ELECTRONICS RESEARCH, INC. ERI®

Electronics Research, Inc. 7777 Gardner Rd. Chandler, IN 47610 Phone (812) 925-6000 Fax (812) 925-4030 http://www.eriinc.com/

Directional Antenna System for KOSY, Anamosa, Iowa

May 5, 2015

Electronics Research Inc. is providing a custom fabricated antenna system that is specially designed to meet the FCC requirements and the general needs of radio station KOSY.

The antenna is the ERI model LP-4E-DA configuration. The circular polarized system consists of 4 full-wavelength spaced bays using one driven circular polarized radiating element, two horizontal parasitic elements placed one quarter wave above and below each bay and three vertical parasitic elements per bay. The antenna was mounted on the North 55 degrees East tower leg with bracketry to provide an antenna orientation of North 88 degrees East. The antenna was tested on a 24" face tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 95.7 megahertz, which is the center of the FM broadcast channel assigned to KOSY.

Pattern measurements were made on a sixty-acre antenna pattern range that is owned and operated by Electronics Research, Inc. The tests were performed under the direction of Thomas B. Silliman, president of Electronics Research, Inc. Mr. Silliman has the Bachelor of Electrical Engineering and the Master of Electrical Engineering degrees from Cornell University and is a registered professional engineer in the states of Indiana, Maryland and Minnesota.

Directional Antenna System
For
KOSY, Anamosa, Iowa

(Continued)

DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of two bay levels of the circular polarized system with the associated horizontal and vertical parasitic elements. The elements and brackets that were used in this test are electrically equivalent to those that will be supplied with the antenna. A section of 1 5/8 inch o.d. rigid coaxial line was used to feed the test antenna, and a section of 1 5/8 inch o.d. rigid outer conductor only was attached above the test antenna. The lines were properly grounded during all tests.

The power distribution and phase relationship to the antenna elements was adjusted in order to achieve the directional radiation patterns for both horizontal and vertical polarization components.

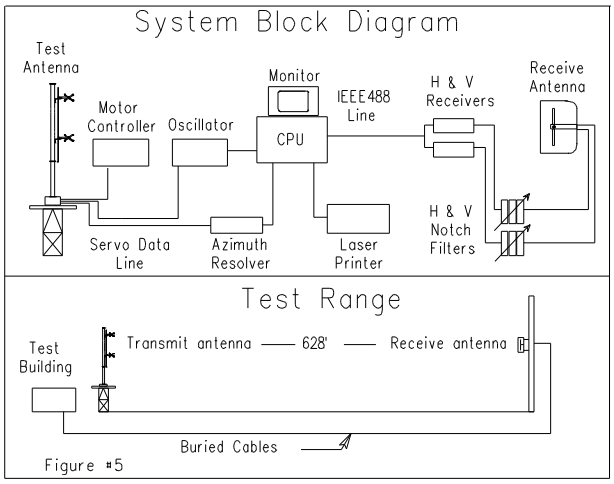

Figure #5

The proof-of-performance was accomplished using a 24" face tower with identical dimension and configuration including all braces, ladders, conduits, coaxial lines and other appurtenances that are included in the actual aperture at which the antenna will be installed. The structure was erected vertically on a turntable mounted on a non-metallic building with the antenna centered vertically on the structure, making the center of radiation of the test approximately 30 feet above ground. The turntable is equipped with a motor drive and a US Digital angle position indicator. The resolution of this angle position indicator is one-hundredth of a degree.

The antenna under test was operated in the transmitting mode and fed from a HP8657D signal generator. The frequency of the signal source was set at 95.7 MHz and was constantly monitored by a Rohde & Schwarz ESVD measuring receiver.

(Continued)

A broadband horizontal and vertical dipole system, located approximately 628 feet from the test antenna, was used to receive the emitted test signals. The dipole system was mounted at the same height above terrain as the center of the antenna under test. The signals received by the dipole system were fed to the test building by way of two buried Heliax cables to a Rohde & Schwarz measuring receiver. This data was interfaced to a laser jet printer by means of a computer system. Relative field strength was plotted as a function of azimuth.

The measurements were performed by rotating the test antenna in a counter-clockwise direction and plotting the received signal on polar co-ordinated graph paper in a clockwise direction. Both horizontal and vertical components were recorded separately.

CONCLUSIONS

The circular polarized system consists of 4 full-wavelength spaced bays using one driven circular polarized radiating element, two horizontal parasitic elements placed one quarter wave above and below each bay and three vertical parasitic elements per bay. The power distribution and phase relationship will be fixed when the antenna is manufactured. Proper maintenance of the elements should be all that is required to maintain the pattern in adjustment.

