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An SNMP MIB extension to RFC3591 to manage optical interface parameters  
of "G.698.2 single channel" in DWDM applications  
draft-galikunze-ccamp-g-698-2-snmp-mib-09

## Abstract

This memo defines a module of the Management Information Base (MIB) used by Simple Network Management Protocol (SNMP) in TCP/IP- based internet. In particular, it defines objects for managing single channel optical interface parameters of DWDM applications, using the approach specified in G.698.2 [ITU.G698.2]. This interface, described in ITU-T G.872, G.709 and G.798, is one type of OTN multi-vendor Intra-Domain Interface (IaDI). This RFC is an extension of RFC3591 to support the optical parameters specified in ITU-T G.698.2 and application identifiers specified in ITU-T G.874.1 [ITU.G874.1]. Note that G.874.1 encompasses vendor-specific codes, which if used would make the interface a single vendor IaDI and could still be managed.

The MIB module defined in this memo can be used for Optical Parameters monitoring and/or configuration of the endpoints of the multi-vendor IaDI based on the Black Link approach.

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## 1. Introduction

This memo defines a portion of the Management Information Base (MIB) used by Simple Network Management Protocol (SNMP) in TCP/IP-based internets. In particular, it defines objects for managing single channel optical interface parameters of DWDM applications, using the approach specified in G.698.2. This RFC is an extension of RFC3591 to support the optical parameters specified in ITU-T G.698.2 [ITU.G698.2] and application identifiers specified in ITU-T G.874.1 [ITU.G874.1]. Note that G.874.1 encompasses vendor-specific codes, which if used would make the interface a single vendor IaDI and could still be managed.

The Black Link approach allows supporting an optical transmitter/receiver pair of one vendor to inject an optical tributary signal and run it over an optical network composed of amplifiers, filters, add-drop multiplexers from a different vendor. In the OTN architecture, the 'black-link' represents a pre-certified network media channel conforming to G.698.2 specifications at the S and R reference points.

[Editor's note: In G.698.2 this corresponds to the optical path from point S to R; network media channel is also used and explained in draft-ietf-ccamp-flexi-grid-fwk-02]

Management will be performed at the edges of the network media channel (i.e., at the transmitters and receivers attached to the S and R reference points respectively) for the relevant parameters specified in G.698.2 [ITU.G698.2], G.798 [ITU.G798], G.874 [ITU.G874], and the performance parameters specified in G.7710/Y.1701 [ITU-T G.7710] and G.874.1 [ITU.G874.1].

G.698.2 [ITU.G698.2] is primarily intended for metro applications that include optical amplifiers. Applications are defined in G.698.2 [ITU.G698.2] using optical interface parameters at the single-channel connection points between optical transmitters and the optical multiplexer, as well as between optical receivers and the optical demultiplexer in the DWDM system. This Recommendation uses a methodology which does not explicitly specify the details of the optical network between reference point Ss and Rs, e.g., the passive and active elements or details of the design. The Recommendation currently includes unidirectional DWDM applications at 2.5 and 10 Gbit/s (with 100 GHz and 50 GHz channel frequency spacing). Work is still under way for 40 and 100 Gbit/s interfaces. There is possibility for extensions to a lower channel frequency spacing. This document specifically refers to the "application code" defined

in the G.698.2 [ITU.G698.2] and included in the Application Identifier defined in G.874.1 [ITU.G874.1] and G.872 [ITU.G872], plus a few optical parameters not included in the G.698.2 application code specification.

This draft refers and supports also the draft-kunze-g-698-2-management-control-framework

The building of an SNMP MIB describing the optical parameters defined in G.698.2 [ITU.G698.2], and reflected in G.874.1 [ITU.G874], allows the different vendors and operator to retrieve, provision and exchange information across the G.698.2 multi-vendor IaDI in a standardized way.

The MIB, reporting the Optical parameters and their values, characterizes the features and the performances of the optical components and allow a reliable black link design in case of multi vendor optical networks.

