

Superseded by New Specification CDL2.0

OpenCable™ Common Download Specification

OC-SP-CD-IF-I08-040831

**ISSUED
SPECIFICATION**

Notice

This document 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 the 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, or fitness for a particular purpose of this document, or any document referenced herein.

© Copyright 2001-2004 Cable Television Laboratories, Inc. All rights reserved.

Document Status Sheet

Document Control Number:	OC-SP-CD-IF-I08-040831			
Document Title:	OpenCable™ Common Download Specification			
Revision History:	I01 – OC-SP-CDS-IF-I01-01121, December 21, 2001 I02 – OC-SP-CDS-IF-I02-020328, March 28, 2002 I03 – OC-SP-CDS-IF-I03-020524, May 24, 2002 I04 – OC-SP-CDS-IF-I04-021126, November 26, 2002 I05 – OC-SP-CDS-IF-I05-030707, July 7, 2003 I06 – OC-SP-CD-IF-I06-030905, September 5, 2003 I07 – OC-SP-CD-IF-I07-040402, April 2, 2004 I08 – OC-SP-CD-IF-I08-040831, August 31, 2004			
Date:	August 31, 2004			
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™, and CableLabs® are trademarks of Cable Television Laboratories, Inc.

Contents

1	OVERVIEW	1
1.1	Introduction (Informative)	1
1.2	Overview of Protocol (Informative)	1
1.2.1	Common Download via the OOB Forward Data Channel	1
1.2.2	Common Download via the IB Forward Application Transport Channel ...	1
1.3	Requirements	3
2	REFERENCES	4
2.1	Normative.....	4
2.2	Informative.....	4
3	OPERATIONAL DETAILS (NORMATIVE)	5
3.1	Download Protocols	5
3.1.1	In-band, one-way, broadcast.....	5
3.1.2	In-band, two-way, command	5
3.1.3	In-band, two-way, on demand	6
3.1.4	DOCSIS.....	6
3.1.5	Not Supported	6
3.1.6	Level of support for OpenCable devices	6
3.2	DSM-CC Data Carousel.....	6
3.2.1	Download Info Indication Message	6
3.3	Download Operation	7
3.3.1	One-Way Operation – OOB Forward Data Channel	7
3.3.2	One-Way Operation – IB Forward Application Transport Channel	8
3.3.3	Two-Way Operation – OOB Forward Data Channel – Command.....	9
3.3.4	Two-Way Operation – OOB Forward Data Channel – On Demand	10
3.3.5	Two-Way Operation – IB FAT Channel – Command	10
3.3.6	Two-Way Operation – IB FAT Channel – On-Demand	10
3.3.7	Summary	10
3.4	Code Authentication	10
3.5	System Control Resource	10
3.5.1	Resource Identifier	10
3.5.2	Application Objects (APDUs)	10
3.5.3	host_info_request.....	10
3.5.4	host_info_response	10
3.5.5	code_version_table	10
3.5.6	code_version_table_reply	10
3.5.7	host_download_control	11
3.5.8	host_download_command	11
3.6	Other Operational Details.....	11
3.6.1	Headend.....	11
3.6.2	Host.....	11
APPENDIX A HEADEND REQUIREMENTS TO SUPPORT OPENCABLE DOWNLOAD SPECIFICATION – OOB FDC METHOD (INFORMATIVE) ...		12

**APPENDIX B SELECTED USE CASE SCENARIOS – OOB-FDC METHOD
(INFORMATIVE)..... 15**

**APPENDIX C HEADEND REQUIREMENTS TO SUPPORT OPENCABLE
DOWNLOAD SPECIFICATION – IB FAT CHANNEL METHOD
(INFORMATIVE)..... 17**

**APPENDIX D USE CASE SCENARIO – IB FAT CHANNEL METHOD
(INFORMATIVE)..... 18**

APPENDIX E REVISION HISTORY..... 21

List of Figures

Figure 1 – One-Way Operation – IB FAT Channel 8

Figure 2 – Two-Way Operation – Forward Data Channel – Command 9

Figure 3 – Headend Architecture 13

1 OVERVIEW

1.1 Introduction (Informative)

It is commonly agreed that a standard download protocol is a requirement to support OCAP. A standard download protocol is one component of enabling application portability and enhancing the attractiveness of retail availability of set-top boxes. The development of such an API standard has been hindered by the lack of common protocols and transport mechanisms. There have been several proposals that have been discussed, including the use of DOCSIS® [11], [10], DSM-CC [3], and SCTE DVS/304 [14].

This document specifies a common download protocol for CableCARD™-enabled OpenCable devices [5] with legacy Out-of-Band (OOB) data channels [8] and [9] as well as the legacy In-Band (IB) Forward Application Transport (FAT) channel [1]. It is intended for OpenCable-certified Hosts running OCAP and not legacy Hosts, which would continue to use existing methods, if any, of performing download.

1.2 Overview of Protocol (Informative)

This section is replaced by Section 8.15.1 of SCTE 28 [7].

1.2.1 Common Download via the OOB Forward Data Channel

This section is replaced by Section 8.15.1.1 of SCTE 28 [7].

1.2.2 Common Download via the IB Forward Application Transport Channel

The IB FAT common download utilizes a combination of a dedicated source ID and/or a headend assigned source ID that identifies the program source associated with the virtual channel that is utilized for carrying the DSM-CC Download Information Indication message and/or the code file. In this scenario the cable plant places the DSM-CC Download Information Indication message and/or the code file on a multiplex, assign the dedicated source ID, which is defined within this document as 65520 (0xFFF0), or define some other source ID, which is defined by the MSO, to the virtual channel that the DSM-CC Download Information Indication message and/or the code file is mapped to and if the multiplex is encrypted, authorize the Host for that service. If the headend opts to assign a source ID other than the dedicated source ID, then the headend transmit the source ID to the CableCARD Device, which in turn transmits the source ID to the Host.

The Download Information Indication message contains the data necessary for the OpenCable Host device to determine if the code file is targeted for that particular device. If the code file is applicable to the device, then the OpenCable Host device downloads the code file. If the code file is not applicable or no code file is present on a different MPEG multiplex, as defined by the CVDT, then the OpenCable Host device terminates the common download process.

The OpenCable Host device is required to parse the contents of the DSM-CC Download Information Indication message in order to determine if a download exists for the device. There are several methods in which the host acquires the DSM-CC Download Information Indication message:

1. The OpenCable Host device monitors the Version Number of the VCT. If the Version Number of the VCT changes, then the Host parses the VCT to see if the dedicated source ID is present. If the source ID is present, then when the Host is in a state that does not interrupt the user's service the Host tunes to the channel defined by the source ID and parse the DSM-CC Download Information Indication message. If the DSM-CC Download Information Indication message indicates that a download is available, then the Host downloads the firmware code file.

