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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
DSCH	Downlink Shared Channel
FACH	Forward Access Channel
FDD	Frequency Division Duplex
FEC	Forward Error Correction
GP	Guard Period
GSM	Global System for Mobile Communication
NRT	Non-Real Time
ODCH	ODMA Dedicated Transport Channel
ODMA	Opportunity Driven Multiple Access
ORACH	ODMA Random Access Channel
OVSF	Orthogonal Variable Spreading Factor
P-CCPCH	Primary CCPCH
PCH	Paging Channel
PDSCH	Physical Downlink Shared Channel
PICH	Page Indicator Channel
PDU	Protocol Data Unit
PRACH	Physical Random Access Channel
PSCH	Physical Synchronisation Channel
PUSCH	Physical Uplink Shared Channel
RACH	Random Access Channel
RLC	Radio Link Control
RF	Radio Frame
RT	Real Time
S-CCPCH	Secondary CCPCH
SCH	Synchronisation Channel
TCH	Traffic Channel
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
USCH	Uplink Shared Channel

## 5.3 Common physical channels

### 5.3.1 Primary common control physical channel (P-CCPCH)

The BCH as described in section 4.1.2 is mapped onto the Primary Common Control Physical Channel (P-CCPCH). The position (time slot / code) of the P-CCPCH is known from the Physical Synchronisation Channel (PSCH), see section 5.3.4.

#### 5.3.1.1 Spreading codes

The P-CCPCH uses fixed spreading with a spreading factor  $SF = 16$  as described in section 5.2.1.1. The P-CCPCH always uses channelisation code  $a_{Q=16}^{(k=1)}$ .

#### 5.3.1.2 Burst Types

The burst type 1 as described in section 5.2.2 is used for the P-CCPCH. No TFCI is applied for the P-CCPCH.

#### 5.3.1.3 Training sequences for spread bursts

The training sequences, i.e. midambles, as described in section 5.2.3 are used for the P-CCPCH. The P-CCPCH always uses midamble  $m^{(1)}$ .

#### 5.3.1.4 Beacon function

The P-CCPCH shall provide a beacon function, i.e.

- it is transmitted with reference power,
- it is transmitted without beamforming,
- it uses midamble  $m^{(1)}$  exclusively in this time slot to simplify measurements,
- it uses burst type 1.

The P-CCPCH may be transmitted in a multiframe structure, i.e. it is transmitted not in every radio frame. In order to enable continuous measurements, all physical channels that are allocated to the same time slot and to the same channelisation code  $a_{Q=16}^{(k=1)}$  as the P-CCPCH, i.e. share the position in a multiframe pattern, shall also provide the beacon function as it is defined above.

In sync case 2, cf. 5.3.4, the beacon function shall be provided in two time slots within one radio frame. Therefore, all physical channels that are allocated to the time slot #k+8 shall also provide the beacon function.

### 5.3.2 Secondary common control physical channel (S-CCPCH)

PCH and FACH as described in section 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.

#### 5.3.2.1 Spreading codes

The S-CCPCH uses fixed spreading with a spreading factor  $SF = 16$  as described in section 5.2.1.1.

#### 5.3.2.2 Burst Types

The burst types 1 or 2 as described in section 5.2.2 are used for the S-CCPCHs. No TFCI is applied for S-CCPCHs.

### 5.3.2.3 Training sequences for spread bursts

The training sequences, i.e. midambles, as described in section 5.2.3 are used for the S-CCPCH.

## 5.3.3 The physical random access channel (PRACH)

The RACH or in case of ODMA networks the ORACH as described in section 4.1.2 are mapped onto one or more uplink physical random access channels (PRACH). In such a way the capacity of RACH and ORACH can be flexibly scaled depending on the operators need.

This description of the physical properties of the PRACH also applies to bursts carrying other signaling or user traffic if they are scheduled on a time slot which is (partly) allocated to the RACH or ORACH.

### 5.3.3.1 PRACH Spreading codes

The uplink PRACH uses either spreading factor SF=16 or SF=8 as described in section 5.2.1.1. 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).

