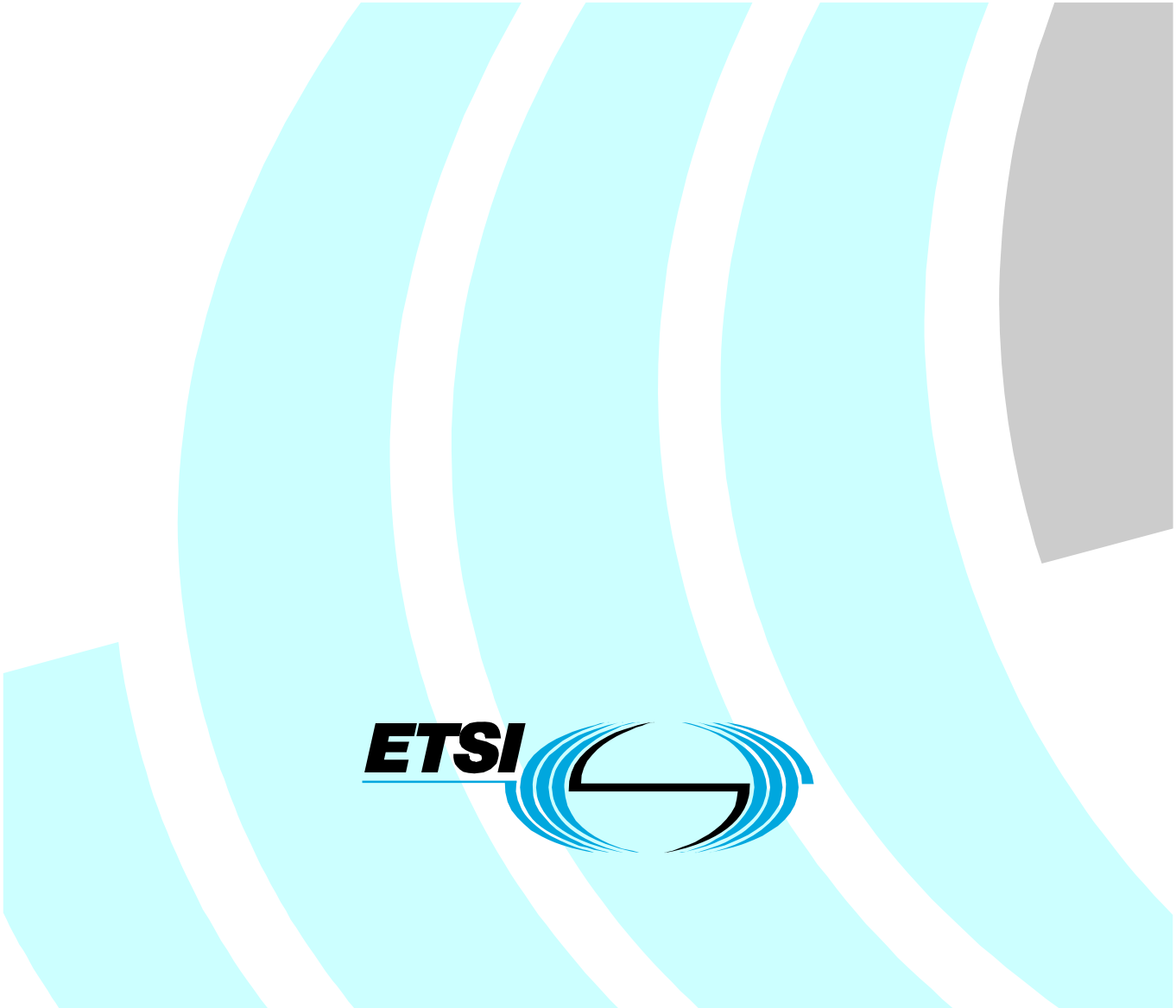
ETSI TS 101 376-3-10 V3.2.1 (2011-02)

Technical Specification

GEO-Mobile Radio Interface Specifications (Release 3);
Third Generation Satellite Packet Radio Service;
Part 3: Network specifications;
Sub-part 10: Functions related to
Mobile Earth Station (MES) in idle mode;
GMR-1 3G 43.022



Reference
RTS/SES-00315-3-10

Keywords
3G, GMPRS, GMR, GPRS, GSM, GSO,
interface, MES, mobile, MSS, radio, satellite,
S-PCN

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Foreword

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- the third digit (n) is incremented when editorial only changes have been incorporated in the specification;
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The present document is part 3, sub-part 10 of a multi-part deliverable covering the GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service, as identified below:

Part 1: "General specifications";

Part 2: "Service specifications";

Part 3: "Network specifications":

Sub-part 1: "Network Functions";

Sub-part 2: "Network Architecture";

Sub-part 3: "Numbering, addressing and identification";

Sub-part 4: "Organization of Subscriber Data";

Sub-part 5: "Technical realization of Supplementary Services";

Sub-part 6: "Location Registration and Position Identification Procedures";

Sub-part 7: "Discontinuous Reception (DRX)";

Sub-part 8: "Support of Dual-Tone Multifrequency Signalling (DTMF)";

Sub-part 9: "Security related Network Functions";

Sub-part 10: "Functions related to Mobile Earth Station (MES) in idle mode";

Sub-part 11: "Technical realization of the Short Message Service (SMS) Point-to-Point (PP)";

Sub-part 12: "Technical realization of the Short Message Service Cell Broadcast (SMSCB)";

Sub-part 13: "Technical realization of group 3 facsimile using transparent mode of transmission";

Sub-part 14: "Transmission Planning Aspects of the Speech Service in the GMR-1 system";

Sub-part 15: "Line Identification supplementary service - Stage 2";

Sub-part 16: "Call Barring (CB) supplementary services - Stage 2";

Sub-part 17: "Unstructured Supplementary Service Data (USSD) - Stage 2";

Sub-part 18: "Terminal-to-Terminal Call (TtT)";

Sub-part 19: "Optimal Routing technical realization";

Sub-part 20: "Technical realization of High-Penetration Alerting";

Sub-part 21: "Position Reporting services; Stage 2 Service description";

Sub-part 22: "Overall description of the GMPRS radio interface; Stage 2";

Sub-part 23: "Radio Access Network; Overall description - Stage 2";

Part 4: "Radio interface protocol specifications";

Part 5: "Radio interface physical layer specifications";

Part 6: "Speech coding specifications";

Part 7: "Terminal adaptor specifications".

Introduction

GMR stands for GEO (Geostationary Earth Orbit) Mobile Radio interface, which is used for Mobile Satellite Services (MSS) utilizing geostationary satellite(s). GMR is derived from the terrestrial digital cellular standard GSM and supports access to GSM core networks.

The present document is part of the GMR Release 3 specifications. Release 3 specifications are identified in the title and can also be identified by the version number:

- Release 1 specifications have a GMR 1 prefix in the title and a version number starting with "1" (V1.x.x).
- Release 2 specifications have a GMPRS 1 prefix in the title and a version number starting with "2" (V2.x.x).
- Release 3 specifications have a GMR-1 3G prefix in the title and a version number starting with "3" (V3.x.x).

The GMR release 1 specifications introduce the GEO Mobile Radio interface specifications for circuit mode Mobile Satellite Services (MSS) utilizing geostationary satellite(s). GMR release 1 is derived from the terrestrial digital cellular standard GSM (phase 2) and it supports access to GSM core networks.

The GMR release 2 specifications add packet mode services to GMR release 1. The GMR release 2 specifications introduce the GEO Mobile Packet Radio Service (GMPRS). GMPRS is derived from the terrestrial digital cellular standard GPRS (included in GSM Phase 2+) and it supports access to GSM/GPRS core networks.

The GMR release 3 specifications evolve packet mode services of GMR release 2 to 3rd generation UMTS compatible services. The GMR release 3 specifications introduce the GEO-Mobile Radio Third Generation (GMR-1 3G) service. Where applicable, GMR-1 3G is derived from the terrestrial digital cellular standard 3GPP and it supports access to 3GPP core networks.

Due to the differences between terrestrial and satellite channels, some modifications to the GSM or 3GPP standard are necessary. Some GSM and 3GPP specifications are directly applicable, whereas others are applicable with modifications. Similarly, some GSM and 3GPP specifications do not apply, while some GMR specifications have no corresponding GSM or 3GPP specification.

Since GMR is derived from GSM and 3GPP, the organization of the GMR specifications closely follows that of GSM or 3GPP as appropriate. The GMR numbers have been designed to correspond to the GSM and 3GPP numbering system. All GMR specifications are allocated a unique GMR number. This GMR number has a different prefix for Release 2 and Release 3 specifications as follows:

- Release 1: GMR n xx.zyy
- Release 2: GMPRS n xx.zyy
- Release 3: GMR-1 3G xx.zyy

where:

- xx.0yy (z = 0) is used for GMR specifications that have a corresponding GSM or 3GPP specification. In this case, the numbers xx and yy correspond to the GSM or 3GPP numbering scheme.
- xx.2yy (z = 2) is used for GMR specifications that do not correspond to a GSM or 3GPP specification. In this case, only the number xx corresponds to the GSM or 3GPP numbering scheme and the number yy is allocated by GMR.
- n denotes the first (n = 1) or second (n = 2) family of GMR specifications.

A GMR system is defined by the combination of a family of GMR specifications and GSM and 3GPP specifications as follows:

- If a GMR specification exists it takes precedence over the corresponding GSM or 3GPP specification (if any). This precedence rule applies to any references in the corresponding GSM or 3GPP specifications.

NOTE: Any references to GSM or 3GPP specifications within the GMR specifications are not subject to this precedence rule. For example, a GMR specification may contain specific references to the corresponding GSM or 3GPP specification.

- If a GMR specification does not exist, the corresponding GSM or 3GPP specification may or may not apply. The applicability of the GSM and 3GPP specifications is defined in GMR-1 3G 41.201 [2].

The clause numbering and the table numbering and figure numbering in the present document are aligned to the corresponding numbering of GMPRS-1 03.022 [15] as far as possible.

1 Scope

The present document gives an overview of the tasks undertaken by a GMR-1 Mobile Earth Station (MES) when in idle mode, that is, switched on but not having a dedicated channel allocated, e.g. not making or receiving a call. It also describes relevant network functions. The idle mode functions are also performed by a MES as long as no dedicated channel is allocated to the MES.

The present document outlines how the idle mode operation shall be implemented. Further details are given in GMR-1 3G 44.008 [4] and GMR-1 3G 45.008 [7].

Clause 4 of the present document gives a general description of the idle mode process. Clause 5 outlines the main requirements and technical solutions of those requirements. Clause 6 describes the processes used in idle mode.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

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] GMPRS-1 01.004 (ETSI TS 101 376-1-1): "GEO-Mobile Radio Interface Specifications (Release 2) General Packet Radio Service; Part 1: General specifications; Sub-part 1: Abbreviations and acronyms".

NOTE: This is a reference to a GMR-1 Release 2 specification. See the introduction for more details.

[2] GMR-1 3G 41.201 (ETSI TS 101 376-1-2): "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 1: General specifications; Sub-part 2: Introduction to the GMR-1 family".

[3] GMR-1 03.299 (ETSI TS 101 376-3-21): "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 21: Position Reporting services; Stage 2 Service description".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

[4] GMR-1 3G 44.008 (ETSI TS 101 376-4-8): "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 4: Radio interface protocol specifications; Sub-part 8: Mobile Radio Interface Layer 3 Specifications".

[5] GMR-1 3G 45.002 (ETSI TS 101 376-5-2): "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 2: Multiplexing and Multiple Access; Stage 2 Service Description".

[6] GMR-1 3G 45.005 (ETSI TS 101 376-5-5): "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 5: Radio Transmission and Reception".

[7] GMR-1 3G 45.008 (ETSI TS 101 376-5-6): "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 6: Radio Subsystem Link Control".

[8] GMR-1 3G 45.010 (ETSI TS 101 376-5-7): "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 7: Radio Subsystem Synchronization".

[9] 3GPP TS 43.022 (ETSI TS 143 022): "3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Functions related to Mobile Station (MS) in idle mode and group receive mode".

[10] Void.

[11] 3GPP TS 23.122 (ETSI TS 123 122): "3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals; Non-Access-Stratum (NAS) functions related to Mobile Station (MS) in idle mode".

[12] 3GPP TS 23.060 (ETSI TS 123 060): "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; General Packet Radio Service (GPRS); Service description; Stage 2".

[13] 3GPP TS 24.008 (ETSI TS 124 008): "3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals; Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".

[14] GMR-1 3G 44.118 (ETSI TS 101 376-4-13): "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 4: Radio interface protocol specifications; Sub-part 13: Radio Resource Control (RRC) protocol; Iu Mode".

[15] GMPRS-1 03.022 (ETSI TS 101 376-3-10): "GEO-Mobile Radio Interface Specifications (Release 2) General Packet Radio Service; Part 3: Network specifications; Sub-part 10: Functions related to Mobile Earth Station (MES) in idle mode".

NOTE: This is a reference to a GMR-1 Release 2 specification. See the introduction for more details.

[16] GMR-1 3G 44.160 (ETSI TS 101 376-4-14): "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 4: Radio interface protocol specifications; Sub-part 14: Mobile Earth Station (MES) - Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol; Iu Mode".

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] 3GPP TS 25.413 (ETSI TS 125 413): "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; UTRAN Iu interface Radio Access Network Application Part (RANAP) signalling".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in GMR-1 3G 41.201 [2] and the following apply:

A-BCCH (A/Gb mode only): broadcast channel which:

1) uses an ARFCN on the BCCH_FULL_LIST for the serving satellite;

2) is illuminated permanently in a satellite system;

3) is always be transmitted with full BCCH power;

4) can be listed on a neighbour BCCH list; and

5) can be used for RSSI-based spot beam selection.

A/Gb mode: MES operating mode that applies with a Release 1 (GMR-1) or Release 2 (GMPRS-1) radio access network

NOTE: For the multi system case the mode is determined by the current serving radio access network.

BCCH carrier: frequency carrier which is used by either an FCCH or an FCCH3 multiplexed with a BCCH/CCCH

Dark Beam (A/Gb mode only): spot beam that is not activated and has no satellite resource allocated, or a spot beam that is activated but not illuminated

NOTE: To activate a beam is to allocate Subband and Frequency Slot resource, and perform routing over the satellite payload. To illuminate a beam is to start BCCH signal transmission using already activated satellite resource.

Iu mode: MES operating mode that applies with a Release 3 (GMR-1 3G) radio access network

NOTE: For the multi system case the mode is determined by the current serving radio access network.

Location Registration (LR): may be either the Location Updating procedure or the Routing Area Update procedure

NOTE 1: A MES that is IMSI attached to non-GMPRS services only performs location registration by the Location Updating procedure. A MES that is IMSI attached to GMPRS services or to GMPRS and non-GMPRS services performs location registration by the Routing Area Update procedure only when in a network of network operation mode I. A MES performs location registration by the Routing Area Update procedure (Iu mode) when in a network of network operation mode I or II.

NOTE 2: Both procedures are performed independently by the MES when it is IMSI attached to GMPRS and non-GMPRS services in a network of network operation mode II or III (see 3GPP TS 23.060 [12]).

NOTE 3: Network operation modes I and II for GMR-1 3G Iu mode correspond to modes I and II for A/Gb mode, respectively. Mode III applies to A/Gb mode only, but not to Iu mode (see 3GPP TS 23.060 [12]).

Registration Area (RA): area in which mobile stations may roam without a need to perform location registration

NOTE: The registration area corresponds to the Location Area (LA) for performing location updating procedure, and it corresponds to the routing area for performing the routing area update procedure.

