SLOVENSKI STANDARD
SIST EN 300 912 V8.2.1:2003

01-december-2003

Digitalni celiļ ni telekomunikacijski sistem (faza 2+) ï Sinhronizacija radijskega podsistema (GSM 05.10, razliļ ica 8.2.1, izdaja 1999)

Digital cellular telecommunications system (Phase 2+) (GSM); Radio subsystem synchronization (GSM 05.10 version 8.2.1 Release 1999)

Ta slovenski standard je istoveten z: EN 300 912 Version 8.2.1

ICS:

33.070.50	Globalni sistem za mobilno telekomunikacijo (GSM)	Global System for Mobile Communication (GSM)

SIST EN 300 912 V8.2.1:2003 **en**

ETSI EN 300 912 V8.2.1 (2000-09)

European Standard (Telecommunications series)

Digital cellular telecommunications system (Phase 2+); Radio subsystem synchronization (GSM 05.10 version 8.2.1 Release 1999)

GLOBAL SYSTEM FOR MOBILE COMMUNICATIONS

Reference
REN/SMG-020510Q8

Keywords
Digital cellular telecommunications system,
Global System for Mobile communications (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

Individual copies of the present document can be downloaded from:
http://www.etsi.org

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the 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://www.etsi.org/tb/status/

If you find errors in the present document, send your comment to:
editor@etsi.fr

Copyright Notification

Contents

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 (http://www.etsi.org/ipr).

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 European Standard (Telecommunications series) has been produced by ETSI Technical Committee Special Mobile Group (SMG).

The present document defines the requirements for synchronization on the GSM radio sub-system of the digital mobile cellular and personal communication systems operating in the 900 MHz and 1 800 MHz band (GSM 900 and DCS 1 800).

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

Version 8.x.y

where:

8 indicates release 1999 of GSM Phase 2+.

x the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

y the third digit is incremented when editorial only changes have been incorporated in the specification.

National transposition dates	
Date of adoption of the present document:	25 August 2000
Date of latest announcement of the present document (doa):	30 November 2000
Date of latest publication of new National Standard or endorsement of the present document (dop/e):	31 May 2001
Date of withdrawal of any conflicting National Standard (dow):	31 May 2001

1 Scope

The present document defines the requirements for synchronization on the radio sub-system of the digital cellular telecommunications systems GSM. However, it does not define the synchronization algorithms to be used in the Base Transceiver Station (BTS), CTS Fixed Part (CTS-FP) and Mobile Station (MS). These are up to the manufacturer to specify.

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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.
- For this Release 1999 document, references to GSM documents are for Release 1999 versions (version 8.x.y).

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

[2] GSM 03.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Service Description Stage 2".

[3] GSM 03.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); GPRS Radio Interface Stage 2".

[4] GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".

[5] GSM 04.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS interface; Radio Link Control (RLC) and Medium Access Control (MAC) Layer Specification".

[6] GSM 05.02: "Digital cellular telecommunications system (Phase 2+); Multiplexing and multiple access on the radio path".

[7] GSM 05.05: "Digital cellular telecommunications system (Phase 2+); Radio transmission and reception".

[8] GSM 05.08: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control".

[9] GSM 03.30: "Digital cellular telecommunications system (Phase 2+); Radio network planning aspects".

[10] GSM 03.52: "Digital cellular telecommunications system (Phase 2+); GSM Cordless Telephony System (CTS), Phase 1; Lower layers of the CTS Radio Interface; Stage 2".

[11] GSM 05.56: "Digital cellular telecommunications system (Phase 2+); GSM Cordless Telephony System (CTS), Phase 1; CTS-FP Radio subsystem".

1.2 Definitions and abbreviations

In addition to those below, abbreviations used in the present document are listed in GSM 01.04.

