Agilent 8614xB Optical Spectrum Analyzer Family

Technical Specifications

NEW!

- **Filter Mode**
  Enables you to drop a single DWDM channel or measure time resolved chirp (TRC)
- **Excellent "Close-In" Dynamic Range**
  Accurately characterize 50 GHz WDM system performance
- **High Throughput**
  Fast sweep speeds at high sensitivity to maximize measurement throughput
- **Built-In Applications**
  Agilent's new application concept makes complex and repetitive measurements simple
- **Benchtop and Portable Platforms**
  Choose between a large screen or small footprint package

	Benchtop	Portable
Ideal for critical WDM system and component characterization	**Agilent 86142B**	**Agilent 86145B**
Ideal for a wide range of applications at value prices	**Agilent 86140B**	**Agilent 86143B**
Features multimode monochromator output	**Agilent 86141B**	——
Features filter mode, single mode monochromator output	**Agilent 86146B**	**Agilent 86144B**

Agilent Technologies offers a wide variety of optical spectrum analyzers (OSA) to meet your test needs whether it's in R&D, manufacturing, installation, or maintenance and commissioning. Both benchtop and portable models are available at different price and performance points so you can choose the most cost effective solution to meet your test needs.

The **specifications** apply to all functions autocoupled over the temperature range 0 to 55° C and relative humidity <95% (unless otherwise noted). All specifications apply after the instrument's temperature has been stabilized after 1 hour continuous operation and the auto-align routine has been run. Unless otherwise noted, specifications apply without USER CAL.

Characteristics and Specifications

The distinction between specifications and characteristics is described as follows:

- Specifications describe warranted performance.
- Characteristics provide useful, but nonwarranted information about the functions and performance of the instrument.

Agilent Technologies

Specifications

The 86144B and 86146B specifications are for the 50 µm internal path only.

Description	Models/Specifications	Notes
Wavelength	**Agilent 8614xB**	
Range	600 nm to 1700 nm	
Span Range	0.2 nm to full range and zero span	
Accuracy		
After calibration with internal calibration source and with enhanced wavelength calibration on for specified range.		
1480-1570 nm	±0.01 nm	With applied input fiber 9/125 µm, Char., T(room)
1570-1620 nm	±0.025 nm	
After calibration with external reference source(s)		
±10 nm of calibration reference point(s)	±0.01 nm	
After user calibration over full wavelength range (600-1700 nm)	±0.2 nm	With applied input fiber 9/125 µm, T(20-30°C)
Absolute Accuracy (factory cal. 2 yr. cycle)	±0.5 nm	
Tuning Repeatability	±0.002 nm	With applied input fiber 9/125 µm
Reproducibility (≤1 min)	±0.002 nm	
Span Linearity		
1525-1570 nm	±0.01 nm	With applied input fiber 9/125 µm, Char., T(20-30°C)
for spans <40 nm	±0.02 nm	

Resolution Bandwidth (RBW)	Agilent 86140B, 86142B, 86143B, 86145B	Agilent 86144B, 86146B	Agilent 86141B, 86140B w/Opt 025, 86143B w/Opt 025	Notes
FWHM (3 dB Bandwidth)	0.06, 0.1, 0.2, 0.5, 1, 2, 5, 10 nm	0.06, 0.07, 0.1, 0.14, 0.2, 0.33, 0.5, 1, 2, 5, 10 nm	0.07, 0.1, 0.2, 0.5, 1, 2, 5, 10 nm	With applied input fiber 9/125 µm, Resolution of 10 nm is available for first order grating response only.
Noise Marker Bandwidth Accuracy				
using noise markers 1525-1610 nm				
≥0.5 nm	±2%		±3%	With applied input fiber 9/125 µm, T(20-30°C)
0.2 nm	±3%		±5%	
0.1 nm	±7%		±10%	
0.06 nm	±12%		——	

Note: Char. indicates the number is a characteristic.
T(#) indicates temperature dependence.

