

Digital Subscriber Line

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Overview

The router adds DSL capability by using a Small Form-factor Pluggable (SFP) network interface module. The DSL solution supports the following Annex:

ADSL2 (A), ADSL2+. VDSL2 supports Annex A,B. All in compliance with TR100, TR105, TR114, TR115.

To enable Annex-J, perform the following:

```
router#config term
router(conf)#controller vdsl 0/0/0
router(conf-if)#capability annex-j
router#(conf-if)#exit
router#
```

To remove Annex-J, perform the following:

```
router#config term
router(conf)#controller vdsl 0/0/0
router(conf-if)#no capability annex-j
router#(conf-if)#exit
router#
```

The command **rx-padding**is used for packets with an MTU less than 64 bytes.

Note If frames less than 64mtu are expected downstream from the service provider, the Vlan configuration must be vlan 96. If frames less than 64mtu are expected downstream from the service provider, only a Single VLAN is supported in a single-PVC, i.e.Vlan96. In future releases, there is plan to extend the range of vlan support to range from Vlan44 to 1024, single-vlan in single-pvc option.

The command example is as follows:

```
router#config term
router#controller vdsl 0/0/0
router(conf-if)#rx-padding
router(conf-if)#end
router#write mem
```

Feature Caveats

This section provides a list of what features are supported and unsupported.

- The DSL SFP operates only when inserted in the router base unit. The router can support only a single DSL SFP on GI0/0/0
- VDSL2 only supports profiles 8a through 17a, 30a is not supported.
- The SFP currently does not have Yang support. This will be provided in a future release.
- Supports Radius and AAA when authenticating and configuring DSL users.
- The DSL interface requires a minimum configuration dependent of the DSL services, therefore Plug and Play (PnP) features are not available on the DSL interface.
- Zero-Touch-Deployment (ZTD) is only supported through IIoT Field Network Director. From FND, use cgna wsma based ZTD only, PnP based ZTD is not supported over the DSL interface. For ZTD, stage with basic minimum configuration and parameters depending on the service provider requirements.
- The show controller vdsl 0/0/0 command is used to display all DSL [VDSL2/ADSL2/ADSL2+] controller information, similar to the c111x platforms. Although the controller command is vdsl, is actually means dsl and is used for adsl and vdsl alike.
- For ADSL2/2+ configurations, there is no ATM interface as with c111x platforms. All configurations are on the DSL SFP WAN g0/0/0 interface, its sub-interface options, and controller vdsl0/0/0 itself. ATM packets are handled by the DSL SFP and re-assembled as Ethernet packets. Annex A, L is supported.
- Using the WebUI, interface g0/0/0 can be configured/monitored as normal.
- For ADSL2/2+ ATM configuration, if your scenario expects frames <64 byte MTU downstream from Service Provider, please ensure following steps:
  1. rx-padding cli is enabled
  2. Vlan96 value is used in interface configuration
  3. There is no multi-VLAN support in single-PVC in this specific scenario

DSL Feature Specifications

Table 1: DSL Feature Specifications

Multimode DSL (VDSL2 and ADSL2/2+)	• Provided through a DSL SFP • SFP has a single RJ-45 interface • Support for double-ended line testing (DELT) diagnostics mode (VDSL2 Only)

Table 2: VDSL2 Feature Specifications

VDSL2	• VDSL2 993.2 Annex A and Annex B • 997 and 998 band plans • G.994.1 ITU G.hs • VDSL2 profiles: 8a, 8b, 8c, 8d, 12a, 12b, and 17a • Vectoring • U0 band support (25 to 276 kHz) • Ethernet packet transfer mode (PTM) based only on IEEE 802.3ah 64/65 octet encapsulation • Dying gasp

Table 3: ADSL2/2+ Feature Specifications

ADSL2/2+	• Annex A and L for ADSL2 • Annex A for ADSL2+ • Annex J for ADSL2+ • G.994.1 ITU G.hs • Reach-extended ADSL2 (G.922.3) Annex L for increased performance on loop lengths greater than 16,000 feet from central office • T1.413 ANSI ADSL2/2+ DMT issue 2 compliance • DSL Forum TR-067, and TR-100 conformity • Impulse noise protection (INP) and extended INP • Downstream power backoff (DPBO) • Dying gasp

Dying gasp is when the the router is using some residual power on capacity to send outage messages to the DSLAM. You can verify your router is ready to send out dying gasp messages by using the **show controller vdsl 0/0/0 local** command:

```
Router#show controllers vdsl 0/0/0 local
SFP Vendor PID: SFPV5311TR
SFP Vendor SN: V021932028C
Firmware embedded in IOS-XE: 1_62_8463
Running Firmware Version: 1_62_8455
Management Link: up
DSL Status: showtime
Dumping internal info: idle
Dying Gasp: armed
Dumping DELT info:  idle
```

Note If Dying Gasp is disabled, the output will show **Dying gasp: disarmed**.

There is no configuration for Dying Gasp. The Software takes care internally for the implementation. Once an SFP shut/no shut has been triggered, 1-2 notifications are sent within 50ns.

Dying-Gasp SMS Notification for EM74XX Modems

Prerequisites:

- Hardware Peripheral: P-LTEA-EA, P-LTEA-LA
- License: Cisco Network-advantage

Pluggable Interface Modules (PIMs) using the EM7430 or EM7455 modem have extra capacitors to supply power to the modem in case of loss of power to the module. This allows a graceful power off of the modem. When loss of power is detected, the modem is expected to send out dying gasp SMS when configured.

The following is an example of configuring dying gasp with a phone number and SMS message:

```
#controller Cellular 0/1/0
#lte dyinggasp sms send 9119110911 "Losing Power"
Warning: Enabling Dying Gasp SMS configuration completed successfully.
Please reset Modem for the changes to take effect
```

Configure dying-gasp detach and SMS notifications

Enable dying-gasp detach requests and configure the phone number and SMS message sent by the cellular modem when the platform or module powers down.

Procedure

Step 1 Use the **configure terminal** command to enter global configuration mode.

Step 2 Use the **controller Cellular** *slot* command to enter configuration mode for the cellular module controller slot.

Step 3 Use the **lte dyinggasp detach enable** command to enable the dying-gasp feature with a detach request.

Step 4 Use the **lte dyinggasp sms send** *phone number SMS message* command to configure the recipient's phone number and the SMS message sent by the modem when the platform or module powers down.

Step 5 Use the **exit** command to exit configuration mode.

Step 6 Use the **write mem** command to save changes to the router configuration.

Configuration Example

The following example shows how to enable dying-gasp feature on cellular module in slot 0/1/0, specify phone number receiving the SMS, and the specific SMS text message to be sent by modem upon power failure.

```
router# configure terminal

router(config)# controller cellular 0/1/0
router (config-controller)# lte dyinggasp detach enable
router (config-controller)# lte dyinggasp sms send 4081112222
 IR1001-#999_EM7455_powered_off!
```

Installing the DSL SFP

Instructions for inserting the DSL SFP are found in your products Hardware Installation Guide.

Warning It is critical that the installer read these instructions and be familiar with the correct method of inserting and removing the SFP. Failure to do so may result in damage to the SFP.

Basic Configuration

Once the SFP is installed, it requires a basic configuration to bring it up. Follow these steps:

```
configure t
Router(conf)#interface g0/0/0
Router(conf-if)#media-type sfp
Router(conf-if)#no shut
Router(conf-if)#exit
```

At this point, SFP insertion SYSLOG messages will appear.

SFP Verification

After safely installing the SFP, you can check its status with the **show inventory** command:

```
Router#show inventory

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
INFO: Please use "show license UDI" to get serial number for licensing.
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

NAME: "Chassis", DESCR: "IR1001 Base Chassis"
PID: IR1001-K9 , VID: V03 , SN: FCW23500H5X

NAME: "Module 0 - Mother Board", DESCR: "Cisco IR1001 motherboard"
PID: IR1001-K9 , VID: V03 , SN: FOC23473SRK
```

```
NAME: "module subslot 0/0", DESCR: "IR1001-ES-5"
PID: IR1001-ES-5 , VID: V01 , SN:

NAME: "subslot 0/0 transceiver 0", DESCR: "GE T"
PID: SFP-VADSL2+-I , VID: V01 , SN: MET2023000A
Ignore the description, it will always reflect GE T for all IR1001 SFPs
PID and S/N are what matter
```

