CableLabs® Specifications

Superseded

Battery Backup MIB

CL-SP-MIB-BB-I01-050128

ISSUED

Notice

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Key to Document Status Codes:

Work in Progress	An incomplete document, designed to guide discussion and generate feedback, that may include several alternative requirements for consideration.
Draft	A document in specification format considered largely complete, but lacking review by Members and vendors. Drafts are susceptible to substantial change during the review process.
Issued	A stable document, which has undergone rigorous member and vendor review and is suitable for product design and development, cross-vendor interoperability, and for certification testing.
Closed	A static document, reviewed, tested, validated, and closed to further engineering change requests to the specification through CableLabs.

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1 SCOPE

This specification describes the Battery Backup Uninterrupted Power Supply (UPS) MIB requirements for CableLabs devices.

1.1 Requirements

Throughout this document, the words that are used to define the significance of particular requirements are capitalized. These words are:

"MUST"	This word or the adjective "REQUIRED" means that the item is an absolute requirement of this specification.
"MUST NOT"	This phrase means that the item is an absolute prohibition of this specification.
"SHOULD"	This word or the adjective "RECOMMENDED" means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighed before choosing a different course.
"SHOULD NOT"	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
"MAY"	This word or the adjective "OPTIONAL" means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.

2 REFERENCES

2.1 Normative References

In order to claim compliance with this specification, it is necessary to conform to the following standards and other works as indicated, in addition to the other requirements of this specification. Notwithstanding, intellectual property rights may be required to use or implement such normative references.

[1] DOCSIS 2.0 Operations Support System Interface Specification, CM-SP-OSSIv2.0-I07-041210, December 10, 2004, Cable Television Laboratories, Inc.

[2] IETF RFC 1628, UPS Management Information Base, May 1994.

2.2 Informative References

[3] IETF RFC 3410, Introduction and Applicability Statements for Internet-Standard Management Framework, December 2002.

2.3 Reference Acquisition

- Cable Television Laboratories, Inc., 858 Coal Creek Circle, Louisville, CO 80027;
  Phone 303-661-9100; Fax 303-661-9199; Internet: http:// www.cablemodem.com.
- Internet Engineering Task Force (IETF) Secretariat c/o Corporation for National Research Initiatives,
  1895 Preston White Drive, Suite 100, Reston, VA 20191-5434, Phone 703-620-8990,
  Fax 703-620-9071, Internet http://www.ietf.org/

3 ABBREVIATIONS

This document uses the following abbreviations and acronyms.

eDOCSIS	Embedded Data-Over-Cable Service Interface Specifications
LED	Light Emitting Diode
MIB	Management Information Base
UPS	Uninterrupted Power Supply

4 UPS MIB AND LED FUNCTIONALITY

4.1 Introduction

CableLabs devices MAY support battery backup capabilities with Uninterrupted Power Supply (UPS) functionality. An example of such device is a PacketCable Embedded MTA eDOCSIS device. This document extends the set of CableLabs MIB modules to provide SNMP management of the UPS power source and battery backup functions.

Support for battery backup capabilities with UPS functionality is becoming important as some broadband services rely on constant uptime. The CableLabs UPS components consist of one or more battery packs and associated management functions to allow the control of power supply inputs and outputs. When the UPS is being provided power via the utility line (power outlet), the battery pack(s) are able to charge. When utility power is removed, the UPS component switches to the battery backup power source to provide power to the device until utility power has been reapplied or the battery pack(s) have been depleted.

CableLabs compliant devices that include battery backup with UPS functionality MUST include a Battery LED that relays information on the status of the UPS and battery pack(s). For more information about the Battery LED requirements, refer to section 4.2.2.

Figure 1 describes the typical functional blocks of a UPS component connected to an eDOCSIS device.

