



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.222.0

Amendment 2
(06/2003)

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 2: Support of IPMP on MPEG-2
systems**

ITU-T Recommendation H.222.0 (2000) –
Amendment 2

ITU-T H-SERIES RECOMMENDATIONS
AUDIOVISUAL AND MULTIMEDIA SYSTEMS

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
MOBILITY AND COLLABORATION PROCEDURES	
Overview of Mobility and Collaboration, definitions, protocols and procedures	H.500–H.509
Mobility for H-Series multimedia systems and services	H.510–H.519
Mobile multimedia collaboration applications and services	H.520–H.529
Security for mobile multimedia systems and services	H.530–H.539
Security for mobile multimedia collaboration applications and services	H.540–H.549
Mobility interworking procedures	H.550–H.559
Mobile multimedia collaboration inter-working procedures	H.560–H.569
BROADBAND AND TRIPLE-PLAY MULTIMEDIA SERVICES	
Broadband multimedia services over VDSL	H.610–H.619

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

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

Amendment 2

Support of IPMP on MPEG-2 systems

Summary

This amendment is for carrying IPMP (Intellectual Property Management and Protection) information defined in ISO/IEC 13818-11 "IPMP on MPEG-2 Systems" over H.222.0 | ISO/IEC 13818-1 PS (Program Stream) or TS (Transport Stream). IPMP information is carried in two places: one is IPMP Elementary Stream that contains such as decryption key to descramble the protected content, the other is PSI (Program Specific Information) that contains IPMP control information such as IPMP Tool List (list of necessary IPMP tools), IPMP Control Graph (indicating where in the system a tool is applied), IPMP Tool Container (software modules of the necessary tool) and IPMP Rights Container (usage rules).

Source

Amendment 2 to ITU-T Recommendation H.222.0 (2000) was approved by ITU-T Study Group 16 (2001-2004) under the ITU-T Recommendation A.8 procedure on 29 June 2003. An identical text is also published as Amendment 2 to ISO/IEC 13818-1.

Keywords

Elementary Stream, IPMP, MPEG-2 systems, PSI.

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.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

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.

© ITU 2003

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

CONTENTS

	<i>Page</i>
1) Subclause 1.2.3	1
2) Subclause 2.4.1	1
3) Subclause 2.4.2.3	1
4) Subclause 2.4.3.7	2
5) Subclause 2.4.4	6
6) Subclause 2.4.4.4	6
7) Subclause 2.4.4.10	7
8) Subclause 2.6	7
9) In subclause 2.6.17	7
10) Subclause C.1	8
11) Subclause C.2	8

**INTERNATIONAL STANDARD
ITU-T RECOMMENDATION**

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

Amendment 2

Support of IPMP on MPEG-2 systems

1) Subclause 1.2.3

Insert the following additional reference:

- ISO/IEC 13818-11:2003, *Information technology – Generic coding of moving pictures and associated audio information – Part 11: IPMP on MPEG-2 systems.*

2) Subclause 2.4.1

Replace the following paragraph (with the changes underlined):

The PSI tables are carried in the Transport Stream. There are six PSI tables:

- Program Association Table;
- Program Map Table;
- Conditional Access Table;
- Network Information Table;
- Transport Stream Description Table;
- IPMP Control Information Table.

These tables contain the necessary and sufficient information to demultiplex and present programs. The Program Map Table, in Table 2-28, specifies, among other information, which PIDs, and therefore which elementary streams are associated to form each program. This table also indicates the PID of the Transport Stream packets which carry the PCR for each program. The Conditional Access Table shall be present if scrambling is employed. The Network Information Table is optional and its contents are not specified by this Recommendation | International Standard. The IPMP Control Information Table shall be present if IPMP as described in ISO/IEC13818-11 is used by any of the components in the ITU-T Rec. H.222.0 | ISO/IEC 13818-1 stream.

3) Subclause 2.4.2.3

Replace the first paragraph with the following text:

Complete Transport Stream packets containing system information, for the program selected for decoding, enter the system transport buffer, TBsys, at the Transport Stream rate. These include Transport Stream packets whose PID values are 0, 1, 2 or 3, and all Transport Stream packets identified via the Program Association Table (see Table 2-25) as having the program_map_PID value for the selected program. Network Information Table (NIT) data as specified by the NIT PID is not transferred to TBsys.

