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Technical Specification

**GEO-Mobile Radio Interface Specifications;
Part 3: Network specifications;
Sub-part 8: Support of Dual-Tone
Multifrequency Signalling (DTMF);
GMR-1 03.014**

Reference

DTS/SES-001-03014

Keywords

DTMF, GMR, GSM, GSO, interface, MES, mobile, MSS, radio, satellite, signalling, S-PCN

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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).

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Version 1.m.n

where:

- 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 8 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 describes processing for dual-tone multifrequency (DTMF) signals within the GMR-1 Mobile Satellite System. It describes how DTMF signals are encoded in the MES and the gateway, and it describes how they are carried across the radio link.

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 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; GMR-1 04.006".

[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] ITU-T Recommendation Q.24: "Multifrequency push-button signal reception".

3 Abbreviations

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

4 Requirements

Dual-tone multifrequency (DTMF) signal is an in-band signal containing dominant energy in two frequencies, one out of a high-group frequency set plus one out of a low-group frequency set. DTMF signals are often used independently of a signalling system and after a call has been established to provide end-user access to specialized services. The applicable international recommendation is ITU-T Recommendation Q.24 [5].

In the GMR-1 system the transport of DTMF signals in all three directions (MES-to-PSTN, PSTN-to-MES, MES-to-MES) shall be supported.

The use of DTMF is only permitted when the speech teleservice is being used or during the speech phase of alternate speech/facsimile teleservices. The mobile earth station (MES) will not initiate DTMF protocol in any other circumstances.

5 Cause of DTMF generation

A user may cause a DTMF tone to be generated by depression of a key in the mobile earth station (MES). Optionally an MES may interface to an analog telephone via equipment such as docking adapters.

6 Support of DTMF in the GMR-1 system

6.1 General

The GMR-1 system transports DTMF signals in a manner similar to that provided by GSM, i.e., in the MES-to-PSTN direction. DTMF carriage is message-based and DTMF is carried in-band in the PSTN-to-MES direction. DTMF between two MESs for a voice-only call will also be message-based between the two MESs. The same message is also received by the gateway from the individual MESs after which the gateway regenerates DTMF towards the legal interception center.

For MES-to-MES alternate voice/fax calls, DTMF is carried double-hop during the voice phase of the call, which is also double-hop. Double-hop DTMF in such call scenarios shall comprise message-based transport from MES to gateway and in-band transport between gateway and MES.

6.2 Specific

6.2.1 MES-to-PSTN direction

In the MES-to-PSTN direction, DTMF carriage is message-based.

The messages to be sent are as follows:

- DTMF_TONE_GENERATE_REQ: Containing multiple digits (from 0 - 9, A, B, C, D, *, #) with appropriate tone durations;
- DTMF_TONE_GENERATE_ACK: An RR layer acknowledgment for DTMF_TONE_GENERATE_REQ.

Details regarding the actual information elements in these messages are provided in GMR-1 04.008 [4].

The multiple key presses are allowed to be passed in the same RR_layer DTMF_TONE_GENERATE_REQ message for the purpose of increasing efficiency and throughput.

The DTMF_TONE_GENERATE_REQ messages will be transmitted to the GSS whose service access point identifier (SAPI) indicates a 0. At the GSS, the RR-Layer parses the digit information and instructs the vocoder in the physical layer to generate DTMF tones with appropriate tone duration toward the MSC, which performs the appropriate routing of the tones.

The tones that are to be generated by the vocoder in the physical layer are specified as follows:

- frequencies are defined in ITU-T Recommendation Q.24 [5];
- tone-sending levels are defined nationally and are operator configurable;
- durations are as specified in DTMF_TONE_GENERATE_REQ messages.

