Carmina
Tunable IR Light-source

IR Light-source for the Combination with s-SNOM and AFM-IR Microscopes

- APE offers an automated IR light-source with a tuning range of 1.46 µm ... 15 µm. Carmina provides unique capabilities in near-field IR spectroscopy - including s-SNOM and AFM-IR - by combining broadband spectroscopy and narrowband chemical imaging to advance new nanoscale chemical applications.

At a Glance

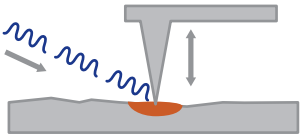
- Spectroscopy & Imaging of organic & inorganic samples with a single laser-source
- Complementary nanoscale IR-techniques covered: s-SNOM and AFM-IR
- Narrowband (~ 20 cm^{-1} FWHM) and broadband (~ 300 cm^{-1} FWTM) operation
- High output power level up to 500 mW
- Continuous sweep mode for fast scanning
- User friendly turnkey operation incl. automated wavelength tuning
- Wavelength tuning broadband: 1.46 µm ... 16.7 µm (600 cm^{-1} ... 6850 cm^{-1})
- Wavelength tuning narrowband: 5.0 µm ... 16.7 µm (600 cm^{-1} ... 2000 cm^{-1})

Spectroscopy & Imaging

Application Examples

- The fully automated IR-source sets new standards in terms of flexibility and tuning range thanks to its OPO/DFG architecture. With the unique combination of 300 cm^{-1} (FWTM) broadband and 20 cm^{-1} (FWHM) narrowband emission, the complementary nanoscale IR techniques s-SNOM Imaging, Spectroscopy and AFM-IR are now covered with a single light-source. A triggered pulsed mode is available for AFM-IR applications.

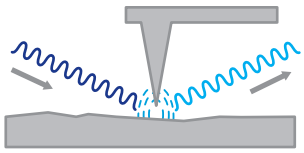
AFM-IR
Photothermal AFM



- **IR pulsed**

Available for broadband & narrowband
Pulsed mode (burst mode) with 50% duty cycle
Continuous wavelength sweep in narrowband mode
(> 100 cm^{-1}/s) for fast spectroscopy

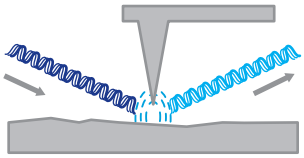
s-SNOM Imaging



- **IR narrowband quasi-cw**

Narrowband mode ~ 20 cm^{-1}
Wavelength tuning 5.0 µm ... 16.7 µm (600 cm^{-1} ... 2000 cm^{-1})
Fast continuous sweep mode in less than 10 seconds for scanning
1000 cm^{-1}... 1800 cm^{-1}

s-SNOM Spectroscopy

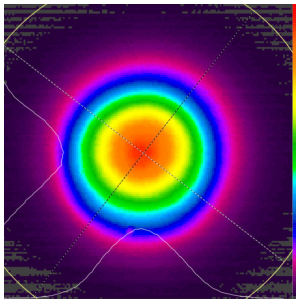


- **IR broadband quasi-cw**

Broadband mode ~ 300 cm^{-1}
Wavelength tuning 1.46 µm ... 16.7 µm (600 cm^{-1} ... 6850 cm^{-1})

Beam Profile

- Carmina offers an excellent output beam profile. Here is an example measurement at 1600 cm^{-1}.



