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Ethernet in the First Mile Copper (EFMCu) Interfaces MIB
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Abstract

This document defines a Management Information Base (MIB) module for use with network management protocols in TCP/IP based internets. This document proposes an extension to the Ethernet-like Interfaces MIB and MAU MIB modules with a set of objects for managing an Ethernet in the First Mile Copper (EFMCu) interfaces 10PASS-TS and 2BASE-TL, defined in IEEE Std 802.3ah-2004.

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1. Introduction

New Ethernet-like interfaces have been defined in the Institute of Electrical and Electronics Engineers (IEEE) Standard 802.3ah-2004 [[802.3ah](#)], a.k.a. Ethernet in the First Mile (EFM). In particular 2BASE-TL and 10PASS-TS physical interfaces (PHYs), defined over voice-grade copper pairs, have been specified for the long and short reach respectively. These interfaces, collectively called EFMCu, are based on ITU-T G.SHDSL [[G.991.2](#)] and VDSL [[G.993.1](#)] specifications and support variable rates and optional Physical Medium Entity (PME) aggregation (a.k.a. multi-pair bonding).

2BASE-TL PHY is capable of providing at least 2Mbps over 2700 m long single copper pair with a mean Bit Error Rate (BER) of 10^{-7} (using 5dB target noise margin).

10PASS-TS PHY is capable of providing at least 10Mbps over 750 m long single copper pair with a mean BER of 10^{-7} (using 6dB target noise margin).

This memo defines a Management Information Base (MIB) module for use with network management protocols in the Internet community to manage EFMCu interfaces.

Note that managed objects for Operation, Administration and Management (OAM) and Ethernet over Passive Optical Networks (EPON) clauses of IEEE 802.3ah are defined in EFM-COMMON-MIB [[I-D.ietf-hubmib-efm-mib](#)] and EFM-EPON-MIB [[I-D.ietf-hubmib-efm-epon-mib](#)] respectively.

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](#)]. A detailed introduction to the current SNMP Management Framework can be found in [RFC 2570](#) [[RFC2570](#)].

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](#)].

3. Relation to other MIB modules

This section outlines the relationship of this MIB with other MIB modules described in the relevant RFCs. Specifically, Interfaces Group MIB (IF-MIB), Ethernet-Like (EtherLike-MIB), MAU (MAU-MIB), SHDSL (HDSL2-SHDSL-LINE-MIB) and VDSL (VDSL-LINE-EXT-MCM-MIB) are discussed.

3.1 Relation to Interfaces Group MIB module

2BASE-TL and 10PASS-TS PHY's specified in this MIB module are stacked Ethernet interfaces and as such are managed using generic interface management objects defined in the IF-MIB [[RFC2863](#)]. The stack management is done via the ifStackTable, as defined in the IF-MIB [[RFC2863](#)] and ifInvStackTable, as defined in the IF-INVERTED-STACK-MIB [[RFC2864](#)].

3.1.1 Layering Model

An EFMCu interface can aggregate up to 32 Physical Medium Entity (PME) sub-layer devices (modems), using so called PME Aggregation Function (PAF).

A generic EFMCu device can have a number of Physical Coding Sublayer (PCS) ports, connected to a MAC via Medium Independent Interface (MII) at the upper layer, and cross-connected to a number of underlying PMEs, with a single PCS per PME relationship, see clause 61.1 of [[802.3ah](#)] for more details.

Each PME in the aggregated EFMCu port is represented in the Interface table (ifTable) as a separate port with ifType of shdsl(169) for 2BASE-TL or vdsl(97) for 10PASS-TS. The ifType values are defined in [[IANAifType-MIB](#)].

ifSpeed for each PME SHALL return the actual data bitrate of the active PME (e.g. for 2BaseTL PMEs it is a multiple of 64Kbps). Zero value SHALL be returned when PME is initializing or down.

The ifSpeed of the PCS is the sum of the current operating data rates of all PMEs in the aggregation group, without the 64/65B encapsulation overhead and PAF overhead, but accounting for the Inter-Frame Gaps (IFG).

When using the stated definition of ifSpeed for the PCS, there would be no frame loss in the following configuration (the test-sets are configured to generate 100% of back to back traffic, i.e. minimal IFG, at 10 or 100Mbps, with min and max frame sizes; the EFM interfaces are obviously aggregated):

```
[testset]--10BaseT--[CO]--2BaseTL--[CPE]--10BaseT--[testset]
  ifSpeed= 10Mbps          10Mbps          10Mbps

[testset]--100BaseT--[CO]--10PassTS--[CPE]--100BaseT--[testset]
  ifSpeed= 100Mbps        100Mbps        100Mbps
```

Figure 1: Example configuration with no frame loss

The following figure shows the layering diagram and corresponding use of ifTable and ifMauTable:

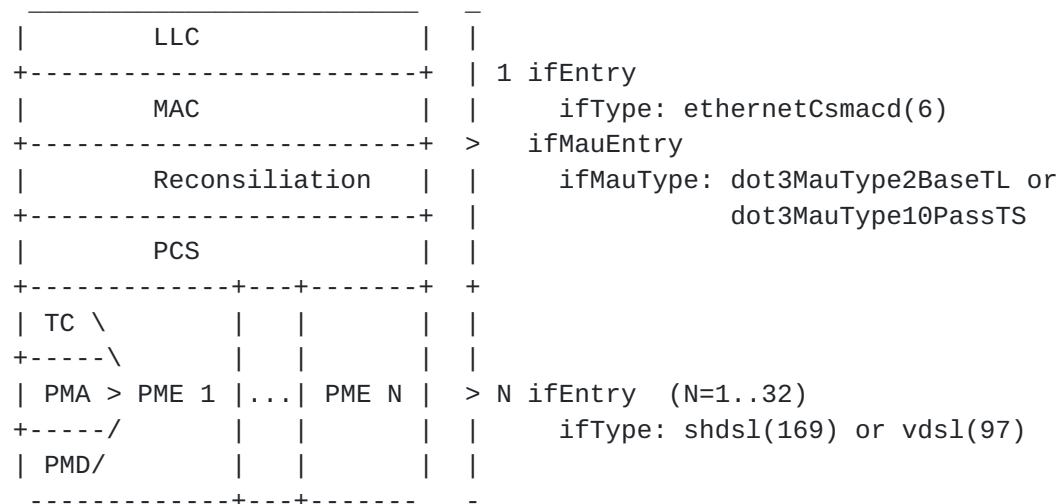


Figure 2: Use of ifTable and ifMauTable for EFMCu ports

The ifStackTable is indexed by the ifIndex values of the aggregated EFMCu port (PCS) and the PMEs connected to it. ifStackTable allows a Network Management application to determine which PMEs are connected to a particular PCS and change connections (if supported by the application). The ifInvStackTable, being an inverted version of the ifStackTable, provides an efficient means for a Network Management application to read a subset of the ifStackTable and thereby determine which PCS runs on top of a particular PME.

A new table ifAvailableStackTable defined in this MIB module, specifies for each PCS a list of PMEs, which can possibly be cross-connected to that PCS, determined by the cross-connect capability of the device. This table, modeled after ifStackTable, is

read only, reflecting current cross-connect capability, which can be dynamic in some implementations (e.g. if PME are located on a pluggable module and the module is pulled out). Note that PME availability per PCS, described by ifAvailableStackTable, can be constrained by other parameters, for example by aggregation capacity of a PCS or by the PME in question being already connected to another PCS. So, in order to ensure that a particular PME can be connected to the PCS, all respective parameters (e.g. ifAvailableStackTable, ifStackTable and efmCuPAFCapacity) SHALL be inspected.

3.1.2 PME Aggregation Function (PAF)

The PME Aggregation Function (PAF) allows a number of PMEs to be aggregated onto a PCS port, by fragmenting the Ethernet frames, transmitting the fragments over multiple PMEs and assembling the original frames at the remote port. PAF is OPTIONAL, meaning that a device with a single PME MAY perform fragmentation and re-assembly if this function is supported by the device. Note however that the agent is REQUIRED to report on the PAF capability for all EFMCu ports (2BASE-TL and 10PASS-TS).

This MIB module allows a Network Management application to query PAF capability and enable/disable it if supported. Note that enabling PAF effectively turns on fragmentation and re-assembly, even on a single-PME port.

3.1.3 Discovery Operation

The EFMCu ports may optionally support discovery operation, whereby PMEs, during initialization, exchange information about their respective aggregation groups (PCS). This information can then be used to detect copper missconnections or for an automatic assignment of the local PMEs into aggregation groups instead of fixed pre-configuration.

This MIB module allows a Network Management application to control EFM Discovery mechanism and query its results. Note that the Discovery mechanism can work only if PAF is supported and enabled.

Two tables are used by Discovery mechanism: ifStackTable and ifAvailableStackTable defined. The following pseudo-code defines an example of Discovery and automatic PME assignment for a generic PAF enabled multi-PCS EFMCu device, located at Central Office (CO), using objects defined in this MIB module. [Note that automatic PME assignment is only shown here for the purposes of the example. Fixed PME pre-assignment, manual assignment or auto-assignment by an alternative internal algorithm may be chosen by a particular implementation]:


```

FOREACH pcs[i] IN co_device
{ // Discover only on PAF enabled ports with room for more PMEs
  IF ( pcs[i].PAFSupported AND pcs[i].NumPMEs < pcs[i].PAFCapacity )
  { dc = pcs[i].DiscoveryCode = MAC[i]; // unique 6 Byte per PCS
    // go over all currently disconnected PMEs, which can
    // potentially be connected to PCS[i]
    FOREACH pme[j] IN ifAvailableStackTable[pcs[i]] AND
      NOT IN ifInvStackTable[pme[j]] // unassigned
    { pme[j].RemoteDiscoveryCode = dc; // Set if Clear
      r = pme[j].RemoteDiscoveryCode; // Get
      IF ( r == dc AND pcs[i].NumPMEs < pcs[i].PAFCapacity )
      { // Remote CPE connected via PME[j] is/was a peer for
        // PCS[i]. Connect this PME to the PCS (there's room)
        ADD pme[j] TO ifStackTable[pcs[i]];
        pcs[i].NumPMEs = pcs[i].NumPMEs + 1;
        // Discover all other currently disconnected PMEs,
        // attached to the same CPE and connect them to the PCS
        // provided there is enough room for more PMEs.
        FOREACH pme[k] IN ifAvailableStackTable[pcs[i]] and
          NOT IN ifInvStackTable[pme[k]]
        { r = pme[k].RemoteDiscoveryCode; // Get
          IF ( r == dc AND
            pcs[i].NumPMEs < pcs[i].PAFCapacity )
          { ADD pme[k] TO ifStackTable[pcs[i]];
            pcs[i].NumPMEs = pcs[i].NumPMEs + 1;
          }
        }
      }
    }
    // Discovered all PMEs which lead to the same CPE and
    // connected them to PCS[i]. Go to the next PCS.
    BREAK;
  }
}
}

```

The SNMP Agent builds efmCuStackTable according to the information contained in the Clause 45 PME_Available_register (see [[802.3ah](#)] 61.1.5.3 and 45.2.3.20).

Adding a PME to the ifStackTable row for a specific PCS, involves actual connection of the PME to the PCS, which can be done by modifying Clause 45 PME_Aggregate_register (see [[802.3ah](#)] 61.1.5.3 and 45.2.3.21).

Note that PCS port does not have to be operationally 'down' for the connection to succeed. In fact, a dynamic PME addition (and removal) MAY be implemented with an available PME being initialized first (by setting its ifAdminStatus to 'up') and then added to an operationally

'up' PCS port, by modifying a respective ifStackTable entry.

It is RECOMMENDED that a removal of the last operationally 'up' PME from an operationally 'up' PCS would be rejected by the implementation, as this action would completely drop the link.

3.1.4 EFMCu ports initialization

EFMCu ports being built on top of xDSL technology, require a lengthy initialization or 'training' process, before any data can pass. During this initialization both ends of a link (peers) work cooperatively to achieve required data rate on a particular copper pair. Sometimes, when the copper line is too long or the noise environment on the line is too high, that 'training' process may fail to achieve a specific target rate with required characteristics.

The ifAdminStatus object from the IF-MIB, controls the desired state of a PCS and a PME port. Setting this object to 'up' instructs a particular PCS or PME to start initialization process, which may take tens of seconds for EFMCu ports, especially if PAF is involved. The ifOperStatus object shows the operational state of an interface (extended by efmCuPmeOperStatus defined in this MIB module for PME interfaces).

A disconnected PME may be initialized by changing the ifAdminState from 'down' to 'up'. Changing the ifAdminState to 'up' on the PCS initializes all PMEs connected to that particular PCS. Note that in case of PAF some interfaces may fail to initialize while others succeed. The PCS is considered operationally 'up' if at least one PME aggregated by its PAF is operationally 'up'. When all PMEs connected to the PCS are 'down' the PCS SHALL be considered operationally 'lowerLayerDown'. The PCS SHALL be considered operationally 'notPresent' if it is not connected to any PME. The PCS/PME interface SHALL remain operationally 'down' during initialization.

The efmCuPmeOperStatus defined in this MIB module expands PME's ifOperStatus value of 'down' to 'downReady', 'downNotReady' and 'init' values, indicating various EFMCu PME specific states.

3.1.5 Usage of ifTable

Both PME and PCS interfaces of the EFMCu PHY are managed using interface specific management objects defined in this MIB module and generic interface objects from the ifTable of IF-MIB, with all management table entries referenced by the interface index ifIndex.

The following table summarizes EFMCu specific interpretations for

some of the ifTable objects specified by the mandatory ifGeneralInformationGroup:

IF-MIB object	EFMCu interpretation
ifIndex	Interface index. Note that each PME and each PCS in the EFMCu PHY MUST have a unique index, as there some PCS and PME specific attributes accessible only on the PCS or PME level.
ifType	ethernetCsmacd(6) for PCS, shdsl(169) for 2BASE-TL PME, vdsl(97) for 10PASS-TS PME
ifSpeed	Operating data rate for the PME. For the PCS it is the sum of the current operating data rates of all PMEs in the aggregation group, without the 64/65B encapsulation overhead and PAF overhead, but accounting for the Inter-Frame Gaps (IFG)
ifAdminStatus	Setting this object to 'up' instructs a particular PCS (with all PMEs connected to it) or PME to start initialization process
ifOperStatus	efmCuPmeOperStatus supplements the 'down' value of ifOperStatus for PMEs.

