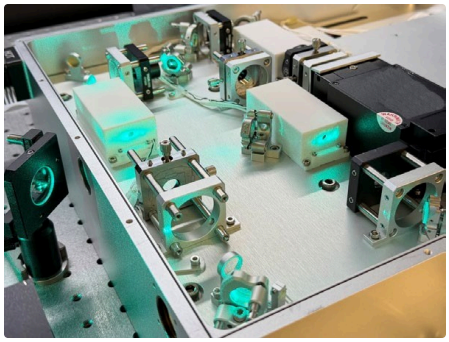
TekLaser™

QTekLaser™ 432 – 515 nm Fiber Laser

Product Description

The QTekLaser™ 432 – 515 nm Fiber Laser class utilizes two second-harmonic generation (SHG) stages to deliver stable, single-frequency, polarization-maintaining light at up to 1.5 W. An IoT-enabled interface and 19" rack-mount chassis make it straightforward to integrate into quantum and precision-spectroscopy systems.



Up to 1.5 W Power | <20 kHz Linewidth | <-125 dBc/Hz Relative Intensity Noise (RIN)

Features

- High output power up to 1.5 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

Fourth-Harmonic Generation (FHG)

QTekLaser™ further extends the wavelength range of its fiber lasers by cascading two second-harmonic generation (SHG) stages. The output of a single-frequency fiber amplifier is first frequency-doubled. The resulting light is then doubled again in a second nonlinear crystal, producing light at one quarter of the fundamental wavelength (figure 1). Starting from our Tm-doped fiber amplifiers (1730 – 2060 nm), fourth-harmonic generation (FHG) reaches the blue-green regime from 432 to 515 nm. High-power, narrow-linewidth light at these wavelengths is difficult to obtain directly from diode or fiber sources. Each conversion stage keeps the single-frequency character of the seed laser, so FHG systems deliver narrow linewidth, low relative intensity noise and excellent beam quality. The maximum power of FHG systems is constrained by the combined efficiency of the two conversion stages and by the damage threshold of the nonlinear crystals at shorter wavelengths.

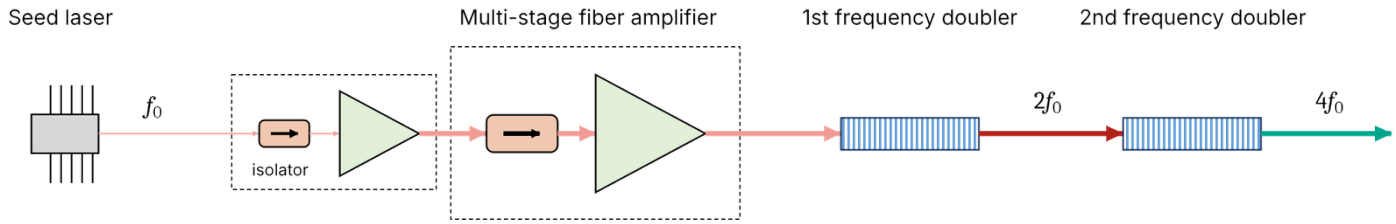


Figure 1. QTekLaser™ fiber laser with fourth-harmonic generation (FHG).

QTEK LASER, LLC
411 Waverley Oaks Road, Suite 111, Waltham, MA 02452 USA
+1 781-373-1446 | sales@qteklaser.com | www.qteklaser.com

	SF-AMP-Yb² (506 – 556 nm)	SF-AMP-Tm² (865 – 1030 nm)	SF-AMP-Yb (1012 – 1112 nm)	SF-AMP-Er (1530 – 1610 nm)	SF-AMP-Tm (1730 – 2060 nm)
SF-AMP-Yb² (506 – 556 nm)	253 – 278 nm				
SF-AMP-Tm² (865 – 1030 nm)	319 – 361 nm	432 – 515 nm			
SF-AMP-Yb (1012 – 1112 nm)	304 – 371 nm	466 – 535 nm	506 – 556 nm		
SF-AMP-Er (1530 – 1610 nm)	380 – 413 nm	553 – 628 nm	609 – 658 nm	765 – 805 nm	
SF-AMP-Tm (1730 – 2060 nm)	391 – 438 nm	576 – 687 nm	638 – 722 nm	812 – 904 nm	865 – 1030 nm

