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S.O. 29182

Report of Test 6810-2-DA

for

THE POWER FOUNDATION

WSWS 89.9 MHz SMITHBORO, IL.

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-2-DA to meet the needs of WSWS and to comply with the requirements of the FCC construction permit, file number BMPED-20110321AAI. This test characterizes only the radiation characteristics of the antenna when mounted on the tower as described. It does not represent or imply any guarantee of specific coverage which can be influenced by factors beyond the scope of this test.

RESULTS:

The following Figures are the results of the measurements from our pattern range:

Figure 1A - Measured Azimuth Pattern with the FCC Composite
Figure 1B - Measured Composite Azimuth Pattern with the FCC Composite
Figure 1C - Tabulation of the Horizontal Polarization for the Measured Azimuth Pattern
Figure 1D - Tabulation of the Vertical Polarization for the Measured Azimuth Pattern
Figure 1E - Tabulation of the Measured Composite Azimuth Pattern
Figure 1F - Tabulation of the FCC Composite

The calculated elevation pattern of the antenna is shown in Figure 3.

Construction permit file number BMPED-20110321AAI indicates that the Horizontal radiation component shall not exceed 2.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

050 Degrees T: 1.040 Kw

165 Degrees T: 0.065 Kw

From Figure 1A, the maximum radiation of the Horizontal component occurs at 280 Degrees T to 295 Degrees T and 325 Degrees T to 0 Degrees T. At the restricted azimuth of 50 Degrees T the Horizontal component is 3.15 dB down from the maximum of 2.0 kW, or 0.97 kW and the restricted azimuth of 165 Degrees T the horizontal component is 15.6 dB down from the maximum of 2.0 kW, or 0.06 kW.

The R.M.S. of the Horizontal component is 0.689. The total Horizontal power gain is 2.207. The R.M.S. of the Vertical component is 0.651. The total Vertical power gain is 2.120. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.749. The R.M.S. of the measured composite pattern is 0.694. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.636. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-2-DA was mounted on a tower of precise scale to the PI-ROD 36 tower at the WSWS site. The spacing of the antenna to the tower was varied to achieve the vertical pattern shown in Figure 1A. A horizontal parasitic element was placed directly under the bay. The position of this horizontal parasitic element was changed until the horizontal pattern shown in Figure 1A was achieved. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BMPED-20110321AAI, a single level of the 6810-2-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 and 10th Editions 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

All testing is carried out in strict accordance with approved procedures under our ISO9001:2008.

TEST PROCEDURES:

The receiving antenna system is mounted so that the horizontal and vertical azimuth patterns are measured independently. The network analyzer was set to 404.55 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 1A.

Respectfully submitted by:

