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S.O. 29558

Report of Test 6810-2-SS-DA

for

Zoe Communications, Inc.

WDMO 95.7 MHz Baldwin, WI

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-2-SS-DA to meet the needs of WDMO and to comply with the requirements of the FCC construction permit, file number BPH-20081010AZO. 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 BPH-20081010AZO indicates that the Horizontal radiation component shall not exceed 4.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

300 Degrees True through 310 degree True: 0.670 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 113 Degrees T to 125 Degrees. At the restricted azimuth of 300 Degrees True through 310 degree True the Vertical component is 8.223 dB down from the maximum of 4.0 kW, or 0.602 kW.

The R.M.S. of the Horizontal component is 0.755. The total Horizontal power gain is 1.290. The R.M.S. of the Vertical component is 0.718. The total Vertical power gain is 1.249. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.907. The R.M.S. of the measured composite pattern is 0.773. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.771. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-2-SS-DA was mounted on a tower of precise scale to the Pirod 45" face tower at the WDMO 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 BPH-20081010AZO, a single level of the 6810-2-SS-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 9^{th} and 10^{th} 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 430.65 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 29558
November 23, 2011

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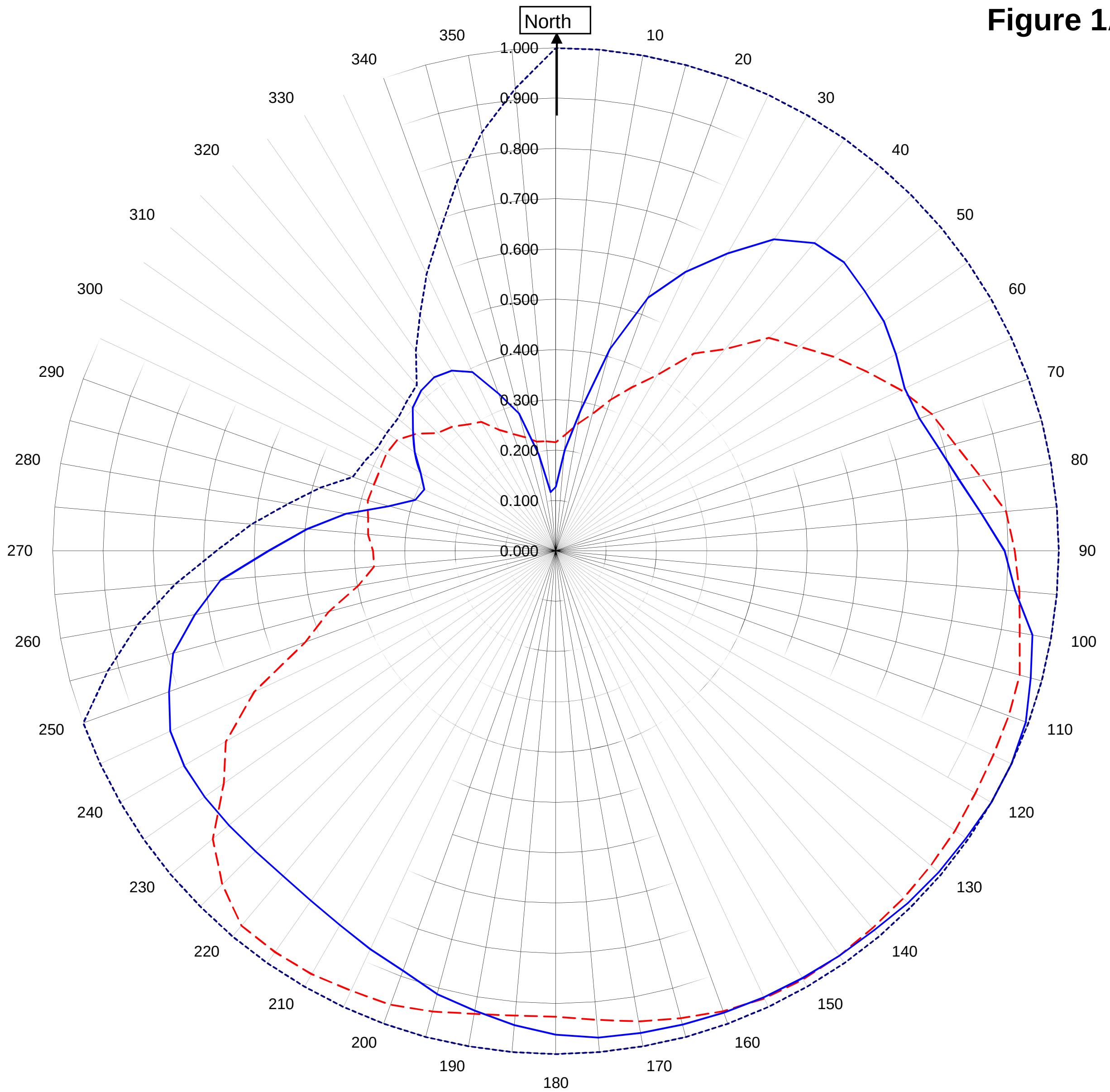
Figure 1A



