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J.189

Corrigendum 1

(04/2003)

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Miscellaneous

Seamless splicing for MPEG-2 bit streams

Corrigendum 1

ITU-T Recommendation J.189 (2002) – Corrigendum 1

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ITU-T Recommendation J.189

Seamless splicing for MPEG-2 bit streams

Corrigendum 1

Source

Corrigendum 1 to ITU-T Recommendation J.189 was approved by ITU-T Study Group 9 (2001-2004) under the WTSA Resolution 1 on 4 April 2003.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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As of the date of approval of this Recommendation, ITU had 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.189

Seamless splicing for MPEG-2 bit streams

Corrigendum 1

1) Clause 1 Scope

Modify this clause as follows:

The processing of the MPEG-2 bit stream is becoming increasingly necessary in television transmission chains to avoid picture quality degradation due to multiple cascaded MPEG-2 encoding and decoding cycles. ~~In fact,~~ Many local television operators normally receive several ~~TV program~~television signals from ~~different or~~ remote sources in the form of MPEG-2 bit streams. They switch these program signals at an appointed time to produce complete ~~TV~~ television programs ~~signals~~, or they insert local advertisements and emergency messages into already complete television programs~~the TV program signals~~. In these switching systems, seamless ~~bit stream insertions,~~ splicing has been ~~strongly demanded~~required to avoid picture quality degradation ~~on the splicing point~~ at the decoder ~~side~~.

For MPEG-2 bit-stream splicing, ~~two~~ a number of techniques have been recommended, including those in ITU-T Recs H.222.0 ~~| ISO/IEC 13818-1~~ and J.181. ~~An MPEG-2 syntax of a spliceable bit stream recommended in ITU-T Rec. H.222.0 | ISO/IEC 13818-1 means a PID stream whose discontinuity in a time-stamp or a time base can be processed seamlessly by the MPEG-2 bit stream splicing device. These syntaxes are defined as splicing point flag, seamless splice flag, splice type and so forth. The transport mechanism of scheduling information on a splicing event for splicing devices is also recommended in ITU-T Rec. J.181.~~

~~This Recommendation specifies a seamless splicing technique for the MPEG-2 bit stream based on the two existing Recommendations above. The MPEG-2 syntax of a spliceable bit stream is fully in accordance with ITU-T Rec. H.222.0 | ISO/IEC 13818-1, while the transport mechanism of scheduling information is modified by applying some constraints on the streams being spliced.~~

"Seamless splicing", as used here, means switching from one MPEG-2 video elementary stream to a second video elementary stream ~~supplied to a single decoder~~in such manner that:

- ~~e~~Continuity of the spliced bit stream is maintained;
- Switching occurs at a Transport Stream packet boundary;
- ~~n~~No underflow or overflow of the decoder buffer occurs as a result of the splice;
- Correct bitstream syntax as defined in ITU-T Rec. H.222.0 is maintained and the splice may result in discontinuities in timebase or continuity counter;
- ~~n~~No visible artifacts in the reconstructed baseband video are introduced.

The syntax of a spliceable bitstream recommended in ITU-T Rec. H.222.0 means that a PID stream whose discontinuity in a time stamp or a time base can be processed seamlessly by an MPEG-2 T-STD decoder. The syntax elements to be used are the splicing point flag, seamless splice flag, splice type, and so forth. This method places constraints on the two bit streams that may be limiting in actual use. The reader is directed to Annex K/H.222.0.

This current Recommendation specifies a seamless splicing technique for the MPEG-2 bit stream based on the two existing Recommendations above. The resulting MPEG-2 syntax of a spliced bit stream is fully in accordance with ITU-T Rec. H.222.0. The splicing signalling information is based on ITU-T Rec. J.181. The bit stream requirements of ITU-T Rec. J.181 are modified,

applying the constraints of SMPTE 312M and additional program splice constraints on the streams being spliced.

In addition, other types of splicing schemes without any ~~splicing information~~bit stream constraints are given in the appendices as reference information.

2) Clause 4.2 MPEG-2 bit-stream syntax required for seamless splicing

Modify the text in this clause as follows:

Those basic fields constituting a spliceable bit stream are defined as splicing_point_flag, splice_countdown, seamless_splice_flag, splice_type and DTS_next_AU in ITU-T Rec. H.222.0 | ISO/IEC 13818-1. These fields are mapped into an adaptation field of transport stream packets as shown in Figure 2, and the definition of each field is summarized thereafter.