2. The headend informs the CableCARD Device that the DSM-CC Download Information Indication message has been modified and likewise the CableCARD Device informs the Host that the DSM-CC Download Information Indication message has been modified. The Host parses the VCT to see if the dedicated source ID is present. If the source ID is present, then when the Host is in a state that does not interrupt the user's service the Host tunes to the channel defined by the source ID and parse the DSM-CC Download Information Indication message. If the DSM-CC Download Information Indication message indicates that a download is available, then the Host downloads the firmware code file.
3. The OpenCable Host device periodically parses the VCT and searches for the applicable source ID. If the source ID is present, then when the Host is in a state that does not interrupt the user's service the Host tune to the channel defined by the source ID and parse the DSM-CC Download Information Indication message. If the DSM-CC Download Information Indication message indicates that a download is available, then the Host downloads the firmware code file.
4. The headend commands the Host, via the CableCARD Device, to tune to the channel defined by the given source ID or tune to the multiplex defined via the provided frequency, modulation type and mpeg number or PID and parse the DSM-CC Download Information Indication message. If the DSM-CC Download Information Indication message indicates that a download is available, then the Host downloads the firmware code file.

After acquiring the Download Information Indication message the OpenCable Host device parses the Download Information Indication message and extracts the Code Version Download Table (CVDT), which is defined in this document. The CVDT is contained in the Private Data sector of the Download Information Indication message. The CVDT indicates the vendor ID and hardware version ID of all OpenCable Host devices that have code files available for download. The CVDT also indicates the source ID associated with the multiplex and/or the frequency, modulation type and MPEG number of the stream that contains the applicable DSM-CC data carousel. The MSO may opt to place the applicable download object within the same stream that contains the CVDT; this would be indicated by the source ID being equal to the previously defined source ID.

It is the responsibility of the OpenCable Host device manufacturer to ensure that the device has the means to verify that the code file is valid.

1.3 Requirements

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

- | | |
|--------------|---|
| “MUST” | This word or the adjective “REQUIRED” means that the item is an absolute requirement of this specification. |
| “MUST 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

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.

2.1 Normative

- [1] ANSI/SCTE 07 2000 (formerly DVS/031): Digital Video Transmission Standard for Cable Television
- [2] EIA-679-B Part B, “National Renewable Security Standard” (March 2000)
- [3] ISO/IEC 13818-6, op cit, Extensions for DSM-CC
- [4] ISO/IEC 18318-1, Generic Coding of Moving Pictures and Associate Audio System
- [5] OC-SP-HOST1.0-CFR-C01-040629, June 29, 2004, “OpenCable Host Device 1.0 Core Functional Requirements”
- [6] OC-SP-CC-IF-I17-040831, August 31, 2004, “OpenCable CableCARD Interface Specification”
- [7] SCTE 28 2003 (Formerly DVS 295) HOST-POD Interface Standard
- [8] ANSI/SCTE 55-1 2002 (formerly DVS 178), 2002, “Digital Broadband Delivery System: Out of Band Transport Part 1: Mode A”
- [9] ANSI/SCTE 55-2 2002 (formerly DVS 167), 2002, “Digital Broadband Delivery System: Out of Band Transport Part 2: Mode B”, Society of Cable Telecommunications Engineers
- [10] SP-BPI+-I11-040407, CableLabs Data-Over-Cable Service Interface Specification, Baseline Privacy Plus Interface Specification, April 7, 2004
- [11] SP-RFIV1.1-I10-030730, CableLabs Data-Over-Cable Service Interface Specification, Radio Frequency Interface, July 30, 2003

2.2 Informative

- [12] SCTE DVS/079, May 28, 1997, Data Broadcasting in a Cable Television Network
- [13] SCTE DVS/082r1, June 27, 1997, Broadcast File System Produce Description
- [14] SCTE DVS/304, January 24, 2000, Host Firmware Download Interface

3 OPERATIONAL DETAILS (NORMATIVE)

The CableCARD Device utilizes the `host_info_request` APDU, as defined in this document, to instruct the OpenCable Host device as to which type of download method to utilize: 1) OOB Forward Data Channel method, 2) IB FAT Channel method or 3) DOCSIS. The Host shall not make any assumptions as to what type of download to utilize. The MSO may opt to initiate a DOCSIS download without informing the CableCARD Device; this scenario is not within the scope of this document.

3.1 Download Protocols

3.1.1 In-band, one-way, broadcast

This section is replaced by Section 8.15.2.1.1 of SCTE 28 [7].

3.1.1.1 IB delivery of CVDT

The DSM-CC data carousel is placed on a multiplex that is defined by either a designated source ID or defined in the `host_download_command` APDU, as defined in this document. The dedicated source ID shall be defined as 65520 (0xFFFF0). If a source ID is utilized, then the OpenCable Host device must parse the VCT for this source ID. If the source ID is found and/or the Host device is able to acquire the transport stream as defined in the `host_download_command` message, then the OpenCable Host device must acquire the DSM-CC data carousel, extract the Download Info Indication message and determine if a download is available. If a download is available, as indicated in the CVDT, then the OpenCable Host device must download the code object. If a code file for a particular host is not defined in the CVDT, then code download for that host is not supported.

3.1.1.2 OOB delivery of CVT

The DSM-CC data carousel is placed on a multiplex, The headend inserts a CVT in the OOB. The CableCARD Device filters all incoming CVTs and determines if a download is applicable for the attached Host. If the download is applicable, then the CableCARD Device informs the Host of the available download. The Host acquires the DSM-CC data carousel and downloads the code object. If a code file for a particular host is not defined in the CVT, then code download for that host is not supported.

3.1.2 In-band, two-way, command

This method requires interaction with the Headend. This method also utilizes the DSM-CC data carousel as defined in Section 3.1.1. Both the In-band method for delivering the CVDT and the OOB method for delivering the CVT are utilized for this protocol. A commanded download operates similar to the broadcast method with the inclusion of additional messaging from the headend that commands the Host to download.

3.1.2.1 IB delivery of CVDT

After the Headend receives a new code file for a Host and/or a set of Hosts that requires an immediate download, the Headend loads the new code file onto the in-band broadcast carousel as defined in Section 3.1.1 and modifies the Download Info Indication message accordingly. The Headend then instructs the CableCARD Device to command the Host to download the code file. Headend knowledge of the existence of the device is made by prior CableCARD-Host interaction and subsequent CableCARD-headend interaction.

