Shively Labs
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S.O. 26317

Report of Test 6510-1-DA

for

AMERICAN FAMILY ASSOCIATION

WWGV 88.1 MHz Grove City, OH

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6510-1-DA to meet the needs of WWGV and to comply with the requirements of the FCC construction permit, file number BMPED-20070523ACB.

RESULTS:

The measured azimuth pattern for the 6510-1-DA is shown in Figure 1. Figure 1A shows the Tabulation of the Vertical Polarization. Figure 1B shows the Tabulation of the FCC Composite Pattern. The calculated elevation pattern of the antenna is shown in Figure 3. Construction permit file number BMPED-20070523ACB indicates that the Vertical radiation component shall not exceed 5.4 kW at any azimuth and is restricted to the following values at the azimuths specified:

270 Degrees T: 3.6 kW

From Figure 1, the maximum radiation of the Vertical component occurs at 339 Degrees T to 346 Degrees T. At the restricted azimuth of 270 Degrees T the Vertical component is 8.4 dB down from the maximum of 5.4 kW, or 0.78 kW.

The R.M.S. of the Vertical component is 0.770. The total Vertical power gain is 1.552. See Figure 4 for calculations.

AMENDED FCC COMPOSITE PATTERN:

The R.M.S. of the measured composite pattern is 0.770. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.830. Therefore the measured pattern does not comply with the FCC requirement of 73.316(c)(ix)(A). In accordance with 73.1690(c)(2)(ii) an amended composite pattern with an R.M.S. value of 0.905 is attached as Figure 5. Figure 5A shows the tabulations of the amended composite pattern. This new composite pattern allows the above measured pattern to comply with the FCC requirement of 73.316(c)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6510-1-DA was mounted on a tower of precise scale to the Pirod self-supporting tower at the WWGV site. The spacing of the antenna to the tower was varied to achieve the vertical pattern shown in Figure 1. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BMPED-20070523ACB, a single level of the 6510-1-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 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 396.45 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
Director of Sales Engineering
S/O 26317
February 25, 2008

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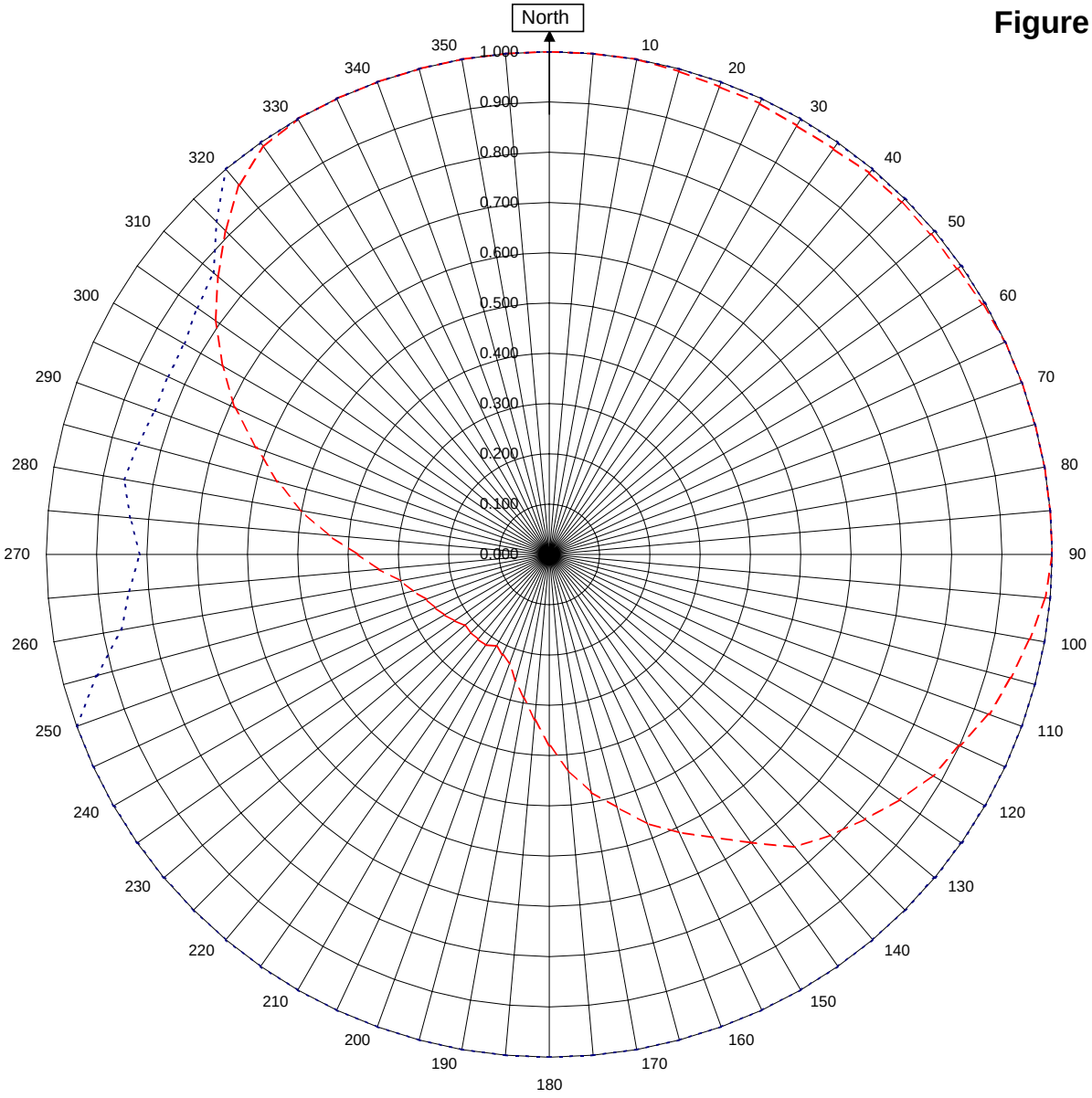
Figure 1



