TSG-RAN Meeting #11 ***RP-010071***
Palm Springs, CA, U.S.A., 13-16 March 2001

Title: **Agreed CRs (Release 4) for WI "Low chip rate TDD option – Physical Layer"**
Work Item Code : ***LCRTDD-Phys***

Source: **TSG-RAN WG1**

Agenda item: **6.7.1**

CRs to TS

No.	R1 T-doc	Spec	CR	Rev	Subject	Cat	V_old	V_new
1	R1-01-0377	25.201	006	1	Inclusion of 1.28Mcps TDD in TS 25.201	B	3.1.0	4.0.0
2	R1-01-0371	25.221	043	1	Inclusion of 1.28Mcps TDD in TS 25.221	B	3.5.0	4.0.0
3	R1-01-0372	25.222	055	1	Inclusion of 1.28Mcps TDD in TS 25.222	B	3.5.0	4.0.0
4	R1-01-0373	25.223	017	1	Inclusion of 1.28Mcps TDD in TS 25.223	B	3.4.0	4.0.0
5	R1-01-0374	25.224	047	1	Inclusion of 1.28Mcps TDD in TS 25.224	B	3.5.0	4.0.0
6	R1-01-0375	25.225	024	1	Inclusion of 1.28Mcps TDD in TS 25.225	B	3.5.0	4.0.0

CR to TR

No.	R1 T-doc	TR	CR	Rev	Subject	Cat	V_old	V_new
1	R1-01-0255	25.944	005	1	1.28 Mcps TDD related changes to 25.944	B	3.3.0	4.0.0

3GPP TSG RAN Meeting #11
Palm Springs, CA, U.S.A., March 13-16, 2001

R1-01-0377

CR-Form-v3

CHANGE REQUEST

⌘	**25.201**	**CR**	**006**	⌘	rev	**1**	⌘	Current version:	**3.1.0** ⌘

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

Title: ⌘	Inclusion of 1.28Mcps TDD in TS 25.201			
Source: ⌘	TSG RAN WG1			
Work item code: ⌘	LCRTDD-Phys		***Date:*** ⌘	28.02.2001
Category: ⌘	**B**		***Release:*** ⌘	REL-4
	Use one of the following categories: ***F*** *(essential correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(Addition of feature),* ***C*** *(Functional modification of feature)* ***D*** *(Editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.			*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *REL-4 (Release 4)* *REL-5 (Release 5)*

Reason for change: ⌘	Inclusion of 1.28 Mcps TDD in 25.201
Summary of change: ⌘	
Consequences if not approved: ⌘	

Clauses affected: ⌘			
Other specs Affected: ⌘	[X]	Other core specifications ⌘	25.221, 25.222, 25.223, 25.224, 25.225
	[ ]	Test specifications	
	[ ]	O&M Specifications	
Other comments: ⌘			

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1 Scope

The present document describes a general description of the physical layer of the UTRA radio interface. The present document also describes the document structure of the 3GPP physical layer specifications, i.e. TS 25.200 series. The TS 25.200 series specifies the Uu point for the 3G mobile system, and defines the minimum level of specifications required for basic connections in terms of mutual connectivity and compatibility.

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 25.211: "Physical channels and mapping of transport channels onto physical channels (FDD)".

[2] 3G TS 25.212: "Multiplexing and channel coding (FDD)".

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

[4] 3G TS 25.214: "Physical layer procedures (FDD)".

[5] 3G TS 25.215: "Physical layer – Measurements (FDD)".

[6] 3G TS 25.221: "Physical channels and mapping of transport channels onto 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 25.225: "Physical layer – Measurements (TDD)".

[11] 3G TR 25.833: "Physical layer items not for inclusion in Release ‘99".

[12] 3G TR 25.944: "Channel coding and multiplexing examples".

[13] 3G TS 25.301: "Radio Interface Protocol Architecture".

[14] 3G TS 25.302: "Services provided by the physical layer".

[15] 3G TS 25.101: "UE Radio transmission and reception (FDD)".

[16] 3G TS 25.102: "UE Radio transmission and reception (TDD)".

[17] 3G TS 25.104: "BTS Radio transmission and reception (FDD)".

[18] 3G TS 25.105: "BTS Radio transmission and reception (TDD)".

3 Abbreviations

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

ARQ	Automatic Repeat Request
BER	Bit Error Rate
CCTrCH	Coded Composite Transport Channel
CPCH	Common Packet Channel
DCA	Dynamic channel allocation
DCH	Dedicated Channel
DS-CDMA	Direct-Sequence Code Division Multiple Access
DSCH	Downlink Shared Channel
DwPCH	Downlink Pilot Channel
DwPTS	Downlink Pilot Time Slot
FAUSCH	Fast Uplink Signalling Channel
FDD	Frequency Division Duplex
FEC	Forward Error Correction
FER	Frame Error Rate
GSM	Global System for Mobile Communication
L1	Layer 1 (physical layer)
L2	Layer 2 (data link layer)
L3	Layer 3 (network layer)
LAC	Link Access Control
MAC	Medium Access Control
Mcps	Mega Chip Per Second
ODMA	Opportunity Driven Multiple Access
QPSK	Quaternary Phase Shift Keying
RACH	Random Access Channel
RF	Radio Frequency
RLC	Radio Link Control
RRC	Radio Resource Control
SAP	Service Access Point
SCCC	Serial Concatenated Convolutional Code
SCH	Synchronisation Channel
SIR	Signal-to-Interference Ratio
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
TFCI	Transport-Format Combination Indicator
UE	User Equipment
UMTS	Universal Mobile Telecommunications System
UpPTS	Uplink Pilot Time Slot
UpPCH	Uplink Pilot Channel
UTRA	UMTS Terrestrial Radio Access
UTRAN	UMTS Terrestrial Radio Access Network
WCDMA	Wide-band Code Division Multiple Access

4 General description of Layer 1

4.1 Relation to other layers

4.1.1 General Protocol Architecture

Radio interface which is prescribed by this specification means the Uu point between User Equipment (UE) and network. The radio interface is composed of Layers 1, 2 and 3. Layer 1 is based on WCDMA/TD-SCDMA technology and the TS 25.200 series describes the Layer-1 specification. Layers 2 and 3 of the radio interface are described in the TS 25.300 and 25.400 series, respectively.

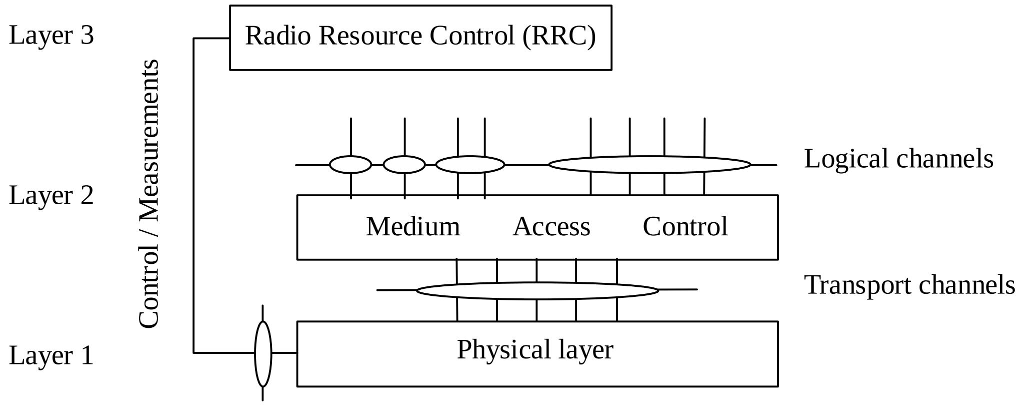

Figure 1: Radio interface protocol architecture around the physical layer

Figure 1 shows the UTRA radio interface protocol architecture around the physical layer (Layer 1). The physical layer interfaces the Medium Access Control (MAC) sub-layer of Layer 2 and the Radio Resource Control (RRC) Layer of Layer 3. The circles between different layer/sub-layers indicate Service Access Points (SAPs). The physical layer offers different Transport channels to MAC. A transport channel is characterized by how the information is transferred over the radio interface. MAC offers different Logical channels to the Radio Link Control (RLC) sub-layer of Layer 2. A logical channel is characterized by the type of information transferred. Physical channels are defined in the physical layer. There are two duplex modes: Frequency Division Duplex (FDD) and Time Division Duplex (TDD). In the FDD mode a physical channel is characterized by the code, frequency and in the uplink the relative phase (I/Q). In the TDD mode the physical channels is also characterized by the timeslot. The physical layer is controlled by RRC.

4.1.2 Service provided to higher layers

The physical layer offers data transport services to higher layers. The access to these services is through the use of transport channels via the MAC sub-layer. The physical layer is expected to perform the following functions in order to provide the data transport service. See also TS 25.302:

- Macrodiversity distribution/combining and soft handover execution.
- Error detection on transport channels and indication to higher layers.
- FEC encoding/decoding of transport channels.
- Multiplexing of transport channels and demultiplexing of coded composite transport channels (CCTrCHs).
- Rate matching of coded transport channels to physical channels.
- Mapping of coded composite transport channels on physical channels.
- Power weighting and combining of physical channels.
- Modulation and spreading/demodulation and despreading of physical channels.
- Frequency and time (chip, bit, slot, frame) synchronisation.
- Radio characteristics measurements including FER, SIR, Interference Power, etc., and indication to higher layers.
- Inner - loop power control.
- RF processing. (Note: RF processing is defined in TS 25.100 series).
- synchronization shift control
- beamforming

When network elements (UEs and network) provide compatible service bearers (for example support a speech bearer) they should be assured of successful interworking. Moreover, different implementation options of the same (optional) feature would lead to incompatibility between UE and network. Therefore, this shall be avoided.

4.2 General description of Layer 1

4.2.1 Multiple Access

The access scheme is Direct-Sequence Code Division Multiple Access (DS-CDMA) with information either spread over approximately 5 MHz (FDD and 3.84 Mcps TDD) bandwidth, thus also often denoted as Wideband CDMA (WCDMA) due that nature or 1.6MHz (1.28Mcps TDD), thus also often denoted as Narrowband CDMA.

UTRA has two modes, FDD (Frequency Division Duplex) & TDD (Time Division Duplex), for operating with paired and unpaired bands respectively. The possibility to operate in either FDD or TDD mode allows for efficient utilisation of the available spectrum according to the frequency allocation in different regions. FDD and TDD modes are defined as follows:

FDD: A duplex method whereby uplink and downlink transmissions use two separated radio frequencies. In the FDD, each uplink and downlink uses the different frequency band. A pair of frequency bands which have specified separation shall be assigned for the system.

TDD: A duplex method whereby uplink and downlink transmissions are carried over same radio frequency by using synchronised time intervals. In the TDD, time slots in a physical channel are divided into transmission and reception part. Information on uplink and downlink are transmitted reciprocally.

UTRA TDD has two options, the 3.84Mcps option and the 1.28Mcps option. In UTRA TDD there is TDMA component in the multiple access in addition to DS-CDMA. Thus the multiple access has been also often denoted as TDMA/CDMA due added TDMA nature.

A 10 ms radio frame is divided into 15 slots (2560 chip/slot at the chip rate 3.84 Mcps). A physical channel is therefore defined as a code (or number of codes) and additionally in TDD mode the sequence of time slots completes the definition of a physical channel.

The information rate of the channel varies with the symbol rate being derived from the 3.84 Mcps chip rate and the spreading factor. Spreading factors are from 256 to 4 with FDD uplink, from 512 to 4 with FDD downlink, and from 16 to 1 for TDD uplink and downlink. Thus the respective modulation symbol rates vary from 960 k symbols/s to 15 k symbols/s (7.5 k symbols/s) for FDD uplink (downlink), and for TDD the momentary modulation symbol rates shall vary from 3.84 M symbols/s to 240 k symbols/s.

For 1.28Mcps TDD option, a 10 ms radio frame is divided into two 5ms sub-frames. In each sub-frame, there are 7 normal time slots and 3 special time slots. A basic physical channel is therefore characterised by the frequency, code and time slot.

The information rate of the channel varies with the symbol rate being derived from the 1.28 Mcps chiprate and the spreading factor. Spreading factors is from 16 to 1 for both uplink and downlink. Thus the respective modulation symbol rates shall vary from 80.0K symbols/s to 1.28M symbols/s.

4.2.2 Channel coding and interleaving

For the channel coding in UTRA three options are supported:

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

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

4.2.3 Modulation and spreading

The UTRA modulation scheme is QPSK (8PSK is also used for 1.28Mcps TDD option). Pulse shaping is specified in the TS 25.100 series.

With CDMA nature the spreading (& scrambling) process is closely associated with modulation. In UTRA different families of spreading codes are used to spread the signal:

- For separating channels from same source, channelisation codes derived with the code tree structure as given in TS 25.213 and 25.223 are used.
- For separating different cells the following solutions are supported.
  - FDD mode: Gold codes with 10 ms period (38400 chips at 3.84 Mcps) used, with the actual code itself length 2^{18}-1 chips, as defined in TS 25.213.
  - TDD mode: Scrambling codes with the length 16 used as defined in TS 25.223.
- For separating different UEs the following code families are defined.
  - FDD mode: Gold codes with 10 ms period, or alternatively S(2) codes 256 chip period.
  - TDD mode: codes with period of 16 chips and midamble sequences of different length depending on the environment.

4.2.4 Physical layer procedures

There are several physical layer procedures involved with UTRA operation. Such procedures covered by physical layer description are:

1) The power control, with both inner loop and slow quality loop for FDD mode, and for 3.84Mcps TDD ~~mode~~ option open loop in uplink and inner loop in downlink, for 1.28Mcps TDD option, open loop in uplink and inner loop in both uplink and downlink.
2) Cell search operation.
3) Uplink synchronization control with open and closed loop.
4) Random access

~~3) ODMA specific procedures such as probing for TDD mode.~~

4.2.5 Physical layer measurements

Radio characteristics including FER, SIR, Interference power, etc., are measured and reported to higher layers and network. Such measurements are:

1) Handover measurements for handover within UTRA. Specific features being determined in addition to the relative strength of the cell, for the FDD mode the timing relation between for cells for support of asynchronous soft handover.
2) The measurement procedures for preparation for handover to GSM900/GSM1800.
3) The measurement procedures for UE before random access process.
4) The measurement procedures for Dynamic Channel Allocation (DCA) of TDD mode.

4.2.6 Relationship of the physical layer functions

The functionality of the layer 1 is split over several specifications each for FDD and TDD. The following figures, although not categorical, show as an introduction the relationship of layer 1 functions by specification in terms of users plane information flow.

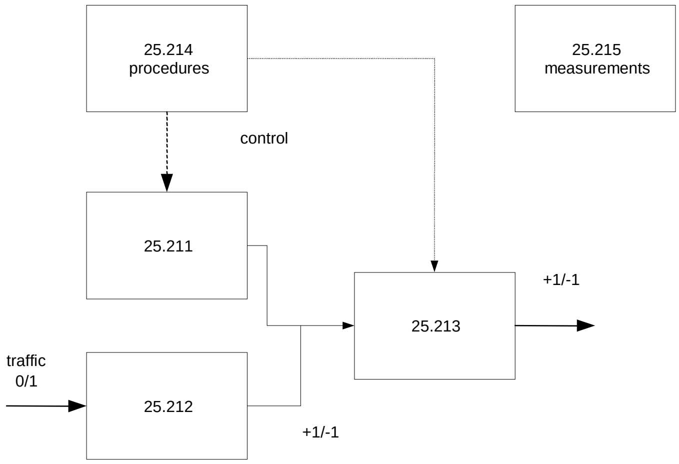

Figure 2 - FDD layer 1 functions relationships by specification

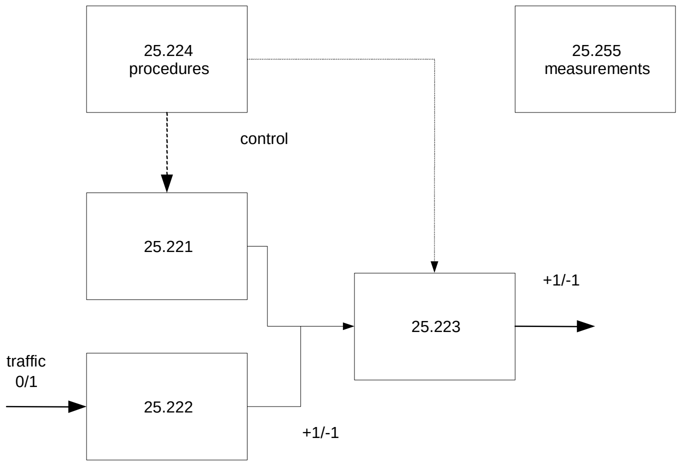

Figure 3 - TDD layer 1 functions relationships by specification

5 Document structure of physical layer specification

5.1 Overview

The physical layer specification consists of a general document (TS 25.201), five FDD mode documents (TS 25.211 through 25.215), five TDD mode documents (TS 25.221 through 25.225). In addition, there are two technical reports (TR 25.833 and 25.944).

5.2 TS 25.201: Physical layer – General description

The scope is to describe:

- the contents of the Layer 1documents (TS 25.200 series);
- where to find information;
- a general description of Layer 1.

5.3 TS 25.211: Physical channels and mapping of transport channels onto physical channels (FDD)

The scope is to establish the characteristics of the Layer-1 transport channels and physical channels in the FDD mode, and to specify:

- the different transport channels that exist;
- which physical channels exist;
- what is the structure of each physical channel, slot format etc.;
- relative timing between different physical channels in the same link, and relative timing between uplink and downlink;
- mapping of transport channels onto the physical channels.

5.4 TS 25.212: Multiplexing and channel coding (FDD)

The scope is to describe multiplexing, channel coding and interleaving in the FDD mode, and to specify:

- coding and multiplexing of transport channels into CCTrCHs;
- channel coding alternatives;
- coding for Layer 1 control information, such as TFCI;
- the different interleavers;
- how is rate matching done;
- physical channel segmentation and mapping.

5.5 TS 25.213: Spreading and modulation (FDD)

The scope is to establish the characteristics of the spreading and modulation in the FDD mode, and to specify:

- the spreading (channelisation plus scrambling);
- generation of channelisation and scrambling codes;
- generation of RACH and CPCH preamble codes;
- generation of SCH synchronisation codes;
- modulation.

RF channel arrangements and Pulse shaping are specified in TS 25.101 for UE and in TS 25.104 for Node-B.

5.6 TS 25.214: Physical layer procedures (FDD)

The scope is to establish the characteristics of the physical layer procedures in the FDD mode, and to specify:

- cell search procedures;
- power control procedures;
- random access procedure.

5.7 TS 25.215: Physical layer – Measurements (FDD)

The scope is to establish the characteristics of the physical layer measurements in the FDD mode, and to specify:

- the measurements that Layer 1 is to perform;
- reporting of measurements to higher layers and network;
- handover measurements, idle-mode measurements etc.

5.8 TS 25.221: Physical channels and mapping of transport channels onto physical channels (TDD)

The scope is to establish the characteristics of the Layer-1 transport channels and physical channels in the TDD mode, and to specify:

- transport channels;
- physical channels, structure and contents;
- mapping of transport channels onto the physical channels.

5.9 TS 25.222: Multiplexing and channel coding (TDD)

The scope is to describe multiplexing, channel coding and interleaving in the TDD mode, and to specify:

- channel coding and multiplexing of transport channels into CCTrCHs;
- channel coding alternatives;
- coding for Layer 1 control information, such as TFCI;
- interleaving;
- rate matching;
- physical channel segmentation and mapping.

5.10 TS 25.223: Spreading and modulation (TDD)

The scope is to establish the characteristics of the spreading and modulation in the TDD mode, and to specify:

- data modulation;
- spreading;
- generation of synchronisation codes.

RF channel arrangements and Pulse shaping are specified in TS 25.102 for UE and in TS 25.105 for Node-B.

5.11 TS 25.224: Physical layer procedures (TDD)

The scope is to establish the characteristics of the physical layer procedures in the TDD mode, and to specify:

- cell synchronisation;
- timing advance;
- power control procedures;
- idle mode tasks.

5.12 TS 25.225: Physical layer – Measurements (TDD)

The scope is to establish the characteristics of the physical layer measurements in the TDD mode, and to specify:

- the measurements that Layer 1 is to perform;
- reporting of measurements to higher layers and network;
- handover measurements, idle-mode measurements etc.

5.13 TR 25.833: Physical layer items not for inclusion in Release '99

The scope is to collect materials on UTRA physical layer items not included in the Release '99 specification documents, such as DSCH control channel, FAUSCH, Hybrid ARQ, 4-state SCCC turbo coding and ODMA.

5.14 TR 25.944: Channel coding and multiplexing examples

The scope is to describe examples of channel coding and multiplexing for transport channels of various types and cases.

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Palm Springs, CA, U.S.A., March 13-16, 2001

R1-01-0371

CR-Form-v3

CHANGE REQUEST

⌘	**25.221**	**CR**	**043**	⌘ rev	**1**	⌘ Current version:	**3.5.0**	⌘

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

Title: ⌘	Inclusion of 1.28Mcps TDD in TS 25.221			
Source: ⌘	TSG RAN WG1			
Work item code: ⌘	LCRTDD-Phys		***Date:*** ⌘	28.02.2001
Category: ⌘	**B**		***Release:*** ⌘	REL-4
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Reason for change: ⌘	Inclusion of 1.28 Mcps TDD
Summary of change: ⌘	• The basis for this document was CR0043, R1-01-0221 • inclusion of contributions approved at WG1#19
Consequences if not approved: ⌘	

Clauses affected: ⌘	3, 5, new section 6, 7, new section 8, new Annex B, new Annex D, new Annex G, new Annex H	
Other specs Affected: ⌘	[X] Other core specifications [ ] Test specifications [ ] O&M Specifications	⌘ 25.201, 25.222, 25.223, 25.224, 25.225
Other comments: ⌘		

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3 Abbreviations

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

BCH	Broadcast Channel
CCPCH	Common Control Physical Channel
CCTrCH	Coded Composite Transport Channel
CDMA	Code Division Multiple Access
DPCH	Dedicated Physical Channel
DRX	Discontinuous Reception
DSCH	Downlink Shared Channel
DwPCH	Downlink Pilot Channel
DwPTS	Downlink Pilot Time Slot
FACH	Forward Access Channel
FDD	Frequency Division Duplex
FEC	Forward Error Correction
GP	Guard Period
GSM	Global System for Mobile Communication
MIB	Master Information Block
NRT	Non-Real Time
OVSF	Orthogonal Variable Spreading Factor
P-CCPCH	Primary CCPCH
PCH	Paging Channel
PDSCH	Physical Downlink Shared Channel
PI	Paging Indicator (value calculated by higher layers)
PICH	Page Indicator Channel
P_q	Paging Indicator (indicator set by physical layer)
PRACH	Physical Random Access Channel
PUSCH	Physical Uplink Shared Channel
RACH	Random Access Channel
RF	Radio Frame
RT	Real Time
S-CCPCH	Secondary CCPCH
SCH	Synchronisation Channel
SFN	Cell System Frame Number
TCH	Traffic Channel
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
TrCH	Transport Channel
UE	User Equipment
UpPTS	Uplink Pilot Time Slot
UpPCH	Uplink Pilot Channel
USCH	Uplink Shared Channel

5 Physical channels for the 3.84 Mcps option

5.6.1.2.2 Common Midamble

The use of the common midamble allocation scheme is signalled to the UE by higher layers as a part of the physical channel configuration. A common midamble may be assigned by layer 1 to all physical channels in one DL time slot, if:

- a single UE uses all physical channels in one DL time slot (as in the case of high rate service);

or

- multiple UEs use the physical channels in one DL time slot; and
- no beamforming is applied to any of these DL physical channels; and
- no closed loop TxDiversity is applied to any of these DL physical channels; and
- midambles are not used for PDSCH physical layer signalling.

The number of channelisation codes currently employed in the DL time slot is associated with the use of a particular common midamble. Different associations apply for different burst types and cell configurations with respect to the maximum number of midambles, see annex ~~B~~C.

6 Physical channels for the 1.28 Mcps option

All physical channels take three-layer structure with respect to timeslots, radio frames and system frame numbering (SFN), see [14]. Depending on the resource allocation, the configuration of radio frames or timeslots becomes different. All physical channels need guard symbols in every timeslot. The time slots are used in the sense of a TDMA component to separate different user signals in the time and the code domain. The physical channel signal format for 1.28Mcps TDD is presented in figure [19].

A physical channel in TDD is a burst, which is transmitted in a particular timeslot within allocated Radio Frames. The allocation can be continuous, i.e. the time slot in every frame is allocated to the physical channel or discontinuous, i.e. the time slot in a subset of all frames is allocated only. A burst is the combination of a data part, a midamble and a guard period. The duration of a burst is one time slot. Several bursts can be transmitted at the same time from one transmitter. In this case, the data part must use different OVSF channelisation codes, but the same scrambling code. The midamble part has to use the same basic midamble code, but can use different midambles.

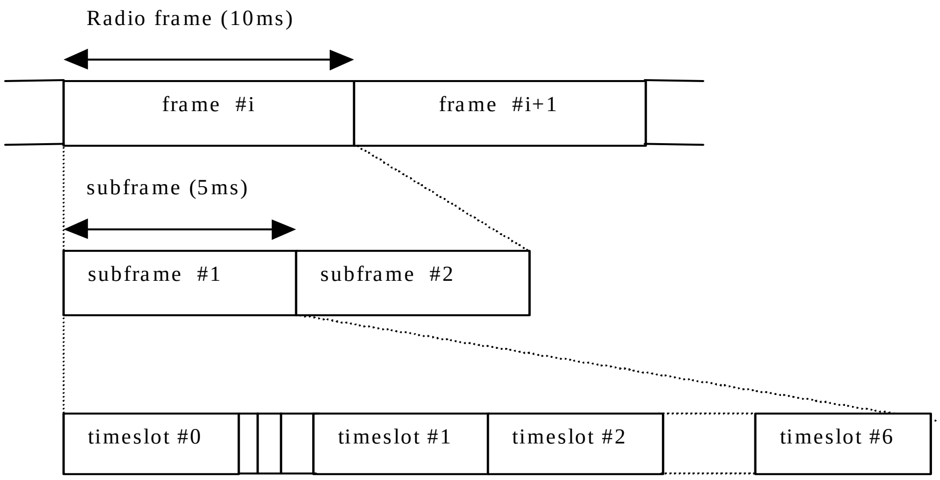


Figure [19]: Physical channel signal format for 1.28Mcps TDD option

The data part of the burst is spread with a combination of channelisation code and scrambling code. The channelisation code is a OVSF code, that can have a spreading factor of 1, 2, 4, 8, or 16. The data rate of the physical channel is depending on the used spreading factor of the used OVSF code.

So a physical channel is defined by frequency, timeslot, channelisation code, burst type and Radio Frame allocation The scrambling code and the basic midamble code are broadcast and may be constant within a cell. When a physical channel is established, a start frame is given. The physical channels can either be of infinite duration, or a duration for the allocation can be defined.

6.1 Frame structure

The TDMA frame has a duration of 10 ms and is divided into 2 sub-frames of 5ms. The frame structure for each sub-frame in the 10ms frame length is the same.

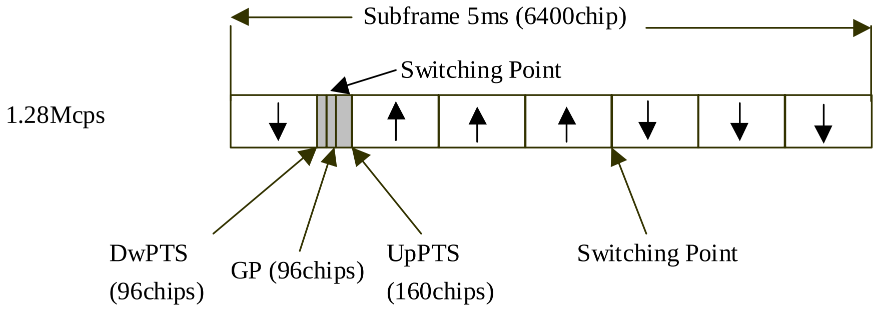


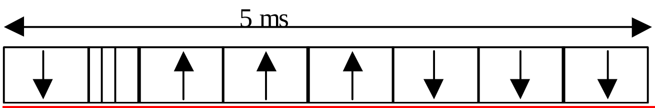
Figure [20]: Structure of the sub-frame for 1.28Mcps TDD option

Time slot#n (n from 0 to 6): the n[th] traffic time slot, 864 chips duration;
DwPTS: downlink pilot time slot, 96 chips duration;
UpPTS: uplink pilot time slot, 160 chips duration;
GP: main guard period for TDD operation, 96 chips duration;

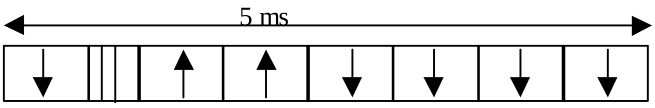
In Figure [20], the total number of traffic time slots for uplink and downlink is 7, and the length for each traffic time slot is 864 chips duration. Among the 7 traffic time slots, time slot#0 is always allocated as downlink while time slot#1 is always allocated as uplink. The time slots for the uplink and the downlink are separated by switching points. Between the downlink time slots and uplink time slots, the special period is the switching point to separate the uplink and downlink. In each sub-frame of 5ms for 1.28Mcps option, there are two switching points (uplink to downlink and vice versa).

Using the above frame structure, the 1.28Mcps TDD option can operate on both symmetric and asymmetric mode by properly configuring the number of downlink and uplink time slots. In any configuration at least one time slot (time slot#0) has to be allocated for the downlink and at least one time slot has to be allocated for the uplink (time slot#1).

Examples for symmetric and asymmetric UL/DL allocations are given in figure [21].



symmetric DL/UL allocation



asymmetric DL/UL allocation

Figure [21]: 1.28Mcps TDD sub-frame structure examples

6.2 Dedicated physical channel (DPCH)

The DCH as described in subclause 4.1 'Dedicated transport channels' is mapped onto the dedicated physical channel.

6.2.1 Spreading

The spreading of physical channels is the same as in 3.84 Mcps TDD (cf. 5.2.1 'Spreading').

6.2.2 Burst Format

A traffic burst consists of two data symbol fields, a midamble of 144 chips and a guard period. The data fields of the burst are 352 chips long. The corresponding number of symbols depends on the spreading factor, as indicated in table 10 below. The guard period is 16 chip periods long.

The burst format is shown in Figure 22. The contents of the traffic burst fields is described in table 11.

Table 10: number of symbols per data field in a traffic burst

Spreading factor (Q)	Number of symbols (N) per data field in Burst
1	352
2	176
4	88
8	44
16	22

Table 11: The contents of the traffic burst format fields

Chip number (CN)	Length of field in chips	Length of field in symbols	Contents of field
0-351	352	cf table 10	Data symbols
352-495	144	-	Midamble
496-847	352	cf table 10	Data symbols
848-863	16	-	Guard period

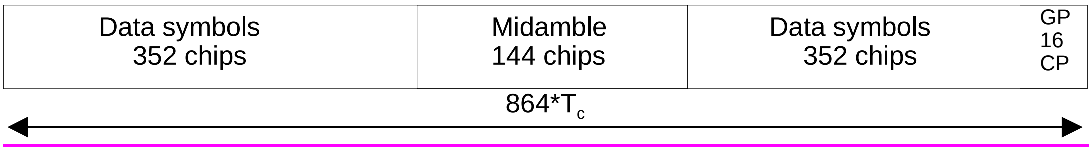


Figure 22: Burst structure of the traffic burst format (GP denotes the guard period and CP the chip periods)

6.2.2.1 Transmission of TFCI

The traffic burst format provides the possibility for transmission of TFCI in uplink and downlink.

The transmission of TFCI is negotiated at call setup and can be re-negotiated during the call. For each CCTrCH it is indicated by higher layer signalling, which TFCI format is applied. Additionally for each allocated timeslot it is signalled individually whether that timeslot carries the TFCI or not. If a time slot contains the TFCI, then it is always transmitted using the first allocated channelisation code in the timeslot, according to the order in the higher layer allocation message.

The transmission of TFCI is done in the data parts of the respective physical channel, this means TFCI and data bits are subject to the same spreading procedure as depicted in [8]. Hence the midamble structure and length is not changed.

The encoded TFCI symbols are equally distributed between the two subframes and the respective data fields. The TFCI information is to be transmitted possibly either directly adjacent to the midamble or after the SS and TPC symbols. Figure [23] shows the position of the TFCI in a traffic burst, if neither SS nor TPC are transmitted. Figure [24] shows the position of the TFCI in a traffic burst , if SS and TPC are transmitted.

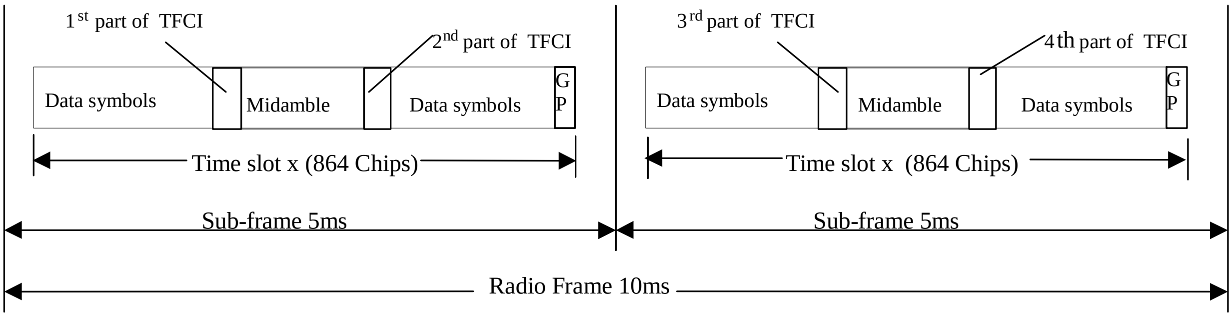


Figure 23: Position of TFCI information in the traffic burst in case of no TPC and SS in 1.28 Mcps TDD

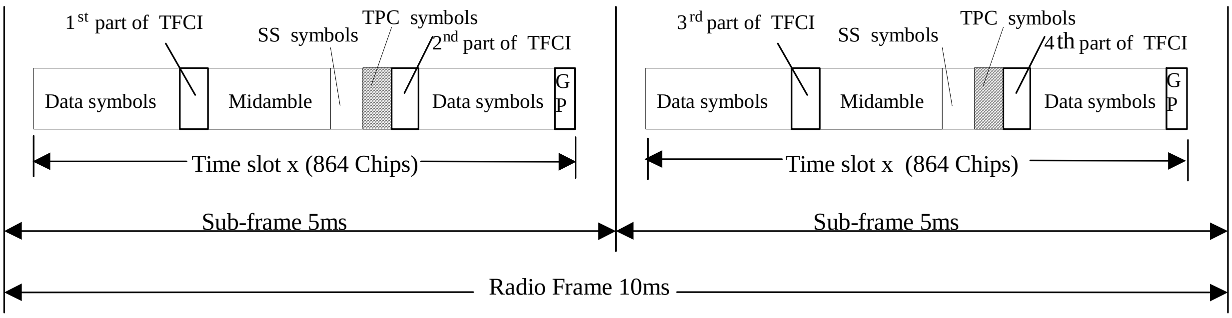


Figure 24:Position of TFCI information in the traffic burst in case of TPC and SS in 1.28 Mcps TDD

6.2.2.2 Transmission of TPC

The burst type for dedicated channels provides the possibility for transmission of TPC in uplink and downlink.

The transmission of TPC is done in the data parts of the traffic burst. Hence the midamble structure and length is not changed. The TPC information is to be transmitted directly after the SS information, which is transmitted after the midamble. Figure 25 shows the position of the TPC command in a traffic burst.

For every user the TPC information is to be transmitted at least once per 5ms sub-frame. If applied, transmission of TPC is done in the data parts of the traffic burst and it can be transmitted using the first allocated channelisation code and the first allocated timeslot (according to the order in the higher layer allocation message). Other allocations (more than one TPC transmission in one sub-frame) of TPC are also possible. The TPC is spread with the same spreading factor (SF) and spreading code as the data parts of the respective physical channel.

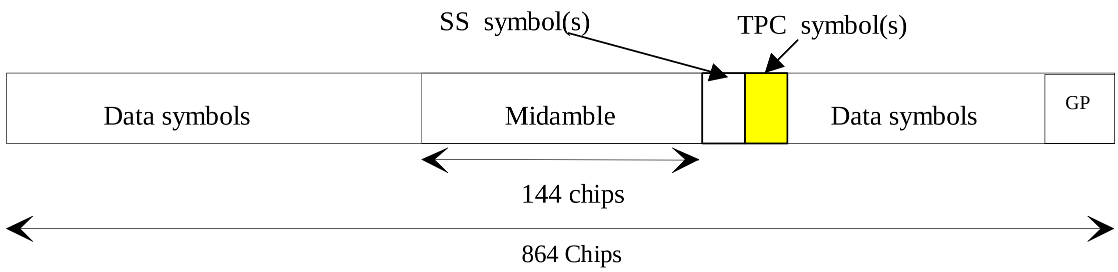


Figure 25: Position of TPC information in the traffic burst in downlink and uplink

For the number of layer 1 symbols per channelisation code there are 3 possibilities for each channelisation code, configured by higher layers:

1) one SS and one TPC symbol
2) no SS and no TPC symbols
3) 16/SF SS and 16/SF TPC symbols

So, in case 3), when SF=1, there are 16 TPC symbols which correspond to 32 bits (for QPSK) and 48 bits (for 8PSK).

In the following the uplink is described only. For the description of the downlink, downlink (DL) and uplink (UL) have to be interchanged.

Each of the TPC symbols for uplink power control in the DL will be associated with an UL time slot and an UL CCTrCH pair. This association varies with

- the number of allocated UL time slots and UL CCTrCHs on these time slots (time slot and CCTrCH pair) and
- the allocated TPC symbols in the DL.

