OpenCable™



# OpenCable™ Host Device Core Functional Requirements

## OC-SP-HOST-CFR-I07-011228

**ISSUED SPECIFICATION**

**Notice**

# Document Status Sheet

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**Key to Document Status Codes:**

| | |
|---|---|
| **Work in Progress** | An incomplete document, designed to guide discussion and generate feedback which 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. |

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**Revision History**

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# 1 INTRODUCTION (INFORMATIVE)



## 1.1 OpenCable Overview

The goal of the OpenCable specifications =is to define a new generation of host devices that are interoperable across cable systems in North America. Information is presented in this document in order to help define the range of capabilities and applications to be supported by digital set-top terminals and integrated terminal devices (also referred to as Set-top Host devices and Terminal Host devices in this specification). Information on the OpenCable Project can be obtained from the OpenCable website http://www.opencable.com.

The OpenCable specifications:

1. Provide for integrated environments for broadcast services (analog and digital) and real-time interactive multimedia services, including IP data services (program synchronous and asynchronous), IP voice communications, video telephony, and on-demand interactive applications. Multiple models of OpenCable Host devices are expected to co-exist within any given system, allowing the network operator to offer various services.
2. Require openness and interoperability. OpenCable takes advantage of "open" computing and network architectures, wherever possible, to minimize costs and maximize the ability to include new technologies as they become available and affordable. "Open" is defined as adherence to, either international standard, North American standard, or published *de facto* industry standard. In all cases, the acquisition of the necessary software, hardware, and intellectual properties will be achievable at fair and reasonable costs. All standard interfaces will be in the public domain or, if such technology standards are to be defined, they will be available for license at a fair and reasonable cost. Closed proprietary systems are to be avoided.
3. Require portability. Retail availability of cable navigation devices is required in compliance with the FCC's 1996 Telecom Reform Act. The OpenCable system permits "point-of-deployment decisions" for network, security and operator-programmed user interfaces enable the anticipated variety of retail devices.
4. Define a renewable and replaceable core encryption system (point-of-deployment (POD) module).
5. Provide cable Multiple System Operators (MSOs) the ability to inform the navigation device (Host) of the services (video, Internet, etc.) that are offered.
6. Present a migration path from uni-directional to bi-directional networks and from broadcast to real-time interactive applications. Media servers and the related hardware (e.g., disk storage, switch fabric, modulators) will support the incremental addition of the required components to preserve any existing investment while taking advantage of more cost-effective solutions. In addition, the system software will be designed to scale efficiently as more interactive applications are added and service offerings expand. Of particular note are "authentication" and "name" services, data base services, fault tolerance, and recovery mechanisms.
7. Allow efficient application and network design by:
    - Improving quality of service and/or reducing the bit rate of a digital stream through improved compression and transmission technologies; for example, by using improved MPEG-2 encoders and higher constellation digital modulation techniques.
    - Optimizing the use of network capacity. During the broadcast applications phase, bandwidth is allocated to accommodate broadcast digital program streams. As systems migrate to real-time interactive applications, the system will make efficient use of the network resources by dynamically allocating bandwidth.

- Developing applications designed to use network resources efficiently, varying their behavior according to the network's resource availability.
- Minimizing the network resources required when the consumer "turns on" the terminal device.

8. Maximize compatibility with existing and/or newly installed operational and customer support systems. All interfaces developed specifically for this effort will be integrated into the current and/or newly installed billing support systems.
9. Co-exist with the embedded base of existing set-top devices.

## 1.2 OpenCable Host Overview

This document describes the all the requirements for all forms of OpenCable Host devices. These devices include a Bi-directional Set top Box (BDC-STB); Bi-directional Terminal (BDC-TERM); Uni-directional STB (UNI-STB) and a Uni-directional Terminal (UNI-TERM). The goals and objectives of the OpenCable Host devices are:

1. To enable new digital broadcast services, and to support future on-demand services.
2. To be developer-friendly.
3. To support non-scrambled analog services as well as new scrambled or in-the-clear digital services.
4. To be sold through retail channels directly to the customer.
5. To receive digital premium (scrambled) cable services via an interface with a CableLabs Qualified POD.
6. To optionally support interactive and two-way services through standardized OOB data channels and direct connection to the cable plant.

## 1.3 Compliance Notation

Throughout this document, the words used to provide normative statements are capitalized as shown below:

| | |
|---|---|
| ***MUST / SHALL*** | These words or the adjective "REQUIRED" means that the item is an absolute requirement of this specification |
| ***MUST NOT / SHALL NOT*** | These phrases mean 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. |

## 1.4 Glossary of Terms

| | |
|---|---|
| OpenCable Host Device | A cable receiver that is compliant with any of the hardware profiles defined by this specification. These profiles include a Bi-directional Set-top Box (BDCS); Bi-directional Terminal (BDCT); Uni-directional Set-top Box (UDCS) and a Uni-directional Terminal (UDCT). |
| Set-top Host Device | A cable receiver that has no integrated display and is compliant with the BDC-STB or the UDC-STB profiles defined by this specification. |
| Terminal Host Device | A cable receiver that includes an integrated display and is compliant with the BDC-TERM or the UDC-TERM profiles defined by this specification. |
| Bi-directional Host Device | An OpenCable Host device that includes the return data channel and is compliant with the BDC-STB or the BDC-TERM profiles defined by this specification. |
| Uni-directional Host Device | A compliant OpenCable Host device that does not include the return data channel and is compliant with the UDC-STB or the UDC-TERM profiles defined by this specification. |
| OpenCable-compatible Digital TV | A digital television that includes an IEEE-1394 interface which is fully compliant with SCTE-DVS194r3 and EIA/CEA-849-A (US profile). |

## 1.5 List of Requirements Applied to Each Hardware Profile

| REQUIREMENT | BDCS | UDCS | UDCT | BDCT | | | |
|---|---|---|---|---|---|---|---|
| ● = Required ◉ = Conditional Mandatory ○ = Optional ⊘ = Not Permitted n/a = Not Applicable | | | | | | | |
| STT-BDI-C-1 | ● | ● | ● | ● | | | |
| STT-BDI-C-2 | ● | ● | ● | ● | | | |
| STT-BDI-C-3 | ● | n/a | n/a | ● | | | |
| STT-BDI-C-3a | n/a | ● | ● | n/a | | | |
| STT-BDI-C-4 | ● | ● | ● | ● | | | |
| STT-BDI-C-5 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-5a | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-6 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-6a | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-7 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-7a | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-8 | ● | ● | ● | ● | | | |
| STT-BDI-C-9 | ● | ● | ● | ● | | | |
| STT-BDI-C-10 | ● | ● | ● | ● | | | |
| STT-BDI-C-11 | ● | ● | ● | ● | | | |
| STT-BDI-C-12 | ● | ● | ● | ● | | | |
| STT-BDI-C-13 | ● | ● | ● | ● | | | |
| STT-BDI-C-14 | ● | ● | ● | ● | | | |
| STT-BDI-C-15 | ● | ● | ● | ● | | | |
| STT-BDI-C-16 | ● | ● | ● | ● | | | |

| REQUIREMENT | BDCS | UDCS | UDCT | BDCT | | | |
|---|---|---|---|---|---|---|---|
| ● = Required ◉ = Conditional Mandatory ○ = Optional ⊘ = Not Permitted n/a = Not Applicable | | | | | | | |
| STT-BDI-C-17 | ● | ● | ● | ● | | | |
| STT-BDI-C-18 | ● | ⊘ | ⊘ | ● | | | |
| STT-BDI-C-19 | ● | ⊘ | ⊘ | ● | | | |
| STT-BDI-C-20 | ● | ⊘ | ⊘ | ● | | | |
| STT-BDI-C-84 | ⊘ | ● | ● | ⊘ | | | |
| STT-BDI-C-100 | ● | ● | ● | ● | | | |
| STT-BDI-C-21 | ● | ● | ● | ● | | | |
| STT-BDI-C-22 | ● | ● | ● | ● | | | |
| STT-BDI-C-85 | n/a | ● | ● | n/a | | | |
| STT-BDI-C-23 | ● | ● | ● | ● | | | |
| STT-BDI-C-66 | ● | ● | ● | ● | | | |
| STT-BDI-C-67 | ● | ● | ● | ● | | | |
| STT-BDI-C-86 | n/a | ● | ● | n/a | | | |
| STT-BDI-C-87 | n/a | ● | ● | n/a | | | |
| STT-BDI-C-92 | ● | ● | ● | ● | | | |
| STT-BDI-C-93 | ● | ● | ● | ● | | | |
| STT-BDI-C-94 | ● | ● | ● | ● | | | |
| STT-BDI-C-95 | ● | ● | ● | ● | | | |
| STT-BDI-C-96 | ● | ● | ● | ● | | | |
| STT-BDI-C-68 | ● | ● | ● | ● | | | |
| STT-BDI-C-69 | ● | ● | ● | ● | | | |
| STT-BDI-C-24 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-24a | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-25 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-25a | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-26 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-27 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-27a | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-28 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-28a | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-29 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-29a | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-30 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-30a | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-31 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-32 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-32a | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-33 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-34 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-35 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-35a | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-36 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-37 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-37a | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-88 | n/a | n/a | ● | ● | | | |

| REQUIREMENT | BDCS | UDCS | UDCT | BDCT | | | |
|---|---|---|---|---|---|---|---|
| ● = Required ◉ = Conditional Mandatory ○ = Optional ⊘ = Not Permitted n/a = Not Applicable | | | | | | | |
| STT-BDI-C-88a | n/a | n/a | ● | ● | | | |
| STT-BDI-C-88b | ◉ | ◉ | n/a | n/a | | | |
| | | | | | | | |
| STT-BDI-C-38 | ● | ● | ● | ● | | | |
| STT-BDI-C-39 | ● | ● | ● | ● | | | |
| STT-BDI-C-40 | ● | ● | ● | ● | | | |
| STT-BDI-C-41 | ● | ● | ● | ● | | | |
| STT-BDI-C-42 | ● | ● | ● | ● | | | |
| STT-BDI-C-43 | ● | ● | ● | ● | | | |
| STT-BDI-C-44 | ● | ● | ● | ● | | | |
| STT-BDI-C-45 | ● | ● | ● | ● | | | |
| STT-BDI-C-46 | ● | ● | ● | ● | | | |
| STT-BDI-C-46a | ⊘ | ⊘ | ● | ● | | | |
| STT-BDI-C-47 | ● | ● | ● | ● | | | |
| STT-BDI-C-47a | ⊘ | ⊘ | ● | ● | | | |
| STT-BDI-C-48 | ● | ● | ● | ● | | | |
| STT-BDI-C-48a | ⊘ | ⊘ | ● | ● | | | |
| STT-BDI-C-49 | ● | ● | ● | ● | | | |
| STT-BDI-C-49a | ⊘ | ⊘ | ● | ● | | | |
| STT-BDI-C-50 | ● | ● | ● | ● | | | |
| STT-BDI-C-90 | ● | ● | ● | ● | | | |
| STT-BDI-C-91 | ● | ● | ● | ● | | | |
| STT-BDI-C-51 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-51a | n/a | n/a | ● | ● | | | |
| STT-BDI-C-51b | ◉ | ◉ | ● | ● | | | |
| STT-BDI-C-52 | ● | ● | ● | ● | | | |
| STT-BDI-C-52a | ◉ | ◉ | ◉ | ◉ | | | |
| STT-BDI-C-53 | ● | ● | ● | ● | | | |
| STT-BDI-C-54 | ◉ | ◉ | n/a | n/a | | | |
| STT-BDI-C-54a | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-54b | ○ | ○ | ○ | ○ | | | |
| STT-BDI-C-54c | ◉ | ◉ | n/a | n/a | | | |
| STT-BDI-C-54d | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-54e | ◉ | ◉ | n/a | n/a | | | |
| STT-BDI-C-54f | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-54g | ◉ | ◉ | ◉ | ◉ | | | |
| STT-BDI-C-97 | ● | ● | ● | ● | | | |
| STT-BDI-C-98 | ● | ● | ● | ● | | | |
| STT-BDI-C-55 | ● | ● | ● | ● | | | |
| STT-BDI-C-56 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-57 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-70 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-99 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-101 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-102 | ● | ● | n/a | n/a | | | |

| REQUIREMENT | BDCS | UDCS | UDCT | BDCT | | | |
|---|---|---|---|---|---|---|---|
| ● = Required ◉ = Conditional Mandatory ○ = Optional ⊘ = Not Permitted n/a = Not Applicable | | | | | | | |
| STT-BDI-C-58 | ● | ● | ● | ● | | | |
| STT-BDI-C-59 | ● | ● | n/a | n/a | | | |
| STT-BDI-C-59a | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-59b | ● | ● | n/a | n/a | | | |
| STT-BDI-C-59c | n/a | n/a | ◉ | ◉ | | | |
| STT-BDI-C-60 | ● | ● | ● | ● | | | |
| STT-BDI-C-71 | ● | ● | ● | ● | | | |
| STT-BDI-C-61 | ● | ● | ● | ● | | | |
| STT-BDI-C-62 | ● | ● | ● | ● | | | |
| STT-BDI-C-63 | ● | ● | ● | ● | | | |
| STT-BDI-C-64 | ● | ● | ● | ● | | | |
| STT-BDI-C-73 | ● | ● | ● | ● | | | |
| STT-BDI-C-74 | ● | ● | ● | ● | | | |
| STT-BDI-C-75 | ● | ● | ● | ● | | | |
| STT-BDI-C-76 | ● | ● | ● | ● | | | |
| STT-BDI-C-77 | ● | ● | ● | ● | | | |
| STT-BDI-C-78 | ● | ● | ● | ● | | | |
| STT-BDI-C-79 | ● | ● | ● | ● | | | |
| STT-BDI-C-80 | ● | ⊘ | ⊘ | ● | | | |
| STT-BDI-C-81 | ◉ | ⊘ | ⊘ | ◉ | | | |
| STT-BDI-C-82 | ● | ● | ● | ● | | | |
| STT-BDI-C-83 | ● | ● | ◉ | ◉ | | | |
| STT-BDI-C-65 | ● | ● | ● | ● | | | |
| STT-BDI-C-72 | ● | ● | ● | ● | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