Table 1

3.2 Relation to SHDSL MIB module

G.SHDSL.bis modems, similar to PME(s) comprising a 2BASE-TL port, are described in HDLSL2-SHDSL-LINE-MIB [[I-D.ietf-adslmib-gshdslbis](#)]. Note that not all attributes of G.SHDSL modems reflected in HDLSL2-SHDSL-LINE-MIB have adequate management objects (Clause 30 attributes and Clause 45 registers) in the EFM standard.

Because of these differences and for the purposes of simplicity, unification of attributes common to both 2BASE-TL and 10PASS-TS PMEs and name consistency (e.g. prefixing the 2BASE-TL PME related objects with 'efmCuPme2B' instead of 'hds12shdsl'), it was decided

not to reference HDSL2-SHDSL-LINE-MIB objects, but define all the relevant objects in this MIB module.

However, if some functionality, not available in this MIB module, is required and supported by the PME, e.g. performance monitoring, relevant HDSL2-SHDSL-LINE-MIB groups MAY be included and applied for PMEs of 2BASE-TL subtype.

3.3 Relation to VDSL MIB module

VDSL (DMT) modems, similar to the PME(s) comprising a 10PASS-TS port, are described in VDSL-LINE-EXT-MCM-MIB [[I-D.ietf-adslmib-vdsl-ext-mcm](#)]. Note that not all attributes of VDSL modems reflected in VDSL-LINE-EXT-MCM-MIB have adequate management objects (Clause 30 attributes and Clause 45 registers) in the EFM standard.

Because of these differences and for the purposes of simplicity, unification of attributes common to both 2BASE-TL and 10PASS-TS PMEs and name consistency, it was decided not to reference VDSL-LINE-EXT-MCM-MIB objects, but define all the relevant objects in this MIB module.

However, if some functionality, not available in this MIB module, is required and supported by the PME, relevant VDSL-LINE-EXT-MCM-MIB groups MAY be included and applied for PMEs of 10PASS-TS subtype.

3.4 Relation to Ethernet-Like and MAU MIB modules

The implementation of EtherLike-MIB [[RFC3635](#)] and MAU-MIB [[I-D.ietf-hubmib-rfc3636bis](#)] is REQUIRED for the EFMCu interfaces.

Two new values of ifMauType (OBJECT-IDENTITIES of dot3MauType) and corresponding bit definitions of ifMauTypeListBits (IANAifMauTypeListBits) have been defined in the IANA-MAU-TC-MIB [[I-D.ietf-hubmib-rfc3636bis](#)] for the EFMCu MAUs:

- o dot3MauType2BaseTL and b2BaseTL - for 2BASE-TL MAU
- o dot3MauType10PassTS and b10PassTS - for 10PASS-TS MAU

As an EtherLike interface every EFMCu port (an ifEntry representing a consolidation of LLC, MAC and PCS (sub)layers) SHALL return an ifType of ethernetCsmacd(6). While most of the MAU characteristics are not applicable to the EFMCu ports (no auto-negotiation, media available, false carriers or jabber), they SHALL return an appropriate ifMauType (dot3MauType2BaseTL or dot3mauType10PassTS) in order to direct the management software to look in the EFM-CU-MIB for the desired

information. For example the information on the particular EFMCu flavor that an EFMCu port is running is available from `efmCuOperSubType`, defined in this MIB module.

Since EFMCu PMEs are not EtherLike interfaces, they cannot be instantiated as MAU interface objects.

4. MIB Structure

4.1 Overview

The main management objects defined in this MIB module are split into 2 groups:

- o `efmCuPort` - containing objects for configuration, capabilities, status and notifications, common to all EFMCu PHYs.
- o `efmCuPme` - containing objects for configuration, capabilities, status and notifications of EFMCu PMEs.

In addition the `ifAvailableStackTable` is defined at the same level.

The `efmCuPme` group in turn contains `efmCuPme2B` and `efmCuPme10P` groups, which define PME Profiles specific to 2BASE-TL and 10PASS-TS PMEs respectively, as well as PME specific status information.

4.2 PME Profiles

Since a managed node can have a large number of EFMCu PHYs, provisioning every parameter on every EFMCu PHY may become burdensome. Moreover, most PMEs are provisioned identically with the same set of parameters. To simplify the provisioning process, this MIB module makes use of configuration profiles, similar to `HDSL2-SHDSL-LINE-MIB` and `VDSL-LINE-EXT-MCM-MIB`. A profile is a set of parameters, used either for configuration or representation of a PME. The same profile can be shared by multiple PME ports, using the same configuration.

The PME profiles are defined in `efmCuPme2BProfileTable` and `efmCu10PProfileTable` for 2BASE-TL and 10PASS-TS PMEs respectively. There are 12 predefined standard profiles for 2BASE-TL and 22 standard profiles for 10PASS-TS, defined in 802.3ah and dedicated for rapid provisioning of EFMCu PHYs in most scenarios. An ability to define new configuration profiles is also provided to allow for EFMCu deployment tailored to specific copper environment and spectral regulations.

A specific configuration or administrative profile is assigned to a

specific PME via efmCuPmeAdminProfile object. If efmCuPmeAdminProfile is zero, then efmCuAdminProfile object of the PCS port, connected to the PME, determines the configuration profile (or a list of possible profiles) for that PME. This mechanism allows to specify a common profile(s) for all PMEs connected to the PCS port, with an ability to change individual PME profiles by setting efmCuPmeAdminProfile objects, which overwrites profile set by efmCuAdminProfile.

A current operating PME profile is pointed to by efmCuPmeOperProfile object. Note that this profile entry, can be created automatically, to reflect achieved parameters in adaptive (not fixed) initialization.

4.3 Mapping of IEEE 802.3ah Managed Objects

This section contains the mapping between managed objects (attributes) defined in [[802.3ah](#)] Clause 30, and managed objects defined in this document and in associated MIB modules, i.e., the IF-MIB [[RFC2863](#)].

Note that majority of the objects defined in this MIB module do not have direct counterparts in Clause 30 and instead refer to Clause 45 registers.

*EdNote: It would be a good idea to update Clause 30 of 802.3ah after this MIB module is approved. I guess this should be done via a maintenance request. *

IEEE 802.3 Managed Object	Corresponding SNMP Object
oPAF - Basic Package (Mandatory)	
aPAFID	ifIndex (IF-MIB)
aPhyEnd	efmCuPhySide
aPHYCurrentStatus	efmCuStatus
aPAFSupported	efmCuPAFSupported
oPAF - PME Aggregation Package (Optional)	
aPAFAdminState	efmCuPAFAdminState
aLocalPAFCapacity	efmCuPAFCapacity
aLocalPMEAvailable	ifAvailableStackTable
aLocalPMEAggregate	ifStackTable (IF-MIB)
aRemotePAFSupported	efmCuRemotePAFSupported
aRemotePAFCapacity	efmCuRemotePAFCapacity
aRemotePMEAggregate	
oPME - 10P/2B Package (Mandatory)	
aPMEID	ifIndex (IF-MIB)
aPMEAdminState	ifAdminState (IF-MIB)
aPMEStatus	efmCuPmeStatus
aPMESNRMgn	efmCuPmeSnrMgn
aTCCodingViolations	efmCuPmeTCCodingErrors
aProfileSelect	efmCuAdminProfile, efmCuPmeAdminProfile
aOperatingProfile	efmCuPmeOperProfile
aPMEFECCorrectedBlocks	efmCuPme10PFECCorrectedBlocks
aPMEFECCorrectableBlocks	efmCuPme10PFECUncorrectedBlocks

Table 2

5. Definitions

EFM-CU-MIB DEFINITIONS ::= BEGIN

IMPORTS

MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE, Integer32,
 Unsigned32, Counter32, mib-2
 FROM SNMPv2-SMI -- [RFC2578]
 TEXTUAL-CONVENTION, TruthValue, RowStatus, PhysAddress
 FROM SNMPv2-TC -- [RFC2579]
 MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
 FROM SNMPv2-CONF -- [RFC2580]
 SnmpAdminString


```
FROM SNMP-FRAMEWORK-MIB -- [RFC3411]
ifIndex, ifSpeed, InterfaceIndex
FROM IF-MIB -- [RFC2863]
;
```

efmCuMIB MODULE-IDENTITY

```
LAST-UPDATED "200504040000Z" -- April 04, 2005
ORGANIZATION "IETF Ethernet Interfaces and Hub MIB Working Group"
CONTACT-INFO
```

"WG charter:

<http://www.ietf.org/html.charters/hubmib-charter.html>

Mailing Lists:

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General Discussion: hubmib@ietf.org
To Subscribe: hubmib-request@ietf.org
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DESCRIPTION

"The objects in this MIB module are used to manage the Ethernet in the First Mile (EFM) Copper (EFMCu) Interfaces 2BASE-TL and 10PASS-TS, defined in IEEE Draft P802.3ah/D3.3.

The following reference is used throughout this MIB module:

[802.3ah] refers to:

IEEE Std 802.3ah-2004: 'IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements -
Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications -

Amendment: Media Access Control Parameters, Physical Layers and Management Parameters for Subscriber Access Networks', 07 September 2004.

Of particular interest are Clause 61, 'Physical Coding Sublayer (PCS) and common specifications, type 10PASS-TS and type 2BASE-TL', Clause 30, 'Management', Clause 45, 'Management Data Input/Output (MDIO) Interface', Annex 62A, 'PMD profiles for 10PASS-TS' and Annex 63A, 'PMD profiles for 2BASE-TL'.

Naming Conventions:

Atn - Attenuation
CO - Central Office
CPE - Customer Premises Equipment
EFM - Ethernet in the First Mile
EFMCu - EFM Copper
MDIO - Management Data Input/Output
Mgn - Margin
PAF - PME Aggregation Function
PCS - Physical Coding Sublayer
PMD - Physical Medium Dependent
PME - Physical Medium Entity
PSD - Power Spectral Density
SNR - Signal to Noise Ratio
TCPAM - Trellis Coded Pulse Amplitude Modulation

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-- EdNote: Replace XXXX with the actual RFC number &
-- remove this note

REVISION "200504040000Z" -- April 04, 2005
DESCRIPTION "Initial version, published as RFC XXXX."

::= { mib-2 160 }

-- EdNote: Replace YYY with a real OID once it is
-- allocated & remove this note.

-- Sections of the module

efmCuObjects OBJECT IDENTIFIER ::= { efmCuMIB 1 }

efmCuConformance OBJECT IDENTIFIER ::= { efmCuMIB 2 }

-- Groups in the module

efmCuPort OBJECT IDENTIFIER ::= { efmCuObjects 1 }

efmCuPme OBJECT IDENTIFIER ::= { efmCuObjects 2 }

-- Textual Conventions

ProfileIndex ::= TEXTUAL-CONVENTION

 DISPLAY-HINT "d"

 STATUS current

 DESCRIPTION

 "A unique value, greater than zero, for each PME configuration profile in the managed EFMCu port. It is recommended that values are assigned contiguously starting from 1. The value for each profile must remain constant at least from one re-initialization of the entity's network management system to the next re-initialization."

 SYNTAX Unsigned32 (1..255)

ProfileIndexOrZero ::= TEXTUAL-CONVENTION

 DISPLAY-HINT "d"

 STATUS current

 DESCRIPTION

 "This textual convention is an extension of the ProfileIndex convention. The latter defines a greater than zero value used to identify a PME profile in the managed EFMCu port. This extension permits the additional value of zero. The value of zero is object-specific and must therefore be defined as part of the description of any object which uses this syntax. Examples of the usage of zero value might include situations where current operational profile is unknown."

 SYNTAX Unsigned32 (0..255)

ProfileIndexList ::= TEXTUAL-CONVENTION

 DISPLAY-HINT "1d:"

 STATUS current

 DESCRIPTION

 "Represents a list of up to 6 ProfileIndex's.
 The ProfileIndex textual convention defines a greater than zero value used to identify a PME profile in the managed EFMCu port. The value of this object is a concatenation of one or more (up to 6) octets, where each octet contains an 8-bit ProfileIndex value.
 The ProfileIndexList specifies a list of alternative profiles, any of which can be chosen for configuration of an PME."

 SYNTAX OCTET STRING (SIZE(1..6))

TruthValueOrUnknown ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"This textual convention is an extension of the TruthValue convention. The latter defines a boolean value with possible values of true(1) and false(2). This extension permits the additional value of unknown(0), which can be returned as a result of GET operation, when an exact true or false value of the object cannot be determined."

SYNTAX INTEGER { unknown(0), true(1), false(2) }

-- Port Notifications Group

efmCuPortNotifications OBJECT IDENTIFIER ::= { efmCuPort 0 }

efmCuLowBandwidth NOTIFICATION-TYPE

OBJECTS {

-- ifIndex is not needed here since we are under specific PCS
ifSpeed,
efmCuThreshLowBandwidth

}

STATUS current

DESCRIPTION

"This notification indicates that EFMCu port's data rate reached or dropped below a Low Bandwidth Threshold (i.e. bandwidth degradation happening in case of PAF when one or more PMEs drop)."

-- EdNote: add throttling limitations here

::= { efmCuPortNotifications 1 }

-- PCS Port group

efmCuPortConfTable OBJECT-TYPE

SYNTAX SEQUENCE OF EfmCuPortConfEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Table for Configuration of EFMCu 2BASE-TL/10PASS-TS (PCS) Ports. Entries in this table MUST be maintained in a persistent manner"

::= { efmCuPort 1 }

efmCuPortConfEntry OBJECT-TYPE

SYNTAX EfmCuPortConfEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the EFMCu Port Configuration table."

Each entry represents an EFMCu port indexed by the ifIndex.
Note that an EFMCu PCS port runs on top of a single
or multiple PME port(s), which are also indexed by ifIndex."

