Cosmic Microwave Technology, Inc.

NEW! Miniaturized
NEW! Multi-Channel

CMT-BA0.5

Cryogenic SiGe Low Noise Amplifier (Ultra Low Frequency)

KEY FEATURES

- Applications include Radio Astronomy and low temperature physics.
- Single supply operation
- Female SMA connectors standard
- SMPM connectors available
- Optional input DC bias tees
- Standard size 27.1 x 15.9 x 8.7 mm
- Miniature size 21.3 x 10.4 x 8.5 mm
- Quad Amplifier size 25.3 x 32.2 x 8.3 mm

PERFORMANCE FEATURES

- RF frequency
  - 500 KHz to 0.5 GHz Useable to 2 GHz
- Gain
  - 30 dB ± 2 dB
- Noise temperature
  - < 3.5 K @ 500KHz to 500MHz
- Optimum DC Power
  - Vd = 2.0 V
  - Id = 13 mA

APPLICATIONS

- ✓ Radio astronomy arrays
- ✓ Superconducting Nano Wire Single Photon Detectors
- ✓ Low Temperature Physics Experiments

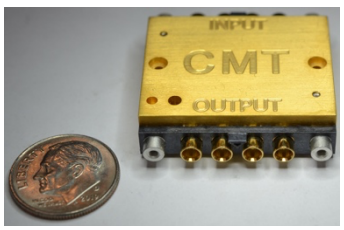
Description

The CMT-BA0.5 is a cryogenic SiGe low noise amplifier ideal for Radio Astronomy and Low Frequency Physics applications. The CMT-BA0.5 is optimized for low frequency applications. This amplifier covers the frequency range down to 500 KHz and up to 500 MHz. The amplifier has acceptable performance up to 2.0 GHz. The typical noise temperature is less than 2.5 K from 500KHz to 500 MHz and less than 5 K up to 2 GHz. The gain of the amplifier is typically 30 dB with a gain flatness of +/- 1 dB.

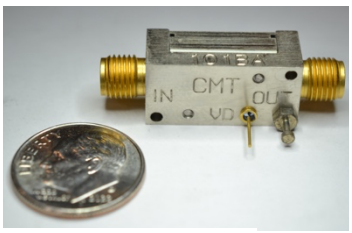
DC power is supplied from a single DC power source. Optimum performance is obtained with a supply voltage of 2.0 V. The supply current is 13 mA at this voltage. The supply voltage can be reduced to 1.5 V @ 6.5 mA for low power applications.

The standard chassis is 27.1 x 15.9 x 8.7 mm excluding connectors. The amplifier is also available in our NEW miniature version which is 21.3 x 10.4 x 8.5 mm without bias tees and 23.0 x 13.2 x 8.5 mm with bias tees.

CMT is also producing a Quad amp version which contains four independent amplifiers in a single package with the size of 25.3 x 32.2 x 8.3 mm and a dual amplifier configuration, and a chassis that incorporated shielded SMA connectors for *ALL* DC connections, amplifier supply and input DC Bias tees.

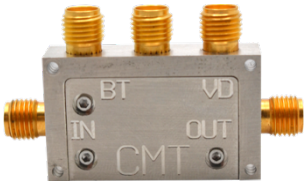


Multichannel Quad Amp

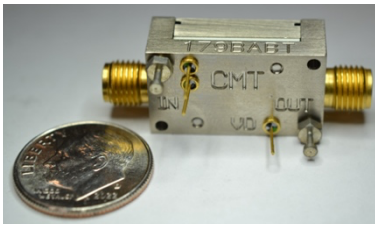


Miniature BA Chassis

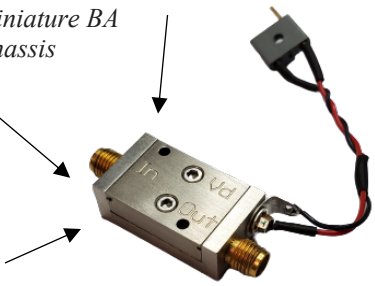
DC CONNECTIONS
For High Noise Environments