Robert A. Surette
Director of Sales Engineering
S/O 29182
Date July 5, 2011

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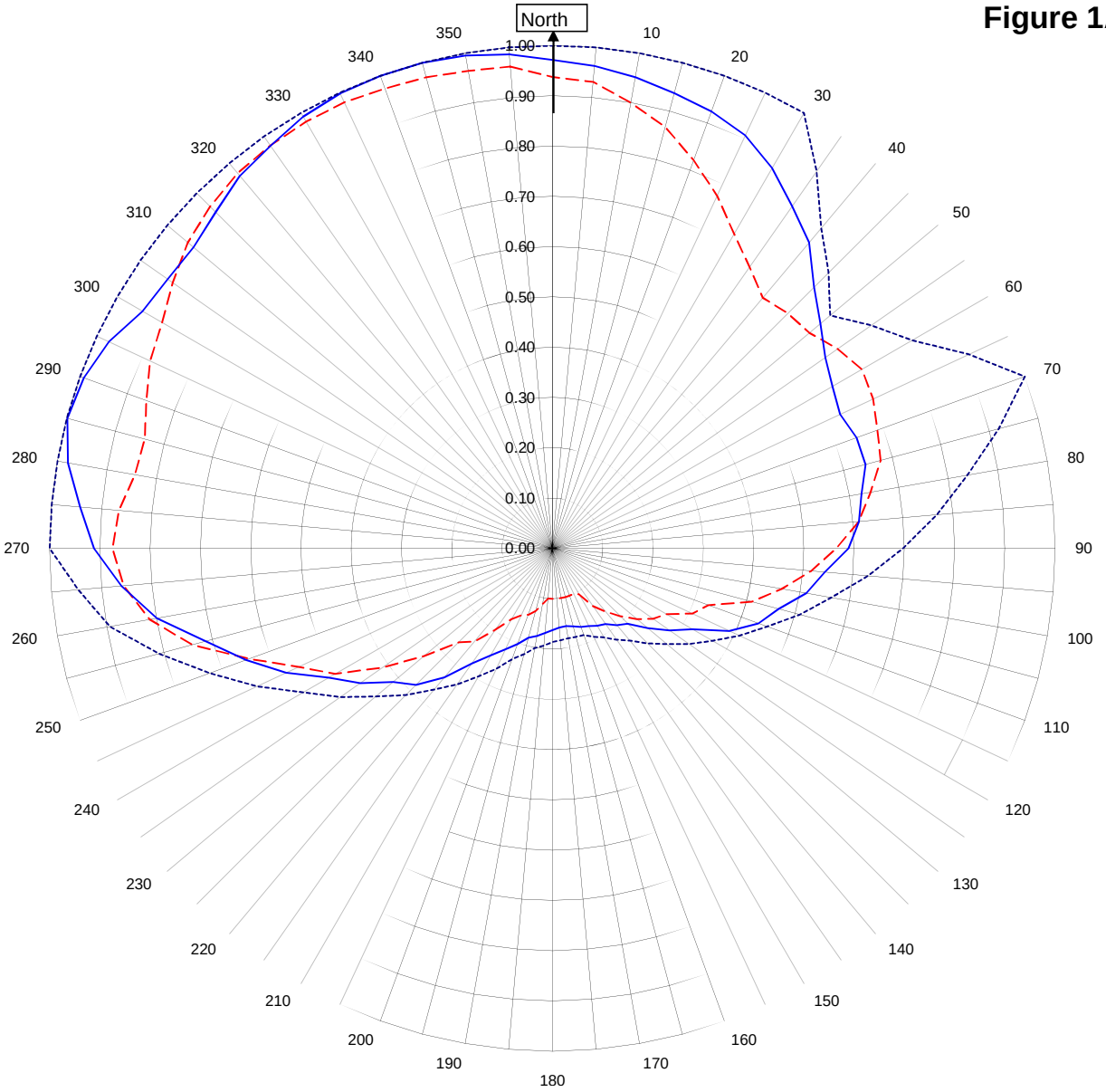
Figure 1A



WSWS SMITHBORO, IL

29182

June 24, 2011

Horizontal RMS	0.689
Vertical RMS	0.651
H/V Composite RMS	0.694
FCC Composite RMS	0.749

Frequency	89.9 / 404.55 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-2-DA
Pattern Type	Directional Azimuth

