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S.O. 31797

Report of Test 6810-2R-SS(0.5)-DA

for

Vermont Broadcast Associates, Inc.

WJJZ 94.5 MHz Irasburg, VT

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-2R-SS(0.5)-DA to meet the needs of WJJZ and to comply with the requirements of the FCC construction permit, file number BNPH-20110630AEC. 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 BNPH-20110630AEC indicates that the Horizontal radiation component shall not exceed 6.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

340 degrees to 350 degrees True: 3.0 kilowatts

From Figure 1A, the maximum radiation of the Horizontal component occurs at 114 Degrees True to 118 Degrees True. At the restricted azimuth of 340 degrees to 350 degrees True the Vertical component is 3.517 dB down from the maximum of 6.0 kW, or 2.669 kW.

The R.M.S. of the Horizontal component is 0.816. The total Horizontal power gain is 1.103. The R.M.S. of the Vertical component is 0.778. The total Vertical power gain is 0.985. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.908. The R.M.S. of the measured composite pattern is 0.835. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.772 Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-2R-SS(0.5)-DA was mounted on a pole of precise scale to the 4" Pipe at the WJJZ 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 BNPH-20110630AEC, a single level of the 6810-2R-SS(0.5)-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 425.25 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 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 31797
June 5, 2014

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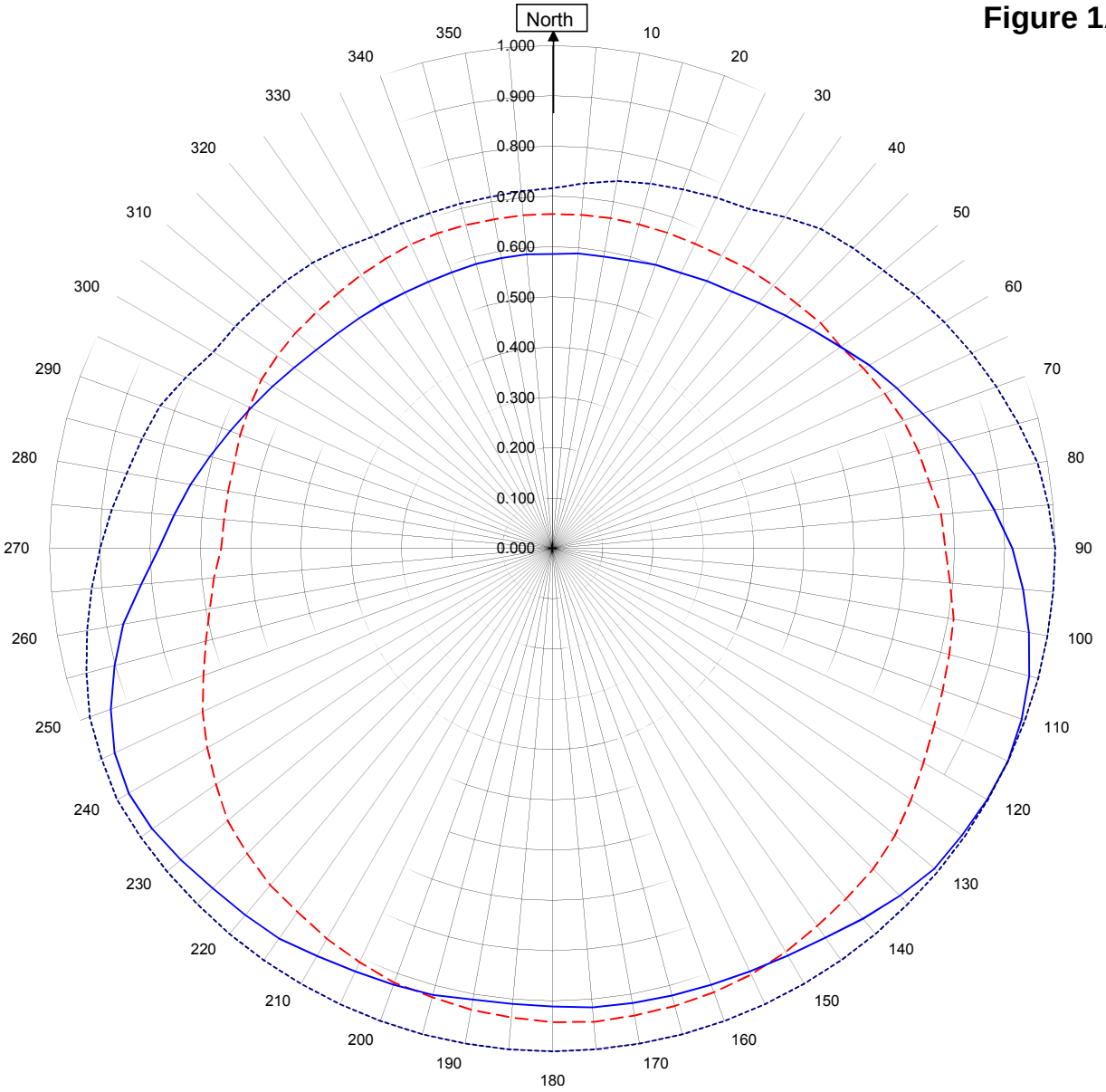
Figure 1A