New shielded SMA connectors



Miniature BABT with Bias Tees



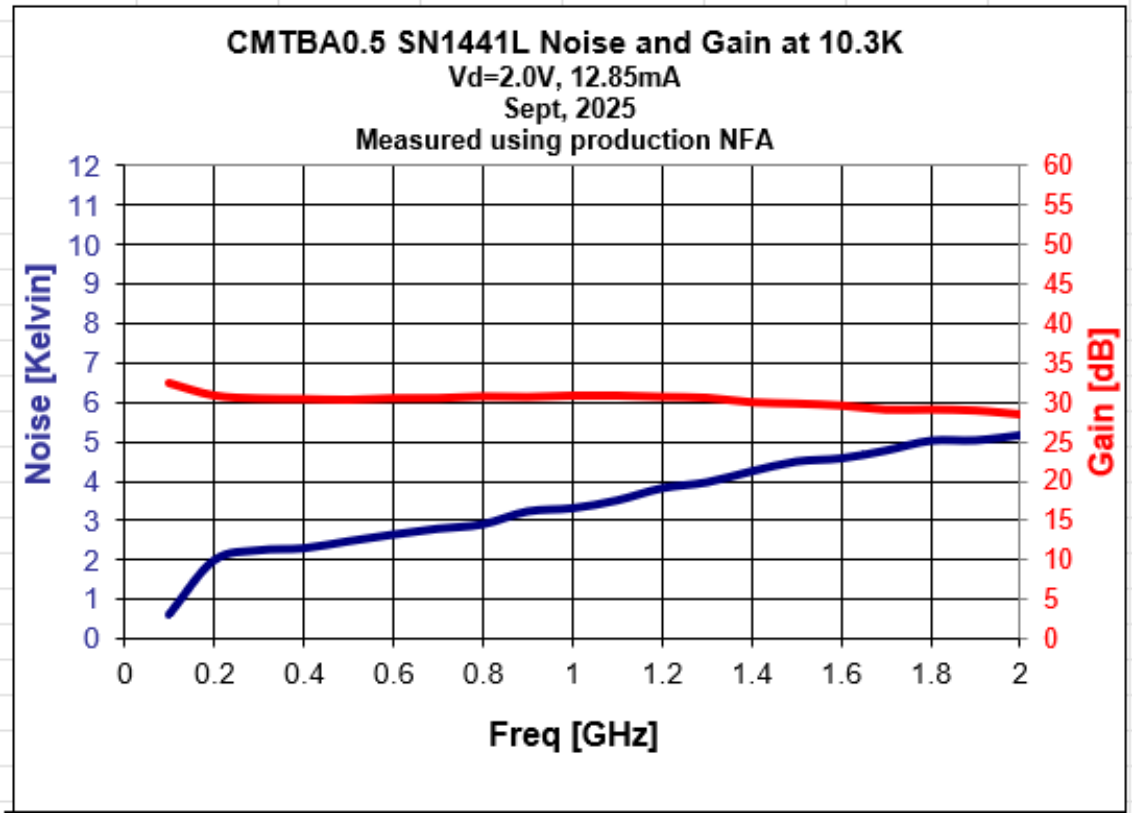
Electrical Specifications @ 12 K

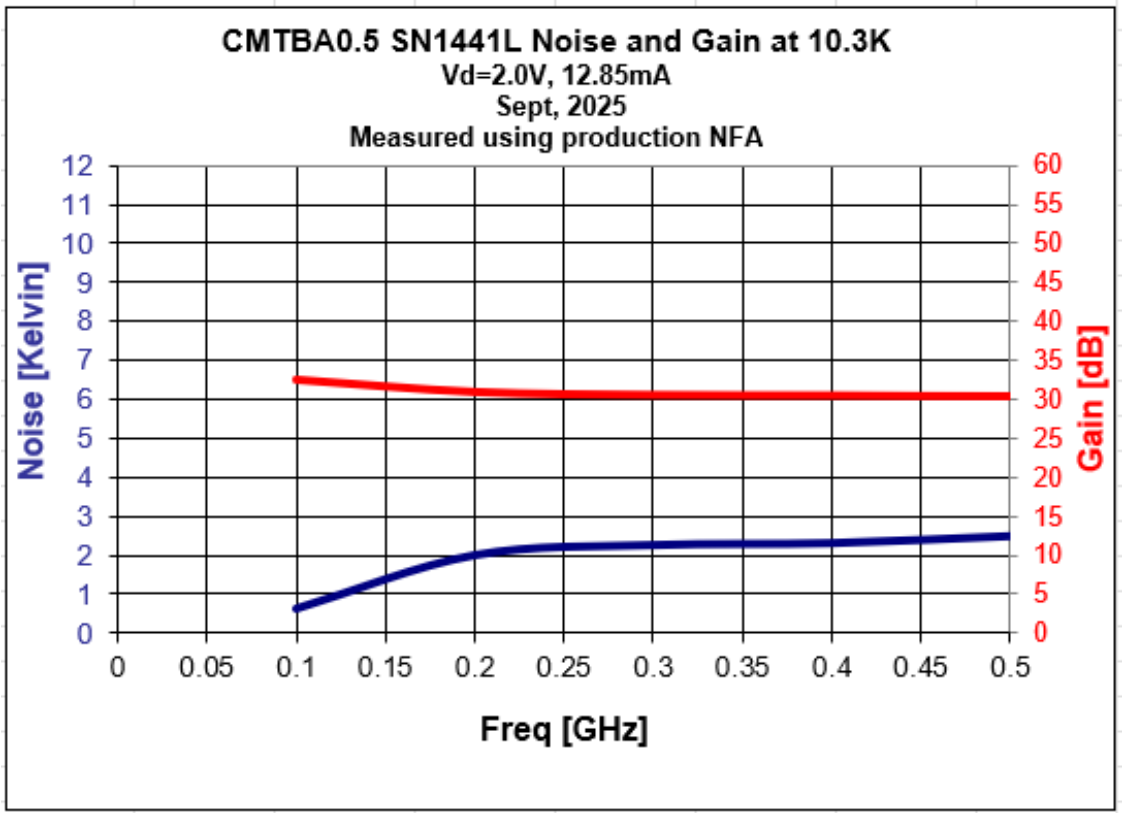
Description	Typical	Minimum	Maximum
RF Frequency		500 KHz	500 MHz
Gain		30 dB ± 2 dB	
Noise Temperature	< 3.5K	3.0 K	2.5 K
IRL (-20log|S_{11}|)	-15 dB	< -10 dB	
ORL (-20log|S_{22}|)	- 10 dB	< -10 dB	
DC Voltage	2.0 V	1.5 V	3 V
DC Current	13.1 mA	6.5 mA	25 mA