Although RFC 3591 [RFC3591] describes and defines the SNMP MIB of a number of key optical parameters, alarms and Performance Monitoring, as this RFC is over a decade old, it is primarily pre-OTN, and a more complete and up-to-date description of optical parameters and processes can be found in the relevant ITU-T Recommendations. The same considerations can be applied to the RFC 4054 [RFC4054]

## 2. The Internet-Standard Management Framework

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

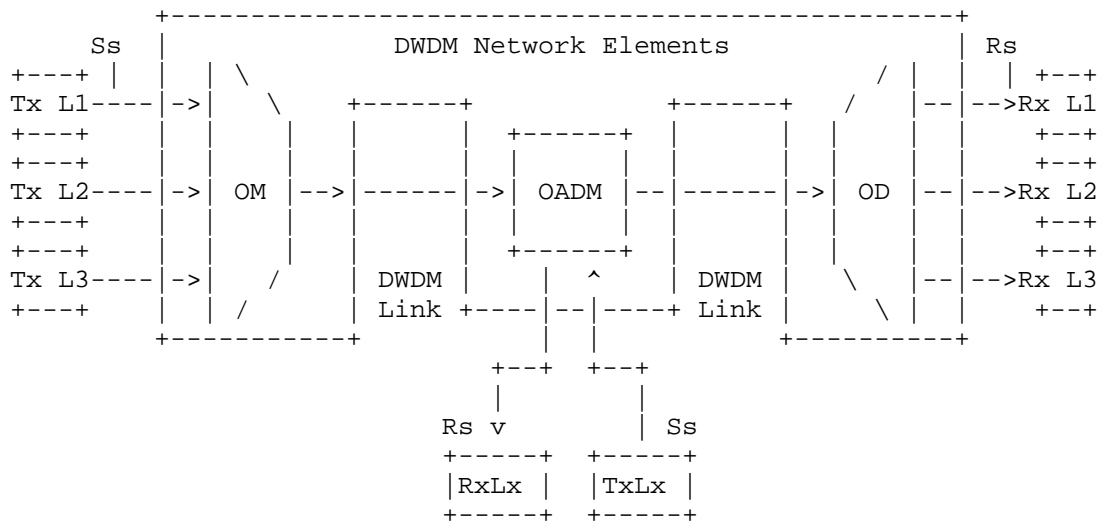
Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information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

## 3. Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119] In the description of OIDs the convention: Set (S) Get (G) and Trap (T) conventions will describe the action allowed by the parameter.

#### 4. Overview

Figure 1 shows a set of reference points, for the linear "black link" approach, for single-channel connection (Ss and Rs) between transmitters (Tx) and receivers (Rx). Here the DWDM network elements include an OM and an OD (which are used as a pair with the opposing element), one or more optical amplifiers and may also include one or more OADMs.



Ss = reference point at the DWDM network element tributary output  
Rs = reference point at the DWDM network element tributary input  
Lx = Lambda x  
OM = Optical Mux  
OD = Optical Demux  
OADM = Optical Add Drop Mux

from Fig. 5.1/G.698.2

Figure 1: Linear Black Link approach

G.698.2 [ITU.G698.2] defines also Ring "Black Link" approach configurations [Fig. 5.2/G.698.2] and Linear "black link" approach for Bidirectional applications[Fig. 5.3/G.698.2]

#### 4.1. Optical Parameters Description

The G.698.2 pre-certified network media channels are managed at the edges, i.e. at the transmitters (Tx) and receivers (Rx) attached to the S and R reference points respectively. The set of parameters that could be managed are specified in G.698.2 [ITU.G698.2] section 5.3 referring the "application code" notation

The definitions of the optical parameters are provided below to increase the readability of the document, where the definition is ended by (G) the parameter can be retrieve with a GET, when (S) it can be provisioned by a SET, (G,S) can be either GET and SET.

To support the management of these parameters, the SNMP MIB in RFC 3591 [RFC3591] is extended with a new MIB module defined in section 6 of this document. This new MIB module includes the definition of new configuration table of the OCh Layer for the parameters at Tx (S) and Rx (R).

##### 4.1.1. Rs-Ss Configuration

The Rs-Ss configuration table allows configuration of Central Frequency, Power and Application identifiers as described in [ITU.G698.2] and G.694.1 [ITU.G694.1]

This parameter report the current Transceiver Output power, it can be either a setting and measured value (G, S).

Central frequency (see G.694.1 Table 1):

This parameter indicates the central frequency value that Ss and Rs will be set, to work (in THz), in particular Section 6/G.694.1 (G, S).