In the below output, ignore the Description and bitrate. The PID/Serial number information are true to the SFP.

```
Router#show interfaces transceiver detail
IDPROM for transceiver Gigabitethernet0/0/0:
Description = SFP or SFP+ optics (type 3)
Transceiver Type: = GE T (26)
Product Identifier (PID) = SFP-VADSL2+-I
Vendor Revision = V5.1
Serial Number (SN) = MET2023000A
Vendor Name = CISCO-METANOIA
Vendor OUI (IEEE company ID) = 00.00.00 (0)
CLEI code =
Cisco part number = 74-124941
Device State = Enabled.
Date code (yy/mm/dd) = 20/23/
Connector type = .
Encoding = 8B10B (1)
Nominal bitrate = GE (1300 Mbits/s)
Minimum bit rate as % of nominal bit rate = not specified
Maximum bit rate as % of nominal bit rate = not specified

Socket Verification


SFP IDPROM Page 0xA0:
000: 03 04 22 08 00 00 00 00 00 00
010: 00 01 0D 00 00 00 00 00 FF 00
020: 43 49 53 43 4F 2D 4D 45 54 41
030: 4E 4F 49 41 20 20 00 00 00 00
040: 53 46 50 56 35 33 31 31 54 52
050: 35 31 43 53 20 20 56 35 2E 31
060: 00 00 00 3F 08 00 00 00 4D 45
070: 54 32 30 32 33 30 30 30 41 20
080: 20 20 20 20 32 30 32 33 20 20
090: 20 20 00 00 00 6D 63 00 30 60
100: FE 53 E4 C1 54 F1 F1 C1 FA 1A
110: 98 EC 6B E0 7F 00 00 00 00 00
120: 00 00 00 00 8C D0 5C F7 00 00
130: 00 00 00 00 00 00 00 00 37 34
140: 2D 31 32 34 39 34 31 20 56 30
150: 31 20 CF EC 55 00 00 00 00 D4
160: 00 00 00 00 00 00 00 00 00 00
170: 00 00 00 00 00 00 00 00 00 00
180: 00 00 00 00 00 00 00 00 00 00
190: 00 00 53 46 50 2D 56 41 44 53
200: 4C 32 2B 2D 49 20 20 20 20 20
210: 20 20 00 00 17 00 00 00 00 00
220: 00 00 00 5A

SFP IDPROM Page 0xA2:
000: 00 00 00 00 00 00 00 00 00 00
010: 00 00 00 00 00 00 00 00 00 00
020: 00 00 00 00 00 00 00 00 00 00
030: 00 00 00 00 00 00 00 00 00 00
```

```
040: 00 00 00 00 00 00 00 00 00 00
050: 00 00 00 00 00 00 00 00 00 00
060: 00 00 00 00 00 00 00 00 00 00
070: 00 00 00 00 00 00 00 00 00 00
080: 00 00 00 00 00 00 00 00 00 00
090: 00 00 00 00 00 00 00 00 00 00
100: 00 00 00 00 00 00 00 00 00 00
110: 00 00 00 00 00 00 00 00 00 00
120: 00 00 00 00 00 00 00 00 00 00
130: 00 00 00 00 00 00 00 00 00 00
140: 00 00 00 00 00 00 00 00 00 00
150: 00 00 00 00 00 00 00 00 00 00
160: 00 00 00 00 00 00 00 00 00 00
170: 00 00 00 00 00 00 00 00 00 00
180: 00 00 00 00 00 00 00 00 00 00
190: 00 00 00 00 00 00 00 00 00 00
200: 00 00 00 00 00 00 00 00 00 00
210: 00 00 00 00 00 00 00 00 00 00
220: 00 00 00 00 00 00 00 00 00 00
230: 00 00 00 00 00 00 00 00 00 00
240: 00 00 00 00 00 00 00 00 00 00
250: 00 00 00 00 00 00
Link reach for 9u fiber (km) = SX(550/270m) (0)
1xFC-MM(500/300m) (0)
2xFC-MM(300/150m) (0)
ESCON-MM(2km) (0)
Link reach for 9u fiber (m) = SX(550/270m) (0)
1xFC-MM(500/300m) (0)
2xFC-MM(300/150m) (0)
ESCON-MM(2km) (0)
Link reach for 50u fiber (m) = SR(2km) (0)
IR-1(15km) (0)
IR-2(40km) (0)
LR-1(40km) (0)
LR-2(80km) (0)
LR-3(80km) (0)
DX(40KM) (0)
HX(40km) (0)
ZX(80km) (0)
VX(100km) (0)
1xFC, 2xFC-SM(10km) (0)
ESCON-SM(20km) (0)
Link reach for 62.5u fiber (m) = SR(2km) (0)
IR-1(15km) (0)
IR-2(40km) (0)
LR-1(40km) (0)
LR-2(80km) (0)
LR-3(80km) (0)
DX(40KM) (0)
HX(40km) (0)
ZX(80km) (0)
VX(100km) (0)
1xFC, 2xFC-SM(10km) (0)
ESCON-SM(20km) (0)
Nominal laser wavelength = 0 nm.
DWDM wavelength fraction = 0.0 nm.

No transceiver present
```

DSL SFP Annex J support

To enable Annex-J, perform the following:

```
router#config term
router(conf)#controller vdsl 0/0/0
router(conf-if)#capability annex-j
router#(conf-if)#exit
router#
```

To remove Annex-J, perform the following:

```
To remove Annex-J:
router#config term
router(conf)#controller vdsl 0/0/0
router(conf-if)#no capability annex-j
router#(conf-if)#exit
router#
```

The **rx-padding**command is used for packets with an MTU less than 64 bytes.

Important If frames less than 64mtu are expected downstream from the service provider, the Vlan configuration must be vlan 96.

The command example is as follows:

```
router#config term
router#controller vdsl 0/0/0
router(conf-if)#rx-padding
router(conf-if)#end
```

Execute **write mem** to save the configuration.

DSL SFP Annex M support

Support is the same as it was for Annex-J.

Support for DSL Annex B

Annex B is not configured by default. To enable Annex B, the following command will be used.

```
controller VDSL 0/0/0
  capability annex-b
```

LED Indications on the SFP

The DSL SFP has two LED indicators built into it. This LED operates independent of any LED that is on the panel of the Router.

Note There is no **show platform led** support for the SFP LED. Use the **show controller vdsl 0/0/0 local** command for DSL link status.

LED Indications

The following table describes the SFP LED indications:

Indicator LED	LED Color	State	Description
LED 1	Orange	On	CPE side (expected to be ON when used on an IR router)
LED 1	Orange	Off	Central office side (not supported
xDSL Status LED	Green	Slow Flash	Idle
xDSL Status LED	Green	Fast Flash	Training
xDSL Status LED	Green	Steady	Showtime
xDSL Status LED	Green	Extremely Rapid Flash	Packet Transmit

SFP LED Workflow

The following table describes the SFP LED indications during a bootup:

Before SFP is inserted	Off
During SFP bootup	Slow Green Flash
After auto-negotiation has completed	Solid Green
SFP shut triggered from the CLI	Off
SFP no shut triggered from the CLI	Flashing, then Solid Green
SFP Traffic	Flashing Green

Auto-Negotiation

You can tell the status of auto-negotiation based on the LED on the SFP. On shut/no shut or during auto-negotiation, the following sequence should be observed:

Slow Flashing Green	Idle
Fast Flashing Green	Training
Solid Green	Handshake success, Showtime

If the SFP LED is toggling between slow flashing green and fast flashing green, it usually means it is in auto-negotiation mode. If this continues for a long time, the DSLAM and Router DSL SFP parameters need to be rechecked. The following chapters cover more details on Router xDSL configuration.

DSL SFP Firmware Upgrade

The DSL SFP has firmware loaded on it. You should check the version loaded on the SFP and compare it to what is available in the router image. The customer should make their decision to upgrade according to their own agreement with their ISP.

The SFP must have a minimum configuration in order to upgrade it:

```
configure t
Router(conf)#interface g0/0/0
Router(conf-if)#media-type sfp
Router(conf-if)#no shut
Router(conf-if)#exit
```

Check your firmware levels by executing **show controller vdsl 0/0/0 local** command.

```
Router#show controllers vdsl 0/0/0 local
SFP Vendor PID: SFPV5311TR
SFP Vendor SN: V021932028C
Firmware embedded in IOS-XE: 1_62_8463
Running Firmware Version: 1_62_8455
Management Link: up
DSL Status: showtime
Dumping internal info: idle
Dying Gasp: armed
Dumping DELT info:  idle
```

Use the following command to upgrade the SFP:

```
Router#upgrade hw-module subslot 0/0 sfp 0
Upgrade SFP firmware on interface GigabitEthernet0/0/0 from 1_62_8455 to 1_62_8463
Connection will be disrupted, Continue(Y/N)?y
Start ebm upgrade!!
..................................................
..................................................
................
firmware update success!!
```

The command loads the new firmware, and then performs a shut/no shut on the interface to reset the SFP.

Note You can upgrade standalone SFP firmware in addition to the firmware bundled with the IOS image.

For example:

```
Router#upgrade hw-module subslot 0/0 sfp 0 {flash|usb0}:sfp_fw_image
```

MTU Limitation

As per the SFP Data sheet specification, the following are MTU limitations:

- For VDSL, the MTU range on the DSL SFP interface is between 64 - 1800 Bytes
- For ADSL2/2+, the MTU range on the DSL SFP interface is between 64 - 1700 Bytes

Support DSL SFP Firmware Signing and Signature Validation

An optional IOS filepath has been added to the end of the existing upgrade command. The file must be signed with SFP-VADSL2-I key. The file could be in bootflash:/flash:, usb0 :. It cannot be from any remote file system.

