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S.O. 35344

Report of Test 6810-3R-SS(0.9)-DA

for

EDUCATIONAL MEDIA FOUNDATION

WVLO 99.3 MHz CRIDERSVILLE, OH.

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-3R-SS(0.9)-DA to meet the needs of WVLO and to comply with the requirements of the FCC construction permit, file number BPED-20170310AAM. 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 BPED-20170310AAM indicates that the Horizontal radiation component shall not exceed 4.5 kW at any azimuth and is restricted to the following values at the azimuths specified:

190-200 Degrees True: 0.910 kilowatts

From Figure 1A, the maximum radiation of the Horizontal component occurs at 269 Degrees True to 274 Degrees True. At the restricted azimuth of 190 - 200 Degrees True the Horizontal component is 7.96 dB down from the maximum of 4.5 kW, or 0.72 Kw.

The R.M.S. of the Horizontal component is 0.738. The total Horizontal power gain is 2.901. The R.M.S. of the Vertical component is 0.740. The total Vertical power gain is 2.860. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.904. The R.M.S. of the measured composite pattern is 0.795. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.768. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-3R-SS(0.9)-DA was mounted on a tower of precise scale to the 36-IN face tower at the WVLO 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 BPED-20170310AAM, a single level of the 6810-3R-SS(0.9)-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 446.85 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:

Angela Gillespie
Vice President, Shively Labs

S/O 35344
Date 3-16-18

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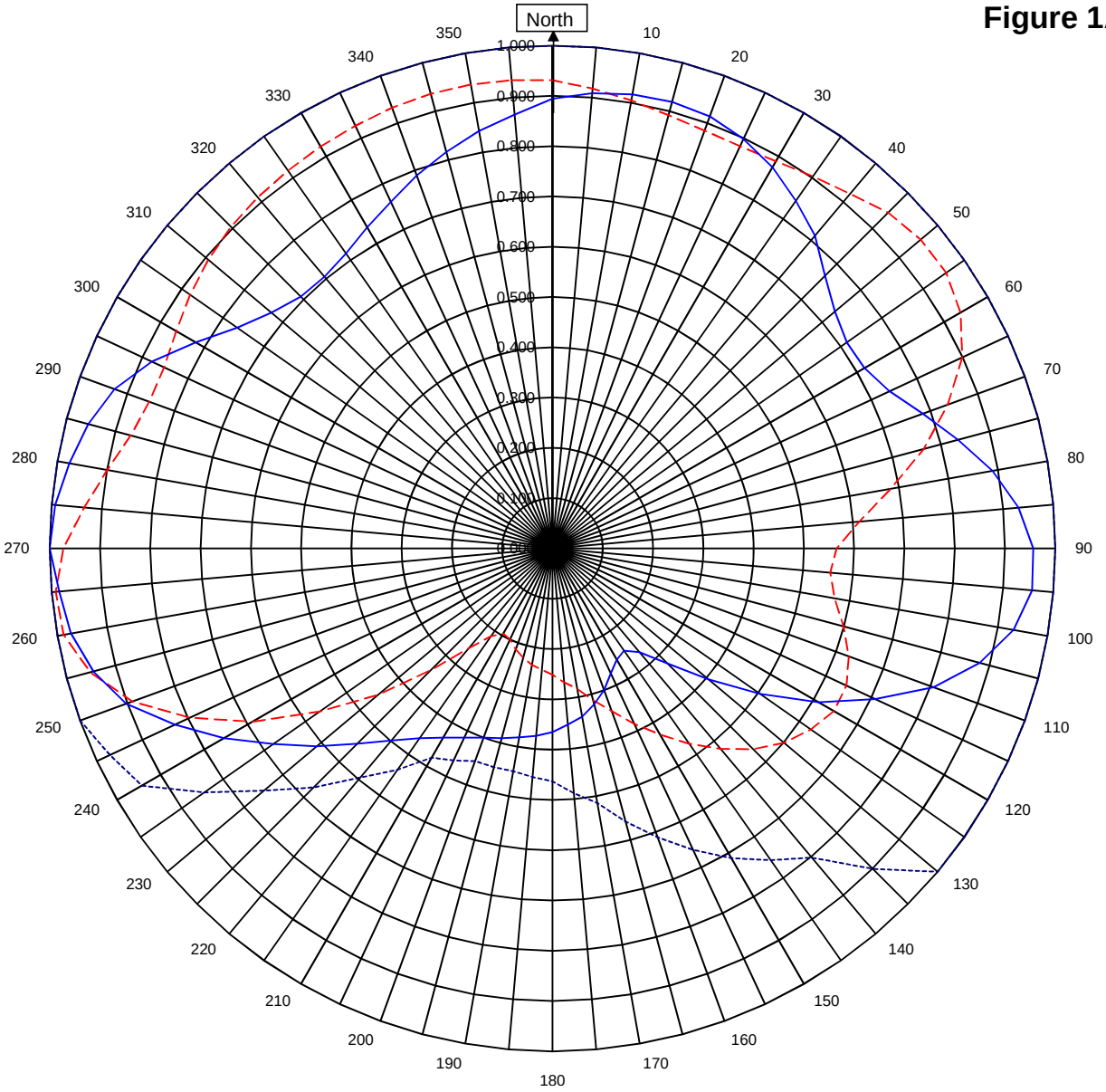
Figure 1A



