
**Information technology — Generic
coding of moving pictures and
associated audio information —**

**Part 1:
Systems**

**AMENDMENT 1: Carriage of LCEVC and
other improvements**

*Technologies de l'information — Codage générique des images
animées et du son associé —*

Partie 1: Systèmes

AMENDEMENT 1: Transport de LCEVC et autres améliorations





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This document was prepared by ITU-T as Amendment 1 to ITU-T H.222.0 (06/2021) and drafted in accordance with its editorial rules, in collaboration with Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

A list of all parts in the ISO/IEC 13818 series can be found on the ISO and IEC websites.

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

Amendment 1

Carriage of LCEVC and other improvements

Summary

Rec. ITU-T H.222.0 | ISO/IEC 13818-1 was developed in 1994 to principally support the combination and synchronization of video and audio coding methods defined in ISO/IEC 13818 Part 2 (Rec. ITU-T H.262) and Part 3. It has since then been extended to support additional video and audio coding specifications as well as multiple kinds of metadata.

Amendment 1 to ITU-T H.222.0 (2021) | ISO/IEC 13818-1:2022 extends the specification by defining how LCEVC (ISO/IEC 23094-2) is carried over MPEG-2 systems. It also defines an additional descriptor signalling the kind of media service and its usage. Further, it includes clarifications for the specification of carriage of JPEG XS.

All of this is done in a way that is compatible with the existing support for other codecs.

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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.

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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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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 1

Carriage of LCEVC and other improvements

Scope

This amendment extends 13818-1 by defining:

- how LCEVC (ISO/IEC 23094-2) is carried over MPEG-2 systems (ITU-T H.222.0 | ISO/IEC 13818-1);
- an additional descriptor signalling the kind of media service and its usage.

It does this in a compatible way with existing support for other codecs.

It includes clarifications for the specification of carriage of JPEG XS.

1) **Clause 1.2.3**

In 1.2.3, *Additional references*, add the following references:

- ISO/IEC 23094-2:2021, *Information technology – General video coding – Part 2: Low complexity enhancement video coding*.
- IETF BCP 47: IETF RFC 4647 (2006) *Matching of Language Tags* combined with IETF RFC 5646 (2009), *Tags for Identifying Languages*.
- ANSI/SCTE 35 (2019), *Digital Program Insertion Cueing Message for Cable*.

2) **Clauses 2.1.90bis to 2.1.90ter**

After clause 2.1.90, add the following clauses 2.1.90bis to 2.1.90ter:

2.1.90bis LCEVC access unit (system): An access unit as defined for byte streams in ISO/IEC 23094-2 with the constraints specified in clause 2.25.1.

2.1.90ter LCEVC video sequence (system): Coded video sequence as defined in ISO/IEC 23094-2.

3) **Clause 2.4.2.7**

In clause 2.4.2.7, replace the sixth paragraph:

The delay of any data through the system target decoder buffers shall be less than or equal to one second except for still picture video data, ISO/IEC 14496 streams, ISO/IEC 23008-2 streams, ISO/IEC 23090-3 streams and ISO/IEC 23094-1 streams. Specifically: $td_n(j) - t(i) \leq 1$ second for all j , and all bytes i in access unit $A_n(j)$.

with:

The delay of any data through the system target decoder buffers shall be less than or equal to one second except for still picture video data, ISO/IEC 14496, ISO/IEC 23008-2, ISO/IEC 23090-3, ISO/IEC 23094-1 and ISO/IEC 23094-2 streams. Specifically: $td_n(j) - t(i) \leq 1$ second for all j , and all bytes i in access unit $A_n(j)$.

Further replace the eighth paragraph:

For ISO/IEC 14496, ISO/IEC 23008-2, ISO/IEC 23090-3 and ISO/IEC 23094-1 streams, the delay is constrained by $td_n(j) - t(i) \leq 10$ seconds for all j , and all bytes i in access unit $A_n(j)$.

with:

For ISO/IEC 14496, ISO/IEC 23008-2, ISO/IEC 23090-3, ISO/IEC 23094-1 and ISO/IEC 23094-2 streams, the delay is constrained by $td_n(j) - t(i) \leq 10$ seconds for all j , and all bytes i in access unit $A_n(j)$.

