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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 CCAP Core implements PNM using various tests: US RxMER, US Capture for Active and Quiet Probes, and Upstream Triggered Spectrum Capture (UTSC). Tests are initiated using SNMP and MIBs. For tests run with dynamic pseudowire, 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**

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.

Note: UTSC with dynamic and static pseudowires are supported for CCAP Core.

UTSC

An Upstream Triggered Spectrum Capture (UTSC) uses the docsPnmCmtsUtscCfgTable to configure the parameters for a UTSC test. For UCAM-2 cards enabled for RPHY, when an RPD comes up for the first time, a MIB row in this table will be created corresponding to each of the upstream RF ports reported in its capability. When an RPD is de-provisioned, the corresponding MIB row(s) will be removed. 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.

UTSC FreeRunning trigger mode is supported for both dynamic and static pseudowires, while support for the SID-based trigger modes, IdleSID and CM MAC Address, is limited to dynamic pseudowires. The E6000 CER CCAP Core supports UTSC FreeRunning trigger mode with repeat capture and continuous capture using a static pseudowire.

With a static pseudowire, the UTSC capture results are transmitted directly to a PNM server as opposed to being stored in a local file on the E6000 CER for later retrieval. The PNM UTSC feature allows a PNM server to receive spectrum capture data directly from a static pseudowire between the RPD and an external PNM server. FreeRunning, IdleSID, and CM MAC Address trigger modes can be used for spectrum captures on any of the RPD upstream RF ports. Concurrently, for each active UCAM-2 in the chassis, the E6000 CER supports:

1. **Test 1:** A single RPHY FreeRunning trigger mode test with static pseudowire concurrently on a subset of the UCAM-2 RPHY RF ports (see note below), PLUS

2. **Test 2:** A single RPHY FreeRunning trigger mode or SID-based trigger mode test with dynamic pseudowire on one of the UCAM-2 RPHY RF ports (see note below)

Note: Test 1 and **Test 2** cannot be run on the same RF port simultaneously. In addition,

- For **Test 1**: if multiple RPHY RF ports are for the same RPD, successful, concurrent test execution by the RPD is dependent on the RPD concurrency capabilities. The RPD will return an error in the GCP response message if it cannot support the requested test initiation.

- For **Test 1**: if multiple RPHY RF ports serve multiple RPDs, then each of the RPDs will run the FreeRunning trigger mode test with static pseudowire concurrently.

For RPHY, the UTSC tests are initiated by specifying an ifIndex for an upstream RF port on an RPHY-enabled UCAM-2. This RF port (US-SG) also corresponds to the RPD's RF port/US-SG. The MAC processing for this US-SG is performed on the E6000 UCAM-2, but the PHY processing is performed on the RPD. The upstream triggered spectrum analysis measurement provides a wideband or narrowband spectrum in the RPD with RPHY operation. This can be triggered to examine upstream transmissions and underlying noise or interference during quiet periods.

Table 1. FFT SAC type associated with each UTSC trigger mode

UTSC Trigger Mode	FFT SAC Type
FreeRunning	Wideband FFT SAC
IdleSID or CM MAC Address with SC-QAM trigger channel	Narrowband FFT SAC
IdleSID or 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 during an idle period when triggered by a grant to a particular SID value on a configured triggering channel. If the configured docsPnmCmtsUtscCfgTriggerCount is greater than one, 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 particular SID value on a configured triggering channel. For this trigger mode, it is intended for the CM to be transmitting on the triggering channel when the capture occurs. If the configured docsPnmCmtsUtscCfgTriggerCount is greater than one, then the capture is repeated when triggered by successive grants to the SID until the number of captures (limited to 10) equals the docsPnmCmtsUtscCfgTriggerCount.

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.

Table 2. Idle period and spectrum corresponding to IdleSID trigger channel type

Trigger Channel Type	Idle Period and Spectrum
SC-QAM	IdleSID: One minislot across the entire width of the SC-QAM channel CM MAC Address: One or more minislots (depending on various parameters) across the entire width of the SC-QAM channel
OFDMA	IdleSID: One symbol including all subcarriers across the OFDMA channel CM MAC Address: Two symbols including all subcarriers across the OFDMA channel

Note: For the CM MAC Address trigger mode, an RPD interoperating with the E6000 CER Core with grants to the SID value configured via RLV 41.4.5 will occur through a RANGE-REQUEST message for SC-QAM trigger channel type and through a PROBE-MAP message for OFDMA trigger channel type.

