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Proactive Network Maintenance

Proactive Network Maintenance (PNM) is a technique that enables the collection of network data to characterize them and make improvements to them. The immediate benefit is to help decide what modulation rate to use for your Interval Usage Codes (IUCs). With the help of sophisticated software analysis, operators can also use it to identify and correct problems in the physical plant. For example, if a number of modems in the same vicinity are experiencing a low Modulation Error Ratio (MER), the software analysis might extrapolate from their locations to identify noise problems in a cable or passive element upstream from them.

The E6000 CER implements PNM using various tests: US RxMER, US Capture for Active and Quiet Probes, US Impulse Noise Statistics, US Histogram, Upstream Triggered Spectrum Capture (UTSC). Tests are initiated using SNMP and MIBs. The results are stored in files on RSM or RSM-2 card in the **/pnm** directory.

PNM file formats follow those defined in the DOCSIS 3.1 OSSIv4.0 103 specifications. This format change results in test outcomes to be placed in the following directories:

- US RxMER: **/pnm/mer**
- US Capture for Active or Quiet Probes: **/pnm/aqprobe**
- UTSC: **/pnm/utsc**
- US Impulse Noise: **/pnm/usimpnoise**
- US Histogram: **/pnm/histogram**

Note: The E6000 CER automatically creates this directory if it does not yet exist and a timestamp is appended to the configured (base) filename for all PNM results files.

You can determine the number and size of files using the du or df CLI commands. The files in the **/pnm/xxx** directory can be copied for analysis.

Note: In the case of a CAM recovery, the tests restart. In the case of a system reboot or RSM soft switch, all files in the **/pnm** directory are deleted.

Parent topic: Support for DOCSIS 3.1

UTSC

An Upstream Triggered Spectrum Capture (UTSC) uses the docsPnmCmtsUtscCfg Table to configure the parameters for a UTSC test. The E6000 CER creates 24 rows in the table to accommodate each upstream RF

port as needed when a UCAM-2 slot is configured and deletes the corresponding rows when a UCAM-2 slot is deleted. The MIB configures which upstream RF port will be tested, including any required parameters for a specific test. When a UTSC results in frequency ranges outside of the allowable center frequency range, an InconsistentValue setting error code is output.

The E6000 CER supports UTSC FreeRunning trigger mode and SID-based trigger modes IdleSID and CM MAC Address used for spectrum captures. For UTSC, the E6000 CER supports concurrently running a single FreeRunning or a single, SID-based trigger mode test on one of the UCAM-2 RF ports.

The three supported trigger modes can be used for spectrum captures on any of the upstream RF ports. The upstream triggered spectrum analysis measurement provides a wideband or narrowband spectrum analyzer in the CCAP with I-CCAP operation. This can be triggered to examine upstream transmissions and underlying noise or interference during quiet periods.

This table summarizes the type of FFT Spectrum Analysis Circuit (SAC) associated with each UTSC trigger mode.

UTSC Trigger Mode	FFT SAC Type
FreeRunning	Wideband FFT SAC
IdleSID and CM MAC Address with SC-QAM trigger channel	Narrowband FFT SAC
IdleSID and CM MAC Address with OFDMA trigger channel	Wideband FFT SAC

- With Freerunning trigger mode, the E6000 CER initiates sampling when the docsPnmCmtsUtscCtrlInitiateTest attribute is set to **true**. Sampling terminates when the time duration configured in docsPnmCmtsUtscCfgFreeRunDuration has elapsed or the test is disabled by setting docsPnmCmtsUtscCtrlInitiateTest to **false**. The interval between captures is determined by the setting of the docsPnmCmtsUtscCfgRepeatPeriod attribute.

- With IdleSID trigger mode, a sample capture is performed when triggered by a grant to a SID value associated with a particular CM on a configured triggering channel If the configured docsPnmCmtsUtscCfgTriggerCount is greater than one, then the capture is repeated when triggered by successive grants to the IdleSID until the number of captures (limited to 10) equals the docsPnmCmtsUtscCfgTriggerCount.

- With CM MAC Address trigger mode, a sample capture is performed when triggered by a grant to a SID value associated with a particular CM on a configured triggering channel (either SC-QAM or OFDMA, as specified by the LogicalChIfIndex attribute). For this trigger mode, the E6000 CER will cause the CM to transmit enough data via grants for the sake of this test (see the table below). If the configured TriggerCount is greater than one, the capture is repeated when triggered by successive grants to the SID until the number of captures equals the TriggerCount. This mode can be used for spectrum captures with either an SC-QAM or OFDMA triggering channel. The particular SID value is not configured by the operator; it is chosen by the CCAP.

This table summarizes the idle period and spectrum corresponding to IdleSID and CM MAC Address trigger modes with SC-QAM and OFDMA trigger channel types.

Trigger mode	Trigger channel type	Grant message type	Grant period and spectrum
IdleSID	SC-QAM	MAP	One minislot across the entire width of the SC-QAM channel
	OFDMA	Probe Map	One symbol including all subcarriers across the OFDMA channel
CM MAC Address	SC-QAM	Ranging opportunity (ie., RANGE-REQUEST)	One or more minislots (depending on various parameters) across the entire width of the SC-QAM channel
	OFDMA	Probe Map	Two symbols including all subcarriers across the OFDMA channel

Note: For CM MAC Address trigger mode only: For both the OFDMA and SC-QAM triggering channel cases, the CM's primary SID is used. If a rare case occurs where the CM's primary SID is not associated with the configured LogicalChIfIndex, then a different SID associated with the CM will be used.

Parent topic: Proactive Network Maintenance

Set a file and store results

To set a file and store results within, configure the parameters for the UTSC of an upstream RF port.

1. Use SNMP to set the base filename.
   Note that the E6000 CER will automatically create the **/pnm/utsc** directory if the directory does not already exist. This is where the test results are placed.

2. The docsPnmCmtsUtscCtrlInitiateTest should be set to **true** to begin the test.

3. When the file is ready, the docsPnmCmtsUtscStatusMeasStatus will be set to **sampleReady** and the file is available in the **/pnm/utsc** directory.

Parent topic: UTSC

Trigger mode timeout values

The table in this topic shows the trigger mode timeout values for RPHY UTSC with dynamic pseudowires and I-CCAP UTSC. If the expected number of result sets is not received within the timer window, the test will be aborted and the E6000 CER will generate a notice-level log message.

Table 1. Trigger mode timeout values

Trigger mode	Timeout value
FreeRunning	60 seconds
IdleSID	90 seconds
CM MAC Address	2 minutes

Parent topic: Set a file and store results

UTSC operational considerations

The E6000 CER will reject setting docsPnmCmtsUtscCtrlInitiateTest to **true** if any of the following are true:

Note: If the E6000 CER rejects setting docsPnmCmtsUtscCtrlInitiateTest to **true**, the E6000 CER will log a notice-level message providing details as to why the write to docsPnmCmtsUtscCtrlInitiateTest was blocked.

