



## PB7100 Frequency Domain Terahertz Spectrometer

The Emcore PB7100 is a simple-to-use turn-key system designed for THz researchers and application developers who need to study materials properties 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 from 100 GHz to 2.0 THz in a single rapid scan with frequency resolution better than 0.250 GHz.

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 results in a system NEP of  $10^{-12}$  W/Hz without any 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 ratio of 60 dB-Hz at 1 THz.

And unlike prior time-domain systems requiring complicated mode-locked lasers, the tunable semiconductor laser diodes in the PB7100 can support linear scans or can 'frequency hop' between frequencies of interest to scan specific regions of the spectrum with varying degrees of resolution. The separate source and detector heads may be configured to make measurements in transmission or reflection configurations.

### Applications

#### Threat signature characterization

- Explosives
- Biologicals
- Chemicals

#### Microwave and THz Spectroscopy

- Transmission mode
- Reflection mode

### Features and Benefits

Full turn key system – nothing else to buy to start taking THz measurements

Continuous rapid scanning from 100 GHz to over 2 THz

Integrated digital controller with data collection software and computer (included)

'Frequency Hopping' function

Active frequency monitoring

Electronic chopping: 10Hz to 50kHz

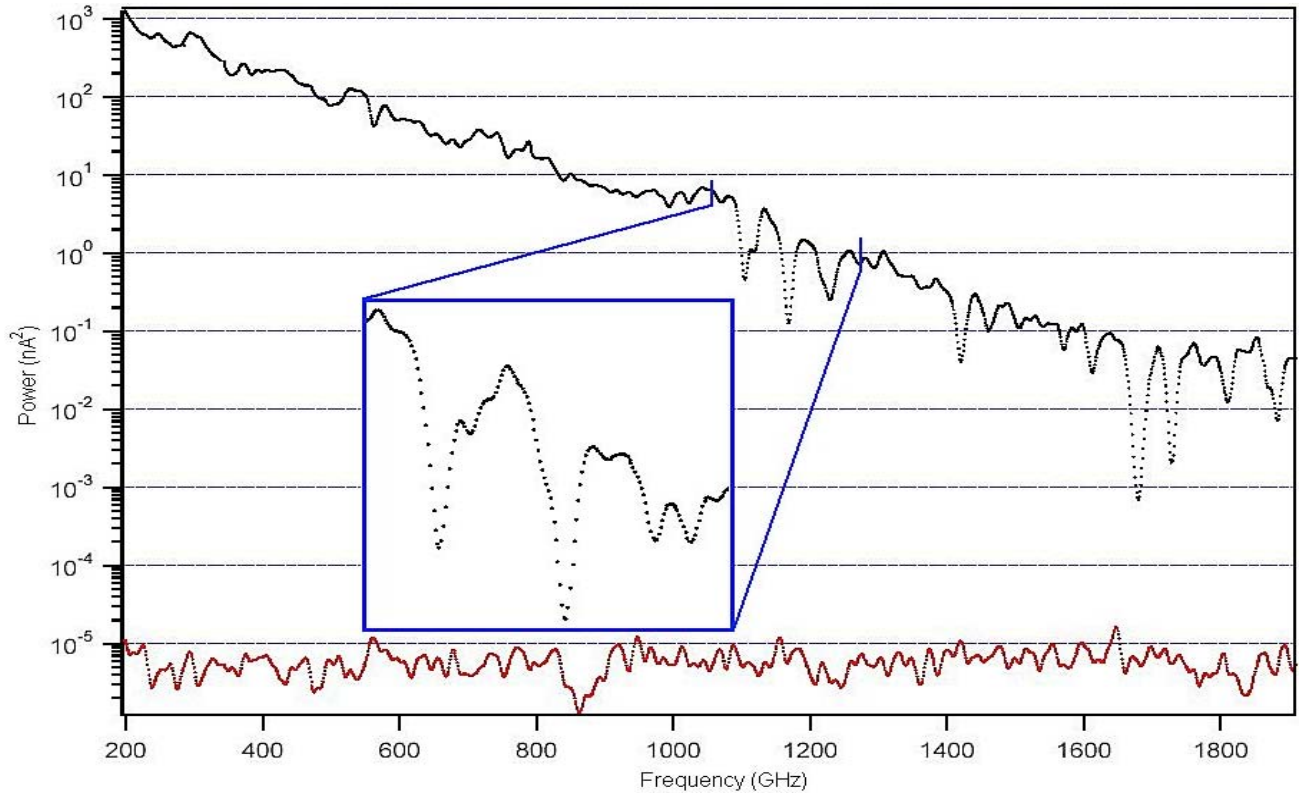
Room Temperature Solid State Detection

### Performance Highlights

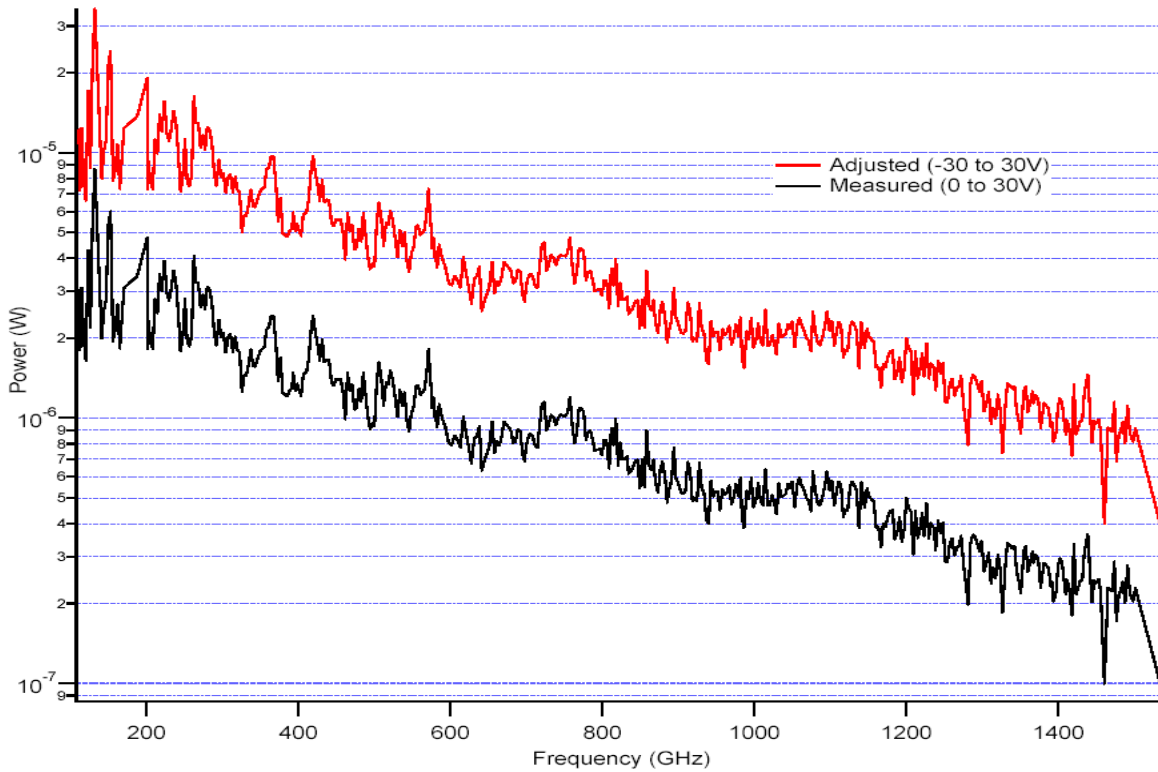
	Min	Typical	Max	Units	
Frequency Tuning Range	100	--	2000	GHz	
Spectral Purity	0.010	0.015	0.025	GHz	
Frequency Resolution	0.100	--	--	GHz	
THz Output Power	100 GHz	2	4	--	uW
	500 GHz	1	2	--	uW
	1000 GHz	0.5	1	--	uW
	1500 GHz	0.1	0.5	--	uW
Detector Sensitivity (NEP @ 1000 GHz)	$10^{-12}$	$10^{-11}$	$10^{-10}$	W/Hz	
Electronic Chopping Frequency	10	--	50,000	Hz	

