

110 – 500 GHz Cryogenic Primary Noise Standard



Figure 1 User Interface Unit with Cryostat

VivaTech's Cryogenic Noise Standard **VTPN-110-500-FS** is a noise source with primary reference performance. Providing precision calibration of low noise components such as amplifiers, diode noise sources or receiver systems, it offers the ultimate in performance. The extended performance design provides wide frequency coverage from 110 – 500 GHz in standard waveguide bands, incorporating replaceable feed-horn assemblies. The standard is particularly suited to sub-mm wave [THz] low noise measurement applications up to 500 GHz. A waveguide side entry interface avoids the need for high loss bends or twists - an essential feature for precision sub-mm measurements.

Applications

- Absolute calibration of sub-mm wave [THz] low noise amplifiers and receivers
- Long term stability tests or adjustments to radiometer systems
- Calibration of secondary standards such as noise sources
- Linearity measurements

Model VTPN-110-500-FS Features

- Side entry design - convenient connections to waveguide components or systems
- Vertical or horizontal waveguide orientation – no mismatched bends or twists needed
- Low maintenance, compact temperature stabilization system without water cooling
- Interchangeable waveguide feed-horn assemblies with precision sub-mm wave [THz] coverage
- Automatic or manual LN2 filling, auto-fill minimizes LN2 use and allows continuous operation
- Convenient, fully automated operation with an integrated PC
- Real time output noise temperature display at any frequency with full data logging
- Complete set of accessories – LN2 dewar, auto fill function, vacuum gauge, and pump (option)
- Control PC and upgradeable software

CONTACT INFORMATION

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Cryostat Vessel

The Cryogenic Noise Standard employs a specially developed evacuated LN2 cryostat with very low heat loss and thus long hold times. The vessel may be filled manually for short term experiments or automatically from a supplied dewar. A single 1 litre LN2 fill lasts on average 15 hours after the initial vessel cooling. The 35 litre dewar with auto-fill provides over 500 hours operation without the need to re-fill. The system software monitors the cool down process and provides a record of relevant temperatures. Once the standard has reached its pre-defined physical temperatures the system effective noise temperature is validated by the PC interface.

A precision feed-horn assembly for each waveguide band is mounted on the vessel and is conveniently attached to either horizontal or vertical waveguides of the user components or systems. The temperature of this feed-horn is precisely controlled and monitored by software. Calibrated feed-horn assemblies are available from 110 – 500 GHz in four standard waveguide bands. These bands are 110 – 170 GHz, 170 – 220 GHz, 220 – 330 GHz and 330 – 500 GHz. The bands 220 – 330 GHz and 330 – 500 GHz use a pair of feed-horns in each for accuracy, with each horn having identical mechanical interfaces, but different electrical properties.

The cryostat is fitted with an internal getter to maintain the factory established vacuum and a sensor for the monitoring of this vacuum. An optional 2 stage rotary pump with accessories can be provided for yearly maintenance.



Figure 2 Cryostat Blackbody with Replaceable Feed-horn Assembly



Figure 3 Controller (PC stowed) with Cryostat in Auto-Fill Operation (Cold)

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User Interface Unit

The Cryogenic Noise Standard controller unit consists of a 19 inch standard rack case assembly with the necessary power supplies and control interfaces for the cryostat vessel. It also houses the system PC in a convenient sliding drawer. Data from the cryostat is collected and processed by the software to provide a real time display of the current effective system temperature at any frequency within the range of the attached feed-horn assembly. Physical temperatures within the cryostat and the horn assembly are precisely monitored and provided to the software algorithms. The outputs of the PC and software are displayed in a choice of formats, including real time effective noise temperature [Figure 5], logged physical temperatures [Figure 6] and a full band calibration plot [Figure 7]. The logging function allows a full history of the use of the standard and recall of important data. A USB port provides for external storage of data.



Figure 4 Controller & PC with Cryostat Vessel

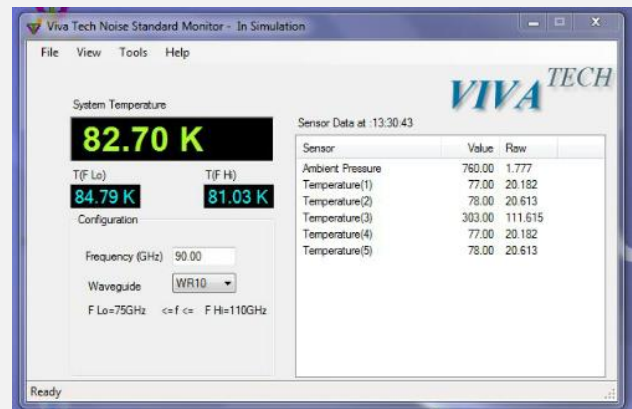


Figure 5 Main Display Screen – System Temperature

 A screenshot of the 'Data Log-Current' window showing a table of recorded data. The table has columns for Date/Time, Frequency/Waveguide, System Temperature, Pressure, and five individual temperature sensors (Temp (1) to Temp (5)), along with a Status column.

