



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 WSRI, Sugar Grove, Illinois

February 13, 2008

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 WSRI.

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 and one horizontal parasitic element per bay. The antenna was mounted on the North 319 degrees East tower face with bracketry to provide an antenna orientation of North 319 degrees East. The antenna was tested on a 45" Pi-Rod tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 88.7 megahertz, which is the center of the FM broadcast channel assigned to WSRI.

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.

7777 Gardner Road	+1 812 925 6000 (tel)	Sales@eriinc.com
Chandler, IN 47610-9219	+1 812 925 4030 (fax)	CustomerSupport@eriinc.com
USA	877 ERI-LINE (toll-free)	WWW.eriinc.com



Directional Antenna System Proposed For WSRI, Sugar Grove, Illinois

(Continued)

DESCRIPTION OF THE TEST PROCEDURE

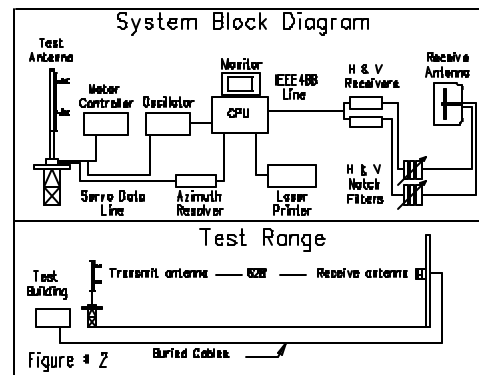
The test antenna consisted of a full-scale model of the complete circular polarized system with the associated horizontal parasitic element. The elements and brackets that were used in this test are electrically equivalent to those that will be supplied with the antenna. A section of 1 5/8 inch o.d. 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 45" Pi-Rod 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 88.7 MHz and was constantly monitored by a Rohde & Schwarz ESVD measuring receiver.

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.



Directional Antenna System
Proposed For
WSRI, Sugar Grove, Illinois

(Continued)

The signals received by the dipole system were fed to the test building by way of two buried Heliac cables to a Rohde & Schwarz measuring receiver. This data was interfaced to a Hewlett-Packard Laser Jet 4P printer by means of a Pentium 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 and one horizontal parasitic element 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-2E-DA-HW array is to be mounted on the North 319 degrees East tower face of the 45" Pi-Rod tower at a bearing of North 319 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 .6 kilowatts (-2.218 dBk).

The power at North 130 degrees East does not exceed .029 kilowatts (-15.376 dBk).

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

Directional Antenna System
Proposed For
WSRI, Sugar Grove, Illinois

(Continued)

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 25 ft 6 in.

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.

A handwritten signature in black ink, appearing to read "Tom Schaefer". The signature is fluid and cursive, with a large initial "T" and a long, sweeping underline.