WDMO BALDWIN, WI.

29558

November 23, 2011

____________Horizontal RMS	0.755
_ _ _ _ _ _ _ _ _ _ Vertical RMS	0.718
H/V Composite RMS	0.773
……………FCC Composite RMS	0.907

Frequency	95.7 / 430.65 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-2-SS-DA
Pattern Type	Directional Azimuth

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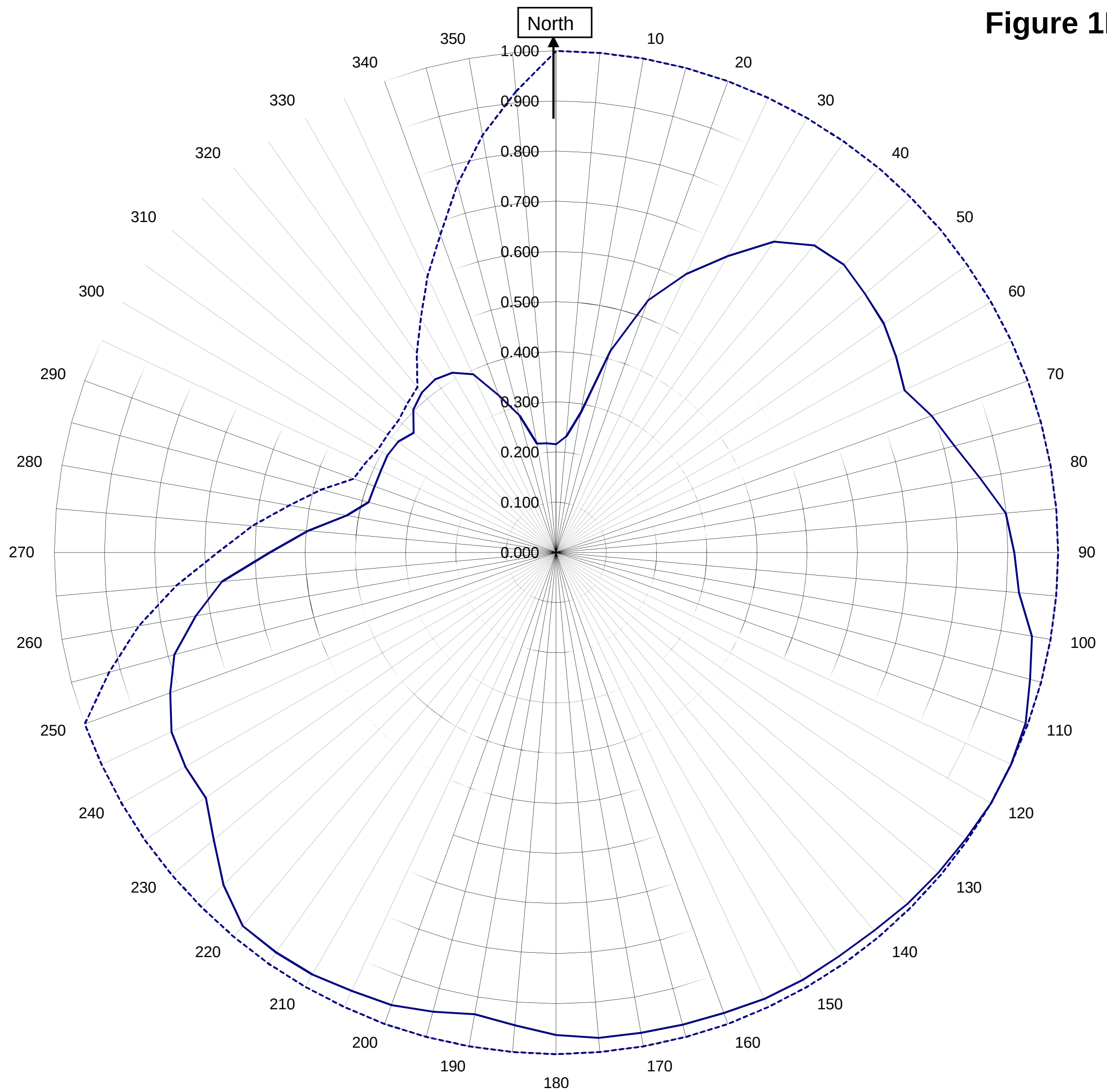
Figure 1B



WDMO BALDWIN, WI.