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

EfmCuPortConfEntry ::=

```
SEQUENCE {  
    efmCuPAFAdminState          INTEGER,  
    efmCuPAFDiscoveryCode      PhysAddress,  
    efmCuAdminProfile           ProfileIndexList,  
    efmCuTargetDataRate        Unsigned32,  
    efmCuTargetSnrMgn           Unsigned32,  
    efmCuThreshLowBandwidth     Unsigned32,  
    efmCuLowBandwidthEnable     TruthValue  
}
```

efmCuPAFAdminState OBJECT-TYPE

```
SYNTAX      INTEGER {  
    enabled(1),  
    disabled(2)  
}
```

MAX-ACCESS read-write
STATUS current

DESCRIPTION

"Administrative (desired) state of the PAF of the EFMCu port
(PCS).

When 'disabled', PME Aggregation will not be performed by the
PCS. No more than a single PME can be assigned to this PCS in
this case.

When 'enabled', PAF will be performed by the PCS when the link
is Up, even on a single attached PME, if PAF is supported.

PCS ports incapable of supporting PAF SHALL return a value of
'disabled'. Attempts to 'enable' such ports SHALL be ignored.

PAF 'enabled' port with multiple PMEs assigned cannot be
'disabled'. Attempts to 'disable' such port SHALL be rejected,
until at most one PME is left assigned.

Changing PAFAdminState is a traffic disruptive operation and
as such SHALL be done when the link is Down. Attempts to
change this object SHALL be ignored if the link is Up or
Initializing.

This object maps to the Clause 30 attribute aPAFAdminState.

If a Clause 45 MDIO Interface to the PCS is present, then this

object maps to the PAF enable bit in the 10P/2B PCS control register.

This object MUST be maintained in a persistent manner."

REFERENCE

"[[802.3ah](#)] 61.2.2, 45.2.3.18.3"

::= { efmCuPortConfEntry 1 }

efmCuPAFDiscoveryCode OBJECT-TYPE

SYNTAX PhysAddress

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"PAF Discovery Code of the EFMCu port (PCS).

A unique 6 Byte long code used by the Discovery function, when PAF is supported.

PCS ports incapable of supporting PAF SHALL return a value of all zeroes. Attempts to change this object SHALL be ignored in this case.

This object MUST be instantiated for the -0 subtype PCS before writing operations on the efmCuPAFRemoteDiscoveryCode (Set_if_Clear and Clear_if_Same) are performed by PMEs associated with the PCS.

The value of this object is read-only for -R port subtypes.

The initial value of this object for -R ports after reset is 0. This value may be changed as a result of writing operation on efmCuPAFRemoteDiscoveryCode variable of remote PME of -0 subtype, connected to one of the local PMEs associated with the PCS.

Discovery MUST be performed when the link is Down.

Attempts to change this object MUST be rejected with the error inconsistentValue if the link is Up or Initializing.

The PAF Discovery code maps to the local Discovery code variable in PAF (note that it does not have a corresponding Clause 45 register)"

REFERENCE

"[[802.3ah](#)] 61.2.2.8.3, 61.2.2.8.4, 45.2.6.6.1"

::= { efmCuPortConfEntry 2 }

efmCuAdminProfile OBJECT-TYPE

SYNTAX ProfileIndexList

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"Desired configuration Profile(s), common for all PMEs in the EFMCu port. This object is a list of pointers to entries in

either efmCuPme2BProfileTable or efmCuPme10PPProfileTable, depending on the current operating SubType of the EFMCu port as indicated by efmCuPortSide.

The value of this object is a list of up to 6 indices of Profiles. If this list consists of a single Profile index, then all PMEs assigned to this EFMCu port SHALL be configured according to the Profile referenced by that index, unless it is overwritten by corresponding non-zero efmCuPmeAdminProfile, which takes precedence over efmCuAdminProfile.

The list, consisting of more than one index, allows each PME in the port to be configured according to any Profile specified in the list.

By default this object has a single profile index 1, referencing 1st entry in efmCuPme2BProfileTable/efmCuPme2BProfileTable.

This object is writable and readable for the -0 subtype (2BaseTL-0 or 10PassTS-0) EFMCu ports. It is unavailable for the -R subtype (2BaseTL-R or 10PassTS-R) ports.

Note that current operational Profile value is available via efmCuPmeOperProfile object.

Modification of this object must be performed when the link is Down. Attempts to change this object MUST be rejected, if the link is Up or Initializing.

Attempts to set this object to a list with a member value, that is not the value of the index for an active entry in the corresponding profile table, MUST be rejected.

This object MUST be maintained in a persistent manner."

REFERENCE

"[[802.3ah](#)] 30.11.2.1.6"

DEFVAL { '01'H }

::= { efmCuPortConfEntry 3 }

efmCuTargetDataRate OBJECT-TYPE

SYNTAX Unsigned32(1..100000|999999)

UNITS "Kbps"

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"Desired EFMCu port 'net' (as seen across MII) Data Rate in Kbps, to be achieved during initialization, under spectral restrictions placed on each PME via efmCuAdminProfile or efmCuPmeAdminProfile, with the desired SNR Margin specified by efmCuTargetSnrMgn.

In case of PAF, this object represents a sum of individual PME data rates, modified to compensate for fragmentation and 64/65B framing overhead (e.g. target data rate of 10Mbps shall allow lossless transmission of full-duplex 10Mbps Ethernet frame stream with minimal inter-frame gap).

The value is limited above by 100Mbps as this is the max burst rate across MII for EFMCu ports.

The value between 1 and 100000 indicates that the total data rate (ifSpeed) of the EFMCu port after initialization should be equal to the target data rate or less, if the target data rate cannot be achieved under spectral restrictions specified by efmCuAdminProfile/efmCuPmeAdminProfile and with desired SNR margin. In case the copper environment allows to achieve higher total data rate than specified by the target, the excess capability SHALL be converted to additional SNR margin and spread evenly across all active PMEs assigned to the (PCS) port.

The value of 999999 means that the target data rate is not fixed and should be set to the maximum attainable rate during initialization (Best Effort), under specified spectral restrictions and with desired SNR Margin.

This object is read-write for the -0 subtype EFMCu ports (2BaseTL-0/10PassTS-0) and not available for the -R subtypes.

Changing of the Target Data Rate MUST be performed when the link is Down. Attempts to change this object MUST be rejected with the error inconsistentValue, if the link is Up or Initializing.

Note that current Data Rate of the EFMCu port is represented by ifSpeed object of IF-MIB.

This object MUST be maintained in a persistent manner."
 ::= { efmCuPortConfEntry 4 }

efmCuTargetSnrMgn OBJECT-TYPE

SYNTAX Unsigned32(0..21)

UNITS "dB"

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"Desired EFMCu port SNR Margin to be achieved on all PMEs assigned to the port, during initialization. (The SNR margin is the difference between the desired SNR and the actual SNR).

Note that 802.3ah recommends using default Target SNR Margin of 5dB for 2BASE-TL ports and 6dB for 10PASS-TS ports in order to achieve mean Bit Error Rate (BER) of 10^{-7} at the PMA service interface.

This object is read-write for the -0 subtype EFMCu ports (2BaseTL-0/10PassTS-0) and not available for the -R subtypes.

Changing of the Target SNR Margin MUST be performed when the link is Down. Attempts to change this object MUST be rejected with the error inconsistentValue, if the link is Up or Initializing.

Note that current SNR Margin of the PMEs comprising the EFMCu port is represented by efmCuPmeSnrMgn.

This object MUST be maintained in a persistent manner."

REFERENCE

"[[802.3ah](#)] 61.1.2"

::= { efmCuPortConfEntry 5 }

efmCuThreshLowBandwidth OBJECT-TYPE

SYNTAX Unsigned32(0..100000)

UNITS "Kbps"

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This object configures the EFMCu port Low Bandwidth alarm threshold. When the current value of ifSpeed for this port reaches or drops below this threshold, an efmCuLowBandwidth notification MAY be generated if enabled by efmCuLowBandwidthEnable.

The value of 0 means no efmCuLowBandwidth notifications SHALL ever be generated.

This object is read-write for the -0 subtype EFMCu ports (2BaseTL-0/10PassTS-0) and not available for the -R subtypes.

This object MUST be maintained in a persistent manner."

::= { efmCuPortConfEntry 6 }

efmCuLowBandwidthEnable OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"Indicates whether efmCuLowBandwidth notifications should be

generated for this interface.

Value of true(1) indicates that efmCuLowBandwidth notification is enabled. Value of false(2) indicates that the notification is disabled.

This object MUST be maintained in a persistent manner."
::= { efmCuPortConfEntry 7 }

efmCuPortCapabilityTable OBJECT-TYPE

SYNTAX SEQUENCE OF EfmCuPortCapabilityEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Table for Capabilities of EFMCu 2BASE-TL/10PASS-TS (PCS) Ports. Entries in this table MUST be maintained in a persistent manner"

::= { efmCuPort 2 }

efmCuPortCapabilityEntry OBJECT-TYPE

SYNTAX EfmCuPortCapabilityEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the EFMCu Port Capability table.
Each entry represents an EFMCu port indexed by the ifIndex.
Note that an EFMCu PCS port runs on top of a single
or multiple PME port(s), which are also indexed by ifIndex."

INDEX { ifIndex }

::= { efmCuPortCapabilityTable 1 }

EfmCuPortCapabilityEntry ::=

SEQUENCE {

efmCuPAFSupported TruthValue,

efmCuPeerPAFSupported TruthValueOrUnknown,

efmCuPAFCapacity Unsigned32,

efmCuPeerPAFCapacity Unsigned32

}

efmCuPAFSupported OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"PME Aggregation Function (PAF) Capability of the EFMCu port (PCS).

This object has a value of true(1) when the PCS can perform

PME aggregation on the available PMEs.

Ports incapable of PAF SHALL return a value of false(2).

This object maps to the Clause 30 attribute aPAFSupported.

If a Clause 45 MDIO Interface to the PCS is present, then this object maps to the PAF available bit in the 10P/2B capability register."

REFERENCE

"[[802.3ah](#)] 61.2.2, 30.11.1.1.4, 45.2.3.17.1"

::= { efmCuPortCapabilityEntry 1 }

efmCuPeerPAFSupported OBJECT-TYPE

SYNTAX TruthValueOrUnknown

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"PME Aggregation Function (PAF) Capability of the EFMCu port (PCS) link partner.

This object has a value of true(1) when the remote PCS can perform PME aggregation on its available PMEs.

Ports whose peers are incapable of PAF, SHALL return a value of false(2).

Ports whose peers cannot be reached because of the link state, SHALL return a value if unknown(0).

This object maps to the Clause 30 attribute aRemotePAFSupported.

If a Clause 45 MDIO Interface to the PCS is present, then this object maps to the Remote PAF supported bit in the 10P/2B capability register."

REFERENCE

"[[802.3ah](#)] 61.2.2, 30.11.1.1.9, 45.2.3.17.2"

::= { efmCuPortCapabilityEntry 2 }

efmCuPAFCapacity OBJECT-TYPE

SYNTAX Unsigned32 (1..32)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Number of PMEs that can be aggregated by the local PAF.

The number of PMEs currently assigned to a particular EFMCu port (efmCuNumPMEs) is never greater than efmCuPAFCapacity.

This object maps to the Clause 30 attribute aLocalPAFCapacity."

REFERENCE

"[[802.3ah](#)] 61.2.2, 30.11.1.1.6"
::= { efmCuPortCapabilityEntry 3 }

efmCuPeerPAFCapacity OBJECT-TYPE

SYNTAX Unsigned32 (0|1..32)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Number of PMEs that can be aggregated by the PAF of the peer
Phy (PCS port).
Value of 0 is returned when peer PAF Capacity is unknown
(peer cannot be reached).

This object maps to the Clause 30 attribute
aRemotePAFCapacity."

REFERENCE

"[[802.3ah](#)] 61.2.2, 30.11.1.1.10"
::= { efmCuPortCapabilityEntry 4 }

efmCuPortStatusTable OBJECT-TYPE

SYNTAX SEQUENCE OF EfmCuPortStatusEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table provides overall status information of EFMCu
2BASE-TL/10PASS-TS ports. This table contains live data from
the equipment. As such, it is NOT persistent."

::= { efmCuPort 3 }

efmCuPortStatusEntry OBJECT-TYPE

SYNTAX EfmCuPortStatusEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the EFMCu Port Status table.
Each entry represents an EFMCu port indexed by the ifIndex.
Note that an EFMCu PCS port runs on top of a single
or multiple PME port(s), which are also indexed by ifIndex."

INDEX { ifIndex }

::= { efmCuPortStatusTable 1 }

EfmCuPortStatusEntry ::=

SEQUENCE {
 efmCuFltStatus BITS,
 efmCuPortSide INTEGER,
 efmCuNumPMEs Unsigned32,


```

efmCuPAFInErrors          Counter32,
efmCuPAFInSmallFragments Counter32,
efmCuPAFInLargeFragments Counter32,
efmCuPAFInBadFragments   Counter32,
efmCuPAFInLostFragments  Counter32,
efmCuPAFInLostStarts     Counter32,
efmCuPAFInLostEnds       Counter32,
efmCuPAFInOverflows      Counter32
}

```

efmCuFltStatus OBJECT-TYPE

```

SYNTAX      BITS {
    noPeer(0),
    pmeSubTypeMismatch(1),
    lowBandwidth(2)
}

```

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"EFMCu (PCS) port Fault Status. This is a bitmap of possible conditions. The various bit positions are:

- noPeer - peer PHY cannot be reached (e.g. no PME's attached, all PME's are Down etc.) More info is available in efmCuPmeFltStatus.
- pmeSubTypeMismatch - local PME's in the aggregation group are not of the same sub-type, e.g. some PME's in the local device are -0 while others are -R subtype.
- lowBandwidth - ifSpeed of the port reached or dropped below efmCuThreshLowBandwidth

This object is intended to supplement ifOperStatus object in IF-MIB.

Additional information is available via efmCuPmeFltStatus object for each PME in the aggregation group (single PME if PAF is disabled)."