Command Line Interface

The command line interface for upgrading the module follows:

router# **upgrade hw-module subslot 0/0 sfp 0** *<IOS filepath>*

Options to the command are:

```
Router#upgrade hw-module subslot 0/0 sfp 0 ?
  bootflash:  Firmware filename on local driver
  crashinfo:  Firmware filename on local driver
  flash:      Firmware filename on local driver
  usb0:  Firmware filename on local driver
```

The following is an example of the command usage:

```
Router#upgrade hw-module subslot 0/0 sfp 0 bootflash:sfp8455_rel.bin
Digital signature successfully verified in file bootflash:sfp8455_rel.bin
Upgrade SFP firmware on interface GigabitEthernet0/0/0 from 1_62_8463 to 1_62_8455
Connection will be disrupted, Continue(Y/N)?y
Start ebm upgrade!!
................................................................................
................................................................................
................................................................................
................................................................................

firmware update success!!
```

ADSL2/2+ Overview

This section provides an overview for ADSL2/2+

Important The Router SFP based DSL support differs in configuration and troubleshooting in comparison to other ISR DSL platforms. There is no ATM interface, ethernet to ATM packet translation is handled internally via Adaption Layer5 (AAL5). All configurations are on the controller vdsl 0/0/0 and g0/0/0 interface/sub-interface. UBR is recommended over AAL5.

All details are listed in the chapters that follow.

ADSL2/2+ works in auto mode (configuration on DSLAM auto-negotiation automatically with the DSL controller). Annex A is supported on ADSL2+. Annex A and reach-extended Annex L mode-1 is supported on ADSL2. This is in compliance with TR-100/TR-105

- For Auto-negotiation handshake procedure, the SFP is compliant with ITU-T G.994.1 DSL TRx and for Physical Layer Management compliant with ITU-T G.997.1 for DSL TRx.

- The DSL SFP complies with ITU-T G.99x standard with supporting AVD2 CPE mode only.
- Supports LLC/SNAP and VCMux ethernet bridged encapsulation option.
- All PPPoX encapsulation is configured via PPPoE only. Internally, packet translation is handled via ATM. There is no PPPoA configuration like there is with the c111x ISR.
- ADSL-PVC is configurable in the Controller VDSL 0/0/0: Each SFP supports 8 PVCs.
- Each PVC supports mapping to/from 802.1q Vlan tagging.
- VPI range is 0-255, VCI range is 32-65535.

The 'mode' reflected in **show controller vdsl 0/0/0** will always be PTM (Packet transfer mode). Internally packet translation to ATM is handled (AAL5).

Configuring ADSL2/2+

The Router supports Asymmetric Digital Subscriber Line (ADSL) 2/2+.

Procedure

Step 1 **enable**

Example:

```
router> enable
```

Enables privileged EXEC mode.

Step 2 **configure terminal**

Example:

```
router# configure terminal
```

Enters global configuration mode.

Step 3 **controller vdsl <port>**

Example:

```
router(config)# controller vdsl 0/0/0
```

Enters configuration mode for the ADSL2/2+ controller.

Step 4 **adsl-pvc <vpi/vci>**

Example:

```
router(config-controller)#adsl-pvc 0/35
```

Configures the PVC's VPI and VCI parameters. Refer to ADSL2/2+ PVC Sub Mode, on page 14 for detailed sub-commands.

Step 5 **bridge-dot1q <1-4094>**

Example:

```
router(config-controller-adsl-pvc)#bridge-dot1q 2
```

Configures the PVC's bridge-dot1q parameter.

Step 6 **encapsulation llcsnap|vcmux**

Example:

```
router(config-controller-adsl-pvc)#encapsulation llcsnap
```

Disabled by default. Can be either llcsnap or vcmux. This example shows the PVC encapsulation as LLCSNAP.

Step 7 **exit**

Example:

router(config-controller-adsl-pvc)# **exit**

Enables new configuration to take effect.

Step 8 **end**

Example:

```
router(config-controller)# end
```

Exits the configuration mode.

ADSL2/2+ Controller Configuration Commands

This section describes some of the CLI commands specific to controller configuration.

Brief	Format	Command Default	Description	Differences From Other IOS-XE ISRs
adsl-pvc	**adsl-pvc** *[name] {<vpi>/<vci>}* **adsl-pvc 0/35** **adsl-pvc PVC1 0/35**	None	ADSL2/2+ PVC Submode VPI/VCI value 0-255 VCI Value 32-65535 For additional details on the ADSL2/2+ submode, refer to ADSL2/2+ PVC Sub Mode, on page 14	VPI: 0-31 VCI: 1-1023
bitswap	—	Default is Enabled	Bitswap	—
carrier-set	**carrier-set** *[a43 a43c b43]*	a43 a43c b43	DSL SFP Carrier Set	c111x defines these tones under the modem vdsl option. For example, v43 has to be disabled via cli. In the Router, tone v43 is disabled by default.
default	—	—	Set a command to its defaults	—
description	—	—	Controller specific description	—

Brief	Format	Command Default	Description	Differences From Other IOS-XE ISRs
exit	—	—	Exit from controller configuration mode. This is mandatory in order to make the configuration take effect.	—
help	—	—	Description of the interactive help system	—
mac-address	**mac-address** <*MAC address*>	The default is the MAC is preconfigured.	DSL SFP MAC Address. There is no need to configure anything to get the controller working.	—
modem vdsl	—	—	Not applicable to the Router. Inherited from the c111x.	Applicable only in the c111x.
mpls	—	—	Not applicable to the Router. Inherited from the c111x.	Applicable only in the c111x.
no	—	—	Negate a command or set its defaults	—
shutdown	—	—	Shutdown vdsl controller	—
sra	—	Default is Enabled	Seamless Rate Adaption	—

ADSL2/2+ PVC Sub Mode

The following table lists related commands.

Brief	Format	Default	Description	Differences From Other IOS-XE ISRs
adsl-pvc	adsl-pvc vpi/vci	None	A maximum of 8 PVCs can be supported on a DSL interface. vci range 32 - 65535 vpi range 0-255	VPI/VCI value 0-31 VCI value 1-1023
bridge-dot1q	**bridge-dot1q** <*1-4094*>	None	802.1Q VLAN ID to PVC mapping	—

Brief	Format	Default	Description	Differences From Other IOS-XE ISRs
cbr	**cbr** <*peak cell rate*> cbr pcr range is 0 to 5500	No	Configure Constant Bit Rate (CBR) Service UBR is recommended over AAL5.	48-1408 in Kbps.
default-pvc	**default-pvc**	First PVC Created	Set PVC as default PVC The default-pvc command under adsl-pvc is an option available with the DSL SFP. It selects which PVC the DSL SFP will treat as the default when there are 2 or more active PVCs.	—
encapsulation	**encapsulation** <*llcsnap|vcmux*>	None	Configure ADSL2/2+ PVC Encapsulation	—
exit	—	—	Exit adsl-pvc sub commands	—
ubr	**ubr** <*peak cell rate*> ubr peak cell rate range is 0 to 5500	Yes	Configure Unspecified Bit Rate (UBR) Service	48-1408 in Kbps.
vbr-nrt	**vbr-nrt** <*peak cell rate*> <*sustainable cell rate*> pcr range is 0 to 5500 scr range is 0 to 5500	No	Configure Non Real-time Variable Bit Rate Service UBR is recommended over AAL5.	48-1408 in Kbps.
vbr-rt	**vbr-rt** <*peak cell rate*> <*sustainable cell rate*> pcr range is 0 to 5500 scr range is 0 to 5500	No	Configure Real-time Variable Bit Rate Service UBR is recommended over AAL5.	48-1408 in Kbps.
vlanid-rx	**vlanid-rx** <*1-4094*>	Depends on bridge-dot1q	Configure the DSL SFP to set the VLAN ID of the Ethernet packet received by the DSL SFP to be sent to the router. Used in conjunction with the DSL SFP VLAN operation vlanop-rx to either remove or replace the VLAN ID from the Ethernet packet.	Only on IoT Routers

Brief	Format	Default	Description	Differences From Other IOS-XE ISRs
vlanid-tx	**vlanid-tx** *<1-4094>*	Depends on bridge-dot1q	Configure the DSL SFP to set VLAN ID of the Ethernet packet for transmission to the network. Used in conjunction with the DSL SFP VLAN operation vlanop-tx to either remove or replace the VLAN ID from the Ethernet packet before transmitting the packet to the network.	Only on IoT Routers
vlanop-rx	**vlanop-rx** *<pass-through|remove|replace>*	Remove	Configure the VLAN ID operation of the DSL SFP to the Ethernet packet received by the DSL SFP to be sent to the router. Remove or replace VLAN operations are used in conjunction with the vlanid-rx. Pass-through option preserves the existing VLAN ID of the Ethernet packet.	Only on IoT Routers
vlanop-tx	**vlanop-tx** *<pass-through|remove|replace>*	Replace	Configure the VLAN ID operation of the DSL SFP to the Ethernet packet for transmission to the network. Remove or replace VLAN operation are used in conjunction with the vlanid-tx. Pass-through option preserves the existing VLAN ID of the Ethernet packet.	Only on IoT Routers

ADSL2+ Example

The following example is from an ADSL2+ configuration:

Note For an explanation of some of the key output messages, see Controller Status Messages, on page 34.

```
Router#show controller vdsl 0/0/0
Controller VDSL 0/0/0 is UP

Daemon Status: UP

XTU-R (DS) XTU-C (US)
Chip Vendor ID: 'META' 'BDCM'.
Chip Vendor Specific: 0x0000 0x0762
Chip Vendor Country: 0xB500 0xB500
Modem Vendor ID: 'META' ' '
Modem Vendor Specific: 0x0000 0x0000
Modem Vendor Country: 0xB500 0x0000
Serial Number Near: MET2023000A V5311TR 1_62_8463
Serial Number Far:
Modem Version Near: 1_62_8463 MT5311.
Modem Version Far: <value>

Modem Status: TC Sync (Showtime!)
DSL Config Mode: AUTO
Trained Mode: G.992.3 (ADSL2) Annex A

TC Mode: PTM
Selftest Result: 0x00
DELT configuration: disabled
DELT state: not running

Failed full inits: 0
Short inits: 0
Failed short inits: 0

Modem FW Version:
Modem PHY Version:
Modem PHY Source: System

Line 0:

XTU-R (DS) XTU-C (US)
Trellis: ON ON
SRA: enabled enabled.
SRA count: 0 0.
Bit swap: enabled enabled.
Bit swap count: 0 0
Line Attenuation: 2.4 dB dB
Signal Attenuation: 5.0 dB 0.0 dB
Noise Margin: 8.2 dB 6.5 dB
Attainable Rate: 12491 kbits/s 1153 kbits/s
Actual Power: 0.0 dBm 10.2 dBm
Total FECC: 0 0
Total ES: 0 399
Total SES: 0 188
Total LOSS: 0 177
Total UAS: 103 6325
Total LPRS: 0 0
Total LOFS: 0 0
Total LOLS: 0 0
```

```
DS Channel1 DS Channel0 US Channel1 US Channel0
Speed (kbps): NA 12491 NA 1093
SRA Previous Speed: NA 0 NA 0
Previous Speed: NA 12583 NA 1097
Reed-Solomon EC: NA 0 NA 0
CRC Errors: NA 209 NA 0
Header Errors: NA 0 NA 0
Interleave (ms): NA 1.00 NA 1.00
Actual INP: NA 0.00 NA 0.00
```

ADSL2 Annex A Example

The following example is from an ADSL2 Annex A configuration:



Note For an explanation of some of the key output messages, see Controller Status Messages, on page 34.

```
show controller vdsl 0/0/0
Controller VDSL 0/0/0 is UP
Daemon Status: UP
XTU-R (DS) XTU-C (US)

Chip Vendor ID: 'META' 'BDCM'
Chip Vendor Specific: 0x0000 0x0762
Chip Vendor Country: 0xB500 0xB500
Modem Vendor ID: 'META' ' '
Modem Vendor Specific: 0x0000 0x0000
Modem Vendor Country: 0xB500 0x0000
Serial Number Near: MET2023000A V5311TR 1_62_8463
Serial Number Far:

Modem Version Near: 1_62_8463 MT5311
Modem Version Far:
Modem Status: TC Sync (Showtime!)
DSL Config Mode: AUTO
Trained Mode: G.992.5 (ADSL2+) Annex A
TC Mode: PTM
Selftest Result: 0x00
DELT configuration: disabled
DELT state: not running

Failed full inits: 0
Short inits: 0
Failed short inits: 0

Modem FW Version:
Modem PHY Version:
Modem PHY Source: System

Line 0:
XTU-R (DS) XTU-C (US)

Trellis: ON ON
SRA: enabled enabled
SRA count: 0 0
Bit swap: enabled enabled
Bit swap count: 0 0
Line Attenuation: 1.4 dB dB
Signal Attenuation: 2.4 dB 0.0 dB
Noise Margin: 9.5 dB 6.3 dB
```

```
Attainable Rate: 23550 kbits/s 1105 kbits/s
Actual Power: 0.0 dBm 12.2 dBm
Total FECC: 1 0
Total ES: 1 396
Total SES: 0 317
Total LOSS: 0 287
Total UAS: 57 3344
Total LPRS: 0 0
Total LOFS: 0 0
Total LOLS: 0 0
DS Channel1 DS Channel0 US Channel1 US Channel0

Speed (kbps): NA 23550 NA 1105
SRA Previous Speed: NA 0 NA 0
Previous Speed: NA 23580 NA 1109
Reed-Solomon EC: NA 0 NA 0
CRC Errors: NA 95 NA 4
Header Errors: NA 0 NA 0
Interleave (ms): NA 1.00 NA 1.00
Actual INP: NA 0.00 NA 0.00
Training Log : Stopped
Training Log Filename : flash:vdsllog.bin
```

ADSL2 Annex L Example

The following example is from an ADSL2 Annex L configuration:

Note For an explanation of some of the key output messages, see Controller Status Messages, on page 34.

```
show controller vdsl 0/0/0
Controller VDSL 0/0/0 is UP
Daemon Status: UP
XTU-R (DS) XTU-C (US)

Chip Vendor ID: 'META' 'BDCM'
Chip Vendor Specific: 0x0000 0x0762
Chip Vendor Country: 0xB500 0xB500
Modem Vendor ID: 'META' ' '
Modem Vendor Specific: 0x0000 0x0000
Modem Vendor Country: 0xB500 0x0000
Serial Number Near: V0219320270 V5311TR 1_62_8463
Serial Number Far:

Modem Version Near: 1_62_8463 MT5311
Modem Version Far:
Modem Status: TC Sync (Showtime!)
DSL Config Mode: AUTO
Trained Mode: G.992.3 (ADSL2) Annex L
TC Mode: PTM
Selftest Result: 0x00
DELT configuration: disabled
DELT state: not running
Failed full inits: 0
Short inits: 0
Failed short inits: 0
Modem FW Version:
Modem PHY Version:
Modem PHY Source: System
Line 0:
XTU-R (DS) XTU-C (US)
```

```
Trellis: ON ON
SRA: enabled enabled
SRA count: 0 0
Bit swap: enabled enabled
Bit swap count: 0 0
Line Attenuation: 2.5 dB dB
Signal Attenuation: 5.7 dB 0.0 dB
Noise Margin: 7.0 dB 6.2 dB
Attainable Rate: 10164 kbits/s 288 kbits/s
Actual Power: 0.0 dBm 8.4 dBm
Total FECC: 0 0
Total ES: 6 0
Total SES: 6 0
Total LOSS: 6 0
Total UAS: 54 31
Total LPRS: 0 0
Total LOFS: 6 0
Total LOLS: 0 0
DS Channel1 DS Channel0 US Channel1 US Channel0

Speed (kbps): NA 10164 NA 243
SRA Previous Speed: NA 0 NA 0
Previous Speed: NA 12495 NA 1089
Reed-Solomon EC: NA 0 NA 0
CRC Errors: NA 0 NA 0
Header Errors: NA 0 NA 0
Interleave (ms): NA 1.00 NA 1.00
Actual INP: NA 0.00 NA 0.00
Training Log : Stopped
Training Log Filename : flash:vdsllog.bin
```

VDSL2 Overview

This section provides an overview for VDSL2,

The Router DSL SFP-VADSL2+-I provides VDSL2 Annex A, B support in conformance to ITU-T standards G.993.2 (VDSL2). This xDSL SFP is also in compliance with TR-114 (VDSL2 Annex A and B performance) and TR-115 (VDSL2 Feature validation tests by University of New Hampshire). The SFP complies with ITU-T G.99x standard with supporting AVD2 CPEmode only.

- Configurable Band Plan, conforms to North America Annex A (G.998) and Europe Annex B (G.997, 998) Band Plans subject to the 3072/4096 and 8-band/4-passband constraints.
- Supports all VDSL2 profiles (8a/b/c/d, 12a/b, 17a, 30a).
- Supports EU type Upstream Band 0 (US0).
- Complies with ITU-T G.994.1 Handshake Procedure for DSL TRx.
- Complies with ITU-T G.997.1 Physical Layer Management for DSL TRx
- Complies with ITU-T G.993.5 Self-FEXT Cancellation (Vectoring) for CPE mode
- Supports Robust Overhead Channel (ROC)
- Supports Online Reconfiguration (OLR) including Seamless Rate Adaptation (SRA) with D/L change and Bit Swapping
- Supports Upstream /Downstream Power Back Off (UPBO/DPBO)

- Supports DELT
- Supported maximum MTU size on VDSL2 is 1800 Bytes
- Standard compliance VDSL2 mode is PTM (Packet transfer mode)
- Supports VDSL2 Vectoring

For configuration and display commands, see the detailed sections below. The **show controller vdsl 0/0/0** is the fundamental command for validation.

Configuring VDSL2

The Router supports Very-high-bit-rate Digital Subscriber Line (VDSL2).

Procedure

Step 1 **enable**

Example:

```
router> enable
```

Enables privileged EXEC mode.

Step 2 **configure terminal**

Example:

```
router# configure terminal
```

Enters global configuration mode.

Step 3 **controller vdsl 0/0/0**

Example:

```
router(config-controller)# controller vdsl 0/0/0
```

Enters configuration mode for the VDSL2 controller.

