

# Shively Labs

a division of **Howell Laboratories, Inc.**

- An Employee-Owned Company -

P. O. Box 389 Harrison Rd.,  
Bridgton, Maine 04009 USA

(207) 647-3327  
888-SHIVELY

Fax: (207) 647-8273

E-mail: [sales@shively.com](mailto:sales@shively.com)

Web site: [www.shively.com](http://www.shively.com)

**S.O. 27802**

**Report of Test 6810-3-(0.73)SS-DA**

**for**

**GEORGIA EAGLE BROADCASTING, INC.**

**WDXQ-FM 107.5 MHz Cochran, GA**

## **OBJECTIVE:**

The objective of this test was to demonstrate the directional characteristics of a 6810-3-(0.73)SS-DA to meet the needs of WDXQ-FM and to comply with the requirements of the FCC construction permit, file number BPH-20090417AJP.

## **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-20090417AJP indicates that the Horizontal radiation component shall not exceed 4.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

260 - 270 Degrees T: 1.50 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 340 Degrees T to 351 Degrees T. At the restricted azimuth of 260 - 270 Degrees T the Vertical component is 4.45 dB down from the maximum of 4.0 kW, or 1.44 kW. At the restricted azimuth of 260-270 Degrees, the Horizontal component does not exceed the Vertical component and thus meets the restriction requirement.

The R.M.S. of the Horizontal component is 0.822. The total Horizontal power gain is 2.058. The R.M.S. of the Vertical component is 0.820. The total Vertical power gain is 1.908. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.946. The R.M.S. of the measured composite pattern is 0.838. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.804. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

#### **METHOD OF DIRECTIONALIZATION:**

One bay of the 6810-3-(0.73)SS-DA was mounted on a pole of precise scale to the 10-inch OD top-mounted pole at the WDXQ-FM site. The spacing of the antenna to the pole was varied and a vertical parasitic element was attached to the interbay feedline to achieve the vertical pattern shown in Figure 1A. The spacing of the antenna to the pole was varied 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-20090417AJP, a single level of the 6810-3-(0.73)SS-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 9<sup>th</sup> and 10<sup>th</sup> 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 483.75 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:



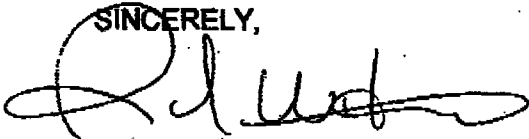
Robert A. Surette  
Director of Sales Engineering  
S/O 27802  
November 3, 2009

## **ENGINEER'S INSTALLATION AFFADAVIT**

RE: WDXQ-FM, COCHRAN, GA

I HEREBY CERTIFY THAT I HAVE PERSONALLY SUPERVISED THE INSTALLATION OF THE DIRECTIONAL ANTENNA AS SPECIFIED IN CONSTRUCTION PERMIT BPH-20090417AJP. THIS INSTALLATION WAS MADE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS AND THE TERMS SPECIFIED IN THE ABOVE REFERENCED CONSTRUCTION PERMIT TO THE BEST OF MY KNOWLEDGE, INFORMATION AND BELIEF. I HEREBY AFFIX MY NAME TO THIS DOCUMENT ON THE 14<sup>TH</sup> DAY OF JANUARY 2010.

SINCERELY,



RICHARD W. HAMILTON  
TECHNICAL CONSULTANT  
111 N. DAVIS DR.  
WARNER ROBINS, GA 31093  
(478) 922-2585 (VOICE)  
(478) 328-6768 (FAX)  
RHAMILTO@REC.MGACOXMAIL.COM