WJJZ IRASBURG, VT.

31797

June 5, 2014

Horizontal RMS	0.816
Vertical RMS	0.778
H/V Composite RMS	0.835
FCC Composite RMS	0.908

Frequency	94.5 / 425.25 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-2R-SS(0.5)-DA
Pattern Type	Directional Azimuth

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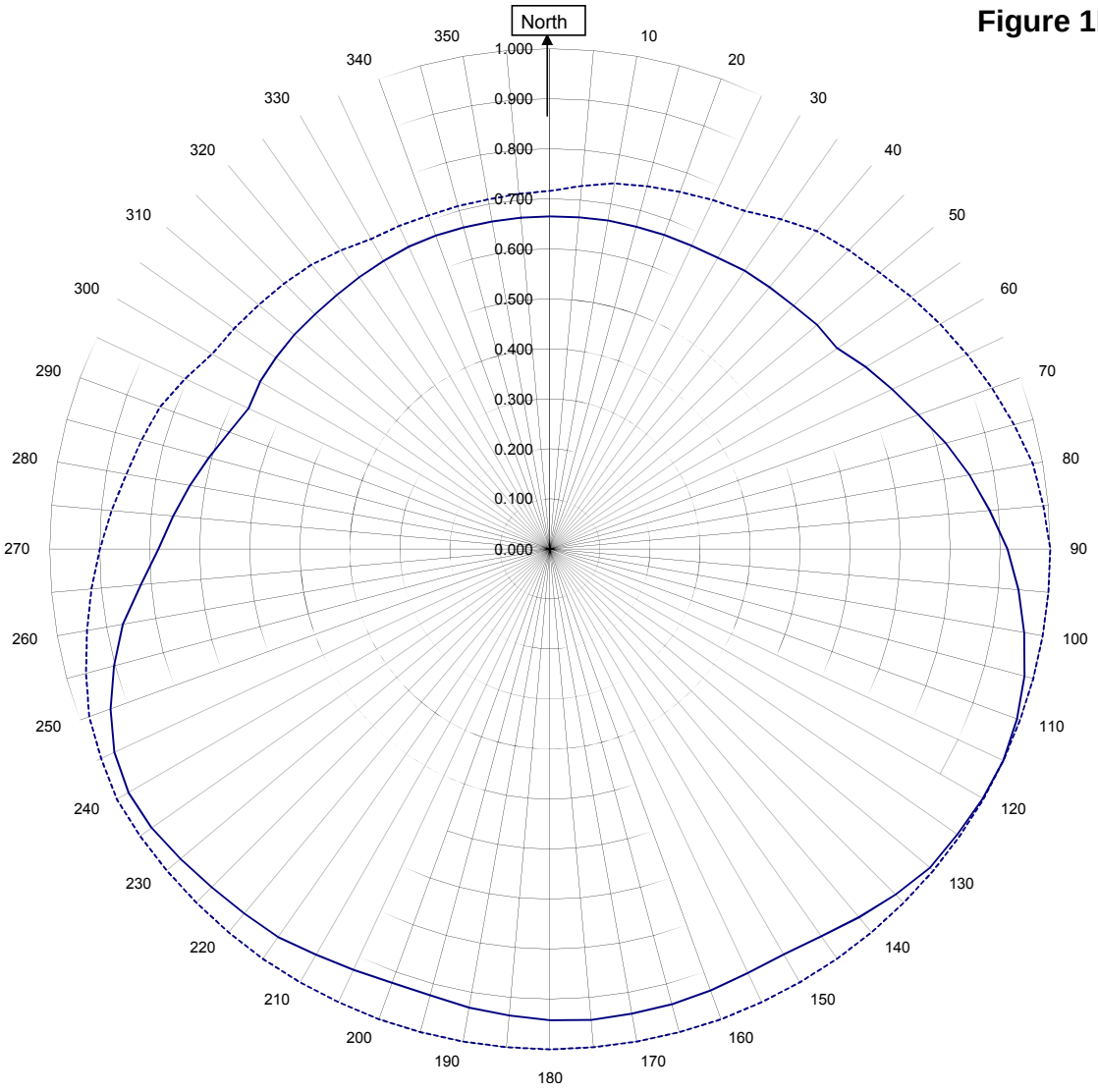
Figure 1B



WJJZ IRASBURG, VT.