Single-channel application identifiers (see G.698.2):

This parameter indicates the transceiver application identifier at Ss and Rs as defined in [ITU.G698.2] Chapter 5.4 - this parameter can be called Optical Interface Identifier OII as per [draft-martinelli-wson-interface-class] (G).

Number of Single-channel application identifiers Supported

This parameter indicates the number of Single-channel application codes supported by this interface (G).

Current Laser Output power:

This parameter report the current Transceiver Output power, see RFC3591.

Current Laser Input power:

This parameter report the current Transceiver Input power see RFC3591.

PARAMETERS	Get/Set	Reference
Central Frequency	G,S	G.694.1 S.6
Single-channel Application Identifier number in use	G	G.874.1
Single-channel Application Identifier Type in use	G	G.874.1
Single-channel Application Identifier in use	G	G.874.1
Number of Single-channel Application Identifiers Supported	G	N.A.
Current Output Power	G,S	RFC3591
Current Input Power	G	RFC3591

Table 1: Rs-Ss Configuration

#### 4.1.2. Table of Application Identifiers

This table has a list of Application Identifiers supported by this interface at point R are defined in G.698.2.

Application Identifier Number:

The number that uniquely identifies the Application Identifier.

Application Identifier Type:

Type of application Identifier: STANDARD / PROPRIETARY in G.874.1

Application Identifier:

This is the application Identifier that is defined in G.874.1.

#### 4.2. Use of ifTable

This section specifies how the MIB II interfaces group, as defined in RFC 2863 [RFC2863], is used for the link ends of a black link. Only the ifGeneralInformationGroup will be supported for the ifTable and the ifStackTable to maintain the relationship between the OCh and OPS layers. The OCh and OPS layers are managed in the ifTable using IfEntries that correlate to the layers depicted in Figure 1.

For example, a device with TX and/or RX will have an Optical Physical Section (OPS) layer, and an OCh layer. There is a one to n relationship between the OPS and OCh layers.

EDITOR NOTE: Reason for changing from OChr to OCh: Edition 3 of G.872 removed OChr from the architecture and G.709 was subsequently updated to account for this architectural change.

Figure 2 In the following figures, opticalPhysicalSection are abbreviated as OPS.

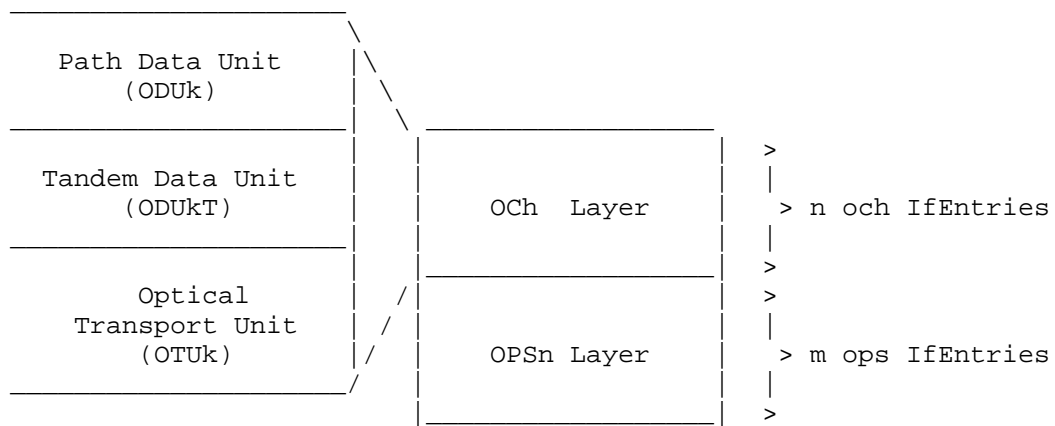


Figure 2: OTN Layers for OPS and OCh

Each opticalChannel IfEntry is mapped to one of the m opticalPhysicalSection IfEntries, where m is greater than or equal to 1. Conversely, each opticalTransPhysicalSection port entry is mapped to one of the n opticalChannel IfEntries, where n is greater than or equal to 1.

The design of the Optical Interface MIB provides the option to model an interface either as a single bidirectional object containing both sink and source functions or as a pair of unidirectional objects, one containing sink functions and the other containing source functions.

