ETSI TS 145 002 V13.1.0 (2016-04)

Digital cellular telecommunications system (Phase 2+) (GSM); Multiplexing and multiple access on the radio path (3GPP TS 45.002 version 13.1.0 Release 13)

3GPP A GLOBAL INITIATIVE
GSM® GLOBAL SYSTEM FOR MOBILE COMMUNICATIONS

Reference

RTS/TSGG-0145002vd10

Keywords

GSM

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

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

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:
http://www.etsi.org/standards-search

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
http://portal.etsi.org/tb/status/status.asp

If you find errors in the present document, please send your comment to one of the following services:
https://portal.etsi.org/People/CommiteeSupportStaff.aspx

Copyright Notification

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Specification (TS) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

The present document may refer to technical specifications or reports using their 3GPP identities, UMTS identities or GSM identities. These should be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between GSM, UMTS, 3GPP and ETSI identities can be found under http://webapp.etsi.org/key/queryform.asp.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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

Version x.y.z

where:

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

1 Scope

The present document defines the physical channels of the radio sub-system required to support the logical channels. For the Flexible Layer One, it defines the physical channels of the radio sub-system required to support the transport channels. It includes a description of the logical channels, transport channels and the definition of frequency hopping, TDMA frames, timeslots and bursts.

1.1 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. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications ".

[2] 3GPP TS 23.003: "Numbering, addressing and identification".

[3] 3GPP TS 23.034: 'High Speed Circuit Switched Data (HSCSD) – Stage 2'.

[4] 3GPP TS 43.052: "GSM Cordless Telephony System (CTS), Phase 1; Lower layers of the CTS Radio Interface; Stage 2".

[5] 3GPP TS 43.059: 'Functional stage 2 description of Location Services (LCS) in GERAN'.

[6] 3GPP TS 43.064: "General Packet Radio Service (GPRS); Overall description of the GPRS Radio Interface; Stage 2".

[7] 3GPP TS 43.246: "Multimedia Broadcast Multicast Service (MBMS) in the GERAN; Stage 2".

[8] 3GPP TS 44.003: "Mobile Station - Base Station System (MS - BSS) interface Channel structures and access capabilities".

[9] 3GPP TS 44.006: "Mobile Station - Base Station System (MS - BSS) interface Data Link (DL) layer specification".

[10] 3GPP TS 44.018: "Mobile radio interface layer 3 specification, Radio Resource Control Protocol".

[11] 3GPP TS 44.060: "General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS interface; Radio Link Control (RLC) and Medium Access Control (MAC) Layer Specification".

[12] 3GPP TS 44.056: "GSM Cordless Telephony System (CTS), Phase 1; CTS radio interface layer 3 specification".

[13] 3GPP TS 45.003: "Channel coding".

[14] 3GPP TS 45.004: "Modulation".

[15] 3GPP TS 45.005: "Radio transmission and reception".

[16] 3GPP TS 45.008: "Radio subsystem link control".

[17] 3GPP TS 45.010: "Radio subsystem synchronization".

[18] 3GPP TS 45.056: "GSM Cordless Telephony System (CTS), Phase 1; CTS-FP radio subsystem".

[19] 3GPP TR 45.902: 'Flexible Layer One'.

[20] 3GPP TS 46.031: 'Discontinuous Transmission (DTX) for full rate speech traffic channels'.

[21] 3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols - Stage 3".

[22] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service Description; Stage 2".

1.2 Abbreviations

Abbreviations used in the present document are listed in 3GPP TR 21.905 [1]. In addition to abbreviations in 3GPP TR 21.905 [1], the following abbreviations are applied:

BTTI Basic Transmission Time Interval
FANR Fast Ack/Nack Reporting
RTTI Reduced Transmission Time Interval
TTI Transmission Time Interval

1.2a Definitions

Coverage Class: see definition in 3GPP TS 43.064 [6].

EC-EGPRS: see definition in 3GPP TS 43.064 [6].

1.3 Restrictions

Independently of what is stated elsewhere in this and other 3GPP specifications, mobile station support for PBCCH and PCCCH is optional for A/Gb-mode of operation. The network shall never enable PBCCH and PCCCH.

2 General

The radio subsystem is required to support a certain number of logical channels that can be separated into two categories as defined in 3GPP TS 44.003:

i) the traffic channels (TCH's);

ii) the control channels.

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

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

With the Flexible Layer One (FLO), the radio subsystem is required to support transport channels (see 3GPP TR 45.902). Clause 8 of this document describes the mapping and multiplexing principles that are specific to FLO. Because FLO offers transport channels instead of logical channels, any reference to logical channels, with the exception of SACCH, does not apply to FLO. Otherwise, and unless otherwise stated, the multiplexing principles described in this document are equally applicable to FLO (e.g. physical resource and physical channels).

3 Logical channels

3.1 General

This subclause 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 in circuit switched mode. Five 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 kbit/s.

ii) Half rate traffic channel (TCH/H). This channel carries information at a gross rate of 11,4 kbit/s.

iii) Enhanced circuit switched full rate traffic channel (E-TCH/F). This channel carries information at a gross rate of 69,6 kbit/s including the stealing symbols.

iv) 8-PSK full rate traffic channel (O-TCH/F). This channel carries information at a gross rate of 68,4 kbit/s.

v) 8-PSK half rate traffic channel (O-TCH/H). This channel carries information at a gross rate of 34,2 kbit/s.

Packet data traffic channels (PDTCH's) are intended to carry user data in packet switched mode. For the purpose of this Technical Specification, any reference to traffic channel does not apply to PDTCH unless explicitly stated.

