Shively Labs
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S.O. 27506

Report of Test Aldena Slant Yagi

for

CALVARY CHAPEL OF JOPLIN

KITG 89.5 MHz Sarcoxie, MO

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of an Aldena Slant Yagi to meet the needs of KITG and to comply with the requirements of the FCC construction permit, file number BMPED-20090403ANK.

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-20090403ANK indicates that the Horizontal radiation component shall not exceed 34 kW at any azimuth and is restricted to the following values at the azimuths specified:

120 - 130 Degrees T: 1.10 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 279 Degrees T to 287 Degrees T. At the restricted azimuth of 120 - 130 Degrees T the Horizontal component is 17.08 dB down from the maximum of 34 kW, or 0.67 kW.

The R.M.S. of the Horizontal component is 0.492. The total Horizontal power gain is 4.770. The R.M.S. of the Vertical component is 0.490. The total Vertical power gain is 3.950. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.597. The R.M.S. of the measured composite pattern is 0.537. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.507. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the Aldena Slant Yagi was mounted on a tower of precise scale to the Valmont-42 tower at the KITG 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-20090403ANK, a single level of the Aldena Slant Yagi 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 402.75 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 27506
May 5, 2009

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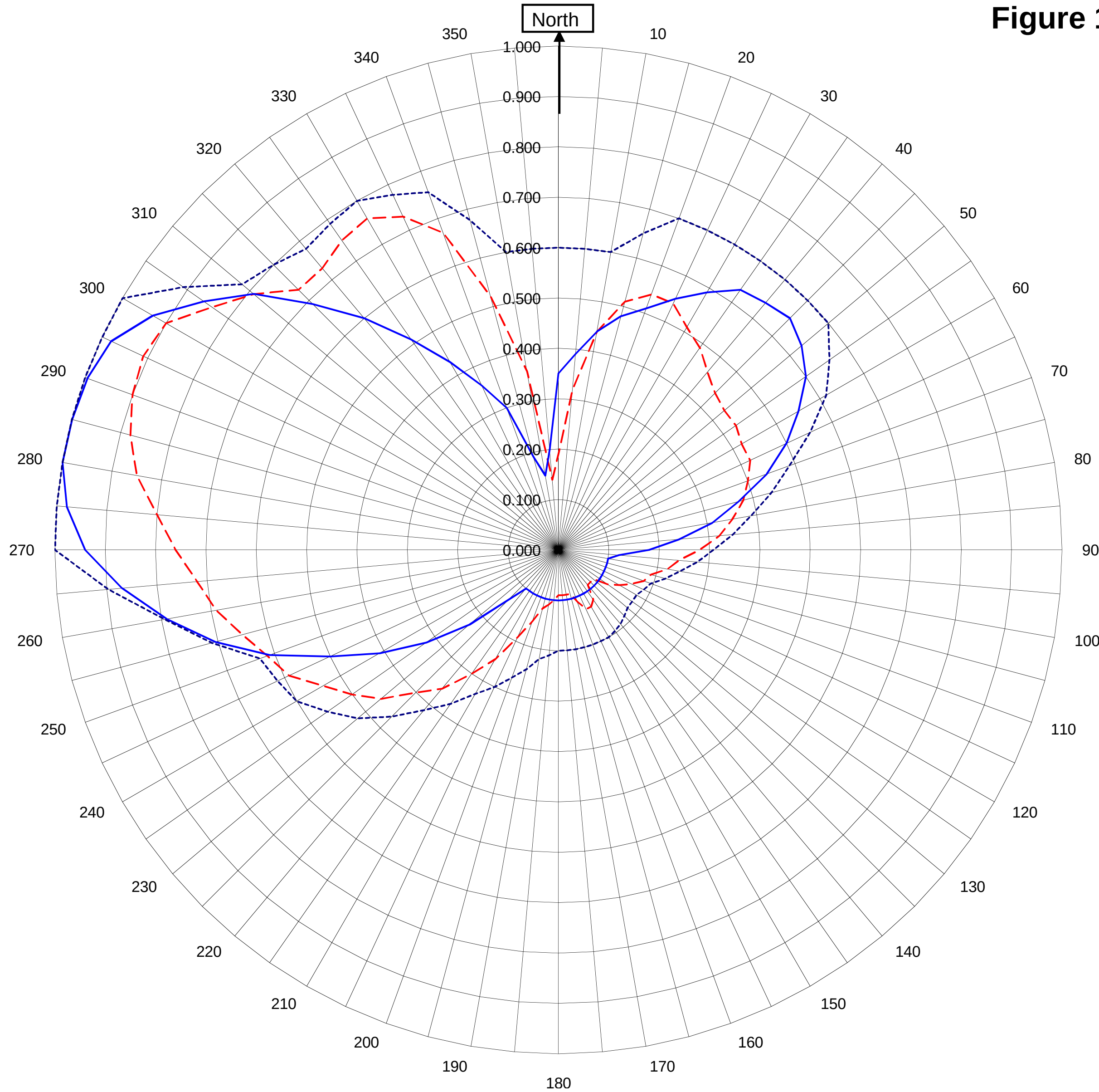
Figure 1a