BTS: Base Transceiver Station

CTS-FP: CTS Fixed Part

CTS-MS: MS operating in CTS mode

Timing Advance: signal sent by the BTS to the MS which the MS uses to advance its timings of transmissions to the BTS so as to compensate for propagation delay

Quarter symbol number: timing of quarter symbol periods (12/13 µs) within a timeslot. Symbol period can be 1 or 3 bit periods depending upon modulation

Timeslot number: timing of timeslots within a TDMA frame

TDMA frame number: count of TDMA frames relative to an arbitrary start point

Current Serving BTS: BTS on one of whose channels (TCH, DCCH, CCCH or PDCH) the MS is currently operating

Current Serving CTS-FP: CTS-FP on one of whose channels (TCH or CTS control channels) the CTS-MS is currently operating

Timebase counters: set of counters which determine the timing state of signals transmitted by a BTS or MS

MS timing offset: delay of the received signal relative to the expected signal from an MS at zero distance under static channel conditions with zero timing advance. This is accurate to ± 1 symbol, and reported once per SACCH or after a RACH as. required (i.e. at the same rate as timing advance). For example, for an MS with a round trip propagation delay of P symbols, but with a timing advance of T symbols, the reported timing offset will be P-T quantized to the nearest symbol. For GPRS the MS timing offset is not reported

Timing Advance Index: Timing Advance Index TAI used for GPRS, which determines the position of the subchannel on PTCCH (see GSM 05.02) used by the MS to send an access burst, from which the network can derive the timing advance

Observed Frequency Offset (OFO): difference of frequency of signals received by a CTS-MS from a CTS-FP and a BTS. The Observed Frequency Offset is measured and reported by the CTS-MS on CTS-FP requirement. The Observed Frequency Offset is expressed in ppm with an accuracy of 1/64 ppm (i.e. about 0.016 ppm)

Time group (TG): Used for Compact**,** time groups shall be numbered from 0 to 3 and a particular time group shall be referred to by its time group number (TG) (see GSM 05.02)

2 General description of synchronization system

This clause gives a general description of the synchronization system. Detailed requirements are given in clauses 3 to 7.

The BTS sends signals on the BCCH or, for COMPACT on the CPBCCH, to enable the MS to synchronize itself to the BTS and if necessary correct its frequency standard to be in line with that of the BTS. The signals sent by the BTS for these purposes are:

a) Frequency correction bursts.

b) Synchronization bursts.

The timings of timeslots, TDMA frames, TCH frames, control channel frames, and (for COMPACT) the rotation of time groups are all related to a common set of counters which run continuously whether the MS and BTS are transmitting or not. Thus, once the MS has determined the correct setting of these counters, all its processes are synchronized to the current serving BTS.

The MS times its transmissions to the BTS in line with those received from the BTS. The BTS sends to each MS a "timing advance" parameter (TA) according to the perceived round trip propagation delay BTS-MS-BTS. The MS advances its timing by this amount, with the result that signals from different MS's arriving at the BTS and compensated for propagation delay. This process is called "adaptive frame alignment".

Additionally, synchronization functions may be implemented in both the MS and the BTS to support the so-called pseudo synchronization scheme. The support of this scheme is optional except that MS shall measure and report the Observed Timing Difference (OTD), which is a mandatory requirement. The detailed specifications of the pseudo-synchronization scheme are included in annex A.

In CTS, the CTS-FP sends signals on the CTSBCH to enable the MS to synchronize itself to the CTS-FP and if necessary correct its frequency standard to be in line with that of the CTS-FP.

The signals sent by the CTS-FP for these purposes are:

a) Frequency correction bursts.

b) Synchronization bursts.

The timings of timeslots, TDMA frames, CTSBCH, CTSARCH, CTSAGCH and CTSPCH frames are all related to a first common set of counters which run continuously whether the CTS-MS and CTS-FP are transmitting or not. Thus, once the CTS-MS has determined the correct setting of these first counters, the CTS-MS is able to attach to the current serving CTS-FP. In addition, during CTS-MS attachment, the CTS-FP sends to the CTS-MS the remaining counters for SACCH and TCH frames. Then, all processes of the CTS-MS are synchronized to the current serving CTS-FP.

