

S.O. 33046
Report of Test 6810-3R-SS(0.78)-DA
for
BROWN BROADCASTING SERVICE, INC.
95.5 WBRU MHz PROVIDENCE, RI.

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-3R-SS(0.78)-DA to meet the needs of WBRU and to comply with the requirements of the FCC construction permit, file number BXPB-20141016ADN. 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 BXPB-20141016ADN indicates that the Horizontal radiation component shall not exceed 26.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

260 - 265 Degrees True: 0.82 kilowatts

From Figure 1A, the maximum radiation of the Horizontal component occurs at 75 Degrees True to 90 Degrees True. At the restricted azimuth of 260 Degrees True to 265 Degrees True the Horizontal component is 20.45 dB down from the maximum of 26.0 kW, or 0.235 kW.

The R.M.S. of the Horizontal component is 0.595. The total Horizontal power gain is 4.209. The R.M.S. of the Vertical component is 0.585. The total Vertical power gain is 4.034. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.642. The R.M.S. of the measured composite pattern is 0.606. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.546. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-3-SS(0.78)-DA was mounted on a tower of precise scale to the 8-inch pole at the WBRU 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 BXPB-20141016ADN, a single level of the 6810-3R-SS(0.78)-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 429.75 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

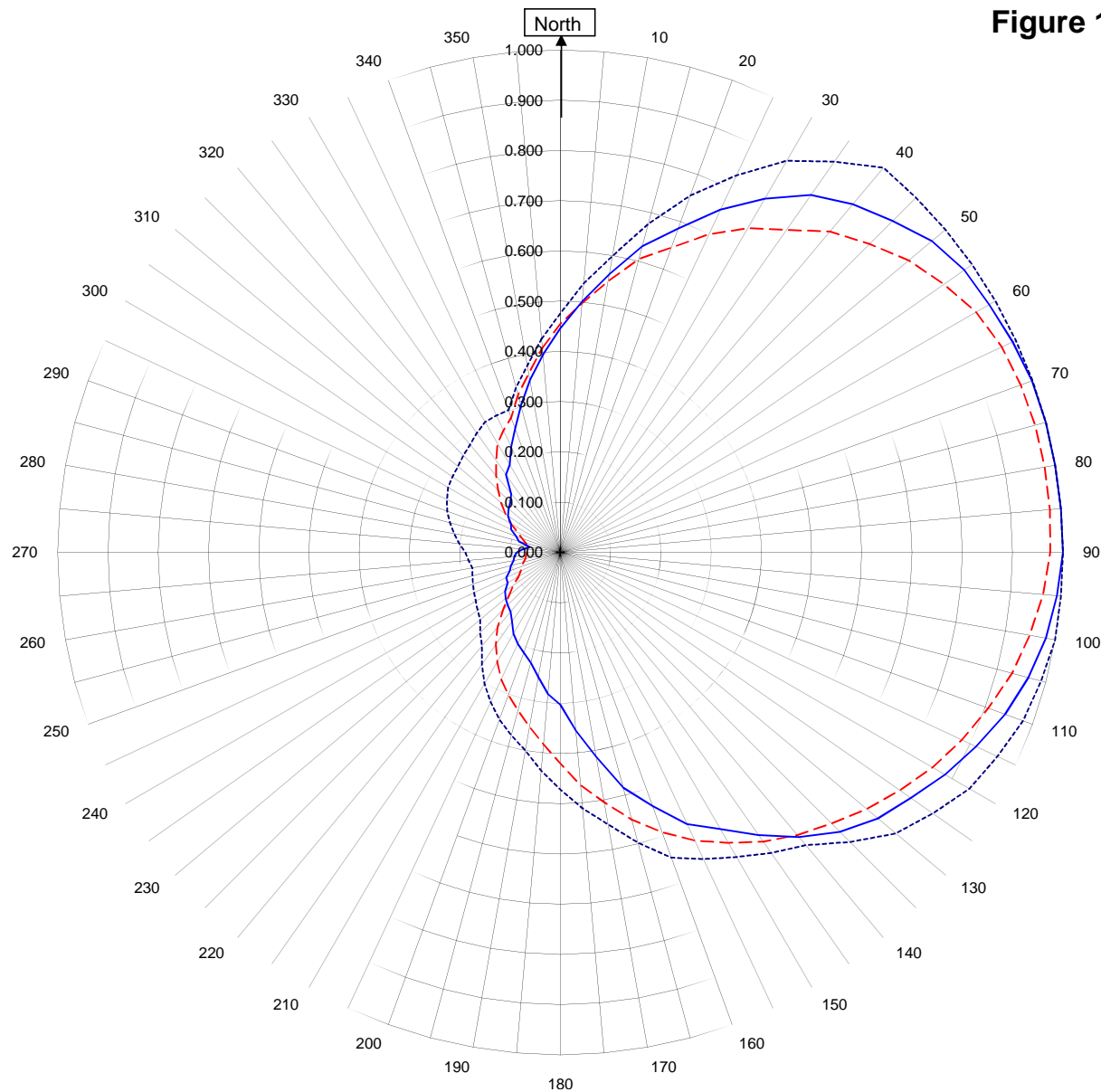
S/O 33046

November 11, 2015

Shively Labs

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

Figure 1A



WBRU PROVIDENCE, RI.
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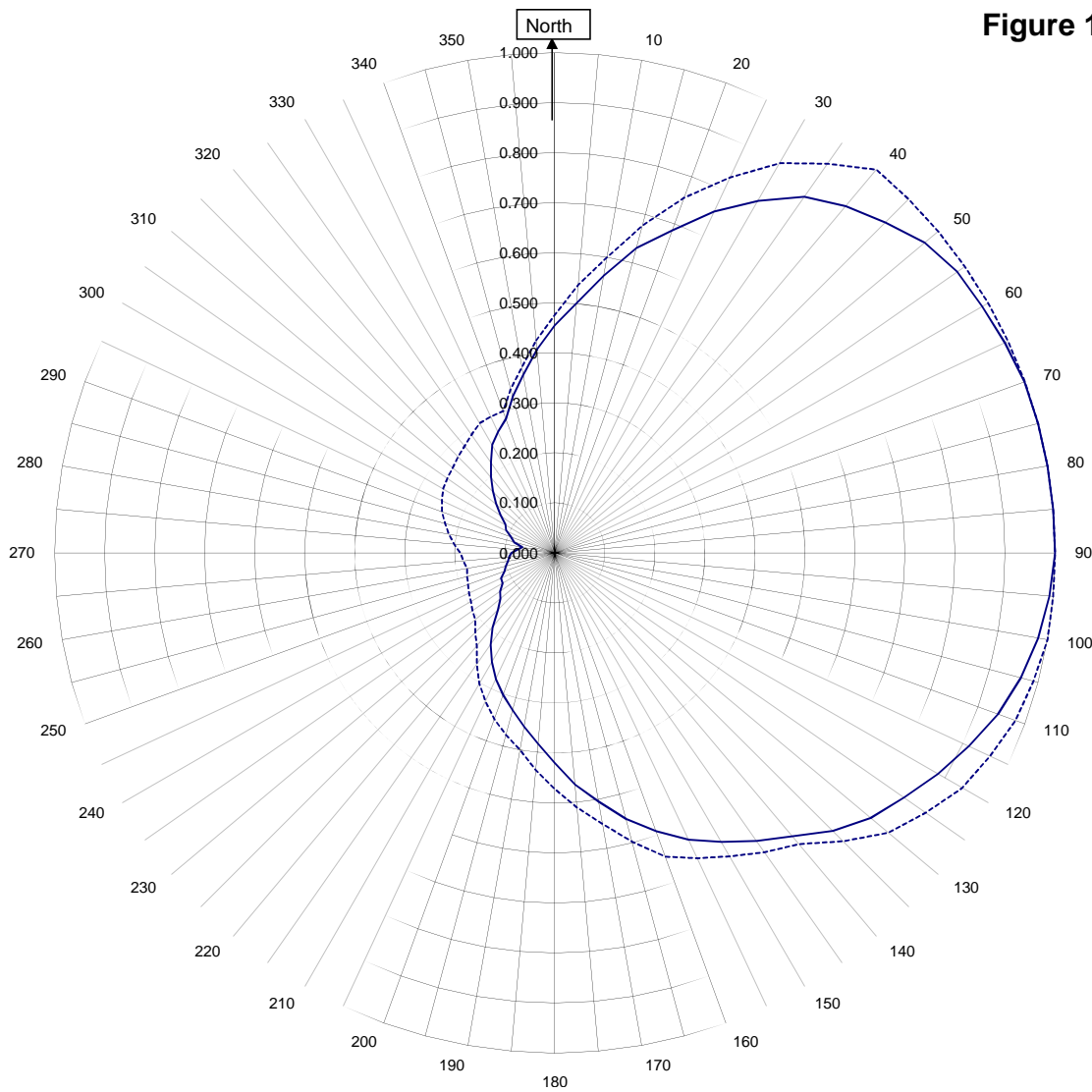
Horizontal RMS	0.595	Frequency	95.5 / 429.75 MHz
Vertical RMS	0.585	Plot	Relative Field
H/V Composite RMS	0.606	Scale	4.5 : 1
FCC Composite RMS	0.642	See Figure 2 for Mechanical Details	

