

S.O. 32534
Report of Test 6810-8R-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 6810-8R-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 125 Degrees True to 136 Degrees True. At the restricted azimuth of 330 to 340 Degrees True (clock wise) the Vertical component is 6.995 dB down from the maximum of 12 kW, or 2.419 kW.

The R.M.S. of the Horizontal component is 0.787. The total Horizontal power gain is 4.673. The R.M.S. of the Vertical component is 0.688. The total Vertical power gain is 4.415 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 0.803. 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 6810-8R-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 and the addition of vertical parasitics were used 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 6810-8R-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:

A handwritten signature in blue ink, appearing to read 'Martyn Gregory', with a stylized flourish at the end.

Martyn Gregory

Vice President, Shively Labs

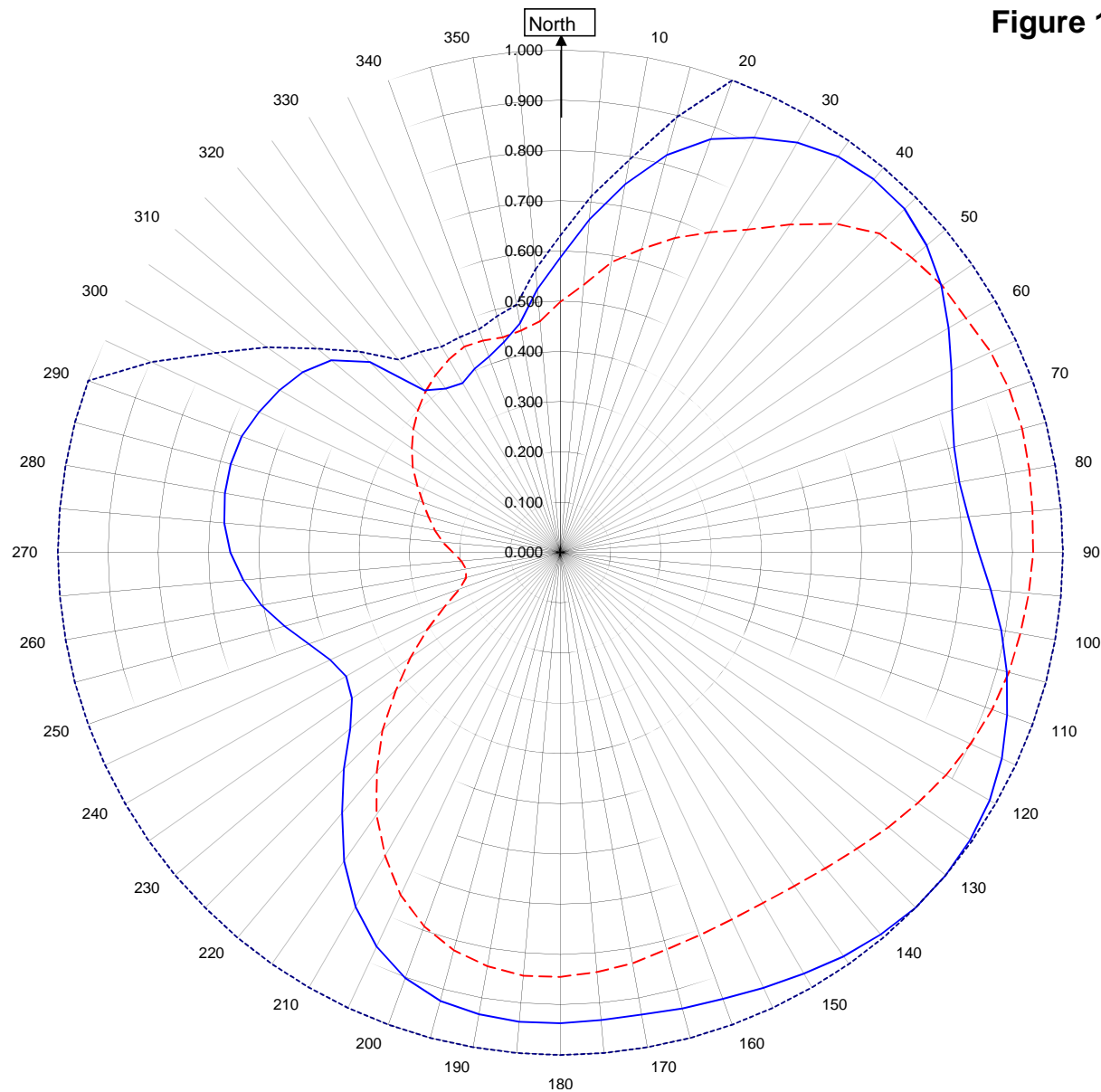
S/O 32534

Date July 31, 2015

Shively Labs

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

Figure 1A



WCIB FALMOUTH, MA.
32534
July 31, 2015

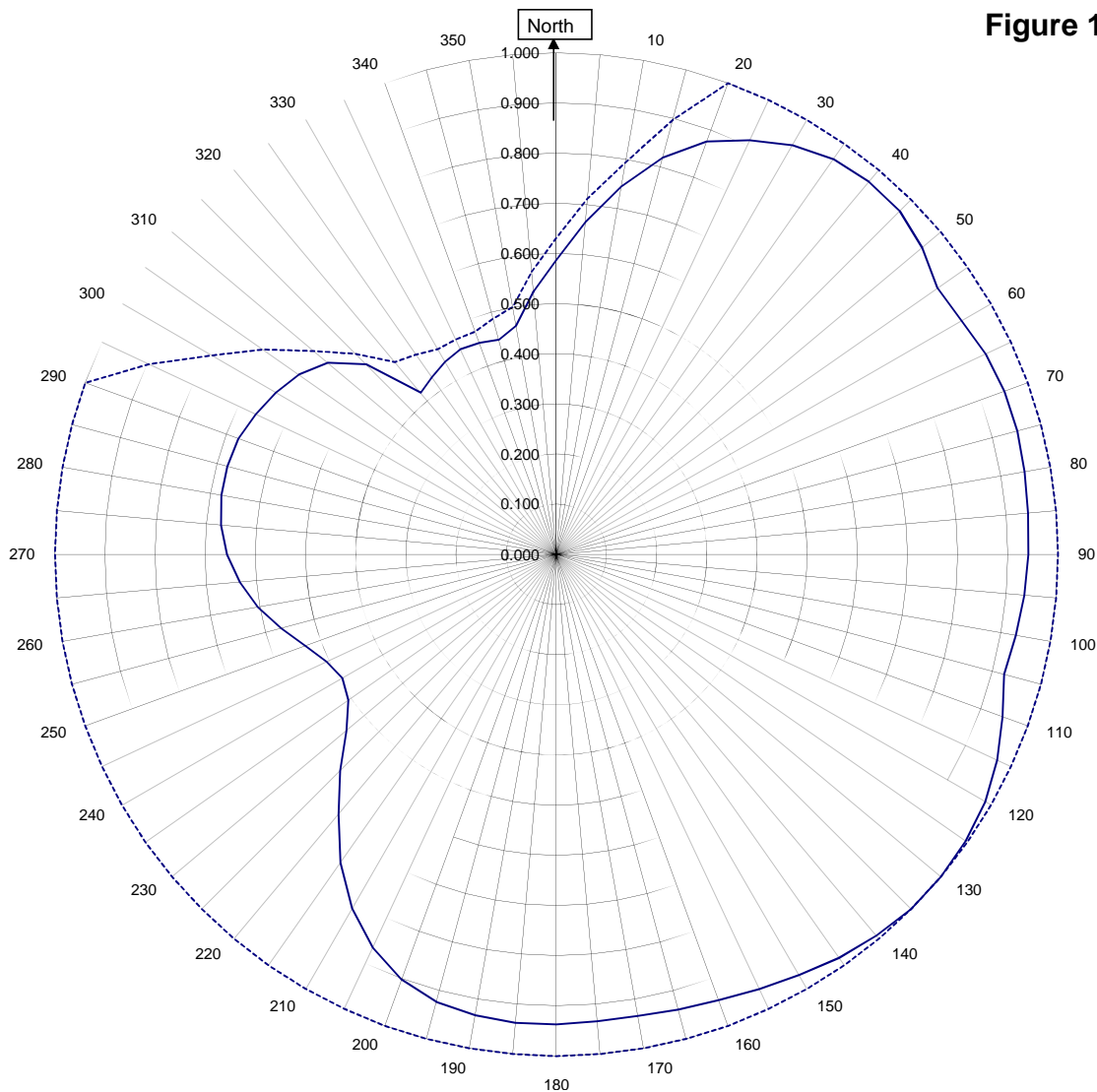
Horizontal RMS	0.787	Frequency	101.9 / 458.55 MHz
Vertical RMS	0.688	Plot	Relative Field
H/V Composite RMS	0.80	Scale	4.5 : 1
FCC Composite RMS	0.928	See Figure 2 for Mechanical Details	

