ERI® Electronics Research, Inc.
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 WJLR, Seymour, Indiana

September 21, 2005

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 WJLR.

The antenna is the ERI model MP-4E-DA configuration. The circular polarized system consists of 4 full-wavelength spaced bays using one driven circular polarized radiating element and two horizontal parasitic elements placed one-quarter wave above and below each bay. The antenna was mounted on the North 173 degrees East tower leg with bracketry to provide an antenna orientation of North 143 degrees East. The antenna was tested on a 24" Pi-Rod tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 91.5 megahertz, which is the center of the FM broadcast channel assigned to WJLR.

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
WJLR, Seymour, Indiana

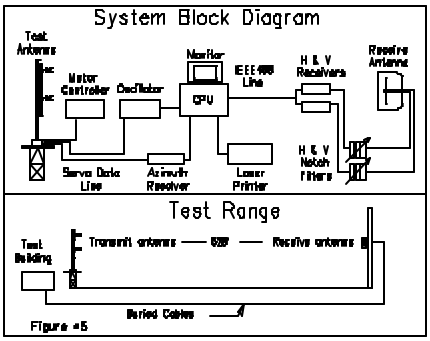
(Continued)

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 3 1/8 inch o.d. rigid coaxial line was used to feed the test antenna, and a section of 3 1/8 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" 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 azimuth indicating mechanism, resolution of this azimuth measuring device is one-tenth of a degree.



The antenna under test was operated in the transmitting mode and fed from a Wavetek Model 3000 signal generator. The frequency of the signal source was set at 91.5 MHz and was constantly monitored by an Anritsu Model ML521B measuring receiver.

A broad-band 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 an Anritsu Model ML521B 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 co-ordinated graph paper in a clockwise direction. Both horizontal and vertical components were recorded separately.

CONCLUSIONS

The circular polarized system consists of 4 full-wavelength spaced bays using one driven circular polarized radiating element and two horizontal parasitic elements placed one-quarter wave above and below each 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 MP-4E-DA array is to be mounted on the North 173 degrees East tower leg of the 24" Pi-Rod 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 34 kilowatts (15.315 dBk).

The power at North 350 degrees East does not exceed 4.91 kilowatts (6.911 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.

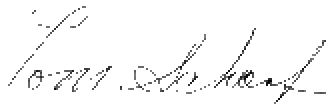
Directional Antenna System
For
WJLR, Seymour, Indiana

(Continued)

The clear vertical length of the structure required to support the antenna is 52 feet 2 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.



