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 WLFX, Berea, Kentucky

August 1, 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 WLFX.

The antenna is the ERI model LP-4E-DA-HW configuration. The circular polarized system consists of 4 half-wavelength spaced bays using one driven circular polarized radiating element per bay and two horizontal parasitic elements per bay. The antenna was mounted on the North 241 degrees East tower leg with bracketry to provide an antenna orientation of North 252 degrees East. The antenna was tested on a 36" face World tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 106.7 megahertz, which is the center of the FM broadcast channel assigned to WLFX.

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
WLFX, Berea, Kentucky

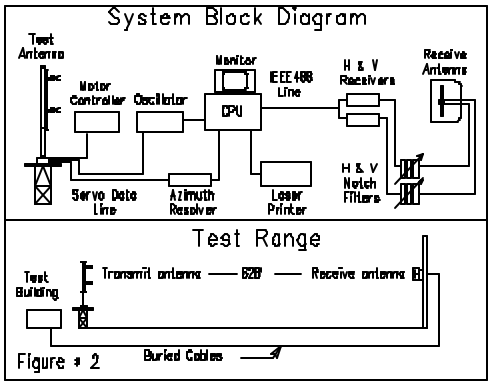
(Continued)

DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of two bay levels of the circular polarized system with the associated horizontal 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 36" face World 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 106.7 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.

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 half-wavelength spaced bays using one driven circular polarized radiating element per bay and two horizontal 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-4E-DA-HW array is to be mounted on the North 241 degrees East tower leg of the 36" face World tower at a bearing of North 252 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 3.300 kilowatts (5.185 dBk).

The power at North 50-90 degrees East does not exceed 0.279 kilowatts (-5.544 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 33 feet 9 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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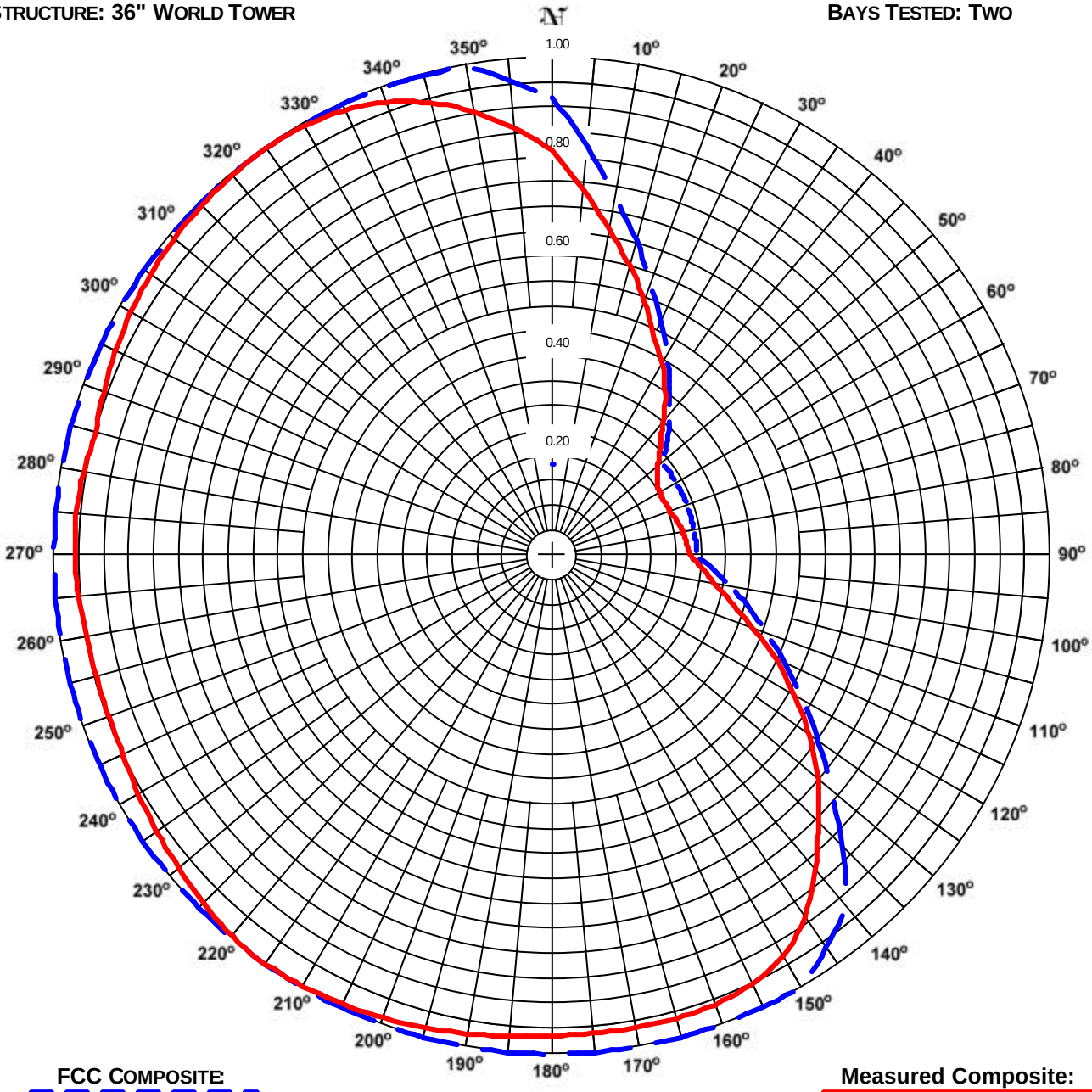
FIGURE NO: 1
STATION: WLFX
LOCATION: BEREA, KY
ANTENNA: LP-4E-DA-HW
STRUCTURE: 36" WORLD TOWER

