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Digitalni celiļ ni telekomunikacijski sistem (faza 2) ï Multipleksiranje in sodostop na radijski poti (GSM 05.02)

Digital cellular telecommunications system (Phase 2) (GSM); Multiplexing and multiple access on the radio path (GSM 05.02 version 4.9.1)

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GLOBAL SYSTEM FOR MOBILE COMMUNICATIONS

Digital cellular telecommunications system (Phase 2); Multiplexing and multiple access on the radio path (GSM 05.02 version 4.9.1)

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 4 92 94 42 00 - Fax: +33 4 93 65 47 16

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Foreword

This European Telecommunication Standard (ETS) has been produced by the Special Mobile Group (SMG) of the European Telecommunications Standards Institute (ETSI).

This ETS defines the physical channels of the radio sub-system required to support the logical channels used within the Digital cellular telecommunications system (Phase 2).

The specification from which this ETS has been derived was originally based on CEPT documentation, hence the presentation of this ETS may not be entirely in accordance with the ETSI/PNE Rules.

Transposition dates	
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1 Scope

This European Telecommunication Standard (ETS) defines the physical channels of the radio sub-system required to support the logical channels. It includes a description of the logical channels and the definition of frequency hopping, TDMA frames, timeslots and bursts.

1.1 Normative references

This ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

[1] GSM 01.04 (ETR 100): "Digital cellular telecommunications system (Phase 2); Abbreviations and acronyms".

[2] GSM 03.03 (ETS 300 523): "Digital cellular telecommunications system (Phase 2); Numbering, addressing and identification".

[3] GSM 04.03 (ETS 300 552): "Digital cellular telecommunications system (Phase 2); Mobile Station - Base Station System (MS - BSS) interface Channel structures and access capabilities".

[4] GSM 04.06 (ETS 300 555): "Digital cellular telecommunications system (Phase 2); Mobile Station - Base Station System (MS - BSS) interface Data Link (DL) layer specification".

[5] GSM 04.08 (ETS 300 557): "Digital cellular telecommunications system (Phase 2); Mobile radio interface layer 3 specification".

[6] GSM 05.03 (ETS 300 575): "Digital cellular telecommunications system (Phase 2); Channel coding".

[7] GSM 05.04 (ETS 300 576): "Digital cellular telecommunications system (Phase 2); Modulation".

[8] GSM 05.05 (ETS 300 577): "Digital cellular telecommunications system (Phase 2); Radio transmission and reception".

[9] GSM 05.08 (ETS 300 578): "Digital cellular telecommunications system (Phase 2); Radio subsystem link control".

[10] GSM 05.10 (ETS 300 579): "Digital cellular telecommunications system (Phase 2); Radio subsystem synchronization".

1.2 Abbreviations

Definitions and abbreviations used in this ETS are listed in GSM 01.04 [1].

2 General

The radio subsystem is required to support a certain number of logical channels that can be separated into two overall categories as defined in GSM 04.03:

i) The traffic channels (TCH's).
ii) The control channels.

More information is given about these logical channels in section 3 which also defines a number of special channels used by the radio sub-system.

Section 4 of this document describes the physical resource available to the radio sub-system, section 5 defines physical channels based on that resource and section 6 specifies how the logical channels shall be mapped onto physical channels. Figure 1 depicts this process.

3 Logical channels

3.1 General

This section describes the logical channels that are supported by the radio subsystem.

3.2 Traffic channels

3.2.1 General

Traffic channels (TCH's) are intended to carry either encoded speech or user data. Two general forms of traffic channel are defined:

i) Full rate traffic channel (TCH/F). This channel carries information at a gross rate of 22.8 kbits/s.
ii) Half rate traffic channel (TCH/H). This channel carries information at a gross rate of 11.4 kbit/s.

The specific traffic channels available in the categories of speech and user data are defined in the sections following.

3.2.2 Speech traffic channels

The following traffic channels are defined to carry encoded speech:

i) Full rate traffic channel for speech (TCH/FS).
ii) Half rate traffic channel for speech (TCH/HS).

