

S.O. 27589

Report of Test 6810-3-DA

for

KAYSER BROADCAST MINISTRIES, INC.

WXMF 91.9 MHz Marion, OH

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-3-DA to meet the needs of WXMF and to comply with the requirements of the FCC construction permit, file number BMPED-20090903ACV.

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 BMPED-20090903ACV indicates that the Horizontal radiation component shall not exceed 6.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

20 to 80 Degrees T: 0.694 kW

230 Degrees T: 4.871 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 180 Degrees T to 200 Degrees T and at 275 Degrees T to 280 Degrees T. At the restricted azimuth of 20 to 80 Degrees T the Horizontal component is 10.84 dB down from the maximum of 6.0 kW, or 0.494 kW. At the restricted azimuth of 230 Degrees T the Vertical component is 0.92 dB down from the maximum of 6.0 kW, or 4.849 kW.

The R.M.S. of the Horizontal component is 0.696. The total Horizontal power gain is 3.261. The R.M.S. of the Vertical component is 0.683. The total Vertical power gain is 3.228. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.729. The R.M.S. of the measured composite pattern is 0.715. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.620. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-3-DA was mounted on a tower of precise scale to the 72" face tower at the WXMF 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 BMPED-20090903ACV, a single level of the 6810-3-DA was set up on the Howell Laboratories scale model antenna pattern measuring range. A scale of 4.5:1 was used.

SUPERVISION:

Mr. Surette was graduated from Lowell Technological Institute, Lowell, Massachusetts in 1973 with the degree of Bachelor of Science in Electrical Engineering. He has been directly involved with design and development of broadcast antennas, filter systems and RF transmission components since 1974, as an RF Engineer for six years with the original Shively Labs in Raymond, ME and for a short period of time with Dielectric Communications. He is currently an Associate Member of the AFCCE and a Senior Member of IEEE. He has authored a chapter on filters and combining systems for the latest edition of the CRC Electronics Handbook and for the 9th and 10th Editions of the NAB Handbook.

EQUIPMENT:

The 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 8753 Network Analyzer

PC Based Controller

Hewlett Packard 7550A Graphics Plotter

The test equipment is calibrated to ANSI/NCSL Z540-1-1994.

TEST PROCEDURES:

The corner reflector is mounted so that the horizontal and vertical azimuth patterns are measured independently by rotating the corner reflector by 90 degrees. The network analyzer was set to 413.55 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:

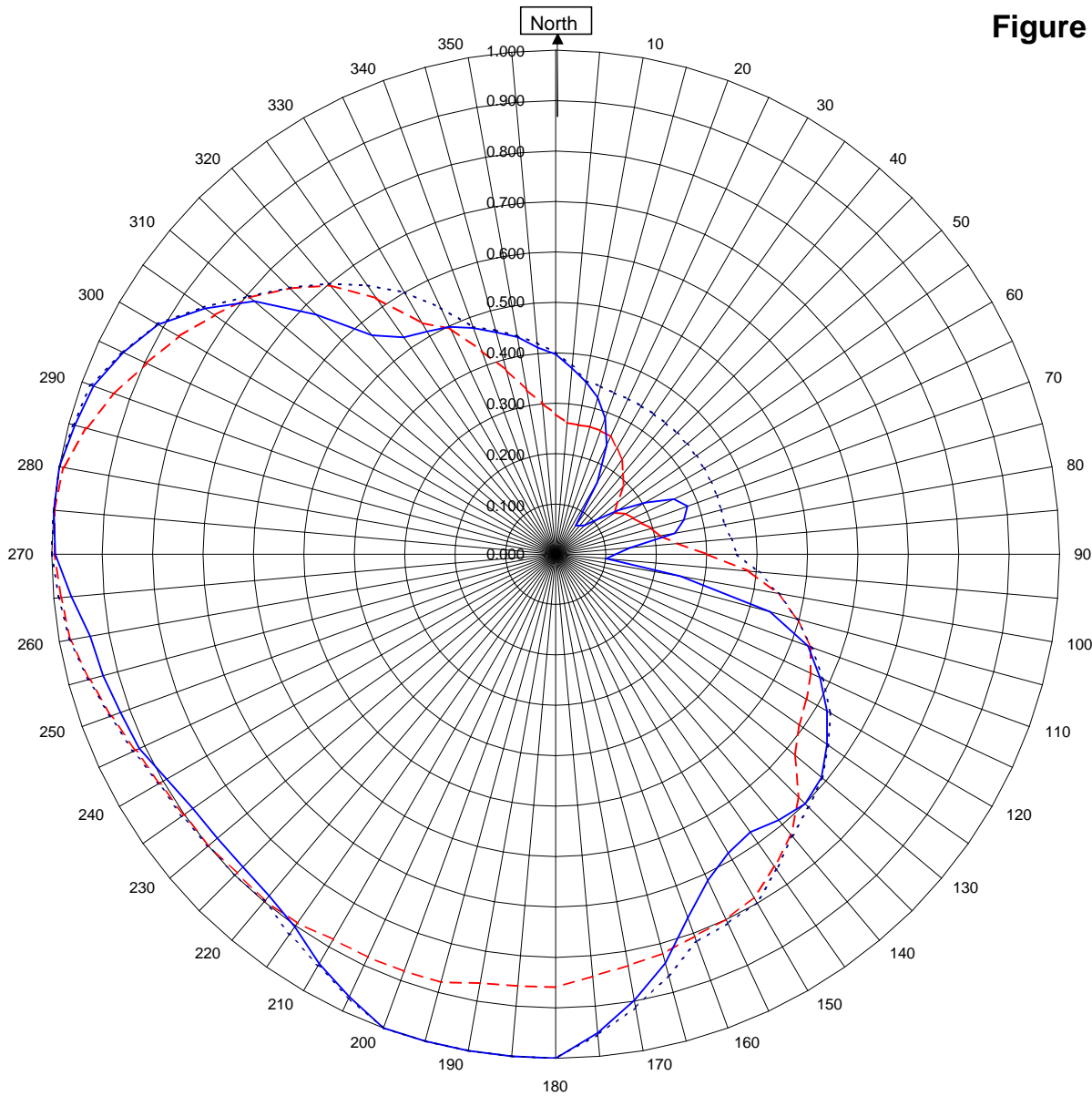


Robert A. Surette
Director of Sales Engineering
S/O 27589
September 4, 2009

Shively Labs

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

Figure 1a



WXMF Marion, OH

27589
July 2, 2009

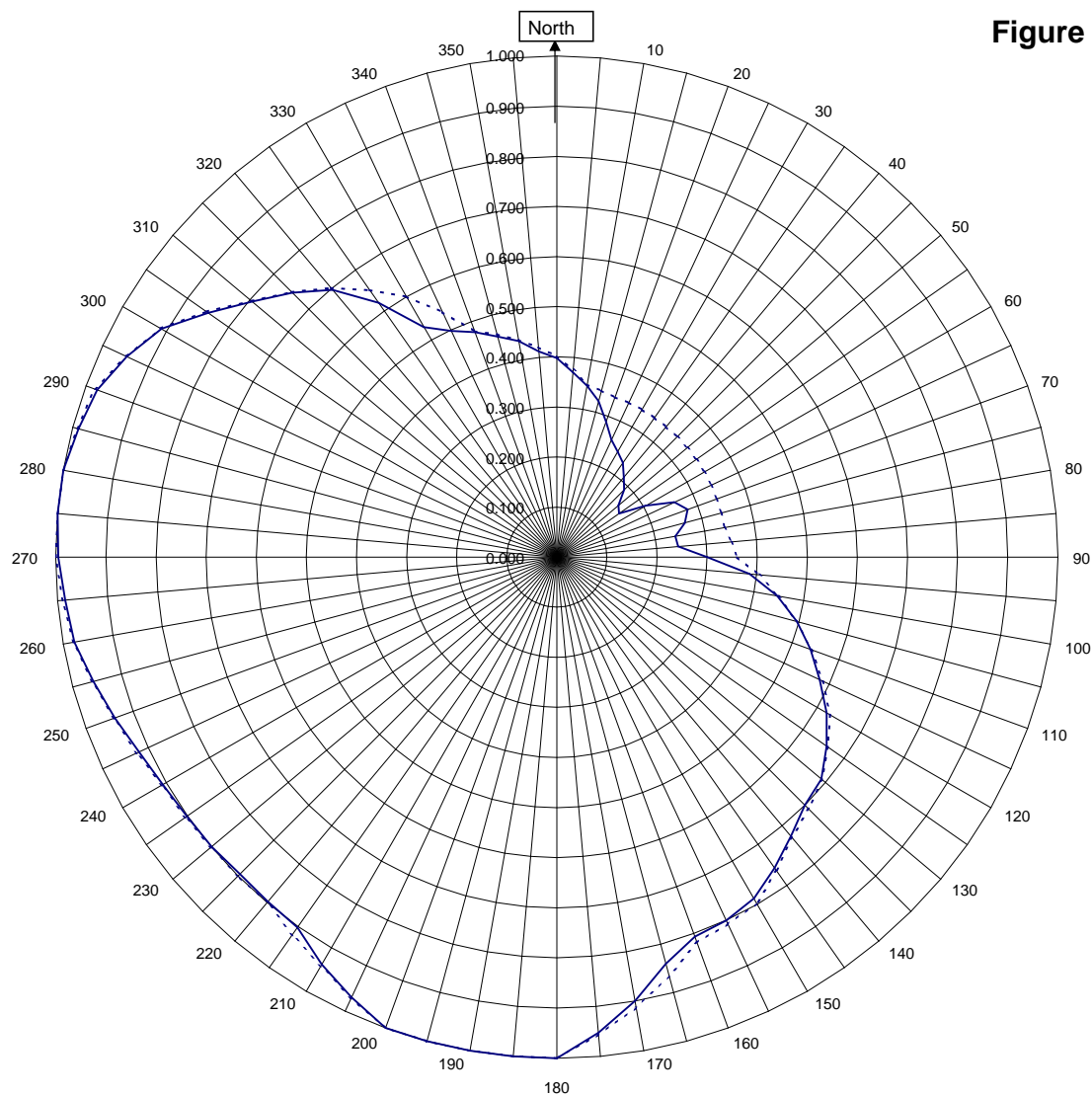
Horizontal RMS	0.696	Frequency	91.9 / 413.55 MHz
Vertical RMS	0.683	Plot	Relative Field
H/V Composite RMS	0.715	Scale	4.5 : 1
FCC Composite RMS	0.729	See Figure 2 for Mechanical Details	

Antenna Model	6810-3-DA
Pattern Type	Directional Azimuth

Shively Labs

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

Figure 1b



WXMF Marion, OH

27589
July 2, 2009

—————H/V Composite RMS	0.715
.....FCC Composite RMS	0.729

Frequency	91.9 / 413.55 MHz
Plot	Relative Field
Scale	4.5 : 1
See Figure 2 for Mechanical Details	

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

Figure 1c

Tabulation of Horizontal Azimuth Pattern
WXMF Marion, OH

Azimuth	Rel Field	Azimuth	Rel Field
0	0.397	180	1.000
10	0.347	190	1.000
20	0.287	200	1.000
30	0.165	210	0.938
40	0.074	220	0.885
45	0.081	225	0.878
50	0.106	230	0.876
60	0.205	240	0.891
70	0.278	250	0.919
80	0.240	260	0.938
90	0.119	270	0.993
100	0.251	280	1.000
110	0.533	290	0.976
120	0.622	300	0.911
130	0.689	310	0.781
135	0.700	315	0.672
140	0.688	320	0.567
150	0.685	330	0.510
160	0.767	340	0.478
170	0.899	350	0.438