4) Clause 2.4.3.7

In clause 2.4.3.7, in Table 2-22, replace:

1110 xxxx	Rec. ITU-T H.262 ISO/IEC 13818-2, ISO/IEC 11172-2, ISO/IEC 14496-2, Rec. ITU-T H.264 ISO/IEC 14496-10, Rec. ITU-T H.265 ISO/IEC 23008-2, Rec. ITU-T H.266 ISO/IEC 23090-3 or ISO/IEC 23094-1 video stream number xxxx
-----------	---

with:

1110 xxxx	Rec. ITU-T H.262 ISO/IEC 13818-2, ISO/IEC 11172-2, ISO/IEC 14496-2, Rec. ITU-T H.264 ISO/IEC 14496-10, Rec. ITU-T H.265 ISO/IEC 23008-2, Rec. ITU-T H.266 ISO/IEC 23090-3, ISO/IEC 23094-1 or ISO/IEC 23094-2 video stream number xxxx
-----------	--

Further, in the **PTS (presentation time stamp)** section, insert the following new paragraph after the paragraph starting with "For EVC video streams ...":

For LCEVC video streams, the PTS shall be present in the PES packet header, and it shall refer to only one LCEVC access unit that commences in this PES packet. To achieve consistency between the STD model and the HRD model defined in Annex C of ISO/IEC 23094-2, for each LCEVC access unit the PTS value in the STD shall, within its accuracy, indicate the same instant in time as the nominal DPB output time in the HRD, as defined in Annex C of ISO/IEC 23094-2.

Further, in the **DTS (decoding time stamp)** section, insert the following new paragraph after the paragraph starting with "For EVC video streams ...":

For LCEVC video streams, the DTS shall not be present in the PES packet header because the LCEVC decoding process is strictly in presentation order. This restriction on the strict coincidence of decoding order and presentation order of the access units refers exclusively to the LCEVC video stream. On the other hand, the base video stream that the LCEVC video stream enhances has no such restriction, which means that in this case the decoding order and the presentation order can be different.

5) Clause 2.4.4.10

In 2.4.4.10 in Table 2-34, replace:

0x36 .. 0x7E	Rec. ITU-T H.222.0 ISO/IEC 13818-1 reserved
--------------	---

with:

0x36	LCEVC video stream conforming to one or more profiles defined in ISO/IEC 23094-2
0x37 .. 0x7E	Rec. ITU-T H.222.0 ISO/IEC 13818-1 reserved

6) Clause 2.6.90

In 2.6.90 in Table 2-109, replace:

```

else if ( extension_descriptor_tag == 0x16) {
    EVC_timing_and_HRD_descriptor()
}

```

with:

```

else if ( extension_descriptor_tag == 0x16) {
    EVC_timing_and_HRD_descriptor()
}
else if ( extension_descriptor_tag == 0x17) {
    LCEVC_video_descriptor ()
}
else if ( extension_descriptor_tag == 0x18) {
    LCEVC_linkage_descriptor()
}

```

```

else if ( extension_descriptor_tag == 0x19) {
    Media_service_kind_descriptor()
}

```

7) Clause 2.6.91

In clause 2.6.91, right before Table 2-110, add:

LCEVC_video_descriptor() – This structure is defined in 2.6.137 and 2.6.138.

LCEVC_linkage_descriptor() – This structure is defined in 2.6.139 and 2.6.140.

Media_service_kind_descriptor() – This structure is defined in 2.6.141 and 2.6.142

Further, in Table 2-110, replace:

0x17 .. 0xFF	n/a	n/a	Rec. ITU-T H.222.0 ISO/IEC 13818-1 Reserved
--------------	-----	-----	---

with

0x17	X	X	LCEVC_video_descriptor()
0x18	X	X	LCEVC_linkage_descriptor()
0x19	X	X	Media_service_kind_descriptor()
0x1A .. 0xFF	n/a	n/a	Rec. ITU-T H.222.0 ISO/IEC 13818-1 Reserved

8) Clause 2.6.127

In clause 2.6.127, in Table 2-132, remove the **descriptor_tag** and **descriptor_length** fields.

