

RUBRIComb™ Frequency Comb



/ˈrū-bri-kōm/, proper noun

A reference, a frequency ruler for precision measurements, a standard for turnkey and reliable optical frequency combs.



You want an optical frequency comb that keeps your experiment or in-the-field solution running smoothly and efficiently. Frequency combs have a reputation for being complicated instruments that cause downtime at the worst times—that era has now ended with the RUBRIComb™. Redefine reliability with a laser that never lets you down.

The RUBRIComb™ from Vescent is a fully stabilized optical frequency comb with precise control over the repetition rate (f_{rep}), the carrier-envelope offset frequency (f_{CEO}), and the optical reference beat (f_{opt}). At its core is a passively mode-locked erbium-doped fiber oscillator. Our unique approach reduces the system size, weight, and power (SWaP). The complete RUBRIComb™ frequency comb is designed and built to ensure stable, low-phase-noise operation, with Allan Deviations supporting the next generation of optical atomic clocks.

The entire laser, including self and external referencing modules, is contained in a single 2U 19" rack mount chassis. The laser mode-locks at startup every time and is specially designed for a robust, long life. Our unique oscillator design also makes it easy to precisely factory-match the repetition rate of several RUBRIComb™ combs for multi-comb spectroscopy experiments.

Leading Application Solutions

- Atomic Clocks and Time Transfer
- Quantum Computing
- Dual Comb Spectroscopy

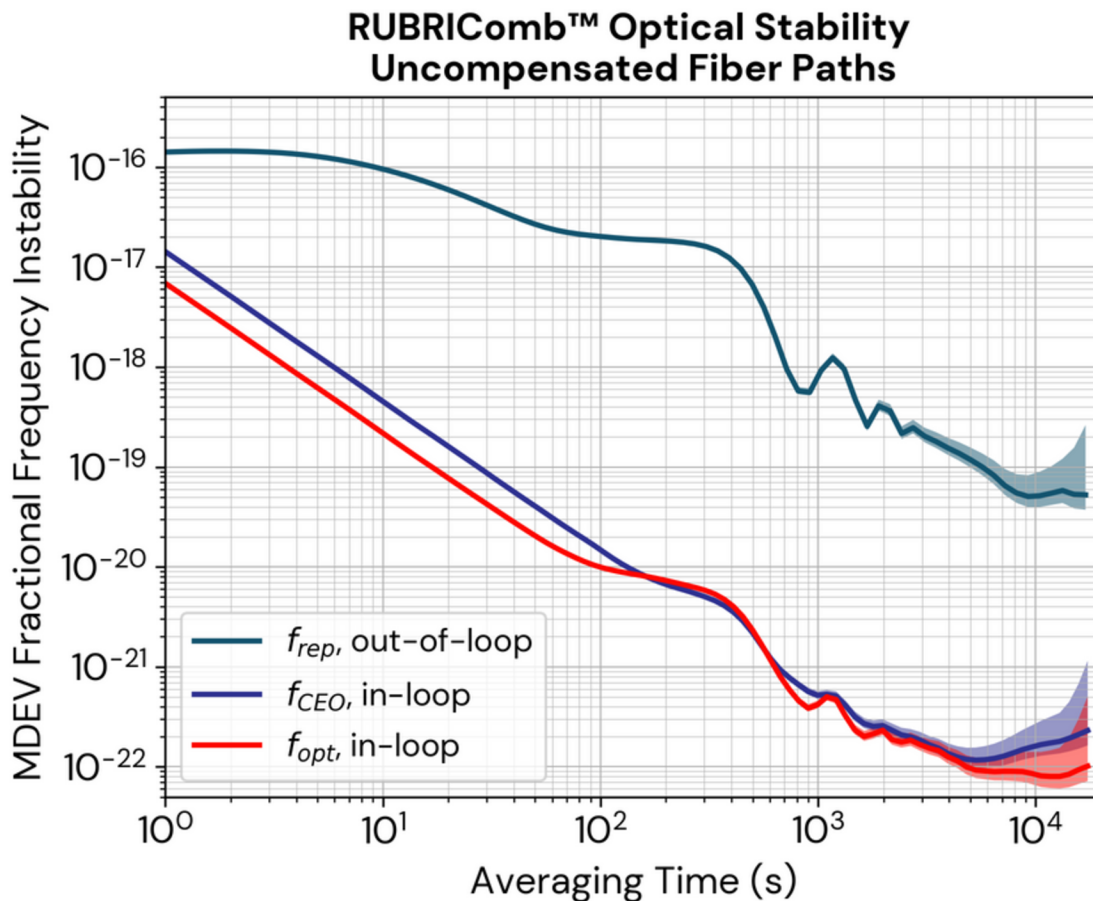


FREQUENCY COMBS | LASERS | CONTROLLERS

RUBRIComb™ Frequency Comb

Features

- Turnkey Operation: up and running in 30 minutes
- Low Noise: supports the best optical clocks and more
- Robust: passes demanding shake, vibe, and thermal tests
- Stable: remains locked for months
- Color Support: lock many lasers with additional options
- Deliver: low noise to every laser in your system



