International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.222.0

Amendment 3

(12/2015)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Transmission multiplexing and synchronization

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

Amendment 3: Carriage of green metadata in MPEG-2 systems

Recommendation ITU-T H.222.0 (2014) – Amendment 3

International Telecommunication Union

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INTERNATIONAL STANDARD ISO/IEC 13818-1
RECOMMENDATION ITU-T H.222.0

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

Amendment 3

Carriage of green metadata in MPEG-2 systems

Summary

This amendment to ITU-T H.222.0 (2014) | ISO/IEC 13818-1:2015 specifies the carriage of "Green metadata" in MPEG-2 transport streams. The amendment does not specify carriage in program streams. Green metadata component is specified using a new stream_type and is associated with media component to optimize display power consumption. Carriage of this metadata consists of a "static" part, which applies to an entire program, as well as a "dynamic" part, which can change for each media access unit. "Static metadata" is specified using a descriptor in the program map table while "dynamic metadata" is specified using the private table syntax.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T H.222.0	1995-07-10	15	11.1002/1000/1071
1.1	ITU-T H.222.0 (1995) Amd. 1	1996-11-11	16	11.1002/1000/3834
1.2	ITU-T H.222.0 (1995) Amd. 2	1996-11-11	16	11.1002/1000/4096
1.3	ITU-T H.222.0 (1995) Technical Cor. 1	1998-02-06	16	11.1002/1000/4532
1.4	ITU-T H.222.0 (1995) Amd. 3	1998-02-06	16	11.1002/1000/4228
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1.6	ITU-T H.222.0 (1995) Amd. 5	1999-05-27	16	11.1002/1000/4498
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2.2	ITU-T H.222.0 (2000) Technical Cor. 2	2002-03-29	16	11.1002/1000/5675
2.3	ITU-T H.222.0 (2000) Amd. 1	2002-12-14	16	11.1002/1000/6190
2.4	ITU-T H.222.0 (2000) Amd. 1/Cor. 1	2003-06-29	16	11.1002/1000/6449
2.5	ITU-T H.222.0 (2000) Amd. 2	2003-06-29	16	11.1002/1000/6363
2.6	ITU-T H.222.0 (2000) Amd. 3	2004-03-15	16	11.1002/1000/7208
2.7	ITU-T H.222.0 (2000) Technical Cor. 3	2005-01-08	16	11.1002/1000/7435
2.8	ITU-T H.222.0 (2000) Amd. 4	2005-01-08	16	11.1002/1000/7436
2.9	ITU-T H.222.0 (2000) Amd. 5	2005-01-08	16	11.1002/1000/7437
2.10	ITU-T H.222.0 (2000) Technical Cor. 4	2005-09-13	16	11.1002/1000/8560
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3.2	ITU-T H.222.0 (2006) Amd. 2	2007-08-29	16	11.1002/1000/9214
3.3	ITU-T H.222.0 (2006) Cor. 1	2008-06-13	16	11.1002/1000/9471
3.4	ITU-T H.222.0 (2006) Cor. 2	2009-03-16	16	11.1002/1000/9692
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3.7	ITU-T H.222.0 (2006) Cor. 4	2009-12-14	16	11.1002/1000/10622
3.8	ITU-T H.222.0 (2006) Amd. 4	2009-12-14	16	11.1002/1000/10623
3.9	ITU-T H.222.0 (2006) Amd. 5	2011-05-14	16	11.1002/1000/11287
3.10	ITU-T H.222.0 (2006) Amd. 6	2011-05-14	16	11.1002/1000/11288
4.0	ITU-T H.222.0	2012-06-29	16	11.1002/1000/11655

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

4.1	ITU-T H.222.0 (2012) Amd. 1	2014-01-13	16	11.1002/1000/12054
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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.

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, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

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Carriage of green metadata in MPEG-2 systems

1) Clause 1.2.3

In clause 1.2.3 add

– ISO/IEC 23001-11:2015, *Information technology – MPEG systems technologies – Part 11: Energy-efficient media consumption (Green Metadata).*

2) Clause 2.1.128

Add the following clause after clause 2.1.127

2.1.128 Green access unit – An access unit that contains dynamic metadata as defined in clause 6.2.1 of ISO/IEC 23001-11.

