

# Enhanced C-Band 96-Channel EDFA Amplifiers for the Cisco ONS 15454 MSTP

## Product Overview

The Cisco® ONS 15454 Multiservice Transport Platform (MSTP) offers enhanced optical amplifiers for extending the reach of a metro, regional, or long-haul network. The optical amplifier cards are part of the Cisco ONS 15454 MSTP intelligent dense wavelength-division multiplexing (DWDM) architecture engineered to reduce DWDM complexity and speed the deployment of next-generation networking solutions.

The Cisco ONS 15454 Enhanced C-Band 96 Channel Amplifier card (Figure 1) is a plug-in module that takes advantage of the proven Cisco ONS 15454 carrier-class features. It delivers the reach and optical performances to support a single DWDM channel all the way to 96 channels today, to meet the requirements of service provider and enterprise networks. Table 1 outlines the enhanced C-band optical amplifier plug-in card types available for the Cisco ONS 15454 MSTP with the applications they are designed to support.

**Figure 1.** Enhanced C-Band 96-Channel EDFA Amplifier for Cisco ONS 15454 MSTP



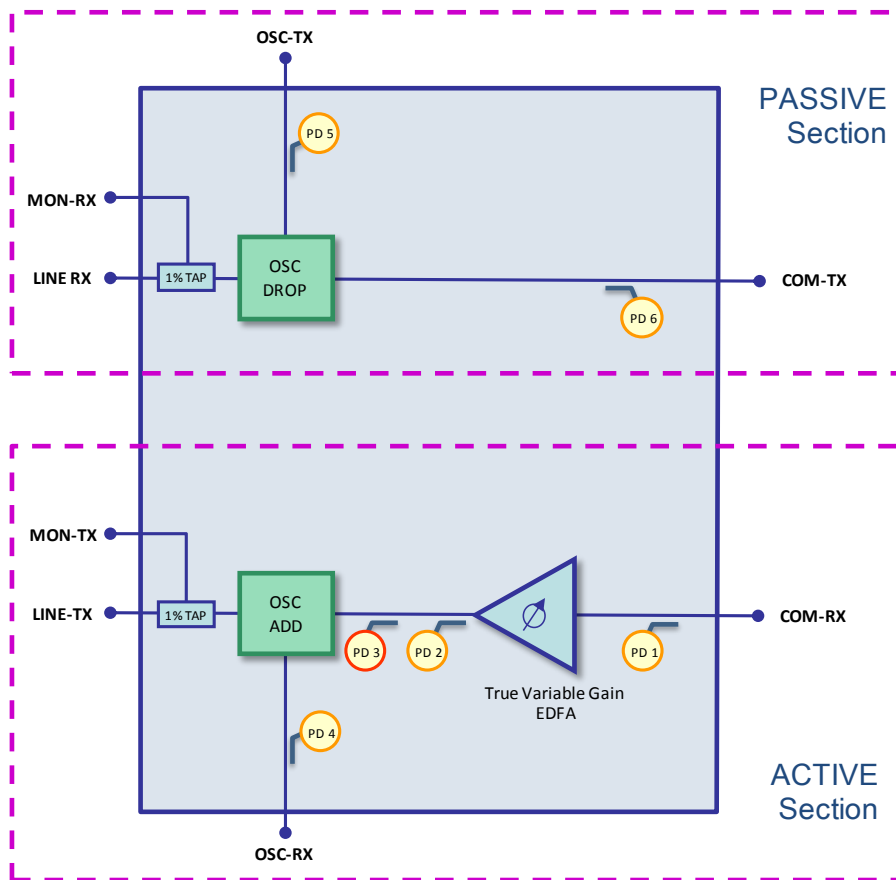
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## Features and Benefits

The Cisco True Variable Gain Booster Amplifiers, with maximum 17- and 24-dB gain are high-power enhanced amplifiers suited for the needs of a next generation of optical networks. The coherent detection technology and a new modulation format like the PM-DQPSK modulation scheme employed in 40- and 100-Gbps transponder units of the recent high-capacity optical networks eliminate the need for dispersion compensation. The noise figure of these erbium-doped fiber amplifiers (EDFAs) is thus optimized by having a single amplification stage with no need for a lossy midstage access to provision dispersion-compensating units. Looking forward, the channel capacity is expected to grow beyond the current 80 channels to a 96-channel total. These amplifiers can also support the amplification of up to 96 channels in the C-band of the spectrum – 50-GHz-spaced ITU grid (wavelength range from 1528.77 to 1566.72 nm).