att: qualifications

GA EAGLE BROADCASTING, INC  
JANUARY 2010

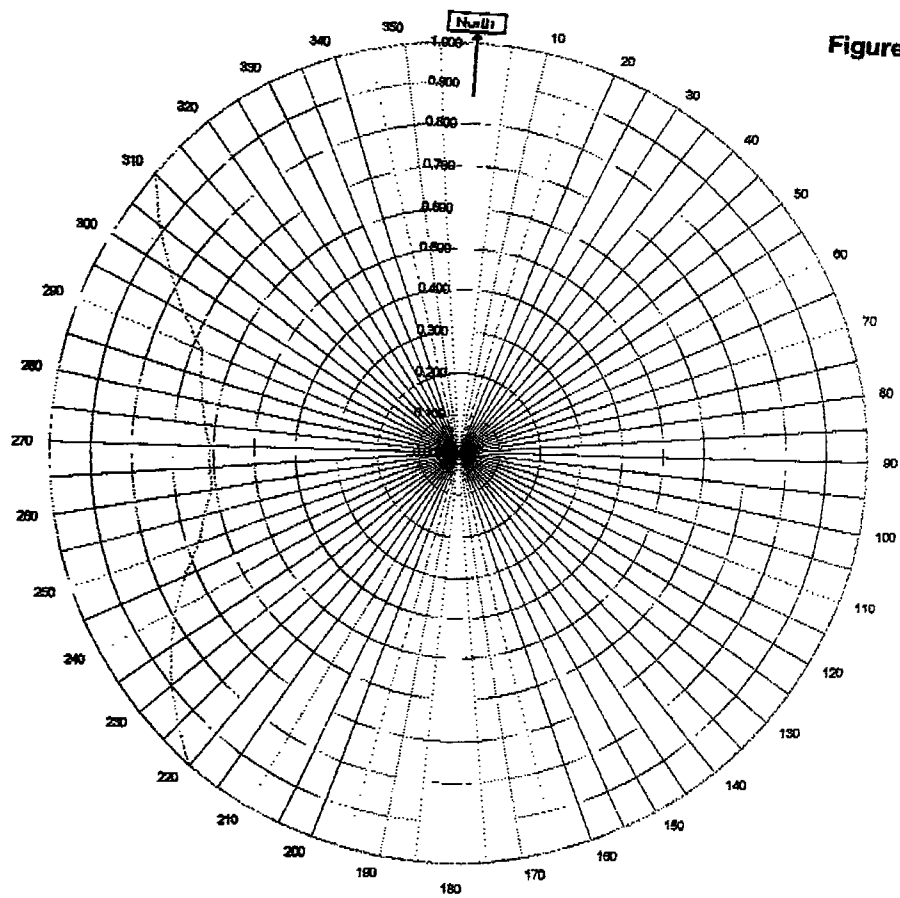


Figure 1a

# WDXQ-FM Cochran, GA

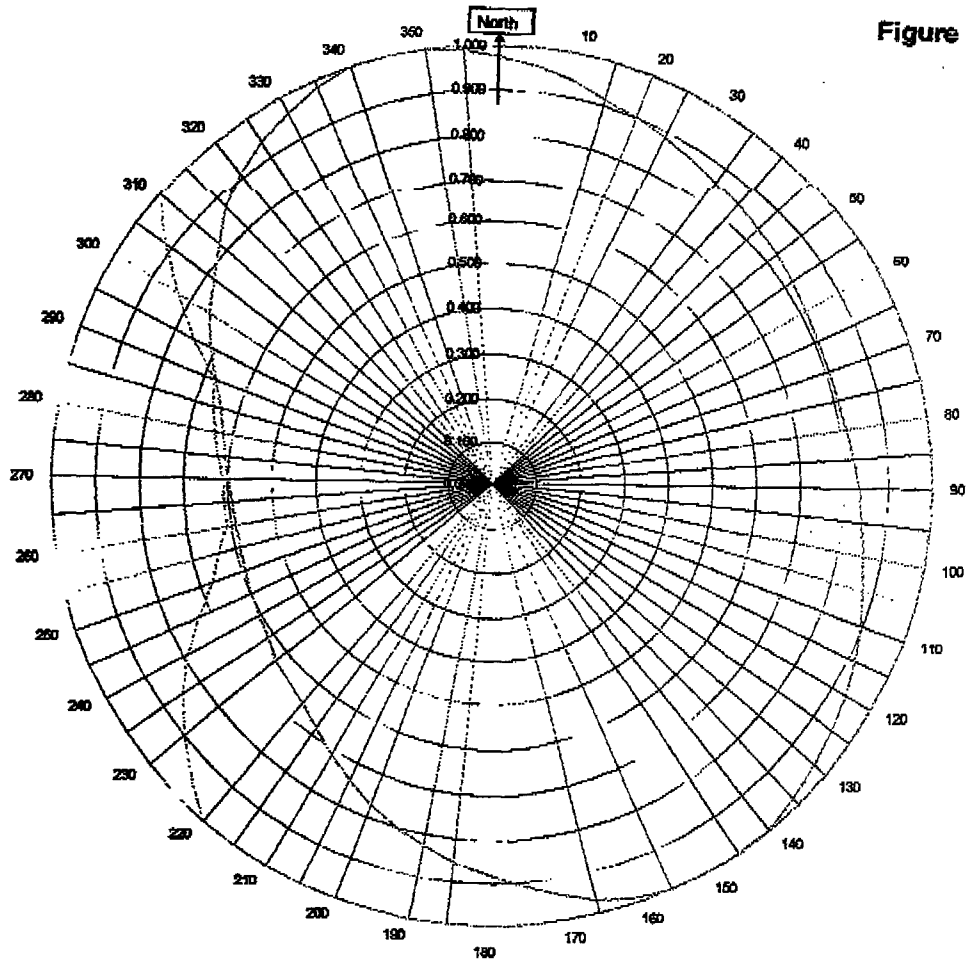
27802

November 3, 2009

	0.822	Frequency	107.5 / 483.75 MHz
HV Composite RMS	0.820	Plot	Relative Field
FCC Composite RMS	0.838	Scale	4.5 : 1
	0.946	See Figure 2 for Mechanical Details	

Antenna Model	6810-3-(0.73)SS-DA Patt 61-DD
Pattern Type	Directional Azimuth

Figure 1b



**WDXQ-FM Cochran, GA**

27802

November 3, 2009

	0.838	Frequency 107.5 / 483.75 mhz
FCC Composite RMS	0.946	Relative Field 4.5 : 1 See Figure 2 for Mechanical Details

Antenna Model	5810-3-(0.73)SS-DA Part 61-DD
Pattern Type	Directional H/V Composite

Figure 1c

Tabulation of Horizontal Azimuth Pattern 61-DD  
WDXQ-FM Cochran, GA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.974	180	0.878
10	0.938	190	0.825
20	0.873	200	0.771
30	0.819	210	0.711
40	0.784	220	0.653
45	0.770	225	0.625
50	0.764	230	0.597
60	0.758	240	0.554
70	0.766	250	0.571
80	0.782	260	0.572
