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Management Information Base for  
Data Over Cable Service Interface Specification (DOCSIS) Cable Modems  
and Cable Modem Termination Systems for Baseline Privacy Plus

Status of This Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

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Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it defines a set of managed objects for Simple Network Management Protocol (SNMP) based management of the Baseline Privacy Plus features of DOCSIS 1.1 and DOCSIS 2.0 (Data-over-Cable Service Interface Specification) compliant Cable Modems and Cable Modem Termination Systems.

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## 1. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIV2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

## 2. Overview

This MIB module (BPI+ MIB) provides a set of objects required for the management of the Baseline Privacy Interface Plus features of DOCSIS 1.1 and DOCSIS 2.0 Cable Modem (CM) and Cable Modem Termination System (CMTS). The specification is derived from the operational model described in the DOCSIS Baseline Privacy Interface Plus Specification [DOCSIS].

DOCSIS Baseline Privacy Plus is composed of four distinct functional and manageable areas:

- o Key exchange and data encryption
- o Cable modem authentication
- o Multicast encryption
- o Authentication of downloaded software images

This MIB module is an extension of the DOCSIS 1.0 Baseline Privacy MIB module [RFC3083] (BPI MIB), which is derived from the Operational model described in the DOCSIS Baseline Privacy Interface Specification [DOCSIS-1.0]. The original Baseline Privacy MIB structure has mostly been preserved in the Baseline Privacy Plus MIB. Please note that the referenced DOCSIS specifications only require that Cable Modems process IPv4 customer traffic. Design choices in this MIB module reflect those requirements. Future versions of the DOCSIS specifications are expected to require support for IPv6 as well.

## Conventions Used in This Document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14, RFC 2119 [RFC2119].

### 2.1. Structure of the MIB

This MIB module is structured into several tables and objects.

#### 2.1.1. Cable Modem

- o The docsBpi2CmBaseTable contains authorization key exchange information for one CM MAC interface.
- o The docsBpi2CmTEKTable contains traffic key exchange and data encryption information for a particular security association ID of the cable modem.
- o Multicast Encryption information is maintained under Docsbpi2CmMulticastObjects. There is currently one multicast table object that manages IP multicast encryption, docsBpi2CmIpMulticastMapTable.
- o Digital certificates used for cable modem authentication are accessible via docsBpi2CmDeviceCertTable.
- o Cryptographic suite capabilities for a CM MAC are maintained in the docsBpi2CmCryptoSuiteTable.

#### 2.1.2. Cable Modem Termination System

- o The docsBpi2CmtsBaseTable contains default settings and summary counters for the cable modem termination system.
- o The DocsBpi2CmtsAuthTable contains Authorization Key Exchange information for each CM MAC interface, as well as data from CM certificates used in cable modem authentication.
- o The docsBpi2CmtsTEKTable contains traffic key exchange and data encryption information for a particular security association ID.
- o Multicast Encryption information is maintained under Docsbpi2CmtsMulticastObjects. There are currently two multicast table objects. The Table docsBpi2CmtsIpMulticastMapTable is

specifically designed for IP multicast encryption, whereas docsBpi2CmtsMulticastAuthTable is meant to manage all multicast security associations.

In particular, the table docsBpi2CmtsIpMulticastMapTable defines the object docsBpi2CmtsIpMulticastMask, which could be a non-contiguous netmask; this is why the object syntax is based on the INET-ADDRESS-MIB MIB Module [RFC4001] Textual Convention InetAddress instead of InetAddressPrefixLength.

This is to facilitate the assignment of same DOCSIS Security Association ID (SAID) to one or more IPv6 multicast group IDs matching one or more IPv6 multicast scope types within an entry in this table. For example, multicast scopes labeled "unassigned" [RFC3513] may be allocated by administrators to a particular SAID, regardless of their multicast scope; such mapping transient multicast group 'Y' to SAID 'z' for ANY multicast scope. The non-contiguous netmask will be FF10:Y. See [RFC3513] for details on IPv6 multicast addressing.

- o DocsBpi2CmtsCertObjects contains 2 manageable tables: one for provisioned cable modem certificates and one for certification authority certificates.

#### 2.1.3. Common

- o The docsBpi2CodeDownloadControl objects manage the authenticated software download process for a given device.

#### 2.2. Relationship of BPI+ and BPI MIB Modules

This section describes the relationship between the BPI+ MIB module defined in this document and the BPI MIB module defined in RFC 3083 [RFC3083]. The BPI+ protocol interface is an enhancement to the BPI protocol, and it is a distinct protocol from BPI. The associated BPI+ managed objects should be considered separate from the BPI MIB objects defined in RFC 3083.

DOCSIS 1.1 and 2.0 systems implement both the BPI+ and BPI protocols to be backward compatible with 1.0 systems. For more information regarding the interoperability between BPI and BPI+ compliant systems, refer to appendix C of the DOCSIS BPI+ specification [DOCSIS]. For MIB modules requirements, refer to section 4.6.1, Figure 9, of the DOCSIS 1.1 OSSI specification [DOCSIS-1.1] and to section 7.6.1, Tables 7-9, of the DOCSIS 2.0 OSSI specification [DOCSIS-2.0].

### 2.3. BPI+ MIB Module Relationship with the Interfaces Group MIB

The BPI+ MIB module is the management framework of Baseline Privacy Plus Interface Specification [DOCSIS], which provides the MAC layer (Media Access Control) security services of DOCSIS through the Baseline Privacy Key Management (BPKM) protocol. The BPI+ MIB module objects are organized as extensions of the Radio Frequency (RF) Interface Management [RFC2670].

The MIB table structures of this MIB Module are extensions of the DOCSIS CATV (Community Antenna Television) MAC layer interface (DocsCableMacLayer by [IANA]). In particular, the provisions of the Interface Group MIB [RFC2863] for counter discontinuities and system re-initialization apply to CM and CMTS to validate the difference between two consecutive counter polls.

All BPI+ MIB module counters are 32 bits and are based on the minimum time to wrap up considerations of [RFC2863] and their possible frequency occurrence as BPI+ FSM (Finite State Machine) event counters. See [DOCSIS] for BPI+ FSM parameter guidelines.

### 3. Definitions

DOCS-IETF-BPI2-MIB DEFINITIONS ::= BEGIN

IMPORTS

```

    MODULE-IDENTITY, OBJECT-TYPE,
    Integer32,
    Unsigned32,
    Counter32,
    mib-2
        FROM SNMPv2-SMI                -- [RFC2578]
    SnmpAdminString
        FROM SNMP-FRAMEWORK-MIB        -- [RFC3411]
    TEXTUAL-CONVENTION,
    MacAddress,
    RowStatus,
    TruthValue,
    DateAndTime,
    StorageType
        FROM SNMPv2-TC                -- [RFC2579]
    OBJECT-GROUP,
    MODULE-COMPLIANCE
        FROM SNMPv2-CONF                -- [RFC2580]
    ifIndex
        FROM IF-MIB                    -- [RFC2863]
    InetAddressType,
    InetAddress

```

FROM INET-ADDRESS-MIB; -- [RFC4001]

docsBpi2MIB MODULE-IDENTITY  
LAST-UPDATED "200507200000Z" -- July 20, 2005  
ORGANIZATION "IETF IP over Cable Data Network (IPCDN)  
Working Group"  
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IETF IPCDN Working Group  
General Discussion: [ipcdn@ietf.org](mailto:ipcdn@ietf.org)  
Subscribe: <http://www.ietf.org/mailman/listinfo/ipcdn>.  
Archive: <ftp://ftp.ietf.org/ietf-mail-archive/ipcdn>.  
Co-chairs: Richard Woundy, [rwoundy@cisco.com](mailto:rwoundy@cisco.com)  
Jean-Francois Mule, [jfm@cablelabs.com](mailto:jfm@cablelabs.com)"

DESCRIPTION

"This is the MIB module for the DOCSIS Baseline  
Privacy Plus Interface (BPI+) at cable modems (CMs)  
and cable modem termination systems (CMTSS).

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version of this MIB module is part of RFC 4131; see the RFC itself for full legal notices."

REVISION "200507200000Z" -- July 20, 2005

DESCRIPTION

"Initial version of the IETF BPI+ MIB module.

This version published as RFC 4131."

::= { mib-2 126 }

-- Textual conventions

DocsX509ASN1DEREncodedCertificate ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"An X509 digital certificate encoded as an ASN.1 DER object."

SYNTAX OCTET STRING (SIZE (0..4096))

DocsSAId ::= TEXTUAL-CONVENTION

DISPLAY-HINT "d"

STATUS current

DESCRIPTION

"Security Association identifier (SAID)."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface specification, Section 2.1.3, BPI+ Security Associations"

SYNTAX Integer32 (1..16383)

DocsSAIdOrZero ::= TEXTUAL-CONVENTION

DISPLAY-HINT "d"

STATUS current

DESCRIPTION

"Security Association identifier (SAID). The value zero indicates that the SAID is yet to be determined."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface specification, Section 2.1.3, BPI+ Security Associations"

SYNTAX Unsigned32 (0 | 1..16383)

DocsBpkmSAType ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"The type of security association (SA).

The values of the named-numbers are associated with the BPKM SA-Type attributes:

'primary' corresponds to code '1', 'static' to code '2',

and 'dynamic' to code '3'.  
 The 'none' value must only be used if the SA type has yet  
 to be determined."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface  
 specification, Section 4.2.2.24"

```
SYNTAX      INTEGER {
                    none(0),
                    primary(1),
                    static(2),
                    dynamic(3)
                }
```

DocsBpkmDataEncryptAlg ::= TEXTUAL-CONVENTION

STATUS current

## DESCRIPTION

"The list of data encryption algorithms defined for  
 the DOCSIS interface in the BPKM cryptographic-suite  
 parameter. The value 'none' indicates that the SAID  
 being referenced has no data encryption."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
 Section 4.2.2.20."

```
SYNTAX      INTEGER {
                    none(0),
                    des56CbcMode(1),
                    des40CbcMode(2),
                    t3Des128CbcMode(3),
                    aes128CbcMode(4),
                    aes256CbcMode(5)
                }
```

DocsBpkmDataAuthentAlg ::= TEXTUAL-CONVENTION

STATUS current

## DESCRIPTION

"The list of data integrity algorithms defined for the  
 DOCSIS interface in the BPKM cryptographic-suite parameter.  
 The value 'none' indicates that no data integrity is used for  
 the SAID being referenced."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
 Section 4.2.2.20."

```
SYNTAX      INTEGER {
                    none(0),
                    hmacSha196(1)
                }
```

docsBpi2MIBObjects OBJECT IDENTIFIER ::= { docsBpi2MIB 1 }



```
-- Cable Modem Group
```

```
docsBpi2CmObjects OBJECT IDENTIFIER ::= { docsBpi2MIBObjects 1 }
```

```
--
```

```
-- The BPI+ base and authorization table for CMs,
```

```
-- indexed by ifIndex
```

```
--
```

```
docsBpi2CmBaseTable OBJECT-TYPE
```

```
    SYNTAX                      SEQUENCE OF      DocsBpi2CmBaseEntry
```

```
    MAX-ACCESS                  not-accessible
```

```
    STATUS                      current
```

```
    DESCRIPTION
```

```
        "This table describes the basic and authorization-
        related Baseline Privacy Plus attributes of each CM MAC
        interface."
```

```
    ::= { docsBpi2CmObjects 1 }
```

```
docsBpi2CmBaseEntry OBJECT-TYPE
```

```
    SYNTAX                      DocsBpi2CmBaseEntry
```

```
    MAX-ACCESS                  not-accessible
```

```
    STATUS                      current
```

```
    DESCRIPTION
```

```
        "Each entry contains objects describing attributes of
        one CM MAC interface.  An entry in this table exists for
        each ifEntry with an ifType of docsCableMaclayer(127)."
```

```
    INDEX                      { ifIndex }
```

```
    ::= { docsBpi2CmBaseTable 1 }
```

```
DocsBpi2CmBaseEntry ::= SEQUENCE {
```

docsBpi2CmPrivacyEnable	TruthValue,
docsBpi2CmPublicKey	OCTET STRING,
docsBpi2CmAuthState	INTEGER,
docsBpi2CmAuthKeySequenceNumber	Integer32,
docsBpi2CmAuthExpiresOld	DateAndTime,
docsBpi2CmAuthExpiresNew	DateAndTime,
docsBpi2CmAuthReset	TruthValue,
docsBpi2CmAuthGraceTime	Integer32,
docsBpi2CmTEKGraceTime	Integer32,
docsBpi2CmAuthWaitTimeout	Integer32,
docsBpi2CmReauthWaitTimeout	Integer32,
docsBpi2CmOpWaitTimeout	Integer32,
docsBpi2CmRekeyWaitTimeout	Integer32,
docsBpi2CmAuthRejectWaitTimeout	Integer32,
docsBpi2CmSAMapWaitTimeout	Integer32,
docsBpi2CmSAMapMaxRetries	Integer32,
docsBpi2CmAuthentInfos	Counter32,

```

docsBpi2CmAuthRequests      Counter32,
docsBpi2CmAuthReplies       Counter32,
docsBpi2CmAuthRejects       Counter32,
docsBpi2CmAuthInvalids      Counter32,
docsBpi2CmAuthRejectErrorCode INTEGER,
docsBpi2CmAuthRejectErrorString SnmpAdminString,
docsBpi2CmAuthInvalidErrorCode INTEGER,
docsBpi2CmAuthInvalidErrorString SnmpAdminString
}

docsBpi2CmPrivacyEnable OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "This object identifies whether this CM is
        provisioned to run Baseline Privacy Plus."
    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,
        Appendix A.1.1."
    ::= { docsBpi2CmBaseEntry 1 }

docsBpi2CmPublicKey OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE (0..524))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The value of this object is a DER-encoded
        RSAPublicKey ASN.1 type string, as defined in the RSA
        Encryption Standard (PKCS #1), corresponding to the
        public key of the CM."

    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,
        Section 4.2.2.4."
    ::= { docsBpi2CmBaseEntry 2 }

docsBpi2CmAuthState OBJECT-TYPE
    SYNTAX      INTEGER {
                    start(1),
                    authWait(2),
                    authorized(3),
                    reauthWait(4),
                    authRejectWait(5),
                    silent(6)
                }
    MAX-ACCESS   read-only
    STATUS       current

```

## DESCRIPTION

"The value of this object is the state of the CM authorization FSM. The start state indicates that FSM is in its initial state."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.1.2.1."

::= { docsBpi2CmBaseEntry 3 }

docsBpi2CmAuthKeySequenceNumber OBJECT-TYPE

SYNTAX Integer32 (0..15)

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the most recent authorization key sequence number for this FSM."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Sections 4.2.1.2 and 4.2.2.10."

