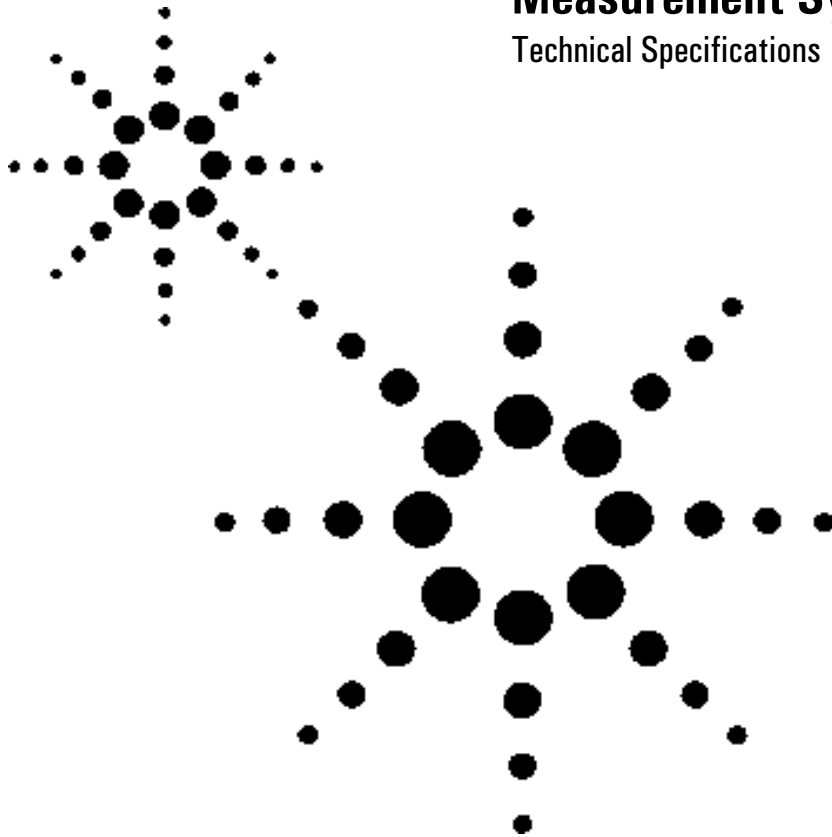


Agilent 8164A Lightwave Measurement System

Technical Specifications



A New Platform for the Test of Fiber Optic Components



The Agilent 8164A Lightwave Measurement System supports a whole range of tunable laser modules and all modules of the Agilent 8153A and 8163A Lightwave Multimeter series. The 8164A mainframe features connectivity to a wide range of controlling equipment through GPIB, RS-232C and PC Card interface. Configurable hardware input and output trigger ports complete the 8164A's ability to operate in an automated test environment. A 3.5" floppy drive, VGA port, keyboard connector and parallel printer port are included.



Agilent Technologies

Innovating the HP Way

Tunable lasers for all gain bands

The Agilent 81680A and 81682A modules operate in the 1550 nm band whereas the Agilent 81640A covers the wavelength range from 1510 nm to 1640 nm.

Optimum tuning precision for the test of critical dense-WDM devices

The Agilent 81640A, 81680A and 81682A Tunable Laser modules with their built-in wavelength control loop push today's performance limits. As they are all mode-hop free tunable with continuous output power, they qualify for the test of the most critical DWDM components. All three modules fit into the bottom slot of the 8164A mainframe.

Polarization Maintaining Fiber for the test of integrated optical devices

The 81640A, 81680A and 81682A modules are ideally constructed to characterize integrated optical devices. Their Panda PMF output ports provide a well defined state of polarization to ensure constant measurement conditions on waveguide devices. A PMF cable easily connects an external optical modulator.

Low spontaneous emission for maximum measurement range

The 81640A and 81680A tunable laser modules are equipped with two optical outputs. One output port delivers a signal with ultra-low source spontaneous emission (SSE). It enables accurate crosstalk measurement of dense-WDM system components with many channels at narrow spacing.