Routing Area Indicator (RAI): Routing Area Indicator has a similar format as the LAI and is similar in function to the LAI, except that the RAI is used for provision of data services

T-BCCH (A/Gb mode only): broadcast channel which:

1) can use any frequency, i.e. it may be assigned to an ARFCN not given in the BCCH_FULL_LIST for the serving satellite;

2) might not be illuminated or activated all the time;

3) might not be transmitted with full BCCH power;

4) is not listed in the neighbour BCCH list; and

5) is not used for RSSI-based spot beam selection.

spot beam: defined by its spot beam ID

NOTE: Several BCCH carriers may share the same spot beam ID. This indicates that the geographic coverage area of the BCCH carriers is coincident.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in GMPRS-1 01.004 [1] apply.

4 General description

4.1 Comparison of GMR-1 and GMR-1 3G satellite systems with terrestrial cellular systems

A GMR-1 or GMR-1 3G satellite system differs from a terrestrial cellular system in several important respects but also incorporates a number of the same radio and network architecture features.

In terrestrial cellular system, a cell is always wholly contained within a single LA. In a GMR-1 or GMR-1 3G satellite system, each BCCH carrier shall be associated with a single LAI. Multiple BCCH channels may be provided in the same spot beam with identical coincident geographic coverage or with overlapping geographic coverage where the individual BCCH carrier LAIs may be associated with the same or different PLMNs.

In a cellular system, a cell always provides access to only one base station and only one MSC or SGSN Core Network (CN) elements. In GMR-1 or GMR-1 3G, a BCCH carrier within a spot beam shall provide access to one GS and to one CN element. Multiple BCCH carriers within coincident or overlapping spot beams may provide access to different GS and different CN elements. The gateways may have the same or different PLMN.

In a terrestrial cellular system, PLMN selection has priority over cell selection, and any suitable cell of a selected PLMN can be selected even if there are other stronger cells belonging to other PLMNs. In GMR-1 or GMR-1 3G, only the strongest or next to the strongest spot beam from a particular satellite should be camped on, and the PLMN should be selected from the BCCHs of these spot beams.

Having coverage from more than one satellite of a single system operator is also a distinct attribute of a GMR-1 or GMR-1 3G system, with no comparable situation in a terrestrial cellular system.

In a terrestrial cellular system, the position of the MS is indicated by cell selection and, optionally, by additional functionality provided by GPS or some other technique. In a GMR-1 or GMR-1 3G system, if the MES supports GPS capability the MES is required to perform GPS position determination, use that position as part of spot beam selection, and report its position to the network during the system access. If the MES does not support GPS capability, spot beam selection is based on power measurements. In a GMR-1 or GMR-1 3G system, spot beam selection may include Gateway selection where suitable or equivalent coverage is provided by spot beams associated with different Gateways.

In a terrestrial cellular system, any detectable signal can be a potential candidate for camp-on. However, due to link margins for the satellite frequency correction and broadcast channels (FCCH and BCCH) and the beamforming properties of the satellite antenna, it is possible to receive a signal that is not from the spot beam associated with the MES's location. The MES scan procedure shall avoid camping on these spurious signals.

In a terrestrial cellular system, registration is permitted on any network for which a minimally acceptable signal can be detected. In a GMR-1 or GMR-1 3G system, and assuming that the spurious signals described above have been rejected, registration is not always allowed on detectable networks. Registration may be position based, as will be described later. In this regard, the GS may participate in the PLMN and RA selection process, which is never the case in a cellular system. However, a GMR-1 or GMR-1 3G system may or may not require MES position reporting.

The GMR-1 or GMR-1 3G system has different service levels: Normal Service, Alerting Service, Limited Service, and No Service. Alerting service is optional for both the network and the MES.

The GMR-1 or GMR-1 3G system in A/Gb mode may use Dark Beams to manage the assignment of resources to spot beams or to minimize unnecessary power consumption on the satellite. A spot beam may not have satellite frequency or timeslot resources allocated, or may have resources allocated but may not be transmitting a BCCH signal. In either case the spot beam is called a Dark Beam.

4.2 Idle mode

The GMR-1 idle mode can be subdivided into four processes:

- Spot beam selection and reselection.
- PLMN selection.
- GPS position determination (for suitably equipped MESs).
- Location registration.

The GMR-1 3G idle mode includes all of these GMR-1 idle mode processes plus one additional process:

- Gateway selection.

Clause 5 introduces the issues to be accommodated by idle mode, and describes at a general level how the idle mode processes shall specifically solve them.

The functional aspects of the idle mode process are described in clause 5. The relationship between these processes is illustrated in figures 6.1 and 6.1a (for GMR-1 3G). The internal states and state transitions within each process are shown in figures 6.2 to 6.5.

5 Requirements and technical solutions

The following clauses list the main requirements of idle mode operation and give an outline of the technical solution.

5.1 Service capabilities

The MES shall provide three levels of service: Normal Service, Limited Service, and No Service. The MES may provide two additional levels of service: Position-Restricted Service (A/Gb mode only) and Alerting Service. The service levels are shown schematically in figure 5.1.

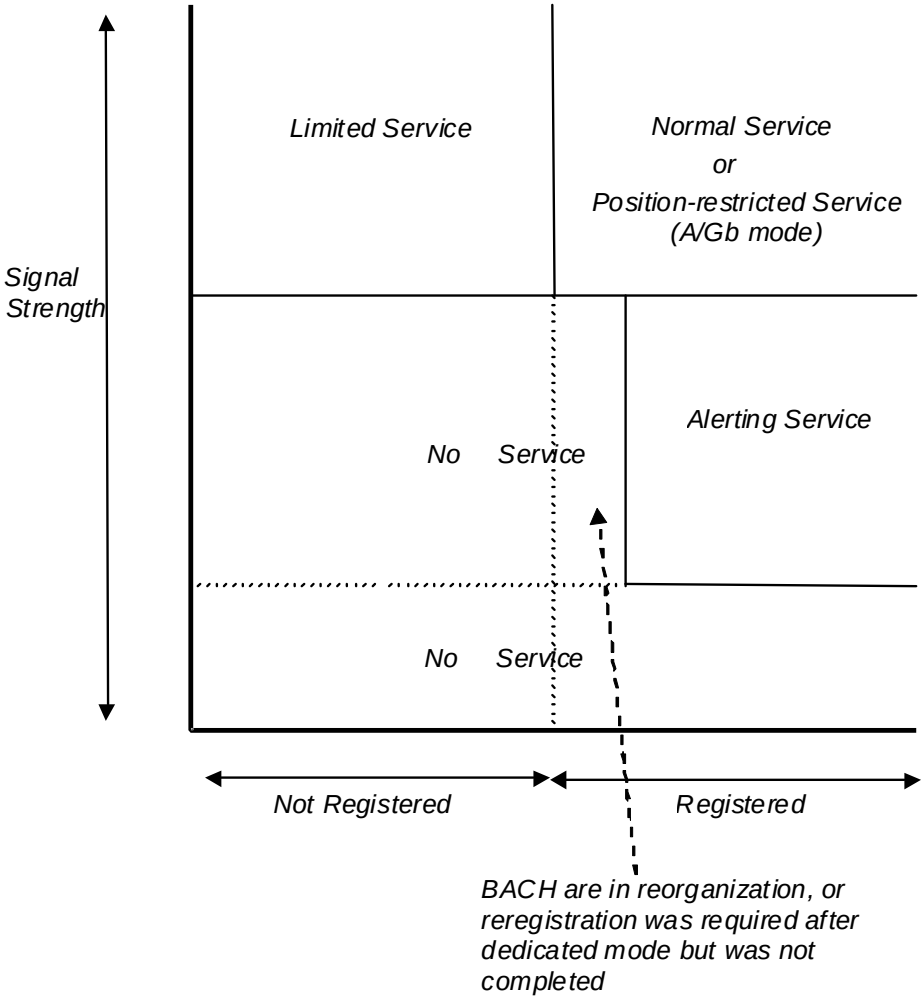


Figure 5.1: Service states

5.1.1 Normal Service

Normal Service is the capability wherein the MES has full service access to the GMR-1 or GMR-1 3G system and sufficient signal quality for two-way communication. In order to be in Normal Service, the MES shall be registered. For Normal Service, the MES shall select a suitable spot beam, tune to that spot beam's BCCH + CCCH associated with the selected PLMN, and register within the PLMN. If it registers successfully, it has Normal Service.

5.1.2 Limited Service

There are a number of situations in which the MES is not allowed to register with any PLMN or the PLMN denies registration, but the signal strength is acceptable for Normal Service. The inability to obtain Normal Service is due to one or more of the following factors:

- No SIM in the MES.
- A "PLMN not allowed" or "LA not allowed" response to an LR.
- An "illegal MES" "illegal MES-ME" response to an LR. Any SIM in the MES-ME is then considered "invalid".
- "IMSI unknown in HLR". This only impacts the non-GMPRS update state. The service state for MESs capable of GMPRS and non-GMPRS services is dependent upon the outcome of the routing area update.

- A "GMPRS not allowed" response to an LR of a MES attached to GMPRS services only. The service state of MESs capable of both GMPRS and non-GMPRS services depends on the outcome of the location updating, as "GMPRS not allowed" only has impact on the GMPRS update state.

- The SIM status is "Updated" but the MES shall reregister before it can obtain Normal Service. It is camped in a different LAI from the one on which it is registered. See clauses 5.1.3 and 5.5.

For a MES, the inability to obtain Normal Service and entry into the Limited Service states may in addition be due to one of the following factors related to an attempt to perform a GMPRS attach to the network (see 3GPP TS 24.008 [13]):

- A "Roaming not allowed in this location area" response to an LR.

- A "No Suitable Cells In Location Area" response to an LR.

Under any of these conditions, the MES is considered to be "not registered". It attempts to camp on an acceptable spot beam so that emergency calls (where applicable) can be made if necessary. When in the Limited Service state with a valid SIM, the MES shall only initiate LRs in the manner described in clause 6.5.3. No LR requests are made until a valid SIM is present. In the Limited Service state, the presence of the MES need not be known to the PLMN on whose spot beam it has camped. Spot beam reselection takes place as normal.

There are also other conditions under which only emergency calls may be made. These are shown in table 6.2.

5.1.3 Position-restricted service (A/Gb mode only)

This clause only applies to terminals operating in the A/Gb mode.

There are a number of situations in which the registration status of the MES cannot be determined, and access to the system is blocked in any case. The inability to obtain Normal Service is due to one or more of the following factors:

- An "Invalid Position" or "Invalid Position for the MES's Service Provider" response to a Channel Request.

- A "Position Too Old" response to a Channel Request for an LR.

Under any of these conditions, the MES's registration status is indeterminate, and the MES provides only Position-Restricted Service. Position-Restricted Service differs from Limited Service in that the MES will not attempt non-emergency calls for the latter. In Position-Restricted Service, and the user attempts a call, the MES will attempt an LR and then follow with the CM Service Request if it is successful. Other aspects of the Position-Restricted and Limited Services, such as non-responsiveness to pages and high-penetration alerts, are the same.

5.1.4 Alerting Service

The GMR-1 or GMR-1 3G system may implement an Alerting Service. The purpose of this service is to notify registered users when they have an incoming call, under highly attenuated signal conditions. The Alerting Service has the following features:

- The signal level is too low for normal operation. Therefore, a special high-penetration alerting channel with modulation suitable for very low signal to noise ratios, called the BACH, is used. This channel sacrifices information carrying capacity in order to deliver alerts. Therefore, the MES has limited knowledge about the incoming call at the point of reception of the alert.

- The MES might not be able to monitor broadcast information in signal conditions where the Alerting Service is functioning.

- The high-penetration alerting channel is one-way. The user shall move the MES into a position in which it can obtain Normal Service in order to respond to the high-penetration alert.

There are several necessary conditions for the MES to provide the Alerting Service:

- The MES shall be registered. In addition, upon a transition from Dedicated Mode to Idle Mode and if reregistration is required, the MES shall reregister before entry into Normal Service. (The LAI in which the MES is registered is not the one upon which it is camped.) If the signal level drops before the MES is able to reregister, it shall enter No Service. See also clause 5.6.
- The signal level received by the MES, although lower than for Normal Service, is sufficient to receive the BACH.
- The MES shall be camped on the proper BACH. While the MES is in the Alerting Service, it shall monitor the BACH organization state from the BACH. If the BACH organization changes, the MES shall transition to No Service and remain in this service state until it updates its BACH channel configuration from the BCCH.

5.1.5 No Service

If the MES cannot obtain any better level of service, it is in No Service. The MES may be in the process of acquiring the system but not camped on any system channel; or the signal may have dropped into the high penetration alerting range, but it is not registered or it may not be camped on the proper BACH; or the signal may be insufficient for high penetration alerting.

5.2 Spot beam selection

Spot beam selection consists of the process of locating a suitable BCCH from a suitable spot beam and camping on it. After initial spot beam selection, multiple BCCHs might be available to camp on. The BCCH selection process involves the PLMN selection process, selection of an LAI if there are more than one available with the same PLMN ID, and also involves the interpretation of information that is returned to the MES in response to Channel Request messages.

5.2.1 Spot beams

5.2.1.1 Normal spot beams

A satellite antenna may be capable of shaping its receptivity pattern into lobes with geographically distinct areas of coverage. The satellite may also have the ability to selectively switch specific channels into the different antenna lobes. The combination of channel resources and associated antenna lobe is called a spot beam. A normal spot beam is a spot beam that carries the normal suite of CCCH and RACH channels.

5.2.1.2 Dark spot beams (A/Gb mode only)

This clause only applies to terminals operating in the A/Gb mode.

A GMR-1 3G system may optionally, temporarily, not transmit control channels in a spot beam. A spot beam that does not transmit control channels in a spot beam, but which provides service in the coverage of the spot beam, is called a Dark Beam. The gateway can turn on control channels in a dark spot beam on a demand basis.

A GMR-1 3G system that utilizes Dark Beams shall co-ordinate system information and resource allocation with a co-operating network that maintains illuminated spot beams.

5.2.2 Multiple satellites

A GMR-1 or GMR-1 3G system may employ resources from more than one satellite. For a given satellite, all channels on all carriers are time-synchronized. In principle, it would be desirable to treat resources from different satellites in an identical way. However, this is not entirely possible due to the fact that the timing of different satellites is not synchronized with respect to one another. This lack of synchronization requires that an MES shall resynchronize when switching from one satellite to another.

Each satellite radiates its own spot beams. The spot beams of two satellites might not precisely coincide on the earth. Therefore a particular spot beam from one satellite could partially overlap the coverage of several spot beams of a different satellite.

5.2.3 Initial spot beam selection

Initial spot beam selection is the process in which the MES uses signal acquisition and measurement to discover and evaluate BCCH carriers. Initial spot beam selection occurs most often at power-on. However, this process may also be necessary to reacquire the satellite signal if, for example, an MES has lost the satellite signal for a significant period or the MES is transitioning from terrestrial service to satellite service. Initial spot beam selection may also make use of position information where available to an MES.

The GMR-1 or GMR-1 3G system provides signalling channels that are broadcast in spot beams, including the BCCH. The MES searches for BCCHs that are available in various spot beams, measures them, and classifies them by signal strength. The MES selects one or more BCCH carriers. Spot beam or beams that contain these BCCHs are called "suitable" spot beams. Where an MES supports GPS capability, the MES position, when available, shall be used in conjunction with the BCCH-broadcast spot beam definition to identify suitable spot beams (see GMR-1 3G 45.008 [7]).

In the neighbourhoods of the spot beam intersections, the BCCHs of neighbouring spot beams have signal levels that are approximately equal. Typically, the MES will identify a single suitable spot beam, but it may identify multiple suitable spot beams in this case. With position-based spot beam selection multiple "suitable beams" may also be identified based on the spot beam definitions and spot beam selection distance criteria (see GMR-1 3G 44.008 [4]).