In case a UE has

- more than one channelisation code

and/or

- channelisation codes being of lower spreading factor than 16 and using 16/SF SS and 16/SF TPC symbols,

the TPC commands for each ULtime slot CCTrCH pair (all channelisation codes on that time slot belonging to the same time slot and CCTrCH pair have the same TPC command) will be distributed to the following rules:

1. The ULtime slots and CCTrCH pairs the TPC commands are intended for will be numbered form the first to the last ULtime slot and CCTrCH pair allocated to the regarded UE (starting with 0). The number of a time slot and CCTrCH pair is smaller then the number of another time slot and CCTrCH pair within the same time slot if its spreading code with the lowest SC number according to the following table has a lower SC number then the spreading code with the lowest SC number of the other time slot and CCTrCH pair.
2. The commanding TPC symbols on all DLCCTrCHs allocated to one UE are numbered consecutively starting with zero according to the following rules:

   a) The numbers of the TPC commands of a regarded DL time slot are lower than those of DL time slots being transmitted after that time slot

   b) Within a DL time slot the numbers of the TPC commands of a regarded channelisation code are lower than those of channelisation codes having a higher spreading code number

   The spreading code number is defined by the following table (see[8]):

SC number	SF (Q)	Walsh code number (k)
0	16	$\mathbf{c}_{Q=16}^{(k=1)}$
	...	
15	16	$\mathbf{c}_{Q=16}^{(k=16)}$
16	8	$\mathbf{c}_{Q=8}^{(k=1)}$
	…	
23	8	$\mathbf{c}_{Q=8}^{(k=8)}$

24	4	$\mathbf{c}_{Q=4}^{(k=1)}$
	…	
27	4	$\mathbf{c}_{Q=4}^{(k=4)}$
28	2	$\mathbf{c}_{Q=2}^{(k=1)}$
29	2	$\mathbf{c}_{Q=2}^{(k=2)}$
30	1	$\mathbf{c}_{Q=1}^{(k=1)}$

Note: Spreading factors 2-8 are not used in DL

c) Within a channelisation code numbers of the TPC commands are lower than those of TPC commands being transmitted after that time

The following equation is used to determine the UL time slot which is controlled by the regarded TPC symbol in the DL:

$$UL_{pos} = (SFN' \cdot N_{UL\_TPCsymbols} + TPC_{DLpos}) \bmod (N_{ULslot}),$$

where

UL_{pos} is the number of the controlled uplink time slot and CCTrCH pairs.

SFN' is the system frame number counting the sub-frames. The system frame number of the radio frames (SFN) can be derived from SFN' by

SFN=SFN' div 2, where div is the reminder free division operation.

$N_{UL\_PCsymbols}$ is the number of UL TPC symbols in a sub-frame.

TPC_{DLpos} is the number of the regarded UL TPC symbol in the DL within the sub-frame.

N_{ULslot} is the number of UL slots and CCTrCH pairs in a frame.

In Annex G two examples of the association of TPC commands to time slots and CCTrCH pairs are shown.

Coding of TPC:

The relationship between the TPC Bits and the transmitter power control command for QPSK is the same as in the 3.84Mcps TDD cf. [5.2.2.5 'Transmission of TPC'].

The relationship between the TPC Bits and the transmitter power control command for 8PSK is given in table [12]

Table 12: TPC Bit Pattern for 8PSK

TPC Bits	TPC command	Meaning
000	'Down'	Decrease Tx Power
110	'Up'	Increase Tx Power

6.2.2.3 Transmission of SS

The burst type for dedicated channels provides the possibility for transmission of uplink synchronisation control (ULSC).

The transmission of ULSC is done in the data parts of the traffic burst. Hence the midamble structure and length is not changed. The ULSC information is to be transmitted directly after the midamble. Figure 26 shows the position of the SS command in a traffic burst.

For every user the ULSC information shall be transmitted at least once per transmitted sub-frame. By default the following rules apply:

1. If TFCI is applied for a CCTrCH, the SS command(s) shall be transmitted using the same channelisation code and the same timeslots as the TFCI.

2. If no TFCI is applied for a CCTrCH, the SS command(s) shall be transmitted using the first allocated channelisation code and the first allocated timeslot, according to the order in the higher layer allocation message.

Apart from the default rules other allocations of SS commands are possible according higher layer signalling – e.g. the transmission of more then one SS command (on more than one time slot).

The SS command is spread with the same spreading factor (SF) and spreading code as the data parts of the respective physical channel.

The SS is utilised to command a timing adjustment by (k/8) Tc each M sub-frames, where Tc is the chip period. The default k and M values are signalled by the network by means of system information that is broadcast in the cell. The SS, as one of L1 signals, is to be transmitted once per 5ms sub-frame.

M (1-8) and k (1-8) can be adjusted during call setup or readjusted during the call.

Note: The smallest step for the SS signalled by the UTRAN is 1/8 Tc. For the UE capabilities regarding the SS adjustment of the UE it is suggested to set the tolerance for the executed command to be [1/9;1/7] Tc.

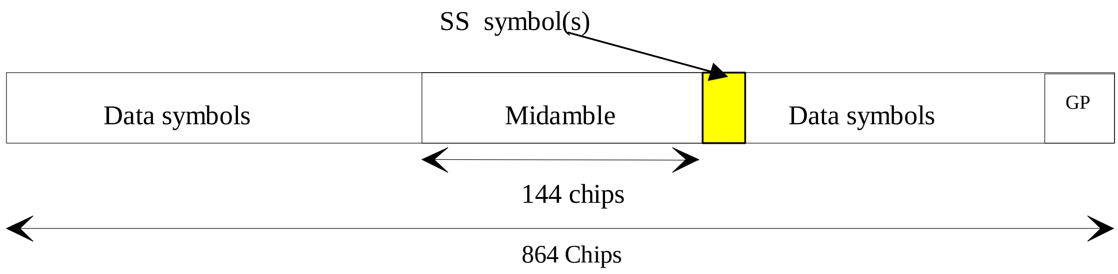


Figure 26: Position of ULSC information in the traffic burst (downlink and uplink)

*Note that for the uplink where there's no SS symbol used, the SS symbol space is reserved for future use. This can keep UL and DL slots the same structure.

For the number of layer 1 symbols there are 3 possibilities configurable for each channelisation code during the call setup:

- one SS symbol
- no SS symbol
- 16/SF SS symbols

So, in case 3, when SF=1, there are 16 SS symbols which correspond to 32 bits (for QPSK) and 48 bits (for 8PSK).

Each of the SS symbols in the DL will be associated with an UL time slot depending on the allocated UL time slots and the allocated SS symbols in the DL.

Note: Even though the different time slots of the UE are controlled with independent SS commands, the UE is not in need to execute SS commands leading to a deviation of more than [3] chip with respect to the average timing advance applied by the UE.

The synchronisation shift commands for each UL time slot (all channelisation codes on that time slot have the same SS command) will be distributed to the following rules:

1. The UL time slots the SS commands are intended for will be numbered form the first to the last UL time slot occupied by the regarded UE (starting with 0) considering all CCTrCHs allocated to that UE.

2. The commanding SS symbols on all downlink CCTrCHs allocated to one UE are numbered consecutively starting with zero according to the following rules:

a) The numbers of the SS commands of a regarded DL time slot are lower than those of DL time slots being transmitted after that time slot

b) Within a DL time slot the numbers of the SS commands of a regarded channelisation code are lower than those of channelisation codes having a bigger spreading code number

The spreading code number is defined by the following table: (see TS 25.223)

Spreading code number	SF (Q)	Walsh code number (k)
0	16	$\mathbf{c}_{Q=16}^{(k=1)}$
	...	
15	16	$\mathbf{c}_{Q=16}^{(k=16)}$
	Spreading factors 2-8 are nor used in DL	
30	1	$\mathbf{c}_{Q=1}^{(k=1)}$

c) Within a channelisation code numbers of the SS commands are lower than those of SS commands being transmitted after that time

The following equation is used to determine the UL time slot which is controlled by the regarded SS symbol:

$$UL_{pos} = (SFN' \cdot N_{SSsymbols} + SS_{pos}) \bmod (N_{ULslot}),$$

where

UL_{pos} is the number of the controlled uplink time slot.

SFN' is the system frame number counting the sub-frames. The system frame number of the radio frames (SFN) can be derived from SFN' by

SFN=SFN' div 2, where div is the reminder free division operation.

$N_{SSsymbols}$ is the number of SS symbols in a frame.

SS_{pos} is the number of the regarded SS symbol within the sub-frame.

N_{ULslot} is the number of UL slots in a frame.

The relationship between the SS Bits and the SS command for QPSK is the given in table 13:

Table 13: Coding of the SS for QPSK

SS Bits	SS command	Meaning
00	'Down'	Decrease synchronisation shift by k/8 Tc
11	'Up'	Increase synchronisation shift by k/8 Tc
01	'Do nothing'	No change

The relationship between the SS Bits and the SS command for 8PSK is given in table [14]:

Table 14: Coding of the SS for 8PSK

SS Bits	SS command	Meaning
000	'Down'	Decrease synchronisation shift by k/8 Tc
110	'Up'	Increase synchronisation shift by k/8 Tc
011	'Do nothing'	No change

6.2.2.4 Timeslot formats

The timeslot format depends on the spreading factor, the number of the TFCI bits, the number of SS and TPC symbols and the applied modulation scheme (QPSK/8PSK) as depicted in the following tables.

6.2.2.4.1 Timeslot formats for QPSK

6.2.2.4.1.1 Downlink timeslot formats

Table 15 : Time slot formats for the Downlink

Slot Format #	Spreading Factor	Midamble length (chips)	N_{TFCI} (bits)	N_{SS} & N_{TPC} (bits)	Bits/slot	$N_{Data/Slot}$ (bits)	$N_{data/data\ field(1)}$ (bits)	$N_{data/data\ field(2)}$ (bits)
0	16	144	0	0 & 0	88	88	44	44
1	16	144	4	0 & 0	88	86	42	44
2	16	144	8	0 & 0	88	84	42	42
3	16	144	16	0 & 0	88	80	40	40
4	16	144	32	0 & 0	88	72	36	36
5	16	144	0	2 & 2	88	84	44	40
6	16	144	4	2 & 2	88	82	42	40
7	16	144	8	2 & 2	88	80	42	38
8	16	144	16	2 & 2	88	76	40	36

Slot Format #	Spreading Factor	Midamble length (chips)	N_{TFCI} (bits)	N_{SS} & N_{TPC} (bits)	Bits/slot	$N_{Data/Slot}$ (bits)	$N_{data/data field(1)}$ (bits)	$N_{data/data field(2)}$ (bits)
9	16	144	32	2 & 2	88	68	36	32
10	1	144	0	0 & 0	1408	1408	704	704
11	1	144	4	0 & 0	1408	1406	702	704
12	1	144	8	0 & 0	1408	1404	702	702
13	1	144	16	0 & 0	1408	1400	700	700
14	1	144	32	0 & 0	1408	1392	696	696
15	1	144	0	2 & 2	1408	1404	704	700
16	1	144	4	2 & 2	1408	1402	702	700
17	1	144	8	2 & 2	1408	1400	702	698
18	1	144	16	2 & 2	1408	1396	700	696
19	1	144	32	2 & 2	1408	1388	696	692
20	1	144	0	32 & 32	1408	1344	704	640
21	1	144	4	32 & 32	1408	1342	702	640
22	1	144	8	32 & 32	1408	1340	702	638
23	1	144	16	32 & 32	1408	1336	700	636
24	1	144	32	32 & 32	1408	1328	696	632

6.2.2.4.1.2 Uplink timeslot formats

Table 16 : Time slot formats for the Uplink

Slot Format #	Spreading Factor	Midamble length (chips)	N_{TFCI} (bits)	N_{SS} & N_{TPC} (bits)	Bits/slot	$N_{Data/Slot}$ (bits)	$N_{data/data field(1)}$ (bits)	$N_{data/data field(2)}$ (bits)
0	16	144	0	0 & 0	88	88	44	44
1	16	144	4	0 & 0	88	86	42	44
2	16	144	8	0 & 0	88	84	42	42
3	16	144	16	0 & 0	88	80	40	40
4	16	144	32	0 & 0	88	72	36	36
5	16	144	0	2 & 2	88	84	44	40
6	16	144	4	2 & 2	88	82	42	40
7	16	144	8	2 & 2	88	80	42	38
8	16	144	16	2 & 2	88	76	40	36
9	16	144	32	2 & 2	88	68	36	32
10	8	144	0	0 & 0	176	176	88	88
11	8	144	4	0 & 0	176	174	86	88
12	8	144	8	0 & 0	176	172	86	86
13	8	144	16	0 & 0	176	168	84	84
14	8	144	32	0 & 0	176	160	80	80

Slot Format #	Spreading Factor	Midamble length (chips)	N_{TFCI} (bits)	N_{SS} & N_{TPC} (bits)	Bits/slot	$N_{Data/Slot}$ (bits)	$N_{data/data field(1)}$ (bits)	$N_{data/data field(2)}$ (bits)
15	8	144	0	2 & 2	176	172	88	84
16	8	144	4	2 & 2	176	170	86	84
17	8	144	8	2 & 2	176	168	86	82
18	8	144	16	2 & 2	176	164	84	80
19	8	144	32	2 & 2	176	156	80	76
20	8	144	0	4 & 4	176	168	88	80
21	8	144	4	4 & 4	176	166	86	80
22	8	144	8	4 & 4	176	164	86	78
23	8	144	16	4 & 4	176	160	84	76
24	8	144	32	4 & 4	176	152	80	72
25	4	144	0	0 & 0	352	352	176	176
26	4	144	4	0 & 0	352	350	174	176
27	4	144	8	0 & 0	352	348	174	174
28	4	144	16	0 & 0	352	344	172	172
29	4	144	32	0 & 0	352	336	168	168
30	4	144	0	2 & 2	352	348	176	172
31	4	144	4	2 & 2	352	346	174	172

Slot Format #	Spreading Factor	Midamble length (chips)	N_{TFCI} (bits)	N_{SS} & N_{TPC} (bits)	Bits/slot	$N_{Data/Slot}$ (bits)	$N_{data/data field(1)}$ (bits)	$N_{data/data field(2)}$ (bits)
32	4	144	8	2 & 2	352	344	174	170
33	4	144	16	2 & 2	352	340	172	168
34	4	144	32	2 & 2	352	332	168	164
35	4	144	0	8 & 8	352	336	176	160
36	4	144	4	8 & 8	352	334	174	160
37	4	144	8	8 & 8	352	332	174	158
38	4	144	16	8 & 8	352	328	172	156
39	4	144	32	8 & 8	352	320	168	152
40	2	144	0	0 & 0	704	704	352	352
41	2	144	4	0 & 0	704	702	350	352
42	2	144	8	0 & 0	704	700	350	350
43	2	144	16	0 & 0	704	696	348	348
44	2	144	32	0 & 0	704	688	344	344
45	2	144	0	2 & 2	704	700	352	348
46	2	144	4	2 & 2	704	698	350	348
47	2	144	8	2 & 2	704	696	350	346
48	2	144	16	2 & 2	704	692	348	344

Slot Format #	Spreading Factor	Midamble length (chips)	N_{TFCI} (bits)	N_{SS} & N_{TPC} (bits)	Bits/slot	$N_{Data/Slot}$ (bits)	$N_{data/data field(1)}$ (bits)	$N_{data/data field(2)}$ (bits)
49	2	144	32	2 & 2	704	684	344	340
50	2	144	0	16 & 16	704	672	352	320
51	2	144	4	16 & 16	704	670	350	320
52	2	144	8	16 & 16	704	668	350	318
53	2	144	16	16 & 16	704	664	348	316
54	2	144	32	16 & 16	704	656	344	312
55	1	144	0	0 & 0	1408	1408	704	704
56	1	144	4	0 & 0	1408	1406	702	704
57	1	144	8	0 & 0	1408	1404	702	702
58	1	144	16	0 & 0	1408	1400	700	700
59	1	144	32	0 & 0	1408	1392	696	696
60	1	144	0	2 & 2	1408	1404	704	700
61	1	144	4	2 & 2	1408	1402	702	700
62	1	144	8	2 & 2	1408	1400	702	698
63	1	144	16	2 & 2	1408	1396	700	696
64	1	144	32	2 & 2	1408	1388	696	692
65	1	144	0	32 & 32	1408	1344	704	640
66	1	144	4	32 & 32	1408	1342	702	640

Slot Format #	Spreading Factor	Midamble length (chips)	N_{TFCI} (bits)	N_{SS} & N_{TPC} (bits)	Bits/slot	$N_{Data/Slot}$ (bits)	$N_{data/data\ field(1)}$ (bits)	$N_{data/data\ field(2)}$ (bits)
67	1	144	8	32 & 32	1408	1340	702	638
68	1	144	16	32 & 32	1408	1336	700	636
69	1	144	32	32 & 32	1408	1328	696	632

6.2.2.4.2 Time slot formats for 8PSK

The Downlink and the Uplink timeslot formats are described together in the following table.

Table 17: Timeslot formats for 8PSK modulation

Slot Format #	Spreading Factor	Midamble length (chips)	N_{TFCI} (bits)	N_{SS} & N_{TPC} (bits)	Bits/slot	$N_{Data/Slot}$ (bits)	$N_{data/data\ field(1)}$ (bits)	$N_{data/data\ field(2)}$ (bits)
0	1	144	0	0 & 0	2112	2112	1056	1056
1	1	144	6	0 & 0	2112	2109	1053	1056
2	1	144	12	0 & 0	2112	2106	1053	1053
3	1	144	24	0 & 0	2112	2100	1050	1050
4	1	144	48	0 & 0	2112	2088	1044	1044
5	1	144	0	3 & 3	2112	2106	1056	1050
6	1	144	6	3 & 3	2112	2103	1053	1050
7	1	144	12	3 & 3	2112	2100	1053	1047

Slot Format #	Spreading Factor	Midamble length (chips)	N_{TFCI} (bits)	N_{SS} & N_{TPC} (bits)	Bits/slot	$N_{Data/Slot}$ (bits)	$N_{data/data field(1)}$ (bits)	$N_{data/data field(2)}$ (bits)
8	1	144	24	3 & 3	2112	2094	1050	1044
9	1	144	48	3 & 3	2112	2082	1044	1038
10	1	144	0	48 & 48	2112	2016	1056	960
11	1	144	6	48 & 48	2112	2013	1053	960
12	1	144	12	48 & 48	2112	2010	1053	957
13	1	144	24	48 & 48	2112	2004	1050	954
14	1	144	48	48 & 48	2112	1992	1044	948
15	16	144	0	0 & 0	132	132	66	66
16	16	144	6	0 & 0	132	129	63	66
17	16	144	12	0 & 0	132	126	63	63
18	16	144	24	0 & 0	132	120	60	60
19	16	144	48	0 & 0	132	108	54	54
20	16	144	0	3 & 3	132	126	66	60
21	16	144	6	3 & 3	132	123	63	60
22	16	144	12	3 & 3	132	120	63	57
23	16	144	24	3 & 3	132	114	60	54
24	16	144	48	3 & 3	132	102	54	48

6.2.3 Training sequences for spread bursts

In this subclause, the training sequences for usage as midambles are defined. The training sequences, i.e. midambles, of different users active in the same cell and same time slot are cyclically shifted versions of one single basic midamble code. The applicable basic midamble codes are given in Annex B.1.

The basic midamble codes in Annex B.1 are listed in hexadecimal notation. The binary form of the basic midamble code shall be derived according to table [18] below.

Table [18]: Mapping of 4 binary elements m_i on a single hexadecimal digit:

4 binary elements m_i	Mapped on hexadecimal digit
-1 -1 -1 -1	0
-1 -1 -1 1	1
-1 -1 1 –1	2
-1 -1 1 1	3
-1 1 -1 –1	4
-1 1 -1 1	5
-1 1 1 –1	6
-1 1 1 1	7
1 -1 -1 –1	8
1 -1 -1 1	9
1 -1 1 –1	A
1 -1 1 1	B
1 1 -1 –1	C
1 1 -1 1	D
1 1 1 –1	E
1 1 1 1	F

For each particular basic midamble code, its binary representation can be written as a vector $\mathbf{m}_P$:

$$\mathbf{m}_P = (m_1, m_2, ..., m_P) \qquad (1)$$

According to Annex B.1, the size of this vector $\mathbf{m}_P$ is P=128. As QPSK modulation is used, the training sequences are transformed into a complex form, denoted as the complex vector $\underline{\mathbf{m}}_P$:

$$\underline{\mathbf{m}}_P = (\underline{m}_1, \underline{m}_2, ..., \underline{m}_P) \qquad (2)$$

The elements $\underline{m}_i$ of $\underline{\mathbf{m}}_P$ are derived from elements m_i of $\mathbf{m}_P$ using equation (3):

$$\underline{m}_i = (\mathrm{j})^i \cdot m_i \text{ for all } i = 1, ..., P \qquad (3)$$

Hence, the elements $\underline{m}_i$ of the complex basic midamble code are alternating real and imaginary.

To derive the required training sequences, this vector $\underline{\mathbf{m}}_P$ is periodically extended to the size:

$$i_{max} = L_m + (K-1)W \qquad (4)$$

Notes on equation (4):

K and W are taken from Annex B.1

So we obtain a new vector $\mathbf{m}$ containing the periodic basic midamble sequence:

$$\mathbf{m} = \left(m_1, m_2, \ldots, m_{i_{max}}\right) = \left(m_1, m_2, \ldots, m_{L_m + (K-1)W}\right) \quad (5)$$

The first P elements of this vector $\mathbf{m}$ are the same ones as in vector $\mathbf{m}_P$, the following elements repeat the beginning:

$$m_i = m_{i-P} \text{ for the subset } i = (P+1), \ldots, i_{max} \quad (6)$$

Using this periodic basic midamble sequence $\mathbf{m}$ for each user k a midamble $\mathbf{m}^{(k)}$ of length L_m is derived, which can be written as a user specific vector:

$$\mathbf{m}^{(k)} = \left(m_1^{(k)}, m_2^{(k)}, \ldots, m_{L_m}^{(k)}\right) \quad (7)$$

The L_m midamble elements $m_i^{(k)}$ are generated for each midamble of the k users (k = 1,...,K) based on:

$$m_i^{(k)} = m_{i+(K-k)W} \text{ with } i = 1, \ldots, L_m \text{ and } k = 1, \ldots, K \quad (8)$$

The midamble sequences derived according to equations (7) to (8) have complex values and are not subject to channelisation or scrambling process, i.e. the elements $m_i^{(k)}$ represent complex chips for usage in the pulse shaping process at modulation.

The term 'a midamble code set' or 'a midamble code family' denotes K specific midamble codes $\mathbf{m}^{(k)}$; k=1,...,K, based on a single basic midamble code $\mathbf{m}_P$ according to (1).

6.2.4 Beamforming

Beamforming is same as that of the 3.84Mcps TDD, cf. [5.2.4 Beamforming].

6.3 Common physical channels

6.3.1 Primary common control physical channel (P-CCPCH)

The BCH as described in section 4.1.2 'Common Transport Channels' is mapped onto the Primary Common Control Physical Channels (P-CCPCH1 and P-CCPCH2). The position (time slot / code) of the P-CCPCHs is fixed in the 1.28Mcps TDD. The P-CCPCHs are mapped onto the first two code channels of timeslot#0 with spreading factor of 16. The P-CCPCH is always transmitted with an antenna pattern configuration that provides whole cell coverage.

6.3.1.1 P-CCPCH Spreading

The P-CCPCH uses fixed spreading with a spreading factor SF = 16. The P-CCPCH1 and P-CCPCH2 always use channelisation code $c_{Q=16}^{(k=1)}$ and $c_{Q=16}^{(k=2)}$ respectively.

6.3.1.2 P-CCPCH Burst Format

The burst format as described in section 6.2.2 is used for the P-CCPCH. No TFCI is applied for the P-CCPCH.

6.3.1.3 P-CCPCH Training sequences

The training sequences, i.e. midambles, as described in subclause 6.2.3 are used for the P-CCPCH. For timeslots#0 in which the P-CCPCH is transmitted, the midambles $m^{(1)}$ and $m^{(2)}$ are reserved for P-CCPCH in order to support Block STTD antenna diversity and the beacon function, see 6.4 and 6.5. The use of midambles depends on whether Block STTD is applied to the P-CCPCH:

- If no antenna diversity is applied to P-CCPCH, $m^{(1)}$ is used and $m^{(2)}$ is left unused.
- If Block STTD antenna diversity is applied to P-CCPCH, $m^{(1)}$ is used for the first antenna and $m^{(2)}$ is used for the diversity antenna.

6.3.2 Secondary common control physical channel (S-CCPCH)

PCH and FACH as described in subclause 4.1.2 are mapped onto one or more secondary common control physical channels (S-CCPCH). In this way the capacity of PCH and FACH can be adapted to the different requirements. The time slot and codes used for the S-CCPCH are broadcast on the BCH.

6.3.2.1 S-CCPCH Spreading

The S-CCPCH uses fixed spreading with a spreading factor SF = 16. The S-CCPCHs (S-CCPCH 1 and S-CCPCH 2) are always used in pairs, mapped onto two code channels with spreading factor 16. There can be more than one pair of S-CCPCHs in use in one cell.

6.3.2.2 S-CCPCH Burst Format

The burst format as described in section 6.2.2 is used for the S-CCPCH. TFCI may be applied for S-CCPCHs.

6.3.2.3 S-CCPCH Training sequences

The training sequences, i.e. midambles, as described in the subclause 6.2.3 are also used for the S-CCPCH.

6.3.3 Fast Physical Access CHannel (FPACH)

The Fast Physical Access CHannel (FPACH) is used by the Node B to carry, in a single burst, the acknowledgement of a detected signature with timing and power level adjustment indication to a user equipment. FPACH makes use of one resource unit only at spreading factor 16, so that its burst is composed by 44 symbols. The spreading code, training sequence and time slot position are configured by the network and signalled on the BCH.

6.3.3.1 FPACH burst

The FPACH burst contains 32 information bits. Table 19 reports the content description of the FPACH information bits and their priority order:

Table 19: FPACH information bits description

Information field	Length (in bits)
Signature Reference Number	3 (MSB)
Relative Sub-Frame Number	2
Received starting position of the UpPCH ($UpPCH_{POS}$)	11
Transmit Power Level Command for RACH message	7

Reserved bits (default value: 0)	9 (LSB)

In the use and generation of the information fields is explained in [9].

6.3.3.1.1 Signature Reference Number

The reported number corresponds to the numbering principle for the cell signatures as described in [8].

The Signature Reference Number value range is 0 – 7 coded in 3 bits such that:

bit sequence(0 0 0) corresponds to the first signature of the cell; …; bit sequence (1 1 1) corresponds to the 8th signature of the cell.

6.3.3.1.2 Relative Sub-Frame Number

The Relative Sub-Frame Number value range is 0 – 3 coded such that:

bit sequence (0 0) indicates one sub-frame difference; …; bit sequence (1 1) indicates 4 sub-frame difference.

6.3.3.1.3 Received starting position of the UpPCH (UpPCH$_{POS}$)

The received starting position of the UpPCH value range is 0 – 2047 coded such that:

bit sequence (0 0 … 0 0 0) indicates the received starting position zero chip; …; bit sequence (1 1 … 1 1 1) indicates the received starting position 2047*1/8 chip.

6.3.3.1.4 Transmit Power Level Command for the RACH message

The transmit power level command is transmitted in 7 bits.

6.3.3.2 FPACH Spreading

The FPACH uses only spreading factor SF=16 as described in subclause 6.3.3. The set of admissible spreading codes for use on the FPACH is broadcast on the BCH.

6.3.3.2 FPACH Burst Format

The burst format as described in section 6.2.2 is used for the FPACH.

6.3.3.3 FPACH Training sequences

The training sequences, i.e. midambles, as described in subclause 6.2.3 are used for FPACH.

6.3.3.4 FPACH timeslot formats

The FPACH uses slot format #0 of the DL time slot formats given in subclause 6.2.2.4.1.1.

6.3.4 The physical random access channel (PRACH)

The RACH as described in subclause 4.1.2 is mapped onto one or more uplink physical random access channels (PRACH). In such a way the capacity of RACH can be flexibly scaled depending on the operators need.

6.3.4.1 PRACH Spreading

The uplink PRACH uses either spreading factor SF=16, SF=8 or SF=4 as described in subclause 6.2.1. The set of admissible spreading codes for use on the PRACH and the associated spreading factors are broadcast on the BCH (within the RACH configuration parameters on the BCH).

6.3.4.2 PRACH Burst Format

The burst format as described in section 6.2.2 is used for the PRACH.

6.3.4.3 PRACH Training sequences

The training sequences, i.e. midambles, of different users active in the same time slot are time shifted versions of a single periodic basic code. The basic midamble codes as described in subclause 6.2.3 are used for PRACH.

6.3.4.4 PRACH timeslot formats

The PRACH uses the following time slot formats taken from the uplink timeslot formats described in sub-clause 6.2.2.4.1.2:

Spreading Factor	Slot Format #
16	0
8	10
4	25

6.3.4.5 Association between Training Sequences and Channelisation Codes

The association between training sequences and channelisation codes of PRACH in the 1.28McpsTDD is same as that of the DPCH.

6.3.5 The synchronisation channels (DwPCH, UpPCH)

There are two dedicated physical synchronisation channels —DwPCH and UpPCH in each 5ms sub-frame of the 1.28Mcps TDD. The DwPCH is used for the down link synchronisation and the UpPCH is used for the uplink synchronisation.

The position and the contents of the DwPCH are equal to the DwPTS as described in the subclause 6.1., while the position and the contents of the UpPCH are equal to the UpPTS.

The DwPCH is transmitted at each sub-frame with an antenna pattern configuration which provides whole cell coverage. Furthermore it is transmitted with a constant power level which is signalled by higher layers.

The burst structure of the DwPCH (DwPTS) is described in the figure 27.

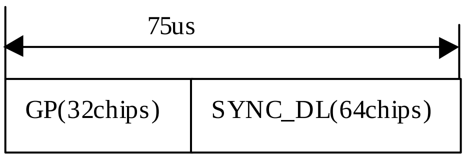


Figure 27: burst structure of the DwPCH (DwPTS)

Note:' GP' for 'Guard Period'

The burst structure of the UpPCH (UpPTS) is described in the figure 28.

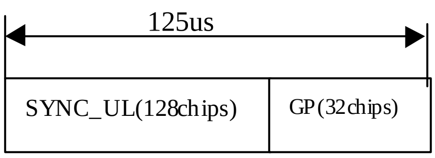


Figure 28: burst structure of the UpPCH (UpPTS)

The SYNC-DL code in DwPCH and the SYNC-UL code in UpPCH are not spreaded. The details about the SYNC-DL and SYNC-UL code are described in the corresponding subclause and annex in [8].

6.3.6 Physical Uplink Shared Channel (PUSCH)

For Physical Uplink Shared Channel (PUSCH) the burst structure of DPCH as described in subclause 6.2 shall be used. User specific physical layer parameters like power control, timing advance or directive antenna settings are derived from the associated channel (FACH or DCH). PUSCH provides the possibility for transmission of TFCI in uplink.

6.3.7 Physical Downlink Shared Channel (PDSCH)

For Physical Downlink Shared Channel (PDSCH) the burst structure of DPCH as described in subclause 6.2 shall be used. User specific physical layer parameters like power control or directive antenna settings are derived from the associated channel (FACH or DCH). PDSCH provides the possibility for transmission of TFCI in downlink.

To indicate to the UE that there is data to decode on the DSCH, three signalling methods are available:

1) using the TFCI field of the associated channel or PDSCH;

2) using on the DSCH user specific midamble derived from the set of midambles used for that cell;

3) using higher layer signalling.

When the midamble based method is used, the UE shall decode the PDSCH if the PDSCH was transmitted with the midamble assigned to the UE by UTRAN, see 6.6.1.1.2 . For this method no other physical channels may use the same time slot as the PDSCH and only one UE may share the PDSCH time slot at the same time.

6.3.8 The Page Indicator Channel (PICH)

The Paging Indicator Channel (PICH) is a physical channel used to carry the paging indicators.

6.3.8.1 Mapping of Paging Indicators to the PICH bits

Figure 28 depicts the structure of a PICH transmission and the numbering of the bits within the bursts. The burst type as described in [6.2.2 'Burst Format'] is used for the PICH. N_{PIB} bits are used to carry the paging indicators, where N_{PIB}=352.

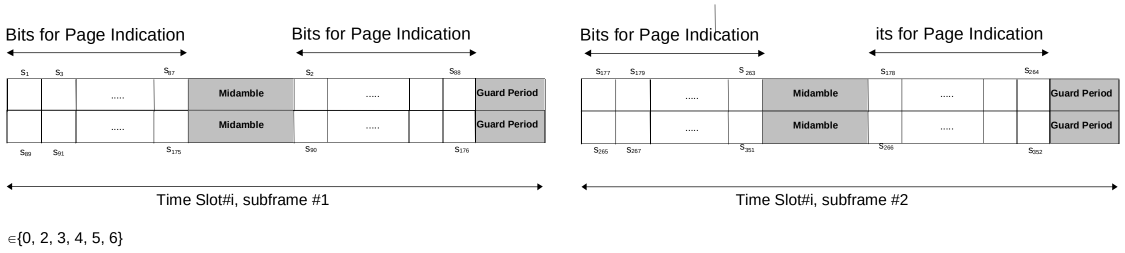


Figure 28: Transmission and numbering of paging indicator carrying bits in the PICH bursts

Each paging indicator P_q (where P_q, $q = 0, ..., N_{PI}-1$, $P_q \in \{0, 1\}$) in one radio frame is mapped to the bits $\{s_{2L_{PI}*q+1},...,s_{2L_{PI}*(q+1)}\}$ in subframe #1 or subframe #2. There are $N_{PIB} = 2*N_{PI}*L_{PI}$ bits used for the paging indicator transmission in one radio frame. The mapping of the paging indicators to the bits s_i, $i = 1, ..., N_{PIB}$ is shown in table 20.

Table 20: Mapping of the paging indicator

P_q	Bits $\{s_{2L_{PI}*q+1}, s_{2L_{PI}*q+2}, ..., s_{2L_{PI}*(q+1)}\}$	Meaning
0	{0, 0, ..., 0}	There is no necessity to receive the PCH
1	{1, 1, ..., 1}	There is the necessity to receive the PCH

The bits s_k, $k = 1, ..., S$ are then transmitted over the air as shown in [7].

In each radio frame, N_{PI} paging indicators are transmitted, using L_{PI}=2, L_{PI}=4 or L_{PI}=8 symbols. In table 21 this number is shown for the different possibilities of paging indicator lengths.

Table 21: Number N_{PI} of paging indicators per radio frame for different paging indicator lengths L_{PI}

	L_{PI}=2	L_{PI}=4	L_{PI}=8
N_{PI} per radio frame	88	44	22

6.3.8.2 Structure of the PICH over multiple radio frames

The structure of the PICH over multiple radio frames is common with 3.84 Mcps TDD, cf. [5.3.7.2 Structure of the PICH over multiple radio frames]

6.4 Transmit Diversity for DL Physical Channels

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

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

Physical channel type	Open loop TxDiversity		Closed loop TxDiversity
	TSTD	Block STTD	
P-CCPCH	X	X	–
DwPCH	X	–	–
DPCH	X	–	X

6.5 Beacon characteristics of physical channels

For the purpose of measurements, physical channels at particular locations (time slot, code) shall have particular physical characteristics, called beacon characteristics. Physical channels with beacon characteristics are called beacon channels. The location of the beacon channels is called beacon location. The beacon channels shall provide the beacon function, i.e. a reference power level at the beacon location, regularly existing in each subframe. Thus, beacon channels must be present in each subframe.

6.5.1 Location of beacon channels

The beacon location is described as follows :

The beacon function shall be provided by the physical channels that are allocated to channelisation code $c_{Q=16}^{(k=1)}$ and $c_{Q=16}^{(k=2)}$ in Timeslot#0.

Note that by this definition the P-CCPCH always has beacon characteristics.

6.5.2 Physical characteristics of the beacon function

The beacon channels shall have the following physical characteristics.

They:

- are transmitted with reference power;
- are transmitted without beamforming;
- use midamble $m^{(1)}$ and $m^{(2)}$ exclusively in this time slot

The reference power corresponds to the sum of the power allocated to both midambles $m^{(1)}$ and $m^{(2)}$. Two possibilities exist:

- If no Block STTD antenna diversity is applied to P-CCPCH, all the reference power of any beacon channel is allocated to $m^{(1)}$.
- If Block STTD antenna diversity is applied to P-CCPCH, for any beacon channel midambles $m^{(1)}$ and $m^{(2)}$ are each allocated half of the reference power. Midamble $m^{(1)}$ is used for the first antenna and $m^{(2)}$ is used for the diversity antenna. Block STTD encoding is used for the data in P-CCPCH, see [9]; for all other beacon channels identical data sequences are transmitted on both antennas.

6.6 Midamble Allocation for Physical Channels

The midamble allocation schemes for physical channels are the same as in the 3.84Mcps TDD option. The associations between channelisation codes and midambles for the default and common midamble allocation differ from the 3.84 Mcps TDD option. The associations are given in Annex B.2 [Association between Midambles and channelisation Codes] and D [Signalling of the number of channelisation codes for the DL common midamble case for 1.28Mcps TDD] respectively

6.6.1 Midamble Allocation for DL Physical Channels

Beacon channels shall always use the reserved midambles $m^{(1)}$ and $m^{(2)}$, see 6.5. For the other DL physical channels that are located in timeslot #0, midambles shall be allocated based on the default midamble allocation scheme, using the association for K=8 midambles. For all other DL physical channels, the midamble is explicitly assigned by higher layers or allocated by layer 1.