31797

June 5, 2014

_____H/VComposite RMS	0.835
……FCC Composite RMS	0.908

Frequency	94.5 / 425.25 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-2R-SS(0.5)-DA
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WJJZ IRASBURG, VT.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.585	180	0.911
10	0.589	190	0.911
20	0.600	200	0.923
30	0.614	210	0.936
40	0.638	220	0.951
45	0.655	225	0.956
50	0.676	230	0.964
60	0.728	240	0.973
70	0.784	250	0.935
80	0.851	260	0.867
90	0.915	270	0.783
100	0.962	280	0.731
110	0.993	290	0.683
120	0.999	300	0.644
130	0.991	310	0.614
135	0.977	315	0.605
140	0.961	320	0.598
150	0.935	330	0.588
160	0.923	340	0.584
170	0.918	350	0.586
115	1.000		

Figure 1D

Tabulation of Vertical Azimuth Pattern
WJJZ IRASBURG, VT.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.665	180	0.942
10	0.667	190	0.931
20	0.668	200	0.919
30	0.672	210	0.897
40	0.683	220	0.874
45	0.688	225	0.859
50	0.697	230	0.843
60	0.715	240	0.793
70	0.743	250	0.739
80	0.761	260	0.692
90	0.781	270	0.659
100	0.810	280	0.655
110	0.826	290	0.661
120	0.852	300	0.669
130	0.889	310	0.667
135	0.902	315	0.664
140	0.909	320	0.663
150	0.927	330	0.665
160	0.939	340	0.667
170	0.943	350	0.665

Figure 1E

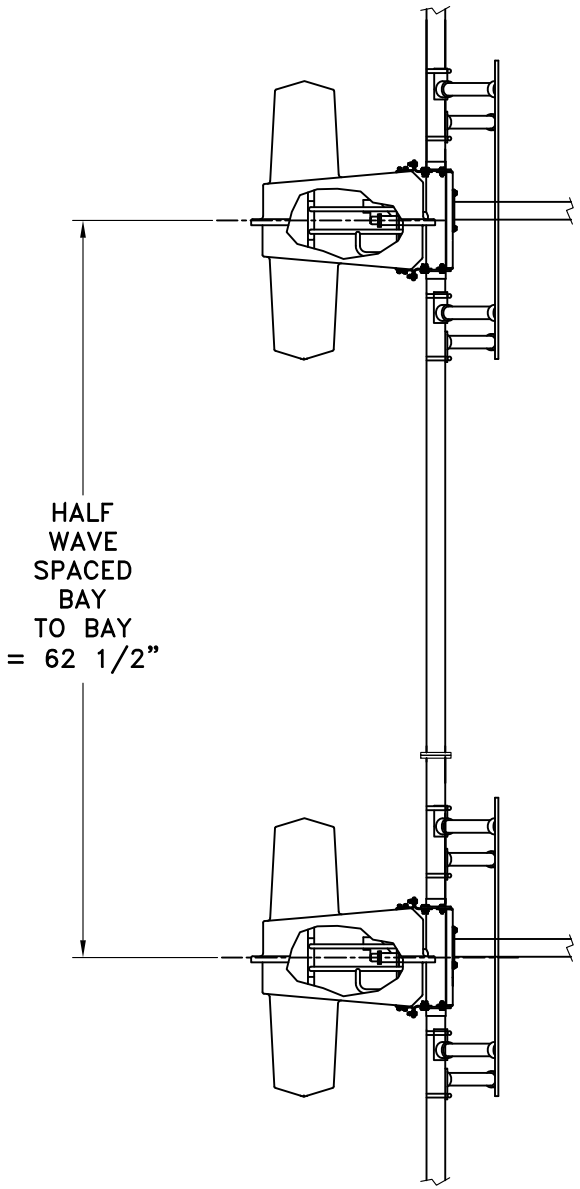
Tabulation of Composite Azimuth Pattern
WJJZ IRASBURG, VT.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.665	180	0.942
10	0.667	190	0.931
20	0.668	200	0.923
30	0.672	210	0.936
40	0.683	220	0.951
45	0.688	225	0.956
50	0.697	230	0.964
60	0.728	240	0.973
70	0.784	250	0.935
80	0.851	260	0.867
90	0.915	270	0.783
100	0.962	280	0.731
110	0.993	290	0.683
120	0.999	300	0.669
130	0.991	310	0.667
135	0.977	315	0.664
140	0.961	320	0.663
150	0.935	330	0.665
160	0.939	340	0.667
170	0.943	350	0.665

