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Radio Frequency (RF) Interface Management Information Base for MCNS/DOCSIS compliant RF interfaces

Status of this Memo

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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 basic set of managed objects for SNMP-based management of MCNS/DOCSIS compliant Radio Frequency (RF) interfaces.

This memo specifies a MIB module in a manner that is compliant to the SNMP SMIv2 [5][6][7]. The set of objects are consistent with the SNMP framework and existing SNMP standards.

This memo is a product of the IPCDN working group within the Internet Engineering Task Force. Comments are solicited and should be addressed to the working group's mailing list at ipcdn@terayon.com and/or the author.

Table of Contents

1. The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

- An overall architecture, described in RFC 2571 [1].
- Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of Management Information (SMI) is called SMIv1 and described in STD 16, RFC 1155 [2], STD 16, RFC 1212 [3] and RFC 1215 [4]. The second version, called SMIv2, is described in STD 58, RFC 2578 [5], STD 58, RFC 2579 [6] and STD 58, RFC 2580 [7].
- Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in RFC 1157 [8]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in RFC 1901 [9] and RFC 1906 [10]. The third version of the message protocol is called SNMPv3 and described in RFC 1906 [10], RFC 2572 [11] and RFC 2574 [12].
- Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, RFC 1157 [8]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [13].
- A set of fundamental applications described in RFC 2573 [14] and the view-based access control mechanism described in RFC 2575 [15].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the mechanisms defined in the SMI.

This memo specifies a MIB module that is compliant to the SMIv2. A MIB conforming to the SMIv1 can be produced through the appropriate translations. The resulting translated MIB MUST be semantically equivalent, except where objects or events are omitted because no translation is possible (use of Counter64). Some machine readable information in SMIv2 will be converted into textual descriptions in SMIv1 during the translation process. However, this loss of machine readable information is not considered to change the semantics of the MIB.

2. Glossary

The terms in this document are derived either from normal cable system usage, or from the documents associated with the Data Over Cable Service Interface Specification process.

2.1. CATV

Originally "Community Antenna Television", now used to refer to any cable or hybrid fiber and cable system used to deliver video signals to a community.

2.2. Channel

A specific frequency allocation with an RF medium, specified by channel width in Hertz (cycles per second) and by center frequency. Within the US Cable Systems, upstream channels are generally allocated from the 5-42MHz range while down stream channels are generally allocated from the 50-750MHz range depending on the capabilities of the given system. The typical broadcast channel width in the US is 6MHz. Upstream channel widths for DOCSIS vary.

2.3. CM Cable Modem.

A CM acts as a "slave" station in a DOCSIS compliant cable data system.

2.4. CMTS Cable Modem Termination System.

A generic term covering a cable bridge or cable router in a head-end.
A CMTS acts as the master station in a DOCSIS compliant cable data system. It is the only station that transmits downstream, and it controls the scheduling of upstream transmissions by its associated CMs.

2.5. Codeword

See [16]. A characteristic of the Foward Error Correction scheme used
above the RF media layer.

2.6. Data Packet

The payload portion of the MAC Packet.

2.7. dBmV

Decibel relative to one milli-volt. A measure of RF power.

2.8. DOCSIS

"Data Over Cable Interface Specification". A term referring to the ITU-T J.112 Annex B standard for cable modem systems [20].

2.9. Downstream

The direction from the head-end towards the subscriber.

2.10. Head-end

The origination point in most cable systems of the subscriber video signals.

2.11. MAC Packet

A DOCSIS PDU.

2.12. MCNS

"Multimedia Cable Network System". Generally replaced in usage by DOCSIS.

2.13. Mini-slot

See [16]. In general, an interval of time which is allocated by the CMTS to a given CM for that CM to transmit in an upstream direction.

2.14. QPSK Quadrature Phase Shift Keying.

A particular modulation scheme on an RF medium. See [19].

2.15. QAM Quadrature Amplitude Modulation.

A particular modulation scheme on on RF medium. Usually expressed with a number indicating the size of the modulation constellation (e.g. 16 QAM). See [19], or any other book on digital communications over RF for a complete explanation of this.

2.16. RF

Radio Frequency.

2.17. Symbol-times

See [16]. A characteristic of the RF modulation scheme.

2.18. Upstream

The direction from the subscriber towards the head-end.

3. Overview

This MIB provides a set of objects required for the management of MCNS/DOCSIS compliant Cable Modem (CM) and Cable Modem Termination System (CMTS) RF interfaces. The specification is derived in part from the parameters and protocols described in DOCSIS Radio Frequency Interface Specification [16].

3.1. Structure of the MIB

This MIB is structured as three groups:

- Management information pertinent to both Cable Modems (CM) and Cable Modem Termination Systems (CMTS) (docsIfBaseObjects).
- Management information pertinent to Cable Modems only (docsIfCmObjects).
- Management information pertinent to Cable Modem Termination Systems only (docsIfCmtsObjects).

Tables within each of these groups group objects functionally - e.g. Quality of Service, Channel characteristics, MAC layer management, etc. Rows created automatically (e.g. by the device according to the hardware configuration) may and generally will have a mixture of configuration and status objects within them. Rows that are meant to be created by the management station are generally restricted to configuration (read-create) objects.

3.1.1. docsIfBaseObjects

docsIfDownstreamChannelTable - This table describes the active downstream channels for a CMTS and the received downstream channel for a CM.

docsIfUpstreamChannelTable - This table describes the active upstream channels for a a CMTS and the current upstream transmission channel for a CM.

docsIfQosProfileTable - This table describes the valid Quality of

Service service profiles for the cable data system.

docsIfSignalQualityTable - This table is used to monitor RF signal quality characteristics of received signals.

3.1.2. docsIfCmObjects

docsIfCmMacTable - This table is used to monitor the DOCSIS MAC interface and can be considered an extension to the ifEntry.

docsIfCmServiceTable - This table describes the upstream service queues available at this CM. There is a comparable table at the CMTS, docsIfCmtsServiceEntry, which describes the service queues from the point of view of the CMTS.

3.1.3. docsIfCmtsObjects

docsIfCmtsStatusTable - This table provides a set of aggregated counters which roll-up values and events that occur on the underlying sub-interfaces.

docsIfCmtsCmStatusTable - This table is used to hold information about known (e.g. registered) cable modems on the system serviced by this CMTS.

docsIfCmtsServiceEntry - This table provides access to the information related to upstream service queues.

docsIfCmtsModulationTable - This table allows control over the modulation profiles for RF channels associated with this CMTS.

docsIfCmtsMacToCmTable - This table allows fast access into the docsIfCmtsCmTable via a MAC address (of the CM) interface.

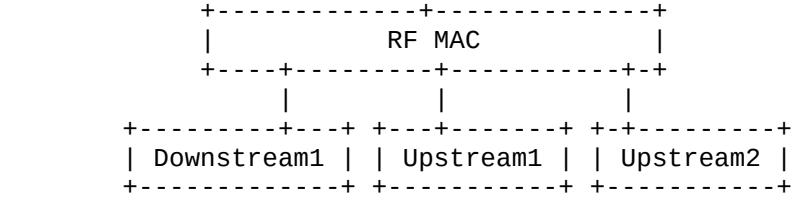
3.2. Relationship to the Interfaces MIB

This section clarifies the relationship of this MIB to the Interfaces MIB [17]. Several areas of correlation are addressed in the following subsections. The implementor is referred to the Interfaces MIB document in order to understand the general intent of these areas.

3.2.1. Layering Model

An instance of ifEntry exists for each RF Downstream interface, for each RF Upstream interface, and for each RF MAC layer. The ifStackTable [17] MUST be implemented to identify relationships among sub-interfaces.

The following example illustrates a MAC interface with one downstream and two upstream channels.



As can be seen from this example, the RF MAC interface is layered on top of the downstream and upstream interfaces.

In this example, the assignment of index values could be as follows:

ifIndex	ifType	Description
1	docsCableMaclayer(127)	CATV MAC Layer
2	docsCableDownstream(128)	CATV Downstream interface
3	docsCableUpstream(129)	CATV Upstream interface
4	docsCableUpstream(129)	CATV Upstream interface

The corresponding ifStack entries would then be:

IfStackHigherLayer	ifStackLowerLayer
0	1
1	2
1	3
1	4
2	0
3	0
4	0

The same interface model can also be used in Telephony or Telco

Return systems. A pure Telco Return system (Cable Modem as well as Cable Modem Termination System) would not have upstream, but only downstream cable channels. Systems supporting both Telco Return and cable upstream channels can use the above model without modification.

Telco Return Upstream channel(s) are handled by the appropriate MIBs, such as PPP or Modem MIBs.

3.2.2. Virtual Circuits

This medium does not support virtual circuits and this area is not applicable to this MIB.

3.2.3. ifTestTable

The ifTestTable is not supported by this MIB.

3.2.4. ifRcvAddressTable

The ifRcvAddressTable is not supported by this MIB.

3.2.5. ifEntry

This section documents only the differences from the requirements specified in the Interfaces MIB. See that MIB for columns omitted from the descriptions below.

