

# Microwave Fabry-Perot Laser Transmitters



1510A, 1510B  
1515A, 1515B  
1530A, 1530B

3510A, 3510B  
3515A, 3515B  
3530A, 3530B

10350A, 10350B  
10355A, 10355B  
10330A, 10330B

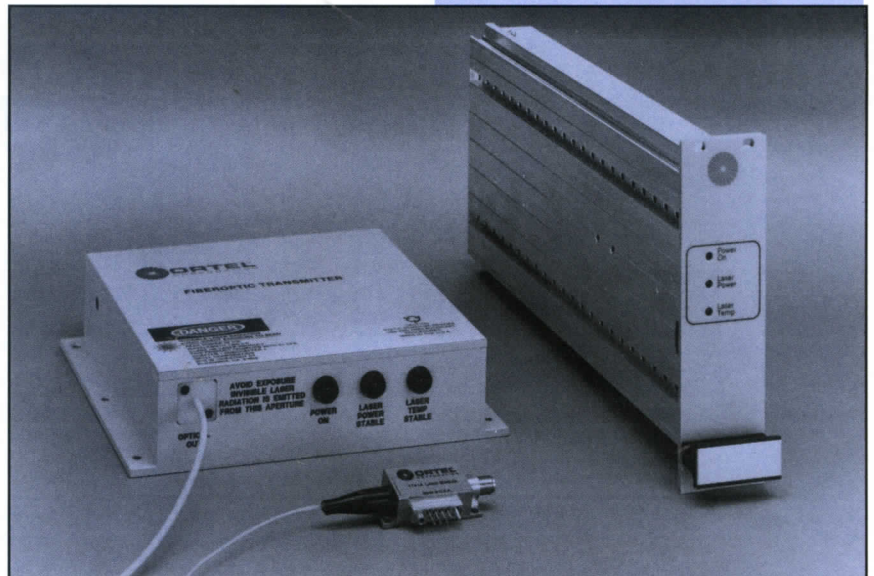
## DATA SHEET

Ortel Fabry-Perot lasers transmit analog microwave signals over singlemode fiber at 1310 nm optical wavelength. By transmitting signals directly at microwave frequencies, these devices simplify and improve a wide array of applications, including antenna remoting, timing and reference signal distribution, telemetry, and measurement.

Several packaging styles are available for these microwave Fabry-Perot lasers. The most basic package, the laser module, contains the laser chip, optical fiber, and impedance matched electrical connections in a hermetically sealed unit. Modules also contain a photodiode for monitoring the laser power, and a thermistor and thermoelectric cooler for monitoring and controlling the laser temperature. Some models also include integrated optical isolators, which improve noise performance and allow for fiber coupling efficiencies roughly 10 dB higher than can be achieved with non-isolated lasers.

In most cases, the basic laser module is integrated into a complete transmitter, packaged either as a flange-mount for extreme environments, or as a plug-in for integration with Ortel's System 10000 rack-mountable chassis and power supplies. Electronics within flange-mount and plug-in transmitters control the laser temperature and DC bias current and provide warnings should the temperature or power deviate from their intended levels, thus providing a self-regulating, fully integrated microwave product.

- Analog communication
- Up to 12 GHz bandwidth
- Optional optical isolator
- 1310 nm wavelength
- Singlemode fiber pigtail