Table 2-31

Replace Table 2-31 with the following

Table 2-31 – Table_id assignment values

Value	Description
0x00	program_association_section
0x01	conditional_access_section (CA_section)
0x02	TS_program_map_section
0x03	TS_description_section
0x04	ISO_IEC_14496_scene_description_section
0x05	ISO_IEC_14496_object_descriptor_section
0x06	Metadata_section
0x07	IPMP_Control_Information_section (defined in ISO/IEC 13818-11)
0x08	ISO_IEC_14496_section
0x09	Green access unit (ISO/IEC 23001-11) section
0x0A-0x37	Rec. ITU-T H.222.0 | ISO/IEC 13818-1 reserved
0x38-0x3F	Defined in ISO/IEC 13818-6
0x40-0xFE	User private
0xFF	Forbidden

Table 2-34

In Table 2-34, add the following:

0x2C	Green access units carried in MPEG-2 sections
0x2D-0x7E	Rec. ITU-T H.222.0 | ISO/IEC 13818-1 reserved

3) Clause 2.6.90

Replace Table 2-105 with:

Table 2-105 – Extension descriptor

Syntax	No. of bits	Mnemonic
Extension_descriptor () {		
descriptor_tag	**8**	**uimsbf**
descriptor_length	**8**	**uimsbf**
extension_descriptor_tag	**8**	**uimsbf**
if (extension_descriptor_tag == 0x02) {		
ObjectDescriptorUpdate()		
}		
else if (extension_descriptor_tag == 0x03) {		
HEVC_timing_and_HRD_descriptor()		
}		
else if (extension_descriptor_tag == 0x04) {		
af_extension_descriptor()		
}		
else if (extension_descriptor_tag == 0x05) {		
HEVC_operation_point_descriptor()		
}		
else if (extension_descriptor_tag == 0x06) {		
hierachy_extension_descriptor()		
}		
else if (extension_descriptor_tag == 0x07) {		
Green_extension_descriptor ()		
}		
else {		
for (i=0; i<N; i++) {		
reserved	**8**	**bslbf**
}		
}		
}		

4) Clause 2.6.91

Add the following immediately before Table 2-106:

Green_extension_descriptor() – This structure is defined in 2.6.104 and 2.6.105.

Replace Table 2-106 with:

Table 2-106 – Extension descriptor tag values

Extension_descriptor_tag	TS	PS	Identification
0	n/a	n/a	Reserved
1	n/a	X	Forbidden
2	X	X	ODUpdate_descriptor
3	X	n/a	HEVC_timing_and_HRD_descriptor()
4	X	n/a	af_extensions_descriptor()
5	X	n/a	HEVC_operation_point_descriptor()
6	X	n/a	hierarchy_extension_descriptor()
7	X	n/a	Green_extension_descriptor()
8-255	n/a	n/a	Rec. ITU-T H.222.0 | ISO/IEC 13818-1 Reserved

5) Clause 2.6.103

Add the following clauses after 2.6.103

2.6.104 Green extension descriptor

The syntax of the green extension descriptor containing static metadata is shown in Table 2-111*quinquies*.

Table 2-111*quinquies* – Green extension descriptor

Syntax	No. bits	Mnemonic
Green_extension_descriptor() {		
descriptor_tag	**8**	**uimsbf**
num_constant_backlight_voltage_time_intervals	**2**	**uimsbf**
reserved	**6**	**bslbf**
for (i=0; i < num_constant_backlight_voltage_time_intervals; i++) {		
constant_backlight_voltage_time_interval[i]	**16**	**uimsbf**
}	**2**	**uimsbf**
num_max_variations		
reserved	**6**	**bslbf**
for (j=0; j < num_max_variations; j++) {		
max_variation[j]	**16**	**uimsbf**
}		
}		

2.6.105 Semantics for green extension descriptor

Semantics for all the syntax elements above are specified in clause 6.4 of ISO/IEC 23001-11.

6) Clause 2.18

Add the following clauses after clause 2.18:

2.18 Carriage of green access units

2.18.1 Carriage of green access units in MPEG-2 sections

Green access units are carried using the MPEG-2 private section syntax with the section_syntax_indicator element set to '0'.

Table 2-111*sexies* – Green access unit section syntax

Syntax	Bits	Mnemonic / description
Green_access_unit_section_message(){		
table_ID	**8**	**uimsbf**
section_syntax_indicator	**1**	**bslbf**
private_indicator	**1**	**bslbf**
reserved	**2**	**bslbf**
private_section_length	**12**	**uimsbf**
'00100	**4**	**bslbf**
Display_in_PTS [32..30]	**3**	**bslbf**
marker_bit	**1**	**bslbf**
Display_in_PTS [29..15]	**15**	**bslbf**
marker_bit	**1**	**bslbf**
Display_in_PTS [14..0]	**15**	**bslbf**
marker_bit	**1**	**bslbf**
Green_Au()		
CRC_32	**32**	**rpchof**
}		
}		

2.18.2 Semantics of green access unit section

table_id – This shall be set to 0x09.

section_syntax_indicator – This shall be set to '0'.

