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H.222.0

Amendment 6
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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Transmission
multiplexing and synchronization

Information technology – Generic coding of moving
pictures and associated audio information: Systems

Amendment 6

ITU-T H-SERIES RECOMMENDATIONS
AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Characteristics of transmission channels used for other than telephone purposes	H.10–H.19
Use of telephone-type circuits for voice-frequency telegraphy	H.20–H.29
Telephone circuits or cables used for various types of telegraph transmission or simultaneous transmission	H.30–H.39
Telephone-type circuits used for facsimile telegraphy	H.40–H.49
Characteristics of data signals	H.50–H.99
CHARACTERISTICS OF VISUAL TELEPHONE SYSTEMS	H.100–H.199
INFRASTRUCTURE OF AUDIOVISUAL SERVICES	
General	H.200–H.219
Transmission multiplexing and synchronization	H.220–H.229
Systems aspects	H.230–H.239
Communication procedures	H.240–H.259
Coding of moving video	H.260–H.279
Related systems aspects	H.280–H.299
Systems and terminal equipment for audiovisual services	H.300–H.399
Supplementary services for multimedia	H.450–H.499

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

INTERNATIONAL STANDARD 13818-1

ITU-T RECOMMENDATION H.222.0

**INFORMATION TECHNOLOGY – GENERIC CODING OF MOVING PICTURES
AND ASSOCIATED AUDIO INFORMATION: SYSTEMS**

AMENDMENT 6

Summary

This amendment defines the splice parameters for 4:2:2 Profile@High level (Amendment 5 to ITU-T Rec. H.262 | ISO/IEC 13818-2) and the buffer model for ISO/IEC 13818-7 (AAC).

Source

The ITU-T Recommendation H.222.0, Amendment 6 was approved on 27 May 1999. The identical text is also published as ISO/IEC International Standard 13818-1, Amendment 6.

FOREWORD

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The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 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

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CONTENTS

	<i>Page</i>
1) Subclause 2.4.2.3.....	1
2) Subclause 2.4.3.5.....	2
3) Subclause 2.7.9.....	2
4) New Annex Q.....	3
Annex Q T-STD and P-STD buffer models for ISO/IEC 13818-7 ADTS	3
Q.1 Introduction.....	3
Q.2 Leak rate from transport buffer	3
Q.3 Buffer size	3
Q.4 Conclusion	5

**INFORMATION TECHNOLOGY – GENERIC CODING OF MOVING PICTURES
AND ASSOCIATED AUDIO INFORMATION: SYSTEMS**

AMENDMENT 6

1) Subclause 2.4.2.3

a) *Replace the following:*

- For audio:

$$R_{x_n} = 2 \times 10^6 \text{ bits per second}$$

with:

- For ISO/IEC 13818-7 ADTS audio:

Number of channels	R _{x_n} [bit/s]
1-2	2 000 000
3-8	5 529 600
9-12	8 294 400
13-48	33 177 600

Channels: channels that require their own decoder buffer in this elementary stream (i.e. individual channel streams in a single channel element or channel pair element and independently switched coupling channel elements).

- For other audio:

$$R_{x_n} = 2 \times 10^6 \text{ bits per second}$$

b) *After the line* The main buffer sizes BS₁ through BS_n are defined as follows, *replace the following:*

Audio

$$BS_n = BS_{\text{mux}} + BS_{\text{dec}} + BS_{\text{oh}} = 3584 \text{ bytes}$$

The size of the access unit decoding buffer BS_{dec}, and the PES packet overhead buffer BS_{oh} are constrained by:

$$BS_{\text{dec}} + BS_{\text{oh}} = 2848 \text{ bytes}$$

A portion (736 bytes) of the 3584 byte buffer is allocated for buffering to allow multiplexing. The rest, 2848 bytes, are shared for access unit buffering BS_{dec}, BS_{oh} and additional multiplexing.

with:

Audio

For ISO/IEC 13818-7 ADTS audio:

Number of channels	BS _n [bytes]
1-2	3 584
3-8	8 976
9-12	12 804
13-48	51 216

Channels: channels that require their own decoder buffer in this elementary stream (i.e. individual channel streams in a single channel element or channel pair element and independently switched coupling channel elements).

