

# Keysight Technologies

## 8160xx Family of Tunable Laser Sources

Data Sheet



## Introduction

The Keysight Technologies 8160xx Family of Tunable Laser Sources offers the full wavelength range from 1240 nm to 1650 nm with no wavelength gaps. All 8160xx Tunable Laser Sources are modules for the Keysight 8164B Lightwave Measurement System mainframe. This provides test instrumentation with maximum flexibility.

Investing in the Keysight 8160xx Family of Tunable Laser Sources can realize the cost efficiency and performance required to test components for coarse and dense wavelength division multiplexing (CWDM, DWDM, 100GBASE-LR4) and passive optical networks (PON).

### **NEW** Fast Two-Way Sweeps and High Power with Low SSE

The new Keysight 81606A top-line Tunable Laser Source has been designed to reach a new accuracy level and to increase test efficiency by enabling faster swept-wavelength tests and lower cost of ownership. It accelerates the automated adjustment of wavelength-selective devices in the new two-way sweep mode up to 200 nm/s speed with sub-picometer repeatability and best-in-class accuracy. With more than +12 dBm output power at the product family's lowest spontaneous emission level, it enables the validation of extremely deep filters.

Through a major redesign, the new Keysight 81606A Tunable Laser Source reaches:

- 15 dB more dynamic range through high signal power at lowest spontaneous emission, enabled by the new cavity and laser module design.
- A 4-fold improvement in absolute accuracy with increased real-time tracking speed and resolution, enabled by the novel wavelength reference unit.
- Faster sweeps at up to 200 nm/s in both directions without impacting the specified dynamic accuracy, enabled by enhanced feedback controls and drive mechanics.

The new value and basic line models share the 81606A's new design with low spontaneous emission and narrow line width, its industry-leading power repeatability and long-term stability. The new modules offer additional price-performance options based on output power, tuning speed, wavelength accuracy and repeatability. Whether you need to verify the design of demanding optical components or adjust more wavelength-selective switches per hour, or you simply need a stable, tunable optical source, the 8160xx family of tunable lasers offers a suitable model.

### Certified quality

The 8160xx Family of Tunable Laser Sources are produced to the ISO 9001 international quality system standard as part of Keysight'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 the Keysight 8160xx Series Tunable Laser Family User's Guide (publication number 81606-90B01).

## Keysight 8160xx Family of Tunable Laser Sources

The Keysight 8160xx tunable laser modules fit into the bottom slot of the Keysight 8164B Lightwave Measurement System mainframe.

### NEW The Keysight 81606A Top-Line Tunable Laser Source

The new 81606A Option 216 Tunable Laser Source is the new flagship model, featuring the widest tuning range of 200 nm, and an outstanding dynamic wavelength accuracy and repeatability. The excellent low-SSE performance of better than 80 dB/nm signal-to-source spontaneous emission ratio (signal-to-SSE ratio) and the high signal power permit measurements of wavelength isolation to 100 dB, most often limited by power meter sensitivity.

### NEW The Keysight 81607A, 81608A Value Line Tunable Laser Sources

The new 81607A value line tunable laser source complements the top line 81606A model at a moderately reduced output power. With a typical wavelength repeatability of  $\pm 1$  pm even during two-way sweeps with up to 200 nm/s, it is ideal for high-throughput test and automated adjustment of passive optical components.

The new 81608A, another member of the value line tunable laser sources, offers a peak output power of more than +12 dBm, at least 75 dB/nm above its spontaneous emission level. The 81608A features a typical wavelength repeatability of  $\pm 1.5$  pm at two-way sweeps up to 200 nm/s. The laser's balance of features, performance and price makes it suitable for both coherent transmission experiments and cost-effective manufacturing-floor component testing.

### NEW The Keysight 81609A Basic Line Step-Tunable Laser Source

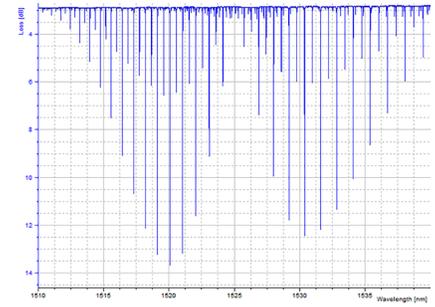
The new 81609A basic line module can step within 300 milliseconds to discrete wavelengths with a resolution of 0.1 pm and a typical wavelength repeatability of  $\pm 3$  pm, making it ideal for cost-effective testing of broadband optical devices. Like the other modules in the family, it delivers more than +12 dBm peak output power with low spontaneous emission levels. At  $\pm 0.01$  dB power stability over an hour, it can also serve as a static local oscillator with a wide tuning range for receiver testing or transmission experiments.

## Full wavelength range from 1240 nm to 1650 nm

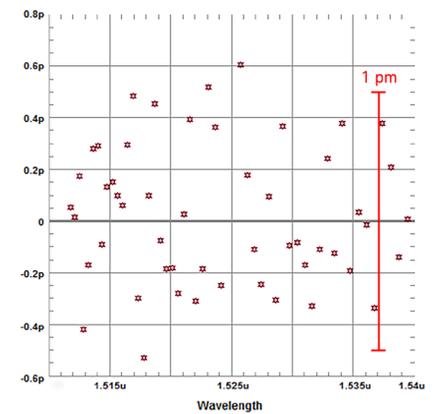
The Keysight 8160xx Family of Tunable Laser Sources offers the full wavelength range from 1240 nm to 1650 nm with no wavelength gaps. The N7700A software suite has a measurement engine for IL and PDL that can combine the sweeps of up to 3 tunable laser wavelength ranges. Such a setup can be used for testing wideband multiplexers and PON devices.

### NEW Improved O-band models for Silicon Photonics applications

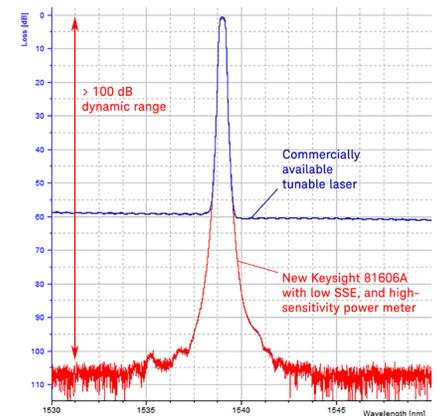
The new 8160xA option 113 covers the wavelength range from 1240 nm to 1380 nm for an important set of applications. Equipped with PMF output fiber, these are a good match for testing and developing components with Silicon Photonics technology. Verifying the spectral responsivity and the sensitivity of receiver optical subassemblies (ROSA) for 100G Ethernet benefit from more than +10 dBm output power - enough to allow for external modulation in BER testing. Combined with very low SSE levels, Option 113 is ideal for testing wavelength filters for LR4 components.



Absorption lines of a C<sub>2</sub>H<sub>2</sub> gas cell acquired at 200 nm/s sweep speed with the new 81606A tunable laser.



Less than  $\pm 1$  pm deviation of the measured center wavelengths from the known values according to NIST.



Crosstalk of a 50 GHz DWDM filter, measured with the N7747A high-sensitivity power meter.

## Integrated solutions for swept-wavelength spectral measurements

The 8160xx family is supported with the N7700A software suite for spectral measurements of insertion loss, polarization dependent loss and dispersion in combination with power meters and polarization instruments. These provide optimal swept-wavelength accuracy and dynamic range. See the N7700A brochure for details.

## Low SSE output for high dynamic range

A laser signal with low source spontaneous emission (SSE) is required for accurate crosstalk measurement of DWDM, CWDM and PON wavelength filtering components by producing light only at the desired wavelength. The 81606A features a single optical output with more than +12 dBm output power. It combines the highest power level with the lowest SSE level in the 8160xx product family, 80 dB/nm below the signal. The 81607A comes with +8 dBm peak output power, 81608A and 81609A with more than +12 dBm, 75 dB/nm above their spontaneous emission level. For all 8160xA modules, the output power can be reduced to 0 dBm by the user.

