

Proactive Network Management

This document describes how to configure the Proactive Network Management on the Cisco cBR Series Converged Broadband Router.

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Hardware Compatibility Matrix for the Cisco cBR Series Routers



Note The hardware components that are introduced in a given Cisco IOS-XE release are supported in all subsequent releases unless otherwise specified.

Table 1: Hardware Compatibility Matrix for the Cisco cBR Series Routers

Cisco CMTS Platform	Processor Engine	Interface Cards
Cisco cBR-8 Converged Broadband Router	Cisco IOS-XE Release 3.15.0S and Later Releases	Cisco IOS-XE Release 3.15.0S and Later Releases
	Cisco cBR-8 Supervisor:	Cisco cBR-8 CCAP Line Cards:
	• PID—CBR-CCAP-SUP-160G	• PID—CBR-CCAP-LC-40G-R
	• PID—CBR-CCAP-SUP-60G ¹	• PID—CBR-CCAP-LC-80G-R
	• PID—CBR-SUP-8X10G-PIC	

¹ Effective with Cisco IOS-XE Release 3.17.0S, CBR-CCAP-SUP-60G supports 8 cable line cards. The total traffic rate is limited to 60 Gbps. The total number of downstream service flows is limited to 72268, and downstream unicast low-latency flow does not count against the limits.

Information about Proactive Network Management

Proactive Network Management (PNM) enables you to measure and report conditions in the network. The PNM detects, identifies, and quantifies undesired impacts to the network, such as cable faults and ingress noise. The DOCSIS 3.1 PHY specification defines the different types of tests and measurements that can be performed at CCAP and CM. You can leverage this information to make the necessary modifications that can improve conditions and monitor networking trends to detect when network improvements are needed.

The PNM tests and receives data output from the CMTS using the Simple Network Management Protocol (SNMP) objects. The PNM feature is supported on RPHY.

Proactive Network Management for Supervisor High Availability, Line Card High Availability and containers

PNM Supervisor High Availability support ensures that all captures are stopped and all the captures states in the Line Card and Supervisor client are cleaned up when Supervisor High Availability happens. You can create new capture configurations and initiate tests on the newly active supervisor through SNMP.

cBR supports Line Card High Availability and Line Card Process Restart for Proactive Network Management, and will support the restart of any test in progress.

Active syncing of capture data between active and standby SUP is not supported for Proactive Network Management. After switchover, all new captures must be configured by the user/client again.

Bulk Data Transfer MIBs enables configuration of the following paramters for PNM:

- TFTP server bulk data transfer IP address
- TFTP server bulk data transfer path

Proactive Network Management Using Upstream Triggered Spectrum Capture

Cisco cBR-8 supports Upstream Triggered Spectrum Capture (UTSC). The upstream triggered spectrum analysis measurement provides a wideband spectrum analyzer in the CCAP which can be triggered to examine upstream transmissions and underlying noise or interference during a quiet period.

The Cisco cBR-8 supports the following Upstream Triggered Spectrum Capture objects:

- UsTriggeredSpectrumCaptureFile
- UsTriggeredSpectrumCaptureCfg
- UsTriggeredSpectrumCaptureCtrl
- UsTriggeredSpectrumCaptureStatus
- UsTriggeredSpectrumCaptureCapabilities
- CCAPBulkDataControl

The Cisco cBR-8 router enables you to trigger a spectrum sample capture and perform spectrum-analysis using the FreeRun mode. FreeRun mode is a continuous-mode with a maximum of 10 samples per second stacked on each capture file).

The CCAP supports one client configuration per port on a line card. Create a capture configuration entry before attempting to start or stop the capture tests. The interface index key for the UsTriggeredSpectrumCaptureCfg object defines the one capture configuration for the FreeRun trigger mode.

The Cisco cBR-8 supports only one capture per end-user client per port simultaneously. Hence, the CCAP sets the Upstream Triggered Spectrum Capture configuration index to 1. The Cisco cBR-8 does not support a PNM MIB query for an Upstream Triggered Spectrum Capture configuration index other than 1. The Cisco cBR-8 supports a maximum of eight captures on upstream ports per line card. The Cisco cBR-8 supports a maximum of 20 captures per router for RPHY.

The Cisco cBR-8 does not support the following scenarios:

- UsTriggeredSpectrumCaptureResult MIB
- Simultaneous captures on adjacent ports on CLC
- RPD support captures only one us-port per RPD at a given time.
- docsPnmCmtsUtscCfgFilename OID



Note The UsTriggeredSpectrumCaptureConfiguration MIB is supported. The docsPnmCmtsUtscCfgFilename OID under this MIB is not supported only for UTSC capture mode for PNM.

The PNM IOX container is used for the TFTP transfer of capture files to a user configured destination server. The **guestshell** IOX container for TFTP transfer of PNM files is supported. The PNM executable is built into the guestshell that is packaged as part of cbr8 image. This executable must be installed on both active and standby SUP manually.

Step 1 Ensure that the guestshell container is running before the captures are started to ensure successful TFTP operation. Use the **show app-hosting list** command to check if the guestshell container is running.

Example:

Step 2 The app-hosting CLI is used to install, deploy, start, and stop the IOX container.

Example:

```
Router# show run | begin app-hosting
app-hosting appid guestshell
app-vnic gateway0 virtualportgroup 4 guest-interface 0
guest-ipaddress 9.32.254.2 netmask 255.255.255.0
app-default-gateway 9.32.254.1 guest-interface
```

Step 3 Ensure that the python is running on the guestshell container.

Example:

cBR8#guestshell run python -V Python 2.7.5

Step 4 Ensure that the PNM TFTP process is active and running on the guestshell container.

Example:

```
cBR8#guestshell run systemctl status pnm
pnm.service - cbr pnm telemetry delivery system
Loaded: loaded (/etc/systemd/system/pnm.service; disabled; vendor preset: disabled)
Active: active (running) since Wed 2019-01-09 15:13:40 UTC; 9min ago
```

The PNM capture tests generate files to report measurements or test results. The results file includes header information that is common to all types of PNM tests and fields. The file also includes data that is specific to the type of PNM test. The abstract PnmCaptureFile object defines the attributes and format of the header information common to all PNM test files. File header fields are right-justified within the field and left-padded with zero values if necessary.

The following fields define the header for the PnmCaptureFile object for Upstream Spectrum Triggered Capture tests.

• FileType - A four-byte hexadecimal identifier specific to the type of PNM test that generated the data file.

For Upstream Triggered Spectrum Capture, the file type is 0x504e4e6a.

• Major Version - This attribute represents the file header version. This value is incremented by one when the header format is modified by this specification.

For Upstream Triggered Spectrum Capture, major version is 0x1.

Minor Version - This attribute is reserved for vendor-specific and vendor-defined version information.

For Upstream Triggered Spectrum Capture, minor version is 0x0.

- CaptureTime This attribute represents the epoch time (also known as 'UNIX time') which is the number of seconds that have elapsed since midnight Coordinated Universal Time (UTC), Thursday, 1 January 1970.
- IfIndex This attribute represents the ifIndex of the upstream RF port sampled.
- UniqueCcapId A 256-byte hexadecimal field representing a unique CCAP identifier (either a loopback address (IPv4 or IPv6) or FQDN). This value is a null-terminated string.

For Upstream Triggered Spectrum Capture, this value is the 'hostname' of the CMTS.

Proactive Network Management Interface Index

To determine which slot/subslot/port of an ifindex translates to that of RPHY, see the mapping in the running configuration.

Before you begin

The Upstream Triggered Spectrum Capture – The Cisco cBR-8 router supports multiple RPDs per line card with multiple US-ports. However, on RPDs, you can configure only one US-port and initiate the captures anytime.

For RPHY, it is not mandatory that the US port is bound to a MAC domain. If it is configured under an RPD, it can be configured for PNM.

The SNMP ifindex for MIB objects can be obtained using the show CLI:

Router# show snmp mib ifmib ifindex | i 0053.0013.2be0 RPD(0053.0013.2be0)-usport0: Ifindex = 435564

where 0053.0013.2be0 is the RPD identifier.

Step 1 Run the following show command to identify the SNMP ifindex value:

Router# show snmp mib ifmib ifindex | i 435564 RPD(0053.0013.2be0)-usport0: Ifindex = 435564

Step 2 Run the following command to identify the slot/subslot/port an ifindex that translates to RPHY:

```
Router# show run | b 0053.0013.2be0
identifier 0053.0013.2be
core-interface Te1/1/0
principal
rpd-ds 0 downstream-cable 1/0/2 profile 2
rpd-us 0 upstream-cable 1/0/2 profile 21
```

The slot/subslot/port is upstream-cable 1/0/2 profile 21.



Note

Cisco IOS XE Gibraltar 16.10.1g introduces an RPHY ifIndex change. Ensure that you have gone through the following updates to enable the changes:

• The RPHY ifIndex feature removes the Cisco private ifIndex for PRHY channels (ifIndex starting from 41,000). The ifIndex are not created manually. All the ifIndex are created automatically when configuring RPD. It is applicable for ifIndex starting from 41w for US (if-type 205) and DS (if-type 128). The RPHY ifIndex feature does not work for ifIndex values that are greater than 41w.

Before the ifIndex feature, in 16.10.1f and earlier releases:

```
Router# show snmp mib ifmib ifindex | i RPD
Upstream-Cable3/0/63:0-RPD(0053.0013.420c)-usport0: Ifindex = 421224
.....
RPD(0053.0013.420c)-usport0: Ifindex = 435560
RPD(0053.0013.420c)-dsport0: Ifindex = 436584
Downstream-Cable3/0/31:0-RPD(0053.0013.420c)-dsport0: Ifindex = 437608
Downstream-Cable3/0/31:1-RPD(0053.0013.420c)-dsport0: Ifindex = 437609
```

With the ifIndex feature, in 16.10.1g:

Router# show snmp mib ifmib ifindex | s RPD RPD(0053.0013.420c)-usport0: Ifindex = 415080 RPD(0053.0013.420c)-dsport0: Ifindex = 416104

 The RPHY ifIndex reimplement CoreToRpdMap/RpdToCoreMap tables to keep them aligned with DOCS-RPHY-MIB-2018-07-26 definition.

You do not need to create a new ifIndex for US (if-type 205) and DS (if-type 128) channels when they are configured to RPD. For versions before Cisco IOS XE Gibraltar 16.10.1g, it was required to create a new ifIndex (>41k) for US (if-type 205) and DS (if-type 128) channels when they are configured to RPD:

```
[CBR]#show snmp mib ifmib ifindex | s RPD
RPD(0053.0013.420c)-usport0: Ifindex = 415080
RPD(0053.0013.420c)-dsport0: Ifindex = 416104
```

With the Cisco cBR-8 16.10.1g RPHY ifIndex feature, you do not need to manually populate any extra item in legacy MIBs.

With the Cisco cBR-8 16.10.1g RPHY ifIndex feature, you must reimplement

docsRphyRpdIfCoreToRpdMapTable / docsRphyRpdIfRpdToCoreMapTable, not mapping to ifIndex (>41k) for US (if-type 205) and DS (if-type 128). See the following:

```
/* docsRphyRpdIfCoreToRpdMapRpdRfChanType OID :1.3.6.1.4.1.4491.2.1.30.1.2.6.1.5
Table Index: docsRphyRpdIfCoreToRpdMapRpdCoreIndex, docsRphyRpdIfCoreToRpdMapRpdUniqueId,
docsRphyRpdIfCoreToRpdMapRpdRfPortDirection, docsRphyRpdIfCoreToRpdMapRpdRfPortIndex*/
SNMPv2-SMI::enterprises.4491.2.1.30.1.2.6.1.5.403561.0.4.159.51.0.145.2.0 = INTEGER:
usAtdma(5)
SNMPv2-SMI::enterprises.4491.2.1.30.1.2.6.1.5.322358.0.4.159.51.0.145.1.0 = INTEGER:
dsScQam(1)
IF-MIB::ifType.403561 = INTEGER: docsCableUpstream(129)
IF-MIB::ifType.322358 = INTEGER: other(1)
```

[CBR]#show snmp mib ifmib ifindex Cable9/0/0-upstream1: Ifindex = 403561 Downstream-Cable9/0/4-downstream14: Ifindex = 322358

- If RfChanType is usAtdma(5), ifType of docsRphyRpdIfCoreToRpdMapRpdCoreIndex is ifType docsCableUpstream(129)
- If RfChanType is dsScQam(1), if Type of docsRphyRpdIfCoreToRpdMapRpdCoreIndex is other(1).

Upstream Triggered Spectrum Capture Configuration Parameters

The following configuration parameters for Upstream Triggered Spectrum Capture are supported. Examples of using the MIBs are also included.

Note PNM capture configuration on cBR8 is supported only through SNMP user interface. Configuration examples for MIB commands for PNM are provided in the following sections with examples using both snmpr (setany/getone commands) as well as net-snmp tools (snmpset/snmpget commands).

Upstream Triggered Spectrum Capture Configuration Objects

The following Upstream Triggered Spectrum Capture configuration objects are supported:

- PNM UTSC OBJECTS OID: 1.3.6.1.4.1.4491.2.1.27.1.3.10
- PNM UTSC CAPTURE CONFIGURATION OID: 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.X.Y.Z

Where X is the capture config parameter, Y is Ifindex, and Z is the PNM UTSC Config Index – Which is always 1. Currently only one capture configuration per upstream port is supported.

• The following capture configuration parameters are supported, and the corresponding MIB OID value is listed.

Capture configuration parameters	Corresponding MIB OID value
I_docsPnmCmtsUtscCfgTriggerMode	1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.3
I_docsPnmCmtsUtscCfgCmMacAddr	1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.6
I_docsPnmCmtsUtscCfgCenterFreq	1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.8
I_docsPnmCmtsUtscCfgSpan	1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.9
I_docsPnmCmtsUtscCfgNumBins	1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.10
I_docsPnmCmtsUtscCfgAveraging	1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.11
I_docsPnmCmtsUtscCfgQualifyCenterFreq	1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.13
I_docsPnmCmtsUtscCfgQualifyBw	1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.14
I_docsPnmCmtsUtscCfgQualifyThrshld	1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.15
I_docsPnmCmtsUtscCfgWindow	1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.16
I_docsPnmCmtsUtscCfgOutputFormat	1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.17
I_docsPnmCmtsUtscCfgRepeatPeriod	1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.18
I_docsPnmCmtsUtscCfgFreeRunDuration	1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.19
I_docsPnmCmtsUtscCfgTriggerCount	1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.20

Table 2: Supported capture configuration parameters and the corresponding MIB OID value

Capture configuration parameters	Corresponding MIB OID value		
I_docsPnmCmtsUtscCfgStatus	1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.21		

Starting from Cisco IOS XE Gibraltar 16.12.1x release, PNM output format 'timeIQ' and UTSC trigger mode 'cmMac' are supported in upstream triggered spectrum capture configuration objects.

