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 WIBI, Carlinville, Illinois

November 27, 2002

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 WIBI.

The antenna is the ERI model MP-6E-DA-HW configuration. The circular polarized system consists of 6 half-wavelength spaced bays using one driven circular polarized radiating element per bay, one horizontal parasitic element per bay and two vertical parasitic elements interleaved between alternate bay pairs. The antenna was tested on a stepped pole, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 91.1 megahertz, which is the center of the FM broadcast channel assigned to WIBI.

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.

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For
WIBI, Carlinville, Illinois

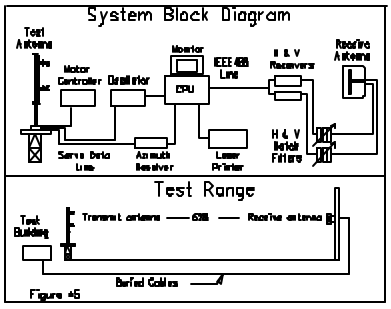
(Continued)

DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of two bay levels of the 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 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 stepped pole 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 91.1 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 6 half-wavelength spaced bays using one driven circular polarized radiating element per bay, one horizontal parasitic element per bay and two vertical parasitic elements interleaved between alternate bay pairs. 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-6E-DA-HW array is to be mounted on the stepped pole at a bearing of North 233 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 50 kilowatts (16.99 dBk).

The power at North 40 degrees East does not exceed 2.70 kilowatts (4.314 dBk).

The power at North 50 degrees East does not exceed 2.78 kilowatts (4.44 dBk).

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

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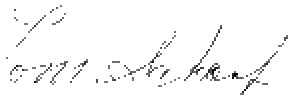
(Continued)

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 that 85% of the filed composite pattern.

The clear vertical length of the structure required to support the antenna is 42 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.