DATE: 7/28/2008
FREQUENCY: 106.7 MHZ
ORIENTATION: 252° TRUE
MOUNTING: STANDARD
BAYS TESTED: TWO



FCC COMPOSITE:

RMS: 0.842
MAXIMUM: 1.000 @ 150° TRUE
MINIMUM: 0.291 @ 50° TRUE

Measured Composite:

RMS: 0.808
Maximum: 1.000 @ 216° True
Minimum: 0.251 @ 62° True

COMMENTS: COMPOSITE PATTERN: THIS PATTERN SHOWS THE MAXIMUM OF EITHER THE H OR V AZIMUTH VALUES. THIS PATTERN IS GREATER THAT 85% OF THE FCC FILED COMPOSITE PATTERN BLH-20010508AAK.

Horizontal Plane Relative Field List

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Station: WLFX
Location: Berea, KY
Frequency: 106.7 MHz

Antenna: LP-4E-DA-HW
Orientation: 252° True
Tower: 36" World Tower

Figure: 1
Date: 7/28/2008
Reference: wlfx1m.fig

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0º	0.815	2.19	3.41	Vertical	180º	0.963	3.06	4.86	Horizontal
5º	0.738	1.80	2.54	Vertical	185º	0.967	3.09	4.89	Horizontal
10º	0.667	1.47	1.67	Vertical	190º	0.973	3.13	4.95	Horizontal
15º	0.604	1.21	0.81	Vertical	195º	0.980	3.17	5.01	Horizontal
20º	0.545	0.98	-0.08	Vertical	200º	0.987	3.21	5.07	Horizontal
25º	0.484	0.77	-1.11	Vertical	205º	0.993	3.26	5.13	Horizontal
30º	0.445	0.65	-1.84	Horizontal	210º	0.997	3.28	5.16	Horizontal
35º	0.398	0.52	-2.83	Horizontal	215º	1.000	3.30	5.18	Horizontal
40º	0.347	0.40	-4.00	Horizontal	220º	0.997	3.28	5.16	Horizontal
45º	0.308	0.31	-5.05	Vertical	225º	0.988	3.22	5.08	Horizontal
50º	0.278	0.25	-5.94	Vertical	230º	0.977	3.15	4.98	Horizontal
55º	0.259	0.22	-6.53	Vertical	235º	0.967	3.08	4.89	Horizontal
60º	0.252	0.21	-6.79	Vertical	240º	0.958	3.03	4.81	Horizontal
65º	0.252	0.21	-6.80	Vertical	245º	0.950	2.98	4.74	Horizontal
70º	0.256	0.22	-6.65	Vertical	250º	0.946	2.95	4.70	Horizontal
75º	0.263	0.23	-6.41	Vertical	255º	0.946	2.95	4.70	Horizontal
80º	0.268	0.24	-6.25	Vertical	260º	0.948	2.97	4.72	Horizontal
85º	0.273	0.25	-6.10	Vertical	265º	0.953	3.00	4.77	Horizontal
90º	0.282	0.26	-5.82	Vertical	270º	0.958	3.03	4.81	Horizontal
95º	0.306	0.31	-5.11	Vertical	275º	0.959	3.03	4.82	Horizontal
100º	0.338	0.38	-4.24	Vertical	280º	0.956	3.02	4.79	Horizontal
105º	0.380	0.48	-3.23	Vertical	285º	0.949	2.97	4.73	Vertical
110º	0.433	0.62	-2.08	Horizontal	290º	0.958	3.03	4.81	Vertical
115º	0.500	0.83	-0.83	Horizontal	295º	0.968	3.09	4.90	Vertical
120º	0.566	1.06	0.24	Horizontal	300º	0.977	3.15	4.98	Vertical
125º	0.633	1.32	1.21	Horizontal	305º	0.985	3.20	5.05	Vertical
130º	0.698	1.61	2.06	Horizontal	310º	0.991	3.24	5.10	Vertical
135º	0.759	1.90	2.79	Horizontal	315º	0.995	3.27	5.15	Vertical
140º	0.823	2.24	3.49	Horizontal	320º	0.999	3.29	5.17	Vertical
145º	0.885	2.58	4.12	Horizontal	325º	1.000	3.30	5.19	Vertical
150º	0.928	2.84	4.53	Horizontal	330º	0.997	3.28	5.16	Vertical
155º	0.949	2.97	4.73	Horizontal	335º	0.988	3.22	5.08	Vertical
160º	0.958	3.03	4.82	Horizontal	340º	0.971	3.11	4.93	Vertical
165º	0.961	3.05	4.84	Horizontal	345º	0.944	2.94	4.68	Vertical
170º	0.962	3.05	4.85	Horizontal	350º	0.908	2.72	4.34	Vertical
175º	0.961	3.05	4.84	Horizontal	355º	0.864	2.46	3.91	Vertical