- splicing_point_flag: When set to "1", this field indicates the presence of the splice_countdown field, specifying the occurrence of a splicing point.
- splice_countdown: A positive value specifies the remaining number of transport stream packets, of the same PID, following the associated transport stream packet until a splice point is reached. The transport stream packet in which the splice_countdown field reaches zero corresponds to the Out Point packet. A negative value specifies that the associated transport stream packet is the packet following the splicing point.
- seamless_splice_flag: When set to "1", it indicates the presence of the splice_type and DTS_next_AU fields.
- splice_type: This field indicates the condition that shall be respected by an associated elementary stream for splicing purposes especially for video PID streams.
- DTS_next_AU: This field indicates the decoding time of the first access unit following the splicing point, where the decoding time is expressed in the time base, which is valid in the transport stream packet in which the splice_countdown reaches zero.

When the bit stream is assumed to be a spliceable one as described above, seamless splicing is basically enabled based on simple bit-stream switching as shown in Figure 3, when using ~~an~~ appropriate splicing~~er~~ equipment. Simple ~~B~~bit-stream splicing is applied directly to bit streams where possible splice points must be provided by the upstream encoder. In addition, the upstream encoder must control the number of encoded bits to put the downstream decoder in a stable buffer state at each Out Point, otherwise simple seamless switching can not be realized. The splicing device based on this approach can be implemented without any re-encoding processing. Other splicing approaches which do not require any constraints on bit-stream splice points exist. Two such approaches are described in the appendices.

3) Clause 4.3.1 Basic mechanism based on ITU-T Rec. J.181

Modify this clause as follows:

Detailed information on a splicing event (the possible splice point, the PID of the spliced stream, the schedule of upcoming splicing events, etc.) can be mapped into a bit stream as the splice information section specified in ITU-T Rec. J.181. The splice information section notifies the splicing device of scheduled splice events prior to the arrival of splice points, and enables the splicing device to ensure a reliable splicing operation. The splice information section shall be carried in transport stream packets within their own PID streams. ITU-T Rec. J.181 itself makes no requirements for the preconditioning of an input MPEG stream in addition to the MPEG-2 standards and it also places no requirements upon how a splicing device must operate. ITU-T Rec. J.181 is limited entirely to the area of signalling. ~~Table 1 shows the syntax of the splice information section.~~See ITU-T Rec. J.181 for details.

~~**Table 1/J.189 – Syntax of the splice information section defined in ITU-T Rec. J.181**~~

~~Syntax~~	~~Bits~~	~~Mnemonic~~	~~Encrypted~~
~~splice_info_section () {~~			
~~table_id~~	~~8~~	~~uimsbf~~	
~~section_syntax_indicator~~	~~1~~	~~bslbf~~	
~~private_indicator~~	~~1~~	~~bslbf~~	
~~reserved~~	~~2~~	~~bslbf~~	
~~section_length~~	~~12~~	~~uimsbf~~	
~~protocol_version~~	~~8~~	~~uimsbf~~	
~~encrypted_packet~~	~~1~~	~~bslbf~~	
~~encryption_algorithm~~	~~6~~	~~uimsbf~~	
~~pts_adjustment~~	~~33~~	~~uimsbf~~	
~~cw_index~~	~~8~~	~~uimsbf~~	
~~reserved~~	~~24~~	~~bslbf~~	
~~splice_command_type~~	~~8~~	~~uimsbf~~	~~E~~
~~if (splice_command_type=0x00)~~			
~~splice_null ()~~			~~E~~
~~if (splice_command_type=0x04)~~			
~~splice_schedule ()~~			~~E~~
~~if (splice_command_type=0x05)~~			
~~splice_insert ()~~			~~E~~
~~descriptor_loop_length~~	~~16~~	~~uimsbf~~	~~E~~
~~for (I=0; I<N; I++)~~			
~~splice_descriptor ()~~			~~E~~
~~for (I=0; I<N; I++)~~			
~~alignment_stuffing~~	~~8~~	~~bslbf~~	~~E~~
~~if (encrypted_packet)~~			
~~E_CRC_32~~	~~32~~	~~rpchof~~	~~E~~
~~CRC_32~~	~~32~~	~~rpchof~~	
~~}~~			

4) Clause 4.3.2 Constraints for seamless splicing

Modify this clause as follows:

When applying ITU-T Rec. J.181 as the splice information section, ITU-T Rec. J.189 requires that the Out Point and the In Point shall meet the following constraints in order to achieve seamless splicing. For video PID streams, seamless splicing between a low-delay sequence and a sequence containing at least one B-picture is not aimed at in this Recommendation.

