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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 defines the location registration procedures for the European digital cellular telecommunications system (Phase 2). This ETS corresponds to GSM Technical Specification (GSM-TS) GSM 03.12 version 4.4.2.

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.

Reference is made within this ETS to 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.

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1 General

1.1 Scope

This Technical Specification describes the procedures in the network related to location registration. They include:

- location updating;
- location cancellation;
- periodic location updating;
- IMSI attach/detach.

The procedures in the MS are described in Technical Specification GSM 03.22. The procedures between MSC, VLR and HLR utilise the Mobile Application Part (MAP) and details concerning the exchange of information are contained in Technical Specification GSM 09.02.

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 telecommunications system (Phase 2); Abbreviations and acronyms".

[2] GSM 03.02 (prETS 300 522): "European digital cellular telecommunications system (Phase 2); Network architecture".

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

[4] GSM 03.07 (prETS 300 525): "European digital cellular telecommunications system (Phase 2); Restoration procedures".

[5] GSM 03.08 (prETS 300 526): "European digital cellular telecommunications system (Phase 2); Organisation of subscriber data".

[6] GSM 03.20 (prETS 300 534): "European digital cellular telecommunications system (Phase 2); Security related network functions".

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

[8] GSM 09.02 (prETS 300 599): "European digital cellular telecommunications system (Phase 2); Mobile Application Part (MAP) specification".

[9] GSM 09.07 (prETS 300 604): "European digital cellular telecommunications system (Phase 2); General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN)".

2 Definitions

In addition to the abbreviations given in the remainder of this section others are listed in GSM 01.04.

2.1 Location registration

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

- the home location register where all subscriber parameters of a mobile station are permanently stored, and where the current location may be stored;

- the visitor location register where all relevant data concerning a mobile station are stored as 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, and Technical Specification 03.08 where the data stored in the location registers are described.

The action taken by a mobile station in order to provide location information to the PLMN will be referred to as location updating.

2.2 Location area and MSC area

The MSC area is composed of the area covered by all base stations controlled by the MSC. A MSC area may consist of several location areas. A location area is an area in which mobile stations may roam without updating the location registers. A location area consists of one or more cells.

The paging procedure is used by the MSC to determine the cell in which the MS is located.

For further details of the network architecture, see Technical Specification GSM 03.02.

2.3 Location area identification

The Location Area Identification (LAI) plan is part of the base station identification plan. The base stations are identified uniquely (see Technical Specification GSM 03.03). The Location Area Identification is included in messages sent in the BCCH.

2.4 IMSI detach/attach operation

The support of IMSI detach/attach operation is mandatory in MSs. The facility is optional in the fixed infrastructure of the PLMN.

2.4.1 Explicit IMSI detach/attach

Explicit IMSI detach operation is the action taken by an MS to indicate to the PLMN that the station has entered an inactive state (e.g. the station is powered down). Explicit IMSI attach operation is the action taken by an MS to indicate that the station has reentered an active state (e.g. the station is powered up).

2.4.2 Implicit IMSI detach

Implicit IMSI detach operation is the action taken by the VLR to mark an MS as detached when there has been no successful contact between the MS and the network for a time determined by the implicit detach timer. The value of the implicit detach timer is derived from the periodic location updating timer. During an established radio contact, the implicit detach timer shall be prevented from triggering implicit detach. At the release of the radio connection, the implicit detach timer shall be reset and restarted. Implicit IMSI detach shall also be performed in the case of a negative response to an IMEI check.

2.5 Use of the term mobile station (MS) in this TS

In order to simplify the text the term mobile station (MS) as used in relation to location registration refers to the entity where the IMSI is stored, i.e., in card operated MSs the term mobile station (MS) refers to the card.

3 Procedures in the network related to location updating

3.1 Procedures in the MSC related to Location Updating

The MSC shall pass messages related to location updating between the MS and the VLR.

3.2 Procedures in the BSC related to Location Updating

The BSC shall insert the Location Area Identification, periodic location updating time-out value and IMSI detach/attach supported information on the BCCH.