Figure 1d

Tabulation of Vertical Azimuth Pattern
WXMF Marion, OH

Azimuth	Rel Field	Azimuth	Rel Field
0	0.278	180	0.859
10	0.260	190	0.864
20	0.261	200	0.880
30	0.243	210	0.882
40	0.208	220	0.897
45	0.190	225	0.894
50	0.161	230	0.899
60	0.161	240	0.908
70	0.181	250	0.939
80	0.210	260	0.978
90	0.300	270	0.995
100	0.447	280	0.992
110	0.539	290	0.932
120	0.575	300	0.864
130	0.620	310	0.793
135	0.682	315	0.746
140	0.727	320	0.696
150	0.786	330	0.530
160	0.806	340	0.430
170	0.829	350	0.332

Figure 1e

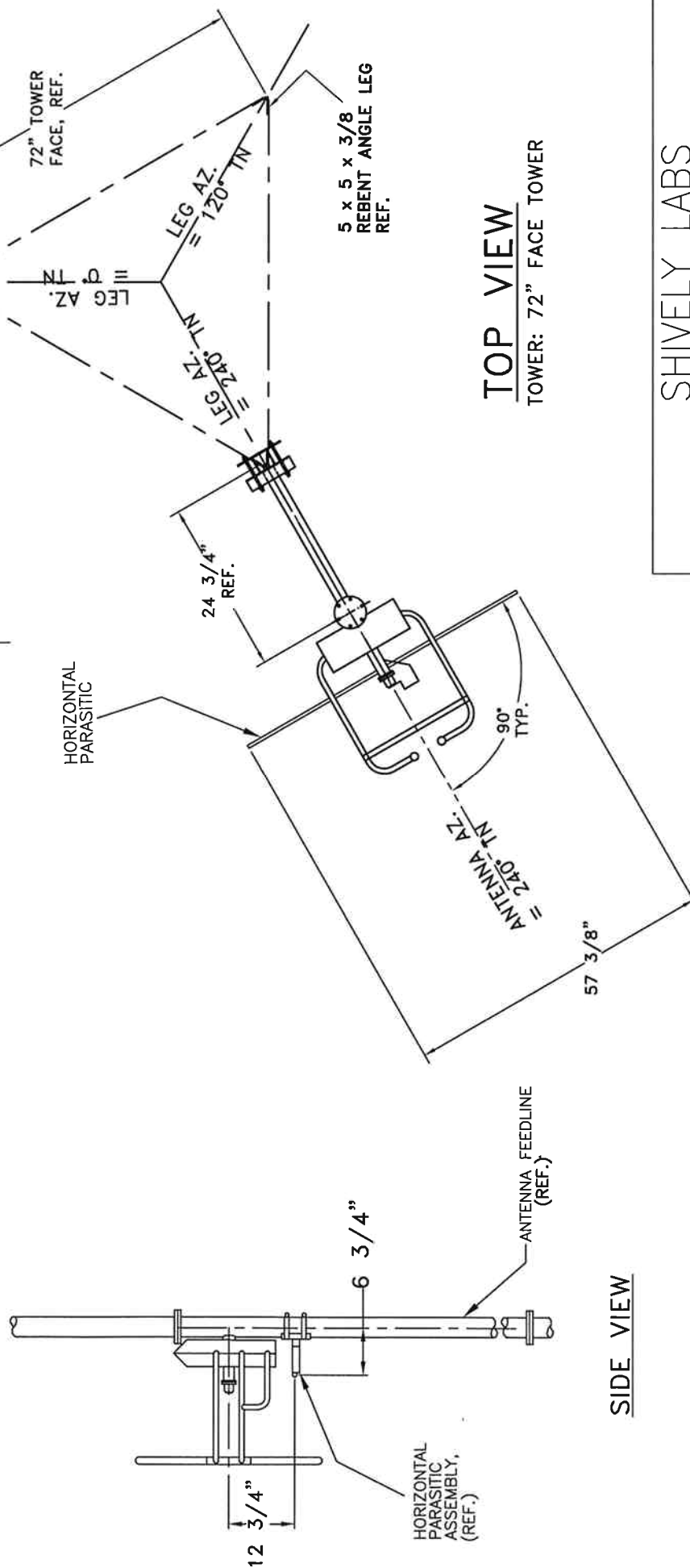
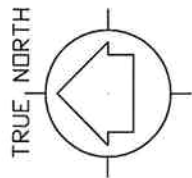
Tabulation of Composite Azimuth Pattern
WXMF Marion, OH

