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Digital Video Broadcasting (DVB); Interaction channel through the Global System for Mobile communications (GSM)

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Foreword

This European Standard (Telecommunications series) has been produced by the Joint Technical Committee (JTC) Broadcast of the European Broadcasting Union (EBU), Comité Européen de Normalisation ELECtrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI).

NOTE: The EBU/ETSI JTC Broadcast was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC Broadcast became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

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Digital Video Broadcasting (DVB) Project

Founded in September 1993, the DVB Project is a marked-led consortium of public and private sector organizations in the television industry. Its aim is to establish the framework for the introduction of MPEG-2 based digital television services. Now comprising over 200 organizations from more than 25 countries around the world, DVB fosters marked-led systems, which meet the real needs, and economic circumstances, of the consumer electronics and the broadcast industry.

National transposition dates	
Date of adoption of this EN:	5 February 1999
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1 Scope

The present document is the baseline specification for the provision of an interaction channel based on Global System for Mobile communications (GSM) to Digital Video Broadcasting (DVB) systems.

The DVB project does not intend to specify an interaction channel solution associated to each broadcast system because the interoperability of different delivery media to transport the interaction channel is desirable. Therefore the GSM solution for the interaction channel apply to satellite, cable, MATV, SMATV, terrestrial, microwave or any future DVB broadcasting or distribution system.

The solutions provided in the present document for an interaction channel through GSM are a part of a wider set of alternatives to implement interactive services for DVB systems.

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, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, subsequent revisions do apply.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] ETS 300 802: "Digital Video Broadcasting (DVB); Network-independent protocols for DVB interactive services".

[2] CENELEC EN 50201: "Interfaces for Digital Video Broadcast Integrated Receiver Decoder (DVB-IRD)".

[3] ETS 300 505: "Digital cellular telecommunications system (Phase 2); Mobile Station (MS) features (GSM 02.07 version 4.8.2)".

[4] ETS 300 556: "European digital cellular telecommunication system (Phase 2); Mobile radio interface signalling layer 3; General aspects GSM 04.07".

[5] ETS 300 557: "Digital cellular telecommunications system (Phase 2); Mobile radio interface; Layer 3 specification (GSM 04.08 version 4.22.0)".

[6] ETS 300 600: "European digital cellular telecommunication 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)".

[7] 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)".

[8] ETS 300 582: "Digital cellular telecommunications system (Phase 2); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS) (GSM 07.01)".

[9] ETS 300 583: "European digital cellular telecommunications system (Phase 2); Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities (GSM 07.02)".

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

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

[12] ETS 300 522: "Digital cellular telecommunications system (Phase 2); Network architecture (GSM 03.02)".

[13] ETS 300 528: "European digital cellular telecommunications system (Phase 2); GSM Public Land Mobile Network (PLMN) connection types (GSM 03.10)".

[14] ETS 300 550: "European digital cellular telecommunications system (Phase 2); Mobile Station - Base Station System (MS - BSS) interface; General aspects and principles (GSM 04.01)".

[15] ETS 300 551: "European digital cellular telecommunications system (Phase 2); GSM Public Land Mobile Network (PLMN) access reference configuration (GSM 04.02)".

[16] ETS 300 552: "European digital cellular telecommunications system (Phase 2); Mobile Station - Base Station System (MS - BSS) interface; Channel structures and access capabilities (GSM 04.03)".

[17] ETS 300 554: "European digital cellular telecommunications system (Phase 2); Data Link (DL) layer; General aspects (GSM 04.05)".

[18] ETS 300 555: "European digital cellular telecommunications system (Phase 2); Mobile Station - Base Station System (MS - BSS) interface; Data Link (DL) layer specification (GSM 04.06)".

[19] ETS 300 562: "European digital cellular telecommunications system (Phase 2); Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface (GSM 04.21)".

[20] GSM 04.22 "Digital cellular telecommunications system (Phase 2+); Radio Link Protocol (RLP) for data and telematic services on the Mobile Station - Base Station System (MS-BSS) interface and the Base Station System -Mobile-services Switching Centre (BSS-MSC) interface".

[21] ETS 300 586: "European digital cellular telecommunications system (Phase 2); Use of the V series Data Terminal Equipment - Data Circuit terminating Equipment (DTE - DCE) interface at the Mobile Station (MS) for Mobile Termination (MT) configuration (GSM 07.06)".

[22] DVB-A008 October 1995: "Commercial requirements for asymmetric interactive services supporting broadcast to the home with narrowband return channels".

