EHA-51B Active Monopole and Loop Antenna Operation Manual

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INTRODUCTION

Model	Frequency Range	Part Number	Description
EHA-51B	1 kHz – 30 MHz	2661	Active 12” Loop/Monopole Antenna

INCLUDED EQUIPMENT

- Amplifier/matching base unit
- 12” shielded loop antenna
- 41” telescoping rod antenna element
- 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 EHA-51B Antenna is an active, general-purpose, receive-only antenna that covers 1 KHz - 60 MHz. This antenna has a switchable front end for receiving as a monopole or loop antenna.

As a monopole antenna it is ideal for instantaneous bandwidth scanning (without tuning) of electric fields in its frequency range and can drive any receiver with 50-ohm input impedance.

The EHA-51B is also an active receive only loop antenna for magnetic field testing. 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. It is suitable for MIL-STD, VDE, and TEMPEST testing, with reliable, repeatable measurements.

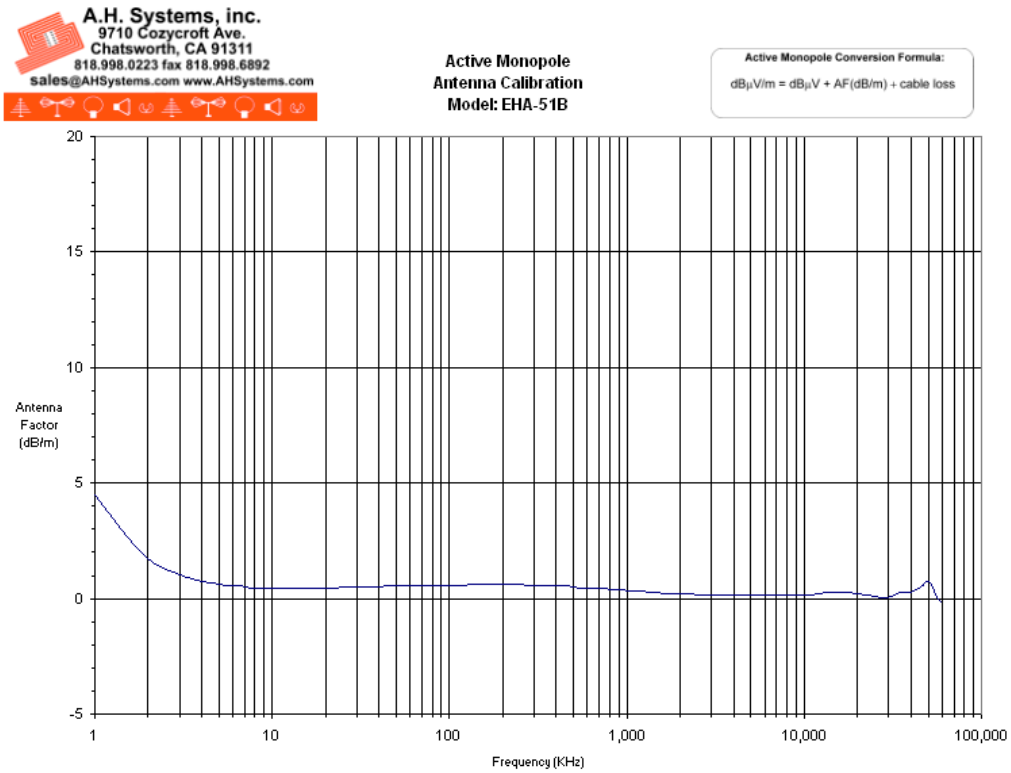
Review this manual and become familiar with all safety markings and instructions.

