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Technical Specification

**GEO-Mobile Radio Interface Specifications;
Part 3: Network specifications;
Sub-part 2: Network Architecture;
GMR-1 03.002**



Reference

DTS/SES-001-03002

Keywords

architecture, GMR, GSM, GSO, interface,
location, MES, mobile, MSS, network, radio,
satellite, S-PCN**ETSI**

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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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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 Throughput Cellular 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 2 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 possible architectures of the GMR-1 Mobile Satellite System. Clause 3 of the present document contains a definition of the different functional entities needed to support the mobile service. In clause 4, the configuration of a Satellite Network is described as well as the organization of the functional entities; the configuration presented is the most general in order to cope with all the possible implementations which can be imagined in the different countries. To illustrate that purpose, some examples of possible configurations are presented. clause 5 of the present document contains a brief description of the interfaces involved which shows the principle of the organization considered.

The present document is based on GSM 03.02 [12].

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 03.003 (ETSI TS 101 376-3-3): "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 3: Numbering, Addressing and identification; GMR-1 03.003".
- [4] GMR-1 03.008 (ETSI TS 101 376-3-4): "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 4: Organization of Subscriber Data; GMR-1 03.008".
- [5] GMR-1 03.012 (ETSI TS 101 376-3-6): "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 6: Location Registration and Position Identification Procedures; GMR-1 03.012".
- [6] GMR-1 03.020 (ETSI TS 101 376-3-9): "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 9: Security related Network Functions; GMR-1 03.020".
- [7] 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".
- [8] GMR-1 03.297 (ETSI TS 101 376-3-19): "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 19: Optimal Routing technical realization; GMR-1 03.297".
- [9] 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; GMR-1 03.298".
- [10] 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; GMR-1 03.299".

- [11] GMR-1 04.002 (ETSI TS 101 376-4-2): "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 2: GMR-1 Satellite Network Access Reference Configuration; GMR-1 04.002".
- [12] GSM 03.02 (ETSI ETS 300 522): "Digital cellular telecommunications system (Phase 2); Network architecture (GSM 03.02 V4.2.1)".
- [13] GSM 03.04 (ETSI ETS 300 524): "European digital cellular telecommunications system (Phase 2); Signalling requirements relating to routing of calls to mobile subscribers (GSM 03.04 V4.0.4)".
- [14] GSM 03.09 (ETSI ETS 300 527): "Digital cellular telecommunications system (Phase 2); Handover procedures (GSM 03.09 V4.6.0)".
- [15] GSM 08.02 (ETSI ETS 300 587-2): "European digital cellular telecommunications system (Phase 2); Base Station System - Mobile-services Switching Centre (BSS - MSC) interface; Interface principles (GSM 08.02 V4.2.0)".
- [16] GSM 09.02 (ETSI ETS 300 599): "Digital cellular telecommunications system (Phase 2); Mobile Application Part (MAP) specification (GSM 09.02 version 4.19.0)".

3 Terminology, definitions and abbreviations

3.1 Terminology

Location register: same as clause 2.1 of GSM 03.02 [12].

Home Location Register (HLR): same as clause 2.1.1 of GSM 03.02 [12].

Visitor Location Register (VLR): same as clause 2.1.2 of GSM 03.02 [12].

Authentication Centre (AuC): same as clause 2.2 of GSM 03.02 [12]. The procedures used for authentication and ciphering are described more in GSM 03.02 [12].

Equipment Identity Register (EIR): same as clause 2.3 of GSM 03.02 [12].

Mobile-services Switching Centre (MSC): same as clause 2.4 of GSM 03.02 [12].

3.2 Definitions

For the purposes of the present document, the following terms and definitions apply:

Satellite Network: is established and operated by an administration or Recognized Private Operation Agency (RPOA) for the specific purpose of providing GeoMobile Radio (GMR-1) satellite telecommunication service to the public.

Spot beam: area of radio coverage controlled and served by one GeoMobile Radio (GMR-1) satellite spot beam

Gateway Station Controller (GSC) area: same as clause 2.7 of GSM 03.02 [12]

Location Area (LA): same as clause 2.8 of GSM 03.02 [12]

MSC area: same as clause 2.9 of GSM 03.02 [12]

VLR area: same as clause 2.10 of GSM 03.02 [12]

Zones for Regional Subscription: same as clause 2.11 of GSM 03.02 [12]. Zones for Regional Subscription and their handling are defined in GMR-1 03.003 [3], GMR-1 03.008 [4] and GSM 09.02 [16].