Below is an example of the SNMP command configuration with PNM output format 'timeIQ' and UTSC trigger mode 'cmMac'.

```
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.1.1.2.0 x "0B 01 01 0C"
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.1.1.3.0 s "path"
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.21.415084.1 i 6
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.21.415084.1 i 4
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.2.415084.1 i ifindex
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.3.415084.1 i 6
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.6.415084.1 x "CM
MAC"
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.8.415084.1 u 16400000
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.9.415084.1 u 6400000
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.10.415084.1 u 1024
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.11.415084.1 u 245
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.13.415084.1 u 10240000
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.14.415084.1 u 25600000
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.15.415084.1 i -200
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.16.415084.1 i 3
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.17.415084.1 i 1
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.18.415084.1 u 25000
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.19.415084.1 u 5000
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.20.415084.1 u 500
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.21.415084.1 i 1
snmpset -v2c -c private 10.74.54.13 1.3.6.1.4.1.4491.2.1.27.1.3.10.3.1.1.415084.1 i 1
```

Upstream Triggered Spectrum Capture Configuration MIB Objects

The following Upstream Triggered Spectrum Capture configuration MIB objects are supported for PNM:

- CaptureCfg Contains the test trigger mode and its required configuration.
- CaptureCtrl Controls when the test is started and stopped.
- CaptureStatus Contains the current status of the test.
- CaptureCapability Exposes CCAP Upstream Triggered Spectrum Capture capabilities.

The following Upstream Triggered Spectrum Capture configuration MIBs are supported. SNMP walk is supported for all the MIB objects.

- docsPnmCmtsUtscCfgTriggerMode This attribute indicates which upstream triggered spectrum capture function trigger modes are supported. Only FreeRun is supported. The following are the enumerated values for trigger mode for PNM.
 - D docsPnmCmtsUsSpecAnTrigMode other 1
 - D_docsPnmCmtsUsSpecAnTrigMode_freeRunning 2
 - D docsPnmCmtsUsSpecAnTrigMode miniSlotCount 3
 - D docsPnmCmtsUsSpecAnTrigMode sid 4

- D_docsPnmCmtsUsSpecAnTrigMode_idleSid 5
- D_docsPnmCmtsUsSpecAnTrigMode_minislotNumber 6
- D_docsPnmCmtsUsSpecAnTrigMode_cmMac 7
- D docsPnmCmtsUsSpecAnTrigMode quietProbeSymbol 8
- For FreeRun mode, the CCAP initiates sampling and continues sampling until the time duration configured in the attribute FreeRunDuration has transpired. Sampling terminates when the time duration configured in FreeRunDuration has elapsed or when FFT is disabled. The interval between captures is the greater of RepeatPeriod and the minimum period that is supported by the CCAP.
- From Cisco IOS XE Gibraltar 16.12.1x release, PNM output format 'timeIQ' and UTSC trigger mode 'cmMac' are supported in upstream triggered spectrum capture configuration objects.
- Trigger mode set and get examples:

snmpr commands:

```
• server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.3.<ifIndex>.1 -i 2
clabProjDocsis.27.1.3.10.2.1.3.<ifIndex>.1 = 2
• server > getone -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.3.<ifIndex>.1
clabProjDocsis.<ifIndex> = 2
• net-snmp commands:
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.3.<ifIndex>.1 i 2
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.3.<ifIndex>.1 = INTEGER: 2
```

- server > snmpget -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.3.<ifIndex>.1
 SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.3.<ifIndex>.1 = INTEGER: 2
- docsPnmCmtsUtscCfgCenterFreq This attribute specifies the center frequency of the upstream spectrum to be sampled for analysis.

• **snmpr** commands:

- server > setany -v2c <cmts_ip> <community_name>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.8.<ifIndex>.1 -g 102400000
 clabProjDocsis.27.1.3.10.2.1.8.<ifIndex> = 102400000
- server > getone -v2c <cmts_ip> <community_name>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.8.<ifIndex>.1
 clabProjDocsis.27.1.3.10.2.1.8.<ifIndex>.1 = 102400000
- net-snmp commands:
 - server > snmpset -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.8.<ifIndex>.1 u 102400000
 SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.8.<ifIndex>.1 = Gauge32: 102400000
 - server > snmpget -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.8.<ifIndex>.1
 SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.8.<ifIndex>.1 = Gauge32: 102400000

- docsPnmCmtsUtscCfgSpan This attribute determines the frequency span of the upstream spectrum sample capture. When this attribute is read, it provides the actual span, which may be different from the requested (configured) span due to implementation effects.
 - snmpr commands:

```
• server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.9.<ifIndex>.1 -g 204800000
clabProjDocsis.27.1.3.10.2.1.9.<ifIndex>.1 = 204800000
• server > getone -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.9.<ifIndex>.1
clabProjDocsis.27.1.3.10.2.1.9.<ifIndex>.1 = 204800000
• net-snmp commands:
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.9.<ifIndex>.1 u 204800000
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.9.<ifIndex>.1 = Gauge32: 204800000
```

```
• server > snmpget -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.9.<ifIndex>.1
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.9.<ifIndex>.1 = Gauge32: 204800000
```



Note The center frequency and span capture parameters are set to zero as per OSSI specifications on capture configuration entry creation. For freerun trigger mode, you must set these values in the valid range to run capture tests on the port.

- docsPnmCmtsUtscCfgNumBins This attribute determines the number of frequency bins or samples per span when sampling the upstream spectrum. This attribute provides the actual number of bins, which may be different from the configured number due to implementation effects.
 - **snmpr** commands

```
• server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.10.<ifIndex>.1 -g 4096
clabProjDocsis.27.1.3.10.2.1.10.<ifIndex>.1 = 4096
```

- server > getone -v2c <cmts_ip> <community_name>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.10.<ifIndex>.1
 clabProjDocsis.27.1.3.10.2.1.10.<ifIndex>.1 = 4096
- net-snmp commands

```
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.10.<ifIndex>.1 u 4096
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.10.<ifIndex>.1 = Gauge32: 4096
• server > snmpget -v2c -c <community_name> <cmts_ip>
```

- 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.10.<ifIndex>.1 SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.10.<ifIndex>.1 = Gauge32: 4096
- docsPnmCmtsUtscCfgAveraging This attribute specifies whether the CCAP should average spectral
 frequency domain sample power to remove spurious spectral peaks and troughs and the number of samples
 to use to calculate the average power. The CCAP must not calculate the average of the upstream spectrum

samples when the value of Averaging is zero. The CCAP MUST calculate the average power of upstream spectrum samples, over the number of samples that are specified, when the value of the Averaging attribute is nonzero.

snmpr commands

```
• server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.11.<ifIndex>.1 -g 245
clabProjDocsis.27.1.3.10.2.1.11.<ifIndex>.1 = 245
• server > getone -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.11.<ifIndex>.1
clabProjDocsis.27.1.3.10.2.1.11.<ifIndex>.1 = 245
• net-snmp commands
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.11.<ifIndex>.1 u 245
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.11.<ifIndex>.1 = Gauge32: 245
```

```
• server > snmpget -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.11.<ifIndex>.1
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.11.<ifIndex>.1 = Gauge32: 245
```

- docsPnmCmtsUtscCfgCmMacAddr This attribute specifies the cable modem from which the CCAP captures upstream transmissions. This attribute is used only when the TriggerMode is CmMac and is ignored otherwise.
 - net-snmp commands

```
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.6.<ifIndex>.1
    x "CM-MAC"
```

- server > snmpget -v2c -c <community_name> <cmts_ip> 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.6.<ifIndex>.1
- docsPnmCmtsUtscCfgQualifyCenterFreq This attribute specifies the center frequency of a band that is used to qualify a spectrum for upload. The average of the FFT linear power values in this band is computed and compared to a threshold. If the average power in the band is below the threshold, the spectrum is discarded. If the power average is greater than or equal to the threshold, the spectrum is considered qualified.
 - snmpr commands
 - server > setany -v2c <cmts_ip> <community_name>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.13.<ifIndex>.1 -g 102400000
 clabProjDocsis.27.1.3.10.2.1.13.<ifIndex>.1 = 102400000
 - server > getone -v2c <cmts_ip> <community_name>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.13.<ifIndex>.1
 clabProjDocsis.27.1.3.10.2.1.13.<ifIndex>.1 = 102400000
 - net-snmp commands

```
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.13.<ifIndex>.1 u 102400000
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.13.<ifIndex>.1 = Gauge32:
102400000
```

```
• server > snmpget -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.13.<ifIndex>.1
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.13.<ifIndex>.1 = Gauge32:
102400000
```

- docsPnmCmtsUtscCfgQualifyBw This attribute specifies the bandwidth of a band that is used to qualify a spectrum for upload. The average of the FFT linear power values in this band is computed and compared to a threshold. If the average power in the band is below the threshold, the spectrum is discarded. If the power average is greater than or equal to the threshold, the spectrum is considered qualified.
 - **snmpr** commands:

```
• server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.14.<ifIndex>.1 -g 25600000
clabProjDocsis.27.1.3.10.2.1.14.<ifIndex>.1 = 25600000
• server > getone -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.14.<ifIndex>.1
clabProjDocsis.27.1.3.10.2.1.14.<ifIndex>.1 = 25600000
```

- net-snmp commands:
 - server > snmpset -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.14.<ifIndex>.1 u 25600000
 SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.14.<ifIndex>.1 = Gauge32: 25600000
 - server > snmpget -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.14.<ifIndex>.1
 SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.14.<ifIndex>.1 = Gauge32: 25600000
- docsPnmCmtsUtscCfgQualifyThrshld This attribute specifies the threshold that is applied to qualify a
 spectrum for upload. The average of the FFT linear power values in the specified band is computed and
 compared to this threshold. If the average power in the band is below the threshold, the spectrum is
 discarded. If the power average is greater than or equal to the threshold, the spectrum is considered
 qualified.
 - **snmpr** commands

```
• server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.15.<ifIndex>.1 -i 200
clabProjDocsis.27.1.3.10.2.1.15.<ifIndex> = -200
• server > getone -v2c <cmts ip> <community name>
```

- 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.15.<ifIndex>.1 clabProjDocsis.27.1.3.10.2.1.15.<ifIndex>.1 = -200
- net-snmp commands

```
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.15.<ifIndex>.1 i -200
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.15.<ifIndex>.1 = INTEGER: -200
```

- server > snmpget -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.15.<ifIndex>.1
 SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.15.<ifIndex>.1 = INTEGER: -200
- docsPnmCmtsUtscCfgWindow This attribute indicates which of the upstream triggered spectrum capture function window formats are supported by the CCAP. Currently Cisco cBR-8 supports rectangular

(default), Blackmann-Harris, and Hann and Hamming formats. The following are the enumerated values for window mode for PNM.

- D_docsPnmCmtsUtscCfgWindow_other 1
- D_docsPnmCmtsUtscCfgWindow_rectangular 2
- D_docsPnmCmtsUtscCfgWindow_hann 3
- D_docsPnmCmtsUtscCfgWindow_blackmanHarris 4
- D_docsPnmCmtsUtscCfgWindow_hamming 5
- D_docsPnmCmtsUtscCfgWindow_flatTop 6
- D_docsPnmCmtsUtscCfgWindow_gaussian 7
- D_docsPnmCmtsUtscCfgWindow_chebyshev 8
- Window mode set and get examples:

snmpr commands:

```
• server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.16.<ifIndex>.1 -i 3
clabProjDocsis.27.1.3.10.2.1.16.<ifIndex>.1= 3
```

- server > getone -v2c <cmts_ip> <community_name>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.16.<ifIndex>.1
 clabProjDocsis.27.1.3.10.2.1.16.<ifIndex>.1 = 3
- server > setany -v2c <cmts_ip> <community_name> 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.16.<ifIndex>.1 -i 6 Error code set in packet - COMMIT_FAILED_ERROR: 1.

• net-snmp commands:

```
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.16.<ifIndex>.1 i 3
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.16.<ifIndex>.1 = INTEGER: 3
```

- server > snmpget -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.16.<ifIndex>.1
 SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.16.<ifIndex>.1 = INTEGER: 3
- server > snmpset -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.16.<ifIndex>.1 i 6
 Error in packet.
 Reason: commitFailed
 Failed object: SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.16.<ifIndex>.1

Note

• Flat-top, Gaussian, and Chebyshev window-modes are not supported.

 docsPnmCmtsUtscCfgOutputFormat - This attribute indicates the upstream triggered spectrum capture function data output formats that are supported by the CCAP. The CCAP is capable of reporting upstream spectrum sample FFT output data in power format. The enumeration value for power format is fftPower. CCAP supports time-IQ and fftPower output format. The time-IQ is supported from Cisco IOS XE Gibraltar 16.12.1x. The following are the enumerated values for output format mode for PNM.

- D docsPnmCmtsUtscCfgOutputFormat timeIQ 1
- D docsPnmCmtsUtscCfgOutputFormat fftPower 2
- D_docsPnmCmtsUtscCfgOutputFormat_rawAdc 3
- D_docsPnmCmtsUtscCfgOutputFormat_fftIQ 4
- D_docsPnmCmtsUtscCfgOutputFormat_fftAmplitude 5
- D_docsPnmCmtsUtscCfgOutputFormat_fftDb 6
- Output format mode set and get examples:
 - **snmpr** commands:

```
• server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.17.<ifIndex>.1 -i 2
clabProjDocsis.27.1.3.10.2.1.16.<ifIndex>.1 = 2
```

- server > getone -v2c <cmts_ip> <community_name>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.17.<ifIndex>.1
 clabProjDocsis.27.1.3.10.2.1.17.<ifIndex>.1 = 2
- server > setany -v2c <cmts_ip> <community_name> 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.17.<ifIndex>.1 -i 4 Error code set in packet - COMMIT_FAILED_ERROR: 1.

• net-snmp commands:

```
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.17.<ifIndex>.1 i 2
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.17.<ifIndex>.1 = INTEGER: 2
• server > snmpget -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.17.<ifIndex>.1
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.17.<ifIndex>.1 = INTEGER: 2
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.17.<ifIndex>.1 i 4
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.17.<ifIndex>.1 i 1
```

Note Only the fft-pwr and time-IQ output formats are currently supported.

