

# SAS-563B Active Loop Antenna Operation Manual

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# INTRODUCTION

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Model	Frequency Range	Part Number	Description
SAS-563B	1 kHz – 30 MHz	2384	Active 12" Loop Antenna

## INCLUDED EQUIPMENT

- Amplifier/matching base unit
- 12" shielded loop antenna
- battery charger

## 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

## GENERAL DESCRIPTION

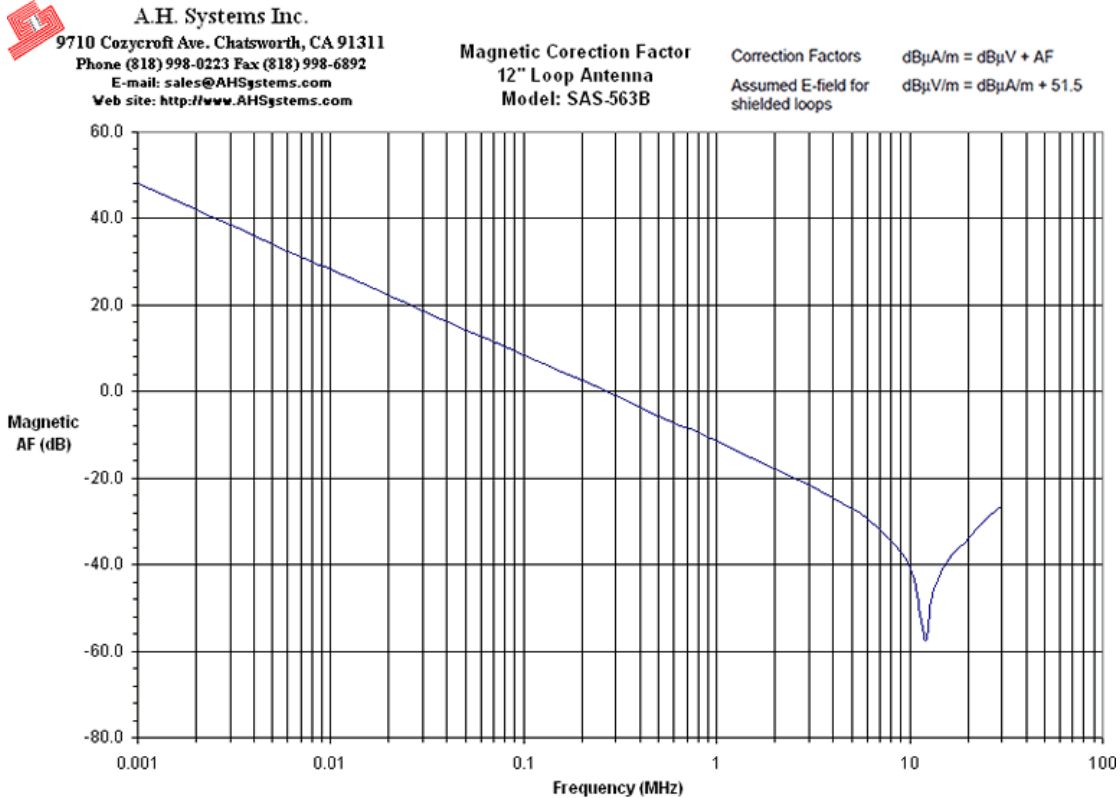
The A.H. Systems active loop antenna is a receiving antenna that covers the 1 KHz – 30 MHz frequency range. This loop antenna is ideal for emissions testing and has a balanced Faraday shield to reduce the E-field response for a pure magnetic field measurement. Review this manual and become familiar with all safety markings and instructions.