- The docsPnmCmtsUtscCfgCmMacAddr attribute of docsPnmCmtsUtscCfgTable is set to a CM MAC address that does not exist.
- The cable modem identified by the docsPnmCmtsUtscCfgCmMacAddr attribute of docsPnmCmtsUtscCfgTable is not registered.
- docsPnmCmtsUtscStatusMeasStatus is already set to **busy** for that RPHY RF port.
- There is an RF port on the same UCAM-2 with docsPnmCmtsUtscCtrlInitiateTest to **true**.
- The UCAM-2 serving the RPHY RF port is not in-service.
- The docsPnmCmtsUtscCfgFilename is set to the null string.
- There is less than 16712 bytes of space left in the **/pnm** directory.
- A configured test parameter is not compatible with the supported capabilities of the I-CCAP.
- An attempt is made to configure docsPnmCmtsUtscCfgFreeRunDuration to a value that exceeds the allowed timeout value.
-

- if docsPnmCmtsUtscCfgTriggerMode is set to **CmMac(6)** and the following are true
  - A PNM Upstream Active Probe test is in progress utilizing the same OFDMA channel, same cable modem, and the same SID value as the UTSC test, or
  - A PNM Upstream RxMER test is in progress utilizing the same OFDMA channel, same cable modem, and the same SID value as the UTSC test

  The E6000 CER will reject setting docsPnmCmtsUsOfdmaAQProveEnable to true if to **true** if a PNM Upstream Triggered Spectrum Capture (UTSC) test with docsPnmCmtsUtscCfgTriggerMode set to**CmMac(6)** is in progress utilizing the same OFDMA channel, same cable modem, and the same SID value as the US Active Probe test. If rejected, the E6000 CER will log a notice-level message providing details of why the test was blocked from running.

- For UTSC tests using a Narrowband FFT with output formats other than TimeIQ, the capture window is supported up to 85 MHz. The capture window is determined by the configuration of the docsPnmCmtsUtscCfgCenterFreq and docsPnmCmtsUtscCfgSpan attributes and the high end must not exceed 85 MHz. A Narrowband FFT is used for IdleSID trigger mode with SC-QAM trigger channel or CM MAC Address trigger mode with SC-QAM trigger channel.

- Support for a docsPnmCmtsUtscCfgSpan setting of 160 MHz has been removed for Narrowband FFT UTSC tests with output formats other than TimeIQ.

See the following topcs:

- Center frequency configuration
- Unsupported UTSC frequency span and number of bins parameters

Parent topic: UTSC

Center frequency configuration

Sample results above 240 MHz are attenuated and samples above 350 MHz are not likely to be distinguished from the noise floor.

- For UTSC tests utilizing a Wideband FFT, the E6000 CER supports the configuration of the docsPnmCmtsUtscCfgCenterFreq attribute in the docsPnmCmtsUtscCfgTable with values in the range from 0 MHz to 204 MHz.

- For UTSC tests utilizing a Narrowband FFT, the E6000 CER supports the configuration of the docsPnmCmtsUtscCfgCenterFreq attribute in the docsPnmCmtsUtscCfgTable with values in the range from 0 MHz to 102 MHz.

- The E6000 CER will reject setting docsPnmCmtsUtscCtrlInitiateTest to **true** if the configured value for the docsPnmCmtsUtscCfgCenterFreq attribute is not in the supported range for the given Wideband or Narrowband FFT type.

- If the E6000 CER rejects setting docsPnmCmtsUtscCtrlInitiateTest to **true**, the E6000 CER logs a notice-level message providing details as to why the test was blocked from running.
- The E6000 CER will return an error code of InconsistentValue if the docsPnmCmtsUtscCfgCenterFreq is configured with a value that is not a multiple of 50 kHz.

Parent topic: UTSC operational considerations

Unsupported UTSC frequency span and number of bins parameters

For UTSC tests, the E6000 CER will reject setting docsPnmCmtsUtscCtrlInitiateTest to **true** if the configured value for the docsPnmCmtsUtscCfgSpan or docsPnmCmtsUtscCfgNumBins attribute of docsPnmCmtsUtscCfgTable is not one of the customer-supported values. This applies to tests utilizing a Wideband FFT Spectrum Analysis Circuit (SAC) or a Narrowband FFT SAC. If the E6000 CER rejects setting docsPnmCmtsUtscCtrlInitiateTest to **true**, the E6000 CER logs a notice-level message providing details as to why the test was blocked from running.

Note: The customer-supported values in the tables in this section represent the customer-usable (frequency span or number of bins) values. In the case of output formats other than TimeIQ, the customer-supported values are lower than the corresponding hardware-configured values due to roll-off effects.

Table 1. TimeIQ output format - docsPnmCmtsUtscCfgSpan - Wideband FFT

Customer-supported Value	Hardware Value
102.4 MHz	102.4 MHz
204.8 MHz	204.8 MHz
409.6 MHz	409.6 MHz

Table 2. TimeIQ output format - docsPnmCmtsUtscCfgSpan - Narrowband FFT

Customer-supported Value	Hardware Value
51.2 MHz	51.2 MHz
102.4 MHz	102.4 MHz
204.8 MHz	204.8 MHz

Table 3. TimeIQ output format - docsPnmCmtsUtscCfgNumBins- Wideband FFT and Narrowband FFT

Customer-supported Value	Hardware Value
256	256
512	512
1024	1024
2048	2048

Customer-supported Value	Hardware Value
4096	4096

Table 4. Formats other than TimeIQ output format - docsPnmCmtsUtscCfgSpan- Wideband FFT

Customer-supported Value	Hardware Value
80 MHz	102.4 MHz
160 MHz	204.8 MHz
320 MHz	409.6 MHz

Table 5. Formats other than TimeIQ output format - docsPnmCmtsUtscCfgSpan- Narrowband FFT

Customer-supported Value	Hardware Value
40 MHz	51.2 MHz
80 MHz	102.4 MHz
160 MHz	204.8 MHz

Table 6. Formats other than TimeIQ output format - docsPnmCmtsUtscCfgNumBins- Wideband and Narrowband FFT

Customer-supported Value	Hardware Value
200	256
400	512
800	1024
1600	2048
3200	4096

Parent topic: UTSC operational considerations

UTSC configuration support summary

The E6000 CER supports the configuration attributes in the docsPnmCmtsUtscCfgTable. This section provides a configuration support summary for Upstream Triggered Spectrum Capture (UTSC).

Parent topic: UTSC

UTSC notes and limitations

This table summarizes the configuration of the attributes of docsPnmCmtsUtscCfgTable.

