



DFM

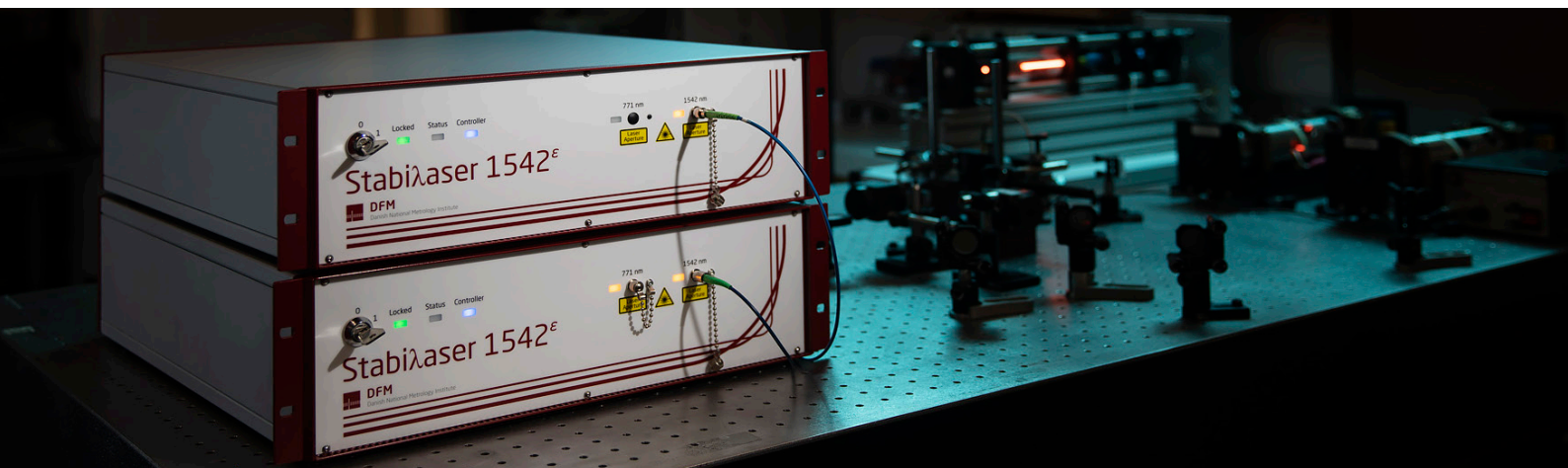
Danish National Metrology Institute

STABILASER 1542^ε - EPSILON EDITION



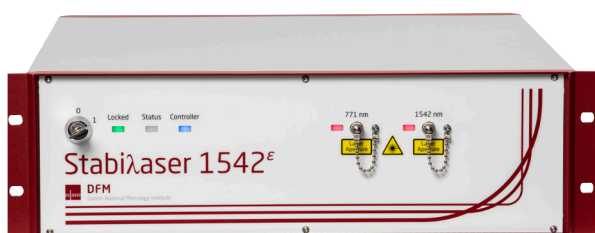
PRODUCT DATASHEET
STABILASER 1542^ε

rev#_2024-10-10



EXCELLENT FOR METROLOGY

The Stabllaser 1542^ε (epsilon edition) is a 2. gen acetylene-stabilized fiber laser that exhibits the same narrow linewidth, excellent long-term stability and high accuracy as its predecessor. The design maintains the short-term linewidth of a high-end fiber laser, and adds the long term stability and accuracy from a molecular transition of acetylene. The result is a high-performance laser source offering continuous trouble-free operation without user intervention.



ULTRA STABLE LASER IN THE FAR-RED SPECTRUM

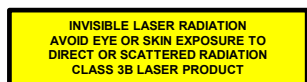
By combining the Stabllaser 1542^ε with all-fiber based frequency doubling technology, it is possible to get an additional output at 771 nm. The solution ensures that

the laser signal at 771 nm inherits the excellent short-term linewidth and long-term stability of the Stabllaser 1542^ε. The Stabllaser 1542^ε can provide both 5 mW of power at 771 nm and 20 mW of power at 1542 nm. It is possible to upgrade the Stabllaser 1542^ε with this solution later on.

