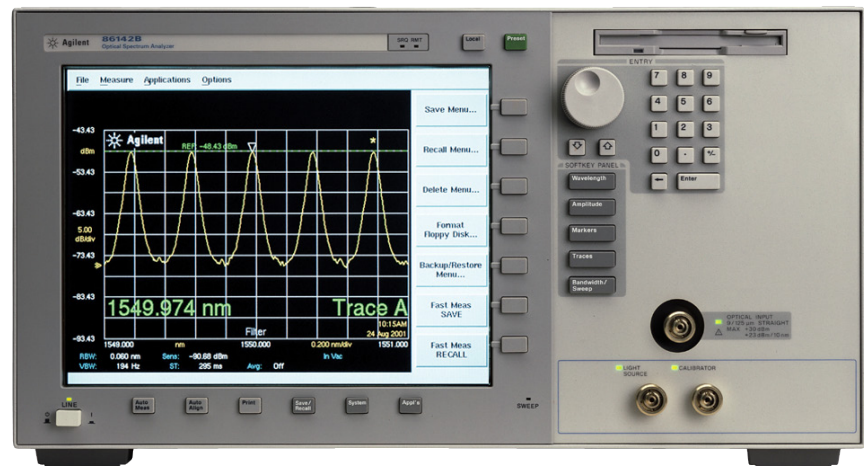


Agilent 86142B Optical Spectrum Analyzer

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 1 hour 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 μ m; ≤ 1 min |
| 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 μ m |
| 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 μ m |
| ± 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 μ m |
| Absolute accuracy | ± 0.5 nm | Factory calibration 2 year cycle; T (20 to 30 °C); with applied input fiber 9/125 μ m |
| Tuning repeatability | ± 0.002 nm | With applied input fiber 9/125 μ m; ≤ 1 min |
| Span linearity | | T (20 to 30 °C); with applied input fiber 9/125 μ m |
| 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 μ m |
| 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 | | Absorption of light by atmospheric moisture affects flatness at 1350 to 1420 nm |
| 1525 to 1570 nm | ± 0.2 dB | | |
| 1525 to 1610 nm | ±0.2 dB | | |
| 1250 to 1610 nm | ± 0.7 dB | | |
| 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 | > 35 dB | | Depends on the quality of the attached connector, with applied 9/125 μm straight connector |
| Straight connector (9/125 μm) | | | |
| 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 μ A steps |
| Accuracy | 2 % ± 50 μ A |
| Clamp voltage (nominal) | ± 2.7 V |
| Noise density at 1 kHz | Typ < 4 nA/ $\sqrt{\text{Hz}}$ |
| Stability within 30 minutes | Typical < 100 ppm ± 500 nA |
| Temperature drift | Typical $< (100 \text{ ppm} \pm 500 \text{ nA})/\text{K}$ |
| Pulse mode | |
| Pulse range | 10 μ s 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 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 ³ | |
| 50/125 μ m fiber | Typical -50 dBm/nm (10 nW/nm) |
| 62.5/125 μ m fiber | Typical -46 dBm/nm (25 nW/nm) |
| Output stability ² | Typical ± 0.02 dB over 10 minutes |
| Lamp lifetime, mean time 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 $< \pm 1$ °C) | |
| Over 15 minutes | Typical $< \pm 0.02$ dB |
| Over 6 hours | Typical $< \pm 0.05$ dB |

1. Filtered below 850 nm.

2. With applied input fiber 9/125 μ m.

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.

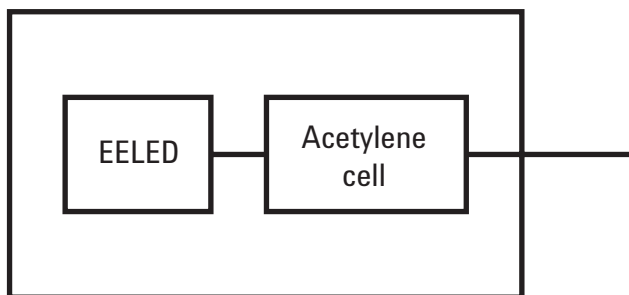


Figure 1. Wavelength calibrator block diagram

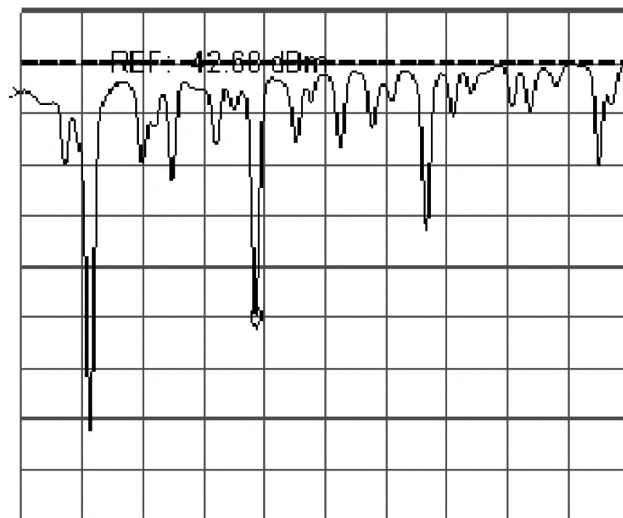


Figure 2. Wavelength calibrator absorption spectrum

Table 9

| Additional parts and accessories | |
|---------------------------------------|---------------------------|
| Additional connector interfaces | See Agilent 81000 Series |
| 9 μ m 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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