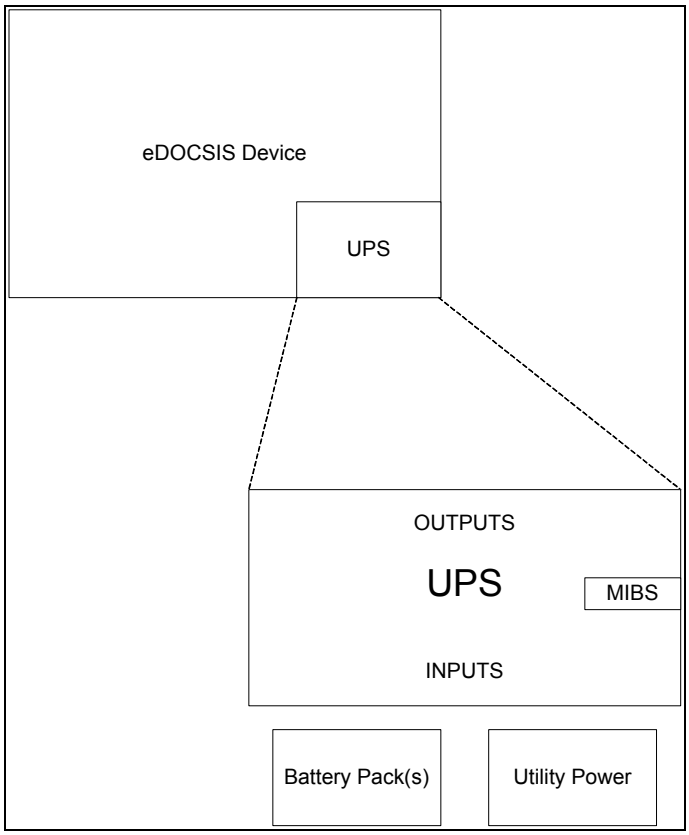

Figure 1 - UPS Components in eDOCSIS Devices

4.2 UPS Management

The purpose of this section is to define the UPS management requirements for CableLabs devices supporting battery backup UPS functionality.

CableLabs compliant devices supporting battery backup functionality MUST support UPS management and MUST comply with the SNMP MIB requirements of IETF RFC 1628 [2] as defined in this section. RFC 1628 [2] contains more information than is required for the simple UPS devices used for PacketCable VoIP or HSD services. This document defines an SMI compliance statement for IETF RFC 1628 [2] that MUST be supported by CableLabs compliant devices with UPS functionality.