::= { docsBpi2CmBaseEntry 4 }

docsBpi2CmAuthExpiresOld OBJECT-TYPE

SYNTAX DateAndTime

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the actual clock time for expiration of the immediate predecessor of the most recent authorization key for this FSM. If this FSM has only one authorization key, then the value is the time of activation of this FSM."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Sections 4.2.1.2 and 4.2.2.9."

::= { docsBpi2CmBaseEntry 5 }

docsBpi2CmAuthExpiresNew OBJECT-TYPE

SYNTAX DateAndTime

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the actual clock time for expiration of the most recent authorization key for this FSM."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Sections 4.2.1.2 and 4.2.2.9."

::= { docsBpi2CmBaseEntry 6 }

docsBpi2CmAuthReset OBJECT-TYPE  
SYNTAX TruthValue  
MAX-ACCESS read-write  
STATUS current  
DESCRIPTION  
"Setting this object to 'true' generates a Reauthorize event in the authorization FSM. Reading this object always returns FALSE.

This object is for testing purposes only, and therefore it is not required to be associated with a last reset object."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.1.2.3.4."

::= { docsBpi2CmBaseEntry 7 }

docsBpi2CmAuthGraceTime OBJECT-TYPE  
SYNTAX Integer32 (1..6047999)  
UNITS "seconds"  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
"The value of this object is the grace time for an authorization key in seconds. A CM is expected to start trying to get a new authorization key beginning AuthGraceTime seconds before the most recent authorization key actually expires."  
REFERENCE  
"DOCSIS Baseline Privacy Plus Interface Specification, Appendix A.1.1.1.3."  
::= { docsBpi2CmBaseEntry 8 }

docsBpi2CmTEKGraceTime OBJECT-TYPE  
SYNTAX Integer32 (1..302399)  
UNITS "seconds"  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
"The value of this object is the grace time for the TEK in seconds. The CM is expected to start trying to acquire a new TEK beginning TEK GraceTime seconds before the expiration of the most recent TEK."  
REFERENCE  
"DOCSIS Baseline Privacy Plus Interface Specification, Appendix A.1.1.1.6."  
::= { docsBpi2CmBaseEntry 9 }

docsBpi2CmAuthWaitTimeout OBJECT-TYPE  
SYNTAX Integer32 (1..30)  
UNITS "seconds"  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The value of this object is the Authorize Wait  
    Timeout in seconds."  
REFERENCE  
    "DOCSIS Baseline Privacy Plus Interface Specification,  
    Appendix A.1.1.1.1."  
 ::= { docsBpi2CmBaseEntry 10 }

docsBpi2CmReauthWaitTimeout OBJECT-TYPE  
SYNTAX Integer32 (1..30)  
UNITS "seconds"  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The value of this object is the Reauthorize Wait  
    Timeout in seconds."  
REFERENCE  
    "DOCSIS Baseline Privacy Plus Interface Specification,  
    Appendix A.1.1.1.2."  
 ::= { docsBpi2CmBaseEntry 11 }

docsBpi2CmOpWaitTimeout OBJECT-TYPE  
SYNTAX Integer32 (1..10)  
UNITS "seconds"  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The value of this object is the Operational Wait  
    Timeout in seconds."  
REFERENCE  
    "DOCSIS Baseline Privacy Plus Interface Specification,  
    Appendix A.1.1.1.4."  
 ::= { docsBpi2CmBaseEntry 12 }

docsBpi2CmRekeyWaitTimeout OBJECT-TYPE  
SYNTAX Integer32 (1..10)  
UNITS "seconds"  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The value of this object is the Rekey Wait Timeout  
    in seconds."  
REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Appendix A.1.1.1.5."

::= { docsBpi2CmBaseEntry 13 }

docsBpi2CmAuthRejectWaitTimeout OBJECT-TYPE

SYNTAX Integer32 (1..600)

UNITS "seconds"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the Authorization Reject  
Wait Timeout in seconds."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Appendix A.1.1.1.7."

::= { docsBpi2CmBaseEntry 14 }

docsBpi2CmSAMapWaitTimeout OBJECT-TYPE

SYNTAX Integer32 (1..10)

UNITS "seconds"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the retransmission  
interval, in seconds, of SA Map Requests from the MAP Wait  
state."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Appendix A.1.1.1.8."

::= { docsBpi2CmBaseEntry 15 }

docsBpi2CmSAMapMaxRetries OBJECT-TYPE

SYNTAX Integer32 (0..10)

UNITS "count"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the maximum number of  
Map Request retries allowed."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Appendix A.1.1.1.9."

::= { docsBpi2CmBaseEntry 16 }

docsBpi2CmAuthentInfos OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the number of times the CM has transmitted an Authentication Information message. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.9."

::= { docsBpi2CmBaseEntry 17 }

## docsBpi2CmAuthRequests OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the number of times the CM has transmitted an Authorization Request message. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.1."

::= { docsBpi2CmBaseEntry 18 }

## docsBpi2CmAuthReplies OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the number of times the CM has received an Authorization Reply message. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.2."

::= { docsBpi2CmBaseEntry 19 }

## docsBpi2CmAuthRejects OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the number of times the CM has received an Authorization Reject message. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.3."

::= { docsBpi2CmBaseEntry 20 }

docsBpi2CmAuthInvalids OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the count of times the CM has received an Authorization Invalid message. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.7."

::= { docsBpi2CmBaseEntry 21 }

docsBpi2CmAuthRejectErrorCode OBJECT-TYPE

SYNTAX INTEGER {  
     none(1),  
     unknown(2),  
     unauthorizedCm(3),  
     unauthorizedSaid(4),  
     permanentAuthorizationFailure(8),  
     timeOfDayNotAcquired(11)  
 }

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the enumerated description of the Error-Code in the most recent Authorization Reject message received by the CM. This has the value unknown(2) if the last Error-Code value was 0 and none(1) if no Authorization Reject message has been received since reboot."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,



Sections 4.2.1.3 and 4.2.2.15."

::= { docsBpi2CmBaseEntry 22 }

```
docsBpi2CmAuthRejectErrorString    OBJECT-TYPE
    SYNTAX          SnmpAdminString (SIZE (0..128))
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The value of this object is the text string in the
        most recent Authorization Reject message received by the
        CM.  This is a zero length string if no Authorization
        Reject message has been received since reboot."
    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,
        Sections 4.2.1.3 and 4.2.2.6."
    ::= { docsBpi2CmBaseEntry 23 }
```

```
docsBpi2CmAuthInvalidErrorCode      OBJECT-TYPE
    SYNTAX          INTEGER {
                                none(1),
                                unknown(2),
                                unauthorizedCm(3),
                                unsolicited(5),
                                invalidKeySequence(6),
                                keyRequestAuthenticationFailure(7)
                            }
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The value of this object is the enumerated
        description of the Error-Code in the most recent
        Authorization Invalid message received by the CM.  This has
        the value unknown(2) if the last Error-Code value was 0 and
        none(1) if no Authorization Invalid message has been received
        since reboot."
    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,
        Sections 4.2.1.7 and 4.2.2.15."
    ::= { docsBpi2CmBaseEntry 24 }
```

```
docsBpi2CmAuthInvalidErrorString    OBJECT-TYPE
    SYNTAX          SnmpAdminString (SIZE (0..128))
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The value of this object is the text string in the
        most recent Authorization Invalid message received by the
        CM.  This is a zero length string if no Authorization
```

Invalid message has been received since reboot."

#### REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Sections 4.2.1.7 and 4.2.2.6."

::= { docsBpi2CmBaseEntry 25 }

--

-- The CM TEK Table, indexed by ifIndex and SAID

--

docsBpi2CmTEKTable OBJECT-TYPE

SYNTAX SEQUENCE OF DocsBpi2CmTEKEntry

MAX-ACCESS not-accessible

STATUS current

#### DESCRIPTION

"This table describes the attributes of each CM Traffic Encryption Key (TEK) association. The CM maintains (no more than) one TEK association per SAID per CM MAC interface."

::= { docsBpi2CmObjects 2 }

docsBpi2CmTEKEntry OBJECT-TYPE

SYNTAX DocsBpi2CmTEKEntry

MAX-ACCESS not-accessible

STATUS current

#### DESCRIPTION

"Each entry contains objects describing the TEK association attributes of one SAID. The CM MUST create one entry per SAID, regardless of whether the SAID was obtained from a Registration Response message, from an Authorization Reply message, or from any dynamic SAID establishment mechanisms."

INDEX { ifIndex, docsBpi2CmTEKSAId }

::= { docsBpi2CmTEKTable 1 }

DocsBpi2CmTEKEntry ::= SEQUENCE {

docsBpi2CmTEKSAId

DocsSAId,

docsBpi2CmTEKSAType

DocsBpkmSAType,

docsBpi2CmTEKDataEncryptAlg

DocsBpkmDataEncryptAlg,

docsBpi2CmTEKDataAuthentAlg

DocsBpkmDataAuthentAlg,

docsBpi2CmTEKState

INTEGER,

docsBpi2CmTEKKeySequenceNumber

Integer32,

docsBpi2CmTEKExpiresOld

DateAndTime,

docsBpi2CmTEKExpiresNew

DateAndTime,

docsBpi2CmTEKKeyRequests

Counter32,

docsBpi2CmTEKKeyReplies

Counter32,

docsBpi2CmTEKKeyRejects

Counter32,

docsBpi2CmTEKInvalids

Counter32,

```

docsBpi2CmTEKAuthPends      Counter32,
docsBpi2CmTEKKeyRejectErrorCode  INTEGER,
docsBpi2CmTEKKeyRejectErrorString SnmpAdminString,
docsBpi2CmTEKInvalidErrorCode   INTEGER,
docsBpi2CmTEKInvalidErrorString SnmpAdminString
}

docsBpi2CmTEKSAId OBJECT-TYPE
    SYNTAX      DocsSAId
    MAX-ACCESS   not-accessible
    STATUS      current
    DESCRIPTION
        "The value of this object is the DOCSIS Security
        Association ID (SAID)."
    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,
        Section 4.2.2.12."
    ::= { docsBpi2CmTEKEntry 1 }

docsBpi2CmTEKSAType OBJECT-TYPE
    SYNTAX      DocsBpkmSAType
    MAX-ACCESS   read-only
    STATUS      current
    DESCRIPTION
        "The value of this object is the type of security
        association."
    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,
        Section 2.1.3."
    ::= { docsBpi2CmTEKEntry 2 }

docsBpi2CmTEKDataEncryptAlg OBJECT-TYPE
    SYNTAX      DocsBpkmDataEncryptAlg
    MAX-ACCESS   read-only
    STATUS      current
    DESCRIPTION
        "The value of this object is the data encryption
        algorithm for this SAID."
    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,
        Section 4.2.2.20."
    ::= { docsBpi2CmTEKEntry 3 }

docsBpi2CmTEKDataAuthentAlg OBJECT-TYPE
    SYNTAX      DocsBpkmDataAuthentAlg
    MAX-ACCESS   read-only
    STATUS      current
    DESCRIPTION

```

"The value of this object is the data authentication algorithm for this SAID."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.2.20."

::= { docsBpi2CmTEKEntry 4 }

docsBpi2CmTEKState OBJECT-TYPE

SYNTAX INTEGER {  
start(1),  
opWait(2),  
opReauthWait(3),  
operational(4),  
rekeyWait(5),  
rekeyReauthWait(6)  
}

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the state of the indicated TEK FSM. The start(1) state indicates that the FSM is in its initial state."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.1.3.1."

::= { docsBpi2CmTEKEntry 5 }

docsBpi2CmTEKKeySequenceNumber OBJECT-TYPE

SYNTAX Integer32 (0..15)

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the most recent TEK key sequence number for this TEK FSM."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Sections 4.2.2.10 and 4.2.2.13."

::= { docsBpi2CmTEKEntry 6 }

docsBpi2CmTEKExpiresOld OBJECT-TYPE

SYNTAX DateAndTime

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the actual clock time for expiration of the immediate predecessor of the most recent TEK for this FSM. If this FSM has only one TEK, then the value is the time of activation of this FSM."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Sections 4.2.1.5 and 4.2.2.9."  
::= { docsBpi2CmTEKEntry 7 }

## docsBpi2CmTEKExpiresNew OBJECT-TYPE

SYNTAX DateAndTime  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION

"The value of this object is the actual clock time for  
expiration of the most recent TEK for this FSM."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Sections 4.2.1.5 and 4.2.2.9."  
::= { docsBpi2CmTEKEntry 8 }

## docsBpi2CmTEKKeyRequests OBJECT-TYPE

SYNTAX Counter32  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION

"The value of this object is the number of times the CM  
has transmitted a Key Request message.  
Discontinuities in the value of this counter can occur at  
re-initialization of the management system, and at other  
times as indicated by the value of  
ifCounterDiscontinuityTime."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section 4.2.1.4."  
::= { docsBpi2CmTEKEntry 9 }

## docsBpi2CmTEKKeyReplies OBJECT-TYPE

SYNTAX Counter32  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION

"The value of this object is the number of times the CM  
has received a Key Reply message, including a message whose  
authentication failed.  
Discontinuities in the value of this counter can occur at  
re-initialization of the management system, and at other  
times as indicated by the value of  
ifCounterDiscontinuityTime."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,

Section 4.2.1.5."

::= { docsBpi2CmTEKEntry 10 }

docsBpi2CmTEKKeyRejects OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the number of times the CM has received a Key Reject message, including a message whose authentication failed.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.6."

::= { docsBpi2CmTEKEntry 11 }

docsBpi2CmTEKInvalids OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the number of times the CM has received a TEK Invalid message, including a message whose authentication failed.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.8."

::= { docsBpi2CmTEKEntry 12 }

docsBpi2CmTEKAuthPends OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the count of times an Authorization Pending (Auth Pend) event occurred in this FSM.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of

ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section 4.1.3.3.3."

::= { docsBpi2CmTEKEntry 13 }

docsBpi2CmTEKKeyRejectErrorCode OBJECT-TYPE

SYNTAX INTEGER {  
none(1),  
unknown(2),  
unauthorizedSaid(4)  
}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the enumerated description of the Error-Code in the most recent Key Reject message received by the CM. This has the value unknown(2) if the last Error-Code value was 0 and none(1) if no Key Reject message has been received since registration."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Sections 4.1.2.6 and 4.2.2.15."

::= { docsBpi2CmTEKEntry 14 }

docsBpi2CmTEKKeyRejectErrorString OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE (0..128))

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the text string in the most recent Key Reject message received by the CM. This is a zero length string if no Key Reject message has been received since registration."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Sections 4.1.2.6 and 4.2.2.6."

::= { docsBpi2CmTEKEntry 15 }

docsBpi2CmTEKInvalidErrorCode OBJECT-TYPE

SYNTAX INTEGER {  
none(1),  
unknown(2),  
invalidKeySequence(6)  
}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the enumerated description of the Error-Code in the most recent TEK Invalid message received by the CM. This has the value unknown(2) if the last Error-Code value was 0 and none(1) if no TEK Invalid message has been received since registration."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Sections 4.1.2.8 and 4.2.2.15."