The CTS-MS times its transmissions to the CTS-FP in line with those received from the CTS-FP. The timing advance parameter is set to zero for CTS.

Additionally, the CTS-FP may be assisted by a CTS-MS to adjust its frequency source. When required by the CTS-FP, the CTS-MS estimates if possible and reports the Observed Frequency Offset of the CTS-FP with a specified BTS. The CTS-FP may then adjust its frequency source according to this value.

3 Timebase counters

3.1 Timing state of the signals

The timing state of the signals transmitted by a BTS, a MS, a CTS-FP, or an Compact BTS and MS is defined by the following counters:

- Quarter symbol number QN (0 - 624)- Symbol number BN (0 - 156);
- Timeslot number TN (0 - 7);
- TDMA frame number FN (0 to (26 x 51 x 2048) - 1 = 2715647);

  or for a non attached CTS-MS, TDMA frame number modulo 52 T4 (0 - 51);

or for Compact, TDMA frame number FN (0 to (52 x 51 x 1024) -1 = 2715647).

In CTS, the CTS-MS shall manage different sets of counters for CTS operation and GSM operation.

3.2 Relationship between counters

The relationship between these counters is as follows:

- QN increments every 12/13 µs;
- BN = Integer part of QN/4;
- TN increments whenever QN changes from count 624 to 0;
- FN increments whenever TN changes from count 7 to 0; or

- for a CTS-MS, T4 increments whenever TN changes from count 7 to 0.

4 Timing of transmitted signals

The timing of signals transmitted by the MS, BTS and CTS-FP are defined in GSM 05.02.

The MS can use the timing of receipt of the synchronization burst to set up its timebase counters as follows:

QN is set by the timing of the training sequence;

TN = 0 when the synch burst is received;

FN = 51 ((T3-T2) mod (26)) + T3 + 51 x 26 x T1 when the synch burst is received,
(where T3 = (10 x T3') + 1, T1, T2 and T3' being contained in information fields in synchronization burst).

For Compact, the MS can use the timing of receipt of the synchronization burst to set up its timebase counters as follows:

QN is set by the timing of the training sequence;

FN = (R1 x 51 + R2) x 52 + 51 when the synch burst is received (where R1 and R2 are contained in information fields in synchronization burst);

TN is determined from TG as described in GSM 05.02, where TG is contained in information fields in synchronization burst.

For CTS, the timebase counters are set as follows:

QN is set by the timing of the training sequence;

TN is set according to the CTSBCH-SB position (see Annex C);

T4 = 51 when the CTSBCH-SB is received (prior to attachment);

FN = (51 ((T3-T2) mod (26)) + T3 + 51 x 26 x T1) mod (2715648) when the CTS-MS receives the last CTSAGCH burst of the non-hopping access procedure, where T2 = T4 mod (26), and T1 and T3 being contained in this CTS immediate assignment message.

Thereafter, the timebase counters are incremented as in subclause 3.2.

(When adjacent BTS's are being monitored for handover purposes, or for cell reselection purposes in group receive mode, the MS may choose to store the values of QN, TN and FN for all the BTS's whose synchronization bursts have been detected relative to QN, TN and FN for its current serving BTS).

5 BTS Requirements for Synchronization

The conditions under which the requirements of subclauses 5.4 and 5.6 must be met shall be 3 dB below the reference sensitivity level or input level for reference performance, whichever applicable, in GSM 05.05 and 3 dB less carrier to interference ratio than the reference interference ratios in GSM 05.05.

5.1 Frequency source

The BTS shall use a single frequency source of absolute accuracy better than 0,05 ppm for both RF frequency generation and clocking the timebase. The same source shall be used for all carriers of the BTS.

For the pico BTS class the absolute accuracy requirement is relaxed to 0,1ppm.

5.2 Timebase counters

It is optional whether the timebase counters of different BTS's are synchronized together.