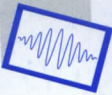


# Microwave Fabry-Perot Laser Transmitters

Package Styles	Model Numbers					
Module	1510A	1510B	1515A	1515B	1530A	1530B
Flange-mount Transmitter	3510A	3510B	3515A	3515B	3530A	3530B
Plug-in Transmitter	10350A	10350B	10355A	10355B	10330A	10330B
RF Parameters <sup>1</sup>						
Maximum Frequency	3 GHz	6 GHz	10 GHz	12 GHz	10 GHz	12 GHz
Minimum Frequency	0.01 GHz	0.01 GHz	0.1 GHz	0.1 GHz	0.1 GHz	0.1 GHz
Option -001	100 kHz	100 kHz	0.01 GHz	0.01 GHz	0.01 GHz	0.01 GHz
Amplitude Flatness <sup>2</sup>	± 2.0 dB	± 2.5 dB	± 3.0 dB	± 3.0 dB	± 3.0 dB	± 3.0 dB
Option -001	± 3.0 dB	± 3.0 dB	± 3.5 dB	± 3.5 dB	± 3.5 dB	± 3.5 dB
1.0 to 6.0 GHz			± 1.5 dB	± 1.5 dB	± 1.5 dB	± 1.5 dB
Amplitude Ripple w/i any 100 MHz, typ. max.	± 1.0 dB	± 1.0 dB	± .5 dB	± .5 dB	± .5 dB	± .5 dB
Input Impedance	50 Ohms	50 Ohms	50 Ohms	50 Ohms	50 Ohms	50 Ohms
Input VSWR	2.0 : 1	2.0 : 1	2.0 : 1	2.5 : 1	2.0 : 1	2.5 : 1
Input 1 dB Compression, typ. min.	+7 dBm	+13 dBm	+13 dBm	+13 dBm	+13 dBm	+13 dBm
Input Third Order Intercept <sup>3</sup> , min (dBm)						
0.01 to 1 GHz	24	29	25	25	25	25
1 to 2 GHz	18	29	25	25	25	25
2 to 3 GHz	16	22	25	25	25	25
3 to 4 GHz		22	25	25	25	25
4 to 6 GHz		16	20	20	20	20
6 to 10 GHz			20	20	20	20
10 to 12 GHz				20		20
Equivalent Input Noise <sup>4</sup> , max. (dBm/Hz)						
0.01 to 0.1 GHz			-110	-110	-110	-110
0.1 to 1 GHz	-100	-100	-125	-125	-125	-125
1 to 2 GHz	-115	-115	-125	-125	-125	-125
2 to 3 GHz	-115	-115	-120	-120	-120	-120
3 to 6 GHz		-115	-120	-120	-120	-120
6 to 10 GHz			-110	-110	-110	-110
10 to 12 GHz				-110		-110
Signal to Noise Ratio <sup>5</sup> , min. (dB)						
0.01 to 0.1 GHz			60	60		
0.1 to 1 GHz	45	45	60	60	60	60
1 to 2 GHz	45	50	60	60	60	60
2 to 3 GHz	45	50	60	60	60	60
3 to 6 GHz		40	60	60	60	60
6 to 10 GHz			55	55	55	55
10 to 12 GHz				55		55
RF connector	SMA (f)	SMA (f)	SMA (f)	SMA (f)	SMA (f)	SMA (f)

Specifications describe warranted performance. Typical values, indicated by "typ.", provide expected levels of performance, but are not guaranteed.





# Microwave Fabry-Perot Laser Transmitters

## 3510A/B, 3515A/B, 3530A/B

### Front Panel LEDs

- Power On
- Laser Power Stable
- Laser Temp Stable

### DC Monitor Voltages

Photodiode Current - Pin 6: 1 V/mA,  $\pm 2\%$  accuracy (into 1M $\Omega$  load).

Proportional to laser output power.

Laser DC Current - Pin 8: 1 V/mA,  $\pm 2\%$  accuracy (into 1M $\Omega$  load).