::= { docsBpi2CmTEKEntry 16 }

```
docsBpi2CmTEKInvalidErrorString    OBJECT-TYPE
    SYNTAX          SnmpAdminString (SIZE (0..128))
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
```

"The value of this object is the text string in the most recent TEK Invalid message received by the CM. This is a zero length string if no TEK Invalid message has been received since registration."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Sections 4.1.2.8 and 4.2.2.6."

::= { docsBpi2CmTEKEntry 17 }

```
--
-- The CM Multicast Objects Group
--
```

```
docsBpi2CmMulticastObjects OBJECT IDENTIFIER
    ::= { docsBpi2CmObjects 3 }
```

```
--
-- The CM Dynamic IP Multicast Mapping Table, indexed by
-- docsBpi2CmIpMulticastIndex and by ifIndex
--
```

```
docsBpi2CmIpMulticastMapTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF DocsBpi2CmIpMulticastMapEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
```

"This table maps multicast IP addresses to SAIDs per CM MAC Interface.

It is intended to map multicast IP addresses associated with SA MAP Request messages."

::= { docsBpi2CmMulticastObjects 1 }

```
docsBpi2CmIpMulticastMapEntry OBJECT-TYPE
```



SYNTAX                DocsBpi2CmIpMulticastMapEntry  
 MAX-ACCESS           not-accessible  
 STATUS                current  
 DESCRIPTION

"Each entry contains objects describing the mapping of one multicast IP address to one SAID, as well as associated state, message counters, and error information.

An entry may be removed from this table upon the reception of an SA Map Reject."

INDEX                { ifIndex, docsBpi2CmIpMulticastIndex }  
 ::= { docsBpi2CmIpMulticastMapTable 1 }

DocsBpi2CmIpMulticastMapEntry ::= SEQUENCE {  
   docsBpi2CmIpMulticastIndex                Unsigned32,  
   docsBpi2CmIpMulticastAddressType        InetAddressType,  
   docsBpi2CmIpMulticastAddress            InetAddress,  
   docsBpi2CmIpMulticastSAId                DocsSAIdOrZero,  
   docsBpi2CmIpMulticastSMapState          INTEGER,  
   docsBpi2CmIpMulticastSMapRequests       Counter32,  
   docsBpi2CmIpMulticastSMapReplies        Counter32,  
   docsBpi2CmIpMulticastSMapRejects        Counter32,  
   docsBpi2CmIpMulticastSMapRejectErrorCode INTEGER,  
   docsBpi2CmIpMulticastSMapRejectErrorString SnmpAdminString  
 }

docsBpi2CmIpMulticastIndex                OBJECT-TYPE  
 SYNTAX                Unsigned32 (1..4294967295)  
 MAX-ACCESS            not-accessible  
 STATUS                current  
 DESCRIPTION  
   "The index of this row."  
 ::= { docsBpi2CmIpMulticastMapEntry 1 }

docsBpi2CmIpMulticastAddressType        OBJECT-TYPE  
 SYNTAX                InetAddressType  
 MAX-ACCESS            read-only  
 STATUS                current  
 DESCRIPTION  
   "The type of Internet address for docsBpi2CmIpMulticastAddress."  
 ::= { docsBpi2CmIpMulticastMapEntry 2 }

docsBpi2CmIpMulticastAddress            OBJECT-TYPE  
 SYNTAX                InetAddress  
 MAX-ACCESS            read-only  
 STATUS                current  
 DESCRIPTION

"This object represents the IP multicast address to be mapped. The type of this address is determined by the value of the docsBpi2CmIpMulticastAddressType object."  
REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 5.4."

::= { docsBpi2CmIpMulticastMapEntry 3 }

docsBpi2CmIpMulticastSAId OBJECT-TYPE

SYNTAX DocSAIdOrZero

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object represents the SAID to which the IP multicast address has been mapped. If no SA Map Reply has been received for the IP address, this object should have the value 0."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.2.12."

::= { docsBpi2CmIpMulticastMapEntry 4 }

docsBpi2CmIpMulticastSAMapState OBJECT-TYPE

SYNTAX INTEGER {  
start(1),  
mapWait(2),  
mapped(3)  
}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the state of the SA Mapping FSM for this IP."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 5.3.1."

::= { docsBpi2CmIpMulticastMapEntry 5 }

docsBpi2CmIpMulticastSAMapRequests OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the number of times the CM has transmitted an SA Map Request message for this IP. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of

ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section 4.2.1.10."

::= { docsBpi2CmIpMulticastMapEntry 6 }

docsBpi2CmIpMulticastSAMapReplies OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the number of times the CM has received an SA Map Reply message for this IP. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section 4.2.1.11."

::= { docsBpi2CmIpMulticastMapEntry 7 }

docsBpi2CmIpMulticastSAMapRejects OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the number of times the CM has received an SA MAP Reject message for this IP. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section 4.2.1.12."

::= { docsBpi2CmIpMulticastMapEntry 8 }

docsBpi2CmIpMulticastSAMapRejectErrorCode OBJECT-TYPE

SYNTAX INTEGER {  
none(1),  
unknown(2),  
noAuthForRequestedDSFlow(9),  
dsFlowNotMappedToSA(10)  
}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the enumerated description of the Error-Code in the most recent SA Map Reject message sent in response to an SA Map Request for This IP. It has the value none(1) if no SA MAP Reject message has been received since entry creation."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Sections 4.2.1.12 and 4.2.2.15."

::= { docsBpi2CmIpMulticastMapEntry 9 }

docsBpi2CmIpMulticastSAMapRejectErrorString OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE (0..128))

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the text string in the most recent SA Map Reject message sent in response to an SA Map Request for this IP. It is a zero length string if no SA Map Reject message has been received since entry creation."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Sections 4.2.1.12 and 4.2.2.6."

::= { docsBpi2CmIpMulticastMapEntry 10 }

--

-- CM Cert Objects

--

docsBpi2CmCertObjects OBJECT IDENTIFIER

::= { docsBpi2CmObjects 4 }

--

-- CM Device Cert Table

--

docsBpi2CmDeviceCertTable OBJECT-TYPE

SYNTAX SEQUENCE OF DocsBpi2CmDeviceCertEntry

MAX-ACCESS not-accessible

STATUS current

## DESCRIPTION

"This table describes the Baseline Privacy Plus device certificates for each CM MAC interface."

::= { docsBpi2CmCertObjects 1 }

docsBpi2CmDeviceCertEntry OBJECT-TYPE

SYNTAX DocsBpi2CmDeviceCertEntry

MAX-ACCESS not-accessible

```

STATUS                current
DESCRIPTION
    "Each entry contains the device certificates of
    one CM MAC interface.  An entry in this table exists for
    each ifEntry with an ifType of docsCableMaclayer(127)."
```

INDEX { ifIndex }

```

 ::= { docsBpi2CmDeviceCertTable 1 }
```

```

DocsBpi2CmDeviceCertEntry ::= SEQUENCE {
    docsBpi2CmDeviceCmCert
        DocsX509ASN1DEREncodedCertificate,
    docsBpi2CmDeviceManufCert
        DocsX509ASN1DEREncodedCertificate
}
```

```

docsBpi2CmDeviceCmCert    OBJECT-TYPE
    SYNTAX                DocsX509ASN1DEREncodedCertificate
    MAX-ACCESS             read-write
    STATUS                 current
    DESCRIPTION
        "The X509 DER-encoded cable modem certificate.
        Note: This object can be set only when the value is the
        zero-length OCTET STRING; otherwise, an error of
        'inconsistentValue' is returned.  Once the object
        contains the certificate, its access MUST be read-only
        and persists after re-initialization of the
        managed system."
    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,
        Section 9.1."
    ::= { docsBpi2CmDeviceCertEntry 1 }
```

```

docsBpi2CmDeviceManufCert    OBJECT-TYPE
    SYNTAX                DocsX509ASN1DEREncodedCertificate
    MAX-ACCESS             read-only
    STATUS                 current
    DESCRIPTION
        "The X509 DER-encoded manufacturer certificate that
        signed the cable modem certificate."
    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,
        Section 9.1."
    ::= { docsBpi2CmDeviceCertEntry 2 }
```

```

--
-- CM Crypto Suite Table
--
```

```

docsBpi2CmCryptoSuiteTable      OBJECT-TYPE
    SYNTAX          SEQUENCE OF      DocsBpi2CmCryptoSuiteEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "This table describes the Baseline Privacy Plus
        cryptographic suite capabilities for each CM MAC
        interface."
    ::= { docsBpi2CmObjects 5 }

docsBpi2CmCryptoSuiteEntry      OBJECT-TYPE
    SYNTAX          DocsBpi2CmCryptoSuiteEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "Each entry contains a cryptographic suite pair
        that this CM MAC supports."
    INDEX          { ifIndex, docsBpi2CmCryptoSuiteIndex }
    ::= { docsBpi2CmCryptoSuiteTable 1 }

DocsBpi2CmCryptoSuiteEntry ::= SEQUENCE {
    docsBpi2CmCryptoSuiteIndex      Unsigned32,
    docsBpi2CmCryptoSuiteDataEncryptAlg
                                   DocsBpkmDataEncryptAlg,
    docsBpi2CmCryptoSuiteDataAuthentAlg
                                   DocsBpkmDataAuthentAlg
}

docsBpi2CmCryptoSuiteIndex OBJECT-TYPE
    SYNTAX          Unsigned32 (1..1000)
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "The index for a cryptographic suite row."
    ::= { docsBpi2CmCryptoSuiteEntry 1 }

docsBpi2CmCryptoSuiteDataEncryptAlg      OBJECT-TYPE
    SYNTAX          DocsBpkmDataEncryptAlg
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The value of this object is the data encryption
        algorithm for this cryptographic suite capability."
    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,
        Section 4.2.2.20."
    ::= { docsBpi2CmCryptoSuiteEntry 2 }

```

```

docsBpi2CmCryptoSuiteDataAuthentAlg      OBJECT-TYPE
    SYNTAX      DocsBpkmDataAuthentAlg
    MAX-ACCESS   read-only
    STATUS      current
    DESCRIPTION
        "The value of this object is the data authentication
        algorithm for this cryptographic suite capability."
    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,
        Section 4.2.2.20."
    ::= { docsBpi2CmCryptoSuiteEntry 3 }

-- Cable Modem Termination System Group

docsBpi2CmtsObjects OBJECT IDENTIFIER ::= { docsBpi2MIBObjects 2 }

--
-- SPECIAL NOTE:  For the following CMTS tables, when a CM is
-- running in BPI mode, replace SAID (Security Association ID)
-- with SID (Service ID).  The CMTS is required to map SAIDs and
-- SIDs to one contiguous space.
--
--
-- The BPI+ base table for CMTSs, indexed by ifIndex
--

docsBpi2CmtsBaseTable      OBJECT-TYPE
    SYNTAX      SEQUENCE OF      DocsBpi2CmtsBaseEntry
    MAX-ACCESS   not-accessible
    STATUS      current
    DESCRIPTION
        "This table describes the basic Baseline Privacy
        attributes of each CMTS MAC interface."
    ::= { docsBpi2CmtsObjects 1 }

docsBpi2CmtsBaseEntry      OBJECT-TYPE
    SYNTAX      DocsBpi2CmtsBaseEntry
    MAX-ACCESS   not-accessible
    STATUS      current
    DESCRIPTION
        "Each entry contains objects describing attributes of
        one CMTS MAC interface.  An entry in this table exists for
        each ifEntry with an ifType of docsCableMaclayer(127)."
```

INDEX        { ifIndex }

```

    ::= { docsBpi2CmtsBaseTable 1 }

DocsBpi2CmtsBaseEntry ::= SEQUENCE {
```

```

docsBpi2CmtsDefaultAuthLifetime      Integer32,
docsBpi2CmtsDefaultTEKLifetime       Integer32,
docsBpi2CmtsDefaultSelfSignedManufCertTrust  INTEGER,
    docsBpi2CmtsCheckCertValidityPeriods      TruthValue,
    docsBpi2CmtsAuthentInfos                   Counter32,
    docsBpi2CmtsAuthRequests                  Counter32,
    docsBpi2CmtsAuthReplies                   Counter32,
    docsBpi2CmtsAuthRejects                   Counter32,
    docsBpi2CmtsAuthInvalids                   Counter32,
    docsBpi2CmtsSAMapRequests                  Counter32,
    docsBpi2CmtsSAMapReplies                   Counter32,
    docsBpi2CmtsSAMapRejects                   Counter32
}

```

docsBpi2CmtsDefaultAuthLifetime      OBJECT-TYPE

SYNTAX                    Integer32 (1..6048000)

UNITS                    "seconds"

MAX-ACCESS               read-write

STATUS                   current

DESCRIPTION

"The value of this object is the default lifetime, in seconds, that the CMTS assigns to a new authorization key. This object value persists after re-initialization of the managed system."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Appendix A.2."

DEFVAL { 604800 }

::= { docsBpi2CmtsBaseEntry 1 }

docsBpi2CmtsDefaultTEKLifetime      OBJECT-TYPE

SYNTAX                    Integer32 (1..604800)

UNITS                    "seconds"

MAX-ACCESS               read-write

STATUS                   current

DESCRIPTION

"The value of this object is the default lifetime, in seconds, that the CMTS assigns to a new Traffic Encryption Key (TEK)."

This object value persists after re-initialization of the managed system."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Appendix A.2."

DEFVAL { 43200 }

::= { docsBpi2CmtsBaseEntry 2 }

docsBpi2CmtsDefaultSelfSignedManufCertTrust      OBJECT-TYPE



```
SYNTAX      INTEGER {
                trusted (1),
                untrusted (2)
            }
```

```
MAX-ACCESS   read-write
```

```
STATUS       current
```

DESCRIPTION

"This object determines the default trust of self-signed manufacturer certificate entries, contained in docsBpi2CmtsCACertTable, and created after this object is set.

This object need not persist after re-initialization of the managed system."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 9.4.1"

```
::= { docsBpi2CmtsBaseEntry 3 }
```

docsBpi2CmtsCheckCertValidityPeriods OBJECT-TYPE

```
SYNTAX      TruthValue
```

```
MAX-ACCESS   read-write
```

```
STATUS       current
```

DESCRIPTION

"Setting this object to 'true' causes all chained and root certificates in the chain to have their validity periods checked against the current time of day, when the CMTS receives an Authorization Request from the CM.

A 'false' setting causes all certificates in the chain not to have their validity periods checked against the current time of day.

This object need not persist after re-initialization of the managed system."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 9.4.2"

```
::= { docsBpi2CmtsBaseEntry 4 }
```

docsBpi2CmtsAuthentInfos OBJECT-TYPE

```
SYNTAX      Counter32
```

```
MAX-ACCESS   read-only
```

```
STATUS       current
```

DESCRIPTION

"The value of this object is the number of times the CMTS has received an Authentication Information message from any CM.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other

times as indicated by the value of  
ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section 4.2.1.9."

