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. 23442

Report of Test 6014-1/1-DA

for

CHRISTIAN MINISTRIES INC.

WAVX 90.9 MHz SCHUYLER FALLS, NY

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6014-1/1-DA to meet the needs of WAVX and to comply with the requirements of the FCC construction permit, file number BMPED-20040819ACC.

RESULTS:

The measured azimuth pattern for the 6014-1/1-DA is shown in Figure 1. Figure 1A shows the Tabulation of the Horizontal Polarization. Figure 1B shows the Tabulation of the Vertical Polarization. The calculated elevation pattern of the antenna is shown in Figure 3. Construction permit file number BMPED-20040819ACC indicates that the Horizontal radiation component shall not exceed 2.70 kW at any azimuth and is restricted to the following values at the azimuths specified:

208 - 258 Degrees T: 0.110 kW
298 - 348 Degrees T: 0.110 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 096 Degrees T to 103 Degrees T. At the restricted azimuth of 208-258 Degrees T the Vertical component is 16.19 dB down from the maximum of 2.70 kW, or 0.065 kW. At the restricted azimuth of 298 - 348 Degrees T the Horizontal component is 15.91 dB down from the maximum of 2.70 kW, or 0.069 kW.

The R.M.S. of the Horizontal component is 0.446. The total Horizontal power gain is 2.339. The R.M.S. of the Vertical component is 0.441. The total Vertical power gain is 2.292. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.51. Therefore this Pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6014-1/1-DA was mounted on a tower of exact scale to the tower at the WAVX site. The spacing of the antenna to the tower was varied to achieve both the horizontal and vertical pattern shown in Figure 1. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BMPED-20040819ACC, a single level of the 6014-1/1-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 Edition 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.

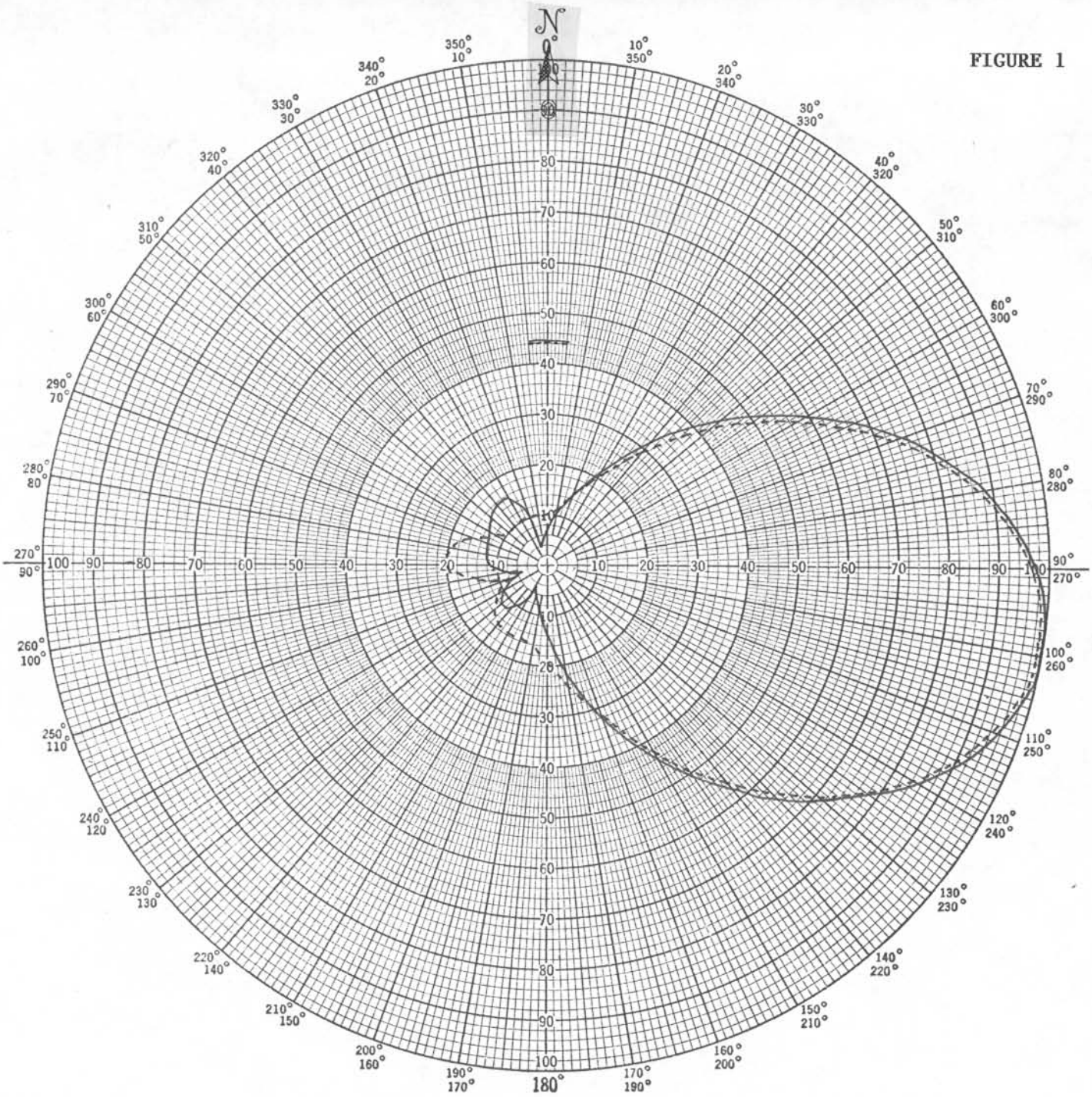
TEST PROCEDURES:

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 409.05 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 1.

Respectfully submitted by:

Robert A. Surette
Manager of RF Engineering
S/O 23442
November 5, 2004

FIGURE 1



Shively Labs

PROJECT NAME WAVX SCHUYLER FALLS, NY

PROJECT NUMBER 23442 DATE 10/7/04

MODEL (X) FULL SCALE ( ) FREQUENCY 409.05/90.9 MHz

POLARIZATION HORIZ (——); VERT (----)

CURVE PLOTTED IN: VOLTAGE (X) POWER( ) DB( )

OBSERVER RAS

ANTENNA TYPE 6014-1/1-DA

PATTERN TYPE DIRECTIONAL AZIMUTH

REMARKS: SEE FIGURE 2 FOR MECHANICAL DETAILS

Figure 1A

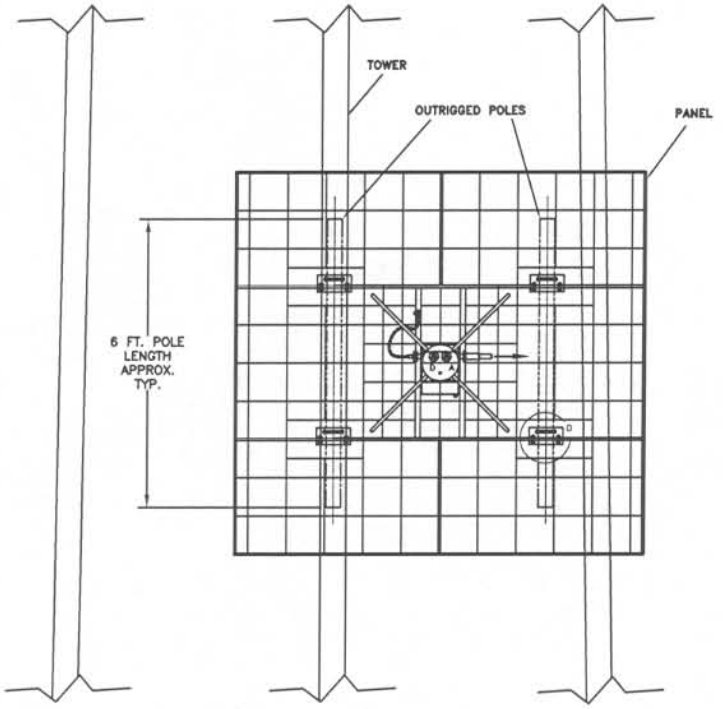
S/O 23442
TABULATION OF HORIZONTAL POLARIZATION
WAVX SCHUYLER FALLS, NY

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.070	180	0.140
10	0.110	190	0.090
20	0.150	200	0.045
30	0.215	210	0.050
40	0.320	220	0.110
45	0.380	225	0.120
50	0.450	230	0.120
60	0.595	240	0.100
70	0.750	250	0.080
80	0.880	260	0.080
90	0.970	270	0.115
100	1.000	280	0.120
110	0.955	290	0.125
120	0.855	300	0.135
130	0.720	310	0.145
135	0.655	315	0.150
140	0.575	320	0.155
150	0.440	330	0.150
160	0.320	340	0.100
170	0.220	350	0.040