**For more information on this and other products:**

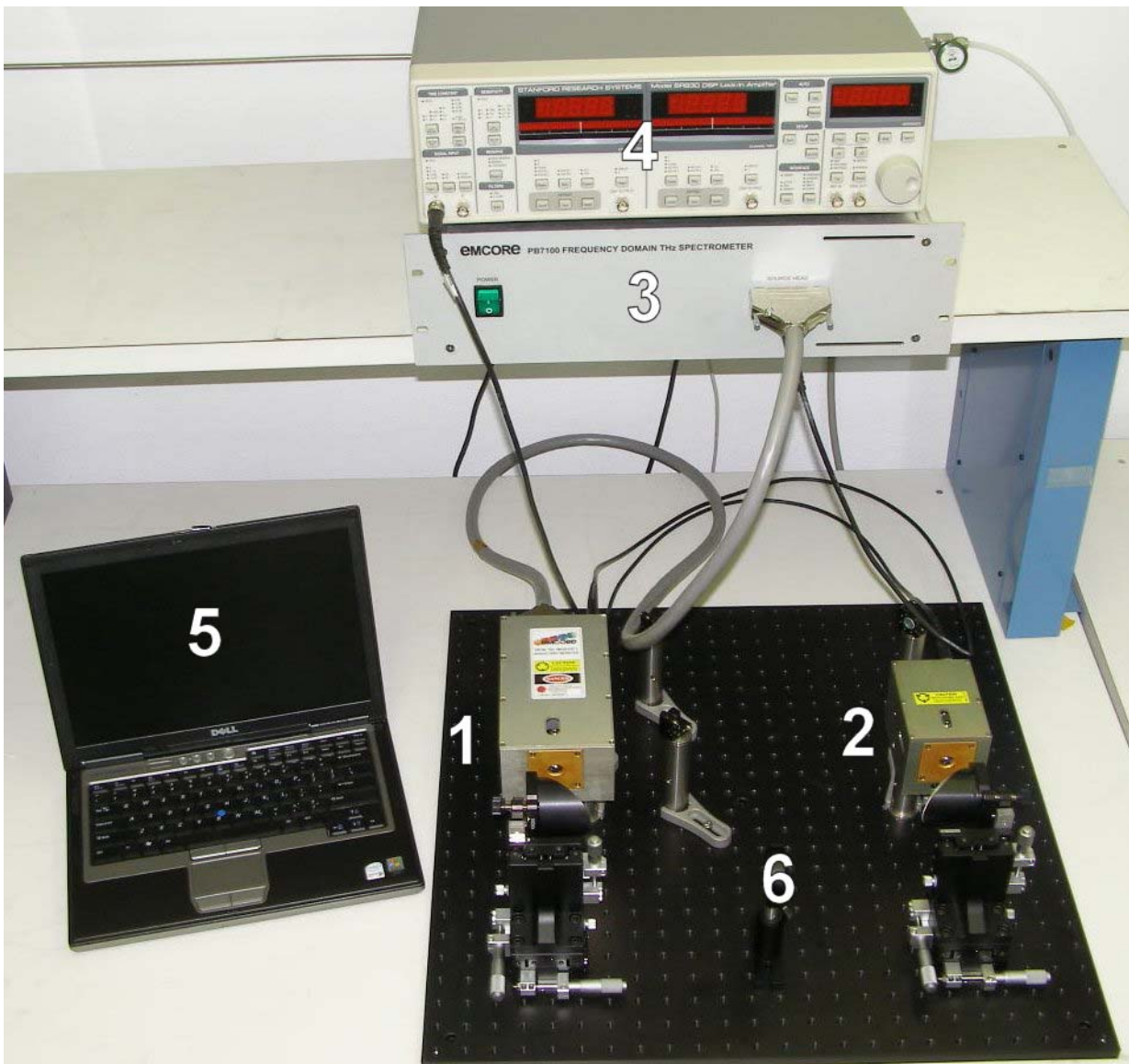
Contact Ron Logan at 626-293-3634, [rlogan@emcore.com](mailto:rlogan@emcore.com) or visit [www.emcore.com](http://www.emcore.com).



