

S.O. 35337
Report of Test 6810-3R-DA
for
MAINE PUBLIC BROADCASTING CORPORATION
WBQE 93.7 MHz MILBRIDGE, ME.

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-3R-DA to meet the needs of WBQE and to comply with the requirements of the FCC license permit, file number BMLED-20161207AAZ. 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 permit file number BMLED-20161207AAZ indicates that the Horizontal radiation component shall not exceed 27.0 kW at peak azimuth.

Test Report 6810-3R-DA

WBQE

Page Two

From Figure 1A, the maximum radiation of the Horizontal component occurs at 72 Degrees True to 98 Degrees True

The R.M.S. of the Horizontal component is 0.730. The total Horizontal power gain is 3.025. The R.M.S. of the Vertical component is 0.702. The total Vertical power gain is 2.633. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.789. The R.M.S. of the measured composite pattern is 0.732. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.670. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-3R-DA was mounted on a tower of precise scale to the 5-inch diameter pole at the WBQE site. The spacing of the antenna to the pole 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 license permit, file number BMLED-20161207AAZ, a single level of the 6810-3R-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.

Test Report 6810-3R-DA

WBQE

Page Three

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 421.65 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 cursive script, appearing to read 'Angela Gillespie', written in dark ink.

Angela Gillespie

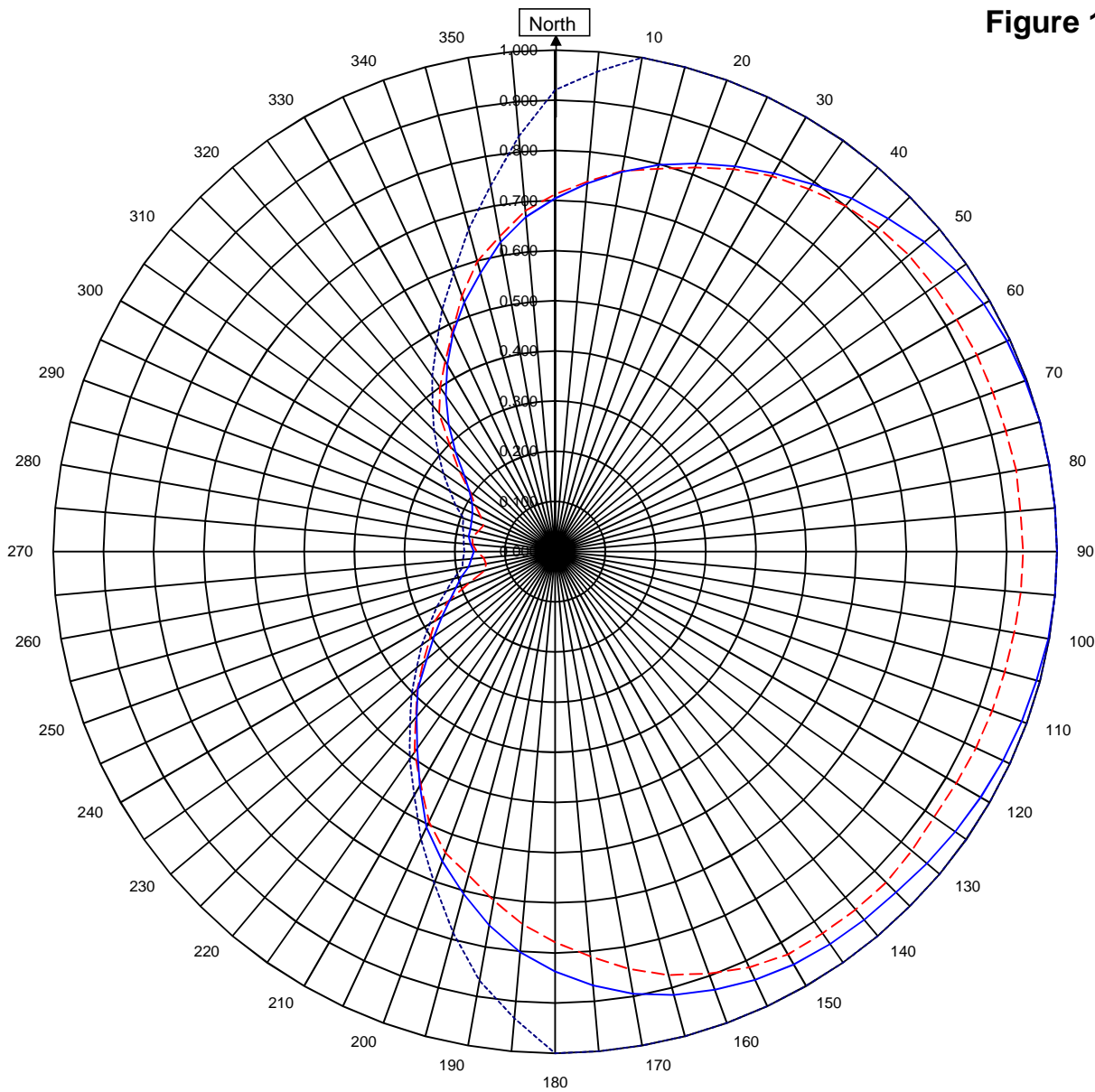
S/O 35337

Date March 6, 2018

Shively Labs

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

Figure 1A



WBQE **MILBRIDGE, ME.**
35337
March 6, 2018

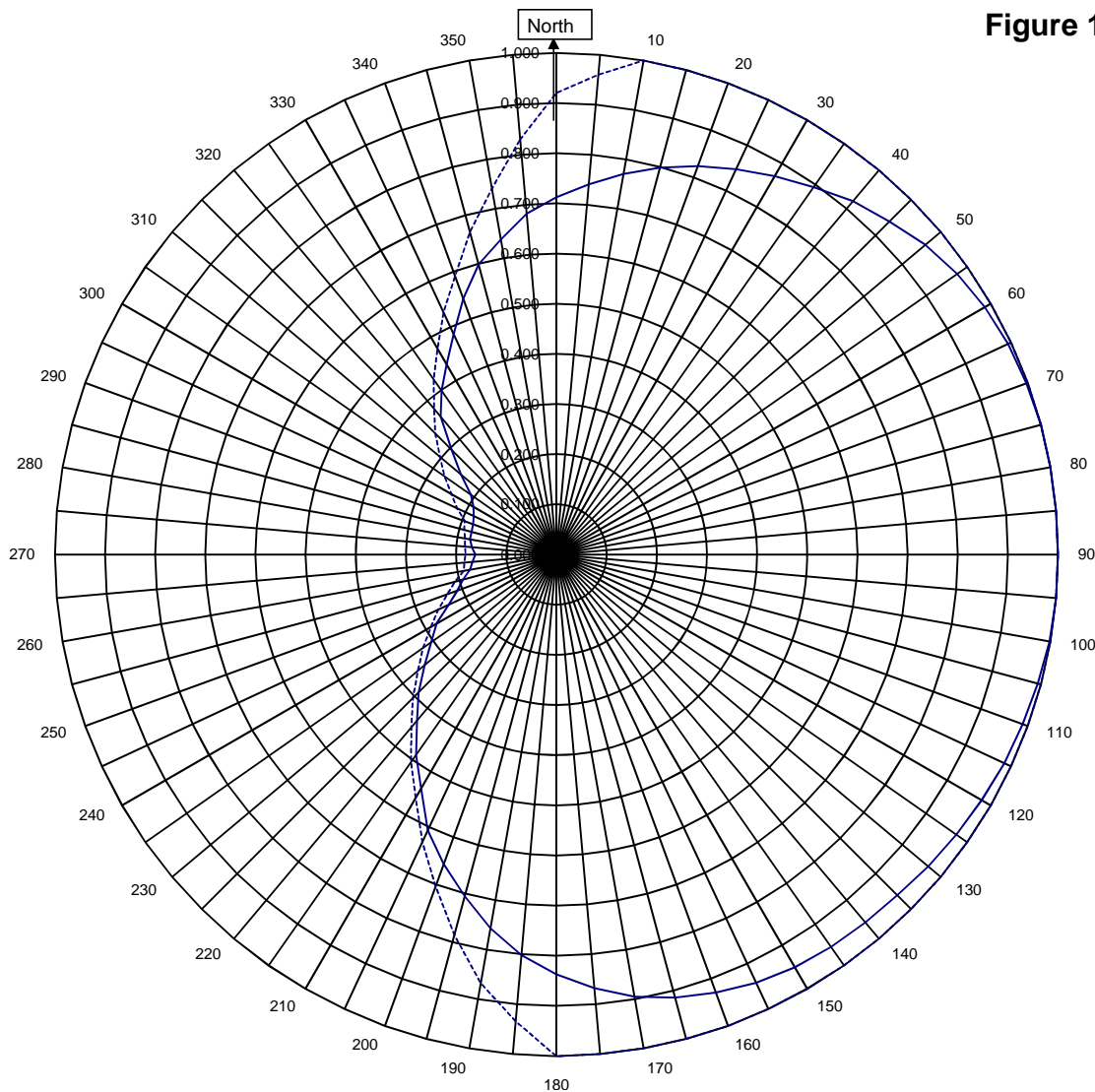
Horizontal RMS	0.730	Frequency	93.7 / 421.65 MHz
Vertical RMS	0.702	Plot	Relative Field
H/V Composite RMS	0.732	Scale	4.5 : 1
FCC Composite RMS	0.789	See Figure 2 for Mechanical Details	