# 2 OVERVIEW OF CORE SERVICES AND FUNCTIONALITIES

This section describes the core services that OpenCable Host devices MUST support as well as the core functions required to implement those services. A block diagram of the OpenCable Bi-directional Set-top Host device components is shown in Figure 1.

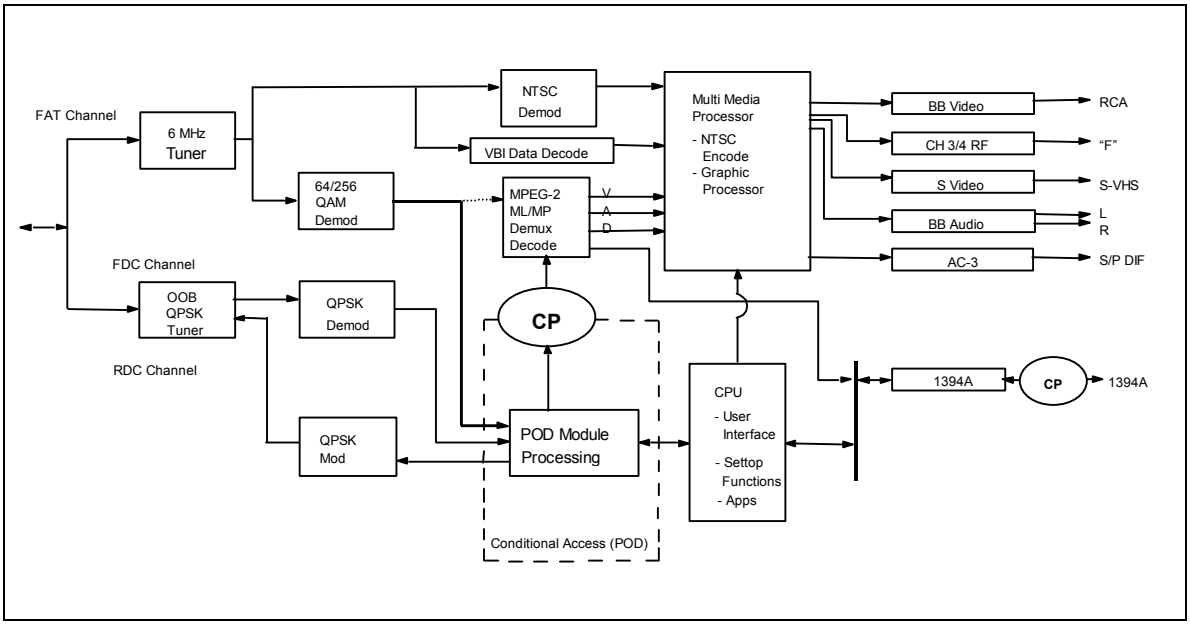



***Figure 1. Block Diagram of the OpenCable Bi-directional Set-top Host Device (Informative)***

The OpenCable Host device receives multimedia information by tuning to one of many 6 MHz input channels available via a bi-directional or uni-directional cable connection. When the input channel is an analog channel, the signal is processed via the NTSC decoder and the VBI data decoder. When the input channel is a digital channel, it is processed via the QAM demodulator and then passed to the Point of Deployment (POD) module where secure and scrambled information are processed. Non-scrambled information is passed through the POD module to the MPEG-2 Transport Demultiplexer. When the POD module is not inserted, the output of the QAM demodulator is routed directly to the MPEG-2 Transport Demultiplexer. The multi-media processor handles the synchronization and display of audio-visual material.

The OpenCable Host device also receives control information and other data by tuning to an out-of-band (OOB) Forward Data Channel (FDC) channel. The terminal will remain tuned to the OOB forward data channel to continuously receive information. This information is passed to the POD for processing, and relevant information is passed back to the OpenCable Host device.

The bi-directional OpenCable Host device transmits information via an out-of-band (OOB) Reverse Data Channel (RDC).

## 2.1 Core Services (Informative)

The following services are provided by the Core Requirements for OpenCable Host device:

- Analog NTSC audio-visual programming: (clear, non-scrambled)
- Digital standard definition audio-visual programming utilizing MPEG-2 main profile @ main level video and Dolby AC-3 audio: broadcast (clear), subscription-based (scrambled), call-

ahead Pay-Per-View (PPV) (scrambled) for all OpenCable Host devices and additionally, Impulse Pay-Per-View (scrambled) for Bi-directional Host devices

- Call-ahead Pay-Per-View is a paid service in which the viewer pre-subscribes selected programming via telephone.
- Impulse Pay-Per-View is a paid service in which the viewer subscribes for selected programming via the user-interface of the terminal.
- Support of digital high definition audio-visual programming by pass through or full decoding, dependent on OpenCable Host device type, as defined in requirements below

## 2.2 Core Functions and Features (Informative)

The features and functions of the OpenCable Host device necessary to support the core services include the following, depending on OpenCable Host device type:

- 864 MHz, analog and digital (64/256 QAM) tuning and demodulation
- Closed Caption pass-through for analog video (line 21, fields 1 and 2) output when input is analog video
- Closed Caption reinsertion into the VBI of reconstructed analog video output when input is digital video
- Copy protection on analog and digital outputs
- Emergency Alert System in compliance with SCTE-DVS208r8
- QPSK out-of-band receiver (compliant with SCTE-DVS167r2and SCTE-DVS178r3)
- QPSK out-of-band transmitter (compliant with SCTE-DVS167r2 and SCTE-DVS178r3)
- Standard I/Os: analog NTSC RF Channel 3/4 output
- Support for RF bypass
- Baseband Video output
- L&R Baseband Audio outputs
- SP/DIF Digital Audio output
- High speed IEEE-1394 digital interface (see SCTE-DVS194r3)
- Host-POD digital interface with copy protection (see OpenCable POD Interface Specification, IS-POD-131-INT07-010803 and OpenCable POD Copy Protection System Specification, IS-POD-CP-INT05-010515)
- Optional processing of interactive services

## 2.3 General Compliance (Normative)

Any features of an OpenCable Host device mandated by law or FCC regulation (e.g., Emergency Alert System, V-Chip) SHALL be supported in the Core Requirements for all OpenCable Host devices.

***STT-BDI-C-1:*** **The OpenCable Host device manufacturer SHALL confirm compliance with all applicable FCC rules and regulations.**
***STT-BDI-C-2:*** **The OpenCable Host device manufacturer SHALL confirm compliance with all applicable UL rules and regulations.**
***STT-BDI-C-3*****: The Bi-directional Host device SHALL comply with the specifications described in Tables A – C and D – K below.**

***STT-BDI-C-3a*: The Uni-directional Host device SHALL comply with the specifications described in Tables A – C, L, and E - K below.**

# 3 SECURITY

This section describes requirements for copy protection of video programs, security of video streams, conditional access to video streams, and security of transmitted data.

## 3.1 Conditional Access

***STT-BDI-C-4:* The OpenCable Host device SHALL utilize the POD module to perform the following Conditional Access functions as defined in EIA-679-B (Part B): decryption, authorization, entitlement, and key generation. These functions SHALL be implemented in the POD module (see IS-POD-131-INT07-010803) and not in the OpenCable Host device. If conditional access functionality is present in the OpenCable Host device, it MUST be disabled under all circumstances, including the absence of POD module.**

## 3.2 Analog Program Copy Protection

***STT-BDI-C-5:* The Set-top Host device SHALL be capable of adding analog copy protection to NTSC outputs from digital programs, in accordance with the [Macrovision] standard. The control of Macrovision is handled in the APS bits as defined in the OpenCable Copy Protection Specification, IS-POD-CP-INT05-010515.**
***STT-BDI-C-5a:* If the Terminal Host device includes analog video outputs it SHALL be capable of adding analog copy protection to NTSC outputs from digital programs, in accordance with the [Macrovision] standard. The control of Macrovision is handled in the APS bits as defined in the OpenCable Copy Protection Specification, IS-POD-CP-INT05-010515.**
***STT-BDI-C-6:* The Set-top Host device SHALL include analog program copy protection, which is software controllable on a per-program basis.**
***STT-BDI-C-6a:* If the Terminal Host device includes analog video outputs it SHALL include analog program copy protection, which is software controllable on a per-program basis.**

## 3.3 Digital Program Copy Protection

***STT-BDI-C-7:* The Set-top Host device SHALL support the copy protection requirements as defined by the 5C Digital Transmission Content Protection Specification. (Use of the technology defined in this specification is subject to licensing by Digital Transmission Licensing Administrator, dtla@dtcp.com.).**
***STT-BDI-C-7a:* If the Terminal Host device includes an IEEE-1394 digital interface it SHALL support the copy protection requirements as defined by the 5C Digital Transmission Content Protection Specification. (Use of the technology defined in this specification is subject to licensing by Digital Transmission Licensing Administrator, dtla@dtcp.com.)..**
***STT-BDI-C-8:* The OpenCable Host device SHALL implement the OpenCable Copy Protection Specification, IS-POD-CP-INT05-010515.**

# 4 BI-DIRECTIONAL PHYSICAL LAYER CHARACTERISTICS

## 4.1 RF Interface

The mechanical and electrical interface between the cable TV system and the OpenCable Host device SHALL be as defined in EIA-23 Section 3, with the additional requirements specified in the remainder of this document.

### 4.1.1 Maximum Individual Carrier Amplitude

The OpenCable Host device SHALL be capable of receiving signals where the maximum rms value of any individual signal whose frequency is between 0.5 MHz and 30 MHz SHALL NOT exceed –7 dBm (+42 dBmV across 75 ohms) measured at the input to the OpenCable Host device. The maximum rms value of any individual signal whose frequency exceeds 54 MHz SHALL be less than 10 mV across a 75 ohm terminating impedance (+20 dBmV) measured at the input to the OpenCable Host device.

## 4.2 Communications Channels

The OpenCable Host device SHALL have the following communications channels:

1. Forward Application Transport (FAT) channel, which carries MPEG-2 Programs.
2. Analog channels with Vertical Blanking Interval (VBI) signals for closed captioning, as may be required.
3. Forward Data Channel (FDC).

In addition to the above communication channels, bi-directional Host devices SHALL also support the Reverse Data Channel (RDC).

The FDC and RDC are referred to as out-of-band (OOB) channels.

Frequency bands for each channel SHALL be 54 to 864 MHz (FAT channel) and 70 to 130 MHz (OOB FDC channel) and 5 to 26.5/42 MHz (OOB RDC channel) [see note 1, Table D].

### 4.2.1 Forward Application Transport (FAT) Channel

The forward application transport channel is a 64 or 256 SCTE-DVS031r5 Quadrature Amplitude Modulation (QAM) channel that transports 27 or 39 megabits/second, respectively. The OpenCable Host device is instructed to tune to a particular FAT channel when a subscriber requests a service that requires transport on a FAT channel. FAT channels can be present and will adhere to the standard, HRC or IRC frequency plans of EIA-542 and can be located anywhere in the 54 to 864 MHz range.

