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S.O. 29514

Report of Test Aldena Yagi Array

for

Penfold Communications, Inc.

WTPG 88.9 MHz Whitehouse, OH

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of an Aldena Yagi Array to meet the needs of WTPG and to comply with the requirements of the FCC construction permit, file number BMPED-20110608AAR. This test characterizes only the radiation characteristics of the antenna when mounted on the tower as described. It does not represent or imply any guarantee of specific coverage which can be influenced by factors beyond the scope of this test.

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-20110608AAR indicates that the Horizontal radiation component shall not exceed 11.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

130 Degrees T: 0.390 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 044 Degrees T to 046 Degrees T.   At the restricted azimuth of 130 Degrees T the Horizontal component is 20.0 dB down from the maximum of 11.0 kW, or 0.110 kW.

The R.M.S. of the Horizontal component is 0.513. The total Horizontal power gain is 2.126. The R.M.S. of the Vertical component is 0.505. The total Vertical power gain is 2.004. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.595. The R.M.S. of the measured composite pattern is 0.524. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.506. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the Aldena Yagi Array was mounted on a tower of precise scale to the Valmont 36 tower at the WTPG 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 BMPED-20110608AAR, a single level of the Aldena Yagi Array was set up on the Shively Labs 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

All testing is carried out in strict accordance with approved procedures under our ISO9001:2008.

TEST PROCEDURES:

The receiving antenna system is mounted so that the horizontal and vertical azimuth patterns are measured independently. The network analyzer was set to 400.05 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 1A.

Respectfully submitted by:

Robert A. Surette
Director of Sales Engineering
S/O 29514
November 2, 2011

Shively Labs

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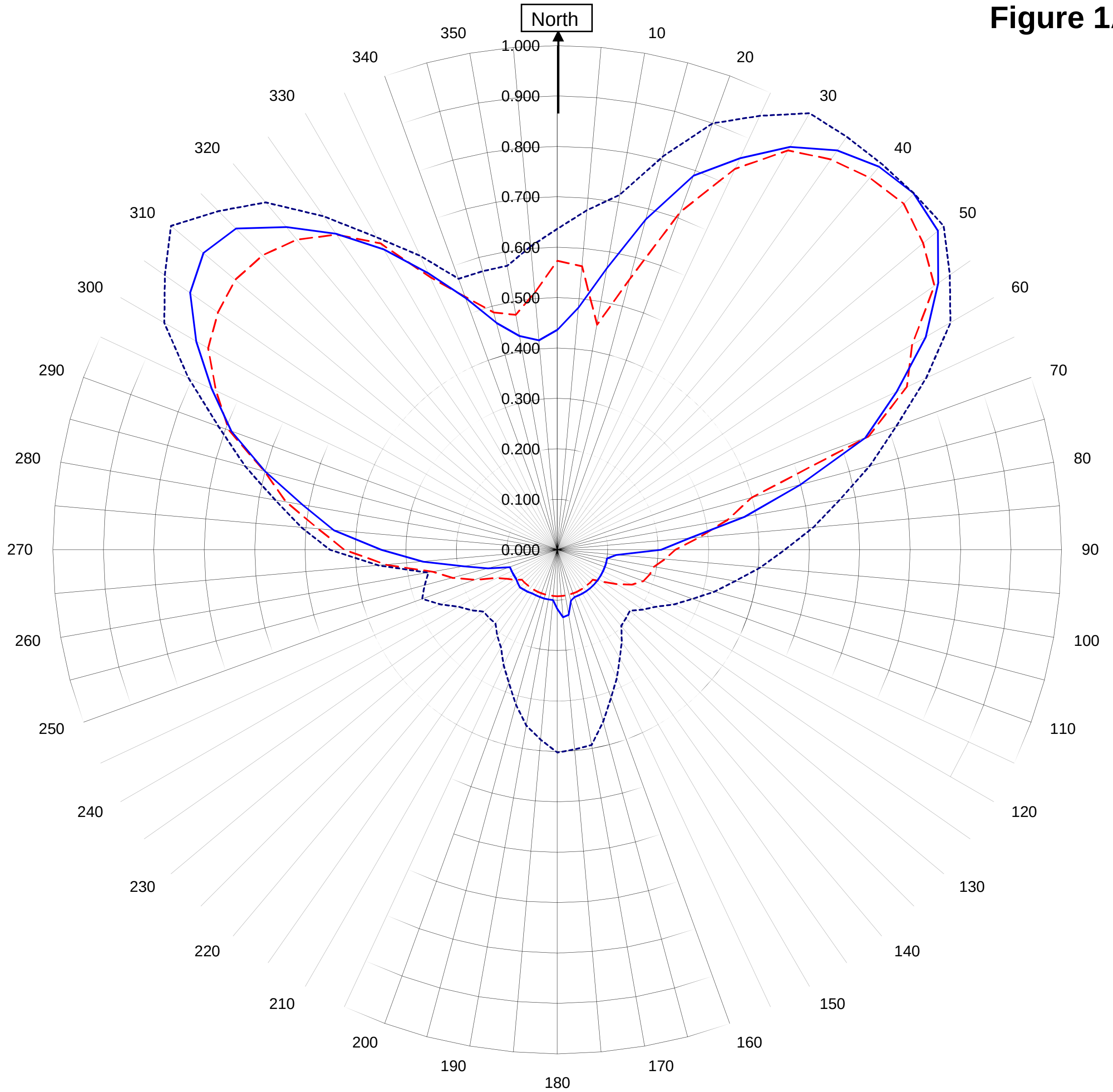
Figure 1A