Multiple Gateways may each provide their own BCCH carrier in a given geographic area with coincident spot beam coverage. Initial spot beam selection selects spot beams using a single BCCH carrier from each spot beam. Once a spot beam has been selected, all of the BCCH carriers serving the coincident spot beam coverage area shall be equally suitable candidates for PLMN and LAI selection. All of the coincident spot beam BCCH frequencies are identified within the Concurrent BCCH List broadcast in the BCCH system information (see GMR-1 3G 44.008 [4]).

5.2.3.1 Spot beam selection with a co-operating gateway (A/Gb mode only)

This clause only applies to terminals operating in the A/Gb mode.

In a GMR-1 3G system, the MES may conduct initial spot beam selection on BCCH carriers that are broadcast from a cooperating network, rather than from the GMR-1 3G network. The MES shall camp on a normal spot beam of the GMR-1 3G network if it is available, and shall camp on a normal spot beam of the cooperating network if the spot beam of the GMR-1 3G network is a Dark Beam.

The MES is able to detect Dark Beam illumination by:

- detecting the addition of a T-BCCH to the concurrent BCCH list of the camped-on BCCH;
- assignment to a T-BCCH as the result of a service request.

5.2.4 Spot beam restriction by system response

The MES can report its GPS position to the Gateway Station in Channel Request messages. Based upon the reported GPS position or other information, the Gateway Station may determine various position-based access errors or enforce position-based access restrictions by responding with reject causes in Immediate Assignment Reject messages.

These reject causes may terminate the interaction between the MES and the Gateway but provide information regarding spot beam and/or LAI selection. They may also restrict the selection of a spot beam or require a reselection and may also restrict the selection of the BCCH within the spot beam.

The MES could choose an incorrect spot beam due to measurement error. The Gateway Station may detect this from the reported GPS position and shall indicate this to the MES with the reject cause "Invalid Position for the Selected Spot Beam". Upon reception of this reject cause, the MES shall select another spot beam. The GS may also provide explicit information to the MES about the routing area within the spot beam to which the MES access should be redirected (see GMR-1 3G 44.008 [4]).

The Gateway Station may also force the MES to camp on a BCCH from a different satellite with this reject cause and appropriate supporting parameters.

The handling for these reject causes are also described in clause 6.2 and in GMR-1 3G 44.008 [4].

5.2.5 System Information (SI)

The Gateway shall provide the following information in System Information in its BCCH (see GMR-1 3G 44.008 [4]):

1) BCCH_NEIGHBOR_LIST. This list shall contain the BCCH carrier frequency and timing information for one BCCH carrier in each of the spot beams that are nearest neighbour to the beam that contains the BCCH. A BCCH carrier and the neighbour BCCH carriers of this list shall always be on the same satellite.

2) BCCH_FULL_LIST. This list shall contain a BCCH carrier frequency for every spot beam in a GMR-1 or GMR-1 3G system. If a GMR-1 or GMR-1 3G system uses a BCCH carrier in multiple spot beams, it only occurs once in the BCCH_FULL_LIST.

3) CONCURRENT_BCCH_INFORMATION. The BCCH shall identify other BCCH carriers that might be suitable for the MES. These carriers might be in the spot beam coverage areas of the same satellite as the BCCH, or they might be in spot beams from different satellites that at least partially overlap the spot beam containing the BCCH.

4) The BCCH shall contain the SB_RESELECT_HYSTERESIS parameter to control spot beam reselection. One value shall disable spot beam reselection. During certain satellite orbit manoeuvres, the Gateway may temporarily modify the value of SB_RESELECT_HYSTERESIS to prevent spot beam reselections.

5) Void.

6) The BCCH shall contain the CELL_BAR_ACCESS, CELL_BAR_ACCESS_EXTENSION, CELL_BAR_ACCESS_EXTENSION2, TEST_GS and TEST_GS2 control bits. The GMR-1 3G terminal type (see GMR-1 3G 45.002 [5]) assigned to the MES determines if the MES should use CELL_BAR_ACCESS_EXTENSION or CELL_BAR_ACCESS_EXTENSION2 bit. Based on its terminal type, the MES shall use these bit values during spot beam selection according to the following tables. The MES shall support the normal mode behaviour but may also support a test mode that controls spot beam selection behaviour as described below.

Table 5.1: A-interface, Iu-CS interface and Gb-interface terminal interpretation of CELL_BAR_ACCESS and related bits

CELL_BAR_ ACCESS	TEST_GS	CELL_BAR_ ACCESS_ EXTENSION2	terminal mode	A-interface or Iu-CS interface Terminal Behaviour	Gb-interface Terminal Behaviour
0	0	0	normal	allowed	barred
			test	barred	barred
1	0	0	normal	barred	barred
			test	barred	barred
0	1	0	normal	allowed	barred
			test	barred	allowed
1	1	0	normal	barred	barred
			test	allowed	barred
0	0	1	normal	allowed	allowed
			test	barred	barred
1	0	1	normal	barred	allowed
			test	barred	barred
0	1	1	normal	allowed	allowed
			test	barred	allowed
1	1	1	normal	barred	allowed
			test	allowed	allowed

Table 5.2: Iu-PS interface terminal interpretation of CELL_BAR_ACCESS and related bits

TEST_GS2	CELL_BAR_ACCESS_EXTENSION	terminal mode	Iu-PS-interface Terminal Behaviour
0	0	normal	barred
		test	barred
0	1	normal	allowed
		test	barred
1	0	normal	barred
		test	allowed
1	1	normal	allowed
		test	allowed

7) The BCCH shall contain parameters which indicate the type(s) of GMR-1 packet services supported in that spotbeam. During spotbeam selection the MES shall use this information to determine if it can obtain normal service in the spotbeam. A MES shall not select a spot beam if the network interface services supported in that spot beam are not compatible with the MES's capabilities.

8) The BCCH shall contain parameters which indicate the type(s) of GMR-1 3G packet services supported in the spotbeam. During spotbeam selection the MES shall use this information to determine if it can obtain normal service in the spotbeam. A MES shall not select a spot beam if the packet services supported in that spot beam is not compatible with the MES's capabilities.

9) The BCCH shall contain satellite and beam centre latitude, longitude position.

10) The BCCH may contain a parameter associated with Gateway station selection called load factor. The load factor contains two four bit sub-fields called the capacity indicator and the load indicator.

11) The BCCH may contain a parameter called system information extension which indicates whether the system information cycle is extended to another ARFCN. The extended SI ARFCN is also indicated.

12) The BCCH shall contain the beam centre position of the six neighbouring spot beams in latitude and longitude coordinates or the six vertices of the current beam within the BCCH NEIGHBOUR LIST. The BEAM_CENTER_DEFINITION parameter shall indicate whether the positions correspond to the beam centre of the neighbouring beams or the vertices of the current beam.

13) The BCCH may contain a spot beam selection distance which defined the distance in terms of percentage relative to a beam's radius that a terminal may consider a neighbour beam as "suitable".

14) The BCCH may contain a list of additional routing areas which are supported by the current BCCH.

15) The BCCH may contain a spot beam selection load count which defines the number of expirations of the SB_RESELECTION_TIMER between the use of load factor in periodic spot beam reselection. Load factor shall therefore be considered in periodic spot beam reselection only after every 2n expirations of the SB_RESELECTION_TIMER.

16) The BCCH shall contain a information element SA_BACH_CONFIG which shall indicate to the terminal whether or not high penetration alerting service is available in that spot beam (see GMR-1 3G 45.002 [5]).

5.2.6 Transition between normal spot beam and dark spot beam (A/Gb mode only)

This clause only applies to terminals operating in the A/Gb mode.

When a Dark Beam is turned on (i.e. has n-CCCH and RACH enabled in the spot beam), it has an FCCH and a BCCH.

When the BCCH is turned off, the MES camps on the BCCH of the co-operating network.

NOTE: The FCCH and the BCCH of the illuminated Dark Beam are required for synchronization in the GMR-1 3G system.

5.2.7 Anchor BCCH (A-BCCH) and Temporary BCCH (T-BCCH) (A/Gb mode only)

This clause only applies to terminals operating in the A/Gb mode.

An Anchor BCCH (A-BCCH) shall have the following features:

1) It shall use an ARFCN on the BCCH_FULL_LIST for the serving satellite.
2) It shall be illuminated permanently in a satellite system.
3) It shall always be transmitted with full BCCH power.
4) It may be listed on a neighbour BCCH list.
5) It may be used for RSSI based spot beam selection.

A Temporary BCCH (T-BCCH) shall have the following features:

1) It may use any frequency, i.e. it may be assigned to an ARFCN not given in the BCCH_FULL_LIST for the serving satellite.
2) It may not be illuminated or activated all the time.
3) It may not be transmitted with full BCCH power.
4) It shall not be listed in the neighbour BCCH list.
5) It shall not be used for RSSI based spot beam selection.

5.3 PLMN selection and roaming

5.3.1 Selection of PLMN (A/Gb mode only)

This clause only applies to terminals operating in the A/Gb mode.

The MES shall select an available PLMN with which to register.

Each BCCH identifies the PLMN ID of its Gateway Station in system information. CONCURRENT_BCCH_INFORMATION in system information also identifies all other PLMNs that provide service via other Gateway Stations. Therefore, a BCCH identifies all PLMNs that are served anywhere in the spot beam. All of these PLMNs are equally eligible for PLMN selection.

The MES camps on a BCCH of a PLMN associated with its current location, which is often its home PLMN. However, a visited PLMN may be selected, e.g. if the MES visits a geographic region where the HPLMN is not available in any suitable spot beam at the current location, or if the HPLMN is a GSM PLMN and is not available in any spot beam of the GMR-1 or GMR-1 3G system.

There are two modes for PLMN selection:

1) Automatic mode. This mode utilizes a list of PLMNs in priority order. The highest priority PLMN that is available and allowable is selected.

2) Manual mode. The MES indicates to the user which PLMNs are available. After the user makes a manual selection, the MES tries to obtain service on the selected PLMN.

If a "Roaming not allowed in this location area" reject cause is received in a LR Reject message, the LA is added to a list of "forbidden LAs for roaming". If a "LA not allowed" reject cause is received in a LR Reject message, the LA is added to a list of "forbidden LAs for regional provision of service". These lists are stored in the MES and are deleted when the MES is switched off or when the SIM is removed.

If the MES receives either of these reject causes, it should attempt to select a different LA or PLMN.

If a "PLMN not allowed" reject cause is received by an MES in an LR Reject message from a Visited PLMN, that the VPLMN is added to a list of "forbidden PLMNs" in the SIM; thereafter, that VPLMN will not be accessed by the MES when in automatic mode. A PLMN is removed from the "forbidden" list if, after a subsequent manual selection of that PLMN, there is a successful LR. This list is retained when the MES is switched off or the SIM is removed.

Optionally the MES may store an extension of the forbidden PLMN list in its memory. The contents of the extension shall be deleted when the MES is switched off or the SIM is removed.

5.3.1.1 PLMN selection in GMR-1 3G

Network selection in GMR-1 3G is identical to the circuit-switched voice system, with one exception. A GMR-1 3G system may utilize dark spot beams. If so, the GMR-1 3G network works in conjunction with another network.

The MES shall use the LAI for network selection, including network selection for provision of data services.

5.3.1a Selection of PLMN and roaming (Iu-mode)

The Iu mode selection of PLMN and roaming in GMR-1 3G is the same as the Iu-mode selection of PLMN and roaming defined in 3GPP TS 23.122 [11].

5.3.2 Geographic restrictions on service delivery (A/Gb mode only)

This clause only applies to terminals operating in the A/Gb mode.

Multiple Gateway Stations may provide service within a spot beam. However, the coverage of a spot beam is large, and the Gateway Stations may only be allowed to provide coverage in a portion of the beam. Also, different Gateway Stations might provide service into different geographic regions within a spot beam. Gateway Stations inform MESs about position based service limitation via reject causes in response to Channel Request messages.

If the MES is at a location from which service might be obtained but not from the LAI that was selected by the MES, a Channel Request message can be rejected with the reject cause "Invalid position for the Selected LAI". The selected LAI is no longer available. The MES shall select any other LAI that is still available. If the MES receives this cause upon access of the final "Available" LAI, it shall treat this case in the same manner as for "Invalid Position".

If the MES is at a location from which service is not available from any Gateway Station, the Channel Request message shall be rejected with the reject cause "Invalid Position" or "Invalid Position for the MES's Service Provider". The MES shall consider all LAIs for this GMR-1 or GMR-1 3G system to be not available and cease PLMN and LAI selection for the GMR-1 or GMR-1 3G system. The MES may remain in the Service Level (Normal Service or Limited Service) that was in effect prior to the Channel Request message.

These reject codes are discussed further in clause 6.2.5.4 and in GMR-1 3G 44.008 [4].

NOTE: All further discussions in the present document concerning the error cause "Invalid Position" equivalently applies to the error cause "Invalid Position for the MES's Service Provider".

5.3.2a Geographic restrictions on service delivery (Iu-mode)

The GMR-1 3G system may support geographic restrictions on service delivery by mapping restricted geographic area to routing areas. Where an MES initiates service from a given geographic area that area shall be mapped to a service area identifier that can be used by the core network as a basis for service access restrictions.

NOTE: The position restrictions may be implemented via the core network (NAS) based on Service Area Identifier (SAI) assignment at the time of Iu signalling connection establishment.
See 3GPP TS 25.413 [i.1].

5.3.2b Regional provision of service (Iu mode)

Same as 3GPP TS 23.122 [11] Iu mode.

An MES may have a "regionally restricted service" where it can only obtain service on certain LAs. If such an MES attempts to camp on a cell of an LA for which it does not have service entitlement, when it does an LR request, it will receive an "LA not allowed" message. In this case:

- The MES stores the forbidden LA Identity (LAI) in a list of "forbidden LAs for regional provision of service", to prevent repeated access attempts on a cell of the forbidden LA. This list is deleted when the MES is switched off or the SIM is removed. The MES enters the limited service state.

5.3.3 Multiple GMR-1/GMR-1 3G systems

There may be more than one GMR-1/GMR-1 3G system in operation throughout the world at one time. Each system may consist of one or more satellites. The footprints of the different systems may or may not overlap.

The user selection for service shall be by PLMN selection. Since the discovery of serving PLMNs is governed by the procedures for spot beam detection and selection, the spot beam selection rules determine the procedures by which PLMNs from different GMR-1 or GMR-1 3G systems are made available for selection.

5.4 Position determination (A/Gb mode)

This clause only applies to terminals operating in the A/Gb mode.

The GMR-1 or GMR-1 3G system utilizes two types of position information:

1) MES may compute a position relative to spot beam centres, and adjusts the timing of system access via the RACH accordingly. See GMR-1 3G 45.008 [7] and GMR-1 3G 45.010 [8] for specific requirements.

2) The GMR-1 or GMR-1 3G system uses position information, which is reported by the MES. See GMR-1 03.299 [3] for a description of services based upon GPS position.

5.4.1 Position reporting

MESs may be required to report their geographic position in a GMR-1 or GMR-1 3G system. If required, the MES shall report GPS position information in two circumstances:

1) The Channel Request and Extended Channel Request messages.

2) Vehicular Terminals (A/Gb mode) and all terminals (Iu mode) that support GPS capability shall periodically report position during a call/connection, if commanded to do so in the Immediate Assignment or Extended Immediate Assignment messages or when specifically requested by the network.

The MES shall periodically execute a Position Determination process to provide the position.

5.4.2 GPS receiver system support

The MES should have a GPS receiver. See GMR-1 03.299 [3] and GMR-1 3G 45.005 [6]. The Gateway may provide broadcast information that a GPS receiver can use to accelerate the time it takes to obtain a position.

The Gateway shall provide a GBCH, provided the GBCH_PRESENT flag is set. The MES should read the GPS Broadcast CHannel (GBCH). This channel will contain system information messages that provide GPS information to the MESs.

The Gateway shall provide GPS almanac information on the PCH, provided the ALMANAC_PRESENT flag is set. The MES should read GPS almanac information from the Paging CHannel (PCH).