Date/ Time	Frequency / Waveguide	System Temperature	Pressure	Temp (1)	Temp (2)	Temp (3)	Temp (4)	Temp (5)	Status
21:32:55	90.0GHz/WR10	287.85 K	760.0 Torr	290.00 K	290.00 K	290.00 K	290.00 K	290.00 K	Not Ready
21:32:45	90.0GHz/WR10	287.85 K	760.0 Torr	290.00 K	290.00 K	290.00 K	290.00 K	290.00 K	Not Ready
21:32:35	90.0GHz/WR10	287.85 K	760.0 Torr	290.00 K	290.00 K	290.00 K	290.00 K	290.00 K	Not Ready
21:32:25	90.0GHz/WR10	287.85 K	760.0 Torr	290.00 K	290.00 K	290.00 K	290.00 K	290.00 K	Not Ready
21:32:15	90.0GHz/WR10	287.85 K	760.0 Torr	290.00 K	290.00 K	290.00 K	290.00 K	290.00 K	Not Ready
21:32:05	90.0GHz/WR10	287.85 K	760.0 Torr	290.00 K	290.00 K	290.00 K	290.00 K	290.00 K	Not Ready
21:31:55	90.0GHz/WR10	287.85 K	760.0 Torr	290.00 K	290.00 K	290.00 K	290.00 K	290.00 K	Not Ready
21:31:45	90.0GHz/WR10	287.85 K	760.0 Torr	290.00 K	290.00 K	290.00 K	290.00 K	290.00 K	Not Ready
21:31:35	90.0GHz/WR10	287.85 K	760.0 Torr	290.00 K	290.00 K	290.00 K	290.00 K	290.00 K	Not Ready
21:31:25	90.0GHz/WR10	287.85 K	760.0 Torr	290.00 K	290.00 K	290.00 K	290.00 K	290.00 K	Not Ready
21:31:15	90.0GHz/WR10	287.85 K	760.0 Torr	290.00 K	290.00 K	290.00 K	290.00 K	290.00 K	Not Ready
21:31:05	90.0GHz/WR10	287.85 K	760.0 Torr	290.00 K	290.00 K	290.00 K	290.00 K	290.00 K	Not Ready
21:30:55	90.0GHz/WR10	287.85 K	760.0 Torr	290.00 K	290.00 K	290.00 K	290.00 K	290.00 K	Not Ready
21:30:45	90.0GHz/WR10	287.85 K	760.0 Torr	290.00 K	290.00 K	290.00 K	290.00 K	290.00 K	Not Ready
21:30:35	90.0GHz/WR10	287.85 K	760.0 Torr	290.00 K	290.00 K	290.00 K	290.00 K	290.00 K	Not Ready

Figure 6 Data Log Extract

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Frequency Coverage & Calibration

The standard covers the range 110 – 500 GHz using a common vessel and replaceable feed-horn assemblies. Table below shows the associated waveguide bands and the nominal available output noise temperature. In operation a calibration plot [Figure 7] of noise temperature versus frequency can be calculated for the selected band. This full-band calibration plot is accurate for the conditions extant at the time of measurement, and can be recalculated at any time. The real time single frequency display of noise temperature is always corrected for variations in atmospheric pressure and ambient horn temperature in real time thus ensuring the best possible accuracy.

Frequency (GHz) ³	Effective Noise Temp (K) ⁴	Waveguide Size	Feed-horn Assembly
110-170	81.06	WR 6	VTA-6-NS
140-220	79.27	WR 5	VTA-5-NS
220-275	76.82	WR 3.4	VTA-3.4FA-NS
275-325	72.45	WR 3.4	VTA-3.4FB-NS
325-400	95.50	WR 2.2	VTA-2.2FA-NS
400-500	75.00	WR 2.2	VTA-2.2FB-NS

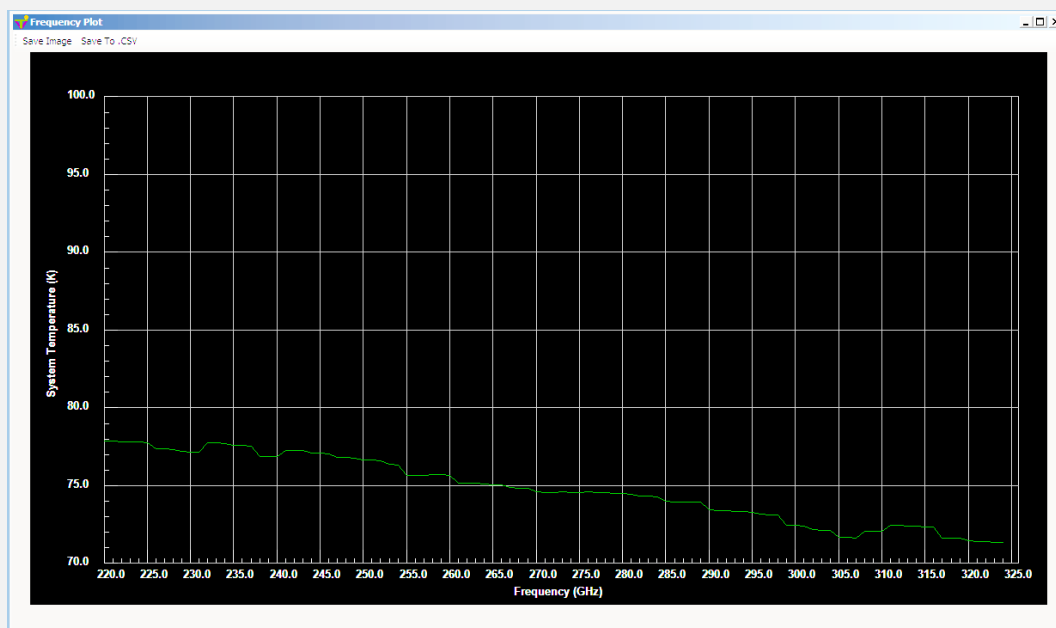


Figure 7 Calibration Plot

How to Order

1. Indicate cryogenic vessel model number: **VTPN-220-500-FS**
2. Chose feed-horn assembly (s) required from table above
3. For other frequency coverage, please chose from our catalogue, available on www.vivatech.biz
4. Typical average mid band output noise temperature
5. Specify manual or automatic liquid nitrogen filling. Auto fill also adds a 35 litre LN2 dewar.
6. Should you require a top viewing configuration, please advise

Please contact us for further product information.

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