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# S T A N D A R D S

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**Digital Video Subcommittee**

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**AMERICAN NATIONAL STANDARD**

**ANSI/SCTE 28 2017**

**HOST-POD Interface Standard**

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This document is identical to SCTE 28 2012 except for informative components which may have been updated such as the title page, NOTICE text, headers and footers. No normative changes have been made to this document.

**NOTE:**

- Instead of the URL <http://www.cablelabs.com/opencable/udcp/>, the reader could consult <https://apps.cablelabs.com/specification/?query=&category=VIDEO&subcat=UNIDIRECTIO> NAL.
- Instead of the URLs <http://www.cablemodem.com/> and <http://www.opencable.com/>, the reader could consult <https://apps.cablelabs.com/specification/?query=&category=VIDEO&subcat=CABLECARD>.
- All references to the Consumer Electronics Association (CEA) should be changed to the Consumer Technology Association (CTA).

## **Host-POD Interface Specification**

### **1 SCOPE**

This standard defines the characteristics and normative specifications for the interface between Point of Deployment (POD) security modules owned and distributed by cable operators, and commercially available consumer receivers and set-top terminals (“Host devices”) that are used to access multi-channel television programming carried on North American cable systems. The Point-of-Deployment module is also known as a CableCARD™ device. These Host devices may also be supplied by the cable operators. The combination of a properly-authorized POD module and a Host device permits the unscrambled display of cable programming that is otherwise protected by a conditional access scrambling system.

This standard applies extensions, modifications, and constraints to the interface defined in CEA-679 [1], the National Renewable Security Standard.

This standard supports a variety of conditional access scrambling systems. Entitlement management messages (EMMs) for such scrambling systems are carried in the cable out of band channel as defined by ANSI SCTE 55-1 [3] and ANSI/SCTE 55-2 [2]. Other data transfer mechanisms such as the signaling methods of the DOCSIS version 1.1 cable modem standard may be supported in the Host device. A cable operator is able to upgrade security in response to a breach by replacing the POD modules, without requiring any change in the host device.

The interface will support Emergency Alert messages transmitted over the out of band channel to the POD module and then delivered by the POD module over the interface to the host device using the format defined in SCTE 18 [4].

It may also support Interactive Program Guide services, Impulse Pay Per View services, Video on Demand, and other messaging and interactive services. It supports

both one way and two way cable systems, as well as host devices that incorporate DOCSIS modems or telco modems.

This standard defines the physical interface, signal timing, the link interface, and the application interface. It includes the extended channel specification, power management specifications, initialization procedures and firmware upgrade methods.

## 2 OVERVIEW OF HOST-POD INTERFACE

### 2.1 Historical Perspective (INFORMATIVE)

This specification has been revised from SCTE 28 2007 with changes limited to this Section 2.1, to update and add references in Sections 2.3.1 and 2.3.2, and to correct naming of references in the text.

Important context and implementation information for this specification is available at: <http://www.cablelabs.com/opencable/udcp/>

### 2.2 Advanced Cable Services (INFORMATIVE)

The POD Module interface specification is designed to support advanced digital cable services by a digital television receiver when a POD Module is inserted.

In this case, “Advanced Digital Cable Services” would include support of the following functions:

- Emergency Alert System
- Interactive Program Guide
- Impulse Pay-Per-View (IPPV)
- Video On Demand (VOD)
- General Messaging
- Interactive Services

#### 2.2.1 Interactive Program Guide (IPG)

The Host may support an Interactive Program Guide (IPG) to enable the user to navigate to available services. The services supported by the IPG may include basic channel, premium channels, and Impulse Pay-Per-View (IPPV) events. Program guide data may be delivered to the application by means of the in-band (QAM) channel and/or by means of the out-of-band (QPSK) channel:

- In-band transmission of program and system information typically describes only the digital multiplex in which it is sent. This means that a single-tuner Host must periodically scan through all channels to receive data for each channel and store this information in memory.
- Optionally, at the discretion of the cable operator, the out-of-band channel may be used to deliver guide data. The format of this information over the OOB channel will be defined by the cable operator and may be used to support specific IPG implementations. The Host receives data from the POD that is sent on the out-of-band channel and delivered over the **Extended Channel** described in Section 5. The guide data typically describes the entire range of services offered by the cable system.

### 2.2.2 Impulse Pay-Per-View (IPPV)

The Host may support the purchase of Impulse Pay-Per-View (IPPV) events. IPPV processing is split as follows:

- All security related and billing functions are in the POD Module.
- All user-interface functions are in the Host.

The IPPV API is specified by “Generic IPPV Support” in section 8.10 and covers all common functions related to (1) IPPV purchase (2) IPPV cancel (3) IPPV purchase review.

### 2.2.3 Video-on-Demand (VOD)

Video-on-Demand (VOD) may be modeled as an IPPV event where the program stream is dedicated to an individual subscriber. The VOD application executes in the Host and supports all of the User Interface (UI) functions.

The additional streaming media control functions (i.e. Pause, Play, Fast-Forward, Rewind) may be supported using DSM-CC User-to-User messages. The **Extended Channel** described in Section 5 may be used as the communication path for VOD signaling, and may also be used for VOD event purchases. After a VOD control session is established via the session creation interface, UDP messages may be exchanged transparently between the Host and the cable system. RFC 1831, 1832 & 1833 may be used as the underlying RPC mechanism for the exchange of DSM-CC UU.

### 2.2.4 Interactive services

Interactive Services may be supported by applications executing on the Host, for example, an email or game application. Typically, information about interactive services are not associated with a streaming media service, so information about them is delivered via the out-of-band channel. The service information is passed to the Host via the **Extended Channel** resource when the POD Module serves as the OOB modem.

The **Extended Channel** may also be used as the communication path for interactive service signaling when the POD Module is serving as the OOB modem. After an interactive service session is established via the session creation interface, UDP messages may be exchanged transparently between the Host and the cable system. RFC 1831, 1832 & 1833 may be used as the underlying RPC mechanism for the exchange of application level messages.

## 2.3 References

### 2.3.1 Normative references

The following standards contain provisions that, through reference in this text, constitute normative provisions of this Specification. At the time of publication, the editions indicated are current. All standards are subject to revision, and parties to agreements based on this Specification are encouraged to investigate the possibility of applying for the most recent editions of the standards listed in this section.

#### Normative reference list

1. CEA-679-C: "National Renewable Security Standard," Part B, (October 2005)
2. ANSI/SCTE 55-2 2008, Digital Broadband Delivery System: Out Of Band Transport – Mode B
3. ANSI/SCTE 55-1 2009, Digital Broadband Delivery System: Out Of Band Transport – Mode A
4. SCTE 18 2007, Emergency Alert Message for Cable, approved as a joint standard with CEA as ANSI-J-STD-042A-2007
5. ANSI/SCTE 65 2008, Service Information Delivered Out-of-Band for Digital Cable Television
6. ANSI/SCTE 54 2009, Digital Video Service Multiplex and Transport System Standard for Cable Television
7. ISO/IEC 13818-6:1998 Information technology: Generic coding of moving pictures and associated audio information -- Part 6: Extension for DSM-CC
8. ISO 8859-1:1998, Information technology - 8-bit single-byte coded graphic character sets - Part 1: Latin alphabet No. 1
9. PC Card Standard, Volume 2 Electrical Specification, March 1997, Personal Computer Memory Card International Association, Sunnyvale, CA.
10. PC Card Standard, Volume 4 Metaformat Specification, 2001, Personal Computer Memory Card International Association, Sunnyvale, CA
11. RFC 2131, Dynamic Host Configuration Protocol, March 1997.

12. RFC 2132, DHCP Options and BOOTP Vendor Extensions, March 1997.
13. PC Card Standard, Volume 3 Physical Specification, Release 7, February 1999, Personal Computer Memory Card International Association, Sunnyvale, CA.
14. ANSI/SCTE 41 2011, POD Copy Protection System
15. HTML 3.2 Reference Specification: W3C Recommendation *14-Jan-1997*  
<http://www.w3.org/TR/REC-html32.html>
16. Hypertext Transfer Protocol – HTTP/1.1:  
<http://www.ietf.org/rfc/rfc2616.txt?number=2616>
17. ANSI/SCTE 23-2 2007, [http://www.scte.org/documents/pdf/Standards/ANSI-SCTE\\_23-2\\_2007.pdf](http://www.scte.org/documents/pdf/Standards/ANSI-SCTE_23-2_2007.pdf) DOCSIS 1.1 Part 2: Baseline Privacy Plus Interface,
18. DOCSIS Set-top Gateway (DSG) Interface Specification, CM-SP-DSG-I18-110623
19. ANSI/SCTE 90-1 2005 SCTE Applications Platform Part 1: OCAP 1.0 Profile
20. RFC 1831, RPC: Remote Procedure Call Protocol Specification, v2 Aug.1995
21. RFC 1832, XDR: External Data Representation Standard, Aug.1995
22. RFC 1833, Binding Protocols for ONC RPC v2, Aug, 1995

## Normative reference acquisition

**ANSI/CEA Standards:** American National Standards Institute, Customer Service, 11 West 42nd Street, New York, NY 10036; Telephone 212-642-4900; Facsimile: 212-302-1286; E-mail: [sales@ansi.org](mailto:sales@ansi.org) ; URL:<http://www.ansi.org>

**CEA Standards: United States of America:** Global Engineering Documents, World Headquarters, 15 Inverness Way East, Englewood, CO USA 80112-5776; Telephone 800-854-7179; Facsimile: 303-397-2740; E-mail: [global@ihs.com](mailto:global@ihs.com); URL: <http://global.ihs.com>

**SCTE Standards:** Society of Cable Telecommunications Engineers Inc., 140 Philips Road, Exton, PA 19341; Telephone 800-542-5040; Facsimile: 610-363-5898; E-mail: [standards@scte.org](mailto:standards@scte.org) ;URL: <http://www.scte.org>

**ITU Standards:** ITU Sales and Marketing Service, International Telecommunication Union, Place des Nations CH-1211, Geneva 20, Switzerland; Telephone: +41 22 730 6141; Facsimile: +41 22 730 5194; E-mail: [sales@itu.int](mailto:sales@itu.int) ; URL: <http://www.itu.org>

**ISO/IEC Standards:** Global Engineering Documents, World Headquarters, 15 Inverness Way East, Englewood, CO 80112-5776, USA; Telephone: 800-854-7179; Facsimile: 303-397-2740; E-mail: [global@ihs.com](mailto:global@ihs.com); URL: <http://global.ihs.com>

- **Internet Specifications:** The Internet Engineering Task Force, IETF Secretariat, c/o Corporation for National Research Initiatives, 1895 Preston White Drive, Suite 100, Reston, VA 20101-5434; Telephone 703-620-8990; Facsimile 703-620-9071; E-mail: [ietf-secretariat@ietf.org](mailto:ietf-secretariat@ietf.org); URL: <http://www.ietf.org/rfc>

**PC Card Standards:** USB-Implementers Forum, Inc. , URL: [www.usb.org](http://www.usb.org)

**DOCSIS and OpenCable Specifications:** Cable Television Laboratories, Inc., 858 Coal Creek Circle, Louisville, CO 80027-9750; URLs: <http://cablelabs.com/>, <http://www.cablemodem.com/>, <http://www.opencable.com/>

### 2.3.2 Informative references

The following documents contain information that is useful in understanding of this Specification. Some of these documents are drafts of standards or balloted standards with unresolved comments.