3.1.2.2 OOB delivery of CVDT

After the Headend receives a new code file for a Host and/or a set of Hosts that requires an immediate download, the Headend loads the new code file on the IB DSM-CC data carousel, which is placed on a multiplex. The headend inserts a CVT in the OOB. The CableCARD Device filters all incoming CVTs and determines if a download is applicable for the attached Host. If the download is applicable, then the CableCARD Device informs the Host of the available download. The Host acquires the DSM-CC data carousel and downloads the code object. The main difference between this download method and the broadcast is that the Host must download as indicated by the download command. If a code file for a particular host is not defined in the CVT, then code download for that host is not supported.

3.1.3 In-band, two-way, on demand

This method requires interaction with the Headend and also utilizes the DSM-CC data carousel. The difference between this download method and the command method is that the code file is added and removed from the DSM-CC data carousel as applicable, i.e., the code file is not continuously spinning on the DSM-CC data carousel. If there are no Hosts in need of a particular code file, then the headend removes the code file from the DSM-CC data carousel. On the other hand, if a Host is placed on the cable plant and a newer code is available but not on the DSM-CC data carousel, then the headend autonomously places the code file on the DSM-CC data carousel and then removes when the download is complete.

3.1.3.1 IB delivery of CVDT

When a Host receives a CVDT and determines that an image download is required, it will either

- a) always notify the CableCARD Device to notify the headend, or
- b) it will look at the DSM-CC carousel location in the CVDT. If it does not detect its image file, it will notify the CableCARD Device to notify the Headend. After the Headend is notified that a particular Host has requested a download, the Headend loads the appropriate code file onto the in-band broadcast carousel.

If no code file is available for a particular host, then code download for that host is not supported.

3.1.3.2 OOB delivery of CVT

When a Host receives a CVT and determines that an image download is required, it will either:

- a) always notify the CableCARD Device to notify the headend, or
- b) it will look at the DSM-CC carousel location in the CVT. If it does not detect its image file, it will notify the CableCARD Device to notify the Headend. After the Headend is notified that a particular Host has requested a download, the Headend loads the appropriate code file onto the in-band broadcast carousel.

3.1.4 DOCSIS

This section is replaced by Section 8.15.2.1.4 of SCTE 28 [7]

3.1.5 Not Supported

The MSO reserves the right to not support upgrade of any Host.

3.1.6 Level of support for OpenCable devices

OpenCable Bidirectional Hosts [6] must support the broadcast in-band carousel method in (section 3.1.1), the in-band command method (section 3.1.2), and the on-demand method (section 3.1.3). OpenCable Advanced Host devices [5] must also support the DOCSIS method (section 3.1.4).

3.2 DSM-CC Data Carousel

All software objects must be transported over the in-band, broadcast channel via the DSM-CC data carousel [3]. The DSM-CC specification does not require the DSM-CC control messages. The Download Information Indication message, as defined in section 7.3.2 of [3] and modified as defined in section 3.2.1 of this document, and the message sequence for data carousel scenario, as defined in section 7.5 of [3], must be supported. The CableCARD-Host control messages are defined in this specification.

3.2.1 Download Info Indication Message

This section is replaced by Section 8.15.2.2.1 of SCTE 28 [7]

3.3 Download Operation

This section is replaced by Section 8.15.2.3 of SCTE 28 [7].

3.3.1 One-Way Operation – OOB Forward Data Channel

This section is replaced by Section 8.15.2.3.1 of SCTE 28 [7].

3.3.2 One-Way Operation – IB Forward Application Transport Channel

The following diagram (Figure 1) describes the communication between the Headend and the CableCARD Device and the CableCARD Device and the Host.