3.2.3 Data traffic channels

The following traffic channels are defined to carry user data:

i) Full rate traffic channel for 9.6 kbit/s user data (TCH/F9.6).
ii) Full rate traffic channel for 4.8 kbit/s user data (TCH/F4.8).
iii) Half rate traffic channel for 4.8 kbit/s user data (TCH/H4.8).
iv) Half rate traffic channel for ≤ 2.4 kbit/s user data (TCH/H2.4).
v) Full rate traffic channel for ≤ 2.4 kbit/s user data (TCH/F2.4).

3.3 Control channels

3.3.1 General

Control channels are intended to carry signalling or synchronization data. Three categories of control channel are defined: broadcast, common and dedicated. Specific channels within these categories are defined in the sections following.

3.3.2 Broadcast channels

3.3.2.1 Frequency correction channel (FCCH)

The frequency correction channel carries information for frequency correction of the mobile station. It is required only for the operation of the radio sub-system.

3.3.2.2 Synchronization channel (SCH)

The synchronization channel carries information for frame synchronization of the mobile station and identification of a base transceiver station. It is required only for the operation of the radio sub-system. Specifically the synchronization channel shall contain two encoded parameters:

a) Base transceiver station identity code (BSIC): 6 bits (before channel coding) consists of 3 bits of PLMN colour code with range 0 to 7 and 3 bits of BS colour code with range 0 to 7 as defined in GSM 03.03.

b) Reduced TDMA frame number (RFN): 19 bits (before channel coding) =

T1	(11 bits)	range 0 to 2047	= FN div (26 x 51)
T2	(5 bits)	range 0 to 25	= FN mod 26
T3'	(3 bits)	range 0 to 4	= (T3 - 1) div 10

where

T3	(6 bits)	range 0 to 50	= FN mod 51

and

FN = TDMA frame number as defined in section 4.3.3.

GSM 04.06 and GSM 04.08 specify the precise bit ordering, GSM 05.03 the channel coding of the above parameters and GSM 05.10 defines how the TDMA frame number can be calculated from T1, T2, and T3'.

3.3.2.3 Broadcast control channel (BCCH)

The broadcast control channel broadcasts general information on a base transceiver station per base transceiver station basis. Of the many parameters contained in the BCCH, the use of the following parameters, as defined in GSM 04.08 are referred to in section 6.5:

a) CCCH_CONF which indicates the organization of the common control channels:

From this parameter, the number of common control channels (BS_CC_CHANS) and whether or not CCCH or SDCCH are combined (BS_CCCH_SDCCH_COMB = true or false) are derived as follows:

CCCH_CONF	BS_CC_CHANS	BS_CCCH_SDCCH_COMB
000	1	false
001	1	true
010	2	false
100	3	false
110	4	false

b) BS_AG_BLKS_RES which indicates the number of blocks on each common control channel reserved for access grant messages:
3 bits (before channel coding) range 0 to 7.

c) BS_PA_MFRMS which indicates the number of 51 TDMA frame multiframes between transmission of paging messages to mobiles of the same paging group:
3 bits (before channel coding) range 2 to 9.

3.3.3 Common control type channels, known when combined as a common control channel (CCCH)

i) Paging channel (PCH): Downlink only, used to page mobiles.
ii) Random access channel (RACH): Uplink only, used to request allocation of a SDCCH.
iii) Access grant channel (AGCH): Downlink only, used to allocate a SDCCH or directly a TCH.

3.3.4 Dedicated control channels

i) Slow, TCH/F associated, control channel (SACCH/TF).
ii) Fast, TCH/F associated, control channel (FACCH/F).
iii) Slow, TCH/H associated, control channel (SACCH/TH).
iv) Fast, TCH/H associated, control channel (FACCH/H).
v) Stand alone dedicated control channel (SDCCH/8).
vi) Slow, SDCCH/8 associated, control channel (SACCH/C8).
vii) Stand alone dedicated control channel, combined with CCCH (SDCCH/4).
viii) Slow, SDCCH/4 associated, control channel (SACCH/C4).

