Provisioning Optical Amplifier Cards

This chapter describes the optical amplifier cards used in Cisco ONS 15454 dense wavelength division multiplexing (DWDM) networks and related procedures.

For card safety and compliance information, refer to the Regulatory Compliance and Safety Information for Cisco ONS Platforms document.

Optical amplifier card architecture includes an optical plug-in module with a controller that manages optical power, laser current, and temperature control loops. An amplifier also manages communication with the control card and operation, administration, maintenance, and provisioning (OAM&P) functions such as provisioning, controls, and alarms.

Note The cards described in this chapter are supported on the Cisco ONS 15454, Cisco ONS 15454 M6, Cisco ONS 15454 M2 platforms, unless noted otherwise.

Note Unless otherwise specified, “ONS 15454” refers to both ANSI and ETSI shelf assemblies.

Note In this chapter, “RAMAN-CTP” refers to the 15454-M-RAMAN-CTP card. “RAMAN-COP” refers to the 15454-M-RAMAN-COP card.

- Applications of Amplifiers, on page 2
- Card Compatibility, on page 2
- OPT-PRE Amplifier Card, on page 5
- OPT-BST and OPT-BST-E Amplifier Card, on page 6
- OPT-BST-L Amplifier Card, on page 8
- OPT-AMP-L Card, on page 9
- OPT-AMP-17-C Card, on page 10
- OPT-AMP-C Card, on page 12
- OPT-RAMP-C and OPT-RAMP-CE Cards, on page 13
- RAMAN-CTP and RAMAN-COP Cards, on page 15
- OPT-EDFA-17, OPT-EDFA-24, and OPT-EDFA-35 Cards, on page 18

• EDRA-1-xx and EDRA-2-xx Cards, on page 21

Applications of Amplifiers

The following amplifiers can be configured as booster or preamplifiers:

- OPT-AMP-C
- OPT-AMP-17C
- OPT-AMP-L
- OPT-BST-E
- OPT-BST
- OPT-EDFA-17
- OPT-EDFA-24

The amplifier functions as a booster amplifier by default. The amplifier role is automatically configured when the CTP NE update configuration file is loaded in CTC. The amplifier role can also be manually modified.

Note The OPT-BST and OPT-BST-E amplifiers are supported as preamplifiers in sites that are equipped with the OPT-RAMP-C card. In any other configuration, the OPT-BST and OPT-BST-E cards must be configured as a booster amplifier.

For more information about the supported configurations and network topologies, see and

Card Compatibility

The following table lists the Cisco Transport Controller (CTC) software compatibility for each optical amplifier card.

Table 1: Software Release Compatibility for Optical Amplifier Cards

Card Name	R4.5 /R4.6	R4.7/R5.0	R6.0	R7.0/R7.2	R8.0
OPT-PRE	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM
OPT-BST	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM
OPT-BST-E	No	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM
OPT-BST-L	No	No	No	15454-DWDM	15454-DWDM
OPT-AMP-L	No	No	No	15454-DWDM	15454-DWDM
OPT-AMP-17-C	No	No	No	No	15454-DWDM
OPT-AMP-C	No	No	No	No	No

Card Name	R4.5 /R4.6	R4.7/R5.0	R6.0	R7.0/R7.2	R8.0
OPT-RAMP-C	No	No	No	No	No
OPT-RAMP-CE	No	No	No	No	No
RAMAN-CTP	No	No	No	No	No
RAMAN-COP	No	No	No	No	No
OPT-EDFA-17	No	No	No	No	No
OPT-EDFA-24	No	No	No	No	No

Card Name	R8.5	R9.0	R9.1	R9.2/R9.2.1	R9.3 - R9.8	R10.0
OPT-PRE	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM, 15454-M2, 15454-M6	15454-DWDM, 15454-M2, 15454-M6	15454-DWDM, 15454-M2, 15454-M6
OPT-BST	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM, 15454-M2, 15454-M6	15454-DWDM, 15454-M2, 15454-M6	15454-DWDM, 15454-M2, 15454-M6
OPT-BST-E	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM, 15454-M2, 15454-M6	15454-DWDM, 15454-M2, 15454-M6	15454-DWDM, 15454-M2, 15454-M6
OPT-BST-L	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM
OPT-AMP-L	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM
OPT-AMP-17-C	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM, 15454-M2, 15454-M6	15454-DWDM, 15454-M2, 15454-M6	15454-DWDM, 15454-M2, 15454-M6
OPT-AMP-C	15454-DWDM	15454-DWDM	15454-DWDM	15454-DWDM, 15454-M2, 15454-M6	15454-DWDM, 15454-M2, 15454-M6	15454-DWDM, 15454-M2, 15454-M6
OPT-RAMP-C	No	15454-DWDM	15454-DWDM	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6

Card Name	R8.5	R9.0	R9.1	R9.2/R9.2.1	R9.3 - R9.8	R10.0
OPT-RAMP-CE	No	No	15454-DWDM	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6	15454-DWDM, 15454-M6
RAMAN-CTP	No	No	No	No	15454-M2, 15454-M6	15454-M2, 15454-M6
RAMAN-COP	No	No	No	No	15454-M2, 15454-M6	15454-M2, 15454-M6
OPT-EDFA-17	No	No	No	No	15454-DWDM, 15454-M2, 15454-M6	15454-DWDM, 15454-M2, 15454-M6
OPT-EDFA-24	No	No	No	No	15454-DWDM, 15454-M2, 15454-M6	15454-DWDM, 15454-M2, 15454-M6
OPT-EDFA-35	No	No	No	No	No	No
EDRA-1-26	No	No	No	No	No	15454-M6
EDRA-1-35	No	No	No	No	No	15454-M6
EDRA-2-26	No	No	No	No	No	15454-M6

Card Name	R8.5	R9.0	R9.1	R9.2/R9.2.1	R9.3 - R9.8	R10.0
EDRA-2-35	No	No	No	No	No	15454-M6

OPT-PRE Amplifier Card

The OPT-PRE card has reached end of support.

Note For OPT-PRE card safety labels, see Class 1M Laser Product Cards.

