SCTE · ISBE

STANDARDS

Digital Video Subcommittee

SCTE STANDARD

SCTE 215-2 2018

HEVC Video Constraints for Cable Television
Part 2- Transport

TABLE OF CONTENTS

LIST OF TABLES

NOTICE

The Society of Cable Telecommunications Engineers (SCTE) / International Society of Broadband Experts (ISBE) Standards and Operational Practices (hereafter called "documents") are intended to serve the public interest by providing specifications, test methods and procedures that promote uniformity of product, interchangeability, best practices and ultimately the long-term reliability of broadband communications facilities. These documents shall not in any way preclude any member or non-member of SCTE•ISBE from manufacturing or selling products not conforming to such documents, nor shall the existence of such standards preclude their voluntary use by those other than SCTE•ISBE members.

SCTE•ISBE assumes no obligations or liability whatsoever to any party who may adopt the documents. Such adopting party assumes all risks associated with adoption of these documents, and accepts full responsibility for any damage and/or claims arising from the adoption of such documents.

Attention is called to the possibility that implementation of this document may require the use of subject matter covered by patent rights. By publication of this document, no position is taken with respect to the existence or validity of any patent rights in connection therewith. SCTE•ISBE shall not be responsible for identifying patents for which a license may be required or for conducting inquiries into the legal validity or scope of those patents that are brought to its attention.

Patent holders who believe that they hold patents which are essential to the implementation of this document have been requested to provide information about those patents and any related licensing terms and conditions. Any such declarations made before or after publication of this document are available on the SCTE•ISBE web site at http://www.scte.org.

All Rights Reserved

© Society of Cable Telecommunications Engineers, Inc. 2018

140 Philips Road
Exton, PA 19341

HEVC Constraints for Cable Television Part 2- Transport

1.0 SCOPE

This document defines the transport constraints on ITU-T Rec. H.265 | ISO/IEC 23008-2 [8] video compression (hereafter called "HEVC") for Cable Television. In particular, this document describes the transmission of a single HEVC coded video elementary stream constrained per SCTE 215-1 [2] over MPEG-2 transport (ISO/IEC 13818-1 [7] for linear delivery systems supporting ad insertion services [5]. Beyond linear delivery with DPI, signaling is provided for segmentation of contents for xDVR applications.

NOTE 1: The carriage of video in the MPEG-2 service multiplex is described in SCTE 54 [1].

1.1 Background (Informative)

This document specifies the transport of an HEVC coded video elementary stream constrained per SCTE 215-1 [2] intended for cable video services. There are other applications such as time-shifting (e.g., PVR/DVR service), Video-on-Demand services, and splicing (e.g., Ad-insertion) that could employ the specifications in this document. However, constraints specific to those applications are outside of the scope of this document at this time.

2.0 NORMATIVE REFERENCES

The following documents contain provisions, which, through reference in this text, constitute provisions of this document. At the time of Subcommittee approval, the editions indicated were valid. All documents are subject to revision; and while parties to any agreement based on this document are encouraged to investigate the possibility of applying the most recent editions of the documents listed below, they are reminded that newer editions of those documents might not be compatible with the referenced version.

2.1 SCTE References

[1] ANSI/SCTE 54 2015, Digital Video Service Multiplex and Transport System Standard for Cable Television.

[2] SCTE 215-1 2018, HEVC Video Constraints for Cable Television Part 1 – Coding.

[3] ANSI/SCTE 128-1 2013, AVC Video Constraints for Cable Television Part 1 – Coding.

[4] ANSI/SCTE 128-2 2013, AVC Video Constraints for Cable Television Part 2 – Transport.

[5] ANSI/SCTE 35 2017, Digital Program Insertion Cueing Message for Cable.

2.2 Standards from other Organizations

[6] ATSC A/65:2013 Program and System Information Protocol for Terrestrial Broadcast and Cable; Section 6.9.2.

[7] ISO/IEC 13818-1:2018, “Information Technology – Generic coding of moving pictures and associated audio – Part 1: Systems

[8] ITU-T Rec H.265 | ISO/IEC 23008-2– MPEG-H Part 2: 2017, High Efficiency Video Coding.

[9] ETSI TS 101 154 V2.4.1 Digital Video Broadcasting (DVB): Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream, 2014.