3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

BC	Broadcast Channel
BIM	Broadcast Interface Module
BSC	Base Station Controller
BTS	Base Transceiver Station
DCE	Data Circuit-terminating Equipment
DTE	Data Terminal Equipment
DVB	Digital Video Broadcasting
ETS	European Telecommunication Standard
EN	European Norm
GMSK	Gaussian Minimum Shift Keying
GSM	Global System for Mobile Communications
IC	Interactive Channel
IIM	Interactive Interface Module
INA	Interactive Network Adapter
ISDN	Integrated Services Digital Network

MS	Mobile Station
MSC	Mobile Switching Centre
MT	Mobile Termination
NIU	Network Interface Unit
OSI	Open Systems Interconnection
PSTN	Public Switched Telephone Network
RA	Rate Adaptation
SMS	Short Message Service
STB	Set Top Box
STU	Set Top Unit
TDMA	Time Division Multiple Access

4 Reference model

A reference model for the system architecture of narrowband interaction channels in a broadband scenario (asymmetric interactive services) is presented in this clause.

4.1 Protocol Stack Model

Within the DVB commercial requirements for asymmetric interactive services supporting broadcast to the home with narrowband return channel [22], a simple communications model has been used to identify the necessity and importance of each commercial requirement consisting of the following layers (the layers do not coincide exactly with the OSI layers):

Physical layer: Where all the physical (electrical) transmission parameters are defined.

Transport layer: Defines all the relevant data structures and communication protocols like data containers, etc.

Application layer: Is the interactive application software and runtime environment (e.g. home shopping application, script interpreter, etc.).

The present document addresses the lower two layers (the physical and transport layers), leaving the application layer open to competitive market forces. A simplified model of the OSI layers was adopted to facilitate the production of specifications for these nodes. Figure 1 points out the lower layers of the simplified model and identifies some of the key parameters. Following the user requirements for interactive services, no attempt will be made to consider higher layers in the present document.

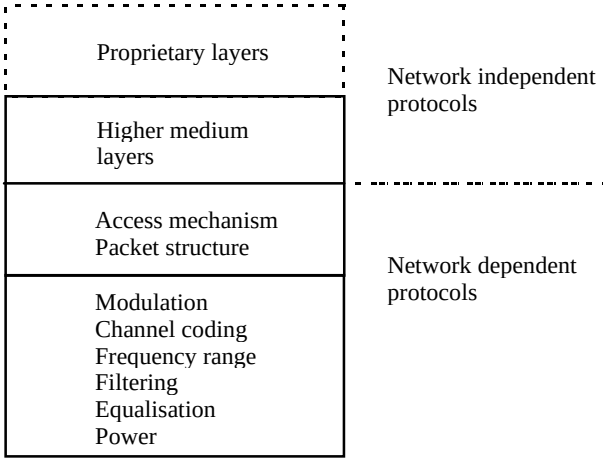

Figure 1: Layer structure for generic system reference model

The present document addresses the GSM specific aspects only. The network independent protocols are specified separately in ETS 300 802 [1].

4.2 System Model

Figure 2 shows the system model which is to be used within DVB for interactive services. In the system model, two channels are established between the service provider and the user:

- *Broadcast Channel (BC):* A unidirectional broadband BC including video, audio and data.
  BC is established from the service provider to the users. It may include the forward interaction path.

- *Interaction Channel (IC):* A bi-directional IC is established between the service provider and the user for interaction purposes. It is formed by:

  - *Return interaction path* (return channel): From the user to the service provider. It is used to make requests to the service provider or to answer questions. It is a narrowband channel. Also commonly known as return channel.

  - *Forward interaction path:* From the service provider to the user. It is used to provide some sort of information by the service provider to the user and any other required communication for the interactive service provision. It may be embedded into the Broadcast Channel. It is possible that this channel is not required in some simple implementations which make use of the Broadcast Channel for the carriage of data to the user.

