![ETSI logo]

GSM
TECHNICAL
SPECIFICATION

GSM 03.01

March 1996

Version 5.0.0

Source: ETSI TC-SMG

Reference: TS/SMG-030301Q

ICS: 33.060.50

Key words: Digital cellular telecommunications system, Global System for Mobile communications (GSM)

![GSM logo]

**GLOBAL SYSTEM FOR
MOBILE COMMUNICATIONS**

Digital cellular telecommunications system (Phase 2+);
Network functions
(GSM 03.01)

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

*

Contents

Blank page

Foreword

This Global System for Mobile communications Technical Specification (GTS) has been produced by the Special Mobile Group (SMG) Technical Committee (TC) of the European Telecommunications Standards Institute (ETSI).

This GTS defines the network functions required to support services and facilities provided by a Public Land Mobile Network (PLMN) within the digital cellular telecommunications system (Phase 2/Phase 2+).

This GTS is a TC-SMG approved GSM technical specification version 5, which contains GSM Phase 2+ enhancements/features to the version 4 GSM technical specification. The ETS from which this Phase 2+ GTS has evolved is Phase 2 GSM ETS 300 521 (GSM 03.01 version 4.0.4).

GTS are produced by TC-SMG to enable the GSM Phase 2 + specifications to become publicly available, prior to submission for the formal ETSI standards approval procedure to become European Telecommunications Standards (ETS). This ensures the earliest possible access to GSM Phase 2 + specifications for all Manufacturers, Network operators and implementors of the Global System for Mobile communications.

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

Version 5.x.y

where:

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

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

Reference is made within this TS to GSM-TSs (note).

NOTE: TC-SMG has produced documents which give the technical specifications for the implementation of the 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/ETSI Technical Reports (ETRs) (Phase 2). TC-SMG has also produced ETSI GSM TSs which give the technical specifications for the implementation of Phase 2+ enhancements of the digital cellular telecommunications system. These version 5.x.x GSM Technical Specifications may be referred to as GTSs.

Blank page

1 Scope

This Technical Specification defines network functions which are necessary to support services and facilities provided by PLMNs. A summary of the network functions is given in Table 1, where also an indication is given whether the network must support the function. The table also indicates whether or not a function requires internetworking signalling between PLMNs (i.e. use of Mobile Application Part, Technical Specification GSM 09.02).

All functions require signalling on the radio path as specified in Technical Specification GSM 04.08.

1.1 Normative references

This GTS 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 GTS 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 02.04 (ETS 300 503): "Digital cellular telecommunications system (Phase 2); General on supplementary service".

[3]   GSM 02.09 (ETS 300 506): "Digital cellular telecommunications system (Phase 2); Security aspects".

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

[5]   GSM 03.07 (ETS 300 525): "Digital cellular telecommunications system (Phase 2); Restoration procedures".

[6]   GSM 03.08 (ETS 300 526): "Digital cellular telecommunications system (Phase 2); Organisation of subscriber data".

[7]   GSM 03.12 (ETS 300 530): "Digital cellular telecommunications system (Phase 2); Location registration procedures".

[8]   GSM 03.13 (ETS 300 531): "Digital cellular telecommunications system (Phase 2); Discontinuous Reception (DRX) in the GSM system".

[9]   GSM 03.14 (ETS 300 532): "Digital cellular telecommunications system (Phase 2); Support of Dual Tone Multi-Frequency signalling (DTMF) via the GSM system".

[10]   GSM 03.20 (ETS 300 534): "Digital cellular telecommunications system (Phase 2); Security related network functions".

[11]   GSM 03.22 (ETS 300 535): "Digital cellular telecommunications system (Phase 2); Functions related to Mobile Station (MS) in idle mode".

[12]   GSM 03.40 (ETS 300 536): "Digital cellular telecommunications system (Phase 2); Technical realization of the Short Message Service (SMS) Point to Point (PP)".

