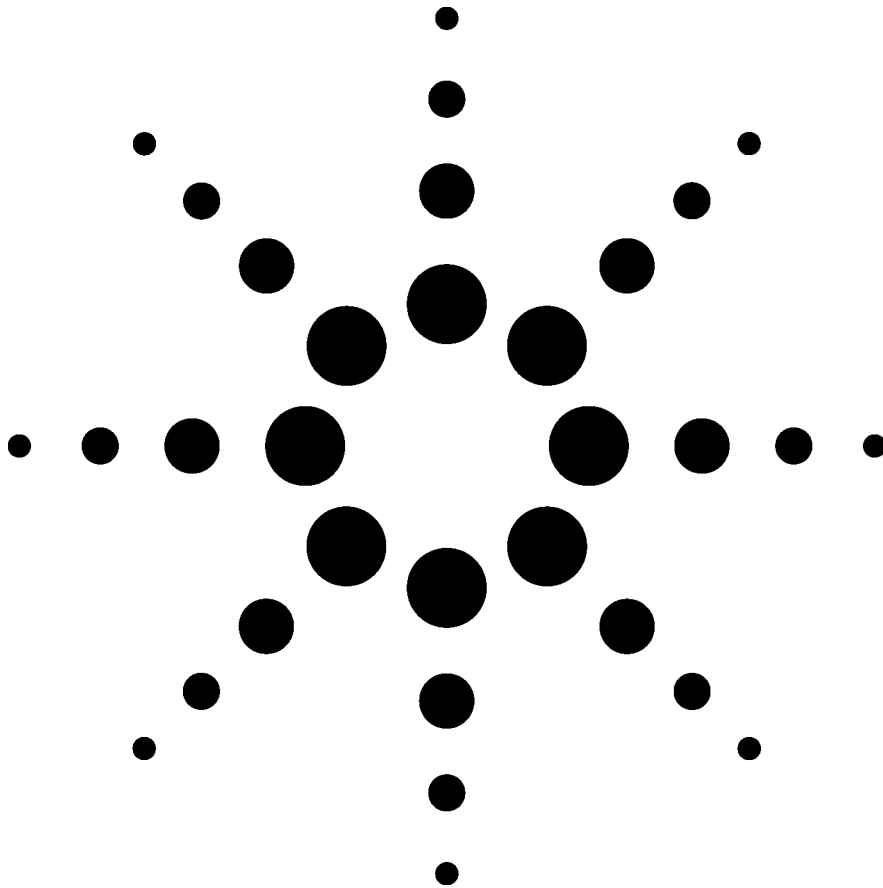


# Agilent 81980/ 81940A, Agilent 81989/ 81949A, Agilent 81944A Compact Tunable Laser Sources

Technical Specifications

December 2004



Agilent's Series 819xxA high-power compact tunable lasers enable optical device characterization at high power levels and measurement of nonlinear effects. They improve the testing of all types of optical amplifiers and other active components, as well as broadband passive optical components.

As single slot plug-in modules for Agilent's 8163A/B, 8164A/B and 8166A/B mainframes, they are a flexible and cost effective stimulus for single channel and DWDM test applications.



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### **High power compact tunable lasers for S, C and L-band**

The Agilent 819xxA compact tunable laser sources provide high output power up to +13 dBm.

Each module covers a total wavelength range of 110 nm, either:

- In the S and C-bands with the high power in C-band (81980A and 81989A), or
- in the C and L-bands with the high power in the L-band (81940A and 81949A).

### **Modular Design for Multichannel Platform**

The 819xxA tunable lasers are a family of plug-in modules for Agilent's 8163A/B, 8164A/B and 8166A/B mainframes. Their compact single-slot format makes them a flexible and cost-effective stimulus for single channel and multichannel DWDM applications.

### **Device Characterization at high power levels**

The high optical output power of the 819xxA tunable lasers improves the testing of all types of optical amplifiers and other active components as well as broadband passive optical components. It helps overcome losses in test setups or in the device under test itself. Thus, engineers can test optical amplifiers such as EDFAs, Raman amplifiers, SOAs and EDWAs to their limits. This tunable laser provides the high power levels required to help speed the development of innovative devices by enabling the test and measurement of nonlinear effects.

### **SBS suppression feature enables high launch power**

A new SBS-suppression feature avoids the reflection of light induced by Stimulated Brillouin Scattering (SBS). It enables the launch of the high optical output power into long fibers without intensity modulation to avoid impairment in time-domain measurements.

### **Coherence Control avoids interference-induced power fluctuations**

A high-frequency modulation function is used to increase the effective linewidth to avoid power fluctuations due to coherent interference effects. The modulation pattern is optimized for stable power measurements, even in the presence of reflections.