***STT-BDI-C-9:*** **The OpenCable Host device SHALL be capable of receiving and demodulating a Forward Application Transport channel with either 64 or 256 QAM modulation.**
***STT-BDI-C-10:*** **The OpenCable Host device SHALL be compliant with SCTE-DVS031r5 for the transmission physical layer modulation, coding, synchronization, and Error Correction.**
***STT-BDI-C-11:*** **The OpenCable Host device SHALL decode the Forward Application Transport channel over the range of input levels for the Forward Application Transport channel as defined in Table A "FAT Channel RF & Modulation Performance" included herein.**
***STT-BDI-C-12:*** **The Forward Application Transport tuner SHALL have agility over the frequency range of 54 to 864 MHz.**

### 4.2.2 NTSC Analog Channels

The OpenCable Host device SHALL receive analog channels that are NTSC RF AM-VSB modulated signals in accordance with current cable-system practice and applicable FCC rules. NTSC Analog channels will adhere to the standard, HRC or IRC frequency plans of EIA-542 and can be located anywhere in the 54 to 864 MHz range.

#### *4.2.2.1 Vertical Blanking Interval*

The Vertical Blanking Interval (VBI) contains data on line 21 of an analog television signal. During this period, the headend can insert VBI data signals on VBI line 21 for closed captioning. VBI data can be inserted within field 1, field 2, or both, on any analog channel operating in the 54 to 864 MHz range.

***STT-BDI-C-13:*** **The OpenCable Host device SHALL include circuitry required to pass through closed captions, text mode data services, and extended data services data that is on the VBI line 21 (field 1 and 2) of NTSC programming, to all NTSC analog video outputs. The format of this data is defined in FCC part 15.119 and CEA/EIA-608-B**

### 4.2.3 Out-Of-Band Signaling (FDC and RDC)

The RF front end provides the generic QPSK physical layer common to the OpenCable choices. These have the following characteristics:

| | |
|---|---|
| Forward receiver: | 1.544/3.088 Mbps and 2.048 Mbps. |
| Reverse transmitter: | 1.544/3.088 Mbps and 256 Kbps |

***STT-BDI-C-14:*** **The OpenCable Host device SHALL be capable of receiving and demodulating an Out-of-Band Forward Data channel with QPSK modulation.**
***STT-BDI-C-15:*** **The OpenCable Host device SHALL be compliant with SCTE- DVS167r2 and SCTE-DVS178r3 for the OOB FDC and OOB RDC transmission physical layer modulation, coding, synchronization, and Error Correction.**
***STT-BDI-C-16:*** **The OpenCable Host device SHALL decode the Out of Band Forward Data channel over the range of input levels as defined in Table B "OOB FDC RF & Modulation Performance" included herein.**
***STT-BDI-C-17:*** **The Forward Data channel tuner SHALL have agility over the frequency range of 70 to 130 MHz and be able to tune any nominal carrier frequency defined in Table B, item 4 as directed by the POD module.**
***STT-BDI-C-18:*** **Bi-directional Host devices SHALL have an Out of Band Reverse Data channel transmitter operating at QPSK modulation, but can only be used under control of the POD module.**
***STT-BDI-C-19:*** **Bi-directional Host devices SHALL transmit the Out of Band Reverse Data channel over the range of output levels as defined in Table D "OOB RDC RF & Modulation Performance" included herein.**
***STT-BDI-C-20:*** **The Reverse Data channel transmitter SHALL have agility over the frequency range of 5 to 26.5 MHz. All OpenCable bi-directional Host devices delivered after December 31, 2000 SHALL support the frequency range of 5 to 42 MHz.**
***STT-BDI-C-84:*** **Uni-directional Host devices SHALL NOT include a Reverse Data Channel (RDC) Transmitter.**

For complete information, see SCTE-DVS167r2, Digital Broadband Delivery System, Out-of-Band Transport, and SCTE-DVS178r3.

## 4.3 Physical Layer Specifications

### 4.3.1 In-Band Downstream Channel, FDC Characteristics and RF Performance

***STT-BDI-C-100:*** **The OpenCable Host device SHALL meet all performance requirements while operating with the downstream transmission characteristics defined by SCTE DVS/313 (rev. 5).**

The Physical Layer RF Performance Specifications are contained in Table A, "Analog and FAT Channel RF Performance Parameters," and Table B, "FDC Channel: RF Performance Parameters," as provided below.

***STT-BDI-C-21:*** **The OpenCable Host device SHALL use a female "F" connector meeting SCTE specification IPS-SP-400 Recommended "F" Port (Female) Specification for the RF video input.**
***STT-BDI-C-22:*** **The "F" connector for RF video input on the OpenCable Host device SHALL be labeled "Cable In."**

| **Table A. Analog and FAT Channel: RF Performance Parameters (0° - 40° C )** | | |
|---|---|---|
| **1.** | RF Input Channel Bandwidth | 6 MHz |
| **2.** | RF Input Tuning Range | 54 MHz to 864 MHz IRC/HRC/Standard Channel Plans |
| **3.** | RF Input Return Loss | 6 dB minimum over full tuning range |
| **4.** | RF Input Impedance | 75 ohm unbalanced |
| **5.** | RF Input Level Range | Analog visual carrier(c) from 0 dBmv minimum to +15 dBmv maximum; Analog aural carrier from -10 to -17 dBc; Digital QAM 64 signal from -15 dBmv to +15 dBmv; Digital QAM 256 signal from -12 dBmv to +15 dBmv |
| **6.** | AGC Range | NTSC baseband video output level variation of not more than ±1 dB with the analog visual carrier or digital QAM signal input level ranges stated above*(See Note 1)* |
| **7.** | AFC Range | Better than ±125 kHz or nominal tuning resolution of 62.5 kHz |
| **8.** | LO Leakage (Input EMC) | -37 dBmV over 54 MHz to 864 MHz |
| **9.** | Conversion Isolation: RF Input to Converted RF Output | 65 dB minimum; where isolation is defined here as the ratio between the converted signal and the unconverted signal present at the channel 3/4 RF output. This parameter SHALL be met with the output measured on the same frequency as the input of the converter, and applies to all assigned input carrier frequencies over the input level range defined in 5 above. *(See Note 2)* |
| **10.** | RF Bypass Isolation | 60 dB minimum over the input tuning range (54-864 MHz) when internal RF bypass option is installed. *(See Note 2)* |
| **11.** | CTB | Not worse than -63 dBc<br>Channel loading assumptions: At least 110 AM-VSB channels at input level of +15 dBmV, at least 20 QAM channels at RF input level of +5 dBmV. *(See Note 2)* |

| | | |
|---|---|---|
| **12.** | X-Mod. | Not worse than -57 dBc<br>Channel loading assumptions: At least 110 AM-VSB channels at input level of +15 dBmV, at least 20 QAM channels at RF input level of +5 dBmV. *(See Note 2)* |
| **13.** | CSO | Not worse than -60 dBc<br>Channel loading assumptions: At least 110 AM-VSB channels at input level of +15 dBmV, at least 20 QAM channels at RF input level of +5 dBmV. *(See Note 2)* |
| **14.** | Spurious Emissions within the output channel (channel 3/4) bandwidth | Not worse than -60 dBc<br>Channel loading assumptions: At least 110 AM-VSB channels at input level of +15 dBmV, at least 20 QAM channels at RF input level of +5 dBmV. *(See Note 2)* |
| **15.** | Spurious Emissions outside the output channel (other than channel 3/4) | Not worse than -10 dBc *(See Note 2)* |
| **16.** | Signal Leakage/RFI | Per FCC Part 15, Class B |
| **17.** | AM Hum Modulation | Not greater than 3% p-p *(See Note 2)* |
| **18.** | Adjacent Channel Rejection | 60 dB min *(See Note 2)* |
| **19.** | (This Parameter deleted) | |
| **20.** | Group Delay Variation Tolerance | $\leq$ 0.25 μsec/MHz across the 6-MHz channel |
| **21.** | Phase Noise Tolerance | $\leq$ -88 dB/Hz @ 10 kHz offset (relative to the center of QAM signal spectrum) |
| **22.** | Amplitude Ripple Tolerance<br>Digital channels<br><br>Analog channels | <br>$\leq$ 5 dB p-p within the 6 MHz channel<br>$\leq$ 4 dB p-p within the 6 MHz channel |
| **23.** | Microreflection Tolerance (assumes one dominant echo with max. specified amplitude in dB relative to the primary QAM signal) | -10 dB at < 0.5 μsec<br>-15 dB at < 1 μsec<br>-20 dB at < 1.5 μsec<br>-30 dB at < 4.5 μsec<br>Echoes > 4.5 μ*sec (see Note 9*) |
| **24.** | Burst Noise Tolerance | Not longer than 25 μsec at 10 Hz repetition rate |

| | | |
|---|---|---|
| **25.** | Image Rejection *(See Note 2)* | Image response less than 60 dBc at final IF or baseband video output, 54 to 714 Mhz<br>Image response less than 50 dBc at final IF or baseband video output, 714 to 860 Mhz<br>60dB standard to apply at 714 Mhz<br>Two equal power CW signals, +15 dBmv<br>$F_{image} = F_{desired} + 90$ Mhz |

*Notes:*

1. *Applicable only when analog video outputs are provided.*
2. *Applicable only when converted RF outputs are provided.*
9. *Micro-reflection longer than 4.5 microseconds rarely occur in conventional cable television systems. Moreover, very low-level micro-reflections (e.g., -40dB) longer than 4.5 microseconds cannot be measured reliably with readily available instruments. Studies on the subject of long Micro-reflections are continuing, which may result in quantifying this parameter at a future date.*

| **Table B. FDC Channel: RF Performance Parameters (0° - 40° C )** | | |
|---|---|---|
| **1.** | Transmission Rate | 1.544/3.088 Mbps for (DVS167r2)<br>2.048 Mbps (DVS178r3) |
| **2.** | RF Input Channel Spacing | 1.0/2.0 MHz (DVS167r2)<br>1.8 MHz (DVS178r3) |
| **3.** | RF Input Tuning Range | 70 MHz to 130 MHz |
| **4.** | Nominal carrier frequency | Any integer multiple of 250 kHz between the minimum and maximum carrier frequencies, inclusive and the specific fixed frequency of 104.200 MHz. |
| **5.** | Frequency acquisition range | +/- 50 ppm |
| **6.** | RF Input level range | -15 to +15 dBmV rms (75 ohms) *(Note 3)* |
| **7.** | Differential Encoding | The differential encoder SHALL accept bits (A, B) in sequence and generate phase changes as follows:<br>A B Phase Change<br>default alternative<br>0 0 none none<br>0 1 +90 deg -90 deg<br>1 0 -90 deg +90 deg<br>1 1 180 deg 180 deg |
| **8.** | (This parameter deleted) | |
| **9.** | (This parameter deleted) | (*Note 4 deleted*) |
| **10.** | Group Delay variation tolerance | 200 ns max in channel, measured over Nyquist bandwidth |
| **11.** | Channel Tune / Carrier acquisition time | < 500ms |

*Notes:*

3. *See section 4.3.1.1 for the variation in level between adjacent channels*

4. *(Deleted)*

#### *4.3.1.1 RF Signal Levels and Adjacent Channel Characteristics*

##### *4.3.1.1.1 RF Signal Levels*

The OpenCable Host device SHALL be capable of receiving an analog signal with a visual signal level that is within ± 3 dB of the visual signal level of any adjacent analog channel (within a 6 MHz nominal frequency separation as specified in FCC part 76.605). To determine the adjacent channel characteristics between digital and analog signals, the following information is provided. The nominal relative carrier power levels for analog and digital signals are given by:

| | |
|---|---|
| Analog channel: | 0 dBc (reference level) |
| 256 QAM FAT: | -5 ± 2 dBc |
| QPSK FDC: | -8 ± 5 dBc |
| 64 QAM FAT: | -10 ± 2 dBc |

The OpenCable Host device SHALL be capable of receiving a digital signal with an average RMS signal power that is within ± 6 dB of its nominal level with respect to the nominal level of the adjacent channel digital or analog signal.

It is noted that the nominal carrier power levels provided above fall within the absolute power range for digital signals, -15 dBmV to +15 dBmV. The analog signal power is measured as the peak envelope power (PEP), which is the average RMS carrier power measured during horizontal sync level. The digital signal power is measured as the average RMS signal power.