Parent topic: Proactive Network Maintenance

Set a file and store results

For Core operation with dynamic pseudowires, you can set a file and store results. Configure the parameters for the UTSC of an upstream RF port:

1. Use SNMP to set the base filename.

   Note: 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. Set the docsPnmCmtsUtscCtrlInitiateTest to **true** to begin the test.

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

   Note: A timestamp is appended to the configured (base) filename for all PNM results files.

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 control interface

UTSC parameters on the E6000 CER are configured by the standard docsPnmCmtsUtscCfgTable in DOCS-PNM-MIB. A proprietary MIB table, cerPnmCmtsUtscCfgTable, is used in conjunction with the docsPnmCmtsUtscCfgTable to provide support for UTSC tests using static pseudowires. The two tables are keyed by the same values. Configuration of a non-default cerPnmCmtsUtscCfgStaticPwDestIpAddr value signifies that a static pseudowire is to be created and applied for this UTSC test instance. The default value for cerPnmCmtsUtscCfgStaticPwDestIpAddr signifies that a dynamic pseudowire is to be used.

Note: The cerPnmCmtsUtscCfgTable MIB is non-persistent and is used only for configuring UTSC with static pseudowires (not used for UTSC with dynamic pseudowires). Configured values return to default settings if the E6000 CER is rebooted. Read-write attributes of cerPnmCmtsUtscCfgTable can only be configured while a test is not in progress.

Table 1. UTSC control interface

Attribute	OID	Access	Description
ifIndex	1.3.6.1.2.1.2.2.1.1	Key	ifIndex of RF port
cerPnmCmtsUtscCfgIndex	1.3.6.1.4.1.4115.1.9.1.9.84.1.1	Key	Index of configuration set (not supported - must be set to 1)
cerPnmCmtsUtscCfgStaticPwDestIpAddrType	1.3.6.1.4.1.4115.1.9.1.9.84.1.2	Read Write	IP address type (IPv4 or IPv6) of static pseudowire destination. Default value is IPv6(2)
cerPnmCmtsUtscCfgStaticPwDestIpAddr	1.3.6.1.4.1.4115.1.9.1.9.84.1.3	Read Write	IP address of static pseudowire destination. Default value is 0:0:0:0:0:0:0:0
cerPnmCmtsUtscCfgStaticPwSessionId	1.3.6.1.4.1.4115.1.9.1.9.84.1.4	Read	Session ID of static pseudowire
cerPnmCmtsUtscCfgStaticPwSrcIpAddr	1.3.6.1.4.1.4115.1.9.1.9.84.1.5	Read	IP address of static pseudowire source (RPD source IP address). Default value is 0:0:0:0:0:0:0:0

Parent topic: UTSC

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 RPD's capabilities for this RF port indicate that UTSC is not supported (see capability TLV types 50.59.x as well as docsPnmCmtsUtscCapabTable DOCS-PNM-MIB).
- docsPnmCmtsUtscStatusMeasStatus is already set to **busy** for that RPHY RF port.

- For UTSC tests with dynamic pseudowires, there is an RPHY RF port served by the same UCAM-2 with docsPnmCmtsUtscCtrlInitiateTest set to **true**.
- The UCAM-2 serving the RPHY RF port is not in-service.
- The RPD is not in-service.
- An attempt is made to run a UTSC test with a dynamic pseudowire where the docsPnmCmtsUtscCfgFilename is set to the null string.
- There is less than 16712 bytes of space left in the **/pnm** directory.
- An attempt is made to run a UTSC test with a dynamic pseudowire where docsPnmCmtsUtscCfgFreeRunDuration is set to zero.
- An attempt is made to configure docsPnmCmtsUtscCfgRepeatPeriod to a value that is less than MinRepeatPeriod reported by the RPD via the capability TLV type 50.59.2.14.
- A configured test parameter is not compatible with the supported capabilities of either the CCAP Core or the RPD or both.
- An attempt is made to configure docsPnmCmtsUtscCfgFreeRunDuration to a value that exceeds the allowed timeout value.
- 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.
- 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.

