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

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140 Philips Road
Exton, PA 19341

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1.0 SCOPE

This document describes the stream Conditioning required to enable Client-DPI Receivers to implement switching in a both non-seamless fashion (“Level 0”, or “L0”), and in a seamless fashion (“Level 1”, or “L1”).

Note: Client-DPI devices include Receivers conforming to OCAP 1.1 (and later) 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 this standard. At the time of subcommittee approval, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

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

2.2 Standards from other Organizations

4. ISO/IEC 13818-1 (2007): International Standard, Information Technology – Generic coding of moving pictures and associated audio information: Systems.
5. ISO/IEC 13818-2 (2000): International Standard, Information Technology – Generic coding of moving pictures and associated audio information: Video
6. ATSC A/52B (2005): Digital Audio Compression Standard (AC-3, E-AC-3)
7. ATSC A/53 Part 5 (2007): AC-3 Audio System Characteristics

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

8. ANSI/SCTE 35 2007: Digital Program Insertion Cueing Message for Cable.

3.2 Standards from other Organizations

9. SMPTE 312M-2001: Television – Splice Points for MPEG-2 Transport Streams

10. OC-SP-OCAP1.1-I01-061229 – OpenCable Application Platform Specification
OCAP1.1 profile

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 weighed 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 typically containing video and/or audio that may be selected as the result of a Switch.

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.

DPI: Digital Program Insertion. [1] [8]

DTS: Decode Time Stamp. [4]

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.

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. [5]

Insertion Channel: As defined in SCTE 30, section 4.

Level 0 / L0: Streams or Switches resulting in non-seamless transitions.

Level 1 / L1: Streams or Switches resulting in seamless transitions.

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 elementary stream to another elementary stream of the same stream_type without any perceptible audio or video artifacts, but which may include the use of black frames and audio silence to mask Switch latency.

Level 1 Switch: This term refers to a Switch from one elementary stream to another elementary stream of the same stream_type without any perceptible delay or audio or video artifacts.

MPTS: Multiprogram Transport Stream. [4]

PCR: Program Clock Reference. [4]

PES: Packetized Elementary Stream. [4]

PID: Packet Identifier. [4]

PMT: Program Map Table. [4]

Primary Channel: As defined in SCTE 30, section 4.

PSI: Program Specific Information. [4]

PTS: Presentation Time Stamp. [4]

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

Seamless: A transition from one content set to another (either video or audio, or both) without any artifacts or discontinuities. This transition is usually invisible to the viewer.

Signaled Switch Point: The point within the MPEG-2 transport stream where the Switching Engine may initiate a Switch.

Switch: The action performed by a Client-DPI Receiver, which chooses certain elementary streams out of an Addressable Content Set. Note: switch and splice are typically used interchangeably.

Switching Engine: The functionality that executes a Switch in a Client-DPI Receiver.

Trigger Signal: An element within the MPEG-2 transport stream multiplex which indicates the location of a Signaled Switch Point.

6.0 SYSTEM OVERVIEW (INFORMATIVE)

This standard enables a form of addressable content delivery in digital television systems by conditioning video and audio elementary streams in an MPEG-2 transport stream. The following is an example application of telecast addressable advertising that employs this Conditioning.

In this telecast addressable advertising implementation, multiple advertisement streams are simultaneously delivered to a Client-DPI Receiver. The Receiver selects one of the advertisements based upon received addressing information and locally stored selection criteria, and switches at the appropriate time. The switch may be accomplished in a non-seamless manner, herein referred to as Level 0 (L0) switching, or in a seamless manner, herein referred to as Level 1 (L1) switching, as described below.

An addressable advertising system may employ either or both Level 0 and/or Level 1 switching.

6.1 Client-DPI Receiver Functionality

In order for a Receiver to be Client-DPI capable, specific functionalities herein referred to as the Decision Engine and Switching Engine are present on that Receiver.

The Decision Engine implements a methodology for determining which stream(s) should be selected for presentation at the time of each Switch.

The Switching Engine implements Level 0 and/or Level 1 switching, and provides an interface that enables a Decision Engine to cause the required switching to take place.