Table 1. Wavelength extension of QTekLaser™ products via nonlinear frequency conversion. Yb² and Tm² denote frequency-doubled Yb and Tm amplifiers. Red: harmonic generation (SHG, or FHG via two cascaded SHG stages). Blue: sum-frequency generation (SFG), including cascaded SHG+SFG.

Quantum Applications

Strontium-based quantum computing, optical clocks and atomic physics. This wavelength drives the 5s5p $^3P_2 \rightarrow$ 5s5d $^3D_2$ transition in neutral strontium. That transition repumps atoms stranded in the long-lived $^3P_2$ state back into the cooling cycle, which keeps atom number and loading rate high in magneto-optical traps, optical lattices and tweezer arrays.

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-FHG-(432–515)-1.5-W-2-2.0-2
Laser Type: Seed + Tm-doped fiber amplifier + FHG

Specifications

Category	Parameter	Value	Unit
Laser	Wavelength	432 – 515	nm
	Operation mode	CW	/
	Max output power	1.5	W
	Linewidth	<20	kHz
	Thermal wavelength tuning	0.6	nm
	PZT tuning range	>3	GHz
	PZT tuning bandwidth	>5	kHz
	Output $1/e^2$ beam diameter	0.5-2	mm
	Beam quality (M^2)	1.02	/
	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)	>45	dB
	Warm-up time	30	min
Electrical	Max power consumption	265	W
	AC power supply voltage	110	V
	Fuse	6.3 A, 250 VAC, 5×20 mm	/
	Remote interlock voltage	3.3	V
	Cooling	Chilled water	/
	Suggested chiller temperature	19.5	℃
	Chilled water flow rate	≥0.65	GPM
	Room temperature	17 – 25	℃
	Room humidity	30 – 60	%
General	Weight	43 (94)	kg (lbs)

Performance

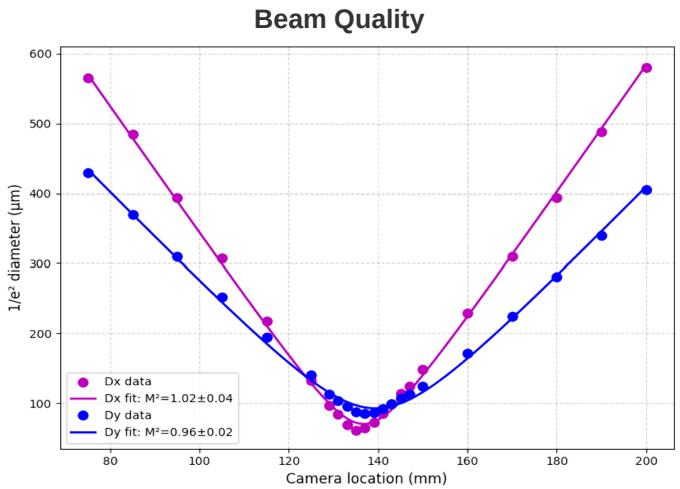


Figure 2. Beam quality: $M^2 = 1.02 \pm 0.04$.

