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Digital Video Broadcasting (DVB); DVB specification for data broadcasting

EBU DVB

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Foreword

This draft European Standard (EN) 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), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

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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The DVB Project is an industry-led consortium of broadcasters, manufacturers, network operators, software developers, regulators and others from around the world committed to designing open, interoperable technical specifications for the global delivery of digital media and broadcast services. DVB specifications cover all aspects of digital television from transmission through interfacing, conditional access and interactivity for digital video, audio and data. The consortium came together in 1993.

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

The DVB System provides a means of delivering MPEG-2 Transport Streams (TS) via a variety of transmission media. MPEG-2 TSs were primarily intended for the delivery of Video and Audio. The present document introduces data broadcasting as an extension to the MPEG-2 based DVB transmission standards.

Five different application areas with different requirements for the data transport are addressed. For each application area a data broadcasting profile is specified in the present document. The following is a short description of the application areas and the profiles.

Data piping:

- The data broadcast specification profile for data pipes (as defined in clause 4) supports data broadcast services that require a simple, asynchronous, end-to-end delivery of data through DVB compliant broadcast networks.

Data streaming:

- The data broadcast specification profile for data streaming supports data broadcast services that require a streaming-oriented, end-to-end delivery of data in either an asynchronous, synchronous or synchronized way through DVB compliant broadcast networks.
- Asynchronous data streaming is defined in clause 5 and allows the streaming of data without any timing requirements (e.g. RS-232 data).
- Synchronous data streaming is defined in clause 6 and allows the streaming of data with timing requirements in the sense that the data and clock can be regenerated at the receiver into a synchronous data stream.

Multiprotocol encapsulation:

- The data broadcast specification profile for multiprotocol encapsulation (as defined in clause 7) supports data broadcast services that require the transmission of datagrams of communication protocols via DVB compliant broadcast networks.
- Clause 8 further defines a standard mechanism for signalling IP/MAC services deployed within DVB networks and enables the implementation of DVB receivers that are completely self-tuning when accessing IP/MAC streams on one or more transport streams.
- Mechanisms for power-optimized reception and forward error correction for multiprotocol encapsulation are defined in clause 9.

Data and object carousels:

- Data broadcast services that require the periodic transmission of data are called data carousels, and are defined in clause 10.
- Object carousels (as defined in clause 11) are based on data carousels, and provide an additional hierarchical structure and further metadata, such as for example needed to build a hierarchical file system.

Higher protocols based on asynchronous data streams:

- The data broadcast specification profile for higher protocols (as defined in clause 12) is based on asynchronous data streams, and supports the transmission of protocols that require a stream-oriented delivery of asynchronous data through DVB compliant broadcast networks.

1 Scope

The present document specifies transport and encapsulation protocols, and signalling for carrying general purpose data over DVB Transport Streams. The present document is designed to be used in conjunction with ETSI EN 300 468 [2].

Data broadcasting is an important extension of the MPEG-2 based DVB transmission standards. Examples are the download of software over satellite, cable or terrestrial links, the delivery of Internet services over broadcast channels (IP tunnelling), interactive TV, etc.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ISO/IEC 13818-1: "Information technology - Generic coding of moving pictures and associated audio information - Systems".

[2] ETSI EN 300 468: "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems".

[3] ETSI TS 101 162: "Digital Video Broadcasting (DVB); Allocation of identifiers and codes for Digital Video Broadcasting (DVB) systems".

[4] ISO/IEC 13818-6: "Information technology - Generic coding of moving pictures and associated audio information - Part 6: Extensions for DSM-CC".

[5] ETSI EN 300 472: "Digital Video Broadcasting (DVB); Specification for conveying ITU-R System B Teletext in DVB bitstreams".

[6] IETF RFC 1112 (August 1989): "Host extensions for IP multicasting".

[7] IETF RFC 2045 (November 1996): "Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies", N. Freed, N. Borenstein.

[8] IETF RFC 2046 (November 1996): "Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types", N. Freed, N. Borenstein.

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

[10] ISO/IEC 8802-1: "Information technology; Telecommunications and information exchange between systems; Local and metropolitan area networks; Specific requirements; Part 1: Overview of Local Area Network Standards".