WVLO CRIDERSVILLE, OH.

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March 15, 2018

Horizontal RMS	0.738
Vertical RMS	0.740
H/V Composite RMS	0.795
FCC Composite RMS	0.904

Frequency	99.3 / 446.85 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-3R-SS(0.9)-DA
Pattern Type	Directional Azimuth

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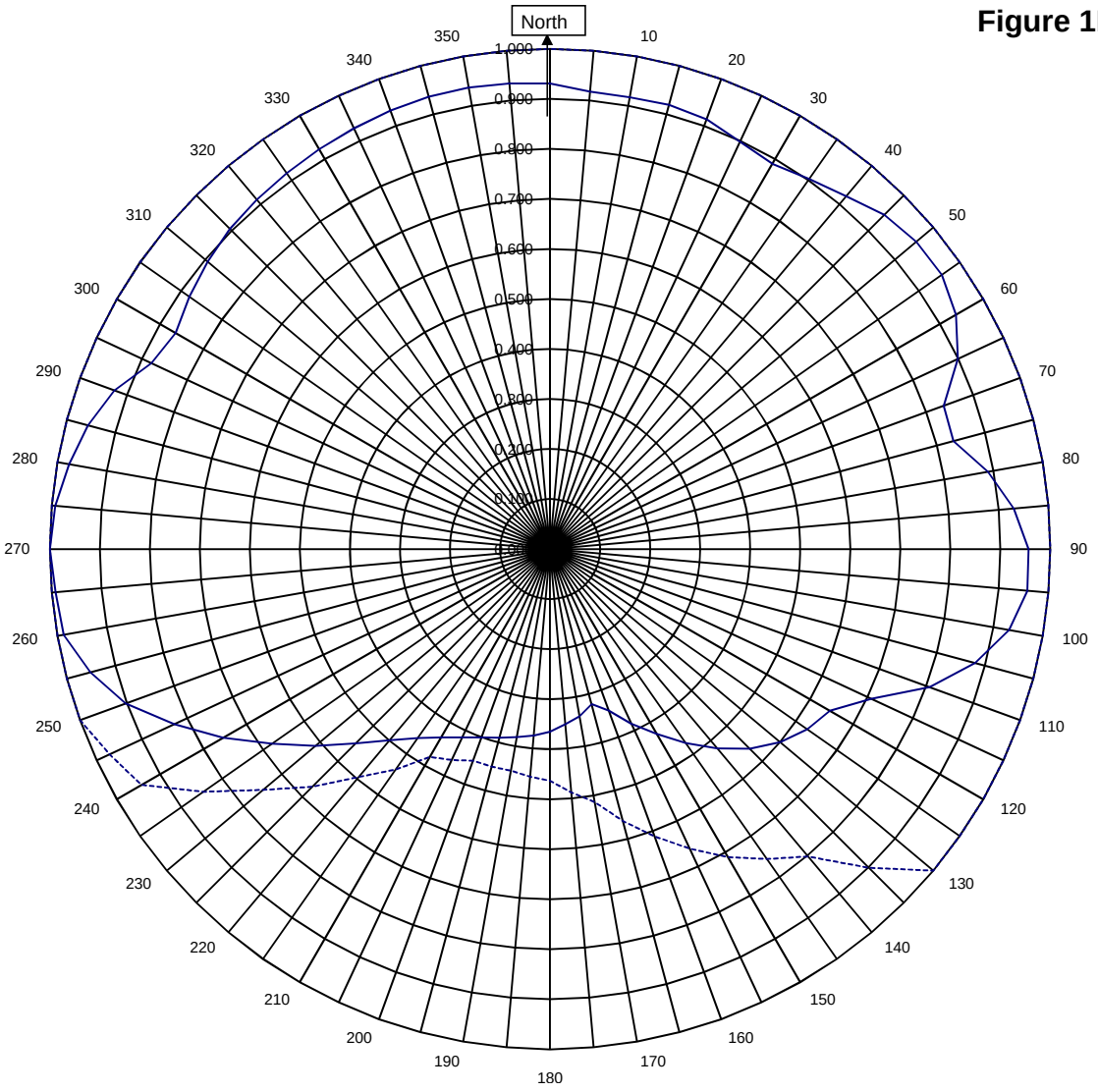
Figure 1B