Antenna Model	6810-3R-SS(0.78)-DA
Pattern Type	Directional Azimuth

Shively Labs

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

Figure 1B



WBRU PROVIDENCE, RI.

33046
November 11, 2015

—————H/V Composite RMS	0.606
.....FCC Composite RMS	0.642

Frequency	95.5 / 429.75 mHz
Plot	Relative Field
Scale	4.5 : 1
See Figure 2 for Mechanical Details	

Antenna Model	6810-3R-SS(0.78)-DA
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WBRU PROVIDENCE, RI.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.446	180	0.303
10	0.563	190	0.252
20	0.686	200	0.212
30	0.813	210	0.187
40	0.905	220	0.154
45	0.934	225	0.148
50	0.965	230	0.142
60	0.986	240	0.121
70	0.999	250	0.107
80	1.000	260	0.095
90	1.000	270	0.087
100	0.981	280	0.062
110	0.942	290	0.094
120	0.884	300	0.114
130	0.824	310	0.135
135	0.786	315	0.141
140	0.739	320	0.152
150	0.635	330	0.202
160	0.537	340	0.263
170	0.413	350	0.349

Figure 1D

Tabulation of Vertical Azimuth Pattern
WBRU PROVIDENCE, RI.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.455	180	0.420
10	0.548	190	0.353
20	0.646	200	0.302
30	0.745	210	0.252
40	0.834	220	0.194
45	0.869	225	0.161
50	0.905	230	0.134
60	0.956	240	0.096
70	0.975	250	0.081
80	0.979	260	0.071
90	0.975	270	0.066
100	0.948	280	0.066
110	0.906	290	0.080
120	0.855	300	0.113
130	0.795	310	0.154
135	0.763	315	0.175
140	0.734	320	0.199
150	0.667	330	0.250
160	0.592	340	0.286
170	0.505	350	0.362

Figure 1E

Tabulation of Composite Azimuth Pattern
WBRU PROVIDENCE, RI.

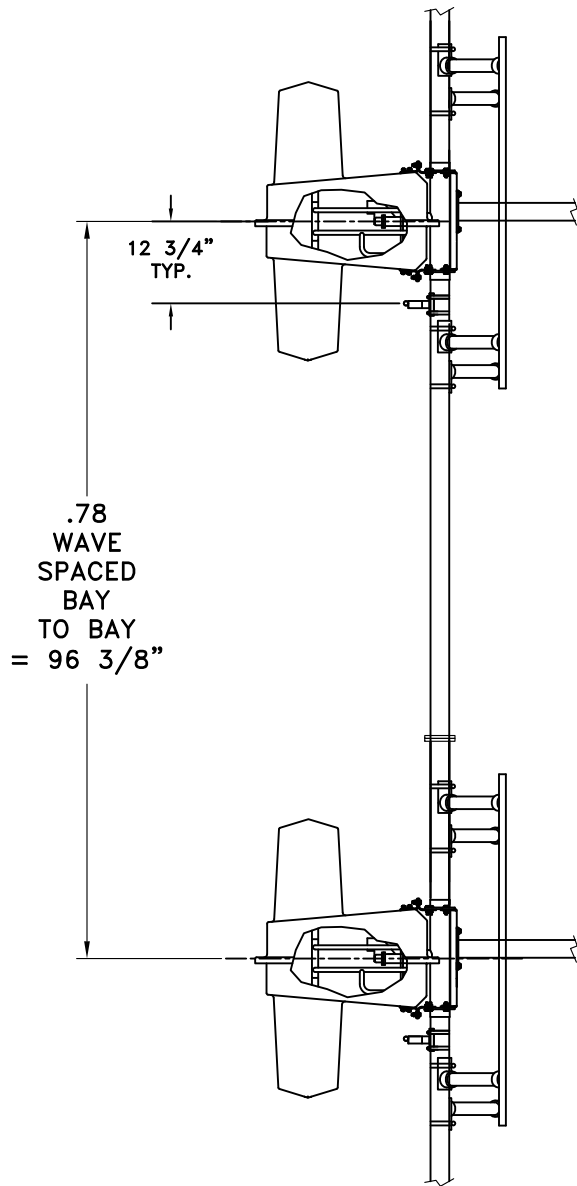
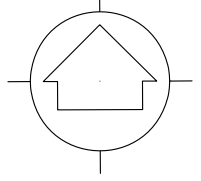
Azimuth	Rel Field	Azimuth	Rel Field
0	0.455	180	0.420
10	0.563	190	0.353
20	0.686	200	0.302
30	0.813	210	0.252
40	0.905	220	0.194
45	0.934	225	0.161
50	0.965	230	0.142
60	0.986	240	0.121
70	0.999	250	0.107
80	1.000	260	0.095
90	1.000	270	0.087
100	0.981	280	0.066
110	0.942	290	0.094
120	0.884	300	0.114
130	0.824	310	0.154
135	0.786	315	0.175
140	0.739	320	0.199
150	0.667	330	0.250
160	0.592	340	0.286
170	0.505	350	0.362

