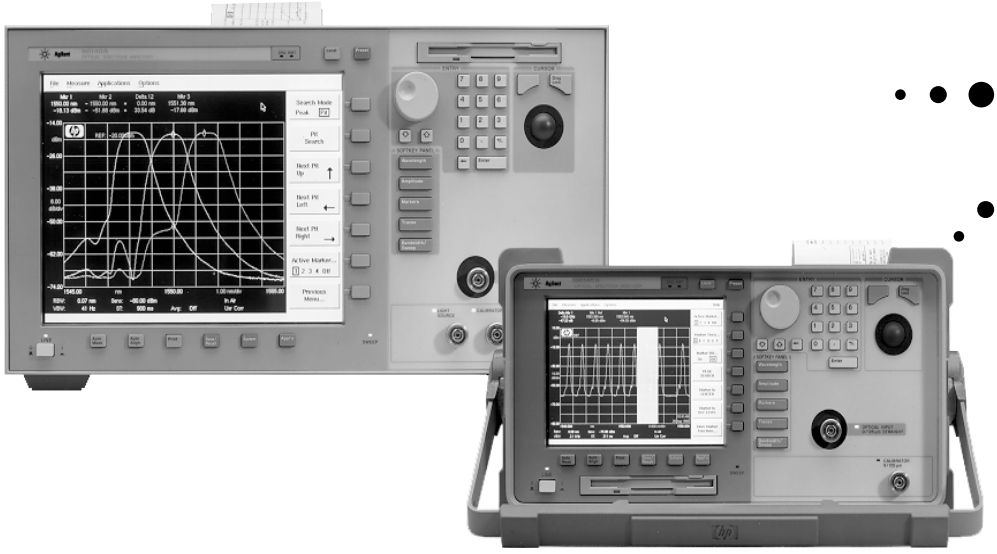
Agilent 86140A
Optical Spectrum Analyzer Family
Technical Specifications



- **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
High Accuracy: Ideal for critical WDM system and component characterization	**Agilent 86142A**	**Agilent 86145A**
Standard: Ideal for a wide range of applications at value prices	**Agilent 86140A**	**Agilent 86143A**

The Agilent 86140A and 86142A optical spectrum analyzers are high performance benchtop instruments that offer a combination of flexibility, high accuracy and throughput for both R&D and manufacturing environments. These are complimented by the portable Agilent 86143A and 86145A, providing performance in a compact 14.5 kg package for environments where small size and weight are important.

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.

Specifications

Agilent 86140A	Agilent 86143A	Agilent 86142A	Agilent 86145A
Standard		High Accuracy	
Benchtop	Portable	Benchtop	Portable

Wavelength

Range	600 nm to 1700 nm
Span range (continuously variable)	0.2 nm to full range and zero span
Accuracy	
After calibration with internal wavelength reference signal[1,2]	±0.025 nm (1510–1570), ±0.035 nm (1570–1640)
After user calibration within ±40 nm of calibration signal[1,2]	±0.05 nm
After user calibration over full wavelength range[1]	±0.2 nm
Absolute accuracy (Factory Calibration Cycle 2 yrs)[1]	±0.5 nm
Reproducibility (≤1 min)[1]	±0.003 nm
Span linearity[1,3]	±0.05 nm, for spans <40nm
Span linearity (1525 nm to 1570 nm)[1,2,3]	±0.02 nm
Tuning repeatability[1]	±0.003 nm

Resolution Bandwidth (RBW)

FWHM (selectable)[1,4]	0.07, 0.1, 0.2, 0.5, 1, 2, 5, 10 nm	0.06, 0.1, 0.2, 0.5, 1, 2, 5, 10 nm
Corrected Res. bandwidth accuracy (using noise markers)[1,3]		
≥0.5 nm, 1525–1610 nm	±4%	± 3%
0.2 nm, 1525–1610 nm	±6%	± 5%
0.1 nm, 1525–1610 nm	±12%	± 10%

Amplitude

Sensitivity[5]		
600–750 nm (No averaging required)[6,7]	–60 dBm	
750–900 nm (No averaging required)[6,7]	–75 dBm	
900–1250 nm (No averaging required)[6]	–75 dBm	
1250–1610 nm (No averaging required)[6]	–90 dBm	
1610–1700 nm (No averaging required)[3]	–80 dBm	
Maximum measurement power[2,8]		
1525–1700 nm	+15 dBm per channel, +30 dBm total	
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	
Calibration accuracy at –20 dBm, 1310 nm/1550 nm[9]	± 0.5 dB	
Scale fidelity (autorange off)[3,10]	± 0.07 dB	± 0.05 dB
(autorange on)[3,10]	± 0.1 dB	± 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	
15 minutes[2]	±0.02 dB	
Flatness		
1290–1330 nm[1]	±0.2 dB	
1525–1570 nm[1]	±0.2 dB	
1525–1610 nm[1]		±0.2 dB
1250–1610 nm[1,11]	±0.7 dB	
Polarization dependence[1,12,13]		
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
1250–1650 nm (Multimode Fiber Opt. 025)	±0.4 dB	—

	Agilent HP 86140A	Agilent HP 86143A	Agilent HP 86142A	Agilent HP 86145A
	Standard		High Accuracy	
	Benchtop	Portable	Benchtop	Portable

Dynamic Range

In 0.1 nm resolution[1,14]		
1250–1610 nm (chop mode on)2 ±0.5 nm, ±1 nm, ±5 nm	–70 dB	
1550 nm at ±0.8 nm (±100 GHz at 1550 nm)[15]	–60 dB	
1550 nm at ±0.5 nm (±62.5 GHz at 1550 nm)	–55 dB	–58 dB
1550 nm at ±0.4 nm (±50 GHz at 1550 nm)	–52 dB	–55 dB
1550 nm at ±0.2 nm (±25 GHz at 1550 nm)[2]		–40 dB