The LP-4E-DA array is to be mounted on the North 55 degrees East tower leg of the 24" face tower at a bearing of North 88 degrees East. Blue prints provided with the antenna will show the proper antenna orientation alignment. The antenna alignment procedure should be directed by a licensed surveyor as prescribed by the FCC.

Figure #1 represents the maximum value of either the horizontal or vertical component at any azimuth. The measured horizontal plane relative field pattern, for both the horizontal and vertical polarization components, is shown on Figure #2 attached. The actual measured pattern does not exceed the authorized FCC composite pattern at any azimuth. A calculated vertical plane relative field pattern is shown on Figure #3 attached. The power in the maximum will reach 18 kilowatts (12.553 dBk).

The power at North 260 degrees East does not exceed 4 kilowatts (6.021 dBk).

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(Continued)

The RMS of the vertically polarized horizontal plane component does not exceed the RMS of the horizontally polarized horizontal plane component.

The composite horizontal and vertical maximum relative field pattern obtained from the measured data as shown on Figure #1 has an RMS that is greater that 85% of the filed composite pattern.

The clear vertical length of the structure required to support the antenna is 46 feet if the antenna is to be top mounted.

The directional antenna should not be mounted on the top of an antenna tower that includes a top-mounted platform larger than the cross-sectional area of the tower in the horizontal plane. No obstructions other than those that are specified by the blue prints supplied with the antenna are to be mounted within 75 ft. horizontally of the system. The vertical distance to the nearest obstruction should be a minimum of 10 ft. from the directional antenna. Metallic guy wires should be a minimum distance of forty feet horizontally from the antenna.

ELECTRONICS RESEARCH, INC.

ERI® Horizontal Plane Relative Field Pattern

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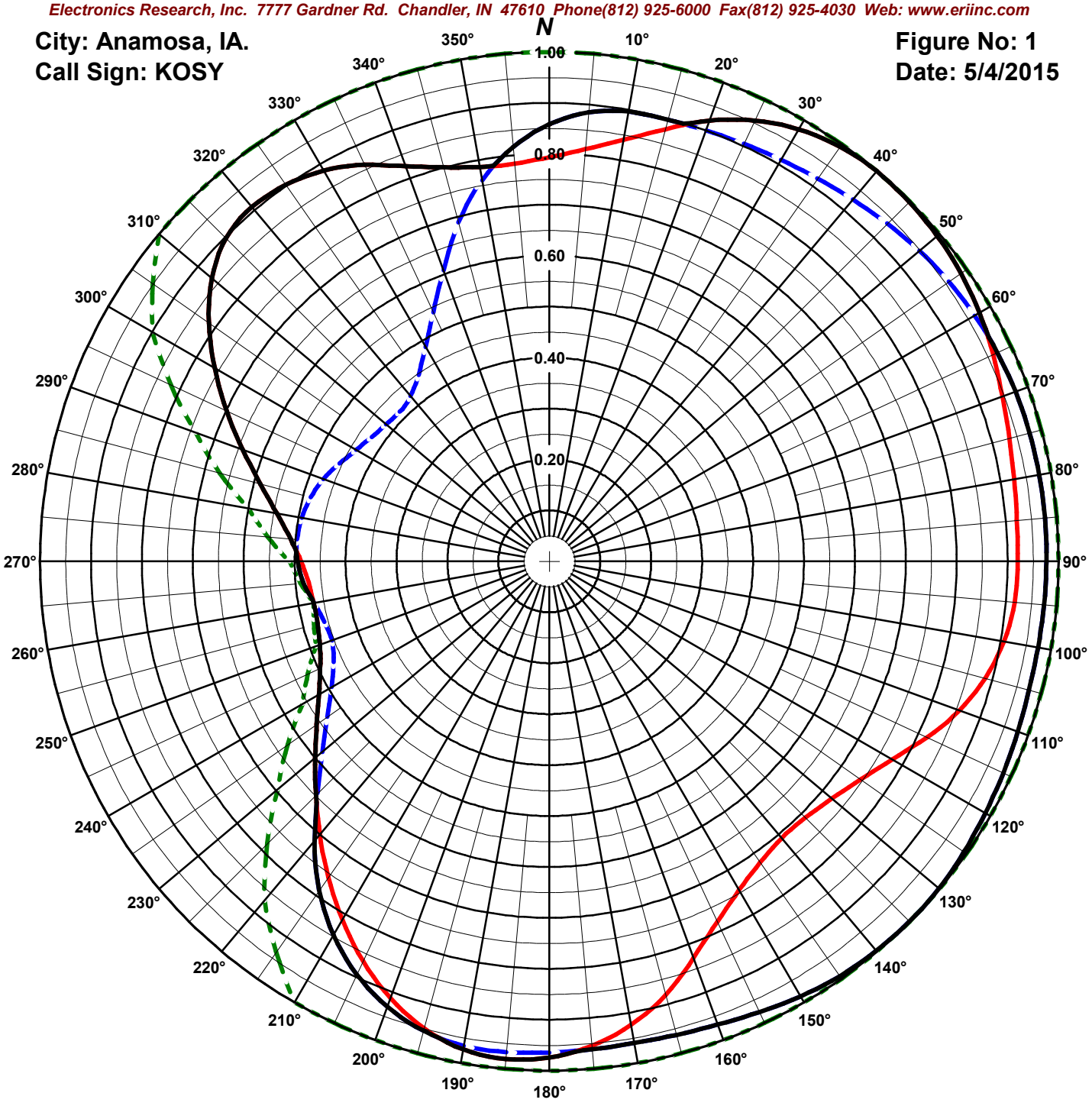
City: Anamosa, IA.
Call Sign: KOSY

