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S.O. 32009

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

for

AMFM RADIO LICENSES, LLC

WCIB 101.9 MHz FALMOUTH, MA.

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 WCIB and to comply with the requirements of the FCC construction permit, file number BPH-20150213ACF. 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-20150213ACF indicates that the Horizontal radiation component shall not exceed 12.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

330 – 340 Degrees True (clock wise): 2.685 kilowatts

From Figure 1A, the maximum radiation of the Horizontal component occurs at 103 Degrees True to 117 Degrees True. At the restricted azimuth of 330 to 340 Degrees True (clock wise) the Horizontal component is 11.09 dB down from the maximum of 12 kW, or 0.934 kW.

The R.M.S. of the Horizontal component is 0.763. The total Horizontal power gain is 1.341. The R.M.S. of the Vertical component is 0.684. The total Vertical power gain is 1.267. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.928. The R.M.S. of the measured composite pattern is 0.790. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.789. 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 tower of precise scale to the Pi-Rod 24" tower at the WCIB 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-20150213ACF, 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.

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

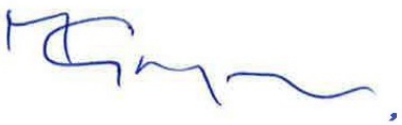
Output Standard Printer or 'pdf'

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 458.55 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:



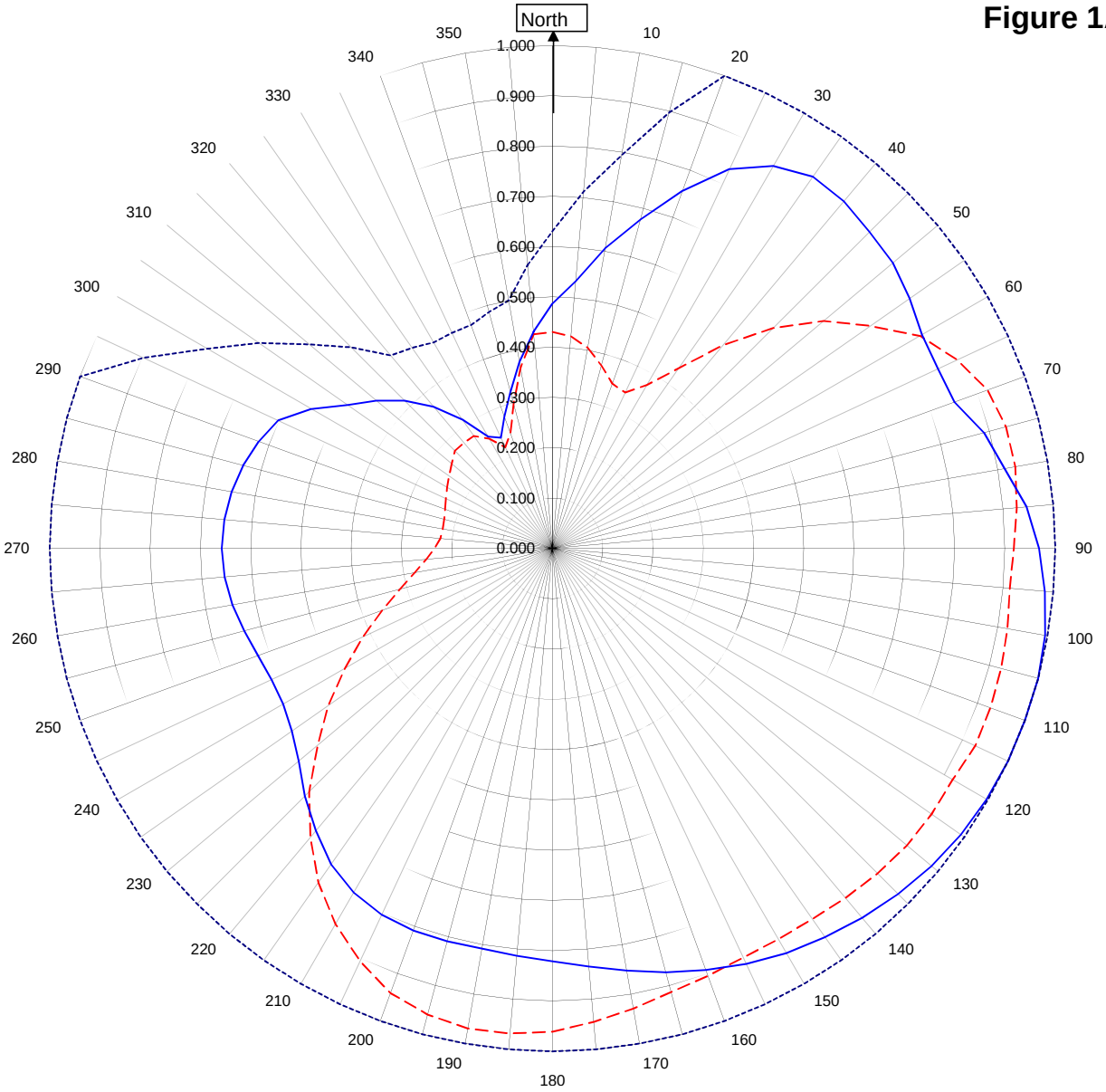
Martyn Gregory

Vice President, Shively Labs
S/O 32009
Date July 31, 2015

Shively Labs

Shively Labs, a division of Howell Laboratories, Inc. Bridgton, ME (207)647-3327

Figure 1A



WCIB FALMOUTH, MA.

32009

July 31, 2015

Horizontal RMS	0.763
Vertical RMS	0.684
H/V Composite RMS	0.79
FCC Composite RMS	0.928

Frequency	101.9 / 458.55 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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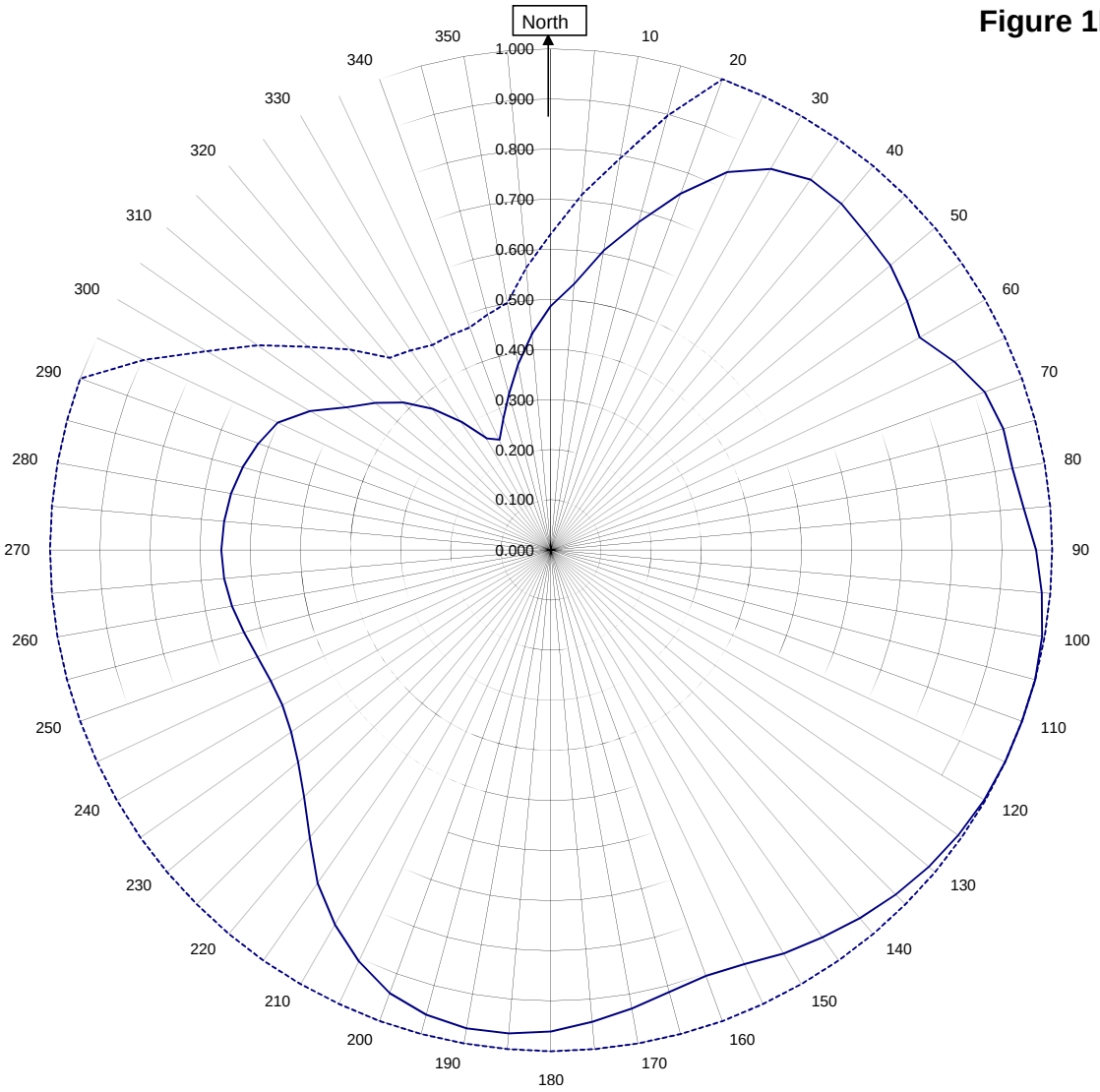
Figure 1B