6.6.1.1 Midamble Allocation by signalling from higher layers

The midamble allocation by signalling is the same like in the 3.84 Mcps TDD cf. [5.6.1.1 Midamble allocation by signalling from higher layers]

6.6.1.2 Midamble Allocation by layer 1

6.6.1.2.1 Default midamble

The default midamble allocation by layer 1 is the same like in the 3.84 Mcps TDD cf. [5.6.1.2.1 Default midamble]. The associations between midambles and channelisation codes are given in Annex B.2 [Association between Midambles and channelisation Codes].

6.6.1.2.2 Common Midamble

The common midamble allocation by layer 1 is the same like in the 3.84 Mcps TDD cf. [5.6.1.2.2 Common midamble]. The respective associations are given in Annex D [Signalling of the number of channelisation codes for the DL common midamble case for 1.28 Mcps TDD].

6.6.2 Midamble Allocation for UL Physical Channels

The midamble allocation for UL Physical Channels is the same as in the 3.84 Mcps TDD cf. [5.6.2 Midamble allocation for UL Physical Channels]

6.7 Midamble Transmit Power

The setting of the midamble transmit power is done as in the 3.84 Mcps TDD option cf. 5.7 ‘Midamble Transmit Power’

~~6~~7 Mapping of transport channels to physical channels for the 3.84 Mcps option

8 Mapping of transport channels to physical channels for the 1.28 Mcps option

This clause describes the way in which the transport channels are mapped onto physical resources, see figure 29.

Transport channels	**Physical channels**
DCH	Dedicated Physical Channel (DPCH)
BCH	Primary Common Control Physical Channels (P-CCPCH)
PCH	Secondary Common Control Physical Channels(S-CCPCH)
FACH	Secondary Common Control Physical Channels(S-CCPCH)
	PICH
RACH	Physical Random Access Channel (PRACH)
USCH	Physical Uplink Shared Channel (PUSCH)
DSCH	Physical Downlink Shared Channel (PDSCH)
	Down link Pilot Channel (DwPCH)
	Up link Pilot Channel (UpPCH)
	FPACH

Figure 29: Transport channel to physical channel mapping for 1.28Mcps TDD

8.1 Dedicated Transport Channels

The mapping of transport blocks to physical bearers is in principle the same as in 3.84 Mcps TDD but due to the subframe structure the coded bits are mapped onto each of the subframes within the given TTI.

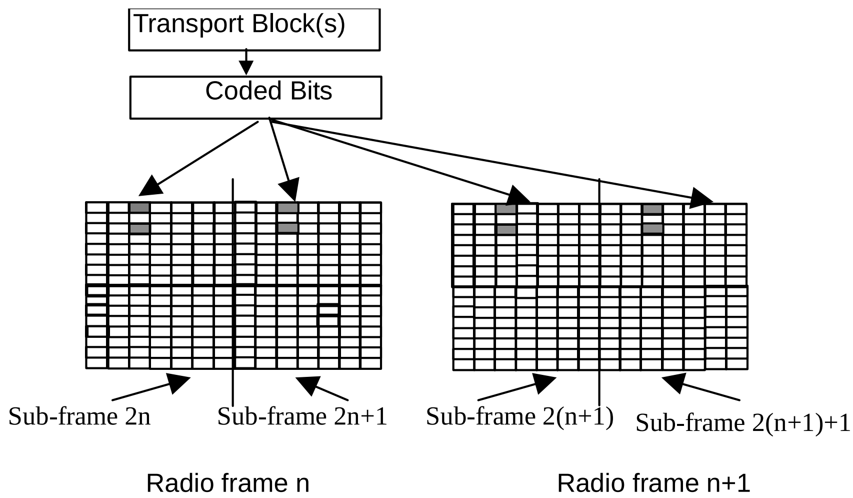


Figure 30 : Mapping of Transport Blocks onto the physical bearer (TTI= 20ms)

8.2 Common Transport Channels

8.2.1 The Broadcast Channel (BCH)

There are two P-CCPCHs, P-CCPCH 1 and P-CCPCH 2 which are mapped onto timeslot#0 using the channelisation codes $c_{Q=16}^{(k=1)}$ and $c_{Q=16}^{(k=2)}$ with spreading factor 16. The BCH is mapped onto the P-CCPCH1+P-CCPCH2.

The position of the P-CCPCHs is indicated by the relative phases of the bursts in the DwPTS with respect to the P-CCPCHs midamble sequences, see [8]. One special combination of the phase differences of the burst in the DwPTS with respect to the P-CCPCH midamble indicates the position of the P-CCPCH in the multi-frame and the start position of the interleaving period.

8.2.2 The Paging Channel (PCH)

The mapping of Paging Channels onto S-CCPCHs and the association between PCHs and Paging Indicator Channels is the same as in the 3.84 Mcps TDD option, cf. 6.2.2 'The paging Channel' and 6.2.2.1 'PCH/PICH Association' respectively.

8.2.3 The Forward Channel (FACH)

The FACH is mapped onto one or several S-CCPCHs. The location of the FACH is indicated on the BCH and both, capacity and location can be changed, if required. FACH may or may not be power controlled.

8.2.4 The Random Access Channel (RACH)

The RACH has intraslot interleaving only and is mapped onto PRACH. More than one slot per frame may be administered for the PRACH. The location of slots allocated to PRACH is broadcast on the BCH. The uplink sync codes (SYNC-UL sequences) used by the UEs for UL synchronisation have a well known association with the P-RACHs, as broadcast on the BCH. On the PRACH, both power control and uplink synchronisation control are used.

8.2.5 The Uplink Shared Channel (USCH)

The uplink shared channel is mapped onto one or several PUSCH, see subclause 6.3.6 'Physical Uplink Shared Channel (PUSCH)'

8.2.6 The Downlink Shared Channel (DSCH)

The downlink shared channel is mapped onto one or several PDSCH, see subclause 6.3.7 'Physical Downlink Shared Channel (PDSCH)'

Annex A (normative): Basic Midamble Codes for the 3.84 Mcps option

Annex B (normative): Basic Midamble Codes for the 1.28 Mcps option

B.1 Basic Midamble Codes

The midamble has a length of L_m=144, which is corresponding to:

K=2, 4, 6, 8, 10, 12, 14, 16, $W = \left\lfloor \frac{P}{K} \right\rfloor$, P=128

Note: that $\lfloor x \rfloor$ denotes the largest integer number less or equal to *x*.

Depending on the possible delay spread cells are configured to use midambles which are generated from the Basic Midamble Codes (see table B.1). The cell configuration is broadcast on BCH.

The mapping of these Basic Midamble Codes to Cell Parameters is shown in [8].

Table B.1: Basic Midamble Codes m_p according to equation (5) from subclause 6.2.3

Code ID	Basic Midamble Codes m_P of length P=128
m_{P0}	B2AC420F7C8DEBFA69505981BCD028C3
m_{P1}	0C2E988E0DBA046643F57B0EA6A435E2
m_{P2}	D5CEC680C36A4454135F86DD37043962
m_{P3}	E150D08CAC2A00FF9B32592A631CF85B
m_{P4}	E0A9C3A8F6E40329B2F2943246003D44
m_{P5}	FE22658100A3A683EA759018739BD690
m_{P6}	B46062F89BB2A1139D76A1EF32450DA0
m_{P7}	EE63D75CC099092579400D956A90C3E0
m_{P8}	D9C0E040756D427A2611DAA35E6CD614
m_{P9}	EB56D03A498EC4FEC98AE220BC390450
m_{P10}	F598703DB0838112ED0BABB98642B665
m_{P11}	A0BC26A992D4558B9918986C14861EFF
m_{P12}	541350D109F1DD68099796637B824F88
m_{P13}	892D344A962314662F01F9455F7BC302
m_{P14}	49F270E29CCD742A40480DD4215E1632
m_{P15}	6A5C0410C6C39AA04E77423C355926DE
m_{P16}	797661553820310 3D4DBCC219B16A9E1
m_{P17}	A6C3C3175845400BD2B738C43EE2645F
m_{P18}	A0FD56258D228642C6F641851C3751ED
m_{P19}	EFA48C3FC84AC625783C6C9510A2269A
m_{P20}	62A8EB1A420334B23396E8D76BC19740
m_{P21}	9E96235699D5D41C9816C921023BC741
m_{P22}	4362AE4CAE0DCC32D60A3FED1341A848
m_{P23}	454C068E6C4F190942E0904B95D61DFB
m_{P24}	607FEEA6E2E99206718A49C0D6A25034
m_{P25}	E1D1BCDA39A09095B5C81645103A077C
m_{P26}	994B445E558344DE211C8286DDD3D1A3
m_{P27}	C15233273581417638906ADB61FDCA3C
m_{P28}	8B79A274D542F096FB1388098230F8A1
m_{P29}	DF58AC1C5F44B2A40266385CE1DA5640
m_{P30}	B5949A1CC69962C464401D05FF5C1A7A
m_{P31}	85AC489841ED3EAA2D83BBB0039CC707

m_{P32}	AE371CC144BC95923CA8108D8B49FE82
m	7F188484A649D1C22BDA1F09D49B5117
m_{P34}	ADAA3C657089DEF7C0284903A491C9B0
m_{P35}	C3F96893C7504DC3B51488604AF64F4C
m_{P36}	B4002F5AE0CE8623AC979D368E9148C1
m_{P37}	0EEBCC0C795C02A106C24ABB36D08C6E
m_{P38}	4B0F537E384A893F58971580D9894433
m_{P39}	08E0035AB29B7ECC53C15DAA0687CC8F
m_{P40}	8611ACBC4C82781D77654EE862506D60
m_{P41}	63315261A8F1CB02549802DBFD197C07
m_{P42}	9A2609A434F43E7DCADC0E22B2EF4012
m_{P43}	F4C9F0A127A88461209ABF8C69CE4D00
m_{P44}	C79124EE3FFC28C5C4524D2B01670D42
m_{P45}	C91985C4FED53D09361914354BA80E79
m_{P46}	82AA517260779ECFF26212C1A10BDC29
m_{P47}	561DE2040ACB458E0DBD354E43E111D9
m_{P48}	2E58C7202D17392BC1235782CEFABB09
m_{P49}	C4FAA121C698047650F6503126A577C1
m_{P50}	E7B75206A9B410E44346E0DAE842A23C
m_{P51}	3F8B1C32682B28D098D3805ED130EA7F
m_{P52}	8D5FC2C1C6715F824B401434C8D4BB82
m_{P53}	0B2A43453ACC028FE6EB6E1CB0740B59
m_{P54}	BC56948FC700BA4883262EE73E12D82A
m_{P55}	558D136710272912FA4F183D1189A7FD
m_{P56}	5709E7F82DC6500B7B12A3072D182645
m_{P57}	86D4F161C844AE5E20EE39FD5493B044
m_{P58}	8729B6EDC382B152185885F013DAE222
m_{P59}	154C45B50720F4C362C14C77FE8335A1
m_{P60}	C6A0962890351F4EB802DE43A7662C9E
m_{P61}	D19D69D6B380B4B22457CB80033519F0
m_{P62}	C7D89509FB0DAE9255998E0A00C2B262
m_{P63}	DFD481C652C0C905D61D66F1732C4AA2
m_{P64}	06C848619AF1D6C910A8EAC4B622FC06
m_{P65}	0635E29D4E7AC8ABC189890241F45ECA
m_{P66}	B272B020586AAD7B093AC2F459076638
m_{P67}	B608ACE46E1A6BC96181EEDD88B54140
m_{P68}	0A516092B3ED7849B168AFE223B8670E
m_{P69}	D1A658C5009E04D0D7D5E9205EE663E8
m_{P70}	AC316DC39B91EB60B1AABD8280740432
m_{P71}	E3F06825476A026CD287625E514519FC
m_{P72}	A56D092080DDE8994F387C175CC56833
m_{P73}	15EA799DE587C506D0CD99A408217B05
m_{P74}	A59C020BAB9AF6D3F813C391CA244CD2
m_{P75}	74B0101EB9F3167434B94BABC8378882
m_{P76}	CE752975C8DA9B0100386DB82A8C3D20
m_{P77}	BBB38DCDB1E9118570AC147DC05241A4
m_{P78}	944ABBF0866098101F6971731AB2E986
m_{P79}	2BB147B2A30C68B4853F90481A166EB6
m_{P80}	444840ACCF3F23C45B56D7704BF18283
m_{P81}	87604F7450D1AD188C452981A5C7FC9B
m_{P82}	8C3842EBC948A65BC4C8B387F11B7090
m_{P83}	10B4767D071CF5DB2288E4029576135A
m_{P84}	6F07AAB697CD0089572C6B062E2018E4
m_{P85}	D3D65B442057E613A8655060C8D29E27
m_{P86}	5EDA330514C604BF4E0894E09EC57A74
m_{P87}	B0899CD094060724DED82AE85F18A43A
m_{P88}	B2D999B86DF902BC25015CAE3A0823C4
m_{P89}	C23CD40F04242B92D46EED82CD9A9A18

m_{P90}	D22DDCC5CB82960125DD24655F3C8788
m	54987218FBD99AE4340FD4C9458E9850
m_{P92}	BE4341822997A7B11EA1E8A1A2767005
m_{P93}	255200FBA6EE48E6DE0A82B0461B8D0F
m_{P94}	6FBD58A663932423503690CF9C171701
m_{P95}	D215033A4AA87EC1C232BAC7EDA09370
m_{P96}	CA0959B01AE48E80204F1E4A3F29CE55
m_{P97}	582043413B9B825903E3A3545ED59463
m_{P98}	501654192297 1C703D16E284CBDF633B
m_{P99}	7347EF160A1733CA98D43608A83A920B
m_{P100}	908B22AD433CCA00B3FD47C691F1A290
m_{P101}	BB22A272FC6923DF1B43BA4118806570
m_{P102}	0FA75C87474836B47DC7624D61193802
m_{P103}	A22EBA0658A4D0FF1E9CA5030A65CC06
m_{P104}	6C9C51CA15F1F4981F4C46180A6A6697
m_{P105}	4C847ACF8BC15359C405322851C9BDE2
m_{P106}	C1D29499C0082C9DE473ED15B14D63E0
m_{P107}	7E85ECC98AC761005076C5572869A431
m_{P108}	D8F11121595B8F49F78A7039E44126A0
m_{P109}	1A0BC814445FD71C8E5B1A9163ED2059
m_{P110}	A7591F27F8B0C00C68CC41697954FA04
m_{P111}	6CA2CE595E7406D79C4840183D41B9D0
m_{P112}	C093D3CC701FC20E66F5AB22516C5460
m_{P113}	D0E0CDE9B595546B96C4F8066B469020
m_{P114}	E99F743A451431C8B427054A4E6F2007
m_{P115}	C0D21A344A2C07DF2A6EBE6250C7B91E
m_{P116}	F031223E282CF7A4D8EF174A908668AE
m_{P117}	E4BD244AC16C55C7137FB068FD44280C
m_{P118}	C44920DE2028F19FC2AAB36A0DCFDAD0
m_{P119}	3FA7054E77135250699E6C8A11600742
m_{P120}	D5740B4D8870C1C5B5A214C4266FC537
$m_{P12}1$	F0B7942D43BB6F38446442EB8126AB80
m_{P122}	83DB9534EAD6238FA8968798CDF04848
m_{P123}	EB9663CDDC2B29169070 3125BABCB800
m_{P124}	84D547225D4BBD20DEF1A583240C6E0F
m_{P125}	B51F6A771838BE934724AEA6A2669802
m_{P126}	D92AC05E10496794BBDC115233B1C068
m_{P127}	D3ACF0078EDA9856BBB0AF8651132103

B.2 Association between Midambles and Channelisation Codes

The following mapping schemes apply for the association between midambles and channelisation codes if no midamble is allocated by higher layers. Secondary channelisation codes are marked with (*). These associations apply for both UL and DL.

B.2.1 Association for K=16 Midambles

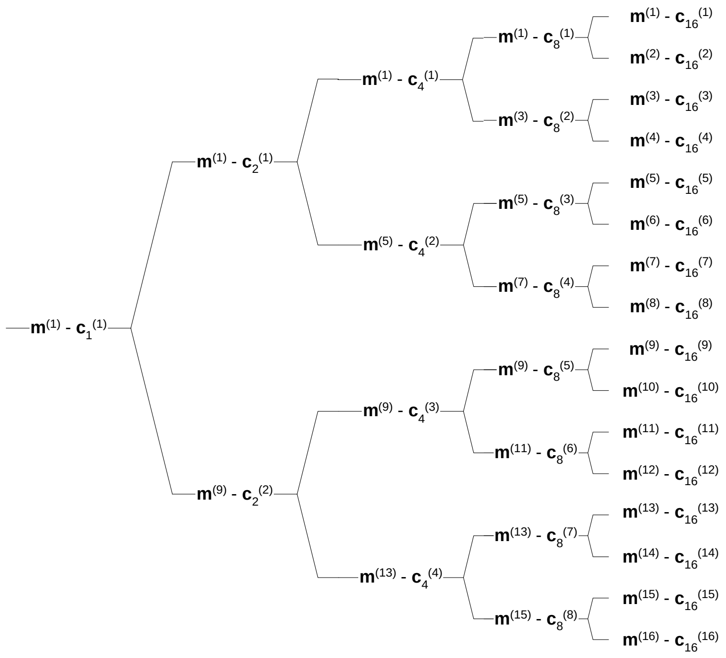


Figure B.2.1: Association of Midambles to Spreading Codes for K=16

B.2.2 Association for K=14 Midambles

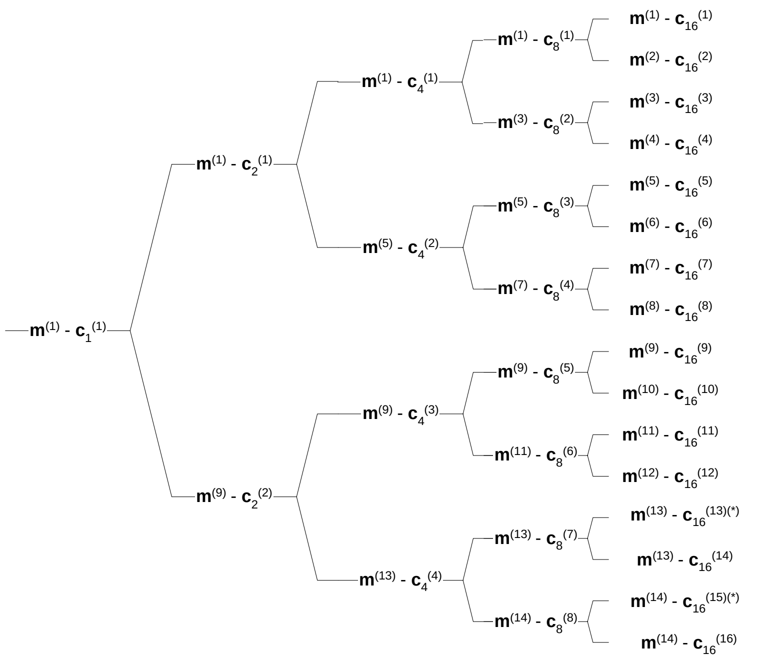


Figure B.2.2: Association of Midambles to Spreading Codes for K=14

B.2.3 Association for K=12 Midambles

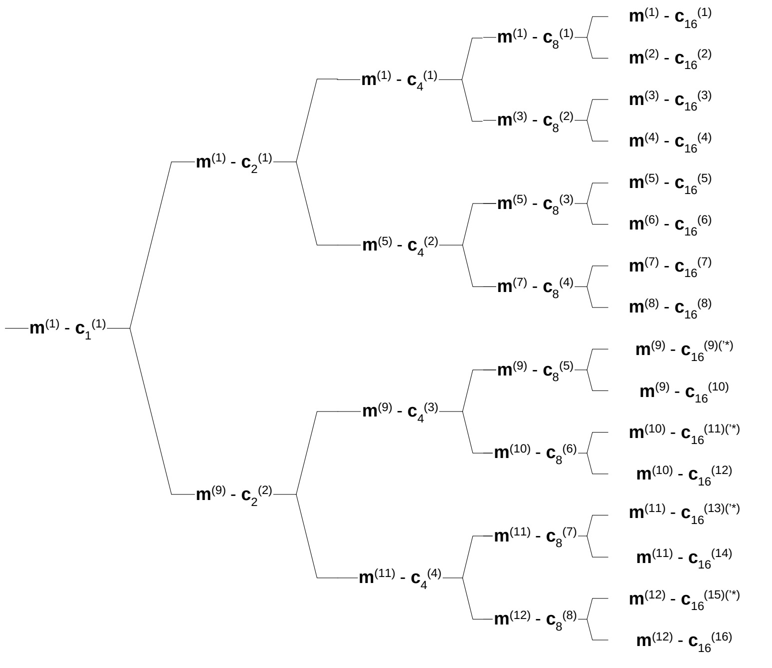


Figure B.2.3: Association of Midambles to Spreading Codes for K=12

B.2.4 Association for K=10 Midambles

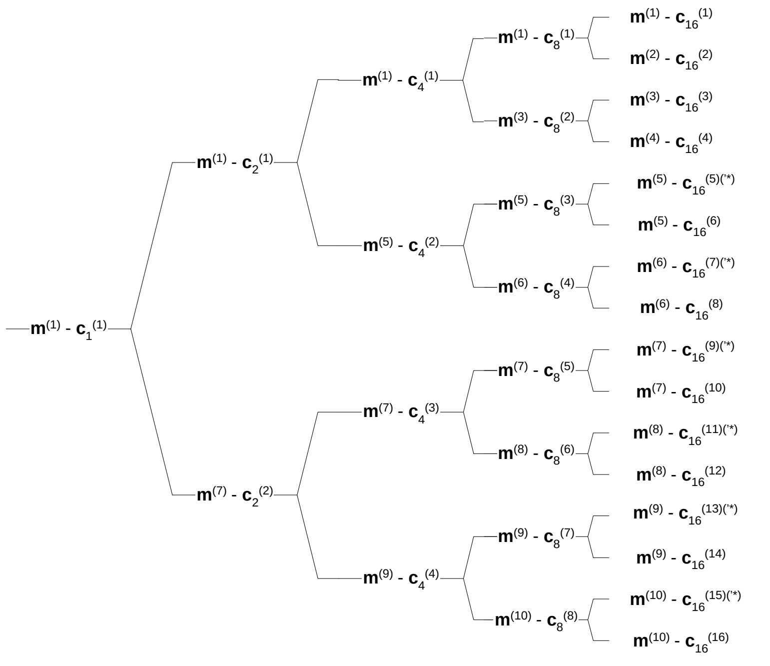


Figure B.2.4: Association of Midambles to Spreading Codes for K=10

B.2.5 Association for K=8 Midambles

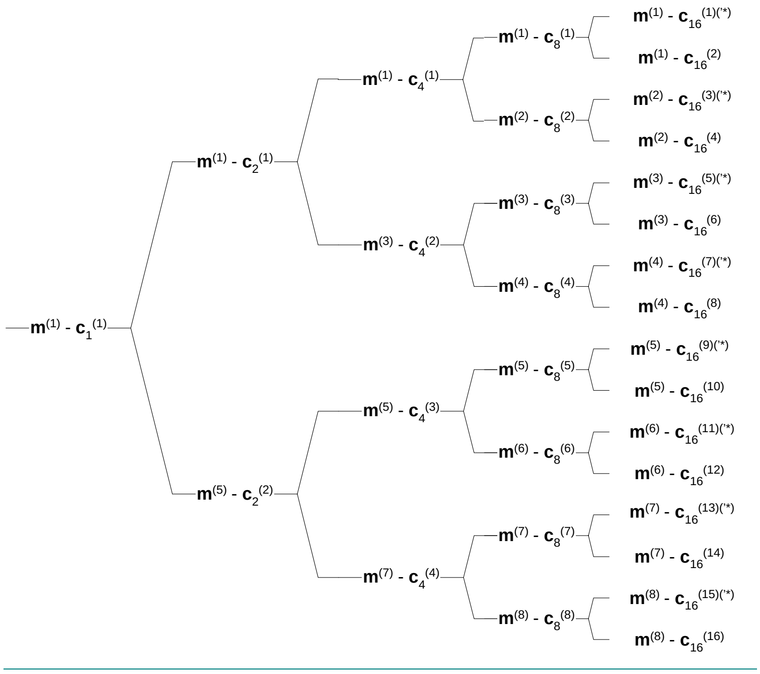


Figure B.2.5: Association of Midambles to Spreading Codes for K=8

B.2.6 Association for K=6 Midambles

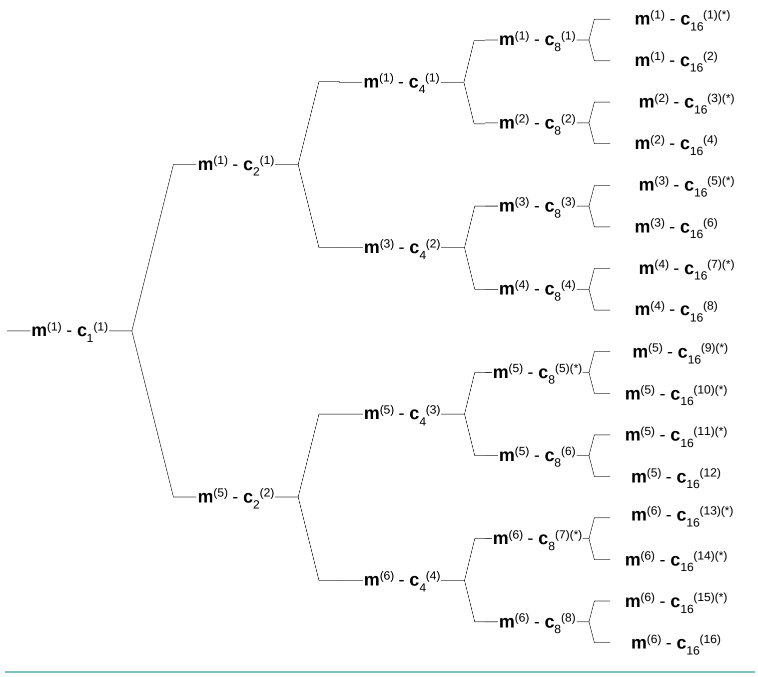


Figure B.2.6: Association of Midambles to Spreading Codes for K=6

B.2.7 Association for K=4 Midambles

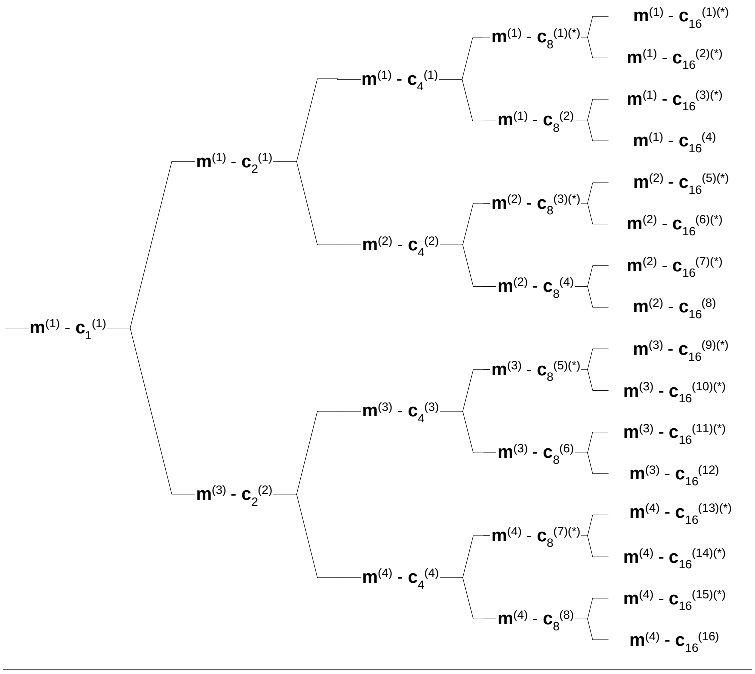


Figure B.2.7: Association of Midambles to Spreading Codes for K=4

B.2.8 Association for K=2 Midambles

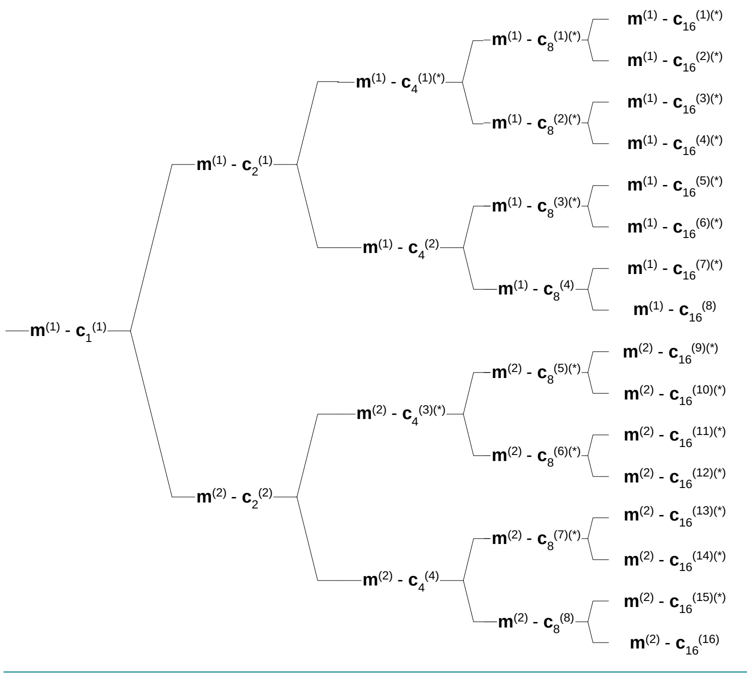


Figure B.2.8: Association of Midambles to Spreading Codes for K=2

Annex ~~B~~ C (normative) Signalling of the number of channelisation codes for the DL common midamble case for 3.84Mcps TDD

Annex D (normative) Signalling of the number of channelisation codes for the DL common midamble case for 1.28Mcps TDD

The following mapping schemes shall apply for the association between the number of channelisation codes employed in a timeslot and the use of a particular midamble shift in the DL common midamble case. In the following tables the presence of a particular midamble shift is indicated by '1'. Midamble shifts marked with '0' are left unused.

D.1 Mapping scheme for K=16 Midambles

m1	m2	m3	m4	m5	m6	M7	M8	m9	m10	m11	m12	M13	m14	m15	m16	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 code
0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2 codes
0	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	3 codes
0	0	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	4 codes
0	0	0	0	**1**	0	0	0	0	0	0	0	0	0	0	0	5 codes
0	0	0	0	0	**1**	0	0	0	0	0	0	0	0	0	0	6 codes
0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	0	0	7 codes
0	0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	0	8 codes
0	0	0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	9 codes
0	0	0	0	0	0	0	0	0	**1**	0	0	0	0	0	0	10 codes
0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	0	0	11 codes
0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	0	12 codes
0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	13 codes
0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	14 codes
0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	15 codes
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	16 codes

D.2 Mapping scheme for K=14 Midambles

m1	m2	m3	m4	m5	m6	M7	M8	m9	m10	m11	m12	M13	m14	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	1 or 15 code(s)
0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	2 or 16 codes
0	0	**1**	0	0	0	0	0	0	0	0	0	0	0	3 codes
0	0	0	**1**	0	0	0	0	0	0	0	0	0	0	4 codes
0	0	0	0	**1**	0	0	0	0	0	0	0	0	0	5 codes
0	0	0	0	0	**1**	0	0	0	0	0	0	0	0	6 codes
0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	7 codes
0	0	0	0	0	0	0	**1**	0	0	0	0	0	0	8 codes
0	0	0	0	0	0	0	0	**1**	0	0	0	0	0	9 codes
0	0	0	0	0	0	0	0	0	**1**	0	0	0	0	10 codes
0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	11 codes
0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	12 codes
0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	13 codes
0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	14 codes

D.3 Mapping scheme for K=12 Midambles

m1	m2	m3	m4	m5	m6	M7	M8	m9	m10	m11	m12	
1	0	0	0	0	0	0	0	0	0	0	0	1 or 13 code(s)
0	**1**	0	0	0	0	0	0	0	0	0	0	2 or 14 codes
0	0	**1**	0	0	0	0	0	0	0	0	0	3 or 15 codes
0	0	0	**1**	0	0	0	0	0	0	0	0	4 or 16 codes
0	0	0	0	**1**	0	0	0	0	0	0	0	5 codes
0	0	0	0	0	**1**	0	0	0	0	0	0	6 codes
0	0	0	0	0	0	**1**	0	0	0	0	0	7 codes
0	0	0	0	0	0	0	**1**	0	0	0	0	8 codes
0	0	0	0	0	0	0	0	**1**	0	0	0	9 codes
0	0	0	0	0	0	0	0	0	**1**	0	0	10 codes
0	0	0	0	0	0	0	0	0	0	**1**	0	11 codes
0	0	0	0	0	0	0	0	0	0	0	**1**	12 codes

D.4 Mapping scheme for K=10 Midambles

m1	m2	m3	m4	m5	m6	M7	M8	m9	m10	
1	0	0	0	0	0	0	0	0	0	1 or 11 code(s)
0	**1**	0	0	0	0	0	0	0	0	2 or 12 codes
0	0	**1**	0	0	0	0	0	0	0	3 or 13codes
0	0	0	**1**	0	0	0	0	0	0	4 or 14 codes
0	0	0	0	**1**	0	0	0	0	0	5 or 15 codes
0	0	0	0	0	**1**	0	0	0	0	6 or 16 codes
0	0	0	0	0	0	**1**	0	0	0	7 codes
0	0	0	0	0	0	0	**1**	0	0	8 codes
0	0	0	0	0	0	0	0	**1**	0	9 codes
0	0	0	0	0	0	0	0	0	**1**	10 codes

D.5 Mapping scheme for K=8 Midambles

m1	m2	m3	m4	m5	m6	m7	m8	
1	0	0	0	0	0	0	0	1 or 9 code(s)
0	**1**	0	0	0	0	0	0	2 or 10 codes
0	0	**1**	0	0	0	0	0	3 or 11 codes
0	0	0	**1**	0	0	0	0	4 or 12 codes
0	0	0	0	**1**	0	0	0	5 or 13 codes
0	0	0	0	0	**1**	0	0	6 or 14 codes
0	0	0	0	0	0	**1**	0	7 or 15 codes
0	0	0	0	0	0	0	**1**	8 or 16 codes

D.6 Mapping scheme for K=6 Midambles

m1	m2	m3	m4	m5	m6	
1	0	0	0	0	0	1 or 7 or 13 code(s)
0	**1**	0	0	0	0	2 or 8 or 14 codes
0	0	**1**	0	0	0	3 or 9 or 15 codes
0	0	0	**1**	0	0	4 or 10 or 16 codes
0	0	0	0	**1**	0	5 or 11 codes
0	0	0	0	0	**1**	6 or 12 codes

D.7 Mapping scheme for K=4 Midambles

m1	m2	m3	m4	
1	0	0	0	1 or 5 or 9 or 13 code(s)
0	**1**	0	0	2 or 6 or 10 or 14 codes
0	0	**1**	0	3 or 7 or 11 or 15 codes
0	0	0	**1**	4 or 8 or 12 or 16 codes

D.8 Mapping scheme for K=2 Midambles

m1	m2	
1	0	1 or 3 or 5 or 7 or 9 or 11 or 13 or 15 code(s)
0	**1**	2 or 4 or 6 or 8 or 10 or 12 or 14 or 16 codes

Annex ~~C~~ E (Informative): CCPCH Multiframe Structure for the 3.84 Mcps option

Annex F (Informative): CCPCH Multiframe Structure for the 1.28 Mcps option

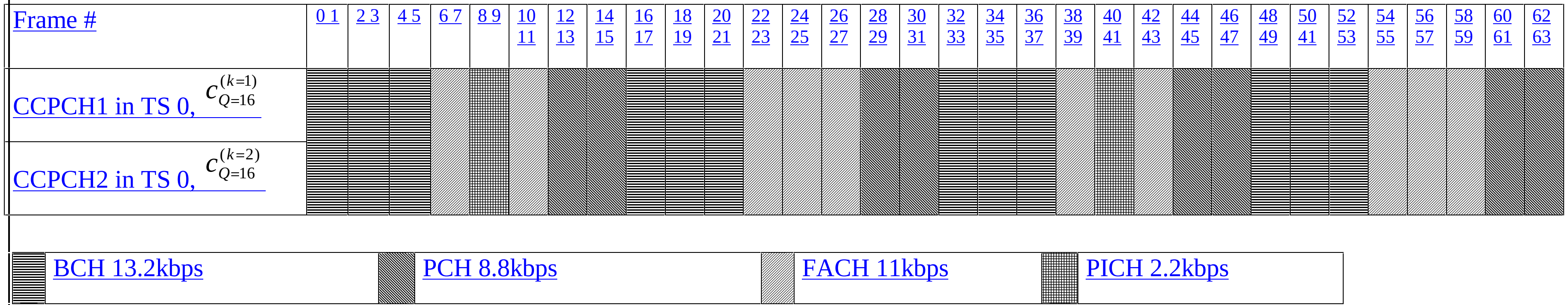


Figure F.1: Example for a multiframe structure for CCPCHs and PICH that is repeated every 64th frame (128 sub-frame)

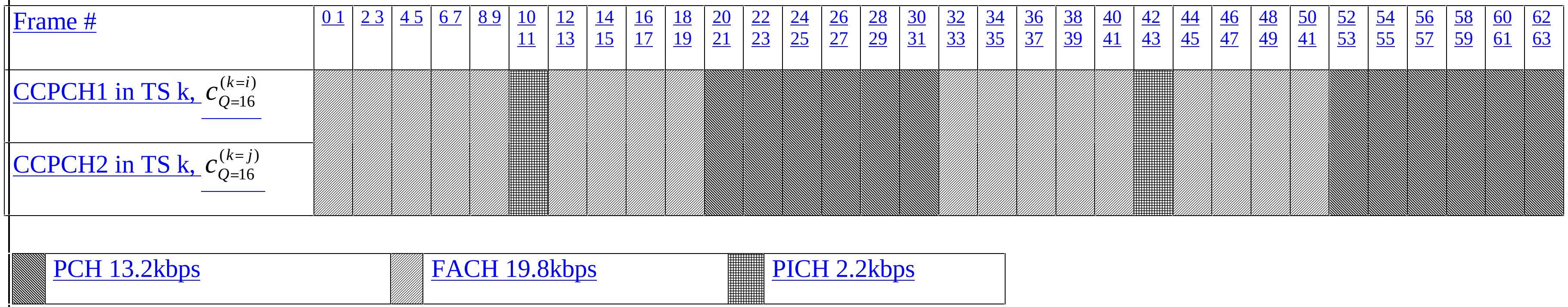


Figure F.2: Example for a multiframe structure for S-CCPCHs and PICH that is repeated every 64th frame, i,j=1…16 (i≠j),k≠0, 1,(128 sub-frame)

Annex G (Informative): Examples of the association of DL TPC commands to UL uplink time slots for 1.28 Mcps TDD

Table G.1 Two examples of the association of DL TPC commands to UL uplink time slots with NULslot=3

In the following two examples of the association of UL TPC commands to UL time slots and CCTrCHs are shown (see 6.2.2.2):

Case 1: $N_{UL\_TPCsymbols}$=2; Case 2: $N_{UL\_TPCsymbols}$=4

Sub-Frame Number	Case 1 (2 UL TPC symbols)		The order of the served UL time slot and CCTrCH pairs (UL time slot and CCTrCH number)	Case 2 (4 UL TPC symbols)	
	The order of UL TPC symbols			The order of UL TPC symbols	
SFN'=0	(1st UL_{pos}=0)	0	0 (TS3)	0	(1st UL_{pos}=0)
		1	1 (TS4)	1	
			2 (TS5)	2	
			0 (TS3)	3	
SFN'=1	(1st UL_{pos}=2)	0	0 (TS3)	0	(1st UL_{pos}=1)
		1	1 (TS4)	1	
			2 (TS5)	2	
			0 (TS3)	3	
			1 (TS4)		
SFN'=2	(1st UL_{pos}=1)	0	0 (TS3)	0	(1st UL_{pos}=2)
		1	1 (TS4)	1	
			2 (TS5)	2	
			0 (TS3)	3	
			1 (TS4)		
			2 (TS5)		
.	.		.	.	
.	.		.	.	
.	.		.	.	