Figure No: 1
Date: 5/4/2015



Antenna Orientation: 88° True

Frequency: 95.7 MHz
Antenna Type: LP-4E-DA

Antenna Mounting: Custom
Tower Type: 24" Tower

HORIZONTAL	VERTICAL	COMPOSITE	FCC ENVELOPE
RMS: .818	RMS: .814	RMS: .868	RMS: .927
Maximum: 1 @ 40°	Maximum: 1 @ 134°	Maximum: 1 @ 40°	Maximum: 1 @ 0°
Minimum: .469 @ 259°	Minimum: .415 @ 316°	Minimum: .469 @ 259°	Minimum: .47 @ 260°

Measured patterns of the horizontal and vertical components. The composite pattern shows the maximum of either the H or V azimuth values. This patterns is greater than 85% of the FCC filed composite pattern BPH-20111209DSS.

ERI® Horizontal Plane Relative Field Pattern

Electronics Research, Inc. 7777 Gardner Rd. Chandler, IN 47610 Phone(812) 925-6000 Fax(812) 925-4030 Web: www.eriinc.com

Figure# 1 **Date: 5/4/2015**
Station: KOSY **Antenna: LP-4E-DA**
Location: Anamosa, IA. **Antenna Orientation: 88° True**
Frequency: 95.7 MHz **Number of Bays: 4**

