

S.O. 24251

Report of Test 6513-2-DA

for

AMERICAN FAMILY ASSOCIATION

KIAD 88.5 MHz DUBUQUE, IA

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6513-2-DA to meet the needs of KIAD and to comply with the requirements of the FCC construction permit, file number BPED-19980908MA.

RESULTS:

The measured azimuth pattern for the 6513-2-DA is shown in Figure 1. Figure 1A shows the Tabulation of the Vertical Polarization. The calculated elevation pattern of the antenna is shown in Figure 3. Construction permit file number BPED-19980908MA indicates that the Vertical radiation component shall not exceed 0.750 kW at any azimuth and is restricted to the following values at the azimuths specified:

320 Degrees T: 0.327 kW

From Figure 1, the maximum radiation of the Vertical component occurs at 047 Degrees T to 072 Degrees T and at 220 Degrees T to 248 Degrees T. At the restricted azimuth of 320 Degrees T the Vertical component is 3.876 dB down from the maximum of 0.750 kW, or 0.307 kW.

The R.M.S. of the Vertical component is 0.769. The total Vertical power gain is 3.355. See Figure 4 for calculations.

AMENDED FCC COMPOSITE PATTERN:

The R.M.S. of the measured composite pattern is 0.769. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.824. Therefore the measured pattern does not comply with the FCC requirement of 73.316(c)(ix)(A). In accordance with 73.1690(c)(2)(ii) an amended composite pattern with an R.M.S. value of 0.904 is attached as Figure 5. Figure 5A shows the tabulations of the amended composite pattern. This new composite pattern allows the above measured pattern to comply with the FCC requirement of 73.316(c)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6513-2-DA was mounted on a tower of exact scale to an ATT self-supported tower at the KIAD site. The spacing of the antenna to the tower was varied and vertical parasitic elements were used to achieve the vertical pattern shown in Figure 1. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BPED-19980908MA, a single level of the 6513-2-DA was set up on the Howell Laboratories scale model antenna pattern measuring range. A scale of 4.5:1 was used.

SUPERVISION:

Mr. Surette was graduated from Lowell Technological Institute, Lowell, Massachusetts in 1973 with the degree of Bachelor of Science in Electrical Engineering. He has been directly involved with design and development of broadcast antennas, filter systems and RF transmission components since 1974, as an RF Engineer for six years with the original Shively Labs in Raymond, ME and for a short period of time with Dielectric Communications. He is currently an Associate Member of the AFCCE and a Senior Member of IEEE. He has authored a chapter on filters and combining systems for the latest edition of the CRC Electronics Handbook and for the 9th Edition of the NAB Handbook.

EQUIPMENT:

The scale model pattern range consists of a wooden rotating pedestal equipped with a position indicator. The scale model bay is placed on the top of this pedestal and is used in the transmission mode at approximately 20 feet above ground level. The receiving corner reflector is spaced 50 feet away from the rotating pedestal at the same level above ground as the transmitting model. The transmitting and receiving signals are carried to a control building by means of RG-9/U double shielded coax cable.

The control building is equipped with:

Hewlett Packard Model 8753 Network Analyzer

PC Based Controller

Hewlett Packard 7550A Graphics Plotter

The test equipment is calibrated to ANSI/NCSL Z540-1-1994.

TEST PROCEDURES:

The corner reflector is mounted so that the horizontal and vertical azimuth patterns are measured independently by rotating the corner reflector by 90 degrees. The network analyzer was set to 398.25 MHz. Calibrated pads are used to check the linearity of the measuring system. For example, 6 dB padding yields a scale reading of 50 from an unpadding reading of 100 in voltage. From the recorded patterns, the R.M.S. values are calculated and recorded as shown in Figure 1.