KITG Sarcoxie, MO

27506

May 5, 2009

Horizontal RMS	0.492
Vertical RMS	0.490
H/V Composite RMS	0.537
...............FCC Composite RMS	0.597

Frequency	89.5 / 402.75 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	Aldena Slant Yagi
Pattern Type	Directional Azimuth

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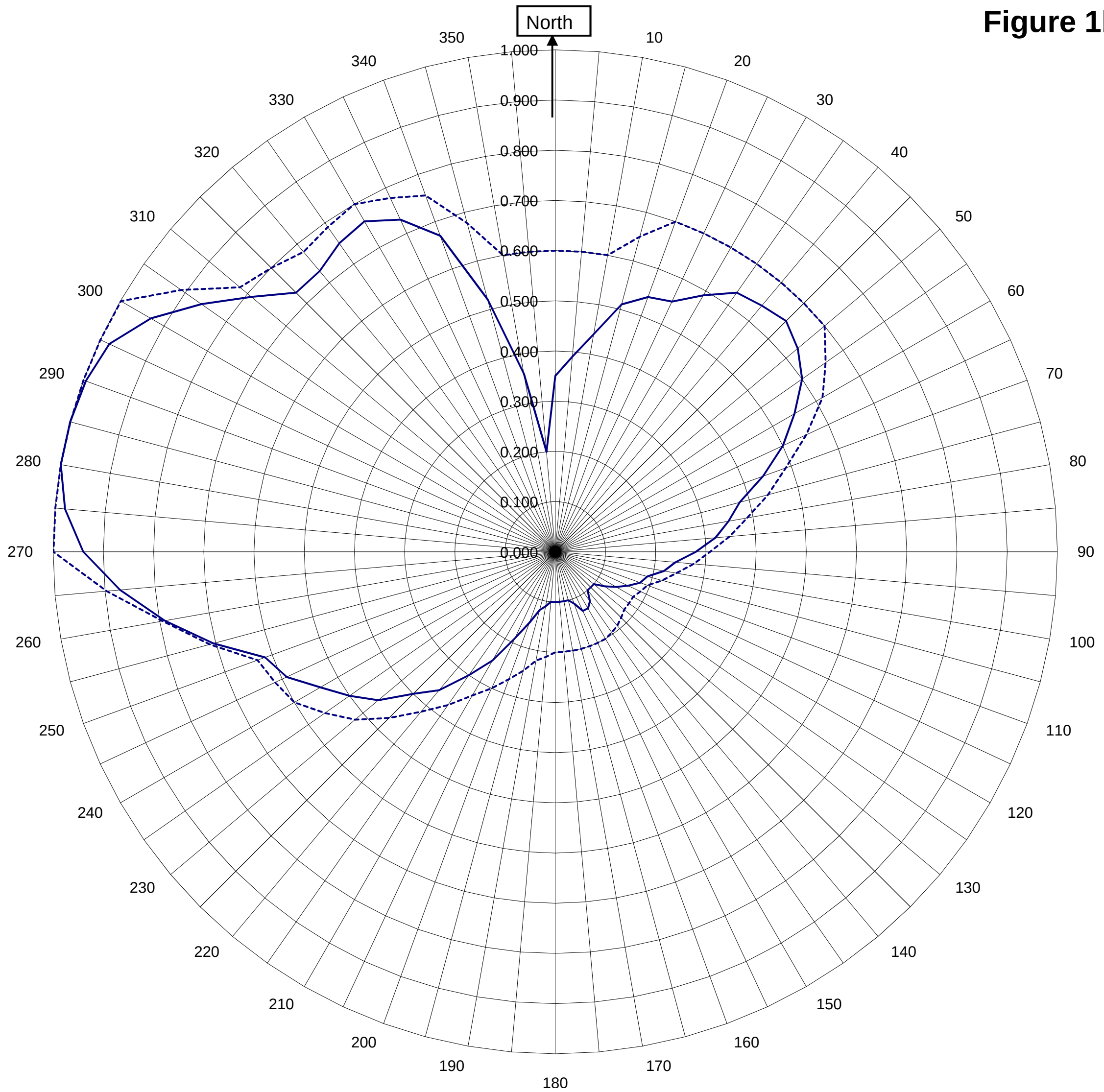
Figure 1b