Step 4 **carrier-set** *a43 a43c b43*

Example:

```
router(config-controller)# carrier-set a43|a43c|b43
```

Configures the carrier set. Multiple choice. Default is a43 a43c b43. v43 is disabled by default.

Step 5 **end**

Example:

```
router(config-controller)# end
```

Exits controller configuration mode.

VDSL2 Controller Configuration Commands

This section describes some of the CLI commands specific to controller configuration.

Brief	Format	Command Default	Description
bitswap	—	Default is Enabled	Bitswap
capability	**capability** *[annex-j]*	None	Set the DSL SFP Capability
carrier-set	**carrier-set** *[a43 b43 a43c]*	a43 b43 a43c	DSL SFP Carrier Set
default	—	—	Set a command to its defaults
description	—	—	Controller specific description
exit	—	—	Exit from controller configuration mode
help	—	—	Description of the interactive help system
mac-address	**mac-address** <*MAC address*>	The default is the MAC is preconfigured.	DSL SFP MAC Address. There is no need to configure anything to get the controller working.
modem vdsl	—	N/A	Modem Configuration
mpls	—	—	Not applicable to the IoT Router. Inherited from the c111x.
no	—	—	Negate a command or set its defaults
shutdown	—	—	Shutdown vdsl controller
sra	—	Default is Enabled	Seamless Rate Adaption

VDSL Example

The following example is from a VDSL configuration:

```
show controllers vdsl 0/0/0
Controller VDSL 0/0/0 is UP
Daemon Status: UP
XTU-R (DS) XTU-C (US)

Chip Vendor ID: 'META' 'IKNS'
Chip Vendor Specific: 0x0000 0x0101
Chip Vendor Country: 0xB500 0xB500
Modem Vendor ID: 'META' ' '
Modem Vendor Specific: 0x0000 0x2AB0
Modem Vendor Country: 0xB500 0x37A0
Serial Number Near: E80462D1B001 SFP-V5311-T-R 8431
Serial Number Far: ^A5u
Modem Version Near: 1_62_8431 MT5311
Modem Version Far: 6.7.0.15IK005010

Modem Status: TC Sync (Showtime!)
DSL Config Mode: AUTO
```

```
Trained Mode: G.993.2 (VDSL2) Profile 17a

TC Mode: PTM
Selftest Result: 0x00
DELT configuration: disabled
DELT state: not running

Failed full inits: 0
Short inits: 0
Failed short inits: 0

Modem FW Version:
Modem PHY Version:
Modem PHY Source: System

Line 0:
XTU-R (DS) XTU-C (US)

Trellis: ON ON
SRA: enabled enabled
SRA count: 0 0
Bit swap: enabled enabled
Bit swap count: 0 0
Line Attenuation: 2.7 dB dB
Signal Attenuation: 3.9 dB dB
Noise Margin: 7.2 dB 24.8 dB
Attainable Rate: 113289 kbits/s 86904 kbits/s
Actual Power: 9.3 dBm 8.1 dBm
Per Band Status: D1 D2 D3 U0 U1 U2 U3
Line Attenuation(dB): 0.0 1.5 2.5 N/A 0.2 0.2 0.6
Signal Attenuation(dB): 0.0 2.0 4.0 N/A 0.0 0.0 0.0
Noise Margin(dB): 0.0 7.2 7.2 0.0 24.7 24.8 24.8
Total FECC: 0 2203
Total ES: 1 2280
Total SES: 0 2199
Total LOSS: 0 2199
Total UAS: 81 2199
Total LPRS: 0 0
Total LOFS: 0 0
Total LOLS: 0 0
DS Channel1 DS Channel0 US Channel1 US Channel0

Speed (kbps): NA 103985 NA 50219
SRA Previous Speed: NA 0 NA 0
Previous Speed: NA 103985 NA 50219
Reed-Solomon EC: NA 0 NA 0
CRC Errors: NA 117 NA 1
Header Errors: NA 0 NA 0
Interleave (ms): NA 0.00 NA 0.02
Actual INP: NA 0.00 NA 0.00
Training Log : Stopped
Training Log Filename : flash:vdsllog.bin
```

For an explanation of some of the key output messages, see Controller Status Messages, on page 34.

Yang Model for DSL

YANG is a popular data modeling language to represent data sent over network management protocols such as NETCONF and RESTCONF.

The **Cisco-IOS-XE-controller-vdsl-oper** has been introduced to edit the Controller vdsl configurations which gives the yang support for the DSL.

An example of a typical yang response for edit config of the dsl controller follows:

```
<native xmlns="http://cisco.com/ns/yang/Cisco-IOS-XE-native">
          <controller>
            <VDSL xmlns="http://cisco.com/ns/yang/Cisco-IOS-XE-controller">
              <name>0/0/0</name>
              <adsl-pvc xmlns="http://cisco.com/ns/yang/Cisco-IOS-XE-adsl">
                <vpi-vci>255/65535</vpi-vci>
                <bridge-dot1q>21</bridge-dot1q>
                <encapsulation>vcmux</encapsulation>
              </adsl-pvc>
            </VDSL>
          </controller>
        </native>
      </nc:config></nc:edit-config></nc:rpc>
```

Note The Controller configurations can be retrieved using **get** and **get-config** operations with the Cisco-IOS-XE-native yang model.

Cisco IOS-XE Yang Data Models are found here:

https://github.com/YangModels/yang/tree/master/vendor/cisco/xe

Support Four ADSL MIB Objects

MIB support has been added to obtain the DSL line speed and attainable rate on the router.

The new MIBS are shown below:

1.3.6.1.2.1.10.94.1.1.4.1.2 ADSL-LINE MIB:adslAtucChanCurrTxRate

1.3.6.1.2.1.10.94.1.1.5.1.2 ADSL-LINE MIB:adslAturChanCurrTxRate

1.3.6.1.2.1.10.94.1.1.2.1.8 ADSL-LINE MIB:adslAtucCurrAttainableRate

1.3.6.1.2.1.10.94.1.1.3.1.8 ADSL-LINE MIB:adslAturCurrAttainableRate

Command Line Interface

On a router with a DSL SFP connected to ADSL DSLAM, the following existing SNMP CLIs can be used to verify support for the above OIDs:

```
!configure SNMP Server
!---------------------
snmp-server community public RO
snmp-server manager
!
!verify MIB OIDs
!---------------
snmp get-next v2c 33.33.33.102 public oid 1.3.6.1.2.1.10.94.1.1.4.1.2
!
```

The following command can also be used to gather the MIB values from another SNMP Client (for example, a linux device):

```
$ snmpwalk -v 2c -c public 33.33.33.102 1.3.6.1.2.1.10.94.1.1.4.1.2
```

Support ADSL MIB Objects

The following ADSL MIB OID will be supported on the router:

```
1.3.6.1.2.1.10.94.1.1.6.1.15 ADSL-LINE-MIB adslAtucPerfCurr15MinInits
1.3.6.1.2.1.10.94.1.1.6.1.22 ADSL-LINE-MIB adslAtucPerfCurr1DayInits
```

