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European digital cellular telecommunications system (Phase 2); Physical layer on the radio path; General description (GSM 05.01)

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Foreword

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

This ETS describes, in general terms, the physical layer on the radio path of GSM and DCS 1800 within the European digital cellular telecommunications system (Phase 2).

This ETS corresponds to GSM technical specification, GSM 05.01 version 4.4.0.

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.

Reference is made within this ETS to GSM Technical Specifications (GSM-TSs) (NOTE).

NOTE: TC-SMG has produced documents which give the technical specifications for the implementation of the European digital cellular telecommunications system. Historically, these documents have been identified as GSM Technical Specifications (GSM-TSs). These TSs may have subsequently become I-ETSs (Phase 1), or ETSs (Phase 2), whilst others may become ETSI Technical Reports (ETRs). GSM-TSs are, for editorial reasons, still referred to in GSM ETSs.

Proposed transposition dates	
Date of adoption of this ETS:	30 July 1995
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1.1 Scope

This technical specification is an introduction to the 05 series of the GSM technical specifications for GSM and DCS 1800. It is not of a mandatory nature, but consists of a general description of the organization of the physical layer with reference to the technical specifications where each part is specified in detail. It introduces furthermore, the reference configuration that will be used throughout this series of technical specifications.

1.2 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): "European digital cellular telecommunication system (Phase 2); Definitions, abbreviations and acronyms".

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

[3] GSM 03.20 (ETS 300 534): "European digital cellular telecommunication system (Phase 2); Security related network functions".

[4] GSM 03.22 (ETS 300 535): "European digital cellular telecommunication system (Phase 2); Functions related to Mobile Station (MS) in idle mode".

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

[6] GSM 04.08 (ETS 300 557): "European digital cellular telecommunication system (Phase 2); Mobile radio interface layer 3 specification".

[7] GSM 04.21 (ETS 300 562): "European digital cellular telecommunication system (Phase 2); Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface ".

[8] GSM 05.02 (ETS 300 574): "European digital cellular telecommunication system (Phase 2); Multiplexing and multiple access on the radio path".

[9] GSM 05.03 (ETS 300 575): "European digital cellular telecommunication system (Phase 2); Channel coding".

[10] GSM 05.04 (ETS 300 576): "European digital cellular telecommunication system (Phase 2); Modulation".

[11] GSM 05.05 (ETS 300 577): "European digital cellular telecommunication system (Phase 2); Radio transmission and reception".

[12] GSM 05.08 (ETS 300 578): "European digital cellular telecommunication system (Phase 2); Radio subsystem link control".

[13] GSM 05.10 (ETS 300 579): "European digital cellular telecommunication system (Phase 2); Radio subsystem synchronisation".

[14] GSM 03.30 (ETR 103): "European digital cellular telecommunication system (Phase 2); Radio network planning aspects".

1.3 Definitions and abbreviations

Definitions and abbreviations used in this specification are listed in GSM 01.04.

2. Set of channels

The radio subsystem provides a certain number of logical channels that can be separated into two categories according to GSM 04.03:

1) the traffic channels (TCH): they are intended to carry two types of user information streams: encoded speech and data. Two types of traffic channels are defined: Bm or full-rate (TCH/F) and Lm or half-rate (TCH/H) traffic channels. For the purpose of this series of technical specifications, the following traffic channels are distinguished:
   - full rate speech TCH (TCH/FS)
   - half rate speech TCH (TCH/HS)
   - 9.6 kbit/s full rate data TCH (TCH/F9.6)
   - 4.8 kbit/s full rate data TCH (TCH/F4.8)
   - 4.8 kbit/s half rate data TCH (TCH/H4.8)
   - ≤ 2.4 kbit/s full rate data TCH (TCH/F2.4)
   - ≤ 2.4 kbit/s half rate data TCH (TCH/H2.4)
   - cell broadcast channel (CBCH)

