

# SAS-551 Passive Monopole Antenna Operation Manual

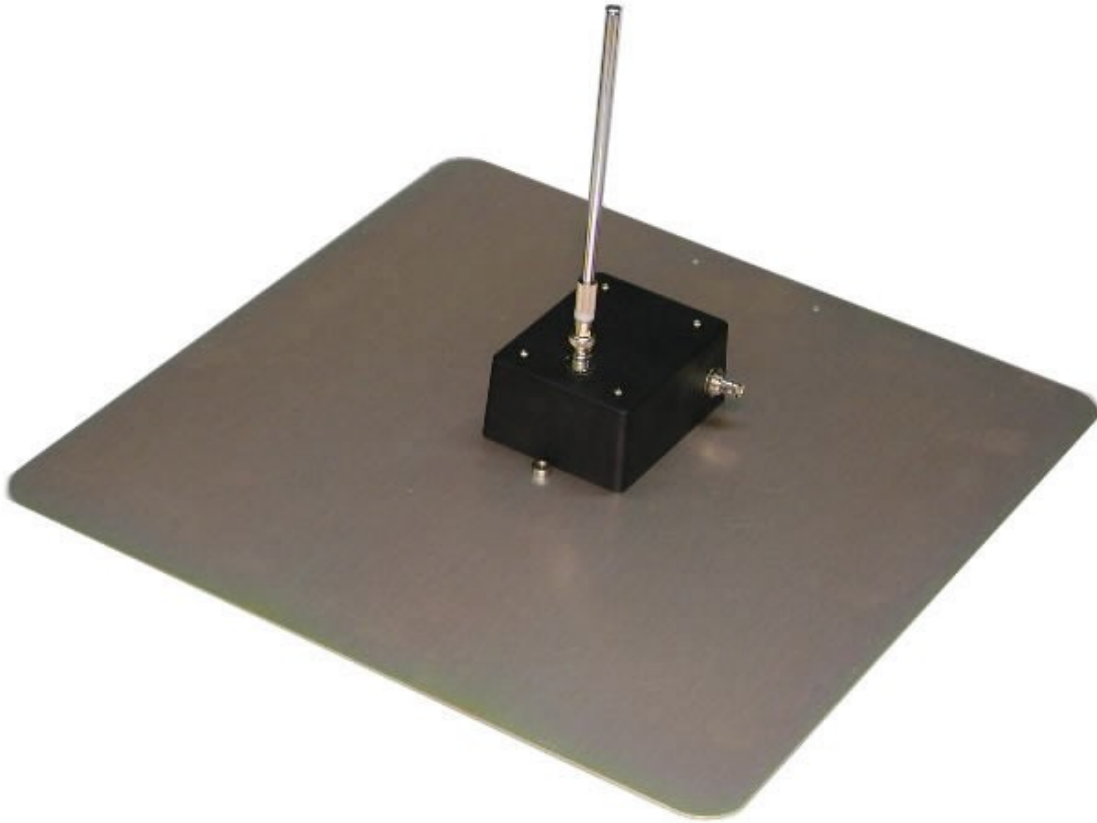
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# INTRODUCTION

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Model	Frequency Range	Part Number	Description
SAS-551	9 kHz – 40 MHz	2348	Passive Monopole Antenna

## INTENDED PURPOSES

This equipment is intended for general laboratory use in a wide variety of industrial and scientific applications and designed to be used in the process of generating, controlling and measuring high levels of electromagnetic Radio Frequency (RF) energy. It is the responsibility of the user to assure that the device is operated in a location which will control the radiated energy such that it will not cause injury and will not violate regulatory levels of electromagnetic interference.

## RANGE OF ENVIRONMENTAL CONDITIONS

This equipment is designed to be safe under the following environmental conditions:

Indoor use

Altitude: up to 2 km

Temperature: 5° C to 40° C

Maximum relative humidity: 80% for temperatures up to 31° C.

Decreasing linearly to 50% at 40° C

Pollution degree 2: Normally non-conductive with occasional condensation.

While the equipment will not cause hazardous condition over this environmental range, performance may vary.

