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**Digital Video Broadcasting (DVB);  
Dynamic substitution of content in linear broadcast;  
Part 1: Carriage and signalling of placement opportunity  
information in DVB Transport Streams**

**EBU DVB<sup>®</sup>**

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**Reference**DTS/JTC-DVB-390-1

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# Foreword

This Technical Specification (TS) has been produced by Joint Technical Committee (JTC) Broadcast of the European Broadcasting Union (EBU), Comité Européen de Normalisation ELECTrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI).

NOTE: The EBU/ETSI JTC Broadcast was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC Broadcast became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

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The Digital Video Broadcasting Project (DVB) is an industry-led consortium of broadcasters, manufacturers, network operators, software developers, regulatory bodies, content owners and others committed to designing global standards for the delivery of digital television and data services. DVB fosters market driven solutions that meet the needs and economic circumstances of broadcast industry stakeholders and consumers. DVB standards cover all aspects of digital television from transmission through interfacing, conditional access and interactivity for digital video, audio and data. The consortium came together in 1993 to provide global standardization, interoperability and future proof specifications.

The present document is part 1 of a multi-part deliverable covering the dynamic substitution of content in linear broadcast, as identified below:

**ETSI TS 103 752-1: "Carriage and signalling of placement opportunity information in DVB Transport Streams";**

ETSI TR 103 752-2: "Interfacing to an advert decisioning service and optimal preparation of media".

Full details of the entire series can be found in the present document (see clause 4).

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## Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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## Introduction

For broadcasters who wish to dynamically substitute advertising in a linear broadcast, or for platform operators who wish to enable the functionality for broadcasters, the present document specifies broadcast signalling used by receivers to identify placement opportunities within a service in a DVB Transport Stream. The signalling described in the present document may also be applied to dynamic substitution of programme content.

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# 1 Scope

The present document specifies broadcast signalling for DVB Dynamic Advertisement Substitution.

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## 2 References

### 2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <https://docbox.etsi.org/Reference>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] SCTE 35 2019r1: "Digital Program Insertion Cueing Message for Cable".
- [2] SCTE 104 2019r1: "Automation System to Compression System Communications Applications Program Interface (API)".
- [3] IETF RFC 3986: "Uniform Resource Identifier (URI): Generic Syntax".
- [4] IETF RFC 4648: "The Base16, Base32, and Base64 Data Encodings".
- [5] ETSI TS 101 162: "Digital Video Broadcasting (DVB); Allocation of identifiers and codes for Digital Video Broadcasting (DVB) systems".
- [6] ETSI TS 102 851: "Digital Video Broadcasting (DVB); Uniform Resource Identifiers (URI) for DVB Systems".
- [7] ETSI TS 103 286-2: "Digital Video Broadcasting (DVB); Companion Screens and Streams; Part 2: Content Identification and Media Synchronization".
- [8] ISO/IEC 13818-1:2018: "Information technology - Generic coding of moving pictures and associated audio information - Part 1: Systems".
- [9] ETSI TS 102 809: "Digital Video Broadcasting (DVB); Signalling and carriage of interactive applications and services in Hybrid broadcast/broadband environments".

### 2.2 Informative references

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI TR 103 752-2: "Digital Video Broadcasting (DVB); Dynamic substitution of content in linear broadcast; Part 2: Interfacing to an advert decisioning service and optimal preparation of media".

[i.2] Event Triggering Distribution Specification (ETDS), Media Perspectives.

NOTE: Available at <https://mediaperspectives.nl/publicationdoc/event-triggers-in-television-broadcasting/>.

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## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

For the purposes of the present document, the following terms apply:

**advert:** See advertisement.

**advertisement:** audio-visual presentation aimed at communicating the benefits of a product or brand

NOTE: An advertisement is an individual, self-contained Commercial, Sponsorship, Promotional (Promo), Bumper or similar item.

**advert media:** particular combination of audio-visual encoding and packaging used by a receiver to render an advert

NOTE: An advert response may reference several versions of advert media.

**advert producer:** organization, often a creative agency, responsible for supplying source media for an advertising campaign to an advert server

**advert request:** resource locator, which when resolved communicates the context of a placement opportunity to an advert server

**advert response:** response delivered in reply to an advert request, encapsulating all information related to a particular instance of an advert e.g. identifiers and resource locators for the advert's media and tracking

**advert server:** trusted web service that is used to decision advert opportunities and which receives advert requests and returns advert responses

**break:** complete block of one or more advertisements in advance of, interrupting, or following a programme

**broadcaster:** entity responsible for compiling and disseminating audio-visual programme content as a TV channel on a linear broadcast stream

**bumper:** specific type of advertisement, acting as channel identification and/or demarcation between different types of segments

NOTE: A bumper usually takes the form of a promotion of the broadcaster's channel brand and may be present going into a break and again coming out of it. Also referred to as a 'sting', 'ident', 'opener' or 'closer'.

**chapter:** part of a program followed by one or more advertisements or by the chapter of another programme

**commercial:** specific type of advertisement containing inducements to buy a product or attract customers

**DAS app:** software application to perform DAS on the receiver via the API exposed by the receiver's capabilities

**Dynamic Advert Substitution (DAS):** operation by which a certain broadcast advert is substituted by a targeted advert (delivered over internet protocol in most cases), chosen specifically for a given individual receiver

NOTE: The substitution is managed by an advert server, which will effectuate the DAS operation in compliance with the business rules set by the broadcaster or platform operator.

**frame-accurate advert substitution:** substitution of a linear advert that is perfectly spliced into a linear broadcast stream to exacting broadcast standards

**General Data Protection Regulation (GDPR):** single set of rules by which all companies operating within the European Union are required to abide by



**horizontal deployment:** deployment where one or more broadcasters output TV channels independently of each other and independently of the suppliers of the receiver hardware needed to view the TV channels

**macro substitution:** substitution method available to advert servers enabling run-time substitution of variables, typically URL parameters, within an advert response

**network operator:** entity responsible for the distribution of TV channels as linear broadcast streams

**placement opportunity:** section of broadcast TV content that may be replaced, typically a delineation of segments such as a block of one or more advertisements

NOTE: This concept generalizes the distributor placement opportunity (traditionally known as "Avail") and the provider placement opportunity.

