Shively Labs
a division of Howell Laboratories,Inc.

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

- An Employee-Owned Company -

(207) 647-3327
888-SHIVELY
Fax: (207) 647-8273
E-mail: sales@shively.com
Web site: www.shively.com

S.O. 28393

Report of Test 6014-3/3-SS-DA

for

SAGA COMMUNICATIONS OF NORTH CAROLINA, LLC

WOXL-FM 96.5 MHz Biltmore Forest, NC

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6014-3/3-SS-DA to meet the needs of WOXL-FM and to comply with the requirements of the FCC construction permit, file number BPH-20100701AFT.

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-20100701AFT indicates that the Horizontal radiation component shall not exceed 2.10 kW at any azimuth and is restricted to the following values at the azimuths specified:

150 - 160 Degrees T: 1.60 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 180 Degrees T and at 295 Degrees T. At the restricted azimuth of 150 - 160 Degrees T the Horizontal component is 1.34 dB down from the maximum of 2.10 kW, or 1.54 kW.

The R.M.S. of the Horizontal component is 0.822. The total Horizontal power gain is 1.489. The R.M.S. of the Vertical component is 0.822. The total Vertical power gain is 1.355. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.993. The R.M.S. of the measured composite pattern is 0.877. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.844. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6014-3/3-SS-DA was mounted on a tower of precise scale to the self-supported Sabre tower at the WOXL-FM site. The spacing of the antenna to the tower was varied to achieve the horizontal and vertical patterns shown in Figure 1A. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BPH-20100701AFT, a single level of the 6014-3/3-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 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 434.25 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.

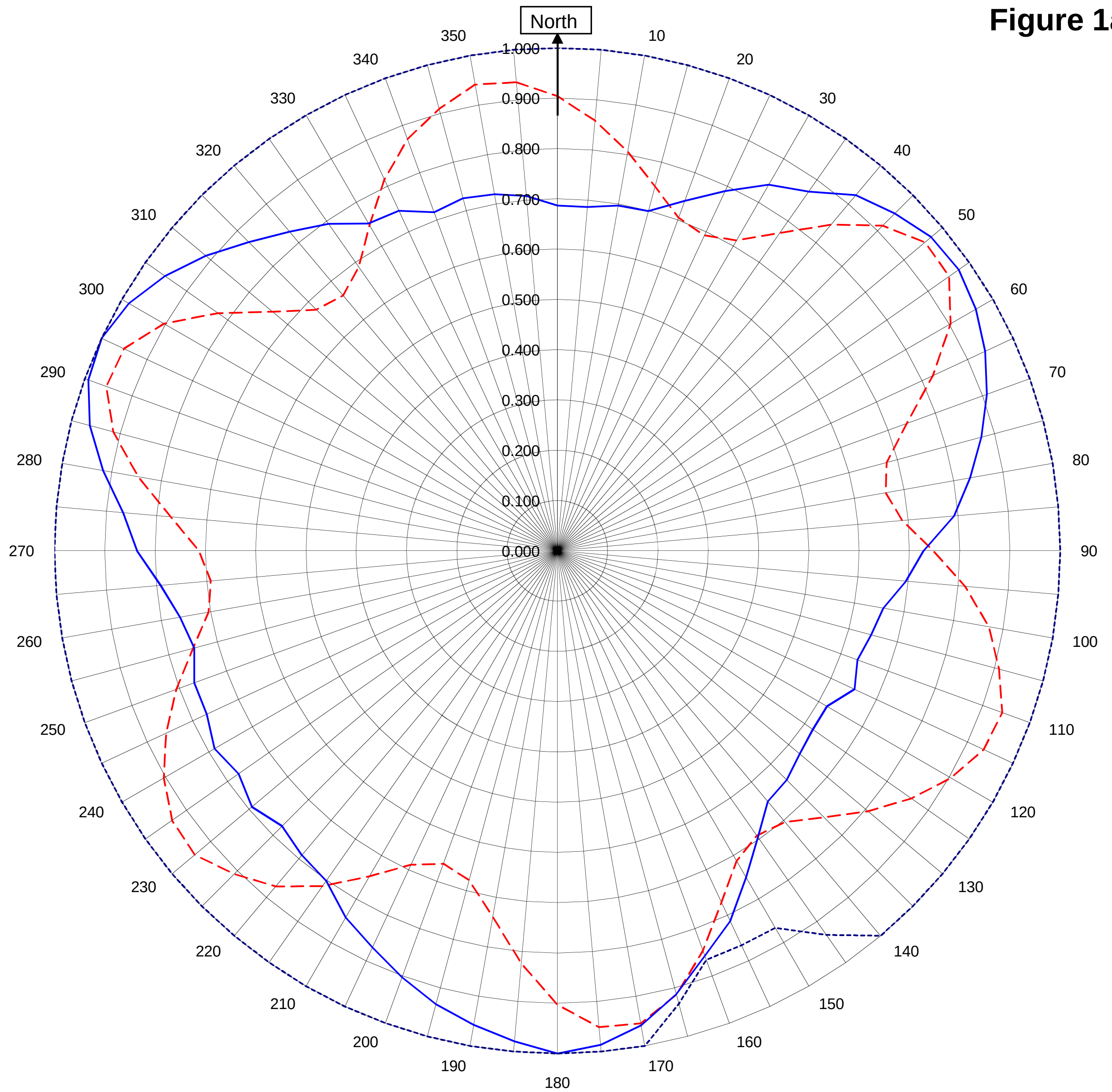
Respectfully submitted by:

Robert A. Surette
Director of Sales Engineering
S/O 28393
September 3, 2010

Shively Labs

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

Figure 1a



WOXL Biltmore Forest, NC

28393

September 3, 2010

____________ Horizontal RMS	0.822
_ _ _ _ _ _ _ _ _ Vertical RMS	0.822
H/V Composite RMS	0.877
...............FCC Composite RMS	0.993

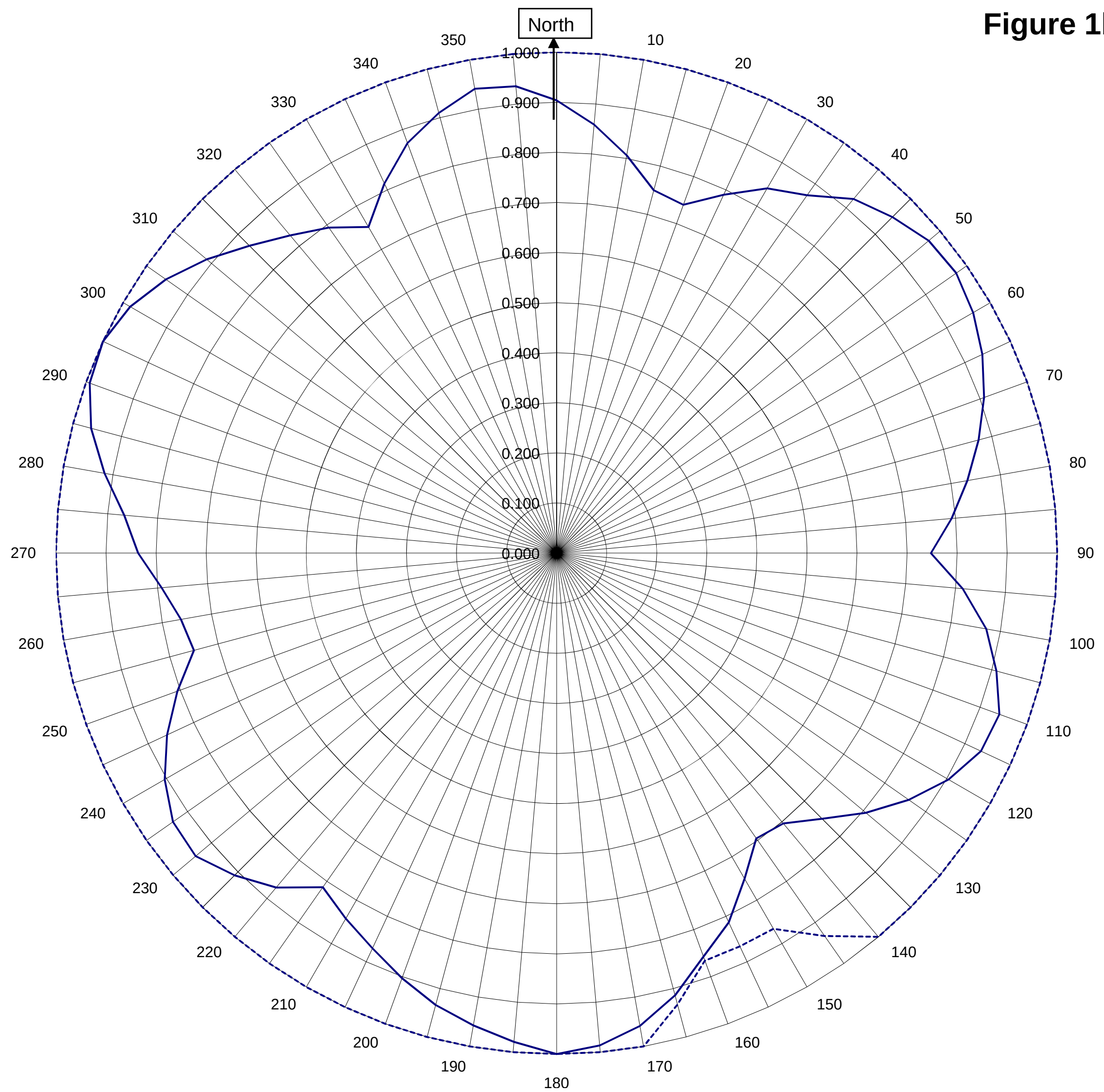
Frequency	96.5 / 434.25 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6014-3/3-SS-DA
Pattern Type	Directional Azimuth

Shively Labs

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

Figure 1b



WOXL Biltmore Forest, NC

28393

September 3, 2010

__________H/VComposite RMS	0.877
...............FCC Composite RMS	0.993

Frequency	96.5 / 434.25 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6014-3/3-SS-DA
Pattern Type	Directional H/V Composite

Figure 1c

Tabulation of Horizontal Azimuth Pattern
WOXL Biltmore Forest, NC