Annex H (Informative): Examples of the association of DL SS commands to UL uplink time slots

In the following two examples of the association of DL SS commands to UL uplink time slots are shown (see 6.2.2.3):

Table H.1 Two examples of the association of DL SS commands to UL uplink time slots with N_{ULslot}=3

Case 1: $N_{SSsymbols}$=2; Case 2: $N_{SSsymbols}$=4

Sub-Frame Number	Case 1 (2 DL SS symbols)		The order of the served UL time slot (UL time slot number)	Case 2 (4 DL SS symbols)	
	The order of DL SS symbols			The order of DL SS symbols	
SFN'=0	(1st UL_{pos}=0)	0	0 (TS3)	0	(1st UL_{pos}=0)
		1	1 (TS4)	1	
			2 (TS5)	2	
			0 (TS3)	3	
SFN'=1	(1st UL_{pos}=2)	0	0 (TS3)	0	(1st UL_{pos}=1)
		1	1 (TS4)	1	
			2 (TS5)	2	
			0 (TS3)	3	
			1 (TS4)		
SFN'=2	(1st UL_{pos}=1)	0	0 (TS3)	0	(1st UL_{pos}=2)
		1	1 (TS4)	1	
			2 (TS5)	2	
			0 (TS3)	3	
			1 (TS4)		
			2 (TS5)		
.	.		.	.	
.	.		.	.	
.	.		.	.	

Annex ~~D~~ I(informative): Change history

3GPP TSG RAN Meeting #11
Palm Springs, CA, U.S.A., March 13-16, 2001

R1-01-0372

CR-Form-v3

CHANGE REQUEST

⌘ **25.222 CR 055** ⌘	rev **1** ⌘	Current version: **3.5.0** ⌘

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

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

Title: ⌘	Inclusion of 1.28Mcps TDD in TS 25.222		
Source: ⌘	TSG RAN WG1		
Work item code: ⌘	LCRTDD-Phys	***Date:*** ⌘	28.02.2001
Category: ⌘	**B**	***Release:*** ⌘	REL-4
	Use one of the following categories: ***F*** *(essential correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(Addition of feature),* ***C*** *(Functional modification of feature)* ***D*** *(Editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *REL-4 (Release 4)* *REL-5 (Release 5)*

Reason for change: ⌘	Inclusion of 1.28 Mcps TDD
Summary of change: ⌘	• The basis for this document was CR055 R1-01-0222 • Only some editorial modifications with respect to CR055 • Removal of PICH coding acc. To R1-01-257
Consequences if not approved: ⌘	

Clauses affected: ⌘	4.2.3, new section 4.2.11 subframe segmentation, new section 4.2.12.2 new Section 4.4	
Other specs affected: ⌘	[X] Other core specifications ⌘ [ ] Test specifications [ ] O&M Specifications	25.201, 25.221, 25.223, 25.224, 25.225
Other comments: ⌘		

How to create CRs using this form:

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

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

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

4.2 Transport channel coding/multiplexing

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

The following coding/multiplexing steps can be identified:

- add CRC to each transport block (see subclause 4.2.1);
- TrBk concatenation / Code block segmentation (see subclause 4.2.2);
- channel coding (see subclause 4.2.3) ;
- radio frame size equalization (see subclause 4.2.4);
- interleaving (two steps, see subclauses 4.2.5 and 4.2.10);
- radio frame segmentation (see subclause 4.2.6);
- rate matching (see subclause 4.2.7);
- multiplexing of transport channels (see subclause 4.2.8);
- physical channel segmentation (see subclause 4.2.9);
- sub-frame segmentation(see subclause 4.2.11 only for 1.28Mcps TDD)
- mapping to physical channels (see subclause 4.2.1112).

The coding/multiplexing steps for uplink and downlink are shown in figures 1 and 2.

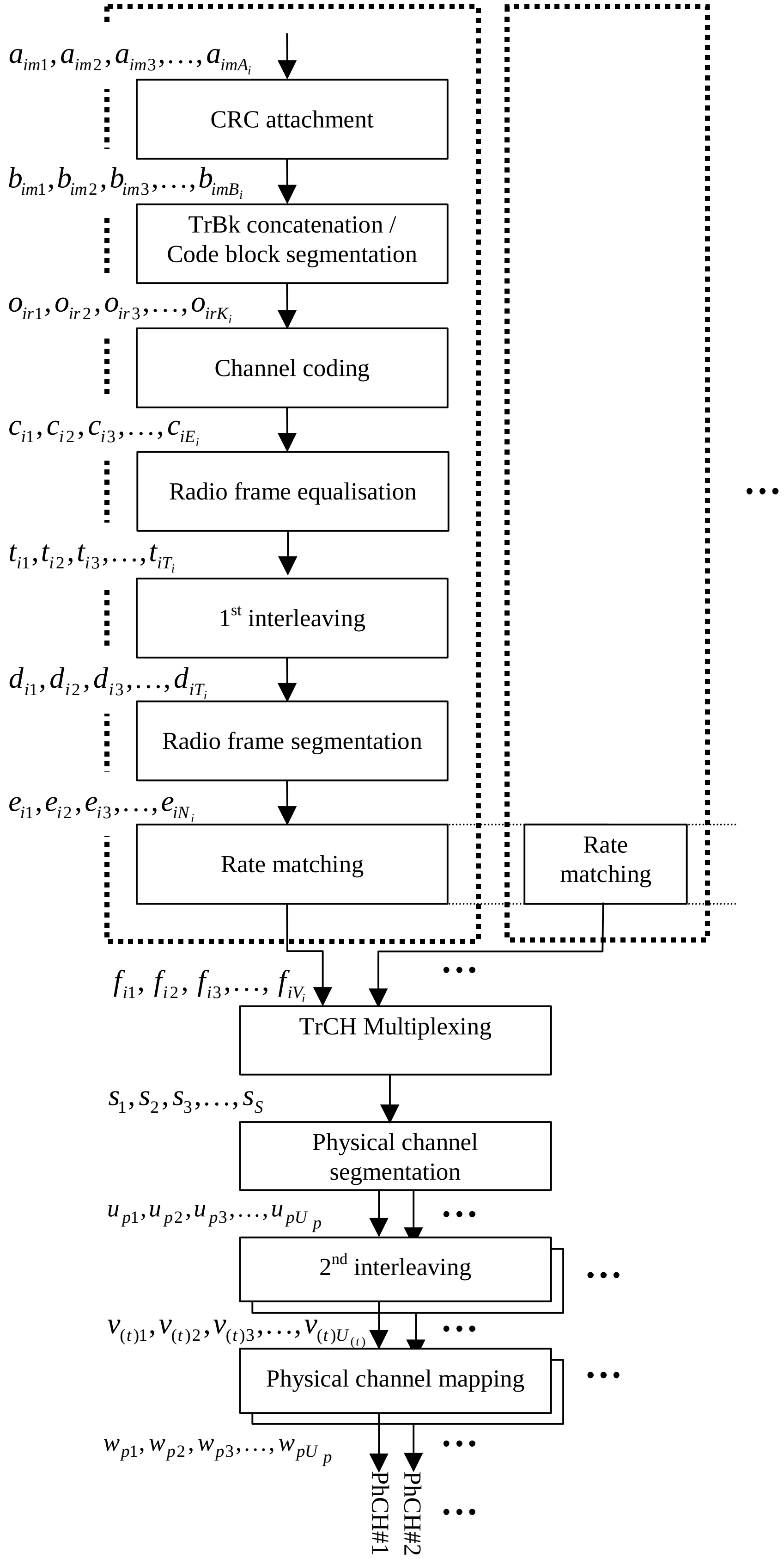


Figure 1: Transport channel multiplexing structure for uplink and downlink for 3.84Mcps TDD

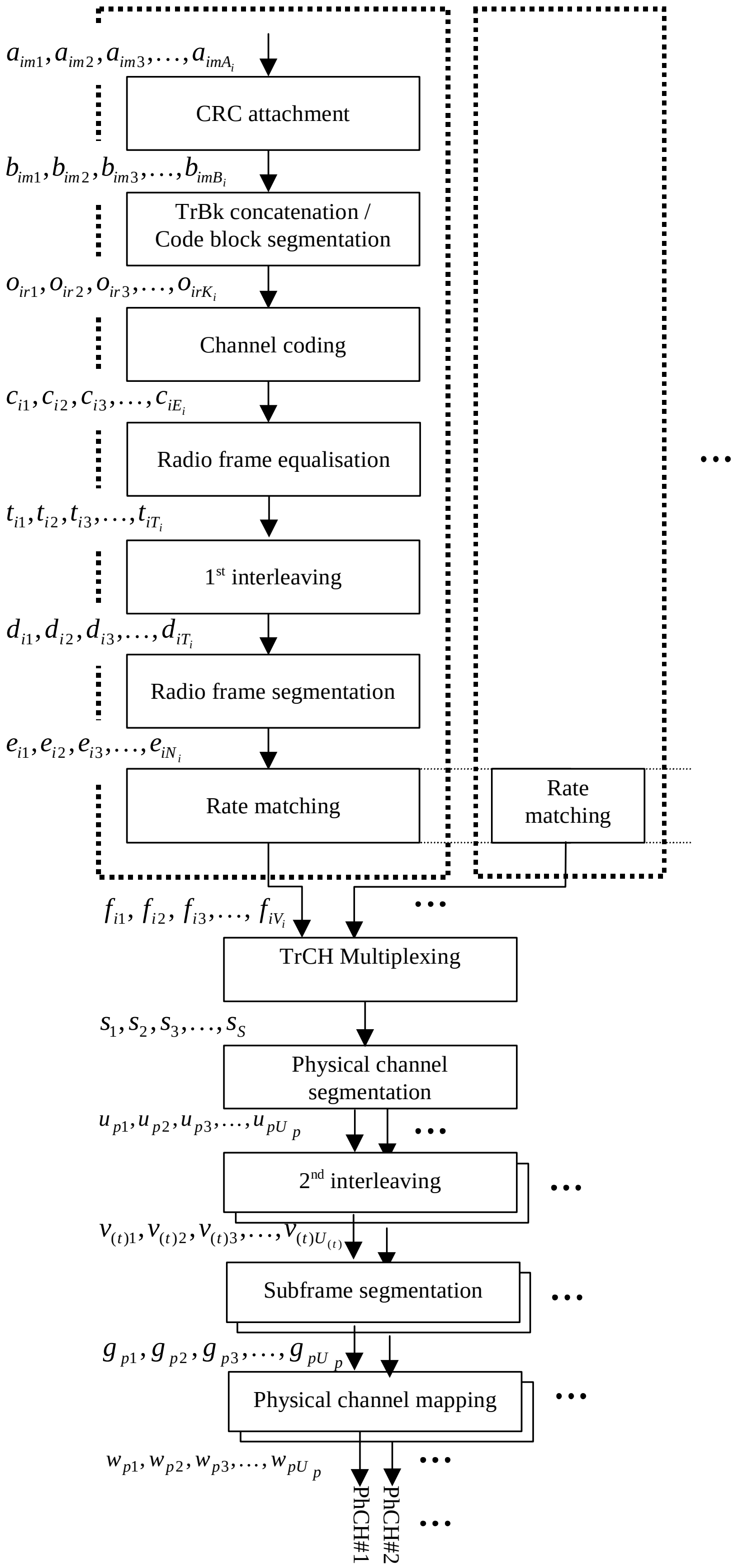


Figure 2: Transport channel multiplexing structure for uplink and downlink of 1.28Mcps TDD

Primarily, transport channels are multiplexed as described above, i.e. into one data stream mapped on one or several physical channels. However, an alternative way of multiplexing services is to use multiple CCTrCHs (Coded Composite Transport Channels), which corresponds to having several parallel multiplexing chains as in figures 1 and 2, resulting in several data streams, each mapped to one or several physical channels.

4.2.3 Channel coding

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

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

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

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

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

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

<table>
<tr><th>Type of TrCH</th><th>Coding scheme</th><th>Coding rate</th></tr>
<tr><td>BCH</td><td rowspan="4">Convolutional coding</td><td rowspan="3">½</td></tr>
<tr><td>PCH</td></tr>
<tr><td>RACH</td></tr>
<tr><td rowspan="3">DCH, DSCH, FACH, USCH</td><td>1/3, ½</td></tr>
<tr><td>Turbo coding</td><td>1/3</td></tr>
<tr><td colspan="2">No coding</td></tr>
</table>

Table2: Usage of channel coding scheme and coding rate for 1.28Mcps TDD

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

4.2.11 Sub-frame segmentation for the 1.28 Mcps option

In the 1.28Mcps TDD, it is needed to add a sub-frame segmentation unit between 2nd interleaving unit and physical channel mapping unit. The operation of rate-matching guarantees that the bit streams is a even number and can be subdivided into 2 sub-frames. The transport channel multiplexing structure for uplink and downlink is shown in figure 2.

The input bit sequence is denoted by $x_{i1}, x_{i2}, x_{i3}, \ldots, x_{iX_i}$ where i is the TrCH number and X_i is the number bits. The two output bit sequences per radio frame are denoted by $y_{i,n_i1}, y_{i,n_i2}, y_{i,n_i3}, \ldots, y_{i,n_iY_i}$ where ni is the sub-frame number in current radio frame and Y_i is the number of bits per radio frame for TrCH i. The output sequences are defined as follows:

$y_{i,n_ik} = x_{i,((n_i-1)\cdot Y_i)+k}$, n_i = 1 or 2, k = 1…Y_i

where

$Y_i = (X_i / 2)$ is the number of bits per sub-frame,

x_{ik} is the k^th bit of the input bit sequence and

y_{i,n_ik} is the k^th bit of the output bit sequence corresponding to the n^th sub-frame

The input bit sequence to the sub-frame segmentation is denoted by $v_{(t)1}, v_{(t)2}, \ldots, v_{(t)U_{(t)}}$, $x_{ik} = v_{(t)k}$ and $X_i = U_{(t)}$.

The output bit sequence corresponding to subframe n_i is denoted by $g_{p1}, g_{p2}, \ldots, g_{pU_p}$, where p is the PhCH number and U_p is the number of bits in one subframe for the respective PhCH. Hence, $g_{pk} = y_{i,n_ik}$ and $U_p = Y_i$.

4.2.12 Physical channel mapping

~~4.2.11~~4.2.12.1 Physical channel mapping for the 3.84 Mcps option

4.2.12.2 Physical channel mapping for the 1.28 Mcps option

The bit streams from the sub-frame segmentation unit are mapped onto code channels of time slots in sub-frames.

The bits after physical channel mapping are denoted by $w_{p1}, w_{p2}, \ldots, w_{pU_p}$, where p is the PhCH number and Up is the number of bits in one sub-frame for the respective PhCH. The bits wpk are mapped to the PhCHs so that the bits for each PhCH are transmitted over the air in ascending order with respect to k.

The mapping of the bits $g_{p1}, g_{p2}, \ldots, g_{pU_p}$ is performed like block interleaving, writing the bits into columns, but a PhCH with an odd number is filled in forward order, were as a PhCH with an even number is filled in reverse order.

The mapping scheme, as described in the following subclause, shall be applied individually for each timeslot t used in the current subframe. Therefore, the bits $g_{p1}, g_{p2}, \ldots, g_{pU_p}$ are assigned to the bits of the physical channels $w_{t1,1...U_{t1}}, w_{t2,1...U_{t2}}, \ldots, w_{tP_t,1...U_{tP_t}}$ in each timeslot.

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

if

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

else

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

end if

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

4.2.12.2.1 Mapping scheme

Notation used in this subclause:

P_t: number of physical channels for timeslot t , $P_t = 1..2$ for uplink ; $P_t = 1...16$ for downlink

U_{tp}: capacity in bits for the physical channel p in timeslot t

U_t.: total number of bits to be assigned for timeslot t

bs_p: number of consecutive bits to assign per code

for downlink all $bs_p = 1$

for uplink if SF1 >= SF2 then $bs_1 = 1$; $bs_2 =$ SF1/SF2 ;

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

fb_p: number of already written bits for each code

pos: intermediate calculation variable

for p=1 to P_t -- reset number of already written bits for every physical channel

$fb_p = 0$

end for

p = 1 -- start with PhCH #1

```
for k=1  to Ut.
do while (fbp == Ut,p)          -- physical channel filled up already ?
p = (p mod P t)  + 1 ;
end do
if (p mod 2) == 0
pos = Ut,p - fbp               -- reverse order
else
pos = fbp + 1                  -- forward order
end if
wtp,pos = gt,k                      -- assignment
fbp = fbp + 1                       -- Increment number of already written bits
If (fbp mod bsp) == 0          -- Conditional change to the next physical channel
p = (p mod P t)  + 1 ;
end if
end for
```

4.2.~~12~~13 Multiplexing of different transport channels onto one CCTrCH, and mapping of one CCTrCH onto physical channels

Different transport channels can be encoded and multiplexed together into one Coded Composite Transport Channel (CCTrCH). The following rules shall apply to the different transport channels which are part of the same CCTrCH:

1) Transport channels multiplexed into one CCTrCh shall have co-ordinated timings. When the TFCS of a CCTrCH is changed because one or more transport channels are added to the CCTrCH or reconfigured within the CCTrCH, or removed from the CCTrCH, the change may only be made at the start of a radio frame with CFN fulfilling the relation

   CFN mod F_{max} = 0,

   where F_{max} denotes the maximum number of radio frames within the transmission time intervals of all transport channels which are multiplexed into the same CCTrCH, including any transport channels *i* which are added reconfigured or have been removed, and CFN denotes the connection frame number of the first radio frame of the changed CCTrCH.

   After addition or reconfiguration of a transport channel *i* within a CCTrCH, the TTI of transport channel *i* may only start in radio frames with CFN fulfilling the relation

   CFN_i mod F_i = 0.

2) Different CCTrCHs cannot be mapped onto the same physical channel.

3) One CCTrCH shall be mapped onto one or several physical channels.

4) Dedicated Transport channels and common transport channels cannot be multiplexed into the same CCTrCH.

5) For the common transport channels, only the FACH and PCH may belong to the same CCTrCH.

6) Each CCTrCH carrying a BCH shall carry only one BCH and shall not carry any other Transport Channel.

7) Each CCTrCH carrying a RACH shall carry only one RACH and shall not carry any other Transport Channel.

Hence, there are two types of CCTrCH.

CCTrCH of dedicated type, corresponding to the result of coding and multiplexing of one or several DCH.

CCTrCH of common type, corresponding to the result of the coding and multiplexing of a common channel, i.e. RACH and USCH in the uplink and DSCH, BCH, FACH or PCH in the downlink, respectively.

Transmission of TFCI is possible for CCTrCH containing Transport Channels of:

- dedicated type;
- USCH type;
- DSCH type;
- FACH and/or PCH type.

4.2.~~12~~13.1 Allowed CCTrCH combinations for one UE

4.2.~~12~~13.1.1 Allowed CCTrCH combinations on the uplink

The following CCTrCH combinations for one UE are allowed, also simultaneously:

1) several CCTrCH of dedicated type;

2) several CCTrCH of common type.

4.2.~~12~~13.1.2 Allowed CCTrCH combinations on the downlink

The following CCTrCH combinations for one UE are allowed, also simultaneously:

3) several CCTrCH of dedicated type;

4) several CCTrCH of common type.

4.2.~~13~~14 Transport format detection

Transport format detection can be performed both with and without Transport Format Combination Indicator (TFCI). If a TFCI is transmitted, the receiver detects the transport format combination from the TFCI. When no TFCI is transmitted, so called blind transport format detection may be used, i.e. the receiver side uses the possible transport format combinations as a priori information.

4.2.~~13~~14.1 Blind transport format detection

Blind Transport Format Detection is optional both in the UE and the UTRAN. Therefore, for all CCTrCH a TFCI shall be transmitted, including the possibilty of a TFCI length zero, if only one TFC is defined.

4.2.~~13~~14.2 Explicit transport format detection based on TFCI

4.2.~~13~~14.2.1 Transport Format Combination Indicator (TFCI)

The Transport Format Combination Indicator (TFCI) informs the receiver of the transport format combination of the CCTrCHs. As soon as the TFCI is detected, the transport format combination, and hence the individual transport channels' transport formats are known, and decoding of the transport channels can be performed.

4.3 Coding for layer 1 control for the 3.84 Mcps option

4.4 Coding for layer 1 control for the 1.28 Mcps option

4.4.1 Coding of transport format combination indicator (TFCI) for QPSK

The coding of TFCI for 1.28Mcps TDD is same as that of 3.84Mcps TDD.cf.[4.3.1 'Coding of transport format combination indicator'].

4.4.1.1 Mapping of TFCI word

Denote the number of bits in the TFCI word by N_{TFCI}, and denote the code word bits by b_k, where k = 0, …, N_{TFCI}-1

When the number of bits in the TFCI is 8,16,32, the mapping of the TFCI word to the TFCI bit positions shall be as follows.

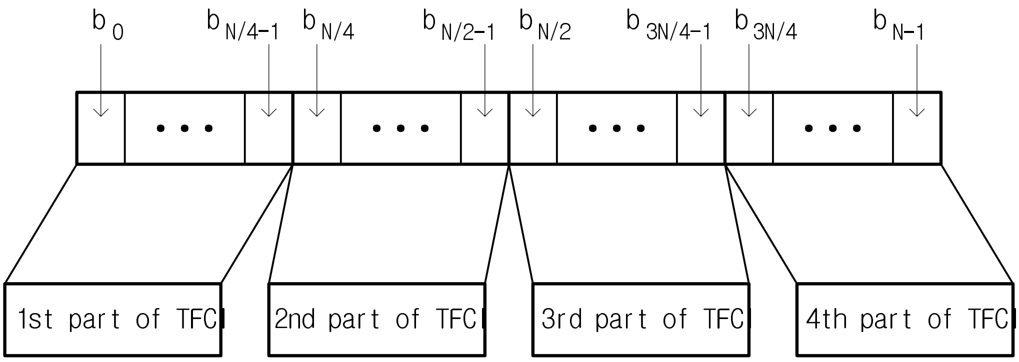


Figure [9]: Mapping of TFCI word bits to TFCI position in 1.28 Mcps TDD option, where N = N_{TFCI}.

When the number of bits in the TFCI is 4 , then the TFCI word is equally divided into two parts for the consecutive two subframe and mapped onto the end of the first data field in each of the consecutive subframes.The mapping for N_{TFCI},=4 is show in figure [10]:

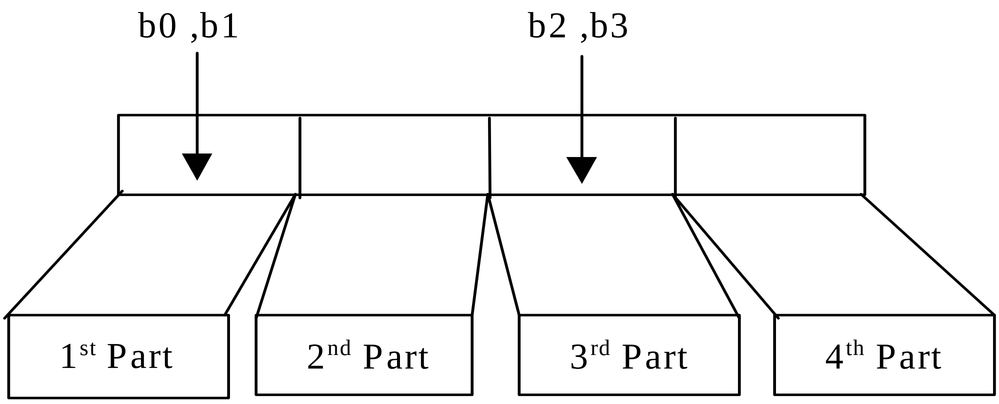


Figure [10]: Mapping of TFCI word bits to TFCI position in 1.28 Mcps TDD option, when N_{TFCI},=4

The location of the 1st to 4th parts of TFCI in the timeslot is defined in [7].

If the shortest transmission time interval of any constituent TrCH is at least 20 ms the successive TFCI words in the frames in the TTI shall be identical. If TFCI is transmitted on multiple timeslots in a frame each timeslot shall have the same TFCI word.

4.4.2 Coding of transport format combination indicator (TFCI) for 8PSK

Encoding of TFCI bits depends on the number of them and the modulation in use. When 2 Mcps service is transmitted, 8PSK modulation is applied in 1.28 Mcps TDD option. The coding scheme for TFCI when the number of bits are 6 – 10, and less than 6 are described in section 4.4.2.1 and 4.4.2.2, respectively.

4.4.2.1 Coding of long TFCI lengths

When the number of TFCI bits are 6 – 10, the TFCI bits are encoded by using a (64,10) sub-code of the second order Reed-Muller code, then 16 bits out of 64 bits are punctured (Puncturing positions are 0, 4, 8, 13, 16, 20, 27, 31, 34, 38, 41, 44, 50, 54, 57, 61st bits). The coding procedure is shown in Figure [11].

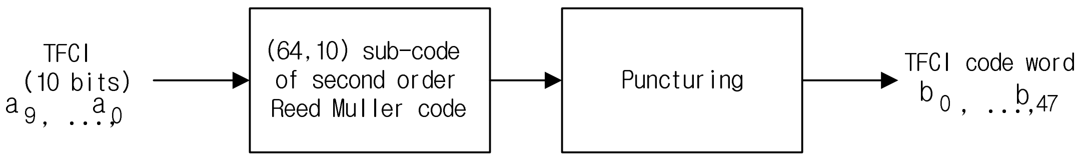


Figure [11]: Channel coding of long TFCI bits for 8PSK

The code words of the punctured (48,10) sub-code of the second order Reed-Muller codes are linear combination of 10 basis sequences. The basis sequences are shown in Table [12].

Table [12]: Basis sequences for (48,10) TFCI code

I	$M_{i,0}$	$M_{i,1}$	$M_{i,2}$	$M_{i,3}$	$M_{I,4}$	$M_{i,5}$	$M_{i,6}$	$M_{I,7}$	$M_{I,8}$	$M_{i,9}$
0	1	0	0	0	0	0	1	0	1	0
1	0	1	0	0	0	0	1	1	0	0
2	1	1	0	0	0	0	1	1	0	1
3	1	0	1	0	0	0	1	1	1	0
4	0	1	1	0	0	0	1	0	1	0
5	1	1	1	0	0	0	1	1	1	0
6	1	0	0	1	0	0	1	1	1	1
7	0	1	0	1	0	0	1	1	0	1
8	1	1	0	1	0	0	1	0	1	0
9	0	0	1	1	0	0	1	1	0	0
10	0	1	1	1	0	0	1	1	0	1
11	1	1	1	1	0	0	1	1	1	1
12	1	0	0	0	1	0	1	0	1	1
13	0	1	0	0	1	0	1	1	1	0
14	1	1	0	0	1	0	1	0	0	1
15	1	0	1	0	1	0	1	0	1	1
16	0	1	1	0	1	0	1	1	0	0
17	1	1	1	0	1	0	1	1	1	0
18	0	0	0	1	1	0	1	0	0	1
19	1	0	0	1	1	0	1	0	1	1
20	0	1	0	1	1	0	1	0	1	0
21	0	0	1	1	1	0	1	0	1	0
22	1	0	1	1	1	0	1	1	0	1
23	0	1	1	1	1	0	1	1	1	0
24	0	0	0	0	0	1	1	1	0	1
25	1	0	0	0	0	1	1	1	1	0
26	1	1	0	0	0	1	1	1	1	1
27	0	0	1	0	0	1	1	0	1	1
28	1	0	1	0	0	1	1	1	0	1
29	1	1	1	0	0	1	1	0	1	1
30	0	0	0	1	0	1	1	0	0	1
31	0	1	0	1	0	1	1	0	0	1
32	1	1	0	1	0	1	1	1	1	1
33	1	0	1	1	0	1	1	0	0	1
34	0	1	1	1	0	1	1	1	1	0
35	1	1	1	1	0	1	1	1	0	1
36	0	0	0	0	1	1	1	1	1	0
37	1	0	0	0	1	1	1	0	1	1
38	1	1	0	0	1	1	1	1	1	1
39	0	0	1	0	1	1	1	1	0	0
40	1	0	1	0	1	1	1	1	0	0
41	1	1	1	0	1	1	1	1	1	1
42	0	0	0	1	1	1	1	1	1	1
43	0	1	0	1	1	1	1	0	1	0
44	1	1	0	1	1	1	1	0	1	0
45	0	0	1	1	1	1	1	0	1	1
46	0	1	1	1	1	1	1	0	0	1
47	1	1	1	1	1	1	1	1	0	0

Let's define the TFCI bits as a_0 , a_1 , a_2 , a_3 , a_4 , a_5 , a_6 , a_7 , a_8 , a_9, where a_0 is the LSB and a_9 is the MSB. The TFCI bits shall correspond to the TFC index (expressed in unsigned binary form) defined by the RRC layer to reference the TFC of the CCTrCH in the associated DPCH radio frame.

The output code word bits b_i are given by:

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

where i=0…47. N_{TFCI}=48.

4.4.2.2 Coding of short TFCI lengths

4.4.2.2.1 Coding very short TFCIs by repetition

When the number of TFCI bits is 1 or 2, then repetition will be used for the coding. In this case, each bit is repeated to a total of 6 times giving 6-bit transmission (N_{TFCI} = 6) for a single TFCI bit and 12-bit transmission (N_{TFCI} = 12) for 2 TFCI bits. For a single TFCI bit b_0, the TFCI code word shall be {b_0, b_0, b_0, b_0, b_0, b_0}. For TFCI bits b_0 and b_1, the TFCI code word shall be {b_0, b_1, b_0, b_1, b_0, b_1, b_0, b_1, b_0, b_1, b_0, b_1}.

4.4.2.2.2 Coding short TFCIs using bi-orthogonal codes

If the number of TFCI bits is in the range of 3 to 5, the TFCI bits are encoded using a (32,5) first order Reed-Muller code, then 8 bits out of 32 bits are punctured (Puncturing positions are 0, 1, 2, 3, 4, 5, 6, 7th bits). The coding procedure is shown in Figure [12].

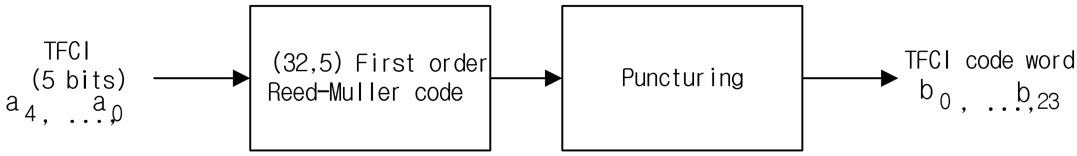


Figure [12]: Channel coding of short TFCI bits for 8PSK

The code words of the punctured (32,5) first order Reed-Muller codes are linear combination of 5 basis sequences shown in Table [13].

Table [13]: Basis sequences for (24,5) TFCI code

I	$M_{i,0}$	$M_{i,1}$	$M_{i,2}$	$M_{i,3}$	$M_{i,4}$
0	0	0	0	1	0
1	1	0	0	1	0
2	0	1	0	1	0
3	1	1	0	1	0
4	0	0	1	1	0
5	1	0	1	1	0
6	0	1	1	1	0
7	1	1	1	1	0
8	0	0	0	0	1
9	1	0	0	0	1
10	0	1	0	0	1
11	1	1	0	0	1
12	0	0	1	0	1
13	1	0	1	0	1
14	0	1	1	0	1
15	1	1	1	0	1
16	0	0	0	1	1
17	1	0	0	1	1
18	0	1	0	1	1
19	1	1	0	1	1
20	0	0	1	1	1
21	1	0	1	1	1

22	0	1	1	1	1
23	1	1	1	1	1

Let's define the TFCI bits as a_0 , a_1 , a_2 , a_3 , a_4, where a_0 is the LSB and a_4 is the MSB. The TFCI bits shall correspond to the TFC index (expressed in unsigned binary form) defined by the RRC layer to reference the TFC of the CCTrCH in the associated DPCH radio frame.

The output code word bits b_i are given by:

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

where i=0…23. N_{TFCI}=24.

4.4.2.3 Mapping of TFCI code word

Denote the number of bits in the TFCI code word by N_{TFCI}, and denote the TFCI code word bits by b_k, where k = 0, …, N_{TFCI}-1.

When the number of bits in the TFCI code word is 12, 24, or 48, the mapping of the TFCI code word to the TFCI bit positions in a time slot shall be as follows.

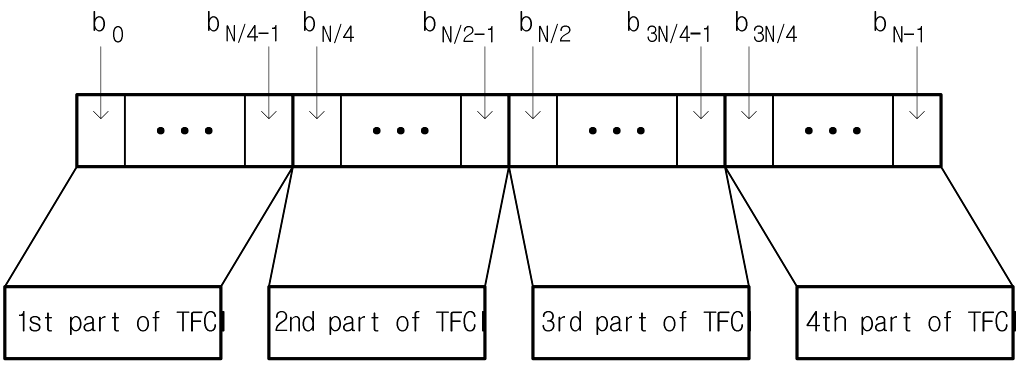


Figure [13]: Mapping of TFCI code word bits to timeslot in 1.28 Mcps TDD option, where N = N_{TFCI}.

When the number of bits in the TFCI code word is 6, the TFCI code word is equally divided into two parts for the consecutive two sub-frames and mapped onto the first data field in each of the consecutive sub-frames. The mapping of the TFCI code word to the TFCI bit positions in a time slot shall be as shown in figure [14].

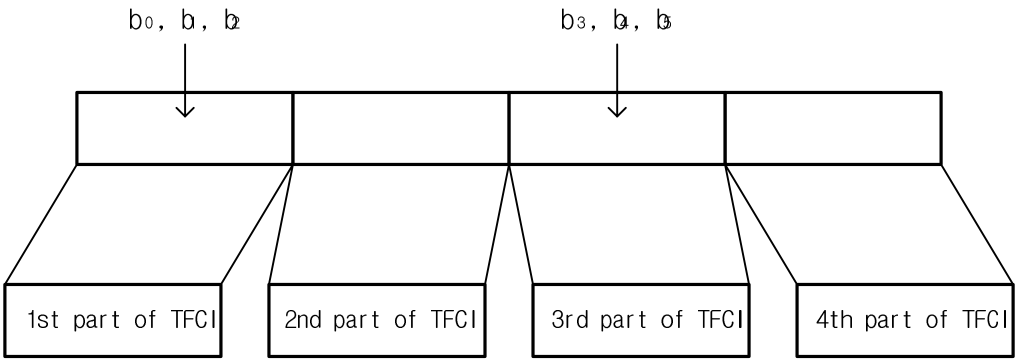


Figure [14]: Mapping of TFCI code word bits to timeslot in 1.28 Mcps TDD option when N_{TFCI} = 6

The location of the 1st to 4th parts of TFCI in the timeslot is defined in [7].