::= { docsBpi2CmtsBaseEntry 5 }

docsBpi2CmtsAuthRequests OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the number of times the  
CMTS has received an Authorization Request message from any  
CM.

Discontinuities in the value of this counter can occur at  
re-initialization of the management system, and at other  
times as indicated by the value of  
ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section 4.2.1.1."

::= { docsBpi2CmtsBaseEntry 6 }

docsBpi2CmtsAuthReplies OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the number of times the  
CMTS has transmitted an Authorization Reply message to any  
CM.

Discontinuities in the value of this counter can occur at  
re-initialization of the management system, and at other  
times as indicated by the value of  
ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section 4.2.1.2."

::= { docsBpi2CmtsBaseEntry 7 }

docsBpi2CmtsAuthRejects OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the number of times the  
CMTS has transmitted an Authorization Reject message to any

CM.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.3."

::= { docsBpi2CmtsBaseEntry 8 }

docsBpi2CmtsAuthInvalids OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the number of times the CMTS has transmitted an Authorization Invalid message to any CM.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.7."

::= { docsBpi2CmtsBaseEntry 9 }

docsBpi2CmtsSAMapRequests OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the number of times the CMTS has received an SA Map Request message from any CM.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.10."

::= { docsBpi2CmtsBaseEntry 10 }

docsBpi2CmtsSAMapReplies OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the number of times the CMTS has transmitted an SA Map Reply message to any CM. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.11."

::= { docsBpi2CmtsBaseEntry 11 }

## docsBpi2CmtsSAMapRejects OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the number of times the CMTS has transmitted an SA Map Reject message to any CM. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.12."

::= { docsBpi2CmtsBaseEntry 12 }

--

-- The CMTS Authorization Table, indexed by ifIndex and CM MAC  
-- address

--

## docsBpi2CmtsAuthTable OBJECT-TYPE

SYNTAX SEQUENCE OF DocsBpi2CmtsAuthEntry

MAX-ACCESS not-accessible

STATUS current

## DESCRIPTION

"This table describes the attributes of each CM authorization association. The CMTS maintains one authorization association with each Baseline Privacy-enabled CM, registered on each CMTS MAC interface, regardless of whether the CM is authorized or rejected."

::= { docsBpi2CmtsObjects 2 }

## docsBpi2CmtsAuthEntry OBJECT-TYPE

SYNTAX DocsBpi2CmtsAuthEntry

MAX-ACCESS not-accessible

STATUS current

## DESCRIPTION

"Each entry contains objects describing attributes of one authorization association. The CMTS MUST create one entry per CM per MAC interface, based on the receipt of an Authorization Request message, and MUST not delete the entry until the CM loses registration."

```
INDEX      { ifIndex, docsBpi2CmtsAuthCmMacAddress }
 ::= { docsBpi2CmtsAuthTable 1 }
```

```
DocsBpi2CmtsAuthEntry ::= SEQUENCE {
    docsBpi2CmtsAuthCmMacAddress      MacAddress,
    docsBpi2CmtsAuthCmBpiVersion      INTEGER,
    docsBpi2CmtsAuthCmPublicKey       OCTET STRING,
    docsBpi2CmtsAuthCmKeySequenceNumber Integer32,
    docsBpi2CmtsAuthCmExpiresOld      DateAndTime,
    docsBpi2CmtsAuthCmExpiresNew      DateAndTime,
    docsBpi2CmtsAuthCmLifetime        Integer32,
    docsBpi2CmtsAuthCmReset            INTEGER,
    docsBpi2CmtsAuthCmInfos            Counter32,
    docsBpi2CmtsAuthCmRequests        Counter32,
    docsBpi2CmtsAuthCmReplies         Counter32,
    docsBpi2CmtsAuthCmRejects         Counter32,
    docsBpi2CmtsAuthCmInvalids        Counter32,
    docsBpi2CmtsAuthRejectErrorCode    INTEGER,
    docsBpi2CmtsAuthRejectErrorString  SnmpAdminString,
    docsBpi2CmtsAuthInvalidErrorCode   INTEGER,
    docsBpi2CmtsAuthInvalidErrorString SnmpAdminString,
    docsBpi2CmtsAuthPrimarySAId        DocsSAIdOrZero,
    docsBpi2CmtsAuthBpkmCmCertValid    INTEGER,
    docsBpi2CmtsAuthBpkmCmCert        DocsX509ASN1DEREncodedCertificate,
    docsBpi2CmtsAuthCACertIndexPtr     Unsigned32
}
```

docsBpi2CmtsAuthCmMacAddress OBJECT-TYPE

```
SYNTAX      MacAddress
MAX-ACCESS  not-accessible
STATUS      current
```

## DESCRIPTION

"The value of this object is the physical address of the CM to which the authorization association applies."

```
::= { docsBpi2CmtsAuthEntry 1 }
```

docsBpi2CmtsAuthCmBpiVersion OBJECT-TYPE

```
SYNTAX      INTEGER {
    bpi (0),
    bpiPlus (1)
}
```

MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION

"The value of this object is the version of Baseline Privacy for which this CM has registered. The value 'bpiplus' represents the value of BPI-Version Attribute of the Baseline Privacy Key Management BPKM attribute BPI-Version (1). The value 'bpi' is used to represent the CM registered using DOCSIS 1.0 Baseline Privacy."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.2.22; ANSI/SCTE 22-2 2002(formerly DSS 02-03) Data-Over-Cable Service Interface Specification DOCSIS 1.0 Baseline Privacy Interface (BPI)"

::= { docsBpi2CmtsAuthEntry 2 }

docsBpi2CmtsAuthCmPublicKey OBJECT-TYPE

SYNTAX OCTET STRING (SIZE (0..524))  
 MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION

"The value of this object is a DER-encoded RSAPublicKey ASN.1 type string, as defined in the RSA Encryption Standard (PKCS #1), corresponding to the public key of the CM. This is the zero-length OCTET STRING if the CMTS does not retain the public key."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.2.4."

::= { docsBpi2CmtsAuthEntry 3 }

docsBpi2CmtsAuthCmKeySequenceNumber OBJECT-TYPE

SYNTAX Integer32 (0..15)  
 MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION

"The value of this object is the most recent authorization key sequence number for this CM."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Sections 4.2.1.2 and 4.2.2.10."

::= { docsBpi2CmtsAuthEntry 4 }

docsBpi2CmtsAuthCmExpiresOld OBJECT-TYPE

SYNTAX DateAndTime  
 MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION

"The value of this object is the actual clock time for expiration of the immediate predecessor of the most recent authorization key for this FSM. If this FSM has only one authorization key, then the value is the time of activation of this FSM.

Note: This object has no meaning for CMTS running in BPI mode; therefore, this object is not instantiated for entries associated to those CMTS."

#### REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Sections 4.2.1.2 and 4.2.2.9."

::= { docsBpi2CmtsAuthEntry 5 }

#### docsBpi2CmtsAuthCmExpiresNew OBJECT-TYPE

SYNTAX DateAndTime

MAX-ACCESS read-only

STATUS current

#### DESCRIPTION

"The value of this object is the actual clock time for expiration of the most recent authorization key for this FSM."

#### REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Sections 4.2.1.2 and 4.2.2.9."

::= { docsBpi2CmtsAuthEntry 6 }

#### docsBpi2CmtsAuthCmLifetime OBJECT-TYPE

SYNTAX Integer32 (1..6048000)

UNITS "seconds"

MAX-ACCESS read-write

STATUS current

#### DESCRIPTION

"The value of this object is the lifetime, in seconds, that the CMTS assigns to an authorization key for this CM."

#### REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.2 and Appendix A.2."

::= { docsBpi2CmtsAuthEntry 7 }

#### docsBpi2CmtsAuthCmReset OBJECT-TYPE

SYNTAX INTEGER {  
noResetRequested(1),  
invalidateAuth(2),  
sendAuthInvalid(3),  
invalidateTeks(4)  
}

MAX-ACCESS read-write

STATUS current

## DESCRIPTION

"Setting this object to invalidateAuth(2) causes the CMTS to invalidate the current CM authorization key(s), but not to transmit an Authorization Invalid message nor to invalidate the primary SAID's TEKs. Setting this object to sendAuthInvalid(3) causes the CMTS to invalidate the current CM authorization key(s), and to transmit an Authorization Invalid message to the CM, but not to invalidate the primary SAID's TEKs. Setting this object to invalidateTek(4) causes the CMTS to invalidate the current CM authorization key(s), to transmit an Authorization Invalid message to the CM, and to invalidate the TEKs associated with this CM's primary SAID.

For BPI mode, substitute all of the CM's unicast TEKs for the primary SAID's TEKs in the previous paragraph.

Reading this object returns the most recently set value of this object or, if the object has not been set since entry creation, returns noResetRequested(1)."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Sections 4.1.2.3.4, 4.1.2.3.5, and 4.1.3.3.5."

::= { docsBpi2CmtsAuthEntry 8 }

docsBpi2CmtsAuthCmInfos OBJECT-TYPE

SYNTAX Counter32  
MAX-ACCESS read-only  
STATUS current

## DESCRIPTION

"The value of this object is the number of times the CMTS has received an Authentication Information message from this CM.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.9."

::= { docsBpi2CmtsAuthEntry 9 }

docsBpi2CmtsAuthCmRequests OBJECT-TYPE

SYNTAX Counter32  
MAX-ACCESS read-only  
STATUS current

## DESCRIPTION

"The value of this object is the number of times the CMTS has received an Authorization Request message from



this CM.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.1."

::= { docsBpi2CmtsAuthEntry 10 }

docsBpi2CmtsAuthCmReplies OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the number of times the CMTS has transmitted an Authorization Reply message to this CM.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.2."

::= { docsBpi2CmtsAuthEntry 11 }

docsBpi2CmtsAuthCmRejects OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the number of times the CMTS has transmitted an Authorization Reject message to this CM.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.3."

::= { docsBpi2CmtsAuthEntry 12 }

docsBpi2CmtsAuthCmInvalids OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the number of times the CMTS has transmitted an Authorization Invalid message to this CM.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.7."

::= { docsBpi2CmtsAuthEntry 13 }

docsBpi2CmtsAuthRejectErrorCode OBJECT-TYPE

SYNTAX INTEGER {  
     none(1),  
     unknown(2),  
     unauthorizedCm(3),  
     unauthorizedSaid(4),  
     permanentAuthorizationFailure(8),  
     timeOfDayNotAcquired(11)  
 }

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the enumerated description of the Error-Code in the most recent Authorization Reject message transmitted to the CM. This has the value unknown(2) if the last Error-Code value was 0 and none(1) if no Authorization Reject message has been transmitted to the CM since entry creation."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Sections 4.2.1.3 and 4.2.2.15."

::= { docsBpi2CmtsAuthEntry 14 }

docsBpi2CmtsAuthRejectErrorString OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE (0..128))

MAX-ACCESS read-only

STATUS current

## DESCRIPTION

"The value of this object is the text string in the most recent Authorization Reject message transmitted to the CM. This is a zero length string if no Authorization Reject message has been transmitted to the CM since entry creation."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,

Sections 4.2.1.3 and 4.2.2.6."  
 ::= { docsBpi2CmtsAuthEntry 15 }

docsBpi2CmtsAuthInvalidErrorCode OBJECT-TYPE  
 SYNTAX INTEGER {  
     none(1),  
     unknown(2),  
     unauthorizedCm(3),  
     unsolicited(5),  
     invalidKeySequence(6),  
     keyRequestAuthenticationFailure(7)  
 }  
 MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION  
     "The value of this object is the enumerated  
     description of the Error-Code in the most recent  
     Authorization Invalid message transmitted to the CM. This  
     has the value unknown(2) if the last Error-Code value was 0  
     and none(1) if no Authorization Invalid message has been  
     transmitted to the CM since entry creation."  
 REFERENCE  
     "DOCSIS Baseline Privacy Plus Interface Specification,  
     Sections 4.2.1.7 and 4.2.2.15."  
 ::= { docsBpi2CmtsAuthEntry 16 }

docsBpi2CmtsAuthInvalidErrorString OBJECT-TYPE  
 SYNTAX SnmpAdminString (SIZE (0..128))  
 MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION  
     "The value of this object is the text string in the  
     most recent Authorization Invalid message transmitted to  
     the CM. This is a zero length string if no Authorization  
     Invalid message has been transmitted to the CM since entry  
     creation."  
 REFERENCE  
     "DOCSIS Baseline Privacy Plus Interface Specification,  
     Sections 4.2.1.7 and 4.2.2.6."  
 ::= { docsBpi2CmtsAuthEntry 17 }

docsBpi2CmtsAuthPrimarySAId OBJECT-TYPE  
 SYNTAX DocsSAIdOrZero  
 MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION  
     "The value of this object is the Primary Security  
     Association identifier. For BPI mode, the value must be

any unicast SID."

#### REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section 2.1.3."

::= { docsBpi2CmtsAuthEntry 18 }

docsBpi2CmtsAuthBpkmCmCertValid OBJECT-TYPE

SYNTAX INTEGER {  
    unknown (0),  
    validCmChained (1),  
    validCmTrusted (2),  
    invalidCmUntrusted (3),  
    invalidCAUntrusted (4),  
    invalidCmOther (5),  
    invalidCAOther (6)  
}

MAX-ACCESS read-only

STATUS current

#### DESCRIPTION

"Contains the reason why a CM's certificate is deemed valid or invalid.

Return unknown(0) if the CM is running BPI mode.

ValidCmChained(1) means the certificate is valid because it chains to a valid certificate.

ValidCmTrusted(2) means the certificate is valid because it has been provisioned (in the docsBpi2CmtsProvisionedCmCert table) to be trusted.

InvalidCmUntrusted(3) means the certificate is invalid because it has been provisioned (in the docsBpi2CmtsProvisionedCmCert table) to be untrusted.

InvalidCAUntrusted(4) means the certificate is invalid because it chains to an untrusted certificate.

InvalidCmOther(5) and InvalidCAOther(6) refer to errors in parsing, validity periods, etc., which are attributable to the CM certificate or its chain, respectively; additional information may be found in docsBpi2AuthRejectErrorString for these types of errors."

#### REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section 9.4.2."

::= { docsBpi2CmtsAuthEntry 19 }

docsBpi2CmtsAuthBpkmCmCert OBJECT-TYPE

SYNTAX DocsX509ASN1DEREncodedCertificate

MAX-ACCESS read-only

STATUS current

#### DESCRIPTION

"The X509 CM Certificate sent as part of a BPKM Authorization Request.

Note: The zero-length OCTET STRING must be returned if the Entire certificate is not retained in the CMTS."

#### REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 9.2."

::= { docsBpi2CmtsAuthEntry 20 }

docsBpi2CmtsAuthCACertIndexPtr OBJECT-TYPE

SYNTAX Unsigned32 (0..4294967295)

MAX-ACCESS read-only

STATUS current

#### DESCRIPTION

"A row index into docsBpi2CmtsCACertTable.

Returns the index in docsBpi2CmtsCACertTable to which CA certificate this CM is chained to. A value of 0 means it could not be found or not applicable."

#### REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 9.2."

::= { docsBpi2CmtsAuthEntry 21 }

--

-- The CMTS TEK Table, indexed by ifIndex and SAID

--

docsBpi2CmtsTEKTable OBJECT-TYPE

SYNTAX SEQUENCE OF DocsBpi2CmtsTEKEntry

MAX-ACCESS not-accessible

STATUS current

#### DESCRIPTION

"This table describes the attributes of each Traffic Encryption Key (TEK) association. The CMTS Maintains one TEK association per SAID on each CMTS MAC interface."

::= { docsBpi2CmtsObjects 3 }

docsBpi2CmtsTEKEntry OBJECT-TYPE

SYNTAX DocsBpi2CmtsTEKEntry

MAX-ACCESS not-accessible

STATUS current

#### DESCRIPTION

"Each entry contains objects describing attributes of one TEK association on a particular CMTS MAC interface. The CMTS MUST create one entry per SAID per MAC interface, based on the receipt of a Key Request message, and MUST not delete the entry before the CM authorization for the SAID

```

    permanently expires."
    INDEX      { ifIndex, docsBpi2CmtsTEKSAId }
    ::= { docsBpi2CmtsTEKTable 1 }

DocsBpi2CmtsTEKEntry ::= SEQUENCE {
    docsBpi2CmtsTEKSAId          DocsSAId,
    docsBpi2CmtsTEKSAType        DocsBpkmSAType,
    docsBpi2CmtsTEKDataEncryptAlg DocsBpkmDataEncryptAlg,
    docsBpi2CmtsTEKDataAuthentAlg DocsBpkmDataAuthentAlg,
    docsBpi2CmtsTEKLifetime      Integer32,
    docsBpi2CmtsTEKKeySequenceNumber Integer32,
    docsBpi2CmtsTEKExpiresOld    DateAndTime,
    docsBpi2CmtsTEKExpiresNew    DateAndTime,
    docsBpi2CmtsTEKReset         TruthValue,
    docsBpi2CmtsKeyRequests      Counter32,
    docsBpi2CmtsKeyReplies       Counter32,
    docsBpi2CmtsKeyRejects       Counter32,
    docsBpi2CmtsTEKInvalids      Counter32,
    docsBpi2CmtsKeyRejectErrorCode INTEGER,
    docsBpi2CmtsKeyRejectErrorString SnmpAdminString,
    docsBpi2CmtsTEKInvalidErrorCode INTEGER,
    docsBpi2CmtsTEKInvalidErrorString SnmpAdminString
}

docsBpi2CmtsTEKSAId OBJECT-TYPE
    SYNTAX      DocsSAId
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "The value of this object is the DOCSIS Security
        Association ID (SAID)."
    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,
        Section 4.2.2.12."
    ::= { docsBpi2CmtsTEKEntry 1 }

docsBpi2CmtsTEKSAType OBJECT-TYPE
    SYNTAX      DocsBpkmSAType
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The value of this object is the type of security
        association. 'dynamic' does not apply to CMs running in
        BPI mode. Unicast BPI TEKs must utilize the 'primary'
        encoding, and multicast BPI TEKs must utilize the 'static'
        encoding."
    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,

```

Section 2.1.3."

::= { docsBpi2CmtsTEKEntry 2 }

docsBpi2CmtsTEKDataEncryptAlg OBJECT-TYPE

SYNTAX DocsBpkmDataEncryptAlg

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the data encryption algorithm for this SAID."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.2.20."

::= { docsBpi2CmtsTEKEntry 3 }

docsBpi2CmtsTEKDataAuthentAlg OBJECT-TYPE

SYNTAX DocsBpkmDataAuthentAlg

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the data authentication algorithm for this SAID."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.2.20."

::= { docsBpi2CmtsTEKEntry 4 }

docsBpi2CmtsTEKLifetime OBJECT-TYPE

SYNTAX Integer32 (1..604800)

UNITS "seconds"

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"The value of this object is the lifetime, in seconds, that the CMTS assigns to keys for this TEK association."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.5 and Appendix A.2."

::= { docsBpi2CmtsTEKEntry 5 }

docsBpi2CmtsTEKKeySequenceNumber OBJECT-TYPE

SYNTAX Integer32 (0..15)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the most recent TEK

key sequence number for this SAID."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Sections 4.2.2.10 and 4.2.2.13."

::= { docsBpi2CmtsTEKEntry 6 }

docsBpi2CmtsTEKExpiresOld OBJECT-TYPE

SYNTAX DateAndTime

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the actual clock time for expiration of the immediate predecessor of the most recent TEK for this FSM. If this FSM has only one TEK, then the value is the time of activation of this FSM."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Sections 4.2.1.5 and 4.2.2.9."

::= { docsBpi2CmtsTEKEntry 7 }

docsBpi2CmtsTEKExpiresNew OBJECT-TYPE

SYNTAX DateAndTime

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the actual clock time for expiration of the most recent TEK for this FSM."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Sections 4.2.1.5 and 4.2.2.9."

::= { docsBpi2CmtsTEKEntry 8 }

docsBpi2CmtsTEKReset OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"Setting this object to 'true' causes the CMTS to invalidate all currently active TEKs and to generate new TEKs for the associated SAID; the CMTS MAY also generate unsolicited TEK Invalid messages, to optimize the TEK synchronization between the CMTS and the CM(s). Reading this object always returns FALSE."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section 4.1.3.3.5."

::= { docsBpi2CmtsTEKEntry 9 }



`docsBpi2CmtsKeyRequests` OBJECT-TYPE

```
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
```

## DESCRIPTION

"The value of this object is the number of times the CMTS has received a Key Request message.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of `ifCounterDiscontinuityTime`."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.4."

```
::= { docsBpi2CmtsTEKEntry 10 }
```

`docsBpi2CmtsKeyReplies` OBJECT-TYPE

```
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
```

## DESCRIPTION

"The value of this object is the number of times the CMTS has transmitted a Key Reply message.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of `ifCounterDiscontinuityTime`."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.5."

```
::= { docsBpi2CmtsTEKEntry 11 }
```

`docsBpi2CmtsKeyRejects` OBJECT-TYPE

```
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
```

## DESCRIPTION

"The value of this object is the number of times the CMTS has transmitted a Key Reject message.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of `ifCounterDiscontinuityTime`."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.6."

```
::= { docsBpi2CmtsTEKEntry 12 }
```

## docsBpi2CmtsTEKInvalids OBJECT-TYPE

SYNTAX Counter32  
 MAX-ACCESS read-only  
 STATUS current

## DESCRIPTION

"The value of this object is the number of times the CMTS has transmitted a TEK Invalid message. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.1.8."

::= { docsBpi2CmtsTEKEntry 13 }

## docsBpi2CmtsKeyRejectErrorCode OBJECT-TYPE

SYNTAX INTEGER {  
     none(1),  
     unknown(2),  
     unauthorizedSaid(4)  
 }

MAX-ACCESS read-only  
 STATUS current

## DESCRIPTION

"The value of this object is the enumerated description of the Error-Code in the most recent Key Reject message sent in response to a Key Request for this SAID. This has the value unknown(2) if the last Error-Code value was 0 and none(1) if no Key Reject message has been received since registration."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Sections 4.2.1.6 and 4.2.2.15."

::= { docsBpi2CmtsTEKEntry 14 }

## docsBpi2CmtsKeyRejectErrorString OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE (0..128))

MAX-ACCESS read-only  
 STATUS current

## DESCRIPTION

"The value of this object is the text string in the most recent Key Reject message sent in response to a Key Request for this SAID. This is a zero length string if no Key Reject message has been received since registration."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,

Sections 4.2.1.6 and 4.2.2.6."  
 ::= { docsBpi2CmtsTEKEntry 15 }

docsBpi2CmtsTEKInvalidErrorCode OBJECT-TYPE  
 SYNTAX INTEGER {  
     none(1),  
     unknown(2),  
     invalidKeySequence(6)  
 }  
 MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION  
     "The value of this object is the enumerated  
     description of the Error-Code in the most recent TEK  
     Invalid message sent in association with this SAID. This  
     has the value unknown(2) if the last Error-Code value was 0  
     and none(1) if no TEK Invalid message has been received  
     since registration."  
 REFERENCE  
     "DOCSIS Baseline Privacy Plus Interface Specification,  
     Sections 4.2.1.8 and 4.2.2.15."  
 ::= { docsBpi2CmtsTEKEntry 16 }

docsBpi2CmtsTEKInvalidErrorString OBJECT-TYPE  
 SYNTAX SnmpAdminString (SIZE (0..128))  
 MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION  
     "The value of this object is the text string in  
     the most recent TEK Invalid message sent in association  
     with this SAID. This is a zero length string if no TEK  
     Invalid message has been received since registration."  
 REFERENCE  
     "DOCSIS Baseline Privacy Plus Interface Specification,  
     Sections 4.2.1.8 and 4.2.2.6."  
 ::= { docsBpi2CmtsTEKEntry 17 }

--  
 -- The CMTS Multicast Objects Group  
 --

docsBpi2CmtsMulticastObjects OBJECT IDENTIFIER  
 ::= { docsBpi2CmtsObjects 4 }

--  
 -- The CMTS IP Multicast Mapping Table, indexed by  
 -- docsBpi2CmtsIpMulticastIndex, and by ifIndex  
 --

```

docsBpi2CmtsIpMulticastMapTable          OBJECT-TYPE
    SYNTAX          SEQUENCE OF DocsBpi2CmtsIpMulticastMapEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "This table maps multicast IP addresses to SAIDs.
        If a multicast IP address is mapped by multiple rows
        in the table, the row with the lowest
        docsBpi2CmtsIpMulticastIndex must be utilized for the
        mapping."
    ::= { docsBpi2CmtsMulticastObjects 1 }

docsBpi2CmtsIpMulticastMapEntry          OBJECT-TYPE
    SYNTAX          DocsBpi2CmtsIpMulticastMapEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "Each entry contains objects describing the mapping of
        a set of multicast IP address and the mask to one SAID
        associated to a CMTS MAC Interface, as well as associated
        message counters and error information."
    INDEX          { ifIndex, docsBpi2CmtsIpMulticastIndex }
    ::= { docsBpi2CmtsIpMulticastMapTable 1 }

DocsBpi2CmtsIpMulticastMapEntry ::= SEQUENCE {
    docsBpi2CmtsIpMulticastIndex          Unsigned32,
    docsBpi2CmtsIpMulticastAddressType    InetAddressType,
    docsBpi2CmtsIpMulticastAddress        InetAddress,
    docsBpi2CmtsIpMulticastMask           InetAddress,
    docsBpi2CmtsIpMulticastSAId           DocsSAIdOrZero,
    docsBpi2CmtsIpMulticastSAType         DocsBpkmSAType,
    docsBpi2CmtsIpMulticastDataEncryptAlg DocsBpkmDataEncryptAlg,
    docsBpi2CmtsIpMulticastDataAuthentAlg DocsBpkmDataAuthentAlg,
    docsBpi2CmtsIpMulticastSAMapRequests  Counter32,
    docsBpi2CmtsIpMulticastSAMapReplies   Counter32,
    docsBpi2CmtsIpMulticastSAMapRejects    Counter32,
    docsBpi2CmtsIpMulticastSAMapRejectErrorCode
                                           INTEGER,
    docsBpi2CmtsIpMulticastSAMapRejectErrorString
                                           SnmpAdminString,
    docsBpi2CmtsIpMulticastMapControl      RowStatus,
    docsBpi2CmtsIpMulticastMapStorageType  StorageType
}

docsBpi2CmtsIpMulticastIndex            OBJECT-TYPE
    SYNTAX          Unsigned32 (1..4294967295)

```

```

MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION
    "The index of this row.  Conceptual rows having the
    value 'permanent' need not allow write-access to any
    columnar objects in the row."
 ::= { docsBpi2CmtsIpMulticastMapEntry 1 }

```

```

docsBpi2CmtsIpMulticastAddressType OBJECT-TYPE
    SYNTAX          InetAddressType
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "The type of Internet address for
        docsBpi2CmtsIpMulticastAddress
        and docsBpi2CmtsIpMulticastMask."
    DEFVAL { ipv4 }
    ::= { docsBpi2CmtsIpMulticastMapEntry 2 }

```

```

docsBpi2CmtsIpMulticastAddress          OBJECT-TYPE
    SYNTAX          InetAddress
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This object represents the IP multicast address
        to be mapped, in conjunction with
        docsBpi2CmtsIpMulticastMask.  The type of this address is
        determined by the value of the object
        docsBpi2CmtsIpMulticastAddressType."
    ::= { docsBpi2CmtsIpMulticastMapEntry 3 }

```

```

docsBpi2CmtsIpMulticastMask          OBJECT-TYPE
    SYNTAX          InetAddress
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This object represents the IP multicast address mask
        for this row.
        An IP multicast address matches this row if the logical
        AND of the address with docsBpi2CmtsIpMulticastMask is
        identical to the logical AND of
        docsBpi2CmtsIpMulticastAddr with
        docsBpi2CmtsIpMulticastMask.  The type of this address is
        determined by the value of the object
        docsBpi2CmtsIpMulticastAddressType.
        Note: For IPv6, this object need not represent a
        contiguous netmask; e.g., to associate a SAID to a
        multicast group matching 'any' multicast scope.  The TC

```

InetAddressPrefixLength is not used, as it only represents contiguous netmask."

::= { docsBpi2CmtsIpMulticastMapEntry 4 }

docsBpi2CmtsIpMulticastSAId OBJECT-TYPE

SYNTAX DocsSAIdOrZero

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object represents the multicast SAID to be used in this IP multicast address mapping entry."

::= { docsBpi2CmtsIpMulticastMapEntry 5 }

docsBpi2CmtsIpMulticastSAType OBJECT-TYPE

SYNTAX DocsBpkmSAType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of this object is the type of security association. 'dynamic' does not apply to CMs running in BPI mode. Unicast BPI TEKs must utilize the 'primary' encoding, and multicast BPI TEKs must utilize the 'static' encoding. By default, SNMP created entries set this object to 'static' if not set at row creation."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 2.1.3."

::= { docsBpi2CmtsIpMulticastMapEntry 6 }

docsBpi2CmtsIpMulticastDataEncryptAlg OBJECT-TYPE

SYNTAX DocsBpkmDataEncryptAlg

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of this object is the data encryption algorithm for this IP."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 4.2.2.20."

