

***Directional Antenna System  
for  
WPKX, Windsor Locks, Connecticut***

October 12, 2011

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 WPKX.

The antenna is the ERI model LP-2E-DA-HW configuration. The circular polarized system consists of two half-wavelength spaced bays using one driven circular polarized radiating element per bay, one horizontal parasitic element per bay and four vertical parasitic elements interleaved between the bays. The antenna was mounted on the North 335 degrees East tower face with bracketry to provide an antenna orientation of North 335 degrees East. The antenna was tested on a 24" **ERI® λ MOUNTING SYSTEM**, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 97.9 megahertz, which is the center of the FM broadcast channel assigned to WPKX.

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 WPKX, Windsor Locks, Connecticut

(Continued)

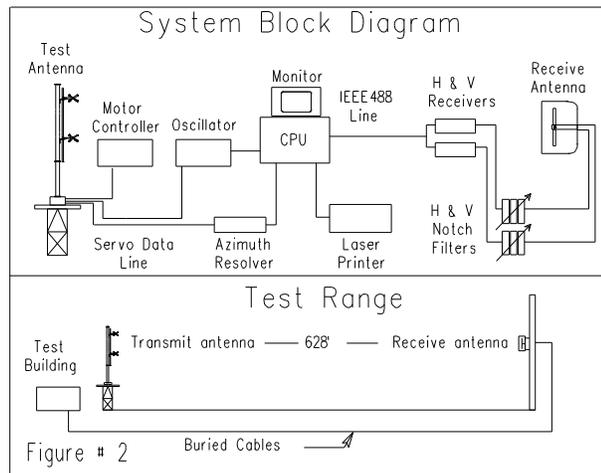
## DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of a full-scale model of the complete 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 24" **ERI**<sup>®</sup> **λ MOUNTING SYSTEM**, 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 97.9 MHz and was constantly monitored by a Rohde & Schwarz ESVD measuring receiver.



# Directional Antenna System For WPKX, Windsor Locks, Connecticut

(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 coordinated graph paper in a clockwise direction. Both horizontal and vertical components were recorded separately.

## CONCLUSIONS

The circular polarized system consists of two half-wavelength spaced bays using one driven circular polarized radiating element per bay, one horizontal parasitic element per bay and four vertical parasitic elements interleaved between the bays. 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-2E-DA-HW array is to be mounted on the North 335 degrees East tower face of the 24" **ERI**<sup>®</sup>  $\lambda$  **MOUNTING SYSTEM**, at a bearing of North 335 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 measured individual horizontal and vertical components, the composite maximum of either the horizontal or vertical component at any azimuth and the FCC filed envelope pattern. The horizontal plane relative field list for the composite pattern and the individual H & V components are shown as Figure #1 & 1A respectively. 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 3.400 kilowatts (5.315 dBk).

Directional Antenna System  
For  
WPKX, Windsor Locks, Connecticut

(Continued)

The measured composite pattern between 354 degrees true to 18 degrees true clockwise maintains a relative field of 1.00 to comply with the condition on the construction permit file number BPH-20110104AAE.

The power at North 110 degrees East does not exceed 1.000 kilowatts (0 dBk).

The power at North 210 degrees East does not exceed 0.460 kilowatts (-3.372 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 than 85% of the filed composite pattern.

The clear vertical length of the structure required to support the antenna is 20 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.