NOTE – Size of IPMP Control Information table could be large, and the repetition rate of this table should be adjusted to meet the buffer requirement.

4) Subclause 2.4.3.7

a) Replace Table 2-17 (PES packet) as follows (with the changes highlighted):

Table 2-17 – PES packet

Syntax	No. of bits	Mnemonic
PES_packet() {		
packet_start_code_prefix	24	bslbf
stream_id	8	uimbsbf
PES_packet_length	16	uimbsbf
if (stream_id != program_stream_map		
&& stream_id != padding_stream		
&& stream_id != private_stream_2		
&& stream_id != ECM		
&& stream_id != EMM		
&& stream_id != program_stream_directory		
&& stream_id != DSMCC_stream		
&& stream_id != ITU-T Rec. H.222.1 type E stream) {		
'10'	2	bslbf
PES_scrambling_control	2	bslbf
PES_priority	1	bslbf
data_alignment_indicator	1	bslbf
Copyright	1	bslbf
original_or_copy	1	bslbf
PTS_DTS_flags	2	bslbf
ESCR_flag	1	bslbf
ES_rate_flag	1	bslbf
DSM_trick_mode_flag	1	bslbf
Additional_copy_info_flag	1	bslbf
PES_CRC_flag	1	bslbf
PES_extension_flag	1	bslbf
PES_header_data_length	8	uimbsbf
if (PTS_DTS_flags == '10') {		
'0010'	4	bslbf
PTS [32..30]	3	bslbf
marker_bit	1	bslbf
PTS [29..15]	15	bslbf
marker_bit	1	bslbf
PTS [14..0]	15	bslbf
marker_bit	1	bslbf
}		
if (PTS_DTS_flags == '11') {		
'0011'	4	bslbf
PTS [32..30]	3	bslbf
marker_bit	1	bslbf
PTS [29..15]	15	bslbf
marker_bit	1	bslbf
PTS [14..0]	15	bslbf
marker_bit	1	bslbf
'0001'	4	bslbf
DTS [32..30]	3	bslbf
marker_bit	1	bslbf
DTS [29..15]	15	bslbf
marker_bit	1	bslbf
DTS [14..0]	15	bslbf
marker_bit	1	bslbf
}		
if (ESCR_flag == '1') {		
reserved	2	bslbf
ESCR_base[32..30]	3	bslbf
marker_bit	1	bslbf
ESCR_base[29..15]	15	bslbf
marker_bit	1	bslbf
ESCR_base[14..0]	15	bslbf
marker_bit	1	bslbf
ESCR_extension	9	uimbsbf
marker_bit	1	bslbf
}		
if (ES_rate_flag == '1') {		
marker_bit	1	bslbf
}		

Syntax	No. of bits	Mnemonic
ES_rate	22	uimbsbf
marker_bit	1	bslbf
}		
if (DSM_trick_mode_flag == '1') {		
trick_mode_control	3	uimbsbf
if (trick_mode_control == fast_forward) {		
field_id	2	bslbf
intra_slice_refresh	1	bslbf
frequency_truncation	2	bslbf
}		
else if (trick_mode_control == slow_motion) {		
rep_cntrl	5	uimbsbf
}		
else if (trick_mode_control == freeze_frame) {		
field_id	2	uimbsbf
reserved	3	bslbf
}		
else if (trick_mode_control == fast_reverse) {		
field_id	2	bslbf
intra_slice_refresh	1	bslbf
frequency_truncation	2	bslbf
else if (trick_mode_control == slow_reverse) {		
rep_cntrl	5	uimbsbf
}		
Else		
reserved	5	bslbf
}		
if (additional_copy_info_flag == '1') {		
marker_bit	1	bslbf
additional_copy_info	7	bslbf
}		
if (PES_CRC_flag == '1') {		
previous_PES_packet_CRC	16	bslbf
}		
if (PES_extension_flag == '1') {		
PES_private_data_flag	1	bslbf
Pack_header_field_flag	1	bslbf
program_packet_sequence_counter_flag	1	bslbf
P-STD_buffer_flag	1	bslbf
reserved	3	bslbf
PES_extension_flag_2	1	bslbf
if (PES_private_data_flag == '1') {		
PES_private_data	128	bslbf
}		
if (pack_header_field_flag == '1') {		
pack_field_length	8	uimbsbf
pack_header()		
}		
if (program_packet_sequence_counter_flag == '1') {		
marker_bit	1	bslbf
program_packet_sequence_counter	7	uimbsbf
marker_bit	1	bslbf
MPEG1_MPEG2_identifier	1	bslbf
original_stuff_length	6	uimbsbf
}		
if (P-STD_buffer_flag == '1') {		
'01'	2	bslbf
P-STD_buffer_scale	1	bslbf
P-STD_buffer_size	13	uimbsbf
}		
if (PES_extension_flag_2 == '1') {		
marker_bit	1	bslbf
PES_extension_field_length	7	uimbsbf
stream_id_extension_flag	1	bslbf
If (stream_id_extension_flag == '0') {		
stream_id_extension	7	uimbsbf
for (i = 1; i <		
PES_extension_field_length; i++){		
reserved	8	bslbf
}		
}		
}		