Antenna Model	6810-8R-SS(0.5)-DA
Pattern Type	Directional Azimuth

Shively Labs

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

Figure 1B



WCIB FALMOUTH, MA.
32534
July 31, 2015

—————H/V Composite RMS	0.803
.....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	6810-8R-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	0.587	180	0.937
10	0.745	190	0.933
20	0.876	200	0.902
30	0.942	210	0.815
40	0.970	220	0.676
45	0.968	225	0.610
50	0.951	230	0.546
60	0.892	240	0.493
70	0.830	250	0.533
80	0.806	260	0.604
90	0.833	270	0.657
100	0.891	280	0.678
110	0.946	290	0.675
120	0.987	300	0.646
130	1.000	310	0.595
135	1.000	315	0.536
140	0.992	320	0.421
150	0.968	330	0.389
160	0.946	340	0.415
170	0.934	350	0.463

Figure 1D

Tabulation of Vertical Azimuth Pattern
WCIB FALMOUTH, MA.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.499	180	0.844
10	0.587	190	0.836
20	0.666	200	0.792
30	0.742	210	0.698
40	0.854	220	0.568
45	0.898	225	0.501
50	0.913	230	0.428
60	0.932	240	0.305
70	0.950	250	0.214
80	0.947	260	0.191
90	0.941	270	0.214
100	0.930	280	0.253
110	0.914	290	0.291
120	0.886	300	0.339
130	0.851	310	0.382
135	0.834	315	0.401
140	0.821	320	0.418
150	0.806	330	0.444
160	0.811	340	0.449
170	0.830	350	0.449

Figure 1E

Tabulation of Composite Azimuth Pattern
WCIB FALMOUTH, MA.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.587	180	0.937
10	0.745	190	0.933
20	0.876	200	0.902
30	0.942	210	0.815
40	0.970	220	0.676
45	0.968	225	0.610
50	0.951	230	0.546
60	0.932	240	0.493
70	0.950	250	0.533
80	0.947	260	0.604
90	0.941	270	0.657
100	0.930	280	0.678
110	0.946	290	0.675
120	0.987	300	0.646
130	1.000	310	0.595
135	1.000	315	0.536
140	0.992	320	0.421
150	0.968	330	0.444
160	0.946	340	0.449
170	0.934	350	0.463

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
Antenna Type: 6810-8R-SS(0.5)-DA