3.3.5 Cell Broadcast Channel (CBCH)

The CBCH, downlink only, is used to carry the short message service cell broadcast (SMSCB). The CBCH uses the same physical channel as the SDCCH.

3.4 Combination of channels

Only certain combinations of channels are allowed as defined in GSM 04.03. Section 6.4 lists the combinations in relation to basic physical channels.

4 The physical resource

4.1 General

The physical resource available to the radio sub-system is an allocation of part of the radio spectrum. This resource is partitioned both in frequency and time. Frequency is partitioned by radio frequency channels (RFCHs) divided into bands as defined in GSM 05.05. Time is partitioned by timeslots and TDMA frames as defined in section 4.3 of this ETS.

4.2 Radio frequency channels

4.2.1 Cell allocation and mobile allocation

GSM 05.05 defines radio frequency channels (RFCHs), and allocates numbers to all the radio frequency channels available to the system. Each cell is allocated a subset of these channels, defined as the cell allocation (CA). One radio frequency channel of the cell allocation shall be used to carry synchronization information and the BCCH, this shall be known as BCCH carrier. The subset of the cell allocation, allocated to a particular mobile, shall be known as the mobile allocation (MA).

4.2.2 Downlink and uplink

The downlink comprises radio frequency channels used in the base transceiver station to mobile station direction.

The uplink comprises radio frequency channels used in the mobile station to base transceiver station direction.

4.3 Timeslots and TDMA frames

4.3.1 General

A timeslot shall have a duration of 3/5 200 seconds (≈ 577 µs). Eight timeslots shall form a TDMA frame (≈ 4,62 ms in duration).

At the base transceiver station the TDMA frames on all of the radio frequency channels in the downlink shall be aligned. The same shall apply to the uplink (see GSM 05.10).

At the base transceiver station the start of a TDMA frame on the uplink is delayed by the fixed period of 3 timeslots from the start of the TDMA frame on the downlink (see figure 2).

At the mobile station this delay will be variable to allow adjustment for signal propagation delay. The process of adjusting this advance is known as adaptive frame alignment and is detailed in GSM 05.10.

The staggering of TDMA frames used in the downlink and uplink is in order to allow the same timeslot number to be used in the downlink and uplink whilst avoiding the requirement for the mobile station to transmit and receive simultaneously. The period includes time for adaptive frame alignment, transceiver tuning and receive/transmit switching (see figure 4).

4.3.2 Timeslot number

The timeslots within a TDMA frame shall be numbered from 0 to 7 and a particular timeslot shall be referred to by its timeslot number (TN).

4.3.3 TDMA frame number

TDMA frames shall be numbered by a frame number (FN). The frame number shall be cyclic and shall have a range of 0 to FN_MAX where FN_MAX = (26 x 51 x 2048) -1 = 2715647 as defined in GSM 05.10. The frame number shall be incremented at the end of each TDMA frame.

The complete cycle of TDMA frame numbers from 0 to FN_MAX is defined as a hyperframe. A hyperframe consists of 2048 superframes where a superframe is defined as 26 x 51 TDMA frames. A 26 TDMA frame multiframe is used to support traffic and associated control channels and a 51 TDMA frame multiframe is used to support broadcast, common control and stand alone dedicated control (and their associated control) channels. Hence a superframe may be considered as 51 traffic/associated control multiframes or 26 broadcast/common control multiframes.

The need for a hyperframe of a substantially longer period than a superframe arises from the requirements of the encryption process which uses FN as an input parameter.

5 Physical channels

5.1 General

A physical channel uses a combination of frequency and time division multiplexing and is defined as a sequence of radio frequency channels and time slots. The complete definition of a particular physical channel consists of a description in the frequency domain, and a description in the time domain.

The description in the frequency domain is addressed in section 5.4, the description in the time domain is addressed in section 5.5.