ERI® Horizontal Plane Relative Field Pattern

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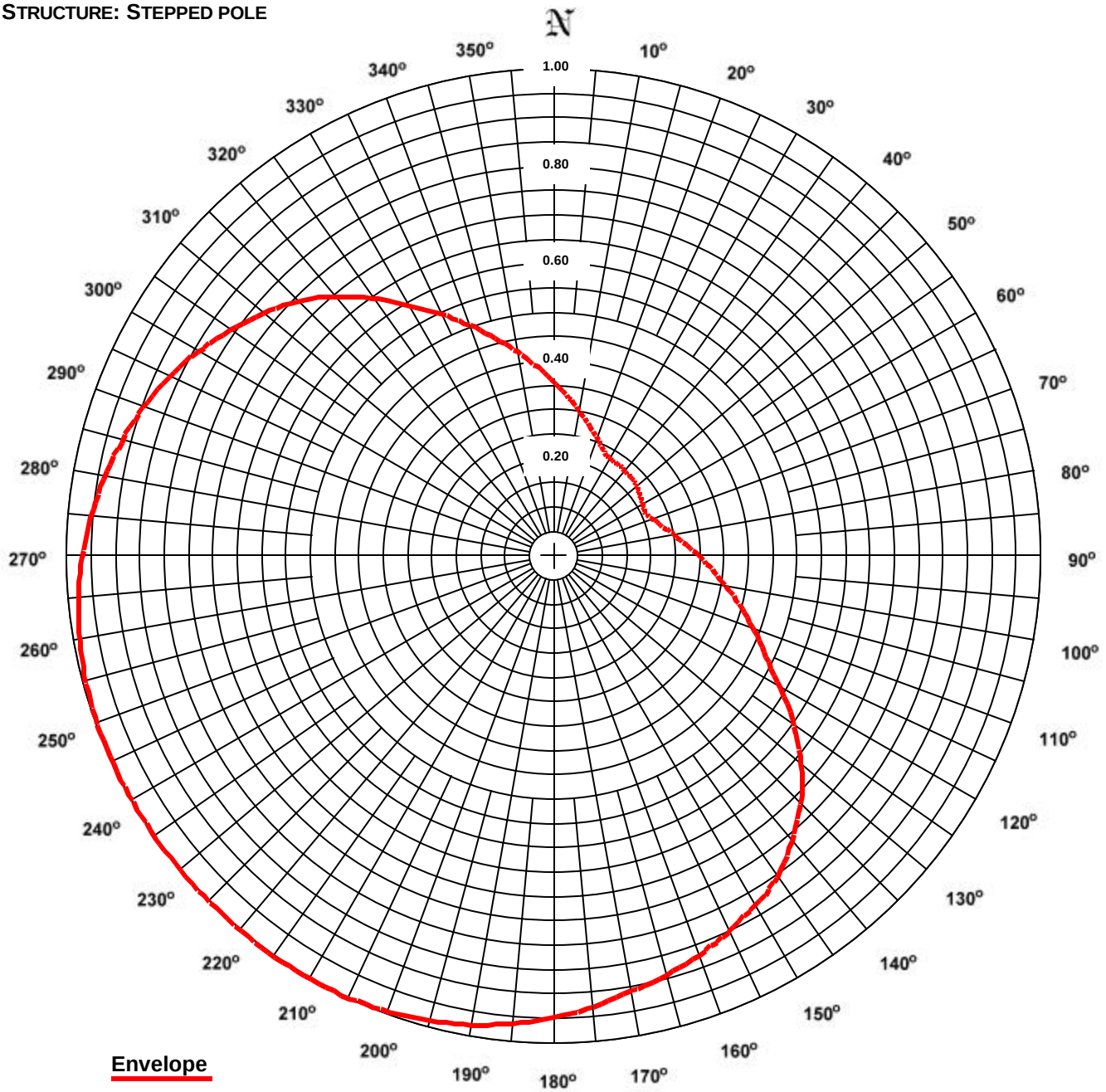
FIGURE: 1
STATION: WIBI
LOCATION: CARLINVILLE, IL
ANTENNA TYPE: MP-6E-DA-HW
STRUCTURE: STEPPED POLE

DATE: 11/27/02
FREQUENCY: 91.1 MHZ
ORIENTATION: 233° TRUE
MOUNTING: STANDARD



Envelope

RMS: 0.719
Maximum: 1.000 @ 212° True
Minimum: 0.208 @ 64° True

COMMENTS: COMPOSITE PATTERN: THIS PATTERN SHOWS THE MAXIMUM OF EITHER THE H OR V AZIMUTH VALUES. THIS PATTERN DOES NOT EXCEED THE FCC FILED COMPOSITE PATTERN AT ANY AZIMUTH. THE RMS OF THIS PATTERN IS GREATER THAN 85% OF THE FILED FCC COMPOSITE PATTERN BPED-20020402AAF.

ERI® Horizontal Plane Relative Field List

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Station: WIBI
Location: Carlinville, IL
Frequency: 91.1 MHz