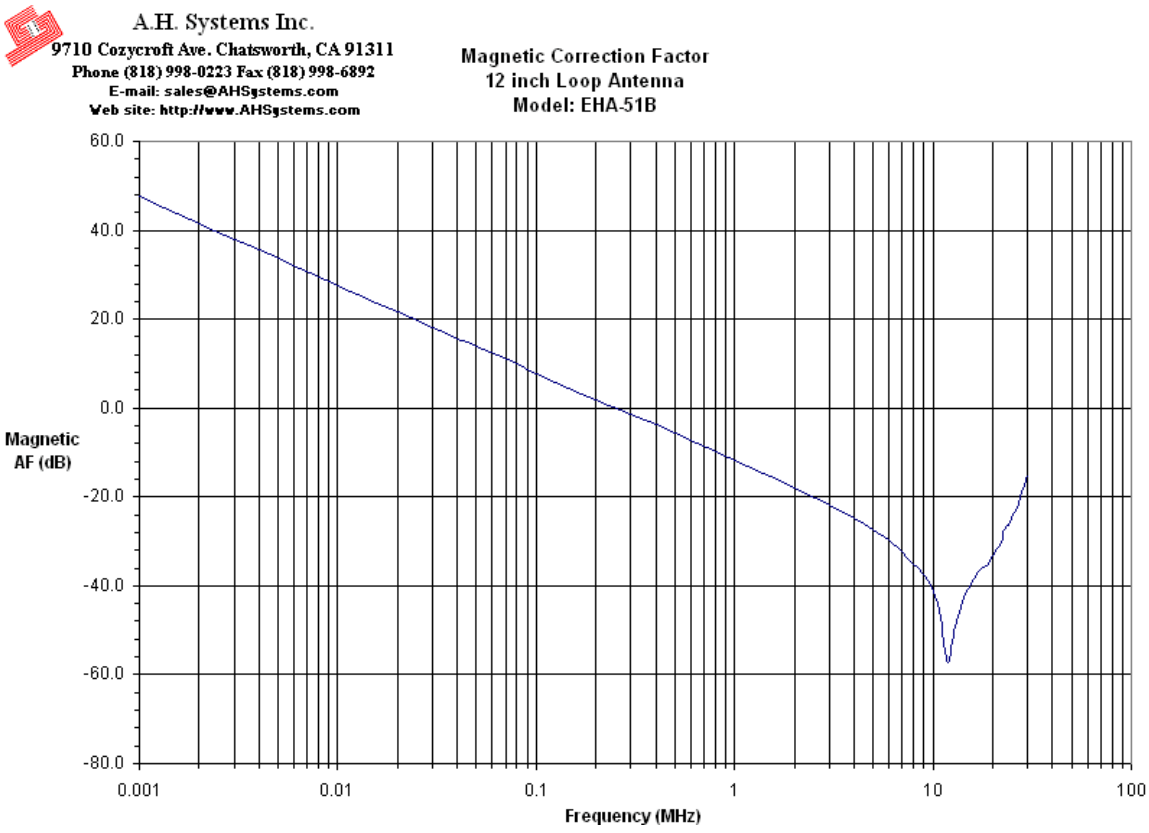
ANTENNA SPECIFICATIONS

EHA-51B Monopole/Loop Antenna specifications:

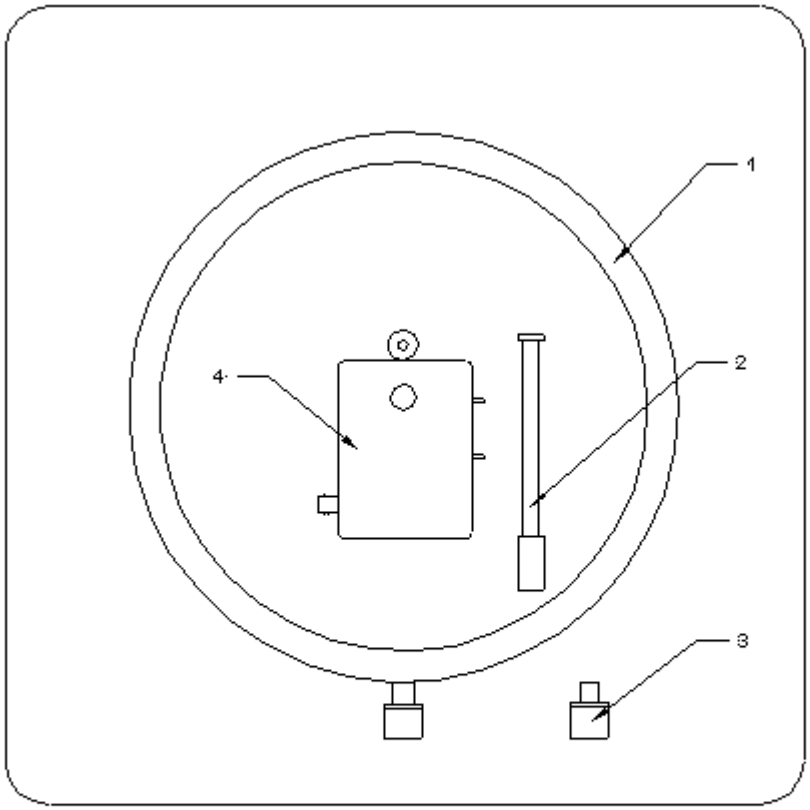
Frequency Range	1 kHz – 30 MHz
Impedance	50 ohms
Output Connector Type	BNC(f)
Mounting	1/4-20 Tread(f)
Weight	2.5 lbs. (1.13 kg)
Loop Diameter	12" (30.5cm)

