Ultra-High Power Tunable Laser

Increased Optical Power Budget to Compensate for Probing Loss or to Drive Complex Optical Paths

Overview

The Keysight N7774C Ultra-High Power Tunable Laser provides the highest output power in the N777-C Family of Tunable Laser Sources. It is particularly suitable for use with test configurations that require splitting a signal power between optical paths that lead to multiple devices under test (DUT), or with complex test setups that need to deal with a large loss budget.

Two wavelength options cover the optical O-band (Option A13), typically used by transceivers for the datacenter infrastructure, and the CL-band (Option A16), typically used for long-distance links. Option A13 offers a tuning range from 1260 nm to 1350 nm with an output power of min. +22 dBm, peaking at +24 dBm. The output power is adjustable over a wide range, down to under 0 dBm.

Option A16, which will become available at the beginning of 2027, features a tuning range from 1520 nm to 1620 nm with min. +17 dBm output power, peak power of +20 dBm.

Equipped with PMF output fiber, the N7774C is a perfect match for testing and developing components with Silicon Photonics/ integrated photonics technology.

The remote user interface on the instrument is accessible with just a web browser, either via LAN or via USB connection. An optional touch-screen display provides local operator access and displays current operating parameters.

KEYSIGHT

Introduction

All N777-C models are based on a common cavity and laser module design and share a narrow linewidth, excellent long-term stability and low spontaneous emission level. N7774C extends this cavity design by an amplified output path. Compared to cavities where the back facet of the gain chip is used to provide high power, this design ensures the output power stays high across the full tuning range. The N7774C belongs to the Top Line models of the tunable laser family and shares the leading-edge tuning and wavelength accuracy with the N7776C.

The N7774C can perform two-way sweeps with up to 200 nm/s to accelerate wavelength-dependent alignment processes and the automated calibration of wavelength-selective devices. Shorter time to testing and faster swept-wavelength tests help reduce test cost per device, improve test margins and lower the cost of ownership. The dynamic specifications for swept operation apply in both directions, independent from the sweep speed.

The new enhanced fine-tuning provides wavelength adjustment without overshooting. No separate fine-tuning control is needed for smooth tuning with 0.1 pm resolution, due to automatic coordination of the motor and piezoelectric actuator. This simplifies wavelength-optimization procedures.

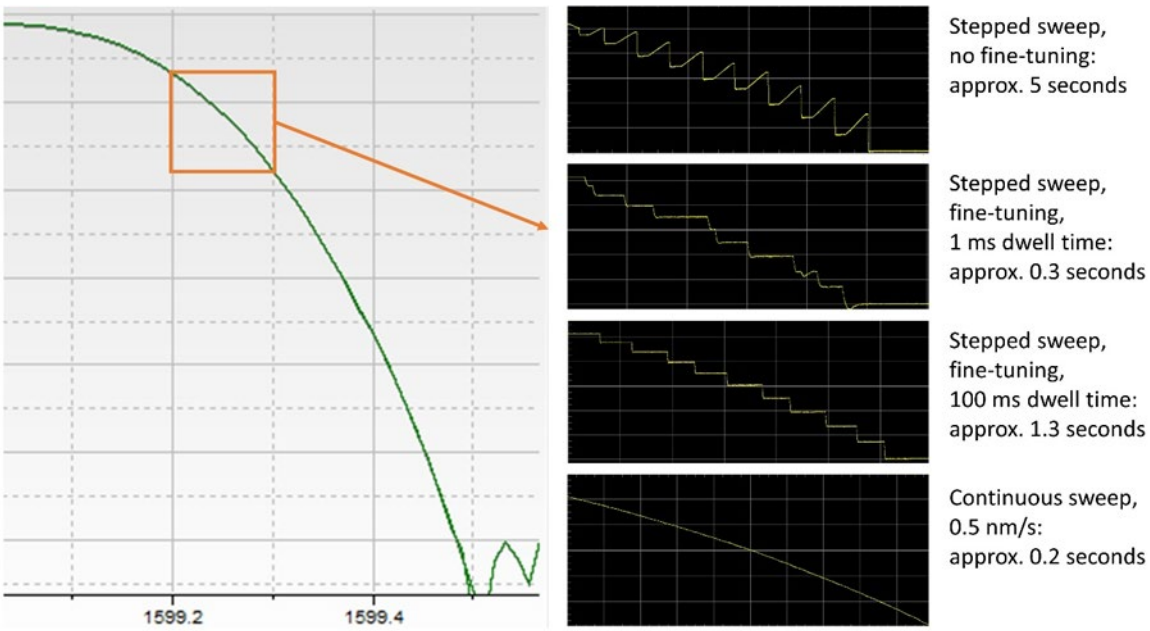


Figure 1. Impact of fine-tuning on stepped wavelength scans (10 steps of 10 pm width); included for reference: continuous sweep

Integrated Solutions for Swept-Wavelength Spectral Measurements

The N777-C family is supported with the photonic application software suite for spectral measurements of insertion loss, polarization dependent loss and polarization mode dispersion in combination with Keysight power meters and polarization instruments. These provide optimal measurement performance and quick time-to-measurement by simplifying system integration.