Support VDSL MIB Objects

The following VDSL MIB OID will be supported on the router:

```
1.3.6.1.2.1.10.251.1.4.1.2.1.3    VDSL2-LINE-MIB   xdsl2PMLInitCurr15MTimeElapsed
1.3.6.1.2.1.10.251.1.4.1.2.1.4    VDSL2-LINE-MIB   xdsl2PMLInitCurr15MFullInits
1.3.6.1.2.1.10.251.1.4.1.2.1.5    VDSL2-LINE-MIB   xdsl2PMLInitCurr15MFailedFullInits
1.3.6.1.2.1.10.251.1.4.1.2.1.6    VDSL2-LINE-MIB   xdsl2PMLInitCurr15MShortInits
1.3.6.1.2.1.10.251.1.4.1.2.1.7    VDSL2-LINE-MIB   xdsl2PMLInitCurr15MFailedShortInits
1.3.6.1.2.1.10.251.1.4.1.2.1.10   VDSL2-LINE-MIB   xdsl2PMLInitCurr1DayTimeElapsed
1.3.6.1.2.1.10.251.1.4.1.2.1.11   VDSL2-LINE-MIB   xdsl2PMLInitCurr1DayFullInits
1.3.6.1.2.1.10.251.1.4.1.2.1.12   VDSL2-LINE-MIB   xdsl2PMLInitCurr1DayFailedFullInits
1.3.6.1.2.1.10.251.1.4.1.2.1.13   VDSL2-LINE-MIB   xdsl2PMLInitCurr1DayShortInits
1.3.6.1.2.1.10.251.1.4.1.2.1.14   VDSL2-LINE-MIB   xdsl2PMLInitCurr1DayFailedShortInits
1.3.6.1.2.1.10.251.1.4.1.1.1.2    VDSL2-LINE-MIB   xdsl2PMLCurr15MValidIntervals
1.3.6.1.2.1.10.251.1.4.1.1.1.3    VDSL2-LINE-MIB   xdsl2PMLCurr15MInvalidIntervals
1.3.6.1.2.1.10.251.1.4.1.1.1.4    VDSL2-LINE-MIB   xdsl2PMLCurr15MTimeElapsed
1.3.6.1.2.1.10.251.1.4.1.1.1.5    VDSL2-LINE-MIB   xdsl2PMLCurr15MFecs
1.3.6.1.2.1.10.251.1.4.1.1.1.6    VDSL2-LINE-MIB   xdsl2PMLCurr15MEs
1.3.6.1.2.1.10.251.1.4.1.1.1.7    VDSL2-LINE-MIB   xdsl2PMLCurr15MSes
1.3.6.1.2.1.10.251.1.4.1.1.1.8    VDSL2-LINE-MIB   xdsl2PMLCurr15MLoss
1.3.6.1.2.1.10.251.1.4.1.1.1.9    VDSL2-LINE-MIB   xdsl2PMLCurr15MUas
1.3.6.1.2.1.10.251.1.4.1.1.1.10   VDSL2-LINE-MIB   xdsl2PMLCurr1DayValidIntervals
1.3.6.1.2.1.10.251.1.4.1.1.1.11   VDSL2-LINE-MIB   xdsl2PMLCurr1DayInvalidIntervals
1.3.6.1.2.1.10.251.1.4.1.1.1.12   VDSL2-LINE-MIB   xdsl2PMLCurr1DayTimeElapsed
1.3.6.1.2.1.10.251.1.4.1.1.1.13   VDSL2-LINE-MIB   xdsl2PMLCurr1DayFecs
1.3.6.1.2.1.10.251.1.4.1.1.1.14   VDSL2-LINE-MIB   xdsl2PMLCurr1DayEs
1.3.6.1.2.1.10.251.1.4.1.1.1.15   VDSL2-LINE-MIB   xdsl2PMLCurr1DaySes
1.3.6.1.2.1.10.251.1.4.1.1.1.16   VDSL2-LINE-MIB   xdsl2PMLCurr1DayLoss
1.3.6.1.2.1.10.251.1.4.1.1.1.17   VDSL2-LINE-MIB   xdsl2PMLCurr1DayUas
1.3.6.1.2.1.10.251.1.4.1.3.1.3    VDSL2-LINE-MIB   xdsl2PMLHist15MMonitoredTime
1.3.6.1.2.1.10.251.1.4.1.3.1.4    VDSL2-LINE-MIB   xdsl2PMLHist15MFecs
1.3.6.1.2.1.10.251.1.4.1.3.1.5    VDSL2-LINE-MIB   xdsl2PMLHist15MEs
1.3.6.1.2.1.10.251.1.4.1.3.1.6    VDSL2-LINE-MIB   xdsl2PMLHist15MSes
1.3.6.1.2.1.10.251.1.4.1.3.1.7    VDSL2-LINE-MIB   xdsl2PMLHist15MLoss
1.3.6.1.2.1.10.251.1.4.1.3.1.8    VDSL2-LINE-MIB   xdsl2PMLHist15MUas
1.3.6.1.2.1.10.251.1.4.1.3.1.9    VDSL2-LINE-MIB   xdsl2PMLHist15MValidInterval
1.3.6.1.2.1.10.251.1.4.1.4.1.3    VDSL2-LINE-MIB   xdsl2PMLHist1DMonitoredTime
1.3.6.1.2.1.10.251.1.4.1.4.1.4    VDSL2-LINE-MIB   xdsl2PMLHist1DFecs
1.3.6.1.2.1.10.251.1.4.1.4.1.5    VDSL2-LINE-MIB   xdsl2PMLHist1DEs
1.3.6.1.2.1.10.251.1.4.1.4.1.6    VDSL2-LINE-MIB   xdsl2PMLHist1DSes
1.3.6.1.2.1.10.251.1.4.1.4.1.7    VDSL2-LINE-MIB   xdsl2PMLHist1DLoss
1.3.6.1.2.1.10.251.1.4.1.4.1.8    VDSL2-LINE-MIB   xdsl2PMLHist1DUas
1.3.6.1.2.1.10.251.1.4.1.4.1.9    VDSL2-LINE-MIB   xdsl2PMLHist1DValidInterval
```

```
1.3.6.1.2.1.10.251.1.4.2.1.1.2    VDSL2-LINE-MIB   xdsl2PMChCurr15MValidIntervals
1.3.6.1.2.1.10.251.1.4.2.1.1.3    VDSL2-LINE-MIB   xdsl2PMChCurr15MInvalidIntervals
1.3.6.1.2.1.10.251.1.4.2.1.1.4    VDSL2-LINE-MIB   xdsl2PMChCurr15MTimeElapsed
1.3.6.1.2.1.10.251.1.4.2.1.1.5    VDSL2-LINE-MIB   xdsl2PMChCurr15MCodingViolations
1.3.6.1.2.1.10.251.1.4.2.1.1.6    VDSL2-LINE-MIB   xdsl2PMChCurr15MCorrectedBlocks
1.3.6.1.2.1.10.251.1.4.2.1.1.7    VDSL2-LINE-MIB   xdsl2PMChCurr1DayValidIntervals
1.3.6.1.2.1.10.251.1.4.2.1.1.8    VDSL2-LINE-MIB   xdsl2PMChCurr1DayInvalidIntervals
1.3.6.1.2.1.10.251.1.4.2.1.1.9    VDSL2-LINE-MIB   xdsl2PMChCurr1DayTimeElapsed
1.3.6.1.2.1.10.251.1.4.2.1.1.10   VDSL2-LINE-MIB   xdsl2PMChCurr1DayCodingViolations
1.3.6.1.2.1.10.251.1.4.2.1.1.11   VDSL2-LINE-MIB   xdsl2PMChCurr1DayCorrectedBlocks
1.3.6.1.2.1.10.251.1.4.2.2.1.3    VDSL2-LINE-MIB   xdsl2PMChHist15MMonitoredTime
1.3.6.1.2.1.10.251.1.4.2.2.1.4    VDSL2-LINE-MIB   xdsl2PMChHist15MCodingViolations
1.3.6.1.2.1.10.251.1.4.2.2.1.5    VDSL2-LINE-MIB   xdsl2PMChHist15MCorrectedBlocks
1.3.6.1.2.1.10.251.1.4.2.2.1.6    VDSL2-LINE-MIB   xdsl2PMChHist15MValidInterval
1.3.6.1.2.1.10.251.1.4.2.3.1.3    VDSL2-LINE-MIB   xdsl2PMChHist1DMonitoredTime
1.3.6.1.2.1.10.251.1.4.2.3.1.4    VDSL2-LINE-MIB   xdsl2PMChHist1DCodingViolations
1.3.6.1.2.1.10.251.1.4.2.3.1.5    VDSL2-LINE-MIB   xdsl2PMChHist1DCorrectedBlocks
1.3.6.1.2.1.10.251.1.4.2.3.1.6    VDSL2-LINE-MIB   xdsl2PMChHist1DValidInterval
```

DSL Troubleshooting

This section provides information for troubleshooting and debugging if the DSL control and/or datapath is not up.

Problem: If WAN interface g0/0/0 is DOWN:

Solution: Try the following:

- Check L1 cabling, networking, and with different SFP
- Capture output for **show int g0/0/0**, **show run all**, and **show version**
- Check if g0/0/0 has **media-type sfp** configuration set and the interface is unshut.
- Try another SFP to see if that is detected.
- Check SFP's LED status. Refer to LED Indications on the SFP, on page 8

Problem: If controller state is DOWN:

For example:

```
Router#show controllers vdsl 0/0/0
Controller VDSL 0/0/0 is DOWN
```

Solution: Try the following:

- Check L1 cabling.
- Try inserting RJ11 cable into an RJ11 male to RJ45 female connector to see if it helps align.
- Ensure Running FW is the same as System FW. If not, upgrade the SFP FW. Refer to DSL SFP Firmware Upgrade, on page 10.
- Gather output for all L1 Training logs. Ensure L1 debug logs in folder are sent to Cisco TAC, as well as the output of service internal command **test vdsl option 0x0 6**, and the output from **show controller 0/0/0 local**. Refer to L1 Training Logs, on page 35.

- Possible workaround: After gathering the above logs, try to reboot the router to see if it recovers. If it still does not work, try to hot remove/insert the SFP again.

Problem: If the controller is UP, but **show controller vdsl 0/0/0** shows the DSL Link Idle.

Solution: Try the following:

- Ensure **show controller vdsl 0/0/0 local** shows Running FW = System FW. If not, upgrade FW and shut/no shut g0/0/0. Refer to DSL SFP Firmware Upgrade, on page 10
- Ensure carrier-set match (in controller vdsl 0/0/0) configuration with DSLAM
- Restart DSLAM interface if any config changes have been made
- Fine-tune the Power Spectrum Density, Freq Bandplan, profile, operating mode, vlan, etc... on the DSLAM end. On the Router DSL controller end, auto mode is the default and no configuration is required except possibly carrier-set. For example: If DSLAM only supports POTS, recommended to set carrier-set to a43. By default, Cisco allows a43, a43c, b43.
- Ensure the DSLAM profile ONLY includes supported Profiles, bands, etc as per VDSL2/ADSL2/2+ Refer to the tables in DSL Feature Specifications, on page 3.
- When using the service internal command **test vdsl rawcli "basic show summary 1"** consecutively, do you see the status move from Idle/Handshake/Training back to Idle, or stuck in Idle? If former case, recheck DSLAM profile configs. If latter, share L1 debug logs.
- If the DSLAM has the same configuration that used to work, and then after an image upgrade, or new SFP change the controller is UP but no negotiation , then please provide following to Cisco:
  - SFP LED status
  - Capture **show version**, **show running-config**, **show run all | sec controller**, **show interface gigabitethernet 0/0/0**, and **show controller vdsl 0/0/0 local**.
- Possible workaround: After providing logs to Cisco, attempt to write erase and reload the router. Also, shut/no shut the DSLAM interface tied to this device, and unplug/plug SFP and cables again.