**platform operator:** entity responsible for packaging and distributing TV channels as linear broadcast streams as well as the hardware receivers needed to view them

**programme:** individual, self-contained editorial grouping of content produced for TV broadcast, not being an advertisement

EXAMPLES: A movie, a news show, or an episode of a TV show.

**promo:** See promotional.

**promotional:** specific type of advertisement drawing attention to a future programme or event provided or organized by the broadcaster

**receiver:** device capable of receiving and rendering the audio-visual content of a linear broadcast stream, usually a television or set top box

**seamless advert substitution:** substitution of a linear broadcast advert which has no discernible visual or audible degradation to the viewer

NOTE: For a seamless advert substitution, the viewer cannot notice that the advert has been substituted without a comparative reference. This differs from frame-accurate substitution in that frames of black or freeze frames may have been introduced to visually improve a transition to the substitute advert.

**segment:** uniquely identifiable broadcast playlist element such as a program, a chapter or an advertisement

**sponsorship:** specific type of advertisement pointing out that the broadcasting of the previous, current or next programme was made possible thanks to a certain company or brand

**spot:** time-bound section of a break dedicated to a single advert

**substitute advert:** advert that is presented instead of the underlying broadcast advert

**substituted advert:** underlying broadcast advert that is omitted for the substitute advert

**time shift:** mode of viewing a linear broadcast stream so that it is presented to a viewer delayed from the live broadcast

**tracking:** resource locator that is resolved at run-time in order to count and measure advert delivery

**trick play:** pause, rewind or fast-forward of a linear broadcast stream

**trusted advert gateway:** server that provides receivers with substitution adverts based on decisions made elsewhere, but may provide restrictions or constraints for the decisioning process

**vertical deployment:** deployment where the end-to-end chain of broadcast-to-receiver infrastructure is the responsibility of a sole entity, e.g. a platform operator

NOTE: In a vertical deployment, the packages of TV channels are broadcast by the sole-entity and the receiver hardware and/or software needed to view the packages are supplied into the market by the same entity.

## 3.2 Symbols

Void.

### 3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

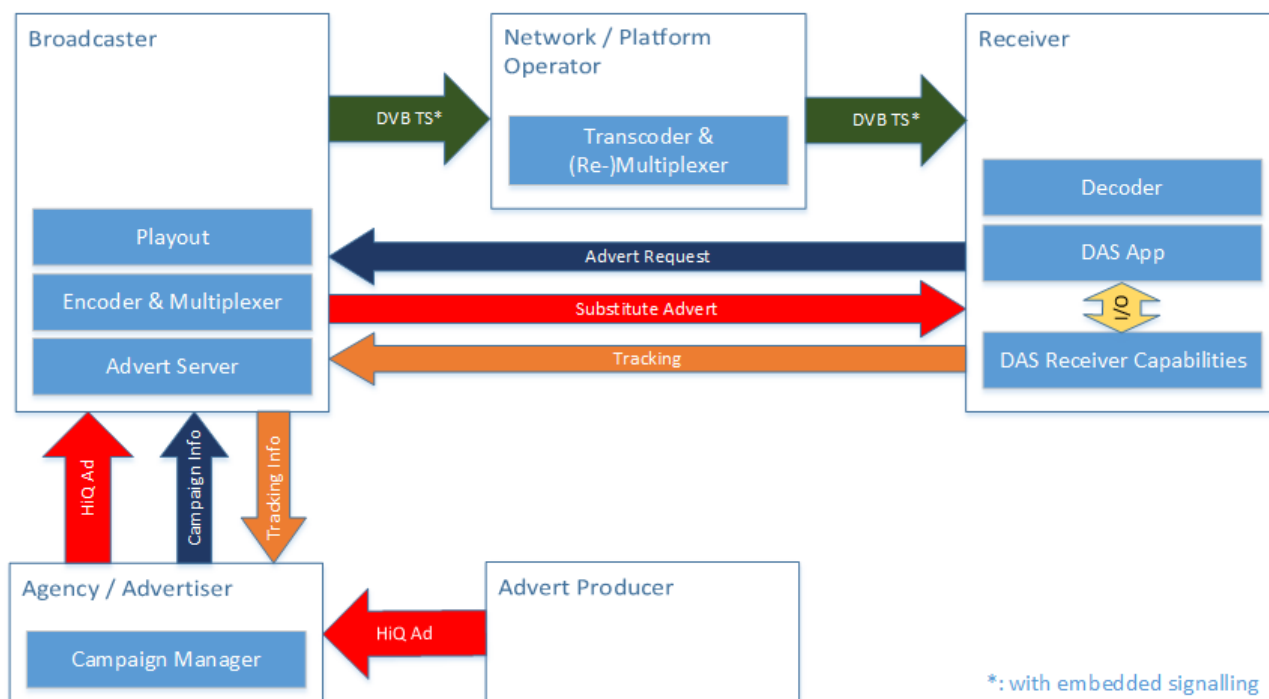
API	Application Programming Interface
CAS	Conditional Access System
CDN	Content Delivery Network
DA	Distributor Advertisement
DAS	Dynamic Advertisement Substitution
DPO	Distributor Placement Opportunity
DSM-CC	Digital Storage Media Command and Control
GPI	General Purpose Interface
HTTP	HyperText Transfer Protocol
HTTPS	HyperText Transfer Protocol Secure
PA	Provider Advertisement
PES	Packetized Elementary Stream
PID	Packet Identifier
PO	Placement Opportunity
PPO	Provider Placement Opportunity
PTS	Presentation Time Stamp
SCTE	Society of Cable Telecommunications Engineers
TA	Targeted Advertising
TEMI	Timed External Media Information
TS	Transport Stream
TV	TeleVision
UPID	Unique Programme Identifier
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
UTC	Universal Time Coordinated
UUID	Universally Unique Identifier

---

## 4 Overview

Linear broadcast television has been established over many years as a reliable marketing channel for delivering brand awareness to a mass audience. Mass market penetration of internet connected TVs presents the opportunity for broadcast TV to support features commonly available in digital advertising.

