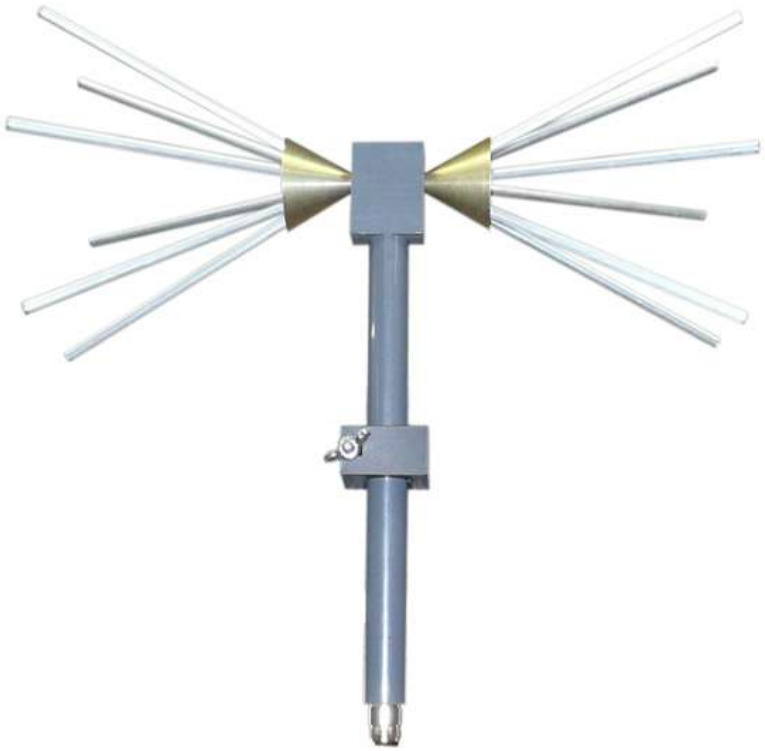
SAS-545
Biconical Antenna
Operation Manual

REV B

TABLE OF CONTENTS

INTRODUCTION



The A.H. Systems SAS-545 Biconical antenna operates efficiently over the frequency range of 30 MHz to 1 GHz. Compact in size, this Biconical Antenna is an ideal solution for broadband and Omni-directional requirements.

OPTIONAL EQUIPMENT

The following is a recommend accessory list for the SAS-545 Biconical Antenna:

CONNECTING ACCESSORIES:
SAC-213
Standard 3 meter N(m) to N(m) RF cable made with RG-58/U. Other cable types available upon request.

Adapters
Need an Adapter? We stock those as well.

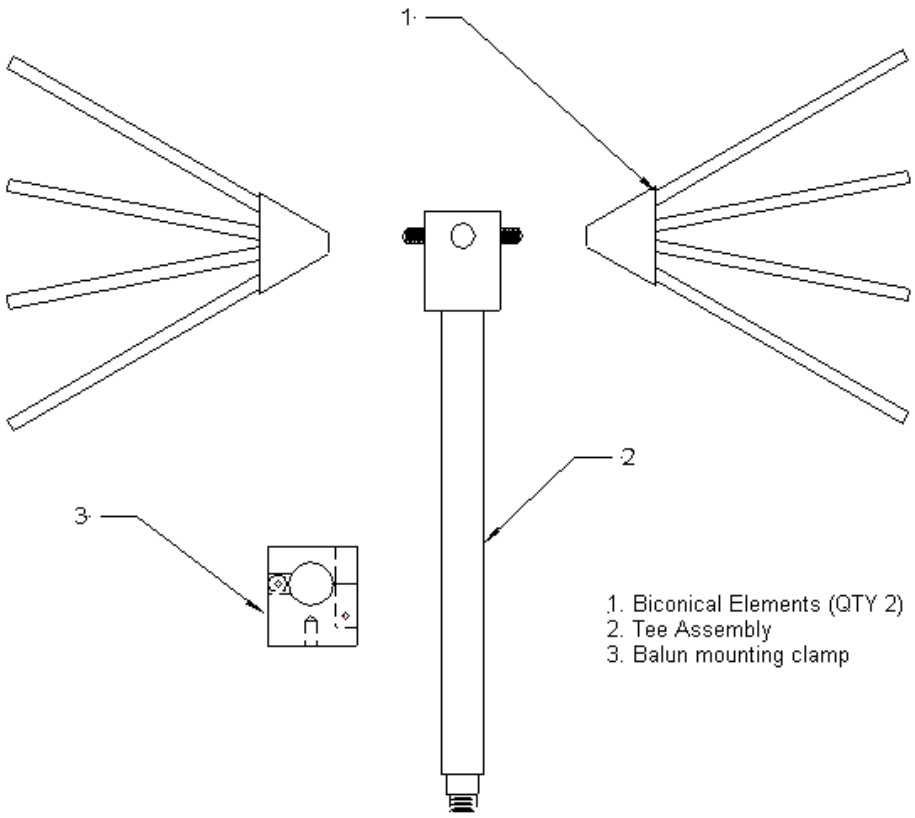
MOUNTING ACCESSORIES:
AEH-510
Azimuth and elevation head to assist the test engineer in orientating biconical antenna at the device under test.