90	0.803	270	0.557
100	0.821	280	0.611
110	0.855	290	0.671
120	0.909	300	0.749
130	0.966	310	0.822
135	0.982	315	0.871
140	0.997	320	0.909
150	1.000	330	0.962
160	0.989	340	1.000
170	0.937	350	1.000

Figure 1C - Addendum

Tabulation of Horizontal Azimuth Pattern  
WDXQ-FM Cochran, GA  
Additional Relative Field Values for the Following Azimuths

Azimuth	Rel Field	Azimuth	Rel Field
141	1.000	148	1.000
142	1.000	149	1.000
143	1.000	151	1.000
144	1.000	152	1.000
145	1.000	153	1.000
146	1.000	154	1.000
147	1.000	155	1.000



Tabulation of Vertical Azimuth Pattern 61-DD  
WDXQ-FM Cochran, GA

Figure 1d

Azimuth	Rel Field	Azimuth	Rel Field
0	0.942	180	0.855
10	0.927	190	0.803
20	0.901	200	0.753
30	0.873	210	0.705
40	0.849	220	0.657
45	0.837	225	0.642
50	0.829	230	0.632
60	0.813	240	0.605
70	0.808	250	0.593
80	0.814	260	0.589
90	0.833	270	0.599
100	0.858	280	0.621
110	0.895	290	0.661
120	0.936	300	0.721
130	0.958	310	0.778
135	0.963	315	0.809
140	0.962	320	0.847
150	0.961	330	0.902
160	0.939	340	0.932
170	0.903	350	0.942