- docsPnmCmtsUtscCfgRepeatPeriod This attribute specifies the length of time in milliseconds for which the CCAP continues to capture and return FFT results when in free running mode. The CCAP is permitted to trigger at larger intervals if unable to support the requested interval. Configuring a zero value indicates that the test is to run once only.
- The Repeat Period is configured in microseconds and default is 50000 usec. The CCAP MUST reject an attempt to set RepeatPeriod to a value greater than the current value of FreeRunDuration.

- Repeat Period set and get examples:
 - snmpr commands:

```
• server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.18.<ifIndex>.1 -g 25000
clabProjDocsis.27.1.3.10.2.1.18.<ifIndex>.1 = 25000
• server > getone -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.18.<ifIndex>.1
clabProjDocsis.27.1.3.10.2.1.18.<ifIndex>.1 = 25000
```

net-snmp commands:

```
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.18.<ifIndex>.1 u 25000
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.18.<ifIndex>.1 = Gauge32: 25000
• server > snmpget -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.18.<ifIndex>.1
```

SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.18.<ifIndex>.1 = Gauge32: 25000

- docsPnmCmtsUtscCfgFreeRunDuration This attribute specifies the length of time in milliseconds for which the CCAP continues to capture and return FFT results when in free running mode. Sample captures are expected to take a few microseconds. If FreeRunDuration is set for longer than a sample capture duration, the CCAP could potentially capture more sample data than it can store.
- The CCAP MUST reject an attempt to set FreeRunDuration to a value less than the current value of RepeatPeriod. Freerun duration is configured in millisec and the default value is 1000ms (1 second). The CCAP CLC currently captures 10 samples per second stacked in a single file. With default freerun duration configuration, there will be 11 samples.
- FreeRun Duration set and get examples:
 - snmpr commands

```
• server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.19.<ifIndex>.1 -g 5000
clabProjDocsis.27.1.3.10.2.1.19.<ifIndex>.1 = 5000
• server > getone -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.19.<ifIndex>.1
clabProjDocsis.27.1.3.10.2.1.19.<ifIndex>.1 = 5000
```

• net-snmp commands

```
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.19.<ifIndex>.1 u 5000
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.19.<ifIndex>.1 = Gauge32: 5000
• server > snmpget -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.19.<ifIndex>.1
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.19.<ifIndex>.1 = Gauge32: 5000
```

 docsPnmCmtsUtscCfgTriggerCount - This attribute determines the number of times to trigger upstream spectrum sample capture when Enable and InitiateTest are set to true and configured trigger conditions are met. The trigger count configuration does NOT apply and is ignored by CCAP for captures in FreeRun trigger mode.

- Trigger count set and get examples:
 - snmpr commands

```
• server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.20.<ifIndex>.1 -g 200
clabProjDocsis.27.1.3.10.2.1.20.<ifIndex>.1 = 200
• server > getone -v2c <cmts ip> <community name>
```

- 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.20.<ifIndex>.1 clabProjDocsis.27.1.3.10.2.1.20.<ifIndex>.1 = 200
- net-snmp commands
 - server > snmpset -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.20.<ifIndex>.1 u 200
 SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.20.<ifIndex>.1 = Gauge32: 200
 - server > snmpget -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.20.<ifIndex>.1
 SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.20.<ifIndex>.1 = Gauge32: 200
- docsPnmCmtsUtscCfgStatus This attribute determines the creation, deletion, and change of status of an actual capture configuration entry on any port of the CCAP CLC. All capture entries must first be created by a client on a port before attempting to initiate any tests on the port. Thereby the client 'owns' that port and its configuration after creation. No other client can run any tests on the port till the currently active client 'destroys' the configuration entry and thereby releases ownership of that port.
- Any tests on a given port that is owned by a client can be run only when the capture configuration status is 'Active'. When a configuration is created, it is created with certain default values and marked 'Not Ready'. All capture parameters must be configured in valid range for the capture entry status to become 'Active'. If the configuration values for various capture parameters are modified by the user/client and not according to the OSSI specification, the configuration status of the entry will be marked 'NotReady'.
- A capture configuration entry cannot be modified to any state unless created first. An entry cannot be recreated without destroying the previous version first. An entry cannot be modified when capture tests are currently running on the port.
- The following are the enumerated values for configuration entry status for PNM:
 - D_docsPnmCmtsUtscCfgStatus_active 1
 - D_docsPnmCmtsUtscCfgStatus_notInService 2
 - D_docsPnmCmtsUtscCfgStatus_notReady 3
 - D docsPnmCmtsUtscCfgStatus createAndGo 4
 - D_docsPnmCmtsUtscCfgStatus_createAndWait 5
 - D_docsPnmCmtsUtscCfgStatus_destroy 6
- Utsc Configuration Entry set/get example:
 - snmpr commands

```
• server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.21.<ifIndex>.1 -i 4
clabProjDocsis.27.1.3.10.2.1.21.<ifIndex>.1 = 4
```

```
• server > getone -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.21.<ifIndex>.1
clabProjDocsis.27.1.3.10.2.1.21.<ifIndex>.1 = 1
```

net-snmp commands

```
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.21.<ifIndex>.1 i 4
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.21.<ifIndex>.1 = INTEGER: 4
• server > snmpget -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.21.<ifIndex>.1
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.21.<ifIndex>.1 = INTEGER: 3
```

Note A configuration can be created with certain default values and is marked 'Not Ready'. It is only changed to 'Active' when valid capture configuration parameters are configured by the user. Capture tests can only be run on configurations that are 'Active'.

• Set multiple capture config parameters at the same time.

```
• Server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.18.<ifIndex>.1 -g 45000
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.20.<ifIndex>.1 -g 10
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.8.<ifIndex>.1 -g 100000000
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.10.<ifIndex>.1 -g 8092
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.15.<ifIndex>.1 -i -100
clabProjDocsis.27.1.3.10.2.1.18.<ifIndex>.1 = 45000
clabProjDocsis.27.1.3.10.2.1.8.<ifIndex>.1 = 10
clabProjDocsis.27.1.3.10.2.1.8.<ifIndex>.1 = 10000000
clabProjDocsis.27.1.3.10.2.1.10.<ifIndex>.1 = 10000000
clabProjDocsis.27.1.3.10.2.1.10.<ifIndex>.1 = 8092
clabProjDocsis.27.1.3.10.2.1.15.<ifIndex>.1 = -100 10.3.1.1.<ifIndex>.1 = 0
```

SNMP walk is supported for all the above MIB objects.

The following is an example of SNMP walk on upstream triggered spectrum capture configuration parameter repeat period:

server > snmpwalk -v2c <cmts ip> -c <community name> 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.18

```
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.18.<ifIndex>.1 = Gauge32: 45000
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.18.<ifIndex>.1 = Gauge32: 50000
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.18.<ifIndex>.1 = Gauge32: 50000
```

Upstream Triggered Spectrum Capture Control Objects and MIBs

The following Upstream Triggered Spectrum Capture control objects and MIBs are supported:

- PNM UTSC OBJECTS OID: 1.3.6.1.4.1.4491.2.1.27.1.3.10
- PNM UTSC CAPTURE CONTROL OID: 1.3.6.1.4.1.4491.2.1.27.1.3.10.3.1.1.Y.Z

Where Y is Ifindex, and Z is the PNM Upstream Triggered Spectrum Capture Configuration Index – Which is always 1. Currently only one capture configuration per upstream port is supported.

- The capture control entry can be used to start captures or stop any active captures. The docsPnmCmtsUtscCtrlInitiateTest is a boolean value which when set, initiates a capture.
- Starting a capture (You can only start a capture only if you have configured and owned the port, and if the capture configuration entry is active).
 - **snmpr** commands:

```
• server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1 -i 1
clabProjDocsis.27.1.3.10.3.1.1.<ifIndex>.1 = 1
• server > getone -v2c <cmts ip> <community name>
```

- 1.3.6.1.4.1.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1 clabProjDocsis.27.1.3.10.3.1.1.<ifIndex>.1 = 1
- net-snmp commands:

```
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1 i 1
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1 = INTEGER: 1
```

- server > snmpget -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1
 SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1 = INTEGER: 1
- Stop a capture (You can stop an active capture only if you own that port):
 - **snmpr** commands:

```
• server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1 -i 2
clabProjDocsis.27.1.3.10.3.1.1.<ifIndex>.1 = 2
• server > getone -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1
clabProjDocsis.27.1.3.10.3.1.1.<ifIndex>.1 = 2
```



Note Ensure that you pass a value '2', for the **setany** command to stop the capture.

net-snmp commands:

```
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1 i 2
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1 = INTEGER: 2
• server > snmpget -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1 = INTEGER: 2
```



Ensure that you pass a value '2', for the **snmpset** command to stop the capture.

Upstream Triggered Spectrum Capture Status Objects and MIBs

The following Upstream Triggered Spectrum Capture status objects and MIBs are supported:

- PNM UTSC OBJECTS OID: 1.3.6.1.4.1.4491.2.1.27.1.3.10
- PNM UTSC CAPTURE STATUS OID: 1.3.6.1.4.1.4491.2.1.27.1.3.10.4.1.1.Y.Z

Where Y is Ifindex, and Z is the PNM Upstream Triggered Spectrum Capture Configuration Index – Which is always 1. Currently only one capture configuration per upstream port is supported.

- The capture status MIB is a read-only MIB. It reports the status of the capture on a given port (if owned by that client).
- When the value is sampleReady, the CCAP has completed capturing and recording samples. Following are the enumerated values for capture status entry for PNM.
 - D_docsPnmCmtsUtscStatusMeasStatus_other 1
 - D docsPnmCmtsUtscStatusMeasStatus inactive 2
 - D docsPnmCmtsUtscStatusMeasStatus busy 3
 - D docsPnmCmtsUtscStatusMeasStatus sampleReady 4
 - D docsPnmCmtsUtscStatusMeasStatus error 5
 - D docsPnmCmtsUtscStatusMeasStatus resourceUnavailable 6
 - D docsPnmCmtsUtscStatusMeasStatus sampleTruncated 7
- The status is inactive when the capture configuration entry is created and is marked busy when the tests are actively running on the port. Any platform resource limitation to run a test to make the status 'resource unavailable' and the error encountered while running a test would mark the status as 'error'.
- Get capture status on a port (You can get the status of capture on the port only if you own that port.
 - **snmpr** commands:

server > getone -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.4.1.1.<ifIndex>.1
clabProjDocsis.27.1.3.10.4.1.1.<ifIndex>.1 = 4

• **net-snmp** commands:

```
server > snmpget -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.4.1.1.<ifIndex>.1
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.4.1.1.<ifIndex>.1 = INTEGER: 4
```

Upstream Triggered Spectrum Capture Capability Objects and MIBs

The following Upstream Triggered Spectrum Capture capability objects and MIBs are supported for PNM:

- PNM UTSC OBJECTS OID: 1.3.6.1.4.1.4491.2.1.27.1.3.10
- PNM UTSC CAPTURE CAPABILITY OID: 1.3.6.1.4.1.4491.2.1.27.1.3.10.1.1.X.Y

Where X is the capability parameter and Y is the Ifindex.

- The capture capability MIB is a read-only MIB. The Upstream Triggered Spectrum Capture Capabilities
 object exposes capabilities that are supported by the CCAP for Upstream Triggered Spectrum Capture
 trigger modes, data output formats, and windowing function used when performing the discrete Fourier
 transform.
- The following are the enumerated values for capture capability entry for PNM for CCAP.
 - docsPnmCmtsUtscCapabTriggerMode 1
 - docsPnmCmtsUtscCapabOutputFormat 2
 - docsPnmCmtsUtscCapabWindow 3
 - docsPnmCmtsUtscCapabDescription 4
- Get capture capability on a port:
 - **snmpr** commands:
 - server > getone -v2c <cmts_ip> <community_name>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.1.1.1.<ifIndex>
 docsPnmCmtsObjects.10.1.1.1.<ifIndex> = 00 02
 - server > getone -v2c <cmts_ip> <community_name>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.1.1.2.<ifIndex>
 docsPnmCmtsObjects.10.1.1.2.<ifIndex> = 04
 - server > getone -v2c <cmts_ip> <community_name>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.1.1.3.<ifIndex>
 docsPnmCmtsObjects.10.1.1.3.<ifIndex> = 1e
 - server > getone -v2c <cmts_ip> <community_name>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.1.1.4.<ifIndex>
 docsPnmCmtsObjects.10.1.1.4.<ifIndex> = Center Frequency range and resolution

• net-snmp commands:

- server > snmpget -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.1.1.1.<ifIndex>
 SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.1.1.1.<ifIndex> = Hex-STRING: 00 02
- server > snmpget -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.1.1.2.<ifIndex>
 SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.1.1.2.<ifIndex> = Hex-STRING: 04
- server > snmpget -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.1.1.3.<ifIndex>
 SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.1.1.3.<ifIndex> = Hex-STRING: 1
- server > snmpget -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.3.10.1.1.4.<ifIndex>
 SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.1.1.4.<ifIndex> = STRING: "Center
 Frequency range and resolution"

Upstream Triggered Spectrum Capture Bulk Data Control Objects and MIBs

The following Upstream Triggered Spectrum Capture bulk data control objects and MIBs are supported for PNM:

- PNM Bulk Data Control Objects OID: 1.3.6.1.4.1.4491.2.1.27.1.1.1
- PNM BULK DATA CONTROL OID: 1.3.6.1.4.1.4491.2.1.27.1.1.1.X

Where X is the bulk data transfer control parameter.

- The Bulk Data Transfer (BDT) control objects that are supported are the IPaddress type, BDT server IP and BDT destination path. This indicates to the CCAP the location where the capture results files are sent through TFTP transfer. In CBR8, the TFTP transfer is done through IOX container and as such, other BDT objects aren't relevant to this design model. IP address type can be automatically set by CCAP based on the server IP value specified.
- The following are the enumerated values for BDT for PNM:
 - docsPnmBulkDestIpAddrType 1
 - docsPnmBulkDestIpAddr 2
 - docsPnmBulkDestPath 3
- Set the BDT IPv4 IP address type and TFTP IP address.
 - snmpr commands:
 - server > setany -v2c <cmts_ip> <community_name> 1.3.6.1.4.1.4491.2.1.27.1.1.1.2.0
 -o 20:01:0d:b8
 docsPnmBulkDestIpAddr.0 = 20 01 0d b8
 - server > getone -v2c <cmts ip> <community name> 1.3.6.1.4.1.4491.2.1.27.1.1.1.0

docsPnmBulkDestIpAddrType.0 = ipv4(1)

• server > getone -v2c <cmts ip> <community name> 1.3.6.1.4.1.4491.2.1.27.1.1.1.2.0

docsPnmBulkDestIpAddr.0 = 20 01 0d b8

- **net-snmp** commands:
 - server > snmpset -v2c -c <community_name> <cmts_ip> 1.3.6.1.4.1.4491.2.1.27.1.1.1.2.0 x 20010db8 SNMPv2-SMI::enterprises.4491.2.1.27.1.1.1.2.0 = Hex-STRING: 20 01 0D B8
 - server > snmpget -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.1.1.1.0
 SNMPv2-SMI::enterprises.4491.2.1.27.1.1.1.1.0 = INTEGER: 1
 - server > snmpget -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.1.1.2.0
 SNMPv2-SMI::enterprises.4491.2.1.27.1.1.1.2.0 = Hex-STRING: 20 01 0D B8
- Set the BDT IPv6 IP address type and TFTP IP address.

