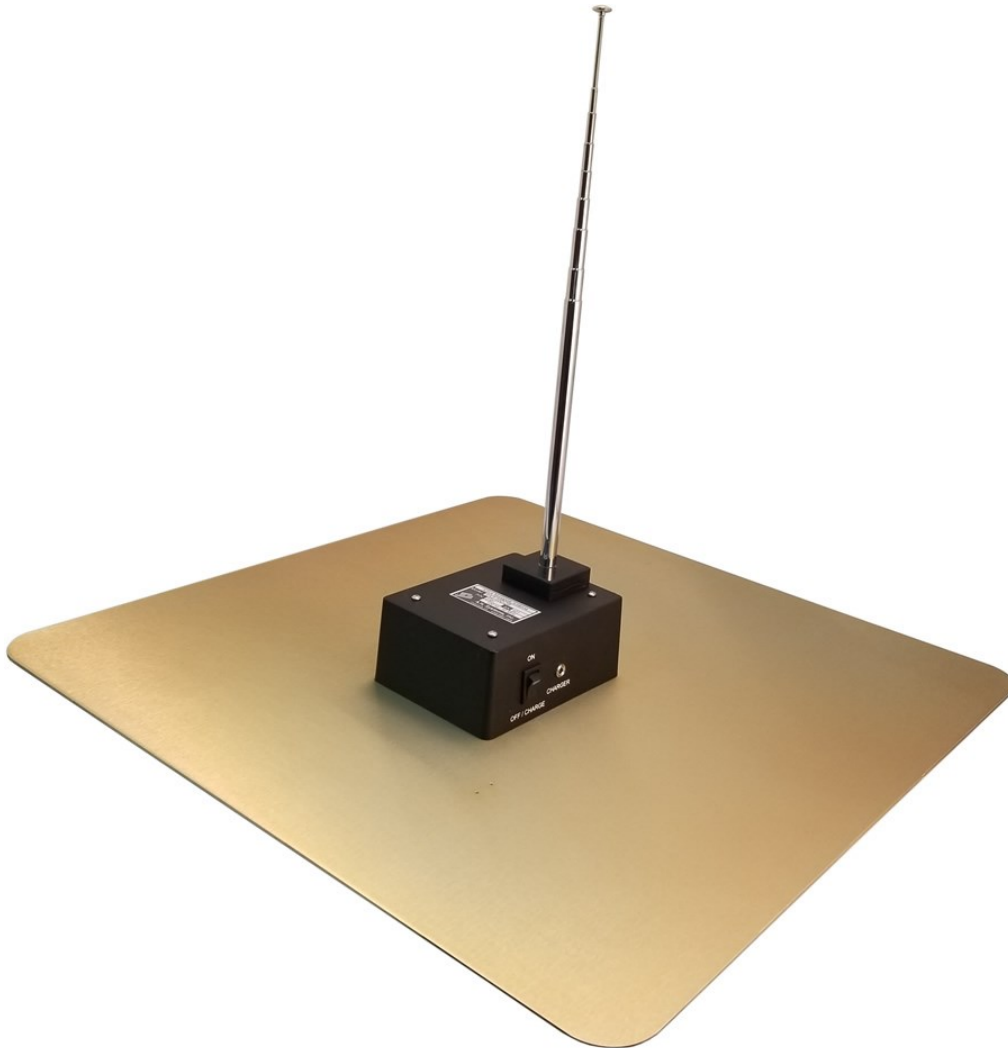


Active Monopole Antennas User Manual

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INTRODUCTION



Model	Frequency Range	Part Number	Description
SAS-550-1B	9 kHz – 60 MHz	2380	Active Monopole Antenna, Battery Powered
SAS-550-2B	100 Hz – 60 MHz	2381	Active Monopole Antenna, Battery Powered

Included parts:

- Antenna Base with ground plane
- Telescoping Antenna Element
- Battery Charger
- Antenna Calibration Manual

* Calibration certificate with data included.

SAFETY PRECAUTIONS

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.