4.2.1 CableLabs Battery Backup UPS MIB Requirements

The Battery Backup and UPS MIB objects MUST be implemented as defined below.

```
CLAB-UPS-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY         FROM SNMPv2-SMI      -- RFC 2578
    MODULE-COMPLIANCE       FROM SNMPv2-CONF     -- RFC 2580

    cableLabs               FROM CLAB-DEF-MIB

    upsIdentManufacturer,
    upsIdentModel,
    upsIdentAgentSoftwareVersion,
    upsIdentName,
    upsIdentAttachedDevices,
    upsBatteryStatus,
    upsSecondsOnBattery,
    upsEstimatedMinutesRemaining,
    upsEstimatedChargeRemaining,
    upsInputLineBads,                           -- optional
    upsInputNumLines,
    upsInputFrequency,                          -- optional
    upsInputVoltage,                            -- optional
    upsOutputSource,
    upsOutputFrequency,                         -- optional
    upsOutputNumLines,
    upsOutputVoltage,                           -- optional
    upsAlarmsPresent,
    upsAlarmDescr,
    upsAlarmTime,
    upsShutdownType,
    upsShutdownAfterDelay,
    upsStartupAfterDelay,
    upsRebootWithDuration,
    upsAutoRestart,                             -- optional
    upsConfigInputVoltage,                      -- optional
    upsConfigInputFreq,                         -- optional
    upsConfigOutputVoltage,                     -- optional
    upsConfigOutputFreq,                        -- optional
    upsConfigOutputVA,                          -- optional
    upsConfigOutputPower,                       -- optional
    upsConfigLowBattTime,
    upsConfigAudibleStatus                      -- optional
                            FROM UPS-MIB;       -- RFC 1628


clabUpsMib MODULE-IDENTITY
    LAST-UPDATED "200501280000Z" -- January 28, 2005
    ORGANIZATION "Cable Television Laboratories, Inc."
    CONTACT-INFO
            "Sumanth Channabasappa - CableLabs
             Postal: Cable Television Laboratories, Inc
             858 Coal Creek Circle
             Louisville, CO 80027
             U.S.A.
             Phone: +1 303 661 9100
             Fax: +1-303 661-9199
             E-mail:mibs@cablelabs.com

             Acknowledgements:
```

```
            Jean-Francois Mule - CableLabs, Inc.
            Kevin Marez, Motorola, Inc."
    DESCRIPTION
            "This MIB module provides the management objects for the
             configuration and monitoring of the battery backup & UPS
             functionality for CableLabs compliant devices."

    ::= { clabCommonMibs 1 }

-- Administrative assignments

clabUpsNotifications OBJECT IDENTIFIER ::= { clabUpsMib 0 }
clabUpsObjects       OBJECT IDENTIFIER ::= { clabUpsMib 1 }
clabUpsConformance   OBJECT IDENTIFIER ::= { clabUpsMib 2 }


-- Object Groups
-- The object groups used in this MIB module are imported from
-- the IETF RFC 1628, see the module compliance statement


-- Conformance Statements
   clabUpsCompliances OBJECT IDENTIFIER ::=
                                          { clabUpsConformance 1 }
   clabUpsGroups OBJECT IDENTIFIER      ::=
                                          { clabUpsConformance 2 }


clabUpsMibCompliance MODULE-COMPLIANCE
       STATUS     current
       DESCRIPTION
               "The compliance statement for CableLabs compliant
                devices that implement battery backup and UPS
                functionality."

       MODULE UPS-MIB -- RFC 1628
           MANDATORY-GROUPS  {
                     upsSubsetIdentGroup,
                     upsFullBatteryGroup,
                     upsBasicInputGroup,
                     upsBasicOutputGroup,
                     upsBasicAlarmGroup,
                     upsBasicControlGroup,
                     upsBasicConfigGroup
                     }


   -- upsSubsetIdentGroup OBJECT-GROUP
   --    OBJECTS { upsIdentManufacturer, upsIdentModel,
   --              upsIdentAgentSoftwareVersion, upsIdentName,
   --              upsIdentAttachedDevices }

   OBJECT       upsIdentManufacturer
   DESCRIPTION
      "The value of the upsIdentManufacturer object MUST contain the
       name of the device manufacturer."

   OBJECT       upsIdentModel                        -- same as RFC 1628
   DESCRIPTION
      "The UPS Model designation."
```

```
OBJECT       upsIdentAgentSoftwareVersion        -- same as RFC 1628
DESCRIPTION
   "The UPS agent software version.
    This object may have the same value as the
    upsIdentUPSSoftwareVersion object."

OBJECT       upsIdentName
DESCRIPTION
   "The upsIdentName object identifies the UPS and its value SHOULD
    be provided in the device configuration file. If the
    upsIdentName value is not provided in the configuration file,
    the default value MUST be an empty string."

OBJECT       upsIdentAttachedDevices
DESCRIPTION
   "The upsIdentAttachedDevices MUST contain the list of
    devices attached to the UPS power output.
    The value of the upsIdentAttachedDevices object SHOULD follow
    the naming conventions defined for CableLabs DHCP option 43
    sub-option 3.
    For example, if the eDOCSIS device is an E-MTA with an
    integrated eCM and an eMTA eSAFE, this object must contain the
    value 'ECM:EMTA' (without the single quotes)."


--   upsFullBatteryGroup OBJECT-GROUP
--    OBJECTS { upsBatteryStatus, upsSecondsOnBattery,
--              upsEstimatedMinutesRemaining,
--              upsEstimatedChargeRemaining }