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.

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.

OPERATING INSTRUCTIONS



ASSEMBLY INSTRUCTIONS

The SAS-545 Biconical Antenna is shipped with the elements detached from the balun. Attach each element to the Biconical balun tee assembly.

MOUNTING INSTRUCTIONS

The SAS-545 biconical antenna is supplied with an ABC-B Balun mounting clamp. The ABC-B has a 1/4-20 mounting holes on the base of the clamp.

Attach the antenna to the ABC-B mounting clamp, azimuth and elevation head (AEH-510) through the screw hole in the antenna base. The azimuth and elevation head (AEH-510) mounts to the tripod (ATU-510) top and allows the antennas to be rotated 360 degrees and tilted between horizontal and vertical polarization. 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.

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 horizontal beamwidth of the biconical antenna is approximately 60 degrees and it should be pointed or aimed in the direction that the received signal is coming from.

OPERATING INSTRUCTIONS

Once the antenna is mounted to a mast or tripod, connect an N-type coaxial cable from the antenna to a receiver. 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

ELECTRICAL SPECIFICATIONS

Frequency Range	30 MHz – 1 GHz
Antenna Factor	45 to 17 dB/m
Antenna Gain	-50 to 2 dBi
Impedance (nominal)	50Ω
Maximum Continuous Power	200 Watts
Connector	N-Type (female)
Mounting	1/4-20 (female)