In response to this, there is a desire from broadcasters and platform operators to evolve the capabilities available in a connected linear broadcast TV environment to include features commonly found in online/digital advertising as this is increasingly required by advertisers and agencies.



**Figure 1: Logical components of the DVB-TA system**

Figure 1 above illustrates the logical components found in the technology framework proposed by DVB to enable Targeted Advertising (DVB-TA), which means the substitution of an advert from a linear broadcast with an advert chosen by an advert decisioning service based on criteria such as viewer profile, viewing behaviour, environmental or contextual factors.

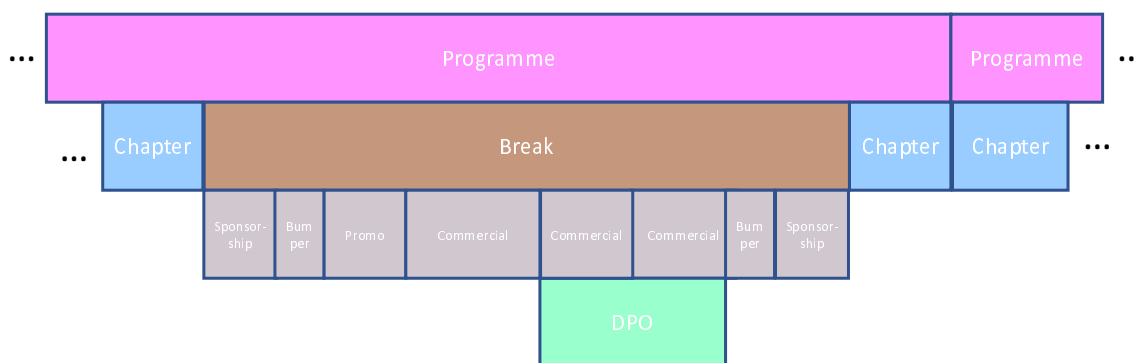
The DVB-TA technology framework addresses the following four areas:

- Signalling
- Seamless advert Splicing at the Connected Receiver
- Measurement & Reporting
- Integration with Existing Advert-Decisioning Systems

ETSI TR 103 752-2 [i.1] provides guidance for points 3 and 4 and gives advice for the preparation of streams and media to aid point 2. The present document covers the first point, and describes how to use SCTE 35 and the related SCTE 104 signalling to convey frame accurate information on where replacement of advertisements (or content) may take place. In addition to this, it describes how SCTE signalling can be used to convey frame accurate information on the location of the various segments in the content stream. This additional information enables more advanced ways of ad replacement. It also enables other use cases such as 'start-again', preventing ad-skipping (in time-shift/recordings) and automated editing.

The terminology in the present document often refers to the primary use-case of both the content being replaced and the replacement content being advertisements. The signalling described in the present document is also applicable to other content replacement scenarios, (e.g. regional content, alternate language content, or accessibility content) and these are not precluded.

Figure 2 displays the usual relations between the segments such as programmes, chapters, breaks and advertisements that are defined in clause 3.1. A Programme typically consists of chapters and breaks, with a break consisting of various advertisements (including bumpers, sponsorships, promos and the actual commercials). The definitions in clause 3 do not imply mandatory signalling behaviour for the various segments. For example, a broadcaster may decide that a Sponsorship is not part of the break, or that a break consists only of commercials. the choice where to define and signal the boundaries of a break is up to the broadcaster to decide.



NOTE: The presence of the DPO indicates that the second and third commercial in the break are eligible for replacement.

**Figure 2: Typical relation between programs, chapters, breaks and advertisements**

According to the SCTE 104 [1] and SCTE 35 [2] standards, broadcast events such as programmes, chapters, breaks, advertisements and many more can be signalled in a frame-accurate manner by using `time_signal()` messages, decorated with the appropriate `segmentation_descriptors`. In addition, opportunities for ad-replacement or content replacement can be signalled by the same method, using the 'Placement Opportunity' (DPO or PPO) `segmentation_descriptors`. This provides a homogeneous and future-proof signalling mechanism for targeted advertising and for other use cases, such as described above (see [i.2] for further examples). Advertisement segments are used to indicate opportunities for replacement of an individual advertisement, when nested signalling is required, see clause 5.3.3.

An alternative for signalling placement opportunities is to use the `splice_insert()` method, which is more widely supported in equipment at the time of writing of the present document. The `splice_insert()` method for signalling placement opportunities may be combined with `time_signal()` messages for signalling other broadcast events such as programmes and chapters.

## 5 Contribution signalling

### 5.1 Introduction

The contribution signalling described in this clause is relevant to the interface between Broadcaster and Network/Platform Operator shown in Figure 1.

### 5.2 Use of SCTE-104

SCTE 104 [2] specifies an API between an automation system and an encoder that allows the encoder to generate a SCTE 35 message. SCTE 104 is closely linked to SCTE 35 [1]. SCTE 104 messages specify a point in time with a "baseband timing" reference. When SCTE 104 data is translated into SCTE 35 messages, most of the metadata are passed through while timings are translated into PTS.

SCTE 104 timings are based on the following principle: the time indicated by the SCTE 104 command is the moment when the encoder takes into account the SCTE 104 message plus the pre-roll time in the pre-roll parameter included in the SCTE 104 message. There are two methods for an encoder to take into account a SCTE 104 message: immediately, or when an event occurs (according to the `time_type` parameter). Three events are specified in the standard: a given timecode (which is the most used mode), a given UTC time, a GPI. The choice between such `time_type` modes to achieve the required accuracy depends on the automation and encoding equipment implementations.

In SCTE 104 messages, the `DPI_PID_Index` can be used to route a given message to a specific encoding channel/PID. The use of multiple SCTE 35 streams with different PIDs is recommended where there are multiple types of downstream devices consuming the SCTE 35 messages, and where each type only has an interest in a subset of the messages. Each downstream device is then configured to consume a SCTE 35 message stream using one of the PID values in order to filter the relevant messages.