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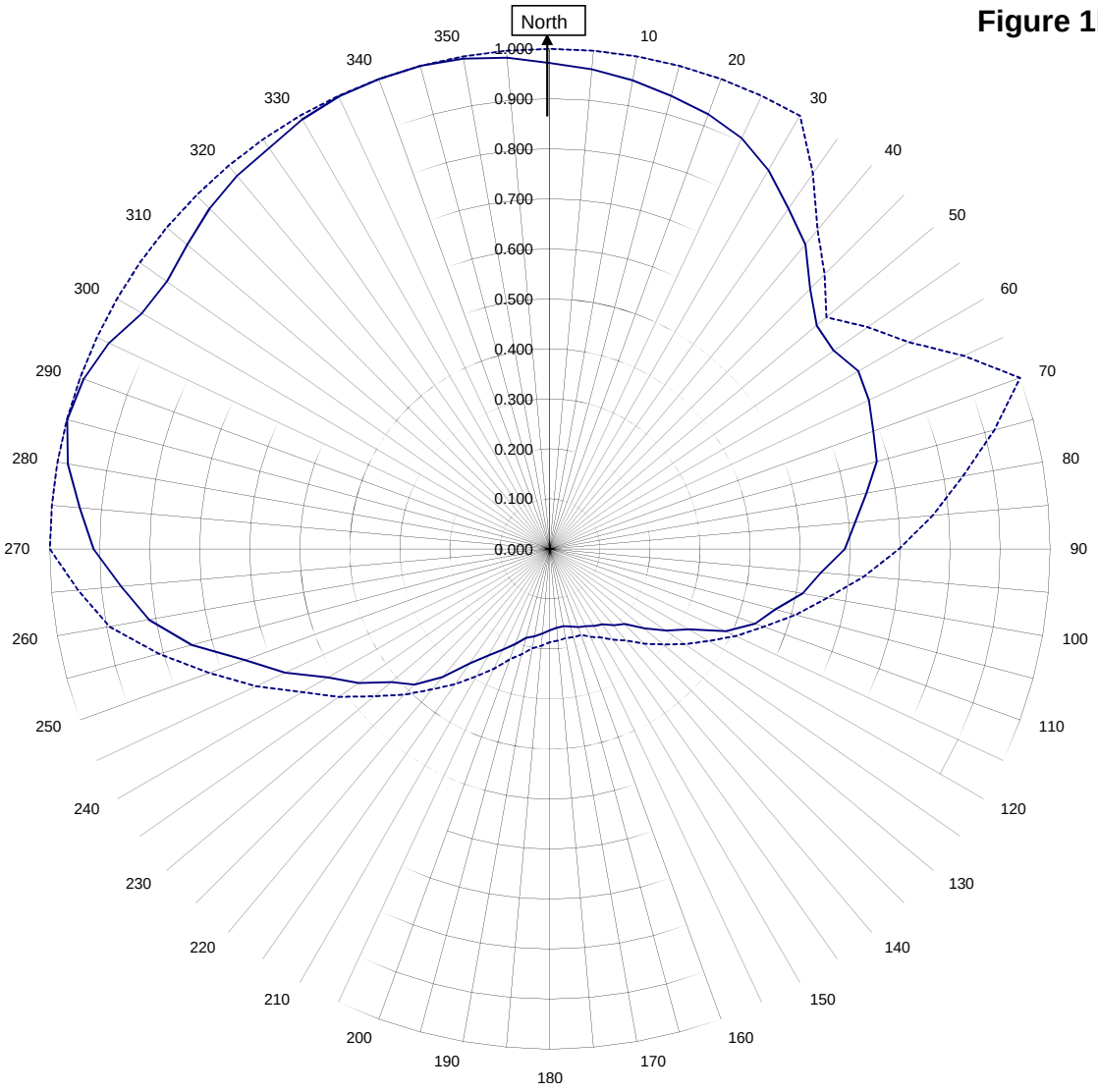
Figure 1B



WSWS SMITHBORO, IL

29182

June 24, 2011

_____H/VComposite RMS	0.694
……FCC Composite RMS	0.749

Frequency	89.9 / 404.55 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-2-DA
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WSWS SMITHBORO, IL

Azimuth	Rel Field	Azimuth	Rel Field
0	0.972	180	0.162
10	0.952	190	0.177
20	0.925	200	0.202
30	0.874	210	0.246
40	0.795	220	0.334
45	0.736	225	0.384
50	0.696	230	0.413
60	0.644	240	0.514
70	0.644	250	0.649
80	0.624	260	0.799
90	0.589	270	0.912
100	0.512	280	0.979
110	0.436	290	0.992
120	0.321	300	0.942
130	0.247	310	0.932
135	0.211	315	0.947
140	0.199	320	0.967
150	0.177	330	0.992
160	0.166	340	1.000
170	0.157	350	0.995

Figure 1D

Tabulation of Vertical Azimuth Pattern
WSWS SMITHBORO, IL

Azimuth	Rel Field	Azimuth	Rel Field
0	0.938	180	0.100
10	0.900	190	0.112
20	0.821	200	0.140
30	0.722	210	0.162
40	0.651	220	0.242
45	0.662	225	0.264
50	0.667	230	0.332
60	0.711	240	0.499
70	0.688	250	0.642
80	0.642	260	0.814
90	0.565	270	0.875
100	0.463	280	0.844
110	0.330	290	0.860
120	0.261	300	0.897
130	0.219	310	0.947
135	0.190	315	0.962
140	0.164	320	0.974
150	0.105	330	0.980
160	0.100	340	0.973
170	0.100	350	0.965

