

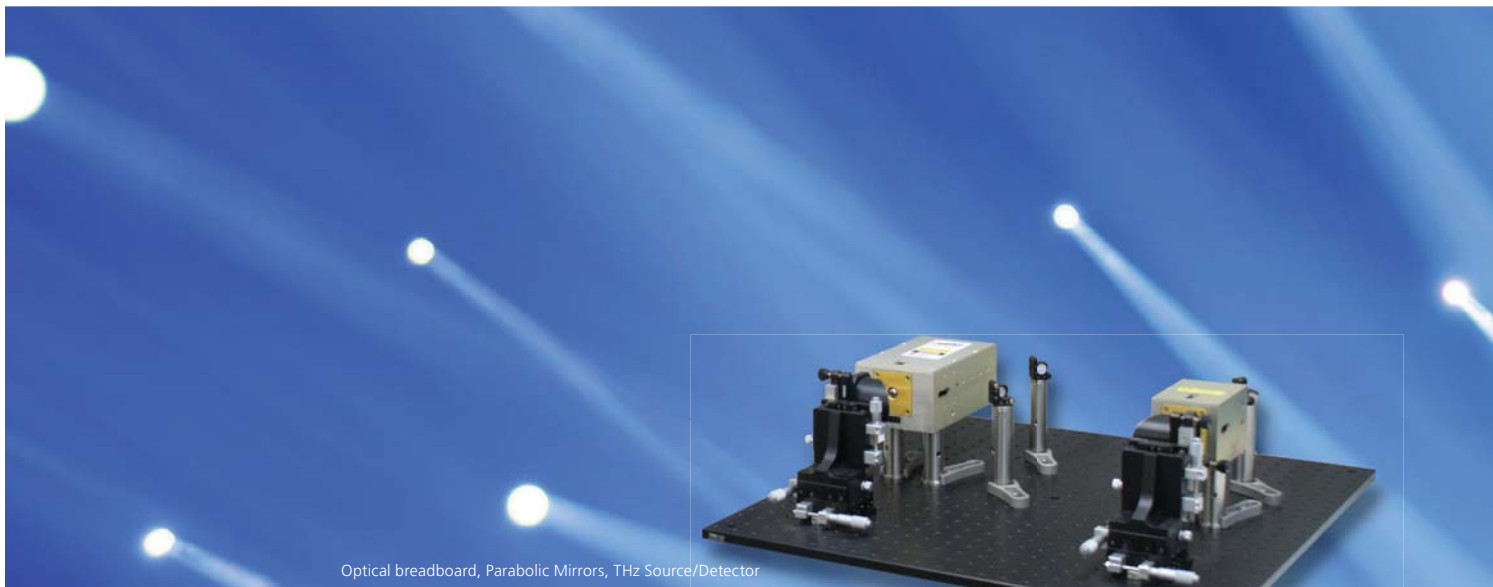
Product Brief

Specialty Photonics
EMCORE Broadband



PB7100

Frequency Domain Terahertz Spectrometer



Optical breadboard, Parabolic Mirrors, THz Source/Detector

Microwave and Terahertz Spectroscopy

EMCORE's versatile PB7100 Spectroscopy Platform is designed for scanning complex compounds to precise specifications with greater accuracy and control:

- **Full Turn-Key System:** Easy setup and configuration allowing for rapid implementation
- **Integrated Digital Control:** Data collection software and hardware included
- **Frequency Hopping Capability:** Custom configuration of scanning frequencies
- **High-Speed Ambient Solid State Detection:** No cryogenics required and fast data acquisition

Compound Signature Characterization

Identify complex compounds and create compound signature libraries faster than ever before:

- **High-Resolution:** Better than 0.25 GHz
- **Wide Spectral Range:** Up to 2 THz
- **Lock-in Detection with Electronic Chopping:** 10 Hz to 25 kHz
- **Active Frequency Monitoring:** EMCORE Proprietary frequency metrology
- **Configurations:** Custom & OEM configurations available
- **Optional:** Nitrogen purged enclosure

PB7100 Terahertz Spectroscopy —

Precise Resolution, Higher Accuracy and Turn-key Setup

Easy Installation, Complex Identifications

Designed for THz researchers and application developers who need to study the properties of materials at THz frequencies with high-resolution, but who don't want to design and build their own high-resolution THz spectroscopy system. The PB7100 can sweep a wide frequency range in a single rapid scan with precise frequency resolution.