Service area: same as clause 2.12 of GSM 03.02 [12]

3.2.1 The entities of the mobile system

The Home Location Register (HLR): same as clause 3.1 of GSM 03.02 [12]. The organization of the subscriber data is outlined in GMR-1 03.008 [4].

The Visitor Location Register (VLR): same as clause 3.2 of GSM 03.02 [12]. The information is passed between VLR and HLR by the procedures described in GMR-1 03.012 [5]. The VLR also contains supplementary service parameters attached to the mobile subscriber and received from the HLR. The organization of the subscriber data is outlined in GMR-1 03.008 [4].

The Authentication Centre (AuC): same as clause 3.3 of GSM 03.02 [12]. The procedures used for authentication and ciphering are described more fully in GMR-1 03.020 [6].

The Equipment Identity Register (EIR): same as clause 3.4 of GSM 03.02 [12].

The Mobile-services Switching Centre (MSC): same as clause 3.5 of GSM 03.02 [12].

The Gateway MSC (GMSC): same as clause 3.6 of GSM 03.02 [12]. See also GSM 03.04 [13].

SMS Gateway MSC (SMS-GMSC): same as clause 3.7 of GSM 03.02 [12].

SMS Interworking MSC: same as clause 3.8 of GSM 03.02 [12].

The Interworking Function (IWF): same as clause 3.9 of GSM 03.02 [12].

The Gateway Station Subsystem (GSS): system of gateway station equipments (transceivers, controllers, etc...) which is viewed by the MSC through a single A-interface as being the entity responsible for communicating with Mobile Earth Stations in a certain area. The radio equipment of a GSS may support one or more spotbeams. The GSS consists of one Gateway Station Controller (GSC) and one or more Gateway Transceiver Station (GTS) which an Abis-interface is implemented. The functionality is described in GSM 08.02 [15].

A Gateway Station Controller (GSC) is a network component in the Satellite Network with the functions for control of one or more GTS.

A Gateway Transceiver Station (GTS) is a network component which serves one cell.

The split of functions between GSS and MSC is described in the 08-series of GMR-1 Technical Specifications.

The Mobile Earth Station (MES): consists of the physical equipment used by a GeoMobile (GMR-1) subscriber; it comprises the Mobile Equipment (ME) and the Subscriber Identity Module (SIM). The ME comprises the Mobile Termination (MT) which, depending on the application and services, may support various combinations of Terminal Adapter (TA) and Terminal Equipment (TE) functional groups. These functional groups are described in GMR-1 04.002 [11].

The GeoMobile Radio (GMR-1) Satellite: consists of the physical equipment that provides gateway-mobile, mobile-gateway, and mobile-mobile communication connectivity.

The Advanced Operations Centre (AOC): performs the services of centralized functions. These include performing management of the system and monitoring and controlling resource allocation to the gateway.

The Traffic Control Subsystem (TCS): manages the real-time resources that are allocated to the Gateway Station by the AOC. The TCS manages the GMR-1 specific functions and teleservices which are not normally associated with GSM such as single hopped terminal-to-terminal calls as described in GMR-1 03.296 [7], optimal routing, as described in GMR-1 03.297 [8], high penetration alerting, as described in GMR-1 03.298 [9], and position based services, as described in GMR-1 03.299 [10].

3.3 Abbreviations

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

4 Configuration of a satellite network

4.1 General

The basic configuration of a Satellite Network and interconnection to the PSTN/ISDN/GSM are presented in figure 4.1. The detailed explanation is given in clause 4.1 of GSM 03.02 [12].

4.2 Basic configuration

In the basic configuration presented in figure 4.1, all the functions are considered implemented in different equipments. Therefore, all the interfaces within Satellite Network are external. Interfaces A and Abis are defined in the GSM 08-series of Technical Specifications. Interfaces B, C, D, E, F and G need the support of the Mobile Application Part of the signalling system No. 7 to exchange the data necessary to provide the mobile service. No protocol for the H-interface is standardized. From this configuration, all the possible Satellite Network organizations can be deduced. In the case when some functions are contained in the same equipment, the relevant interfaces become internal to that equipment.

