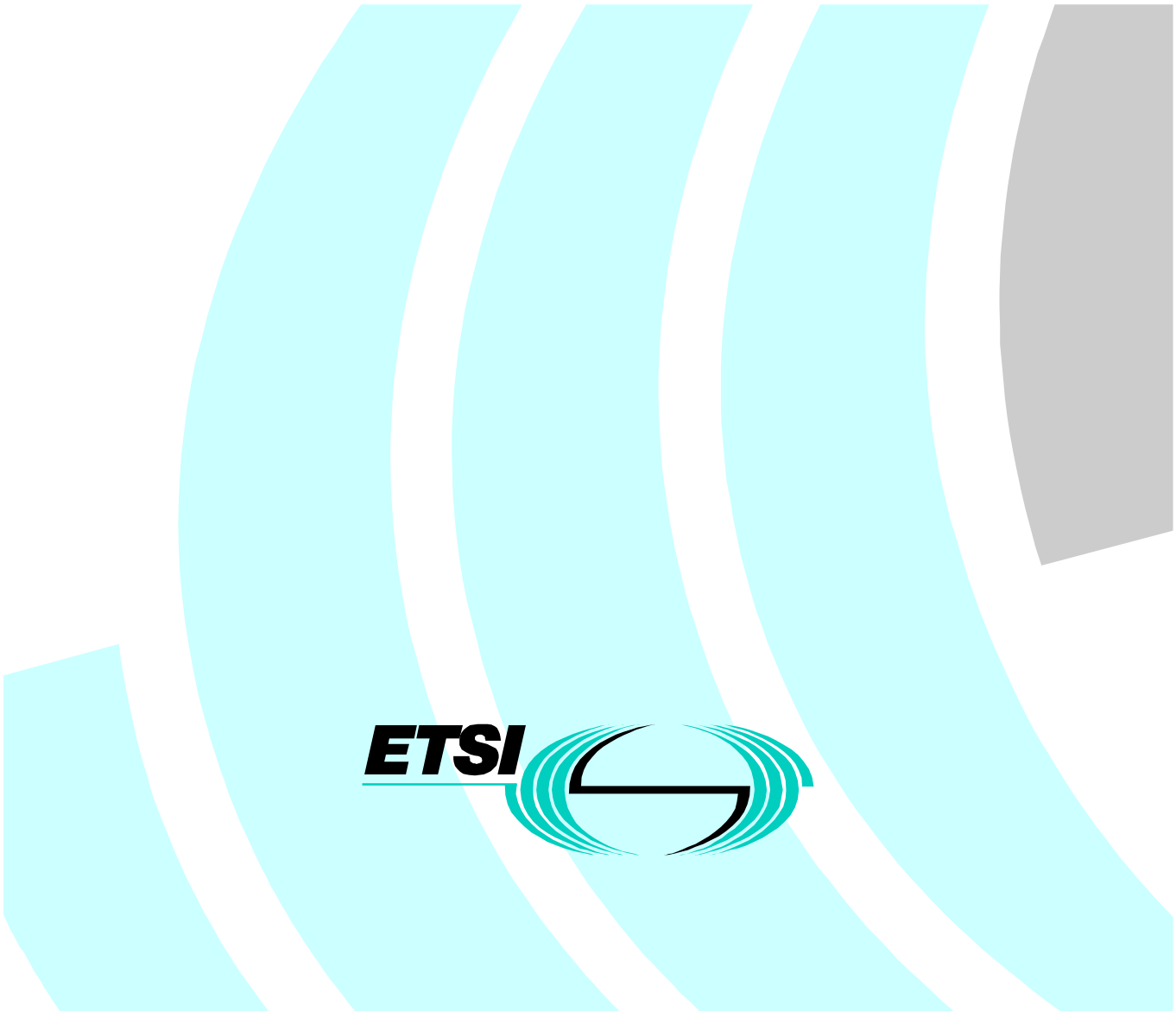
ETSI TS 101 376-3-20 V1.1.1 (2001-03)

Technical Specification

GEO-Mobile Radio Interface Specifications;
Part 3: Network specifications;
Sub-part 20: Technical realization of High-Penetration Alerting;
GMR-1 03.298



Reference
DTS/SES-001-03298

Keywords
GMR, GSM, GSO, interface, MES, mobile, MSS,
radio, satellite, S-PCN, stage 1, stage 2

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Contents

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IPRs:

Project	Company	Title	Country of Origin	Patent n°	Countries Applicable
TS 101 376 V1.1.1	Digital Voice Systems Inc		US	US 5,226,084	US
TS 101 376 V1.1.1	Digital Voice Systems Inc		US	US 5,715,365	US
TS 101 376 V1.1.1	Digital Voice Systems Inc		US	US 5,826,222	US
TS 101 376 V1.1.1	Digital Voice Systems Inc		US	US 5,754,974	US
TS 101 376 V1.1.1	Digital Voice Systems Inc		US	US 5,701,390	US

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Project	Company	Title	Country of Origin	Patent n°	Countries Applicable
TS 101 376 V1.1.1	Ericsson Mobile Communication	Improvements in, or in relation to, equalisers	GB	GB 2 215 567	GB
TS 101 376 V1.1.1	Ericsson Mobile Communication	Power Booster	GB	GB 2 251 768	GB
TS 101 376 V1.1.1	Ericsson Mobile Communication	Receiver Gain	GB	GB 2 233 846	GB
TS 101 376 V1.1.1	Ericsson Mobile Communication	Transmitter Power Control for Radio Telephone System	GB	GB 2 233 517	GB

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Project	Company	Title	Country of Origin	Patent n°	Countries Applicable
TS 101 376 V1.1.1	Hughes Network Systems		US	Pending	US

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Project	Company	Title	Country of Origin	Patent n°	Countries Applicable
TS 101 376 V1.1.1	Lockheed Martin Global Telecommunic. Inc	2.4-to-3 KBPS Rate Adaptation Apparatus for Use in Narrowband Data and Facsimile Communication Systems	US	US 6,108,348	US
TS 101 376 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Cellular Spacecraft TDMA Communications System with Call Interrupt Coding System for Maximizing Traffic ThroughputCellular Spacecraft TDMA Communications System with Call Interrupt Coding System for Maximizing Traffic Throughput	US	US 5,717,686	US
TS 101 376 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Enhanced Access Burst for Random Access Channels in TDMA Mobile Satellite System	US	US 5,875,182	
TS 101 376 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Spacecraft Cellular Communication System	US	US 5,974,314	US
TS 101 376 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Spacecraft Cellular Communication System	US	US 5,974,315	US
TS 101 376 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Spacecraft Cellular Communication System with Mutual Offset High-argin Forward Control Signals	US	US 6,072,985	US
TS 101 376 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Spacecraft Cellular Communication System with Spot Beam Pairing for Reduced Updates	US	US 6,118,998	US

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

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

Version 1.m.n

where:

- the third digit (n) is incremented when editorial only changes have been incorporated in the specification;
- the second digit (m) is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.

The present document is part 3, sub-part 20 of a multi-part deliverable covering the GEO-Mobile Radio Interface Specifications, as identified below:

Part 1: "General specifications";

Part 2: "Service specifications";

Part 3: "Network specifications";

Sub-part 1: "Network Functions; GMR-1 03.001";

Sub-part 2: "Network Architecture; GMR-1 03.002";

Sub-part 3: "Numbering, Addressing and identification; GMR-1 03.003";

Sub-part 4: "Organization of Subscriber Data; GMR-1 03.008";

Sub-part 5: "Technical realization of Supplementary Services; GMR-1 03.011";

Sub-part 6: "Location Registration and Position Identification Procedures; GMR-1 03.012";

Sub-part 7: "Discontinuous Reception (DRX); GMR-1 03.013";

Sub-part 8: "Support of Dual-Tone Multifrequency Signalling (DTMF); GMR-1 03.014";

Sub-part 9: "Security related Network Functions; GMR-1 03.020";

Sub-part 10: "Functions related to Mobile Earth station (MES) in idle mode; GMR-1 03.022";

Sub-part 11: "Technical realization of the Short Message Service (SMS) Point-to-Point (PP); GMR-1 03.040";

Sub-part 12: "Technical realization of the Short Message Service Cell Broadcast (SMSCB); GMR-1 03.041";

Sub-part 13: "Technical realization of group 3 facsimile using transparent mode of transmission; GMR-1 03.045";

Sub-part 14: "Transmission Planning Aspects of the Speech Service in the GMR-1 system; GMR-1 03.050";

Sub-part 15: "Line Identification supplementary service - Stage 2; GMR-1 03.081";

Sub-part 16: "Call Barring (CB) supplementary services - Stage 2; GMR-1 03.088";

Sub-part 17: "Unstructured Supplementary Service Data (USSD) - Stage 2; GMR-1 03.290";

Sub-part 18: "Terminal-to-Terminal Call (TtT); GMR-1 03.296";

Sub-part 19: "Optimal Routing technical realization; GMR-1 03.297";

Sub-part 20: "Technical realization of High-Penetration Alerting; GMR-1 03.298";

Sub-part 21: "Position Reporting services; Stage 2 Service description; GMR-1 03.299";

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.