Amplitude	**Agilent 8614xB**			**Notes**
Sensitivity				Sensitivity is defined as signal value >6 x RMS noise value.
600-750 nm	–60 dBm			$T^{(0\text{-}30°C)}$, 2nd Order
750-900 nm	–75 dBm			
900-1250 nm	–75 dBm			$T^{(0\text{-}30°C)}$
1250-1610 nm	–90 dBm			
1610-1700 nm	–80 dBm			$T^{(20\text{-}30°C)}$
Maximum Measurement Power				Resolution bandwidth setting < channel spacing.
1525-1700 nm	+15 dBm per channel, +30 dBm total			Char.
600-1000 nm	+15 dBm per channel, +30 dBm total			
1000-1525 nm	+12 dBm per channel, +30 dBm total			
Maximum Safe Power				
Total safe power	+30 dBm			
Total power within any 10 nm portion of the spectrum	+23 dBm			
Absolute Accuracy				
at –20 dBm, 1310 nm/1550 nm	±0.5 dB			For resolution ≥0.1 nm
Scale Fidelity				Excluding amplitude errors at low power levels due to noise.
autorange off	±0.05 dB			$T^{(20\text{-}30°C)}$
autorange on	±0.07 dB			
Display Scale (log scale)	0.01-20 dB/DIV, –120 to +90 dBm			
Amplitude Stability (1310 nm, 1550 nm)				
1 minute	±0.01 dB			For signals within 8 dB of top of screen.
15 minutes	±0.02 dB			Char.
Flatness	**Agilent 86140B, 86143B, 86144B**	**Agilent 86142B, 86145B, 86146B**	**Agilent 86141B, 86140B w/Opt 025, 86143B w/Opt 025**	
1290-1330 nm		±0.2 dB		With applied input fiber 9/125 µm
1525-1570 nm	±0.2 dB	——	±0.2 dB	
1525-1610 nm	——	±0.2 dB	——	
1250-1610 nm	±0.7 dB			With applied input fiber 9/125 µm. Absorption of light by atmospheric moisture affects flatness at 1350-1420nm.
Polarization Dependence				With applied input fiber 9/125 µm, for resolution ≥0.2 nm, $T^{(room)}$.
1310 nm	±0.25 dB	±0.12 dB	——	
1530 nm, 1565 nm	±0.2 dB	±0.05 dB	——	
1600 nm	±0.25 dB	±0.08 dB	——	
1250-1650 nm	±0.3 dB	±0.25 dB	±0.5 dB	

Note: The 86144B and 86146B specifications are for the 50 µm internal path only.
Char. indicates the number is a characteristic.
T(#) indicates temperature dependence.

Specifications (cont'd)

Dynamic Range	Agilent 86140B, 86143B, 86144B	Agilent 86142B, 86145B, 86146B	Agilent 86141B, 86140B w/Opt 025, 86143B w/Opt 025	Notes
In 0.1 nm Resolution Bandwidth				With applied input fiber 9/125 µm, excluding multiple order grating response.
1250-1610 nm (chop mode on) ±0.5 nm, ±1 nm, ±5 nm	–70 dB			Char., Chop mode not available on the 86144B/86146B models
1550 nm				
at ±0.8 nm (±100 GHz at 1550 nm)	–60 dB			Average of all states of polarization
at ±0.5 nm (±62.5 GHz at 1550 nm)	–58 dB		–55 dB	Char. (86140B, 86141B, 86143B, 86144B, 86140B w/Opt 025, 86143B w/Opt 025)
at ±0.4 nm (±50 GHz at 1550 nm)	–55 dB		–52 dB	
at ±0.2 nm (±25 GHz at 1550 nm)	–40 dB	–40 dB	——	Char.

Monochromator Input	Agilent 8614xB	Notes
Input Return Loss		Depends on the quality of the attached connector.
Straight connector (9/125 µm)	>35 dB	

Sweep	Agilent 8614xB	Notes
Max. Sweep Rate	40 nm/56.3 ms	Char.
Max. Sampling Rate in Zero Span	50 µs/trace point	
Sweep Cycle Time		
50 nm span, auto zero off	<180 ms	Char.
50 nm span, auto zero on	<340 ms	
100 nm span	<400 ms	
500 nm span	<650 ms	
ADC Trigger Accuracy		
Jitter (distributed uniformly)	<±0.5 µs	Char.
Trigger delay range	2 µs-6.5 ms	

Pulse Mode Accuracy	Agilent 86140B, 86143B, 86144B	Agilent 86142B, 86145B, 86146B	Agilent 86141B, 86140B w/Opt 025, 86143B w/Opt 025	Notes
Turn On (≥2 µs after rising edge)	<±0.2 dB (starting from dark)			Char.
Turn Off (≥10 µs after falling edge)	<±0.2 dB	<±0.2 dB (30 dB extinction)	±0.2 dB	Char. (86140B, 86141B, 86143B, 86144B, 86146B, 86140B w/Opt. 025)

