



SLOVENSKI STANDARD
SIST EN 301 790 V1.3.1:2003
01-december-2003

Digitalna videoradiodifuzija (DVB) – Povratni kanal za satelitske distribucijske sisteme

Digital Video Broadcasting (DVB); Interaction channel for satellite distribution systems

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Ta slovenski standard je istoveten z: EN 301 790 Version 1.3.1

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ICS:

33.070.40	Satelit	Satellite
33.170	Televizijska in radijska difuzija	Television and radio broadcasting

SIST EN 301 790 V1.3.1:2003 **en**

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ETSI EN 301 790 V1.3.1 (2003-03)

European Standard (Telecommunications series)

Digital Video Broadcasting (DVB); Interaction channel for satellite distribution systems

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Reference

REN/JTC-DVB-138

Keywords

broadcasting, DVB, interaction, satellite

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Sous-Préfecture de Grasse (06) N° 7803/88

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Foreword

This European Standard (Telecommunications series) has been produced by 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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Founded in September 1993, the DVB Project is a market-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 market-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:	7 March 2003
Date of latest announcement of this EN (doa):	30 June 2003
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 December 2003
Date of withdrawal of any conflicting National Standard (dow):	31 December 2003

1 Scope

The present document forms the specification for the provision of the interaction channel for GEO satellite interactive networks with fixed return channel satellite terminals (RCST). The present document facilitates the use of RCSTs for individual or collective installation (e.g. SMATV) in a domestic environment. It also supports the connection of such terminals with in-house data networks. The present document may be applied to all frequency bands allocated to GEO satellite services.

The solutions provided for interaction channel for satellite interactive networks are a part of a wide set of alternatives to implement interactive services through Digital Video Broadcasting (DVB) systems.

The revision accomplished in 2002 provides the means to extend the applicability of the standard to regenerative satellite systems. This revision also allows for reduction in terminal costs without significantly impacting the performance.

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.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

- [1] ETSI EN 300 421: "Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for 11/12 GHz satellite services".
- [2] ETSI TR 101 202: "Digital Video Broadcasting (DVB); Implementation guidelines for Data Broadcasting".
- [3] ETSI ETS 300 802: "Digital Video Broadcasting (DVB); Network-independent protocols for DVB interactive services".
- [4] ETSI EN 300 468: "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems".
- [5] ETSI EN 301 192: "Digital Video Broadcasting (DVB); DVB specification for data broadcasting".
- [6] ETSI EN 301 459: "Satellite Earth Stations and Systems (SES); Harmonized EN for Satellite Interactive Terminals (SIT) and Satellite User Terminals (SUT) transmitting towards satellites in geostationary orbit in the 29,5 to 30,0 GHz frequency bands covering essential requirements under article 3.2 of the R&TTE Directive".
- [7] IETF RFC 2684 (1999): "Multiprotocol Encapsulation over ATM Adaptation Layer 5".
- [8] ETSI TR 100 815: "Digital Video Broadcasting (DVB); Guidelines for the handling of Asynchronous Transfer Mode (ATM) signals in DVB systems".
- [9] ISO/IEC 13818-1 (1996): "Information technology - Generic coding of moving pictures and associated audio information - Part 1: Systems".
- [10] ETSI TR 101 154: "Digital Video Broadcasting (DVB); Implementation guidelines for the use of MPEG-2 Systems, Video and Audio in satellite, cable and terrestrial broadcasting applications".

- [11] ITU-T Recommendation Q.2931 (1995): "Digital Subscriber Signalling System No. 2 - User-Network Interface (UNI) - Layer 3 specification for basic call/connection control".
- [12] IEEE 802.3 (1996): "Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications".
- [13] ITU-T Recommendation I.432 (all parts): "B-ISDN user-network interface - Physical layer specification".
- [14] ETSI ES 200 800: "Digital Video Broadcasting (DVB); DVB interaction channel for Cable TV distribution systems (CATV)".
- [15] IETF RFC 2104 (1997): "HMAC: Keyed-Hashing for Message Authentication".
- [16] ANSI/IEEE 754 (1985): "IEEE Standard for Binary Floating-Point Arithmetic".
- [17] ISO/IEC 13818-6 (1998): "Information technology - Generic coding of moving pictures and associated audio information - Part 6: Extensions for DSM-CC".
- [18] ITU-T Recommendation I.363-5 (1996): "B-ISDN ATM Adaptation Layer specification: Type 5 AAL".

3 Definitions, symbols and abbreviations

3.1 Definitions

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For the purposes of the present document, the following term and definition applies:

reserved: when used in the clauses defining the coded bit stream, indicates that the value may be used for future extensions

NOTE: The value of reserved bits follows EN 300 468 [4] except in encrypted DVB-RCS specific messages as explicitly stated in clause 8.

