



***Society of Cable  
Telecommunications  
Engineers***

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**ENGINEERING COMMITTEE  
Digital Video Subcommittee**

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**AMERICAN NATIONAL STANDARD**

**ANSI/SCTE 172 2017**

**Constraints On AVC and HEVC Structured Video  
Coding for Digital Program Insertion**

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## 1. Introduction

### 1.1. Scope

This document defines additional video coding and transport constraints on ANSI/SCTE 128 [2][3] (which constrains ITU-T H.264/ ISO/IEC 14496-10 (“AVC”) video compression [7]) or on ANSI/SCTE 215 [4][5] (which constrains ITU-T H.265/ISO/IEC 23008-2 (“HEVC”) video compression [9]) for Digital Program Insertion applications using SCTE 35 messaging [1]. AVC and HEVC video uses a network abstraction layer structure to carry video and in this document “NAL structured video” will collectively refer to both AVC and HEVC Video.

Note: This standard applies only when both the insertion content and the network both use AVC video coding or both use HEVC video coding.

## 2. 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 35-2016, Digital Program Insertion Cueing Message for Cable
- [2] ANSI/SCTE 128-1 2013, AVC Video Constraints for Cable Television Part 1- Coding
- [3] ANSI/SCTE 128-2 2013, AVC Video Constraints for Cable Television Part 2-Transport
- [4] ANSI/SCTE 215-1 2015, HEVC Video Constraints for Cable Television Part 1- Coding
- [5] ANSI/SCTE 215-2 2015, HEVC Video Constraints for Cable Television Part2- Transport

### 2.2. Standards from Other Organizations

- [6] ISO/IEC 13818-1:2016 (E), International Standard, Information technology – Generic coding of moving pictures and associated audio information: Systems.
- [7] ISO/IEC 14496-10 (ITU-T H.264), International Standard (2009), Advanced video coding for generic audiovisual services.
- [8] OC-SP-HOST2.1-CFR-I17-130418, OpenCable Host Device 2.1 Core Functional Requirements, see <https://apps.cablelabs.com/specification/opencable-host-device-2-1-core-functional-requirements-2>
- [9] ISO/IEC 23008-2 (ITU-T Rec. H.265), International Standard (2015) – MPEG H Information technology – High efficiency coding and media delivery in heterogeneous environments Part 2: High efficiency video coding.

### 2.3. Published Materials

- No normative references are applicable.

### 3. Informative References

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

#### 3.1. SCTE References

- [10] ANSI/SCTE 104 2015, Automation System to Compression System Communications Applications Program Interface (API).
- [11] ANSI/SCTE 214-1 2016, MPEG DASH for IP-Based Cable Services Part 1: MPD Constraints and Extensions.

#### 3.2. Standards from Other Organizations

- [12] Guidelines for Implementation: DASH-IF Interoperability Points, Version 4.0, <http://dashif.org/wp-content/uploads/2016/12/DASH-IF-IOP-v4.0-clean.pdf>

#### 3.3. Published Materials

- No informative references are applicable.

### 4. Compliance Notation

<i>shall</i>	This word or the adjective “ <i>required</i> ” means that the item is an absolute requirement of this document.
<i>shall not</i>	This phrase means that the item is an absolute prohibition of this document.
<i>forbidden</i>	This word means the value specified shall never be used.
<i>should</i>	This word or the adjective “ <i>recommended</i> ” 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.
<i>should not</i>	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.
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<i>deprecated</i>	Use is permissible for legacy purposes only. Deprecated features may be removed from future versions of this document. Implementations should avoid use of deprecated features.

### 5. Abbreviations and Definitions

Note: Throughout this document, the terms used have specific meanings. Because some of the terms that are defined in ISO/IEC 13818-1 [6], ISO/IEC 14496-10 [7], and ISO/IEC 23008-2 [9] have very specific technical meanings, the reader is referred to the original sources for their definition. For terms used in this document, brief definitions are given below.

