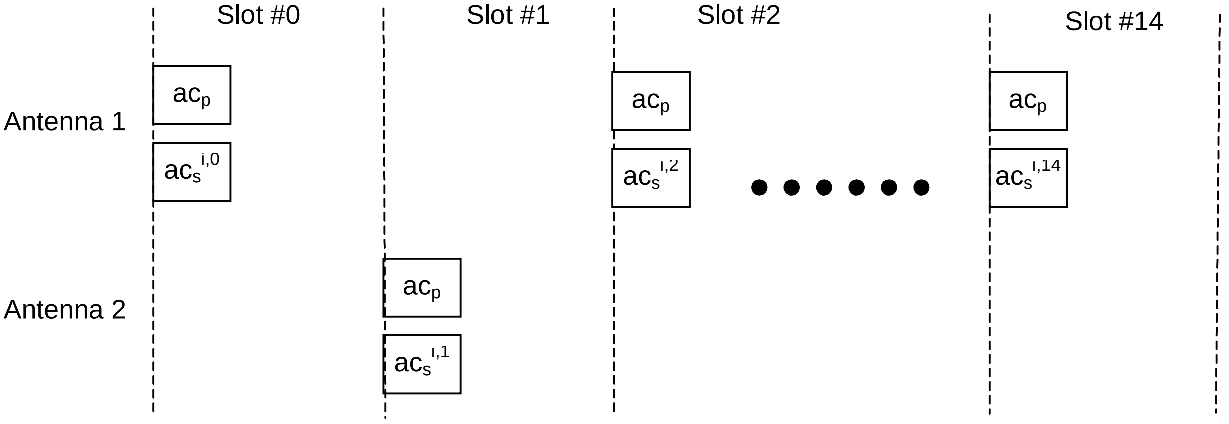


Figure 17: Structure of SCH transmitted by TSTD scheme

5.3.3.5 Physical Downlink Shared Channel (PDSCH)

The Physical Downlink Shared Channel (PDSCH), used to carry the Downlink Shared Channel (DSCH), is shared by users based on code multiplexing. As the DSCH is always associated with a DCH, the PDSCH is always associated with a downlink DPCH.

The frame and slot structure of the PDSCH are shown on figure 18.

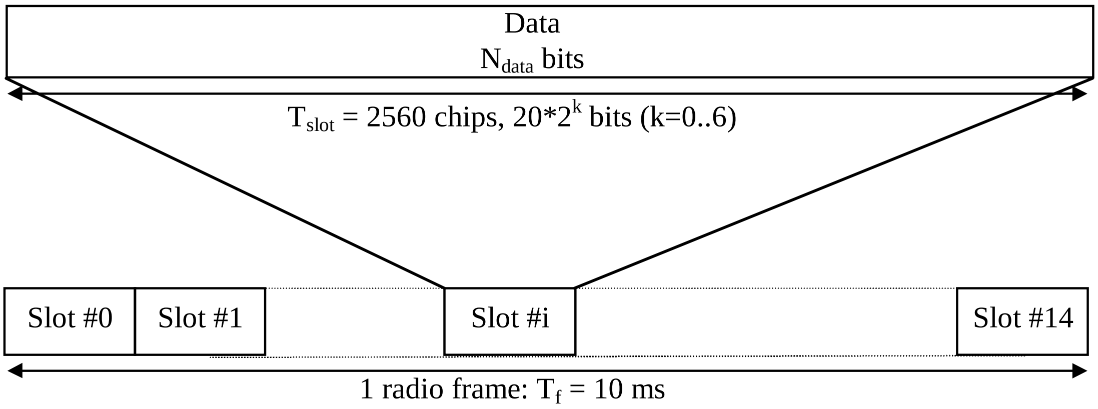


Figure 18: Frame structure for the PDSCH

To indicate for UE that there is data to decode on the DSCH, two signalling methods are possible, either using the TFCI field, or higher layer signalling.