[11] ISO/IEC 8802-2: "Information technology; Telecommunications and information exchange between systems; Local and metropolitan area networks; Specific requirements; Part 2: Logical link control".

[12] ETSI EN 300 743: "Digital Video Broadcasting (DVB); subtitling systems".

[13] ISO/IEC 8859-1: "Information technology - 8-bit single-byte coded graphic character sets - Part 1: Latin alphabet No. 1".

[14] ISO 639-2:1998: "Code for the representation of names of languages - Part 2: Alpha-3 code".

[15] IETF RFC 1950 (May 1996): "ZLIB Compressed Data Format Specification version 3.3".

[16] "RTCM Recommended Standards for Differential GNSS (Global Navigation Satellite Systems) Service", Version 2.2, Radio Technical Commission For Maritime Services, January 1998.

[17] CEN ISO/TS 18234: "Traffic and Travel Information (TTI) -- TTI via Transport Protocol Expert Group (TPEG) data-streams".

[18] ETSI TS 102 006: "Digital Video Broadcasting (DVB); Specification for System Software Update in DVB Systems".

[19] IETF RFC 2464 (1998): "Transmission of IPv6 Packets over Ethernet Networks".

[20] IETF RFC 1661 (1994): "The Point-to-Point Protocol (PPP)".

[21] ETSI TS 103 197: "Digital Video Broadcasting (DVB); Head-end implementation of DVB SimulCrypt".

[22] ETSI EN 302 307-1: "Digital Video Broadcasting (DVB); Second generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications; Part 1: DVB-S2".

[23] ETSI EN 302 755: "Digital Video Broadcasting (DVB); Frame structure channel coding and modulation for a second generation digital terrestrial television broadcasting system (DVB-T2)".

[24] ETSI EN 302 769: "Digital Video Broadcasting (DVB); Frame structure channel coding and modulation for a second generation digital transmission system for cable systems (DVB-C2)".

[25] DVB BlueBook A160: "Next Generation broadcasting system to Handheld, physical layer specification (DVB-NGH)".

[26] ETSI EN 302 307-2: "Digital Video Broadcasting (DVB); Second generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications; Part 2: DVB-S2 Extensions (DVB-S2X)".

[27] ETSI TS 102 606-2: "Digital Video Broadcasting (DVB); Generic Stream Encapsulation (GSE); Part 2: Logical Link Control (LLC)".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] Void.

[i.2] IEEE 802-2001™: "Standard for Local and Metropolitan Area Networks: Overview and Architecture".

3 Definition of terms, symbols and abbreviations

3.1 Terms

Void.

3.2 Symbols

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

kbits	kilo bits
Mbits	Mega bits
ms	millisecond

3.3 Abbreviations

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

AFI	Authority and Format Identifier
BAT	Bouquet Association Table
bslbf	bit string, left bit first
CA	Conditional Access
CAT	Conditional Access Table
CRC	Cyclic Redundancy Code
DAVIC	Digital Audio VIsual Council
dGNSS	differential GNSS
DII	DownloadInfoIndication
DSI	DownloadServerInitiate
DSM-CC	DSM-CC data carousel specification (Digital Storage Media- Command and Control)
DVB	Digital Video Broadcasting
DVB-C2	Second Generation DVB Cable Modulation

NOTE: See ETSI EN 302 769 [24].

DVB-S2	Second Generation DVB Satellite Modulation

NOTE: See ETSI EN 302 307-1 [22].

DVB-T	DVB Terrestrial Modulation (first generation)
DVB-T2	Second Generation DVB Terrestrial Modulation

NOTE: See ETSI EN 302 755 [23].

EBU	European Broadcasting Union
ECM	Entitlement Control Message
EIT	Event Information Table
EMM	Entitlement Management Message
FEC	Forward Error Correction
GNSS	Global Navigation Satellite Systems
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers (USA)
INT	IP Notification Table
IP	Internet Protocol
IRD	Integrated Receiver/Decoder
ISDN	Integrated Services Digital Network
ISI	Input Stream Identifier

NOTE: See ETSI EN 302 307-1 [22].