Just a power meter module is sufficient to characterize steep notch filters such as Fiber Bragg Gratings.

The second output port provides increased optical power and allows adjustment by more than 60 dB through a built-in optical attenuator.

Test of optical amplifiers and passive components

The 81682A Tunable Laser module provides the high stimulus power needed to test today's optical amplifiers. An optional, built-in optical attenuator allows an output power dynamic range of more than 60 dB. Its excellent wavelength precision makes it a multi-purpose instrument for all kinds of component test.



Compact module for multi-channel test

A variable amount of the compact, yet fully remote controlled Agilent 81689A Tunable Laser modules, in combination with the 81682A high power Tunable Laser, is the ideal solution to characterize optical amplifiers for use in dense-WDM applications. Furthermore the 81689A allows a realistic multi-channel test bed for dense-WDM transmission systems to be set up.

Its continuous, mode-hop free tuning makes it quick and easy to set even the most complex configurations to the target wavelengths and power levels, just by dialing or using the vernier keys. The 81689A is available with both, standard single-mode fiber and Panda- type PMF. Each 8164A mainframe can host up to four units of the 81689A in its upper slots.

The 8164A, 81640A, 81680A, 81682A and 81689A are produced to ISO 9001 international quality system standard as part of Agilent's commitment to continually increasing customer satisfaction through improved quality control.

Specifications describe the instrument's warranted performance. They are verified at the end of a 2 m long patchcord and are valid after warm-up and for the stated output power and wavelength ranges.

Each specification is assured by thoroughly analyzing all measurement uncertainties. Supplementary performance characteristics describe the instrument's non-warranted typical performance.

Every instrument is delivered with a commercial certificate of calibration and a detailed test report.

For further details on specifications, see the Definition of Terms in Appendix C of the Tunable Laser User's Guide.

81680A Tunable Laser for the test of critical dense-WDM components

	Agilent 81680A	
Wavelength range	1460 nm to 1580 nm	
Wavelength resolution	0.1 pm, 12.5 MHz at 1550 nm	
Mode-hop free tuning range	full wavelength range	
Absolute wavelength accuracy ^{[1][2]}	±0.01 nm	
Relative wavelength accuracy ^{[1][2]}	±5 pm, typ. ±2 pm	
Wavelength repeatability ^[2]	±1 pm, typ. ±0.5 pm	
Wavelength stability (typ., 24 h at const. temp.) ^[2]	≤ ±1 pm	
Tuning speed (typ. for a 1/10/100 nm step)	400 ms/ 600 ms/ 2.8 s	
Linewidth (typ.), coherence control off	100 kHz	
Effective linewidth (typ.), coherence ctrl. on	> 50 MHz (1480 – 1580 nm, at maximum flat output power)	
	Output 1 (low SSE)	Output 2 (high power)
Output power ^[3] (continuous power during tuning)	≥ -4 dBm peak typ. ≥ -6 dBm (1520 – 1570 nm) ≥ -10 dBm (1480 – 1580 nm) ≥ -13 dBm (1460 – 1580 nm)	≥ 6 dBm peak typ. ≥ 5 dBm (1520 – 1570 nm) ≥ 1 dBm (1480 – 1580 nm) ≥ -3 dBm (1460 – 1580 nm)
Minimum output power ^[3]	-13 dBm	-3 dBm (-60 dBm in attenuation mode)
Power stability ^{[3][9]}	±0.01 dB, 1 hour typ. ±0.03 dB, 24 hours	
Power repeatability (typ.) ^[3]	±0.01 dB	
Power linearity ^[3]	±0.1 dB	±0.3 dB
Power flatness versus wavelength ^[3]	±0.2 dB, typ. ±0.1 dB	±0.3 dB, typ. ±0.15 dB
Side-mode suppression ratio (typ.) ^{[4][8]}	≥ 40 dBc (1480 – 1580 nm)	
Signal to source spontaneous emission ratio ^{[5][8]}	≥ 63 dB/ nm ^[7] (1520 – 1570 nm) ≥ 58 dB/ nm ^[7] (typ., 1480– 1580 nm) ≥ 53 dB/ nm ^[7] (typ., 1460 – 1580 nm)	≥ 45 dB/ nm (1520 – 1570 nm) ≥ 40 dB/ nm (1480 – 1580 nm) ≥ 35 dB/ nm (1460 – 1580 nm)
Signal to total source spontaneous emission ratio ^{[6][8]}	≥ 60 dB (1520 – 1570 nm) ^[7] ≥ 50 dB (typ., 1460 – 1580 nm) ^[7]	≥ 30 dB (typ., 1520 – 1570 nm)
Relative intensity noise (RIN, typ.) ^[8]	-145 dB/Hz (1480 – 1580 nm)	