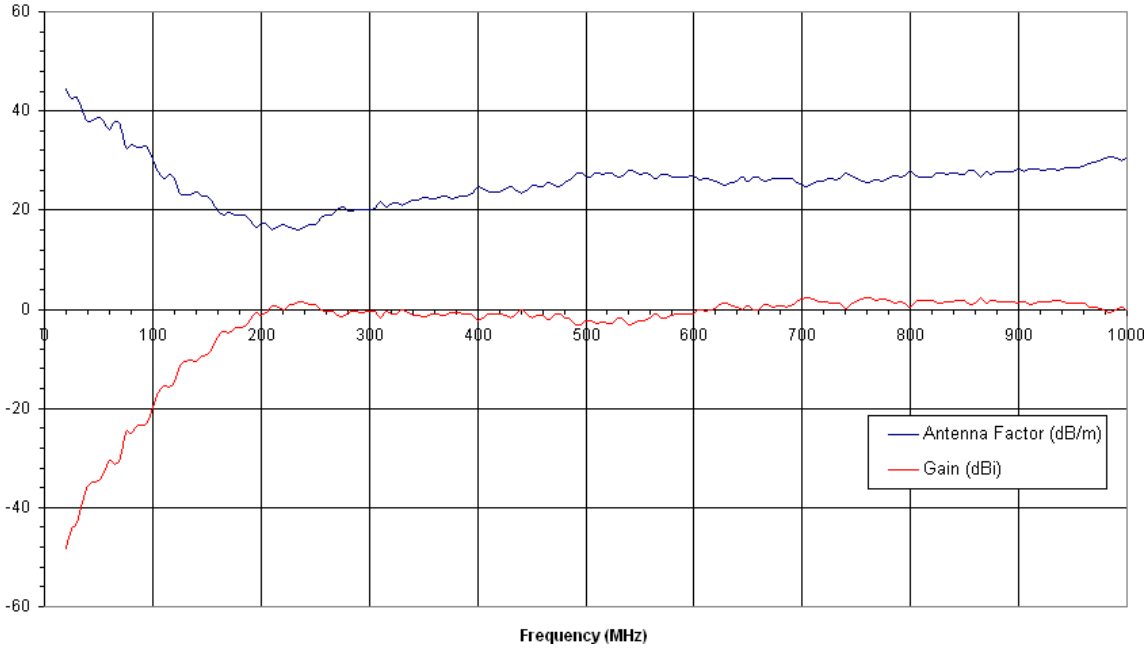
PHYSICAL SPECIFICATIONS

Weight	1.6 lbs. *(725 g)*
Size (W x H)	14.25" x 15" (36cm x 38cm)

TYPICAL DATA

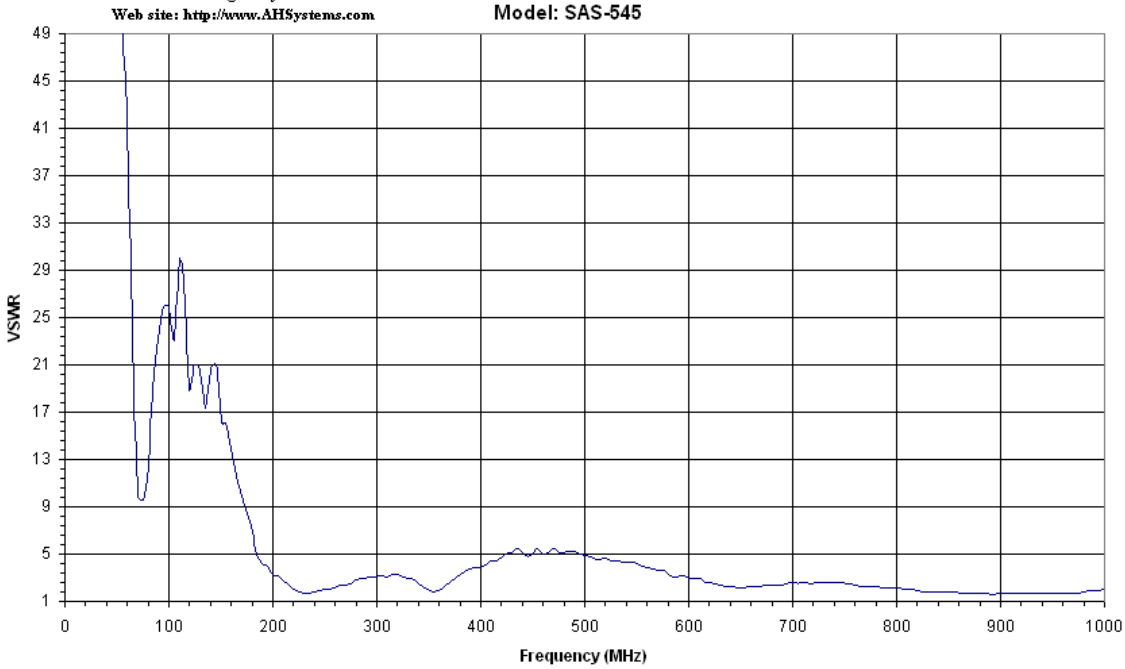
A.H. Systems Inc.
9710 Cozycroft Ave. Chatsworth, CA 91311
Phone (818) 998-0223 Fax (818) 998-6892
E-mail: sales@AHSystems.com
Web site: http://www.AHSystems.com