Respectfully submitted by:

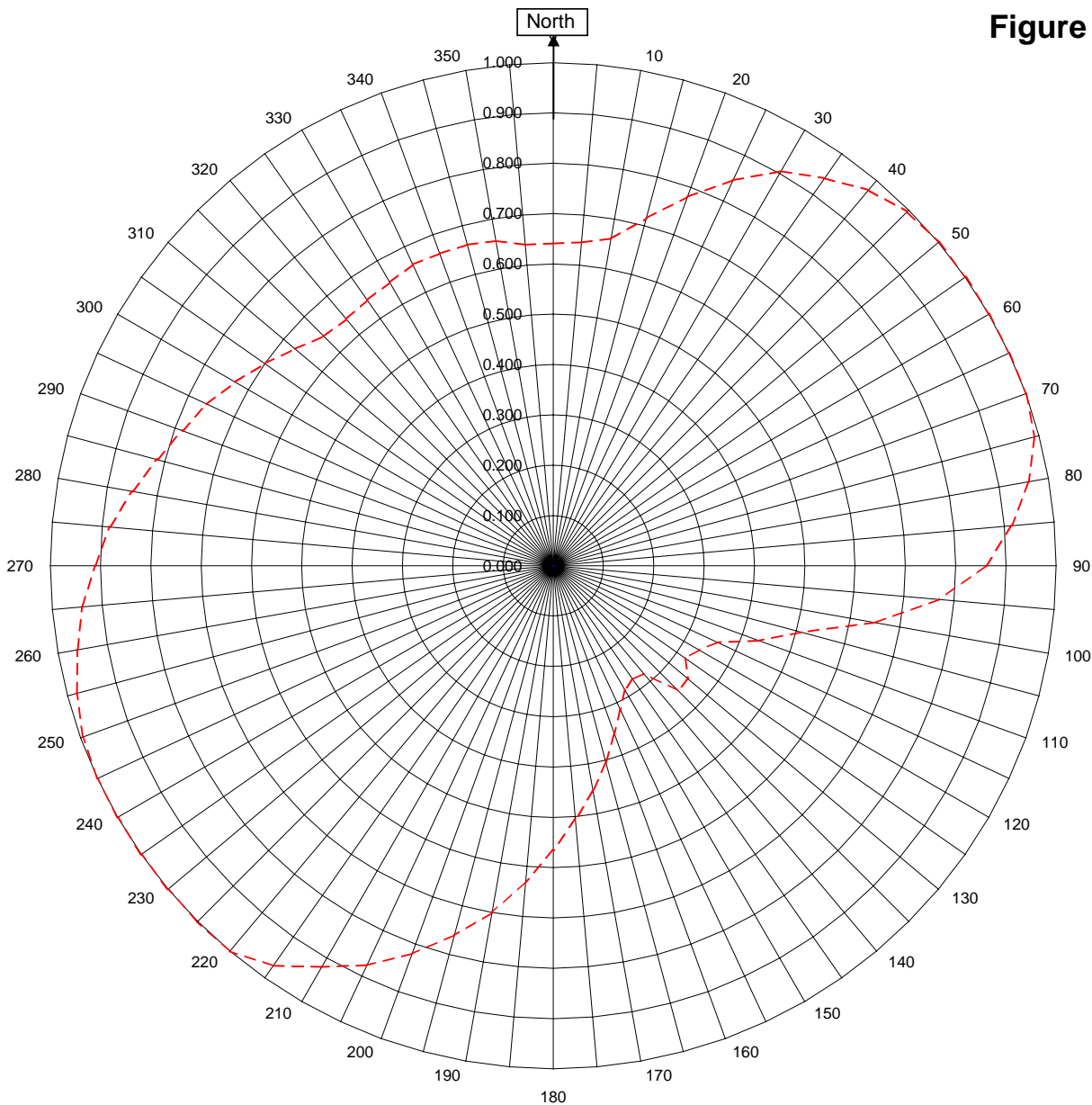
A handwritten signature in blue ink, appearing to read "Robert A. Surette", with a long horizontal flourish extending to the right.

Robert A. Surette
Manager of RF Engineering
S/O 24251
December 14, 2005

Shively Labs

Shively Labs, a division of Howell Laboratories, Inc. Bridgton, ME (207)647-3327

Figure 1



KIAD Dubuque, IA

24251
December 12, 2005

Horizontal RMS	0.000	Frequency	88.5 / 398.25 MHz
Vertical RMS	0.769	Plot	Relative Field
H/V Composite RMS	0.769	Scale	4.5 : 1