### 5.3.3.2 PRACH Burst Types

The mobile stations send the uplink access bursts randomly in the PRACH. The PRACH burst consists of two data symbol fields, a midamble and a guard period. The second data symbol field is shorter than the first symbol data field by 96 chips in order to provide additional guard time at the end of the PRACH time slot.

The precise number of collision groups depends on the spreading codes (i.e. the selected RACH configuration. The access burst is depicted in figure 10, the contents of the access burst fields are listed in table 7 and table 8.

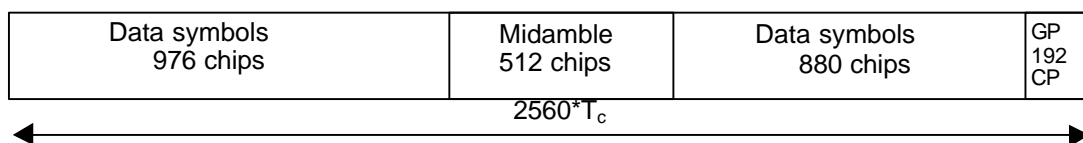


Figure 12: PRACH burst, GP denotes the guard period

Table 7: number of symbols per data field in PRACH burst

Spreading factor (Q)	Number of symbols in data field 1	Number of symbols in data field 2
8	122	110
16	61	55

Table 8: The contents of the PRACH burst field

Chip number (CN)	Length of field in chips	Length of field in symbols	Contents of field
0-975	976	cf table 1	Data symbols
976-1487	512	-	Midamble
1488-2367	880	cf table 1	Data symbols
2368-2559	192	-	Guard period

### 5.3.3.3 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 used for PRACH bursts are the same as for burst type 1 and are shown in Annex A. The necessary time shifts are obtained by choosing either *all*  $k=1,2,3,\dots,K'$  (for cells with small

radius) or *uneven*  $k=1,3,5,\dots\leq K'$  (for cells with large radius). Different cells use different periodic basic codes, i.e. different midamble sets.

For cells with large radius additional midambles may be derived from the time-inverted Basic Midamble Sequence. Thus, the second Basic Midamble Code  $m_2$  is the time inverted version of Basic Midamble Code  $m_1$ .

In this way, a joint channel estimation for the channel impulse responses of all active users within one time slot can be performed by a maximum of two cyclic correlations (in cells with small radius, a single cyclic correlator suffices). The different user specific channel impulse response estimates are obtained sequentially in time at the output of the cyclic correlators.

### 5.3.3.4 Association between Training Sequences and Spreading Codes

For the PRACH there exists a fixed association between the training sequence and the spreading code. The generic rule to define this association is based on the order of the spreading codes  $a_Q^{(k)}$  given by  $k$  and the order of the midambles  $m_j^{(k)}$  given by  $k$ , firstly, and  $j$ , secondly, with the constraint that the midamble for a spreading factor  $Q$  is the same as in the upper branch for the spreading factor  $2Q$ . The index  $j=1$  or  $2$  indicates whether the original Basic Midamble Sequence ( $j=1$ ) or the time-inverted Basic Midamble Sequence is used ( $j=2$ ).

- For the case that all  $k$  are allowed and only one periodic basic code  $m_1$  is available for the RACH, the association depicted in figure 13 is straightforward.
- For the case that only odd  $k$  are allowed the principle of the association is shown in figure 14. This association is applied for one and two basic periodic codes.