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



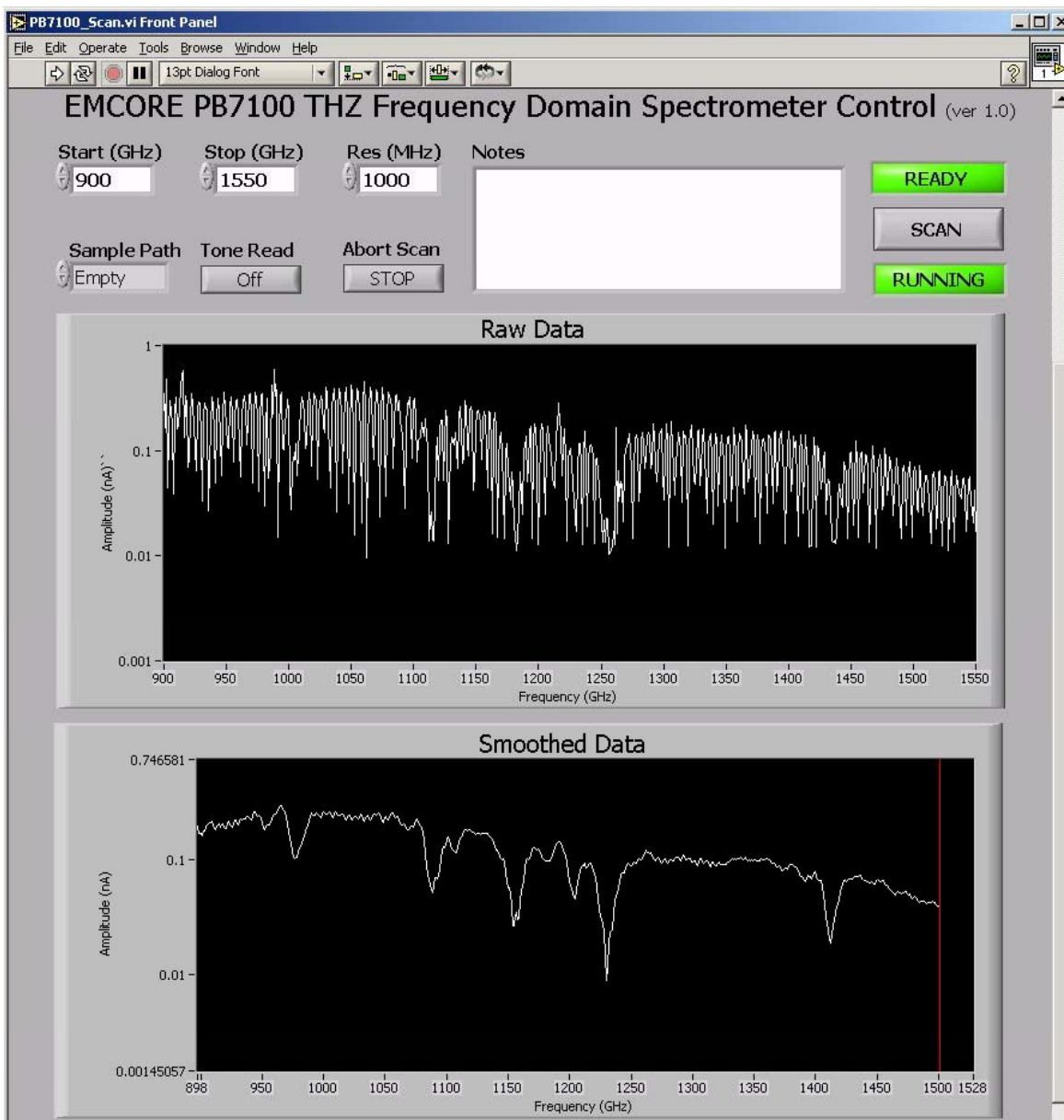
The bottom trace is the sub-mm power as measured directly on a calibrated Goly cell with the optical beam mechanically chopped. The top trace is the calculated power when electronic chopping is employed.



The PB7100 Frequency Domain THz Spectrometer is a complete system and includes:

1. THz source head
2. THz detector head
3. Rack unit with control electronics
4. Stanford Research Systems SR830 lock-in amplifier
5. Control and data acquisition computer with USB GPIB interface and software
6. 2' x 2' Optical breadboard as shown with 2 parabolic mirrors on 5-axis translation stages
7. Users manual (not shown)

The system is delivered as shown on a 2' X 2' optical breadboard with the parabolic THz mirrors aligned for a 1 cm diameter collimated THz beam, approximately 25 cm working space with the beam 15 cm off the optical breadboard.



The software interface provided with the PB7100 is straightforward and simple to use. The user simply 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.