TYPICAL CORRECTION FACTOR

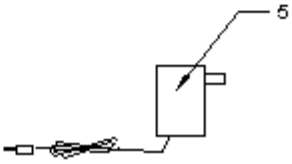




OPERATING INSTRUCTIONS



1. 12" shielded loop antenna element
2. Telescoping rod antenna element
3. BNC(f) to N(m) adpater
4. Impedance matching/amplifier base
5. Battery charger



ASSEMBLY INSTRUCTIONS

To prepare the antenna for operation, select the appropriate antenna switch on the side of the impedance matching/amplifier base and attached the corresponding antenna element. The telescoping rod antenna element will require a BNC(f) to N(m) adapter.

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 impedance matching amplifier base to the input of a 50 Ω analyzer or receiver.

GENERAL USE INSTRUCTIONS

The EHA-51B 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 dBμV 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 EFFECTIVNESS TESTING

Both the EHA-51B with the loop antenna element attached and the SAS-564 loop antenna can be used for shielding effectiveness testing. The EHA-51B 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 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 assembly to the PC card. Snug the four 6-32 flat head screws.

RECOMMENDED ACCESSORIES

The following is a recommend accessory list for the EHA-51B Active Monopole/Loop 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.

SAC-461F
The SAC-461F is a cable kit required by MIL-STD 461F that contains the appropriate ferrite bead and floor mounting bracket.

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 dBμV to convert to field strength in dBμA/meter.

Field Strength(dBuA/m) = SA(dBuV) + MAF(dB/m) + 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:

dBμV/m = dBμA/m + 51.5

TYPICAL ANTENNA FORMULAS

LOG -> LINEAR VOLTAGE

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

LOG -> LINEAR CURRENT

dBμA to uA	$\mu A = 10^{(dB\mu A / 20)}$
μA to dBμA	$dB\mu A = 20 \log(\mu A)$
dBA to A	$A = 10^{(dBA / 20)}$
A to dBA	$dBA = 20\log(A)$
dBA to dBμA	$dB\mu A = dBA + 120$
dBμA 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 dBμV	$dB\mu V = dBm + 107$ (50Ω) *$dB\mu V = dBm + 10\log(Z) + 90$*
dBμV to dBm	$dBm = dB\mu V - 107$ (50Ω) *$dBm = dB\mu V - 10\log(Z) - 90$*
dBm to dBμA	$dB\mu A = dBm - 73$ (50Ω) *$dB\mu A = dBm - 10\log(Z) + 90$*
dBμA to dBm	$dBm = dB\mu A + 73$ (50Ω) *$dBm = dB\mu A + 10\log(Z) - 90$*
dBμA to dBμV	$dB\mu V = dB\mu A + 34$ (50Ω) *$dB\mu V = dB\mu A + 20\log(Z)$*
dBμV to dBμA	$dB\mu A = dB\mu V - 34$ (50Ω) *$dB\mu A = dB\mu V - 20\log(Z)$*

FIELD STRENGTH & POWER DENSITY

dBμV/m to V/m	$V/m = 10 (((dB\mu V/m) -120) / 20)$
V/m to dBμV/m	$dB\mu V/m = 20 \log(V/m) + 120$
dBμV/m to dBmW/m²	$dBmW/m^2 = dB\mu V/m - 115.8$
dBmW/m² to dBμV/m	$dB\mu V/m = dBmW/m^2 + 115.8$
dBμV/m to dBμA/m	$dB\mu A/m = dB\mu V/m - 51.5$
dBμA/m to dBμV/m	$dB\mu V/m = dB\mu A + 51.5$
dBμA/m to dBpT	$DBpT = dB\mu A/m + 2$
dBpT to dBμA/m	$dB\mu A/m = dBpT - 2$
W/m² to V/m	$V/m = SQRT(W/m^2 * 377)$
V/m to W/m²	$W/m^2 = (V/m)^2 / 377$
μT to A/m	$A/m = \mu T / 1.25$
A/m to μT	$\mu T = 1.25 * A/m$

E-FIELD ANTENNAS

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

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 50Ω load and Probe Insertion Loss (I_L)

$$Watts = 10^{((I_L + 10\log(V^2/50))/10)}$$

MAINTENANCE

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 or call (818) 998-0223.

WARRANTY INFORMATION

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 it's 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.