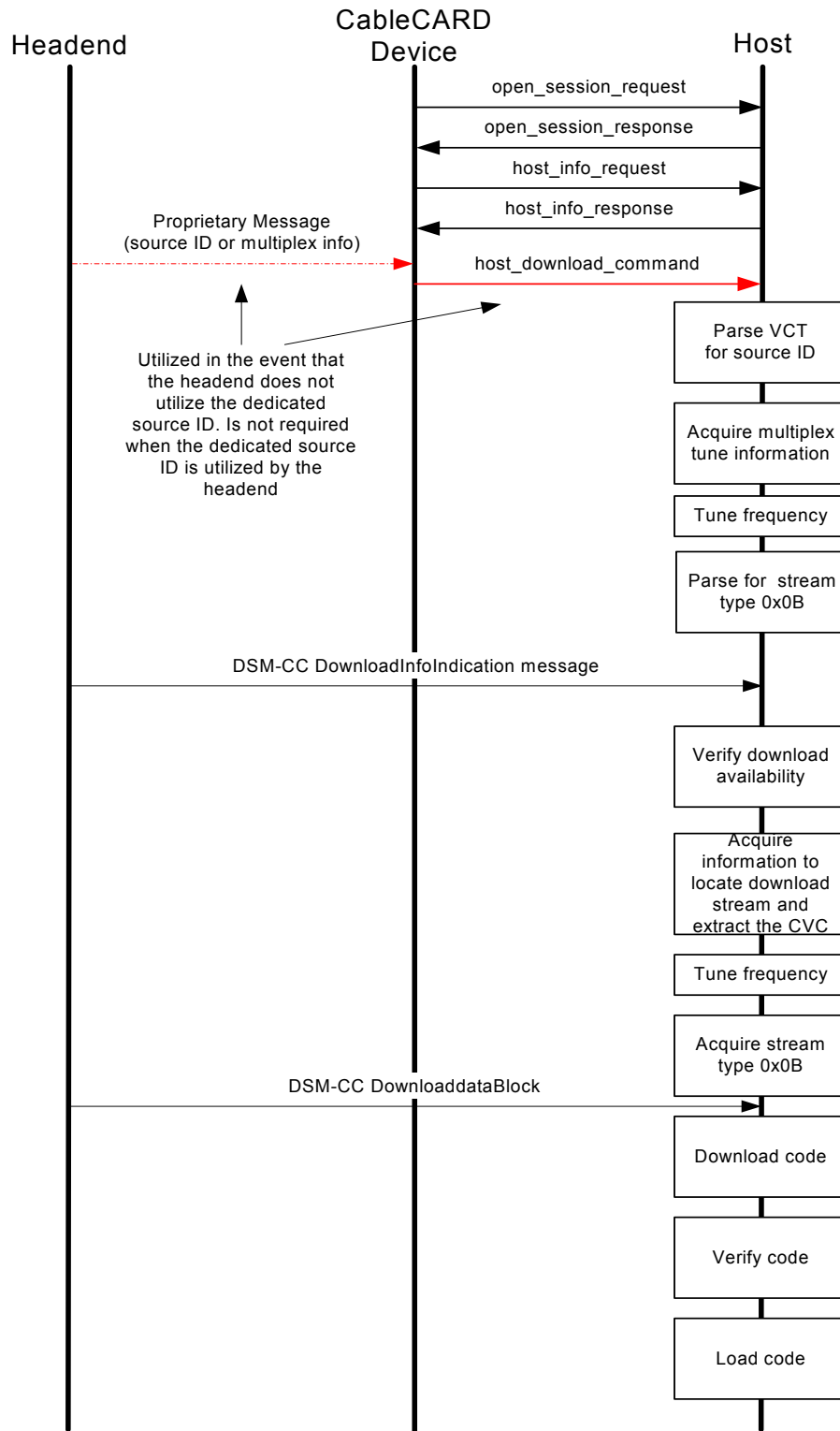


Figure 1 – One-Way Operation – IB FAT Channel

3.3.3 Two-Way Operation – OOB Forward Data Channel – Command

The two-way operation is similar to the one-way operation, except that there is some handshaking between the CableCARD Device and the Headend. After the Host receives a CVT and determines that the download is commanded, the Host initiates the download as indicated in the command type field of the CVT.

The following diagram (Figure 2) describes the communication between the Headend and the CableCARD Device and the CableCARD Device and the Host.

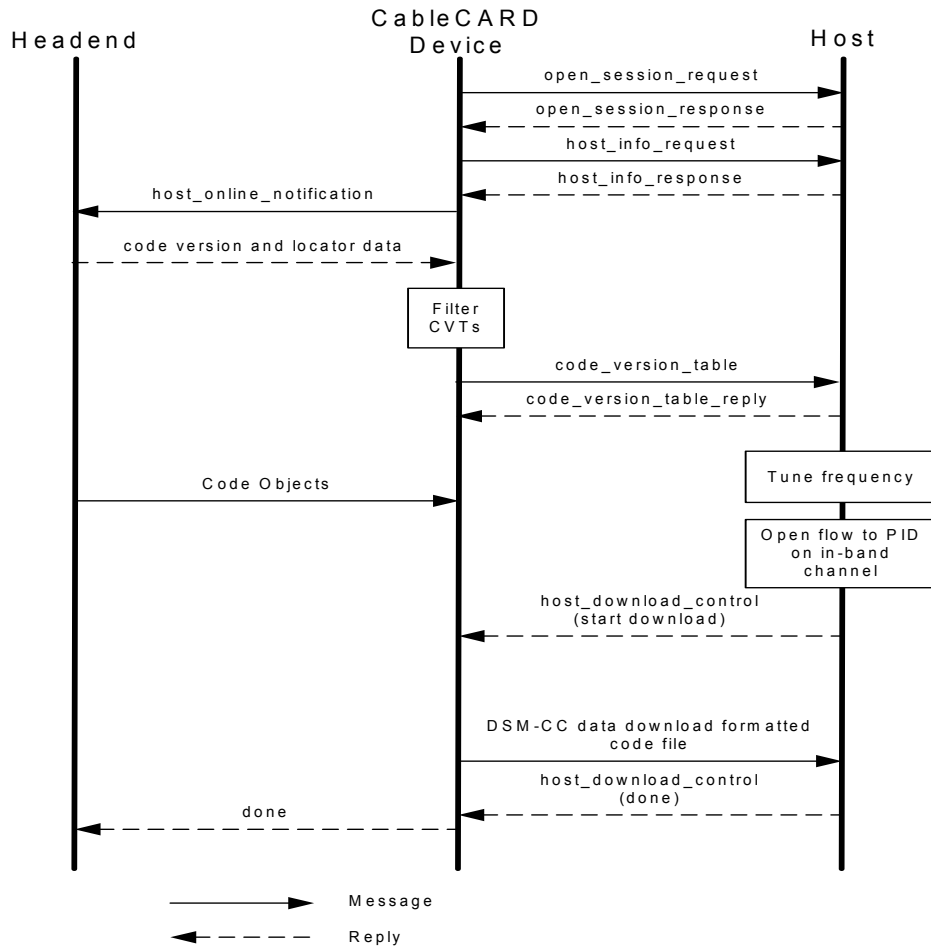


Figure 2 – Two-Way Operation – Forward Data Channel – Command

3.3.4 Two-Way Operation – OOB Forward Data Channel – On Demand

This section is replaced by Section 8.15.2.3.3 of SCTE 28 [7].

3.3.5 Two-Way Operation – IB FAT Channel – Command

This section is replaced by Section 8.15.2.3.4 of SCTE 28 [7].

3.3.6 Two-Way Operation – IB FAT Channel – On-Demand

This section is replaced by Section 8.15.2.3.5 of SCTE 28 [7].

3.3.7 Summary

This section is replaced by Section 8.15.2.4 of SCTE 28 [7].

3.3.7.1 OOB Forward Data Channel Summary

This section is replaced by Section 8.15.2.4.1 of SCTE 28 [7].

3.3.7.2 IB Forward Application Transport Channel Summary

This section is replaced by Section 8.15.2.4.2 of SCTE 28 [7].

3.4 Code Authentication

This section is replaced by Section 8.15.2.5 of SCTE 28 [7].

3.5 System Control Resource

This section is replaced by Section 8.15.3 of SCTE 28 [7].

3.5.1 Resource Identifier

This section is replaced by Section 8.15.3.1 of SCTE 28 [7].

3.5.2 Application Objects (APDUs)

This section is replaced by Section 8.15.3.2 of SCTE 28 [7].

3.5.3 host_info_request

This section is replaced by Section 8.15.3.3 of SCTE 28 [7].

3.5.4 host_info_response

This section is replaced by Section 8.15.3.4 of SCTE 28 [7].

3.5.5 code_version_table

This section is replaced by Section 8.15.3.5 of SCTE 28 [7] with the following addition: After the definition of code_file_name_byte the following wording will be added “For download_type = 0x01, 0x02, and 0x04, the DSM-CC data carousel shall carry the Code File Name in the DownloadInfoIndication message, module_info_byte loop. All bytes in the code_version_table APDU code_file_name_byte loop and the associated byte in the DownloadInfoIndication message moduleInfoByte loop must be the same. The DownloadInfoIndication compatibilityDescriptor shall be ignored by the Host when using the OOB forward download method.”