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

Since GMR is derived from GSM, the organization of the GMR specifications closely follows that of GSM. The GMR numbers have been designed to correspond to the GSM numbering system. All GMR specifications are allocated a unique GMR number as follows:

GMR-n xx.zyy

where:

- xx.0yy (z = 0) is used for GMR specifications that have a corresponding GSM specification. In this case, the numbers xx and yy correspond to the GSM numbering scheme.
- xx.2yy (z = 2) is used for GMR specifications that do not correspond to a GSM specification. In this case, only the number xx corresponds to the GSM 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 specifications as follows:

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

NOTE: Any references to GSM 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 specification.

- If a GMR specification does not exist, the corresponding GSM specification may or may not apply. The applicability of the GSM specifications is defined in GMR-1 01.201 [2].

1 Scope

The present document presents the description for the technical realization of high-penetration alerting (HPA) in the GMR-1 Mobile Satellite System.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] GMR-1 01.004 (ETSI TS 101 376-1-1): "GEO-Mobile Radio Interface Specifications; Part 1: General specifications; Sub-part 1: Abbreviations and acronyms; GMR-1 01.004".

[2] GMR-1 01.201 (ETSI TS 101 376-1-2): "GEO-Mobile Radio Interface Specifications; Part 1: General specifications; Sub-part 2: Introduction to the GMR-1 Family; GMR-1 01.201".

[3] 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; GMR-1 03.022".

[4] GMR-1 04.008 (ETSI TS 101 376-4-8): "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 8: Mobile Radio Interface Layer 3 Specifications; GMR-1 04.008".

[5] GMR-1 05.008 (ETSI TS 101 376-5-6): "GEO-Mobile Radio Interface Specifications; Part 5: Radio interface physical layer specifications; Sub-part 6: Radio Subsystem Link Control; GMR-1 05.008".

[6] ITU-T Recommendation Q.764: "Signalling System No. 7 - ISDN User Part Signalling Procedures".

3 Definitions and abbreviations

For the purposes of the present document, the definitions given in GMR-1 01.004 [1] and the following apply.

T_{HPA}: this timer is started when the network has sent a Paging (Alert) Request message and is stopped when the network has received the Paging Response message. If this timer expires, the network will send an additional Paging (Alert) Request message if the HPA repetition is so configured at the MSC. The timer units are seconds.

T3112: refer to GMR-1 04.008 [4]

T3113: refer to GMR-1 04.008 [4]

4 Stage 1 specification

4.1 Description

4.1.1 General

HPA is a modified paging procedure on a higher penetration channel intended to reach MESs in poor radio reception areas. The MES alerts the user to move to an area of better reception for call set-up.

4.1.2 Applicability

HPA alerting may be applied to all MES-terminated voice, alternate voice and fax, and unknown bearer service calls at call set-up within a gateway station. HPA shall not be attempted for SMS, fax, or data calls.

4.1.3 Alerting operation

Alerting is activated by the MSC when the MSC does not receive a response to paging within a configurable amount of time.

The time period during which HPA can take place is determined in a PSTN-to-MES call by how long the PSTN can wait between receipt of the Early ACM and ANM messages. The MSC should continue HPA for an equivalent time period in a MES-to-MES call to achieve service consistency over all call types. Call set-up shall continue as normal when a paging response to HPA is received at the MSC. If no paging response is received to HPA, then the call should be forwarded to the applicable treatment for no answer.

A Call-In-Progress (CIP) tone shall be applied to the calling party during paging and HPA.

4.1.4 Time line

Figure 4.1 presents a time line for a possible HPA procedure scenario for a PSTN-originated call at the MSC. The number of Page and Alert retries and timer periods (T3113 and T_{HPA}) are configurable.