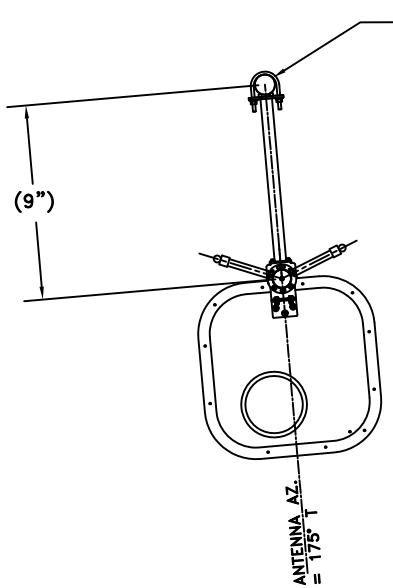
Figure 1F

Tabulation of FCC Directional Composite
WJJZ IRASBURG, VT.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.716	180	1.000
10	0.742	190	1.000
20	0.760	200	1.000
30	0.780	210	1.000
40	0.830	220	1.000
50	0.860	230	1.000
60	0.900	240	1.000
70	0.940	250	0.980
80	0.980	260	0.940
90	1.000	270	0.900
100	1.000	280	0.860
110	1.000	290	0.830
120	1.000	300	0.780
130	1.000	310	0.760
140	1.000	320	0.742
150	1.000	330	0.716
160	1.000	340	0.710
170	1.000	350	0.710

