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 KOUA, Ada, Oklahoma

August 18, 2010

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 new station.

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 three vertical parasitic elements interleaved between the bays. The antenna was mounted on the North 183 degrees East tower leg with bracketry to provide an antenna orientation of North 143 degrees East. The antenna was tested on a Rohn 55G tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 91.9 megahertz, which is the center of the FM broadcast channel assigned to KOUA.

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
Proposed For
KOUA, Ada, Oklahoma

(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 Rohn 55G 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.

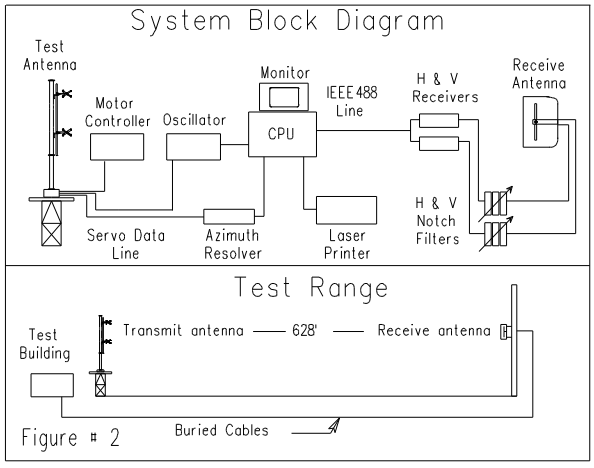


Figure # 2

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 91.9 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 two half-wavelength spaced bays using one driven circular polarized radiating element per bay, one horizontal parasitic element per bay and three 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 183 degrees East tower leg of the Rohn 55G tower at a bearing of North 143 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 1.500 kilowatts (1.761 dBk).

The power at North 140 degrees East does not exceed 0.544 kilowatts (-2.644 dBk).

Directional Antenna System
Proposed For
KOUA, Ada, Oklahoma

(Continued)

The power at North 330 degrees East does not exceed 0.272 kilowatts (-5.654 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 25 feet 4 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.

