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.

Scontel 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		0.3-3	
Upper level of dynamic range, μW (3dB compression point)		0.1	
Noise equivalent power (NEP), $W \cdot Hz^{-1/2}$		$5\text{-}7 \times 10^{-14}$	$3\text{-}5 \times 10^{-13}$
Responsivity, V/W (own HEB characteristic)		~10,000	~ 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		1-12 (40)	
Upper level of dynamic range, μW (3dB compression point)		50	
Noise equivalent power (NEP), $W \cdot Hz^{-1/2}$		$1\text{-}2 \times 10^{-11}$	$6\text{-}8 \times 10^{-11}$
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		25-70	
Upper level of dynamic range, μW (3dB compression point)		2	
Noise equivalent power (NEP), $W \cdot Hz^{-1/2}$		$1\text{-}2 \times 10^{-12}$	$4\text{-}5 \times 10^{-12}$
Responsivity, V/W (own HEB characteristic)		~ 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:

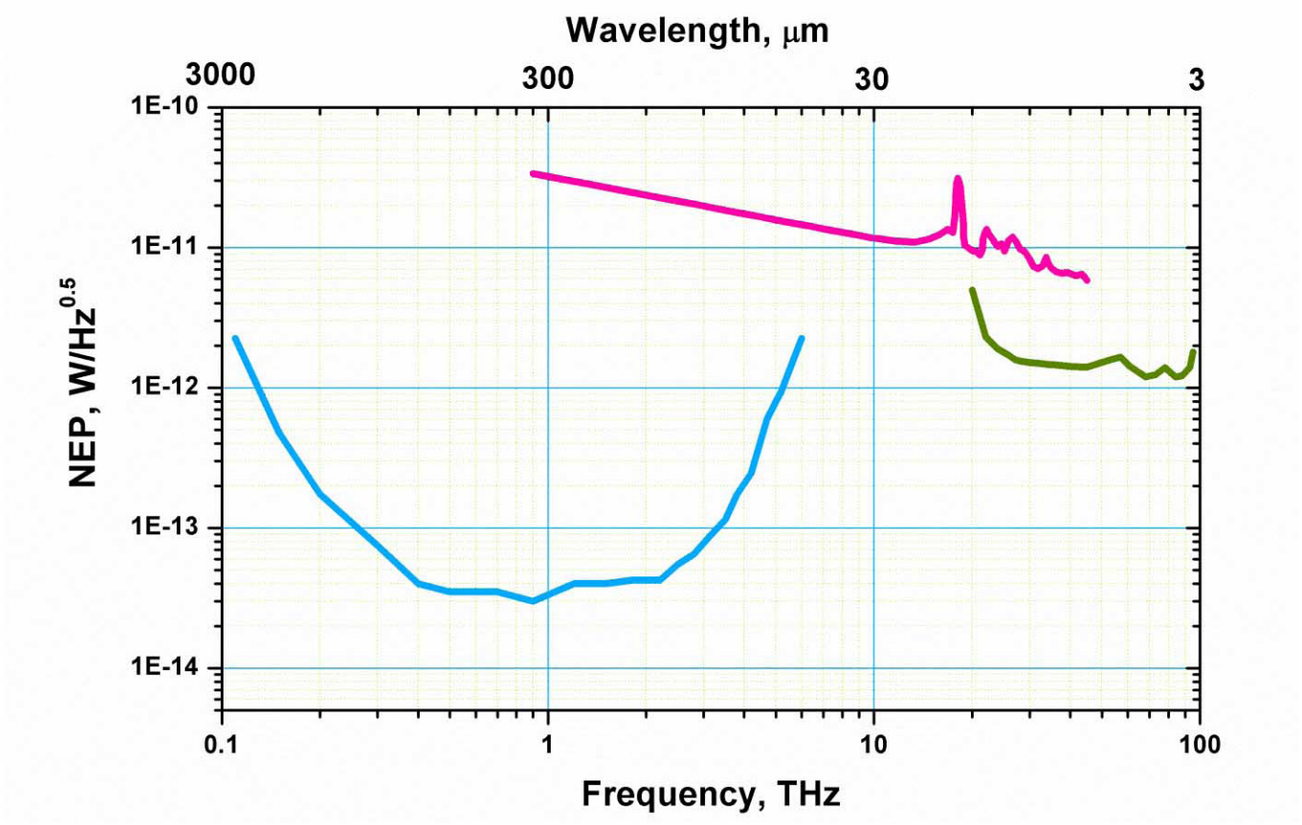
Response time down to **50 ps**

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:



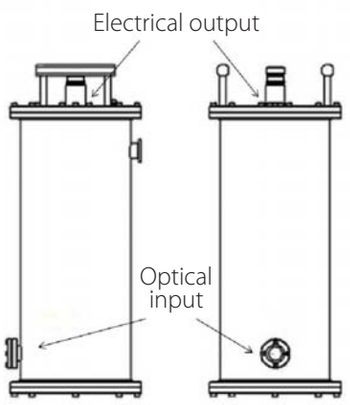
Blue line - type 1; Red line - type 2; Green line - type 3

II. CHARACTERISTICS of the COOLING SYSTEMS

Two types of cooling system are available:

1) Liquid helium Cryostat

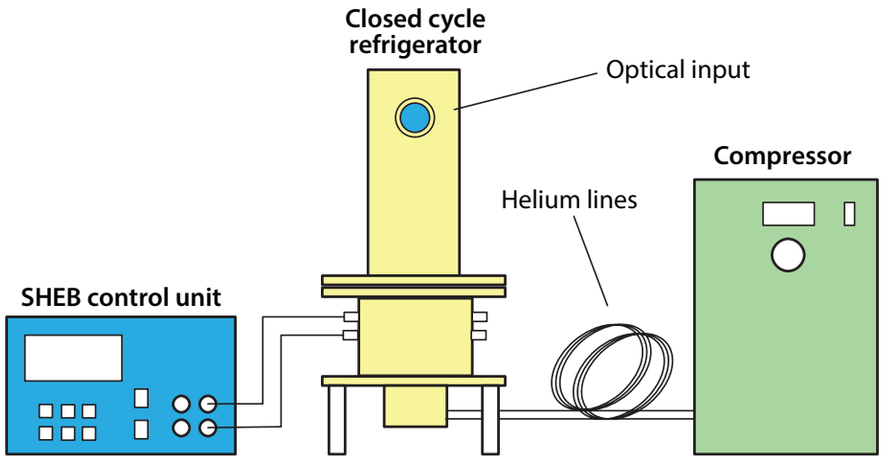
Type of cryostat	1	2
Volume of liquid helium	1 liter	2 liters
Liquid helium hold time	more than 5 hours	more than 7 hours
Weight	9 kg	13 kg
Height	380 mm	490 mm
Diameter	150 mm	250 mm



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	**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) THz window IR radiation filter Cupronickel or Stainless steel coaxial cable Bolometer holder: SHEB Bolometet chip Micro-strip line with SMA connector Hypersemispherical lens (HRFZ Si or Ge) Heater 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 **2. Control Unit** Input voltage AC: 200-240 V, 50-60 Hz 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 (optionally): 0.1 – 250 MHz 1 – 3500 MHz **3. Compressor** **4. Operation manual**

IV. DELIVERY TERMS OF TERAHETZ DETECTION SYSTEMS

Delivery Time:

Type 1, 1a: 12-14 weeks after receipt of Purchase Order;

Type 2, 2a: 12-14 weeks after receipt of Purchase Order.

Type 3, 3a: 13-15 weeks after receipt of Purchase Order.

Delivery Terms: DAP Buyer's city (Incoterms 2010)

Payment Terms: Payment only after 30 days of successful testing.

All bank charges are at the Seller's cost