Table 1. Attributes of docsPnmCmtsUtscCfgTable

docsPnmCmtsUtscCfgTable attribute	Notes
ifIndex	This key value is the ifIndex of the RPD's RF port.
docsPnmCmtsUtscCfgIndex(key- set to "1")	Not supported
docsPnmCmtsUtscCfgLogicalChIfIndex	Supported for SC-QAM and OFDMA channels for CM MAC Address and IdleSID trigger modes.
docsPnmCmtsUtscCfgTriggerMode	MIB settings: FreeRunning (value 2) IdleSID (value 5) cmMAC (value 6) Support for CM MAC Address trigger mode added Release 13.0.
docsPnmCmtsUtscCfgMinislotCount	Not supported
docsPnmCmtsUtscCfgSid	Not supported
docsPnmCmtsUtscCfgCmMacAddr	Supported and applies to CM MAC Address trigger mode only.
docsPnmCmtsUtscCfgTimestamp	Not supported
docsPnmCmtsUtscCfgCenterFreq	ScCfgCenterFreq settings must be multiples of 50 KHz. See the Center frequency configuration topic.
docsPnmCmtsUtscCfgSpan	A configuration request for a docsPnmCmtsUtscCfgNumSpan other than one of the supported values will be rejected. docsPnmCmtsUtscCfgSpan settings must be multiples of 50 KHz. See the Unsupported UTSC frequency span and number of bins parameter topic.
docsPnmCmtsUtscCfgNumBins	A configuration request for a docsPnmCmtsUtscCfgNumBins other than one of the supported values will be rejected. See Unsupported UTSC frequency span and number of bins parameter topic.
docsPnmCmtsUtscCfgAveraging	The MIB attribute is not allowed to be changed.

docsPnmCmtsUtscCfgTable attribute	Notes
docsPnmCmtsUtscCfgFilename	Must be set to the null string “”, "/pnm/utsc/filename, or "filename" (base filename) with no directories. After a PNM test completes, the E6000 CER appends a timestamp to the filename of the results file. • The timestamp is applied as ‘filename'_<timestamp> where ‘filename' is the string configured with the docsPnmCmtsUtscCfgFilename attribute • The timestamp is formatted in military time format as follows: <Year:4d>-<Month:2d>-<Day:2d>_<Hour:2d>.<Minute:2d>.<Second:2d>.<Millisecond:3d> The file name with appended timestamp is not reflected in a MIB attribute.
docsPnmCmtsUtscCfgQualifyCenterFreq	Not supported
docsPnmCmtsUtscCfgQualifyBw	Not supported
docsPnmCmtsUtscCfgQualifyThrshld	The MIB attribute is not allowed to be changed.
docsPnmCmtsUtscCfgWindow	Supported Window values: CORE and I-CCAP • 2 - rectangular I-CCAP • 3 - hann • 4 - blackmanHarris • 5 - hamming
docsPnmCmtsUtscCfgOutputFormat	1 - timeIQ 2 - fftPower: This is the only supported output format when the repeat period (docsPnmCmtsUtscCfgRepeatPeriod) is set between 1 microsecond and 49,999 microseconds. 4 - fftIQ

docsPnmCmtsUtscCfgTable attribute	Notes
	5 - fftAmplitude

docsPnmCmtsUtscCfgRepeatPeriod	Applies to FreeRunning trigger mode.
	Supported range: 0 to 1000 milliseconds details:
	• 0 milliseconds: capture once (docsPnmCmtsUtscCfgFreeRunDuration is ignored in this case).
	• Values greater than 0 and less than 50 milliseconds: Special case ("hardware-restricted" mode, supported for static pseudowires not dynamic) with RepeatPeriod varying but less than or equal to 2 milliseconds as determined by the RPD hardware.
	• Values greater than or equal to 50 milliseconds and less than or equal to 1000 milliseconds: The configured value in milliseconds will be accepted; however, the repeat period will be set operationally to the next highest 50 milliseconds (granularity is 50 milliseconds).
	• 50,000 microseconds corresponds to the minimum value supported on the CommScope E6000 CER products.
	• Values greater than 1000 milliseconds:
	  • Not supported - the configuration will be rejected
	  • Default value = 0

docsPnmCmtsUtscCfgFreeRunDuration	Applies to FreeRunning trigger mode. Supported values: 1 second to 10 minutes. Capture indefinitely (run until E6000 CER stops), however, docsPnmCmtsUtscCfgFreeRunDuration is ignored if docsPnmCmtsUtscCfgRepeatPeriod= 0. • Values greater than 0 seconds and les than or equal to 10 minutes (600,000 milliseconds): the configured value in milliseconds will be

docsPnmCmtsUtscCfgTable attribute	Notes

	accepted; however, the duration will be set operationally to the next highest 50 milliseconds (granularity is 50 milliseconds).
	• Values greater than 10 minutes (600,000 milliseconds):
	  • Not supported - the configuration will be rejected
	  • Default value = 0

docsPnmCmtsUtscCfgTriggerCount	Applies to IdleSID and CM MAC Address trigger modes. Supported for values 1 to 10. Value 0 (continuous capture) is not supported.
docsPnmCmtsUtscCfgBurstIuc	Not supported
docsPnmCmtsUtscCfgMaxResultsPerFile	Default value is 1 and this is not allowed to be changed.

Parent topic: UTSC configuration support summary

UPC active and quiet probes

- Active probe captures measure plant response while a cable modem is transmitting a known sequence of bits. The measurements are reported in either the time domain or the frequency domain.
- Quiet probe captures (also called silent probe captures) measure the underlying noise floor in the OFDMA band being measured. The measurements are reported in either the time domain or the frequency domain.

Note: Active probe or quiet probe captures are supported for OFDMA channels with 25kHz or 50 kHz subcarrier spacing. Only one active probe or quiet probe capture can be active on the UCAM-2 at a time.

The generated test file results are stored in the **/pnm/aqprobe** directory on the RSM or RSM-2 card.

Active and quiet probes are controlled by the docsPnmCmtsUsOfdmaAQProbeTable MIB table.

For more information, refer to:

- CableLabs: Data-Over-Cable Service Interface Specifications DOCSIS® 4.0 CCAP Operations Support System Interface Specification; CM-SP-CCAP-OSSIv4.0-I03-2101
- CableLabs: DOCS-RPHY-MIB-2021-03-11.txt

Parent topic: Proactive Network Maintenance

Active probes

Active probes measure noise while the modem is transmitting a known sequence of bits. The measurements are reported in the time domain or frequency domain. The results are stored in the **/pnm/aqprobe** directory on the RSM or RSM-2 card. The name of the directory, **aqprobe**, refers to both active and quiet probes, which are controlled by the same MIB table. Only one active or quiet probe can be active on a UCAM-2 at a time. The functional limit of this directory is 96 files. Once the maximum of 96 is reached, the oldest file is automatically deleted.

Parent topic: UPC active and quiet probes

Start an active probe

The docsPnmCmtsUsOfdmaAQProbeTable MIB table controls which OFDMA channel to test with a quiet probe capture. Use this procedure to configure the parameters to run a quiet probe capture on an OFDMA channel.

1. Specify a test results file name with the docsPnmCmtsUsOfdmaAQProbeFileName attribute. The test results file will be placed in the local **/pnm/aqprobe** directory on the E6000 CER.
2. Set the docsPnmCmtsUsOfdmaAQProbeUseIdleSid attribute to **true**.

   Note: By default, docsPnmCmtsUsOfdmaAQProbeUseIdleSid is set to **false**. This means that an active probe capture will be generated.

3. Set the docsPnmCmtsUsOfdmaAQProbeCmMacAddr attribute to the MAC address of the cable modem of interest.
4. Set the docsPnmCmtsUsOfdmaAQProbePreEqOn attribute to **true** to enable pre-equalization for the cable modem transmitting the active probe capture to be measured.
5. Set the docsPnmCmtsUsOfdmaAQProbeNumSymToCapt for the number of symbols to capture for the cable modem whose probe is being measured.
6. Set the docsPnmCmtsUsOfdmaAQProbeFreqDomainSamples attribute to configure the collection of output samples in the time domain or the frequency domain - **true** indicates that the values are in the frequency domain, **false** indicates that they are in the time domain.
7. Set the docsPnmCmtsUsOfdmaAQProbeEnable to **true**.