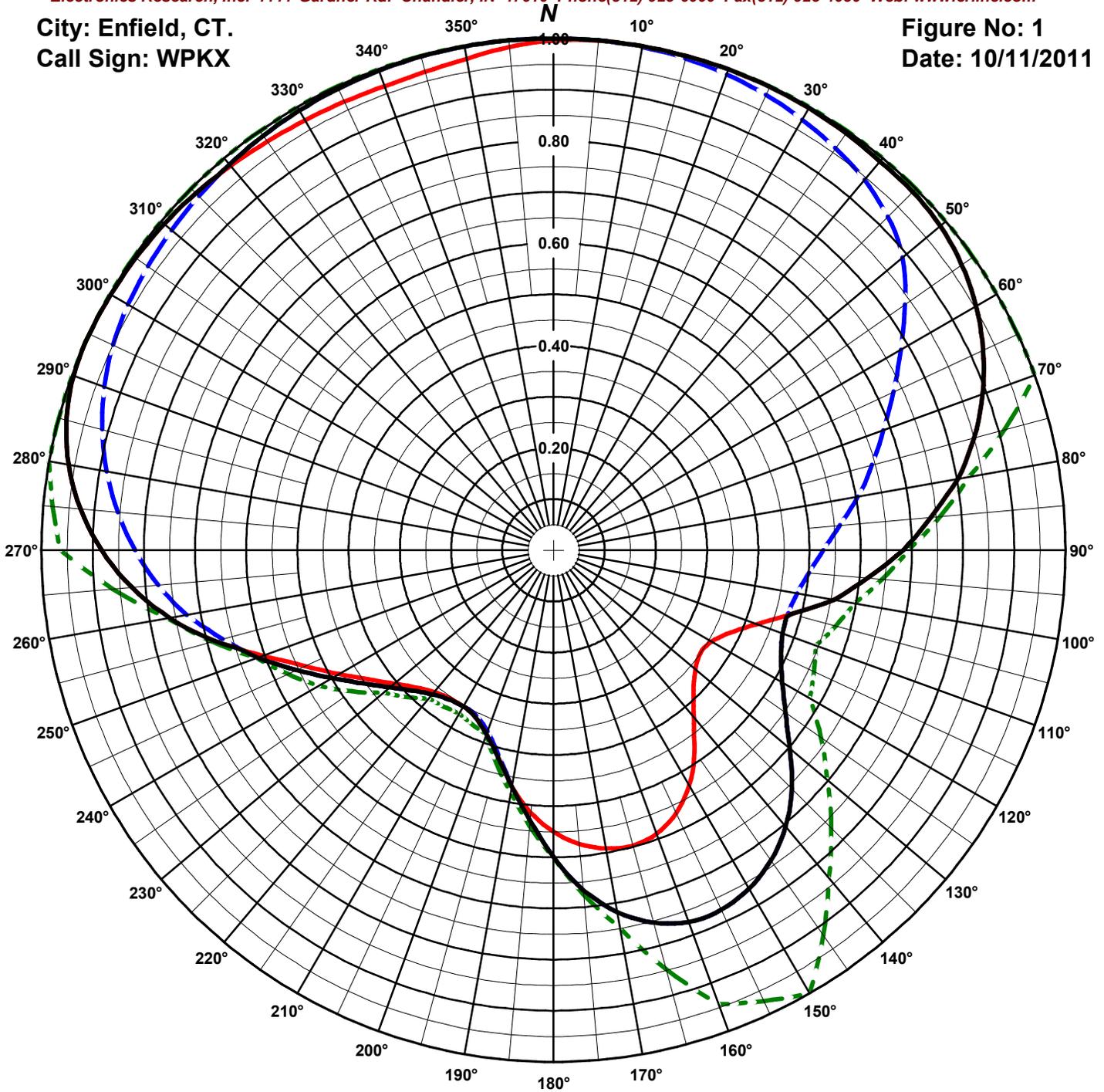
The Microsoft Word document on file electronically at Electronic Research, Inc. governs the specifications, scope, and configuration of the product described. All other representations whether verbal, printed, or electronic are subordinate to the master copy of this document on file at ERI.

# ERI<sup>®</sup> 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

City: Enfield, CT.  
Call Sign: WPKX

Figure No: 1  
Date: 10/11/2011



Antenna Orientation: 335° True

Frequency: 97.9 MHz

Antenna Type: LP-2E-DA-HW

Antenna Mounting: Standard

Tower Type: 24" Lambda

**HORIZONTAL**

RMS: .771

Maximum: 1 @ 6°

Minimum: .35 @ 124°

**VERTICAL**

RMS: .765

Maximum: 1 @ 0°

Minimum: .352 @ 208°

**COMPOSITE**

RMS: .801

Maximum: 1 @ 0°

Minimum: .353 @ 210°

**FCC ENVELOPE**

RMS: .835

Maximum: 1 @ 0°

Minimum: .368 @ 210°

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 compsite pattern BPH-20110104AAE.