ENABLING NEXT-LEVEL APPLICATIONS

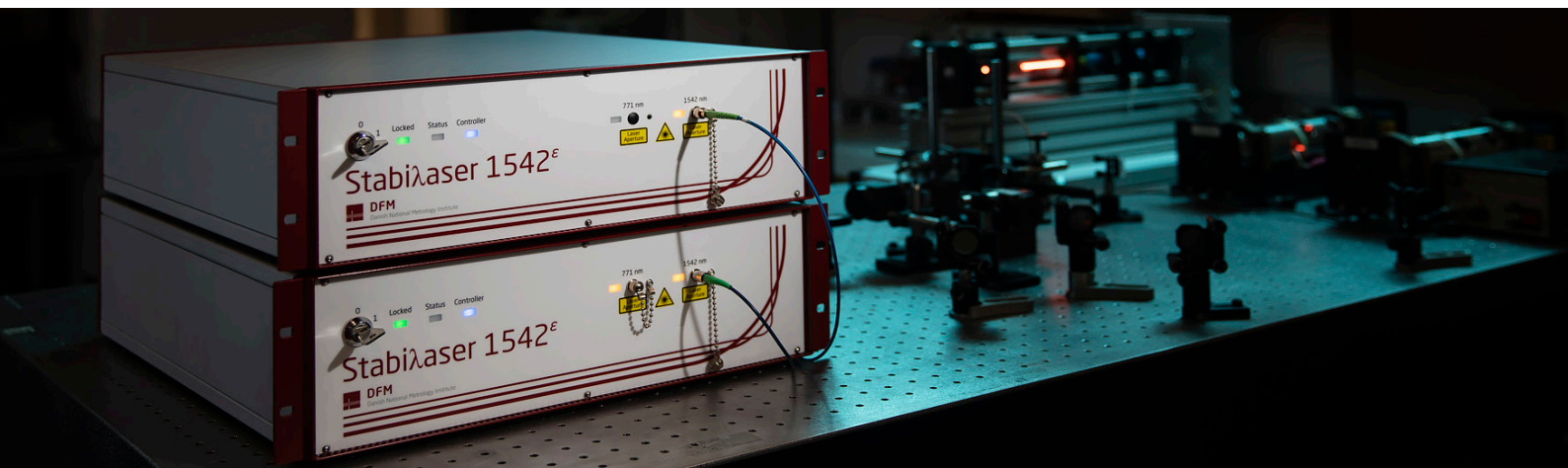
Thanks to the Stabllaser 1542^ε, affordable access to the high levels of performance needed for cutting edge scientific research, is now available. A diverse and growing range of applications include stabilization of frequency combs and length metrology. As a reference, the Stabllaser 1542^ε is an essential component for stabilization and line narrowing of lasers for spectroscopy or laser cooling on narrow-line atomic or molecular transitions, as well as in dual comb spectroscopy.

The 771 nm module is designed for dimensional metrology based on interferometric methods where lasers in, or near, the visible spectrum are required. In length metrology applications, the specific wavelength of 771 nm may lead to relaxed requirements in the calibration process. Additionally, wavelength meters can now be calibrated with unprecedented accuracy at a wavelength outside the IR spectrum.