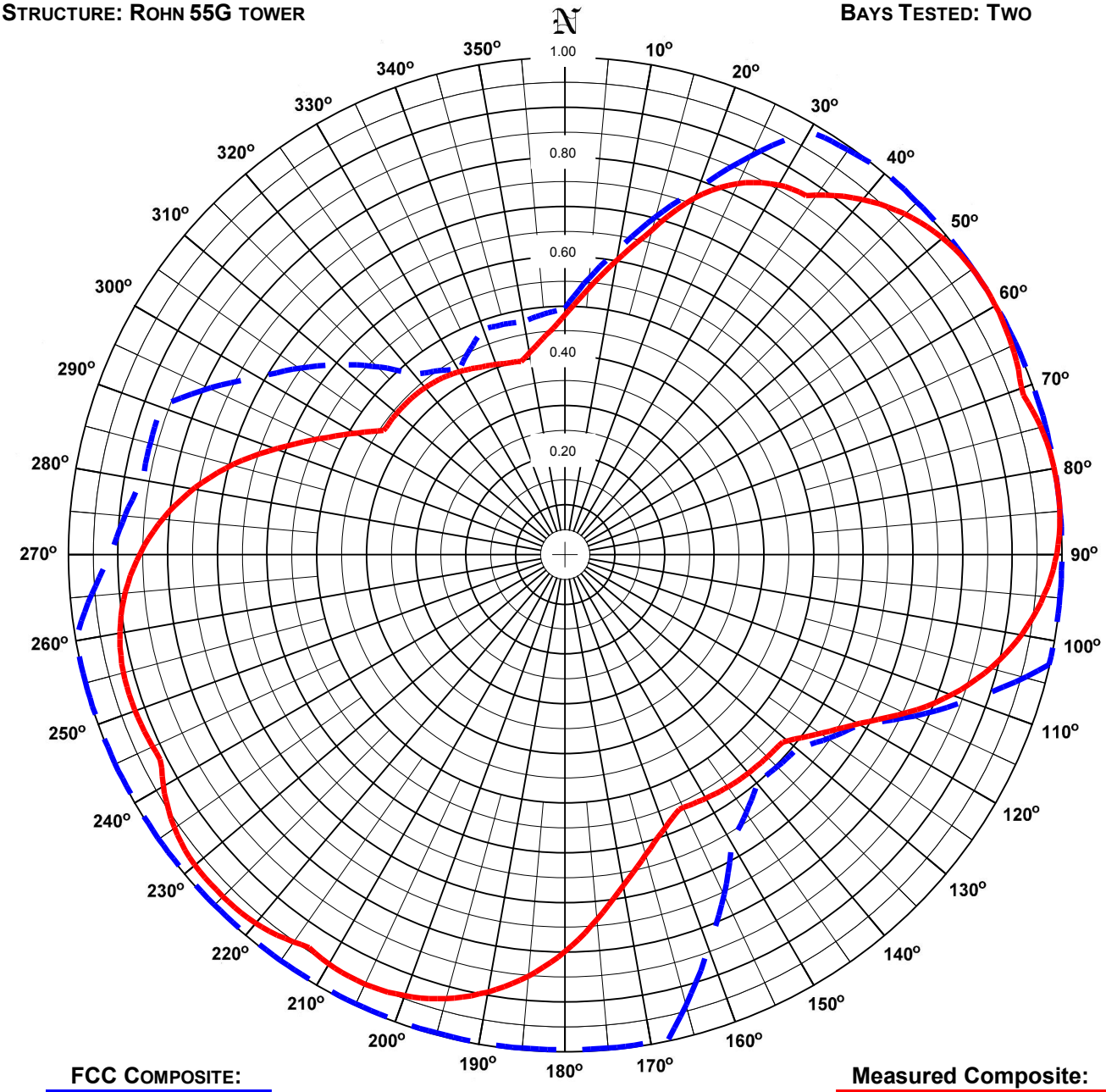
Tom Schaaf

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: KOUA
LOCATION: ADA, OK
ANTENNA: LP-2E-DA-HW
STRUCTURE: ROHN 55G TOWER

DATE: 8/13/2010
FREQUENCY: 91.9 MHZ
ORIENTATION: 143° TRUE
MOUNTING: STANDARD
BAYS TESTED: TWO



FCC COMPOSITE:

RMS: 0.856
MAXIMUM: 1.000 @ 40° TRUE
MINIMUM: 0.426 @ 330° TRUE

Measured Composite:

RMS: 0.782
Maximum: 1.000 @ 58° True
Minimum: 0.395 @ 347° 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 BNPED-20071018ACT.

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: KOUA
Location: Ada, OK
Frequency: 91.9 MHz