Computer Interfacing	Agilent 8614xB	Notes
Remote Control	Web enabled controls	
Compatibility	IEEE-488.1, IEEE-488.2 (100%)	
Interfaces	GPIB, Parallel Printer Port, External VGA Monitor, Keyboard and Mouse (PS/2)	
Floppy Disk	3.5" 1.44MB, MS-DOS	MS-DOS is a U.S.
Data export	Spreadsheet and Word Processor Compatible (CSV ASCII)	registered trademark of
Graphics export	CGM, PCL, GIF	Microsoft Corporation
Instrument Drivers	Universal Instrument Drivers (PNP), Compatible with VEE, Labview, Visual Basic and C++	Labview is a U.S. registered trademark of National Instruments.

Note: The 86144B and 86146B specifications are for the 50 µm internal path only.
Char. indicates the number is a characteristic.
T(#) indicates temperature dependence.

	Benchtop OSA Agilent 86140B, 86141B, 86142B, 86146B	Portable OSA Agilent 86143B, 86144B, 86145B
General Specifications		
Dimensions	222 high x 425 wide x 427 mm long	163 high x 325 wide x 427 mm long
Weight	16.5 Kg	14.5 Kg
Environmental		
Temperature	Operating 0°C to 55°C, Storage –40°C to 70°C	
Humidity	Operating <95% RH, Storage: Noncondensing	
EMI	Conducted and radiated interference is in compliance with CISPR pub11, IEC 801-3,IEC 801-4 and IEC 555-2	
Power Requirements		
Voltage and frequency	90 Vac to 260 Vac, 44 to 444 Hz	
Maximum power consumption	230 W	

Additional Specifications

Agilent 86141B

Monochromator Insertion Loss (into 62.5 µm fiber)

(See characteristic plot)[1]

850 nm: <19 dB
1300 nm: <7 dB
1550 nm: <10 dB

Maximum Input Power
+30 dBm total, +23 dBm within any 10 nm portion of the spectrum

Characteristic Monochromator Loss

WARNING
The light emitted from this connector is filtered and slightly attenuated light input to the front-panel MONOCHROMATOR INPUT connector. In the following instrument modes: preselector, and stimulus response, light energy can radiate from the front-panel MONOCHROMATOR OUTPUT connector.

Monochromator

Polarization Dependence[2] for Resolutions ≥0.2 nm
1250 nm to 1650 nm: ±*0.5 dB*[3] *(char.)*
Resolution Selections (FWHM): 0.07 nm and 0.1 nm to 10 nm in a 1, 2, 5 sequence
Input: 50 µm
Output: 62.5 µm

Photodetector Input (in power meter mode)

Accuracy at –20 dBm[4] (1550 nm)
20°C to 30°C: ±0.35 dB
Maximum Safe Power Level: +20 dBm
Scale Fidelity (for ≤0 dBm inputs)[5]
For any Measurement with Fixed Reference Level: ±0.05 dB (char.)
For Multiple Measurements with Different Reference Levels: ±0.07 dB (char.)
Display Resolution
Log: 0.01 dB
Linear: 0.23% of measurement + 0.01% of reference level
Power Range (up to 50 dB in any reference level setting)
Maximum Displayed Level (Char.): 10 dBm, 1250–1610 nm
Sensitivity[6]: –95 dBm (char.), 1250–1610 nm
Flatness (for ≤0 dBm input):[4] *±0.4 dB (char.), 1250–1610 nm*

---

[1] Second order is selected when the stop wavelength is at or below 900 nm and resolution is <10 nm.
[2] With applied input fiber that is standard single mode at wavelength of interest
[3] At room temperature
[4] With applied input fiber 9/125 µm
[5] To within 20 dB of the sensitivity noise limit
[6] Sensitivity applied within 1 minute of last zeroing.

