Agilent 81980A, 81960A, 81940A, 81989A, 81949A, and 81950A Compact Tunable Laser Sources

Data Sheet

Introduction

The Agilent 819xxA Series of compact tunable lasers enables optical device characterization at high power levels and measurement of nonlinear effects. Each of the 819xxA lasers enhances the testing of systems, all types of optical amplifiers and other active components, as well as passive optical components.

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

New: Fast Swept Spectral Loss Measurement

The Agilent 81960A sets a new mark in tunable laser performance with faster sweep speeds and repetition rates combined with the dynamic accuracy specifications needed for DWDM component measurements.

Dynamically specified sweeps in both directions enhance the repetition rate even further for real-time use in adjustment and calibration procedures. Rocket-fast and accurate, the 81960A helps you hit your development and production targets.

Anticipate Accelerate Achieve

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High Power Compact Tunable Lasers for S-, C-, and L-Band

Agilent's 8198xA, 81960A and 8194xA compact tunable laser sources provide high output power up to +13 dBm.

The 81980A and 81989A modules cover a 110 nm wavelength range in the S- and C-band, the 81940A and 81949A modules operate over 110 nm in the C- and L-band, and the 81960A scans even 125 nm including the C- and L-band.

The Agilent Technologies 81950A system-loading source is step-tunable for setting channel frequencies within the C- or L-band. With high output power up to +15 dBm, narrow linewidth of 100 kHz, gridless and grid-defined wavelength setting, and offset fine-tuning capability, the 81950A is a universal source for realistic loading of the latest transmission systems.

Modular Design for Multichannel Platform

The 819xxA tunable lasers are a family of plug-in modules for the Agilent Technologies 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 dense wavelength division multiplexing (DWDM) applications.

Internal Modulation

The internal modulation feature of 81940A, 81960A, 81980A, 81949A and 81989A enables an efficient and simple time-domain extinction (TDE) method for Erbium-based optical amplifier test. It also supports the transient testing of optical amplifiers by simulating channel add and drop events.

Accurate DWDM Component Measurements at Full Scan Rate

The 81960A module adds the new and unique capability to sweep in both directions, and sports increased sweep speeds and acceleration. Its dramatically improved and fully specified dynamic accuracy enables DWDM component measurements and adjustments at high repetition rate, and boosts the characterization of single and multichannel components. The laser is especially well supported by the swept-wavelength measurement engines in the N7700A software suite and can be programmed directly.

The most specially adapted application for this laser is high repetition-rate scanning for real-time updates, enabled by the Agilent N7700A-102 fast-sweep insertion loss engine. It synchronizes the laser with the N7744A or N7745A power meters to produce power and loss spectra in a convenient GUI display, and accelerates the uploading of the logged wavelength monitor data.

The wavelength resolution and 50-60 dB dynamic range achieved surpass comparable measurements by an Optical Spectrum Analyzer (OSA), with repetition rates better than 2 Hz for add-drop filter adjustment and calibration.

The high performance in continuous sweeps also matches this laser well to the single-sweep PDL and IL N7700A-101 measurement engine. The enhanced dynamic wavelength accuracy will satisfy the test needs for many DWDM components at an optimized performance/price balance. The source to spontaneous noise ratio, SSE, while not as high as the 81600B series, is also sufficient to qualify the isolation of many filter devices. The higher sweep speeds save time measuring broadband devices not needing such high wavelength resolution.

These same advantages apply to use with the N7788B component analyzer for measuring PMD and DGD in addition to PDL and IL. The relative wavelength accuracy during the sweeps is especially important for accurate DGD measurements using the JME method, since the result depends on the derivatives with respect to wavelength. The high speed is great for measuring isolators, PMF and other broadband components.

The powerful lambda scan functions of the 816x Plug&Play driver for customized programs, and the N7700A IL engine which provides a GUI interface to these functions also support power and IL measurements together with any of the Agilent power meters. And the performance of swept-wavelength measurements in the N4150A PFL, including fast repetitive sweeps are also supported with this newest member of the Agilent swept tunable lasers.

Certified Quality

The 81940A, 81950A, 81960A, 81980A, 81949A, and 81989A 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-meter-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, refer to Chapter 3 in Agilent 81940A, 44A, 49A, 80A, and 89A Compact Tunable Laser Source Modules User's Guide (publication number 81980-90A11), or respectively, to Chapter 5 in the Agilent 81950A Tunable System Source User's Guide (publication number 81950-90B01) or, respectively, to Chapter 5 in the Agilent 81960A Compact Tunable Laser User's Guide (publication number 81960-90B01).