The OPT-PRE is a C-band, DWDM, two-stage erbium-doped fiber amplifier (EDFA) with midamplifier loss (MAL) that can be connected to a dispersion compensating unit (DCU). The OPT-PRE is equipped with a built-in variable optical attenuator (VOA) that controls the gain tilt and can also be used to pad the DCU to a reference value. The card is designed to support up to 80 channels at 50-GHz channel spacing. The OPT-PRE card features include:

- Fixed gain mode with programmable tilt
- True variable gain
- Fast transient suppression
- Nondistorting low-frequency transfer function
- Settable maximum output power
- Fixed output power mode (mode used during provisioning)
- MAL for fiber-based DCU
- Amplified spontaneous emissions (ASE) compensation in fixed gain mode
- Full monitoring and alarm handling with settable thresholds
- Four signal photodiodes to monitor the input and output optical power of the two amplifier stages through CTC
- An optical output port for external monitoring

Note The optical splitter has a ratio of 1:99, resulting in about 20 dB-lower power at the MON port than at the COM TX port.

You can install the OPT-PRE card in slots 1 to 6 and 12 to 17 in ONS 15454 M12.

You can install the OPT-PRE card in the following slots.

- Slots 2 and 3 in ONS 15454 M2
- Slots 2 to 7 in ONS 15454 M6

- Slots 2 to 16 in NCS 2015.

For more information about the OPT-PRE Amplifier card, see http://www.cisco.com/en/US/prod/collateral/optical/ps5724/ps2006/product_data_sheet0900aecd800e4d24.html and Card Features.

Related Procedures for OPT-PRE Card

The following is the list of procedures and tasks related to the configuration of the OPT-PRE card:

- NTP-G30 Install the DWDM Cards
- NTP-G34 Install Fiber-Optic Cables on DWDM Cards and DCUs
- NTP-G38 Provision OSC Terminations
- NTP-G37 Run Automatic Node Setup
- NTP-G51 Verify DWDM Node Turn Up
- NTP-G76 Verify Optical Span Loss Using CTC
- NTP-G74 Monitor DWDM Card Performance
- DLP-G140 View Power Statistics for Optical Amplifier, 40-SMR1-C, and 40-SMR2-C Cards
- NTP-G77 Manage Automatic Power Control

OPT-BST and OPT-BST-E Amplifier Card

The OPT-BST card has reached end of support.

Note For OPT-BST and OPT-BST-E cards safety labels, see "Class 1M Laser Product Cards". .

The OPT-BST is designed to ultimately support up to 80 channels at 50-GHz channel spacing. The OPT-BST-E amplifier card is a gain-enhanced version of the OPT-BST card. It is designed to support up to 80 channels at 50-GHz channel spacing. Both the cards are C-band, DWDM EDFA with optical service channel (OSC) add-and-drop capability. When an OPT-BST or an OPT-BST-E is installed, an OSCM card is also needed to process the OSC. The OPT-BST cards features include:

- Fixed gain mode (with programmable tilt)
- Gain range of 5 to 20 dB in constant gain mode and output power mode for an OPT-BST card
- Gain range of 8 to 23 dBm with the tilt managed at 0 dBm in constant gain mode and output power mode for an OPT-BST-E card
- Enhanced gain range of 23 to 26 dBm with unmanaged tilt with OPT-BST-E card
- True variable gain
- Built-in VOA to control gain tilt

- Fast transient suppression
- Nondistorting low-frequency transfer function
- Settable maximum output power
- Fixed output power mode (mode used during provisioning)
- ASE compensation in fixed gain mode
- Full monitoring and alarm handling with settable thresholds
- Optical Safety Remote Interlock (OSRI), a CTC software feature capable of shutting down optical output power or reducing the power to a safe level (automatic power reduction)
- Automatic laser shutdown (ALS), a safety mechanism used in the event of a fiber cut. For information about using the card to implement ALS in a network, see "Network Optical Safety". .

Note The optical splitters each have a ratio of 1:99. The result is that MON TX and MON RX port power is about 20 dB lower than COM TX and COM RX port power.

You can install the OPT-BST and OPT-BST-E cards in slots 1 to 6 and 12 to 17 in ONS 15454 M12.

You can install the OPT-BST and OPT-BST-E cards in the following slots.

- Slots 2 and 3 in ONS 15454 M2
- Slots 2 to 7 in ONS 15454 M6
- Slots 2 to 16 in NCS 2015.

For more information about the OPT-BST and OPT-BST-E Amplifier cards, see http://www.cisco.com/en/US/prod/collateral/optical/ps5724/ps2006/product_data_sheet0900aecd802be30a.html and Card Features.

Related Procedures for OPT-BST and OPT-BST-E Cards

The following is the list of procedures and tasks related to the configuration of the OPT-BST and OPT-BST-E cards:

- NTP-G30 Install the DWDM Cards
- NTP-G34 Install Fiber-Optic Cables on DWDM Cards and DCUs
- NTP-G38 Provision OSC Terminations
- NTP-G37 Run Automatic Node Setup
- NTP-G51 Verify DWDM Node Turn Up
- NTP-G76 Verify Optical Span Loss Using CTC
- NTP-G74 Monitor DWDM Card Performance
- DLP-G140 View Power Statistics for Optical Amplifier, 40-SMR1-C, and 40-SMR2-C Cards

- NTP-G77 Manage Automatic Power Control

OPT-BST-L Amplifier Card

Note For OPT-BST-L safety labels, see "Class 1M Laser Product Cards".

