Shively Labs
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S.O. 24541

Report of Test 6513-4-DA

for

AMERICAN FAMILY ASSOCIATION

KWVI 88.9 MHz WAVERLY, IA

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6513-4-DA to meet the needs of KWVI and to comply with the requirements of the FCC construction permit, file number BMPED-20050629ACB.

RESULTS:

The measured azimuth pattern for the 6513-4-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 BMPED-20050629ACB indicates that the Vertical radiation component shall not exceed 20 kW at any azimuth and is restricted to the following values at the azimuths specified:

40 Degrees T: 16.6 kW
100 Degrees T: 9.88 kW
110 Degrees T: 8.63 kW
130 Degrees T: 14.0 kW

From Figure 1, the maximum radiation of the Vertical component occurs at 165 Degrees T to 317 Degrees T. At the restricted azimuth of 40 Degrees T the Vertical component is 8.29 dB down from the maximum of 20 kW, or 2.96 kW. At the restricted azimuth of 100 Degrees T the Vertical component is 7.54 dB down from the maximum of 20 kW, or 3.53 kW. At the restricted azimuth of 110 Degrees T the Vertical component is 6.38 dB down from the maximum of 20 kW, or 4.61 kW. At the restricted azimuth of 130 Degrees T the Vertical component is 1.94 dB down from the maximum of 20 kW, or 12.8 kW.

The R.M.S. of the Vertical component is 0.819. The total Vertical power gain is 6.386. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.963. The R.M.S. of the measured composite pattern is 0.819. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.819. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6513-4-DA was mounted on a tower of exact scale to the Allied 24SR tower at the KWVI site. The spacing of the antenna to the tower was varied 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 BMPED-20050629ACB, a single level of the 6513-4-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 400.05 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 unpadded 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:

Robert A. Surette
Director of Sales Engineering
S/O 24541
April 12, 2006

Shively Labs

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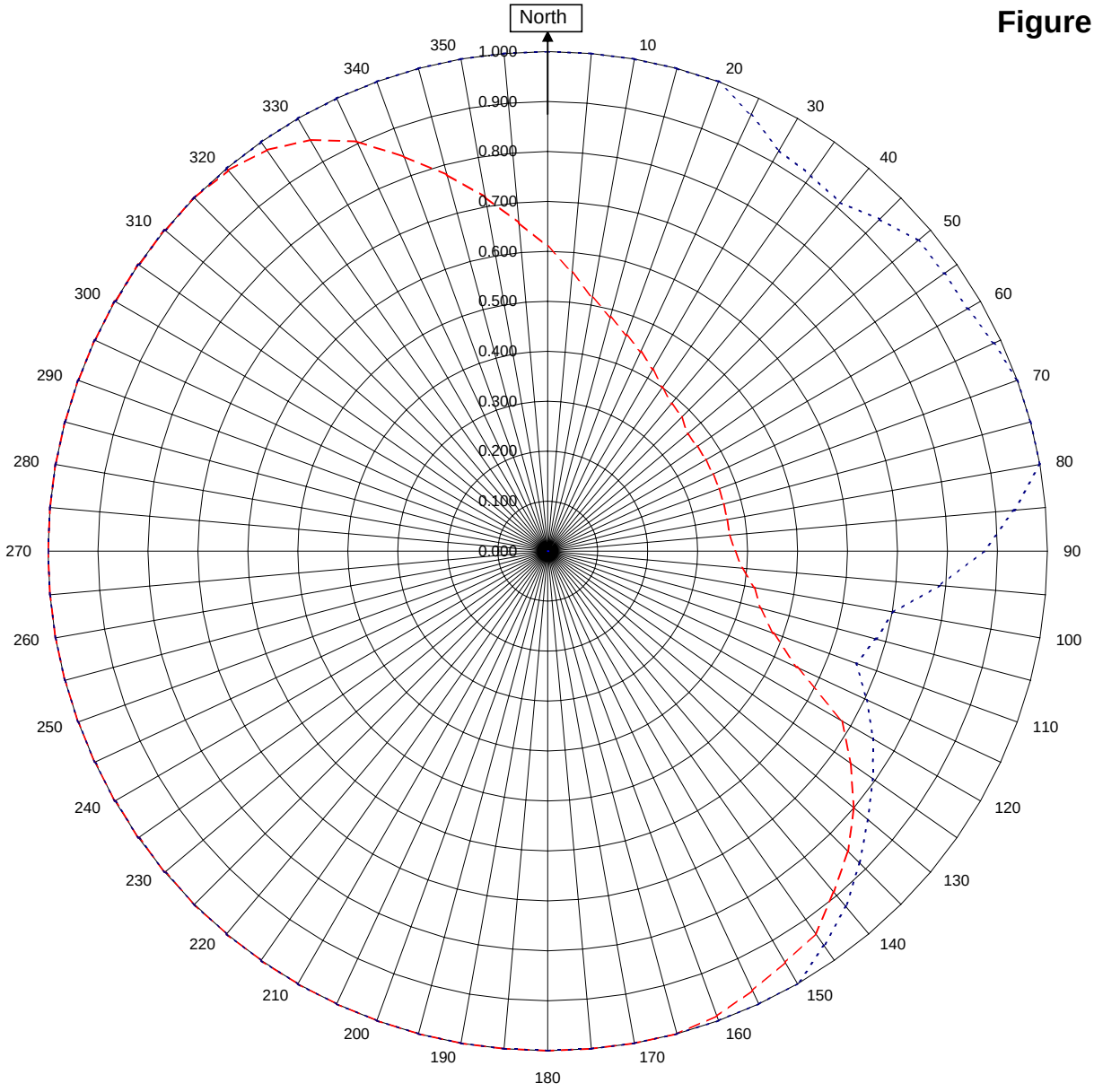
Figure 1



