

Apex Tunable Laser Sources

Modular, mode-hop free solutions using external cavity Littman configurations

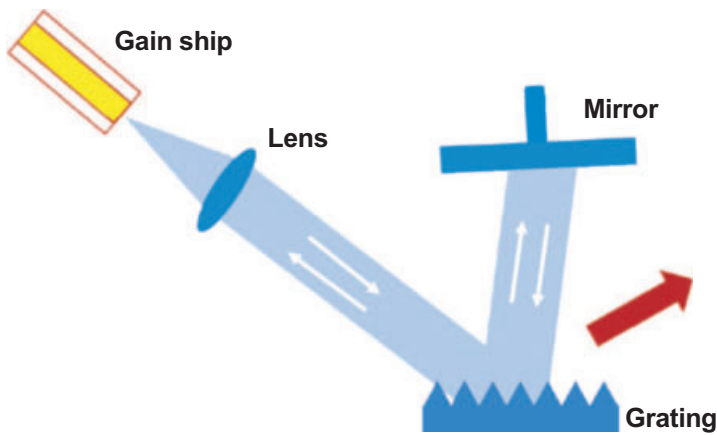


Apex Technologies external cavity Littman tunable laser sources offer high performance across a wide tuning range, with high output power and high signal-to-noise ratio. Each laser chassis is designed to incorporate between 1 and 4 separate tunable laser options from the T-band to the extended C+L band. With each laser module covering a 110nm mode-hop-free tuning span and narrow linewidth of 280kHz for 1s integration, Apex Technologies tunable lasers are ideal solutions for component validation and research into fibre networks in various bands.

Apex Technologies offer both benchtop as well as OEM versions. Alongside using these instruments as standalone tunable lasers, they can also be integrated into Apex Technologies OSA and OFDR solutions without the need to buy a separate laser to operate these instruments. Customised wavelength ranges between 730-2000nm can be provided under request.

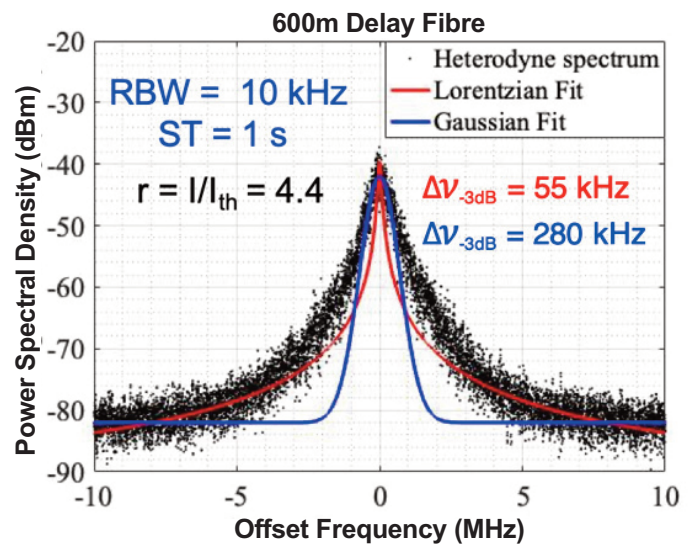
Design Principle

The external cavity design consists of a gain chip, a grating used as dispersion element and a piezoelectric mirror used for mode selection. The external cavity mode and the grating selected mode are synchronized by controlling the rotation of the pivot point that changes the length of the cavity and the incidence angle on the grating that changes the wavelength selectivity of the grating. This technique provides a wide tuning range mode-hop-free sweeping with a narrow linewidth and high output power.