Azimuth	Rel Field	Azimuth	Rel Field
0	0.397	180	1.000
10	0.347	190	1.000
20	0.287	200	1.000
30	0.243	210	0.938
40	0.208	220	0.897
45	0.190	225	0.894
50	0.161	230	0.899
60	0.205	240	0.908
70	0.278	250	0.939
80	0.240	260	0.978
90	0.300	270	0.995
100	0.447	280	1.000
110	0.539	290	0.976
120	0.622	300	0.911
130	0.689	310	0.793
135	0.700	315	0.746
140	0.727	320	0.696
150	0.786	330	0.530
160	0.806	340	0.478
170	0.899	350	0.438

Figure 1f

Tabulation of FCC Directional Composite
WXMF Marion, OH

Azimuth	Rel Field	Azimuth	Rel Field
0	0.401	180	1.000
10	0.349	190	1.000
20	0.340	200	1.000
30	0.340	210	0.942
40	0.340	220	0.899
50	0.340	230	0.901
60	0.340	240	0.910
70	0.340	250	0.941
80	0.340	260	0.980
90	0.360	270	1.000
100	0.449	280	1.000
110	0.541	290	0.982
120	0.630	300	0.913
130	0.691	310	0.795
140	0.730	320	0.701
150	0.798	330	0.600
160	0.818	340	0.480
170	0.913	350	0.440



TOP VIEW

TOWER: 72" FACE TOWER

SIDE VIEW

SHIVELY LABS			
A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE			
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY:
27589	91.9 MHZ.	N.T.S.	ASP
TITLE:			APPROVED BY:
MODEL-6810-3-DIRECTIONAL ANTENNA			DAB
DATE:			
6/29/09			