Note: The docsPnmCmtsUsOfdmaAQProbeTimeout attribute is not supported. The E6000 CER performs a sanity check. If there is a problem, then setting the docsPnmCmtsUsOfdmaAQProbeEnable attribute to **true** is rejected. If the sanity check does not block the test, then the docsPnmCmtsUsOfdmaAQProbeMeasStatus attribute reads **busy** while the test is in progress. After the test has successfully completed, docsPnmCmtsUsOfdmaAQProbeMeasStatus will read **sampleReady** meaning the results of the quiet probe have been received and data has been written to the file in the **/pnm/aqprobe** directory. If the test fails, docsPnmCmtsUsOfdmaAQProbeMeasStatus will read **error**. The E6000 CER will log a notice-level message providing details as to why the test failed.

Parent topic: Active probes

Quiet probes

Quiet probes (also called silent probes) measure the background noise per channel. The measurements are reported in the time domain or frequency domain. The results are stored in the **/pnm/aqprobe** directory on the RSM or RSM-2 card. The name of the directory, aqprobe, refers to both active and quiet probes, which are controlled by the same MIB table. Only one quiet probe or active probe can be active on a UCAM-2 at a time. The functional limit of this directory is 96 files. Once the maximum of 96 is reached, the oldest file is automatically deleted.

Parent topic: UPC active and quiet probes

Start a quiet probe

The docsPnmCmtsUsOfdmaAQProbeTable MIB table controls which OFDMA channel to test with a quiet probe capture. Configure the parameters to run a quiet probe capture on an OFDMA channel.

1. Specify a test results file name with the docsPnmCmtsUsOfdmaAQProbeFileName attribute. The test results file will be placed in the local **/pnm/aqprobe** directory on the E6000 CER.

2. Set the docsPnmCmtsUsOfdmaAQProbeUseIdleSid attribute to **true**.

   Note: By default, docsPnmCmtsUsOfdmaAQProbeUseIdleSid is set to **false** which means that an active probe capture will be generated.

3. Set the docsPnmCmtsUsOfdmaAQProbePreEqOn attribute to **true** to enable pre-equalization for the cable modem transmitting the active probe capture to be measured.

4. Set the docsPnmCmtsUsOfdmaAQProbeNumSymToCapt for the number of symbols to capture for the cable modem whose probe is being measured.

5. Set the docsPnmCmtsUsOfdmaAQProbeFreqDomainSamples attribute to configure the collection of output samples in the time domain or the frequency domain - **true** indicates that the values are in the frequency domain, **false** indicates that they are in the time domain.

6. Set the docsPnmCmtsUsOfdmaAQProbeEnable to **true**.

Note: The docsPnmCmtsUsOfdmaAQProbeTimeout attribute is not supported. The E6000 CER performs a sanity check. If there is a problem, then setting the docsPnmCmtsUsOfdmaAQProbeEnable attribute to **true** is rejected.

If the sanity check does not block the test, then the docsPnmCmtsUsOfdmaAQProbeMeasStatus attribute reads **busy** while the test is in progress.

After the test has successfully completed, docsPnmCmtsUsOfdmaAQProbeMeasStatus will read **sampleReady** meaning the results of the quiet probe have been received and data has been written to the file in the **/pnm/aqprobe** directory.

If the test fails, docsPnmCmtsUsOfdmaAQProbeMeasStatus will read **error**. The E6000 CER will log a notice-level message providing details as to why the test failed.

Parent topic: Quiet probes

UPC operational considerations

The E6000 CER will reject writing the docsPnmCmtsUsOfdmaAQProbeEnable attribute to **true** under any of the following conditions:

- docsPnmCmtsUsOfdmaAQProbeMeasStatus is already set to busy for that OFDMA channel.
- There is another OFDMA channel on the same UCAM-2 with docsPnmCmtsUsOfdmaAQProbeEnable set to **true**.
- The OFDMA channel is not in-service.
- The docsPnmCmtsUsOfdmaAQProbeFileName is set to the null string.
- There is less than one of the following amounts of space left in the RAM disk PNM:
  - 16,955bytes for a quiet probe (2 symbols) for 50 kHz subcarrier spacing.
  - 66,107bytes for an active probe (8 symbols) for 50 kHz subcarrier spacing.
  - 131,899 bytes for an active probe with 25 kHz subcarrier spacing and 8 symbols.
  - 33,595 bytes for a quiet probe with 25 kHz subcarrier spacing and 2 symbols.

If the E6000 CER rejects setting docsPnmCmtsUsOfdmaAQProbeEnable to **true**, the E6000 CER will log a notice-level message to the provide details as to why the write to docsPnmCmtsUsOfdmaAQProbeEnable was blocked.

When docsPnmCmtsUsOfdmaAQProbeEnable is written to **true**, the E6000 CER will change docsPnmCmtsUsOfdmaAQProbeMeasStatus to **busy** unless docsPnmCmtsUsOfdmaAQProbeUseIdleSid is set to **false** and one or both of the following conditions are true:

- The cable modem identified by docsPnmCmtsUsOfdmaAQProbeCmMacAddr attribute is not currently registered (this includes the case when the docsPnmCmtsUsOfdmaAQProbeCmMacAddr is not set).

- The TCS of the cable modem identified by docsPnmCmtsUsOfdmaAQProbeCmMacAddr attribute does not contain the OFDMA channel for this row in the docsPnmCmtsUsOfdmaAQProbeTable.

If either of the above cases are true, the E6000 CER will set docsPnmCmtsUsOfdmaAQProbeMeasStatus to **error**.

When docsPnmCmtsUsOfdmaAQProbeEnable is written to **true**, the E6000 CER will change docsPnmCmtsUsOfdmaAQProbeMeasStatus to **busy** unless docsPnmCmtsUsOfdmaAQProbeUseIdleSid is set to **false** and one or both of the following conditions are true:

- Schedule a quiet probe using the idle SID if the docsPnmCmtsUsOfdmaAQProbeUseIdleSid attribute is set to **true**, or

- Initiate an active probe using a valid SID for this cable modem if the docsPnmCmtsUsOfdmaAQProbeUseIdleSid attribute is set to **false**

In both cases, the probe will cover all active subcarriers. The number of symbols is controlled by the setting of the docsPnmCmtsUsOfdmaAQProbeNumSymToCapt attribute.

Parent topic: UPC active and quiet probes

Upstream RxMER measurement

Upstream OFDMA Receive Modulation Error Ratio (RxMER) per subcarrier provides measurements of the upstream RxMER for each OFDMA subcarrier on a single modem. The results of these measurements are written in the **/pnm/mer** directory on the RSM or RSM-2 card.

The functional limit of this directory is 96 files. After the maximum of 96 is reached, the oldest file is automatically deleted. Only one RxMER measurement can be active on a UCAM-2 at a time. MER probes can be created with or without pre-equalization.

Note: RxMER probes are supported for OFDMA channels with 25 kHz and 50 kHz subcarrier spacing. 25 kHz subcarrier spacing is supported as of R11.0.