Antenna Model	6810-3R-DA
Pattern Type	Directional Azimuth

Shively Labs

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

Figure 1B



WBQE MILBRIDGE, ME.
35337
March 6, 2018

—————H/V Composite RMS	0.732
.....FCC Composite RMS	0.789

Frequency	93.7 / 421.65 mHz
Plot	Relative Field
Scale	4.5 : 1
See Figure 2 for Mechanical Details	

Antenna Model	6810-3R-DA
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WBQE MILBRIDGE, ME.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.704	180	0.837
10	0.769	190	0.757
20	0.824	200	0.656
30	0.871	210	0.539
40	0.919	220	0.429
45	0.939	225	0.387
50	0.960	230	0.334
60	0.986	240	0.261
70	0.997	250	0.210
80	1.000	260	0.175
90	1.000	270	0.162
100	0.998	280	0.175
110	0.989	290	0.177
120	0.979	300	0.191
130	0.967	310	0.236
135	0.961	315	0.280
140	0.958	320	0.330
150	0.951	330	0.430
160	0.929	340	0.529
170	0.895	350	0.626

Figure 1D

Tabulation of Vertical Azimuth Pattern
WBQE MILBRIDGE, ME.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.712	180	0.779
10	0.771	190	0.706
20	0.815	200	0.639
30	0.864	210	0.535
40	0.900	220	0.432
45	0.913	225	0.389
50	0.920	230	0.343
60	0.925	240	0.276
70	0.928	250	0.183
80	0.933	260	0.140
90	0.933	270	0.156
100	0.929	280	0.168
110	0.927	290	0.152
120	0.923	300	0.184
130	0.928	310	0.249
135	0.933	315	0.295
140	0.932	320	0.359
150	0.927	330	0.438
160	0.895	340	0.543
170	0.845	350	0.638