3.0 INFORMATIVE REFERENCES

The following documents may provide valuable information to the reader but are not required when complying with this standard.

3.1 SCTE References

[10] ANSI/SCTE 43, Digital Video Systems Characteristics Standard for Cable Television.

[11] ANSI/SCTE 21, Standard for Carriage of NTSC VBI Data in Cable Digital Transport Streams.

[12] ANSI/SCTE 07, Digital Transmission Standard for Cable Television.

[13] ANSI/SCTE 172, Constraints on AVC Video Coding for Digital Program Insertion.

[14] ANCI/SCTE 67, Recommended Practice for SCTE 35 Digital Program Insertion Cueing Message for Cable.

3.2 Standards from other Organizations

[15] SMPTE ST 170, Television – Composite Analog Video Signal – NTSC for Studio Applications.

[16] SMPTE ST 274 Standard for television, 1920 x 1080 Scanning and Interface.

[17] SMPTE ST 296, Standard for television, 1280 x 720 Scanning, Analog and Digital Representation, and Analog Interface.

[18] ITU-R BT.601-6 Encoding parameters of digital television for studios.

[19] ITU-R BT.709-6, Basic Parameter Values for the HDTV Standard for the Studio and for International Programme exchange.

[20] ITU-R BT.2020-2, Parameter values for ultra-high definition television systems for production and international Programme exchange.

[21] ITU-T J.83, Digital Video Transmission Standard for Cable Television.

[22] CTA-CEB16: Active Format Description (AFD) & Bar Data Recommended Practice.

[23] SMPTE ST 125, Standard for television, Component Video Signal 4:2:2, Bit Parallel Digital Interface.

[24] SMPTE ST 293, Standard for television, 720x483 Active Line at 59.95 Hz Progressive Scan Production, Digital Representation.

[25] SMPTE ST 267, Standard for television, Bit Parallel Digital Interface- Component Video Signal 4:2:2 16x9 Aspect Ratio.

[26] ATSC A/53, Part 3, “Service Multiplex and Transport Subsystem Characteristics”.

[27] CTA-861-G “A DTV Profile for Uncompressed High Speed Digital Interfaces”.

[28] ISO/IEC 13818-2, Information Technology – Generic coding of moving pictures and associated audio -Part 2: Video.

4.0 COMPLIANCE NOTATION

Throughout this document, there are words that are used to define the significance of particular requirements. These words are:

shall	This word or the adjective "***required***" means that the item is an absolute requirement of this specification.
shall not	This phrase means that the item is an absolute prohibition of this specification.
forbidden	This word means the value specified shall never be used.
should	This word or the adjective "*recommended*" means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighted before choosing a different course.
should not	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
may	This word or the adjective "*optional*" means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.
deprecated	Use is permissible for legacy purposes only. Deprecated features may be removed from future versions of the standard. Implementations should avoid use of deprecated features.

This document contains symbolic references to syntactic elements used in the video and transport coding subsystems. These references are typographically distinguished by the use of a different font (e.g., reserved), may contain the underscore character (e.g., constraint_set0_flag) and may consist of character strings that are not English words (e.g., pic_width_in_mbs_minus1).

5.0 DEFINITIONS AND ACRONYMS

5.1 Acronyms

The following definitions and acronyms are used in this document:

AFD	Active Format Description
ATSC	Advanced Television Systems Committee
AU	Access Unit
AVC	Advanced Video Coding
CPB	Coded Picture Buffer
DPI	Digital Program Insertion
DTS	Decoding Time Stamp
DTV	Digital Television
DVB	Digital Video Broadcasting
DVS	Digital Video Subcommittee
ESPI	Elementary_Stream_Priority_Indicator
ETSI	European Telecommunications Standards Institute
HDR	High Dynamic Range
HDTV	High Definition Television
HRD	hypothetical reference decoder
IEC	International Electrotechnical Commission