Figure 1E

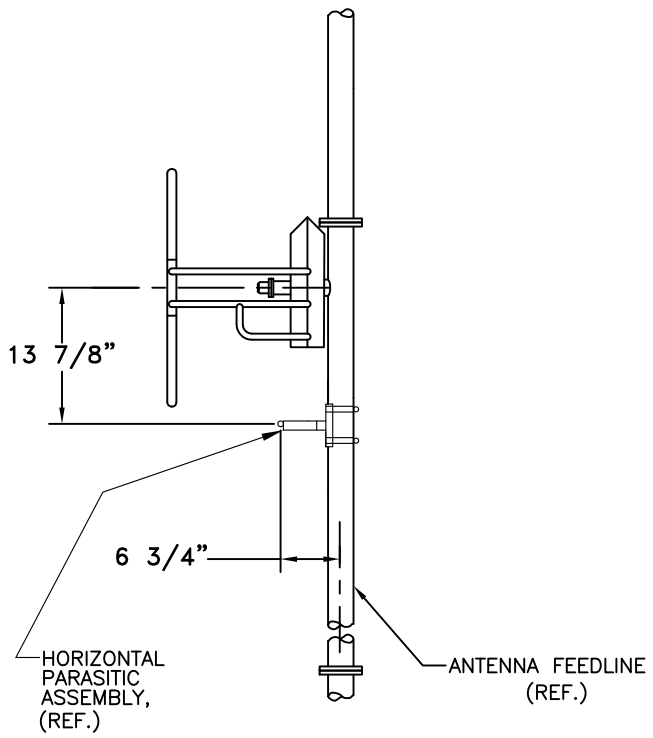
Tabulation of Composite Azimuth Pattern
WSWS SMITHBORO, IL

Azimuth	Rel Field	Azimuth	Rel Field
0	0.972	180	0.162
10	0.952	190	0.177
20	0.925	200	0.202
30	0.874	210	0.246
40	0.795	220	0.334
45	0.736	225	0.384
50	0.696	230	0.413
60	0.711	240	0.514
70	0.688	250	0.649
80	0.642	260	0.814
90	0.589	270	0.912
100	0.512	280	0.979
110	0.436	290	0.992
120	0.321	300	0.942
130	0.247	310	0.947
135	0.211	315	0.962
140	0.199	320	0.974
150	0.177	330	0.992
160	0.166	340	1.000
170	0.157	350	0.995