3.2.5.1. ifEntry for Downstream interfaces

The ifEntry for Downstream interfaces supports the ifGeneralInformationGroup and the ifPacketGroup of the Interfaces MIB. This is an output only interface at the CMTS and all input status counters - ifIn* - will return zero. This is an input only interface at the CM and all output status counters - ifOut* - will return zero.

3.2.5.1.1. ifEntry for Downstream interfaces in Cable Modem Termination Systems

ifTable	Comments
ifIndex	Each RF Cable Downstream interface is represented by an ifEntry.
ifType	The IANA value of docsCableDownstream(128).

ifSpeed	Return the speed of this downstream channel. The returned value the raw bandwidth in bits/s of this interface. This is the symbol rate multiplied with the number of bits per symbol.
ifPhysAddress	Return an empty string.
ifAdminStatus	The administrative status of this interface.
ifOperStatus	The current operational status of this interface.
ifMtu	The size of the largest frame which can be sent on this interface, specified in octets. The value includes the length of the MAC header.

ifInOctets	Return zero.
ifInUcastPkts	Return zero.
ifInMulticastPkts	Return zero.
ifInBroadcastPkts	Return zero.
ifInDiscards	Return zero.
ifInErrors	Return zero.
ifInUnknownProtos	Return zero.
ifOutOctets	The total number of octets transmitted on this interface. This includes MAC packets as well as data packets, and includes the length of the MAC header.
ifOutUcastPkts	The number of Unicast packets transmitted on this interface. This includes MAC packets as well as data packets.
ifOutMulticastPkts	Return the number of Multicast packets transmitted on this interface. This includes MAC packets as well as data packets.
ifOutBroadcastPkts	Return the number of broadcast packets transmitted on this interface.

	This includes MAC packets as well as data packets.
ifOutDiscards	The total number of outbound packets which were discarded. Possible reasons are: buffer shortage.
ifOutErrors	The number of packets which could not be transmitted due to errors.
ifPromiscuousMode	Return false.

3.2.5.1.2. ifEntry for Downstream interfaces in Cable Modems

ifTable	Comments
ifIndex	Each RF Cable Downstream interface is represented by an ifEntry.
ifType	The IANA value of docsCableDownstream(128).
ifSpeed	Return the speed of this downstream channel. The returned value the raw bandwidth in bits/s of this interface. This is the symbol rate multiplied with the number of bits per symbol.
ifPhysAddress	Return an empty string.
ifAdminStatus	The administrative status of this interface.
ifOperStatus	The current operational status of this interface.
ifMtu	The size of the largest frame which can be received from this interface, specified in octets. The value includes the length of the MAC header.
ifInOctets	The total number of octets received on this interface. This includes data packets as well as MAC layer packets, and includes the length of the MAC header.
ifInUcastPkts	The number of Unicast packets received on this

interface. This includes data packets as well as MAC layer packets.

ifInMulticastPkts Return the number of Multicast packets received on this interface. This includes data packets as well as MAC layer packets.

ifInBroadcastPkts Return the number of Broadcast packets received on this interface. This includes data packets as well as MAC layer packets.

ifInDiscards The total number of received packets which have been discarded.
The possible reasons are: buffer shortage.

ifInErrors The number of inbound packets that contained errors preventing them from being deliverable to higher layers.

Possible reasons are: MAC FCS error.

ifInUnknownProtos The number of frames with an unknown packet type. These are MAC frames with an unknown packet type.

ifOutOctets Return zero.

ifOutUcastPkts Return zero.

ifOutMulticastPkts
Return zero.

ifOutBroadcastPkts
Return zero.

ifOutDiscards Return zero.

ifOutErrors Return zero.

ifPromiscuousMode Refer to the Interfaces MIB.

3.2.5.2. ifEntry for Upstream interfaces

The ifEntry for Upstream interfaces supports the ifGeneralInformationGroup and the ifPacketGroup of the Interfaces MIB. This is an input only interface at the CMTS and all output status counters - ifOut* - will return zero. This is an output only interface at the CM and all input status counters - ifIn* - will return zero.

3.2.5.2.1. ifEntry for Upstream interfaces in Cable Modem Termination Systems

ifTable	Comments
ifIndex	Each RF Cable Upstream interface is represented by an ifEntry.
ifType	The IANA value of docsCableUpstream(129).
ifSpeed	Return the speed of this upstream channel. The returned value is the raw bandwidth in bits/s of this interface, regarding the highest speed modulation profile that is defined. This is the symbol rate multiplied with the number of bits per symbol for this modulation profile.

ifPhysAddress	Return an empty string.
ifAdminStatus	The administrative status of this interface.
ifOperStatus	The current operational status of this interface.
ifMtu	The size of the largest frame which can be received on this interface, specified in octets. The value includes the length of the MAC header.
ifInOctets	The total number of octets received on this interface. This includes data packets as well as MAC layer packets, and includes the length of the MAC header.
ifInUcastPkts	The number of Unicast packets received on this interface. This includes data packets as well as MAC layer packets.
ifInMulticastPkts	Return the number of Multicast packets received on this interface. This includes data packets as well as MAC layer packets.
ifInBroadcastPkts	Return the number of Broadcast packets received on this interface. This includes data packets as well as MAC layer packets.
ifInDiscards	The total number of received packets which have

	been discarded. The possible reasons are: buffer shortage.
ifInErrors	The number of inbound packets that contained errors preventing them from being deliverable to higher layers. Possible reasons are: MAC FCS error.
ifInUnknownProtos	The number of frames with an unknown packet type. This are MAC frames with an unknown packet type.
ifOutOctets	Return zero.
ifOutUcastPkts	Return zero.
ifOutMulticastPkts	Return zero.
ifOutBroadcastPkts	Return zero.

ifOutDiscards	Return zero.
ifOutErrors	Return zero.

3.2.5.2.2. ifEntry for Upstream interfaces in Cable Modems

ifTable	Comments
ifIndex	Each RF Cable Upstream interface is represented by an ifEntry.
ifType	The IANA value of docsCableUpstream(129).
ifSpeed	Return the speed of this upstream channel. The returned value is the raw bandwidth in bits/s of this interface, regarding the highest speed modulation profile that is defined. This is the symbol rate multiplied with the number of bits per symbol for this modulation profile.
ifPhysAddress	Return an empty string.
ifAdminStatus	The administrative status of this interface.
ifOperStatus	The current operational status of this interface.

ifMtu	The size of the largest frame which can be transmitted on this interface, specified in octets. The value includes the length of the MAC header.
ifInOctets	Return zero.
ifInUcastPkts	Return zero.
ifInMulticastPkts	Return zero.
ifInBroadcastPkts	Return zero.
ifInDiscards	Return zero.
ifInErrors	Return zero.
ifInUnknownProtos	Return zero.

ifOutOctets	The total number of octets transmitted on this interface. This includes MAC packets as well as data packets, and includes the length of the MAC header.
ifOutUcastPkts	The number of Unicast packets transmitted on this interface. This includes MAC packets as well as data packets.
ifOutMulticastPkts	Return the number of Multicast packets transmitted on this interface. This includes MAC packets as well as data packets.
ifOutBroadcastPkts	Return the number of broadcast packets transmitted on this interface. This includes MAC packets as well as data packets.
ifOutDiscards	The total number of outbound packets which were discarded. Possible reasons are: buffer shortage.
ifOutErrors	The number of packets which could not be transmitted due to errors.

ifPromiscuousMode Return false.

3.2.5.3. ifEntry for the MAC Layer

The ifEntry for the MAC Layer supports the ifGeneralInformationGroup and the ifPacketGroup of the Interfaces MIB. This interface provides an aggregate view of status for the lower level Downstream and Upstream interfaces.

ifTable	Comments
ifIndex	Each RF Cable MAC layer entity is represented by an ifEntry.
ifType	The IANA value of docsCableMaclayer(127).
ifSpeed	Return zero.
ifPhysAddress	Return the physical address of this interface.
ifAdminStatus	The administrative status of this interface.

ifOperStatus	The current operational status of the MAC layer interface.
ifHighSpeed	Return zero.
ifMtu	Return 1500.
ifInOctets	The total number of data octets received on this interface, targeted for upper protocol layers.
ifInUcastPkts	The number of Unicast packets received on this interface, targeted for upper protocol layers.
ifInMulticastPkts	Return the number of Multicast packets received on this interface, targeted for upper protocol layers.
ifInBroadcastPkts	Return the number of Broadcast packets received on this interface, targeted for upper protocol layers.
ifInDiscards	The total number of received packets which have been discarded.

The possible reasons are: buffer shortage.

ifInErrors The number of inbound packets that contained errors preventing them from being deliverable to higher layers.
Possible reasons are: data packet FCS error, invalid MAC header.

ifInUnknownProtos The number of frames with an unknown packet type. This is the number of data packets targeted for upper protocol layers with an unknown packet type.

ifOutOctets The total number of octets, received from upper protocol layers and transmitted on this interface.

ifOutUcastPkts The number of Unicast packets, received from upper protocol layers and transmitted on this interface.

ifOutMulticastPkts
Return the number of Multicast packets received from upper protocol layers and transmitted on this interface.

ifOutBroadcastPkts
Return the number of broadcast packets received from upper protocol layers and transmitted on this interface.

ifOutDiscards The total number of outbound packets which were discarded. Possible reasons are: buffer shortage.

ifOutErrors The number of packets which could not be transmitted due to errors.

ifPromiscuousMode Refer to the Interfaces MIB.

