Shively Labs®
a division of Howell Laboratories, Inc.

P. O. Box 389, 188 Harrison Rd.
Bridgton, Maine 04009 USA
(207) 647-3327
888-SHIVELY
Fax: (207) 647-8273
E-mail: sales@shively.com
Web site: www.shively.com

S.O. 33206

Report of Test 6810-2R-SS-DA

for

New Hampshire Public Radio, Incorporated

WEVQ 91.9 MHz Littleton, NH.

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-2R-SS-DA to meet the needs of WEVQ and to comply with the requirements of the FCC Broadcast License, file number BMLED-20120531AAX. 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.

License file number BMLED-20120531AAX indicates that the Horizontally Polarized radiation component shall not exceed 0.58 kW at any azimuth and is restricted to the following values at the azimuths specified:

320 Degrees True: 0.115 kilowatts

From Figure 1A, the maximum radiation of the Horizontal component occurs at 97 Degrees True to 138 Degrees True. At the restricted azimuth of 320 Degrees True the Horizontal component is 9.12 dB down from the maximum of 0.58 kW, or 0.071 kW.

The R.M.S. of the Horizontal component is 0.752. The total Horizontal power gain is 1.292. The R.M.S. of the Vertical component is 0.731. The total Vertical power gain is 1.243. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.920. The R.M.S. of the measured composite pattern is 0.784. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.782. 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-DA was mounted on a tower of precise scale to the Valmont 5-ft face tower at the WEVQ site. The spacing of the antenna to the tower was varied and the addition of vertical parasitics were uesed 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 broadcast license, file number BMLED-20120531AAX, a single level of the 6810-2R-SS-DA was set up on the Shively Labs scale model antenna pattern measuring range. A scale of 4.5:1 was used.

EQUIPMENT:

The 4.5:1 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 4395-A Network Analyzer

PC Based Controller

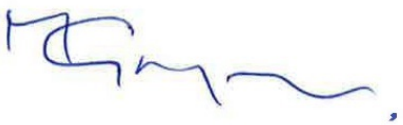
Output Standard Printer or 'pdf'

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 413.55 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:



Martyn Gregory

Vice President, Shively Labs
S/O 33206
Date January 11, 2016

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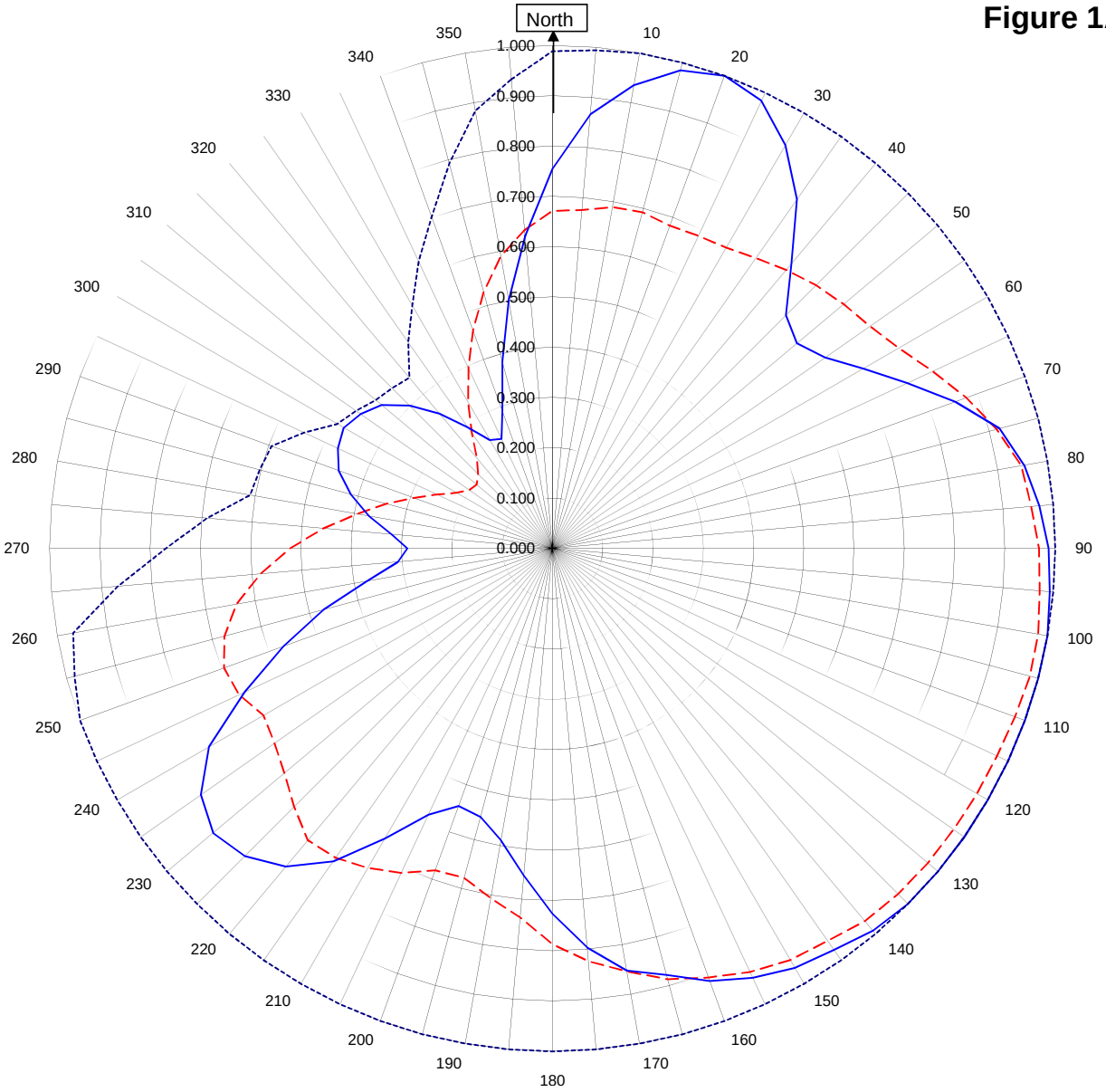
Figure 1A



WEVQ LITTLETON, NH.

33206

January 16, 2016

Horizontal RMS	0.752
Vertical RMS	0.731
H/V Composite RMS	0.784
FCC Composite RMS	0.920