WTPG WHITEHOUSE, OH.

29514

November 2, 2011

____________Horizontal RMS	0.513
_ _ _ _ _ _ _ _ _ Vertical RMS	0.505
H/V Composite RMS	0.524
……………FCC Composite RMS	0.595

Frequency	88.9 / 400.05 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	ALDENA YAGI
Pattern Type	Directional Azimuth

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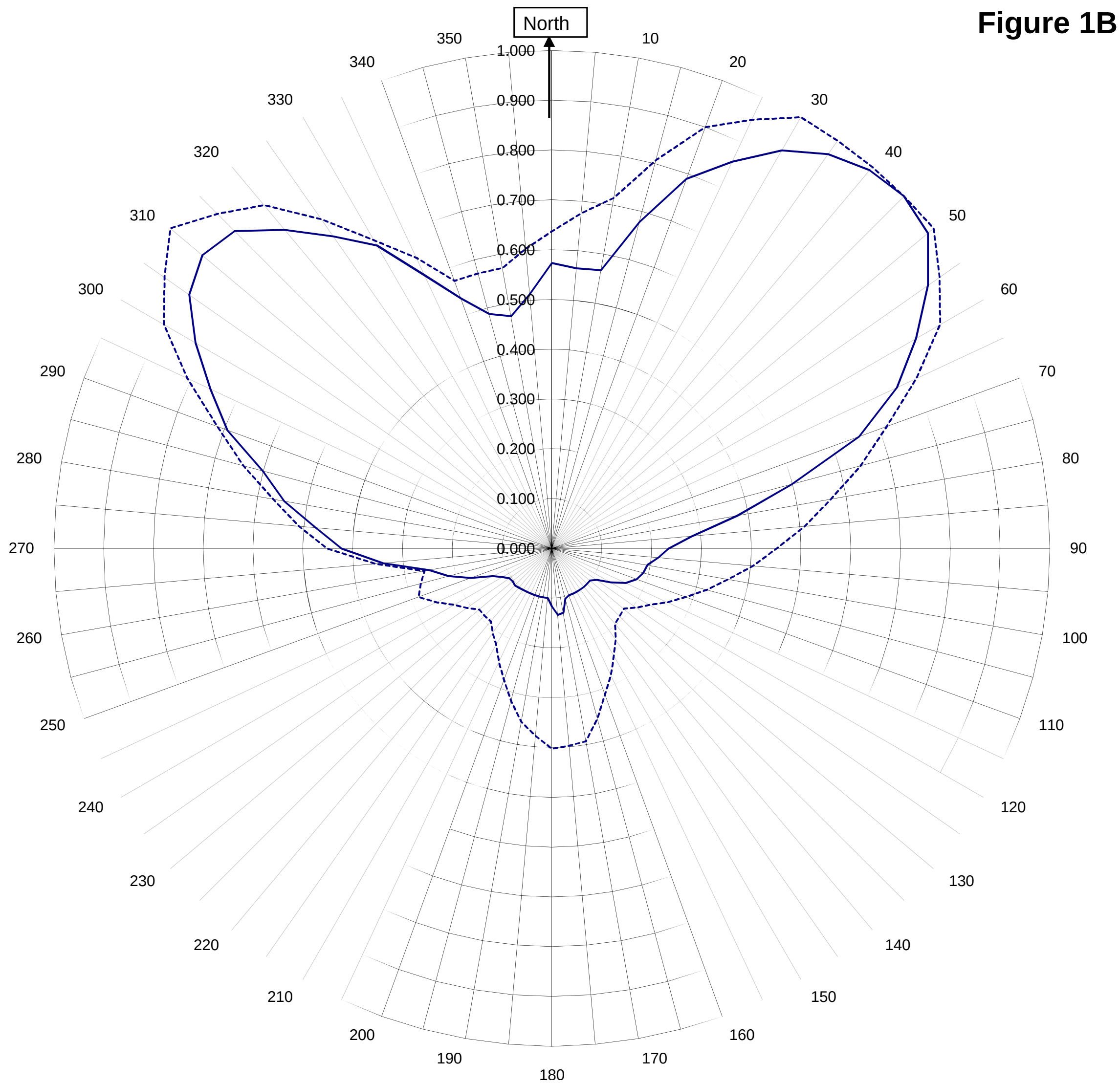
Figure 1B



WTPG WHITEHOUSE, OH.