OBJECT       upsBatteryStatus
SYNTAX     INTEGER {
    batteryNormal(2),
    batteryLow(3),
    batteryDepleted(4)
}
DESCRIPTION
   "The support of the upsBatteryStatus object value unknown(1) is
    not required."

OBJECT       upsSecondsOnBattery
DESCRIPTION
   "If the device is on battery power, the
    upsSecondsOnBattery object MUST return the elapsed time
    since the UPS last switched to battery power, or the
    time since the device was last restarted, whichever is
    less.
    The upsSecondsOnBattery object MUST return a value of 0 if the
    attached devices are not on battery power."

OBJECT       upsEstimatedMinutesRemaining     -- same as RFC 1628
DESCRIPTION
   "An estimate of the time to battery charge depletion
    under the present load conditions if the utility power
    is off and remains off, or if it were to be lost and
    remain off."

OBJECT       upsEstimatedChargeRemaining      -- same as RFC 1628
DESCRIPTION
```

```
      "An estimate of the battery charge remaining expressed
       as a percent of full charge."


--   upsBasicInputGroup OBJECT-GROUP
--       OBJECTS { upsInputLineBads, upsInputNumLines,
--                 upsInputFrequency, upsInputVoltage }

   OBJECT       upsInputLineBads
   DESCRIPTION
      "The upsInputLineBads object MAY be supported."

   OBJECT       upsInputNumLines
   DESCRIPTION
      "The upsInputNumLines object specifies the number of input
       lines utilized in this device.
       For example, for an eDOCSIS E-MTA device with 1 battery pack
       and 1 AC power source, this object value must be 2."

   OBJECT       upsInputFrequency
   DESCRIPTION
      "The upsInputFrequency object MAY be supported."

   OBJECT       upsInputVoltage
   DESCRIPTION
      "The upsInputVoltage object MAY be supported."


--   upsBasicOutputGroup OBJECT-GROUP
--       OBJECTS { upsOutputSource, upsOutputFrequency,
--                 upsOutputNumLines, upsOutputVoltage }

   OBJECT       upsOutputSource
   SYNTAX INTEGER {
       none(2),
       normal(3),
       battery(5)
   }
   DESCRIPTION
      "The devices capable of supporting battery backup and UPS
       functionality MUST support the upsOutputSource values of
       none(2), normal(3), battery(5). The upsOutputSource value of
       other(1) may be used to represent transient states."

   OBJECT       upsOutputFrequency
   DESCRIPTION
      "The upsOutputFrequency object MAY be supported."

   OBJECT       upsOutputNumLines
   DESCRIPTION
      "The upsOutputNumLines object specifies the number of output
       lines utilized in this eDOCSIS device.
       For example, for an eDOCSIS E-MTA devices with both the eCM and
       eMTA attached to the UPS, this object value must be 2."

   OBJECT        upsOutputVoltage
   DESCRIPTION
      "The upsOutputVoltage object MAY be supported."
```

```
--   upsBasicAlarmGroup OBJECT-GROUP
--       OBJECTS { upsAlarmsPresent, upsAlarmDescr, upsAlarmTime }

   OBJECT       upsAlarmsPresent                  -- same as RFC 1628
   DESCRIPTION
      "The upsAlarmsPresent object indicates the current number of
       active alarm conditions."

   OBJECT       upsAlarmDescr
   DESCRIPTION
      "The following well known alarm types MUST be supported by
       the CableLabs UPS capable devices:
          upsAlarmBatteryBad,
          upsAlarmOnBattery,
          upsAlarmLowBattery,
          upsAlarmDepletedBattery,
          upsAlarmOutputOffAsRequested,
          upsAlarmUpsOutputOff,
          upsAlarmGeneralFault,
          upsAlarmAwaitingPower,
          upsAlarmShutdownPending,
          and upsAlarmShutdownImminent."

   OBJECT       upsAlarmTime                      -- same as RFC 1628
   DESCRIPTION
      "The upsAlarmTime object indicates the value of sysUpTime when
       the alarm condition was detected."


--   upsBasicControlGroup OBJECT-GROUP
--       OBJECTS { upsShutdownType, upsShutdownAfterDelay,
--                 upsStartupAfterDelay, upsRebootWithDuration,
--                 upsAutoRestart }

   OBJECT       upsShutdownType
   SYNTAX     INTEGER {
                        output(1)
                      }
   DESCRIPTION
      "The upsShutdownType object defines the nature of the action to
       be taken at the time when the countdown of the
       upsShutdownAfterDelay and upsRebootWithDuration object values
       reach zero.
       The support for the upsShutdownType value system is not
       required (for CableLabs compliant devices, a system shutdown or
       reset can be achieved using other mechanisms."

   OBJECT       upsStartupAfterDelay
   SYNTAX     INTEGER (-1..604800) -- max range is 7 days or 604800s
   DESCRIPTION
      "The upsStartupAfterDelay MUST be supported.
       The CableLabs devices capable of support battery backup and UPS
       functionality MUST support a maximum upsStartupAfterDelay value
       of 604800 seconds, equivalent to 7 days."

   OBJECT       upsRebootWithDuration             -- same as RFC 1628
   DESCRIPTION
      "The upsRebootWithDuration controls a reboot procedure with
       a countdown. It also indicates whether a reboot procedure is in
       progress and the number of seconds remaining in the countdown."
```

```
   OBJECT       upsAutoRestart                    -- same as RFC 1628
   DESCRIPTION
      "The upsAutoRestart is only applicable for UPS system shutdown;
       it MAY be supported."


