

# Mid-IR Comb

## Mid-Infrared Optical Frequency Comb

**MenloSystems**



### KEY SPECIFICATIONS

- Repetition Rate 100 MHz or 250 MHz
- Spectral Range 3 -14  $\mu\text{m}$
- High Output Power of up to 120 mW
- Large Spectral Bandwidth of 50  $\text{cm}^{-1}$  – 300  $\text{cm}^{-1}$

### APPLICATIONS

- Fourier-Transform Spectroscopy in the Mid-IR
- Spectroscopy in the “Fingerprint Region” of Molecular Science
- Chemical and Biomolecular Sensing of Molecules
- Fast and Precise Detection of Atmospheric Gases

### FEATURES

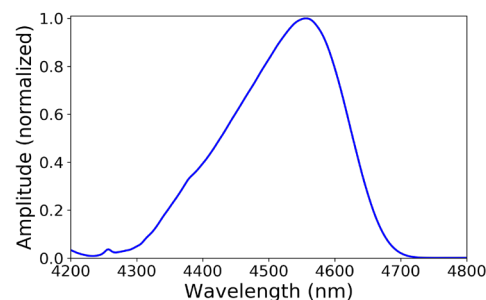
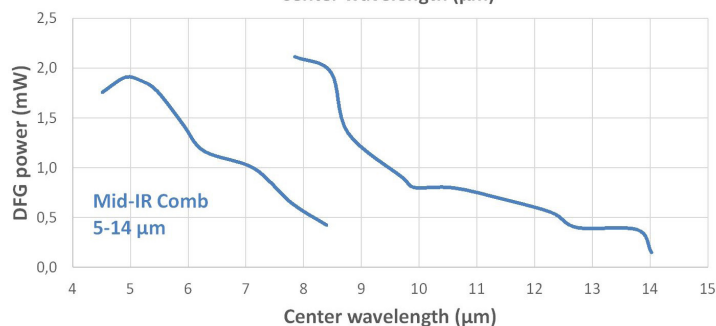
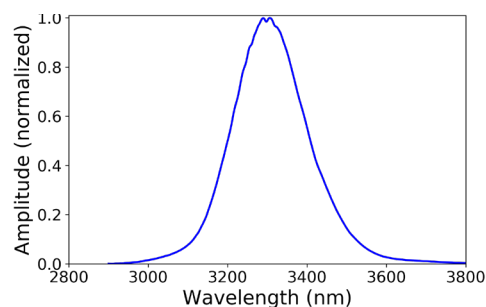
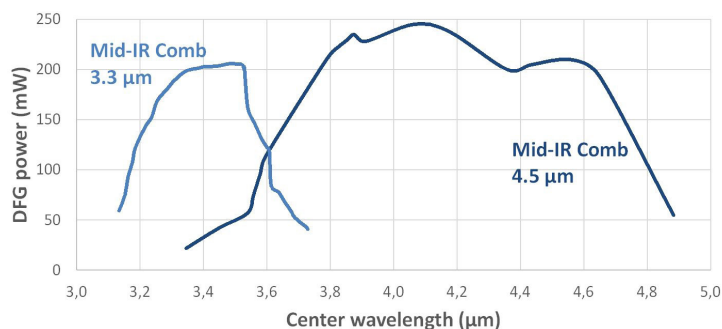
- Carrier-Envelope Offset Free Frequency Comb
- Femtosecond Laser Pulses in the Mid-Infrared
- Repetition Rate can be Phase Locked

### OPTIONS

- **MID-IR COMB-ULN**  
Intracavity EOM for high-performance phase locking to an optical reference resulting in Hz-range optical linewidth

World-leading optical frequency comb technology is now available in the mid-infrared region. Taking advantage of Menlo Systems' proprietary figure 9<sup>®</sup> mode-locking technology, Menlo Systems' difference frequency generation (DFG) based Mid-IR combs provide access to the 3-14  $\mu\text{m}$  range. The reliable, turn-key mid-IR Comb is an enabling tool for applications in the important fingerprint region for high accuracy spectroscopy or nanoFTIR.