For other audio:

$$BS_n = BS_{mux} + BS_{dec} + BS_{oh} = 3584 \text{ bytes}$$

The size of the access unit decoding buffer BS_{dec}, and the PES packet overhead buffer BS_{oh} are constrained by:

$$BS_{dec} + BS_{oh} \leq 2848 \text{ bytes}$$

A portion (736 bytes) of the 3584 byte buffer is allocated for buffering to allow multiplexing. The rest, 2848 bytes, are shared for access unit buffering BS_{dec}, BS_{oh} and additional multiplexing.

2) Subclause 2.4.3.5

Add the following table:

**Table 2-16-4 – Splice parameters Table 14
4:2:2 Profile High Level Video**

Splice_type	Conditions
0000	splice_decoding_delay = 45 ms; max_splice_rate = 300.0 × 10 ⁶ bit/s
0001	splice_decoding_delay = 90 ms; max_splice_rate = 300.0 × 10 ⁶ bit/s
0010-0011	Reserved
0100	splice_decoding_delay = 250 ms; max_splice_rate = 180.0 × 10 ⁶ bit/s
0101-1011	Reserved
1100-1111	User-defined

3) Subclause 2.7.9

Add the following as the last paragraph of Decoder Buffer Size:

In the case of ISO/IEC 13818-7 ADTS audio elementary stream in a CSPS, the following applies to support 8 channels:

$$BS_n \leq 8976 \text{ bytes}$$

4) New Annex Q

Add the following after Annex P:

Annex Q

T-STD and P-STD buffer models for ISO/IEC 13818-7 ADTS

(This annex does not form an integral part of this Recommendation | International Standard)

Q.1 Introduction

The Transport Stream system target decoder model for audio streams is defined in 2.4.2. In this annex, the buffer model for ISO/IEC 13818-7 ADTS is described.

ISO/IEC 13818-7 ADTS audio streams can be recognized in an ITU-T Rec. H.222.0 | ISO/IEC 13818-1 multiplex through the presence of stream_id = 0x110yyyyy ('y' = "don't care") and stream_type = 0x0F as defined in Amendment 5 to ITU-T Rec. H.222.0 | ISO/IEC 13818-1.

Q.2 Leak rate from transport buffer

For audio except ISO/IEC 13818-7 ADTS, the leak rate from Transport Buffer is 2 Mbit/s. This rate is, however, lower than the maximum rate of ISO/IEC 13818-7 ADTS. Therefore, the leak rate for the ISO/IEC 13818-7 ADTS stream is set to a different value from ISO/IEC 11172-3 and ISO/IEC 13818-3 audio streams.

ISO/IEC 13818-7 ADTS elementary stream consists of one or more channels. The maximum rate of each channel is 576 kbit/s where the sampling frequency is 96 kHz. Therefore, the leak rate for ISO/IEC 13818-7 ADTS is calculated as following equation:

$$R_{x_n} = 1.2 \times R_{\max} \times N \text{ bits per second}$$

where:

R_{\max} is a constant 576 kbit/s as defined in 3.2.2 of ISO/IEC 13818-7. It is an upper bound of the bit rate per channel of AAC ADTS stream corresponding to the maximum value of sampling frequency (i.e. $F_s = 96$ kHz).

and where:

N is the number of audio channels that require their own decoder buffer in this elementary stream (i.e. individual channel streams in a single channel element or channel pair element and independently switched coupling channel elements).

Q.3 Buffer size

For audio except ISO/IEC 13818-7 ADTS, the main buffer size is 3584 bytes. This size is, however, smaller than the maximum decoder input buffer size of ISO/IEC 13818-7 ADTS. Therefore, the main buffer size for the ISO/IEC 13818-7 ADTS stream is set to a different value from ISO/IEC 11172-3 and ISO/IEC 13818-3 audio streams.