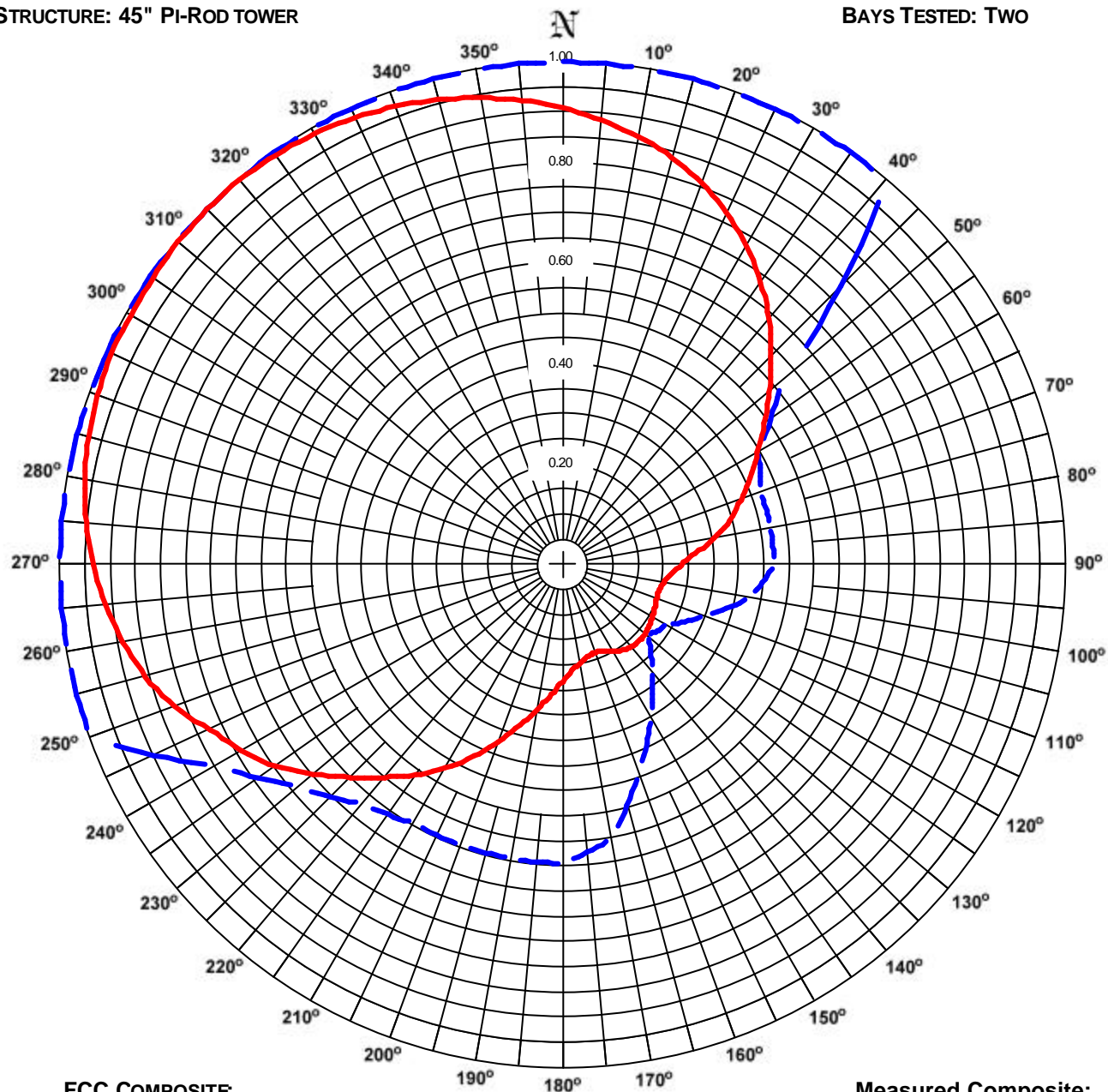
The Microsoft Word document on file electronically at Electronic Research, Inc. governs the specifications, scope, and configuration of the product described. All other representations whether verbal, printed, or electronic are subordinate to the master copy of this document on file at ERI.

ERI® *Horizontal Plane Relative Field Pattern*

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

FIGURE NO: 1
STATION: WSRI
LOCATION: SUGAR GROVE, IL
ANTENNA: LP-2E-DA-HW
STRUCTURE: 45" PI-ROD TOWER

DATE: 2/11/2008
FREQUENCY: 88.7 MHz
ORIENTATION: 319° TRUE
MOUNTING: STANDARD
BAYS TESTED: TWO



FCC COMPOSITE

RMS: 0.762
MAXIMUM: 1.000 @ 0° TRUE
MINIMUM: 0.220 @ 130° TRUE

Measured Composite:

RMS: 0.668
Maximum: 1.000 @ 315° True
Minimum: 0.186 @ 161° True

COMMENTS: COMPOSITE PATTERN: THIS PATTERN SHOWS THE MAXIMUM OF EITHER THE H OR V AZIMUTH VALUES. THIS PATTERN IS GREATER THAN 85% OF THE FCC FILED COMPOSITE PATTERN BPED-20061103ADG.