Azimuth	Rel Field	Azimuth	Rel Field
0	0.686	180	1.000
10	0.697	190	0.957
20	0.740	200	0.903
30	0.841	210	0.842
40	0.923	220	0.790
45	0.949	225	0.774
50	0.970	230	0.793
60	0.961	240	0.787
70	0.909	250	0.769
80	0.833	260	0.762
90	0.729	270	0.836
100	0.658	280	0.917
110	0.635	290	0.993
120	0.619	300	0.984
130	0.629	310	0.913
135	0.645	315	0.868
140	0.651	320	0.828
150	0.751	330	0.752
160	0.857	340	0.716
170	0.958	350	0.720

Figure 1d

Tabulation of Vertical Azimuth Pattern
WOXL Biltmore Forest, NC

Azimuth	Rel Field	Azimuth	Rel Field
0	0.904	180	0.903
10	0.806	190	0.740
20	0.704	200	0.663
30	0.713	210	0.748
40	0.847	220	0.871
45	0.914	225	0.910
50	0.954	230	0.941
60	0.903	240	0.904
70	0.740	250	0.806
80	0.663	260	0.704
90	0.748	270	0.713
100	0.871	280	0.847
110	0.941	290	0.954
120	0.904	300	0.903
130	0.806	310	0.740
135	0.750	315	0.678
140	0.704	320	0.663
150	0.713	330	0.748
160	0.847	340	0.871
170	0.954	350	0.941