WCIB FALMOUTH, MA.

32009

July 31, 2015

_____H/VComposite RMS	0.786
……FCC Composite RMS	0.928

Frequency	101.9 / 458.55 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
WCIB FALMOUTH, MA.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.487	180	0.821
10	0.607	190	0.808
20	0.757	200	0.808
30	0.878	210	0.790
40	0.901	220	0.733
45	0.891	225	0.697
50	0.884	230	0.659
60	0.849	240	0.619
70	0.851	250	0.623
80	0.913	260	0.646
90	0.968	270	0.658
100	0.995	280	0.648
110	1.000	290	0.621
120	0.998	300	0.555
130	0.983	310	0.457
135	0.972	315	0.416
140	0.959	320	0.368
150	0.930	330	0.257
160	0.892	340	0.279
170	0.852	350	0.377

Figure 1D

Tabulation of Vertical Azimuth Pattern
WCIB FALMOUTH, MA.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.430	180	0.961
10	0.405	190	0.969
20	0.348	200	0.941
30	0.376	210	0.863
40	0.527	220	0.749
45	0.620	225	0.684
50	0.704	230	0.610
60	0.845	240	0.476
70	0.921	250	0.360
80	0.935	260	0.279
90	0.918	270	0.235
100	0.919	280	0.222
110	0.927	290	0.227
120	0.920	300	0.242
130	0.920	310	0.262
135	0.914	315	0.274
140	0.907	320	0.274
150	0.897	330	0.252
160	0.904	340	0.245
170	0.929	350	0.365

Figure 1E

Tabulation of Composite Azimuth Pattern
WCIB FALMOUTH, MA.