#### Informative document list

1. OC-SP-CD-IF-I08-040831 OpenCable Common Download Specification
2. Data-Over-Cable Service Interface Specifications, DOCSIS 1.1, Radio Frequency Interface Specification, CM-SP-RFIV1.1-C01-050907.
3. Data-Over-Cable Service Interface Specifications, DOCSIS 2.0, Radio Frequency Interface Specification, CM-SP-RFIV2.0-C02-090422
4. DOCSIS 1.1 Part 3: Operations Support System Interface, ANSI/SCTE 23-3 2010.
5. Data-Over-Cable Service Interface Specifications, DOCSIS 2.0, Operations Support System Interface Specification, CM-SP-OSSIV2.0-C01-081104.

#### Informative document acquisition

Same as listed under Normative reference acquisition.

### 3 CEA 679 [1] COMPLIANCE

#### 3.1 Exceptions to Compliance

In all aspects not covered in this document, the POD Module interface requires complete CEA-679 [1] compliance with the following exceptions:

| <b>Table 3.1-A CEA-679 [1] Compliance Exceptions</b> |                |                                                                                                                                                                         |                                                                          |
|------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| <b>Item</b>                                          | <b>Section</b> | <b>Issue</b>                                                                                                                                                            | <b>Comment</b>                                                           |
| 1                                                    | 4.1            | Second paragraph states “It also allows for multiple instance of CA processes to exist for the same Host.”                                                              | SCTE 28 supports only one POD Module per POD/Host Interface.             |
| 2                                                    | 4.1            | Third paragraph is a description of handling multiple modules.                                                                                                          | SCTE 28 supports only one POD Module per POD/Host Interface              |
| 3                                                    | 5.3            | First paragraph states “This functionality includes: the ability to support multiple modules on one host, ...”.                                                         | SCTE 28 supports only one POD Module per POD/Host Interface              |
| 4                                                    | 5.4.1          | Item 5 of the requirements and limits list is “5) use of multiple modules”.                                                                                             | SCTE 28 supports only one POD Module per POD/Host Interface              |
| 5                                                    | 5.4.2          | Item 3 of the transport stream interface restrictions regarding the use of the word contiguous.                                                                         | Packets arrive synchronously with clock but not necessarily continuously |
| 6                                                    | 5.4.2          | Item 5 of the transport stream interface specifies the maximum data rate of 58 Mbps..                                                                                   | Section 6.1.1 specifies rates around 27 and 39 Mbps.                     |
| 7                                                    | 5.4.2          | Maximum jitter is not defined in the document.                                                                                                                          | Defined in Section 6.1.1                                                 |
| 8                                                    | 5.4.4          | Entire paragraph is about multiple modules.                                                                                                                             | SCTE 28 supports only one POD Module per POD/Host Interface              |
| 9                                                    | 5.5            | First paragraph sentence contains “... and indicates to the host that it is a NRSS-conformant module.”                                                                  | “NRSS-conformant module” should be changed to a POD module.              |
| 10                                                   | 7.2.4          | Item 2 of the SPDU list states “a conditional body of variable length which contains an integer number of APDUs belonging to the same session (see application layer).” | Section 8.1 limits the number of APDUs in an SPDU to one.                |
| 11                                                   | 7.2.6          | “... which is always followed by a SPDU body containing one or several APDUs.”                                                                                          | Section 8.1 limits the number of APDUs in an SPDU to one.                |

**Table 3.1-A CEA-679 [1] Compliance Exceptions**

| Item | Section       | Issue                                                                                                                                                                                                                 | Comment                                                                                                                          |
|------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 12   | 8.2.1         | First paragraph contains “Resources with higher version number shall be backwards compatible with previous versions, so that applications requesting a previous version will have a resource with expected behavior.  | All resources that are defined in CEA-679 [1] that are modified in SCTE 28 should have a different type value or version number. |
| 13   | 8.4.1.1       | First paragraph contains “When a module is plugged in or the host is powered up one or perhaps two transport connections are created to the module, ...”.                                                             | Section 8.1 limits the number of transport connections to one.                                                                   |
| 14   | 8.4.2         | Entire section.                                                                                                                                                                                                       | Section 8.4 replaces this entire section.                                                                                        |
| 15   | 8.5           | <b>Entire section.</b>                                                                                                                                                                                                | Section 8.8 of SCTE 28 replaces Section 8.5 of CEA 679 [1] except for Section 8.5.2 which remains.                               |
| 16   | 8.6           | Entire section                                                                                                                                                                                                        | Section 8.3 replaces this entire section.                                                                                        |
| 17   | 8.7           | Entire section.                                                                                                                                                                                                       | Section 8.5 modifies this operation.                                                                                             |
| 18   | 8.8           | Entire section.                                                                                                                                                                                                       | Section 8.13 replaces this entire section.                                                                                       |
| 19   | 8.9           | Entire section.                                                                                                                                                                                                       | This entire section is replaced by ANSI/SCTE 41 [14]                                                                             |
| 20   | 8.10          | Entire section.                                                                                                                                                                                                       | SCTE 28 does not require this resource.                                                                                          |
| 21   | 8.11          | Table 87 & 91                                                                                                                                                                                                         | Table 87 is replaced by Table 3.1-B and Table 91 is replaced by Table 3.1-C.                                                     |
| 22   | 8.11-8.13     | The obsolete spec. EIA-679-B Part B erroneously contained two sections numbered 8.11 and a section numbered 8.12. In the current reference CEA-679 [1] these sections are numbered 8.11, 8.12, and 8.13 respectively. |                                                                                                                                  |
| 23   | 8.12.2        | Host Control sections                                                                                                                                                                                                 | Host Control operation in Sections 8.12.1 and 8.12.2 of CEA-679 [1] is replaced by Section 8.8.                                  |
| 24   | 8.12.3-8.12.6 | Extended Channel Support                                                                                                                                                                                              | These sections of CEA-679 [1] Part B are replaced by Sections 5 and 8.9                                                          |
| 25   | 8.13          | Entire section                                                                                                                                                                                                        | Section 8.13 of CEA-679[1] is replaced by Section 8.10.                                                                          |

**Table 3.1-A CEA-679 [1] Compliance Exceptions**

| Item | Section  | Issue                                                                         | Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------|----------|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 26   | A.2.2.1  | Status register description.                                                  | IIR flag and operation description is given in Section 6.5.2 of SCTE 28.                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 27   | A.4.1.3  | Entire section                                                                | Removed by section 6.7.6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 28   | A.5.5.1  | “Hosts shall support 5V working and may optionally support 3.3V working.”     | Section 6.1.2 specifically states that the POD module is only implemented as a 3.3V device.                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 29   | A.5.5.2  | Table 119                                                                     | <ol style="list-style-type: none"> <li>1. MCLKO has been moved from pin 57 to pin 14. Pin 14 is shared with A14 and becomes an I/O. Pin 57 shall be VS2# always.</li> <li>2. Pin 11 Address 9 is also DRX.</li> <li>3. Pin 12 Address 8 is also CRX.</li> <li>4. Pin 22 Address 7 is also QTX. It is also changed to an I/O.</li> <li>5. Pin 23 Address 6 is also ETX. It is also changed to an I/O.</li> <li>6. Pin 24 Address 5 is also ITX. It is also changed to an I/O.</li> <li>7. Pin 25 Address 4 is also CTX,</li> </ol> |
| 30   | A.5.5.10 | Item 1 of the power management features list: “Except in standby mode, ...”   | POD Standby mode is not defined in SCTE 28.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 31   | A.5.5.10 | Item 2 of the power management features list.                                 | Section 6.1.2 modifies this to 1 amp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 32   | A.5.5.10 | Item 4 of the power management features list.                                 | Section 6.1.2 modifies this to 250 ma on Vpp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 33   | A.5.6    | Item 5 of the metaformat list regarding ID number.                            | Section 6.1.1 changes this to 0341h.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 34   | A.5.6    | Item 5 of the metaformat list lists STCI_STR as “NRSS_CI_V1.00”.              | Section 6.2 changes this to “OPENCABLE_POD_MODULE”.                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 35   | A.5.6    | Item 7 of the metaformat list lists system name as “NRSS_HOST”                | Change this to “OPENCABLE_HOST”                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 36   | A.5.6    | Item 8 of the metaformat list lists physical device name as “NRSS_CI_MODULE”. | Section 6.2 changes this to “OPENCABLE_POD_MODULE”.                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

**Table 3.1-A CEA-679 [1] Compliance Exceptions**

| Item | Section           | Issue                              | Comment                                                             |
|------|-------------------|------------------------------------|---------------------------------------------------------------------|
| 37   | A.5.6             | CISTPL_LINKTARGET is not included. | Section 6.3 requires this tuple per PCMCIA recommendations.         |
| 38   | B                 | Entire appendix                    | Should be replaced by appendix C.                                   |
| 39   | C.1               | Entire section                     | SCTE 28 does not support this resource.                             |
| 40   | C.2               | Entire section                     | SCTE 28 does not support this resource.                             |
| 41   | C.3               | Entire section                     | SCTE 28 does not support this resource.                             |
| 42   | D                 | Entire section                     | Homing operation is modified by Section 8.13.                       |
| 43   | E                 | Entire section.                    | SCTE 28 supports only one POD Module per POD/Host Interface         |
| 44   | F                 | Entire section                     | SCTE 28 does not require smart-card resource.                       |
| 45   | A.2.1.2.2-A.2.2.2 | Single buffer implementation       | SCTE 28 does not support a single buffer implementation in the POD. |

- The requirement of section 7.2.6.1 of CEA-679 [1] that the Host or POD module must support earlier versions of a resource shall only apply to versions of resources described in this specification.
- Transport layer timeout period shall be modified from 300 ms to 5 seconds.
- Hardware Interface Description – The term “command register” is used erroneously. It shall therefore be referred to as “Control Register.”
- The requirement of Section 8.3.3 of CEA-679 [1] to support an integer number of APDUs in a body of a single SPDU shall be changed to only a single APDU shall be supported in the body of a SPDU.
- The requirement of Section 8.4.3.5 of CEA-679 [1] that the POD shall implement its CA application such that when ca\_enable is present in ca\_pmt\_reply() both at program level and elementary stream level, only the ca\_enable at ES level applies for that elementary stream shall be applicable to a POD in a network that support different authorization at program level and elementary stream level.
- NOTE: Section 8.4.3.5 of CEA-679 [1] states that the CA PMT Reply "may" also be sent after reception of a CA PMT object. Implementors should be aware that sending a CA\_PMT object to the POD with ca\_pmt\_cmd\_id set to 'ok\_mmi' is not guaranteed to return a response.

- Products compliant with this specification shall provide a double buffer implementation. The single buffer implementation permitted by CEA-679 [1] shall not be used.

**Table 3.1-B Replacement for CEA-679 [1] Table 87  
Resource Identifier Values**

| Resource                   | class | type | Version | resource identifier |
|----------------------------|-------|------|---------|---------------------|
| Resource Manager           | 1     | 1    | 1       | 00010041            |
| Application Information    | 2     | 2    | 1       | 00020081            |
| Conditional Access Support | 3     | 1    | 2       | 00030042            |
| Host Control               | 32    | 1    | 3       | 00200043            |
| System Time                | 36    | 1    | 1       | 00240041            |
| MMI                        | 64    | 2    | 1       | 00400081            |
| Low Speed Communication    | 96    | **   | 2       | 0060xxx2            |
| Homing                     | 17    | 1    | 2       | 00110042            |
| Copy Protection            | 176   | 3    | 1       | 00B000C1            |
| Specific Application       | 144   | 1    | 1       | 00900041            |
| Generic Feature            | 42    | 1    | 1       | 002A0041            |
| Extended Channel           | 160   | 1    | 1       | 00A00041            |
| Generic IPPV Support       | 128   | 2    | 1       | 00800081            |

\*\* - See section 8.5 for details.

