

Directional Antenna System for WPWX, Hammond, Indiana

June 29, 2011

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 WPWX.

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 four vertical parasitic elements interleaved between alternate bay pairs. The antenna was tested on a 12.75" o.d. pole, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 92.3 megahertz, which is the center of the FM broadcast channel assigned to WPWX.

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 WPWX, Hammond, Indiana

(Continued)

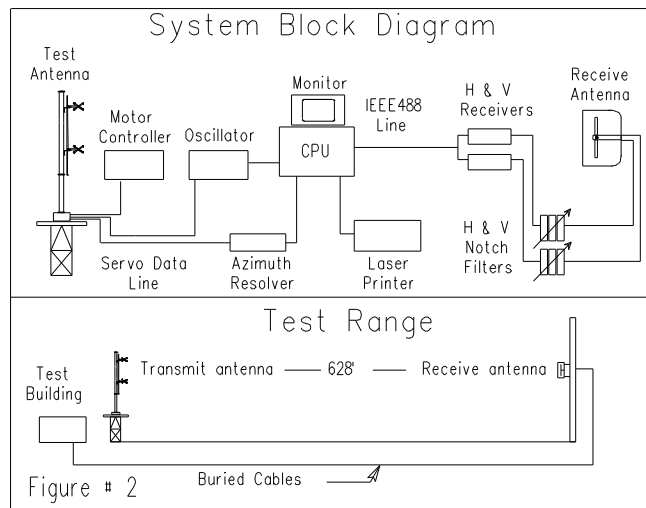
DESCRIPTION OF THE TEST PROCEDURE

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 12.75" o.d. 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 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 92.3 MHz and was constantly monitored by a Rohde & Schwarz ESVD measuring receiver.



Directional Antenna System Proposed For WPWX, Hammond, Indiana

(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 coordinated 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 four 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 12.75" o.d. pole at a bearing of North 55 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 measured individual horizontal and vertical components, the composite maximum of either the horizontal or vertical component at any azimuth and the FCC filed envelope pattern. The horizontal plane relative field list for the composite pattern and the individual H & V components are shown as Figure #1 & 1A respectively. 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 50.000 kilowatts (16.99 dBk).

Directional Antenna System
Proposed For
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(Continued)

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 than 85% of the filed composite pattern.

The clear vertical length of the structure required to support the antenna is 41 feet 6 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.

A handwritten signature in black ink, appearing to read "Tom Schaefer". The signature is fluid and cursive, with the first name "Tom" and last name "Schaefer" clearly distinguishable.

