OpenCable™ Specifications

Host 2.X DVR Extension

OC-SP-HOST2-DVREXT-I03-110512

ISSUED

Notice

This OpenCable specification is the result of a cooperative effort undertaken at the direction of Cable Television Laboratories, Inc. for the benefit of the cable industry and its customers. This document may contain references to other documents not owned or controlled by CableLabs. Use and understanding of this document may require access to such other documents. Designing, manufacturing, distributing, using, selling, or servicing products, or providing services, based on this document may require intellectual property licenses from third parties for technology referenced in this document.

Neither CableLabs nor any member company is responsible to any party for any liability of any nature whatsoever resulting from or arising out of use or reliance upon this document, or any document referenced herein. This document is furnished on an "AS IS" basis and neither CableLabs nor its members provides any representation or warranty, express or implied, regarding the accuracy, completeness, noninfringement, or fitness for a particular purpose of this document, or any document referenced herein.

Document Status Sheet

Document Control Number:	OC-SP-HOST2-DVREXT-I03-110512			
Document Title:	Host 2.X DVR Extension			
Revision History:	I01 – Issued 5/2/05 I02 – Issued 2/4/11 I03 – Issued 5/12/11			
Date:	May 12, 2011			
Status:	~~Work in Progress~~	~~Draft~~	Issued	~~Closed~~
Distribution Restrictions:	~~Author Only~~	~~CL/Member~~	~~CL/ Member/ Vendor~~	Public

Key to Document Status Codes:

Work in Progress	An incomplete document, designed to guide discussion and generate feedback, that MAY include several alternative requirements for consideration.
Draft	A document in specification format considered largely complete, but lacking review by Members and vendors. Drafts are susceptible to substantial change during the review process.
Issued	A stable document, which has undergone rigorous member and vendor review and is suitable for product design and development, cross-vendor interoperability, and for certification testing.
Closed	A static document, reviewed, tested, validated, and closed to further engineering change requests to the specification through CableLabs.

Trademarks:

Contents

Figures

1 SCOPE

1.1 Introduction and Overview

The OpenCable Host 2.X specification defines bidirectional digital set-top boxes (OCS2) and bidirectional integrated terminal devices (OCT2). This specification defines the requirements for either OCS2 or OCT2 devices to be extended to include Digital Video Recording (DVR) support using the OCAP DVR APIs. These devices will be referred to as OCDVR hosts.