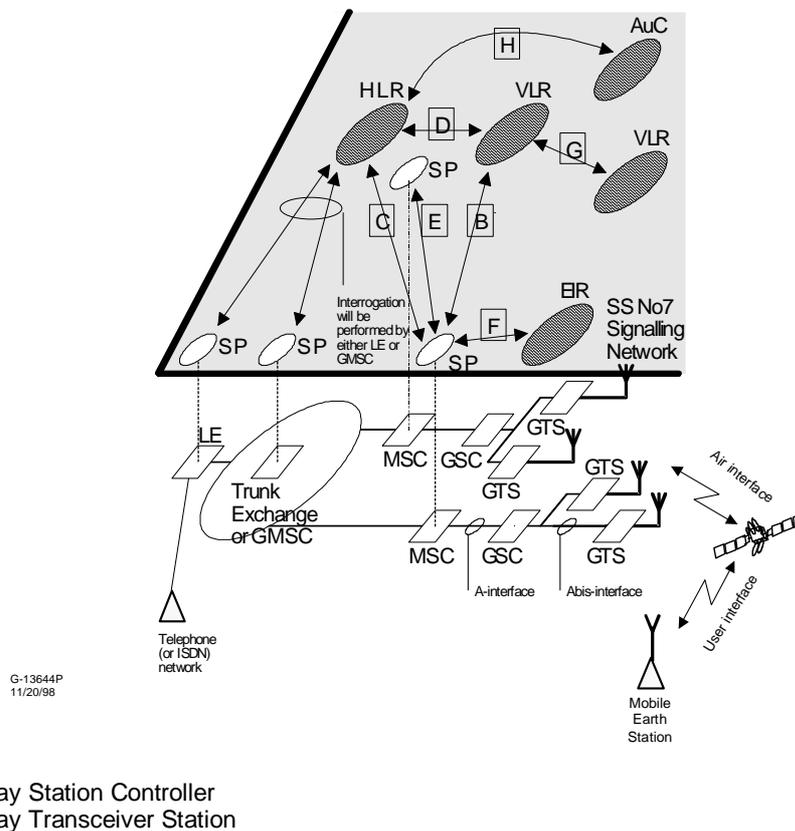


Figure 4.1: Configuration of a Satellite Network and interfaces

5 Satellite network interfaces

5.1 General

Same as clause 5.1 of GSM 03.02 [12].

5.2 Interface between the MSC and Gateway Station System (A-interface)

Same as clause 5.2 of GSM 03.02 [12].

The interface between the MSC and GSS is specified in the 08-series of GSM Technical Specifications.

5.3 Interface between GSC and GTS (Abis-interface)

Same as clause 5.3 of GSM 03.02 [12].

5.4 Interface between the MSC and its associated VLR (B-interface)

Same as clause 5.4 of GSM 03.02 [12].

5.5 Interface between the HLR and the MSC (C-interface)

Same as clause 5.5 of GSM 03.02 [12].

5.6 Interface between the HLR and the VLR (D-interface)

Same as clause 5.6 of GSM 03.02 [12].

5.7 Interface between MSCs (E-interface)

This interface is not applicable for handover procedure. See detail in GSM 03.09 [14].

When a short message is to be transferred between a Mobile Earth Station (MES) and Short Message Service Centre (SC), in either direction, this interface is used to transfer the message between the MSC serving the Mobile Earth Station (MES) and the MSC which acts as the interface to the SC.

5.8 Interface between MSC and EIR (F-interface)

Same as clause 5.8 of GSM 03.02 [12].

5.9 Interface between VLRs (G-interface)

Same as clause 5.9 of GSM 03.02 [12].

5.10 Interface between HLR and AuC (H-Interface)

Same as clause 5.10 of GSM 03.02 [12].

6 Interface between the fixed networks and the MSC

Same as clause 6 of GSM 03.02 [12].

Annex A (informative): Bibliography

GSM 02.16 (ETSI ETS 300 508): "European digital cellular telecommunications system (Phase 2); International Mobile station Equipment Identities (IMEI) (GSM 02.16 V4.5.0)".

GSM 08.01 (ETSI ETS 300 587-1): "European digital cellular telecommunications system (Phase 2); Base Station System - Mobile-services Switching Centre (BSS - MSC) interface; General aspects (GSM 08.01 V4.0.3)".