Parent topic: Proactive Network Maintenance

Start a MER probe on a modem

The docsPnmCmtsUsOfdmaRxMerTable MIB table controls which OFDMA channel to measure with a MER probe. Configure the parameters to run a MER probe on an OFDMA channel.

1. Specify a test results filename with the docsPnmCmtsUsOfdmaRxMerFileName attribute. The test results file will be placed in the local **/pnm/mer** directory.

2. Set the docsPnmCmtsUsOfdmaRxMerCmMac attribute to the MAC address of the cable modem of interest.

3. Set the docsPnmCmtsUsOfdmaRxMerEnable to **true**.

After the test has successfully completed, docsPnmCmtsUsOfdmaRxMerMeasStatus will read **sampleReady** meaning the results of the MER probe have been received and data has been written to the file in the **/pnm/mer** directory.

If the test fails, docsPnmCmtsUsOfdmaRxMerMeasStatus will read **error**. The E6000 CER will log a notice-level message providing details as to why the test failed.

Parent topic: Upstream RxMER measurement

Other RxMER configuration parameters

- docsPnmCmtsUsOfdmaRxMerPreEq enables or disables pre-equalization of the probe and can be set to either **true** or **false.** This parameter cannot be changed while a capture is in progress. It will return a value of **inconsistentValue** if set while the value of docsPnmCmtsUsOfdmaRxMerMeasStatus is set to **busy**.

- docsPnmCmtsUsOfdmaRxMerNumAvgs is set to a default of 1 by the E6000 CER and is not allowed to be changed. Averaging is not supported.

Parent topic: Start a MER probe on a modem

RxMER measurement operational considerations

The E6000 CER will reject setting the docsPnmCmtsUsOfdmaRxMerEnable attribute to **true** under any of the following conditions:

- docsPnmCmtsUsOfdmaRxMerMeasStatus is already set to **busy**.

- There is another OFDMA channel on the same upstream RF port or the other upstream RF port of the E6000 CER with docsPnmCmtsUsOfdmaRxMerEnable set to **true**.

- The OFDMA channel is not in-service.

- The docsPnmCmtsUsOfdmaRxMerFileName attribute is set to the null string.

- There is less than 2197 bytes for 50 kHz/4097 bytes for 25 kHz subcarrier spacing left in the RAM disk PNM.

- There is a UPC test in progress for this OFDMA channel (docsPnmCmtsUsOfdmaAQProbeMeasStatus set to **busy**).

- There is another OFDMA channel being served by the same upstream RF port or the other upstream RF port of the E6000 CER with docsPnmCmtsUsOfdmaAQProbeMeasStatus or

docsPnmCmtsUsOfdmaRxMerMeasStatus set to **busy** (multiple upstream RxMER or UPC tests cannot be run simultaneously on the same RF port). A configured test parameter is not compatible with the supported capabilities of the E6000 CER.

If the E6000 CER rejects setting docsPnmCmtsUsOfdmaRxMerEnable to **true**, the E6000 CER will log a notice-level message providing details as to why the write to docsPnmCmtsUsOfdmaRxMerEnable was blocked.

When docsPnmCmtsUsOfdmaRxMerEnable is written to **true**, the E6000 CER will change docsPnmCmtsUsOfdmaRxMerMeasStatus to **busy** unless one or more of the following conditions are true:

- The cable modem identified by docsPnmCmtsUsOfdmaRxMerCmMac is not currently registered (this includes the case when the docsPnmCmtsUsOfdmaRxMerCmMac is not set).
- The TCS of the cable modem identified by docsPnmCmtsUsOfdmaRxMerCmMac does not contain the OFDMA channel for this row in the docsPnmCmtsUsOfdmaRxMerTable.

If either of the above conditions are true, the E6000 CER will set docsPnmCmtsUsOfdmaRxMerMeasStatus to **error**.

If the E6000 CER changes docsPnmCmtsUsOfdmaRxMerMeasStatus to **busy**, the E6000 CER will immediately schedule sending an eight symbol MER probe with a skip value of zero to the configured cable modem on the channel for that row. The probe will cover all active subcarriers.

Parent topic: Upstream RxMER measurement

Upstream impulse noise statistics

This PNM feature provides details and data on burst/impulse noise occurring within a selected narrow band.

This feature:

- Only applies only to UCAM-2 cards in the E6000 CER I-CCAP system
- Utilizes one designated SC-QAM receiver per RF connector to perform the impulse noise statistics testing
- Results in the maximum number of SC-QAM channels being 11 per connector instead of 12 when the feature is enabled
- Either one or both RF ports in the connector group can be identified for testing once the single SC-QAM receiver has been configured
- A CLI command must be entered to enable an upstream SC-QAM receiver for impulse noise statistics mode. SNMP access is not currently supported
- Is disabled by default

Note: A channel configured for impulse noise statistics mode persists even after a system reset.

Parent topic: Proactive Network Maintenance

Configure impulse noise stats for unprovisioned US SC-QAM channel

To enable one upstream SC-QAM channel in the connector group for impulse noise statistics mode, there are two different scenarios for configuration. This procedure applies to an unprovisioned upstream SC-QAM channel.

1. Enable the channel for impulse noise statistics mode. No additional steps are needed in this case. Enter:
   configure interface cable-upstream <slot/connector-group/channel> cable impulse-noise-stats enable

2. Impulse noise statistics testing can be performed on either RF port on the connector group.
   Impulse noise statistics mode can be disabled for the upstream SC-QAM channel if testing is no longer needed on either RF port of the connector group. Use the **no** version of the command to disable the feature.

Parent topic: Upstream impulse noise statistics

Configure impulse noise stats for provisioned US SC-QAM channel

This procedure applies to a previously provisioned upstream SC-QAM channel to enable the upstream impulse noise statistics feature.

1. Prior to configuring the specific channel for impulse noise stats mode, the channel must first be shut down and removed from its cable-mac and fiber node by entering these commands:

   a. **configure interface cable-upstream <slot/connector-group/channel> cable shutdown**

   b. **configure interface cable-upstream <slot/connector-group/channel> cable cable-mac [<MAC>] no**

   c. **configure interface cable-upstream <slot/connector-group/channel> cable connector no**

   d. **configure cable fiber-node <WORD> cable-upstream <slot/connector-group/channel> no**

   e. **configure interface cable-upstream <slot/connector-group/channel> cable no**

2. Enable the channel for impulse noise statistics mode by entering:
   configure interface cable-upstream <slot/connector-group/channel> cable impulse-noise-stats enable
   The impulse noise statistics testing can be implemented on either RF port of the connector-group.

3. To return the upstream SC-QAM channel back to regular data traffic and operation, enter the following:

   a. **configure interface cable-upstream <slot/connector-group/channel> cable impulse-noise-stats enable no**

b. Reset the CAM:
configure slot <0-13> shutdown
configure slot <0-13> shutdown no

c. Configure all necessary channel parameters and associate the channel with the cable-mac and fiber-node. This is dependent on individual requirements.

d. Configure the channel back into service:
configure interface cable-upstream <slot/connector-group/channel> cable no shutdown

Parent topic: Upstream impulse noise statistics

Recommendations regarding changes to upstream RF channel power

If there is a need to change the upstream power settings for the SC-QAM channels in the same upstream RF port that is running an Impulse Noise Statistics test, do the following:

1. Terminate the Impulse Noise Statistics test on the RF port.

2. Configure the upstream power on the SC-QAM channel(s) to the desired settings. Refer to the Change the receive power level settings for the UCAM topic for the procedure. Settings must conform to the upstream power level group constraints.