Frequency	91.9 / 413.55 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

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

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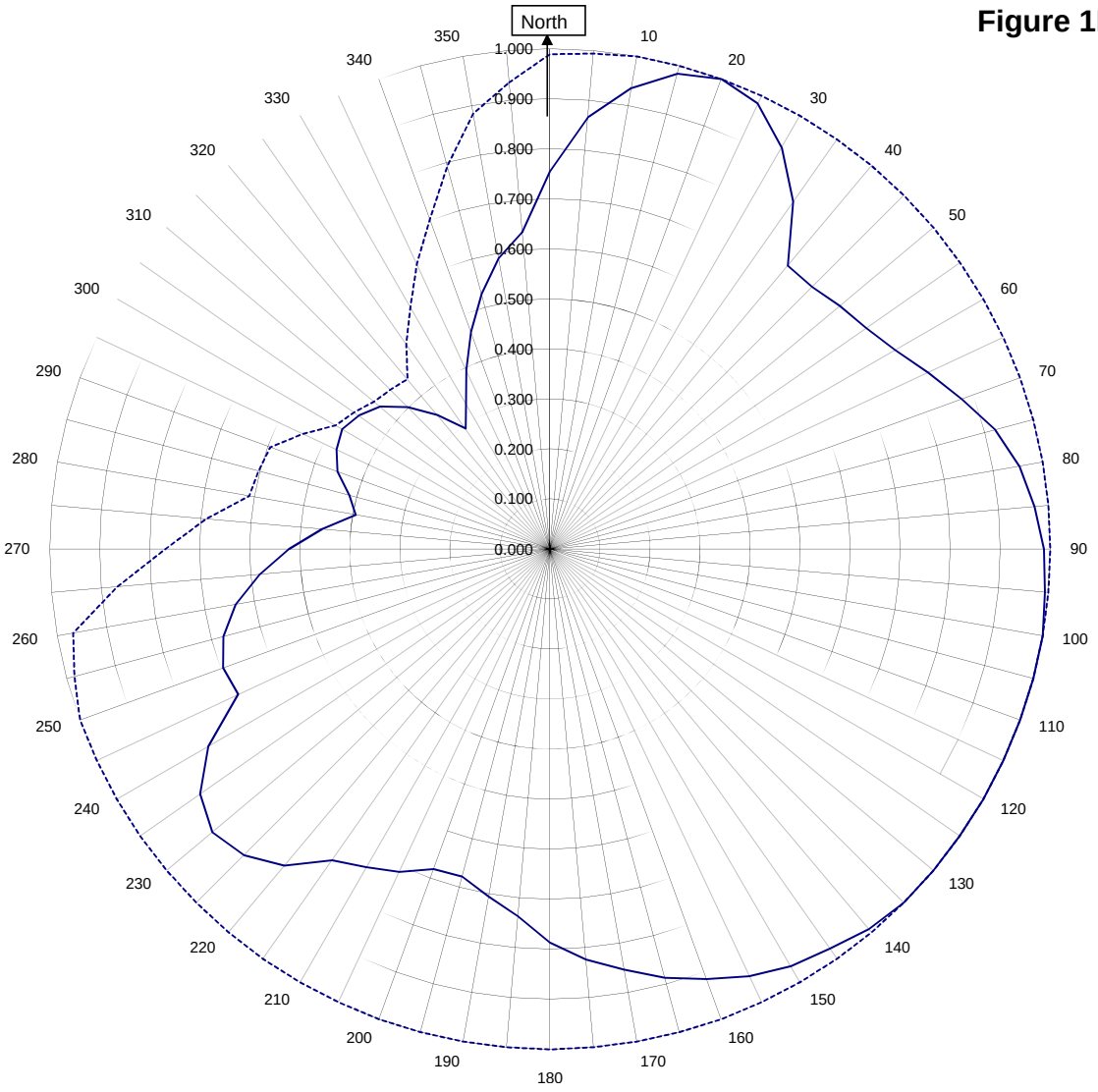
Figure 1B



WEVQ LITTLETON, NH.

33206

January 16, 2016

_____H/VComposite RMS	0.784
……FCC Composite RMS	0.920

Frequency	91.9 / 413.55 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

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

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WEVQ LITTLETON, NH.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.755	180	0.726
10	0.936	190	0.589
20	1.000	200	0.545
30	0.926	210	0.666
40	0.739	220	0.826
45	0.656	225	0.865
50	0.635	230	0.881
60	0.715	240	0.789
70	0.853	250	0.570
80	0.953	260	0.374
90	0.987	270	0.289
100	1.000	280	0.370
110	1.000	290	0.453
120	1.000	300	0.480
130	1.000	310	0.443
135	1.000	315	0.402
140	0.992	320	0.350
150	0.963	330	0.249
160	0.915	340	0.291
170	0.852	350	0.501

Figure 1D

Tabulation of Vertical Azimuth Pattern
WEVQ LITTLETON, NH.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.671	180	0.787
10	0.689	190	0.706
20	0.683	200	0.681
30	0.691	210	0.734
40	0.723	220	0.757
45	0.741	225	0.727
50	0.756	230	0.696
60	0.796	240	0.664
70	0.876	250	0.695
80	0.947	260	0.638
90	0.968	270	0.522
100	0.981	280	0.394
110	0.979	290	0.294
120	0.975	300	0.221
130	0.974	310	0.197
135	0.972	315	0.209
140	0.967	320	0.234
150	0.945	330	0.336
160	0.908	340	0.462
170	0.854	350	0.591

