



## ABOUT DFM

DFM is Denmark's National Metrology Institute (NMI). DFM is a signatory to the CIPM-MRA arrangement that ensures mutual recognition of measurements worldwide

## TRACEABILITY

All measurements are traceable to recognised national and international standard.

## ISO CERTIFICATION

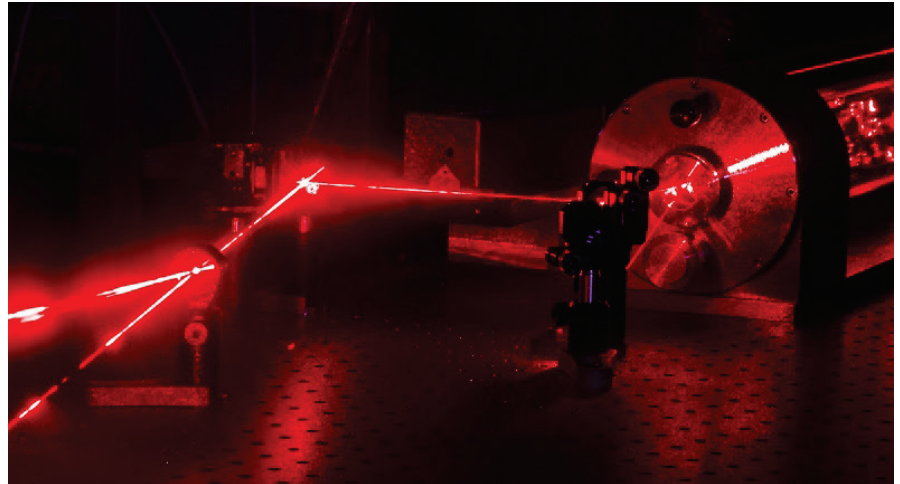
All services are covered by DFM's ISO 9001 certification

## CONTACT DFM

DFM A/S  
Kogle Alle 5  
DK-2970 Hørsholm  
Denmark

[www.dfm.dk](http://www.dfm.dk)  
[administration@dfm.dk](mailto:administration@dfm.dk)  
Tlf.: +45 7730 5800

# RIN Measurements



## What is RIN?

Relative intensity noise (RIN) is the intensity noise power normalized to the average power level. The RIN noise term is an important parameter to describe lasers used for optical communication, bio-optics, LIDAR sensing and many more applications. RIN is specified as a relative power density over a specified frequency range (Power Spectral Density, PSD) in dBc/Hz. RIN may also be specified as an RMS value over a frequency range, relative to the output power.

## Technology

Our calibration technique is based on self-homodyne detection, where the currents from two photodetectors are either added or subtracted. In the frequency domain the sum and difference photocurrents are directly proportional to the intensity noise and shot noise of the laser, respectively. DFM performs RIN measurements for lasers in the visible range to NIR (400 nm-1800 nm). The uncertainty of our service is +/- 1 dBc/Hz at the -155 dBc/Hz level.



**CONSULTANCY SERVICES**

Do you need new measurement capabilities, does a method call for a bit of scrutiny, or are you perhaps seeking to acquire new equipment? Take advantage of the consultancy services we provide in addition to our calibration services.

As an independent institute deeply rooted within research and metrology, DFM has gained the reputation of being an agile, solid, and valuable partner. Contact us and find out why.

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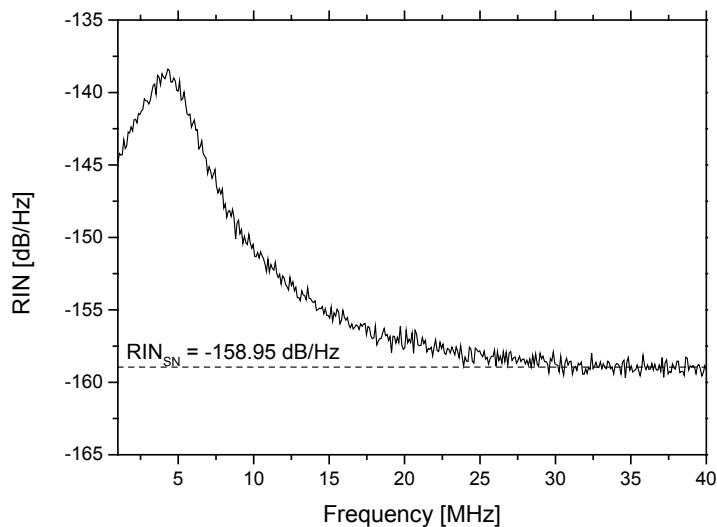
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# Services and specifications

Wavelength: ..... 400 – 1800 nm  
Power range: ..... Up to +3 dBm  
Bandwidth (-3 dB): ..... 25 kHz – 150 MHz  
Uncertainty: ..... +/- 1 dBc/Hz at the -155 dBc/Hz level (K = 2)

The figure below shows a typical example of an actual RIN measurement. You see the typical relaxation noise of the system at approximately 5 MHz, which sets the limit of the laser's performance. For this particular laser, the relaxation noise has a value of -138 dBc/Hz around 5 MHz, and the laser is shot-noise limited for frequencies above 30 MHz.



## Applications

Thanks to the wide wavelength range, wide bandwidth and low noise floor the RIN measurements at DFM allow characterization of lasers for optical communication, bio-optics, LIDAR sensing and much more.

Contact DFM to get more information on RIN measurements, to find out how you may benefit from our knowledge within photonics and laser technology, or to get a quotation.

## Related services

Our standard RIN measurements, service K05.090, complement our existing test and measurement services within photonics, such as wavelength or power measurements, laser classification, spectroscopy, etc.

- K05.072 Laser classification, per wavelength
- K05.08x Calibration of optical spectrum analyzers, wavelength meters or laser wavelength, under accreditation