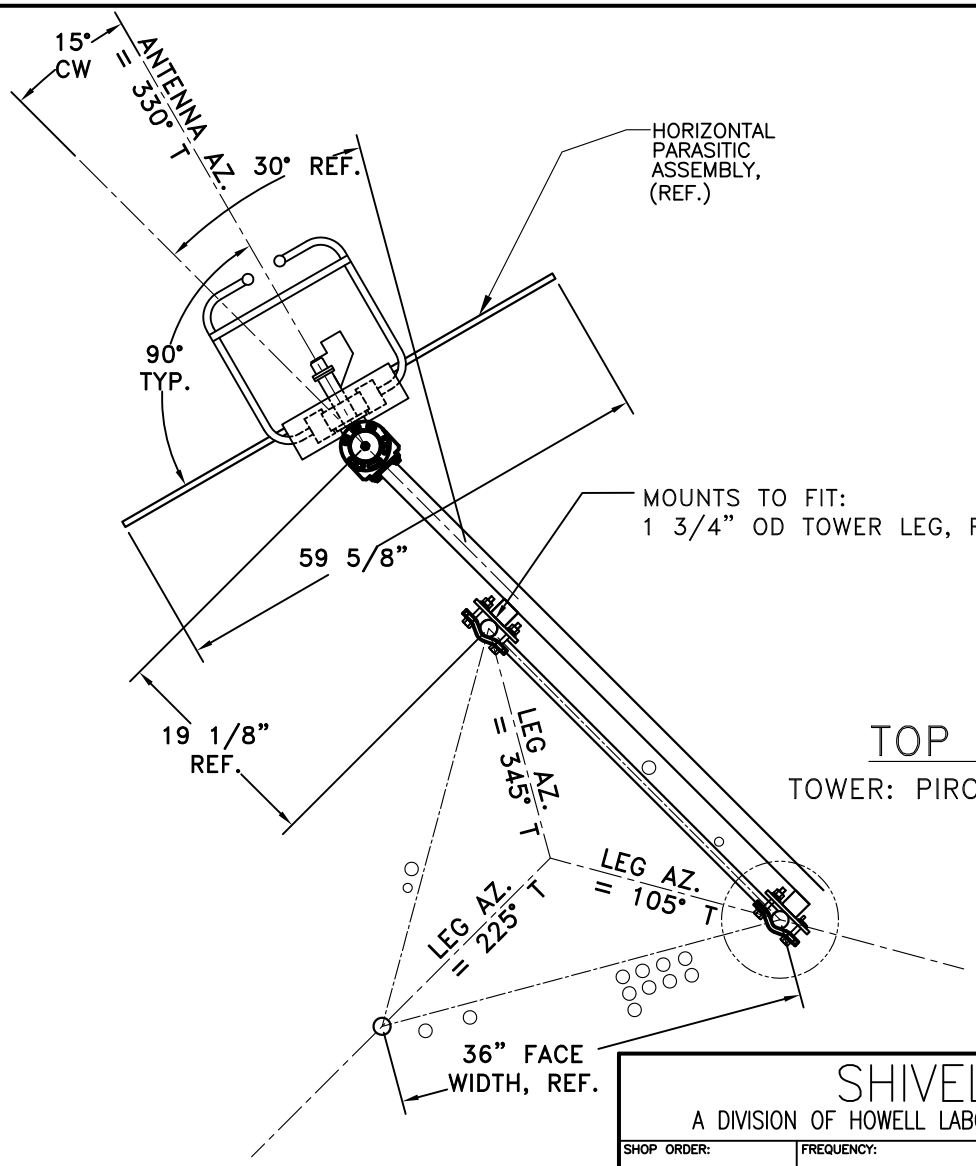
Figure 1F

Tabulation of FCC Directional Composite
WSWS SMITHBORO, IL

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.186
10	1.000	190	0.201
20	1.000	200	0.234
30	1.000	210	0.293
40	0.832	220	0.366
50	0.721	230	0.458
60	0.827	240	0.572
70	1.000	250	0.725
80	0.838	260	0.894
90	0.697	270	1.000
100	0.563	280	1.000
110	0.454	290	1.000
120	0.367	300	1.000
130	0.296	310	1.000
140	0.239	320	1.000
150	0.204	330	1.000
160	0.183	340	1.000
170	0.181	350	1.000