Problem: If the controller is Up, but the daemon is Down.

Solution: Try the following:

- Enable debug vdsl for debug, share with Cisco TAC
- Provide last known working configs and software version
- Possible workaround: After providing logs to Cisco, attempt to write erase and reload the router. Also, shut/no shut the DSLAM interface tied to this device, and unplug/plug SFP and cables again.
- Check if the appropriate datak9, securityk9, and network-advantage licenses are enabled on both Peer and Client.

Problem: If Controller is up, profile with DSLAM up in **show controller vdsl 0/0/0**, but Dialer did not acquire IP

Solution: Try the following:

- Check routes
- Check the output of **debug dialer** to see if it offers any information. If dialer idle time is resetting too soon, modify dialer idle-timeout (default is 120s , which ideally should be enough).
  - Ensure there are SW Licenses (datak9, securityk9, and network-advantage) on both PPPoE server and the PPPoE Client/CPE.
  - The following is a basic Dialer configuration that works:

```
interface Dialer1
ip address negotiated
no ip redirects
encapsulation ppp
dialer pool 1
dialer-group 1
no cdp enable
ppp authentication chap callin
ppp chap hostname WORD
ppp chap password 0 WORD
ppp ipcp route default
!
ip route 0.0.0.0 0.0.0.0 Dialer1 (or any route that works in user environment)
```

- Ensure PPPoE Server authentication credentials match PPPoE client
- If using DHCP, ensure the Server has enough addresses to lease out
- Enable debug ppp session and debug ip dhcp server packet detail on the headend/Peer router to debug if we receive any packets. Enable debug ppp session on router.
- If the above steps did not resolve the issue, provide all of the above debug information to Cisco TAC, along with the following:
  - Output of **show version**, **show running**, **show run all | sec controller**, **show controller vdsl 0/0/0** and **show controller vdsl 0/0/0 local**.
  - Output of service internal commands **test vdsl rawcli "basic show summary 1"**, **basic show summary 1**, and **test vdsl option 0x0 6**.
  - Configuration of the DSLAM.
  - L1 training logs. Refer to L1 Training Logs, on page 35.
- Possible workaround: After gathering the above logs in sequence for Cisco, you can try to write erase and reload Peer and Router. Specifically removing the Dialer interface with PPP configurations and reapplying. As a last resort, try to shut/no shut DSLAM interface attached to this Router DSL SFP interface. Additionally, to isolate behavior, validate this SFP on another Router if available. If it works, then validate multiple SFPs on same Router (to narrow down if it is an SFP or Router issue).

Problem: If controller is Up, Dialer is Up, but Dialer did not acquire IP, Authentication works only with PAP and does not work with CHAP.

Solution: Suppose there is a scenario where:

show controller vdsl 0/0/0 shows showtime

show pppoe session shows PPP session established.

Then we see Virtual Access bound with Dialer successfully, but still Dialer didn't acquire an IP with PAP config in dialer all as well, but CHAP would not work On PPPoE Server end, it showed CHAP authentication passed and device ack too, but still IP not acquiring on PPPoE Client/device end.

debug ppp packet showed everything was okay, but still IP not acquiring. In such cases, enable following to monitor: **debug ppp authentication** enabled, we may notice that after successful chap handshake, there was another attempt by our device/client to validate based on local hostname set on Router CLI required to disable, if there is default local hostname set for chap in Router client (or any IOS router):

```
config t
service internal
Int Dialer1
no ppp chap ignoreus
no shut
exit
```

For further information see the Understanding and Configuring PPP CHAP Authentication link:https://www.cisco.com/c/en/us/support/docs/wan/point-to-point-protocol-ppp/25647-understanding-ppp-chap.html

Problem If controller is up, Dialer acquired an IP, but cannot self-ping Dialer or ping PPPoE Server

Solution: Try the following:

- Ensure the appropriate SW licenses (datak9, securityk9, and network-advantage) are enabled on both the PPPoe Server and Client
- Verify if icmp is enabled on PPPoE client session (enable via access list)
- Ensure pap/chap authentication match is seen in **debug pppoe session**.
- show pppoe session should reflect session (virtual-access binding with Dialer)
- For PPPoE session debugging, this section is common to all IOS platforms: https://www.cisco.com/c/en/us/td/docs/routers/ir910/software/release/1_0/configuration/guide/ir910scg/swpppoe.pdf
- Apply Static IP on g0/0/0 DSL interface and check if you can ping the DSLAM and Peer (to isolate DSL SFP issues)
- The following is a Basic PPPoE Server and PPPoE client configuration that works, presuming PPPoE Server is a Cisco IOS device as well:

```
PPPoE Server
ip dhcp excluded-address 41.41.41.1 41.41.41.9
!
ip dhcp pool 41-41-41-pool
network 41.41.41.0 255.255.255.0
default-router 41.41.41.1
```

```
 lease 2
!
username dslpeer password 0 dslpeerpass
!!
bba-group pppoe global
virtual-template 1
!
interface GigabitEthernet0/0/0
no ip address
media-type sfp
!
interface GigabitEthernet0/0/0.1
encapsulation dot1Q 1 native
ip address 41.41.41.1 255.255.255.0
pppoe enable group global
!
interface Virtual-Template1
ip unnumbered GigabitEthernet0/0/0.1
peer default ip address dhcp-pool 41-41-41-pool
ppp authentication pap chap
!
 >>>>>> Add routes as relevant, next hop being the IP that Router Dialer acquires
!
ip route 10.0.0.0 255.255.255.0 41.41.41.3 >> dialer ip, change as necessary

PPPoE Client:
controller VDSL 0/0/0
Carrier-set a43 >>> Can set to whichever [a43, b43, a43c, v43 depending on DSLAM support]
interface GigabitEthernet0/0/0
no ip address
media-type sfp
!
interface GigabitEthernet0/0/0.1
encapsulation dot1Q 1 native
pppoe enable group global
pppoe-client dial-pool-number 1
!
interface Dialer1
ip address negotiated
no ip redirects
encapsulation ppp
dialer pool 1
dialer-group 1
no cdp enable
ppp authentication chap callin
ppp chap hostname dslpeer
ppp chap password 0 dslpeerpass
ppp ipcp route default
!
ip route 0.0.0.0 0.0.0.0 Dialer1
```

Problem: If DSL traffic has been going through for a while, however bandwidth drops in time:

Solution: Try the following:

- Ensure DSLAM profile PSD, Freq band plan configurations are fine-tuned (in such cases, ideally unrelated to Router DSL SFP).
- Ensure ip arp timeout is increased in the Cisco Router DSL interface, Dialer interface - this may specially help in bursty traffic or during congestion.

Note The following commands may be helpful for troubleshooting:

Interface Status:

```
Router#show ip interface brief
Use this command to validate if Dialer acquired an IP address
```

Inventory Status:

```
Router#show inventory

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
INFO: Please use "show license UDI" to get serial number for licensing.
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

NAME: "Chassis", DESCR: "IR1001 Base Chassis"
PID: IR1001-K9 , VID: V03 , SN: FCW23500H5X

NAME: "Module 0 - Mother Board", DESCR: "Cisco IR1001 motherboard"
PID: IR1001-K9 , VID: V03 , SN: FOC23473SRK

NAME: "module subslot 0/0", DESCR: "IR1001-ES-5"
PID: IR1001-ES-5 , VID: V01 , SN:

NAME: "subslot 0/0 transceiver 0", DESCR: "GE T"
PID: SFP-VADSL2+-I , VID: V01 , SN: MET2023000A
Ignore the description, it will always reflect GE T for all ISR Router SFPs
PID and S/N are what matter
```

Commands to display the running software details:

```
Router#show running-config all
Router#dir flash:
Router#dir nvram:
Router#show version
```

There are some debugging commands that will also reflect the status of auto-negotiation:

```
Router#configure terminal
Router#service internal
Router#exit
The following test command will reflect auto-negotiation status:
Router#test vdsl rawcli "basic show summary 1"
Link time Rate US/DS Mode Status Annex TxPkts/RxPkts
4 1097/12491 ADSL2 Showtime AnnexA 0/0
```

Frequently Asked Questions

This section provides answers to some common questions.

Question: How can I set VDSL2 or ADSL2/2+ to a specific Annex and profile in Controller?

Answer: The Router DSL SFP operates in auto mode only. There are no options to configure on the SFP controller end. You can only make changes on the DSLAM side.