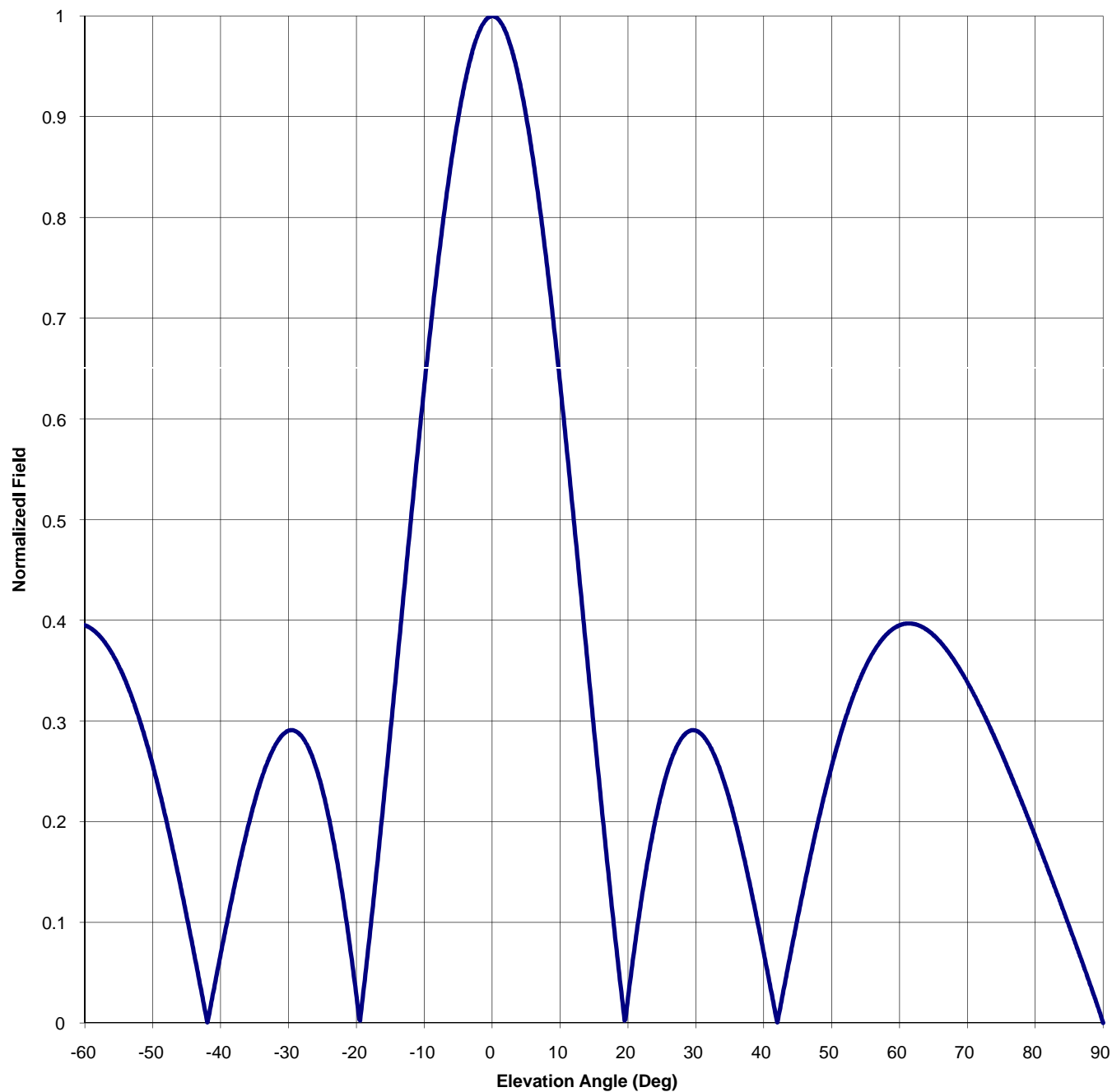
ANTENNA HEADING 240° TRUE NORTH

FIGURE 2

Antenna Mfg.: Shively Labs
Antenna Type: 6810-3-DA
Station: WXMf
Frequency: 91.9
Channel #: 220
Figure: 3