Syntax	No. of bits	Mnemonic
<pre> } for (i < 0; i < N1; i++) { stuffing_byte } for (i < 0; i < N2; i++) { PES_packet_data_byte } } else if (stream_id == program_stream_map stream_id == private_stream_2 stream_id == ECM stream_id == EMM stream_id == program_stream_directory stream_id == DSMCC_stream stream_id == ITU-T Rec. H.222.1 type E stream) { for (i = 0; i < PES_packet_length; i++) { PES_packet_data_byte } } else if (stream_id == padding_stream) { for (i < 0; i < PES_packet_length; i++) { padding_byte } } } </pre>	8 8 8 8	bslbf bslbf bslbf bslbf

b) Replace Table 2-18 (Stream_id assignments) as follows (with the changes underlined):

Table 2-18 – Stream_id assignments

stream_id	Note	stream coding
1011 1100	(1)	program_stream_map
1011 1101	(2)	private_stream_1
1011 1110		padding_stream
1011 1111	(3)	private_stream_2
110x xxxx		ISO/IEC 13818-3 or ISO/IEC 11172-3 or ISO/IEC 13818-7 or ISO/IEC 14496-3 audio stream number x xxxx
1110 xxxx		ITU-T Rec. H.262 ISO/IEC 13818-2 or ISO/IEC 11172-2 or ISO/IEC 14496-2 video stream number xxxx
1111 0000	(3)	ECM_stream
1111 0001	(3)	EMM_stream
1111 0010	(5)	ITU-T Rec. H.222.0 ISO/IEC 13818-1 Annex A or ISO/IEC 13818-6_DSM-CC_stream
1111 0011	(2)	ISO/IEC_13522_stream
1111 0100	(6)	ITU-T Rec. H.222.1 type A
1111 0101	(6)	ITU-T Rec. H.222.1 type B
1111 0110	(6)	ITU-T Rec. H.222.1 type C
1111 0111	(6)	ITU-T Rec. H.222.1 type D
1111 1000	(6)	ITU-T Rec. H.222.1 type E
1111 1001	(7)	ancillary_stream
1111 1010		ISO/IEC 14496-1_SL-packetized stream
1111 1011		ISO/IEC 14496-1_FlexMux_stream
1111 1100		metadata stream
<u>1111 1101</u>	<u>(8)</u>	<u>extended_stream_id</u>
1111 1110		reserved data stream
1111 1111	(4)	program_stream_directory

The notation x means that the value '0' or '1' are both permitted and results in the same stream type. The stream number is given by the values taken by the x's.

NOTE 1 – PES packets of type program_stream_directory have unique syntax specified in 2.5.4.1.

NOTE 2 – PES packets of type private_stream_1 and ISO/IEC 13552_stream follow the same PES packet syntax as those for ITU-T Rec. H.262 | ISO/IEC 13818-2 video and ISO/IEC 13818-3 audio streams.