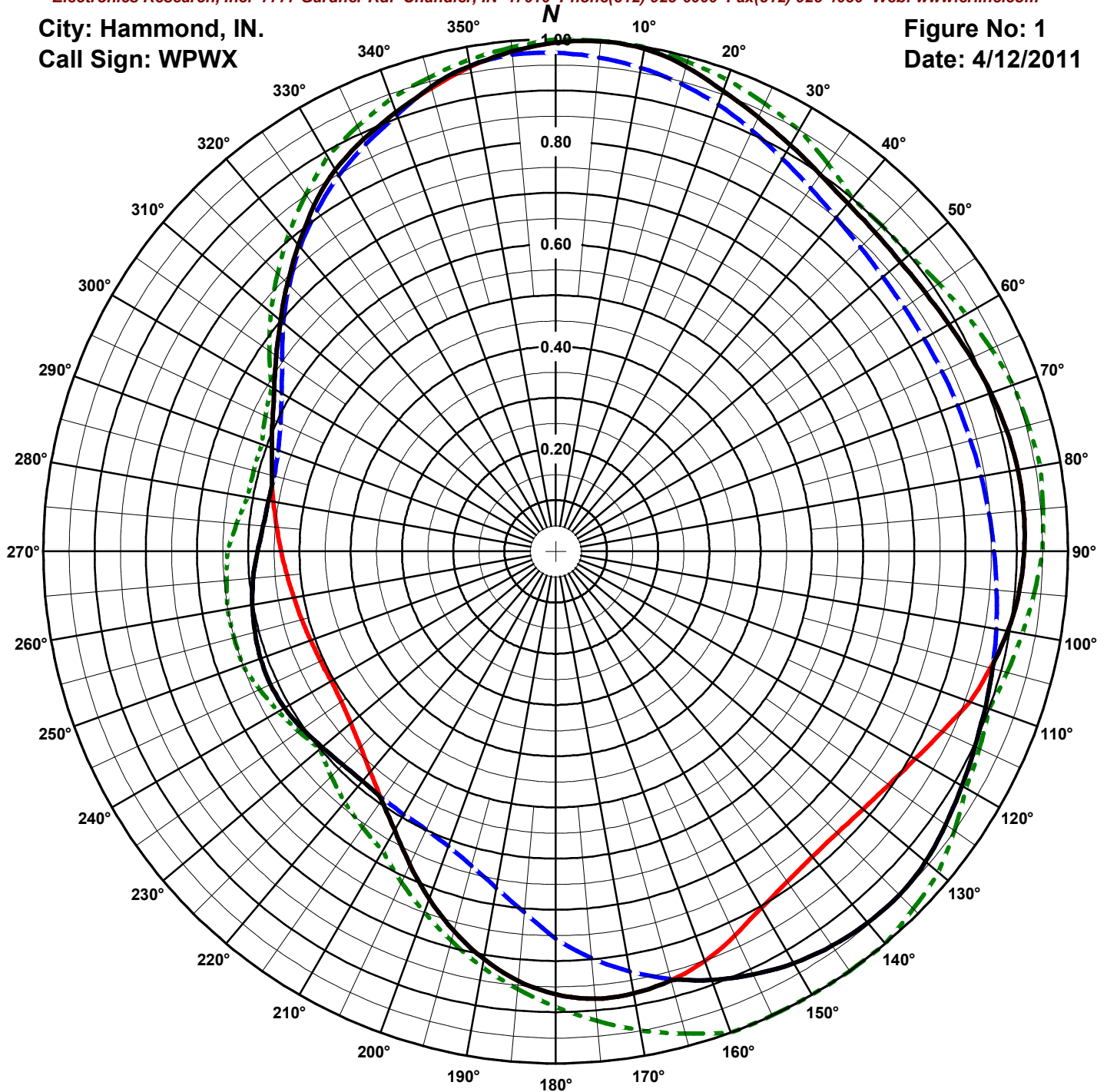
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ERI[®] Horizontal Plane Relative Field Pattern

Electronics Research, Inc. 7777 Gardner Rd. Chandler, IN 47610 Phone(812) 925-6000 Fax(812) 925-4030 Web: www.eriinc.com

City: Hammond, IN.
Call Sign: WPWX

Figure No: 1
Date: 4/12/2011



Frequency: 92.3 MHz
Antenna Type: MP-6E-DA-HW

Antenna Mounting: Standard
Tower Type: 12 3/4" Pole

HORIZONTAL

RMS: .795

Maximum: 1 @ 6°

Minimum: .506 @ 241°

VERTICAL

RMS: .795

Maximum: .974 @ 357°

Minimum: .568 @ 283°

COMPOSITE

RMS: .822

Maximum: 1 @ 6°

Minimum: .568 @ 282°

FCC ENVELOPE

RMS: .855

Maximum: 1 @ 0°

Minimum: .6 @ 230°

Measured patterns of the horizontal and vertical components. This pattern is greater than 85% of the FCC filed composite pattern.

ERI[®] Horizontal Plane Relative Field Pattern

Electronics Research, Inc. 7777 Gardner Rd. Chandler, IN 47610 Phone(812) 925-6000 Fax(812) 925-4030 Web: www.eriinc.com

Figure# 1

Date: 4/12/2011

Station: WPWX

Antenna: MP-6E-DA-HW

Location: Hammond, IN.