Figure 1E

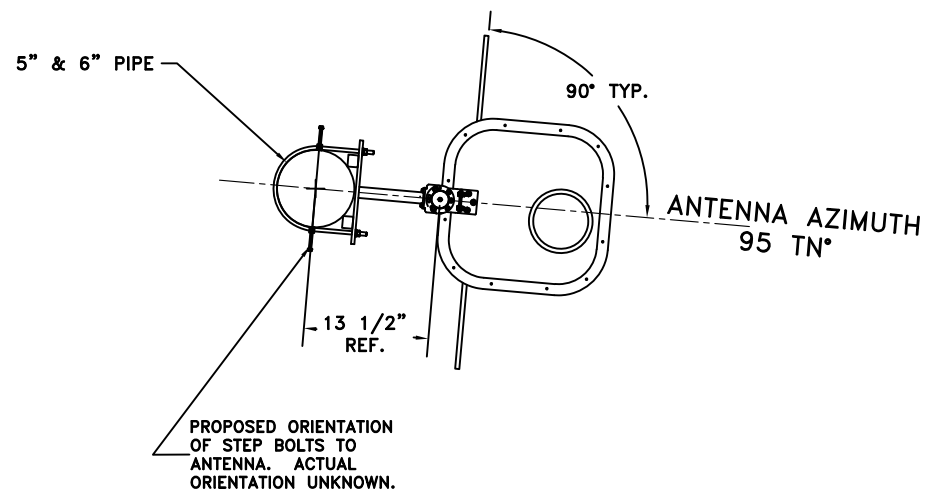
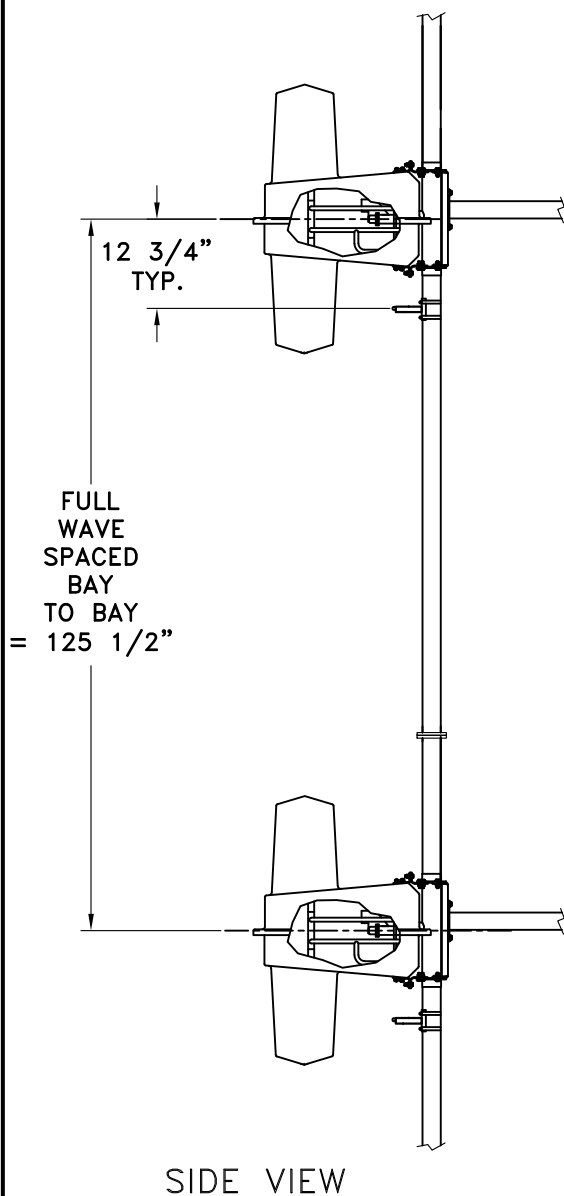
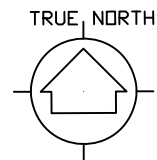
Tabulation of Composite Azimuth Pattern
WBQE MILBRIDGE, ME.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.712	180	0.837
10	0.771	190	0.757
20	0.824	200	0.656
30	0.871	210	0.539
40	0.919	220	0.432
45	0.939	225	0.389
50	0.960	230	0.343
60	0.986	240	0.276
70	0.997	250	0.210
80	1.000	260	0.175
90	1.000	270	0.162
100	0.998	280	0.175
110	0.989	290	0.177
120	0.979	300	0.191
130	0.967	310	0.249
135	0.961	315	0.295
140	0.958	320	0.359
150	0.951	330	0.438
160	0.929	340	0.543
170	0.895	350	0.638

Figure 1F

Tabulation of FCC Directional Composite
WBQE MILBRIDGE, ME.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.920	180	1.000
10	1.000	190	0.868
20	1.000	200	0.704
30	1.000	210	0.561
40	1.000	220	0.450
50	1.000	230	0.360
60	1.000	240	0.289
70	1.000	250	0.231
80	1.000	260	0.188
90	1.000	270	0.181
100	1.000	280	0.185
110	1.000	290	0.195
120	1.000	300	0.242
130	1.000	310	0.303
140	1.000	320	0.380
150	1.000	330	0.474
160	1.000	340	0.591
170	1.000	350	0.741



TOP VIEW
TOWER MAKE: 5" & 6" TOP MOUNTED PIPE

ANTENNA HEADING 95° TRUE NORTH

SHIVELY LABS			
A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE			
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY:
35337	93.7	N.T.S.	ASP
TITLE:		APPROVED BY:	
MODEL-6810-3R-DIRECTIONAL ANTENNA		DAB	
DATE:	FIGURE 2		
3-5-18			