### Alarm Circuits

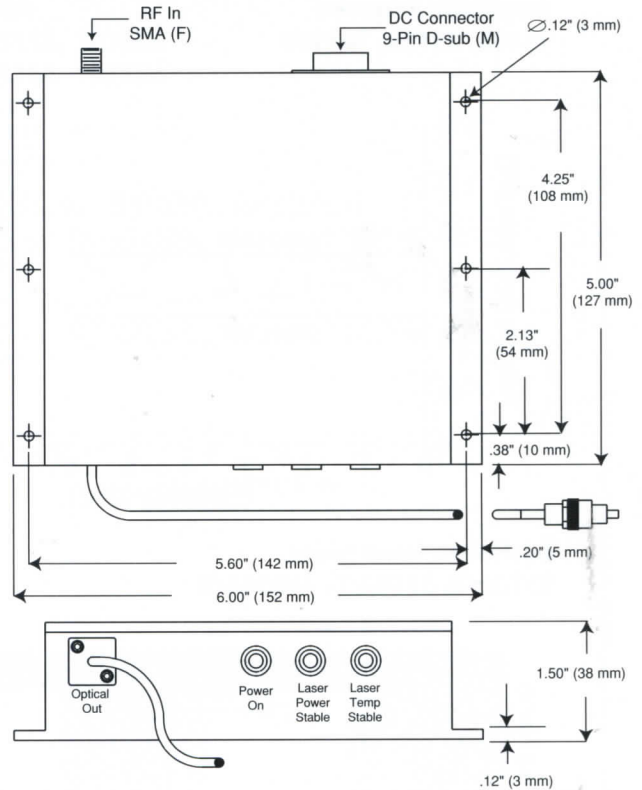
The alarms are open collector outputs capable of sinking 20 mA when active and withstanding 15 V when off.

Low Optical Power - Pin 7: sinks current when power is below 90% of setpoint.

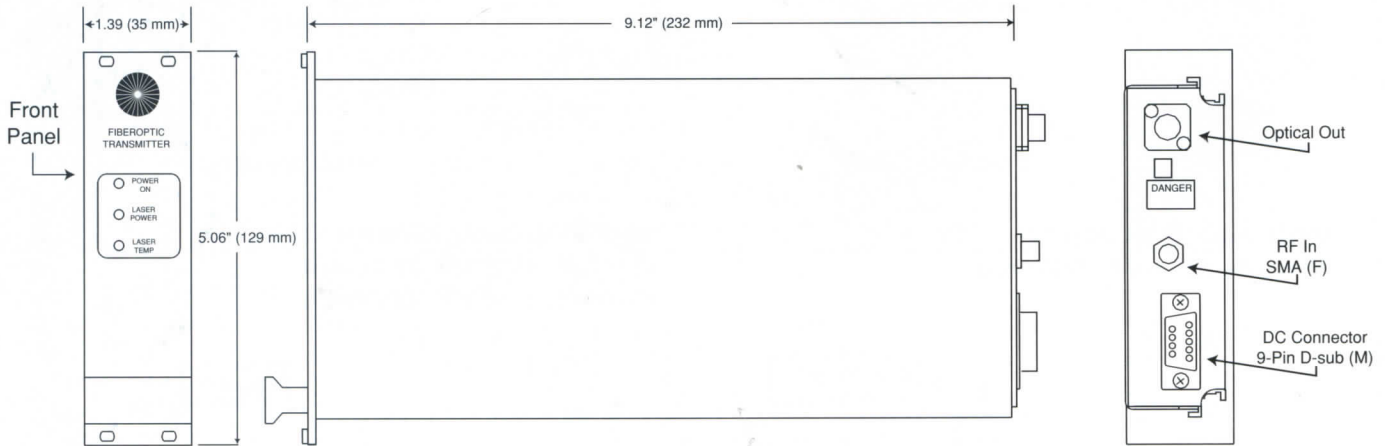
Laser Temperature - Pin 9: sinks current when laser internal temperature exceeds 2°C of setpoint (nominally 20°C).

9 Pin D-sub Connector			
Pin	Function	Pin	Function
1	+15 VDC	6	photodiode current monitor
2	+5 VDC	7	low optical power alarm*
3**	NC / -5 VDC	8	laser current monitor
4	power ground	9	over-temperature alarm*
5	ref. ground		

\*Open collector outputs.  
\*\* -5 VDC only for 3510A/B, 3515A/B.