## 5.3 Use of SCTE-35 with PTS

### 5.3.1 Overview

Signalling for placement opportunities shall use one of the two following methods:

- Method A: Sending SCTE `time_signal()` structures combined with Placement Opportunity `segmentation_descriptors` to signal the Start/End boundaries of the PO as well as its duration. To support partial replacement of a PO, the boundaries and duration of the individually replaceable segments within the PO shall be signalled via `segmentation_descriptors` as well (see clause 5.3.3.2).
- Method B: Sending SCTE `splice_insert()` structures. To support partial replacement of a PO, the starts and durations of the individually replaceable segments within the PO shall be signalled also by `splice_insert()` structures referencing the time periods of the individually replaceable segments within the PO (see clause 5.3.3.3).

An implementation shall select one of the methods and shall not mix the use of the two methods for signalling placement opportunities.

The Placement Opportunity and Advertisement `segmentation_descriptors` may be of type "Provider" or "Distributor". The present document does not distinguish between these types. An implementation may have further private semantics for the two types to enable the selection of relevant placement opportunities in an implementation-specific manner.

### 5.3.2 Additional segmentation information

For both methods A and B described in clause 5.3.1, additional segmentation information may be signalled, describing content boundaries and associated context data. If signalled, this information shall be sent via the `time_signal()` structure enriched with appropriate `segmentation_descriptors`. The most important examples of `segmentation_descriptors` to be sent have the following `segmentation_type_ids`:

- Programme Start/End
- Chapter Start/End
- Break Start/End

Downstream applications shall not be adversely affected by any additional received data that is compliant with the SCTE-35 standard [1].

The following constraints and interpretations apply to Placement Opportunities:

- Placement opportunities can be signalled without additional content segments being signalled. The required signalling only needs to identify the replaceable content segments.
- When breaks and/or chapters are being signalled, any placement opportunity should be fully within either a break or a chapter.

### 5.3.3 Partial replacement of a PO

#### 5.3.3.1 Signalling for partial replacement of a PO

Signalling a PO (either via method A or B) is sufficient to support the basic scenario where all the content in the PO is to be replaced. For more advanced scenarios (e.g. replacement of consecutive versus non-consecutive ads) partial replacement is needed, i.e. it is needed to replace only some of the individually replaceable segments within a PO. In particular, it might be necessary to enable downstream applications to select either full or partial replacement, depending e.g. on technical and commercial conditions.

### 5.3.3.2 Partial Replacement of a PO using `time_signal()` structures

To support partial replacement scenarios using `time_signal()` structures, it is necessary to signal the start/end boundaries of the individually replaceable segments within the PO. For the case of ad replacement, this shall be done by sending Advertisement Start/End segmentation\_descriptors in a `time_signal()` structure.

An example situation can be seen in Figure 2, where the PO contains two ads. To enable partial replacement for this case, the boundaries of each of the two individual commercials shall be signalled using Advertisement Start/End segmentation\_descriptors.

### 5.3.3.3 Partial Replacement of a PO using `splice_insert()` structures

To support partial replacement scenarios using `splice_insert()` structures, starts and durations of the individually replaceable segments within the PO are also signalled using `splice_insert()` structures.

For the example situation in Figure 2, to enable replacement of the entire PO or individual replacement of the two commercials within the PO, three `splice_insert()` structures are signalled, one for the whole PO, and one for each of the commercials within the PO.

## 5.3.4 SCTE 35 section structure

### 5.3.4.1 Section encryption

SCTE 35 sections may be encrypted (`encrypted_packet = 1`) or unencrypted (`encrypted_packet = 0`). If encrypted, the encryption algorithm is specified in SCTE 35 [1], Table 27.

A decryption key, if needed, is delivered via the associated DAS application, and so is out of scope of the present document.

If the service is protected by a Conditional Access System (CAS), then the TS packets carrying SCTE 35 messages may be protected by this CAS.

### 5.3.4.2 Maximum section length

SCTE 35 [1] constrains SCTE 35 sections to start at the beginning of the payload of an MPEG TS packet. SCTE 35 sections for DVB DAS may be up to 4 096 bytes long, as specified in SCTE 35, and so can span multiple TS packets. The maximum length is reduced if the section is subsequently encapsulated in DSM-CC stream events, as described in clauses 6.3 and 7.2.

### 5.3.4.3 PTS adjustment field

The `pts_adjustment` field may be used in SCTE 35 message generation and re-multiplexing equipment. The value of this field shall be added to the times specified in `pts_time` fields to give the correct time reference.

## 5.3.5 SCTE 35 `segmentation_descriptor()` and `splice_insert()` contents

### 5.3.5.1 Introduction

The following constraints apply for the two methods for signalling advertisement (or content) replacement opportunities. Where appropriate, the differing field names for the same function are given. The `segmentation_descriptor` may be of any of the following types: DPO, PPO, distributor advertisement, provider advertisement.

### 5.3.5.2 `Segmentation_event_id` or `splice_event_id`

These fields provide an identifier for the signalled point in time which can be used by the DAS application.

### 5.3.5.3 Segmentation\_event\_cancel\_indicator or splice\_event\_cancel\_indicator

These fields shall be set to '0', i.e. cancellation of events is not permitted for DVB DAS.

### 5.3.5.4 DPO or PPO start and end segmentation messages or out\_of\_network\_indicator

Using the DPO or PPO segmentation\_descriptor, both start and end messages should be signalled in accordance with SCTE 35. For the DAS function, the end message conveys no additional information as the signalled end time shall be equal to the value given by start time + duration. The applicable segmentation\_type\_id values for POs are 0x34, 0x35, 0x36, and 0x37.

A splice\_insert() with out\_of\_network\_indicator = 1 is equivalent to a PPO/DPO start segmentation message. For splice\_insert() messages, it is recommended that only messages with out\_of\_network\_indicator set to '1' are used.

### 5.3.5.5 Segmentation\_duration\_flag or duration\_flag

These flags shall be set to '1' indicating that the duration is specified (not applicable to End segmentation messages).

### 5.3.5.6 Splice\_immediate\_flag (splice\_insert() only)

The flag shall be set to '0' indicating that the splice immediate mode is not permitted for DVB DAS.

### 5.3.5.7 Time\_specified\_flag

The flag in the splice\_time() structure shall be set to '1', indicating that the time is always specified for DVB DAS.

