

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**

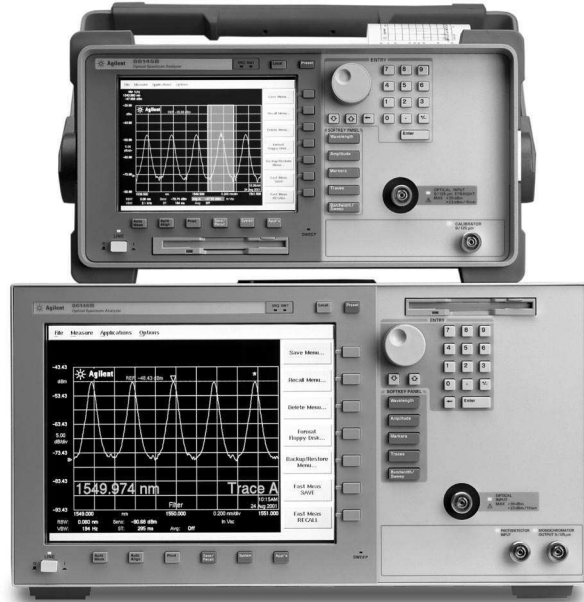
Fast sweep speeds at high sensitivity to maximize measurement throughput

- **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 μ m 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			
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			T(20-30°C)
Absolute Accuracy (factory cal. 2 yr. cycle)	± 0.5 nm			
Tuning Repeatability	± 0.002 nm			
Reproducibility (≤ 1 min)	± 0.002 nm			
Span Linearity				
1525-1570 nm	± 0.01 nm			Char., T(20-30°C)
for spans <40 nm	± 0.02 nm			
	Agilent 86140B, 86142B, 86143B, 86145B	Agilent 86144B, 86146B	Agilent 86141B, 86140B-025, 86143B-025	
Resolution Bandwidth (RBW)				
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	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	$\pm 2\%$			$\pm 3\%$
0.2 nm	$\pm 3\%$			$\pm 5\%$
0.1 nm	$\pm 7\%$			$\pm 10\%$
0.06 nm	$\pm 12\%$			—

Char. indicates the number is a characteristic.

T(#) indicates temperature dependence.

With applied input fiber 9/125 μ m.

Amplitude	Agilent 8614xB			Notes
Sensitivity				Sensitivity is defined as signal value >6 x RMS noise value.
600-750 nm	-60 dBm			T(0-30°C), 2nd 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 -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(20-30°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-025, 86143B-025	
1290-1330 nm	±0.2 dB	±0.2 dB	±0.2 dB	
1525-1570 nm	±0.2 dB	—	±0.2 dB	
1525-1610 nm	—	±0.2 dB	—	
1250-1610 nm	±0.7 dB			Absorption of light by atmospheric moisture affects flatness at 1350-1420nm.
Polarization Dependence*				
1310 nm	±0.25 dB	±0.12 dB	—	For resolution ≥0.2 nm, T(room).
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	

The 86144B and 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.

Specifications (cont'd)

	Agilent 86140B, 86143B, 86144B	Agilent 86142B, 86145B, 86146B	Agilent 86141B, 86140B-025, 86143B-025	Notes
Dynamic Range				
In 0.1 nm Resolution Bandwidth*				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-025, 86143B-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				
Straight connector (9/125 μ m)	>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 μ s/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 μ s			Char.
Trigger delay range	2 μ s-6.5 ms			
Pulse Mode Accuracy	Agilent 86140B, 86143B, 86144B	Agilent 86142B, 86145B, 86146B	Agilent 86141B, 86140B-025, 86143B-025	Notes
Turn On (≥ 2 μ s after rising edge)	< ± 0.2 dB (starting from dark)			Char.
Turn Off (≥ 10 μ s after falling edge)	< ± 0.2 dB	< ± 0.2 dB (30 dB extinction)	± 0.2 dB	Char. (86140B, 86141B, 86143B, 86144B, 86146B, 86140B-025, 86143B-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. registered trademark of
Data export	Spreadsheet and Word Processor Compatible (CSV ASCII)			Microsoft Corporation
Graphics export	CGM, PCL, GIF			
Instrument Drivers	Universal Instrument Drivers (PNP), Compatible with VEE, Labview, Visual Basic and C++			Labview is a U.S. registered trademark of National Instruments.

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

Char. indicates the number is a characteristic.

T(#) indicates temperature dependence.

* With applied input fiber 9/125 μ m.

