

OpenCable™ Specifications

Host 2.0 DVR Extension

OC-SP-HOST2-DVREXT-I01-050502

ISSUED

Notice

This OpenCable specification is a cooperative effort undertaken at the direction of Cable Television Laboratories, Inc. (CableLabs®) for the benefit of the cable industry. Neither CableLabs, nor any other entity participating in the creation of this document, is responsible for any liability of any nature whatsoever resulting from or arising out of use or reliance upon this document by any party. This document is furnished on an AS-IS basis and neither CableLabs, nor other participating entity, provides any representation or warranty, express or implied, regarding its accuracy, completeness, or fitness for a particular purpose.

© Copyright 2005 Cable Television Laboratories, Inc.
All rights reserved.

Document Status Sheet

Document Control Number:	OC-SP-HOST2-DVREXT-I01-050502			
Document Title:	Host 2.0 DVR Extension			
Revision History:	D01 – Released 4/11/05			
	I01 – Issued 5/2/05			
Date:	May 2, 2005			
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:

DOCSIS[®], eDOCSIS[™], PacketCable[™], CableHome[®], CableOffice[™], OpenCable[™], CableCARD[™], OCAP[™], and CableLabs[®] are trademarks of Cable Television Laboratories, Inc.

Contents

1	SCOPE	1
1.1	Introduction and Overview	1
1.2	Purpose of document	1
1.3	Organization of document.....	2
1.4	Requirements	2
2	REFERENCES	3
2.1	Normative References	3
2.2	Reference Acquisition	4
3	TERMS AND DEFINITIONS	5
4	ABBREVIATIONS AND ACRONYMS	6
5	TECHNICAL REQUIREMENTS	7
5.1	General Requirements	7
5.1.1	OpenCable HOST 2.0 Compliance	7
5.1.2	Middleware	7
5.1.3	CableCard Support.....	7
5.2	Copy Protection.....	7
5.2.1	Encryption Methods.....	7
5.2.2	Recording of Content including Controlled Content	7
5.2.3	Handling of CCI transitions.....	8
5.2.4	APS Bits	9
5.3	Storage.....	9
5.3.1	Internal.....	9
5.3.2	External	9
5.3.3	Moving of recorded content	9
5.4	Recording and Playback.....	9
5.4.1	Input Formats	9
5.4.2	Recording Bit Rates and Formats	10
5.4.3	Number of Time Shift Buffers	10
5.4.4	Time Shift Buffer Recording Capacity	10
5.4.5	Simultaneous Record and Playback Sessions	10
5.4.6	External Inputs.....	10
5.4.7	VBI Data	10
5.4.8	Rewind and Forward speeds.....	10
5.5	Input Devices	10
5.5.1	Remote Control Keys	10
5.6	Tuner Support.....	10
5.7	Operation without CableCARD	10
5.8	Recording of CA-encrypted Content	11

5.9 Emergency Alert System Messages..... 11

Figures

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

1 SCOPE

1.1 Introduction and Overview

The OpenCable Host 2.0 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.