The PDSCH transmission with associated DPCH is a special case of multicode transmission. The PDSCH and DPCH do not have necessary the same spreading factors and for PDSCH the spreading factor may vary from frame to frame. The relevant Layer 1 control information is transmitted on the DPCCH part of the associated DPCH, the PDSCH does not contain physical layer information. The channel bit and symbol rates for PDSCH are given in table 19.

For PDSCH the allowed spreading factors may vary from 256 to 4.

If the spreading factor and other physical layer parameters can vary on a frame-by-frame basis, the TFCI shall be used to inform the UE what are the instantaneous parameters of PDSCH including the channelisation code from the PDSCH OVSF code tree.

A DSCH may be mapped to multiple parallel PDSCHs as well, as negotiated at higher layer prior to starting data transmission. In such a case the parallel PDSCHs shall be operated with frame synchronization between each other.

Table 19: PDSCH fields

Slot format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{data}
0	30	15	256	300	20	20
1	60	30	128	600	40	40
2	120	60	64	1200	80	80
3	240	120	32	2400	160	160
4	480	240	16	4800	320	320
5	960	480	8	9600	640	640
6	1920	960	4	19200	1280	1280

When transmit diversity is employed for the PDSCH, STTD encoding is used on the data bits as described in section 5.3.1.1.1.

5.3.3.6 Acquisition Indicator Channel (AICH)

The Acquisition Indicator channel (AICH) is a physical channel used to carry Acquisition Indicators (AI). Acquisition Indicator AI_s corresponds to signature s on the PRACH or PCPCH. Note that for PCPCH, the AICH either corresponds to an access preamble or a CD preamble. The AICH corresponding to the access preamble is an AP-AICH and the AICH corresponding to the CD preamble is a CD-AICH. The AP-AICH and CD-AICH use different channelization codes, see further[4], Section 4.3.3.2.

Figure 19 illustrates the structure of the AICH. The AICH consists of a repeated sequence of 15 concecutive *access slots* (AS), each of length 40 bit intervals. Each access slot consists of two parts, an *Acquisition-Indicator* (AI) part consisting of 32 real-valued symbols a_0, …, a_{31} and an unused part consisting of 8 real-valued symbols a_{32}, …, a_{39}.

The phase reference for the AICH is the Primary CPICH.

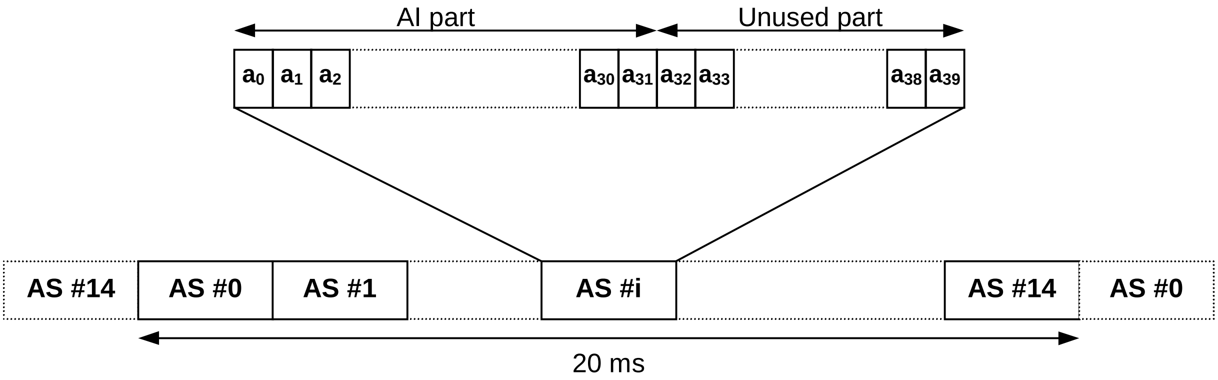


Figure 19: Structure of Acquisition Indicator Channel (AICH)

The real-valued symbols a_0, a_1, …, a_{31} in Figure 19 are given by

$$a_j = \sum_{s=0}^{15} AI_s b_{s,j}$$

where AI_s, taking the values +1, -1, and 0, is the acquisition indicator corresponding to signature s and the sequence $b_{s,0}$, …, $b_{s,31}$ is given by Table 20.