GSM 08.04 (ETSI ETS 300 588): "European digital cellular telecommunications system (Phase 2); Base Station System - Mobile-services Switching Centre (BSS - MSC) interface; Layer 1 specification (GSM 08.04 V4.0.3)".

GSM 08.06 (ETSI ETS 300 589): "European digital cellular telecommunications system (Phase 2); Signalling transport mechanism specification for the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface (GSM 08.06 V4.5.0)".

GSM 08.08 (ETSI ETS 300 590): "Digital cellular telecommunications system (Phase 2); Mobile-services Switching Centre - Base Station System (MSC - BSS) interface; Layer 3 specification (GSM 08.08 version 4.12.1)".

GSM 08.20 (ETSI ETS 300 591): "European digital cellular telecommunications system (Phase 2); Rate adaption on the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface (GSM 08.20 V4.2.3)".

GSM 08.51 (ETSI ETS 300 592): "European digital cellular telecommunications system (Phase 2); Base Station Controller - Base Transceiver Station (BSC - BTS) interface; General aspects (GSM 08.51 V4.1.0)".

GSM 08.52 (ETSI ETS 300 593): "Digital cellular telecommunications system (Phase 2); Base Station Controller -Base Transceiver Station (BSC - BTS) interface; Interface principles (GSM 08.52 V4.2.0)".

GSM 08.54 (ETSI ETS 300 594): "European digital cellular telecommunications system (Phase 2); Base Station Controller - Base Transceiver Station (BSC - BTS) interface; Layer 1 structure of physical circuits (GSM 08.54 V4.1.0)".

GSM 08.56 (ETSI ETS 300 595): "European digital cellular telecommunications system (Phase 2); Base Station Controller - Base Transceiver Station (BSC - BTS) interface; Layer 2 specification (GSM 08.56 V4.0.2)".

GSM 08.58 (ETSI ETS 300 596): "Digital cellular telecommunications system (Phase 2); Base Station Controller - Base Transceiver Station (BSC - BTS) interface; Layer 3 specification (GSM 08.58 V4.9.0)".

GSM 08.60 (ETSI ETS 300 597): "Digital cellular telecommunications system (Phase 2); In-band control of remote transcoders and rate adaptors for Enhanced Full Rate (EFR) and full rate traffic channels (GSM 08.60 version 4.4.1)".

GSM 08.61 (ETSI ETS 300 598): "European digital cellular telecommunications system (Phase 2); In-band control of remote transcoders and rate adaptors for half rate traffic channels (GSM 08.61 V4.0.2)".

GSM 09.03 (ETSI ETS 300 600): "European digital cellular telecommunications system (Phase 2); Signalling requirements on interworking between the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN) and the Public Land Mobile Network (PLMN) (GSM 09.03 V4.0.3)".

GSM 09.04 (ETSI ETS 300 601): "European digital cellular telecommunications system (Phase 2); Interworking between the Public Land Mobile Network (PLMN) and the Circuit Switched Public Data Network (CSPDN); (GSM 09.04 V4.0.2)".

GSM 09.05 (ETSI ETS 300 602): "European digital cellular telecommunications system (Phase 2); Interworking between the Public Land Mobile Network (PLMN) and the Packet Switched Public Data Network (PSPDN) for Packet Assembly/Disassembly (PAD) facility access; (GSM 09.05 V4.4.2)".

GSM 09.06 (ETSI ETS 300 603): "European digital cellular telecommunications system (Phase 2); Interworking between a Public Land Mobile Network (PLMN) and a Packet Switched Public Data Network/Integrated Services Digital Network (PSPDN/ISDN) for the support of packet switched data transmission services (GSM 09.06 V4.5.0)".

GSM 09.07 (ETSI ETS 300 604): "Digital cellular telecommunications system (Phase 2); General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN); (GSM 09.07 V4.12.1)".

GSM 09.10 (ETSI ETS 300 605): "Digital cellular telecommunications system (Phase 2); Information element mapping between Mobile Station - Base Station System (MS - BSS) and Base Station System - Mobile-services Switching Centre (BSS - MSC) signalling procedures and the Mobile Application Part (MAP); (GSM 09.10 version 4.4.1)".

GSM 09.11 (ETSI ETS 300 606): "Digital cellular telecommunications system (Phase 2); Signalling interworking for supplementary services; (GSM 09.11 V4.6.1)".

History

Document history		
V1.1.1	March 2001	Publication