# ERI<sup>®</sup> 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: 10/11/2011

Station: WPKX

Antenna: LP-2E-DA-HW

Location: Enfield, CT.

Antenna Orientation: 335° True

Frequency: 97.9 MHz

Number of Bays: 2

Azimuth	Envelope			Polarization Maximum	Azimuth	Envelope			Polarization Maximum
	Field	kW	dBk			Field	kW	dBk	
0°	1.000	3.400	5.315	Vertical	180°	0.599	1.219	0.859	Vertical
5°	1.000	3.400	5.315	Vertical	185°	0.530	0.953	-0.207	Vertical
10°	1.000	3.400	5.315	Horizontal	190°	0.468	0.746	-1.273	Horizontal
15°	1.000	3.400	5.315	Horizontal	195°	0.419	0.596	-2.250	Horizontal
20°	1.000	3.400	5.314	Horizontal	200°	0.383	0.498	-3.031	Horizontal
25°	0.999	3.395	5.308	Horizontal	205°	0.360	0.442	-3.549	Horizontal
30°	0.998	3.384	5.294	Horizontal	210°	0.353	0.423	-3.741	Vertical
35°	0.995	3.367	5.272	Horizontal	215°	0.356	0.431	-3.658	Vertical
40°	0.992	3.344	5.242	Horizontal	220°	0.368	0.460	-3.374	Vertical
45°	0.992	3.344	5.242	Horizontal	225°	0.388	0.512	-2.908	Vertical
50°	0.986	3.306	5.192	Horizontal	230°	0.417	0.591	-2.287	Vertical
55°	0.973	3.220	5.079	Horizontal	235°	0.454	0.701	-1.545	Vertical
60°	0.953	3.089	4.899	Horizontal	240°	0.500	0.849	-0.712	Vertical
65°	0.926	2.916	4.648	Horizontal	245°	0.554	1.042	0.181	Vertical
70°	0.892	2.705	4.321	Horizontal	250°	0.615	1.287	1.097	Vertical
75°	0.851	2.460	3.909	Horizontal	255°	0.684	1.593	2.022	Horizontal
80°	0.802	2.187	3.399	Horizontal	260°	0.761	1.970	2.944	Horizontal
85°	0.740	1.864	2.703	Horizontal	265°	0.827	2.326	3.666	Horizontal
90°	0.683	1.588	2.008	Horizontal	270°	0.882	2.648	4.229	Horizontal
95°	0.617	1.294	1.121	Horizontal	275°	0.927	2.923	4.658	Horizontal
100°	0.557	1.055	0.233	Horizontal	280°	0.961	3.142	4.972	Horizontal
105°	0.481	0.787	-1.039	Horizontal	285°	0.985	3.297	5.181	Horizontal
110°	0.476	0.772	-1.126	Vertical	290°	0.997	3.383	5.293	Horizontal
115°	0.490	0.818	-0.874	Vertical	295°	1.000	3.399	5.313	Horizontal
120°	0.516	0.905	-0.432	Vertical	300°	0.999	3.390	5.302	Horizontal
125°	0.553	1.041	0.174	Vertical	305°	0.996	3.373	5.280	Horizontal
130°	0.602	1.233	0.910	Vertical	310°	0.992	3.347	5.247	Horizontal
135°	0.659	1.475	1.688	Vertical	315°	0.987	3.313	5.202	Horizontal
140°	0.705	1.691	2.282	Vertical	320°	0.984	3.293	5.176	Vertical
145°	0.740	1.863	2.702	Vertical	325°	0.989	3.323	5.215	Vertical
150°	0.764	1.982	2.971	Vertical	330°	0.992	3.347	5.247	Vertical
155°	0.775	2.043	3.103	Vertical	335°	0.995	3.367	5.273	Vertical
160°	0.773	2.030	3.075	Vertical	340°	0.997	3.383	5.292	Vertical
165°	0.753	1.930	2.855	Vertical	345°	0.999	3.393	5.306	Vertical
170°	0.718	1.752	2.437	Vertical	350°	1.000	3.399	5.313	Vertical
175°	0.666	1.510	1.789	Vertical	355°	1.000	3.400	5.315	Vertical

