



Telecommunications

ANTENNA TRAINING AND MEASURING SYSTEM MODEL 8092



GENERAL DESCRIPTION

The Lab-Volt Antenna Training and Measuring System (ATMS) provides teachers and students with training materials for hands-on experimentation on antennas in the 1-GHz and 10-GHz bands. A convenient and powerful antenna measuring system, the ATMS can also be utilized by design and research teams at a very affordable cost.

The complete system includes sets of antennas, an RF Generator, a receiving system, and the Lab-Volt Data Acquisition and Management software for Antennas (LVDAM-ANT), a user-friendly software utility operating under the Microsoft® Windows™ environment. The receiving system consists of a rotating Antenna Positioner linked to a Data Acquisition Interface connected to the parallel port of an IBM®-compatible personal computer (to be purchased separately).

The ATMS is designed for low-power safe operation, both in the 1-GHz and 10-GHz bands (specifically at 915 MHz and 10.5 GHz), allowing measurement of antenna characteristics in these bands. The Data Acquisi-

tion Interface controls the Antenna Positioner and acquires the received antenna signal.

The LVDAM-ANT software provides a toolbox for controlling antenna rotation and data acquisition, and for displaying measured antenna characteristics in the E and H planes. Different forms of 2-D and 3-D representations are available from the results of the E- and H-plane pattern measurements. The LVDAM-ANT software also includes algorithms for estimating the beam width and directivity of antennas from measurements or from external data.

The ATMS is a self-contained, stand-alone system that does not require other microwave equipment. However, it is compatible with the Lab-Volt 10.5-GHz Microwave Technology Training System, Model 8090. The VSWR Meter and the Power Meter of the Lab-Volt Microwave Technology Training System, along with microwave components such as the slotted line, the Gunn oscillator, attenuators, and couplers, can be put to use for various creative laboratory projects.

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SYSTEM MODULES

Model 9505 RF Generator



The RF Generator contains two independent generators capable of producing CW or 1-kHz AM modulated RF signals at 915 MHz and 10.5 GHz. Each generator has a push-button switch for turning RF power on and off, an LED that flashes on and off when RF power is turned on, and an SMA output connector. The oscillator in the 915-MHz generator can be tuned to different frequencies via an external tuning voltage input. All outputs are fully protected against short circuits and misconnections. The RF Generator is self-powered and has a Lab-Volt standard unregulated DC power bus for supplying power to other compatible modules through its top panel connector. The unit beeps when RF power is turned on to help avoid interference and to warn students in the laboratory that RF power is being emitted.

Model 9506 Antenna Positioner



The Antenna Positioner consists of the mast for the receiving antenna, a drive motor, a signal detector, a variable attenuator, and a shaft encoder. The drive motor is used to rotate the mast while the rotation is controlled by the LVDAM-ANT software via the Data Acquisition Interface. An SMA connector, mounted on the base of the mast, allows a connection to be made between the receiving antenna and the signal detector. This detector provides a signal whose voltage is regulated by the level of the RF signal received. This signal is available from a BNC connector for connection to the Data Acquisition Interface.

The variable attenuator allows adjustments to be made to the sensitivity of the receiving system according to the strength of the received signal, in order to prevent system saturation. This attenuator is controlled by the LVDAM-ANT software via the Data Acquisition Interface. The shaft encoder is coupled with the shaft of the drive motor and provides signals to monitor the rotation of the mast. Two multi-pin connectors on the Antenna Positioner allow connection to the Data Acquisition Interface / Power Supply .

Model 9507 Data Acquisition Interface / Power Supply



The Data Acquisition Interface links the Antenna Positioner with the personal computer that runs the

LVDAM-ANT software. The link to the computer is achieved through a standard 25-pin parallel port connector mounted on the rear panel of the module. The Data Acquisition Interface converts the received signal coming from the Antenna Positioner into a digital signal which can be used by the computer. It also routes the shaft encoder signals coming from the Antenna Positioner to the computer. The Data Acquisition Interface also provides the signals required to control the drive motor and the variable attenuator in the Antenna Positioner. A BNC connector and a multi-pin connector allow connection of the Data Acquisition Interface to the Antenna Positioner .

The Power Supply, which provides regulated DC power to the Data Acquisition Interface, has a Lab-Volt standard unregulated DC power bus for supplying power to other compatible modules through its top panel connector. The unregulated DC power bus also supplies power to the Antenna Positioner through a multi-pin connector mounted on its front panel. The Power Supply also provides AC power to the drive motor in the Antenna Positioner through a multi-pin connector mounted on its front panel. An illuminated power switch allows the Power Supply to be turned on and off.