3.2 Symbols

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

\times	multiplication
\wedge	power
\sim	concatenation
mod	modulo division
(unsigned char)x	ANSI C cast operator: converts value x to unsigned char
""	empty string (zero length)
nonce1	random string (NCC)
nonce2	random string (RCST)
N_{atm}	Number of ATM cells in an ATM TRF burst (1, 2 or 4).
N_{mpeg}	Number of MPEG packets in an optional MPEG2-TS TRF burst ($1, 2 \times n$ for $n = 1$ to 12).
$N_{\text{p,atm}}$	Number of bytes of the optional prefix used on ATM TRF bursts (0, 2 or 4).
$N_{\text{p,sync}}$	Number of bytes of the optional SAC field used on SYNC bursts, after randomization and including optional CRC: 0, 2...31 for concatenated code, 0, 12 or 16 for the Turbo code (see clause 6.4).

3.3 Abbreviations

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

AAL	ATM Adaptation Layer
ACQ	Acquisition burst
ATM	Asynchronous Transfer Mode
AVBDC	Absolute Volume-Based Dynamic Capacity
BCD	Binary Coded Decimal
BTP	Burst Time Plan
CBC	Cipher Block Chaining
CMF	Control and Monitoring Functions
CMT	Correction Message Table
CR	Capacity Requests
CRA	Constant-Rate Assignment
CRC	Cyclic Redundancy Check
CRSC	Circular Recursive Systematic Convolutional
CSC	Common Signalling Channel
CTRL/MNGM	Control/Management virtual channel used in DULM
DES	Data Encryption Standard
DSM-CC	Digital Storage Medium - Command and Control
DULM	Data Unit Labelling Method
DVB	Digital Video Broadcast
DVB-S	Digital Video Broadcast by Satellite
EKE	Explicit Key Exchange
FCA	Free Capacity Assignment
FCT	Frame Composition Table
FLS	Forward Link Signalling
GEO	Geostationary Earth Orbit
GFC	Generic Flow Control
HMAC	Hash-based Message Authentication Code
I	In-phase
ID	Identifier
IDU	Indoor unit
IE	Information Element
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISO	International Standards Organization
ITU	International Telecommunication Union
IV	Initialization Vector
LFSR	Linear Feedback Shift Register
LLC	Logical Link Control
LSB	Least Significant Bit
MAC	Medium Access Control
MandC	Monitoring and Control
MF-TDMA	Multiple-Frequency Time-Division Multiple Access
MIB	Management Information Base
MKE	Main Key Exchange
MPEG	Moving Picture Experts Group
MSB	Most Significant bit
NCC	Network Control Centre
NCR	Network Clock Reference
NIT	Network Information Table
NIU	Network Interface Unit
ODU	Outdoor unit
OSI	Open Systems Interconnection
PAT	Program Association Table
PC	Personal Computer
PCR	Program Clock Reference

PID	Packet IDentifier
PMT	Program Map Table
ppm	parts per million
PRBS	Pseudo Random Binary Sequence
PRNG	Pseudo-Random Number Generator
PSI	Program Specific Information
PSTN	Public Switched Telephone Network
PVC	Permanent Virtual Circuit
Q	Quadrature
QKE	Quick Key Exchange
QPSK	Quadrature Phase-Shift Keying
RBDC	Rate-Based Dynamic Capacity
RCST	Return Channel Satellite Terminal
RMT	RCS Map Table
RS	Reed-Solomon
SAC	Satellite Access Control
SAR	Segmentation And Re-assembly
SCT	Superframe Composition Table
SDT	Service Description Table
SI	Service Information
SIT	Satellite Interactive Terminal
SMATV	Satellite Master Antenna Television
SNAP	Sub Network Access Protocol
SNMP	Simple Network Management Protocol
SPT	Satellite Position Table
SUT	Satellite User Terminal
SVC	Switched Virtual Circuit
SYNC	Synchronization burst type
TBTP	Terminal Burst Time Plan
TCT	Time-slot Composition Table
TDMA	Time-Division Multiple Access
TG	Traffic Gateway
TIM	Terminal Information Message
TRF	Traffic (burst type)
TS	Transport Stream
Tx	Transmitter
UNI	User Network Interface
VBDC	Volume-Based Dynamic Capacity
VCI	Virtual Circuit Identifier
VPI	Virtual Path Identifier

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4 Reference models for satellite interactive networks in DVB

4.1 Protocol stack model

For interactive services supporting broadcast to the end user with return channel, a simple communications model consists of the following 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.).

A simplified model of the OSI layers was adopted to facilitate the production of specifications for these layers. Figure 1 points out the lower layers of the simplified model and identifies some of the key parameters for the lower two layers.

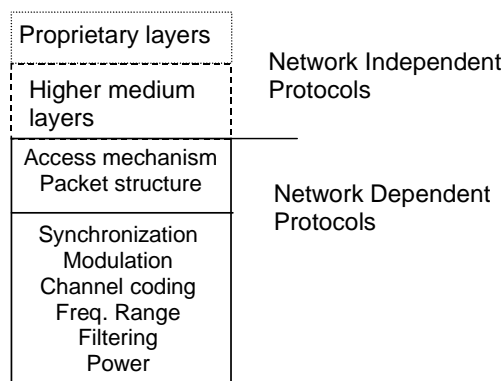


Figure 1: Layer structure for generic system reference model

The present document addresses the satellite interactive network dependent aspects only.

