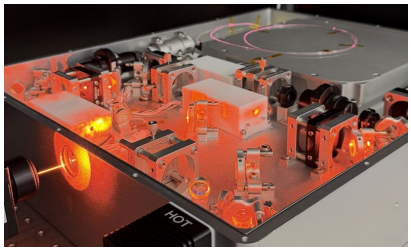
TekLaser™

QTekLaser™ 604 nm Fiber Laser

Product Description

The QTekLaser™ 604 nm Fiber Laser combines second-harmonic generation (SHG) and sum-frequency generation (SFG) to deliver stable, single-frequency, polarization-maintaining light up to 6 W at 603.8 nm. Beam quality is < 1.1 and relative intensity noise is <-125 dBc/Hz above 10 kHz. An IoT-enabled interface and 19" rack-mount chassis make it straightforward to integrate into quantum and precision-spectroscopy systems.



6 W Power | < 10 kHz Linewidth | < -125 dBc/Hz Relative Intensity Noise (RIN)

Features

- High output power (6 W)
- High reliability
- Excellent power stability (<1%)
- User-friendly interface via IoT technology
- 4U 19" Rack mount
- Certified to IEC 60825-1:2014 safety standards

Applications

- Quantum computing
- Atomic and molecular physics
- Precision spectroscopy
- Laser-based metrology
- Nonlinear optics and frequency conversion
- Research

Second-Harmonic and Sum-Frequency Generation

The wavelength range of QTekLaser™ products can be further extended using the nonlinear processes of second-harmonic generation (SHG) and sum-frequency generation (SFG). The 604 nm system uses both: a 1987.3 nm Tm-doped fiber amplifier is frequency-doubled to 993.7 nm, and that light is then sum-mixed with a 1539.0 nm Er-doped fiber amplifier to produce 603.8 nm. The SFG architecture is illustrated in figure 1. The extended wavelength values are summarized in the blue-shaded cells of table 1; 604 nm falls in the Er × Tm² band spanning 553–628 nm. This method achieves high power at wavelengths no fiber gain medium reaches directly.

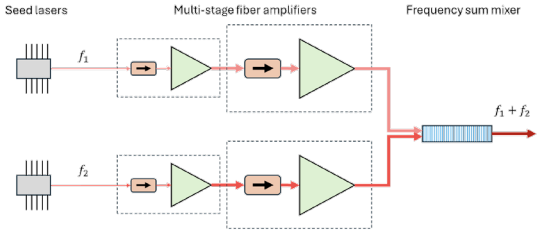


Figure 1. QTekLaser™ sum-frequency generation (SFG) fiber laser system. The frequency sum mixer is integrated into the product.

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	SF-AMP-Tm^2 (865 – 1030 nm)	SF-AMP-Yb (1012 – 1112 nm)	SF-AMP-Er (1530 – 1610 nm)	SF-AMP-Tm (1730 – 2060 nm)
SF-AMP-Yb (1012 – 1112 nm)	466 – 535 nm	506 – 556 nm		
SF-AMP-Er (1530 – 1610 nm)	553 – 628 nm	609 – 658 nm	765 – 805 nm	
SF-AMP-Tm (1730 – 2060 nm)	576 – 687 nm	638 – 722 nm	812 – 904 nm	865 – 1030 nm

Table 1. Wavelength extension of QTekLaser™ products via nonlinear frequency conversion. The red-shaded cells represent second-harmonic generation (SHG) and the blue-shaded cells sum-frequency generation (SFG).

Specifications

Category	Parameter	Value	Unit
Laser	Wavelength	603.8	nm
	Operation mode	CW	/
	Max output power	6	W
	Linewidth	<20	kHz
	Output 1/e² beam diameter	1.3	mm
	Beam quality (M^2)	<1.1	/
	Relative intensity noise (RIN) for freq. >10 kHz	<-125	dBc/Hz
	Fiber length to chassis	2	m
	Polarization direction	Vertical	/
	Polarization extinction ratio (PER)	>20	dB
	Optical signal-to-noise ratio (OSNR)	58	dB
Electrical	Fuse	6.3 A, 250 VAC, 5×20 mm	/
	Remote interlock voltage	3.3	V
	Max power consumption	490	W
	AC power supply voltage	110	V
General	Warm-up time	30	min
	Cooling	Chilled water	/
	Suggested chiller temperature	19.5	°C
	Chilled water flow rate	≥0.65	GPM
	Room temperature	17 – 25	°C
	Room humidity	30 – 60	%
	Weight	66 (145)	kg (lbs)

Safety & Retro-Reflection Advisory



QTekLaser™ lasers comply with Federal Regulations (21 CFR Subchapter J, Part 1040) as administered by the Center for Devices and Radiological Health and are certified to IEC 60825-1:2014 standards.