The 81600B option 201, 200, 160, 150, 140 and 130 Tunable Laser Sources are equipped with two optical outputs. The low-SSE output port of the dual-output models is suitable for the measurement of passive devices. The second output port provides high optical power, adjustable over a power range of more than 60 dB via a built-in optical attenuator. It is particularly well suited for use in experiments which require a strong, tunable-wavelength source.

## Multipurpose component tests in the E-band

The Keysight 81600B Option 142 provides one output port with high stimulus power for applications where the SSE level is not critical. The module can also be equipped with a built-in optical attenuator, so providing an adjustable power range of 60 dB.

## Built-in wavelength meter for optimum tuning precision

The Keysight 8160xx Family of Tunable Laser Sources includes a built-in real time wavelength meter which realizes the family's excellent absolute and relative wavelength accuracy, and delivers wavelength logging data after each sweep.

The new Keysight 81606A takes this concept even further by adding a gas cell for long-term stability and absolute referencing. The wavelength reference unit's faster response and finer wavelength resolution enable the 81606A to sweep with sub-picometer repeatability. It is the key to the 81606A's superior accuracy and temperature stability, and it enables a greater degree of self-diagnosis than previously possible. The Keysight 81607A, 81608A and 81609A share the 81606A's long-term stability due to the built-in gas cell, yet mark different performance levels with respect to wavelength accuracy and repeatability.

## Specified performance in the continuous sweep mode

As manufacturing yield expectations becomes more and more stringent, it is important that all instruments deliver optimum performance under all measurement conditions.

The new Keysight 81606A, 81607A and 81608A can perform two-way sweeps with up to 200 nm/s. The dynamic specifications for swept operation apply in both directions. The Keysight 81600B can sweep at up to 80 nm/s with specified accuracy during the forward sweep. The new Keysight 81609A Basic Line module tunes in wavelength steps of 0.1 pm resolution.

## Realize the cost efficiency and performance benefits in WDM component tests

The testing of optical filters is based on a generic principle, namely the stimulus-response test. The state-of-the-art approach is a wavelength-resolved stimulus-response measurement utilizing a tunable laser source that is capable of fast and precise sweeps across the entire wavelength range, and optical power meters.

For DWDM components, high wavelength accuracy and dynamic range are critical. For CWDM and PON components, a wide wavelength range, dynamic range and tight costing are key targets. If the investment in the test solution can be shared among many different types of filters, the contribution to each individual filter is minimized. In this way, cost targets for CWDM and PON components can be met without sacrificing accuracy.

Investing in the Keysight 8160xx Family of Tunable Laser Sources can realize both the cost efficiency and performance benefits required.

## Polarization maintaining fiber for the test of integrated optical devices

The 8160xx Family of Tunable Laser Sources is ideal for characterizing integrated optical devices. Its PMF output ports provide a well-defined state of polarization to ensure constant measurement conditions for waveguide devices. A PMF cable easily connects to an external optical modulator.

## 81606A Tunable Laser Source, High Power with Low SSE

Keysight 81606A	O-band	SCL-band / CL-band
Wavelength range	1240 nm to 1380 nm (Option 113)	1450 nm to 1650 nm (Option 216) 1490 nm to 1640 nm (Option 116)
Wavelength resolution	0.1 pm, 17.5 MHz at 1310 nm	0.1 pm, 12.5 MHz at 1550 nm
Continuous sweep range	Full wavelength range <sup>4</sup>	
Maximum sweep speed	200 nm/s, bidirectional	
Wavelength stability <sup>3</sup> (typical)	$\leq \pm 0.5$ pm, 24 hours	
Linewidth (typical)	< 10 kHz	
Maximum output power (continuous power during sweep)	<b>Option 113</b> > +13 dBm peak > +11 dBm (1290 nm – 1340 nm) > +10 dBm (1260 nm – 1360 nm) > +5 dBm (1240 nm – 1380 nm)	<b>Option 216</b> > +12 dBm peak > +11 dBm (1515 nm – 1620 nm) > +9 dBm (1480 nm – 1630 nm) > +5 dBm (1450 nm – 1650 nm) <b>Option 116</b> > +12 dBm peak > +11 dBm (1515 nm – 1620 nm) > +8 dBm (1490 nm – 1640 nm)
Side-mode suppression ratio (typical) <sup>6</sup>	$\geq 70$ dB (1290 nm - 1340 nm) $\geq 60$ dB (1250 nm - 1380 nm)	$\geq 70$ dB (1515 nm - 1620 nm) $\geq 60$ dB (full wavelength range)
Relative intensity noise (RIN) (0.1 to 6 GHz) <sup>6</sup>	< -150 dB/Hz (typical, 1290 nm - 1340 nm)	< -150 dB/Hz (typical, 1515 nm - 1620 nm)
Signal to source spontaneous emission ratio <sup>2</sup>	$\geq 80$ dB/nm $\geq 90$ dB/0.1 nm	
Signal to total source spontaneous emission ratio <sup>2</sup>	$\geq 75$ dB	
	<b>Stepped mode</b>	<b>Continuous sweep mode, both directions (typical) <sup>4</sup></b>
Absolute wavelength accuracy <sup>1</sup>	$\pm 2$ pm; typical $\pm 1.5$ pm	$\pm 1.5$ pm
Relative wavelength accuracy <sup>1</sup>	$\pm 1.5$ pm; typical $\pm 1$ pm	$\pm 1$ pm
Wavelength repeatability	$\pm 0.5$ pm; typical $\pm 0.2$ pm	$\pm 0.3$ pm
Power repeatability (typical)	$\pm 0.002$ dB	Not applicable
Power stability <sup>3</sup>	$\pm 0.01$ dB, 1 hour Typical $\pm 0.025$ dB, 24 hours	Not applicable
Power linearity	$\pm 0.05$ dB	Not applicable
Power flatness versus wavelength	$\pm 0.25$ dB typical $\pm 0.1$ dB (Options 216, 116) typical $\pm 0.15$ dB (Option 113)	Not applicable
Dynamic power reproducibility	Not applicable	$\pm 0.01$ dB
Dynamic relative power flatness	Not applicable	$\pm 0.02$ dB <sup>5</sup>

- Valid for 24 hours and within a  $\pm 5$  K temperature range after wavelength zeroing.
- At maximum output power, between 1320 nm and 1350 nm (Option 113);  
at maximum output power, between 1520 nm and 1580 nm (Options 216, 116).
- At constant temperature  $\pm 1$  K.
- Full wavelength range for sweep speeds  $\leq 50$  nm/s.  
Full wavelength range reduced by 0.5 nm on both ends for 80 nm/s sweep speed.  
Full wavelength range reduced by 3 nm on both ends for sweep speeds  $\geq 100$  nm/s and  $\leq 150$  nm/s.  
Full wavelength range reduced by 5 nm on both ends for  $\geq 160$  nm/s sweep speed.  
Mode-hop free tunable across the full wavelength range.  
Stop wavelength below 1345 nm (Option 113).
- Add  $\pm 0.01$  dB for sweep speeds  $> 80$  nm/s.
- At maximum output power.