DEFVAL { des56CbcMode }

::= { docsBpi2CmtsIpMulticastMapEntry 7 }

docsBpi2CmtsIpMulticastDataAuthentAlg OBJECT-TYPE

SYNTAX DocsBpkmDataAuthentAlg

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of this object is the data authentication

algorithm for this IP."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section 4.2.2.20."

DEFVAL { none }

::= { docsBpi2CmtsIpMulticastMapEntry 8 }

docsBpi2CmtsIpMulticastSAMapRequests OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the number of times the CMTS has received an SA Map Request message for this IP. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section 4.2.1.10."

::= { docsBpi2CmtsIpMulticastMapEntry 9 }

docsBpi2CmtsIpMulticastSAMapReplies OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the number of times the CMTS has transmitted an SA Map Reply message for this IP. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section 4.2.1.11."

::= { docsBpi2CmtsIpMulticastMapEntry 10 }

docsBpi2CmtsIpMulticastSAMapRejects OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the number of times the CMTS has transmitted an SA Map Reject message for this IP. Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other

times as indicated by the value of  
ifCounterDiscontinuityTime."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section 4.2.1.12."

::= { docsBpi2CmtsIpMulticastMapEntry 11 }

docsBpi2CmtsIpMulticastSAMapRejectErrorCode OBJECT-TYPE

SYNTAX INTEGER {  
none(1),  
unknown(2),  
noAuthForRequestedDSFlow(9),  
dsFlowNotMappedToSA(10)  
}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the enumerated  
description of the Error-Code in the most recent SA Map  
Reject message sent in response to an SA Map Request for  
this IP. It has the value unknown(2) if the last Error-Code  
Value was 0 and none(1) if no SA MAP Reject message has  
been received since entry creation."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Sections 4.2.1.12 and 4.2.2.15."

::= { docsBpi2CmtsIpMulticastMapEntry 12 }

docsBpi2CmtsIpMulticastSAMapRejectErrorString OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE (0..128))

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the text string in  
the most recent SA Map Reject message sent in response to  
an SA Map Request for this IP. It is a zero length string  
if no SA Map Reject message has been received since entry  
creation."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Sections 4.2.1.12 and 4.2.2.6."

::= { docsBpi2CmtsIpMulticastMapEntry 13 }

docsBpi2CmtsIpMulticastMapControl OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION



"This object controls and reflects the IP multicast address mapping entry. There is no restriction on the ability to change values in this row while the row is active.

A created row can be set to active only after the corresponding instances of docsBpi2CmtsIpMulticastAddress, docsBpi2CmtsIpMulticastMask, docsBpi2CmtsIpMulticastSAId, and docsBpi2CmtsIpMulticastSAType have all been set."

::= { docsBpi2CmtsIpMulticastMapEntry 14 }

docsBpi2CmtsIpMulticastMapStorageType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The storage type for this conceptual row.

Conceptual rows having the value 'permanent' need not allow write-access to any columnar objects in the row."

::= { docsBpi2CmtsIpMulticastMapEntry 15 }

--

-- The CMTS Multicast SAID Authorization Table,

-- indexed by ifIndex by

-- multicast SAID by CM MAC address

--

docsBpi2CmtsMulticastAuthTable OBJECT-TYPE

SYNTAX SEQUENCE OF DocsBpi2CmtsMulticastAuthEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table describes the multicast SAID authorization for each CM on each CMTS MAC interface."

::= { docsBpi2CmtsMulticastObjects 2 }

docsBpi2CmtsMulticastAuthEntry OBJECT-TYPE

SYNTAX DocsBpi2CmtsMulticastAuthEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Each entry contains objects describing the key authorization of one cable modem for one multicast SAID for one CMTS MAC interface.

Row entries persist after re-initialization of the managed system."

INDEX { ifIndex, docsBpi2CmtsMulticastAuthSAId,  
docsBpi2CmtsMulticastAuthCmMacAddress }

::= { docsBpi2CmtsMulticastAuthTable 1 }

```

DocsBpi2CmtsMulticastAuthEntry ::= SEQUENCE
{
    docsBpi2CmtsMulticastAuthSAId          DocsSAId,
    docsBpi2CmtsMulticastAuthCmMacAddress   MacAddress,
    docsBpi2CmtsMulticastAuthControl        RowStatus
}

docsBpi2CmtsMulticastAuthSAId OBJECT-TYPE
    SYNTAX          DocsSAId
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "This object represents the multicast SAID for
        authorization."
    ::= { docsBpi2CmtsMulticastAuthEntry 1 }

docsBpi2CmtsMulticastAuthCmMacAddress OBJECT-TYPE
    SYNTAX          MacAddress
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "This object represents the MAC address of the CM
        to which the multicast SAID authorization applies."
    ::= { docsBpi2CmtsMulticastAuthEntry 2 }

docsBpi2CmtsMulticastAuthControl OBJECT-TYPE
    SYNTAX          RowStatus
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "The status of this conceptual row for the
        authorization of multicast SAIDs to CMs."
    ::= { docsBpi2CmtsMulticastAuthEntry 3 }

--
-- CMTS Cert Objects
--

docsBpi2CmtsCertObjects OBJECT IDENTIFIER
    ::= { docsBpi2CmtsObjects 5 }

--
-- CMTS Provisioned CM Cert Table
--

docsBpi2CmtsProvisionedCmCertTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF
                    DocsBpi2CmtsProvisionedCmCertEntry

```

MAX-ACCESS not-accessible  
 STATUS current  
 DESCRIPTION

"A table of CM certificate trust entries provisioned to the CMTS. The trust object for a certificate in this table has an overriding effect on the validity object of a certificate in the authorization table, as long as the entire contents of the two certificates are identical."

::= { docsBpi2CmtsCertObjects 1 }

docsBpi2CmtsProvisionedCmCertEntry OBJECT-TYPE

SYNTAX DocsBpi2CmtsProvisionedCmCertEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the CMTS's provisioned CM certificate table. Row entries persist after re-initialization of the managed system."

REFERENCE

"Data-Over-Cable Service Interface Specifications: Operations Support System Interface Specification SP-OSSiv2.0-I05-040407, Section 6.2.14"

INDEX { docsBpi2CmtsProvisionedCmCertMacAddress }

::= { docsBpi2CmtsProvisionedCmCertTable 1 }

DocsBpi2CmtsProvisionedCmCertEntry ::= SEQUENCE

```
{
  docsBpi2CmtsProvisionedCmCertMacAddress MacAddress,
  docsBpi2CmtsProvisionedCmCertTrust      INTEGER,
  docsBpi2CmtsProvisionedCmCertSource     INTEGER,
  docsBpi2CmtsProvisionedCmCertStatus     RowStatus,
  docsBpi2CmtsProvisionedCmCert
    DocsX509ASN1DEREncodedCertificate
}
```

docsBpi2CmtsProvisionedCmCertMacAddress OBJECT-TYPE

SYNTAX MacAddress

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The index of this row."

::= { docsBpi2CmtsProvisionedCmCertEntry 1 }

docsBpi2CmtsProvisionedCmCertTrust OBJECT-TYPE

```
SYNTAX INTEGER {
    trusted(1),
    untrusted(2)
}
```

```

MAX-ACCESS      read-create
STATUS          current
DESCRIPTION
    "Trust state for the provisioned CM certificate entry.
    Note: Setting this object need only override the validity
    of CM certificates sent in future authorization requests;
    instantaneous effect need not occur."
REFERENCE
    "DOCSIS Baseline Privacy Plus Interface Specification,
    Section 9.4.1."
DEFVAL { untrusted }
::= { docsBpi2CmtsProvisionedCmCertEntry 2 }

```

```

docsBpi2CmtsProvisionedCmCertSource      OBJECT-TYPE
SYNTAX      INTEGER {
                                snmp(1),
                                configurationFile(2),
                                externalDatabase(3),
                                other(4)
                                }
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "This object indicates how the certificate reached the
    CMTS. Other(4) means that it originated from a source not
    identified above."
REFERENCE
    "DOCSIS Baseline Privacy Plus Interface Specification,
    Section 9.4.1."
::= { docsBpi2CmtsProvisionedCmCertEntry 3 }

```

```

docsBpi2CmtsProvisionedCmCertStatus OBJECT-TYPE
SYNTAX  RowStatus
MAX-ACCESS read-create
STATUS  current
DESCRIPTION
    "The status of this conceptual row. Values in this row
    cannot be changed while the row is 'active'."
::= { docsBpi2CmtsProvisionedCmCertEntry 4 }

```

```

docsBpi2CmtsProvisionedCmCert OBJECT-TYPE
SYNTAX      DocsX509ASN1DEREncodedCertificate
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
    "An X509 DER-encoded Certificate Authority
    certificate.
    Note: The zero-length OCTET STRING must be returned, on

```

```

reads, if the entire certificate is not retained in the
CMTS."
REFERENCE
    "DOCSIS Baseline Privacy Plus Interface Specification,
    Section 9.2."
 ::= { docsBpi2CmtsProvisionedCmCertEntry 5 }

--
-- CMTS CA Cert Table
--

docsBpi2CmtsCACertTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF DocsBpi2CmtsCACertEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "The table of known Certificate Authority certificates
        acquired by this device."
    ::= { docsBpi2CmtsCertObjects 2 }

docsBpi2CmtsCACertEntry OBJECT-TYPE
    SYNTAX          DocsBpi2CmtsCACertEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "A row in the Certificate Authority certificate
        table. Row entries with the trust status 'trusted',
        'untrusted', or 'root' persist after re-initialization
        of the managed system."
    REFERENCE
        "Data-Over-Cable Service Interface Specifications:
        Operations Support System Interface Specification
        SP-OSSiv2.0-I05-040407, Section 6.2.14"
    INDEX           { docsBpi2CmtsCACertIndex }
    ::= { docsBpi2CmtsCACertTable 1 }

DocsBpi2CmtsCACertEntry ::= SEQUENCE {
    docsBpi2CmtsCACertIndex      Unsigned32,
    docsBpi2CmtsCACertSubject    SnmpAdminString,
    docsBpi2CmtsCACertIssuer     SnmpAdminString,
    docsBpi2CmtsCACertSerialNumber OCTET STRING,
    docsBpi2CmtsCACertTrust      INTEGER,
    docsBpi2CmtsCACertSource     INTEGER,
    docsBpi2CmtsCACertStatus     RowStatus,
    docsBpi2CmtsCACert
                                DocsX509ASN1DEREncodedCertificate,
    docsBpi2CmtsCACertThumbprint OCTET STRING
}

```

```
docsBpi2CmtsCACertIndex OBJECT-TYPE
    SYNTAX          Unsigned32 (1.. 4294967295)
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "The index for this row."
    ::= { docsBpi2CmtsCACertEntry 1 }
```

```
docsBpi2CmtsCACertSubject OBJECT-TYPE
    SYNTAX          SnmpAdminString
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The subject name exactly as it is encoded in the
        X509 certificate.
        The organizationName portion of the certificate's subject
        name must be present. All other fields are optional. Any
        optional field present must be prepended with <CR>
        (carriage return, U+000D) <LF> (line feed, U+000A).
        Ordering of fields present must conform to the following:

        organizationName <CR> <LF>
        countryName <CR> <LF>
        stateOrProvinceName <CR> <LF>
        localityName <CR> <LF>
        organizationalUnitName <CR> <LF>
        organizationalUnitName=<Manufacturing Location> <CR> <LF>
        commonName"
    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,
        Section 9.2.4"
    ::= { docsBpi2CmtsCACertEntry 2 }
```

```
docsBpi2CmtsCACertIssuer OBJECT-TYPE
    SYNTAX          SnmpAdminString
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The issuer name exactly as it is encoded in the
        X509 certificate.
        The commonName portion of the certificate's issuer
        name must be present. All other fields are optional. Any
        optional field present must be prepended with <CR>
        (carriage return, U+000D) <LF> (line feed, U+000A).
        Ordering of fields present must conform to the following:

        CommonName <CR><LF>
        countryName <CR><LF>
```

```

stateOrProvinceName <CR><LF>
localityName <CR><LF>
organizationName <CR><LF>
organizationalUnitName <CR><LF>
organizationalUnitName=<Manufacturing Location>"
REFERENCE
    "DOCSIS Baseline Privacy Plus Interface Specification,
    Section 9.2.4"
 ::= { docsBpi2CmtsCACertEntry 3 }

```

```

docsBpi2CmtsCACertSerialNumber OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE (1..32))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "This CA certificate's serial number, represented as
        an octet string."
    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,
        Section 9.2.2"
    ::= { docsBpi2CmtsCACertEntry 4 }

```

```

docsBpi2CmtsCACertTrust OBJECT-TYPE
    SYNTAX      INTEGER {
        trusted (1),
        untrusted (2),
        chained (3),
        root (4)
    }
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "This object controls the trust status of this
        certificate. Root certificates must be given root(4)
        trust; manufacturer certificates must not be given root(4)
        trust. Trust on root certificates must not change.
        Note: Setting this object need only affect the validity of
        CM certificates sent in future authorization requests;
        instantaneous effect need not occur."
    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,
        Section 9.4.1"
    DEFVAL { chained }
    ::= { docsBpi2CmtsCACertEntry 5 }

```

```

docsBpi2CmtsCACertSource OBJECT-TYPE
    SYNTAX      INTEGER {
        snmp (1),

```

```

        configurationFile (2),
        externalDatabase (3),
        other (4),
        authenticInfo (5),
        compiledIntoCode (6)
    }
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object indicates how the certificate reached
        the CMTS. Other(4) means that it originated from a source
        not identified above."
    REFERENCE
        "DOCSIS Baseline Privacy Plus Interface Specification,
        Section 9.4.1"
    ::= { docsBpi2CmtsCACertEntry 6 }

```

## docsBpi2CmtsCACertStatus OBJECT-TYPE

```

    SYNTAX          RowStatus
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "The status of this conceptual row. An attempt
        to set writable columnar values while this row is active
        behaves as follows:
        - Sets to the object docsBpi2CmtsCACertTrust are allowed.
        - Sets to the object docsBpi2CmtsCACert will return an
          error of 'inconsistentValue'.
        A newly created entry cannot be set to active until the
        value of docsBpi2CmtsCACert is being set."
    ::= { docsBpi2CmtsCACertEntry 7 }

```

## docsBpi2CmtsCACert OBJECT-TYPE

```

    SYNTAX          DocsX509ASN1DEREncodedCertificate
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "An X509 DER-encoded Certificate Authority
        certificate.
        To help identify certificates, either this object or
        docsBpi2CmtsCACertThumbprint must be returned by a CMTS for
        self-signed CA certificates.

```

Note: The zero-length OCTET STRING must be returned, on reads, if the entire certificate is not retained in the CMTS."

## REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,



Section 9.2."