HAZARDOUS RF VOLTAGES

The active monopole antenna is reliable when operated under specified conditions; however, the use of sensitive, high-performance semiconductors causes the active monopole to be susceptible to ESD and EOS. The risk of damage due to ESD is small, but possible.

To reduce the risk of fire, electric shock and/or injury to persons, basic safety precautions should always be followed when using electrical devices, including the following:

1. **READ ALL INSTRUCTIONS BEFORE OPERATING THE ACTIVE MONOPOLE ANTENNA.**
2. Use the antenna only as specified.
3. Please dispose of batteries responsibly and in accordance with all applicable laws and regulations.
4. To protect against electric shock, do not immerse the power cord, power plug or Antenna in water or in any other liquid.
5. Do not operate the product with a damaged charger cord or charger plug or after the antenna malfunctions or has been damaged in any manner.
6. This is not intended for permanent outdoor use.
7. Do not allow the cord or the antenna to rest on or near hot surfaces such as a hot gas or electric burner or a heated oven.
8. Disconnect the charger from the active monopole when not in use and before user servicing and cleaning.
9. Do not use this product for anything other than its intended use.

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 monopole antennas are active, general-purpose, receive-only antennas which cover the 100 Hz – 60 MHz frequency range. They are ideal for instantaneous bandwidth scanning (without tuning) of electric fields in its frequency range and can drive any receiver with an input impedance of 50 Ω . Each unit comes with a telescoping rod, ground plane with a high impedance matched preamplifier and battery charger. Review this manual and become familiar with all safety markings and instructions. Verify that the antenna impedance is compatible with the receiver impedance.

ANTENNA SPECIFICATIONS

SAS-550-1B Active Monopole Antenna specifications:

Frequency Range	9 kHz – 60 MHz
Antenna Factor	0 dB/m
Flatness	+/- 0.5 dB from 20 kHz– 30 MHz
.....	+/- 5 dB whole range
Sensitivity	5 dB μ V/m @ 10 kHz
.....	-20 dB μ V/m @ 1 MHz
Dynamic Range	96 dB @ 10 kHz
.....	122 dB @ 1 MHz
Saturation.....	87 dBuV/m
Output Connector Type.....	BNC(f)
Input Power	12 Vdc Battery
Weight	4.7 lbs. / 2.1 kg
Size (W x H x D)	18" x 18" x 41" (46 cm x 46 cm x 104 cm)

SAS-550-2B Active Monopole Antenna specifications:

Frequency Range	100 Hz – 60 MHz
Antenna Factor	0 dB/m
Flatness	+/- 3.5 dB from 2 kHz – 30 MHz
.....	+/- 24 dB whole range
Sensitivity	5 dB μ V/m @ 10 kHz
.....	-20 dB μ V/m @ 1 MHz
Dynamic Range	96 dB @ 10 kHz
.....	122 dB @ 1 MHz
Saturation.....	87 dBuV/m
Output Connector Type.....	BNC(f)
Input Power	12 Vdc Battery
Weight	4.7 lbs / 2.1 kg
Size (W x H x D)	18" x 18" x 41" (46 cm x 46 cm x 104 cm)

OPERATING INSTRUCTIONS

ASSEMBLY INSTRUCTIONS

To prepare the antenna for operation, attach the telescoping rod antenna element to the top of the high impedance preamplifier. Adjust the rod length to 41" (1.04 meters). Do not operate the Monopole antenna with the Battery Charger connected.

BATTERY CHARGING INSTRUCTIONS

Position the input voltage selector on the 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 active monopole 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.

Longest life and best performance can be obtained if the battery is charged when the air temperature is between 65°F and 75°F (18° - 24°C). DO NOT charge the battery in an air temperature below 40°F (4.5°C), or above 105°F (40.5°C).

SETUP INSTRUCTIONS

The active monopole and ground plane can be mounted to any tripod with a 1/4-20 attaching stud. Attach the rod antenna to the connector on the top of the amplifier. Extend the rod antenna to 41" (104 cm) above the ground plane. Connect the output BNC connector on the side of the amplifier to the input of a 50 Ω receiver or spectrum analyzer. Establish a ground connection to the ground plane if required by the test specification.

