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 KCCU, Lawton, Oklahoma

May 10, 2012

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 KCCU.

The antenna is the ERI model LP-3E-DA configuration. The circular polarized system consists of 3 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 four vertical parasitic elements per bay. The antenna was tested on a 42" face tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 89.3 megahertz, which is the center of the FM broadcast channel assigned to KCCU.

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.

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For
KCCU, Lawton, Oklahoma

(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.

The proof-of-performance was accomplished using a 42" 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.

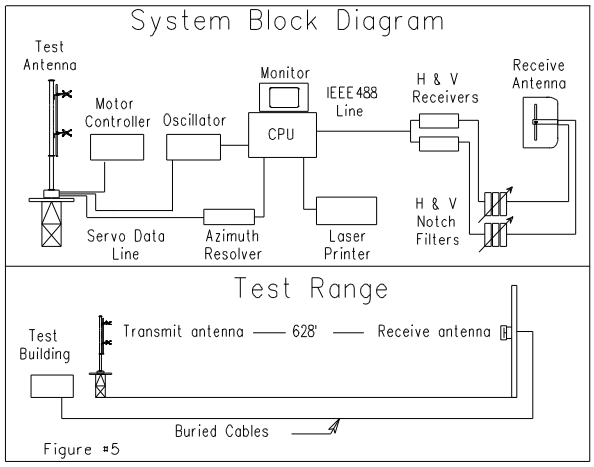

Figure #5

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 89.3 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 3 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 four vertical parasitic elements