Azimuth	Envelope			Polarization	Azimuth	Envelope			Polarization
	Field	kW	dBk	Maximum		Field	kW	dBk	Maximum
0°	0.858	13.249	11.222	Vertical	180°	0.974	17.073	12.323	Horizontal
5°	0.885	14.087	11.488	Vertical	185°	0.981	17.322	12.386	Horizontal
10°	0.897	14.468	11.604	Vertical	190°	0.973	17.042	12.315	Horizontal
15°	0.898	14.510	11.617	Vertical	195°	0.954	16.387	12.145	Vertical
20°	0.921	15.260	11.836	Horizontal	200°	0.930	15.582	11.926	Vertical
25°	0.955	16.407	12.150	Horizontal	205°	0.895	14.412	11.587	Vertical
30°	0.979	17.261	12.371	Horizontal	210°	0.847	12.923	11.114	Vertical
35°	0.994	17.797	12.503	Horizontal	215°	0.788	11.176	10.483	Vertical
40°	1.000	18.000	12.553	Horizontal	220°	0.717	9.247	9.660	Vertical
45°	0.999	17.954	12.542	Horizontal	225°	0.648	7.557	8.784	Horizontal
50°	0.994	17.793	12.502	Horizontal	230°	0.600	6.479	8.115	Horizontal
55°	0.987	17.518	12.435	Horizontal	235°	0.557	5.594	7.477	Horizontal
60°	0.976	17.133	12.338	Horizontal	240°	0.522	4.912	6.912	Horizontal
65°	0.970	16.947	12.291	Vertical	245°	0.496	4.432	6.466	Horizontal
70°	0.974	17.079	12.325	Vertical	250°	0.479	4.135	6.165	Horizontal
75°	0.976	17.151	12.343	Vertical	255°	0.471	3.996	6.017	Horizontal
80°	0.977	17.180	12.350	Vertical	260°	0.470	3.970	5.988	Horizontal
85°	0.977	17.186	12.352	Vertical	265°	0.485	4.226	6.259	Vertical
90°	0.976	17.153	12.343	Vertical	270°	0.494	4.399	6.433	Vertical
95°	0.975	17.116	12.334	Vertical	275°	0.510	4.684	6.706	Horizontal
100°	0.974	17.088	12.327	Vertical	280°	0.543	5.314	7.254	Horizontal
105°	0.975	17.113	12.333	Vertical	285°	0.587	6.206	7.928	Horizontal
110°	0.979	17.242	12.366	Vertical	290°	0.640	7.380	8.681	Horizontal
115°	0.984	17.411	12.408	Vertical	295°	0.699	8.802	9.446	Horizontal
120°	0.988	17.583	12.451	Vertical	300°	0.758	10.355	10.151	Horizontal
125°	0.994	17.793	12.503	Vertical	305°	0.816	11.983	10.786	Horizontal
130°	0.999	17.961	12.543	Vertical	310°	0.865	13.467	11.293	Horizontal
135°	1.000	17.998	12.552	Vertical	315°	0.898	14.500	11.614	Horizontal
140°	0.998	17.936	12.537	Vertical	320°	0.908	14.847	11.717	Horizontal
145°	0.994	17.789	12.501	Vertical	325°	0.902	14.646	11.657	Horizontal
150°	0.986	17.511	12.433	Vertical	330°	0.886	14.117	11.497	Horizontal
155°	0.976	17.159	12.345	Vertical	335°	0.859	13.277	11.231	Horizontal
160°	0.968	16.859	12.268	Vertical	340°	0.826	12.267	10.887	Horizontal
165°	0.962	16.674	12.220	Vertical	345°	0.801	11.544	10.624	Horizontal
170°	0.960	16.603	12.202	Vertical	350°	0.786	11.133	10.466	Horizontal
175°	0.962	16.644	12.212	Vertical	355°	0.816	11.995	10.790	Vertical

Horizontal Polarization:
Maximum: 3.043 (4.833 dB)
Horizontal Plane: 3.043 (4.833 dB)
Maximum ERP: 18.000 kW

Vertical Polarization:
Maximum: 3.043 (4.833 dB)
Horizontal Plane: 3.043 (4.833 dB)
Maximum ERP: 18.000 kW

Total Input Power: 5.916 kW
Reference: KOSY1M.FIG

This list shows the the maximum azimuth values of either the horizontal or vertical components.

ERI® Horizontal Plane Relative Field Pattern

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Figure# 1A **Date: 5/4/2015**
Station: KOSY **Antenna: LP-4E-DA**
Location: Anamosa, IA. **Antenna Orientation: 88° True**
Frequency: 95.7 MHz **Number of Bays: 4**