The POWER indicator LED will illuminate and stay lit as long as the battery has sufficient voltage to power the active monopole. If the LED does not illuminate, do not use the active monopole until the battery has been recharged.

GENERAL USE INSTRUCTIONS

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 μ 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. Ensure that the active monopole antenna is turned on and use the appropriate correction factors. The active monopole antenna is easy to set up and provides good reception with a minimal need for space. Its flat 0 dB antenna factor makes it a convenient choice when calculating the field intensity. The signal field strength is the receiver voltage in dB μ V plus the antenna factor (refer to the antenna factor calibration tables) plus any cable loss.

ANTENNA FORMULAS AND CALCULATIONS

A specific antenna factor is associated with each frequency. This number is to be added to the receiver reading (in dB μ V) to convert to field intensity in dB μ V/m.

EXAMPLE:

Assume the transmitter to be measured is operating at 1 MHz and the receiver reading indicates 44.0 dB μ V

AF (dB/m) = 0.1

Receiver reading (dB μ V) = 44 dB μ V

Cable loss (dB) = 0.7

Field Intensity = AF + receiver reading + cable loss

Field Intensity = 0.1 + 44.0 + 0.7

Field Intensity = 44.8 dB μ V/m

CALIBRATION

Equivalent Capacitance

With changes to our Active monopole antenna (converting the input connection from a BNC to a more rugged 1/4-20 input) our element diameter changed to 6.17mm (Average). It is our recommendation to use a 12 pF for the ECSM fixture for an element height of 41" (1.04 meter) as per ANSI C63.5:2017 and CISPR 16-1-6:2017.

The formula for calculating the capacitance is (per ANSI C63.5:2017 and CISPR 16-1-6:2017):

$$C_a = (55.6 h) / (\ln(h / a) - 1) * (\tan(2 \pi h / \lambda)) / (2 \pi h / \lambda) \quad \text{Eq. 1}$$

where:

h = actual length of the monopole element (adjusted to 1.04m), m

a = average radius of the antenna element (6.17mm), m

λ = wavelength in meters

C_a = capacitance of the dummy load

NOTE - Other fixtures with different capacitance are available as an option.

Effective Height Calculation

The correction factor for the calibration is dependent on the height of the monopole. The effective height calculation is:

$$h_e = (\lambda / 2\pi) * \tan(\pi h / \lambda) \quad \text{Eq. 2}$$

where:

λ = wavelength in meters

h = Telescoping element height in meters

Examples:

- For a 41" (1.04 Meter) length, the effective height would be 0.52 meters (up to approximately 2 MHz) and the correction factor should be $20 * \text{Log}(0.52) = -5.68$ dB.
- For a 1 Meter length, the effective height would be 0.5 meters (up to approximately 2 MHz) and the correction factor should be $20 * \text{Log}(0.5) = -6.02$ dB.

Active Monopole Calibration

The antenna factor for the rod antenna shall be determined by measuring the signal transfer characteristics with 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 30 minutes.