Electrical Specifications @ 300 K

Description	Typical	Minimum	Maximum
RF Frequency		500 KHz	500 MHz
Gain @ 2.5V	27 dB	27 dB ± 2 dB	
Noise Temperature @ 2.5V	< 60K	35K	55K
IRL (-20log|S_{11}|)		< -10 dB	
ORL (-20log|S_{22}|)		< -15 dB	
DC Voltage	2.5 V	1.1 V	5 V
DC Current	10.6 mA	2.2 mA	2.6 mA

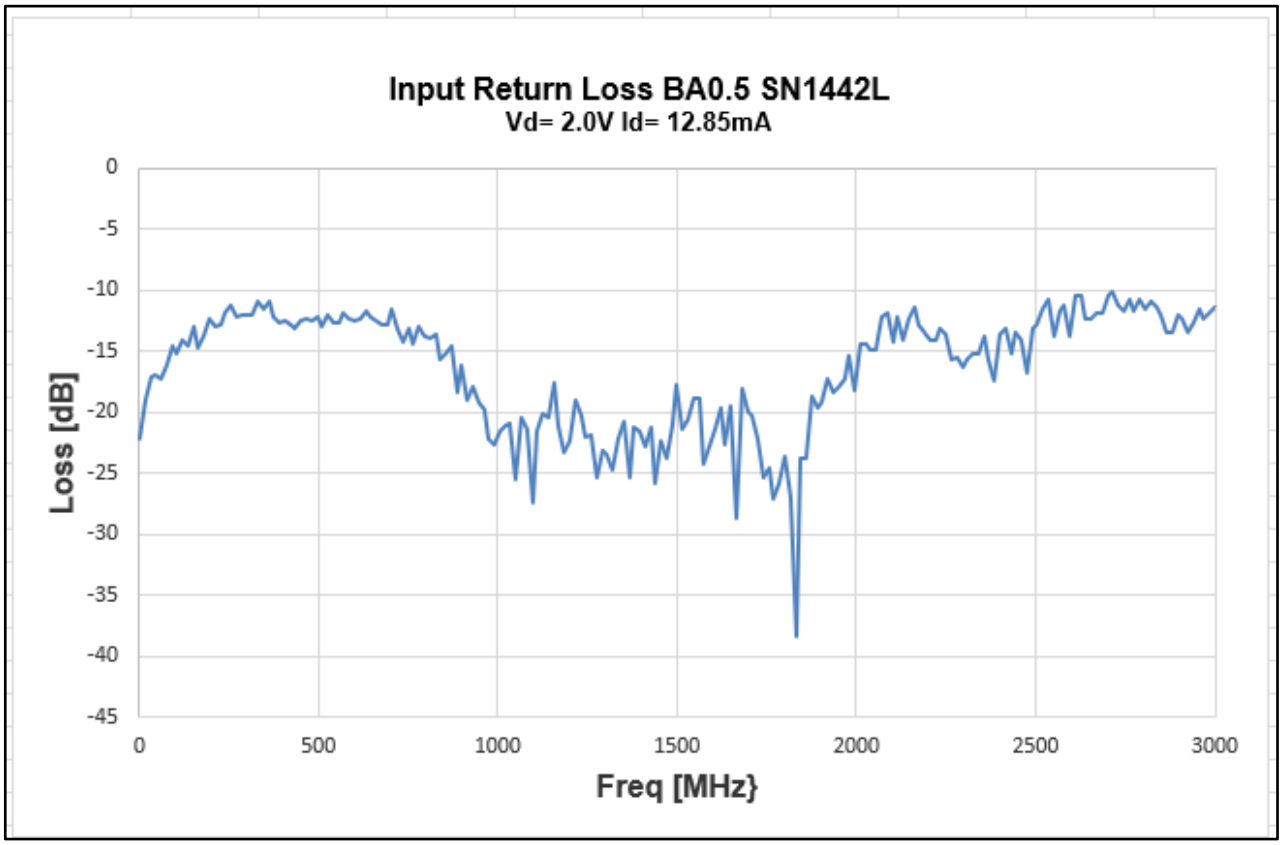
Noise and Gain Measurements