3.5.6 code_version_table_reply

This section is replaced by Section 8.15.3.6 of SCTE 28 [7].

3.5.7 host_download_control

This section is replaced by Section 8.15.3.7 of SCTE 28 [7].

3.5.8 host_download_command

This section is replaced by Section 8.15.3.8 of SCTE 28 [7].

3.6 Other Operational Details

3.6.1 Headend

For utilizing the mechanism outlined in this document, each Host vendor must supply the code file for each version of hardware and software they have released to the Headend vendors. This document does not define that format. The Headend vendor must then be responsible for implementing Headend systems and their associated CableCARD Devices such that the download data can be delivered reliably to the Host devices.

To enhance the security of the code file download, the Headend may place the DCM-CC data carousel on an encrypted multiplex. If the data carousel is on an encrypted multiplex, then the Headend must authorize the CableCARD Device to decrypt the service.

It is also suggested that, when utilizing the IB FAT Channel download method, the Download Information Indication message, which contains the CVC and the location of the code files, be placed on a separate multiplex than the actual DSM-CC Download Data Block(s) that contain the code file to be downloaded.

It is assumed that the Headend transmits 1 KB segments.

The broadcast carousel carries code image files as PKCS#7 code files [10], referred to by the `software_upgrade_filename` parameter. The locator transmitted to the CableCARD Device and put into the `code_version_table` points to this file.

In the OOB Forward Data Channel on-demand case, the `software_upgrade_filename_length` in the CVT must be set to 0 with no locator if the object is not available.

It is up to the operator to ensure unique file names for the various code files on the carousel.

When implementing the OOB Forward Data Channel download method, code version tables should be available for all Hosts that can appear on the network. The `download_type` parameter should be set to zero (download unsupported), until an appropriate code file is put on the carousel or is available.

3.6.2 Host

It is highly recommended that Host vendors provide the following features in their systems:

- Include additional error detection on all downloaded parameters and data.
- Implement an emergency recovery mechanism. This would have the minimum firmware that can recover from an internal Host program memory corruption. This can be implemented using the protected sectors available in flash memory or in ROM memory.

It cannot be assumed that the Host must receive contiguous segments of data, since the CableCARD Device may drop segments.

Upon receipt of the entire code file, the host must process that file per DOCSIS BPI+ authentication methods [10].

Appendix A Headend Requirements to Support OpenCable Download Specification – OOB FDC Method (Informative)

A.1 INTRODUCTION

This specification is to make cable operators aware of the changes that will be needed in the existing CA systems in order to fully support the OpenCable Common Download Specification. This specification is not intended to identify shortcomings in any particular Headend architecture it is merely an attempt to bring awareness to the upgrades that are going to be necessary. Each individual Member will make their own decisions as to the requirements for their particular system(s). This appendix is written with the assumption that the MSO has provided a customer in the field a qualified CableCARD Device with the System Control Resource, and that the MSO knows nothing about the HOST the CableCARD Device will be mated with. This appendix does not address the messaging between the CableCARD Device and the HOST. It only addresses the communication between the CableCARD Device and the Headend and what the Headend will be capable of in order to support a Common Download.

A.2 Requirements for on-demand download (see Figure 3)

When the CableCARD Device replies to the Headend with its `host_online_notification` which consist of a `vendor_id` & `hardware_version_id`, the CA system will have the capability to add this new Host to its database. This data, in conjunction with the `host_id` obtained during mating according to the CableCARD Copy Protection Specification, will enable the MSO to keep track of what host an issued CableCARD Device is mated with. This will be very useful when a MSO wants to determine how many host devices of a particular manufacturer are present in a system. This will also provide information as to if a CableCARD Device is moved form one Host to another.

Once the Host has been added to the database the CAS will compare the `vendor_id` and the `hardware_version_id` contained within the `host_online_notification` message to the CAS database of objects.

The CAS will then create an appropriate CVT as defined in the OpenCable Common Download Specification. The CVT will be sent to the CableCARD Device via the OOB channel. In conjunction with the CVT message sent to the Host in the field, it will be the responsibility of the CAS to signal the DCM-CC server to load the appropriate object on the carrousel for this operation. The CAS will define the physical channel and the PID for the broadcast object, to coincide with the CVT sent to the CableCARD Device.

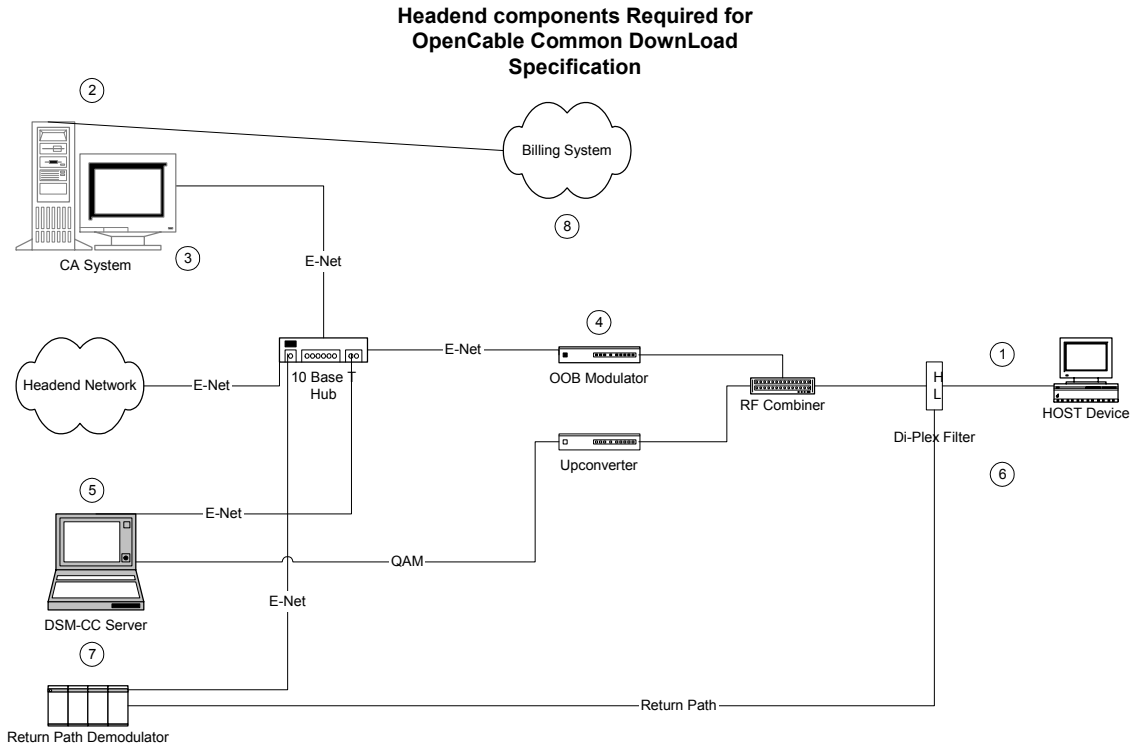
Once the download is complete the CableCARD Device will send a `DONE` message to the Headend. The CAS will, upon reception of the `DONE` message, signal the object spooler to stop the broadcast and remove the object from the spooler. The CAS will be able to track what physical channels and what PIDS are in use at any time, to reallocate bandwidth and PIDS once the download is complete (Clean up). If there is more than one download for a particular object the CAS will let all downloads for that particular object complete prior to removing it from the spooler.

