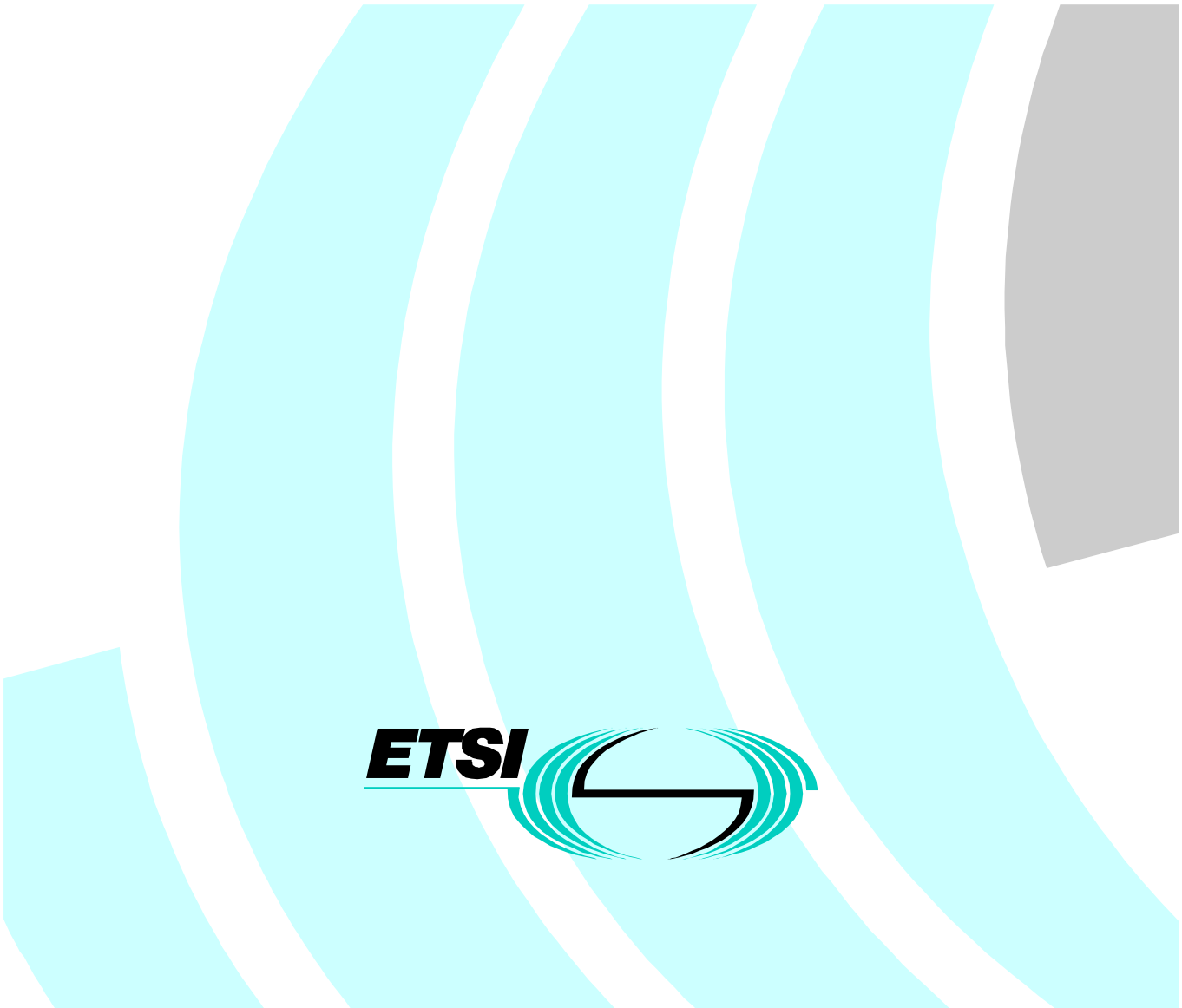
ETSI TS 101 376-3-14 V1.1.1 (2001-03)

Technical Specification

GEO-Mobile Radio Interface Specifications;
Part 3: Network specifications;
Sub-part 14: Transmission Planning Aspects of the Speech Service in the GMR-1 system;
GMR-1 03.050



Reference
DTS/SES-001-03050

Keywords
GMR, GSM, GSO, interface, MES, mobile, MSS, network, public, radio, satellite, S-PCN, transmission

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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 14 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 is concerned with the transmission planning aspects pertaining to the speech service in the GMR-1 Mobile Satellite System. The descriptions of the services are similar to those defined in GSM 03.50 [3] for the GSM system. There are two basic configurations for the operation of the PLMN, MES to MES and MES to GS to PSTN. Due to technical and economic factors, there cannot be full compliance with the general characteristics of international telephone connections and circuits recommended by ITU-T.