See GMR-1 03.299 [3] for a description of the almanac and GBCH information.

5.4.3 Position verification system access

In addition to Location Updates and CM Service Requests, the Gateway supports system accesses that only report the position to the Gateway. These accesses have the following functions:

1) Obtain a response that either implicitly accepts the position or specifically rejects the access due to a position-based restriction.

2) Update the displayed country and/or region.

3) Allow the MES to report its current position so that it can be proactively redirected to the correct spotbeam or routing area while in idle mode and prior to system service access.

This system access is done with a Channel Request message with an establishment cause of Position Verification. See GMR-1 3G 44.008 [4].

5.5 Dedicated mode to idle mode transition (A/Gb mode only)

This clause only applies to terminals operating in the A/Gb mode.

The MES may temporarily register, while in Dedicated Mode, in an LA that is different from the one in which it was registered in Idle Mode. Dedicated Mode operation may involve a change of satellite, which also entails a change of LA.

Upon return from Dedicated Mode to Idle Mode, if the MES has registered to a different LA from the one to which it was registered in Idle Mode, the MES shall camp on the BCCH last camped-on in Idle Mode and reregister in the same LAI last registered in Idle Mode. Failing this reregistration, the MES shall enter Limited Service.

5.6 Barred LAs and access control

System access by MESs is limited by two types of control: LA barring and access control classes.

An MES shall not select in idle mode any BCCH that is restricted by the CELL_BAR_ACCESS parameter. A MES in idle mode shall not select for packet access any BCCH that is restricted by the CELL_BAR_ACCESS CELL_BAR_ACCESS_EXTENSION and CELL_BAR_ACCESS_EXTENSION2 parameters, as described in GMR-1 3G 44.008 [4].

Due to problems in certain areas, network operators may decide to restrict access from some MESs (e.g. in case of congestion on the AGCH), and for this reason the access control mechanism is provided.

At subscription, one or more access control classes are allocated to the subscriber and stored in the SIM. The information providing all authorized classes is broadcast on the BCCH (together with a bit indicating whether emergency calls may be made). This information is modified dynamically, and therefore the MES shall check the BCCH before each attempt to access.

The MES shall ignore the access control information when selecting a spot beam to camp on, i.e. it shall not reject a spot beam for camping on because access on that spot beam is not allowed.

5.7 Radio constraints

The MES uses a combination of signal level, signal quality, and MES location information to determine the suitability of BCCH's for camp-on, as described in GMR-1 3G 45.008 [7].

The MES can operate in several different ways, depending upon signal level. First, the signal level may be sufficient for two-way communication and the MES is capable of camping on the Paging CHannel (PCH). A state in which the MES is camped on the PCH is called a "Paging" state.

Second, the signal level may drop below the threshold for two-way communication capability but the MES can monitor the high-penetration alerting channel. A state in which the MES is camped on the BACH is called a "High penetration" state.

Third, the signal level may be too low for high-penetration alerting. The MES may enter a state that allows it an opportunity to recover from signal fades in excess of the alerting link margin and retain the high-penetration alerting function if the signal level improves. This state is called a "Frequency Search" state. An MES camped on a system which does not support high penetration alerting or an MES which does not support high penetration alerting may enter the "Frequency Search" state from the Paging state.

These signal-quality-dependent activities are captured in states of the Spot Beam Selection Process and are described in clause 6.2. The state change conditions are subject to the MES performance requirements defined in GMR-1 3G 45.005 [6].

5.8 Transition in/out GMR-1 idle mode (A/Gb mode only)

This clause only applies to terminals operating in the A/Gb mode.

This clause lists the requirements for mode interactions of multi-mode MESs, where the modes are GMR-1 and any other mode. This description uses GSM for the alternate mode of operation. However, the MES shall apply these requirements to any alternate mode of operation.

A SIM card shall only have one IMSI and therefore only one Home PLMN. At no time shall the MES be registered to more than one PLMN, i.e. there shall be only one Registered PLMN at a time stored in the MES. There shall only be one IMSI associated with an MES.

5.8.1 Modes of operation

A dual mode MES may have the operational modes listed in table 5.1. If the MES has more than one mode of table 5.1, it shall be contained in a mode selection setting. The mode selection setting shall be stored in non-volatile memory. The mode selection is set by the user and is not a subscription-based parameter.

An MES may implement other modes in addition to the modes listed in table 5.3. The rest of this clause applies only to the modes listed in table 5.3.

Table 5.3: Dual mode MES mode selections

Mode selection	Mode selection definition
GSM only	The MES only accesses GSM.
GMR-1 only	The MES only accesses GMR-1.

The Home PLMN of the MES shall have no effect on mode selection or mode interactions. The mode-selection and mode-interaction rules take priority over Home PLMN. The Home PLMN only has priority during network selection within a mode.

The specifications of 3GPP TS 43.022 [9] shall apply for GSM Only mode.

The specifications contained in the rest of the present document shall apply for GMR-1 Only mode.

5.8.2 Dual Mode Hold Timer

If an MES implements any mode of operation in which it automatically switches modes, then the Dual Mode Hold Timer shall apply.

The Gateway shall broadcast the Dual Mode Hold Timer parameter in system information, with a value that ranges from 15 minutes to 120 minutes, in increments of 15 minutes.

The MES shall not autonomously change mode from any other mode to GMR-1 more often than once per Dual Mode Hold Timer.

The limitation imposed by the Dual Mode Hold Timer shall only apply for Automatic Mode.

The Dual Mode Hold Timer restrictions shall be restarted upon any mode change.

6 Overall process structure

6.1 Process goal

The aim of the idle mode processes is to achieve the Normal Service state:

- The MES is camped on a suitable spot beam.
- The MES is registered in an LA consistent with its position. The SIM status may be "Not Updated", but it is registered in the network and camped on the same network.
- The registered PLMN is the selected PLMN.

There may be temporary conditions under which not all of these are fully satisfied, e.g. during spot beam selection, while in the process of reselecting another spot beam, or after movement out of an LA but before a registration with the new LA has been completed. However, if the above are not satisfied at the completion of operations that normally correct these transitory conditions, the MES will normally enter a "Limited Service state" in which it will try to camp on an acceptable spot beam. In this state, only emergency calls are possible.

Each of the processes of spot beam selection, PLMN selection, GPS position determination, Gateway (GW) selection and location registration can be described by a set of states. A/Gb mode supports the four processes shown in figure 6.1. Iu-mode supports five processes as shown in figure 6.1a with the additional GW selection process. The overall state of the mobile is thus a composite of the states of the five processes. In some cases, an event that causes a change of state in one process may trigger a change of state in another process, e.g. a response to an LR request may cause a spot beam reselection, followed by another LR request. The relationship among the processes is illustrated in figure 6.1. The three processes in the dotted line box in figure 6.1a are analogous to terrestrial cellular cell selection process (see 3GPP TS 23.122 [11]).

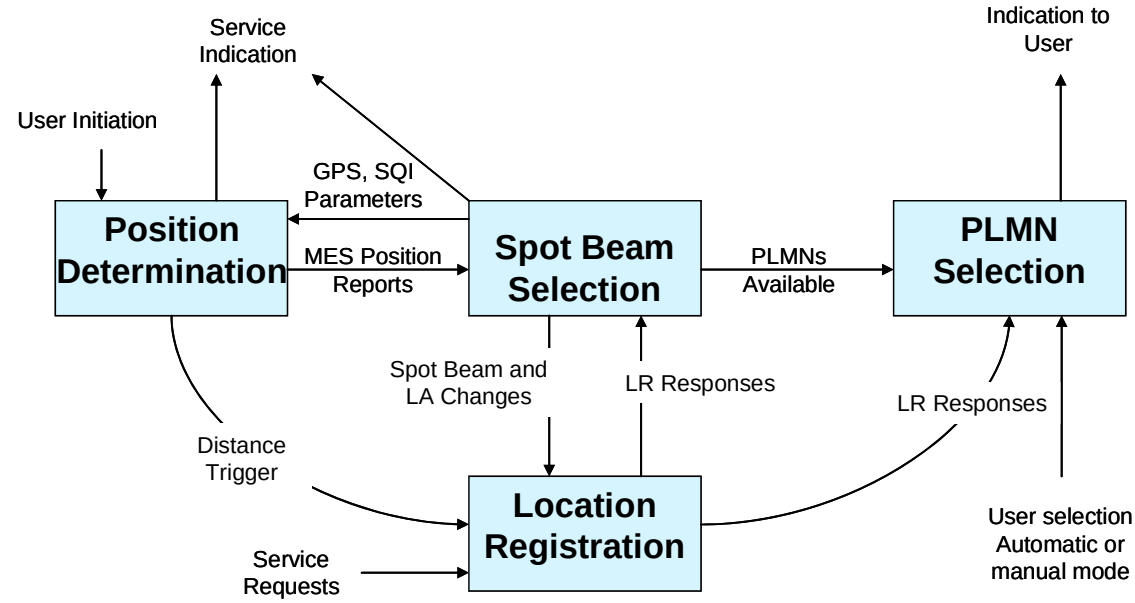


Figure 6.1: Four processes of idle mode (A/Gb mode)

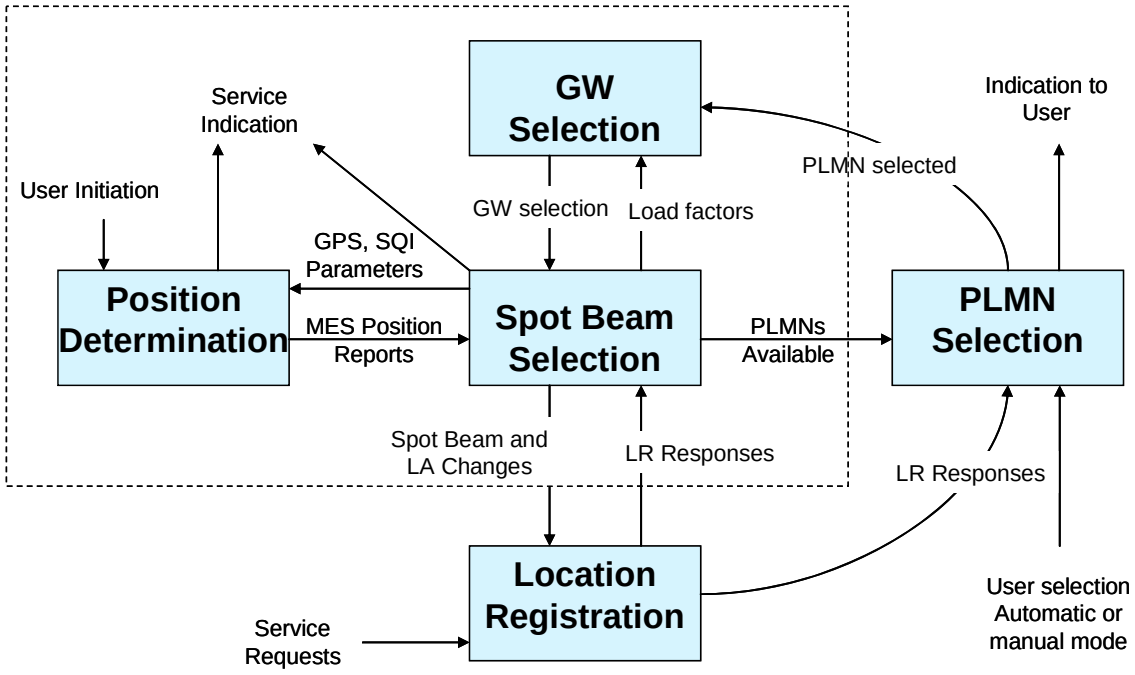


Figure 6.1a: Five processes of idle mode (Iu mode)

The states in which the MES may be for each of the processes are described below and illustrated in figures 6.2 to 6.5. For many of the states, a fuller description can be found in other GMR-1 technical specifications, and a reference to the GMR-1 Technical Specification and the relevant clause within it are given after the state description.

In the event of any conflict between the diagrams and the text in the present document, the text takes precedence.

6.2 Spot beam selection process

The Spot Beam Selection Process includes the procedures that perform spot beam selection and the procedures for LA identification and LA selection**.** Selection of the LA is equivalent to selection of a BCCH to camp on. In Iu-mode systems using load balancing, GW selection may be required to select the BCCH to camp on. The MES GPS position shall be used when it is available and neighbour beam measurements shall be used only when MES GPS position is not available. For more detail see GMR-1 3G 45.008 [7].

6.2.1 List of states for the spot beam selection process

Refer to figure 6.2.

B1 **Primary spot beam selection:** This is the state in which the MES creates a list of suitable spot beams, with no current camp-on history. This state is entered at power-on, at entry into GMR-1 or GMR-1 3G mode, when the user restarts PLMN selection, and when there is no suitable spot beam (including when all suitable spot beams are rejected by the Gateway Station).

B2 **Select a spot beam:** This is the state in which the MES selects and camps on a particular spot beam. PLMN selection occurs while in this state. This occurrence implies in turn that the MES selects and camps on a selected BCCH from a particular LA in this state. The MES moves to state B4 either upon the success of a registration or to state B8 if it determines that no registration can be successful (possibly requiring one or more LAI and or PLMN reselections). If the MES selects the same LAI as the one to which it was registered before the last power-down, the transition through this state is automatic without a new LR attempt. During the course of registration attempts, there may be changes of LAI selection to camp on due to Gateway Station responses to system accesses. This state may also be entered due to spot beam reselection or due to the error causes that cause an LAI reselection: "Invalid Position for the Selected Spot Beam" or "Invalid Position for the Selected LAI".

B3 **RF Carrier synchronization:** The MES enters this state if it is necessary to synchronize to a carrier from another satellite or to locate a carrier of the same satellite whose timing is unknown to the MES. This occurrence may be due to an autonomous Idle Mode procedure or it may be indicated to the MES supporting information along with an "Invalid Position for this spot beam" error cause. The MES performs a complete BCCH carrier acquisition and synchronization in this state. (These steps may not be necessary for carrier switching among carriers on the same satellite.) The MES moves to state B2 upon synchronization to the FCCH or FCCH3 and BCCH.

B4 **Camped normally paging:** The MES is camped on a spot beam and is able to make and receive calls. The MES is in Normal Service in this state. The MES executes the spot beam reselection process in this state. In Iu mode this will correspond to the RRC-idle or RRC_GRA_PCH states (see GMR-1 3G 44.118 [14] for Iu mode RRC states).

B5 **Normal service dedicated mode or RRC connected mode (Iu mode):** The MES is not in idle mode but is connected to the GMR-1 network for a call. For GMR-1 3G the MES has an established RRC context with the network and is in a RRC Cell-shared Cell-Dedicated (see GMR-1 3G 44.118 [14] for Iu mode RRC states).

B6 **Camped normally high penetration:** The MES is at least capable of receiving the BACH and synchronizing with the FCCH or FCCH3 in this state. The MES is in Alerting Service provided it satisfies the requirements of clause 5.1.3. Otherwise, the MES is in No Service in this state. In Iu mode this will correspond to the RRC-Idle or RRC-GRA_PCH states (see GMR-1 3G 44.118 [14] for Iu mode RRC states) and the sub-states are called Idle-alert or gra-pch-alert respectively.

B7 **Normal service frequency search:** The MES is not capable of receiving the BACH. It may be tracking the FCCH or FCCH3 or may attempt to reacquire the FCCH or FCCH3 if it has lost synchronization. The MES is in No Service in this state. If the MES cannot reacquire synchronization, it will go to state B1. The specific criteria for the transition from B7 to B1 are implementation-dependent.

B8 **Camped limited service - paging:** This is the state in which the MES has selected a spot beam but cannot obtain service because the MES is not registered in the selected LAI. The MES is in Limited Service in this state. The MES camps on the BCCH carrier so that emergency calls can be made. The MES monitors received level and BCCH data and checks periodically whether spot beam reselection is needed. The MES executes the spot beam reselection process in this state.