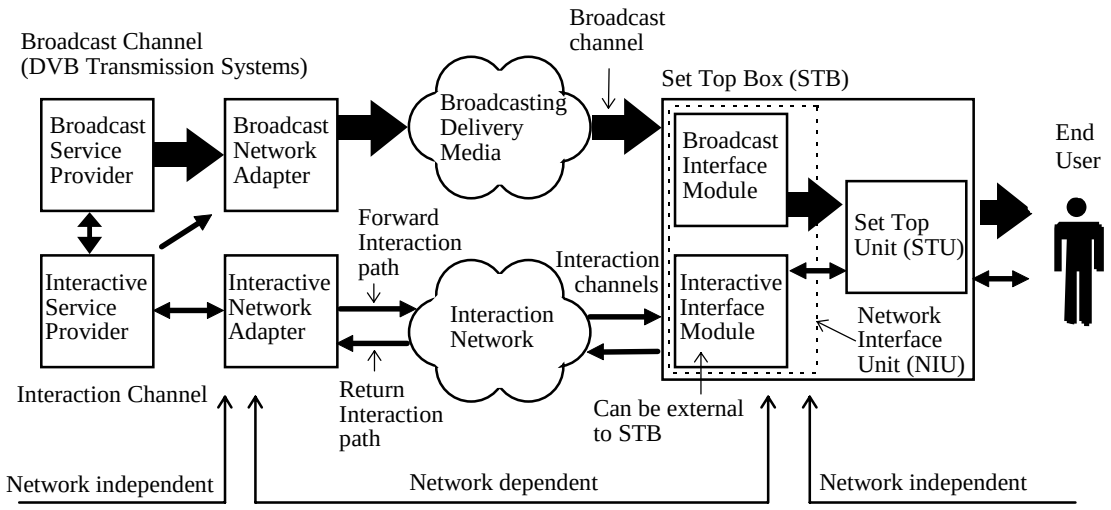

Figure 2: A generic system reference model for interactive systems

The user terminal, here named Set Top Box (STB), is formed by the Network Interface Unit (NIU) (consisting of the Broadcast Interface Module (BIM) and the Interactive Interface Module (IIM)) and the Set Top Unit (STU). The user terminal provides interfaces for both broadcast and interaction channels. The interface between the user terminal and the interaction network is via the Interactive Interface Module (IIM).

5 DVB interaction channel specification for GSM

A GSM infrastructure can support the implementation of the interaction channel for DVB broadcasting systems, by providing a wireless bi-directional communication path between the user terminal and an infrastructure connecting to the service provider.

GSM is a wireless access technology which constitutes the whole or a part of the Interaction Network. The GSM Network may be complemented with another network to reach the service provider (commonly PSTN/ISDN).

In order to allow the access to the GSM Network, the user terminal shall be provided with a GSM Interactive Interface Module (IIM) referred to as a Mobile Station (MS). The interface between the MS and the GSM Network shall be compliant with the standard requirements on General Terminal Adaption Functions (TAF) for Mobile Stations (MS) as in GSM 07.01 [8] and Terminal Adaption Functions for services using asynchronous bearer capabilities GSM 07.02 [9].

The interface between the GSM Network and the external network to provide the whole Interaction Channel shall be compliant with the general and signalling requirements on interworking between the GSM Network and the ISDN or PSTN as in GSM 09.07 [7] and GSM 09.03 [6] or any other GSM interworking specification.

Depending on the network linking (if used) the GSM Network to the service provider, the Mobile Station should be configured to support the right bearer capabilities. In the annex B the interworking functions for PSTN and ISDN are described for informative purposes. When possible it is preferential to implement GSM-ISDN interworking, which provides an end to end digital link between the IIM (Set Top Box) and the INA (Service provider) with lower connection set-up times.

The basic characteristics of GSM are described in annex A.

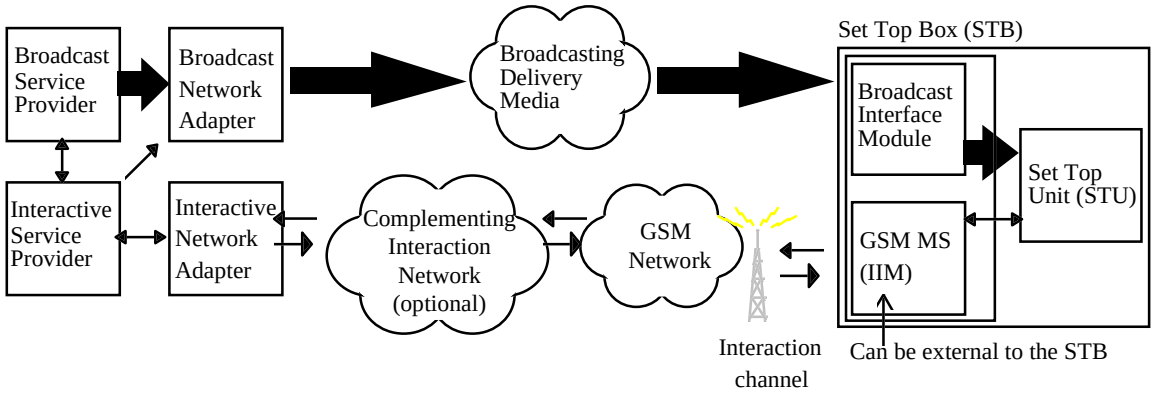

Figure 3: System architecture when GSM is used as the interaction channel

5.1 Physical interfaces

The physical interfaces relate to how the GSM MS is connected to the STU. It applies to user terminals with internal or external MS.