REFERENCE

"ifOperStatus in IF-MIB; efmCuPmeFltStatus"
 ::= { efmCuPortStatusEntry 1 }

efmCuPortSide OBJECT-TYPE

```

SYNTAX      INTEGER {
    subscriber(1),
    office(2),
    unknown(3)
}

```

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"EFM port mode of operation (subtype).

The value of 'subscriber' indicates the port is designated as '-R' subtype (all PMEs assigned to this port are of subtype '-R').

The value of the 'office' indicates that the port is designated as '-O' subtype (all PMEs assigned to this port are of subtype '-O').

The value of 'unknown' indicates that the port has no assigned PMEs yet or that the assigned PMEs are not of the same side (subTypePMEMismatch).

This object partially maps to the Clause 30 attribute aPhyEnd"

REFERENCE

"[[802.3ah](#)] 61.1, 30.11.1.1.2"
 ::= { efmCuPortStatusEntry 2 }

efmCuNumPMEs OBJECT-TYPE

SYNTAX Unsigned32 (0..32)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Number of PMEs that is currently aggregated by the local PAF (assigned to the EFMCu port using ifStackTable).

This number is never greater than efmCuPAFCapacity.

This object SHALL be automatically incremented or decremented when a PME is added or deleted to/from the EFMCu port using ifStackTable."

REFERENCE

"[[802.3ah](#)] 61.2.2, 30.11.1.1.6"
 ::= { efmCuPortStatusEntry 3 }

efmCuPAFInErrors OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A number of fragments that have been received across the gamma interface with RxErr asserted and discarded.

This read-only counter is inactive (not incremented) when the PAF is unsupported or disabled. Upon disabling the PAF, the counter retains its previous value.

If a Clause 45 MDIO Interface to the PCS is present, then this object maps to the 10P/2B PAF RX error register."

REFERENCE

"[[802.3ah](#)] 45.2.3.21"
::= { efmCuPortStatusEntry 4 }

efmCuPAFInSmallFragments OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A number of fragments smaller than minFragmentSize (64 Bytes), that have been received across the gamma interface and discarded.

This read-only counter is inactive when the PAF is unsupported or disabled. Upon disabling the PAF, the counter retains its previous value.

If a Clause 45 MDIO Interface to the PCS is present, then this object maps to the 10P/2B PAF small fragments register."

REFERENCE

"[[802.3ah](#)] 45.2.3.22"
::= { efmCuPortStatusEntry 5 }

efmCuPAFInLargeFragments OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A number of fragments larger than maxFragmentSize (512 Bytes), that have been received across the gamma interface and discarded.

This read-only counter is inactive when the PAF is unsupported or disabled. Upon disabling the PAF, the counter retains its previous value.

If a Clause 45 MDIO Interface to the PCS is present, then this object maps to the 10P/2B PAF large fragments register."

REFERENCE

"[[802.3ah](#)] 45.2.3.23"
::= { efmCuPortStatusEntry 6 }

efmCuPAFInBadFragments OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A number of fragments which do not fit into the sequence

expected by the frame assembly function, that have been received across the gamma interface and discarded (the frame buffer is flushed to the next valid frame start). This read-only counter is inactive when the PAF is unsupported or disabled. Upon disabling the PAF, the counter retains its previous value.

If a Clause 45 MDIO Interface to the PCS is present, then this object maps to the 10P/2B PAF bad fragments register."

REFERENCE

"[[802.3ah](#)] 45.2.3.25"

::= { efmCuPortStatusEntry 7 }

efmCuPAFInLostFragments OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A number of gaps in the sequence of fragments, that have been received across the gamma interface (the frame buffer is flushed to the next valid frame start, when fragment/fragments expected by the frame assembly function is/are not received). This read-only counter is inactive when the PAF is unsupported or disabled. Upon disabling the PAF, the counter retains its previous value.

If a Clause 45 MDIO Interface to the PCS is present, then this object maps to the 10P/2B PAF lost fragment register."

REFERENCE

"[[802.3ah](#)] 45.2.3.26"

::= { efmCuPortStatusEntry 8 }

efmCuPAFInLostStarts OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A number of missing StartOfPacket indicators expected by the frame assembly function. This read-only counter is inactive when the PAF is unsupported or disabled. Upon disabling the PAF, the counter retains its previous value.

If a Clause 45 MDIO Interface to the PCS is present, then this object maps to the 10P/2B PAF lost start of fragment register."

REFERENCE

"[[802.3ah](#)] 45.2.3.27"
::= { efmCuPortStatusEntry 9 }

efmCuPAFInLostEnds OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A number of missing EndOfPacket indicators expected by the frame assembly function.

This read-only counter is inactive when the PAF is unsupported or disabled. Upon disabling the PAF, the counter retains its previous value.

If a Clause 45 MDIO Interface to the PCS is present, then this object maps to the 10P/2B PAF lost start of fragment register."

REFERENCE

"[[802.3ah](#)] 45.2.3.28"
::= { efmCuPortStatusEntry 10 }

efmCuPAFInOverflows OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A number of framgements, received accross the gamma interface and discarded, which would have caused the frame assembly buffer to overflow.

This read-only counter is inactive when the PAF is unsupported or disabled. Upon disabling the PAF, the counter retains its previous value.

If a Clause 45 MDIO Interface to the PCS is present, then this object maps to the 10P/2B PAF overflow register."

REFERENCE

"[[802.3ah](#)] 45.2.3.24"
::= { efmCuPortStatusEntry 11 }

-- PME Notifications Group

efmCuPmeNotifications OBJECT IDENTIFIER ::= { efmCuPme 0 }

-- EdNote: Should I add more notifications here, for example

-- efmCuPmePerfES,
-- efmCuPmePerfSES,
-- efmCuPmePerfCRCAnomalies,


```
--      efmCuPmePerfLOSWS,  
--      efmCuPmePerfUAS,  
--      efmCuPmeDeviceFault,  
--      efmCuPmeLocalPowerLoss  
-- Another option would be to reference HDSL2-SHDSL-LINE-MIB  
-- or VDSL-LINE-EXT-MCM-MIB, reusing notifications defined there.
```

efmCuPmeLineAtnCROSSING NOTIFICATION-TYPE

```
OBJECTS {  
    efmCuPmeLineAtn,  
    efmCuPmeThreshLineAtn  
}
```

STATUS current

DESCRIPTION

"This notification indicates that the loop attenuation threshold (as per the efmCuPmeThreshLineAtn value) has been reached/exceeded for the 2BASE-TL/10PASS-TS PME. This notification MAY be send on the crossing event in both directions: from normal to exceeded and from exceeded to normal.

Generation of this notification is controlled by the efmCuPmeLineAtnCROSSINGEnable object."

-- EdNote: add throttling limitations here, with 10 sec
-- debouncing on clear to prevenmt intermittent alarms

::= { efmCuPmeNotifications 1 }

efmCuPmeSnrMgnCROSSING NOTIFICATION-TYPE

```
OBJECTS {  
    efmCuPmeSnrMgn,  
    efmCuPmeThreshSnrMgn  
}
```

STATUS current

DESCRIPTION

"This notification indicates that the SNR margin threshold (as per the efmCuPmeThreshSnrMgn value) has been reached/exceeded for the 2BASE-TL/10PASS-TS PME. This notification MAY be send on the crossing event in both directions: from normal to exceeded and from exceeded to normal.

Generation of this notification is controlled by the efmCuPmeSnrMgnCROSSINGEnable object."

-- EdNote: add throttling limitations here, with 10 sec
-- debouncing on clear to prevenmt intermittent alarms

::= { efmCuPmeNotifications 2 }

efmCuPmeDeviceFault NOTIFICATION-TYPE


```
OBJECTS {
    efmCuPmeFltStatus
}
STATUS      current
DESCRIPTION
    "This notification indicates that a fault in the PME has been
    detected by a vendor specific diagnostic or a self-test.

    Generation of this notification is controlled by the
    efmCuPmeDeviceFaultEnable object."
 ::= { efmCuPmeNotifications 3 }

efmCuPmeConfigInitFailure NOTIFICATION-TYPE
OBJECTS {
    efmCuPmeFltStatus,
    efmCuAdminProfile,
    efmCuPmeAdminProfile
}
STATUS      current
DESCRIPTION
    "This notification indicates that PME initialization has
    failed, due to inability of the PME link to achieve requested
    configuration profile.

    Generation of this notification is controlled by the
    efmCuPmeConfigInitFailEnable object."
 ::= { efmCuPmeNotifications 4 }

efmCuPmeProtocolInitFailure NOTIFICATION-TYPE
OBJECTS {
    efmCuPmeFltStatus,
    efmCuPmeOperSubType
}
STATUS      current
DESCRIPTION
    "This notification indicates that peer PME was using
    incompatible protocol during initialization.

    Generation of this notification is controlled by the
    efmCuPmeProtocolInitFailEnable object."
 ::= { efmCuPmeNotifications 5 }

-- The PME group

efmCuPmeConfTable OBJECT-TYPE
SYNTAX      SEQUENCE OF EfmCuPmeConfEntry
MAX-ACCESS  not-accessible
STATUS      current
```


DESCRIPTION

"Table for Configuration of common aspects for EFMCu 2BASE-TL/10PASS-TS PME ports (modems). Configuration of aspects specific to 2BASE-TL or 10PASS-TS PME types is represented in efmCuPme2BConfTable and efmCuPme10PConfTable respectively.

Entries in this table MUST be maintained in a persistent manner."

::= { efmCuPme 1 }

efmCuPmeConfEntry OBJECT-TYPE

SYNTAX EfmCuPmeConfEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the EFMCu PME Configuration table.

Each entry represents common aspects of an EFMCu PME port indexed by the ifIndex. Note that an EFMCu PME port can be stacked below a single PCS port, also indexed by ifIndex, possibly together with other PME ports if PAF is enabled."

INDEX { ifIndex }

::= { efmCuPmeConfTable 1 }

EfmCuPmeConfEntry ::=

SEQUENCE {

efmCuPmeAdminSubType	INTEGER,
efmCuPmeAdminProfile	ProfileIndexOrZero,
efmCuPAFRemoteDiscoveryCode	PhysAddress,
efmCuPmeThreshLineAtn	Integer32,
efmCuPmeThreshSnrMgn	Integer32,
efmCuPmeLineAtnCrossingEnable	TruthValue,
efmCuPmeSnrMgnCrossingEnable	TruthValue,
efmCuPmeDeviceFaultEnable	TruthValue,
efmCuPmeConfigInitFailEnable	TruthValue,
efmCuPmeProtocolInitFailEnable	TruthValue

}

efmCuPmeAdminSubType OBJECT-TYPE

SYNTAX INTEGER {

ieee2BaseTL0(1),
ieee2BaseTLR(2),
ieee10PassTS0(3),
ieee10PassTSR(4),
ieee2BaseTLor10PassTSR(5),
ieee2BaseTLor10PassTS0(6),
ieee10PassTSor2BaseTL0(7)

}

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"Administrative (desired) sub-type of the PME.

Possible values are:

- ieee2BaseTL0 - PME shall operate as 2BaseTL-0
- ieee2BaseTLR - PME shall operate as 2BaseTL-R
- ieee10PassTS0 - PME shall operate as 10PassTS-0
- ieee10PassTSR - PME shall operate as 10PassTS-R
- ieee2BaseTLor10PassTSR - PME shall operate as 2BaseTL-R or 10PassTS-R. Actual value will be set by -0 link partner during initialization (handshake).
- ieee2BaseTLor10PassTS0 - PME shall operate as 2BaseTL-0 (preferred) or 10PassTS-0. Actual value will be set during initialization depending on -R link partner capability (i.e. if -R is incapable of the preferred 2BaseTL mode, 10PassTS will be used).
- ieee10PassTSor2BaseTL0 - PME shall operate as 10PassTS-0 (preferred) or 2BaseTL-0. Actual value will be set during initialization depending on -R link partner capability (i.e. if -R is incapable of the preferred 10PassTS mode, 2BaseTL will be used).

Changing efmCuPmeAdminSubType is a traffic disruptive operation and as such SHALL be done when the link is Down. Attempts to change this object SHALL be ignored if the link is Up or Initializing.

Attempts to change this object to an unsupported subtype (see efmCuPmeSubTypesSupported) SHALL be rejected.

The current operational sub type is indicated by efmCuPmeOperSubType variable.

If a Clause 45 MDIO Interface to the PMA/PMD is present, then this object combines values of the Port sub-type select bits and the PMA/PMD type selection bits in the 10P/2B PMA/PMD control register"

REFERENCE

"[[802.3ah](#)] 61.1, 45.2.1.11.4, 45.2.1.11.7"

::= { efmCuPmeConfEntry 1 }

efmCuPmeAdminProfile OBJECT-TYPE

SYNTAX ProfileIndexOrZero

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"Desired PME configuration Profile. This object is a pointer to an entry in either efmCuPme2BProfileTable or efmCuPme10PProfileTable, depending on the current operating SubType of the PME. The value of this object is the index of the referenced profile.

The value of zero (default) indicates that the PME is configured via efmCuAdminProfile object for the PCS port, to which this PME is assigned. That is, the profile referenced by efmCuPmeAdminProfile takes precedence over the profile(s) referenced by efmCuAdminProfile.

This object is writable and readable for the C0 subtype PMEs (2BaseTL-0 or 10PassTS-0). It is unavailable for the CPE subtype (2BaseTL-R or 10PassTS-R).

Note that current operational Profile value is available via efmCuPmeOperProfile object.

Modification of this object must be performed when the link is Down. Attempts to change this object MUST be rejected, if the link is Up or Initializing.

Attempts to set this object to a value that is not the value of the index for an active entry in the corresponding profile table, MUST be rejected."

REFERENCE

"[[802.3ah](#)] 30.11.2.1.6"

DEFVAL { 0 }

::= { efmCuPmeConfEntry 2 }

efmCuPAFRemoteDiscoveryCode OBJECT-TYPE

SYNTAX PhysAddress

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"PAF Remote Discovery Code of the PME port at C0.

A 6 Byte long Discovery Code of the peer PCS connected via the PME.