per bay. The power distribution and phase relationship will be fixed when antenna is manufactured. Proper maintenance of the elements should be all that is required to maintain the pattern in adjustment.

The LP-3E-DA array is to be mounted on the North 279 degrees East tower face of the 42" face tower at a bearing of North 279 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 5.000 kilowatts (6.99 dBk).

The power at North 40-60 degrees East does not exceed 1.991 kilowatts (2.991 dBk).

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(Continued)

The power at North 120-130 degrees East does not exceed 1.991 kilowatts (2.991 dBk).

The power at North 270 degrees East does not exceed 2.292 kilowatts (3.602 dBk).

The power at North 310-320 degrees East does not exceed 3.152 kilowatts (4.986 dBk).

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 41 feet 11 inches.

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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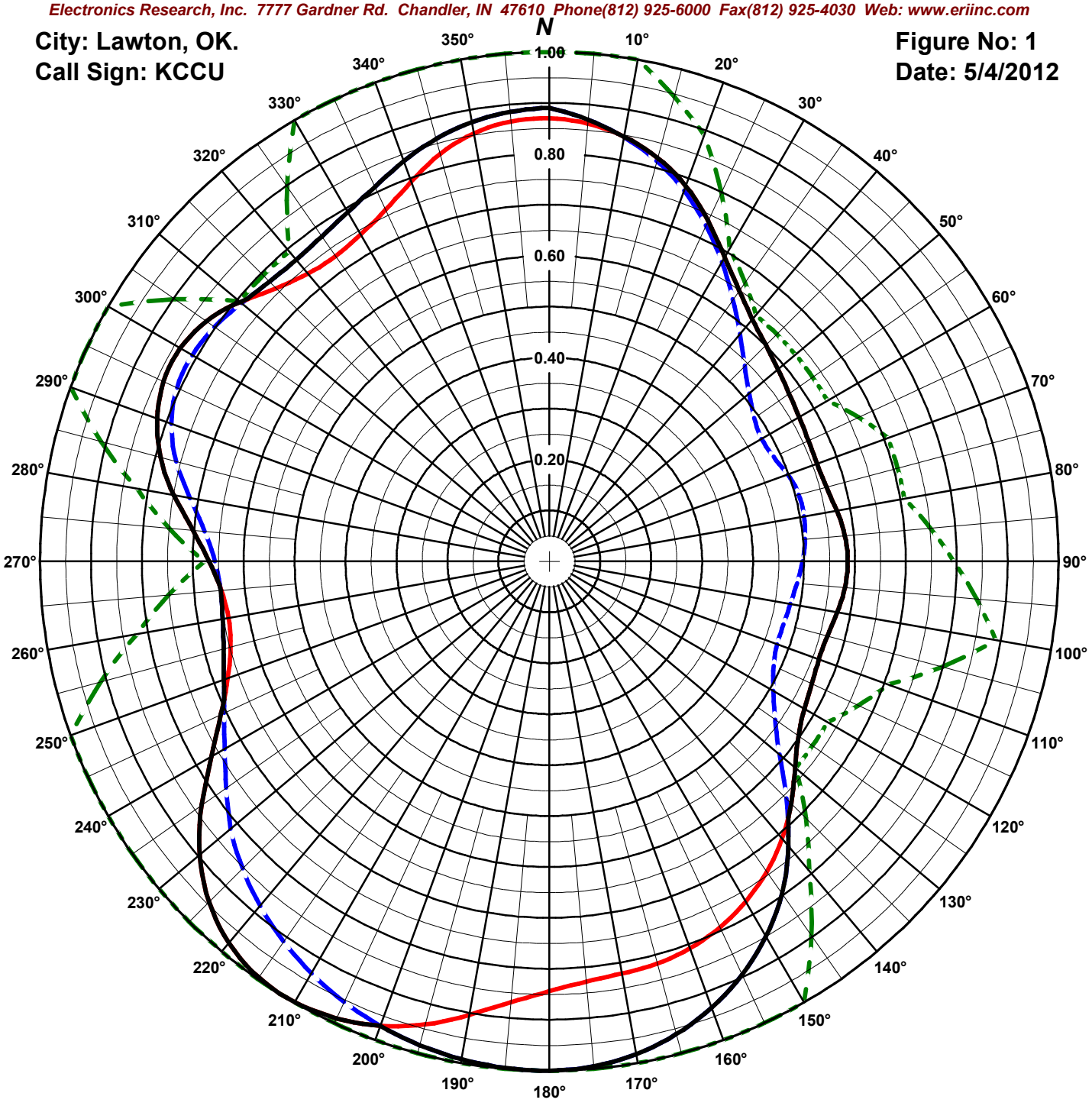
City: Lawton, OK.
Call Sign: KCCU