ERI® *Horizontal Plane Relative Field List*

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

Station: WSRI

Location: Sugar Grove, IL

Frequency: 88.7 MHz

Antenna: LP-2E-DA-HW

Orientation: 319° True

Tower: 45" Pi-Rod tower

Figure: 1

Date: 2/11/2008

Reference: wsri1m.fig

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0°	0.909	0.50	-3.05	H (and/or) V	180°	0.231	0.03	-14.93	H (and/or) V
5°	0.888	0.47	-3.25	H (and/or) V	185°	0.258	0.04	-13.97	H (and/or) V
10°	0.865	0.45	-3.48	H (and/or) V	190°	0.292	0.05	-12.92	H (and/or) V
15°	0.839	0.42	-3.74	H (and/or) V	195°	0.331	0.07	-11.83	H (and/or) V
20°	0.808	0.39	-4.07	H (and/or) V	200°	0.374	0.08	-10.77	H (and/or) V
25°	0.772	0.36	-4.47	H (and/or) V	205°	0.420	0.11	-9.74	H (and/or) V
30°	0.731	0.32	-4.94	H (and/or) V	210°	0.467	0.13	-8.83	H (and/or) V
35°	0.686	0.28	-5.49	H (and/or) V	215°	0.510	0.16	-8.07	H (and/or) V
40°	0.638	0.24	-6.12	H (and/or) V	220°	0.551	0.18	-7.39	H (and/or) V
45°	0.587	0.21	-6.85	H (and/or) V	225°	0.597	0.21	-6.70	H (and/or) V
50°	0.536	0.17	-7.63	H (and/or) V	230°	0.647	0.25	-6.00	H (and/or) V
55°	0.490	0.14	-8.42	H (and/or) V	235°	0.698	0.29	-5.34	H (and/or) V
60°	0.448	0.12	-9.19	H (and/or) V	240°	0.738	0.33	-4.86	H (and/or) V
65°	0.411	0.10	-9.95	H (and/or) V	245°	0.775	0.36	-4.44	H (and/or) V
70°	0.377	0.09	-10.70	H (and/or) V	250°	0.821	0.40	-3.93	H (and/or) V
75°	0.344	0.07	-11.49	H (and/or) V	255°	0.858	0.44	-3.54	H (and/or) V
80°	0.307	0.06	-12.48	H (and/or) V	260°	0.888	0.47	-3.25	H (and/or) V
85°	0.264	0.04	-13.79	H (and/or) V	265°	0.912	0.50	-3.01	H (and/or) V
90°	0.237	0.03	-14.74	H (and/or) V	270°	0.934	0.52	-2.81	H (and/or) V
95°	0.217	0.03	-15.49	H (and/or) V	275°	0.951	0.54	-2.65	H (and/or) V
100°	0.204	0.02	-16.03	H (and/or) V	280°	0.965	0.56	-2.52	H (and/or) V
105°	0.198	0.02	-16.28	H (and/or) V	285°	0.977	0.57	-2.42	H (and/or) V
110°	0.198	0.02	-16.26	H (and/or) V	290°	0.985	0.58	-2.35	H (and/or) V
115°	0.202	0.02	-16.12	H (and/or) V	295°	0.991	0.59	-2.30	H (and/or) V
120°	0.206	0.03	-15.93	H (and/or) V	300°	0.993	0.59	-2.28	H (and/or) V
125°	0.210	0.03	-15.75	H (and/or) V	305°	0.995	0.59	-2.26	H (and/or) V
130°	0.213	0.03	-15.64	H (and/or) V	310°	0.999	0.60	-2.23	H (and/or) V
135°	0.214	0.03	-15.60	H (and/or) V	315°	1.000	0.60	-2.22	H (and/or) V
140°	0.213	0.03	-15.67	H (and/or) V	320°	0.999	0.60	-2.23	H (and/or) V
145°	0.207	0.03	-15.89	H (and/or) V	325°	0.995	0.59	-2.26	H (and/or) V
150°	0.199	0.02	-16.24	H (and/or) V	330°	0.989	0.59	-2.32	H (and/or) V
155°	0.191	0.02	-16.61	H (and/or) V	335°	0.981	0.58	-2.39	H (and/or) V
160°	0.186	0.02	-16.85	H (and/or) V	340°	0.970	0.56	-2.48	H (and/or) V
165°	0.189	0.02	-16.68	H (and/or) V	345°	0.958	0.55	-2.59	H (and/or) V
170°	0.198	0.02	-16.28	H (and/or) V	350°	0.943	0.53	-2.73	H (and/or) V
175°	0.211	0.03	-15.72	H (and/or) V	355°	0.927	0.52	-2.88	H (and/or) V