Reading this object results in a Discovery Get operation.

Writing a zero to this object results in a Discovery Clear_if_Same operation (the value of efmCuPAFDiscoveryCode at the peer PCS shall be the same as efmCuPAFDiscoveryCode of the local PCS associated with the PME for the operation to succeed).

Writing a non-zero value to this object results in a Discovery Set_if_Clear operation.

This object does not exist in CPE port subtypes. A zero length octet string SHALL be returned for CPE port subtypes and also when PAF aggregation is not enabled.

Discovery MUST be performed when the link is Down.

Attempts to change this object MUST be rejected with the error inconsistentValue, if the link is Up or Initializing.

If a Clause 45 MDIO Interface to the PMA/PMD is present, then this object is a function of 10P/2B aggregation discovery control register, Discovery operation result bits in 10P/2B aggregation and discovery status register and 10P/2B aggregation discovery code register"

REFERENCE

"[[802.3ah](#)] 61.2.2.8.4, 45.2.6.6-45.2.6.8"

::= { efmCuPmeConfEntry 3 }

efmCuPmeThreshLineAtn OBJECT-TYPE

SYNTAX Integer32(-127..128)

UNITS "dB"

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"Desired Line Attenuation Threshold for the 2B/10P PME.

This object configures the line attenuation alarm threshold.

When the current value of Line Attenuation reaches or exceeds this threshold, a efmCuPmeLineAtnCrossing notification MAY be generated, if enabled by efmCuPmeLineAtnCrossingEnable.

This object is writable for the C0 subtype PMEs (-0).

It is read-only for the CPE subtype (-R).

Changing of the Line Attenuation Threshold must be performed when the link is Down. Attempts to change this object MUST be rejected with the error inconsistentValue, if the link is Up or Initializing.

If a Clause 45 MDIO Interface to the PME is present, then this object will map to the Loop attenuation threshold bits in the 2B PMD line quality thresholds register"

REFERENCE

"[[802.3ah](#)] 45.2.1.36"

::= { efmCuPmeConfEntry 4 }

efmCuPmeThreshSnrMgn OBJECT-TYPE

SYNTAX Integer32(-127..128)

UNITS "dB"

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"Desired SNR Margin Threshold for the 2B/10P PME.

This object configures the SNR margin alarm threshold.

When the current value of SNR Margin reaches or exceeds this threshold, a efmCuPmeSnrMgnCrossing notification MAY be generated, if enabled by efmCuPmeSnrMgnCrossingEnable.

This object is writable for the C0 subtype PMEs (2BaseTL-0/10PassTS-R). It is read-only for the CPE subtype (2BaseTL-R/10PassTS-R).

Changing of the SNR Margin Threshold must be performed when the link is Down. Attempts to change this object MUST be rejected with the error inconsistentValue, if the link is Up or Initializing.

If a Clause 45 MDIO Interface to the PME is present, then this object will map to the SNR margin threshold bits in the 2B PMD line quality thresholds register"

REFERENCE

"[[802.3ah](#)] 45.2.1.36"

::= { efmCuPmeConfEntry 5 }

efmCuPmeLineAtnCrossingEnable OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"Indicates whether efmCuPmeLineAtnCrossing notifications should be generated for this interface.

Value of true(1) indicates that efmCuPmeLineAtnCrossing notification is enabled. Value of false(2) indicates that the notification is disabled."

::= { efmCuPmeConfEntry 6 }

efmCuPmeSnrMgnCrossingEnable OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"Indicates whether efmCuPmeSnrMgnCrossing notifications should be generated for this interface.

Value of true(1) indicates that efmCuPmeSnrMgnCrossing notification is enabled. Value of false(2) indicates that the notification is disabled."

::= { efmCuPmeConfEntry 7 }

efmCuPmeDeviceFaultEnable OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"Indicates whether efmCuPmeDeviceFault notifications should be generated for this interface.

Value of true(1) indicates that efmCuPmeDeviceFault notification is enabled. Value of false(2) indicates that the notification is disabled."

::= { efmCuPmeConfEntry 8 }

efmCuPmeConfigInitFailEnable OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"Indicates whether efmCuPmeConfigInitFailure notifications should be generated for this interface.

Value of true(1) indicates that efmCuPmeConfigInitFailure notification is enabled. Value of false(2) indicates that the notification is disabled."

::= { efmCuPmeConfEntry 9 }

efmCuPmeProtocolInitFailEnable OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"Indicates whether efmCuPmeProtocolInitFailure notifications should be generated for this interface.

Value of true(1) indicates that efmCuPmeProtocolInitFailure notification is enabled. Value of false(2) indicates that the notification is disabled."

::= { efmCuPmeConfEntry 10 }

efmCuPmeCapabilityTable OBJECT-TYPE

SYNTAX SEQUENCE OF EfmCuPmeCapabilityEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Table for Configuration of common aspects for EFMCu 2BASE-TL/10PASS-TS PME ports (modems). Configuration of aspects specific to 2BASE-TL or 10PASS-TS PME types is represented in efmCuPme2BConfTable and efmCuPme10PConfTable respectively.

Entries in this table MUST be maintained in a persistent manner."

::= { efmCuPme 2 }

efmCuPmeCapabilityEntry OBJECT-TYPE

SYNTAX EfmCuPmeCapabilityEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the EFMCu PME Capability table.
Each entry represents common aspects of an EFMCu PME port indexed by the ifIndex. Note that an EFMCu PME port can be stacked below a single PCS port, also indexed by ifIndex, possibly together with other PME ports if PAF is enabled."

INDEX { ifIndex }

::= { efmCuPmeCapabilityTable 1 }

EfmCuPmeCapabilityEntry ::=

SEQUENCE {

efmCuPmeSubTypesSupported BITS

}

efmCuPmeSubTypesSupported OBJECT-TYPE

SYNTAX BITS {

ieee2BaseTL0(0),

ieee2BaseTLR(1),

ieee10PassTS0(2),

ieee10PassTSR(3)

}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"PME supported sub-types. This is a bitmap of possible sub-types. The various bit positions are:

ieee2BaseTL0 - PME is capable of operating as 2BaseTL-0

ieee2BaseTLR - PME is capable of operating as 2BaseTL-R

ieee10PassTS0 - PME is capable of operating as 10PassTS-0

ieee10PassTSR - PME is capable of operating as 10PassTS-R

An desired mode of operation is determined by

efmCuPmeAdminSubType, while efmCuPmeOperSubType reflects the current operating mode.

If a Clause 45 MDIO Interface to the PCS is present, then this object combines the 10PASS-TS capable and 2BASE-TL capable bits in the 10P/2B PMA/PMD speed ability register and the C0 supported and CPE supported bits in the 10P/2B PMA/PMD status register"

REFERENCE

"[[802.3ah](#)] 61.1, 45.2.1.4.1, 45.2.1.4.2, 45.2.1.12.2, 45.2.1.12.3"

::= { efmCuPmeCapabilityEntry 1 }

efmCuPmeStatusTable OBJECT-TYPE

SYNTAX SEQUENCE OF EfmCuPmeStatusEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table provides common status information of EFMCu 2BASE-TL/10PASS-TS PME ports. Status information specific to 10PASS-TS PME is represented in efmCuPme10PStatusTable.

This table contains live data from the equipment. As such, it is NOT persistent."

::= { efmCuPme 3 }

efmCuPmeStatusEntry OBJECT-TYPE

SYNTAX EfmCuPmeStatusEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the EFMCu PME Status table.

Each entry represents common aspects of an EFMCu PME port indexed by the ifIndex. Note that an EFMCu PME port can be stacked below a single PCS port, also indexed by ifIndex, possibly together with other PME ports if PAF is enabled."

INDEX { ifIndex }

::= { efmCuPmeStatusTable 1 }

EfmCuPmeStatusEntry ::=

SEQUENCE {

efmCuPmeOperStatus INTEGER,

efmCuPmeFltStatus BITS,

efmCuPmeOperSubType INTEGER,

efmCuPmeOperProfile ProfileIndexOrZero,

efmCuPmeSnrMgn Integer32,

efmCuPmePeerSnrMgn Integer32,


```

    efmCuPmeLineAtn          Integer32,
    efmCuPmePeerLineAtn      Integer32,
    efmCuPmeTCCodingErrors    Counter32
}

```

efmCuPmeOperStatus OBJECT-TYPE

```

SYNTAX      INTEGER {
    up(1),
    downNotReady(2),
    downReady(3),
    init(4)
}

```

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Current PME link Operational Status. Possible values are:

- up(1) - link is Up and ready to pass 64/65B encoded frames or fragments.
- downNotReady(2) - link is Down and the PME does not detect Handshake tones from its peer. This value may indicate a possible problem with the peer PME.
- downReady(3) - link is Down and the PME detects Handshake tones from its peer.
- init(4) - link is initializing, as a result of ifAdminStatus being set to 'up' for a particular PME or a PCS the PME is connected to.

This object is intended to supplement Down state of ifOperStatus.

This object partially maps to the Clause 30 attribute aPMEStatus.

If a Clause 45 MDIO Interface to the PME is present, then this object partially maps to PMA/PMD link status bits in 10P/2B PMA/PMD status register."

REFERENCE

"[[802.3ah](#)] 30.11.2.1.3, 45.2.1.12.4"
 ::= { efmCuPmeStatusEntry 1 }

efmCuPmeFltStatus OBJECT-TYPE

```

SYNTAX      BITS {
    lossOfFraming(0),
    snrMgnDefect(1),
    lineAtnDefect(2),
    deviceFault(3),

```



```

    configInitFailure(4),
    protocolInitFailure(5)
}

```

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Current/Last PME link Fault Status. This is a bitmap of possible conditions. The various bit positions are:

- | | |
|---------------------|--|
| lossOfFraming | - Loss of Framing for 10P or
Loss of Sync word for 2B PMD or
Loss of 64/65B Framing |
| snrMgnDefect | - SNR Margin dropped below the Threshold |
| lineAtnDefect | - Line Attenuation exceeds the Threshold |
| deviceFault | - Indicates a vendor-dependent
diagnostic or self-test fault
has been detected. |
| configInitFailure | - Configuration initialization failure,
due to inability of the PME link to
support configuration profile,
requested during initialization. |
| protocolInitFailure | - Protocol initialization failure,
due to incompatible protocol used by
the Peer PME during init (that could
happen if a peer PMD is G.SDHSL/VDSL
modem for 2BASE-TL/10PASS-TS PME
respectively). |

This object is intended to supplement ifOperStatus in IF-MIB.

The indications hold information about the last fault.
efmCuPmeFltStatus is cleared by the device restart.
In addition lossOfFraming, configInitFailure and
protocolInitFailure are cleared by PME init.
deviceFault is cleared by successful diagnostics/test.
snrMgnDefect and lineAtnDefect are cleared by SNR Margin
and line Attenuation respectively returning to norm and by
PME init.

This object partially maps to the Clause 30 attribute
aPMESatus.

If a Clause 45 MDIO Interface to the PME is present, then this
object consolidates information from various PMA/PMD
registers, namely: Fault bit in PMA/PMD status 1 register,
10P/2B PMA/PMD link loss register,
10P outgoing indicator bits status register,
10P incoming indicator bits status register,

2B state defects register."

REFERENCE

"[[802.3ah](#)] 30.11.2.1.3, 45.2.1.2.1, 45.2.1.38,
45.2.1.39, 45.2.1.54"

::= { efmCuPmeStatusEntry 2 }

efmCuPmeOperSubType OBJECT-TYPE

SYNTAX INTEGER {
ieee2BaseTL0(1),
ieee2BaseTLR(2),
ieee10PassTS0(3),
ieee10PassTSR(4)
}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Current operational sub-type of the PME.

Possible values are:

ieee2BaseTL0	- PME operates as 2BaseTL-0
ieee2BaseTLR	- PME operates as 2BaseTL-R
ieee10PassTS0	- PME operates as 10PassTS-0
ieee10PassTSR	- PME operates as 10PassTS-R

The operational sub type of the PME can be configured via
efmCuPmeAdminSubType variable.

If a Clause 45 MDIO Interface to the PMA/PMD is present, then
this object combines values of the Port sub-type select
bits, the PMA/PMD type selection bits in the 10P/2B
PMA/PMD control register and the PMA/PMD link status bits in
the 10P/2B PMA/PMD status register."

REFERENCE

"[[802.3ah](#)] 61.1, 45.2.1.11.4, 45.2.1.11.7, 45.2.1.12.4"

::= { efmCuPmeStatusEntry 3 }

efmCuPmeOperProfile OBJECT-TYPE

SYNTAX ProfileIndexOrZero

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"PME current operating Profile. This object is a pointer to
an entry in either efmCuPme2BProfileTable or
efmCuPme10PProfileTable, depending on the current
operating SubType of the PME as indicated by
efmCuPmeOperSubType.

Note that a profile entry, to which efmCuPmeOperProfile is
pointing to, can be created automatically, to reflect achieved
parameters in adaptive (not fixed) initialization,

i.e. values of efmCuPmeOperProfile and efmCuAdminProfile or efmCuPmeAdminProfile MAY differ.
The value of zero indicates that PME is down or initializing.

This object partially maps to the aOperatingProfile attribute in Clause 30."

REFERENCE

"[[802.3ah](#)] 30.11.2.1.7"
::= { efmCuPmeStatusEntry 4 }

efmCuPmeSnrMgn OBJECT-TYPE

SYNTAX Integer32(-127..128|65535)
UNITS "dB"
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"The current Signal-to-Noise Ratio (SNR) margin with respect to the received signal as perceived by the local PME.
The value of 65535 is returned when PME is down or initializing.

This object maps to the aPMESNRMgn attribute in Clause 30.

If a Clause 45 MDIO Interface is present, then this object maps to the 10P/2B RX SNR margin register."

REFERENCE

"[[802.3ah](#)] 30.11.2.1.4, 45.2.1.16"
::= { efmCuPmeStatusEntry 5 }

efmCuPmePeerSnrMgn OBJECT-TYPE

SYNTAX Integer32(-127..128|65535)
UNITS "dB"
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"The current SNR margin in dB with respect to the received signal, as perceived by the remote (link partner) PME.
The value of 65535 is returned when PME is down or initializing.