Antenna: MP-6E-DA-HW
Orientation: 233° True
Tower: Stepped pole

Figure: 1
Date: 11/27/02
Reference: wibi1ma.fig

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0º	0.361	6.52	8.14	Vertical	180º	0.943	44.51	16.48	Vertical
5º	0.331	5.49	7.39	Vertical	185º	0.960	46.03	16.63	Vertical
10º	0.305	4.64	6.66	Vertical	190º	0.973	47.33	16.75	Vertical
15º	0.281	3.94	5.96	Vertical	195º	0.984	48.37	16.85	Vertical
20º	0.260	3.38	5.29	Vertical	200º	0.992	49.17	16.92	Vertical
25º	0.242	2.93	4.67	Vertical	205º	0.997	49.70	16.96	Vertical
30º	0.234	2.73	4.36	Horizontal	210º	1.000	49.97	16.99	Vertical
35º	0.232	2.69	4.29	Horizontal	215º	1.000	50.00	16.99	Vertical
40º	0.231	2.66	4.24	Horizontal	220º	1.000	50.00	16.99	Vertical
45º	0.228	2.59	4.13	Horizontal	225º	1.000	50.00	16.99	Vertical
50º	0.223	2.48	3.95	Horizontal	230º	1.000	50.00	16.99	Horizontal
55º	0.217	2.35	3.71	Horizontal	235º	1.000	50.00	16.99	Horizontal
60º	0.211	2.23	3.48	Horizontal	240º	1.000	50.00	16.99	Horizontal
65º	0.210	2.21	3.44	Vertical	245º	1.000	50.00	16.99	Horizontal
70º	0.221	2.45	3.89	Vertical	250º	0.999	49.94	16.98	Horizontal
75º	0.236	2.79	4.45	Vertical	255º	0.996	49.61	16.96	Horizontal
80º	0.254	3.23	5.10	Vertical	260º	0.990	49.02	16.90	Horizontal
85º	0.276	3.81	5.81	Vertical	265º	0.982	48.17	16.83	Horizontal
90º	0.301	4.54	6.57	Vertical	270º	0.970	47.06	16.73	Horizontal
95º	0.330	5.46	7.37	Vertical	275º	0.956	45.71	16.60	Horizontal
100º	0.363	6.58	8.18	Vertical	280º	0.939	44.12	16.45	Horizontal
105º	0.399	7.94	9.00	Vertical	285º	0.920	42.31	16.26	Horizontal
110º	0.438	9.59	9.82	Vertical	290º	0.898	40.30	16.05	Horizontal
115º	0.481	11.56	10.63	Vertical	295º	0.873	38.09	15.81	Horizontal
120º	0.537	14.43	11.59	Horizontal	300º	0.845	35.73	15.53	Horizontal
125º	0.602	18.15	12.59	Horizontal	305º	0.815	33.21	15.21	Horizontal
130º	0.662	21.88	13.40	Horizontal	310º	0.782	30.58	14.85	Horizontal
135º	0.716	25.63	14.09	Horizontal	315º	0.746	27.85	14.45	Horizontal
140º	0.760	28.87	14.60	Horizontal	320º	0.702	24.62	13.91	Horizontal
145º	0.799	31.95	15.05	Horizontal	325º	0.652	21.27	13.28	Vertical
150º	0.825	34.05	15.32	Horizontal	330º	0.602	18.10	12.58	Vertical
155º	0.847	35.86	15.55	Horizontal	335º	0.554	15.36	11.86	Vertical
160º	0.868	37.70	15.76	Horizontal	340º	0.510	12.99	11.13	Vertical
165º	0.887	39.30	15.94	Horizontal	345º	0.468	10.95	10.39	Vertical
170º	0.903	40.81	16.11	Horizontal	350º	0.429	9.22	9.65	Vertical
175º	0.925	42.75	16.31	Vertical	355º	0.394	7.75	8.89	Vertical

Polarization: **Envelope**
Maximum Field: **1.000 @ 212° True**
Minimum Field: **0.208 @ 64° True**
RMS: **0.719**
Maximum ERP: **50.000 kW**
Maximum Power Gain: **3.585 (5.545 dB)**

