

# SAS-544 Biconical Antenna Operation Manual

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# INTRODUCTION

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The SAS-544 Biconical Antenna is designed with a coaxial wound balun for increased power capability and intended for both transmitting and receiving high electromagnetic RF fields. This Biconical antenna may be used for radiating immunity measurements. Whether testing in a shielded enclosure, or outdoors, the rugged construction of the A.H. Systems Biconical antenna will ensure long life, and reliable performance.

## INTENDED PURPOSES

The Biconical antenna is intended for general laboratory use in a wide variety of industrial and scientific applications and has been 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.

## OPTIONAL EQUIPMENT

The following is a recommend accessory list for the SAS-543 High Power Biconical Antenna:

### CONNECTING ACCESSORIES:

**SAC-211**

Standard 3 meter N(m) to N(m) RF cable made with RG-214/U. Other cable types available upon request.

### **Adapters**

Need an Adapter? We stock those as well.

### MOUNTING ACCESSORIES:

**AEH-510**

Azimuth and elevation head to assist the test engineer in orientating biconical antenna at the device under test.

**ATU-510**

Each tripod leg is independently adjustable in angle and length to facilitate antenna height setting. The tripod legs have a rubber tip on one end for indoor or hard surface use, and a metal spike on the other end for outdoor soft surface (such as dirt) use.

# OPERATING INSTRUCTIONS

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## ASSEMBLY INSTRUCTIONS

The SAS-544 Biconical Antenna is shipped with the elements detached from the balun. Simply remove the elements from the shipping container and attach the elements to the balun assembly.

## MOUNTING INSTRUCTIONS

The SAS-544 biconical antenna is supplied with an antenna balun clamp. Place the SAS-544 balun assembly into the balun mounting clamp, attach the balun mounting clamp on to a tripod or azimuth and elevation head with a 1/4-20 thread.

Mount the antenna such that the elements are parallel to the ground for horizontal polarization testing, or perpendicular to the ground for vertical testing. The biconical antenna should be pointed or aimed in the direction of the transmission path with the elements perpendicular to the transmission path.

## OPERATING INSTRUCTIONS

Once the antenna is mounted to a mast or tripod, connect an N-type coaxial cable from the antenna to a receiver or RF generator. The cable should be matched to 50 ohms, relatively low loss and adequately shielded against leakage such as RG-214/U or better.

The Biconical Antenna is in the horizontal polarization when the antenna elements are parallel to the ground, and vertical polarization when the elements are perpendicular to the ground.

To minimize impedance mismatch errors, it is recommended that high-quality in-line attenuators be used to reduce reflections. Connect the attenuator at the antenna end of the transmitting cable, or when receiving connect the attenuator at the measuring instrument or preamplifier input.

Dress the cables straight back from the antenna connector at least 1 meter before being dressed vertically down to the ground plane. Signal cables that are dressed orthogonal to the antenna elements will have minimal coupling to the antenna field, but the cable shields may carry external currents caused by impedance imperfections. Also, portions of the cables that are not straight down or straight back will couple to the antenna fields.

# SPECIFICATIONS

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## ELECTRICAL SPECIFICATIONS

Frequency Range .....	20 Mhz – 300 MHz
Antenna Factor .....	6 to 21 dB/m
Antenna Gain .....	-23 to 2.8 dBi
Impedance (nominal) .....	50Ω
Maximum Continuous Power .....	300 Watts
Maximum Radiated Field .....	20 V/m
Connector .....	N-Type (female)
Mounting .....	1/4-20 (female)

## PHYSICAL SPECIFICATIONS

Weight .....	4.3 lbs. (1.95 kg)
Size (W x H).....	52.75" x 29" (134cm x 73.7cm)

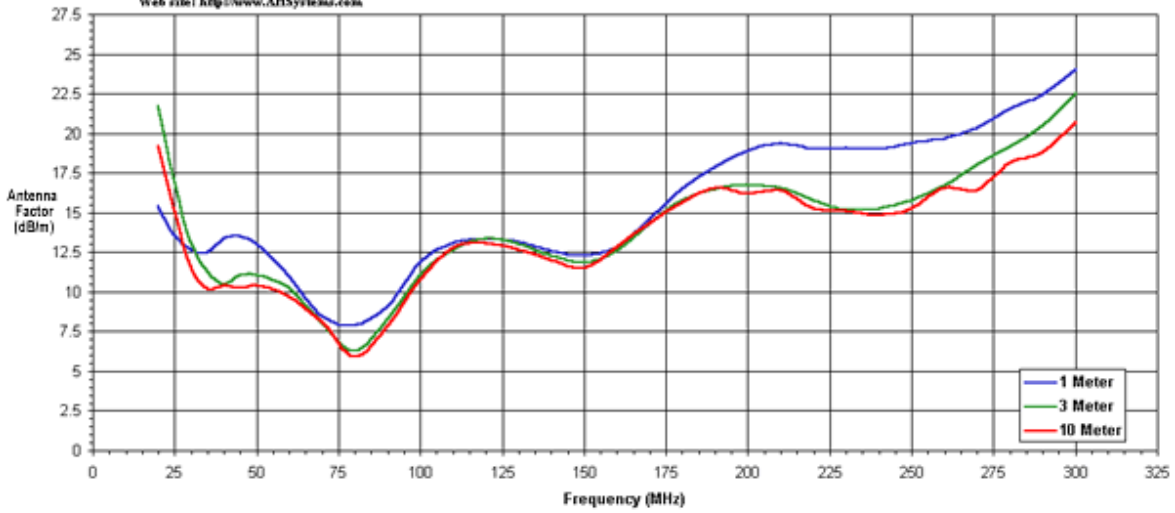
### TYPICAL DATA



**A.H. Systems Inc.**  
9710 Cozycroft Ave. Chatsworth, CA 91311  
Phone (818) 998-0223 Fax (818) 998-6892  
E-mail: [Info@AHSystems.com](mailto:Info@AHSystems.com)  
Web site: <http://www.AHSystems.com>