Figure 1E

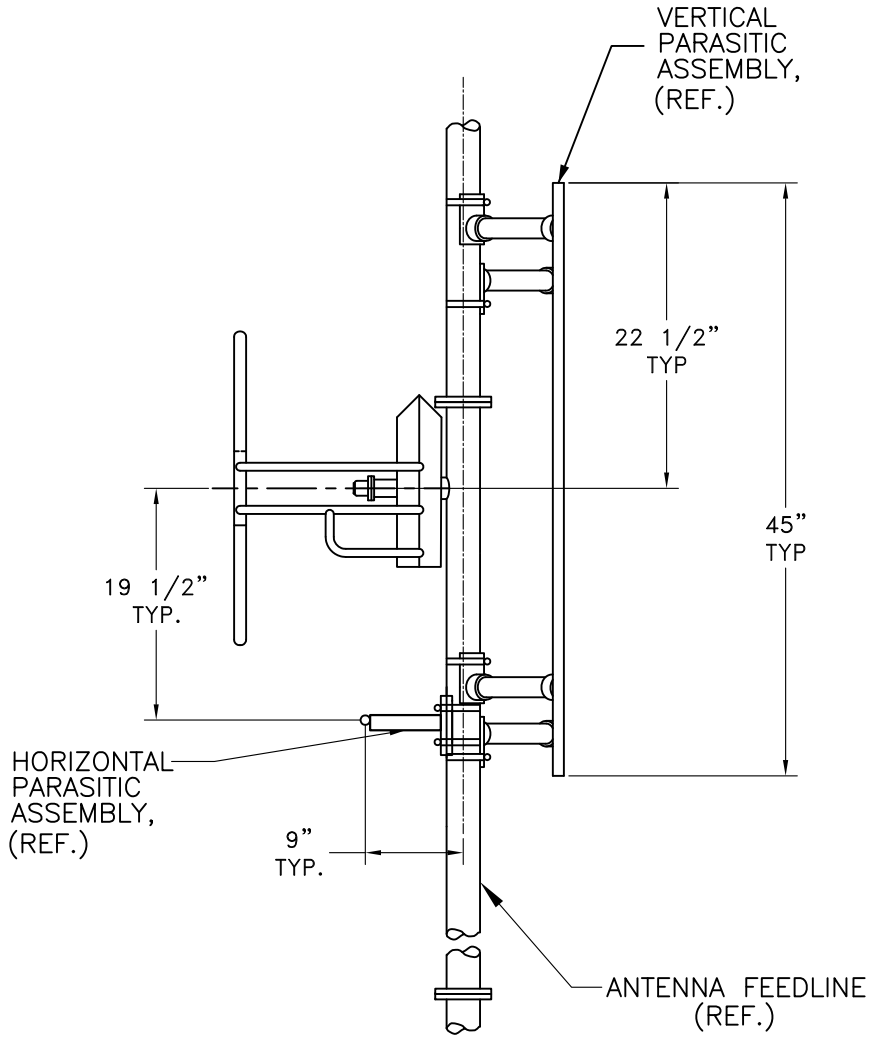
Tabulation of Composite Azimuth Pattern
WEVQ LITTLETON, NH.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.755	180	0.787
10	0.936	190	0.706
20	1.000	200	0.681
30	0.926	210	0.734
40	0.739	220	0.826
45	0.741	225	0.865
50	0.756	230	0.881
60	0.796	240	0.789
70	0.876	250	0.695
80	0.953	260	0.638
90	0.987	270	0.522
100	1.000	280	0.394
110	1.000	290	0.453
120	1.000	300	0.480
130	1.000	310	0.443
135	1.000	315	0.402
140	0.992	320	0.350
150	0.963	330	0.336
160	0.915	340	0.462
170	0.854	350	0.591