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 81940A, 81960A and 81980A can also be operated in the continuous sweep mode with dynamic wavelength logging to make measurements during the wavelength sweep.

Built-In Wavelength Meter for Active Wavelength Control

The 81940A, 81960A and 81980A feature a built-in wavelength meter with a closed feedback loop for enhanced wavelength accuracy. In continuous sweep mode, the meter allows dynamic wavelength logging to make accurate measurements during the sweep.

Dynamic Power Control for Excellent Reproducibility

The integrated dynamic power control loop ensures a high reproducibility in power level. Highly repeatable measurements reduce errors when comparing the results of several wavelength sweeps. As the 81940A, 81960A and 81980A feature mode-hop-free tunability over their entire tuning range with continuous output power, they achieve highly accurate measurements over wavelength.

Coherence Control Avoids Interference-Induced Power Fluctuations

In 8194xA, 81960A and 8198xA modules, 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.

Device Characterization at High Power Levels

The high optical output power of the 819xxA tunable lasers makes them ideal sources for the test of active and passive optical components. Each laser 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 the amplifier's limits. The 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

The stimulated Brillouin scattering (SBS) suppression feature avoids the reflection of light induced by SBS. The feature enables the launch of the high optical output power into long fibers without intensity modulation, avoiding impairment in time-domain measurements.

81960A Fast-Swept Compact Tunable Laser Source, 1505 nm to 1630 nm

Unless otherwise noted, specifications apply to sweeps in both directions.

	Agilent 81960A					
Wavelength range, Option 162	1505 nm to 1630 nm					
Wavelength (frequency) resolution	0.1 pm, 12.5 MHz at 1550 nm					
Mode-hop free tunability	Full wavelength range					
Absolute wavelength accuracy [1]	± 10 pm; typical ± 5 pm					
Relative wavelength accuracy	± 7 pm; typical ± 3 pm					
Wavelength repeatability	± 2.5 pm; typical ± 1.5 pm					
Wavelength stability (typical) [3]	≤ ±0.5 pm, 1 minute					
	≤ ±2.5 pm, 15 minutes					
Maximum output power (continuous power during sweep)	≥ +14 dBm peak, typical					
	≥ +13 dBm (1570 nm to 1620 nm)					
	≥ +10 dBm (1505 nm to 1630 nm)					
Power range (nominal)	+6 dBm to maximum output power					
Power repeatability (typical)	± 0.01 dB					
Power stability [3]	± 0.01 dB, 1 hour					
	± 0.03 dB, typical, 24 hours					
Power linearity	± 0.15 dB (1505 nm, 1575 nm, 1630 nm)					
Power flatness versus wavelength	± 0.2 dB (1570 nm to 1620 nm, +13 dBm)					
	± 0.3 dB (full wavelength range)					
Continuous sweep mode, both directions [7]	5 nm/s	10 nm/s	20, 40 nm/s	50 nm/s	80, 100 nm/s	200 nm/s
Absolute wavelength accuracy (typical)	± 5 pm	± 10 pm	± 15 pm	± 8 pm	± 8 pm	± 15 pm
Relative wavelength accuracy (typical)	± 4 pm	± 9 pm	± 14 pm	± 7 pm	± 7 pm	± 14 pm
Wavelength repeatability (typical) [6]	± 0.8 pm	± 4 pm	± 4 pm	± 2 pm	± 3 pm	± 3 pm
Dynamic power reproducibility (typical) [6]	± 0.01 dB	± 0.01 dB	± 0.02 dB	± 0.02 dB	± 0.04 dB	± 0.04 dB
Dynamic relative power flatness (typical)	± 0.01 dB	± 0.01 dB	± 0.03 dB	± 0.03 dB	± 0.07 dB	± 0.10 dB
Linewidth, coherence control off (typical)	100 kHz					
Effective linewidth, coherence control on (typical) [2]	> 50 MHz (at max. constant output power)					
Side-mode suppression ratio (typical) [2]	≥ 50 dB					
Signal to source spontaneous emission ratio [2]	≥ 45 dB/nm (full wavelength range, +10 dBm) [4]					
	≥ 50 dB/nm (1525 nm to 1620 nm, +12 dBm) [4]					
	≥ 60 dB/0.1 nm (typical, 1525 nm to 1620 nm, +12 dBm) [5]					
Signal to total source spontaneous emission ratio (typical) [2]	≥ 25 dB (full wavelength range, +10 dBm)					
	≥ 30 dB (1525 nm to 1620 nm, +12 dBm)					
Relative intensity noise (RIN) (typical) [2]	-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					