# SPECIFICATIONS

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## GENERAL DESCRIPTION

The A.H. Systems passive monopole antenna is a general-purpose transmitting antenna which cover the 10 KHz – 40 MHz frequency range. Each unit comes with a telescoping rod and ground plane. Review this manual and become familiar with all safety markings and instructions.

## ANTENNA SPECIFICATIONS

SAS-551 Monopole Antenna specifications:

Frequency Range .....	9 kHz – 40 MHz
Input Connector Type.....	BNC(f)
Mounting Base.....	1/4-20 Tread(f)
Weight.....	3.5 lbs.
Size (W x H x D).....	18" x 18" x 41"
	46 cm x 46 cm x 104 cm

# OPERATING INSTRUCTIONS

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## ASSEMBLY INSTRUCTIONS

To prepare the antenna for operation, attach the telescoping rod antenna element to the top of the ground plane box.

**Connect the rod antenna by pushing straight down on the female connector on top of the amplifier. Do not apply excessive sideways force, as this can cause the antenna center-pin to break.**

## SETUP INSTRUCTIONS

The ground plane can be mounted to any tripod with a 1/4-20 attaching stud. Extend the rod antenna to 41" (104 cm) above the ground plane. Connect the output BNC connector on the side of the antenna to the output of a 50  $\Omega$  generator or amplifier. Establish a ground connection to the ground plane if required by the test specification.

## GENERAL USE INSTRUCTIONS

The SAS-551 Monopole antenna is a passive antenna designed to transmit high electric fields

This antenna may also be used as a passive receive antenna for testing in areas with high fields.

Each antenna is individually calibrated per ANSI C63.5 (ECSM) and comes with a calibration certificate references the NIST traceable test equipment.

The calibration tables shown provide a listing of the frequency of operation and its antenna factor in dB/m. The field strength is the receiver voltage in dB $\mu$ V plus the antenna factor (refer to the antenna factor calibration) plus any cable loss. When making a measurement, mount the antenna on an appropriate mast or tripod.

## OPTIONAL EQUIPMENT

The following is a recommend accessory list for the SAS-551 Passive Monopole Antenna:

### **ECF-10**

The ECF-10 is an equivalent capacitance fixture constructed per IEEE 291 and ARP 958. This is an indispensable tool used for gain adjustment and calibration of the active monopole antennas. The ECF-10 is used as a signal substitution source when calibrating the active monopole antennas. Refer to the calibration procedures below.

### **SAC-210**

Standard 3 meter BNC(m) to BNC(m) RF cable made with RG-58. Optional ferrite loading and custom lengths can be made to your specifications. Other cable types available upon request.

### **Adapters**

Need an Adapter? We stock those as well.

## CALCULATIONS

### EMISSIONS TESTING

Individual calibration data for the passive monopole antenna is supplied to comply with various emissions test requirements. For emissions measurements, add antenna factor plus cable loss to receiver reading in dB $\mu$ V to convert to field strength in dB $\mu$ V/meter.

$$\text{Field Strength(dBuV/m)} = \text{SA(dBuV)} + \text{AF(dB/m)} + \text{cable loss (dB)}$$

SA = Spectrum Analyzer or Receiver voltage reading

AF = Antenna Correction Factor

CL = Cable Loss in dB

### IMMUNITY TESTING

For Immunity measurements, the generated electric field strength can be calculated by:

FS = Approximate Field Strength in (V/m)

$$\text{FS (V/m)} = \frac{\sqrt{30Pg}}{d}$$

P = Power in watts

g = Numeric Gain

d = Distance in meters



## TYPICAL CONVERSION FORMULAS

### LOG -> LINEAR VOLTAGE

dB $\mu$ V to Volts	$V = 10^{((dB\mu V - 120) / 20)}$
Volts to dB $\mu$ V	$dB\mu V = 20 \log(V) + 120$
dBV to Volts	$V = 10^{(dBV / 20)}$
Volts to dBV	$dBV = 20 \log(V)$
dBV to dB $\mu$ V	$dB\mu V = dBV + 120$
dB $\mu$ V to dBV	$dBV = dB\mu V - 120$

