

***Directional Antenna System  
for  
WPLY, Media, Pennsylvania***

December 15, 2003

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 WPLY.

The antenna is the ERI model MP-3E-DA configuration. The circular polarized system consists of 3 full-wavelength spaced bays using one driven circular polarized radiating element, two horizontal parasitic elements placed one quarter wave above and below each bay and two vertical parasitic elements per bay. The antenna was tested on a 6 7/8" o.d. pole, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 100.3 megahertz, which is the center of the FM broadcast channel assigned to WPLY.

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 WPLY, Media, Pennsylvania

(Continued)

## DESCRIPTION OF THE TEST PROCEDURE

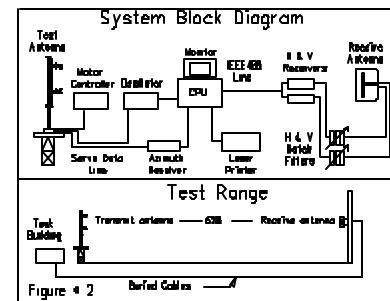
The test antenna consisted of two bay levels of the circular polarized system with the associated horizontal and vertical parasitic elements. The elements and brackets that were used in this test are electrically equivalent to those that will be supplied with the antenna. A section of 3 1/8 inch o.d. 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 6 7/8" 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 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 100.3 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.



# Directional Antenna System For WPLY, Media, Pennsylvania

(Continued)

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 3 full-wavelength spaced bays using one driven circular polarized radiating element, two horizontal parasitic elements placed one quarter wave above and below each bay and two vertical 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 MP-3E-DA array is to be mounted on the 6 7/8" o.d. pole at a bearing of North 67 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 33 kilowatts (15.185 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 than 85% of the filed composite pattern.

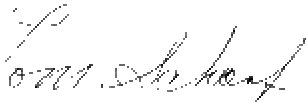
Directional Antenna System  
For  
WPLY, Media, Pennsylvania

(Continued)

The clear vertical length of the structure required to support the antenna is 35 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.

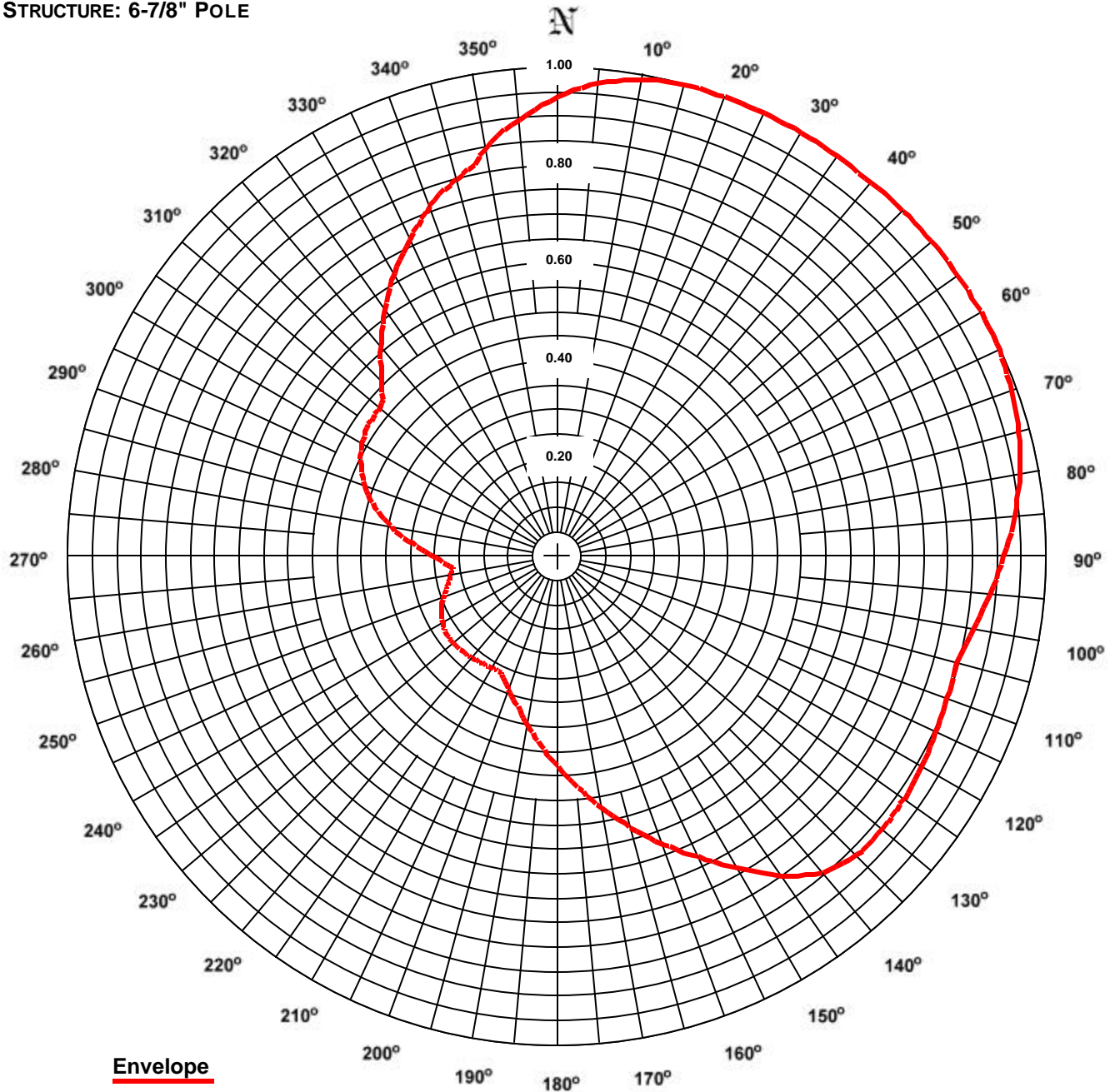
A handwritten signature in cursive script, appearing to read "Tom DeLong".