If the sink and source for a given protocol layer are to be modelled as separate objects, then there need to be two ifTable entries, one that corresponds to the sink and one that corresponds to the source, where the directionality information is provided in the configuration



tables for that layer via the associated Directionality objects. The agent is expected to maintain consistent directionality values between ifStackTable layers (e.g., a sink must not be stacked in a 1:1 manner on top of a source, or vice-versa), and all protocol layers that are represented by a given ifTable entry are expected to have the same directionality.

When separate ifTable entries are used for the source and sink functions of a given physical interface, association between the two uni-directional ifTable entries (one for the source function and the other for the sink functions) should be provided. It is recommended that identical ifName values are used for the two ifTable entries to indicate such association. An implementation shall explicitly state what mechanism is used to indicate the association, if ifName is not used.

#### 4.2.1. Use of ifTable for OPS Layer

Only the ifGeneralInformationGroup needs to be supported.

ifTable Object	Use for OTN OPS Layer
=====	
ifIndex	The interface index.
ifDescr	Optical Transport Network (OTN) Optical Physical Section (OPS)
ifType	opticalPhysicalSection (xxx)
<<<Editor Note: Need new IANA registration value for xxx. >>>	
ifSpeed	Actual bandwidth of the interface in bits per second. If the bandwidth of the interface is greater than the maximum value of 4,294,967,295, then the maximum value is reported and ifHighSpeed must be used to report the interface's speed.
ifPhysAddress	An octet string with zero length. (There is no specific address associated with the interface.)
ifAdminStatus	The desired administrative state of the interface. Supports read-only access.
ifOperStatus	The operational state of the interface. The

value lowerLayerDown(7) is not used, since there is no lower layer interface. This object is set to notPresent(6) if a component is missing, otherwise it is set to down(2) if either of the objects optIfOPSnCurrentStatus indicates that any defect is present.

ifLastChange	The value of sysUpTime at the last change in ifOperStatus.
ifName	Enterprise-specific convention (e.g., TL-1 AID) to identify the physical or data entity associated with this interface or an OCTET STRING of zero length. The enterprise-specific convention is intended to provide the means to reference one or more enterprise-specific tables.
ifLinkUpDownTrapEnable	Default value is enabled(1). Supports read-only access.
ifHighSpeed	Actual bandwidth of the interface in Mega-bits per second. A value of n represents a range of 'n-0.5' to 'n+0.499999'.
ifConnectorPresent	Set to true(1).
ifAlias	The (non-volatile) alias name for this interface as assigned by the network manager.

#### 4.2.2. Use of ifTable for OCh Layer

Use of ifTable for OCh Layer See RFC 3591 [RFC3591] section 2.4

#### 4.2.3. Use of ifStackTable

Use of the ifStackTable and ifInvStackTable to associate the opticalPhysicalSection and opticalChannel interface entries is best illustrated by the example shown in Figure 3. The example assumes an ops interface with ifIndex i that carries two multiplexed OCh interfaces with ifIndex values of j and k, respectively. The example shows that j and k are stacked above (i.e., multiplexed into) i. Furthermore, it shows that there is no layer lower than i and no layer higher than j and/or k.

Figure 3

HigherLayer	LowerLayer
0	j
0	k
j	i
k	i
i	0

Figure 3: Use of ifStackTable for an OTN port

For the inverse stack table, it provides the same information as the interface stack table, with the order of the Higher and Lower layer interfaces reversed.