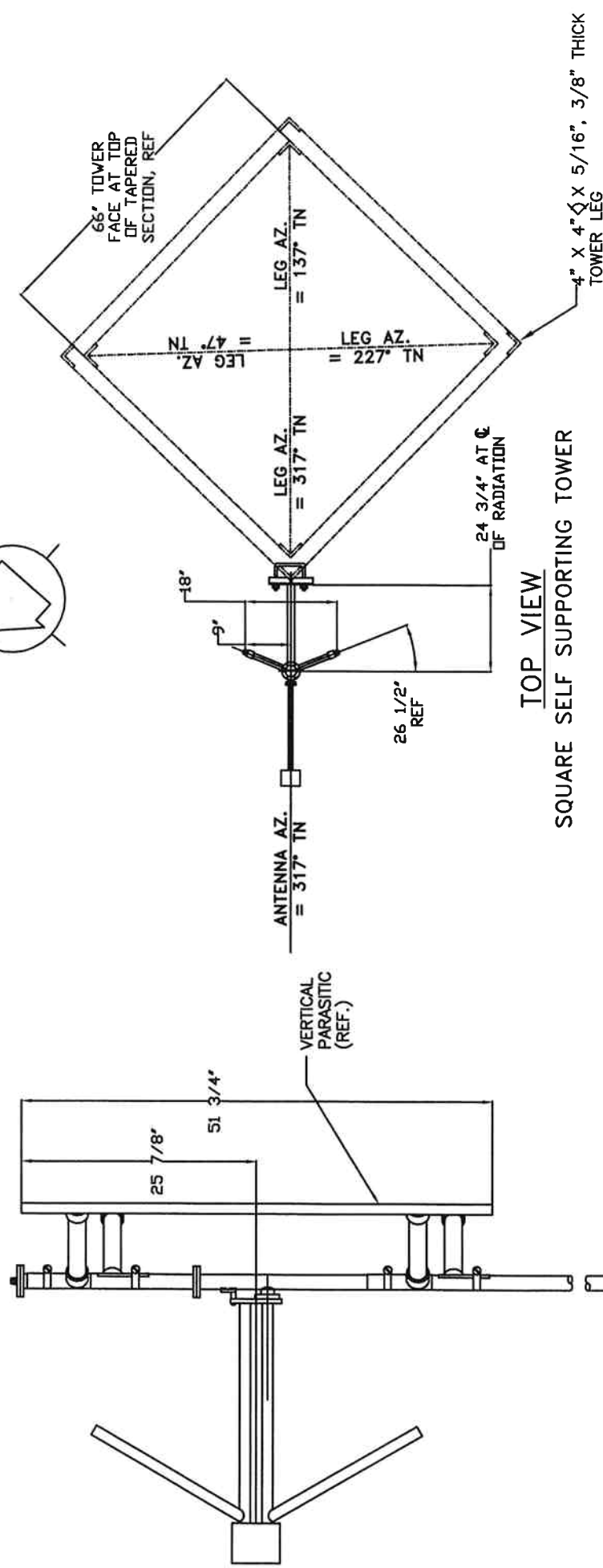
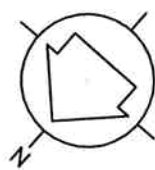
Antenna Model	6513-2-DA
Pattern Type	Directional Azimuth

See Figure 2 for Mechanical Details

Figure 1a

Tabulation of Vertical Azimuth Pattern
KIAD Dubuque, IA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.640	180	0.565
10	0.660	190	0.700
20	0.780	200	0.820
30	0.905	210	0.920
40	0.975	220	1.000
45	0.995	225	1.000
50	1.000	230	1.000
60	1.000	240	1.000
70	1.000	250	0.995
80	0.960	260	0.960
90	0.860	270	0.910
100	0.650	280	0.850
110	0.435	290	0.785
120	0.335	300	0.730
130	0.350	310	0.670
135	0.350	315	0.645
140	0.280	320	0.640
150	0.285	330	0.650
160	0.355	340	0.660
170	0.455	350	0.655



TOP VIEW
SQUARE SELF SUPPORTING TOWER

SIDE VIEW

SHIVELY LABS			
A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE, USA			
SHOP ORDER	FREQUENCY	SCALE	DRAWN BY:
24251	88.5	N.T.S.	LRA
TITLE:		APPROVED BY:	
MODEL 6513--2--DIRECTIONAL ANTENNA		ASP	
FM STATION			
DATE:	FIGURE 2		
12/20/05			