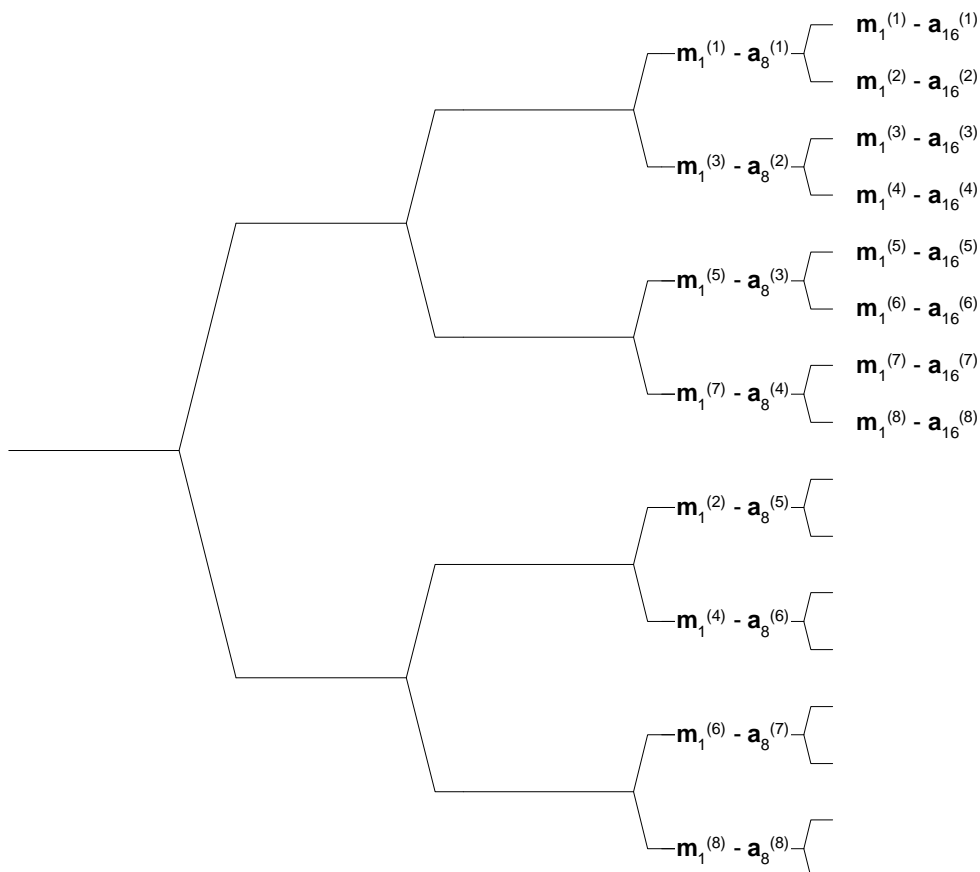


Figure 13: Association of Midambles to Spreading Codes in the OVSF tree for all  $k$