### LOG -> LINEAR CURRENT

dB $\mu$ A to $\mu$ A	$\mu A = 10^{(dB\mu A / 20)}$
$\mu$ A to dB $\mu$ A	$dB\mu A = 20 \log(\mu A)$
dBA to A	$A = 10^{(dBA / 20)}$
A to dBA	$dBA = 20 \log(A)$
dBA to dB $\mu$ A	$dB\mu A = dBA + 120$
dB $\mu$ A to dBA	$dBA = dB\mu A - 120$

### LOG -> LINEAR POWER

dBm to Watts	$W = 10^{((dBm - 30) / 10)}$
Watts to dBm	$dBm = 10 \log(W) + 30$
dBW to Watts	$W = 10^{(dBW / 10)}$
Watts to dBW	$dBW = 10 \log(W)$
dBW to dBm	$dBm = dBW + 30$
dBm to dBW	$dBW = dBm - 30$

### TERM CONVERSIONS

dBm to dB $\mu$ V	$dB\mu V = dBm + 107 \quad (50\Omega)$ $dB\mu V = dBm + 10 \log(Z) + 90$
dB $\mu$ V to dBm	$dBm = dB\mu V - 107 \quad (50\Omega)$ $dBm = dB\mu V - 10 \log(Z) - 90$
dBm to dB $\mu$ A	$dB\mu A = dBm - 73 \quad (50\Omega)$ $dB\mu A = dBm - 10 \log(Z) + 90$
dB $\mu$ A to dBm	$dBm = dB\mu A + 73 \quad (50\Omega)$ $dBm = dB\mu A + 10 \log(Z) - 90$
dB $\mu$ A to dB $\mu$ V	$dB\mu V = dB\mu A + 34 \quad (50\Omega)$ $dB\mu V = dB\mu A + 20 \log(Z)$
dB $\mu$ V to dB $\mu$ A	$dB\mu A = dB\mu V - 34 \quad (50\Omega)$ $dB\mu A = dB\mu V - 20 \log(Z)$

### FIELD STRENGTH & POWER DENSITY

dB $\mu$ V/m to V/m	$V/m = 10^{(((dB\mu V/m) - 120) / 20)}$
V/m to dB $\mu$ V/m	$dB\mu V/m = 20 \log(V/m) + 120$
dB $\mu$ V/m to dBmW/m <sup>2</sup>	$dBmW/m^2 = dB\mu V/m - 115.8$
dBmW/m <sup>2</sup> to dB $\mu$ V/m	$dB\mu V/m = dBmW/m^2 + 115.8$
dB $\mu$ V/m to dB $\mu$ A/m	$dB\mu A/m = dB\mu V/m - 51.5$
dB $\mu$ A/m to dB $\mu$ V/m	$dB\mu V/m = dB\mu A + 51.5$
dB $\mu$ A/m to dBpT	$dBpT = dB\mu A/m + 2$
dBpT to dB $\mu$ A/m	$dB\mu A/m = dBpT - 2$
W/m <sup>2</sup> to V/m	$V/m = \text{SQRT}(W/m^2 * 377)$
V/m to W/m <sup>2</sup>	$W/m^2 = (V/m)^2 / 377$
$\mu$ T to A/m	$A/m = \mu T / 1.25$
A/m to $\mu$ T	$\mu T = 1.25 * A/m$

### E-FIELD ANTENNAS

Correction Factor	$dB\mu V/m = dB\mu V + AF$
Field Strength	$V/m = \sqrt{\frac{30 * \text{watts} * \text{Gain}_{\text{numeric}}}{\text{meters}}}$
Required Power	$\text{Watts} = \frac{(V/m * \text{meters})^2}{30 * \text{Gain}_{\text{numeric}}}$

### LOOP ANTENNAS

Correction Factors	$dB\mu A/m = dB\mu V + AF$
Assumed E-field for shielded loops	$dB\mu V/m = dB\mu A/m + 51.5$ $dBpT = dB\mu V + dBpT/\mu V$

