

# Optiva OTS-2 22 GHz Unamplified Microwave Band Fiber Optic Links



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## Applications

- Microwave Antenna Signal Distribution
- Electronic Warfare (EW) Systems
- Broadband Delay Line and Signal Processing Systems
- Frequency Distribution Systems
- Radar System Calibration
- Phased Array Antenna Systems, Interferometric Antenna Arrays

## Features / Benefits

- 50 MHz-22 GHz - Eliminates the performance and cost penalty of block up/down conversion
- Low RIN Source Laser - Provides high-dynamic-range of  $>105 \text{ dB-Hz}^{2/3}$  sub-octave
- Microprocessor-Based Transmitter Control for Laser Bias, Modulator Bias & Link Gain - Provides consistent high performance operation and allows for modulator low-bias operation and higher SFDR
- SNMP V.1 and RS-232 Monitor & Control Interface - Flexible user interface options
- Compatible with EMCORE's Modular Optiva Platform - Allows multiple format and frequency transport in a single chassis
- DWDM Operation
  - Increases transport capacity without increasing fiber count
  - Cooled DFB laser with 10 dBm output

## 50 MHz to 22 GHz Unamplified Microwave Transport System

The Optiva OTS-2 22 GHz Microwave Band transmitter and receiver are ideal to construct transparent fiber optic links in the 50 MHz to 22 GHz frequency range for antenna remoting, electronic warfare systems, broadband delay lines, signal processing systems and other high-dynamic-range applications.



Optiva satellite and microwave transmitters and receivers are SNMP compliant. They can be housed in the same chassis and monitored by the same Network Management System (NMS) as Optiva HD video, audio, serial data, and USB extension / distribution cards to support transport of multiple signal formats and frequency bands in a single flexible platform.

## System Design

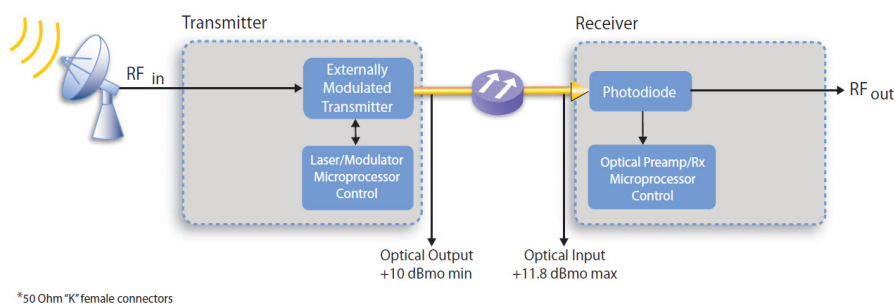
The Optiva platform includes a wide range fiber optic transport products for satellite and microwave

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communications from 1 MHz to 40 GHz. These units can be used to construct transparent inter- and intra-facility links from 1 meter to  $>100 \text{ km}$  for RF and microwave signal transport, antenna remoting, video transport, electronic warfare systems and other high-dynamic-range applications.

Optiva is a completely modular, hot-swappable platform. Both 19" rack-mount and compact tabletop, or wall-mountable enclosures are available. The 3RU 19" rack-mount, fan-cooled enclosures (Model OT-CC-16 and OT-CC-16F) can support up to 16 insert cards and utilize two dual-redundant, hot-swappable, 100 or 200 watt power supplies. The 1RU 19" rack-mount, fan-cooled enclosure (Model: OT-CC-6-1U) can accommodate 6 insert cards and utilizes two hot-swappable 60 watt power supplies. Compact one-slot (OT-DTCR-1), or two-slot (OT-DTCR-2) enclosures are also available that use an external wall-mount power supply.