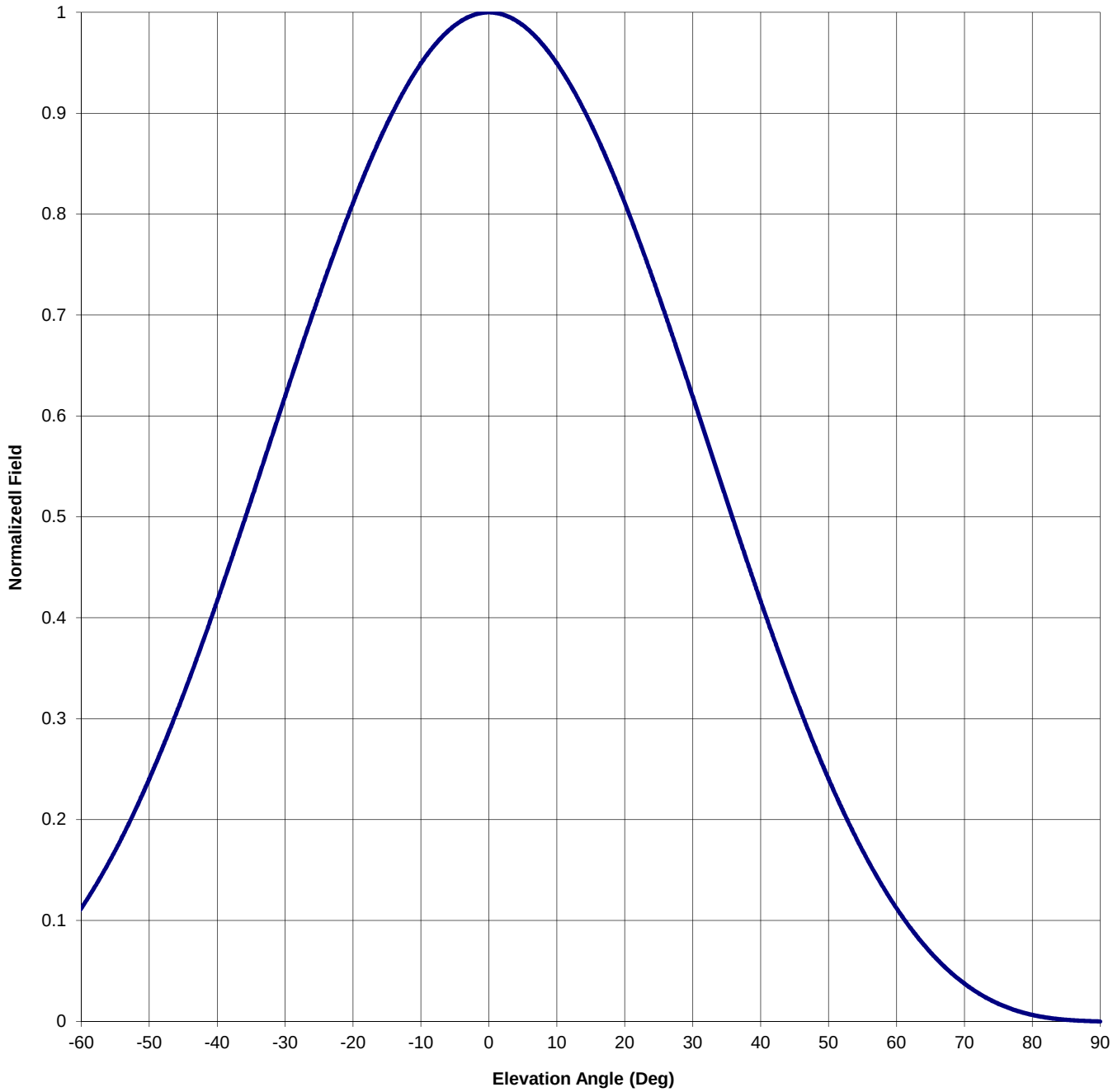
Azimuth	Rel Field	Azimuth	Rel Field
0	0.487	180	0.961
10	0.607	190	0.969
20	0.757	200	0.941
30	0.878	210	0.863
40	0.901	220	0.749
45	0.891	225	0.697
50	0.884	230	0.659
60	0.849	240	0.619
70	0.921	250	0.623
80	0.935	260	0.646
90	0.968	270	0.658
100	0.995	280	0.648
110	1.000	290	0.621
120	0.998	300	0.555
130	0.983	310	0.457
135	0.972	315	0.416
140	0.959	320	0.368
150	0.930	330	0.257
160	0.904	340	0.279
170	0.929	350	0.377

Figure 1F

Tabulation of FCC Directional Composite
WCIB FALMOUTH, MA.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.631	180	1.000
10	0.794	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	1.000
90	1.000	270	1.000
100	1.000	280	1.000
110	1.000	290	1.000
120	1.000	300	0.794
130	1.000	310	0.631
140	1.000	320	0.501
150	1.000	330	0.473
160	1.000	340	0.473
170	1.000	350	0.501

Antenna Mfg.:	**Shively Labs**				**Date: 7/31/2015**
Antenna Type:	**6810-2R-SS(0.5)-DA**				
Station:	**WCIB**	**Beam Tilt**	**0**		
Frequency:	**101.9**	**Gain (Max)**	**1.341**	**1.274 dB**	
Channel #:	**270**	**Gain (Horizon)**	**1.341**	**1.274 dB**	
Figure:	**Figure 3**				



