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**STREAM CONDITIONING FOR SWITCHING OF
ADDRESSABLE CONTENT IN DIGITAL TELEVISION
RECEIVERS**

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1.0 SCOPE

This document describes the stream Conditioning required to enable Client-DPI Receivers to implement switching of MPEG-2 and AVC video streams with associated AC-3 audio.

For “Level 0”, or “L0” systems, it defines switching among MPEG-2 streams, among AVC streams and between AVC and MPEG-2 video streams in a non-seamless fashion (similar to a channel change).

For “Level 1”, or “L1” systems, it defines switching among MPEG-2 video streams and among AVC streams in a seamless fashion. Switching between MPEG-2 and AVC video streams is forbidden in L1 systems.

Triggers and signaling are out of scope for this standard.

Note: Client-DPI devices include Receivers conforming to OCAP as well as other cable-compatible Receivers.

2.0 NORMATIVE REFERENCES

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

2.1 SCTE References

1. ANSI/SCTE 30 2009: Digital Program Insertion Splicing API.
2. ANSI/SCTE 43 2005: Digital Video Systems Characteristics Standard for Cable Television.
3. ANSI/SCTE 54 2009: Digital Video Service Multiplex and Transport System for Cable Television
4. ANSI/SCTE 128-2010: AVC Video Systems and Transport Constraints for Cable Television
5. SCTE 172 2011: Constraints On AVC Video Coding For Digital Program Insertion

2.2 Standards from other Organizations

6. ISO/IEC 13818-1 (2007): International Standard, Information Technology – Generic coding of moving pictures and associated audio information: Systems.

7. ISO/IEC 13818-2 (2000): International Standard, Information Technology – Generic coding of moving pictures and associated audio information: Video
8. ISO/IEC 14496-10 (ITU-T H.264): International Standard (2010), Advanced video coding for generic audiovisual services.
9. ATSC A/52 (2012): Digital Audio Compression Standard (AC-3, E-AC-3)
10. ATSC A/53 Part 5 (2010): AC-3 Audio System Characteristics

2.2.1 Normative Reference Acquisition

2.2.1.1 ANSI/CEA Standards:

American National Standards Institute, Customer Service, 11 West 42nd Street, New York, NY 10036; Phone 212-642 4900; Fax 212-302-1286; email: sales@ansi.org; Internet: <http://www.ansi.org>.

2.2.1.2 SCTE Standards: United States of America:

Society of Cable Telecommunications Engineers Inc., 140 Philips Road, Exton, PA 19341; Telephone 800-542-5040; Facsimile: 610-363-5898; E-mail: standards@scte.org; URL: <http://www.scte.org>.

2.2.1.3 ISO/IEC Standards:

Global Engineering Documents, World Headquarters, 15 Inverness Way East, Englewood, CO, USA 80112-5776; Phone 800-854-7179; Fax 303-397-2740; Internet <http://global.ihs.com>; email global@ihs.com.

2.2.1.4 ATSC Standards:

Advanced Television Systems Committee (ATSC), 1776 K Street NW STE 200 - Washington, DC 20006-2304; Ph.-202.872.9160 Fax-202.872.9161; <http://www.atsc.org/standards.html>.

3.0 INFORMATIVE REFERENCES

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

3.1 SCTE References

11. ANSI/SCTE 35 2013: Digital Program Insertion Cueing Message for Cable.

3.2 Standards from other Organizations

12. SMPTE 312M-2001: Television – Splice Points for MPEG-2 Transport Streams
13. OC-SP-OCAP1.1-I01-061229: OpenCable Application Platform Specification OCAP1.1 profile

14. OC-SP-HOST2.1-CFR-I09-090904: OpenCable Host Device 2.1 Core Functional Requirements

3.2.1 Informative Reference Acquisition

3.2.1.1 ANSI/CEA Standards:

See Section 2.2.1.1.

3.2.1.2 SCTE Standards: United States of America:

See Section 2.2.1.2

3.2.1.3 SMPTE:

<https://store.smpte.org/>.

3.2.1.4 OC - OpenCable Specifications:

Cable Television Laboratories, Inc., 400 Centennial Parkway, Louisville, CO 80027; Phone 303-661-9100; Fax 303-661-9199; Internet: <http://www.opencable.com/> email: opencable@cablelabs.com.

