Agilent 86142B and 86146B Optical Spectrum Analyzers

Technical Overview

Full-Feature Optical Spectrum Analyzer

Exhibits excellent speed and dynamic range with convenient and powerful user interface.

Filter Mode

Wavelength - filtered signal can be coupled to a single-mode fiber output for tunable-filter and channel-drop applications.

Dispersion Penalty Calculation

Dispersion penalty calculation software combines 86146B and 86100C to measure time-resolved chirp and calculate dispersion penalty.

Agilent Technologies

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. Characteristics are indicated below as typical, Typ.

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 1hour 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.

Table 1.

Wavelength		
	Agilent 86142B & 86146B	Notes
Range	600 nm to 1700 nm	
Reproducibility	± 0.002 nm	With applied input fiber 9/125 µm; ≤ 1min
Span range	0.2 nm to full range and zero span	
Accuracy after calibration with internal source and with enhanced wavelength calibration for specified range. 1480-1570 nm 1570-1620 nm	 Typ. ± 0.01 nm Typ. ± 0.025 nm	At room temp; with applied input fiber 9/125 µm
After calibration with external reference source(s) ± 10 nm of calibration reference point(s)	 Typ. ± 0.01 nm	At room temp, with applied input fiber 9/125 µm
After user calibration over full wavelength range (600-1700 nm)	± 0.2 nm	T(20 - 30 °C); with applied input fiber 9/125 µm
Absolute accuracy	± 0.5 nm	Factory cal. 2 yr. cycle; T(20 - 30°C); with applied input fiber 9/125 µm
Tuning repeatability	± 0.002 nm	With applied input fiber 9/125 µm; ≤ 1 min
Span linearity 1525-1570 nm for spans < 40 nm	 Typ. ± 0.01 nm, Typ. ± 0.02 nm	T(20 - 30 °C); with applied input fiber 9/125 µm

1. *T(#) indicates temperature range and dependence*

Table 2.

Resolution bandwidth (RBW)				
	Agilent 86142B	Agilent 86146B	Agilent 86142B w/Opt E02	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	Resolution of 10 nm is available for first order grating response only; with applied input fiber 9/125 µm
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 %		 ± 3 % ± 5 % ± 10 % ——	 T(20 - 30 °C)

1. T(#) indicates temperature range and dependence

Table 3.

Amplitude			
	Agilent 86142B & 86146B		Notes
Sensitivity			Sensitivity is defined as signal value > 6 x RMS noise value
600-750 nm, 750-900 nm	- 60 dBm, - 75 dBm		T(0 - 30 °C), 2nd order
900-1250 nm, 1250-1610 nm	- 75 dBm, - 90 dBm		T(0 - 30 °C)
1610-1700 nm	- 80 dBm		T(20 - 30 °C)
Maximum measurement power			Resolution bandwidth setting < channel spacing
1525-1700 nm 600-1000 nm 1000-1525 nm	Typ. + 15 dBm per channel, + 30 dBm total Typ. + 15 dBm per channel, + 30 dBm total Typ. + 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			For resolution ≥ 0.1 nm, with applied input fiber 9/125 µm
at –20 dBm, 1310 nm/1550 nm	± 0.5 dB		
Scale fidelity			
Autorange off Autorange on	± 0.05 dB ± 0.07 dB		Excluding amplitude errors at low power levels due to noise, T(20 - 30 °C), with applied input fiber 9/125 µm
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, with applied input fiber 9/125 µm
15 minute	Typ. ± 0.02 dB		with applied input fiber 9/125 µm
Flatness	Agilent 86142B, 86146B	Agilent 86142B w/Opt E02	With applied input fiber 9/125 µm
1290-1330 nm 1525-1570 nm 1525-1610 nm	± 0.2 dB —— ± 0.2 dB	—— ± 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, at room temp, with applied input fiber 9/125 µm
1310 nm 1530 nm, 1565 nm 1600 nm 1250-1650 nm	± 0.12 dB ± 0.05 dB ± 0.08 dB ± 0.25 dB	 ± 0.5 dB	

1. T(#) indicates temperature range and dependence

Table 4.