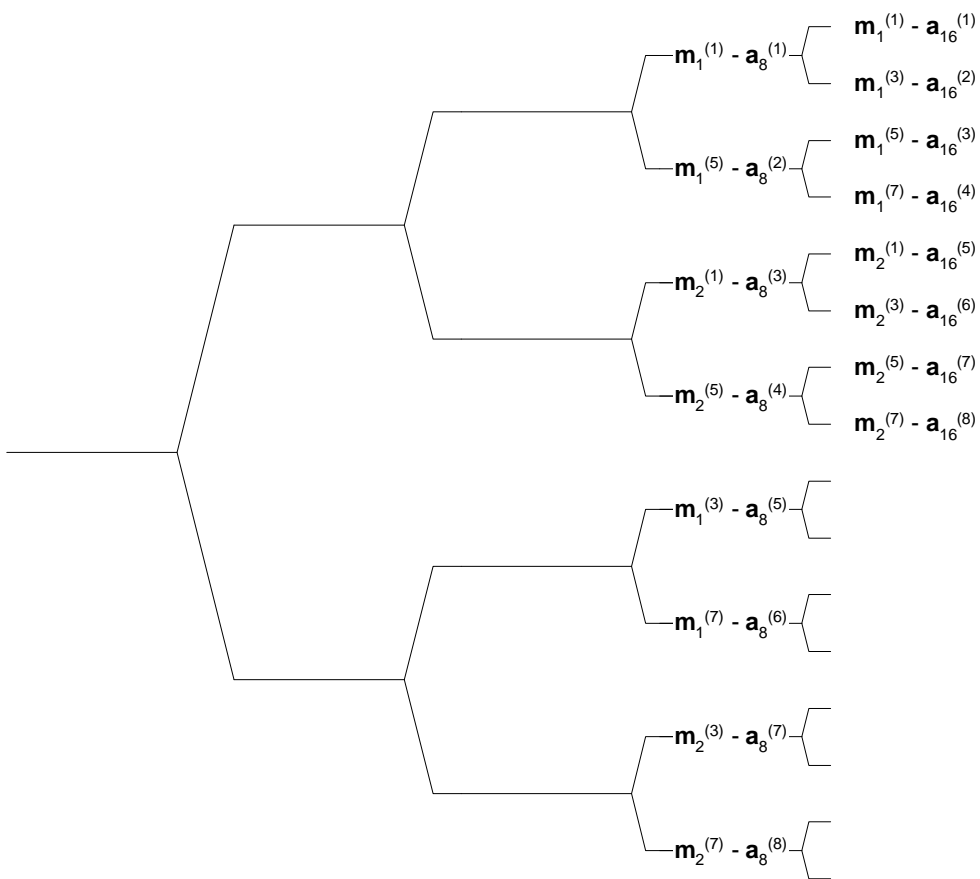


Figure 14: Association of Midambles to Spreading Codes in the OVFS tree for odd *k*

### 5.3.4 The physical synchronisation channel (PSCH)

In TDD mode code group of a cell can be derived from the synchronisation channel. Additional information, received from higher layers on SCH transport channel, is also transmitted to the UE in PSCH in case 3 from below. In order not to limit the uplink/downlink asymmetry the PSCH is mapped on one or two downlink slots per frame only.

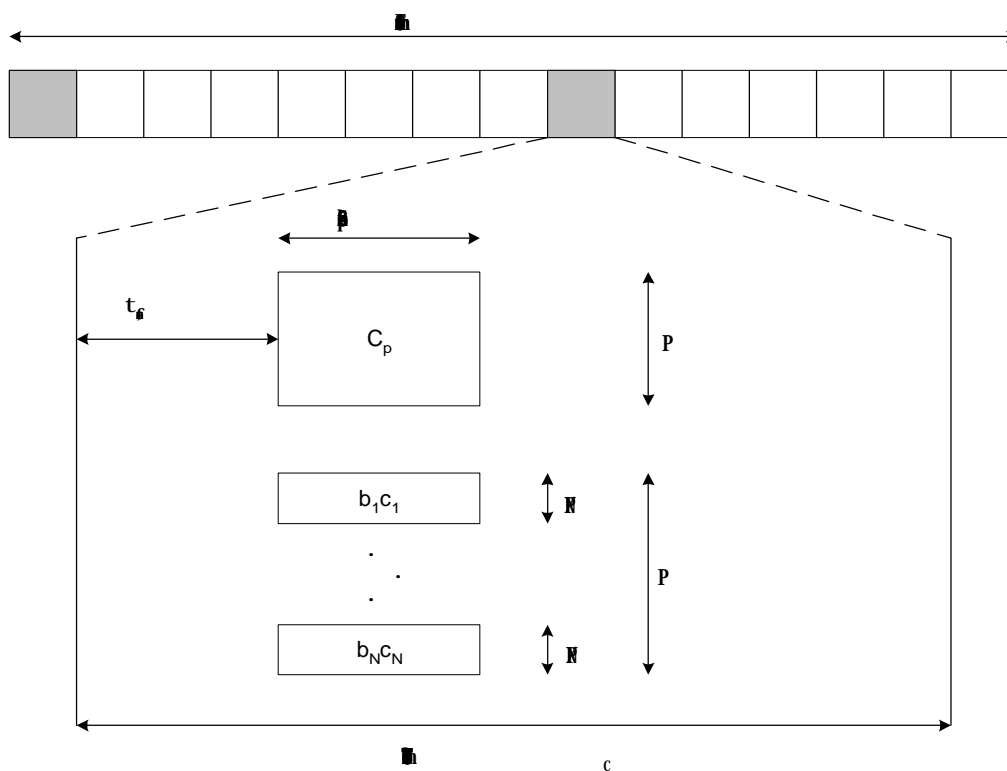
There are three cases of PSCH and P-CCPCH allocation as follows:

- Case 1) PSCH and P-CCPCH allocated in TS#k, k=0...14
- Case 2) PSCH allocated in two TS: TS#k and TS#k+8, k=0...6; P-CCPCH allocated in TS#k.
- Case 3) PSCH allocated in two TS, TS#k and TS#k+8, k=0...6, and the P-CCPCH allocated in TS#i, i=0...14, pointed by PSCH. Pointing is determined via the SCH from the higher layers.

These three cases are addressed by higher layers using the SCCH in TDD Mode. The position of PSCH (value of k) in frame can change on a long term basis in any case.