Antenna Mfg.: Shively Labs **Date:** 7/31/2015

Antenna Type: 6810-2R-SS(0.5)-DA

Station: WCIB **Beam Tilt** 0

Frequency: 101.9 **Gain (Max)** 1.341 1.274 dB

Channel #: 270 **Gain (Horizon)** 1.341 1.274 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	0.341	0	1.000	46	0.306
-89	0.000	-43	0.360	1	0.999	47	0.289
-88	0.000	-42	0.378	2	0.998	48	0.272
-87	0.001	-41	0.397	3	0.995	49	0.256
-86	0.001	-40	0.417	4	0.992	50	0.240
-85	0.002	-39	0.436	5	0.987	51	0.225
-84	0.002	-38	0.456	6	0.982	52	0.210
-83	0.003	-37	0.476	7	0.975	53	0.196
-82	0.004	-36	0.496	8	0.967	54	0.183
-81	0.005	-35	0.517	9	0.959	55	0.170
-80	0.007	-34	0.537	10	0.949	56	0.157
-79	0.008	-33	0.558	11	0.939	57	0.145
-78	0.010	-32	0.578	12	0.928	58	0.134
-77	0.012	-31	0.599	13	0.916	59	0.123
-76	0.015	-30	0.619	14	0.903	60	0.112
-75	0.018	-29	0.640	15	0.890	61	0.102
-74	0.021	-28	0.660	16	0.875	62	0.093
-73	0.024	-27	0.680	17	0.860	63	0.084
-72	0.028	-26	0.700	18	0.844	64	0.076
-71	0.033	-25	0.719	19	0.828	65	0.069
-70	0.038	-24	0.738	20	0.811	66	0.061
-69	0.043	-23	0.757	21	0.794	67	0.055
-68	0.048	-22	0.776	22	0.776	68	0.048
-67	0.055	-21	0.794	23	0.757	69	0.043
-66	0.061	-20	0.811	24	0.738	70	0.038
-65	0.069	-19	0.828	25	0.719	71	0.033
-64	0.076	-18	0.844	26	0.700	72	0.028
-63	0.084	-17	0.860	27	0.680	73	0.024
-62	0.093	-16	0.875	28	0.660	74	0.021
-61	0.102	-15	0.890	29	0.640	75	0.018
-60	0.112	-14	0.903	30	0.619	76	0.015
-59	0.123	-13	0.916	31	0.599	77	0.012
-58	0.134	-12	0.928	32	0.578	78	0.010
-57	0.145	-11	0.939	33	0.558	79	0.008
-56	0.157	-10	0.949	34	0.537	80	0.007
-55	0.170	-9	0.959	35	0.517	81	0.005
-54	0.183	-8	0.967	36	0.496	82	0.004
-53	0.196	-7	0.975	37	0.476	83	0.003
-52	0.210	-6	0.982	38	0.456	84	0.002
-51	0.225	-5	0.987	39	0.436	85	0.002
-50	0.240	-4	0.992	40	0.417	86	0.001
-49	0.256	-3	0.995	41	0.397	87	0.001
-48	0.272	-2	0.998	42	0.378	88	0.000
-47	0.289	-1	0.999	43	0.360	89	0.000
-46	0.306	0	1.000	44	0.341	90	0.000
-45	0.323			45	0.323		

S.O. 32009 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WCIB FALMOUTH, MA.

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 0.763292 V RMS 0.683877 H/V Ratio 1.116

Elevation Gain of Horizontal Component 0.781

Elevation Gain of Vertical Component 0.627

Horizontal Azimuth Gain equals $1/(RMS)^2$. 1.716

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 2.020

Max. Vertical 0.972

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

Total Horizontal Power Gain = **1.341**

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

Total Vertical Power Gain = **1.267**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