ANTENNAS

The ATMS provides a great variety of 1 GHz or 10 GHz antennas. With the exception of the horn- and waveguide-type antennas, connection to each antenna

is made through an SMA connector. The 1-GHz and 10-GHz antennas available in the ATMS are listed below:

1-GHz Antennas

- Dipoles ($\lambda/2$, λ , $3\lambda/2$)
- Folded Dipole
- Folded Dipole with Balun
- Monopole (over ground plane)
- Drooping Monopole
- Loops (circular, square, lozenge)
- Yagi (fixed, adjustable)

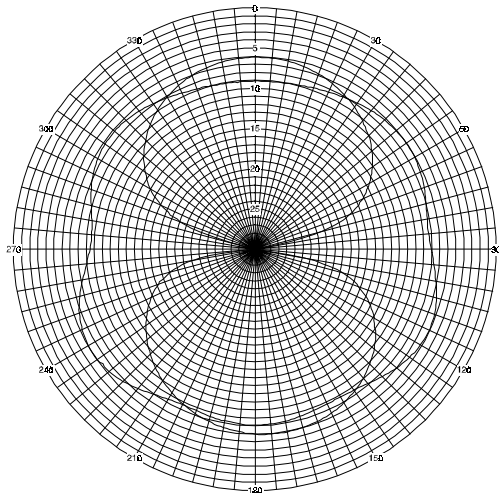
10-GHz Antennas

- Open-Ended Waveguide
- Slotted Waveguide
- Horns (small and large aperture)
- Helical (right-hand and left-hand circular polarization)
- Patch (rectangular, parallel-fed array, series-fed array)

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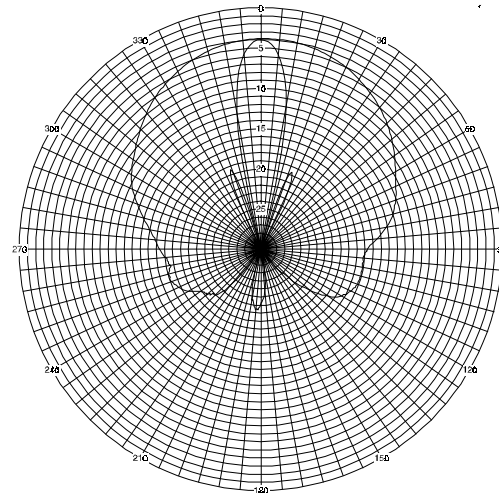
The following figures show polar plots of the radiation patterns of the folded dipole and slotted-waveguide antennas, obtained using the Antenna Training and Measuring System .

Folded Dipole Antenna



Antenna Type	Attenuation (dB)	Maximum Signal		Half Power Beamwidth (°)
		Level (dB)	Position (°)	
PC-DIPDANT		Dipole (Folded)		
Plane E	0	-5.0	0	75
Plane H	0	-5.0	225	255
Anten2.gant				
Plane E				
Plane H				
Anten3.gant				
Plane E				
Plane H				
Last Acquisition				

Slotted-Waveguide Antenna



Antenna Type	Attenuation (dB)	Maximum Signal		Half Power Beamwidth (°)
		Level (dB)	Position (°)	
SLOTANT		Waveguide (slotted)		
Plane E	00	-0.5	0	72
Plane H	00	-0.5	0	12
Anten2.gant				
Plane E				
Plane H				
Anten3.gant				
Plane E				
Plane H				
Last Acquisition				

Radiation patterns

OTHER HARDWARE

Model 9594-1 Cables and Accessories

This kit contains cables necessary for the interconnection of the modules in the ATMS, including the cable required to connect the Data Acquisition Interface to a personal computer. The kit also includes SMA connector coaxial cables (flexible) of different lengths for the RF connections, as well as a 90° adapter required when using the adjustable Yagi antenna and patch antennas. A plastic case is supplied for storage.

Model 9594-A Waveguide Accessories

This kit contains the accessories required when using the horn- and waveguide-type antennas of the ATMS. The kit includes quick-lock fasteners, waveguide-to-coaxial cable adapters (SMA connector), a waveguide plastic holder, a waveguide short-circuit, and copper tape to modify the characteristics of the slotted-waveguide and patch antennas.

Model 9595 Antenna Support

The Antenna Support is used as a mount for the fixed (transmitting) antenna of the ATMS. It comes with different adapters for mounting different types of antennas.