4.4.3 Coding of the Forward Physical Access Channel (FPACH) information bits

The FPACH burst is composed by 32 information bits which are block coded and convolutional coded, and then delivered in one sub-frame as follows:

1. The 32 information bits are protected by 8 parity bits for error detection as described in sub-clause 4.2.1.1.
2. Convolutional code with constraint length 9 and coding rate ½ is applied as described in sub-clause 4.2.3.1. The size of data block c(k) after convolutional encoder is 96 bits.
3. To adjust the size of the data block c(k) to the size of the FPACH burst, 8 bits are punctured as described in sub-clause 4.2.7 with the following clarifications:
   - $N_{i;j}$ =96 is the number of bits in a radio sub-frame before rate matching
   - $\Delta N_{i,j}$ = -8 is the number of bits to punctured in a radio sub-frame
   - e_{ini} = a x N_{ij}

   The 88 bits after rate matching are then delivered to the intra-frame interleaving.
4. The bits in input to the interleaving unit are denoted as {x(0), …, x(87)}. The coded bits are block rectangular interleaved according to the following rule: the input is written row by row, the output is read column by column.

$$\begin{bmatrix} x(0) & x(1) & x(2) & \dots\, x(7) \\ x(8) & x(9) & x(10) & \dots\, x(15) \\ \vdots & \vdots & \vdots & \dots\quad \vdots \\ x(80) & x(81) & x(82) & \dots\, x(87) \end{bmatrix}$$

Hence, the interleaved sequence is denoted by y (i) and are given by:

y(0), y(1), …, y(87)=x(0), x(8), …,x(80),x(1), …, x(87).

3GPP TSG RAN Meeting #11
Palm Springs, CA, U.S.A., March 13-16, 2001

R1-01-0373

CR-Form-v3

CHANGE REQUEST

⌘ **25.223 CR 017**	⌘ rev	**1**	⌘ Current version:	**3.4.0**	⌘

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

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

Title: ⌘	Inclusion of 1.28Mcps TDD in TS 25.223		
Source: ⌘	TSG RAN WG1		
Work item code: ⌘	LCRTDD-Phys	***Date:*** ⌘	28.02.2001
Category: ⌘	**B**	***Release:*** ⌘	REL-4
	Use one of the following categories: ***F*** *(essential correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(Addition of feature),* ***C*** *(Functional modification of feature)* ***D*** *(Editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *REL-4 (Release 4)* *REL-5 (Release 5)*

Reason for change: ⌘	Inclusion of 1.28 Mcps TDD
Summary of change: ⌘	• The basis for this document was CR017, R1-01-0223 • Some editorial corrections
Consequences if not approved: ⌘	

Clauses affected: ⌘	New section 6, new section 7.6, new section 9, new Annex B	
Other specs affected: ⌘	[X] Other core specifications [ ] Test specifications [ ] O&M Specifications	⌘ 25.201, 25.221, 25.222, 25.224, 25.225
Other comments: ⌘		

How to create CRs using this form:

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

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

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

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

3 Symbols and abbreviations

3.1 Symbols

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

C_p:	PSC
C_i:	i:th secondary SCH code

3.2 Abbreviations

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

CDMA	Code Division Multiple Access
MIB	Master Information Block
OVSF	Orthogonal Variable Spreading Factor
P-CCPCH	Primary Common Control Physical Channel
PN	Pseudo Noise
PRACH	Physical Random Access Channel
PSC	Primary Synchronisation Code
QPSK	Quadrature Phase Shift Keying
RACH	Random Access Channel
SCH	Synchronisation Channel

4 General

In the following, a separation between the data modulation and the spreading modulation has been made. The data modulation for 3.84Mcps TDD is defined in clause 5 'Data modulation for the 3.84 Mcps option', the data modulation for 1.28Mcps TDD is defined in clause 6 'Data modulation for the 1.28 Mcps option' and the spreading modulation in clause 67 'Spreading modulation'.

Table 1: Basic modulation parameters

Chip rate	Same as FDD basic chiprate: 3.84 Mchip/s	Low chiprate: 1.28 Mchip/s
Data modulation	QPSK	QPSK, 8PSK
Spreading characteristics	Orthogonal Q chips/symbol, where $Q = 2^p$, $0 <= p <= 4$	Orthogonal Q chips/symbol, where $Q = 2^p$, $0 <= p <= 4$

5 Data modulation for the 3.84 Mcps option

5.1 Symbol rate

The symbol duration T_S depends on the spreading factor Q and the chip duration T_C: $T_s = Q \times T_c$, where $T_c = \frac{1}{chiprate}$.

6 Data modulation for the 1.28 Mcps option

6.1 Symbol rate

The symbol duration T_S depends on the spreading factor Q and the chip duration T_C: $T_s = Q \times T_c$, where $T_c = \frac{1}{chiprate}$.

6.2 Mapping of bits onto signal point constellation

6.2.1 QPSK modulation

The mapping of bits onto the signal point constellation for QPSK modulation is the same as in the 3.84Mcps TDD cf. [5.2.1 Mapping for burst type 1 and 2].

6.2.2 8PSK modulation

The data modulation is performed to the bits from the output of the physical channel mapping procedure. In case of 8PSK modulation 3 consecutive binary bits are represented by one complex valued data symbol. Each user burst has two data carrying parts, termed data blocks:

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

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

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

The data modulation is 8PSK, thus the data symbols $\underline{d}_n^{(k,i)}$ are generated from 3 consecutive data bits from the output of the physical channel mapping procedure in [8]:

using the following mapping to complex symbols:

Consecutive binary bit pattern	complex symbol
$b_{1,n}^{(k,i)}\ b_{2,n}^{(k,i)}\ b_{3,n}^{(k,i)}$	$\underline{d}_n^{(k,i)}$
000	cos(11pi/8)+ jsin(11pi/8)
001	cos(9pi/8)+ jsin(9pi/8)
010	cos(5pi/8)+ jsin(5pi/8)
011	cos(7pi/8)+ jsin(7pi/8)
100	cos(13pi/8)+ jsin(13pi/8)
101	cos(15pi/8)+ jsin(15pi/8)
110	cos(3pi/8)+ jsin(3pi/8)
111	cos(pi/8)+ jsin(pi/8)

The mapping corresponds to a 8PSK modulation of the interleaved and encoded data bits $b_{l,n}^{(k,i)}$ of the table above and $\underline{d}_n^{(k,i)}$ of equation 1.

~~6~~7 Spreading modulation

~~6~~7.1 Basic spreading parameters

Spreading of data consists of two operations: Channelisation and Scrambling. Firstly, each complex valued data symbol $\underline{d}_n^{(k,i)}$ of equation 1 is spread with a real valued channelisation code $\mathbf{c}^{(k)}$ of length $Q_k \in \{1,2,4,8,16\}$. The resulting sequence is then scrambled by a complex sequence $\underline{\mathbf{v}}$ of length 16.

~~6~~7.2 Channelisation codes

The elements $c_q^{(k)}$; k=1,...,K; q=1,...,Q_k; of the real valued channelisation codes

$$\mathbf{c}^{(k)} = (c_1^{(k)}, c_2^{(k)}, \ldots, c_{Q_k}^{(k)})\text{ ; k=1,...,K;}$$

shall be taken from the set

$$V_c = \{1, -1\} \qquad (3)$$

The $\mathbf{c}_{Q_k}^{(k)}$ are Orthogonal Variable Spreading Factor (OVSF) codes, allowing to mix in the same timeslot channels with different spreading factors while preserving the orthogonality. The OVSF codes can be defined using the code tree of figure 1.

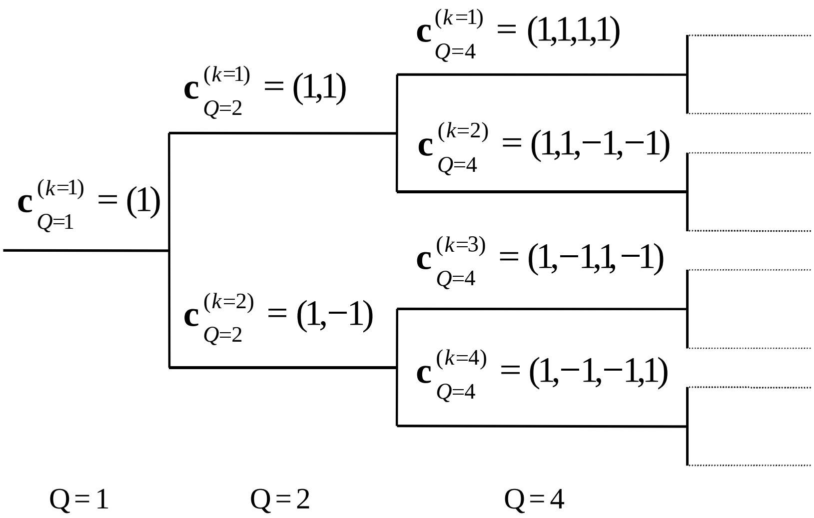


Figure 1: Code-tree for generation of Orthogonal Variable Spreading Factor (OVSF) codes for Channelisation Operation

Each level in the code tree defines a spreading factor indicated by the value of Q in the figure. All codes within the code tree cannot be used simultaneously in a given timeslot. A code can be used in a timeslot if and only if no other code on the path from the specific code to the root of the tree or in the sub-tree below the specific code is used in this timeslot. This means that the number of available codes in a slot is not fixed but depends on the rate and spreading factor of each physical channel.

The spreading factor goes up to Q_{MAX}=16.

~~6~~7.3 Scrambling codes

The spreading of data by a real valued channelisation code $\mathbf{c}^{(k)}$ of length Q_k is followed by a cell specific complex scrambling sequence $\underline{\mathbf{v}} = (\underline{v}_1, \underline{v}_2, \ldots, \underline{v}_{16})$. The elements $\underline{v}_i; i = 1,\ldots,16$ of the complex valued scrambling codes shall be taken from the complex set

$$\underline{V}_{\underline{v}} = \{1, j, -1, -j\} \tag{4}$$

In equation 4 the letter j denotes the imaginary unit. A complex scrambling code $\underline{\mathbf{v}}$ is generated from the binary scrambling codes $v = (v_1, v_2, \ldots, v_{16})$ of length 16 shown in Annex A. The relation between the elements $\underline{\mathbf{v}}$ and $\mathbf{v}$ is given by:

$$\underline{v}_i = (j)^i \cdot v_i \qquad v_i \in \{1, -1\}, \; i = 1,\ldots,16 \tag{5}$$

Hence, the elements $\underline{v}_i$ of the complex scrambling code $\underline{\mathbf{v}}$ are alternating real and imaginary.

The length matching is obtained by concatenating Q_{MAX}/Q_k spread words before the scrambling. The scheme is illustrated in figure 2 and is described in more detail in subclause 6.4.

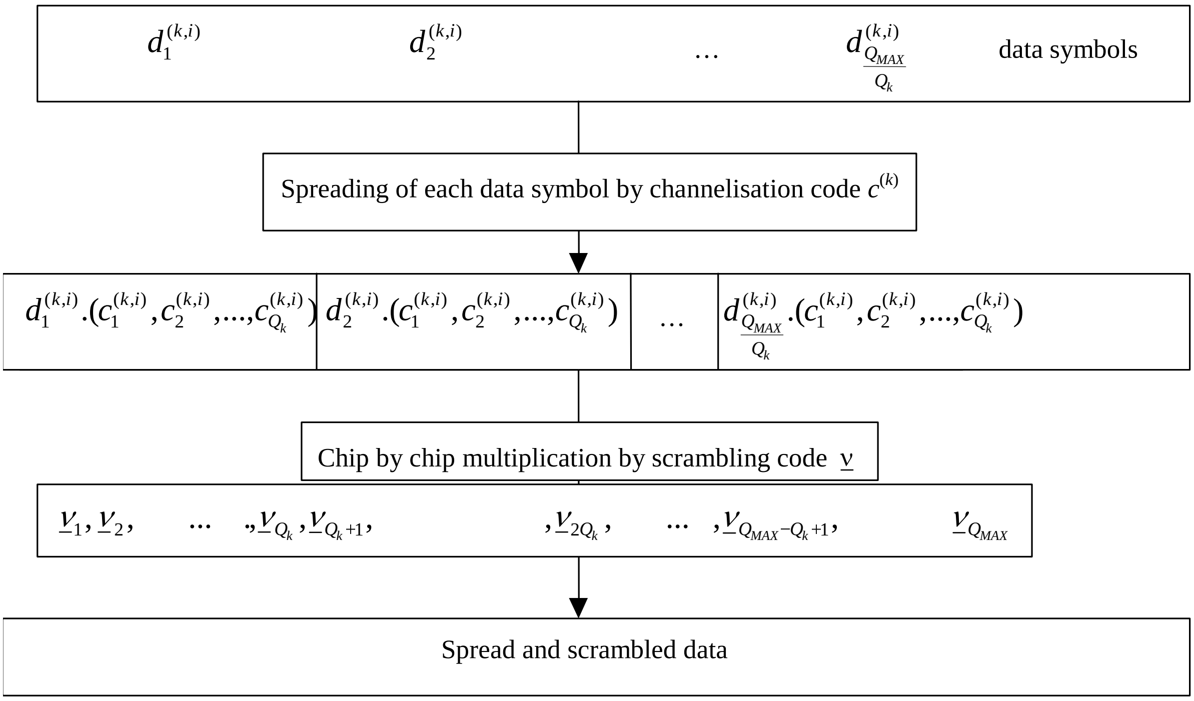


Figure 2: Spreading of data symbols

~~6~~7.4 Spread signal of data symbols and data blocks

The combination of the user specific channelisation and cell specific scrambling codes can be seen as a user and cell specific spreading code $\mathbf{s}^{(k)} = (s_p^{(k)})$ with

$$s_p^{(k)} = c^{(k)}_{1+[(p-1)\bmod Q_k]} \cdot \underline{v}_{1+[(p-1)\bmod Q_{MAX}]}, \quad k=1,\ldots,K,\; p=1,\ldots,N_k Q_k.$$

With the root raised cosine chip impulse filter $Cr_0(t)$ the transmitted signal belonging to the data block $\underline{\mathbf{d}}^{(k,1)}$ of equation 1 transmitted before the midamble is

$$\underline{d}^{(k,1)}(t) = \sum_{n=1}^{N_k} \underline{d}_n^{(k,1)} \sum_{q=1}^{Q_k} s_{(n-1)Q_k+q}^{(k)} \cdot Cr_o(t-(q-1)T_c-(n-1)Q_kT_c) \quad (6)$$

and for the data block $\underline{\mathbf{d}}^{(k,2)}$ of equation 1 transmitted after the midamble

$$\underline{d}^{(k,2)}(t) = \sum_{n=1}^{N_k} \underline{d}_n^{(k,2)} \sum_{q=1}^{Q_k} s_{(n-1)Q_k+q}^{(k)} \cdot Cr_0(t-(q-1)T_C-(n-1)Q_kT_c-N_kQ_kT_c-L_mT_c). \quad (7)$$

where L_m is the number of midamble chips.

~~6.5~~7.5 Modulation for the 3.84 Mcps option

The complex-valued chip sequence is QPSK modulated as shown in figure 3.

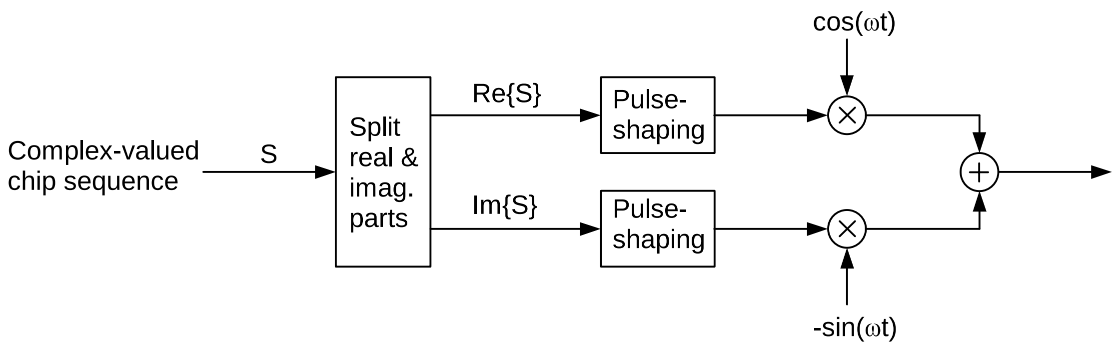


Figure 3: Modulation of complex valued chip sequences

The pulse-shaping characteristics are described in [9] and [10].

~~6~~7.5.1 Combination of physical channels in uplink

Figure 4 illustrates the principle of combination of two different physical uplink channels within one timeslot. The DPCHs to be combined belong to same CCTrCH, did undergo spreading as described in sections before and are thus represented by complex-valued sequences. First, the amplitude of all DPCHs is adjusted according to UL open loop power control as described in [10]. Each DPCH is then separately weighted by a weight factor γ_i and combined using complex addition. After combination of Physical Channels the gain factor β_j is applied, depending on the actual TFC as described in [10].

In case of different CCTrCH, principle shown in Figure 4 applies to each CCTrCH separately.

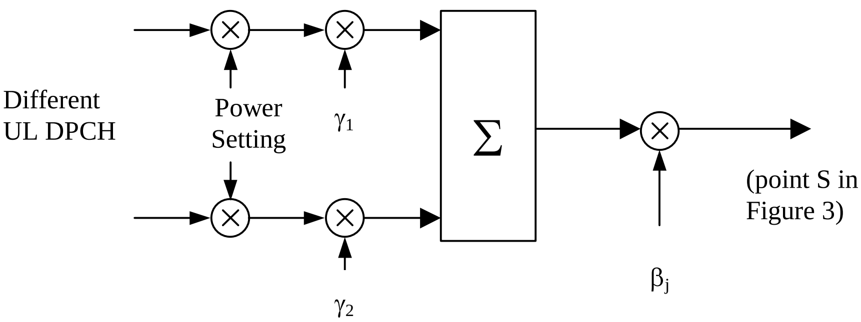


Figure 4: Combination of different physical channels in uplink

The values of weight factors γ_i are depending on the spreading factor SF of the corresponding DPCH:

SF of DPCH$_i$	γ_i
16	1
8	$\sqrt{2}$
4	2
2	$2\sqrt{2}$
1	4

The possible values for gain factors β_j (corresponding to *j*–th TFC) are listed in table below:

Signalling value for β_j	Quantized value β_j
15	16/8
14	15/8
13	14/8
12	13/8
11	12/8
10	11/8
9	10/8
8	9/8
7	8/8
6	7/8
5	6/8
4	5/8
3	4/8
2	3/8
1	2/8
0	1/8

~~6~~7.5.2 Combination of physical channels in downlink

Figure 5 illustrates how different physical downlink channels are combined within one timeslot. Each complex-valued spread channel is separately weighted by a weight factor G_i. If a timeslot contains the SCH, the complex-valued SCH, as described in [7] is separately weighted by a weight factor G_{SCH}. All downlink physical channels are then combined using complex addition.

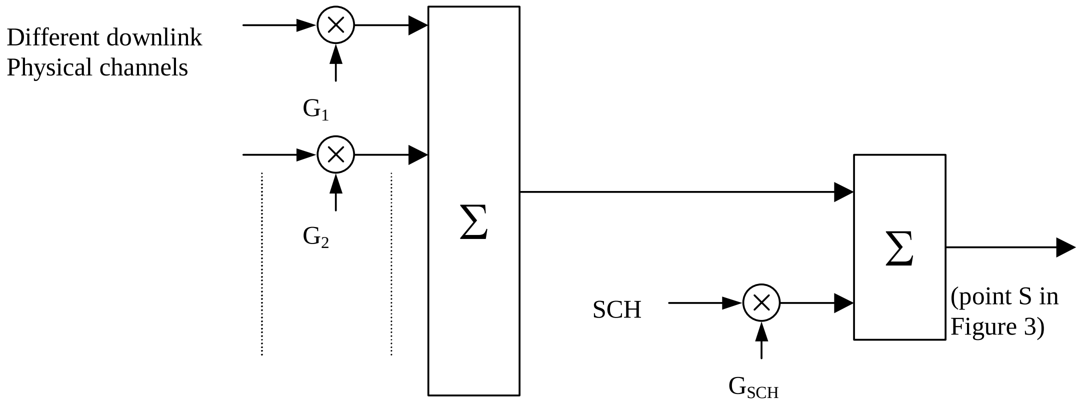


Figure 5: Combination of different physical channels in downlink in case of SCH timeslot

7.6 Modulation for the 1.28 Mcps option

The complex-valued chip sequence is modulated as shown in figure [6].

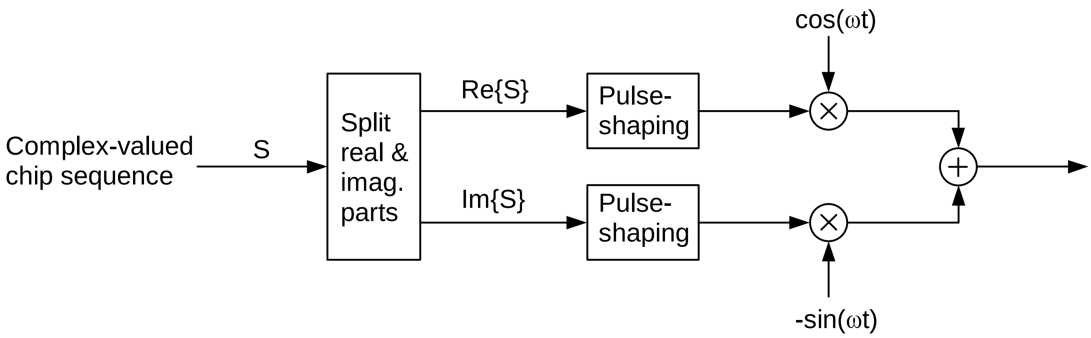


Figure [6]: Modulation of complex valued chip sequences

The pulse-shaping characteristics are described in [9] and [10].

7.6.1 Combination of physical channels in uplink

The combination of physical channels in uplink is the same as in the 3.84 Mcps TDD cf. [7.5.1 Combination of physical channels in uplink]

7.6.2 Combination of physical channels in downlink

Figure 7 illustrates how different physical downlink channels are combined within one timeslot. Each spread channel is separately weighted by a weight factor G_i.. All downlink physical channels are then combined using complex addition.

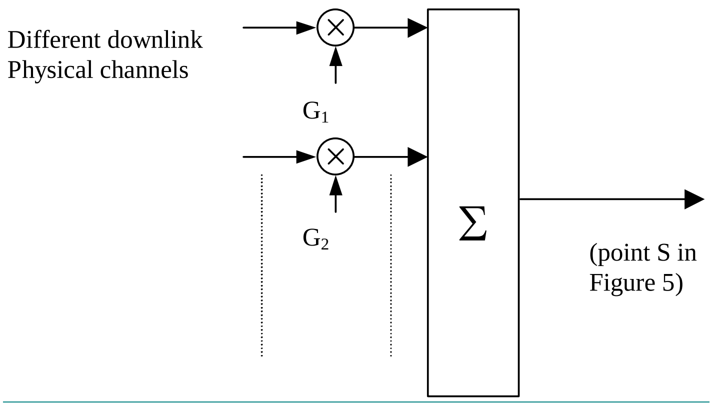


Figure 7: Combination of different physical channels in downlink

~~7~~8 Synchronisation codes for the 3.84 Mcps option

9 Synchronisation codes for the 1.28 Mcps option

9.1 The downlink pilot timeslot (DwPTS)

The contents of DwPTS is composed of 64 chips of a SYNC-DL sequence, cf.[B.1 Basic SYNC-DL sequence] and 32 chips of guard period (GP). The SYNC-DL code is not scrambled

There should be 32 different basic SYNC-DL codes for the whole system.

For the generation of the complex valued SYNC-DL codes of length 64 , the basic binary SYNC-DL codes $\mathbf{s} = (s_1, s_2, \ldots, s_{64})$ of length 64 shown in Table 9 are used. The relation between the elements $\underline{\mathbf{s}}$ and $\mathbf{s}$ is given by:

$$\underline{s}_i = (j)^i \cdot s_i \qquad s_i \in \{1, -1\} \quad i = 1, \ldots, 64 \qquad (1)$$

Hence, the elements $\underline{\mathbf{s}}_i$ of the complex SYNC-DL code $\underline{\mathbf{s}}$ are alternating real and imaginary.

The SYNC-DL is QPSK modulated and the phase of the SYNC-DL is used to signal the presence of the P-CCPCH in the multi-frame of the resource units of code $c_{Q=16}^{(k=1)}$ and $c_{Q=16}^{(k=2)}$ in time slot #0.

9.1.1 Modulation of the SYNC-DL

The SYNC-DL sequences are modulated with respect to the midamble ($m^{(1)}$) in time slot #0.

Four consecutive phases (phase quadruple) of the SYNC-DL are used to indicate the presence of the P-CCPCH in the following 4 sub-frames. In case the presence of a P-CCPCH is indicated, the next following sub-frame is the first sub-frame of the interleaving period. As QPSK is used for the modulation of the SYNC-DL, the phases 45, 135, 225, and 315° are used.

The total number of different phase quadruples is 2 (S1 and S2). A quadruple always starts with an even system frame number ((SFN mod 2) =0). Table 8 is showing the quadruples and their meaning.

Table 8: Sequences for the phase modulation for the SYNC-DL

Name	Phase quadruple	Meaning
S1	135, 45, 225, 135	There is a P-CCPCH in the next 4 sub-frames
S2	315, 225, 315, 45	There is no P-CCPCH in the next 4 sub-frames

9.2 The uplink pilot timeslot (UpPTS)

The contents in UpPTS is composed of 128chips of a SYNC-UL sequence, cf. [B.2 Basic SYNC-UL sequence] and 32chips of guard period (GP) .The SYNC-UL code is not scrambled.

There should be 256 different basic SYNC-UL codes (see Table 10) for the whole system.

For the generation of the complex valued SYNC-UL codes of length 128, the basic binary SYNC-UL codes $=(s_1, s_2, \ldots, s_{128})$ of length 128 shown in Table 10 are used. The relation between the elements $\underline{\mathbf{s}}$ and $\mathbf{s}$ is given by:

$$\underline{s}_i = (j)^i \cdot s_i \qquad s_i \in \{1, -1\}, \; i = 1, \ldots, 128 \qquad (2)$$

Hence, the elements $\underline{\mathbf{s}}_i$ of the complex SYNC-UL code $\underline{\mathbf{s}}$ are alternating real and imaginary.

9.3 Code Allocation

Relationship between the SYNC-DL and SYNC-UL sequences, the scrambling codes and the midamble codes

Code Group	Associated Codes			
	SYNC-DL ID	SYNC-UL ID	Scrambling Code ID	Basic Midamble Code ID
Group 1	0	0...7	0	0
			1	1
			2	2
			3	3
Group 2	1	8...15	4	4
			5	5
			6	6
			7	7
. . .				
Group 32	31	248...255	124	124
			125	125
			126	126
			127	127

Annex B (Normative) Synchronisation sequence

B.1 Basic SYNC-DL sequence

Table 9: Basic SYNC-DL Codes

Code ID	SYNC-DL Codes of length 64
0	B3A7CC05A98688E4
1	9D559BD290606791
2	2CE7BA12A017C3A2
3	34511D20672F4712
4	9A772841474603F2
5	9109B1A5CE01F228
6	8FD429B3594501C0
7	25251354AA3F8C19
8	C9A3B8E0C043EA56
9	BA04B888E5BC1802
10	A735354299370207
11	74C3C8DA4415AE51
12	F4FD0458A0124663
13	A011D4E16C3D6064
14	BDA0661B0CAA8C68
15	8E31123F28928698
16	F095C1632E2906AB
17	B60B4A8A664071CF
18	AA094DCCE91E041A
19	C0C31CDA8A256807
20	D516964FB18C1890
21	30DE01834F4AACCE
22	8F700323BA5CAD34
23	1B50F4DEE0C1380C
24	443382164F56F2D1
25	E1E4005D49B846B4
26	040A97165330BFAA
27	C48E26881693AD78
28	D4354B2FE02361CC
29	5383AB6C8A10CE84
30	D417A730F2F12244
31	ABF0A0D905A939C4

B.2 Basic SYNC-UL Codes

Table 10: Basic SYNC-UL Codes

Code ID	SYNC-UL Codes of length 128
0	C11C20F0D1807DB8859175B798EC094A
1	91278068081EC8E74543DBC1C9AD4235
2	38F5AEE2E513DB12A663BA04160103E5
3	7AA8A0A210F12A1E4332F2EDD33011FC
4	C180EA3B9BA1774EB9611BD249C4A508
5	B072A2C839489D496B98CE9D0132FBC9
6	B2723EAC6EB01667F2B33961C8074234
7	C4144AD060F0EC095E227B92CF7C8280
8	653036A10D3054146FCF815986C63A14
9	F899CA61435D64DC07FDF04C4A0C053A
10	B56F2D6893A8051407F4C341D88DC7DC
11	DC0BE838242142EDE6413A72C88D74AA
12	22A2FD86E4086C70A4860B13C76E579F
13	A3CBC21322C97D2A02728E7875F39588
14	D4EC4F694A082CB38E3B1558A0FCC89F
15	CC891141C4E216D235C15CF5D3F9B002
16	A1993114C50B77CB0C0725D1E22FD016
17	24F73A979DE52F82E8800CCB93842A59
18	8F878FA04659842E294D8DEAB20BA2FD
19	AC90B0442D70662B028CF76A6BECDF09
20	D94A284DF64D7B0102F0E084C29C88C8
21	8603200C7596F24E865FD3815693358D
22	B466B12CF433642BD8B08F1F452E0550
23	86A3A1772C1C99FCA7DBBA0C312E34A0
24	622A1889F72A9A2C042D46F08EFEE1AC
25	BF220A362BC0D3B0D7CE400954C6CFAE
26	D28D73C52E89CF57905C502244F63616
27	AD4E1C2103697D64D8B9D4C035D90548
28	8F081A9BA12B6C6BD024531AA984D21C
29	E4092429BE82988E1E3585BF6A6AE550
30	08BD36E0A9C061782CB38B35B335CA56
31	1CDFF3CC2685D1C44F4A1059AB03F40A
32	506ED4E88FB1CECE3243F2A27A0221A4
33	846CF58A7AB613C83A24130B5778C0E2
34	A2711A99E26A0C75AC026F4CFAECE893
35	D846EEEBA2432AC05A01043C62579DCF
36	6B16B4E851CAF2121FC4CF88820C89E7
37	AA4889A78207674A74E10C6F2BE11D48
38	8534CF8145BC991052814ED5C72709EE
39	01AEF15D2290A84A607425746D9963C7

40	999188F758245D5164FE16D852942C71
41	CF71C008599287E446E30745BD56E2D2
42	248414BA0DF8CDC4711FE7C8707ED0AD
43	EB2E263EC016191C81AB714BFE4D2B30
44	862082A7482FAC1C499793A0D8CED670
45	DE2C22B2783AB75A7342608DE413840A
46	E31AA60B727F2CA2A78DAAC10665011D
47	CEF6CD06509870AC9E0177ACD550921D
48	E52C84D499FFCDC287581691471540F2
49	B33BF6551A4322504BEE0930BCA1EC68
50	555BE6886D0FC43D72315E6C6D384148
51	8444F67451EE23CE1240C90F0B52A492
52	5C290D28E84060E69D09788A261B10FF
53	337E0C35E83CD38CCC5D45804241F952
54	A7879F0D31A8982A01EE6AC4952984DC
55	A37F506508928C70A83D69A2373781B9
56	42F55208EE12909803A7CBEB19B5419E
57	57E5E268A328FCC9ED04B9E5420AC702
58	EB033AD1222F84D8642C4E3FAAD28206
59	98EE1415F026AC0E862C520451697DD0
60	6A0528AEA4B7CD6702660D81F8821E19
61	763D626A87C603BCB09E1A4C800A378F
62	EEA61897879289340C23F669D6A03762
63	A6571B3CC2D0E04F017ACC808B92DCE7
64	DDF88B52EA1831D293A803CF23C8C471
65	6CA4D333A2684140475DAB491F61C17A
66	A7D2AD23043989A13289F7C3E135580A
67	B1C752FA66B41C81904EDE27EA000E2E
68	8694BE3CC1CB36BE2A095F89CC619080
69	9C20334E1BBC596B25E151180BF99940
70	484256214F81070DD9C49A2B05A43DCE
71	401A20BCBE29B7438A7AEE44635A9E23
72	8858585C3239CBF628033FA0DF189378
73	EFA36404C1BA5118CC5F9052FD28D9C3
74	155609873D8A042D496E6477B747C4F8
75	8446077883A6D7D2549CC9742E3FD023
76	E630142B189AA209371A6F0FFDBC30A7
77	C46060535AC6DBB2095F1D7826D0CD5C
78	E00D19E48797148B28DEDA9D429362E2
79	645DE447E938485489416CAFCC1C571F
80	DA10AFBF2AE61C593A1D88584DE30598
81	BB248AEA5FD3FE210CD48FC401E1A686
82	A89F146BD9191F445301C081CB6F5625
83	15BBF04F247C59150208949EB6B9CC58

84	08F48BFA7804B5B2CC2E96510232E062
85	9AA2BE74005A3679C626B209580B8D03
86	9D40664A2C808F2F293E255398B37E6A
87	6869C98A8AAD81CAE41A23C83FF9EEA0
88	576E8948E61BD0927C4140C3C04C4CF3
89	0F942C67A1137B6EAA058C2A74872C73
90	9D058E27ED546C10632684BBC84E5BC1
91	79D4B840E20148B134F90B51164BCBD0
92	0E35E1D8D1214C05FAC790B69B239150
93	FFA1BB0232CD71480BE5CA1C2A269F89
94	B2956F5F4E270446F9211584792628DB
95	F56CCA23421C8EC8F8A41F7DA4A41EA2
96	0B5ECA04F1789A7148C80C39D57D05F6
97	A10B538E8A8CFC8F8925C485F2A88660
98	9925C2C715001D9FC78ACCC51DA1AF34
99	0DAC9CFDEA40429A8B12C7D320D60F70
100	377FC9A097017958440914E83118E39D
101	8421096FA8B47E4E943B6473671955CC
102	574086183477C4F68540CB7E858263B1
103	895B6A8980C6703C779F49F40C5CFC19
104	D0D253E157BC19262150CEA668679E71
105	B8889C60EBA812BD7F0B6498823296D2
106	A13FB9F3A08528E44B13C12CF0D461AA
107	8D4DCFBE43D6E2024B1F8470224AA330
108	536D159E119E0893838657B12A074E64
109	DCFD49C504AD3A2F049A0CB70238EC8A
110	D363DB4C46C11757FA8FB18139789102
111	424A1E8A1D4DA256E4CA3BC8C2201BE3
112	417B619ED30FEB0A847CC3A191A20398
113	843FBBC95453C61786D1332612B45B4D
114	F26CACC0732CF8ED0C5BC1462B1620B4
115	88E0FE440C70E9249A92A7AF94638880
116	99A52B7D8C950308057E0661D7459960
117	A5C28218BF5D16E63E42698A0A6B0896
118	B2763BEEC784A12E8C50778536921806
119	987B2B6A3A77A059B30A082457AB84E0
120	820DB500F1B206358D7A7F210AB85AA8
121	97760A5CFC5E03EB439C914590045938
122	896A720E8857C8708A59F8C94DE0841E
123	2D101F0CF95263843412577340DEBB11
124	E8E5214B4DCF5D11A245B0149D49C87C
125	51224EAA10099ACDE384834A5ADF03D8
126	64E51253554A230C186FDE4E8781BC09
127	A499E391E69ED08890AC1A82A6115BEC

128	EE54C6E1834210D3EC1B07A456B92AA8
129	949DB5CA82420B54C1E0BCC111E704D9
130	9439EE9A9E4C447D1AA350926495047F
131	AD095CC0E7438AECE38D60980B3F2D00
132	83089C254C5EE9788072BC3D9282F798
133	A27DC1A457BC5A56563D8A9B11203615
134	713053A9C0B1B08B14705FF5A7244DB4
135	D36D4B9F4007354E0EC1B0CA8C8C7124
136	82E7C990612114F1CCE1BD9509FD4386
137	C8D83FF0B48B14830D2015D53F8C0672
138	08AF223C869A36B169148FDDABB7D120
139	B6C284C600AD0A99F86C449F8F4C53A6
140	DC741B320C07682AF92AC4DBDE0C28C2
141	89B8D84FA902265850C0FA6FF0EB2C4F
142	A69445B3A52201DB984BC03D1956D7F3
143	0FE0F7224B7AD72E4D4530D0223F590C
144	1B8C06F051434048EB925133AD3BD3F9
145	E133D4C3C942726A351300C37E55D0DF
146	9E09481D1881A66F562D8B453BC83AB2
147	2397B04B60A3C5700907BDBBA4E818C8
148	8F81F7A08CC6C8DA3D692AD34F50C012
149	9AB325352981BCCFA072F8FDE3009221
150	4FA88B7F1F8A620C31B0D486C52AC2F6
151	097AF0ADD16D7D39851049F0130EE444
152	A5027732DACFF11C388D5820A4A9BA49
153	1CD981EA2EDB46218A407C7E20D4BE84
154	D0FD94279FA67EC61A3904C0AD8ACA04
155	EA73A9415EC2004D49E9D0F645961C75
156	005AF0614A7552041194DEECBF8DD016
157	B514481533DA0A731705B93CF634E40D
158	983054521841A6E4FF34B2C07B5684FE
159	C46D927D0FD2B2F509550025677C6871
160	2AD85C08127487C87ECE014D65169102
161	0F617852FA3930AA7EE74B400B2CC831
162	AE9D395004C6E27540C378625D36E0D6
163	DC4FA55750F10B0636248F12C212FFE4
164	D3602B8D6CBF1809C88B827185631ECF
165	A94825850708E7723EA8F22C44BF78B2
166	A62D231C16AEEFE0B0026B306662945A
167	9C7BE810A86465A50551F89125D93B12
168	9712D9338B9CC60485C10172F50F121F
169	A3902CE0E0B9912591FF28C695728257
170	4167057891AB29473A9E0F67F3658921
171	B3368B91EC12A284BC414C8F0D7F8D20