Display_in_PTS – This is the 33-bit PTS specified similar to that defined in the PES header and is used with the associated video access unit.

Green_Au() – Defined in 2.18.3.

2.18.3 Green access unit

The format of the green access unit is defined in Table 2-111*septies*. Green access units contain dynamic metadata and are carried in MPEG private section format.

Table 2-111*septies* – Green access unit

Syntax	No. bits	Mnemonic
Green_Au {		
num_quality_levels	**4**	**uimsbf**
reserved	**4**	**bslbf**
for (k=0; k < num_constant_backlight_voltage_time_intervals; k++) {		
for (j=0; j < num_max_variations; j++) {		
lower_bound	**8**	**uimsbf**
if (lower_bound > 0)		
upper_bound	**8**	**uimsbf**
rgb_component_for_infinite_psnr	**8**	**uimsbf**
for (i=1; i <= num_quality_levels; i++){		
max_rgb_component	**8**	**uimsbf**
scaled_psnr_rgb	**8**	**uimsbf**
}		
}		
}		

As explained in clause 6.4 of ISO/IEC 23001-11, each combination of constant_backlight_voltage_time_interval and max_variation is associated with contrast-enhancement metadata and a set of quality levels defined in Table 2-111*septies*.

The metadata in the Green_AU is applicable to the presentation subsystem until the next Green_AU containing metadata arrives.

Semantics for all the elements in Table 2-111*septies* is defined in clause 6.4 of ISO/IEC 23001-11.

2.18.4 Timing relationship between green access unit and media access unit

The green access unit should be decoded and information should be available before the associated media access unit is decoded. Such a timing relationship guarantees that the metadata within the green access unit is made available to the display with sufficient lead time relative to the PTS of the associated media access unit. Note that the PTS of the media access unit and the PTS of the green access unit are identical. The green access unit is transmitted in the transport stream with a sufficient lead time so that the display control settings can be adjusted in advance of presentation time for correct operation. If num_constant_backlight_voltage_time_intervals > 1, then the lead time should be equal to or larger than the largest constant_backlight_voltage_time_interval. The PMT shall not contain more than one green metadata component (stream_type equal to 0x2C).

NOTE – Applications that use carouseling of green access unit data carouseling in a given program can do so as long as the display_in_PTS value is adjusted to conform to the PCR clock and T-STD buffer.

2.18.5 Buffer model for processing green access units

The buffer model reflects the processing required to handle green access units. The model can be used to establish constraints which can be used to verify the validity of dynamic green metadata prepared in accordance with this standard.

Figure 2-21 illustrates the buffer model for processing green access units.

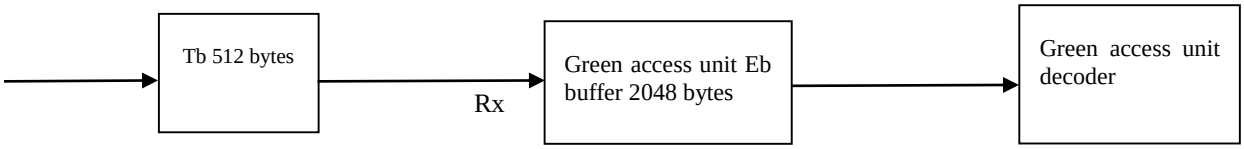

Figure 2-21 – Green access unit decoder processing model

MPEG-2 transport stream packets come into the model at the left, and are filtered by PID. Packets whose PID matches the green access unit PID flow into the 512 byte transport buffer. These buffered packets are removed at a rate of Rx = 300 kbps (kilobits/second) and stored in the green access unit Eb buffer (2048 Bytes). Green access unit table sections are removed from the Eb buffer immediately after the full access unit is available (based on section length) and these are passed onto the green access unit decoder at a rate Rbx = 300 kbps for decoding and each decoded access unit is associated with the video at time = display_in_PTS. The Eb buffer shall not overflow and the green access unit section shall be available in the Eb buffer at least 100 ms before display_in_PTS.

NOTE – In the worst-case, a green AU would contain 4488 bits. Under such conditions, the Eb buffer is large enough to hold up to three green AUs and the rate Rx is high enough to allow the removal of green AUs that are associated with video frames at 60 fps.

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