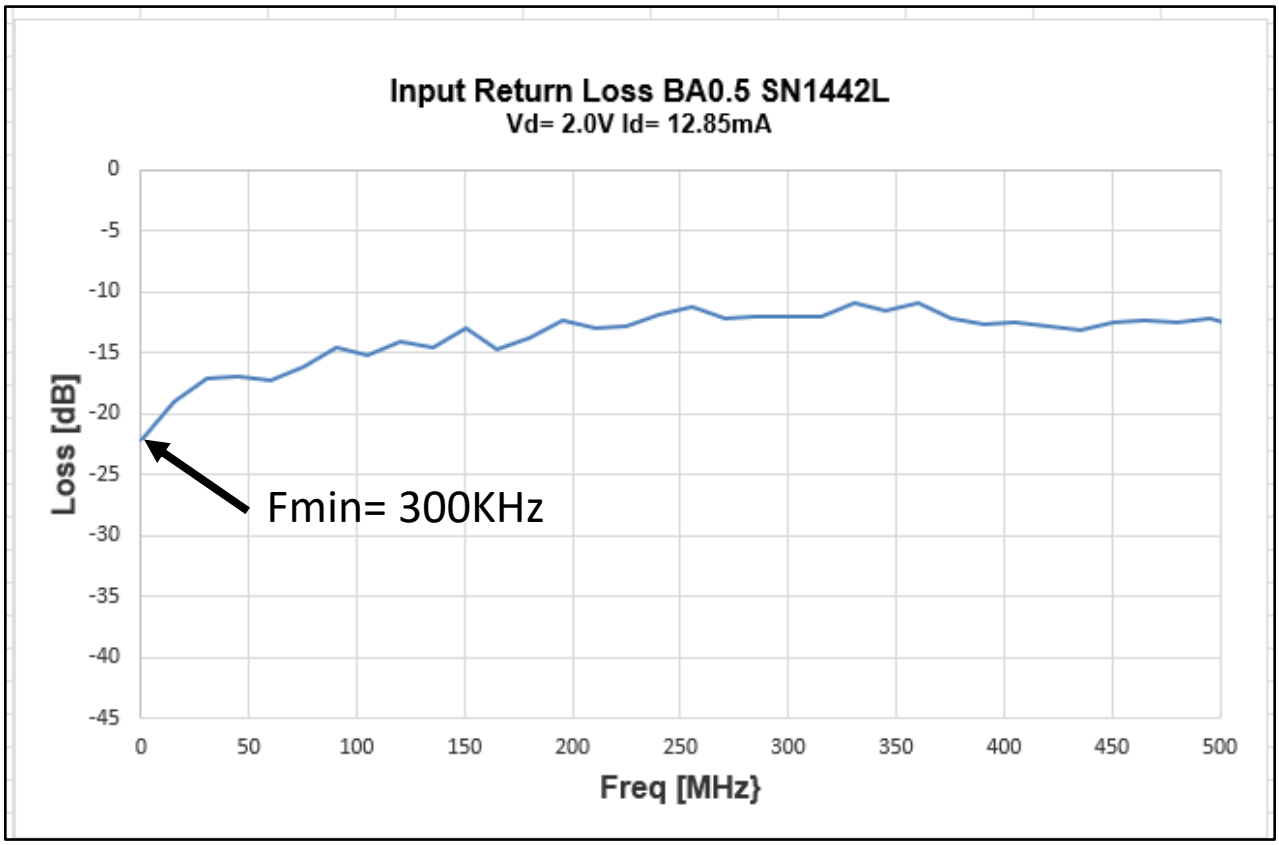




These measurements were made using CMT's production test dewar at a physical temperature of 10.3K. The production test dewars are calibrated from 100 MHz to 18 GHz. These measurements were made up 2 GHz. The production test dewar calibrations are checked on a monthly basis using known reference amplifiers.