Antenna: LP-2E-DA-HW
Orientation: 143° True
Tower: 18" Rohn

Figure: 1
Date: 8/11/2010
Reference: Ada OK1M.fig

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0º	0.478	0.34	-4.64	Horizontal	180º	0.802	0.97	-0.15	Horizontal
5º	0.533	0.43	-3.70	Horizontal	185º	0.855	1.10	0.40	Horizontal
10º	0.598	0.54	-2.71	Horizontal	190º	0.897	1.21	0.82	Horizontal
15º	0.672	0.68	-1.69	Horizontal	195º	0.928	1.29	1.11	Horizontal
20º	0.759	0.86	-0.64	Horizontal	200º	0.948	1.35	1.30	Horizontal
25º	0.820	1.01	0.03	Horizontal	205º	0.957	1.37	1.38	Horizontal
30º	0.855	1.10	0.40	Horizontal	210º	0.954	1.36	1.35	Horizontal
35º	0.879	1.16	0.64	Vertical	215º	0.955	1.37	1.36	Vertical
40º	0.929	1.29	1.12	Vertical	220º	0.971	1.41	1.51	Vertical
45º	0.965	1.40	1.45	Vertical	225º	0.976	1.43	1.55	Vertical
50º	0.989	1.47	1.66	Vertical	230º	0.974	1.42	1.54	Vertical
55º	0.999	1.50	1.75	Vertical	235º	0.961	1.38	1.41	Vertical
60º	0.999	1.50	1.75	Vertical	240º	0.934	1.31	1.17	Vertical
65º	0.992	1.48	1.69	Vertical	245º	0.917	1.26	1.01	Horizontal
70º	0.977	1.43	1.56	Vertical	250º	0.922	1.28	1.06	Horizontal
75º	0.990	1.47	1.67	Horizontal	255º	0.921	1.27	1.05	Horizontal
80º	0.999	1.50	1.75	Horizontal	260º	0.910	1.24	0.94	Horizontal
85º	0.999	1.50	1.76	Horizontal	265º	0.888	1.18	0.73	Horizontal
90º	0.990	1.47	1.67	Horizontal	270º	0.855	1.10	0.40	Horizontal
95º	0.968	1.41	1.48	Horizontal	275º	0.811	0.99	-0.06	Horizontal
100º	0.934	1.31	1.17	Horizontal	280º	0.756	0.86	-0.67	Horizontal
105º	0.889	1.18	0.74	Horizontal	285º	0.690	0.71	-1.46	Horizontal
110º	0.831	1.04	0.15	Horizontal	290º	0.615	0.57	-2.46	Horizontal
115º	0.761	0.87	-0.62	Horizontal	295º	0.544	0.44	-3.53	Horizontal
120º	0.686	0.71	-1.51	Horizontal	300º	0.483	0.35	-4.57	Horizontal
125º	0.632	0.60	-2.23	Horizontal	305º	0.440	0.29	-5.37	Vertical
130º	0.588	0.52	-2.86	Horizontal	310º	0.440	0.29	-5.36	Vertical
135º	0.578	0.50	-3.00	Vertical	315º	0.439	0.29	-5.39	Vertical
140º	0.577	0.50	-3.02	Vertical	320º	0.435	0.28	-5.46	Vertical
145º	0.574	0.49	-3.07	Vertical	325º	0.430	0.28	-5.58	Vertical
150º	0.569	0.49	-3.13	Vertical	330º	0.422	0.27	-5.74	Vertical
155º	0.565	0.48	-3.19	Vertical	335º	0.412	0.25	-5.94	Vertical
160º	0.588	0.52	-2.85	Horizontal	340º	0.404	0.24	-6.12	Vertical
165º	0.628	0.59	-2.28	Horizontal	345º	0.397	0.24	-6.26	Vertical
170º	0.679	0.69	-1.60	Horizontal	350º	0.409	0.25	-6.00	Horizontal
175º	0.740	0.82	-0.85	Horizontal	355º	0.440	0.29	-5.38	Horizontal

Polarization: **Envelope**
Maximum Field: **1.000 @ 58° True**
Minimum Field: **0.395 @ 347° True**
RMS: **0.782**
Maximum ERP: **1.500 kW**
Maximum Power Gain: **1.234 (0.912 dB)**
Horizontal Plane Gain: **1.234 (0.912 dB)**