### **Built-in wavelength meter for active wavelength control**

The 81980A and 81940A feature a built-in wavelength meter with a closed feedback loop for enhanced wavelength accuracy. In continuous sweep mode, it allows dynamic wavelength logging to make measurements during the sweep.

### **Dynamic power control for excellent reproducibility**

The integrated dynamic power control loop ensures a high reproducibility in power level. This allows highly repeatable measurements to reduce errors when comparing the results of several wavelength sweeps. As these modules feature mode-hop free tunability over their entire tuning range with continuous output power, they achieve highly accurate measurements over wavelength.

### **Continuous Sweep Mode with wavelength logging**

All 819xxA modules can be operated in the stepped mode usually used, where measurements are done at particular wavelength.

The 81980A and 81940A can also be operated in the continuous sweep mode with dynamic wavelength logging to make measurements during the wavelength sweep.

### **Internal Modulation**

The internal modulation feature enables an efficient and simple Time-Domain Extinction (TDE) method for Erbium based optical amplifier test when used together with the external gating feature of Agilent's OSA.

It also supports the transient testing of optical amplifiers by simulating channel add and drop events.

The 81980A, 81940A, 81944A, 81989A and 81949A are produced to the 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 Compact Tunable Laser User's Guide.

## 81980A Compact Tunable Laser Source, 1465 nm to 1575 nm

	<b>Agilent 81980A</b>	1.0
Wavelength range	1465 nm to 1575 nm	
Wavelength resolution	1 pm, 125 MHz at 1550 nm	
Mode-hop free tunability	full wavelength range	
Maximum sweep speed	50 nm/s	
Absolute wavelength accuracy	$\pm 20$ pm, typ $\pm 5$ pm <sup>[1]</sup>	
Relative wavelength accuracy	$\pm 10$ pm, typ. $\pm 5$ pm	
Wavelength repeatability	$\pm 2.5$ pm, typ. $\pm 1$ pm	
Wavelength stability (typ., over 24 h) <sup>[4]</sup>	$\pm 2.5$ pm	
Linewidth (typ.), coherence control off	100 kHz	
Effective linewidth (typ.), coherence control on <sup>[2]</sup>	> 50 MHz (1525 nm to 1575 nm)	
Maximum output power (continuous power during tuning)	$\geq +14.5$ dBm peak (typ.) $\geq +13$ dBm (1525 nm to 1575 nm) $\geq +10$ dBm (1465 nm to 1575 nm)	
Power linearity	$\pm 0.1$ dB	
Power stability <sup>[4]</sup>	$\pm 0.01$ dB over 1 hour typ. $\pm 0.0075$ dB over 1 hour typ. $\pm 0.03$ dB over 24 hours	
Power flatness versus wavelength	$\pm 0.2$ dB, typ. $\pm 0.1$ dB (1525 nm to 1575 nm) $\pm 0.3$ dB, typ. $\pm 0.15$ dB (full range)	
Power repeatability (typ.)	$\pm 0.01$ dB	
Side-mode suppression ratio (typ.) <sup>[2]</sup>	$\geq 50$ dB	
Signal to source spontaneous emission ratio <sup>[2]</sup>	$\geq 45$ dB/nm <sup>[3]</sup> $\geq 48$ dB/nm (1525 nm to 1575 nm) <sup>[3]</sup> typ. 58 dB/0.1 nm (1525 nm to 1575 nm) <sup>[5]</sup>	
Signal to total source spontaneous emission ratio (typ.) <sup>[2]</sup>	$\geq 25$ dB $\geq 30$ dB (1525 nm to 1575 nm)	
Relative intensity noise (RIN) (typ.) <sup>[2]</sup>	-145 dB/Hz (0.1 GHz to 6 GHz)	
Dimensions (H x W x D)	75 mm x 32 mm x 335 mm	
Weight	0.95 kg	

<sup>[1]</sup> At day of calibration.

<sup>[2]</sup> At maximum output power as specified per wavelength range.

<sup>[3]</sup> Value for 1 nm resolution bandwidth.