Antenna Data
Model: SAS-545



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

Antenna VSWR
Model: SAS-545



Frequency (MHz)	Antenna Factor	Gain (dBi)	Gain (Numeric)	VSWR
20	44.405	-48.1378	1.54E-05	69.492
25	42.516	-44.3106	3.71E-05	52.648
30	42.921	-43.132	4.86E-05	54.000
35	40.067	-38.9391	0.000128	52.700
40	37.911	-35.6232	0.000274	52.200
45	38.202	-34.8912	0.000324	49.600
50	38.801	-34.575	0.000349	50.600
55	37.968	-32.9142	0.000511	49.500
60	36.362	-30.5524	0.000881	40.200
65	37.94	-31.4352	0.000719	23.177
70	37.311	-30.1625	0.000963	9.960
75	32.638	-24.8902	0.003243	9.528
80	33.312	-25.0036	0.00316	12.347
85	32.529	-23.6941	0.004272	18.900
90	32.815	-23.4836	0.004484	23.177
95	32.632	-22.831	0.005211	25.941
100	30.07	-19.8234	0.010415	25.941
105	27.612	-16.9416	0.020223	23.177
110	26.399	-15.3246	0.029346	29.962
115	27.092	-15.6315	0.027343	26.334
120	26.513	-14.6828	0.034019	19.107
125	23.449	-11.2642	0.074744	20.946
130	23.039	-10.5136	0.088847	20.697
135	23.202	-10.3488	0.092284	17.391
140	23.736	-10.5669	0.087763	20.697
145	22.804	-9.33007	0.116679	20.946
150	22.951	-9.1826	0.120709	16.106
155	21.763	-7.70979	0.169442	16.106
160	19.816	-5.48703	0.282681	13.921
165	19.12	-4.52375	0.352878	11.610
170	19.669	-4.81345	0.330107	9.960
175	19.085	-3.97767	0.40016	8.392
180	19.083	-3.73098	0.423548	6.997
185	18.902	-3.31199	0.466445	5.030
190	17.812	-1.99036	0.63236	4.169
195	16.63	-0.58274	0.874433	4.023
200	17.37	-1.10283	0.775742	3.314
205	17.102	-0.62035	0.866892	3.131
210	16.122	0.568957	1.139976	2.731
215	16.599	0.29634	1.070617	2.323
220	17.114	-0.01898	0.99564	2.021
225	16.547	0.743222	1.186649	1.795
230	16.392	1.089128	1.285029	1.662
235	16.071	1.596929	1.444418	1.689
240	16.537	1.313796	1.353255	1.817
245	17.167	0.862893	1.219802	1.939
250	17.214	0.991371	1.256427	1.980
255	18.425	-0.04763	0.989094	1.978
260	18.925	-0.37896	0.91644	2.150
265	19.052	-0.34051	0.924589	2.364