^[1] Valid for one month and within a ±5 K temperature range after automatic wavelength zeroing.

Wavelength Zeroing is an internal function that performs an automatic self-adjustment.

^[2] At CW operation. Measured with wavelength meter based on wavelength in vacuum.

^[3] Applies to the selected output.

^[4] Measured by heterodyning method.

^[5] Measured with optical spectrum analyzer at 1 nm resolution bandwidth.

^[6] Measured with optical spectrum analyzer.

^[7] Measured with Fiber Bragg Grating to suppress the signal.

^[8] Output power as specified per wavelength range and output port.

^[9] Warm up time 1 hour

81640A Tunable Laser for the test of critical components in both dense-WDM bands

	Agilent 81640A	
Wavelength range	1510 nm to 1640 nm	
Wavelength resolution	0.1 pm, 12.5 MHz at 1550 nm	
Mode-hop free tuning range	full wavelength range	
Absolute wavelength accuracy ^{[1][2]}	±0.015 nm	
Relative wavelength accuracy ^{[1][2]}	±7 pm, typ. ±3 pm	
Wavelength repeatability ^[2]	±1 pm, typ. ±0.5 pm	
Wavelength stability (typ., 24 h at const. temp.) ^[2]	≤ ±1 pm	
Tuning speed (typ. for a 1/10/100 nm step)	400 ms/ 600 ms/ 2.8 s	
Linewidth (typ.), coherence control off	100 kHz	
Effective linewidth (typ.), coherence ctrl. on	> 50 MHz (1520 – 1620 nm, at maximum flat output power)	
	Output 1 (low SSE)	Output 2 (high power)
Output power ^[3] (continuous power during tuning)	≥ -5 dBm peak typ. ≥ -7 dBm (1530 – 1610 nm) ≥ -9 dBm (1520 – 1620 nm) ≥ -13 dBm (1510 – 1640 nm)	≥ 4 dBm peak typ. ≥ 2 dBm (1530 – 1610 nm) ≥ 0 dBm (1520 – 1620 nm) ≥ -5 dBm (1510 – 1640 nm)
Minimum output power ^[3]	-13 dBm	-5 dBm (-60 dBm in attenuation mode)
Power stability ^{[3][9]}	±0.01 dB, 1 hour typ. ±0.03 dB, 24 hours	
Power repeatability (typ.) ^[3]	±0.01 dB	
Power linearity ^[3]	±0.1 dB	±0.3 dB
Power flatness versus wavelength ^[3]	±0.2 dB, typ. ±0.1 dB	±0.3 dB, typ. ±0.15 dB
Side-mode suppression ratio (typ.) ^{[4][8]}	≥ 40 dBc (1530 – 1610 nm)	
Signal to source spontaneous emission ratio ^{[5][8]}	≥ 60 dB/nm (1530 – 1610 nm) ^[7] ≥ 55 dB/nm (typ., 1520 – 1620 nm) ^[7] ≥ 50 dB/nm (typ., 1510 – 1640 nm) ^[7]	≥ 45 dB/nm (1530 – 1610 nm) ≥ 40 dB/nm (1520 – 1620 nm) ≥ 35 dB/nm (1510 – 1640 nm)
Signal to total source spontaneous emission ratio ^{[6][8]}	≥ 55 dB (1530 – 1610 nm) ^[7] ≥ 45 dB (typ., 1510 – 1640 nm) ^[7]	≥ 27 dB (typ., 1530 – 1610 nm)
Relative intensity noise (RIN, typ.) ^[8]	-145 dB/Hz (1530 – 1610 nm)	

