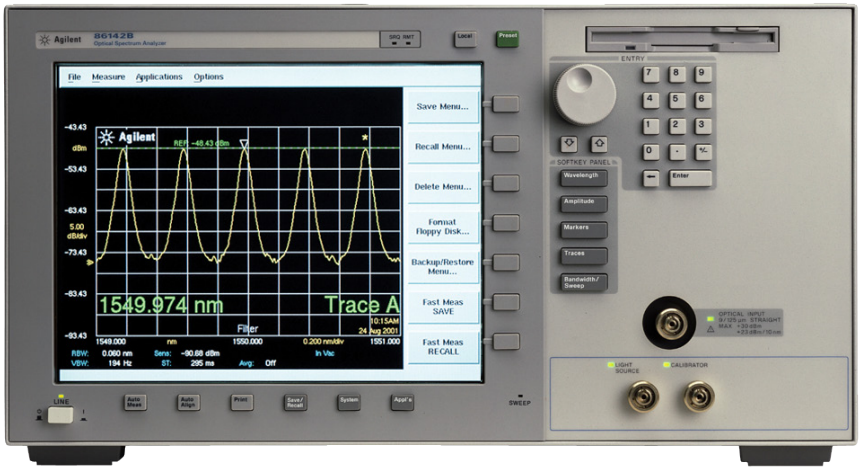
Agilent 86142B Optical Spectrum Analyzer

Technical Overview



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, Typical

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.

Agilent Technologies

Specifications

Table 1

Wavelength		
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		At room temp; with applied input fiber 9/125 µm
1480 to 1570 nm	Typical ± 0.01 nm	
1570 to 1620 nm	Typical ± 0.025 nm	
After calibration with external reference source(s)		At room temp, with applied input fiber 9/125 µm
± 10 nm of calibration reference point(s)	Typical ± 0.01 nm	
After user calibration over full wavelength range (600 to 1700 nm)	± 0.2 nm	T (20 to 30 °C); with applied input fiber 9/125 µm
Absolute accuracy	± 0.5 nm	Factory calibration 2 year cycle; T (20 to 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		T (20 to 30 °C); with applied input fiber 9/125 µm
1525 to 1570 nm	Typical ± 0.01 nm	
For spans < 40 nm	Typical ± 0.02 nm	

T (#) indicates temperature range and dependence.

Table 2

	Agilent 86142B	Agilent 86142B with Opt E02	Notes
Resolution bandwidth (RBW)			
FWHM (3 dB bandwidth)	0.06, 0.1, 0.2, 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 to 1610 nm			
≥ 0.5 nm	± 2 %	± 3 %	
0.2 nm	± 3 %	± 5 %	
0.1 nm	± 7 %	± 10 %	
0.06 nm	± 12 %		T (20 to 30 °C)

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

Table 3

	Agilent 86142B	Agilent 86142B with Opt E02	Notes
Amplitude			
Sensitivity			**Sensitivity is defined as signal value > 6 x RMS noise value**
600 to 750 nm, 750 to 900 nm	–60 dBm, –75 dBm		T (0 to 30 °C), 2nd order
900 to 1250 nm, 1250 to 1610 nm	–75 dBm, –90 dBm		T (0 to 30 °C)
1610 to 1700 nm	–80 dBm		T (20 to 30 °C)
Maximum measurement power			**Resolution bandwidth setting < channel spacing**
1525 to 1700 nm	Typical +15 dBm per channel, +30 dBm total		
600 to 1000 nm	Typical +15 dBm per channel, +30 dBm total		
1000 to 1525 nm	Typical +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	± 0.05 dB		Excluding amplitude errors at low power levels due to noise, T (20 to 30 °C), with applied input fiber 9/125 µm
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, with applied input fiber 9/125 µm
15 minute	Typical ± 0.02 dB		With applied input fiber 9/125 µm
Flatness			With applied input fiber 9/125 µm
1290 to 1330 nm	± 0.2 dB		
1525 to 1570 nm		± 0.2 dB	
1525 to 1610 nm	±0.2 dB		
1250 to 1610 nm	± 0.7 dB		Absorption of light by atmospheric moisture affects flatness at 1350 to 1420 nm
Polarization dependence			**For resolution ≥ 0.2 nm, at room temp, with applied input fiber 9/125 µm**
1310 nm	± 0.12 dB		
1530 nm, 1565 nm	± 0.05 dB		
1600 nm	± 0.08 dB		
1250 to 1650 nm	± 0.25 dB	± 0.5 dB	

T (#) indicates temperature range and dependence.

Table 4

	Agilent 86142B	Agilent 86142B with Opt E02	Notes
Dynamic range			
In 0.1 nm resolution bandwidth			Excluding multiple order grating response, with applied input fiber 9/125 µm
1250 to 1610 nm (chop mode on) ± 0.5 nm, ± 1nm, ± 5 nm	Typical –70 dB		
1550 nm			
At ± 0.8 nm (± 100 GHz at 1550 nm)	–60 dB	–60 dB	Average of all states of polarization
At ± 0.5 nm (± 62.5 GHz at 1550 nm)	–58 dB	Typical –55 dB	
At ± 0.4 nm (± 50 GHz at 1550 nm)	–55 dB	Typical –52 dB	
At ± 0.2 nm (± 25 GHz at 1550 nm)	Typical –40 dB		
Monochromator input			
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			
Max. sweep rate	Typical 40 nm/56.3 ms		
Max. sampling rate in zero span	Typical 50 µs/trace point		
Sweep cycle time			
50 nm span, auto zero off	Typical < 180 ms		
50 nm span, auto zero on	Typical < 340 ms		
100 nm span	Typical < 400 ms		
500 nm span	Typical < 650 ms		
ADC trigger accuracy			
Jitter (distributed uniformly)	Typical < ± 0.5 µs		
Trigger delay range	Typical 2 µs to 6.5 ms		
Pulse mode accuracy			
Turn on (≥ 2 µs after rising edge)	Typical < ± 0.2 dB	Typical < ± 0.2 dB	(Starting from dark)
Turn off (≥ 10 µs after falling edge)	Typical < ± 0.2 dB (30 dB extinction)	Typical < ± 0.2 dB	