4. Definitions

```
DOCS-IF-MIB DEFINITIONS ::= BEGIN

  IMPORTS
        MODULE-IDENTITY,
        OBJECT-TYPE,
  -- do not import        BITS,
        Unsigned32,
        Integer32,
        Counter32,
        TimeTicks,
        IpAddress,
        transmission
                FROM SNMPv2-SMI
        TEXTUAL-CONVENTION,
        MacAddress,
        RowStatus,
        TruthValue,
        TimeInterval,
        TimeStamp
```

```
                FROM SNMPv2-TC
        OBJECT-GROUP,

        MODULE-COMPLIANCE
                FROM SNMPv2-CONF
        ifIndex, InterfaceIndexOrZero
                FROM IF-MIB;

docsIfMib MODULE-IDENTITY
        LAST-UPDATED    "9908190000Z" -- August 19, 1999
        ORGANIZATION    "IETF IPCDN Working Group"
        CONTACT-INFO
            "        Michael StJohns
             Postal: @Home Network
                     425 Broadway
                     Redwood City, CA
                     U.S.A.
             Phone:  +1 650 569 5368
             E-mail: stjohns@corp.home.net"
        DESCRIPTION
            "This is the MIB Module for MCNS/DOCSIS compliant Radio
             Frequency (RF) interfaces in Cable Modems (CM) and
             Cable Modem Termination Systems (CMTS)."
        REVISION "9908190000Z"
        DESCRIPTION
            "Initial Version, published as RFC 2670.
             Modified by Mike StJohns to fix problems identified by
```



```
             the first pass of the MIB doctor.  Of special note,
             docsIfRangingResp and docsIfCmtsInsertionInterval were
             obsoleted and replaced by other objects with the same
             functionality, but more appropriate SYNTAX."
        ::= { transmission 127 }

-- Textual Conventions

TenthdBmV ::= TEXTUAL-CONVENTION
        DISPLAY-HINT "d-1"
        STATUS       current
        DESCRIPTION
            "This data type represents power levels that are normally
             expressed in dBmV. Units are in tenths of a dBmV;
             for example, 5.1 dBmV will be represented as 51."
        SYNTAX       Integer32

TenthdB ::= TEXTUAL-CONVENTION
        DISPLAY-HINT "d-1"
        STATUS       current
```

```
        DESCRIPTION
            "This data type represents power levels that are normally
             expressed in dB. Units are in tenths of a dB;
             for example, 5.1 dB will be represented as 51."
        SYNTAX       Integer32

docsIfMibObjects  OBJECT IDENTIFIER ::= { docsIfMib 1 }
docsIfBaseObjects OBJECT IDENTIFIER ::= { docsIfMibObjects 1 }
docsIfCmObjects   OBJECT IDENTIFIER ::= { docsIfMibObjects 2 }
docsIfCmtsObjects OBJECT IDENTIFIER ::= { docsIfMibObjects 3 }

--
-- BASE GROUP
--

--
-- The following table is implemented on both the Cable Modem (CM)
-- and the Cable Modem Termination System (CMTS).
--

docsIfDownstreamChannelTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF DocsIfDownstreamChannelEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "This table describes the attributes of downstream
             channels (frequency bands)."
        REFERENCE
```



```
            "DOCSIS Radio Frequency Interface Specification,
             Table 4-12 and Table 4-13."
        ::= { docsIfBaseObjects 1 }

docsIfDownstreamChannelEntry OBJECT-TYPE
        SYNTAX      DocsIfDownstreamChannelEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "An entry provides a list of attributes for a single
             Downstream channel.
             An entry in this table exists for each ifEntry with an
             ifType of docsCableDownstream(128)."
        INDEX { ifIndex }
        ::= { docsIfDownstreamChannelTable 1 }

DocsIfDownstreamChannelEntry ::= SEQUENCE {
            docsIfDownChannelId              Integer32,
            docsIfDownChannelFrequency       Integer32,
```

```
            docsIfDownChannelWidth            Integer32,
            docsIfDownChannelModulation       INTEGER,
            docsIfDownChannelInterleave       INTEGER,
            docsIfDownChannelPower            TenthdBmV
        }

docsIfDownChannelId OBJECT-TYPE
        SYNTAX      Integer32 (0..255)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The Cable Modem Termination System (CMTS) identification
             of the downstream channel within this particular MAC
             interface. If the interface is down, the object returns
             the most current value. If the downstream channel ID is
             unknown, this object returns a value of 0."
        ::= { docsIfDownstreamChannelEntry 1 }

docsIfDownChannelFrequency  OBJECT-TYPE
        SYNTAX      Integer32 (0..1000000000)
        UNITS       "hertz"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The center of the downstream frequency associated with
             this channel. This object will return the current tuner
             frequency. If a CMTS provides IF output, this object
             will return 0, unless this CMTS is in control of the
             final downstream RF frequency.  See the associated
```



```
             compliance object for a description of valid frequencies
             that may be written to this object."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Section 4.3.3."
        ::= { docsIfDownstreamChannelEntry 2 }

docsIfDownChannelWidth  OBJECT-TYPE
        SYNTAX      Integer32 (0..16000000)
        UNITS       "hertz"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The bandwidth of this downstream channel. Most
             implementations are expected to support a channel width
             of 6 MHz (North America) and/or 8 MHz (Europe).  See the
             associated compliance object for a description of the
             valid channel widths for this object."
```

```
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Table 4-12 and Table 4-13."
        ::= { docsIfDownstreamChannelEntry 3 }

docsIfDownChannelModulation OBJECT-TYPE
        SYNTAX      INTEGER {
            unknown(1),
            other(2),
            qam64(3),
            qam256(4)
        }
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The modulation type associated with this downstream
             channel. If the interface is down, this object either
             returns the configured value (CMTS), the most current
             value (CM), or the value of unknown(1).  See the
             associated conformance object for write conditions and
             limitations. See the reference for specifics on the
             modulation profiles implied by qam64 and qam256."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Section 3.6.2."
        ::= { docsIfDownstreamChannelEntry 4 }

docsIfDownChannelInterleave OBJECT-TYPE
        SYNTAX      INTEGER {
            unknown(1),
```



```
            other(2),
            taps8Increment16(3),
            taps16Increment8(4),
            taps32Increment4(5),
            taps64Increment2(6),
            taps128Increment1(7)
        }
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The Forward Error Correction (FEC) interleaving used
             for this downstream channel.
             Values are defined as follows:
             taps8Increment16(3):   protection 5.9/4.1 usec,
                                    latency .22/.15 msec
             taps16Increment8(4):   protection 12/8.2 usec,
                                    latency .48/.33 msec
```

```
             taps32Increment4(5):   protection 24/16 usec,
                                    latency .98/.68 msec
             taps64Increment2(6):   protection 47/33 usec,
                                    latency 2/1.4 msec
             taps128Increment1(7):  protection 95/66 usec,
                                    latency 4/2.8 msec
             If the interface is down, this object either returns
             the configured value (CMTS), the most current value (CM),
             or the value of unknown(1).
             The value of other(2) is returned if the interleave
             is known but not defined in the above list.
             See the associated conformance object for write
             conditions and limitations. See the reference for the FEC
             configuration described by the setting of this object."
         REFERENCE
             "DOCSIS Radio Frequency Interface Specification,
             Section 4.3.2."
         ::= { docsIfDownstreamChannelEntry 5 }

docsIfDownChannelPower OBJECT-TYPE
         SYNTAX      TenthdBmV
         UNITS       "dBmV"
         MAX-ACCESS  read-write
         STATUS      current
         DESCRIPTION
             "At the CMTS, the operational transmit power. At the CM,
             the received power level. May be set to zero at the CM
             if power level measurement is not supported.
             If the interface is down, this object either returns
             the configured value (CMTS), the most current value (CM)
             or the value of 0. See the associated conformance object
```



```
             for write conditions and limitations. See the reference
             for recommended and required power levels."
         REFERENCE
             "DOCSIS Radio Frequency Interface Specification,
             Table 4-12 and Table 4-13."
         ::= { docsIfDownstreamChannelEntry 6 }

--
-- The following table is implemented on both the CM and the CMTS.
-- For the CM, only attached channels appear in the table.  For the
-- CM, this table is read only as well.
--

docsIfUpstreamChannelTable OBJECT-TYPE
         SYNTAX      SEQUENCE OF DocsIfUpstreamChannelEntry
         MAX-ACCESS  not-accessible
```

```
        STATUS      current
        DESCRIPTION
            "This table describes the attributes of attached upstream
             channels (frequency bands)."
        ::= { docsIfBaseObjects 2 }

docsIfUpstreamChannelEntry OBJECT-TYPE
        SYNTAX      DocsIfUpstreamChannelEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "List of attributes for a single upstream channel.
             An entry in this table exists for each ifEntry with an
             ifType of docsCableUpstream(129)."
        INDEX { ifIndex }
        ::= { docsIfUpstreamChannelTable 1 }

DocsIfUpstreamChannelEntry ::= SEQUENCE {
            docsIfUpChannelId                     Integer32,
            docsIfUpChannelFrequency              Integer32,
            docsIfUpChannelWidth                  Integer32,
            docsIfUpChannelModulationProfile      Unsigned32,
            docsIfUpChannelSlotSize               Unsigned32,
            docsIfUpChannelTxTimingOffset         Unsigned32,
            docsIfUpChannelRangingBackoffStart    Integer32,
            docsIfUpChannelRangingBackoffEnd      Integer32,
            docsIfUpChannelTxBackoffStart         Integer32,
            docsIfUpChannelTxBackoffEnd           Integer32
        }