## 81607A Tunable Laser Source, Value Line, Low SSE

<b>Keysight 81607A Option 116</b>		
Wavelength range	1490 nm to 1640 nm	
Wavelength resolution	0.1 pm, 12.5 MHz at 1550 nm	
Continuous sweep range	Full wavelength range <sup>4</sup>	
Maximum sweep speed	200 nm/s, bidirectional	
Wavelength stability <sup>3</sup> (typical)	≤ ±1 pm, 24 hours	
Linewidth (typical)	< 10 kHz	
Maximum output power (continuous power during sweep)	> +8 dBm peak (typical) > +7 dBm (1515 nm – 1620 nm) > +4 dBm (1490 nm – 1640 nm)	
Side-mode suppression ratio (typical)	≥ 65 dB (1515 nm – 1620 nm, max. output power) ≥ 55 dB (full wavelength range, max. output power)	
Relative intensity noise (RIN) (0.1 – 6 GHz)	< -135 dB/Hz (typical, 1515 nm – 1620 nm, max. output power)	
Signal to source spontaneous emission ratio <sup>2</sup>	≥ 75 dB/nm ≥ 85 dB/0.1 nm	
Signal to total source spontaneous emission ratio <sup>2</sup>	≥ 70 dB	
	<b>Stepped mode</b>	<b>Continuous sweep mode, both directions (typical) <sup>4</sup></b>
Absolute wavelength accuracy <sup>1</sup>	± 5 pm; typical ± 3 pm	± 3 pm
Relative wavelength accuracy <sup>1</sup>	± 3 pm; typical ± 2 pm	± 2 pm
Wavelength repeatability	± 1.5 pm; typical ± 1 pm	± 1 pm
Power repeatability (typical)	± 0.005 dB	Not applicable
Power stability <sup>3</sup>	± 0.01 dB, 1 hour Typical ± 0.025 dB, 24 hours	Not applicable
Power linearity	± 0.05 dB	Not applicable
Power flatness versus wavelength	± 0.25 dB; typical ± 0.1 dB	Not applicable
Dynamic power reproducibility	Not applicable	± 0.01 dB
Dynamic relative power flatness	Not applicable	± 0.02 dB <sup>5</sup>

- Valid for 24 hours and within a ± 5 K temperature range after wavelength zeroing.
- At maximum output power, between 1520 nm and 1580 nm.
- At constant temperature ± 1 K.
- Full wavelength range for sweep speeds ≤ 50 nm/s.  
Full wavelength range reduced by 0.5 nm on both ends for 80 nm/s sweep speed.  
Full wavelength range reduced by 3 nm on both ends for sweep speeds ≥ 100 nm/s and ≤ 150 nm/s.  
Full wavelength range reduced by 5 nm on both ends for ≥ 160 nm/s sweep speed. Mode-hop free tunable across the full wavelength range.
- Add ± 0.01 dB for sweep speeds > 80 nm/s.

## 81608A Tunable Laser Source, Value Line, High Power with Low SSE

Keysight 81608A	O-band	SCL-band / CL-band
Wavelength range	1240 nm to 1380 nm (Option 113)	1450 nm to 1650 nm (Option 216) 1490 nm to 1640 nm (Option 116)
Wavelength resolution	0.1 pm, 17.5 MHz at 1310 nm	0.1 pm, 12.5 MHz at 1550 nm
Continuous sweep range	Full wavelength range <sup>4</sup>	
Maximum sweep speed	200 nm/s, bidirectional	
Wavelength stability <sup>3</sup> (typical)	≤ ±2.5 pm, 24 hours	
Linewidth (typical), coherence control off	< 10 kHz	
Effective linewidth (typical), coherence control on <sup>6</sup>	> 50 MHz (1290 nm - 1340 nm)	> 50 MHz (1515 nm - 1620 nm)
Maximum output power (continuous power during sweep)	<b>Option 113</b> > +13 dBm peak (typical) > +11 dBm (1290 nm - 1340 nm) > +10 dBm (1260 nm - 1360 nm) > +5 dBm (1240 nm - 1380 nm)	<b>Option 216</b> > +12 dBm peak (typical) > +11 dBm (1515 nm - 1620 nm) > +9 dBm (1480 nm - 1630 nm) > +5 dBm (1450 nm - 1650 nm) <b>Option 116</b> > +12 dBm peak (typical) > +11 dBm (1515 nm - 1620 nm) > +8 dBm (1490 nm - 1640 nm)
Side-mode suppression ratio (typical) <sup>6</sup>	≥ 70 dB (1290 nm - 1340 nm) ≥ 60 dB (1250 nm - 1380 nm)	≥ 70 dB (1515 nm - 1620 nm) ≥ 60 dB (full wavelength range)
Relative intensity noise (RIN) (0.1 - 6 GHz) <sup>6</sup>	< -150 dB/Hz (typical, 1290 nm - 1340 nm)	< -150 dB/Hz (typical, 1515 nm - 1620 nm)
Signal to source spontaneous emission ratio <sup>2</sup>	≥ 75 dB/nm ≥ 85 dB/0.1 nm	
Signal to total source spontaneous emission ratio <sup>2</sup>	≥ 70 dB	
	<b>Stepped mode</b>	<b>Continuous sweep mode, both directions (typical) <sup>4</sup></b>
Absolute wavelength accuracy <sup>1</sup>	±20 pm; typ. ±5 pm	±10 pm
Relative wavelength accuracy <sup>1</sup>	±10 pm; typ. ±3 pm	±5 pm
Wavelength repeatability	±2.5 pm; typ. ±1 pm	±1.5 pm
Power repeatability (typical)	±0.01 dB	Not applicable
Power stability <sup>3</sup>	±0.01 dB, 1 hour typ. ±0.03 dB, 24 hours	Not applicable
Power linearity	±0.1 dB	Not applicable
Power flatness versus wavelength	±0.25 dB typical ±0.1 dB (Options 216, 116) typical ±0.15 dB (Option 113)	Not applicable
Dynamic power reproducibility	Not applicable	± 0.01 dB
Dynamic relative power flatness	Not applicable	± 0.02 dB <sup>5</sup>

- Valid for 24 hours and within a ± 5 K temperature range after wavelength zeroing.
- At maximum output power, between 1320 nm and 1350 nm (Option 113);  
at maximum output power, between 1520 nm and 1580 nm (Options 216, 116).
- At constant temperature ± 1 K.
- Full wavelength range for sweep speeds ≤ 50 nm/s.  
Full wavelength range reduced by 0.5 nm on both ends for 80 nm/s sweep speed.  
Full wavelength range reduced by 3 nm on both ends for sweep speeds ≥ 100 nm/s and ≤ 150 nm/s.  
Full wavelength range reduced by 5 nm on both ends for ≥ 160 nm/s sweep speed.  
Mode-hop free tunable across the full wavelength range.  
Stop wavelength below 1345 nm (Option 113).
- Add ± 0.01 dB for sweep speeds > 80 nm/s.
- At maximum output power.

81608A-216: v1.0

81608A-116: v1.0

81608A-113: v1.0

## 81609A Step-Tunable Laser Source, Basic Line, High Power with Low SSE

Keysight 81609A Option 216, 116	O-band	SCL-band / CL-band
Wavelength range	1240 nm to 1380 nm (Option 113)	1450 nm to 1650 nm (Option 216) 1490 nm to 1640 nm (Option 116)
Wavelength resolution	0.1 pm, 17.5 MHz at 1310 nm	0.1 pm, 12.5 MHz at 1550 nm
Continuous tuning range	Full wavelength range, mode-hop free	
Tuning time <sup>4</sup> (typical)	300 ms (1 nm step, max. output power) 1.5 s (100 nm step, max. output power)	
Wavelength stability <sup>3</sup> (typical)	≤ ±5 pm, 24 hours	
Linewidth (typical), coherence control off	< 10 kHz	
Effective linewidth (typical), coherence control on <sup>5</sup>	> 50 MHz (1290 nm - 1340 nm)	> 50 MHz (1515 nm - 1620 nm)
Maximum output power (continuous power during tuning)	<b>Option 113</b> > +13 dBm peak (typical) > +11 dBm (1290 nm - 1340 nm) > +10 dBm (1260 nm - 1360 nm) > +5 dBm (1240 nm - 1380 nm)	<b>Option 216</b> > +12 dBm peak (typical) > +11 dBm (1515 nm - 1620 nm) > +9 dBm (1480 nm - 1630 nm) > +5 dBm (1450 nm - 1650 nm) <b>Option 116</b> > +12 dBm peak (typical) > +11 dBm (1515 nm - 1620 nm) > +8 dBm (1490 nm - 1640 nm)
Side-mode suppression ratio (typical) <sup>5</sup>	≥ 70 dB (1290 nm - 1340 nm) ≥ 60 dB (1250 nm - 1380 nm)	≥ 70 dB (1515 nm - 1620 nm) ≥ 60 dB (full wavelength range)
Relative intensity noise (RIN) (0.1 - 6 GHz) <sup>5</sup>	< -150 dB/Hz (typical, 1290 nm - 1340 nm)	< -150 dB/Hz (typical, 1515 nm - 1620 nm)
Signal to source spontaneous emission ratio <sup>2</sup>	≥ 75 dB/nm ≥ 85 dB/0.1 nm	
Signal to total source spontaneous emission ratio <sup>2</sup>	≥ 70 dB	
Absolute wavelength accuracy <sup>1</sup>	±30 pm; typ. ±10 pm	
Relative wavelength accuracy <sup>1</sup>	±15 pm; typ. ±5 pm	
Wavelength repeatability	±5 pm; typ. ±3 pm	
Power repeatability (typical)	±0.01 dB	
Power stability <sup>3</sup>	±0.01 dB, 1 hour typ. ±0.03 dB, 24 hours	
Power linearity	±0.1 dB	
Power flatness versus wavelength	±0.25 dB; typical ±0.1 dB (Options 216, 116); typical ±0.15 dB (Option 113)	