The real-valued symbols a_{32}, a_{33}, …, a_{39} in Figure 19 are undefined.

In case STTD-based open-loop transmit diversity is applied to AICH, STTD encoding according to section 5.3.1.1.1 is applied to each sequence $b_{s,0}$, $b_{s,1}$, ..., $b_{s,31}$ separately before the sequences are combined into AICH symbols a_0, …, a_{31}.

Table 20: AICH signature patterns

s	$b_{s,0}, b_{s,1}\ldots, b_{s,31}$																															
0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1
2	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1
3	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1
4	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1
5	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1
6	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1
7	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
9	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1
10	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1
11	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1
12	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1
13	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1
14	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	1	1	1	1	-1	-1	-1	-1
15	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1

5.3.3.7 Page Indicator Channel (PICH)

The Page Indicator Channel (PICH) is a fixed rate (SF=256) physical channel used to carry the Page Indicators (PI). The PICH is always associated with an S-CCPCH to which a PCH transport channel is mapped.

Figure 20 illustrates the frame structure of the PICH. One PICH frame of length 10 ms consists of 300 bits (b_0, b_1, …, b_{299}). Of these, 288 bits (b_0, b_1, …, b_{287}) are used to carry Page Indicators. The remaining 12 bits (b_{288}, b_{289}, …, b_{299}) are undefined.

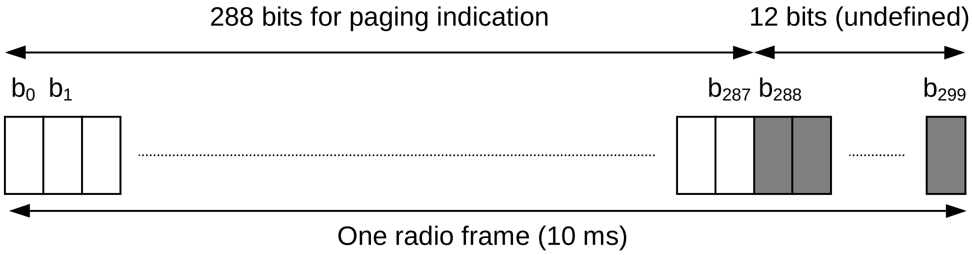


Figure 20: Structure of Page Indicator Channel (PICH)

N Page Indicators $\{PI_0, \ldots, PI_{N-1}\}$ are transmitted in each PICH frame, where N=18, 36, 72, or 144.

The PI calculated by higher layers for use for a certain UE, is mapped to the paging indicator PI_p, where p is computed as a function of the PI computed by higher layers, the SFN of the P-CCPCH radio frame during which the start of the PICH radio frame occurs, and the number of paging indicators per frame (N):

$$p = \left(PI + \left\lfloor \left(\left(18 \times \left(SFN + \lfloor SFN/8 \rfloor + \lfloor SFN/64 \rfloor + \lfloor SFN/512 \rfloor \right) \right) \bmod 144 \right) \times \frac{N}{144} \right\rfloor \right) \bmod N .$$

The mapping from $\{PI_0, \ldots, PI_{N-1}\}$ to the PICH bits $\{b_0, \ldots, b_{287}\}$ are according to table 21.

Table 21: Mapping of Page Indicators (PI) to PICH bits

Number of PI per frame (N)	**$PI_p = 1$**	**$PI_p = 0$**
N=18	$\{b_{16p}, \ldots, b_{16p+15}\} = \{1,1,\ldots,1\}$	$\{b_{16p}, \ldots, b_{16p+15}\} = \{0,0,\ldots,0\}$
N=36	$\{b_{8p}, \ldots, b_{8p+7}\} = \{1,1,\ldots,1\}$	$\{b_{8p}, \ldots, b_{8p+7}\} = \{0,0,\ldots,0\}$
N=72	$\{b_{4p}, \ldots, b_{4p+3}\} = \{1, 1,\ldots,1\}$	$\{b_{4p}, \ldots, b_{4p+3}\} = \{0, 0,\ldots,0\}$
N=144	$\{b_{2p}, b_{2p+1}\} = \{1,1\}$	$\{b_{2p}, b_{2p+1}\} = \{0,0\}$

If a Paging Indicator in a certain frame is set to "1" it is an indication that UEs associated with this Page Indicator should read the corresponding frame of the associated S-CCPCH.

