## **Product**Feature

# LN2 Calibrated Noise Source Family Aids in Noise Figure Measurements

Eravant, formerly Sage Millimeter Inc. *Torrance, Calif.* 

TABLE 1					
ERAVANT NOISE SOURCE MODELS					
Model	RF Port	Frequency (GHz)	ENR (dB)		
STZ-05240318-KM-0T2	2.92 mm	0.5 to 40	18		
STZ-05250318-2M-0T2	2.4 mm	0.5 to 50	18		
STZ-05267313-VM-0T2	1.85 mm	0.5 to 67	18		
STZ-42-0T2	WR-42	18 to 26.5	18		
STZ-28-0T2	WR-28	26.5 to 40	18		
STZ-22-0T2	WR-22	33 to 50 18			
STZ-19-0T2	WR-19	40 to 60	13		
STZ-15-IT2	WR-15	50 to 75 15			
STZ-50375320-12-IT2	WR-15	50 to 75 20			
STZ-12-IT2	WR-12	60 to 90	15		
STZ-60396320-12-IT2	WR-12	60 to 96 20			
STZ-10-IT2	WR-10	75 to 110 15			
STZ-75311420-10-IT2	WR-10	75 to 110 20			
STZ-65312415-10-IT2	WR-10	65 to 116	15		
STZ-06-IT2	WR-06	110 to 170	15		
STZ-14420412-05-IT2	WR-05	140 to 200	12		

oise sources play a pivotal role in various test and measurement applications. Primarily, they serve as reference signals to measure internally generated noise levels in components, subsystems and systems. These sources are adept at providing wideband stimulus signals for built-in test functions in radar and communication systems and they contribute to assessing the linearity and stability of high-power amplifiers. They are integral components in the calibration circuitry of microwave radiometers and radio astronomy receivers. The noise source injects a predetermined and known amount of noise power into the receiver. This injected noise power enables testing the receiver output power to determine gain and calibrate its variance. The noise source can be toggled on and off to supply two different injected power levels. This creates two corresponding output power levels, facilitating the gain and noise figure measurements of the receiver. This comprehensive process

Fig. 1 Eravant Liquid Nitrogen (LN2) calibrated noise source.

enables the complete calibration of the receiver system. *Table 1* shows Eravant's noise source offerings.

With the advancements in mmWave and sub-terahertz technologies, there is a growing demand for noise sources operating at frequencies beyond W-Band (75 to 110 GHz). Presently, discussions around 6G at D-Band (110 to 170 GHz) are burgeoning, leading to the development of numerous systems tailored for various applications. The assessment of gain and noise figures for these systems is crucial for validation and testing. Consequently, D-Band noise sources garner increased attention from academic and industrial circles. Yet, commercial noise sources capable of covering the complete set of sub-terahertz frequency bands are presently not widely available. Addressing this market need, Eravant has introduced the STZ series of noise source products, offering a diverse range to meet various test and measurement requirements within the frequency range of 0.5 to 220 GHz. An example of this series is depicted in *Figure 1*.

Typically, coaxial connectorbased noise sources are available for frequencies below 67 GHz, while waveguide versions cater to the 18 to 220 GHz range. The excess noise ratios (ENRs) of these STZ models range from 12 to 20 dB. For the waveguide noise sources, the typical ENR flatness is  $\pm 2$  dB across the entire operating bandwidth. The ENR calibration for waveguide models uses the LN2-based true cold/hot termination method. All models necessitate a nominal supply voltage of +28 VDC. All models are equipped with either a Faraday isolator or an internal attenuator to offer high return loss and isolate the port impedance variations. This ensures a consistent, flat ENR across

TABLE 2					
Parameter	Minimum	Typical	Maximum		
Input Frequency	110 GHz		170 GHz		
ENR		15 dB			
ENR Flatness		±3 dB			
AM Modulation Rate		1 kHz			
Return Loss		15 dB			
DC Voltage		+28 VDC			
DC Current		45 mA			
Specification Temperature		+25°C			
Operating Temperature	0°C		+50°C		



▲ Fig. 2 Calibrated D-Band STZ ENR.

frequency bands. The STZ series includes different RF ports and operates across various frequency bands as detailed in Table 1.

These noise sources support TTLlevel input for on/off control signals and can accommodate modulation rates of up to 1 kHz. In addition, a manual toggle switch is provided to turn the noise source on and off. The specifications for the D-Band STZ model are detailed in **Table 2** and calibrated ENR over the band is depicted in **Figure 2**, with the device achieving a typical ENR of 15 dB.

Eravant not only offers calibrated noise sources but also provides noise source calibration services. Eravant has adopted the Y-factor method to determine the ENR of a noise source under test. To ascertain the noise temperature of the device under test (DUT) requires a reference noise source with a known noise temperature. This method utilizes a liquid nitrogen-cooled termination as the cold state of the reference noise source with a noise temperature of 77K and a room

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temperature termination as the hot state with a noise temperature 290K. of Noise power readings from the reference noise source are collected by the noise figure measurement system at its hot and cold states, normalizing the noise figure of the measurement system. By gathering noise power readings from the noise source under test in its on and off states, the

ENR of the DUT can be calculated, completing the calibration process. The effective noise temperatures of these terminations are meticulously regulated and measured with high precision to ensure the accuracy and reliability of noise source calibrations.

Signal analyzers and noise figure analyzers that are currently available lack the direct capability to measure noise power within the mmWave and sub-THz frequency ranges. To facilitate noise figure measurements in these frequency ranges, integrating down-converters within the measuring system is essential. Eravant offers full waveguide band down-converters extending the operating frequency of the analyzers up to 220 GHz and typically providing a conversion gain from 20 to 30 dB.

Eravant provides a comprehensive solution set for mmWave and sub-THz frequency challenges. Critical to these solutions are noise sources. In addition to noise sources with flat ENRs, Eravant offers calibration services for waveguide-banded noise sources. Eravant also supplies down-converters for precise noise figure and gain measurements up to 220 GHz.

### **VENDORVIEW**

Eravant, formerly Sage Millimeter Inc. Torrance, Calif. www.eravant.com