KWVI Waverly, IA

24541

April 12, 2006

Horizontal RMS	0.000
Vertical RMS	0.819
H/V Composite RMS	0.819
FCC Composite RMS	0.963

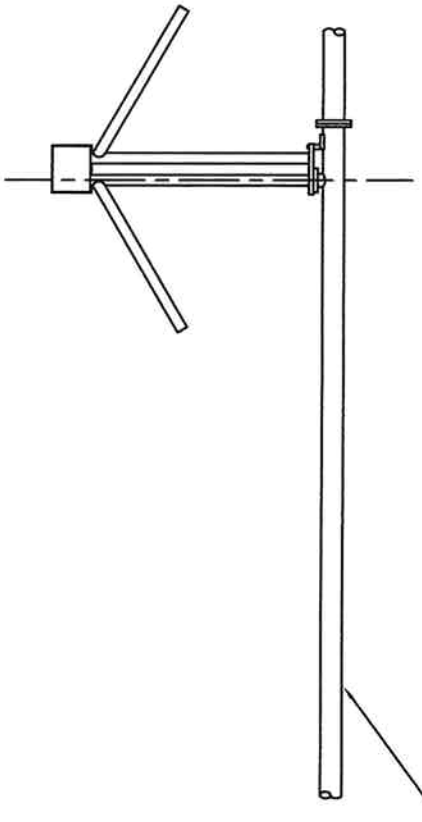
Frequency	88.9 / 400.05 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6513-4-DA
Pattern Type	Directional Azimuth