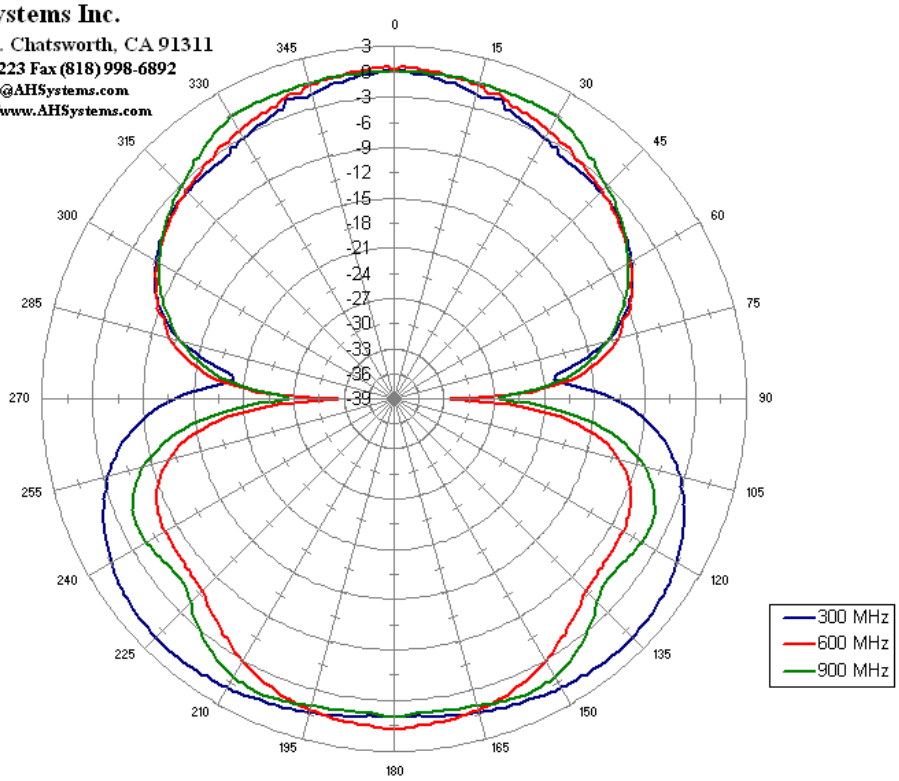
270	20.054	-1.18015	0.762052	2.323
275	20.668	-1.63477	0.686313	2.458
280	19.826	-0.63627	0.86372	2.828
285	19.693	-0.34953	0.922671	2.898
290	20.144	-0.64947	0.861099	2.968
295	20.223	-0.57999	0.874986	3.047
300	20.206	-0.417	0.908447	3.047
305	20.453	-0.52043	0.887068	3.172
310	21.729	-1.65519	0.683094	3.086
315	20.713	-0.50022	0.891206	3.263
320	21.201	-0.85143	0.821972	3.263
325	21.434	-0.94976	0.80357	3.091
330	20.875	-0.25815	0.942291	2.937
335	21.407	-0.65953	0.859106	2.796
340	22.05	-1.17385	0.763159	2.534
345	22.108	-1.10505	0.775346	2.134
350	22.586	-1.45807	0.714814	1.913
355	22.402	-1.15086	0.767209	1.764
360	22.298	-0.92538	0.808094	1.925
365	22.613	-1.12057	0.772579	2.303
370	22.707	-1.09639	0.776892	2.615
375	22.385	-0.6578	0.859448	2.898
380	22.448	-0.60576	0.86981	3.263
385	22.88	-0.92421	0.808311	3.570
390	22.896	-0.82814	0.826392	3.748
395	23.406	-1.22749	0.753792	3.809
400	24.631	-2.34323	0.583011	3.880
405	24.184	-1.78833	0.662471	4.086
410	23.573	-1.07075	0.781493	4.419
415	23.625	-1.01747	0.79114	4.419
420	23.587	-0.87544	0.81744	4.704
425	24.059	-1.24465	0.750819	5.030
430	24.735	-1.81906	0.6578	5.145
435	24.035	-1.01864	0.790926	5.407
440	23.374	-0.25838	0.942242	5.160
445	24.049	-0.83523	0.825044	4.804
450	24.972	-1.66118	0.682154	5.030
455	24.69	-1.2832	0.744183	5.407
460	24.777	-1.27527	0.745543	5.030
465	25.614	-2.01837	0.628294	5.145
470	24.951	-1.26247	0.747744	5.407
475	24.752	-0.97156	0.799548	5.145
480	25.667	-1.7956	0.661363	5.145
485	26.092	-2.13059	0.612267	5.280
490	27.262	-3.21151	0.477364	5.265
495	27.386	-3.24732	0.473443	5.030
500	26.515	-2.28903	0.590333	4.921
505	26.558	-2.2456	0.596266	4.804
510	27.356	-2.95803	0.506055	4.597
515	27.098	-2.61528	0.54761	4.507
520	27.48	-2.91336	0.511286	4.609
525	27.602	-2.95224	0.506729	4.419
530	26.518	-1.78591	0.66284	4.419