29558

November 23, 2011

__________H/VComposite RMS	0.773
……………FCC Composite RMS	0.907

Frequency	95.7 / 430.65 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

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

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WDMO BALDWIN, WI.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.128	180	0.962
10	0.284	190	0.928
20	0.536	200	0.889
30	0.682	210	0.859
40	0.799	220	0.844
45	0.811	225	0.845
50	0.803	230	0.848
60	0.781	240	0.854
70	0.769	250	0.819
80	0.815	260	0.729
90	0.893	270	0.571
100	0.962	280	0.424
110	0.995	290	0.297
120	1.000	300	0.311
130	0.994	310	0.371
135	0.990	315	0.403
140	0.985	320	0.416
150	0.980	330	0.414
160	0.977	340	0.333
170	0.973	350	0.195

Figure 1D

Tabulation of Vertical Azimuth Pattern
WDMO BALDWIN, WI.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.216	180	0.926
10	0.258	190	0.934
20	0.320	200	0.960
30	0.404	210	0.972
40	0.524	220	0.972
45	0.599	225	0.938
50	0.632	230	0.891
60	0.714	240	0.758
70	0.796	250	0.531
80	0.857	260	0.399
90	0.913	270	0.364
100	0.937	280	0.379
110	0.958	290	0.385
120	0.963	300	0.388
130	0.974	310	0.362
135	0.977	315	0.332
140	0.979	320	0.322
150	0.984	330	0.296
160	0.973	340	0.247
170	0.949	350	0.221

Figure 1E

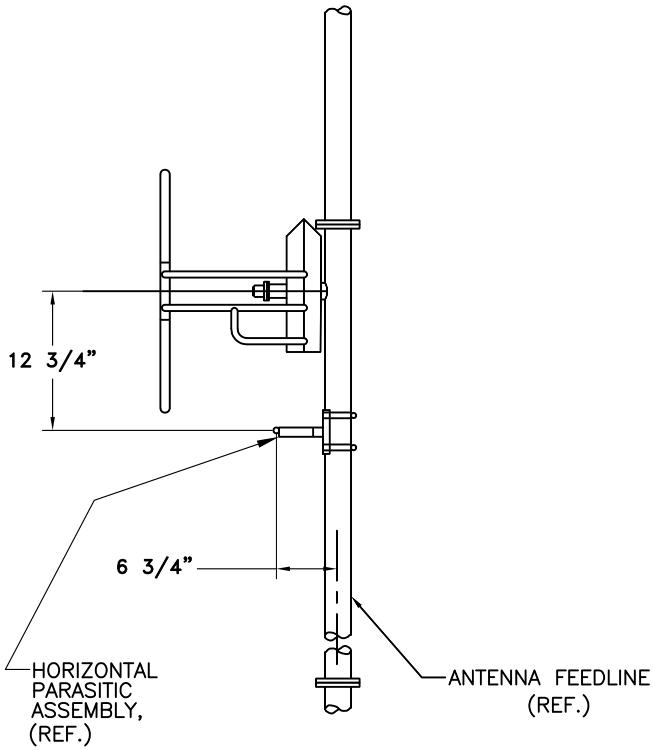
Tabulation of Composite Azimuth Pattern
WDMO BALDWIN, WI.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.216	180	0.962
10	0.284	190	0.934
20	0.536	200	0.960
30	0.682	210	0.972
40	0.799	220	0.972
45	0.811	225	0.938
50	0.803	230	0.891
60	0.781	240	0.854
70	0.796	250	0.819
80	0.857	260	0.729
90	0.913	270	0.571
100	0.962	280	0.424
110	0.995	290	0.385
120	1.000	300	0.388
130	0.994	310	0.371
135	0.990	315	0.403
140	0.985	320	0.416
150	0.984	330	0.414
160	0.977	340	0.333
170	0.973	350	0.221