Total Input Power: 13.948 kW

ERI® Horizontal Plane Relative Field Pattern

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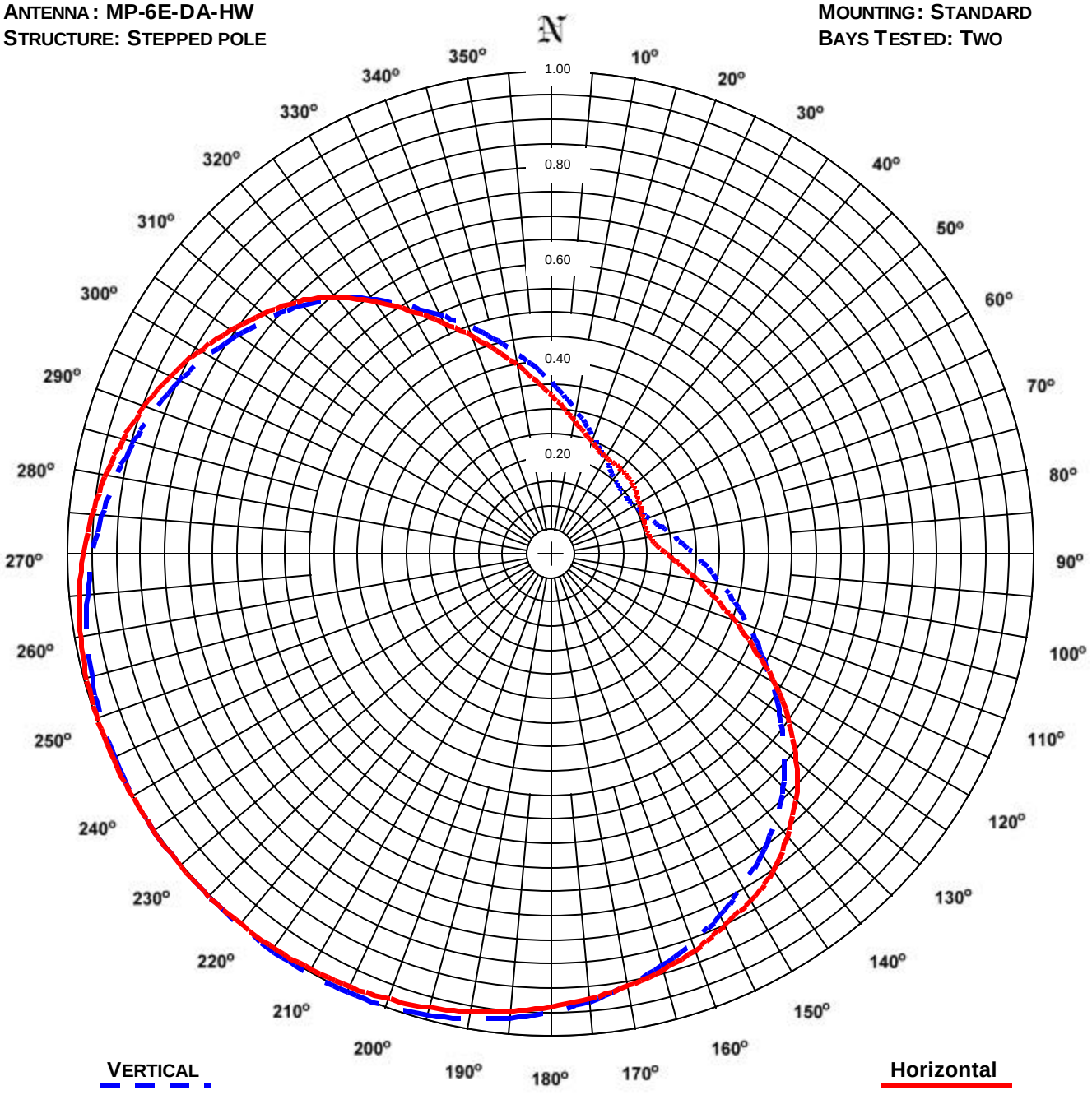
FIGURE NO: 2
STATION: WIBI
LOCATION: CARLINVILLE, IL
ANTENNA: MP-6E-DA-HW
STRUCTURE: STEPPED POLE

DATE: 11/27/02
FREQUENCY: 91.1 MHZ
ORIENTATION: 233° TRUE
MOUNTING: STANDARD
BAYS TESTED: TWO



VERTICAL

RMS: 0.711
MAXIMUM: 1.000 @ 212° TRUE
MINIMUM: 0.197 @ 52° TRUE

Horizontal

RMS: 0.713
Maximum: 1.000 @ 229° True
Minimum: 0.204 @ 74° True

COMMENTS: MEASURED PATTERNS OF THE HORIZONTAL AND VERTICAL COMPONENTS.