Due to this PSCH scheme, the position of P-CCPCH is known from the PSCH. EMBEDDED

Figure 15 is an example for transmission of PSCH, k=0, of Case 2 or Case 3.



**Figure 15: Scheme for Physical Synchronisation channel PSCH consisting of one primary sequence  $C_p$  and  $N=3$  parallel secondary sequences in slot k and k+8**

(example for k=0 in Case 2 or Case 3)

As depicted in figure 15, the PSCH consists of a primary and three secondary code sequences with 256 chips length. The primary and secondary code sequences are defined in [8] chapter 7 'Synchronisation codes'. The secondary codes are transmitted either in the I channel or the Q channel, depending on the code group.

Due to mobile to mobile interference, it is mandatory for public TDD systems to keep synchronisation between base stations. As a consequence of this, a capture effect concerning PSCH can arise. The time offset  $t_{offset}$  enables the system to overcome the capture effect.

The time offset  $t_{\text{offset}}$  is one of 32 values, depending on the cell parameter, thus on the code group of the cell, cf. 'table 7 Mapping scheme for Cell Parameters, Code Groups, Scrambling Codes, Midambles and  $t_{\text{offset}}$ ' in [8]. The exact value for  $t_{\text{offset}}$ , regarding column 'Associated  $t_{\text{offset}}$ ' in table 7 from [8] is given by:

$$\begin{aligned} t_{\text{offset},n} &= n \cdot T_c \left\lfloor \frac{2560 - 96 - 256}{31} \right\rfloor \\ &= n \cdot 71T_c ; \quad n = 0, \dots, 31 \end{aligned}$$

Please note that  $\lfloor x \rfloor$  denotes the largest integer number less or equal to  $x$  and that  $T_c$  denotes the chip duration.



### 5.3.5 Physical Uplink Shared Channel (PUSCH)

For Physical Uplink Shared Channel (PUSCH) the burst structure of DPCH as described in section 5.2 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.

### 5.3.6 Physical Downlink Shared Channel (PDSCH)

For Physical Downlink Shared Channel (PDSCH) the burst structure of DPCH as described in section 5.2 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 indicated for the UE by UTRAN.

### 5.3.7 The Page Indicator Channel (PICH)

The Page Indicator Channel (PICH) is a physical channel used to carry the Page Indicators (PI). The PICH substitutes one or more paging sub-channels that are mapped on a S-CCPCH, see 6.2.2. The page indicator indicates a paging message for one or more UEs that are associated with it.

The page indicators of length  $L_{PI}=2$ ,  $L_{PI}=4$  or  $L_{PI}=8$  symbols are transmitted in a normal burst (type 1 or 2) as seen in figure 16. The PI may be repeated within one superframe. The number of repetitions within one superframe is given by the repetition factor  $RF_{PI}$ . The number of page indicators  $N_{PI}$  per superframe is given by the number of time slots per superframe  $N_{PICH}$ , used for the PICH, the number  $L_{PI}$  of symbols for the page indicators, the burst type BT and the repetition factor of the paging indicators,  $RF_{PI}$ . The same burst type is used for the PICH in every cell. In case of  $L_{PI}=4$  or  $L_{PI}=8$ , one symbol in each data part adjacent to the midamble is left over. These symbols are filled by dummy bits that are transmitted with the same power as the PI. Figure 16 shows an example for  $L_{PI}=4$ , BT 1,  $N_{PICH}=4$ ,  $RF_{PI}=2$ .