ERI® Horizontal Plane Relative Field Pattern

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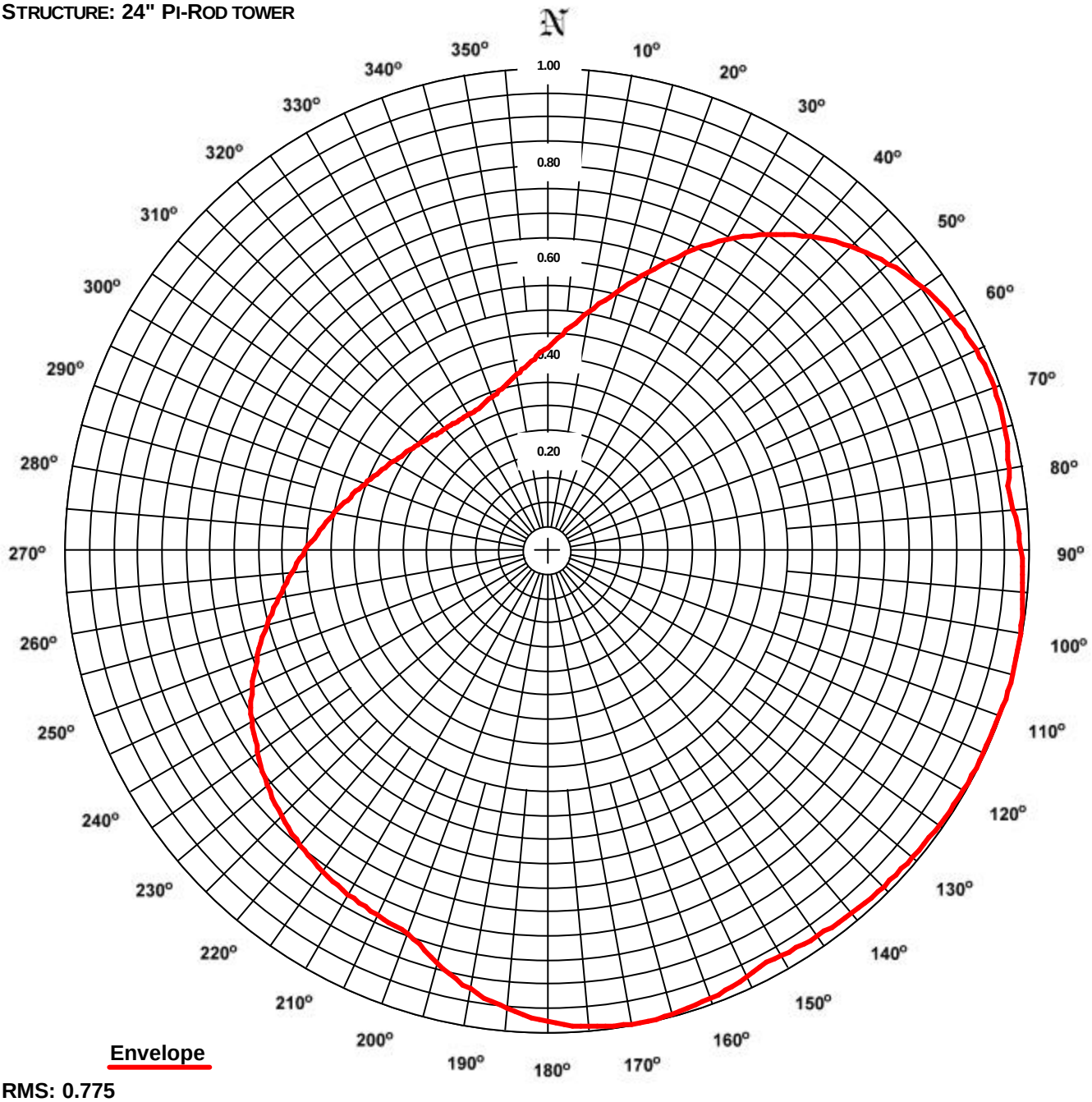
FIGURE: 1
STATION: WJLR
LOCATION: SEYMOUR, IN
ANTENNA TYPE: MP-4E-DA
STRUCTURE: 24" PI-ROD TOWER

DATE: 9/21/2005
FREQUENCY: 91.5 MHZ
ORIENTATION: 143° TRUE
MOUNTING: CUSTOM



Envelope

RMS: 0.775
Maximum: 1.000 @ 106° True
Minimum: 0.325 @ 329° 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 BPED-20020619ABT.

ERI® Horizontal Plane Relative Field List

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Station: WJLR
Location: Seymour, IN
Frequency: 91.5 MHz