When transmit diversity is employed for the PICH, STTD encoding is used on the PICH bits as described in section 5.3.1.1.1.

6 Mapping of transport channels onto physical channels

Figure 21 summarises the mapping of transport channels onto physical channels.

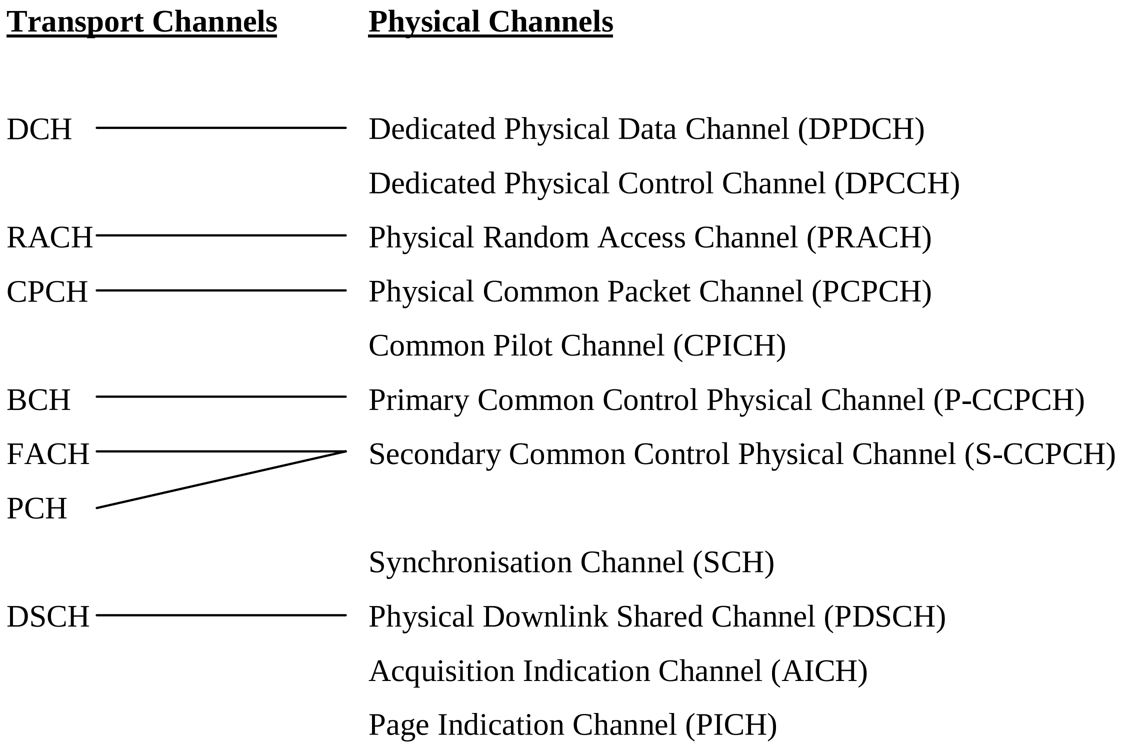


Figure 21: Transport-channel to physical-channel mapping

The DCHs are coded and multiplexed as described in [3] , and the resulting data stream is mapped sequentially (first-in-first-mapped) directly to the physical channel(s). The mapping of BCH and FACH/PCH is equally straightforward, where the data stream after coding and interleaving is mapped sequentially to the Primary and Secondary CCPCH respectively. Also for the RACH, the coded and interleaved bits are sequentially mapped to the physical channel, in this case the message part of the random access burst on the PRACH.

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 22 below describes the frame timing of the downlink physical channels. For the AICH the access slot timing is included. Timing for uplink physical channels is given by the downlink timing, as described in the following sections.