beam profile at 1600 cm^{-1}

Carmina Broadband & Narrowband
Specifications

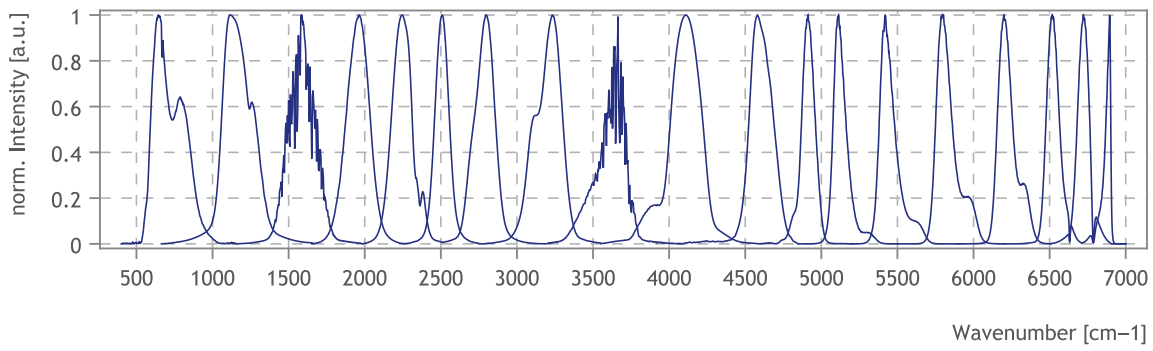
Available Configurations

	Version A	Version B	Version C
Broadband quasi-cw	■	■	■
Narrowband quasi-cw	■	■	-
Broadband Pulsed Mode	■	-	-
Narrowband Pulsed Mode	■	-	-
Additional 1032 nm Output Port	Available for all Configurations		

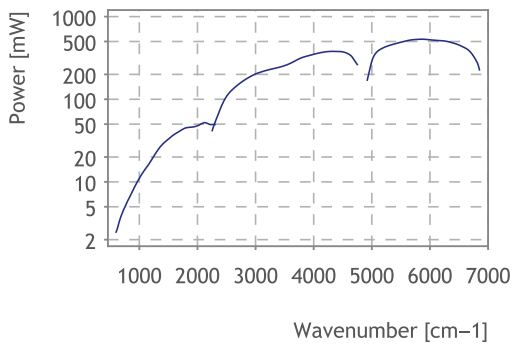
Broadband Operation

Tuning Range	1.46 µm ... 16.7 µm (600 cm^{-1}... 6850 cm^{-1})
Wavelength Tuning	Fully automated, no user adjustment required
Step- and Settle Time	Typ. 2 s
Power	> 15 mW at 1600 cm^{-1}
Bandwidth Typical	300 cm^{-1} (FWTM, 10 dB level), 170 cm^{-1} (FWHM)
Beam Quality M^2	< 1.3 at 1600 cm^{-1}, typ. < 1.3 over complete tuning range
Polarization	Horizontal > 4850 cm^{-1}, Vertical < 4850 cm^{-1}
Beam Diameter at Exit	Typ. 5 mm at 1600 cm^{-1}

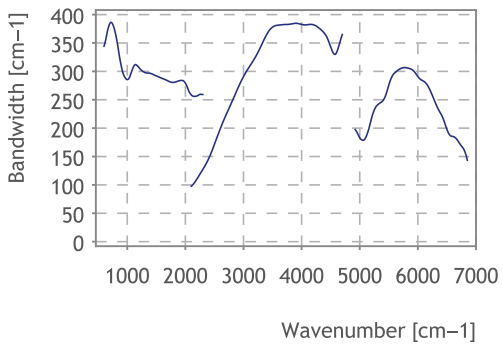
Broadband Operation Spectra (typical)



Broadband Operation Power (typical)



Broadband Operation Bandwidth (typical)