The OPT-BST-L is an L-band, DWDM EDFA with OSC add-and-drop capability. The card is well suited for use in networks that employ dispersion shifted (DS) fiber or SMF-28 single-mode fiber. The OPT-BST-L is designed to ultimately support 64 channels at 50-GHz channel spacing, but in Software R9.0 and earlier it is limited to 32 channels at 100-GHz spacing. When the system has an OPT-BST-L installed, an OSCM card is needed to process the OSC. You can install the OPT-BST-L card in Slots 1 to 6 and 12 to 17 of ONS 15454 M12. The card's features include:

- Fixed gain mode (with programmable tilt)
- Standard gain range of 8 to 20 dB in the programmable gain tilt mode
- True variable gain
- 20 to 27 dB gain range in the uncontrolled gain tilt mode
- Built-in VOA to control gain tilt
- Fast transient suppression
- Nondistorting low-frequency transfer function
- Settable maximum output power
- Fixed output power mode (mode used during provisioning)
- ASE compensation in fixed gain mode
- Full monitoring and alarm handling with settable thresholds
- OSRI
- ALS

Note The optical splitters each have a ratio of 1:99. The result is that MON TX and MON RX port power is about 20 dB lower than COM TX and COM RX port power.

For more information about the OPT-BST-L Amplifier card, see Data Sheet and Card Features.

Related Procedures for OPT-BST-L Card

The following is the list of procedures and tasks related to the configuration of the OPT-BST-L card:

- NTP-G143 Import the Cisco Transport Planner NE Update Configuration File

- NTP-G30 Install the DWDM Cards
- NTP-G34 Install Fiber-Optic Cables on DWDM Cards and DCUs
- NTP-G38 Provision OSC Terminations
- NTP-G37 Run Automatic Node Setup
- NTP-G51 Verify DWDM Node Turn Up
- NTP-G76 Verify Optical Span Loss Using CTC
- NTP-G74 Monitor DWDM Card Performance
- DLP-G140 View Power Statistics for Optical Amplifier, 40-SMR1-C, and 40-SMR2-C Cards
- NTP-G77 Manage Automatic Power Control

OPT-AMP-L Card

Note For OPT-AMP-L card safety labels, see "Class 1M Laser Product Cards"..

The OPT-AMP-L is an L-band, DWDM optical amplifier card consisting of a two-stage EDFA with midstage access loss (MSL) for an external DCU and OSC add-and-drop capability. Using CTC, the card is provisionable as a preamplifier (OPT-PRE) or booster amplifier (OPT-BST), and is well suited for use in networks that employ DS or SMF-28 fiber. The amplifier can operate up to 64 optical transmission channels at 50-GHz channel spacing in the 1570 nm to 1605 nm wavelength range.

When an OPT-AMP-L installed, an OSCM card is needed to process the OSC. You can install the two-slot OPT-AMP-L card in slots 1 to 6 and 12 to 17 of ONS 15454 M12.

The card has the following features:

- Maximum power output of 20 dBm
- True variable gain amplifier with settable range from 12 to 24 dBm in the standard gain range and 24 dBm to 35 dbM with uncontrolled gain tilt
- Built-in VOA to control gain tilt
- Up to 12 dBm MSL for an external DCU
- Fast transient suppression; able to adjust power levels in hundreds of microseconds to avoid bit errors in failure or capacity growth situations
- Nondistorting low frequency transfer function
- Midstage access loss for dispersion compensation unit
- Constant pump current mode (test mode)
- Constant output power mode (used during optical node setup)
- Constant gain mode

- Internal ASE compensation in constant gain mode and in constant output power mode
- Full monitoring and alarm handling capability
- Optical safety support through signal loss detection and alarm at any input port, fast power down control (less than one second), and reduced maximum output power in safe power mode. For information on using the card to implement ALS in a network, see "Network Optical Safety".

Note Before disconnecting any OPT AMP-L fiber for troubleshooting, first make sure the OPT AMP-L card is unplugged.

For more information about the OPT-AMP-L card, see the Data Sheet.

Related Procedures for OPT-AMP-L Card

The following is the list of procedures and tasks related to the configuration of the OPT-AMP-L card:

- NTP-G143 Import the Cisco Transport Planner NE Update Configuration File
- NTP-G30 Install the DWDM Cards
- NTP-G34 Install Fiber-Optic Cables on DWDM Cards and DCUs
- NTP-G38 Provision OSC Terminations
- NTP-G37 Run Automatic Node Setup
- NTP-G51 Verify DWDM Node Turn Up
- NTP-G76 Verify Optical Span Loss Using CTC
- NTP-G74 Monitor DWDM Card Performance
- DLP-G140 View Power Statistics for Optical Amplifier, 40-SMR1-C, and 40-SMR2-C Cards
- NTP-G77 Manage Automatic Power Control
- NTP-G160 Modify OPT-AMP-L, OPT-AMP-17-C, OPT-AMP-C, OPT-RAMP-C, OPT-RAMP-CE, 15454-M-RAMAN-CTP, 15454-M-RAMAN-COP, OPT-EDFA-17, and OPT-EDFA-24 Card Line Settings and PM Thresholds

OPT-AMP-17-C Card

Note For OPT-AMP-17-C safety labels, see "Class 1M Laser Product Cards"..

The OPT-AMP-17-C is a 17-dB gain, C-band, DWDM EDFA amplifier/preamplifier with OSC add-and-drop capability. It supports 80 channels at 50-GHz channel spacing in the C-band (that is, the 1529 nm to 1562.5 nm wavelength range). When the system has an OPT-AMP-17-C installed, an OSCM card is needed to process the OSC.

The card features include:

- Fixed gain mode (no programmable tilt)
- Standard gain range of 14 to 20 dB at startup when configured as a preamplifier
- Standard gain range of 20 to 23 dB in the transient mode when configured as a preamplifier
- Gain range of 14 to 23 dB (with no transient gain range) when configured as a booster amplifier
- True variable gain
- Fast transient suppression
- Nondistorting low-frequency transfer function
- Settable maximum output power
- Fixed output power mode (mode used during provisioning)
- ASE compensation in fixed gain mode
- Full monitoring and alarm handling with settable thresholds
- OSRI
- ALS

You can install the OPT-AMP-17-C card in slots 1 to 6 and 12 to 17 in ONS 15454 M12.

You can install the OPT-AMP-17-C card in the following slots.

- Slots 2 and 3 in ONS 15454 M2
- Slots 2 to 7 in ONS 15454 M6
- Slots 2 to 16 in NCS 2015.