ERI® Horizontal Plane Relative Field List

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Station: WIBI
Location: Carlinville, IL
Frequency: 91.1 MHz

Antenna: MP-6E-DA-HW
Orientation: 233° True
Tower: Stepped pole

Figure: 2
Date: 11/27/02
Reference: wibi1ma.fig

Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0º	0.334	5.58	7.46	0.361	6.52	8.14	180º	0.933	43.54	16.39	0.943	44.51	16.48
5º	0.307	4.70	6.72	0.331	5.49	7.39	185º	0.946	44.75	16.51	0.960	46.03	16.63
10º	0.283	4.01	6.04	0.305	4.64	6.66	190º	0.957	45.84	16.61	0.973	47.33	16.75
15º	0.264	3.50	5.44	0.281	3.94	5.96	195º	0.968	46.81	16.70	0.984	48.37	16.85
20º	0.250	3.12	4.95	0.260	3.38	5.29	200º	0.976	47.66	16.78	0.992	49.17	16.92
25º	0.240	2.87	4.58	0.242	2.93	4.67	205º	0.984	48.38	16.85	0.997	49.70	16.96
30º	0.234	2.73	4.36	0.227	2.58	4.12	210º	0.990	48.97	16.90	1.000	49.97	16.99
35º	0.232	2.69	4.29	0.215	2.32	3.66	215º	0.994	49.43	16.94	1.000	50.00	16.99
40º	0.231	2.66	4.24	0.207	2.13	3.29	220º	0.998	49.75	16.97	1.000	50.00	16.99
45º	0.228	2.59	4.13	0.201	2.01	3.04	225º	0.999	49.95	16.98	1.000	50.00	16.99
50º	0.223	2.48	3.95	0.198	1.95	2.91	230º	1.000	50.00	16.99	1.000	50.00	16.99
55º	0.217	2.35	3.71	0.198	1.96	2.93	235º	1.000	50.00	16.99	1.000	50.00	16.99
60º	0.211	2.23	3.48	0.202	2.05	3.11	240º	1.000	50.00	16.99	0.999	49.95	16.99
65º	0.207	2.15	3.32	0.210	2.21	3.44	245º	1.000	50.00	16.99	0.997	49.69	16.96
70º	0.205	2.10	3.22	0.221	2.45	3.89	250º	0.999	49.94	16.98	0.992	49.22	16.92
75º	0.204	2.09	3.20	0.236	2.79	4.45	255º	0.996	49.61	16.96	0.985	48.53	16.86
80º	0.211	2.22	3.46	0.254	3.23	5.10	260º	0.990	49.02	16.90	0.976	47.64	16.78
85º	0.225	2.52	4.01	0.276	3.81	5.81	265º	0.982	48.17	16.83	0.965	46.55	16.68
90º	0.246	3.03	4.81	0.301	4.54	6.57	270º	0.970	47.06	16.73	0.951	45.27	16.56
95º	0.275	3.79	5.79	0.330	5.46	7.37	275º	0.956	45.71	16.60	0.936	43.80	16.41
100º	0.312	4.88	6.88	0.363	6.58	8.18	280º	0.939	44.12	16.45	0.918	42.16	16.25
105º	0.357	6.37	8.04	0.399	7.94	9.00	285º	0.920	42.31	16.26	0.898	40.35	16.06
110º	0.409	8.38	9.23	0.438	9.59	9.82	290º	0.898	40.30	16.05	0.876	38.39	15.84
115º	0.469	11.02	10.42	0.481	11.56	10.63	295º	0.873	38.09	15.81	0.852	36.30	15.60
120º	0.537	14.43	11.59	0.527	13.90	11.43	300º	0.845	35.73	15.53	0.826	34.09	15.33
125º	0.602	18.15	12.59	0.577	16.66	12.22	305º	0.815	33.21	15.21	0.797	31.77	15.02
130º	0.662	21.88	13.40	0.631	19.88	12.99	310º	0.782	30.58	14.85	0.766	29.37	14.68
135º	0.716	25.63	14.09	0.678	23.01	13.62	315º	0.746	27.85	14.45	0.734	26.91	14.30
140º	0.760	28.87	14.60	0.718	25.81	14.12	320º	0.702	24.62	13.91	0.698	24.33	13.86
145º	0.799	31.95	15.05	0.756	28.58	14.56	325º	0.646	20.88	13.20	0.652	21.27	13.28
150º	0.825	34.05	15.32	0.791	31.27	14.95	330º	0.589	17.33	12.39	0.602	18.10	12.58
155º	0.847	35.86	15.55	0.823	33.86	15.30	335º	0.536	14.34	11.57	0.554	15.36	11.86
160º	0.868	37.70	15.76	0.852	36.33	15.60	340º	0.487	11.84	10.73	0.510	12.99	11.13
165º	0.887	39.30	15.94	0.879	38.65	15.87	345º	0.442	9.77	9.90	0.468	10.95	10.39
170º	0.903	40.81	16.11	0.903	40.80	16.11	350º	0.402	8.07	9.07	0.429	9.22	9.65
175º	0.919	42.23	16.26	0.925	42.75	16.31	355º	0.366	6.69	8.25	0.394	7.75	8.89