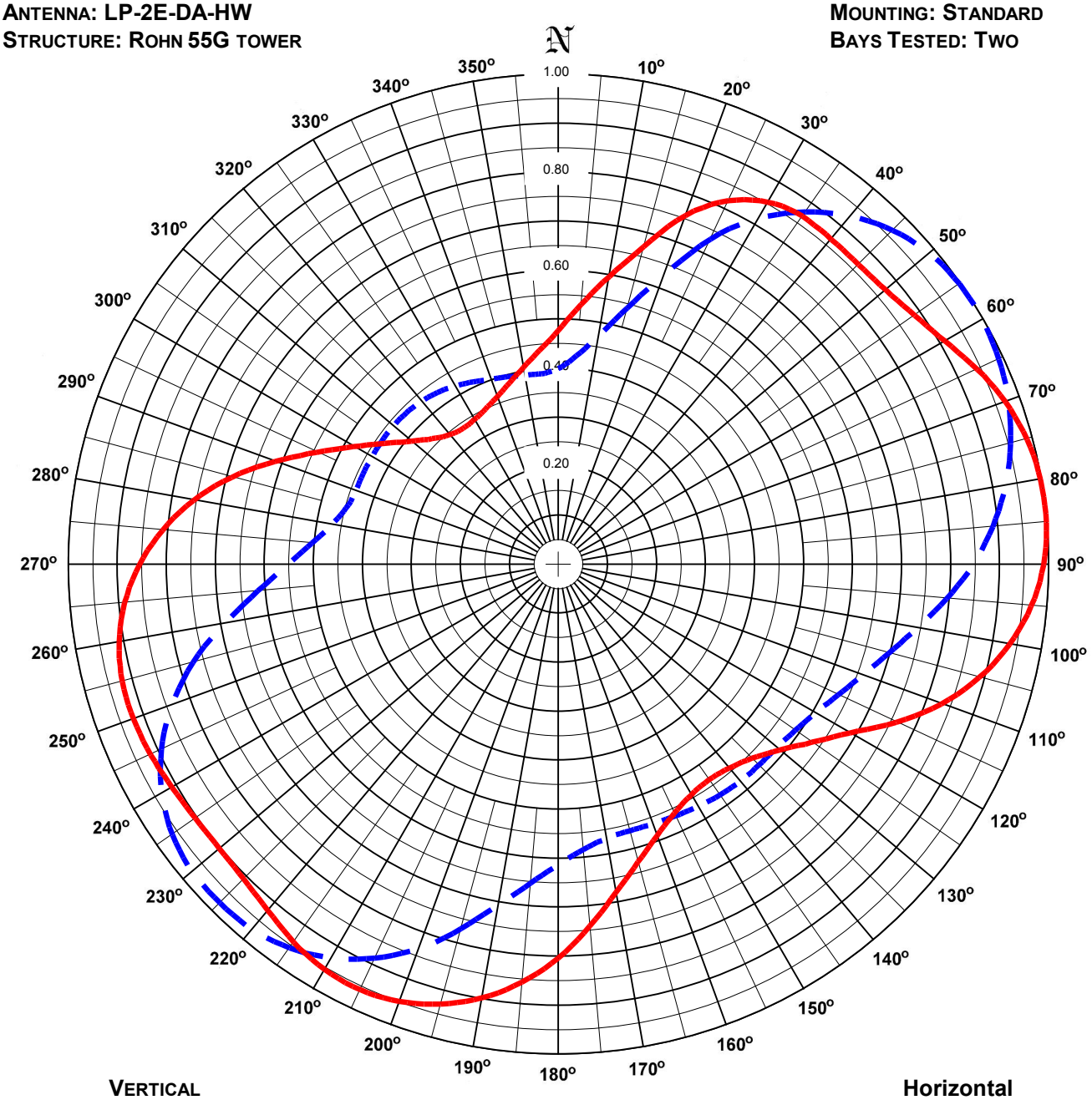
Total Input Power: 1.216 kW

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: KOUA
LOCATION: ADA, OK
ANTENNA: LP-2E-DA-HW
STRUCTURE: ROHN 55G TOWER

DATE: 8/13/2010
FREQUENCY: 91.9 MHZ
ORIENTATION: 143° TRUE
MOUNTING: STANDARD
BAYS TESTED: TWO



VERTICAL

RMS: 0.706
MAXIMUM: 1.000 @ 58° TRUE
MINIMUM: 0.392 @ 354° TRUE

Horizontal

RMS: 0.763
Maximum: 1.000 @ 83° True
Minimum: 0.340 @ 326° 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: KOUA
Location: Ada, OK
Frequency: 91.9 MHz