The 17- and 24-dB amplifiers take advantage of the latest in amplifier technology, variable optical attenuators, photo diodes, and extensive software to facilitate a high degree of automation for simplified operations. They feature a low-noise-gain block for C-band optical amplification requirements with an embedded gain-flattening filter. For flexibility of application support, the amplifiers support two modes of operation – constant gain and constant power – while also providing Amplified Spontaneous Emission (ASE) compensation in either modes. They also provide fast-transient suppression to respond quickly to network changes without adding impairments and degradation. Both cards allow a programmable tilt and possess a non-distorting low-frequency transfer function. Each card integrates software-controllable variable optical attenuators (VOAs) along with extensive optical monitoring with photo diodes, to provide nodal- and network-based automatic power-level management. Extensive optical safety algorithms provide user safety when operating the network. The optical amplifier cards incorporate faceplate-mounted LEDs to provide a quick visual check of the operational status at the card. Printed on each of the faceplates is an icon, an orange circle, which corresponds to shelf-slot icons located on the shelf assembly; it indicates the shelf slot where the cards can be inserted. The cards are supported by the integrated Cisco Transport Controller, a craft manager, which provides the user access for operations, administration, maintenance, and provisioning (OAM&P) for the system. Figure 2 depicts the functional block diagram of both amplifiers.

**Figure 2.** Functional Block Diagram (OPT-EDFA-17 and OPT-EDFA-24)



**Table 1.** Enhanced C-Band 96-Channel EDFA Amplifier Cards with Applications

Component	Deployment Application
Cisco True Variable Gain Booster Amplifier with maximum 17-dB gain (15454-OPT-EDFA-17)	You can use this flexible amplifier as a preamplifier or as a booster amplifier, providing a total output power of 20 dBm and maximum gain of 17 dB. It integrates an optical service channel splitter or combiner to allow the optical supervisory channel (OSC) to be sent to and received from the optical service channel module (OSCM) card or the OSC signal from the OSC pluggable associated with the Transport Node Controller (TNC) card. Deployment locations include any site where high per-channel power is required to enter the fiber span.
Cisco True Variable Gain Booster Amplifier with maximum 24-dB gain (15454-OPT-EDFA-24)	You can use this flexible amplifier as a preamplifier or as a booster amplifier, providing a total output power of 20 dBm and maximum gain of 24 dB. It integrates an optical service channel splitter or combiner to allow the OSC to be sent to and received from the OSCM card or the OSC signal from the OSC pluggable associated with the Transport Node Controller (TNC) card. Deployment locations include any site where high per-channel power is required to hit the fiber span.

## Product Specifications

Tables 2 through 7 give the specifications for the Cisco ONS 15454 Enhanced C-Band 96-Channel EDFA Optical Amplifiers.