docsIfUpChannelId OBJECT-TYPE
        SYNTAX      Integer32 (0..255)
```



```
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The CMTS identification of the upstream channel."
        ::= { docsIfUpstreamChannelEntry 1 }

docsIfUpChannelFrequency OBJECT-TYPE
        SYNTAX      Integer32 (0..1000000000)
        UNITS       "hertz"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The center of the frequency band associated with this
             upstream channel. This object returns 0 if the frequency
             is undefined or unknown. Minimum permitted upstream
```

```
             frequency is 5,000,000 Hz for current technology.  See
             the associated conformance object for write conditions
             and limitations."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Table 2-2."
        ::= { docsIfUpstreamChannelEntry 2 }

docsIfUpChannelWidth OBJECT-TYPE
        SYNTAX      Integer32 (0..20000000)
        UNITS       "hertz"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The bandwidth of this upstream channel. This object
             returns 0 if the channel width is undefined or unknown.
             Minimum permitted channel width is 200,000 Hz currently.
             See the associated conformance object for write conditions
             and limitations."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Table 4-3."
        ::= { docsIfUpstreamChannelEntry 3 }

docsIfUpChannelModulationProfile OBJECT-TYPE
        SYNTAX      Unsigned32
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "An entry identical to the docsIfModIndex in the
             docsIfCmtsModulationTable that describes this channel.
             This channel is further instantiated there by a grouping
             of interval usage codes which together fully describe the
```



```
             channel modulation. This object returns 0 if the
             docsIfCmtsModulationTable entry does not exist or
             docsIfCmtsModulationTable is empty. See
             the associated conformance object for write conditions
             and limitations."
        ::= { docsIfUpstreamChannelEntry 4 }

docsIfUpChannelSlotSize OBJECT-TYPE
        SYNTAX      Unsigned32
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The number of 6.25 microsecond ticks in each upstream
mini-
```

```
             slot. Returns zero if the value is undefined or unknown.
             See the associated conformance object for write
             conditions and limitations."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Section 6.1.2.4."
        ::= { docsIfUpstreamChannelEntry 5 }

docsIfUpChannelTxTimingOffset OBJECT-TYPE
        SYNTAX      Unsigned32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "A measure of the current round trip time at the CM, or the
             maximum round trip time seen by the CMTS.  Used for timing
             of CM upstream transmissions to ensure synchronized
             arrivals at the CMTS. Units are in terms of
             (6.25 microseconds/64)."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Section 6.5."
        ::= { docsIfUpstreamChannelEntry 6 }

docsIfUpChannelRangingBackoffStart OBJECT-TYPE
        SYNTAX      Integer32 (0..16)
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The initial random backoff window to use when retrying
             Ranging Requests. Expressed as a power of 2. A value of 16
             at the CMTS indicates that a proprietary adaptive retry
             mechanism is to be used. See the associated conformance
             object for write conditions and limitations."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
```



```
             Section 6.4.4."
        ::= { docsIfUpstreamChannelEntry 7 }

docsIfUpChannelRangingBackoffEnd OBJECT-TYPE
        SYNTAX      Integer32 (0..16)
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The final random backoff window to use when retrying
             Ranging Requests. Expressed as a power of 2. A value of 16
             at the CMTS indicates that a proprietary adaptive retry
             mechanism is to be used. See the associated conformance
```

```
             object for write conditions and limitations."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Section 6.4.4."
        ::= { docsIfUpstreamChannelEntry 8 }

docsIfUpChannelTxBackoffStart OBJECT-TYPE
        SYNTAX      Integer32 (0..16)
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The initial random backoff window to use when retrying
             transmissions. Expressed as a power of 2. A value of 16
             at the CMTS indicates that a proprietary adaptive retry
             mechanism is to be used. See the associated conformance
             object for write conditions and limitations."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Section 6.4.4."
        ::= { docsIfUpstreamChannelEntry 9 }

docsIfUpChannelTxBackoffEnd OBJECT-TYPE
        SYNTAX      Integer32 (0..16)
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The final random backoff window to use when retrying
             transmissions. Expressed as a power of 2. A value of 16
             at the CMTS indicates that a proprietary adaptive retry
             mechanism is to be used. See the associated conformance
             object for write conditions and limitations."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Section 6.4.4."
        ::= { docsIfUpstreamChannelEntry 10 }
```



```
-- The following table describes the attributes of each class of
-- service.  The entries in this table are referenced from the
-- docsIfServiceEntries.  They exist as a separate table in order to
-- reduce redundant information in docsIfServiceTable.
--
-- This table is implemented at both the CM and the CMTS.
-- The CM need only maintain entries for the classes of service
-- referenced by its docsIfServiceTable.
--

docsIfQosProfileTable OBJECT-TYPE
```

```
        SYNTAX      SEQUENCE OF DocsIfQosProfileEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Describes the attributes for each class of service."
        ::= { docsIfBaseObjects 3 }

docsIfQosProfileEntry OBJECT-TYPE
        SYNTAX      DocsIfQosProfileEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Describes the attributes for a single class of service.

             If implemented as read-create in the Cable Modem
             Termination System, creation of entries in this table is
             controlled by the value of
docsIfCmtsQosProfilePermissions.

             If implemented as read-only, entries are created based
             on information in REG-REQ MAC messages received from
             Cable Modems (Cable Modem Termination System
             implementation), or based on information extracted from
             the TFTP option file (Cable Modem implementation).
             In the Cable Modem Termination system, read-only entries
             are removed if no longer referenced by
             docsIfCmtsServiceTable.

             An entry in this table must not be removed while it is
             referenced by an entry in docsIfCmServiceTable (Cable
Modem)
             or docsIfCmtsServiceTable (Cable Modem Termination
System).

             An entry in this table should not be changeable while
             it is referenced by an entry in docsIfCmtsServiceTable.

             If this table is created automatically, there should only
             be a single entry for each Class of Service. Multiple
             entries with the same Class of Service parameters are not
```



```
             recommended."
        INDEX { docsIfQosProfIndex }
        ::= { docsIfQosProfileTable 1 }

DocsIfQosProfileEntry ::= SEQUENCE {
            docsIfQosProfIndex              Integer32,
            docsIfQosProfPriority           Integer32,
```

```
            docsIfQosProfMaxUpBandwidth       Integer32,
            docsIfQosProfGuarUpBandwidth      Integer32,
            docsIfQosProfMaxDownBandwidth     Integer32,
            docsIfQosProfMaxTxBurst           Integer32,
            docsIfQosProfBaselinePrivacy      TruthValue,
            docsIfQosProfStatus               RowStatus
        }

docsIfQosProfIndex OBJECT-TYPE
        SYNTAX      Integer32 (1..16383)
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The index value which uniquely identifies an entry
             in the docsIfQosProfileTable."
        ::= { docsIfQosProfileEntry 1 }

docsIfQosProfPriority  OBJECT-TYPE
        SYNTAX      Integer32 (0..7)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "A relative priority assigned to this service when
             allocating bandwidth. Zero indicates lowest priority;
             and seven indicates highest priority.
             Interpretation of priority is device-specific.
             MUST NOT be changed while this row is active."
        DEFVAL { 0 }
        ::= { docsIfQosProfileEntry 2 }

docsIfQosProfMaxUpBandwidth OBJECT-TYPE
        SYNTAX      Integer32 (0..100000000)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The maximum upstream bandwidth, in bits per second,
             allowed for a service with this service class.
             Zero if there is no restriction of upstream bandwidth.
             MUST NOT be changed while this row is active."
        DEFVAL { 0 }
        ::= { docsIfQosProfileEntry 3 }
```



```
docsIfQosProfGuarUpBandwidth OBJECT-TYPE
        SYNTAX      Integer32 (0..100000000)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Minimum guaranteed upstream bandwidth, in bits per second,
```

```
             allowed for a service with this service class.
             MUST NOT be changed while this row is active."
        DEFVAL { 0 }
        ::= { docsIfQosProfileEntry 4 }

docsIfQosProfMaxDownBandwidth OBJECT-TYPE
        SYNTAX      Integer32 (0..100000000)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The maximum downstream bandwidth, in bits per second,
             allowed for a service with this service class.
             Zero if there is no restriction of downstream bandwidth.
             MUST NOT be changed while this row is active."
        DEFVAL { 0 }
        ::= { docsIfQosProfileEntry 5 }

docsIfQosProfMaxTxBurst OBJECT-TYPE
        SYNTAX      Integer32 (0..255)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The maximum number of mini-slots that may be requested
             for a single upstream transmission.
             A value of zero means there is no limit.
             MUST NOT be changed while this row is active."
        DEFVAL { 0 }
        ::= { docsIfQosProfileEntry 6 }

docsIfQosProfBaselinePrivacy  OBJECT-TYPE
        SYNTAX      TruthValue
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Indicates whether Baseline Privacy is enabled for this
             service class.
