

# **CableLabs® Specifications**

## **Battery Backup MIB**

**CL-SP-MIB-BB-I02-070119**

**ISSUED**

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## Document Status Sheet

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### Key to Document Status Codes:

<b>Work in Progress</b>	An incomplete document, designed to guide discussion and generate feedback, that may include several alternative requirements for consideration.
<b>Draft</b>	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.
<b>Issued</b>	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.
<b>Closed</b>	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 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 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 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-I09-050812, August 12, 2005, 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 +1-303-661-9100; Fax +1-303-661-9199; [http:// www.cablelabs.com](http://www.cablelabs.com).
- Internet Engineering Task Force (IETF) Secretariat 46000 Center Oak Plaza, Sterling, VA 20166, Phone: +1-571-434-3500, Fax: +1-571-434-3535, <http://www.ietf.org/Abbreviations>

## 3 ABBREVIATIONS

This document uses the following abbreviations and acronyms.

<b>eDOCSIS</b>	Embedded Data-Over-Cable Service Interface Specifications
<b>eCM</b>	Embedded Cable Modem
<b>E-MTA</b>	Embedded Multimedia Terminal Adapter
<b>LED</b>	Light Emitting Diode
<b>MIB</b>	Management Information Base
<b>MTA</b>	Multimedia Terminal Adapter
<b>SNMP</b>	Simple Network Management Protocol
<b>UPS</b>	Uninterrupted Power Supply

## 4 UPS MIB AND LED FUNCTIONALITY

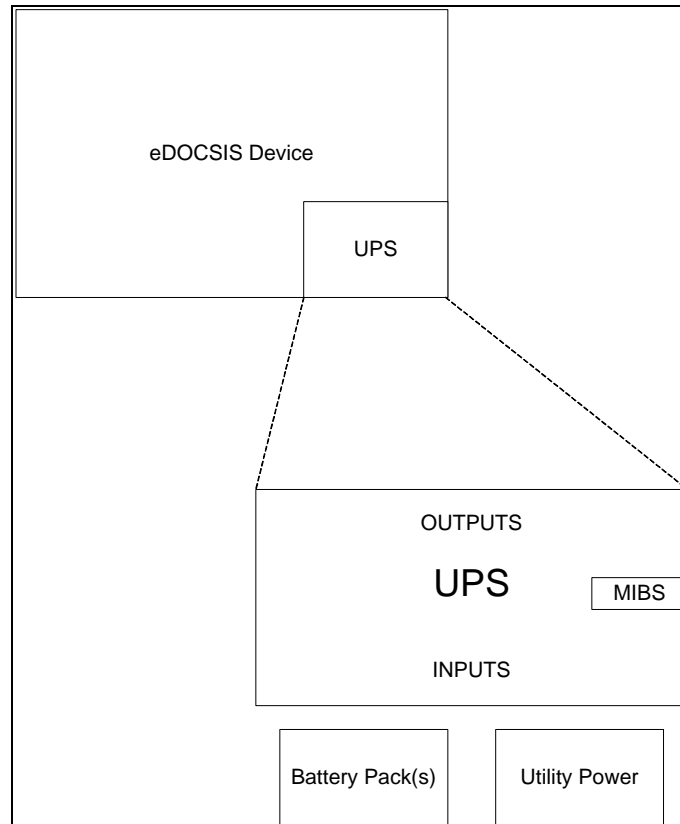
### 4.1 Introduction

CableLabs devices MAY support battery backup capabilities with Uninterrupted Power Supply (UPS) functionality. An example of such device is a PacketCable Embedded Multimedia Terminal Adapter (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 digital voice or DOCSIS broadband data services. This document defines an SMI compliance statement for IETF RFC 1628 [2] that **MUST** be supported by CableLabs compliant devices with UPS functionality. Further, access to the UPS MIB objects **MUST** be provided via the eCM interface.

### 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
```

```
    clabCommonMibs          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 "200701190000Z" -- January 19, 2007
ORGANIZATION "Cable Television Laboratories, Inc."
CONTACT-INFO

```

```

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```

```

    Acknowledgements:
    Jean-Francois Mule, CableLabs.
    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."

```

```

    Copyright 2004-2007 Cable Television Laboratories, Inc.
    All rights reserved."

```

```

REVISION "200701191700Z" -- January 19, 2007

```

## DESCRIPTION

```

    "This revision published as CL-SP-MIB-BB-I02-070119."

```

```

REVISION "200501280000Z" -- January 28, 2005

```

```
DESCRIPTION
    "This revision published as CL-SP-MIB-BB-
I01-050128."

 ::= { 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
DESCRIPTION
    "The UPS Model designation."

OBJECT      upsIdentAgentSoftwareVersion
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 MUST	COMPLIANCE GROUP
--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 x upsSubsetIdentGroup
--
--upsBatteryStatus x x x x upsFullBatteryGroup
--upsSecondsOnBattery x x x x upsFullBatteryGroup
--upsEstimatedMinutesRemaining x x x upsFullBatteryGroup
--upsEstimatedChargeRemaining x 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 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 I 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:

Eugene Nechamkin (Broadcom Corp.)

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## Appendix II Revision History

The following ECNs have been incorporated in CL-SP-MIB-BB-I02-070119.

<b>ECN</b>	<b>Date Accepted</b>	<b>Summary</b>
MIB-BB-N-06.0022-2	3/13/06	Clarification of UPS MIB SNMP access
MIB-BB-N-07.0026-1	1/18/07	Editorial Changes