Polarization:

Maximum Field:

Minimum Field:

RMS:

Maximum ERP:

Maximum Power Gain:

Envelope

1.000 @ 315° True

0.186 @ 161° True

0.668

0.600 kW

1.540 (1.874 dB)

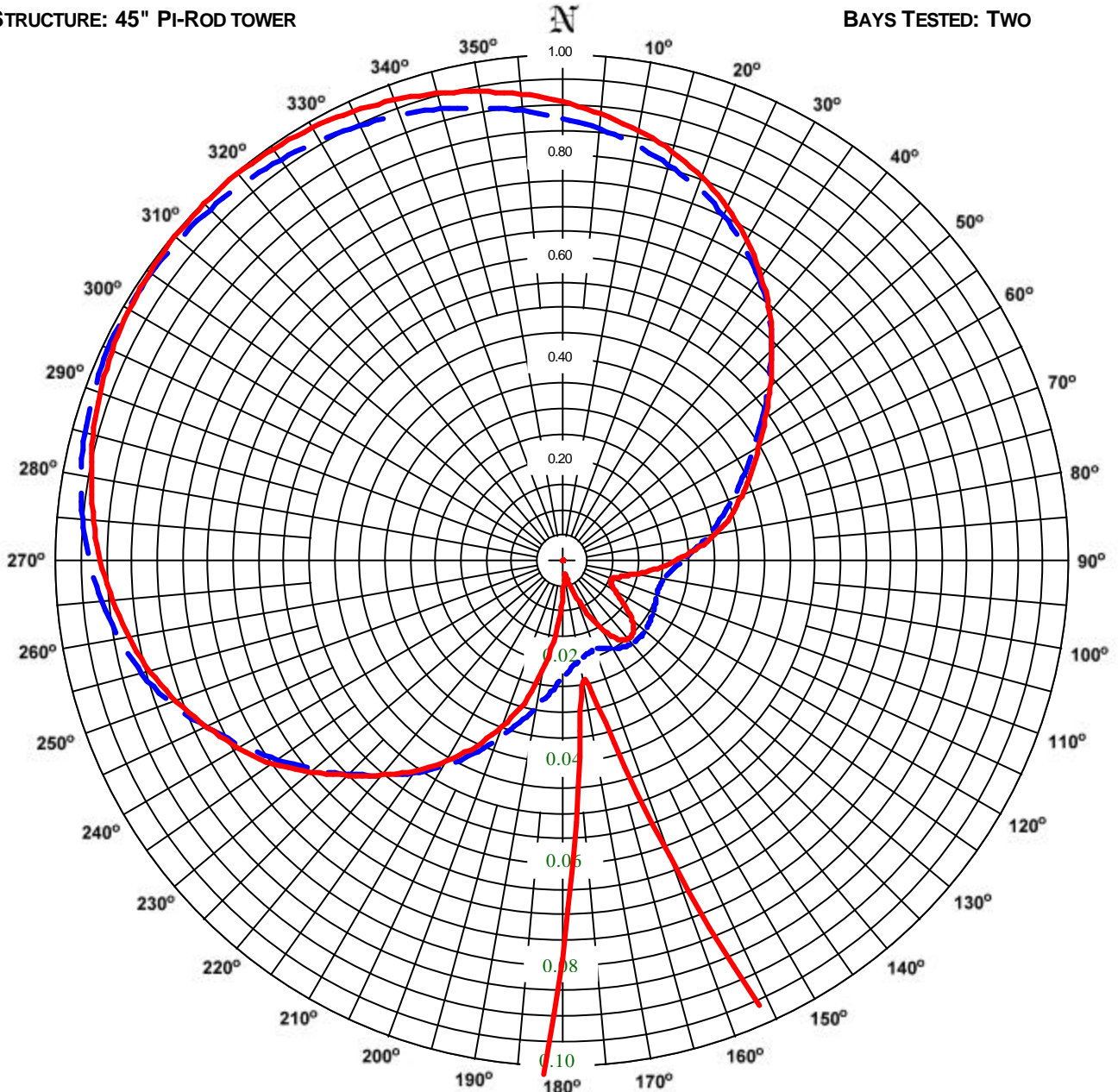
Total Input Power: 0.390 kW

ERI[®] Horizontal Plane Relative Field Pattern

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

FIGURE NO: 2
STATION: WSRI
LOCATION: SUGAR GROVE, IL
ANTENNA: LP-2E-DA-HW
STRUCTURE: 45" PI-ROD TOWER

DATE: 2/11/2008
FREQUENCY: 88.7 MHz
ORIENTATION: 319° TRUE
MOUNTING: STANDARD
BAYS TESTED: TWO



VERTICAL

RMS: 0.658
MAXIMUM: 0.993 @ 301° TRUE
MINIMUM: 0.186 @ 161° TRUE

10X Scale

Horizontal

RMS: 0.658
Maximum: 1.000 @ 315° True
Minimum: 0.024 @ 169° True

COMMENTS: MEASURED PATTERNS OF THE HORIZONTAL AND VERTICAL COMPONENTS.

ERI[®] *Horizontal Plane Relative Field List*

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

Station: WSRI

Location: Sugar Grove, IL

Frequency: 88.7 MHz

Antenna: LP-2E-DA-HW

Orientation: 319° True

Tower: 45" Pi-Rod tower

Figure: 2

Date: 2/11/2008

Reference: wsri1m.fig

Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.909	0.50	-3.05	0.876	0.46	-3.37	180°	0.079	0.00	-24.31	0.231	0.03	-14.93
5°	0.888	0.47	-3.25	0.858	0.44	-3.55	185°	0.143	0.01	-19.10	0.258	0.04	-13.97
10°	0.865	0.45	-3.48	0.836	0.42	-3.78	190°	0.221	0.03	-15.34	0.292	0.05	-12.92