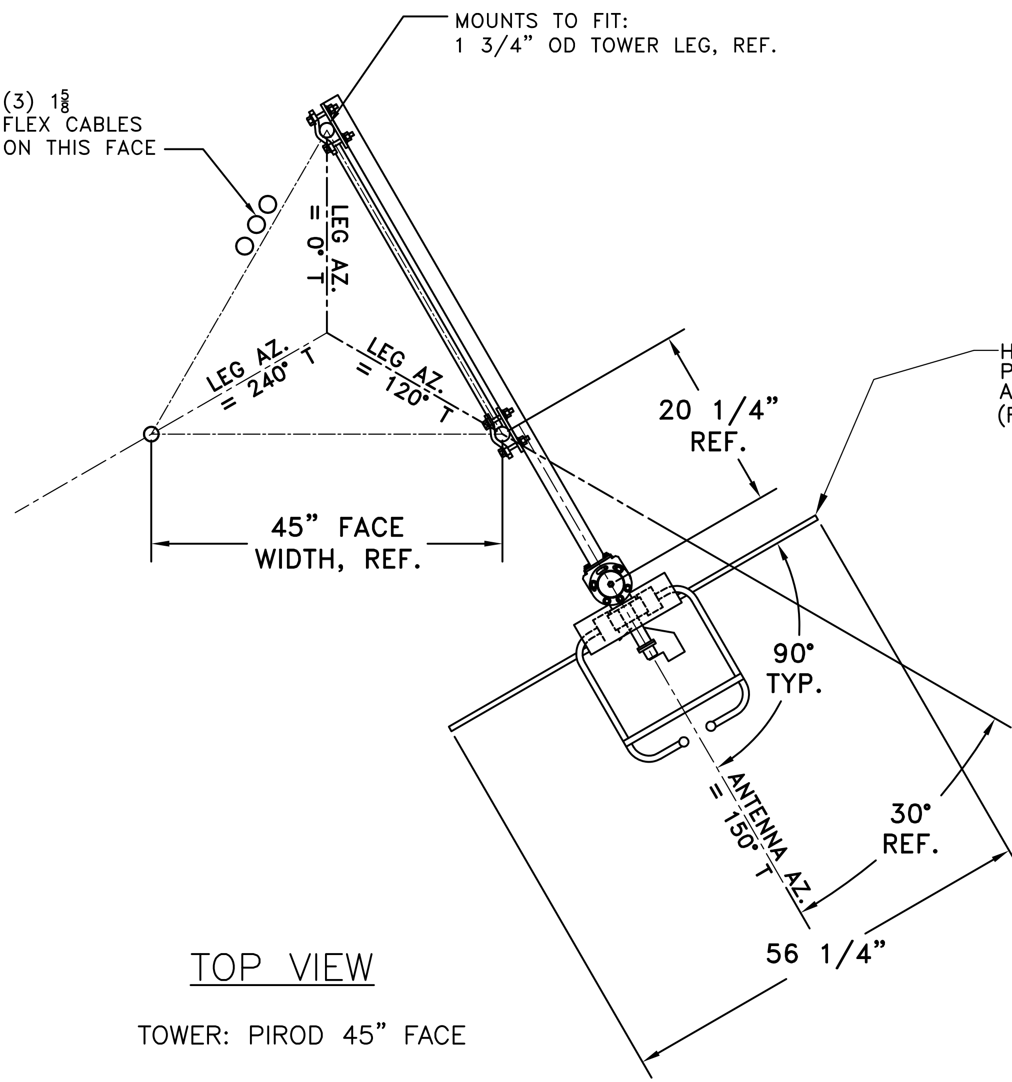
Figure 1F

Tabulation of FCC Directional Composite
WDMO BALDWIN, WI.