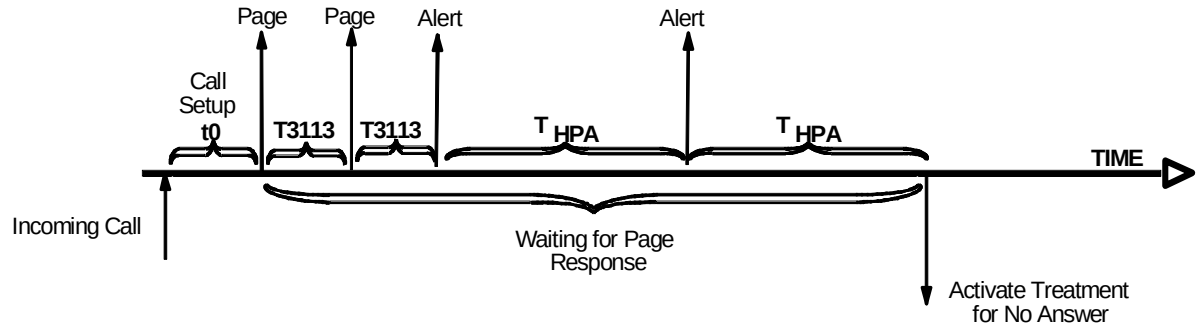

Figure 4.1: High-Penetration Alerting time line

4.1.5 MES requirements

The MES shall access the network on the RACH with a Channel Request message after receiving the Alert Request. The MES shall monitor the BCH power level as part of its idle mode procedures (see GMR-1 03.022 [3]). The MES shall not attempt network access on the RACH until a transition is made to the paging state (see GMR-1 03.022 [3]).

The MES shall indicate to the user when the MES is in the Alerting Service state. The MES should also provide an additional indication to the user upon receipt of an Alert Request message.

4.1.6 Call in progress tones

The CIP tone applied to the calling party during HPA shall be identical to that employed during paging.

4.1.7 Charging aspects

There are no charging aspects to HPA.

4.1.8 Operations and maintenance aspects

- An MSC parameter shall determine whether zero, one, or two Paging messages are sent from the MSC to the GSS.
- An MSC parameter shall determine whether HPA is applied in the MSC.
- An MSC parameter shall determine whether zero, one or two HPA Paging messages are sent from the MSC to the GSS.
- Timer T_{HPA} shall be used by the MSC for the operation of HPA in order to guard the HPA period for MES-terminated calls.
- Timer T3112 shall be broadcast on the BCCH.
- A "Page/Alert flag" at the GSS shall determine whether simultaneous paging and alerting are performed when an HPA Paging message is received by the GSS from the MSC.

4.2 Exceptional procedures

4.2.1 No TMSI at MSC

The GSS shall discard the Paging (Alert) message if a Paging (Alert) message is received that does not contain a TMSI. (The MSC can page with only the IMSI in the event of VLR failure, for example.)

4.2.2 BACH reorganization

The MES will be informed when the network decides to reorganize the BACH channels by the value of the Alerting Information IE in the Alert Request message. When this occurs, the MES shall go into the "No Service" state until it is able to reread the BCCH to identify the new BACH organization. (See GMR-1 04.008 [4] for details.)

4.3 Interworking requirements

4.3.1 Supplementary services

All applicable supplementary services can be used with the HPA feature.

The calling party shall be forwarded to the applicable treatment for no answer on expiry of the permitted alerting period.

5 Stage 2 specification

5.1 Main concepts

5.1.1 High-penetration alerting objectives

HPA provides an additional capability to reach a subscriber while the subscriber is located in an area of poor signal strength. Signals of normal strength are not adequate in poor reception areas and do not allow a subscriber to complete a call. However, the HPA service allows an MES to indicate to a user that an incoming call is waiting. This indication also signals the user to move to an area of better reception for the call set-up to be completed.

The indication made by the MES to signal HPA to the user shall be MES implementation dependent. The permitted time delay between the MSC starting the call set-up and the receipt of the Paging Response at the MSC depends upon the fixed PLMN/PSTN network and shall determine the period for which HPA can continue.

5.2 Alerting operation

The MSC can be configured to generate zero, one, or two Paging messages. The time between successive pages (T3113) sent from the MSC shall be configurable to a maximum value of 10 seconds. If Paging does not elicit a response from the MES, then the MSC shall activate HPA (if the MSC is configured for this). If the MSC is configured to generate a zero Paging message, then the MSC shall immediately activate HPA and generate at least one HPA Paging message.