**Table 3.1-C Replacement for CEA-679 [1] Table 91  
Application Object Tag Values**

| apdu_tag                          | tag value (hex) | Resource         | Direction<br>Host ↔ POD |
|-----------------------------------|-----------------|------------------|-------------------------|
| T <sub>profile_inq</sub>          | 9F 80 10        | Resource Manager | ↔                       |
| T <sub>profile_reply</sub>        | 9F 80 11        | Resource Manager | ↔                       |
| T <sub>profile_changed</sub>      | 9F 80 12        | Resource Manager | ↔                       |
| T <sub>application_info_req</sub> | 9F 80 20        | Application Info | →                       |
| T <sub>application_info_cnf</sub> | 9F 80 21        | Application Info | ←                       |
| T <sub>server_query</sub>         | 9F 80 22        | Application Info | →                       |
| T <sub>server_reply</sub>         | 9F 80 23        | Application Info | ←                       |
| T <sub>ca_info_inq**</sub>        | 9F 80 30        | CA Support       | →                       |
| T <sub>ca_info**</sub>            | 9F 80 31        | CA Support       | ←                       |
| T <sub>ca_pmt**</sub>             | 9F 80 32        | CA Support       | →                       |
| T <sub>ca_pmt_reply**</sub>       | 9F 80 33        | CA Support       | ←                       |
| T <sub>ca_update</sub>            | 9F 80 34        | CA Support       | ←                       |
| T <sub>OOB_TX_tune_req</sub>      | 9F 84 04        | Host Control     | ←                       |
| T <sub>OOB_TX_tune_cnf</sub>      | 9F 84 05        | Host Control     | →                       |
| T <sub>OOB_RX_tune_req</sub>      | 9F 84 06        | Host Control     | ←                       |
| T <sub>OOB_RX_tune_cnf</sub>      | 9F 84 07        | Host Control     | →                       |
| T <sub>inband_tune</sub>          | 9F 84 08        | Host Control     | ←                       |
| T <sub>inband_tune_cnf</sub>      | 9F 84 09        | Host Control     | →                       |
| T <sub>system_time_inq**</sub>    | 9F 84 42        | System Time      | ←                       |

**Table 3.1-C Replacement for CEA-679 [1] Table 91**  
**Application Object Tag Values**

| apdu_tag                               | tag value (hex) | Resource                | Direction<br>Host ↔ POD |
|----------------------------------------|-----------------|-------------------------|-------------------------|
| T <sub>system_time</sub> **            | 9F 84 43        | System Time             | →                       |
| T <sub>open_mmi_req</sub>              | 9F 88 20        | MMI                     | ←                       |
| T <sub>open_mmi_cnf</sub>              | 9F 88 21        | MMI                     | →                       |
| T <sub>close_mmi_req</sub>             | 9F 88 22        | MMI                     | ←                       |
| T <sub>close_mmi_cnf</sub>             | 9F 88 23        | MMI                     | →                       |
| T <sub>comms_cmd</sub>                 | 9F 8C 00        | Low speed comms.        | ←                       |
| T <sub>connection_descriptor</sub>     | 9F 8C 01        | Low speed comms.        | ←                       |
| T <sub>comms_reply</sub>               | 9F 8C 02        | Low speed comms.        | →                       |
| T <sub>comms_send_last</sub>           | 9F 8C 03        | Low speed comms.        | ←                       |
| T <sub>comms_send_more</sub>           | 9F 8C 04        | Low speed comms.        | ←                       |
| T <sub>comms_rcv_last</sub>            | 9F 8C 05        | Low speed comms.        | →                       |
| T <sub>comms_rcv_more</sub>            | 9F 8C 06        | Low speed comms.        | →                       |
| T <sub>new_flow_req</sub>              | 9F 8E 00        | Extended Channel        | ↔*                      |
| T <sub>new_flow_cnf</sub>              | 9F 8E 01        | Extended Channel        | ↔*                      |
| T <sub>delete_flow_req</sub>           | 9F 8E 02        | Extended Channel        | ↔*                      |
| T <sub>delete_flow_cnf</sub>           | 9F 8E 03        | Extended Channel        | ↔*                      |
| T <sub>lost_flow_ind</sub>             | 9F 8E 04        | Extended Channel        | ↔*                      |
| T <sub>lost_flow_cnf</sub>             | 9F 8E 05        | Extended Channel        | ↔*                      |
| T <sub>program_req</sub>               | 9F 8F 00        | Generic IPPV Support    | →                       |
| T <sub>program_cnf</sub>               | 9F 8F 01        | Generic IPPV Support    | ←                       |
| T <sub>purchase_req</sub>              | 9F 8F 02        | Generic IPPV Support    | →                       |
| T <sub>purchase_cnf</sub>              | 9F 8F 03        | Generic IPPV Support    | ←                       |
| T <sub>cancel_req</sub>                | 9F 8F 04        | Generic IPPV Support    | →                       |
| T <sub>cancel_cnf</sub>                | 9F 8F 05        | Generic IPPV Support    | ←                       |
| T <sub>history_req</sub>               | 9F 8F 06        | Generic IPPV Support    | →                       |
| T <sub>history_cnf</sub>               | 9F 8F 07        | Generic IPPV Support    | ←                       |
| T <sub>feature_list_req</sub>          | 9F 98 02        | Generic Feature Control | ↔                       |
| T <sub>feature_list</sub>              | 9F 98 03        | Generic Feature Control | ↔                       |
| T <sub>feature_list_cnf</sub>          | 9F 98 04        | Generic Feature Control | ↔                       |
| T <sub>feature_list_changed</sub>      | 9F 98 05        | Generic Feature Control | ↔                       |
| T <sub>feature_parameters_req</sub>    | 9F 98 06        | Generic Feature Control | ↔                       |
| T <sub>feature_parameters</sub>        | 9F 98 07        | Generic Feature Control | ↔                       |
| T <sub>feature_parameters_cnf</sub>    | 9F 98 08        | Generic Feature Control | ↔                       |
| T <sub>open_homing</sub>               | 9F 99 90        | Homing                  | →                       |
| T <sub>homing_cancelled</sub>          | 9F 99 91        | Homing                  | →                       |
| T <sub>open_homing_reply</sub>         | 9F 99 92        | Homing                  | ←                       |
| T <sub>homing_active</sub>             | 9F 99 93        | Homing                  | →                       |
| T <sub>homing_complete</sub>           | 9F 99 94        | Homing                  | ←                       |
| T <sub>firmware_upgrade</sub>          | 9F 99 95        | Homing                  | ←                       |
| T <sub>firmware_upgrade_reply</sub>    | 9F 99 96        | Homing                  | →                       |
| T <sub>firmware_upgrade_complete</sub> | 9F 99 97        | Homing                  | ←                       |

\* - Direction depends on if Host has modem. See section 8.9.

\*\* These values are copied directly from Table 91 of CEA-679 [1] and do not appear explicitly in this document.

## 4 SYSTEM ARCHITECTURE (INFORMATIVE)

### 4.1 Introduction

At the subscriber premises, a reception system includes a cable navigation device, or Host, and a POD Module. This combination allows the isolation of cable operator hardware specifics into a renewable POD Module and therefore provides the architectural foundation for retail availability of cable navigation devices. The POD Module interface consists of a standardized:

- Bi-directional access to the Out-Of-Band RF Front End, or alternatively access to forward Out-Of-Band Messaging supplied by one or more DSG Tunnels via the DOCSIS Set-top Gateway (DSG) [18]
- In-band MPEG-2 Transport Stream input and output, and
- CPU interface.

The Host-POD Interface will operate in one of two modes, a mode using SCTE 55-1 or SCTE 55-2 OOB channels (the OOB mode), or a mode that uses the DOCSIS Set-top Gateway (DSG) for the forward OOB messaging and the normal DOCSIS IP channel for return traffic (the DSG mode).

In the first mode of operation, the signaling functions are split between the Host and the POD Module such that only the RF processing and QPSK demodulation and modulation are done in the Host. The Advanced Host will operate in either of these two modes, OOB or DSG, based on network configurations. All other Hosts will operate in the OOB mode.

The remainder of the processing, including all of the Data-link and MAC protocols, is implemented in the POD Module. This split was chosen for the following reasons:

- SCTE 55-1 and SCTE 55-2 use common modulation (QPSK), but in all other respects are quite different. Only the parts of the protocol stack common to both OOB schemes are included in the Host.
- Future development of OOB protocols should not be precluded. By placing the majority of the OOB processing in the POD Module, the OOB can be renewed at a future time by replacement of the POD Module.
- It is important to the cable operator that the reverse (upstream) transmissions from any device are correctly controlled, because a single uncontrolled device can impair a significant portion of the shared access network. By implementing the media access control processing in the POD Module, the cable operator can maintain the integrity of the access network.

- All processing of conditional access messages is done in the POD Module. This approach is taken to protect from theft-of-service attacks.

In the DSG mode of operation, all of the Data-link and MAC level protocols are implemented in the embedded DOCSIS cable modem in the Host. In this case the POD is not responsible for implementing these protocols, since they are provided via the embedded DOCSIS cable modem. The OOB messaging in this case is transported as follows:

- The forward OOB messaging is transported via one or more DSG Tunnels to the Host
- The Host filters the IP packets on the DSG Tunnels identified by the Ethernet MAC addresses specified by the POD.
- The Host optionally removes the IP headers of these packets as instructed by the POD (the POD specifies the number of bytes to be removed from the header of the IP packet).
- The resulting data packets are transmitted over the extended channel to the POD module.

The POD Module can be used in a number of different networks, as described in the sections below.

## 4.2 Two-way Networks

Figure 4.2-1 gives a schematic view of the system when the cable network includes an OOB return Data Channel based on ANSI/SCTE 55-1 [3] or ANSI/SCTE 55-2 [2].

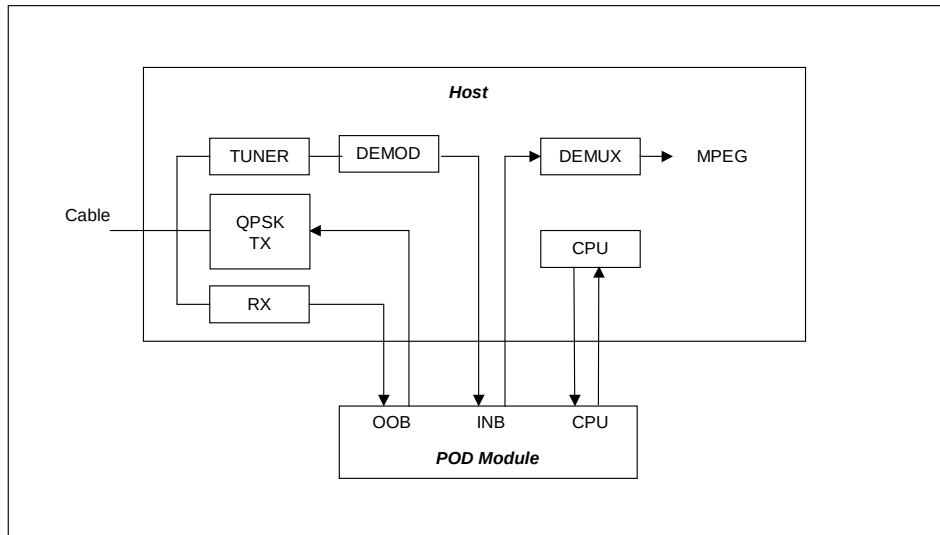


**Figure 4.2-1 System with Two-way Network**

The QPSK receiver circuit in the Host tunes and demodulates the QPSK Forward Data Channel (FDC). The receiver circuit adapts to the 1.544/3.088 Mbps or 2.048 Mbps FDC bit rate, and delivers the serial bit-stream and clock to the POD Module. (This serial data is used primarily to send conditional access entitlement management messages from the cable system to the POD Module. These messages are beyond the scope of this standard.)