Figure No: 1
Date: 5/4/2012



Antenna Orientation: 279° True

Frequency: 89.3 MHz
Antenna Type: LP-3E-DA

Antenna Mounting: Custom
Tower Type: 42" Face tower

HORIZONTAL	VERTICAL	COMPOSITE	FCC ENVELOPE
RMS: .755	RMS: .755	RMS: .781	RMS: .88
Maximum: 1 @ 212°	Maximum: 1 @ 181°	Maximum: 1 @ 181°	Maximum: 1 @ 0°
Minimum: .559 @ 69°	Minimum: .475 @ 108°	Minimum: .559 @ 69°	Minimum: .631 @ 40°

Measured patterns of the horizontal and vertical components, with the composite maximum of either the the H or V components and the filed FCC envelope pattern BPED-20110902AAB.

ERI® Horizontal Plane Relative Field Pattern

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Figure# 1 **Date: 5/4/2012**
Station: KCCU **Antenna: LP-3E-DA**
Location: Lawton, OK. **Antenna Orientation: 279° True**
Frequency: 89.3 MHz **Number of Bays: 3**

Azimuth	Envelope			Polarization	Azimuth	Envelope			Polarization
	Field	kW	dBk	Maximum		Field	kW	dBk	Maximum
0°	0.890	3.962	5.979	Vertical	180°	1.000	5.000	6.989	Vertical
5°	0.871	3.790	5.786	Vertical	185°	0.998	4.982	6.974	Vertical
10°	0.847	3.585	5.545	Horizontal	190°	0.993	4.925	6.924	Vertical
15°	0.820	3.365	5.270	Horizontal	195°	0.983	4.834	6.843	Vertical
20°	0.784	3.073	4.876	Horizontal	200°	0.970	4.708	6.728	Vertical
25°	0.737	2.719	4.344	Horizontal	205°	0.990	4.897	6.899	Horizontal
30°	0.689	2.375	3.757	Horizontal	210°	0.999	4.993	6.984	Horizontal
35°	0.650	2.113	3.249	Horizontal	215°	0.996	4.964	6.959	Horizontal
40°	0.620	1.924	2.842	Horizontal	220°	0.978	4.785	6.799	Horizontal
45°	0.601	1.806	2.567	Horizontal	225°	0.945	4.464	6.497	Horizontal
50°	0.586	1.718	2.350	Horizontal	230°	0.896	4.018	6.040	Horizontal
55°	0.575	1.651	2.178	Horizontal	235°	0.833	3.469	5.401	Horizontal
60°	0.566	1.604	2.051	Horizontal	240°	0.766	2.933	4.673	Horizontal
65°	0.561	1.575	1.972	Horizontal	245°	0.711	2.531	4.033	Horizontal
70°	0.560	1.565	1.946	Horizontal	250°	0.680	2.312	3.639	Vertical
75°	0.563	1.587	2.005	Horizontal	255°	0.662	2.192	3.409	Vertical
80°	0.573	1.642	2.154	Horizontal	260°	0.651	2.120	3.264	Vertical
85°	0.582	1.696	2.295	Horizontal	265°	0.648	2.097	3.216	Vertical
90°	0.586	1.717	2.349	Horizontal	270°	0.668	2.230	3.483	Horizontal
95°	0.583	1.698	2.301	Horizontal	275°	0.702	2.467	3.922	Horizontal
100°	0.574	1.647	2.168	Horizontal	280°	0.749	2.801	4.474	Horizontal
105°	0.565	1.599	2.038	Horizontal	285°	0.790	3.123	4.946	Horizontal
110°	0.563	1.587	2.006	Horizontal	290°	0.820	3.358	5.261	Horizontal
115°	0.569	1.616	2.085	Horizontal	295°	0.836	3.490	5.429	Horizontal
120°	0.579	1.676	2.242	Horizontal	300°	0.837	3.500	5.441	Horizontal
125°	0.598	1.788	2.523	Horizontal	305°	0.822	3.378	5.286	Horizontal
130°	0.631	1.988	2.984	Horizontal	310°	0.792	3.136	4.963	Horizontal
135°	0.672	2.255	3.531	Horizontal	315°	0.777	3.018	4.797	Vertical
140°	0.730	2.667	4.260	Vertical	320°	0.773	2.988	4.753	Vertical
145°	0.797	3.173	5.014	Vertical	325°	0.779	3.033	4.818	Vertical
150°	0.850	3.617	5.583	Vertical	330°	0.792	3.134	4.961	Vertical
155°	0.896	4.010	6.031	Vertical	335°	0.811	3.289	5.170	Vertical
160°	0.933	4.348	6.383	Vertical	340°	0.836	3.494	5.433	Vertical
165°	0.961	4.622	6.648	Vertical	345°	0.859	3.687	5.667	Vertical
170°	0.982	4.825	6.835	Vertical	350°	0.875	3.832	5.834	Vertical
175°	0.995	4.952	6.948	Vertical	355°	0.886	3.923	5.936	Vertical

Horizontal Polarization:
Maximum: 2.597 (4.145 dB)
Horizontal Plane: 2.597 (4.145 dB)
Maximum ERP: 5.000 kW

Vertical Polarization:
Maximum: 2.597 (4.145 dB)
Horizontal Plane: 2.597 (4.145 dB)
Maximum ERP: 5.000 kW

Total Input Power: 1.925 kW
Reference: KCCU1M.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: 5/4/2012**
Station: KCCU **Antenna: LP-3E-DA**
Location: Lawton, OK. **Antenna Orientation: 279° True**
Frequency: 89.3 MHz **Number of Bays: 3**