• **snmpr** commands:

• server > setany -v2c <cmts_ip> <community_name> 1.3.6.1.4.1.4491.2.1.27.1.1.1.2.0
 -o 20:01:0d:b8:85:a3:00:00:00:00:8a:2e:03:70:73:11

docsPnmBulkDestIpAddr.0 = 2001 0db8 85a3 0000 0000 8a2e 0370 7311

- server > getone -v2c <cmts_ip> <community_name> 1.3.6.1.4.1.4491.2.1.27.1.1.1.1.0
 docsPnmBulkDestIpAddrType.0 = ipv6(2)
- server > getone -v2c <cmts_ip> <community_name> 1.3.6.1.4.1.4491.2.1.27.1.1.1.2.0 docsPnmBulkDestIpAddr.0 = 2001 0db8 85a3 0000 0000 8a2e 0370 7311

• **net-snmp** commands:

• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.1.1.2.0 x 20010db885a300000008a2e03707311
SNMPv2-SMI::enterprises.4491.2.1.27.1.1.1.2.0 = Hex-STRING: 20 01 0D B8 85 A3
00 00 00 00 8A 2E 03 70 73 11
server > snmpget -v2c -c <community name> <cmts ip>

```
1.3.6.1.4.1.4491.2.1.27.1.1.1.1.0
SNMPv2-SMI::enterprises.4491.2.1.27.1.1.1.1.0 = INTEGER: 2
```

• server > snmpget -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.1.1.2.0
SNMPv2-SMI::enterprises.4491.2.1.27.1.1.1.2.0 = Hex-STRING: 20 01 0D B8 85 A3
00 00 00 8A 2E 03 70 73 11

Set the BDT destination TFTP path.

snmpr commands:

- server > getone -v2c <cmts ip> <community name> 1.3.6.1.4.1.4491.2.1.27.1.1.1.3.0

docsPnmBulkDestPath.0 = pnm

- **net-snmp** commands:
 - server > snmpset -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.1.1.3.0 s 'pnm/test'
 SSNMPv2-SMI::enterprises.4491.2.1.27.1.1.1.3.0 = STRING: "pnm/test"
 - server > snmpget -v2c -c <community_name> <cmts_ip>
 1.3.6.1.4.1.4491.2.1.27.1.1.1.3.0
 SNMPv2-SMI::enterprises.4491.2.1.27.1.1.1.3.0 = STRING: "pnm/test"

Multiple TFTP Servers Support for PNM BDT SNMP Infra

In releases before Cisco IOS XE Cupertino 17.9.1y, only one BDT TFTP destination server per CCAP is supported to store the captured UTSC or RxMER data, and maximum eight captures on upstream ports per line card and a maximum of 20 captures per CBR8 is supported for both I-CMTS and RPHY. All captured files are stored into the same TFTP server.

 Starting with Cisco IOS XE Cupertino 17.9.1y, the new PNM BDT MIB (docsPnmBulkDataTransferCfgTable) support has been added. It introduces support for multiple TFTP destination servers, and simultaneous capture of both UTSC freerun and RxMER data and store into different TFTP server locations. PNM captured files can be stored in three different TFTP servers simultaneously. Each TFTP server detail is stored into BDT table using unique index values (that is, 1, 2 and 3).

- The existing PNM Bulk Data Control Table MIB remains supported with the following changes.
 - Capture doesn't start if the destination TFTP IP address and PATH aren't configured.
 - For UTSC other mode, the path isn't required and only IP is required.
- Starting with Cisco IOS XE Cupertino 17.9.1y, PNM BulkData Transfer Cfg MIB and the legacy PNM Bulk Data Control MIB, can be configured and used at the same time.

The captured UTSC or RxMER data are stored into the same TFTP server or different TFTP servers. This is done based on the destination index mappings between BDT table and RxMER or UTSC configuration settings. The destination index is configured as part of the docsPnmCmtsUtscCfgTable for UTSC and docsPnmCmtsUsOfdmaRxMerTable for Rxmer captures and should map to one of the indices created in the BDT table - docsPnmBulkDataTransferCfgTable. So based on this destination index mapping, captured data is stored into respective TFTP server locations.

LCs can run captures as long the max limit per LC and per cBR-8 aren't exceeded but only using one of the three allowed TFTP servers. That is, there's no restriction that a server can be mapped to only one utsc capture config at a time, the same server can be mapped to different type of captures

A BDT table entry may be modified at any given time. However, if there's a capture running using the BDT entry, the capture continues to run with the prior TFTP information with which it was started. The updated BDT details take effect only for new captures which started after that update.

Proactive Network Management

- · Provides measurement and reporting of network conditions.
- Detection of plant impairments and interference.

Basic Infrastructure to Support Multiple TFTP Servers

PNM CCAP Bulk File Transfer Objects

The following are the DataTransferCfg MIB objects specified in DOCS-PNM-MIB in CM-SP-CCAP-OSSIv3.1-I23-220216 spec and these MIB objects is used to support multiple TFTP destination servers to upload the captured UTSC and RxMER data from cBR-8.

CCAP bulk data control Objects	OID	Supported
docsPnmBulkFileTransfer	1.3.6.1.4.1.4491.2.1.27.1.1.3	Yes
docsPnmBulkDataTransferCfgTable	1.3.6.1.4.1.4491.2.1.27.1.1.3.1	Yes
docsPnmBulkDataTransferCfgEntry	1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1	Yes
docsPnmBulkDataTransferCfgDestIndex	1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.1	Yes
docsPnmBulkDataTransferCfgDestHostname	1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.2	No
$\label{eq:constraint} docs PnmBulkDataTransferCfgDestHostIpAddrType$	1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.3	Yes
docsPnmBulkDataTransferCfgDestHostIpAddress	1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.4	Yes

Table 3: PNM CCAP Bulk File Transfer Objects

CCAP bulk data control Objects	OID	Supported
docsPnmBulkDataTransferCfgDestPort	1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.5	No
docsPnmBulkDataTransferCfgDestBaseUri	1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.6	Yes
docsPnmBulkDataTransferCfgProtocol	1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.7	No
docsPnmBulkDataTransferCfgLocalStore	1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.8	No
docsPnmBulkDataTransferCfgRowStatus	1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.9	Yes

The destination port and protocol are set to default values which are shown below, it only has read access.

- docsPnmBulkDataTransferCfgDestPort = 69 (UDP)
- docsPnmBulkDataTransferCfgProtocol = 1 (tftp)

UTSC Config Table Object

The new objects below are added to the existing UTSC Capture config table as mentioned in the spec but the object which is relevant to DataTransferCfg is supported as shown in the following table.

Table 4: UTSC Config Table Object

UTSC docsPnmCmtsUtscCfgTable Objects	OID	Supported
docsPnmCmtsUtscCfgDestinationIndex	1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.24	Yes

Upstream OFDMA RxMER table object

The following new object is added to the existing Upstream OFDMA RxMER table:

Table 5: Upstream OFDMA RxMER table object

docsPnmCmtsUsOfdmaRxMerTable object	OID	Supported
docsPnmCmtsUsOfdmaRxMerDestinationIndex	1.3.6.1.4.1.4491.2.1.27.1.3.7.1.7	Yes

Legacy PNM Bulk Data Control Objects

The legacy docsPnmBulkCtl objects continue to be supported for all capture types with a Guest shell design.

Table 6: Legacy PNM Bulk Data Control Objects

docsPnmCmtsUsOfdmaRxMerTable object	OID
docsPnmBulkDestIpAddrType	1.3.6.1.4.1.4491.2.1.27.1.1.1.1
docsPnmBulkDestIpAddr	1.3.6.1.4.1.4491.2.1.27.1.1.1.2
docsPnmBulkDestPath	1.3.6.1.4.1.4491.2.1.27.1.1.1.3
docsPnmBulkUploadControl	1.3.6.1.4.1.4491.2.1.27.1.1.1.4

The IP type and upload control are set to default values as shown below, it only has read access.

- docsPnmBulkDestIpAddrType is automatically set as the IPV4 (1)/IPV6(2), will be set automatically while configuring ipv4 or ipv6 address.
- docsPnmBulkUploadControl is set to default as autoupload (3).



Note Thi object only read-access. You cannot modify the value via the snmpset command.

UTSC/RxMER capture is blocked to start capture if Destination IP address and PATH aren't configured.



Note

The CM-MAC or OTHER mode capture types aren't supported with docsPnmBulkDataTransferCfg MIB.

PNM UTSC/RxMER Config Destination Index

The BDT and UTSC/RxMER configs are linked using below destination the docsPnmCmtsUtscCfgDestinationIndex and docsPnmCmtsUsOfdmaRxMerDestinationIndex indices with the default index values as **0xFFFFFFF**.

You need to configure this index to one of the valid BDT config indexes. If capture is started with default index value, then it uses TFTP server details configured using Legacy MIBs. If valid BDT index is mapped, then it uses the TFTP server details configured in that BDT index. Capture can't be started if the row status of the mapped BDT index isn't in ACTIVE state.

PNM BDT MIB Details

docsPnmBulkDataTransferCfgTable DocsPnmBulkDataTransferCfgEntry.[DestIndex]

BDT MIB table rows are created with unique index value from 1 to 3 to store three different TFTP server details. In CBR8, the following BDT objects are supported.

OBJECTS	Supported
docsPnmBulkDataTransferCfgDestHostname	NO
$\label{eq:constraint} docs PnmBulkDataTransferCfgDestHostIpAddrType$	YES
docsPnmBulkDataTransferCfgDestHostIpAddress	YES
docsPnmBulkDataTransferCfgDestPort	NO
docsPnmBulkDataTransferCfgDestBaseUri	YES
docsPnmBulkDataTransferCfgProtocol	NO
docsPnmBulkDataTransferCfgLocalStore	NO
docsPnmBulkDataTransferCfgRowStatus	YES

Table 7: PNM BDT MIB Details

• docsPnmBulkDataTransferCfgDestHostIpAddrType: To set IP types either IPV4 (1) and IPV6 (2)

- docsPnmBulkDataTransferCfgDestHostIpAddress: To set IPV4/IPV6 address in hex value. Configure BDT URI in this format - tftp://{tftp_ip}/{tftp_path}
- docsPnmBulkDataTransferCfgDestBaseUri: To set IPV4/IPV6 address and PATH details in TFTP URL format.
- docsPnmBulkDataTransferCfgRowStatus: To create or update or delete a row in BDT table.
- docsPnmBulkDataTransferCfgProtocol: This object is hardcoded, same for port and supported for read.

Rows can be created with createandgo and createandwait.

If created with "createandgo then one time mandatory configs (ip address and Uri) are configured, and then row is moved to ACTIVE state automatically, else it remains in NOT READY state.

If created with **createandwait** then one time mandatory configs (ip address and Uri) are configured, and then row is moved to NotInuse state and user need to configure the row to ACTIVE state manually.

SUPHA, LCHA, and LCPR

SUPHA - All BDT MIB configs get erased on SUPSO, you need to reconfigure the BDT rows with all required details.

LCHA/LCPR - BDT MIB runs in SUP IOSd process so BDT configs remain intact after LCHA/LCPR.

The following is an example of the steps required for PNM BDT configuration.

1. Row: Create a BDT entry.

snmpset -v2c -c pnm 113.113.113.113 1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.9.1 i 4

2. **IP Type:** Set an IP type.

snmpset -v2c -c pnm 113.113.113 1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.3.1 i 1

3. IP/IPV6 address: Set IPV4/IPV6 address.

snmpset -v2c -c pnm 113.113.113.113 1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.4.1 x COA8648C

4. Uri: Set TFTP URL format.

snmpset -v2c -c pnm 113.113.113 1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.6.1 s
tftp://192.168.100.140/pnm1

N,

Note You must configure both TFTP IP and BDT URI to initiate the UTSC capture.

```
RPHY#test cable pnm bdt config get-ip
BDT TABLE ip addresses:
The destination index : 1
The assigned IP is type : 1
IPv4: 192.168.100.140
IPv6: ---
BDT V0 TFTP details:
The assigned IP is type: 0
IPv4: ---
IPv6: ---
CHN3-RACK3-RPHY#test cable pnm bdt config get-path
```

```
BDT TABLE TFTP path:
Destination Index = 1 : TFTP path is = tftp://192.168.100.140/pnm1
BDT VO TETP Path:
oob-auto@oob-auto:/tftpboot/pnm1$ snmpwalk -v2c -c pnm 113.113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.2.1 = ""
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.3.1 = INTEGER: 1
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.4.1 = Hex-STRING: CO A8 64 8C
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.5.1 = Gauge32: 69
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.6.1 = STRING: "tftp://192.168.100.140/pnml"
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.7.1 = INTEGER: 1
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.8.1 = INTEGER: 0
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.9.1 = INTEGER: 1
oob-auto@oob-auto:/tftpboot/pnm1$
To Delete a row:
snmpset -v2c -c pnm 113.113.113.113 1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.9.1 i 6
PHY#test cable pnm bdt config get-ip
BDT TABLE ip addresses:
```

```
BDT V0 TFTP details:
```

```
The assigned IP is type: 0
IPv4: ---
IPv6: ---
RPHY#test cable pnm bdt config get-path
BDT TABLE TFTP path:
BDT V0 TFTP Path:
```

RPHY#

The following example shows PNM BDT dest index mapping to UTSC configs.

- UTSC destination index should be set to BDT index before starting the capture. If destination
 index is not set in UTSC (DocsPnmCmtsUtscCfgEntry), it uses the legacy PNM Bulk Data
 objects for getting the TFTP details.
- RxMER destination index should be set to BDT index before starting the capture. If not set it
 uses the legacy TFTP infra. If destination index is not set in RxMER table
 (DocsPnmCmtsUsOfdmaRxMerEntry), it uses the legacy PNM Bulk Data objects for TFTP
 purpose.