1. *At day of calibration.*
2. *At maximum output power as specified per wavelength range.*
3. *At constant temperature ± 0.5 K.*
4. *Value for 1 nm resolution bandwidth.*
5. *Value for 0.1 nm resolution bandwidth.*
6. *Repeatability within the same sweep direction. At 200 nm/s, the specification value is double for sweeps from long to short wavelength.*
7. *For sweep range 1510 nm to 1625 nm. For 200 nm/s, sweep range is 1528 nm to 1608 nm.*

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

	Agilent 81980A
Wavelength range	1465 nm to 1575 nm
Wavelength (frequency) resolution	1 pm, 125 MHz at 1550 nm
Mode-hop free tunability	Full wavelength range
Maximum sweep speed	50 nm/s
Absolute wavelength accuracy	± 20 pm, typical ± 5 pm [1]
Relative wavelength accuracy	± 10 pm, typical ± 5 pm
Wavelength repeatability	± 2.5 pm, typical ± 1 pm
Wavelength stability (typical, over 24 hours) [4]	± 2.5 pm
Linewidth (typical), coherence control off	100 kHz
Effective linewidth (typical), coherence control on [2]	> 50 MHz (1525 nm to 1575 nm)
Maximum output power (continuous power during tuning)	≥ +14.5 dBm peak (typical)
	≥ +13 dBm (1525 nm to 1575 nm)
	≥ +10 dBm (1465 nm to 1575 nm)
Power linearity	± 0.1 dB
Power stability [4]	± 0.01 dB over 1 hour
	Typical ± 0.0075 dB over 1 hour
	Typical ± 0.03 dB over 24 hours
Power flatness versus wavelength	± 0.2 dB, typical ± 0.1 dB (1525 nm to 1575 nm)
	± 0.3 dB, typical ± 0.15 dB (full range)
Power repeatability (typical)	± 0.01 dB
Side-mode suppression ratio (typical) [2]	≥ 50 dB
Signal to source spontaneous emission ratio [2]	≥ 45 dB/nm [3]
	≥ 48 dB/nm (1525 nm to 1575 nm) [3]
	Typical 58 dB/0.1 nm (1525 nm to 1575 nm) [5]
Signal to total source spontaneous emission ratio (typical) [2]	≥ 25 dB
	≥ 30 dB (1525 nm to 1575 nm)
Relative intensity noise (RIN) (typical) [2]	-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

1. *At day of calibration.*
2. *At maximum output power as specified per wavelength range.*
3. *Value for 1 nm resolution bandwidth.*
4. *At constant temperature ± 0.5 K.*
5. *Value for 0.1 nm resolution bandwidth.*

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

	Agilent 81940A
Wavelength range	1520 nm to 1630 nm
Wavelength (frequency) resolution	1 pm, 125 MHz at 1550 nm
Mode-hop free tunability	Full wavelength range
Maximum sweep speed	50 nm/s
Absolute wavelength accuracy	± 20 pm, typical ± 5 pm [1]
Relative wavelength accuracy	± 10 pm, typical ± 5 pm
Wavelength repeatability	± 2.5 pm, typical ± 1 pm
Wavelength stability (typical, over 24 hours) [4]	± 2.5 pm
Linewidth (typical), coherence control off	100 kHz
Effective linewidth (typical), coherence control on [2]	> 50 MHz (1570 nm to 1620 nm)
Maximum output power (continuous power during tuning)	≥ +14.5 dBm peak (typical)
	≥ +13 dBm (1570 nm to 1620 nm)
	≥ +10 dBm (1520 nm to 1630 nm)
Power linearity	± 0.1 dB
Power stability [4]	± 0.01 dB over 1 hour
	Typical ± 0.0075 dB over 1 hour
	Typical ± 0.03 dB over 24 hours
Power flatness versus wavelength	± 0.2 dB, typical ± 0.1 dB (1570 nm to 1620 nm)
	± 0.3 dB, typical ± 0.15 dB (full range)
Power repeatability (typical)	± 0.01 dB
Side-mode suppression ratio (typical) [2]	≥ 50 dB
Signal to source spontaneous emission ratio [2]	≥ 45 dB/nm [3]
	≥ 48 dB/nm (1570 nm to 1620 nm) [3]
	Typical 58 dB/0.1 nm (1570 nm to 1620 nm) [5]
Signal to total source spontaneous emission ratio (typical) [2]	≥ 25 dB
	≥ 30 dB (1570 nm to 1620 nm)
Relative intensity noise (RIN) (typical) [2]	-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