Antenna: MP-4E-DA
Orientation: 143° True
Tower: 24" Pi-Rod tower

Figure: 1
Date: 9/21/2005
Reference: wjlr1m.fig

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0º	0.421	6.02	7.79	Horizontal	180º	0.979	32.57	15.13	Horizontal
5º	0.457	7.10	8.51	Horizontal	185º	0.956	31.09	14.93	Horizontal
10º	0.502	8.55	9.32	Horizontal	190º	0.926	29.14	14.64	Horizontal
15º	0.554	10.42	10.18	Horizontal	195º	0.887	26.76	14.28	Horizontal
20º	0.613	12.78	11.06	Horizontal	200º	0.848	24.44	13.88	Vertical
25º	0.680	15.70	11.96	Horizontal	205º	0.836	23.75	13.76	Vertical
30º	0.743	18.79	12.74	Horizontal	210º	0.826	23.21	13.66	Vertical
35º	0.800	21.75	13.38	Horizontal	215º	0.814	22.55	13.53	Vertical
40º	0.849	24.50	13.89	Horizontal	220º	0.799	21.71	13.37	Vertical
45º	0.890	26.96	14.31	Horizontal	225º	0.781	20.72	13.16	Vertical
50º	0.925	29.07	14.63	Horizontal	230º	0.759	19.58	12.92	Vertical
55º	0.951	30.77	14.88	Horizontal	235º	0.734	18.31	12.63	Vertical
60º	0.971	32.03	15.06	Horizontal	240º	0.708	17.04	12.32	Horizontal
65º	0.983	32.82	15.16	Horizontal	245º	0.676	15.54	11.91	Horizontal
70º	0.987	33.12	15.20	Horizontal	250º	0.640	13.91	11.43	Horizontal
75º	0.983	32.86	15.17	Horizontal	255º	0.602	12.33	10.91	Horizontal
80º	0.972	32.15	15.07	Horizontal	260º	0.566	10.90	10.38	Horizontal
85º	0.971	32.05	15.06	Vertical	265º	0.533	9.65	9.85	Horizontal
90º	0.983	32.84	15.16	Vertical	270º	0.502	8.56	9.32	Horizontal
95º	0.992	33.44	15.24	Vertical	275º	0.473	7.61	8.82	Horizontal
100º	0.997	33.82	15.29	Vertical	280º	0.447	6.80	8.33	Horizontal
105º	1.000	33.99	15.31	Vertical	285º	0.424	6.10	7.86	Horizontal
110º	1.000	33.98	15.31	Vertical	290º	0.403	5.51	7.41	Horizontal
115º	0.999	33.91	15.30	Vertical	295º	0.384	5.02	7.01	Horizontal
120º	0.997	33.80	15.29	Vertical	300º	0.368	4.61	6.64	Horizontal
125º	0.995	33.64	15.27	Vertical	305º	0.355	4.28	6.31	Horizontal
130º	0.992	33.43	15.24	Vertical	310º	0.344	4.02	6.04	Horizontal
135º	0.988	33.17	15.21	Vertical	315º	0.335	3.82	5.82	Horizontal
140º	0.983	32.87	15.17	Vertical	320º	0.329	3.68	5.66	Horizontal
145º	0.978	32.52	15.12	Vertical	325º	0.326	3.61	5.57	Horizontal
150º	0.972	32.12	15.07	Vertical	330º	0.325	3.59	5.55	Horizontal
155º	0.979	32.57	15.13	Horizontal	335º	0.329	3.67	5.65	Horizontal
160º	0.991	33.38	15.24	Horizontal	340º	0.337	3.87	5.88	Horizontal
165º	0.998	33.86	15.30	Horizontal	345º	0.351	4.19	6.22	Horizontal
170º	1.000	33.98	15.31	Horizontal	350º	0.369	4.64	6.66	Horizontal
175º	0.993	33.54	15.26	Horizontal	355º	0.393	5.24	7.19	Horizontal

Polarization: **Envelope**
Maximum Field: **1.000 @ 106° True**
Minimum Field: **0.325 @ 329° True**
RMS: **0.775**
Maximum ERP: **34.000 kW**
Maximum Power Gain: **3.715 (5.700 dB)**