Before setting BDT index:

```
RPHY#test cable pnm uts configure show 0 client-id 1 2/0/0
Acquire capcfg for capture entry success, ret: No error
Capture Config params for client 1 on clc 2/0/0
utsc config index 1
BDT TFTP dest index FFFFFFF
physical channel
                    0
logical channel
                    0
snmp ifIndex
                    490350
trigger-mode
                    freerun
frequency
                    70000000
                    30000000
span
bins
                    4096
```

window mode blackman-harris output format fft-pwr 50000 repeat-period duration 500000 trigger-count 0 capcfg entry status active minislot count 0 sid 0 timestamp 0 0000.0000.0000 cm-mac 0 averaging qualify frequency 0 qualify bandwidth 5120000 qualify threshold -100 RPHY# snmpset -v2c -c pnm 113.113.113.113 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.24.490446.1 u 1 RPHY#test cable pnm uts configure show 0 client-id 1 2/0/0 Acquire capcfg for capture entry success, ret: No error Capture Config params for client 1 on clc 2/0/0 utsc config index 1 BDT TFTP dest index 1 physical channel 0 logical channel 0 snmp ifIndex 490350 490350 freerun trigger-mode 70000000 frequency 30000000 span 4096 bins window mode blackman-harris output format fft-pwr repeat-period 50000 repeat-period 500000 duration trigger-count 0 capcfg entry status active minislot count 0 sid 0 timestamp 0 cm-mac 0000.0000.0000 0 averaging qualify frequency 0 qualify bandwidth 5120000 qualify threshold -100 RPHY# Before setting BDT index: RPHY#test cable pnm rxmer show-job-list Job Client ifIndex CM-Mac Status Enable Pre-Eq Num-Avgs Retry BdtDestIndex _____ _____ 0 SNMP 490350 9058.515c.a3e8 INACTIVE N N 1 0 FFFFFFFF PNM RxMER job count 1 RPHY# After setting BDT index: snmpset -v2c -c pnm 113.113.113 1.3.6.1.4.1.4491.2.1.27.1.3.7.1.7.490350 u 1 RPHY#test cable pnm rxmer show-job-list

Job BdtD	Client estIndex	ifIndex	CM-Mac	Status	Enable	Pre-Eq	Num-Avgs	Retry	
0	SNMP	490350	9058.515c.a3e8	INACTIVE	N	N	1	0	1
PNM	RxMER jo	b count 1							

RPHY#

Successful creation for three rows:

```
oob-auto@oob-auto:/tftpboot/pnm1$
oob-auto@oob-auto:/tftpboot/pnml$ snmpset -v2c -c pnm 113.113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.9.1 i 4
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.9.1 = INTEGER: 4
oob-auto@oob-auto:/tftpboot/pnml$ snmpset -v2c -c pnm 113.113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.3.1 i 1
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.3.1 = INTEGER: 1
oob-auto@oob-auto:/tftpboot/pnml$ snmpset -v2c -c pnm 113.113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.4.1 x COA8648C
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.4.1 = Hex-STRING: CO A8 64 8C
oob-auto@oob-auto:/tftpboot/pnml$ snmpset -v2c -c pnm 113.113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.6.1 s tftp://192.168.100.140/pnm1
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.6.1 = STRING: "tftp://192.168.100.140/pnm1"
oob-auto@oob-auto:/tftpboot/pnm1$
oob-auto@oob-auto:/tftpboot/pnm1$ snmpset -v2c -c pnm 113.113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.9.2 i 4
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.9.2 = INTEGER: 4
oob-auto@oob-auto:/tftpboot/pnm1$ snmpset -v2c -c pnm 113.113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.3.2 i 1
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.3.2 = INTEGER: 1
oob-auto@oob-auto:/tftpboot/pnml$ snmpset -v2c -c pnm 113.113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.4.2 x COA8648D
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.4.2 = Hex-STRING: CO A8 64 8D
oob-auto@oob-auto:/tftpboot/pnml$ snmpset -v2c -c pnm 113.113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.6.2 s tftp://192.168.100.141/pnm2
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.6.2 = STRING: "tftp://192.168.100.141/pnm2"
oob-auto@oob-auto:/tftpboot/pnm1$
oob-auto@oob-auto:/tftpboot/pnm1$ snmpset -v2c -c pnm 113.113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.9.3 i 4
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.9.3 = INTEGER: 4
oob-auto@oob-auto:/tftpboot/pnm1$ snmpset -v2c -c pnm 113.113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.3.3 i 1
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.3.3 = INTEGER: 1
oob-auto@oob-auto:/tftpboot/pnm1$ snmpset -v2c -c pnm 113.113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.4.3 x COA8648E
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.4.3 = Hex-STRING: CO A8 64 8E
oob-auto@oob-auto:/tftpboot/pnm1$
oob-auto@oob-auto:/tftpboot/pnml$ snmpset -v2c -c pnm 113.113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.6.3 s tftp://192.168.100.142/pnm3
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.6.3 = STRING: "tftp://192.168.100.142/pnm3"
oob-auto@oob-auto:/tftpboot/pnm1$
```

Snmpwalk of three BDT rows

oob-auto@oob-auto:/tftpboot/pnml\$ snmpwalk -v2c -c pnm 113.113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.3.1.1
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.2.1 = ""
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.2.2 = ""
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.2.3 = ""
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.3.1 = INTEGER: 1
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.3.2 = INTEGER: 1
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.3.3 = INTEGER: 1
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.4.1 = Hex-STRING: CO A8 64 8C
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.4.2 = Hex-STRING: CO A8 64 8D

```
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.4.3 = Hex-STRING: CO A8 64 8E
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.5.1 = Gauge32: 69
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.5.2 = Gauge32: 69
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.5.3 = Gauge32: 69
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.6.1 = STRING: "tftp://192.168.100.140/pnml"
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.6.2 = STRING: "tftp://192.168.100.141/pnm2"
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.6.3 = STRING: "tftp://192.168.100.142/pnm3"
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.7.1 = INTEGER: 1
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.7.2 = INTEGER: 1
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.7.3 = INTEGER: 1
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.8.1 = INTEGER: 0
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.8.2 = INTEGER: 0
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.8.3 = INTEGER: 0
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.9.1 = INTEGER: 1
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.9.2 = INTEGER: 1
iso.3.6.1.4.1.4491.2.1.27.1.1.3.1.1.9.3 = INTEGER: 1
Legacy PNM MIB configuration and snmpwalk:
```

```
oob-auto@oob-auto:/tftpboot/pnm1$ snmpset -v2c -c pnm 113.113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.1.2.0 x COA8648C
iso.3.6.1.4.1.4491.2.1.27.1.1.1.2.0 = Hex-STRING: CO A8 64 8C
oob-auto@oob-auto:/tftpboot/pnm1$ snmpset -v2c -c pnm 113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.1.3.0 s pnm1
iso.3.6.1.4.1.4491.2.1.27.1.1.1.3.0 = STRING: "pnm1"
oob-auto@oob-auto:/tftpboot/pnm1$
cob-auto@oob-auto:/tftpboot/pnm1$ snmpwalk -v2c -c pnm 113.113.113.113
1.3.6.1.4.1.4491.2.1.27.1.1.1
iso.3.6.1.4.1.4491.2.1.27.1.1.1
iso.3.6.1.4.1.4491.2.1.27.1.1.1
iso.3.6.1.4.1.4491.2.1.27.1.1.1.0 = INTEGER: 1
iso.3.6.1.4.1.4491.2.1.27.1.1.1.2.0 = Hex-STRING: CO A8 64 8C
iso.3.6.1.4.1.4491.2.1.27.1.1.1.3.0 = STRING: "pnm1"
iso.3.6.1.4.1.4491.2.1.27.1.1.1.4.0 = INTEGER: 3
oob-auto@oob-auto:/tftpboot/pnm1$
oob-auto@oob-auto:/tftpboot/pnm1$
oob-auto@oob-auto:/tftpboot/pnm1$
```

High-Split Upstream Spectrum Capture Support

This feature allows 409.6M span to be configured with Upstream Triggered Spectrum Capture "other" mode for cBR-8 routers. This allows the full spectrum capture range of 0 MHz to 204.8MHz to be supported. Pass through occurs on cBR-8. L2TP packets go directly to a Viavi RCI Agent.

BCM Chip Limitation:

- When sample rate is set as 204.8 MHz, useful span = 204.8 MHz * 80% = 163.84 MHz
- When sample rate is set as 409.6 MHz, useful span = 409.6 MHz * 80% = 327.68 MHz

Limitations

- Only accepts span greater than 204.8MHz when trigger mode is other.
- Any span greater than 204.8MHz is converted to 409.6MHz on the RPD side.
- Resolution is 100KHz for span greater than 204.8MHz and bin size is equal to 4096.

Example

• Center Frequency = 153.6MHz

- Span = 307.2MHZ (adopt to 409.6MHz on RPD)
- Reported frequency range [-51.2 MHz to 358.4MHz]
- Expected frequency range [0 MHz to 204.8MHz] need to extract from bin data [512, 2560]

Configuring the PNM MAX-HOLD Trigger Mode

When RPHY configuration is for MAX-HOLD PNM mode, RPHY sends PNM data continuously, until the user issues stop command or the duration is complete.

To configure for MAX-HOLD trigger mode on the Supervisor, complete the following steps:

Step 1 Configure the PNM docsPnmCmtsUsSpecAnTrigMode to 'other' mode. Both the SNMP and CLI can set the trigger mode. See the following examples: • For SNMP: snmpset -v2c -c private 80.4.2.11 1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.3.435572.1 i 1 • For CLI: test cable pnm uts configure trigger-mode other Adding a new TrigMode to MIB might take long and cause many specification changes. Step 2 Set the PNM bulk destination IP address. • For SNMP: snmpset -v2c -c private 80.4.2.11 1.3.6.1.4.1.4491.2.1.27.1.1.1.2.0 x "20 01 0d b8" • For CLI: test cable pnm bdt config set-ip 32.1.13.184 Step 3 Start and stop the capture test. • Starting the SNMP: snmpset -v2c -c private 80.4.2.11 1.3.6.1.4.1.4491.2.1.27.1.3.10.3.1.1.435572.1 i 1 • Starting the CLI: test cable pnm uts start client-id 1 test-id 1 0004.9f00.0591 0 • Stopping the SNMP: snmpset -v2c -c private 80.4.2.11 1.3.6.1.4.1.4491.2.1.27.1.3.10.3.1.1.435572.1 i 0 • Stopping the CLI: test cable pnm uts stop client-id 1 test-id 1 0004.9f00.0591 0 Step 4 Enable GCP message support. Send the TFTP server IP address and Static L2TP session ID through TLV58 message, and the TrigMode 'other' is send to RPD through TLV41 message.

Proactive Network Management MAX-HOLD trigger mode

The cBR enables MAX-HOLD trigger mode support in PNM. The non-CCAP defined MAX-HOLD mode offers significant advantages over the existing FREE-RUN mode that was used earlier. With the MAX-HOLD trigger mode, the RPD sends samples much faster - one sample every 2ms, compared to the earlier rate of one sample per 100ms. The RPD also sends the sample to the server, instead of the Line Card.

The MAX-HOLD trigger mode support functionality includes:

- cBR support for the configuration of the MAX-HOLD trigger mode
- cBR support for notify UBUNTU server IP and Static L2tp session IDs to RPD
- RPD usage of the max hold mode to capture the upstream spectrum
- RPD sending the captured BIN to UBUNTU server

Debugging the PNM feature on cBR8

cBR supports debugging on Upstream Triggered Spectrum Capture – Proactive Network Management by using the debug commands available for the UTSCOM client on supervisor.

Use the CLI to enable the debug commands:

- debug cable pnm utscom-error
- debug cable pnm utscom-debug

Use the following show command to check the state of capture on the Line Card. It lists the total number of samples per capture context in the CLC. When the capture tests are running, the packet counts on the corresponding Line Card would keep incrementing.

```
Router# show cable card 6/0 us-triggered-spectrum its-commonLAST event
UTSCOM event STATUS
client id
            1
test id
             1
port
             0
dev
             8
            0
phy chan
logi chan
           0
            4
status
WBFFT
       Dev trig-mode,
                          data-readv,
                                        packets on WBFFT dev.
                                                              countdown :
              0
0
      dev 0:
                                0
                                                                0
wbfft
                                                   11
wbfft dev 1:
                                0
                                                   0
                                                                0
wbfft dev 2: 0
                              0
                                                   0
                                                                0
wbfft dev 3:
               0
                               0
                                                   0
                                                                0
               0
                               0
                                                   0
                                                                0
wbfft dev 4:
wbfft.
      dev 5:
                0
                                0
                                                    0
                                                                0
wbfft
      dev 6:
                0
                                0
                                                    0
                                                                0
wbfft. dev 7:
                                0
                                                    0
                                                                0
                0
total packets: 11
```

The **dtrack** utility can also be used for debugging the packets punted through CPP from CLC to container. To use the **dtrack** utility, complete the following steps:

1. On the supervisor, use the following CLI:

test platform hardware qfp active feature docsis dtrack mac 0001.aaaa.cccc test platform hardware qfp active feature docsis dtrack packe

2. Start the trigger and use the following CLI to dump the packets (this can be very verbose as there are 10 samples per file per second):

show platform hardware qfp active feature docsis dtrack statistics verbose

To obtain the dumping statistics on the IOX container, use the following CLI:

- dir harddisk:/iox/repo-lxc/lxc-data/<CAF id>/logs/
- more harddisk:/iox/repo-lxc/lxc-data/<CAF id>/logs/.stats
- more harddisk:/iox/repo-lxc/lxc-data/<CAF id>/logs/pnm.log

To change configuration on the container console, complete the following steps:

- 1. Log onto the CAF console as root.
- 2. Run the echo "DEBUG" > /data/logs/.loglevel command.

debug level are: ERROR, WARNING, INFO, DEBUG, DEBUG1, DEBUG2, DEBUG3, DEBUG4

3. Run the echo "0" > /data/logs/.resend command.

value "0" disable "tftp resend" due to tftp error. value "12" enable clc log pnm file at local.