1. *At day of calibration.*
2. *At maximum output power as specified per wavelength range.*
3. *Value for 1 nm resolution bandwidth.*
4. *At constant temperature ± 0.5 K.*
5. *Value for 0.1 nm resolution bandwidth.*

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

	Agilent 81989A
Wavelength range	1465 nm to 1575 nm
Wavelength (frequency) resolution	5 pm, 625 MHz at 1550 nm
Mode-hop free tunability	Full wavelength range
Tuning time (typical)	3 sec for 100 nm
Absolute wavelength accuracy	± 100 pm
Relative wavelength accuracy	± 50 pm
Wavelength repeatability	± 5 pm
Wavelength stability (typical, over 24 hours) [3]	± 5 pm
Linewidth (typical), coherence control off	100 kHz
Effective linewidth (typical), coherence control on [1]	> 50 MHz (1525 nm to 1575 nm)
Maximum output power (continuous power during tuning)	≥ +14.5 dBm peak (typical)
	≥ +13 dBm (1525 nm to 1575 nm)
	≥ +10 dBm (1465 nm to 1575 nm)
Power linearity	± 0.1 dB
Power stability [3]	± 0.01 dB over 1 hour
	Typical ± 0.0075 dB over 1 hour
	Typical ± 0.03 dB over 24 hours
Power flatness versus wavelength	± 0.2 dB, typical ± 0.1 dB (1525 nm to 1575 nm)
	± 0.3 dB, typical ± 0.15 dB (full range)
Power repeatability (typical)	± 0.01 dB
Side-mode suppression ratio (typical) [1]	≥ 50 dB
Signal to source spontaneous emission ratio [1]	≥ 45 dB/nm [2]
	≥ 48 dB/nm (1525 nm to 1575 nm) [2]
	Typical 58 dB/0.1 nm (1525 nm to 1575 nm) [4]
Signal to total source spontaneous emission ratio (typical) [1]	≥ 25 dB
	≥ 30 dB (1525 nm to 1575 nm)
Relative intensity noise (RIN) (typical) [1]	-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

1. *At maximum output power as specified per wavelength range.*
2. *Value for 1 nm resolution bandwidth.*
3. *At constant temperature ± 0.5 K.*
4. *Value for 0.1 nm resolution bandwidth.*

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

	Agilent 81949A
Wavelength range	1520 nm to 1630 nm
Wavelength (frequency) resolution	5 pm, 625 MHz at 1550 nm
Mode-hop free tunability	Full wavelength range
Tuning time (typical)	3 sec for 100 nm
Absolute wavelength accuracy	± 100 pm
Relative wavelength accuracy	± 50 pm
Wavelength repeatability	± 5 pm
Wavelength stability (typical, over 24 hours) [3]	± 5 pm
Linewidth (typical), coherence control off	100 kHz
Effective linewidth (typical), coherence control on [1]	> 50 MHz (1570 nm to 1620 nm)
Maximum output power (continuous power during tuning)	≥ +14.5 dBm peak (typical)
	≥ +13 dBm (1570 nm to 1620 nm)
	≥ +10 dBm (1520 nm to 1630 nm)
Power linearity	± 0.1 dB
Power stability [3]	± 0.01 dB over 1 hour
	Typical ± 0.0075 dB over 1 hour
	Typical ± 0.03 dB over 24 hours
Power flatness versus wavelength	± 0.2 dB, typical ± 0.1 dB (1570 nm to 1620 nm)
	± 0.3 dB, typical ± 0.15 dB (full range)
Power repeatability (typical)	± 0.01 dB
Side-mode suppression ratio (typical) [1]	≥ 50 dB
Signal to source spontaneous emission ratio [1]	≥ 45 dB/nm [2]
	≥ 48 dB/nm (1570 nm to 1620 nm) [2]
	Typical 58 dB/0.1 nm (1570 nm to 1620 nm) [4]
Signal to total source spontaneous emission ratio (typical) [1]	≥ 25 dB
	≥ 30 dB (1570 nm to 1620 nm)
Relative intensity noise (RIN) (typical) [1]	-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

1. *At maximum output power as specified per wavelength range.*
2. *Value for 1 nm resolution bandwidth.*
3. *At constant temperature ± 0.5 K.*
4. *Value for 0.1 nm resolution bandwidth.*

81950A Tunable System Source

This laser source is available in a C-band and L-band version. Specifications apply to wavelengths on the 50 GHz ITU-T grid, after warm up.