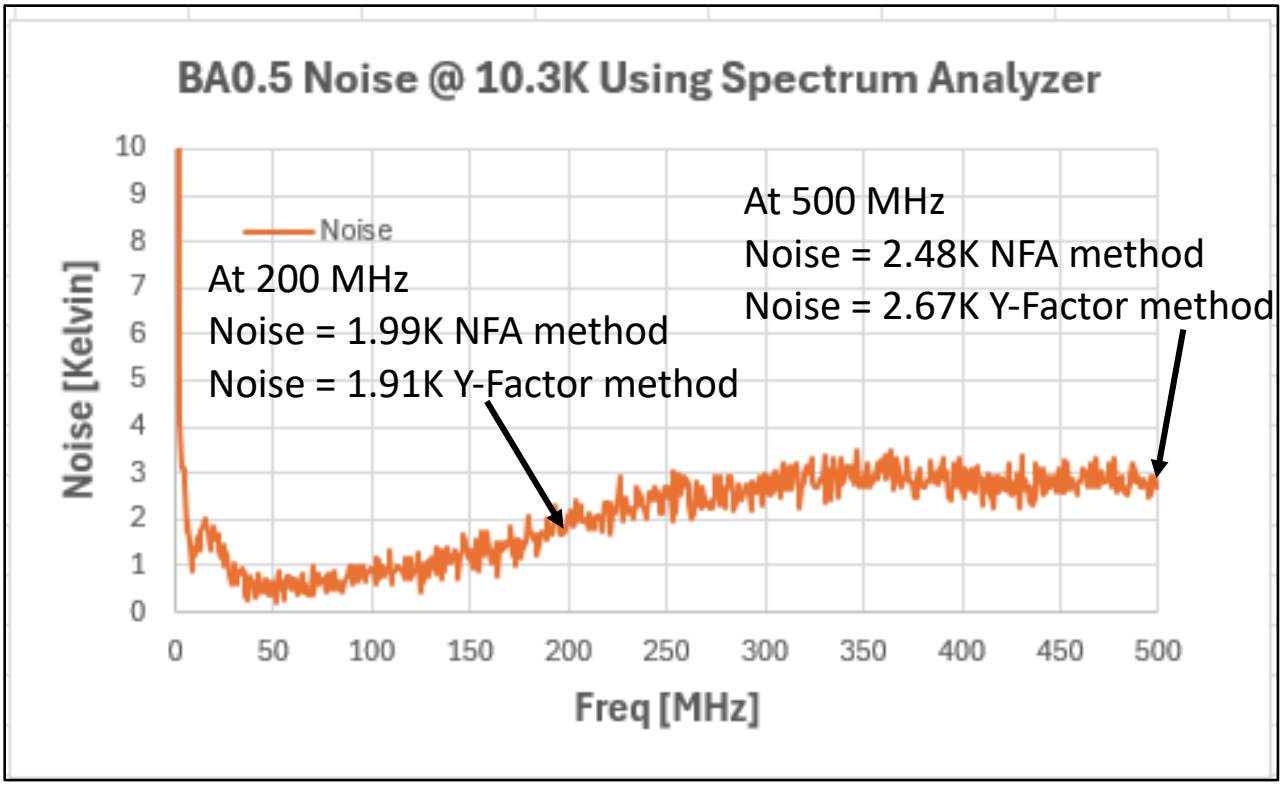
CMT-BA0.5 S11 Measurements





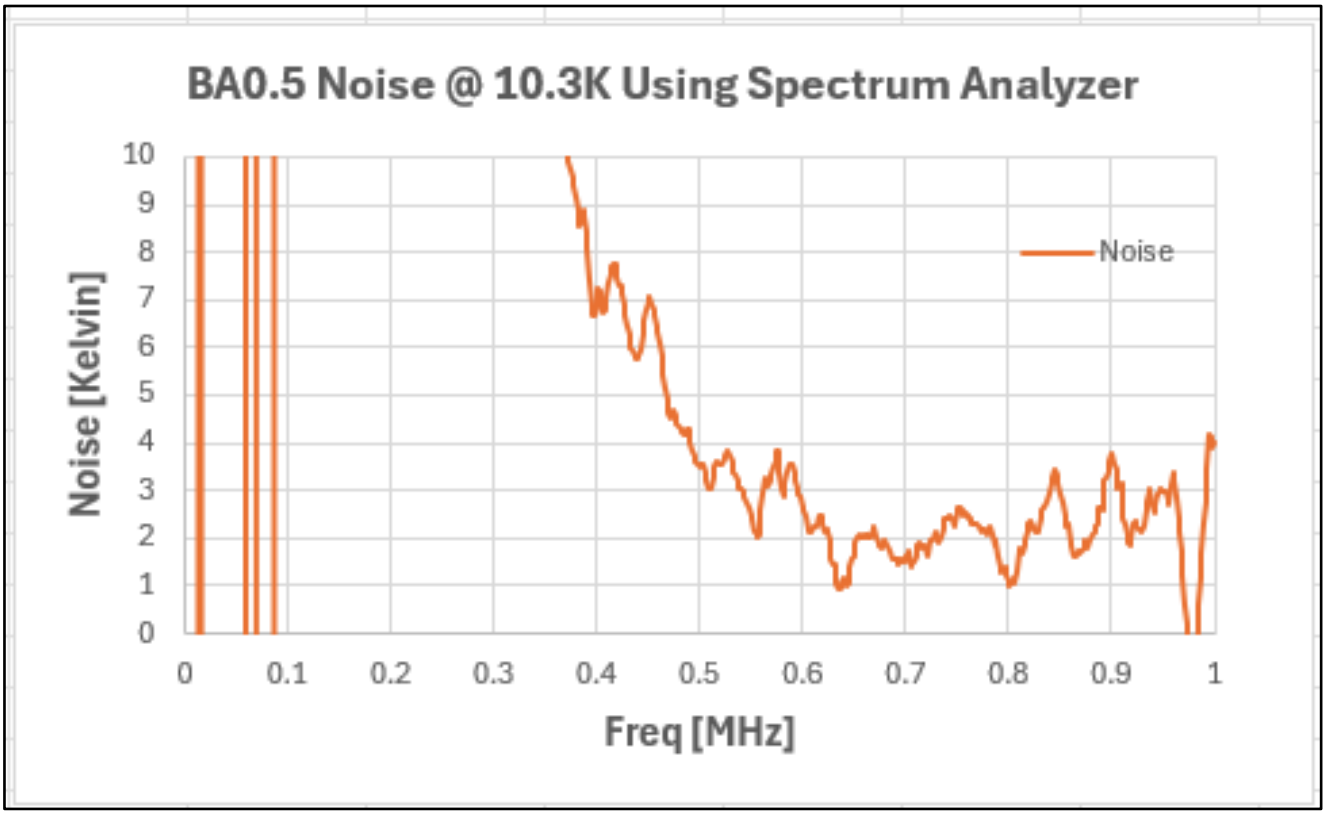
These measurements were made using CMT's production test dewar at a physical temperature of 10.3K. Return Loss measurements were made using an HP 8753C VNA.