This object is not supported by -R PME subtypes.

If a Clause 45 MDIO Interface is present, then this object maps to the 10P/2B link partner RX SNR margin register."

REFERENCE

"[[802.3ah](#)] 45.2.1.17"
::= { efmCuPmeStatusEntry 6 }

efmCuPmeLineAtn OBJECT-TYPE

SYNTAX Integer32(-127..128|65535)

UNITS "dB"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The current Line Attenuation in dB as perceived by the local PME.

The value of 65535 is returned when PME is down or initializing.

If a Clause 45 MDIO Interface is present, then this object maps to the Line Attenuation register"

REFERENCE

"[[802.3ah](#)] 45.2.1.18"

::= { efmCuPmeStatusEntry 7 }

efmCuPmePeerLineAtn OBJECT-TYPE

SYNTAX Integer32(-127..128|65535)

UNITS "dB"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The current Line Attenuation in dB as perceived by the remote (link partner) PME.

The value of 65535 is returned when PME is down or initializing.

This object is not supported by CPE port subtypes.

If a Clause 45 MDIO Interface is present, then this object maps to the 20P/2B link partner Line Attenuation register."

REFERENCE

"[[802.3ah](#)] 45.2.1.19"

::= { efmCuPmeStatusEntry 8 }

efmCuPmeTCCodingErrors OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A number of 64/65-octet encapsulation errors. This counter is incremented for each 64/65-octet encapsulation error detected by the 64/65-octet receive function.

The value of zero SHALL be returned when PME is down or initializing.

If a Clause 45 MDIO Interface to the PME TC is present, then this object maps to the TC coding violations register (see 45.2.6.12)."

REFERENCE

"[[802.3ah](#)] 61.3.3.1, 45.2.6.12"

::= { efmCuPmeStatusEntry 9 }

-- 2BASE-TL specific PME group

efmCuPme2B OBJECT IDENTIFIER ::= { efmCuPme 5 }

efmCuPme2BProfileTable OBJECT-TYPE

SYNTAX SEQUENCE OF EfmCuPme2BProfileEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table supports definitions of administrative and operating Profiles for 2BASE-TL PMEs.

First 14 entries in this table SHALL always be defined as follows (see 802.3ah Annex 63A):

-----+-----+-----+-----+-----				
Profile index	Rate (Kbps)	Power (dBm)	Region (G.991.2)	Constellation
-----+-----+-----+-----+-----				
1	512	13.5	1	16-TCPAM (default)
2	704	13.5	1	16-TCPAM
3	1024	13.5	1	16-TCPAM
4	2048	13.5	1	16-TCPAM
5	3072	13.5	1	32-TCPAM
6	5696	13.5	1	32-TCPAM
7	512	13.5	2	16-TCPAM
8	704	13.5	2	16-TCPAM
9	1024	13.5	2	16-TCPAM
10	2048	14.5	2	16-TCPAM
11	3072	14.5	2	32-TCPAM
12	5696	14.5	2	32-TCPAM
13	0	0	1	0 (best effort)
14	0	0	2	0 (best effort)

These default entries SHALL be created during agent initialization and MUST not be deleted.

Entries following the first 14, can be dynamically created and deleted, to provide custom administrative (configuration) profiles and automatic operating profiles.

This table MUST be maintained in a persistent manner."

REFERENCE

"[[802.3ah](#)] Annex 63A, 30.11.2.1.6"
 ::= { efmCuPme2B 2 }

efmCuPme2BProfileEntry OBJECT-TYPE

SYNTAX EfmCuPme2BProfileEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Each entry corresponds to a single 2BASE-TL PME profile. Each profile contains a set of parameters, used either for configuration or representation of a 2BASE-TL PME. In case a particular profile is referenced via efmCuPmeAdminProfile object (or efmCuAdminProfile if efmCuPmeAdminProfile is zero), it represent the desired parameters the 2BaseTL-0 PME initialization. If a profile is referenced via efmCuPmeOperProfile object, it represents current operating parameters of the operational PME.

Profiles may be created/deleted using the row creation/deletion mechanism via efmCuPme2BProfileRowStatus. If an active entry is referenced, the entry MUST remain 'active' until all references are removed.

Default entries MUST not be removed."

INDEX { efmCuPme2BProfileIndex }

::= { efmCuPme2BProfileTable 1 }

EfmCuPme2BProfileEntry ::=

```
SEQUENCE {
    efmCuPme2BProfileIndex      ProfileIndex,
    efmCuPme2BProfileDescr     SnmpAdminString,
    efmCuPme2BRegion           INTEGER,
    efmCuPme2BDataRate         Unsigned32,
    efmCuPme2BPower            Unsigned32,
    efmCuPme2BConstellation    INTEGER,
    efmCuPme2BProfileRowStatus RowStatus
}
```

efmCuPme2BProfileIndex OBJECT-TYPE

SYNTAX ProfileIndex

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"2BASE-TL PME Profile index. This object is the unique index associated with this profile. Entries in this table are referenced via efmCuAdminProfile or efmCuPmeAdminProfile objects."

::= { efmCuPme2BProfileEntry 1 }

efmCuPme2BProfileDescr OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE(0..255))

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"A textual string containing information about 2BASE-TL PME Profile. The string MAY include information about data rate and spectral limitations of this particular profile."

::= { efmCuPme2BProfileEntry 2 }

efmCuPme2BRegion OBJECT-TYPE

SYNTAX INTEGER {

region1(1),

region2(2)

}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Power Spectral Density (PSD) Regional settings as specified in the relevant Regional Annex of [[G.991.2](#)]. Regional settings place limitations on the max allowed data rate, power and constellation.

Possible values for this object are:

region1 -- Annexes A and F (e.g. North America)

region2 -- Annexes B and G (e.g. Europe)

Changing of the Region must be performed when the link is Down.

Attempts to change this object MUST be rejected with the error inconsistentValue, if the link is Up or Initializing.

If a Clause 45 MDIO Interface to the PME is present, then this object maps to the Region bits in the 2B general parameter register."

REFERENCE

 "[[802.3ah](#)] 45.2.1.42"

::= { efmCuPme2BProfileEntry 3 }

efmCuPme2BDataRate OBJECT-TYPE

SYNTAX Unsigned32(0..5696)

UNITS "Kbps"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"2BASE-TL PME Data Rate.

The rate is fixed when the value of this object is n x 64Kbps,

where $n=3..60$ for 16-TCPAM and $n=12..89$ for 32-TCPAM.

The value of 0 in the administrative profile means that data rate is not fixed but is adaptive and should be set to the maximum attainable rate during line probing, under the spectral limitations placed by the efmCuPme2BRegion.

If a Clause 45 MDIO Interface to the PME is present, then this object maps to the Min/Max Data Rate1 bits in the 2B PMD parameters register.

This object MUST be maintained in a persistent manner."

REFERENCE

"[[802.3ah](#)] 45.2.1.43"

::= { efmCuPme2BProfileEntry 4 }

efmCuPme2BPower OBJECT-TYPE

SYNTAX Unsigned32(0|10..42)

UNITS "0.5 dBm"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Signal Transmit Power. Multiple of 0.5dBm.

The value of 0 in the administrative profile means that the signal transmit power is not fixed and should be set to maximize the attainable rate, under the spectral limitations placed by the efmCuPme2BRegion.

Changing of the Signal Transmit Power must be performed when the link is Down. Attempts to change this object MUST be rejected with the error inconsistentValue, if the link is Up or Initializing.

If a Clause 45 MDIO Interface to the PME is present, then this object will map to the Power1 bits in the 2B PMD parameters register"

REFERENCE

"[[802.3ah](#)] 45.2.1.43"

::= { efmCuPme2BProfileEntry 5 }

efmCuPme2BConstellation OBJECT-TYPE

SYNTAX INTEGER {

adaptive(0),

tcpam16(1),

tcpam32(2)

}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"TCPAM Constellation of the 2BASE-TL PME.

The possible values are:

```

    adaptive(0)    - either 16- or 32-TCPAM
    tcpam16(1)     - 16-TCPAM
    tcpam32(2)     - 32-TCPAM

```

The value of adaptive(0) in the administrative profile means that the constellation is not fixed and should be set to maximize the attainable rate, under the spectral limitations placed by the efmCuPme2BRegion.

If a Clause 45 MDIO Interface to the PME is present, then this object map to the Constellation1 bits in the 2B general parameter register."

REFERENCE

"[[802.3ah](#)] 45.2.1.43"

::= { efmCuPme2BProfileEntry 6 }

efmCuPme2BProfileRowStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object controls creation/deletion of the associated entry in efmCuPme2BProfileTable per the semantics of RowStatus.

If an 'active' entry is referenced via efmCuAdminProfile or efmCuPmeAdminProfile, the entry MUST remain 'active' until all references are removed."

::= { efmCuPme2BProfileEntry 7 }

-- 10PASS-TS specific PME group

efmCuPme10P OBJECT IDENTIFIER ::= { efmCuPme 6 }

efmCuPme10PProfileTable OBJECT-TYPE

SYNTAX SEQUENCE OF EfmCuPme10PProfileEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table supports definitions of configuration profiles for 10PassTL PMEs.

First 22 entries in this table SHALL always be defined as follows (see 802.3ah Annex 62B.3):

```

-----+-----+-----+-----+-----+-----
Profile Bandplan UPB0 BandNotch DRate URate
Index PSDMask#  p#      p#          p#      p#
-----+-----+-----+-----+-----+-----

```


1	1	3	2,6,10,11	20	20(default)
2	13	5	0	20	20
3	1	1	0	20	20
4	16	0	0	100	100
5	16	0	0	70	50
6	6	0	0	50	10
7	17	0	0	30	30
8	8	0	0	30	5
9	4	0	0	25	25
10	4	0	0	15	15
11	23	0	0	10	10
12	23	0	0	5	5
13	16	0	2,5,9,11	100	100
14	16	0	2,5,9,11	70	50
15	6	0	2,6,10,11	50	10
16	17	0	2,5,9,11	30	30
17	8	0	2,6,10,11	30	5
18	4	0	2,6,10,11	25	25
19	4	0	2,6,10,11	15	15
20	23	0	2,5,9,11	10	10
21	23	0	2,5,9,11	5	5
22	30	0	0	200	50

These default entries SHALL be created by during agent initialization and MUST not be deleted.

Entries following the first 22, can be dynamically created and deleted, to provide custom administrative (configuration) profiles and automatic operating profiles.

This table MUST be maintained in a persistent manner."

REFERENCE

"[[802.3ah](#)] Annex 62B.3, 30.11.2.1.6"

::= { efmCuPme10P 1 }

efmCuPme10PProfileEntry OBJECT-TYPE

SYNTAX EfmCuPme10PProfileEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Each entry corresponds to a single 10PASS-TS PME profile.

Each profile contains a set of parameters, used either for configuration or representation of a 10PASS-TS PME.

In case a particular profile is referenced via efmCuPmeAdminProfile object (or efmCuAdminProfile if efmCuPmeAdminProfile is zero), it represent the desired parameters the 10PassTS-0 PME initialization.

If a profile is referenced via efmCuPmeOperProfile object, it represents current operating parameters of the PME.

Profiles may be created/deleted using the row creation/deletion mechanism via efmCuPme10PProfileRowStatus. If an 'active' entry is referenced, the entry MUST remain 'active' until all references are removed.

Default entries MUST not be removed."

```
INDEX { efmCuPme10PProfileIndex }  
::= { efmCuPme10PProfileTable 1 }
```

EfmCuPme10PProfileEntry ::=

```
SEQUENCE {  
    efmCuPme10PProfileIndex      ProfileIndex,  
    efmCuPme10PProfileDescr      SnmpAdminString,  
    efmCuPme10PBandplanPSDMskProfile INTEGER,  
    efmCuPme10PUPBReferenceProfile INTEGER,  
    efmCuPme10PBandNotchProfiles BITS,  
    efmCuPme10PPayloadURateProfile INTEGER,  
    efmCuPme10PPayloadDRateProfile INTEGER,  
    efmCuPme10PProfileRowStatus  RowStatus  
}
```

efmCuPme10PProfileIndex OBJECT-TYPE

```
SYNTAX      ProfileIndex  
MAX-ACCESS  not-accessible  
STATUS      current  
DESCRIPTION
```

"10PASS-TS PME Profile Index.