- Valid for 24 hours and within a ± 5 K temperature range after wavelength zeroing.
- At maximum output power, between 1320 nm and 1350 nm (Option 113);  
at maximum output power, between 1520 nm and 1580 nm (Options 216, 116).
- At constant temperature ± 1 K.
- Including power stabilization. When "step finished" trigger is received.
- At maximum output power.

81609A-216: v1.0

81609A-116: v1.0

81609A-113: v1.0

## 81600B Option 201 Tunable Laser, 1455 nm to 1640 nm, Low SSE

## 81600B Option 200 Tunable Laser, 1440 nm to 1640 nm, Low SSE

<b>Keysight 81600B Option 201, 200</b>				
Wavelength range	1455 nm to 1640 nm (81600B Option 201)			
	1440 nm to 1640 nm (81600B Option 200)			
Wavelength resolution	0.1 pm, 12.5 MHz at 1550 nm			
Mode-hop free tunability	Full wavelength range; see page 17 for conditions to assure mode-hop free continuous sweeps			
Maximum sweep speed	80 nm/s			
	<b>Stepped mode</b>	<b>Continuous sweep mode (typical)</b>		
		At 5 nm/s	At 40 nm/s	At 80 nm/s
Absolute wavelength accuracy <sup>1</sup>	± 10 pm, typical ± 3.6 pm	± 4.0 pm	± 4.6 pm	± 6.1 pm
Relative wavelength accuracy <sup>1</sup>	± 5 pm, typical ± 2 pm	± 2.4 pm	± 2.8 pm	± 4.0 pm
Wavelength repeatability	± 0.8 pm, typical ± 0.5 pm	± 0.3 pm	± 0.4 pm	± 0.7 pm
Wavelength stability <sup>4</sup> (typical)	≤ ± 1 pm, 24 hours			
Linewidth (typical), coherence control off	100 kHz			
Effective linewidth (typical), coherence control on	> 50 MHz (1475 nm to 1625 nm, at max. constant output power)			
Maximum output power (continuous power during sweep)	<b>Output 1 (low SSE)</b>	<b>Output 2 (high power)</b>		
	≥ +3 dBm peak (typical)	≥ +9 dBm peak (typical)		
	≥ +2 dBm (1520 nm to 1610 nm)	≥ +8 dBm (1520 nm to 1610 nm)		
	≥ -2 dBm (1475 nm to 1625 nm)	≥ +4 dBm (1475 nm to 1625 nm)		
	≥ -7 dBm <sup>5</sup>	≥ -1 dBm <sup>5</sup>		
Attenuation	Max. 60 dB			
Power repeatability (typical)	± 0.003 dB			
Power stability <sup>4</sup>	± 0.01 dB, 1 hour			
	Typical ± 0.03 dB, 24 hours			
Power linearity	± 0.1 dB		± 0.1 dB (± 0.3 dB in attenuation mode)	
Power flatness versus wavelength	± 0.25 dB <sup>3</sup> , typical ± 0.1 dB		± 0.3 dB <sup>3</sup> , typical ± 0.15 dB	
	<b>Continuous sweep mode</b>			
		At 5 nm/s	At 40 nm/s	At 80 nm/s
Dynamic power reproducibility (typical)	± 0.005 dB		± 0.01 dB	± 0.015 dB
Dynamic relative power flatness (typical)	± 0.01 dB		± 0.02 dB	± 0.04 dB
Side-mode suppression ratio (typical)	≥ 60 dB (1520 nm to 1610 nm)			
Signal to source spontaneous emission ratio <sup>2</sup>	<b>Output 1 (low SSE)</b>	<b>Output 2 (high power)</b>		
	≥ 70 dB/nm (1520 nm to 1610 nm)	≥ 48 dB/nm (1520 nm to 1610 nm)		
	≥ 80 dB/0.1 nm (typical, 1520 nm to 1610 nm)	≥ 58 dB/0.1 nm (typical, 1520 nm to 1610 nm)		
	≥ 66 dB/nm (typical, 1475 nm to 1625 nm)	≥ 43 dB/nm (1475 nm to 1625 nm)		
	≥ 60 dB/nm (typical) <sup>5</sup>	≥ 37 dB/nm <sup>5</sup>		
Signal to total source spontaneous emission ratio <sup>2</sup>	≥ 65 dB (1520 nm to 1610 nm)		≥ 30 dB (typical, 1520 nm to 1610 nm)	
	≥ 57 dB (typical) <sup>5</sup>			
Relative intensity noise (RIN) (0.1 to 6 GHz) (typical) <sup>2</sup>	-145 dB/Hz (1520 nm to 1610 nm)			

- Valid for one month and within a ± 4.4 K temperature range after automatic wavelength zeroing.
- At maximum output power as specified per wavelength range.
- Wavelength range 1455 nm to 1640 nm (81600B Option 201); 1440 nm to 1630 nm (81600B Option 200).
- At constant temperature ± 1 K.
- Wavelength range 1455 nm to 1640 nm (81600B Option 201); 1440 nm to 1640 nm (81600B Option 200).

## 81600B Option 160 Tunable Laser Source, 1495 nm to 1640 nm, Low SSE

<b>Keysight 81600B Option 160</b>				
Wavelength range	1495 nm to 1640 nm			
Wavelength resolution	0.1 pm, 12.5 MHz at 1550 nm			
Mode-hop free tunability full	Full wavelength range; see page 17 for conditions to assure mode-hop free continuous sweeps			
Maximum sweep speed	80 nm/s			
	<b>Stepped mode</b>	<b>Continuous sweep mode (typical)</b>		
		At 5 nm/s	At 40 nm/s	At 80 nm/s
Absolute wavelength accuracy <sup>1</sup>	± 10 pm, typical ± 3.6 pm	± 4.0 pm	± 4.6 pm	± 6.1 pm
Relative wavelength accuracy <sup>1</sup>	± 5 pm, typical ± 2 pm	± 2.4 pm	± 2.8 pm	± 4.0 pm
Wavelength repeatability	± 0.8 pm, typical ± 0.5 pm	± 0.3 pm	± 0.4 pm	± 0.7 pm
Wavelength stability <sup>3</sup> (typical)	≤ ± 1 pm, 24 hours			
Linewidth (typical), coherence control off	100 kHz			
Effective linewidth (typical), coherence control on	> 50 MHz (1510 nm to 1620 nm, at max. constant output power)			
Maximum output power (continuous power during sweep)	<b>Output 1 (low SSE)</b>	<b>Output 2 (high power)</b>		
	≥ -2 dBm peak (typical)	≥ +7 dBm peak (typical)		
	≥ -4 dBm (1520 nm to 1610 nm)	≥ +5 dBm (1520 nm to 1610 nm)		
	≥ -6 dBm (1510 nm to 1620 nm)	≥ +3 dBm (1510 nm to 1620 nm)		
	≥ -7 dBm (1495 nm to 1640 nm)	≥ -1 dBm (1495 nm to 1640 nm)		
Attenuation	Max. 60 dB			
Power repeatability (typical)	± 0.003 dB			
Power stability <sup>3</sup>	± 0.01 dB, 1 hour Typical ± 0.03 dB, 24 hours			
Power linearity	± 0.1 dB		± 0.1 dB (± 0.3 dB in attenuation mode)	
Power flatness versus wavelength	± 0.25 dB, typical ± 0.1 dB (1495 nm to 1630 nm)		± 0.3 dB, typical ± 0.15 dB	
	<b>Continuous sweep mode</b>			
	At 5 nm/s	At 40 nm/s	At 80 nm/s	
Dynamic power reproducibility (typical)	± 0.005 dB	± 0.01 dB	± 0.015 dB	
Dynamic relative power flatness (typical)	± 0.01 dB	± 0.02 dB	± 0.04 dB	
Side-mode suppression ratio (typical) <sup>2</sup>	≥ 40 dB (1520 nm to 1610 nm)			
Signal to source spontaneous emission ratio <sup>2</sup>	<b>Output 1 (low SSE)</b>	<b>Output 2 (high power)</b>		
	≥ 64 dB/nm (1520 nm to 1610 nm)	≥ 45 dB/nm (1520 nm to 1610 nm)		
	≥ 74 dB/0.1 nm (typical, 1520 nm to 1610 nm)	≥ 55 dB/0.1 nm (typical, 1520 nm to 1610 nm)		
	≥ 62 dB/nm (typical, 1510 nm to 1620 nm)	≥ 42 dB/nm (1510 nm to 1620 nm)		
	≥ 59 dB/nm (typical, 1495 nm to 1640 nm)	≥ 37 dB/nm (1495 nm to 1640 nm)		
Signal to total source spontaneous emission ratio <sup>2</sup>	≥ 59 dB (1520 nm to 1610 nm)	≥ 27 dB (typical, 1520 nm to 1610 nm)		
	≥ 56 dB (typical, 1495 nm to 1640 nm)			
Relative intensity noise (RIN) (0.1 to 6 GHz) (typical) <sup>2</sup>	-145 dB/Hz (1520 nm to 1610 nm)			