Date: 7/2/2009

Beam Tilt	0	
Gain (Max)	3.261	5.133 dB
Gain (Horizon)	3.261	5.133 dB



Antenna Mfg.: Shively Labs

Date: 7/2/2009

Antenna Type: 6810-3-DA

Station: WXMF

Beam Tilt 0

Frequency: 91.9

Gain (Max) 3.261

5.133 dB

Channel #: 220

Gain (Horizon) 3.261

5.133 dB

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	0.138
-89	0.021	-43	0.036	1	0.996	47	0.170
-88	0.040	-42	0.001	2	0.984	48	0.200
-87	0.059	-41	0.035	3	0.963	49	0.228
-86	0.078	-40	0.069	4	0.935	50	0.255
-85	0.096	-39	0.103	5	0.900	51	0.279
-84	0.114	-38	0.136	6	0.858	52	0.301
-83	0.132	-37	0.166	7	0.809	53	0.321
-82	0.150	-36	0.195	8	0.755	54	0.339
-81	0.168	-35	0.220	9	0.697	55	0.354
-80	0.185	-34	0.243	10	0.634	56	0.367
-79	0.203	-33	0.261	11	0.568	57	0.377
-78	0.220	-32	0.276	12	0.500	58	0.385
-77	0.236	-31	0.285	13	0.430	59	0.391
-76	0.252	-30	0.290	14	0.360	60	0.395
-75	0.268	-29	0.290	15	0.290	61	0.397
-74	0.284	-28	0.284	16	0.222	62	0.396
-73	0.298	-27	0.272	17	0.155	63	0.394
-72	0.312	-26	0.254	18	0.091	64	0.391
-71	0.326	-25	0.230	19	0.031	65	0.385
-70	0.338	-24	0.201	20	0.025	66	0.378
-69	0.350	-23	0.165	21	0.077	67	0.370
-68	0.361	-22	0.124	22	0.124	68	0.361
-67	0.370	-21	0.077	23	0.165	69	0.350
-66	0.378	-20	0.025	24	0.201	70	0.338
-65	0.385	-19	0.031	25	0.230	71	0.326
-64	0.391	-18	0.091	26	0.254	72	0.312
-63	0.394	-17	0.155	27	0.272	73	0.298
-62	0.396	-16	0.222	28	0.284	74	0.284
-61	0.397	-15	0.290	29	0.290	75	0.268
-60	0.395	-14	0.360	30	0.290	76	0.252
-59	0.391	-13	0.430	31	0.285	77	0.236
-58	0.385	-12	0.500	32	0.276	78	0.220
-57	0.377	-11	0.568	33	0.261	79	0.203
-56	0.367	-10	0.634	34	0.243	80	0.185
-55	0.354	-9	0.697	35	0.220	81	0.168
-54	0.339	-8	0.755	36	0.195	82	0.150
-53	0.321	-7	0.809	37	0.166	83	0.132
-52	0.301	-6	0.858	38	0.136	84	0.114
-51	0.279	-5	0.900	39	0.103	85	0.096
-50	0.255	-4	0.935	40	0.069	86	0.078
-49	0.228	-3	0.963	41	0.035	87	0.059
-48	0.200	-2	0.984	42	0.001	88	0.040
-47	0.170	-1	0.996	43	0.036	89	0.021
-46	0.138	0	1.000	44	0.071	90	0.000
-45	0.105			45	0.105		

S.O. 27589

Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WXMF 91.9 MHz Marion, OH

Model 6810-3-DA

Elevation Gain of Antenna

1.55

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

H RMS 0.696

V RMS 0.683

H/V Ratio 1.019

Elevation Gain of Horizontal Component 1.580

Elevation Gain of Vertical Component 1.521

Horizontal Azimuth Gain equals $1/(\text{RMS})^2$. 2.064

Vertical Azimuth Gain equals $1/(\text{RMS}/\text{Max Vert})^2$. 2.122

Max. Vertical 0.995

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

Total Horizontal Power Gain = 3.261

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

Total Vertical Power Gain = 3.228

ERP divided by Horizontal Power Gain equals Antenna Input Power

6

kW ERP

Divided by H Gain

3.261

equals

1.84

kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

1.84

kW

Times V Gain

3.228

equals

5.94

kW V ERP

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

$(0.995)^2$ Times 6.00 Equals 5.94 kW Vertical ERP

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



FOX SURVEYING COMPANY

106 S. Elm Street
P.O. Box 133

Prospect, Ohio 43342

Phone (740) 494-2028
Fax (740) 494-2730

September 23, 2009

CERTIFICATION OF SURVEYOR

Re: WXMF 91.9 Mhz. Marion, Ohio
FCC Construction Permit No. BMPED-20090903ACV

This is to certify that WXMF's 91.9 Mhz antenna (Shively Labs Model-6810-3-DA) was oriented to the manufacturer's specifications, on an azimuth of 240 degrees, from North as specified in the materials provided by Shively, the manufacturer, dated September 4, 2009. I also certify the height of the radiation center above ground level of this antenna is 82 meters (269.0 ft.) based on my measurements.



Steven A. Fox, Ohio Professional Surveyor 7000

Date of Certification



15905 W. 4B Road
Plymouth, IN 46563
574-936-7211

SEPTEMBER 28, 2009

WXMF RADIO 91.9 MHZ

MARION OHIO

RE: CERTIFICATION OF ANTENNA INSTALLATION

TOWERS FOR JESUS INC. DID INSTALL ONE FM ANTENNA. MANUFACTURED BY SHIVELY LABS MODEL-6810-3-DA AS INSTRUCTED AND PLACED ON AN AZIMUTH OF 240 DEGREES AND AT THE ELEVATION OF 82 METERS.

SINCERELY,

JIM HULSE

TOWERS FOR JESUS

Matthew 19:26 with man this is impossible,
But with God all things are possible