9) Clauses 2.6.137 to 2.6.142

After 2.6.136, add the following clauses 2.6.137 to 2.6.142:

2.6.137 LCEVC video descriptor

Table 2-141bis provides a description of the LCEVC video descriptor.

Table 2-141bis – LCEVC video descriptor

Syntax	No. of bits	Mnemonic
LCEVC_video_descriptor() {		
lcevc_stream_tag	8	uimsbf
profile_idc	4	uimsbf
level_idc	4	uimsbf
sublevel_idc	2	uimsbf
processed_planes_type_flag	1	bslbf
picture_type_bit_flag	1	bslbf
field_type_bit_flag	1	bslbf
reserved	3	bslbf
HDR_WCG_idc	2	uimsbf
reserved_zero_2bit	2	bslbf
video_properties_tag	4	uimsbf
}		

2.6.138 Semantic definition of fields of LCEVC video descriptor

lcevc_stream_tag – This is an 8-bit field specifying the identifier of an association between base and enhancement streams of an LCEVC encoding.

profile_idc, level_idc, sublevel_idc – These fields shall be coded according to the semantics defined for profile_idc, level_idc, sublevel_idc in clause 7.3.4 (SC, sequence_configuration) of ISO/IEC 23094-2.

processed_planes_type_flag – This field shall be coded according to the semantics defined for processed_planes_type_flag in clause 7.3.5 (GC, global_configuration) of ISO/IEC 23094-2.

picture_type_bit_flag, field_type_bit_flag – These fields shall be coded according to the semantics defined for picture_type_bit_flag, field_type_bit_flag in clause 7.3.6 (PC, picture_configuration) of ISO/IEC 23094-2.

HDR_WCG_idc – This 2-bit field indicates the presence or absence of high dynamic range (HDR) and/or wide colour gamut (WCG) video components in the associated PID according to Table 2-134.

video_properties_tag – This 4-bit field is used to indicate specific widely used video property CICP combinations as indicated by ITU-T H.Supp. 19 | ISO/IEC 23091-4 for SDR, WCG, or HDR/WCG streams depending on the value of HDR_WCG_idc. When HDR_WCG_idc is equal to 0, Table 2-135 applies. When HDR_WCG_idc is equal to 1, Table 2-136 applies. When HDR_WCG_idc is equal to 2, Table 2-137 applies. When HDR_WCG_idc is equal to 3, Table 2-138 applies.

NOTE 1 – Since the LCEVC enhancement stream and the base video stream that is enhanced are encoded separately, there can be separate values for HDR_WCG_idc and HDR_WCG_idc in the base and in the enhancement streams, and such values are not necessarily identical.

NOTE 2 – There is no Buffering Period SEI and Picture Timing SEI messages defined for LCEVC because the ones from the base encoding are used. For this reason, LCEVC timing and HRD descriptors are not needed.

2.6.139 LCEVC linkage descriptor

Table 2-141ter provides a description of the LCEVC linkage descriptor.

Table 2-141ter – LCEVC linkage descriptor

Syntax	No. of bits	Mnemonic
LCEVC_linkage_descriptor() { num_lcevc_stream_tags for (i=0; i<num_lcevc_stream_tags; i++) { lcevc_stream_tag } }	8 8	uimsbf uimsbf

2.6.140 Semantic definition of fields of LCEVC linkage descriptor

num_lcevc_stream_tags – The number of lcevc_stream_tag items that will follow.

lcevc_stream_tag – Tag value that allows indicating this video elementary stream as the base of an LCEVC video stream that carries the same tag value in its LCEVC video descriptor.

2.6.141 Media service kind descriptor

The media_service_kind_descriptor can read on the program or PID ES stream itself or can read on auxiliary PID ES that are dependent on the principal PID media component ES (i.e., in most cases the principal media component is video). The media service kind descriptor can also read upon the entire program to describe content with a single principal media component. Multiple data elements (N) can be included in the descriptor, each with one or more language code/media_service_type pairs.