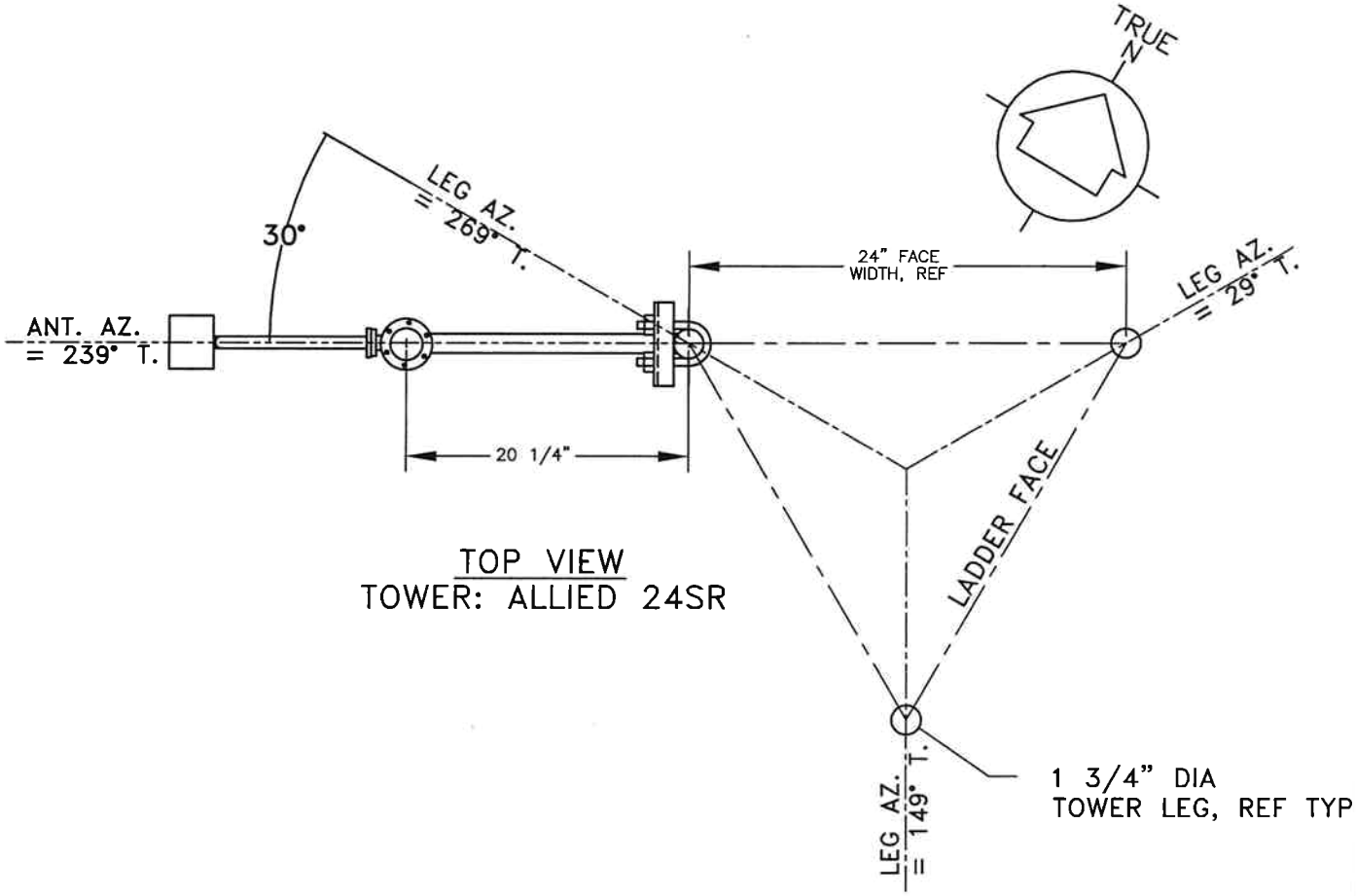
Figure 1a

Tabulation of Vertical Azimuth Pattern
KWVI Waverly, IA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.610	180	1.000
10	0.515	190	1.000
20	0.460	200	1.000
30	0.420	210	1.000
40	0.385	220	1.000
45	0.380	225	1.000
50	0.365	230	1.000
60	0.365	240	1.000
70	0.365	250	1.000
80	0.365	260	1.000
90	0.375	270	1.000
100	0.420	280	1.000
110	0.480	290	1.000
120	0.680	300	1.000
130	0.800	310	1.000
135	0.850	315	1.000
140	0.890	320	0.995
150	0.950	330	0.950
160	0.990	340	0.840
170	1.000	350	0.720