5.1.1 External MS

The external MS shall support the interfaces requirements between the User Terminal (DTE) and de MS (DCE) according to GSM 07.06 [21] and in the same way as described in EN 50201 [2] for "modem interface" (subclause 4.3.1.1).

5.1.2 Integrated MS

The internal MS shall meet the same requirements as the external MS with the exception of providing the 9 pin interface connector.

5.2 Calling procedures

The connection to the GSM Network shall be established according to GSM 04 series. The signalling protocols are described in "Mobile Radio Interface; Layer 3 Specification" (GSM 04.08) [5]. In case the service provider is not reachable because any reason (line is busy, coverage issues, channel availability, etc.) the upper layers will be responsible to repeat the calling attempts and/or inform to the user.

5.3 Forced disconnection

Disconnection for emergency calls can be implemented by the upper layer protocols using the signalling channel.

Annex A (informative): Basic characteristics of GSM

A.1 GSM, general

The GSM (Global System for Mobile Communications) systems can be operated in several frequency bands, e.g. 900 MHz, 1 800 MHz, and has reached world-wide success. The GSM network is realized as a network of contiguous cells, providing a complete coverage of the service area. Each cell has a Base Transceiver Station (BTS) operating on a dedicated set of radio channels. BTSs are logically grouped together and controlled by a Base Station Controller. A group of BSCs is served by a Mobile services Switching Centre (MSC). The GSM system uses TDMA access technique and GMSK modulation on 200 kHz wide carriers which results in a gross data rate of 270 kbit/s. This capacity is split in 8 full- or 16 half-rate channels and some signalling channels.

GSM is a digital cellular radio network containing standardized services as speech, fax and data. Some of the GSM data services that can be used in the DVB context is presented below. A GSM network does not have to offer all the specified data services, so described data services may not be implemented in all GSM networks.

GSM teleservices offer an end-to-end communication capability, including terminal equipment functions. GSM bearer services operate at OSI layer 1 to 3 between access points, serving as a base for teleservices (not the teleservice SMS) or user specific communication protocols. GSM offers secure data transfer within the GSM network, due to subscriber authentication and data enciphering.

GSM specifies a teleservice called, SMS (Short Message Service). The short message MT/PP (Mobile Terminated/ Point-to-Point) and short message MO/PP (Mobile Originated/Point-to-Point) services can be used to transmit text messages with a maximum length of 160 characters (SMS messages longer than 160 characters are specified and achieved by a concatenation procedure) between a mobile station and an SMS Service Centre (SMS-SC). An SMS-SC operates as a store and forward relay for messages and can be accessed via different sources.

GSM specifies several bearer services. Bearer services are circuit switched and data rates up to 9,6 kbit/s are at present supported. A non-transparent bearer service uses ARQ (automatic retransmission request) and has, therefore an error rate of effectively zero, but a variable delay.

A GSM Network can interwork with other GSM Networks, PSTN (Public Switched Telephone Network), ISDN (Integrated Services Digital Network) and PSPDN (Packet Switched Public Data Network).

A.2 Future GSM data services

The GSM phase 1 and phase 2 data services, as those presented in clause A.1, are introduced in most networks. GSM is still evolving, where ETSI is standardizing GSM phase 2+ services.

One of the phase 2+ services are packet data in GSM with speeds up to around 100 kbit/s. The GPRS (General Packet Radio Service) standardization is in its final stages.

A high-speed circuit-switched data (HSCSD) service formed by combining several traffic channels has also been standardized.

Annex B (informative): Interworking types

When two dissimilar networks are required to interwork in order to support a communication between two subscribers, one on each network, a number of Interworking Functions (MSC/IWFs) are required to support the communication.

Service interworking is required when the Teleservices at the calling and called terminals are different. No service interworking has been identified as a requirement of GSM system for the purpose of this specification. However, network interworking is required whenever a GSM network and a non-GSM network together are involved to provide an end-to-end connection.

The concept of Bearer Services was developed for the ISDN and has been extended to the GSM. A Bearer Service is described as a type of telecommunication service that provides the capability for the transmission of signals between user-network interfaces.

Bearer Services are described by a number of attributes, where an attribute is defined as a specified characteristic of an object or element whose values distinguish that object or element from others. Refer to GSM 02.02 [11] for complete list of bearer services, and GSM 04.08 [5] for coding of Bearer Capabilities.