--   upsBasicConfigGroup OBJECT-GROUP
--       OBJECTS { upsConfigInputVoltage, upsConfigInputFreq,
--                 upsConfigOutputVoltage, upsConfigOutputFreq,
--                 upsConfigOutputVA, upsConfigOutputPower,
--                 upsConfigLowBattTime, upsConfigAudibleStatus }

   OBJECT       upsConfigInputVoltage
   DESCRIPTION
      "The upsConfigInputVoltage MAY be supported."

   OBJECT       upsConfigInputFreq
   DESCRIPTION
      "The upsConfigInputFreq MAY be supported."

   OBJECT       upsConfigOutputVoltage
   DESCRIPTION
      "The upsConfigOutputVoltage MAY be supported."

   OBJECT       upsConfigOutputFreq
   DESCRIPTION
      "The upsConfigOutputFreq MAY be supported."

   OBJECT       upsConfigOutputVA
   DESCRIPTION
      "The upsConfigOutputVA MAY be supported."

   OBJECT       upsConfigOutputPower
   DESCRIPTION
      "The upsConfigOutputPower MAY be supported."

   OBJECT       upsConfigLowBattTime              -- same as RFC 1628
   DESCRIPTION
      "The upsConfigLowBattTime specifies the value of
       upsEstimatedMinutesRemaining at which a lowBattery condition is
       declared.
       Implementation of all possible values may be onerous for some
       systems.  Consequently, not all possible values must be
       supported. However, at least two different
       manufacturer-selected values for upsConfigLowBattTime MUST be
       supported."

   OBJECT       upsConfigAudibleStatus
   DESCRIPTION
      "The upsConfigAudibleStatus MAY be supported."

       ::= { clabUpsCompliances 1 }


   --
   -- Units of conformance for CableLabs UPS capable devices
   -- Adapted from RFC 1628, a column was added for CableLabs devices
   -- An 'x' in the column means the object MUST be supported; all the
   -- rest is optional and left for vendor decision.
```

```
-- Summary at a glance:

   --                                    subset  basic   adv CLAB-UPS
COMPLIANCE GROUP
   --                                                          MUST
   --upsIdentManufacturer                  x       x       x    x
upsSubsetIdentGroup
   --upsIdentModel                         x       x       x    x
upsSubsetIdentGroup
   --upsIdentUPSSoftwareVersion                    x       x
   --upsIdentAgentSoftwareVersion          x       x       x    x
upsSubsetIdentGroup
   --upsIdentName                          x       x       x    x
upsSubsetIdentGroup
   --upsIdentAttachedDevices               x               x    x
upsSubsetIdentGroup
   --
   --upsBatteryStatus                      x       x       x    x
upsFullBatteryGroup
   --upsSecondsOnBattery                   x       x       x    x
upsFullBatteryGroup
   --upsEstimatedMinutesRemaining                          x    x
upsFullBatteryGroup
   --upsEstimatedChargeRemaining                           x    x
upsFullBatteryGroup
   --upsBatteryVoltage
   --upsBatteryCurrent
   --upsBatteryTemperature
   --
   --upsInputLineBads                      x       x       x
   --upsInputNumLines                              x       x    x
upsBasicInputGroup
   --upsInputFrequency                             x       x
   --upsInputVoltage                               x       x
   --upsInputCurrent
   --upsInputTruePower
   --
   --upsOutputSource                       x       x       x    x
upsBasicOutputGroup
   --upsOutputFrequency                            x       x
   --upsOutputNumLines                             x       x    x
upsBasicOutputGroup
   --upsOutputVoltage                              x       x
   --upsOutputCurrent                                      x
   --upsOutputPower                                        x
   --upsOutputPercentLoad                                  x
   --
   --
   --upsBypassFrequency                            x       x
   --upsBypassNumLines                             x       x
   --upsBypassVoltage                              x       x
   --upsBypassCurrent
   --upsBypassPower
   --
```

```
   --
   --upsAlarmsPresent                  x       x       x   x
upsBasicAlarmGroup
   --upsAlarmDescr                     x       x       x   x
upsBasicAlarmGroup
   --upsAlarmTime                      x       x       x   x
upsBasicAlarmGroup
   --
   --upsTestId                                 x       x
   --upsTestSpinLock                           x       x
   --upsTestResultsSummary                     x       x
   --upsTestResultsDetail                      x       x
   --upsTestStartTime                          x       x
   --upsTestElapsedTime                        x       x
   --
   --upsShutdownType                   x       x       x   x
upsBasicControlGroup
   --upsShutdownAfterDelay             x       x       x   x
upsBasicControlGroup
   --upsStartupAfterDelay                      x       x   x
upsBasicControlGroup
   --upsRebootWithDuration                     x       x   x
upsBasicControlGroup
   --upsAutoRestart                    x       x       x
   --
   --upsConfigInputVoltage             x       x       x
   --upsConfigInputFreq                x       x       x
   --upsConfigOutputVoltage            x       x       x
   --upsConfigOutputFreq               x       x       x
   --upsConfigOutputVA                 x       x       x
   --upsConfigOutputPower              x       x       x

   --upsConfigLowBattTime                                  x
upsBasicConfigGroup

END
```