The PB7100 employs precisely tuned semiconductor DFB lasers, advanced photo-mixing source and detector, and sophisticated digital control hardware and software to provide a fully turn-key laboratory THz spectrometer system. The room temperature solid-state homodyne detection technique can result in a system NEP of 10^{-12} W/Hz without the need for cryogenics. The highly efficient CW nature of the photo-mixing source puts all the THz power at the frequency of interest, yielding excellent signal-to-noise ratios across the scan range.

The previous generation time-domain THz spectroscopy systems required complicated and expensive ultra-fast mode-locked lasers and moving-mirror optical delay line assemblies which typically limited frequency resolution to 10 GHz at best. They also required the entire THz frequency range to be excited with broadband energy during the measurement interval. The highly precise tunable semiconductor laser diodes in the PB7100 excite only a single THz frequency for each frequency point in a scan, and can support linear scans with unprecedented frequency resolution of up to 100 MHz. They can also "frequency hop" between specific regions of interest in the spectrum with varying degrees of resolution, which can significantly speed data collection by omitting regions of the spectrum that do not need to be scanned. The separate source and detector heads may be configured to make measurements in a variety of transmission or reflection configurations, with or without an optional nitrogen-purged enclosure.

Table 1. PB7100 Performance Specifications

	Minimum	Typical	Maximum	Units
System Bandwidth	1800	1900	2000	GHz
Spectral Purity	0.010	0.015	0.025	GHz
Frequency Resolution	0.100	--	--	GHz
THz Output Power	100 GHz	2	4	μ W
	500 GHz	1	2	μ W
	1000 GHz	0.5	1	μ W
	1500 GHz	0.1	0.5	μ W
Detector Sensitivity (NEP @ 1000 GHz)	10^{-12}	10^{-11}	10^{-10}	W/Hz
Electronic Chopping Frequency	100	--	25,000	Hz
SNR @ 1000 GHz	40	55	60	dB Hz

Client Software Interface

The software interface provided with the PB7100 is straightforward and simple to use. The user inputs a start frequency, stop frequency and a resolution and starts the scan. The software automatically conducts the frequency scan and stores the data in a file on the hard drive. The Raw Data plot shows the interference pattern from the coherent detection while the Smoothed Data plot shows the data with the low frequency smoothing applied. Several absorptions due to atmospheric water vapor are visible in this trace.