Dynamic range			
	Agilent 86142B, 86146B	Agilent 86142B with Opt E02	Notes
In 0.1 nm resolution bandwidth			Excluding multiple order grating response, with applied input fiber 9/125 µm
1250-1610 nm (chop mode on) ± 0.5 nm, ± 1nm, ± 5 nm	Typ. - 70 dB		Chop mode not available on the 86146B model
1550 nm			
at ± 0.8 nm (± 100 GHz at 1550 nm) at ± 0.5 nm (± 62.5 GHz at 1550 nm) at ± 0.4 nm (± 50 GHz at 1550 nm) at ± 0.2 nm (± 25 GHz at 1550 nm)	- 60 dB - 58 dB - 55 dB Typ. - 40 dB	- 60 dB Typ - 55 dB Typ - 52 dB ——	Average of all states of polarization

Monochromator input		
	Agilent 86142B & 86146B	Notes
Input return loss Straight connector (9/125 µm)	> 35 dB	Depends on the quality of the attached connector, with applied 9/125 µm straight connector

Sweep			
	Agilent 86142B & 86146B		Notes
Max. sweep rate	Typ. 40 nm/56.3 ms		
Max. sampling rate in zero span	Typ. 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	Typ < 180 ms Typ < 340 ms Typ < 400 ms Typ < 650 ms		
ADC trigger accuracy			
Jitter (distributed uniformly) Trigger delay range	Typ. < ± 0.5 µs Typ. 2 µs - 6.5 ms		

Pulse mode accuracy			
	Agilent 86142B, 86146B	Agilent 86142B with Opt E02	Notes
Turn On (≥ 2 µs after rising edge)	Typ. < ± 0.2 dB	Typ. < ± 0.2 dB	(Starting from dark)
Turn Off (≥ 10 µs after falling edge)	< ± 0.2 dB (30 dB extinction)	Typ. < ± 0.2 dB	

Computer interfacing		
	Agilent 86142B & 86146B	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	MS-DOS is a U.S. registered trademark of microsoft corporation
Data export	Spreadsheet and word processor compatible (CSV ASCII)	
Graphics export	CGM, PCL, GIF	
Instrument drivers	Universal instrument drivers (PNP), compatible with agilent VEE, labview, visual basic and C++	Labview is a U.S. registered trademark of national instruments

Table 5.

General specifications	
Agilent 86142B & 86146B	
Dimensions	222 mm high x 425 mm wide x 427 mm long
Weight	16.5 Kg
Environmental	
Temperature* Humidity Altitude EMI	Operating 0 °C to 55 °C, storage – 40 °C to 70 °C Operating < 95 % RH, Storage: Noncondensing Up to 200 meters (6.600 feet) 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 230 W

1. ** Floppy disk and printer operating temperature range 0 °C to 45 °C*

Additional Specifications: Agilent 86146B (for 9 µm filter mode output only)

Table 6.

Insertion loss stability			
1550 nm, 15 minutes	0.5 dB	Immediately following enhanced single point auto align, at constant temperature	
Insertion loss			
1550 nm	Typ. 10 dB max	At room temperature	
Filter bandwidth: (from 1530 nm to 1610 nm)			
	0.5 dB	1.0 dB	3.0 dB
RBW nominal setting	Actual bandwidth (Typ.)		
0.04 nm 0.05 nm 0.07 nm 0.1 nm 0.2 nm 0.3 nm 0.5 nm	0.016 0.019 0.033 0.076 0.134 0.257 0.421	0.023 0.026 0.044 0.089 0.147 0.270 0.434	0.039 0.045 0.063 0.115 0.173 0.297 0.460
	± 20 %		

Table 7.