For more information about the OPT-AMP-17-C card, see http://www.cisco.com/en/US/prod/collateral/optical/ps5724/ps2006/product_data_sheet0900aecd800e4d24.html and Card Features.

Related Procedures for OPT-AMP-17-C Card

The following is the list of procedures and tasks related to the configuration of the OPT-AMP-17-C card:

- NTP-G143 Import the Cisco Transport Planner NE Update Configuration File
- NTP-G30 Install the DWDM Cards
- NTP-G34 Install Fiber-Optic Cables on DWDM Cards and DCUs
- NTP-G38 Provision OSC Terminations
- NTP-G37 Run Automatic Node Setup
- NTP-G51 Verify DWDM Node Turn Up
- NTP-G76 Verify Optical Span Loss Using CTC
- NTP-G74 Monitor DWDM Card Performance

- DLP-G140 View Power Statistics for Optical Amplifier, 40-SMR1-C, and 40-SMR2-C Cards
- NTP-G77 Manage Automatic Power Control
- NTP-G160 Modify OPT-AMP-L, OPT-AMP-17-C, OPT-AMP-C, OPT-RAMP-C, OPT-RAMP-CE, 15454-M-RAMAN-CTP, 15454-M-RAMAN-COP, OPT-EDFA-17, and OPT-EDFA-24 Card Line Settings and PM Thresholds

OPT-AMP-C Card

The OPT-AMP-C card is a 20-dB output power, C-band, DWDM EDFA amplifier or preamplifier. It contains midstage access loss for a Dispersion Compensation Unit (DCU). A Variable Optical Attenuator (VOA) is used to control gain tilt. The VOA can also be used to attenuate the signal of the DCU to a reference value. The amplifier module also includes the OSC add (TX direction) and drop (RX direction) optical filters.

The OPT-AMP-C card supports 80 channels at 50-GHz channel spacing in the C-band (that is, the 1529 to 1562.5-nm wavelength range). When the system has an OPT-AMP-C card that is installed, an OSCM card is needed to process the OSC.

The features of the card include:

- Fast transient suppression
- Nondistorting low-frequency transfer function
- Mid-stage access for DCU
- Constant pump current mode (test mode)
- Fixed output power mode
- Constant gain mode
- Amplified spontaneous emissions (ASE) compensation in Constant Gain and Constant Output Power modes
- Programmable tilt
- Full monitoring and alarm handling capability
- Gain range with gain tilt control of 12–24 dB
- Extended gain range (with uncontrolled tilt) of 24–35 dB
- Full monitoring and alarm handling with settable thresholds
- Optical Safety Remote Interlock (OSRI)—Shuts down optical output power or reduces the power to a safe level
- Automatic laser shutdown (ALS)—Safety mechanism used in case of fiber cut

In ONS 15454 M12, slots 2–6 and slots 12–16 are the default slots for provisioning the OPT-AMP-C card as a preamplifier, and slots 1 and 17 are the default slots for provisioning the OPT-AMP-C card as a booster amplifier.

You can install the OPT-AMP-C card in the following slots:

- Slots 2–7 in ONS 15454 M6

For more information about the OPT-AMP-C card, see http://www.cisco.com/en/US/prod/collateral/optical/ps5724/ps2006/prod_data_sheet0900aecd8072b322.html. and Card Features.

Related Procedures for OPT-AMP-C Card

The following is the list of procedures and tasks related to the configuration of the OPT-AMP-C card:

- NTP-G143 Import the Cisco Transport Planner NE Update Configuration File
- NTP-G30 Install the DWDM Cards
- NTP-G34 Install Fiber-Optic Cables on DWDM Cards and DCUs
- NTP-G38 Provision OSC Terminations
- NTP-G37 Run Automatic Node Setup
- NTP-G51 Verify DWDM Node Turn Up
- NTP-G76 Verify Optical Span Loss Using CTC
- NTP-G74 Monitor DWDM Card Performance
- DLP-G140 View Power Statistics for Optical Amplifier, 40-SMR1-C, and 40-SMR2-C Cards
- NTP-G77 Manage Automatic Power Control
- NTP-G160 Modify OPT-AMP-L, OPT-AMP-17-C, OPT-AMP-C, OPT-RAMP-C, OPT-RAMP-CE, 15454-M-RAMAN-CTP, 15454-M-RAMAN-COP, OPT-EDFA-17, and OPT-EDFA-24 Card Line Settings and PM Thresholds

OPT-RAMP-C and OPT-RAMP-CE Cards

Note For OPT-RAMP-C or OPT-RAMP-CE card safety labels, see "Class 1M Laser Product Cards".

The OPT-RAMP-C card is a double-slot card that improves unregenerated sections in long spans using the span fiber to amplify the optical signal. Different wavelengths in C-band receive different gain values. To achieve Raman amplification, two Raman signals (that do not carry any payload or overhead) are required to be transmitted on the optical fiber because the gain generated by one signal is not flat. The energy of these Raman signals transfer to the higher region of the spectrum thereby amplifying the signals transmitted at higher wavelengths. The Raman effect reduces span loss but does not compensate it completely.

When the Raman optical powers are set correctly, a gain profile with limited ripple is achieved. The wavelengths of the Raman signals are not in the C-band of the spectrum (used by MSTP for payload signals). The two Raman wavelengths are fixed and always the same. Due to a limited Raman gain, an EDFA amplifier is embedded into the card to generate a higher total gain. An embedded EDFA gain block provides a first amplification stage, while the mid stage access (MSA) is used for DCU loss compensation.

The OPT-RAMP-CE card is a 20 dBm output power, gain-enhanced version of the OPT-RAMP-C card and is optimized for short spans. The OPT-RAMP-C and OPT-RAMP-CE cards can support up to 80 optical transmission channels at 50-GHz channel spacing over the C-band of the optical spectrum (wavelengths from 1529 nm to 1562.5 nm). To provide a counter-propagating Raman pump into the transmission fiber, the Raman amplifier provides up to 500 mW at the LINE-RX connector. The OPT-RAMP-C or OPT-RAMP-CE card can be installed in Slots 1 to 5 and 12 to 16, and supports all network configurations. However, the OPT-RAMP-C or OPT-RAMP-CE card must be equipped on both endpoints of a span.