Figure 6.1 shows the call flow representation of MES-to-PSTN DTMF transport. The MES waits for a $T_{FIRST\_DTMF\_MESSAGE}$ (=1 second) to expire from the time the first key is pressed before forming a DTMF_TONE_GENERATE_REQ message toward GSS. If the first digit has not been released at the expiry of the $T_{FIRST\_DTMF\_MESSAGE}$, then the MES waits for its release before the first DTMF_TONE_GENERATE_REQ message is sent to the network. After that the MES collects all the digits pressed until a DTMF_TONE_GENERATE_ACK is received by the MES and forms a new message to be transmitted to GSS. This scheme also implies that a key that is pressed but not released will also be transmitted in the DTMF_TONE_GENERATE_REQ message, except that for this digit it will indicate that the key has not yet been released. The GSS vocoder resumes normal voice decoding operation upon receipt of an active voice burst while waiting for another instruction from RR-layer. An exception to this rule is when the last digit of previous instruction from RR specified a tone duration of less than 50 msec and the digit was not released at MES. In this case, the GSS vocoder will continue tone generation for another 80 msec before resuming normal voice-decoding operation.

Though not shown in figure 6.1, an audio tone is generated internally by the MES when a key is pressed.

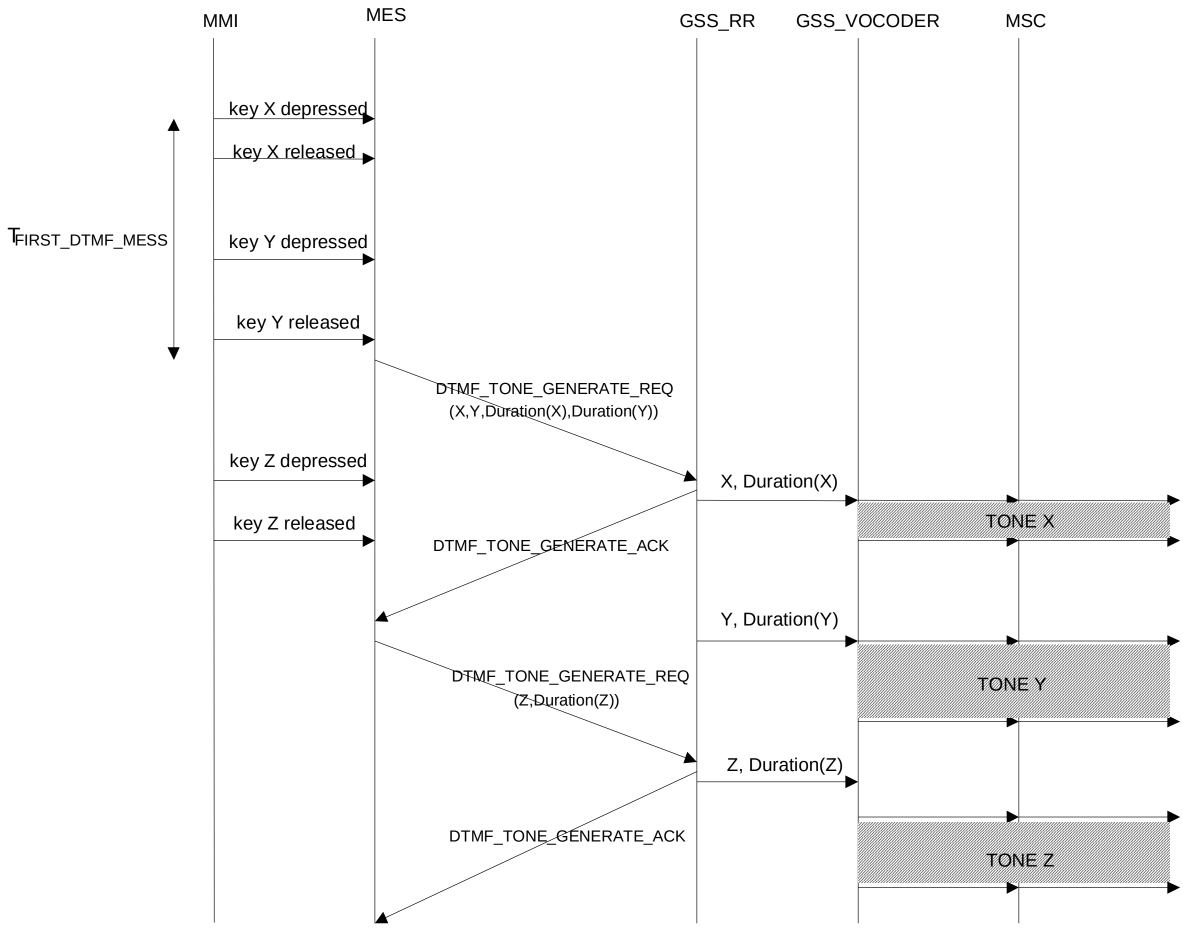

Figure 6.1: Call flow representation of the MES-to-PSTN DTMF transport for the GMR-1 system