Figure 1F

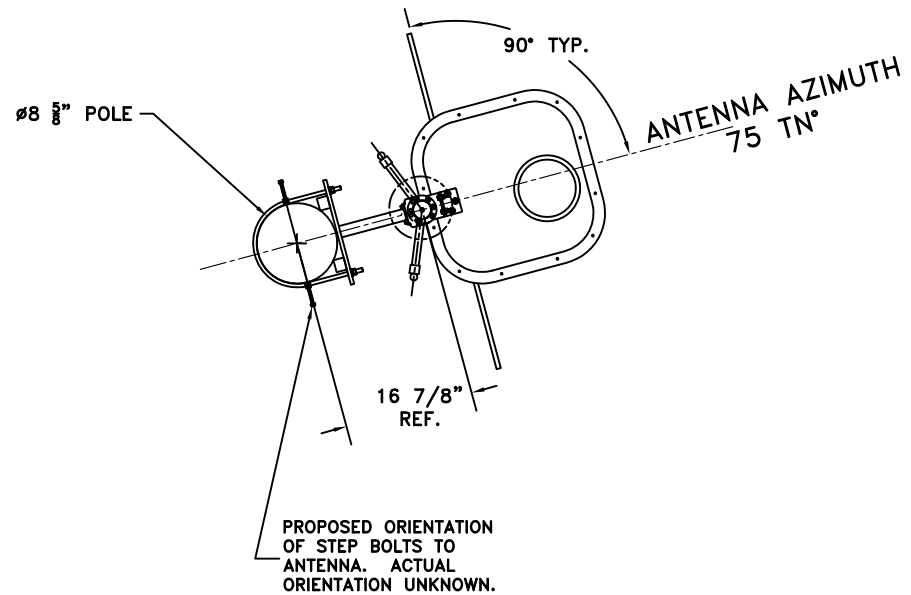
Tabulation of FCC Directional Composite
WBRU PROVIDENCE, RI.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.476	180	0.472
10	0.600	190	0.400
20	0.756	200	0.354
30	0.900	210	0.302
40	1.000	220	0.243
50	1.000	230	0.208
60	1.000	240	0.194
70	1.000	250	0.185
80	1.000	260	0.178
90	1.000	270	0.189
100	1.000	280	0.215
110	0.980	290	0.240
120	0.940	300	0.258
130	0.870	310	0.266
140	0.760	320	0.280
150	0.700	330	0.300
160	0.646	340	0.302
170	0.550	350	0.378

TRUE NORTH



SIDE VIEW



TOP VIEW

TOWER MAKE:
8" PIPE (8 5/8" OD)

ANTENNA HEADING 75° TRUE NORTH

SHIVELY LABS			
A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE			
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY:
33046	95.5	N.T.S.	ASP
		APPROVED BY:	
		DAB	
TITLE:			
MODEL-6810-3R-.78SS-DIRECTIONAL ANTENNA			
DATE:			
11-11-15	FIGURE 2		