The Raman total power and Raman ratio can be configured using CTC. The Raman configuration can be viewed on the Maintenance > Installation tab.

The features of the OPT-RAMP-C and OPT-RAMP-CE card include:

- Raman pump with embedded EDFA gain block
- Raman section: 500 mW total pump power for two pump wavelengths
- EDFA section:
  - OPT-RAMP-C: 16 dB gain and 17 dB output power
  - OPT-RAMP-CE: 11 dB gain and 20 dB output power
- Gain Flattening Filter (GFF) for Raman plus EDFA ripple compensation
- MSA for DC units
- VOA for DC input power control
- Full monitoring of pump, OSC, and signal power
- Fast gain control for transient suppression
- Low-FIT (hardware-managed) optical laser safety
- Hardware output signals for LOS monitoring at input photodiodes
- Optical service channel add and drop filters
- Raman pump back-reflection detector

You can install the OPT-RAMP-C and OPT-RAMP-CE cards in the following slots.

- Slots 2 and 3 in ONS 15454 M2
- Slots 2 to 7 in ONS 15454 M6
- Slots 2 to 7 in Cisco 2015 chassis. These cards upgrade to a new bootcode automatically when they are installed between slots 2 and 7.

  After the bootcode upgrade, the cards can be installed in Slots from 2 to 16 in Cisco NCS 2015 chassis.

For more information about the OPT-RAMP-C and OPT-RAMP-CE cards, see http://www.cisco.com/en/US/prod/collateral/optical/ps5724/ps2006/data_sheet_c78-500925.html. and Card Features.

Related Procedures for OPT-RAMP-C and OPT-RAMP-CE Cards

The following is the list of procedures and tasks related to the configuration of the OPT-RAMP-C and OPT-RAMP-CE cards:

- NTP-G30 Install the DWDM Cards
- NTP-G34 Install Fiber-Optic Cables on DWDM Cards and DCUs
- NTP-G38 Provision OSC Terminations
- NTP-G37 Run Automatic Node Setup
- NTP-G51 Verify DWDM Node Turn Up
- NTP-G201 Configure the Raman Pump on an MSTP Link
- NTP-G76 Verify Optical Span Loss Using CTC
- NTP-G74 Monitor DWDM Card Performance
- DLP-G140 View Power Statistics for Optical Amplifier, 40-SMR1-C, and 40-SMR2-C Cards
- NTP-G77 Manage Automatic Power Control
- NTP-G160 Modify OPT-AMP-L, OPT-AMP-17-C, OPT-AMP-C, OPT-RAMP-C, OPT-RAMP-CE, 15454-M-RAMAN-CTP, 15454-M-RAMAN-COP, OPT-EDFA-17, and OPT-EDFA-24 Card Line Settings and PM Thresholds

RAMAN-CTP and RAMAN-COP Cards

Note The RAMAN-CTP and RAMAN-COP cards are supported in R9.3.02 and later.

Caution LASER ENERGY - EXPOSURE NEAR APERTURE MAY CAUSE BURNS

The single-slot RAMAN-CTP and RAMAN-COP cards support counter and co-propagating Raman amplification on very long unregenerated spans.

The cards manage up to 96 ITU-T 50-GHz spaced channels over the C-band of the optical spectrum (wavelengths from 1528.77 nm to 1566.72 nm). The counter-propagating RAMAN-CTP card is the primary unit. The co-propagating RAMAN-COP card is the secondary unit and can be used only when the counter-propagating unit is present. The RAMAN-CTP card and the RAMAN-COP card must be installed in adjacent slots for Cisco NCS 2000 Series chassis. For example, you can install in Slots 2 and 3, 4 and 5, or 6 and 7 in ONS 15454 M6. However, these adjacent slots must not be used to install two RAMAN-CTP or two RAMAN-COP cards.

The RAMAN-CTP card can be calibrated either manually or using the Automatic Raman Pump Amplification (ARPC) procedure from the Card tab in the Provisioning panel in CTC. When the RAMAN-COP card is used, the RAMAN-CTP card can be calibrated only using the manual option. ARPC is supported only in the NCS Flex package.

The features of the RAMAN-CTP and RAMAN-COP cards include:

- Raman section: 1000 mW total pump power for four pumps and two wavelengths
- Embedded distributed feedback (DFB) laser at 1568.77 nm to be used for optical safety and link continuity (in RAMAN-CTP card only)
- Photodiodes to enable monitoring of Raman pump power
- Photodiodes to enable monitoring of the DFB laser and signal power (in RAMAN-CTP card only)
- Hardware managed automatic laser shutdown (ALS) for optical laser safety
- Hardware output signals for loss of signal (LOS) monitoring at input photodiodes
- Raman pump back reflection detector to check for excessive back reflection

You can install the RAMAN-CTP and RAMAN-COP cards in the following slots.

- Slots 2 and 3 in ONS 15454 M2
- Slots 2 to 7 in ONS 15454 M6
- Slots 2 to 16 in NCS 2015.

Important Notes Regarding Patchcord Installation

Warning Avoid eye or skin exposure to direct or scattered radiation.

- Two E-2000 PS PC to F-3000s SM PC patchcords are shipped with the RAMAN-CTP card.
- One E-2000 PS PC to E-2000 PS PC patchcord is shipped with the RAMAN-COP card.
- Connect the F-3000s SM PC connector to the RAMAN-CTP card before connecting the E2000 PS PC high optical power connector to the card.
- The F-3000s SM PC connector is mechanically and optically compatible with the LC PC connectors and the LC PC mating adapters. If the connectors are clean, the standard connectors and the F-3000s SM PC connectors can be used for optical power of 250 mW and higher.

RAMAN-CTP and RAMAN-COP Cards Power Monitoring

Physical photodiodes P1 through P10 monitor the power for the RAMAN-CTP card.