It is the end user's responsibility to ensure that no significant light is retroreflected back into QTekLaser™ systems as this can degrade performance and potentially damage the lasers. To prevent this, the use of an external optical isolator is strongly recommended. Damage due to retroreflected light is not covered under warranty.

Ordering Information

Part Number: QT-LASR-SHG-SFG-604-6-W-2-2.0-2
Laser Type: Seed + Er-doped fiber amplifier + Tm-doped fiber amplifier + SHG + SFG

Performance Figures

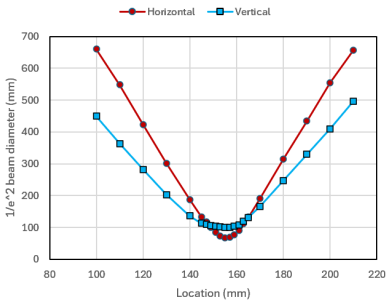


Figure 2. Beam quality: 604 nm, $M^2 = 1.01 \pm 0.03$.

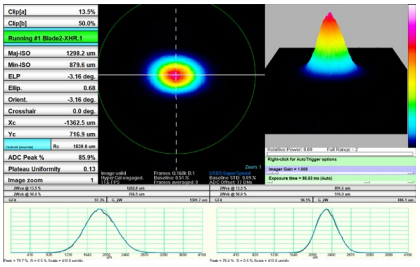


Figure 3. Beam profile at 604 nm. $1/e^2$ beam diameter 1.3 mm horizontally and 0.9 mm vertically.

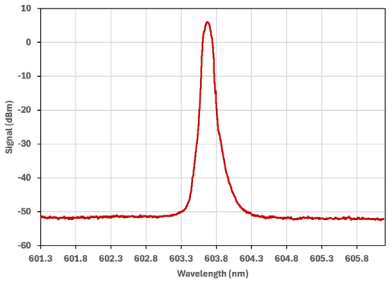


Figure 4. Optical spectrum at 6 W, measured with an Anritsu MS9710B optical spectrum analyzer at 0.001 nm resolution. The optical signal-to-noise ratio (OSNR) is 58 dB.

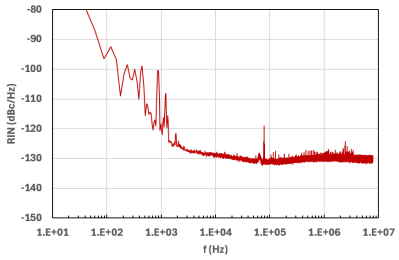


Figure 5. Relative intensity noise (RIN) < -125 dBc/Hz for frequencies >10 kHz.

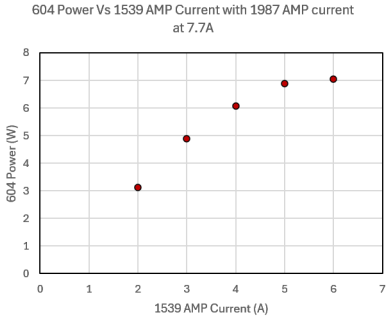


Figure 6. Output power at 604 nm vs. 1539 nm amplifier current, with the 1987 nm amplifier held at 7.7 A.

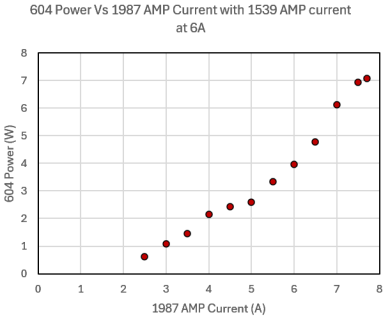


Figure 7. Output power at 604 nm vs. 1987 nm amplifier current, with the 1539 nm amplifier held at 6 A.