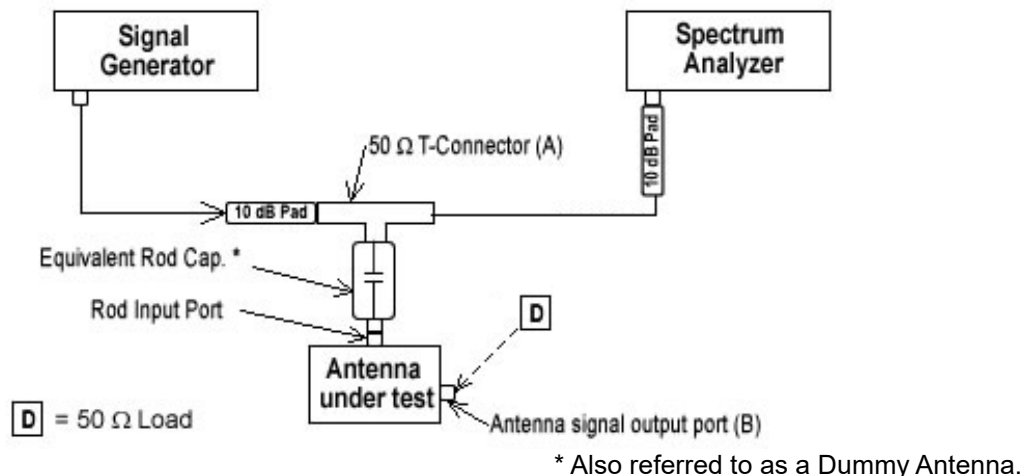


Figure 1

- 1) With the equipment connected as shown in Figure 1, measure the drive signal voltage V_D in $\text{dB}\mu\text{V}$ at the T-connector (A).

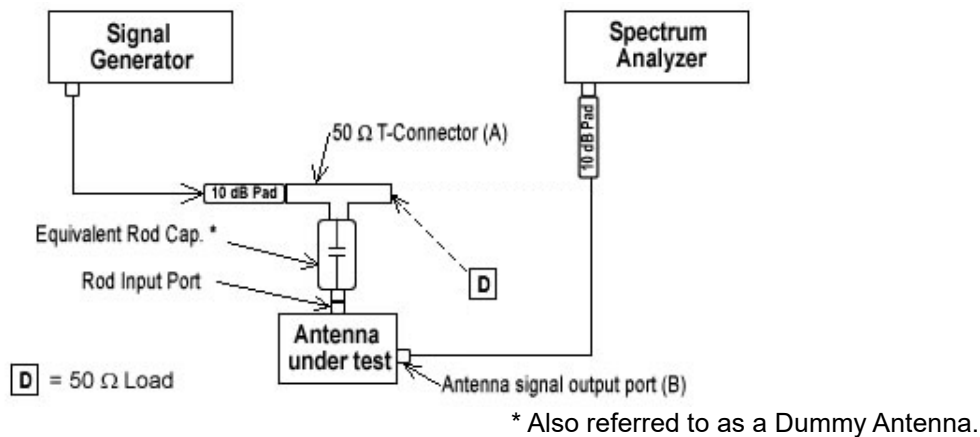


Figure 2

- 2) Leaving the RF output of the signal generator unchanged, transfer the $50\ \Omega$ termination to the T-connector (A) and transfer the receiver input cable to the signal output port (B). Measure the output signal voltage V_L in $\text{dB}\mu\text{V}$.
- 3) The antenna factor (in dB) is calculated by the following equation.

$$AF(\text{dB}) = V_D - V_L - (20 \cdot \log(h_e)) \quad \text{Eq.3}$$

NOTES – If the VSWR of the receiver or signal generator is low, pads (attenuators) may not be needed or reduced to 6dB or 3dB. The signal generator does not need to be calibrated, but it shall be stable per manufacturers recommendations. The $50\ \Omega$ termination and attenuators shall have low VSWR. The spectrum analyzer shall be calibrated and have low VSWR.

ACCESSORIES

ECF-12K (Equivalent Capacitance Fixture)

The ECF-12K is an equivalent capacitance fixture constructed per ANS C63.5:2017 and CISPR 16-1-6:2017. This is an indispensable tool used for gain adjustment and calibration of the active monopole antennas. The ECF-12K is used as a signal substitution source when calibrating the active monopole antennas. Refer to the alignment and calibration procedures below.

SAC-212 (3 Meter Antenna BNC/N Cable)

3 Meter BNC(m) to N(m) RF cable assembly providing repeatable, reliable performance for use in a variety of commercial and industrial applications.

SAC-461F (Cable kit for MIL-STD 461)

An optional cable kit is available to comply with MIL-STD 461F/G which includes an appropriate length cable, ferrite bead and a right-angle bracket to mount to the floor of the chamber.

ATU-510 (Antenna Tripod, wooden)

The ATU-510 wooded Tripod comes with a spring loaded 1/4-20 male thread for mounting all of A.H. Systems and most other compliance measurement antennas. This wood tripod can hold up to 30 lbs. (13.6 Kg). Each wooden leg is adjustable independently of each other. They can adjust from 38" in length to 63" and locked up to a 90-degree angle, allowing an infinite number of settings.