Polarization: **Envelope**
Maximum Field: **1.000 @ 216° True**
Minimum Field: **0.251 @ 62° True**
RMS: **0.808**
Maximum ERP: **3.300 kW**
Maximum Power Gain: **2.040 (3.095 dB)**

Total Input Power: 1.618 kW

ERI® Horizontal Plane Relative Field Pattern

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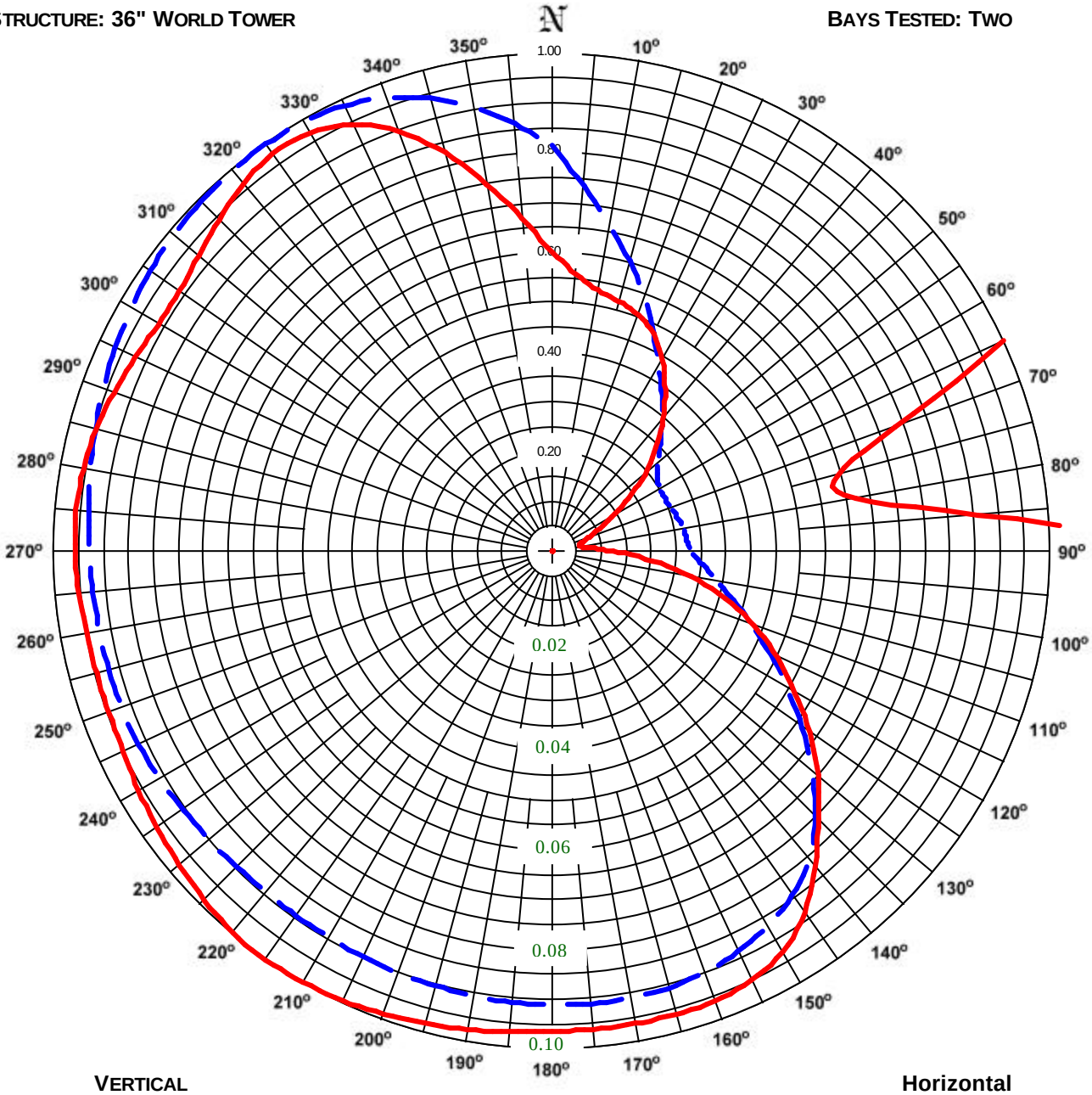
FIGURE NO: 2
STATION: WLFX
LOCATION: BEREA, KY
ANTENNA: LP-4E-DA-HW
STRUCTURE: 36" WORLD TOWER

