DATA SHEET

81602A Extra High Power Tunable Laser



KEYSIGHT TECHNOLOGIES

Introduction

The new Keysight Technologies, Inc. 81602A Tunable Laser Source has been designed to explore new application areas in photonic device testing: it combines output power levels beyond +18 dBm with the excellent power flatness, repeatability and stability, the outstanding wavelength accuracy and the fast repetition rate of the 8160xA Family of Tunable Laser Sources. For maximum flexibility, all 8160xA tunable laser modules fit into the bottom slot of the Keysight 8164B Lightwave Measurement System Mainframe.

O-Band Tunable Laser Source Exceeding 63 mW Output Power

The 81602A Tunable Laser Source reaches an optical power level of over +18 dBm. The high output power helps compensate for the coupling loss of optical surface probes or the insertion loss of external modulators during the verification of integrated photonic designs. This allows testing photonic devices at relevant signal levels and wavelengths. With a tuning range of 1250 nm to 1370 nm, the laser addresses the latest Silicon Photonics research.

The extra high power tunable laser model extends power budget limits in test setups and speeds fiber or probe alignment by getting first light faster: +18 dBm output power help overcome the limitations of probe coupling efficiency, particularly where surface probes need to operate over a broad wavelength range.

Photonic devices can be tested at relevant signal levels, even with probe coupling or external modulation: with +16 dBm output power across the 100GBASE-LR4 wavelength range (1290 nm - 1315 nm), the new laser helps advance Silicon Photonics for the latest data center standards. Even at the more distant CWDM channels used by 100GBASE-CLR4 or CWDM4 (1271/1291/1311/1331 nm), the new laser provides +12 dBm output power. Combined with an external modulator, a waveform generator, and an optical attenuator, it enables the test of receivers for 100G Ethernet or the next generation of PON standards. The laser’s tuning capability allows for corner case testing and ensures it is ready for arbitrary wavelength plans.

For the evaluation of passive components like optical filters or demultiplexers the 81606A tunable laser and its sister models 81607A, 81608A and 81609A provide even lower spontaneous emission levels, better than 80 dB/nm signal-to-SSE ratio. This and a signal power above +12 dBm permit measurements of wavelength isolation to 100 dB, most often limited by power meter sensitivity. Please refer to the 8160xx tunable laser family data sheet for further details (publication no. 5989-7321EN).

Built-in wavelength meter for optimum tuning precision

All Keysight 8160xA Tunable Laser Sources include 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 wavelength reference unit includes a gas cell for long-term stability and absolute referencing. Its fast response and fine wavelength resolution enable the 81602A to sweep with sub-picometer repeatability. Originally introduced with the 81606A top line model, it is the key to the 81602A's superior accuracy and temperature stability, and it enables a greater degree of self-diagnosis than previously possible.

Specified performance in the continuous sweep mode

As manufacturing yield expectations become more and more stringent, it is important that all instruments deliver optimum performance under all measurement conditions. The built-in wavelength reference unit delivers real-time wavelength readings with sub-picometer resolution, and at a very high update rate. As a result, the dynamic specifications for swept operation apply in both directions, at all sweep speeds up to 200 nm/s.

Polarization maintaining fiber for the test of integrated optical devices

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

Certified quality

The 8160xA 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 patch cord 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 81602A Tunable Laser User's Guide (publication number 81602-90B01).

Laser safety information

Option 013 tunable laser sources specified by this data sheet are classified as Class 3B 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. Operating the 81602A Option 013 O-band Extra High-Power Tunable Laser Source requires implementing and registering a Laser Class 3B compliant workspace. If you are uncertain about applicable laser safety regulations, consult a certified Laser Safety Officer or contact your local environmental health and safety department. The Keysight 81602A Tunable Laser Source is equipped with a separate, bright red warning LED that indicates when the laser unit is active. The 8164B Lightwave Measurement System mainframe offers a remote interlock connector to ease the implementation of automatic safety measures. A passkey is required to boot the laser module.