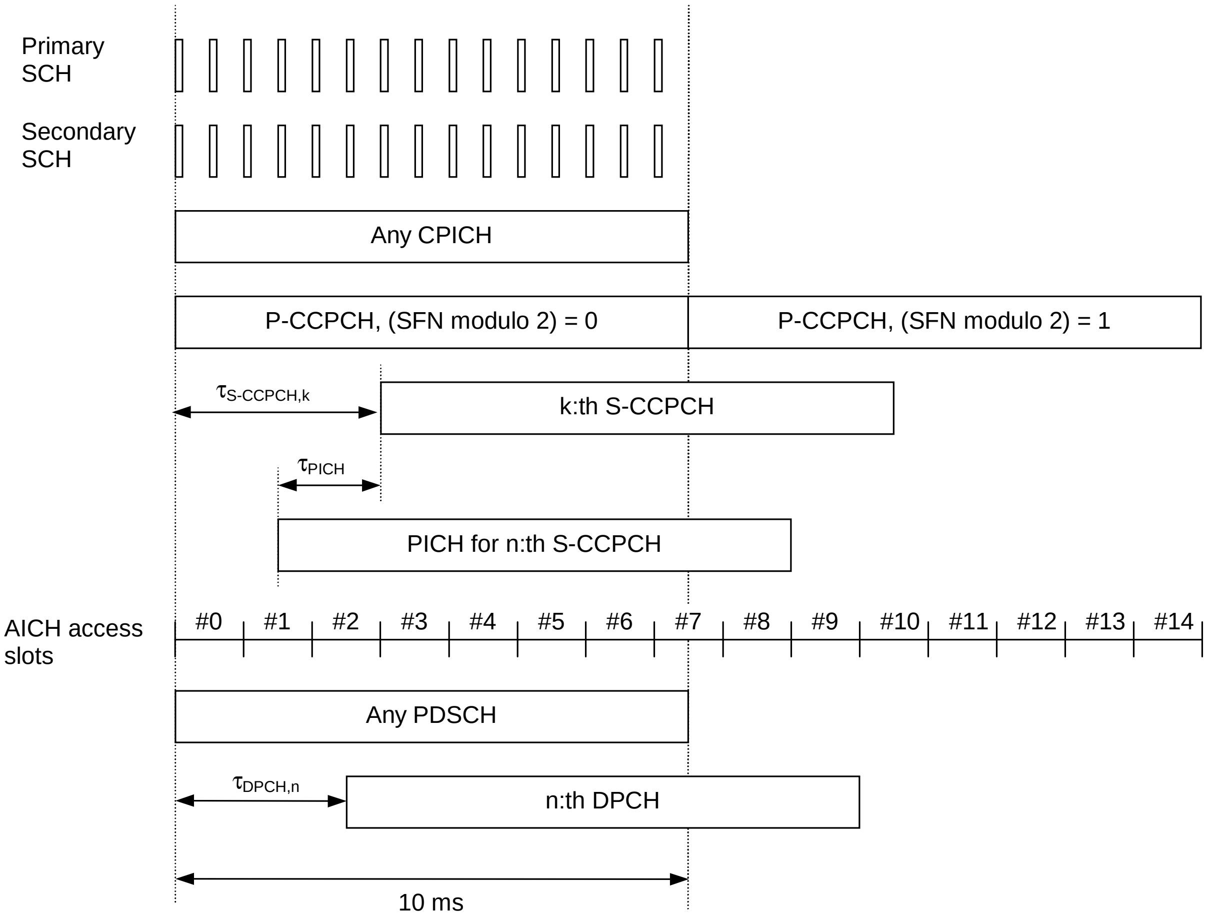


Figure 22: Frame timing and access slot timing of downlink physical channels

In figure 22 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. $\tau_{S\text{-}CCPCH,k} = T_k \times 256$ chip, $T_k \in \{0, 1, \ldots, 149\}$.
- The PICH timing is τ_{PICH} = 7680 chips prior to its corresponding S-CCPCH frame timing. The PICH timing relation to the S-CCPCH is described more in section 7.2.
- The AICH access slot #0 starts the same time as a P-CCPCH frame with (SFN modulo 2) = 0. The AICH/PRACH and AICH/PCPCH timing is described in sections 7.3 and 7.4 respectively.
- The PDSCH timing relative the DPCH timing is described in section 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. $\tau_{DPCH,n} = T_n \times 256$ chip, $T_n \in \{0, 1, \ldots, 149\}$. The DPCH (DPCCH/DPDCH) timing relation with uplink DPCCH/DPDCHs is described in section 7.6.