1. Valid for one month and within a ± 4.4 K temperature range after automatic wavelength zeroing.

2. At maximum output power as specified per wavelength range.

3. At constant temperature ± 1 K.

## 81600B Option 150 Tunable Laser Source, 1450 nm to 1590 nm, Low SSE

<b>Keysight 81600B Option 150</b>				
Wavelength range	1450 nm to 1590 nm			
Wavelength resolution	Wavelength resolution 0.1 pm, 12.5 MHz at 1550 nm			
Mode-hop free tunability	Full wavelength range; see page 17 for conditions to assure mode-hop free continuous sweeps			
Maximum sweep speed	80 nm/s			
	<b>Stepped mode</b>	<b>Continuous sweep mode (typical)</b>		
		At 5 nm/s	At 40 nm/s	At 80 nm/s
Absolute wavelength accuracy <sup>1</sup>	± 10 pm, typical ± 3.6 pm	± 4.0 pm	± 4.6 pm	± 6.1 pm
Relative wavelength accuracy <sup>1</sup>	± 5 pm, typical ± 2 pm	± 2.4 pm	± 2.8 pm	± 4.0 pm
Wavelength repeatability	± 0.8 pm, typical ± 0.5 pm	± 0.3 pm	± 0.4 pm	± 0.7 pm
Wavelength stability <sup>3</sup> (typical)	≤ ± 1 pm, 24 hours			
Linewidth (typical), coherence control off	100 kHz			
Effective linewidth (typical), coherence control on	> 50 MHz (1480 nm to 1580 nm, at max. constant output power)			
Maximum output power (continuous power during sweep)	<b>Output 1 (low SSE)</b>	<b>Output 2 (high power)</b>		
	≥ -1 dBm peak (typical)	≥ +7 dBm peak (typical)		
	≥ -3 dBm (1520 nm to 1570 nm)	≥ +5 dBm (1520 nm to 1570 nm)		
	≥ -6 dBm (1480 nm to 1580 nm)	≥ +4 dBm (1480 nm to 1580 nm)		
	≥ -7 dBm (1450 nm to 1590 nm)	≥ -1 dBm (1450 nm to 1590 nm)		
Attenuation	Max 60 dB			
Power repeatability (typical)	± 0.003 dB			
Power stability <sup>3</sup>	± 0.01 dB, 1 hour			
	Typical ± 0.03 dB, 24 hours			
Power linearity	± 0.1 dB		± 0.1 dB (± 0.3 dB in attenuation mode)	
Power flatness versus wavelength	± 0.2 dB, typical ± 0.1 dB		± 0.3 dB, typical ± 0.15 dB	
	<b>Continuous sweep mode</b>			
	At 5 nm/s	At 40 nm/s	At 80 nm/s	
Dynamic power reproducibility (typical)	± 0.005 dB	± 0.01 dB	± 0.015 dB	
Dynamic relative power flatness (typical)	± 0.01 dB	± 0.02 dB	± 0.04 dB	
Side-mode suppression ratio (typical) <sup>2</sup>	≥ 40 dB (1480 nm to 1580 nm)			
Signal to source spontaneous emission ratio <sup>2</sup>	<b>Output 1 (low SSE)</b>	<b>Output 2 (high power)</b>		
	≥ 65 dB/nm (1520 nm to 1570 nm)	≥ 45 dB/nm (1520 nm to 1570 nm)		
	≥ 75 dB/0.1 nm (typical, 1520 nm to 1570 nm)	≥ 55 dB/0.1 nm (typical, 1520 nm to 1570 nm)		
	≥ 61 dB/nm (typical, 1480 nm to 1580 nm)	≥ 42 dB/nm (1480 nm to 1580 nm)		
	≥ 59 dB/nm (typical, 1450 nm to 1590 nm)	≥ 37 dB/nm (1450 nm to 1590 nm)		
Signal to total source spontaneous emission ratio <sup>2</sup>	≥ 60 dB (1520 nm to 1570 nm)	≥ 30 dB (typical, 1520 nm to 1570 nm)		
	≥ 50 dB (typical, 1450 nm to 1590 nm)			
Relative intensity noise (RIN) (0.1 to 6 GHz) (typical) <sup>2</sup>	-145 dB/Hz (1480 nm to 1580 nm)			

1. Valid for one month and within a ± 4.4 K temperature range after automatic wavelength zeroing.
2. At maximum output power as specified per wavelength range.
3. At constant temperature ± 1 K.