## 10350A/B, 10355A/B, 10330A/B



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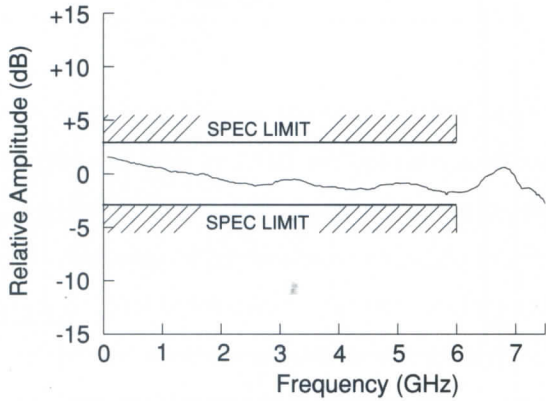
**Safety Considerations** – The light emitted from this laser diode is invisible and may be harmful to the human eye. Avoid looking directly into the fiber pigtail or into the collimated beam along its axis when the device is in operation. Operating the laser diode outside of its maximum ratings may cause device failure or a safety hazard.



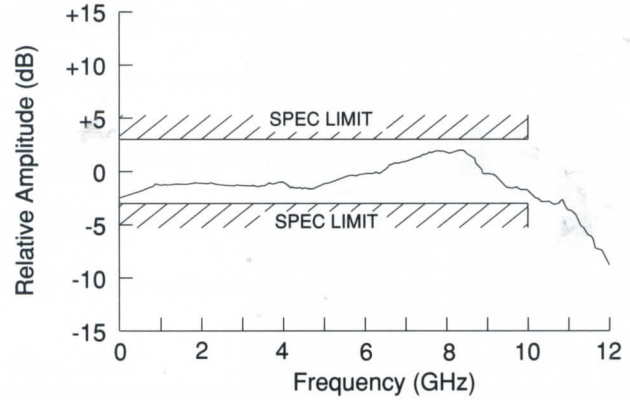
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The following operating characteristics are intended for estimating the performance of a typical unit. For more detailed calculations, see the *Linear Fiberoptic Products Selection Guide* and *A System Designer's Guide to RF and Microwave Fiber Optics*, both published by Ortel, or contact Ortel.

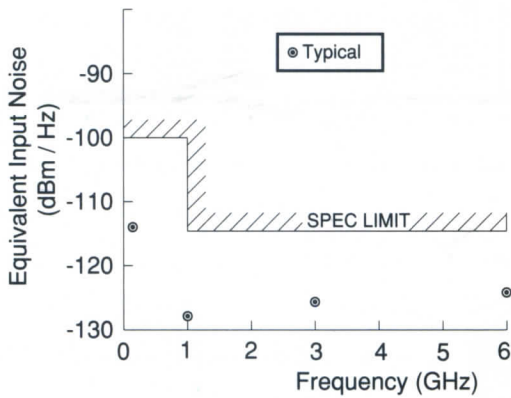
**Amplitude Response**  
1510B, 3510B, 10350B



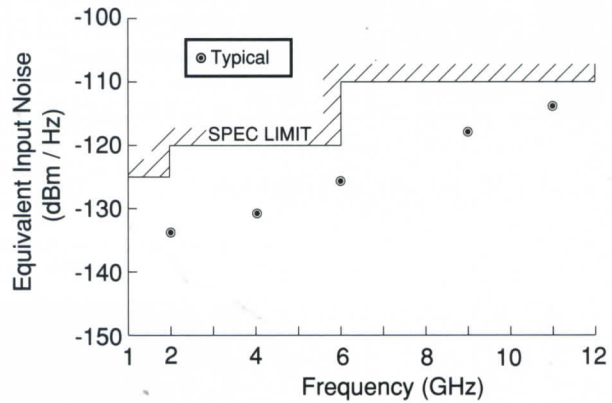
**Amplitude Response**  
1515A, 3515A, 10355A  
1530A, 3530A, 10330A