In the case where there is not an object that matches the `vendor_id` or the `hardware_version_id` contained within the `host_online_notification` message, the CAS will create a CVT that contains `download_type` set to "03" (Download Unsupported, signaling the CableCARD Device to exit from the Download Protocol).

A.3 Requirements for broadcast (one-way) download (see Figure 3)

In the case of a Unidirectional network the customer will have to call the MSO and request an initialization/configuration download. In this scenario a CSR will take the call in place of the `host_online_notification`. The CSR interfaces with the Billing System to generate a message (essentially the `host_online_notification` message) from the Billing System to the CAS (requires creation of a billing system message). The CAS processes the Billing System request and initiates a Bi-Directional Case for downloading through the step of the CableCARD Device generating a `Done` message. If

the customer and CSR are still online together the customer will be able to signal the CSR that the download is done, allowing the CSR to signal the CAS/Billing System to complete the Bi-Directional Case (i.e., remove the object from the carousel). If the customer and CSR are not still online together, the download shifts to the unidirectional process. This leaves the object on the carousel since there are no DONE signals from the Host now. The CAS will have to perform clean up after a pre-determined amount of time that the object is no longer in use in any downloads. This will be the most bandwidth efficient mode of operation compared to a 24/7 broadcast of objects.



1. CableCARD Device replies to the Headend with its host_online_notification
2. CAS system MUST have the capability to add this new Host to its database.
3. The CAS MUST then create an appropriate CVT as defined in the OpenCable Common Download Specification.
4. The CVT must be sent to the CableCARD Device via the OOB channel.
5. The CAS signals the DCM-CC server to load the appropriate object on the carousel for this operation.
6. Once the download is complete the CableCARD Device will send a DONE message to the headend.
7. Upon reception of the DONE message the CAS signals the object spooler to stop the broadcast and remove the object from the spooler.
8. In the case of a Unidirectional Host or network the customer will call the MSO and request an initialization/configuration download via the billing system.

Figure 3 – Headend Architecture

A.4 Use Cases impacting head-end operation

A.4.1 Default CVT

This CVT will be sent to all the different types set top boxes that pass CableLabs certification. That is, upon certification, a default CVT will be generated. For Hosts that the operator wants to upgrade, the particular CVTs involved will be changed accordingly.

The effect of having default CVTs being broadcast is that this allows the Host to proceed ‘as-is’ and assumes that any Host arriving on the network has a valid, certified OCAP software stack in it. The operator can upgrade the Host as some future date or not at all.

A.4.2 Forced download

In the event that a certified HOST will need an upgrade in the field, the CAS will create a message to be sent from the Headend to the CableCARD Device that will force the CableCARD Device to issue a

`host_info_request` to the HOST. This message will be necessary to start the download protocol to force an upgrade in the field.

If for some reason, the operator would want to force a download, even though the OCAP version in the Host matches the version on the carousel, after the CableCARD Device is requested to send a `host_info_request` message and receives the `host_info_response` message, a CVT will be sent to the Host with the `download_command` parameter equal to 03 (download now, no exceptions).

A.5 Relationships between Certification and CVT generation

A.5.1 Failure to change CVT to default after a certification wave

Sony certifies their Sony 3500 with SonyCAP v3.4 – rendering obsolete the Sony 3500's with all previous versions of SonyCAP. The operator will ensure that CVT pointing to the pre-SonyCAP v3.4 object is changed to default. Otherwise, the SonyCAP 3.4 boxes will be downgraded when they hear the old CVTs (only to be upgraded later when the MSO process catches up and updates the objects).

In other words, whenever the operator supports a certified version of OCAP, the CVT for that version will be valid only until the next version becomes certified. The default CVT also becomes an acknowledgement message to the Host, signaling the Host to not waste any cycles on the download protocol (unless signaled by a new `Host_info_request` message. The absence of a CVT does effectively the same thing except that the host does not exit from the download procedure.

A.6 CVTs having a Time-To_Live (TTL) property

If the operator does not manage CVTs as described in section A.3, CVTs can automatically be given a specified TTL. However, specifying a TTL will be done with caution. If CVT is generated to upgrade all Sony 3500/SonyCAP v1.8 to SonyCAP v2.0...all the Sony 3500s will upgrade in short order. Six months later, we want to issue a CVT to upgrade the Sony 3500s to SonyCAP v3.0. In a case like this, the TTL for a CVT needs to be 6 months, to catch all the Sony 3500/SonyCap v1.8's that were between the end of the production line and the MSOs network (sitting in Circuit City warehouses or in garages somewhere)...unless we are tolerant of these stragglers on our network. They will be upgraded to SonyCAP v3.0 once they are plugged into the network and the SonyCAP 3.0 CVT is in place.

Appendix B Selected Use Case Scenarios – OOB-FDC Method (Informative)

B.1 Scenarios Common to both broadcast and on-demand

B.1.1 On initialization

On reset, the CableCARD Device issues a `open_session_request` message to the Host. The host responds with a `open_session_response` message. The CableCARD Device issues a `host_info_request` message and the Host responds with a `host_info_response` informing the CableCARD Device of the `vendor_id`, `hardware_version_id`, and `communication_channel`. The CableCARD Device sets its hardware filters to filter the CVTs such that only the CVT corresponding to the `vendor_id` and `hardware_version_id` of the Host get passed to the Host.

B.1.2 Initiation of download protocol without CableCARD reset

After a CableCARD-host session has been established, the CableCARD Device can issue a `host_info_request` by proprietary message(s) from the Headend to the CableCARD Device.