### PERFORMANCE DATA FOR MID-IR COMBS



DFG output power as function of DFG center wavelength

DFG output spectra at 3.3  $\mu\text{m}$  and 4.5  $\mu\text{m}$

# Mid-IR Comb

## Mid-Infrared Optical Frequency Comb

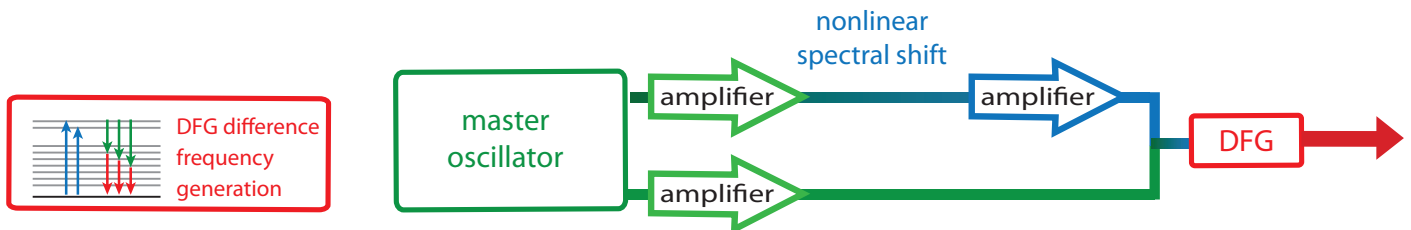
### SPECIFICATIONS

	MID-IR COMB 3.3 $\mu\text{m}$	MID-IR COMB 4.5 $\mu\text{m}$	MID-IR COMB 5-14 $\mu\text{m}$
Center Wavelength	3.3 $\mu\text{m}$ $\pm$ 0.1 $\mu\text{m}$	4.5 $\mu\text{m}$ $\pm$ 0.1 $\mu\text{m}$	5-14 $\mu\text{m}$ $\pm$ 0.1 $\mu\text{m}$
Power	>120 mW (at center wavelength)	>120 mW (at center wavelength)	>0.5 mW (between 5-13 $\mu\text{m}$ )
Tuning Range (optional)	>100 nm	4.0-4.7 $\mu\text{m}$	either 5-8 $\mu\text{m}$ or 8-14 $\mu\text{m}$
Repetition Rate	100 MHz or 250 MHz	100 MHz or 250 MHz	100 MHz
Bandwidth	>200 nm (>180 $\text{cm}^{-1}$ )	$\sim$ 100 nm ( $\sim$ 50 $\text{cm}^{-1}$ )	1-3 $\mu\text{m}$ depending on center wavelength (>200 $\text{cm}^{-1}$ )
Accuracy	$10^{-14}$ or same as reference, whichever applies first		
Stability	$5 \cdot 10^{-13}$ in 1 s or same as reference, whichever applies first		

### REQUIREMENTS

Input Requirements	10 MHz frequency reference, power level +7 dBm
Operating Voltage	100/115/230 VAC
Frequency	50 to 60 Hz
Operating Temperature	$22 \pm 5$ $^{\circ}\text{C}$

### OPTICAL SCHEME



Starting from Menlo's turn-key, reliable figure 9<sup>®</sup> fiber laser oscillators, a two-color femtosecond laser system is realized using spectral shifting in highly nonlinear fibers. The two branches of femtosecond pulses of different wavelengths are spatially and temporally overlapped and subsequently focused into a nonlinear crystal for difference frequency generation (DFG). This allows the generation of femtosecond pulses in the mid-IR covering the spectral range from 3  $\mu\text{m}$  to 14  $\mu\text{m}$  with high output power levels of up to 120 mW. Depending on the wavelength range, the mid-IR emission wavelength can be tuned by adjusting operation parameters, such as the DFG crystal temperature, DFG crystal poling periods, or DFG crystal angle. For accurate measurements, Menlo offers an easy to use stabilization of the comb repetition rate, which can be phase locked to an RF reference or optical reference allowing to generate sub-Hz optical linewidth in the mid-IR.

### ORDERING INFORMATION

<b>Product Code</b>	Mid-IR Comb
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Please call for pricing. Specifications are subject to change without notice. Custom modifications are available, please inquire.



Invisible laser radiation  
avoid exposure to beam  
Class 4 laser