The MES may also enter this state upon completion of a call and where reregistration in the camped-on LAI is required but not completed. This state is then transitory until the MES either reregisters or the signal drops and the MES shall go to state B10.

B9 **Limited service dedicated mode:** The MES is not in idle mode but is connected to the GMR-1 network to make an emergency call.

B10 **Camped no service high penetration:** The MES is camped on a spot beam. The signal level is not sufficient for making emergency calls. The MES is synchronized to the FCCH or FCCH3. The MES is not registered and therefore is in No Service in this state. The MES does not monitor the BACH.

B11 **No service frequency search:** The MES may be tracking the FCCH or FCCH3 or may attempt to reacquire the FCCH or FCCH3 if it has lost synchronization. The MES is in No Service in this state. If the MES cannot reacquire synchronization, it shall go to state B1. The specific criteria for the transition from B11 to B1 are implementation-dependent.

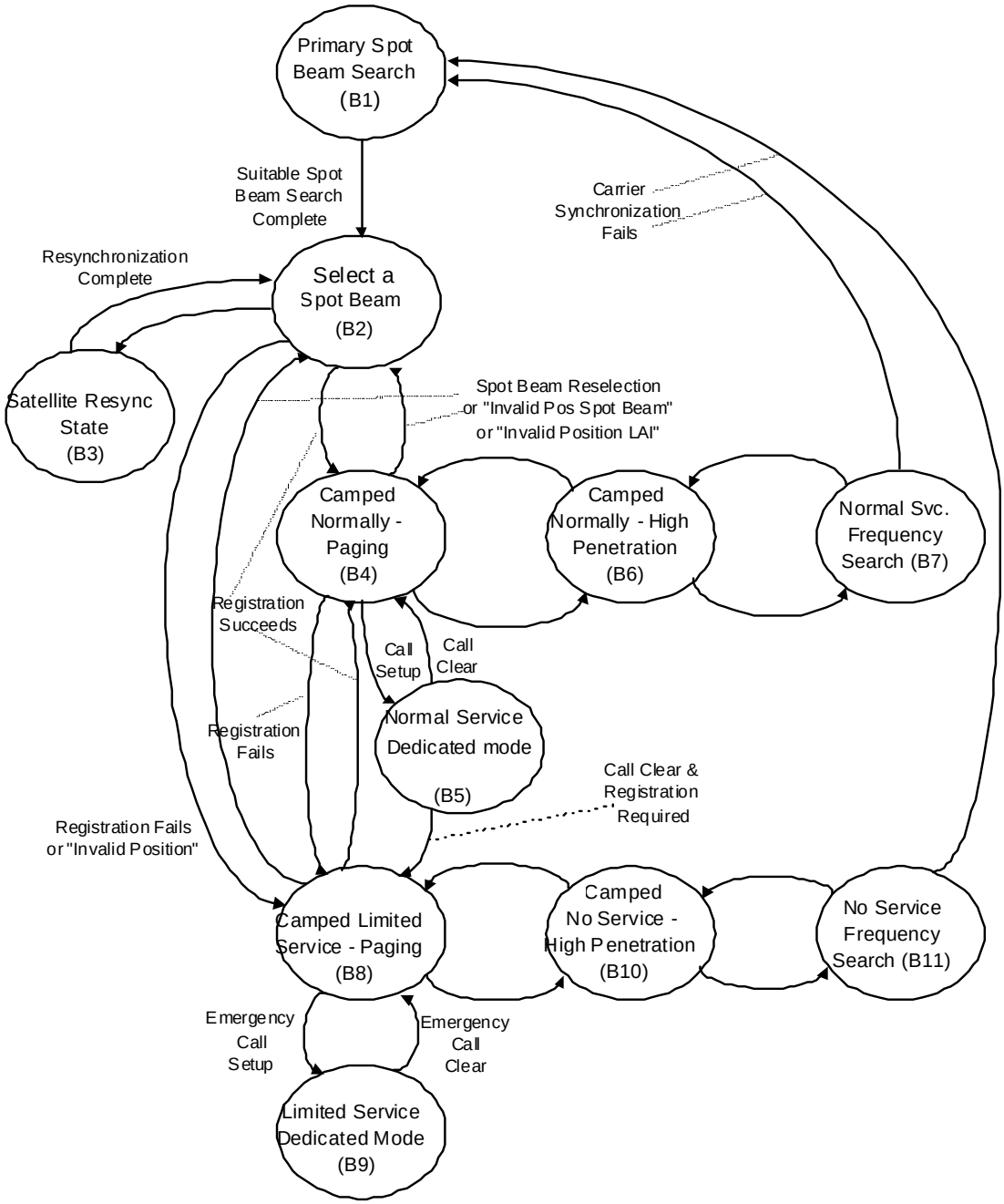


Figure 6.2: Spot beam selection process

6.2.2 Initial spot beam selection

The initial spot beam selection includes the signal scan and acquisition procedures and signal strength measurement and comparison procedures that the MES uses to locate suitable BCCHs. It is executed whenever the MES searches for a spot beam in states B1, B7, and B11 of the spot beam selection process.

The MES shall conduct initial spot beam selection in a manner that is consistent with the requirements of PLMN selection. Therefore, if a suitable BCCH of a PLMN is detected, then BCCHs that are also suitable that are from any PLMN with higher priority (from the Home PLMN or PLMN of the Preferred List) shall also be detected.

If the MES is equipped with a GPS receiver, the MES shall attempt to acquire a fresh GPS position during neighbour spot beam measurements. If a GPS position can be acquired, this position shall be used for position-based spot beam selection instead of measurements as described in GMR-1 3G 45.008 [7].

The MES shall use the C1 criterion (refer to GMR-1 3G 45.008 [7]) for minimum signal strength for spot beam selection.

The MES is not required to search the full LMSS band for BCCH carriers when in Automatic PLMN selection mode.

The MES may segment frequency searches subsequent to the first one in a discontinuous manner to conserve battery power.

The MES shall use beam access control flags as described in clause 5.2.5. MESs that support packet services shall use offered GMPRS packet service information as described in clause 5.2.5.

GMR-1 3G 45.008 [7] contains other spot beam selection requirements.

6.2.3 Spot beam reselection

If an MES that is satisfactorily camped on a BCCH moves far enough, it may move out of the region of coverage of the initial spot beam and into another spot beam. The MES should preferentially obtain service in the new, stronger spot beam when this happens. It is therefore necessary for the MES to periodically monitor its GPS position where so equipped and compare to the spot beam definitions broadcast on the BCCH to determine the optimum spot beam. For an MES without GPS capability it will periodically monitor the BCCH signals contained in spot beams that are geographically adjacent to the initial spot beam and to camp on a BCCH from the new, stronger spot beam when one is detected. This process is called spot beam reselection.

For A/Gb mode only, spot beam reselection is based on comparison between power measurements made on A-BCCHs, even when the UT is camped on a T-BCCH. If camped on an A-BCCH the MES shall periodically monitor the camped-on A-BCCH of the selected spot beam and the A-BCCHs from each of its immediate neighbour spot beams as listed in the BCCH_NEIGHBOR_LIST to determine if it will select a new spot beam. If camped on a T-BCCH the MES shall periodically monitor the A-BCCH of the selected spot beam that is highest in the Primary BCCH list and the A-BCCHs from each of its immediate neighbour spot beams as listed in the BCCH_NEIGHBOR_LIST to determine if it will select a new spot beam.

The MES shall execute the spot beam reselection procedure upon expiration of the SB_RESELECTION_TIMER while in states B4 or B8. If the timer expires while in states B5, B6, B7, B9, B10, or B11, the MES shall execute spot beam reselection as soon as possible upon re-entry into states B4 or B8. The MES shall reset the timer upon exit from state B1.

The MES shall limit reselection of different spot beams as follows, depending on whether a GPS location is currently held or not (see clause 6.6.3).

- Without a current GPS location: reselection shall be based on application of the SB_RESELECT_HYSTERESIS parameter when signal strength based spot beam selection is applied.
- With a current GPS location: reselection shall be based on SB_SELECTION_DISTANCE. This parameter defines an area in each beam within which that beam is considered suitable (see GMR-1 3G 45.008 [7]).

The MES shall obtain the SB_RESELECT_HYSTERESIS parameter from System Information before performing reselection, at all decision points that normally trigger reselection.

The method of measurement is defined in GMR-1 3G 45.008 [7].

The detection and action taken upon idle mode link loss is described in GMR-1 3G 45.008 [7].

6.2.4 Gateway response to channel requests

Spot beam selection is influenced by the "Invalid Position for the Selected Spot Beam" error cause in the Immediate Assignment Reject message.

If the MES receives "Invalid Position for the Selected Spot Beam" and the Satellite Indication (SI) (see GMR-1 3G 44.008 [4]) bit is:

- not set, no BCCH from this spot beam (on the same satellite and coincident) shall be allowed for camp-on;
- set, no BCCH from this satellite shall be allowed for camp-on.

This error cause shall always have a BCCH Carrier associated with it. The MES shall synchronize to the associated BCCH carrier. If the Reselection Indication (RI) (see GMR-1 3G 44.008 [4]) bit is not set, the MES shall evaluate the spot beam for suitability for camping on. If the RI bit is set, the MES shall conduct a spot beam selection among this BCCH and the BCCHs of its BCCH_NEIGHBOR_LIST and identify suitable spot beams
(see also GMR-1 3G 45.008 [7]). After identifying new suitable spot beams, if any, the MES shall identify new suitable BCCHs, if any.

During a spot beam selection procedure that is executed in compliance with this clause, the MES might only identify new suitable BCCHs that are also on the Forbidden BCCH List (see later clauses). In this circumstance, the MES may identify a spot beam as suitable even if it is more than SB_SELECTION_POWER dB weaker than the strongest spot beam, provided that it is the strongest spot beam not already disallowed for camp-on and that it exceeds C1.

6.2.5 BCCH selection

After the MES has selected suitable BCCH(s), it shall select and camp on the BCCH of a proper Gateway. This clause describes detailed requirements regarding BCCH selection. These activities occur in states B2 and B3. In some cases, the MES may be required to repeat initial spot beam selection.

This description uses three lists called the Primary BCCH List, the Secondary BCCH List, and the Forbidden BCCH List. The lists are informative only, but the functions that are to be performed by the MES and that are illustrated by application of the lists are normative. The PLMNs for which there is a BCCH on the Primary BCCH List and not restricted by the Forbidden BCCH List are the Available PLMNs.

PLMN selection shall select only from Available PLMNs. PLMN selection has precedence over BCCH selection, but multiple BCCHs may be available with the same PLMN.

6.2.5.1 Primary BCCH list

The MES shall construct a Primary BCCH List. This list shall contain an entry for every suitable BCCH. The Primary BCCH List shall contain entries for the following BCCHs:

- Each BCCH that was identified as "suitable" by initial spot beam selection or by spot beam reselection. Spot beam selection may have identified more than one "suitable" BCCH.
- All BCCHs that are identified as concurrent BCCHs by CONCURRENT_BCCH_INFORMATION on each of the suitable BCCHs.

The list identifies, at minimum, the PLMN, the BCCH carrier number, the SYSTEM_ID and the SATELLITE_ID but can also include any other useful information.

For A/Gb mode only, when the MES is camped on a T-BCCH and the system is making use of Dark Beams, then the first entry in the Primary BCCH List shall be either the G-BCCH or an A-BCCH of a cooperating network.

The MES shall construct a new Primary BCCH List at the following times:

1) When the MES conducts an initial spot beam selection.
2) When the MES conducts a spot beam reselection.
3) When the MES has detected a change in the Concurrent_BCCH_Info list.

6.2.5.2 Selection procedure for BCCHs

The Primary BCCH List may have multiple entries. Assuming that a BCCH is allowed by higher-priority considerations (is from the selected PLMN, is not barred by the forbidden PLMN or forbidden LAI lists), does not appear on the Forbidden BCCH List, and is not barred by CELL_BAR_ACCESS, the MES shall prioritize the selection among multiple BCCHs from this list in the following order:

1) The BCCH whose matching LAI is stored in the SIM (last registered LAI).
2) A BCCH that does not require a change of satellite.

3) A BCCH from the strongest spot beam as determined by MES GPS position and spot beam definition (beam centre and vertices geographic coordinates) or through direct signal measurements (see GMR-1 3G 45.008 [7]). BCCHs in the same spot beam shall be considered to have the same signal strength. It is not necessary to measure the BCCH signal strength of different BCCHs in a spot beam. If it is required to change satellite, the signal strength might not be known for BCCH carriers from the new satellite.

4) A BCCH from the strongest spot beam that has the lowest loading factor and highest resource availability (see GMR-1 3G 45.008 [7]) when the load factor comparison is enabled (see clause 6.11.2).

5) Select the BCCH in random order.

Even when load factor is turned on criteria, 4) shall be applied in the prioritization of the Primary BCCH List only during initial spot beam selection and during spot be reselection when the interval between the repeated spot beam reselection attempts is equal to the value specified by the BCCH system information parameter SB_RESELECTION_LOAD_COUNT (see GMR-1 3G 44.008 [4]).

If a BCCH is chosen on a different satellite, Spot Beam Verification shall be performed, subject to the limitations in the next clause.

6.2.5.3 Spot beam verification

Spot Beam Verification is a procedure which validates the entries of the Primary BCCH List for an alternate satellite before the BCCH on the alternate satellite is actually selected.

Spot Beam Verification involves the following steps:

1) Select the BCCH. If the BCCH is from a different satellite, acquire and synchronize to the BCCH on the selected BCCH carrier.

2) Verify the BCCH is not prohibited by CELL_BAR_ACCESS, if not already done.

3) Obtain the BCCH_NEIGHBOR_LIST and the SATELLITE_ID.

4) Perform a BCCH_NEIGHBOR_LIST search (see GMR-1 3G 45.008 [7]).

5) Construct a Secondary BCCH List. This list is similar to the Primary BCCH List except that the Secondary List is limited to entries where the SATELLITE_ID matches the SATELLITE_ID of step 3 (i.e. All BCCHs are on the second satellite).

6) Eliminate those BCCHs from the Primary BCCH List, that have the same SATELLITE_ID as the second satellite but do not appear in the Secondary BCCH List. All BCCHs whose SATELLITE_ID does not match are not affected. No BCCHs are added to the Primary BCCH List.

7) If the BCCH that was selected in step 1) is still available in the Primary BCCH List, remain camped on the BCCH and proceed with Idle or Dedicated mode procedures. If the BCCH that was selected in step 1) is no longer in the Primary BCCH List, repeat the PLMN or BCCH selection process with the modified Primary BCCH List.

Spot Beam Verification shall be executed in all cases when the MES selects a BCCH that requires a change of satellite, and the selection was caused by an autonomous selection of BCCH by the MES (either PLMN or BCCH selection). Spot Beam Verification shall not be executed if the MES is commanded to a BCCH carrier by use of the "Invalid Position for the Selected Spot Beam" reject cause and with the SI bit set. Spot Beam Verification is not required until the MES selects the BCCH and synchronizes to it.

6.2.5.4 Availability expansion and restriction by system responses

After processing the "Invalid Position for the Selected Spot Beam" error cause, the MES shall augment the Primary BCCH List with new suitable BCCHs and with BCCHs from CONCURRENT_BCCH_INFORMATION of the new suitable BCCHs.

The MES shall also construct a temporary list called the Forbidden BCCH List. The entries may have the same form as those of the Primary BCCH List in order to make matches between the lists. The MES shall add BCCHs to the Forbidden BCCH List, or create a list if one does not exist, in the following circumstances:

a) The SI bit is not set and the MES receives "Invalid Position for the Selected Spot Beam". The MES shall enter all BCCHs onto the Forbidden BCCH List as follows:

   1) The current BCCH.