3. Bring the SC-QAM channel(s) (other than the channel enabled for Impulse Noise Statistics mode) back in service.

4. The Impulse Noise Statistics testing can be resumed for the RF ports in the connector group.

Note: If these steps are not followed prior to changing upstream channel power settings, the Impulse Noise Statistics test results are considered invalid. This is because changing the upstream channel power level causes a change to the effective start and end trigger levels for the Impulse Noise Statistics test.

Parent topic: Upstream impulse noise statistics

Upstream histogram description

The upstream histogram feature supports the UCAM-2 cards in the E6000 CER I-CCAP system, as part of DOCSIS maintenance functionality. The histogram measurement is enabled for one RF port at a time on the specified UCAM-2 card.

Upstream histogram provides a measurement of nonlinear effects in the channel including amplifier compression and laser clipping, which can cause of end of the histogram to be truncated and replaced with a spike. When the measurement is enabled, the I-CCAP begins capturing the histogram of time domain samples

at the wideband front end of the receiver, or full upstream band. The histogram encompasses values from far-negative to far-positive values of the samples.

Each invocation of the US histogram feature collects a single dwell count and a single hit count for each of the 256 bins. Accumulating multiple captures within a configured time duration is not supported. The different histogram measurements include:

- The dwell count, a 32-bit unsigned integer, is the number of samples observed while counting hits for a given bin. The number may be the same for all 256 bins.
- The hit count, a 32-bit unsigned integer, is the number of samples falling in a given bin.

The E6000 CER stores the measurement counts in a file for retrieval as needed.

Parent topic: Proactive Network Maintenance

Upstream histogram object attributes

The upstream histogram feature is initiated by setting the docsPnmCmtsUsHistEnable attribute of the docsPnmCmtsUsHistTable using SNMP. This lets the I-CCAP know to begin collecting histogram data. Once the feature is enabled, the system continues to produce new data accordingly.

The CCAP created an instance of the Upstream Histogram object for each IfIndex of an upstream RF port.

Table 1. docsPnmCmtsUsHistTable attributes

Attribute Name	Type	Access Type Constraints	Units	Default Value
ifIndex	InterfaceIndex	Key	N/A	N/A
docsPnmCmtsUsHistEnable	Boolean	R/W	N/A	False
docsPnmCmtsUsHistTimeOut	UnsignedShort	R/W	N/A	1800
docsPnmCmtsUsHistMeasStatus	MeasStatusType	R/O	N/A	N/A
docsPnmCmtsUsHistFileName	AdminString	R/W	SIZE (0.255)	""

Enable:

- Setting this attribute to a value of **true** instructs the CCAP to begin collection of histogram data and when enabled, the CCAP continues producing new data at its own rate.
- This value is only allowed to be set to **true** if the value of **MeasStatus** is a value other than **busy**.

- Setting this value to **true** will change the value of the **MeasStatus** attribute to **busy**. Setting this attribute to a value of **false** instructs the CCAP to stop the collection of histogram data and to generate the file.
- This attribute returns **true** if the CCAP is actively collecting histogram data. Otherwise it returns **false**.
- A restart may be accomplished by setting this attribute to **false** and then back to **true**.

Timeout:

- This attribute sets a seconds time-out timer for capturing histogram data. This attribute is used to automatically clear the Enable attribute when the timeout expires. If the value of Timeout is zero, the CCAP collects data until the timeout value is changed, the test is stopped, or until any dwell counter reaches its 32-bit rollover value. When the dwell count reaches its 32-bit maximum, the CCAP ends the test and report counts accumulated to that point. If the Timeout attribute is re-written while Enable is **true**, the CCAP restarts the timeout timer with the new Timeout value and continues collecting data.
- When the timeout expires, the Enable object will be set to **false** and the capture stops. Data collected up to this point will be saved in the file defined by the **FileName**, and the value of **MeasStatus** will be set to **sampleReady**.
- Setting this value does not start a capture. Captures can only be started by setting the Enable attribute.
- If this attribute is written while the Enable attribute is **true**, the timer is restarted.
- This object returns the value with which it was last set.

MeasStatus:

- This attribute is used to determine the status of the command. When the status is **sampleReady**, the CCAP is ready for the Histogram data to be read.

Filename: see Upstream histogram description and PNM files and directories.

Parent topic: Upstream histogram description

Operational considerations for US histogram

Various considerations and limitations apply to the upstream histogram feature:

- Only supported on the E6000 CER I-CCAP and with UCAM-2 cards.
- The docsPnmCmtsUsHistTimeOut attribute of docsPnmCmtsUsHistTable is read only and the default of 3 seconds cannot be changed. This implies a single 256-bin measurement at a time is supported (as opposed to multiple accumulated captures in a configured time duration).
- File storage in the **/pnm/histogram** folder is limited to 64 histogram results files.

- Histogram measurements can be enabled for one RF port on the specified UCAM-2 card at a time.
- Support is limited to histogram bin center Even Symmetry, as reported in the Symmetry field of the histogram results file. Odd Symmetry is not supported.

Parent topic: Upstream histogram description

PNM test concurrency

PNM tests may be run concurrently on each of the active UCAM-2 cards in the chassis. See the descriptions of the various PNM tests for the limitations of concurrency per UCAM-2 cards.

Parent topic: Proactive Network Maintenance

PNM test results file sizes

Note: For total maximum file storage sizes, see PNM files and directories.

Upstream Triggered Spectrum Capture (UTSC)

- Total header size per file = 328 bytes
- Maximum size of sample data = 16384 bytes
- Total bytes per file = 328 bytes + 16384 bytes = 16712 bytes (assuming maximum sample data of 16384 bytes)

Upstream Capture for active and quiet probes (UPC)

For 50 kHz OFDMA subcarrier spacing:

- Total bytes for file = 571 header bytes plus capture data
- Total maximum file size = 571 header bytes + 65,536 bytes capture data = 66107 bytes

  Note: This UPC file size is for an active probe capture using 2K FFTs (50 kHz subcarrier spacing) and 8 symbols.

For 25 kHz ODMA subcarrier spacing:

- Total bytes for file = 827 header bytes plus capture data
- Total maximum file size = 827 header bytes + 131,072 bytes capture data = 131,899 bytes;

Note: This UPC file size is for an active probe capture using 4K FFTs (25 kHz subcarrier spacing) and 8 symbols.