Antenna: LP-2E-DA-HW
Orientation: 143° True
Tower: 18" Rohn

Figure: 2
Date: 8/11/2010
Reference: Ada OK1M.fig

Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0º	0.478	0.34	-4.64	0.400	0.24	-6.19	180º	0.802	0.97	-0.15	0.612	0.56	-2.51
5º	0.533	0.43	-3.70	0.428	0.28	-5.60	185º	0.855	1.10	0.40	0.652	0.64	-1.95
10º	0.598	0.54	-2.71	0.476	0.34	-4.69	190º	0.897	1.21	0.82	0.705	0.74	-1.28
15º	0.672	0.68	-1.69	0.543	0.44	-3.55	195º	0.928	1.29	1.11	0.769	0.89	-0.52
20º	0.759	0.86	-0.64	0.630	0.59	-2.26	200º	0.948	1.35	1.30	0.833	1.04	0.18
25º	0.820	1.01	0.03	0.734	0.81	-0.92	205º	0.957	1.37	1.38	0.886	1.18	0.71
30º	0.855	1.10	0.40	0.816	1.00	0.00	210º	0.954	1.36	1.35	0.926	1.29	1.09
35º	0.868	1.13	0.53	0.879	1.16	0.64	215º	0.941	1.33	1.23	0.955	1.37	1.36
40º	0.867	1.13	0.52	0.929	1.29	1.12	220º	0.921	1.27	1.05	0.971	1.41	1.51
45º	0.866	1.13	0.51	0.965	1.40	1.45	225º	0.907	1.23	0.91	0.976	1.43	1.55
50º	0.872	1.14	0.57	0.989	1.47	1.66	230º	0.902	1.22	0.86	0.974	1.42	1.54
55º	0.887	1.18	0.72	0.999	1.50	1.75	235º	0.903	1.22	0.88	0.961	1.38	1.41
60º	0.912	1.25	0.96	0.999	1.50	1.75	240º	0.910	1.24	0.94	0.934	1.31	1.17
65º	0.943	1.33	1.25	0.992	1.48	1.69	245º	0.917	1.26	1.01	0.893	1.20	0.78
70º	0.971	1.41	1.51	0.977	1.43	1.56	250º	0.922	1.28	1.06	0.839	1.06	0.24
75º	0.990	1.47	1.67	0.955	1.37	1.36	255º	0.921	1.27	1.05	0.772	0.89	-0.49
80º	0.999	1.50	1.75	0.926	1.29	1.09	260º	0.910	1.24	0.94	0.691	0.72	-1.45
85º	0.999	1.50	1.76	0.889	1.19	0.74	265º	0.888	1.18	0.73	0.616	0.57	-2.45
90º	0.990	1.47	1.67	0.846	1.07	0.30	270º	0.855	1.10	0.40	0.554	0.46	-3.38
95º	0.968	1.41	1.48	0.795	0.95	-0.24	275º	0.811	0.99	-0.06	0.505	0.38	-4.18
100º	0.934	1.31	1.17	0.743	0.83	-0.82	280º	0.756	0.86	-0.67	0.470	0.33	-4.80
105º	0.889	1.18	0.74	0.698	0.73	-1.37	285º	0.690	0.71	-1.46	0.448	0.30	-5.21
110º	0.831	1.04	0.15	0.660	0.65	-1.85	290º	0.615	0.57	-2.46	0.440	0.29	-5.37
115º	0.761	0.87	-0.62	0.629	0.59	-2.27	295º	0.544	0.44	-3.53	0.439	0.29	-5.38
120º	0.686	0.71	-1.51	0.606	0.55	-2.60	300º	0.483	0.35	-4.57	0.440	0.29	-5.38
125º	0.632	0.60	-2.23	0.589	0.52	-2.83	305º	0.432	0.28	-5.53	0.440	0.29	-5.37
130º	0.588	0.52	-2.86	0.581	0.51	-2.96	310º	0.393	0.23	-6.36	0.440	0.29	-5.36
135º	0.559	0.47	-3.30	0.578	0.50	-3.00	315º	0.364	0.20	-7.02	0.439	0.29	-5.39
140º	0.541	0.44	-3.57	0.577	0.50	-3.02	320º	0.346	0.18	-7.45	0.435	0.28	-5.46
145º	0.536	0.43	-3.66	0.574	0.49	-3.07	325º	0.340	0.17	-7.61	0.430	0.28	-5.58
150º	0.542	0.44	-3.56	0.569	0.49	-3.13	330º	0.342	0.18	-7.55	0.422	0.27	-5.74
155º	0.559	0.47	-3.28	0.565	0.48	-3.19	335º	0.351	0.18	-7.33	0.412	0.25	-5.94
160º	0.588	0.52	-2.85	0.563	0.47	-3.23	340º	0.365	0.20	-6.99	0.404	0.24	-6.12
165º	0.628	0.59	-2.28	0.562	0.47	-3.25	345º	0.385	0.22	-6.54	0.397	0.24	-6.26
170º	0.679	0.69	-1.60	0.567	0.48	-3.17	350º	0.409	0.25	-6.00	0.393	0.23	-6.34
175º	0.740	0.82	-0.85	0.583	0.51	-2.92	355º	0.440	0.29	-5.38	0.392	0.23	-6.38