If the same media component is described at a program level and at an elementary level, then the elementary stream media_service_kind description shall take precedence.

Table 2-141quater provides a description of the media service kind descriptor.

Table 2-141quater – Media service kind descriptor

Syntax	No. of bits	Mnemonic
Media_service_kind_descriptor() {		
for (i=0; i<N; i++) {		
media_description_flag	1	bslbf
identifier_flag	1	bslbf
lang_pairs	3	uimbsf
media_type_idc	2	uimbsf
reserved	1	bslbf
if (identifier_flag) {		
ID_length_code	3	uimbsf
ID_type	13	uimbsf
if (ID_length_code == '7') {		
ID_len	8	uimbsf
}		
media_ID_field	ID_len*8	bslbf
}		
for (j= 0; j<lang_pairs; j++) {		
configuration_type	2	uimbsf
lang_purpose_cnt	3	uimbsf
lang_len_idc	2	uimbsf
reserved	1	bslbf
if (lang_len_idc == 0) {		
lang_len	8	uimbsf
}		
IETF_BCP_47_language_code	lang_len*8	bslbf
for (k=0; k<lang_purpose_cnt; k++) {		
media_service_type	8	uimbsf
}		
}		
}		

2.6.142 Semantic definition of fields in media service kind descriptor

media_description_flag – This flag indicates if the specific entry in the descriptor applies to the elementary stream or program itself, or indicates an entry for another stream associated with the elementary stream/program which is needed to produce a specific purpose of the program. The flag will have the values of "1-self" or "2-associate". In the first loop, M would stand for the number of self or auxiliary media_type described in the kind-media-service descriptor on that specific elementary stream/program. Associate descriptions can indicate properties of dependent media components to the principal media component that can be often in a demuxed elementary stream. For example, a program or video elementary stream could associate a dependent audio stream that indicates the native language of the produced work. Given a candidate selection of demuxed audio streams, the best audio-video synchronization experience for audio and text could then be selected. The principal video elementary stream can also indicate dependent video elementary streams such as a video signing language track that maybe needed as an overlay to the video track.

identifier_flag – A flag to indicate if the media_service_kind descriptor data element will carry an identifier.

lang_pairs – This field indicates the number of language code/media_service_type pairs carried with the data element.

media_type_idc – This indicator would have the values "0-unknown", "1-Video", "2-Audio" or "3-Text", as indicated in Table 2-141quinques.

Table 2-141quinquies – Media type indicator

media_type_idc	Media type value
0	unknown
1	video
2	audio
3	text/data

ID_length_code – This parameter assigns to ID_len the number of bytes from the list of potential byte numbers needed for the carriage of the optional identifier. When the parameter has a value of 7 then the ID_len can be configured to other byte length numbers. See Table 2-141sexies.

Table 2-141sexies – ID_length_code

Value	Length, bytes (ID_len)
0	1
1	2
2	4
3	8
4	12
5	16
6	20
7	Explicit value provided in field ID_len

ID_type – Parameter to indicate the type of identifier used according to Table 2-141septies.

NOTE 1 – This parameter can originate from a list of SCTE UPID identifiers list. Alternatively, identifiers can be reserved outside of the UPID identifiers list.

Table 2-141septies – ID_type

Range	Definition
0x0000 .. 0x01FF	Reserved for MPEG standardization
0x0200 .. 0x02FF	Value defined in ANSI/SCTE 35 Table 22 (segmentation_upid_type) + 0x200
0x0300 .. 0x0FFF	Reserved for MPEG standardization
0x1000 .. 0x1FFF	User Private types

ID_len – The number of bytes needed to carry an optional identifier in the data element of the descriptor.

media_ID_field – The parameter carrying the identifier in the data element of the descriptor.

configuration_type – This parameter, as defined in Table 2-141octies, indicates if the elementary stream or associate stream is complete (value= 0 e.g., a 5.1 audio stream) and playable as an independent media component or is partial (value= 1 e.g., M&E or dialogue only) and not playable alone as the media component stream. A complete combination (value= 2 e.g., 5.1/2.0 stream with multiple dialogue languages) contains several variants with each version playable as an independent media component. Internal coding configurations if defined are deferred to the elementary specific format metadata.