29514

November 2, 2011

___________H/VComposite RMS	0.524
……………FCC Composite RMS	0.595

Frequency	88.9	/	400.05	mHz
Plot	Relative Field			
Scale	4.5 : 1			
	See Figure 2 for Mechanical Details			

Antenna Model	ALDENA YAGI
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WTPG WHITEHOUSE, OH.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.436	180	0.117
10	0.568	190	0.100
20	0.790	200	0.100
30	0.923	210	0.100
40	0.992	220	0.103
45	1.000	225	0.105
50	0.986	230	0.103
60	0.844	240	0.100
70	0.650	250	0.100
80	0.378	260	0.188
90	0.205	270	0.349
100	0.100	280	0.512
110	0.100	290	0.688
120	0.100	300	0.827
130	0.100	310	0.916
135	0.100	315	0.901
140	0.100	320	0.836
150	0.100	330	0.688
160	0.100	340	0.531
170	0.131	350	0.431

Figure 1D

Tabulation of Vertical Azimuth Pattern
WTPG WHITEHOUSE, OH.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.574	180	0.092
10	0.454	190	0.092
20	0.714	200	0.092
30	0.915	210	0.092
40	0.964	220	0.092
45	0.971	225	0.092
50	0.947	230	0.092
60	0.813	240	0.115
70	0.657	250	0.174
80	0.343	260	0.250
90	0.234	270	0.423
100	0.194	280	0.546
110	0.181	290	0.694
120	0.136	300	0.800
130	0.092	310	0.834
135	0.092	315	0.827
140	0.092	320	0.803
150	0.092	330	0.702
160	0.092	340	0.534
170	0.092	350	0.474

Figure 1E

Tabulation of Composite Azimuth Pattern
WTPG WHITEHOUSE, OH.

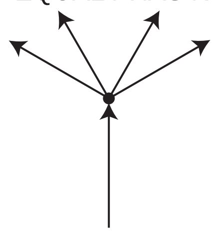
Azimuth	Rel Field	Azimuth	Rel Field
0	0.574	180	0.117
10	0.568	190	0.100
20	0.790	200	0.100
30	0.923	210	0.100
40	0.992	220	0.103
45	1.000	225	0.105
50	0.986	230	0.103
60	0.844	240	0.115
70	0.657	250	0.174
80	0.378	260	0.250
90	0.234	270	0.423
100	0.194	280	0.546
110	0.181	290	0.694
120	0.136	300	0.827
130	0.100	310	0.916
135	0.100	315	0.901
140	0.100	320	0.836
150	0.100	330	0.702
160	0.100	340	0.534
170	0.131	350	0.474

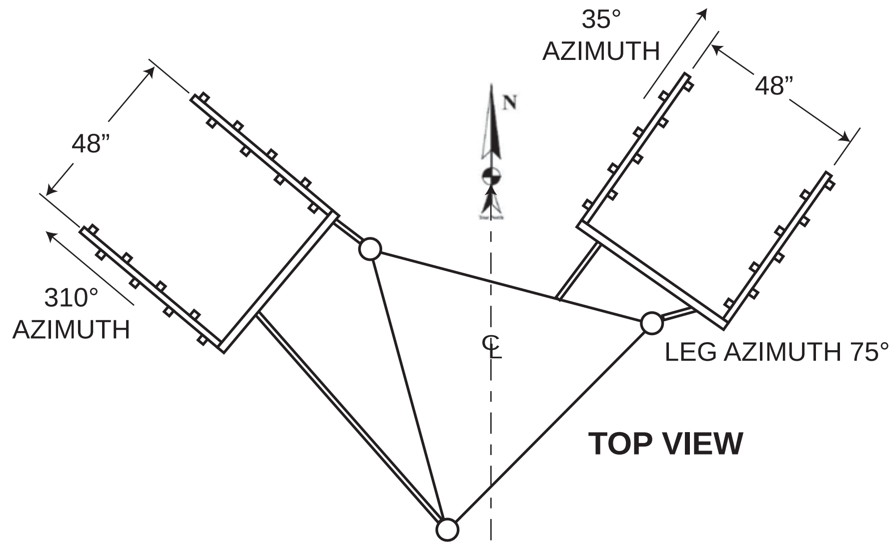
Figure 1F

Tabulation of FCC Directional Composite
WTPG WHITEHOUSE, OH.