## ANTENNA SPECIFICATIONS

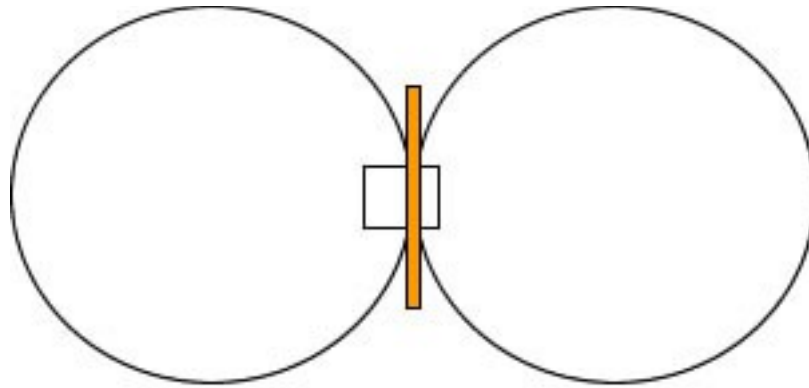
SAS-563B Loop Antenna specifications:

Frequency Range .....	1 kHz – 30 MHz
Impedance .....	50 ohms
Output Connector Type .....	BNC(f)
Mounting .....	1/4-20 Tread(f)
Weight .....	2.5 lbs. (1.13 kg)
Loop Diameter .....	12" (30.5cm)

Typical correction factor:



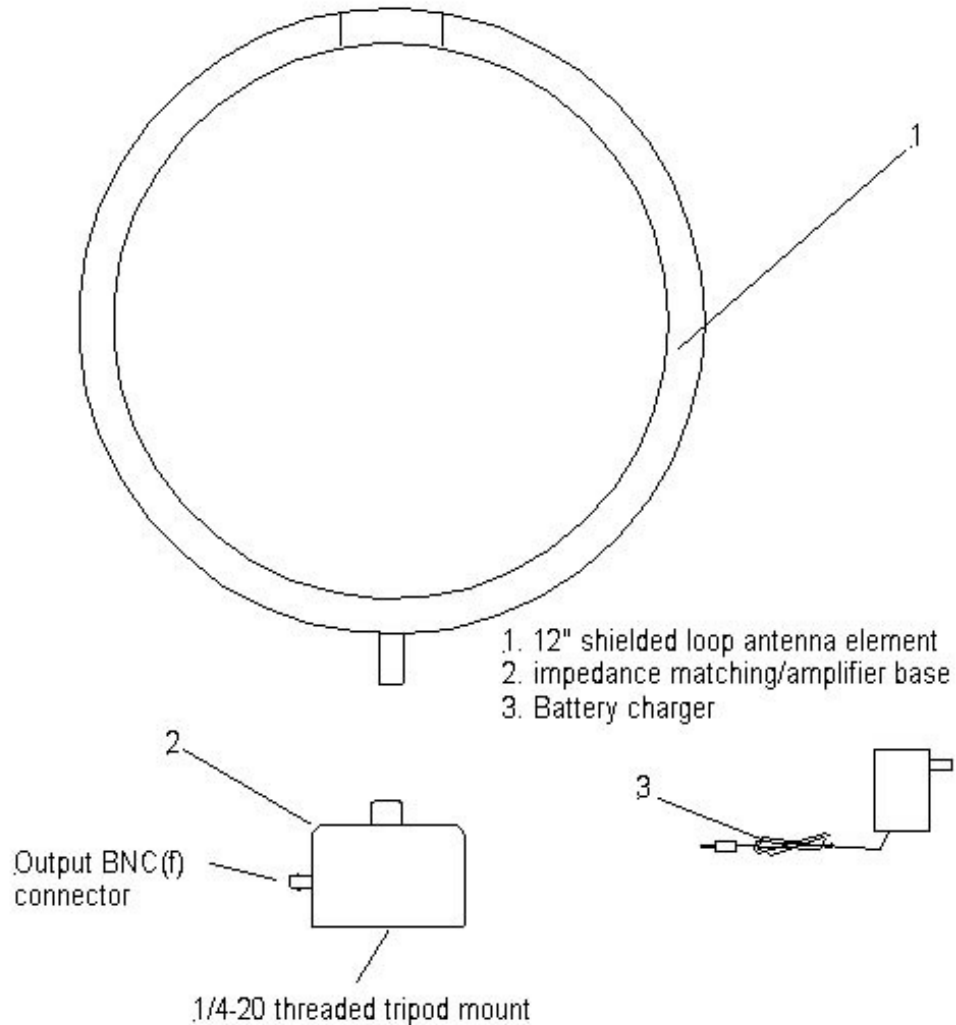
## Typical Radiation pattern



*top view of loop*

# OPERATING INSTRUCTIONS

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## ASSEMBLY INSTRUCTIONS

To prepare the antenna for operation, attach the shielded loop antenna element to the top of the impedance matching/amplifier base.