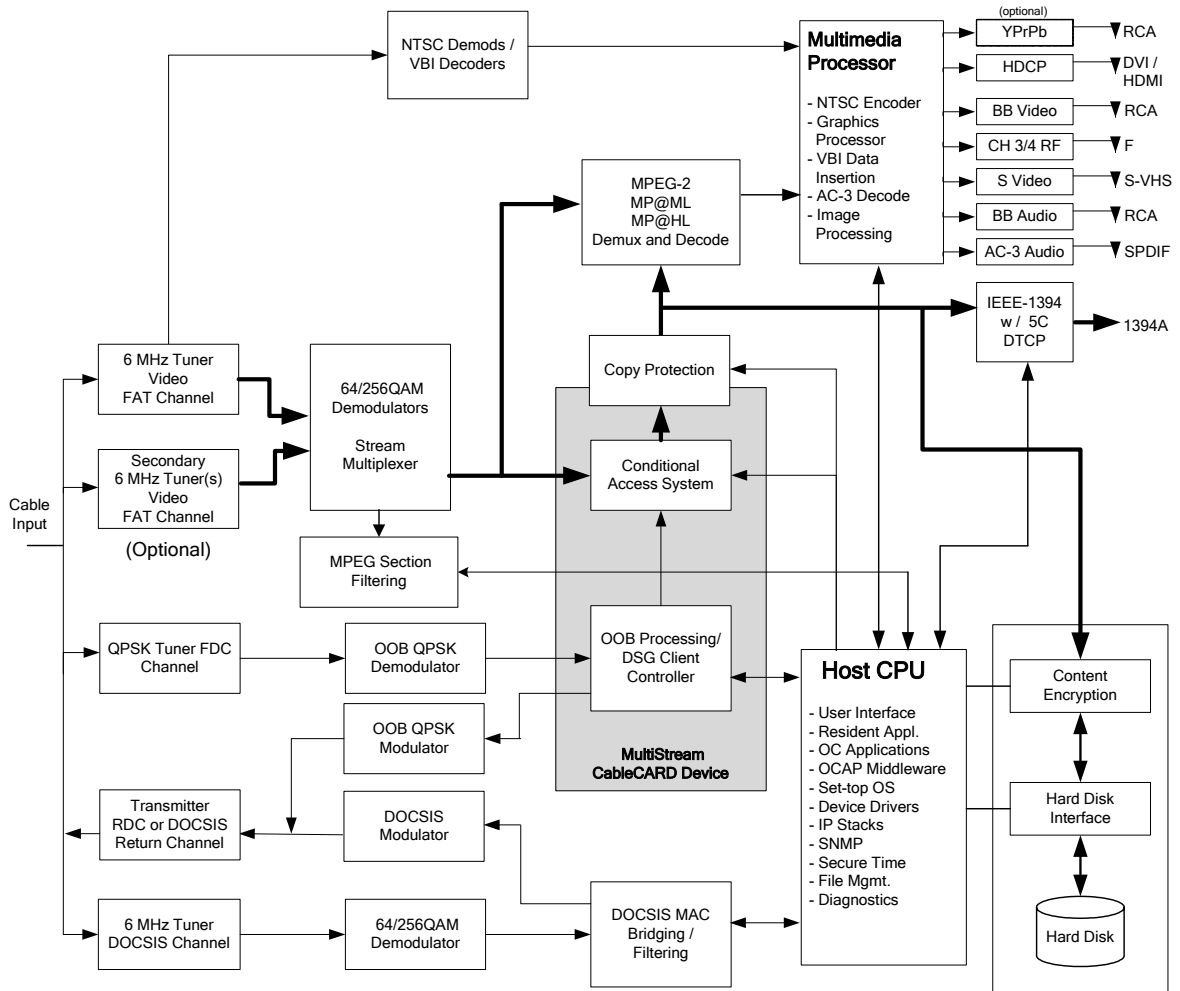


Figure 1 - Block Diagram of the OpenCable DVR Set-top (Informative)

1.2 Purpose of document

This specification defines minimum technical requirements and additional features that must be added to an OpenCable Host 2.0 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.

- [HOST2.0] OpenCable Host Device 2.0 Core Functional Requirements, OC-SP-HOST2.0-CFR-I04-050415, April 15, 2005, Cable Television Laboratories, Inc.
- [MHOST] OpenCable Host 2.0 Multi-FAT Receiver Extension, OC-SP-HOST2-MFATEXT-I01-050502, May 2, 2005, Cable Television Laboratories, Inc.
- [OCAPDVR] OCAP Digital Video Recorder Specification, OC-SP-OCAP-DVR-I01-040524, May 24, 2004, Cable Television Laboratories, Inc.
- [OCAP] OpenCable Application Platform Specification (OCAP) 1.0, OC-SP-OCAP1.0-I15-050415, April 15, 2005, Cable Television Laboratories, Inc.
- [CHILA] CableLabs CableCARD-Host Interface License Agreement
- [CCCP] OpenCable CableCARD Copy Protection 2.0 Specification, OC-SP-CCCP2.0-I01-050331, March 31, 2005, Cable Television Laboratories, Inc.
- [CCIF] OpenCable CableCARD Interface 2.0 Specification, OC-SP-CCIF2.0-IF-I01-050331, March 31, 2005, Cable Television Laboratories, Inc.
- [SCTE 20] ANSI/SCTE 20, 2001: 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 (formerly DVS 053): Standard for Carriage of NTSC VBI Data in Cable Digital Transport Streams.
- [CEA-608-B] CEA-608-B: Recommended Practice for Line 21 Data Service, October 2000.
- [CEA-708-B] CEA-708-B: Digital Television (DTV) Closed Captioning, December 1999.

2.2 Reference Acquisition

CableLabs Specifications and License Agreements:

Cable Television Laboratories, Inc., 858 Coal Creek Circle, Louisville, CO 80027;
Phone 303-661-9100; Fax 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: 610-363-6888 / 800-542-5040; Fax: 610-363-5898; <http://www.scte.org/>

CEA Standards:

Global Engineering, 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].
permanent recording preserve	Content that is stored and is accessible in a usable form for playback. 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 2.0 Compliance

OCDVR-1: The OCDVR SHALL comply with all normative requirements in [HOST2.0].

5.1.2 Middleware

OCDVR-2: The OCDVR SHALL comply with all normative requirements of [OCAP].

OCDVR-3: The OCDVR SHALL comply with all normative requirements of [OCAPDVR].

OCDVR-4: 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 [OCAPDVR] APIs.

5.1.3 CableCard Support

OCDVR-5: The OCDVR SHALL provide an implementation of the S-Card or M-Card interface [CCIF].