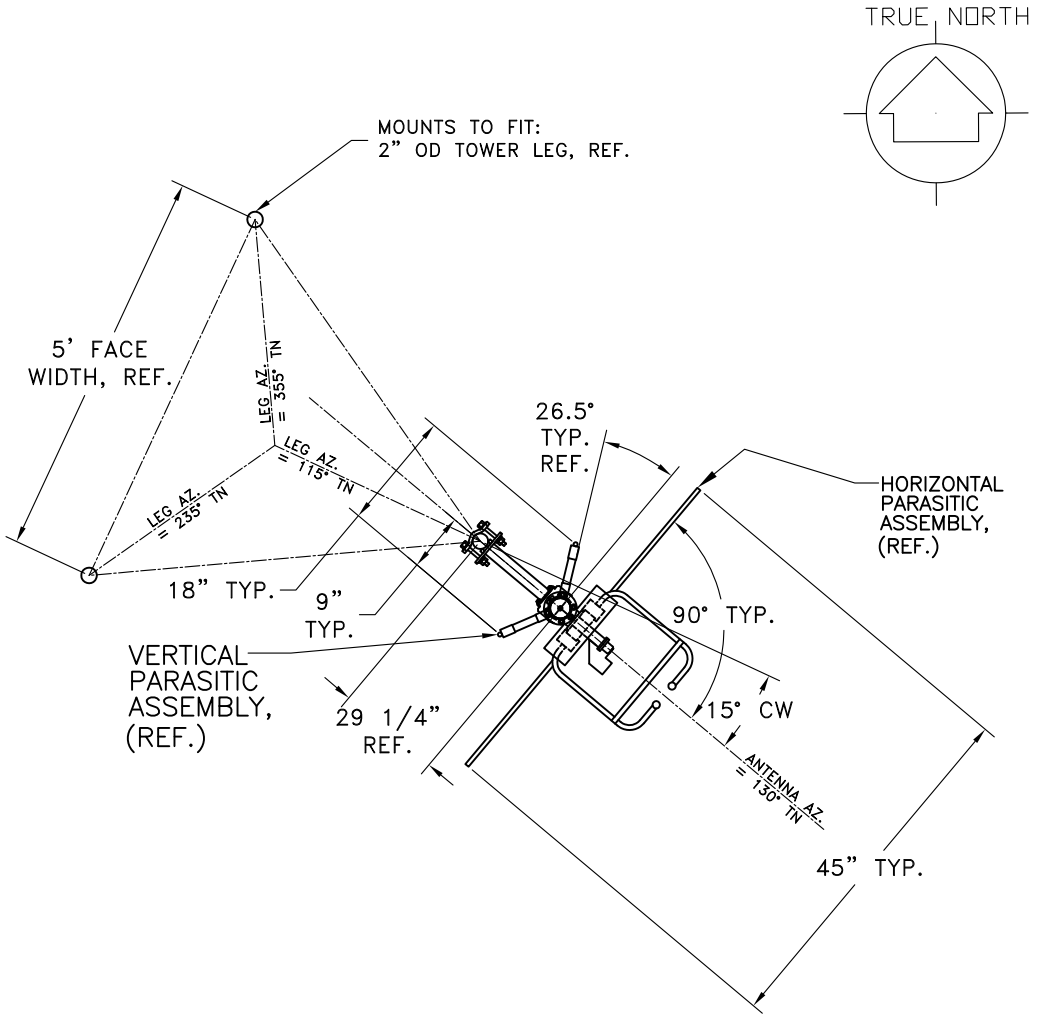
Figure 1F

Tabulation of FCC Directional Composite
WEVQ LITTLETON, NH.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.989	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	0.968
90	1.000	270	0.769
100	1.000	280	0.611
110	1.000	290	0.595
120	1.000	300	0.495
130	1.000	310	0.459
140	1.000	320	0.443
150	1.000	330	0.558
160	1.000	340	0.702
170	1.000	350	0.884