WWGV Grove City, OH

26317

February 25, 2008

Horizontal RMS	0.000
Vertical RMS	0.770
H/V Composite RMS	0.770
FCC Composite RMS	0.976

Frequency	88.1 / 396.45 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6510-1-DA Pattern 3
Pattern Type	Directional Azimuth

Figure 1A

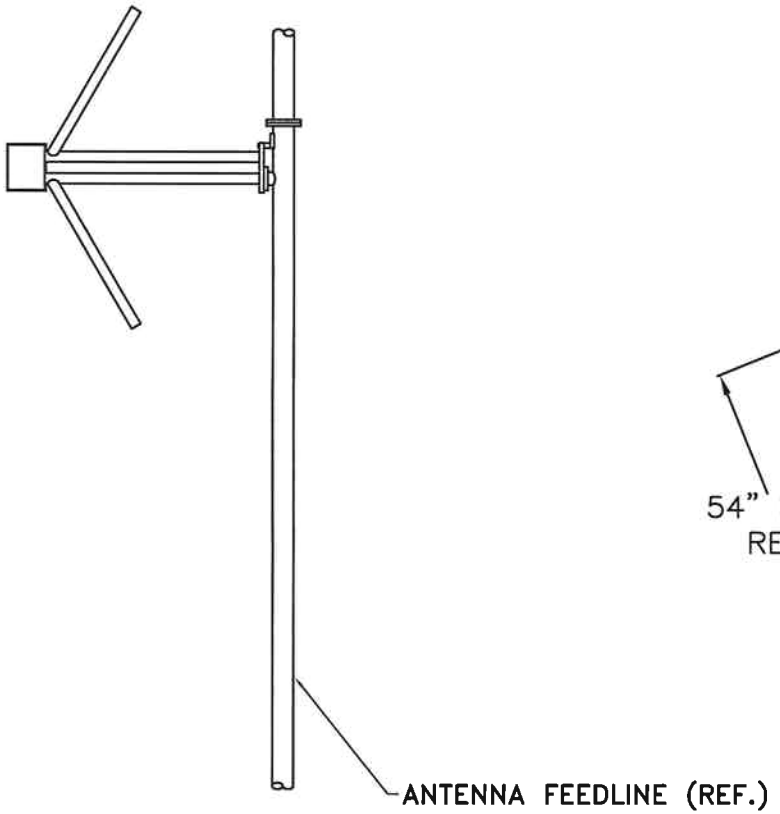
Tabulation of Vertical Azimuth Pattern
WWGV Grove City, OH

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.380
10	1.000	190	0.290
20	0.990	200	0.230
30	0.985	210	0.210
40	0.990	220	0.220
45	0.990	225	0.220
50	0.990	230	0.220
60	0.995	240	0.240
70	1.000	250	0.260
80	1.000	260	0.300
90	1.000	270	0.380
100	0.970	280	0.500
110	0.930	290	0.620
120	0.880	300	0.750
130	0.820	310	0.860
135	0.790	315	0.910
140	0.760	320	0.960
150	0.650	330	1.000
160	0.570	340	1.000
170	0.480	350	1.000

