

OTS-1L1, OTS-1LC

# Optiva™ L-band Transmission System Installations Manual



# Table of Contents

- General .....3**
  - Interface and Controls ..... 4
  - Transmitter ..... 4
  - Receiver ..... 5
- Installation.....6**
- Operation.....6**
  - Peak Signal Optimizer Gain Control Mode (PEAK)(TX) ..... 6
  - Smart Gain Control Mode (SGC)(TX)..... 7
  - Manual Gain Control Mode (MGC)(TX) ..... 7
  - LED Indicator Tables & Diagram ..... 7
- Remote Monitoring .....8**
  - Simple Network Management Protocol (SNMP)..... 8
- Specifications.....10**
- Ordering Information .....12**
- Optics Handling & Safety .....13**
- Warranty .....14**

**EMCORE** Corporation offers a broad portfolio of compound semiconductor-based components and systems for the broadband, fiber optic, satellite communication, defense and solar power markets. EMCORE has two primary operating segments: Fiber Optics and Photovoltaics. The company’s integrated solutions philosophy embodies state-of-the-art technology, material science expertise, and a shared vision of our customer’s goals and objectives to be leaders in fiber optics and photovoltaics.

EMCORE’s solutions include: optical components and subsystems for fiber-to-the-premise, cable television, high speed data and telecommunication networks; defense photonics products for commercial and military applications including lasers, modulators, spectrometers, sensors, fiber gyro components and diagnostic instruments; solar cells, solar panels, and fiber optic ground station links for global satellite communications.



## General

- 50 to 3000 MHz optimized for IF-, L- and S-band satellite signals
- Supports 20 km links
- 30 dB adjustable gain range for perfect level match for signal distribution
- Peak optimizer for quick/easy setup, SmartGain™ optimizes for consistent performance over a wide input range
- High-dynamic-range, optically-isolated DFB lasers
- Smart RF gain control (SGC) optimizes for consistent performance over a wide input range
- Manual gain control (MGC) override
- 50 & 75 Ohm BNC or 50 Ohm SMA
- Multiple monitoring and control options provide for panel LED, SMA & SNMP
- SNMP monitoring and control
- LNB Power
  - Fits in Optiva™ enclosures which support daisy chain® video, audio and data links
- Hot swap redundant power supplies virtually eliminate downtime
- 16, 6, 2, & 1 slot enclosures available



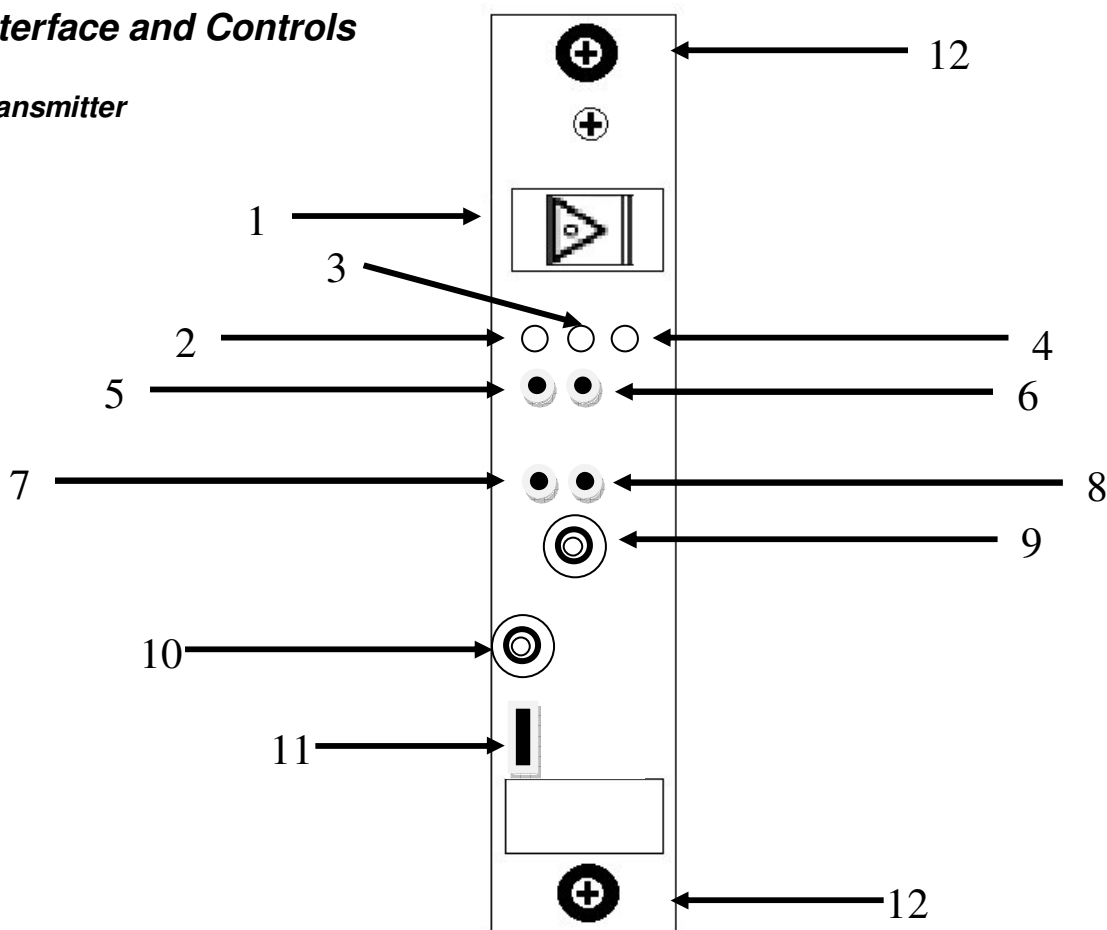
Optiva™ L-band fiber optic intra-facility links are a high-performance, cost-effective alternative to coaxial cable. They provide much longer transmission distances than copper cables, which simplify network design, ease installation and even enhance immunity from EMI, RFI and lightning. These transmitters and receivers take the best RF design features of Emcore's extensive families of products and combine them into a compact package compatible with the Optiva™ family of OT-CC and OT-DTCR enclosures.