3.3 Normal location updating and IMSI detach/attach operation

When receiving a Location Updating Request or an IMSI detach/attach message from an MS, the MSC shall convey the message to its associated visitor location register. Any response from the location register shall similarly be conveyed to the MS.

3.4 IMSI enquiry procedure

The MS shall identify itself by either the IMSI or the TMSI plus Location Area Identification of the previous VLR. In the latter case the new VLR shall attempt to request the IMSI and authentication parameters from the previous VLR by the methods defined in Technical Specification GSM 09.02.

If this procedure fails, or if the TMSI is not allocated, the VLR shall request that the MS identifies itself by use of the IMSI.

3.5 Information transfer between visitor and home location registers

3.5.1 Procedures for location registration

Detailed procedures for exchange of and location updating information between visitor and home location registers are given in Technical Specification GSM 09.02. Below follows an overview of these procedures.

3.5.1.1 Location updating procedure

This procedure is used when an MS registers with a visitor location register.

The visitor location register provides routing information to the home location register. This information consists, for instance, of VLR address used for routing of MAP messages.

The VLR may also allocate an optional identity for the MS at location updating: the Local Mobile Station Identity: see Technical Specification GSM 03.03.

3.5.1.2 Downloading of subscriber parameters to the VLR

As a part of the location updating procedure, the home location register will convey the subscriber parameters of the MS which need to be known by the visitor location register for proper call handling. This procedure is also used whenever there is a change in the subscriber parameters that need to be conveyed to the VLR (e.g. change in subscription, a change in supplementary services activation status).

If the HPLMN applies the multinumbering option, different MSISDNs are allocated for different Basic Services (see Technical Specification GSM 09.07) and stored in the HLR. Among these MSISDNs, the Basic MSISDN Indicator as part of the HLR subscriber data (see Technical Specification GSM 03.08) marks the 'Basic MSISDN' to be sent to the VLR at location update. It is used in the VLR for call handling as calling party and as line identity.

3.5.1.3 Location cancellation procedure

The procedure is used by the home location register to remove a mobile station from a visitor location register. The procedure will normally be used when the MS has moved to an area controlled by a different location register. The procedure can also be used in other cases, e.g. an MS ceases to be a subscriber of the home PLMN.

3.5.1.4 Subscriber parameter request procedure

This procedure enables a visitor location register to request the HLR (at any time) to provide subscriber parameters for a specified MS (e.g. after a restart).

3.5.1.5 Mobile subscriber purging procedure

A VLR may purge the subscriber data for an MS which has not established radio contact for a period determined by the network operator. Purging means to delete the subscriber data and to "freeze" the TMSI that has been allocated to the purged MS in order to avoid TMSI double allocation. The VLR shall inform the HLR of the purging.

When the HLR is informed of the purging, it shall set the flag "MS purged" in the IMSI record of the MS concerned. Presence of the "MS purged" flag will cause any request for routing information for a call or short message to the MS to be treated as if the MS were not reachable.

In the VLR, the "frozen" TMSI is freed for usage in the TMSI allocation procedure by location updating for the purged MS in the same VLR, location cancellation for the purged MS or, in exceptional cases, by O&M.

In the HLR, the "MS purged" flag is reset by the location updating procedure and after reload of data from the non-volatile back-up that is performed when the HLR restarts after a failure.

3.5.1.6 Recovery procedures

Recovery and restoration procedures for location registers are defined in Technical Specifications GSM 03.07 and 09.02.

Recovery arrangements should be such that MSs with a valid subscription are not deleted from the HLR as a result of HLR failure. The worst result of an HLR failure will thus be that some MSs are stored with errors in the temporary subscriber data.

4 Authentication

Authentication at location updating and IMSI attach shall be in accordance with Technical Specification GSM 03.20.

History

Document history	
September 1994	First Edition
November 1995	Converted into Adobe Acrobat Portable Document Format (PDF)