Figure 1e

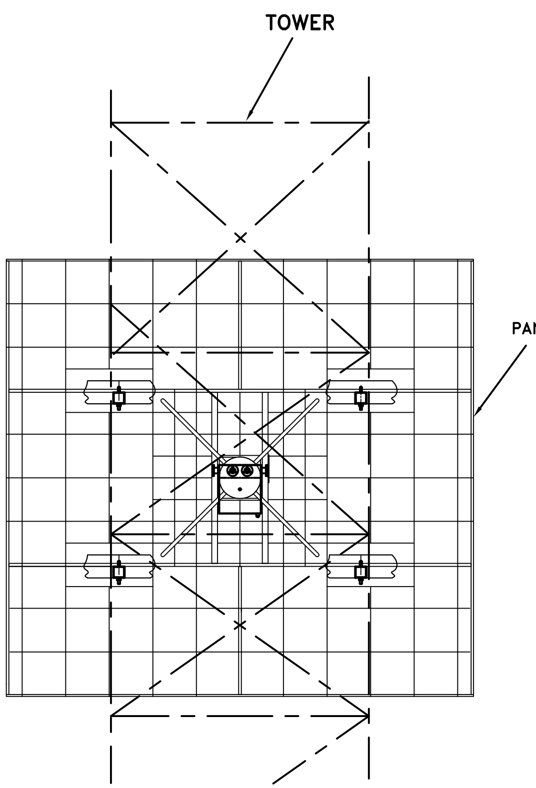
Tabulation of Composite Azimuth Pattern
WOXL Biltmore Forest, NC