## 5.1. Abbreviations

<b>AVC</b>	advanced video coding (refers specifically to video compression standardized in ISO/IEC 14496-10 [7].)
<b>BLA</b>	broken link access (as defined in ISO/IEC 23008-2 [9].)
<b>CPB</b>	coded picture buffer (as defined in ISO/IEC 14496-10 [7] and as defined in ISO/IEC 23008-2 [9] . )
<b>CRA</b>	clean random access (as defined in ISO/IEC 23008-2 [9] .)
<b>DPB</b>	decoded picture buffer (as defined in ISO/IEC 14496-10 [7] and as defined in ISO/IEC 23008-2 [9].)
<b>DTS</b>	decoding time stamp (defined in ISO/IEC 13818-1 [6] .)
<b>HEVC</b>	high efficiency video coding (refers specifically to video compression standardized in ISO/IEC 23008-2 [9].)
<b>IDR</b>	instantaneous decoding refresh (A picture type defined in ISO/IEC 14496-10 [7] and as defined in ISO/IEC 23008-2 [9].)
<b>NAL</b>	network abstraction layer (as defined in ISO/IEC 14496-10 [7] or as defined in ISO/IEC 23008-2 [9] .)
<b>PES</b>	packetized elementary stream (defined in ISO/IEC 13818-1 [6].)
<b>PTS</b>	presentation time stamp (defined in ISO/IEC 13818-1 [6].)
<b>RADL</b>	random access decodable leading (as defined in ISO/IEC 23008-2 [9].)
<b>RASL</b>	random access skipped leading (as defined in ISO/IEC 23008-2 [9].)
<b>SAP</b>	stream access point (as defined in ANSI/SCTE 214-1 [11].)
<b>SGOP</b>	SCTE Group of Pictures (as defined in ANSI/SCTE 128-1-2013 [2] or as defined in ANSI/SCTE 215-1 2015 for HEVC [4] .)
<b>SHRAP</b>	SCTE- HEVC Random Access Point (as defined in ANSI/SCTE 215-1 2015 [4].)
<b>SRAP</b>	SCTE Random Access Point (as defined in ANSI/SCTE 128-1 2013 [2].)
<b>TS</b>	transport stream (as defined in ISO/IEC 13818-1 [6].)

## 6. Digital Program Insertion System Overview (Informative)

Digital Program Insertion assumes a linear program delivery with periodic insertion opportunities signaled by ANSI/SCTE 35 [1] `splice_info_section()` messages carried in TS packets of a particular PID or PIDs within the program's TS. Insertion opportunities signal first a splice from network PTS value (usually to an advertisement) and optionally followed some time later by the signaling of a splice back into a different (usually later) network PTS value. An alternative signaling method signals only the first PTS but supplies a duration and signals "auto return to network." Signaling may also, in the case of content which may be delivered in a non-time-linear method (e.g. VoD), specify that the return to network PTS value be the same as the initial PTS value.

Insertion durations are seconds in length normally, although they are sometimes hours in length. For typical commercials durations run 30, 60, or 120 seconds.

Different delivery mechanisms may use different technologies to perform the insertions. For example, insertions in linear program delivery are typically done by a splicer/content server pair. In a VOD environment a VOD server may assemble a playlist of entertainment content and the inserted ads. For DASH delivery ad content segments may be inserted into or replaced in the manifest. The coding constraints defined in the specification are applicable to all delivery mechanisms. The transport constraints are applicable to delivery mechanisms that are based on MPEG transport [6]

### 6.1. Collective Terminology for NAL Based Video Streams (Informative)

Text in this specification related to NAL based video streams use the following structures and syntax to support use of common collective terminology across codecs for describing spliced based expectations and constraints in this specification. The "context" when referring to NAL based terminology is determined by expectations of which coding format (e.g. AVC or HEVC) is being used. There is no intention of mixing of different coding format NAL structures so collective terminology is not to be interpreted as such. If there are splicing conditions that are specific to particular codec formats then this will be explicitly documented in the specification without the use of collective NAL terminology.

