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SERIES J: CABLE NETWORKS AND TRANSMISSION OF TELEVISION, SOUND PROGRAMME AND OTHER MULTIMEDIA SIGNALS

Miscellaneous

Transport mechanism for component-coded digital high-definition television signals using MPEG-2 video coding including all service elements for contribution and primary distribution

ITU-T Recommendation J.187

For further details, please refer to the list of ITU-T Recommendations.

ITU-T Recommendation J.187

Transport mechanism for component-coded digital high-definition television signals using MPEG-2 video coding including all service elements for contribution and primary distribution

Summary

This Recommendation specifies the general transport mechanism for conveying all the service elements required for contribution and primary distribution applications of TV programs whose vertical resolution is quite high compared to 525/60 or 625/50 television systems (e.g. 1125/60 system) using the MPEG-2 4:2:2 profile or Main profile at High level compression. The service elements provided to MPEG-2 coding systems are assumed to be (4:2:2) component video signals, studio quality audio signals and various data signals, e.g. time code. This Recommendation ensures the compatibility on the level of the bit-stream into a decoder. It is based on and is in conformity with the MPEG-2 standard ITU-T Rec. H.222.0 | ISO/IEC 13818-1.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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ITU-T Recommendation J.187

Transport mechanism for component-coded digital high-definition television signals using MPEG-2 video coding including all service elements for contribution and primary distribution

1   Scope

This Recommendation specifies the general transport mechanism for conveying all the service elements required for contribution and primary distribution applications of TV programs whose vertical resolution is quite high compared to 525/60 or 625/50 television systems (e.g. 1125/60 system) using the MPEG-2 4:2:2 profile or Main profile at High level compression. The service elements provided to MPEG-2 coding systems are assumed to be (4:2:2) component video signals, studio quality audio signals and various data signals e.g. time code. This Recommendation ensures the compatibility on the level of the bit-stream into a decoder. It is based on, and is in conformity with the MPEG-2 standard ITU-T Rec. H.222.0 | ISO/IEC 13818-1. The scope of this Recommendation is basically in accordance with ITU-T Rec. J.89, which specifies the transport mechanism of 525/60 and 625/50 television systems, excluding the compatibility for any VBI data specific to composite video signals.

2   References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

2.1   Normative references

–   ITU-T Recommendation H.222.0 (2000) | ISO/IEC 13818-1:2000, *Information technology – Generic coding of moving pictures and associated audio information: Systems*.

–   ITU-T Recommendation H.262 (2000) | ISO/IEC 13818-2:2000, *Information technology – Generic coding of moving pictures and associated audio information: Video*.

–   ITU-T Recommendation J.89 (1999), *Transport Mechanism for component-coded digital television signals using MPEG-2 4:2:2P@ML including all service elements for contribution and primary distribution*.

–   ITU-R Recommendation BT.1304 (1997), *Checksum for error detection and status information in interfaces conforming with Recommendations ITU-R BT.656 and ITU-R BT.799*.

–   ITU-R Recommendation BT.1305 (1997), *Digital audio and auxiliary data as ancillary data signals in interfaces conforming to Recommendations ITU-R BT.656 and ITU-R BT.799*.

–   ITU-R Recommendation BT.1364 (1998), *Format of ancillary data signals carried in digital component studio interfaces*.

–   ITU-R Recommendation BT.1366 (1998), *Transmission of time code and control code in the ancillary data space of a digital television stream according to ITU-R BT.656, ITU-R BT.799 and ITU-R BT.1120*.

2.2 Informative references

– SMPTE 12M-1999, *Television, Audio and Film – Time and Control Code*.

3 Terms, definitions and acronyms

This Recommendation defines the following terms:

3.1 access unit: A coded representation of a presentation unit. In the case of audio, an access unit is the coded representation of an audio frame. In the case of video, an access unit includes all the coded data for a picture, and any stuffing that follows it, up to, but not including, the start of the next access unit. If a picture is not preceded by a group_start_code or a sequence_header_code, the access unit begins with the picture_start_code. If a picture is preceded by a group_start_code and/or a sequence_header_code, the access unit begins with the first byte of the first of these start codes. If it is the last picture preceding a sequence_end_code in the bitstream, all bytes between the last byte of the coded picture and the sequence_end_code (including the sequence_end_code) belong to the access unit.

3.2 decoding time-stamp: A field that may be present in a PES packet header that indicates the time that an access unit is decoded in the system target decoder.

3.3 packet identifier: A unique integer value used to identify elementary streams of a program in a single or multi-program transport stream as described in 2.4.3 of ITU-T Rec. H.222.0 | ISO/IEC 13818-1.