Total Input Power: 9.152 kW

ERI® Horizontal Plane Relative Field Pattern

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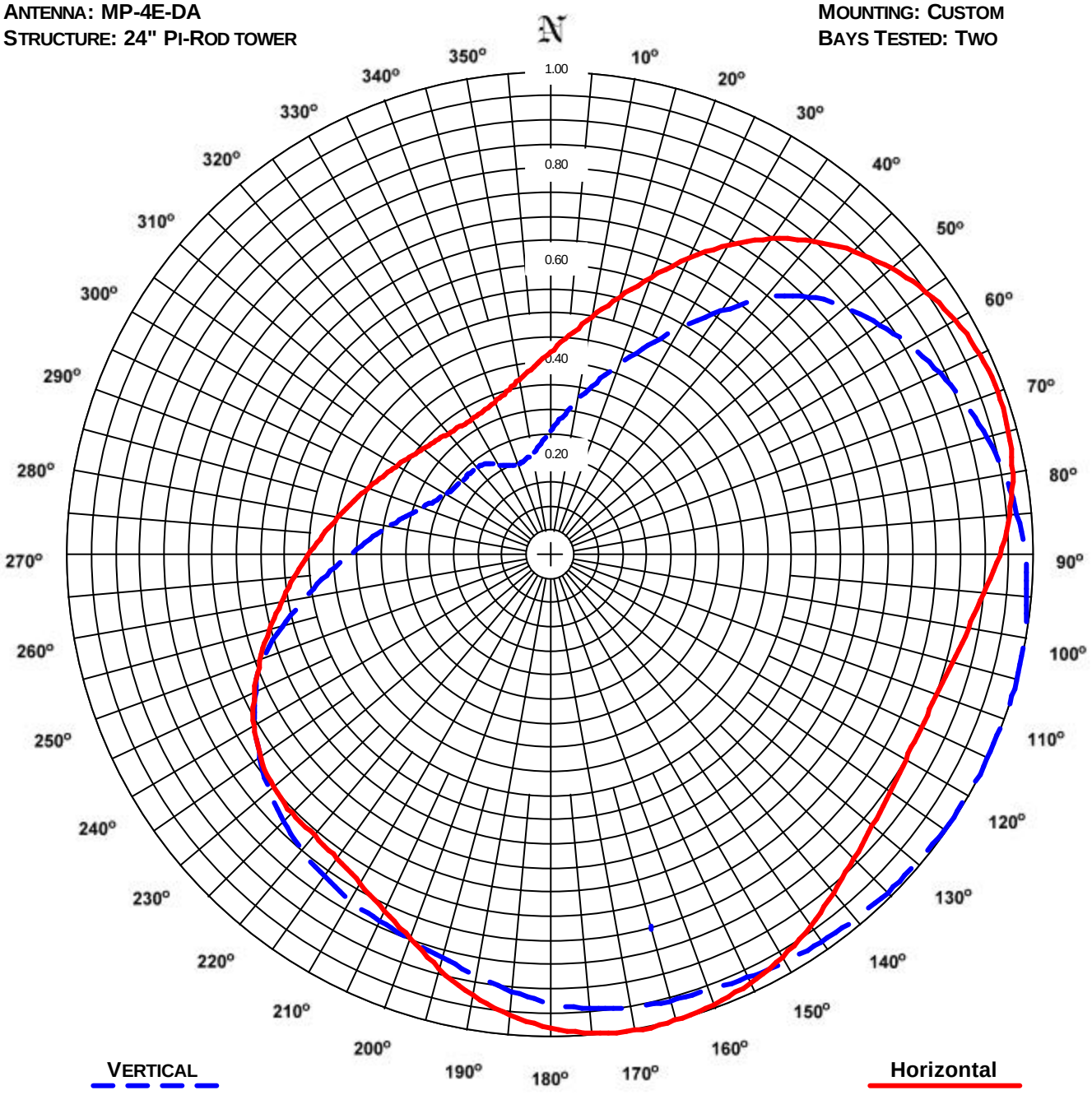
FIGURE NO: 2
STATION: WJLR
LOCATION: SEYMOUR, IN
ANTENNA: MP-4E-DA
STRUCTURE: 24" PI-ROD TOWER

DATE: 9/21/2005
FREQUENCY: 91.5 MHZ
ORIENTATION: 143° TRUE
MOUNTING: CUSTOM
BAYS TESTED: TWO



VERTICAL

RMS: 0.727
MAXIMUM: 1.000 @ 106° TRUE
MINIMUM: 0.200 @ 340° TRUE

Horizontal

RMS: 0.750
Maximum: 1.000 @ 169° True
Minimum: 0.325 @ 329° True

COMMENTS: MEASURED PATTERNS OF THE HORIZONTAL AND VERTICAL COMPONENTS.