SIDE VIEW



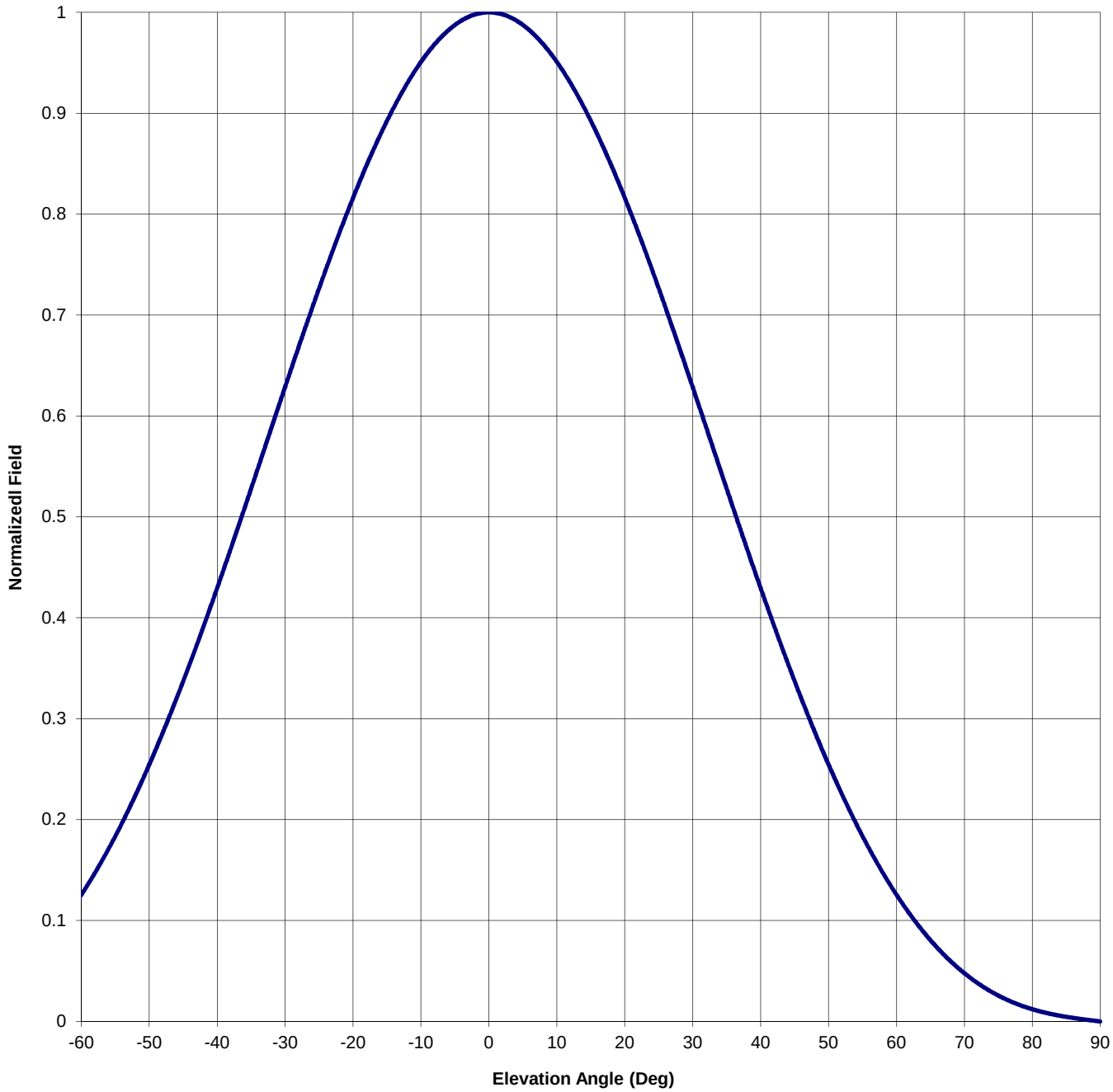
TOP VIEW

TOWER: 60" FACE

ANTENNA HEADING 130° TRUE NORTH

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 33206	FREQUENCY: 91.9	SCALE: N.T.S.	DRAWN BY: ASP APPROVED BY: DAB
TITLE: MODEL-6810-2R-SS-DIRECTIONAL ANTENNA			
DATE: 1/13/16	FIGURE 2		

Antenna Mfg.:	**Shively Labs**				**Date: 1/13/2016**
Antenna Type:	**6810-2R-SS-DA**				
Station:	**WEVQ**	**Beam Tilt**	**0**		
Frequency:	**91.9**	**Gain (Max)**	**1.292**	**1.113 dB**	
Channel #:	**220**	**Gain (Horizon)**	**1.292**	**1.113 dB**	
Figure:	**Figure 3**				