Tabulation of Composite Azimuth Pattern 61-DD  
WDXQ-FM Cochran, GA

Figure 1e

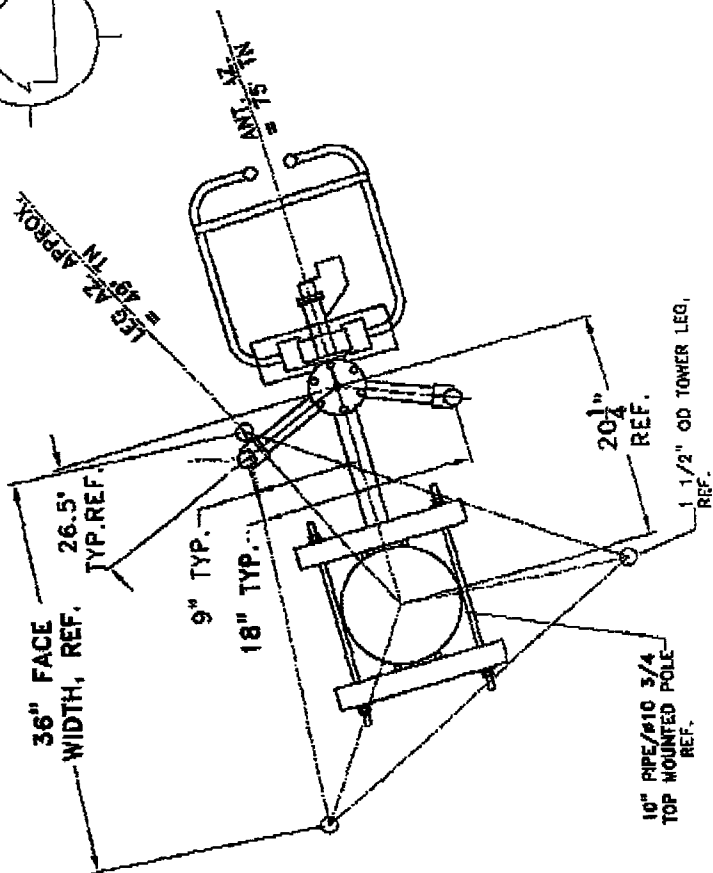
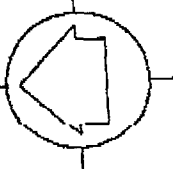
Azimuth	Rel Field	Azimuth	Rel Field
0	0.974	180	0.878
10	0.938	190	0.825
20	0.901	200	0.771
30	0.873	210	0.711
40	0.849	220	0.657
45	0.837	225	0.642
50	0.829	230	0.632
60	0.813	240	0.605
70	0.808	250	0.593
80	0.814	260	0.589
90	0.833	270	0.599
100	0.858	280	0.621
110	0.895	290	0.671
120	0.936	300	0.749
130	0.966	310	0.822
135	0.982	315	0.871
140	0.997	320	0.909
150	1.000	330	0.962
160	0.989	340	1.000
170	0.937	350	1.000