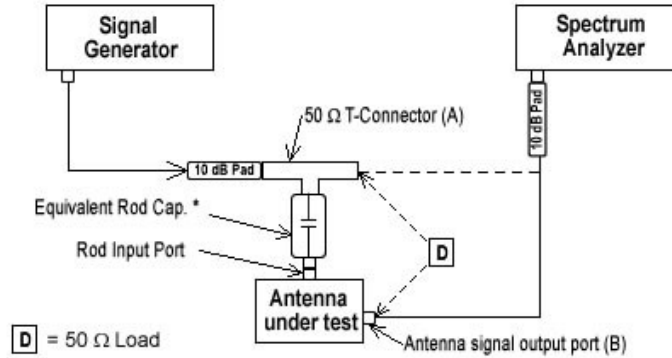
### CURRENT PROBES

Correction Factor	$dB\mu A = dB\mu V - dB_{(ohm)}$
Power needed for injection probe given voltage(V) into 50 $\Omega$ load and Probe Insertion Loss (I <sub>L</sub> )	$\text{Watts} = 10^{((I_L + 10 \log(V^2/50)) / 10)}$

# CALIBRATION

## Monopole Calibration

The antenna factor for the rod antenna shall be determined by measuring the signal transfer characteristics of the matching device and assuming that the antenna is a short monopole with an infinite ground plane. Set up the monopole to be calibrated and the test equipment per Figure 3. Allow all equipment to warm up for 15 minutes.



\* Also referred to as a Dummy Antenna.

Figure 3

### NOTES

If the VSWR of the receiver or signal generator is low, pads may not be needed or reduced to 6 dB or 3 dB.

With the equipment connected as shown and a 50 Ω termination on the T-connector (A), measure the received signal voltage  $V_L$  in dB $\mu$ V at the signal output port (B).

Leaving the RF output of the signal generator unchanged, transfer the 50 Ω termination to the signal output port (B) and transfer the receiver input cable to the T-connector (A). Measure the drive signal voltage  $V_D$  in dB $\mu$ V.

Subtract  $V_L$  from  $V_D$  and add 6 dB to obtain the antenna factor (in dB) of the antenna.

Records providing evidence that the required final inspection and tests are carried out shall be maintained and shall be available for review by the customer and third party inspectors. Such records include signed off ITPs, job cards, nonconformance reports, test reports and inspection reports, if any.

NOTE – The signal generator does not need to be calibrated, but it shall be stable. The 50 Ω termination shall have low VSWR. The spectrum analyzer shall be calibrated and have low VSWR.

# MAINTENANCE

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To ensure reliable and repeatable long-term performance, annual re-calibration of your active monopole preamplifier by A.H. Systems' experienced technicians is recommended. Our staff can recalibrate almost any type or brand of antenna.

For more information about our calibration services or to place an order for antenna calibration, visit our website at [www.AHSystems.com](http://www.AHSystems.com) or call (818) 998-0223.

## WARRANTY INFORMATION

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A.H. Systems Inc., warrants that our Antennas, Sensors and Probes will be free from defects in materials and workmanship for a period of three (3) years. All other products delivered under contract will be warranted for a period of two (2) years. Damage caused by excessive signals at the product's input is not covered under the warranty. A.H. Systems' obligation under this warranty shall be limited to repairing or replacing, F.O.B. Chatsworth, California, each part of the product which is defective, provided that the buyer gives A.H. Systems notice of such defect within the warranty period commencing with the delivery of the product by A.H. Systems.

The remedy set forth herein shall be the only remedy available to the buyer, and in no event shall A.H. Systems be liable for direct, indirect, incidental or consequential damages.

This warranty shall not apply to any part of the product which, without fault of A.H. Systems has been subject to alteration, failure caused by a part not supplied by A.H. Systems, accident, fire or other casualty, negligence, misuse or normal wear of materials.

Except for the warranty set forth above, there are no other warranties, expressed or implied, with respect to the condition of the product or its suitability for the use intended for them by the buyer.

For prompt service, please contact our service department for a Return Material Authorization Number before shipping equipment back to us.