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	0.845
90	1.000	270	0.675
100	1.000	280	0.540
110	1.000	290	0.430
120	1.000	300	0.410
130	1.000	310	0.410
140	1.000	320	0.430
150	1.000	330	0.540
160	1.000	340	0.675
170	1.000	350	0.845

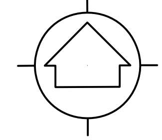


SIDE VIEW



TOP VIEW

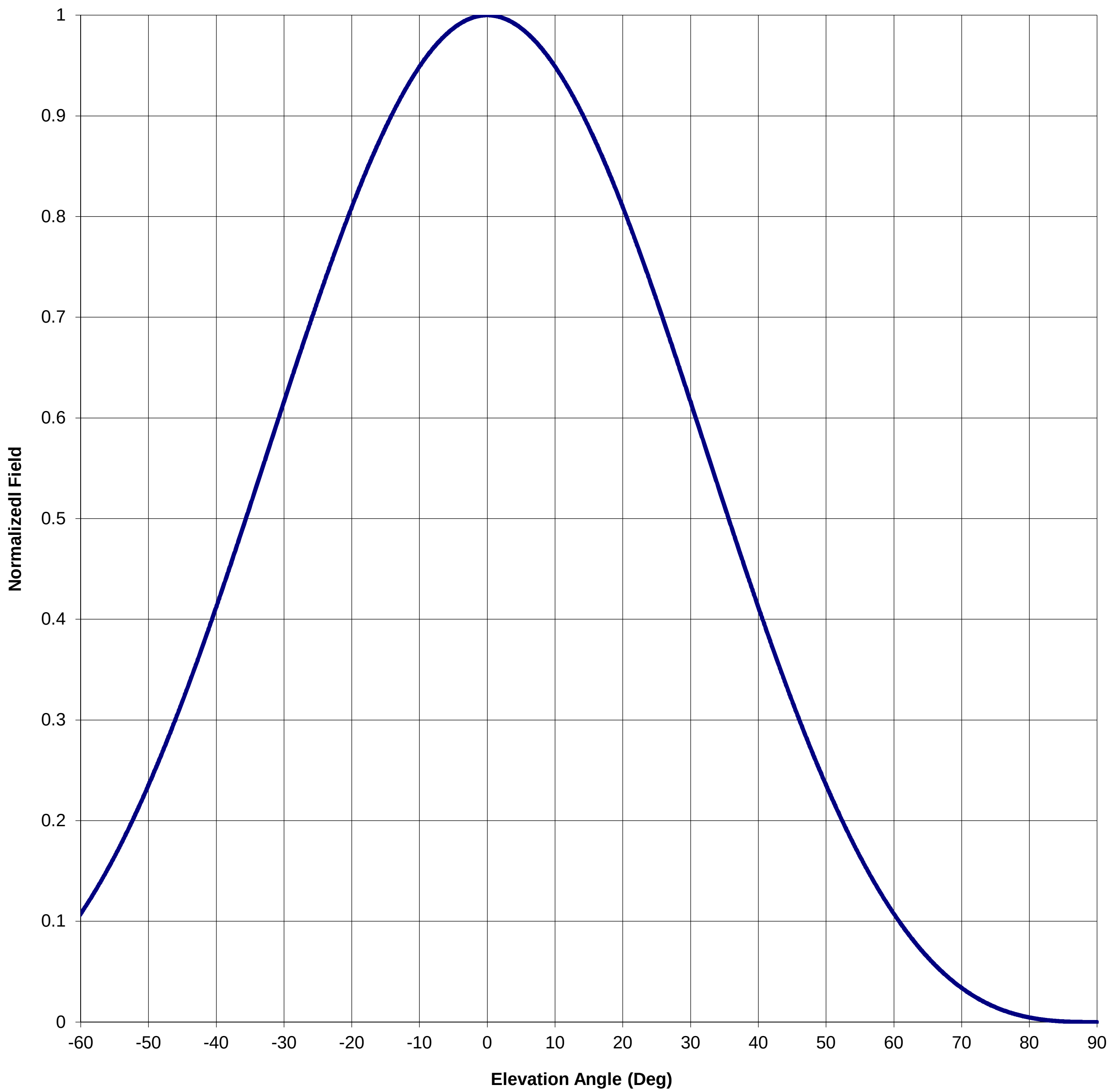
TOWER: PIROD 45" FACE



ANTENNA HEADING 150° TRUE NORTH

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE			
SHOP ORDER: 29558	FREQUENCY: 95.7	SCALE: N.T.S.	DRAWN BY: ASP APPROVED BY: DAB
TITLE: MODEL-6810-2-SS-DIRECTIONAL ANTENNA			
DATE: 11/15/11	FIGURE 2		

Antenna Mfg.:	Shively Labs				Date: 11/22/2011
Antenna Type:	6810-2-SS-DA				
Station:	WDMO	Beam Tilt	0		
Frequency:	95.7	Gain (Max)	1.290	1.106 dB	
Channel #:	239	Gain (Horizon)	1.290	1.106 dB	
Figure:	Figure 3				