### 5.3.5.8 pts\_time

The pts\_time in the splice\_time() structure shall contain a PTS value to provide frame accurate information on the boundary between the segments/opportunities that are being signalled. This boundary is located immediately prior to the presentation unit whose presentation time most closely matches the signalled PTS value, where the signalled PTS value equals the signalled pts\_time as modified by the pts\_adjustment.

NOTE: For a Start message the PTS refers to the first frame of the segment, and for an End message the PTS refers to the first frame after the segment. This convention is aligned with how In Points and Out Points are defined in SCTE 35.

### 5.3.5.9 Auto\_return (splice\_insert() only)

The field shall be set to '1' indicating that a splice\_insert() command with out\_of\_network\_indicator set to '0' is not required at the end of the placement opportunity.

### 5.3.5.10 Segmentation\_upid\_type (segmentation\_descriptor() only)

To ensure interoperability of the Placement Opportunity signalling with downstream consumers such as DVB DAS applications, the segmentation\_upid\_type shall be set to '0x0F' indicating that the segmentation\_upid() contains a Universal Resource Identifier (see IETF RFC 3986 [3]).

### 5.3.5.11 Unique\_program\_id or segmentation\_upid()

These fields identify the specific instance of content such as a Programme or an Advertisement, or delineation of a collection of Segments such as a Break or a Placement. These fields can be used by the DAS application. The unique\_program\_id in the splice\_insert() structure is a 16-bit field, whereas the segmentation\_upid in the segmentation\_descriptor() is a variable length field, further specified by segmentation\_upid\_type.

The Unique Programme Identifier (UPID) in the segmentation\_upid() field shall conform to URI format (see IETF RFC 3986 [3]), with the following structure:

urn: <reverse domain name of broadcaster>: <identifier>

The use of the reverse domain name ensures that there is no overlap of UPIDs from different broadcasters. The <identifier> field is defined by the broadcaster. Unless specific requirements exist for another format, it is recommended that the <identifier> field contains an Airing ID represented as 16 hexadecimal characters.

EXAMPLES: urn:com.broadcaster:112210F47DE98115

(<identifier> is an Airing ID)

urn:tv.acme:B637643-50A9-4C2D-BC7B-09FD8312190F

(<identifier> is a UUID according to application-specific requirements)

The time period over which the signalling is unique should be sufficient to prevent misinterpretation by the DAS system and needs to be managed accordingly by each broadcaster.

### 5.3.5.12 Sub\_segment\_num and sub\_segments\_expected for PPO/DPO

These fields can be used to convey the position of the placement opportunity and the number of placement opportunities expected within the break being described. These fields can be used by the DAS application.

### 5.3.5.13 Segment\_num and segments\_expected for PA/DA

These fields can be used to convey the position of the advertisement and the number of advertisements expected within the break being described. These fields can be used by the DAS application.

### 5.3.5.14 Avail\_num and avails\_expected for splice\_insert

These fields can be used to convey the position of the placement opportunity and the number of placement opportunities expected within the break being described. These fields can be used by the DAS application.

### 5.3.5.15 Segment\_num and segments\_expected for DPO/PPO

These fields can be used to convey the number of the break within a programme and the total number of breaks expected within the programme. These fields can be used by the DAS application. There is no equivalent for splice\_insert() defined by SCTE 35.

### 5.3.5.16 DVB DAS descriptor

For full equivalence between splice\_insert() and segmentation\_descriptor methods, a DVB descriptor is defined which can be optionally included within a splice\_insert() command. See Table 1.

**Table 1: DVB DAS descriptor**

Syntax	No. of Bits	Mnemonic
DVB_DAS_descriptor() {		
splice_descriptor_tag	8	uimbsf
descriptor_length	8	uimbsf
identifier	32	uimbsf
break_num	8	uimbsf
breaks_expected	8	uimbsf
reserved	4	uimbsf
equivalent_segmentation_type	4	bslbf
upid	N*8	uimbsf
}		

#### Semantics for the DVB DAS descriptor()

**splice\_descriptor\_tag:** This 8-bit number defines the syntax for the private bytes that make up the body of this descriptor. The splice\_descriptor\_tag shall have a value of 0xF0.

**descriptor\_length:** This 8-bit number gives the length, in bytes, of the descriptor following this field.



**identifier:** This 32-bit number is used to identify the owner of the descriptor. The identifier shall have a value of 0x4456425F (ASCII "DVB\_").

**break\_num:** This 8-bit number identifies the position of the break within the programme. The field is set to '0' if it is not being used.

**breaks\_expected:** This 8-bit number identifies the number of breaks expected within the programme. The field is set to '0' if it is not being used.

**Equivalent\_segmentation\_type:** This 4-bit number identifies the segmentation\_type that would be used for the equivalent segmentation\_descriptor in a time\_signal() command.

**Table 2: Equivalent Segmentation Type**

Value	Meaning
0x0	no equivalent
0x1	Distributor Placement Opportunity
0x2	Provider Placement Opportunity
0x3	Distributor Advertisement
0x4	Provider Advertisement
0x5 to 0xF	reserved for future use

**upid:** This variable length field identifies the specific placement opportunity by a Unique Programme Identifier (UPID), and conforms to the URI format described in clause 5.3.5.11.

## 6 Distribution signalling

### 6.1 Introduction

The distribution signalling described in this clause is relevant to the interface between network/platform operator and the consumer receiver shown in Figure 1.

### 6.2 Use of SCTE-35 with PTS

SCTE 35 messages with PTS as described and profiled in clause 5.3 of the present document for contribution may also be used directly for distribution. In this case, any distribution re-multiplexer passes through the SCTE 35 messages from the contribution feed.

The signalling required by a specific platform might be a subset of the various SCTE 35 messages generated by the broadcaster. It is recommended for the contribution signalling to separate messages for different uses by generating the SCTE 35 messages on multiple PIDs, such that a single PID can be selected for a particular downstream usage, such as for distribution signalling. Other methods for filtering SCTE 35 messages include:

- Selection from the UPID value
- Use of a private\_descriptor
- Private semantics defining different applications for "Provider" and "Distributor" segmentation types

SCTE 35 [1] allows the table payload to be encrypted; this can be used by broadcasters to prevent information mining by competitors, and to prevent ad-replacement-blockers for consumer devices.