## 81600B Option 140 Tunable Laser Source, 1370 nm to 1495 nm, Low SSE

<b>Keysight 81600B Option 140</b>				
Wavelength range	1370 nm to 1495 nm			
Wavelength resolution	0.1 pm, 15 MHz at 1450 nm			
Mode-hop free tunability full	Full wavelength range; see page 17 for conditions to assure mode-hop free continuous sweeps			
Maximum sweep speed	80 nm/s (1372 nm to 1495 nm)			
	<b>Stepped mode</b>	<b>Continuous sweep mode (typical)</b>		
		At 5 nm/s	At 40 nm/s	
			At 80 nm/s	
Absolute wavelength accuracy <sup>1</sup>	± 10 pm, typical ± 3.6 pm	± 4.0 pm	± 4.6 pm	± 6.1 pm
Relative wavelength accuracy <sup>1</sup>	± 5 pm, typical ± 2 pm	± 2.4 pm	± 2.8 pm	± 4.0 pm
Wavelength repeatability	± 0.8 pm, typical ± 0.5 pm	± 0.3 pm	± 0.4 pm	± 0.7 pm
Wavelength stability <sup>4</sup> (typical)	≤ ± 1 pm, 24 hours			
Linewidth (typical), coherence control off	100 kHz			
Effective linewidth (typical), coherence control on	> 50 MHz (1430 nm to 1480 nm, at max. constant output power)			
Maximum output power (continuous power during sweep)	<b>Output 1 (low SSE)</b>	<b>Output 2 (high power)</b>		
	≥ -4.5 dBm peak (typical)	≥ +5.5 dBm peak (typical)		
	≥ -5 dBm (1430 nm to 1480 nm)	≥ +5 dBm (1430 nm to 1480 nm)		
	≥ -7 dBm (1420 nm to 1480 nm)	≥ +3 dBm (1420 nm to 1480 nm)		
	≥ -13 dBm (1370 nm to 1495 nm)	≥ -3 dBm (1370 nm to 1495 nm)		
Attenuation		Max 60 dB		
Power repeatability (typical)	± 0.003 dB			
Power stability <sup>4</sup>	± 0.01 dB, 1 hour (1420 nm to 1495 nm)			
	Typical ± 0.01 dB, 1 hour (1370 nm to 1420 nm)			
	Typical ± 0.03 dB, 24 hours			
Power linearity	± 0.1 dB (1420 nm to 1495 nm)	± 0.3 dB (1420 nm to 1495 nm)		
	Typical ± 0.1 dB (1370 nm to 1420 nm)	Typical ± 0.3 dB (1370 nm to 1420 nm)		
Power flatness versus wavelength	± 0.2 dB	± 0.3 dB		
	Typical ± 0.1 dB (1420 nm to 1495 nm)	Typical ± 0.2 dB (1420 nm to 1495 nm)		
	Typical ± 0.2 dB (1370 nm to 1420 nm)	Typical ± 0.3 dB (1370 nm to 1420 nm)		
	<b>Continuous sweep mode <sup>3</sup></b>			
	At 5 nm/s	At 40 nm/s	At 80 nm/s	
Dynamic power reproducibility (typical)	± 0.005 dB	± 0.01 dB	± 0.015 dB	
Dynamic relative power flatness (typical)	± 0.01 dB	± 0.015 dB	± 0.03 dB	
Side-mode suppression ratio (typical) <sup>2</sup>	≥ 40 dB (1430 nm to 1480 nm)			
Signal to source spontaneous emission ratio <sup>2</sup>	<b>Output 1 (low SSE)</b>	<b>Output 2 (high power)</b>		
	≥ 63 dB/nm (1430 nm to 1480 nm)	≥ 42 dB/nm (1430 nm to 1480 nm)		
	≥ 73 dB/0.1 nm (typical, 1430 nm to 1480 nm)	≥ 52 dB/0.1 nm (typical, 1430 nm to 1480 nm)		
	≥ 61 dB/nm (1420 nm to 1480 nm)	≥ 40 dB/nm (1420 nm to 1480 nm)		
	≥ 55 dB/nm (typical, 1370 nm to 1495 nm)	≥ 35 dB/nm (typical, 1370 nm to 1495 nm)		
Signal to total source spontaneous emission ratio <sup>2</sup>	≥ 60 dB (1430 nm to 1480 nm)	≥ 28 dB (typical, 1430 nm to 1480 nm)		
	≥ 58 dB (1420 nm to 1480 nm)			
	≥ 53 dB (typical, 1370 nm to 1495 nm)			
Relative intensity noise (RIN) (0.1 to 6 GHz) (typical) <sup>2</sup>	-145 dB/Hz (1430 nm to 1480 nm)			

1. Valid for one month and within a ± 4.4 K temperature range after automatic wavelength zeroing.

2. At maximum output power as specified per wavelength range.

3. Valid for absolute humidity of 11.5 g/m<sup>3</sup> (For example, equivalent to 50% relative humidity at 25 °C).

4. At constant temperature ± 1 K.

## 81600B Option 130 Tunable Laser Source, 1260 nm to 1375 nm, Low SSE

<b>Keysight 81600B Option 130</b>				
Wavelength range	1260 nm to 1375 nm			
Wavelength resolution	0.1 pm, 17.7 MHz at 1300 nm			
Mode-hop free tunability	Full wavelength range; see page 17 for conditions to assure mode-hop free continuous sweeps			
Maximum sweep speed	80 nm/s			
	<b>Stepped mode</b>	<b>Continuous sweep mode (typical)</b>		
		At 5 nm/s	At 40 nm/s	At 80 nm/s
Absolute wavelength accuracy <sup>1</sup>	± 10 pm, typical ± 3.6 pm	± 4.0 pm	± 4.6 pm	± 6.1 pm
Relative wavelength accuracy <sup>1</sup>	± 5 pm, typical ± 2 pm	± 2.4 pm	± 2.8 pm	± 4.0 pm
Wavelength repeatability	± 0.8 pm, typical ± 0.5 pm	± 0.3 pm	± 0.4 pm	± 0.7 pm
Wavelength stability <sup>4</sup> (typical)	≤ ±1 pm, 24 hours			
Linewidth (typical), coherence control off	100 kHz			
Effective linewidth (typical), coherence control on	> 50 MHz (1270 nm to 1350 nm, at max. constant output power)			
Maximum output power (continuous power during sweep)	<b>Output 1 (low SSE)</b>	<b>Output 2 (high power)</b>		
	≥ -4 dBm peak (typical)	≥ +5 dBm peak (typical)		
	≥ -6 dBm (1290 nm to 1370 nm)	≥ +4 dBm (1290 nm to 1370 nm)		
	≥ -9 dBm (1270 nm to 1375 nm)	≥ +1 dBm (1270 nm to 1375 nm)		
	≥ -13 dBm (1260 nm to 1375 nm)	≥ -3 dBm (1260 nm to 1375 nm)		
Attenuation	Max 60 dB			
Power repeatability (typical)	± 0.003 dB			
Power stability <sup>4</sup>	± 0.01 dB, 1 hour (1260 nm to 1350 nm)			
	Typical ± 0.01 dB, 1 hour (1350 nm to 1375 nm)			
	Typical ± 0.03 dB, 24 hours			
Power linearity	± 0.1 dB (1260 nm to 1350 nm)	± 0.3 dB (1260 nm to 1350 nm)		
	Typical ± 0.1 dB (1350 nm to 1375 nm)	Typical ± 0.3 dB (1350 nm to 1375 nm)		
Power flatness versus wavelength	± 0.2 dB	± 0.3 dB		
	Typical ± 0.1 dB (1260 nm to 1350 nm)	Typical ± 0.15 dB (1260 nm to 1350 nm)		
	Typical ± 0.2 dB (1350 nm to 1375 nm)	Typical ± 0.3 dB (1350 nm to 1375 nm)		
	<b>Continuous sweep mode<sup>3</sup></b>			
	At 5 nm/s	At 40 nm/s	At 80 nm/s	
Dynamic power reproducibility (typical)	± 0.005 dB	± 0.01 dB	± 0.015 dB	
Dynamic relative power flatness (typical)	± 0.01 dB	± 0.02 dB	± 0.04 dB	
Side-mode suppression ratio (typical) <sup>2</sup>	≥ 40 dB (1290 nm to 1370 nm)			
Signal to source spontaneous emission ratio (typical) <sup>2</sup>	<b>Output 1 (low SSE)</b>	<b>Output 2 (high power)</b>		
	≥ 63 dB/nm (1290 nm to 1370 nm)	≥ 42 dB/nm (1290 nm to 1370 nm)		
	≥ 61 dB/nm (1270 nm to 1375 nm)	≥ 40 dB/nm (1270 nm to 1375 nm)		
	≥ 55 dB/nm (1260 nm to 1375 nm)	≥ 35 dB/nm (1260 nm to 1375 nm)		
Signal to total source spontaneous emission ratio (typical) <sup>2</sup>	≥ 58 dB (1290 nm to 1370 nm)	≥ 26 dB (1290 nm to 1370 nm)		
	≥ 56 dB (1270 nm to 1375 nm)			
	≥ 51 dB (1260 nm to 1375 nm)			
Relative intensity noise (RIN) (0.1 to 6 GHz) (typical) <sup>2</sup>	-140 dB/Hz (1270 nm to 1375 nm)			