Polarization:	**Horizontal**	**Vertical**
Maximum Field:	**1.000 @ 229° True**	**1.000 @ 212° True**
Minimum Field:	**0.204 @ 74° True**	**0.197 @ 52° True**
RMS:	**0.713**	**0.711**
Maximum ERP:	**50.000 kW**	**50.000 kW**
Maximum Power Gain:	**3.585 (5.545 dB)**	**3.585 (5.545 dB)**

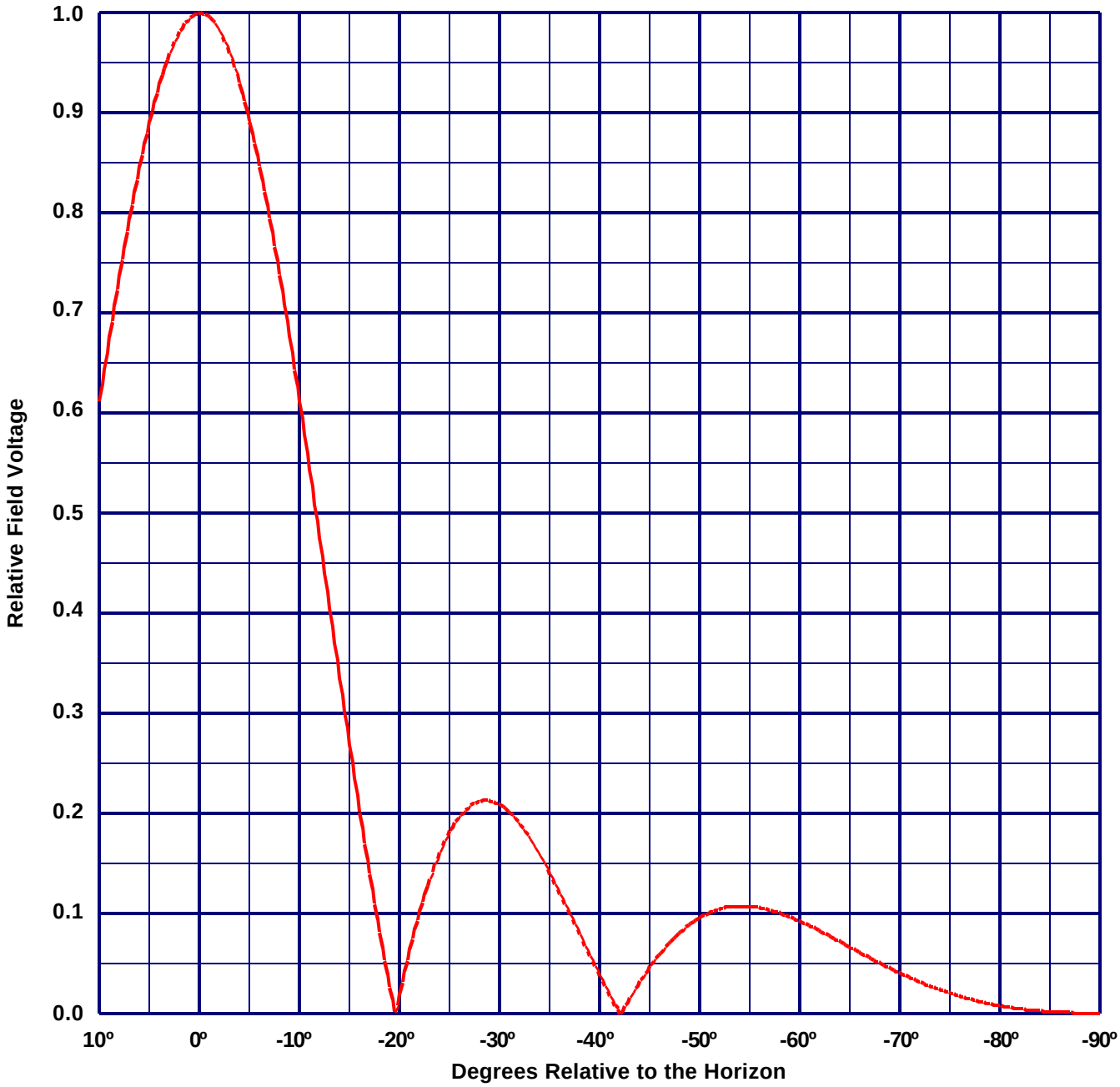
Total Input Power: 13.948 kW

Vertical Plane Relative Field Pattern

WIBI, Carlinville, IL, 91.1 MHz

Figure#: 3 Date: 11/27/02

A 6 level, .5 wave-length spaced MP-6E-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: 3.585 (5.545 dB)	Maximum: 3.585 (5.545 dB)
Horizontal Plane: 3.585 (5.545 dB)	Horizontal Plane: 3.585 (5.545 dB)