Some processing operations, e.g. video transcoding, in the network/platform operator's distribution network could involve modification of PTS values. After such operations, the SCTE 35 message will need to be updated to reflect the modified PTS value. The modification is facilitated by the `pts_adjustment` field in the SCTE 35 message. This field is in a fixed position relative to the start of an SCTE 35 section, and remains unencrypted in the message encryption scheme described in SCTE 35 [1].

NOTE: A transcoding operation will need to be implemented in a manner to preserve or re-introduce any stream conditioning required to facilitate content replacement.

## 6.3 Use of DSM-CC stream events

### 6.3.1 DSM-CC stream event payload format and carriage

The SCTE 35 message section may be carried either directly in a DSM-CC stream event, or in a DSM-CC object carousel file, referenced by the DSM-CC stream event. In the former method, the maximum SCTE 35 section length is limited to 180 bytes when referencing PTS, or 178 bytes if a TEMI timeline is used (maximum values of the `section_length` field in `splice_info_section()` are 177 and 175 respectively). The latter method of referencing a DSM-CC carousel object enables the carriage of larger SCTE 35 sections.

The payload of a DSM-CC stream event for Targeted Advertising signalling of POs is initially generated in a binary form as described in Table 3 using the binary SCTE 35 message section.

The `DSM-CC_stream_event_payload_binary()` structure shall be base-64 encoded prior to being encapsulated by a DSM-CC stream event. The base-64 encoding shall be carried out according to IETF RFC 4648 [4].

**Table 3: Binary version of DSM-CC stream event payload**

Syntax	No. of Bits	Mnemonic
<code>DSM-CC_stream_event_payload_binary() {</code>		
<code>DVB_data_length</code>	8	uimbsf
<code>reserved_zero_future_use</code>	3	bslbf
<code>event_type</code>	1	bslbf
<code>timeline_type</code>	4	uimbsf
<code>if (timeline_type == 0x2) {</code>		
<code>temi_component_tag</code>	8	uimbsf
<code>temi_timeline_id</code>	8	uimbsf
<code>}</code>		
<code>reserved_zero_future_use</code>	N*8	bslbf
<code>private_data_length</code>	8	uimbsf
<code>if (private_data_length &gt; 0) {</code>		
<code>private_data_specifier</code>	32	uimbsf
<code>for(i=0;i&lt;private_data_length-4;i++) {</code>		
<code>private_data_byte</code>	8	uimbsf
<code>}</code>		
<code>}</code>		
<code>if (event_type == 1) {</code>		
<code>carousel_object_name_length</code>	8	uimbsf
<code>for(i=0;i&lt;carousel_object_name_length;i++) {</code>		
<code>char</code>	8	uimbsf
<code>}</code>		
<code>}</code>		
<code>If (event_type == 0) {</code>		
<code>SCTE_35_section()</code>		
<code>}</code>		
<code>}</code>		

#### Semantics for the binary version of DSM-CC stream event payload

**DVB\_data\_length:** This 8-bit number gives the length, in bytes, of the fields following the `DVB_data_length` field prior to the `private_data_length` field.

**reserved\_zero\_future\_use:** Use of these fields may be defined by ETSI in future versions of the present document.

NOTE: All "reserved\_zero\_future\_use" bits are set to "0".

**event\_type:** This 1-bit field, when set to "1" indicates that this DSM-CC stream event contains a reference to a DSM-CC carousel object conveying the SCTE 35 message section. When set to "0", it indicates that the SCTE 35 message section is conveyed within this DSM-CC stream event.

**timeline\_type:** This 4-bit number identifies the timeline being referenced by PTS values in the SCTE 35 section.

**Table 4: Timeline Type**

Value	Meaning
0x0	no timeline used
0x1	PTS in SCTE 35 message references video PTS
0x2	PTS in SCTE 35 message references the time in a TEMI timeline associated with the service
0x2 to 0xF	reserved for future use

**temi\_component\_tag:** This 8-bit number is the component\_tag of the TEMI timeline being referenced by PTS values in the SCTE 35 message. This field is only present when timeline\_type is 0x2.

**temi\_timeline\_id:** This 8-bit number is the timeline\_id of the TEMI timeline being referenced by PTS values in the SCTE 35 message. This field is only present when timeline\_type is 0x2.

**private\_data\_length:** This 8-bit field specifies the length in bytes of the following private data.

**private\_data\_specifier:** The assignment of values for this field is given in ETSI TS 101 162 [5].

**private\_data\_byte:** This is an 8-bit field, the value of which is privately defined.

**carousel\_object\_name\_length:** This is an 8-bit field conveying the length of the DVB URI [6] of the carousel object containing the SCTE 35 message.

**char:** This is an 8-bit field, a sequence of which conveys the DVB URI [6] of a DSM-CC carousel object containing the SCTE 35 message.

**SCTE\_35\_section:** The entire SCTE 35 splice\_info\_section() structure commencing with table\_id and finishing with CRC\_32. The splice\_info\_section() syntax is defined in Table 5 of SCTE 35 [1].

### 6.3.2 Use of DSM-CC stream events with PTS

The timeline\_type is set to '0x1' to indicate that the PTS in the SCTE 35 message references the video PTS for the service. The SCTE 35 message conforms to clause 5.3.

Some processing operations, e.g. video transcoding, in the Network/Platform Operator's network could involve modification of PTS values. After such operations, the DSM-CC stream event payload will need to be updated to reflect the modified PTS value, e.g. by changing the value of the pts\_adjustment field in the SCTE\_35\_section().

NOTE: A transcoding operation will need to be implemented in a manner to preserve or re-introduce any stream conditioning required to facilitate content replacement.

### 6.3.3 Use of DSM-CC stream events with TEMI

The timeline\_type is set to '0x2' to indicate that the PTS in the SCTE 35 message references a TEMI timeline associated with the service.

NOTE 1: For comparison between TEMI timeline and pts\_field value, the time on the timeline is first converted to a 90 kHz value, and then the 33 LSBs of the result are compared with the pts\_field value.