The MSC can be configured to generate zero, one, or two HPA Paging messages. HPA is disabled at the MSC when the MSC is configured to generate zero HPA Paging messages. The MSC shall never be configured to generate zero HPA Paging messages when it is set to generate zero Paging messages. The time between successive HPA Paging messages sent from the MSC shall be configurable to a maximum value dependent upon the PSTN. An HPA indication to the GSS should be similar to a Paging message with an additional element indicating HPA. The MES shall reply to alerting in the same LAI in which the Alert Request message was received by the MES. The MSC does not distinguish between a Paging Response message generated from regular paging or HPA.

If the Page/Alert flag at the GSS is turned on, then the GSS shall send both Alert Request and Paging Request messages to the MES when the GSS receives an Alert message from the MSC.

The following table shows the sequence of Paging Request and Alert Request messages sent by the GSS to the MES for different values of the "Page/Alert" flag set at the GSS as well as for different numbers of page and alert repetitions set at the MSC.

Table 5.1

Number of Page Repetitions and Alert Repetitions set at the MSC	The sequence of Page and Alert Requests sent to the MES when the "Page/Alert" flag Is turned off at the GSS	The sequence of Page and Alert Requests sent to the MES when the "Page/Alert" flag Is turned on at the GSS
Page = 0, Alert = 0	Invalid Setting	Invalid Setting
Page = 0, Alert =1	Alert	Page and Alert
Page = 0, Alert =2	Alert Alert	Page and Alert Page and Alert
Page = 1, Alert =0	Page	Page
Page = 1, Alert =1	Page Alert	Page Page and Alert
Page = 1, Alert =2	Page Alert Alert	Page Page and Alert Page and Alert
Page = 2, Alert =0	Page Page	Page Page
Page = 2, Alert =1	Page Page Alert	Page Page Page and Alert
Page = 2, Alert =2	Page Page Alert Alert	Page Page Page and Alert Page and Alert

5.2.1 Message definitions on the A-Interface

The A-Interface Paging message requires modification to include an HPA indicator. The Paging message on the A-Interface shall be coded as described in ITU-T Recommendation Q.764 [6].

5.2.2 Message definitions on the air interface

The Alert Request message on the air interface is defined in GMR-1 04.008 [4]. When a Paging Request is received at the MES, then the MSC_ID and Channel Needed information is provided in the data fields of the Paging Request message.

The Alert Request message is limited to 36 bits. The Alert Request message contains no space to send the MSC_ID and Channel Needed data to the MES. Instead, the MES fills these fields in the Channel Request message with values treated as invalid by the network. The definitions for the Alert Request and Channel Request messages are included in GMR-1 04.008 [4].

5.2.3 Functions and information flows

The correct broadcast/alerting group is selected based on the IMSI and spot beam identifier upon receipt of the Paging (Alert) message at the GSS. The Alert Request message is transmitted on the correct group of the BACH. See GMR-1 05.008 [5].

The user is notified when the MES has received the Alert Request. The MES then waits until the radio environment has improved enough to transition to the camped normally, Paging state. The MES now begins the RR connection procedure by sending out a Channel Request message.

5.2.3.1 PSTN-to-MES call set-up message flow with high-penetration alerting

Figure 5.1 illustrates the message flow between the PSTN and MES during HPA.

