

Agilent 8614xB Optical Spectrum Analyzer Family Technical Specifications

August 2003

- **Filter Mode**
Enables you to drop a single DWDM channel or measure time resolved chirp (TRC) and calculate dispersion penalty (DPC).
- **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 powerful 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 filter mode, single mode monochromator output	Agilent 86146B	

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.

Specifications

Characteristics and Specifications

The distinction between specifications and characteristics is described as follows:

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

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.

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

Wavelength	Agilent 8614xB	Notes
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 1570-1620 nm	 ±0.01 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	T(20-30°C)
Absolute Accuracy	±0.5 nm	Factory cal. 2 yr. cycle
Tuning Repeatability *	±0.002 nm	
Reproducibility (≤1 min) *	±0.002 nm	
Span Linearity * 1525-1570 nm for spans <40 nm	 ±0.01 nm, ±0.02 nm	Char ., T(20-30°C)

Resolution Bandwidth (RBW)	Agilent 86140B, 86142B, 86143B, 86145B	Agilent 86146B	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	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 0.2 nm 0.1 nm 0.06 nm	 ±2% ±3% ±7% ±12%		

Char. indicates the number is a characteristic.

T(#) indicates temperature dependence.

* With applied input fiber 9/125 µm.

Amplitude	Agilent 8614xB		Notes
Sensitivity			Sensitivity is defined as signal value > 6 x RMS noise value.
600-750 nm	-60dBm		T ^(0-30°C) , 2 nd Order
750-900 nm	-75 dBm		
900-1250 nm	-75 dBm		T ^(0-30°C)
1250-1610 nm	-90 dBm		
1610-1700 nm	-80 dBm		T ^(20-30°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 -20dBm, 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 ^(20-30°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)			For signals within 8 dB of top of screen
1 minute	±0.01 dB		
15 minutes	±0.02 dB		Char.
Flatness*	Agilent 86140B, 86143B	Agilent 86142B, 86145B, 86146B	
1290-1330 nm	±0.2 dB	±0.2 dB	
1525-1570 nm	±0.2 dB	—	
1525-1610 nm	—	±0.2 dB	
1250-1610 nm	±0.7 dB		Absorption of light by atmospheric moisture affects flatness at 1350-1420 nm
Polarization Dependence*			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	

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

Char. indicates the number is a characteristic.

T(#) indicates temperature dependence.

* With applied input fiber 9/125 μm.

Dynamic Range	Agilent 86140B, 86143B	Agilent 86142B, 86145B, 86146B	Notes
In 0.1 nm Resolution Bandwidth *			Excluding multiple order grating response
1250-1610 nm (chop mode on) ±0.5 nm, ± 1nm, ±5 nm	-70 dB		Char., Chop mode not available on the 86146B model
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		Char. (86140B, 86143B)
At ±0.4 nm (±50 GHz at 1550 nm)	-55 dB		
At ±0.2 nm (±25 GHz at 1550 nm)	-40 dB	-40 dB	Char.

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

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 50 nm span, auto zero on 100 nm span 500 nm span	<180 ms <340 ms <400 ms <650 ms	Char.
ADC Trigger Accuracy Jitter (distributed uniformly) Trigger delay range	<±0.5 μs 2 μs-6.5 ms	Char.

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

Computer Interfacing	Agilent 8614xB	Notes
Remote Control	Web enabled controls	
Compatibility	IEEE-488.1, IEEE-488-2 (100%)	
Interfaces	LAN, GPIB, Parallel Printer Port, External VGA Monitor, Keyboard and Mouse (PS/2)	
Floppy Disk	3,5" 1.44 MB, MS-DOS	
Data export	Spreadsheet and Word Processor Compatible (CSV ASCII)	
Graphics export	CGM, PCL, GIF	
Instrument Drivers	Universal Instrument Drivers (PNP), Compatible with VEE, Labview, Visual Basic and C++	
		MS-DOS is a U.S. registered trademark of Microsoft Corporation
		Labview is a U.S. registered trademark of National Instruments.

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

Char. Indicates the number is a characteristic.

T(#) indicates temperature dependence.

* With applied input fiber 9/125 μm

General Specifications	Benchtop OSA Agilent 86140B, 86142B, 86146B	Portable OSA Agilent 86143B, 86145B
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 Humidity EMI	Operating 0°C to 55°C, Storage -40°C to 70°C Operating <95% RH, Storage: Noncondensing Conducted and radiated interference is in compliance with CISPR pub 11, IEC 801-3, IEC 801-4 and IEC 555-2	
Power Requirements Voltage and frequency Maximum power consumption	90 Vac to 260 Vac, 44 to 444 Hz 230W	

Additional Specifications: Agilent 86146B

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

1550 nm, 15 minutes	0.5 dB
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Insertion Loss*** (For 0.1 nm filter bandwidth and greater)

1550 nm	10 dB max
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Filter Bandwidth: (From 1530 nm - 1610 nm)