The Optiva™ family's wide range of RF, video, audio and data transport products include a unique data bus design that provides a higher level of monitoring and control with a single chassis mix and match flexibility. The final result is a chassis system that can be factory or user custom configured to meet a wide range of fiber transport applications.

All units come as an insert card version. The cards can be inserted into the Optiva™ 3RU 16-slot, 19" rack-mountable card cage (OT-CC-16), 1RU 6-slot 19" rack (OT-CC-6), desktop 2-slot enclosure (OT-DTCR-2), and desktop 1-slot enclosure (OT-DTCR-1).

## Interface and Controls

### Transmitter



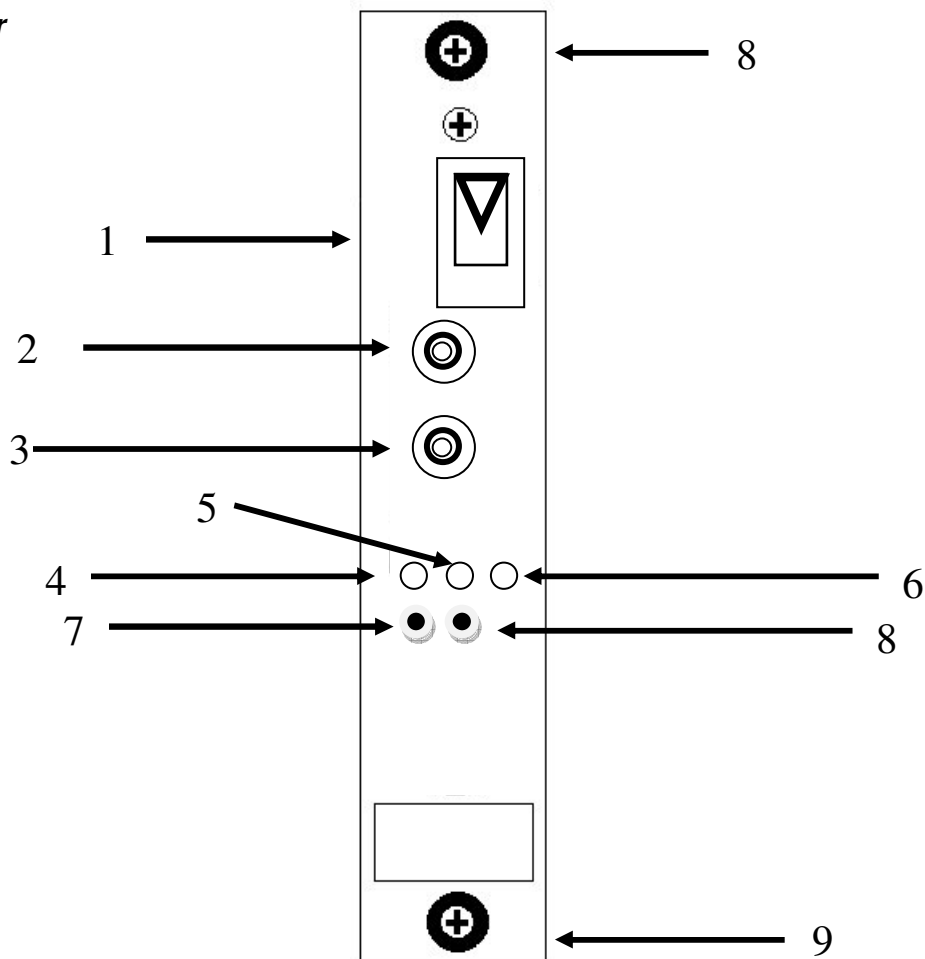
**Figure 1**

### Transmitter

1. **OUT** The output of the laser is provided from this SC-APC socket. (see “*Optics Handling*” section)
2. **STATUS** This LED glows green when OK and red when there is a major alarm.
3. **RF** The illuminated LED color indicates the RF power on the laser. Green is optimum.
4. **MGC** This illuminated LED indicates manual operation mode.
5. **GAIN INCREASE** This button will increase the RF when in the MGC mode.
6. **GAIN DECREASE** This button will decrease the RF when in the MGC mode.
7. **MGC** This button will toggle between SGC and MGC mode.
8. **PEAK RF** This button will optimize the RF input to the laser while in SGC or MGC mode.
9. **MONITOR** This connector provides a  $-32\text{dB}$  representation of the laser input RF.
10. **RF IN** The RF input signal is applied to this RF connector.
11. **LNB DC** Switching to the 1 position will enable DC voltage present at the RF input connector.
12. The chassis retention screws will secure the seated module into the chassis.

NOTE: A toothpick or cotton swab end provides a convenient, safe way to access the recessed buttons and switches. For a toothpick, break off the end for a flatter surface.

### Receiver



## Receiver

**Figure 2**

1. **IN** The input optical fiber is inserted into this SC-APC socket. (see “*Optics Handling*” section)
2. **RF OUT** The RF output signal is available at this RF connector.
3. **MONITOR** This connector provides a –32dB representation of the laser input RF.
4. **STATUS** This LED glows green when OK and red when there is a major alarm.
5. **RF** The illuminated LED color indicates the RF power on the laser. Green is optimum.
6. **OPTICAL** The illuminated LED indicates the presence of fiber optic light.
7. **RF-HIGH** This button increases the output RF level approximately 1dB per step.