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

Configure UTSC on a static pseudowire

When initiating a new test, write the value for cerPnmCmtsUtscCfgStaticPwDestIpAddr if the test parameters for this iteration in the docsPnmCmtsUtscCfgTable have changed. This is necessary even if the value for cerPnmCmtsUtscCfgStaticPwDestIpAddr is the same value that was used for the previous test run (cerPnmCmtsUtscCfgStaticPwDestIpAddr would be re-written with the same value). This procedural requirement is necessary in order to trigger the E6000 CER to evaluate whether a new pseudowire must be created to support a new set of test parameters.
This procedure is the recommended sequence for configuring UTSC on a static pseudowire.

1. Perform reads of the cerPnmCmtsUtscCfgStaticPwDestIpAddr in the cerPnmCmtsUtscCfgTable. If the value is non-default and is not the IP address of the desired PNM server, this indicates that the UTSC feature on the upstream port is in use by another PNM server. The PNM server must wait then re-check the default value. If the value is the default value or is the IP address of the desired PNM server, the PNM server moves to step 2. The PNM server may skip step 4 when the value is the IP address of the desired PNM server.
2. Perform reads of the docsPnmCmtsUtscStatusMeasStatus and confirm that the returned value is not **busy**. If the returned value is **busy**, you must write the docsPnmCmtsUtscCtrlInitiateTest attribute to **false** (as in step 8) to direct the E6000 CER to set docsPnmCmtsUtscStatusMeasStatus to **Inactive**.

Note: docsPnmCmtsUtscStatusMeasStatus set to **busy** may be an indication that a capture by another PNM server is in progress.

3. Configure all necessary attributes for the UTSC test on this RF port in the docsPnmCmtsUtscCfgTable MIB.

Note: The docsPnmCmtsUtscCfgFilename attribute is used for a dynamic pseudowire and is not applicable in this case.

4. In the cerPnmCmtsUtscCfgTable, configure cerPnmCmtsUtscCfgStaticPwDestIpAddrType and a non-default value for cerPnmCmtsUtscCfgStaticPwDestIpAddr (indicating that a static pseudowire is to be configured).

   a. The default value for cerPnmCmtsUtscCfgStaticPwDestIpAddr indicates a dynamic pseudowire will be used for UTSC tests on this RF port.

   b. Setting cerPnmCmtsUtscCfgStaticPwDestIpAddr to a non-default value initiates a static pseudowire setup between the RPD and the PNM server.

5. Perform reads of the cerPnmCmtsUtscCfgStaticPwSessionId and cerPnmCmtsUtscCfgStaticPwSrcIpAddr attributes. When valid, non-zero values are read. This indicates that the static pseudowire is up and ready for operation.

6. Setting the docsPnmCmtsUtscCtrlInitiateTest attribute in docsPnmCmtsUtscCtrlTable to **true** triggers the E6000 CER to start the test by sending the UscCommand (TLV 41.2). The applicable SAC is determined by the E6000 CER based on the docsPnmCmtsUtscCfgTable configuration attributes. Other test parameters are also written by GCP TLVs to the E6000 CER based on the docsPnmCmtsUtscCfgTable attributes. The docsPnmCmtsUtscStatusMeasStatus attribute in docsPnmCmtsUtscStatusTable is also set to **busy** by the E6000 CER.

7. The PNM server checks docsPnmCmtsUtscStatusMeasStatus to determine if the test failed or was successful.

8. When the PNM server determines that the test is complete and the spectrum capture data over the static pseudowire is collected, the PNM server writes docsPnmCmtsUtscCtrlInitiateTest to **false**.

Note: When docsPnmCmtsUtscCtrlInitiateTest is set to **false**, the E6000 CER sets docsPnmCmtsUtscStatusMeasStatus to **Inactive**.