Table 2: RAMAN-CTP Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P1	DFB in-fiber Output Power	LINE-TX
P2	DWDM RX Input Power	LINE-RX
P3	Pump 1 in-fiber Output Power	LINE-RX
P4	Pump 2 in-fiber Output Power	LINE-RX

Photodiode	CTC Type Name	Calibrated to Port
P5	Total Pump in-fiber Output Power	LINE-RX
P6	Back-Reflected Pump Power	LINE-RX
P7	DWDM TX Input Power	COM-RX
P8	Total Co-Pump in-fiber Output Power	LINE-TX
P9	DFB Input Power	LINE-RX
P10	ASE Input Power	LINE-RX

Physical photodiodes P3 through P6 monitor the power for the RAMAN-COP card.

Table 3: RAMAN-CTP Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
P3	Pump 1 in-fiber Output Power	RAMAN-TX
P4	Pump 2 in-fiber Output Power	RAMAN-TX
P5	Total Pump in-fiber Output Power	RAMAN-TX
P6	Back-Reflected Pump Power	RAMAN-TX

The PM parameters for the power values are listed at Optics and 8b10b PM Parameter Definitions.

For information on the associated TL1 AIDs for the optical power monitoring points, see the “CTC Port Numbers and TL1 Aids” section in Cisco ONS SONET TL1 Command Guide, Release 9.8.

For more information about the RAMAN-CTP and RAMAN-COP cards, see http://www.cisco.com/en/US/prod/collateral/optical/ps5724/ps2006/data_sheet_c78-658538.html and Card Features.

Related Procedures for RAMAN-CTP and RAMAN-COP Cards

Caution During a software upgrade, do not unplug the RAMAN-CTP or RAMAN-COP card fibers or connectors. The ends of unterminated fibers or connectors emit invisible laser radiation.

The following is the list of procedures and tasks related to the configuration of the RAMAN-CTP and RAMAN-COP cards:

- NTP-G30 Install the DWDM Cards
- NTP-G34 Install Fiber-Optic Cables on DWDM Cards and DCUs
- NTP-G38 Provision OSC Terminations
- NTP-G37 Run Automatic Node Setup
- NTP-G51 Verify DWDM Node Turn Up

- NTP-G201 Configure the Raman Pump on an MSTP Link
- NTP-G76 Verify Optical Span Loss Using CTC
- NTP-G74 Monitor DWDM Card Performance
- DLP-G140 View Power Statistics for Optical Amplifier, 40-SMR1-C, and 40-SMR2-C Cards
- NTP-G77 Manage Automatic Power Control
- NTP-G160 Modify OPT-AMP-L, OPT-AMP-17-C, OPT-AMP-C, OPT-RAMP-C, OPT-RAMP-CE, 15454-M-RAMAN-CTP, 15454-M-RAMAN-COP, OPT-EDFA-17, and OPT-EDFA-24 Card Line Settings and PM Thresholds
- NTP-G184 Create a Provisionable Patchcord
- DLP-G690 Configure the Raman Pump Using Manual Day-0 Installation

OPT-EDFA-17, OPT-EDFA-24, and OPT-EDFA-35 Cards

The OPT-EDFA-17, OPT-EDFA-24, and OPT-EDFA-35 cards are C-band DWDM EDFA amplifiers and preamplifiers. The cards are true variable gain amplifiers, offering an optimal equalization of the transmitted optical channels over a wide gain range. They support 96 channels at 50-GHz channel spacing in the C-band (that is, 1528.77 to 1566.72-nm wavelength range). The OPT-EDFA-17 and OPT-EDFA-24 cards deliver 20-dBm output powers and the OPT-EDFA-35 card delivers +23-dBm output power. These cards do not contain mid-stage access loss for a Dispersion Compensation Unit (DCU). The cards provide a noise-figure optimized version of the EDFA amplifiers to cope with new modulation formats like PM-DQPSK, which do not need dispersion compensation. To control gain tilt, a VOA is used. The amplifier module also includes the OSC add (TX direction) and drop (RX direction) optical filters.

The OPT-EDFA-17, and OPT-EDFA-24 cards share the same hardware platform and firmware architecture, but they differ in their operative optical gain range, which is 17 and 24 dB respectively.

The OPT-EDFA-35 card includes two identical amplification sections to serve two fiber directions simultaneously. Each section has a switchable gain range that allows its usage over a wide gain range. The OPT-EDFA-35 card is bidirectional. The card acts on both pairs of fibers entering and exiting from the node.

The OPT-EDFA-35 card has two possible gain ranges: gain range 1 from 12–24, gain range 2 from 20–35. The card also has extended gain range up to 40 dB without tilt control.

The OPT-EDFA-35 card is managed in a similar way as the OPT-EDFA-17 and OPT-EDFA-24 cards. For each EDFA unit inside the OPT-EDFA-35 card, the following settings are allowed:

- Configuration of PRE or BST role
- Configuration of Constant Gain working mode
- Configuration of Gain Range

The main functionalities of the OPT-EDFA-17, OPT-EDFA-24, and OPT-EDFA-35 cards are:

- (OPT-EDFA-17 and OPT-EDFA-24) Amplification of the input signal at the COM-RX port toward the LINE-TX port through a true-variable gain EDFA block.

  (OPT-EDFA-35) Two EDFA amplifier units embedded into the card, amplification of the input signal at the LINE-1-RX port toward the LINE-2-TX port through a true-variable gain EDFA-2 block, and

amplification of the input signal at the LINE-2-RX port toward the LINE-1-TX port through a true-variable gain EDFA-1 block.

- Multiplexing the OSC to the LINE-TX port
- Demultiplexing the OSC from the LINE-RX port
- Monitoring of the LINE input or output signal with 1% TAP splitters

The features of the OPT-EDFA-17, OPT-EDFA-24, and OPT-EDFA-35 cards are:

- Embedded Gain Flattening Filter
- Constant pump current mode (test mode)
- Constant output power mode
- Constant gain mode
- Nondistorting low-frequency transfer function
- ASE compensation in Constant Gain and Constant Output Power modes
- Fast transient suppression
- Programmable tilt
- Full monitoring and alarm handling capability
- Gain range with gain tilt control of 5–17 dB (for OPT-EDFA-17 card) , 12 to 24 dB and 20 to 35 dB (for OPT-EDFA-35 card), and 12–24 dB (for OPT-EDFA-24 card).
- Extended gain range (with uncontrolled tilt) of 17–20 dB (for OPT-EDFA-17 card) , (for OPT-EDFA-35 card) of upto 27dB (for Gain Range1) and 40dB (for Gain Range2), and 24–27 dB (for OPT-EDFA-24 card).
- Optical Safety Remote Interlock (OSRI)
- Automatic Laser Shutdown (ALS)

You can install the OPT-EDFA-17 and OPT-EDFA-24 cards in slots 1–6 and 12–17 in ONS 15454 M12.