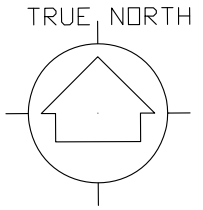


SIDE VIEW



TOP VIEW

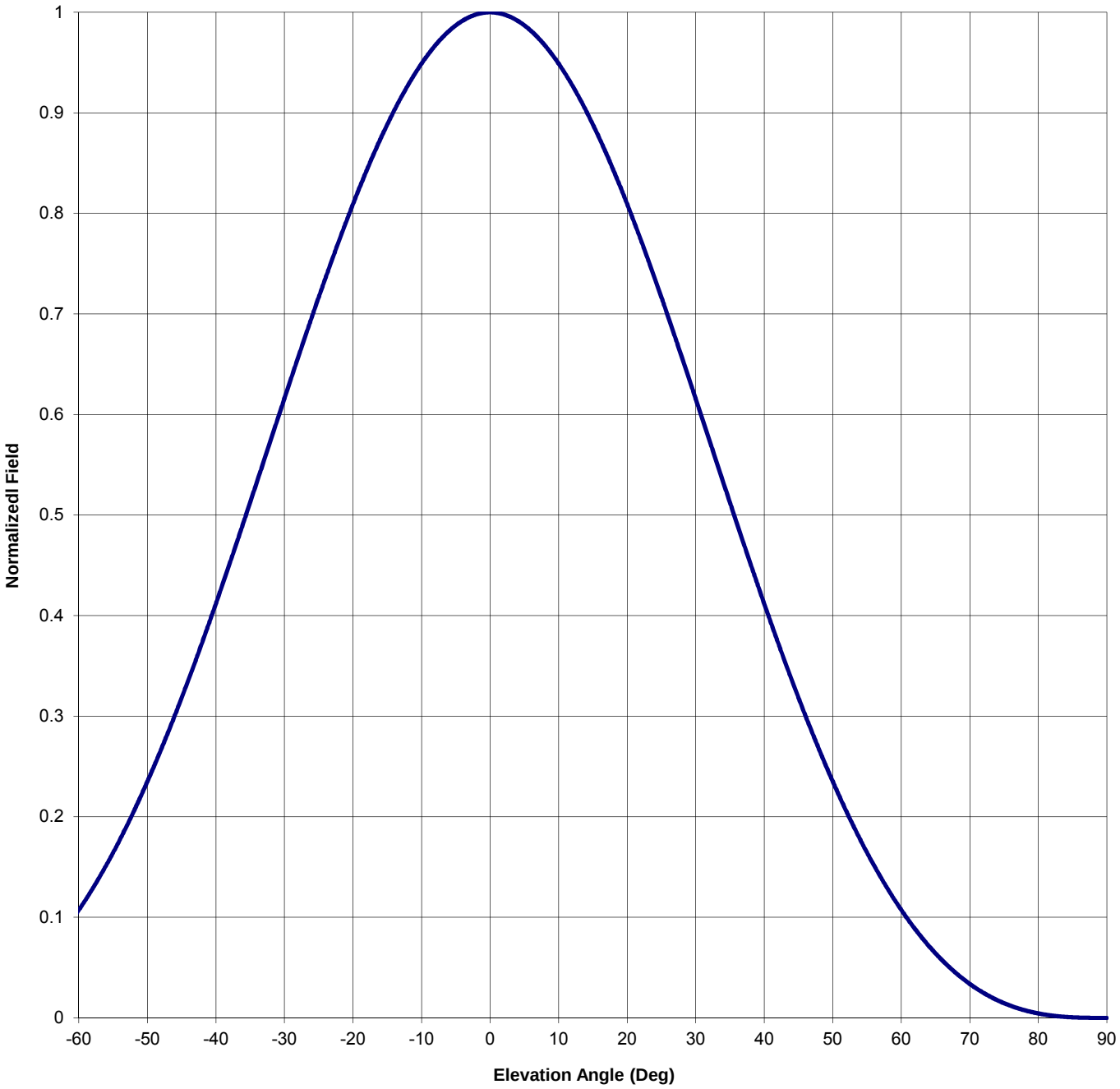
TOWER MAKE: 4 1/2" OD
POLE



ANTENNA HEADING 175° TRUE NORTH

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 31797	FREQUENCY: 94.5	SCALE: N.T.S.	DRAWN BY: ASP APPROVED BY: DAB
TITLE: MODEL-6810-2R-SS-DIRECTIONAL ANTENNA			
DATE: 6-9-14	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date: 6/5/2014**
Antenna Type:	**6810-2R-SS-DA**			
Station:	**WJJZ**	**Beam Tilt**	**0**	
Frequency:	**94.5**	**Gain (Max)**	**1.103**	**0.426 dB**
Channel #:	**233**	**Gain (Horizon)**	**1.103**	**0.426 dB**
Figure:	**Figure 3**			



Antenna Mfg.: Shively Labs **Date:** 6/5/2014

Antenna Type: 6810-2R-SS-DA

Station: WJJZ **Beam Tilt** 0

Frequency: 94.5 **Gain (Max)** 1.103 0.426 dB

Channel #: 233 **Gain (Horizon)** 1.103 0.426 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	0.336	0	1.000	46	0.301
-89	0.000	-43	0.355	1	0.999	47	0.284
-88	0.000	-42	0.373	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	0.177
-81	0.003	-35	0.513	9	0.958	55	0.164
-80	0.004	-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	0.128
-77	0.010	-31	0.595	13	0.915	59	0.118
-76	0.012	-30	0.616	14	0.902	60	0.107
-75	0.015	-29	0.636	15	0.888	61	0.098
-74	0.018	-28	0.657	16	0.874	62	0.088
-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	0.044	-22	0.774	22	0.774	68	0.044
-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	0.088	-16	0.874	28	0.657	74	0.018
-61	0.098	-15	0.888	29	0.636	75	0.015
-60	0.107	-14	0.902	30	0.616	76	0.012
-59	0.118	-13	0.915	31	0.595	77	0.010
-58	0.128	-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	0.004
-55	0.164	-9	0.958	35	0.513	81	0.003
-54	0.177	-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	0.373	88	0.000
-47	0.284	-1	0.999	43	0.355	89	0.000
-46	0.301	0	1.000	44	0.336	90	0.000
-45	0.318			45	0.318		

S.O. 31797 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WJJZ IRASBURG, VT.

MODEL 6810-2R-SS(0.5)-DA

Elevation Gain of Antenna 0.7

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

H RMS 0.815923 V RMS 0.777982 H/V Ratio 1.049

Elevation Gain of Horizontal Component 0.734

Elevation Gain of Vertical Component 0.667

Horizontal Azimuth Gain equals $1/(RMS)^2$. 1.502

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 1.475

Max. Vertical 0.945

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

Total Horizontal Power Gain = **1.103**

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

Total Vertical Power Gain = **0.985**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

6 kW ERP Divided by H Gain 1.103 equals 5.441 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

5.441 kW Times V Gain 0.985 equals 5.358 kW V ERP

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

(0.945)^2 Times 6.00 Equals 5.358 kW Vertical ERP

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