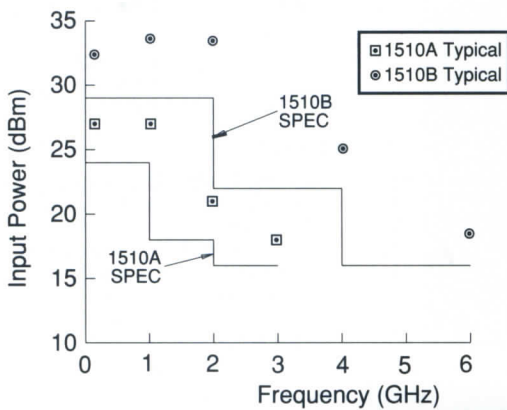
**Equivalent Input Noise**  
1510A/B, 3510A/B, 10350A/B



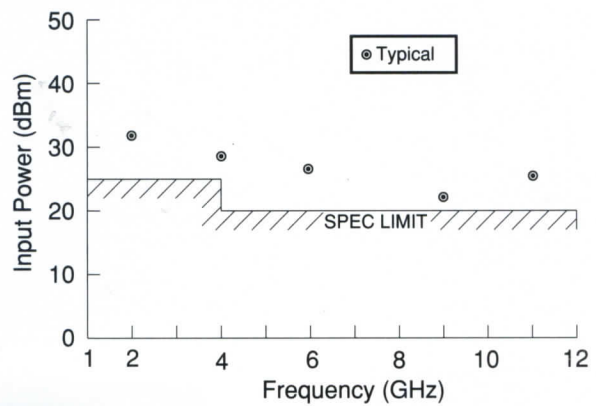
**Equivalent Input Noise**  
1515A/B, 3515A/B, 10355A/B  
1530A/B, 3530A/B, 10330A/B



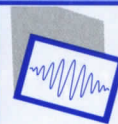
**Input Third Order Intercept**  
1510A/B, 3510A/B, 10350A/B



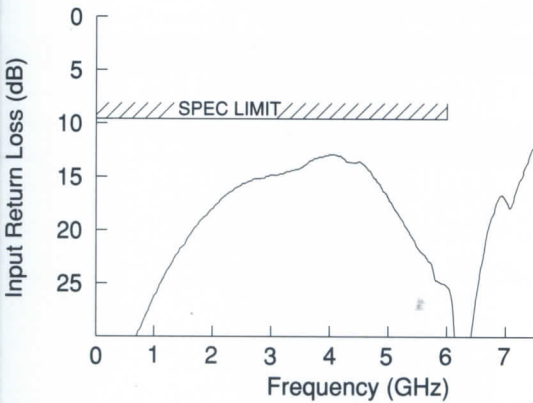
**Input Third Order Intercept**  
1515A/B, 3515A/B, 10355A/B  
1530A/B, 3530A/B, 10330A/B



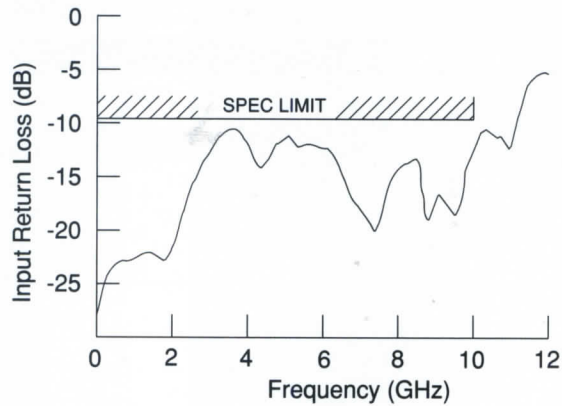
# Microwave Fabry-Perot Laser Transmitters