## Block Diagram



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## Performance Highlights

Parameter	Min	Typical	Max	Units
Frequency Range	.05	--	22	GHz
RF Input Power	--	--	20	dBm
Wavelength	--	1550	--	nm
Optical Output Power	9	--	11	dBm
Operating Temperature Range	-10	--	50	°C

## Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the datasheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min	Max	Units
Operating Temperature	T <sub>OP</sub>	-20	60	°C
Storage Temperature	T <sub>STG</sub>	-40	85	°C
RF Input	S <sub>in</sub>	--	25	dBm

## Transmitter & Receiver Optical Characteristics

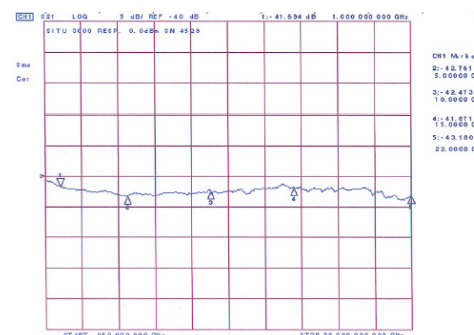
Parameter	Symbol	Condition	Min	Typical	Max	Units
Wavelength	$\lambda$	--	1530	1550	1562	nm
Optical Output Power	P <sub>L</sub>	--	9	10	11	dBm
Connector Return Loss	--	--	40	--	--	dB
Optical Connector Type	--	SC/APC	--	--	--	dBm
Receiver Optical Input Power	P <sub>in</sub>	--	--	--	+10	dBm
Receiver Responsivity	--	--	0.7	--	--	A/W

Note: In order to prevent reflection-induced distortion degradation, the laser should be connected to an optical cable having a return loss of at least 55 dB for discrete reflections and 30 dB for distributed reflections.

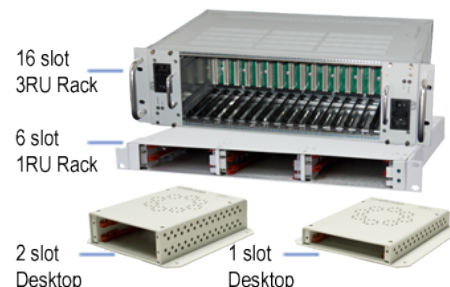
## DC Power Consumption - Max

Module Type	Input Voltage (VDC)	Max Current (@+70 °C)
Transmitter	+12	750 mA
Receiver	+12	750 mA

## 22 GHz Wideband S21 Frequency Response



## Enclosure Options



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## Transmitter & Receiver RF Characteristics

Parameter	Symbol	Condition	Min	Typical	Max	Units
Operational Bandwidth*		--	0.05	--	22	GHz
RF Input Impedance		--	--	50	--	
RF Return Loss		--	--	--	-9	dB
Amplitude Flatness Tx	$S_{Out} - S_{In}$	50 MHz - 1 GHz 1 GHz - 22 GHz Any 500 MHz 50 MHz - 22 GHz	-- -- -- --	-- -- -- --	3.0 6.0 1.75 9.0	dB, p-p
Amplitude Flatness Rx	$P_R - S_{Out}$	Any 500 MHz 50 MHz - 22 GHz	-- --	-- --	0.75 5.0	dB, p-p
2nd Harmonic Suppression		RF Input 0 dBm	--	-70	-50	dBc
1 dB Compression Point		@10 GHz @22 GHz	+14 +15	--	--	dBm
RF Connector		2.92 mm (K) Female				

\*RF response below 50 MHz and above the maximum stated RF frequency is provided with degraded performance and not guaranteed.