CMT-BA0.5 Noise Measurements



These measurements were made using the Y-Factor method. Data was measured using a Rigol DSA832E Spectrum Analyzer. An external, calibrated, Anristu M848 noise source was used for the THot. An Anristu 20 dB Attenuator, integrated with a Lakeshore DT670 temperature sensor mounted on the cold plate, was used for TCold.

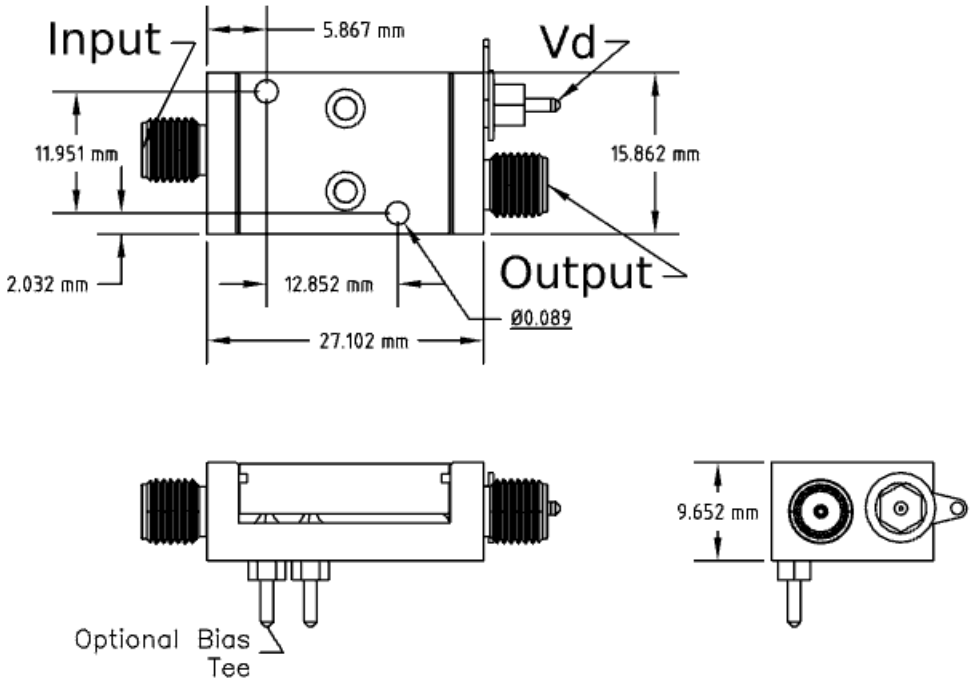
CMT-BA0.5 Noise Measurements



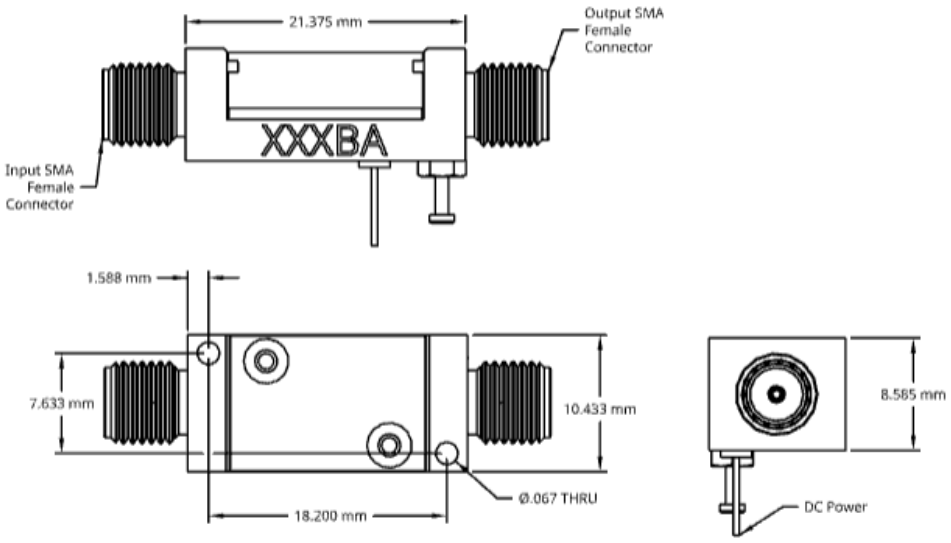
These measurements were made using the Y-Factor method using a low frequency MSC noise source. Calibrations are uncertain below 500KHz. **CMT is currently measuring the noise using 50 ohm loads at 2 physical temperatures. This will be the definitive measurement.**