Find out more at: www.keysight.com/find/n7700

Built-In Wavelength Meter for Optimum Tuning Precision

The Keysight N777-C 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. An integrated gas cell ensures long-term stability and provides an absolute reference. The wavelength reference unit's fast response and fine wavelength resolution enable the N7774C to sweep with sub-picometer repeatability. It is the key to the N777-C family's superior accuracy and temperature stability, and it enables self-diagnosis and automated lambda-zeroing.

Certified Quality

The N777-C TLS 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. Every instrument is delivered with a commercial certificate of calibration and a detailed test report.

Definitions

Generally, all specifications are valid at the stated operating and measurement conditions and settings, with uninterrupted line voltage.

Specifications (Guaranteed)

Describes warranted product performance that is valid under the specified conditions. Specifications include guard bands to account for the expected statistical performance distribution, measurement uncertainties changes in performance due to environmental changes and aging of components.

Typical Values (Characteristics)

Characteristics describe the product performance that is usually met but not guaranteed. Typical values are based on data from a representative set of instruments.

General Characteristics

Give additional information for using the instrument. These are general descriptive terms that do not imply a level of performance.

Preliminary Technical Specifications

Description	N7774C-A13	N7774C-A16
Tuning range	1260 nm to 1350 nm	1520 nm to 1620 nm
Maximum output power	> +24.0 dBm peak > +22.0 dBm (1260 nm – 1350 nm)	> +20.0 dBm peak > +17.0 dBm (1520 nm – 1620 nm)
Output power setting range	< 0 dBm to +24 dBm	< 0 dBm to +20 dBm
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 [6, 7], mode-hop free	
Max. sweep speed	200 nm/s, bidirectional	
Tuning time (characteristic) [1]	300 ms (1 nm step, max. output power) 1.5 s (100 nm step, max. output power)	
Side-mode suppression ratio (SMSR), typical [2, 8]	≥ 70 dB [3] ≥ 60 dB [4]	
Relative intensity noise (RIN), typical, 0.1 to 6 GHz [2, 3]	< –155 dB/Hz (typ.)	< –155 dB/Hz (typ.)
Signal to source spontaneous emission ratio [2, 5]	≥ 50 dB/nm (typ.)	≥ 50 dB/nm (typ.)
Signal to total source spontaneous emission ratio [2, 5]	≥ 40 dB (typ.)	≥ 40 dB (typ.)
Linewidth (intrinsic [9], typical), coherence control off	< 10 kHz	< 10 kHz
Effective linewidth (typical), coherence control on [2, 3]	> 150 MHz	> 50 MHz

1. Including power stabilization. When "step finished" trigger is received.
2. At maximum output power
3. 1290 nm – 1340 nm (Option A13), 1525 nm – 1620 nm (Option A16).
4. 1260 nm – 1350 nm (Option A13), full wavelength range (Option A16)
5. 1320 nm – 1350 nm (Option A13), 1520 nm – 1580 nm (Option A16).
6. 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.
7. Mode-hop free tunable across the full wavelength range, except: Stop wavelength below 1345 nm (Option A13).
8. Measures the impact of side-modes on RIN. Contributions from upper and lower side-modes cancel partially.
9. Based on white-noise contribution to phase noise. Note that the wavelength also oscillates over a typical range of up to 0.4 pm during a 1 ms timespan.

Wavelength Accuracy and Optical Power Stability	Stepped Mode	Continuous Sweep Mode, Both Directions (Typical) [3, 4]
Absolute wavelength accuracy [1]	±2 pm Typical ±1.5 pm	±1.5 pm
Relative wavelength accuracy [1]	±1.5 pm Typical ±1 pm	±1 pm
Wavelength repeatability	±0.4 pm Typical ±0.2 pm	±0.4 pm
Wavelength stability [2]	Typical ≤ ±0.5 pm, 24 hours	Not applicable
Power repeatability (typical)	±0.005 dB	Not applicable
Power stability [2]	Typical ±0.05 dB, 24 hours	Not applicable
Power linearity	±0.05 dB typ.	Not applicable
Power flatness versus wavelength	Typical ±0.25 dB	Not applicable
Dynamic power reproducibility	Not applicable	±0.04 dB
Dynamic relative power flatness	Not applicable	±0.05 dB [5]

1. Valid for 24 hours and within ±5 K temperature range after wavelength zeroing.
2. At constant temperature ±1 K.
3. 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.
4. Mode-hop free tunable across the full wavelength range, except: Stop wavelength below 1345 nm (Option A13).
5. Add ±0.01 dB for sweep speeds > 80 nm/s.