#### 5. Structure of the MIB Module

EDITOR NOTE: text will be provided based on the MIB module in Section 6

#### 6. Object Definitions

EDITOR NOTE: Once the scope in Section 1 and the parameters in Section 4 are finalized, a MIB module will be defined. It could be an extension to the OPT-IF-MIB module of RFC 3591. >>>

```
OPT-IF-698-MIB DEFINITIONS ::= BEGIN
```

```
IMPORTS
```

```
    MODULE-IDENTITY,
    OBJECT-TYPE,
    Gauge32,
    Integer32,
    Unsigned32,
    Counter64,
    transmission,
    NOTIFICATION-TYPE
        FROM SNMPv2-SMI
    TEXTUAL-CONVENTION,
    RowPointer,
    RowStatus,
    TruthValue,
    DisplayString,
    DateAndTime
        FROM SNMPv2-TC
    SnmpAdminString
        FROM SNMP-FRAMEWORK-MIB
    MODULE-COMPLIANCE, OBJECT-GROUP
        FROM SNMPv2-CONF
    ifIndex
        FROM IF-MIB
    optIfMibModule
        FROM OPT-IF-MIB;
```

```
-- This is the MIB module for the optical parameters -
-- Application codes associated with the black link end points.
```

```
optIfXcvrMibModule MODULE-IDENTITY
    LAST-UPDATED "201401270000Z"
    ORGANIZATION "IETF Ops/Camp MIB Working Group"
    CONTACT-INFO
        "WG charter:
         http://www.ietf.org/html.charters/

        Mailing Lists:
        Editor: Gabriele Galimberti
        Email: ggalimbe@cisco.com"
    DESCRIPTION
        "The MIB module to describe Black Link tranceiver
        characteristics to rfc3591.
        Copyright (C) The Internet Society (2014). This version
        of this MIB module is an extension to rfc3591; see the RFC
        itself for full legal notices."
    REVISION "201305050000Z"
    DESCRIPTION
        "Draft version 1.0"
    REVISION "201305050000Z"
    DESCRIPTION
        "Draft version 2.0"
    REVISION "201302270000Z"
    DESCRIPTION
        "Draft version 3.0"
    REVISION "201307020000Z"
    DESCRIPTION
        "Draft version 4.0
        Changed the draft to include only the G.698 parameters."
    REVISION "201311020000Z"
    DESCRIPTION
        "Draft version 5.0
        Mib has a table of application code/vendor
        transcievercode G.698"
    REVISION "201401270000Z"
    DESCRIPTION
        "Draft version 6.0"
    REVISION "201407220000Z"
    DESCRIPTION
        "Draft version 8.0
        Removed Vendor transceiver code"
    ::= { optIfMibModule 4 }

-- Addition to the RFC 3591 objects
optIfOchSsRsGroup OBJECT IDENTIFIER ::= { optIfXcvrMibModule 1 }
```

```
-- OCh Ss/Rs config table
-- The application code/vendor transceiver class for the Black Link
-- Ss-Rs will be added to the OchConfigTable

optIfOchSsRsConfigTable OBJECT-TYPE
    SYNTAX SEQUENCE OF OptIfOchSsRsConfigEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "A table of Och General config extension parameters"
    ::= { optIfOchSsRsGroup 1 }

optIfOchSsRsConfigEntry OBJECT-TYPE
    SYNTAX OptIfOchSsRsConfigEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "A conceptual row that contains G.698 parameters for an
        interface."
    INDEX { ifIndex }
    ::= { optIfOchSsRsConfigTable 1 }

OptIfOchSsRsConfigEntry ::=
    SEQUENCE {
        optIfOchCentralFrequency Unsigned32,
        optIfOchInterfaceApplicationIdentifierNumber Unsigned32,
        optIfOchInterfaceApplicationIdentifierType Unsigned32,
        optIfOchInterfaceApplicationIdentifier DisplayString,
        optIfOchNumberApplicationCodesSupported Unsigned32
    }

optIfOchCentralFrequency OBJECT-TYPE
    SYNTAX Unsigned32
    MAX-ACCESS read-write
    UNITS "THz"
    STATUS current
    DESCRIPTION
        " This parameter indicates the frequency of this interface.
        "
    ::= { optIfOchSsRsConfigEntry 1 }

optIfOchInterfaceApplicationIdentifierNumber OBJECT-TYPE
    SYNTAX Unsigned32
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "This parameter uniquely indicates the transceiver application
        code at Ss and Rs as defined in [ITU.G874.1], that
```

```

        is used by this interface. The
        optIfOChSrcApplicationIdentifierTable has all the application
        codes supported by this interface. "
 ::= { optIfOChSsRsConfigEntry 2 }

optIfOChInterfaceApplicationIdentifierType OBJECT-TYPE
    SYNTAX Unsigned32
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "This parameter indicates the transceiver type of application
        code at Ss and Rs as defined in [ITU.G874.1], that
        is used by this interface. The
        optIfOChSrcApplicationIdentifierTable has all the application
        codes supported by this interface
        Standard = 0, PROPRIETARY = 1. "
 ::= { optIfOChSsRsConfigEntry 3 }

optIfOChInterfaceApplicationIdentifier OBJECT-TYPE
    SYNTAX DisplayString
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "This parameter indicates the transceiver application code at
        Ss and Rs as defined in [ITU.G698.2] Chapter 5.3, that
        is used by this interface. The
        optIfOChSrcApplicationCodeTable has all the application
        codes supported by this interface. "
 ::= { optIfOChSsRsConfigEntry 4 }

optIfOChNumberApplicationIdentifiersSupported OBJECT-TYPE
    SYNTAX Unsigned32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of Application codes supported by this interface."
 ::= { optIfOChSsRsConfigEntry 5 }

-- Table of Application codes supported by the interface
-- OptIfOChSrcApplicationCodeEntry

optIfOChSrcApplicationIdentifierTable OBJECT-TYPE
    SYNTAX SEQUENCE OF OptIfOChSrcApplicationIdentifierEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "A Table of Application codes supported by this interface."
 ::= { optIfOChSsRsGroup 2 }