CAD Housing Drawing

Regular Chassis

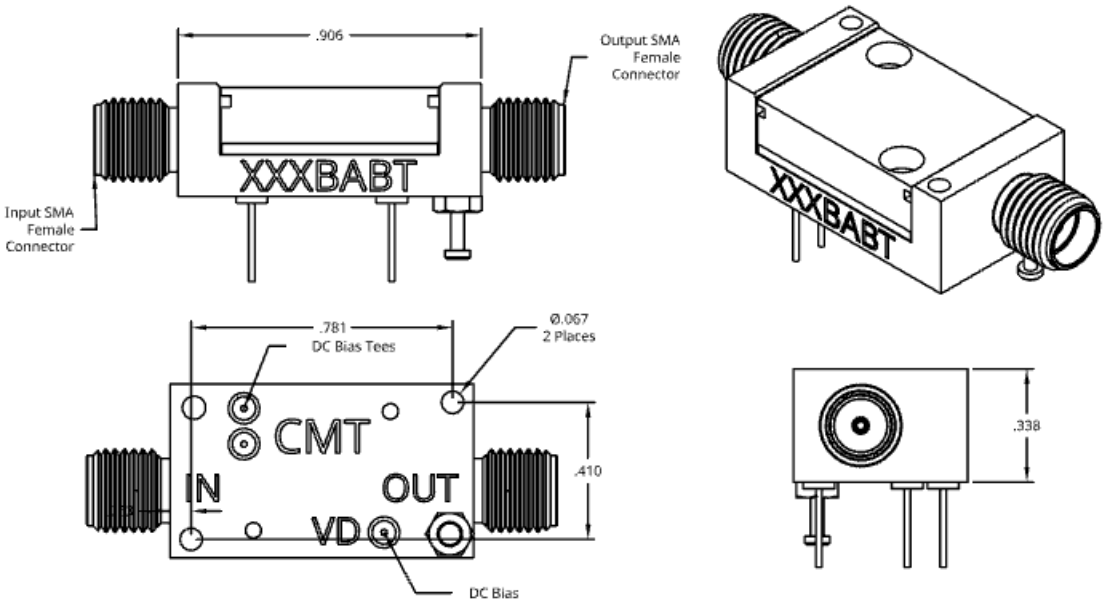


Miniature Chassis

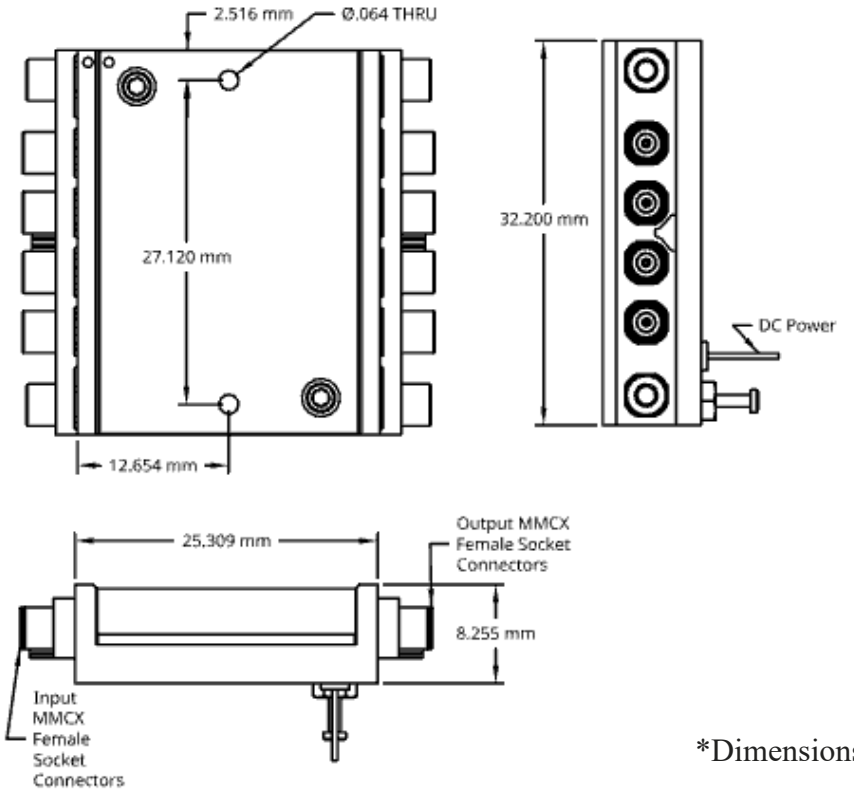


*Dimensions are in mm

Miniature Chassis with Bias Tees

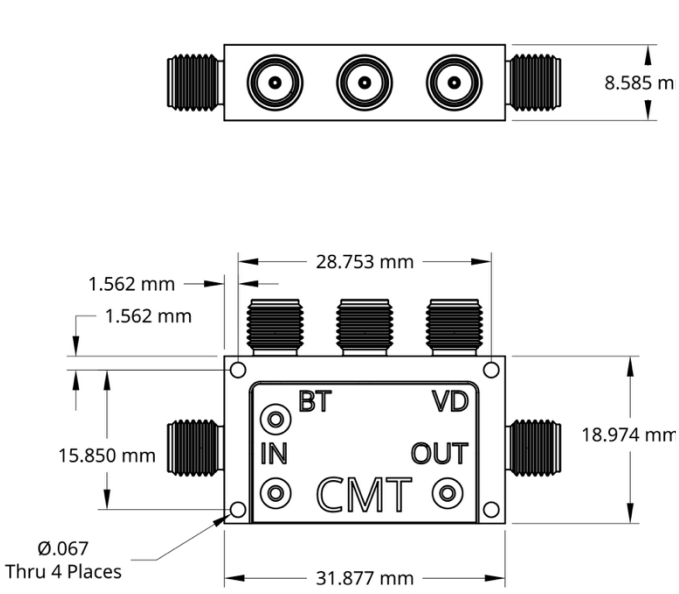


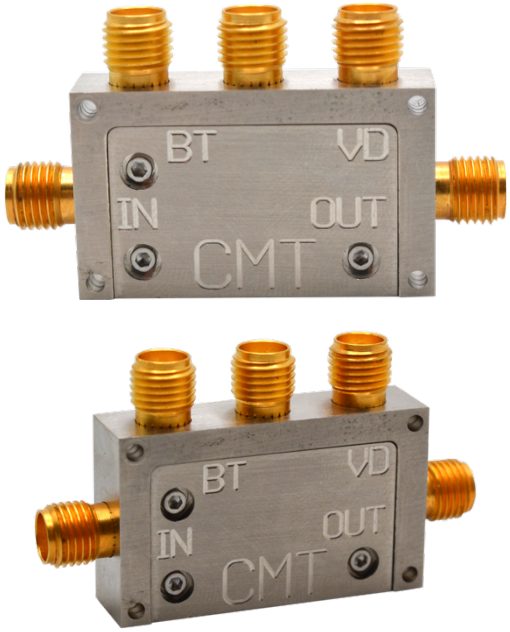
Multichannel Quad Amp



*Dimensions are in mm

CAD Housing Drawing – Shielded SMA Connectors





Optional Input Bias Tee

As an option, the amplifier can be supplied with a DC bias tee for an external device connected to the amplifier input. The bias tee is formed by two (2) resistors connected to the input; as shown in Figure 1. One (1) resistor can be used as a source of current and the other senses the voltage across the external device. Voltages applied to the bias tee have a small effect on amplifier operation. At 12 K, 20 KΩ resistors increase noise by 0.5 K.

To order an amplifier with internal bias resistors, add the resistance to the part #. For instance, CMT-BA0.5-20K.

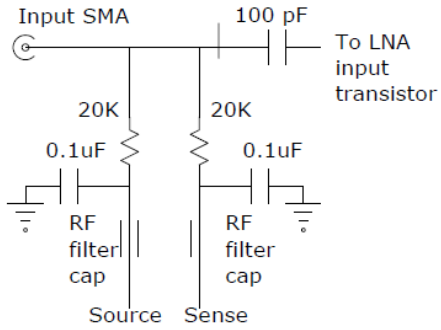


Figure 1. Bias Tee Schematic

Optional Input Protection Diodes