4.0 COMPLIANCE NOTATION

“SHALL”	This word or the adjective “REQUIRED” means that the item is an absolute requirement of this specification.
“SHALL NOT”	This phrase means that the item is an absolute prohibition of this specification.
“SHOULD”	This word or the adjective “RECOMMENDED” means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighted before choosing a different course.
“SHOULD NOT”	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
“MAY”	This word or the adjective “OPTIONAL” means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.

5.0 DEFINITIONS AND ACRONYMS

Throughout this standard the terms below have specific meanings. Because some of the terms are defined in other documents having very specific technical meanings, the reader is referred to the original source for their definition. For terms used within this standard, brief definitions are given below.

Addressable Content Set: A collection of simultaneously transmitted elementary streams of equal presentation duration typically containing appropriate combinations of media streams (video, audio and data) that may be selected as the result of a Switch.

AVC: Advanced Video Coding refers specifically to video compression standardized in ISO/IEC 14496-10 [8].

CAT: Conditional Access Table. [6]

CPB: Coded Picture Buffer [8].

Client-DPI Receiver: A Receiver that is able to select among elementary streams from within an Addressable Content Set.

Conditioning: This term refers to the set of rules that specify constraints on transport, video and audio that enable both a seamless and a non-seamless Switch within Client-DPI Receivers.

Decision Engine: The algorithm in a Client-DPI Receiver that selects which particular content should be selected from an Addressable Content Set and presented to the viewer.

DPB: Decoded Picture Buffer [8].

DPI: Digital Program Insertion. [1] [11]

DTS: Decode Time Stamp. [6]

Filler: Used in Level 0 Streams, this is the region within which the Client-DPI Receiver begins and completes a Switch. The Filler is inserted into all video and audio elementary streams that comprise an Addressable Content Set.

FPP: Forward Predicted Picture [4]

Gap: Used in Level 1 Streams, this is the region within which the Client-DPI Receiver begins and completes a Switch. The Gap is inserted into all video and audio elementary streams that comprise an Addressable Content Set.

GOP: Group of Pictures. [7]

IDR: Instantaneous Decoding Refresh. A picture type defined in ISO/IEC 14496-10 [8].

IDR NAL unit: An IDR slice [8]. (A NAL unit with nal_unit_type = 5.)

Insertion Channel: The MPEG Programs comprising the Addressable Content Set that replaces the Primary Channel in whole or in part for the duration of a Switch Event.

Insertion Sequence: A set of back-to-back Switch Events.

Level 0 / L0: Streams or Switches resulting in non-seamless transitions. Transitions between MPEG-2 video and AVC video are permitted.

Level 1 / L1: Streams or Switches resulting in seamless transitions. Transitions between MPEG-2 video and AVC video are not permitted.

Level 0 Stream: A Primary Channel or Insertion Channel that has been conditioned in order to enable a Level 0 Switch. [1]

Level 1 Stream: A Primary Channel or Insertion Channel that has been conditioned in order to enable a Level 1 Switch. [1]

Level 0 Switch: This term refers to a Switch from one video elementary stream to another video elementary stream (MPEG-2 video or AVC video) and one AC-3 audio elementary stream to another AC-3 audio elementary stream without any perceptible audio or video artifacts, but which may include the use of black pictures and audio silence to mask any artifacts during the latency of the Switch.

Level 1 Switch: This term refers to a Switch from one video elementary stream to another video elementary stream (MPEG-2 video or AVC video) of the same stream_type and/or one AC-3 audio elementary stream to another AC-3 audio elementary stream without any perceptible delay, or audio or video artifacts.

MPTS: Multiprogram Transport Stream. [6]

NAL: Network Abstraction Layer defined in ISO/IEC 14496-10 [8].

PAT: Program Association Table. [6]

PCR: Program Clock Reference. [6]

PES: Packetized Elementary Stream. [6]

PID: Packet Identifier. [6]

PMT: Program Map Table. [6]

Primary Channel: The MPEG Program that is replaced in whole or in part by members of the Addressable Content Set during a Switch Event.

PSI: Program Specific Information. [6]

PTS: Presentation Time Stamp. [6]

Receiver: A cable television receiving device which is typically a set-top box or a DTV receiver.