

## Fiber-coupled THz Emitter and Detector



Fiber-coupled THz emitters and detectors offered by TERAVAL are designed for broadband operation and can be used in standard time-domain (THz-TDS) setup (Fig. 1).

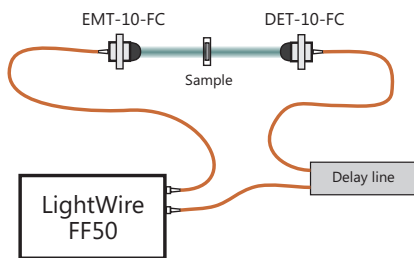


Fig. 1. THz time-domain spectroscopy setup

Depending on pump laser wavelength either low temperature grown GaAs (LT-GaAs) or GaBiAs is used as photoconductor. Materials features excellent sensitivity for wavelengths up to approx. 800 nm and 1060 nm with electron lifetime shorter than 1 ps. As a result ultra short half-cycle THz pulses with broad spectra up to 4 THz can be generated and detected. Pump beam fiber delivery eliminates time-consuming adjustments and ensures maximum flexibility of experiment. As an example, this feature allows fast and convenient switching between different geometries: transmission,

reflection, etc. THz emitters and detectors are mounted into compact housing compatible with standard 1" optical holders. Performance of each device is checked and technical passport, including testing report, is provided for customer.

### INTEGRATED SILICON LENS

THz emitters and detectors are supplied with integrated hyper-hemispherical lenses, made from high-resistivity silicon, attached to PCA to increase the radiation efficiency of THz waves into free space. TERAVAL offers two standard types of these lenses: for collimated or diverging THz beam output. Advantage of collimated THz beam output is simple setup, because no additional optical components between THz emitter and detector are required for experiment. However, this design features bigger spherical aberrations of THz beam, which affects focusing. In second case design of lens assumes positioning of the PCA in aplanatic point, which significantly reduces spherical aberrations. As a result nearly diffraction limited spot of THz beam can be achieved.

### FEATURES

- ▶ Based on unique GaAs and GaBiAs photoconductive materials
- ▶ Optimized for wavelengths around 800 nm and 1060 nm
- ▶ Technical passport and test report included

### APPLICATIONS

- ▶ Time-resolved broadband THz spectroscopy
- ▶ Optical pump-THz probe spectroscopy
- ▶ Suitable for all-in-fiber system solution



FC-Emitter (or detector) mounted on 1" optical holder

**PHOTOCONDUCTIVE ANTENNA (PCA)**

Photoconductive antennas are particularly designed for THz emitter or THz detector. The substrate of GaAs contains mesa-etched epitaxial active layer of GaBiAs in order to achieve high dark resistance. High photosensitivity of the material allows use of low average power optical pulses for excitation. On its surface a coplanar Hertzian type dipole antenna structure is formed using AuGeNi metallization (Fig. 2). The gap between metallic contacts is similar to laser spot diameter in detector case and larger – in emitter case. Photoconductive chip is mounted on PCB and placed inside metallic housing of device. SMA sockets on back side of the housing are used to connect DC or AC bias to THz emitter or lock-in amplifier input to THz detector.

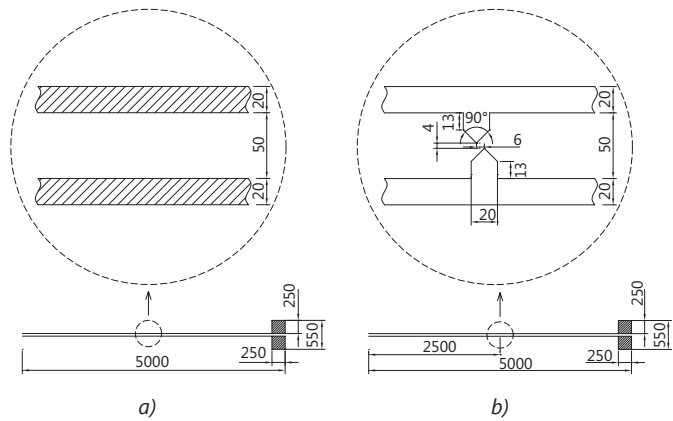


Fig. 2. Microstrip antenna drawings: (a) emitter, (b) detector (all dimensions are in micrometers)

**SPECIFICATIONS**

Model	Emitters		Detectors <sup>3)</sup>	
	EMT-08-FC	EMT-10-FC	DET-08-FC	DET-10-FC
<b>PHOTOCONDUCTIVE ANTENNA</b>				
Photoconductive material	LT-GaAs	GaBiAs	LT-GaAs	GaBiAs
Dimensions of the wafer	5 × 1.5 mm			
Thickness	600 μm			
Antenna type	strip line		dipole	
Bias voltage	50 V max, 40 V typical			
Central THz frequency	~0.5 THz		0.5 THz	
Detected THz bandwidth	-		up to 5 THz	
<b>INTEGRATED FOCUSING LENS</b>				
Material	HRFZ-silicon			
Geometrical form	hyper-hemi-sphere			
THz beam output	collimated or diverging		-	
<b>FIBER DELIVERY</b>				
Wavelength	800±40 nm	1060±40 nm	800±40 nm	1060±40 nm
Fiber length <sup>1)</sup>	1±0.1 m			
Maximum optical power on fiber input <sup>2)</sup>	<100 mW			
Fiber connector	FC/PC			

<sup>1)</sup> Other fiber lengths are available on request.

<sup>2)</sup> For laser pulse repetition rate in range 10-100 MHz.

<sup>3)</sup> Could be ordered with operational preamplifier.

**ORDERING INFORMATION**

Description	Model	Notes
Fiber-coupled THz emitter for 800 nm wavelength	EMT-8-FC	Includes Si lens, optical fiber with FC/APC connector and coaxial cable with BNC connector
Fiber-coupled THz detector for 800 nm wavelength	DET-8-FC	Includes Si lens, optical fiber with FC/APC connector and coaxial cable with BNC connector
Fiber-coupled THz emitter for 1060 nm wavelength	EMT-10-FC	Includes Si lens, optical fiber with FC/APC connector and coaxial cable with BNC connector
Fiber-coupled THz detector for 1060 nm wavelength	DET-10-FC	Includes Si lens, optical fiber with FC/APC connector and coaxial cable with BNC connector

**FIBER DELIVERY**

Teravil supply zero dispersion optical fiber. In such fiber femtosecond pulse keeps its form and pulse duration doesn't differ much on input and output of fiber. Laser radiation is delivered through FC/PC fiber connector. It is focused onto PCA using lenses fixed inside the housing of THz emitter and THz detector.