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S.O. 29694

Report of Test 6810-7-DA

for

American Family Association

WATU 89.3 MHz Port Gibson, MS

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-7-DA to meet the needs of WATU and to comply with the requirements of the FCC construction permit, file number BPED-20091208AAK. 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 BPED-20091208AAK indicates that the Horizontal radiation component shall not exceed 24.5 kW at any azimuth and is restricted to the following values at the azimuths specified:

290 Degrees T: 7.6 kW

300 Degrees T: 7.5 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 044 Degrees T to 048 Degrees T. At the restricted azimuth of 290 Degrees T the Horizontal component is 5.531 dB down from the maximum of 24.5 kW, or 6.856 kW and at the restricted azimuth of 300 Degrees T the horizontal component is 5.416 dB down from the maximum of 24.5 kW, or 7.039 kW.

The R.M.S. of the Horizontal component is 0.798. The total Horizontal power gain is 6.101. The R.M.S. of the Vertical component is 0.795. The total Vertical power gain is 5.955. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.935. The R.M.S. of the measured composite pattern is 0.828. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.795. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-7-DA was mounted on a tower of precise scale to the J-CROW 24tower at the WATU 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 BPED-20091208AAK, a single level of the 6810-7-DA was set up on the Shively Labs 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 401.85 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 29694
August 9, 2012

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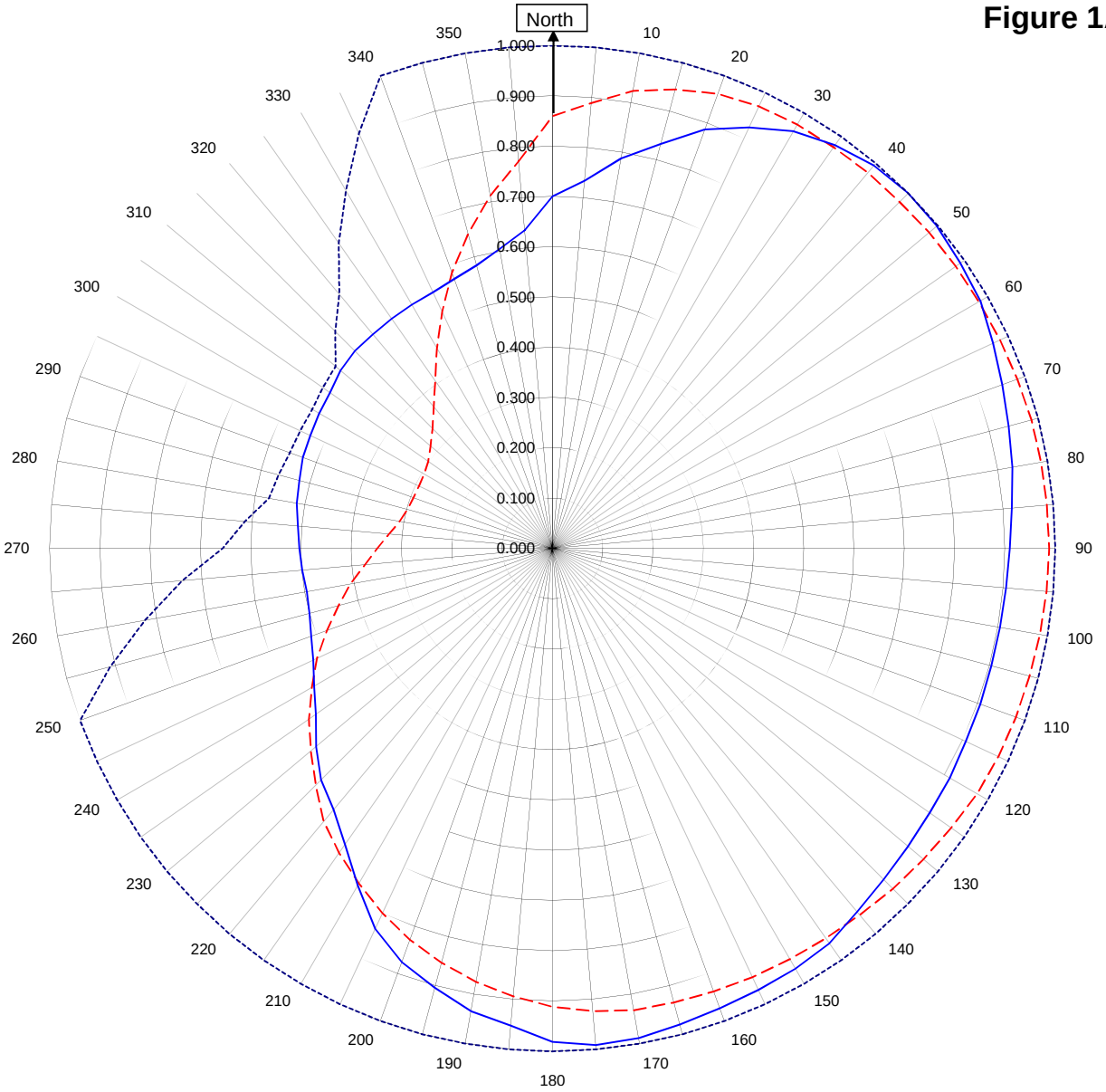
Figure 1A