Antenna Mfg.:	**Shively Labs**				**Date:**	**11/22/2011**	
Antenna Type:	**6810-2-SS-DA**						
Station:	**WDMO**	**Beam Tilt**	**0**				
Frequency:	**95.7**	**Gain (Max)**	**1.290**		**1.106**	**dB**	
Channel #:	**239**	**Gain (Horizon)**	**1.290**		**1.106**	**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	0.337	0	1.000	46	0.301
-89	0.000	-43	0.355	1	0.999	47	0.284
-88	0.000	-42	0.374	2	0.998	48	0.267
-87	0.000	-41	0.393	3	0.995	49	0.251
-86	0.000	-40	0.412	4	0.992	50	0.235
-85	0.001	-39	0.432	5	0.987	51	0.220
-84	0.001	-38	0.452	6	0.981	52	0.205
-83	0.002	-37	0.472	7	0.975	53	0.191
-82	0.002	-36	0.492	8	0.967	54	0.178
-81	0.003	-35	0.513	9	0.959	55	0.165
-80	0.005	-34	0.533	10	0.949	56	0.152
-79	0.006	-33	0.554	11	0.939	57	0.140
-78	0.008	-32	0.575	12	0.927	58	0.129
-77	0.010	-31	0.595	13	0.915	59	0.118
-76	0.012	-30	0.616	14	0.902	60	0.108
-75	0.015	-29	0.637	15	0.888	61	0.098
-74	0.018	-28	0.657	16	0.874	62	0.089
-73	0.021	-27	0.677	17	0.859	63	0.080
-72	0.025	-26	0.697	18	0.843	64	0.072
-71	0.029	-25	0.717	19	0.826	65	0.064
-70	0.034	-24	0.736	20	0.809	66	0.057
-69	0.039	-23	0.755	21	0.792	67	0.051
-68	0.045	-22	0.774	22	0.774	68	0.045
-67	0.051	-21	0.792	23	0.755	69	0.039
-66	0.057	-20	0.809	24	0.736	70	0.034
-65	0.064	-19	0.826	25	0.717	71	0.029
-64	0.072	-18	0.843	26	0.697	72	0.025
-63	0.080	-17	0.859	27	0.677	73	0.021
-62	0.089	-16	0.874	28	0.657	74	0.018
-61	0.098	-15	0.888	29	0.637	75	0.015
-60	0.108	-14	0.902	30	0.616	76	0.012
-59	0.118	-13	0.915	31	0.595	77	0.010
-58	0.129	-12	0.927	32	0.575	78	0.008
-57	0.140	-11	0.939	33	0.554	79	0.006
-56	0.152	-10	0.949	34	0.533	80	0.005
-55	0.165	-9	0.959	35	0.513	81	0.003
-54	0.178	-8	0.967	36	0.492	82	0.002
-53	0.191	-7	0.975	37	0.472	83	0.002
-52	0.205	-6	0.981	38	0.452	84	0.001
-51	0.220	-5	0.987	39	0.432	85	0.001
-50	0.235	-4	0.992	40	0.412	86	0.000
-49	0.251	-3	0.995	41	0.393	87	0.000
-48	0.267	-2	0.998	42	0.374	88	0.000
-47	0.284	-1	0.999	43	0.355	89	0.000
-46	0.301	0	1.000	44	0.337	90	0.000
-45	0.319			45	0.319		

S.O. 29558 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WDMO BALDWIN, WI.

MODEL 6810-2-SS-DA

Elevation Gain of Antenna 0.7

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

H RMS 0.755338 V RMS 0.718315 H/V Ratio 1.052

Elevation Gain of Horizontal Component	0.736
Elevation Gain of Vertical Component	0.666
Horizontal Azimuth Gain equals $1/(RMS)^2$.	1.753
Vertical Azimuth Gain equals $1/(RMS/Max Vert)^2$.	1.877

Max. Vertical 0.984

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

Total Horizontal Power Gain = **1.290**

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

Total Vertical Power Gain = **1.249**

==

ERP divided by Horizontal Power Gain equals Antenna Input Power

4.0 kW ERP Divided by H Gain 1.290 equals 3.100 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

3.100 kW Times V Gain 1.249 equals 3.873 kW V ERP

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

(0.984)^2 Times 4.00 Equals 3.873 kW Vertical ERP

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