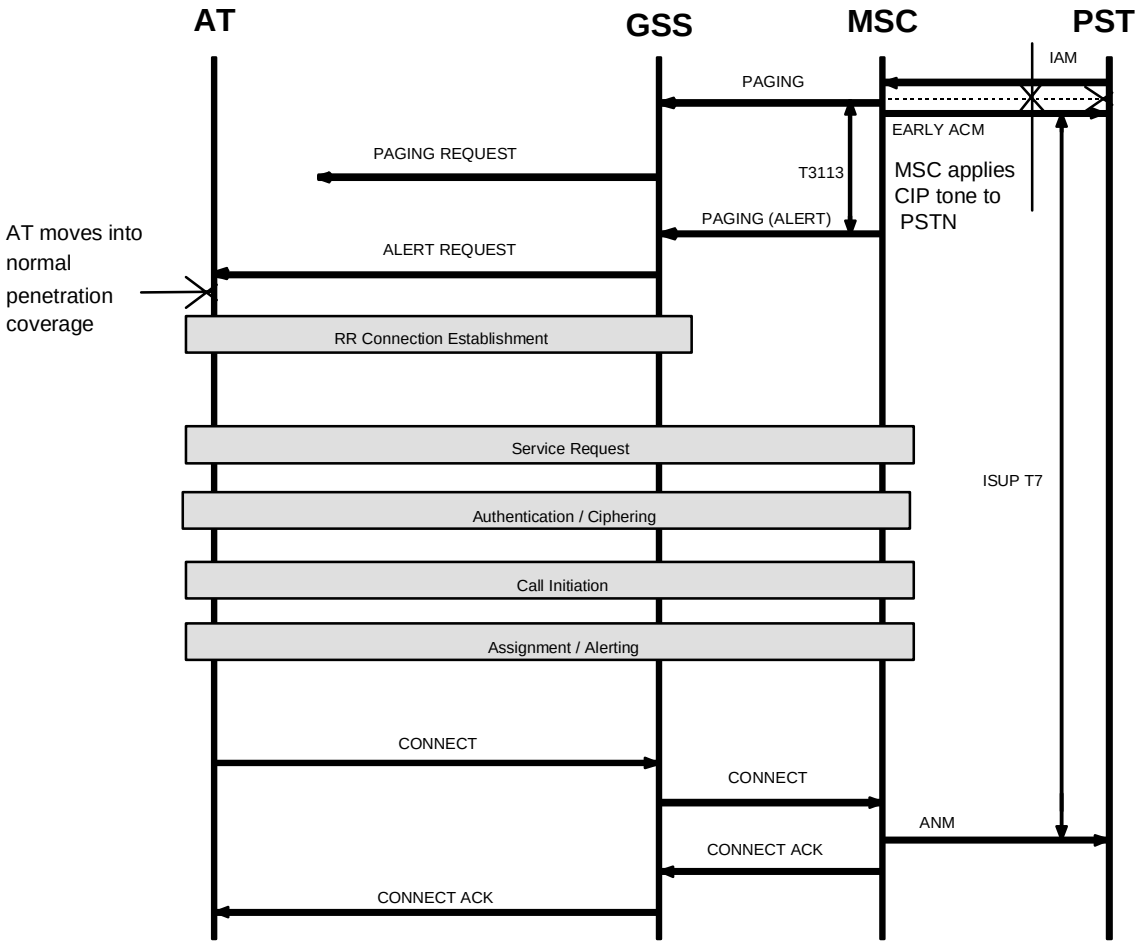

Figure 5.1: PSTN-to-MES call set-up message flow with High-Penetration Alerting

A CIP tone shall be applied to the calling party after the first Paging message is sent from the MSC to the GSS. If paging produces no response from the GSS, then timer T3113 shall expire. If HPA is enabled at the MSC, then a Paging (Alert) message shall be sent from the MSC to the GSS.

The early ACM is sent from the MSC to the PSTN after the first Paging message has been sent from the MSC to the GSS. This event occurs regardless of the value of the Paging repetition parameter. The Connect message shall be received at the MSC for the ANM to be sent to the PSTN before the ISUP protocol timer T7 expires. This ISUP T7 timer can range from 60 to 180 seconds. .

5.2.3.2 MES to local MES call set-up message flow with High-Penetration Alerting

Figure 5.2 illustrates the message flow for an MES to local MES during HPA. This scenario assumes that the Paging and Paging (Alert) messages are sent out only once from the MSC.

