SAS-570
Double Ridge Guide Horn
Operation Manual
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A.H. Systems SAS-570 Double Ridge Guide Horn Antenna

INTRODUCTION

The SAS-570 Double Ridge Guide Horn Antenna is lightweight, compact and has been manufactured for maximum gain, low VSWR and broadband response. The SAS-570 is a linearly polarized broadband antenna that covers the frequency range of 170 MHz – 3 GHz and is typically used to generate high RF fields with relatively low input power. With the high gain characteristics of the SAS-570, this antenna can also be used for receiving low signals.

GENERAL DESCRIPTION

The SAS-570 Double Ridge Guide Horn Antenna mounts directly to the tripod azimuth and elevation head (AEH-511) at the base of the antenna. The azimuth and elevation head allows the operator to vary the antenna azimuth (left right direction) and elevation (up, down direction) and makes it easy to change the antenna polarity (horizontal or vertical).

To obtain the field strength of the signal being measured, the operator must add the receiver reading in dBUV, the antenna factor in dB, and the cable attenuation in dB. This yields the field strength in dBUV/m. Calibrations for the E-field antennas are supplied at appropriate spacings (1, 3, and 10 meter) to comply with various specification requirements.
INTENDED PURPOSES

The double ridge guide horn antenna is intended for general laboratory use in a wide variety of industrial and scientific applications. It 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-570 Double Ridge Guide Horn Antenna:

CONNECTING ACCESSORIES:

PAM-0204
This preamplifier has a broad frequency range and high gain, designed to match the double ridge guide horn antenna. An ideal solution for improving overall system sensitivity.

SAC-211
Our Low-Loss High-Frequency flexible cables are the preferred choice over standard cable types. With improved power handling, low VSWR, and high frequency capabilities, the Low-Loss cables can be made to your specified length.

MOUNTING ACCESSORIES:

AEH-511
Azimuth and elevation head is used to assist the test engineer in orientating horn antenna towards 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

ASSEMBLY INSTRUCTIONS

The SAS-570 Horn antenna comes fully assembled.

MOUNTING INSTRUCTIONS

Attach the antenna to a tripod with the 1/4-20 threaded hole in the tripod bracket. For horizontal polarization, mount the antenna such that the ridge guides and connector are parallel to the ground. For vertical polarization, mount the antenna such that the ridge guides are perpendicular to the ground.

The SAS-570 horn antenna has a beamwidth of approximately 40 degrees and it should be pointed or aimed in the direction that the received signal is coming from. The measurement reference point is at the aperture of the antenna for all distances.
OPERATING INSTRUCTIONS

Once the antenna is mounted to a tripod, connect a N-type coaxial cable from the Double Ridge Guide Horn antenna to a receiver or RF generator. The cable should be matched to 50 ohms, and it is recommended to use a high-frequency low-loss cable (i.e. SAC-18G-3 Low Loss cable). For certain applications where an increased dynamic range is required, an optional preamplifier (PAM-0204) may be used to increase the total system sensitivity.

CAUTION: Even though the horn antenna does not have any ESD concerns, touching the horn antenna while connected to a sensitive preamplifier may cause damage to that device.

The double ridge guide horn antenna is in the horizontal polarization when the ridge guides are parallel to the ground, and vertical polarization when the ridge guides are perpendicular to the ground.

To minimize impedance mismatch errors, it is recommended that high-quality inline 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.
SPECIFICATIONS

The SAS-570 Horn Antenna specifications:

ELECTRICAL

Frequency Range .............................................. 170 MHz - 3 GHz
Antenna Factor .................................................. 11 to 33 dB/m
Average Gain ..................................................... 0 to 10.9 dBi
Maximum Continuous Power ............................. 800 Watts
Peak Power ....................................................... 1500 Watts
Impedance (nominal) ........................................... 50 Ω
Maximum Radiated Field: ................................. 200 V/m with
................................................................. (800 watts input)
Connector: ...................................................... N-type (female)
Mounting ......................................................... 1/4-20 (female)

MECHANICAL

Weight ................................................................. 22.5 lbs.
................................................................. (10.2 Kg)
Size (W x H x D) ................................................. 28.7" x 38.5" x 36.7"
................................................................. 73cm x 98cm x 93cm
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 dBµV to convert to field strength in dBµV/meter.

\[ FS = \text{Field Strength in dBµV/m} \]

\[ FS \ (\text{dBµV/m}) = \text{SA} \ (\text{dBµV}) + \text{AF} \ (\text{dB}) + \text{CL} \ (\text{dB}) \]

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:

\[ FS = \text{Approximate Field Strength in (V/m)} \]

\[ FS \ (\text{V/m}) = \frac{\sqrt{30P_g}}{d} \]

P = Power in watts
g = Numeric Gain
d = Distance in meters
### Typical Conversion Formulas