All traffic channels are bi-directional unless otherwise stated. Unidirectional downlink full rate channels, TCH/FD, are defined as the downlink part of the corresponding TCH/F.

Multiple full rate channels can be assigned to the same MS. This is referred to as multislot configurations, which is defined in subclause 6.4.2.1.

Multiple packet data traffic channels can be assigned to the same MS or, in the case of point-to-multipoint transmission, a group of MSs. This is referred to as multislot packet configurations, as defined in subclause 6.4.2.2 and subclause 6.4.2.3a.

A combination of a half rate traffic channel and a half rate packet data traffic channel on the same basic physical channel can be assigned to the same MS as defined in subclause 6.4.2.3.

A combination of a traffic channel and one or more full rate packet data traffic channels can be assigned to the same MS.

A pair of speech traffic channels along with their associated control channels sharing the same timeslot number (see subclause 4.3), ARFCN (see subclause 6.2.3) and TDMA frame number (see subclause 4.3) is referred to as a *VAMOS pair*. The speech traffic channels along with their associated control channels in a *VAMOS pair* are said to be in *VAMOS mode* and are referred to as *VAMOS subchannels*.

In case of speech traffic channels in *VAMOS mode*, up to 4 speech traffic channels can be mapped on the same basic physical channel both in downlink and uplink (see subclause 6.4.1).

The specific traffic channels available in the categories of speech and user data are defined in the subclauses 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);

iii) enhanced full rate traffic channel for speech (TCH/EFS);

iv) adaptive full rate traffic channel for speech (TCH/AFS);

v) adaptive half rate traffic channel for speech (TCH/AHS);

vi) adaptive full rate traffic channel for wideband speech (TCH/WFS);

vii) adaptive half rate 8PSK traffic channel for speech (O-TCH/AHS);

viii) adaptive full rate 8PSK traffic channel for wideband speech (O-TCH/WFS);

ix) adaptive half rate 8PSK traffic channel for wideband speech (O-TCH/WHS).

3.2.3 Circuit switched 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);

vi) full rate traffic channel for 14,4 kbit/s user data (TCH/F14.4);

vii) enhanced circuit switched full rate traffic channel for 28,8 kbit/s user data (E-TCH/F28.8);

viii) enhanced circuit switched full rate traffic channel for 32,0 kbit/s user data (E-TCH/F32.0);

ix) enhanced circuit switched full rate traffic channel for 43.2 kbit/s user data (E-TCH/F43.2).

3.2.4 Packet data traffic channels (PDTCH and EC-PDTCH)

A PDTCH/F corresponds to the resource assigned to a single MS or, in the case of point-to-multipoint transmission, to multiple MSs for user data transmission. An EC-PDTCH/F always corresponds to the resource assigned to a single MS in BTTI configuration.

In BTTI configuration, an (EC-)PDTCH/F is mapped onto one physical channel (see subclause 6.3.2.1). Due to the dynamic multiplexing onto the same physical channel of different logical channels (see subclause 6.3.2), an (EC-)PDTCH/F in BTTI configuration carries information at an instantaneous bit rate ranging from 0 to a maximum value dependent on the modulation and on the symbol rate, as given in table 3.2.4-1.

Table 3.2.4-1: Maximum instantaneous bit rate (kbit/s) for different modulations

Modulation	Maximum instantaneous bit rate (kbit/s)	
	Normal symbol rate[1]	Higher symbol rate[1]
GMSK	22,8	-
QPSK	-	55,2
8-PSK	69,6	-
16QAM	92,8	110,4
32QAM	116,0	138,0
NOTE: see 3GPP TS 45.004 [14]		

In RTTI configuration, a PDTCH/F is mapped onto two physical channels, i.e. a PDCH-pair (see subclause 6.3.2.1). A PDTCH/F in RTTI configuration carries information at an instantaneous bit rate ranging from 0 to a maximum value which is double the corresponding value for that modulation and the symbol rate.

A PDTCH/H corresponds to the resource assigned to a single MS on half a physical channel for user data transmission. The maximum instantaneous bit rate for a PDTCH/H is half that for a PDTCH/F. A PDTCH/H is only possible in BTTI configuration if FANR is not activated (see 3GPP TS 44.060 [11]).

All packet data traffic channels are uni-directional, either uplink ((EC-)PDTCH/U), for a mobile originated packet transfer or downlink ((EC-)PDTCH/D) for a mobile terminated packet transfer.

In the case of point-to-multipoint transmission, a PDTCH/D can be used for communication with multiple MSs.

3.3 Control channels

3.3.1 General

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

3.3.2 Broadcast channels

3.3.2.1 Frequency correction channels (FCCH and CFCCH)

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. Different mapping is used for FCCH and COMPACT CFCCH (see clause 7).

3.3.2.2 Synchronization channels

3.3.2.2.0 General

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. Different channels are used for SCH, EC-SCH and COMPACT CSCH.

3.3.2.2.1 Synchronization channel (SCH)

Specifically the synchronization channel (SCH) 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 3GPP TS 23.003 [2].

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 subclause 4.3.3.

3GPP TS 44.006 [9] and 3GPP TS 44.018 [10] specify the precise bit ordering, 3GPP TS 45.003 [13] the channel coding of the above parameters and 3GPP TS 45.010 [17] defines how the TDMA frame number can be calculated from T1, T2, and T3'.

3.3.2.2.2 COMPACT synchronization channel (CSCH)

The COMPACT packet synchronization channel CSCH 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 BS colour code with range 0 to 7 as defined in 3GPP TS 23.003 [2].

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

R1 (10 bits) range 0 to 1023 = FN div (51 x 52)

R2 (6 bits) range 0 to 50 = (FN div 52) mod 51