##### *4.3.1.1.2 Adjacent Channel Characteristics*

The OpenCable Host device SHALL be capable of receiving digital and analog signals with "Worst Case" Adjacent Channel performance as characterized in Table C, "Adjacent Channel Characteristics", provided below.

| Table C. Adjacent Channel Characteristics | | | |
|---|---|---|---|
| | Desired (D) Channel Modulation | Undesired (U) Adjacent Channel Modulation | Worst Case D/U Ratio* |
| **1.** | Analog NTSC | 64-QAM | -1 dB |
| **2.** | Analog NTSC | 256-QAM | -6 dB |
| **3.** | Analog NTSC | QPSK FDC | -6 dB |
| **4.** | 64-QAM | Analog NTSC | -21 dB |
| **5.** | 64-QAM | 256-QAM | -21 dB |
| **6.** | 64-QAM | QPSK FDC | -21 dB |
| **7.** | 256-QAM | Analog NTSC | -16 dB |
| **8.** | 256-QAM | 64-QAM | -11 dB |
| **9.** | 256-QAM | QPSK FDC | -16 dB |
| **10.** | QPSK FDC | Analog NTSC | -22 dB |
| **11.** | QPSK FDC | 64-QAM | -17 dB |
| **12.** | QPSK FDC | 256-QAM | -22 dB |
| * Independent of the D/U ratios, the C/(N+I) and the absolute signal levels range SHALL meet the requirements for those parameters as described elsewhere in the specification. | | | |

#### *4.3.1.1.3 Ranges for Digital Signals*

Independently of meeting the requirements specified in Sections 4.3.1.1.1 and 4.3.1.1.2 above, the OpenCable Host device SHALL be capable of receiving digital signals that fall within the ranges specified in Table A (QAM signals) and Table B (QPSK FDC signals).

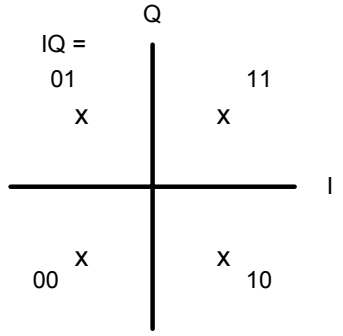
### *4.3.1.2 Spurious Emissions from Uni-directional Host Devices*

***STT-BDI-C-85:*** **OpenCable Uni-directional Host devices SHALL limit all spurious emissions according to the table shown below.**

| Table L. In Band Downstream Spurious Emissions | | |
|---|---|---|
| **Item** | **Parameter** | **Uni-directional Host Requirement** |
| **1** | Spurious Emissions, 5 – 42 MHz | < -37 dBmV |
| **2** | Spurious Emissions, 54 – 864 MHz | < -37 dBmV |

### 4.3.2 Upstream Transmission Characteristics

The Upstream Transmission Characteristics are contained in Table D "Reverse Data Channel: RF & Modulation Performance Parameters" as provided below.

| **Table D. Reverse Data Channel: RF & Modulation Performance Parameters (0° - 40° C)** | | |
|---|---|---|
| **1.** | Transmission Rate | 1.544/3.088 Mbps (DVS167r2)<br>256 Kbps (DVS178r3) |
| **2.** | Output Channel Spacing | 1.0/2.0 MHz (DVS167r2)<br>192 KHz (DVS178r3) |
| **3.** | RF Output Frequency Range | 5 MHz to 26.5/42 MHz. (*Note 5*) |
| **4.** | Frequency Step Size Granularity *(Note 8)* | 2 KHz |
| **5.** | Frequency Accuracy | +/- 50 ppm |
| **6.** | Differential Encoding | The differential encoder SHALL accept bits (A, B) in sequence and generate phase changes as follows:<br>A B Phase Change<br>default alternative<br>0 0 none none<br>0 1 +90 deg -90 deg<br>1 0 -90 deg +90 deg<br>1 1 180 deg 180 deg |
| **7.** | Quadrant Mapping |  |
| **8.** | Transmit spectral mask and excess bandwidth | As specified in DVS167r2 and DVS178r3 |
| **9.** | Carrier suppression | > 30 dB |
| **10.** | Carrier suppression: 4 symbols before start of first symbol of burst, or 4 symbols after end of last symbol. | > 35 dB |
| **11.** | Carrier suppression when transmitter idle | > 60 dB with respect to level when transmitter is on |
| **12.** | I/Q amplitude imbalance | < 1 dB |
| **13.** | I/Q phase imbalance | < 2 degree |
| **14.** | Transmit level range at Host RF connector. | 26 to 57 dBmV |
| **15.** | Level step size | < 2 dB |

| | | |
|---|---|---|
| **16.** | Level absolute accuracy | < +/- 2 dB |
| **17.** | Level flatness, 14 - 26.5MHz | < 2 dB |
| **18.** | Spurious outputs 8 - 42 MHz | < -45 dBc |
| **19.** | Harmonic outputs, 16 – 42MHz | < -45 dBc |
| **20.** | Out of band spurious and harmonics, 54 – 864 MHz | < -37 dBmV |
| **21.** | C/No, as measured +/- $f_w/2$ from center channel frequency, where $f_w$ is the channel spacing. (See Table D.2)<br>Carrier level > 35 dBmV | > 113 dB (1 Hz) |
| **22.** | C/No, 5 - 42 MHz when transmitter is idle | < - 105 dBmV (1 Hz)<br>75 ohms |
| **23.** | Return Loss, 75 ohms<br>8 - 14 MHz<br>14 - 26.5 MHz | <br>> 9 dB<br>> 11 dB |
| **24.** | Channel tune time | ≤ 100 ms |
| **25.** | Latency | Latency of the transmitter SHALL remain constant for a given symbol rate. |

*Notes:*

5. *42 MHz will become the requirement for OpenCable Host devices delivered after December 31, 2000.*
8. *OpenCable Host device implementations MAY be limited to all discrete frequencies defined in both SCTE-DVS167r2 and SCTE-DVS178r3.*

# 5 POINT-OF-DEPLOYMENT (POD) MODULE INTERFACE

The OpenCable Host device provides an interface to the POD module to facilitate the processing of digital information, which is received over the forward application transport (FAT) channel and the OOB forward data channel (FDC). The interfaces between the OpenCable Host device (host) and the POD module are described in the OpenCable Host-Pod Interface Specification, IS-POD-131-INT07-010803.

***STT-BDI-C-23:*** **The OpenCable Host device SHALL implement the HOST-POD Interface according to IS-POD-131-INT07-010803**
***STT-BDI-C-66:*** **The OpenCable Host device SHALL be required to support transport stream interface data rates of 26.97035 Mb/s and 38.81070 Mb/s averaged over the period between the sync bytes of successive transport packets with allowable jitter of +/- one MCLKI clock period.**
***STT-BDI-C-67:*** **The OpenCable Host device SHALL implement all aspects of the Host operation specified in SCTE-DVS297r1, Point-of-Deployment (POD) Module Firmware Upgrade Host Interface.**
***STT-BDI-C-86:*** **The uni-directional Host device SHALL NOT utilize signals ITX, QTX, ETX, and CTX.**

***STT-BDI-C-87*: The uni-directional Host device SHALL NOT be required to support the APDUs listed below:**

i. **OOB_TX_tune_request (Host Control Resource)**
ii. **OOB_TX_tune_cnf (Host Control Resource)**
iii. **connection_descriptor (Low Speed Communications)**
iv. **comms_send (Low Speed Communications)**

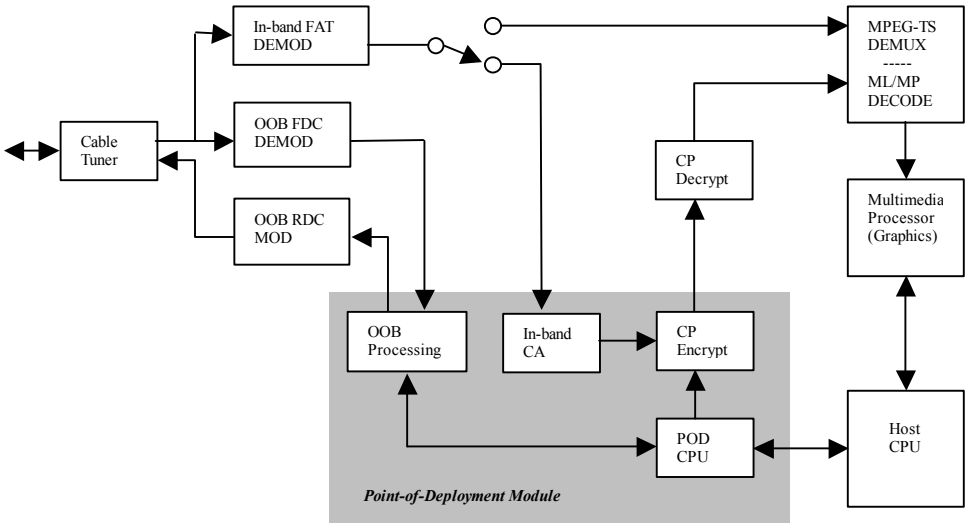



***Figure 2. Block Diagram of the OpenCable Host-POD Interface (Informative)***

## 5.1 OpenCable Host device Functionality without POD

The OpenCable Host device SHALL function without a POD security module and process the information received via the Analog and FAT channels directly. The Host SHALL have the following minimum performance characteristics without the POD security module:

***STT-BDI-C-92:* The OpenCable Host device SHALL process and display unscrambled analog NTSC audio-visual programming transported in adherence to standard, HRC or IRC frequency plans of EIA/CEA -542-A.**
***STT-BDI-C-93:* The OpenCable Host device SHALL discover, process and display unscrambled digital standard definition audio-visual programming according to Table H utilizing MPEG-2 main profile @ main level video and Dolby AC-3 audio and transported in adherence to standard, HRC or IRC frequency plans of EIA/CEA -542-A.**
***STT-BDI-C-94:* Each digital channel SHALL be identified by the EIA/CEA-542-A RF channel in which it is received. For digital transport streams containing multiple single program transport streams ("SPTS"), each SPTS SHALL be identified by a two-part channel number where the major channel number indicates the EIA/CEA -542-A RF channel and the minor channel number indicates a particular SPTS. The OpenCable Host device SHALL operate in the absence of Program and System Information Protocol ("PSIP") or when such information contains errors.**
***STT-BDI-C-95:* The OpenCable Host device SHALL process all Emergency Alert System messages, which MAY be transmitted via the FAT channels and Content Advisory messages, which MAY be transmitted via the Analog and FAT channels.**

***STT-BDI-C-96:*** **The OpenCable Host device SHALL disable the OOB Transmit function. A POD-less OpenCable Host device has no upstream communications capability and is, by definition, a one-way device.**

## 5.2 Host-POD Standby Power Management

The operation of the OpenCable Host device in Standby mode is not defined in this document. The minimum requirements for Standby mode, however, SHALL include the following:

1. The Host OOB Receive circuitry MUST be fully powered.
2. The POD Module MUST be fully powered.

## 5.3 Man Machine Interface (MMI) Support

The OpenCable Host device MUST be capable of operating in a unidirectional system and MUST support copy protection in this operational case. As defined in the OpenCable Copy Protection System (IS-POD-CP-INT05-010515), for a unidirectional system, the copy protection system performs authorization utilizing the MMI resource.

***STT-BDI-C-68:*** **The OpenCable Host device SHALL support the MMI resource defined in IS-POD-131-INT07-010803.**
***STT-BDI-C-69:*** **The OpenCable Host device SHALL support a navigation method to allow user navigation with the MMI resource defined in IS-POD-131-INT07-010803.**

# 6 MULTI-MEDIA INTERFACES

The physical user interface seen by the cable subscriber SHALL have the following characteristics.