WATU PORT GIBSON, MS

29694

August 9, 2012

Horizontal RMS	0.798
Vertical RMS	0.795
H/V Composite RMS	0.828
FCC Composite RMS	0.935

Frequency	89.3 / 401.85 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-7-DA
Pattern Type	Directional Azimuth

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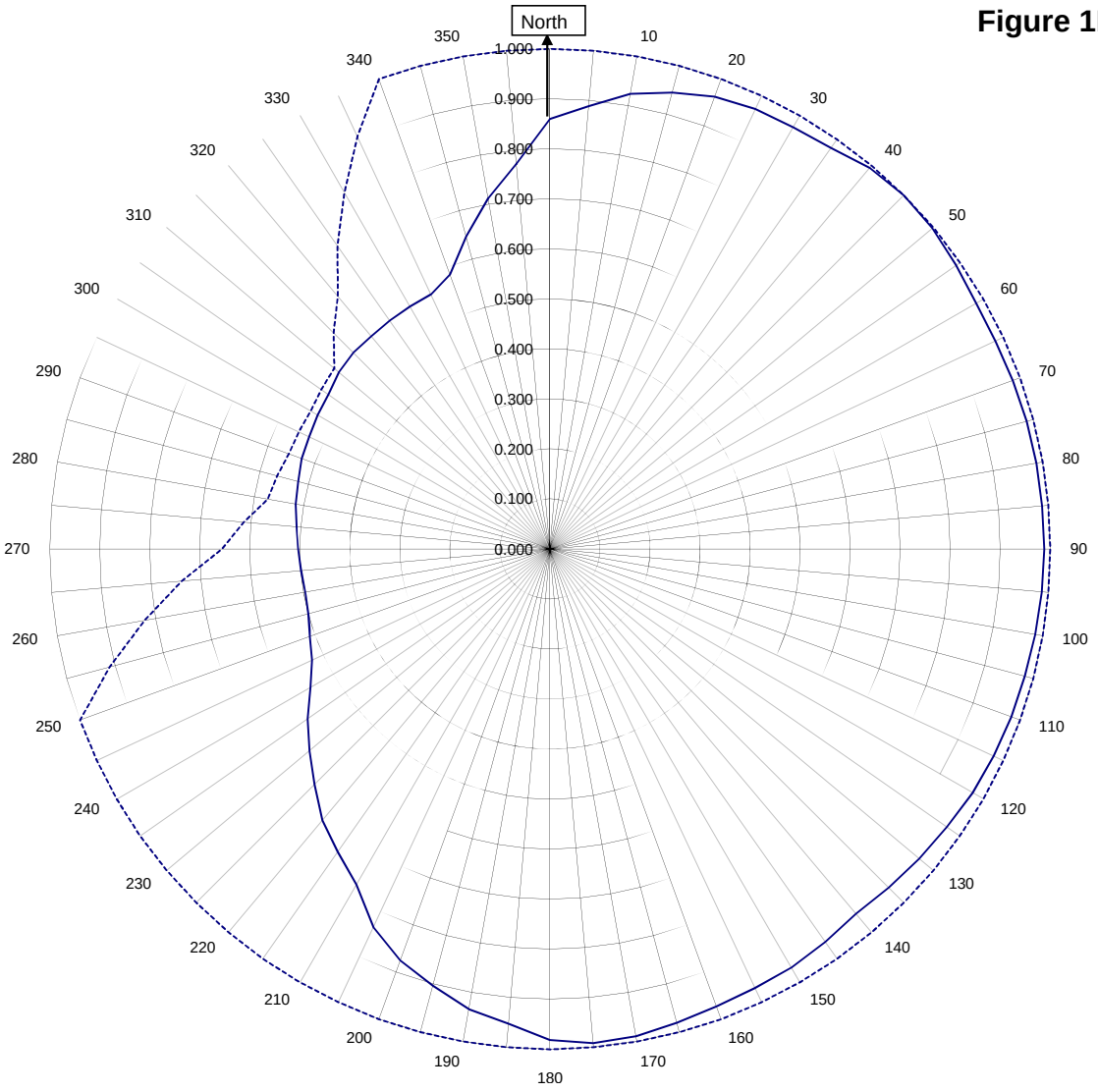
Figure 1B