Ensure that the PNM TFTP process is active and running on the guestshell container as listed:

cbr8# guestshell run systemctl status pnm â pnm.service - cbr pnm telemetry delivery system

```
Loaded: loaded (/etc/systemd/system/pnm.service; disabled; vendor preset: disabled)
Active: active (running) since Wed 2019-01-09 15:13:40 UTC; 1min 28s ago
```

- If the PNM service is not active, attempt recovery by going through the following steps:
- 1. Destroy the guestshell instance. Run the guestshell destroy command.
- 2. Recreate the gusetshell by running the guestshell enable command.
- **3.** Check if the guestshell instance is running by using the show app-hosting list command. Verify that the PNM service is active.
- Verify that the TFTP server IP is reachable from the guestshell container and ping is successful.

guestshell run ping -c5 <tftp server ip>

Quick Install Guide

You can bring up the Proactive Network Management and get the captures running using a minimal configuration. Complete the following steps to enable PNM with a minimal configuration:

1. Find the correct PNM Interface Index for the RPD. Run the show snmp mib ifmib ifindex | include <rpd_mac> command.

Router# show snmp mib ifmib ifindex | i badb.ad13.2be0
RPD(badb.ad13.2be0)-usport0: Ifindex = 435564

Where badb.ad13.2be0 is the RPD identifier.

2. Ensure that the guestshell container is up and running on both active and standby SUP. Run the show app-hosting list command.

```
Router# show app-hosting list
App id State
guestshell RUNNING
```

- **3.** Ensure that the pnm process is running on the guestshell. Run the **guestshell run systemctl status pnm** command. For more information on the command usage, go through Step 4, on page 4.
- Configure the Bulk Data Ttransfer parameters. Go through the following steps to set the TFTP IP address and TFTP path. Alternatively, also go through Upstream Triggered Spectrum Capture Bulk Data Control Objects and MIBs, on page 21 for detailed information.
 - Set the BDT IPv4 IP address type and TFTP IP address
 - **snmpr** commands:

```
• server > setany -v2c <cmts_ip> <community_name> 1.3.6.1.4.1.4491.2.1.27.1.1.1.2.0 -o 20:01:0d:b8
```

docsPnmBulkDestIpAddr.0 = 20 01 0d b8

• net-snmp commands:

```
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.1.1.2.0 x 20010db8
SNMPv2-SMI::enterprises.4491.2.1.27.1.1.1.2.0 = Hex-STRING: 20 01 0D B8
• server > snmpget -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.1.1.0
SNMPv2-SMI::enterprises.4491.2.1.27.1.1.1.1.0 = INTEGER: 1
• server > snmpget -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.1.1.2.0
SNMPv2-SMI::enterprises.4491.2.1.27.1.1.1.2.0 = Hex-STRING: 20 01 0D B8
```

- · Set the BDT destination TFTP path
 - **snmpr** commands:
 - server > setany -v2c <cmts_ip> <community_name>
 1.3.6.1.4.1.4491.2.1.27.1.1.1.3.0 -o pnm
 docsPnmBulkDestPath.0 = pnm
 - **net-snmp** commands:

```
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.1.1.3.0 s `pnm/test'
SSNMPv2-SMI::enterprises.4491.2.1.27.1.1.1.3.0 = STRING: "pnm/test"
```

- server > snmpget -v2c -c <community_name> <cmts_ip> 1.3.6.1.4.1.4491.2.1.27.1.1.1.3.0 SNMPv2-SMI::enterprises.4491.2.1.27.1.1.1.3.0 = STRING: "pnm/test"
- 5. Create and configure a capture config entry. Go through the Upstream Triggered Spectrum Capture Control Objects and MIBs, on page 17 for information on creating and configuring a capture config entry.

- 6. Set the minimum capture config paramters that are needed (center-frequency, span and duration).
 - a. Set the D docsPnmCmtsUtscCfgStatus createAndGo 4.

```
server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.21.<ifIndex>.1 -i 4
clabProjDocsis.27.1.3.10.2.1.21.<ifIndex>.1 = 4
```

b. Set the docsPnmCmtsUtscCfgCenterFreq.

```
server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.8.<ifIndex>.1 -g 102400000
clabProjDocsis.27.1.3.10.2.1.8.<ifIndex>.1 = 102400000
```

c. Set the docsPnmCmtsUtscCfgSpan.

```
server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.9.<ifIndex>.1 -g 204800000
clabProjDocsis.27.1.3.10.2.1.9.<ifIndex>.1 = 204800000
```

d. Set the docsPnmCmtsUtscCfgFreeRunDuration. Increase the duration to a large value to keep the freerun capture running.

```
server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.19.<ifIndex>.1 -g 5000
clabProjDocsis.27.1.3.10.2.1.19.<ifIndex>.1 = 5000
```

e. Ensure that the config entry status is active.

```
server > snmpget -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.2.1.21.<ifIndex>.1
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.2.1.21.<ifIndex>.1 = INTEGER: 1
```



Note Ensure that the capture center frequency and span are in a valid range. IOS error messages are triggered if the user attempts to start capture tests with an invalid capture configuration. The recommended configuration values are provided in the messages.

- 7. Start the PNM capture.
 - **snmpr** commands:

```
• server > setany -v2c <cmts_ip> <community_name>
1.3.6.1.4.1.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1 -i 1
clabProjDocsis.27.1.3.10.3.1.1.<ifIndex>.1 = 1
```

- server > getone -v2c <cmts_ip> <community_name> 1.3.6.1.4.1.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1 clabProjDocsis.27.1.3.10.3.1.1.<ifIndex>.1 = 1
- net-snmp commands:

```
• server > snmpset -v2c -c <community_name> <cmts_ip>
1.3.6.1.4.1.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1 i 1
SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1 = INTEGER: 1
• server > snmpget -v2c -c <community_name> <cmts_ip>
```

- 1.3.6.1.4.1.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1 SNMPv2-SMI::enterprises.4491.2.1.27.1.3.10.3.1.1.<ifIndex>.1 = INTEGER: 1
- 8. The captures are running and files should appear on the TFTP server under the BDT TFTP path configured.

Proactive Network Management using OFDMA RxMER Probes

Cisco cBR 16.12.1y supports Proactive Network Management using OFDMA RxMER Probes. This feature enables collection and reporting of the OFDMA channel Receive Modulation Error Ratio (RxMER) for every subcarrier.

The DOCSIS 3.1 CMTS and CM support OFDMA RxMER probes. The CM transmits signals over the OFDMA upstream channel to the CMTS. The signals are received at the upstream PHY, and each subcarrier in the OFDMA channel is evaluated. RxMER is defined as the ratio of the average power of the ideal QAM constellation to the average error-vector power. The error vector is the difference between the equalized received probe value and the known correct probe value. If some subcarriers (such as exclusion bands) cannot be measured by the CMTS, a value of 0xFF will be returned for that subcarrier.

PNM RxMER probes are initiated and controlled through SNMP MIB commands. The DOCS-PNM-MIB specification details the applicable commands under the **docsPnmCmtsUsOfdmaRxMerTable**. A single RxMER probe can be started for each OFDMA channel in the system by specifying the target cable modem mac-address. The RxMER probe results are sent to a remote TFTP server using the IOX Guestshell PNM service

The following command options are supported for **DocsPnmCmtsUsOfdmaRxMerTable**:

docsPnmCmtsUsOfdmaRxMerEntry.[ifIndex]

Each row of the **DocsPnmCmtsUsOfdmaRxMerTable** is uniquely identified by the OFDMA channel ifIndex. You can identify the ifIndex of a particular OFDMA channel by running the following command:

Router# show snmp mib ifmib ifindex | i Cable1/0/2-upstream7 Cable1/0/2-upstream7: Ifindex = 389839

docsPnmCmtsUsOfdmaRxMerEnable

Set to TRUE to initiate collection of the RxMER data and send to TFTP server. Setting it to FALSE restores the MIB values to defaults.

docsPnmCmtsUsOfdmaRxMerCmMac

Specifies the mac-address of the CM that performs the RxMER probe.

docsPnmCmtsUsOfdmaRxMerPreEq

You can either set the value to TRUE to perform RxMER probe with Pre-Equalization, or choose to set the value to FALSE to perform RxMER probe without Pre-Equalization.



Note We recommend that probing is done with Pre-Equalization, as this will have the CM transmit on each sub-carrier using a gain that will normalize the signal arriving at the CMTS.

docsPnmCmtsUsOfdmaRxMerNumAvgs

This is in the range of 1-255. Any integer greater than one will generate multiple probes and average the result before sending it to the TFTP server.

docsPnmCmtsUsOfdmaRxMerMeasStatus

Indicates the status of the probe request [Inactive, Busy, SampleReady, Error]. See the MIB definition for complete details. Ensure that no modifications are made to other MIB fields for the table entry while the probe is in Busy state.

docsPnmCmtsUsOfdmaRxMerFileName

Displays the name of the file written to the TFTP server. You can choose to leave it blank, and an autogenerated filename will be used. The filename is read back after the probe is complete and the status is read as SampleReady.



Note

Do note that new file names are not autogenerated for subsequent probes. Hence, ensure that your filename value is cleared or set to a new value before initiating a subsequent probe. This will avoid the problem of new probe data overwriting information on the previous probe with the same filename.

PNM RxMER Probe High Availability

docsPnmCmtsUsOfdmaRxMerTable

- SUPHA: In progress operation will need to be restarted by the operator after the switchover. Currently the IOX PNM service is not available after a SUP-HA event.
- LCHA: In progress operation will need to be restarted by the operator after switchover



Note

When restarting the RxMER probe on the Standby Line Card, care should be taken to identify the new ifIndex of the OFMDA channel. This will be different from the Primary Line Card.

• LCPR: Operations that are in progress will be restarted by SUP after the LCPR completion. An internal operation timeout will restart the RxMER probe after one minute, for a maximum of three attempts. During this time, the RxMER status will remain as "Busy".

RxMer Probe Debugging

You can use the following command options to display the status and count of the PNM RxMER jobs.

• To display the status of PNM RxMER jobs by ifIndex, use the **test cable pnm rxmer show** command. See the following usage example:

Rout	er# test	cable pr	m rxmer show					
Job	Client	ifIndex	CM-Mac	Status	Enable	Pre-Eq	Num-Avgs	Retry
0	SNMP	389838	0000.0000.0000	INACTIVE	 N	N	1	0
0	SNMP	389839	0000.0000.0000	INACTIVE	N	N	1	0
0	SNMP	389933	0000.0000.0000	INACTIVE	N	Ν	1	0
0	SNMP	389981	0000.0000.0000	INACTIVE	Ν	Ν	1	0

 O
 SNMP
 404239
 0000.0000.0000
 INACTIVE
 N
 N
 1
 0

 0
 SNMP
 404246
 0000.0000
 INACTIVE
 N
 N
 1
 0

 0
 SNMP
 404246
 0000.0000
 INACTIVE
 N
 N
 1
 0

 0
 SNMP
 404247
 0000.0000
 INACTIVE
 N
 N
 1
 0

PNM RxMER job count 33

 To display the count of all the PNM RxMER jobs by ifIndex, use the test cable pnm rxmer <ifIndex> get all command. See the following example:

```
Router# test cable pnm rxmer 389838 get all PNM RxMER MIB for ifIndex 389838
Status: INACTIVE
CM-mac: 0000.0000.0000
Enable: False
Pre-Eq: OFF
Num-Avgs: 1
TFTP filename: <default>
```

When upstream profile management is enabled, the **show cable modem <mac> prof-mgmt upstream verbose** command can also be used to view the OFDMA RxMER probe data. The values shown should be similar to, but not exactly the same as the values reported in the TFTP upload file. This is because data was collected using probes at different times.

The RxMER probe data can also be collected and displayed directly on the CBR8 console using the **ping docsis pnm <ip-address> upstream <us-chan> ignored** command. This command will initiate a RxMER probe to the targeted cable modem upstream OFDMA channel. The **ignore** option on the command will prevent the RxMER probe results from impacting OFDMA profile management. The RxMER probe data can then be viewed on the console using the **show cable modem <ip-address> prof-mgmt upstream ignored** command. For example:

```
Router# ping docsis pnm 9.23.4.91 upstream 6 ignore
Queueing 1 MAC-layer station maintenance intervals, timeout is 80 msec:
Success rate is 100 percent (1/1)
cbr8# show cable modem 9.23.4.91 prof-mgmt upstream ignored
Upstream Profile Management Data (Ignored):
MAC Address : 4800.33ea.6e3e
Number of US Chan : 1
Ucid
                     : 7
RxMer Exempt Percent : 0
RxMer Margin gDB
                      : 0
RxMer Threshold Percent : 2
Start Sc : 148
End Sc
                     : 1067
Num RxMER Measurement : 1068
          : 0h:03m:49s ago
Tx Time
Rx Time
                     : 0h:03m:49s ago
MER Poll Period (min) : 5
Auto Profile Upgrade : Yes
Upgrd Dly Cnt (cur/cfg) : 0/1
Upgrd Dly rcmd IUC : none
Recommended IUC
                    : 13
Downgrade IUC
                      : 13
                     : 13
RxMER send/recv count : 196/196
DBC
                     : 31/31/0/0/0
```