   2) All BCCHs from CONCURRENT_BCCH_INFORMATION that are in this spot beam (from the same satellite).

   3) All BCCHs from CONCURRENT_BCCH_INFORMATION that are from other satellites and for which this BCCH is the only remaining link. (If a BCCH on a second satellite is identified as available in CONCURRENT_BCCH_INFORMATION from more than one spot beam of a first satellite, the BCCH is not added to the Forbidden BCCH List until all BCCHs that link to it are on the Forbidden BCCH List).

b) The SI bit is set and the MES receives "Invalid Position for the Selected Spot Beam". The MES shall enter BCCHs onto the Forbidden BCCH List as follows:

   1) The current BCCH.

   2) All other BCCHs from all spot beams from the same satellite as the current BCCH. This shall include spot beams from this satellite that are subsequently added to the Primary BCCH List, up to the point that the Forbidden BCCH List is deleted.

c) If the MES receives "Invalid Position for the Selected LAI", it shall add the BCCH to the Forbidden BCCH List.

NOTE 1: There is a 1:1 correspondence between the BCCH carrier and LAI in the GMR-1 or GMR-1 3G system.

d) If the MES receives "Invalid Position", it shall add the BCCH and all other BCCHs that share the same SYSTEM_ID to the Forbidden BCCH List.

NOTE 2: The Forbidden BCCH List is different from the Forbidden LAI Lists. The Forbidden BCCH List is used to force an MES to camp on a Gateway Station that provides service in the geographic region in which the MES is located, if any. The Forbidden BCCH List is constructed according to responses to Channel Request messages. The Forbidden LAI Lists identify LAIs whose selection is prohibited, based upon responses to Location Updating Request messages.

The MES shall construct a new Forbidden BCCH List whenever it constructs a new Primary BCCH List.

The MES shall delete the Forbidden BCCH List whenever it deletes the Primary BCCH List, or assumes a state in which it ceases to attempt to register with the network (see GMR-1 3G 44.008 [4]). In the latter case, the MES might be either registered or unregistered, and will allow the MES to retry a registration in a rejected LAI if by chance it moves in location during the intervening interval.

6.2.6 Dedicated mode to idle mode transition (A/Gb mode only)

This clause only applies to terminals operating in the A/Gb mode.

This clause describes the use of a BCCH Carrier Register. This description is informative only, but the functions that are to be performed by the MES and are illustrated by application of the BCCH Carrier Register are normative.

Immediately before entry into Dedicated Mode, the MES shall save the frequency number of the BCCH carrier upon which the MES is camped in a memory location called the BCCH carrier register. During Dedicated Mode, the MES may be required to synchronize to a BCCH carrier from a different satellite and may be required to register to a different LAI than registered to in Idle Mode.

Upon return from Dedicated Mode to Idle Mode, the MES shall take the following actions:

- The MES shall synchronize to the BCCH identified in the BCCH Carrier Register and camp on it.
- If the LAI from the BCCH does not match the LAI stored in the SIM, the MES shall attempt to register with the LAI of the BCCH. The MES shall perform this registration before a new CM Service Request is attempted.
- The MES should determine the BACH reorganization state immediately before entry into any high penetration state.

6.2.7 Limited service

If the MES is unable to register or if there is no SIM in the MES, the MES selects an RA on which it shall camp so that emergency calls can be made. The MES shall give the following priority to RAs for camp-on:

- Shall be an RA of a suitable spot beam (therefore, spot beam selection has been completed).
- RA to which most recently registered.
- RAs that are not allowable (therefore, GPS position has been accepted by the Gateway Station).
- RAs that are not available.

6.3 PLMN selection process (A/Gb mode only)

This clause only applies to terminals operating in the A/Gb mode.

6.3.1 List of states for the PLMN selection process

There are two modes for Satellite Network selection, automatic and manual. These are illustrated in figures 6.3 and 6.4.

6.3.1.1 List of states for automatic mode (figure 6.3)

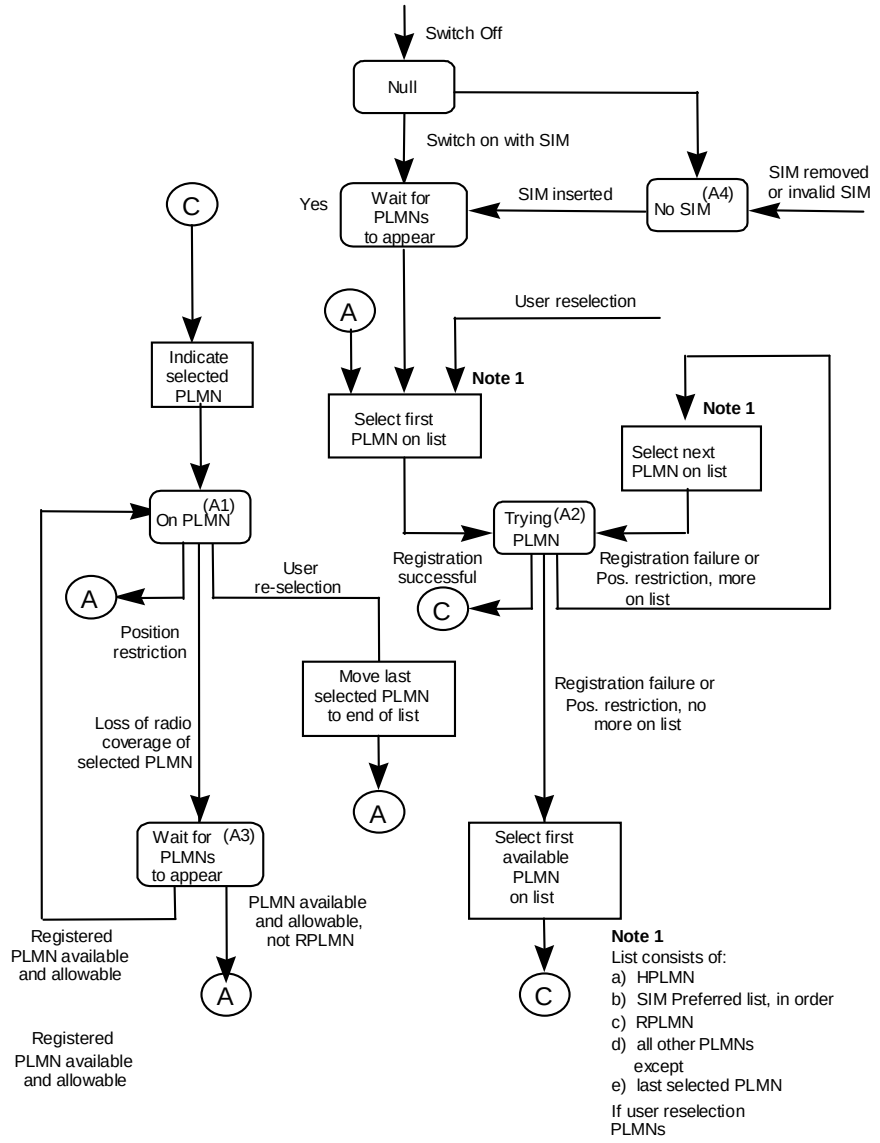


Figure 6.3: PLMN selection state diagram (automatic mode)

A1 On PLMN. The MES has successfully registered on a PLMN.

A2 Trying PLMN. The MES is trying to register on a PLMN in the ordered list of PLMN.

A3 Wait for PLMN to appear. There are no allowable and available PLMNs at present and the MES is waiting for one to appear.

A4 No SIM. There is no SIM in the MES, or certain LR responses have been received.

6.3.1.2 List of states for manual mode (figure 6.4)

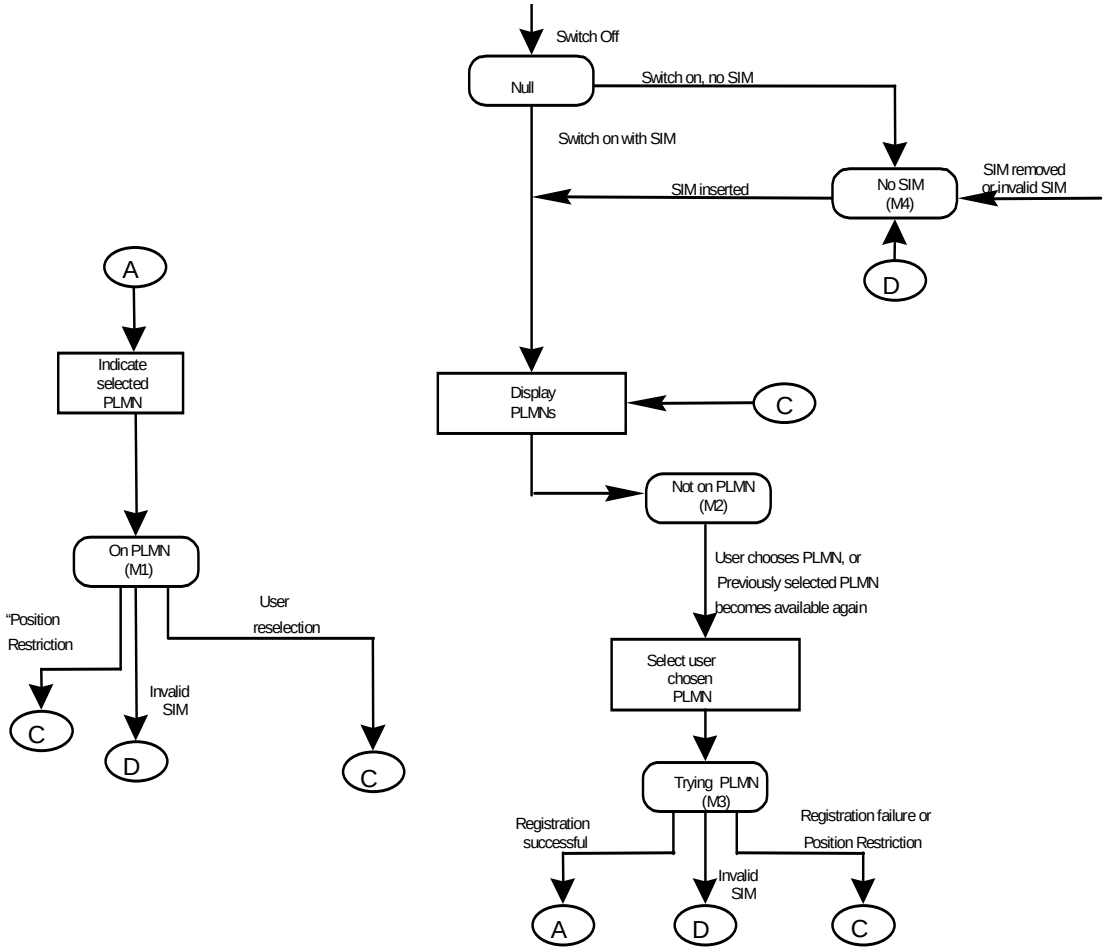


Figure 6.4: PLMN selection state diagram (manual mode)

M1 On PLMN. The MES has successfully registered on a PLMN.

M2 Not on PLMN. The MES has failed to register on the selected PLMN.

M3 Trying PLMN. The MES is trying to register on a user selected PLMN.

M4 No SIM. There is no SIM in the MES, or certain LR responses have been received.

6.3.2 Registration on a PLMN

In both automatic and manual modes, the concept of registration on a PLMN is used. An MES successfully registers on a PLMN if:

a) the MES has found a suitable BCCH of the PLMN to camp on; and

b) a LR request from the MES has been accepted by the BCCH on which the MES is camped (see table 6.1).

Table 6.1: Effect of LR outcomes on PLMN registration

Location updating task state	Registration status	Registered PLMNs
Updated	Successful	Indicated in the stored LAI
Idle, No IMSI	Unsuccessful	No registered PLMN
Roaming not allowed: a) PLMN not allowed b) LA not allowed c) Roaming not allowed in this LA	 Unsuccessful Indeterminate Indeterminate	 No registered PLMN No registered PLMN No registered PLMN
Not updated	Unsuccessful	No registered PLMN
NOTE 1: The registered PLMN is determined by looking at the stored registration area identity and stored location registration status. NOTE 2: MESs capable of GMPRS and non-GMPRS services may have different registration status for GMPRS and non-GMPRS.		

In automatic mode, the MES may conduct spot beam selection in a manner such that preferred PLMNs are discovered in the order of preference, assuming the MES is in coverage of them. The search may be terminated as soon as the MES can determine that it has found the highest priority PLMN (i.e. the MES is not required to perform a complete search in all cases).

In manual mode, the MES may display PLMNs as they are discovered, reordering the display by priority if necessary.

6.3.3 PLMN selection

6.3.3.1 MES switch-on or recovery from lack of coverage

On recovery from lack of coverage, the MES selects the registered PLMN (if it is available) and, if necessary (see clause 6.5.3) attempts to perform a location registration.

If successful registration is achieved, the MES indicates the selected PLMN.

A switch-on or if registration is not possible due to the PLMN being unavailable or registration failure, or at switch-on, the MES follows one of the following two procedures depending on its operating mode.

If registration is not possible upon recovery from lack of coverage due to the registered PLMN being unavailable, an MES should continue looking for the registered PLMN for an implementation-dependent period of time.

6.3.3.1.1 Automatic network selection mode procedure

The MES selects and attempts registration on PLMNs, if available and allowable, in the following order:

a) Home PLMN (if not previously selected).

b) Each PLMN in the "PLMN Selector" data field in the SIM (in priority order).

c) The registered PLMN.

d) All other PLMNs.

If successful registration is achieved, the MES indicates the selected PLMN.

If there are no suitable spot beams, the MES indicates "no service" to the user.

If registration cannot be achieved the MES indicates "limited service" to the user. If there is a PLMN available but no PLMN is allowable, it indicates "limited service" to the user and enters a limit service state.

6.3.3.1.2 Manual network selection mode procedure

The MES indicates whether there are any PLMNs available, in all suitable spot beams (see clause 5.6), which may be available including "Forbidden PLMNs". Any PLMN shall only be presented once.

The MES should present PLMN as they are discovered by spot beam selection. If displayed, PLMNs are presented in the following order:

a) Home PLMN.

b) PLMNs contained in the "PLMN Selector" data field in the SIM (in priority order).

c) All other PLMNs.

The user may select his or her desired PLMNs and the MES then initiates registration on this PLMN. (The selection may take place at any time during the presentation of PLMNs.) For such a registration, the MES shall ignore the contents of the forbidden LAI and PLMN lists.

If the user does not select a PLMN, the selected PLMN shall be any PLMN associated with the spot beam with the strongest received signal strength. The MES shall attempt to camp on only this spot beam and enter the Limited Service state.

6.3.3.2 User reselection

At any time the user may request the MES to initiate reselection and registration onto an available PLMN according to the following procedures, dependent upon the operating mode.

6.3.3.2.1 Automatic network selection mode

The MES selects and attempts registration on PLMNs, if available and allowable in accordance with the following order:

a) Home PLMN.

b) PLMNs contained in the "PLMN Selector" data field in the SIM (in priority order).

c) All other PLMNs excluding the previously selected PLMN.

d) The previously selected PLMN.

The previously selected PLMN is the PLMN that the MES has selected prior to the start of the user reselection procedure.

6.3.3.2.2 Manual network selection mode

The manual network selection mode procedure of clause 6.3.3.1 is followed.

6.3.4 Abnormal cases

If there is no SIM in the MES, if there is an authentication failure, or if the MES receives an "IMSI unknown in HLR", "illegal MES-ME" or "illegal MES" response to an LR request, then effectively there is no selected PLMN ("No SIM" state). In these cases, the states of the spot beam selection process are such that no PLMN selection information is used. No further attempts at registration on any PLMNs are made until the MES is switched off and on again or a SIM is inserted.

Some terminal types, such as fixed terminals, may restrict PLMN selection to the Home PLMN or to the Home PLMN and the SIM Preferred List.