ISO	International Organization for Standardization

ISP	Internet Service Provider
LLC	Logical Link Control
MAC	Media Access Control
MHP	Multimedia Home Platform
mi	ModuleInfoBytes
MIME	Multipurpose Internet Mail Extensions
MPE	Multi-Protocol Encapsulation
MPEG	Moving Pictures Expert Group
MSB	Most Significant Bit
NIT	Network Information Table
NSAP	Network Service Access Point
OFDM	Orthogonal Frequency-Division Multiplexing
OSI	Open Systems Interconnection
OUI	Organizational Unique Identifier
PAT	Program Association Table

NOTE: See ISO/IEC 13818-1 [1].

PCR	Program Clock Reference
PES	Program Elementary Stream
PID	Packet IDentifier
PLP	Physical Layer Pipe

NOTE: See ETSI EN 302 755 [23], ETSI EN 302 769 [24] and DVB BlueBook A160 [25].

PLR	Packet Loss Radio
PMT	Program Map Table
PPP	Point-to-Point Protocol
PSI	Program Specific Information
PSTN	Public Switched Telephone Network
PTS	Presentation Time Stamps
RF	Radio Frequency
RFC	Request For Comment
rpchof	remainder polynomial coefficients, highest order first
RS	Reed Solomon
RTCM	Radio Technical Commission For Maritime services
SDT	Service Description Table
SI	Service Information
SIS	Systems for Interactive Services
SNAP	SubNetwork Attachment Point
SSU	System Software Update
TPEG	Transport Protocol Experts Group
TS	Transport Stream
T-STD	Transport System Target Decoder
UDP	User Datagram Protocol
uimsbf	unsigned integer most significant bit first
UNT	Update Notification Table
U-U	User-User
VLSM	Variable-Length Subnet Mask
XOR	eXclusive OR

NOTE: See ETSI TS 102 006 [18].

4 Data piping

4.1 Data transport specification

The data broadcast service shall insert the data to be broadcast directly in the payload of MPEG-2 TS packets.

The data broadcast service may use the payload_unit_start_indicator field and the transport_priority field of the MPEG-2 Transport Stream packets in a service private way. The use of the adaptation_field shall be MPEG-2 compliant.

The delivery of the bits in time through a data pipe is service private and is not specified in the present document.

4.2 PSI and SI specifications

4.2.0 General rules

The data broadcast service shall indicate the use of a data pipe by including one or more data_broadcast_descriptors in SI (see ETSI EN 300 468 [2]). Each descriptor shall be associated with a particular data pipe via a component_tag identifier. In particular, the value of the component_tag field shall be identical to the value of the component_tag field of a stream_identifier_descriptor (see ETSI EN 300 468 [2]) that may be present in the PSI program map section for the stream that is used as a data pipe.

4.2.1 Data_broadcast_descriptor

The data_broadcast_descriptor is used in the following way:

data_broadcast_id: this field shall be set to 0x0001 to indicate a DVB data pipe (see ETSI TS 101 162 [3]).

component_tag: this field shall have the same value as a component_tag field of a stream_identifier_descriptor (if present in the PSI program map section) for the stream that is used as a data pipe.

selector_length: this field shall be set to zero.

selector_byte: this field is not present.

4.2.2 Stream type

The specification of the stream_type in the program map section is not defined in the present document.

5 Asynchronous data streaming

5.1 Data transport specification

The data broadcast service shall insert the data to be broadcast in PES packets as defined by MPEG-2 Systems ISO/IEC 13818-1 [1]. The PES packets shall be of non-zero length. The mapping of the PES packets into MPEG-2 Transport Stream packets is defined in MPEG-2 Systems ISO/IEC 13818-1 [1].

The asynchronous data streaming specification uses the standard PES packet syntax and semantics with the following constraints:

stream_id: this field shall be set to the value of 0xBF (private_stream_2).

PES_packet_length: this is a 16-bit field which shall be set to a non-zero value.

5.2 PSI and SI specifications

5.2.0 General rules

The data broadcast service shall indicate the use of an asynchronous data stream by including one of more data broadcast descriptors in SI (see ETSI EN 300 468 [2]). Each descriptor shall be associated with a particular stream via a component_tag identifier. In particular, the value of the component_tag field shall be identical to the value of the component_tag field of a stream_identifier_descriptor (see ETSI EN 300 468 [2]) that may be present in the PSI program map section for the stream that is used as a data stream.