#### Log to Linear Voltage
- **dBμV to Volts**: \( V = 10^{\left(\frac{dBμV - 120}{20}\right)} \)
- **Volts to dBμV**: \( dBμV = 20 \log(V) + 120 \)
- **dBV to Volts**: \( V = 10^{\left(\frac{dBV}{20}\right)} \)
- **Volts to dBV**: \( dBV = 20 \log(V) \)
- **dBV to dBμV**: \( dBμV = dBV + 120 \)
- **dBμV to dBV**: \( dBV = dBμV - 120 \)

#### Log to Linear Current
- **dBμA to μA**: \( μA = 10^{\left(\frac{dBμA}{20}\right)} \)
- **μA to dBμA**: \( dBμA = 20 \log(μA) \)
- **dBA to A**: \( A = 10^{\left(\frac{dBA}{20}\right)} \)
- **A to dBA**: \( dBA = 20 \log(A) \)
- **dBA to dBμA**: \( dBμA = dBA + 120 \)
- **dBμA to dBA**: \( dBA = dBμA - 120 \)

#### Log to Linear Power
- **dBm to Watts**: \( W = 10^{\left(\frac{dBm - 30}{10}\right)} \)
- **Watts to dBm**: \( dBm = 10 \log(W) + 30 \)
- **dBW to Watts**: \( W = 10^{\left(\frac{dBW}{10}\right)} \)
- **Watts to dBW**: \( dBW = 10 \log(W) \)
- **dBm to dBA**: \( dBA = dBm - 120 \)
- **dBA to dBm**: \( dBm = dBA + 120 \)

#### Field Strength & Power Density
- **dBμV/m to V/m**: \( V/m = 10^{\left((dBμV/m) - 120\right)/20} \)
- **V/m to dBμV/m**: \( dBμV/m = 20 \log(V/m) + 120 \)
- **dBmW/m² to dBμV/m**: \( dBμV/m = dBmW/m² - 115.8 \)
- **dBμV/m to dBμA/m**: \( dBμA/m = dBμV/m - 51.5 \)
- **dBμA/m to dBμV/m**: \( dBμV/m = dBμA/m + 51.5 \)
- **dBμA/m to dBpT**: \( dBpT = dBμA/m + 2 \)
- **dBpT to dBμA/m**: \( dBμA/m = dBpT - 2 \)
- **W/m² to V/m**: \( V/m = \sqrt{W/m² \times 377} \)
- **V/m to W/m²**: \( W/m² = (V/m)^2 / 377 \)
- **μT to A/m**: \( A/m = μT / 1.25 \)
- **A/m to μT**: \( μT = 1.25 \times A/m \)

#### E-Field Antennas
- **Correction Factor**: \( dBμV/m = dBμV + AF \)
- **Field Strength**: \( V/m = \sqrt{30 \times watts \times \text{Gain}_{\text{numeric}} \text{meters}} \)
- **Required Power**: \( \text{Watts} = (V/m \times \text{meters})^2 \times 30 \times \text{Gain}_{\text{numeric}} \)

#### Loop Antennas
- **Correction Factors**: \( dBμA/m = dBμV + AF \)
- **Assumed E-field for shielded loops**: \( dBμV/m = dBμA/m + 51.5 \)
- **dBpT = dBμV + dBpT/μV \)

#### Term Conversions
- **dBm to dBμV**: \( dBμV = dBm + 107 \quad (50Ω) \)
  - **dBμV to dBm**: \( dBm = dBμV - 107 \quad (50Ω) \)
- **dBμV to dBm**: \( dBm = dBμV - 107 \quad (50Ω) \)
- **dBμA to dBm**: \( dBm = dBμA - 73 \quad (50Ω) \)
  - **dBμA to dBm**: \( dBm = dBμA + 10 \log(Z) + 90 \)
- **dBm to dBμA**: \( dBμA = dBm + 73 \quad (50Ω) \)
  - **dBm to dBμA**: \( dBμA = dBm - 10 \log(Z) - 90 \)
- **dBμA to dBm**: \( dBμA = dBm + 73 \quad (50Ω) \)
  - **dBμA to dBm**: \( dBm = dBμA - 10 \log(Z) + 90 \)
- **dBm to dBμA**: \( dBμA = dBm + 73 \quad (50Ω) \)
  - **dBm to dBμA**: \( dBμA = dBm - 10 \log(Z) + 90 \)
- **dBμA to dBm**: \( dBμA = dBm + 73 \quad (50Ω) \)
  - **dBμA to dBm**: \( dBm = dBμA + 10 \log(Z) + 90 \)
- **dBμA to dBm**: \( dBμA = dBm + 73 \quad (50Ω) \)
  - **dBμA to dBm**: \( dBm = dBμA - 10 \log(Z) + 90 \)

#### Current Probes
- **Correction Factor**: \( dBμA = dBμV - dB_{\text{obm}} \)
- **Power needed for injection probe given voltage(V) into 50Ω load and Probe Insertion Loss (I_L)**: \( \text{Watts} = 10^{\left((I_L + 10 \log(V^2/50))/10\right)} \)
MAINTENANCE

MAINTENANCE PROCEDURES

Proper antenna maintenance should include:

- Visual inspection of RF connectors
- Check for loose or missing hardware
- Check for corrosion near the 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.
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. 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.