WVLO CRIDERSVILLE, OH.

35344

March 15, 2018

_____H/VComposite RMS	0.795
……..FCC Composite RMS	0.904

Frequency	99.3 / 446.85 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-3R-SS(0.9)-DA
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WVLO CRIDERSVILLE, OH.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.894	180	0.365
10	0.917	190	0.381
20	0.914	200	0.400
30	0.875	210	0.435
40	0.812	220	0.499
45	0.767	225	0.549
50	0.733	230	0.612
60	0.717	240	0.755
70	0.784	250	0.903
80	0.889	260	0.973
90	0.956	270	1.000
100	0.932	280	0.976
110	0.807	290	0.927
120	0.612	300	0.820
130	0.405	310	0.730
135	0.323	315	0.708
140	0.269	320	0.706
150	0.256	330	0.737
160	0.300	340	0.789
170	0.340	350	0.843

Figure 1D

Tabulation of Vertical Azimuth Pattern
WVLO CRIDERSVILLE, OH.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.931	180	0.251
10	0.904	190	0.235
20	0.884	200	0.213
30	0.889	210	0.196
40	0.921	220	0.260
45	0.945	225	0.342
50	0.956	230	0.452
60	0.937	240	0.689
70	0.837	250	0.890
80	0.684	260	0.987
90	0.565	270	0.973
100	0.570	280	0.899
110	0.627	290	0.854
120	0.646	300	0.864
130	0.601	310	0.893
135	0.564	315	0.905
140	0.520	320	0.912
150	0.427	330	0.923
160	0.344	340	0.933
170	0.284	350	0.937

Figure 1E

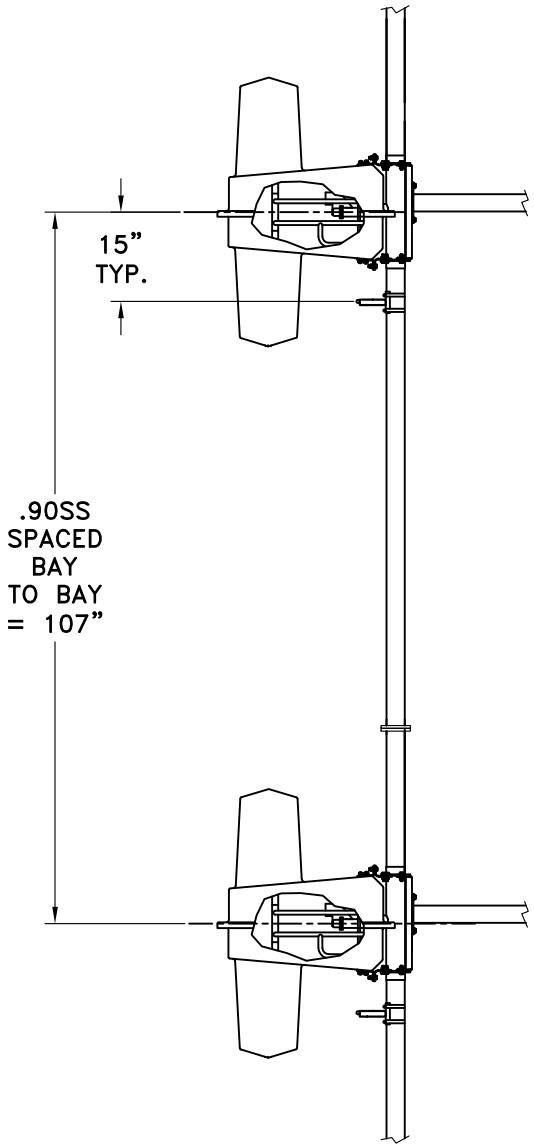
Tabulation of Composite Azimuth Pattern
WVLO CRIDERSVILLE, OH.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.931	180	0.365
10	0.917	190	0.381
20	0.914	200	0.400
30	0.889	210	0.435
40	0.921	220	0.499
45	0.945	225	0.549
50	0.956	230	0.612
60	0.937	240	0.755
70	0.837	250	0.903
80	0.889	260	0.987
90	0.956	270	1.000
100	0.932	280	0.976
110	0.807	290	0.927
120	0.646	300	0.864
130	0.601	310	0.893
135	0.564	315	0.905
140	0.520	320	0.912
150	0.427	330	0.923
160	0.344	340	0.933
170	0.340	350	0.937