**Horizontal Polarization:**

**Maximum: 1.132 (0.537 dB)**

**Horizontal Plane: 1.132 (0.537 dB)**

**Maximum ERP: 3.400 kW**

**Vertical Polarization:**

**Maximum: 1.132 (0.537 dB)**

**Horizontal Plane: 1.132 (0.537 dB)**

**Maximum ERP: 3.400 kW**

**Total Input Power: 3.004 kW**

**Reference: WPKX1M.FIG**

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

# ERI<sup>®</sup> 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# 1A

Date: 10/11/2011

Station: WPKX

Antenna: LP-2E-DA-HW

Location: Enfield, CT.

Antenna Orientation: 335° True

Frequency: 97.9 MHz

Number of Bays: 2

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.996	3.373	5.280	1.000	3.400	5.315	180°	0.550	1.028	0.120	0.599	1.219	0.859
5°	1.000	3.399	5.313	1.000	3.400	5.315	185°	0.514	0.898	-0.467	0.530	0.953	-0.207
10°	1.000	3.400	5.315	0.999	3.391	5.303	190°	0.468	0.746	-1.273	0.468	0.746	-1.274
15°	1.000	3.400	5.315	0.995	3.368	5.273	195°	0.419	0.596	-2.250	0.414	0.583	-2.342
20°	1.000	3.400	5.314	0.990	3.329	5.224	200°	0.383	0.498	-3.031	0.377	0.483	-3.161
25°	0.999	3.395	5.308	0.982	3.277	5.155	205°	0.360	0.442	-3.549	0.357	0.432	-3.642
30°	0.998	3.384	5.294	0.972	3.211	5.066	210°	0.352	0.422	-3.751	0.353	0.423	-3.741
35°	0.995	3.367	5.272	0.960	3.131	4.957	215°	0.353	0.424	-3.726	0.356	0.431	-3.658
40°	0.992	3.344	5.242	0.945	3.038	4.826	220°	0.362	0.445	-3.514	0.368	0.460	-3.374
45°	0.992	3.344	5.242	0.923	2.894	4.616	225°	0.379	0.489	-3.105	0.388	0.512	-2.908
50°	0.986	3.306	5.192	0.890	2.691	4.300	230°	0.405	0.559	-2.526	0.417	0.591	-2.287
55°	0.973	3.220	5.079	0.838	2.387	3.778	235°	0.440	0.659	-1.810	0.454	0.701	-1.545
60°	0.953	3.089	4.899	0.783	2.086	3.193	240°	0.484	0.796	-0.990	0.500	0.849	-0.712
65°	0.926	2.916	4.648	0.733	1.826	2.615	245°	0.536	0.977	-0.099	0.554	1.042	0.181
70°	0.892	2.705	4.321	0.686	1.598	2.037	250°	0.603	1.238	0.926	0.615	1.287	1.097
75°	0.851	2.460	3.909	0.644	1.411	1.497	255°	0.684	1.593	2.022	0.669	1.522	1.825
80°	0.802	2.187	3.399	0.604	1.239	0.930	260°	0.761	1.970	2.944	0.728	1.800	2.554
85°	0.740	1.864	2.703	0.562	1.073	0.307	265°	0.827	2.326	3.666	0.775	2.043	3.102
90°	0.683	1.588	2.008	0.527	0.944	-0.250	270°	0.882	2.648	4.229	0.817	2.271	3.563
95°	0.617	1.294	1.121	0.501	0.853	-0.692	275°	0.927	2.923	4.658	0.854	2.481	3.946
100°	0.557	1.055	0.233	0.483	0.794	-1.000	280°	0.961	3.142	4.972	0.886	2.668	4.262
105°	0.481	0.787	-1.039	0.475	0.766	-1.158	285°	0.985	3.297	5.181	0.912	2.829	4.517
110°	0.423	0.607	-2.168	0.476	0.772	-1.126	290°	0.997	3.383	5.293	0.933	2.961	4.715
115°	0.381	0.494	-3.064	0.490	0.818	-0.874	295°	1.000	3.399	5.313	0.949	3.063	4.861
120°	0.357	0.433	-3.633	0.516	0.905	-0.432	300°	0.999	3.390	5.302	0.960	3.131	4.957
125°	0.351	0.418	-3.788	0.553	1.041	0.174	305°	0.996	3.373	5.280	0.967	3.178	5.022
130°	0.362	0.445	-3.514	0.602	1.233	0.910	310°	0.992	3.347	5.247	0.973	3.221	5.080
135°	0.387	0.510	-2.927	0.659	1.475	1.688	315°	0.987	3.313	5.202	0.979	3.259	5.131
140°	0.427	0.619	-2.087	0.705	1.691	2.282	320°	0.981	3.270	5.146	0.984	3.293	5.176
145°	0.480	0.783	-1.065	0.740	1.863	2.702	325°	0.975	3.231	5.094	0.989	3.323	5.215
150°	0.530	0.956	-0.194	0.764	1.982	2.971	330°	0.970	3.201	5.053	0.992	3.347	5.247
155°	0.567	1.093	0.385	0.775	2.043	3.103	335°	0.967	3.179	5.023	0.995	3.367	5.273
160°	0.589	1.181	0.723	0.773	2.030	3.075	340°	0.965	3.166	5.005	0.997	3.383	5.292
165°	0.598	1.215	0.846	0.753	1.930	2.855	345°	0.968	3.185	5.031	0.999	3.393	5.306
170°	0.592	1.191	0.759	0.718	1.752	2.437	350°	0.976	3.236	5.099	1.000	3.399	5.313
175°	0.576	1.127	0.521	0.666	1.510	1.789	355°	0.987	3.314	5.204	1.000	3.400	5.315