2) the signaling channels: these can be sub-divided into BCCH (broadcast control channel), CCCH (common control channel), SDCCH (stand-alone dedicated control channel) and ACCH (associated control channel). An associated control channel is always allocated in conjunction with, either a TCH, or a SDCCH. Two types of ACCH are defined: continuous stream (slow ACCH) and burst stealing mode (fast ACCH). For the purpose of this series of technical specifications, the following signalling channels are distinguished:
   - stand-alone dedicated control channel, four of them mapped on the same basic physical channel as the CCCH (SDCCH/4)
   - stand-alone dedicated control channel, eight of them mapped on a separate basic physical channel (SDCCH/8)
   - full rate fast associated control channel (FACCH/F)
   - half rate fast associated control channel (FACCH/H)
   - slow, TCH/F associated, control channel (SACCH/TF)
   - slow, TCH/H associated, control channel (SACCH/TH)
   - slow, SDCCH/4 associated, control channel (SACCH/C4)
   - slow, SDCCH/8 associated, control channel (SACCH/C8)
   - broadcast control channel (BCCH)
   - random access channel (ie uplink CCCH) (RACH)
   - paging channel (part of downlink CCCH) (PCH)
   - access grant channel (part of downlink CCCH) (AGCH)

When there is no need to distinguish between different sub-categories of the same logical channel, only the generic name will be used, meaning also all the sub-categories (SACCH will mean all categories of SACCHs, SACCH/T will mean both the slow, TCH associated, control channels,..).

The logical channels mentioned above are mapped on physical channels that are described in this set of technical specifications. The different physical channels provide for the transmission of information pertaining to higher layers according to a block structure.

3. Reference configuration

For the purpose of elaborating the physical layer specification, a reference configuration of the transmission chain is used as shown in annex A. This reference configuration also indicates which parts are dealt with in details in which technical specification. It shall be noted that only the transmission part is specified, the receiver being specified only via the overall performance requirements. With reference to this configuration, the technical specifications in the 05 series address the following functional units:

- GSM 05.02: burst building, and burst multiplexing;
- GSM 05.03: coding, reordering and partitioning, and interleaving;
- GSM 05.04: differential encoding, and modulation;
- GSM 05.05: transmitter, antenna, and receiver (overall performance).

This reference configuration defines also a number of points of vocabulary in relation to the name of bits at different levels in the configuration. It must be outlined, in the case of the encrypted bits, that they are named only with respect to their position after the encryption unit, and not to the fact that they pertain to a flow of information that is actually encrypted.

4. The block structures

The different block structures are described in more detail in GSM 05.03 (Channel coding). A summarised description appears in table 1, in terms of net bit rate, length and recurrence of blocks.

Table 1: Channel block structures

Type of channel	net bit rate (kbit/s)	block length (bits)	block recurrence (ms)
full rate speech TCH[1]	13,0	182 + 78	20
half rate speech TCH[2]	5,6	95 + 17	20
data TCH (9,6 kbit/s)[3]	12,0	60	5
data TCH (4,8 kbit/s)[3]	6,0	60	10
data TCH (≤ 2,4 kbit/s)[3]	3,6	36	10
full rate FACCH (FACCH/F)	9,2	184	20
half rate FACCH (FACCH/H)	4,6	184	40
SDCCH	598/765 (≈ 0,782)	184	3060/13 (235)
SACCH (with TCH)[4]	115/300 (≈ 0,383)	168 + 16	480
SACCH (with SDCCH)[4]	299/765 (≈ 0,391)	168 + 16	6120/13 (≈ 471)
BCCH	598/765 (≈ 0,782)	184	3060/13 (≈ 235)
AGCH[5]	n*598/765 (≈ 0,782)	184	3060/13 (≈ 235)
PCH[5]	p*598/765 (≈ 0,782)	184	3060/13 (≈ 235)
RACH[5]	r*26/765 (≈ 0,034)	8	3060/13 (≈ 235)
CBCH	598/765 (≈ 0,782)	184	3060/13 (≈ 235)

NOTE 1: For full rate speech, the block is divided into two classes according to the importance of the bits (182 bits for class I and 78 bits for class II).
NOTE 2: For half rate speech, the block is divided into two classes according to the importance of the bits (95 bits for class I and 17 bits for class II).
NOTE 3: For data services, the net bit rate is the adaptation rate as defined in GSM 04.21.
NOTE 4: On SACCH, 16 bits are reserved for control information on layer 1, and 168 bits are used for higher layers.
NOTE 5: CCCH channels are common to all users of a cell; the total number of blocks (n, p, r) per recurrence period is adjustable on a cell by cell basis and depends upon the parameters (BS_CC_CHANS, BS_BCCH_SDCCH_COMB and BS_AG_BLKS_RES) broadcast on the BCCH and specified in GSM 05.02 and GSM 04.08.