ANTENNA HEADING: 317° TRUE NORTH

Antenna Mfg.: Shively Labs

Antenna Type: 6513-2-DA

Station: KIAD

Frequency: 88.5

Channel #: 203

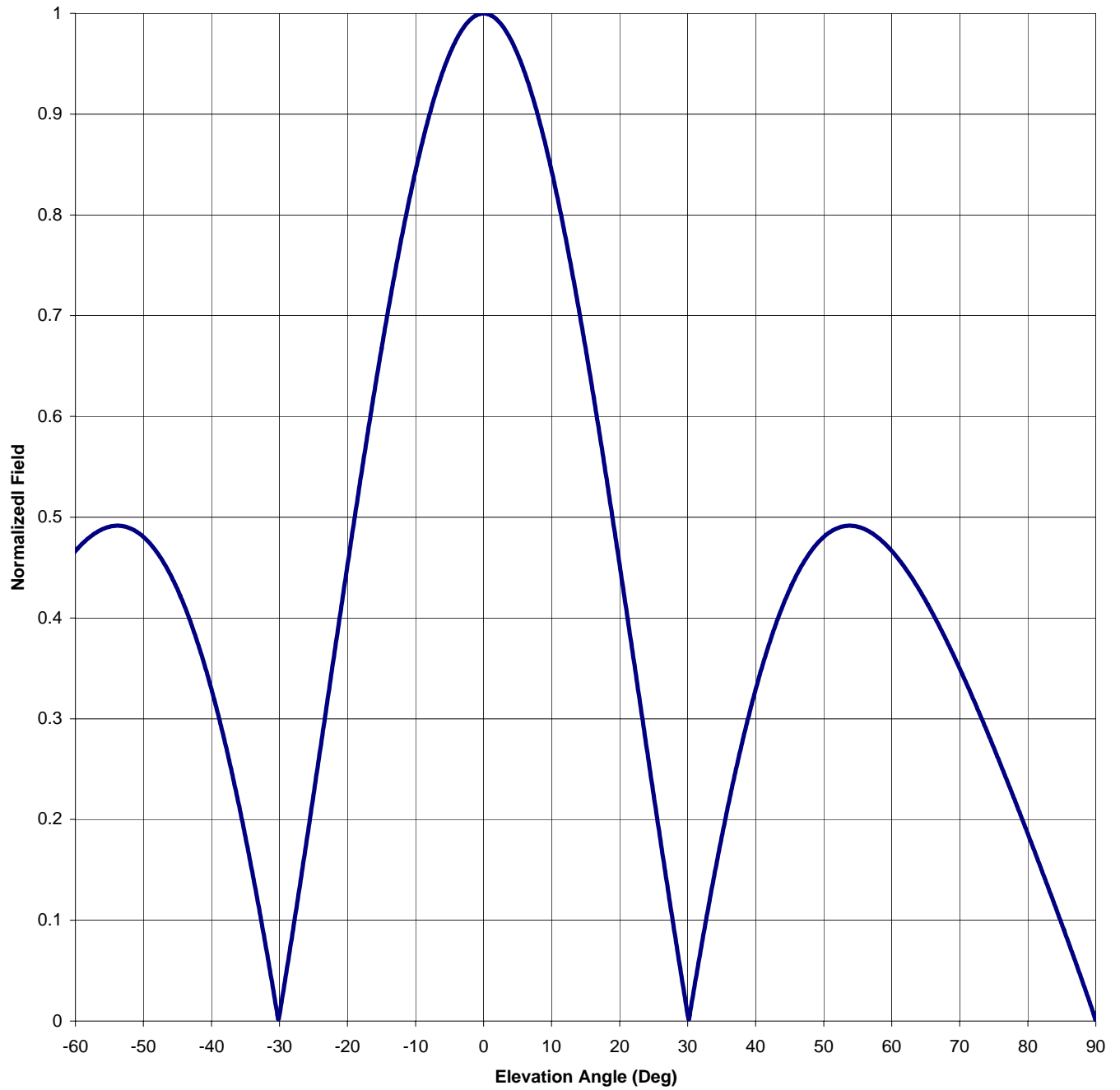
Figure: 3

Date: 12/14/2005

Beam Tilt 0

Gain (Max) 3.355 5.257 dB

Gain (Horizon) 3.355 5.257 dB



Antenna Mfg.: Shively Labs

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Antenna Type: 6513-2-DA

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Beam Tilt 0

Frequency: 88.5

Gain (Max) 3.355 5.257 dB

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Gain (Horizon) 3.355 5.257 dB