Figure 1 (Left). PB7100 Client Software

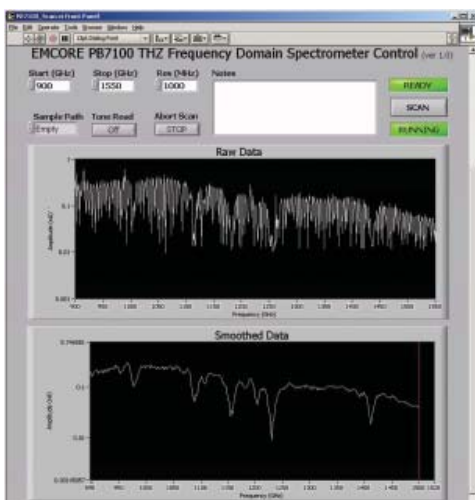
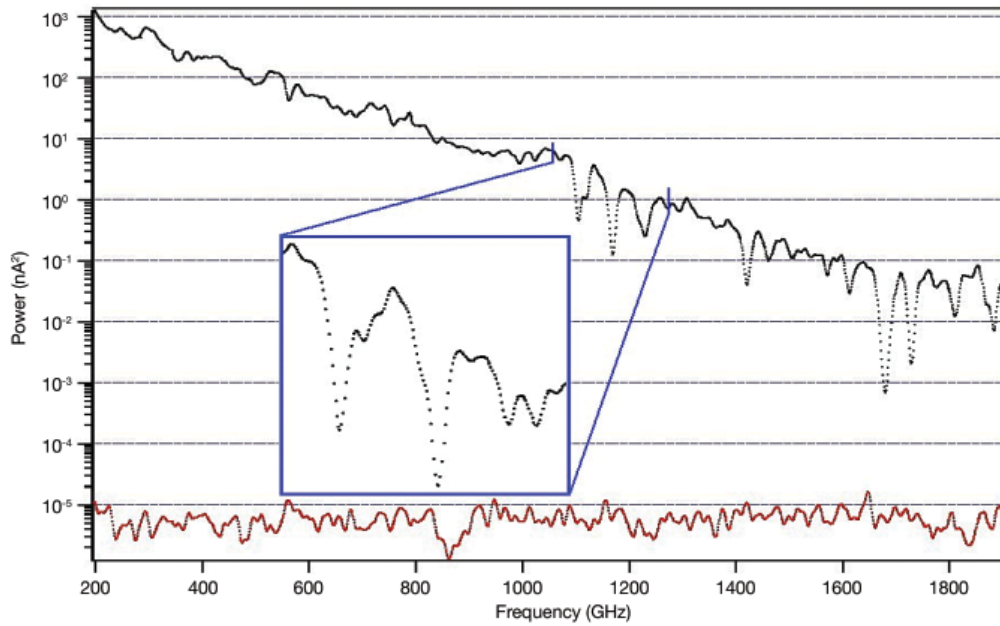
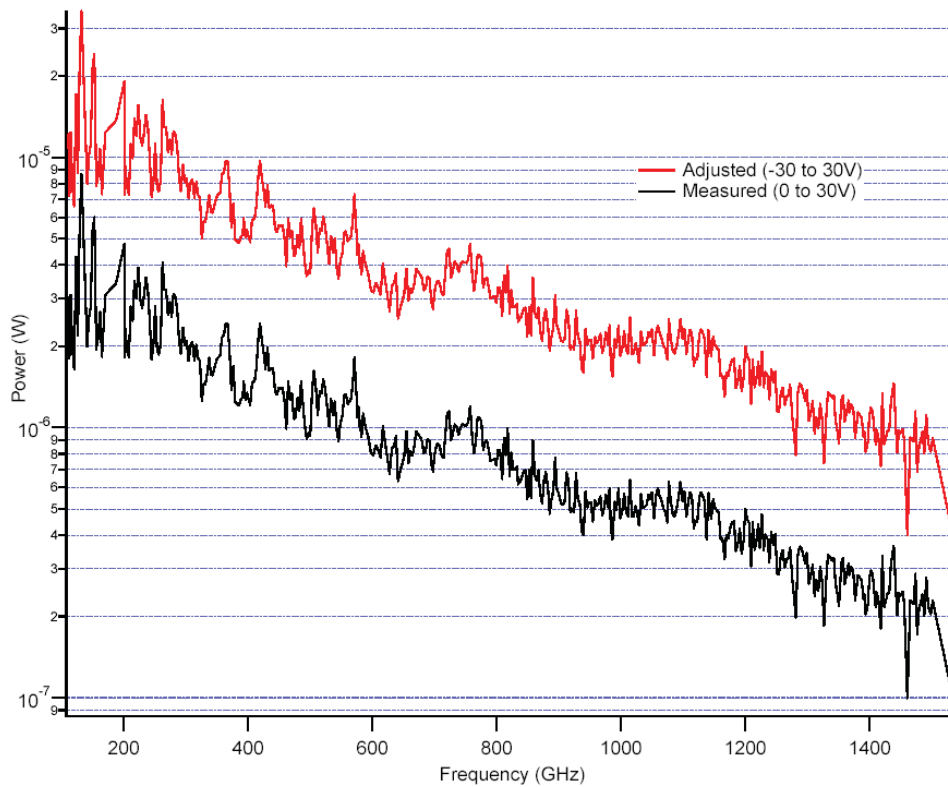


Figure 2. Smoothed Data Plot¹



An exemplary 1700 GHz scan of atmospheric water vapor in a 1 ft. path length with 1 GHz resolution and a 1 second time constant as compared to a scan with a blocked path. The inset is a rescan at higher resolution clearly showing the five water transitions.

Figure 3. Power / Frequency, with Electronic Chopping (Partial Frequency Range)¹



The bottom trace is the sub-mm power as measured directly on a calibrated Goly cell with the optical beam mechanically chopped. The top trace is the calculated power when electronic chopping and with phase sensitive detection is employed.