Monochromator Input

Input return loss	
Straight connector (9/125 µm)[16]	>35 dB

Sweep

Max. sweep rate[2]	40 nm/50 ms
Max. sampling rate in zero span[2]	50 µs/trace point
Sweep cycle time[2]	
50 nm span auto zero off	<180 ms
50 nm span	<340 ms
100 nm span	<400 ms
500 nm span	<650 ms
ADC trigger accuracy[2]	
Jitter (distributed uniformly)	<±0.5 µs
Trigger delay range	2 µs–6.5 ms

Pulse Mode Accuracy

Turn on (≥2 µs after rising edge)[2]	<± 0.2 dB (starting from dark)	
Turn off (≥10 µs after falling edge)	<±0.2 dB2	<±0.2 dB (30 dB extinction)

Computer Interfacing

Remote control	
Compatibility	IEEE-488-1, IEEE-488.2 (100%)
Interfaces	GPIB, Parallel Printer Port, External VGA Monitor, Keyboard (PS/2) and Mouse
Floppy Disk	3.5" 1.44MB, MS-DOS®
Data export	Spreadsheet and Word Processor Compatible (CSV ASCII)
Graphics export	CGM
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.

General Specifications

	Benchtop OSA Agilent 86140A/86142	Portable OSA Agilent 86143A/86145A
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[17]	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 IEC555-2	
Power Requirements		
Voltage and frequency	90 Vac to 260 Vac, 44 to 444 Hz	
Maximum power consumption	230 W	

Option 004/005 EELED Sources

Minimum spectral power density[18]		
1540 to 1560 nm (Option 005)	>–40 dBm/nm 100 nW/nm	
1470 to 1620 nm (Option 005)[2]	>–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)[2]	>–60 dBm/nm 1 nW/nm	
Return loss[2]		
With straight connector	>25 dB	
Stability (ambient temp. <±1°C)[2]		
Over 15 minutes	<±0.02 dB	
Over 6 hours	<±0.05 dB	

1 With applied input fiber 9/125 µm
2 Characteristic
3 Temperature range 20 to 30°C
4 Resolution of 10 nm is available in first order only
5 Sensitivity is defined as signal value >6 x RMS noise value.
6 Temperature range 0 to 30°C.
7 Second order
8 Resolution bandwidth setting <channel spacing.
9 For resolution ≥0.1 nm
10 Excluding amplitude errors at low power levels due to noise
11 Between 1350 nm and 1420 nm absorption of light by atmospheric moisture affects flatness.
12 For resolution ≥0.2 nm
13 At room temperature
14 Excluding multiple order grating response
15 Average of all states of polarization.
16 Depends on the quality of the attached connector
17 Floppy disk and printer operating temperature range 0 to 45°C.
18 Temperature range 0 to 45°C

Options and Accessories

	Benchtop OSA Agilent 86140A/86142A	Portable OSA Agilent 86143A/86145A

Options (available on new instruments only)

Built-in 1310 & 1550 nm EELED Source	Opt. 004	—
Built-in 1550 nm EELED Source Opt. 005	—	
Wavelength Calibrator	Opt. 006	Opt. 006
Passive Component Test Aplication	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[19]	Opt. 025 (Agilent 86140A)	Opt. 025 (Agilent 86143A)
Certificate of Calibration	Included	Included

[19] 50 µm multimode input available on Agilent 86140A and 86143A OSAs only.

Wavelength Calibrator Option 006

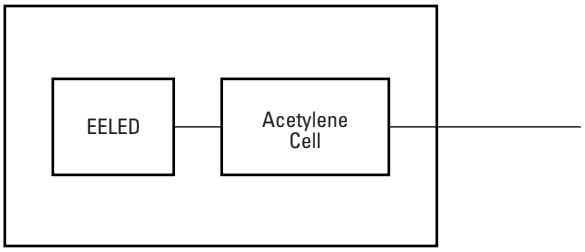


Figure 1. Wavelength calibrator block diagram

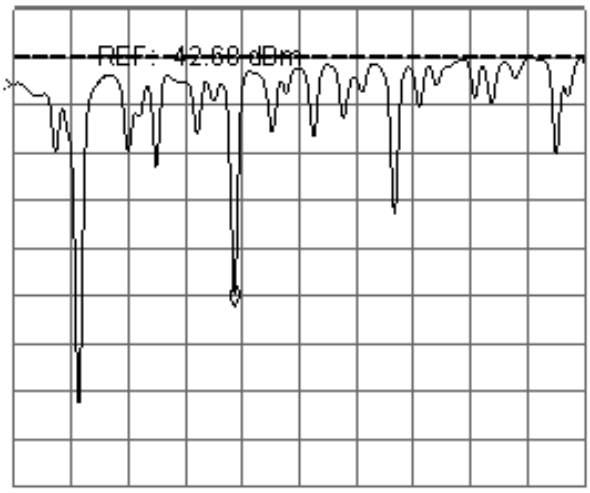


Figure 2. Wavelength calibrator absorption spectrum

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 ±50 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 86140A/86142A	**Portable OSA Agilent 86143A/86145A**
Printer Paper (5 rolls / box)	9270-1370	9270-1370
Additional Connector Interfaces	See Agilent 81000 series	See Agilent 81000 series
101/102 Keyboard (OSA requires US layout)	C4735A	C4735A
PS/2 Style Mouse	C3751B	C3751B
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[20]	Standard	Standard

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

Literature Reference

Brochure (Agilent literature # 5968-1123E)

Agilent 86140 Series Optical Spectrum Analysis Remote Programming. Agilent product note (Agilent literature # 5968-1548E)

Agilent Lightwave Catalog

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.
- 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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