ETSI TS 103 286-2 [7] defines support in a receiver for the decoding of TEMI timeline descriptors in the adaptation field of Transport Stream packets carrying Packetized Elementary Streams (PESs). A TEMI timeline referenced in the manner described in clause 6.3.1 shall be carried in adaptation fields of:

- any audio, video or subtitle component; or
- any component with stream\_type 6 (private PES and stream\_id 1011 1101 for "private\_stream\_1") in the PES packet header, including, but not limited to components where the PES packet payloads are empty.

TEMI timeline\_descriptors for a TEMI timeline shall occur sufficiently frequently that the delta between successive timeline timestamp values does not exceed 1 second.

NOTE 2: A timeline discontinuity may cause an exception to the maximum delta value.

The temi\_timeline\_component\_tag is the component\_tag of the component carrying the timeline and the temi\_timeline\_id is the timeline\_id found within the TEMI timeline\_descriptor of the timeline. The SCTE 35 message conforms to clause 5.3 except that for clause 5.3.4.3, the pts\_adjustment field is not modified in re-multiplexing operations.

Propagation of a TEMI timeline through a Network/Platform Operator's network will require the network equipment to preserve the TEMI. Where a component carrying TEMI is passed through, it is sufficient to correct the PTS as would normally be done for any other passed-through component containing PES. For operations (such as transcoding) that discard existing transport stream packets but preserve or transform the media essence, the TEMI timeline\_descriptors can be passed through unmodified and included in the adaptation fields of the new Transport Stream packets, while preserving the timing relationship to the media essence.

NOTE 3: The timing relationship between TEMI and PES payloads containing media essence is defined by which TS packet the timeline\_descriptor is carried in relative to the start of PES payloads. This is defined in clause U.3.6 of ISO/IEC 13818-1 [8].

NOTE 4: Timestamps contained in the TEMI timeline descriptor as well as the payload of the DSM-CC stream events are not modified.

NOTE 5: A transcoding operation will need to be implemented in a manner to preserve or re-introduce any stream conditioning required to facilitate content replacement.

## 6.4 Timing of Signalling

The DVB-TA signalling shall allow the pre-announcement of placement opportunities sufficiently far in advance to allow the decision to be made about what ad to insert and for DAS to be performed.

The DAS application can obtain advance knowledge of the approximate time for a placement opportunity by on-line communications with the relevant DAS servers, such that sufficient time for both ad decision and ad download is available ahead of the placement opportunity.

Additionally, broadcast SCTE 35 messages and their equivalent DSM-CC stream events signal the position of a placement opportunity ahead of the opportunity. There is no limit in the SCTE 35 [1] specification as to how far in advance the signalling can be, so that the SCTE 35 message and the equivalent DSM-CC stream event can potentially provide a pre-announcement function. If the SCTE 35 message is generated from a SCTE 104 message, there is a maximum of 65,535 seconds for the pre-roll\_time field, potentially allowing pre-announcement up to slightly more than one minute before the opportunity.

NOTE: The maximum pre-roll time may be limited in implementations by the amount of buffering available in the encoding system for pending messages. Also, some encoding system implementations may delay the issue of SCTE 35 messages generated from an SCTE 104 [2] message such that the SCTE 104 pre-roll time does not directly determine the SCTE 35 pre-announcement timing.

SCTE 35 messages and their equivalent DSM-CC stream events may be sent more than once for a given placement opportunity.

A private\_descriptor within the SCTE 35 message, as mentioned in clause 6.2, may be used to distinguish between messages for pre-announcement and messages that are close to the time of a placement opportunity.

Other mechanisms for pre-announcement of placement opportunities (e.g. a dedicated pre-announcement message) are for further study.

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## 7 Converting contribution signalling to distribution signalling

### 7.1 Converting from SCTE-35 with PTS to SCTE-35 with PTS

No conversion is necessary in this case, as the same format is used in both contribution and distribution.

If and when PTS values are modified by distribution network processing, the `pts_adjustment` field shall be set or modified as described in clause 6.2.

### 7.2 Converting from SCTE-35 with PTS to DSM-CC stream events with PTS

The term 'converter' in this clause refers to apparatus (which can be implemented in hardware, software or a combination thereof) capable of converting from SCTE-35 with PTS to DSM-CC stream events with PTS.

SCTE-35 messages to be converted shall be provided using a dedicated PID, so that the relevant packets can be selected by PID value as the input stream to the converter. The converter can either remove the input stream from the TS or forward the input stream to downstream devices.

For signalling POs by means of DSM-CC stream events, the same PID used for delivering any other "do-it-now" stream events to the DAS application shall be used by the converter for delivering the DSM-CC sections contained in TS packets. The converter will need to multiplex the data carried on the PID so that contents of different sections are not interleaved. If there are no other "do-it-now" stream events, a new dedicated PID shall be used by the converter for the DSM-CC stream events providing the PO signalling.

The converter performs the following steps (in the given order):

- 1) Create the binary payload for the DSM-CC stream event as specified in clause 6.3.1 for the DSM-CC stream event payload. In the present case the `timeline_type` field shall be set to "1" in order to identify PTS as the referenced timeline.
- 2) Apply base-64 encoding according to IETF RFC 4648 [4] to `DSM-CC_stream_event_payload_binary()` structure.
- 3) Insert the base-64 encoded payload for the DSM-CC stream event as private data to the `privateDataByte` field of a stream event descriptor of a "do it now" event in compliance with ETSI TS 102 809 [9].
- 4) Transmit the DSM-CC stream event (i.e. the "do it now" event) immediately.

NOTE 1: There is a maximum of 245 bytes of payload per DSM-CC stream event as specified in ETSI TS 102 809 [9]. The base-64 encoding increases the message size from its binary form in the ratio 4:3. The maximum section payload size and effect of base-64 encoding needs to be taken into account when creating DSM-CC stream events from SCTE 35 messages. If the binary SCTE 35 message section exceeds 180 bytes (i.e. `section_length` field greater than 177), then the method described in clause 6.3.1 of conveying the SCTE 35 section in a DSM-CC carousel object needs to be used.