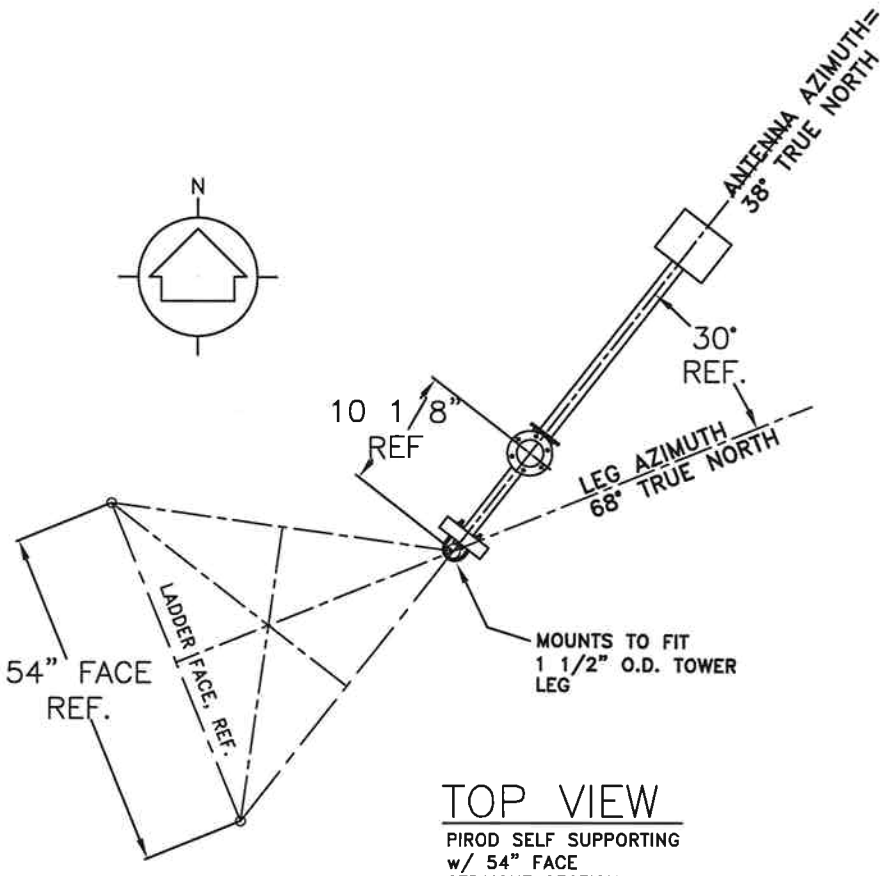
Figure 1B

Tabulation of FCC Directional Composite
WWGV Grove City, OH

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	0.864
90	1.000	270	0.814
100	1.000	280	0.858
110	1.000	290	0.835
120	1.000	300	0.838
130	1.000	310	0.871
140	1.000	320	1.000
150	1.000	330	1.000
160	1.000	340	1.000
170	1.000	350	1.000