Antenna Mfg.: Shively Labs
Antenna Type: 6810-3R-DA

Date: 3/7/2018

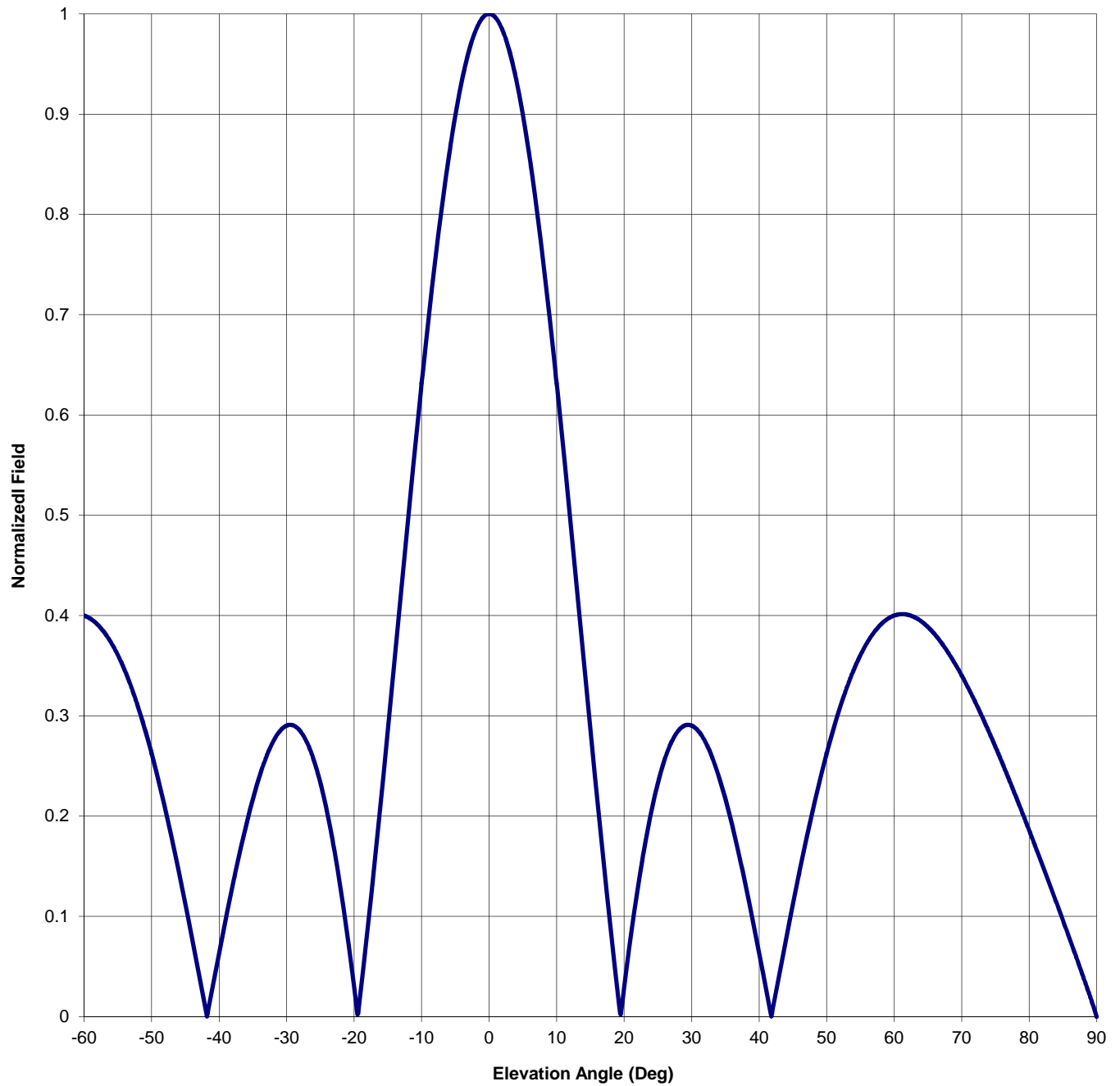
Station: WBQE

Frequency: 93.7

Channel #: 229

Figure: Figure 3

Beam Tilt	0	
Gain (Max)	3.025	4.807 dB
Gain (Horizon)	3.025	4.807 dB



Antenna Mfg.: Shively Labs

Date: 3/7/2018

Antenna Type: 6810-3R-DA

Station: WBQE

Beam Tilt 0

Frequency: 93.7

Gain (Max) 3.025

4.807 dB

Channel #: 229

Gain (Horizon) 3.025

4.807 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	0.078	0	1.000	46	0.146
-89	0.021	-43	0.043	1	0.996	47	0.177
-88	0.040	-42	0.007	2	0.983	48	0.208
-87	0.059	-41	0.028	3	0.963	49	0.236
-86	0.078	-40	0.063	4	0.935	50	0.263
-85	0.096	-39	0.098	5	0.899	51	0.287
-84	0.114	-38	0.131	6	0.857	52	0.309
-83	0.132	-37	0.162	7	0.808	53	0.328
-82	0.150	-36	0.191	8	0.754	54	0.346
-81	0.168	-35	0.217	9	0.695	55	0.361
-80	0.186	-34	0.240	10	0.631	56	0.373
-79	0.203	-33	0.259	11	0.565	57	0.383
-78	0.220	-32	0.274	12	0.497	58	0.391
-77	0.237	-31	0.285	13	0.427	59	0.397
-76	0.253	-30	0.290	14	0.356	60	0.400
-75	0.269	-29	0.290	15	0.286	61	0.401
-74	0.285	-28	0.285	16	0.218	62	0.401
-73	0.300	-27	0.274	17	0.151	63	0.398
-72	0.314	-26	0.257	18	0.087	64	0.394
-71	0.327	-25	0.233	19	0.027	65	0.389
-70	0.340	-24	0.204	20	0.030	66	0.381
-69	0.352	-23	0.169	21	0.081	67	0.373
-68	0.363	-22	0.128	22	0.128	68	0.363
-67	0.373	-21	0.081	23	0.169	69	0.352
-66	0.381	-20	0.030	24	0.204	70	0.340
-65	0.389	-19	0.027	25	0.233	71	0.327
-64	0.394	-18	0.087	26	0.257	72	0.314
-63	0.398	-17	0.151	27	0.274	73	0.300
-62	0.401	-16	0.218	28	0.285	74	0.285
-61	0.401	-15	0.286	29	0.290	75	0.269