7.2 PICH/S-CCPCH timing relation

Figure 23 illustrates the timing between a PICH frame and its associated S-CCPCH 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 section 7.1.

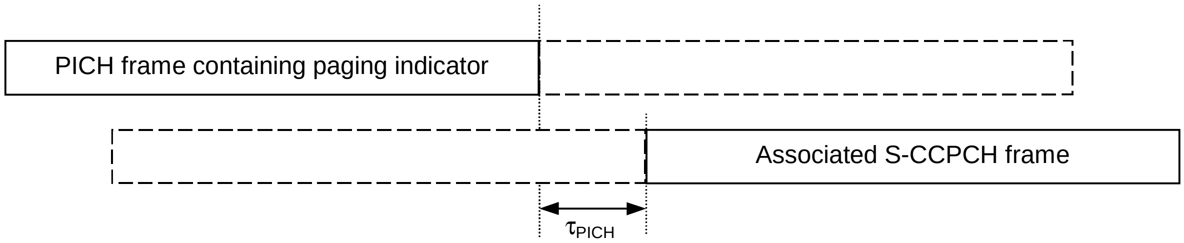


Figure 23: Timing relation between PICH frame and associated S-CCPCH frame

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 section 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 τ_{p-a} chips prior to the reception of downlink access slot number *n*, *n* = 0, 1, …, 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 24.

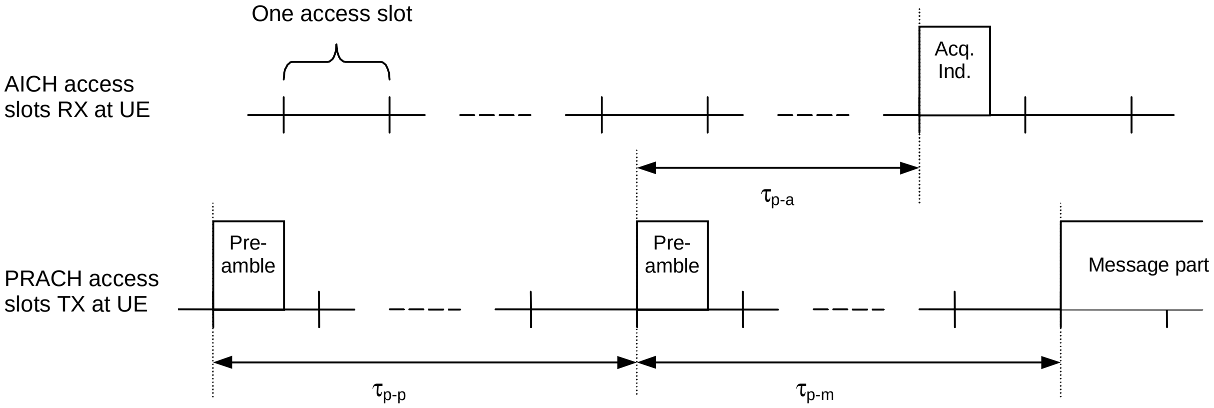


Figure 24: Timing relation between PRACH and AICH as seen at the UE

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

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

- when AICH_Transmission_Timing is set to 0, then

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

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

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

- when AICH_Transmission_Timing is set to 1, then

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

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

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

7.4 PCPCH/AICH timing relation

Transmission of random access bursts on the PCPCH is aligned with access slot times. The timing of the access slots is derived from the received Primary CCPCH timing The transmit timing of access slot n starts n×20/15 ms after the frame boundary of the received Primary CCPCH, where n = 0, 1, …,14. In addition, transmission of access preambles in PCPCH is limited to the allocated access slot subchannel group which is assigned by higher layer signalling to each CPCH set. Twelve access slot subchannels are defined and PCPCH may be allocated all subchannel slots or any subset of the twelve subchannel slots. The access slot subchannel identification is identical to that for the RACH and is described in table 6 of section 6.1 of [5].

