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Agilent 81480/ 680/ 640A Tunable Lasers
Agilent 81682/ 642A Tunable Lasers
Technical Specifications
February 2002





The 81480A, 81640A, 81680A, 81642A and 81682A Tunable Laser modules with their built-in wavelength control loop push today's performance limits. As they are mode-hop free tunable with continuous output power, they qualify for the test of the most critical DWDM components.

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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 and the Agilent 81480A covers the wavelength range from 1370nm to 1480nm.

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

The Agilent 81480A 81640A, 81642A 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.

Test of optical amplifiers and passive components

The 81682A and 81642A 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.



Polarization Maintaining Fiber for the test of integrated optical devices

The 81480A, 81640A, 81642A, 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 81480A, 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.

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 and 81642A 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, 81480A, 81640A, 81642A, 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.

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81480A Tunable Laser

	Agilent 81480A	
Wavelength range	1370 nm to 1480 nm	
Wavelength resolution	0.1 pm, 15 MHz at 1450 nm	
Mode-hop free tuning range [9]	full wavelength range	
Absolute wavelength accuracy [1] [2] [9]	±0.01 nm	
Relative wavelength accuracy [1] [2] [9]	±5 pm, typ. ±2 pm	
Wavelength repeatability [2][9]	±1 pm, typ. ±0.5 pm	
Wavelength stability [9] (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 Effective linewidth (typ.), coherence ctrl. on	100 kHz > 50 MHz (1420 - 1470 nm), at maximum flat output power)	
	Output 1 (low SSE)	Output 2 (high power)
Output power [3] (continuous power during tuning)	≥ -4.5 dBm peak typ ≥ -7 dBm (1420 – 1470 nm) ≥ -13 dBm (1370 – 1480 nm)[9]	≥ +5.5 dBm peak typ ≥ +3 dBm (1420 - 1470 nm) ≥ -3 dBm (1370 - 1480 nm)[9]
Minimum output power [3]	-13 dBm	-3 dBm (-60 dBm in attenuation mode)
Power stability [3]	±0.01 dB, 1 hour (1420nm-1480nm) typ. ±0.01 dB, 1 hour (1370nm-1420nm) [9] typ. ±0.03 dB, 24 hours	
Power repeatability (typ.) [3][9]	±0.01 dB	
Power linearity [3]	±0.1 dB (1420nm-1480nm) typ. ±0.1dB (1370nm-1420nm) [9]	±0.3 dB (1420nm-1480nm) typ. ±0.3 dB (1370nm-1420nm) [9]
Power flatness versus wavelength [3] [9]	±0.2 dB, typ. ±0.1 dB (1420-1480nm) ±0.2 dB typ (1370nm-1420nm)	±0.3 dB, typ. ±0.2 dB (1420nm-1480nm) ±0.3 dB typ (1370nm-1420nm)
Side-mode suppression ratio (typ.) [4] [8] [9]	≥ 40 dB (1380 - 1480 nm)	
Signal to source spontaneous emission ratio [5] [8]	≥ 61 dB/nm [7] (1420 – 1470 nm) ≥ 55 dB/nm [7] [9] (typ., 1370 – 1480 nm)	≥ 40 dB/ nm (1420 – 1470 nm) ≥ 35 dB/ nm (1370 – 1480 nm)
Signal to total Source spontaneous emission ratio [6] [8]	≥ 58 dB (1420 – 1470 nm) [7] ≥ 53 dB (typ., 1370 - 1480 nm) [7] [9]	≥ 28 dB (typ., 1420 - 1470 nm)
Relative intensity noise (RIN, typ.) [8]	-145 dB/Hz (1420 - 1470 nm)	

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

[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] wavelength must not be equal to any water absorption line

continuous sweep mode 81480A

mode-hop free span 1420-1470nm at flat output power > =0 dBm

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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 Effective linewidth (typ.), coherence ctrl. on	100 kHz > 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 dB (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

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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 Effective linewidth (typ.), coherence ctrl. on	100 kHz > 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 dB (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

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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 Effective linewidth (typ.), coherence control on	100 kHz > 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 dB (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