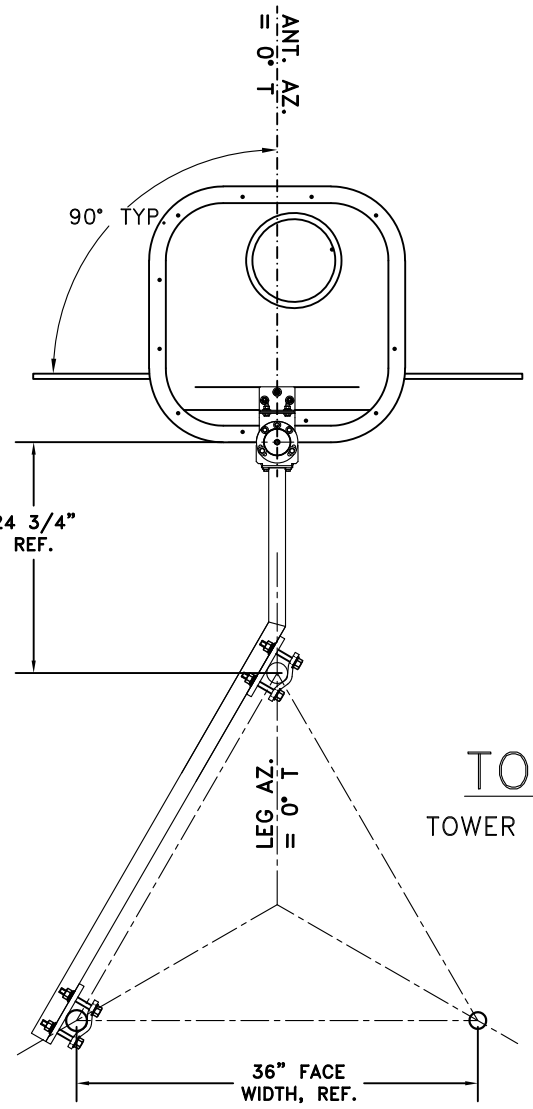
Figure 1F

Tabulation of FCC Directional Composite
WVLO CRIDERSVILLE, OH.

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.463
10	1.000	190	0.450
20	1.000	200	0.450
30	1.000	210	0.480
40	1.000	220	0.595
50	1.000	230	0.749
60	1.000	240	0.943
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	1.000
130	1.000	310	1.000
140	0.802	320	1.000
150	0.711	330	1.000
160	0.611	340	1.000
170	0.514	350	1.000