B.1.3 CVT changes during download operation

Once the Host has sent an ACK in the `code_version_table_reply`, the CableCARD Device does not send any more CVTs to the Host. Thus, code object changes after this point, will be signaled by a new `host_info_request` message. In this case, the Host stops the download and responds.

B.1.4 Deferred download

Policy will be established for this option by determining the appropriate time for the download to occur. Examples of such policies could be: when the Host is in the 'stand-by' state for 30 minutes, when the Host has had no activity for 3 hours (i.e., no channel/volume changes), 2 AM, no matter what.

The Host can periodically send a `host_info_response` message to the CableCARD Device receiving the deferred download notification, and then awaiting a CVT with the `parameter_type` set to download now. In this way, the policy be partially set, on-the-fly, by the operator.

B.1.5 Use of default CVT

In order to prevent undesired code upgrades or downgrades, the default CVT can be used for any or all Hosts. Thus, after CableCARD Device receives the `host_info_response` it can send the default CVT to the Host, which is essentially a signal to ignore the download. The Host responds with the `code_version_table_reply`, which informs the CableCARD Device to turn off CVT filtering.

B.2 Broadcast

B.2.1 Code file available

The CableCARD Device sends a CVT to the host containing the locator data and the code file name. The host determines validates the `vendor_id` and `hardware_version_id` and compares the code file name in the CVT with that stored in non-volatile memory. Regardless of the comparison, the Host responds with an ACK message. If the names compare, the Host continues with its normal operation. If the names do not compare, the Host initiates a download per instructions in the `download_command` parameter in the CVT.

B.2.2 Download not supported

A default CVT is sent to the Host, which continues or assumes normal operation.

B.2.3 Forced Upgrade

The Host on receiving a CVT containing this message, will initiate a download of the code file object pointed to in the CVT. In this case, the Host ignores the comparison of the code file name.

B.3 On-Demand**B.3.1 Code file available on carousel**

If a code file object is immediately available on the carousel, that information is signaled to the CableCARD Device, which sends a CVT with the locator information to the Host.

B.3.2 Code file available but not on carousel

If a code file object is not immediately available on the carousel, the CVT is delayed until the object is mounted on the carousel.

B.3.3 Download not supported

Same as for broadcast.

Appendix C Headend Requirements to Support OpenCable Download Specification – IB FAT Channel Method (Informative)

C.1 INTRODUCTION

This specification is to make cable operators aware of the changes that are needed in the existing systems in order to fully support the IB FAT Channel method. Each individual Member is required to make their own decisions as to the requirements for their particular system(s). This appendix is written with the assumption that the MSO has provided a customer in the field a qualified CableCARD Device, and that the MSO knows nothing about the HOST the CableCARD Device is mated with. This appendix does not address the messaging between the CableCARD Device and the HOST. This appendix only addresses the communication between the CableCARD Device and the Headend and what the Headend is capable of in order to support a Common Download.

C.2 Requirements for IB FAT Channel common download.

In order to support the IB FAT Channel common download the Headend is required to transport code files over an in-band channel via the DSM-CC data carousel [3]. The Headend is also required to support the Download Information Indication message, as defined in section 7.3.2 of [3], the extensions to the private data section of the Download Info Indication message as defined in this document and the message sequence for data carousel scenario, as defined in section 7.5 of [3]. If the MSO opts to utilize the well-known source ID and place the data carousel in a transport stream defined by the source ID, then the MSO is required to modify the channel map and define the frequency, modulation type and program ID associated with the source ID that points to the data carousel.

Appendix D Use Case Scenario – IB FAT Channel Method (Informative)

D.1 Broadcast Download Scenario

Open Cable Host device manufacturer XYZ provides MSO ZYX with the latest version of a CableLab's OCAP certified code file for Open Cable Host device 'ABC'. The MSO places the code file onto a DSM-CC capable server, which is set-up to segment the code file and place it into a DSM-CC data carousel. The MSO defines the Download Information Indication message and inserts the CVDT, which contains the CVC associated with the code file for Host device 'ABC'. The MSO then does one of the following:

1. Modifies the VCT and defines the well-known source ID, which shall be 65520 (0xFFF0). The MSO then inserts the DSM-CC data carousel into an inband multiplex as defined by the source ID.
2. Modifies the VCT and defines a value unique to the headend. The MSO then inserts the DSM-CC data carousel into an inband multiplex as defined by the source ID
3. Do nothing with the VCT and place the data carousel into an inband multiplex.

If the MSO utilizes a unique source ID or uses no source ID and simply places the data carousel into an inband multiplex, then the MSO must relay this information to the CableCARD Device, which in turn utilizes the Host Download Command APDU to relay this information to the Host.

The MSO has two ways in which to indicate that new download is available: 1) modify the version number of the VCT or 2) directly inform the Host of the availability via the CableCARD Device utilizing the Host Download Command APDU.

If the source ID is utilized to define the location of the data carousel then the following sequence of events are performed by the OpenCable Host device:

1. The OpenCable Host device must parse the VCT and search for the dedicated source ID (65520) or the source ID defined by the CableCARD Device.
2. If the source ID exists, then the OpenCable Host device must obtain the MPEG program number, multiplex frequency, modulation mode and tune to the defined frequency.
 - a. When executing the common download process, the OpenCable Host device must not interrupt current services when tuning to the defined frequency.
3. After tuning to the defined frequency, the OpenCable Host device must acquire the PAT and correlate the MPEG program number to the corresponding MPEG PMT PID.
4. The OpenCable Host device must acquire the PMT and parse the PMT to determine if a DSM-CC stream (stream_type 0x0B) is defined within the PMT.

If the source ID is not utilized to define the location of the data carousel and the CableCARD Device informs the Host of a download via the Host Download Command APDU and the Host Download Command APDU contains the frequency information necessary to acquire a transport stream, then the following sequence of events are performed by the OpenCable Host device:

1. The OpenCable Host device must utilize the MPEG program number or PID, multiplex frequency, and modulation mode defined by the Host Download Command APDU and tune to the defined frequency.
 - a. When executing the common download process, the OpenCable Host device must not interrupt current services when tuning to the defined frequency.
2. If the Host Download Command APDU defines a program number, then the following event must occur:
 - a. After tuning to the defined frequency, the OpenCable Host device must acquire the PAT and correlate the MPEG program number to the corresponding MPEG PMT PID.