Filter bandwidth: adjacent channel rejection (at 1550 nm)* (Typ.)				
RBN setting	12.5 GHz ± 0.1 nm	25 GHz ± 0.2 nm	50 GHz ± 0.4 nm	100 GHz ± 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				
1550 nm	Typ ± 0.2 dB	for 0.2 nm filter bandwidth and greater, at room temperature		

1. ** Adjacent channel rejection limited to 60 dB below total integrated power*

Options and accessories

Table 8.

Agilent 86142B & 86146B	
Options (available on new instruments only)	
Multimode fiber interface (50µm)	86142B-E02
Current source	8614xB-001
White light source *	8614xB-002
Built-in 1310 & 1550 nm EELED source *	8614xB-004
Wavelength calibrator	8614xB-006
DWDM spectral analysis application	Included
Passive component test application	Included
Amplifier test application	Included
Source test application	Included
Time resolved Chirp with dispersion penalty calculation application software (also available separately)	86146B-DPC
Connector interface	FC/PC: 81000FI SC/PC: 81000KI DIN: 81000SI ST: 81000VI
Certificate of calibration	Included

1. ** 8614xB-002 and 004 are mutually exclusive*

Table 9.

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
86142B-E02	50 µm	62.5 µm	9 µm	9 µm	N/A	
86142B	9 µm					
86146B					50 µm	9 µm

1. ** 8614xB-002 and 004 are exclusive*

Options and accessories: Specifications

Table 10.

Agilent 86142B & 86146B	
8614xB-001 current source	
Range	0 to ± 200 mA (source or sink)
Resolution	Typ 50 µA steps
Accuracy	2 % ± 50 µA
Clamp voltage (nominal)	± 2.7 V
Noise density at 1 kHz	Typ < 4 nA/√Hz
Stability within 30 minutes	Typ. < 100 ppm ± 500 nA
Temperature drift	Typ. < (100 ppm ± 500 nA)/K
Pulse mode Pulse range Pulse resolution Duty cycle range	 10 µs to 6.5 ms 100 ns Pulse width/1 s to 100 %
8614xB-002 white light source	
Wavelength*	900 nm to 1700 nm
Minimum output power spectral density** (9/125 µm fiber) 900 to 1600 nm 900 to 1600 nm 1600 to 1700 nm	 - 67 dBm/nm (0.2 nW/nm) Typ. - 64 dBm/nm (0.4 nW/nm) - 70 dBm/nm (0.1 nW/nm)
Minimum output power spectral density*** 50/125 µm fiber 62.5/125 µm fiber	 Typ. - 50 dBm/nm (10 nW/nm) Typ. - 46 dBm/nm (25 nW/nm)
Output stability**	Typ. ± 0.02 dB over 10 minutes
Lamp lifetime, mean iime between failures (MTBF)	Typ > 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 (100nW/nm) Typ. > - 60 dBm/nm (1nW/nm)
Return loss with straight connector	Typ. > 25 dB
Stability (ambient temp. < ± 1 °C) Over 15 minutes Over 6 hours	 Typ. < ± 0.02 dB Typ. < ± 0.05 dB

1. ** filtered below 850 nm.*
2. *** with applied input fiber 9/125 µm*
3. **** Typ; includes power in full numerical aperture of fiber*

8614xB-006 wavelength calibrator

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.