Table 4 (Continued)

	Agilent 86142B	Agilent 86142B with Opt E02	Notes
Computer interfacing			
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	
Dimensions (W x H x D)	425 mm x 222 mm x 427 mm
Weight	16.5 kg
Environmental	
Temperature [1]	Operating 0 °C to 55 °C, storage –40 °C to 70 °C
Humidity	Operating < 95 % RH, Storage: Noncondensing
Altitude	Up to 200 meters (6.600 feet)
EMI	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	90 Vac to 260 Vac, 44 to 444 Hz
Maximum power consumption	230 W

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

Options and Accessories

Table 6

Options (Available on new instruments only)	
Multimode fiber interface (50 µm)	86142B-E02
Current source	86142B-001
White light source [1]	86142B-002
Built-in 1310 and 1550 nm EELED source [1]	86142B-004
Wavelength calibrator	86142B-006
DWDM spectral analysis application	Included
Passive component test application	Included
Amplifier test application	Included
Source test application	Included
Connector interface	FC/PC: 81000FI
	SC/PC: 81000KI
	DIN: 81000SI
	ST: 81000VI
Certificate of calibration	Included

1. 86142B-002 and 004 are mutually exclusive.

Table 7

OSA fiber sizes				
Model number	Optical input	86142B-002 [1] (White light source)	86142B-004 [1] (1310/1550 EELED)	86142B-006 (Calibrator)
86142B-E02	50 µm	62.5 µm	9 µm	9 µm
86142B	9 µm			

1. 86142B-002 and 004 are exclusive.

Options and Accessories: Specifications

Table 8

86142B-001 current source	
Range	0 to ± 200 mA (source or sink)
Resolution	Typical 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	Typical < 100 ppm ± 500 nA
Temperature drift	Typical < (100 ppm ± 500 nA)/K
Pulse mode	
Pulse range	10 µs to 6.5 ms
Pulse resolution	100 ns
Duty cycle range	Pulse width/1 s to 100 %
86142B-002 white light source	
Wavelength [1]	900 nm to 1700 nm
Minimum output power spectral density [2] (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 [3]	
50/125 µm fiber	Typical –50 dBm/nm (10 nW/nm)
62.5/125 µm fiber	Typical –46 dBm/nm (25 nW/nm)
Output stability [2]	Typical ± 0.02 dB over 10 minutes
Lamp lifetime, mean iime between failures (MTBF)	Typical > 5000 hours
86142B-004 EELED sources	
Minimum spectral power density	
1250 to 1620 nm	Typical > –60 dBm/nm (1 nW/nm)
1300 to 1320 nm, 1540 to 1560 nm	> –40 dBm/nm (100 nW/nm)
Return loss with straight connector	Typical > 25 dB
Stability (Ambient temperature < ± 1 °C)	
Over 15 minutes	Typical < ± 0.02 dB
Over 6 hours	Typical < ± 0.05 dB

1. *Filtered below 850 nm.*
2. *With applied input fiber 9/125 µm.*
3. *Typical; includes power in full numerical aperture of fiber.*

86142B-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.

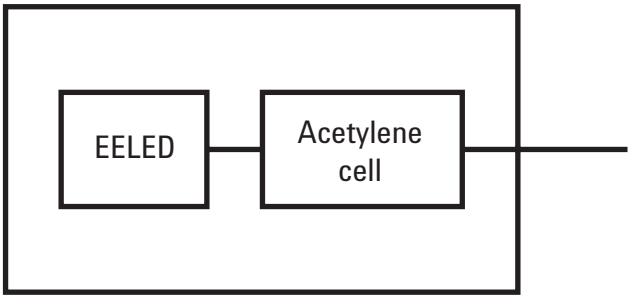


Figure 1. Wavelength calibrator block diagram

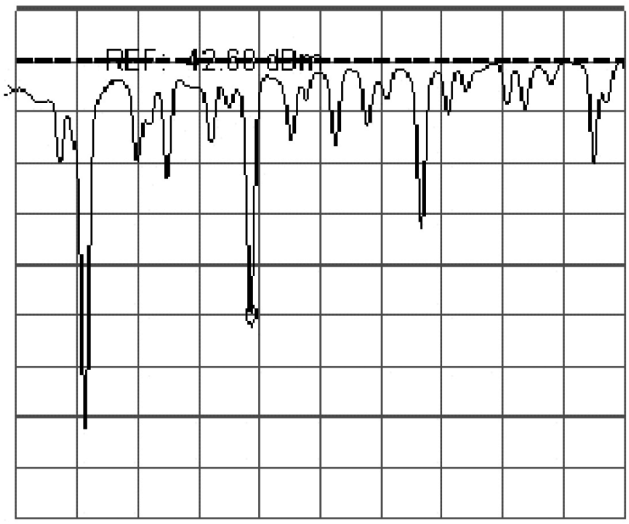


Figure 2. Wavelength calibrator absorption spectrum

Table 9

Additional parts and accessories	
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.

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