Figure 6.2 shows the functional block diagram of DTMF handling in MES-to-PSTN direction in the GMR-1 system. In those applications where the DTMF signals are generated by analog telephones, the DTMF detector in the MES (or in the docking adapter, depending on implementation) instructs the RR-layer of a DTMF signal, which in turn generates the appropriate DTMF_TONE_GENERATE_REQ message toward the gateway. Consequently, in-band carriage of tones (as described for PSTN-to- MES direction below) will be suppressed.

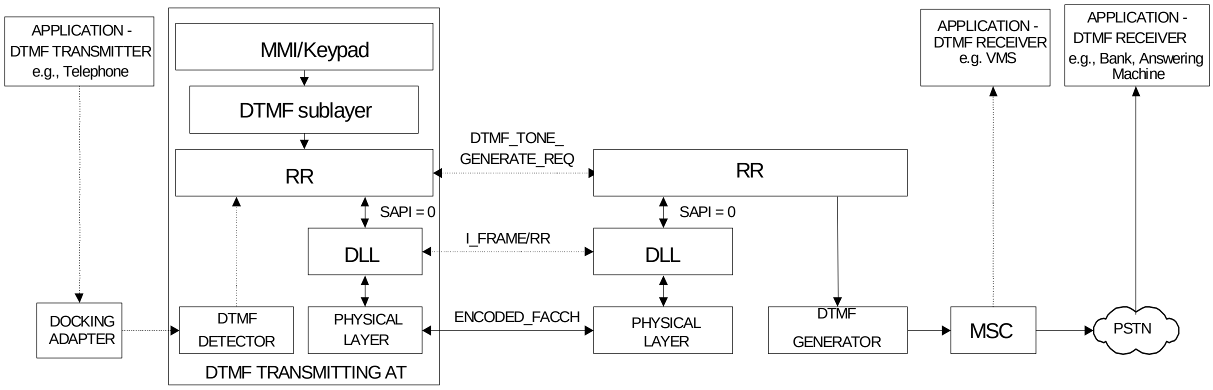

Figure 6.2: Functional block diagram of DTMF handling in the MES-to-PSTN direction in the GMR-1 system

6.2.2 PSTN-to-MES direction

In PSTN-to- MES direction, GMR-1 carries DTMF in-band.

The GMR-1 vocoder will have an integrated DTMF detector that can classify a given frame of signal into several classes, such as voice, single frequency tone, DTMF, silence and background noise, and can perform appropriate modelling and quantization, depending on the classification. Thus, the DTMF-encoded packet carries a unique pattern across the air interface to the voice decoder at the MES, which is capable of identifying a DTMF carrying packet pattern and generates a DTMF tone as indicated in the voice-encoded packet. This scheme can ensure that a clean and correct DTMF signal is generated toward the MES.

6.2.3 MES-to-MES direction

In MES-to-MES direction, transport of DTMF in the GMR-1 system is single-hop and RR message-based, similar to the transport in the MES-to-PSTN direction. The DTMF_TONE_GENERATE_REQ message is transmitted on SAPI = 2 between the two MESs.

The same message is received by GSS on the L → C link, in order to satisfy the requirement of legal interception at the gateway. The RR layer in GSS instructs the vocoder in GSC to generate in-band tones toward the MSC, which is in turn is routed to the legal interception center.

For single-hop MES-to-MES calls, a traffic channel does not exist on the C → L link, which implies that messages on SAPI-2 link between the MES and gateway are unidirectional. Hence, the DLL functionality for handling SAPI-2 messages is augmented to handle missing and/or repeated layer-2 frames. This process is described in GMR-1 04.006 [3].