Tuning of the QPSK receiver circuit is under control of the POD Module, as explained in Section 8.8.2. The tuning range is between 70 and 130 MHz.

In the return path, the POD Module generates QPSK symbols and clock and transfers them to the QPSK transmitter circuit in the Host. The transmitter circuit adapts to the 1.544/3.088 Mbps or 0.256 Mbps RDC bit rate. The QPSK transmitter circuit modulates the QPSK symbols onto a narrow band carrier.

Tuning and level control of the QPSK transmitter are under control of the POD Module as explained in Section 8.8.1. The tuning range is between 5 MHz and 42 MHz .

### 4.3 One-way Networks

The configuration shown in Figure 4.3-1 applies where there is a no return channel.

The QPSK transmitter in the Host is not active (and it is therefore omitted from the diagram). The receiver circuit operates in the same manner as described in Section 8.8.

An optional telephone modem may be used in one-way networks to allow limited interactive services. In this case, the standard telephone modem is incorporated into the Host.

The Host may opt to allow the POD to have access to the telephone modem. In the event that the Host permits the POD to have access to the telephone modem, the POD Module may access the telephone modem via the Low Speed Communications Resource defined in CEA 679 [1]. Support of the Low Speed Communication Resource as defined in CEA 679 [1] is optional.

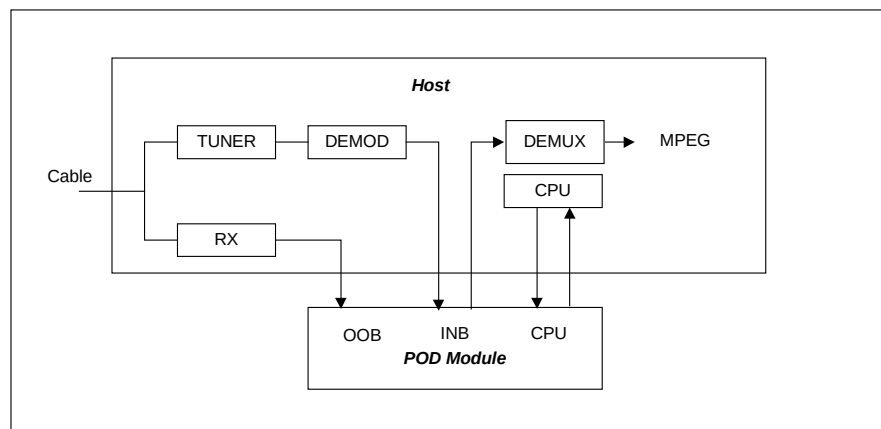


**Figure 4.3-1 System with One-way Network**

After POD Module initialization, the Host informs the POD Module about the available Low Speed Communication resources as defined by CEA-679 [1] (see the Reference List in the Informative Annex). Then, when the POD Module requires setting up a connection with the cable headend, datagrams are sent to the telephone modem via the CPU interface as defined by CEA-679 [1].

## 4.4 Two-way Networks with DOCSIS

The configuration shown in Figure 4.4-1 applies where a DOCSIS capability exists in the Host.

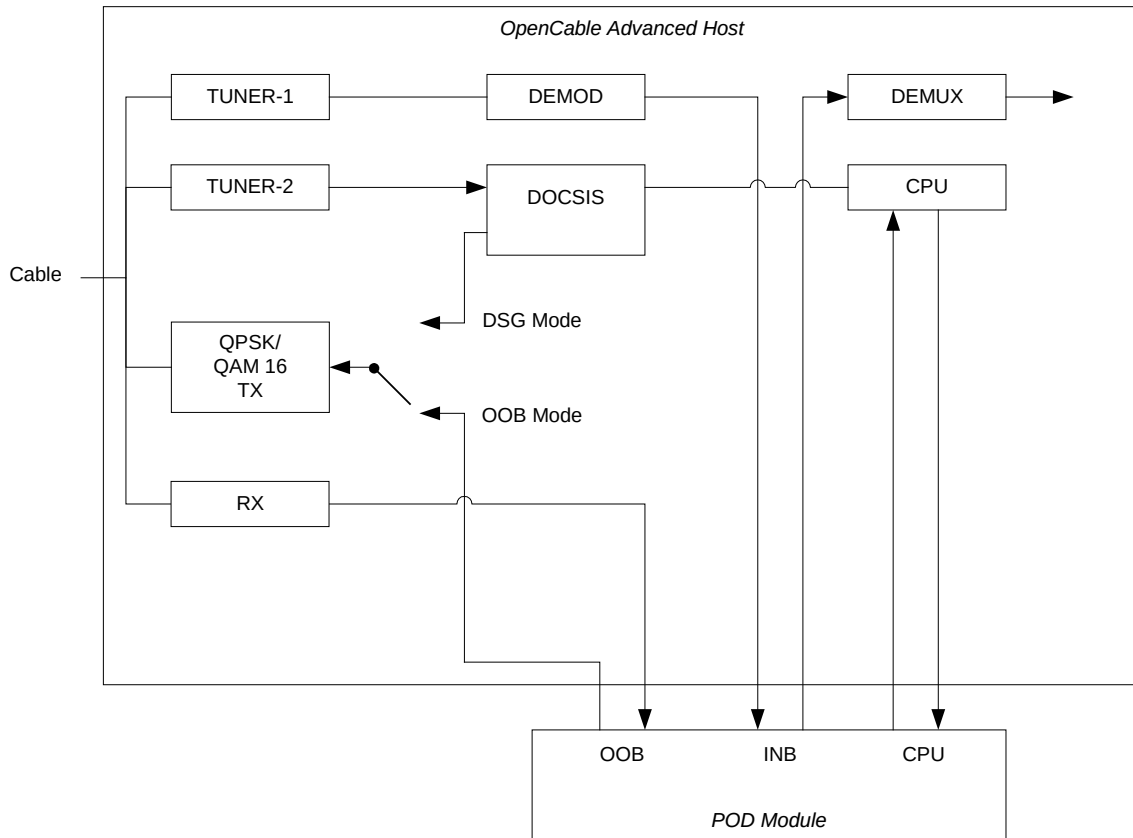


**Figure 4.4-1 - System with DOCSIS Two-way Network**

In this configuration a single upstream transmit path is shared between the POD Module and the DOCSIS modem. In order to prevent conflict between the DOCSIS upstream and the OOB upstream the system will operate in one of two modes.

- **OOB mode** – The downstream Conditional Access Messages and network management messages will be delivered to the POD Module via the QPSK receive interface on the POD Module using, e.g., SCTE 55-1, SCTE 55-2, or other agreed OOB specification. The upstream Conditional Access Messages and network management messages will be transmitted from the POD Module via the QPSK transmit interface on the POD Module using, e.g., SCTE 55-1, SCTE 55-2, or other agreed OOB specification.
- **DSG mode** – The downstream Conditional Access Messages and network management messages will be delivered to the POD Module by the Extended Channel using the DSG Service\_type using the DOCSIS downstream in

accordance with the DOCSIS Set-top Gateway (DSG) Specification [1]. The upstream Conditional Access Messages and network management messages will be transmitted from the POD module via IP over the DOCSIS upstream channel using the Extended Channel. The DOCSIS bi-directional channel can be used by any applications running in the Host, simultaneously with the POD module's communication with the headend via the Extended Channel using DOCSIS. The use of the Extended Channel by the POD module for IP flows does not change DSG usage of the DSG Service\_type on the Extended Channel.

The mode used is based on whether the DOCSIS Set-top Gateway is supported by the network. The POD informs the Host which of these modes is to be used as detailed later in this specification.

## 5 EXTENDED CHANNEL DATA FLOWS

### 5.1 Internet Protocol Flows (Informative)

The Extended Channel supports delivery of IP packets across the POD interface. Both unicast (point to point) and multicast (point to multipoint) addressing shall be supported by this protocol. If the Host is in OOB mode, then the POD module shall service the IP flow via utilization of the Host's RDC and shall supply the Host with an IP address. On request of a "new flow request" from the Host, the POD Module shall respond to the request to open the flow by obtaining an IP address for use by the Host. That IP address shall be returned in the "new flow confirmation" message. Informative Note: The POD is not required to grant a request for service type IP Unicast when requested by the Host.

In DSG mode, the Card resides at the Network Layer and the Host shall utilize its eCM to provide the Data Link Layer to the underlying DOCSIS network. When the Card wishes to utilize the DOCSIS network to transfer IP datagrams upstream, it shall first submit a "new flow request" to the Host to establish an IP flow to transfer datagrams between the Card and the Host's eCM interface. The Card shall submit its MAC address in its request to the Host for an IP flow.

If the Host grants the new IP flow request, then the Host shall utilize DHCP to acquire an IP address for the Card, and shall send this information, along with the DOCSIS maximum transmission unit (MTU) (1500 bytes for IP datagrams) to the Card in a new flow confirmation. The Host shall then open an IP flow to the Card over the Extended Data Channel.

The Host shall utilize the MAC address provided in the Card's IP flow request to filter Ethernet frames from the eCM that are intended for the Card. The Host shall extract all unicast IP datagrams from Ethernet frames addressed to the CableCARD's MAC address and shall forward them over the Extended Data Channel to the CableCARD.

The Host shall utilize the Extended Data Channel's IP flow to forward IP datagrams it receives over the eCM interface on behalf of the Card. The Host shall not forward the Card any datagrams received over other interfaces (e.g. Ethernet port, USB port, etc.).

The Host shall forward all IP datagrams received from the Card to the eCM interface. The Host shall not forward any IP datagrams received from the Card to any other interface, including but not limited to: IEEE-1394, Ethernet, USB, 802.11a/b/g/n/x, Multimedia Over Coax Alliance (MoCA), etc. The Host shall resolve the destination MAC address of the IP datagrams that it receives from the Card and shall apply the appropriate MAC addresses to the Ethernet frames it sends upstream. If an established IP type of flow becomes unavailable for any reason, the device that has granted the flow shall report that fact to the one that has requested the flow. The "lost flow indication" transaction shall be used to report this type of event. One example case where a flow may become unavailable is due to a change in the state of the eCM that may have resulted from a change via SNMP to the eCM's operational state.

## 5.2 Flow Examples—QPSK Modem Case (Informative)

Figure 5.2-1 diagrams a POD-Host interface in which four flows have been set up. In this example case, the POD provides a full-duplex modem function for the benefit of the Host (as well as itself).

The rounded rectangle boxes represent applications. In this example, the Host has a Navigation application that receives Service Information data on the Extended Channel via the POD interface (#1). The Host has opened up three flows to receive MPEG data from the POD, and has supplied different PID values for filtering for each. The navigation function (#1) uses two SI flows in the example, and another application (#2) uses the third flow. The Host also has a web browser application (#3) and a Video On Demand (VOD) application (#4).