5) Clause 4.3.2.1.2 For video or audio PID streams

Modify this clause as follows:

- The seamless_splice_flag shall be set to 1 in the Out Point packet.
- DTS_next_AU shall be set in the Out Point packet, according to the definition in ITU-T Rec. H.222.0 | ISO/IEC 13818-1.

- The Out Point packet shall carry the splice_type field.
- For video PID streams, the value of the splice_type shall be selected from the table defined in ITU-T Rec. H.222.0 | ISO/IEC 13818-1. For audio PID streams, the value of the splice_type shall be set to "0000".
- For video PID streams, the last picture (in presentation order) preceding an Out Point shall be either a P- or an I-picture. An Out Point shall not occur between the two fields of a coded frame.
- To enable seamless splicing, the last payload byte of the Out Point Packet shall remain in the VBV buffer an amount of time equal to:

  – splice_decoding_delay – Display_Period_last_AU_{old};

  where Display_Period_last_AU_{old} is the display duration of the video access unit of the old material which begins presentation at the time when the last video access unit is removed from the buffer (see ITU-T Rec. H.222.0 (2000) | ISO/IEC 13818-1:2000).
- To enable seamless splicing, the last picture (in presentation order) before an Out Point shall be either a frame picture or a bottom field picture.

  In the case of an interlaced sequence (progressive_sequence equals '0'), the following constraints on the use of top_field_first and repeat_first_field shall apply:

  – If the last picture (in presentation order) before an Out Point is a frame picture with the **top_field_first** bit equal to '1', then the **repeat_first_field** bit of that picture shall be '0'.

  – If the last picture (in presentation order) before an Out Point is a frame picture with the **top_field_first** bit equal to '0', then the **repeat_first_field** bit of that picture shall be '1'.
- For audio PID streams, if audio is organized into frames, then the last byte of an Out Point packet shall be the last byte of an audio frame.

6) Clause 4.3.2.2.2 For video or audio PID streams

Modify this clause as follows:

- For video or audio PID streams, the data_alignment_indicator of the PES packet shall be set to 1.
- For video or audio PID streams, the random_access_indicator shall be set to 1 in the In Point packet.
- For video PID streams, the first PES packet payload following an In Point shall begin with a sequence header. Any P-picture or B-picture following an In Point shall not use a prediction which references pictures prior to the In Point. In the case of a progressive refresh coding structure being applied, the first coded picture after the sequence header shall be a P picture whose macroblocks are all intra coded. When progressive refresh coding is not being used, the first coded picture following an In Point shall be an I-frame.
- The value of splice_type shall be selected from Table 1. To enable seamless splicing, the value shall not be '1111'. For In Points which do not satisfy the constraints for seamless splicing, the value shall be '1111'.
- To enable seamless splicing, the time between when the first byte of the PES payload following an In Point enters the VBV buffer and the time when that byte is removed from the VBV buffer shall be equal to the splice_decoding_delay time given in Table 1 as determined by the value of splice_type in the In Point Packet and the profile_and_level_indication in the sequence_extension.

- To enable seamless splicing, the picture_structure of the first picture (in presentation order) after an In Point shall be either Frame picture ('11') or Top Field ('01'). In the case of an interlaced sequence (progressive_sequence equals '0'), the following constraint shall hold:
  - If the **picture_structure** of the first picture (in presentation order) after an In Point is Frame picture, then the **top_field_first** bit shall be equal to '1' for that picture.
- For audio PID streams, if audio is organized into frames, the first payload byte following an In Point shall be the first byte of an audio frame.
- For audio PID streams, data required for decoding the audio access units following the In Point shall not be contained in any audio frames prior to the In Point.

Table 1/J.189 – Splice_type

Application[1]	Profile@Level	Splice_type	Splice_decoding_delay	Max_splice_rate
ATSC Transmission	MP@HL	1100	250 ms	19 Mbit/s
Other Transmission	MP@ML	0011	250 ms	7.2 Mbit/s
Contribution	422P@ML	0100	250 ms	36 Mbit/s
HDTV Contribution	422P@HL	0100	250 ms	180 Mbit/s
Studio	422P@ML	0001	90 ms	50 Mbit/s
HDTV Studio	422P@HL	0001	90 ms	300 Mbit/s
Studio	422P@ML	0000	45 ms	50 Mbit/s
HDTV Studio	422P@HL	0000	45 ms	300 Mbit/s
non-seamless	Any	1111	undefined	undefined

[1] When these applications are implemented with constrained bit streams, as specified in this Recommendation, the value of splice_type shall be selected from Table 1 accordingly.

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