As an option, the amplifier can be supplied with ESD protection & voltage spike protection at the RF input to the amplifier. There will be a slight degradation of the amplifier performance. Please note that the optional input protection diodes cannot be used if DC voltages are applied to the RF line using input bias tees.

To order an amplifier with internal bias resistors, add the resistance to the part #. For instance, CMT-BA0.5-12D-PD.

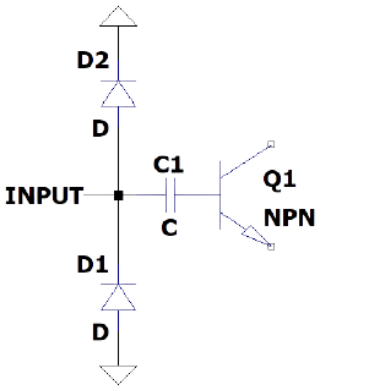


Figure 2. Protection Diodes Schematic

Product Care and Maintenance

- Use care to not bend (and break) the DC bias pin when tightening the output SMA connector.
- The amplifier should not be connected to the power supply when connecting the input connector.
- Set the power of Port 1 in your VNA to be less than -45 dB when testing the amplifier. Otherwise, the amplifier may saturate, and the data obtained will be incorrect.
- Do not attempt to open the amplifier.
- Electrostatic discharge may damage the amplifier.

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