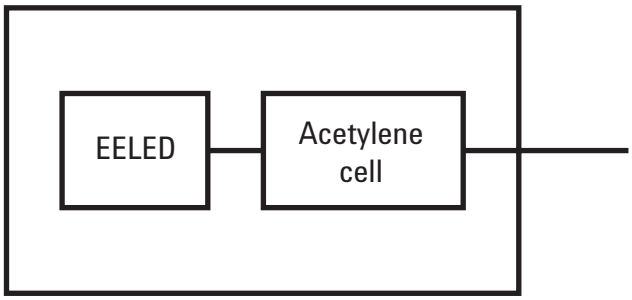

Figure 1. Wavelength calibrator block diagram

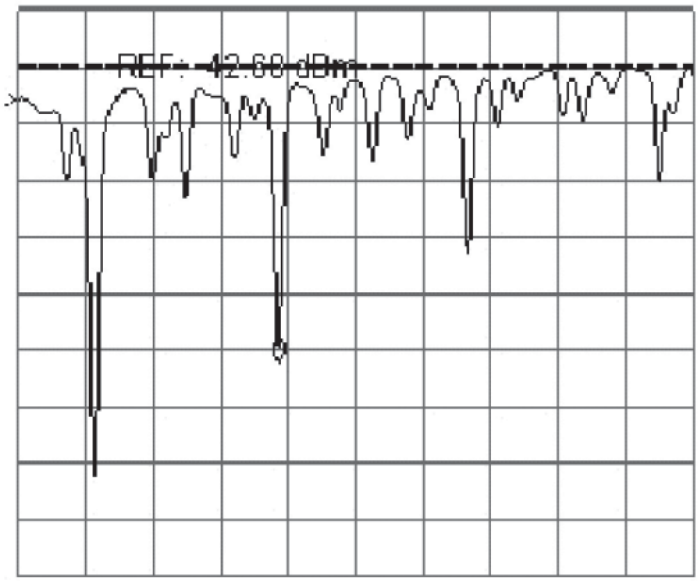

Figure 2. Wavelength calibrator absorption spectrum

Table 11.

Agilent 86142B & 86146B	
Additional parts and accessories	
Printer paper (5 rolls/box)	9270-1370
Additional connector interfaces	See Agilent 81000 Series
9 µm single mode connector saver	Standard
Rack-mount flange kit (with handles)	8614xB-A X 4 (8614xB-AXE)
Transit case	9211-2657
Soft carrying case	N/A

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.

Agilent Email Updates

www.agilent.com/find/emailupdates
Get the latest information on the products and applications you select.

Remove all doubt

Our repair and calibration services will get your equipment back to you, performing like new, when promised. You will get full value out of your Agilent equipment throughout its lifetime. Your equipment will be serviced by Agilent-trained technicians using the latest factory calibration procedures, automated repair diagnostics and genuine parts. You will always have the utmost confidence in your measurements. For information regarding self maintenance of this product, please contact your Agilent office.

Agilent offers a wide range of additional expert test and measurement services for your equipment, including initial start-up assistance, onsite education and training, as well as design, system integration, and project management.

For more information on repair and calibration services, go to:

www.agilent.com/find/removealldoubt

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

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

Microsoft is a U.S. registered trademark of Microsoft Corporation.

www.agilent.com
http://www.agilent.com/comms/octspectral

For more information on Agilent Technologies' products, applications or services, please contact your local Agilent office. The complete list is available at:

www.agilent.com/find/contactus

Americas

Canada	(877) 894-4414
Latin America	305 269 7500
United States	(800) 829-4444

Asia Pacific

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 112 929
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Thailand	1 800 226 008

Europe & Middle East

Austria	01 36027 71571
Belgium	32 (0) 2 404 93 40
Denmark	45 70 13 15 15
Finland	358 (0) 10 855 2100
France	0825 010 700*
	*0.125 €/minute
Germany	07031 464 6333
Ireland	1890 924 204
Israel	972-3-9288-504/544
Italy	39 02 92 60 8484
Netherlands	31 (0) 20 547 2111
Spain	34 (91) 631 3300
Sweden	0200-88 22 55
Switzerland	0800 80 53 53
United Kingdom	44 (0) 118 9276201

Other European Countries:
www.agilent.com/find/contactus

Revised: October 6, 2008

© Agilent Technologies, Inc. 2009
Printed in USA, January 16, 2009
5980-0177E

Agilent Technologies