15°	0.839	0.42	-3.74	0.812	0.40	-4.03	195°	0.289	0.05	-13.00	0.331	0.07	-11.83
20°	0.808	0.39	-4.07	0.785	0.37	-4.32	200°	0.348	0.07	-11.40	0.374	0.08	-10.77
25°	0.772	0.36	-4.47	0.755	0.34	-4.66	205°	0.402	0.10	-10.13	0.420	0.11	-9.74
30°	0.731	0.32	-4.94	0.719	0.31	-5.09	210°	0.455	0.12	-9.07	0.467	0.13	-8.83
35°	0.686	0.28	-5.49	0.680	0.28	-5.57	215°	0.504	0.15	-8.16	0.510	0.16	-8.07
40°	0.638	0.24	-6.12	0.636	0.24	-6.15	220°	0.551	0.18	-7.40	0.551	0.18	-7.39
45°	0.587	0.21	-6.85	0.584	0.20	-6.89	225°	0.597	0.21	-6.70	0.595	0.21	-6.73
50°	0.536	0.17	-7.63	0.531	0.17	-7.72	230°	0.647	0.25	-6.00	0.640	0.25	-6.10
55°	0.490	0.14	-8.42	0.480	0.14	-8.59	235°	0.698	0.29	-5.34	0.684	0.28	-5.52
60°	0.448	0.12	-9.19	0.435	0.11	-9.45	240°	0.738	0.33	-4.86	0.728	0.32	-4.97
65°	0.411	0.10	-9.95	0.394	0.09	-10.31	245°	0.774	0.36	-4.45	0.775	0.36	-4.44
70°	0.377	0.09	-10.70	0.357	0.08	-11.16	250°	0.810	0.39	-4.05	0.821	0.40	-3.93
75°	0.344	0.07	-11.49	0.324	0.06	-12.02	255°	0.843	0.43	-3.71	0.858	0.44	-3.54
80°	0.307	0.06	-12.48	0.293	0.05	-12.89	260°	0.869	0.45	-3.44	0.888	0.47	-3.25
85°	0.264	0.04	-13.79	0.263	0.04	-13.83	265°	0.891	0.48	-3.22	0.912	0.50	-3.01
90°	0.220	0.03	-15.35	0.237	0.03	-14.74	270°	0.911	0.50	-3.02	0.934	0.52	-2.81
95°	0.181	0.02	-17.07	0.217	0.03	-15.49	275°	0.930	0.52	-2.85	0.951	0.54	-2.65