8. **RF-LOW** This button decreases the output RF level approximately 1dB per step.
9. The chassis retention screws will secure the seated module into the chassis.

## Installation

### Module Installation

- Align the top and bottom card edges in the chassis channel and slide firmly into the back plane.
- Tighten the top and bottom module screws to secure in chassis.

### Transmitter Installation

- Prior to connecting the input RF connector, ensure that the LNB power switch is in the desired mode and verify with the LNB LED. *Refer to figure 1.*
- Connect satellite signal to the RF input connector.
- Press and release the PEAK button to optimize the RF level to the laser. (Optional)
- Insert the SC/APC connector in the fiber output connector socket. (See “*Optics Handling*” section.)

### Receiver Installation

- Insert the SC/APC connector in the fiber input connector socket.
- Connect satellite signal output to the RF output connector.
- Press and release the RF-HIGH or RF-LOW button to adjust the output RF to the desired level.
- Reference the LED bar graph to ensure optimized operation.
- Signal level can be monitored through the provided SMA monitor port.

## Operation

### Peak Signal Optimizer Gain Control Mode (PEAK)(TX)

The peak button is designed to optimize the RF signal level introduced to the laser. This ensures that the transmitter module is providing the optimum performance. Pressing the “PEAK” button once causes the circuits to adjust the RF gain up/down automatically to the ideal RF power based on the input RF level at that moment. In SGC mode the module will hold this level stable within a window. In MGC mode this feature is only instantaneous and will not adjust for level variances.

## Smart Gain Control Mode (SGC)(TX)

Every step has been taken to ensure simple hands free operation. The Smart Gain Control mode provides for a wide input range optimized to the laser input. Variances to the input RF level are automatically adjusted, but in a unique way to minimize cross-talk between different transponder signals (*patent pending*). This will provide the lowest possible noise and distortion.

The transmitter RF LED indicator will display the input RF status:

Red:	The Input RF is far above the optimum SGC range.
Blinking Green:	The Input RF is above the optimum SGC range.
Green:	The Input RF is within the optimum SGC range.
Amber:	The Input RF is below the optimum SGC range.
Blank:	The Input RF is below the detectable range.