Date: 7/31/2015

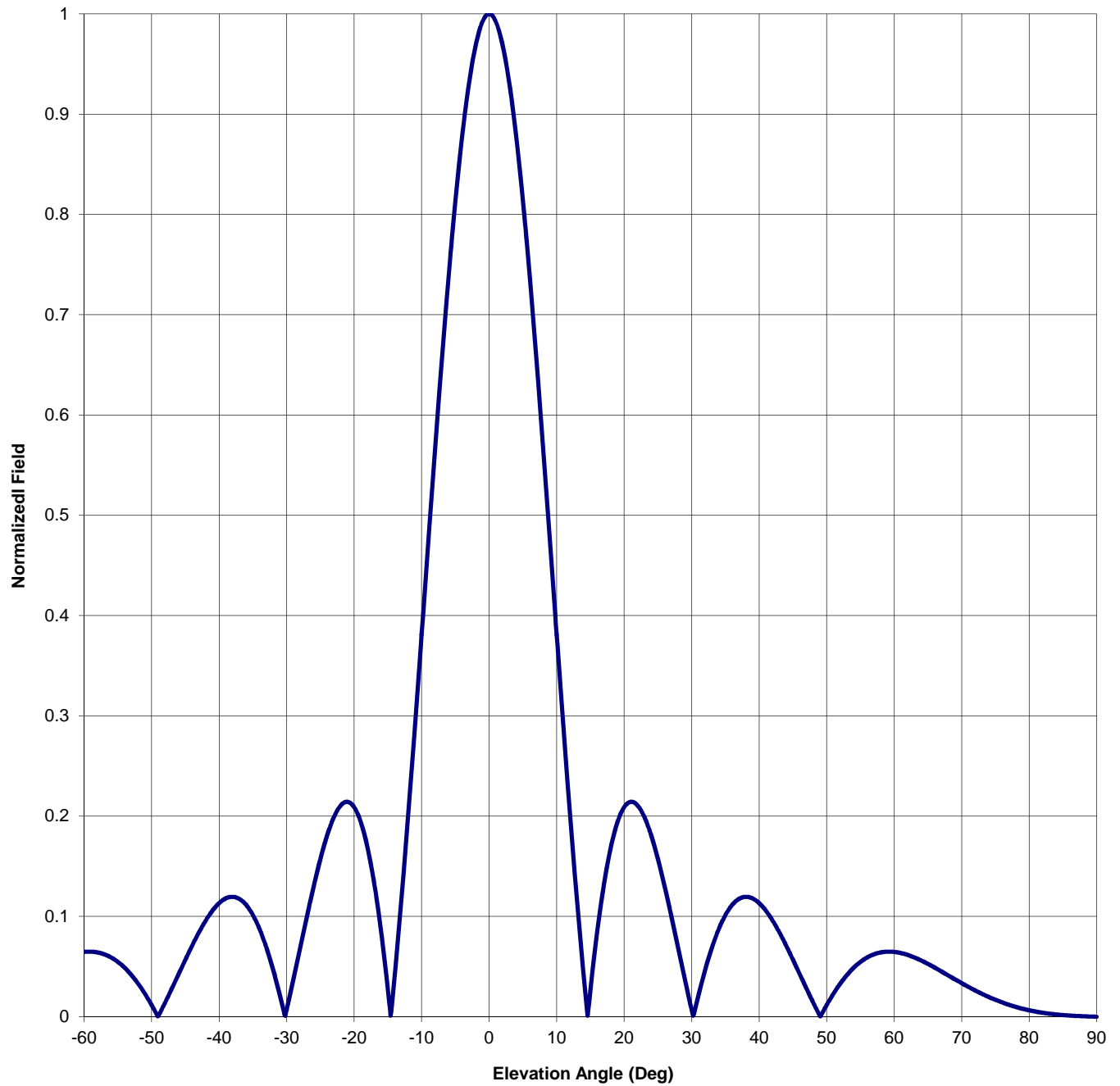
Station: WCIB

Frequency: 101.9

Channel #: 270

Figure: Figure 3

Beam Tilt	0	
Gain (Max)	4.673	6.696 dB
Gain (Horizon)	4.673	6.696 dB



Antenna Mfg.: Shively Labs
Antenna Type: 6810-8R-SS(0.5)-DA

Date: 7/31/2015

Station: WCIB

Beam Tilt 0

Frequency: 101.9

Gain (Max) 4.673

6.696 dB

Channel #: 270

Gain (Horizon) 4.673

6.696 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	0.071	0	1.000	46	0.043
-89	0.000	-43	0.084	1	0.992	47	0.028
-88	0.000	-42	0.096	2	0.969	48	0.014
-87	0.001	-41	0.106	3	0.930	49	0.001
-86	0.001	-40	0.113	4	0.878	50	0.012
-85	0.002	-39	0.118	5	0.814	51	0.023
-84	0.002	-38	0.120	6	0.739	52	0.033
-83	0.003	-37	0.117	7	0.656	53	0.042
-82	0.004	-36	0.111	8	0.567	54	0.049
-81	0.005	-35	0.101	9	0.475	55	0.055
-80	0.006	-34	0.087	10	0.381	56	0.059
-79	0.008	-33	0.069	11	0.289	57	0.062
-78	0.010	-32	0.047	12	0.200	58	0.064
-77	0.012	-31	0.021	13	0.117	59	0.065
-76	0.014	-30	0.007	14	0.041	60	0.065
-75	0.017	-29	0.037	15	0.027	61	0.064
-74	0.020	-28	0.069	16	0.085	62	0.062
-73	0.023	-27	0.100	17	0.132	63	0.059
-72	0.026	-26	0.130	18	0.168	64	0.056
-71	0.030	-25	0.157	19	0.194	65	0.053
-70	0.033	-24	0.181	20	0.209	66	0.049
-69	0.037	-23	0.199	21	0.214	67	0.045
-68	0.041	-22	0.211	22	0.211	68	0.041
-67	0.045	-21	0.214	23	0.199	69	0.037
-66	0.049	-20	0.209	24	0.181	70	0.033
-65	0.053	-19	0.194	25	0.157	71	0.030
-64	0.056	-18	0.168	26	0.130	72	0.026
-63	0.059	-17	0.132	27	0.100	73	0.023
-62	0.062	-16	0.085	28	0.069	74	0.020
-61	0.064	-15	0.027	29	0.037	75	0.017
-60	0.065	-14	0.041	30	0.007	76	0.014
-59	0.065	-13	0.117	31	0.021	77	0.012
-58	0.064	-12	0.200	32	0.047	78	0.010
-57	0.062	-11	0.289	33	0.069	79	0.008
-56	0.059	-10	0.381	34	0.087	80	0.006
-55	0.055	-9	0.475	35	0.101	81	0.005
-54	0.049	-8	0.567	36	0.111	82	0.004
-53	0.042	-7	0.656	37	0.117	83	0.003
-52	0.033	-6	0.739	38	0.120	84	0.002
-51	0.023	-5	0.814	39	0.118	85	0.002
-50	0.012	-4	0.878	40	0.113	86	0.001
-49	0.001	-3	0.930	41	0.106	87	0.001
-48	0.014	-2	0.969	42	0.096	88	0.000
-47	0.028	-1	0.992	43	0.084	89	0.000
-46	0.043	0	1.000	44	0.071	90	0.000
-45	0.057			45	0.057		