This object is the unique index associated with this profile. Entries in this table are referenced via efmCuAdminProfile or efmCuPmeAdminProfile."

```
::= { efmCuPme10PProfileEntry 1 }
```

efmCuPme10PProfileDescr OBJECT-TYPE

```
SYNTAX      SnmpAdminString (SIZE(0..255))  
MAX-ACCESS  read-create  
STATUS      current  
DESCRIPTION
```

"A textual string containing information about 10PASS-TS PME Profile. The string MAY include information about data rate and spectral limitations of this particular profile."

```
::= { efmCuPme10PProfileEntry 2 }
```

efmCuPme10PBandplanPSDMskProfile OBJECT-TYPE

```
SYNTAX  INTEGER {  
    profile1(1),  
    profile2(2),
```



```

    profile3(3),
    profile4(4),
    profile5(5),
    profile6(6),
    profile7(7),
    profile8(8),
    profile9(9),
    profile10(10),
    profile11(11),
    profile12(12),
    profile13(13),
    profile14(14),
    profile15(15),
    profile16(16),
    profile17(17),
    profile18(18),
    profile19(19),
    profile20(20),
    profile21(21),
    profile22(22),
    profile23(23),
    profile24(24),
    profile25(25),
    profile26(26),
    profile27(27),
    profile28(28),
    profile29(29)
}
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
    "10PASS-TS PME Bandplan and PSD Mask profile,
    as specified in 802.3ah Annex 62A. Possible values are:

```

```

-----+-----+-----+-----
Profile Name      PSD Mask                      Bands      Bandplan
-----+-----+-----+-----
profile1(1)      - T1.424/T-U P1 FTTCab.M1  x/D/U/D/U  A
profile2(2)      - T1.424/T-U P1 FTTEEx.M1
profile3(3)      - T1.424/T-U P1 FTTCab.M2
profile4(4)      - T1.424/T-U P1 FTTEEx.M2
profile5(5)      - T1.424/T-U P1 FTTCab.M1  D/D/U/D/U
profile6(6)      - T1.424/T-U P1 FTTEEx.M1
profile7(7)      - T1.424/T-U P1 FTTCab.M2
profile8(8)      - T1.424/T-U P1 FTTEEx.M2
profile9(9)      - T1.424/T-U P1 FTTCab.M1  U/D/U/D/x
profile10(10)    - T1.424/T-U P1 FTTEEx.M1
profile11(11)    - T1.424/T-U P1 FTTCab.M2
profile12(12)    - T1.424/T-U P1 FTTEEx.M2

```



```

profile13(13) - TS1 101 270-1 Pcab.M1.A  x/D/U/D/U  B
profile14(14) - TS1 101 270-1 Pcab.M1.B
profile15(15) - TS1 101 270-1 Pex.P1.M1
profile16(16) - TS1 101 270-1 Pex.P2.M1
profile17(17) - TS1 101 270-1 Pcab.M2
profile18(18) - TS1 101 270-1 Pex.P1.M2
profile19(19) - TS1 101 270-1 Pex.P2.M2
profile20(20) - TS1 101 270-1 Pcab.M1.A  U/D/U/D/x
profile21(21) - TS1 101 270-1 Pcab.M1.B
profile22(22) - TS1 101 270-1 Pex.P1.M1
profile23(23) - TS1 101 270-1 Pex.P2.M1
profile24(24) - TS1 101 270-1 Pcab.M2
profile25(25) - TS1 101 270-1 Pex.P1.M2
profile26(26) - TS1 101 270-1 Pex.P2.M2
profile27(27) - G.993.1 F.1.2.1 (VDSL0POTS) x/D/U/D/U  F
profile28(28) - G.993.1 F.1.2.2 (VDSL0TCM-ISDN)
profile29(29) - G.993.1 F.1.2.3 (PSD reduction)

```

This object maps to the aBandplanPSDMaskProfile attribute in Clause 30."

REFERENCE

"[[802.3ah](#)] Annex 62A, 30.5.1.1.22"

```
::= { efmCuPme10PPProfileEntry 3 }
```

efmCuPme10PUPB0ReferenceProfile OBJECT-TYPE

SYNTAX INTEGER {

```

    profile1(1),
    profile2(2),
    profile3(3),
    profile4(4),
    profile5(5),
    profile6(6),
    profile7(7),
    profile8(8),
    profile9(9)

```

}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"10PASS-TS PME Upstream Power Back-Off (UPB0) Reference PSD Profile, as specified in 802.3ah Annex 62A. Possible values are:

```

    profile1(1) - T1.424/T-U      Noise A M1
    profile2(2) - T1.424/T-U      Noise A M2
    profile3(3) - T1.424/T-U      Noise F M1
    profile4(4) - T1.424/T-U      Noise F M2
    profile5(5) - ETSI TS 101 270-1 Noise A&B
    profile6(6) - ETSI TS 101 270-1 Noise C

```



```

profile7(7)   - ETSI TS 101 270-1 Noise D
profile8(8)   - ETSI TS 101 270-1 Noise E
profile9(9)   - ETSI TS 101 270-1 Noise F

```

This object maps to the aUPB0ReferenceProfile attribute in Clause 30."

REFERENCE

"[[802.3ah](#)] Annex 62A.3.4, 30.5.1.1.23"

```
::= { efmCuPme10PPProfileEntry 4 }
```

efmCuPme10PBandNotchProfiles OBJECT-TYPE

SYNTAX BITS {

```

profile0(0),
profile1(1),
profile2(2),
profile3(3),
profile4(4),
profile5(5),
profile6(6),
profile7(7),
profile8(8),
profile9(9),
profile10(10),
profile11(11)

```

}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"10PASS-TS PME Egress Control Band Notch Profile bitmap, as specified in 802.3ah Annex 62A. Possible values are:

Profile Name	G.991.3 Table	T1.424/T-U Table	TS101 270-1 Table	StartF (MHz)	EndF (MHz)
profile0(0)	- no profile				
profile1(1)	- F-5 #01	-	-	1.810	1.825
profile2(2)	- 6-2	15-1	17	1.810	2.000
profile3(3)	- F-5 #02	-	-	1.907	1.912
profile4(4)	- F-5 #03	-	-	3.500	3.575
profile5(5)	- 6-2	-	17	3.500	3.800
profile6(6)	- -	15-1	-	3.500	4.000
profile7(7)	- F-5 #04	-	-	3.747	3.754
profile8(8)	- F-5 #05	-	-	3.791	3.805
profile9(9)	- 6-2	-	17	7.000	7.100
profile10(10)	- F-5 #06	15-1	-	7.000	7.300
profile11(11)	- 6-2	15-1	1	10.100	10.150

Any combination of profiles can be specified by ORing

individual profiles, for example value of 0x0622 selects profiles 2,6,10 and 11.

This object maps to the aBandNotchProfile attribute in Clause 30."

REFERENCE

"[[802.3ah](#)] Annex 62A.3.5, 30.5.1.1.19"

::= { efmCuPme10PPProfileEntry 5 }

efmCuPme10PPayloadURateProfile OBJECT-TYPE

SYNTAX INTEGER {

profile5(5),
profile10(10),
profile15(15),
profile20(20),
profile25(25),
profile30(30),
profile50(50),
profile70(70),
profile100(100)

}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"10PASS-TS PME Upstream Payload Rate Profile,
as specified in 802.3ah Annex 62A. Possible values are:

profile5(5)	- 2.5 Mbps
profile10(10)	- 5 Mbps
profile15(15)	- 7.5 Mbps
profile20(20)	- 10 Mbps
profile25(25)	- 12.5 Mbps
profile30(30)	- 15 Mbps
profile50(50)	- 25 Mbps
profile70(70)	- 35 Mbps
profile100(100)	- 50 Mbps

Each value represents a target for the PME's Upstream Payload Bitrate as seen at the MII. If the payload rate of the selected profile cannot be achieved based on the loop environment, bandplan and PSD mask, the PME initialization SHALL fail.

This object maps to the aPayloadRateProfileUpstream attribute in Clause 30."

REFERENCE

"[[802.3ah](#)] Annex 62A.3.6, 30.5.1.1.20"

::= { efmCuPme10PPProfileEntry 6 }

efmCuPme10PPayloadDRateProfile OBJECT-TYPE

SYNTAX INTEGER {

profile5(5),
profile10(10),
profile15(15),
profile20(20),
profile25(25),
profile30(30),
profile50(50),
profile70(70),
profile100(100),
profile140(140),
profile200(200)

}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"10PASS-TS PME Downstream Payload Rate Profile,
as specified in 802.3ah Annex 62A. Possible values are:

profile5(5)	- 2.5 Mbps
profile10(10)	- 5 Mbps
profile15(15)	- 7.5 Mbps
profile20(20)	- 10 Mbps
profile25(25)	- 12.5 Mbps
profile30(30)	- 15 Mbps
profile50(50)	- 25 Mbps
profile70(70)	- 35 Mbps
profile100(100)	- 50 Mbps
profile140(140)	- 70 Mbps
profile200(200)	- 100 Mbps

Each value represents a target for the PME's Downstream Payload Bitrate as seen at the MII. If the payload rate of the selected profile cannot be achieved based on the loop environment, bandplan and PSD mask, the PME initialization SHALL fail.

This object maps to the aPayloadRateProfileDownstream attribute in Clause 30."

REFERENCE

"[[802.3ah](#)] Annex 62A.3.6, 30.5.1.1.21"

::= { efmCuPme10PPProfileEntry 7 }

efmCuPme10PPProfileRowStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object controls creation/deletion of the associated entry in efmCuPme10PProfileTable per the semantics of RowStatus.

If an active entry is referenced via efmCuAdminProfile or efmCuPmeAdminProfile, the entry MUST remain 'active' until all references are removed."

::= { efmCuPme10PProfileEntry 8 }

efmCuPme10PStatusTable OBJECT-TYPE

SYNTAX SEQUENCE OF EfmCuPme10PStatusEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Table reflecting status of EFMCu 10PASS-TS PMEs (modems)."

::= { efmCuPme10P 2 }

efmCuPme10PStatusEntry OBJECT-TYPE

SYNTAX EfmCuPme10PStatusEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the EFMCu 10PASS-TS PME Status table."

AUGMENTS { efmCuPmeStatusEntry }

::= { efmCuPme10PStatusTable 1 }

EfmCuPme10PStatusEntry ::=

SEQUENCE {

efmCuPme10PElectricalLength Integer32,

efmCuPme10PFECCorrectedBlocks Counter32,

efmCuPme10PFECUncorrectedBlocks Counter32

-- EdNote: To be continued

}

efmCuPme10PElectricalLength OBJECT-TYPE

SYNTAX Integer32(0..8192|65535)

UNITS "m"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Electrical Length in meters as perceived by the 10PASS-TS PME after the link is established.

The value of 65535 is returned if the link is Down or Initializing or the PME is unable to estimate the Electrical Length.

If a Clause 45 MDIO Interface to the PME is present, then this object maps to the 10P Electrical Length register"

REFERENCE

"[[802.3ah](#)] 45.2.1.21"
::= { efmCuPme10PStatusEntry 1 }

efmCuPme10PFECCorrectedBlocks OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of received and corrected FEC codewords in 10PASS-TS PME.

This object maps to aPMEFECCorrectedBlocks attribute in clause 30.

If a Clause 45 MDIO Interface to the PMA/PMD is present, then this object maps to the 10P FEC correctable errors register"

REFERENCE

"[[802.3ah](#)] 45.2.1.22"
::= { efmCuPme10PStatusEntry 2 }

efmCuPme10PFECUncorrectedBlocks OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of received FEC codewords in 10PASS-TS PME, which are uncorrectable.

This object maps to aPMEFECUncorrectableBlocks attribute in clause 30.

If a Clause 45 MDIO Interface to the PMA/PMD is present, then this object maps to the 10P FEC uncorrectable errors register"

REFERENCE

"[[802.3ah](#)] 45.2.1.23"
::= { efmCuPme10PStatusEntry 3 }

-- ifAvailableStackTable for use in Discovery

ifAvailableStackTable OBJECT-TYPE

SYNTAX SEQUENCE OF IfAvailableStackEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table, modeled after ifStackTable from [IF-MIB],

contains information on the possible 'on-top-of' relationships between the multiple sub-layers of network interfaces (as opposed to actual relationships in ifStackTable). In particular, it contains information on which PCS ports (sublayers) can possibly run 'on top of' which PMEs (sublayers), as determined by cross-connect capability of the EFMCu device, where each sub-layer corresponds to a conceptual row in the ifTable. For example, when the PCS port with ifIndex value x can be connected to run on top of the PME with ifIndex value y, then this table contains:

```
ifAvailableStackStatus.x.y=capable
```

Note that there's always at least one PCS for each PME and at least one PME for each PCS in the EFMCu devices, with efmCuPAFCapacity and efmCuPeerPAFCapacity indicating maximum number of PMEs which can be aggregated by local and remote PCS port respectively.

This table is read only as it describes device capability"

REFERENCE

"ifStackTable of [RFC 2863](#)"

```
::= { efmCuObjects 3 }
```

ifAvailableStackEntry OBJECT-TYPE

SYNTAX IfAvailableStackEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Information on a particular relationship between two sub-layers, specifying that one sub-layer (PCS) runs on 'top' of the other sub-layer (PME). Each sub-layer corresponds to a conceptual row in the ifTable (interface index for PCS and PME respectively)."

INDEX {

ifAvailableStackHigherLayer,

ifAvailableStackLowerLayer

}

```
::= { ifAvailableStackTable 1 }
```

IfAvailableStackEntry ::=

SEQUENCE {

ifAvailableStackHigherLayer InterfaceIndex,

ifAvailableStackLowerLayer InterfaceIndex,

ifAvailableStackStatus INTEGER

}

ifAvailableStackHigherLayer OBJECT-TYPE

SYNTAX InterfaceIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "The value of ifIndex corresponding to the higher sub-layer
 of the 'cross-connect capability' relationship, i.e., the
 PCS sub-layer which MAY run on 'top' of the PME sub-layer
 identified by the corresponding instance of
 ifAvailableStackLowerLayer."
 ::= { ifAvailableStackEntry 1 }

ifAvailableStackLowerLayer OBJECT-TYPE

SYNTAX InterfaceIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "The value of ifIndex corresponding to the lower sub-layer
 of the 'cross-connect capability' relationship, i.e., the
 PME sub-layer which MAY run 'below' the PCS sub-layer
 identified by the corresponding instance of
 ifAvailableStackHigherLayer."
 ::= { ifAvailableStackEntry 2 }

ifAvailableStackStatus OBJECT-TYPE

SYNTAX INTEGER {
 capable(1),
 outOfService(2)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "The status of the 'cross-connect capability' relationship
 between two sub-layers. The following values are defined:
 capable(1) - the PME sub-layer interface, identified by
 the ifAvailableStackLowerLayer MAY be
 connected to run 'below' the PCS sub-layer
 interface, identified by the
 ifAvailableStackLowerLayer.
 outOfService(2) - the PME sub-layer interface cannot be
 connected due to unavailability of the
 interface.

Note that PME availability per PCS, indicated by 'capable'
value, can be constrained by other parameters,
for example by aggregation capacity of a PCS or by the PME in
question being already connected to another PCS. So, in
order to ensure that a particular PME can be connected to the

PCS, all respective parameters (e.g. ifAvailableStackTable, ifStackTable and efmCuPAFCapacity) SHALL be inspected.

This object is read only, unlike ifStackStatus, as it describes the device capability."