General Specifications

Description	N7774C
Return loss	Typical 60 dB
Output isolation	Built-in optical isolator
Output connector	Angled contact (requires 81000xI connector interface)
Fiber type and orientation	Panda, electrical field is oriented in slow axis, in line with the connector key
Polarization extinction ratio	Typical 18 dB
Recommended recalibration period	2 years
Line power	AC 100 V to 240 V ± 10%, 50/60 Hz, 200 VA max.
Operating temperature	+15 °C to +35 °C
Operating humidity	≤ 80%, non-condensing
Storage temperature	–40 °C to +70 °C (Option D00, standard front panel) –30 °C to +70 °C (Option D01, touchscreen display)
Max. operating altitude	2000 m (6000 ft)
Warm-up time	60 minutes, immediate operation after boot-up 30 minutes if previously stored at the same room temperature
Recommended recalibration period	2 years
	All specifications are typical at wavelengths < 1250 nm. Specifications apply for wavelengths not equal to any water absorption line. Note: if the laser is operated in a dry box filled with dry air or nitrogen, specifications also apply at water absorption lines. Alternatively, use the optional adapter N7799C-DRY to purge the laser with a flux of 50 l/min. The adapter N7799C-DRY attaches to the rear side of the instrument and provides a standard inlet for compressed, dry air or nitrogen according to Euro standard 7.6 (7.4).
Laser Safety Information	All laser sources specified by this data sheet are classified as Class 3B according to IEC 60825-1:2014 and EN 60825-1:2014/A11:2021. All laser sources comply with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 56, dated 2019, May 24. 
Dimensions (H x W x L)	88 mm × 426 mm × 545 mm (excluding connectors)
Weight	8.5 kg net (17 lbs) shipping 13 kg (26 lbs)

External Wavelength Locking	N7774C
Modulation depth	> ±70 pm at 10 Hz > ±7 pm at 100 Hz
Modulation input	±5 V (BNC input, front panel)

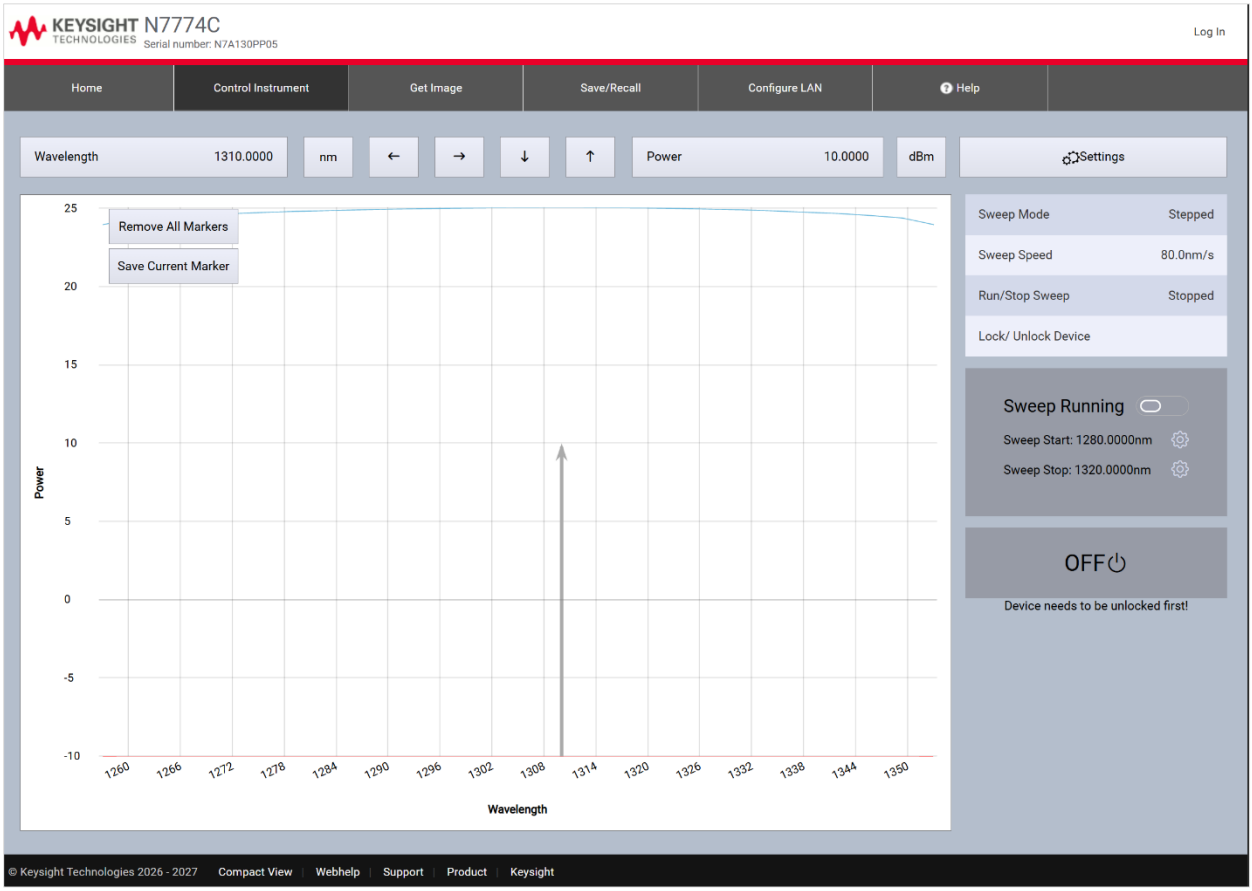
Coherence control	N7774C
For measurements on components with 2 m long patch cords and connectors with 14 dB return loss, the effective linewidth results in a typical power stability of < ±0.025 dB over 1 minute by significantly reducing interference effects in the test setup.	
Available at max. output power, for wavelength range 1260 nm – 1350 nm (Option A13), 1520 nm – 1620 nm (Option A16).	

