

I. TECHNICAL SPECIFICATION OF TERAHERTZ DETECTION SYSTEMS

Product description:

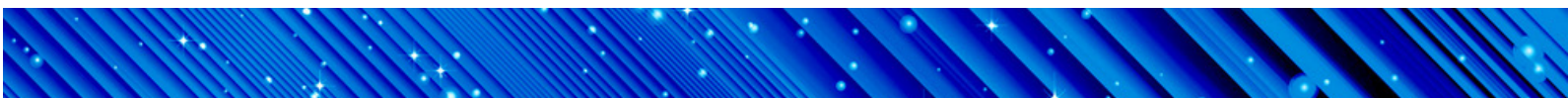
The Terahertz detection systems are optimized for three frequency ranges, which cover the overall range of 0.3-70 THz. The system incorporates a MoRe/NbN Superconducting Hot-Electron Bolometer (SHEB) mounted on a silicon/germanium lens and low-noise cryogenically cooled high electron mobility field-effect transistors (HEMT) amplifier.

Scotel offers the fastest Terahertz receivers, which have a sensitivity comparable with the best detection systems available today.

Technical specifications:

Type 1, 1a: Hybrid antenna (Ø12 mm silicon hyperhemispherical lens and logarithmic periodic spiral antenna)

Type	1	1a
Frequency range, THz	0.1-6	
Upper level of dynamic range, μW (3dB compression point)	0.1	
Noise equivalent power (NEP), $\text{W}\cdot\text{Hz}^{-1/2}$	$5-7 \times 10^{-14}$	$3-5 \times 10^{-13}$
Responsivity, V/W (own HEB characteristic)	$\sim 10,000$	$\sim 3,000$
Response time, ns	1	0.05
Sensitive material	MoRe	NbN
Bandwidth of HEMT amplifier, MHz	0.01-200	1-3500
Maximum power handling capacity	50 μW	
Input beam	Max diameter	10 mm
	Beam pattern	F/3 to F/ ∞ (collimated beam)

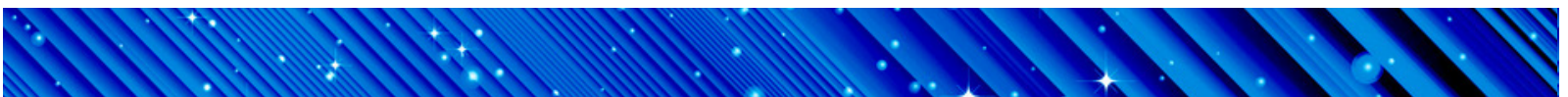


Type 2, 2a: Silicon lens (Ø12mm or Ø4mm silicon hyperhemispherical lens)

Type	2	2a
Frequency range, THz	1-40	
Upper level of dynamic range, μW (3dB compression point)	50	
Noise equivalent power (NEP), $\text{W}\cdot\text{Hz}^{-1/2}$	$1-2 \times 10^{-11}$	$6-8 \times 10^{-11}$
Responsivity, V/W (own HEB characteristic)	~ 300	~ 100
Response time, ns	1	0.1
Sensitive material	MoRe	NbN
Bandwidth of HEMT amplifier, MHz	0.01-200	1-3500
Maximum power handling capacity	10 mW	
Input beam	Max diameter	10 mm (3 mm)
	Beam pattern	F/3 to F/∞ (collimated beam)

Type 3, 3a: Germanium lens (Ø12 mm germanium hyperhemispherical lens)

Type	3	3a
Frequency range, THz	25-100	
Upper level of dynamic range, μW (3dB compression point)	2	
Noise equivalent power (NEP), $\text{W}\cdot\text{Hz}^{-1/2}$	$1-2 \times 10^{-12}$	$4-5 \times 10^{-12}$
Responsivity, V/W (own HEB characteristic)	$\sim 2,000$	~ 500
Response time, ns	1	0.1
Sensitive material	MoRe	NbN
Bandwidth of HEMT amplifier, MHz	0.01-200	1-3500
Maximum power handling capacity	1 mW	
Input beam	Max diameter	10 mm
	Beam pattern	F/3 to F/∞ (collimated beam)