## Environmental Specifications

Parameter	Symbol	Min	Max	Units
Operating Temperature	$T_{OP}$	-10	50	°C
Operating Humidity, Maximum Non-Condensing	--	--	95%	
Operating Altitude, Above Sea Level	--	--	6000	ft
	--	--	1828.8	m
Storage Temperature	$T_{STG}$	-40	70	°C
Storage Humidity, Maximum Non-Condensing	--	--	95%	--
Storage Altitude, Above Sea Level	--	--	50,000	ft
			15,240	m

## Link Performance - 22 GHz Wideband

Parameter	Symbol	Condition	Min	Typical	Max	Units
RF Bandwidth	--	--	0.05	--	18	GHz
Link Gain (+10 dBm Rx optical input)*^	G	@ 10 GHz	-28	--	--	dB
	G	@ 22 GHz	-30	--	--	
Link Gain (+0 dBm Rx optical input)*^	G	@ 10 GHz	-48	--	--	dB
	G	@ 22 GHz	-50	--	--	
Noise Figure (+10 dBm Rx optical input)^	NF	@ 10 GHz	--	--	50	dB
	NF	@ 22 GHz	--	--	52	
Input IP3^	IIP3	@ 10 GHz	24	--	--	dBm
	IIP3	@ 22 GHz	25	--	--	
Spurious Free Dynamic Range^	SFDR	@ 10 GHz	98	100	--	dB-Hz <sup>2/3</sup>
	SFDR	@ 22 GHz	98	100	--	
Gain Variation	--	50 MHz - 1 GHz	--	--	3.0	dB
	--	1 GHz - 22 GHz	--	--	11.0	
	--	Any 500 MHz	--	--	2.5	
	--	50 MHz - 22 GHz	--	--	14.0	

\*Link Gain output will change 2 dB for every 1 dB of optical attenuation.

^Performance based on OTS-2T/K5 without EDFA unamplified, OTS-2R/K5 unamplified

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## Ordering Information: Transmitter

Transmitter
OTS-2T / 3.5-UUUU-VV-WW-XX-Y-00-Z

- When ordering replace "UUUU" with one of the Wideband Frequency Options
- When ordering replace "VV" with one of the ITU Channel Options
- When ordering replace "WW" with one of the Optical Power Options
- When ordering replace "XX" with one of the Optical Connector Options
- When ordering replace "Y" with one of the Optical Output Options
- When ordering replace "Z" with one of the Enclosure Options

	Wideband Frequency Options (GHz) "UUUU"	ITU Channel Options (THz / nm) "VV"	Optical Power Options (dBm) "WW"	Optical Connector Options "XX"	Optical Output "Y"	Variable Gain RF Amplifier	Enclosure Options "Z"
3.5 = 50 Ω 3.5 mm	.0522 = 0.05-22 GHz .1022 = 0.10-22 GHz .5022 = 0.50-22 GHz 1.022 = 1.0-22 GHz	Standard: 00 = non-ITU: 1520-1580 nm  Optional: 18 = 191.8 THz/1563.05 nm 19 = 191.9 THz/1562.23 nm 20 = 192 THz/1561.42 nm 21 = 192.1 THz/1560.61 nm 22 = 192.2 THz/1559.79 nm 23 = 192.3 THz/1558.98 nm 24 = 192.4 THz/1558.17 nm 25 = 192.5 THz/1557.36 nm 26 = 192.6 THz/1556.56 nm 27 = 192.7 THz/1555.75 nm 28 = 192.8 THz/1554.94 nm 29 = 192.9 THz/1554.13 nm 30 = 193 THz/1553.33 nm 31 = 193.1 THz/1552.52 nm 32 = 193.2 THz/1551.72 nm 33 = 193.3 THz/1550.92 nm 34 = 193.4 THz/1550.12 nm 35 = 193.5 THz/1549.32 nm 36 = 193.6 THz/1548.51 nm 37 = 193.7 THz/1547.72 nm 38 = 193.8 THz/1546.92 nm 39 = 193.9 THz/1546.12 nm 40 = 194 THz/1545.32 nm 41 = 194.1 THz/1544.53 nm 42 = 194.2 THz/1543.73 nm 43 = 194.3 THz/1542.94 nm 44 = 194.4 THz/1542.14 nm 45 = 194.5 THz/1541.35 nm 46 = 194.6 THz/1540.56 nm 47 = 194.7 THz/1539.77 nm 48 = 194.8 THz/1538.98 nm 49 = 194.9 THz/1538.19 nm 50 = 195 THz/1537.4 nm 51 = 195.1 THz/1536.61 nm 52 = 195.2 THz/1535.82 nm 53 = 195.3 THz/1535.04 nm 54 = 195.4 THz/1534.25 nm 55 = 195.5 THz/1533.46 nm 56 = 195.6 THz/1532.68 nm 57 = 195.7 THz/1531.9 nm 58 = 195.8 THz/1531.12 nm 59 = 195.9 THz/1530.33 nm 60 = 196 THz/1529.55 nm 61 = 196.1 THz/1528.77 nm 62 = 196.2 THz/1527.99 nm	Standard: 10 = +10 Optical Output (no EDFA)  Optional: 14, 17, 20 = +14, +17, +20 integrated EDFA	Standard: SA = SC / APC  Optional: FA = FC / APC EA = E2000 / APC	1 = Single Optical Output  2 = Dual Optical Output	00 = No Amp	1 = Optiva Indoor Rack-Mount Installation  2 = Optiva Outdoor MiniHub Installation