[13]   GSM 03.81 (ETS 300 542): "Digital cellular telecommunications system (Phase 2); Line identification supplementary services - Stage 2".

[14]   GSM 03.82 (ETS 300 543): "Digital cellular telecommunications system (Phase 2); Call Forwarding (CF) supplementary services - Stage 2".

[15]   GSM 03.83 (ETS 300 544): "Digital cellular telecommunications system (Phase 2); Call Waiting (CW) and Call Hold (HOLD) supplementary services - Stage 2".

[16]   GSM 03.84 (ETS 300 545): "Digital cellular telecommunications system (Phase 2); MultiParty (MPTY) supplementary services - Stage 2".

[17]   GSM 03.85 (ETS 300 546): "Digital cellular telecommunications system (Phase 2); Closed User Group (CUG) supplementary services - Stage 2".

[18]   GSM 03.86 (ETS 300 547): "Digital cellular telecommunications system (Phase 2); Advice of Charge (AoC) supplementary services - Stage 2".

[19]   GSM 03.88 (ETS 300 548): "Digital cellular telecommunications system (Phase 2); Call Barring (CB) supplementary services - Stage 2".

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

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

[22]   GSM 09.02 (ETS 300 599): "Digital cellular telecommunications system (Phase 2); Mobile Application Part (MAP) specification".

[23]   GSM 12.00 (ETS 300 612-1): "Digital cellular telecommunications system (Phase 2); Objectives and structure of Network Management (NM)".

[24]   GSM 12.01 (ETS 300 612-2): "Digital cellular telecommunications system (Phase 2); Common aspects of GSM Network Management (NM)".

[25]   GSM 12.07 (ETS 300 612-3): "Digital cellular telecommunications system (Phase 2); Operations and performance management".

[26]   GSM 12.02 (ETS 300 613): "Digital cellular telecommunications system (Phase 2); Subscriber, Mobile Equipment (ME) and services data administration".

[27]   GSM 12.03 (ETS 300 614): "Digital cellular telecommunications system (Phase 2); Security management".

[28]   GSM 12.04 (ETS 300 615): "Digital cellular telecommunications system (Phase 2); Performance data measurements".

[29]   GSM 12.05 (ETS 300 616): "Digital cellular telecommunications system (Phase 2); Subscriber related event and call data".

[30]   GSM 12.06 (ETS 300 617): "Digital cellular telecommunications system (Phase 2); GSM Network change control".

[31]   GSM 12.10 (ETS 300 618): "Digital cellular telecommunications system (Phase 2); Maintenance provisions for operational integrity of Mobile Stations (MS)".

[32]   GSM 12.11 (ETS 300 619): "Digital cellular telecommunications system (Phase 2); Maintenance of the Base Station System (BSS)".

[33]   GSM 12.13 (ETS 300 620): "Digital cellular telecommunications system (Phase 2); Maintenance of the Mobile-services Switching Centre (MSC)".

[34]   GSM 12.14 (ETS 300 621): "Digital cellular telecommunications system (Phase 2); Maintenance of location registers".

[35]   GSM 12.20 (ETS 300 622): "Digital cellular telecommunications system (Phase 2); Network Management (NM) procedures and messages".

[36]   GSM 12.21 (ETS 300 623): "Digital cellular telecommunications system (Phase 2); Network Management (NM) procedures and message on the A-bis interface".

[37]   GSM 12.22 (ETS 300 624): "Digital cellular telecommunications system (Phase 2); Interworking of GSM Network Management (NM) procedures and messages at the Base Station Controller (BSC)".

1.2   Abbreviations

Abbreviations used in this specification are listed in GSM 01.04.

2 Network functions for basic service provision

2.1 Call handling

This set of functions enables the establishment of communications between a mobile subscriber and another network subscriber in one of the following types of network PSTN, ISDN, PSPDN, CSPDN and other PLMNs.