LIST OF EQUIPMENT FOR ANTENNA TRAINING AND MEASURING SYSTEM, MODEL 8092

QTY	DESCRIPTION	MODEL NUMBER
1	RF Generator	9505
1	Antenna Positioner	9506
1	Data Acquisition Interface / Power Supply	9507
1	Horn Antenna, Small Aperture	9535-A
2	Horn Antenna, Large Aperture	9550
2	Helical Antenna, Right-Hand Circular Polarization	9551
1	Helical Antenna, Left-Hand Circular Polarization	9552
1	Patch Antennas	9553
1	Slotted-Waveguide Antenna	9554
1	Open-Ended Waveguide Antenna	9555
1	Yagi Antenna	9560
1	Wire Antennas	9561
1	Cables and Accessories	9594-1
1	Waveguide Accessories	9594-A
1	Antenna Support	9595
1	Storage Module	9598

LIST OF OPTIONAL EQUIPMENT FOR ANTENNA TRAINING AND MEASURING SYSTEM, MODEL 8092

QTY	DESCRIPTION	MODEL NUMBER
1	Directional Coupler, 1 GHz	9529
1	Parabolic Reflector	9596

SPECIFICATIONS

Model 9505 RF Generator		
Power Requirement		120 V - 1 A - 60 Hz; 220 V - 0.5 A - 50 Hz; 240 V - 0.5 A - 50 Hz
Unregulated DC Output (Power Bus)		+25 V - 1 A; -25 V - 1 A; +11 V - 1 A
1-GHz RF Power Output	Impedance	50 Ω
	Power Level	+3 dBm (typical); 0 dBm (minimum)
10-GHz RF Power Output	Impedance	50 Ω
	Power Level	+10 dBm (typical)
1-GHz Tuning Voltage Input	Voltage Range	0 to 10 V
	Frequency Range	700 to 1200 MHz
Protection	AC Line Input	Circuit Breaker
	Unregulated DC Power Bus	Circuit Breaker
Physical Characteristics	Dimensions (H x W x D)	112 x 330 x 300 mm (4.4 x 13.0 x 11.8 in)
	Net Weight	6.1 kg (13.4 lb)
Model 9506 Antenna Positioner		
Power Requirement		+25 V - 90 mA, -25 V - 90 mA, +11 V - 90 mA, unregulated
Drive Motor Power Input		24 V - 1.25 A - AC
RF Generator	Frequency Range	1 to 15 GHz
	Input Impedance	50 Ω
	Maximum Input Power	100 mW, CW

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SPECIFICATIONS (cont'd)

Signal Amplifier Input	Impedance	10 k Ω
	Center Frequency	1 kHz
Signal Output	Voltage Range	0 to +10 V
	Impedance	600 Ω
Physical Characteristics	Dimensions (H x W x D)	260 x 385 x 250 mm (10.2 x 15.2 x 9.8 in)
	Net Weight	10.2 kg (22.4 lb)
Model 9507 Data Acquisition Interface / Power Supply		
Power Requirement		120 V - 1.5 A - 60 Hz; 220 V - 0.8 A - 50 Hz; 240 V - 0.8 A - 50 Hz
Data Acquisition Interface	Analog Signal Input Voltage Range	0 to +2.5 V
	Analog Signal Input Impedance	1 M Ω
Power Supply	Unregulated DC Power Bus Output	+25 V - 1 A; -25 V - 1 A; +11 V - 1 A
	Drive Motor Power Output	24 V - 1.5 A - AC
Physical Characteristics	Dimensions (H x W x D)	324 x 330 x 300 mm (12.8 x 13.0 x 11.8 in)
	Net Weight	14.1 kg (31.1 lb)
1-GHz Antennas		
Gain (typical)	Dipole ($\lambda/2$)	1.9 dB
	Folded Dipole with Balun	2.1 dB
	Monopole (over ground plane)	2.5 dB
	Drooping Monopole	1.6 dB
	Circular Loop	2.9 dB
	Square Loop	2.9 dB
	Lozenge Loop	2.9 dB
10-GHz Antennas		
Gain (typical)	Horn (small aperture)	13.8 dB
	Horn (large aperture)	16.7 dB
	Helical (RHCP)	13.6 dB
	Helical (LHCP)	13.6 dB
	Patch (rectangular)	7.7 dB
	Patch (series-fed array)	13.0 dB
	Patch (parallel-fed array)	14.0 dB
	Slotted Waveguide	13.2 dB

COURSEWARE

ORDERING NUMBER¹

Student's Manual

Antenna Fundamentals TM30857-00

Instructor's Guide

Antenna Fundamentals TM30857-10

User's Manual

Antenna Training and Measuring System TM30857-E0

¹Ordering numbers shown are for 120 V versions. Other versions are available. Refer to Ordering Numbers section.

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