Table 2-141octies – configuration type values

configuration_type	configuration type value
0	complete
1	partial
2	complete combination
3	reserved

configuration_type value semantics

complete: Describes a media component stream that is a single version playable video/audio/text experience otherwise known as complete or complete main.

partial: Describes a media component stream that is not a playable video/audio/text experience without additional streams.

complete combination: Describes a media component stream that contains multiple playable video/audio/text experiences which can be extracted through different parameter settings.

lang_purpose_cnt – This parameter indicates the number of media_service_types (up to 6) associated with a single language code. If the count is zero it means to use the default media_service_type of "und" and if no "main" exists for the track, then this defaults to "main". A value of 7 is reserved for future purposes.

lang_len_idc – Indicator to determine if a default length is used to indicate the IETF_BCP_47_language_code field length. If indicator is 0, then char length is assignable by a byte value. When set to 1 or 2, the value of lang_len is given in Table 2-141nonies. A value of 3 is reserved for future use.

Table 2-141nonies – lang_len_indicator

lang_length_idc	lang_len
0	No default length. Explicit value provided in field lang_len
1	2
2	3
3	reserved

IETF_BCP47_language_code – Identifies the language or languages, including sign language, used by the associated program element. The IETF_BCP47_language_code contains a multi-character code as specified by IETF BCP 47 where the number of characters is determined by the value in the preceding lang_len field. IETF BCP 47 incorporates ISO 639-3 language code with additional description. Each character is coded into 8 bits according to ISO 8859-1 and inserted in order into this field. In the case of multilingual audio streams, the sequence of ISO_639_language_code fields shall reflect the content of the audio stream or designated as 'mul' three character subtag for dynamic multilingual cases but in the case that the descriptor needs to remain static. In the case of video components that are not sign language, 'zxx' can be used as a three-character primary language subtag.

media_service_type – This 8-bit field specifies the purpose(s) of the stream(s) described in the descriptor as defined in Table 2-141decies.

Table 2-141decies – Media service type values

Value	Description
0x00	undefined
0x01	main
0x02	alternate
0x03	supplementary
0x04	emergency
0x05	description
0x06	enhanced-audio-intelligibility
0x07	dub
0x08	primary commentary
0x09	primary
0x0A	native
0x0B	Music and effects
0x0C	dialogue
0x0D	voice-over
0x0E	sign
0x0F	multi-view
0x10	karaoke

Table 2-141decies – Media service type values

Value	Description
0x11	caption
0x12	subtitle
0x13	forced-subtitle
0x14	metadata
0x15	non-primary
0x16	substitution
0x17	alternate commentary
0x18	stadium sound
0x19 .. 0xEF	Reserved
0xF0 .. 0xFF	User private

media_service_type value semantics**[General]**

undefined: This is a default value that indicates that the purpose of the stream is unknown. It is different from the language code "und", which would indicate that the language of the audio is unknown. If "main" is not assigned in the descriptor for the stream, then this defaults to "main".

main: Main media component(s) that is/are intended for presentation if no other information is provided.

alternate: Media content component(s) that is/are an alternative to (a) main media content component(s) of the same media component type.

supplementary: Media content component that is supplementary to a media content component of a different media component type.

emergency: Experience that provides information about a current emergency. It is intended to enable the protection of life, health, safety and property, and may also include critical details regarding the emergency and how to respond to the emergency.

substitution: Indicates that the media content component is continuous but may have a substitution in language or media_service_type that defaults to the main type for that media content component when not available. This often occurs in linear channels where Spanish or audio description may not continuously exist for all programs on the channel, but the linear channel track does need to be continuous.