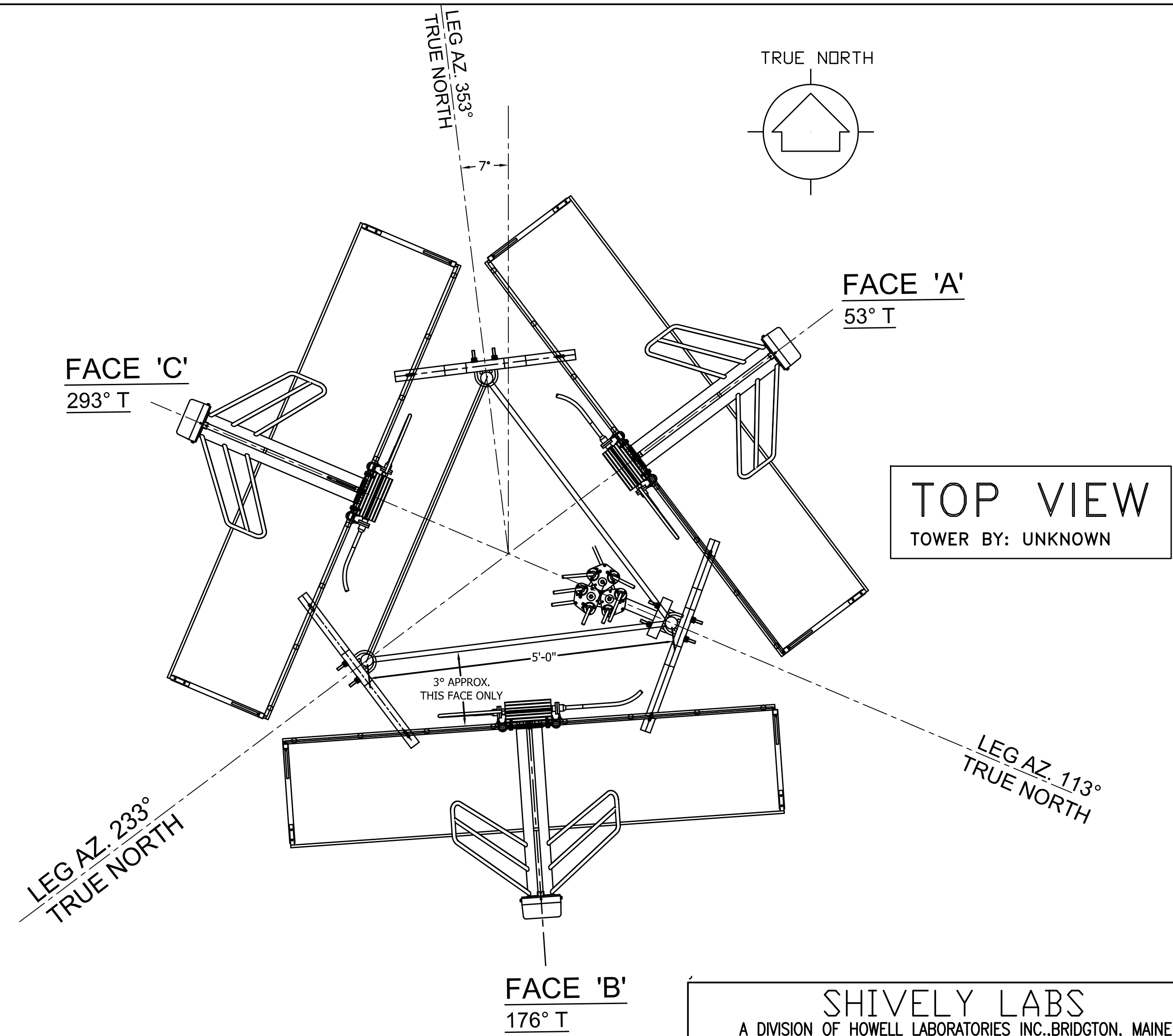
Azimuth	Rel Field	Azimuth	Rel Field
0	0.904	180	1.000
10	0.806	190	0.957
20	0.740	200	0.903
30	0.841	210	0.842
40	0.923	220	0.871
45	0.949	225	0.910
50	0.970	230	0.941
60	0.961	240	0.904
70	0.909	250	0.806
80	0.833	260	0.762
90	0.748	270	0.836
100	0.871	280	0.917
110	0.941	290	0.993
120	0.904	300	0.984
130	0.806	310	0.913
135	0.750	315	0.868
140	0.704	320	0.828
150	0.751	330	0.752
160	0.857	340	0.871
170	0.958	350	0.941

Figure 1f

Tabulation of FCC Directional Composite
WOXL Biltmore Forest, NC

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	1.000
60	1.000	240	1.000
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	1.000	320	1.000
150	0.866	330	1.000
160	0.866	340	1.000
170	1.000	350	1.000