535	26.893	-2.07935	0.619533	4.336
540	28.099	-3.20455	0.478129	4.326
545	27.809	-2.8345	0.520655	4.336
550	27.264	-2.21017	0.60115	4.169
555	27.508	-2.37557	0.578686	4.015
560	27.087	-1.87667	0.649132	3.809
565	26.38	-1.09246	0.777596	3.748
570	27.169	-1.80493	0.659944	3.682
575	27.327	-1.88707	0.647579	3.625
580	26.659	-1.14387	0.768446	3.308
585	26.656	-1.06631	0.782292	3.047
590	26.568	-0.90439	0.81201	3.047
595	26.56	-0.82309	0.827353	3.131
600	26.806	-0.9964	0.794986	2.973
605	26.132	-0.25032	0.943991	2.898
610	26.298	-0.34483	0.92367	2.898
615	26.164	-0.13993	0.968294	2.642
620	25.864	0.230405	1.054485	2.588
625	25.274	0.890172	1.227488	2.509
630	25.138	1.095382	1.286881	2.388
635	25.673	0.629046	1.155858	2.262
640	25.962	0.408171	1.098543	2.283
645	26.581	-0.14323	0.967557	2.185
650	25.774	0.730838	1.18327	2.134
655	26.602	-0.0306	0.992978	2.185
660	26.765	-0.12755	0.971058	2.243
665	25.878	0.825004	1.209206	2.283
670	26.076	0.692067	1.172753	2.303
675	26.488	0.344647	1.082592	2.388
680	26.35	0.54675	1.134162	2.343
685	26.467	0.493383	1.12031	2.364
690	26.333	0.690553	1.172345	2.343
695	25.485	1.601267	1.445862	2.435
700	25.106	2.042532	1.600491	2.559
705	24.797	2.413354	1.743152	2.534
710	25.287	1.984738	1.579333	2.615
715	25.818	1.514692	1.417324	2.534
720	25.888	1.505221	1.414237	2.482
725	26.298	1.155331	1.304768	2.588
730	26.198	1.315028	1.353639	2.588
735	26.443	1.129318	1.296976	2.559
740	27.552	0.079206	1.018405	2.642
745	26.866	0.823697	1.208842	2.615
750	26.271	1.476797	1.405011	2.509
755	25.844	1.96151	1.570909	2.458
760	25.423	2.439843	1.753817	2.343
765	25.777	2.1428	1.637872	2.241
770	26.225	1.751386	1.496713	2.281
775	25.958	2.074605	1.612354	2.283
780	26.321	1.767463	1.502264	2.262
785	26.849	1.294964	1.3474	2.185
790	26.751	1.448113	1.395762	2.116
795	26.944	1.309914	1.352046	2.134

800	27.971	0.337371	1.08078	2.100
805	26.993	1.369489	1.37072	2.038
810	26.695	1.721272	1.486371	2.007
815	26.636	1.833723	1.52536	1.980
820	26.743	1.779848	1.506554	1.862
825	27.399	1.17665	1.311188	1.795
830	27.341	1.287133	1.344972	1.796
835	27.287	1.393301	1.378257	1.807
840	27.353	1.379157	1.373775	1.817
845	27.128	1.655705	1.464099	1.775
850	27.159	1.67595	1.47094	1.754
855	28.015	0.870894	1.222051	1.754
860	27.83	1.10654	1.290191	1.697
865	26.77	2.216893	1.666055	1.679
870	27.715	1.321956	1.3558	1.680
875	27.195	1.891732	1.545871	1.679
880	27.675	1.461225	1.399982	1.671
885	27.619	1.566437	1.434312	1.655
890	27.769	1.465371	1.401319	1.614
895	27.713	1.570032	1.4355	1.622
900	28.232	1.099421	1.288078	1.663
905	27.881	1.498543	1.412064	1.663
910	28.41	1.017399	1.263979	1.671
915	28.179	1.295993	1.347719	1.663
920	28.123	1.399328	1.380171	1.638
925	28.061	1.508406	1.415274	1.663
930	28.17	1.44623	1.395157	1.688
935	27.943	1.719803	1.485868	1.671
940	28.171	1.538128	1.424993	1.646
945	28.574	1.181207	1.312565	1.679
950	28.597	1.204043	1.319485	1.697
955	28.615	1.231639	1.327895	1.716
960	28.728	1.163996	1.307373	1.688
965	29.45	0.487118	1.118695	1.707
970	29.563	0.419006	1.101287	1.707
975	30	0.026664	1.006158	1.725
980	30.517	-0.44591	0.902421	1.805
985	30.669	-0.5537	0.880298	1.899
990	30.351	-0.19172	0.956814	1.911
995	29.918	0.285033	1.067833	1.925
1000	30.69	-0.44343	0.902936	2.038