[Video specific]

sign: Visual media component representing a sign-language interpretation of an audio component.

multi-view: This value indicates that the video stream is an alternate view of the main video feed. This can be used for different sports angle feed in a football game.

caption: Textual representation of the audio track usually including both dialogue and all sounds. This text is often embedded in the video track intended for an audience with loss or partial loss of hearing and is in the same language as the dialogue.

forced-subtitle: Textual information meant for display when no other text representation is selected. It is used to clarify dialogue, alternative languages, texted graphics or location/person IDs that are not otherwise covered in the dubbed/localized audio.

[Audio specific]

description: This value indicates that the referenced program element is prepared for the visually impaired viewer. Alternate labels for this are "audio descriptive services" (ADS) or "descriptive video services" (DVS) or "visual impaired commentary".

enhanced-audio-intelligibility: Experience containing an element for improved intelligibility of the dialogue. An alternative label for this is "hearing impaired".

dub: Experience that contains an element that is presented in a language different from the original (e.g., dubbed audio, translated captions).

primary commentary: This value indicates the referenced program element is prepared with narration in addition to the natural sound of the content. This narration can be an announcer to a sporting event or the director's comments on a film or program, and is the default commentary for the content.

alternate commentary: This value indicates the referenced program element is prepared as bonus or alternate narration in addition to the natural sound of the content. This additional commentary is of the same language as the primary commentary and can be used for cases such as an additional away announcer to a sporting event or producer's comments of the film or program.

primary: This value indicates the default recommended language of the channel or program. This is a separate value from the language code itself. If the language code is Welsh with an undefined media_service_type, it means "this is Welsh". When the language code is welsh with media_service_type 0x09, it means "this is Welsh, and it is the primary language of this program."

non-primary: This value indicates a secondary language of the channel or program. This is a separate value from the language code itself, and indicates a secondary priority of language in the channel or program. Secondary languages may have substitutions in its track when that language is not available in order to provide a continuous track for the channel.

substitution: This value indicates the language in the channel or program may be replaced by another language if the language is sometimes unavailable, but the track needs to be continuous with the program. An example of this is a Spanish SAP (secondary audio program) where the commercial does not have a Spanish language track so an English language track is substituted until the advertisement is done.

native: This value indicates the language in which the program was produced. An absence of this value indicates that it is either undefined or a dubbed language.

Music and effects: This value indicates that the referenced program element has no language. This can also be known as "clean effects".

dialogue: An isolated language track intended to be combined with a music and effects track.

stadium sound: Audio track for an event (e.g., sporting event) devoid of any additional commentary. It would be the natural sound one would hear if physically attending the event at the stadium. An alternative term for this would be natural sound.

voice-over: An isolated narration track intended to be combined with audio that reflects the natural sound of the scene content.

[Text/Data specific]

dub: Experience that contains an element that is presented in a language different from the original (e.g., dubbed audio, translated captions).

commentary: Experience that contains a commentary (e.g., director's commentary, sports announcer).

primary: This value indicates the default recommended textual language of the channel or program. This is a separate value from the language code itself. If the language code is Welsh with an undefined media_service_type, it means "this is Welsh subtitles". When the language code is Welsh with media_service_type 0x09, it means "this is Welsh, and it is the primary subtitles language of this program".

non-primary: This value indicates a secondary textual language of the channel or program. This is a separate value from the language code itself and indicates a secondary priority of textual language in the channel or program. Secondary textual languages may have substitutions in its track when that textual language is not available in order to provide a continuous track for the channel.

native: This value indicates the language in which the program was produced. An absence of this value indicates that it is either an undefined or a dubbed language.

karaoke: Textual representation of a song's lyrics, usually in the same language as the associated songs.

subtitle: Textual representation of the audio track. It usually represents only the dialogue and often in a language other than the audio track dialogue. This is intended for a foreign language audience.

metadata: Media component containing information intended to be processed by application specific elements.

NOTE 2 – Similar corresponding description values can be found in the definition of the ISO_639_language descriptor and in other standards/specifications ISO/IEC 23009-1 (MPEG-DASH), SMPTE ST 2067-2 (IMF Core Constraints), or DASH-IF interoperability points.

Figure 2-3bis and Figure 2-3ter show examples of the Media Service Kind Descriptor.