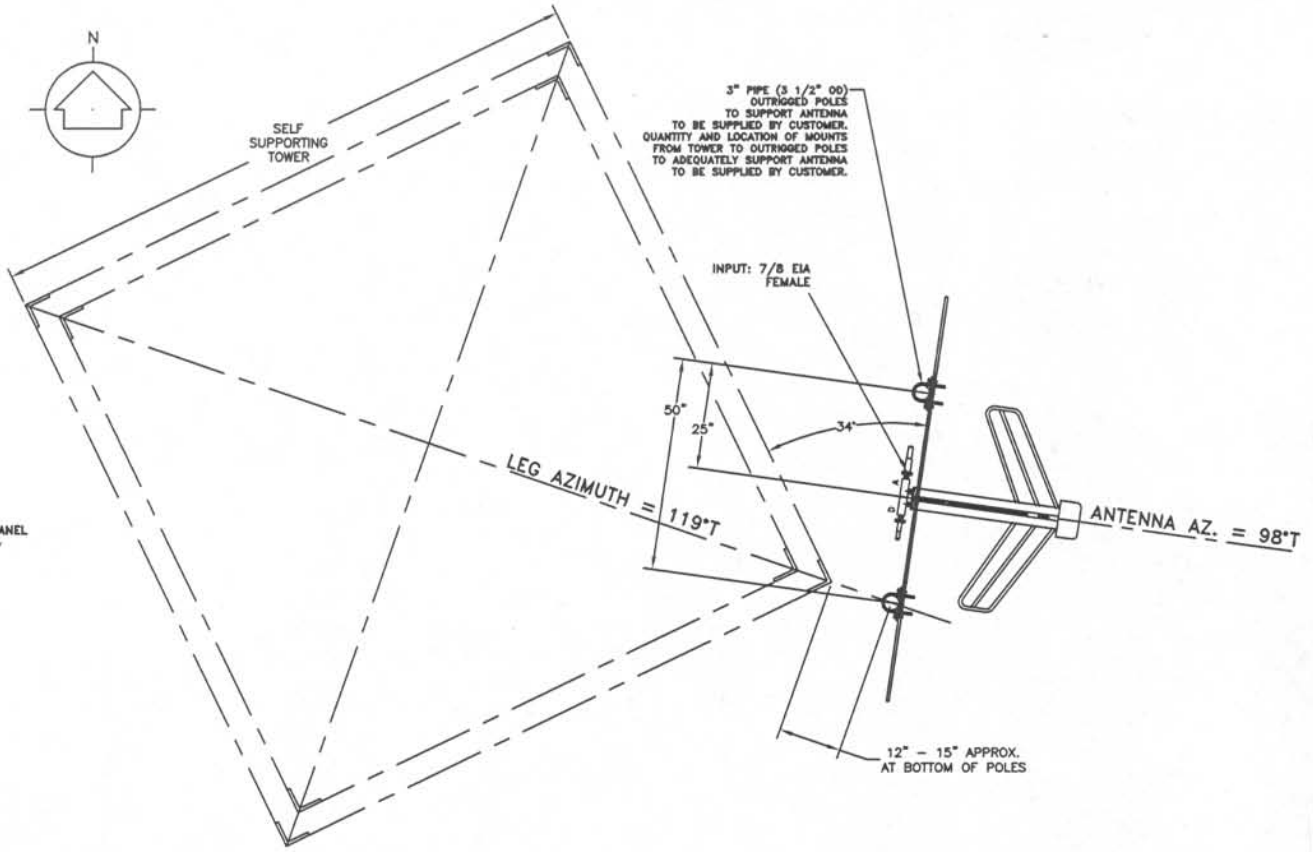
Figure 1B

S/O 23442
TABULATION OF VERTICAL POLARIZATION
WAVX SCHUYLER FALLS, NY

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.100	180	0.195
10	0.110	190	0.160
20	0.150	200	0.155
30	0.210	210	0.155
40	0.290	220	0.150
45	0.355	225	0.150
50	0.425	230	0.140
60	0.575	240	0.110
70	0.725	250	0.090
80	0.870	260	0.145
90	0.965	270	0.200
100	0.990	280	0.195
110	0.945	290	0.160
120	0.845	300	0.120
130	0.705	310	0.100
135	0.630	315	0.100
140	0.560	320	0.215
150	0.425	330	0.100
160	0.320	340	0.100
170	0.245	350	0.100