Antenna Mfg.: Shively Labs **Date:** 1/13/2016

Antenna Type: 6810-2R-SS-DA

Station: WEVQ **Beam Tilt** 0

Frequency: 91.9 **Gain (Max)** 1.292 1.113 dB

Channel #: 220 **Gain (Horizon)** 1.292 1.113 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	0.355	0	1.000	46	0.320
-89	0.001	-43	0.373	1	0.999	47	0.303
-88	0.002	-42	0.392	2	0.998	48	0.286
-87	0.003	-41	0.410	3	0.995	49	0.270
-86	0.004	-40	0.430	4	0.992	50	0.255
-85	0.005	-39	0.449	5	0.988	51	0.239
-84	0.006	-38	0.468	6	0.982	52	0.225
-83	0.007	-37	0.488	7	0.976	53	0.210
-82	0.009	-36	0.508	8	0.968	54	0.197
-81	0.010	-35	0.528	9	0.960	55	0.184
-80	0.012	-34	0.548	10	0.951	56	0.171
-79	0.014	-33	0.568	11	0.941	57	0.159
-78	0.017	-32	0.588	12	0.930	58	0.147
-77	0.019	-31	0.609	13	0.918	59	0.136
-76	0.022	-30	0.629	14	0.906	60	0.126
-75	0.026	-29	0.649	15	0.893	61	0.116
-74	0.029	-28	0.668	16	0.879	62	0.106
-73	0.033	-27	0.688	17	0.864	63	0.097
-72	0.038	-26	0.707	18	0.849	64	0.089
-71	0.043	-25	0.726	19	0.833	65	0.081
-70	0.048	-24	0.745	20	0.816	66	0.073
-69	0.053	-23	0.764	21	0.799	67	0.066
-68	0.059	-22	0.782	22	0.782	68	0.059
-67	0.066	-21	0.799	23	0.764	69	0.053
-66	0.073	-20	0.816	24	0.745	70	0.048
-65	0.081	-19	0.833	25	0.726	71	0.043
-64	0.089	-18	0.849	26	0.707	72	0.038
-63	0.097	-17	0.864	27	0.688	73	0.033
-62	0.106	-16	0.879	28	0.668	74	0.029
-61	0.116	-15	0.893	29	0.649	75	0.026
-60	0.126	-14	0.906	30	0.629	76	0.022
-59	0.136	-13	0.918	31	0.609	77	0.019
-58	0.147	-12	0.930	32	0.588	78	0.017
-57	0.159	-11	0.941	33	0.568	79	0.014
-56	0.171	-10	0.951	34	0.548	80	0.012
-55	0.184	-9	0.960	35	0.528	81	0.010
-54	0.197	-8	0.968	36	0.508	82	0.009
-53	0.210	-7	0.976	37	0.488	83	0.007
-52	0.225	-6	0.982	38	0.468	84	0.006
-51	0.239	-5	0.988	39	0.449	85	0.005
-50	0.255	-4	0.992	40	0.430	86	0.004
-49	0.270	-3	0.995	41	0.410	87	0.003
-48	0.286	-2	0.998	42	0.392	88	0.002
-47	0.303	-1	0.999	43	0.373	89	0.001
-46	0.320	0	1.000	44	0.355	90	0.000
-45	0.337			45	0.337		

S.O. 33206 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WEVQ LITTLETON, NH.

MODEL 6810-2R-SS-DA

Elevation Gain of Antenna 0.71

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

H RMS 0.752232 V RMS 0.730797 H/V Ratio 1.029

Elevation Gain of Horizontal Component 0.731

Elevation Gain of Vertical Component 0.690

Horizontal Azimuth Gain equals $1/(RMS)^2$. 1.767

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 1.802

Max. Vertical 0.981

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

Total Horizontal Power Gain = **1.292**

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

Total Vertical Power Gain = **1.243**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

0.58 kW ERP Divided by H Gain 1.292 equals 0.449 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

0.449 kW Times V Gain 1.243 equals 0.558 kW V ERP

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

(0.981)^2 Times 0.58 Equals 0.558 kW Vertical ERP

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