SIDE VIEW

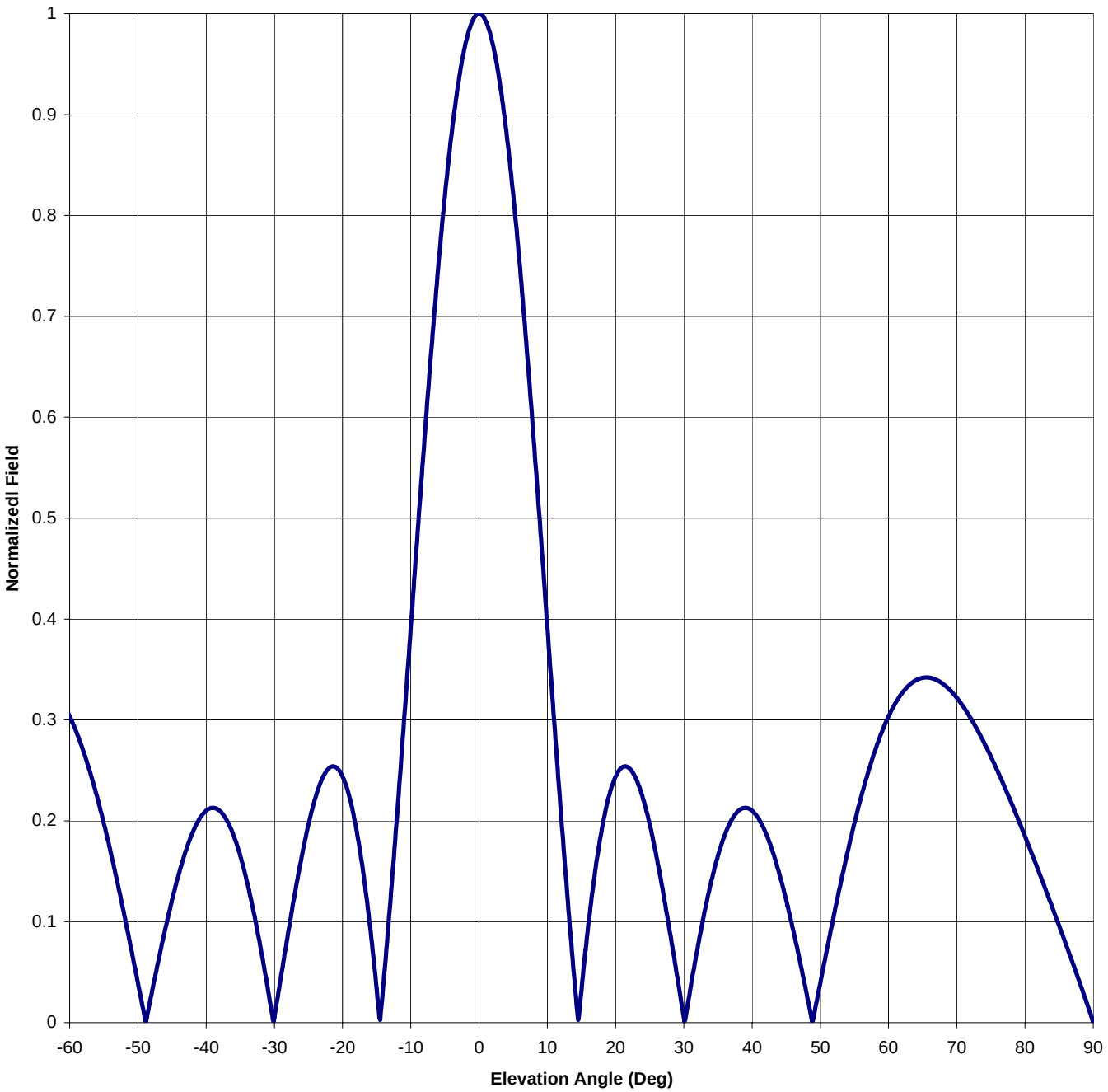


TOP VIEW
TOWER: ALLIED 24SR

ANTENNA HEADING = 239° TRUE NORTH

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 24541	FREQUENCY: 88.9 MHz.	SCALE: N.T.S.	DRAWN BY: LRA APPROVED BY: DAB
TITLE: MODEL-6513-4-DIRECTIONAL ANTENNA			
DATE: 2/23/06	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date: 4/12/2006**
Antenna Type:	**6513-4-DA**			
Station:	**KWVI**	**Beam Tilt**	**0**	
Frequency:	**88.9**	**Gain (Max)**	**6.386**	**8.053 dB**
Channel #:	**205**	**Gain (Horizon)**	**6.386**	**8.053 dB**
Figure:	**3**			