When NAL ISO/IEC Video Coding Standard is used this either refers to ISO/IEC 14496-10 (ITU-T H.264), International Standard, Advanced video coding for generic audiovisual services [7] or ISO/IEC 23008-2 (ITU-T Rec. H.265), International Standard (2015) – MPEG H Information technology – High efficiency coding and media delivery in heterogeneous environments Part 2: High efficiency video coding [9].

The following list is the set of NAL collective terminologies used in this specification. The specific codec context needs to be selected to understand details relevant to that specific format.

- NAL Video Coding Standard
  - 14496-10 context:* AVC ISO/IEC 14496-10 Coding Specification [7].
  - 23008-2 context:* HEVC ISO/IEC 23008-2 Coding Specification [9].
- NAL SCTE In-Point
  - 14496-10 context:* refers to an IDR picture that meets the requirements of an SRAP as defined in Section 6.4.1 of ANSI/SCTE 128-1 2013 [2].
  - 23008-2 context:* refers to an IDR, BLA, or CRA picture or a TRAIL\_R field picture that meets the requirements of an SHRAP as defined in Section 7.1.2.1 of ANSI/SCTE 215-1 2015 [4]. BLA or CRA pictures can have associated RADL pictures but no associated RASL pictures.

Note: To condition a NAL SCTE In-Point that is also aligned as a start of an adaptive streaming segment, NAL SCTE In-Points also needs to meet the requirements of SAP type 1 or 2 [11].

- **NAL SRAP**  
*14496-10 context:* refers to an I or IDR picture contained in an access unit that meets the requirements of an SRAP as defined in as defined in ANSI/SCTE 128-1 2013 [2].  
*23008-2 context:* refers to an IDR, BLA, or CRA pictures or TRAIL\_R field picture contained in an access unit that meets the requirements of an SHRAP as defined in Section 7.1.2.1 of ANSI/SCTE 215-1 2015 [4]. BLA or CRA pictures can have associated RADL pictures but no associated RASL pictures.

Note: To condition a NAL SCTE In-Point that is also aligned as a start of an adaptive streaming segment, NAL SCTE In-Points also needs to meet the requirements of SAP type 1 or 2 [11].

- **NAL IDRPicture**  
*14496-10 context:* refers to an IDR picture [7].  
*23008-2 context:* refers to an IRAP picture that is an IDR, BLA, or [CRA] picture or a TRAIL\_R field picture [9].
- **NAL SGOP**  
*14496-10 context:* refers to an AVC SCTE GOP (SGOP) [2].  
*23008-2 context:* refers to an HEVC SCTE GOP (SGOP) [4].
- **NAL structured video**  
*14496-10 context:* refers to an AVC coded video stream [7].  
*23008-2 context:* refers to an HEVC coded video stream [9].
- **NAL EOS**  
*14496-10 context:* refers to an AVC **end\_of\_stream\_rbsp()** NAL unit [7].  
*23008-2 context:* refers to an HEVC **end\_of\_bitstream\_rbsp()** NAL unit [9].
- **NAL no\_output\_of\_prior\_pics\_flag**  
*14496-10 context:* refers to the **no\_output\_of\_prior\_pics\_flags** syntax [7].  
*23008-2 context:* refers to the **no\_output\_of\_prior\_pics\_flag** syntax with conditioned constraints as specified in 23008-2 [9].
- **NAL receiver**  
*14496-10 context:* refers to an AVC receiver [2].  
*23008-2 context:* refers to an HEVC receiver [4].
- **NAL AU**  
*14496-10 context:* refers to an AVC access unit [7].  
*23008-2 context:* refers to an HEVC access unit [9].
- **NAL PU**  
*14496-10 context:* refers to an AVC presentation unit [7].  
*23008-2 context:* refers to an HEVC presentation unit [9].