## 6.1 OpenCable Host device Outputs

***The required outputs from the Set-top Host device are shown schematically in Figure 1 and detailed below. A Terminal Host device MAY include those outputs in Figure 1. Copy protection must be applied as applicable to any of optional interfaces as defined in STT-BDI-C-5 through STT-BDI-C-8 above. Copy protection signaling is described in the OpenCable POD Copy Protection System Specification. STT-BDI-C-24:*** **The Set-top Host device SHALL have a RF-modulated output compliant with Tables E, F, G and J-1 below, which is subscriber configurable to analog NTSC channel 3 or 4. The default channel setting SHALL be configurable by the cable operator using the Generic Feature resource defined in IS-POD-131-INT07-010803.**
***STT-BDI-C-24a:*** **If the Terminal Host device includes a RF-modulated output, that output SHALL be compliant with Tables E, F, G and J-1 below, which is subscriber configurable to analog NTSC channel 3 or 4. The default channel setting SHALL be configurable by the cable operator using the Generic Feature resource defined in IS-POD-131-INT07-010803.**
***STT-BDI-C-25:*** **The Set-top Host device SHALL use a female "F" connector meeting SCTE specification IPS-SP-400 Recommended "F" Port (Female) Specification for the RF modulated output.**
***STT-BDI-C-25a:*** **If the Terminal Host device includes a RF-modulated output, it SHALL use a female "F" connector meeting SCTE specification IPS-SP-400 Recommended "F" Port (Female) Specification.**
***STT-BDI-C-26:*** **The "F" connector for RF-modulated output on the Set-top Host device SHALL be labeled "To TV/VCR".**

***STT-BDI-C-27:*** **The Set-top Host device SHALL have baseband video as defined by Tables F and G and L&R baseband audio outputs as defined by Tables J-2 and J-3.**
***STT-BDI-C-27a:*** **If the Terminal Host device includes outputs, the baseband video outputs SHALL be defined by Tables F and G and the L&R baseband audio outputs SHALL be defined by Tables J-2 and J-3.**
***STT-BDI-C-28:*** **The Set-top Host device SHALL use a female RCA phono connector for baseband video output.**
***STT-BDI-C-28a:*** **If the Terminal Host device includes baseband video output, it SHALL use a female RCA phono connector.**
***STT-BDI-C-29:*** **The RCA phono connector for baseband video output on the Set-top Host device SHALL have a yellow dielectric. This RCA phono connector SHALL be labeled "Video" or "Video Out".**
***STT-BDI-C-29a:*** **If the Terminal Host Device includes a baseband video output, the RCA phono connector SHALL have a yellow dielectric. This RCA phono connector SHALL be labeled "Video" or "Video Out".**
***STT-BDI-C-30:*** **The Set-top Host device SHALL include a S-Video output that uses a female 4-pin connector.**
***STT-BDI-C-30a:*** **If the Terminal Host device includes a S-Video output, it SHALL use the female 4-pin connector.**
***STT-BDI-C-31:*** **The 4-pin connector for S-Video output on the Set-top Host device SHALL be labeled "S-Video".**

***STT-BDI-C-32:*** **The Set-top Host device SHALL use female RCA phono connectors for left and right audio outputs.**
***STT-BDI-C-32a:*** **If the Terminal Host device includes audio outputs, it SHALL use female RCA phono connectors for left and right audio outputs.**
***STT-BDI-C-33:*** **The RCA phono connector for the right audio output on the Set-top Host device SHALL have a red dielectric. This RCA phono connector SHALL be labeled to indicate the function of right audio output, for example: "R", "Right" or "Right Audio".**
***STT-BDI-C-34:*** **The RCA phono connector for the left audio output on the Set-top Host device SHALL have a white dielectric. This RCA phono connector SHALL be labeled to indicate the function of left audio output, for example: "L", "Left" or "Left Audio".**
***STT-BDI-C-35:*** **The Set-top Host device SHALL use a female RCA phono connector for the S/P DIF audio output.**
***STT-BDI-C-35a:*** **If the Terminal Host device includes a S/P DIF audio output, it SHALL use a female RCA phono connector.**
***STT-BDI-C-36:*** **The RCA phono connector for the IEC60958/61937 (S/P DIF) audio output on the Set-top Host device SHALL be labeled to indicate the function of the IEC60958/61937 (S/P DIF) audio output; for example "Digital Audio Output".**
***STT-BDI-C-37:*** **In order to support connections to multiple devices via the IEEE-1394 bus, the Set-top Host device SHALL provide at least two 4-pin or 6-pin standard 1394 connectors operated as a source device. Both connectors MUST have the same number of pins.**
***STT-BDI-C-37a:*** **If the Terminal Host device includes the IEEE-1394 interface, it SHALL provide at least two 4-pin or 6-pin standard IEEE-1394 connectors. Both connectors MUST have the same number of pins.**

## 6.2 RF Output Requirements (Channel 3/4 RF Output)

| Table E. Channel 3/4 RF Output Performance Parameters (0° - 40° C) | | |
|---|---|---|
| **1.** | RF Output Carrier Frequencies | Channels 3 & 4 standard |
| **2.** | RF Output Impedance | 75 ohm, unbalanced |
| **3.** | RF Output Return Loss | Ch 3/4 RF output: 10 dB minimum for either channel |
| **4.** | Ch 3/ 4 RF Output Level | +4.5 dBmV to +15 dBmV |
| **5.** | Ch 3/ 4 RF Output Level Stability | Not vary more than ±1.5 dB. |
| **6.** | Output Visual Carrier Frequency Accuracy | Within ±80 kHz or better |
| **7.** | Output Video Frequency Response for RF Output (worst case for analog NTSC or digital MPEG input signals) | -2 to +2 dB, -500 kHz to 3.75 MHz |
| **8.** | Terminal Contribution to Output Frequency Response for RF Output (worst case for analog NTSC or digital MPEG input signals) | -1 to +1 dB, -500 kHz to 3.75 MHz |
| **9.** | Output Visual/Aural Carrier Level Difference | Aural carrier is –10 to –17 dB relative to visual carrier level |
| **10.** | Output Visual/Aural Carrier Frequency Separation | 4.5 MHz, ±5 kHz |
| **11.** | Output Depth of Modulation | 85%, with variation not more than +5% to –2.5% |
| **12.** | Modulation Variation with APL | Not more than ±5%, relative to 50% APL over 10 % to 90% APL range |
| **13.** | Conversion Isolation: RF Input to Converted RF Output | 65 dB minimum; where isolation is defined here as the ratio between the converted signal and the unconverted signal present at the channel 3/4 RF output. This parameter SHALL be met with the output measured on the same frequency as the input of the converter, and applies to all assigned input carrier frequencies over the input level range defined in 5 above. |
| **14.** | RF Bypass Isolation | 60 dB minimum over the input tuning range (54-864 MHz) when internal RF bypass option is installed |

| | | |
|---|---|---|
| **15.** | Spurious Emissions within the output channel (channel 3/4) bandwidth | Not worse than –60 dBc<br>Channel loading assumptions: At least 110 AM-VSB channels at input level of +15 dBmV, at least 20 QAM channels at RF input level of +5 dBmV. |
| **16.** | Spurious Emissions outside the output channel (other than channel 3/4) | Not worse than –10 dBc. |
| **17.** | AM Hum Modulation | Not greater than 3% p-p |

## 6.3 OpenCable Host device Inputs

***STT-BDI-C-88:*** ***The Terminal Host device SHALL include an IEEE-1394 input, which SHALL provide at least two 4-pin or 6-pin standard IEEE-1394 connectors operated as a sink device. Both connectors MUST have the same number of pins.***
***STT-BDI-C-88a:*** ***The Terminal Host device SHALL include copy protection as defined in STT-BDI-C-7 above, initialization and discovery as defined in STT-BDI-C-70 below, bit-mapped graphics support (profile 0b) as defined in Section I.2.3.5 and all normative elements defined in Section II, and analog source switching as defined in Section II.3.5 of SCTE-DVS/194r3.***
***STT-BDI-C-88b:*** **If the Set-top Host Device supports the sink function for the 1394 interface, it SHALL include copy protection on the IEEE-1394 input as defined in STT-BDI-C-7 above, initialization and discovery as defined in STT-BDI-C-70 below, bit-mapped graphics support (profile 0b) as defined in Section I.2.3.5 and all normative elements defined in Section II, and analog source switching as defined in Section II.3.5 of SCTE-DVS/194r3.**

# 7 VIDEO

## 7.1 Analog Video

The OpenCable Host device will be introduced into an environment containing many existing analog set-top devices. The OpenCable Host device MUST be able to receive analog services in the clear. Analog video and audio SHALL be NTSC in accordance with current cable-system practice and applicable FCC rules.

### 7.1.1 Analog Tuning

***STT-BDI-C-38:*** **The OpenCable Host device SHALL support all existing clear, non-scrambled video analog services.**
***STT-BDI-C-39:*** **The OpenCable Host device SHALL have the capability to tune and demodulate NTSC-encoded channels from 54 to 864 MHz.**

## 7.2 STT-BDI-C-40*: The OpenCable Host device SHALL support the Standard, IRC, and HRC channel plans as defined in EIA-542.* Digital Video

### 7.2.1 The OpenCable Host device is required to handle all digital transport streams according to the following requirements:MPEG-2 Transport

***STT-BDI-C-41:*** **The OpenCable Host device SHALL be able to process MPEG-2 compliant Transport Streams in accordance with SCTE-DVS241r1.**
***STT-BDI-C-42:*** **The OpenCable Host device SHALL support System Information tables provided in SCTE-DVS234r2, Service Information Carried Out-of-Band for Digital Television, for broadcast systems.**
***STT-BDI-C-43:*** **The OpenCable Host device SHALL be capable of acquiring and displaying a Digital Service contained within the same multiplex within 1.5 seconds, worst case. The nominal acquisition and display target time SHALL be within 1.0 seconds. Network conditions in which these values are valid SHALL be defined in the OpenCable Test Plan. The nominal and worst-case acquisition and display times of the Host device will be certified using a vendor-provided navigator to be tested according to CableLabs test procedure (TBD).**
***STT-BDI-C-44:*** **The OpenCable Host device SHALL be capable of acquiring and displaying a Digital Service contained within a different multiplex within 2.0 seconds, worst case. The nominal acquisition and display time SHALL be within 1.0 seconds. Network conditions in which these values are valid SHALL be defined in the OpenCable Test Plan. The nominal and worst-case acquisition and display times of the Host device will be certified using a vendor-provided navigator to be tested according to CableLabs test procedure (TBD).**
***STT-BDI-C-45:*** **The video channel map SHALL be stored in a non-volatile memory in memory in the OpenCable Host device.**

### 7.2.2 Digital Video Decoding

***STT-BDI-C-46:*** **The OpenCable Host device SHALL decode MPEG-2 Main Profile @ Main Level per IEC 13818-2. The constraints and extensions that apply to video SHALL be those specified in ATSC A/53 Annex A.**
***STT-BDI-C-46a:*** **The Terminal Host devices SHALL decode and display MPEG-2 Main Profile @ High Level per IEC 13818-2. The constraints and extensions that apply to video SHALL be those specified in ATSC A/53 Annex A.**
***STT-BDI-C-47:*** **The OpenCable Host device SHALL decode the resolutions shown in Table H below.**
***STT-BDI-C-47a:*** **The Terminal Host device SHALL decode and display the resolutions shown in Table I below.**
***STT-BDI-C-48:*** **The OpenCable Host device SHALL decode aspect ratios as shown in Table H below.**
***STT-BDI-C-48a:*** **The Terminal Host device SHALL decode and display aspect ratios as shown in Table I below.**
***STT-BDI-C-49:*** **The OpenCable Host device MPEG-2 decoder SHALL support a variable bit rate input with peak rates up to the maximum rate allowed by MPEG-2 Main Profile @ Main Level.**
***STT-BDI-C-49a:*** **The Terminal Host devices MPEG-2 decoder SHALL support a variable bit rate input with peak rates up to the maximum rate allowed by MPEG-2 Main Profile @ High Level.**
***STT-BDI-C-50:*** **The OpenCable Host device MPEG-2 decoder SHALL support error concealment to minimize macroblock and stream synchronization errors.**

Standard test streams with known errors will be used to evaluate error concealment implementations. These streams will be documented in the OpenCable Host Test Plan.