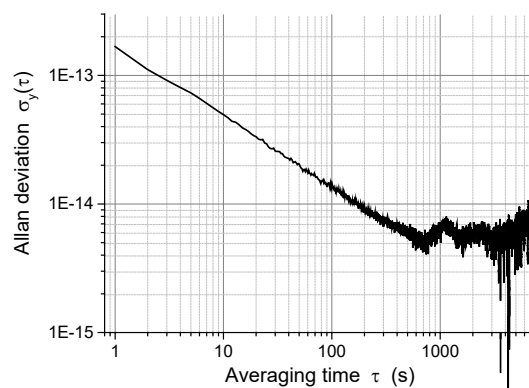
PRODUCT DATASHEET STABILASER 1542^ε

rev#_2024-10-10

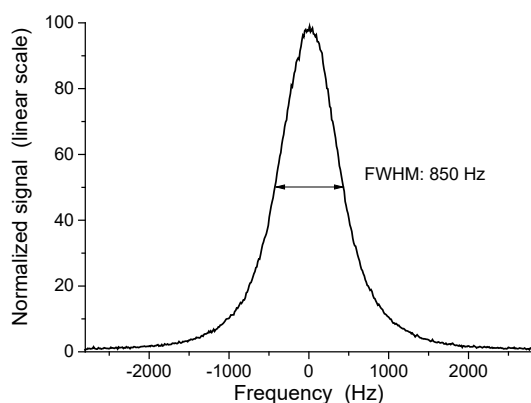


TECHNOLOGY

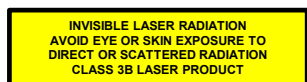
At the heart of the Stabllaser 1542^E is a compact ultra low-noise fiber laser stabilized to the acetylene $^{13}\text{C}_2\text{H}_2$ P(16) ($\nu_1 + \nu_3$) transition at $\lambda = 1542.383\,712\,38\text{ nm}$, corresponding to the frequency $f = c/\lambda = 194\,369\,569\,384\text{ kHz}$ (laser output is shifted 80 MHz due to internal modulation). The laser meets the conditions of the CIPM recommendation on standard frequencies and can be used as a primary standard with an uncertainty of 5 kHz. The proprietary optical design and control software ensure both autonomous operation and a high quality laser output.



The figure shows a typical Allan Deviation (ADEV) plot for a Stabllaser 1542^E in a well controlled laboratory enviroment.



Measured beat note between two Stabllaser 1542^E units averaged for one hour.



PRODUCT DATASHEET STABILASER 1542^E

rev#_2024-10-10

Specifications

Optical specifications

1542 nm module

Wavelength (nominal ¹ , vacuum)	1542.384 347 2 (4) nm
Linewidth (short term)	≤300 Hz
Stability ² (Allan deviation, sampling time ≥ 1 s)	≤3 × 10 ⁻¹³
Stability ² (Allan deviation, sampling time = 200 s)	≤3 × 10 ⁻¹⁴
Long-term accuracy ³ (drift per year)	≤2 × 10 ⁻¹²
Output power, locked (nominal)	20 mW
Fiber connector (laser aperture)	FC/APC (PM)

Option: 771 nm module

Wavelength (nominal, vacuum)	771.192 173 6 (2) nm
Linewidth (short term)	≤600 Hz
Stability ² (Allan deviation, sampling time ≥ 1 s)	≤3 × 10 ⁻¹³
Stability ² (Allan deviation, sampling time = 200 s)	≤3 × 10 ⁻¹⁴
Long-term accuracy ³ (drift per year)	≤2 × 10 ⁻¹²
Output power, locked (nominal)	5 mW

Environmental specifications

Operating environment	Indoor laboratory
Ambient operating temperature	18 °C - 28 °C
Maximum ambient operating temperature change in one hour ⁴	1 °C

Electrical and dimensional specifications

Power requirements	100 - 240 VAC, 50 or 60 Hz
Power consumption (average/max)	85 W / 150 W
Dimension (h x w x d)	13.3 cm x 48.3 cm x 49.6 cm
Weight	14 kg

- 1 The laser is locked to the acetylene line at 1542.3837 nm, but the available output is shifted by a fixed frequency of nominally 80 MHz, see also sections 7.1 and 10.1 in the manual.
- 2 The specified stability may not be achieved if the Stabilaser 1542^E is operated in a noisy and unstable environment.
- 3 This parameter reflects the annual drift of the average laser frequency when the laser is operated in a stable environment. Accuracy at the same level can be obtained by an in-situ calibration using a reference of better accuracy.
- 4 The Stabilaser 1542^E will maintain lock during a temperature change but might have reduced frequency stability.

CONTACT DFM

DFM A/S
Kogle Allé 5
DK-2970 Hørsholm
Denmark
sales@dfm.dk



DFM

Danish National Metrology Institute