ISO	International Organization for Standardization
MPEG	Moving Picture Experts Group
NAL	Network Abstraction Layer
NCG	Narrow Color Gamut
nPVR	Network based Personal Video Recorder
PCR	Program Clock Reference
PES	Packetized Elementary Stream
PID	Packet Identifier
PMT	Program Map Table
PPS	Picture Parameter Set
PTS	Presentation Time Stamp
PVR	Personal Video Recorder
QAM	Quadrature Amplitude Modulation
RAI	Random_Access_Indicator
RF	Radio Frequency
SDR	Standard Dynamic Range
SGOP	SCTE Group Of Pictures [see definitions in 5.2]
SHRAP	SCTE HEVC Random Access Point [see definitions in 5.2]
SPS	Sequence Parameter Set
T-STD	Transport Stream System Target Decoder
TS	Transport Stream
VBI	Vertical Blanking Interval
VOD	Video on Demand
WCG	Wide Color Gamut
xDVR	Generic Digital Video Recorder [see definitions in 5.2]

5.2 Definitions

HEVC ITU-T Rec. H. 265 | ISO/IEC 23008-2:2013, High Efficiency Video Coding [8]

HEVC Receiver The term "HEVC Receiver" in this standard for transport means a receiver having at least the additional attributes (in no particular order) listed below:

1. Able to support Video coding related attributes for an HEVC Receiver definition found in SCTE 215-1 (Coding).
2. Able to parse and decode all the normative elements from ISO/IEC 13818-1 [7] that are normatively included and/or constrained by this standard;
3. Not adversely affected by the presence or absence of optional elements from ISO/IEC 13818-1 [7] (such as data in adaptation fields) that are specified with constraints in this standard;

Program An ISO-IEC 13818-1 MPEG-2 Program

SGOP A SCTE Group Of Pictures (SGOP) is the group of pictures spanning two consecutive SHRAPs including the prior SHRAP AU but not including the subsequent SHRAP AU.

SHRAP An SCTE HEVC Random Access Point (SHRAP) is an HEVC access unit as defined in SCTE 215-1 that allows for the decoding process to start at a specific point in a bitstream.

SHRAP Picture As defined in SCTE 215-1, this is an Intra picture that is part of an SHRAP AU

xDVR Generic DVR implementation. This could be 'Cloud DVR (cDVR)', 'Network DVR (nDVR), local DVR or any other generic DVR.

Numerical formats are defined in Table 1.

Table 1: Numerical Format Definitions

Example Values	Description
12345	Example of a decimal value format
0x2A	Example of a hexadecimal value format
'10010100'	Example of a string of binary digits

6.0 MPEG-2 MULTIPLEX AND TRANSPORT CONSTRAINTS FOR HEVC

This section and its subsections describe MPEG-2 System details pertaining to HEVC that extends the specifications of SCTE 54 [1].

6.1 Services and Features

This section describes additional services and features details pertaining to HEVC.

NOTE 2: As described in SCTE 54 [1] and other SCTE standards, the MPEG-2 Transport provides services and features enabled by information carried at the MPEG-2 Transport multiplex level and not at the video elementary stream component level. Some of these services are System Information and Program Guide, Emergency Alerts, and Specification of Private Data Services.

NOTE 3: The bitrate value for the HEVC Bitstream is application dependent and limited by the contiguous bandwidth of the transmission channel. In the application of HEVC transmission over a 64-QAM channel, bitrate value in combination with other bitstreams in the MPEG-2 Transport multiplex, conforms to a channel bitrate of less than or equal to 26.97 Mbps; in transmissions over a 256-QAM channels to less than or equal to 38.81 Mbps [12].

6.2 MPEG-2 Systems Standard

6.2.1 Video T-STD

Video T-STD for HEVC ***shall*** be based on Section 2.14.3.1 of ISO/IEC 13818-1 [7] and ***shall*** follow the constraints for the profile and level encoded in the video elementary stream in Appendix A of HEVC [8].

6.3 Assignment of identifiers

This section describes additional identifiers relevant to HEVC video elementary stream components.

6.3.1 HEVC Stream Type Codes

The value of stream_type for a HEVC video stream is 0x24 as per 13818-1 FDAM3 [7]. The value of 0x25 for stream_type is precluded.

6.3.2 Descriptors

6.3.2.1 Video descriptor

Information associated with the HEVC video stream may be signaled by the HEVC_video_descriptor() in accordance with ISO/IEC 13818-1:2013 with FDAM 3 [7]. This descriptor, when present, ***shall*** be placed in the descriptor loop for the video program element of the PMT with a descriptor tag value of '56' or '0x38'.