- NAL SCTE Coding Level Constraints
  - 14496-10 context:* refers to the SCTE 128-1 specification [2].
  - 23008-2 context:* refers to the SCTE 215-1 specification [4].
- NAL SCTE Transport Level Constraints
  - 14496-10 context:* refers to the SCTE 128-2 specification [3].
  - 23008-2 context:* refers to the SCTE 215-2 specification [5].
- NAL Capable Splicing Devices
  - 14496-10 context:* refers to AVC capable splicing devices.
  - 23008-2 context:* refers to HEVC capable splicing devices.

## 6.2. Content Creation System Expectations (Informative)

It is expected that the creator of NAL structured video content with insertion opportunities compliant with this document will use ANSI/SCTE 104 [10] triggers to generate the ANSI/SCTE 35 [1] splice messages in the Transport Stream. In situations where NAL structured video content is created by “digital turnaround” systems, then the insertion of the resulting splice messages will be in reaction to splice messages in an incoming service, which should be compliant with ANSI/SCTE 35 [1].

ANSI/SCTE 35 [1] requires placement of splice messages at least 4 seconds before the signaled splice event (splice messages placed earlier than 4 seconds might help splicers). This should provide encoders with more than adequate notice for the placement of the syntax elements required by this document.

Use of “immediate mode” splicing operations with NAL structured video coding is strongly discouraged, as its use will likely result in the transition having video and/or audio anomalies.

## 6.3. Expectations for NAL Based Video Receiver Behavior (Informative)

This specification describes stream conditioning that makes it possible for a NAL receiver to decode and present a NAL structured video bitstream containing spliced content without disruption. This section describes expectations around receiver behavior when decoding these bitstreams.

Streams conforming to this specification will contain a NAL EOS immediately prior to a splice, followed by the spliced-in bitstream. The access unit following this NAL AU will meet the requirements for a NAL In-Point and may be accompanied by a signaled time base discontinuity. NAL receivers are expected to handle these discontinuities.

To effect clean playback across a splice the NAL receiver is expected to continue processing the bitstream. If the first access unit following the splice has the NAL `no_output_of_prior_pics_flag` set to “0”, the receiver should not infer it to be “1”.

Note: If the first picture output from the DPB for the following bitstream does not immediately follow the last output picture from the DPB for the stream preceding, the NAL receiver repeats the last output picture from the DPB until the first picture from the following bitstream is outputted from the DPB.

Note: these requirements were originally specified for AVC receivers in CableLabs OC-SP-HOST2.1-CFR- I17-130418 [8].

NAL receivers are expected to seamlessly handle picture resolution changes.

## 6.4. Consequences of the Difference between MPEG-2 and NAL Based Video (Informative)

ANSI/SCTE 35 [1] splice messages use presentation time stamps (PTS) to signal splice points. NAL structured video frames are usually transmitted in a different order than their display order. While this is also true of MPEG-2 video coding, NAL structured video has much larger buffers, holding several pictures at a time. Each picture is decoded and moved into the DPB at the time indicated by its decoding time stamp (DTS). For further constraints see section 8.1.

## 7. Constraints On Video Coding For Digital Program Insertion

Both the insertion content and the network *shall* be coded in accordance with NAL SCTE Coding Level Constraints, subject to the additional constraints of this standard.

Note: Constraints are provided for both network (see Section 7.2) and insertion content (see Section 7.4).

### 7.1. Definition of Out Point and In Point

#### 7.1.1. Out Point

As defined in ANSI/SCTE 35 [1], an Out Point is a point between two presentation units and the corresponding point between two NAL AUs in the coded stream in decode order. An Out Point is a suitable place to exit a NAL structured video stream.

When the **out\_of\_network\_indicator** in a **splice\_info\_section()** is '1', specifying an Out Point (as opposed to an In Point), the intended Out Point of a signaled splice event will be the point immediately prior to the NAL PU whose presentation time most closely matches the signaled **pts\_time** as modified by **pts\_adjustment**.