WATU PORT GIBSON, MS

29694

August 9, 2012

_____H/VComposite RMS	0.828
……FCC Composite RMS	0.935

Frequency	89.3 / 401.85 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-7-DA
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WATU PORT GIBSON, MS

Azimuth	Rel Field	Azimuth	Rel Field
0	0.700	180	0.981
10	0.787	190	0.934
20	0.887	200	0.876
30	0.958	210	0.775
40	0.994	220	0.677
45	1.000	225	0.651
50	0.998	230	0.614
60	0.983	240	0.548
70	0.952	250	0.511
80	0.929	260	0.496
90	0.910	270	0.504
100	0.904	280	0.516
110	0.906	290	0.529
120	0.913	300	0.536
130	0.923	310	0.551
135	0.931	315	0.556
140	0.943	320	0.556
150	0.965	330	0.560
160	0.973	340	0.570
170	0.989	350	0.605

Figure 1D

Tabulation of Vertical Azimuth Pattern
WATU PORT GIBSON, MS

Azimuth	Rel Field	Azimuth	Rel Field
0	0.860	180	0.911
10	0.924	190	0.875
20	0.962	200	0.828
30	0.974	210	0.769
40	0.976	220	0.708
45	0.976	225	0.666
50	0.978	230	0.628
60	0.980	240	0.553
70	0.984	250	0.478
80	0.987	260	0.408
90	0.988	270	0.348
100	0.985	280	0.309
110	0.981	290	0.295
120	0.976	300	0.295
130	0.963	310	0.317
135	0.957	315	0.337
140	0.951	320	0.367
150	0.943	330	0.459
160	0.938	340	0.584
170	0.932	350	0.712

Figure 1E

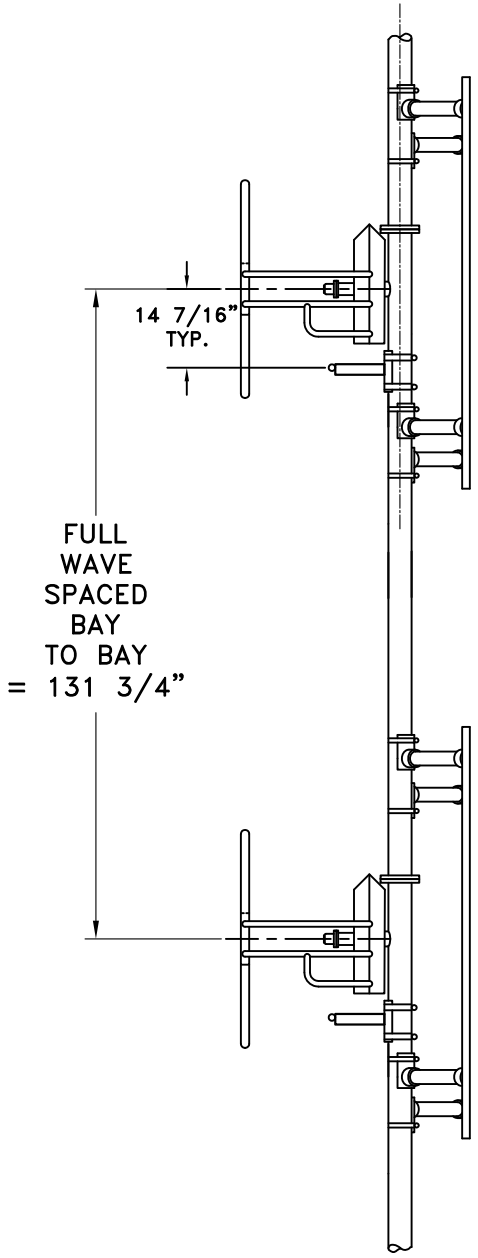
Tabulation of Composite Azimuth Pattern
WATU PORT GIBSON, MS