9. When testing for this RF port is complete, the PNM server sets cerPnmCmtsUtscCfgStaticPwDestIpAddr to the default value. This causes the E6000 CER to tear down the static pseudowire and set cerPnmCmtsUtscCfgStaticPwSessionId and cerPnmCmtsUtscCfgStaticPwSrcIpAddr back to their default values. This procedural requirement is necessary in order to trigger the E6000 CER to re-evaluate whether a new pseudowire needs to be created to support the new set of test parameters.

The PNM server may start another capture with the same or different capture parameter settings without tearing down the static pseudowire. In this case, the PNM server starts the procedure from step 1.

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 SAC or a Narrowband FFT Spectrum Analysis Circuit (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
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

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

You can configure UTSC test parameters with the docsPnmCmtsUtscCfgTable MIB table and the configuration is specified on one of the RPD's upstream RF ports. The E6000 CER must choose an appropriate Spectrum Analysis Circuit (SAC) which serves the selected RF port and supports the specified test parameters. The configuration capabilities provided by the RPD's SACs are commonly known and are also maintained in docsRphyRpdDevSacCapTable. If the E6000 CER is unable to find a SAC that supports the requested UTSC parameters on the RF port, the E6000 CER will set the docsPnmCmtsUtscStatusMeasStatus MIB object to **error** and generate a notice- level log message.

Parent topic: UTSC operational considerations

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

- An active probe capture measures 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.
- A quiet probe capture (also called silent probe capture) measures the underlying noise floor in the OFDMA band being measured. The measurements are reported in either the time domain or the frequency domain.

Note: For CCAP Core, active probe or quiet probe captures are supported for OFDMA channels with 25 kHz 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 and are only supported with dynamic pseudowires.

For more information, refer to:

- CableLabs: Data-Over-Cable Service Interface Specifications DOCSIS® 4.0CCAP 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 filename with the docsPnmCmtsUsOfdmaAQProbeFileName attribute. The test results file will be placed in the local **/pnm/aqprobe** directory on the E6000 CER.

   Note: A timestamp is appended to the configured (base) filename for all PNM results files.

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

   Note: By default, docsPnmCmtsUsOfdmaAQProbeUseIdleSid is set to **false**, which will generate an active probe capture.

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. Use the docsPnmCmtsUsOfdmaAQProbeFileName attribute to specify a test results file name. The test results file are placed in the local **/pnm/aqprobe** directory on the E6000 CER.

   Note: A timestamp is appended to the configured (base) filename for all PNM results files.

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 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**. This means that 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:
  - 16,955 bytes for a quiet probe (2 symbols) for 50 kHz subcarrier spacing.

  - 66,107 bytes for an active probe (8 symbols) for 50 kHz subcarrier spacing.
  - 33,595 bytes for a quiet probe (2 symbols) for 25 kHz subcarrier spacing.
  - 131,899 bytes for an active probe (8 symbols) for 25 kHz subcarrier spacing.
- There is an US RxMER test in progress for this OFDMA channel (docsPnmCmtsUsOfdmaRxMerMeasStatus set to **busy**) and both UPC and US RxMER tests share the same UEPI pseudowire.
- There is another OFDMA channel being served by the same upstream RF port with docsPnmCmtsUsOfdmaRxMerMeasStatus or docsPnmCmtsUsOfdmaAQProbeMeasStatus set to **busy** (multiple UPC or upstream RxMER 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 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: For CCAP Core, RxMER probes are supported for OFDMA channels with 25 kHz or 50 kHz subcarrier spacing. Only dynamic pseudowires are supported for this test.

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 file name with the docsPnmCmtsUsOfdmaRxMerFileName attribute. The test results file will be placed in the local **/pnm/mer** directory.

   Note: A timestamp is appended to the configured (base) filename for all PNM results files.

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 default is set to 1 by the E6000 CER and cannot 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 UCAM-2 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 subcarrier spacing left in the RAM disk PNM.
- There is less than 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**) and both UPC and US RxMER tests share the same UEPI pseudowire.
- There is another OFDMA channel being served by the same upstream RF port or the other E6000 CER upstream RF port 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

Using the Viavi Upstream Sweep Application

You can configure the Viavi Upstream Sweep feature in an E6000 CER CCAP Core and CommScope Remote PHY device (RPD) deployment.