5.2.1 Data_broadcast_descriptor

The data broadcast descriptor is used in the following way:

data_broadcast_id: this field shall be set to 0x0002 to indicate an asynchronous data stream (see ETSI TS 101 162 [3]).

component_tag: this field shall have the same value as a component_tag field of a stream_identifier_descriptor (if present in the PSI program map section) for the stream on which the data is broadcast.

selector_length: this field shall be set to zero.

selector_byte: this field is not present.

5.2.2 Stream type

The presence of an asynchronous data stream in a service shall be indicated in the program map of that service by setting the stream type of that stream to the value of 0x06 or a user private value.

6 Synchronous and synchronized data streaming

6.1 Data transport specification

The data broadcast service shall insert the data to be broadcast in PES packets as defined by MPEG-2 Systems. The PES packets shall be of non-zero length. The mapping of the PES packets into MPEG-2 Transport Stream packets is defined in MPEG-2 Systems ISO/IEC 13818-1 [1].

The synchronous and synchronized data streaming specifications use the standard PES packet syntax and semantics with the following constraints:

stream_id: this field shall be set to the value of 0xBD (private_stream_1) for synchronous and synchronized data streams.

PES_packet_length: this is a 16-bit field which shall be set to a non-zero value.

The data is inserted in PES packets using the PES_data_packet structure. The syntax and semantics of the PES_data_packet structure are defined in Table 1.

Table 1: Syntax for PES_data_packet structure

Syntax	No. of bits	Mnemonic
PES_data_packet () {		
data_identifier	8	uimsbf
sub_stream_id	8	uimsbf
PTS_extension_flag	1	bslbf
output_data_rate_flag	1	bslbf
reserved	2	bslbf
PES_data_packet_header_length	4	uimsbf
if (PTS_extension_flag=="1") {		
reserved	7	bslbf
PTS_extension	9	bslbf
}		
if (output_data_rate_flag=="1") {		
reserved	4	bslbf
output_data_rate	28	uimsbf
}		
for (i=0;i<N;i++) {		
PES_data_private_data_byte	8	bslbf
}		
for (i=0;i<N;i++) {		
PES_data_byte	8	bslbf
}		
}		

The semantics of the PES_data_packet are as follows:

data_identifier: this 8-bit field identifies the type of data carried in the PES data packet. It is coded as in Table 2 (see also ETSI TS 101 162 [3] and ETSI EN 300 472 [5]).

Table 2: Coding for data_identifier field

data_identifier	Value
0x00 to 0x0F	reserved for future use
0x10 to 0x1F	reserved for EBU data (see ETSI EN 300 472 [5])
0x20	DVB subtitling (see ETSI EN 300 743 [12])
0x21	DVB synchronous data stream
0x22	DVB synchronized data stream
0x23 to 0x7F	reserved for future use
0x80 to 0xFF	user defined

The data_identifier field shall be set to the same value for each PES packet conveying data in the same data stream.

sub_stream_id: this is an 8-bit field. Its use is user private.

PTS_extension_flag: this is a 1-bit field. It shall be set to "1" for synchronous data streams. For synchronized data streams, a value of "1" indicates the presence of the PTS_extension field in the PES_data_packet. If the PTS_extension field is not present for synchronized data streams, this flag shall be set to "0".

output_data_rate_flag: this is a 1-bit field. It shall be set to "0" for synchronized data streams. For synchronous data streams a value of "1" indicates the presence of the output_rate field in the PES_data_packet. If the output_rate field is not present for synchronous data streams, this flag shall be set to "0".

PES_data_packet_header_length: this is a 4-bit field. It shall specify the length of the optional fields in the packet header including the PES_data_private_data_bytes.

PTS_extension: this is a 9-bit field. This field extends the PTS conveyed in the PES header of this PES packet. This field contains the 9-bit Program Clock Reference (PCR) extension as defined in MPEG-2 Systems (see ISO/IEC 13818-1 [1]) that extends the time resolution of data PTS's (synchronous or synchronized) from the MPEG-2 standard resolution of 11,1 µs (90 kHz) to 37 ns (27 MHz).