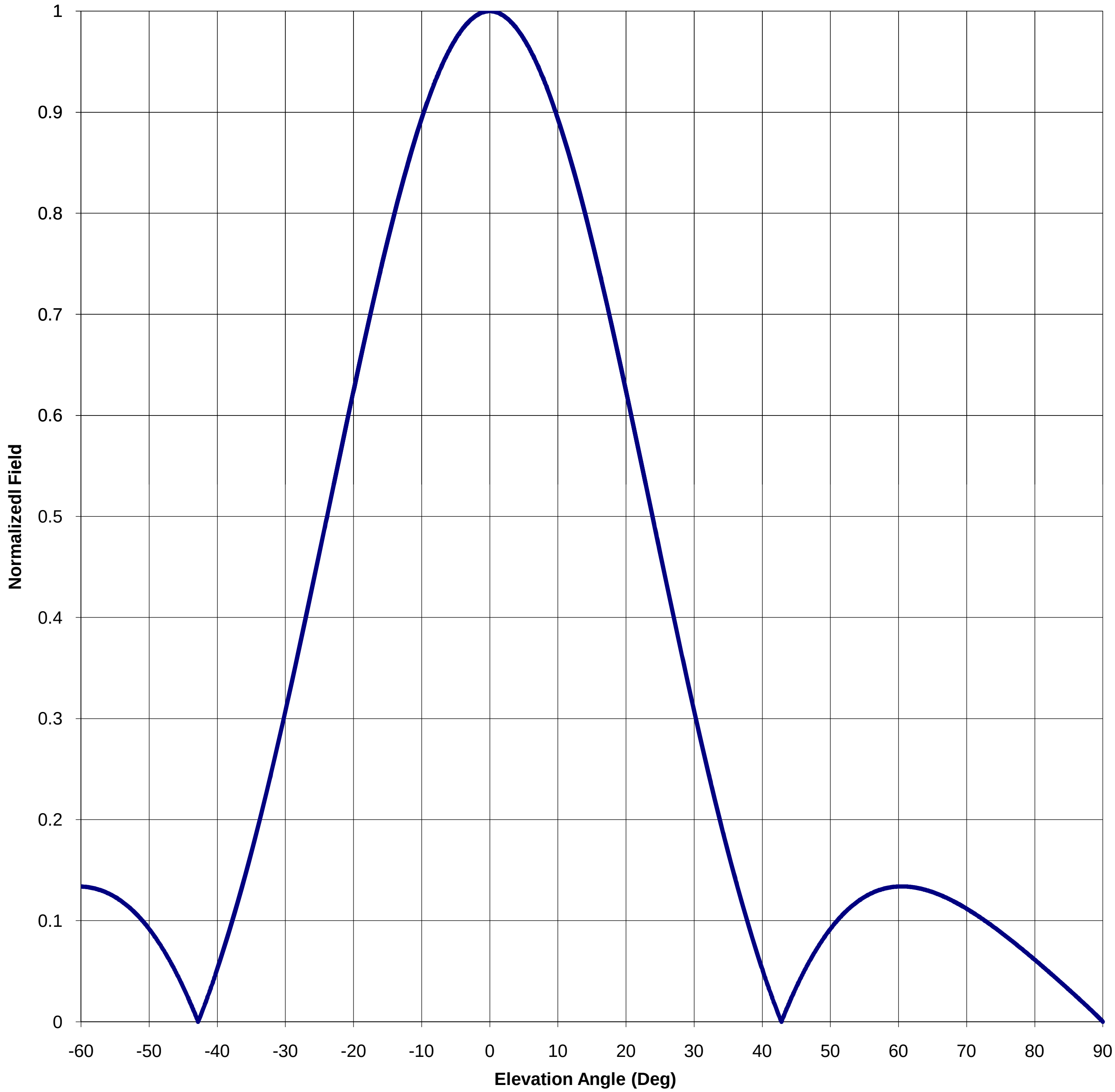


TOP VIEW
TOWER BY: UNKNOWN

FACE 'A' ANTENNA HEADING 53° T
FACE 'B' ANTENNA HEADING 176° T
FACE 'B' ANTENNA HEADING 293° T

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 28393	FREQUENCY: 96.5 MHz	SCALE: N.T.S.	DRAWN BY: DAB APPROVED BY: ASP
TITLE: MODEL-6014B-3/3-SS-DIRECTIONAL ANTENNA			
DATE: 10/6/10	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date:**	**9/3/2010**
Antenna Type:	**6014-3/3-SS-DA**				
Station:	**WOXL**	**Beam Tilt**	**0**		
Frequency:	**96.5**	**Gain (Max)**	**1.489**	**1.729**	**dB**
Channel #:	**243**	**Gain (Horizon)**	**1.489**	**1.729**	**dB**
Figure:	**3**				



Antenna Mfg.: Shively Labs
Antenna Type: 6014-3/3-SS-DA
Station: WOXL
Frequency: 96.5
Channel #: 243
Figure: 3

Date: 9/3/2010

Beam Tilt	**0**	
Gain (Max)	**1.489**	**1.729 dB**
Gain (Horizon)	**1.489**	**1.729 dB**