Figure 1f

Tabulation of FCC Directional Composite  
WDXQ-FM Cochran, GA

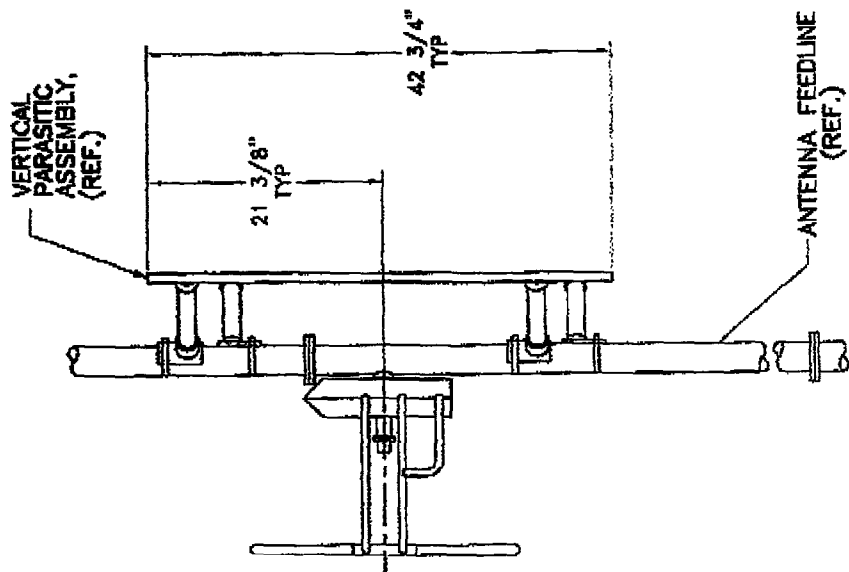
Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	1.000
10	1.000	190	1.000
20	1.000	200	1.000
30	1.000	210	1.000
40	1.000	220	1.000
50	1.000	230	0.900
60	1.000	240	0.790
70	1.000	250	0.670
80	1.000	260	0.610
90	1.000	270	0.610
100	1.000	280	0.640
110	1.000	290	0.675
120	1.000	300	0.832
130	1.000	310	1.000
140	1.000	320	1.000
150	1.000	330	1.000
160	1.000	340	1.000
170	1.000	350	1.000

TRUE NORTH



## TOP VIEW

TOWER MAKE: GEORGIA-CAROLINA TOWER CO  
TOWER: TOP MOUNTED POLE



## SIDE VIEW

SHIVELY LABS			
A DIVISION OF HOWELL LABORATORIES INC. PRODUCTION NAME			
TOP VIEW	FRONT VIEW	LEFT VIEW	RIGHT VIEW
27802	107.5	61.5	ASP
MODEL-6810-3-73SS-DIRECTIONAL ANTENNA			
10/28/09			