			(send/suc	ceed/err/	reject/tir	neout)		
State		:	Ready					
Profile	Downgrade	e :	Disabled					
0x0000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
0x0020	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
0x0040	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
0x0060	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
0x0080	00000000	00000000	00000000	00000000	00000000	B3AEB0BB	AEACA9B1	A8A9AEB8
0x00A0	ABADB6A7	AAB1B2AE	B1B9B5A8	B4A7ABB0	A4B3ACAE	AEB1BAB4	B2ADB3B4	B0B7B9B5
0x00C0	BAB3B5AA	A5A3A7AB	ABB2ACB1	B1B1B3AC	B4ADAFAB	9DACA5AE	AEB5ACB1	A6ADB4B2
0x00E0	A3B7ADBB	B5ADAEB7	A8A7ABB2	9EAEBDB1	AABIB6B7	BZAFAABU	9BB0BIAF	B7ACB5AD
0x0100	AFBUBUAF	A9B/A8AB	BIAEB5BI	B59FAEB3	A4ADBIB3	AFBUAEBI	AEABADB /	ABB6B9B6
0x0120	ACD/DJAE	ADADDJA/	DONONODO	ADB2BOAD	DIADALDO	R4DZDJAF	ALD/AJAL	A FRANCAE
0x0140	BAAJBJBB BAAABAA7	12178683	BUAUA0B5 B1B9ADB7	R5218720	AGADBCA8	AEB3B4AD	AUB2B1BB	AFBJACAF
0x0100	ASAFACAF	BOADB4A4	A5ACB0AF	BJAIB7AD B1B7B2B0	B2A5B8AC	9FABAFB7	R7A9AFR0	B6B3B1B3
0x0100	B7AAB1B2	ACBBADC1	A8B3AAB2	B7B1B5B5	BEB1AEB6	ADB3B1AD	ACBOB1B2	B7BBAFB8
0x01C0	AFAEACB5	ACB5B1B0	AEA8ACAE	B4B5B0AC	B4B9ADB5	B4ADB5B6	B2B3AAAB	A8AEB4AC
0x01E0	AEAFADB5	AAAFBOB6	ADADAAB4	ABACABB6	B3A5ABB1	ADB4B7B9	AEB6BFAF	B1B5B3B0
0x0200	ACAFBAB2	B4B5B3AF	B2B4B1BB	B5AFADB7	B5B1B3B2	B4B0B0B3	B7B0ACB5	B1B1B0B7
0x0220	AEAAACB9	B8AFACAF	B7B1AFAD	ADB1B3AE	A9B9B0B0	BOAFB2AB	ACADACB2	ACB4B2AE
0x0240	A8ABB1AF	ADBBA8AC	B4B1B3B4	B4AFADB8	B1AEA6AD	BOAFAEAD	BBB1B4B7	AEA7ADA7
0x0260	AEB2AEB5	B0AAB5B1	B3ACAFB6	B1ACB2A3	A8B7BCAA	B5A9ABA9	B6B7AAA8	ACB1A9B3
0x0280	BOB1AFAA	B4AEB1A9	ABACB4AF	B3B4AFAC	B1B0B2B1	BOBOBOBO	B5B7AEB0	B7B2B9A1
0x02A0	B1B0AFB1	AEAEB4A7	ABB4B8B0	ADBOABAE	B1A9B9AD	B2B1BBAF	B1B4AAAF	A8ADB3A9
0x02C0	BDA9B9B0	B2ADB0B2	AEAFB3B4	BOAEAAAF	AEAFB4A9	B4A9ADB0	B6A9B1AB	BOAFAEAB
0x02E0	B1ADA9B2	A8A9A9AC	ACACB2AF	A8AAB1B4	ABBOADAD	B8ADB1B6	ADB4AEAE	AEB0ABB1
0x0300	B2ADACAF	ABADABB7	ACA8ACAD	A9AFAAB5	A9B0B1BA	B1ADB4B3	ABB0AFB0	AEB0ADB2
0x0320	AFABADB7	BOAEABA8	ABAFAFB1	A8A7ADAB	B3AFAAB2	A9B1B6AE	B1B0B1AE	ACADB4B7
0x0340	ADB2B0AF	B4B1ACA9	B7AFADB5	A9ACB1AD	A6ADA6B1	АААЗАЗА4	B7A5AFAA	A7B2ABB4
0x0360	A8AFA7A7	A6A8ACAF	ADA3B4AB	A8AAB8AB	A5A5ABA4	A7A8BBB1	ABA6A8A4	A79FA9A1
0x0380	AEA3AFAC	BIAEABAD	ACA8A7A6	B4A2A9A8	A8B2A2AB	ABA2A6AE	A99B9EA6	A9A59EA4
0x03A0	9FAD99A5	9FA39FA4	ABACA3A5	AA9FA9A1	9EA59AA2	9F9EAA9D	A4A5A6A2	A59FA7A1
0x03C0	A09E98A0	9DAUA39F	9C9CA09F	90999899	9695969A	9597939D	97979B9B	90909291
0X03E0	938D9790	88929492	998B8D95	8085898A	8D8/8D8/	/E/E/E83	81/B84/F	7E888071
0x0400	7278707222	16101515	10000009	00380303	012D2B08	555/5458	55405046	3041452B
0X0420	39402E32	IOIJIDIA	10225454					
SC RxME	R Distribu	ution (Exe	cluded SC:	s are igno	ored):			
*: 2%								
>44dB:	* * * * * * * * *	* * * * * * * * * *	***** 46	.95%				
44dB:	******	** 21.19%						
43dB:	***** 11	.30%						
42dB:	** 5.109	20						
41dB:	* 2.28%							
40dB:	* 2.50%							
39dB:	1.08%							
38dB:	1.63%							
37dB:	0.65%							
36dB:	0.76%							
35dB:	0.54%							
34dB:	0.218							
330B:	** 5 76	D_						
<330B:		ō 				100)	
		Percent	t of Subca	arriers				
Active S	SC RXMER S	Statistic	s (in 1/4	dB):				
Active S	Subcarrie	r RxMER Me	ean		: 0x2	AA		
Active S	Subcarrie	r RxMER St	tandard De	eviation	: 0x3	52		
Active S	Subcarrie	r RxMER Tl	hreshold V	Value	: 0x5	ΞF		
Active S	Subcarrie	r RxMER Tl	hreshold 1	Frequency	(Hz): 468	300000		

Proactive Network Management using OFDMA RxPwr Probes

PNM OFDMA RxPwr MIB Overview

- Provides an estimate of the received power in a specified OFDMA channel at the F connector input of either a CMTS-integrated linecard or RPD.
- The measurement is based on upstream probes, which are typically the same probes used for pre-equalization adjustment.

Proactive Network Management:

- · Provides measurement and reporting of network conditions.
- Detection of plant impairments and interference.

Orthogonal Frequency-Division Multiple Access (OFDMA).

- DOCSIS 3.1 Upstream Channel modulation scheme where multiple users are allocated to a channel in both the time and frequency domain.
- OFDMA channels have multiple subcarriers (frequency and modulation).

The following command options are supported for **docsPnmCmt UsOfdmaRxPwrTable**

```
DocsPnmCmtsUsOfdmaRxPwrEntry.
[OFDMA channel ifIndex, CmMac]
```

```
docsPnmCmtsUsOfdmaRxPwrEnable,
docsPnmCmtsUsOfdmaRxPwrCmMac,
docsPnmCmtsUsOfdmaRxPwrPreEq,
docsPnmCmtsUsOfdmaRxPwrNumAvgs,
docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd,
docsPnmCmtsUsOfdmaRxPwrMeasStatus,
```

PNM RxPwr MIB Details

DocsPnmCmtsUsOfdmaRxPwrTable DocsPnmCmtsUsOfdmaRxPwrEntry[OFDMA channel ifIndex, CM Mac]

- A MIB table with rows corresponding to the OFDMA channels configured on the system.
- Each OFDMA channel is identified by a unique ifIndex.

```
router #show snmp mib ifmib ifindex | i Cable1/0/2-upstream7
Cable1/0/2-upstream7: Ifindex = 389839
```

docsPnmCmtsUsOfdmaRxPwrEnable

- Set to **TRUE** to **initiate measurement** of the received power.
- Set to FALSE to restore MIB values to defaults.

Example:

```
./setany -v2c 8.23.1.1 private docsPnmCmtsUsOfdmaRxPwrEnable.389838.00000000001 -i 1
docsPnmCmtsUsOfdmaRxPwrEnable.389838.00000000001 = true(1)
```

```
router#show cable modem 0000.0000.0001 pnm us-rxpwr
```

```
MAC Address IP Address I/F MAC Num Pre RxPwr
TimeStamp
```

Avgs

Εq

(dBmv)

State

0000.0000.001 9.23.0.14 2023-03-02 14:55:52	Ca1/0/0:u6	w-online(pt)	1	Y	-0.2
	100016				
router#test cable pnm us-rxpv	vr 488046 cm-mac	0000.0000.0001	get all	<u> </u>	
PNM US-RxPwr Get Entry for if	EIndex 488046, CN	4 0000.0000.0001			
ifIndex: 488046					
chid: 6					
CM-Mac: 0000.0000.0001					
Status: SAMPLE READY (4)					
Enable: Disable (2)					
Pre-Eq: On (1)					
Num-Avgs: 1					
Rx Power: -2 (-0.2 dBmv)					
Probe Retry Cnt: 0					
Probe Configured: Y					
Partial-Mode: 0x00 (None	e)				
TimeStamp: 2023-03-02 14	1:55:52				

- docsPnmCmtsUsOfdmaRxPwrCmMac: The mac-address of the modem that performs the RxPwr probe.
- docsPnmCmtsUsOfdmaRxPwrPreEq
 - Set TRUE to request modem enable equalizer during probe burst.

The Upstream Controller OFDMA Channel's "equalization-coefficient" must also be enabled (default).

- Set FALSE to request modem disable equalizer during probe burst.
- Probing with equalizer enabled is preferred as the CM transmits on each sub-carrier using a gain that normalizes the signal arriving at the CMTS.

Example:

```
./setany -v2c 8.23.1.1 private docsPnmCmtsUsOfdmaRxPwrPreEq.488046.00000000001 -i 1
docsPnmCmtsUsOfdmaRxPwrPreEq.3488046.00000000001 = true(1)
```

router#show cable modem 0000.0000.0001 pnm us-rxpwr

MAC Address	IP Address	1 / E'	MAC	Num	Pre	RxPwr
TimeStamp						
			State	Avgs	Eq	(dBmv)
0000.0000.001	9.23.0.14	Ca1/0/0:u6	w-online(pt)	1	Y	
0						

router#test cable pnm us-rxpwr 488046 cm-mac 0000.0000.0001 get all PNM US-RxPwr Get Entry for ifIndex 488046, CM 0000.0000.0001

```
ifIndex: 488046
chid: 6
CM-Mac: 0000.0000.0001
Status: INACTIVE (2)
Enable: Disable (2)
Pre-Eq: On (1)
Num-Avgs: 1
Rx Power: -255 (-25.5 dBmv)
Probe Retry Cnt: 0
Probe Configured: Y
Partial-Mode: 0x00 (None)
TimeStamp: 0
```

docsPnmCmtsUsOfdmaRxPwrNumAvgs

- Range is 1-32. cBR-8 doesn't support values above 32.
- >1 generates multiple probes and average the result reported by docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd

Example:

```
./setany -v2c 8.23.1.1 private docsPnmCmtsUsOfdmaRxPwrNumAvgs.488046.00000000001 -I 1
docsPnmCmtsUsOfdmaRxPwrNumAvgs.488046.00000000001 = 1
```

router# show c	able modem 0000.0	000.0001 pnm us	-rxpwr			
MAC Address	IP Address	I/F	MAC	Num	Pre	RxPwr
TimeStamp						
			State	Avgs	Eq	(dBmv)
0000.0000.001	9.23.0.14	Ca1/0/0:u6	w-online(pt)	1	Ν	
0						
0						

```
router #test cable pnm us-rxpwr 488046 cm-mac 0000.0000.0001 get all
PNM US-RxPwr Get Entry for ifIndex 488046, CM 0000.0000.0001
    ifIndex: 488046
    chid: 6
    CM-Mac: 0000.0000.0001
    Status: INACTIVE (2)
    Enable: Disable (2)
    Pre-Eq: Off (2)
    Num-Avgs: 1
    Rx Power: -255 (-25.5 dBmv)
    Probe Retry Cnt: 0
    Probe Configured: Y
    Partial-Mode: 0x00 (None)
    TimeStamp: 0
```

- docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd: After triggering the measurement via Enable, wait for MeasStatus to return SampleReady and then read this MIB variable to retrieve the resulting power measurement.
- docsPnmCmtsUsOfdmaRxMerMeasStatus: Indicates the status of the requested measurements and result [Inactive, Busy, SampleReady, Error]

PNM RxMER Probe High Availability

- SUPHA
 - MIBs may be temporarily unavailable while newly active SUP completes initialization of non-dataplane subsystems after becoming active.
 - SNMP architecture of cBR-8 changes the ifIndex of channels to match the currently active slot.
 - In Progress operation will need to be restarted by operator after switchover for entry with ifIndex of newly active slot.

```
Before Switchover:
docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd[488046][STRING: 4800.33ef.3b0a] = INTEGER: -6.0
```

```
dB
```

```
After Switchover to Secondary:
```

```
docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd[485742][STRING: 4800.33ef.3b0a] = INTEGER: -6.0
```

dB

• LCPR

IOSd-CLC and CDMAN LCPR: If measurement is in progress when LCPR is triggered, some measurement samples may be lost and MeasStatus may report "Error" instead of "SampleReady". If this occurs, set Enable to TRUE to restart the measurement.

The following is a sample output for the show cable modem pnm us-rxpwr command:

router#show cal	ble modem pnm u	s-rxpwr					
MAC Address	IP Address	I/F	MAC State	Num Avgs	Pre Eq	RxPwr (dBr	TimeStamp nv)
4800.33ef.053e 09:23:55	9.38.8.21	Ca1/0/0:u6	w-online(pt)	10	N	-5.7	2023-03-02
4800.33ef.053e 09:24:46	9.38.8.21	Ca1/0/0:u7	w-online(pt)	3	Ν	-6.0	2023-03-02
4800.33ef.093a 09:28:57	9.38.8.5	Ca1/0/0:u6	w-online(pt)	32	Ν	-6.0	2023-03-02
4800.33ef.093a 09:29:48	9.38.8.5	Ca1/0/0:u7	w-online(pt)	5	Ν	-6.0	2023-03-02
206a.9454.30ac 09:32:17	9.38.8.34	Ca1/0/2:u6	w-online(pt)	1	Ν	-6.2	2023-03-02
4800.33ef.0d1a 09:46:33	9.38.8.11	Ca9/0/0:u6	w-online(pt)	32	Ν	-6.0	2023-03-02
4800.33ef.0d1a 09:46:33	9.38.8.11	Ca9/0/0:u6	w-online(pt)	32	Ν	-6.0	2023-03-02
4800.33ef.3f12 09:41:30	9.38.8.27	Ca9/0/0:u6/p	w-online(pt)	1	Ν		2023-03-02
4800.33ef.3f12 09:42:21	9.38.8.27	Ca9/0/0:u7/p	w-online(pt)	7	Ν	-6.0	2023-03-02
4800.33ef.3e86 09:48:11	9.38.8.20	Ca9/0/1:u6	w-online(pt)	2	Ν	-6.0	2023-03-02
4800.33ef.3e86 09:49:02	9.38.8.20	Ca9/0/1:u7	w-online(pt)	1	Ν	-6.0	2023-03-02
4800.33ef.0666 09:49:53	9.38.8.2	Ca9/0/8:u6	w-online(pt)	1	Ν	-6.0	2023-03-02
4800.33ef.0666 09:50:44	9.38.8.2	Ca9/0/8:u7	w-online(pt)	3	Ν	-5.7	2023-03-02
4800.33ef.3f3e 09:51:3	9.38.8.16	Ca9/0/9:u6	w-online(pt)	2	Ν	-6.0	2023-03-02
4800.33ef.3f3e 09:52:22	9.38.8.16	Ca9/0/9:u7	w-online(pt)	32	Ν	-3.0	2023-03-02