Table B.1

Bearer Service category in GSM network	Bearer Service in GSM	Bearer Service in ISDN	Service in PSTN
Circuit mode unstructured with unrestricted digital capability. Transparent and Non transparent	Asynchronous Data 300 bit/s	Circuit mode structured 64 kbit/s unrestricted	Not Applicable
	Asynchronous Data 1,2 kbit/s		
	Asynchronous Data 1 200/75 bit/s		
	Asynchronous Data 2,4 kbit/s		
	Asynchronous Data 4,8 kbit/s		
	Asynchronous Data 9,6 kbit/s		
3,1 kHz Audio Ex PLMN Transparent and Non transparent	Asynchronous Data 300 bit/s	Circuit mode 3,1 kHz Audio	Circuit mode 3,1 kHz Audio
	Asynchronous Data 1,2 kbit/s		
	Asynchronous Data 1 200/75 bit/s		
	Asynchronous Data 2,4 kbit/s		
	Asynchronous Data 4,8 kbit/s		
	Asynchronous Data 9,6 kbit/s		

It is necessary to consider separately each type of interworking (i.e. GSM-ISDN and GSM-PSTN) since, in the worst case, "PSTN" could refer to an essentially analogue network without common-channel signalling.

B.1 Interworking to PSTN

For interworking of data calls between GSM and a PSTN a modem will be utilized to provide the interworking function.

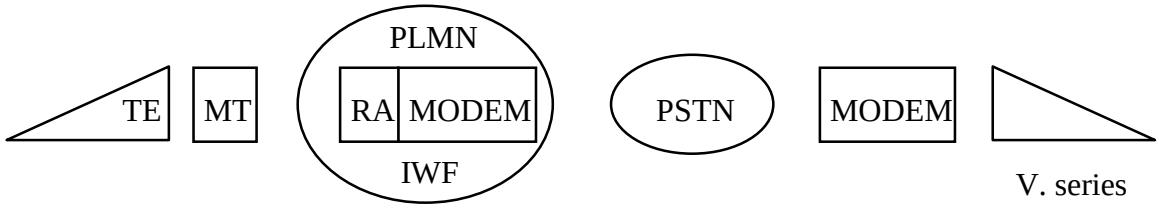

Figure B.1: PLMN PSTN interworking for circuit switched calls

The interworking function will need to negotiate with the user to establish the appropriate modem selection e.g. data rate, modulation scheme, etc. In addition, it will also be required to convert the signalling format, from a combination of out-of-band and in-band, to that suitable for controlling the modem and the autocalling line procedure function where applicable. In the following modem selection procedures it is assumed that the interworking function and modems will be associated with each MSC.

For a data call originated by a circuit mode data terminal on the GSM network, the modem selection is done by using the field "modem type" in the call set-up message ((bearer capability information element)).

In addition, other elements of the call set-up will indicate the user rate, etc. to be used via that modem. The use of this information however, means that the network is only able to select a modem from the modem pool which conforms to the speed which the terminal is utilizing at the DTE/DCE interface at the mobile station (e.g. V.22 for 1 200 bit/s). The exception to this is where the user has selected the non transparent service in which case either an auto-bauding or multi self-selecting-speed modem (e.g. V.32) may be used.

B.2 Interworking to ISDN

Low layer compatibility checking of the mobile originated call is carried out by the MSC/IWF to determine the appropriate bearer service selection in the ISDN. This will entail the MSC/IWF in mapping appropriately the GSM BC-IE (Bearer Capability Information Element) to the ISDN BC-IE. If it is not possible for the MSC/IWF to provide a bearer service match, then the MSC/IWF should fail the call and indicate the reason to the user.

The MS should provide further compatibility information (LLC/HLC-IEs) if required for defining end-to-end compatibility.

Where the bearer capability information indicates that the call is a circuit switched unrestricted digital call, then the MSC/IWF should select the appropriate rate adapted ISDN bearer service.

The selection of the MSC/IWF will be by means of the bearer capability information within the call set up message. The mobile subscriber should be able to select the unrestricted digital capability, which the MSC/IWF will map to the same capability in the ISDN call set up message. If an interworking point is encountered within the ISDN which does not support this service request, then a cause failure message indicating network unable to support service requested will be returned to the GSM network which will then pass this to the mobile subscriber. This will be used at the MS to clear the call. It will then be possible for the mobile subscriber to initiate a new call request this time indicating the transfer capability "3,1 kHz Ex GSM" plus other attributes such as user rate, modem type, etc.

History

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