You can install the OPT-EDFA-17, OPT-EDFA-24, and OPT-EDFA-35 cards in the following slots:

- Slots 2–7 in ONS 15454 M6
- Slots 2–16 in NCS 2015

Power Monitoring of OPT-EDFA-17, OPT-EDFA-24, and OPT-EDFA-35 Cards

Physical photodiodes PD1 through PD6 monitor the power for the OPT-EDFA-17 and OPT-EDFA-24 cards.

Table 4: Port Calibration of OPT-EDFA-17 and OPT-EDFA-24 Cards

Photodiode	Calibrated to Port
PD1	COM-RX

Photodiode	Calibrated to Port
PD2	LINE-TX
PD3	LINE-TX
PD4	OSC-RX
PD5	LINE-RX
PD6	LINE-RX

Physical photodiodes PD1 through PD8 monitor the power for the OPT-EDFA-35 card.

Table 5: Port Calibration of OPT-EDFA-35 Card

Photodiode	Calibrated to Port
PD1	LINE-2-RX
PD2	LINE-1-TX
PD3	LINE-1-RX
PD4	LINE-2-TX
PD5	OSC-2-RX
PD6	OSC-2-TX
PD7	OSC-1-TX
PD8	OSC-1-RX

Related Procedures for OPT-EDFA-17, OPT-EDFA-24, and OPT-EDFA-35 Cards

The list of procedures and tasks related to the configuration of the OPT-EDFA-17, OPT-EDFA-24, and OPT-EFDA-35 cards are:

- NTP-G143 Import the Cisco Transport Planner NE Update Configuration File
- NTP-G30 Install the DWDM Cards
- NTP-G31 Install the DWDM Dispersion Compensating Units
- NTP-G34 Install Fiber-Optic Cables on DWDM Cards and DCUs
- NTP-G38 Provision OSC Terminations
- NTP-G37 Run Automatic Node Setup
- NTP-G51 Verify DWDM Node Turn Up
- NTP-G76 Verify Optical Span Loss Using CTC
- NTP-G74 Monitor DWDM Card Performance

- DLP-G140 View Power Statistics for Optical Amplifier, 40-SMR1-C, and 40-SMR2-C Cards
- NTP-G77 Manage Automatic Power Control
- NTP-G160 Modify OPT-AMP-L, OPT-AMP-17-C, OPT-AMP-C, OPT-RAMP-C, OPT-RAMP-CE, 15454-M-RAMAN-CTP, 15454-M-RAMAN-COP, OPT-EDFA-17, OPT-EDFA-24, and OPT-EDFA-35 Card Line Settings and PM Thresholds
- NTP-G107 Remove Permanently or Remove and Replace DWDM Cards

EDRA-1-xx and EDRA-2-xx Cards

(Cisco ONS 15454 M6)

Note For EDRA-1-xx and EDRA-2-xx card safety labels, see the section, Class 1M Laser Product Cards.

The double-slot EDRA-1-xx and EDRA-2-xx cards are erbium-doped Raman amplifiers that support Raman amplification on long unregenerated spans.

The cards manage up to 96 ITU-T 50 GHz spaced channels over the C-band of the optical spectrum (wavelengths from 1528.77 nm to 1566.72 nm). You can install the EDRA-1-xx and EDRA-2-xx cards in the lowest slots to allow high output power. The power output is limited to 21dBm when the cards are inserted in any slot. The OSC pluggable used with the cards is ONS-SC-OSC-18.0=.

The cards can be used in point-to-point, ring, multi-ring, or mesh topologies and are supported on flexible nodes in these node configurations:

- Optical line amplifier nodes
- Terminal nodes
- Dynamic gain equaliser nodes

Apart from these node configurations having only EDRA cards as amplifiers, the system also supports hybrid configurations with OPT-EDFA-17, OPT-EDFA-24, RAMAN-CTP, and RAMAN-COP cards. These cards support span loss and gain values that are not supported in EDRA cards.

- For gain less than 15dB, OPT-EDFA-17 or OPT-EDFA-24 must be used.
- For gain greater than 35dB, RAMAN-CTP, RAMAN-COP, OPT-EDFA-17 or OPT-EDFA-24 must be used.

Note The EDRA-1-xx and EDRA-2-xx cards are not compatible with 15454 -M6-FTA= fan tray assembly. The cards are compatible only with 15454 -M6-FTA2 fan tray assembly or a subsequent fan tray assembly release.

You can install the EDRA-1-xx and EDRA-2-xx cards in the following slots.