Warning

Invisible Laser Radiation avoid exposure to Beam Class 3B Laser Product (IEC 60825-1)

81602A Extra High-Power Tunable Laser Source

Keysight 81602A	Option 013	
Wavelength range	1250 nm to 1370 nm	
Wavelength resolution	0.1 pm, 17.5 MHz at 1310 nm	
Continuous sweep range	Full wavelength range [4]	
Maximum sweep speed	200 nm/s, bidirectional	
Wavelength stability [3] (typ.)	≤ ±0.5 pm, 24 hours	
Linewidth (typ.)	< 10 kHz	
Maximum output power (continuous power during sweep)	> +18 dBm peak > +16 dBm (1290 nm - 1340 nm) > +12 dBm (1260 nm – 1360 nm) > +10 dBm (1250 nm - 1370 nm)	
Side-mode suppression ratio (typ.) [6]	≥ 70 dB (1290 nm - 1340 nm) ≥ 60 dB (full wavelength range)	
Relative intensity noise (RIN) (0.1 – 6 GHz) [6]	< -150 dB/Hz (typical, 1290 nm - 1340 nm)	
Signal to source spontaneous emission ratio [2]	≥ 50 dB/nm ≥ 60 dB/0.1 nm	
Signal to total source spontaneous emission ratio (typ.) [2]	≥ 40 dB	
	Stepped mode	**Continuous sweep mode, both directions (typ.) [4]**
Absolute wavelength accuracy [1]	±2 pm; typ. ±1.5 pm	±1.5 pm
Relative wavelength accuracy [1]	±1.5 pm; typ. ±1 pm	±1 pm
Wavelength repeatability	±0.5 pm; typ. ±0.2 pm	typ. ±0.4 pm
Power repeatability (typ.)	±0.002 dB	Not applicable
Power stability [3]	±0.01 dB, 1 hour typ. ±0.025 dB, 24 hours	Not applicable
Power linearity	±0.05 dB	Not applicable
Power flatness versus wavelength	±0.25 dB; typ. ±0.15 dB	Not applicable
Dynamic power reproducibility	Not applicable	±0.01 dB
Dynamic relative power flatness	Not applicable	±0.02 dB [5]

1. Valid for 24 hours after lambda zeroing, within a ±5 K temperature range.
2. At maximum output power, between 1320 nm and 1350 nm.
3. At constant temperature ±1 K.
4. 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.
5. Add ±0.01 dB for sweep speeds > 80 nm/s.
6. At maximum output power.

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, non-condensing
Specifications apply for wavelengths not equal to any water absorption line.	
Warm-up time	30 minutes if previously stored at the same temperature.
Output power	
Specifications are valid at output power levels greater than +10 dBm	
Continuous sweep mode	
	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.

General Specifications and Supplementary Characteristics

Supplementary performance characteristics

External wavelength locking	
Modulation depth	> ± 70 pm at 10 Hz
	> ± 7 pm at 100 Hz
Modulation input	± 5 V
Coherence control	
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 < ± 0.025 dB over 1 minute by significantly reducing interference effects in the test setup.	
Output isolation	
Built-in optical isolator	

General specifications

Return loss (typical)	
60 dB	
Polarization maintaining fiber	
Fiber type	Panda
Orientation	TE mode in slow axis, in line with the connector key
Polarization extinction ratio	
16 dB typical	
Recommended re-calibration period	
2 years	
Laser safety information	
All laser sources specified by this data sheet are classified according to IEC 60825-1:2014 as Laser Class 3B. **Warning** Invisible Laser Radiation avoid exposure to Beam Class 3B Laser Product (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.	

Ordering Information

Lightwave Measurement System mainframe 8164B		
		
Tunable Laser Module: 81602A top line, ±1.5 pm typical wavelength accuracy		
81602A Option 013	Extra high-power tunable laser source 1250 nm to 1370 nm, top line	
Mainframe compatibility		
8164B Lightwave Measurement System mainframe.		
Connection option		
The module comes with PMF, angled contact output connector.		
Connector interface		
One 81000xI-series connector interface is required for 81602A.		

Learn more at: www.keysight.com

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