-60	0.400	-14	0.356	30	0.290	76	0.253
-59	0.397	-13	0.427	31	0.285	77	0.237
-58	0.391	-12	0.497	32	0.274	78	0.220
-57	0.383	-11	0.565	33	0.259	79	0.203
-56	0.373	-10	0.631	34	0.240	80	0.186
-55	0.361	-9	0.695	35	0.217	81	0.168
-54	0.346	-8	0.754	36	0.191	82	0.150
-53	0.328	-7	0.808	37	0.162	83	0.132
-52	0.309	-6	0.857	38	0.131	84	0.114
-51	0.287	-5	0.899	39	0.098	85	0.096
-50	0.263	-4	0.935	40	0.063	86	0.078
-49	0.236	-3	0.963	41	0.028	87	0.059
-48	0.208	-2	0.983	42	0.007	88	0.040
-47	0.177	-1	0.996	43	0.043	89	0.021
-46	0.146	0	1.000	44	0.078	90	0.000
-45	0.112			45	0.112		

VALIDATION OF TOTAL POWER GAIN CALCULATION

WBQE MILBRIDGE, ME.

MODEL 6810-3R-DA

Elevation Gain of Antenna

1.55

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

H RMS

0.730225

V RMS

0.701687

H/V Ratio

1.041

Elevation Gain of Horizontal Component

1.613

Elevation Gain of Vertical Component

1.489

Horizontal Azimuth Gain equals $1/(\text{RMS})^2$.

1.875

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

1.768

Max. Vertical

0.933

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

Total Horizontal Power Gain =

3.025

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

Total Vertical Power Gain =

2.633

ERP divided by Horizontal Power Gain equals Antenna Input Power

27

kW ERP

Divided by H Gain

3.025

equals

8.925

kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

8.925 kW

Times V Gain

2.633

equals

23.503 kW V ERP

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

 $(0.933)^2$ Times 27.00 Equals 23.503 kW Vertical ERP

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