::= { docsBpi2CmtsCACertEntry 8 }

docsBpi2CmtsCACertThumbprint OBJECT-TYPE

SYNTAX OCTET STRING (SIZE (20))

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The SHA-1 hash of a CA certificate.

To help identify certificates, either this object or docsBpi2CmtsCACert must be returned by a CMTS for self-signed CA certificates.

Note: The zero-length OCTET STRING must be returned, on reads, if the CA certificate thumb print is not retained in the CMTS."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section 9.4.3"

::= { docsBpi2CmtsCACertEntry 9 }

--

-- Authenticated Software Download Objects

--

--

-- Note: the authenticated software download objects are a  
-- CM requirement only.

--

docsBpi2CodeDownloadControl OBJECT IDENTIFIER

::= { docsBpi2MIBObjects 4 }

docsBpi2CodeDownloadStatusCode OBJECT-TYPE

SYNTAX INTEGER {  
    configFileCvcVerified (1),  
    configFileCvcRejected (2),  
    snmpCvcVerified (3),  
    snmpCvcRejected (4),  
    codeFileVerified (5),  
    codeFileRejected (6),  
    other (7)  
}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value indicates the result of the latest config file CVC verification, SNMP CVC verification, or code file

verification."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Sections D.3.3.2 and D.3.5.1."

::= { docsBpi2CodeDownloadControl 1 }

docsBpi2CodeDownloadStatusString OBJECT-TYPE

SYNTAX SnmpAdminString

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object indicates the additional  
information to the status code. The value will include  
the error code and error description, which will be defined  
separately."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section D.3.7"

::= { docsBpi2CodeDownloadControl 2 }

docsBpi2CodeMfgOrgName OBJECT-TYPE

SYNTAX SnmpAdminString

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the device manufacturer's  
organizationName."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section D.3.2.2."

::= { docsBpi2CodeDownloadControl 3 }

docsBpi2CodeMfgCodeAccessStart OBJECT-TYPE

SYNTAX DateAndTime (SIZE(11))

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object is the device manufacturer's  
current codeAccessStart value. This value will always  
refer to Greenwich Mean Time (GMT), and the value  
format must contain TimeZone information (fields 8-10)."

REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification,  
Section D.3.2.2."

::= { docsBpi2CodeDownloadControl 4 }

docsBpi2CodeMfgCvcAccessStart OBJECT-TYPE

SYNTAX DateAndTime (SIZE(11))

MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION  
   "The value of this object is the device manufacturer's current cvcAccessStart value. This value will always refer to Greenwich Mean Time (GMT), and the value format must contain TimeZone information (fields 8-10)."  
 REFERENCE  
   "DOCSIS Baseline Privacy Plus Interface Specification, Section D.3.2.2."  
 ::= { docsBpi2CodeDownloadControl 5 }

docsBpi2CodeCoSignerOrgName OBJECT-TYPE  
 SYNTAX SnmpAdminString  
 MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION  
   "The value of this object is the co-signer's organizationName. The value is a zero length string if the co-signer is not specified."  
 REFERENCE  
   "DOCSIS Baseline Privacy Plus Interface Specification, Section D.3.2.2."  
 ::= { docsBpi2CodeDownloadControl 6 }

docsBpi2CodeCoSignerCodeAccessStart OBJECT-TYPE  
 SYNTAX DateAndTime (SIZE(11))  
 MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION  
   "The value of this object is the co-signer's current codeAccessStart value. This value will always refer to Greenwich Mean Time (GMT), and the value format must contain TimeZone information (fields 8-10).  
   If docsBpi2CodeCoSignerOrgName is a zero length string, the value of this object is meaningless."  
 REFERENCE  
   "DOCSIS Baseline Privacy Plus Interface Specification, Section D.3.2.2."  
 ::= { docsBpi2CodeDownloadControl 7 }

docsBpi2CodeCoSignerCvcAccessStart OBJECT-TYPE  
 SYNTAX DateAndTime (SIZE(11))  
 MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION  
   "The value of this object is the co-signer's current cvcAccessStart value. This value will always refer to

Greenwich Mean Time (GMT), and the value format must contain TimeZone information (fields 8-10).

If docsBpi2CodeCoSignerOrgName is a zero length string, the value of this object is meaningless."

#### REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section D.3.2.2."

::= { docsBpi2CodeDownloadControl 8 }

docsBpi2CodeCvcUpdate OBJECT-TYPE

SYNTAX DocsX509ASN1DEREncodedCertificate

MAX-ACCESS read-write

STATUS current

#### DESCRIPTION

"Setting a CVC to this object triggers the device to verify the CVC and update the cvcAccessStart values. The content of this object is then discarded. If the device is not enabled to upgrade codefiles, or if the CVC verification fails, the CVC will be rejected. Reading this object always returns the zero-length OCTET STRING."

#### REFERENCE

"DOCSIS Baseline Privacy Plus Interface Specification, Section D.3.3.2.2."

::= { docsBpi2CodeDownloadControl 9 }

--

-- The BPI+ MIB Conformance Statements (with a placeholder for  
-- notifications)

--

docsBpi2Notification OBJECT IDENTIFIER

::= { docsBpi2MIB 0 }

docsBpi2Conformance OBJECT IDENTIFIER

::= { docsBpi2MIB 2 }

docsBpi2Compliances OBJECT IDENTIFIER

::= { docsBpi2Conformance 1 }

docsBpi2Groups OBJECT IDENTIFIER

::= { docsBpi2Conformance 2 }

docsBpi2CmCompliance MODULE-COMPLIANCE

STATUS current

#### DESCRIPTION

"This is the compliance statement for CMs that implement the DOCSIS Baseline Privacy Interface Plus."

MODULE -- docsBpi2MIB

```
-- unconditionally mandatory group
MANDATORY-GROUPS {
    docsBpi2CmGroup,
    docsBpi2CodeDownloadGroup
}

-- constrain on Encryption algorithms
OBJECT docsBpi2CmTEKDataEncryptAlg
    SYNTAX      DocsBpkmDataEncryptAlg {
                                none(0),
                                des56CbcMode(1),
                                des40CbcMode(2)
                        }
    DESCRIPTION
        "It is compliant to support des56CbcMode(1) and
        des40CbcMode(2) for data encryption algorithms."

-- constrain on Integrity algorithms
OBJECT docsBpi2CmTEKDataAuthentAlg
    SYNTAX      DocsBpkmDataAuthentAlg {
                                none(0)
                        }
    DESCRIPTION
        "It is compliant to not support data message
        authentication algorithms."

-- constrain on IP addressing
OBJECT docsBpi2CmIpMulticastAddressType
    SYNTAX      InetAddressType { ipv4(1) }
    DESCRIPTION
        "An implementation is only required to support IPv4
        addresses. Support for other address types may be defined
        in future versions of this MIB module."

-- constrain on IP addressing
OBJECT docsBpi2CmIpMulticastAddress
    SYNTAX      InetAddress (SIZE(4))
    DESCRIPTION
        "An implementation is only required to support IPv4
        addresses Other address types support may be defined in
        future versions of this MIB module."

-- constrain on Encryption algorithms
OBJECT docsBpi2CmCryptoSuiteDataEncryptAlg
    SYNTAX      DocsBpkmDataEncryptAlg {
                                none(0),
                                des56CbcMode(1),
                                des40CbcMode(2)
                        }
```

```

    }
    DESCRIPTION
        "It is compliant to only support des56CbcMode(1)
        and des40CbcMode(2) for data encryption algorithms."

-- constrain on Integrity algorithms
OBJECT docsBpi2CmCryptoSuiteDataAuthentAlg
    SYNTAX      DocsBpkmDataAuthentAlg {
                                none(0)
        }
    DESCRIPTION
        "It is compliant to not support data message
        authentication algorithms."

 ::= { docsBpi2Compliances 1 }

docsBpi2CmtsCompliance MODULE-COMPLIANCE
    STATUS      current
    DESCRIPTION
        "This is the compliance statement for CMTSS that
        implement the DOCSIS Baseline Privacy Interface Plus."

    MODULE -- docsBpi2MIB
    -- unconditionally mandatory group
    MANDATORY-GROUPS {
        docsBpi2CmtsGroup
    }

-- unconditionally optional group
GROUP      docsBpi2CodeDownloadGroup
    DESCRIPTION
        "This group is optional for CMTSes. The implementation
        decision of this group is left to the vendor"

-- constrain on mandatory range

OBJECT      docsBpi2CmtsDefaultAuthLifetime
    SYNTAX      Integer32 (86400..6048000)
    DESCRIPTION
        "The refined range corresponds to the minimum and
        maximum values in operational networks."

-- constrain on mandatory range

OBJECT      docsBpi2CmtsDefaultTEKLifetime
    SYNTAX      Integer32 (1800..604800)
    DESCRIPTION

```

"The refined range corresponds to the minimum and maximum values in operational networks."

-- constrain on mandatory range

```
OBJECT      docsBpi2CmtsAuthCmLifetime
SYNTAX      Integer32 (86400..6048000)
DESCRIPTION
    "The refined range corresponds to the minimum and
    maximum values in operational networks."
```

-- constrain on Encryption algorithms

```
OBJECT      docsBpi2CmtsTEKDataEncryptAlg
SYNTAX      DocsBpkmDataEncryptAlg {
                                none(0),
                                des56CbcMode(1),
                                des40CbcMode(2)
                                }
DESCRIPTION
    "It is compliant to only support des56CbcMode(1)
    and des40CbcMode(2) for data encryption."
```

-- constrain on Integrity algorithms

```
OBJECT      docsBpi2CmtsTEKDataAuthentAlg
SYNTAX      DocsBpkmDataAuthentAlg {
                                none(0)
                                }
DESCRIPTION
    "It is compliant to not support data message
    authentication algorithms."
```

-- constrain on mandatory range

```
OBJECT      docsBpi2CmtsTEKLifetime
SYNTAX      Integer32 (1800..604800)
DESCRIPTION
    "The refined range corresponds to the minimum and
    maximum values in operational networks."
```

-- constrain on access

-- constrain on IP Addressing

```
OBJECT      docsBpi2CmtsIpMulticastAddressType
SYNTAX      InetAddressType { ipv4(1) }
MIN-ACCESS  read-only
DESCRIPTION
```

"Write access is not required.  
An implementation is only required to support IPv4  
addresses. Support for other address types may be defined  
in future versions of this MIB module."

OBJECT docsBpi2CmtsIpMulticastAddress  
SYNTAX InetAddress (SIZE(4))  
MIN-ACCESS read-only  
DESCRIPTION  
"Write access is not required.  
An implementation is only required to support IPv4  
addresses. Support for other address types may be defined  
in future versions of this MIB module."

OBJECT docsBpi2CmtsIpMulticastMask  
SYNTAX InetAddress (SIZE(4))  
MIN-ACCESS read-only  
DESCRIPTION  
"Write access is not required.  
An implementation is only required to support IPv4  
addresses. Support for other address types may be defined  
in future versions of this MIB module."

-- constrain on access

OBJECT docsBpi2CmtsIpMulticastSAId  
MIN-ACCESS read-only  
DESCRIPTION  
"Write access is not required."

OBJECT docsBpi2CmtsIpMulticastSAType  
MIN-ACCESS read-only  
DESCRIPTION  
"Write access is not required."

-- constrain on access  
-- constrain on Encryption algorithms

OBJECT docsBpi2CmtsIpMulticastDataEncryptAlg  
SYNTAX DocsBpkmDataEncryptAlg {  
none(0),  
des56CbcMode(1),  
des40CbcMode(2)  
}  
MIN-ACCESS read-only  
DESCRIPTION  
"Write access is not required.  
It is compliant to only support des56CbcMode(1)



```

        and des40CbcMode(2) for data encryption"

-- constrain on access
-- constrain on Integrity algorithms

OBJECT      docsBpi2CmtsIpMulticastDataAuthentAlg
SYNTAX      DocsBpkmDataAuthentAlg {
                                none(0)
                                }
MIN-ACCESS   read-only
DESCRIPTION
    "Write access is not required.
    It is compliant to not support data message
    authentication algorithms."

-- constrain on access

OBJECT      docsBpi2CmtsMulticastAuthControl
MIN-ACCESS   read-only
DESCRIPTION
    "Write access is not required."

    ::= { docsBpi2Compliances 2 }

docsBpi2CmGroup      OBJECT-GROUP
OBJECTS {
    docsBpi2CmPrivacyEnable,
    docsBpi2CmPublicKey,
    docsBpi2CmAuthState,
    docsBpi2CmAuthKeySequenceNumber,
    docsBpi2CmAuthExpiresOld,
    docsBpi2CmAuthExpiresNew,
    docsBpi2CmAuthReset,
    docsBpi2CmAuthGraceTime,
    docsBpi2CmTEKGraceTime,
    docsBpi2CmAuthWaitTimeout,
    docsBpi2CmReauthWaitTimeout,
    docsBpi2CmOpWaitTimeout,
    docsBpi2CmRekeyWaitTimeout,
    docsBpi2CmAuthRejectWaitTimeout,
    docsBpi2CmSAMapWaitTimeout,
    docsBpi2CmSAMapMaxRetries,
    docsBpi2CmAuthentInfos,
    docsBpi2CmAuthRequests,
    docsBpi2CmAuthReplies,
    docsBpi2CmAuthRejects,
    docsBpi2CmAuthInvalids,
    docsBpi2CmAuthRejectErrorCode,

```

```

docsBpi2CmAuthRejectErrorString,
docsBpi2CmAuthInvalidErrorCode,
docsBpi2CmAuthInvalidErrorString,
docsBpi2CmTEKSAType,
docsBpi2CmTEKDataEncryptAlg,
docsBpi2CmTEKDataAuthentAlg,
docsBpi2CmTEKState,
docsBpi2CmTEKKeySequenceNumber,
docsBpi2CmTEKExpiresOld,
docsBpi2CmTEKExpiresNew,
docsBpi2CmTEKKeyRequests,
docsBpi2CmTEKKeyReplies,
docsBpi2CmTEKKeyRejects,
docsBpi2CmTEKInvalids,
docsBpi2CmTEKAuthPends,
docsBpi2CmTEKKeyRejectErrorCode,
docsBpi2CmTEKKeyRejectErrorString,
docsBpi2CmTEKInvalidErrorCode,
docsBpi2CmTEKInvalidErrorString,
docsBpi2CmIpMulticastAddressType,
docsBpi2CmIpMulticastAddress,
docsBpi2CmIpMulticastSAId,
docsBpi2CmIpMulticastSAMapState,
docsBpi2CmIpMulticastSAMapRequests,
docsBpi2CmIpMulticastSAMapReplies,
docsBpi2CmIpMulticastSAMapRejects,
docsBpi2CmIpMulticastSAMapRejectErrorCode,
docsBpi2CmIpMulticastSAMapRejectErrorString,
docsBpi2CmDeviceCmCert,
docsBpi2CmDeviceManufCert,
docsBpi2CmCryptoSuiteDataEncryptAlg,
docsBpi2CmCryptoSuiteDataAuthentAlg
}
STATUS          current
DESCRIPTION
    "This collection of objects provides CM BPI+ status
    and control."
 ::= { docsBpi2Groups 1 }

docsBpi2CmtsGroup  OBJECT-GROUP
    OBJECTS {
        docsBpi2CmtsDefaultAuthLifetime,
        docsBpi2CmtsDefaultTEKLifetime,
        docsBpi2CmtsDefaultSelfSignedManufCertTrust,
        docsBpi2CmtsCheckCertValidityPeriods,
        docsBpi2CmtsAuthentInfos,
        docsBpi2CmtsAuthRequests,
        docsBpi2CmtsAuthReplies,
    }