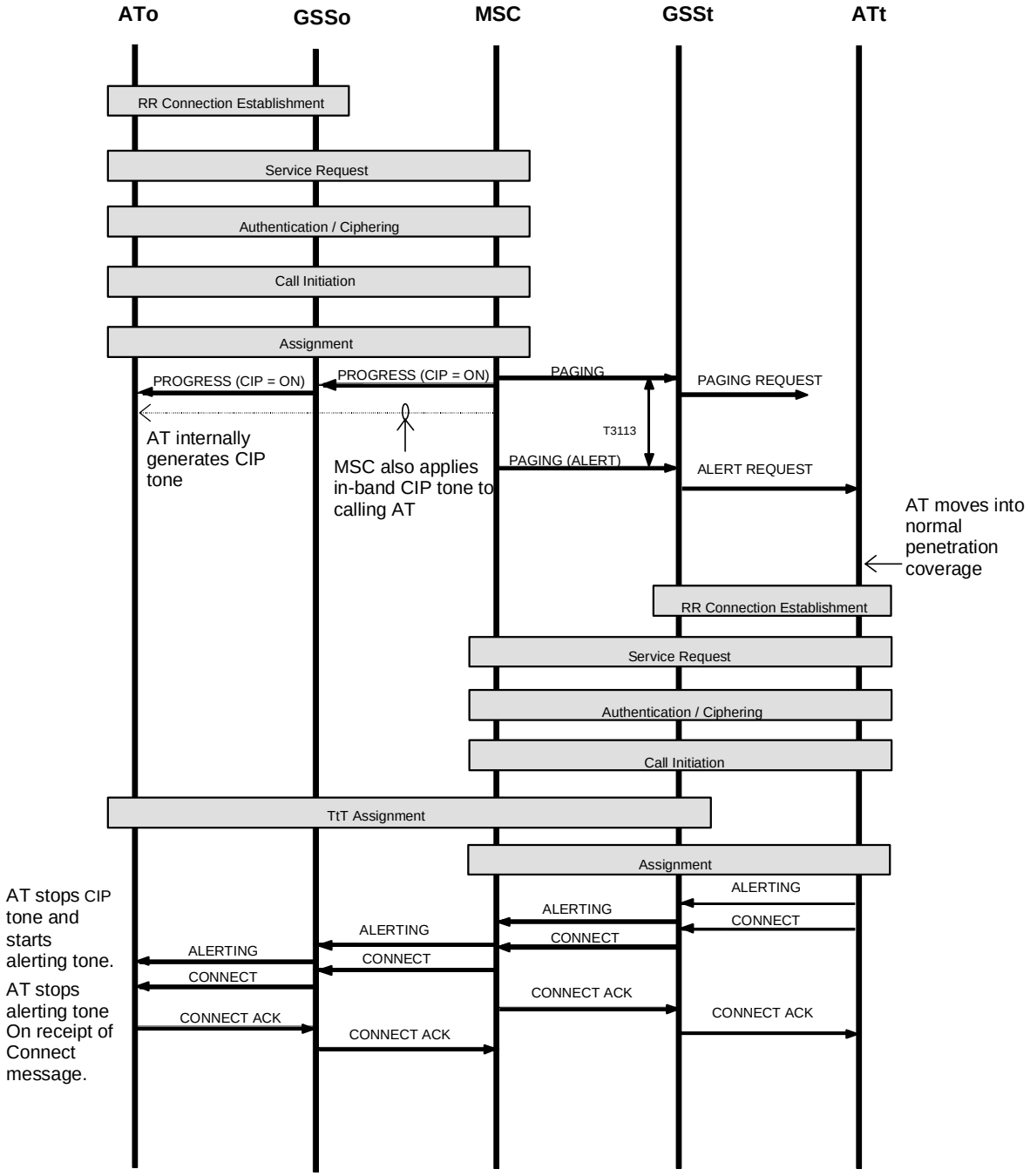

Figure 5.2: MES to Local MES call set-up message flow with High-Penetration Alerting

A CIP tone shall be applied to the calling party after the first Paging message is sent from the MSC to GSSt. An in-band CIP tone requires that a dedicated channel has been set up on the originating side of the call and configured for voice rather than signalling. The CIP tone is activated by the arrival of the Progress message at the originating MES.

If paging produces no response from the GSS, then timer T3113 shall expire. A Paging (Alert) message shall be sent from the MSC to GSSt if HPA is enabled at the MSC.

The MES is permitted to take T_{HPA} to establish an RR connection and send a Paging response message to the MSC. T_{HPA} is started when the MSC sends out the first Paging (Alert) message.

5.2.3.3 Abnormal cases

The MSC may repeat the paging message and restart T3113 if timer T3113 expires and a Paging Response message has not been received. The number of successive paging attempts shall be configurable and default to 0 with a maximum value of 1.

The number of HPA attempts made by the MSC shall be configurable with a maximum value of 2 and a minimum value of zero.

If no TMSI is available at the MSC, then the HPA Paging message shall still be sent to the GSS from the MSC. The GSS shall not transmit an alert if an HPA Paging message is received that does not contain a TMSI.

5.2.4 MES idle mode

In the event of any conflicts, the MES shall implement the idle mode procedures as described in GMR-1 03.022 [3]. The text in GMR-1 03.022 [3] and GMR-1 05.008 [5] takes precedence over the text in this clause.

The MES shall contain a state permitting it to camp onto a spot beam with sufficient signal strength for the reception of regular paging (the camped normally paging state) as well as a state in which the signal strength is only sufficient for the reception of the FCCH and BACH (the camped normally alerting state). These states are defined in GMR-1 03.022 [3]. The transition criteria between the states are described in GMR-1 05.008 [5].