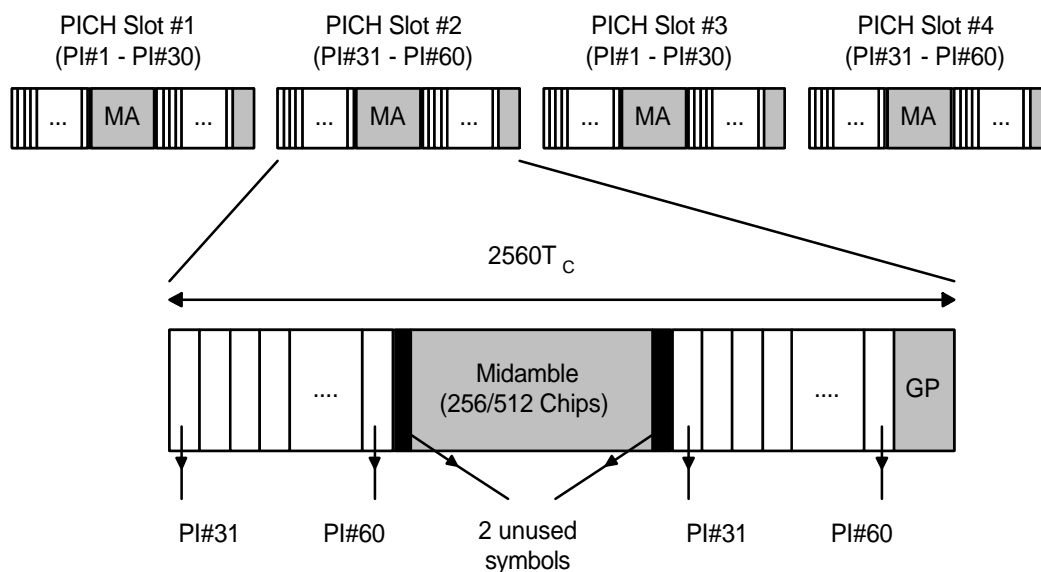


Figure 16: Example of PI Transmission in the PICH

## 6 Mapping of transport channels to physical channels

This section describes the way in which transport channels are mapped onto physical resources, see figure 17.

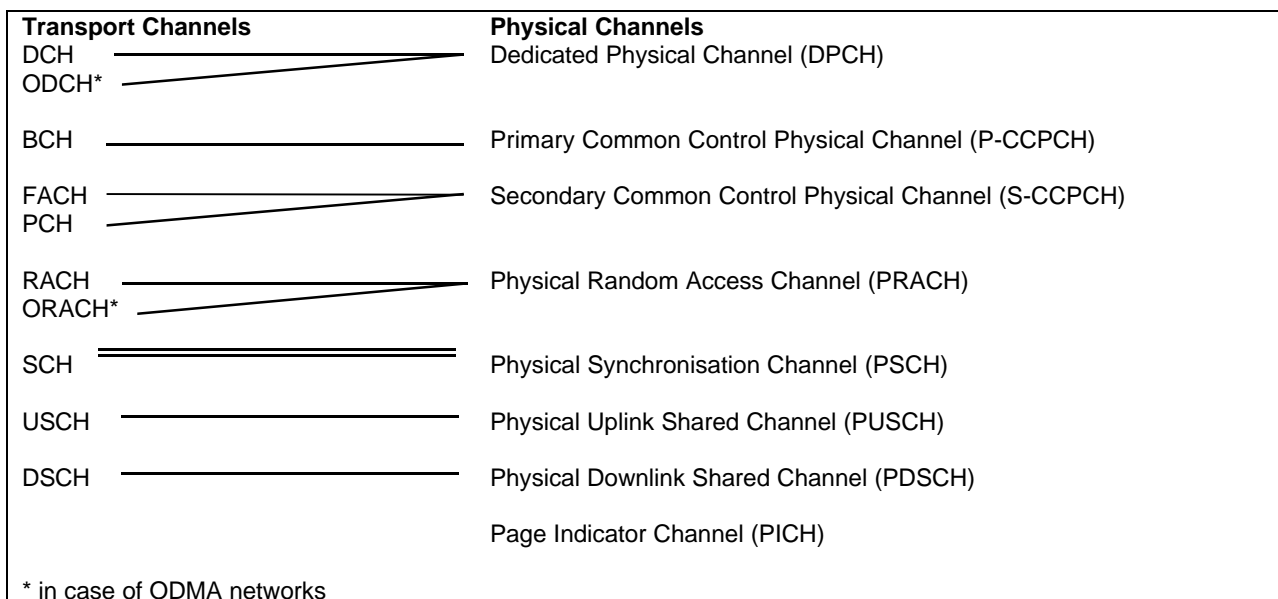


Figure 17: Transport channel to physical channel mapping

### 6.1 Dedicated Transport Channels

A dedicated transport channel is mapped onto one or more physical channels. An interleaving period is associated with each allocation. The frame is subdivided into slots that are available for uplink and downlink information transfer. The mapping of transport blocks on physical channels is described in TS25.222 (“multiplexing and channel