DATE: 7/28/2008
FREQUENCY: 106.7 MHZ
ORIENTATION: 252° TRUE
MOUNTING: STANDARD
BAYS TESTED: TWO



VERTICAL

RMS: 0.780
MAXIMUM: 1.000 @ 325° TRUE
MINIMUM: 0.251 @ 62° TRUE

10X Scale

Horizontal

RMS: 0.781
Maximum: 1.000 @ 216° True
Minimum: 0.058 @ 77° True

COMMENTS: MEASURED PATTERNS OF THE HORIZONTAL ANAD VERTICAL COMPONENTS.

ERI® Horizontal Plane Relative Field List

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Station: WLFX
Location: Berea, KY
Frequency: 106.7 MHz

Antenna: LP-4E-DA-HW
Orientation: 252° True
Tower: 36" World Tower

Figure: 2
Date: 7/28/2008
Reference: wlfx1m.fig

Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0º	0.603	1.20	0.80	0.815	2.19	3.41	180º	0.963	3.06	4.86	0.909	2.73	4.36
5º	0.561	1.04	0.16	0.738	1.80	2.54	185º	0.967	3.09	4.89	0.907	2.72	4.34
10º	0.535	0.94	-0.25	0.667	1.47	1.67	190º	0.973	3.13	4.95	0.905	2.70	4.31
15º	0.522	0.90	-0.47	0.604	1.21	0.81	195º	0.980	3.17	5.01	0.901	2.68	4.28
20º	0.508	0.85	-0.70	0.545	0.98	-0.08	200º	0.987	3.21	5.07	0.898	2.66	4.25
25º	0.484	0.77	-1.12	0.484	0.77	-1.11	205º	0.993	3.26	5.13	0.896	2.65	4.23
30º	0.445	0.65	-1.84	0.430	0.61	-2.15	210º	0.997	3.28	5.16	0.894	2.64	4.21
35º	0.398	0.52	-2.83	0.386	0.49	-3.09	215º	1.000	3.30	5.18	0.893	2.63	4.20
40º	0.347	0.40	-4.00	0.346	0.40	-4.03	220º	0.997	3.28	5.16	0.893	2.63	4.20
45º	0.297	0.29	-5.36	0.308	0.31	-5.05	225º	0.988	3.22	5.08	0.894	2.64	4.21
50º	0.244	0.20	-7.05	0.278	0.25	-5.94	230º	0.977	3.15	4.98	0.898	2.66	4.25
55º	0.189	0.12	-9.30	0.259	0.22	-6.53	235º	0.967	3.08	4.89	0.903	2.69	4.30
60º	0.139	0.06	-11.95	0.252	0.21	-6.79	240º	0.958	3.03	4.81	0.910	2.73	4.37
65º	0.100	0.03	-14.79	0.252	0.21	-6.80	245º	0.950	2.98	4.74	0.915	2.77	4.42
70º	0.073	0.02	-17.49	0.256	0.22	-6.65	250º	0.946	2.95	4.70	0.919	2.79	4.45
75º	0.059	0.01	-19.35	0.263	0.23	-6.41	255º	0.946	2.95	4.70	0.921	2.80	4.47