             MUST NOT be changed while this row is active."
        DEFVAL { false }
        ::= { docsIfQosProfileEntry 7 }

docsIfQosProfStatus OBJECT-TYPE
        SYNTAX      RowStatus
```



```
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "This is object is to used to create or delete rows in
             this table.  This object MUST NOT be changed from active
```

```
             while the row is referenced by the any entry in either
             docsIfCmServiceTable (on the CM), or the
             docsIfCmtsServiceTable (on the CMTS)."
        ::= { docsIfQosProfileEntry 8 }


docsIfSignalQualityTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF DocsIfSignalQualityEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "At the CM, describes the PHY signal quality of downstream
             channels. At the CMTS, describes the PHY signal quality of
             upstream channels. At the CMTS, this table may exclude
             contention intervals."
        ::= { docsIfBaseObjects 4 }

docsIfSignalQualityEntry OBJECT-TYPE
        SYNTAX      DocsIfSignalQualityEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "At the CM, describes the PHY characteristics of a
             downstream channel. At the CMTS, describes the PHY signal
             quality of an upstream channel.
             An entry in this table exists for each ifEntry with an
             ifType of docsCableUpstream(129) for Cable Modem
Termination
             Systems and docsCableDownstream(128) for Cable Modems."
        INDEX { ifIndex }
        ::= { docsIfSignalQualityTable 1 }

DocsIfSignalQualityEntry ::= SEQUENCE {
            docsIfSigQIncludesContention  TruthValue,
            docsIfSigQUnerroreds          Counter32,
            docsIfSigQCorrecteds          Counter32,
            docsIfSigQUncorrectables      Counter32,
            docsIfSigQSignalNoise         TenthdB,
            docsIfSigQMicroreflections    Integer32,
            docsIfSigQEqualizationData    OCTET STRING
        }

docsIfSigQIncludesContention OBJECT-TYPE
        SYNTAX      TruthValue
```



```
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
```

```
            "true(1) if this CMTS includes contention intervals in
             the counters in this table. Always false(2) for CMs."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Section 6.4.4"
        ::= { docsIfSignalQualityEntry 1 }

docsIfSigQUnerroreds OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Codewords received on this channel without error.
             This includes all codewords, whether or not they
             were part of frames destined for this device."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Section 4.2.3 and 4.3.6"
        ::= { docsIfSignalQualityEntry 2 }

docsIfSigQCorrecteds OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Codewords received on this channel with correctable
             errors. This includes all codewords, whether or not
             they were part of frames destined for this device."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Section 4.2.3 and 4.3.6"
        ::= { docsIfSignalQualityEntry 3 }

docsIfSigQUncorrectables OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Codewords received on this channel with uncorrectable
             errors. This includes all codewords, whether or not
             they were part of frames destined for this device."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Section 4.2.3 and 4.3.6"
        ::= { docsIfSignalQualityEntry 4 }
```



```
docsIfSigQSignalNoise OBJECT-TYPE
        SYNTAX      TenthdB
```

```
        UNITS       "dB"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Signal/Noise ratio as perceived for this channel.
             At the CM, describes the Signal/Noise of the downstream
             channel.  At the CMTS, describes the average Signal/Noise
             of the upstream channel."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Table 2-1 and 2-2"
        ::= { docsIfSignalQualityEntry 5 }

docsIfSigQMicroreflections OBJECT-TYPE
        SYNTAX      Integer32 (0..255)
        UNITS       "dBc"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Total microreflections including in-channel response
             as perceived on this interface, measured in dBc below
             the signal level.
             This object is not assumed to return an absolutely
             accurate value, but should give a rough indication
             of microreflections received on this interface.
             It is up to the implementor to provide information
             as accurate as possible."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Table 2-1 and 2-2"
        ::= { docsIfSignalQualityEntry 6 }

docsIfSigQEqualizationData OBJECT-TYPE
        SYNTAX      OCTET STRING
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "At the CM, returns the equalization data for the
downstream
             channel. At the CMTS, returns the average equalization
             data for the upstream channel. Returns an empty string
             if the value is unknown or if there is no equalization
             data available or defined."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Figure 6-23."
        ::= { docsIfSignalQualityEntry 7 }
```

```
--
-- CABLE MODEM GROUP
--

-- #######

--
-- The CM MAC Table
--

docsIfCmMacTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF DocsIfCmMacEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Describes the attributes of each CM MAC interface,
             extending the information available from ifEntry."
        ::= { docsIfCmObjects 1 }

docsIfCmMacEntry OBJECT-TYPE
        SYNTAX      DocsIfCmMacEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "An entry containing objects describing attributes of
             each MAC entry, extending the information in ifEntry.
             An entry in this table exists for each ifEntry with an
             ifType of docsCableMaclayer(127)."
        INDEX { ifIndex }
        ::= { docsIfCmMacTable 1 }

DocsIfCmMacEntry ::= SEQUENCE {
            docsIfCmCmtsAddress           MacAddress,
            docsIfCmCapabilities          BITS,
            docsIfCmRangingRespTimeout    TimeTicks,
            docsIfCmRangingTimeout        TimeInterval
        }

docsIfCmCmtsAddress OBJECT-TYPE
        SYNTAX      MacAddress
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Identifies the CMTS that is believed to control this MAC
             domain. At the CM, this will be the source address from
             SYNC, MAP, and other MAC-layer messages. If the CMTS is
             unknown, returns 00-00-00-00-00-00."
        ::= { docsIfCmMacEntry 1 }
```

```
docsIfCmCapabilities OBJECT-TYPE
        SYNTAX      BITS {
            atmCells(0),
            concatenation(1)
        }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Identifies the capabilities of the MAC implementation
             at this interface. Note that packet transmission is
             always supported. Therefore, there is no specific bit
             required to explicitely indicate this capability."
        ::= { docsIfCmMacEntry 2 }

-- This object has been obsoleted and replaced by
-- docsIfCmRangingTimeout to correct the typing to TimeInterval. New
-- implementations of the MIB should use docsIfCmRangingTimeout
instead.

docsIfCmRangingRespTimeout OBJECT-TYPE
        SYNTAX      TimeTicks
        MAX-ACCESS  read-write
        STATUS      obsolete
        DESCRIPTION
            "Waiting time for a Ranging Response packet."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Figure 7-6 and 7-7, timer T3."
        DEFVAL { 20 }
        ::= { docsIfCmMacEntry 3 }

docsIfCmRangingTimeout OBJECT-TYPE
        SYNTAX      TimeInterval
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "Waiting time for a Ranging Response packet."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Figure 7-6 and 7-7, timer T3."
        DEFVAL { 20 }
        ::= { docsIfCmMacEntry 4 }

--
-- CM status table.
-- This table is implemented only at the CM.
--

docsIfCmStatusTable OBJECT-TYPE
```

```
        SYNTAX      SEQUENCE OF DocsIfCmStatusEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "This table maintains a number of status objects
             and counters for Cable Modems."
        ::= { docsIfCmObjects 2 }

docsIfCmStatusEntry OBJECT-TYPE
        SYNTAX      DocsIfCmStatusEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "A set of status objects and counters for a single MAC
             layer instance in a Cable Modem.
             An entry in this table exists for each ifEntry with an
             ifType of docsCableMaclayer(127)."
        INDEX { ifIndex }
        ::= { docsIfCmStatusTable 1 }

DocsIfCmStatusEntry ::= SEQUENCE {
            docsIfCmStatusValue                     INTEGER,
            docsIfCmStatusCode                      OCTET STRING,
            docsIfCmStatusTxPower                   TenthdBmV,
            docsIfCmStatusResets                    Counter32,
            docsIfCmStatusLostSyncs                 Counter32,
            docsIfCmStatusInvalidMaps               Counter32,
            docsIfCmStatusInvalidUcds               Counter32,
--            docsIfCmStatusInvalidRangingResp        Counter32,
            docsIfCmStatusInvalidRangingResponses   Counter32,
--            docsIfCmStatusInvalidRegistrationResp   Counter32,
            docsIfCmStatusInvalidRegistrationResponses Counter32,
            docsIfCmStatusT1Timeouts                Counter32,
            docsIfCmStatusT2Timeouts                Counter32,
            docsIfCmStatusT3Timeouts                Counter32,
            docsIfCmStatusT4Timeouts                Counter32,
            docsIfCmStatusRangingAborteds           Counter32
        }

docsIfCmStatusValue OBJECT-TYPE
        SYNTAX      INTEGER {
            other(1),
            notReady(2),
            notSynchronized(3),
            phySynchronized(4),
            usParametersAcquired(5),
            rangingComplete(6),
            ipComplete(7),
```

```
            todEstablished(8),
            securityEstablished(9),
            paramTransferComplete(10),
            registrationComplete(11),
            operational(12),
            accessDenied(13)
        }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Current Cable Modem connectivity state, as specified
             in the RF Interface Specification."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Chapter 7.2."
        ::= { docsIfCmStatusEntry 1 }

docsIfCmStatusCode OBJECT-TYPE
        SYNTAX      OCTET STRING
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Status code for this Cable Modem as defined in the
             RF Interface Specification. The status code consists