Antenna Orientation: 55° True

Frequency: 92.3 MHz

Number of Bays: 6

Azimuth	Envelope			Polarization	Azimuth	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0°	0.993	49.334	16.931	Horizontal	180°	0.865	37.417	15.731	Horizontal
5°	1.000	49.973	16.987	Horizontal	185°	0.842	35.439	15.495	Horizontal
10°	0.996	49.641	16.958	Horizontal	190°	0.808	32.652	15.139	Horizontal
15°	0.980	48.041	16.816	Horizontal	195°	0.767	29.440	14.689	Horizontal
20°	0.957	45.756	16.604	Horizontal	200°	0.722	26.064	14.160	Horizontal
25°	0.935	43.726	16.407	Horizontal	205°	0.674	22.715	13.563	Horizontal
30°	0.916	41.956	16.228	Horizontal	210°	0.629	19.779	12.962	Horizontal
35°	0.899	40.422	16.066	Horizontal	215°	0.592	17.542	12.441	Horizontal
40°	0.887	39.339	15.948	Horizontal	220°	0.586	17.184	12.351	Vertical
45°	0.881	38.830	15.892	Horizontal	225°	0.588	17.313	12.384	Vertical
50°	0.879	38.616	15.868	Horizontal	230°	0.595	17.695	12.478	Vertical
55°	0.881	38.796	15.888	Horizontal	235°	0.604	18.242	12.611	Vertical
60°	0.886	39.282	15.942	Horizontal	240°	0.611	18.671	12.712	Vertical
65°	0.895	40.041	16.025	Horizontal	245°	0.614	18.862	12.756	Vertical
70°	0.904	40.888	16.116	Horizontal	250°	0.613	18.776	12.736	Vertical
75°	0.912	41.548	16.186	Horizontal	255°	0.608	18.470	12.665	Vertical
80°	0.916	41.941	16.226	Horizontal	260°	0.601	18.066	12.569	Vertical
85°	0.917	42.043	16.237	Horizontal	265°	0.593	17.554	12.444	Vertical
90°	0.915	41.820	16.214	Horizontal	270°	0.582	16.923	12.285	Vertical
95°	0.908	41.224	16.151	Horizontal	275°	0.573	16.419	12.154	Vertical
100°	0.896	40.153	16.037	Horizontal	280°	0.569	16.178	12.089	Vertical
105°	0.883	38.977	15.908	Vertical	285°	0.574	16.464	12.165	Horizontal
110°	0.892	39.818	16.001	Vertical	290°	0.590	17.386	12.402	Horizontal
115°	0.903	40.755	16.102	Vertical	295°	0.610	18.577	12.690	Horizontal
120°	0.916	41.935	16.226	Vertical	300°	0.634	20.123	13.037	Horizontal
125°	0.930	43.199	16.355	Vertical	305°	0.666	22.162	13.456	Horizontal
130°	0.942	44.412	16.475	Vertical	310°	0.701	24.573	13.905	Horizontal
135°	0.949	45.015	16.534	Vertical	315°	0.740	27.385	14.375	Horizontal
140°	0.947	44.855	16.518	Vertical	320°	0.781	30.497	14.843	Horizontal
145°	0.940	44.211	16.455	Vertical	325°	0.823	33.877	15.299	Horizontal
150°	0.929	43.119	16.347	Vertical	330°	0.860	36.980	15.680	Horizontal
155°	0.912	41.594	16.190	Vertical	335°	0.887	39.372	15.952	Horizontal
160°	0.891	39.663	15.984	Vertical	340°	0.912	41.622	16.193	Horizontal
165°	0.868	37.645	15.757	Horizontal	345°	0.939	44.089	16.443	Vertical
170°	0.877	38.421	15.846	Horizontal	350°	0.963	46.338	16.659	Vertical
175°	0.877	38.449	15.849	Horizontal	355°	0.980	48.015	16.814	Horizontal

Horizontal Polarization:

Maximum: 2.873 (4.583 dB)

Horizontal Plane: 2.873 (4.583 dB)

Maximum ERP: 50.000 kW

Vertical Polarization:

Maximum: 2.727 (4.357 dB)

Horizontal Plane: 2.727 (4.357 dB)

Maximum ERP: 47.456 kW

Total Input Power: 17.400 kW

Reference: WPWX1M.FIG

This list shows the maximum azimuth values of either the horizontal or vertical components.