Azimuth	Rel Field	Azimuth	Rel Field
0	0.860	180	0.981
10	0.924	190	0.934
20	0.962	200	0.876
30	0.974	210	0.775
40	0.994	220	0.708
45	1.000	225	0.666
50	0.998	230	0.628
60	0.983	240	0.553
70	0.984	250	0.511
80	0.987	260	0.496
90	0.988	270	0.504
100	0.985	280	0.516
110	0.981	290	0.529
120	0.976	300	0.536
130	0.963	310	0.551
135	0.957	315	0.556
140	0.951	320	0.556
150	0.965	330	0.560
160	0.973	340	0.584
170	0.989	350	0.712

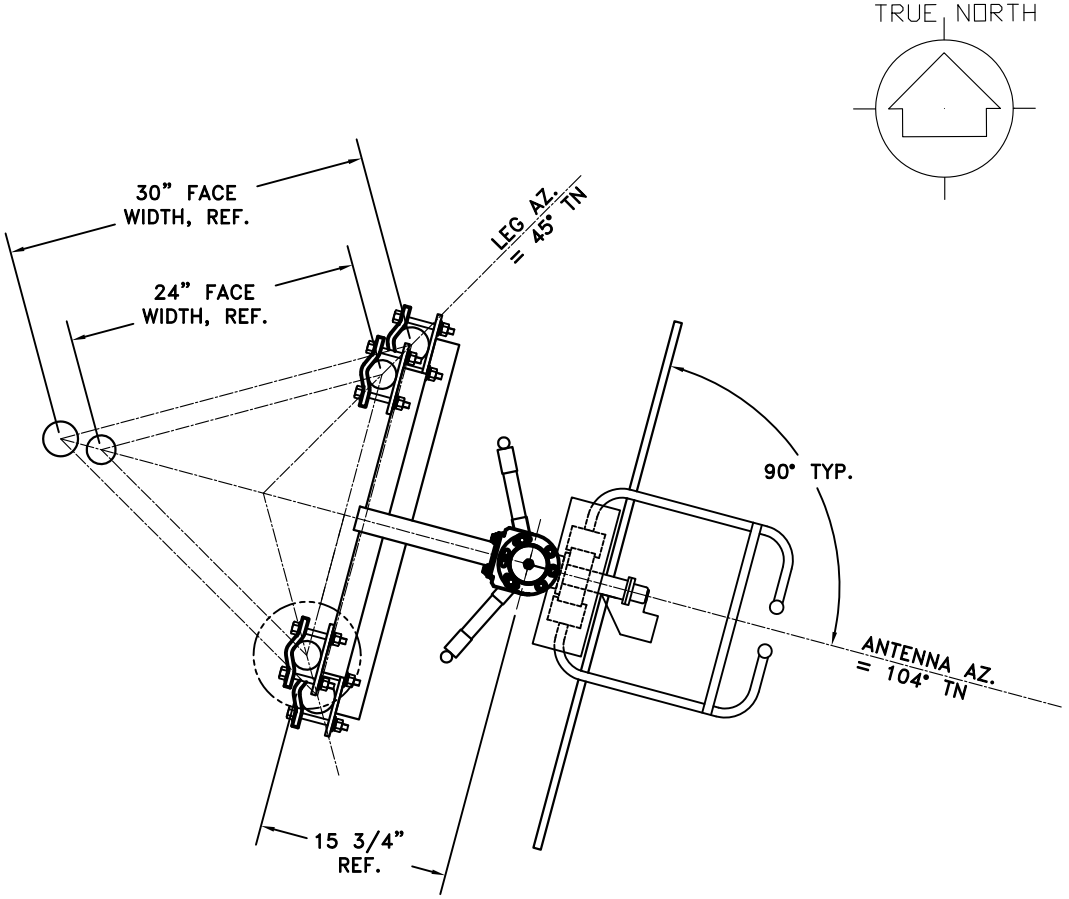
Figure 1F

Tabulation of FCC Directional Composite
WATU PORT GIBSON, MS

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	1.000
10	1.000	190	1.000
20	1.000	200	1.000
30	1.000	210	1.000
40	1.000	220	1.000
50	1.000	230	1.000
60	1.000	240	1.000
70	1.000	250	1.000
80	1.000	260	0.823
90	1.000	270	0.656
100	1.000	280	0.573
110	1.000	290	0.556
120	1.000	300	0.552
130	1.000	310	0.563
140	1.000	320	0.660
150	1.000	330	0.822
160	1.000	340	1.000
170	1.000	350	1.000