             of a single character indicating error groups, followed
             by a two- or three-digit number indicating the status
             condition."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Cable Modem status codes."
        ::= { docsIfCmStatusEntry 2 }

docsIfCmStatusTxPower OBJECT-TYPE
        SYNTAX      TenthdBmV
        UNITS       "dBmV"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The operational transmit power for the attached upstream
             channel."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Section 4.2.8."
        ::= { docsIfCmStatusEntry 3 }

docsIfCmStatusResets OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
```

```
        STATUS      current
        DESCRIPTION
            "Number of times the CM reset or initialized
             this interface."
        ::= { docsIfCmStatusEntry 4 }

docsIfCmStatusLostSyncs OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Number of times the CM lost synchronization with
             the downstream channel."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Section 6.5."
        ::= { docsIfCmStatusEntry 5 }

docsIfCmStatusInvalidMaps OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Number of times the CM received invalid MAP messages."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Section 6.3.2.3 and 6.4.2."
        ::= { docsIfCmStatusEntry 6 }

docsIfCmStatusInvalidUcds OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Number of times the CM received invalid UCD messages."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Section 6.3.2.2."
        ::= { docsIfCmStatusEntry 7 }

-- docsIfCmStatusInvalidRangingResp replaced for Counter32
-- naming requirements

docsIfCmStatusInvalidRangingResponses OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
```

```
            "Number of times the CM received invalid ranging response
             messages."
        ::= { docsIfCmStatusEntry 8 }

-- docsIfCmStatusInvalidRegistrationResp replaced for
-- Counter32 naming requirements
docsIfCmStatusInvalidRegistrationResponses OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Number of times the CM received invalid registration
             response messages."
        ::= { docsIfCmStatusEntry 9 }

docsIfCmStatusT1Timeouts OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Number of times counter T1 expired in the CM."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Figure 7-3."
        ::= { docsIfCmStatusEntry 10 }

docsIfCmStatusT2Timeouts OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Number of times counter T2 expired in the CM."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Figure 7-6."
        ::= { docsIfCmStatusEntry 11 }

docsIfCmStatusT3Timeouts OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Number of times counter T3 expired in the CM."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Figure 7-6 and 7-7."
        ::= { docsIfCmStatusEntry 12 }
```

```
docsIfCmStatusT4Timeouts OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Number of times counter T4 expired in the CM."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Figure 7-7."
        ::= { docsIfCmStatusEntry 13 }

docsIfCmStatusRangingAborteds OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Number of times the ranging process was aborted
             by the CMTS."
        ::= { docsIfCmStatusEntry 14 }

--
-- The Cable Modem Service Table
--

docsIfCmServiceTable  OBJECT-TYPE
        SYNTAX      SEQUENCE OF DocsIfCmServiceEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Describes the attributes of each upstream service queue
             on a CM."
        ::= { docsIfCmObjects 3 }

docsIfCmServiceEntry OBJECT-TYPE
        SYNTAX      DocsIfCmServiceEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Describes the attributes of an upstream bandwidth service
             queue.
             An entry in this table exists for each Service ID.
             The primary index is an ifIndex with an ifType of
             docsCableMaclayer(127)."
        INDEX { ifIndex, docsIfCmServiceId }
        ::= { docsIfCmServiceTable 1 }

DocsIfCmServiceEntry ::= SEQUENCE {
            docsIfCmServiceId               Integer32,
```

```
            docsIfCmServiceQosProfile       Integer32,
            docsIfCmServiceTxSlotsImmed     Counter32,
            docsIfCmServiceTxSlotsDed       Counter32,
            docsIfCmServiceTxRetries        Counter32,

--            docsIfCmServiceTxExceeded       Counter32,
            docsIfCmServiceTxExceededs      Counter32,
            docsIfCmServiceRqRetries        Counter32,
--            docsIfCmServiceRqExceeded       Counter32
            docsIfCmServiceRqExceededs      Counter32
        }

docsIfCmServiceId OBJECT-TYPE
        SYNTAX      Integer32 (1..16383)
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Identifies a service queue for upstream bandwidth. The
             attributes of this service queue are shared between the
             CM and the CMTS. The CMTS allocates upstream bandwidth
             to this service queue based on requests from the CM and
             on the class of service associated with this queue."
        ::= { docsIfCmServiceEntry 1 }

docsIfCmServiceQosProfile OBJECT-TYPE
        SYNTAX      Integer32 (0..16383)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The index in docsIfQosProfileTable describing the quality
             of service attributes associated with this particular
             service. If no associated entry in docsIfQosProfileTable
             exists, this object returns a value of zero."
        ::= { docsIfCmServiceEntry 2 }

docsIfCmServiceTxSlotsImmed OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of upstream mini-slots which have been used to
             transmit data PDUs in immediate (contention) mode. This
             includes only those PDUs which are presumed to have
             arrived at the headend (i.e., those which were explicitly
             acknowledged.) It does not include retransmission attempts
             or mini-slots used by Requests."
        REFERENCE
```

```
            "DOCSIS Radio Frequency Interface specification,
```



```
             Section 6.4."
        ::= { docsIfCmServiceEntry 3 }

docsIfCmServiceTxSlotsDed OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of upstream mini-slots which have been used to
             transmit data PDUs in dedicated mode (i.e., as a result
             of a unicast Data Grant)."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Section 6.4."
        ::= { docsIfCmServiceEntry 4 }

docsIfCmServiceTxRetries OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of attempts to transmit data PDUs containing
             requests for acknowledgment which did not result in
             acknowledgment."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Section 6.4."
        ::= { docsIfCmServiceEntry 5 }

-- docsIfCmServiceTxExceeded renamed for Counter32 naming requirements
docsIfCmServiceTxExceededs OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of data PDUs transmission failures due to
             excessive retries without acknowledgment."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Section 6.4."
        ::= { docsIfCmServiceEntry 6 }

docsIfCmServiceRqRetries OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
```

```
        DESCRIPTION
            "The number of attempts to transmit bandwidth requests
```



```
             which did not result in acknowledgment."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Section 6.4."
        ::= { docsIfCmServiceEntry 7 }


-- docsIfCmServiceRqExceeded renamed for Counter 32 naming
-- requirements
docsIfCmServiceRqExceededs OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of requests for bandwidth which failed due to
             excessive retries without acknowledgment."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Section 6.4."
        ::= { docsIfCmServiceEntry 8 }

--
-- CMTS GROUP
--

--
-- The CMTS MAC Table
--

docsIfCmtsMacTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF DocsIfCmtsMacEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Describes the attributes of each CMTS MAC interface,
             extending the information available from ifEntry.
             Mandatory for all CMTS devices."
        ::= { docsIfCmtsObjects 1 }

docsIfCmtsMacEntry OBJECT-TYPE
        SYNTAX      DocsIfCmtsMacEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "An entry containing objects describing attributes of each
```

```
             MAC entry, extending the information in ifEntry.
             An entry in this table exists for each ifEntry with an
             ifType of docsCableMaclayer(127)."
```



```
        INDEX { ifIndex }
        ::= { docsIfCmtsMacTable 1 }

DocsIfCmtsMacEntry ::= SEQUENCE {
            docsIfCmtsCapabilities            BITS,
            docsIfCmtsSyncInterval            Integer32,
            docsIfCmtsUcdInterval             Integer32,
            docsIfCmtsMaxServiceIds           Integer32,
            docsIfCmtsInsertionInterval       TimeTicks,   -- Obsolete
            docsIfCmtsInvitedRangingAttempts  Integer32,
            docsIfCmtsInsertInterval          TimeInterval
        }

docsIfCmtsCapabilities OBJECT-TYPE
        SYNTAX      BITS {
            atmCells(0),
            concatenation(1)
        }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Identifies the capabilities of the CMTS MAC
             implementation at this interface. Note that packet
             transmission is always supported. Therefore, there
             is no specific bit required to explicitely indicate
             this capability."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Chapter 6."
        ::= { docsIfCmtsMacEntry 1 }

docsIfCmtsSyncInterval OBJECT-TYPE
        SYNTAX      Integer32 (1..200)
        UNITS       "Milliseconds"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The interval between CMTS transmission of successive SYNC
             messages at this interface."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Section 6.5 and Appendix B."
        ::= { docsIfCmtsMacEntry 2 }
```

```
docsIfCmtsUcdInterval OBJECT-TYPE
        SYNTAX      Integer32 (1..2000)
        UNITS       "Milliseconds"
        MAX-ACCESS  read-write
```



```
        STATUS      current
        DESCRIPTION
            "The interval between CMTS transmission of successive
             Upstream Channel Descriptor messages for each upstream
             channel at this interface."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Section 6.5 and Appendix B."
        ::= { docsIfCmtsMacEntry 3 }

docsIfCmtsMaxServiceIds OBJECT-TYPE
        SYNTAX     Integer32 (1..16383)
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