Additional Specifications
(Preliminary)

Agilent 86144B, 86146B

Insertion Loss Stability**
(For 0.1 nm filter bandwidth and greater)

	Agilent 86144B/86146B
1550 nm 15 minutes	0.5 dB

Insertion Loss***
(For 0.1 nm filter bandwidth and greater)

	Agilent 86146B	Agilent 86144B
1550 nm	10 dB max	10 dB max

Filter Bandwidth
(From 1530-1610 nm)

	Agilent 86146B			Agilent 86144B		
	0.5 dB*	1.0 dB*	3.0 dB*	0.5 dB*	1.0 dB*	3.0 dB*
RBW Nominal Setting	**Actual Bandwidth**					
0.04 nm	0.016	0.023	0.039	0.016	0.023	0.039
0.05 nm	0.019	0.026	0.045	0.019	0.026	0.045
0.07 nm	0.033	0.044	0.063	0.033	0.044	0.063
0.1 nm	0.076	0.089	0.115	0.076	0.089	0.115
0.2 nm	0.134	0.147	0.173	0.134	0.147	0.173
0.3 nm	0.257	0.270	0.297	0.257	0.270	0.297
0.5 nm	0.421	0.434	0.460	0.421	0.434	0.460
	±20 %			±30 %		

Filter Bandwidth
Adjacent Channel Rejection* (at 1550 nm)

	Agilent 86146B				Agilent 86144B	
	12.5 GHz	25 GHz	50 GHz	100 GHz	50 GHz	100 GHz
	±0.1 nm	±0.2 nm	±0.4 nm	±0.8 nm	±0.4 nm	±0.8 nm
0.04 nm	40 dB	50 dB	55 dB	55 dB	50 dB	50 dB
0.05 nm	40 dB	50 dB	55 dB	55 dB	50 dB	50 dB
0.07 nm	N/A	50 dB	55 dB	55 dB	50 dB	50 dB
0.1 nm	N/A	40 dB	50 dB	55 dB	45 dB	50 dB
0.2 nm	N/A	40 dB	45 dB	55 dB	40 dB	50 dB
0.3 nm	N/A	N/A	45 dB	55 dB	40 dB	50 dB
0.5 nm	N/A	N/A	45 dB	50 dB	40 dB	45 dB

Filter Bandwidth
Polarization Dependence
(for 0.2 nm filter bandwidth and greater)

	Agilent 86144B/86146B
1550 nm***	±0.2 dB

* Characteristic value
** Immediately following enhanced single point auto align, at constant temperature
*** At room temperature
All data applies across 0–55 degrees C operating range unless otherwise noted.
After warmup period of 2 hrs
Adjacent Channel Rejection limited to 60 dB below total integrated power.

Options and Accessories

		Benchtop OSA Agilent 86140B, 86141B, 86142B, 86146B	Portable OSA Agilent 86143B, 86144B, 86145B
Options (available on new instruments only)			
Current Source		Opt. 001	—
White Light Source		Opt. 002	—
Built-in 1310 & 1550 nm EELED Source		Opt. 004	—
Built-in 1550 nm EELED Source		Opt. 005	—
Wavelength Calibrator		Opt. 006	Opt. 006
DWDM Spectral Analysis Application		Included	Included
Passive Component Test Application		Included	Included
Amplifier Test Application		Included	Included
Source Test Application		Included	Included
Alternative Connector Interface	FC/PC	Standard	Standard
	HMS-10	Opt. 011	Opt. 011
	DIN	Opt. 013	Opt. 013
	ST	Opt. 014	Opt. 014
	SC	Opt. 017	Opt. 017
Multimode Fiber Input*		Opt. 025 (Agilent 86140B)	Opt. 025 (Agilent 86143B)
Certificate of Calibration		Included	Included

* 50 µm multimode input available on Agilent 86140B and 86143B OSA's only.

OSA Fiber Sizes

Model Number	Optical Input	Option 002* (White Light Source)	Option 004* (1310/1550 EELED)	Option 005* (1550nm EELED)	Option 006 (Calibrator)	Photodiode Input	Mono Output 1
86143B	9 µm	N/A			9 µm	N/A	
Opt 025	50 µm				9 µm		
86145B	9 µm				9 µm		
86140B	9 µm	62.5 µm	9 µm	9 µm	9 µm		
Opt 025	50 µm	62.5 µm	9 µm	9 µm	9 µm		
86142B	9 µm	62.5 µm	9 µm	9 µm	9 µm		
86141B**	50 µm	62.5 µm	9 µm	9 µm	9 µm	62.5 µm	62.5 µm
86144B/86146B	9 µm	62.5 µm	9 µm	9 µm	9 µm	50 µm	9 µm

* Options 002, 004 and 005 are exclusive.
** Only one option is available on the 86141B.