FRONT VIEW



TOP VIEW
SELF-SUPPORTING TOWER

SHIVELY LABS
A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE

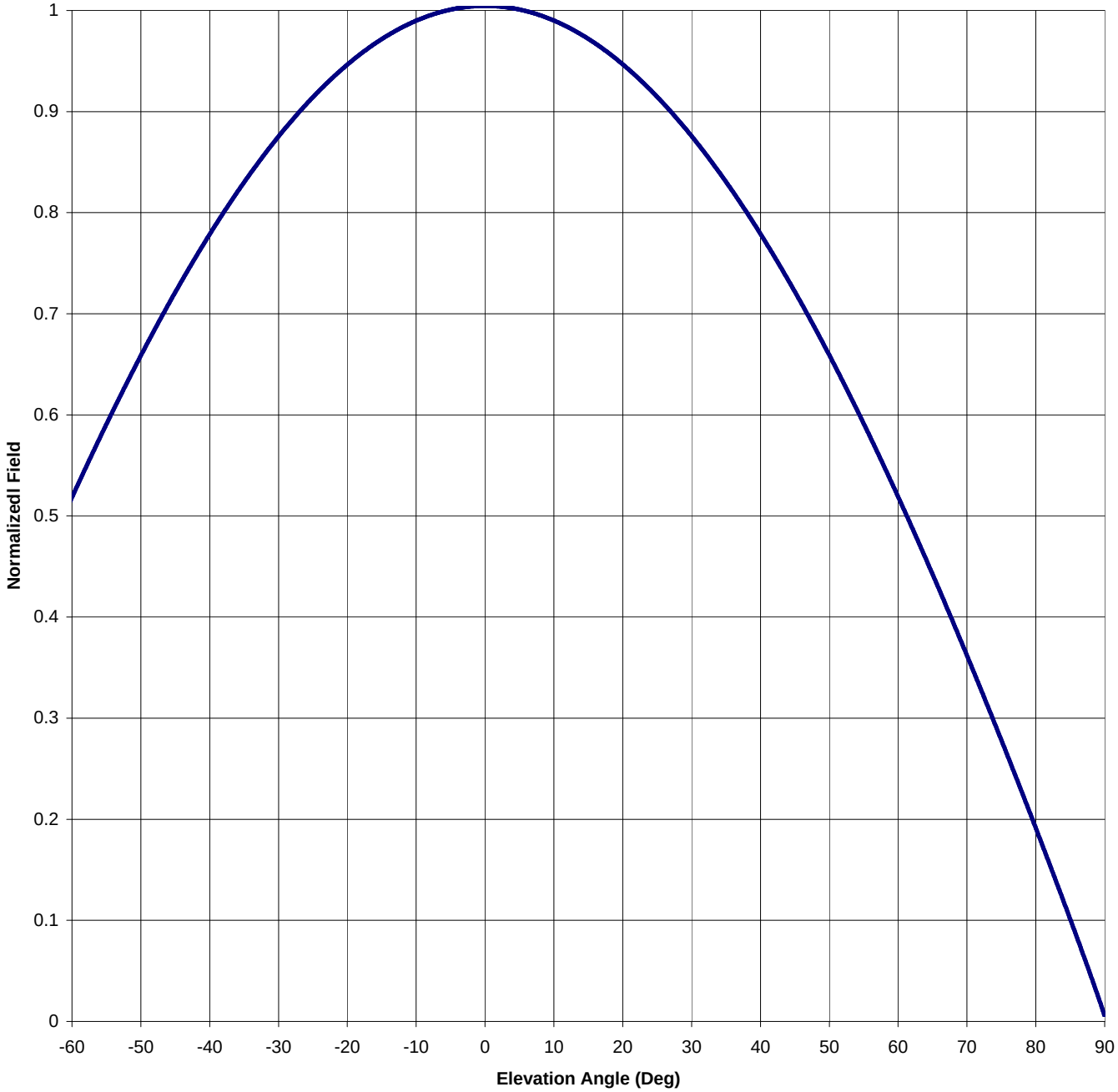
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY:
23442	90.9 MHz	N.T.S.	ASP
			APPROVED BY:

TITLE: MODEL-6014B-1/1-DIRECTIONAL ANTENNA

DATE: 11/5/04

FIGURE 2

Antenna Mfg.:	**Shively Labs**			**Date: 10/19/2004**
Antenna Type:	**6014-1/1-DA**			
Station:	**WAVX**	**Beam Tilt**	**0**	
Frequency:	**90.9**	**Gain (Max)**	**2.339**	**3.691 dB**
Channel #:	**215**	**Gain (Horizon)**	**2.339**	**3.691 dB**
Figure:	**3**			



Antenna Mfg.: Shively Labs **Date:** 10/19/2004

Antenna Type: 6014-1/1-DA

Station: WAVX **Beam Tilt** 0

Frequency: 90.9 **Gain (Max)** 2.339 3.691 dB

Channel #: 215 **Gain (Horizon)** 2.339 3.691 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	0.729	0	1.000	46	0.705
-89	0.021	-43	0.741	1	1.000	47	0.693
-88	0.040	-42	0.752	2	0.999	48	0.680
-87	0.059	-41	0.763	3	0.999	49	0.667
-86	0.078	-40	0.774	4	0.998	50	0.654
-85	0.096	-39	0.785	5	0.996	51	0.641
-84	0.114	-38	0.796	6	0.995	52	0.628
-83	0.133	-37	0.806	7	0.993	53	0.614
-82	0.151	-36	0.816	8	0.991	54	0.600
-81	0.168	-35	0.826	9	0.988	55	0.586
-80	0.186	-34	0.835	10	0.985	56	0.572
-79	0.204	-33	0.845	11	0.982	57	0.558
-78	0.221	-32	0.854	12	0.979	58	0.544
-77	0.239	-31	0.862	13	0.975	59	0.529
-76	0.256	-30	0.871	14	0.971	60	0.514
-75	0.273	-29	0.879	15	0.967	61	0.499
-74	0.290	-28	0.887	16	0.963	62	0.484
-73	0.307	-27	0.895	17	0.958	63	0.469
-72	0.324	-26	0.903	18	0.953	64	0.453
-71	0.341	-25	0.910	19	0.948	65	0.437
-70	0.357	-24	0.917	20	0.942	66	0.422
-69	0.373	-23	0.924	21	0.936	67	0.406
-68	0.390	-22	0.930	22	0.930	68	0.390
-67	0.406	-21	0.936	23	0.924	69	0.373
-66	0.422	-20	0.942	24	0.917	70	0.357
-65	0.437	-19	0.948	25	0.910	71	0.341
-64	0.453	-18	0.953	26	0.903	72	0.324
-63	0.469	-17	0.958	27	0.895	73	0.307
-62	0.484	-16	0.963	28	0.887	74	0.290
-61	0.499	-15	0.967	29	0.879	75	0.273
-60	0.514	-14	0.971	30	0.871	76	0.256
-59	0.529	-13	0.975	31	0.862	77	0.239
-58	0.544	-12	0.979	32	0.854	78	0.221
-57	0.558	-11	0.982	33	0.845	79	0.204
-56	0.572	-10	0.985	34	0.835	80	0.186
-55	0.586	-9	0.988	35	0.826	81	0.168
-54	0.600	-8	0.991	36	0.816	82	0.151
-53	0.614	-7	0.993	37	0.806	83	0.133
-52	0.628	-6	0.995	38	0.796	84	0.114
-51	0.641	-5	0.996	39	0.785	85	0.096
-50	0.654	-4	0.998	40	0.774	86	0.078
-49	0.667	-3	0.999	41	0.763	87	0.059
-48	0.680	-2	0.999	42	0.752	88	0.040
-47	0.693	-1	1.000	43	0.741	89	0.021
-46	0.705	0	1.000	44	0.729	90	0.000
-45	0.717			45	0.717		

S.O. 23442 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WAVX 90.9 Schuyler Falls, NY

MODEL 6014-1/1-DA

Elevation Gain of Antenna 0.46

The RMS values are calculated utilizing the data of a planimeter

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

H RMS 0.446 V RMS 0.441 H/V Ratio 1.011

Elevation Gain of Horizontal Component 0.465

Elevation Gain of Vertical Component 0.455

Horizontal Azimuth Gain equals 1/(RMS)SQ. 5.027

Vertical Azimuth Gain equals 1/(RMS/Max Vert)SQ. 5.040
Max. Vertical 0.99

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

Total Horizontal Power Gain = **2.339**

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

Total Vertical Power Gain = **2.292**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

2.7 KW ERP Equals 1.154 KW Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

1.154 KW Times 2.292 KW Equals 2.646 KW ERP

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

0.99 Equals 2.646 KW Vertical ERP

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