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	0.019	0	1.000	46	0.048
-89	0.007	-43	0.003	1	0.999	47	0.061
-88	0.013	-42	0.014	2	0.996	48	0.072
-87	0.020	-41	0.032	3	0.990	49	0.083
-86	0.026	-40	0.052	4	0.982	50	0.092
-85	0.032	-39	0.073	5	0.973	51	0.100
-84	0.038	-38	0.095	6	0.961	52	0.107
-83	0.044	-37	0.118	7	0.947	53	0.114
-82	0.050	-36	0.142	8	0.931	54	0.119
-81	0.056	-35	0.167	9	0.913	55	0.123
-80	0.061	-34	0.194	10	0.894	56	0.127
-79	0.067	-33	0.221	11	0.872	57	0.130
-78	0.073	-32	0.249	12	0.850	58	0.132
-77	0.078	-31	0.278	13	0.825	59	0.133
-76	0.083	-30	0.308	14	0.800	60	0.134
-75	0.089	-29	0.338	15	0.773	61	0.134
-74	0.094	-28	0.369	16	0.745	62	0.133
-73	0.099	-27	0.400	17	0.716	63	0.132
-72	0.103	-26	0.432	18	0.686	64	0.130
-71	0.108	-25	0.464	19	0.655	65	0.128
-70	0.112	-24	0.496	20	0.624	66	0.126
-69	0.116	-23	0.528	21	0.593	67	0.123
-68	0.119	-22	0.561	22	0.561	68	0.119
-67	0.123	-21	0.593	23	0.528	69	0.116
-66	0.126	-20	0.624	24	0.496	70	0.112
-65	0.128	-19	0.655	25	0.464	71	0.108
-64	0.130	-18	0.686	26	0.432	72	0.103
-63	0.132	-17	0.716	27	0.400	73	0.099
-62	0.133	-16	0.745	28	0.369	74	0.094
-61	0.134	-15	0.773	29	0.338	75	0.089
-60	0.134	-14	0.800	30	0.308	76	0.083
-59	0.133	-13	0.825	31	0.278	77	0.078
-58	0.132	-12	0.850	32	0.249	78	0.073
-57	0.130	-11	0.872	33	0.221	79	0.067
-56	0.127	-10	0.894	34	0.194	80	0.061
-55	0.123	-9	0.913	35	0.167	81	0.056
-54	0.119	-8	0.931	36	0.142	82	0.050
-53	0.114	-7	0.947	37	0.118	83	0.044
-52	0.107	-6	0.961	38	0.095	84	0.038
-51	0.100	-5	0.973	39	0.073	85	0.032
-50	0.092	-4	0.982	40	0.052	86	0.026
-49	0.083	-3	0.990	41	0.032	87	0.020
-48	0.072	-2	0.996	42	0.014	88	0.013
-47	0.061	-1	0.999	43	0.003	89	0.007
-46	0.048	0	1.000	44	0.019	90	0.000
-45	0.034			45	0.034		

S.O. 28393 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WOXL 96.5 MHz Biltmore Forest, NC

Model 6014-3/3-SS-DA

Elevation Gain of Antenna 1.006

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

H RMS	0.822	V RMS	0.822	H/V Ratio	1.000

Elevation Gain of Horizontal Component 1.006

Elevation Gain of Vertical Component 1.006

Horizontal Azimuth Gain equals $1/(RMS)^2$. 1.480

Vertical Azimuth Gain equals $1/(RMS/Max Vert)^2$. 1.347
Max. Vertical 0.954

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

Total Horizontal Power Gain = **1.489**

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

Total Vertical Power Gain = **1.355**

==

ERP divided by Horizontal Power Gain equals Antenna Input Power

2.1 kW ERP Divided by H Gain 1.489 equals 1.41 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

1.41 kW Times V Gain 1.355 equals 1.91 kW V ERP

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

(0.954)^2 Times 2.10 Equals 1.91 kW Vertical ERP

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