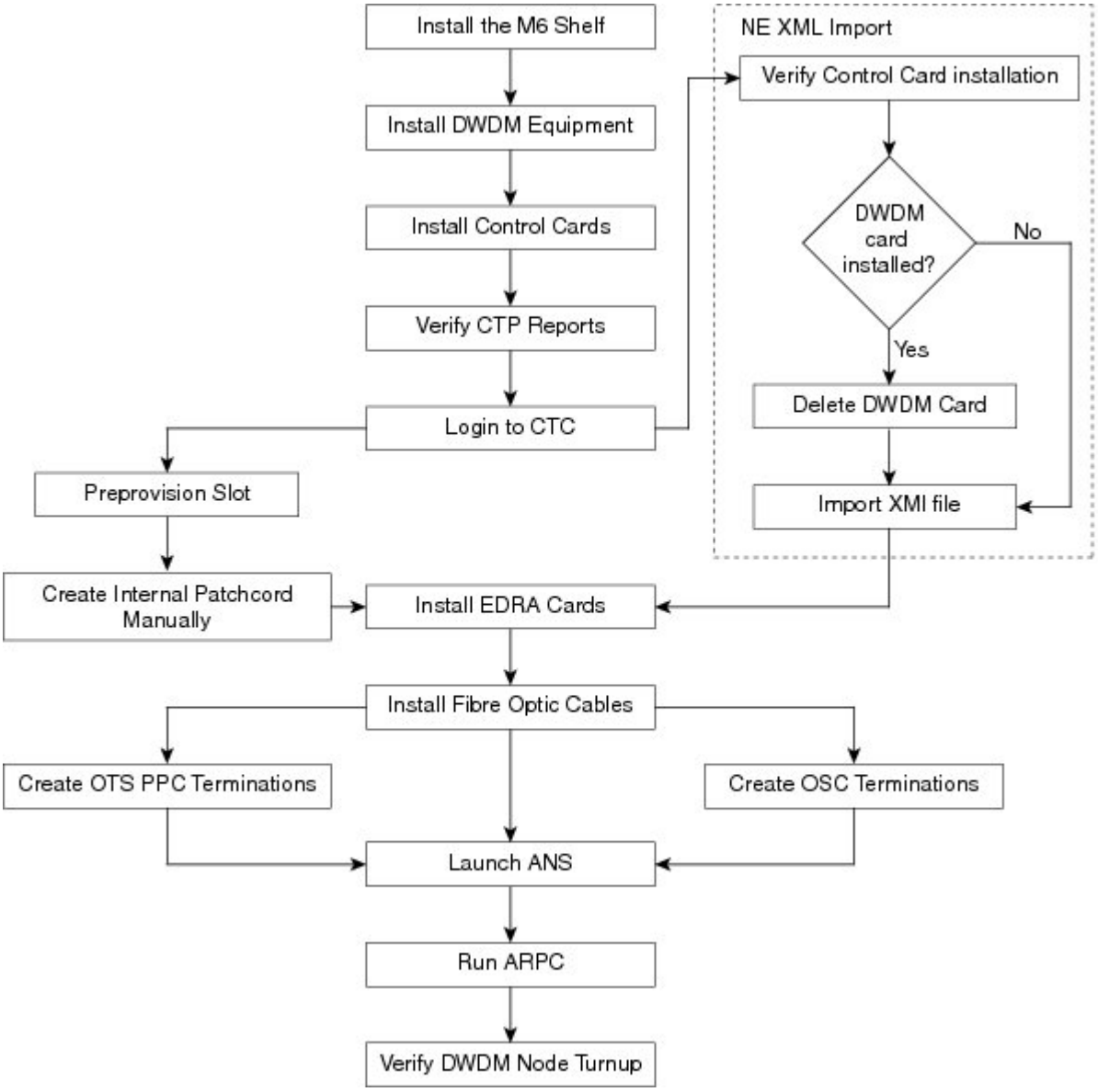
- Slots 2 to 7 in ONS 15454 M6
- Slots 2 to 16 in NCS 2015.

For more information about the EDRA-1-xx and EDRA-2-xx cards, see http://www.cisco.com/en/US/solutions/collateral/ns340/ns394/ns398/ns406/data_sheet_c78-729313.html.

EDRA Workflow Diagram

This figure shows the workflow diagram of the EDRA card. The diagram depicts the tasks required to configure the EDRA card.

Figure 1: EDRA Card Workflow Diagram



EDRA-1-xx and EDRA-2-xx Cards Power Monitoring

The following table lists the physical photodiodes that monitor the power for the EDRA-1-xx and EDRA-2-xx cards.

Table 6: EDRA-1-xx and EDRA-2-xx Port Calibration

Photodiode	CTC Type Name	Calibrated to Port
PD1	Remnant Pump Input power	LINE-TX
PD2	OSC Add Input Power	OSC-RX
PD3	EDFA1 Input Power	LINE-RX
PD4	EDFA1 Output Power	COM-TX
PD5	EDFA2 Input Power	COM-RX
PD6	EDFA2/LINE-TX Output Power	LINE-TX
PD7	OSC Drop Output Power	LINE-TX
PD11	Pump λ1 in-fibre Output Power	LINE-RX
PD12	Pump λ2 in-fibre Output Power	LINE-RX
PD13	Pump λ3 in-fibre Output Power	LINE-RX
PD14	Pump λ4 in-fibre Output Power	LINE-RX
PD15	Total Pump in-fibre Output Power	LINE-RX
PD16	Back-Reflected Pump Power	LINE-RX
PD17	OTDR2-L Input Power	OTDR2-L-RX

The PM parameters for the power values are listed at Optics and 8b10b PM Parameter Definitions.

For information on the associated TL1 AIDs for the optical power monitoring points, see the “CTC Port Numbers and TL1 Aids” section in *Cisco NCS 2000 Series TL1 Command Guide*.

Related Procedures for EDRA-1-xx and EDRA-2-xx Cards

The list of procedures and tasks related to the configuration of the EDRA-1-xx and EDRA-2-xx cards are:

- NTP-G30 Install the DWDM Cards
- NTP-G34 Install Fiber-Optic Cables on DWDM Cards and DCUs
- NTP-G38 Provision OSC Terminations
- NTP-G37 Run Automatic Node Setup
- NTP-G51 Verify DWDM Node Turn Up

- NTP-G76 Verify Optical Span Loss Using CTC
- NTP-G74 Monitor DWDM Card Performance
- DLP-G140 View Power Statistics for Optical Amplifier, 40-SMR1-C, and 40-SMR2-C Cards
- NTP-G77 Manage Automatic Power Control
- NTP-G160 Modify OPT-AMP-L, OPT-AMP-17-C, OPT-AMP-C, OPT-RAMP-C, OPT-RAMP-CE, 15454-M-RAMAN-CTP, 15454-M-RAMAN-COP, OPT-EDFA-17, and OPT-EDFA-24 Card Line Settings and PM Thresholds
- NTP-G184 Create a Provisionable Patchcord