```

```

optIfOChSrcApplicationIdentifierEntry OBJECT-TYPE
    SYNTAX      OptIfOChSrcApplicationIdentifierEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A conceptual row that contains the Application code for this
        interface."
    INDEX { ifIndex, optIfOChApplicationIdentifierNumber }
    ::= { optIfOChSrcApplicationIdentifierTable 1 }

```

```

OptIfOChSrcApplicationIdentifierEntry ::=
    SEQUENCE {
        optIfOChApplicationIdentifierNumber      Integer32,
        optIfOChApplicationIdentifierType        Integer32,
        optIfOChApplicationIdentifier            DisplayString
    }

```

```

optIfOChApplicationIdentifierNumber OBJECT-TYPE
    SYNTAX      Integer32 (1..255)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        " The number/identifier of the application code supported at
        this interface. The interface can support more than one
        application codes.
        "
    ::= { optIfOChSrcApplicationIdentifierEntry 1}

```

```

optIfOChApplicationIdentifierType OBJECT-TYPE
    SYNTAX      Integer32 (1..255)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        " The type of identifier of the application code supported at
        this interface. The interface can support more than one
        application codes.
        "
    ::= { optIfOChSrcApplicationIdentifierEntry 2}

```

```

optIfOChApplicationIdentifier OBJECT-TYPE
    SYNTAX      DisplayString
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        " The application code supported by this interface DWDM
        link."
    ::= { optIfOChSrcApplicationIdentifierEntry 3}

```



-- Notifications

-- Central Frequency Change Notification

optIfOChCentralFrequencyChange NOTIFICATION-TYPE

OBJECTS { optIfOChCentralFrequency }

STATUS current

DESCRIPTION

"Notification of a change in the central frequency."

::= { optIfXcvrMibModule 1 }

END

7. Relationship to Other MIB Modules

7.1. Relationship to the [TEMPLATE TODO] MIB

7.2. MIB modules required for IMPORTS

8. Definitions

[TEMPLATE TODO]: put your valid MIB module here.

A list of tools that can help automate the process of checking MIB definitions can be found at <http://www.ops.ietf.org/mib-review-tools.html>

9. Security Considerations

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

o

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

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPsec), even then, there is no control as to who on the secure network is

allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module.

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

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

#### 10. IANA Considerations

##### Option #1:

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

Descriptor	OBJECT IDENTIFIER value
-----	-----
sampleMIB	{ mib-2 XXX }

##### Option #2:

Editor's Note (to be removed prior to publication): the IANA is requested to assign a value for "XXX" under the 'mib-2' subtree and to record the assignment in the SMI Numbers registry. When the assignment has been made, the RFC Editor is asked to replace "XXX" (here and in the MIB module) with the assigned value and to remove this note.

Note well: prior to official assignment by the IANA, an internet draft MUST use place holders (such as "XXX" above) rather than actual numbers. See RFC4181 Section 4.5 for an example of how this is done in an internet draft MIB module.

##### Option #3:

This memo includes no request to IANA.

## 11. Contributors

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## Appendix A. Change Log

This optional section should be removed before the internet draft is submitted to the IESG for publication as an RFC.

Note to RFC Editor: please remove this appendix before publication as an RFC.

## Appendix B. Open Issues

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