The E6000 CER CCAP Core supports Upstream Triggered Spectrum Capture (UTSC) FreeRunning Trigger Mode with repeat capture and continuous capture using a static pseudowire in Remote PHY (RPD) deployments. The PNM UTSC feature allows a PNM server to receive spectrum capture data directly from the RPDs through a static pseudowire between the RPD and an external PNM server.

This feature supports the following:

- Repeat Capture with configured RepeatPeriod (50 ms to 1000 ms) with a finite configured RunDuration (up to 10 min).
- Repeat "hardware-restricted" capture mode (RepeatPeriod <= 2 ms, but not configurable) with a finite configured RunDuration (up to 10 min).
- Continuous capture mode with a configured RepeatPeriod (50 ms to 1000 ms).
- Continuous "hardware-restricted" capture mode (RepeatPeriod <= 2 ms, but not configurable).
- The docsPnmCmtsUtscCfgTable and docsPnmCmtsUtscCtrlTable MIBs for UTSC configuration and control.
- NDF/NDR channel activation/deactivation through SNMP.
- New MIB attributes for source IP addresses in the NDR upstream channel table.

High level configuration overview

- You configure NDF/NDR channels using the E6000 CER CLI.
- Prior to upstream sweep measurement collection, the Viavi Upstream Sweep controller enables NDF/NDR channels, which are used to control handheld devices in the field.
- The Upstream Sweep continuous- or repeat-capture mode enables upstream spectrum capture on the RPD through the E6000 CER using the continuous/repeat capture mode of the PNM UTSC feature.

  UTSC continuous capture mode can start in the morning and stop at the end of the day, or UTSC measurement can be initiated when a handheld device appears at the target node.

- When the spectrum measurement collection is completed, the Viavi Upstream Sweep controller disables the NDF/NDR channels.

Note: A capture with "hardware-restricted" mode generates a large amount of traffic in the CIN from the RPD to the PNM server. The amount of traffic is about 155 Mbps for a single upstream RF port.

Parent topic: Proactive Network Maintenance

NDF/NDR control interfaces

NDF/NDR channel status

CommScope assumes that the Viavi Upstream Sweep controller will only control enabling (no shutdown) or disabling (shutdown) of the Narrow band Digital Forward (NDF) and Narrow band Digital Return (NDR) channels. Prior to this enable/disable control by Viavi Upstream Sweep controller, all other configuration of the NDF/NDR channels is done by you through E6000 CER CLI commands.

Enabling/disabling of NDF/NDR channels is available through SNMP. With SNMP SET, write to the ifTable MIB (which is defined in IF-MIB) using the cerOobNdfDsChanIfIndex (NDF) or cerOobNdrUsChanIfIndex (NDR) value as the key. The channel's "administrative" status is then written to the ifAdminStatus attribute in the ifTable MIB.

- To enable the NDF or NDR channel, write ifAdminStatus to "1" (up).
- To disable the NDF or NDR channel, write ifAdminStatus to "2" (down).

Source IP address of NDR channel

The source IP address of the NDR channel connection to the Viavi Upstream Sweep server may be retrieved through an SNMP read of a proprietary MIB on the E6000 CER CCAP Core.

There is no standard MIB that reports the source IP address currently. The E6000 CER stores the source IP address in the following proprietary MIB objects:

- cerOobNdrUsChanSrcIpAddrType 1.3.6.1.4.1.4115.1.9.1.9.69.1.11
- cerOobNdrUsChanSrcIpAddr 1.3.6.1.4.1.4115.1.9.1.9.69.1.12

These MIB objects are attributes in cerOobNdrUsChanEntry (1.3.6.1.4.1.4115.1.9.1.9.69.1) and are indexed with theIfIndex of the NDR channel.

Note: For an RPD with 2 upstream RF ports and an NDR channel configured/enabled on both ports, it is possible that the source IP address may be the same for both NDR upstream connections to the NDF/NDR engine. Also, the destination IP address may be the same for both NDR upstream connections. Thus, the only connection attribute that must be unique is the Session ID (cerOobNdrUsChanDataPwId).