### 7.2.3 Digital Television (DTV) In-band Service/System Information

***STT-BDI-C-90:*** **The OpenCable Host device SHALL process in-band System and Service Information for programs that are transported in-the-clear in accordance with Section 5.5 of SCTE-DVS241r1.**

### 7.2.4 Digital Television (DTV) Out-of-band Service/System Information

***STT-BDI-C-91:*** **The OpenCable Host device SHALL process out-of-band System and Service Information that is sent across the Host-POD interface in Extended Channel data flows, using** Service_type MPEG_section**, as defined in OpenCable IS-POD-131-INT07-010803 and SCTE-DVS234r2. The set of MPEG-2 tables provided to support the navigation function in the OpenCable Host device conforms to one or more of the profiles specified in SCTE-DVS234r2. The OpenCable Host device SHALL be able to process all profiles specified in SCTE-DVS/234r2.**

### 7.2.5 Digital Television (DTV) Closed Captioning

***STT-BDI-C-51:*** **The Set-top Host device SHALL process NTSC Closed Captioning information, when available in the MPEG-2 Picture User Data, as specified in EIA-708B, section 4, or as specified in EIA-608B and transported according to SCTE-DVS053r7 or SCTE-DVS157r1 on a program-by-program basis. This will include all data of cc_type 00 and 01, as defined in FCC part 15.119 and EIA-608B. The Set-top Host device SHALL reconstruct line 21 VBI (both field 1 and field 2) according to EIA-608B in all NTSC analog video outputs.**
***STT-BDI-C-51a:*** **If the Terminal Host device includes baseband video outputs, it SHALL process NTSC Closed Captioning information, when available in the MPEG-2 Picture User Data, as specified in EIA-708B, section 4, or as specified in EIA-608B and transported according to SCTE-DVS053r7 or SCTE-DVS157r1 on a program-by-program basis. This will include all data of cc_type 00 and 01, as defined in FCC part 15.119 and EIA-608B. The Terminal Host device SHALL also reconstruct line 21 VBI (both field 1 and field 2) according to EIA-608B in all NTSC analog video outputs.**
***STT-BDI-C-51b:*** **If the Set top Host device provides component analog or uncompressed digital output streams, decoding and display of this caption data SHALL be provided according to FCC rules part 15.119.**
***STT-BDI-C-51c:*** **The Terminal Host device SHALL decode and display this caption data according to FCC rules part 15.119.**
***STT-BDI-C-52:*** **All OpenCable Host devices submitted to Cable Labs for certification for delivery after July 1, 2002 SHALL process the Digital Television (DTV) Closed Captioning information, when available in the MPEG-2 Picture User Data, as specified in EIA-708B, section 9 and delivered according to ATSC A/53 amendment 1 (with cc_type set to '10' or '11'). This caption data, when present, SHALL be passed through to a DTV display via the IEEE-1394 interface.**
***STT-BDI-C-52a:*** **If the OpenCable Host device provides component analog or uncompressed digital output streams, decoding and display of this caption data SHALL be provided by the OpenCable Host device according to FCC rules part 15.122. If the OpenCable Host device provides an NTSC analog video output, and the network stream dual carries EIA-608B caption data transported according to SCTE DVS053r7 or DVS**

**157r1, then the OpenCable Host device SHALL reconstruct line 21 VBI in the analog output as required by FCC rules part 15.122 (a)(*2).***
***STT-BDI-C-53:*** **The OpenCable Host device SHALL process the caption_service_descriptor, when available, as defined by ATSC A/65 and SCTE-DVS097r7 (once it is harmonized with ATSC A/65) and carried in either the PMT of the in-band MPEG-2 transport stream or passed across the POD Extended Data Channel according to OpenCable IS-POD-131-INT07-010803.**

### 7.2.6 Digital Television (DTV) Content Advisory Information

To support the interoperable availability of content rating information for hosts and/or POD modules, OpenCable specifies the use of the Content Advisory Descriptor found in section 6.7.4 of ATSC A/65 (Program and System Information Protocol for Terrestrial Broadcast and Cable - PSIP). The syntax follows Table 6.18 in that reference. This descriptor is placed in the Program Map Table (PMT) as permitted in Table 6.16 of ATSC A/65 and in accordance with the standard descriptor mapping for the TS_program_map_section() found in ISO/IEC 13818-1. The only rating region currently defined for OpenCable use is Region One (value 0x01 for the rating_region field). Semantics for the coding of the fields found in the PSIP Content Advisory Descriptor follow the rules given in section 6.74 of ATSC A/65.

***STT-BDI-C-54:*** **For the purposes of passing the content advisory information through on line 21 of the NTSC analog video output, the Set-top Host device SHALL process the content advisory information, when present, as specified in EIA 608-B and transported according to SCTE DVS 053r6 or SCTE DVS 157r1.**
***STT-BDI-C-54a:*** **If the Terminal Host device includes NTSC analog video output, it SHALL process the content advisory information, when present, as specified in EIA 608-B and transported according to SCTE DVS 053r6 or SCTE DVS 157r1.**
***STT-BDI-C-54b:*** **The OpenCable Host device MAY also process the content_advisory_descriptor, when present, as defined by ATSC A/65-A, SCTE-DVS097r7 (once it is harmonized with ATSC A/65-A) and EIA-766-A and transported in either the PMT of the in-band MPEG-2 transport stream or passed across the POD Extended Data Channel according to OpenCable IS-POD-131-INT07-010803.**
***STT-BDI-C-54c:*** **Digital programs passed through from a Set-top Host device to a DTV receiver via the IEEE-1394 interface SHALL contain content advisory information, when present.**
***STT-BDI-C-54d:*** **If the Terminal Host device includes an IEEE-1394 interface, digital programs passed through it SHALL contain content advisory information, when present.**
***STT-BDI-C-54e:*** **The Set-top Host device SHALL reconstruct line 21, when present, as specified in EIA 608-B and transported according to SCTE DVS 053r6 or SCTE DVS 157r1.** ***STT-BDI-C-54f:*** **If the Terminal Host device provides an NTSC video output, then it SHALL reconstruct line 21 as defined in EIA 608 B.**
***STT-BDI-C-54g:*** **If the OpenCable Host device provides component analog or uncompressed digital output streams, decoding and display of this content advisory data SHALL be provided by the OpenCable Host device as defined in EIA 608-B and required by FCC rules part 15.120.**
***STT-BDI-C-97:*** **All OpenCable Host devices SHALL have a priori knowledge of the U.S. RRT (Region Rating Table for Region One) that is defined in EIA-766 (i.e., the table is stored in the OpenCable Host device).**
***STT-BDI-C-98:*** **The U.S. RRT SHALL be the default RRT for all OpenCable Host devices. It is noted that this approach is consistent with that specified in Annex C.1 of DVS234.**

### 7.2.7 Digital Television (DTV) Emergency Alert Service (EAS)

The OpenCable Host device processes emergency messages that utilize the EAS message syntax, which is compatible with MPEG-2 transport and is defined in SCTE-DVS208r8. For in-band transmission, it appears in the transport packet with the same PID as those used for Service/System Information (SI). The table ID for the EAS message is 0xD8 as defined in SCTE-DVS208r8 . For out-of-band (OOB) transmission, the EAS message is transmitted according to SCTE-DVS208r8 .

***STT-BDI-C-55:*** **The OpenCable Host device SHALL process EAS messages, when received, as defined in SCTE-DVS208r8.**

## 7.3 Video Performance Specifications

**Table F. Analog Video Output Performance Parameters (0 °- 40 ° C)**

Each line item parameter specification applies to both baseband and RF modulator output video signals, unless otherwise stated.

| | | |
|---|---|---|
| **1.** | Video Standard | NTSC composite, EIA-563 |
| **2.** | Signal Level (composite video) | 1.0 volt peak-to-peak, sync tip (-40 IRE) to reference white (100 IRE) ±10% |
| **3.** | Long Time Distortion (Bounce) | ±1%, settle in less than 1 second |
| **4.** | Field Time Distortion | ±4% |
| **5.** | Line Time Distortion | Baseband: ±2%, RF Modulated: ±3 |
| **6.** | Short Time Distortion | ±6% (Rising and/or Falling) |
| **7.** | Chroma to Luminance Gain Inequality | Not more than ±10 % |
| **8.** | Chroma to Luminance Delay for Baseband Video Output (box only, not including headend and plant) | ≤ 100 nsec (AM-VSB analog) |
| **9.** | Frequency Response for Baseband Video Output (worst case for analog NTSC or digital MPEG input signals) | -2 to +2dB, 0 kHz to 3.75 MHz |
| **10.** | Terminal Contribution to Output Frequency Response for RF Output (worst case for analog NTSC or digital MPEG input signals) | -1 to +1 dB, 0 kHz to 3.75 MHz |
| **11.** | Luminance Non-Linearity | 5% p-p maximum |
| **12.** | Chroma Non-Linear Phase Distortion | ± 5° |
| **13.** | Chroma Non-Linear Gain Distortion | ±5% |
| **14.** | Chroma/Luma Intermod | ±3% |
| **15.** | Differential Gain<br>(over 10% to 90% APL range) | 10% peak to peak max. for RF modulated output;<br>5% peak to peak max. for baseband video output |
| **16.** | Differential Phase<br>(over 10% to 90% APL range) | 10° peak to peak max. for RF modulated output;<br>5° peak to peak max. for baseband video output |
| **17.** | 920 kHz Beat | -52 dBc |

| | | |
|---|---|---|
| **18.** | Video Signal-to-Noise Ratio<br>(over the full input tuning range stated in Table A.2 above) | For RF Modulated Output: 53 dB with a digital input signal and 48 dB with an analog input signal at 0 dBmv. (*Note 6)*<br>For Baseband Video Output: 57 dB with a digital input signal and 49 dB with an analog input signal at 0 dBmv. (*Note 6*) |
| **19.** | Baseband Video Output Impedance | 75 ohm ± 10% |
| **20.** | Baseband Video Output Return Loss | 16 dB minimum across video bandwidth |

*Notes:*
*6. Video SNR measured with Unified Weighting filter.*

**Table G. Analog Video Output Performance when processing a digital video program source (0 °- 40 ° C)**

| | | |
|---|---|---|
| **1.** | Bar Level (rel. Back Porch) | 100 IRE nominal |
| **2.** | Sync Polarity | Negative (normal) |
| **3.** | Sync Level (rel. Back Porch) | 40 IRE ±4 |
| **4.** | Color Burst Amplitude | 40 IRE ±4 |
| **5.** | Color Burst Duration | 2.5 microseconds = 9 cycles ±1 (EIA RS-170) |
| **6.** | Front Porch Duration | 1.4 microseconds minimum<br>(+4 IRE to -20 IRE) |
| **7.** | Sync to Setup Duration | 8.5 microseconds minimum<br>(-20 IRE to +4 IRE) |
| **8.** | Horizontal Blanking Duration | 10.9 microseconds, ±0.3 microseconds (+4 IRE to -4 IRE) |
| **9.** | Sync Pulse Duration | 4.7 microseconds, ±0.2 microsecond (50% width) |
| **10.** | Sync Pulse Rise Time | 140 nsec ± 30 nsec<br>(10% to 90% amplitude) |
| **11.** | Equalization Pulse | 2.3 microseconds ±0.2 (50% width) |
| **12.** | Vertical Pulse | (H/2 - 4.7 microsecond) ±0.2 (50% width) |
| **13.** | Breezeway Duration | 0.6 microseconds |
| **14.** | Setup | 7.5 IRE |

| **Table H. Compression Format Constraints for OpenCable Host device Processing** | | | | |
|---|---|---|---|---|
| vertical_size_ value | horizontal_size _ value | aspect_ratio_ information | frame_rate_ code | Progressive_ sequence |
| 480 | 704 | 2,3 | 1 | 1 |
| 480 | 720 | 2,3 | 1 | 1 |
| 480 | 704 | 2,3 | 4 | 0 |
| 480 | 720 | 2,3 | 4 | 0 |
| 480 | 528 | 2 | 1 | 1 |
| 480 | 544 | 2 | 1 | 1 |
| 480 | 528 | 2 | 4 | 0 |
| 480 | 544 | 2 | 4 | 0 |
| 480 | 352 | 2 | 1 | 1 |
| 480 | 352 | 2 | 4 | 0 |
| 480 | 704 | 2,3 | 2,4,5 | 1 |
| 480 | 720 | 2,3 | 2,4,5 | 1 |
| 480 | 704 | 2,3 | 5 | 0 |
| 480 | 720 | 2,3 | 5 | 0 |
| 480 | 640 | 1,2 | 1,2,4,5 | 1 |
| 480 | 640 | 1,2 | 4,5 | 0 |

| **Legend for MPEG-2 coded values in Table H** |
|---|
| aspect_ratio_information 1 = square samples 2 = 4:3 display aspect ratio 3 = 16:9 display aspect ratio |
| frame_rate_code 1 = 23.976 Hz 2 = 24 Hz 4 = 29.97 Hz 5 = 30 Hz |
| progressive_sequence 0 = interlaced scan 1 = progressive scan |

# 8 HIGH DEFINITION PASS-THROUGH

The OpenCable Host device supports pass-through of compressed High Definition (HD) Audio-Visual programs using MPEG-2 Transport Streams through the IEEE-1394 interface, if present, to an OpenCable-compatible Digital TV.