KITG Sarcoxie, MO

27506

May 5, 2009

__________H/VComposite RMS	0.537
……………FCC Composite RMS	0.597

Frequency	89.5 / 402.75 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	Aldena Slant Yagi
Pattern Type	Directional H/V Composite

Figure 1c

Tabulation of Horizontal Azimuth Pattern
KITG Sarcoxie, MO

Azimuth	Rel Field	Azimuth	Rel Field
0	0.350	180	0.100
10	0.440	190	0.100
20	0.510	200	0.100
30	0.590	210	0.100
40	0.640	220	0.100
45	0.650	225	0.140
50	0.630	230	0.230
60	0.550	240	0.410
70	0.440	250	0.610
80	0.310	260	0.790
90	0.180	270	0.940
100	0.100	280	1.000
110	0.100	290	0.995
120	0.100	300	0.930
130	0.100	310	0.790
135	0.100	315	0.690
140	0.100	320	0.600
150	0.100	330	0.430
160	0.100	340	0.300
170	0.100	350	0.150

Figure 1d

Tabulation of Vertical Azimuth Pattern
KITG Sarcoxie, MO

Azimuth	Rel Field	Azimuth	Rel Field
0	0.190	180	0.090
10	0.440	190	0.110
20	0.540	200	0.150
30	0.510	210	0.250
40	0.460	220	0.360
45	0.440	225	0.400
50	0.430	230	0.460
60	0.420	240	0.540
70	0.400	250	0.615
80	0.350	260	0.690
90	0.280	270	0.760
100	0.220	280	0.850
110	0.180	290	0.900
120	0.140	300	0.900
130	0.090	310	0.790
135	0.090	315	0.730
140	0.090	320	0.730
150	0.130	330	0.760
160	0.110	340	0.670
170	0.090	350	0.360

Figure 1e

Tabulation of Composite Azimuth Pattern
KITG Sarcoxie, MO

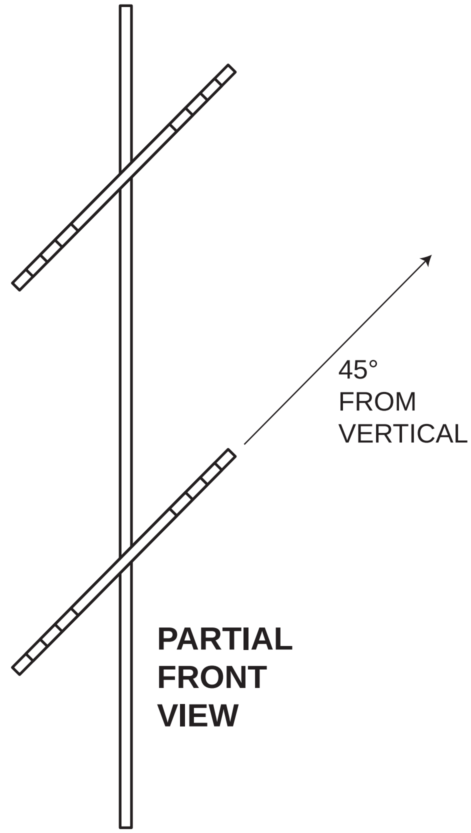
Azimuth	Rel Field	Azimuth	Rel Field
0	0.350	180	0.100
10	0.440	190	0.110
20	0.540	200	0.150
30	0.590	210	0.250
40	0.640	220	0.360
45	0.650	225	0.400
50	0.630	230	0.460
60	0.550	240	0.540
70	0.440	250	0.615
80	0.350	260	0.790
90	0.280	270	0.940
100	0.220	280	1.000
110	0.180	290	0.995
120	0.140	300	0.930
130	0.100	310	0.790
135	0.100	315	0.730
140	0.100	320	0.730
150	0.130	330	0.760
160	0.110	340	0.670
170	0.100	350	0.360