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.793	11.328	10.541	0.858	13.249	11.222	180°	0.974	17.073	12.323	0.964	16.736	12.236
5°	0.812	11.873	10.746	0.885	14.087	11.488	185°	0.981	17.322	12.386	0.967	16.842	12.264
10°	0.840	12.715	11.043	0.897	14.468	11.604	190°	0.973	17.042	12.315	0.966	16.798	12.253
15°	0.878	13.882	11.425	0.898	14.510	11.617	195°	0.949	16.225	12.102	0.954	16.387	12.145
20°	0.921	15.260	11.836	0.900	14.588	11.640	200°	0.912	14.987	11.757	0.930	15.582	11.926
25°	0.955	16.407	12.150	0.904	14.721	11.679	205°	0.866	13.491	11.300	0.895	14.412	11.587
30°	0.979	17.261	12.371	0.910	14.912	11.735	210°	0.812	11.881	10.749	0.847	12.923	11.114
35°	0.994	17.797	12.503	0.918	15.161	11.807	215°	0.757	10.307	10.131	0.788	11.176	10.483
40°	1.000	18.000	12.553	0.927	15.469	11.895	220°	0.701	8.840	9.464	0.717	9.247	9.660
45°	0.999	17.954	12.542	0.938	15.837	11.997	225°	0.648	7.557	8.784	0.643	7.448	8.721
50°	0.994	17.793	12.502	0.949	16.199	12.095	230°	0.600	6.479	8.115	0.582	6.088	7.844
55°	0.987	17.518	12.435	0.958	16.505	12.176	235°	0.557	5.594	7.477	0.532	5.089	7.066
60°	0.976	17.133	12.338	0.965	16.755	12.241	240°	0.522	4.912	6.912	0.494	4.387	6.422
65°	0.961	16.640	12.212	0.970	16.947	12.291	245°	0.496	4.432	6.466	0.468	3.936	5.950
70°	0.947	16.134	12.078	0.974	17.079	12.325	250°	0.479	4.135	6.165	0.453	3.699	5.681
75°	0.935	15.743	11.971	0.976	17.151	12.343	255°	0.471	3.996	6.017	0.458	3.769	5.762
80°	0.927	15.463	11.893	0.977	17.180	12.350	260°	0.470	3.970	5.988	0.469	3.956	5.972
85°	0.922	15.293	11.845	0.977	17.186	12.352	265°	0.475	4.053	6.078	0.485	4.226	6.259
90°	0.920	15.229	11.827	0.976	17.153	12.343	270°	0.487	4.276	6.310	0.494	4.399	6.433
95°	0.917	15.149	11.804	0.975	17.116	12.334	275°	0.510	4.684	6.706	0.497	4.445	6.479
100°	0.906	14.787	11.699	0.974	17.088	12.327	280°	0.543	5.314	7.254	0.493	4.379	6.414
105°	0.886	14.135	11.503	0.975	17.113	12.333	285°	0.587	6.206	7.928	0.485	4.233	6.266
110°	0.857	13.212	11.210	0.979	17.242	12.366	290°	0.640	7.380	8.681	0.472	4.010	6.031
115°	0.818	12.049	10.809	0.984	17.411	12.408	295°	0.699	8.802	9.446	0.454	3.717	5.702
120°	0.778	10.890	10.370	0.988	17.583	12.451	300°	0.758	10.355	10.151	0.438	3.450	5.378
125°	0.747	10.033	10.014	0.994	17.793	12.503	305°	0.816	11.983	10.786	0.426	3.263	5.136
130°	0.725	9.449	9.754	0.999	17.961	12.543	310°	0.865	13.467	11.293	0.418	3.150	4.983
135°	0.712	9.116	9.598	1.000	17.998	12.552	315°	0.898	14.500	11.614	0.416	3.108	4.925
140°	0.710	9.068	9.575	0.998	17.936	12.537	320°	0.908	14.847	11.717	0.424	3.230	5.092
145°	0.722	9.373	9.719	0.994	17.789	12.501	325°	0.902	14.646	11.657	0.447	3.603	5.566
150°	0.745	9.998	9.999	0.986	17.511	12.433	330°	0.886	14.117	11.497	0.486	4.251	6.285
155°	0.781	10.974	10.404	0.976	17.159	12.345	335°	0.859	13.277	11.231	0.539	5.238	7.192
160°	0.828	12.345	10.915	0.968	16.859	12.268	340°	0.826	12.267	10.887	0.608	6.649	8.228
165°	0.882	13.989	11.458	0.962	16.674	12.220	345°	0.801	11.544	10.624	0.689	8.535	9.312
170°	0.924	15.374	11.868	0.960	16.603	12.202	350°	0.786	11.133	10.466	0.760	10.394	10.168
175°	0.955	16.415	12.152	0.962	16.644	12.212	355°	0.784	11.060	10.438	0.816	11.995	10.790

Horizontal Polarization:
Maximum: 3.043 (4.833 dB)
Horizontal Plane: 3.043 (4.833 dB)
Maximum ERP: 18.000 kW

Vertical Polarization:
Maximum: 3.043 (4.833 dB)
Horizontal Plane: 3.043 (4.833 dB)
Maximum ERP: 18.000 kW

Total Input Power: 5.916 kW
Reference: KOSY1M.FIG

This list shows the azimuth values for the horizontal and vertical components.