## SETUP INSTRUCTIONS

The antenna can be mounted to any tripod with a 1/4-20 attaching stud. Connect the output BNC connector on the side of the antenna to the input of a 50  $\Omega$  analyzer or receiver.

## GENERAL USE INSTRUCTIONS

The SAS-563B loop antenna is an active loop designed to perform magnetic field and shielding effectiveness testing. The loop antenna has a balanced Faraday shield to reduce the E-field response for a pure magnetic field measurement.

Each antenna is individually calibrated per IEEE 291-1991 and comes with a calibration certificate references the NIST traceable test equipment. Initially the antenna comes with a 1 year calibration interval, however depending on the type of use and standards that the antenna is being used, this interval can be adjusted.

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 with the plane of the loop antenna facing the DUT.

## SHIELDING EFFECTIVENESS TESTING

Both the SAS-563B and the SAS-564 loop antenna is used for shielding effectiveness testing. The SAS-563B is used as the receive antenna and should be connect to an analyzer or receiver, where the SAS-564 Loop antenna is a passive loop antenna used to transmit.



## CHARGING THE BATTERY

Position the input voltage selector located next to the wall plug on the back of charger to the proper voltage (either 110 – 120 Vac, 60 Hz or 220 – 240 Vac, 50 Hz). Be sure to check the available voltage and adjust the voltage selector as needed before use. The amplifier ON-OFF switch must be in the OFF/CHARGE position to charge the battery. Every hour of charge will result in two hours of operation for up to 10 hours of charging. Charging for up to 24 hours will not damage the battery. Using the battery charger to operate the amplifier directly is not recommended.

## REPLACING THE BATTERIES

Remove the four 6-32 flat head screws from the bottom of the base unit. Disconnect the battery lead from the PC card. Re-connect the lead from the new battery pack to the PC card. Snug the four 6-32 flat head screws.

## RECOMMENDED ACCESSORIES

The following is a recommend accessory list for the SAS-563B Active Loop Antenna:

### **SAS-564**

The SAS-564 has an input handling capability up to 500 Watts and rugged design which makes this loop antenna excellent for immunity and shielding effectiveness testing.

### **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.

### **Tripod**

The ATU-510 wooded Tripod comes with a spring loaded 1/4-20 male thread for mounting the SAS-563B Loop antenna.

### **Adapters**

Need an Adapter? We stock those as well.

## CALCULATIONS

### EMISSIONS TESTING

Individual calibration data for the active loop 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 $\mu$ A/meter.

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

SA = Spectrum Analyzer or Receiver voltage reading

MAF = Magnetic Antenna Correction Factor

CL = Cable Loss in dB

Fictitious electric field strength can be calculated by the following:

$$\text{dB}\mu\text{V/m} = \text{dB}\mu\text{A/m} + 51.5$$

## TYPICAL ANTENNA 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	$dB\mu V = dBm + 107$ (50 $\Omega$ ) $dB\mu V = dBm + 10 \log(Z) + 90$
dB $\mu$ V to dBm	$dBm = dB\mu V - 107$ (50 $\Omega$ ) $dBm = dB\mu V - 10 \log(Z) - 90$
dBm to dB $\mu$ A	$dB\mu A = dBm - 73$ (50 $\Omega$ ) $dB\mu A = dBm - 10 \log(Z) + 90$
dB $\mu$ A to dBm	$dBm = dB\mu A + 73$ (50 $\Omega$ ) $dBm = dB\mu A + 10 \log(Z) - 90$
dB $\mu$ A to dB $\mu$ V	$dB\mu V = dB\mu A + 34$ (50 $\Omega$ ) $dB\mu V = dB\mu A + 20 \log(Z)$
dB $\mu$ V to dB $\mu$ A	$dB\mu A = dB\mu V - 34$ (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> )	$\text{Watts} = 10^{((I_L + 10 \log(V^2/50)) / 10)}$

# MAINTENANCE

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

Repair maintenance is not recommended in the field. The antenna should be returned to A.H. Systems.

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.