Splicing devices are responsible for locating the corresponding splice point in decode order of a respective Out Point (see Section 7.2.1). Methods to assist splicing devices in locating the splice point in decode order may be provided by other means.

#### 7.1.2. In Point

As defined in ANSI/SCTE 35 [1], an In Point is a point between two NAL PUs and the corresponding point between two NAL AUs in the coded stream in decode order. An In Point is a suitable place to enter a NAL structured video stream. The first coded picture following an In Point (in decode order, not presentation order), *shall* be a NAL SCTE In-Point .

When the **out\_of\_network\_indicator** in a **splice\_info\_section()** is '0', specifying an In Point (as opposed to an Out Point), the intended In Point of a signaled splice event will be the point between two NAL PUs that is immediately prior to the corresponding NAL AU whose presentation time most closely matches the signaled **pts\_time** as modified by **pts\_adjustment**.

#### 7.1.3. Out Point and In Point Co-location

When an Out Point and an In Point are co-located (at the same point in the stream), the values of the respective **pts\_time** as modified by **pts\_adjustment** values *shall* point to the same access unit (presentation unit) (as defined by Section 7.5.2.1 of ANSI/SCTE 35 [1]).

Note: The two values of **pts\_time** as modified by **pts\_adjustment** in such a case may not be bit-for-bit identical.

## 7.2. Coding Constraints for Network Content

### 7.2.1. Constraints at network Out Points

The access unit in decode order prior to the Out Point *shall* end with either a NAL EOS unit or a filler data NAL unit (**filler\_data\_rbsp()** syntax element with a single filler (0xFF) byte). The presence of the filler data NAL unit is to permit a splicing device to convert the filler data NAL unit and the filler byte into a NAL EOS in the splicer's output when the splice is performed. That NAL EOS unit or the filler data NAL unit (as the case may be) *shall* be entirely contained within the payload of a single TS packet. Also, note the additional constraint in section 6.1 which requires each PES packet to contain exactly one NAL AU.

The next video access unit in decode order may be a NAL SCTE In-Point . It *shall* contain a NAL IDRPicture access unit if the access unit preceding this in decode order contained a NAL EOS.

Note: If the NAL structured video format is interlaced, it is recommended that the last displayed picture before the network Out Point end with a bottom field and the first displayed picture following the network Out Point begin with a top field. For HEVC codec, Trail\_R fields would need to be converted to IDR or BLA picture and leading picture are then skipped by converting to RASL pictures.

In the network stream, at the moment when the last access unit prior to an Out Point is decoded, all of the pictures in the DPB which are not yet output (displayed/presented) *shall* be, starting immediately, contiguously displayable (no gaps in their PTS values).

### 7.2.2. Constraints at network In Points

The intended network In Point *shall* be preceded, in decode order, by a NAL EOS unit (NAL EOS syntax element) or filler data NAL unit (**filler\_data\_rbsp()** syntax element). The next video access unit in decode order, following the In Point, *shall* be a NAL SCTE In-Point . That access unit *shall* contain a NAL IDRPicture and be placed in the bitstream immediately following the intended network In Point specified in the associated ANSI/SCTE 35 [1] **splice\_info\_section()** . The network In Point may be either explicitly signaled or implicitly signaled via the ANSI/SCTE 35 [1] **splice\_info\_section()** that specified the network Out Point.

If explicitly signaled, the ANSI/SCTE 35 [1] **splice\_info\_section()** signaling the end of the avail which will have the **out\_of\_network\_indicator** set to '0' *shall* be provided to specify the location of the network In Point. If implicitly signaled, the **splice\_time()** event duration value *shall* be present in the ANSI/SCTE 35 [1] **splice\_info\_section()** that specified the network Out Point.