Everything in the previous section [PRACH/AICH] applies to this section as well. 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-AICH is identical to RACH Preamble and AICH. The timing relationship between CD-AICH 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-AICH.

$\tau_{p\text{-}p}$ = Time to next available access slot, between Access Preambles.

Minimum time = 15360 chips + 5120 chips X Tcpch

Maximum time = 5120 chips X 12 = 61440 chips

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

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

$\tau_{a1\text{-}cdp}$ = Time between receipt of AP-AICH and transmission of the CD Preamble has one value: 7680 chips.

$\tau_{p\text{-}cdp}$ = Time between the last AP and CD Preamble. is either 3 or 4 access slots, depending on T_{cpch}

$\tau_{cdp\text{-}a2}$ = Time between the CD Preamble and the CD-AICH has two alternative values: 7680 chips or 12800 chips, depending on T_{cpch}

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

Figure 25 illustrates the PCPCH/AICH timing relationship whenT_{cpch} is set to 0 and all access slot subchannels are available for PCPCH.

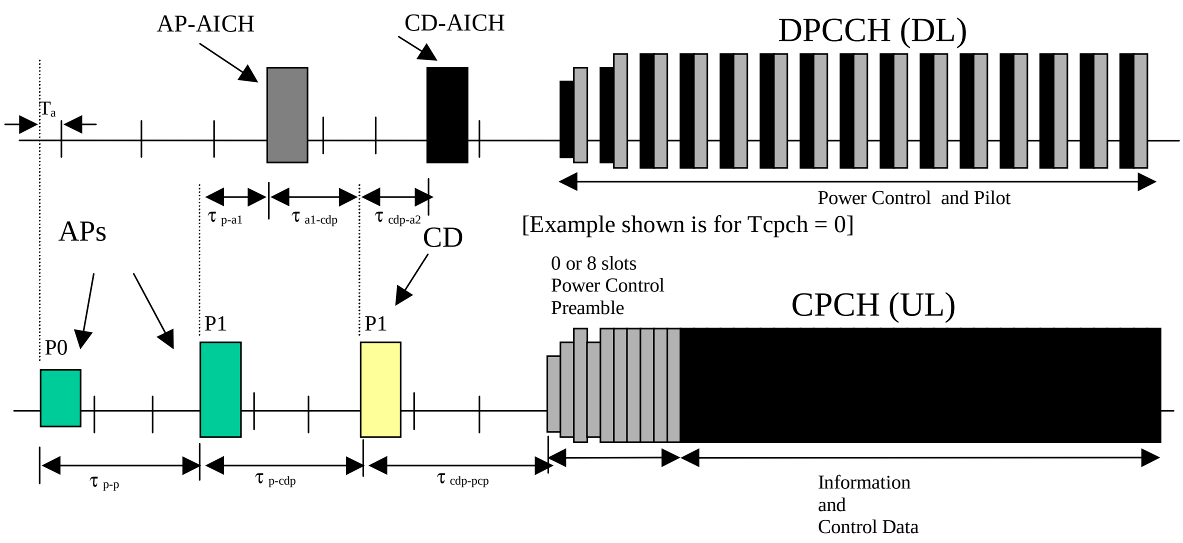


Figure 25: Timing of PCPCH and AICH transmission as seen by the UE, with T_{cpch}= 0

7.5 DPCH/PDSCH timing

The relative timing between a DPCH frame and the associated PDSCH frame is shown in figure 26.