SIDE VIEW



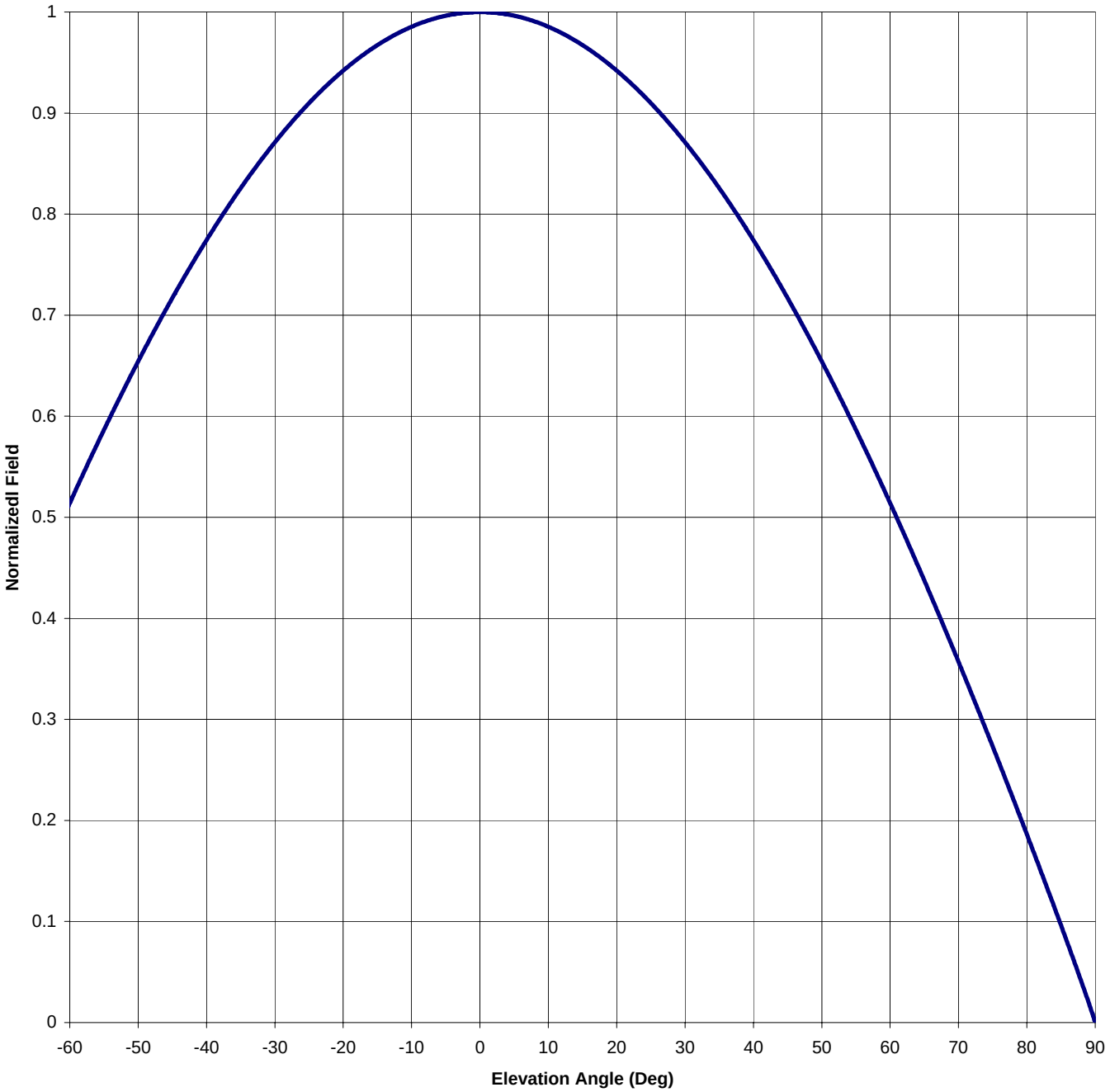
TOP VIEW

PIROD SELF SUPPORTING
w/ 54" FACE
STRAIGHT SECTION
IN ANTENNA AREA

ANTENNA HEADING = 38° TRUE NORTH

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 26317	FREQUENCY: 88.1 MHz.	SCALE: N.T.S.	DRAWN BY: DAB APPROVED BY: ASP
TITLE: MODEL-6510-1-DIRECTIONAL ANTENNA			
DATE: 2/18/08	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date:**	**2/25/2008**
Antenna Type:	**6510-1-DA**				
Station:	**WWGV**	**Beam Tilt**	**0**		
Frequency:	**88.1**	**Gain (Max)**	**1.552**	**1.908**	**dB**
Channel #:	**201**	**Gain (Horizon)**	**1.552**	**1.908**	**dB**
Figure:	**3**				



Antenna Mfg.: Shively Labs **Date:** 2/25/2008

Antenna Type: 6510-1-DA

Station: WWGV **Beam Tilt** 0

Frequency: 88.1 **Gain (Max)** 1.552 1.908 dB

Channel #: 201 **Gain (Horizon)** 1.552 1.908 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		

FIGURE 4

S.O. 26317

VALIDATION OF GAIN CALCULATION

WWGV 88.1 MHz GROVE CITY, OH

MODEL 6510-1-DA

Elevation Gain of 6510-1-DA equals 0.92

Vertical Azimuth Gain equals $1/(RMS)^2$
$1/(0.770)^2 = 1.687$

*** Total Vertical Gain is Elevation Gain times Azimuth Gain**
0.92 x 1.687 = 1.552

ERP divided by Vertical Gain equals Antenna Input Power
5.4 kW ÷ 1.552 = 3.480 kW