**Horizontal Polarization:**

**Maximum: 1.132 (0.537 dB)**

**Horizontal Plane: 1.132 (0.537 dB)**

**Maximum ERP: 3.400 kW**

**Vertical Polarization:**

**Maximum: 1.132 (0.537 dB)**

**Horizontal Plane: 1.132 (0.537 dB)**

**Maximum ERP: 3.400 kW**

**Total Input Power: 3.004 kW**

**Reference: WPKX1M.FIG**

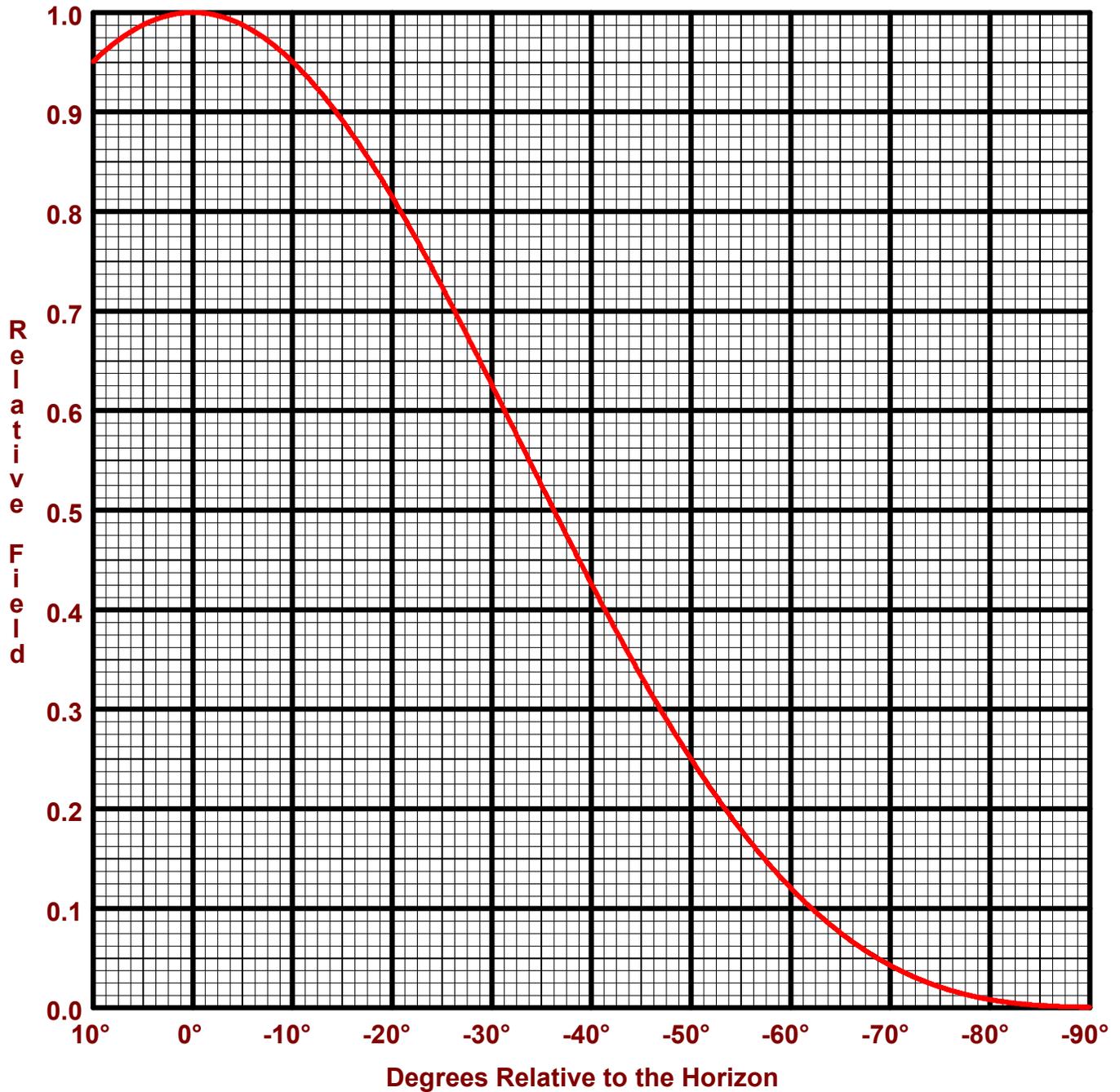
**This list shows the azimuth values for the horizontal and vertical components.**

# ERI<sup>®</sup> Vertical 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 No: 3  
Call Sign: WPKX  
Location: Enfield, CT.  
Frequency: 97.9 MHz  
2 bay LP-2E-DA-HW antenna

Date: 10/11/2011  
H/V Power Ratio: 1  
.5 Wave-length Spacing  
0° Beam Tilt  
0% First Null Fill



Horizontal Polarization:  
Maximum: 1.132 (0.537 dB)  
Horizontal Plane: 1.132 (0.537 dB)  
Maximum ERP: 3.400 kW

Vertical Polarization:  
Maximum: 1.132 (0.537 dB)  
Horizontal Plane: 1.132 (0.537 dB)  
Maximum ERP: 3.400 kW

# Directional Antenna System for WPKX, Windsor Locks, Connecticut

(Continued)

## ANTENNA SPECIFICATIONS

Antenna Type: LP-2E-DA-HW  
Frequency: 97.9 MHz  
Number of Bays: Two

## MECHANICAL SPECIFICATIONS

Mounting: Custom  
System length: 13 ft 7 in  
Aperture length required: 20 ft  
Orientation: 335° true  
Input flange to the antenna 1 5/8" female.

## ELECTRICAL SPECIFICATIONS

(For directional use)

Maximum horizontal ERP: 3.400 kW (5.315 dBk)  
Horizontal maximum power gain: 1.132 (0.537 dB)  
Maximum vertical ERP: 3.400 kW (5.315 dBk)  
Vertical maximum power gain: 1.132 (0.537 dB)  
Total input power: 3.004 kW (4.777 dBk)