The present document gives guidance as to the precautions, measures and minimum requirements needed for successful operation of the PLMN and interworking of the PLMN with the national and international PSTN. The specification identifies a number of routing and network configurations. The objective is to reach a quality as close as possible to ITU-T standards in order to safeguard the performance seen by PLMN and PSTN customers.

The present document is applicable to networks that conform to the GMR-1 specifications, and to mobile earth stations. The present document is based on GSM 03.50 [3].

In most cases, the description of transmission planning aspects pertaining to the speech service differs from GSM in terminology only. The relevant clauses of the present document refer to equivalent clauses of GSM 03.50 [3].

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] GSM 03.50 (ETSI ETS 300 540): "Digital cellular telecommunications system (Phase 2); Transmission planning aspects of the speech service in the GSM Public Land Mobile Network (PLMN) system (GSM 03.50 version 4.4.1)".

3 Abbreviations

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

ADC	Analogue to Digital Converter
ADPCM	Adaptive Differential Pulse Code Modulation
AEC	Acoustic Echo Control
BSC'	Base Station Controller (excluding transmission systems)
BTS'	Base Transceiver Station (excluding transmission systems)
DAC	Digital to Analogue Converter
DMR	Digital Mobile Radio
DSI	Digital Speech Interpolation
EEC	Electric Echo Control
EL	Echo Loss
ERP	Ear Reference Point
FDM	Frequency Division Multiplex

LSTR	Listener Sidetone Rating
MRP	Mouth Reference Point
OLR	Overall Loudness Rating
PCM	Pulse Code Modulation
POI	Point of Interconnection (with PSTN)
PSMN	Public Satellite Mobile Network
RLR	Receiver Loudness Rating
SLR	Send Loudness Rating
STMR	Sidetone Masking Rating
UPCMI	13-bit Uniform PCM Interface

4 Overview

Refer to clause 1.3 of GSM 03.50 [3].

5 Network configurations

5.1 General

Refer to clause 2.1 of GSM 03.50 [3].

5.2 Model of the PSMN

Refer to clause 2.2 of GSM 03.50 [3].

5.3 Interfaces

Refer to clause 2.3 of GSM 03.50 [3].

5.4 Configurations of connections

5.4.1 General configurations of connections

Refer to clause 2.4.1 of GSM 03.50 [3].

5.4.2 Reference configurations to illustrate delay and echo control issues

Refer to clause 2.4.2 of GSM 03.50 [3].

5.5 4-wire circuits in the PSMN

Refer to clause 2.5 of GSM 03.50 [3].

6 Transmission performance

Refer to clause 3 of GSM 03.50 [3].

For MES to MES Connections, the overall transmission performance of connections in alternate conversation mode can be considered as a summation of the effects of:

- The audio part between the MRP/ERP and the UPCMI interface in both MESs;
- The speech transcoder part including the effects of radio transmission, and speech processing between the two UPCMIs.

6.1 Overall loss/loudness ratings

Refer to clause 3.1 of GSM 03.50 [3].

6.1.1 Connections with handset MESs

Refer to clause 3.1.1 GSM 03.50 [3].

6.1.2 Connections with handsfree MESs using loudspeakers

Refer to clause 3.1.2 of GSM 03.50 [3].

6.1.3 Connections with headset MESs

Refer to clause 3.1.3 of GSM 03.50 [3].

6.2 Stability loss

Refer to clause 3.2 of GSM 03.50 [3].

6.3 Delay

6.3.1 General

Refer to clause 3.3.1 of GSM 03.50 [3].

6.3.2 Sources of delay

6.3.2.1 Elements of the PSMN that cause delay

Refer to clause 3.3.2.1 of GSM 03.50 [3].

6.3.2.2 Elements of the PSTN that cause delay

Refer to clause 3.3.2.2 of GSM 03.50 [3].

6.3.3 Effects of delay

Refer to clause 3.3.3 of GSM 03.50 [3].

6.3.4 Allocation of delay to the PSMN

The maximum both-way delay in the PSMN between the MRP/ERP and the Point of Interconnection (see figure 1 of GSM 03.50 [3]) will be 820 ms. The maximum both-way delay between the MRP/ERP of two MESs will be 880 ms.

6.3.5 Delay of various network configurations

6.3.5.1 National and international connections with no echo control in the PSTN (reference configurations A)

Refer to clause 3.3.5.1 of GSM 03.50 [3].

6.3.5.2 National and international connections with echo control in the PSTN (reference configurations B)

Refer to clause 3.3.5.2 of GSM 03.50 [3].

6.3.5.3 Connections where rerouting leads to a significant increase in transmission path length (reference configurations C)

Refer to clause 3.3.5.3 of GSM 03.50 [3].

6.3.6 Delay related requirements on the MES

In accordance with the outline of transmission delay in various GMR system elements contained in the present document the delay in the MES shall not exceed the values defined in annex C.