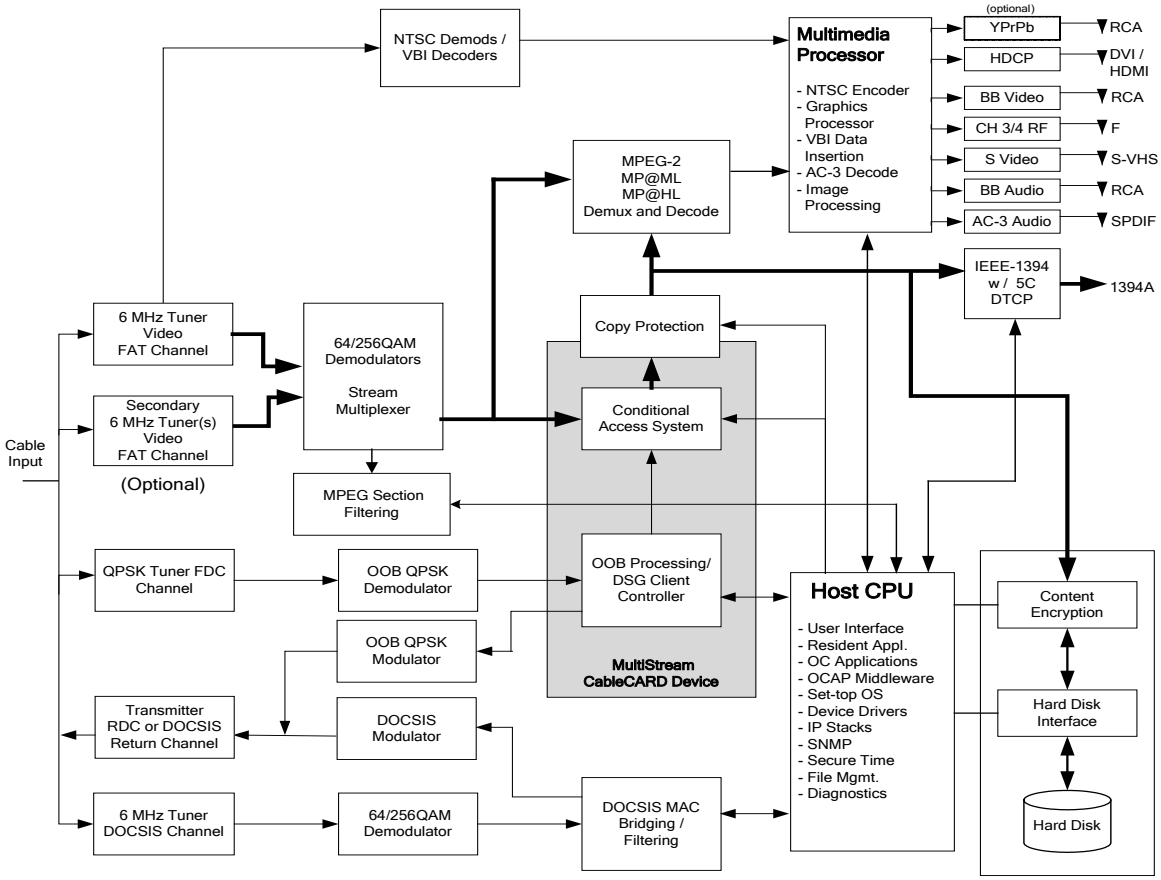

Figure 1 - Block Diagram of the OpenCable DVR Set-top (Informative)

1.2 Purpose of document

This specification defines minimum technical requirements and additional features that must be added to an OpenCable Host 2.X device to support a digital video recording capability.

1.3 Organization of document

The remainder of this document is organized as follows:

Section 2 – Provides normative references used in this specification.

Section 3 – Provides definitions of terms used in this specification.

Section 4 – Provides definitions of abbreviations and acronyms used in this specification.

Section 5 – Provides the detailed specification of technical requirements for the OCDVR device.

1.4 Requirements

Throughout this document, the words that are used to define the significance of particular requirements are capitalized. These words are:

"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.

2 REFERENCES

2.1 Normative References

In order to claim compliance with this specification, it is necessary to conform to the following standards and other works as indicated, in addition to the other requirements of this specification. Notwithstanding, intellectual property rights may be required to use or implement such normative references.

All references are subject to revision, and parties to agreement based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific:

- For a specific reference, subsequent revisions do not apply.
- For a non-specific, non-Bundle reference, the latest version applies.
- For non-specific CableLabs references that are part of the [OC-BUNDLE] the versions mandated in a particular Bundle apply.

[CCCP] CableCARD Copy Protection 2.0 Specification, OC-SP-CCCP2.0, Cable Television Laboratories, Inc. Referenced in [OC-BUNDLE].

[CCIF] CableCARD Interface 2.0 Specification, OC-SP-CCIF2.0, Cable Television Laboratories, Inc. Referenced in [OC-BUNDLE].

[CEA-608-D] CEA-608-D: Recommended Practice for Line 21 Data Service, August 1, 2005.

[CEA-708-C] CEA-708-C: Digital Television (DTV) Closed Captioning, July 30, 2006.

[CEP] OpenCable Content Encoding Profiles 3.0 Specification, OC-SP-CEP3.0-I02-110131, January 31, 2011, Cable Television Laboratories, Inc.

[CHILA] CableLabs CableCARD-Host Interface License Agreement

[HOST] OpenCable Host Device 2.1 Core Functional Requirements, OC-SP-HOST2.1, Cable Television Laboratories, Inc. Referenced in [OC-BUNDLE].

[HOST-MFAT] Multi-FAT Receiver Extension, OC-SP-HOST2-MFATEXT, Cable Television Laboratories, Inc. Referenced in [OC-BUNDLE].

[OC-BUNDLE] OpenCable Bundle Requirements, OC-SP-BUNDLE. See Section 2.2.1 to acquire this specification.

[OCAP] OpenCable Application Platform (OCAP), OC-SP-OCAP, Cable Television Laboratories, Inc. Referenced in [OC-BUNDLE].

[OCAP-DVR] OCAP Digital Video Recorder (DVR), OC-SP-OCAP-DVR, Cable Television Laboratories, Inc. Referenced in [OC-BUNDLE].

[SCTE 20] ANSI/SCTE 20, 2004: Standard Methods for Carriage of Closed Captions and Non-Real Time Sampled Video.

Note: Non-Real Time Sampled Video support is “optional” for Host Devices.

[SCTE 21] ANSI/SCTE 21, 2001 R2006: Standard for Carriage of NTSC VBI Data in Cable Digital Transport Streams.