Figure 1f

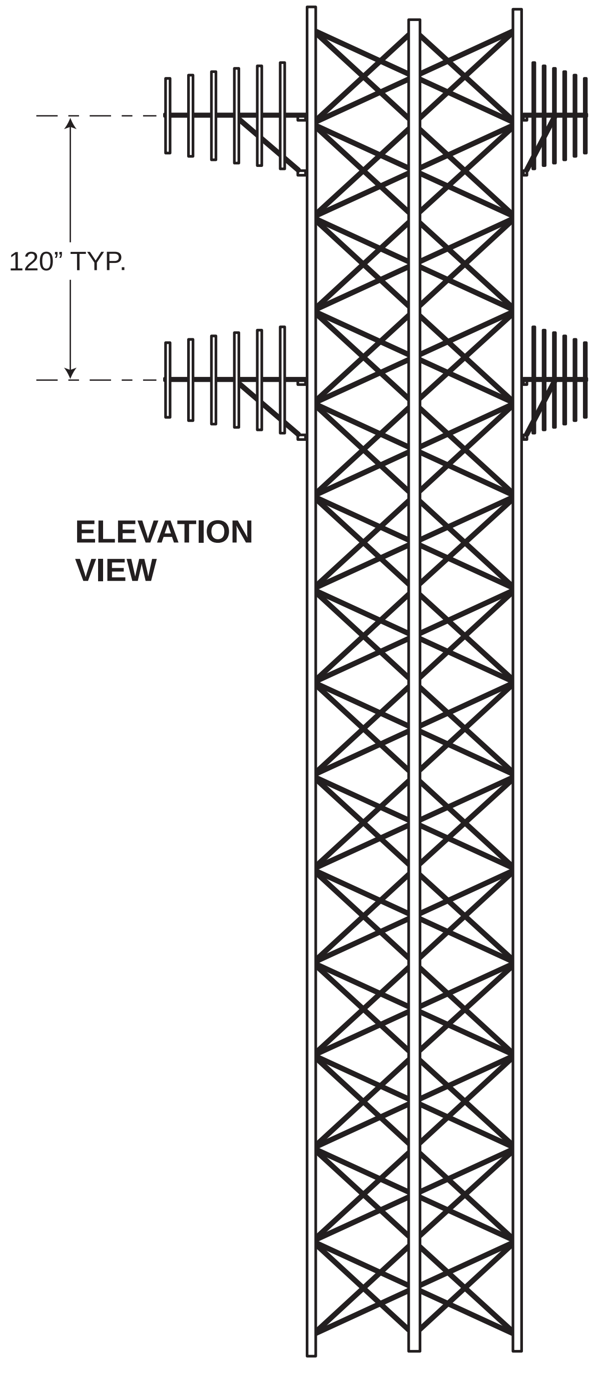
Tabulation of FCC Directional Composite
KITG Sarcoxie, MO

Azimuth	Rel Field	Azimuth	Rel Field
0	0.600	180	0.200
10	0.600	190	0.220
20	0.700	200	0.270
30	0.700	210	0.330
40	0.700	220	0.415
50	0.700	230	0.520
60	0.615	240	0.600
70	0.488	250	0.631
80	0.388	260	0.794
90	0.308	270	1.000
100	0.245	280	1.000
110	0.195	290	1.000
120	0.179	300	0.999
130	0.179	310	0.820
140	0.192	320	0.780
150	0.200	330	0.800
160	0.200	340	0.755
170	0.200	350	0.600

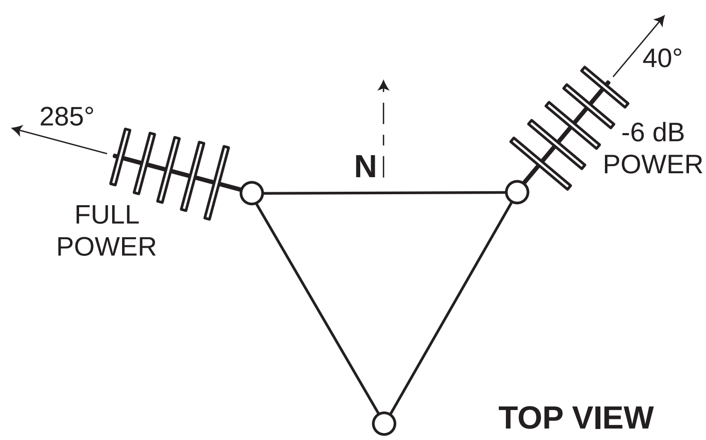
REV NO	REVISION	DATE	APP'D
A	ROTATED TOWER 60°. ANTENNAS WERE AT 40° AND 175°.	7/22/09	