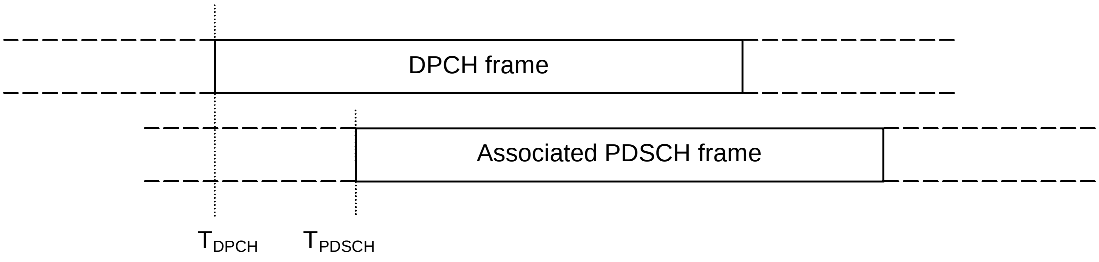


Figure 26: Timing relation between DPCH frame and associated PDSCH frame

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 -35840 chips < T_{DPCH} - T_{PDSCH} ≤ 2560 chips, i.e. the associated PDSCH frame starts anywhere between 1 slot before or up to 14 slots behind the DPCH.

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.

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 significant path of the corresponding downlink DPCCH/DPDCH frame. T_0 is a constant defined to be 1024 chips. More information about the uplink/downlink timing relation and meaning of T_0 can be found in [5].

~~In case of USTS, the uplink DPCCH/DPDCH frame transmission for Initial synchronization takes place T_0+T_{INIT_SYNC} after the reception of the first significant path of the corresponding downlink DPCCH/DPDCH frame where T_{INIT_SYNC} is Initial synchronization time delivered by UTRAN. However the uplink DPCCH/DPDCH frame transmission for Tracking of USTS takes place approximately T_0+T_{INIT_SYNC}±δT after the reception of the first significant path of the corresponding downlink DPCCH/DPDCH frame where δT is the resultant timing adjustment due to the timing control by TAB command bits. More information on T_{INIT_SYNC} and δT can be found in section 9.2 and 9.3 of [5]~~

7.7 Timing relations for initialisation of channels

Figure 27 shows the timing relationships between the physical channels involved in the initialisation of a DCH.

The maximum time permitted for the UE to decode the relevant FACH frame before the first frame of the DPCCH is received shall be $T_{B\text{-min}}$ = 38400 chips (i.e.15 slots).

The downlink DPCCH shall commence at a time T_B after the end of the relevant FACH frame, where $T_B \geq T_{B\text{-min}}$ according to the following equation:

$$T_B = (T_n - T_k) \times 256 - N_{pcp} \times 2560 + N_{offset\_1} \times 38400 \text{ chips},$$ where:

N_{pcp} is a higher layer parameter set by the network, and represents the length (in slots) of the power control preamble (see [5], section 5.1.2.4).

N_{offset_1} is a parameter derived from the activation time set by higher layers. In order that $T_B \geq T_{B\text{-min}}$, N_{offset_1} shall be an integer number of frames such that:

$$N_{offset\_1} \geq \begin{cases} 1 \text{ when } T_n - T_k \geq \dfrac{T_{B-\min}}{256} + 10N_{pcp} - 150 \\ 2 \text{ when } \dfrac{T_{B-\min}}{256} + 10N_{pcp} - 300 \leq T_n - T_k < \dfrac{T_{B-\min}}{256} + 10N_{pcp} - 150 \\ 3 \text{ when } T_n - T_k < \dfrac{T_{B-\min}}{256} + 10N_{pcp} - 300 \end{cases}$$

T_n and T_k are parameters defining the timing of the frame boundaries on the DL DPCCH and S-CCPCH respectively (see section 7.1). These parameters are provided by higher layers.

The uplink DPCCH shall commence at a time T_C after the end of the relevant FACH frame, where

$T_C = T_B + T_0 + N_{offset\_2} \times 38400 \text{ chips}$, where T_0 is as in section 7.6.3 and N_{offset_2} is a UE-specific higher-layer parameter which shall be an integer number of frames greater than or equal to zero.