Dynamic substitution of content in linear broadcast

Part 2: Carriage and signalling of placement opportunity information in DVB Transport Streams

DVB Document A178-2

February 2020

Contents

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee {ETSI Technical Committee|ETSI Project|<other>} <long techbody> (<short techbody>).

The present document is part 2 of a multi-part deliverable. Full details of the entire series can be found in part [x] [Bookmark reference].

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).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

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, this document specifies broadcast signalling used by receivers to identify placement opportunities within a service in a DVB Transport Stream. The signalling described in this document may also be applied to dynamic substitution of programme content.

1 Scope

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

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] ETSI TS 101 162: "Digital Video Broadcasting (DVB); Allocation of identifiers and codes for Digital Video Broadcasting (DVB) systems"

[5] RFC 4648: "The Base16, Base32, and Base64 Data Encodings"

[6] ETSI TS 103 286-2: "Digital Video Broadcasting (DVB); Companion Screens and Streams; Part 2: Content Identification and Media Synchronization"

[7] ISO/IEC 13818-1:2018: "Information technology – Generic coding of moving pictures and associated audio information – Part 1: Systems"

[8] 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

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.

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

[i.1] Event Triggering Distribution Specification (ETDS), Media Perspectives

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

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

Advertisement: see Interstitial

Break: complete block of one or more Interstitials in advance of, interrupting, or following a Programme

Bumper: specific type of Interstitial, acting as channel identification and/or demarcation between different types of segments

Chapter: part of a Program followed by one or more Interstitials or by the Chapter of another Programme

Commercial: specific type of Interstitial containing inducements to buy a product or attract customers

Interstitial: individual, self-contained Commercial, Sponsorship, Promotional (Promo), Bumper or similar item

NOTE: The time window for an Interstitial is sometimes call a 'Spot'.

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 generalises the Distributor Placement Opportunity (traditionally known as “Avail”) and the Provider Placement Opportunity.

Programme: individual, self-contained editorial grouping of content produced for TV broadcast, not being an Interstitial

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

Promo: see Promotional

Promotional: specific type of Interstitial drawing attention to a future Programme or event provided or organised by the broadcaster

Segment: uniquely identifiable broadcast playlist element such as a Program, a Chapter or an Interstitial

Sponsorship: specific type of Interstitial pointing out that the broadcasting of the previous, current or next Programme was made possible thanks to a certain company or brand

3.2 Symbols

3.3 Abbreviations

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

API	Application Programming Interface
CAS	Conditional Access System
DAS	Dynamic Advertisement Substitution
DA	Distributor Advertisement
DPO	Distributor Placement Opportunity
DSM-CC	Digital Storage Media Command and Control
GPI	General Purpose Interface
PA	Provider Advertisement
PES	Packetised Elementary Stream
PID	Packet Identifier
PO	Placement Opportunity
PPO	Provider Placement Opportunity
PTS	Presentation Time Stamp
SCTE	Society of Cable Telecommunications Engineers
SCTE 35	SCTE 35 2019r1[1]
SCTE 104	SCTE 104 2019r1[2]
TA	Targeted Advertising
TEMI	Timed External Media Information
TS	Transport Stream
TV	Television
UPID	Unique Programme Identifier
URI	Uniform Resource Identifier
UUID	Universally Unique Identifier
UTC	Universal Time Coordinated

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.