2.2 Reference Acquisition

2.2.1 OpenCable Bundle Requirements

The OpenCable Bundle Requirements specification [OC-BUNDLE] indicates the set of CableLabs specifications required for the implementation of the OpenCable Bundle. The version number of [OC-BUNDLE] corresponds to the release number of the OpenCable Bundle that it describes. One or more versions of [OC-BUNDLE] reference this specification. Current and past versions of [OC-BUNDLE] may be obtained from CableLabs at http://www.cablelabs.com/opencable/specifications.

2.2.2 Other References

CableLabs Specifications and License Agreements:

Cable Television Laboratories, Inc., 858 Coal Creek Circle, Louisville, CO 80027;
Phone +1-303-661-9100; Fax +1-303-661-9199; Internet: http://www.opencable.com/

SCTE/DVS Standards:

SCTE - Society of Cable Telecommunications Engineers Inc., 140 Philips Road, Exton, PA 19341
Phone: +1-610-363-6888 / +1-800-542-5040; Fax: +1-610-363-5898; http://www.scte.org/

CEA Standards:

Global Engineering, +1-877-413-5184, http://global.ihs.com/

3 TERMS AND DEFINITIONS

This specification uses the following terms:

Approved method	The encryption method used to secure MSO-provided controlled content for permanent storage on the mass storage device and temporary storage in a Time Shift Buffer, determined by the licensee subject to CableLabs approval under [CHILA].
Time Shift Buffer	A storage area that allows temporary storage of content up to a specified limit. A different set of rules may apply to the storage and retrieval of controlled content in this area. A common implementation is to use a circular buffer area, which when full will advance by overwriting frame by frame the earliest recorded content.
CCI-marked	Identified by the EMI bits in the CCI byte received from the CableCARD or the Error or Default CCI value according to [CCCP].
OpenCable Host Device 2.1	A cable receiver that is compliant with one of the hardware profiles defined by this specification. The OCHD2.1 profiles include: • OpenCable Set-top 2.1 (OCS2.1) • OpenCable Terminal 2.1 (OCT2.1)
OpenCable Bundle	The OpenCable Bundle defines a set of specifications required to build a specific version of an OpenCable device. See [OC-BUNDLE].
OpenCable Set-top 2.1	A cable receiver that has no integrated display and is compliant with the OCS2.1 profile defined by this specification.
OpenCable Terminal 2.1	A cable receiver that includes an integrated display and is compliant with the OCT2.1 profile defined by this specification.
Out-Of-Band Messaging	The control and information messages sent from the Network Controller via the Host to the CableCARD requiring a dedicated QPSK channel or DSG channel that may contain the following types of messages: • Conditional Access (CA) messages including entitlements • System Information (SI) messages • Electronic Program Guide (EPG) messages • Emergency Alert System (EAS) messages • Other generic messages
permanent recording	Content that is stored and is accessible in a usable form for playback.
preserve	Store on the recording medium such that the original format can be reproduced upon playback without material modification.

4 ABBREVIATIONS AND ACRONYMS

This specification uses the following abbreviations:

APS	Analog Protection System
CA	Conditional Access
CCI	Copy Control Information
CBR	Constant Bit Rate
EMI	Encryption Mode Indicator
OCDVR	OpenCable Digital Video Recorder
TSB	Time Shift Buffer
VBI	Vertical Blanking Interval
VBR	Variable Bit Rate

5 TECHNICAL REQUIREMENTS

5.1 General Requirements

5.1.1 OpenCable HOST 2.X Compliance

The OCDVR SHALL comply with all normative requirements in [HOST].

5.1.2 Middleware

The OCDVR SHALL comply with all normative requirements of [OCAP].

The OCDVR SHALL comply with all normative requirements of [OCAP-DVR].

The OCDVR SHALL record content to the TSB, record content to permanent storage and move content from the TSB to permanent storage under control of the [OCAP-DVR] APIs.

5.1.3 CableCARD Support

The OCDVR SHALL provide an implementation of the S-Card or M-Card interface [CCIF].

5.2 Copy Protection

5.2.1 Encryption Methods

The encryption method used to secure MSO-provided controlled content (per section 5.2.2 rules) for permanent storage on the mass storage device and temporary storage in a Time Shift Buffer SHALL be determined by the licensee subject to CableLabs approval under [CHILA]. This specification refers to this encryption method as the "approved method".

MSO-provided controlled content, CCI-marked other than *COPY FREELY*, stored on the mass storage device, SHALL employ a cryptographic protocol which uniquely associates such content with a single device (the OCDVR) so that it cannot be played on another device or such that no further usable copies may be made thereof subject to CableLabs approval under [CHILA].