80º	0.062	0.01	-18.98	0.268	0.24	-6.25	260º	0.948	2.97	4.72	0.922	2.81	4.48
85º	0.086	0.02	-16.11	0.273	0.25	-6.10	265º	0.953	3.00	4.77	0.925	2.82	4.51
90º	0.134	0.06	-12.29	0.282	0.26	-5.82	270º	0.958	3.03	4.81	0.929	2.85	4.54
95º	0.204	0.14	-8.61	0.306	0.31	-5.11	275º	0.959	3.03	4.82	0.934	2.88	4.59
100º	0.284	0.27	-5.75	0.338	0.38	-4.24	280º	0.956	3.02	4.79	0.941	2.92	4.65
105º	0.360	0.43	-3.68	0.380	0.48	-3.23	285º	0.948	2.96	4.72	0.949	2.97	4.73
110º	0.433	0.62	-2.08	0.429	0.61	-2.16	290º	0.935	2.89	4.61	0.958	3.03	4.81
115º	0.500	0.83	-0.83	0.485	0.78	-1.10	295º	0.923	2.81	4.48	0.968	3.09	4.90
120º	0.566	1.06	0.24	0.547	0.99	-0.06	300º	0.914	2.75	4.40	0.977	3.15	4.98
125º	0.633	1.32	1.21	0.614	1.24	0.95	305º	0.913	2.75	4.40	0.985	3.20	5.05
130º	0.698	1.61	2.06	0.684	1.54	1.88	310º	0.925	2.83	4.51	0.991	3.24	5.10
135º	0.759	1.90	2.79	0.748	1.85	2.66	315º	0.944	2.94	4.68	0.995	3.27	5.15
140º	0.823	2.24	3.49	0.806	2.14	3.31	320º	0.964	3.07	4.87	0.999	3.29	5.17
145º	0.885	2.58	4.12	0.843	2.34	3.70	325º	0.976	3.15	4.98	1.000	3.30	5.19
150º	0.928	2.84	4.53	0.867	2.48	3.95	330º	0.972	3.12	4.94	0.997	3.28	5.16
155º	0.949	2.97	4.73	0.886	2.59	4.13	335º	0.947	2.96	4.71	0.988	3.22	5.08
160º	0.958	3.03	4.82	0.898	2.66	4.26	340º	0.899	2.66	4.26	0.971	3.11	4.93
165º	0.961	3.05	4.84	0.906	2.71	4.33	345º	0.830	2.28	3.57	0.944	2.94	4.68
170º	0.962	3.05	4.85	0.910	2.73	4.36	350º	0.751	1.86	2.70	0.908	2.72	4.34
175º	0.961	3.05	4.84	0.910	2.73	4.37	355º	0.673	1.49	1.75	0.864	2.46	3.91

Polarization:	**Horizontal**	**Vertical**
Maximum Field:	**1.000 @ 216° True**	**1.000 @ 325° True**
Minimum Field:	**0.058 @ 77° True**	**0.251 @ 62° True**
RMS:	**0.781**	**0.780**
Maximum ERP:	**3.300 kW**	**3.300 kW**
Maximum Power Gain:	**2.040 (3.095 dB)**	**2.040 (3.095 dB)**