<sup>[4]</sup> At const. temperature  $\pm 0.5$  K

<sup>[5]</sup> Value for 0.1 nm resolution bandwidth

## 81940A Compact Tunable Laser Source, 1520 nm to 1630 nm

	<b>Agilent 81940A</b>	1.0
Wavelength range	1520 nm to 1630 nm	
Wavelength resolution	1 pm, 125 MHz at 1550 nm	
Mode-hop free tunability	full wavelength range	
Maximum sweep speed	50 nm/s	
Absolute wavelength accuracy	$\pm 20$ pm, typ $\pm 5$ pm <sup>[1]</sup>	
Relative wavelength accuracy	$\pm 10$ pm, typ. $\pm 5$ pm	
Wavelength repeatability	$\pm 2.5$ pm, typ. $\pm 1$ pm	
Wavelength stability (typ., over 24 h) <sup>[4]</sup>	$\pm 2.5$ pm	
Linewidth (typ.), coherence control off	100 kHz	
Effective linewidth (typ.), coherence control on <sup>[2]</sup>	> 50 MHz (1570 nm to 1620 nm)	
Maximum output power (continuous power during tuning)	$\geq +14.5$ dBm peak (typ.) $\geq +13$ dBm (1570 nm to 1620 nm) $\geq +10$ dBm (1520 nm to 1630 nm)	
Power linearity	$\pm 0.1$ dB	
Power stability <sup>[4]</sup>	$\pm 0.01$ dB over 1 hour typ. $\pm 0.0075$ dB over 1 hour typ. $\pm 0.03$ dB over 24 hours	
Power flatness versus wavelength	$\pm 0.2$ dB, typ. $\pm 0.1$ dB (1570 nm to 1620 nm) $\pm 0.3$ dB, typ. $\pm 0.15$ dB (full range)	
Power repeatability (typ.)	$\pm 0.01$ dB	
Side-mode suppression ratio (typ.) <sup>[2]</sup>	$\geq 50$ dB	
Signal to source spontaneous emission ratio <sup>[2]</sup>	$\geq 45$ dB/nm <sup>[3]</sup> $\geq 48$ dB/nm (1570 nm to 1620 nm) <sup>[3]</sup> typ. 58 dB/0.1 nm (1570 nm to 1620 nm) <sup>[5]</sup>	
Signal to total source spontaneous emission ratio (typ.) <sup>[2]</sup>	$\geq 25$ dB $\geq 30$ dB (1570 nm to 1620 nm)	
Relative intensity noise (RIN) (typ.) <sup>[2]</sup>	-145 dB/Hz (0.1 GHz to 6 GHz)	
Dimensions (H x W x D)	75 mm x 32 mm x 335 mm	
Weight	0.95 kg	

<sup>[1]</sup> At day of calibration.

<sup>[2]</sup> At maximum output power as specified per wavelength range.

<sup>[3]</sup> Value for 1 nm resolution bandwidth.

<sup>[4]</sup> At const. temperature  $\pm 0.5$  K

<sup>[5]</sup> Value for 0.1 nm resolution bandwidth

## 81989A Compact Tunable Laser Source, 1465 nm to 1575 nm

	<b>Agilent 81989A</b>	1.0
Wavelength range	1465 nm to 1575 nm	
Wavelength resolution	5 pm, 625 MHz at 1550 nm	
Mode-hop free tunability	full wavelength range	
Tuning time (typ.)	3 s for 100 nm	
Absolute wavelength accuracy	±100 pm	
Relative wavelength accuracy	±50 pm	
Wavelength repeatability	±5 pm	
Wavelength stability (typ., over 24 h) <sup>[3]</sup>	±5 pm	
Linewidth (typ.), coherence control off	100 kHz	
Effective linewidth (typ.), coherence control on <sup>[1]</sup>	> 50 MHz (1525 nm to 1575 nm)	
Maximum output power (continuous power during tuning)	≥ +14.5 dBm peak (typ.) ≥ +13 dBm (1525 nm to 1575 nm) ≥ +10 dBm (1465 nm to 1575 nm)	
Power linearity	±0.1 dB	
Power stability <sup>[3]</sup>	±0.01 dB over 1 hour typ. ±0.0075 dB over 1 hour typ. ±0.03 dB over 24 hours	
Power flatness versus wavelength	±0.2 dB, typ. ±0.1 dB (1525 nm to 1575 nm) ±0.3 dB, typ. ±0.15 dB (full range)	
Power repeatability (typ.)	± 0.01 dB	
Side-mode suppression ratio (typ.) <sup>[1]</sup>	≥ 50 dB	
Signal to source spontaneous emission ratio <sup>[1]</sup>	≥ 45 dB/nm <sup>[2]</sup> ≥ 48 dB/nm (1525 nm to 1575 nm) <sup>[2]</sup> typ. 58 dB/0.1 nm (1525 nm to 1575 nm) <sup>[4]</sup>	
Signal to total source spontaneous emission ratio (typ.) <sup>[1]</sup>	≥ 25 dB ≥ 30 dB (1525 nm to 1575 nm)	
Relative intensity noise (RIN) (typ.) <sup>[1]</sup>	-145 dB/Hz (0.1 GHz to 6 GHz)	
Dimensions (H x W x D)	75 mm x 32 mm x 335 mm	
Weight	0.95 kg	

<sup>[1]</sup> At maximum output power as specified per wavelength range.