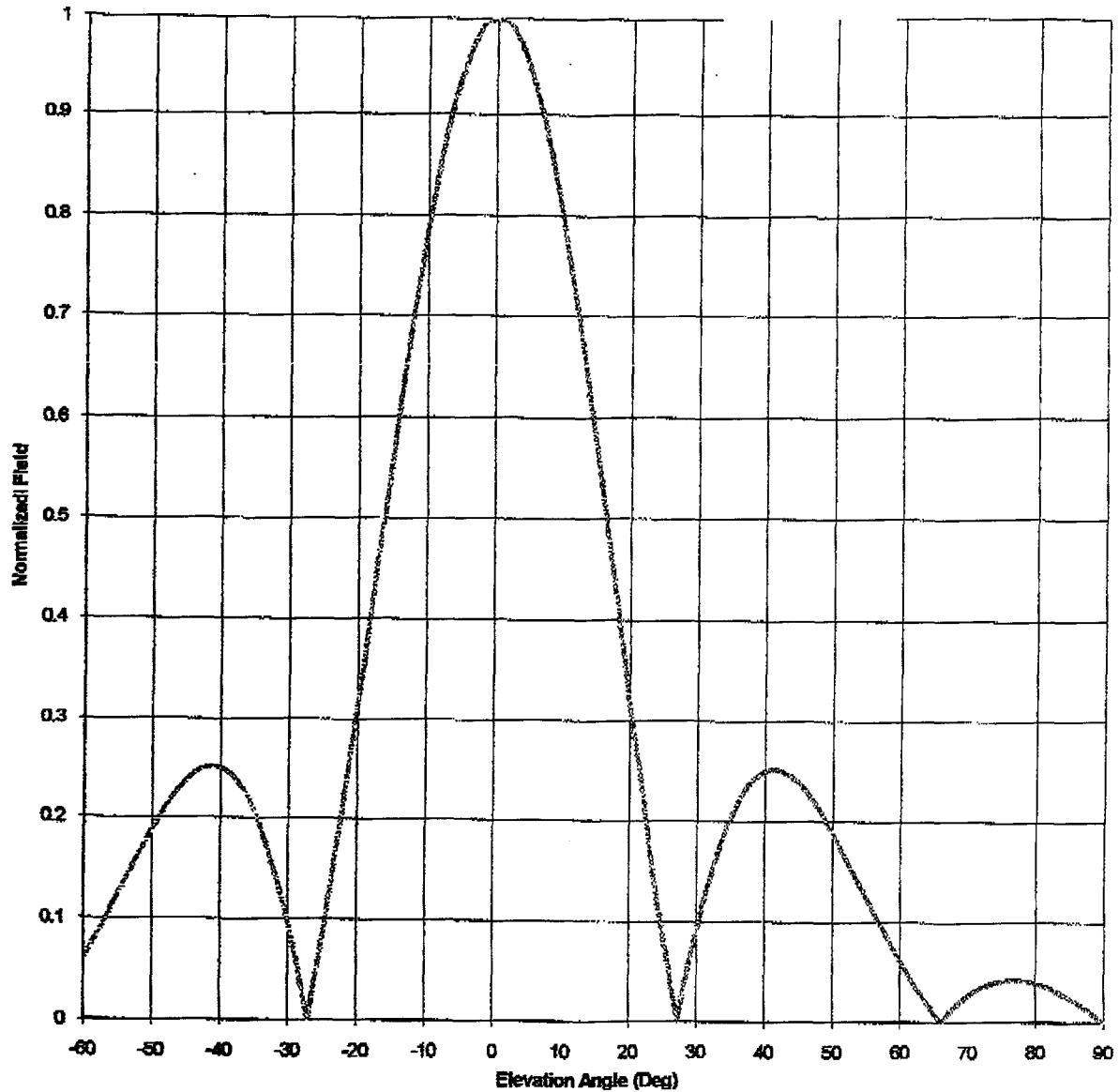
FIGURE 2

ANTENNA HEADING 75° TRUE NORTH

Antenna Mfg.: Shively Labs  
Antenna Type: 6810-3-(0.73)SS-DA  
Station: WDXQ-FM  
Frequency: 107.5  
Channel #: 298  
Figure: 3