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:** a unidirectional broadband Broadcast Channel including video, audio and data is established from the service provider to the users. It may include the Forward Interaction Path.
- **Interaction Channel:** a bi-directional Interaction Channel is established between the service provider/user 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/user, to answer questions or to transfer data.
 - **Forward Interaction Path:** from the service provider to the user. It is used to provide information from the service provider/user to the user(s) 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.

The RCST is formed by the Network Interface Unit (consisting of the Broadcast Interface Module and the Interactive Interface Module) and the Set Top Unit. The RCST provides interface for both Broadcast and Interaction Channels. The interface between the RCST and the interaction network is via the Interactive Interface Module.

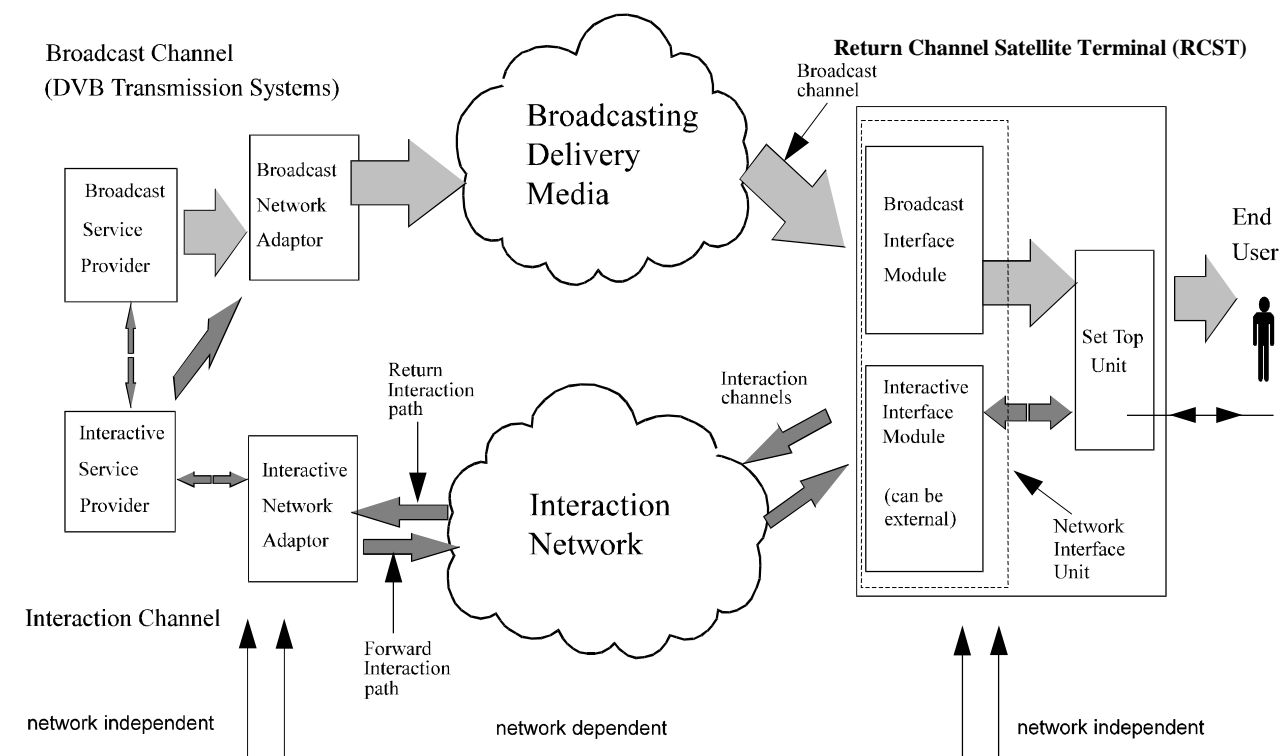


Figure 2: A generic system reference model for interactive systems

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4.3 Reference model of the Satellite Interactive Network

An overall Satellite Interactive Network, within which a large number of Return Channel Satellite Terminal (RCST) will operate, will comprise the following functional blocks, as shown in figure 3:

- **Network Control Centre:** a NCC provides Control and Monitoring Functions (CMF). It generates control and timing signals for the operation of the Satellite Interactive Network to be transmitted by one or several Feeder Stations.
- **Traffic Gateway:** a TG receives the RCST return signals, provides accounting functions, interactive services and/or connections to external public, proprietary and private service providers (data bases, pay-per-view TV or video sources, software download, tele-shopping, tele-banking, financial services, stock market access, interactive games etc.) and networks (Internet, ISDN, PSTN, etc.).
- **Feeder:** a Feeder transmits the forward link signal, which is a standard satellite digital video broadcast (DVB-S) uplink, onto which are multiplexed the user data and/or the control and timing signals needed for the operation of the Satellite Interactive Network.

An RCST is e.g. a SIT or a SUT as described in [6].