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.870	3.783	5.778	0.890	3.962	5.979	180°	0.844	3.562	5.516	1.000	5.000	6.989
5°	0.863	3.724	5.710	0.871	3.790	5.786	185°	0.869	3.778	5.772	0.998	4.982	6.974
10°	0.847	3.585	5.545	0.845	3.574	5.532	190°	0.904	4.087	6.114	0.993	4.925	6.924
15°	0.820	3.365	5.270	0.814	3.313	5.202	195°	0.941	4.429	6.463	0.983	4.834	6.843
20°	0.784	3.073	4.876	0.774	2.997	4.767	200°	0.970	4.707	6.727	0.970	4.708	6.728
25°	0.737	2.719	4.344	0.728	2.648	4.229	205°	0.990	4.897	6.899	0.954	4.549	6.580
30°	0.689	2.375	3.757	0.678	2.300	3.617	210°	0.999	4.993	6.984	0.934	4.360	6.395
35°	0.650	2.113	3.249	0.628	1.975	2.956	215°	0.996	4.964	6.959	0.910	4.143	6.173
40°	0.620	1.924	2.842	0.583	1.697	2.297	220°	0.978	4.785	6.799	0.883	3.899	5.909
45°	0.601	1.806	2.567	0.543	1.473	1.682	225°	0.945	4.464	6.497	0.852	3.630	5.599
50°	0.586	1.718	2.350	0.512	1.311	1.177	230°	0.896	4.018	6.040	0.817	3.336	5.232
55°	0.575	1.651	2.178	0.491	1.207	0.818	235°	0.833	3.469	5.401	0.774	2.997	4.767
60°	0.566	1.604	2.051	0.481	1.159	0.639	240°	0.766	2.933	4.673	0.736	2.709	4.328
65°	0.561	1.575	1.972	0.486	1.180	0.719	245°	0.711	2.531	4.033	0.705	2.482	3.948
70°	0.560	1.565	1.946	0.498	1.242	0.942	250°	0.672	2.258	3.538	0.680	2.312	3.639
75°	0.563	1.587	2.005	0.507	1.286	1.093	255°	0.648	2.098	3.219	0.662	2.192	3.409
80°	0.573	1.642	2.154	0.508	1.290	1.105	260°	0.639	2.042	3.101	0.651	2.120	3.264
85°	0.582	1.696	2.295	0.504	1.271	1.042	265°	0.647	2.090	3.202	0.648	2.097	3.216
90°	0.586	1.717	2.349	0.497	1.237	0.922	270°	0.668	2.230	3.483	0.656	2.153	3.331
95°	0.583	1.698	2.301	0.488	1.192	0.761	275°	0.702	2.467	3.922	0.679	2.306	3.628
100°	0.574	1.647	2.168	0.481	1.156	0.628	280°	0.749	2.801	4.474	0.716	2.564	4.089
105°	0.565	1.599	2.038	0.476	1.135	0.548	285°	0.790	3.123	4.946	0.758	2.876	4.587
110°	0.563	1.587	2.006	0.476	1.134	0.545	290°	0.820	3.358	5.261	0.790	3.117	4.937
115°	0.569	1.616	2.085	0.486	1.181	0.722	295°	0.836	3.490	5.429	0.807	3.253	5.123
120°	0.579	1.676	2.242	0.508	1.289	1.102	300°	0.837	3.500	5.441	0.809	3.276	5.154
125°	0.598	1.788	2.523	0.541	1.466	1.661	305°	0.822	3.378	5.286	0.802	3.218	5.076
130°	0.631	1.988	2.984	0.590	1.740	2.406	310°	0.792	3.136	4.963	0.788	3.108	4.924
135°	0.672	2.255	3.531	0.659	2.169	3.363	315°	0.758	2.874	4.586	0.777	3.018	4.797
140°	0.711	2.525	4.022	0.730	2.667	4.260	320°	0.737	2.718	4.342	0.773	2.988	4.753
145°	0.744	2.767	4.421	0.797	3.173	5.014	325°	0.732	2.677	4.277	0.779	3.033	4.818
150°	0.771	2.975	4.735	0.850	3.617	5.583	330°	0.741	2.742	4.381	0.792	3.134	4.961
155°	0.793	3.143	4.973	0.896	4.010	6.031	335°	0.761	2.897	4.620	0.811	3.289	5.170
160°	0.808	3.267	5.141	0.933	4.348	6.383	340°	0.793	3.146	4.978	0.836	3.494	5.433
165°	0.818	3.344	5.243	0.961	4.622	6.648	345°	0.828	3.427	5.350	0.859	3.687	5.667
170°	0.822	3.377	5.285	0.982	4.825	6.835	350°	0.853	3.639	5.609	0.875	3.832	5.834
175°	0.828	3.431	5.355	0.995	4.952	6.948	355°	0.867	3.757	5.748	0.886	3.923	5.936

Horizontal Polarization:
Maximum: 2.597 (4.145 dB)
Horizontal Plane: 2.597 (4.145 dB)
Maximum ERP: 5.000 kW

Vertical Polarization:
Maximum: 2.597 (4.145 dB)
Horizontal Plane: 2.597 (4.145 dB)
Maximum ERP: 5.000 kW