**Table 2.** Regulatory Compliance

ANSI (SONET) System	ETSI (SDH) System
<b>Countries Supported</b>	
<ul style="list-style-type: none"> <li>• Canada</li> <li>• United States</li> <li>• Korea</li> </ul>	<ul style="list-style-type: none"> <li>• Europe</li> <li>• Latin America</li> <li>• Japan</li> <li>• Asia Pacific</li> <li>• Middle East and Africa</li> </ul>
<b>EMC (Class A)</b>	
<ul style="list-style-type: none"> <li>• ICES-003 Issue 4 (2004)</li> <li>• GR-1089-CORE, Issue 4 (Type 2 and Type 4 equipment)</li> <li>• GR-1089-CORE – Issue 03 (Oct 2002) (Objective O3-2 – Section 3.2.1 – Radiated Emissions requirements with all doors open)</li> <li>• FCC 47CFR15, Class A subpart B (2006)</li> </ul>	<ul style="list-style-type: none"> <li>• EN 300 386 v1.3.3 (2005) and v1.4.1 (2007)</li> <li>• CISPR 22 – Fifth edition (2005-04) Class A and the amendment 1 (2005-07)</li> <li>• CISPR 24 – First edition (1997-09) and amendment 1 (2001-07) and amendment 2 (2002-10).</li> <li>• EN 55022:1998 Class A – CENELEC Amendment A2:2003</li> <li>• EN 55024:1998 – CENELEC Amendment A1:2001 and Amendment A2:2003</li> <li>• Resolution 237 (Brazil)</li> <li>• VCCI V-3/2006.04</li> <li>• EN 61000-6-1:2001</li> <li>• EN 61000-6-2:1999</li> </ul>
<b>Safety</b>	
<ul style="list-style-type: none"> <li>• UL/CSA 60950 -1 First Edition (2003)</li> <li>• GR-1089-CORE, Issue 4 (Type 2 and Type 4 equipment)</li> </ul>	<ul style="list-style-type: none"> <li>• UL/CSA 60950 -1 First Edition (2003)</li> <li>• IEC 60950-1 (2001/10)/Amendment 11:2004 to EN 60950-1:2001, 1st Edition (with all country deviations)</li> </ul>
<b>Laser</b>	
<ul style="list-style-type: none"> <li>• UL/CSA 60950 -1 First Edition (2003)</li> <li>• IEC 60950 -1 (2001-01) First Edition/EN60950 -1 (2001), First Edition</li> <li>• IEC 60825-2 (2004-06 ) Third Edition</li> <li>• IEC 60825-1 +Am.1+ Am.2 (2001)</li> <li>• CDRH (Accession letter and report)</li> </ul>	
<b>Environmental</b>	
<ul style="list-style-type: none"> <li>• GR-63-CORE, Issue 3 (2006)</li> </ul>	<ul style="list-style-type: none"> <li>• ETS 300-019-2-1 V2.1.2 (Storage, Class 1.1)</li> <li>• ETS 300-019-2-2 V2.1.2 (Transportation, Class 2.3)</li> <li>• ETS 300-019-2-3 V2.1.2 (Operational, Class 3.1E)</li> <li>• EU WEEE regulation</li> <li>• EU RoHS regulation</li> </ul>
<b>Optical Safety</b>	
<ul style="list-style-type: none"> <li>• EN or IEC-60825-2 Third edition (2004-06)</li> <li>• EN or IEC 60825-1 Consol. Ed. 1.2 – incl. am1+am2 (2001-08)</li> <li>• 21CFR1040 (2004/04) (Accession Letter and CDRH Report)</li> <li>• IEC-60825-2 Third edition (2004-06)</li> <li>• ITU-T G.664 (2006)</li> </ul>	

ANSI (SONET) System	ETSI (SDH) System
<b>Miscellaneous</b>	
<ul style="list-style-type: none"> <li>• Acoustic noise <ul style="list-style-type: none"> <li>◦ GR-63-CORE, Issue 3 (2006)</li> <li>◦ ETS 300 753 ed.1 (1997-10)</li> </ul> </li> <li>• Rain, sand, dust, and moisture proofing <ul style="list-style-type: none"> <li>◦ AS 1939-1990, 4.2, IP 53</li> </ul> </li> <li>• Mechanical shock and bumps <ul style="list-style-type: none"> <li>◦ AS1099- 2.27</li> </ul> </li> <li>• Customer-specific requirements <ul style="list-style-type: none"> <li>◦ AT&amp;T Network Equipment Development Standards (NEDS) Generic Requirements, AT&amp;T 802-900-260</li> <li>◦ SBC TP76200MP</li> <li>◦ Verizon SIT.NEBS.NPI.2002.010</li> </ul> </li> </ul>	

**Table 3.** System Requirements

Component	ANSI (SONET) System	ETSI (SDH) System
Processor	TCC2P, TCC2, TCC3, TNC, TSC, TNC-E, TSC-E	TCC2P, TCC2, TCC3, TNC, TSC, TNC-E, TSC-E
Shelf assembly	15454-SA-HD or 15454-SA-HD-DDR or 15454-M6-SA or 15454-M2-SA shelf assembly with CC-FTA or 15454-M6-FTA or 15454-M2-FTA version fan-tray assembly	15454E-SA-ETSI or 15454-M6-SA or 15454-M2-SA shelf assembly with CC-FTA or 15454-M6-FTA or 15454-M2-FTA version fan-tray assembly
System software	Release 9.3 ANSI or later	Release 9.3 ETSI or later
Slot compatibility	1 to 6 or 12 to 17 in Cisco ONS 15454 shelf (M12), 2 to 7 in Cisco ONS 15454 M6 and slots 2 and 3 in Cisco ONS 15454 M2	1 to 6 or 12 to 17 in Cisco ONS 15454 shelf (M12), 2 to 7 in Cisco ONS 15454 M6 and slots 2 and 3 in Cisco ONS 15454 M2