User Interface	N7774C
Optical power	Linear (Watt) and logarithmic (dBm)
Wavelength	m, µm, nm
Frequency	Hz, THz
Sampling resolution	0.01 pm; 0.01 dB; 0.1 mW
Connectivity	**N7774C**
LAN Access (1 Gbit/s): HTTP VXI-11 SCPI-telnet SCPI-raw HISLIP	IPv4 and IPv6 Socket connection: http://<ip_address> or http://<host_name> port 111 (IPv4 only) port 5024 port 5025 port 4880
USB Access (USB 2.0)	Remote NDIS (virtual Ethernet link over USB); USB Mass Storage functions (read-only); USBTMC
Trigger	BNC input (rear panel), BNC output (rear panel)
Remote Interlock	BNC input (front panel)

Ordering Information

Product/Option	Description
N7774C	Ultra-High Power Tunable Laser
Option	**Wavelength Selection (Must choose one)**
N7774C-A13	Wavelength range 1260 nm to 1350 nm
N7774C-A16	Wavelength range 1520 nm to 1620 nm
Option	**Front Panel Selection (Must choose one)**
N7774C-D00	Standard front panel
N7774C-D01	Touchscreen display, 5 inches
Product	**Required Accessories**
81000xl	One (1) 81000xl connector interface is required
Product/Option	**Recommended Accessories**
N7799C-2CM	Rack Mount Kit for full-width instrument, 2 Rack Height Units. Includes low profile rails, fitted to Keysight System II racks with 24-inch-spaced mounts.
N7799C-DOC	Documentation of N77-C Platform, Physical Medium
N7799C-DRY	Dry air adapter for N777-C tunable lasers
	Included Accessories
	Test report Keysight safety leaflet, China RoHS Addendum USB-A to USB-B cable, 2 m/ 7 ft Ethernet LAN cable. CAT-6, RJ45 plugs, 2 m/ 7 ft Country-specific power cord

User Interface Screen Captures



The N7774C Ultra-High Power Tunable Laser's graphical user interface offers detailed information about the instrument's current wavelength and power setting. Separate tabs allow controlling additional operating parameters, such as Coherence Control, or changing LAN address settings and opening the context-sensitive help system. Responsive design ensures that the display adjusts to the browser window and the chosen zoom factor, allowing you to comfortably arrange multiple instrument views on one screen.

Web User Interface but No LAN?

Connect instrument and PC via USB. The instrument shows up as a new drive: double-click the shortcut on that drive. This lets any modern browser open a connection to the instrument: the graphical user interface appears. It's as simple as that!

For More Information

To find more optical test instruments, check the following links:

Optical test instruments: www.keysight.com/find/oct

Tunable laser sources: www.keysight.com/find/tls

Coherent transmission test instruments: www.keysight.com/find/n4391c

Lightwave component analyzers: www.keysight.com/find/lca