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81642A Tunable Laser

	Agilent 81642A
Wavelength range	1510nm to 1640mn
Wavelength resolution	0.1 pm, 12.5 MHz at 1550 nm
Mode-hop free tuning range	Full wavelength range
Absolute wavelength accuracy [1] [2]	±0.015nm
Relative wavelength accuracy[1] [2]	±7 pm, typ. ±3 pm
Wavelength repeatability [2]	±1 pm, typ. ±0.5 pm
Wavelength stability [2]	< ±1 pm (typ., 24 h at const. temp.)
Tuning speed (typ. for a 1/10/100 nm step)	400ms/600ms/2.8s
Linewidth (typ.), coherence control off Effective linewidth (typ.), coherence control on	100 kHz > 50 MHz (1520-1620 nm, at maximum flat output power)
Output power (continuous power during tuning) [3] for #003	≥ +7 dBm peak typ. ≥ +6 dBm (1560 -1610 nm) ≥ +4 dBm (1530 -1610 nm) ≥ +2 dBm (1520 -1620 nm) ≥ - 3 dBm (1510 -1640 nm) reduced by 1.5dB
Minimum output power[3] with option #003	-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 [3]	±0.3 dB
Power flatness versus wavelength [3]	±0.3 dB, typ. ±0.15 dB
Side-mode suppression ratio (typ.) [4] [7]	≥ 40 dB (1530 – 1610 nm)
Signal to source spontaneous emission ratio [5] [7]	≥45 dB/nm (1530 –1620 nm) ≥40 dB/nm (1520 – 1620 nm) ≥35 dB/nm (1510 –1640 nm)
Signal to total source spontaneous emission ratio (typ.) [6] [7]	≥ 27 dB (typ.,1530 – 1610 nm)
Relative intensity noise (RIN, typ.) [7]	-145 dB/Hz (1530 – 1610 nm)

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

[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

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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 Vp-p

External wavelength locking
(Agilent 81480/
81680A/640A/682A/642A)
> ±70 pm at 10 Hz
> ±7 pm at 100 Hz.

Modulation input:
± 5 V

Coherence control
(81480A/81640A/81642A/ 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

(81480A/81640A/81462A/ 80A/ 82A)
Tuning velocity adjustable to
40 nm/sec, 5 nm/sec and 0.5 nm/sec.
Mode-hop free span
Agilent 81480A:
1420-1470 nm at flat output power
≥ 0 dBm
Agilent 81680A/82A:
1520-1570 nm at flat output power
≥ 3dBm
Agilent 81640A:
Any 50 nm within 1520-1620 nm at flat output power ≥ 0 dBm
Agilent 81642A:
Any 50 nm within 1520-1620 nm at flat output power ≥ 2 dBm
Ambient temperature within +20 °C and +35 °C.

General

Output isolation (typ.):
50 dB.

Return loss (typ.):
60 dB (options 022, 072);
40 dB (options 021, 071).

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
immediate operation after boot-up.

Environmental

Storage temperature:
–40 °C to + 70 °C.

Operating temperature:
10 °C to 35 °C.

Humidity:
< 80 % R.H. at 10 °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.

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8164A Lightwave Measurement System

Display:
Active color LCD, 600 x 400 pixels visible. VGA connector for external monitor.
GPIB Interface:
GPIB interface function code: SH1, AH1, T6, L4, SR1, RL1, PP0, DC2, DT0, C0.
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, ±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.

Option 022: standard single mode fiber, angled contact output connector.

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

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

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

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.



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Related Agilent Literature:

Agilent 8163A Lightwave Multimeter
Agilent 8164A Lightwave Measurement System
Agilent 8166A Lightwave Multichannel System
Technical Specifications
p/n 5988-1568EN

Agilent 81662A DFB Laser
Agilent 81663A 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 8163A Lightwave Multimeter
Agilent 8164A Lightwave Measurement System
Agilent 8166A Lightwave Multichannel System
Configuration Guide
p/n 5988-1571EN

Agilent 8163B Lightwave Multimeter
Agilent 8164B Lightwave Measurement System
Agilent 8166B Lightwave Multichannel System
Technical Specifications
p/n 5988-3924EN

Agilent 81689A/81689B/81649A
Compact Tunable Laser Modules
Technical Specifications
p/n 5988-3675EN



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