^[1] Valid for one month and within a ±5 K temperature range after automatic wavelength zeroing.

Wavelength Zeroing is an internal function that performs an automatic self-adjustment.

^[2] At CW operation. Measured with wavelength meter based on wavelength in vacuum.

^[3] Applies to the selected output.

^[4] Measured by heterodyning method.

^[5] Measured with optical spectrum analyzer at 1 nm resolution bandwidth.

^[6] Measured with optical spectrum analyzer.

^[7] Measured with Fiber Bragg Grating to suppress the signal.

^[8] Output power as specified per wavelength range and output port.

^[9] Warm up time 1 hour

81682A Tunable Laser for the test of optical amplifiers and passive components

	Agilent 81682A
Wavelength range	1460 nm to 1580 nm
Wavelength resolution	0.1 pm, 12.5 MHz at 1550 nm
Mode-hop free tuning range	full wavelength range
Absolute wavelength accuracy ^{[1], [2]}	±0.01 nm
Relative wavelength accuracy ^{[1], [2]}	±5 pm, typ. ±2 pm
Wavelength repeatability ^[2]	±1 pm, typ. ±0.5 pm
Wavelength stability (typ., over 24 h at constant temperature) ^[2]	< ±1 pm
Tuning speed (typ. for a 1/10/100 nm step)	400 ms/ 600 ms/ 2.8 s
Linewidth (typ.), coherence control off	100 kHz
Effective linewidth (typ.), coherence control on	> 50 MHz (1480 – 1580 nm, at max. flat output power)
Output power (continuous power during tuning) for #003 ^[3]	≥ 8 dBm peak typ. ≥ 6 dBm (1520 – 1570 nm) ≥ 2 dBm (1480 – 1580 nm) ≥ -3 dBm (1460 – 1580 nm) reduce by 1.5 dB
Minimum output power with option #003 ^[3]	-3 dBm -4.5 dBm (-60 dBm in attenuation mode)
Power stability ^[8]	±0.01 dB, 1 hour typ. ±0.03 dB, 24 hours
Power repeatability (typ.)	±0.01 dB
Power linearity/ with #003 (typ.) ^[3]	±0.1 dB/ ±0.2 dB
Power flatness versus wavelength with option #003 ^[3]	±0.2 dB, typ. ±0.1 dB ±0.3 dB, typ. ±0.2 dB
Side-mode suppression ratio (typ.) ^{[4], [7]}	≥ 40 dBc (1480 – 1580 nm)
Signal to source spontaneous emission ratio ^{[5], [7]}	≥ 45 dB/ nm (1520 – 1570 nm) ≥ 40 dB/ nm (1480 – 1580 nm) ≥ 35 dB/ nm (1460 – 1580 nm)
Signal to total source spontaneous emission ratio (typ.) ^{[6], [7]}	≥ 30 dB (1520 – 1570 nm)
Relative intensity noise (RIN, typ.) ^[7]	-145 dB/Hz (1480 – 1580 nm)

^[1] Valid for one month and within a ±5 K temperature range after automatic wavelength zeroing.

Wavelength Zeroing is an internal function that performs an automatic self-adjustment.

^[2] At CW operation. Measured with wavelength meter based on wavelength in vacuum.