<sup>[2]</sup> Value for 1 nm resolution bandwidth.

<sup>[3]</sup> At const. temperature ±0.5 K

<sup>[4]</sup> Value for 0.1 nm resolution bandwidth

## 81949A Compact Tunable Laser Source, 1520 nm to 1630 nm

	<b>Agilent 81949A</b>	1.0
Wavelength range	1520 nm to 1630 nm	
Wavelength resolution	5 pm, 625 MHz at 1550 nm	
Mode-hop free tunability	full wavelength range	
Tuning time (typ.)	3 s for 100 nm	
Absolute wavelength accuracy	±100 pm	
Relative wavelength accuracy	±50 pm	
Wavelength repeatability	±5 pm	
Wavelength stability (typ., over 24 h) <sup>[3]</sup>	±5 pm	
Linewidth (typ.), coherence control off	100 kHz	
Effective linewidth (typ.), coherence control on <sup>[1]</sup>	> 50 MHz (1570 nm to 1620 nm)	
Maximum output power (continuous power during tuning)	≥ +14.5 dBm peak (typ.) ≥ +13 dBm (1570 nm to 1620 nm) ≥ +10 dBm (1520 nm to 1630 nm)	
Power linearity	±0.1 dB	
Power stability <sup>[3]</sup>	±0.01 dB over 1 hour typ. ±0.0075 dB over 1 hour typ. ±0.03 dB over 24 hours	
Power flatness versus wavelength	±0.2 dB, typ. ±0.1 dB (1570 nm to 1620 nm) ±0.3 dB, typ. ±0.15 dB (full range)	
Power repeatability (typ.)	± 0.01 dB	
Side-mode suppression ratio (typ.) <sup>[1]</sup>	≥ 50 dB	
Signal to source spontaneous emission ratio <sup>[1]</sup>	≥ 45 dB/nm <sup>[2]</sup> ≥ 48 dB/nm (1570 nm to 1620 nm) <sup>[2]</sup> typ. 58 dB/0.1 nm (1570 nm to 1620 nm) <sup>[4]</sup>	
Signal to total source spontaneous emission ratio (typ.) <sup>[1]</sup>	≥ 25 dB ≥ 30 dB (1570 nm to 1620 nm)	
Relative intensity noise (RIN) (typ.) <sup>[1]</sup>	-145 dB/Hz (0.1 GHz to 6 GHz)	
Dimensions (H x W x D)	75 mm x 32 mm x 335 mm	
Weight	0.95 kg	

<sup>[1]</sup> At maximum output power as specified per wavelength range.

<sup>[2]</sup> Value for 1 nm resolution bandwidth.

<sup>[3]</sup> At const. temperature ±0.5 K

<sup>[4]</sup> Value for 0.1 nm resolution bandwidth

## 81944A Compact Tunable Laser Source

This laser source is used in combination with the Agilent N3909A PMD test set.

	<b>Agilent 81944A</b>	1.1
Wavelength range	1525 nm to 1620 nm	
Wavelength resolution	1 pm, 125 MHz at 1550 nm	
Mode-hop free tunability	full wavelength range	
Tuning time (typ.)	50 nm/s	
Absolute wavelength accuracy	$\pm 20$ pm, typ. $\pm 5$ pm <sup>[1]</sup>	
Relative wavelength accuracy	$\pm 10$ pm, typ. $\pm 5$ pm	
Wavelength repeatability	$\pm 2.5$ pm, typ. $\pm 1$ pm	
Wavelength stability (typ., over 24 h) <sup>[4]</sup>	$\pm 2.5$ pm	
Linewidth (typ.), coherence control off	100 kHz	
Effective linewidth (typ.), coherence control on <sup>[2]</sup>	> 50 MHz (1570 nm to 1620 nm)	
Maximum output power (mean value) (continuous power during tuning)	$\geq +10.5$ dBm typ. (1525 nm to 1620 nm) $\geq +9.5$ dBm (1525 nm to 1620 nm)	
Side-mode suppression ratio (typ.) <sup>[2]</sup>	$\geq 50$ dB	
Signal to source spontaneous emission ratio <sup>[2]</sup>	$\geq 45$ dB/nm <sup>[3]</sup>	
Signal to total source spontaneous emission ratio (typ.) <sup>[2]</sup>	$\geq 25$ dB	
Relative intensity noise (RIN) (typ.) <sup>[2]</sup>	- 145 dB/Hz (0.1 GHz to 6 GHz)	
Dimensions (H x W x D)	75 mm x 64 mm x 335 mm	
Weight	1.8 kg	

<sup>[1]</sup> At day of calibration.