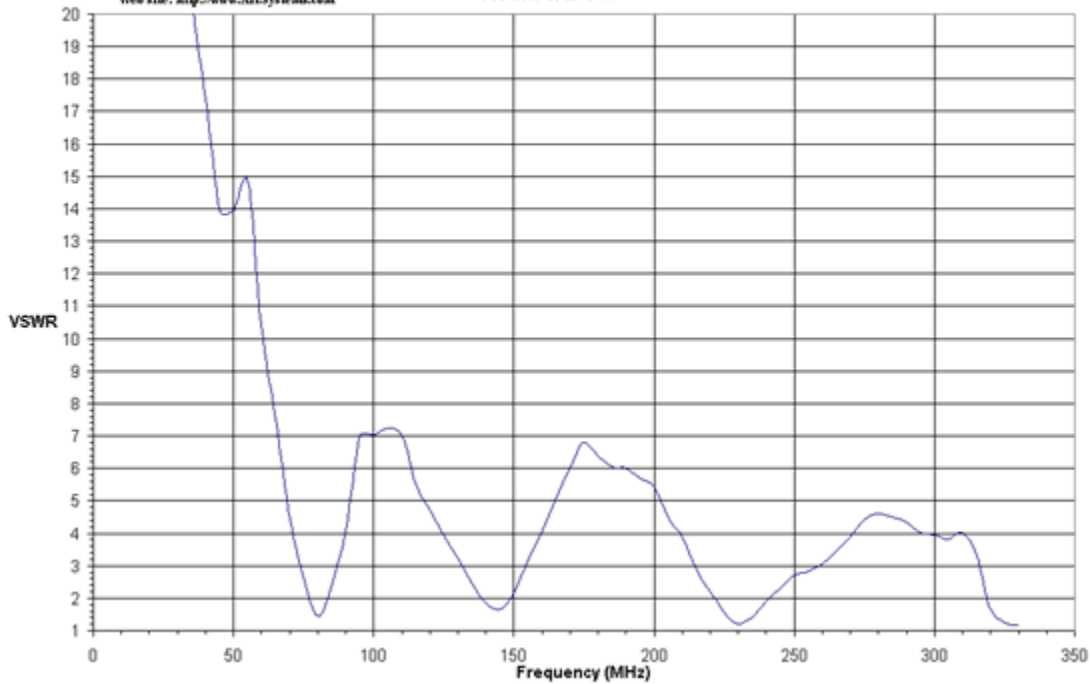
**Antenna Factor**  
High Field Biconical Antenna  
Model SAS-544

Conversion of meter reading  
to field strength:  
 $\text{dBuV/m} = \text{dBuV} + \text{AF} + \text{cable loss}$



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Web site: <http://www.AHSystems.com>

**VSWR**  
Model: SAS-544



## CALCULATIONS

### EMISSIONS TESTING

Individual calibration data for the log periodic antenna is supplied at appropriate distances (3, and 10 meter) 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	$\sqrt{V/m} = \sqrt{30 * \text{watts} * \text{Gain}_{\text{numeric}}}$ 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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## MAINTENANCE PROCEDURES

Proper antenna maintenance should include:

- Visual inspection of RF connectors
- Check for bent and loose elements
- Check for loose or missing hardware
- Corrosion near the element joints

At least once a month it is a good idea to wipe down the antenna with a damp rag.

## ANNUAL CALIBRATION

To ensure reliable and repeatable long-term performance, annual re-calibration of your antennas, preamplifiers and current probes by A.H. Systems experienced technicians is recommended. Our staff can calibrate almost any type or brand of antenna.

It is always up to the user to determine the appropriate interval for calibration certification based on the requirements of the end users specific test/application. The calibration of EMC antennas is important for those conforming to compatibility standard. Radiated emissions testing for electromagnetic compatibility (EMC) requires the measurement of electric field (E-field) strength, which is compared with a limit level. The output voltage of an antenna is converted to E-field strength via its antenna factor, the measurement of which must include the uncertainty components related to that particular antenna, taking into consideration the environment in which the antenna is to be used for the testing. Most standards will specify the appropriate interval for re-calibration of your EMC antenna.

In some cases these antennas are used for a manufacturers pre-compliance testing, field monitoring, surveillance and/or other applications where the exact field intensity of the received signal is not of importance. For those customers a yearly re-calibration is not necessary, however it is recommended that an interval for maintenance be performed.

For more information about our calibration services or to place an order for antenna calibration visit our website at <http://www.AHSystems.com> or call 1(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.