Polarization:	**Horizontal**	**Vertical**
Maximum Field:	**1.000 @ 83° True**	**1.000 @ 58° True**
Minimum Field:	**0.340 @ 326° True**	**0.392 @ 354° True**
RMS:	**0.763**	**0.706**
Maximum ERP:	**1.500 kW**	**1.500 kW**
Maximum Power Gain:	**1.234 (0.912 dB)**	**1.234 (0.912 dB)**

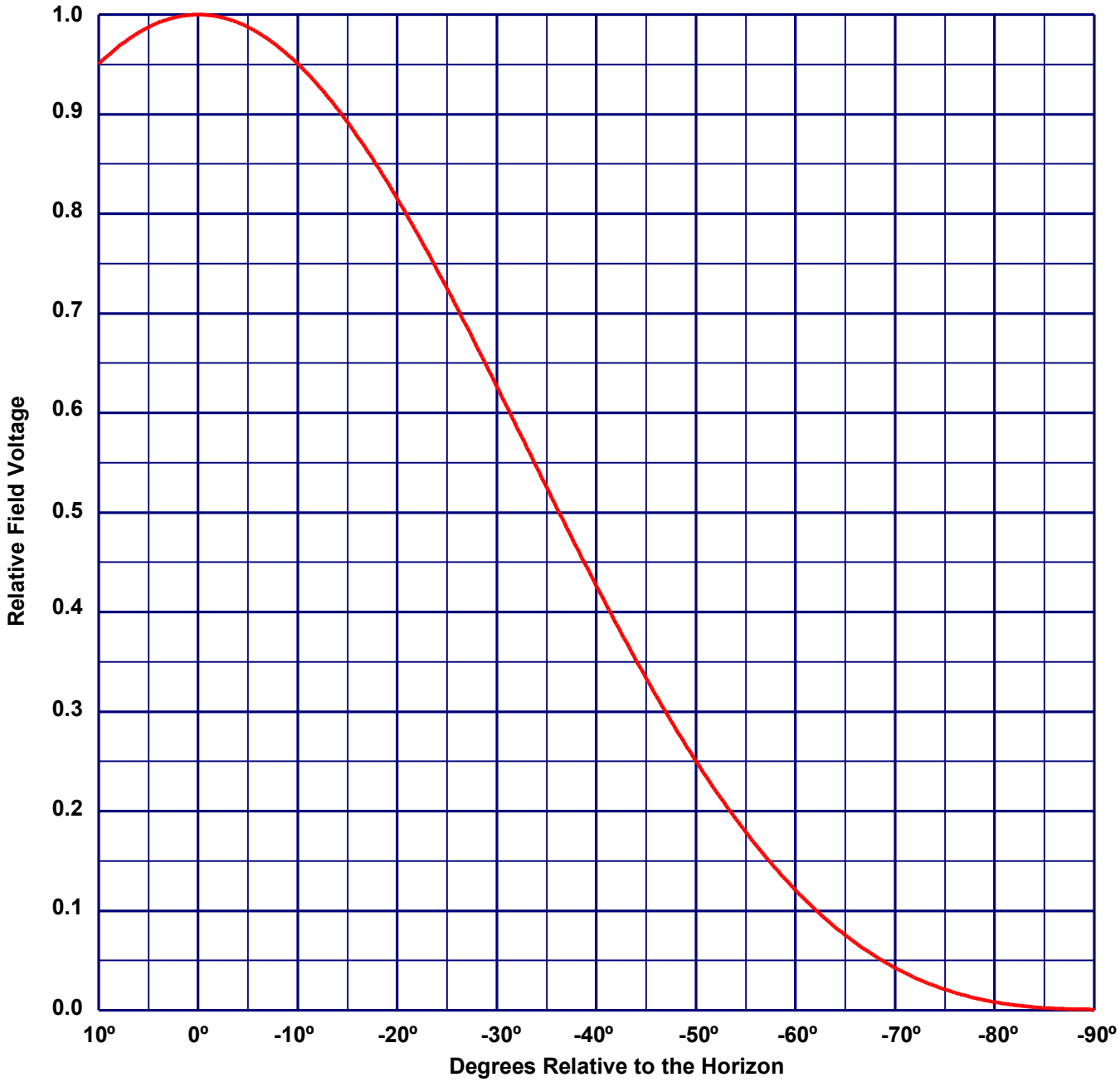
Total Input Power: 1.216 kW

Vertical Plane Relative Field Pattern

KOUA, Ada, OK, 91.9 MHz

Figure#: 3 Date: 8/13/2010

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 1.000



Vertical Polarization Gain:	Horizontal Polarization Gain:
Maximum: 1.234 (0.912 dB)	Maximum: 1.234 (0.912 dB)
Horizontal Plane: 1.234 (0.912 dB)	Horizontal Plane: 1.234 (0.912 dB)

