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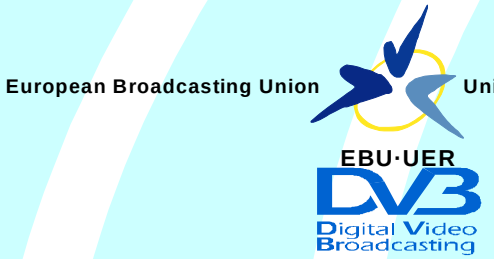
European Standard (Telecommunications series)

Digital Video Broadcasting (DVB); Specification for conveying ITU-R System B Teletext in DVB bitstreams



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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), and is now submitted for the ETSI standards One-step 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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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.

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

1 Scope

The present document specifies the method by which ITU-R System B Teletext (ITU-R Recommendation BT.653 [3]), also known as EBU Teletext (see EN 300 706 [4]), may be carried in DVB bitstreams. This transport mechanism is intended to satisfy the following requirements:

- to support the transcoding of the Teletext data into the Vertical Blanking Interval (VBI) of analogue video. The transcoded signal should be compatible with existing TV receivers with Teletext decoders;
- the maximum data rate for each Teletext service is equivalent to 16 lines per field so that the service is always suitable for transcoding into the VBI;
- the transmission mechanism should be capable of transmitting subtitles with accurate timing with respect to the video (i.e. to within or near frame accuracy).

A more general data transport mechanism for conveying new types of data services is outside the scope of the present document, but the transport syntax specified here can also be adapted for other data.

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] 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] ITU-R Recommendation BT.653: "Teletext systems Teletext systems".

[4] ETSI EN 300 706: "Enhanced Teletext specification".

3 Definitions and abbreviations

3.1 Definitions

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

MPEG-2: Refers to the standard ISO/IEC 13818. Systems coding is defined in part 1. Video coding is defined in part 2. Audio coding is defined in part 3 of ISO/IEC 13818.

section: syntactic structure used for mapping all service information defined in EN 300 468 into ISO/IEC 13818-1 Transport Stream (TS) packets

service: sequence of programmes under the control of a broadcaster which can be broadcast as part of a schedule

Teletext descriptor: See EN 300 468 [2], it is used in the Program Specific Information (PSI) Program Map Table (PMT) to identify streams which carry EBU data. The descriptor is located in a program map section following the relevant ES_info_length field.

3.2 Abbreviations

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

DVB	Digital Video Broadcasting
MPEG	Moving Pictures Expert group
PES	Packetized Elementary Stream
PID	Packet IDentifier
PMT	Program Map Table
PSI	Program Specific Information
PTS	Presentation Time Stamp
SI	Service Information
TS	Transport Stream
TV	TeleVision
VBI	Vertical Blanking Interval

4 Insertion of Teletext into MPEG-2 transport multiplex

Teletext data are conveyed in Packetized Elementary Stream (PES) packets which are carried by Transport Stream (TS) packets as defined in ISO/IEC 13818-1 [1].

The Packet Identifier (PID) of a Teletext stream associated with a service is identified in the Program Map Table (PMT) of the Program Specific Information (PSI) for that service.

The Teletext data stream is given stream_type value 0x06 (which indicates a PES stream carrying private data).

The appropriate ES_info field of the program map section describing Teletext data streams shall contain a Teletext descriptor as defined in EN 300 468 [2].

A service may include more than one Teletext data stream, provided that each stream has a different value of data_identifier, and that the streams are distinguishable by their respective Teletext descriptors in the PSI.

4.1 Transport Stream (TS) packet format

The standard TS packet syntax and semantics are followed, noting the following constraint:

adaptation_field_control only the values "01" and "10" are permitted.

4.2 PES packet format

The standard PES packet syntax and semantics are followed noting the following constraints:

stream_id set to "1011 1101" meaning "private_stream_1".

PES_packet_length set to the value (N × 184)-6, where N is an integer, so that the PES packet finishes at the end of a Transport packet.

Data_alignment_indicator set to "1" indicating that the Teletext access units are aligned with the PES packets.

PES_header_data_length set to "0x24".

stuffing_byte the PES header is followed by as many stuffing bytes as are required to make up the header data length, so that the entire PES header is 45 bytes long.

PES_packet_data_byte these bytes are coded in accordance with the PES_data_field syntax specified below.

PTS and other optional fields may be present in the PES header, but the header length is always fixed for streams identified in the Program Specific Information (PSI) by the DVB Teletext descriptor (see EN 300 468 [2]).

NOTE: See annex A.

4.3 Syntax for PES data field

Table 1: Syntax for PES data field

Syntax	No. of bits	Identifier
PES_data_field(){		
data_identifier	8	uimsbf
for(i=0;i<N;i++){		
data_unit_id	8	uimsbf
data_unit_length	8	uimsbf
data_field()		
}		
}		

Data_field for EBU Teletext

Table 2: Syntax for Data_field for EBU Teletext

Syntax	No. of bits	Identifier
data_field(){		
reserved_future_use	2	bslbf
field_parity	1	bslbf
line_offset	5	uimsbf
framing_code	8	bslbf
magazine_and_packet_address	16	bslbf
data_block	320	bslbf
}		

4.4 Semantics for PES data field

data_identifier: this 8-bit field identifies the type of data carried in the PES packet. It is coded as in table 3:

Table 3: data_identifier

data_identifier	value
0x00 to 0x0F	reserved for future use
0x10 to 0x1F	EBU data
0x02 to 0x7F	reserved for future use
0x80 to 0xFF	user defined