When the HEVC_video_descriptor() is present it shall be associated with a single HEVC stream that conforms to a single profile within the MPEG transport stream, and the following constraints ***shall*** apply:

- All temporal sublayers layers ***shall*** be carried in a single PID with appropriate signaling in HEVC descriptor
- The associated HEVC video stream ***shall*** not contain any HEVC 24-hour pictures. HEVC_24_hour_picture_present_flag ***shall*** be set to '0'.
- HDR_WCG_idc value parameters ***shall*** be set for each type of content in the manner designated in this subsection. For informational purposes, Table 2-112 (Semantics of HDR_WCG_idc) in 13818-1 [7] is reproduced here as Table 2.

Table 2: Semantics of HDR_WCG_idc [7]

HDR_WCG_idc	Description
0	SDR, i.e., video is based on the Rec. ITU-R BT.1886 reference EOTF with a color gamut that is contained within Rec. ITU-R BT.709 with a Rec. ITU-R BT.709 container (see Note 1)
1	WCG only, i.e., video color gamut in a Rec ITU-R BT.2020 container that exceeds Rec. ITU-R BT.709 (see Note 2)
2	Both HDR and WCG are to be indicated in the stream (see Note 3)
3	No indication made regarding HDR/WCG or SDR characteristics of the stream
NOTE 1 – An example where it would be desirable to set HDR_WCG_idc to 0 would be when the colour_description_present_flag, as defined in Rec. ITU-T H.265 | ISO/IEC 23008-2, is set to '0', with colour_primaries and transfer_characteristics not present in the video stream. NOTE 2 – An example where it would be desirable to set HDR_WCG_idc to 1 would be when colour_primaries as defined in Rec. ITU-T H.265 | ISO/IEC 23008-2 is equal to 9 to indicate Rec. ITU-R BT.2020. NOTE 3 – An example where it would be desirable to set HDR_WCG_idc to 2 would be when transfer_characteristics as defined in Rec. ITU-T H.265 | ISO/IEC 23008-2 is equal to 16 to indicate BT.2100 PQ EOTF or equal to 18 to indicate BT.2100 HLG EOTF, and when colour_primaries as defined in Rec. ITU-T H.265 | ISO/IEC 23008-2 is equal to 9 to indicate Rec. ITU-R BT.2020.	

- SDR indicated video streams shall be signaled with an HDR_WCG_idc value set to '0'.
- HDR indicated video streams shall be signaled with an HDR_WCG_idc value set to '2'.
- All other video streams where no indication is made shall be signaled with an HDR_WCG_idc value set to '3'.
- HDR_WCG_idc value of '1' is SCTE reserved.
- Changes in the HDR_WCG_idc parameter ***shall*** only occur at SHRAPs.

Certain services may include video elementary streams that contain one or more HEVC still pictures that conform to the still picture model of ISO/IEC 13818-1 [7]. Any elementary stream containing still pictures ***shall*** include a HEVC_video_descriptor() with HEVC_still_present_flag set to "1" in accordance with section 2.6.64 of 13818-1 [7]. In addition, maximum value of Temporal**I**d and minimum value of Temporal**I**d ***shall*** be set to '0'. Constraints for transmitting HEVC still pictures are defined in section 6.6.2 of this document.

6.3.2.2 Caption service descriptor

This ***shall*** comply with the requirements of SCTE 128-2 [4] section 6.3.2.2.

NOTE 4: Receivers rendering captions and/or other types of graphics overlays need to be aware of both the stream format and end device display capabilities to avoid mismatches in video presentation.

6.3.2.3 SCTE Adaptation field data descriptor

This ***shall*** comply with the requirements of SCTE 128-2 [4] section 6.3.2.3

6.4 HEVC Program Constraints

MPEG-2 Programs ***shall*** be constrained to carry at most one HEVC video elementary stream component with a stream_type value of 0x24; as defined in ISO/IEC 13818-1:2013 with FDAM 3 [7].

6.4.1 SCTE HEVC Random Access Point (SHRAP) Access Unit Composition

An **SCTE HEVC Random Access Point** access unit (SHRAP) demarcates a location within an HEVC bitstream where an HEVC Receiver is able to begin decoding video. The spacing of successive random access points is an important contributor to channel change time, but is not the only factor contributing to channel change time. Other factors that contribute to channel change time include physical device tuning constraints, RF tuning, or conditional access operations. Picture coding constraints for low delay mode are found in SCTE HEVC Coding Constraints [2].