***STT-BDI-C-56:*** **The Set-top Host device SHALL support the transfer of MPEG-2 single program transport streams (SPTS) containing HD programs via the IEEE-1394 isochronous Data Channel as specified in sections 4.1 – 4.3, 4.5 – 4.8 and 8.1 – 8.2 of EIA-775-A.**
***STT-BDI-C-57:*** **The Set-top Host device SHALL support the Analog/Digital source selection function as defined in sections 4.10 – 4.11 and 6.1 of EIA-775-A.**
***STT-BDI-C-70:*** **The Set-top Host device SHALL comply with SCTE-DVS194r3 section 4.1 and section 4.2**
***STT-BDI-C-99:*** **The Set-top Host device SHALL support simultaneous local decode and pass-through of compressed Standard Definition MPEG-2 A/V programming. The video formats that will be passed through the interface are provided in Table I (high definition) and Table H (standard definition).**
***STT-BDI-C-101:*** **The set-top Host device SHALL support the Isochronous Resource Manager (IRM) functionality as defined in Section 8 of the IEEE 1394-1995: Standard for a High Performance Serial Bus specification.**
***STT-BDI-C-102:*** **The set-top Host device SHALL support the Cycle Master functionality as defined in Section 8 of the IEEE 1394-1995: Standard for a High Performance Serial Bus specification.**

**Table I. Compression Format Constraints for HD Decoding & Pass Through**

| vertical_size_ value | horizontal_size _ value | aspect_ratio_ information | frame_rate_ code | Progressive_ sequence |
|---|---|---|---|---|
| 1080 | 1920 | 1,3 | 1,2,4,5 | 1 |
| 1080 | 1920 | 1,3 | 4,5 | 0 |
| 1080 | 1440 | 3 | 1,2,4,5 | 1 |
| 1080 | 1440 | 3 | 4,5 | 0 |
| 720 | 1280 | 1,3 | 1,2,4,5,7,8 | 1 |
| 480 | 720 | 2,3 | 7,8 | 1 |
| 480 | 704 | 2,3 | 7,8 | 1 |
| 480 | 640 | 1,2 | 7,8 | 1 |

| **Legend for MPEG-2 coded values in Table I** |
|---|
| aspect_ratio_information 1 = square samples 2 = 4:3 display aspect ratio 3 = 16:9 display aspect ratio |
| frame_rate_code 1 = 23.976 Hz 2 = 24 Hz 4 = 29.97 Hz 5 = 30 Hz 7 = 59.94 Hz 8 = 60 Hz |
| progressive_sequence 0 = interlaced scan 1 = progressive scan |

# 9 AUDIO

***STT-BDI-C-58:*** **The OpenCable Host device SHALL decode Dolby AC-3 digital audio in accordance with ATSC A/52 as constrained per Annex B of ATSC A/53, with additional data rates up to 448 kbps.**
***STT-BDI-C-59*****: Selected and authorized digital signals on Set-top Host devices SHALL be present simultaneously on the baseband left and right outputs, the RF output, and the digital output for digital services as listed in Table H or I above.**
***STT-BDI-C-59a*****: If the Terminal Host device includes audio outputs, the selected and authorized digital signals SHALL be present simultaneously on the baseband left and right outputs, the RF output, and the digital output for digital services as listed in Table H or I above.**
***STT-BDI-C-59b:*** **For analog services on Set-top Host devices, the selected and authorized audio signals SHALL be present on the baseband left and right outputs and the RF output, and MAY be present on the digital output.**
***STT-BDI-C-59c:*** **If the Terminal Host device includes audio outputs, the selected and authorized analog signals SHALL be present on the baseband left and right outputs and the RF output, and MAY be present on the digital output.**
***STT-BDI-C-60:*** **The OpenCable Host device SHALL process the AC-3 Audio Descriptor (when it is delivered) as defined in ATSC A/52 and constrained by ATSC A/53.**
***STT-BDI-C-71:*** **The OpenCable Host device SHALL be certified by Dolby Laboratories Inc. for Dolby Digital™ decoding.**

## 9.1 Audio Performance Specifications

All audio performance requirements are valid over the operational environmental parameters defined in Tables J-1, J-2, and J-3. These parameters apply to all OpenCable Host devices with audio outputs.

| Table J-1. RF Output | | |
|---|---|---|
| **1.** | Modulated Audio Mode | Monophonic or BTSC encoded |
| **2.** | Modulation<br>Note: For set-tops with volume control, this spec applies when commanded to "unity" or "nominal" gain | 50 kHz peak deviation ±7 kHz for a digital audio signal of 400Hz at 0dBFS. For analog inputs, the RF output MUST reproduce the original carrier deviation, + or - 10%. |
| **3.** | Audio Mute | Minimum 48 dB attenuation |

| **Table J-2. Baseband Audio Output when a Digital Service is Selected.** | | |
|---|---|---|
| **1.** | Audio Frequency Response | +/-1 dB from 20 Hz to 20 kHz |
| **2.** | Audio Mute | Minimum 60 dB attenuation |
| **3.** | Baseband Audio Output Impedance | < 5k ohm for each L&R audio outputs |
| **4.** | Audio Output Signal Level<br>(as measured into a 100k ohm load)<br>Note: For set-tops with volume control, this spec applies when commanded to "unity" or "nominal" gain | 2.4V p-p +/- 10% with digital levels (0 dBFS), and excluding the effects of dialog normalization and dynamic range compression |
| **5.** | Intermodulation Distortion (CCIF method using 4040 Hz and 3960 Hz tones at -14 dBFS input per tone) | 0.15% max. referenced to output |
| **6.** | Stereo L&R Channel Separation | 60 dB min. from 20 Hz to 20 kHz |
| **7.** | Stereo L&R Channel Gain Difference | +/- 0.5 dB max. from 20 Hz to 20 kHz, referenced to the left channel response |
| **8.** | Stereo L&R Channel Phase Difference | 5° max. from 20 Hz to 20 kHz |
| **9.** | Total Harmonic Distortion | 0.3% max. from 20 Hz to 20 kHz at -10 dB relative to full scale |
| **10.** | Audio Signal-to-Noise Ratio<br>Note: For set-tops with volume control, this spec applies when commanded to "unity" or "nominal" gain | 80 dB min., 20 Hz to 20 kHz, with 1 kHz test tone at full scale encoder input, dialog normalization and dynamic range compression disabled, using CCIR- 2k weighting |
| **11.** | Audio to Video Transmission Time Difference | $\pm$ 20 msec max |

| Table J-3. Baseband Audio Output with Analog Service.* | | |
|---|---|---|
| **1.** | Audio Frequency Response | Mono or BTSC Signal: ±3 dB from 50 Hz to 13 kHz |
| **2.** | Audio Mute | Minimum 60 dB attenuation |
| **3.** | Baseband Audio Output Impedance | < 5k ohm for each L&R audio outputs |
| **4.** | Audio Output Signal Level (as measured into a 100k ohm load)<br>Note: For set-tops with volume control, this spec applies when commanded to "unity" or "nominal" gain | Mono Signal: 1.2V p-p, +/- 10%, with 400 Hz test tone at +/-25 KHz p-p audio subcarrier deviation.<br>BTSC Signal: 1.2V p-p, +/- 10%, with 400 Hz test tone at +/- 12.5 kHz p-p audio subcarrier deviation for each L&R channel. |
| **5.** | Stereo L&R Channel Separation | BTSC Signal: 20 dB min. at 1 kHz |
| **6.** | Stereo L&R Channel Gain Difference | BTSC Signal: +/- 0.5 dB maximum from 50 Hz to 13 kHz, referenced to the left channel response |
| **7.** | Stereo L&R Channel Phase Difference | BTSC Signal: 15° maximum from 50 Hz to 13 kHz |
| **8.** | Total Harmonic Distortion | Mono and BTSC Signals: 3.5% max. from 50 Hz to 13 kHz |
| **9.** | Audio Signal-to-Noise Ratio<br>Note: For set-tops with volume control, this spec applies when commanded to "unity" or "nominal" gain | Mono and BTSC: 48 dB min., 50 Hz to 13 kHz, referenced to a 1000 Hz test tone at +/- 25 kHz p-p audio subcarrier deviation, CCIR-2k weighting. |

* *Requirements are based on input test signals provided by NTSC and BTSC signal sources RF modulated to Channel 4.*

*7. (Deleted)*

# 10 OPENCABLE HOST DEVICE POWERING STATES

Once the OpenCable Host device has AC power applied and has performed POD installation and initialization, it always has access to network services through the out-of-band channel, for network monitoring purposes or for receipt of messages, alarms, or notifications. Thus, when the OpenCable Host device is “On” (from the subscriber’s perspective), it is fully active and providing services that are displayed on the subscriber’s television. When it is “Off”, it still maintains network connectivity and thus is still consuming power and running the processor, operating system, and navigator shell.

When the OpenCable Host device is disconnected from AC power or from the cable connection, it is truly off (i.e., not connected to the network). When reconnected, the OpenCable Host device does not have to re-initialize, but MUST re-establish network connectivity. The AC power up sequence is slightly longer than the “Off” to “On” sequence but not as long as initialization.

# 11 OPENCABLE HOST DEVICE DIAGNOSTICS

***STT-BDI-C-61:*** **The OpenCable Host device SHALL be capable of performing self-diagnostics and displaying the results via the LED readout. A minimum set of diagnostics SHALL be available, including, but not limited to:**

- **OpenCable Host device power status**
- **OpenCable Host device boot status**
- **Indication of fatal error (e.g., Checksum error)**

***STT-BDI-C-62:*** **The OpenCable Host device SHALL be capable of performing self-diagnostics and displaying via the on-screen display (OSD) the results, that SHALL include, but are not limited to:**

- **OpenCable Host device power status**
- **OpenCable Host device boot status**
- **OpenCable Host device memory allocation**
- **Software version numbers of code in the OpenCable Host device**
- **Firmware version**
- **MAC addresses**
- **OpenCable Host device network addresses**
- **Status of FDC**
- **Status of FAT**
- **Status of RDC (for bi-directional Host devices only)**
- **Current channel status**
- **IEEE-1394 Port status (when present)**

**These diagnostics MAY also be displayed on the LED.**

***STT-BDI-C-63:*** **The OSD display of diagnostics can only be triggered by a pre-determined keystroke sequence.**

***STT-BDI-C-64:*** **The Uni-directional OpenCable Host device self-diagnostics SHALL be remotely controllable.**

***STT-BDI-C-64a:*** **The Bi-directional OpenCable Host device self-diagnostics SHALL be remotely controllable and reportable to the headend**

## 11.1 Diagnostic Parameters

The following paragraphs detail a minimal set of parameters that are displayed and remotely controllable and reportable for the self-diagnostics specified in STT-BDI-C-62.

### 11.1.1 OpenCable Host device Memory Allocation

***STT-BDI-C-73:*** **The OpenCable Host device SHALL be capable of displaying and reporting self-diagnostic memory allocation results that SHALL include, but are not limited to:**

- **Type of memory being reported (as applicable: ROM, DRAM, SRAM, Flash, and NVM)**
- **Physical size of memory type (in kilobytes, defined to 1024 bytes)**

### 11.1.2 Software Version Numbers of Code in the OpenCable Host device

***STT-BDI-C-74:*** **The OpenCable Host device SHALL be capable of displaying and reporting self-diagnostic software version number results, of all available applications, that SHALL include, but are not limited to:**

- **Application's name string**
- **Application's version number**
- **Software status (active, inactive or downloading)**
- **If applicable, Application's signature**

### 11.1.3 Firmware Version (OpenCable Host device)

***STT-BDI-C-75:*** **The OpenCable Host device SHALL be capable of displaying and reporting self-diagnostic firmware version results that SHALL include, but are not limited to:**

- **Firmware version number of entire firmware image**
- **Firmware's release or installation date of entire firmware image.**

### 11.1.4 MAC Addresses

***STT-BDI-C-76:*** **The OpenCable Host device SHALL be capable of displaying and reporting self-diagnostic media access control (MAC) address results that SHALL include, but are not limited to:**

- **Type of devices being reported (as applicable: Host, POD, IEEE-1394, USB, DOCSIS, and/or Ethernet)**
  - **NOTE: If multiple devices of the same type exist, then the MAC address for each device type SHALL be reported.**
- **MAC address of each reported device**

### 11.1.5 OpenCable Host device Network Addresses

***STT-BDI-C-77:*** **The OpenCable Host device SHALL be capable of displaying and reporting self-diagnostic network address results that SHALL include, but are not limited to:**

- **Network address of device**

**NOTE: If multiple network addresses exist, then each network address SHALL be reported.**

### 11.1.6 Status of FDC

***STT-BDI-C-78*****: The OpenCable Host device SHALL be capable of displaying and reporting forward data channel (FDC) status results that SHALL include, but are not limited to:**

- **FDC center frequency, in MHz**
- **Carrier lock status (e.g. LOCKED – NOT LOCKED)**
- **Packet synchronization status; packet in sync/not in sync (e.g. SYNC – NOT In SYNC)**

### 11.1.7 Status of FAT

***STT-BDI-C-79:*** **The OpenCable Host device SHALL be capable of displaying and reporting forward application transport (FAT) channel status results that SHALL include, but are not limited to:**

- **Modulation mode indicator; analog, 64 QAM, or 256 QAM.**
- **Carrier lock status**
- **If the currently tuned channel is digital, then PCR lock status; the FAT channel tuner is locked or not locked to the currently tuned service**
- **Numerical estimate of the channel's signal to noise ratio in tenths of a dB**
- **Numerical estimate of the signal level in tenths of a dBmV**

**NOTE:** When operated at nominal line voltage, at normal room temperature, the reported Level and SNR MUST be within 6 dBmV and 3 dB of the actual received channel level and SNR, respectively, for the input level range of -15 dBmV to +15 dBmV. Across the input level range from -15 dBmV to +15 dBmV, for any 1 dB change in input level or SNR, the Host MUST report a power change in the same direction that is not less than 0.5 dB and not more than 2.0 dB.