ERI[®] Horizontal Plane Relative Field Pattern

Electronics Research, Inc. 7777 Gardner Rd. Chandler, IN 47610 Phone(812) 925-6000 Fax(812) 925-4030 Web: www.eriinc.com

Figure# 1A

Date: 4/12/2011

Station: WPWX

Antenna: MP-6E-DA-HW

Location: Hammond, IN.

Antenna Orientation: 55° True

Frequency: 92.3 MHz

Number of Bays: 6

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.993	49.334	16.931	0.973	47.364	16.754	180°	0.865	37.417	15.731	0.756	28.592	14.563
5°	1.000	49.973	16.987	0.968	46.852	16.707	185°	0.842	35.439	15.495	0.707	25.013	13.982
10°	0.996	49.641	16.958	0.959	45.946	16.622	190°	0.808	32.652	15.139	0.667	22.252	13.474
15°	0.980	48.041	16.816	0.945	44.679	16.501	195°	0.767	29.440	14.689	0.636	20.204	13.054
20°	0.957	45.756	16.604	0.928	43.065	16.341	200°	0.722	26.064	14.160	0.613	18.787	12.738
25°	0.935	43.726	16.407	0.907	41.135	16.142	205°	0.674	22.715	13.563	0.599	17.940	12.538
30°	0.916	41.956	16.228	0.885	39.182	15.931	210°	0.629	19.779	12.962	0.594	17.627	12.462
35°	0.899	40.422	16.066	0.867	37.543	15.745	215°	0.592	17.542	12.441	0.589	17.353	12.394
40°	0.887	39.339	15.948	0.852	36.265	15.595	220°	0.563	15.833	11.996	0.586	17.184	12.351
45°	0.881	38.830	15.892	0.841	35.338	15.482	225°	0.539	14.542	11.626	0.588	17.313	12.384
50°	0.879	38.616	15.868	0.834	34.748	15.409	230°	0.522	13.626	11.344	0.595	17.695	12.478
55°	0.881	38.796	15.888	0.831	34.488	15.377	235°	0.511	13.052	11.157	0.604	18.242	12.611
60°	0.886	39.282	15.942	0.830	34.485	15.376	240°	0.506	12.802	11.073	0.611	18.671	12.712
65°	0.895	40.041	16.025	0.832	34.609	15.392	245°	0.506	12.824	11.080	0.614	18.862	12.756
70°	0.904	40.888	16.116	0.835	34.825	15.419	250°	0.509	12.946	11.121	0.613	18.776	12.736
75°	0.912	41.548	16.186	0.838	35.134	15.457	255°	0.513	13.156	11.191	0.608	18.470	12.665
80°	0.916	41.941	16.226	0.843	35.535	15.507	260°	0.519	13.457	11.289	0.601	18.066	12.569
85°	0.917	42.043	16.237	0.849	36.031	15.567	265°	0.526	13.851	11.415	0.593	17.554	12.444
90°	0.915	41.820	16.214	0.856	36.623	15.638	270°	0.536	14.343	11.566	0.582	16.923	12.285
95°	0.908	41.224	16.151	0.864	37.314	15.719	275°	0.547	14.936	11.742	0.573	16.419	12.154
100°	0.896	40.153	16.037	0.873	38.105	15.810	280°	0.560	15.663	11.949	0.569	16.178	12.089
105°	0.879	38.626	15.869	0.883	38.977	15.908	285°	0.574	16.464	12.165	0.569	16.173	12.088
110°	0.860	36.994	15.681	0.892	39.818	16.001	290°	0.590	17.386	12.402	0.576	16.595	12.200
115°	0.833	34.667	15.399	0.903	40.755	16.102	295°	0.610	18.577	12.690	0.592	17.543	12.441
120°	0.811	32.859	15.167	0.916	41.935	16.226	300°	0.634	20.123	13.037	0.618	19.069	12.803
125°	0.794	31.536	14.988	0.930	43.199	16.355	305°	0.666	22.162	13.456	0.652	21.242	13.272
130°	0.783	30.668	14.867	0.942	44.412	16.475	310°	0.701	24.573	13.905	0.694	24.079	13.816
135°	0.778	30.239	14.806	0.949	45.015	16.534	315°	0.740	27.385	14.375	0.735	27.019	14.317
140°	0.779	30.326	14.818	0.947	44.855	16.518	320°	0.781	30.497	14.843	0.776	30.087	14.784
145°	0.788	31.023	14.917	0.940	44.211	16.455	325°	0.823	33.877	15.299	0.812	32.974	15.182
150°	0.804	32.320	15.095	0.929	43.119	16.347	330°	0.860	36.980	15.680	0.847	35.871	15.547
155°	0.828	34.254	15.347	0.912	41.594	16.190	335°	0.887	39.372	15.952	0.877	38.448	15.849
160°	0.851	36.244	15.592	0.891	39.663	15.984	340°	0.912	41.622	16.193	0.906	41.081	16.136
165°	0.868	37.645	15.757	0.864	37.354	15.723	345°	0.937	43.868	16.422	0.939	44.089	16.443
170°	0.877	38.421	15.846	0.833	34.709	15.404	350°	0.960	46.121	16.639	0.963	46.338	16.659
175°	0.877	38.449	15.849	0.797	31.770	15.020	355°	0.980	48.015	16.814	0.973	47.370	16.755