6.4.2 SHRAP Transport Constraints

An SHRAP ***shall*** meet the following transport constraints.

6.4.2.1 TS Packet Header and Adaptation Field Constraints

A TS packet containing the first byte of a PES packet header of an SHRAP ***shall*** have an adaptation field. The payload_unit_start_indicator bit ***shall*** be set to '1' in the TS packet header and the adaptation_field_control bits ***shall*** be set to '11'(as per ISO/IEC 13818-1 [7]). In addition, the random_access_indicator bit in the adaptation field of the TS packet that contains the first byte of the PES packet header containing the SHRAP ***shall*** be set to '1' and ***shall*** follow the constraints as specified in ISO/IEC 13818-1 [7] in Subclause 2.4.3.5.

Per ISO/IEC 13818-1 [7], the elementary_stream_priority_indicator bit ***shall*** be set to '1' in the adaptation field of the TS packet that contains the first slice start code of the SHRAP Picture.

The first byte of the PES Packet Header containing an SHRAP and the first byte of the first slice start code of the SHRAP picture ***shall*** occur either in the same TS packet or in successive TS packets of the same PID. If both occur in the same TS packet, then both the random_access_indicator and elementary_stream_priority_indicator bits ***shall*** be set to '1' in the adaptation field of this TS packet. If the first byte of the PES header and the first slice start code of the SHRAP picture occur in successive TS packets of the same PID, then both TS packets ***shall*** contain adaptation fields. The first TS packet adaptation field ***shall*** contain random_access_indicator = 1. The second TS packet ***shall*** contain elementary_stream_priority_indicator = 1.

NOTE 5: Setting of both a random_access_indicator and elementary_stream_priority_indicator bits for the access unit signifies an SHRAP access unit.

NOTE 6: Multiple PPSs may be present in an SHRAP access unit. The number of PPSs that may be present in an SHRAP access unit is constrained by the TS packet restrictions above (requiring both RAI and ESPI bits set in either the same TS packet or of successive TS packets). According to MPEG-2 Systems 13818-1 [7], this requires all the bytes between the access unit delimiter NAL Unit and the start of the first slice of the SHRAP Picture to be part of the payload of either the same TS packet or two successive TS packets.

6.4.2.2 SHRAP Picture Decoding Time Stamp and SHRAP Picture Presentation Time Stamp Constraints

The HEVC Bitstream ***shall*** contain necessary elements such that all pictures with PTS greater than or equal to DTS_{SHRAP} + 0.5 seconds (where DTS_{SHRAP} represents the decoding time stamp of an SHRAP Picture) are fully reconstructable and displayable when decoding starts at the SHRAP picture.

NOTE 7: This implies that any picture that has a PTS >= [DTS_{SHRAP} + 0.5 seconds] cannot be predicted directly or indirectly from reference pictures that were transmitted prior to the SHRAP (i.e., with a lower value of DTS than DTS_{SHRAP}). This also implies that any picture that was transmitted prior to the SHRAP as well as any partially reconstructed pictures in the time interval [DTS_{SHRAP}, DTS_{SHRAP} + 0.5 seconds], cannot have a PTS that is greater than or equal to [DTS_{SHRAP} + 0.5 seconds].

NOTE 8: This also implies that the PTS of the first clean displayed picture output is less than or equal to [DTS_{SHRAP} + 0.5 seconds]

The time difference between the receipt of an SHRAP (actual value of PCR if present in the transport packet or computed value of PCR for the transport packet containing SHRAP) and the DTS/PTS of its SHRAP Picture is another key component in determining channel change time. The time difference between the receipt of an SHRAP and the DTS of its SHRAP Picture is also known as the initial video buffering delay of the HEVC Bitstream in the CPB.

The initial video buffering delay ***shall not*** be greater than 3 seconds. For applications requiring fast channel change or small initial delay after random access, the initial video buffering delay *should* be limited to one second or less.

NOTE 9: The maximum initial video buffering delay for a given bitrate is not permitted to have a value that exceeds the maximum CPB size permissible in HEVC [8].