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

Filter Bandwidth: Adjacent Channel Rejection* (at 1550 nm)

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

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

1550 nm***	±0.2 dB
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* 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



Options (available on new instruments only)	Benchtop OSA Agilent 86140B, 86142B, 86146B	Portable OSA Agilent 86143B, 86145B
Current Source *	8614xB-001	—
White Light Source *	8614xB-002	—
Built-in 1310 & 1550 nm EELED Source	8614xB-004	—
Wavelength Calibrator	8614xB-006	8614xB-006
DWDM Spectral Analysis Application	Included	Included
Passive Component Test Application	Included	Included
Amplifier Test Application	Included	Included
Source Test Application	Included	Included
Connector Interface	FC/PC: 81000PI SC/PC: 81000KI DIN: 81000SI ST: 81000VI	
Certificate of Calibration	Included	Included

OSA Fiber Sizes

Model Number	Optical Input	8614xB-002* (White Light Source)	8614xB-004* (1310/1550 EELED)	8614xB-006 (Calibrator)	Photodiode Input	Mono Output 1
86143B	9 μm	N/A		9 μm	N/A	
86145B		N/A			N/A	
86140B		N/A			N/A	
86142B		62.5 μm	9 μm	N/A		
86146B		50 μm	9 μm	N/A		

* 8614xB-002 and 004 are exclusive.

Options and Accessories: Specifications

8614xB-001 Current Source	Benchtop OSA Agilent 86140B, 86142B, 86146B
Range	0 to ± 200 mA (source or sink)
Resolution (char)	50 μ A steps
Accuracy	2% ± 50 μ A
Clamp Voltage (nominal)	± 2.7 V
Noise Density at 1 kHz (char)	< 4 nA/ $\sqrt{\text{Hz}}$
Stability Within 30 Minutes (char)	< 100 ppm ± 500 nA
Temperature Drift (char)	$< (100 \text{ ppm } \pm 500 \text{ nA}) / ^\circ\text{C}$
Pulse Mode	
Pulse Range	10 μ s to 6.5 ms
Pulse Resolution	100 ns
Duty Cycle Range	Pulse width/1 s to 100%

8614xB-002 White Light Source	
Wavelength	900 nm to 1700 nm
Minimum Output Power Spectral Density (9/125 μ m 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 μ m fiber	-50 dBm/nm (10 nW/nm)
62.5/125 μ m 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

8614xB-004 EELED Sources	
Minimum Spectral Power Density 1300 to 1320 nm, 1540 to 1560 nm 1250 to 1620 nm	> -40 dBm/nm (10nW/nm) > -60 dBm/nm (1nW/nm)
Return Loss With straight connector	> 25 dB
Stability (ambient temp. $< \pm 1^\circ\text{C}$)	
Over 15 minutes	$< \pm 0.02$ dB
Over 6 hours	$< \pm 0.05$ dB

8614xB-006 Wavelength Calibrator

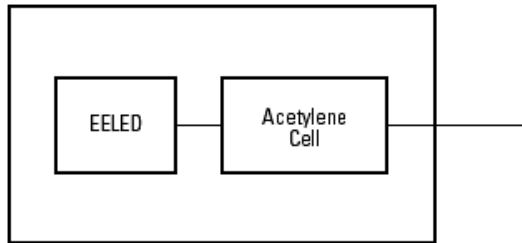


Figure 1. Wavelength calibrator block diagram

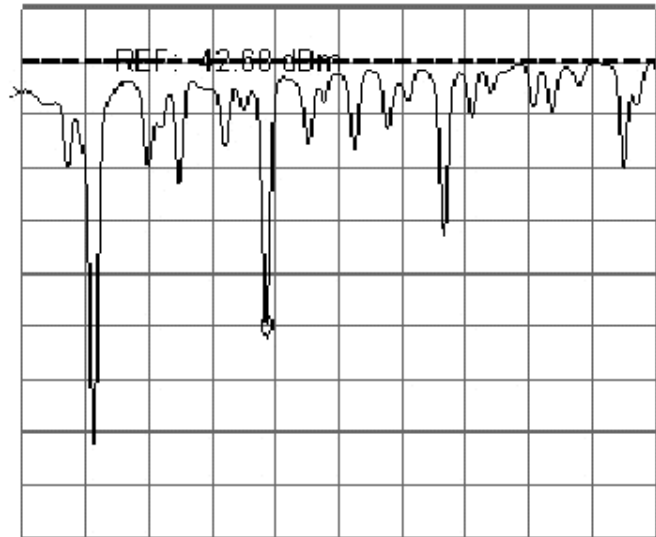


Figure 2. Wavelength calibrator absorption spectrum

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, 86142B, 86146B	Portable OSA Agilent 86143B, 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
Rack-mount Flange Kit	8614xB-AX4	N/A
Transit Case	9211-2657	9211-5604
Soft Carrying Case	N/A	8614xB-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 powerlevel 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.

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