

Portable Appendix A Test System (PAATS)



SARA PAATS Transmit and Receive Chassis with Optional Antennas

Exceptional Performance from
the Leader in HEMP Protection



ABOUT MIL-STD-188-125-1/2 HARDNESS SURVEILLANCE AND SARA

Critical military, government, and civilian assets, particularly critical communications, are often required to be High Altitude Electromagnetic Pulse (HEMP) survivable. Assessment of low-risk, high-confidence HEMP survivability, based on testing, documentation of hardening, and inspections are described in MIL-STD-188-125-1/2 (fixed/mobile facility), MIL-STD-3023 (aircraft), and MIL-STD-4023 (ships). These standards define the performance requirements of a HEMP-protection subsystem, including allowable leakage of external fields into a shielded volume – known as Shielding Effectiveness (SE). Shields must be independently tested and certified, then Hardness Assurance and periodic Hardness Surveillance testing must be conducted to ensure adequate SE of panels, racks, containers, apertures, etc. over the life-cycle of the asset. Prior to certification, vendors may desire the capability to perform pre-certification testing on new designs to detect and correct deficiencies and avoid costly certification re-tests.

SARA Inc. offers the easily configurable Portable Appendix A Test System (PAATS) designed to provide MIL-STD compliant Shielding Effectiveness (SE) measurements. This system is fully compliant with the MIL-STD required Dynamic Range (DR) across the required frequency span (10 kHz – 1 GHz) and can be utilized for pre-certification, certification, Hardness Assurance, and Hardness Surveillance. When combined with the optional HF-SA-17L antennas, the coupled system produces a complete, turn-key MIL-STD compliant test set. The PAATS graphical interface guides the user through the MIL-STD SE test beginning at calibration and culminating in report quality SE graphs, allowing the user to produce quality real-time documentation. In addition, PAATS includes a sniffer application, so that trouble frequencies can be localized spatially and red-tagged for re-work.

All PAATS units include a 1 year limited warranty, operations manuals, and optional on-site training at customer facilities. All PAATS systems are fabricated in Colorado Springs, Colorado.

PAATS OVERVIEW

Theory of Operation

PAATS is comprised of two major components: the transmit (TX) system and the receive (RX) system. The TX and the RX systems combine to perform a radiative insertion loss measurement of the shielded enclosure, as described in the MIL-STDs. The TX system is placed on one side of the shielded enclosure and produces a frequency stepped RF signal that is monitored by the synchronized RX system, which is emplaced on the opposite side of the electromagnetic barrier.

As delivered, the output maximum TX power level of 100mW, overall RX gain of 52dB, and HF-SA-17L antennas deliver a DR that's 20dB better than the MIL-STD requirement over most of the 10kHz-1GHz measurement range. The system can be augmented with a separate power amplifier if the ambient noise in the environment is high. Several levels of transmit power are available to fit customer requirements to limit exposure and interference of equipment. In addition, if upset to critical equipment is found, the frequency table can be updated to move off of interfering frequencies.

The TX and RX systems shown in Figure 2 are 4"x16.25"x14.25" and are powered with 120 VAC. Feet and handles are included for portable use. PAATS' Windows 7 processor include video, USB and Ethernet ports on the transmitter for network communication and control, and a video port on the receiver to accommodate a monitor for the sniffing mode.

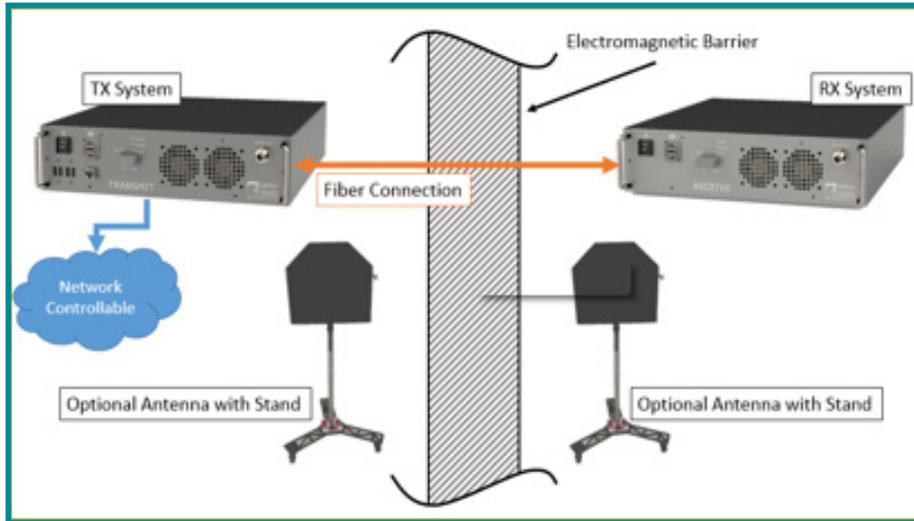


Figure 1. Typical SE Measurement Configuration



Figure 2 TX (top) and RX (bottom) Bench Top Units.