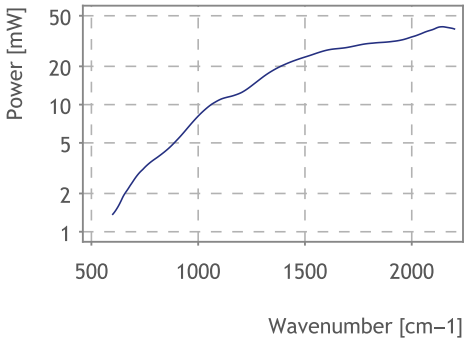


Carmina Broadband & Narrowband
Specifications

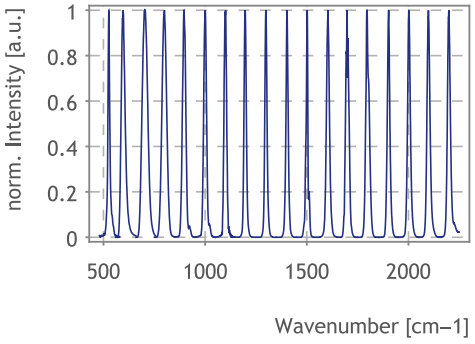
Narrowband Operation

Tuning Range	5.0 µm ... 16.7 µm (600 cm^{-1} ... 2000 cm^{-1})
Wavelength Tuning	Fully automated, no user adjustment required
Step and Settle Time	Typ. < 2 s
Sweep Mode	Continuous sweep Max. speed > 100 cm^{-1}/s, speed and range software adjustable
Power	> 15 mW at 1600 cm^{-1}
Bandwidth typical	< 20 cm^{-1} (FWHM) for 1000 cm^{-1} ... 1800 cm^{-1}
Beam Quality M^2	< 1.3 at 1600 cm^{-1}, typ. < 1.3 over whole tuning range
Polarization	Horizontal
Beam Diameter at Exit	Typ. 5 mm at 1600 cm^{-1}

Narrowband Operation Power (typical)



Narrowband Operation Spectra (typical)



...Specifications

Quasi-cw Mode

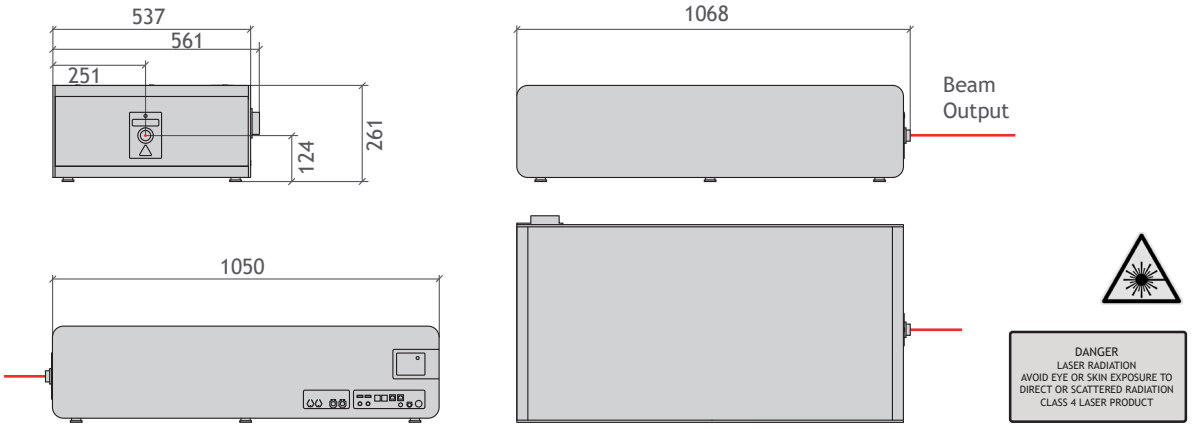
Repetition Rate	40.5 MHz ± 0.5 MHz

Pulsed Mode

Frequency Modulation	50 kHz ... > 1.5 MHz externally triggered via TTL signal (BNC)
Duty Cycle	50%
Energy per Cycle	> 15 nJ at 1600 cm^{-1} at 500 kHz

Further Specifications and Requirements

Dimensions & Weight	Laser: 537 mm x 1068 mm x 261 mm, 105 kg Electronics: 3U x 482.5 mm x 389.5 mm, 11 kg
Electrical Supply	110 - 240 V, 50 - 60 Hz, max. 4.5 A (at 110 V)
Cooling Unit (Included)	Water cooling ~ 22°C, max. 6 A (at 110 V)
Purging Unit (Included)	Purging gas for H_2O and CO_2 removal



Contact

APE Angewandte Physik & Elektronik GmbH
Plauener Str. 163-165|Haus N|13053 Berlin|Germany
T: +49 30 986 011-30 F: +49 30 986 011-333
E: sales@ape-berlin.de www.ape-berlin.de