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Directional Antenna System
for
WIBI, Carlinville, Illinois

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	MP-6E-DA-HW
Frequency:	91.1 MHz
Number of Bays:	6

MECHANICAL SPECIFICATIONS

Mounting:	Standard
System length:	35 ft 9 in
Aperture length required:	42 ft.
Orientation:	233° true
Input flange to the antenna	3 1/8 inch female

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	50 kW (16.99 dBk)
Horizontal maximum power gain:	3.585 (5.545 dB)
Maximum vertical ERP:	50 kW (16.99 dBk)
Vertical maximum power gain:	3.585 (5.545 dB)
Total input power:	13.948 kW (11.445 dBk)

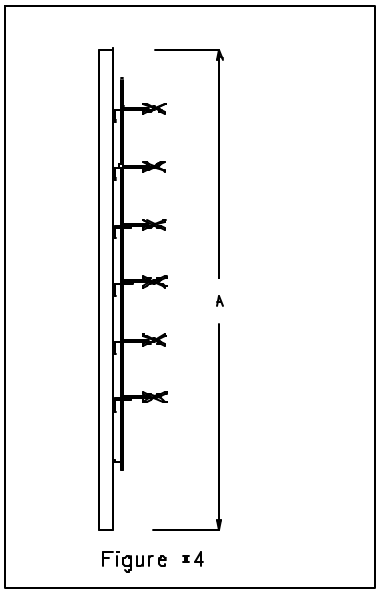

Figure 4