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

data_unit_id: this 8-bit field identifies the type of data unit. It is coded as in table 4:

Table 4: data_unit_id

data_unit_id	value
0x00 to 0x01	reserved for future use
0x02	EBU Teletext non-subtitle data
0x03	EBU Teletext subtitle data
0x04 to 0x7F	reserved for future use
0x80 to 0xFE	user defined
0xFF	data_unit for stuffing

For streams identified in the PSI by the DVB Teletext descriptor (see EN 300 468 [2]), only values 0x02, 0x03 and 0xFF are permitted.

data_unit_length: this 8-bit field indicates the number of bytes in the data unit following the length field.
For data units carrying EBU Teletext data, this field shall always be set to 0x2C.

reserved_future_use: this field may be used in the future for ETSI defined extensions.
As a default reserved_future_use bits are set to "1".

field_parity: this 1-bit flag specifies the field for which the data is intended; the value "1" indicates the first field of a frame, the value "0" indicates the second field of a frame.

line_offset: this 5-bit field specifies the line number on which the Teletext data packet is intended to be presented if it is transcoded into the VBI.
Within a field, the line_offset numbering shall follow a progressive incremental order except for the undefined line_offset value "0".
The toggling of the field_parity flag indicates a new field.

The line_offset is coded as in table 5:

Table 5: line_offset

line_offset	Meaning	
	field_parity = 1	field_parity = 0
0x00	Line number undefined	Line number undefined
0x01 to 0x06	reserved for future use	reserved for future use
0x07	Line number = 7	Line number = 320
0x08	Line number = 8	Line number = 321
:	:	:
0x16	Line number = 22	Line number = 335
0x17 to 0x1F	reserved for future use	reserved for future use

Only values 0x00 and 0x07 to 0x16 are permitted for EBU Teletext data_units in streams identified in the PSI by the DVB Teletext descriptor, see EN 300 468 [2].

framing_code, magazine_and_packet_address, data_block: these fields correspond to the 43 bytes following the clock-run-in sequence of an EBU Teletext data packet as defined in ITU-R Recommendation BT.653 [3], and also in EN 300 706 [4]. Data packets are inserted in the same order as they are intended to arrive at the Teletext decoder or to be transcoded into the VBI. Data bits are inserted in the PES packet in the same order as they would appear in the VBI, e.g. the framing code is 11100100.

5 Teletext decoder model

The Teletext decoder model is a conceptual model for decoding, which the bitstream is required to satisfy.
The decoder model does not specify the operation or behaviour of a real decoder implementation and implementations which do not follow the architecture or timing of this model are not precluded.

A Teletext access unit is defined as a Teletext data packet. The PTS applies to the first access unit following the PTS field. The presentation time is that at which the decoded text is intended to be presented on the screen, or in the case of a transcoding operation, the time at which the access unit is to be inserted in the VBI.

The system target decoder has buffers TB_{ttx} = 480 bytes, and B_{ttx} = 1 504 bytes.
The transfer rate from TB_{ttx} to B_{ttx} is 6,75 Mbit/s.

For a transcoding process an access unit is extracted from B_{ttx} instantaneously whenever a video line of the appropriate number and field-parity is available in the associated video, provided that the system time clock has reached the value of the PTS associated with this or any previous access unit.
For a direct decoding process, access units are extracted from B_{ttx} instantaneously whenever a complete access unit is available, provided that the system time clock has reached the value of the PTS associated with this or any previous access unit.

NOTE 1: The model for the direct decoding process is always satisfied if the transcoding model is obeyed.

Data remains in the buffer B_{ttx} for a maximum of 40 ms.

NOTE 2: In a real decoder implementation, there may need to be additional buffering relative to the target decoder model described here to account for the variable synchronization process between the decoded video and the display output.

Annex A (informative): PTS transmission

It appears that the wording *"PTS and other optional fields may be present in the PES header"* in clause 4.2 on the PES packet format has led to multiple interpretations.

Though the original intention of the authors was to express that the PTS should always be included in the transmission - hence the choice of the PES format - it was also recognized that not all decoders might need the accuracy offered by the PTS. Therefore, clause 5 on the Teletext decoder model, includes the specification of a maximum retention time of 40 ms for the B_{ttx} buffer of the System Target Decoder's buffer model. By adding this timing constraint to the transmission channel it was ensured that decoders could work with reasonable accuracy even if the PTS values in the coded Teletext stream were ignored.

In practice, however, this specification resulted in at least two ways of conveying and subsequently decoding Teletext data:

- the method where PTS *is* indeed transmitted and actually used for decoding (and for validation of the 40 ms timing constraint in the multiplex), and
- the method where not only the PTS is *not* used for decoding, but is also *not* transmitted.

As for legacy reasons we cannot change PTS transmission from mandatory to optional or vice versa depending on the interpretation of the current standard the recommended practice for new implementations should be as follows:

- encoders should support the insertion of Presentation Time Stamps whenever possible, and
- decoders may use the PTS to synchronize the decoding process, but shall also be able to perform the decoding process before the maximum retention time of 40 ms is elapsed.

History

Document history		
Edition 1	December 1994	Publication as ETS 300 472
Edition 2	October 1996	Publication as ETS 300 472
V1.2.2	August 1997	Publication
V1.3.1	January 2003	One-step Approval Procedure OAP 20030523: 2003-01-22 to 2003-05-23