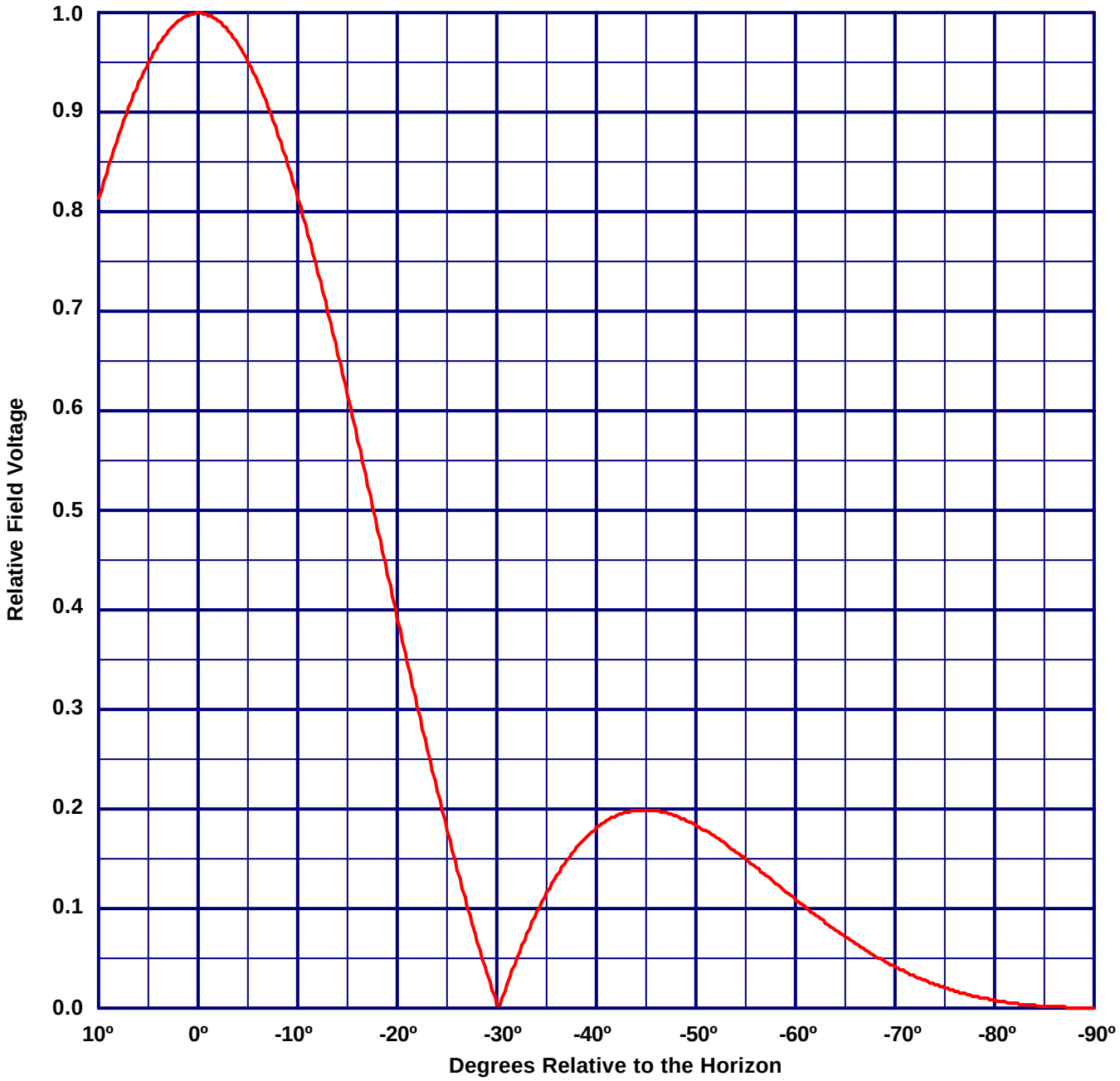
Total Input Power: 1.618 kW

Vertical Plane Relative Field Pattern

WLFX, Berea, KY, 106.7 MHz

Figure#: 3 Date: 7/28/2008

A 4 level, .5 wave-length spaced LP-4E-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: 2.040 (3.095 dB)	Maximum: 2.040 (3.095 dB)
Horizontal Plane: 2.040 (3.095 dB)	Horizontal Plane: 2.040 (3.095 dB)

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Directional Antenna System
for
WLFX, Berea, Kentucky

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	LP-4E-DA-HW
Frequency:	106.7 MHz
Number of Bays:	Four

MECHANICAL SPECIFICATIONS

Mounting:	Standard
System length:	22 ft
Aperture length required:	33 ft 9 in
Orientation:	252° true

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

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	3.300 kW (5.185 dBk)
Horizontal maximum power gain:	2.040 (3.095 dB)
Maximum vertical ERP:	3.300 kW (5.185 dBk)
Vertical maximum power gain:	2.040 (3.095 dB)
Total input power:	1.618 kW (2.090 dBk)