            "The maximum number of service IDs that may be
             simultaneously active."
        ::= { docsIfCmtsMacEntry 4 }


-- This object has been obsoleted and replaced by
-- docsIfCmtsInsertInterval to fix a SYNTAX typing problem.  New
-- implementations of this MIB should use that object instead.
docsIfCmtsInsertionInterval OBJECT-TYPE
        SYNTAX      TimeTicks
        MAX-ACCESS  read-write
        STATUS      obsolete
        DESCRIPTION
            "The amount of time to elapse between each broadcast
             station maintenance grant. Broadcast station maintenance
             grants are used to allow new cable modems to join the
             network. Zero indicates that a vendor-specific algorithm
             is used instead of a fixed time. Maximum amount of time
             permitted by the specification is 2 seconds."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Appendix B, Ranging Interval."
        ::= { docsIfCmtsMacEntry 5 }

docsIfCmtsInvitedRangingAttempts OBJECT-TYPE
        SYNTAX      Integer32 (0..1024)
        MAX-ACCESS  read-write
        STATUS      current
```

```
        DESCRIPTION
            "The maximum number of attempts to make on invitations
             for ranging requests. A value of zero means the system
             should attempt to range forever."
        REFERENCE
```



```
            "DOCSIS Radio Frequency Interface specification,
             Section 7.2.5 and Appendix B."
        ::= { docsIfCmtsMacEntry 6 }

docsIfCmtsInsertInterval OBJECT-TYPE
        SYNTAX      TimeInterval
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The amount of time to elapse between each broadcast
             station maintenance grant. Broadcast station maintenance
             grants are used to allow new cable modems to join the
             network. Zero indicates that a vendor-specific algorithm
             is used instead of a fixed time. Maximum amount of time
             permitted by the specification is 2 seconds."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Appendix B."
        ::= { docsIfCmtsMacEntry 7 }

--
--
-- CMTS status table.
--

docsIfCmtsStatusTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF DocsIfCmtsStatusEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "For the MAC layer, this group maintains a number of
             status objects and counters."
        ::= { docsIfCmtsObjects 2 }

docsIfCmtsStatusEntry OBJECT-TYPE
        SYNTAX      DocsIfCmtsStatusEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Status entry for a single MAC layer.
             An entry in this table exists for each ifEntry with an
             ifType of docsCableMaclayer(127)."
```

```
        INDEX { ifIndex }
        ::= { docsIfCmtsStatusTable 1 }

DocsIfCmtsStatusEntry ::= SEQUENCE {
            docsIfCmtsStatusInvalidRangeReqs        Counter32,
            docsIfCmtsStatusRangingAborteds         Counter32,
```



```
            docsIfCmtsStatusInvalidRegReqs          Counter32,
            docsIfCmtsStatusFailedRegReqs           Counter32,
            docsIfCmtsStatusInvalidDataReqs         Counter32,
            docsIfCmtsStatusT5Timeouts              Counter32
        }

docsIfCmtsStatusInvalidRangeReqs OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "This object counts invalid RNG-REQ messages received on
             this interface."
        ::= { docsIfCmtsStatusEntry 1 }

docsIfCmtsStatusRangingAborteds OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "This object counts ranging attempts that were explicitely
             aborted by the CMTS."
        ::= { docsIfCmtsStatusEntry 2 }

docsIfCmtsStatusInvalidRegReqs OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "This object counts invalid REG-REQ messages received on
             this interface."
        ::= { docsIfCmtsStatusEntry 3 }

docsIfCmtsStatusFailedRegReqs OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "This object counts failed registration attempts, i.e.,
             authentication failures and class of service failures,
             on this interface."
```

```
        ::= { docsIfCmtsStatusEntry 4 }

docsIfCmtsStatusInvalidDataReqs OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
```



```
            "This object counts invalid data request messages
             received on this interface."
        ::= { docsIfCmtsStatusEntry 5 }

docsIfCmtsStatusT5Timeouts OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "This object counts the number of times counter T5
             expired on this interface."
        ::= { docsIfCmtsStatusEntry 6 }

--
-- CM status table (within CMTS).
-- This table is implemented only at the CMTS.
-- It contains per CM status information available in the CMTS.
--

docsIfCmtsCmStatusTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF DocsIfCmtsCmStatusEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "A set of objects in the CMTS, maintained for each
             Cable Modem connected to this CMTS."
        ::= { docsIfCmtsObjects 3 }

docsIfCmtsCmStatusEntry OBJECT-TYPE
        SYNTAX      DocsIfCmtsCmStatusEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Status information for a single Cable Modem.
             An entry in this table exists for each Cable Modem
             that is connected to the CMTS implementing this table."
        INDEX { docsIfCmtsCmStatusIndex }
        ::= { docsIfCmtsCmStatusTable 1 }

DocsIfCmtsCmStatusEntry ::= SEQUENCE {
```

```
            docsIfCmtsCmStatusIndex               Integer32,
            docsIfCmtsCmStatusMacAddress          MacAddress,
            docsIfCmtsCmStatusIpAddress           IpAddress,
            docsIfCmtsCmStatusDownChannelIfIndex  InterfaceIndexOrZero,
            docsIfCmtsCmStatusUpChannelIfIndex    InterfaceIndexOrZero,
            docsIfCmtsCmStatusRxPower             TenthdBmV,
            docsIfCmtsCmStatusTimingOffset        Unsigned32,
            docsIfCmtsCmStatusEqualizationData    OCTET STRING,
```



```
            docsIfCmtsCmStatusValue               INTEGER,
            docsIfCmtsCmStatusUnerroreds          Counter32,
            docsIfCmtsCmStatusCorrecteds          Counter32,
            docsIfCmtsCmStatusUncorrectables      Counter32,
            docsIfCmtsCmStatusSignalNoise         TenthdB,
            docsIfCmtsCmStatusMicroreflections    Integer32
        }

docsIfCmtsCmStatusIndex OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Index value to uniquely identify an entry in this table.
             For an individual Cable Modem, this index value should
             not change during CMTS uptime."
        ::= { docsIfCmtsCmStatusEntry 1 }

docsIfCmtsCmStatusMacAddress OBJECT-TYPE
        SYNTAX      MacAddress
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "MAC address of this Cable Modem. If the Cable Modem has
             multiple MAC addresses, this is the MAC address associated
             with the Cable interface."
        ::= { docsIfCmtsCmStatusEntry 2 }

docsIfCmtsCmStatusIpAddress OBJECT-TYPE
        SYNTAX      IpAddress
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "IP address of this Cable Modem. If the Cable Modem has no
             IP address assigned, or the IP address is unknown, this
             object returns a value of 0.0.0.0. If the Cable Modem has
             multiple IP addresses, this object returns the IP address
             associated with the Cable interface."
        ::= { docsIfCmtsCmStatusEntry 3 }
```

```
docsIfCmtsCmStatusDownChannelIfIndex OBJECT-TYPE
        SYNTAX      InterfaceIndexOrZero
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "IfIndex of the downstream channel this CM is connected
             to. If the downstream channel is unknown, this object
             returns a value of zero."
```



```
        ::= { docsIfCmtsCmStatusEntry 4 }

docsIfCmtsCmStatusUpChannelIfIndex OBJECT-TYPE
        SYNTAX      InterfaceIndexOrZero
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "IfIndex of the upstream channel this CM is connected
             to. If the upstream channel is unknown, this object
             returns a value of zero."
        ::= { docsIfCmtsCmStatusEntry 5 }

docsIfCmtsCmStatusRxPower OBJECT-TYPE
        SYNTAX      TenthdBmV
        UNITS       "dBmV"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The receive power as percieved for upstream data from
             this Cable Modem.
             If the receive power is unknown, this object returns
             a value of zero."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Table 4-13."
        ::= { docsIfCmtsCmStatusEntry 6 }

docsIfCmtsCmStatusTimingOffset OBJECT-TYPE
        SYNTAX      Unsigned32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "A measure of the current round trip time for this CM.
             Used for timing of CM upstream transmissions to ensure
             synchronized arrivals at the CMTS. Units are in terms
             of (6.25 microseconds/64). Returns zero if the value
             is unknown."
        REFERENCE
```

```
            "DOCSIS Radio Frequency Interface Specification,
             Section 6.5."
        ::= { docsIfCmtsCmStatusEntry 7 }

docsIfCmtsCmStatusEqualizationData OBJECT-TYPE
        SYNTAX      OCTET STRING
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Equalization data for this CM. Returns an empty string
```



```
             if the value is unknown or if there is no equalization
             data available or defined."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Figure 6-23."
        ::= { docsIfCmtsCmStatusEntry 8 }

docsIfCmtsCmStatusValue OBJECT-TYPE
        SYNTAX      INTEGER {
            other(1),
            ranging(2),
            rangingAborted(3),
            rangingComplete(4),
            ipComplete(5),
            registrationComplete(6),
            accessDenied(7)
        }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Current Cable Modem connectivity state, as specified
             in the RF Interface Specification. Returned status
             information is the CM status as assumed by the CMTS,
             and indicates the following events:
             other(1)
                Any state other than below.
             ranging(2)
                The CMTS has received an Initial Ranging Request
                message from the CM, and the ranging process is not
                yet complete.
             rangingAborted(3)
                The CMTS has sent a Ranging Abort message to the CM.
             rangingComplete(4)
                The CMTS has sent a Ranging Complete message to the CM.
             ipComplete(5)
                The CMTS has received a DHCP reply message and
forwarded
```

```
                it to the CM.
             registrationComplete(6)