In Figure 5.2-1, the types of services that the POD is required to support are shown with black arrows. As shown in the figure, three flows delivering MPEG table sections are required. Flows that may be available at the option of the supplier of the POD are shaded gray. In the figure, the POD supports an IP flow, but a compliant POD can choose not to support the IP service type.

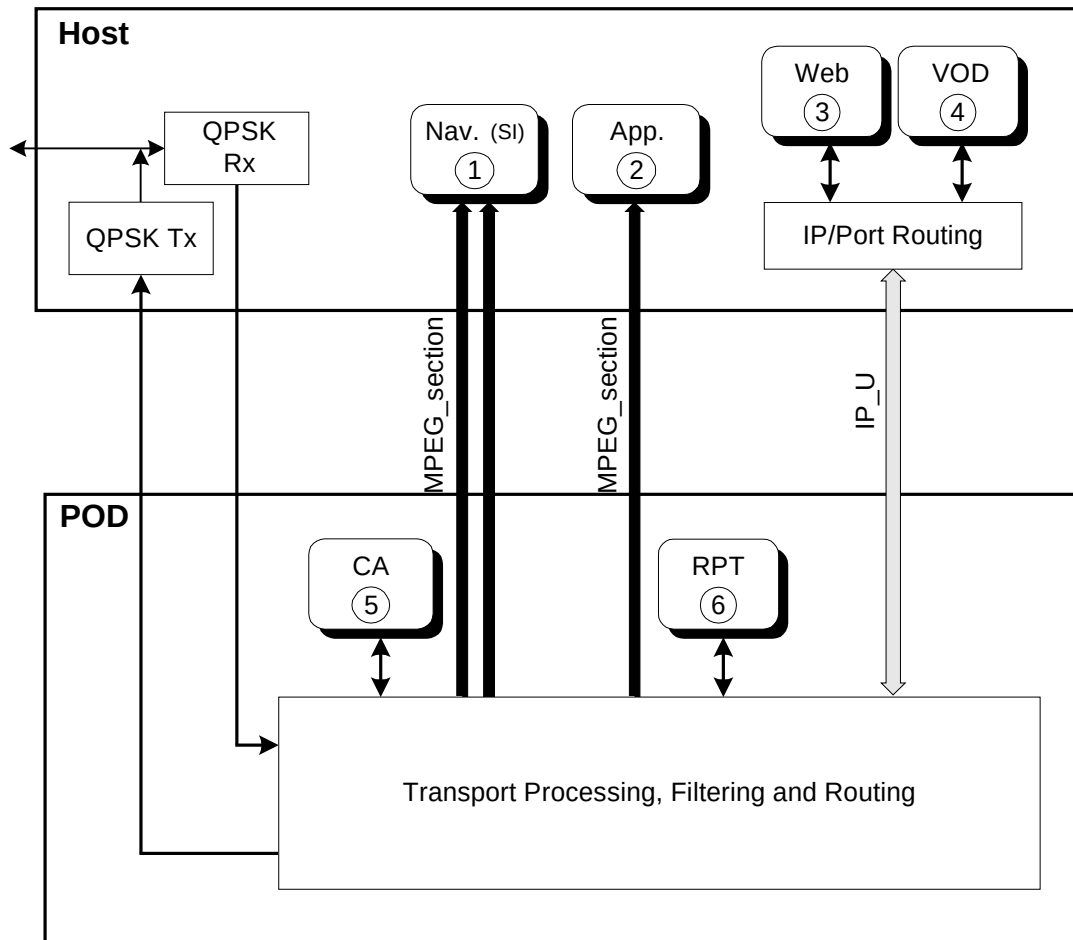


**Figure 5.2-1 Flow Examples - QPSK Modem Case**

The POD includes two applications of its own. The Conditional Access process (#5) receives data via downstream QPSK. The POD includes a pay-per-view reportback function (#6).

Note that none of these POD applications use flows that travel across the POD interface.

### 5.3 Flow Examples— High Speed Host Modem Case DSG Mode

In the next example case, the Host includes a High Speed Host Modem. Figure 5.3-1 diagrams a POD-Host interface in which five flows have been set up. When a Host includes a High Speed Host Modem, the Host is required to support at least one flow of service type IP Unicast (IP\_U). As before, the POD must support three MPEG section flows if the Host requests them.

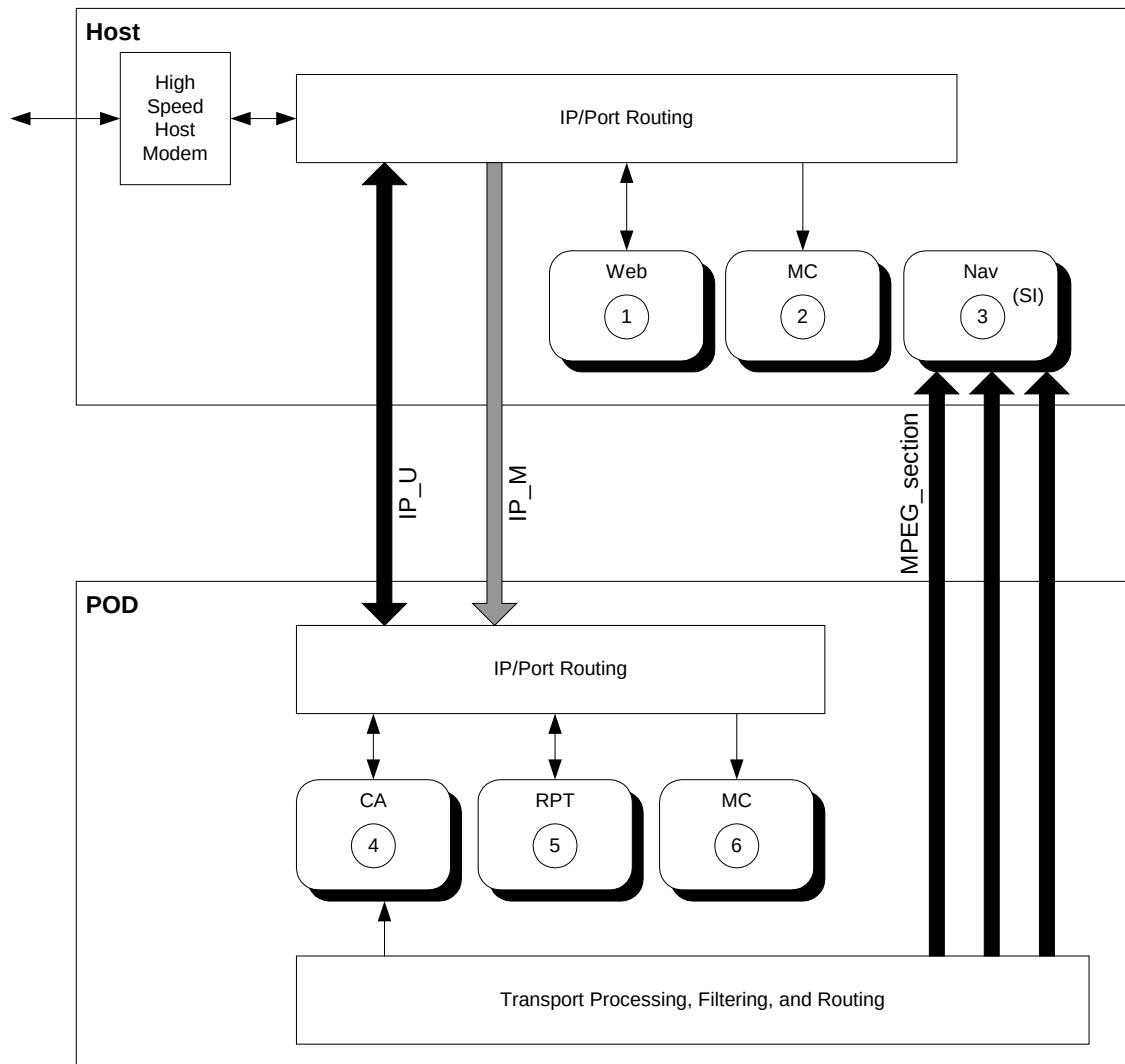


**Figure 5.3-1 Flow Examples - High Speed Host Modem Case**

In this example, the Host has a web browser application (#1), some application that uses multicast addressed packets (#2) and a Navigation application (#3) that receives Service Information data on the Extended Channel via the POD interface via three separate flows.

The Navigation application can open three different simultaneous flows, specifying different PID values for each. For example, it might set one to the base PID that carries SI network data including the Master Guide Table, Virtual Channel Table and System Time. It can set a second one to point to a PID value where Event Information Tables for a specific time slot may be found, and another to collect associated Extended Text Tables (ETTs).

The POD includes three applications of its own. The Host routes IP packets to the POD applications based on IP address. For unicast packets, those that match the IP address assigned to the POD will be routed across the interface. For multicast

packets, those matching the multicast group address associated with a particular flow will be delivered.

The POD includes a pay-per-view reportback function (#5) that uses standard IP packets for data transport. Finally, the POD includes some application (#6) that has registered with the Host to receive multicast-addressed IP packets through the Host modem.

## 5.4 Summary of Extended Channel Flow Requirement (Normative)

Compliance with this standard requires Host and POD devices to support certain flows. Other types of flows may be supported at the discretion of the Host or POD. The following table summarizes the requirements.

| <b>Table 5.4-A Flow Requirements</b>                                                    |                       |                     |                                   |
|-----------------------------------------------------------------------------------------|-----------------------|---------------------|-----------------------------------|
| <b>Requestor</b>                                                                        | <b>Data Direction</b> | <b>Service Type</b> | <b>Number of Concurrent Flows</b> |
| Host                                                                                    | POD → Host            | MPEG section        | 6 or more                         |
| If Host implements High Speed Host Modem or if ANSI/SCTE 90-1 [19] (OCAP) is supported: |                       |                     |                                   |
| POD                                                                                     | Host ↔ POD            | IP Unicast          | At least 1                        |
| If Host implements DSG:                                                                 |                       |                     |                                   |
| POD                                                                                     | Host → POD            | DSG                 | 1                                 |

## 5.5 System/Service Information Requirements (Normative)

The POD module shall supply System and Service Information across the HOST-POD interface, using **Service\_type MPEG\_section**, as defined in Section 8.9.1 and ANSI/SCTE 65 [5]. The set of MPEG-2 tables provided to support the navigation function in the terminal device shall conform to one or more of the profiles specified in ANSI/SCTE 65 [5].

Note: 1 (Informative) Profiles 1 through 5 are compatible with terminal devices deployed as of Jan 1, 2000. Terminal devices that are intended to be portable across the US will need to function with any of the six profiles of ANSI/SCTE 65 [5]. For operational considerations of various profiles, see section A.3 in ANSI/SCTE 65 [5].

## 5.6 Emergency Alert Requirements (Normative)

The POD module may receive Emergency Alert messaging on either the FAT channels or the Out-of-Band Forward Data channel (OOB FDC). The EAS message syntax is compatible with MPEG-2 transport and is defined in ANSI/SCTE 18 [4].

For FAT channel transmission, the EAS message shall appear in transport packets with the same PID as those used for Service/System Information (SI) and shall be transmitted by the POD to the HOST. The table ID for the EAS message is 0xD8 as defined in SCTE 18 [4]. For out-of-band (OOB) transmission, EAS messages shall be processed by the POD module and shall be transmitted over the Extended Channel according to SCTE 18 [4].

## 6 PHYSICAL INTERFACE (NORMATIVE)

### 6.1 PC Card Compliance

#### 6.1.1 POD Module Port Custom Interface (0341h)

The POD Module interface is registered to the PC Card Standard as the POD Module Custom Interface with the interface ID number (STCI\_IFN) allocated to equal hexadecimal 341. In case the Host is not capable of operating with the POD Module, the Host shall ignore the POD Module.