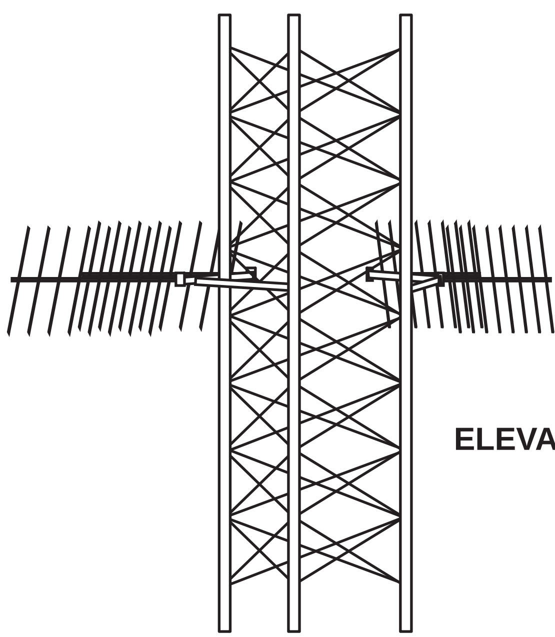
Azimuth	Rel Field	Azimuth	Rel Field
0	0.637	180	0.402
10	0.715	190	0.354
20	0.900	200	0.281
30	1.000	210	0.224
40	1.000	220	0.191
50	1.000	230	0.191
60	0.900	240	0.226
70	0.715	250	0.285
80	0.568	260	0.260
90	0.451	270	0.451
100	0.358	280	0.568
110	0.285	290	0.715
120	0.226	300	0.900
130	0.188	310	1.000
140	0.197	320	0.900
150	0.248	330	0.715
160	0.312	340	0.572
170	0.393	350	0.572