172	EE21888101ABF06C1175828CB58B598D
173	E43923A00ECC32CCC2D162A4A44BD7F4
174	CC9E30B8538AD51703EEB6F70801AB22
175	B908AD2F1501DA1C156811736CD798CD
176	2B46302ACCC2F808797FC648A614326D
177	8A54494F1BE27235B8764023AA0FBCFA
178	BC1041E6F636421E89277DC154439103
179	275B39A63029B974E3561AE0A8FC8032
180	9283F6FE819B80492A22B85CE5CE5DC4
181	4CCB52C0CE058A78022C22DF5788CBCC
182	B0DF9608DE549A6F6C581516919A81E6
183	2CA185163CC36060D1E85BB0A7FBB988
184	66101D2846155CAC986FC790D2124EFC
185	8016E3904644D2093579B83BD7AB5071
186	531CAB7085BEC14257439658023647CF
187	DF2910165AA5051E41F6EB198E4D491C
188	BA32052042B0FB2188DE7857DA1B6788
189	9E6D075AFF0EA4153615E140BF380666
190	9ACC5A037902534642A3BE391AA40F9B
191	4D741A3B4499843010D7E5FA8988DC80
192	FA1421C96EDC6092726154560B1C2FC8
193	882946076223CAE0B0BFE3EDA59826D5
194	CEBB288C28B7472A0D3917012276C034
195	BD35A6E00C9528DB38289CF823C34F30
196	E2C93618B6B2800D51171A5F85746A55
197	B43EF39A1A64F0E220AF740F9494291B
198	AC537817C2612744A58132A8AFBC44A3
199	98A321249A821DDBF81C38235A371A14
200	AE1D46069090D81BB6B08FED9E687285
201	7EAE2415DC2CD60AE083249A33B56E05
202	3D942AAA9BC9F27289421CE0B301FB98
203	1548BA6D08530727AC6D059C005C6C42
204	FF47C21142C65B502DA70647BAE831D1
205	C83AA7FEAC5E51A08091E10DB0C233D9
206	E86EDD2EC2DAA3104229EDC43471A16A
207	22FAFB9C184B78B56EE91B6602C03244
208	E45631DC509B1290C08D2C1A1F15DBFE
209	D203C51207092B56568FDAD9E2D44473
210	2AA87F31A7D1AB1C90024F936006C4A5
211	913136153593DEABC7305BF0C5A62180
212	D8DA5FE401F2758642A082C53A6A5CB8
213	23C2295213147F324DE8EC1C103BAE88
214	883AF097FCDE82B366A1844245E0D727
215	79E5E9F8C933159ACADC22A06F900A70

216	FE40502B44A9E44B2C336250D47538CC
217	670452E19172C843176F1278FE41D584
218	B7EAA436078E6886A3024F593AD57580
219	1044D4CDD7230E7B1953AD1232DF07E2
220	4D821ECAC3D845A2E1011695624576FF
221	96622ED2FBD44D1B859D70601999F438
222	CCC31C3D6D5B41B8D82FF4522A4C0146
223	4A84F7CD62E0C712980E6A0C89BF394F
224	10E56751F000927284DBE174E68ECC4C
225	A3DE70921356F026E084CFE302A210A9
226	B12DA0621B343A8C3FE941A32EA5D571
227	D653135DE825A74B743E275C19020C71
228	5CAD301BF846B2EE921D33A3D4BB1220
229	1292445ACBB548C668FC3853578474E6
230	B94B4B89C0654688C9E007D9061DF5FE
231	75A2C91E76061A8680884E8BFD14A64A
232	83726F3070B47ECE21504A5065D74A36
233	964A471444A270840919F7FE07382D14
234	A582701EBFCA899B8497088C3560F300
235	64FCB63E21CAC63002D1E09FD1543274
236	B1E1C83F689ADF422C865F98D288838A
237	A06A0D822165D3F3416B47419ECCB547
238	1D2068039A32B7EF728914ECE07CB416
239	64C0CF81F78E8823ECC8661A5295422A
240	902A7243F593F2180E5A306A8438E6A9
241	A4CCED356D56BF1B41C28E1504301FE8
242	82AE90E2F76B3055A2E3A966025CC01A
243	8B90D5A62364E18574145C5895CEFF60
244	43F7EA1AB0D19032551AD9DE21307353
245	DD5D8424AC60360B1C14E65815C9B15E
246	C632A67382ECB2681DFB8525140E2878
247	3A6ACF212B6F8B9C53FF224C2E00C16C
248	86A90C267B1171093F362FE5CB14E3A0
249	EA262EC36E6589C3BB005426AF2590F4
250	200F03126C5B0D7B901128E7757C5F70
251	68FC090C2221AA98BF0D24E85066EFC2
252	9E26CEC67832FC42A87E92FA1015212E
253	ACD889634F79506F2582EA03240F2A07
254	AA65407E1F4A33BF9A62860A3D6A4CC0
255	B1B950AC76A608AA32D04B03C7FF24D3

Annex ~~B~~ C (informative): Generalised Hierarchical Golay Sequences

Annex ~~C~~ D (informative): Change history

CR-Form-v3

CHANGE REQUEST

⌘ **25.224 CR 047** ⌘ rev **1** ⌘ Current version: **3.5.0** ⌘

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

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

Title: ⌘	Inclusion of 1.28Mcps TDD in TS 25.224		
Source: ⌘	TSG RAN WG1		
Work item code: ⌘	LCRTDD-Phys	***Date:*** ⌘	28.02.2001
Category: ⌘	**B**	***Release:*** ⌘	REL-4
	Use one of the following categories: ***F*** *(essential correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(Addition of feature),* ***C*** *(Functional modification of feature)* ***D*** *(Editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *REL-4 (Release 4)* *REL-5 (Release 5)*

Reason for change: ⌘	Inclusion of 1.28 Mcps TDD
Summary of change: ⌘	• The basis for this document was CR047, R1-01-0224 • Contributions, which have been approved by WG1 at meeting #19 have been included in revision 1
Consequences if not approved: ⌘	

Clauses affected: ⌘	New section 5, new Annex D, new Annex A.3, A.4 and A.5	
Other specs affected: ⌘	[X] Other core specifications [ ] Test specifications [ ] O&M Specifications	⌘ 25.201, 25.221, 25.222, 25.223, 25.225
Other comments: ⌘		

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

4 Physical layer procedures for the 3.84 Mcps option(TDD)

5 Physical layer procedures for the 1.28 Mcps option

5.1 Transmitter Power Control

The basic purpose of power control is to limit the interference level within the system thus reducing the intercell interference level and to reduce the power consumption in the UE.

The main characteristics of power control are summarized in the following table.

Table 2: Transmit Power Control characteristics

	Uplink	**Downlink**
Power control rate	Variable Closed loop: 0-200 cycles/sec. Open loop: (about 200us – 3575us delay)	Variable Closed loop: 0-200 cycles/sec.
Step size	1,2,3 dB (closed loop)	1,2,3 dB (closed loop)
Remarks	All figures are without processing and measurement times	Within one timeslot the powers of all active codes may be balanced to within a range of 20 dB

Note: All codes within one timeslot allocated to the same CCTrCH use the same transmission power in case they have the same Spreading Factor.

5.1.1 Uplink Control

5.1.1.1 General limits

By means of higher layer signalling, the Maximum_Allowed_UL_TX_ power for uplink may be set to a value lower than what the terminal power class is capable of. The total transmit power shall not exceed the allowed maximum. If this would be the case, then the transmit power of all uplink physical channels in a timeslot is reduced by the same amount in dB.

5.1.1.2 UpPTS

Open loop power control is used for UpPTS.

The transmit power level by a UE on the UpPTS shall be calculated based on the following equation:

$$P_{UpPTS} = L_{P\text{-}CCPCH} + PRX_{UpPTS,des}$$

where, P_{UpPTS} : transmit power level in dBm,

$L_{P\text{-}CCPCH}$: measured path loss in dB (P-CCPCH reference transmit power level is broadcast on BCH),

$PRX_{UpPTS,des}$: desired RX power level at cell's receiver in dBm, which is an average value and is broadcast on BCH.

5.1.1.3 PRACH

In 1.28Mcps TDD, the F-PACH is the response of a node B to the SYNC-UL burst of the UE. The response, a one burst long message, shall bring besides the acknowledgement to the received SYNC-UL burst, the timing and power level indications to prepare the transmission of the RACH burst.

The transmit power level on the PRACH is calculated by the following equation:

$$P_{PRACH} = L_{P\text{-}CCPCH} + PRX_{PRACH,des}$$

Where, P_{PRACH} is the UE transmit power level on the PRACH;

$PRX_{PRACH,des}$ is the desired receive power level on the PRACH, which is signalled by the higher layer signalling on the F-PACH.

5.1.1.4 DPCH and PUSCH

The closed loop power control makes use of layer 1 symbol in the DPCH. The power control step can take the values 1,2,3 dB within the overall dynamic range 80dB. The initial transmission power of the uplink Dedicated Physical Channel is signalled by the UTRAN.

Closed-loop TPC is based on SIR and the TPC processing procedures are described in this section.

The node B should estimate signal-to-interference ratio SIR_{est} of the received uplink DPCH. The node B should then generate TPC commands and transmit the commands according to the following rule: if $SIR_{est} > SIR_{target}$ then the TPC command to transmit is "down", while if $SIR_{est} < SIR_{target}$ then the TPC command to transmit is "up".

At the UE, soft decision on the TPC bits is performed, and when it is judged as ‘down’, the mobile transmit power shall be reduced by one power control step, whereas if it is judged as ‘up’, the mobile transmit power shall be raised by one power control step. A higher layer outer loop adjusts the target SIR. This scheme allows quality based power control.

The closed loop power control procedure for UL DPCH is not affected by the use of TSTD.

An example of UL power control procedure for DPCH is given in Annex A.3.

5.1.1.4.1 Out of synchronization handling

Same as that of 3.84Mcps TDD, cf.[4.2.2.3.3 Out of synchronisation handling].

5.1.2 Downlink Control

5.1.2.1 P-CCPCH

Same as that of 3.84Mcps TDD, cf.[4.2.3.1 P-CCPCH].

5.1.2.2 The power of the F-PACH

The transmit power for the F-PACH is set by the higher layer signalling.

5.1.2.3 S-CCPCH, PICH

Same as that of 3.84Mcps TDD, cf.[4.2.3.2 S-CCPCH , PICH].

5.1.2.4 DPCH, PDSCH

The initial transmission power of the downlink Dedicated Physical Channel is set by the higher layer signalling until the first UL DPCH arrives. After the initial transmission, the node B transits into SIR-based closed-loop TPC.

The UE should estimate signal-to-interference ratio SIR_{est} of the received downlink DPCH. The UE should then generate TPC commands and transmit the commands according to the following rule: if $SIR_{est} > SIR_{target}$ then the TPC command to transmit is "down", while if $SIR_{est} < SIR_{target}$ then the TPC command to transmit is "up".

At the Node B, soft decision on the TPC bits is performed, and when it is judged as ‘down’, the transmission power shall be reduced by one power control step, whereas if judged as ‘up’, the transmission power shall be raised by one power control step.

When TSTD is applied, the UE can use two consecutive measurements of the received SIR in two consecutive sub-frames to generate the power control command. An example implementation of DL power control procedure for 1.28 Mcps TDD when TSTD is applied is given in Annex A.4.

5.1.2.3.1 out of synchronisation handling

Same as that of 3.84Mcps TDD, cf.[4.2.3.3.1 Out of synchronisation handling].

5.2 UL Synchronisation

5.2.1 General Description

Support of UL synchronization is mandatory for the UE.

5.2.1.1 Preparation of uplink synchronization (downlink synchronization)

When a UE is powered on, it first needs to establish the downlink synchronisation with the cell. Only after the UE has established the downlink synchronisation, it shall start the uplink synchronisation procedure.

5.2.1.2 Establishment of uplink synchronization

The establishment of uplink synchronization is done during the random access procedure and involves the UpPCH and the PRACH.

Although the UE can receive the downlink signal from the Node B, the distance to Node B is still uncertain. This would lead to unsynchronised uplink transmission. Therefore, the first transmission in the uplink direction is performed in a special time-slot UpPTS to reduce interference in the traffic time-slots.

The timing used for the UpPCH is set e.g. according to the received power level of DwPCH and/or P-CCPCH.

After the detection of the SYNC-UL sequence in the searching window, the Node B will evaluate the timing, and reply by sending the adjustment information to the UE to modify its timing for next transmission. This is done with the FPACH within the following 4 sub-frames. After sending the PRACH the uplink synchronization is established. The uplink synchronisation procedure shall also be used for the re-establishment of the uplink synchronisation when uplink is out of synchronisation.

5.2.1.3 Maintenance of uplink synchronisation

Uplink synchronization is maintained in 1.28Mcps TDD by sending the uplink advanced in time with respect to the timing of the received downlink.

For the maintenance of the uplink synchronization, the midamble field of each uplink burst can be used.

In each uplink time slot the midamble for each UE is different. The Node B may estimate the timing by evaluating the channel impulse response of each UE in the same time slot. Then, in the next available downlink time slot, the Node B will signal Synchronisation Shift (SS) commands to enable the UE to properly adjust its Tx timing.

5.2.2 UpPCH

Open loop uplink synchronisation control is used for UpPCH.

The UE may estimate the propagation delay Δt_p based upon the path loss using the received P-CCPCH and/or DwPCH power.

The UpPCH is sent to the Node B advanced in time according to the timing of the received DwPCH. The time of the beginning of the UpPCH $T_{TX\text{-}UpPCH}$ is given by:

$T_{TX\text{-}UpPCH} = T_{RX\text{-}DwPCH} - 2\Delta t_p + 12*16\ T_C$

in multiple of 1/8 chips, where

$T_{TX\text{-}UpPCH}$ is the beginning time of UpPCH transmission with the UE's timing,

$T_{RX\text{-}DwPCH}$ is the received beginning time of DwPCH with the UE's timing,

$2\Delta t_p$ is the timing advance of the UpPCH ($UpPCH_{ADV}$).

5.2.3 PRACH

The Node B shall measure the received SYNC-UL timing deviation $UpPCH_{POS}$. $UpPCH_{POS}$ is sent in the FPACH and is represented as an 11 bit number (0-2047) being the multiple of 1/8 chips which is nearest to received position of the UpPCH.

Time of the beginning of the PRACH $T_{TX\text{-}PRACH}$ is given by:

$$T_{TX\text{-}PRACH} = T_{RX\text{-}PRACH} - (UpPCH_{ADV} + UpPCH_{POS} - 8*16\ T_C)$$

in multiple of 1/8 chips, where

$T_{TX\text{-}PRACH}$ is the beginning time of PRACH transmission with the UE's timing,

$T_{RX\text{-}PRACH}$ is the beginning time of PRACH reception with the UE's timing if the PRACH was a DL channel.

5.2.4 DPCH and PUSCH

The closed loop uplink synchronisation control uses layer 1 symbols (SS commands) for DPCH and PUSCH. After establishment of the uplink synchronisation, NodeB and UE start to use the closed loop UL synchronisation control procedure. This procedure is continuous during connected mode.

The Node B will continuously measure the timing of the UE and send the necessary synchronisation shift commands in each sub-frame. On receipt of these synchronisation shift commands the UE shall adjust the timing of its transmissions accordingly, in steps of ±k/8 chips or do nothing, each M sub-frames.

The default value of M (1-8) and k (1-8) is broadcast in the BCH. The value of M and k can also be adjusted during call setup or readjusted during the call.

During a 1.28 Mcps TDD to 1.28 Mcps TDD hand-over the UE shall transmit in the new cell with timing advance TA adjusted by the relative timing difference Δt between the new and the old cell:

$$TA_{new} = TA_{old} + 2\Delta t.$$

5.2.4.1 Out of synchronization handling

Same as that of 3.84Mcps TDD, cf.[4.2.2.3.3 Out of synchronisation handling.]

5.3 Synchronisation procedures

5.3.1 Cell search

During the initial cell search, the UE searches for a cell. It then determines the DwPTS synchronisation, scrambling code and basic midamble code, control multi-frame synchronisation and then reads the BCH. How cell search is typically done is described in Annex D.

5.3.2 DCH synchronization

The DPCH synchronisation is the same as that of 3.84Mcps TDD, cf. [4.4.2 Dedicated channel synchronisation].

5.4 Discontinuous transmission (DTX) of Radio Frames

DTX is the same as in the 3.84 Mcps TDD option, cf. [4.5 Discontinuous transmission (DTX) of Radio Frames]. The special burst is transmitted in both consecutive subframes (subframe#1 and #2).

5.5 Downlink Transmit Diversity

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

5.5.1 Transmit Diversity for DPCH

Closed loop Transmit Diversity or Time Switched Transmit Diversity (TSTD) may be employed as transmit diversity scheme for downlink DPCH.

5.5.1.1 TSTD for DPCH

TSTD can be employed as transmit diversity scheme for downlink DPCH. An example for the transmitter structure of the TSTD transmitter is shown in figure [6]. Channel coding, rate matching, interleaving, bit-to-symbol mapping, spreading, and scrambling are performed as in the non-diversity mode. Then the data is time multiplexed with the midamble sequence. Then, after pulse shaping, modulation and amplification, DPCH is transmitted from antenna 1 and antenna 2 alternately every sub-frame. Not all DPCH in the sub-frame need to be transmitted on the same antenna and not all DPCH within a sub-frame have to use TSTD. Figure [7] shows an example for the antenna switching pattern for the transmission of DPCH for the case that all physical channels are transmitted with TSTD and are using the same antenna in the sub-frame.

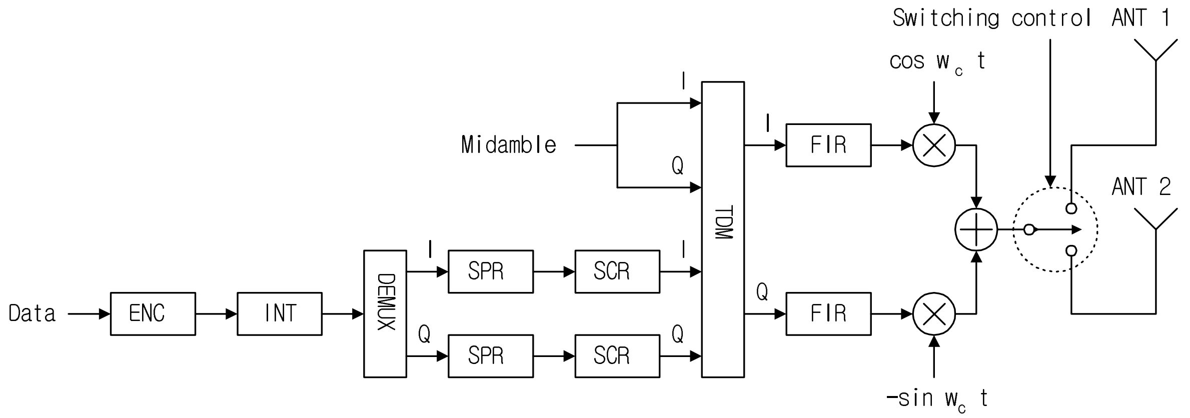

Figure [6]: Example for TSTD Transmitter structure for DPCH and P-CCPCH.

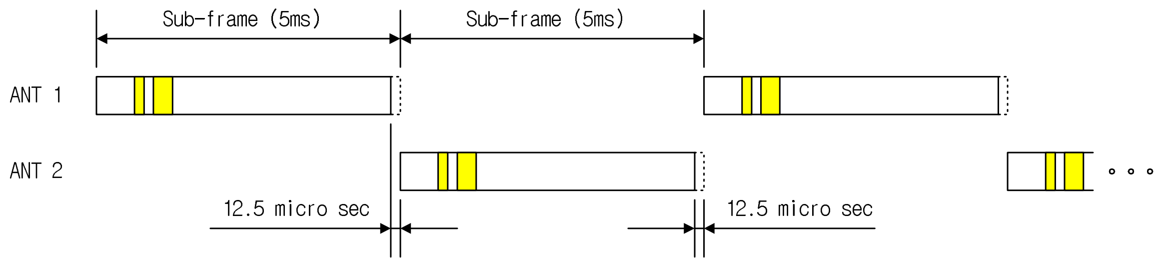

Figure [7]: Example for the antenna swithing pattern for TSTD transmission of DPCH and P-CCPCH: all physical channels are transmitted with TSTD and are using the same antenna in the sub-frame.

5.5.1.2 Closed Loop Tx Diversity for DPCH

The transmitter structure to support transmit diversity for DPCH transmission is shown in figure [8]. Channel coding, interleaving and spreading are done as in non-diversity mode. The spread complex valued signal is fed to both TX antenna branches, and weighted with antenna specific weight factors w_1 and w_2. The weight factors are complex valued signals (i.e., $w_i = a_i + jb_i$), in general. These weight factors are calculated on a per slot and per user basis.

The weight factors are determined by the UTRAN.

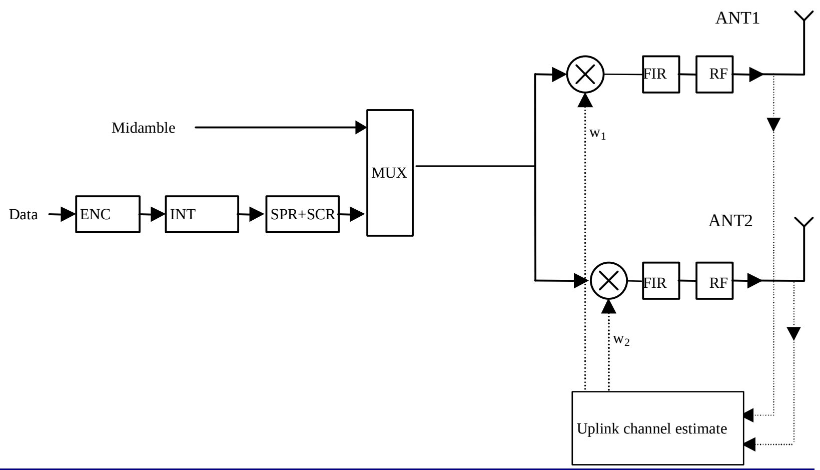

Figure [8]: Downlink transmitter structure to support Transmit Diversity for DPCH transmission (UTRAN Access Point) in 1.28Mcps TDD

5.5.2 Transmit Diversity for DwPTS

The transmitter structure to support transmit diversity for DwPCH transmission is shown in figure [9]. DwPCH is transmitted from antenna 1 and antenna 2 alternatively.

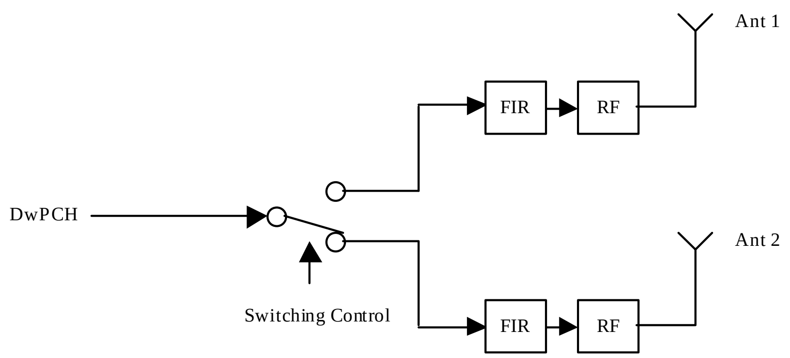

Figure [9]: Downlink transmitter structure to support Transmit Diversity for DwPCH transmission (UTRAN Access Point) in 1.28Mcps TDd

5.5.3 Transmit Diversity for P-CCPCH

TSTD or Block Space Time Transmit Diversity (Block STTD) can be employed as transmit diversity scheme for the Primary Common Control Physical Channel (P-CCPCH)

5.5.3.1 TSTD Transmission Scheme for P-CCPCH

A block diagram of an example of a TSTD transmitter is shown in figure [6]. Channel coding, rate matching, interleaving, bit-to-symbol mapping, spreading, and scrambling are performed as in the non-diversity mode. Then the data is time multiplexed with the midamble sequence. Then, after pulse shaping and modulation and amplification, P-CCPCH is transmitted from antenna 1 and antenna 2 alternately every sub-frame. If there is a DPCH that uses TSTD, TSTD is also applied to P-CCPCH. An example of the antenna-switching pattern is shown in figure [7].

5.5.3.2 Block STTD Transmission Scheme for P-CCPCH

The open loop downlink transmit diversity employs a Block Space Time Transmit Diversity scheme (Block STTD).

A block diagram of the Block STTD transmitter is shown in figure [10]. Before Block STTD encoding, channel coding, rate matching, interleaving and bit-to-symbol mapping are performed as in the non-diversity mode.

Block STTD encoding is separately performed for each of the two data fields present in a burst (each data field contains N data symbols). For each data field at the encoder input, 2 data fields are generated at its output, corresponding to each of the diversity antennas. The Block STTD encoding operation is illustrated in figure [11], where the superscript * stands for complex conjugate. If N is an odd number, the first symbol of the block shall not be STTD encoded and the same symbol will be transmitted with equal power from both antennas.

After Block STTD encoding both branches are separately spread and scrambled as in the non-diversity mode.

The use of Block STTD encoding will be indicated by higher layers.

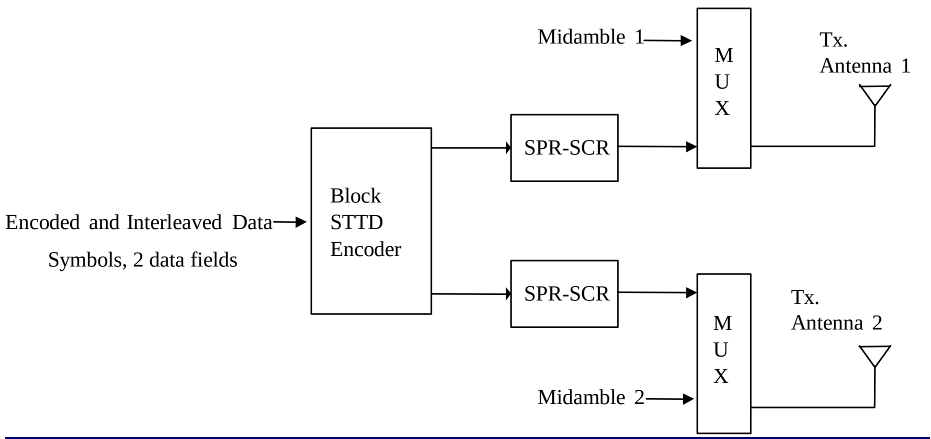

Figure [10]: Block Diagram of the transmitter (STTD) in 1.28Mcps TDD

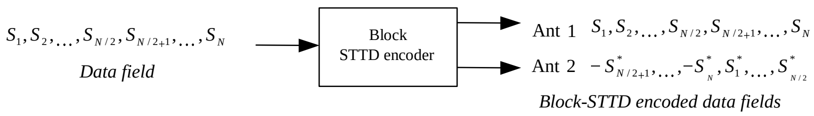

Figure [11]: Block Diagram of Block STTD encoder in 1.28Mcps TDD.

The symbols S_i are QPSK. N is the length of the block to be encoded.

5.6 Random Access Procedure

The physical random access procedure described below is invoked whenever a higher layer requests transmission of a message on the RACH. The physical random access procedure is controlled by primitives from RRC and MAC.

5.6.1 Definitions

$FPACH_i$: FPACH number i

L_i : Length of RACH message associated to $FPACH_i$ in sub-frames

N_{RACHi} : The number of PRACHs associated to the i^{th} FPACH

n_{RACHi} : The number of a PRACH associated to the i^{th} FPACH ranging from 0 to N_{RACHi}-1

M : Maximum number transmissions in the UpPCH

WT : Maximum number of sub-frames to wait for the network acknowledgement to a sent signature

SFN' : The sub-frame number counting the sub-frames. At the beginning of the frame with the system frame number SFN=0 the sub-frame number is set to zero.

5.6.2 Preparation of random access

When the UE is in Idle mode, it will keep the downlink synchronisation and read the cell broadcast information. From the used SYNC-DL code in DwPCH, the UE will get the code set of 8 SYNC-UL codes (signatures) assigned to UpPCH for random access.

The description (codes, spreading factor, midambles, time slots) of the P-RACH, FPACH, and S-CCPCH (carrying the FACH logical channel) channel is broadcast on the BCH.

Thus, when sending a SYNC-UL sequence, the UE knows which FPACH resources, P-RACH resources and CCPCH resources will be used for the access.

The UE needs to decode the BCH information regarding the random access prior to transmission on the UpPCH.

The physical random access procedure described in this sub-clause is initiated upon request of a PHY-Data-REQ primitive from the MAC sub-layer (see [18] and [19]).

Before the physical random-access procedure can be initiated, Layer 1 shall receive the following information by a CPHY-TrCH-Config-REQ from the RRC layer:

- The association between which signatures and which FPACHs; which FPACHs and which PRACHs; which PRACHs and which CCPCHs; including the parameter values for each listed physical channel.
- The length L_i of a RACH message associated to $FPACH_i$ can be configured to be either 1 or 2 or 4 sub-frames corresponding to a length in time of either 5 ms or 10 ms or 20 ms.

  NOTE 1: N_{RACHi} PRACHs can be associated with to $FPACH_i$. The maximum allowed N_{RACHi} is L_i.
- The available UpPCH sub-channels for each Access Service Class (ASC);

  NOTE 2: An UpPCH sub-channel is defined by a (sub-set of) signature(s) and sub-frame numbers.
- The set of Transport Format parameters for the PRACH message;
- The “M” maximum number transmissions in the UpPCH;
- The “WT” maximum number of sub-frames to wait for the network acknowledgement to a sent signature; (1..4) the maximum value supported by Layer 1 is 4 sub-frames.
- The initial signature power “Signature_Initial_Power”;

NOTE 2: The above parameters may be updated from higher layers before each physical random access procedure is initiated.

At each initiation of the physical random access procedure, Layer 1 shall receive the following information from the higher layers (MAC):

- The Transport Format to be used for the specific PRACH message;
- The ASC for the specific Random Access procedure with the timing and power level indication;
- The data to be transmitted (Transport Block Set).

5.6.3 Random access procedure

The physical random-access procedure shall be performed as follows:

UE side:

1 Set the Signature Re-Transmission Counter to M.

2 Set the Signature transmission power to Signature_Initial_Power.

3 Randomly select the UpPCH sub-channel from the available ones for the given ASC. The random function shall be such that each of the allowed selections is chosen with equal probability.

4 Transmit a signature using the selected UpPCH sub-channel at the signature transmission power.

5 After sending a signature, listen to the relevant FPACH for the next WT sub-frames to get the network acknowledgement. The UE will read the $FPACH_i$ associated to the transmitted UpPCH only in the sub-frames fulfilling the following relation:

$(SFN' \bmod L_i)=n_{RACHi}$; $n_{RACHi}=0,\ldots, N_{RACHi}-1,$

6 In case no valid answer is detected in the due time: decrease the Signature Re-transmission counter by one and if it is still greater than 0, then repeat from step 3; else report a random access failure to the MAC sub-layer.

7 In case a valid answer is detected in the due time

a) set the timing and power level values according to the indication received by the network in the $FPACH_i$

b) send at the sub-frame coming 2 sub-frames after the one carrying the signature acknowledgement, the RACH message on the relevant PRACH. In case L_i is bigger than one and the sub-frame number of the acknowledgement is odd the UE will wait one more sub-frame. The relevant PRACH is the n_{RACHi} th PRACH associated to the $FPACH_i$ if the following equation ifs fulfilled:

$(SFN' \bmod L)=n_{RACHi}$;

Here SFN' if the sub-frame number of the arrival of the acknowledgement.

Both on the UpPCH and on the PRACH, the transmit power level shall never exceed the indicated value signalled by the network.

Network side:

- The node B will transmit the $FPACH_i$ associated the transmitted UpPCH only in the sub-frames fulfilling the following relation:

$(SFN' \bmod L)=n_{RACHi}$; $n_{RACHi}=0,\ldots, N_{RACHi}-1,$

- The Node B will not acknowledge UpPCHs transmitted more than WT sub-frames ago

At the reception of a valid signature:

- Measure the timing deviation with respect to the reference time T_{ref} of the received first path in time from the UpPCH and acknowledge the detected signature sending the FPACH burst on the relevant FPACH.

For examples on the random access procedure refer to Annex E.

5.6.3.1. The use and generation of the information fields transmitted in the FPACH

The Fast Physical Access CHannel (FPACH) is used by the Node B to carry, in a single burst, the acknowledgement of a detected signature with timing and power level adjustment indication to a user equipment.

The length and coding of the information fields is explained in TS25.221 sub-clause 6.3.3.1.

5.6.3.1.1 Signature Reference Number

The Signature Reference Number field contains the number of the acknowledged signature.The user equipment shall use this information to verify whether it is the recipient of the FPACH message.

5.6.3.1.2 Relative Sub-Frame Number

The Relative Sub-Frame Number field indicates the current sub-frame number with respect to the sub-frame at which the acknowledged signature has been detected.

The user equipment shall use this information to verify whether it is the recipient of the FPACH message.

5.6.3.1.3 Received starting position of the UpPCH (UpPCH$_{POS}$)

The *received starting position of the UpPCH (UpPCH$_{POS}$)* field indirectly indicates to the user equipment the timing adjustment it has to implement for the following transmission to the network. The node B computes the proper value for this parameter according to the following rules: UpPCH$_{POS}$ = UpPTS$_{Rxpath}$ - UpPTS$_{TS}$
where
UpPTS$_{Rxpath}$: time of the reception in the Node B of the SYNC-UL to be used in the uplink synchronization process
UpPTS$_{TS}$: time instance two symbols prior to the end of the DwPCH according to the Node B internal timing

This information shall be used by the UE to adjust its timing when accessing the network, as described in section [5.2 'Uplink Synchronisation'] .

5.6.3.1.4 Transmit Power Level Command for the RACH message

This field indicates to the user equipment the power level to use for the RACH message transmission on the FPACH associated P-RACH.

The network may set this value based on the measured interference level (I) (in dBm) on the specific PRACH and on the desired signal to interference ratio (SIR) (in dB) on this channel as follows:

*Transmit Power Level Command for the PRACH(*PRX$_{PRACH,des}$*)*

PRX$_{PRACH,des}$ is the desired receive power level on the PRACH.

The UE shall add to this value the estimated path-loss to compute the power level to transmit for the PRACH.

5.6.4 Random access collision

When a collision is very likely or in bad propagation environment, the Node B does not transmit the FPACH or cannot receive the SYNC-UL. In this case, the UE will not get any response from the Node B. Thus the UE will have to adjust its Tx time and Tx power level based on a new measurement and send a SYNC-UL again after a random delay.
Note that at each (re-)transmission, the SYNC-UL sequence will be randomly selected again by the UE.

Note : Due to the two-step approach a collision most likely happens on the UpPCH. The RACH RUs are virtually collision free. This two-step approach will guarantee that the RACH RUs can be handled with conventional traffic on the same UL time slots.

Annex A (informative): Power Control

A.1 An Example for Calculating α

This annex presents an example for calculating the path loss weighting parameter for open loop power control α.

α can be calculated as α = 1-(D-1)/6 where D is the delay, expressed in number of slots, between the uplink slot and the most recent downlink slot. Note that α=1 for a delay of one slot (minimal delay), and α=0 for a delay of 7 slots (maximal delay).

A.2 Example Implementation of Downlink Power Control in the UE

The measurement of received SIR shall be carried out periodically at the UE. When the measured value is higher than the target SIR value, TPC command = "down". When this is lower than or equal to the target SIR value, TPC command = "up".

In case of a downlink transmission pause on the DPCH or PDSCH, the receive power (RSCP) of the data can no longer be used for inner loop SIR calculations in the UE. In this casevthe UE should trace the fluctuations of the pathloss based on the P-CCPCH and use these values instead for generating the TPC commands. This pathloss together with the timeslot ISCP measurement in the data timeslot, which is ongoing, should be used to calculate a virtual SIR value:

$$SIR_{virt}(i) = RSCP_{virt}(i) - ISCP(i),$$

$$RSCP_{virt}(i) = RSCP_0 + L_0 - L(i) + \sum_{k=1}^{i-1} TPC(k),$$

RSCP: Received signal code power in dB

ISCP: Interference signal code power in the DPCH / PDSCH timeslot in dB

L: pathloss in dB measured on the P-CCPCH. The same weighting of the long- and short-term pathloss should be used as for uplink open loop power control, see Annex A.1

i: index for the frames during a transmission pause, $1 \le i \le$ number of frames in the pause

L_0: weighted pathloss in the last frame before the transmission pause

$RSCP_0$: RSCP of the data that was used in the SIR calculation of the last frame before the pause

TPC (k): ± power control stepsize in dB according to the TPC bit generated and transmitted in frame k, TPC bit "up" = +stepsize, TPC bit "down" = –stepsize

A.3 Example Implementation of Closed Loop Uplink Power Control in Node B for 1.28 Mcps TDD

The measurement of received SIR shall be carried out periodically at Node B. When the measured value is higher than the target SIR value, TPC command = “down”. When the measurement is lower than or equal to the target SIR, TPC command = “up”.

In case of an uplink transmission pause on DPCH, the initial uplink transmission power of DPCH after the pause can be determined by an open loop power control. After the initial transmission after the pause, a closed loop uplink power control procedure can resume.

A.4 Example Implementation of Downlink Power Control in UE for 1.28 Mcps TDD when TSTD is used

When TSTD is applied, the UE can use the consequtive measurements of SIR to calculate SIR_{AVG}:

$$SIR_{AVG}(i) = w_1 \Delta SIR(i-1) + w_2 \Delta SIR(i),$$

where, $w_1 + w_2 = 1$, $w_1 >= 0$, $w_2 >= 0$, and SIR(i) is the measurement of SIR in sub-frame i and $SIR_{AVG}(i)$ is the measurement of SIR_{AVG} in sub-frame i. If SIR_{AVG} is greater than the target SIR value, TPC command = "down". If the SIR_{AVG} is smaller than the target SIR value, TPC command = "up".