## Manual Gain Control Mode (MGC)(TX)

The Optiva L-band transmission system is designed to work in a wide frequency spectrum. In the event of the presence of undesired out-of-band signals that vary greatly in level, or for situations such as up-links where a very stable gain is introduced, Emcore recommends that the transmitter be placed in MGC. To use MGC mode, on the transmitter press and release the GAIN button. The MGC LED indicator will illuminate in MGC mode. Use the RF-HIGH or RF-LOW buttons to bring the RF level into range. The transmitter RF LED indicator will display green when the input RF is within the optimum range. Alternatively, pressing the PEAK RF button once will adjust the Tx RF gain for the ideal RF laser power on the laser, based on the RF power into the Tx at that moment. In MGC mode, the gain setting remains constant regardless of the RF input power changes.

## LED Indicator Tables & Diagram

### TX Status LED

Table 1

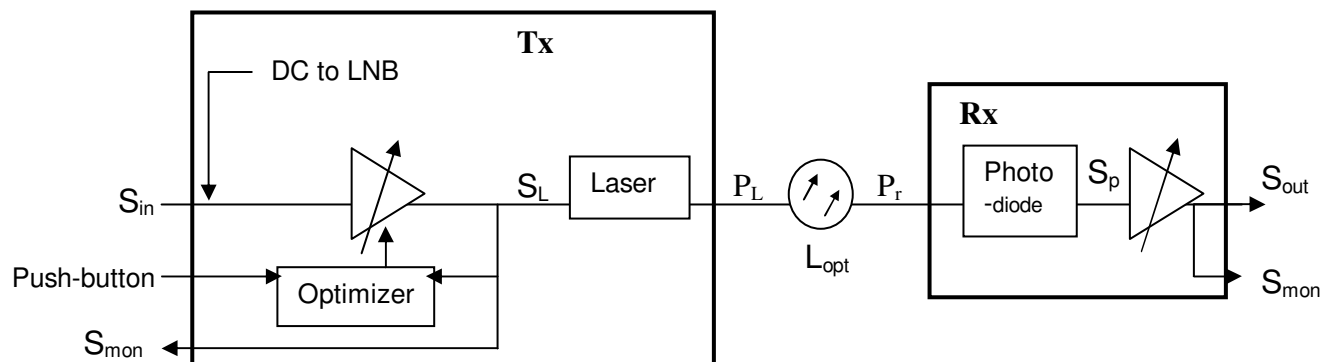
“RF” Transmitter LED	“STATUS” LED, Transmitter	“STATUS” Chassis LED,	“ALERT” Chassis LED	Notes
Red	Green	Blue	OFF	RF High alarm
Green, fast blink	Green	Blue	OFF	RF High, warning
Green	Green	Blue	OFF	Optimum range. (Within SGC locking range.)
Amber	Green	Blue	OFF	RF Low, warning
OFF	Green	Blue	OFF	Loss of RF signal
--	Red	OFF	Red	Summary Alarm

### RX Status LED

Table 2

“OPTICAL” Receiver LED	“STATUS” Receiver LED	“STATUS” Chassis LED	“ALERT”, Chassis LED	Notes
Green	Green	Blue	OFF	Optimal range
Amber	Green	Blue	OFF	Low, warning
Off	Red	OFF	Red	Low, alarm

## Optiva L-band Fiberoptic Transmission System



## Remote Monitoring

### Simple Network Management Protocol (SNMP)

The Optiva System is designed to provide remote status and control monitoring via SNMP monitoring programs. Use of this feature requires the use of a network management system agent card (NMS) that serves as the interface between the data retrieved from the system cards and the management program. Management Interface Bases (MIB's) are available with the purchase of the NMS card (OPV-CTLR-IC). The MIB defines the detailed variables and protocol for the particular product.

#### ▪ OTS-1LT1 & OTS-1LC (Transmitter)

##### Monitored Values

Laser Bias	LNB voltage	Serial #
Optical Power	Summary Alarm	Manufacture date
Temperature	RF Alarm	Firmware #
RF Attenuator Setting	Optical Power Alarm	Hardware #
RF Power at Laser	Model #	

##### Controlled Values

SGC/MGC mode	RF power at Laser Major Low*
RF Gain	RF power at Laser High*
Peak	RF power at Laser Minor High*
RF power at Laser Low*	RF power at Laser Major High*
RF power at Laser Minor Low*	



\* Asterisked values are factory set to optimal performance for most satellite signal applications. Consult with Emcore prior to changing.