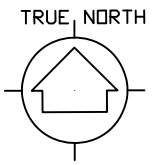


SIDE VIEW



TOP VIEW

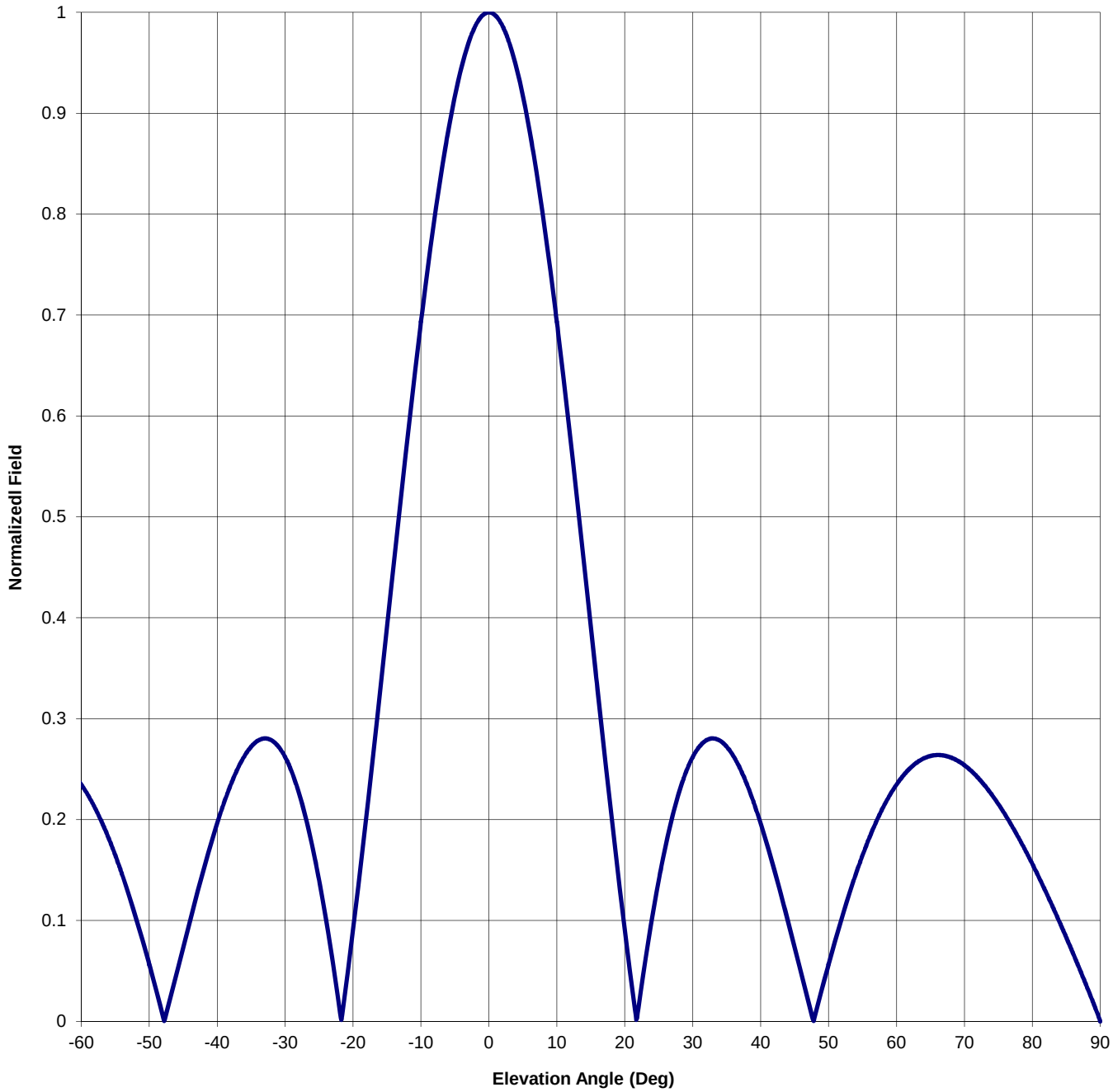
TOWER MAKE: 36" FACE



ANTENNA HEADING 0° TRUE NORTH

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 35344	FREQUENCY: 99.3	SCALE: N.T.S.	DRAWN BY: ASP APPROVED BY: DAB
TITLE: MODEL-6810-3R-.90SS-DIRECTIONAL ANTENNA			
DATE: 3-14-18	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date:**	**3/16/2018**
Antenna Type:	**6810-3R-SS(0.9)-DA**				
Station:	**WVLO**	**Beam Tilt**	**0**		
Frequency:	**99.3**	**Gain (Max)**	**2.901**	**4.625**	**dB**
Channel #:	**257**	**Gain (Horizon)**	**2.901**	**4.625**	**dB**
Figure:	**Figure 3**				