In case of a downlink transmission pause on the DPCH, the example in Annex A.2 can be used for DL power control with $RSCP_{virt}(i)$ and ISCP(i) replaced by $RSCP_{AVG}(i)$ and $ISCP_{AVG}(i)$, where

$$RSCP_{AVG}(i) = w_1 \Delta\ RSCP_{virt}(i-1) + w_2 \Delta\ RSCP_{virt}(i),$$

$$ISCP_{AVG}(i) = w_1 \Delta\ ISCP(i-1) + w_2 \Delta\ ISCP(i).$$

A.5 Example Implementation of open Loop Power Control for access procedure for 1.28 Mcps TDD

The higher layer signals (on BCH) a power increment that is applied only for the access procedure. At each new transmission of a SYNC-UL burst during the access procedure, the transmit power level can be increased by this power increment.

Annex C (informative): Cell search procedure for 3.84Mcps TDD

Annex D (informative): Cell search procedure for 1.28Mcps TDD

During the initial cell search, the UE searches for a cell. It then determines the DwPTS synchronization, scrambling and basic midamble code identification, control multi-frame synchronisation and then reads the contents in BCH. This initial cell search is carried out in 4 steps:

Step 1: Search for DwPTS

During the first step of the initial cell search procedure, the UE uses the SYNC-DL (in DwPTS) to acquire DwPTS synchronization to a cell. This is typically done with one or more matched filters (or any similar device) matched to the received SYNC-DL which is chosen from PN sequences set. A single or more matched filter (or any similar device) is used for this purpose. During this procedure, the UE needs to identify which of the 32 possible SYNC-DL sequences is used.

Step 2: Scrambling and basic midamble code identification

During the second step of the initial cell search procedure, the UE receives the midamble of the P-CCPCH.The P-CCPCH is followed by the DwPTS. In the 1.28Mcps TDD each DwPTS code corresponds to a group of 4 different basic midamble code. Therefore there are total 128 midamble codes and these codes are not overlapping with each other. Basic midamble code number divided by 4 gives the SYNC-DL code number. Since the SYNC-DL and the group of basic midamble codes of the P-CCPCH are related one by one (i.e, once the SYNC-DL is detected, the 4 midamble codes can be determined), the UE knows which 4 basic midamble codes are used. Then the UE can determine the used basic midamble code using a try and error technique. The same basic midamble code will be used throughout the frame. As each basic midamble code is associated with a scrambling code, the scrambling code is also known by that time. According to the result of the search for the right midamble code, UE may go to next step or go back to step 1.

Step 3: Control multi-frame synchronisation

During the third step of the initial cell search procedure, the UE searches for the MIB(Master Indication Block) of multi-frame of the BCH in the P-CCPCH indicated by QPSK phase modulation of the DwPTS with respect to the P-CCPCH midamble. The control multi-frame is positioned by a sequence of QPSK symbols modulated on the DwPTS. [n] consecutive DwPTS are sufficient for detecting the current position in the control multi-frame. According to the result of the control multi-frame synchronisation for the right midamble code, UE may go to next step or go back to step 2.

Step 4: Read the BCH

The (complete) broadcast information of the found cell in one or several BCHs is read. According to the result the UE may move back to previous steps or the initial cell search is finished.

Annex E (informative): Examples random access procedure for 1.28Mcps TDD

Figure E-1 Single burst RACH WT=4, L =1, SF4 PRACH

Sub-frame Number	0	1	2	3	4	5	6	7	8	9	10
Users sending on UpPCH	1 2	3 4	5 6	7 8							
Acknowledged user on FPACH		1	2	3	4	5	6	7			
User sending RACH 0				1	2	3	4	5	6	7	

User 8 is not granted because more than 5 frames would have passed since the UpPCH.

Figure E-2 Two burst RACH WT=4, L =2, SF8 RACH

Sub-frame Number	0	1	2	3	4	5	6	7	8	9	10	11
Users sending on UpPCH	1 2	3 4	5 6	7 8								
Acknowledged user on FPACH		1	2	3	4	5	6	7				
User sending RACH 0					2	2	4	4	6	6		
User sending RACH 1					1	1	3	3	5	5	7	7

User 8 is not granted because more than 5 frames would have passed since the UpPCH.

Figure E-3 four burst RACH WT=4, L =4, SF16 RACH

Sub-frame Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Users sending on UpPCH	1 2	3 4	5 6	7 8										
Acknowledged user on FPACH		1	2	3	4	5	6	7						
User sending RACH 0							4	4	4	4				
User sending RACH 1					1	1	1	1	5	5	5	5		
User sending RACH 2					2	2	2	2	6	6	6	6		
User sending RACH 3							3	3	3	3	7	7	7	7

User 8 is not granted because more than 5 frames would have passed since the UpPCH.

Figure E-4 four burst RACH WT=4, L =4, SF16 RACH

Sub-frame Number	0	1	2	3	4	5	6	7	8	9	10	11	12
Users sending on UpPCH	1 2	3 4	5 6	7 8									
Acknowledged user on FPACH	X	1			2	3			X	X			
User sending RACH 0							2	2	2	2			
User sending RACH 1					1	1	1	1	3	3	3	3	

The FPACH is used ONLY in sub-frames 0, 1, 4, 5, 8, 9,… because they correspond to the used RACH resources.

The FPACH in sub-frame 0 is not used because no UpPCH is preceding.

The FPACH in sub-frames 8,9 is not used because no UpPCH is preceding in the last 4 sub-frames.

In contrast to the previous examples users 4,5,6,7 are not granted because they would no lead to a RACH anyway. In this example their grand would come too late.

User 8 is not granted because more than 4 frames would have passed since the UpPCH.

Annex ~~D~~ F(informative): Change history

3GPP TSG RAN Meeting #11
Palm Springs, CA, U.S.A., March 13-16, 2001

R1-01-0375

CR-Form-v3

CHANGE REQUEST

⌘ **25.225 CR 024** ⌘ rev **1** ⌘ Current version: **3.5.0** ⌘

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

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

Title: ⌘	Inclusion of 1.28Mcps TDD in TS 25.225		
Source: ⌘	TSG RAN WG1		
Work item code: ⌘	LCRTDD-Phys	***Date:*** ⌘	28.02.2001
Category: ⌘	**B**	***Release:*** ⌘	REL-4
	Use one of the following categories: ***F*** *(essential correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(Addition of feature),* ***C*** *(Functional modification of feature)* ***D*** *(Editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *REL-4 (Release 4)* *REL-5 (Release 5)*

Reason for change: ⌘	Inclusion of 1.28 Mcps TDD
Summary of change: ⌘	• The basis for this document was CR024, R1-01-0185 • in revision 1, the approved contributions from WG1#19 have been included
Consequences if not approved: ⌘	

Clauses affected: ⌘	**5.2.8 (section name revised),** **New section:** 5.1.14 Timing Advance (T_{ADV}) for 1.28 Mcps TDD **New section:** 5.2.10 Received SYNC-UL Timing Deviation for 1.28 Mcps TDD	
Other specs affected: ⌘	[X] Other core specifications ⌘ [ ] Test specifications [ ] O&M Specifications	25.221, 25.222, 25.223, 25.224
Other comments: ⌘		

How to create CRs using this form:

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

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

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

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

5.1.14 Timing Advance (T_{ADV}) for 1.28 Mcps TDD

Definition	The 'timing advance (T_{ADV})' is the time difference $$T_{ADV} = T_{RX} - T_{TX}$$ Where T_{RX}: calculated beginning time of a certain uplink time slot with the UE timing according to the reception of a certain downlink time slot (for the timing it is assumed that the time slots within a sub-frame are scheduled like given in the frame structure described in 25.221 chapter 6.1) T_{TX}: time of the beginning of the same uplink time slot by the UE (for the timing it is assumed that the time slots within a sub-frame are scheduled like given in the frame structure described in 25.221 chapter 6.1)

Note: This measurement can be used for uplink synchronisation or location services.

5.2.8 RX Timing Deviation (for the 3.84 Mcps option)

Definition	'RX Timing Deviation' is the time difference $T_{RXdev} = T_{TS} – T_{RXpath}$ in chips, with T_{RXpath}: time of the reception in the Node B of the first detected uplink path (in time) to be used in the detection process. The reference point for T_{RXpath} shall be the Rx antenna connector. T_{TS}: time of the beginning of the respective slot according to the Node B internal timing

NOTE: This measurement can be used for timing advance calculation or location services.

5.2.10 Received SYNC-UL Timing Deviation for 1.28 Mcps TDD

Definition	'Received SYNC-UL Timing Deviation' is the time difference $UpPCH_{POS} = UpPTS_{Rxpath} – UpPTS_{TS}$ Where $UpPTS_{Rxpath}$: time of the reception in the Node B of the SYNC-UL to be used in the uplink synchronization process $UpPTS_{TS}$: time instance two symbols prior to the end of the DwPCH according to the Node B internal timing UE can calculate Round Trip Time (RTT) towards the UTRAN after the reception of the FPACH containing $UpPCH_{POS}$ transmitted from the UTRAN. Round Trip Time RTT is defined by $RTT = UpPCH_{AVD} + UpPCH_{POS} – 8*16\ T_C$ Where $UpPCH_{ADV}$: the amount of time by which the transmission of UpPCH is advanced in time relative to the end of the guard period according to the UE Rx timing.

Annex A (informative): Monitoring GSM from TDD: Calculation Results

A.1 Low data rate traffic using 1 uplink and 1 downlink slot (for the 3.84 Mcps option)

A.2 Low data rate traffic using 1 uplink and 1 downlink slot (for the 1.28 Mcps option)

NOTE: The section evaluates the time to acquire the FCCH if all idle slots are devoted to the tracking of a FCCH burst, meaning that no power measurements is done concurrently. The derived figures are better than those for GSM. The section does not derive though any conclusion. A conclusion may be that the use of the idle slots is a valid option. An alternative conclusion may be that this is the only mode to be used, removing hence the use of the slotted frames for low data traffic or the need for a dual receiver, if we were to considering the monitoring of GSM cells only, rather than GSM, TDD and FDD.

If a single synthesiser UE uses only one uplink and one downlink slot, e.g. for speech communication, the UE is not in transmit or receive state during 5 slots in each frame. According to the timeslot numbers allocated to the traffic, this period can be split into two continuous idle intervals A and B as shown in the figure below.

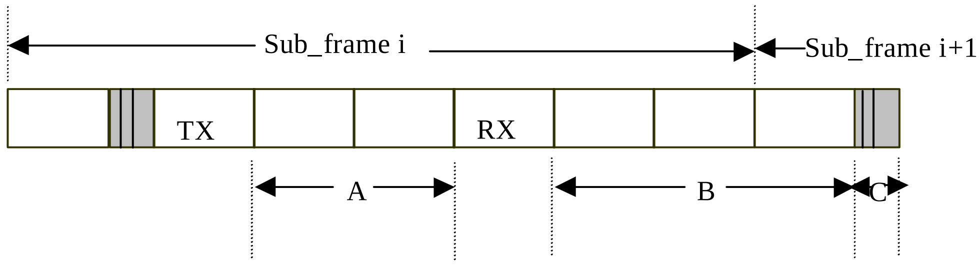

Figure A.2: Possible idle periods in a subframe with two occupied timeslots

A is defined as the number of idle slots between the Tx and Rx slots and B the number of idle slots between the Rx and Tx slots. It is clear that A+B=5 time slots and C is equal to the DwPTS+GP+UpPTS.

In the scope of low cost terminals, a [0.5] ms period is supposed to be required to perform a frequency jump from 1.28Mcps TDD to GSM and vice versa. This lets possibly two free periods of A*Timeslots-1 ms and B*Timeslots+C-1 ms during which the mobile station can monitor GSM, Timeslots being the slot period.

Following table evaluates the average synchronisation time and maximum synchronisation time, where the announced synchronisation time corresponds to the time needed to find the FCCH. The FCCH is supposed to be perfectly detected which means that it is entirely present in the monitoring window. The FCCH being found the SCH location is unambiguously known from that point. All the 5 idle slots and the DwPTS+GP+UpPTS are assumed to be devoted to FCCH tracking and the UL traffic is supposed to occupy the time slot 1.

Table A.2: example- of average and maximum synchronisation time with two busy timeslots per frame and with 0.5 ms switching time

Downlink time slot number	Number of free Timeslots in A	Number of free Timeslots in B	Average synchronisation time (ms)	Maximum synchronisation time (ms)
0	5	0	83	231
2	0	5	75	186
3	1	4	98	232
4	2	3	185	558
5	3	2	288	656
6	4	1	110	371

(*) All simulations have been performed with a random initial delay between GSM frames and 1.28Mcps TDD sub-frames.

Each configuration of Timeslots allocation described above allows a monitoring period sufficient to acquire synchronisation.

NOTE: Considering about the frame structure of 1.28Mcps TDD, there are total 7 timeslot in each sub-frame that can be used as data traffic. If more than 1 uplink and/or 1 downlink TDD timeslot are used for data traffic, that means it will occupy at least 3 time slot, equal to 0.675*3=2.205ms. And more time slots for traffic data means more switching point are needed to switch between the GSM and the 1.28Mcps TDD. As it was mentioned above, each switching will take 0.5ms. As a result, the idle time left for monitoring the GSM will be very little. So monitoring GSM from 1.28Mcps TDD under this situation will be considered in the future. It will need more carefully calculation and simulation.

A.2.1 Higher data rate traffic using more than 1 uplink and/or 1 downlink TDD timeslot (for 1.28Mcps TDD)

The minimum idle time to detect a complete FCCH burst for all possible alignments between the GSM and the 1.28Mcps TDD frame structure (called ‘guaranteed FCCH detection’), assuming that monitoring happens every sub-frame, can be calculated as follows (t_{FCCH} = one GSM slot):

$$t_{\min, guaranteed} = 2 \times t_{synth} + t_{FCCH} + \frac{5\,ms}{13} = 2 \times t_{synth} + \frac{25\,ms}{26}$$

- (e.g for t_{synth} =0ms: 2 1.28Mcps TDD **consecutive** idle timeslots needed, for t_{synth} =0.3ms: 3 slots (or 2 slots and the DwPTS+GP+UpPTS), for t_{synth} =0.5ms: 3 slots, for t_{synth} =0.8ms: 4 slots). Under this conditions the FCCH detection time can never exceed the time of 660ms.
- (For a more general consideration t_{synth} may be considered as a sum of all delays before starting monitoring is possible).
- For detecting SCH instead of FCCH (for a parallel search) the same equation applies.
- In the equation before the dual synthesiser UE is included if the synthesiser switching time is 0ms.

Table A.2.1 : FCCH detection time for a single synthesizer UE monitoring GSM from 1.28Mcps TDD every sub-frame

Occupied Slots	Cases	**AVERAGE** FCCH detection time in ms	**MAXIMUM** FCCH detection time in ms
2	21	136.625	660.785
3	35	188.451	660.785
4	35	231.115	660.785
5	21	-	-
6	7	-	-
7	1	-	-

The result in the above table is based on the following assumption:

- A single synthesizer is used.
- A [0.5] ms period is supposed to be required to perform a frequency jump from 1.28Mcps TDD to GSM and vice versa.
- For a given number of occupied slots in the TDD mode all possible cases of distributions of these occupied TDD slots are considered (see ‘cases’). For every case arbitrary alignments of the TDD and the GSM frame structure are taken into account for calculating the average FCCH detection time (only these cases are used which guarantee FCCH detection for all alignments; only the non-parallel FCCH search is reflected by the detection times in the above table).

The term ‘occupied slots’ means that the UE is not able to monitor in these TDD slots.

For a synthesiser switching time of one or one half TDD timeslot the number of needed consecutive idle TDD timeslots is summarized in the table below:

Table A.2.2 : Link between the synthesiser performance and the number of free consecutive Timeslots for guaranteed FCCH detection, needed for GSM monitoring

One-way switching time for the synthesiser	Number of free consecutive 1.28Mcps TDD timeslots needed in the sub-frame for a guaranteed FCCH detection
1 Timeslot (=864 chips)	4
0.5 Timeslot (=432 chips)	3
0 (dual synthesiser)	2

3GPP TSG RAN Meeting #11
Palm Springs, CA, U.S.A., March 13-16, 2001

R1-01-0255

CR-Form-v3

CHANGE REQUEST

⌘ 25.944 CR 005	⌘ rev 1	⌘ Current version: 3.3.0 ⌘

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

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

Title: ⌘	1.28 Mcps TDD related changes to 25.944		
Source: ⌘	TSG RAN WG1		
Work item code: ⌘	LCRTDD-Phys	***Date:*** ⌘	21.02.2001
Category: ⌘	**B**	***Release:*** ⌘	REL-4
	Use one of the following categories: ***F*** *(essential correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(Addition of feature),* ***C*** *(Functional modification of feature)* ***D*** *(Editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *REL-4 (Release 4)* *REL-5 (Release 5)*

Reason for change: ⌘	Inclusion of the Workitem LCRTDD in release 4
Summary of change: ⌘	This CR describes coding and multiplexing examples for 1.28Mcps TDD. In revision 1, the CR has been extended by the FPACH – coding (4.3.1.3) and by a 64kbps streaming example (4.3.1.4.2.5 and 4.3.2.2.2.5). Additionally the TrBlk Sizes in the “Example for PCH and FACH” (4.3.1.2) have been aligned with TSG T1 cf. Tdoc T1S-010029 for 34.108.
Consequences if not approved: ⌘	Incompleteness of TR25.944 with respect to LCR-TDD (1.28 Mcps TDD)

Clauses affected: ⌘	4.2 (only heading), 4.3 (new section)	
Other specs affected: ⌘	[ ] Other core specifications ⌘ [ ] Test specifications [ ] O&M Specifications	
Other comments: ⌘		

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

4.2 TDD mode – 3.84Mcps TDD option

4.3 TDD mode – 1.28Mcps TDD option

4.3.1 Downlink

4.3.1.1 BCH

Table XX: Parameters for BCH

Transport block size	246 bit
CRC	16 bit
Coding	CC, coding rate = 1/3
TTI	20 ms
Codes and time slots	SF = 16 x 2 codes x 1 time slot
TFCI	0 bit
TPC	0 bit

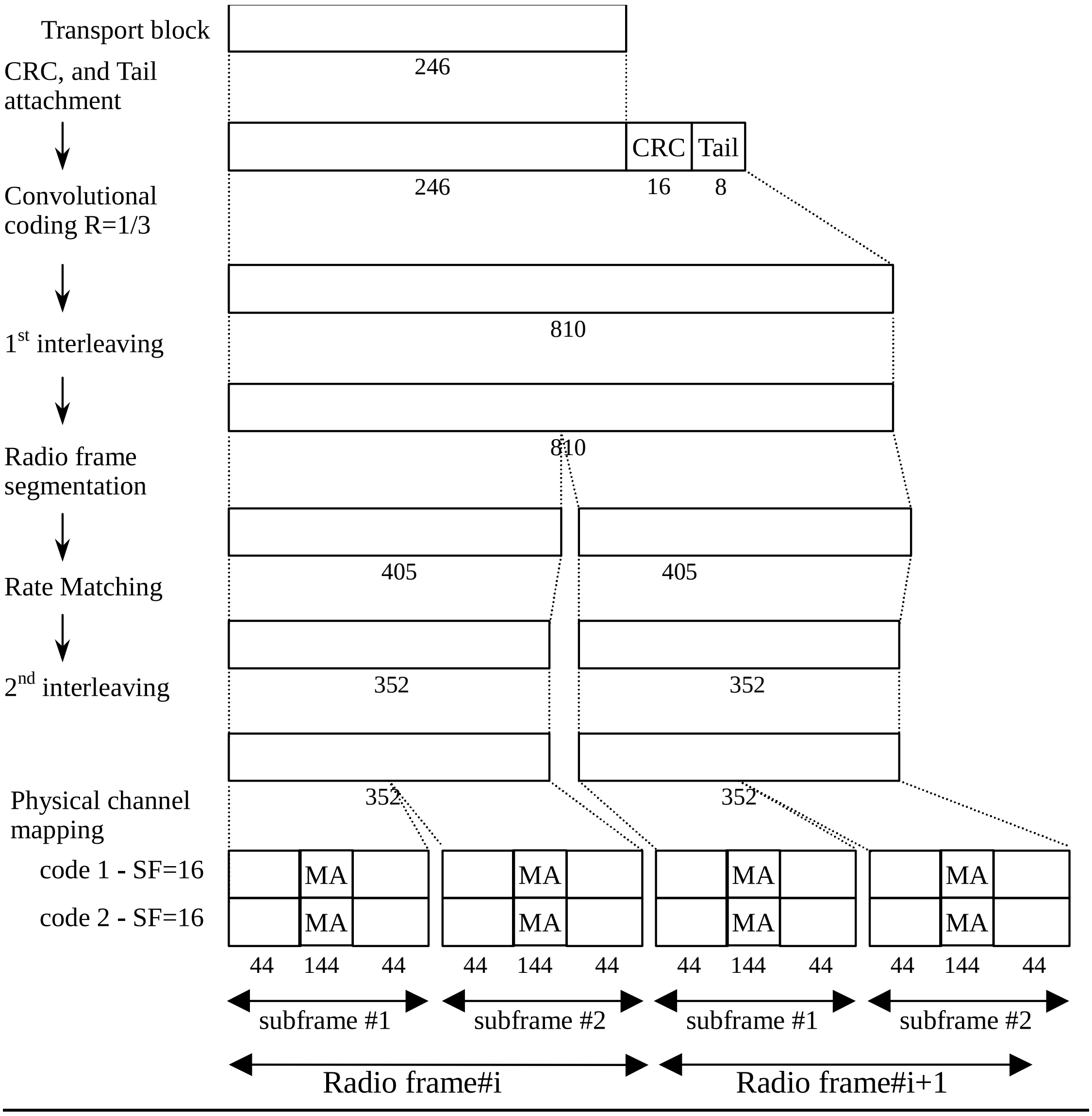

Figure XX: Channel coding for BCH

4.3.1.2 Example for PCH and FACH

Table XX: Parameters for PCH and FACH

Transport block size	PCH	N_{PCH}=80 or 240 bit
	FACH1	363 bit
	FACH2	171 bit
Transport block set size	PCH	80*B_{PCH} or 240*B_{PCH} bit (B_{PCH}=0,1)
	FACH1	363*B_{FACH1} bit (B_{FACH1}=0,1)
	FACH2	171*B_{FACH2} bit (B_{FACH2}=0,1,2)
Coding	PCH, FACH2	CC, coding rate = 1/2
	FACH1	TC
TTI		10 ms
Codes and time slots		SF = 16 x 6 codes x 1 time slot
TFCI		16 bit
TPC		0 bit

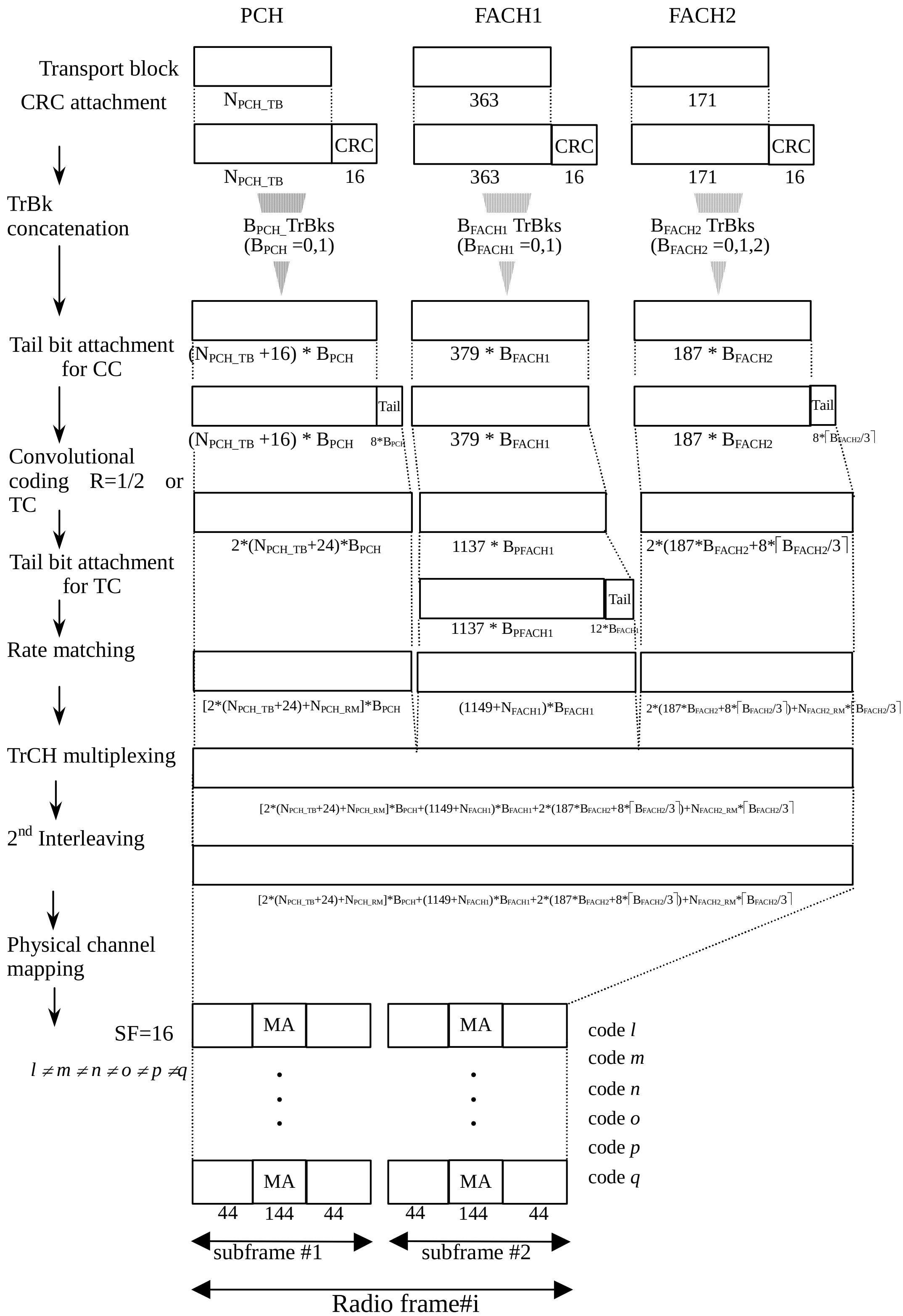

Figure XX: Channel coding and multiplexing example for PCH and FACH

4.3.1.3 Coding of FPACH

Table XX: Parameters for FPACH

FPACH block size	32 bit
Coding	CC 1/2
TTI	5 ms, 1 subframe
Codes and time slots	SF = 16 x 1 codes x 1 time slot x 1 subframe
CRC	8 bit

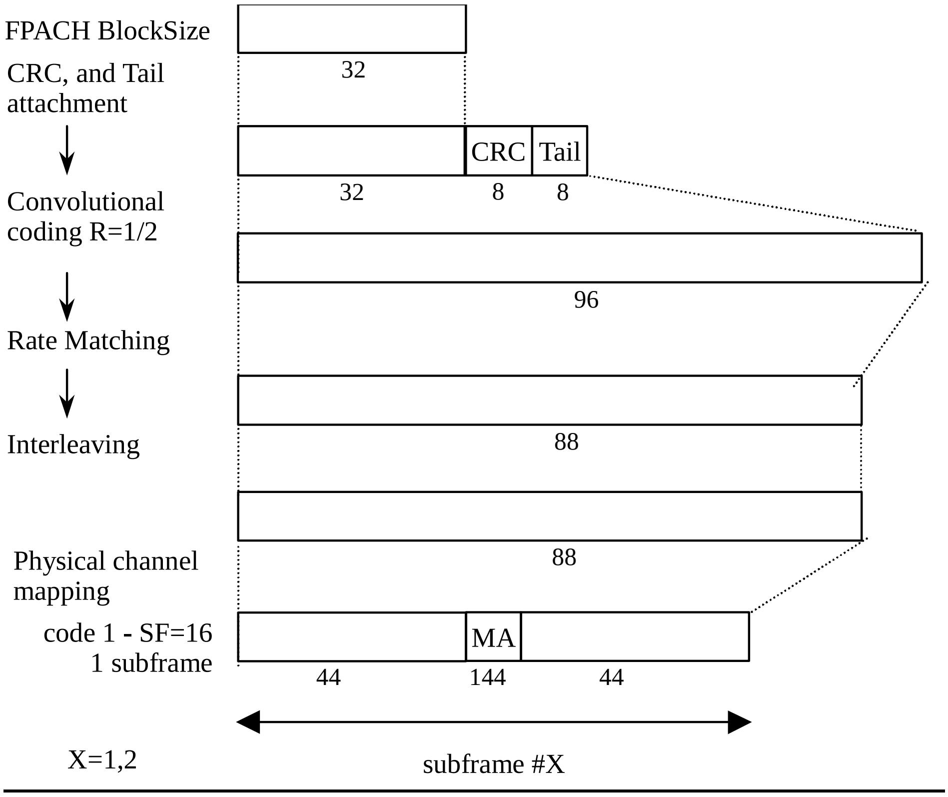

Figure XX: Coding for FPACH

4.3.1.4 Example for DCH

4.3.1.4.1 DCH-> Radio frame segmentation

The channel coding and multiplexing for DCH is common with the 3.84Mcps TDD option [cf. 4.2.1.3.1 ‘DCH-> Radio frame segmentation’]

4.3.1.4.2 TrCH multiplexing -> Physical channel mapping

4.3.1.4.2.1 Example for Stand-alone mapping of 3.4 kbps data

NOTE: This example can be applied to Stand-alone mapping of DCCH.

Table XX shows example of physical channel parameters for Stand-alone mapping of 3.4 kbps data.

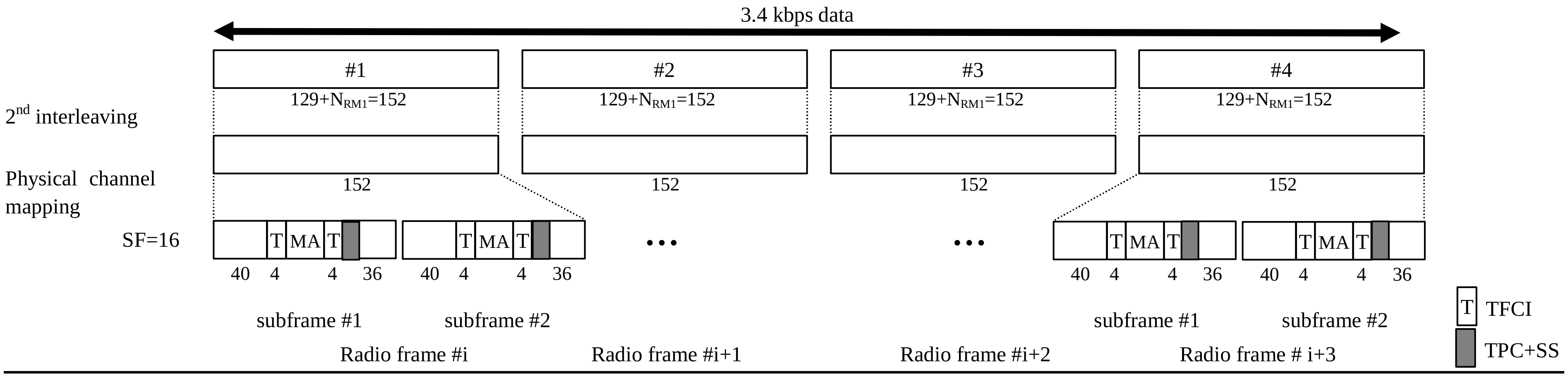

Figure XX: Channel coding and multiplexing example for Stand-alone mapping of 3.4 kbps data

Table XX: Physical channel parameters for Stand-alone mapping of 3.4 kbps data

Codes and time slots	SF16 x 1 code x 1 time slot
TFCI	16 bit
TPC + SS	2 bit + 2bit

4.3.1.4.2.2 Example for multiplexing of 12.2 kbps data and 3.4 kbps data

NOTE: This example can be applied to multiplexing AMR speech and DCCH.

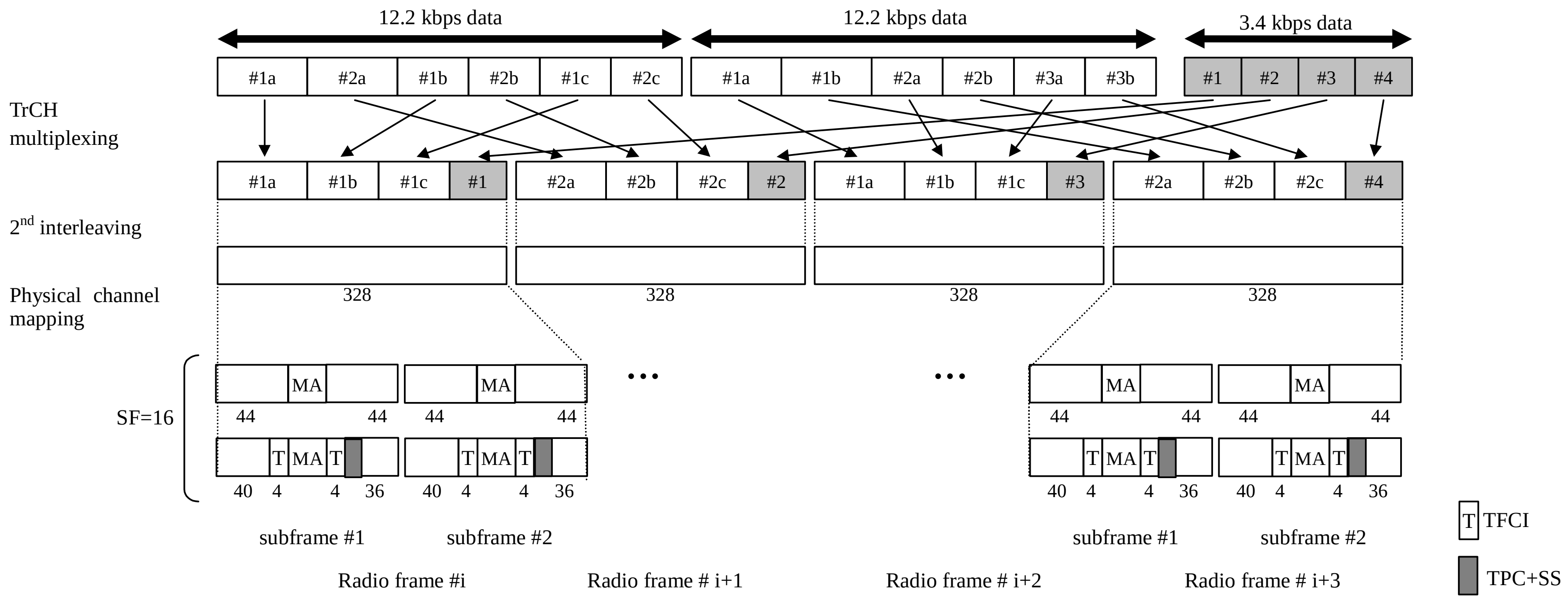

Figure XX: Channel coding and multiplexing example for multiplexing of 12.2 kbps data and 3.4 kbps data

Table XX: Physical channel parameters for multiplexing of 12.2 kbps data and 3.4 kbps data

Codes and time slots	SF16 x 2 codes x 1 time slot
TFCI	16 bit
TPC + SS	2 bit + 2bit

4.3.1.4.2.3 Example for multiplexing of 28.8/57.6 kbps data 3.4 kbps data

NOTE: This example can be applied to multiplexing of Modem/FAX and DCCH.

Table XX shows example of physical channel parameters for multiplexing of 28.8/57.6 kbps data and 3.4 kbps data.

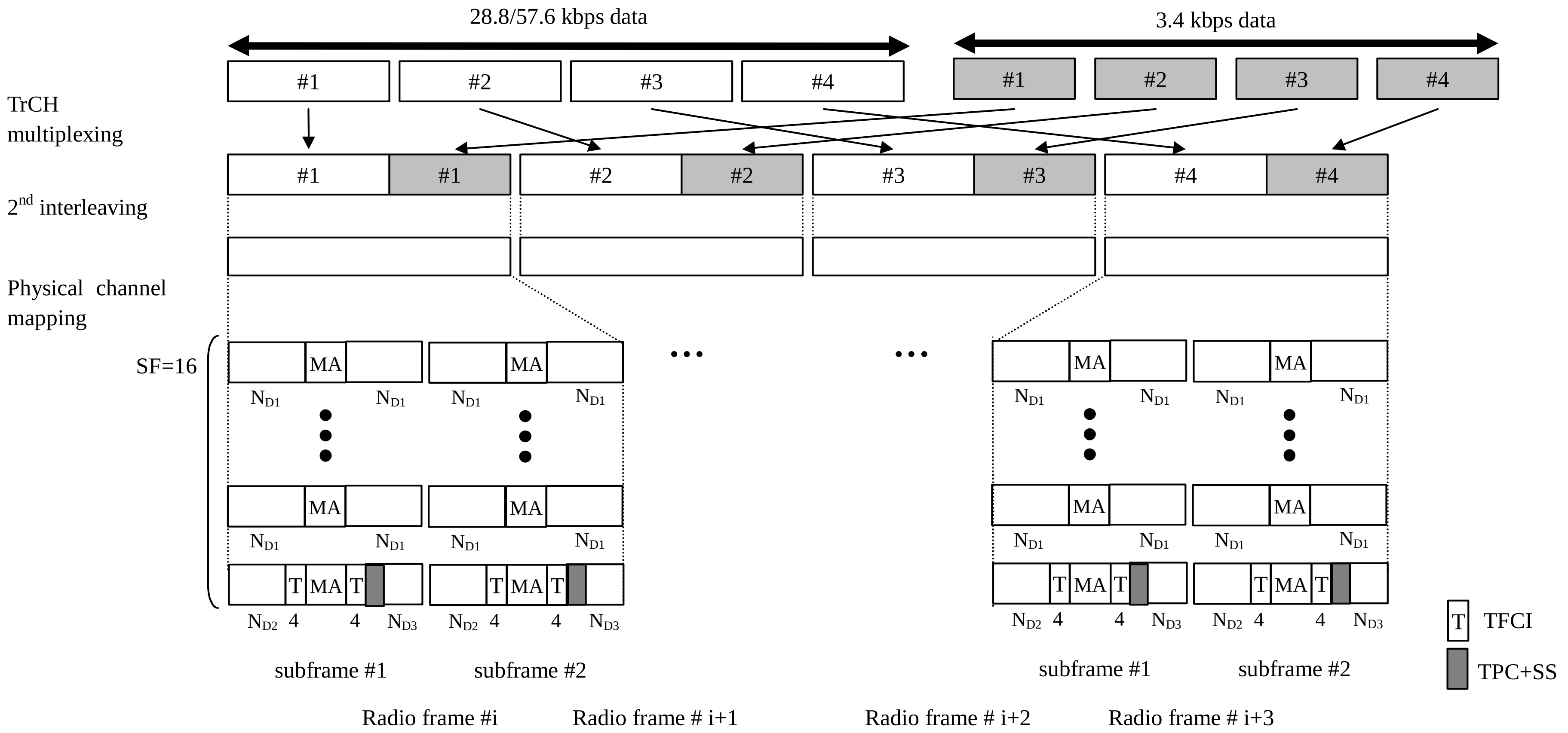

Figure XX: Channel coding and multiplexing example for multiplexing 28.8/57.6 kbps data and 3.4 kbps data

Table XX: Physical channel parameters for multiplexing of 28.8/57.6 kbps packet data and 3.4 kbps data

N_{D1}, N_{D2}, , N_{D3}	28.8/57.6 kbps	44 bit, 40 bit, 36 bit
Code & time	28.8 kbps	SF16 x 3 codes x 1 time slot
slots	57.6 kbps	SF16 x 6 codes x 1 time slot
TFCI		16 bit
TPC + SS		2 bit + 2bit

4.3.1.4.2.4 Example for multiplexing of 64/128/144/384 kbps packet data and 3.4 kbps data

NOTE: This example can be applied to multiplexing 64/128/144/384 kbps packet data and DCCH.