COAX SYSTEM FOR
2 YAGIS @ 35°; FULL POWER
2 YAGIS @ 310°; ATTENUATED 1dB
EQUAL PHASING

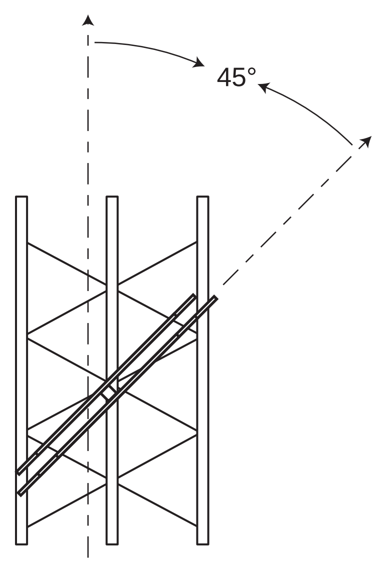




TOP VIEW



ELEVATION VIEW



PARTIAL FRONT VIEW

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SHIVELY LABS

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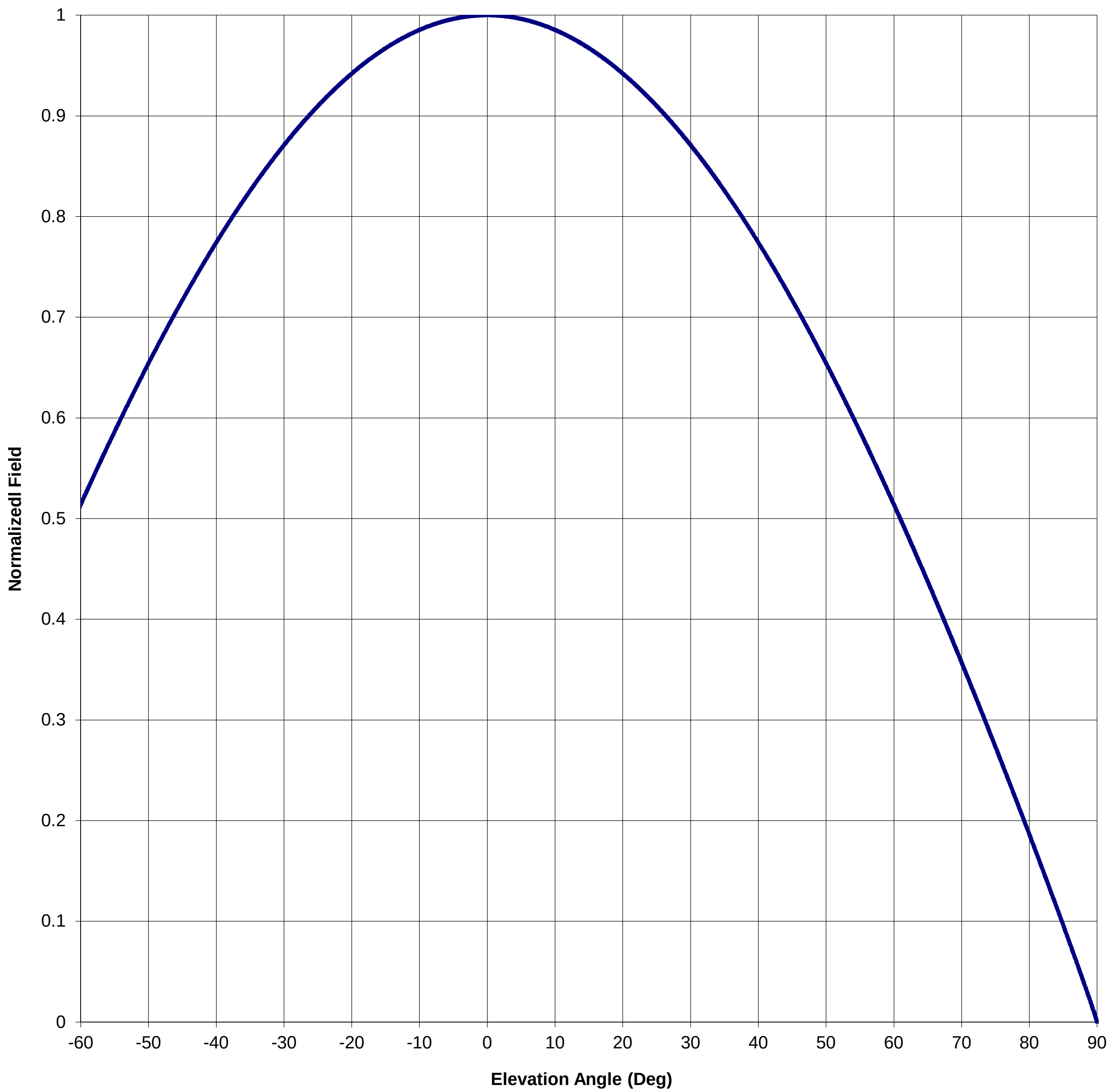
FIGURE 2, WTPG, 88.9 MHz
ALDENA SLANT (45°) YAGI ARRAY
WHITEHOUSE, OHIO

SIZE	CODE IDENT. NO.	DRAWING NO.	REV
A	26750	AGF111102-001	—

SCALE			SHEET
NONE	S/O 29514		1 OF 1

Antenna Mfg.:	**Shively Labs**			**Date:**	**11/2/2011**
Antenna Type:	**Aldena Yagi**				
Station:	**WTPG**	**Beam Tilt**	**0**		
Frequency:	**88.9**	**Gain (Max)**	**2.126**	**3.275**	**dB**
Channel #:	**205**	**Gain (Horizon)**	**2.126**	**3.275**	**dB**
Figure:	**Figure 3**				



Antenna Mfg.:	**Shively Labs**		**Date: 11/2/2011**
Antenna Type:	**Aldena Yagi**		
Station:	**WTPG**	**Beam Tilt**	**0**
Frequency:	**88.9**	**Gain (Max)**	**2.126**
Channel #:	**205**	**Gain (Horizon)**	**2.126**
Figure:	**Figure 3**		

Gain (Max): 2.126 — **3.275 dB**; Gain (Horizon): 2.126 — **3.275 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	0.729	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. 29514 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WTPG WHITEHOUSE, OH.

MODEL ALDENA YAGI

Elevation Gain of Antenna 0.55

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

H RMS 0.5125 V RMS 0.504852 H/V Ratio 1.015

Elevation Gain of Horizontal Component 0.558

Elevation Gain of Vertical Component 0.542

Horizontal Azimuth Gain equals $1/(RMS)^2$. 3.807

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 3.699
Max. Vertical 0.971

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

Total Horizontal Power Gain = **2.126**

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

Total Vertical Power Gain = **2.004**

===

ERP divided by Horizontal Power Gain equals Antenna Input Power

11.00 kW ERP Divided by H Gain 2.126 equals 5.175 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

5.175 kW Times V Gain 2.004 equals 10.371 kW V ERP

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

(0.971)^2 Times 11.00 Equals 10.371 kW Vertical ERP

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