Antenna Mfg.: Shively Labs **Date:** 3/16/2018

Antenna Type: 6810-3R-SS(0.9)-DA

Station: WVLO **Beam Tilt** 0

Frequency: 99.3 **Gain (Max)** 2.901 4.625 dB

Channel #: 257 **Gain (Horizon)** 2.901 4.625 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	0.100	0	1.000	46	0.047
-89	0.018	-43	0.126	1	0.997	47	0.021
-88	0.035	-42	0.151	2	0.986	48	0.006
-87	0.051	-41	0.174	3	0.970	49	0.031
-86	0.067	-40	0.196	4	0.947	50	0.057
-85	0.083	-39	0.217	5	0.917	51	0.081
-84	0.098	-38	0.235	6	0.882	52	0.104
-83	0.114	-37	0.250	7	0.842	53	0.125
-82	0.128	-36	0.263	8	0.796	54	0.146
-81	0.142	-35	0.272	9	0.747	55	0.165
-80	0.156	-34	0.278	10	0.693	56	0.182
-79	0.169	-33	0.280	11	0.637	57	0.198
-78	0.182	-32	0.279	12	0.577	58	0.212
-77	0.194	-31	0.273	13	0.516	59	0.224
-76	0.205	-30	0.262	14	0.454	60	0.235
-75	0.215	-29	0.247	15	0.391	61	0.244
-74	0.225	-28	0.227	16	0.328	62	0.251
-73	0.234	-27	0.203	17	0.266	63	0.257
-72	0.242	-26	0.174	18	0.206	64	0.261
-71	0.248	-25	0.140	19	0.147	65	0.263
-70	0.254	-24	0.102	20	0.091	66	0.264
-69	0.258	-23	0.059	21	0.037	67	0.264
-68	0.262	-22	0.013	22	0.013	68	0.262
-67	0.264	-21	0.037	23	0.059	69	0.258
-66	0.264	-20	0.091	24	0.102	70	0.254
-65	0.263	-19	0.147	25	0.140	71	0.248
-64	0.261	-18	0.206	26	0.174	72	0.242
-63	0.257	-17	0.266	27	0.203	73	0.234
-62	0.251	-16	0.328	28	0.227	74	0.225
-61	0.244	-15	0.391	29	0.247	75	0.215
-60	0.235	-14	0.454	30	0.262	76	0.205
-59	0.224	-13	0.516	31	0.273	77	0.194
-58	0.212	-12	0.577	32	0.279	78	0.182
-57	0.198	-11	0.637	33	0.280	79	0.169
-56	0.182	-10	0.693	34	0.278	80	0.156
-55	0.165	-9	0.747	35	0.272	81	0.142
-54	0.146	-8	0.796	36	0.263	82	0.128
-53	0.125	-7	0.842	37	0.250	83	0.114
-52	0.104	-6	0.882	38	0.235	84	0.098
-51	0.081	-5	0.917	39	0.217	85	0.083
-50	0.057	-4	0.947	40	0.196	86	0.067
-49	0.031	-3	0.970	41	0.174	87	0.051
-48	0.006	-2	0.986	42	0.151	88	0.035
-47	0.021	-1	0.997	43	0.126	89	0.018
-46	0.047	0	1.000	44	0.100	90	0.000
-45	0.074			45	0.074		

S.O. 35344 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WVLO CRIDERSVILLE, OH.

MODEL 6810-3R-SS(0.9)-DA

Elevation Gain of Antenna 1.584

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

H RMS 0.738036 V RMS 0.739865 H/V Ratio 0.998

Elevation Gain of Horizontal Component 1.580

Elevation Gain of Vertical Component 1.588

Horizontal Azimuth Gain equals $1/(RMS)^2$. 1.836

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 1.801

Max. Vertical 0.993

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

Total Horizontal Power Gain = **2.901**

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

Total Vertical Power Gain = **2.860**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

4.5 kW ERP Divided by H Gain 2.901 equals 1.551 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

1.551 kW Times V Gain 2.860 equals 4.437 kW V ERP

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

(0.993)^2 Times 4.50 Equals 4.437 kW Vertical ERP

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