Figure: 3

Angle of Depression (Deg)	Relative Field	Angle of Depression (Deg)	Relative Field	Angle of Depression (Deg)	Relative Field	Angle of Depression (Deg)	Relative Field
-90	0.000	-44	0.412	0	1.000	46	0.442
-89	0.021	-43	0.395	1	0.998	47	0.455
-88	0.040	-42	0.375	2	0.993	48	0.465
-87	0.059	-41	0.353	3	0.985	49	0.474
-86	0.078	-40	0.329	4	0.974	50	0.480
-85	0.096	-39	0.304	5	0.960	51	0.486
-84	0.114	-38	0.276	6	0.942	52	0.489
-83	0.132	-37	0.247	7	0.922	53	0.491
-82	0.150	-36	0.215	8	0.898	54	0.492
-81	0.168	-35	0.182	9	0.872	55	0.491
-80	0.186	-34	0.148	10	0.844	56	0.488
-79	0.203	-33	0.111	11	0.813	57	0.485
-78	0.221	-32	0.074	12	0.779	58	0.480
-77	0.238	-31	0.034	13	0.744	59	0.474
-76	0.255	-30	0.006	14	0.706	60	0.467
-75	0.271	-29	0.048	15	0.667	61	0.458
-74	0.288	-28	0.091	16	0.627	62	0.449
-73	0.304	-27	0.135	17	0.585	63	0.439
-72	0.319	-26	0.179	18	0.542	64	0.428
-71	0.335	-25	0.224	19	0.498	65	0.417
-70	0.350	-24	0.270	20	0.453	66	0.405
-69	0.364	-23	0.316	21	0.407	67	0.392
-68	0.378	-22	0.362	22	0.362	68	0.378
-67	0.392	-21	0.407	23	0.316	69	0.364
-66	0.405	-20	0.453	24	0.270	70	0.350
-65	0.417	-19	0.498	25	0.224	71	0.335
-64	0.428	-18	0.542	26	0.179	72	0.319
-63	0.439	-17	0.585	27	0.135	73	0.304
-62	0.449	-16	0.627	28	0.091	74	0.288
-61	0.458	-15	0.667	29	0.048	75	0.271
-60	0.467	-14	0.706	30	0.006	76	0.255
-59	0.474	-13	0.744	31	0.034	77	0.238
-58	0.480	-12	0.779	32	0.074	78	0.221
-57	0.485	-11	0.813	33	0.111	79	0.203
-56	0.488	-10	0.844	34	0.148	80	0.186
-55	0.491	-9	0.872	35	0.182	81	0.168
-54	0.492	-8	0.898	36	0.215	82	0.150
-53	0.491	-7	0.922	37	0.247	83	0.132
-52	0.489	-6	0.942	38	0.276	84	0.114
-51	0.486	-5	0.960	39	0.304	85	0.096
-50	0.480	-4	0.974	40	0.329	86	0.078
-49	0.474	-3	0.985	41	0.353	87	0.059
-48	0.465	-2	0.993	42	0.375	88	0.040
-47	0.455	-1	0.998	43	0.395	89	0.021
-46	0.442	0	1.000	44	0.412	90	0.000
-45	0.428			45	0.428		

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VALIDATION OF GAIN CALCULATION

KIAD 88.5 MHz DUBUQUE, IA

MODEL 6513-2-DA

Elevation Gain of 6513-2-DA equals 1.984

The RMS values are calculated utilizing the data of a planimeter.