The main buffer size for ISO/IEC 13818-7 ADTS is calculated as follows:

$$BS_n = BS_{\text{mux}} + BS_{\text{dec}} + BS_{\text{oh}}$$

where BS_{oh} , PES packet overhead buffering, is defined as:

$$BS_{\text{oh}} = 528 \text{ bytes}$$

and BS_{mux} , additional multiplexing buffering, is defined as:

$$BS_{\text{mux}} = 0.004 \text{ s} \times R_{\max} \times N$$

and BS_{dec} , access unit buffering, is defined as:

$$BS_{dec} = 6144 \text{ bits} \times N$$

where:

R_{max} is a constant 576 kbit/s as defined in 3.2.2 of ISO/IEC 13818-7. It is an upper bound of the bit rate per channel of AAC ADTS stream corresponding to the maximum value of sampling frequency (i.e. $F_s = 96$ kHz).

and where:

N is the number of audio channels that require their own decoder buffer in this elementary stream (i.e. individual channel streams in a single channel element or channel pair element and independently switched coupling channel elements).

Q.3.1 TBS_n : same as other audio

In terms of the smoothing buffer, there is no difference in TB_n between ISO/IEC 13818-7 ADTS and other audio streams. Consequently, it is not necessary to change TBS_n , which is size of TB_n .

Q.3.2 BS_{mux} : different from other audio

BS_{mux} , additional multiplexing buffering, shall be changed to accept up to 4 ms of delay jitter. This is similar to the approach taken for other streams in ITU-T Rec. H.222.0 | ISO/IEC 13818-1.

Q.3.3 BS_{dec} : different from other audio

BS_{dec} , access unit buffering, is based on the decoder input buffer size of the elementary stream. As defined in 3.2.2 of ISO/IEC 13818-7, total decoder input buffer size is 6144 bit multiplied by the number of channels which each require their decoder input buffer.

Q.3.4 BS_{oh} : different from other audio

BS_{oh} corresponds to the PES packet header overhead.

In 2.4.2.6:

The delay of any data through the System Target Decoders buffers shall be less than or equal to one second except for still picture video data.

Besides, in 2.7.4:

The Program Stream and Transport Stream shall be constructed so that the maximum difference between coded presentation timestamps referring to each elementary video or audio stream is 0.7 s.

BS_{oh} shall be set to the appropriate size corresponding to the PES packet header overhead when AAC stream is packetized with the above rules. The maximum size of PES packet header is 264 bytes. Therefore, $BS_{oh} = 528$ bytes, i.e. twice the maximum size of PES packet header, assures that at least two PES packet headers can enter the main buffer regardless of the size of PES packet header. It means that PES packet header with PTS can be inserted at less than 0.7 s intervals even when the data of one second will be in the main buffer.

Example: sampling frequency is 48 kHz

The size of PES packet header without any optional fields except PTS is 18 bytes. The number of Access Units of one second is about 47. When the data of one second is in the main buffer (i.e. the worst case), PES packet header overhead can fit to the BS_{oh} with packetizing more than or equal to two Access Units into one packet.

$$\text{number_of_AU} = 48 \text{ kHz}/1024 = 46 \text{ 875 per second}$$

$$(\text{number_of_AU}/2) \times 18[\text{byte}] = 421 \text{ 875 bytes} < BS_{oh}$$

More frequent PES packet headers can be fit to BS_{oh} , if the delay of any data through the main buffer is shorter than one second.

Q.4 Conclusion

The decoder buffer model should cover the maximum size of buffer, however AAC can handle up to 48 channels and very high bit rate. Therefore the 3 levels of number of channels, 2, 8 and 48, are used to define the leak rate and the main buffer size. In a case of 2, the same leak rate and main buffer size as the conventional values are used to keep the compatibility. In other cases (8 and 48), the proposed formulas are applied.

T-STD leak rate for ISO/IEC 13818-7 ADTS audio

Number of channels	R_{x_n} [bit/s]
1-2	2 000 000
3-8	5 529 600
9-12	8 294 400
13-48	33 177 600

Channels: channels that require their own decoder buffer in this elementary stream (i.e. individual channel streams in a single channel element or channel pair element and independently switched coupling channel elements).

T-STD main buffer size for ISO/IEC 13818-7 ADTS audio

Number of channels	BS_n [bytes]
1-2	3 584
3-8	8 976
9-12	12 804
13-48	51 216

Channels: channels that require their own decoder buffer in this elementary stream (i.e. individual channel streams in a single channel element or channel pair element and independently switched coupling channel elements).

For Program Stream, the above main buffer size should be set in the P-STD_buffer_scale and P-STD_buffer_size as follows:

Number of channels	P-STD_buffer_scale	P-STD_buffer_size
1-2	0	28
3-8	0	71
9-48	0	401

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