1. Valid for one month and within a ± 4.4 K temperature range after automatic wavelength zeroing.

2. At maximum output power as specified per wavelength range.

3. Valid for absolute humidity of 11.5 g/m<sup>3</sup> (For example, equivalent to 50% relative humidity at 25 °C).

4. At constant temperature ± 1 K.

## 81600B Option 142 Tunable Laser Source, 1370 nm to 1495 nm, High Power

<b>Keysight 81600B Option 142</b>				
Wavelength range	1370 nm to 1495 nm			
Wavelength resolution	0.1 pm, 15 MHz at 1450 nm			
Mode-hop free tunability	Full wavelength range; see page 17 for conditions to assure mode-hop free continuous sweeps			
Maximum sweep speed	80 nm/s (1372 nm to 1495 nm)			
	<b>Stepped mode</b>	<b>Continuous sweep mode (typical)</b>		
		At 5 nm/s	At 40 nm/s	At 80 nm/s
Absolute wavelength accuracy <sup>1</sup>	± 10 pm, typical ± 3.6 pm	± 4.0 pm	± 4.6 pm	± 6.1 pm
Relative wavelength accuracy <sup>1</sup>	± 5 pm, typical ± 2 pm	± 2.4 pm	± 2.8 pm	± 4.0 pm
Wavelength repeatability	± 0.8 pm, typical ± 0.5 pm	± 0.3 pm	± 0.4 pm	± 0.7 pm
Wavelength stability <sup>4</sup> (typical)	≤ ± 1 pm, 24 hours			
Linewidth (typical), coherence control off	100 kHz			
Effective linewidth (typical), coherence control on	> 50 MHz (1430 nm to 1480 nm, at max. constant output power)			
Maximum output power (continuous power during sweep)	≥ +8.5 dBm peak (typical) ≥ +7.5 dBm (1430 nm to 1480 nm) ≥ +5 dBm (1420 nm to 1480 nm) ≥ 0 dBm (1370 nm to 1495 nm)			
With option 003	Reduced by 1.5 dB			
Power repeatability (typical)	± 0.003 dB			
Power stability <sup>4</sup>	± 0.01 dB, 1 hour (1420 nm to 1495 nm) Typical ± 0.01 dB, 1 hour (1370 nm to 1420 nm) Typical ± 0.03 dB, 24 hours			
Power linearity	± 0.1 dB (1420 nm to 1495 nm) Typical ± 0.1 dB (1370 nm to 1420 nm)			
With option 003	Add ± 0.2 dB			
Power flatness versus wavelength	± 0.2 dB Typical ± 0.1 dB (1420 nm to 1495 nm) Typical ± 0.2 dB (1370 nm to 1420 nm)			
With option 003	Add ± 0.1 dB			
	<b>Continuous sweep mode <sup>3</sup></b>			
	At 5 nm/s	At 40 nm/s	At 80 nm/s	
Dynamic power reproducibility (typical)	± 0.005 dB	± 0.01 dB	± 0.015 dB	
Dynamic relative power flatness (typical)	± 0.01 dB	± 0.015 dB	± 0.03 dB	
Side-mode suppression ratio (typical) <sup>2</sup>	≥ 40 dB (1430 nm to 1480 nm)			
Signal to source spontaneous emission ratio <sup>2</sup>	≥ 42 dB/nm (1430 nm to 1480 nm) ≥ 52 dB/0.1 nm (typical, 1430 nm to 1480 nm) ≥ 40 dB/nm (1420 nm to 1480 nm) ≥ 35 dB/nm (typical, 1370 nm to 1495 nm)			
Signal to total source spontaneous emission ratio (typical) <sup>2</sup>	≥ 28 dB (1430 nm to 1480 nm)			
Relative intensity noise (RIN) (0.1 to 6 GHz) (typical) <sup>2</sup>	-145 dB/Hz (1430 nm to 1480 nm)			

1. Valid for one month and within a ± 4.4 K temperature range after automatic wavelength zeroing.

2. At maximum output power as specified per wavelength range.

3. Valid for absolute humidity of 11.5 g/m<sup>3</sup> (For example, equivalent to 50% relative humidity at 25 °C).

4. At constant temperature ± 1 K.

## 81600B Option 132 Tunable Laser Source, 1260 nm to 1375 nm, High Power

<b>Keysight 81600B Option 132</b>				
Wavelength range	1260 nm to 1375 nm			
Wavelength resolution	0.1 pm, 17.7 MHz at 1300 nm			
Mode-hop free tunability	Full wavelength range; see page 17 for conditions to assure mode-hop free continuous sweeps			
Maximum sweep speed	80 nm/s			
	<b>Stepped mode</b>	<b>Continuous sweep mode (typical)</b>		
		At 5 nm/s	At 40 nm/s	At 80 nm/s
Absolute wavelength accuracy <sup>1</sup>	± 10 pm, typical ± 3.6 pm	± 4.0 pm	± 4.6 pm	± 6.1 pm
Relative wavelength accuracy <sup>1</sup>	± 5 pm, typical ± 2 pm	± 2.4 pm	± 2.8 pm	± 4.0 pm
Wavelength repeatability	± 0.8 pm, typical ± 0.5 pm	± 0.3 pm	± 0.4 pm	± 0.7 pm
Wavelength stability <sup>2</sup> (typical)	≤ ± 1 pm, 24 hours			
Linewidth (typical), coherence control off	100 kHz			
Effective linewidth (typical), coherence control on	> 50 MHz (1270 nm to 1350 nm, at max. constant output power)			
Maximum output power (continuous power during sweep)	≥ +9 dBm peak (typical)			
	≥ +7 dBm (1290 nm to 1370 nm)			
	≥ +3 dBm (1270 nm to 1375 nm)			
	≥ 0 dBm (1260 nm to 1375 nm)			
Power repeatability (typical)	± 0.003 dB			
Power stability <sup>4</sup>	± 0.01 dB, 1 hour (1260 nm to 1350 nm)			
	Typical ± 0.01 dB, 1 hour (1350 nm to 1375 nm)			
	Typical ± 0.03 dB, 24 hours			
Power linearity	± 0.1 dB (1260 nm to 1350 nm)			
	Typical ± 0.1 dB (1350 nm to 1375 nm)			
Power flatness versus wavelength	± 0.2 dB			
	Typical ± 0.1 dB (1260 nm to 1350 nm)			
	Typical ± 0.2 dB (1350 nm to 1375 nm)			
	<b>Continuous sweep mode <sup>3</sup></b>			
	At 5 nm/s	At 40 nm/s	At 80 nm/s	
Dynamic power reproducibility (typical)	± 0.005 dB	± 0.01 dB	± 0.015 dB	
Dynamic relative power flatness (typical)	± 0.01 dB	± 0.015 dB	± 0.03 dB	
Side-mode suppression ratio (typical) <sup>2</sup>	≥ 40 dB (1270 nm to 1375 nm)			
Signal to source spontaneous emission ratio <sup>2</sup>	≥ 45 dB/nm (1290 nm to 1370 nm)			
	≥ 55 dB/0.1 nm (typical, 1290 nm to 1370 nm)			
	≥ 40 dB/nm (1270 nm to 1375 nm)			
	≥ 35 dB/nm (typical, 1260 nm to 1375 nm)			
Signal to total source spontaneous emission ratio (typical) <sup>2</sup>	≥ 28 dB (1290 nm to 1370 nm)			
Relative intensity noise (RIN) (0.1 to 6 GHz) (typical) <sup>2</sup>	-145 dB/Hz (1270 nm to 1375 nm)			