**Input Match**  
510B, 3510B, 10350B



**Input Match**  
1515A, 3515A, 10355A  
1530A, 3530A, 10330A



## Transmitter Options

		module	flange	plug-in
-001	DC coupled <sup>8</sup>	x	x	x
-005	1.5 stage optical isolator	x	x	x
-020	FC/APC bulkhead optical connector		x	x
-021	FC/SPC bulkhead optical connector		x	x
-022	FC/APC optical connector, 3 mm fiber cable pigtail		x	
-023	FC/SPC optical connector, 3 mm fiber cable pigtail		x	
-026	FC/PC bulkhead optical connector		x	x
-028	FC/PC optical connector, 3 mm fiber cable pigtail		x	
-030	no optical connector, 900 $\mu$ m buffered fiber pigtail	x		
-031	FC/PC optical connector, 900 $\mu$ m buffered fiber pigtail	x		
-032	FC/APC optical connector, 900 $\mu$ m buffered fiber pigtail	x		

VSWR specifications not applicable for option -001.



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Flange-mount Transmitter	3510A	3510B	3515A	3515B	3530A	3530B
Plug-in Transmitter	10350A	10350B	10355A	10355B	10330A	10330B
Optical Parameters <sup>1</sup>						
Wavelength	1310 ± 30nm	1310 ± 30nm	1310 ± 30nm	1310 ± 30nm	1310 ± 30nm	1310 ± 30nm
Spectral Width, FWHM <sup>4</sup> , typ. max.	3 nm	5 nm	5 nm	5 nm	5 nm	5 nm
Optical Power, min.	0.4 mW	0.8 mW	0.8 mW	0.8 mW	3 mW	3 mW
typ.	1 mW	1.25 mW	1.25 mW	1.25 mW	4.4 mW	5.5 mW
DC Modulation Gain, min. (mW/mA)	0.020	0.020	0.020	0.020	0.075	0.075
typ.	0.025	0.025	0.025	0.025	0.11	0.11
Relative Intensity Noise <sup>4</sup> , max. (dB/Hz)						
0.01 to 0.1 GHz			-130	-130	-130	-130
0.1 to 1 GHz	-120	-120	-145	-145	-145	-145
1 to 2 GHz	-135	-135	-145	-145	-145	-145
2 to 3 GHz	-135	-135	-140	-140	-140	-140
3 to 6 GHz		-135	-140	-140	-140	-140
6 to 10 GHz			-130	-130	-130	-130
10 to 12 GHz				-130		-130
Optical Isolator	no	no	no	no	yes	yes
Fiber	Singlemode (9/125)				Singlemode (9/125)	

DC Power Requirements for Flange-mounts & Plug-ins <sup>6,7</sup>						
Pin	Min.	Nom.	Max.	Max. Ripple	3510A/B, 3515A/B	All Others
1	+14 V	+15 V	+16 V	100 mV p-p	0.3 A max.	0.3 A max.
2	+4.75 V	+5 V	+5.5 V	200 mV p-p	1.2 A max.	1.5 A max.
3	-4 V	-5 V	-10 V	200 mV p-p	1.0 A max.	Not Used

Maximum Ratings		
	Modules & Flange-mounts	Plug-ins
Operating Temperature of Baseplate	-40 to +65°C	0 to +50°C
Storage Temperature	-40 to +85°C	-20 to +65°C
RF Input Power	+20 dBm/60 sec.	

- Specifications guaranteed when unit is connected to an optical path with return loss > 35 dB.
- Peak to peak.
- Two carrier test.
- No RF input.
- 1 MHz bandwidth measured at Pin = +5 dBm (1510A), +11 dBm (1510B), +10 dBm (1515A/B, 1530A/B).
- Plug-in products are powered with the 10990A rack mount chassis and 10901 A/B power supply.
- For laser module products, contact Ortel for an OEM data sheet.