Quantum Applications

The 604 nm system delivers 6 W of single-frequency orange-red light for quantum computing and atomic physics. Its narrow linewidth, M^2 <1.1, and low relative intensity noise (<-125 dBc/Hz above 10 kHz) suit coherent manipulation and readout of atomic and solid-state qubits, where added amplitude noise translates directly into gate and measurement error. This is usually doubled to 302 nm.

Mechanical Dimensions

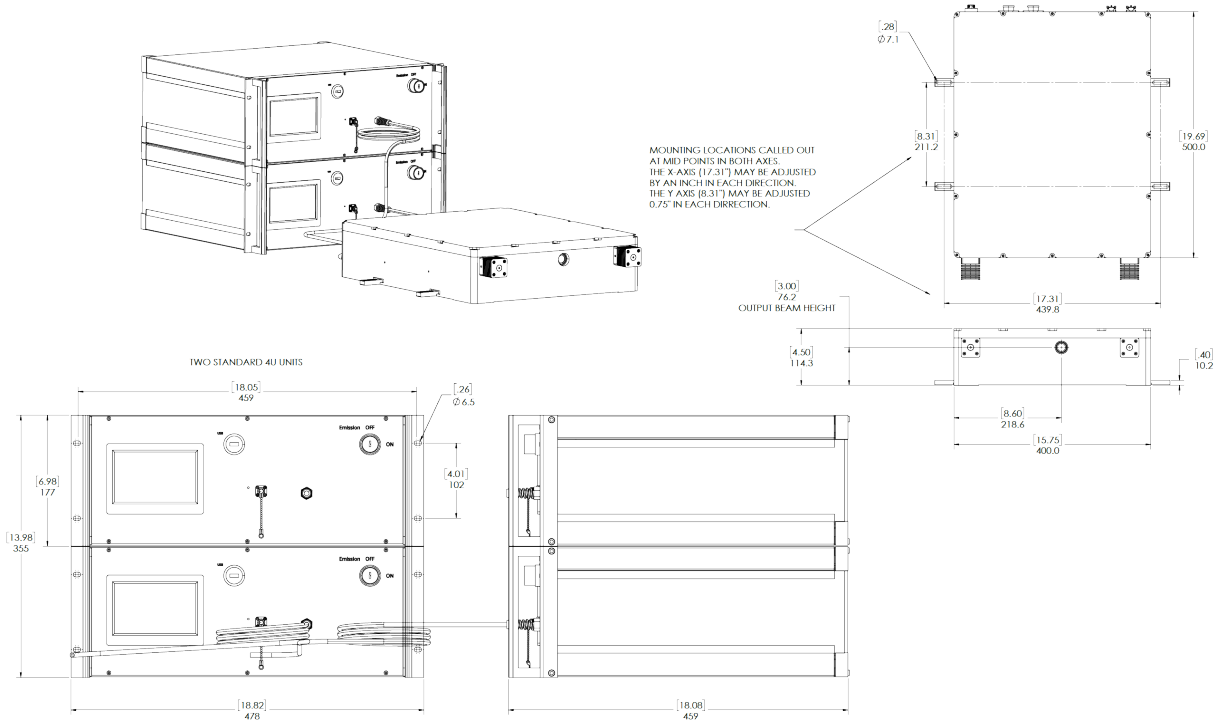


Figure 8. 604 nm fiber laser mechanical dimensions.

Product Photos

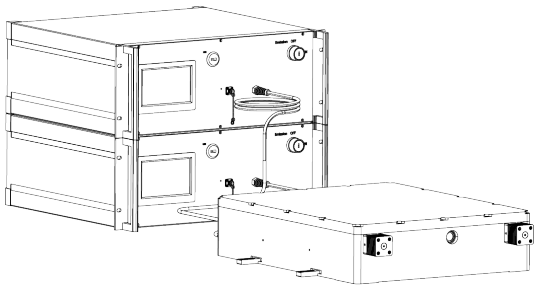


Figure 9. 604 nm fiber laser, 2×4U chassis + laser head, water cooled.



Figure 10. QTekLaser fiber laser, 4U chassis back panel, water cooled.

Web Page Reference

Product page: www.qteklaser.com/604-nm-fiber-laser

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