Antenna Mfg.: Shively Labs
Antenna Type: 6513-4-DA
Station: KWVI
Frequency: 88.9
Channel #: 205
Figure: 3

Beam Tilt 0
Gain (Max) 6.386
Gain (Horizon) 6.386

Date: 4/12/2006
8.053 dB
8.053 dB

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	0.147	0	1.000	46	0.093
-89	0.021	-43	0.170	1	0.992	47	0.061
-88	0.040	-42	0.188	2	0.970	48	0.028
-87	0.059	-41	0.202	3	0.933	49	0.005
-86	0.078	-40	0.210	4	0.883	50	0.039
-85	0.096	-39	0.213	5	0.820	51	0.073
-84	0.114	-38	0.210	6	0.747	52	0.107
-83	0.132	-37	0.201	7	0.666	53	0.139
-82	0.150	-36	0.186	8	0.578	54	0.169
-81	0.167	-35	0.165	9	0.486	55	0.198
-80	0.185	-34	0.139	10	0.392	56	0.224
-79	0.201	-33	0.109	11	0.299	57	0.248
-78	0.218	-32	0.073	12	0.207	58	0.269
-77	0.234	-31	0.035	13	0.121	59	0.288
-76	0.249	-30	0.005	14	0.040	60	0.304
-75	0.264	-29	0.047	15	0.033	61	0.317
-74	0.277	-28	0.088	16	0.096	62	0.327
-73	0.290	-27	0.128	17	0.150	63	0.334
-72	0.302	-26	0.164	18	0.192	64	0.339
-71	0.313	-25	0.197	19	0.224	65	0.342
-70	0.322	-24	0.223	20	0.244	66	0.342
-69	0.330	-23	0.242	21	0.253	67	0.340
-68	0.336	-22	0.252	22	0.252	68	0.336
-67	0.340	-21	0.253	23	0.242	69	0.330
-66	0.342	-20	0.244	24	0.223	70	0.322
-65	0.342	-19	0.224	25	0.197	71	0.313
-64	0.339	-18	0.192	26	0.164	72	0.302
-63	0.334	-17	0.150	27	0.128	73	0.290
-62	0.327	-16	0.096	28	0.088	74	0.277
-61	0.317	-15	0.033	29	0.047	75	0.264
-60	0.304	-14	0.040	30	0.005	76	0.249
-59	0.288	-13	0.121	31	0.035	77	0.234
-58	0.269	-12	0.207	32	0.073	78	0.218
-57	0.248	-11	0.299	33	0.109	79	0.201
-56	0.224	-10	0.392	34	0.139	80	0.185
-55	0.198	-9	0.486	35	0.165	81	0.167
-54	0.169	-8	0.578	36	0.186	82	0.150
-53	0.139	-7	0.666	37	0.201	83	0.132
-52	0.107	-6	0.747	38	0.210	84	0.114
-51	0.073	-5	0.820	39	0.213	85	0.096
-50	0.039	-4	0.883	40	0.210	86	0.078
-49	0.005	-3	0.933	41	0.202	87	0.059
-48	0.028	-2	0.970	42	0.188	88	0.040
-47	0.061	-1	0.992	43	0.170	89	0.021
-46	0.093	0	1.000	44	0.147	90	0.000
-45	0.121			45	0.121		

FIGURE 4

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VALIDATION OF GAIN CALCULATION

KWVI 88.9 MHz WAVERLY, IA

MODEL 6513-4-DA

Elevation Gain of 6513-4-DA equals 4.284

Vertical Azimuth Gain equals $1/(RMS)^2$
$1/(0.819)^2 = 1.4908$

*** Total Vertical Gain is Elevation Gain times Azimuth Gain**
4.284 x 1.4908 = 6.386

ERP divided by Vertical Gain equals Antenna Input Power
20 kW ÷ 6.386 = 3.132 kW