### ▪ OTS-1LSR (Receiver)

#### Monitored Values

Temperature

RF Power Level

Photo Diode Current

Summary Alarm

Power Supply Alarm

Photo Diode Alarm

Model #

Serial #

Manufacture date

Firmware #

Hardware #

#### Controlled Values

RF Gain

# Specifications

## OTS-1LT1 Wideband Optical Link

	Parameter	Min	Typical	Max	Units
Link	Frequency Range				
	50 Ohm	50	-	3000	MHz
	75 Ohm	50	-	2500	MHz
	Optical Loss (C/N>10 dB, BW 36 MHz Carrier Level - 35 dBm)	-	-23	-	dBo
	Noise Figure (TG at max, 2150 MHz, 1 dBo loss)	-	13	-	dB
	Input IP3 (TG max, 2150 MHz, 1 dBo loss)	-	2	-	dBm
	Spur Free Dynamic Range (1 dBo loss)	-	108	-	dB/Hz <sup>2/3</sup>
	Air Temperature	-10	-	50	°C
TX	RF Input within SGC range <sup>1</sup>	-	0 to -35	-	dBm
	TX Gain (TG) at max, 1 GHz <sup>2</sup>	0	8	-	dB (W/A)
	TG Adjustment Range (reduction from max)	30	-	-	dB
	Wavelength	1280	-	1340	nm
	Input Return Loss				
	50-200 MHz	-	10	-	dB
	950-2150 MHz	-	15	-	
	50-3000 MHz	-	19	-	
	LNB Voltage	16	17	19	V
	Current	-	-	350	mA
Optical Power	3	5	6	dBmo	
DC Power	-	12	-	V	
LNB Off	-	-	350	mA	
RX	RF Output (Tx at peak, 1 dBmo into Rx)	-	-8 to -25	-	dBm
	RX Gain (RG), at max, 1 GHz <sup>2</sup>	20	22	-	dB (A/W)
	RG Adjustment Range (reduction from max)	30	-	-	dB
	Output IP3 (2150 MHz)	20	25	-	dBm
	Output 1dB compression (2150 MHz)	-	15	-	dBm
	Receiver Sensitivity	-	-20	-	dBmo
	Output Return Loss				
	50-200 MHz	-	10	-	dB
	950-2150 MHz	-	15	-	
	50-3000 MHz	-	10	-	
DC Power	-	12	-	V	
	-	-	250	mA	

1. Wider RF inputs are acceptable, but will set the RF amp gain to its limit.

2. Link RF Gain<sub>dB</sub> = TG + RG - 2 \* FiberLoss<sub>dB</sub> (assumes Rin = Rout)

3. dBmo & dBo indicate optical power & loss to minimize confusion with RF dBm & dB

## OTS-1LCT CWDM Wideband Optical Link

	Parameter	Min	Typical	Max	Units
Link	Frequency Range				
	50 Ohm	50	-	3000	MHz
	75 Ohm	50	-	2500	MHz
	Fiber Distance	0	-	20	Km
	Optical Loss	0	-	8	dB <sub>o</sub>
	Air Temperature	-10	-	50	°C
TX	RF Input within SGC range <sup>1</sup>	-	0 to -35	-	dBm
	TX Gain (TG) at max, 1 GHz <sup>2</sup>	0	8	-	dB (W/A)
	TG Adjustment Range (reduction from max)	30	-	-	dB
	Noise Figure (TG at max, 2150 MHz, 1dB <sub>o</sub> loss)	19	13	--	dB
	Noise Figure (TG at min, 2150 MHz, 1dB <sub>o</sub> loss)	40	35	--	
	Input IP3		-5		dBm
	Spur Free Dynamic Range (1dB <sub>o</sub> loss)	100	103-108	-	dB/Hz <sup>2</sup>
	Wavelengths (See center Wavelength table for specific channel center)	1470	-	1610	nm
	Input Return Loss				
	50 - 200 MHz	-	10	-	dB
	950 - 2150 MHz	-	12	-	
	50 MHz - 3000 MHz	-	10	-	
	LNB Voltage	16	17	19	V
	Current	-	-	350	mA
	Optical Power	3	4	5	dBm <sub>o</sub>
	DC Power	-	12	-	V
LNB Off	-	-	350	mA	
RX	RF Output (Tx at peak, 1 dBm <sub>o</sub> into Rx)	-	-8 to -25	-	dBm
	RX Gain (RG), at max, 1 GHz <sup>2</sup>	20	22	-	dB (A/W)
	RG Adjustment Range (reduction from max)	30	-	-	dB
	Output IP3 (2150 MHz)	20	25	-	dBm
	Output 1dB compression (2150 MHz)	-	15	-	dBm
	Receiver Sensitivity	-	-20	-	dBm <sub>o</sub>
	Output Return Loss				
	50 - 200 MHz			-	dB
	950 - 2150 MHz	10	15	-	
	50 MHz - 3000 MHz			-	
Optical Input	-12	-	10	dBm <sub>o</sub>	
Optimal	-6	-	10	dBm <sub>o</sub>	