The following is a sample output for the test cable pnm us-rxpwr snmp-walk all command:

router# te	est cal	ble pnm us-rxpwr	snmp-walk all	L					
	Chan					Num		Retry	
Probe			Partial						
ifIndex	ID	CM-Mac	Status	Enable	Pre-Eq	Avgs	RxPwr	Cnt	Config
Timestan	np	Mode							
488046	6	4800.33ef.053e	SAMPLE READY	N	N	10	-57	0	Y
2023-03-	-02 09	:23:55 0x00 (N	one)						
488046	6	4800.33ef.093a	SAMPLE READY	N	N	32	-60	0	Y
2023-03-	-02 09	:28:57 0x00 (N	one)						
488047	7	4800.33ef.053e	SAMPLE READY	Ν	N	3	-60	0	Y
2023-03-	-02 09	:24:46 0x00 (N	one)						
488047	7	4800.33ef.093a	SAMPLE READY	N	N	5	-60	0	Y

2023-03-02	09:29:48 0x00 (N	one)						
488142 6	206a.9454.30ac	SAMPLE READ	Y N	N	1	-62	0	Y
2023-03-02	09:32:17 0x00 (N	one)						
501870 6	4800.33ef.0d1a	SAMPLE READ	Y N	N	32	-60	0	Y
2023-03-02	09:46:33 0x00 (N	one)						
501870 6	4800.33ef.3f12	SAMPLE READ	Y N	Ν	7	-255	0	Y
2023-03-02	09:42:21 0x01 (R	NG)						
501871 7	4800.33ef.0d1a	SAMPLE READ	Y N	Ν	1	-57	0	Y
2023-03-02	09:47:20 0x00 (N	one)						
501871 7	4800.33ef.3f12	SAMPLE READ	Y N	N	7	-60	0	Y
2023-03-02	09:42:21 0x01 (R	NG)						
501918 6	4800.33ef.3e86	SAMPLE READ	Y N	N	2	-255	0	Y
2023-03-02	09:48:11 0x00 (N	one)						
501919 7	4800.33ef.3e86	SAMPLE READ	Y N	N	1	-60	0	Y
2023-03-02	09:49:02 0x00 (N	one)						
502254 6	4800.33ef.0666	SAMPLE READ	Y N	N	1	-60	0	Y
2023-03-02	09:49:53 0x00 (N	one)						
502255 7	4800.33ef.0666	SAMPLE READ	Y N	N	3	-57	0	Y
2023-03-02	09:50:44 0x00 (N	one)						
502302 6	4800.33ef.3f3e	SAMPLE READ	Y N	N	2	-60	0	Y
2023-03-02	09:51:32 0x00 (N	one)						
502303 7	4800.33ef.3f3e	SAMPLE READ	Y N	N	32	-30	0	Y
2023-03-02	09:52:22 0x00 (N	one)						

SNMP Agent docsPnmCmtsUsOfdmaRxPwrEntry Walk

docsPnmCmtsUsOfdmaRxPwrEnable[488046][STRING:	4800.33ef.53e] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrEnable[488046][STRING:	4800.33ef.93a] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrEnable[488047][STRING:	4800.33ef.53e] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrEnable[488047][STRING:	4800.33ef.93a] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrEnable[488142][STRING:	206a.9454.30ac] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrEnable[501870][STRING:	4800.33ef.d1a] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrEnable[501871][STRING:	4800.33ef.d1a] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrEnable[501871][STRING:	4800.33ef.3f12] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrEnable[501918][STRING:	4800.33ef.3e86] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrEnable[501919][STRING:	4800.33ef.3e86] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrEnable[502254][STRING:	4800.33ef.666] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrEnable[502255][STRING:	4800.33ef.666] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrEnable[502302][STRING:	4800.33ef.3f3e] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrEnable[502303][STRING:	4800.33ef.3f3e] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrPreEq[488046][STRING:	4800.33ef.53e] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrPreEq[488046][STRING:	4800.33ef.93a] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrPreEq[488047][STRING:	4800.33ef.53e] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrPreEq[488047][STRING:	4800.33ef.93a] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrPreEq[488142][STRING:	206a.9454.30ac] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrPreEq[501870][STRING:	4800.33ef.dla] = INTEGER: false(2)
<pre>docsPnmCmtsUsOfdmaRxPwrPreEq[501871][STRING:</pre>	4800.33ef.d1a] = INTEGER: false(2)
<pre>docsPnmCmtsUsOfdmaRxPwrPreEq[501871][STRING:</pre>	4800.33ef.3f12] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrPreEq[501918][STRING:	4800.33ef.3e86] = INTEGER: false(2)
<pre>docsPnmCmtsUsOfdmaRxPwrPreEq[501919][STRING:</pre>	4800.33ef.3e86] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrPreEq[502254][STRING:	4800.33ef.666] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrPreEq[502255][STRING:	4800.33ef.666] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrPreEq[502302][STRING:	4800.33ef.3f3e] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrPreEq[502303][STRING:	4800.33ef.3f3e] = INTEGER: false(2)
docsPnmCmtsUsOfdmaRxPwrNumAvgs[488046][STRING	G: 4800.33ef.53e] = Gauge32: 10
docsPnmCmtsUsOfdmaRxPwrNumAvgs[488046][STRING	G: 4800.33ef.93a] = Gauge32: 32
docsPnmCmtsUsOfdmaRxPwrNumAvgs[488047][STRING	G: 4800.33ef.53e] = Gauge32: 3
docsPnmCmtsUsOfdmaRxPwrNumAvgs[488047][STRING	G: 4800.33ef.93a] = Gauge32: 5
docsPnmCmtsUsOfdmaRxPwrNumAvgs[488142][STRING	G: 206a.9454.30ac] = Gauge32: 1
docsPnmCmtsUsOfdmaRxPwrNumAvgs[501870][STRING	3: 4800.33ef.d1a] = Gauge32: 32
docsPnmCmtsUsOfdmaRxPwrNumAvgs[501871][STRING	G: 4800.33ef.dla] = Gauge32: 1
docsPnmCmtsUsOfdmaRxPwrNumAvgs[501871][STRING	G: 4800.33ef.3f12] = Gauge32: 7
docsPnmCmtsUsOfdmaRxPwrNumAvgs[501918][STRING	G: 4800.33ef.3e86] = Gauge32: 2

<pre>docsPnmCmtsUsOfdmaRxPwrNumAvgs[501919][STRING: 4800.33ef.3e86] = Gauge32: 1</pre>
<pre>docsPnmCmtsUsOfdmaRxPwrNumAvgs[502254][STRING: 4800.33ef.666] = Gauge32: 1</pre>
<pre>docsPnmCmtsUsOfdmaRxPwrNumAvgs[502255][STRING: 4800.33ef.666] = Gauge32: 3</pre>
<pre>docsPnmCmtsUsOfdmaRxPwrNumAvgs[502302][STRING: 4800.33ef.3f3e] = Gauge32: 2</pre>
<pre>docsPnmCmtsUsOfdmaRxPwrNumAvgs[502303][STRING: 4800.33ef.3f3e] = Gauge32: 32</pre>
docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd[488046][STRING: 4800.33ef.53e] = INTEGER: -5.7 dB
<pre>docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd[488046][STRING: 4800.33ef.93a] = INTEGER: -6.0 dB</pre>
<pre>docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd[488046][STRING: 4800.33ef.93a] = INTEGER: -6.0 dB</pre>
<pre>docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd[488047][STRING: 4800.33ef.93a] = INTEGER: -6.0 dB</pre>
<pre>docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd[488142][STRING: 206a.9454.30ac] = INTEGER: -6.2 dB</pre>
<pre>docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd[501870][STRING: 4800.33ef.dla] = INTEGER: -6.0 dB</pre>
docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd[501871][STRING: 4800.33ef.dla] = INTEGER: -5.7 dB
<pre>docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd[501871][STRING: 4800.33ef.3f12] = INTEGER: -6.0 dB</pre>
docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd[501918][STRING: 4800.33ef.3e86] = INTEGER: -6.0 dB
<pre>docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd[501919][STRING: 4800.33ef.3e86] = INTEGER: -6.0 dB</pre>
<pre>docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd[502254][STRING: 4800.33ef.666] = INTEGER: -6.0 dB</pre>
docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd[502255][STRING: 4800.33ef.666] = INTEGER: -5.7 dB
<pre>docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd[502302][STRING: 4800.33ef.3f3e] = INTEGER: -6.0 dB</pre>
<pre>docsPnmCmtsUsOfdmaRxPwrOnePtSixPsd[502303][STRING: 4800.33ef.3f3e] = INTEGER: -3.0 dB</pre>
docsPnmCmtsUsOfdmaRxPwrMeasStatus[488046][STRING: 4800.33ef.53e] = INTEGER: sampleReady(4)
docsPnmCmtsUsOfdmaRxPwrMeasStatus[488046][STRING: 4800.33ef.93a] = INTEGER: sampleReady(4)
docsPnmCmtsUsOfdmaRxPwrMeasStatus[488047][STRING: 4800.33ef.53e] = INTEGER: sampleReady(4)
docsPnmCmtsUsOfdmaRxPwrMeasStatus[488047][STRING: 4800.33ef.93a] = INTEGER: sampleReady(4)
docsPnmCmtsUsOfdmaRxPwrMeasStatus[488142][STRING: 206a.9454.30ac] = INTEGER: sampleReady(4)
docsPnmCmtsUsOfdmaRxPwrMeasStatus[501870][STRING: 4800.33ef.dla] = INTEGER: sampleReady(4)
docsPnmCmtsUsOfdmaRxPwrMeasStatus[501871][STRING: 4800.33ef.dla] = INTEGER: sampleReady(4)
docsPnmCmtsUsOfdmaRxPwrMeasStatus[501871][STRING: 4800.33ef.3f12] = INTEGER: sampleReady(4)
docsPnmCmtsUsOfdmaRxPwrMeasStatus[501918][STRING: 4800.33ef.3e86] = INTEGER: sampleReady(4)
docsPnmCmtsUsOfdmaRxPwrMeasStatus[501919][STRING: 4800.33ef.3e86] = INTEGER: sampleReady(4)
docsPnmCmtsUsOfdmaRxPwrMeasStatus[502254][STRING: 4800.33ef.666] = INTEGER: sampleReady(4)
docsPnmCmtsUsOfdmaRxPwrMeasStatus[502255][STRING: 4800.33ef.666] = INTEGER: sampleReady(4)
docsPnmCmtsUsOfdmaRxPwrMeasStatus[502302][STRING: 4800.33ef.3f3e] = INTEGER: sampleReady(4)
docsPnmCmtsUsOfdmaRxPwrMeasStatus[502303][STRING: 4800.33ef.3f3e] = INTEGER: sampleReady(4)

Troubleshooting Upstream Triggered Spectrum Capture – Proactive Network Management Issues

The Upstream Triggered Spectrum Capture – Proactive Network Management issues, their possible causes, and resolution are listed.

- Capture configuration failure:
 - Ensure that the ifindex that is used is correct and the port is configured correctly under RPD for RPHY.
 - Ensure that the capture configuration entry was created properly and the client/snmp owns the capture port using MIB commands.
 - Ensure that the parameters being configured are supported and within the valid range.
 - Enable debug cable pnm utscom-error to check for any errors.
- Capture control or initiate test failure:
 - Ensure that the capture configuration is created and configured correctly by the client using MIB commands.

- Verify that the capture configuration entry status is active using MIB commands.
- The total number of captures is below the enforced limit.
- Ensure that no other tests are already running on the port using MIB commands.
- Ensure that only one port per RPD is running the test.
- TFTP file transfer failure:
 - Ensure that the BDT TFTP information is configured correctly on the CMTS.
 - Ensure that the TFTP server is reachable and the destination location is writable.
 - Ensure that the container is in running state using show commands.
 - Ensure that the PNM TFTP process is active and running on the guestshell container and the TFTP server IP is reachable from the guestshell container.
 - Ensure that the capture tests are running correctly and with the CLC show, CLI show, files are being generated.
 - Check dtrack to ensure that the punt path is working and packets are being sent to the container.
 - Use the PNM debug and the container statistics/log file to check for any errors.
- PNM packets are not reaching guestshell:
 - Check dtrack. All PNM packets should be punted with punt-cause Service-Engine.
 - · Run bash in guestshell, and check RX packets in ifconfig.
 - Run bash in guestshell, and use tcpdump to check if the PNM packets are arriving.
 - PNM packets from CLC use the Global Routing Table, and there is no mechanism to allow these packets to use anything other than GRT. If the guestshell and VirtualPortGroup are in the VRF, you can add a static route which directs the PNM packets into VRF. For example:

The current configuration is:

```
ip vrf vrf_pnm
rd yyy:zzz
route-target export yyy:w
route-target import yyy:w
!
interface VirtualPortGroup0
ip vrf forwarding vrf_pnm
ip address P.Q.R.253 255.255.252
no mop enabled
no mop sysid
!
app-hosting appid guestshell
app-vnic gateway0 virtualportgroup 0 guest-interface 0
guest-ipaddress P.Q.R.254 netmask 255.255.252
app-default-gateway P.Q.R.253 guest-interface 0
!
```

Add a static route:

(config) # ip route P.Q.R.254 255.255.255.255 VirtualPortGroup0

Feature Information for Proactive Network Management

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Feature Name	Releases	Feature Information
DOCSIS 3.1 Upstream Triggered Spectrum Capture	Cisco IOS XE Gibraltar 16.10.1	This feature was integrated into Cisco IOS XE Gibraltar 16.10.1 on the Cisco cBR Series Converged Broadband Routers.
MAX-HOLD trigger mode	Cisco IOS XE Gibraltar 16.10.1d	This feature was integrated into Cisco IOS XE Gibraltar 16.10.1d on the Cisco cBR Series Converged Broadband Routers.
Support PNM output format 'timeIQ' and UTSC trigger mode 'cmMac'	Cisco IOS XE Gibraltar 16.12.1x	This feature was integrated into Cisco IOS XE Gibraltar 16.12.1x on the Cisco cBR Series Converged Broadband Routers.
Proactive Network Management using OFDMA RxMER Probes	Cisco IOS XE Gibraltar 16.12.1y	This feature was integrated into Cisco IOS XE Gibraltar 16.12.1y on the Cisco cBR Series Converged Broadband Routers.

Table 8: Feature Information for Upstream Triggered Spectrum Capture - Proactive Network Management