When in automatic network selection mode and the MES is in the "not updated" state with one or more suitable BCCHs to camp on, then after four unsuccessful LR requests, the MES may continue (or start if it is not running) the user reselection procedure of clause 6.3.3.2.

6.3.5 Roaming not allowed in this LA

If in either PLMN selection mode the LR response "Roaming not allowed in this LA" is received, the PLMN automatic or manual mode selection procedure of clause 6.3.3.1 is followed.

6.3.6 PLMN selection process (Iu-mode)

The Iu mode PLMN selection process in GMR-1 3G is the same as the Iu-mode PLMN selection process defined in 3GPP TS 23.122 [11].

6.4 Position determination process

6.4.1 Idle mode parameters

The position determination process shall maintain parameters that determine when the MES shall attempt to obtain a position and what the MES shall do after it has obtained a position. The MES shall maintain separate parameters for Idle Mode and Dedicated Mode for A/Gb mode. For Iu mode the MES shall maintain separate parameters for MAC-idle (RRC-idle and RRC_GRA-PCH) and MAC-Active states (see GMR-1 3G 44.160 [16] and GMR-1 3G 44.118 [14] for the applicable GMR-1 3G MAC and RRC states respectively). The rest of the description of the Position Determination Process is for both Idle Mode A/Gb mode and MAC-idle Iu mode respectively. The Idle Mode parameters are the parameters: GPS_UPDATE_TIMER and GPS_UPDATE_DISTANCE.

See GMR-1 03.299 [3] and GMR-1 3G 44.008 [4] for definition of parameters for Dedicated Mode, and/or other requirements and restrictions on position reporting. See GMR-1 3G 44.160 [16] for GMR-1 3G 44.118 [14] for the applicable Iu mode GMR-1 3G MAC and RRC connected mode states respectively.

6.4.2 Receiver operation

A MES may run a position determination receiver, such as a GPS receiver, discontinuously. The MES may obtain position more frequently than is minimally required.

The MES shall run to obtain a position in Idle Mode in the following circumstances:

- Upon expiration of an Idle Mode timer of duration GPS_UPDATE_TIMER.
- Before a system access for a LR, Iu mode CHANNEL REQUEST TYPE 3, CM Service request, or in response to a page or an alert, and a newer position is required than any that is already stored in the MES.
- Before all system accesses for Position Verification. (The Position Verification shall only be executed with a new position, without regard to the stored "current position".)

In addition, the MES should obtain a position at other times that improve the likelihood that it will have a "current" position when needed.

6.4.3 Configuration of position determination

The Gateway Station shall broadcast a default GPS_UPDATE_TIMER value and a default GPS_UPDATE_DISTANCE parameter value on the BCCH. The MES shall revert to the default parameter values each time it selects a new BCCH.

The Gateway Station may update the GPS_UPDATE_TIMER and GPS_UPDATE_DISTANCE on a MES-by-MES basis, to a MES-specific value. The MES shall store MES-specific parameter values in non-volatile memory for use at power-on. The Gateway Station may update these parameters by any of the following messages:

- Position Verification Notify (including Iu mode Position Verification Notify Type 2).
- Immediate Assignment Reject.
- Immediate Assignment Reject with Position.

- RRC Connection Setup (Iu mode).

When a change in the GPS_UPDATE_TIMER value occurs and the timer is running, the timer shall be reloaded so that the new time to expiration will be "old time to expiration" modulo "new GPS_UPDATE_TIMER value".

6.4.4 "Current" position storage

Each time the MES determines a position, it shall store the position as the "current" position and a timestamp of when it was obtained. The position and timestamp shall be stored in non-volatile memory.

The "current" position and timestamp shall be updated any time a position is determined.

6.4.5 "Reported" position storage

The MES shall store the "reported" position and its timestamp. The "reported" position is the last MES position for which either of the following conditions is true:

- The MES has sent a Channel Request message and has received an Immediate Assignment (including Iu mode IA messages), an Immediate Assignment Reject (or IAR with Position), or a Position Verification Notify (including Iu mode Position Verification Notify Type 2), but has not been requested to send an Extended Channel Request. If the response was an IAR, the reject cause was not "Lack of resources", "Position too old", or "Invalid Position for the Selected Spot Beam".

- The MES has sent an Extended Channel Request message and has received an Extended Immediate Assignment or an Extended Immediate Assignment Reject. If the response was an IAR, the reject cause was not "Lack of resources", "Position too old", or "Invalid Position for the Selected Spot Beam".

6.4.6 Distance check

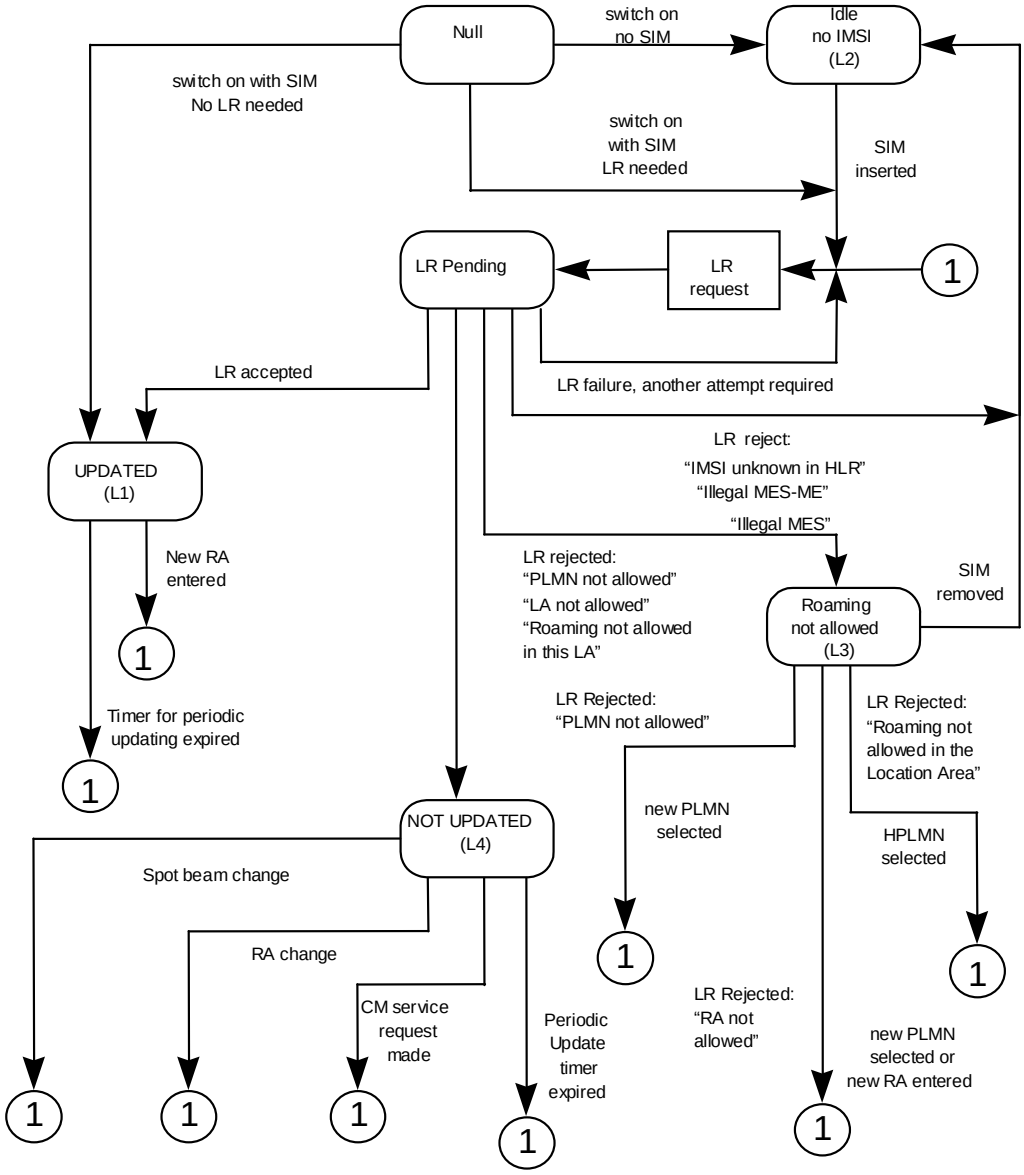
A computation of distance moved since the position was last reported to the Gateway Station shall be implemented in the Position Determination Process in Idle Mode.

Each time the MES determines its position for the first reason identified in clause 6.4.2 or at other times while in Idle Mode, it shall execute a check of the distance moved. The distance moved is the calculated distance between the new position and the "reported" position. If this distance exceeds GPS_UPDATE_DISTANCE, and GPS_UPDATE_DISTANCE is not equal to zero, the MES shall initiate a Position Verification.

6.5 Location registration process (A/Gb mode only)

This clause only applies to terminals operating in the A/Gb mode.

6.5.1 List of states for location registration (figure 6.5)



NOTE: Whenever the MES goes to connected mode and then returns to Idle mode again, the MES selects the appropriate state.

Figure 6.5: Location updating task state diagram

The states are entered depending on responses to location registration (LR) requests.

L1 **Updated:** The MES enters this state if an LR request is accepted. The update status on the SIM is set to "updated". The GMPRS and the non-GMPRS update state of an MES may enter "updated" as a result of combined signalling or as a result of individual signalling depending on the capabilities of the network.

L2 **Idle, No IMSI:** The MES enters this state if an LR request is rejected with cause:
a) IMSI unknown in HLR
b) Illegal MES-ME
c) Illegal MES
d) GMPRS not allowed

or if there is no SIM. All update states of an MES enter this state regardless of whether they are received by individual or combined signalling for events (b) and (c). Event (a) results in "Roaming not allowed" for the non-GMPRS update state only. Event (a) has no influence on the GMPRS update state. Event (d) has no influence on the non-GMPRS update state.

If a SIM is present, the non-GMPRS update status of the SIM is set to "Roaming not allowed" for events (a), (b), and (c).

L3 **Roaming not allowed:** The MES enters this state if it receives an LR reject message with the cause:
a) PLMN not allowed
b) Location area not allowed
c) Roaming not allowed in this location area

All MES update status is set to "Roaming not allowed" regardless of whether it is received by individual or combined signalling.

The behaviour of the MES in the "roaming not allowed" state is dependent on the LR reject cause as shown in table 6.2. Additionally:

- In automatic mode, "PLMN not allowed" and "roaming not allowed in this location area" cause the automatic network selection procedure of clause 6.3.3.1 to be started; it is also caused by "GMPRS not allowed" when received by a MES capable of GMPRS only.
- In manual mode, "PLMN not allowed" and "roaming not allowed" cause the manual network selection procedure of clause 6.3.3.1 to be started; it is also caused by "GMPRS not allowed" when received by an MES capable of GMPRS only.

L4 **Not updated:** The MES enters this state if any LR failure not specified for states L2 or L3 occurs, in which cases the MES is not certain whether or not the network has received and accepted the LR attempt. The non-GMPRS update status on the SIM and/or the GMPRS update status are set to "not updated", depending on the specific location registration procedure and its outcome.

6.5.2 General

When the MES is switched on, the action taken by the location registration process is as follows:

1) SIM present and no LR needed (because of the status of the stored LAI and "attach" flag): The MES is in the update state UPDATED.

2) SIM present and LR needed: An LR request is made.

3) No SIM present: The MES enters the update state Idle, NO IMSI.

In case 2) above, and subsequently whenever an LR request is made, the MES enters a state depending on the outcome of the LR request, as listed in the above clause 6.5.1. In case 3) the GMPRS and the non-GMPRS state enter "IDLE, NO IMSI".

Whenever the MES goes to connected mode and then returns to idle mode again, the MES selects the appropriate state.

6.5.3 Initiation of location registration

An LR request indicating normal location registration is made when in idle mode.

- The MES detects that it has entered a new registration area, i.e. when the received registration identity, differs from the one stored in the MES, and the LAI or the PLMN identity is not contained in a list of forbidden LAIs or PLMN identities, respectively, while being in one of the following update states:
  - Updated.
  - Not updated.
  - Roaming not allowed.
- The Periodic Location Updating Timer expires while in the non-GMPRS update state NOT UPDATED (triggers Location Updating).
- The Periodic Routing Area Update Timer expires while in the GMPRS update state NOT UPDATED (triggers Routing Area Update).
- A manual network reselection has been performed, a suitable spot beam of the selected PLMN is present, and the MES is not in the UPDATED state for the LAI of the selected PLMN.
- Both of the following conditions apply:
  - In response to a Position Verification message, the MES receives either a Position Verification Notify or Immediate Assignment Reject with error cause "Reported Position Acceptable".
  - The MES is in the NOT UPDATED state.

An LR request indicating Periodic Location Updating is made when, in idle mode, the Periodic Location Updating Timer expires while in the non-GMPRS update state, UPDATED.

An LR request indicating Periodic Routing Area Update is made when the Periodic Routing Area Update Timer expires while in the GMPRS update state, UPDATED.

An LR request indicating IMSI attach is made when the MES is activated in the same location area in which it was deactivated while being in the non-GMPRS update state, UPDATED, and the BCCH indicates that IMSI attach/detach shall be used.

A GMPRS attach is made by a MES when activated and capable of GMPRS services that require registration. Depending on system information about GMPRS network operation mode, MESs capable of GMPRS and non-GMPRS services perform combined or non-combined location registration procedures. When the combined routing area update or GMPRS attach is accepted with indication "MSC not reachable" or is not answered, the MES performs the corresponding location updating procedure or falls back to a GMPRS-only service. When the combined routing area update or GMPRS attach is rejected with the cause, "GMPRS not allowed", the GMPRS update state is "IDLE, NO IMSI" and the MES performs the corresponding location updating procedure or falls back to a GMPRS-only service.

Furthermore, an LR request indicating Normal Location Updating is also made when the response to an outgoing request shows that the MES is unknown in the VLR or SGSN, respectively.

Table 6.2 summarizes the events in each state that trigger a new LR request. The actions that may be taken while being in the various states are also outlined in table 6.2.

A MES, which is both IMSI attached for GMPRS and non-GMPRS services and which is capable of simultaneous operation of GMPRS and non-GMPRS services, shall perform Routing Area Update in connected mode when it has entered a new routing area that is not part of an LA contained in the list of forbidden LAIs.

Table 6.2: LR process states and allowed actions

Location updating task state	New LR request when			Normal calls supported (see note 1)	Paging responded to
	Changing LA (see notes 6 and 7)	Changing PLMN	Other		
Null (see note 4)	Yes	Yes	No	No	No
Updated (see note 5)	Yes	Yes	(see note 2)	Yes	Yes
Idle, No IMSI (see note 10)	No	No	No	No	No
Roaming not allowed:					
a) Idle PLMN not allowed	No	Yes	No	No	Optional if with IMSI
b) Idle LA not allowed	Yes (see note 9)	Yes	No	No	Optional if with IMSI
c) Idle Roaming not allowed in this LA	Yes (see note 9)	Yes	No	No	Optional if with IMSI
Not updated	Yes	Yes	(see notes 2, 3 and 8)	(see note 3)	Yes if with IMSI

NOTE 1: Emergency calls may always be made, subject to access control permitting it.
NOTE 2: A new LR is made when the periodic registration timer expires.
NOTE 3: If a normal call request is made, an LR request is made. If successful, the updated state is entered and the call may be made.
NOTE 4: The MES is in the null state from switch-on until it has camped on a spot beam and either made an LR attempt or decided that no LR attempt is needed.
NOTE 5: In this state, IMSI detach is performed if the MES is deactivated and the BCCH indicates that IMSI attach/detach shall be used. An LR request indicating IMSI attach is performed if the MES is activated in the same location area in which it was deactivated while being in this state.
NOTE 6: Change of spot beam always means a change of LA.
NOTE 7: A change of registered LA may happen as a result of optimal routing. It is necessary to re-register.
NOTE 8: Response to a Position Verify message indicates the position is acceptable.
NOTE 9: A MES shall not perform a new LR when the new routing area is part of an LA contained in a list of forbidden LAs.
NOTE 10: The GMPRS registration status "IDLE, NO IMSI" is entered when the LR is rejected with the cause, "GMPRS not allowed". The non-GMPRS registration status, "IDLE, NO IMSI", is entered when the cause, "IMSI unknown in HLR", is received.