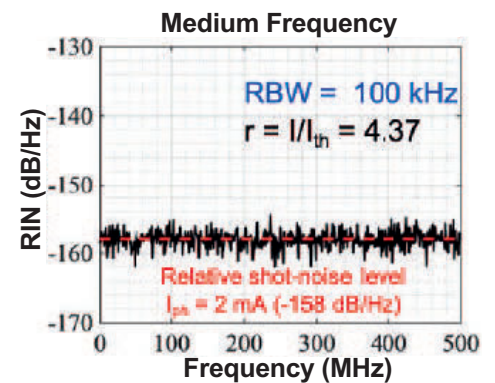
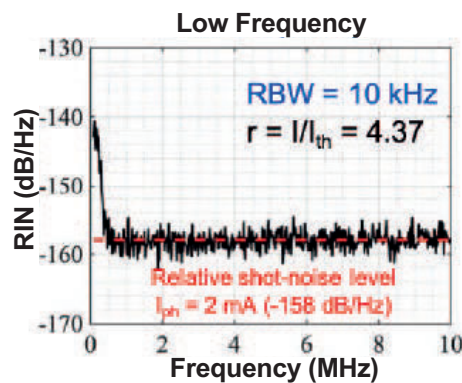
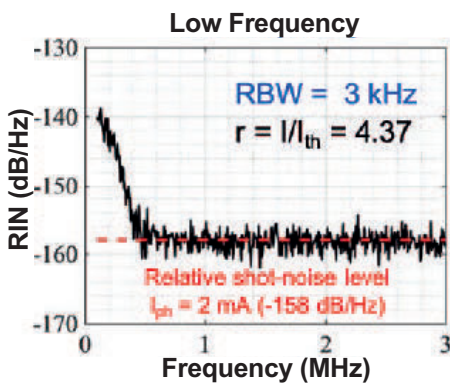
Wavelength Characteristics

Each TLS model reaches an excellent wavelength accuracy by using two internal wavelength calibrators. One part of the output power is connected to a wavelength etalon in which an interferometer system allows a high relative frequency calibration. Absolute wavelength accuracy of ± 3 pm are achieved by using the absorption spectrum of a gas cell. Apex Technologies TLS series provide a narrow linewidth < 280 kHz as we can see in the measurement below.



Low Noise Operation: RIN < -140 dB/Hz

These TLSs provide an excellent power level stability. A Relative Intensity Noise better than -140 dB/Hz at low frequencies (< 500 kHz) was measured. At higher frequencies (up to 500 MHz), the laser RIN is limited by the shot noise level (-158 dB/Hz).



Laser Module Models

APEX Technologies offers TLS models that cover the wavelength range between 1030 to 1630nm in a benchtop or OEM versions. The output power depends on the TLS model and can go up to 15dBm. Customised wavelength range between 730 to 2000nm can be provided under request.

TLS-APBX/TLS-APX Models	Wavelength range (nm)	Peak output power (dBm)	Power max full span (dBm)	Minimum output power (dBm)
TLS-AP(B)-T	1030-1075	11	8	-10
TLS-AP(B)-O1	1265-1345	15	9	0
TLS-AP(B)-O2	1265-1355	15	9	0
TLS-AP(B)-E	1345-1450	13	8	0
TLS-AP(B)-S	1445-1525	11	8	-10
TLS-AP(B)-CL1	1525-1607	10	7	-10
TLS-AP(B)-CL2	1520-1630	10	7	-10

Common Characteristics

Wavelength setting resolution	3 pm
Wavelength stability	+/- 1pm
Absolute Wavelength Accuracy*	+/- 3pm (typical)
Wavelength Repeatability*	+/- 3pm (typical)
Power flatness (step mode)	0.05dB
Sweep speed**	Adjustable from 5 to 100 nm/s
Fine tuning scan range (piezo control)	3 GHz
Power stability @24h	+/- 0.2dB
Power repeatability (step mode)	+/- 0.05dB
Dynamic power repeatability (Sweep mode @ 10 nm/s)	+/- 0.01dBm
Dynamic power repeatability (Sweep mode@100 nm/s)	+/- 0.06dBm
RIN	-158dB/Hz
Lorentzian Linewidth (Fundamental)	55 kHz
Linewidth (Integration over 1s)	280kHz
SMSR	45dB/0.1nm
Signal to total source spontaneous emission ratio	50dB

*Maximum accuracy of +/- 5 pm

** Maximum sweep speed of 100 nm/s for O band TLS