PAATS is capable of working with most antennas. Larger antennas provide greater sensitivity allowing lower TX radiated power. For cabinet SE applications, SARA offers the HF-SA-17L antennas, shown in Figure 3 below, as well as the HF-SA-6L for tighter fits. Both are capable of meeting all three MIL-STD HEMP measurement requirements for SE in typical ambient EM environments. The HF-SA-6L antenna is a lower profile antenna with approximate dimensions of 6" x 1/2", and the HF-SA-17L has a larger profile with dimensions of 17 3/4" x 17 3/4" x 2 3/4".

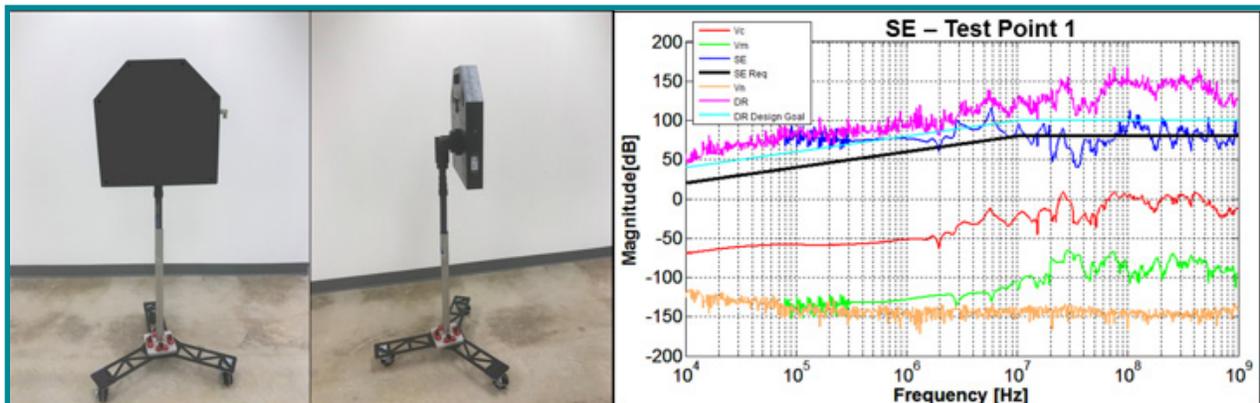


Figure 3. Left: HF-SA-17L with Articulating Mounts and Stands Right: Report-ready SE Result Produced by PAATS SE Application, Using the HF-SA-17L

System Features

A block diagram of the systems constituent components can be seen in Figure 4. The primary components of PAATS include a vector network analyzer (VNA), TX-RX fiber system (FOL), and WINDOWS 7 control PC. The PAATS application controls the VNA which drives the TX antenna through a power amplifier (PA) with a range of .01mW to 100mW output. The external signal strength is monitored at the same frequency as the transmit system through the RX antenna. The low noise amplifiers LNAs provide gain of 0dB, 26dB, or 52dB. The output of the LNAs is returned to the VNA over a single mode (SM) FOL. USB control and video signals are also sent over the FOL. The PC records the scaled output of the VNA, including the option of a scalar for an external PA on the TX side, or external attenuators or LNAs on the RX side.