6.4 Echo

6.4.1 General

Refer to clause 3.4.1 of GSM 03.50 [3].

With the expected maximum one-way delay in the PSMN for connection with the PSTN and for connection from MES to MES, acoustic echo control will be required in the MES to reduce the echo returned to the distant end and electrical echo control will be required at the POI to reduce the echo returned to the PSMN user from the PSTN. The design of these echo control devices should be such as to provide operation in full duplex mode (as opposed to alternate mode).

6.4.2 Electrical echo control in the PSMN (reference configurations A)

The electrical echo control device at the interface with the PSTN should meet the requirements given in ITU-T Recommendations G.165 and G.131, but with an end delay of 60 ms. This refers to t_d in clause 3.2 of ITU-T Recommendations G.165 and G.131. The 60 ms is calculated as follows. ITU-T Recommendation G.165 and G.131 states that the maximum length of connection which need not have echo control has a mean one-way propagation time of 25 ms. However, this figure is the sum of the delays of the international connection and the maximum national delays at each end of the connection. Since the interconnection of the PSMN to the PSTN is unlikely to be at a point where the PSTN delay is > 22 ms (without echo control), and the dispersion may be up to 8 ms, the maximum expected end delay which the echo canceller in the GS should expect is:

$2 \times (22 + 8) = 60$ ms (see figure 3.7 of GSM 03.50 [3]).

Certain countries on the geographical limits of a continent may need to increase this limit as there may be a proportion of connections which do not comply with ITU-T Recommendations G.165 and G.131 having a mean one-way delay of greater than 25 ms and yet are not provided with echo control.

6.4.3 Acoustic echo control in the PSMN

Refer to clause 3.4.3 of GSM 03.50 [3].

6.4.3.1 Acoustic echo control in a handsfree MES

Refer to clause 3.4.3.1 of GSM 03.50 [3].

6.4.3.2 Acoustic echo control in a handset MES

Refer to clause 3.4.3.2 of GSM 03.50 [3].

6.4.3.3 Acoustic echo control in a headset MES

Refer to clause 3.4.3.3 of GSM 03.50 [3].

6.4.4 Interaction between tandem echo control devices (Reference Configurations B & C)

Refer to clause 3.4.4 of GSM 03.50 [3].

6.5 Clipping

6.5.1 General

Refer to clause 3.5.1 of GSM 03.50 [3].

6.5.2 Properties of voice switches in the PSMN

Refer to clause 3.5.2 of GSM 03.50 [3].

6.5.3 Problems of tandem voice switching

Refer to clause 3.5.3 of GSM 03.50 [3].

6.6 Idle channel noise

6.6.1 Sending

Refer to clause 3.6.1 of GSM 03.50 [3].

6.6.2 Receiving

Refer to clause 3.6.2 of GSM 03.50 [3].

6.7 Noise contrast

6.7.1 General

Refer to clause 3.7.1 of GSM 03.50 [3].

6.7.2 Elements of a PSMN which can cause noise contrast impairment

Refer to clause 3.7.2 of GSM 03.50 [3].

6.7.3 Reduction of noise contrast

Refer to clause 3.7.3 of GSM 03.50 [3].

6.7.3.1 Reduction of noise contrast by limiting the noise received by the microphone

Refer to clause 3.7.3.1 of GSM 03.50 [3].

6.7.3.1.1 Headset MES

Refer to clause 3.7.3.1.1 of GSM 03.50 [3].

6.7.3.1.2 Handsfree MES

Refer to clause 3.7.3.1.2 of GSM 03.50 [3].

6.7.3.2 Reduction of noise contrast by insertion of comfort noise

Refer to clause 3.7.3.2 of GSM 03.50 [3].

6.7.4 Consequence of the introduction of high comfort noise levels on other voice-operated devices

Refer to clause 3.7.4 of GSM 03.50 [3].

6.8 Sensitivity/frequency characteristics

6.8.1 Headset and handset MSs

6.8.1.1 Sending

Refer to clause 3.8.1.1 of GSM 03.50 [3].

6.8.1.2 Receiving

Refer to clause 3.8.1.2 of GSM 03.50 [3].

6.8.2 Handsfree MES

Refer to clause 3.8.2 of GSM 03.50 [3].

6.9 Distortion

6.9.1 Sending

Refer to clause 3.9.1 of GSM 03.50 [3].

6.9.2 Receiving

Refer to clause 3.9.2 of GSM 03.50 [3].

6.10 Sidetone

6.10.1 Sidetone loss

Refer to clause 3.10.1 of GSM 03.50 [3].

6.10.2 Sidetone distortion

Refer to clause 3.10.2 of GSM 03.50 [3].

