

## ABOUT DFM

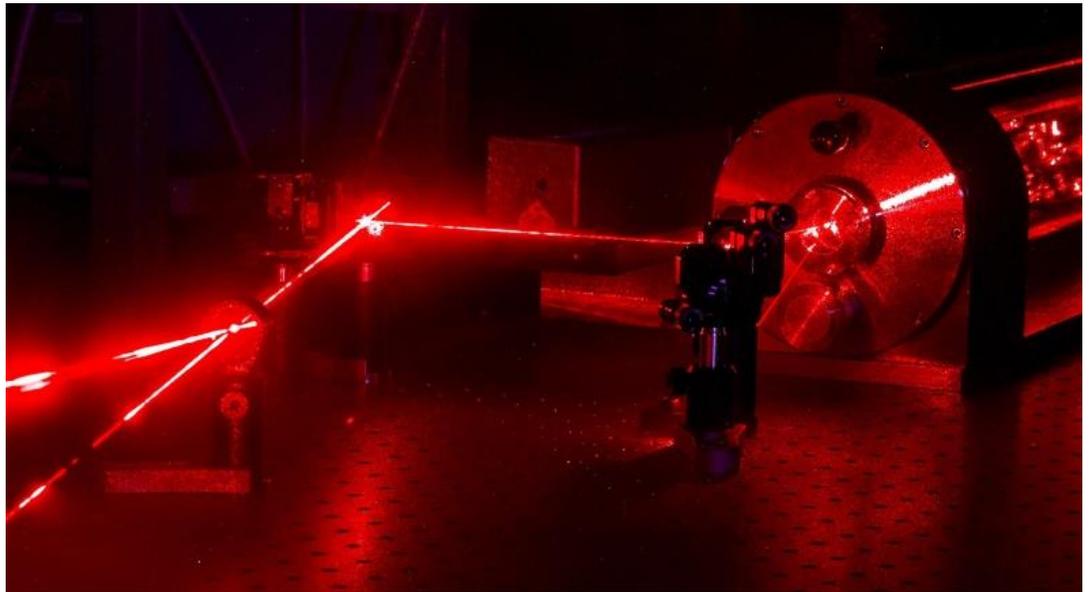
DFM is the Danish National Metrology Institute. DFM develops and maintains selected national standards.

DFM provides metrology services and technology primarily to high-tech companies within the pharmaceutical, photonics and advanced manufacturing industries.

DFM is a signatory to the CIPM-MRA arrangement that ensures mutual recognition of measurements worldwide.

DFM is ISO 9001 certified.

# 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.

## CONTACT DFM

DFM A/S  
Matematiktorvet 307  
DK-2800 Kgs. Lyngby  
Denmark  
[www.dfm.dk](http://www.dfm.dk)  
[info@dfm.dk](mailto:info@dfm.dk)  
Tel.: +45 4593 1144



## CALIBRATION SERVICES

DFM offers a wide range of calibration services within photonics, nanometrology, electrochemistry and acoustics as well as primary level calibration services for mass, length, CMM, and DC electricity.

All measurements are traceable to recognized national and international standards. A majority of our calibrations are performed under ISO 17025 accreditation.

## CONTRACT RESEARCH

DFM offers metrology related contract research such as development of new measurement technology, assistance in obtaining accreditation and other areas where specialized metrology competences are required

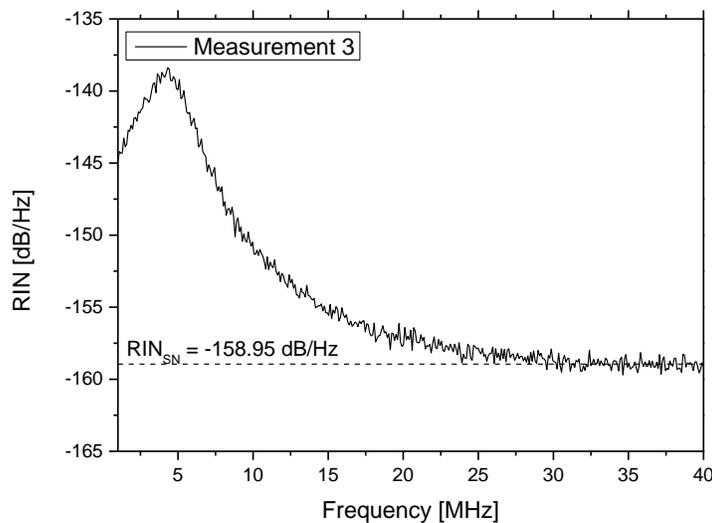
## CONTACT DFM

DFM A/S  
Matematiktorvet 307  
DK-2800 Kgs. Lyngby  
Denmark  
www.dfm.dk  
info@dfm.dk  
Tel.: +45 4593 1144

## 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.

## Examples of related services

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