PARTIAL FRONT VIEW



ELEVATION VIEW



TOP VIEW

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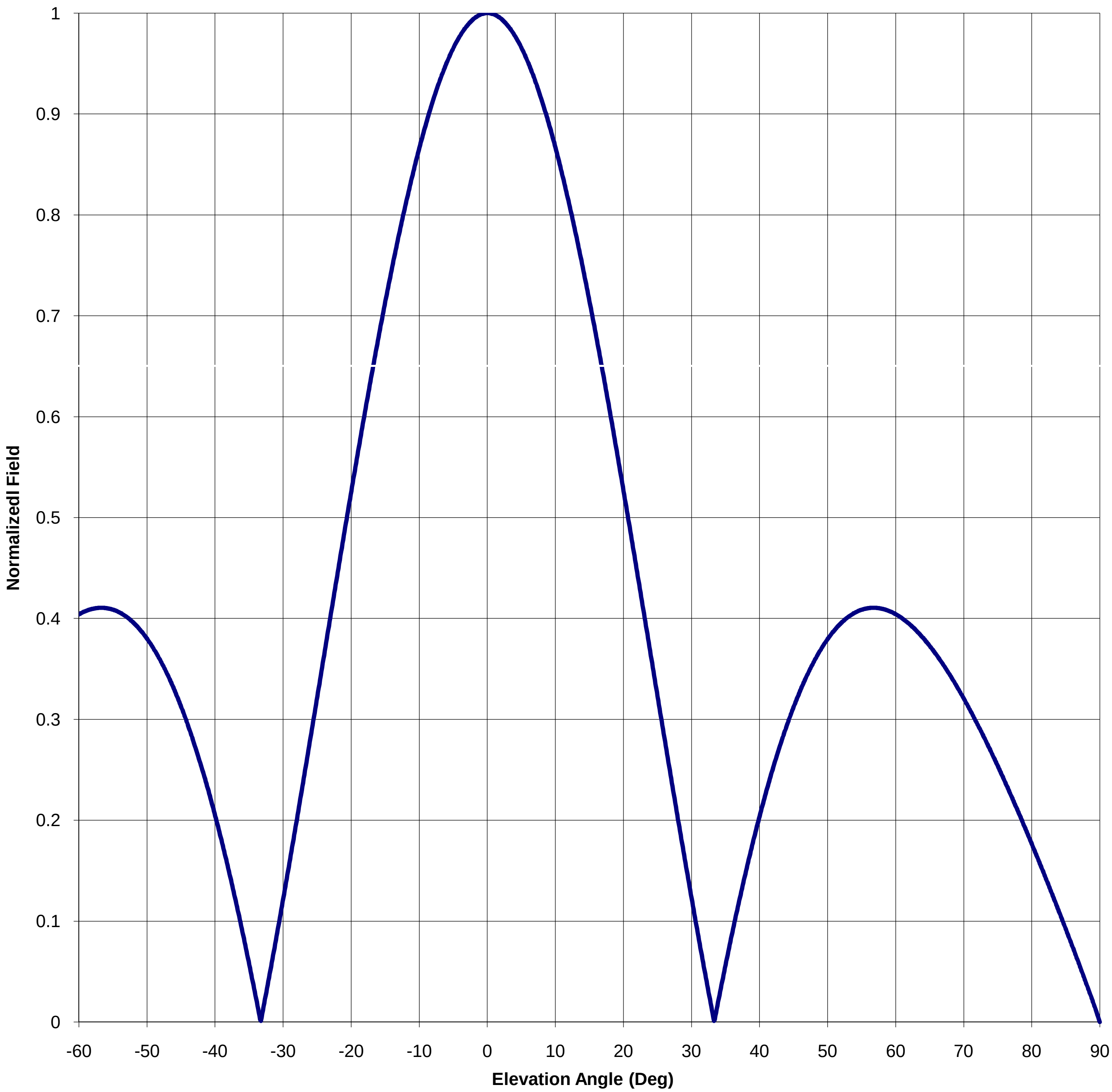
Figure 2, KITG 89.5 MHz 2 LEVELS				
SIZE A	CODE IDENT NO. 22501	DRAWING NO. AGF090505-001		REV A
SCALE NONE		S/O 27506	SHEET 1 of 1	