VALIDATION OF TOTAL POWER GAIN CALCULATION

WCIB FALMOUTH, MA.

MODEL 6810-8R-SS(0.5)-DA

Elevation Gain of Antenna

2.53

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

H RMS	0.78727	V RMS	0.687742	H/V Ratio	1.145
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Elevation Gain of Horizontal Component	2.896
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Elevation Gain of Vertical Component	2.210
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Horizontal Azimuth Gain equals $1/(\text{RMS})^2$.	1.613
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Vertical Azimuth Gain equals $1/(\text{RMS}/\text{Max Vert})^2$.	1.997
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Max. Vertical	0.972
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***Total Horizontal Power Gain is the Elevation Gain Times the Azimuth Gain**

Total Horizontal Power Gain = 4.673

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

Total Vertical Power Gain = 4.415

ERP divided by Horizontal Power Gain equals Antenna Input Power

12	kW ERP	Divided by H Gain	4.673	equals	2.568	kW H Antenna Input Power
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Antenna Input Power times Vertical Power Gain equals Vertical ERP

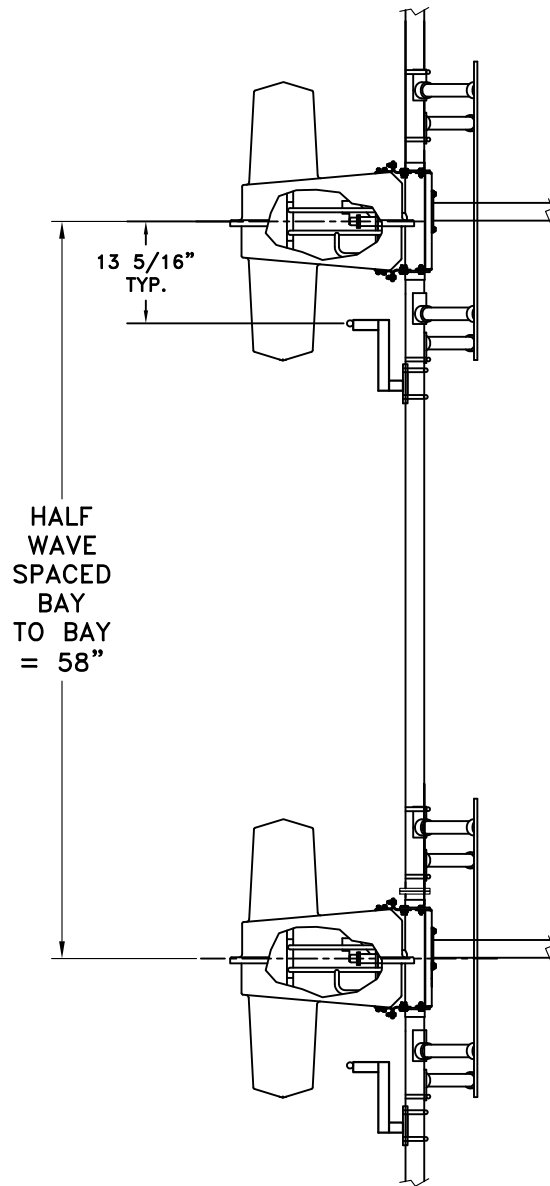
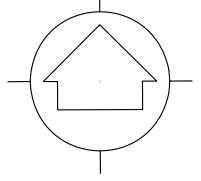
2.568	kW	Times V Gain	4.415	equals	11.337	kW V ERP
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Maximum Value of the Vertical Component squared times the Maximum ERP equals the Vertical ERP