Total Input Power: 1.925 kW
Reference: KCCU1M.FIG

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

ERI® Vertical Plane Relative Field Pattern

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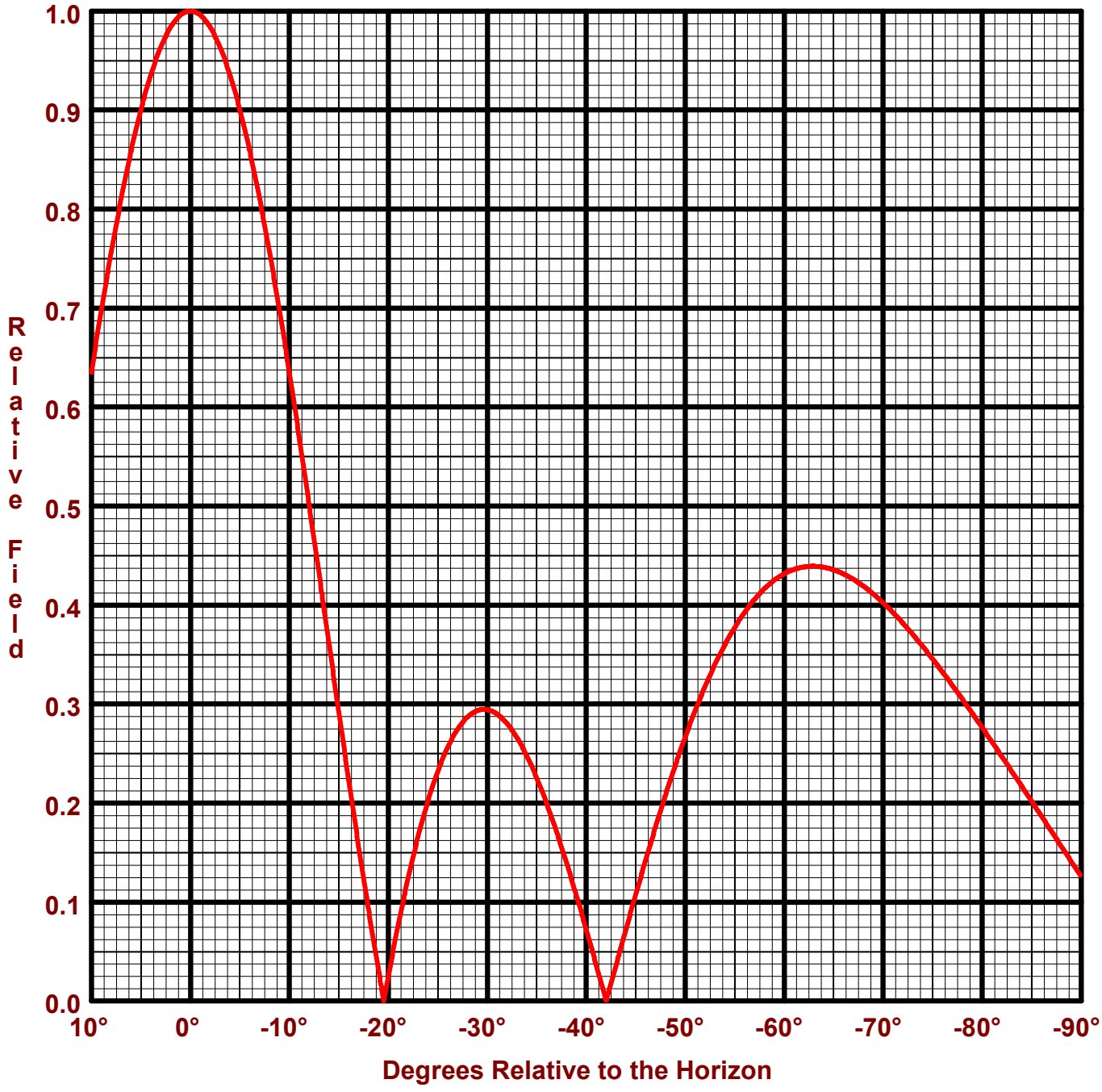
Figure No: 3
Call Sign: KCCU
Location: Lawton, OK.
Frequency: 89.3 MHz
3 bay LP-3E-DA antenna

Date: 5/4/2012
H/V Power Ratio: 1
1 Wave-length Spacing
0° Beam Tilt
0% First Null Fill



Horizontal Polarization:
Maximum: 2.597 (4.145 dB)
Horizontal Plane: 2.597 (4.145 dB)
Maximum ERP: 5.000 kW

Vertical Polarization:
Maximum: 2.597 (4.145 dB)
Horizontal Plane: 2.597 (4.145 dB)
Maximum ERP: 5.000 kW

Directional Antenna System
for
KCCU, Lawton, Oklahoma

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	LP-3E-DA
Frequency:	89.3 MHz
Number of Bays:	Three

MECHANICAL SPECIFICATIONS

Mounting:	Custom
System length:	30 ft 9 in
Aperture length required:	41 ft 11 in
Orientation:	279° true

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

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	5.000 kW (6.99 dBk)
Horizontal maximum power gain:	2.597 (4.145 dB)
Maximum vertical ERP:	5.000 kW (6.99 dBk)
Vertical maximum power gain:	2.597 (4.145 dB)
Total input power:	1.925 kW (2.844 dBk)