Horizontal Polarization:

Maximum: 2.873 (4.584 dB)

Horizontal Plane: 2.873 (4.583 dB)

Maximum ERP: 50.000 kW

Vertical Polarization:

Maximum: 2.727 (4.357 dB)

Horizontal Plane: 2.727 (4.357 dB)

Maximum ERP: 47.456 kW

Total Input Power: 17.400 kW

Reference: WPWX1M.FIG

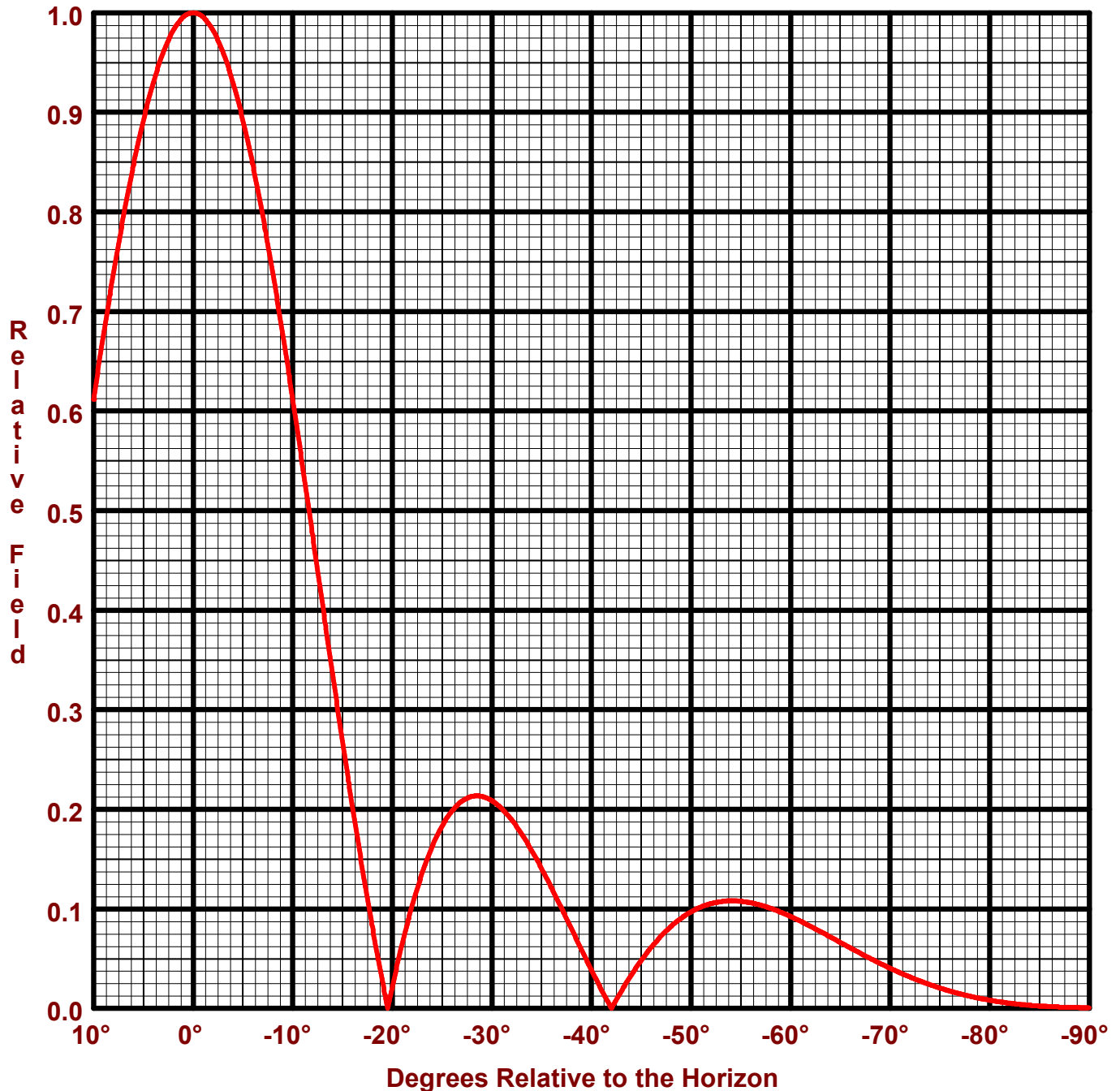
This list shows the azimuth values of the horizontal and vertical components.

ERI[®] Vertical Plane Relative Field Pattern

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Figure No: 3
Call Sign: WPWX
Location: Hammond, IN.
Frequency: 92.3 MHz
6 bay MP-6E-DA-HW antenna

Date: 4/12/2011
.5 Wave-length Spacing
0° Beam Tilt
0% First Null Fill



Horizontal Polarization:
Maximum: 2.873 (4.583 dB)
Horizontal Plane: 2.873 (4.583 dB)
Maximum ERP: 50.000 kW

Vertical Polarization:
Maximum: 2.727 (4.357 dB)
Horizontal Plane: 2.727 (4.357 dB)
Maximum ERP: 47.456 kW

Directional Antenna System for WPWX, Hammond, Indiana

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	MP-6E-DA-HW
Frequency:	92.3 MHz
Number of Bays:	Six

MECHANICAL SPECIFICATIONS

Mounting:	Standard
System length:	35 ft 4 in
Aperture length required:	41 ft 6 in
Orientation:	55° true
Input flange to the antenna 3 1/8" female.	

ELECTRICAL SPECIFICATIONS

(For directional use)

Maximum horizontal ERP:	50.000 kW (16.99 dBk)
Horizontal maximum power gain:	2.873 (4.583 dB)
Maximum vertical ERP:	47.456 kW (16.99 dBk)
Vertical maximum power gain:	2.727 (4.357 dB)
Total input power:	17.400 kW (12.993 dBk)