The POD Module shall present the 16-bit PC Card memory-only interface following the application of VCC or the RESET signal. When operating in this configuration, D7-D0 are retained as a byte-oriented I/O port, and the capability to read the Attribute Memory is retained.

Only two address lines are required for four Bytes of register space. Pin CE2# is assigned to select the Extended Channel function required for the POD Module CPU interface to enable the access to the Extended Channel resource. Pin IOIS16# is never asserted.

The Host-POD interface 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.

#### 6.1.2 Power Management

In order to remain compliant with the PC Card standard and to simplify the Host and POD Module implementations, and regardless of the powering state of the Host (i.e., active or standby), the following power management features are required.

- The Host shall permanently supply 3.3V on the VCC pins. The Host shall be capable of supplying up to a maximum of 1 amp total on the VCC pins (500 ma each) at 3.3 VDC per POD Module supported.
- The Host shall supply 5V on the VPP pins if requested by the POD Module Card Information Structure. The Host shall be capable of supplying up to 250 ma total on the VPP pins (125 ma each) at 5 VDC per POD Module supported.

- The Host shall continuously supply 3.3V on the VPP pins upon Host power-up and also when a POD module is not installed. When a POD module or a PC Card is installed, if the voltage sense pins are set as required per the Host-POD Interface Specification, the Host shall supply 5 V on the VPP pins only if requested by the POD Module Card Information Structure. Otherwise, the Host shall continue to supply 3.3 V on the VPP pins while the POD module/PC Card is installed. Upon removal of a POD module or a PC Card, the Host shall revert to or continue to supply 3.3V on the VPP pins. The Host shall be capable of supplying up to 250 ma total on the VPP pins (125 ma each) at 5 VDC per POD module supported.
- The Host shall not be required to support the separate nominal voltage parameter descriptors in the power descriptor structures for VPP1 and/or VPP2.
- The POD module shall only support the value of 0x2 in the Power field of the Feature Selection Byte (TPCE\_FS) and the associated parameter descriptor according to section 3.3.2.3 of PC Card Standard, Volume 4 if the POD module requires a switched nominal voltage level of +5V on the VPP lines.
- There is no standby power mode for the POD module.
- The POD Module shall draw no more than 2.5 watts averaged over a period of 10 seconds.
- The Host OOB Receive circuitry must continue to operate in all powering states of the Host.
- The Host shall support hot insertion and removal of the POD Module.
- The POD Module shall implement the mechanical Low Voltage Keying.
- The POD Module shall force VS1 (pin 43) to ground and VS2 (pin 57) to high impedance until it switches to the POD Module Custom Interface mode.
- The POD Module shall support 3.3V hot insertion.
- The POD module does not have to meet the requirement of section 4.12.2 of the PCMCIA Electrical Specification to limit its average current to 70 mA prior to the POD Personality Change (writing to the Configuration Option Register).

### 6.1.3 Pin Assignment

The following table shows the function of various PC Card signals when the POD Module Port custom interface mode is set to active in the Host.

Differences between CEA-679 [1] and this Host-POD Interface Specification affect the A4 to A9 signals, which are now assigned to the OOB RF I/Os, and CE2#, which is used to access the Extended Channel. The MCLKO is provided on pin 14 to be fully PC Card compliant. This is a modification from CEA-679 [1]. Pin 57 remains

the PC Card VS2# signal. Shaded entries in Table 6.1-A highlight the differences between CEA-679 [1] and this specification.

**Table 6.1-A PC Card Signal Definitions**

| Pin | Signal  | I/O | Comment     | Pin | Signal  | I/O | Comment          |
|-----|---------|-----|-------------|-----|---------|-----|------------------|
| 1   | GND     | DC  | Ground      | 35  | GND     |     | Ground           |
| 2   | D3      | I/O |             | 36  | CD1#    | O   |                  |
| 3   | D4      | I/O |             | 37  | MDO3    | I/O | (D11)            |
| 4   | D5      | I/O |             | 38  | MDO4    | I/O | (D12)            |
| 5   | D6      | I/O |             | 39  | MDO5    | I/O | (D13)            |
| 6   | D7      | I/O |             | 40  | MDO6    | I/O | (D14)            |
| 7   | CE1#    | I   |             | 41  | MDO7    | I/O | (D15)            |
| 8   | A10     | I   |             | 42  | CE2#    | I   | Extended Channel |
| 9   | OE#     | I   |             | 43  | VS1#    | O   |                  |
| 10  | A11     | I   |             | 44  | IORD#   | I   | (RFU)            |
| 11  | DRX     | I   | (A9)        | 45  | IOWR#   | I   | (RFU)            |
| 12  | CRX     | I   | (A8)        | 46  | MISTRT  | I   | (A17)            |
| 13  | A13     | I   |             | 47  | MDI0    | I   | (A18)            |
| 14  | MCLKO   | I/O | (A14)       | 48  | MDI1    | I   | (A19)            |
| 15  | WE#     | I   |             | 49  | MDI2    | I   | (A20)            |
| 16  | IREQ#   | O   | (READY)     | 50  | MDI3    | I   | (A21)            |
| 17  | VCC     | DC  | 3.3V        | 51  | VCC     | DC  | 3.3V             |
| 18  | VPP-1   | DC  | Switched 5V | 52  | VPP-2   | DC  | Switched 5V      |
| 19  | MIVAL   | I   | (A16)       | 53  | MDI4    | I   | (A22)            |
| 20  | MCLKI   | I   | (A15)       | 54  | MDI5    | I   | (A23)            |
| 21  | A12     | I   |             | 55  | MDI6    | I   | (A24)            |
| 22  | QTX     | I/O | (A7)        | 56  | MDI7    | I   | (A25)            |
| 23  | ETX     | I/O | (A6)        | 57  | VS2#    | O   |                  |
| 24  | ITX     | I/O | (A5)        | 58  | RESET   | I   |                  |
| 25  | CTX     | I   | (A4)        | 59  | WAIT#   | O   |                  |
| 26  | A3      | I   |             | 60  | INPACK# | O   |                  |
| 27  | A2      | I   |             | 61  | REG#    | I   |                  |
| 28  | A1      | I   |             | 62  | MOVAL   | O   | (BVD2)           |
| 29  | A0      | I   |             | 63  | MOSTRT  | O   | (BVD1)           |
| 30  | D0      | I/O |             | 64  | MDO0    | I/O | (D8)             |
| 31  | D1      | I/O |             | 65  | MDO1    | I/O | (D9)             |
| 32  | D2      | I/O |             | 66  | MDO2    | I/O | (D10)            |
| 33  | IOIS16# | O   | (WP)        | 67  | CD2#    | O   |                  |
| 34  | GND     | DC  | Ground      | 68  | GND     | DC  | Ground           |

Note: “I” indicates signal is input to POD Module, “O” indicates signal is output from POD Module

## 6.2 POD Module Identification

The Host has two different ways to recognize a POD Module: (1) at the application level, using the Application Info CEA-679 [1] resource, or (2) at the physical level as defined by PCMCIA. .

In PCMCIA memory mode, the Host accesses the POD Module's Attribute Memory to read the Card Information Structure (CIS) on the even addresses (first byte at address 000h, second byte at address 002h, etc.). Since the POD Module interface is a PC Card Custom Interface the CIS must include a custom interface subtuple (CCST\_CIF) that provides the interface ID number (STCI\_IFN) defined by PCMCIA (hex341).

For a more explicit identification, the CIS also includes in the tuple CISTPL\_VER\_1, the field name of the product of subtuple TPLLV1\_INFO defined as "OPENCABLE\_POD\_MODULE".

This information in the CIS is mandatory to ensure backup operation in case of trouble when the CI stack is lost (e.g., power shut down, POD Module extraction).

## 6.3 Card Information Structure

The Card Information Structure (CIS) shall be readable whenever the SCTE POD module is powered, the SCTE POD module has been reset by the Host in accordance with section 4.12.1 of Volume 2, "Electrical Specification" of the PC Card Standard, the SCTE POD module is asserting the READY signal, and the POD Personality Change has not occurred. The CIS contains the information needed by the Host to verify that a POD module has been installed. . After the POD Personality Change, the CIS shall no longer be available.

The following table is the minimum set of tuples required for the POD Module.

**Table 6.3-A CIS Minimum Set of Tuples**

|                      |
|----------------------|
| CISTPL_LINKTARGET    |
| CISTPL_DEVICE_0A     |
| CISTPL_DEVICE_0C     |
| CISTPL_VERS_1        |
| CISTPL_MANFID        |
| CISTPL_CONFIG        |
| CISTPL_CFTABLE_ENTRY |
| CISTPL_NO_LINK       |
| CISTPL_END           |

## 6.4 Host-POD OOB Interface

This standard requires support for OOB signaling. This signaling is provided in one of two modes, Out of Band (OOB) Mode and DOCSIS Settop Gateway (DSG) Mode:

### 6.4.1 Out of Band (OOB) Mode

- The Host RF front-end specification provides the QPSK physical layer to support OOB (downstream and upstream) communications according to SCTE 55-1 or SCTE 55-2. The data link and media access control protocols for SCTE 55-1 or SCTE 55-2 are implemented in the POD Module.

The interface data rates are:

- o Forward Receiver: 1.544/3.088 Mbps and 2.048 Mbps
- o Reverse Transmitter: 772/1544 Ksymbol/s and 128 Ksymbol/s (i.e., 1.544/3.088 Mbps and 256 Kbps)

The transmit and receive interfaces for the Host-POD OOB Interface are shown in Figure 6.4-1 below. The receiver interface comprises a serial bit stream and a clock, while the transmitter interface comprises I and Q data, a symbol clock, and a transmit-enable signal. The clock signal should be transferred from the Host to the POD, as shown in Figure 6.4-1.

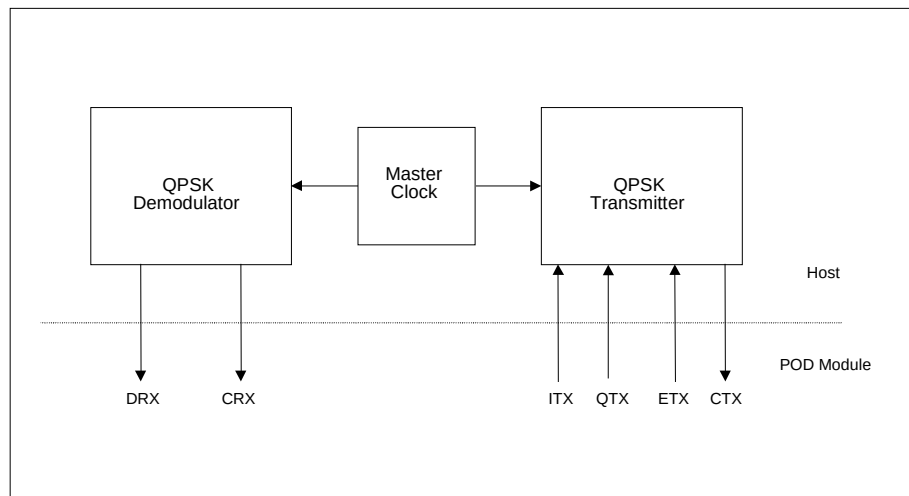


**Figure 6.4-1 Host-POD Out-of-Band Interface**

The interface symbols are defined below.

| <b>Table 6.4-A Transmission Signals for Host-POD Interface</b> |                        |                            |             |
|----------------------------------------------------------------|------------------------|----------------------------|-------------|
| <b>Signal</b>                                                  | <b>Definition</b>      | <b>Rates</b>               | <b>Type</b> |
| DRX                                                            | RX Data                | 1.544/3.088 and 2.048 Mbps | I           |
| CRX                                                            | RX Gapped Clock        | 1.544/3.088 and 2.048 MHz  | I           |
| ITX                                                            | TX I Channel           | 772/1544 and 128 Ksymbol/s | O           |
| QTX                                                            | TX Q Channel           | 772/1544 and 128 Ksymbol/s | O           |
| ETX                                                            | TX Enable              | [ n/a ]                    | O           |
| CTX                                                            | TX Gapped Symbol Clock | 772/1544 and 128 KHz       | I           |

#### 1. DRX/CRX

DRX – The DRX data directly from the Host FDC QPSK receiver.