Antenna Mfg.:	**Shively Labs**				**Date:**	**5/5/2009**
Antenna Type:	**Aldena Slant Yagi**					
Station:	**KITG**	**Beam Tilt**	**0**			
Frequency:	**89.5**	**Gain (Max)**	**4.770**	**6.786**	**dB**	
Channel #:	**202**	**Gain (Horizon)**	**4.770**	**6.786**	**dB**	
Figure:	**3**					



Antenna Mfg.: Shively Labs **Date:** 5/5/2009
Antenna Type: Aldena Slant Yagi
Station: KITG **Beam Tilt** 0
Frequency: 89.5 **Gain (Max)** 4.770 6.786 dB
Channel #: 202 **Gain (Horizon)** 4.770 6.786 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	0.294	0	1.000	46	0.329
-89	0.020	-43	0.274	1	0.999	47	0.344
-88	0.038	-42	0.252	2	0.994	48	0.358
-87	0.056	-41	0.229	3	0.988	49	0.369
-86	0.074	-40	0.204	4	0.978	50	0.380
-85	0.092	-39	0.178	5	0.966	51	0.388
-84	0.109	-38	0.150	6	0.951	52	0.396
-83	0.126	-37	0.120	7	0.933	53	0.401
-82	0.143	-36	0.089	8	0.913	54	0.406
-81	0.160	-35	0.057	9	0.891	55	0.409
-80	0.176	-34	0.023	10	0.866	56	0.410
-79	0.193	-33	0.012	11	0.840	57	0.411
-78	0.208	-32	0.048	12	0.811	58	0.410
-77	0.224	-31	0.085	13	0.781	59	0.407
-76	0.239	-30	0.123	14	0.748	60	0.404
-75	0.254	-29	0.162	15	0.714	61	0.400
-74	0.268	-28	0.201	16	0.679	62	0.395
-73	0.282	-27	0.241	17	0.642	63	0.388
-72	0.295	-26	0.282	18	0.605	64	0.381
-71	0.308	-25	0.323	19	0.566	65	0.373
-70	0.321	-24	0.364	20	0.527	66	0.364
-69	0.332	-23	0.405	21	0.486	67	0.354
-68	0.344	-22	0.446	22	0.446	68	0.344
-67	0.354	-21	0.486	23	0.405	69	0.332
-66	0.364	-20	0.527	24	0.364	70	0.321
-65	0.373	-19	0.566	25	0.323	71	0.308
-64	0.381	-18	0.605	26	0.282	72	0.295
-63	0.388	-17	0.642	27	0.241	73	0.282
-62	0.395	-16	0.679	28	0.201	74	0.268
-61	0.400	-15	0.714	29	0.162	75	0.254
-60	0.404	-14	0.748	30	0.123	76	0.239
-59	0.407	-13	0.781	31	0.085	77	0.224
-58	0.410	-12	0.811	32	0.048	78	0.208
-57	0.411	-11	0.840	33	0.012	79	0.193
-56	0.410	-10	0.866	34	0.023	80	0.176
-55	0.409	-9	0.891	35	0.057	81	0.160
-54	0.406	-8	0.913	36	0.089	82	0.143
-53	0.401	-7	0.933	37	0.120	83	0.126
-52	0.396	-6	0.951	38	0.150	84	0.109
-51	0.388	-5	0.966	39	0.178	85	0.092
-50	0.380	-4	0.978	40	0.204	86	0.074
-49	0.369	-3	0.988	41	0.229	87	0.056
-48	0.358	-2	0.994	42	0.252	88	0.038
-47	0.344	-1	0.999	43	0.274	89	0.020
-46	0.329	0	1.000	44	0.294	90	0.000
-45	0.312			45	0.312		

S.O. 27506 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

KITG Sarcoxie, MO

Aldenia Yagi Slant 45 Degrees

Elevation Gain of Antenna 1.15

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

H RMS	0.492	V RMS	0.49	H/V Ratio	1.004

Elevation Gain of Horizontal Component 1.155

Elevation Gain of Vertical Component 1.145

Horizontal Azimuth Gain equals $1/(RMS)^2$. 4.131

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 3.449
Max. Vertical 0.91

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

Total Horizontal Power Gain = **4.770**

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

Total Vertical Power Gain = **3.950**

===

ERP divided by Horizontal Power Gain equals Antenna Input Power

34 kW ERP Times H Gain 4.770 equals 7.13 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

7.13 kW Times V Gain 3.950 equals 28.16 kW V ERP

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

(0.91)^2 Times 34.00 Equals 28.16 kW Vertical ERP

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