^[3] Option #003: built-in optical attenuator.

^[4] Measured by heterodyning method.

^[5] Measured with optical spectrum analyzer at 1 nm resolution bandwidth.

^[6] Measured with optical spectrum analyzer.

^[7] Output power as specified per wavelength range.

^[8] Warm up time 1 hour

81689A Compact Tunable Laser for Multi-channel test applications

	Agilent 81689A
Wavelength range	1525 nm to 1575 nm
Wavelength resolution	0.01 nm, 1.25 GHz at 1550 nm
Absolute wavelength accuracy (typ.) ^[1]	± 0.3 nm
Relative wavelength accuracy ^[1]	± 0.3 nm
Wavelength repeatability ^[1]	± 0.05 nm
Wavelength stability (typ., over 24 h at constant temperature) ^[1]	< ± 0.02 nm
Tuning speed (typ.)	< 10 sec/ 50 nm
Linewidth (typ.) ^[2]	20 MHz
Output power (continuous power on during tuning)	≥ 6 dBm (1525 – 1575nm)
Minimum output power	-3 dBm
Power stability (at constant temperature) ^[3]	± 0.03 dB over 1 hour, typ. ± 0.06 dB over 24 hours
Power repeatability (typ.) ^[3]	± 0.02 dB
Power linearity	± 0.1dB
Power flatness versus wavelength	± 0.3 dB
Side-mode suppression ratio (typ.) ^[4]	> 40 dBc (1525 – 1575 nm at 0 dBm)
Signal to source spontaneous emission ratio (typ.) ^[5]	≥ 39 dB/ nm (1525 – 1575 nm at 6 dBm)
Relative intensity noise (RIN, typ.)	< -137 dB/Hz (100 MHz – 2.5 GHz)
Dimensions	75 mm H, 32 mm W, 335 mm D (2.8" x 1.3" x 13.2")
Weight	1 kg

^[1] At CW operation. Measured with wavelength meter based on wavelength in vacuum.

^[2] Measured by heterodyning method with 20 ms sweep time, 50 MHz span, 1 MHz resolution.

^[3] 500 ms after changing power.

^[4] Measured by heterodyning method.

^[5] Measured with optical spectrum analyzer at 1 nm resolution bandwidth.

Supplementary performance characteristics

Modulation

Internal digital modulation ^[1]

50% duty cycle, 200 Hz to 300 kHz.

Modulation output:

TTL reference signal.

External digital modulation ^[1]

> 45% duty cycle, fall time
< 300 ns, 200 Hz to 1 MHz.

Modulation input:

TTL signal.

External analog modulation

≥ ±15% modulation depth,
5 kHz to 20 MHz (for Agilent 81689A:
5 kHz to 1 MHz).

Modulation input:

5 V_{p-p}

External wavelength locking

(81640A/ 80A/ 82A)
> ±70 pm at 10 Hz
> ±7 pm at 100 Hz.

Modulation input:

± 5 V

Coherence control

(81640A/ 80A/ 82A)

For measurements on components with 2 m long patchcords and connectors with 14 dB return loss, the effective linewidth results in a typical power stability of < ±0.025 dB over 1 minute by drastically reducing interference effects in the test setup.

Continuous sweep mode

(81640A/ 80A/ 82A)

Tuning velocity adjustable to
40 nm/sec, 5 nm/sec and 0.5 nm/sec.
Mode-hop free span 1520 - 1570 nm at
flat output power ≥ 3 dBm
(for HP 81640A: any 50 nm within
1520 - 1620 nm at flat output power
≥ 0 dBm).

Ambient temperature within +20 °C
and +35 °C.

General

Output isolation (typ.):

50 dB (for 81689A: 38 dB).

Return loss (typ.):

60 dB (options 022, 072;
for 81689A: 55dB);
40 dB (options 021, 071;
for 81689A: 40dB).

Polarization maintaining fiber

(Options 071, 072)

Fiber type:

Panda.