CRX – Gapped clock is a clock signal in which some of the clock cycles are missing, creating an artificial gap in the clock pattern. The clock rate is one of 1.544, 3.088 or 2.048 MHz

2. ITX, QTX – Differential encoding shall take place within the POD module. The Host shall map ITX, QTX directly to the phase states shown in Figure 5.4-3 below.
3. ETX – ETX is an output from the POD Module and an input to the Host. It is defined to be active high. When ETX is inactive, the values of ITX and QTX are not valid and the upstream transmitter shall not transmit such values. When ETX is active, the values of ITX and QTX are both valid and the upstream transmitter shall transmit these values.

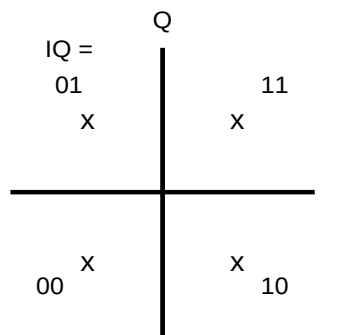


**Figure 6.4-2. Phase States for Mapping ITX and QTX OK**

### 6.4.2 DOCSIS Settop Gateway (DSG Mode)

The Host DOCSIS cable modem provides the physical, data link, and media access control protocols. Unlike the OOB mode, the data link and media access control protocols for SCTE 55-1 or SCTE 55-2 are bypassed in the POD Module. The downstream communications are implemented in accordance with the DOCSIS Set-top Gateway (DSG) Specification. The upstream Conditional Access Messages and network management messages will be transmitted from the POD Module via IP over the DOCSIS upstream channel using the Extended Channel.

The interface data rates are:

- o Downstream direction: 2.048 Mbps
- o Upstream direction: Limited by DOCSIS return channel capacity

The first two bytes of the frame are the total number of bytes following in the frame, i.e. they do not include this two-byte length field. There is no CRC check required on

the frame, as the interface between the Host and POD is reliable. It is the responsibility of the POD vendor to implement error detection in the DSG encapsulated data. The POD should disregard any invalid packets received from the Host. The Host must provide buffer space for a minimum of two DSG IP packets, one for transmission to the POD and one for receiving from the DOCSIS channel. Informational note: The DSG rate limits the aggregate data rate to 2.048 Mbps to avoid buffer overflow. Figure 5.4-2 below shows how the DSG packets are transported across the POD/Host interface with and without removal of the header bytes. Prior to transmission across the POD/Host interface, the CRC of the DSG packet received from the eCM is removed, then optionally header bytes may be removed in order from the Ethernet header through the IP header and the UDP header resulting in the removal of X header bytes where X is defined by the POD as per the `remove_header_bytes` of the `set_dsg_mode()` APDU (note that X may be zero, thus no header bytes are removed). A two byte field containing the DSG byte count of the resulting data payload is prepended to the remaining frame and transmitted across the POD/Host interface.

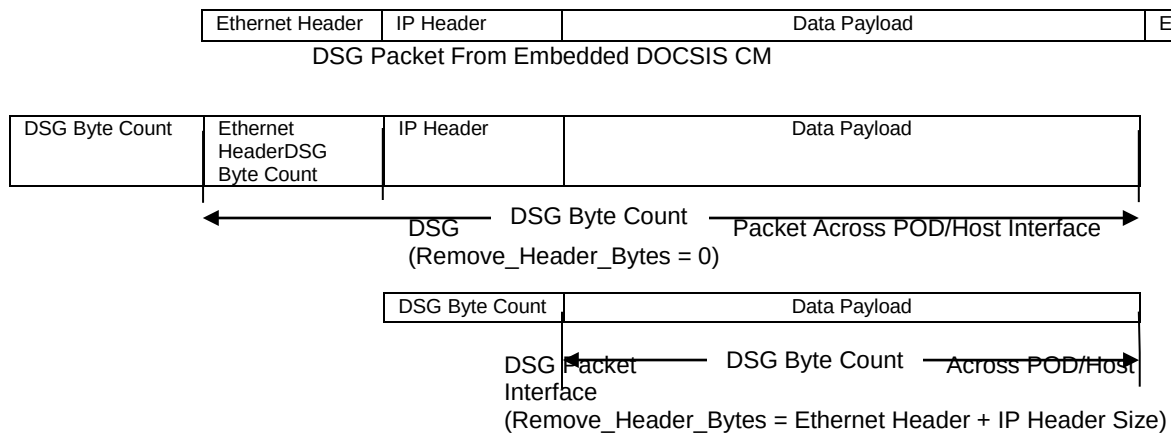


**Figure 6.4-3. DSG Packet Format Across POD/Host Interface**

### 6.4.3 Timing and Voltage Parameters

All POD signal requirements and timing requirements shall comply with Table 6.4-B and Figures 6.4-2 and 6.4-3, and shall be measured with no less than the maximum load of the receiver as defined in table 4-19 of [10].

The PC Card A7, A6, and A5 pin definitions have been modified to QTX, ETX, and ITX. These pins will be driven by the POD and will have Data Signal characteristics per table 4-19 of [10]. Additionally, the signals MOVAL and MOSTRT will be driven by the POD and will have Data Signal characteristics per table 4-19 of [10]. The remaining signals follow the signal type assignments as listed in table 4-19 of [10].

All signal voltage levels are compatible with normal 3.3V CMOS levels.

| <b>Table 6.4-B POD Signal Parameters</b> |               |             |            |             |            |                                                                                                                   |
|------------------------------------------|---------------|-------------|------------|-------------|------------|-------------------------------------------------------------------------------------------------------------------|
| <b>Parameter</b>                         | <b>Signal</b> | <b>Unit</b> | <b>Min</b> | <b>Type</b> | <b>Max</b> | <b>Conditions</b>                                                                                                 |
| Frequency                                | CTX           | kHz         |            |             | 3088       |                                                                                                                   |
| Frequency                                | CRX           | kHz         |            |             | 3088       |                                                                                                                   |
| Hold ( $T_{HCTX}$ )                      | CTX           | ns          | 250        |             |            | Note 1,2                                                                                                          |
| Hold ( $T_{HCRX}$ )                      | CRX           | ns          | 250        |             |            | Note 1,2                                                                                                          |
| Delay ( $t_D$ )                          | ETX, ITX, QTX | ns          | 5          |             | 180        | Note 1,2                                                                                                          |
| Set-up ( $T_{su}$ )                      | DRX           | ns          | 10         |             |            | From time signal reaches 90% of high level (rising) or 10% of high level (falling) until CRX mid-point transition |
| Hold ( $T_h$ )                           | DRX           | ns          | 5          |             |            | From CRX mid-point transition until signal reaches 10% of high level (rising) or 90% of high level (falling)      |

**Note1:** Refer to Figure 6.4-2 POD Return Data Channel Timing Diagram.

**Note2:** AC Timing is measured with Input/Output Timing Reference level at 1.5V.

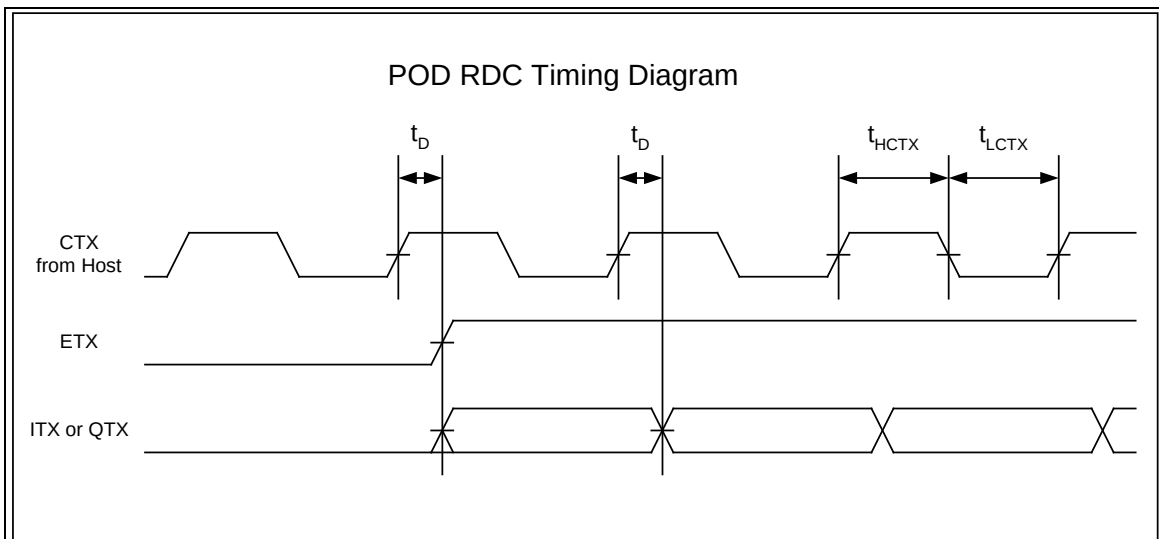


**Figure 6.4-3 POD Output Timing Diagram**

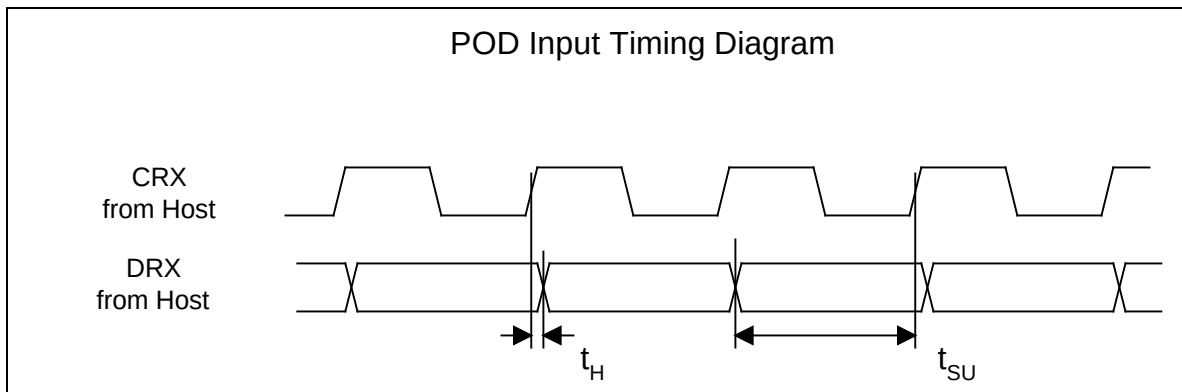


Figure 6.4-4 POD Input Timing Diagram

## 6.5 CPU Interface

With OOB traffic included, the POD Module requires more bandwidth and connections on the CPU Interface than are supported by the Data Channel alone. Two communication paths shall share the same pins on the PC Card connector.