Vertical Azimuth Gain equals $1/(\text{RMS})^2$
 $1/(0.769)^2 = 1.691$

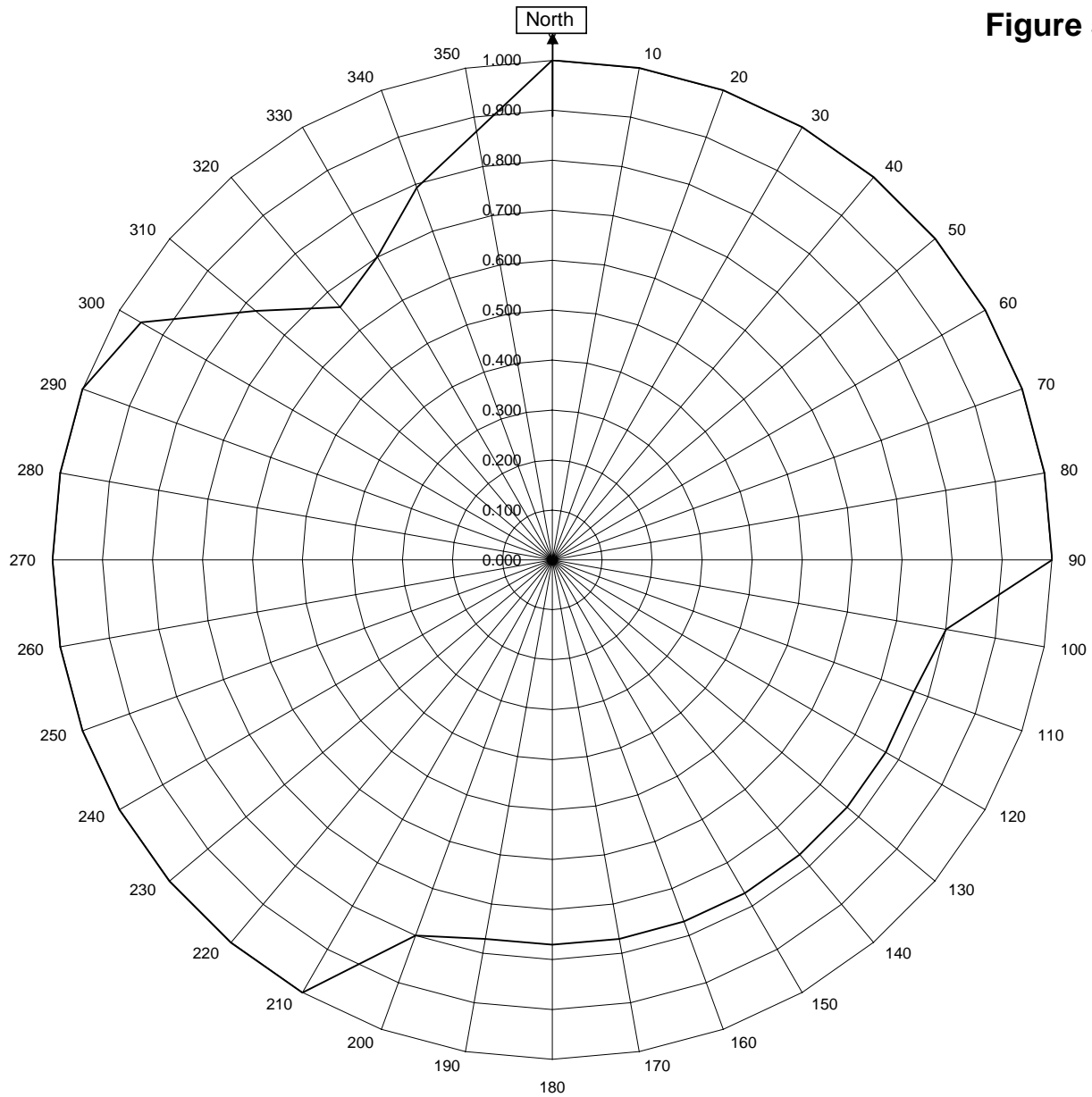
* Total Vertical Gain is Elevation Gain times Azimuth Gain
 $1.984 \times 1.691 = 3.355$

ERP divided by Vertical Gain equals Antenna Input Power
 $0.750 \text{ kW} \div 3.355 = 0.224 \text{ kW}$

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Figure 5



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Amended Composite RMS	0.904
85% Amended Composite RMS	0.769

Frequency	88.5 / 398.25 mHz
Plot	Relative Field

Antenna Model	6513-2-DA
Pattern Type	Amended FCC Composite

Figure 5a

Tabulation of Amended Composite Pattern
KIAD Dubuque, IA

Azimuth Rel Field		Azimuth Rel Field	
0	1.000	180	0.770
10	1.000	190	0.770
20	1.000	200	0.800
30	1.000	210	1.000
40	1.000	220	1.000
45	1.000	225	1.000
50	1.000	230	1.000
60	1.000	240	1.000
70	1.000	250	1.000
80	1.000	260	1.000
90	1.000	270	1.000
100	0.800	280	1.000
110	0.770	290	1.000
120	0.770	300	0.950
130	0.770	310	0.775
135	0.770	315	0.720
140	0.770	320	0.660
150	0.770	330	0.700
160	0.770	340	0.793
170	0.770	350	0.871