NOTE 3 – PES packets of type private_stream_2, ECM_stream and EMM_stream are similar to private_stream_1 except no syntax is specified after PES_packet_length field.

NOTE 4 – PES packets of type program_stream_directory have a unique syntax specified in 2.5.5.

NOTE 5 – PES packets of type DSM-CC_stream have a unique syntax specified in ISO/IEC 13818-6, which is a compatible extension of ITU-T Rec. H.222.0 | ISO/IEC 13818-1 Annex A.

NOTE 6 – This stream_id is associated with stream_type 0x09 in Table 2-29.

NOTE 7 – This stream_id is only used in PES packets, which carry data from a Program Stream or an ISO/IEC 11172-1 System Stream, in a Transport Stream (refer to 2.4.3.7).

NOTE 8 – The use of stream_id 0xFD (extended_stream_id) identifies that this PES packet employs an extended syntax to permit additional stream types to be identified.

c) Insert the following text and table after the existing semantics for PES_extension_field_length:

stream_id_extension_flag – A 1-bit flag, which when set to '0' indicates that a stream_id_extension field is present in the PES packet header. The value of '1' for this flag is reserved.

stream_id_extension – In Program Streams, the stream_id_extension specifies the type and number of the elementary stream as defined by the stream_id_extension in Table Amd.2-1. In Transport Streams, the stream_id_extension may be set to any valid value which correctly describes the elementary stream type as defined in Table Amd.2-1. In Transport Streams, the elementary stream type is specified in the Program Specific Information as specified in 2.4.4. Note that this field is used as an extension of the stream_id defined above. This field shall not be used unless the value of stream_id is 1111 1101.

Table Amd.2-1 – Stream_id_extension assignments

stream_id_extension	Note	stream coding
000 0000	1	IPMP Control Information stream
000 0001	2	IPMP stream
000 0010 ... 011 1111		reserved_data_stream
100 0000 ... 111 1111		private_stream
NOTE 1 – PES packets of stream_id_extension 0b000 0000 (IPMP Control Information Stream) have a unique syntax specified in ISO/IEC 13818-11 (MPEG-2 IPMP).		
NOTE 2 – PES packets of stream_id_extension 0b000 0001 (IPMP Stream) have a unique syntax specified in ISO/IEC 13818-11 (MPEG-2 IPMP).		

5) Subclause 2.4.4

Replace Table 2-23 (Program specific info) as follows (with the changes underlined):

Table 2-23 – Program specific information

Structure Name	Stream Type	Reserved PID #	Description
Program Association Table	ITU-T Rec. H.222.0 ISO/IEC 13818-1	0x00	Associates Program Number and Program Map Table PID
Program Map Table	ITU-T Rec. H.222.0 ISO/IEC 13818-1	Assigned in the PAT	Specifies PID values for components of one or more programs
Network Information Table	Private	Assigned in the PAT	Physical network parameters such as FDM frequencies, Transponder Numbers, etc.
Conditional Access Table	ITU-T Rec. H.222.0 ISO/IEC 13818-1	0x01	Associates one or more (private) EMM streams each with a unique PID value
Transport Stream Description Table	ITU-T Rec. H.222.0 ISO/IEC 13818-1	0x02	Associates one or more descriptors from Table 2-39 to an entire Transport Stream
<u>IPMP Control Information Table</u>	<u>ITU-T Rec. H.222.0 ISO/IEC 13818-1</u>	<u>0x03</u>	<u>Contains IPMP Tool List, Rights Container, Tool Container defined in ISO/IEC 13818-11</u>

6) Subclause 2.4.4.4

Replace Table 2-26 (Table_id) as follows (with the changes underlined):

Table 2-26 – 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
<u>0x07</u>	<u>IPMP_Control_Information_section (defined in ISO/IEC13818-11)</u>
<u>0x08-0x3F</u>	<u>ITU-T Rec. H.222.0 ISO/IEC 13818-1 reserved</u>
0x40-0xFE	User private
0xFF	Forbidden

7) Subclause 2.4.4.10

Replace Table 2-29 (Stream type assignment) as follows (with the changes underlined):

Add the row with the value of 0x1A for IPMP stream type into the original table and adjust the reserved range of values.