6.11 Out-of-band signals

6.11.1 Discrimination against out-of-band input signals

Refer to clause 3.11.1 of GSM 03.50 [3].

6.11.2 Spurious out-of-band signals

Refer to clause 3.11.2 of GSM 03.50 [3].

6.12 Requirements for information tones

Refer to clause 3.12 of GSM 03.50 [3].

6.13 Crosstalk

6.13.1 Near and far end crosstalk

Refer to clause 3.13.1 of GSM 03.50 [3].

6.13.2 Go/return crosstalk

Refer to clause 3.13.2 of GSM 03.50 [3].

See clause 6.3 for relevant delay values.

Annex A (informative): Considerations on the acoustic interface of the mobile earth station

A.1 Handsfree MES

Refer to clause A.1 of GSM 03.50 [3].

A.2 Handset MES

Refer to clause A.2 of GSM 03.50 [3].

A.3 Headset MES

Refer to clause A.3 of GSM 03.50 [3].

A.4 Inter-reaction with DTX

Refer to clause A.4 of GSM 03.50 [3].

Annex B (normative): Transmission requirements testing

B.1 Loudness ratings

B.1.1 Sending Loudness Rating (SLR)

Refer to clause B.1.1 of GSM 03.50 [3].

B.1.2 Receiving Loudness Rating (RLR)

Refer to clause B.1.2 of GSM 03.50 [3].

B.2 Idle channel noise

B.2.1 Sending

Refer to clause B.2.1 of GSM 03.50 [3].

B.2.2 Receiving

Refer to clause B.2.2 of GSM 03.50 [3].

B.3 Sensitivity/frequency characteristics

B.3.1 Sending

Refer to clause B.3.1 of GSM 03.50 [3].

B.3.2 Receiving

Refer to clause B.3.2 of GSM 03.50 [3].

B.4 Distortion

B.4.1 Sending

Refer to clause B.4.1 of GSM 03.50 [3].

B.4.2 Receiving

Refer to clause B.4.2 of GSM 03.50 [3].

B.5 Variation of gain with input level

B.5.1 Sending

Refer to clause B.5.1 of GSM 03.50 [3].

B.5.2 Receiving

Refer to clause B.5.2 of GSM 03.50 [3].

B.6 Sidetone

Refer to clause B.6 of GSM 03.50 [3].

B.6.1 Talker sidetone (STMR)

Refer to clause B.6.1 of GSM 03.50 [3].

B.6.2 Listener sidetone (LSTR)

Refer to clause B.6.2 of GSM 03.50 [3].

B.7 Sidetone distortion

Refer to clause B.7 of GSM 03.50 [3].

B.8 Out-of-band signals

B.8.1 Discrimination against out-of-band input signal

Refer to clause B.8.1 of GSM 03.50 [3].

B.8.2 Spurious out-of-band signals

Refer to clause B.8.2 of GSM 03.50 [3].

B.9 Acoustic echo loss

Refer to clause B.9 of GSM 03.50 [3].

Annex C (informative): MES delay requirement definition

The symbol definitions for the calculations in this clause are:

Ttx:	Nominal time from an acoustic event at the MRP to the corresponding bits at the MES antenna.
Tprop(PSTN-MES):	Nominal delay from the earth to the satellite, through the satellite, and back to the earth for MES to PSTN calls.
Tprop(MES-MES):	Nominal delay from the earth to the satellite, through the satellite, and back to the earth for MES to MES calls.
TGSS(forward):	Nominal delay from the PSTN interface through the GSS.
Trx(PSTN-MES):	Nominal time from receipt of bits at the MES antenna to the corresponding acoustic event at the ERP for PSTN to MES calls.
Trx(MES-MES):	Nominal time from receipt of bits at the MES antenna to the corresponding acoustic event at the ERP for MES to MES calls.
TGSS(return):	Nominal delay through the GSS to the PSTN interface.

Note that some voice coding algorithms do not reproduce waveforms that lend themselves to time-domain measurement of delays and that direct measurement of the delays listed above is not practical. The delays are identified to provide guidance to the allocation of delay between the MES and the rest of the system.

The one-way delay from an acoustic event at the MRP to the corresponding bits at the GSS to PSTN interface is therefore

Ttx + Tprop(PSTN-MES) + TGSS(return) = 104 + 265 + 41 = 410 msec

The one-way delay from bits at the PSTN to GSS interface to the corresponding acoustic event at the ERP is therefore:

TGSS(return) + Tprop(PSTN-MES) + Trx(PSTN-MES) = 128 + 265 + 17 = 410 msec

The one-way delay from an acoustic event at the MRP of one MES to the corresponding event at the ERP of another MES is:

Ttx + Tprop(MES-MES) + Trx(MES-MES) = 104 + 305 + 31 = 440 msec

History

Document history		
V1.1.1	March 2001	Publication