12 kW ERP Divided by H Gain 1.341 equals 8.949 kW H Antenna Input Power

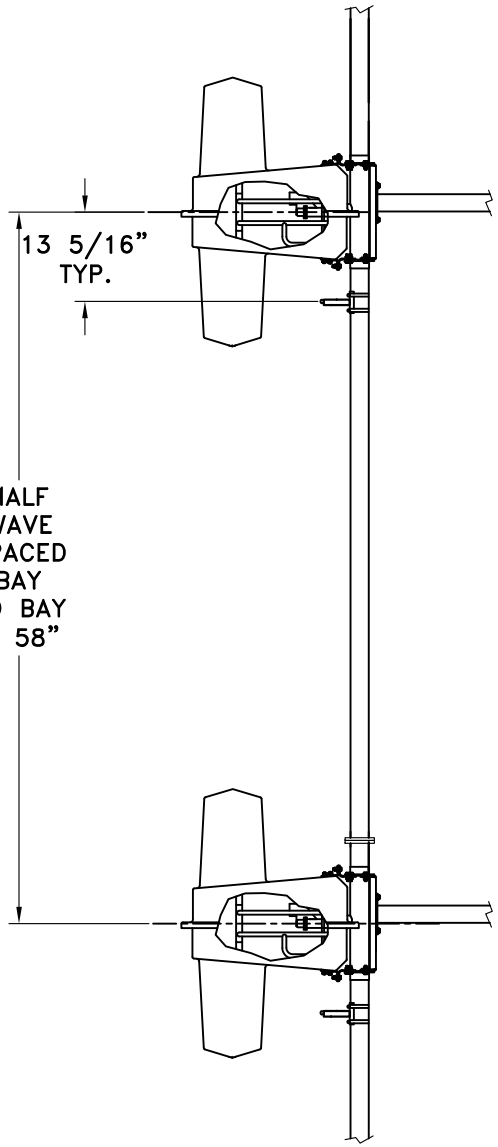
Antenna Input Power times Vertical Power Gain equals Vertical ERP

8.949 kW Times V Gain 1.267 equals 11.337 kW V ERP

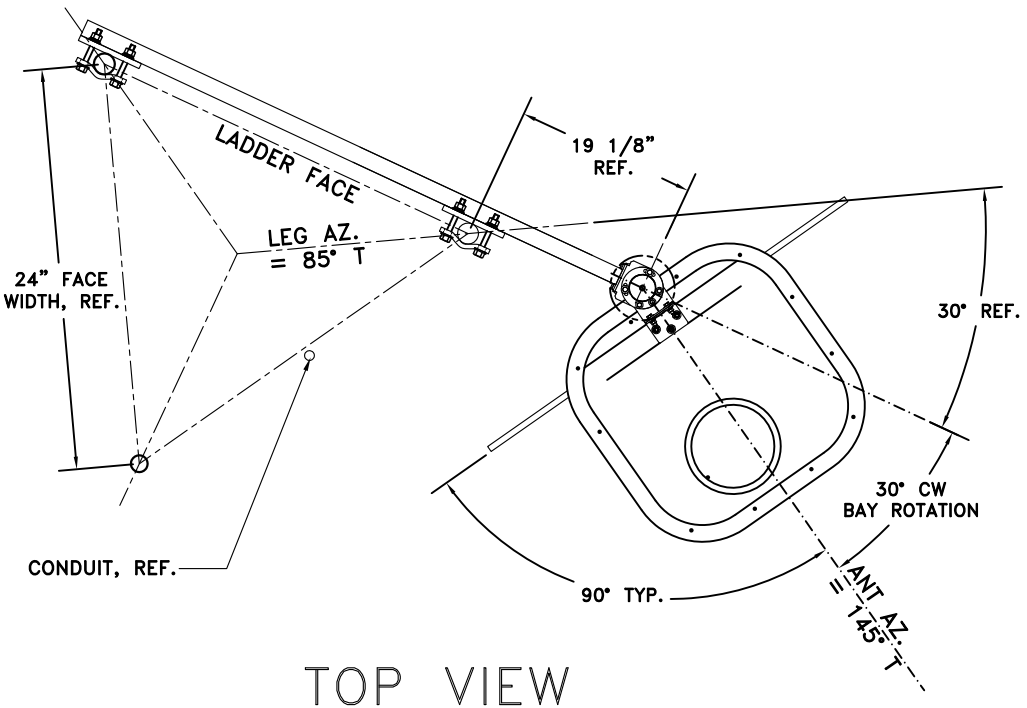
Maximum Value of the Vertical Component squared times the Maximum ERP equals the Vertical ERP

(0.972)^2 Times 12.00 Equals 11.337 kW Vertical ERP

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



SIDE VIEW



TOP VIEW

TOWER MAKE: PIROD 24"FACE

ANTENNA HEADING 145° TRUE NORTH

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 32009	FREQUENCY: 101.9	SCALE: N.T.S.	DRAWN BY: ASP APPROVED BY: DAB
TITLE: MODEL-6810-2R-SS-DIRECTIONAL ANTENNA			
DATE: 10-15-14	FIGURE 2		