Orientation:

TE mode in slow axis, in line with
connector key.

Extinction ratio: 16 dB typ.

Laser class:

Class IIIb according to FDA 21 CFR
1040.10, Class 3A according to IEC
825 - 1; 1993.

Recommended re-calibration period:

2 years.

Warm-up time:

< 20 min
(for 81689A: < 40 min),
immediate operation after boot-up.

Environmental

Storage temperature:

-40 °C to + 70 °C
(for 81689A: -20 °C to +70 °C).

Operating temperature:

10 °C to 35 °C
(for 81689A: 15 °C to 35 °C).

Humidity:

< 80 % R.H. at 10 °C to 35 °C
(for 81689A: < 80 % R.H. at 15 °C to
35 °C).

Specifications are valid in
non-condensing conditions.

^[1] 81640A/ 80A/ 82A:
displayed wavelength represents average
wavelength while digital modulation is
active.

8164A Lightwave Measurement System

Display:

Active color LCD, 600 x 400 pixels visible. VGA connector for external monitor.

GPIO Interface:

GPIO interface function code: SH1, AH1, T6, L4, SR1, RL1, PPO, DC2, DTO, CO.

RS-232C Interface:

Max. baud rate: 115,200 bps

Parallel Printer Interface:

Centronics

PCCard slot:

One type I, II and III compliant with PC Card Standard PCMCIA 2.1/JEIDA 4.1

External keyboard:

PS/2 connector

Data Storage:

Internal Hard Disk Drive, 2000 MB ATA PC and SRAM PC cards according to PCMCIA type I, II and III.

Power: 100 to 240 Vrms, $\pm 10\%$, 280 VA max.

Dimensions: 145 mm H, 426 mm W, 545 mm D (5.8" x 16.9" x 21.6")

Weight: net, 20 kg (45 lb.), shipping, 23 kg (51 lb.), including modules.

Built-in Application:

Software 2.0 enables the measurement of loss vs. wavelength of up to 8 channels with trace display and data storage. This software version supports full performance of the laser in stepped mode.

Listed options

Option 003: built-in optical attenuator, 60 dB attenuation (81682A; included with 81640A and 81680A).

Option 021: standard single mode fiber, straight contact output connector (81689A).

Option 022: standard single mode fiber, angled contact output connector (81689A).

Option 071: polarization maintaining fiber, straight contact output connector (81640A, 81680A, 81682A, 81689A).

Option 072: polarization maintaining fiber, angled contact output connector (81640A, 81680A, 81682A, 81689A).

Option 1CM: rack mount kit without front handles for the 8164A mainframe.

Option 1CN: front handles for the 8164A mainframe.

Agilent 81645A Filler Module:

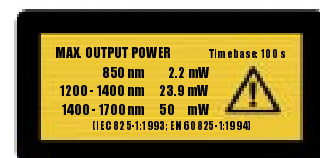
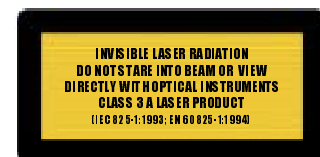
The 81645A filler module is required to operate the 8164A mainframe if it is used without an 81640A/80A/82A tunable laser module.

Laser Safety Information

In the USA, all tunable lasers specified by this data sheet are classified as Class IIIb according to 21 CFR 1040.10.



Internationally, the same tunable lasers are classified as Class 3A according to IEC 60825-1.



Related Agilent literature:

8164A Lightwave Measurement System,
configuration guide,
p/n **5968-0062E**

8164A Lightwave Measurement System,
product overview
p/n **5968-3405E**

For more information about Agilent Technologies test and measurement products, applications, services, and for a current sales office listing, visit our web site:

www.agilent.com/comms/lightwave

You can also contact one of the following centers and ask for a test and measurement sales representative.

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(tel) 1 800 452 4844

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Innovating the HP Way