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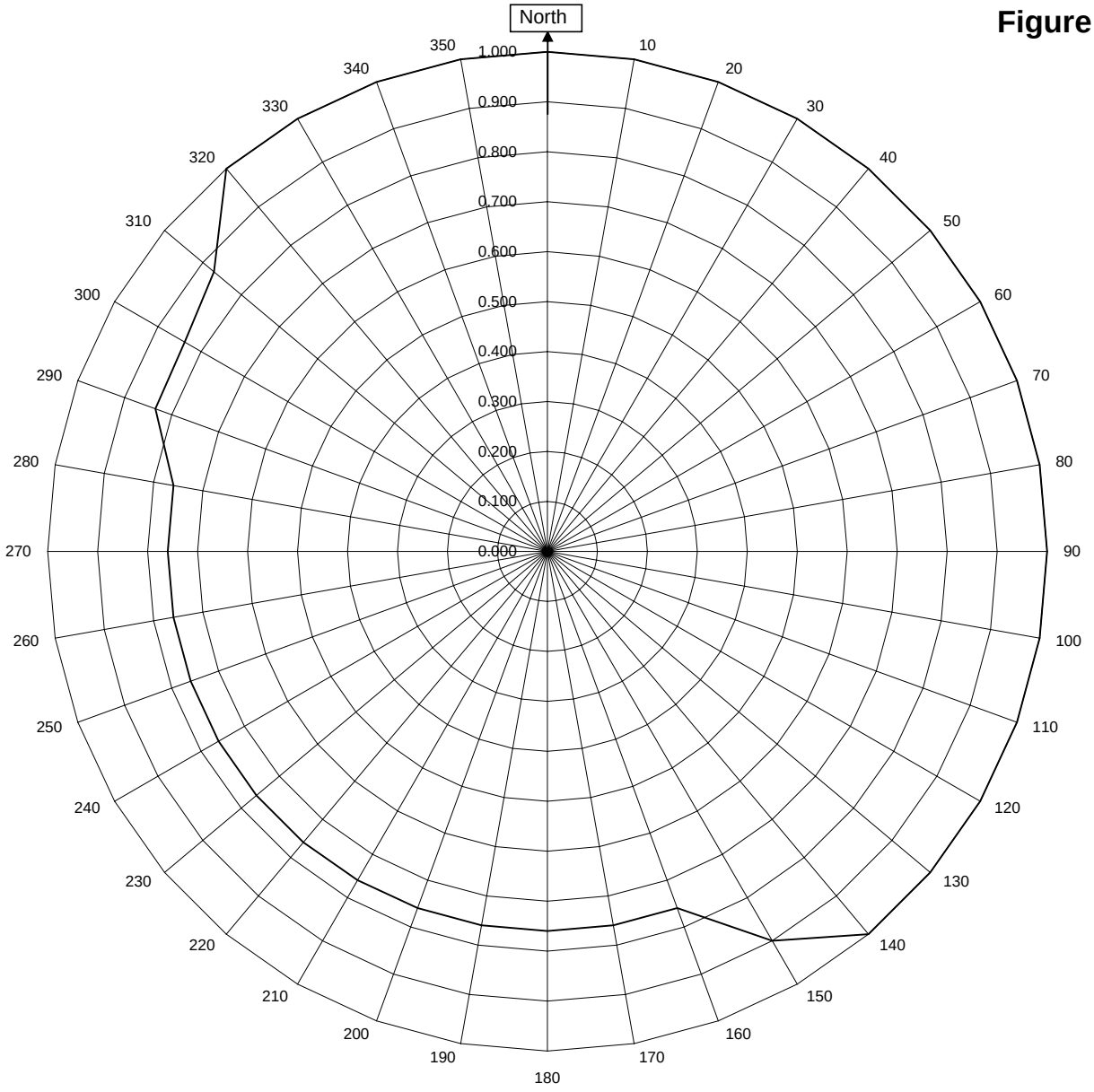
Figure 5



WWGV Grove City, OH

26317

February 22, 2008

Amended Composite RMS	0.905
85% Amended Composite RMS	0.769

Frequency	88.1 / 396.45 mHz
Plot	Relative Field

Antenna Model	6510-1-DA Pattern 3
Pattern Type	Amended FCC Composite

Figure 5a

Tabulation of Amended Composite Pattern
WWGV Grove City, OH

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.760
10	1.000	190	0.760
20	1.000	200	0.760
30	1.000	210	0.760
40	1.000	220	0.760
45	1.000	225	0.680
50	1.000	230	0.760
60	1.000	240	0.760
70	1.000	250	0.760
80	1.000	260	0.760
90	1.000	270	0.760
100	1.000	280	0.760
110	1.000	290	0.835
120	1.000	300	0.838
130	1.000	310	0.871
135	0.655	315	1.000
140	1.000	320	1.000
150	0.900	330	1.000
160	0.760	340	1.000
170	0.760	350	1.000