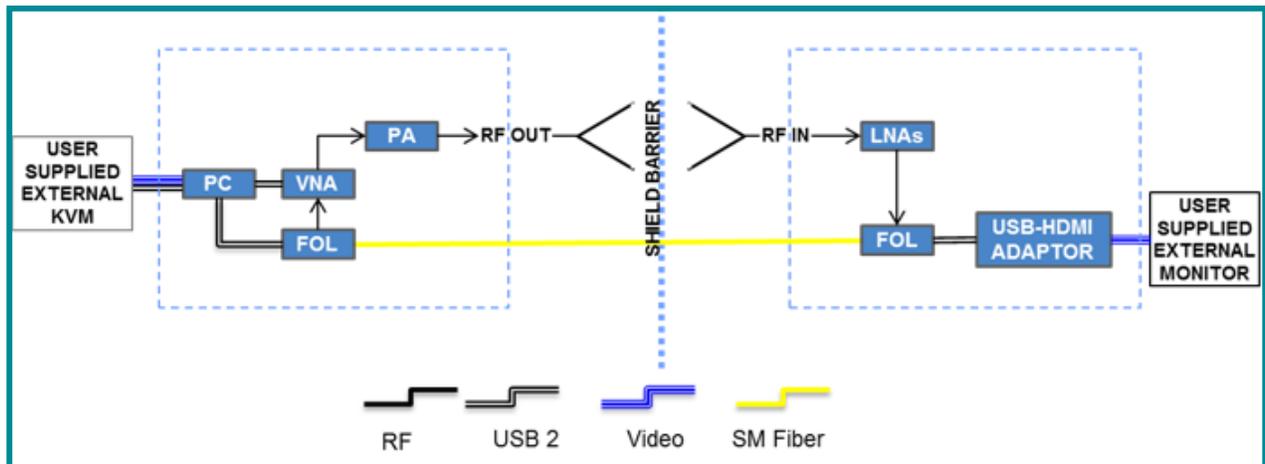


Figure 4. Simplified PAATS Block Diagram

Figure 5 displays the PAATS application GUIs. The SE app provides for typical instrument setup inputs on the left, as well as selecting the MIL-STD sweep type (Signal, Ambient, etc.). A special CAL button at the bottom of the screen steps the user through creation of Cal measurements used for SE testing. In the sniffer mode, again typical instrument setup inputs on the left, but on the right an easily viewable power meter displays the peak over the selected band (in this case 1MHz). In this fast sweeping mode, personnel can wand an antenna near a leak at selected peak frequencies, and easily observe jumps in the power meter to localize the leak.



Figure 5. Left: PAATS SE Application GUI. Right: PAATS

DATA SHEET

Table 1 provides the most up-to-date technical information on the PAATS system.

Data Rates		For 801 Points (>2x Mil-std)	
10 Hz IF BW		70s	
100 Hz IF BW		11s	

Dynamic Range Using SA-HF-17L Antenna pairs with 20dBm output		
Range	Conditions	Typical Value over MIL-STD SE Req
10kHz-10MHz	LNA1 on	>30dB
10MHz-1GHz	LNA s off	>40dB

Minimum Detectable Signal Level @ 3dB SNR, 10 Hz IF BW	
10kHz-70kHz	-117dBm
70kHz-300kHz	-133dBm
>300kHz	-137dBm

Frequency (for SE and Sniffer App)	
Range	10kHz-1GHz
1/1.5/2/3/5/7 steps	1Hz-100kHz
Frequency Setting Resolution	1Hz
Number of Measurement Points	1 to 200,001

Environmental	
Parameter	Value
Operational Temp.	5°C to 40°C
Storage Temp.	-45°C to 55°C
Max Humidity	90% at 25°C
TX Power Consumption	314 W
RX Power Consumption	231 W

Input/Output Connectors		
Connector	Unit	Type
Optical, TX & RX	TX&RX	2x Duplex LC
RF*	TX&RX	1xN (F)
	HF-SA-17L	1xN (F)
Computer	TX	4xUSB 2, 1xLAN
Video	TX&RX	1xHDMI
Power	TX&RX	1xHP

Maximum RF Input IP1		
RX Gain	Max RX input (dBm)	Raw VNA Input (dBm)
0dB	0	2
26dB (LNA1)	-26	2
(LNA1+LNA2)	-54	0

Output Amplitude, Nominal (for SE and Sniffer App)	
Minimum	-20dBm
Maximum	+20dBm

Physical Dimensions & Weight		
Parameter	Unit	Value
Dimensions	TX&RX	4"x16.25"x14.25"
Weight	TX	22 lbs
Weight	RX	16 lbs
Dimensions	HF-17L Antennas	17 3/4" x 17 3/4" x 2 3/4"
Weight	HF-17L Antennas**	12.1 lbs

**Without stand

PAATS / Antennas Standard Models	
Model	Features
BAATS (Benchtop Appendix A Test Set)	<ul style="list-style-type: none"> MIL-STD Compliant 1 W TX Power 120VAC Power on both TX and RX
Advanced	<ul style="list-style-type: none"> MIL-STD Compliant 1 W TX Power Compact RX chassis Battery powered RX chassis Includes integrated monitor and keyboard
HF-SA-6L	<ul style="list-style-type: none"> Compact Magnet Mounting Available
HF-SA-17L	<ul style="list-style-type: none"> Improved Frequency Response Mounting Stands Available
Supports standard antenna sweeps and sniffing mode.	Quantity price breaks available. All system are built to order. The specific price varies depending on COTS components availability / pricing.

CONTACT SARA

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