Upstream RxMER

For 50 kHz OFDMA subcarrier spacing:

- Total bytes per file = 297 header bytes plus RxMER data
- Total maximum bytes per file = 297 header bytes + 1900 bytes RxMER data = 2197 bytes

For 25 kHz OFDMA subcarrier spacing:

- Total bytes per file = 297 header bytes plus RxMER data
- Total maximum bytes per file = 297 header bytes + 3800 bytes RxMER data = 4097 bytes

Upstream Histogram

- Total maximum bytes per file = 1314 bytes
- Total maximum bytes for 64 files =64 * 1314 = 84.1 Kbytes

Upstream Impulse Noise

- Total maximum bytes per file = 14629
- Total maximum bytes for 64 files = 64 * 14629 = 936.3 kBytes

Parent topic: Proactive Network Maintenance

PNM files and directories

Upon enabling a PNM test, PNM tests may run concurrently on each of the active UCAM-2 cards in the chassis, and the E6000 CER stores the results files. PNM tests that store a results file locally on the E6000 CER are listed in the table below. The number of concurrent tests shown in the table is based on support for up to 6 active UCAM-2 cards in a chassis. Only a single PNM test type can run at a time on each UCAM-2. The total maximum PNM results file storage for the system = 16.0 MBytes + 12.7 MBytes + 393.3 KBytes + 84.1 KBytes + 936.3 KBytes = **30.1 MBytes**.

Table 1. PNM tests that store a results file locally

PNM Test	Directory	Maximum Number of Files	Number of Concurrent Tests	Number of Files per Test Invocation
Upstream Triggered Spectrum Capture (I-CCAP and RPHY)	/pnm/utsc	960	6	10
Upstream Capture for Active and Quiet Probes (I-CCAP and RPHY)	/pnm/aqprobe	96	6	1
Upstream RxMER (I-CCAP and RPHY)	/pnm/mer	96	6	1
Upstream Histogram (I-CCAP)	/pnm/histogram	64	6	1
Upstream Impulse Noise (I-CCAP)	/pnm/usimpnoise	64	6	1

Parent topic: Proactive Network Maintenance

PNM files and directories explained

The number of files allowed in the directory after enabling the test is determined by the following formula:

The maximum number of files minus (the number of tests that can run concurrently times the number of files per test invocation).

The E6000 CER iteratively deletes the oldest files until the number of files equals this quantity (not including the new file). The number of PNM result files stored locally for a given test type is limited whether the result files were produced by the Bulk File Transfer mechanism or by the standard PNM functionality (that is, **DestinationIndex** unconfigured or set to `0`).

Example for the Upstream RxMER test:

- The E6000 CER allows up to 96 results files stored in **/pnm/mer**.
- The number of supported concurrent Upstream RxMER tests is 6.
- The maximum number of files per test invocation is 1.

Applying the formula, 96 - (6 * 1) = 90. When docsPnmCmtsUsOfdmaRxMerEnable is set to **true**, the E6000 CER checks if the current number of files in **/pnm/mer** is greater than 90, and if so, iteratively deletes the oldest files until there are 90 files remaining (not including the new file for this test invocation).

- After setting docsPnmCmtsUsOfdmaAQProbeEnable to **true**, if there are already 6 or more files in the **/pnm/aqprobe** directory, the E6000 CER will iteratively delete the oldest file until there are only 5 files in the directory NOT including the new file.

- After setting docsPnmCmtsUsOfdmaRxMerEnable to **true**, if there are already 6 or more files in the **/pnm/mer** directory, the E6000 CER will iteratively delete the oldest file until there are only 5 files in the directory not including the new file

File formula example using the Upstream RxMER test

From the table above, the E6000 CER allows up to 6 RxMER results files to be stored in the **/pnm/mer** directory. The number of supported concurrent Upstream RxMER tests is 2 and there is a maximum of one file produced for each RxMER test run.

When the formula 6 - (2 * 1) = 4 is applied, and upon docsPnmCmtsUsOfdmaRxMerEnable being set to **true** to initiate the RxMER test, the E6000 CER will check if the current number of files in the **/pnm/mer** directory is greater than 4. If so, it will delete the oldest files until there are 4 files remaining not including the two new test result files from the two concurrent Upstream RxMER tests run.

Parent topic: PNM files and directories

PNM Bulk File Transfer

Proactive Network Maintenance (PNM), and potentially other applications, may generate data files that need to be transferred to a server. The Bulk File Transfer mechanism defines file storage operation, destination and protocol specification, and a mechanism to initiate a transfer. Transfer of the bulk data file may be initiated automatically by the E6000 CER on file creation or, alternatively, the file may be stored locally for later retrieval through a transfer initiated by an external server. Supported control and monitoring is per the Bulk File Transfer information model specified in CM-SP-CCAP-OSSIv4.0-I07-220629 and DOCS-PNM-MIB-2022-03-31.

Note: The legacy DOCSIS Bulk Data Information Model has been deprecated.

For a complete definition of the docsPnmBulkDataTransferCfgTable MIB which includes some CommScope-specific updates from the current CableLabs standard definition in DOCS-PNM-MIB, see the PNM MIB tables in the Standard and third-party MIBs topic, the PNM Bulk File Transfer notes and limitations topic, and the New MIB Objects topic in this User Guide.

Although the E6000 CER supports this feature for both CCAP Core and I-CCAP operation, for CCAP Core, PNM Bulk File Transfer is only applicable to dynamic pseudowires (PNM results transmitted back to the CCAP Core). This feature does not apply to tests run with static pseudowires (where the RPD transmits the PNM results directly to a PNM server).

The configuration MIB table for each individual PNM test (for example, Upstream Triggered Spectrum Capture) includes a new **DestinationIndex** attribute. A non-zero value configured for this attribute represents an index to an instance of the docsPnmBulkDataTransferCfgTable MIB. This MIB table entry contains attributes for specifying the destination and protocol if an auto upload of PNM results is configured, as well as an attribute for controlling whether a local PNM results file(s) will be produced.

Note: Using the PNM test's **DestinationIndex** attribute default value (zero) results in legacy operation where the Bulk File Transfer feature is not enabled. In this case, a local file(s) is produced when the test has completed (per pre-Release 12.0 operation). As with legacy/pre-Release 12.0 operation, when configuring a PNM test for Bulk File Transfer, the **Filename** attribute for the the given PNM test must be configured by the operator along with other test parameters prior to initiating the test.

Further details and limitations of this feature see PNM Bulk File Transfer notes and limitations.

Parent topic: Proactive Network Maintenance

PNM Bulk File Transfer notes and limitations

The following table indicates E6000 CER support limitations for the attributes of the docsPnmBulkDataTransferCfgTable as well as implementation differences from the current definitions as specified in CCAP-OSSIv4.0 and DOCS-PNM-MIB.

Note: Observe the following considerations:

- Do not change the destination (docsPnmBulkDataTransferCfgDestHostIpAddrType and docsPnmBulkDataTransferCfgDestHostIpAddress) or any other attribute of docsPnmBulkDataTransferCfgTable before a PNM test has completed.
- There may be multiple PNM servers accessing the E6000 CER concurrently. If more than one PNM server is initiating PNM tests, for a given PNM server, do not change or remove any docsPnmBulkDataTransferCfgTable entries that were created by another PNM server.
- The E6000 CER supports 96 entries in the docsPnmBulkDataTransferCfgTable and any attempt to configure more will be rejected.
- The number of PNM result files stored locally for a given test type is limited whether the result files were produced by the Bulk File Transfer mechanism or by the standard PNM functionality (that is, **DestinationIndex** unconfigured or set to `0`). For information about the number of stored files allowed by test, see PNM files and directories and PNM files and directories explained.
- docsPnmBulkFileStatusTable will not maintain its entries after a CCR side switch; the table may be cleared in this case.
- Support for the docsPnmBulkDataTransferCfgDestBaseUri for Release 12.0 is limited to the following:
  - Supported base URI format: **<path_string> "/"**

Note: The trailing slash character is required.