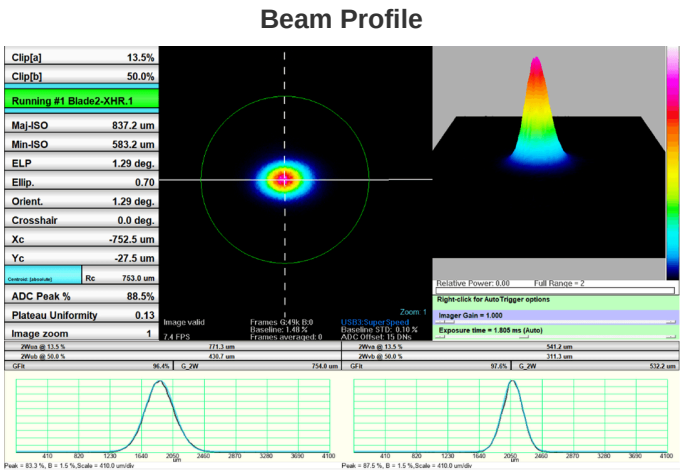


Figure 3. Beam profile. $1/e^2$ beam diameter 0.77 mm horizontally and 0.54 mm vertically.

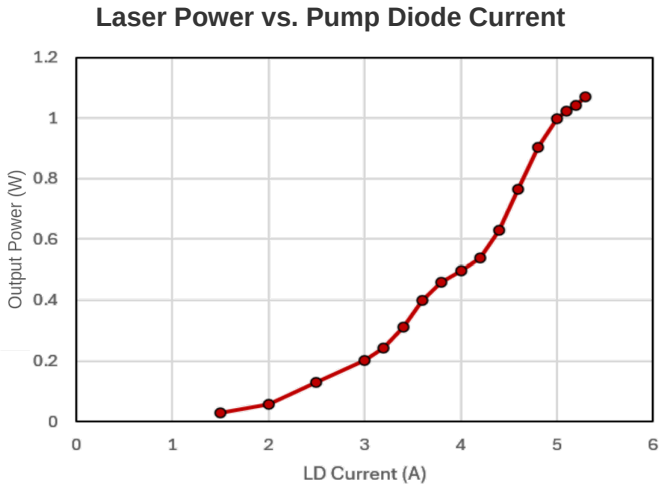


Figure 4. Output power.

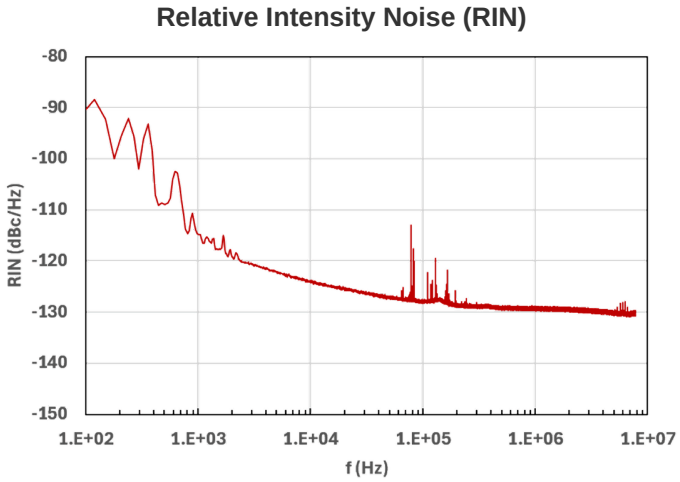


Figure 5. Relative intensity noise (RIN) < -125 dBc/Hz for frequencies >10 kHz.