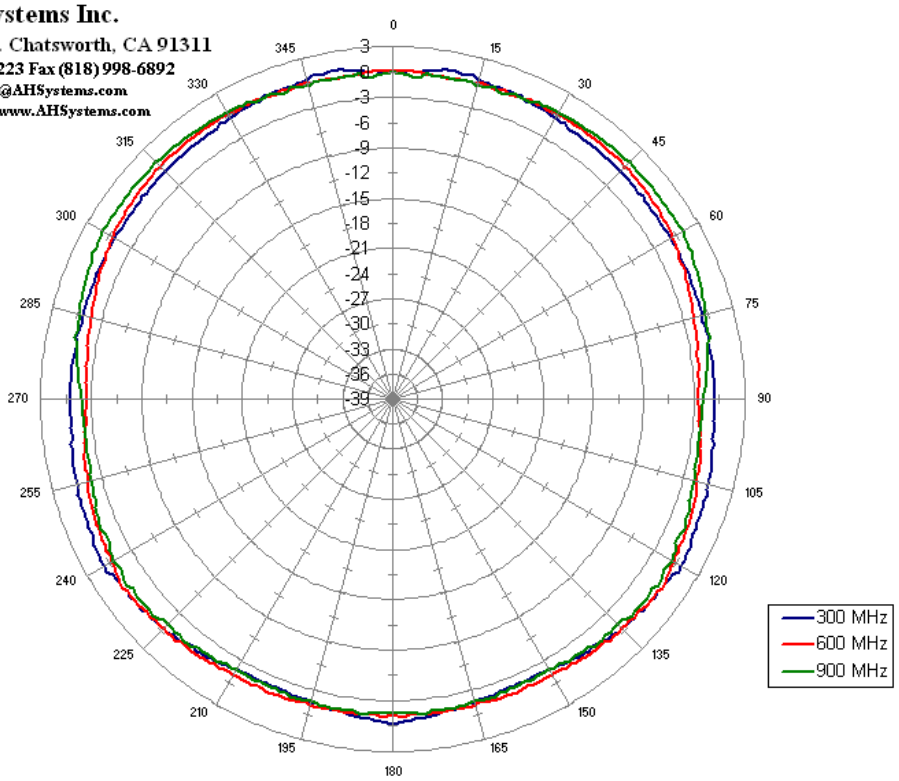
A.H. Systems Inc.
9710 Cozycroft Ave. Chatsworth, CA 91311
Phone (818) 998-0223 Fax (818) 998-6892
E-mail: sales@AHSystems.com
Web site: http://www.AHSystems.com

Antenna Beamwidth
Horizontal
Model: SAS-545



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

Antenna Beamwidth
Vertical
Model: SAS-545



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.

Field Strength(dBuV/m) = SA(dBuV) + AF(dB/m) + 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)

$$FS\ (V/m) = \frac{\sqrt{30Pg}}{d}$$

P = Power in watts
g = Numeric Gain
d = Distance in meters

TYPICAL CONVERSION 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

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

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.