The EMCORE PB7100 Advantage

Only EMCORE offers a modular photonic solution with such a broad range of capabilities. The platform is turn-key, simplifying setup and installation, so you can start sampling complex compounds almost immediately. The custom nature of the PB7100 allows for many scanning options including: Continuous rapid scanning up to 2 THz, frequency hopping for customized scans, active frequency monitoring, precision scan resolutions better than 0.25 GHz & adaptable THz optical layout.

EMCORE PB7100 Specifications¹

Parameter	Specification
Operating ambient temperature	20° to 30° C
Storage temperature	5° to 50° C
Supply voltage	100V to 240V AC
Power consumption	15 W
Custom & OEM Configurations	Available

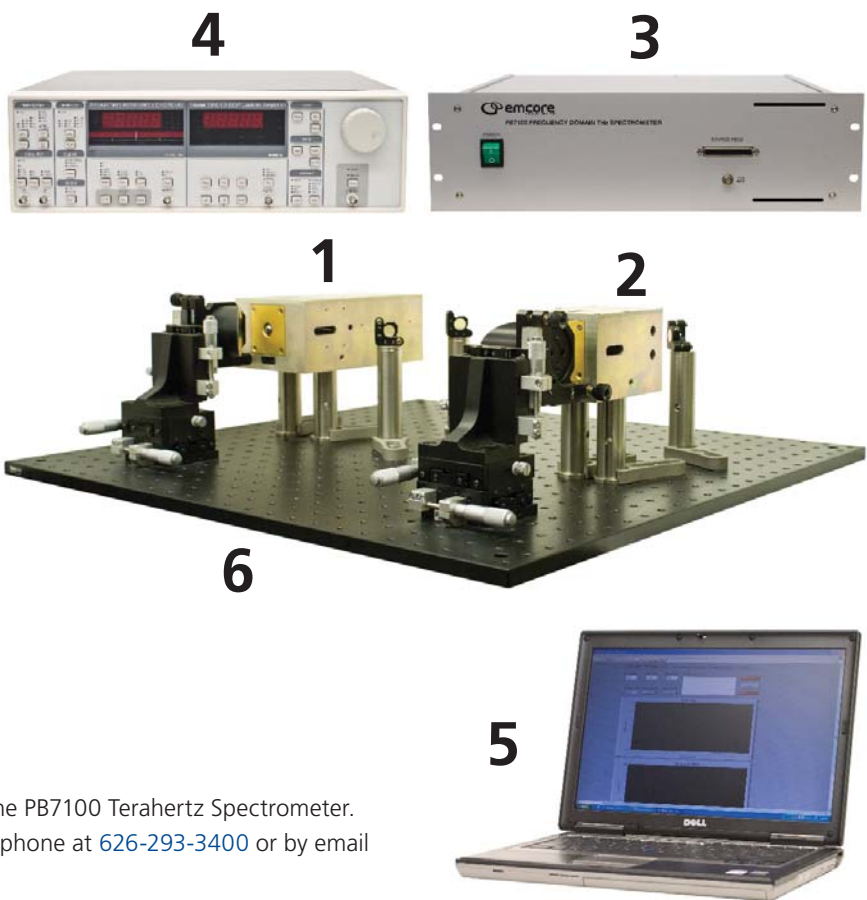
PB7100 Component Overview

1. THz source head
2. THz detector head
3. Rack unit with control electronics
4. Stanford Research Systems SR810 lock-in amplifier
5. Control and data acquisition computer pre-loaded with software
6. 2' x 2' Optical breadboard as shown with 2 parabolic mirrors on 5-axis translation stages
7. User Manual (not shown)
8. Nitrogen Purged Enclosure (optional)

For more information about the PB7100 Terahertz Spectrometer, visit www.emcore.com/fiber_optics

How To Buy

EMCORE Broadband is accepting orders for the PB7100 Terahertz Spectrometer. Please contact EMCORE Broadband either by phone at [626-293-3400](tel:626-293-3400) or by email specialty-sales@emcore.com.



¹Source: EMCORE internal testing, measurements, and calculations.

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Revision 20090109