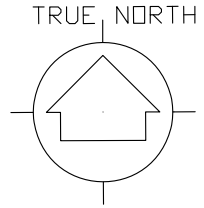


SIDE VIEW



TOP VIEW

TOWER: PIROD 36" FACE



ANTENNA HEADING 330° TRUE NORTH

SHIVELY LABS

A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE

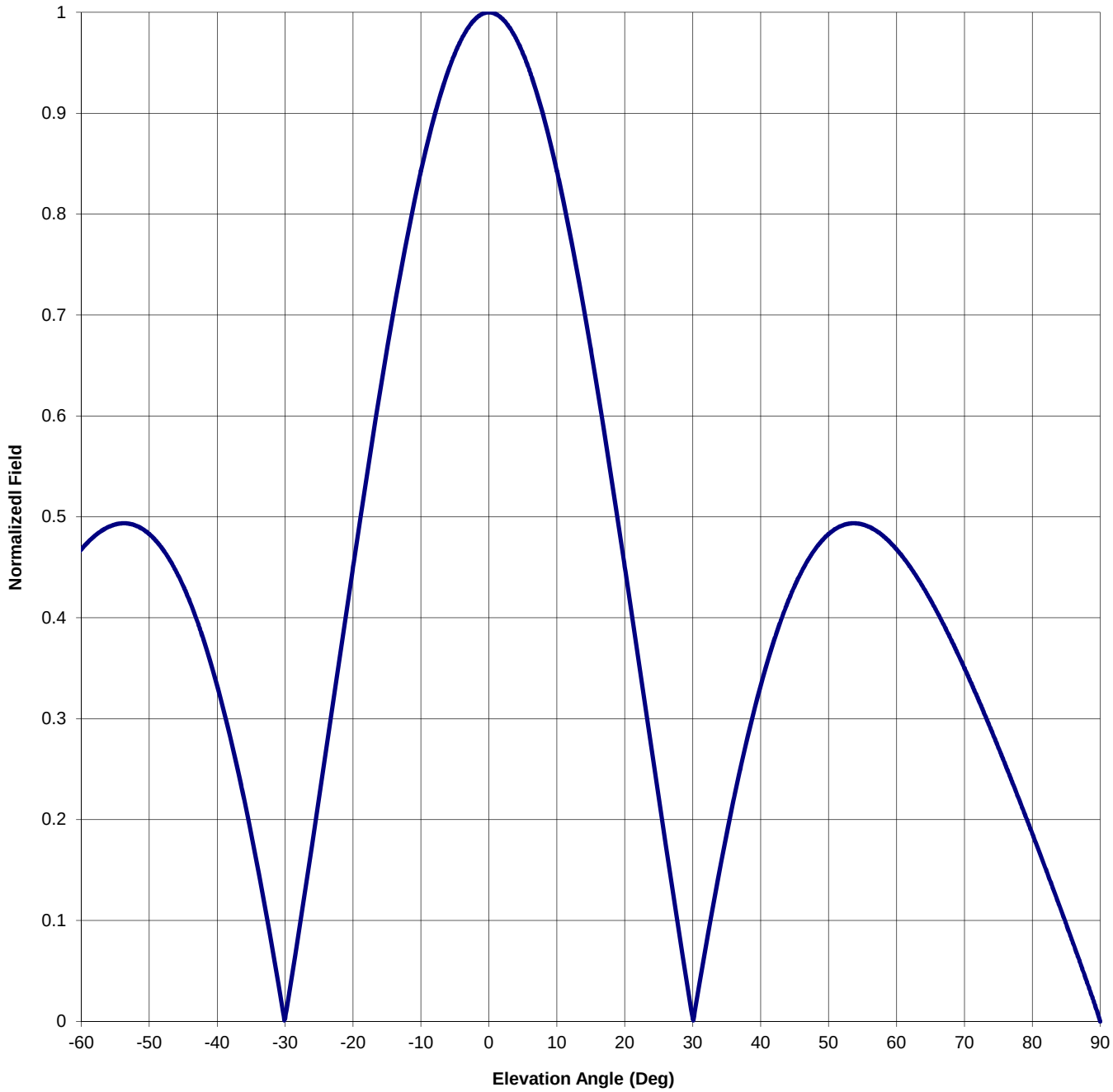
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY:
29182	89.9	N.T.S.	ASP
			APPROVED BY: DAB

TITLE: MODEL-6810-2-DIRECTIONAL ANTENNA

DATE: 7/19/11

FIGURE 2

Antenna Mfg.:	**Shively Labs**			**Date:**	**7/5/2011**
Antenna Type:	**6810-2-DA**				
Station:	**WSWS**	**Beam Tilt**	**0**		
Frequency:	**89.9**	**Gain (Max)**	**2.207**	**3.438**	**dB**
Channel #:	**210**	**Gain (Horizon)**	**2.207**	**3.438**	**dB**
Figure:	**Figure 3**				