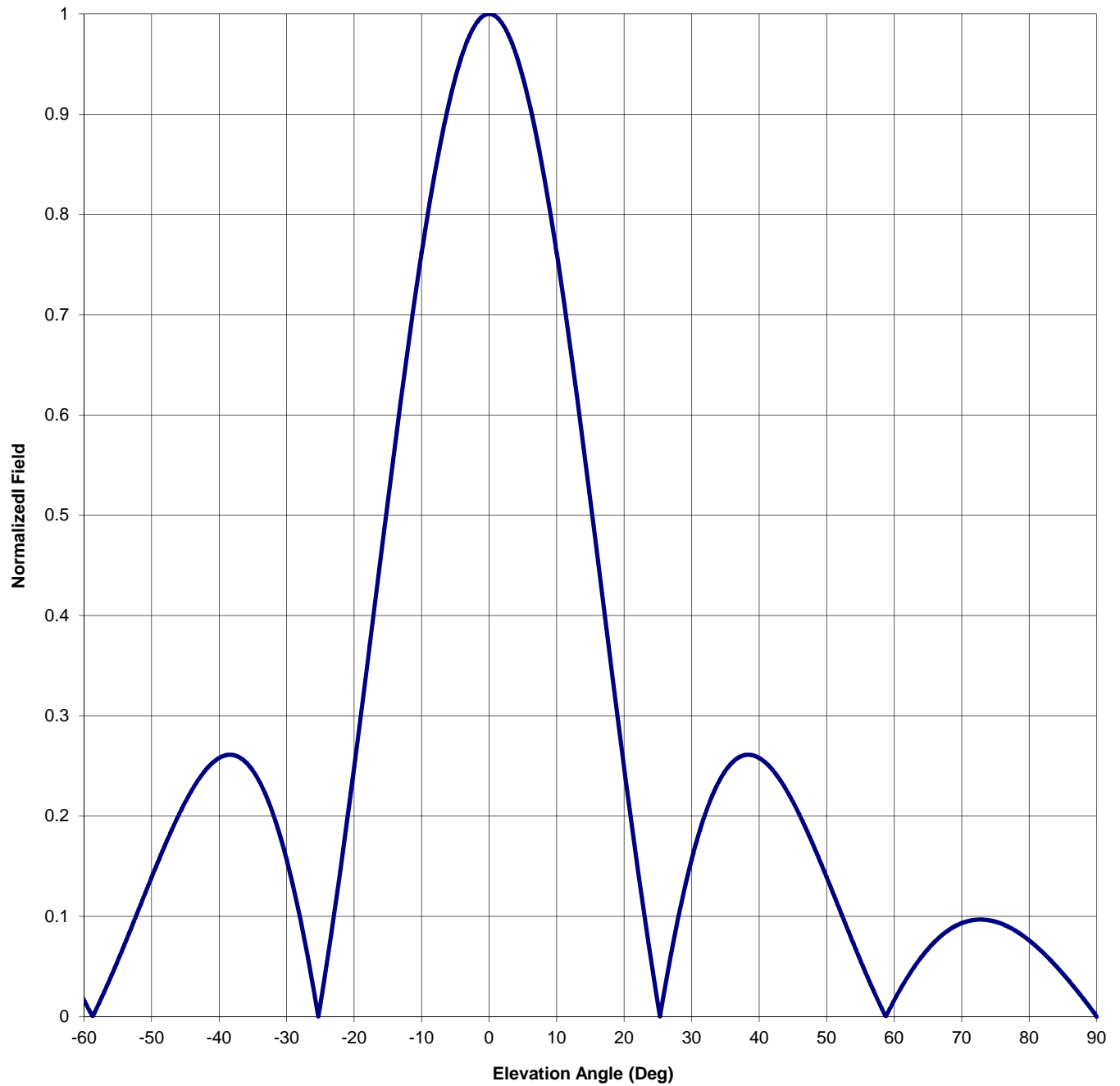
Antenna Mfg.: Shively Labs
Antenna Type: 6810-3R-SS(0.78)-DA