3.4 payload: Payload refers to the bytes which follow the header bytes in a packet. For example, the payload of some transport stream packets includes a PES_packet_header and its PES_packet_data_bytes, or pointer_field and PSI sections, or private data; however, a PES_packet_payload consists of only PES_packet_data_bytes. The transport stream packet header and adaptation fields are not payload.

3.5 PES packet: The data structure used to carry elementary stream data. A PES packet consists of a PES packet header followed by a number of contiguous bytes from an elementary data stream. It is a layer in the system coding syntax described in 2.4.3.6 of ITU-T Rec. H.222.0 | ISO/IEC 13818-1.

3.6 PES packet header: The leading fields in a PES packet up to and not including the PES_packet_data_byte fields, where the stream is not a padding stream. In the case of a padding stream the PES packet header is similarly defined as the leading fields in a PES packet up to and not including padding_byte fields.

3.7 PES stream: A PES stream consists of PES packets, all of whose payloads consist of data from a single elementary stream, and all of which have the same stream_id. Specific semantic constraints apply. Refer to Intro. 4 of ITU-T Rec. H.222.0 | ISO/IEC 13818-1.

3.8 presentation time-stamp: A field that may be present in a PES packet header that indicates the time that a presentation unit is presented in the system target decoder.

3.9 presentation unit: A decoded audio access unit or a decoded picture.

3.10 program clock reference: A time-stamp in the transport stream from which decoder timing is derived.

3.11 reserved: The term "reserved", when used in the clauses defining the coded bit stream, indicates that the value may be used in the future for ISO-defined extensions. Unless otherwise specified within ITU-T Rec. H.222.0 | ISO/IEC 13818-1, all reserved bits shall be set to "1".

3.12 time-stamp: A term that indicates the time of a specific action such as the arrival of a byte or the presentation of a presentation unit.

3.13   transport stream packet header: The leading fields in a transport stream packet, up to and including the continuity_counter field.

4   Transport mechanism

This Recommendation follows the method of describing bit stream syntax and uses symbols given in clause 2 of ITU-T Rec. H.222.0 | ISO/IEC 13818-1.

4.1   Systems layer

PCR repetition rate: The PCR shall occur typically every field interval (e.g. 16.6 ms for the 1125/60 TV system) and at least every 100 ms.

PCR position: PCRs (and adaptation fields) shall be inserted either in the video stream or in a separate PCR stream.

4.2   Video

4.2.1   Video PES format

Stream_Id: "1110 xxxx" (video stream number xxxx).

PES_packet_length: "0x0000" (neither specified nor bounded and allowed only in PES packets whose payload consists of bytes from a video elementary stream contained in transport stream packets).

data_alignment_indication: "1" (the PES packet header is immediately followed by the video start code).

Alignment type 0x03 (GOP or SEQ).

PTS_DTS_flags: "10" (PTS fields shall be present in the PES packet header).

"11"(Both the PTS fields and DTS fields shall be present in the PES packet header).

4.2.2   Video layers

Profile: The MPEG-2 4:2:2 profile or Main profile shall be implemented.

Level: The MPEG-2 High level shall be implemented.

4.3   Compressed audio

The PES mapping of compressed audio is defined in ITU-T Rec. J.89.

4.4   Uncompressed audio

The PES mapping of uncompressed audio is defined in ITU-T Rec. J.89.

4.5   Ancillary data

Ancillary data is defined by ITU-R Rec. BT.1364 and includes checksum, time code and uncompressed digital audio defined in ITU-R Rec. BT.1304, ITU-R Rec. BT.1366 and ITU-R Rec. BT.1305, respectively. The following applies to transport of the ancillary data. This method may optionally be applied to the audio stream according to ITU-R Rec. BT.1305.

4.5.1 PES packet format

Stream_Id: "1011 1101" (private_stream_1).

data_alignment_indicator: "1" (the PES packet header is immediately followed by the sync word). Alignment_type "0x02" (Video Access Unit).

PTS_DTS_flags: "10" (PTS fields shall be present in the PES packet header).

PES_packet_data_byte: These bytes are coded in accordance with the ANC_data ( ) syntax as defined in Table 1.