**Data Channel** – This channel is compliant with the Command Interface protocol of CEA-679 [1], plus the interrupt mode extension. POD Module applications shall use this path when they require support from Host resources.

**Extended Channel** – This second communication only includes physical and link layers. The purpose of the **Extended Channel** is to provide a communication path between the POD Module and the Host such that applications in one (e.g. Host, POD Module) can communicate with the headend via a link layer or modem function in the other (POD Module, Host respectively). Whereas the content and format of the messages for the **Data Channel** are well defined, the content and format of the messages for the **Extended Channel** are application specific.

Depending on whether the POD Module or the Host is acting as the modem (or link device), the **Extended Channel** has a reversible function as described in figure 6.5-1 and figure 6.5-2.

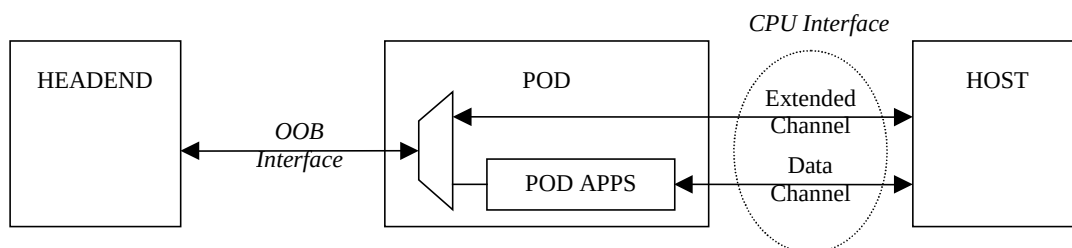


Figure 6.5-1 Modem-in-the-POD Module System Overview

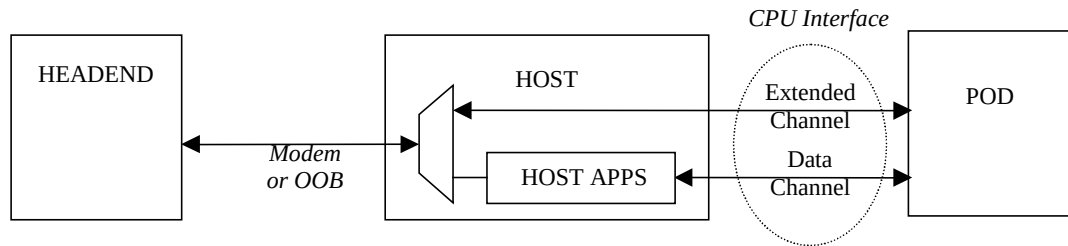


**Figure 6.5-2 Modem in-the-Host System View**

When the **Data Channel** is physically activated by CE1# (Card Enable 1) as defined by CEA-679 [1], the **Extended Channel** is enabled by CE2# (Card Enable 2), which is not used by CEA-679 [1].

The **Extended Channel** includes the same type of registers as defined by CEA-679 [1] for the Command Interface. The POD Module enables access to the **Extended Channel** after the initialization phase. At this time, the CE2# signal interpretation begins, and the Extended hardware interface registers can be read and written. The signals mentioned in the table below are all inputs for the POD Module. The registers depicted in figure 6.5-3 are part of the POD Module.

| <b>Table 6.5-A Extended Interface Registers</b> |             |             |             |           |           |              |              |
|-------------------------------------------------|-------------|-------------|-------------|-----------|-----------|--------------|--------------|
| <b>Extended Interface Reg.</b>                  | <b>REG#</b> | <b>CE2#</b> | <b>CE1#</b> | <b>A1</b> | <b>A0</b> | <b>IORD#</b> | <b>IOWR#</b> |
| Standby mode                                    | X           | H           | H           | X         | X         | X            | X            |
| Ext_Data Write                                  | L           | L           | H           | L         | L         | H            | L            |
| Ext_Data Read                                   | L           | L           | H           | L         | L         | L            | H            |
| Ext_Command Write                               | L           | L           | H           | L         | H         | H            | L            |
| Ext_Status_Reg. Read                            | L           | L           | H           | L         | H         | L            | H            |
| Ext_Size (LS) Write                             | L           | L           | H           | H         | L         | H            | L            |
| Ext_Size (LS) Read                              | L           | L           | H           | H         | L         | L            | H            |
| Ext_Size (MS) Write                             | L           | L           | H           | H         | H         | H            | L            |
| Ext_Size (MS) Read                              | L           | L           | H           | H         | H         | L            | H            |

The **Extended Channel** has its own data buffer that may have a different size than the **Data Channel** buffer.

Since there are two physical channels (data channel and extended channel), the behavior of the interface is defined in such a way that when the Host sets the RS\_flag on either channel, the interface is reset for both channels. Therefore, if the Host sets an RS\_flag after detection of an error condition, it should set the RS-flag for both channels.

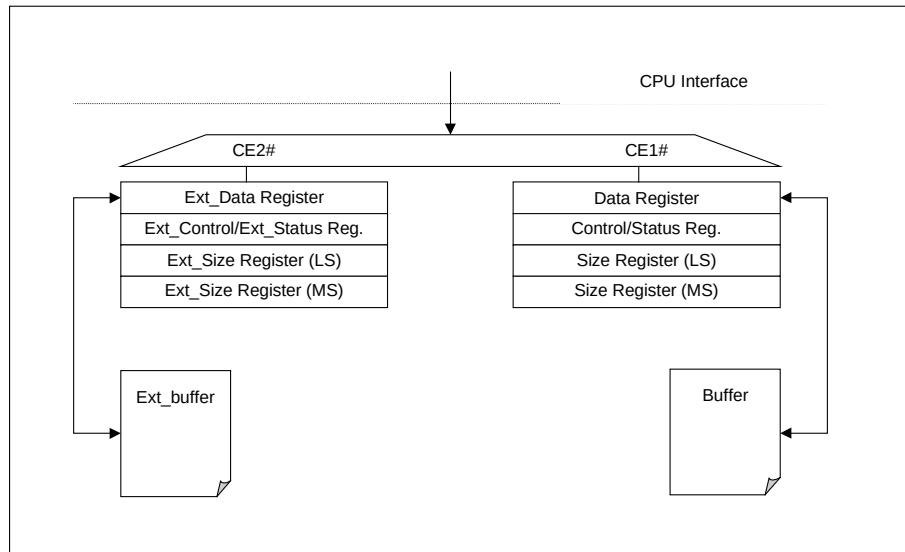


Figure 6.5-3 Map of Hardware Interface Registers

### 6.5.1 Control Register Modification

The following extension to the CEA-679 [1] Command Interface shall be used in order to facilitate the interrupt mode over the **Data Channel** and the **Extended Channel**.

The DA & FR bits of the Status Register should be gated onto the IREQ# line by two new Interrupt Enable bits for the Control Register: DAIE (bit 7) and FRIE (bit 6) respectively. The Control register now becomes:

| Table 6.5-B Control Register Definitions |      |      |   |   |    |    |    |    |
|------------------------------------------|------|------|---|---|----|----|----|----|
| Bit                                      | 7    | 6    | 5 | 4 | 3  | 2  | 1  | 0  |
|                                          | DAIE | FRIE | R | R | RS | SR | SW | HC |

RS, SR, SW and HC retain their function, as described in CEA-679 [1] specification.

When set, DAIE allows any assertion of the DA bit in the Status register also to assert IREQ#.

When set, FRIE allows any assertion of the FR bit in the Status register also to assert IREQ#.

When IREQ# is asserted, the Host shall first check the data channel, and then the extended channel to determine the source of the interrupt.

## 6.5.2 Status Register Modification

The following extension to CEA-679 [1] Status Interface shall be used in order to allow the POD to request the initialization process to occur. A new status bit called the Initialize Interface Request (IIR) is added to bit 4 of the Status Register to allow the POD Module to request that the interface be re-initialized. This bit exists in both the data channel and extended channel. When the POD module sets the IIR flag, the POD must also reset the IIR flag when the RS flag is set.

| <b>Table 6.5-C Status Register Definitions</b> |    |    |   |            |   |   |    |    |
|------------------------------------------------|----|----|---|------------|---|---|----|----|
| bit                                            | 7  | 6  | 5 | 4          | 3 | 2 | 1  | 0  |
|                                                | DA | FR | R | <b>IIR</b> | R | R | WE | RE |

## 6.6 Copy Protection on the FAT Channel

Copy protection shall be provided for 'high value' content delivered in MPEG transport streams flowing from the POD to the Host. Such protection, including scrambling of content from POD to Host and authenticated delivery of messages through the CPU interface for permitted use of 'high value' content, is defined in the POD Copy Protection System specification, ANSI/SCTE 41 [14].

## 6.7 Host-POD Interface Initialization

This section defines the interface initialization procedure between the POD module and the Host.

### 6.7.1 Descriptions

Initialization is a very general term. The following are definitions of the how the term initialization is used in this section.

#### 6.7.1.1 Interface Initialization Definition (Informative)

Any computing device must go through an initialization phase whenever a reset condition occurs, such as when initial power is applied, manual reset, or an unrecoverable software error condition occurs. What is covered in this section is the initialization of the interface between the host and the POD module. This is defined to be the **interface initialization**.

### 6.7.1.2 **POD Personality Change Definition (Informative)**

The host and POD module shall initialize to the PCMCIA interface and will, at a particular point in the sequence, change to the POD interface. This point is defined as the **POD Personality Change**.

### 6.7.1.3 **Reset Definition**

There are two possible resets that can occur in the POD interface, a hard reset (called PCMCIA reset) and a soft reset (called POD reset).

#### 6.7.1.3.1 PCMCIA Reset

The PCMCIA reset is defined to be one in which the Host shall bring the RESET signal to the POD module active. The interface shall revert to the PCMCIA interface including no longer routing the MPEG data stream through the POD module. Obviously this will cause problems to the viewer and should be avoided except in the case that a catastrophic failure has occurred in the POD module or in the interface between the Host and the POD module.

#### 6.7.1.3.2 POD Reset

The POD reset is defined to be when Host sets the RS bit in the control register anytime after the POD personality change has occurred. The Host shall set the RS bit in both the data channel and extended channel. The POD module shall detect whether the RS bit has been set in either channel and, if so, shall close all open sessions and transport connections and operation shall revert to that of just after the POD personality change. This reset shall prevent the change of routing of the MPEG data stream, thereby preventing the viewer from noticing any problems unless the video/audio stream being viewed is scrambled. Since the conditional access session is closed, the POD module shall cease descrambling the data stream until a new session is opened and the appropriate APDU transmitted to the POD module.

The POD reset should occur when the Host detects an error in the POD module interface or the POD module has set the IIR flag (see below).

#### 6.7.1.3.3 Initialize Interface Request Flag

A status bit called the **Initialize Interface Request (IIR)** flag is included in bit 4 of the status register to allow the POD module to request that the interface be re-initialized. This bit exists in both the data channel and extended channel. When a condition occurs that the POD module needs to request an interface initialization, it shall set both IIR bits. Upon recognition of the IIR flag being set, the Host shall implement a POD reset. The POD module will clear the IIR flag when the RS bit is set. To further ensure reliable interoperability, POD modules shall be prohibited from sending LPDUs to the Host after setting the IIR bit and prior to recognizing an active RS bit.

#### 6.7.1.3.4 Detailed POD Reset Operation

The following flowchart (POD Reset Sequence) is the required implementation of the POD RS operation. LPDUs shall not be transmitted until the completion of the POD Reset sequence.