ERI® Horizontal Plane Relative Field List

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Station: WJLR
Location: Seymour, IN
Frequency: 91.5 MHz

Antenna: MP-4E-DA
Orientation: 143° True
Tower: 24" Pi-Rod tower

Figure: 2
Date: 9/21/2005
Reference: wjlr1m.fig

Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0º	0.421	6.02	7.79	0.257	2.24	3.50	180º	0.979	32.57	15.13	0.928	29.25	14.66
5º	0.457	7.10	8.51	0.288	2.82	4.50	185º	0.956	31.09	14.93	0.906	27.93	14.46
10º	0.502	8.55	9.32	0.326	3.61	5.57	190º	0.926	29.14	14.64	0.884	26.55	14.24
15º	0.554	10.42	10.18	0.370	4.67	6.69	195º	0.887	26.76	14.28	0.863	25.33	14.04
20º	0.613	12.78	11.06	0.422	6.05	7.82	200º	0.846	24.32	13.86	0.848	24.44	13.88
25º	0.680	15.70	11.96	0.480	7.84	8.94	205º	0.812	22.42	13.51	0.836	23.75	13.76
30º	0.743	18.79	12.74	0.545	10.11	10.05	210º	0.786	21.02	13.23	0.826	23.21	13.66
35º	0.800	21.75	13.38	0.617	12.94	11.12	215º	0.769	20.08	13.03	0.814	22.55	13.53
40º	0.849	24.50	13.89	0.696	16.45	12.16	220º	0.759	19.58	12.92	0.799	21.71	13.37
45º	0.890	26.96	14.31	0.757	19.47	12.89	225º	0.756	19.43	12.89	0.781	20.72	13.16
50º	0.925	29.07	14.63	0.799	21.70	13.36	230º	0.748	19.03	12.79	0.759	19.58	12.92
55º	0.951	30.77	14.88	0.833	23.59	13.73	235º	0.732	18.22	12.61	0.734	18.31	12.63
60º	0.971	32.03	15.06	0.864	25.37	14.04	240º	0.708	17.04	12.32	0.706	16.93	12.29
65º	0.983	32.82	15.16	0.892	27.02	14.32	245º	0.676	15.54	11.91	0.674	15.44	11.89
70º	0.987	33.12	15.20	0.916	28.53	14.55	250º	0.640	13.91	11.43	0.633	13.62	11.34
75º	0.983	32.86	15.17	0.938	29.88	14.75	255º	0.602	12.33	10.91	0.576	11.27	10.52
80º	0.972	32.15	15.07	0.956	31.06	14.92	260º	0.566	10.90	10.38	0.518	9.11	9.60
85º	0.955	31.02	14.92	0.971	32.05	15.06	265º	0.533	9.65	9.85	0.465	7.36	8.67
90º	0.931	29.50	14.70	0.983	32.84	15.16	270º	0.502	8.56	9.32	0.418	5.95	7.74
95º	0.903	27.70	14.42	0.992	33.44	15.24	275º	0.473	7.61	8.82	0.377	4.82	6.83
100º	0.879	26.26	14.19	0.997	33.82	15.29	280º	0.447	6.80	8.33	0.341	3.95	5.96
105º	0.862	25.24	14.02	1.000	33.99	15.31	285º	0.424	6.10	7.86	0.310	3.27	5.14
110º	0.851	24.62	13.91	1.000	33.98	15.31	290º	0.403	5.51	7.41	0.285	2.76	4.41
115º	0.847	24.39	13.87	0.999	33.91	15.30	295º	0.384	5.02	7.01	0.265	2.39	3.79
120º	0.850	24.57	13.90	0.997	33.80	15.29	300º	0.368	4.61	6.64	0.251	2.14	3.31
125º	0.858	25.04	13.99	0.995	33.64	15.27	305º	0.355	4.28	6.31	0.242	2.00	3.00
130º	0.871	25.81	14.12	0.992	33.43	15.24	310º	0.344	4.02	6.04	0.239	1.94	2.88
135º	0.890	26.90	14.30	0.988	33.17	15.21	315º	0.335	3.82	5.82	0.237	1.92	2.83
140º	0.913	28.33	14.52	0.983	32.87	15.17	320º	0.329	3.68	5.66	0.236	1.89	2.77
145º	0.939	30.00	14.77	0.978	32.52	15.12	325º	0.326	3.61	5.57	0.231	1.82	2.59
150º	0.962	31.44	14.97	0.972	32.12	15.07	330º	0.325	3.59	5.55	0.218	1.61	2.08
155º	0.979	32.57	15.13	0.965	31.68	15.01	335º	0.329	3.67	5.65	0.205	1.42	1.54
160º	0.991	33.38	15.24	0.958	31.20	14.94	340º	0.337	3.87	5.88	0.200	1.36	1.32
165º	0.998	33.86	15.30	0.956	31.07	14.92	345º	0.351	4.19	6.22	0.204	1.41	1.50
170º	1.000	33.98	15.31	0.951	30.72	14.87	350º	0.369	4.64	6.66	0.215	1.57	1.95
175º	0.993	33.54	15.26	0.942	30.16	14.79	355º	0.393	5.24	7.19	0.232	1.83	2.63