5.2.2 Recording of Content including Controlled Content

5.2.2.1 COPY FREELY

Content received by the OCDVR CCI-marked *COPY FREELY* MAY be recorded permanently without the requirement for encryption.

Content received by the OCDVR CCI-marked *COPY FREELY* MAY be recorded to the TSB without the requirement for encryption.

Content received by the OCDVR not CCI-marked MAY be recorded permanently without the requirement for encryption. [1]

[1] Nothing in this specification supersedes the obligations on the manufacturer under FCC rules, e.g., broadcast flag.

Content received by the OCDVR not CCI-marked MAY be recorded to the TSB without the requirement for encryption. [1]

5.2.2.2 COPY ONE GENERATION

Content received by the OCDVR CCI-marked *COPY ONE GENERATION* SHALL be permitted to be recorded permanently if the content is written to the TSB and is CCI-marked COPY NO MORE when moved from the TSB to an OCDVR output.

Content received by the OCDVR CCI-marked COPY ONE GENERATION SHALL be permitted to be recorded permanently if the content is written directly to permanent storage bypassing the TSB.

Content received by the OCDVR CCI-marked COPY ONE GENERATION that is recorded into permanent storage SHALL be CCI-marked as COPY NO MORE and retain this CCI marking when the content is moved from permanent storage to an OCDVR output.

Content received by the OCDVR CCI-marked COPY ONE GENERATION SHALL NOT be recorded permanently if the content is written to the TSB and retains the CCI marking of COPY ONE GENERATION when moved from the TSB to an OCDVR output.

Content received by the OCDVR CCI-marked COPY ONE GENERATION SHALL be encrypted according to the approved method while residing in a Time Shift Buffer.

Content received by the OCDVR CCI-marked *COPY ONE GENERATION* SHALL be encrypted according to the approved method when moved to permanent storage.

5.2.2.3 COPY NO MORE

Content received by the OCDVR CCI-marked *COPY NO MORE* SHALL NOT be recorded permanently.

Content received by the OCDVR CCI-marked *COPY NO MORE* when received by the OCDVR SHALL be encrypted according to the approved method while residing in a Time Shift Buffer.

Content received by the OCDVR CCI-marked *COPY NO MORE* SHALL NOT persist in a Time Shift Buffer for a period longer than 90 minutes. After this time, content SHALL be rendered inaccessible on a minute-by-minute basis starting with the oldest recorded content.

Content received by the OCDVR CCI-marked *COPY NO MORE* SHALL be CCI-marked COPY NO MORE when the content is moved from the Time Shift Buffer to an OCDVR output.

5.2.2.4 COPY NEVER

Content received by the OCDVR CCI-marked *COPY NEVER* SHALL NOT be recorded permanently.

Content received by the OCDVR CCI-marked *COPY NEVER* SHALL be encrypted according to the approved method while residing in a Time Shift Buffer.

Content received by the OCDVR CCI-marked *COPY NEVER* SHALL NOT persist in a Time Shift Buffer for a period longer than 90 minutes. After this time, content SHALL be rendered inaccessible on a minute-by-minute basis starting with the oldest recorded content.

Content received by the OCDVR CCI-marked *COPY NEVER* SHALL be CCI-marked *COPY NEVER* when the content is moved from the Time Shift Buffer to an OCDVR output.

5.2.3 Handling of CCI transitions

The OCDVR SHALL apply the appropriate default state, error state or authenticated state of CCI setting as defined in [CCCP].

Within 10 seconds of receiving an updated EMI message, the CCI rules SHALL be applied to the content.

5.2.4 APS Bits

The OCDVR SHALL respond to APS data stored with content upon playback as defined according to [CCCP].

5.3 Storage

5.3.1 Internal

The OCDVR MAY implement internal mass storage, of which the minimum capacity and physical implementation is outside the scope of this specification.

5.3.2 External

The OCDVR MAY implement external mass storage (outside the main Host unit), which SHALL be considered a digital output subject to CableLabs approval under [CHILA].

5.3.3 Moving of recorded content

Recorded content originally received by the OCDVR CCI-marked *COPY ONE GENERATION* SHALL only be moved from permanent storage to an external recording device according to the Compliance Rules in section 3.5.2 in Exhibit C of [CHILA] and summarized here:

(a) the external recording device indicates that it is authorized to perform this Move function in accordance with [CHILA];

(b) such content is marked for transmission by the OCDVR as *COPY ONE GENERATION*;

(c) the CCI-marked content is output over a protected output in accordance with [CHILA];

(d) before the Move is completed, the originating OCDVR recording is rendered inaccessible and the moved CCI-marked content is marked *COPY NO MORE*.