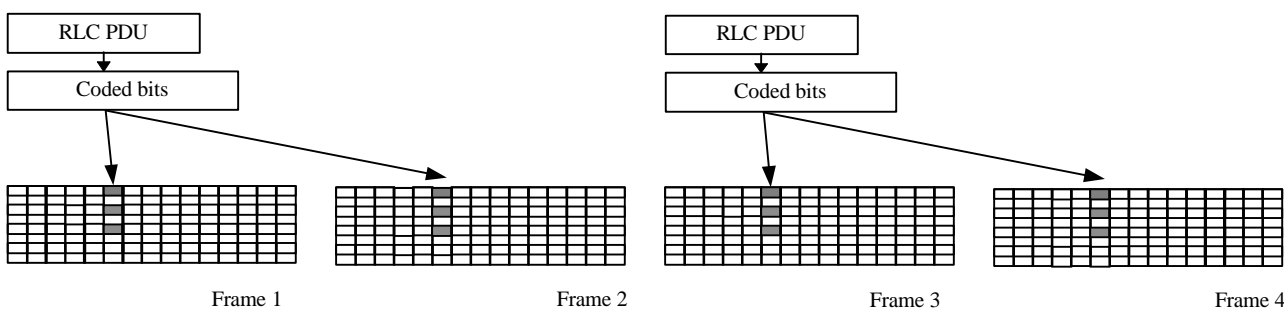


Figure 19: Mapping of PDU onto the physical bearer

For NRT packet data services, shared channels (USCH and DSCH) can be used to allow efficient allocations for a short period of time.

An ODCH is also mapped onto one or more sets of slots and codes within a TDD frame as shown in figure 4. The actual transmission mode (i.e. combination of slots, codes, TX power, interleaving depth etc.) chosen for a relay link will be negotiated between nodes prior to transmission. Several of these transmission mode parameters can be adapted during transmission due to changes in propagation and data traffic.

## 6.2 Common Transport Channels

### 6.2.1 The Broadcast Channel (BCH)

The BCH is mapped onto the P-CCPCH. The secondary SCH indicates in which timeslot a mobile can find the P-CCPCH containing BCH. If the broadcast information requires more resources than provided by the P-CCPCH, the BCH in P-CCPCH will comprise a pointer to additional S-CCPCH resources for FACH in which this additional broadcast information shall be sent.

### 6.2.2 The Paging Channel (PCH)

The PCH is mapped onto one or several S-CCPCHs so that capacity can be matched to requirements. The location of the PCH is indicated on the BCH. It is always transmitted at a reference power level.

To allow an efficient DRX, the PCH is divided into several paging sub-channels within the multiframe structure of one superframe. Examples of multiframe structures are given in the Annex B of this document. Each paging sub-channel is mapped on 2 consecutive frames that are allocated to the PCH on the same S-CCPCH. Thus, the number of paging sub-channels per S-CCPCH is half of the number of frames used for the PCH in one superframe. Layer 3 information to a particular paging group is transmitted only in the associated paging sub-channel. The assignment of UEs to paging groups is independent of the assignment of UEs to page indicators.

### 6.2.3 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.

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## Annex B (Informative): CCPCH Multiframe Structure

In the following figures B.1 to B.3 some examples for Multiframe Structures on Primary and Secondary CCPCH are given. The figures show the placement of Common Transport Channels on the Common Control Physical Channels. Additional S-CCPCH capacity can be allocated on other codes and timeslots of course, e.g. FACH capacity is related to overall cell capacity and can be configured according to the actual needs. Channel capacities in the annex are derived using bursts with long midambles (Burst format 1). Every TrCH-box in the figures is assumed to be valid for two frames (see row 'Frame #'), i.e. the transport channels in CCPCHs have an interleaving time of 20msec.

The actual CCPCH Multiframe Scheme used in the cell is described and broadcast on BCH. Thus the system information structure has its roots in this particular transport channel and allocations of other Common Channels can be handled this way, i.e. by pointing from BCH.