Antenna Mfg.: Shively Labs **Date:** 7/5/2011

Antenna Type: 6810-2-DA

Station: WSWS **Beam Tilt** 0

Frequency: 89.9 **Gain (Max)** 2.207 3.438 dB

Channel #: 210 **Gain (Horizon)** 2.207 3.438 dB

Figure: 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	0.416	0	1.000	46	0.445
-89	0.021	-43	0.398	1	0.998	47	0.458
-88	0.040	-42	0.378	2	0.993	48	0.468
-87	0.059	-41	0.356	3	0.985	49	0.476
-86	0.078	-40	0.333	4	0.974	50	0.483
-85	0.096	-39	0.307	5	0.959	51	0.488
-84	0.114	-38	0.280	6	0.942	52	0.491
-83	0.133	-37	0.250	7	0.921	53	0.493
-82	0.150	-36	0.219	8	0.898	54	0.494
-81	0.168	-35	0.186	9	0.872	55	0.493
-80	0.186	-34	0.151	10	0.843	56	0.490
-79	0.203	-33	0.115	11	0.812	57	0.486
-78	0.221	-32	0.077	12	0.778	58	0.481
-77	0.238	-31	0.038	13	0.743	59	0.475
-76	0.255	-30	0.003	14	0.705	60	0.468
-75	0.271	-29	0.045	15	0.666	61	0.460
-74	0.288	-28	0.088	16	0.625	62	0.450
-73	0.304	-27	0.132	17	0.583	63	0.440
-72	0.320	-26	0.176	18	0.540	64	0.429
-71	0.335	-25	0.222	19	0.496	65	0.418
-70	0.350	-24	0.267	20	0.451	66	0.405
-69	0.365	-23	0.313	21	0.405	67	0.392
-68	0.379	-22	0.359	22	0.359	68	0.379
-67	0.392	-21	0.405	23	0.313	69	0.365
-66	0.405	-20	0.451	24	0.267	70	0.350
-65	0.418	-19	0.496	25	0.222	71	0.335
-64	0.429	-18	0.540	26	0.176	72	0.320
-63	0.440	-17	0.583	27	0.132	73	0.304
-62	0.450	-16	0.625	28	0.088	74	0.288
-61	0.460	-15	0.666	29	0.045	75	0.271
-60	0.468	-14	0.705	30	0.003	76	0.255
-59	0.475	-13	0.743	31	0.038	77	0.238
-58	0.481	-12	0.778	32	0.077	78	0.221
-57	0.486	-11	0.812	33	0.115	79	0.203
-56	0.490	-10	0.843	34	0.151	80	0.186
-55	0.493	-9	0.872	35	0.186	81	0.168
-54	0.494	-8	0.898	36	0.219	82	0.150
-53	0.493	-7	0.921	37	0.250	83	0.133
-52	0.491	-6	0.942	38	0.280	84	0.114
-51	0.488	-5	0.959	39	0.307	85	0.096
-50	0.483	-4	0.974	40	0.333	86	0.078
-49	0.476	-3	0.985	41	0.356	87	0.059
-48	0.468	-2	0.993	42	0.378	88	0.040
-47	0.458	-1	0.998	43	0.398	89	0.021
-46	0.445	0	1.000	44	0.416	90	0.000
-45	0.431			45	0.431		

S.O. 29182 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WSWS SMITHBORO, IL.

Model 6810-2-DA

Elevation Gain of Antenna 0.99

Horizontal RMS value divided by the Vertical RMS value equals the Horiz. - Vert. Ratio

H RMS	0.689	V RMS	0.651	H/V Ratio	1.058

Elevation Gain of Horizontal Component 1.048

Elevation Gain of Vertical Component 0.935

Horizontal Azimuth Gain equals $1/(RMS)^2$. 2.107

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 2.266

Max. Vertical 0.98

***Total Horizontal Power Gain is the Elevation Gain Times the Azimuth Gain**

Total Horizontal Power Gain = **2.207**

***Total Vertical Power Gain is the Elevation Gain Times the Azimuth Gain**

Total Vertical Power Gain = **2.120**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

2	kW ERP	Divided by H Gain	2.207	equals	0.906	kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

0.906	kW	Times V Gain	2.120	equals	1.921	kW V ERP

Maximum Value of the Vertical Component squared times the Maximum ERP equals the Vertical ERP

(0.98)^2	Times	2.00	Equals	1.921	kW Vertical ERP

NOTE: Calculating the ERP of the Vertical Component by two methods validates the total power gain calculations