1. Valid for one month and within a ± 4.4 K temperature range after automatic wavelength zeroing.

2. At maximum output power as specified per wavelength range.

3. Valid for absolute humidity of 11.5 g/m<sup>3</sup> (For example, equivalent to 50% relative humidity at 25 °C).

4. At constant temperature ± 1 K.

## Conditions (all modules)

Storage temperature	-40 °C to +70 °C
Operating temperature	+10 °C to +35 °C
Humidity	< 80% R.H. at +10 °C to +35 °C, non-condensing
Specifications apply for wavelengths not equal to any water absorption line. All specifications are typical at wavelengths < 1250 nm.	
Warm-up time	60 minutes; immediate operation after boot up 81606A, 81607A, 81608A, 81609A: 30 minutes if previously stored at the same temperature
<b>Output power</b>	
Specifications are valid at the following output power levels:	
81606A, 81607A, 81608A, 81609A	> 0 dBm
81600B Options 201, 200, 160 and 150	≥ -7 dBm (for Output 1); ≥ -1 dBm (for Output 2, -60 dB in attenuation mode)
81600B Option 140 and 130	≥ -13 dBm (for Output 1); ≥ -3 dBm (for Output 2, -60 dB in attenuation mode)
81600B Option 142	≥ -3 dBm; ≥ -4.5 dBm (with Option 003: -60 dB in attenuation mode)
81600B Option 132	≥ 0 dBm
<b>Continuous sweep mode</b>	
81606A, 81607A, 81608A	Full wavelength range for sweep speeds ≤ 50 nm/s. Full wavelength range reduced by 0.5 nm on both ends for 80 nm/s sweep speed. Full wavelength range reduced by 3 nm on both ends for sweep speeds ≥ 100 nm/s and ≤ 150 nm/s. Full wavelength range reduced by 5 nm on both ends for ≥160 nm/s sweep speed. Operating temperature within +10 °C and +35 °C.
81600B	Specifications are valid for mode-hop free sweeping. Maximum 50 nm at constant output power levels as follows:
- 81600B Option 200, 201	1475 nm to 1620 nm; ≥ -2 dBm (for Output 1); ≥ +4 dBm (for Output 2)
- 81600B Option 160	1510 nm to 1620 nm; ≥ -6 dBm (for Output 1); ≥ +3 dBm (for Output 2)
- 81600B Option 150	1520 nm to 1570 nm; ≥ -6 dBm (for Output 1); ≥ +3 dBm (for Output 2)
- 81600B Option 140	1430 nm to 1480 nm; ≥ -9 dBm (for Output 1); ≥ 0 dBm (for Output 2)
- 81600B Option 130	1300 nm to 1350 nm; ≥ -9 dBm (for Output 1); ≥ +1 dBm (for Output 2)
- 81600B Option 142	1430 nm to 1480 nm; ≥ -3 dBm; ≥ +1.5 dBm (with Option 003)
- 81600B Option 132	1300 nm to 1350 nm; ≥ +3 dBm
- Operating temperature within	+20 °C and +35 °C

## General Specifications and Supplementary Characteristics

<b>Supplementary performance characteristics</b>	
<b>Internal digital modulation (81600B only)</b>	
	50% duty cycle; 200 Hz to 300 kHz frequency range Displayed wavelength represents average wavelength.
Modulation output	TTL reference signal
<b>External digital modulation (81600B only)</b>	
Delay time	< 300 ns > 45% duty cycle; 200 Hz to 1 MHz frequency range Displayed wavelength represents average wavelength.
Modulation input	TTL signal
<b>External analog modulation (81600B only)</b>	
	$\geq \pm 15\%$ modulation depth; 5 kHz to 20 MHz frequency range
Modulation input	5 Vp-p
<b>External wavelength locking (81606A, 81600B)</b>	
Modulation depth	> $\pm 70$ pm at 10 Hz > $\pm 7$ pm at 100 Hz
Modulation input	$\pm 5$ V
<b>Coherence control (81608A, 81609A, 81600B)</b>	
For measurements on components with 2 m long patch cords 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 significantly reducing interference effects in the test setup.	
<b>Output isolation</b>	
	Built-in optical isolator
<b>General specifications</b>	
<b>Return loss (typical)</b>	
81606A, 81607A, 81608A, 81609A	60 dB
81600B Option 072	60 dB
81600B Option 071	40 dB
<b>Polarization maintaining fiber</b>	
Fiber type	Panda
Orientation	TE mode in slow axis, in line with the connector key
<b>Polarization extinction ratio</b>	
81606A, 81607A, 81608A, 81609A	16 dB typical
81600B Options 130, 132, 140, 142, 150, 160	16 dB typical
81600B Options 200, 201	14 dB typical
<b>Recommended re-calibration period</b>	
	2 years
<b>Laser safety information</b>	
All laser sources specified by this data sheet are classified as Class 1M according to IEC 60825-1.	
All laser sources comply with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50, dated 2007, June 24.	

**INVISIBLE LASER RADIATION**  
**DO NOT VIEW DIRECTLY WITH**  
**OPTICAL INSTRUMENTS**  
**CLASS 1M LASER PRODUCT**  
**(IEC 60825-1)**

## Ordering Information

### Lightwave measurement system mainframe 8164B



#### Tunable laser module: 81606A top-line, $\pm 1.5$ pm typical wavelength accuracy

One of the following is required:

- 81606A Option 216	Tunable laser source 1450 nm to 1650 nm, top-line, high power with lowest SSE
- 81606A Option 116	Tunable laser source 1490 nm to 1640 nm, top-line, high power with lowest SSE
- 81606A Option 113	Tunable laser source 1240 nm to 1380 nm, top-line, high power with lowest SSE

#### Tunable Laser Module: 81607A value line, $\pm 3$ pm typical wavelength accuracy

- 81607A Option 116	Tunable laser source 1490 nm to 1640 nm, value line, low SSE
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#### Tunable Laser Module: 81608A value line, $\pm 5$ pm typical wavelength accuracy

One of the following is required:

- 81608A Option 216	Tunable laser source 1450 nm to 1650 nm, value line, high power with low SSE
- 81608A Option 116	Tunable laser source 1490 nm to 1640 nm, value line, high power with low SSE
- 81608A Option 113	Tunable laser source 1240 nm to 1380 nm, value line, high power with low SSE

#### Step-Tunable Laser Module: 81609A basic line, $\pm 10$ pm typical wavelength accuracy

One of the following is required:

- 81609A Option 216	Step-tunable laser source 1450 nm to 1650 nm, basic line, high power with low SSE
- 81609A Option 116	Step-tunable laser source 1490 nm to 1640 nm, basic line, high power with low SSE
- 81609A Option 113	Step-tunable laser source 1240 nm to 1380 nm, basic line, high power with low SSE

#### Tunable laser module: 81600B

One of the following is required:

- 81600B Option 200	Tunable laser source 1440 nm to 1640 nm, low SSE
- 81600B Option 201	Tunable laser source 1455 nm to 1640 nm, low SSE
- 81600B Option 160	Tunable laser source 1495 nm to 1640 nm, low SSE
- 81600B Option 150	Tunable laser source 1450 nm to 1590 nm, low SSE
- 81600B Option 140	Tunable laser source 1370 nm to 1495 nm, low SSE
- 81600B Option 130	Tunable laser source 1260 nm to 1375 nm, low SSE
- 81600B Option 142	Tunable laser source 1370 nm to 1495 nm, high power
- 81600B Option 132	Tunable laser source 1260 nm to 1375 nm, high power

#### Mainframe compatibility

81600B (all options)	Lightwave Measurement System mainframes 8164A and 8164B
81606A, 81607A, 81608A, 81609A (all options)	8164B Lightwave Measurement system mainframe

#### Connector option

81606A, 81607A, 81608A, 81609A	All modules come with PMF, angled contact output connector
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One of the following is required for 81600B:

- 81600B Option 071	PMF, straight contact output connector
- 81600B Option 072 (recommended)	PMF, angled contact output connector

#### Other option

81600B Option 003	Built-in optical attenuator, 60 dB attenuation (for Option 142)
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#### Connector interface

One Keysight 81000xl-series connector interface is required for 81606A, 81607A, 81608A, 81609A (all options) and 81600B Options 142 and 132

Two Keysight 81000xl-series connector interfaces are required for 81600B Options 201, 200, 160, 150, 140 and 130

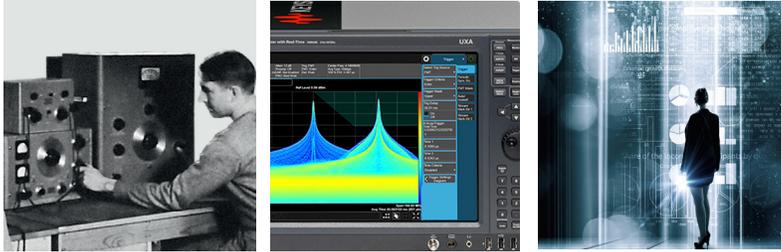
#### Custom-made TLS

Additional wavelength ranges or higher output power are available on request. Please contact your local Keysight Sales Office.

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