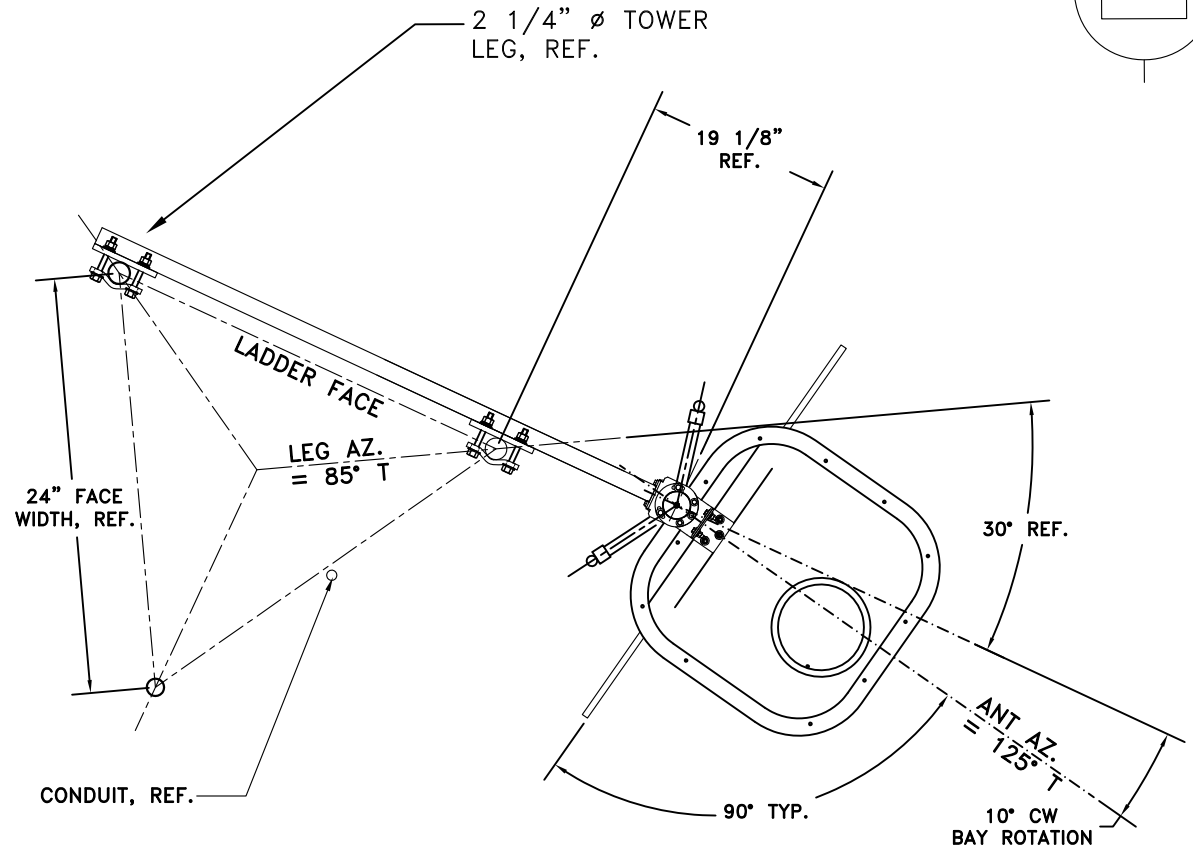
$(0.972)^2$	Times	12.00	Equals	11.337	kW Vertical ERP
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NOTE: Calculating the ERP of the Vertical Component by two methods validates the total power gain calculations

TRUE NORTH



SIDE VIEW



TOP VIEW

TOWER MAKE: PIROD 24"FACE

ANTENNA HEADING 125° TRUE NORTH

SHIVELY LABS			
A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE			
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY:
32534	101.9	N.T.S.	ASP
TITLE:			APPROVED BY:
MODEL-6810-8R-CF-SS-DIRECTIONAL ANTENNA			DAB
DATE:			
6-25-15	FIGURE 2		