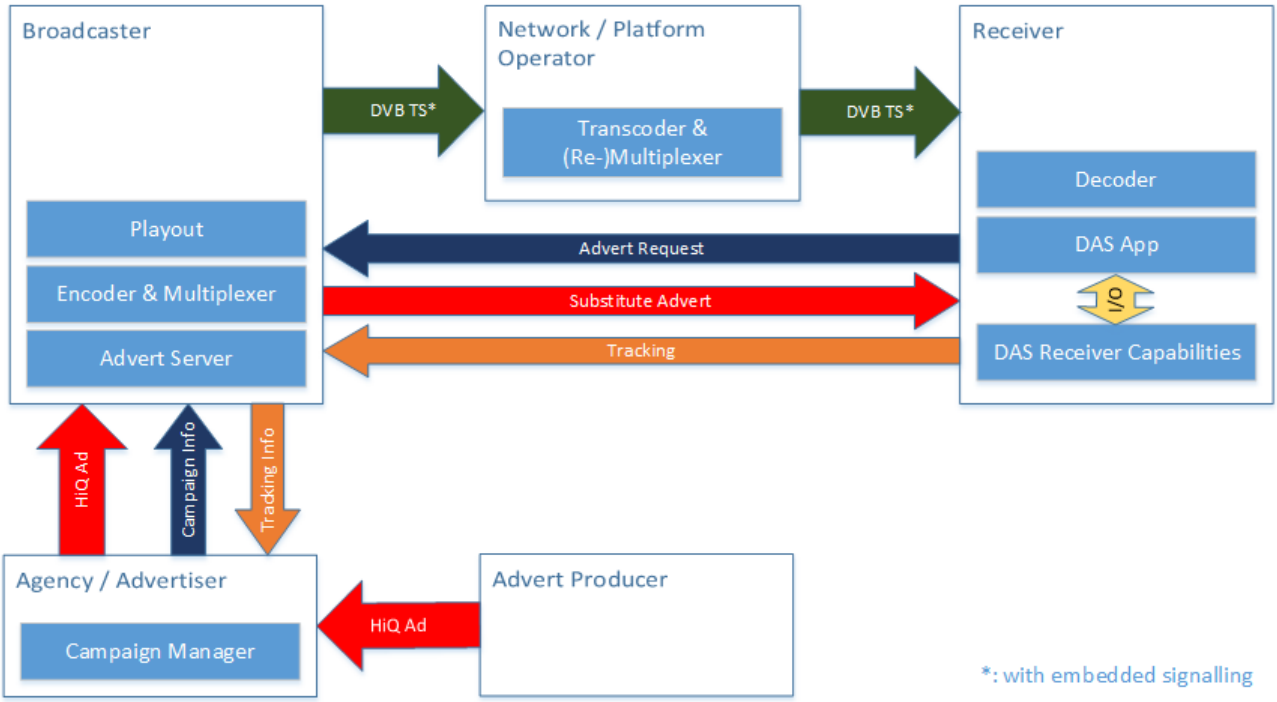

Figure 1: Logical components of the DVB-TA system

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

The present document covers the first area, 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 this 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.

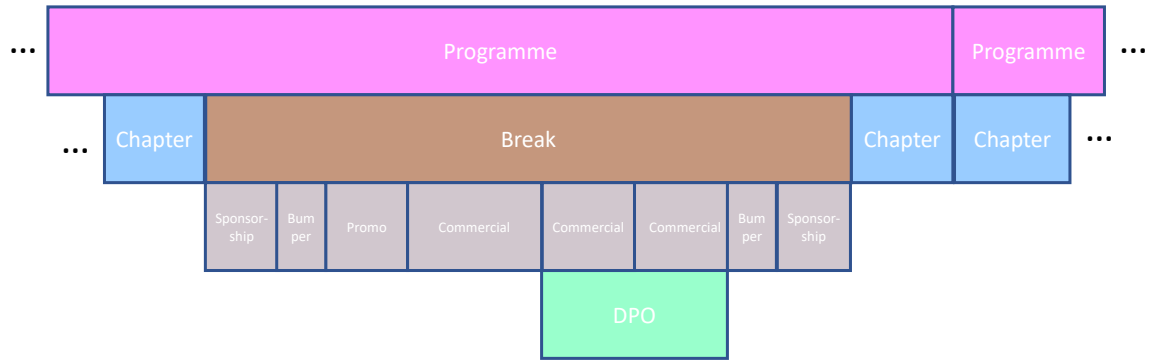

Figure 2: Typical relation between Programs, Chapters, Breaks and Advertisements. The presence of the DPO indicates that the second and third commercial in the break are eligible for replacement.