Figure 6.3 shows the functional block diagram of DTMF handling between two MESs in GMR-1 systems.

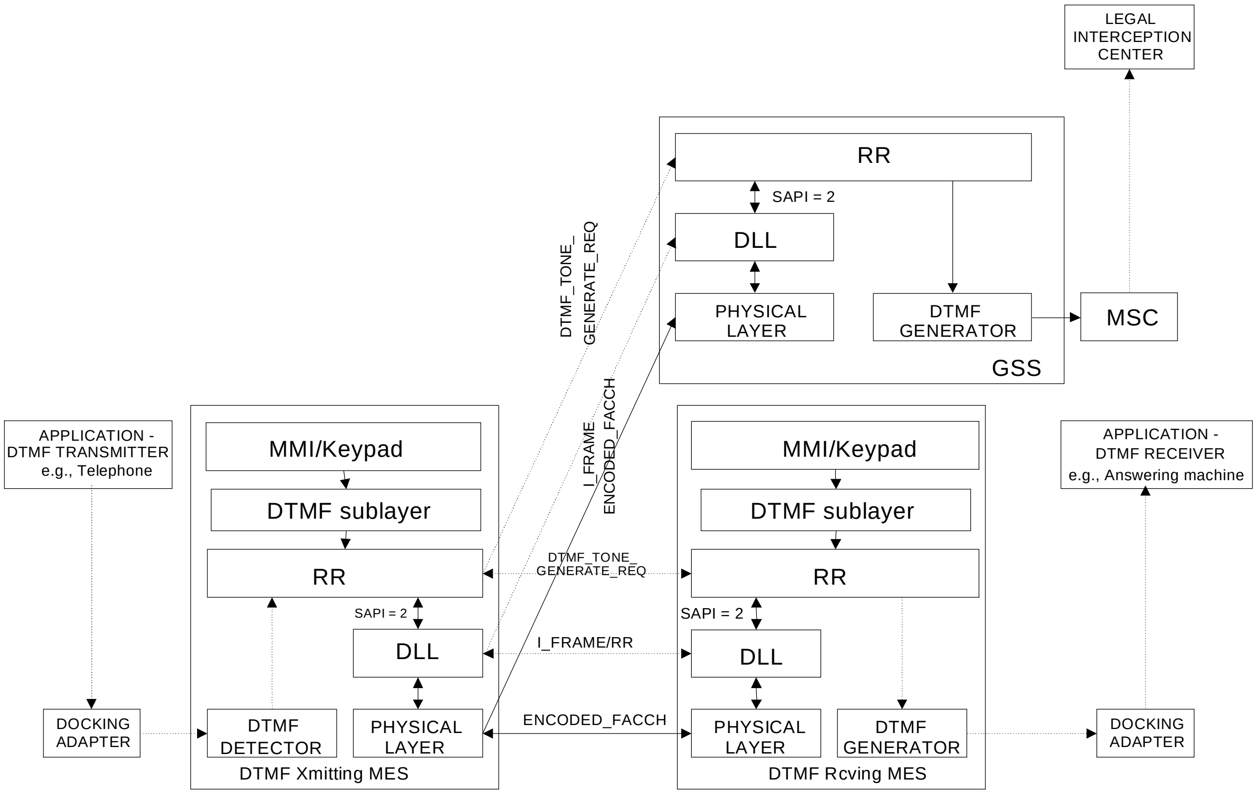

Figure 6.3: Functional block diagram of DTMF handling between two MESs in the GMR-1 system

6.3 Minimum tone and pause durations

The minimum tone duration and pause durations produced by the GSS vocoder shall meet or exceed the corresponding values specified in ITU-T Recommendation Q.24 [5]. A minimum tone duration of 50 msec and a minimum pause duration of 80 msec will satisfy the requirement specified by ITU-T Recommendation Q.24 [5].

Annex A (informative): Bibliography

GSM-03.14 (ETSI ETS 300 532): "European digital cellular telecommunications system (Phase 2); Support of Dual Tone Multi-Frequency signalling (DTMF) via the GSM system (GSM 03.14 V4.1.1)".

History

Document history		
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