4.2.2 Power and Battery LED requirements

CableLabs devices with UPS functionality MUST provide a special LED labeled as "BATTERY" (referred to as BATTERY LED or Battery LED in this document). The BATTERY LED conventions MUST comply with the requirements defined in this section in Table 1. The "POWER" LED of CableLabs devices with UPS functionality MUST also support the additional requirements defined in Table 1 of this section when the device is running on battery backup power.

The Power and Battery LED requirements and location on CableLabs devices with UPS functionality MUST be consistent with the requirements in Section 7 of the DOCSIS 2.0 OSSI specification [1].

The following table defines the LED functionality used to relay power and battery status information:

Table 1 - Power and Battery LED Operations By State

Mode of Operation	UPS Power Input Source	Battery Status	POWER LED Requirements	BATTERY LED Requirements
Device Initialization			Unlit	Lit
Normal Operation	**AC Power** (AC Power is ON)	**Good Battery**	Lit	Lit
		Low Battery	Lit	Flash
		Bad Battery	Lit	Unlit
	Battery Power (AC Power is OFF, battery input source is ON	**Good Battery**	Flash	Unlit
		Low Battery	Flash	Flash
		Bad Battery	Unlit (see Note 1*)	Unlit

**Note 1*: During AC Power Fail with a bad battery, device operation may not be possible due to lack of battery power; the POWER and BATTERY LEDs may be 'Unlit'.

The Battery LED MUST be 'Lit' under the following conditions:

- The Battery LED MUST be 'Lit' during the initialization of all the components attached to the UPS (the list of components or eSAFE devices attached to the UPS is defined by the `upsIdentAttachedDevices` object in the `CLAB-UPS-MIB` module).

- The Battery LED MUST be 'Lit' if the eDOCSIS UPS is operating on AC power and the battery is functioning normally.

The Battery LED MUST be 'Unlit' under the following conditions:

- One or more batteries are determined to be in "bad" condition.
  A battery "bad" condition occurs when one or more batteries have been determined to require replacement, for example when a battery is malfunctioning or may not be rechargeable. Such condition also triggers the `upsAlarmBatteryBad` alarm in the `CLAB-UPS-MIB` module.

- The UPS is operating on battery power and the battery is functioning normally.

The Battery LED MUST 'Flash' under the following condition:

- The Battery LED MUST 'Flash' if the battery is low. A low battery condition is reached when the remaining battery run-time is less than or equal to the value of the `upsConfigLowBattTime`

MIB object in the `CLAB-UPS-MIB` module (such condition also triggers the `upsAlarmLowBattery` alarm condition).

4.2.3 Applicability of the CableLabs Battery Backup UPS MIB requirements

The battery backup and UPS functionality may be implemented in various CableLabs devices, for example a PacketCable Embedded Multimedia Terminal Adapter (E-MTA), a standalone Cable Modem or any eDOCSIS device. This section specifies additional applicability statements.

4.2.3.1 PacketCable E-MTA devices

In the case of a PacketCable Embedded Multimedia Terminal Adapter (E-MTA) device used to provide telephony services, service uptime is critical and the usage of battery backup UPS components may be an operator requirement.

A PacketCable E-MTA supporting battery backup UPS functionality MUST provide UPS output power to both the embedded cable modem (eCM) and the MTA eSAFE device (eMTA). Therefore, the upsIdentAttachedDevices object MUST contain the value 'ECM:EMTA' (without the single quotes).

Appendix A Acknowledgements

On behalf of CableLabs and its participating member companies, we would like to extend our thanks to all those who contributed to the development of this specification. Certainly all the participants of the provisioning focus team have added value to this effort by participating in the review and weekly conference calls. Particular thanks are given to:

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