Polarization:	**Horizontal**	**Vertical**
Maximum Field:	**1.000 @ 169° True**	**1.000 @ 106° True**
Minimum Field:	**0.325 @ 329° True**	**0.200 @ 340° True**
RMS:	**0.750**	**0.727**
Maximum ERP:	**34.000 kW**	**34.000 kW**
Maximum Power Gain:	**3.715 (5.700 dB)**	**3.715 (5.700 dB)**

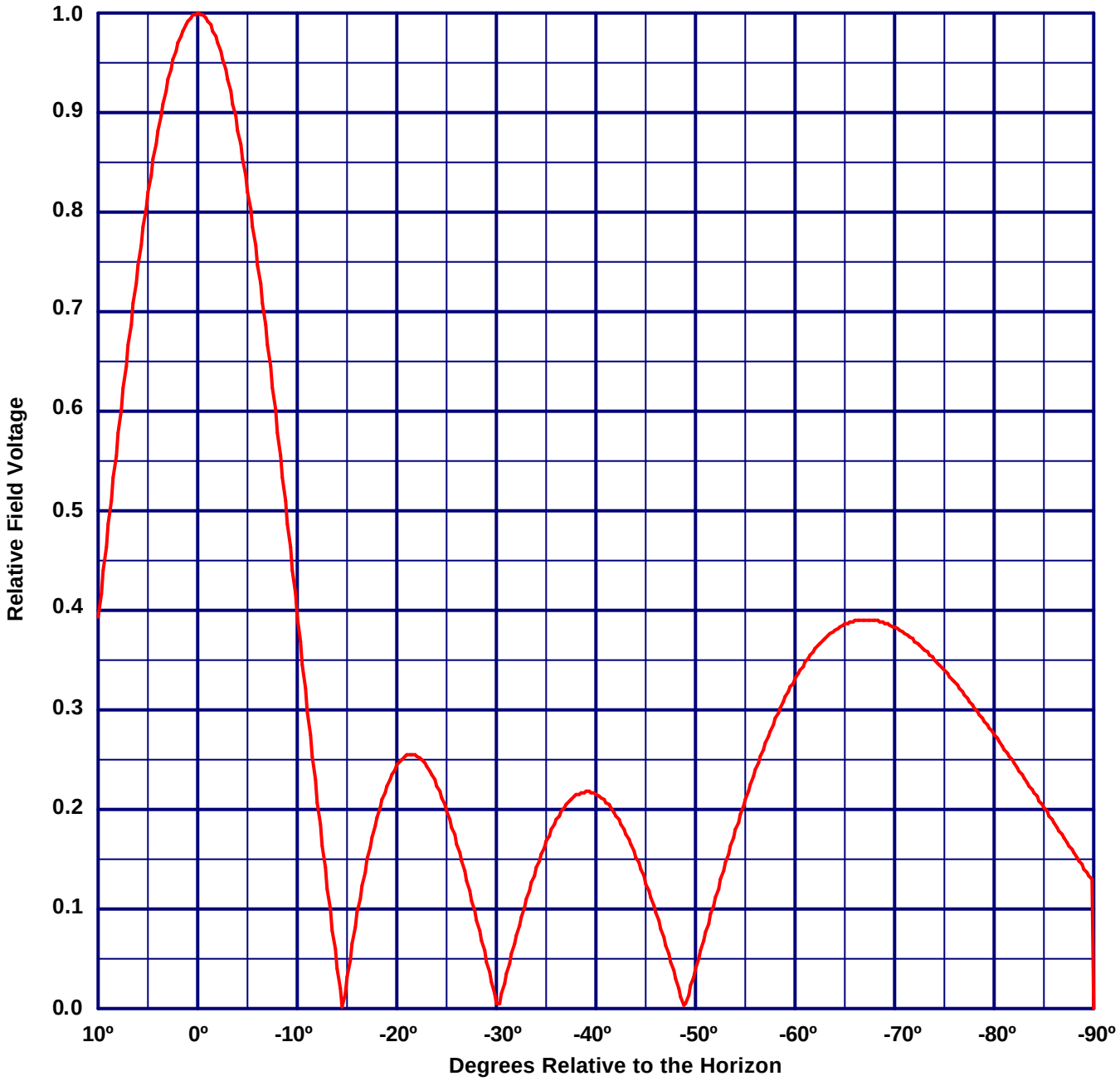
Total Input Power: 9.152 kW

Vertical Plane Relative Field Pattern

WJLR, Seymour, IN, 91.5 MHz

Figure#: 3 Date: 9/21/2005

A 4 level, 1 wave-length spaced MP-4E-DA 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: 3.715 (5.700 dB)	Maximum: 3.715 (5.700 dB)
Horizontal Plane: 3.715 (5.700 dB)	Horizontal Plane: 3.715 (5.700 dB)