1. Wider RF inputs are acceptable, but will set the RF amp gain to its limit.

2. Link RF Gain<sub>link</sub> = TG + RG - 2\*FiberLoss<sub>link</sub> (assumes Rin = Rout)

3. dBm<sub>o</sub> & dB<sub>o</sub> indicate optical power & loss to minimize confusion with RF dBm & dB

## Ordering Information

### OTS-1L Wideband Optical Link

Product Code	Specifications
OTS-1LT1/S5-1306-SA-IC	Transmitter, 50-3000 MHz, SMA 50 ohm, 1310 nm, 6 dBm, SC/APC
OTS-1LT1/B5-1306-SA-IC	Transmitter, 50-3000 MHz, BNC 50 ohm, 1310 nm, 6 dBm, SC/APC
OTS-1LT1/B7-1306-SA-IC	Transmitter, 50-2500 MHz, BNC 75 ohm, 1310 nm, 6 dBm, SC/APC
OTS-1LR/S5-SA-IC	Receiver, Standard, 50-3000 MHz, SMA 50 ohm, SC/APC
OTS-1LR/B5-SA-IC	Receiver, Standard, 50-3000 MHz, BNC 50 ohm, SC/APC
OTS-1LR/B7-SA-IC	Receiver, Standard, 50-2500 MHz, BNC 75 ohm, SC/APC
OTS-1LSR/S5-SA-IC	Receiver, Hi-Sensitivity, 50-3000 MHz, SMA 50 ohm, SC/APC
OTS-1LSR/B5-SA-IC	Receiver, Hi-Sensitivity, 50-3000 MHz, BNC 50 ohm, SC/APC
OTS-1LSR/B7-SA-IC	Receiver, Hi-Sensitivity, 50-2500 MHz, BNC 75 ohm, SC/APC
OPV-CTLR-IC	NMS SNMP Controller Card & MIB for Optiva Family
OTP-1ETR-A2/A2	Optical Tcvr, 1Ch, Ethernet, SM, Dual LC
OT-CC-16F-XXX	Chassis, Rack-Mount, 16-Slot, 3 RU -- See OT-CC-16F data sheet for exact models
PS-200F-XX	Power Supply, 12 VDC, 100 to 240 VAC, 50/60 Hz. - See PS-200F datasheet for exact models
OT-CC-6-XX	Chassis, Rack-Mount, 6-Slot, 1 RU with Power Supply - See OT-CC-6-XX datasheet for exact models
OT-DTCR-1 / OT-DTCR-2	Chassis, Flange-Mount, w/ Power Supply, 1 slot / 2 slot - See OT-DTCR data sheet for exact models

### OTS-1LC CWDM Wideband Optical Link

Product Code	Specifications
OTS-1LCT/S5-XX06-SA-IC	Transmitter, 50-2700 MHz, SMA 50 ohm, CWDM Channel XX, 6dBm, SC/APC
OTS-1LCT/B5-XX06-SA-IC	Transmitter, 50-2700 MHz, BNC 50 ohm, CWDM Channel XX, 6dBm, SC/APC
OTS-1LCT/B7-XX06-SA-IC	Transmitter, 50-2500 MHz, BNC 75 ohm, CWDM Channel XX, 6dBm, SC/APC
OTS-1LR/S5-SA-IC	Receiver, 50-2700 MHz, SMA 50 ohm, SC/APC
OTS-1LR/B5-SA-IC	Receiver, 50-2700 MHz, BNC 50 ohm, SC/APC
OTS-1LR/B7-SA-IC	Receiver, 50-2500 MHz, BNC 75 ohm, SC/APC
OTS-1LSR/S5-SA-IC	Receiver, Hi-Sensitivity, 50-2700 MHz, SMA 50 ohm, SC/APC
OTS-1LSR/B5-SA-IC	Receiver, Hi-Sensitivity, 50-2700 MHz, BNC 50 ohm, SC/APC
OTS-1LSR/B7-SA-IC	Receiver, Hi-Sensitivity, 50-2500 MHz, BNC 75 ohm, SC/APC
OPV-CTLR-IC	NMS SNMP Controller Card & MIB for Optiva Family
OTP-1ETR-A2/A2	Optical Tcvr, 1Ch, Ethernet, SM, Dual LC
OT-CC-16F-XXX	Chassis, Rack-Mount, 16-Slot, 3 RU -- See OT-CC-16F data sheet for exact models
PS-200F-XX	Power Supply, 12 VDC, 100 to 240 VAC, 50/60 Hz. - See PS-200F datasheet for exact models
OT-CC-6-XX	Chassis, Rack-Mount, 6-Slot, 1RU -- See OT-CC-6 data sheet for exact models
OT-DTCR-1 / OT-DTCR-2	Chassis, Flange-Mount, w/Power Supply, 1 slot / 2 slot