Table XX shows example of physical channel parameters for multiplexing of 64/128/144/384 kbps packet data and 3.4 kbps data.

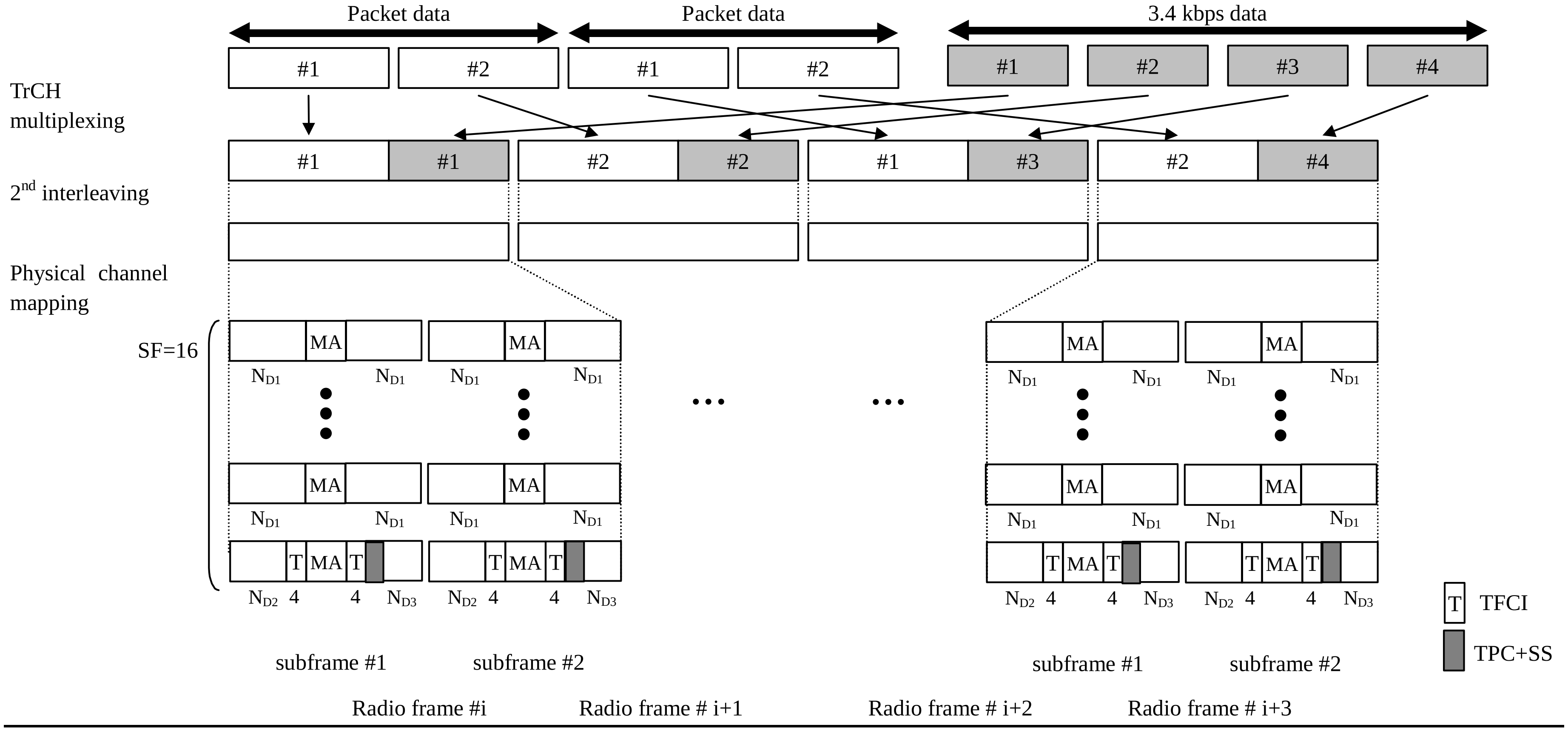

Figure XX: Channel coding and multiplexing example for multiplexing of 64/128/144/384 kbps packet data and 3.4 kbps data

Table XX: Physical channel parameters for multiplexing of 64/128/144/384 kbps packet data and 3.4 kbps data

N_{D1}, N_{D2}, N_{D3}	64 & 128 & 144 & 384 kbps	44 bit, 40 bit, 36 bit
Code & time	64 kbps	SF16 x 8 codes x 1 time slot
slots	128 kbps	SF16 x 14 codes x 1 time slot
	144 kbps	SF16 x 8 codes x 2 time slots
	384 kbps	SF16 x 10 codes x 4 time slots
TFCI		16 bit
TPC + SS		2 bit + 2bit

4.3.1.4.2.5 Example for multiplexing of 64 kbps data and 3.4 kbps data

NOTE: This example can be applied to multiplexing ISDNs data and DCCH.

Table XX shows example of physical channel parameters for multiplexing of 64 kbps data and 3.4 kbps data.

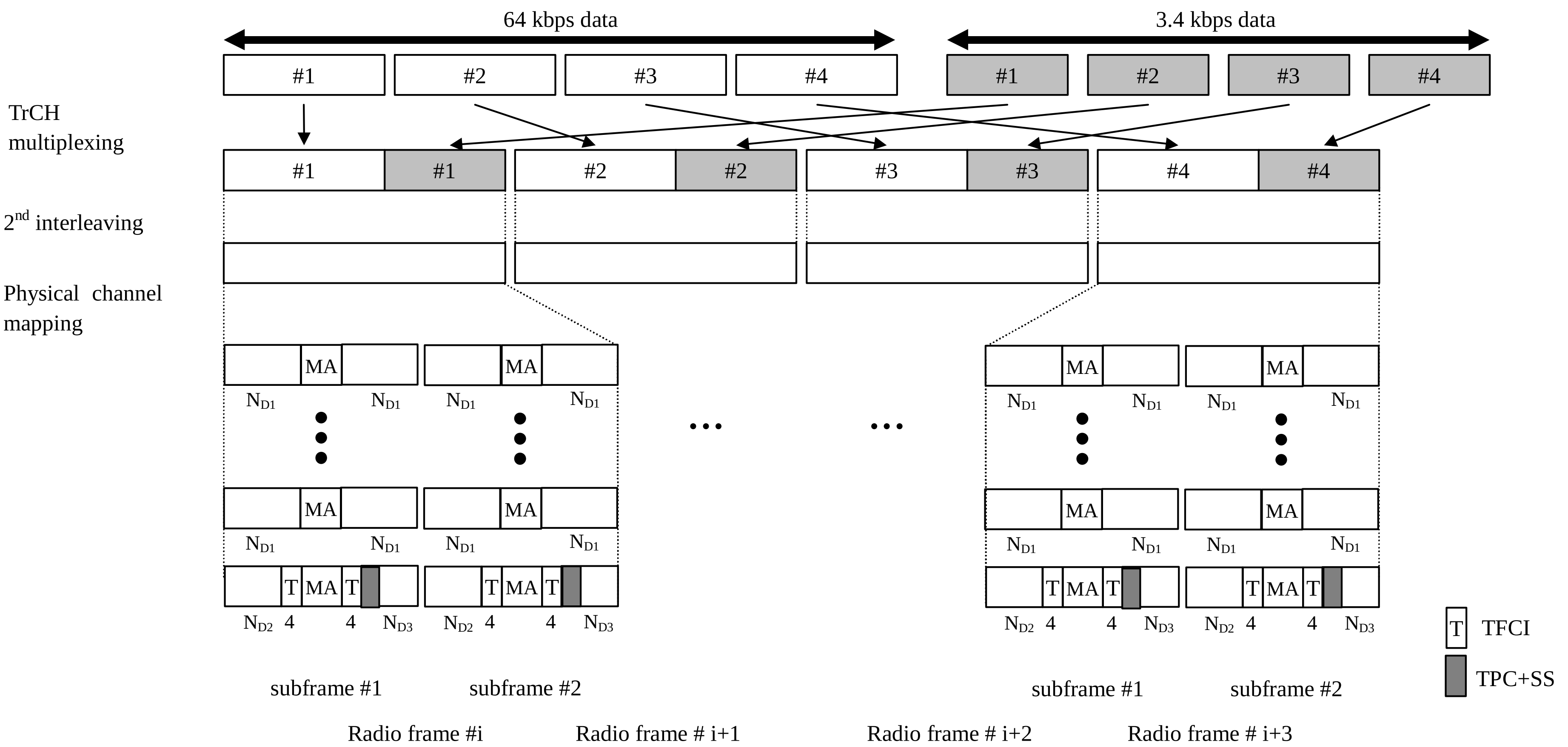

Figure XX: Channel coding and multiplexing example for multiplexing of 64 kbps data and 3.4 kbps data

Table XX: Physical channel parameters for multiplexing of 64 kbps packet data and 3.4 kbps data

N_{D1}, N_{D2}, N_{D3}	44 bit, 40 bit, 36 bit
Code & time slots	SF16 x 8 codes x 1 time slot
TFCI	16 bit
TPC + SS	2 bit + 2bit

4.3.1.4.2.6 Example for multiplexing of 12.2 kbps data, 64/128/144/384 kbps packet data and 3.4 kbps data

NOTE: This example is corresponding to multiplexing of AMR speech, 64/128/144/384 kbps packet and DCCH.

Table XX shows example of physical channel parameters for multiplexing of 12.2 kbps data, 64/128/144/384 kbps packet data and 3.4 kbps data.

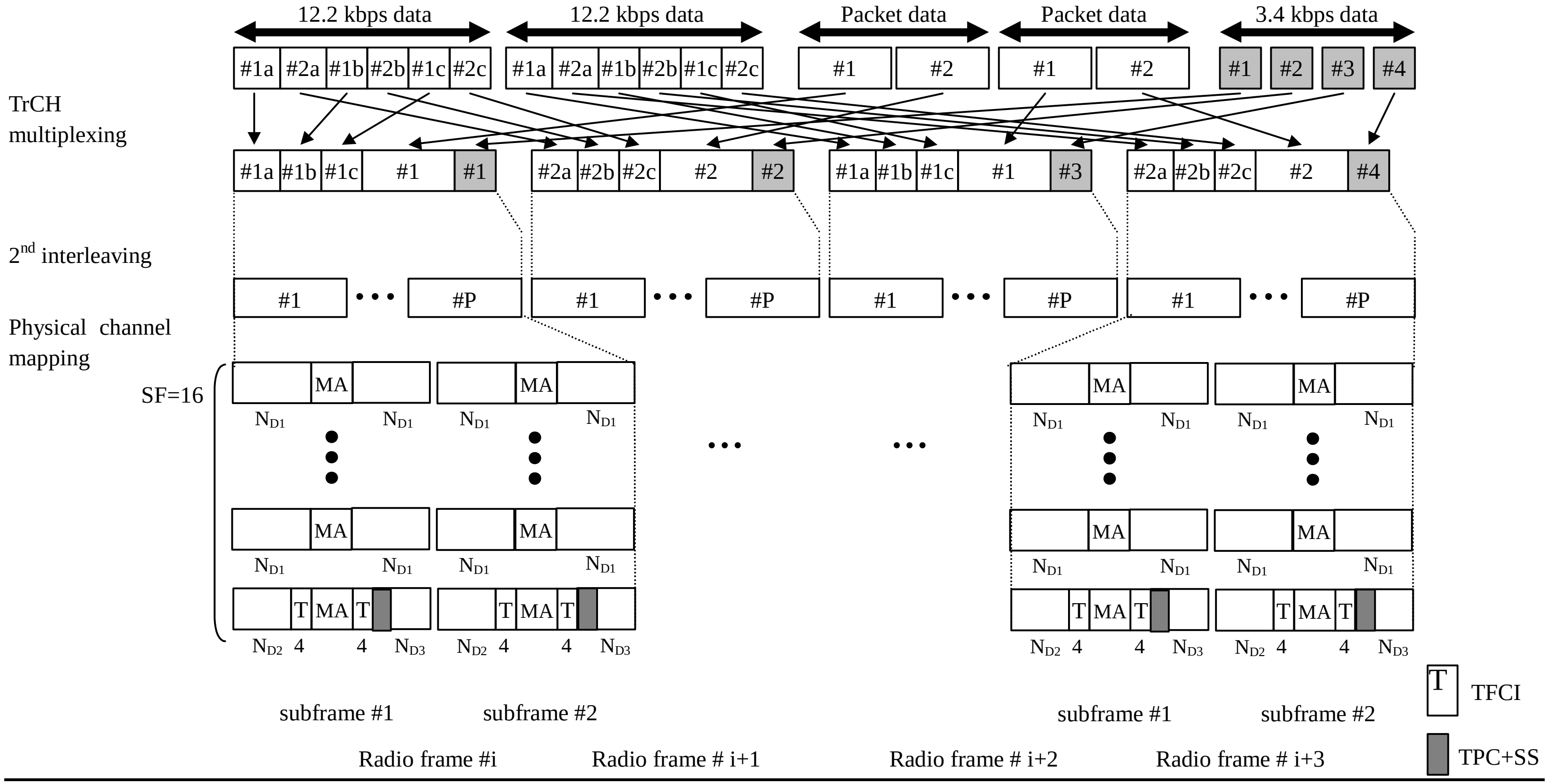

Figure XX: Channel coding and multiplexing example for multiplexing of 12.2 kbps data, 64/128/144/384 kbps packet data and 3.4 kbps data

Table XX Physical channel parameters for multiplexing of 12.2 kbps data, 64/128/144/384 kbps packet data and 3.4 kbps data

Data rate (kbps)	No. of timeslots	No. of physical channels with SF16 per used TS	N_{TFCI}	$N_{TPC} + N_{TPC}$
64	1	8	16	2 + 2
128	1	14	16	2 + 2
144	2	8	16	2 + 2
384	4	10	16	2 + 2

4.3.2 Uplink

4.3.2.1 RACH

Table XX: Parameters for RACH

Transport block size	N_{RACH}=168
CRC	16 bit
Coding	CC, coding rate = 1/2
TTI	10 ms
Codes and time slots	SF = 8 x 1 x 1code x 1 time slot
TFCI	0 bit
TPC	0 bit

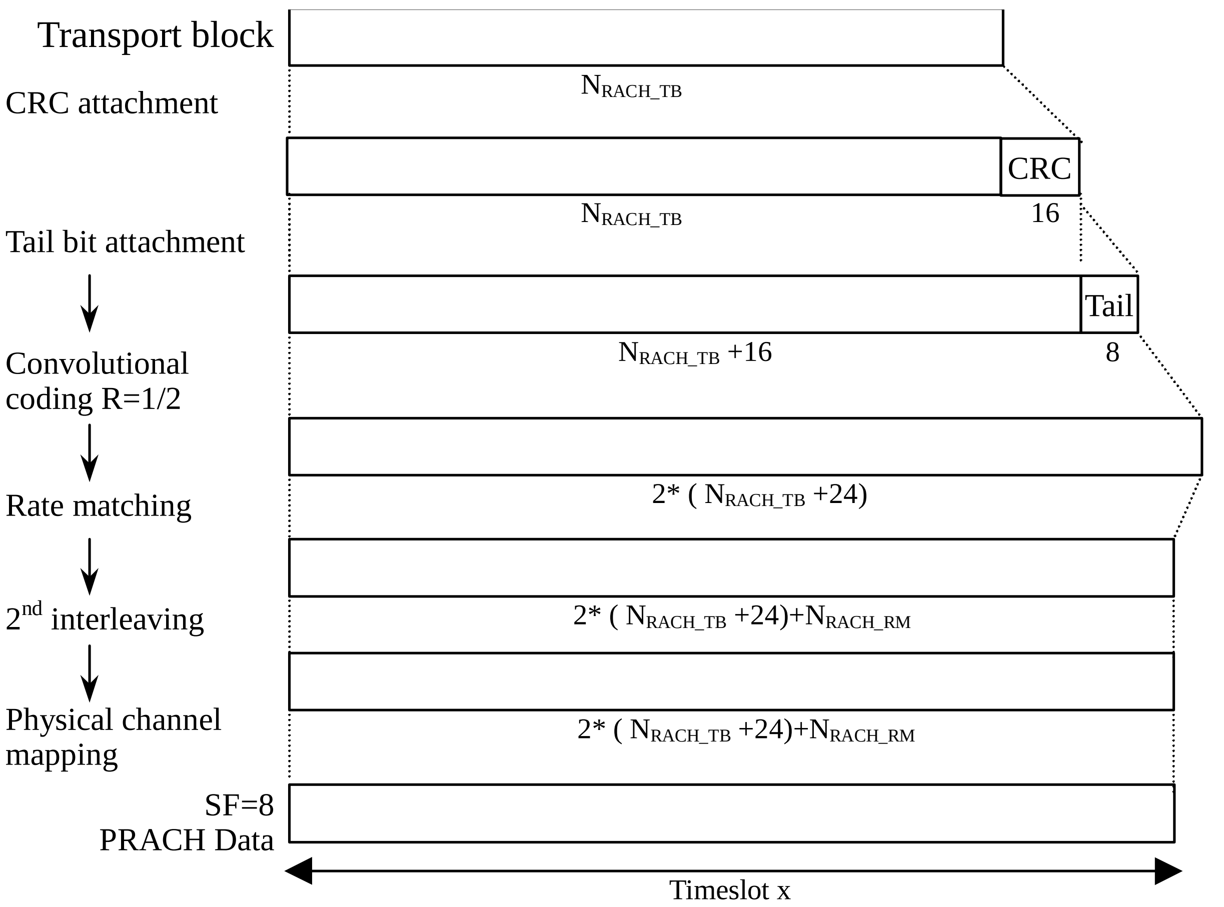

Figure XX: Channel coding and multiplexing example for PRACH

4.3.2.2 Example for DCH

4.3.2.2.1 DCH-> Radio frame segmentation

See 4.3.1.3.1

4.3.2.2.2 TrCH multiplexing -> Physical channel mapping

4.3.2.2.2.1 Example for Stand-alone mapping of 3.4 kbps data

NOTE: This example can be applied to Stand-alone mapping of DCCH.

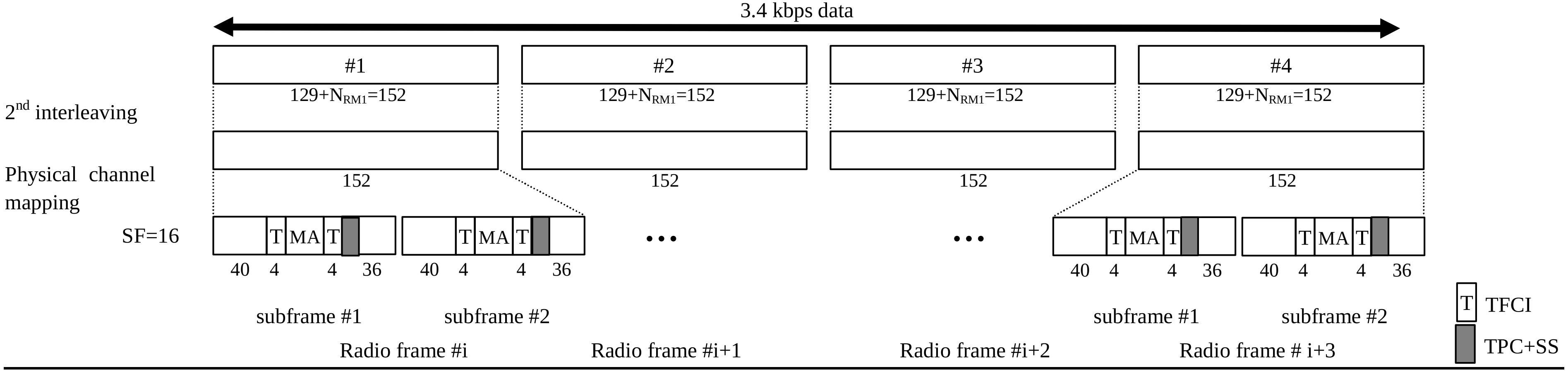

Figure XX: Channel coding and multiplexing example for Stand-alone mapping of 3.4 kbps data

4.3.2.2.2.2 Example for multiplexing of 12.2 kbps data and 3.4 kbps data

NOTE: This example can be applied to multiplexing AMR speech and DCCH.

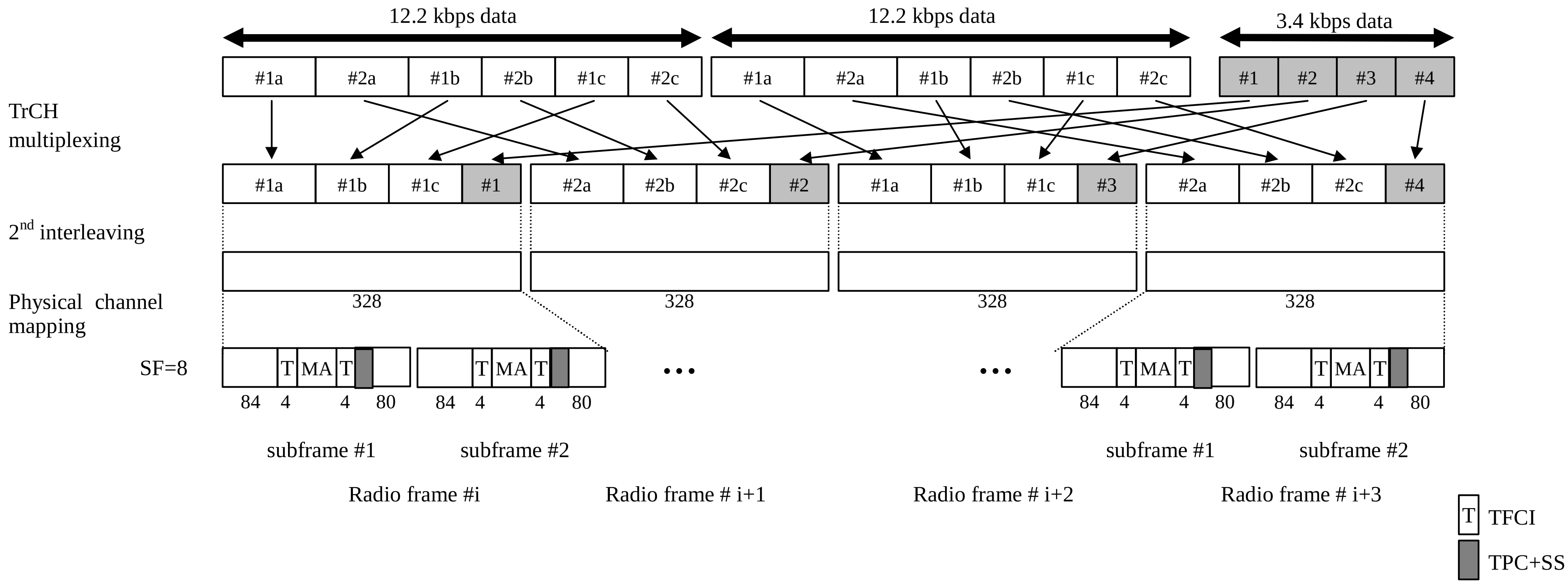

Figure XX: Channel coding and multiplexing example for multiplexing of 12.2 kbps data and 3.4 kbps data

Table XX: Physical channel parameters for multiplexing of 12.2 kbps data and 3.4 kbps data

Codes and time slots	SF8 x 1 code x 1 time slot
TFCI	16 bit
TPC + SS	2 bit + 2bit

4.3.2.2.2.3 Example for multiplexing of 28.8/57.6 kbps data and 3.4 kbps data

NOTE: This example can be applied to multiplexing of Modem/FAX and DCCH.

Table XX shows example of physical channel parameters for multiplexing of 28.8/57.6 kbps data and 3.4 kbps data.

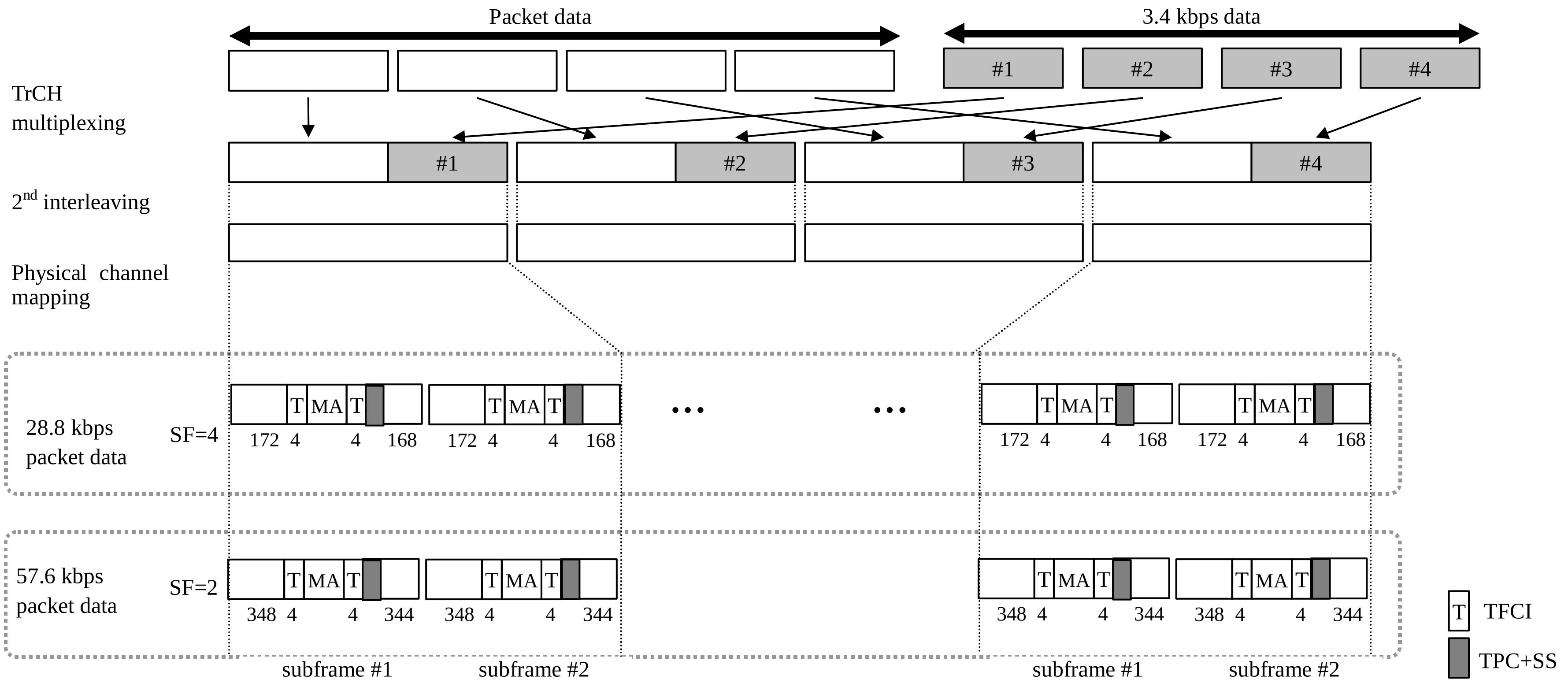

Figure XX: Channel coding and multiplexing example for multiplexing of 28.8/57.6 kbps data and 3.4 kbps data

Table XX: Physical channel parameters for multiplexing of 28.8/57.6 kbps data and 3.4 kbps data

Codes & time slots	28.8 kbps	(SF4 x 1 code) x 1 time slot
	57.6 kbps	(SF2 x 1 code) x 1 time slot
TFCI		16 bit
TPC + SS		2 bit + 2bit

4.3.2.2.2.4 Example for multiplexing of 64/128/144/384 kbps packet data and 3.4 kbps data

NOTE: This example can be applied to multiplexing 64/128/144/384 kbps packet data and DCCH.

Table XX shows example of physical channel parameters for multiplexing of 64/128/144/384 kbps packet data and 3.4 kbps data.

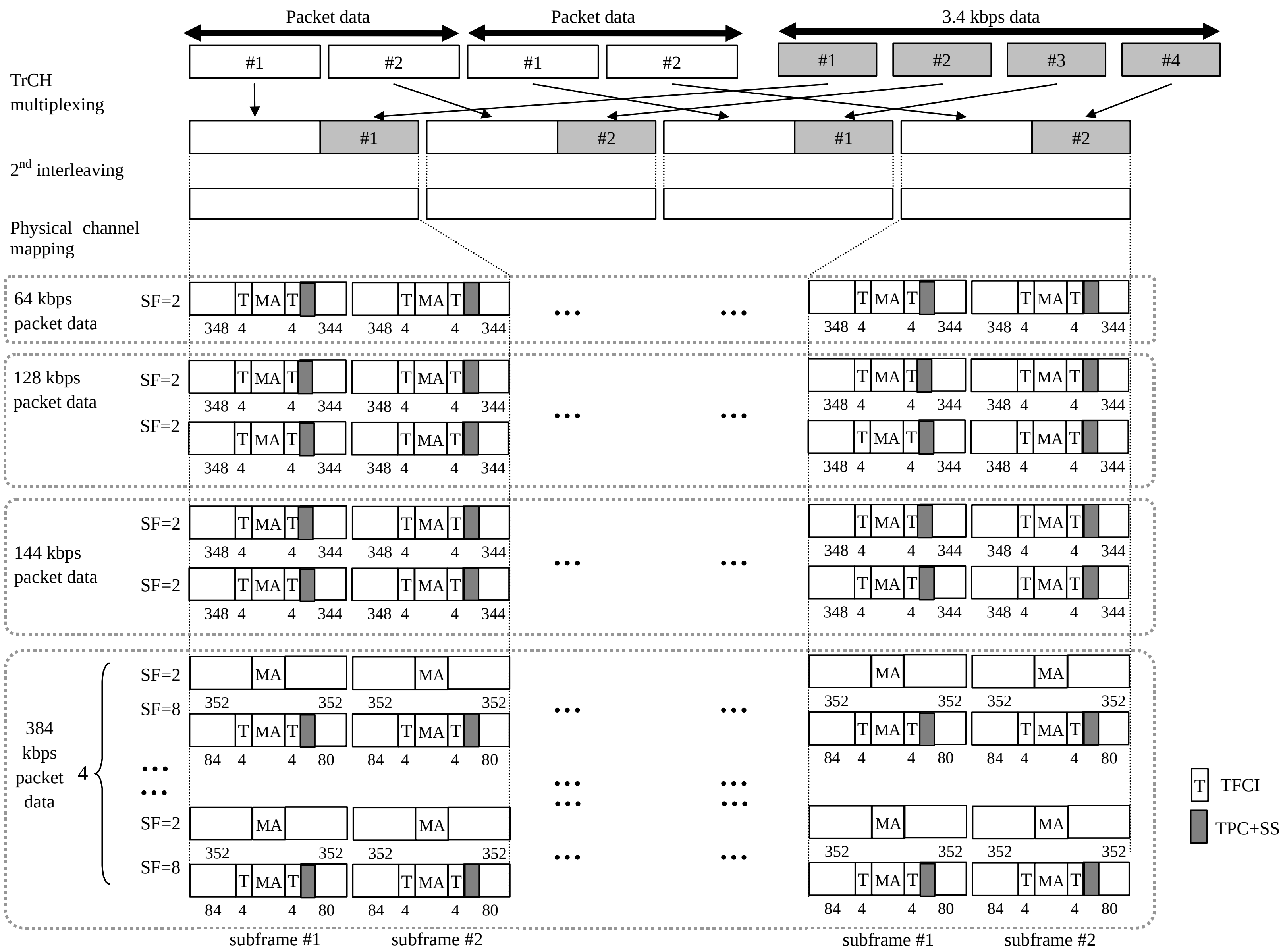
Packet data
Packet data
3.4 kbps data
#1
#2
#3
#4
TrCH multiplexing
2nd interleaving
Physical channel mapping
64 kbps packet data
128 kbps packet data
144 kbps packet data
384 kbps packet data
4
SF=2
SF=8
T
MA
348 4 4 344
352 352
84 4 4 80
subframe #1
subframe #2
T TFCI
TPC+SS

Figure XX: Channel coding and multiplexing example for multiplexing of 64/128/144/384 kbps packet data and 3.4 kbps data

Table XX: Physical channel parameters for multiplexing of 64/128/144/384 kbps packet data and 3.4 kbps data

Codes & time slots	64 kbps	(SF2 x 1 code) x 1 time slot
	128 kbps	(SF2 x 1 code) x 2 time slots
	144 kbps	(SF2 x 1 code) x 2 time slots
	384 kbps	{(SF8 x 1code) + (SF2 x 1 code)} x 4 time slots
TFCI		16 bit
TPC + SS		2 bit + 2bit

4.3.2.2.2.5 Example for multiplexing of 64 kbps data and 3.4 kbps data

NOTE: This example can be applied to multiplexing ISDNs data and DCCH.

Table XX shows example of physical channel parameters for multiplexing of 64 kbps data and 3.4 kbps data.

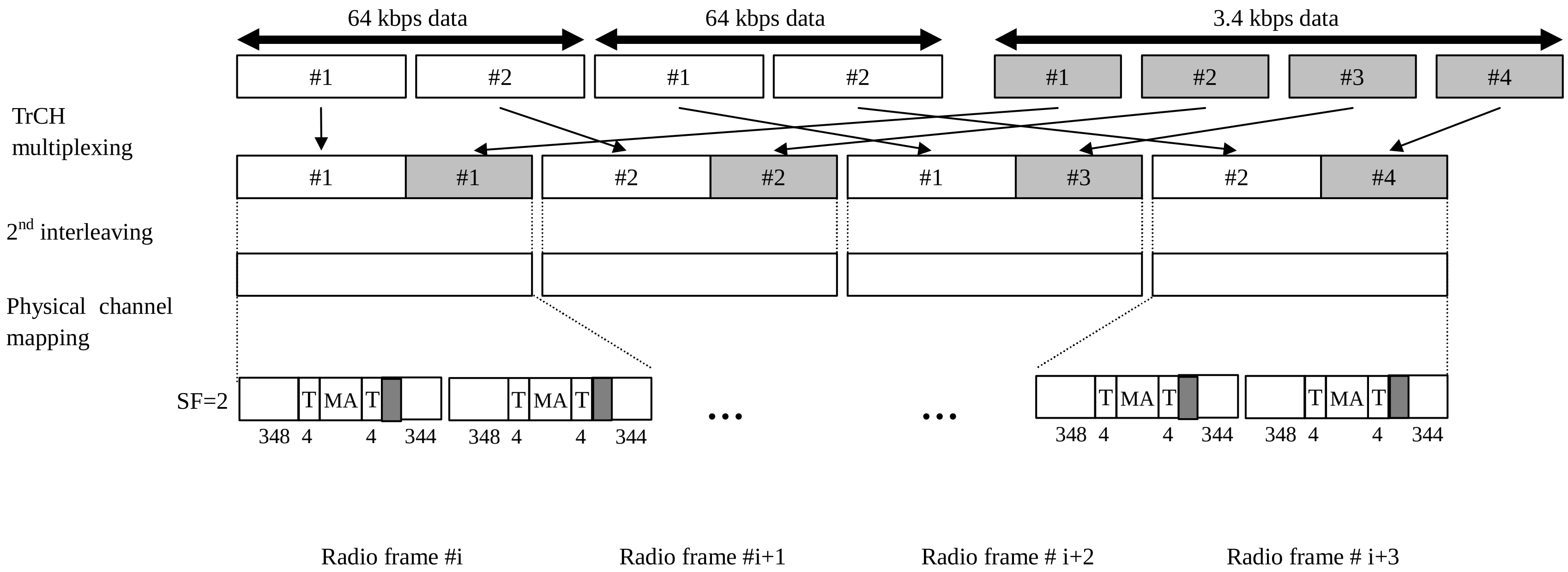

Figure XX: Channel coding and multiplexing example for multiplexing of 64 kbps packet data and 3.4 kbps data

Table XX: Physical channel parameters for multiplexing of 64 kbps packet data and 3.4 kbps data

Codes & time slots	(SF2 x 1 code) x 1 time slot
TFCI	16 bit
TPC + SS	2 bit + 2bit