100°	0.145	0.01	-19.00	0.204	0.02	-16.03	280°	0.946	0.54	-2.70	0.965	0.56	-2.52
105°	0.117	0.01	-20.87	0.198	0.02	-16.28	285°	0.960	0.55	-2.58	0.977	0.57	-2.42
110°	0.104	0.01	-21.91	0.198	0.02	-16.26	290°	0.971	0.57	-2.47	0.985	0.58	-2.35
115°	0.107	0.01	-21.63	0.202	0.02	-16.12	295°	0.981	0.58	-2.38	0.991	0.59	-2.30
120°	0.125	0.01	-20.29	0.206	0.03	-15.93	300°	0.989	0.59	-2.31	0.993	0.59	-2.28
125°	0.153	0.01	-18.53	0.210	0.03	-15.75	305°	0.995	0.59	-2.26	0.992	0.59	-2.29
130°	0.180	0.02	-17.10	0.213	0.03	-15.64	310°	0.999	0.60	-2.23	0.989	0.59	-2.31
135°	0.198	0.02	-16.30	0.214	0.03	-15.60	315°	1.000	0.60	-2.22	0.984	0.58	-2.36
140°	0.200	0.02	-16.18	0.213	0.03	-15.67	320°	0.999	0.60	-2.23	0.977	0.57	-2.42
145°	0.185	0.02	-16.85	0.207	0.03	-15.89	325°	0.995	0.59	-2.26	0.970	0.56	-2.49
150°	0.152	0.01	-18.58	0.199	0.02	-16.24	330°	0.989	0.59	-2.32	0.960	0.55	-2.57
155°	0.105	0.01	-21.76	0.191	0.02	-16.61	335°	0.981	0.58	-2.39	0.950	0.54	-2.67
160°	0.062	0.00	-26.38	0.186	0.02	-16.85	340°	0.970	0.56	-2.48	0.939	0.53	-2.77
165°	0.033	0.00	-31.87	0.189	0.02	-16.68	345°	0.958	0.55	-2.59	0.926	0.51	-2.89
170°	0.024	0.00	-34.66	0.198	0.02	-16.28	350°	0.943	0.53	-2.73	0.911	0.50	-3.03
175°	0.039	0.00	-30.46	0.211	0.03	-15.72	355°	0.927	0.52	-2.88	0.894	0.48	-3.19