5.2 Copy Protection

5.2.1 Encryption Methods

OCDVR-6: 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".

OCDVR-7: 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*

OCDVR-8: Content received by the OCDVR CCI-marked *COPY FREELY* MAY be recorded permanently without the requirement for encryption.

OCDVR-9: Content received by the OCDVR CCI-marked *COPY FREELY* MAY be recorded to the TSB without the requirement for encryption.

OCDVR-10: Content received by the OCDVR not CCI-marked MAY be recorded permanently without the requirement for encryption.¹

OCDVR-11: Content received by the OCDVR not CCI-marked MAY be recorded to the TSB without the requirement for encryption.¹

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

5.2.2.2 COPY ONE GENERATION

OCDVR-12:	Content received by the OCDVR CCI-marked <i>COPY ONE GENERATION</i> 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.
OCDVR-13:	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.
OCDVR-14:	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.
OCDVR-15:	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.
OCDVR-16:	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.
OCDVR-17:	Content received by the OCDVR CCI-marked <i>COPY ONE GENERATION</i> SHALL be encrypted according to the approved method when moved to permanent storage.

5.2.2.3 COPY NO MORE

OCDVR-18:	Content received by the OCDVR CCI-marked <i>COPY NO MORE</i> SHALL NOT be recorded permanently.
OCDVR-19:	Content received by the OCDVR CCI-marked <i>COPY NO MORE</i> when received by the OCDVR SHALL be encrypted according to the approved method while residing in a Time Shift Buffer.
OCDVR-20:	Content received by the OCDVR CCI-marked <i>COPY NO MORE</i> 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.
OCDVR-21:	Content received by the OCDVR CCI-marked <i>COPY NO MORE</i> 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

OCDVR-22:	Content received by the OCDVR CCI-marked <i>COPY NEVER</i> SHALL NOT be recorded permanently.
OCDVR-23:	Content received by the OCDVR CCI-marked <i>COPY NEVER</i> SHALL be encrypted according to the approved method while residing in a Time Shift Buffer.
OCDVR-24:	Content received by the OCDVR CCI-marked <i>COPY NEVER</i> 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.
OCDVR-25:	Content received by the OCDVR CCI-marked <i>COPY NEVER</i> SHALL be CCI-marked <i>COPY NEVER</i> when the content is moved from the Time Shift Buffer to an OCDVR output.

5.2.3 Handling of CCI transitions

OCDVR-26:	The OCDVR SHALL apply the appropriate default state, error state or authenticated state of CCI setting as defined in [CCCP].
-----------	--

OCDVR-27: Within 10 seconds of receiving an updated EMI message, the CCI rules SHALL be applied to the content.

5.2.4 APS Bits

OCDVR-28: The OCDVR SHALL respond to APS data stored with content upon playback as defined according to [CCCP].

5.3 Storage

5.3.1 Internal

OCDVR-29: 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

OCDVR-30: 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

OCDVR-31: 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

OCDVR-32: The OCDVR SHALL support recording, playback and trick modes 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-1 layer 2 audio, Dolby AC-3 audio and MPEG-1 layer 3 (MP3) audio. Other formats are optional.

NOTE: Only Dolby AC-3 audio is required in a standard OpenCable Host Device [HOST2.0].

OCDVR-33: The OCDVR SHALL support recording of video content received in both CBR and VBR.

5.4.2 Recording Bit Rates and Formats

OCDVR-34: 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

OCDVR-35: The OCDVR SHALL implement at least one Time Shift Buffer.

5.4.4 Time Shift Buffer Recording Capacity

OCDVR-36: 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

OCDVR-37: At a minimum, the OCDVR SHALL support the ability to playback a previously recorded stream while recording an incoming stream.

OCDVR-38: An OCDVR that implements the Multi-tuner HOST extension [MHOST] SHALL support the ability to playback a previously recorded stream while simultaneously recording two incoming streams.

5.4.6 External Inputs

OCDVR-39: The OCDVR MAY support recording from external baseband analog or digital inputs.

5.4.7 VBI Data

OCDVR-40: The OCDVR SHALL preserve Line 21 data services through the recording and playback process for analog services.

OCDVR-41: 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-B] and closed captioning services as specified in [CEA-608-B] and [CEA-708-B].

5.4.8 Rewind and Forward speeds

OCDVR-42: The OCDVR SHALL support the playback rates defined in section 7.2 of [OCAPDVR].

5.5 Input Devices

5.5.1 Remote Control Keys

OCDVR-43: 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

OCDVR-44: If the OCDVR includes more than one tuner, then all normative requirements of the Multi-tuner HOST extension [MHOST] SHALL be met.

5.7 Operation without CableCARD

OCDVR-45: 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.

OCDVR-46: 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

OCDVR-47: The OCDVR SHALL NOT record or time-shift CA-encrypted content.

5.9 Emergency Alert System Messages

OCDVR-48: 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.