When explicitly signaled, the **out\_of\_network\_indicator** in a **splice\_info\_section()** *shall* be '0', specifying an In Point. The intended In Point of that signaled splice event will be the point between two presentation units that is immediately prior to the presentation unit whose presentation time most closely matches the signaled **pts\_time** as modified by **pts\_adjustment**. When implicitly signaled, (the **out\_of\_network\_indicator** in a **splice\_info\_section()** is '1'), specifying an Out Point, and the duration field of this **splice\_info\_section()**, when added to the **pts\_time** as modified by **pts\_adjustment**, indicates the signaled In Point time of a signaled splice event. The intended In Point is the point between two presentation units that is immediately prior to the presentation unit whose presentation time most closely matches the signaled In Point time as calculated from the duration field.

If the video format is interlaced, the last displayed picture before the network In Point should end with a bottom field and the first displayed picture following the network In Point should begin with a top field.

Note: To ensure that a splicer running in real-time can return to the network in the case of a slight mismatch in insertion length versus the intended length, it is recommended (while giving consideration to bandwidth limitations) that the first two NAL SRAPs following a network In Point should also be coded as NAL SCTE In-Points. The successive NAL SCTE In-Points will represent acceptable places to enter the stream but will not likely be signaled by an ANSI/SCTE 35 [1] `splice_info_section()`.

### 7.3. Constraints on splice point Access Units

Each access unit which immediately follows an indicated In Point *shall* comply with the requirements for a NAL SCTE In-Point. The access unit *shall* have `no_output_of_prior_pics_flag` set to '0' in all slice headers or slice segment headers within the access unit.

Note: Output of splicers must conform to both the relevant NAL Video Coding Standards and NAL SCTE Coding Level Constraints specifications. Setting the NAL `no_output_of_prior_pics_flag` to '0' (in a splicer's output) ensures that splices which do not result in conformance errors are "seamless." However, there may be conflicts in the presentation time (PTS) between the network content and the insertion content (such as when there is a mismatch in GOP structures) and thus result in a conformance error. To avoid this conformance error splicers should first determine whether there is a conformance error and, if an error exists, should reset the NAL `no_output_of_prior_pics_flag` to '1' in the slice header of the NAL unit. This conformance verification and appropriate action must be done at all splice points because all splice operations will by definition involve an NAL SCTE in-point.

#### 7.3.1. Constraints on fields in `seq_parameter_set_rbsp()`

For AVC video, `profile_idc` is set as indicated in Section 7.2.1.1 of ANSI/SCTE 128-1 [2].

`pic_order_cnt_type` is set to zero. `vui_parameters_present_flag` is set to '1' and the `vui_parameters()` follows. The value of `seq_parameter_set_id` is not to be changed from the prior value.

For HEVC video, `general_profile_idc` is set as indicated in Section 7.1.1.1 of ANSI/SCTE 215-1 [4].

`pic_order_cnt_type` is set to zero. `vui_parameters_present_flag` is set to '1' and the `vui_parameters()` follows. The value of `seq_parameter_set_id` is not to be changed from the prior value.

### 7.4. Coding Constraints on Insertion Material

#### 7.4.1. Constraints on Insertion Material In Points

Coded Insertion Material (to be inserted into a Network following its Out Point) *shall* begin with a NAL SCTE in-point (in decode order). This *shall* be an Insertion Material In Point. There may exist additional points of entry (In Points) within the Insertion Material.

The NAL SCTE in-point access unit should have NAL `no_output_of_prior_pics_flag` set to '1' in all slice headers within that access unit, unless there is another way to guarantee conformance with both the NAL Video Coding Standard and NAL SCTE Coding Level Constraints specifications.