Date: 11/9/2009

Beam Tilt	0	
Gain (Max)	2.058	3.134 dB
Gain (Horizon)	2.058	3.134 dB



Antenna Mfg.: Shively Labs  
Antenna Type: 6810-3-(0.73)SS-DA

Date: 11/9/2009

Station: WDXQ-FM

Beam Tilt 0

Frequency: 107.5

Gain (Max) 2.058

3.134 dB

Channel #: 208

Gain (Horizon) 2.058

3.134 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	0.242	0	1.000	46	0.229
-89	0.005	-43	0.247	1	0.998	47	0.221
-88	0.010	-42	0.249	2	0.991	48	0.211
-87	0.014	-41	0.250	3	0.980	49	0.200
-86	0.019	-40	0.248	4	0.964	50	0.188
-85	0.023	-39	0.245	5	0.944	51	0.176
-84	0.027	-38	0.238	6	0.920	52	0.164
-83	0.030	-37	0.230	7	0.892	53	0.151
-82	0.033	-36	0.219	8	0.861	54	0.137
-81	0.036	-35	0.205	9	0.826	55	0.124
-80	0.038	-34	0.188	10	0.788	56	0.111
-79	0.039	-33	0.169	11	0.747	57	0.098
-78	0.041	-32	0.146	12	0.704	58	0.085
-77	0.041	-31	0.121	13	0.659	59	0.072
-76	0.041	-30	0.093	14	0.612	60	0.060
-75	0.040	-29	0.063	15	0.564	61	0.048
-74	0.039	-28	0.029	16	0.515	62	0.037
-73	0.037	-27	0.007	17	0.465	63	0.027
-72	0.034	-26	0.045	18	0.415	64	0.017
-71	0.030	-25	0.086	19	0.365	65	0.008
-70	0.026	-24	0.128	20	0.316	66	0.000
-69	0.020	-23	0.173	21	0.267	67	0.008
-68	0.014	-22	0.219	22	0.219	68	0.014
-67	0.008	-21	0.267	23	0.173	69	0.020
-66	0.000	-20	0.316	24	0.128	70	0.026
-65	0.008	-19	0.365	25	0.086	71	0.030
-64	0.017	-18	0.415	26	0.045	72	0.034
-63	0.027	-17	0.465	27	0.007	73	0.037
-62	0.037	-16	0.515	28	0.029	74	0.039
-61	0.048	-15	0.564	29	0.063	75	0.040
-60	0.060	-14	0.612	30	0.093	76	0.041
-59	0.072	-13	0.659	31	0.121	77	0.041
-58	0.085	-12	0.704	32	0.146	78	0.041
-57	0.098	-11	0.747	33	0.169	79	0.039
-56	0.111	-10	0.788	34	0.188	80	0.038
-55	0.124	-9	0.826	35	0.205	81	0.036
-54	0.137	-8	0.861	36	0.219	82	0.033
-53	0.151	-7	0.892	37	0.230	83	0.030
-52	0.164	-6	0.920	38	0.238	84	0.027
-51	0.176	-5	0.944	39	0.245	85	0.023
-50	0.188	-4	0.964	40	0.248	86	0.019
-49	0.200	-3	0.980	41	0.250	87	0.014
-48	0.211	-2	0.991	42	0.249	88	0.010
-47	0.221	-1	0.998	43	0.247	89	0.005
-46	0.229	0	1.000	44	0.242	90	0.000
-45	0.237			45	0.237		

## VALIDATION OF TOTAL POWER GAIN CALCULATION

WDXQ-FM 107.5 MHz Cochran, GA

Model 6810-3-(0.73)SS-DA

Elevation Gain of Antenna 1.387

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

H RMS	0.822	V RMS	0.82	H/V Ratio	1.002
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Elevation Gain of Horizontal Component 1.390

Elevation Gain of Vertical Component 1.384

Horizontal Azimuth Gain equals  $1/(\text{RMS})^2$ . 1.480Vertical Azimuth Gain equals  $1/(\text{RMS}/\text{Max Vert})^2$ . 1.379

Max. Vertical 0.963

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

Total Horizontal Power Gain = 2.058

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

Total Vertical Power Gain = 1.908

ERP divided by Horizontal Power Gain equals Antenna Input Power

4	KW ERP	Divided by H Gain	2.058	equals	1.94	KW H Antenna Input Power
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Antenna Input Power times Vertical Power Gain equals Vertical ERP

1.94	KW	Times V Gain	1.908	equals	3.71	KW V ERP
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Maximum Value of the Vertical Component squared times the Maximum ERP equals the Vertical ERP

(0.963)<sup>2</sup> Times 4.00 Equals 3.71 kW Vertical ERP

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

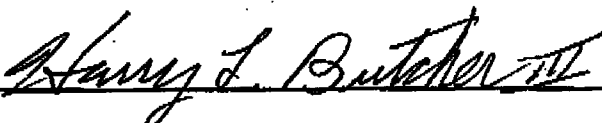


### Antenna Orientation Certification

**To Whom It May Concern:**

This is to certify that on January 19, 2010, I conducted an "As Built" survey on the broadcast antenna of radio station WDXQ. The antenna is located in Twiggs County, Georgia, on the north side of State Route 96, 7.9 miles east of State Route 247 in Kathleen, Georgia, and 1.4 miles west of U.S. Route 23.

A base line referenced to true north was established on site utilizing GPS methods. From this baseline the survey was extended to a point from which observations could be made directly on the antenna structure. Those observations confirmed the antenna alignment to be 75 degrees clockwise from true north, plus or minus one degree.

 *Ca RLS 2220*  
1/20/2010

Harry L. Butcher, III-Georgia RLS No. 2220