## Optics Handling & Safety

Working with fiber optic cables and interfaces require a clean dust free environment. The optical power is confined in the optical core only a few microns in diameter. Small particles of dust can block the proper transfer of light through the connectors. It is therefore important to keep connectors as clean as possible, and when in doubt of the cleanliness of a connector, clean it prior to inserting into a transmitter or receiver receptacle.

A number of events can damage fiber optic connectors. Unprotected connector ends can experience damage by impact, airborne dust particles, or excess humidity or moisture. Never touch the fiber end face of the connector.

When cleaning fiber optic connectors use only Industrial grade 99% pure isopropyl alcohol, lens-grade, lint-free tissue, and optionally canned dry air. Alternatively, there are a number of simple, effective products that are specifically designed for cleaning fiber optic connectors.

**Never look into an illuminated fiber end.**

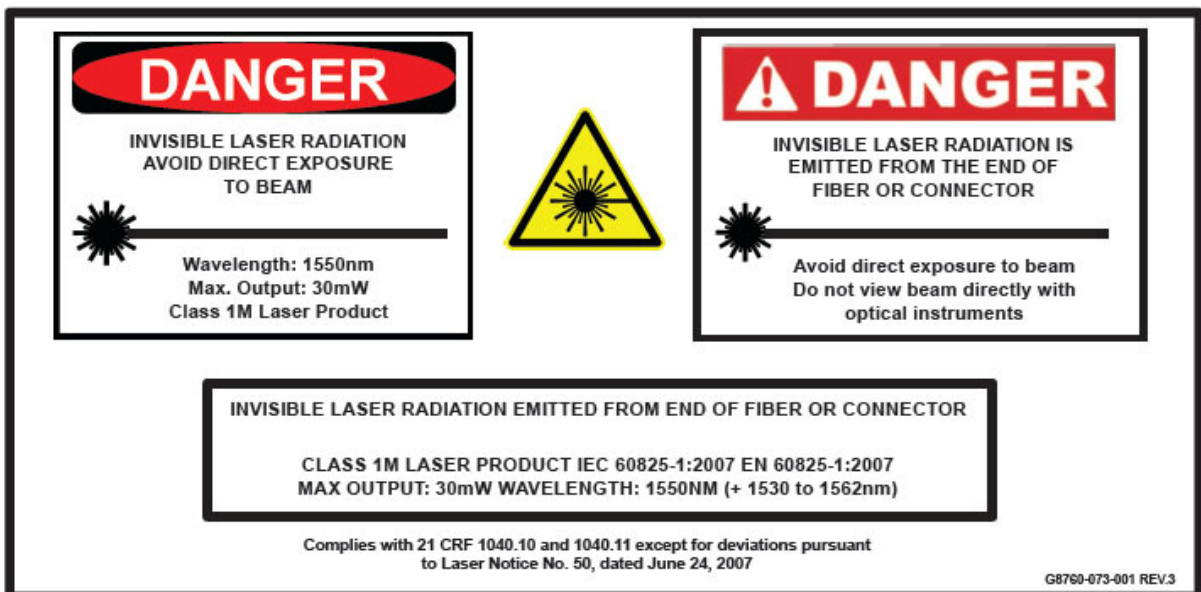
### Disclaimer

Every attempt has been made to make this material complete, accurate and up-to-date. Users are cautioned that EMCORE reserves the right to make changes without notice and shall not be held responsible for any damages, including consequential, caused by reliance on the material presented, including, but not limited to, typographical, arithmetical, or listing errors.

### WARNINGS, CAUTIONS, LIABILITY, WARRANTY AND GENERAL NOTES

#### Safety Considerations

When installing or using this product, observe all safety precautions during handling and operation. Failure to comply with the following general safety precautions and with specific precautions described elsewhere in this manual violates the safety standards of the design, manufacture, and intended use of this product. Emcore assumes no liability for the customer's failure to comply with these precautions.



\* Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

\* IEC is a registered trademark of the International Electrotechnical Commission.