Options and Accessories Specifications

	Benchtop OSA Agilent 86140B, 86141B, 86142B, 86146B	Portable OSA Agilent 86143B, 86144B, 86145B
Option 001 Current Source		
Range	0 to ±200 mA (source or sink)	—
Resolution *(char)*	*50 µA steps*	—
Accuracy	2% ±50 µA	—
Clamp Voltage (nominal)	±2.7 V	—
Noise Density at 1 kHz *(char)*	$<4\ nA/\sqrt{Hz}$	—
Stability Within 30 Minutes *(char)*	*<100 ppm ±500 nA*	—
Temperature Drift *(char)*	*<(100 ppm ±500 nA)/ ° C*	—
Pulse Mode		
Pulse Range	10 µs to 6.5 ms	—
Pulse Resolution	100 ns	—
Duty Cycle Range	Pulse width/1 s to 100%	—
Option 002 White Light Source		
Wavelength	900 nm to 1700 nm	—
Minimum Output Power Spectral Density (9/125 µm fiber)		
900 to 1600 nm	–67 dBm/nm (0.2 nW/nm)	—
900 to 1600 nm (typical)	–64 dBm/nm (0.4 nW/nm)	—
1600 to 1700 nm	–70 dBm/nm (0.1 nW/nm)	—
Minimum Output Power Spectral Density *(char)*		
50/125 µm fiber	–50 dBm/nm (10 nW/nm)	—
62.5/125 µm fiber	–46 dBm/nm (25 nW/nm)	—
Output Stability *(characteristic)*	*±0.02 dB over 10 minutes*	—
Lamp Lifetime, Mean Time Between Failures *(MTBF) (char)*	*>5000 hours*	—
Option 004/005 EELED Sources		
Minimum Spectral Power Density		
1540 to 1560 nm (Option 005)	> –40 dBm/nm (100 nW/nm)	—
1470 to 1620 nm (Option 005)	> –60 dBm/nm (1 nW/nm)	—
1300 to 1320 nm, 1540 to 1560 nm (Option 004)	> –40 dBm/nm (100 nW/nm)	—
1250 to 1620 nm (Option 004)	> –60 dBm/nm (1 nW/nm)	—
Return Loss		
With straight connector	>25 dB	—
Stability (ambient temp. <±1°C)		
Over 15 minutes	<±0.02 dB	—
Over 6 hours	<±0.05 dB	—

Option 006 Wavelength Calibrator

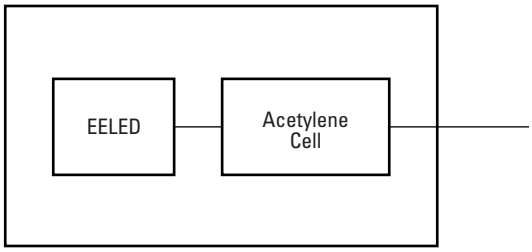

Figure 1. Wavelength calibrator block diagram

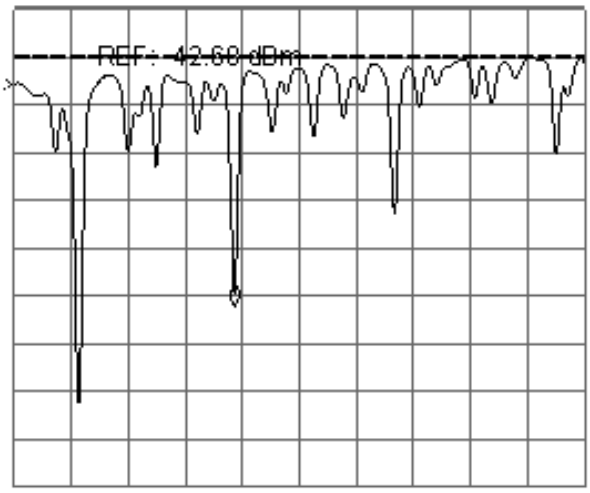

Figure 2. Wavelength calibrator absorption spectrum

The wavelength calibrator option provides an onboard wavelength reference that can be used to automatically calibrate the optical spectrum analyzer. The calibrator is based on an EELED and an Acetylene gas absorption cell, Figure 1. The Acetylene absorbs light at very specific wavelengths based on the molecular properties of gas. The cell is illuminated by an EELED and the OSA uses the absorption pits to perform a wavelength calibration, Figure 2. Since the absorption of the Acetylene gas is a physical constant it never needs calibrating.