::= { ifAvailableStackEntry 3 }

--

-- Conformance Statements

--

efmCuGroups OBJECT IDENTIFIER ::= { efmCuConformance 1 }

efmCuCompliances OBJECT IDENTIFIER ::= { efmCuConformance 2 }

-- Object Groups

efmCuBasicGroup OBJECT-GROUP

OBJECTS {

efmCuPAFSupported,
efmCuAdminProfile,
efmCuTargetDataRate,
efmCuTargetSnrMgn,
efmCuPortSide,
efmCuFltStatus

}

STATUS current

DESCRIPTION

"A collection of objects required for all of EFMCu ports."

::= { efmCuGroups 1 }

efmCuPAFGroup OBJECT-GROUP

OBJECTS {

efmCuPeerPAFSupported,
efmCuPAFCapacity,
efmCuPeerPAFCapacity,
efmCuPAFAdminState,
efmCuPAFDiscoveryCode,
efmCuPAFRemoteDiscoveryCode,
efmCuNumPMES,
ifAvailableStackStatus

}

STATUS current

DESCRIPTION

"A collection of objects required for optional PME
Aggregation Function (PAF) and PAF discovery in EFMCu ports."

::= { efmCuGroups 2 }

ifStackCapabilityGroup OBJECT-GROUP

```
OBJECTS {  
    ifAvailableStackStatus  
}
```

```
STATUS current
```

DESCRIPTION

"A collection of objects providing information on the stacking capability of MIB-II interfaces."

```
::= { efmCuGroups 3 }
```

efmCuPAFErrorsGroup OBJECT-GROUP

```
OBJECTS {  
    efmCuPAFInErrors,  
    efmCuPAFInSmallFragments,  
    efmCuPAFInLargeFragments,  
    efmCuPAFInBadFragments,  
    efmCuPAFInLostFragments,  
    efmCuPAFInLostStarts,  
    efmCuPAFInLostEnds,  
    efmCuPAFInOverflows  
}
```

```
STATUS current
```

DESCRIPTION

"A collection of objects supporting optional error counters of PAF on EFMCu ports."

```
::= { efmCuGroups 4 }
```

efmCuPmeGroup OBJECT-GROUP

```
OBJECTS {  
    efmCuPmeAdminProfile,  
    efmCuPmeOperStatus,  
    efmCuPmeFltStatus,  
    efmCuPmeSubTypesSupported,  
    efmCuPmeAdminSubType,  
    efmCuPmeOperSubType,  
    efmCuPAFRemoteDiscoveryCode,  
    efmCuPmeOperProfile,  
    efmCuPmeSnrMgn,  
    efmCuPmePeerSnrMgn,  
    efmCuPmeLineAtn,  
    efmCuPmePeerLineAtn,  
    efmCuPmeTCCodingErrors,  
    efmCuPmeThreshLineAtn,  
    efmCuPmeThreshSnrMgn  
}
```

```
STATUS current
```

DESCRIPTION

"A collection of objects providing information about


```
    a 2BASE-TL/10PASS-TS PME."
 ::= { efmCuGroups 5 }

efmCuAlarmConfGroup OBJECT-GROUP
  OBJECTS {
    efmCuThreshLowBandwidth,
    efmCuLowBandwidthEnable,
    efmCuPmeThreshLineAtn,
    efmCuPmeLineAtnCrossingEnable,
    efmCuPmeThreshSnrMgn,
    efmCuPmeSnrMgnCrossingEnable,
    efmCuPmeLineAtnCrossingEnable,
    efmCuPmeDeviceFaultEnable,
    efmCuPmeConfigInitFailEnable,
    efmCuPmeProtocolInitFailEnable
  --   efmCuPmeThreshES,
  --   efmCuPmethreshSES,
  --   efmCuPmeThreshCRCAnomalies,
  --   efmCuPmeThreshLOSWS,
  --   efmCuPmeThreshUAS
  }
  STATUS      current
  DESCRIPTION
    "A collection of objects required for configuration of alarm
    thresholds and notifications in EFMCu ports."
  ::= { efmCuGroups 6 }

efmCuNotificationGroup NOTIFICATION-GROUP
  NOTIFICATIONS {
    efmCuLowBandwidth,
    efmCuPmeLineAtnCrossing,
    efmCuPmeSnrMgnCrossing,
    efmCuPmeDeviceFault,
    efmCuPmeConfigInitFailure,
    efmCuPmeProtocolInitFailure
  --   efmCuPmePerfES,
  --   efmCuPmePerfSES,
  --   efmCuPmePerfCRCAnomalies,
  --   efmCuPmePerfLOSWS,
  --   efmCuPmePerfUAS,
  --   efmCuPmeDeviceFault,
  --   efmCuPmeLocalPowerLoss
  }
  STATUS      current
  DESCRIPTION
    "This group supports notifications of significant conditions
    associated with EFMCu ports."
  ::= { efmCuGroups 7 }
```


efmCuPme2BProfileGroup OBJECT-GROUP

OBJECTS {

efmCuPme2BProfileDescr,
efmCuPme2BRegion,
efmCuPme2BDataRate,
efmCuPme2BPower,
efmCuPme2BConstellation,
efmCuPme2BProfileRowStatus

}

STATUS current

DESCRIPTION

"A collection of objects that constitute a configuration
profile for configuration of 2BASE-TL ports."

::= { efmCuGroups 8 }

efmCuPme10PProfileGroup OBJECT-GROUP

OBJECTS {

efmCuPme10PProfileDescr,
efmCuPme10PBandplanPSDMskProfile,
efmCuPme10PUPBReferenceProfile,
efmCuPme10PBandNotchProfiles,
efmCuPme10PPayloadURateProfile,
efmCuPme10PPayloadDRateProfile,
efmCuPme10PProfileRowStatus

}

STATUS current

DESCRIPTION

"A collection of objects that constitute a configuration
profile for configuration of 10PASS-TS ports."

::= { efmCuGroups 9 }

efmCuPme10PStatusGroup OBJECT-GROUP

OBJECTS {

efmCuPme10PElectricalLength,
efmCuPme10PFECCorrectedBlocks,
efmCuPme10PFECUncorrectedBlocks

}

STATUS current

DESCRIPTION

"A collection of objects providing status information
specific to 10PASS-TS PMEs."

::= { efmCuGroups 10 }

-- Compliance Statements

efmCuCompliance MODULE-COMPLIANCE

STATUS current

DESCRIPTION

"The compliance statement for 2BASE-TL/10PASS-TS interfaces. Compliance with the following external compliance statements is prerequisite:

MIB Module	Compliance Statement
-----	-----
IF-MIB	ifCompliance3
IF-INVERTED-STACK-MIB	ifInvCompliance
EtherLike-MIB	dot3Compliance2
MAU-MIB	mauModIfCompl3"

```
MODULE -- this module
MANDATORY-GROUPS {
    efmCuBasicGroup,
    efmCuPmeGroup,
    efmCuAlarmConfGroup,
    efmCuNotificationGroup
}

GROUP          efmCuPme2BProfileGroup
DESCRIPTION
    "Support for this group is only required for implementations
    supporting 2BASE-TL Phy."

GROUP          efmCuPme10PProfileGroup
DESCRIPTION
    "Support for this group is only required for implementations
    supporting 10PASS-TS Phy."

GROUP          efmCuPAFGroup
DESCRIPTION
    "Support for this group is only required for
    implementations supporting PME Aggregation Function (PAF)."

GROUP          ifStackCapabilityGroup
DESCRIPTION
    "Support for this group is optional for implementations
    supporting layered interfaces architecture with
    flexible cross-connect between the layers."

GROUP          efmCuPAFErrorsGroup
DESCRIPTION
    "Support for this group is optional for implementations
    supporting PME Aggregation Function (PAF)."

GROUP          efmCuPme10PStatusGroup
DESCRIPTION
    "Support for this group is optional for implementations
```


supporting 10PASS-TS Phy."

OBJECT efmCuPmeSubTypesSupported

SYNTAX BITS {
ieee2BaseTL0(0),
ieee2BaseTLR(1),
ieee10PassTS0(2),
ieee10PassTSR(3)
}

DESCRIPTION

"Support for all subtypes is not required. However at least one value SHALL be supported"

OBJECT efmCuPmeAdminSubType

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required (needed only for PMEs supporting more than a single subtype, e.g. ieee2BaseTL0 and ieee2BaseTSR or ieee2BaseTLR and ieee10PassTSR)"

OBJECT efmCuTargetSnrMgn

MIN-ACCESS read-only

DESCRIPTION

"Write access is optional. For PHYs without write access the target SNR margin SHALL be fixed at 5dB for 2BASE-TL and 6dB for 10PASS-TS."

-- EdNote: To be Continued

::= { efmCuCompliances 1 }

END

6. Security Considerations

There is a number of managed objects defined in this MIB module that have a MAX-ACCESS clause of read-write or read-create. Most objects are writeable only when the link is Down. Writing to these objects can have potentially disruptive effects on network operation, for example:

- o Changing of efmCuPmeAdminSubType MAY lead to a potential locking of the link, as peer PMEs of the same sub-type cannot exchange handshake messages.
- o Changing of efmCuPAFAdminState to enabled MAY lead to a potential

locking of the link, if the peer Phy does not support PAF.

- o Changing of efmCuPAFDiscoveryCode, before the discovery operation, MAY lead to a wrongful discovery, for example when two -0 ports are connected to the same multi-PME -R port and both -0 ports have the same Discovery register value.
- o Changing PCS or PME configuration parameters (e.g. profile of a PCS or PME via efmCuAdminProfile or efmCuPmeAdminProfile) MAY lead to anything from link quality and rate degradation to a complete link initialization failure, as ability of an EFMCu port to support a particular configuration depends on the copper environment.
- o Activation of a PME can cause a severe degradation of service for another EFMCu Phy, whose PME(s) MAY be affected by the cross-talk from the newly activated PME.
- o Removal of a PME from an operationally 'up' EFMCu port, aggregating several PMEs, MAY cause port's rate degradation

The user of this MIB module must therefore be aware that support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations.

The readable objects in this MIB module (i.e., those with MAX-ACCESS other than not-accessible) may be considered sensitive in some environments since, collectively, they provide information about the performance of network interfaces and can reveal some aspects of their configuration. In particular since EFMCu can be carried over Unshielded Twisted Pair (UTP) voice grade copper in a bundle with other pairs belonging to another operator/customer, it is theoretically possible to evasdrop to an EFMCu transmission simply by "listening" to a cross-talk from an EFMCu pair, especially if the parameters of the EFMCu link in question are known. In such environments it is important to control even GET and NOTIFY access to these objects and possibly even to encrypt their values 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.

7. IANA Considerations

The two new values of dot3MauType (dot3MauType2BaseTL and dot3MauType10PasSTS) and corresponding IANAifMauTypeListBits bit definitions (b2BaseTL and b10PasSTS) SHALL be defined by the IANA in the IANA-MAU-TC-MIB module (see [[I-D.ietf-hubmib-rfc3636bis](#)]) before this document is published as an RFC.

8. Acknowledgments

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Dan Romascanu

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9. References

9.1 Normative References

- [802.3ah] IEEE, "IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications - Amendment: Media Access Control Parameters, Physical Layers and Management Parameters for Subscriber Access Networks", IEEE Std 802.3ah-2004, September 2004.

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC2570] Case, J., Mundy, R., Partain, D. and B. Stewart, "Introduction to Version 3 of the Internet-standard Network Management Framework", [RFC 2570](#), April 1999.
- [RFC2578] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., McCloghrie, K., Rose, M. and S. Waldbusser, "Structure of Management Information Version 2 (SMIv2)", STD 58, [RFC 2578](#), April 1999.
- [RFC2579] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., McCloghrie, K., Rose, M. and S. Waldbusser, "Textual Conventions for SMIv2", STD 58, [RFC 2579](#), April 1999.
- [RFC2580] McCloghrie, K., Perkins, D. and J. Schoenwaelder, "Conformance Statements for SMIv2", STD 58, [RFC 2580](#), April 1999.
- [RFC3410] Case, J., Mundy, R., Partain, D. and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework", [RFC 3410](#), December 2002.

9.2 Informative References

- [G.991.2] ITU-T, "Single-pair High-speed Digital Subscriber Line (SHDSL) transceivers", ITU-T Recommendation G.991.2, December 2003.
- [G.993.1] ITU-T, "Very High speed Digital Subscriber Line transceivers", ITU-T Recommendation G.993.1, June 2004.
- [I-D.ietf-adslmib-gshdslbis]
Sikes, C., Ray, B. and R. Abbi, "Definitions of Managed Objects for G.shdsl.bis Lines",
[draft-ietf-adslmib-gshdslbis-09](#) (work in progress), March 2005.
- [I-D.ietf-adslmib-vdsl-ext-mcm]
Dodge, M. and B. Ray, "Definitions of Managed Object Extensions for Very High Speed Digital Subscriber Lines (VDSL) Using Multiple Carrier Modulation (MCM) Line Coding", [draft-ietf-adslmib-vdsl-ext-mcm-06](#) (work in progress), January 2005.
- [I-D.ietf-hubmib-efm-epon-mib]

Khermosh, L., "Managed Objects for the Ethernet Passive Optical Networks", [draft-ietf-hubmib-efm-epon-mib-03](#) (work in progress), March 2005.

[I-D.ietf-hubmib-efm-mib]

Squire, M., "Ethernet in the First Mile (EFM) Common MIB", [draft-ietf-hubmib-efm-mib-03](#) (work in progress), March 2005.

[I-D.ietf-hubmib-rfc3636bis]

Beili, E., "Definitions of Managed Objects for IEEE 802.3 Medium Attachment Units (MAUs)", [draft-ietf-hubmib-rfc3636bis-00](#) (work in progress), October 2004.

[IANAifType-MIB]

Internet Assigned Numbers Authority (IANA), "IANAifType Textual Convention definition", <http://www.iana.org/assignments/ianaiftype-mib>.

[RFC2863] McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB", [RFC 2863](#), June 2000.

[RFC2864] McCloghrie, K. and G. Hanson, "The Inverted Stack Table Extension to the Interfaces Group MIB", [RFC 2864](#), June 2000.

[RFC3635] Flick, J., "Definitions of Managed Objects for the Ethernet-like Interface Types", [RFC 3635](#), September 2003.

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