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Directional Antenna System
for
WJLR, Seymour, Indiana

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	MP-4E-DA
Frequency:	91.5 MHz
Number of Bays:	4

MECHANICAL SPECIFICATIONS

Mounting:	Custom
System length:	40 ft 9 in
Aperture length required:	52 ft 2 in
Orientation:	143° true

Input flange to the antenna 3 1/8 inch female

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	34 kW (15.315 dBk)
Horizontal maximum power gain:	3.715 (5.700 dB)
Maximum vertical ERP:	34 kW (15.315 dBk)
Vertical maximum power gain:	3.715 (5.700 dB)
Total input power:	9.152 kW (9.615 dBk)

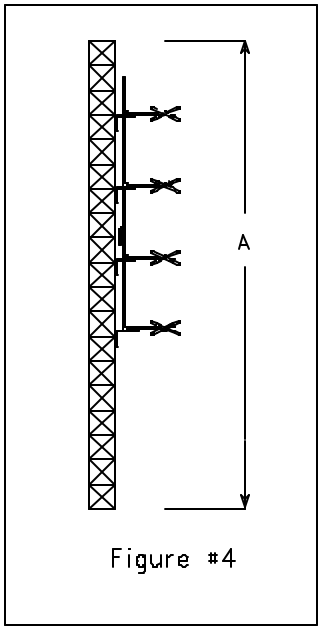

Figure #4