	Agilent 81950A
Wavelength (frequency) range • Option 210 • Option 201	 • 1527.6 nm to 1565.50 nm (196.25 THz to 191.50 THz) • 1570.01 nm to 1608.76 nm (190.95 THz to 186.35 THz)
Frequency resolution	100 MHz, 0.8 pm at 1550 nm
Tuning time	Typical < 30 sec [3]
Fine tuning range	Typical ± 6 GHz
Fine tuning resolution	Typical 1 MHz
Absolute wavelength (frequency) accuracy	± 22 pm (± 2.5 GHz)
Relative wavelength (frequency) accuracy	± 12 pm (± 1.5 GHz)
Wavelength (frequency) repeatability [2]	Typical ± 2.5 pm (± 0.3 GHz)
Wavelength (frequency) stability (typical, over 24 hours) [2]	Typical ± 2.5 pm (± 0.3 GHz), 24 hours
Linewidth (typical), SBS suppression off	< 100 kHz
Maximum output power	≥ +13.5 dBm (typical ≥ +15 dBm)
Power stability	Typical ± 0.03 dB over 1 hour [2]
	Typical ± 0.03 dB over 24 hours [2]
Power flatness	Typical ± 0.2 dB (full wavelength range)
Power repeatability	Typical ± 0.08 dB [2]
Side-mode suppression ratio	Typical 50 dB
Signal to source spontaneous emission ratio	Typical 50 dB/1 nm [1]
	Typical 60 dB/0.1 nm [1]
Relative intensity noise (RIN)	Typical -145 dB/Hz [1] (10 MHz to 40 GHz)
Dimensions (H x W x D)	75 mm x 32 mm x 335 mm
Weight	0.45 kg

1. *At maximum output power, as specified, per wavelength range.*
2. *At constant temperature ± 0.5 K.*
3. *Including power stabilization.*

Specifications

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 hour, immediate operation after boot-up
Output power	Specifications are valid at output power ≥ +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 (2007). All laser sources comply with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50, dated 2007, June 24.

Supplementary performance characteristics, non-warranted	
Agilent 81940A, 81949A, 81960A, 81980A, 81989A	
Internal digital modulation [1]	50% duty cycle
	200 Hz to 1 MHz (extinction ratio > 30 dB)
	Rise and fall time < 100 ns
	Modulation output (mainframe): TTL reference signal
External analog modulation [2]	≥ 15% modulation depth
	5 kHz to 1 MHz
	Modulation input: 5 Vp-p
External digital modulation [1]	> 45% duty cycle
	Fall time < 300 ns, 200 Hz to 1 MHz
	Modulation input (mainframe): TTL signal
Coherence control	For measurements on components with 2 m long patch cords and connectors with 14 dB return loss, the effective line width results in a typical power stability of < ± 0.025 dB over 1 minute by drastically reducing interference effects in the test setup
SBS suppression	Effective line width: 500 MHz
	Residual amplitude modulation: < ± 0.5%
Agilent 81940A, 81960A and 81980A	
Continuous sweep mode	Mode-hop free sweeping: • Full wavelength range at output power ≥ +10 dBm • Ambient temperature within +20 °C and +30 °C

1. *Displayed wavelength represents average wavelength while digital modulation is active.*
2. *External analog modulation is not available for 81960A.*

Specifications (continued)

Agilent 81950A	
External analog modulation	5% pp at 2.5 Vp-p input voltage swing (max)
	10 kHz to 1000 kHz
	Modulation input: max 5 Vp-p
	Input impedance: 50 Ω
SBS suppression	FM p-p modulation range: 0 GHz to 1 GHz (typical)
	Dither frequency: 20.8 kHz
Power setting	Power attenuation range: 8 dB
	Power setting resolution: 0.1 dB
	Residual output power (shutter closed): ≤ -45 dBm
Fine tuning speed	15 sec from -6 GHz to +6 GHz
Grid spacing	100 GHz, 50 GHz, 25 GHz, or arbitrary grid
General Specifications	
Output isolation (typical) • 8194xA, 81960A and 8198xA • 81950A	 • 50 dB • 30 dB
Return loss (typical)	60 dB (Option 072, 8194xA, 81960A and 8198xA)
	40 dB (Option 071, 8194xA and 8198xA)
Wavelength stability (typical, over 1 min)	± 0.5 pm
Fiber type	Panda
Orientation	TE mode in slow axis, in line with connector key
Polarization extinction ratio	16 dB typical
Recommended re-calibration period	2 years
Connector option (required)	Tunable laser must be ordered with one connector option
Option 071	PMF, straight contact output connector (not available for 81960A)
Option 072	PMF, angled contact output connector
Connector interface	One Agilent 81000xI-Series connector interface is required

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