6.4.2.3 Constraints on Decoding Time Stamps

The maximum time interval between the decoding time stamp of successive SHRAP Pictures ***shall*** be less than or equal to 3 seconds.

For applications where fast channel change or random access is important, the maximum time interval between the decoding time stamp of successive SHRAP Pictures *should* be less than or equal to 1.2 seconds.

NOTE 10: The frequency at which SHRAP access units are inserted into an HEVC Bitstream is one of the key components in determining the channel change time and may simplify splicing and trick mode operations. If the interval between the Decoding Time Stamps of two successive SHRAP Pictures is too small, compression efficiency might be lowered significantly. On the other hand, if the interval between the Decoding Time Stamps of two successive SHRAP Pictures is too large, the time to effect a channel change or the initial delay after random access may be longer.

6.4.3 Adaptation Field Private Data

The signaling of adaptation field private data is described in SCTE 128-2 [4] section 6.4.3. Tag Values for HEVC ***shall*** be as described in the Table 3.

Table 3: Tag Values

Tag Values	Description
0x00	*Forbidden*
0x01	Used by DVB
0x02	Reserved
0x03	Reserved
0x04-0xDE	Reserved for future standardized use. See ATSC Code Points Registry in addition to this standard.
0xDF	Registered Private Data
0xE0-0xFE	User Private (unmanaged, therefore collisions between different users or applications may occur, except perhaps in totally closed systems)
0xFF	Reserved for future extensions

NOTE 11: This standard places no constraint on the definition of new tag values that conform to the structure defined herein. The syntax and semantics for other tag values, when defined, may be found in other SCTE or other standards.

6.4.3.1 Optional Transport Adaptation Layer Information

Multiple tag values *should not* be used in the same program. Use of tag values 0x02 and 0x03 is *deprecated*. HEVC Receivers may ignore tag values 0x02 and 0x03 and their corresponding information.

6.5 PES constraints

Each PES packet ***shall*** contain exactly one HEVC access unit, as defined in Sections 2.1.3 and 2.14.1 of 13818-1 [7]. The HEVC access unit start ***shall*** occur in the same TS packet as contains the corresponding payload_unit_start_indicator==1 or in the next TS packet with the same PID. Each PES packet header ***shall*** contain a PTS. Each PES packet header also ***shall*** contain a DTS if DTS differs from the PTS. PES packetization ***shall*** comply to ISO/IEC 13818-1 [7] even under system time base or continuity counter discontinuities signaled by setting discontinuity_indicator to '1' in the adaptation header.

NOTE 12: Per 13818-1 [7], the payload_unit_start_indicator bit is set to '1' in the TS packet header of a TS packet containing a PES packet header. The payload of this TS packet will commence with the first byte of the PES packet.

6.6 Constraints on Alternative Application Modes

6.6.1 Low Delay Mode

Low Delay mode is signaled by low_delay_hrd_flag[i] = '1' in the HRD Parameters (per SCTE HEVC Coding Constraints [2] TABLE 9)**.** Low Delay mode ***shall*** satisfy all of the following transport constraints. Picture coding constraints for low delay mode are found in SCTE HEVC Coding Constraints [2] Section 7.3.1.

1. The PTS of each picture ***shall*** be equal to or inferred equal to its DTS. The DTS may or may not be present in the PES packet header.
2. Each picture in the bitstream ***shall*** be greater than the PTS of the prior picture.

6.6.2 Support for HEVC Still Pictures

HEVC still pictures may be used in the transport multiplex and when used ***shall*** comply with the following transport constraints. Picture coding constraints for HEVC still pictures are found in SCTE HEVC Coding Constraints [2] Section 7.3.3.

1. A PES packet ***shall*** contain one and only one complete access unit with a still picture, which ***shall*** be aligned to the PES packet header. The PES packet header ***shall*** contain a coded PTS value.
2. The still picture coding ***shall*** comply with Section 2.1.103 of 13818-1[7].
3. The PMT for this program element ***shall*** include the HEVC_video_descriptor with the HEVC_still_present_flag set to '1'.

APPENDIX A- PVR ASSIST INFORMATION (REMOVED)

Material formerly in this appendix has been removed in this revision of the specification. In future specification versions, this appendix will be removed in its entirety.