                The CMTS has sent a Registration Response mesage to
                the CM.
             accessDenied(7)
                The CMTS has sent a Registration Aborted message
                to the CM.
             The CMTS only needs to report states it is able to
detect."
        REFERENCE
            "DOCSIS Radio Frequency Interface Specification,
             Chapter 7.2."
        ::= { docsIfCmtsCmStatusEntry 9 }
```



```
docsIfCmtsCmStatusUnerroreds OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Codewords received without error from this Cable Modem."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Section 4.2.3"
        ::= { docsIfCmtsCmStatusEntry 10 }

docsIfCmtsCmStatusCorrecteds OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Codewords received with correctable errors from this
             Cable Modem."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Section 4.2.3"
        ::= { docsIfCmtsCmStatusEntry 11 }

docsIfCmtsCmStatusUncorrectables OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Codewords received with uncorrectable errors from this
             Cable Modem."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Section 4.2.3"
        ::= { docsIfCmtsCmStatusEntry 12 }
```

```
docsIfCmtsCmStatusSignalNoise OBJECT-TYPE
        SYNTAX      TenthdB
        UNITS       "dB"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Signal/Noise ratio as perceived for upstream data from
             this Cable Modem.
             If the Signal/Noise is unknown, this object returns
             a value of zero."
        ::= { docsIfCmtsCmStatusEntry 13 }

docsIfCmtsCmStatusMicroreflections OBJECT-TYPE
```



```
        SYNTAX      Integer32 (0..255)
        UNITS       "dBc"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Total microreflections including in-channel response
             as perceived on this interface, measured in dBc below
             the signal level.
             This object is not assumed to return an absolutely
             accurate value, but should give a rough indication
             of microreflections received on this interface.
             It is up to the implementor to provide information
             as accurate as possible."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Table 2-1 and 2-2"
        ::= { docsIfCmtsCmStatusEntry 14 }

--
-- The CMTS Service Table.
--

docsIfCmtsServiceTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF DocsIfCmtsServiceEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Describes the attributes of upstream service queues
             in a Cable Modem Termination System."
        ::= { docsIfCmtsObjects 4 }

docsIfCmtsServiceEntry OBJECT-TYPE
        SYNTAX      DocsIfCmtsServiceEntry
```

```
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Describes the attributes of a single upstream bandwidth
             service queue.
             Entries in this table exist for each ifEntry with an
             ifType of docsCableMaclayer(127), and for each service
             queue (Service ID) within this MAC layer.
             Entries in this table are created with the creation of
             individual Service IDs by the MAC layer and removed
             when a Service ID is removed."
        INDEX { ifIndex, docsIfCmtsServiceId }
        ::= { docsIfCmtsServiceTable 1 }

DocsIfCmtsServiceEntry ::= SEQUENCE {
```



```
            docsIfCmtsServiceId               Integer32,
            docsIfCmtsServiceCmStatusIndex    Integer32,
            docsIfCmtsServiceAdminStatus      INTEGER,
            docsIfCmtsServiceQosProfile       Integer32,
            docsIfCmtsServiceCreateTime       TimeStamp,
            docsIfCmtsServiceInOctets         Counter32,
            docsIfCmtsServiceInPackets        Counter32
        }

docsIfCmtsServiceId OBJECT-TYPE
        SYNTAX      Integer32 (1..16383)
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Identifies a service queue for upstream bandwidth. The
             attributes of this service queue are shared between the
             Cable Modem and the Cable Modem Termination System.
             The CMTS allocates upstream bandwidth to this service
             queue based on requests from the CM and on the class of
             service associated with this queue."
        ::= { docsIfCmtsServiceEntry 1 }

docsIfCmtsServiceCmStatusIndex OBJECT-TYPE
        SYNTAX      Integer32 (0..65535)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Pointer to an entry in docsIfCmtsCmStatusTable identifying
             the Cable Modem using this Service Queue. If multiple
             Cable Modems are using this Service Queue, the value of
             this object is zero."
        ::= { docsIfCmtsServiceEntry 2 }
```

```
docsIfCmtsServiceAdminStatus OBJECT-TYPE
        SYNTAX      INTEGER {
            enabled(1),
            disabled(2),
            destroyed(3) }
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "Allows a service class for a particular modem to be
             suppressed, (re-)enabled, or deleted altogether."
        ::= { docsIfCmtsServiceEntry 3 }

docsIfCmtsServiceQosProfile OBJECT-TYPE
        SYNTAX      Integer32 (0..16383)
        MAX-ACCESS  read-only
```



```
        STATUS      current
        DESCRIPTION
            "The index in docsIfQosProfileTable describing the quality
             of service attributes associated with this particular
             service. If no associated docsIfQosProfileTable entry
             exists, this object returns a value of zero."
        ::= { docsIfCmtsServiceEntry 4 }

docsIfCmtsServiceCreateTime OBJECT-TYPE

--      SYNTAX      TimeTicks
        SYNTAX      TimeStamp
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The value of sysUpTime when this entry was created."
        ::= { docsIfCmtsServiceEntry 5 }

docsIfCmtsServiceInOctets OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The cumulative number of Packet Data octets received
             on this Service ID. The count does not include the
             size of the Cable MAC header"
        ::= { docsIfCmtsServiceEntry 6 }

docsIfCmtsServiceInPackets OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
```

```
        STATUS      current
        DESCRIPTION
            "The cumulative number of Packet Data packets received
             on this Service ID."
        ::= { docsIfCmtsServiceEntry 7 }

--
-- The following table provides upstream channel modulation profiles.
-- Entries in this table can be
-- re-used by one or more upstream channels. An upstream channel will
-- have a modulation profile
-- for each value of docsIfModIntervalUsageCode.
--

docsIfCmtsModulationTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF DocsIfCmtsModulationEntry
        MAX-ACCESS  not-accessible
```



```
        STATUS      current
        DESCRIPTION
            "Describes a modulation profile associated with one or more
             upstream channels."
        ::= { docsIfCmtsObjects 5 }

docsIfCmtsModulationEntry OBJECT-TYPE
        SYNTAX      DocsIfCmtsModulationEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Describes a modulation profile for an Interval Usage Code
             for one or more upstream channels.
             Entries in this table are created by the operator. Initial
             default entries may be created at system initialization
             time. No individual objects have to be specified in order
             to create an entry in this table.
             Note that some objects do not have DEFVALs, but do have
             calculated defaults and need not be specified during row
             creation.
             There is no restriction on the changing of values in this
             table while their associated rows are active."
        INDEX { docsIfCmtsModIndex, docsIfCmtsModIntervalUsageCode }
        ::= { docsIfCmtsModulationTable 1 }

DocsIfCmtsModulationEntry ::= SEQUENCE {
            docsIfCmtsModIndex                  Integer32,
            docsIfCmtsModIntervalUsageCode      INTEGER,
            docsIfCmtsModControl                RowStatus,
            docsIfCmtsModType                   INTEGER,
```

```
            docsIfCmtsModPreambleLen              Integer32,
            docsIfCmtsModDifferentialEncoding     TruthValue,
            docsIfCmtsModFECErrorCorrection       Integer32,
            docsIfCmtsModFECCodewordLength        Integer32,
            docsIfCmtsModScramblerSeed            Integer32,
            docsIfCmtsModMaxBurstSize             Integer32,
            docsIfCmtsModGuardTimeSize            Unsigned32,
            docsIfCmtsModLastCodewordShortened    TruthValue,
            docsIfCmtsModScrambler                TruthValue
        }

docsIfCmtsModIndex OBJECT-TYPE
        SYNTAX       Integer32 (1..2147483647)
        MAX-ACCESS   not-accessible
        STATUS      current
        DESCRIPTION
             "An index into the Channel Modulation table representing
              a group of Interval Usage Codes, all associated with the
```



```
              same channel."
        ::= { docsIfCmtsModulationEntry 1 }

docsIfCmtsModIntervalUsageCode OBJECT-TYPE
        SYNTAX       INTEGER {
            request(1),
            requestData(2),
            initialRanging(3),
            periodicRanging(4),
            shortData(5),
            longData(6)
        }
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "An index into the Channel Modulation table which, when
             grouped with other Interval Usage Codes, fully
             instantiate all modulation sets for a given upstream
             channel."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
             Table 6-16."
        ::= { docsIfCmtsModulationEntry 2 }

docsIfCmtsModControl OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
```

```
            "Controls and reflects the status of rows in this table."
        ::= { docsIfCmtsModulationEntry 3 }

docsIfCmtsModType OBJECT-TYPE
        SYNTAX      INTEGER {
            other(1),
            qpsk(2),
            qam16(3)
        }
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The modulation type used on this channel. Returns
             other(1) if the modulation type is neither qpsk or
             qam16. See the reference for the modulation profiles
             implied by qpsk or qam16.  See the conformance object for
             write conditions and limitations."
        REFERENCE
            "DOCSIS Radio Frequency Interface specification,
```



```
             Section 4.2.2."
        DEFVAL { qpsk }
        ::= { docsIfCmtsModulationEntry 4 }

docsIfCmtsModPreambleLen OBJECT-TYPE
        SYNTAX      Integer32 (0..1024)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The preamble length fo
```