2.1.1 Call from a mobile subscriber registered in VLR

This is the normal case where the call is routed according to the dialled number. After the call, the MSC will send the charging information to the HLR, a billing entity and/or store the charging data on tapes or discs as described in Technical Specification GSM 12.05.

2.1.2 Call from a mobile subscriber not registered in VLR

When the VLR receives a request for call set-up parameters from an MSC for an MS originating call, where the MS is not registered in the VLR, the VLR shall initiate a location updating procedure towards the HLR and in response parameters are given concerning category, services and restrictions. The call is then set up as in 2.1.1. This case only happens when a VLR or an MS failure has occurred.

2.1.3   Call to a mobile subscriber

The call is routed (re-routed or forwarded) according to location data obtained from the HLR to the actual MSC and the MS is paged over the standardised radio interface.

Table 1: Overview of network functions

Class of Network Function (NF)	Network Function	Network Support	Interworking with MAP
NF for basic service provision	Call Handling	M	X
	Subscriber Authentication	M	X
	Emergency calls	M	-
	Supplementary Services	M	X
	Voice group services	O	X
	Short Message Service (SMS)	M	X
	Signalling information element confidentiality	M	X
NF for supporting:	Location registration	M	X
	Handover - in the same BSS - in the same MSC - in the same PLMN	 M M M	 - - X
	Call re-establishment	M	-
Additional NF for call handling	Queuing	O	-
	OACSU	O	-
	Security related services	M	X
	Discontinuous reception	M	-
	Discontinuous Transmission	M/O Note 2	-
	DTMF	M	-
Network management oriented NF		M (Note 1)	X

NOTE 1:   The function will not be fully specified by GSM (national specifications will complement).

NOTE 2:   Only the receiver requirements are mandatory, the transmitter requirements support are optional.

2.1.4 Call handling functions in HLR

The HLR should also support control functions for handling of supplementary services as described for each service in the GSM 03.8x series of Technical Specifications.

The HLR should provide information to the gateway MSC to allow it to route calls directed to a mobile subscriber: either a Mobile Station Roaming Number (MSRN) to allow the call to be routed to the visited MSC or a forwarding number if the call is to be forwarded to a destination different from the original one.

The HLR should provide the identity of the visited MSC to the SMS gateway MSC to allow it to route short messages directed to a mobile subscriber; further detail is given in Technical Specification GSM 03.40.

2.1.5 Call handling functions in VLR

The VLR must provide subscriber parameters to the MSC as required for call handling.

The VLR must also support control functions for handling of supplementary services as described for each service in the GSM 03.8x series of Technical Specifications.

2.1.6 Call handling functions in MSC

The MSC must perform normal call routing and call control functions. The MSC will obtain subscriber parameters from its associated VLR.

The MSC must also be capable of performing handover as defined in section 3.2.

In some cases, the MSC must be able to act as a gateway MSC to provide an interface to other circuit-switched networks.

2.2 Subscriber identity authentication

The purpose of subscriber identity authentication is defined in Technical Specification GSM 02.09.

The authentication mechanism is defined in Technical Specification GSM 03.20 and corresponding procedures on the MS-BSS interface are defined in Technical Specification GSM 04.08.

2.3   Emergency call

2.3.1   General

The land mobile system should be capable of efficient handling of emergency calls from mobile stations. The signalling procedures on the radio path for emergency calls are given in Technical Specification GSM 04.08.

2.3.2   Routeing

The call should be routed automatically to an appropriate emergency centre based on the geographical location of the mobile station (e.g. based on the identity of the cell on which the call is established).

2.4   Supplementary services

PLMN may offer supplementary services as shown in Technical Specification GSM 02.04. The support of supplementary services will require control procedures in HLRs, VLRs and MSCs in addition to the control procedure in the fixed network. The technical realisation of supplementary services is given in the GSM 03.8x series of Technical Specifications.