ERI® Vertical Plane Relative Field Pattern

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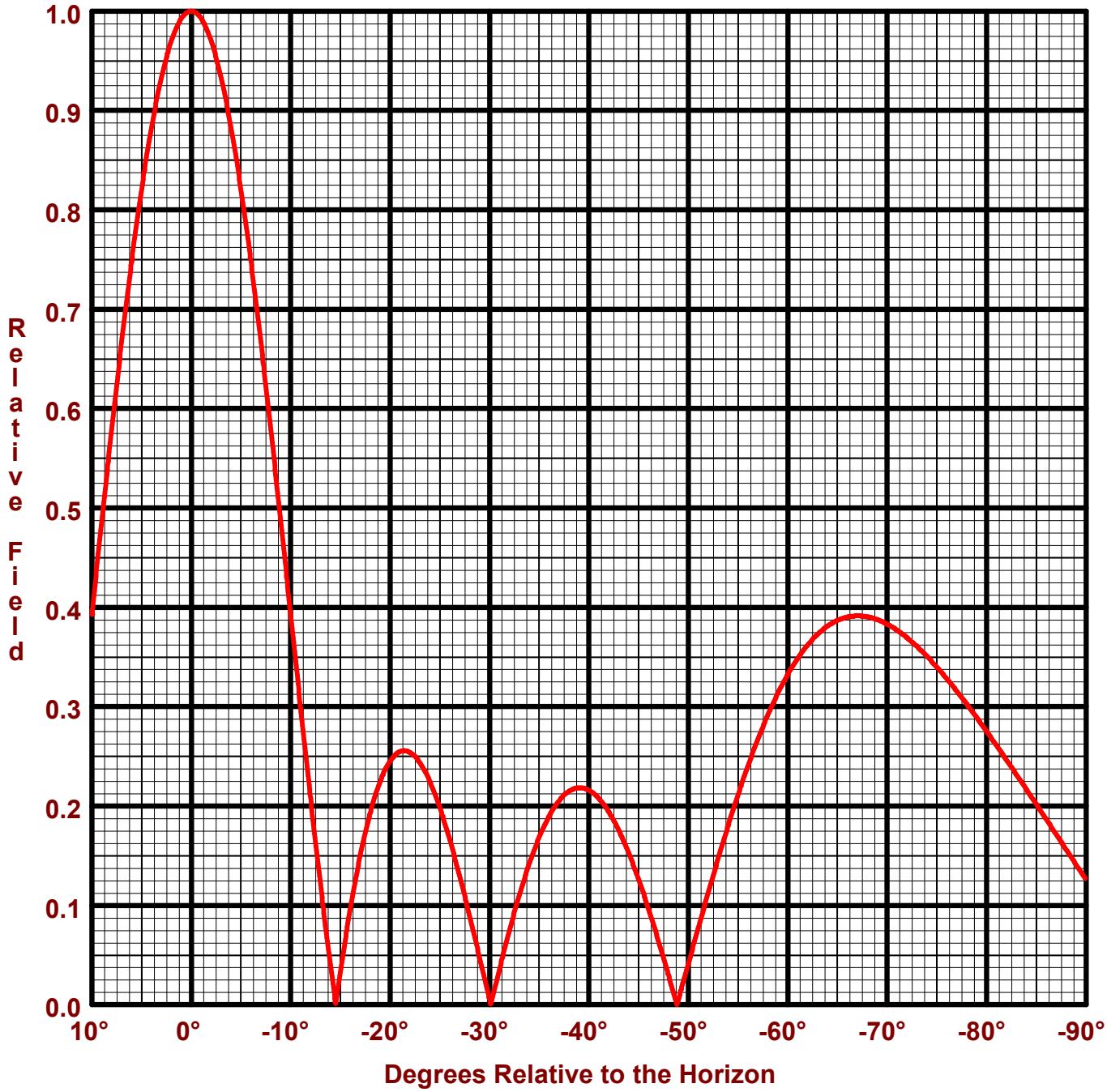
Figure No: 3
Call Sign: KOSY
Location: Anamosa, IA.
Frequency: 95.7 MHz
4 bay LP-4E-DA antenna

Date: 5/4/2015
H/V Power Ratio: 1
1 Wave-length Spacing
0° Beam Tilt
0% First Null Fill



Horizontal Polarization:
Maximum: 3.043 (4.833 dB)
Horizontal Plane: 3.043 (4.833 dB)
Maximum ERP: 18.000 kW

Vertical Polarization:
Maximum: 3.043 (4.833 dB)
Horizontal Plane: 3.043 (4.833 dB)
Maximum ERP: 18.000 kW

Directional Antenna System
for
KOSY, Anamosa, Iowa

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	LP-4E-DA
Frequency:	95.7 MHz
Number of Bays:	Four

MECHANICAL SPECIFICATIONS

Mounting:	Custom
System length:	39 ft 5 in
Aperture length required:	50 ft 9 in
Orientation:	88° true

Input flange to the antenna 1 5/8” female.

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	18.000 kW (12.553 dBk)
Horizontal maximum power gain:	3.041 (4.831 dB)
Maximum vertical ERP:	18.000 kW (12.553 dBk)
Vertical maximum power gain:	3.041 (4.831 dB)
Total input power:	5.918 kW (7.722 dBk)