Table 1/J.187 – ANC data field

Syntax	No. of bits	Mnemonic
ANC_data ( ) {		
for (i=0; i<N; i++) {		
ANC_data_field ( )		
while (!byte_aligned)		
zero_bit	**1**	**"1"**
}		
for (i=0; i<N1; i++){		
stuffing_byte	**8**	**"1111 1111"**
}		
}		
ANC_data_field ( ) {		
"0x00"	**6**	**bslbf**
Y/C_identifier	**1**	**bslbf**
line_number	**11**	**uimsbf**
horizontal_offset	**12**	**uimsbf**
data_ID	**10**	**bslbf**
DBN_SDID	**10**	**bslbf**
data_count	**10**	**bslbf**
for (i=0, i<data_count; i++){		
user_data_word	**10**	**bslbf**
}		
checksum_word	**10**	**bslbf**
}		
NOTE – The ANC_data_field ( ) consists of a header which consists of "0x000", Y/C_identifier (0:Y, 1:C), line_number and horizontal_offset followed by the ancillary data packet content (as defined in ITU-R Rec. BT.1364) starting after the ancillary data flag.		
line_number: This 11-bit word contains the line number (1 to 1250).		
horizontal_offset: This 12-bit word contains the horizontal address (0 to 2376) in a line indicated by the line_number.		

4.6 Data

The PES mapping of optional user data channels (excluding ancillary data) is defined in ITU-T Rec. J.89.

4.6.1 PES format

Stream_Id: "10111101" (private_stream_1).

PES_packet_length: N * 184 – 6, where N is the integer.

data_alignment_indicator: "0" (no alignment) or "1" (the PES packet header is immediately followed by the sync word).

Alignment_type 0x01 (Sync word).

PTS_DTS_flags: "10" (PTS fields shall be present in the PES packet header).

PES_header_data_length: 6.

PES_packet_data_bytes: Filled with the bits of the data channel with removed channel coding.

4.7 Data lines

The content of the data lines (time code and encoder information) are carried by packets defined with the syntax stated below. The data lines of one video frame form one or more access units.

4.7.1 PES packet format

As defined in ITU-T Rec. J.89.

4.7.2 Syntax for PES data field

As defined in ITU-T Rec. J.89.

4.7.3 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 indicated in Table 2.

Table 2/J.187 – Data identifier

Data identifier	Value
0x00-0x7F	reserved
0x80	TC data
0x81-0x9F	reserved
0xA0	encoder information
0xA1-0xFF	reserved

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 indicated in Table 3.

Table 3/J.187 – Data unit id

Data unit id	Value
0x00-0x80	reserved
0x81	VITC and LTC
0x82	VITC
0x83-0xA0	reserved
0xA1	encoder status
0xA2	video coding parameters
0xA3-0xFE	reserved
0xFF	stuffing unit

4.8 Time code

In the case where the time code is delivered as LTC or VITC the following applies:

4.8.1 PES packet format

As defined in ITU-T Rec. J.89.

4.8.2 Syntax for PES data field

The syntax for the PES data field is defined in ITU-T Rec. J.89.

The syntax for the data field is given in Table 4.

Table 4/J.187 – Time code data field

Syntax	No. of bits	Mnemonic
data_field ( ){		
reserved	**2**	**bslbf**
field_parity	**1**	**bslbf**
line_offset	**5**	**uimsbf**
VITC_block	**90**	**bslbf**
reserved	**38**	**bslbf**
LTC_block	**80**	**bslbf**
reserved	**17*8**	**bslbf**
}		

4.8.3 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 indicated in Table 2.

data_unit_id: This 8-bit field identifies the type of data unit. It is coded as given in Table 3.

data_unit_length: This 8-bit field indicates the number of bytes in the data unit following the length field. For data units carrying the time code only this field shall always be set to "0x2C".

reserved: 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 or a progressive frame, the value "0" indicates the second field of a frame.

line_offset: This 5-bit field specifies the line number on which the time code 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/J.187 – Line offset

line_offset	line number		
	1125-line system		750-line system
	field_parity = 1	field_parity = 0	field_parity = 1
0x00	undefined	undefined	undefined
0x01-0x06	reserved	reserved	reserved
0x07	7	570	7
0x08	8	571	8
0x09	9	572	9
0x0A	10	573	10
---	---	---	---
0x13	19	582	19
0x14	20	583	20
0x15	reserved	reserved	21
0x16	reserved	reserved	22
0x17	reserved	reserved	23
0x18	reserved	reserved	24
0x19	reserved	reserved	25
0x1A-0x1F	reserved	reserved	reserved

VITC_block: This field corresponds to the 90 VITC data bits as defined in SMPTE 12M 1), starting with bit number 0. An unused block is filled with ones.

LTC_block: This field corresponds to the 80 LTC data bits defined in SMPTE 12M 1), starting with bit number 0. An unused block is filled with ones.

4.9 Encoder information

Real-time information from the encoder to the decoder may be conveyed by PES packets. The PES mapping of the encoder information is defined in ITU-T Rec. J.89.

5 Channel adaptations

PES packets generated by this Recommendation could be adapted to network channels with some recommended approaches defined in ITU-T Rec. J.89.

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