6.5.4 Periodic location registration

A Periodic Location Updating Timer (for non-GMPRS operation) and a Periodic Routing Area Update Timer (for GMPRS operation) with the following characteristics shall be implemented in the MES (capable of GMPRS and non-GMPRS operation shall implement both timers):

1) Upon switch-on of the MES or when the BCCH indicates that periodic location updating shall be applied and the timer is not running, the timer shall be loaded with a random value between 0 and the broadcast or signalled timeout value and started.

2) The timeout value shall be within the range of 1 deci-hour to 255 deci-hours with a granularity of 1 deci-hour.

3) When the timer reaches its expiration value, it shall be reinitiated to the relevant timeout value, and the MES shall initiate the Periodic Location Registration corresponding to the expired timer.

4) The Periodic Location Updating Timer shall be prevented from triggering Periodic Location Updating during connected mode. When the MES returns to idle mode, the Periodic Location Updating Timer shall be initiated with respect to the broadcast timeout value, then started. Thereafter, the procedure in item 3) shall be followed.

5) The Periodic Routing Area Update Timer shall be prevented from triggering Periodic Routing Area Update during Ready state. At transition from Ready to Standby state, the Periodic Routing Area Update Timer shall be initiated with respect to its timeout value, then started. Thereafter, the procedure in item 3) shall be followed.

6) If the MES performs a successful combined Routing Area Update, the Periodic Location Updating Timer shall be prevented from triggering the Periodic Location Updating until the MES starts using Location Updating procedure, e.g. because of a changed network operation mode or because the MES uses non-GMPRS services only.

7) When a change in the time-out value occurs (at a change of serving spot beam, or a change in the broadcast timeout value, or a change in the signalling time-out value), the related timer shall be reloaded so that the new time to expiration will be: "old time to expiration" modulo "new broadcast timeout value".

8) When a periodic timer has expired and the MES has information that it is not able to complete an LR because a system access may not be completed, the MES should queue the condition that a Periodic LR is required pending a change in the condition limiting the system access. These conditions may include insufficient link quality to access the system or a previous "Invalid Position" error cause in response to a system access.

6.5.5 IMSI attach/detach operation

System information will contain an indicator indicating whether or not IMSI attach/detach operation is mandatory to use in the spot beam. The MES shall operate in accordance with the received value of the indicator.

A MES shall perform GMPRS attach/detach procedures independent of the value of the IMSI attach/detach indicator. When a MES has to perform IMSI attach/detach independent of GMPRS procedures (for example GMPRS network operation mode II), the handling described in the paragraph above applies.

When the IMSI attach/detach operation applies, an MES shall send the IMSI detach message to the network when the MES is powered down or the SIM is removed while being in the update state UPDATED. The IMSI detach message will not be acknowledged by the network.

When the MES returns to the active state, the MES shall perform an LR request indicating IMSI attach, provided that the MES still is in the same location area. If the location area has changed, an LR request indicating Normal Location Updating according to clause 6.5.3 shall be performed.

6.5.6 Location registration process (Iu-mode only)

The Iu mode location registration process in GMR-1 3G is the same as the Iu-mode location registration process defined in 3GPP TS 23.122 [11].

6.6 User indications

6.6.1 Service indication

The MES shall indicate to the user whether the MES is in the satellite A/Gb mode, or satellite Iu mode or any terrestrial cellular mode of operation.

6.6.2 GMR-1 or GMR-1 3G service indication

The MES shall indicate to the user the appropriate level of service:

- Normal service;
- Alerting service (optional);
- Limited service;
- Position-restricted service (A/Gb mode only);
- No service.

Due to the fact that there may be some transitory changes of state, the service indications are permitted to continue to be set for up to 10 seconds after the applicable conditions cease to be met. The service indication is permitted to take up to 1 second to be set after the applicable conditions are met.

6.6.3 GPS indication

The MES shall indicate to the user whether a GPS position is currently held by the MES. The indicator shall be set if the current GPS position stored in the MES is newer than the GPS_POSITION_AGE parameter (has not expired); otherwise the indicator shall be not set.

The MES shall indicate the GPS position to the user. This display may be made subject to mode or menu selection by the user.

6.7 Non-volatile storage requirements

The MES shall store the following information in non-volatile memory:

- BCCH_FULL_LISTs. The MES shall provide storage for at least three BCCH_FULL_LISTs.
- Current GPS position and timestamp, reported GPS position and timestamp, MES-specific GPS_UPDATE_TIMER and GPS_UPDATE_DISTANCE parameters, and flag indicating whether MES-specific values are in use.

6.8 BCCH broadcasting and storage

System information contains a BCCH carrier list, called the BCCH_FULL_LIST, that the MES uses to scan for BCCHs, rather than scanning the full LMSS band. A BCCH_FULL_LIST consists of a set of RF carriers that are used by a GMR-1 or GMR-1 3G system as BCCH carriers, such that there is at least one BCCH carrier in the list for all geographic areas of coverage of a GMR-1 or GMR-1 3G system. Each GMR-1 or GMR-1 3G system has its own BCCH_FULL_LIST.

When an MES is first switched on in a PLMN, it first of all has no knowledge of which RF channels are BCCH carriers (of that PLMN or any other PLMN), and has to search the strongest RF carriers in order to find which are BCCH carriers. Second, the MES is limited in its consideration of BCCH carriers to those that are approximately the strongest BCCH carriers, in order to obtain service via resources that are associated with its location under the satellite coverage; it shall select the spot beam. Finally it has to determine which BCCH carriers belong to the selected PLMN.

The process of scanning for BCCH carriers is a relatively slow process. Consequently the MES is only required to scan the full band in manual PLMN selection mode. In automatic mode, the MES is only required to scan BCCH_FULL_LISTs. Scanning a BCCH_FULL_LIST fulfils the need to locate BCCH carriers and, in co-operation with the spot beam selection procedure, the need that the BCCH carrier is from a proper spot beam. However, a scan of a BCCH_FULL_LIST followed by spot beam selection only satisfies these considerations for a single GMR-1 or GMR-1 3G system.

A BCCH_FULL_LIST may have BCCH carriers of one or more PLMNs. It does not necessarily contain all the BCCH carriers of any PLMN and does not necessarily contain a BCCH carrier of every PLMN that is available in the GMR-1 or GMR-1 3G system. A BCCH_FULL_LIST may have BCCH carriers from more than one satellite, but it does not necessarily contain a BCCH carrier of every satellite of a GMR-1 or GMR-1 3G system at every location within system coverage. Therefore, after spot beam selection on a GMR-1 or GMR-1 3G system, the MES reads CONCURRENT_BCCH_INFORMATION from system information to discover the range of PLMNs and BCCH carriers that are available for selection at the MES's current location. All concurrent BCCHs on BCCH carriers of a spot beam from a satellite are transmitted at the same time.

The system information contains a second BCCH carrier list, called the BCCH_NEIGHBOR_LIST, that the MES uses for spot beam reselection. The BCCH_NEIGHBOR_LIST and BCCH_FULL_LIST do not necessarily contain the same RF channels.

The MES may store other information in non-volatile memory to accelerate the processes of spot beam selection and PLMN selection.

6.9 Pageability of the mobile subscriber

An MES is required to listen to all paging messages that could address it (as defined by its paging subchannel and the page mode, see GMR-1 3G 45.002 [5]), when the following conditions are all satisfied:

- A SIM is inserted.
- The MES is camped on a spot beam.
- The MES is not in state "Idle, No IMSI".
- The MES is not performing the task to search for available PLMNs. (Whenever possible during this task, the MES should listen for paging.)

A MES that is camped on the control channels of a spot beam from a cooperating network is not required to listen for pages and is not pageable.

NOTE 1: During spot beam reselection there is a period when the MES is no longer camped on the old spot beam but might be decoding the BCCH and perform other processing before camping on the new spot beam. During this period, the MES will not be pageable.

NOTE 2: It is permissible for an MES to miss pages to scan for service on a non-GMR-1/GMR-1 3G system.

6.10 MM/GMM restart procedure

In some cases, e.g. on change of SIM data, there is a need for the MM/GMM to be restarted without the need for user intervention.

To perform the procedure, the MES shall behave as if the SIM is removed; afterward a new SIM is inserted.

6.11 Gateway (GW) selection (Iu mode only)

In the event that the MES has selected a suitable spot beam which is illuminated by more than one BCCH and the selected PLMN is supported by more than one of these BCCHs, the MES shall read the load factor from each candidate BCCH (within the selected spot beam and with the selected PLMN) and compare and select the BCCH which has the lowest value of load factor (see GMR-1 3G 44.008 [4]). The MES shall only enter this process when performing initial GMR-1 3G access or when performing periodic RA or GERAN Registration Area (GRA) updates (see GMR-1 3G 44.118 [14]). Load factor is checked before camping on BCCH. Consideration of GW change due to load factors shall only be made as part of initial spot beam selection or periodic spot beam re-selection as defined by BCCH system information parameter. Load factor checking shall only be performed after BCCHs in the "forbidden BCCH list" or corresponding "forbidden LAIs" are removed.

6.11.1 Gateway Selection Frequency

The MES shall only enter this process when performing initial GMR-1 3G access or when performing periodic spot beam selection defined in accordance with the SB_RESELECTION_LOAD_COUNT parameter broadcast as part of the BCCH system information (see GMR-1 3G 44.008 [4]). As indicated in clause 6.2.5.2, load factor checking shall only be performed in conjunction with the derived Primary BCCH List (that is, after BCCHs in the "forbidden BCCH list" or corresponding "forbidden LAIs" and BCCHs associated with barred cells are removed).

6.11.2 Load Factor Assessment

The BCCH broadcast load factor allows the MES to derive an indication of the available capacity in the spot beam associated with a particular Gateway. Loading is also assessed when Load Factor is turned on in a beam (as specified through the setting of the Load Indicator to a value other than all 1s). Loading is assessed using load factor comprised of two parameters: Load Indicator and Capacity Indicator as specified in GMR-1 3G 44.008 [4].

From the values of the load factor parameters broadcast on the BCCH system information, the available capacity of the spot beam is given by:

Available Capacity = (1 – Load Indicator) × Capacity Indicator

Where the Load Indicator is the fractional percentage loading and Capacity Indicator is the total bandwidth capacity (in 5x bandwidth equivalents) allocated in the spot beam.

Annex A (informative): Bibliography

GMR-1 02.011 (ETSI TS 101 376-2-1): "GEO-Mobile Radio Interface Specifications; Part 2: Service specifications; Sub-part 1: Service Accessibility".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

GMR-1 03.022 (ETSI TS 101 376-3-10): "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 10: Functions related to Mobile Earth Station (MES) in idle mode".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

GMR-1 3G 23.003 (ETSI TS 101 376-3-3): " GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 3: Network specifications; Sub part 3: Numbering, addressing and identification".

GMPRS-1 03.297 (ETSI TS 101 376-3-19): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service; Part 3: Network specifications; Sub-part 19: Optimal Routing technical realization".

NOTE: This is a reference to a GMR-1 Release 2 specification. See the introduction for more details.

GMR-1 03.298 (ETSI TS 101 376-3-20): "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 20: Technical realization of High-Penetration Alerting".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

GMR-1 04.003 (ETSI TS 101 376-4-3): "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 3: Channel Structures and Access Capabilities".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

GMR-1 04.006 (ETSI TS 101 376-4-6): "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 6: Mobile earth Station-Gateway Station Interface Data Link Layer Specifications".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

GMR-1 3G 45.003 (ETSI TS 101 376-5-3): "GEO-Mobile Radio Interface Specifications (Release 3) Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 3: Channel Coding".

GMR-1 3G 45.004 (ETSI TS 101 376-5-4): "GEO-Mobile Radio Interface Specifications (Release 3) Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 4: Modulation".

GSM 02.01 (ETSI ETS 300 500): "Digital cellular telecommunications system (Phase 2); Principles of telecommunication services supported by a GSM Public Land Mobile Network (PLMN) (GSM Phase 2)".

GSM 02.02 (ETSI ETS 300 501): "European digital cellular telecommunications system (Phase 2); Bearer Services (BS) supported by a GSM Public Land Mobile Network (PLMN) (GSM Phase 2)".

GSM 02.03 (ETSI ETS 300 502): "European digital cellular telecommunications system (Phase 2); Teleservices supported by a GSM Public Land Mobile Network (PLMN) (GSM Phase 2)".

GSM 02.04 (ETSI ETS 300 503): "Digital cellular telecommunications system (Phase 2) (GSM); General on supplementary services (GSM Phase 2)".

GSM 02.06 (ETSI ETS 300 504): "Digital cellular telecommunications system (Phase 2) (GSM); Types of Mobile Stations (MS) (GSM Phase 2)".

GSM 02.07 (ETSI ETS 300 505): "Digital cellular telecommunications system (Phase 2) (GSM); Mobile Station (MS) features (GSM Phase 2)".

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

GSM 02.16 (ETSI ETS 300 508): "European digital cellular telecommunications system (Phase 2); International Mobile station Equipment Identities (IMEI) (GSM Phase 2)".

GSM 02.17 (ETSI ETS 300 509): "European digital cellular telecommunications system (Phase 2); Subscriber Identity Module (SIM); Functional characteristics (GSM Phase 2)".

GSM 02.24 (ETSI ETS 300 510): "Digital cellular telecommunications system (Phase 2) (GSM); Description of Charge Advice Information (CAI) (GSM Phase 2)".

GSM 02.30 (ETSI ETS 300 511): "European digital cellular telecommunications system (Phase 2); Man-Machine Interface (MMI) of the Mobile Station (MS) (GSM Phase 2)".

GSM 02.40 (ETSI ETS 300 512): "Digital cellular telecommunications system (Phase 2) (GSM); Procedures for call progress indications (GSM Phase 2)".

GSM 02.41 (ETSI ETS 300 513): "European digital cellular telecommunications system (Phase 2); Operator determined barring (GSM Phase 2)".

GSM 02.81 (ETSI ETS 300 514): "Digital cellular telecommunications system (Phase 2) (GSM); Line identification supplementary services; Stage 1 (GSM Phase 2)".

GSM 02.82 (ETSI ETS 300 515): "Digital cellular telecommunications system (Phase 2) (GSM); Call Forwarding (CF) supplementary services; Stage 1 (GSM Phase 2)".

GSM 02.83 (ETSI ETS 300 516): "Digital cellular telecommunications system (Phase 2) (GSM); Call Waiting (CW) and Call Hold (HOLD) supplementary services; Stage 1 (GSM Phase 2)".

GSM 02.84 (ETSI ETS 300 517): "Digital cellular telecommunications system (Phase 2) (GSM); Multi Party (MPTY) supplementary services; Stage 1 (GSM Phase 2)".

GSM 02.85 (ETSI ETS 300 518): "Digital cellular telecommunications system (Phase 2) (GSM); Closed User Group (CUG) supplementary services; Stage 1 (GSM Phase 2)".

GSM 02.86 (ETSI ETS 300 519): "Digital cellular telecommunications system (Phase 2) (GSM); Advice of Charge (AoC) supplementary services; Stage 1 (GSM Phase 2)".

GSM 02.88 (ETSI ETS 300 520): "Digital cellular telecommunications system (Phase 2) (GSM); Call Barring (CB) supplementary services; Stage 1 (GSM Phase 2)".

History

Document history		
V3.1.1	July 2009	Publication
V3.2.1	February 2011	Publication