Question: There is no Controller ADSL option to configure.

Answer: Controller vdsl 0/0/0 is common nomenclature across Cisco IOS-XE products. The same cli is valid for ALL DSL protocols - VDSL2, ADSL2, ADSL2+.

Question: There is no ATM interface to configure.

Answer: There is no ATM interface for user configuration. On all configuration options on controller vdsl 0/0/0 and DSL SFP WAN interface g0/0/0 and its sub-interface options, ATM packets are handled by the DSL SFP and re-assembled as Ethernet packets. Annex A, L is supported.

Question: The training log in show controller vdsl 0/0/0 is not working. There is no option to start/stop.

Answer: This option is only specific to the c111x platform and not the Router DSL SFP. For Router platform L1 debugging, refer to: L1 Training Logs, on page 35

Question: Where can I download DSL SFP Firmware?

Answer:

Standalone FW is available to upgrade via Flash:,usb0: in IOS To upgrade DSL Firmware, refer to: DSL SFP Firmware Upgrade, on page 10

Question: ADSL2 Annex L is not working.

Answer: Ensure the DSLAM profile configuration has the right bit rate allowed. Since the Router DSL SFP is auto-mode, it will negotiate with the profile with the highest bit rate (so this is predominantly determined by DSLAM config fine-tuning).

Question: Annex-L Mode1 is supported, but not Mode2.

Answer: Ensure that unsupported modes/profiles/bands in DSLAM configuration are disabled. Refer to DSL Feature Specifications, on page 3 for supported specifications.

Question: In ADSL2/2+ if burst size (peak cell rate and sustainable cell rate) are configured to the maximum 5500, dialer keeps flapping.

Answer: If Dialer is flapping, could be receiving Peer upstream and was unable to handle high rate of downstream traffic. Either disable **`ip keepalive`** in dialer configuration, or increase default keepalive to the maximum.

Question: How many PVCs are allowed?

Answer: 8

Question: Controller configurations are not taking effect.

Answer: Ensure you exit out of controller configuration mode for the configuration to take effect. As a workaround, shut/no shut the controller interface. Ideally this should reflected the moment you 'exit' out of controller config mode. Check the DSLAM for matching profile criteria, unsupported bands/profiles should be removed as they may delay the Handshake.

Question: In ADSL2/2+ controller configuration, Maximum Burst Size configuration is not taking affect.

Answer: When configuring either nrt-VBR or rt-VBR, only the configuration of Peak Cell Rate (PCR) and Sustainable Cell Rate (SCR) are supported. The optional Maximum Burst Size (MBS) is not supported.

Question: System hangs during L1 Debug Logs capture, taking very long. show commands are not working.

Answer: When **debug vdsl controller 0/0/0 dump** *internal folder_name* is executed, it drains most of the system resources. A warning syslog to that effect is displayed as well. This takes approximately 10 minutes to complete depending on state of controller. Multiple times during the process the controller is shut/no shut, during this activity do NOT intervene. Once complete, you should observe 'DONE' in syslog and prompted to shut/no shut g0/0/0.

Question: Are there any new SNMP MIBS added?

Answer: Refere the following ADSL2+ MIBS:

- 1.3.6.1.2.1.10.94.1.1.4.1.2 ADSL-LINE MIB:adslAtucChanCurrTxRate
- 1.3.6.1.2.1.10.94.1.1.5.1.2 ADSL-LINE MIB:adslAturChanCurrTxRate
- 1.3.6.1.2.1.10.94.1.1.2.1.8 ADSL-LINE MIB:adslAtucCurrAttainableRate
- 1.3.6.1.2.1.10.94.1.1.3.1.8 ADSL-LINE MIB:adslAturCurrAttainableRate

Question: SFP is stuck in the Router.

Answer: This can occur on older models of the router. There was a faceplate rework.

Follow these steps to ensure the SFP Latch is handled cautiously (as with all SFPs). When doing a hot removal of SFP:

- Remove the latch (hear the click) and tilt to ~ 45deg - 90deg, without pressuring it or forcing it to snap.
- Remove the cable.
- Remove the SFP

Caution When inserting the SFP, make sure you hear it lock in. Insert the cable and then close the latch. You should hear the click again. If you force the latch and it breaks, the SFP will be stuck in the Router. Workaround is to remove the faceplate and remove the SFP.

Controller Status Messages

This section explains some of the key output messages from the **`show controller vdsl 0/0/0`** command.

Refer to the following table:

Output message	Description
Controller VDSL 0/0/0 is UP	State of the controller
Daemon Status: UP	State of internal IOS DSL Daemon
Chip Vendor ID: 'META' 'BDCM'.	SFP Metanoia Chip information
Chip Vendor Specific: 0x0000 0x0762	SFP Metanoia Chip Information burnt in EEPROM programming
Chip Vendor Country: 0xB500 0xB500	SFP Metanoia Chip information
Modem Vendor ID: 'META'	SFP Metanoia Chip information
Modem Vendor Specific: 0x0000 0x0000	SFP Metanoia Chip information
Modem Vendor Country: 0xB500 0x0000	SFP Metanoia Chip information
Serial Number Near: MET2023000A V5311TR 1_62_8463	SFP Metanoia Chip information
Serial Number Far:	SFP Metanoia Chip information, ignore if empty, Serial Number Near is the value required
Modem Version Near: 1_62_8463 MT5311.	Modem Firmware information

Output message	Description
Modem Version Far: <value>	Ignore if empty, the above Near version is what is important
Modem Status: TC Sync (Showtime!)	Shows L1 SFP auto-negotiation status. When SFP is shut/no shut, you see following auto-negotiation sequence: Idle , Handshake, Training, Showtime! Showtime implies auto-neg complete
DSL Config Mode: AUTO	Always in AUTO mode, no specific CLI to configure for ADSL2/2+, VDSL2
Trained Mode: G.992.3 (ADSL2) Annex A	Specifies ITU and Annex type
TC Mode: PTM	Always in Packet Transfer Mode, even for ADSL2/+. The SFP is already translating ATM to Ethernet frames.
SRA: enabled enabled.	Default is enabled
Bit swap: enabled enabled.	Default is enabled

L1 Training Logs

To configure the device perform the following:

```
Router#configure terminal
Router#service internal
Router#logging console
Router#exit
```

To configure debug, perform the following:

```
Router#debug vdsl sfp debug | error | event | info | packet For SFP level debuging
```

```
Router#debug vdsl controller 0/0/0 dump internal {dir} For L1 debugging
```

When the L1 debug dump starts you should see the following:

```
%VDSL_SFP_MGR-5-DUMP_START: Dump internal info started on interface GigabitEthernet0/0/0
```



Important **At this point, the device is unusable. Wait approximately 10 minutes until it completes.**

At that point you should see the following:

```
%VDSL_SFP_MGR-4-DUMP_DONE: Dump internal info done, please shut/no shut on interface
GigabitEthernet0/0/0 to recover
```

To recover the device into normal operational mode, preform the following:

```
Router#configure terminal
Router#interface g0/0/0
Router#shut
```

```
Router#no shut
Router#exit
```

Provide directory logs saved in bootflash: to Cisco.



Note Cisco recommends that each time you start a new log or debug, save it to a new directory rather than append to the existing information.

To enable Metanoia SFP debug commands, perform the following:

```
Router#configure terminal
Router#service internal
Router#exit
Router#test vdsl rawcli "basic show summary 1" This command shows the L1 auto-negotiation
status
Link time Rate US/DS Mode Status Annex TxPkts/RxPkts
773 1089/23628 ADSL2+ Showtime AnnexA 470/338

Router#test vdsl option 6 0x0 If functional, State = 2 should display. This command shows
basic L1 bringup of DSL SFP and it's states. Provide to Cisco for L1 troubleshooting.
Debug flags: 0x8000
Seq 0: slot=0 slot_port=0 bay=0 port=0 Name:MetaMgr0_0_0
MetanoiaPort=0 SFP type: 1 State: 2 cnt=855
MAC:00:00:00:00:00:00 Choice:0
hw interface:GigabitEthernet0/0/0 sw interface:GigabitEthernet0/0/0
Firmware file: /etc/SFP_V5311-T-R_CSP.b, size=491520, version=1_62_8463
SFP version: 1_62_8463
Notification Seq: 0x1 cnt: 0xB3 Stat Cycle:255
VDSL State: 5
EBM Tx: 21039 Rx: 21031
EBM Wait Timeout: 8 Rx Loss: 0
G994 vid CO: BDCM CPE: META
Serial No CO: CPE: MET2023000A V5311TR 1_62_8463
Version CO: CPE: 1_62_8463 MT5311
Capability CO: 000000000001000000 CPE: 000000000001000000
Line Attn: UP: 65535 DOWN: 13
```

Tips for resetting the SFP:

- Ideally g0/0/0 shut/no shut will work in most cases (for example: after firmware upgrade, hot OIR, etc).

For hard reload of SFP, perform the following:

```
Router#hw-module subslot 0/0 reload
```

This option will force the entire subslot to reload, including the software module. So if connectivity is via telnet/ssh you might lose access for 1-2 minutes, and then all messages/syslogs buffered will print out.