2.5   Voice group services

The PLMN may offer the voice group services. These are the voice group call service (VGCS) and voice broadcast service (VBS), as shown in GSM 02.68 and GSM 02.69, respectively. The support of the voice group call and voice broadcast services will require control procedures in HLRs, VLRs, MSCs and Group Call Register (GCR) and possibly control procedures in the fixed network. The technical realisation of these services is given in GSM 03.68 and GSM 03.69, respectively.

2.6   Short Message Service

This set of functions allows the transfer of short messages in either direction between a mobile station and a short message service centre. More detailed information is given in Technical Specification GSM 03.40.

2.6.1   Short Message Handling functions in the HLR

The HLR should be able to provide information to allow a short message to be routed from the SMS gateway MSC to the visited MSC and thence to the required mobile station.

2.6.2   Short Message Handling Functions in the VLR

The VLR should provide subscriber parameters to the MSC as required for handling short messages.

2.6.3   Short Message Handling Functions in the MSC

The MSC should perform the functions of relaying short messages in both directions between the fixed network of the PLMN and the BSS.

In some cases the MSC should be able to act as an SMS Gateway MSC to relay short messages from a Short Message Service Centre (SC) to a PLMN, or an SMS Interworking MSC to relay short messages from a PLMN to an SC.

2.7   Signalling information element confidentiality

A procedure should be implemented providing for the confidentiality of signalling information elements on the radio path. In Technical Specification GSM 02.09 the signalling information elements which need to be protected are given.

The Encryption Key is calculated in both the MS and the network. Detailed information is given in Technical Specification GSM 03.20.

3   Network functions for supporting cellular operation

3.1   Location registration

3.1.1   Definitions

Location registration means that the PLMNs keep track of where mobile stations are located in the system area. The location information is stored in functional units called location registers. Functionally there are two types of location registers:

- the home location register (HLR) where the current location and all subscriber parameters of a mobile station are permanently stored;

- the visitor location register (VLR) where all relevant parameters concerning a mobile station are stored so long as the station is within the area controlled by that visitor location register.

See also Technical Specification GSM 03.02 where the network architecture is described.

3.1.2   Procedures

Procedures related to location registration are specified in Technical Specification GSM 03.12.

They comprise:

i)   location register updating which enables the MS to inform the network that its location has to be updated, i.e. the MS has received a location area identity which is different from that contained in its memory. In order to avoid unnecessary updating, the current location area identity should be stored in a non-volatile memory in the MS;

ii)   location cancellation which is used to delete an MS from a VLR;

iii)   periodic location updating which enables the location of stationary MSs to be confirmed at a rate determined by the operator;

iv)   as a network option, IMSI detach/attach operation. When a Mobile Station has informed the network that it is IMSI detached, the network is aware that the subscriber is not active.

The procedures also include mechanisms for restoration of location registers after failure. These procedures are defined in Technical Specification GSM 03.07.

3.1.3   Information stored in location registers

Information to be stored in location registers is listed in Technical Specification GSM 03.08.

3.2 Handover

3.2.1 Definitions

The following case are required:

i)   handover between physical channels of the same Base Station System (BSS). This capability could be used in the following situations:

  -   when the physical channel carrying the call is subject to interference or other disturbances;

  -   when a physical channel or channel equipment carrying a call has be to be taken out of service for maintenance or other reasons;

ii)   handover between Base Station Systems (BSSs) of the same MSC;

iii)   handover between BSSs of different MSCs of the same PLMN.

Cases ii) and iii) are used in order to ensure continuity of the connection when an MS moves from one BSS area to another.

For case iii) two procedures are defined:

a)   basic handover procedure where the call is handed over from the controlling MSC (MSC-A) to another MSC (MSC-B);

b)   subsequent handover procedure where the call is handed over from MSC-B to MSC-A or to a third MSC (MSC-B').

3.2.2 Procedures

The procedures are described in Technical Specification GSM 03.09.

3.3 Call re-establishment

Re-establishment of a call may be performed when a traffic channel (TCH) has been lost during the call, e.g. when a handover could not be completed in time.