Benchtop OSA Agilent 86140B, 86141B, 86142B, 86146B	Portable OSA Agilent 86143B, 86144B, 86145B
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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 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 pub11, 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 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 Dependence² for Resolutions ≥ 0.2 nm
1250 nm to 1650 nm: ± 0.5 dB³ (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 dBm⁴ (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

Sensitivity⁶: -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
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Options (available on new instruments only)

Current Source		8614xB-001	—
White Light Source		8614xB-002	—
Built-in 1310 & 1550 nm EELED Source		8614xB-004	—
Built-in 1550 nm EELED Source		8614xB-005	—
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
Alternative Connector Interface	FC/PC	Standard	Standard
	HMS-10	8614xB-011	8614xB-011
	DIN	8614xB-013	8614xB-013
	ST	8614xB-014	8614xB-014
	SC	8614xB-017	8614xB-017
Multimode Fiber Input*		86140B-025	86143B-025
Certificate of Calibration		Included	Included

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

OSA Fiber Sizes

Model Number	Optical Input	8614xB-002* (White Light Source)	8614xB-004* (1310/1550 EELED)	8614xB-005* (1550nm EELED)	8614xB-006 (Calibrator)	Photodiode Input	Mono Output 1
86143B	9 μ m	N/A	N/A	N/A	9 μ m	N/A	N/A
86143B-025	50 μ m				9 μ m		
86145B	9 μ m				9 μ m		
86140B	9 μ m	62.5 μ m	9 μ m	9 μ m	9 μ m	62.5 μ m	62.5 μ m
86140B-025	50 μ m	62.5 μ m	9 μ m	9 μ m	9 μ m		
86142B	9 μ m	62.5 μ m	9 μ m	9 μ m	9 μ m		
86141B**	50 μ m	62.5 μ m	9 μ m	9 μ m	9 μ m	62.5 μ m	62.5 μ m
86144B/86146B	9 μ m	62.5 μ m	9 μ m	9 μ m	9 μ m	50 μ m	9 μ m

* 8614xB-002, 004 and 005 are exclusive.

** Only one fiber size is available on the 86141B.

Options and Accessories Specifications

	Benchtop OSA Agilent 86140B, 86141B, 86142B, 86146B	Portable OSA Agilent 86143B, 86144B, 86145B
8614xB-001 Current Source		
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-004/005 EELED Sources		
Minimum Spectral Power Density		
1540 to 1560 nm (8614xB-005)	> -40 dBm/nm (100 nW/nm)	—
1470 to 1620 nm (8614xB-005)	> -60 dBm/nm (1 nW/nm)	—
1300 to 1320 nm, 1540 to 1560 nm (8614xB-004)	> -40 dBm/nm (100 nW/nm)	—
1250 to 1620 nm (8614xB-004)	> -60 dBm/nm (1 nW/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

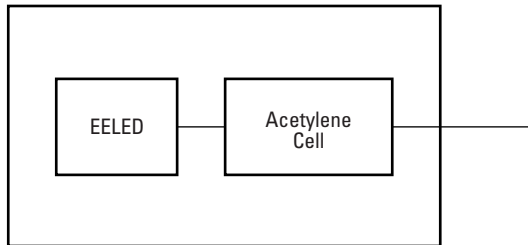


Figure 1. Wavelength calibrator block diagram

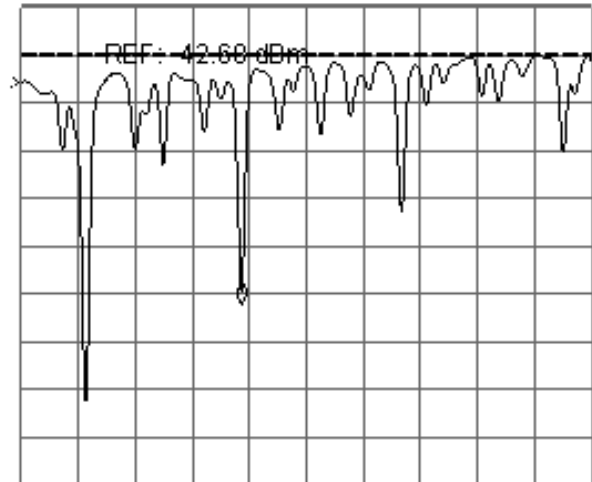


Figure 2. Wavelength calibrator absorption spectrum

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.

Benchtop OSA Agilent 86140B, 86141B, 86142B, 86146B	Portable OSA Agilent 86143B, 86144B, 86145B
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Additional Parts and Accessories

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)	8614xB-030	8614xB-030
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 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

- *Agilent 8614xB Family Brochure* (Agilent literature # 5988-4699EN)
 - *Remote Programming for the 86140 Series, Product Note 86140-1* (Agilent literature # 5968-1548E)
 - *Wavelength Calibration for the 8614x Series, Product Note 86140-2* (Agilent literature # 5980-0043E)
 - *Optimizing Remote Measurement Speed for the 8614xB Series, Product Note 86140-3* (Agilent literature # 5988-2918EN)
 - *Optical Spectrum Analyzer WDM Test Application, Product Note 86140-4* (Agilent literature # 5988-5297EN)
 - *Optical Spectrum Analyzer Amplifier Test Application, Product Note 86140-5* (Agilent literature # 5988-5615EN)
 - *Making Time-Resolved Chirp Measurements, Application Note 1550-7* (Agilent literature # 5988-5614EN)
 - *Optical Spectrum Analyzer Source Test Application, Product Overview* (Agilent literature # 5988-1030EN)
 - *Optical Spectrum Analyzer Web-Enabled Software, Product Overview* (Agilent literature # 5988-4782EN)
 - *Agilent Lightwave Test and Measurement Catalog*
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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."

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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

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