Informative note: The device to which the removable recording medium is moved needs to be unable or rendered unable to output the CCI-marked content except through outputs authorized by [CHILA], and the copy needs to be stored using an encryption protocol, approved by CableLabs, that uniquely associates such copy with a single device so that it cannot be played on another device or, if stored to removable media, so that no further usable copies may be made thereof.

5.4 Recording and Playback

5.4.1 Input Formats

The OCDVR SHALL support recording, and playback of the following input formats:

NTSC analog, MPEG-2 video (MP @ ML and MP @ HL) including progressive refresh and low_delay flag enabled video, MPEG-4/AVC (Main and High Profile @ Level 3.0 and 4.0) video, stereoscopic 3D formats as defined in

[CEP], MPEG-1 (layer 1, 2, and 3) audio, Dolby AC-3 audio and MPEG-4 AAC, MPEG-4 HE-AAC, MPEG-4 HE-AAC-v2 audio. Other formats are optional.

The OCDVR SHALL support the above video formats during trick mode playback.

The OCDVR SHALL mute the audio for all playback rates other than 1.0.

The OCDVR SHALL support recording of video content received in both CBR and VBR.

5.4.2 Recording Bit Rates and Formats

The recording bit rates and format of the recorded content are not within the scope of this document and SHALL be determined by the manufacturer.

5.4.3 Number of Time Shift Buffers

The OCDVR SHALL implement at least one Time Shift Buffer.

5.4.4 Time Shift Buffer Recording Capacity

The storage size of the TSB is outside the scope of this document and SHALL be determined by the manufacturer.

5.4.5 Simultaneous Record and Playback Sessions

At a minimum, the OCDVR SHALL support the ability to playback a previously recorded stream while recording an incoming stream.

An OCDVR that implements the Multi-tuner HOST extension [HOST-MFAT] SHALL support the ability to playback a previously recorded stream while simultaneously recording two incoming streams.

5.4.6 External Inputs

The OCDVR MAY support recording from external baseband analog or digital inputs.

5.4.7 VBI Data

The OCDVR SHALL preserve Line 21 data services through the recording and playback process for analog services.

The OCDVR SHALL preserve [SCTE 20] and/or [SCTE 21] MPEG-2 Picture Level user_data through the recording and playback process on digital services including content advisory information as specified in [CEA-608-D] and closed captioning services as specified in [CEA-608-D] and [CEA-708-C].

5.4.8 Rewind and Forward speeds

The OCDVR SHALL support the playback rates defined in section 7.2 of [OCAP-DVR].

5.4.9 Closed Captioning Playback

If enabled and present, the OCDVR SHALL display Closed Captions according to the following conditions:

When the rate of playback is greater than or equal to 0.0 and less than 1.0, closed captions may be presented if and only if closed captions can be presented on the display device in proper synchronization with the video.

When the rate of playback is equal to 1.0, closed captions will be presented on the display device in synchronization with the video.

When the rate of playback is greater than 1.0 and less than or equal to 2.0, closed captions may be presented if and only if closed captions can be presented on the display device in proper synchronization with the video.

When the rate of playback is greater than 2.0 or less than 0.0, closed captions will not be presented on the display device.

5.5 Input Devices

5.5.1 Remote Control Keys

The remote control device supplied with the OCDVR SHALL support the key functions defined in Table 25-2 Minimum Keycode Set of [OCAP].

5.6 Tuner Support

If the OCDVR includes more than one tuner, then all normative requirements of the Multi-tuner HOST extension [HOST-MFAT] SHALL be met.

5.7 Operation without CableCARD

The OCDVR MAY use TSB and permanent recording of non CA-encrypted content when operating without a CableCARD under the control of the Host Device Manufacturer software application.

The OCDVR MAY play back any stored content in the absence of a CableCARD under the control of the Host Device Manufacturer software application.

5.8 Recording of CA-encrypted Content

The OCDVR SHALL NOT record or time-shift CA-encrypted content.

5.9 Emergency Alert System Messages

The OCDVR SHALL extract and process Emergency Alert System Messages contained in incoming cable transport streams and deliver such messages to the appropriate outputs regardless of current OCDVR operating mode.

Appendix I Revision History

The following ECN was incorporated into version I02 of this specification:

EC Identifier	Title	Date Accepted
HOST2-DVREXT-N-10.1626-3	Closed Captioning during Trick Mode Playback	1/14/11

The following ECN was incorporated into version I03 of this specification:

EC Identifier	Title	Date Accepted
HOST2-DVREXT-N-11.1660-2	Host DVR: Reference edits for OpenCable bundle inclusions	5/9/11