MAINTENANCE

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 or call (818) 998-0223.

CLEANING

Turn off and unplug the unit before cleaning.

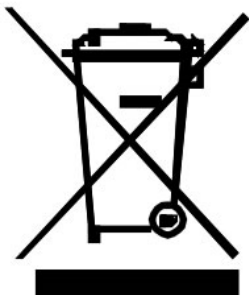
1. The outside of the Active monopole antenna can be cleaned with a soft, damp cloth.
2. The ground plane can be removed and washed in warm soapy water (not dishwasher safe). Do not use abrasive cleaners as they may damage the surface. Dry before replacing in the unit.
3. The BNC connectors can be cleaned of dust with a small soft brush.

REPLACING THE BATTERY ASSEMBLY

Turn off and unplug the unit before changing the battery pack assembly.

1. Remove the four 6-32 flat head screws from the bottom of the ground plane.
2. Disconnect the battery lead from the PC card.
3. Re-connect the lead from the new battery pack to the PC card.
4. Snug the four 6-32 flat head screws.
5. Ensure that the orientation of the amplifier box is that the input rod connector is facing toward the center of the ground plane.

Safety: Please dispose of batteries responsibly; never dispose of batteries in a fire, batteries may explode or leak.



Never dispose of used batteries or rechargeable batteries in household waste. As consumers, users are legally required to take used batteries to appropriate collection sites, the retail store where the batteries were purchased, or wherever batteries are sold.

Disposal: Do not dispose of this instrument in common waste. The user is obligated to take end-of-life devices to a designated collection point for the disposal of electrical and electronic equipment.

FAQ's

Q: Is your output connector bonded to the network case per MIL-STD 461F/G?

A: The signal output connector is bonded to the antenna matching network case.

Q: The product page states that the antenna includes an 18" ground plane but the standard I'm testing to requires at least a 60cm ground plane?

A: Our standard monopole antennas comes with an 18" ground plane. A 24" ground plane is also available and typically in stock.

Q: What is the ECSM calibration?

A: ECSM stands for equivalent capacitance substitution method and it's a calibration method that measures the insertion loss of the matching unit with an equivalent antenna fixture (our model ECF-12K).

Q: Can the active monopole antennas be used for transmitting applications?

A: No, the active monopole antennas are a receive only antenna. Any attempt to transmit power will damage the antenna.

Q: My telescoping rod has a BNC connector; do you still carry this part?

A: Yes, the telescoping rod with a BNC connector (P/N 2337-1) is for our older active monopole antennas. All new active monopole antennas have been re-designed to accept a telescoping rod with a 1/4-20 thread instead of a BNC connector. This new connection makes for a better electrical performance as well as an improved rugged design.

Q: Can I use a different element length?

A: Yes, however calibration results were based on a 41" (1.04 Meter) element length and they will not be valid for different lengths. Please contact our calibration department for a custom calibration of the active monopole with a different element length.

Q: What type of battery is included with the active monopole antennas?

A: The active monopole antenna has a 12VDC NiMH 2000mAh battery assembly (P/N 2351-3).

Q: How long does it take to charge the batteries?

A: 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.

Q: What is the lifetime of the battery pack?

A: That will depend on the amount of usage (charge/discharge cycles). A typical battery pack will last 3 to 5 years

TROUBLESHOOTING

Problem	Possible Cause	Possible Solution
Unit will not turn on	Battery pack not charged	Check battery pack charging requirements
	Battery pack loose or not installed properly	Check battery pack installation
Battery pack will not charge	Bad battery pack	Replace battery pack assembly
	Loose battery charger connection	Make sure that the plug is completely inserted into plug
	Charger not plugged in	Replace battery pack assembly
	Charger has no output	Re-connect charger
Low response / No gain	Front end damage, possible ESD	Contact A.H. Systems, inc.

SERVICE INFORMATION

If you have any questions or comments regarding this unit's operation or you need technical advice, repair, or genuine factory replacement parts, please contact our Customer Service Department or visit our website at www.AHSystems.com.

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 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.