Mechanical Dimensions

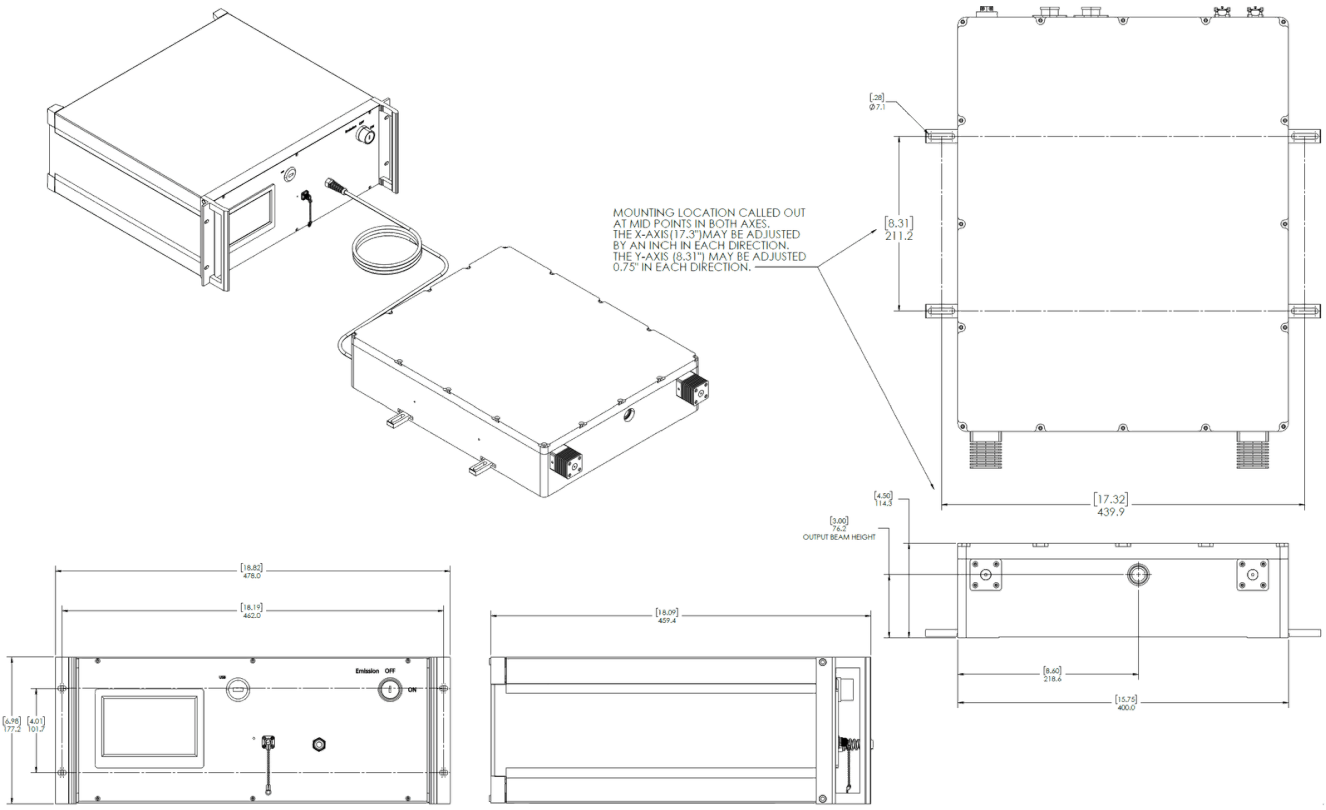


Figure 6. Mechanical dimensions.

Product Images

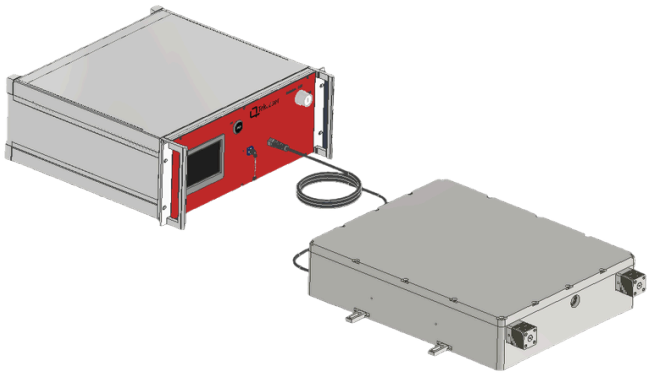


Figure 7. 4U chassis + laser head, water cooled.



Figure 8. QTekLaser fiber laser, 4U chassis back panel, water cooled.