The fiber optic laser transmitter used in Emcore's Optiva link contains a FDA/CDRH Class 1M laser and meets the appropriate standard in Title 21 of the Code of Federal Regulations (CFR). This device has been classified with the FDA/CDRH under accession number 0220191. All versions of the laser are Class 1 laser product, tested according to IEC 60825-1: 2007 / EN 60825-1:2007.

An additional warning for Class 1M laser products. For diverging beams, this warning shall state that viewing the laser output with certain optical instruments (examples: eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. For collimated beams, this warning shall state that viewing the laser output with certain instruments designed for use at a distance (examples: telescopes and binoculars) may pose an eye hazard.

Wavelength = 1.3/1.5  $\mu\text{m}$   
Maximum power = 30 mW

Do not attempt to modify or to service the laser diode module. Return it to Emcore for service and repair. Contact the Emcore Customer Service Department for a return authorization and further instructions.

### **Electrostatic Sensitivity**

Observe electrostatic precautionary procedures. Semiconductor laser transmitters and receivers provide highly reliable performance when operated in conformity with their intended design. However, a semiconductor laser may be damaged by an electrostatic charge inadvertently imposed by careless handling.

Static electricity can be conducted to the laser chip from the center pin of the RF input connector, and through the DC connector pins. When unpacking and otherwise handling the transmitter, follow ESD precautionary procedures including use of grounded wrist straps, grounded workbench surfaces, and grounded floor mats.

Exposure to electrostatic charge is greatly reduced after the transmitter or receiver has been installed in an operational circuit.

### **Service**

Do not attempt to modify or service any part of the system other than in accordance with procedures outlined in this Operation Manual. If the system does not meet its warranted specifications, or if a problem is encountered that requires service, return the apparently faulty plug-in or assembly to Emcore for evaluation in accordance with Emcore's warranty policy.

When returning a plug-in or assembly for service, include the following information: Owner, Model Number, Serial Number, Return Authorization Number (obtained in advance from Emcore's Customer Service Dept.), service required and/or description of the problem encountered.

## **Warranty**

Emcore warrants to the original purchaser all standard products sold by Emcore to be free of defects in material and workmanship for one (1) year from date of shipment from Emcore. During the warranty period, Emcore's obligation, at our option, is limited to repair or replacement of any product that Emcore proves to be defective. This warranty does not apply to any product that has been subject to alteration, abuse, improper installation or application, accident, electrical or environmental over-stress, negligence in use, storage, transportation, or handling.

This warranty is the only warranty made by Emcore and is in lieu of all other warranties, expressed or implied, except as to title, and can be amended only by a written instrument signed by an officer of Emcore. Emcore sales agents or representatives are not authorized to make commitments on warranty returns.

### **Limitations of Liabilities**

Emcore's liability on any claim of any kind, including negligence, for any loss or damage arising from, connected with, or resulting from the purchase order, contract, or quotation, or from the performance or breach thereof, or from the design, manufacture, sale, delivery, installation, inspection, operation or use of any equipment covered by or furnished under this contract, shall in no case exceed the purchase price of the device which gives rise to the claim.

EXCEPT AS EXPRESSLY PROVIDED HEREIN, EMCORE MAKES NO WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, WITH RESPECT TO ANY GOODS, PARTS AND SERVICES PROVIDED IN CONNECTION WITH THIS AGREEMENT INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. EMCORE SHALL NOT BE LIABLE FOR ANY OTHER DAMAGE INCLUDING, BUT NOT LIMITED TO, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF OR IN CONNECTION WITH FURNISHING OF GOODS, PARTS AND SERVICE HEREUNDER, OR THE PERFORMANCE, USE OF, OR INABILITY TO USE THE GOODS, PARTS AND SERVICE.

Emcore will not be responsible for loss of output or reduced output of opto-electronic devices if the customer performs chip mounting, ribbon bonding, wire bonding, fiber coupling, fiber connectorization, or similar operations. These processes are critical and may damage the device or may affect the device's output or the fiber output.

Emcore test reports or data indicating mean-time-to-failure, mean-time-between-failure, or other reliability data are design guides and are not intended to imply that individual products or samples of products will achieve the same results. These numbers are to be used as management and engineering tools, and are not necessarily indicative of expected field operation. These numbers assume a mature design, good parts, and no degradation of reliability due to manufacturing procedures and processes.

Emcore is not liable for normal laser output degradation or fiber coupling efficiency degradation over the life of the device.

Every attempt has been made to make this material as complete and accurate and up to date. Users are cautioned that Emcore reserves the right to make changes without notice and shall not be held responsible for any damages, including consequential, caused by reliance on the material presented, including, but not limited to, typographical, arithmetical, or listing errors.

**© Copyright 2012 EMCORE Corporation**