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Directional Antenna System
for
Ada, Oklahoma

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	LP-2E-DA-HW
Frequency:	91.9 MHz
Number of Bays:	Two

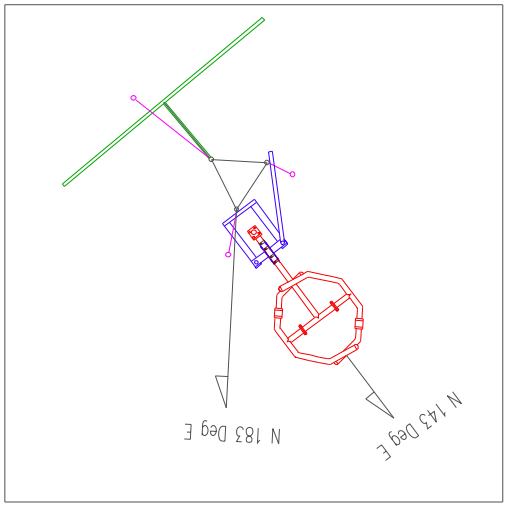
MECHANICAL SPECIFICATIONS

Mounting:	Standard
System length:	14 ft 1 in
Aperture length required:	25 ft 4 in
Orientation:	143° true

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

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	1.500 kW (1.761 dBk)
Horizontal maximum power gain:	1.234 (0.912 dB)
Maximum vertical ERP:	1.500 kW (1.761 dBk)
Vertical maximum power gain:	1.234 (0.912 dB)
Total input power:	1.216 kW (0.848 dBk)



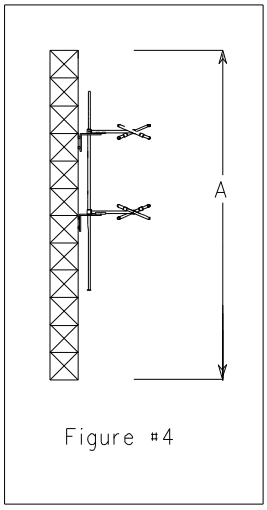


Figure #4