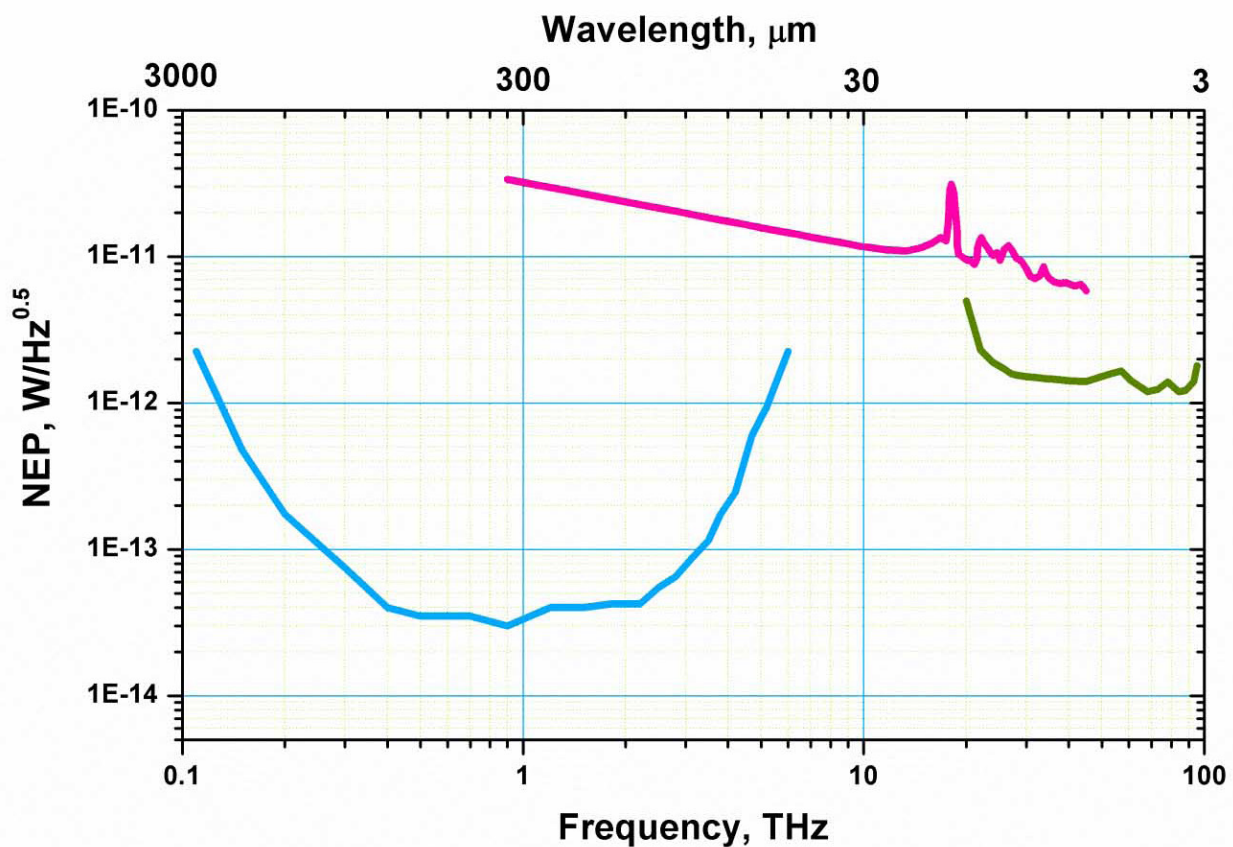
General parameters:

Number of channels: **1 or 2**
 Electrical connection: **SMA-50 Ohm**
 Driver interface: USB, LabVIEW

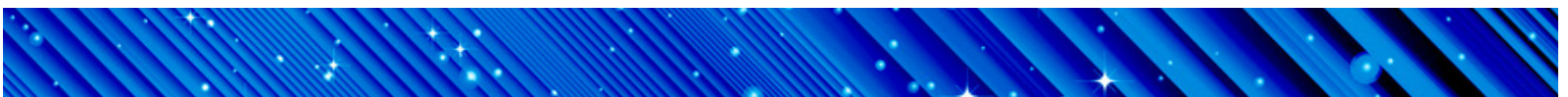
Advantages of the System:

Response time down to **50 ps**
 Possibilities for different beam geometry [beam pattern **F/3** to **F/∞** (collimated beam)]
 Registration of short pulses (THz pulses from **nano-** to **pico**seconds)
 Ultra-high sensitivity

Typical frequency dependence of the noise equivalent power (NEP) for three types of detecting system:



Blue line - type 1; Red line - type 2; Green line - type 3

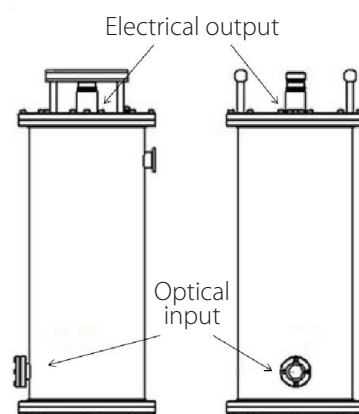


II. CHARACTERISTICS of the COOLING SYSTEMS

Two types of cooling system are available:

1) Liquid helium Cryostat

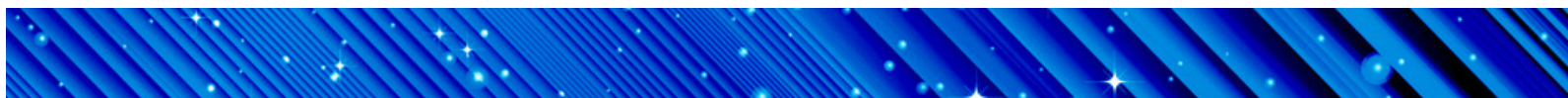
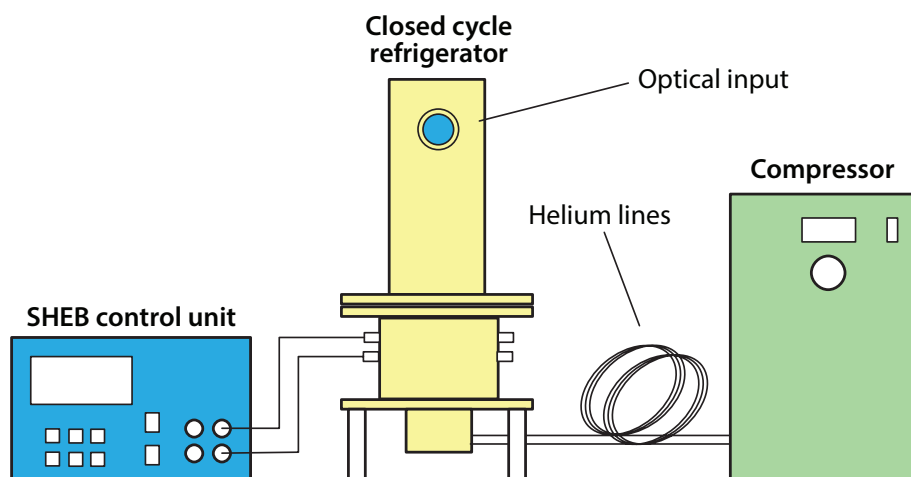
Type of cryostat	1	2
Volume of liquid helium	1 liter	2 liters
Liquid helium hold time	more than 5 hours	more than 7 hours
Weight	9 kg	13 kg
Height	380 mm	490 mm
Diameter	150 mm	250 mm



2) Closed-Cycle Refrigerator (Cryogenic-Free)

Element/Parameter	Closed-cycle refrigerator	Compressor	Control unit
Weight, kg	25	75	1
Length x width x height	240 x 240 x 580 mm	450 x 320 x 560 mm	240 x 260 x 140 mm
Preparation time	150 min	-	-
Maintenance, hours	10,000	30,000	-
Power consumption	1.5 kW*		30 W*

*Voltage of control unit and compressor: 100-240 V/ 50-60 Hz (can be adapted to any other standard networks)



III. CONFIGURATION OF THE TERAHERTZ DETECTION SYSTEMS

TYPE OF SYSTEM	THE COMPLETE SYSTEM
ALL TYPES	<p>1. Detection Unit Based on: Liquid helium cryostat (Capacity – 1 liter (2 liters)) LHe bath hold time – ≥ 5 hours (≥ 7 hours) or Closed cycle refrigeration (time to reach operating temperature < 2.5 hours)</p> <p>THz window IR radiation filter Cupronickel or Stainless steel coaxial cable</p> <p>Bolometer holder: SHEB Bolometet chip Micro-strip line with SMA connector Hypersemispherical lens (HRFZ Si or Ge) Heater</p> <p>Cryogenically cooled HEMT preamplifier Gain – > 27 dB (with Bias-T adapter) Optimal frequency range: 0.1 – 250 MHz 1 ns version 1 – 3500 MHz 50 ps version</p> <p>2. Control Unit Input voltage AC: 200-240 V, 50-60 Hz</p> <p>Output for HEMT amplifier: DC +/-6 V, 50 mA Output for Heater: DC 0-5 V, accuracy +/-1 mV Output for bolometer: It can be used in two modes - constant current and constant voltage Room temperature amplifier (<u>optionally</u>): 0.1 – 250 MHz 1 – 3500 MHz</p> <p>3. Compressor</p> <p>4. Operation manual</p>