According to the SCTE 104 and SCTE 35 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.1] 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 this specification. 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 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. 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 5.3.3.1).

- 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 5.3.3.2).

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 current specification 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.

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

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.

5.3.3.1 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.

5.3.3.2 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, 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, then the TS packets carrying SCTE 35 messages may be protected by this CAS.

5.3.4.2 Maximum section length

SCTE 35 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 4096 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

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.

5.3.5.1 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.

5.3.5.2 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.

5.3.5.3 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, although for the DAS function, the end message conveys no additional information. 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.

5.3.5.4 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).

5.3.5.5 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.

5.3.5.6 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.

5.3.5.7 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.

5.3.5.8 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.

5.3.5.9 Segmentation_upid_type (segmentation_descriptor() only)

The segmentation_upid_type shall be set to '0x0F' indicating that the segmentation_upid() contains a Universal Resource Identifier (see RFC 3986 [3]).

5.3.5.10 Unique_program_id or segmentation_upid()

These fields identify the specific instance of content such as a Programme or an Interstitial, 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 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.

5.3.5.11 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.

5.3.5.12 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.

5.3.5.13 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.

5.3.5.14 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.

5.3.5.15 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	uimsbf
descriptor_length	8	uimsbf
identifier	32	uimsbf
break_num	8	uimsbf
breaks_expected	8	uimsbf
reserved	4	uimsbf
equivalent_segmentation_type	4	bslbf
upid	N*8	uimsbf
}		

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 0x01.

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 5.3.5.10.

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 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.

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 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 RFC 4648 [5].

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

Syntax	No. of Bits	Mnemonic
DSM-CC_stream_event_payload_binary() {		
DVB_data_length	8	uimsbf
reserved_zero_future_use	4	bslbf
timeline_type	4	uimsbf
if (timeline_type == 0x2) {		
temi_component_tag	8	uimsbf
temi_timeline_id	8	uimsbf
}		
reserved_zero_future_use	N*8	bslbf
private_data_length	8	uimsbf
if (private_data_length > 0){		
private_data_specifier	32	uimsbf
for(i=0;i<private_data_length-4;i++){		
private_data_byte	8	uimsbf
}		
}		
SCTE_35_section()		
}		

Semantics for the DVB DAS descriptor()

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 this specification.

NOTE: All "reserved_zero_future_use" bits are set to "0".

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 TS 101 162 [4].

private_data_byte: This is an 8-bit field, the value of which is privately defined.

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.

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

ETSI TS 103 286-2 [6] defines support in a receiver for the decoding of TEMI timeline descriptors in the adaptation field of Transport Stream packets carrying Packetized Elementary Streams (PES). 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 (“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: 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: 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 13818-1 [7].

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

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.

6.4 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 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, allowing pre-announcement up to slightly more than one minute before the opportunity.

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.

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 RFC 4648 [5] 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 [8].
4. Transmit the DSM-CC stream event (i.e. the “do it now” event) immediately.

NOTE: There is a maximum of 4 084 bytes of payload per DSM-CC section as specified in ETSI TS 102 809 [8]. 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 shall be taken into account when creating DSM-CC stream events from SCTE 35 messages.

NOTE: 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 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 RFC 4648 [5] 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 [8].

4. Transmit the DSM-CC stream event (i.e. the “do it now” event) immediately.

NOTE: There is a maximum of 4 084 bytes of payload per DSM-CC section as specified in ETSI TS 102 809 [8]. 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 shall be taken into account when creating DSM-CC stream events from SCTE 35 messages.

NOTE: 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.

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: 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; and
  - 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: 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 13818-1 [7]. 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: 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.

History

Document history		
Version	Feb 2020	First DVB BlueBook publication