Once a transition is made to the camped normally alerting state, then the MES displays an indication to the user that this state has been entered. If a transition to no service (frequency search/beam selection procedure) is made, then the user indication for the camped normally alerting state will be removed and the applicable no service indication will be displayed.

If a transition is made from the camped normally alerting state to the camped normally paging state, then the user indication for the camped normally alerting state will be removed.

The camping state notification (paging or alerting) to the user will be made from the RR layer of the MES directly to the MMI of the MES. There will be no RR-to-MM interaction. The physical design of the camped normally, high-penetration (or Alerting Service state) notification to the MES user is left to the discretion of the MES manufacturers.

See GMR-1 03.022 [3] for a discussion of the processing that occurs when a position update timer expires while the MES is in the camped normally, high-penetration state.

See GMR-1 03.022 [3] for a discussion of the resulting processing that occurs when the periodic location update timer expires while the MES is in the camped normally, high-penetration state.

5.2.5 Network timer ranges

The total time allotted for the MES to respond to an Alert is limited by the ISUP timer T7. The time between receipt at the PSTN of the early ACM message and the receipt of the ANM message at the PSTN cannot exceed T7. The actual length of time that the MES has to respond to the Alert is less than T7 because an allowance shall be made for Paging, for the timeout of paging (T3113) (before which alerting will not be attempted), for whether normal Paging will be repeated (indicated by N1), for processing delays in the MSC and GSS, and for the satellite hop duration.

It is recommended that timer values be selected so that alerting operates in a similar manner for both PSTN and MES-originated calls. The timer T_{HPA} is derived from the value of the ISUP T7 timer.

5.2.5.1 PSTN-to-MES call

Time T3113 is the existing paging repetition time. Time T3113 is configurable at the MSC.

The value of the ISUP T7 timer can range from 60 seconds to 180 seconds depending upon the PSTN. This value is the maximum time permitted between the ACM and ANM messages.

Time T_{HPA} is the time permitted between the repetition of paging messages with the HPA indicator set and the interval from the moment the network issues the last paging message with the HPA indicator set to the time the network gives up paging to the MES. Time T_{HPA} is configurable at the MSC.

T_{HPA} depends upon Timer T3113, whether there is paging repetition (N_1) or HPA paging repetition (N_2) and on the value of the ISUP T7 timer as well as on the permissible time between the ACM and ANM for PSTN-originated calls, as shown below:

$$T_{HPA} = \frac{T7 - (N_1 \times T3113)}{N_2}$$

5.2.5.2 MES to local MES call

For a consistent alerting service to be provided to subscribers, MES to local MES calls should implement a similar time frame for HPA as is perceived by the calling party in PSTN-to-MES calls. T_{HPA} is therefore defined as the same value as for PSTN-to-MES calls and MES-to-MES calls.

5.2.6 MES timer ranges

The MES is required to maintain a timer to inform the user of how much time there is to move into a location of normal signal penetration. This time shall be defined as the time from the receipt of an Alert Request message to the transition to the camped normally, paging state. If a transition to normal penetration is not made prior to the expiration of Timer T3112, then the HPA indication at the MES shall be deactivated. The entire procedure is then aborted and a subsequent transition to the paging state will not result in call set-up for this Alert Request. See GMR-1 05.008 [5] for the definition of the criteria for this transition. See GMR-1 04.008 [4] for the details pertaining to other types of MES processing at this time.

The time allowed for HPA at the network is governed by the ISUP T7 timer and allows for normal (unsuccessful) paging. The processing time in the MSC and GSS, satellite hop delays, and connection establishment by the MES with the network (giving total time Td), require that the timer be maintained in the MES (T3112). It shall be computed as follows:

$$T3112 = T7\ (N1 \times T3113) - Td$$

It shall be necessary for T3112 to be broadcast to the MES on the BCCH System Information because this timer shall be a system wide parameter. A typical value for Td is 5 seconds.

Annex A (informative): Bibliography

GMR-1 03.296 (ETSI TS 101 376-3-18):"GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 18: Terminal-to-Terminal Call (TtT); GMR-1 03.296".

GMR-1 05.002 (ETSI TS 101 376-5-2):"GEO-Mobile Radio Interface Specifications; Part 5: Radio interface physical layer specifications; Sub-part 2: Multiplexing and Multiple Access; Stage 2 Service Description; GMR-1 05.002".

History

Document history		
V1.1.1	March 2001	Publication