Note: Splicers can examine the structures in both the network and the insertion material to ensure conformance. Should the two match, then the NAL `no_output_of_prior_pics_flag` should be set to '0' by the splicer. Setting the NAL `no_output_of_prior_pics_flag` to '1' makes the splicer output conform to

both the NAL Video Coding Standard and NAL SCTE Coding Level Constraints specifications. However, the splice may not be “seamless” at both the in point and out point. In order to achieve a “seamless” splice (such as when both the network content and the insertion content have a matched NAL SGOP structure) some splicers may decide to delete the NAL EOS unit (replace it by a or by a **filler\_data\_rbsp()**) and set the NAL **no\_output\_of\_prior\_pics\_flag** to '0' appropriately at the “in” and “out” splice points.

Note: For NAL video based codec formats, both NAL Video Coding Standard and NAL SCTE Coding Level Constraints Specification place additional constraints upon the construction of the NAL SCTE in-point access unit. The reader should consult respective documents for specifics.

ANSI/SCTE 35 [1] messages are not necessary, and not prohibited, in the Insertion Material content.

If the video format is interlaced, the first displayed picture of the Insertion Material should begin with a top field.

#### **7.4.2. Constraints on Insertion Material Out Points**

Each segment of Insertion Material to be inserted into a Network stream **shall** be terminated by an Out Point as described in this section of this document. There may exist additional Out Points within the body of the Insertion Material.

Each such segment **shall** be a complete “coded video sequence” as defined by NAL Video Coding Standard and terminated by a NAL EOS.

If the video format is interlaced, the last displayed picture of the Insertion Material and the last display picture of each Out Point should end with a bottom field.

At an Insertion Material Out Point, at the moment when the last access unit is decoded, all of the pictures in the DPB which are not yet displayed **shall** be, starting immediately, contiguously displayable (no gaps in their PTS values).

#### **7.5. Use of splice event cancel**

If an ANSI/SCTE 35 [1] **splice\_info\_section()** occurs in the Transport Stream with **splice\_event\_cancel\_indicator** set to ‘1’, the structure of the video stream is not constrained and a seamless splice should not be expected.

### **8. Constraints On Transport**

#### **8.1. Constraints beyond NAL SCTE Transport Level Constraints**

The Transport Constraints of NAL SCTE Transport Level Constraints specification **shall** be followed. Further, each PES packet **shall** contain exactly one NAL access unit as defined in PES Constraint Section as specified in Sections 6.5 of NAL SCTE Transport Level Constraints.

The access unit following the intended splice point specified in the ANSI/SCTE 35 [1] **splice\_info\_section()** (and which may be either a splice from network or a splice into the network) **shall** begin a PES packet, which in turn **shall** begin a TS packet. This PES packet **shall** contain a PTS and a DTS, should it differ from the PTS.

The previous access unit (in TS order) may be terminated by a NAL EOS or by a **filler\_data\_rbsp()**.

An NAL IDRPicture access unit which follows the intended splice point specified in the ANSI/SCTE 35 [1] **splice\_info\_section()** should not be directly preceded by another NAL IDRpicture access unit.

## 8.2. Constraints on SCTE 35 messages associated with AVC coding

The intended splice point specified in the ANSI/SCTE 35 [1] **splice\_info\_section()** may be for either a splice from network (“network Out Point”) or a splice into the network (“network In Point”). If a splice from network, **auto\_return** may be set to ‘1’ in the **break\_duration()** of the message.

The PTS sample (**pts\_time** in the **splice\_time()** structure) specified in the ANSI/SCTE 35 [1] message *shall* comply with the requirements of Section 7.5.2.1 of ANSI/SCTE 35 [1].

## 9. Function of Splicing Devices (Informative)

NAL capable splicing devices should keep the following in mind during operation:

The output of the splicing operation must be conformant to the NAL Video Coding Standard.

The splicer, to produce a compliant output stream, may need to set the NAL **no\_output\_of\_prior\_pics\_flag** to ‘1’ in the access unit which starts an insertion.

Field parity must always be maintained across the splice at all out and in-points.

Splicers may remove the NAL EOS from their output stream if they can guarantee a conformant output stream without it.