SIDE VIEW



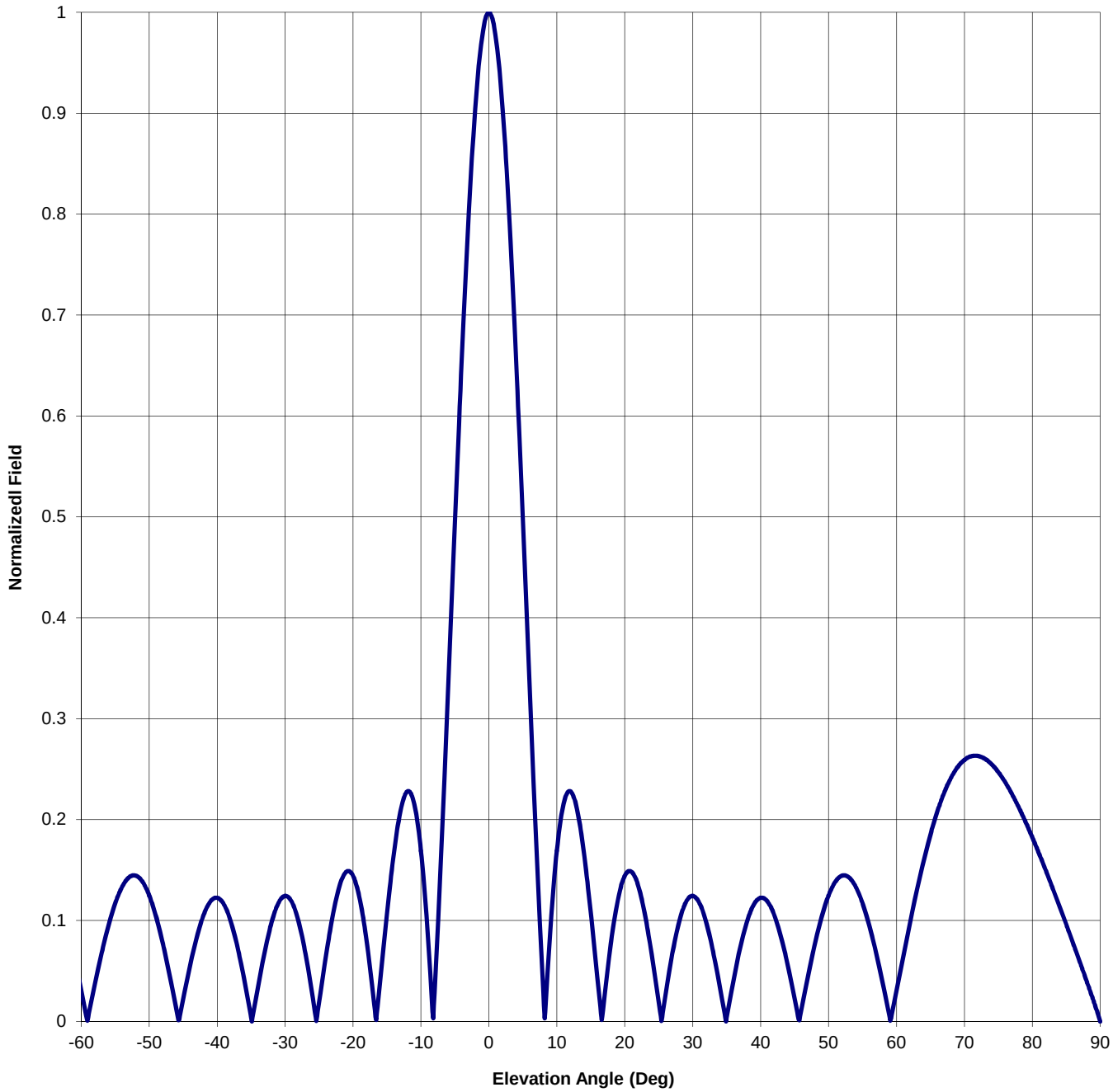
TOP VIEW

TOWER: J CROW TOWER WORKS 24/30

ANTENNA HEADING 104° TRUE NORTH

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 29694	FREQUENCY: 89.3	SCALE: N.T.S.	DRAWN BY: ASP APPROVED BY: DAB
TITLE: MODEL-6810-7-DIRECTIONAL ANTENNA			
DATE: 8-9-12	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date:**	**8/9/2012**
Antenna Type:	**6810-7-DA**				
Station:	**WATU**	**Beam Tilt**	**0**		
Frequency:	**89.3**	**Gain (Max)**	**6.101**	**7.854**	**dB**
Channel #:	**207**	**Gain (Horizon)**	**6.101**	**7.854**	**dB**
Figure:	**Figure 3**				