NOTE 2: When signalling a PO by means of DSM-CC stream events, receivers are likely to require some advance notice. SCTE 35 requires a minimum advance timing of 4 seconds for an SCTE 35 message. For the DSM-CC stream events, this will be reduced by the converter processing time. If required by the combination of the target receiver population and the converter, the SCTE 35 message can be sent further in advance than the minimum 4 seconds. If the DSM-CC stream event is referencing a carousel object, further consideration needs to be given to the SCTE 35 message timing to accommodate the synchronization with the carousel object and the receiver acquisition and processing time.

If and when PTS values are modified by the converter, the `pts_adjustment` field shall be set or modified as described in clause 6.2 before embedding the `SCTE_35_section` in the DSM-CC stream event.

## 7.3 Converting from SCTE-35 with PTS to DSM-CC stream events with TEMI

The term 'converter' in this clause refers to apparatus (which can be implemented in hardware, software or a combination thereof) capable of converting from SCTE-35 with PTS to DSM-CC stream events with TEMI. The changes made by a converter to a transport stream shall be compliant with the requirements in clause 6.3.1 for how SCTE-35 messages are to be packaged as DSM-CC stream events and clause 6.3.3 for the carriage of a TEMI timeline.

SCTE-35 messages to be converted shall be provided using a dedicated PID, so that the relevant packets can be selected by PID value as the input stream to the converter. The converter can either remove the input stream from the TS or forward the input stream to downstream devices.

For signalling POs by means of DSM-CC stream events, the same PID used for delivering any other "do-it-now" stream events to the DAS application shall be used by the converter for delivering the DSM-CC sections contained in TS packets. The converter will need to multiplex the data carried on the PID so that contents of different sections are not interleaved. If there are no other "do-it-now" stream events, a new dedicated PID shall be used by the converter for the DSM-CC stream events providing the PO signalling.

The converter performs the following steps (in the given order):

- 1) Create the binary payload for the DSM-CC stream event as specified in clause 6.3.1. In the present case the `timeline_type` field shall be set to "2" in order to identify TEMI as the referenced timeline. The fields `temi_component_tag` and `temi_timeline_id` shall be present in the DSM-CC stream event payload.
- 2) Apply base-64 encoding according to IETF RFC 4648 [4] to the `DSM-CC_stream_event_payload_binary()` structure.
- 3) Insert the base-64 encoded payload for the DSM-CC stream event as private data to the `privateDataByte` field of a stream event descriptor of a "do it now" event in compliance with ETSI TS 102 809 [9].
- 4) Transmit the DSM-CC stream event (i.e. the "do it now" event) immediately.

NOTE 1: There is a maximum of 245 bytes of payload per DSM-CC stream event as specified in ETSI TS 102 809 [9]. The base-64 encoding increases the message size from its binary form in the ratio 4:3. The maximum section payload size and effect of base-64 encoding needs to be taken into account when creating DSM-CC stream events from SCTE 35 messages. If the binary SCTE 35 message section exceeds 178 bytes (i.e. `section_length` field greater than 175), then the method described in clause 6.3.1 of conveying the SCTE 35 section in a DSM-CC carousel object needs to be used.

NOTE 2: When signalling a PO by means of DSM-CC stream events, receivers are likely to require some advance notice. SCTE 35 requires a minimum advance timing of 4 seconds for an SCTE 35 message. For the DSM-CC stream events, this will be reduced by the converter processing time. If required by the combination of the target receiver population and the converter, the SCTE 35 message can be sent further in advance than the minimum 4 seconds. If the DSM-CC stream event is referencing a carousel object, further consideration needs to be given to the SCTE 35 message timing to accommodate the synchronization with the carousel object and the receiver acquisition and processing time.

Where the converter is acting on a MPEG-2 Transport Stream for a service with an existing TEMI timeline, PTS values in the SCTE 35 messages are adjusted to correspond to times on that existing TEMI timeline prior to embedding in the DSM-CC stream events. The adjustment can be performed by replacing the value in the `pts_time` field of the SCTE 35 message, altering the value of the `pts_adjustment` field of the SCTE 35 message, or a combination of both.

NOTE 3: If the SCTE 35 messages are encrypted according to the encryption scheme specified in SCTE 35, the `pts_time` field will be encrypted, but the `pts_adjustment` field remains unencrypted, facilitating modification of the latter field without requiring decryption of the SCTE 35 messages within the converter.

Alternatively, if there is no suitable existing TEMI timeline in the Transport Stream, a new TEMI timeline can be generated by the converter that meets the requirements defined in clause 6.3.3.

A simple example approach to generating and using a TEMI timeline is described below:

- Derive the TEMI timeline directly from PTS as follows:
  - generate a separate component using a dedicated PID with stream\_type 6 to carry the TEMI timeline\_descriptors occurring with a frequency no greater than the video frame rate and no lower than once per second;
  - give the timeline a timescale (tickrate) of 90 000; and
  - use 32-bit TEMI media\_timestamps whose value is the least significant 32 bits of the PTS value.
- Clear the most significant bit of pts\_time fields in the SCTE 35 message and preserve the remaining 32 least significant bits.

NOTE 4: Using a 32-bit (instead of 64-bit) media\_timestamp for the TEMI timestamps ensures that the timeline wraps cleanly with an interval of just over half a day. Clearing the top bit of the pts\_time field ensures that the field value represents a time on this timeline.

The timing relationship between TEMI timestamps (carried in TEMI timeline\_descriptors) and PTS (carried in the header of PES payloads) is defined in clause U.3.6 of ISO/IEC 13818-1 [8]. It is not required for there to be a TEMI timeline descriptor for every instance of PTS. In these situations, the TEMI timestamp corresponding to a PTS value can be extrapolated from the most recent (in presentation order) occurrence of a TEMI timestamp and its corresponding PTS value.

NOTE 5: The extrapolation involves calculating a difference between these two PTS values. Care needs to be taken to ensure this works correctly at the point where PTS values wrap.

## 7.4 Converting from SCTE-104 to SCTE-35 with PTS

SCTE 104 provides a standard interface for controlling SCTE 35 message generation, as described in clause 5.2. If the contribution feed is provided in an uncompressed form, then it should be accompanied by SCTE 104 signalling so that the content encoding and SCTE 35 message generation can both be performed by the distribution platform.

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## History

<b>Document history</b>		
V1.1.1	December 2020	Publication