```

docsBpi2CmtsAuthRejects,  
docsBpi2CmtsAuthInvalids,  
docsBpi2CmtsSAMapRequests,  
docsBpi2CmtsSAMapReplies,  
docsBpi2CmtsSAMapRejects,  
docsBpi2CmtsAuthCmBpiVersion,  
docsBpi2CmtsAuthCmPublicKey,  
docsBpi2CmtsAuthCmKeySequenceNumber,  
docsBpi2CmtsAuthCmExpiresOld,  
docsBpi2CmtsAuthCmExpiresNew,  
docsBpi2CmtsAuthCmLifetime,  
docsBpi2CmtsAuthCmReset,  
docsBpi2CmtsAuthCmInfos,  
docsBpi2CmtsAuthCmRequests,  
docsBpi2CmtsAuthCmReplies,  
docsBpi2CmtsAuthCmRejects,  
docsBpi2CmtsAuthCmInvalids,  
docsBpi2CmtsAuthRejectErrorCode,  
docsBpi2CmtsAuthRejectErrorString,  
docsBpi2CmtsAuthInvalidErrorCode,  
docsBpi2CmtsAuthInvalidErrorString,  
docsBpi2CmtsAuthPrimarySAId,  
docsBpi2CmtsAuthBpkmCmCertValid,  
docsBpi2CmtsAuthBpkmCmCert,  
docsBpi2CmtsAuthCACertIndexPtr,  
docsBpi2CmtsTEKSAType,  
docsBpi2CmtsTEKDataEncryptAlg,  
docsBpi2CmtsTEKDataAuthentAlg,  
docsBpi2CmtsTEKLifetime,  
docsBpi2CmtsTEKKeySequenceNumber,  
docsBpi2CmtsTEKExpiresOld,  
docsBpi2CmtsTEKExpiresNew,  
docsBpi2CmtsTEKReset,  
docsBpi2CmtsKeyRequests,  
docsBpi2CmtsKeyReplies,  
docsBpi2CmtsKeyRejects,  
docsBpi2CmtsTEKInvalids,  
docsBpi2CmtsKeyRejectErrorCode,  
docsBpi2CmtsKeyRejectErrorString,  
docsBpi2CmtsTEKInvalidErrorCode,  
docsBpi2CmtsTEKInvalidErrorString,  
docsBpi2CmtsIpMulticastAddressType,  
docsBpi2CmtsIpMulticastAddress,  
docsBpi2CmtsIpMulticastMask,  
docsBpi2CmtsIpMulticastSAId,  
docsBpi2CmtsIpMulticastSAType,  
docsBpi2CmtsIpMulticastDataEncryptAlg,  
docsBpi2CmtsIpMulticastDataAuthentAlg,

```

docsBpi2CmtsIpMulticastSAMapRequests,
docsBpi2CmtsIpMulticastSAMapReplies,
docsBpi2CmtsIpMulticastSAMapRejects,
docsBpi2CmtsIpMulticastSAMapRejectErrorCode,
docsBpi2CmtsIpMulticastSAMapRejectErrorString,
docsBpi2CmtsIpMulticastMapControl,
docsBpi2CmtsIpMulticastMapStorageType,
docsBpi2CmtsMulticastAuthControl,
docsBpi2CmtsProvisionedCmCertTrust,
docsBpi2CmtsProvisionedCmCertSource,
docsBpi2CmtsProvisionedCmCertStatus,
docsBpi2CmtsProvisionedCmCert,
docsBpi2CmtsCACertSubject,
docsBpi2CmtsCACertIssuer,
docsBpi2CmtsCACertSerialNumber,
docsBpi2CmtsCACertTrust,
docsBpi2CmtsCACertSource,
docsBpi2CmtsCACertStatus,
docsBpi2CmtsCACert,
docsBpi2CmtsCACertThumbprint
}
STATUS          current
DESCRIPTION
    "This collection of objects provides CMTS BPI+ status
    and control."
 ::= { docsBpi2Groups 2 }

docsBpi2CodeDownloadGroup OBJECT-GROUP
    OBJECTS {
        docsBpi2CodeDownloadStatusCode,
        docsBpi2CodeDownloadStatusString,
        docsBpi2CodeMfgOrgName,
        docsBpi2CodeMfgCodeAccessStart,
        docsBpi2CodeMfgCvcAccessStart,
        docsBpi2CodeCoSignerOrgName,
        docsBpi2CodeCoSignerCodeAccessStart,
        docsBpi2CodeCoSignerCvcAccessStart,
        docsBpi2CodeCvcUpdate
    }
    STATUS          current
    DESCRIPTION
        "This collection of objects provides authenticated
        software download support."
 ::= { docsBpi2Groups 3 }

END

```

#### 4. Acknowledgements

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#### 5. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.
- [RFC2578] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Structure of Management Information Version 2 (SMIv2)", STD 58, RFC 2578, April 1999.
- [RFC2579] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Textual Conventions for SMIv2", STD 58, RFC 2579, April 1999.
- [RFC2580] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Conformance Statements for SMIv2", STD 58, RFC 2580, April 1999.
- [RFC3411] Harrington, D., Presuhn, R., and B. Wijnen, "An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks", STD 62, RFC 3411, December 2002.
- [RFC4001] Daniele, M., Haberman, B., Routhier, S., and J. Schoenwaelder, "Textual Conventions for Internet Network Addresses", RFC 4001, February 2005.
- [RFC2863] McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB", RFC 2863, June 2000.

- [RFC2670] St. Johns, M., "Radio Frequency (RF) Interface Management Information Base for MCNS/DOCSIS compliant RF interfaces", RFC 2670, August 1999.
- [DOCSIS] "Data-Over-Cable Service Interface Specifications: Baseline Privacy Plus Interface Specification SP-BPI+-I11-040407", DOCSIS, April 2004, available at <http://www.cablemodem.com>.  
<http://www.cablelabs.com/specifications/archives>.

## 6. Informative References

- [RFC3083] Woundy, R., "Baseline Privacy Interface Management Information Base for DOCSIS Compliant Cable Modems and Cable Modem Termination Systems", RFC 3083, March 2001.
- [RFC3410] Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework", RFC 3410, December 2002.
- [RFC3513] Hinden, R. and S. Deering, "Internet Protocol Version 6 (IPv6) Addressing Architecture", RFC 3513, April 2003.
- [DOCSIS-1.0] "Data-Over-Cable Service Interface Specifications: DOCSIS 1.0 Baseline Privacy Interface (BPI) ANSI/SCTE 22-2 2202, Available at <http://www.scte.org>.
- [DOCSIS-1.1] "Data-Over-Cable Service Interface Specifications: Operations Support System Interface Specification SP-OSSiv1.1-I07-030730", DOCSIS 1.1 July 2003, available at <http://www.cablemodem.com>.  
<http://www.cablelabs.com/specifications/archives>.
- [DOCSIS-2.0] "Data-Over-Cable Service Interface Specifications: Operations Support System Interface Specification SP-OSSiv2.0-I05-040407", DOCSIS 2.0 April 2004,  
<http://www.cablemodem.com>.  
<http://www.cablelabs.com/specifications/archives>.
- [IANA] "Protocol Numbers and Assignment Services", IANA,  
<http://www.iana.org/assignments/ianaiftype-mib>.

## 7. Security Considerations

There are a number of management objects defined in this MIB module with a MAX-ACCESS clause of read-write and/or read-create. Such objects may be considered sensitive or vulnerable in some network environments. The support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations. These are the tables and objects and their sensitivity/vulnerability:

- The following objects, if SNMP SET maliciously, could constitute denial of service or theft of service attacks or compromise the intended data privacy of users:

Objects related to the Baseline Privacy Key Management (BPKM)

docsBpi2CmAuthReset,  
docsBpi2CmtsAuthCmReset,  
docsBpi2CmtsTEKReset:

These objects are used for initiating a re-key process. A malicious massive SET attack may cause CMTS processing overload and may compromise the service.

docsBpi2CmtsDefaultAuthLifetime,  
docsBpi2CmtsDefaultTEKLifetime,  
docsBpi2CmtsAuthCmLifetime,  
docsBpi2CmtsTEKLifetime:

To minimize the risk of malicious or unintended short periods of time when key updates may lead to degradation or denial of service, implementers are encouraged to follow these objects' range constraints, as defined in the docsBpi2CmtsCompliance MODULE-COMPLIANCE clause for operational deployments.

docsBpi2CmtsDefaultSelfSignedManufCertTrust:

A malicious SET in a self-signed certificate as reject message, which may constitute denial of service. This object is designed for testing purposes; therefore, it is not RECOMMENDED for use in commercial deployments [DOCSIS]. Administrators can make use of View-based Access Control (VACM) introduced in section 7.9 of [RFC3410] to restrict write access to this object.

docsBpi2CmtsCheckCertValidityPeriods:

A malicious SET in this object that enables the period validity and a wrong clock time in the CMTS could cause denial of service, as CM authorization requests will be rejected.

For more details in the validation of CM certificates, refer to section 9 of [DOCSIS] .

Objects related to the CM only:

Objects in docsBpi2CmDeviceCertTable

docsBpi2CmDeviceCmCert:

This object is not harmful, considering that a CM received a Certificate during the manufacturing process. Therefore, the object access becomes read-only. See the object DESCRIPTION clause in section 3 for details.

Objects for Secure Software Download in table docsBpi2CodeDownloadControl:

docsBpi2CodeCvcUpdate:

A malicious SET on this object may not constitute a risk, since the CM holds the DOCSIS root key to verify the CVC authenticity. The operator, if configured, could receive a notification for event occurrences, which may lead to detecting the source of the attack. Moreover, [DOCSIS] recommends that CMs CVC be regularly updated to minimize the risk of potential code-signing keys being compromised (e.g., by configuration file).

Objects related to the CMTS only:

Objects in docsBpi2CmtsProvisionedCmCertTable and docsBpi2CmtsCACertTable containing CM Certificates and Certificate Authority information, respectively:

docsBpi2CmtsProvisionedCmCertTrust,  
docsBpi2CmtsProvisionedCmCertStatus,  
docsBpi2CmtsProvisionedCmCert,  
docsBpi2CmtsCACertStatus,  
docsBpi2CmtsCACert:

A malicious SET on these objects may constitute a denial of service attack that will be experienced after the CMs perform authorization requests. It does not affect CMs in the authorized state.

Objects in multicast tables docsBpi2CmtsIpMulticastMapTable and docsBpi2CmtsMulticastAuthTable:

docsBpi2CmtsIpMulticastAddressType,  
docsBpi2CmtsIpMulticastAddress,  
docsBpi2CmtsIpMulticastMaskType,



docsBpi2CmtsIpMulticastMask,  
docsBpi2CmtsIpMulticastSAId,  
docsBpi2CmtsIpMulticastSAType:

Malicious SET on these objects may cause misconfiguration, causing interruption of the users' active multicast applications.

docsBpi2CmtsIpMulticastDataEncryptAlg,  
docsBpi2CmtsIpMulticastDataAuthentAlg:

Malicious SETs on these objects may create service misconfiguration, causing service interruption or theft of service if encryption algorithms are removed for the multicast groups.

docsBpi2CmtsIpMulticastMapControl,  
docsBpi2CmtsMulticastAuthControl:

Malicious SETs on these objects may remove and/or disable customers and/or multicast groups, causing service disruption. This may also constitute theft of service by authorizing non-subscribed users to multicast groups or by adding other multicast groups in the forward path.

Some of the readable objects in this MIB module (i.e., objects with a MAX-ACCESS other than not-accessible) may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP. These are the tables and objects and their sensitivity/vulnerability:

Objects in docsBpi2CmBaseTable, docsBpi2CmTEKTable,  
docsBpi2CmtsBaseTable, docsBpi2CmtsAuthTable,  
docsBpi2CmtsTEKTable, docsBpi2CmtsProvisionedCmCertTable, and  
docsBpi2CmtsCACertTable:

If this information is accessible, attackers may use it to distinguish users configured to work without data encryption (e.g., docsBpi2CmPrivacyEnable) and to know current Baseline Privacy parameters in the network.

Objects in docsBpi2CmIpMulticastMapTable and  
docsBpi2CmtsMulticastAuthTable:

In addition to the vulnerabilities around BPI plus multicast objects described in the previous part, the read-only objects of this table may help attackers monitor the status of the intrusion.

Objects in docsBpi2CodeDownloadControl:

In addition to the vulnerability of the read-write object docsBpi2CodeCvcUpdate, attackers may be able to monitor the status of a denial of service using Secure Software Download.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPsec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module.

It is RECOMMENDED that implementers consider the security features as provided by the SNMPv3 framework (see [RFC3410], section 8), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

BPI+ Encryption Algorithms:

The BPI+ Traffic Encryption Keys (TEK) defined in the DOCSIS BPI+ specification [DOCSIS] use 40-bit or 56-bit DES for encryption (DES CBC mode). Currently, there is no mechanism or algorithm defined for data integrity.

Due to the DES cryptographic weaknesses, future revisions of the DOCSIS BPI+ specification should introduce more advanced encryption algorithms, as proposed in the DocsBpkmDataEncryptAlg textual convention, to overcome the progress in cheaper and faster hardware or software decryption tools. Future revisions of the DOCSIS BPI+ specification [DOCSIS] should also adopt authentication algorithms, as described in the DocsBpkmDataAuthentAlg textual convention.

It is important to note that frequent key changes do not necessarily help in mitigating or reducing the risks of a DES attack. Indeed, the traffic encryption keys, which are configured on a per cable modem basis and per BPI+ multicast group, can be utilized to decrypt old traffic, even when they are no longer in active use.

Note that, not exempt to the same recommendations above, the CM BPI+ authorization protocol uses triple DES encryption, which offers improved robustness in comparison to DES for CM authorization and TEK re-key management.

## 8. IANA Considerations

The MIB module in this document uses the following IANA-assigned OBJECT IDENTIFIER value, recorded in the SMI Numbers registry:

Descriptor	OBJECT IDENTIFIER Value
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docsBpi2MIB	{ mib-2 126 }

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