Recommended operation for NDF/NDR channel control

CommScope recommends that the PNM server create a list of ifIndex values for the NDF and NDR channels on the E6000 CER by reading the entire cerOobNdfDsChanTable and cerOobNdrUsChanTable first. The number of entries in these tables corresponds to the number of NDF (cerOobNdfDsChanTable) and NDR (cerOobNdrUsChanTable) channels defined. Then reading the ifAlias in ifXEntry with the key of IfIndex will provide the correct mapping of IfIndex and the target NDF/NDR channel.

Note: The NDF and NDR MIB tables include most of the information about the characteristics of the NDF or NDR channel (channel width, center frequency, session ID, and so on).

- **NDF channels**

  cerOobNdfDsChanEntry 1.3.6.1.4.1.4115.1.9.1.9.68.1

  cerOobNdfDsChanIfIndex 1.3.6.1.4.1.4115.1.9.1.9.68.1.1

- **NDR channels**

  cerOobNdrUsChanEntry 1.3.6.1.4.1.4115.1.9.1.9.69.1

  cerOobNdrUsChanIfIndex 1.3.6.1.4.1.4115.1.9.1.9.69.1.1

NDF/NDR channel status (shutdown/no-shutdown) and the source IP address of the NDR channel are now available through the MIB with IfIndex as the key.

Note: The NDR channel must be enabled before reading the associated source IP address. We recommend reading ifOperStatus from ifTable after setting ifAdminStatus to confirm that the NDF or NDR channel is successfully enabled.

Parent topic: Using the Viavi Upstream Sweep Application

UTSC control interface

For information about the UTSC control interface, see UTSC control interface.

Parent topic: Using the Viavi Upstream Sweep Application

Operational considerations

For the operational considerations, see UTSC operational considerations.

Parent topic: Using the Viavi Upstream Sweep Application

Configure UTSC with a static pseudowire

See Configure UTSC on a static pseudowire.

Parent topic: Using the Viavi Upstream Sweep Application

PNM test concurrency

The E6000 CER supports concurrently running PNM UTSC tests for each active UCAM-2 in the chassis, as follows:

- TEST A: A single RPHY FreeRunning trigger mode test with static pseudowire concurrently on each RPHY RF port in any set of the UCAM-2's RPHY RF ports, and
- TEST B: A single RPHY FreeRunning trigger mode or IdleSID trigger mode test with dynamic pseudowire on one of the UCAM-2's RPHY RF ports

The following conditions apply:

- For TEST A: If multiple RPHY RF ports are for the same RPD, successful concurrent test execution by the RPD is dependent on the RPD's concurrency capabilities. The RPD will return an error in the GCP response message if it cannot support the requested test initiation.
- For TEST A: If multiple RPHY RF ports serve multiple RPDs, then each of the RPDs will run the FreeRunning trigger mode test with static pseudowire concurrently.
- TEST A and TEST B cannot be run on the same RF port simultaneously.

  TEST A and TEST B are not supported concurrently on RF ports of the same RPD.

Note: The UTSC FreeRunning trigger mode tests with static pseudowire are limited to the supported settings of the docsPnmCmtsUtscCfgRepeatPeriod and docsPnmCmtsUtscCfgFreeRunDuration attributes of docsPnmCmtsUtscCfgTable.

Note: Other PNM tests (US Capture for Active and Quiet Probes and US RxMER) may also be run concurrently on each of the active UCAM-2 cards in the chassis.

Note: For initiation of UTSC on multiple RPHY RF ports of the same RPD, successful concurrent test execution by the RPD is dependent on the RPD's concurrency capabilities. The RPD will return an error in the GCP response message if it cannot support the requested test initiation. The CCAP Core will, in turn, set the docsPnmCmtsUtscStatusMeasStatus attribute of docsPnmCmtsUtscStatusTable to an appropriate value.

Parent topic: Proactive Network Maintenance

PNM test results file sizes

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

UTSC with dynamic pseudowires

- 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 OFDMA 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

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

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). 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 CERchecks 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.

Upon applying the formula 6 - (2 * 1) = 4, and the 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 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

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