Call re-establishment is only performed on TCHs and when the call is in the connected state (see Technical Specification GSM 04.08). The procedures are specified in Technical Specification GSM 04.08.

4 Additional network functions for call handling

4.1 Queuing

As a PLMN option MS originating and/or MS terminating calls may be queued at the BSS. (NOTE: this queuing is additional to that for normal call handling). However, the following conditions must be met:

- for MS originating calls no queuing indication will be provided to the MS. The queuing will thus be seen as a delayed call set-up for the MS;

- for MS terminating calls the queuing must not conflict with abnormal release conditions in the fixed network. In general, calls that may have passed international circuits should not be queued, i.e. it should not be applied to calls where the originating network is not known to the PLMN.

4.2 Off-Air-Call-Set-Up (OACSU)

4.2.1 General

OACSU may be implemented in PLMNs in order to increase the call handling capacity of the PLMN.

OACSU may be implemented in PLMNs on an optional basis subject to the following conditions:

i) OACSU should not be used for calls to an international number;

ii) OACSU should not be used for incoming international calls, except where bilateral agreement has been reached to allow such an application of OACSU. For the avoidance of doubt, OACSU shall not be applied to calls where the call type or originating network is not known by the PLMN;

iii) foreign MSs not supporting the OACSU procedure should be allowed to access the PLMNs where OACSU is used;

iv) MSs supporting OACSU should be capable of operating in PLMNs where OACSU is not implemented;

v) OACSU should only be used for telephone calls.

4.2.2   Signalling procedures

Signalling procedures supporting OACSU are specified in Technical Specification GSM 04.08.

4.3   Security related services

PLMNs will offer three security related services on the radio path: confidentiality of the user identity, confidentiality of user data and confidentiality of signalling information elements and connectionless user data.

4.3.1   Identity confidentiality

This service provides for the privacy of the identities of subscribers. An intruder cannot identify which subscriber is using a certain resource on the radio path. Instead of IMSI a temporary identity is used. This identity (TMSI) is a local number only valid in a given location area. The TMSI is allocated by the VLR and is sent to the MS in a ciphered mode, when ciphering is available as a network option. The IMSI and IMEI should also be transmitted in ciphered mode, whenever the procedure allows this, and when ciphering is available as a network option.

The structure of the TMSI is defined in Technical Specification GSM 03.03.

4.3.2   User data confidentiality

This service provides for the confidentiality of anything transmitted on a traffic channel. Encryption/decryption is done in the MS and BSS with a key which is calculated in both the MS and network. Detailed information is given in Technical Specification GSM 03.20.

4.3.3   Signalling Information Element Confidentiality

This service provides for the confidentiality of anything transmitted on a signalling channel: signalling information to control the service offered to a subscriber or connectionless user data. Encryption/decryption is done in the MS and BSS with a key which is calculated in both the MS and the network. Detailed information is given in Technical Specification GSM 03.20.

4.4   Discontinuous reception

Discontinuous reception is a technique used to reduce the battery consumption of mobile stations. The operation of the technique is specified in Technical Specification GSM 03.13. This function must be supported by the network, but is optional for mobile stations.

4.5   Discontinuous Transmission

Discontinuous transmission is a technique used to reduce overall interference level on the air interface, and to reduce the battery consumption in the mobile station. The operation of the technique is specified in Technical Specification GSM 05.08. This function must be supported by the mobile stations, whereas only the receiver requirements are mandatory in the network.

4.6   Support of DTMF

DTMF is supported as defined in Technical Specification GSM 03.14.

5   Network management oriented network functions

Network management functions are dealt with in the 12 series of GSM Technical Specifications. An overview is given in Technical Specification GSM 12.00.

History

Document history	
February 1995	Creation of Version 5.0.0 (GSM 03.01-4.0.4 +CR03.01-B001)
March 1995	Publication of Version 5.0.0