The wavelength calibrator enhances the OSA to achieve better than ±10 pm wavelength accuracy and removes the need to use a tunable laser source and multi-wavelength meter as an external reference.

Additional Parts and Accessories

	Benchtop OSA Agilent 86140B, 86141B, 86142B, 86146B	**Portable OSA Agilent 86143B, 86144B, 86145B**
Printer Paper (5 rolls / box)	9270-1370	9270-1370
Additional Connector Interfaces	See Agilent 81000 series	See Agilent 81000 series
9 µm Single Mode Connector Saver	Standard	Standard
External 10 dB Attenuator (FC/PC)	Opt. 030	Opt. 030
Rack-mount Flange Kit	Opt. AX4	N/A
Transit Case	9211-2657	9211-5604
Soft Carrying Case	N/A	Opt. 042
BenchLink Lightwave Software*	Standard	Standard

* Agilent N1031A BenchLink Lightwave allows transfer of measurement results over a GPIB Interface to a PC for the purposes of archiving, printing and further analysis.

Definition of Terms

Wavelength

- Absolute Accuracy (after user cal) refers to the wavelength accuracy after the user has performed the internal wavelength calibration using a source of known wavelength.

- Reproducibility refers to the amount of wavelength drift which can occur over the specified time while the OSA is swept across a source of known wavelength.

- Tuning Repeatability refers to the wavelength accuracy of returning to a wavelength after having tuned to a different wavelength.

Resolution

- FWHM refers to the Full-Width-Half-Maximum resolutions that are available. This indicates the width at half power level of the signal after passing through the resolution slits.

Amplitude

- Scale Fidelity refers to the potential errors in amplitude readout at amplitudes other than at the calibration point. This specification is sometimes called linearity.

- Flatness defines a floating band which describes the error in signal amplitude over the indicated wavelength range.
  (This error may be removed at a given wavelength by performing the user amplitude calibration.)

- Polarization Dependence refers to the amplitude change that can be seen by varying the polarization of the light entering the OSA. This is not to be confused with amplitude variations caused by the varying distribution of energy between the different modes in fiber that are multimode at the wavelength of interest.

Sensitivity

- Sensitivity is defined as the signal level that is equal to six times the RMS value of the noise. Displayed sensitivity values are nominal. Slightly lower values may have to be entered to achieve specified sensitivity.

Dynamic Range

- Dynamic Range is a measure of the ability to see low-level signals that are located very close (in wavelength) to a stronger signal. In electrical spectrum analyzers, this characteristic is generally called shape factor.

Sweep Time

- Maximum Sweep Rate refers to the maximum rate that the instrument is able to acquire data and display it. This rate may be limited by multiple internal processes when using default number of trace points.

- Sweep Cycle Time refers to the time required to make a complete sweep and prepare for the next sweep. It can be measured as the time from the start of one sweep to the start of the next sweep.

Literature Reference

Brochure (Agilent literature # 5968-3657EN)
Agilent 8614x Series Optical Spectrum Analysis Remote Programming. Agilent product note (Agilent literature # 5968-1548E)
Agilent 8614x Series External Multi-Point Wavelength Calibration. Agilent product note (Agilent literature # 5980-0043E)
Agilent Lightwave Catalog

Agilent Technologies'
Test and Measurement Support, Services, and Assistance

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

Our Promise

Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Agilent equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

Your Advantage

Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

By internet, phone, or fax, get assistance with all your test & measurement needs.

Online assistance:
www.agilent.com/comms/lightwave

Phone or Fax

United States:
(tel) 1 800 452 4844

Canada:
(tel) 1 877 894 4414
(fax) (905) 282 6495

China:
(tel) 800-810-0189
(fax) 1-0800-650-0121

Europe:
(tel) (31 20) 547 2323
(fax) (31 20) 547 2390

Japan:
(tel) (81) 426 56 7832
(fax) (81) 426 56 7840

Korea:
(tel) (82-2) 2004-5004
(fax)(82-2) 2004-5115

Latin America:
(tel) (305) 269 7500
(fax) (305) 269 7599

Taiwan:
(tel) 080-004-7866
(fax) (886-2) 2545-6723

Other Asia Pacific Countries:
(tel) (65) 375-8100
(fax) (65) 836-0252
Email: tm_asia@agilent.com

Product specifications and descriptions in this document subject to change without notice.

Printed in USA February 8, 2002
5980-0177E

Agilent Technologies