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RELEASE NOTE

Recommendation GSM 03.12-DCS

Location Registration Procedures

Previously distributed version : 3.0.1 (Updated Release 1/90)
New Released version February 92 : 3.0.1 (Release 92, Phase 1)

1. Reason for changes

No changes since the previously distributed version.

PREFATORY NOTE

ETSI has constituted stable and consistent documents which give specifications for the implementation of the European Cellular Telecommunications System. Historically, these documents have been identified as "GSM recommendations".

Some of these recommendations may subsequently become Interim European Telecommunications Standards (I-ETSs) or European Telecommunications Standards (ETSs), whilst some continue with the status of ETSI-GSM Technical Specifications. These ETSI-GSM Technical Specifications are for editorial reasons still referred to as GSM recommendations in some current GSM documents.

The numbering and version control system is the same for ETSI-GSM Technical Specifications as for "GSM recommendations".

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Location Registration Procedures

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1. SCOPE

This Recommendation specifies the procedures related to locationregistration. They include :

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

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

GSM 03.12-DCS consists of GSM 03.12 with section 1 and 3.3 in this recommendation replacing their counterpart in GSM 03.12.

2. DEFINITIONS

2.1 Location registration

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 where the current location and all subscriber parameters of a mobile station are permanently stored,
- the visitor location register 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 Recommendation GSM 03.02 where the network architecture is 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. An 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 base station areas.

The paging procedure is used by the MSC to determine the base station area in which the MS is located.

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

2.3 Location area identification

The location area identification plan is part of the base station identification plan. The base stations are identified uniquely (see Recommendation GSM 03.03). The location area identification is included in messages sent in the BCCH.

2.4 IMSI detach/attach operation

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). 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).

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

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

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 MS RELATED TO LOCATION REGISTRATION

3.1. Initiation of location updating

Automatic location updating should take place as follows.

The mobile station initiates location updating when it detects that it has entered into a new location area, i.e. when the received location area identification differs from the one stored in the MS. The location area identification should be stored in a nonvolatile memory in the MS so that the memory content does not disappear when the MS is turned off. This will avoid unnecessary location updating when the MS is turned on and is still in the same location area.

If the MS has lost the location information from memory, it will initiate location updating as soon as it is an operational state and within radio coverage.

Location updating is also initiated when the MS receives a reject on an outgoing transaction with "unknown in VLR" as cause value.

Location updating is also initiated on timeout of the timer T defined in section 3.2.

Location updating requiring manual selection of PLMN in the MS is described in Recommendation GSM 02.11.

3.2 Periodic location updating

A timer T with the following characteristics should be implemented in the MS :

i) timer T is reset to 0 and started when a signalling activity (see recommendation GSM 04.08, timer T3212) has taken place on the radio path;

ii) when the MS is powered down the current value of T is kept in memory. When the MS is powered up the timer starts running from the value thus contained in memory ;

iii) when timer T reaches its time-out value, the MS initiates a location updating.

Timer T thus measures the accumulated time between signalling activities in the MS while the MS is in the power up state.

In order to ensure :

i) that the location of silent and stationary MSs are checked at a reasonable rate,

ii) that the timer T does not mature to time-out in the majority of cases,

the timeout value of timer T shall be defined by a parameter sent in the broadcast channel. The parameter shall be capable of defining timer, T, timeout over a range from 6 minutes (1 deci-hour) to 25.5 hours (255 deci-hours) with a granularity of one deci-hour. The parameter shall also be capable of being set to indicate the disable of this timeout, i.e. the period becomes infinite. The coding of the parameter and its use in layer 3 messages are given in Recommendation GSM 04.08.

Note : It is not expected that the timeout for timer T would be set to six minutes. The actual value used will be a result of operational experience and system tuning. Further, in the event of message failure, it is important that the MS re-attempts after an appropriate time. This area is for further study, pending the results on layer 2 definition work.

The timer T and IMSI should be embodied in the same entity (e.g. the card).

3.3 Receiving acknowledgement from the PLMN

The MS may receive either of the following acknowledgements from the PLMN :

i) Location updated accept. In this case, normal call handling operations will take place in the MS ;

ii) Location updating reject, PLMN not allowed or Location area not allowed. In these cases, the MS will not be allowed to make calls. So long as this condition exists in the MS, the MS should reject any call attempts from the user, possibly except emergency calls. However, the MS should follow the procedure of section 3.1 above, with the exception of periodic location updating (i.e. location updating triggered by the expiration of timer T).. The MS will resume normal operation if it receives a location updated, roaming allowed indication from the PLMN.

iii) Location updating reject, network failure, indicating that the procedure in the PLMN failed. In this case, the MS should initiate a new updating after 30 to 60 seconds. If this attempt fails, the MS should follow the normal procedures of sections 3.1 and 3.2, with the addition that location updating is triggered if a new cell is entered. . When receiving the updating failure indication, the MS should be capable of normal call handling operation.

iv) Location updating reject, IMSI unknown in HLR, indicating that the MS is not known in the HLR. In this case the MS shall enter the "Idle, no IMSI" state and take actions as described in GSM 04.08.

v) Location updating reject, illegal MS, indicating that the authentication procedure has detected an invalid response.

vi) Location updating reject, National Roaming not allowed in this location area. This cause is sent to an MS which requests a location update in a location area of a PLMN which offers national roaming to that MS but not in that specific location area. The decision for offering national roaming is made on the basis of the MSs MCC and MNC.

If the MS identified itself with an unallocated TMSI, the network will initiate the identification procedure in order to obtain the IMSI of the MS.

3.4 Procedure when acknowledgement is not received

If the MS does not receive an acknowledgement (on layer 3) on an updating request, the MS tries a new location updating request after at least 10 seconds (see section 3.5). If the procedure fails also, the MS enters the idle "not updated" state.

3.5 Minimum time between locating updatings

The minimum time between consecutive location updatings shall be 10 seconds. The MS must contain a timer for meeting this requirement.

3.6 IMSI detach/attach operation

The use of the IMSI detach/attach operation is an optional facility in PLMNs. The support of the facility in the MS is mandatory.

The BCCH will contain an indicator indicating whether or not IMSI detach/attach operation is mandatory to use in the cell. MSs shall operate in accordance with the received value of the indicator.

When IMSI detach/attach operation applies, an MS located in an area where roaming is allowed should send the IMSI detach signal to the MSC when the MS enters the inactive state (e.g. when the MS is powered down).