**Table 4.** Card Specifications

Specification	Value
<b>Management</b>	
Card LEDs <ul style="list-style-type: none"> <li>• Failure (FAIL)</li> <li>• Active/standby (ACT/STBY)</li> <li>• Signal fail (SF)</li> </ul>	Red Green/Yellow Yellow
<b>General Specifications</b>	
General power drawn <ul style="list-style-type: none"> <li>• Typical</li> <li>• Maximum</li> </ul>	40W 50W
Weight (not including clam shell)	2 kg (4.41 lb)
Optical connectors	LC
Size	1 slot
<b>Reliability</b>	
Predicted mean time between failure (MTBF)	147,018 hr
<b>Operating Environment</b>	
Temperature	32 to 113°F (0 to 45°C)
Humidity	5 to 95 % noncondensing
<b>Storage Environment</b>	
Temperature	–40 to 158°F (–40 to 70°C)
Humidity	5 to 95% noncondensing
<b>Transport Environment</b>	
Temperature	–40 to 158°F (–40 to 70°C)
Humidity	5 to 95% noncondensing

**Table 5.** Optical Amplifier Specifications

Specification	17-dB Amplifier (15454-OPT-EDFA-17)	24-dB Amplifier (15454-OPT-EDFA-24)
Input power range ( $P_{IN}$ )	Single channel at $-5$ -dBm output power: $-25$ to $-10$ dBm	Single channel at $-5$ -dBm output power: $-32$ to $-17$ dBm
Full-channel load or single-channel load	Full-channel load at 20-dBm output power: 0 to 15 dBm	Full-channel load at 20-dBm output power: $-7$ to 8 dBm
Output power range	$-5$ to 20 dBm	$-5$ to 20 dBm
Output power shut-off threshold	20.5 dBm	20.5 dBm
Standard gain range (with controlled gain tilt)	5 to 17 dB	12 to 24 dB
Extended gain range (with uncontrolled gain tilt)	17 to 20 dB	24 to 27 dB
Transient suppression	Refer to Table 7	Refer to Table 7

**Table 6.** Common Optical Amplifier Specifications

Specification	Value
Gain ripple at target gain tilt = 0 dB	Single amplifier: 0.5 to 1.2 dB Six amplifiers in cascade: Up to 4 dB
Gain tilt error at target gain tilt = 0 dB	$\pm 0.5$ dB
Gain set resolution (constant gain mode)	0.1 dB
Output power set resolution (constant power mode)	0.1 dB
Gain and power regulation settling time (from 10 to 90% of final set point)	5 ms to 1 sec
Short-term stability: Gain, output power, and gain tilt	$\pm 0.1$ , $\pm 0.1$ , and $\pm 0.1$ dB
Maximum output power in amplifier-disable mode	$-15$ dBm
Input reflectance	40 dB
Output reflectance	40 dB
Backward ASE power	$-25$ dB
Pump-power leakage	$-20$ dB
Polarization-dependant gain (maximum)	0.2 dB
Polarization-mode dispersion (maximum)	0.5 ps
Polarization-dependant loss (maximum)	0.2 dB
OSC filter operating bandwidth	1500 to 1520 nm
Channels filter operating bandwidth	1528 to 1570 nm
Total number of channels supported	96 channels; 50-GHz-spaced
Insertion loss of OSC filter <ul style="list-style-type: none"> <li>Drop channel (maximum)</li> <li>Drop OSC (maximum)</li> <li>Add OSC (maximum)</li> </ul>	1 dB 1.8 dB 1.8 dB

**Table 7.** Transient Suppression Specifications

Input Power Excursion	Under- and Overshoot		Settling Time	
	Maximum	Typical	Maximum	Typical
15 dB	3 dB	0.5 dB	1000 microsec	500 microsec
6 dB	2 dB	0.5 dB	800 microsec	210 microsec
3 dB	1.5 dB	0.5 dB	500 microsec	190 microsec

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## Warranty Information

Warranty information is available on Cisco.com at the [Product Warranties](#) page.

## Ordering Information

To place an order, visit the [Cisco Ordering Home Page](#) and refer to Table 8. To download software, visit the [Cisco Software Center](#).

**Table 8.** Ordering Information

Part Number	Description
15454-OPT-EDFA-17=	Enhanced C-band 96 channel EDFA amplifier 17 dB max gain, 50 GHz compatible, LC connector
15454-OPT-EDFA-24=	Enhanced C-band 96 channel EDFA amplifier 24 dB max gain, 50 GHz compatible, LC connector



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**Americas Headquarters**  
Cisco Systems, Inc.  
San Jose, CA

**Asia Pacific Headquarters**  
Cisco Systems (USA) Pte. Ltd.  
Singapore

**Europe Headquarters**  
Cisco Systems International BV Amsterdam,  
The Netherlands

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