Antenna Mfg.: Shively Labs **Date:** 8/9/2012

Antenna Type: 6810-7-DA

Station: WATU **Beam Tilt** 0

Frequency: 89.3 **Gain (Max)** 6.101 7.854 dB

Channel #: 207 **Gain (Horizon)** 6.101 7.854 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	0.055	0	1.000	46	0.012
-89	0.021	-43	0.084	1	0.976	47	0.046
-88	0.040	-42	0.105	2	0.906	48	0.077
-87	0.059	-41	0.119	3	0.796	49	0.104
-86	0.078	-40	0.123	4	0.656	50	0.125
-85	0.096	-39	0.116	5	0.496	51	0.138
-84	0.114	-38	0.099	6	0.330	52	0.144
-83	0.132	-37	0.073	7	0.170	53	0.143
-82	0.149	-36	0.041	8	0.028	54	0.133
-81	0.166	-35	0.004	9	0.087	55	0.117
-80	0.182	-34	0.034	10	0.169	56	0.095
-79	0.198	-33	0.069	11	0.216	57	0.068
-78	0.212	-32	0.098	12	0.228	58	0.037
-77	0.225	-31	0.117	13	0.209	59	0.004
-76	0.237	-30	0.124	14	0.166	60	0.030
-75	0.247	-29	0.118	15	0.107	61	0.065
-74	0.255	-28	0.099	16	0.041	62	0.098
-73	0.260	-27	0.067	17	0.024	63	0.130
-72	0.263	-26	0.027	18	0.080	64	0.159
-71	0.263	-25	0.019	19	0.121	65	0.185
-70	0.259	-24	0.065	20	0.144	66	0.208
-69	0.252	-23	0.105	21	0.148	67	0.226
-68	0.241	-22	0.134	22	0.134	68	0.241
-67	0.226	-21	0.148	23	0.105	69	0.252
-66	0.208	-20	0.144	24	0.065	70	0.259
-65	0.185	-19	0.121	25	0.019	71	0.263
-64	0.159	-18	0.080	26	0.027	72	0.263
-63	0.130	-17	0.024	27	0.067	73	0.260
-62	0.098	-16	0.041	28	0.099	74	0.255
-61	0.065	-15	0.107	29	0.118	75	0.247
-60	0.030	-14	0.166	30	0.124	76	0.237
-59	0.004	-13	0.209	31	0.117	77	0.225
-58	0.037	-12	0.228	32	0.098	78	0.212
-57	0.068	-11	0.216	33	0.069	79	0.198
-56	0.095	-10	0.169	34	0.034	80	0.182
-55	0.117	-9	0.087	35	0.004	81	0.166
-54	0.133	-8	0.028	36	0.041	82	0.149
-53	0.143	-7	0.170	37	0.073	83	0.132
-52	0.144	-6	0.330	38	0.099	84	0.114
-51	0.138	-5	0.496	39	0.116	85	0.096
-50	0.125	-4	0.656	40	0.123	86	0.078
-49	0.104	-3	0.796	41	0.119	87	0.059
-48	0.077	-2	0.906	42	0.105	88	0.040
-47	0.046	-1	0.976	43	0.084	89	0.021
-46	0.012	0	1.000	44	0.055	90	0.000
-45	0.023			45	0.023		

S.O. 29694 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WATU	PORT GIBSON, MS
MODEL	6810-7-DA

Elevation Gain of Antenna 3.87

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

H RMS 0.798274 V RMS 0.794645 H/V Ratio 1.005

Elevation Gain of Horizontal Component 3.888

Elevation Gain of Vertical Component 3.852

Horizontal Azimuth Gain equals $1/(RMS)^2$. 1.569

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 1.546

Max. Vertical 0.988

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

Total Horizontal Power Gain = **6.101**

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

Total Vertical Power Gain = **5.955**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

24.5 kW ERP Divided by H Gain 6.101 equals 4.016 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

4.016 kW Times V Gain 5.955 equals 23.916 kW V ERP

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

(0.988)^2 Times 24.50 Equals 23.916 kW Vertical ERP

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