<sup>[2]</sup> At maximum output power as specified.

<sup>[3]</sup> Value for 1 nm resolution bandwidth.

<sup>[4]</sup> At const. temperature  $\pm 0.5$  K.

## Conditions

### Storage temperature:

– 40 °C to + 70 °C.

### Operating temperature:

10 °C to 35 °C.

### Humidity:

< 80 % R.H. at 10 °C to 35 °C.

### Warm-up time:

1 h

immediate operation after boot-up.

### Output power:

Specifications are valid at output power  $\geq +5$  dBm.

Specifications are valid in non-condensing conditions, in CW operation.

## Laser Safety Information

All laser sources specified by this data sheet are classified as Class 1M according to IEC 60825-1 (2001).

All laser sources comply with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50, dated 2001-July-26.



## Supplementary performance characteristics

### Modulation

#### Internal digital modulation <sup>[1]</sup>

50% duty cycle,  
200 Hz to 1 MHz (extinction > 30 dB),  
rise and fall time < 100 ns.

#### Modulation output: (mainframe)

TTL reference signal.

#### External digital modulation <sup>[1]</sup>

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

Modulation input: (mainframe)  
TTL signal.

#### External analog modulation

$\geq 15\%$  modulation depth,  
5 kHz to 1 MHz.

Modulation input: 5 Vp-p

### Coherence control

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  $< \pm 0.025$  dB over 1 minute by drastically reducing interference effects in the test setup

### SBS suppression

Effective linewidth: 500 MHz  
Residual amplitude modulation:  
 $< \pm 0.5\%$

<sup>[1]</sup> Displayed wavelength represents average wavelength while digital modulation is active.

## Continuous sweep mode Agilent 81980A, 81940A and 81944A:

### Mode-hop free sweeping:

full wavelength range at flat output power  $\geq +10$  dBm

Ambient temperature within +20°C and +30°C.

## General

### Output isolation (typ.):

50 dB. <sup>[2]</sup>

### Return loss (typ.):

60 dB (options 072),  
40 dB (options 071).

### Wavelength Stability:

(typ., over 1 min):  $\pm 0.5$  pm

### Polarization maintaining fiber: (Options 071, 072) <sup>[2]</sup>

#### Fiber type:

Panda. <sup>[2]</sup>

#### Orientation:

TE mode in slow axis, in line with connector key. <sup>[2]</sup>

### Polarization extinction ratio:

16 dB typ. <sup>[2]</sup>

### Recommended re-calibration period:

2 years.

### Connector Option: (Must)

Tunable Laser must be ordered with one connector option.

#### Option 071:

PMF <sup>[3]</sup>, straight contact output connector.

#### Option 072:

PMF <sup>[3]</sup>, angled contact output connector.

### Connector Interface:

One Agilent 81000xl-series connector interface is required.

<sup>[2]</sup> Does not apply to 81944A.

<sup>[3]</sup> 81944A: Standard SMF fiber used.



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(fax) 1 800 829 4433

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(tel) 1 877 894 4414

(fax) 1 905 282 6495

##### Europe:

(tel) +31 20 547 2111

(fax) +31 20 547 2190

##### Japan:

(tel) 120 421 345

(fax) 120 421 678

##### Latin America:

(tel) +55 11 4197 3600

(fax) +55 11 4197 3800

##### Australia:

(tel) 800 629 485

(fax) 800 142 134

##### Asia Pacific:

(tel) +852 800 930 871

(fax) +852 2 506 9233

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#### Related Agilent Literature

[www.agilent.com/comms/octsources](http://www.agilent.com/comms/octsources)

Agilent 8163B Lightwave Multimeter

Agilent 8164B Lightwave Measurement System

Agilent 8166B Lightwave Multichannel System

Technical Specifications

p/n 5988-3924EN

Agilent 81662A DFB Laser

Agilent 816623A DFB Laser

Agilent Fabry Perot Laser

Technical Specifications

p/n 5988-1570EN

Agilent Power Sensor Modules

Agilent Optical Heads

Agilent Return loss Modules

Technical Specifications

p/n 5988-1569EN

Agilent 8159xB Modular Optical Switches

Technical Specifications

p/n 5988-1287EN

Agilent 8157xA Optical Attenuators

Technical Specifications

p/n 5988-2696EN

Agilent Compact Tunable Lasers

Product Overview

p/n 5988-4007EN



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