- b. The OpenCable Host device must acquire the PMT and parse the PMT to determine if a DSM-CC stream (stream_type 0x0B) is defined within the PMT.
 - c. If a DSM-CC stream is defined, then the OpenCable Host device must acquire the stream based on the associated PID, as defined in the PMT; else the OpenCable Host device terminates the common download process.
 3. If the Host Download Command APDU defines a PID, then the OpenCable Host device must parse the transport stream and attempt to acquire the DSM-CC defined by the PID.
 4. If the DSM-CC stream is present and acquired, then the OpenCable Host device must extract the Download Information Indication message, as defined within the DSM-CC specification [3].
 5. The OpenCable Host device must check the Transaction ID field of the DSMCC Message Header and compare this value with the value associated with a previous Download Information Indication message.
 6. If the Transaction ID has changed and/or is a new value, then the OpenCable Host device must parse the Download Information Indication message and determine if the associated download is applicable to the device; else the OpenCable Host device terminates the common download process.
 - a. The Download Information Indication message contains the data necessary for the OpenCable Host device to determine if the code file is targeted for that particular device.
 - b. The Private Sector of the Download Information Indication message contains the CVDT, as defined in Section 3.2.1, which contains the available code file download information.
 7. If the code file is applicable to the device, as defined by the CVDT, then the OpenCable Host device must download the code file on the multiplex as defined by the CVDT.
 - a. The OpenCable Host device must also extract and temporarily store the CVC.
 8. If the code file is not applicable or no code file is present on the MPEG multiplex, then the OpenCable Host device must terminate the common download process.
 9. After the OpenCable Host device has completed the download of the code file, the OpenCable Host device must authenticate the code, as defined in Section 3.4.

D.2 Command Download Scenario

The Command Download scenario is the same as the broadcast with the exception of the version number changes in the VCT. The Command Download scenario does not utilize changes in the VCT as an indicator that a download is available. The Command Download scenario is strictly based on the CableCARD Device sending the Host the Host Download Command APDU.

The CableCARD Device and Host complete their pairing process. The CableCARD Device opens the Application Information resource session. The CableCARD Device sends the Host the Application Information request APDU. The Host sends the CableCARD Device the Application Information response APDU, which contains the Host's Vendor ID and Hardware Version ID. The CableCARD Device transmits the Vendor ID and Hardware Version ID to the Headend. The Headend stores this data for later use. At some point in the future the MSO receives a new code file for a specific Vendor ID that updates a specific Hardware Version ID. The MSO defines the Download Information Indication message and inserts the CVDT, which contains the CVC.

The MSO then does one of the following:

1. Modify the VCT and define a source ID that points to the data carousel.
2. Define the frequency, modulation type and program number or PID that contains the data carousel.

The MSO then inserts the DSM-CC data carousel into the applicable inband multiplex and instructs the CableCARD Device to command the Host to download a code file utilizing the defined parameters (i.e. source ID or frequency). The CableCARD Device sends the Host a Host Download Command APDU and

commands the Host to download a code file. The Host Command field of the Host Download Command APDU indicates the type of command.

The Host acquires the download in the same manner as defined for the broadcast download scenario. If the Host Command field indicates that the download was of the type download now (field value 0x01 or 0x03) then the Host sends the CableCARD Device the Host Download Control APDU, which informs the CableCARD Device that the Host has started the download. After the Host has completed the download the Host sends the CableCARD Device a second Host Download Control APDU, which informs the CableCARD Device that the Host has completed the download. The CableCARD Device then sends this information to the Headend. After all applicable Host devices have completed the download the Headend may opt to remove the code file from the DSM-CC carousel or allow it to continue to spin on the carousel.

D.3 On-demand Download Scenario

The On-Demand download scenario is similar to both the broadcast download scenario and the command download scenario with inclusion of some interactivity between the Headend and the Host. In this scenario the Headend automatically updates any Host that enters the system that has a code file that is older than an available code file that the Headend has for the Host. The Headend make this determination after the CableCARD Device and Host have mated and the CableCARD Device has transmitted the Host's information to the Headend. The Headend checks to see if a code file is available for the Host. If a file is, then the Headend place the code file on the plant and instruct the Host to download the code file. The Host then informs the Headend when it has finished the download, and if no other devices require the code file, then the Headend may opt to remove the code file from the carousel. The Headend has the option to initiate the download utilizing one of the methods discussed in the previous sections of this appendix.

Appendix E Revision History

OC-SP-CD-IF-I08-040831 contains modifications from the following ECNs.

ECN	Date Accepted	Summary
CD-IF-N-04.0619-3	6/11/04	OOB Download Filename DSM-CC Location.
CD-IF-N-04.0629-1	6/24/04	Fix typographical error.

OC-SP-CD-IF-I07-040402 contains modifications from the following ECNs.

ECN	Date Accepted	Summary
CD-IF-N-03.0524-1	2/4/04	Correct DSM-CC stream type. NOTE: Supersedes change to section 3.3.2 contained in CD-IF-N-03.0544-2.
CD-IF-N-03.0544-2	2/11/04	Remove sections that have been incorporated into SCTE 28. See note for CD-IF-N-03.0524-1 above.

OC-SP-CD-IF-I06-030905 contains editorial changes, updating POD to CableCARD.

OC-SP-CDS-IF-I05-030707 contains modifications from the following ECNs.

ECN	Date Accepted	Summary
ECN-03-0422	6/4/03	Remove requirement for POD to continue transmitting CVT until ACK is received.
ECN-03-0443	6/23/03	Update Common Download to refer to SCTE 28 2003
ECN-03-0409	6/23/03	Editorial changes to the Common Download Specification to add clarity

OC-SP-CDS-IF-I04-021126 contains modifications from the following ECNs.

ECN	Date Accepted	Summary
ECN 02-0279	9/5/02	Remove req. for POD to send Host info to headend at pwr up
ECN 02-0312	11/18/02	Define a complete in-band solution for the CDS Sections 1 - 3.1.5
ECN 02-0313	11/18/02	Define a complete in-band solution for the CDS Sections 3.2 - 3.3.6.
ECN 02-0314	11/18/02	Define a complete in-band solution for the CDS Sections 3.5 - 3.5.8.
ECN 02-0315	11/18/02	Define a complete in-band solution for the CDS Sections 3.6 - Appendix D.

OC-SP-CDS-IF-I03-020524 contains modifications from the following ECN.

ECN	Date Accepted	Summary
ECN 02-0253	3/25/02	Redefine Vendor/Hardware ID fields and remove com. channel support.

OC-SP-CDS-IF-I02-020328 contains modifications from the following ECNs.

ECN	Date Accepted	Summary
ECN 02-0239	3/4/02	To have more flexibility in the CVT
ECN 02-0240	3/4/02	Correct errors in implementation of descriptor tags