Date: 11/12/2015

Station: WBRU
Frequency: 95.5
Channel #: 238

Beam Tilt	0	
Gain (Max)	4.209	6.242 dB
Gain (Horizon)	4.209	6.242 dB

Figure: Figure 3



Antenna Mfg.: Shively Labs
Antenna Type: 6810-3R-SS(0.78)-DA

Date: 11/12/2015

Station: WBRU

Beam Tilt 0

Frequency: 95.5

Gain (Max) 4.209

6.242 dB

Channel #: 238

Gain (Horizon) 4.209

6.242 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	0.226	0	1.000	46	0.201
-89	0.009	-43	0.237	1	0.997	47	0.187
-88	0.018	-42	0.246	2	0.990	48	0.171
-87	0.027	-41	0.253	3	0.977	49	0.155
-86	0.035	-40	0.258	4	0.959	50	0.139
-85	0.043	-39	0.261	5	0.937	51	0.122
-84	0.050	-38	0.261	6	0.910	52	0.106
-83	0.057	-37	0.259	7	0.878	53	0.089
-82	0.064	-36	0.253	8	0.843	54	0.072
-81	0.070	-35	0.245	9	0.804	55	0.056
-80	0.076	-34	0.234	10	0.762	56	0.040
-79	0.081	-33	0.220	11	0.716	57	0.025
-78	0.086	-32	0.202	12	0.669	58	0.010
-77	0.089	-31	0.181	13	0.619	59	0.003
-76	0.092	-30	0.157	14	0.567	60	0.016
-75	0.095	-29	0.129	15	0.515	61	0.029
-74	0.096	-28	0.098	16	0.461	62	0.040
-73	0.097	-27	0.064	17	0.407	63	0.050
-72	0.097	-26	0.027	18	0.354	64	0.059
-71	0.095	-25	0.013	19	0.300	65	0.068
-70	0.093	-24	0.055	20	0.248	66	0.075
-69	0.090	-23	0.100	21	0.197	67	0.081
-68	0.086	-22	0.148	22	0.148	68	0.086
-67	0.081	-21	0.197	23	0.100	69	0.090
-66	0.075	-20	0.248	24	0.055	70	0.093
-65	0.068	-19	0.300	25	0.013	71	0.095
-64	0.059	-18	0.354	26	0.027	72	0.097
-63	0.050	-17	0.407	27	0.064	73	0.097
-62	0.040	-16	0.461	28	0.098	74	0.096
-61	0.029	-15	0.515	29	0.129	75	0.095
-60	0.016	-14	0.567	30	0.157	76	0.092
-59	0.003	-13	0.619	31	0.181	77	0.089
-58	0.010	-12	0.669	32	0.202	78	0.086
-57	0.025	-11	0.716	33	0.220	79	0.081
-56	0.040	-10	0.762	34	0.234	80	0.076
-55	0.056	-9	0.804	35	0.245	81	0.070
-54	0.072	-8	0.843	36	0.253	82	0.064
-53	0.089	-7	0.878	37	0.259	83	0.057
-52	0.106	-6	0.910	38	0.261	84	0.050
-51	0.122	-5	0.937	39	0.261	85	0.043
-50	0.139	-4	0.959	40	0.258	86	0.035
-49	0.155	-3	0.977	41	0.253	87	0.027
-48	0.171	-2	0.990	42	0.246	88	0.018
-47	0.187	-1	0.997	43	0.237	89	0.009
-46	0.201	0	1.000	44	0.226	90	0.000
-45	0.214			45	0.214		

VALIDATION OF TOTAL POWER GAIN CALCULATION

WBRU PROVIDENCE, RI.

MODEL 6810-3R-SS(0.78)-DA

Elevation Gain of Antenna

1.465

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

H RMS	0.594524	V RMS	0.585457	H/V Ratio	1.015
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Elevation Gain of Horizontal Component	1.488
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Elevation Gain of Vertical Component	1.443
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Horizontal Azimuth Gain equals $1/(\text{RMS})^2$.	2.829
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Vertical Azimuth Gain equals $1/(\text{RMS}/\text{Max Vert})^2$.	2.796
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Max. Vertical	0.979
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***Total Horizontal Power Gain is the Elevation Gain Times the Azimuth Gain**

Total Horizontal Power Gain =	4.209
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***Total Vertical Power Gain is the Elevation Gain Times the Azimuth Gain**

Total Vertical Power Gain =	4.034
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ERP divided by Horizontal Power Gain equals Antenna Input Power

26	kW ERP	Divided by H Gain	4.209	equals	6.177	kW H Antenna Input Power
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Antenna Input Power times Vertical Power Gain equals Vertical ERP

6.177	kW	Times V Gain	4.034	equals	24.919	kW V ERP
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Maximum Value of the Vertical Component squared times the Maximum ERP equals the Vertical ERP

$(0.979)^2$	Times	26.00	Equals	24.919	kW Vertical ERP
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NOTE: Calculating the ERP of the Vertical Component by two methods validates the total power gain calculations