RUBRIComb™: Exceptional Stability

This plot highlights the stability of the RUBRIComb optical frequency comb, as measured by the Modified Allan Deviation (MDEV). The log-log axes show the stability between 1 and 10,000 seconds, demonstrating fractional frequency stability that averages below the 10^{-18} level. The out-of-loop trace was measured from the beat note between two RUBRICombs phase-locked to the same optical reference (Stabilaser 1542e) and demonstrates the low-noise of independent comb systems. The in-loop traces of f_{CEO} (blue) and f_{rep} (green) showcase the comb's intrinsic noise floor, enabling it to support cutting-edge applications like optical clocks and low-phase-noise microwave generation.



RUBRIComb™ Specifications

Parameter	Min	Typical	Max	Comments
Center Wavelength		1560 nm		
Repetition Rate		100 MHz (for -100) 200 MHz (for -200)		
Optical Outputs - All connectors are PM FC/APC				
Oscillator Average Output Power	0.01 mW			
Oscillator Optical Bandwidth	18 nm	35 nm (for -100) 25 nm (for -200)		FWHM
Amplifier Average Output Power	4 mW			
Amplifier Optical Bandwidth	40 nm	70 nm		-10 dB full width
RF Outputs - All connectors are SMA				
f_{CEO} Signal-to-Noise Ratio	35 dB			100 kHz RBW
f_{CEO} Integrated Phase Noise		400 mrad	1000 mrad	10 Hz-1 MHz
f_{CEO} Frequency Stability ¹			5×10^{-17}	At 1 s, In-loop Modified Allan Deviation
f_{opt} Optical Input Power	0.1 mW		0.6 mW	
f_{opt} Signal-to-Noise Ratio ²		40 dB		100 kHz RBW
f_{opt} Integrated Phase Noise ²	200 mrad			10 Hz-1 MHz
f_{opt} Frequency Stability ^{1,2}			5×10^{-17}	At 1 s, In-loop Modified Allan Deviation
f_{rep} Output Power Level	-10 dBm	0 dBm	5 dBm	

¹ Allan Deviation from zero-dead-time lambda counter with 1 s gate time.

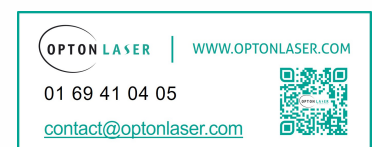
² Depends on user-supplied optical reference. Data given for 1kHz 1560 nm reference laser with >0.1 mW input power when phase locked with a SLICE-FPGA.



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RUBRIComb™ Specifications Continued...

Parameter	Min	Typical	Max	Comments
Frequency Transducers				
f_{CEO} Tuning Range	100 MHz (for -100) 200 MHz (for -200)			Pump Current Tuning
f_{CEO} Input Voltage Tuning Range	-5 V		5 V	SMA Input
f_{rep} PZT Tuning Range	30 Hz	60 Hz (for -100) 240 Hz (for -200)		Depends on Repetition Rate. Temperature tuning spec allows for larger changes in f_{rep} .
f_{rep} Input Voltage Tuning Range	0 V		6 V	SMA Input
f_{rep} Temperature Tuning Range		25 kHz (for -100) 50 kHz (for -200)		Cavity temperature between 20 and 45 °C
f_{rep} Temperature Tuning Sensitivity		1 kHz/°C (for -100) 2 kHz/°C (for -200)		Depends on Repetition Rate
Size, Weight, and Power				
Line Voltage	100 VAC		230 VAC	50/60 Hz
Power Consumption			40 W	
Weight		7.3 kg		
Chassis Volume		17 L		
Dimensions (in)		19 x 19 x 3.875 W x D x H		2U 19" rack mount
Dimensions (cm)		48.3 x 48.3 x 9.8 W x D x H		2U 19" rack mount
Environmental				
Operating Temperature	15 °C		35 °C	Minimum temp must be above dew point
Storage Temperature	-10 °C		70 °C	

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