Table 2-29 – Stream type assignments

Value	Description
0x00	ITU-T ISO/IEC Reserved
0x01	ISO/IEC 11172 Video
0x02	ITU-T Rec. H.262 ISO/IEC 13818-2 Video or ISO/IEC 11172-2 constrained parameter video stream
0x03	ISO/IEC 11172 Audio
0x04	ISO/IEC 13818-3 Audio
...	...
<u>0x1A</u>	<u>IPMP Stream (defined in ISO/IEC 13818-11, MPEG-2 IPMP)</u>
<u>0x1B-0x7E</u>	<u>ITU-T Rec. H.222.0 ISO/IEC 13818-1 Reserved</u>
0x80-0xFF	User private

8) Subclause 2.6

Replace Table 2-39 (descriptors) as follows (with the changes underlined):

Add the row with the value of 41 for IPMP Descriptor tag into the original table and adjust the reserved range for ITU-T.

Table 2-39 – Program and program element descriptors

descriptor_tag	TS	PS	Identification
0	n/a	n/a	Reserved
1	n/a	n/a	Reserved
2	X	X	video_stream_descriptor
3	X	X	audio_stream_descriptor
4	X	X	hierarchy_descriptor
...	..	..	...
<u>41</u>	<u>X</u>	<u>X</u>	<u>IPMP Descriptor (defined in ISO/IEC 13818-11, MPEG-2 IPMP)</u>
<u>42-63</u>	<u>n/a</u>	<u>n/a</u>	<u>ITU-T Rec. H.222.0 ISO/IEC 13818-1 Reserved</u>
64-255	n/a	n/a	User private

9) Subclause 2.6.17

Insert the following paragraph after the existing semantics for CA_PID:

In Transport Streams, the presence of PID 0x03 indicates that there is IPMP as described in ISO/IEC 13818-11 used by components in the Transport Stream. In Program Streams, the presence of stream_ID_extension value 0x00 indicates that IPMP as described in ISO/IEC 13818-11 is used by components in the Program Stream. Within a given ITU-T Rec. H.222.0 | ISO/IEC 13818-1 stream, components could use both IPMP as described in ISO/IEC 13818-11 as well as CA as defined in ISO/IEC 13818-1:2000. Compatibility between the two schemes is described in ISO/IEC 13818-11.

10) Subclause C.1

Replace the following paragraph (with the changes underlined):

The PSI may be thought of as belonging to six tables:

- 1) Program Association Table (PAT);
- 2) TS Program Map Table (PMT);
- 3) Network Information Table (NIT);
- 4) Conditional Access Table (CAT);
- 5) Transport Stream Description Table; and
- 6) IPMP Control Information Table.

The contents of the PAT, PMT, CAT and TSDT are specified in this Recommendation | International Standard. ICIT is defined in ISO/IEC 13818-11 (MPEG-2 IPMP). The NIT is a private table, and the PID value of the Transport Stream packets which carry it is specified in the PAT. Both the NIT and ICIT must follow the section structure defined in this Recommendation | International Standard.

11) Subclause C.2

Replace the following paragraph (with the changes underlined):

The 8-bit table_id identifies to which table the section belongs.

- Sections with table_id 0x00 belong to the Program Association Table.
- Sections with table_id 0x01 belong to the Conditional Access Table.
- Sections with table_id 0x02 belong to the TS Program Map Table.
- Sections with table_id 0x03 belong to the TS_description_section.
- Sections with table_id 0x04 belong to the ISO_IEC_14496_scene_description_section.
- Sections with table_id 0x05 belong to the ISO_IEC_14496_object_descriptor_section.
- Sections with table_id 0x06 belong to the metadata_section.
- Sections with table_id 0x07 belong to the IPMP_Control_Information_section.

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series B	Means of expression: definitions, symbols, classification
Series C	General telecommunication statistics
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Cable networks and transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	TMN and network maintenance: international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality, telephone installations, local line networks
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks and open system communications
Series Y	Global information infrastructure, Internet protocol aspects and Next Generation Networks
Series Z	Languages and general software aspects for telecommunication systems