- The configured base URI string is used to construct the relative destination path used to upload a PNM results file to an external server.

  Note: If the configured base URI does not exist on the destination, the upload will fail.

  - **Example:** A complete destination path for a TFTP transfer (assuming the docsPnmBulkDataTransferCfgDestBaseUri attribute is configured with a value of "mer/")

    <TFTP_ROOT>/mer/results_filename.

  - **Result:** The PNM **results_filename** is transmitted through TFTP protocol to the server at the configured destination address and placed in the <TFTP_ROOT>/mer/ folder.

  Note: If the value of docsPnmBulkDataTransferCfgDestBaseUri is not changed (that is, the default empty string applies), then the results file for the TFTP case is written as <TFTP_ROOT>/ results_filename.

Table 1. Support for docsPnmBulkDataTransferCfgTable

docsPnmBulkDataTransferCfgTable Attribute	SnmpAdminString Syntax	Max-Access	Default Value	Notes
docsPnmBulkDataTransferCfgDestIndex	Unsigned32	not-accessible (key)	N/A	This key uniquely identifies a destination for PNM test result measurements.
docsPnmBulkDataTransferCfgDestHostname	SnmpAdminString	read-create	""	A fully-qualified domain name (FQDN) of the destination host. Not supported by the E6000 CER. Default value added by CommScope - not currently defined in CCAP-OSSIv4.0, DOCS-PNM-MIB.

docsPnmBulkDataTransferCfgTable Attribute	Supported Syntax	Max-Access	Default Value	Notes
docsPnmBulkDataTransferCfgDestHostIpAddrType	InetAddressType	read-create	IPv4(1)	This attribute indicates the type of the Internet address for the destination host. E6000 CERsupport is limited to IPv4. Default value added by CommScope - not currently defined in CCAP-OSSIv4.0, DOCS-PNM-MIB.
docsPnmBulkDataTransferCfgDestHostIpAddress	InetAddress	read-create	'00000000'h	This attribute indicates the destination host IP address. If specified, it must be preceeded by the IpAddrType. E6000 CER support is limited to IPv4. Default value added by CommScope - not currently defined in CCAP-OSSIv4.0, DOCS-PNM-MIB.
docsPnmBulkDataTransferCfgDestPort	Unsigned32	read-create	69	This attribute identifies a destination port number for PNM test result measurements. Default value added by CommScope - not currently defined in CCAP-OSSIv4.0, DOCS-PNM-MIB.

docsPnmBulkDataTransferCfgTable Attribute	Supported Syntax	Max-Access	Default Value	Notes
docsPnmBulkDataTransferCfgDestBaseUri	Uri	read-create	""	This attribute identifies a destination base Uniform Resource Identifier (URI) for PNM test result measurements. This attribute does not contain the actual filename. Default value added by CommScope - not currently defined in CCAP-OSSIv4.0, DOCS-PNM-MIB.
docsPnmBulkDataTransferCfgProtocol	INTEGER {tftp(1)}	read-create	tftp(1)	This attribute identifies the data transfer protocol for the PNM test result measurements. E6000 CER support limited to tftp(1). Max-Access corrected from read-write to read-create by Commscope - currently this is read-write in CCAP-OSSIv4.0, DOCS-PNM-MIB.
docsPnmBulkDataTransferCfgLocalStore	TruthValue	read-create	false(2)	This attribute identifies whether the device stores PNM test result measurements locally. The E6000 CER supports settings of either true or false.

docsPnmBulkDataTransferConfigTable Attribute	SnmpObject Syntax	Max-Access	Default Value	Notes
				• If the value of LocalStore is set to 'false', the attributes for DestHostIpAddrType/ DestHostIpAddressmust be configured. LocalStore=false is preferred as this setting utilizes less system resources. **Note:** The device will upload the results file to the DestinationHost using the Protocol configured for that host. • If the value of LocalStore is set to 'true', the device will store the test result measurements locally on the device. If DestHostIpAddrType/ DestHostIpAddress

docsPnmBulkDataTransferCfgTable Attribute	Supported Syntax	Max-Access	Default Value	Notes
				attributes are set to valid values, then the file will also be auto uploaded. Default value added by CommScope - not currently defined in CCAP-OSSIv4.0, DOCS-PNM-MIB.
docsPnmBulkDataTransferCfgRowStatus	RowStatus	read-create	N/A	The conceptual row status for this table

Parent topic: PNM Bulk File Transfer

Auto file upload

A PNM results file is placed in a backlog until the E6000 CER is ready to process it. Until then, there is NO entry created in docsPnmBulkFileStatusTable. The sustained file transmission rate for PNM Bulk File Transfer with TFTP auto-upload is limited to 5 files per second.

Note: It is possible that, due to backlog, the E6000 CER never auto uploads a file because, in the meantime, the file was deleted in the file system.

The E6000 CER supports a maximum of 255 docsPnmBulkFileStatusTable entries (per the limit specified in DOCS-PNM-MIB) for the docsPnmBulkFileStatusIndex attribute. When the maximum storage limit is reached, the oldest entry is overwritten. For auto-upload, once the transfer has completed (successfully or unsuccessfully) the file may be removed from local storage, but the entry in docsPnmBulkFileStatusTable will remain as status history until overwritten (as the oldest entry).

Note: See PNM Bulk File Transfer notes and limitations, PNM files and directories, and PNM files and directories explained for information about limits for file storage by test.

Entries in the docsPnmBulkFileStatusTable are officially supported for PNM result files configured for auto upload. Entries in the docsPnmBulkFileStatusTable are NOT supported for PNM result files that are only stored locally on the E6000 CER.

As of Release 12.0, the docsPnmBulkFileStatusFileStatus attribute of the docsPnmBulkFileStatusTable supports settings of:

- uploadInProgress(3)
- uploadCompleted(4)
- error(7)

The following table illustrates the transitions of the docsPnmBulkFileStatus attribute for the various scenarios.

Table 1. docsPnmBulkFileStatus attribute transitions

Scenario	Entry Created in table?	Transitions of table attribute
File is successfully auto uploaded	Yes	uploadInProgress(3) → uploadCompleted(4)
File is created and auto upload is initiated but error occurred due to incorrect baseURI or insufficient permissions to remote file system	Yes	uploadInProgress(3) → error(7)
File is created but it is determined that there is no Destination IP address configured	No	Not applicable
Auto upload of a file is initiated but it is determined that the transfer was not successful (for example, due to a mistyped Destination IP address)	Yes	uploadInProgress(3) → error(7)

Note: docsPnmBulkFileStatusTable will not maintain its entries after a CCR side switch; the table may be cleared in this case.

Note: PNM bulk file transfer file notifications and the docsPnmBulkFileMgmtTable are not supported. For more information about supported and unsupported MIBs and objects, see Supported DOCSIS MIB Objects.

Parent topic: PNM Bulk File Transfer

PNM CLI command

The E6000 CER uses the following PNM CLI command to display information about the PNM tests that an E6000 CER is capable of running. Enter: `show interface rpd <> pnm supported-tests`

Parent topic: Proactive Network Maintenance

Corporate Headquarters

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