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## Ordering Information: Receiver

### Receiver

OTS-2R / 3.5-*UUUU*-*VV*-*WW*-*XX*-*Y*-Z-00-*A*

- When ordering replace "*UUUU*" with one of the Wideband Frequency Options
- When ordering replace "*VV*" with one of the Optical Power Options
- When ordering replace "*WW*" with one of the Optical Connector Options
- When ordering replace "*XX*" with one of the ITU Filter Options
- When ordering replace "*Y*" with one of the Optical AGC Options
- When ordering replace "*Z*" with one of the Coupling Options
- When ordering replace "*A*" with one of the Enclosure Options

	Wideband Frequency Options (GHz) " <i>UUUU</i> "	Optical Power Options (dBm) " <i>VV</i> "	Optical Connector Options " <i>WW</i> "	ITU Filter Options for Improved Optical Isolation in DWDM Systems (THz / nm) " <i>XX</i> "	Optical AGC Options " <i>Y</i> "	Coupling Options " <i>Z</i> "	Variable Gain RF Amplifier	Enclosure Options " <i>A</i> "
3.5 = 50 $\Omega$ 3.5 mm	.0522 = 0.05-22 GHz .1022 = 0.10-22 GHz .5022 = 0.50-22 GHz 1.022 = 1.0-22 GHz	10 = +10 Max Optical Input	Standard: SA = SC / APC  Optional: FA = FC / APC EA = E2000 / APC	Standard: 00 = No filter  Optional: 18 = 191.8 THz/1563.05 nm 19 = 191.9 THz/1562.23 nm 20 = 192 THz/1561.42 nm 21 = 192.1 THz/1560.61 nm 22 = 192.2 THz/1559.79 nm 23 = 192.3 THz/1558.98 nm 24 = 192.4 THz/1558.17 nm 25 = 192.5 THz/1557.36 nm 26 = 192.6 THz/1556.56 nm 27 = 192.7 THz/1555.75 nm 28 = 192.8 THz/1554.94 nm 29 = 192.9 THz/1554.13 nm 30 = 193 THz/1553.33 nm 31 = 193.1 THz/1552.52 nm 32 = 193.2 THz/1551.72 nm 33 = 193.3 THz/1550.92 nm 34 = 193.4 THz/1550.12 nm 35 = 193.5 THz/1549.32 nm 36 = 193.6 THz/1548.51 nm 37 = 193.7 THz/1547.72 nm 38 = 193.8 THz/1546.92 nm 39 = 193.9 THz/1546.12 nm 40 = 194 THz/1545.32 nm 41 = 194.1 THz/1544.53 nm 42 = 194.2 THz/1543.73 nm 43 = 194.3 THz/1542.94 nm 44 = 194.4 THz/1542.14 nm 45 = 194.5 THz/1541.35 nm 46 = 194.6 THz/1540.56 nm 47 = 194.7 THz/1539.77 nm 48 = 194.8 THz/1538.98 nm 49 = 194.9 THz/1538.19 nm 50 = 195 THz/1537.4 nm 51 = 195.1 THz/1536.61 nm 52 = 195.2 THz/1535.82 nm 53 = 195.3 THz/1535.04 nm 54 = 195.4 THz/1534.25 nm 55 = 195.5 THz/1533.46 nm 56 = 195.6 THz/1532.68 nm 57 = 195.7 THz/1531.9 nm 58 = 195.8 THz/1531.12 nm 59 = 195.9 THz/1530.33 nm 60 = 196 THz/1529.55 nm 61 = 196.1 THz/1528.77 nm 62 = 196.2 THz/1527.99 nm	1 = No Optical AGC 2 = With Optical AGC	1 = Standard Coupling (AC) 2 = Decoupled PD (DC)	00 = No Amp	1 = Optiva Indoor Rack-Mount Installation 2 = Optiva Outdoor MiniHub Installation