### 11.1.8 Status of RDC

***STT-BDI-C-80:*** **If the return data channel (RDC) is established, then the OpenCable Host device SHALL be capable of displaying and reporting reverse data channel (RDC) status results that SHALL include, but are not limited to:**

- **RDC center frequency, in MHz**
- **RDC transmitter power level, in dBmV**
- **RDC data rate (256kbps, 1544kbps, 2048kbps or 3088kbps)**

***STT-BDI-C-81:*** **If a DOCSIS cable modem is present, then the RDC status results SHALL also include, but are not limited to:**

- **DOCSIS modulation type (QPSK or 16-QAM)**

### 11.1.9 Current Channel Status

***STT-BDI-C-82:*** **The OpenCable Host device SHALL be capable of displaying and reporting current channel status results that SHALL include, but are not limited to:**

- **Channel type; analog or digital**
- **Authorization status; OpenCable Host device is authorized or not authorized for currently tuned service**
- **Purchasable status; currently tuned service MAY or MAY NOT be purchased**
- **Purchased status; currently tuned service is or is not purchased**
- **Preview status; currently tuned service is or is not in preview mode**
- **If the OpenCable Host device is utilizing parental control, then parental control status; currently tuned service is blocked or is not blocked via parental control**

### 11.1.10 IEEE-1394 Port Status

***STT-BDI-C-83:*** **The OpenCable Host device SHALL be capable of displaying and reporting IEEE-1394 Port status results that include, but are not limited to:**

- **Loop status (loop/no loop exists)**
- **Root status (OpenCable Host device is/is not Root node)**
- **Cycle Master status (OpenCable Host device is/is not Cycle Master)**
- **Port connection status**

- **Port 1 - connected/not connected**
- **Port 2 – connected/not connected**

- **Total number of nodes (devices) connected to IEEE-1394 bus.**

# 12 MECHANICAL

***STT-BDI-C-65:*** **The OpenCable Host device SHALL be capable of dissipating the heat from a POD module drawing an average of 2.5 watts across the POD interface, and with compliance of item 16 of Table K.**

***STT-BDI-C-72:*** **The OpenCable Host device SHALL have a non-removable nameplate(s) or sticker(s) that includes the following information:**

| | |
|---|---|
| ***Vendor ID:*** | ***24-bit vendor ID represented as 3 bytes (6 hexadecimal digits). This number SHOULD be assigned by OpenCable to ensure uniqueness.*** |
| ***Vendor Name:*** | ***40 ASCII characters maximum.*** |
| ***Serial Number or Serial No:*** | ***40 ASCII character maximum.*** |
| ***Return Path Capability:*** | ***(Indicate all that apply): N=None, T=Telco Return, R=OpenCable RF return, D=DOCSIS, X=Other.*** |

| **Table K. Environmental / Mechanical Requirements (meet all operational specs. without malfunction, or hard or soft failures, under the following)** | | |
|---|---|---|
| **1.** | Required Compliance | All applicable regulatory requirements including, but not limited to: FCC, UL, CSA, and EIA |
| **2.** | Input Line Voltage | 95 to 125 volts AC |
| **3.** | Input Line Frequency | 57 to 63 Hz |
| **4.** | Nominal Power Consumption | To be specified in watts by manufacturer |
| **5.** | Physical Security/Tampering-Resistance | Secure means of evidencing entry into the security portions of the device |
| **6.** | RF Susceptibility | RF field of 2 volts/ meter from 40 MHz to 1 GHz |
| **7.** | Radiated RF | FCC part 15 (b) compliant |
| **8.** | Conducted | FCC part 15 (b), ANSI C63.4-1992 compliant |
| **9.** | Lightning Surge Tolerance | UL 1409 voltage surge test 38.1, UL 1449, IEEE C62.41, IEEE 587 compliant.<br>RF Input: 1.5 kV at 1kV/usec, 60 amp peak;<br>AC line input: 6 kV, oscillatory 0.5 μsec rise time 100 kHz. |
| **10.** | Line Surge Test | μ FCC part 68, UL 1459, CSA compliant.<br>Metallic: 3500 v minimum at 5 μsec max. rise time and 600 μsec min. fall time, 20 joules min.<br>Longitudinal: 6500 v at 5 μsec max. rise time, 600 μsec min. decay time, 30 joules min.<br><br>Note: Only applies to a Host with a phone return modem. |
| **10a.** | Line Surge Test | UL 1449<br>Measured Limiting Voltage test<br>Duty Cycle Test<br>Abnormal Over Voltage Tests. |
| **11.** | Power Cross (if Host supports phone modem return) | Metallic: will survive 10 events of 600 v, 10 sec duration and operate. Longitudinal: will survive 10 events of 600 v, 10 sec duration and operate. |
| **12.** | Electrostatic Discharge | IEC 801-2, withstand 10 discharges at 15 kV to each corner and center of keypad, through a 150 pf capacitor in series with 150 ohm resistor, with device chassis grounded to ESD generator |

| | | |
|---|---|---|
| **13.** | Brown Out Effects | No corruption of non-volatile memory due to input voltage fluctuations from nominal to zero volts |
| **14.** | Operating Ambient Temperature and Humidity | 0° to 40° C and 5% to 95% RH non-condensing humidity *(See Note 10)* |
| **15.** | External Surface Temperature (with 125 vac input applied and device on, 25° C ambient temperature, without internal or external fan) | UL 1409 compliant. No external protruding surface point hotter than 50° C for metallic and 60° C for nonmetallic surfaces. No non-accessible surface point hotter than 65° C. |
| **16.** | Storage Temperature (non-powered, non-operating) | -20° to +60° C *(See Note 10)* |
| **17.** | Storage Humidity (non-powered, non-operating) | 5% to 95% RH non-condensing at 40° C *(See Note 10)* |
| **18.** | Altitude | Operating: -150 to 10,000 ft. AMSL<br>Storage: -150 to 15,000 ft. AMSL *(See Note 10)* |
| **19.** | Thermal Shock | Device meets all operational specs after subjection to:<br>-40° C. for 30 minutes<br>+25° C. for 10 minutes<br>+60° C. for 30 minutes *(See Note 10)* |
| **20.** | Humidity Shock | Mil-std-810d method 507.2 Device meets all operational specs after subjection to: raise temp to +60° C and 95% RH over 26 hrs., maintain for 6 hrs., drop to 85% RH while reducing temp to +30° C over 8 hrs., maintain +30° C and 95% RH for 8 hrs. Repeat for 10 cycles. *(See Note 10)* |
| **21.** | Solvent Resistance | No external surface deformation effect of common household solvents, cleaners, waxes *(See Note 10)* |
| **22.** | Shipping Vibration | Fully operational after subjection to swept frequency vibration test applied in each of x, y, z planes with excursion of 0.3 inches at a frequency varied from 10 to 30 Hz back to 10 Hz done six times within 30 minutes. *(See Note 10)* |
| **23.** | Mounting Feet | No marks or stain to varnished wooden surface after 40° C and 95% RH exposure for 10 days under force of 0.75 kg *(See Note 10)* |
| **24.** | Keypad Keys | Fully operational after subjection to 100,000 cycles of each key through its full travel to closure with a 10- to 12-ounce force applied at 60 times per minute. *(See Note 10)* |

| | | |
|---|---|---|
| **25.** | Impact Test | Device will not develop any openings creating electrical shock risks after subjection to an impact force of 5 ft. lbs. obtained from a free fall of a 2-inch diameter solid smooth steel sphere weighing 1.18 lbs. *(See Note 10)* |
| **26.** | Static Load on Keypad Keys | No mechanical damages or visible deformation after keypad subjection to a static load of 25 lbs. in the direction of operation of the keys. *(See Note 10)* |
| **27.** | Handling Drop Test | Device fully operational and not develop any openings exposing risk of electrical shock after subjection to one drop on the face of the device from a height of 20 inches onto a 2-inch thick smooth surface concrete floor. *(See Note 10)* |
| **28.** | Strain Relief Test | For permanently attached power supply cords, device will withstand steady pull force of 35 lbs. applied to the cord. *(See Note 10)* |
| **29.** | Non-volatile Memory Battery Life | Batteries used to back up non-volatile memory will have a minimum life of: unplugged: 1.5 yrs storage life @ 60° C or less; powered 8 yrs @ 40° C or less. |
| **30.** | Microphonic Shock | Device will remain error- or interference-free (i.e., no audio pops, clicks, no data errors, no video artifacts) when subjected to tapping with a reasonable force by placing device on a hard surface without padding or mats and inducing 20 taps from knuckles, flat hands, fists, finger nails, screwdriver handles, plastic hammers to all external surfaces of the device. *(See Note 10)* |

*Notes:*

*10. For Terminal Host devices, these parameters are superceded by the manufacturer's specifications.*

# 13 NORMATIVE REFERENCES

[1] ATSC A/52: ATSC Digital Audio Compression Standard

[2] ATSC A/53: ATSC Digital Television Standard

[3] ATSC A/65: Program and System Information Protocol for Terrestrial Broadcast and Cable

[4] EIA-542: Cable Television Channel Identification Plan

[5] EIA 608A: Recommended Practice for Line 21 Data Service

[6] EIA 708B: Digital Television (DTV) Closed Captioning

[7] FCC 47 CFR Chapter 1 (10-1-98 Edition), Part 15 – Radio Frequency Devices

[8] FCC 47 CFR Chapter 1 (10-1-98 Edition), Part 76 – Cable Television Service

[9] IEEE-1394-1995: Standard for a High Performance Serial Bus

[10] OC-SP-HOSTPOD-IF-I08-0111221: OpenCable HOST POD Interface Specification

[11] OC-SP-PODCP-IF-I06-011221: OpenCable POD Copy Protection System Specification

[12] ISO/IEC 13818-2: MPEG-2 Video

[13] SCTE IPS-SP-400: Recommended "F" Port (Female) Specification

[14] SCTE-DVS031r5: Digital Video Transmission Standard for Cable Television

[15] EIA-679-B (Part B): National Renewable Security Standard, March 2000

[16] SCTE-DVS157r1: SCTE Proposed Standard Methods for Carriage of Closed Captions and non-Real Time Sampled Video

[17] SCTE-DVS167r2: Digital Broadband Delivery System: Out-of-band Transport

[18] SCTE-DVS178r3: Cable System Out-of-band Specifications

[19] SCTE-DVS194r3: Home Digital Network Interface Specification Proposal with Copy Protection

[20] SCTE-DVS208r8: Emergency Alert Message for Cable

[21] SCTE-DVS234r2: Service Information for Digital Television

[22] SCTE-DVS241r1: Digital Video Service Multiplex and Transport System Standard for Cable Television

[23]

[24] SCTE-DVS313r5: Digital Cable Network Interface Standard

[25] SCTE-DVS 343 "Amendment to DVS 208r6

[26] EIA-775-A: DTV 1394 Interface Specification

[27] 5C Digital Transmission Protection Specification (Use of the technology defined in this specification is subject to licensing by Digital Transmission Licensing Administrator, dtla@dtcp.com. An informational version is available at http://www.dtcp.com/data/).

# 14 INFORMATIVE REFERENCES

[28] EIA/TIA-250-C: Electrical Performance Standards for Television Relay Facilities

[29] ISO/IEC 13818-1: MPEG-2 System

[30] ISO/IEC 13818-6: MPEG-2 Digital Storage Media-Command and Control (DSM-CC)

[31] MIL-C-39012: General Specifications for Connectors, Coaxial, Radio Frequency

[32] SCTE-DVS053r6: SCTE VBI Extensions for the ATSC Digital TV Standard

[33] SCTE-DVS 216r4 "POD Extended Channel Specification"

[34] SCTE-DVS 258r3 "Digital Video Systems Characteristics Standard for Cable Television"

[35] SCTE-DVS267r1: Point-of-Deployment (POD) Module Firmware Upgrade Host Interface

[36] SCTE-DVS 321 "POD/Host IP Flow Initialization and Management

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