Polarization:

Maximum Field:

Minimum Field:

RMS:

Maximum ERP:

Maximum Power Gain:

Horizontal

1.000 @ 315° True

0.024 @ 169° True

0.658

0.600 kW

1.540 (1.874 dB)

Vertical

0.993 @ 301° True

0.186 @ 161° True

0.658

0.591 kW

1.517 (1.810 dB)

Total Input Power: 0.390 kW



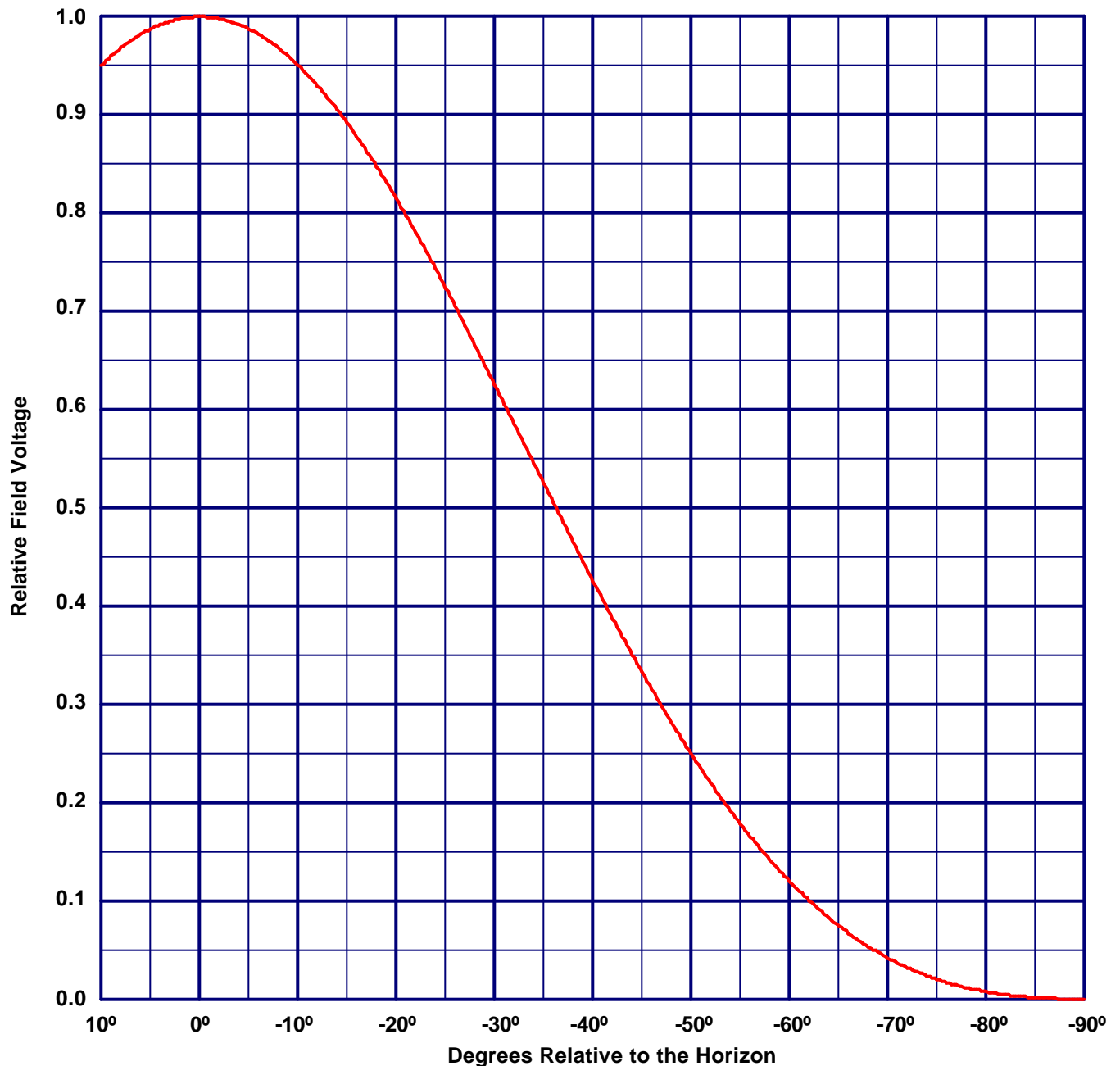
Vertical Plane Relative Field Pattern

WSRI, Sugar Grove, IL, 88.7 MHz

Figure#: 3

Date: 2/11/2008

***A 2 level, .5 wave-length spaced LP-2E-DA-HW directional antenna
with 0° beam tilt, 0% null fill and a H/V maximum power ratio of 1.015***



Vertical Polarization Gain:

Maximum: 1.517 (1.810 dB)

Horizontal Plane: 1.517 (1.810 dB)

Horizontal Polarization Gain:

Maximum: 1.540 (1.874 dB)

Horizontal Plane: 1.540 (1.874 dB)

Directional Antenna System for WSRI, Sugar Grove, Illinois

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	LP-2E-DA-HW
Frequency:	88.7 MHZ
Number of Bays:	Two

MECHANICAL SPECIFICATIONS

Mounting:	Standard
System length:	14 ft 3 in
Aperture length required:	25 ft 6 in
Orientation:	319° true

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

ELECTRICAL SPECIFICATIONS (For directional use)

Maximum horizontal ERP:	0.600 kW (-2.218 dBk)
Horizontal maximum power gain:	1.540 (1.874 dB)
Maximum vertical ERP:	0.591 kW (-2.283 dBk)
Vertical maximum power gain:	1.517 (1.810 dB)
Total input power:	0.390 kW (-4.091 dBk)