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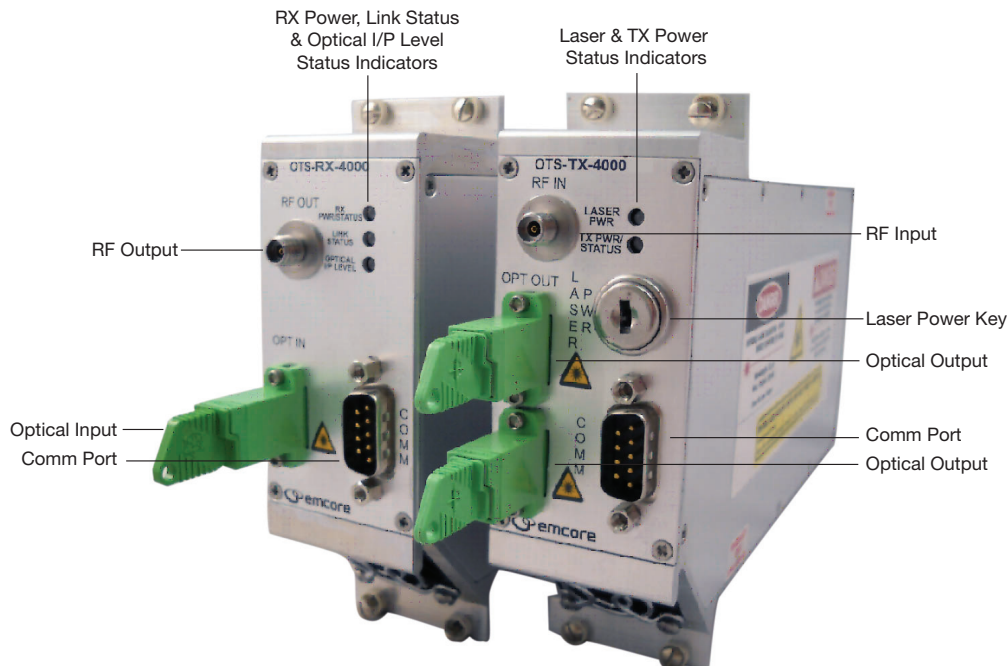


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## Mechanical Configuration

Each Transmitter and Receiver module occupies two slots in the EMCORE Optiva Chassis.



## Laser Safety

This product meets the appropriate standard in Title 21 of the Code of Federal Regulations (CFR). FDA/CDRH Class 1M laser product. All versions of this laser are Class 1M 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 (for example: 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 (for example: telescopes and binoculars) may pose an eye hazard.

Wavelength = 1.3/1.5  $\mu$ m.

Maximum power = 30 mW.



\*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.