# **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: 1  
STATION: WPLY  
LOCATION: MEDIA, PA  
ANTENNA TYPE: MP-3E-DA  
STRUCTURE: 6-7/8" POLE

DATE: 12/15/03  
FREQUENCY: 100.3 MHz  
ORIENTATION: 67° TRUE  
MOUNTING: STANDARD



RMS: 0.709  
Maximum: 1.000 @ 16° True  
Minimum: 0.215 @ 264° 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 BXPB-20030903AAF

# ERI<sup>®</sup> *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: WPLY**  
**Location: Media, PA**  
**Frequency: 100.3 MHz**

**Antenna: MP-3E-DA**  
**Orientation: 67° True**  
**Tower: 6-7/8" Pole**

**Figure: 1**  
**Date: 12/15/03**  
**Reference: wply1m.fig**

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0°	0.940	29.14	14.65	Horizontal	180°	0.431	6.13	7.87	Horizontal
5°	0.971	31.10	14.93	Horizontal	185°	0.389	5.00	6.99	Horizontal
10°	0.991	32.39	15.10	Horizontal	190°	0.352	4.08	6.11	Horizontal
15°	1.000	32.97	15.18	Horizontal	195°	0.318	3.33	5.23	Horizontal
20°	1.000	33.00	15.19	Horizontal	200°	0.292	2.81	4.48	Horizontal
25°	1.000	33.00	15.19	Horizontal	205°	0.268	2.38	3.76	Horizontal
30°	1.000	32.98	15.18	Horizontal	210°	0.265	2.32	3.65	Vertical
35°	0.998	32.88	15.17	Horizontal	215°	0.267	2.36	3.73	Vertical
40°	0.997	32.81	15.16	Vertical	220°	0.272	2.43	3.86	Vertical
45°	1.000	32.98	15.18	Vertical	225°	0.275	2.50	3.98	Vertical
50°	1.000	33.00	15.19	Vertical	230°	0.277	2.54	4.05	Vertical
55°	1.000	33.00	15.19	Vertical	235°	0.278	2.54	4.05	Vertical
60°	1.000	32.99	15.18	Vertical	240°	0.272	2.45	3.88	Vertical
65°	0.996	32.76	15.15	Vertical	245°	0.263	2.27	3.57	Vertical
70°	0.988	32.24	15.08	Vertical	250°	0.248	2.04	3.09	Vertical
75°	0.976	31.44	14.98	Vertical	255°	0.233	1.79	2.52	Vertical
80°	0.959	30.38	14.83	Vertical	260°	0.221	1.61	2.08	Vertical
85°	0.938	29.06	14.63	Vertical	265°	0.220	1.60	2.04	Horizontal
90°	0.913	27.51	14.39	Vertical	270°	0.255	2.14	3.31	Horizontal
95°	0.888	26.00	14.15	Vertical	275°	0.297	2.92	4.65	Horizontal
100°	0.863	24.58	13.91	Vertical	280°	0.345	3.93	5.94	Horizontal
105°	0.846	23.62	13.73	Horizontal	285°	0.386	4.92	6.92	Horizontal
110°	0.848	23.75	13.76	Horizontal	290°	0.419	5.80	7.63	Horizontal
115°	0.853	24.02	13.81	Horizontal	295°	0.444	6.51	8.14	Horizontal
120°	0.860	24.43	13.88	Horizontal	300°	0.462	7.03	8.47	Horizontal
125°	0.866	24.74	13.93	Horizontal	305°	0.471	7.32	8.65	Horizontal
130°	0.869	24.90	13.96	Horizontal	310°	0.474	7.42	8.71	Horizontal
135°	0.865	24.68	13.92	Horizontal	315°	0.510	8.58	9.34	Vertical
140°	0.844	23.49	13.71	Horizontal	320°	0.563	10.46	10.20	Vertical
145°	0.799	21.07	13.24	Horizontal	325°	0.615	12.49	10.96	Vertical
150°	0.737	17.94	12.54	Horizontal	330°	0.669	14.75	11.69	Vertical
155°	0.679	15.21	11.82	Horizontal	335°	0.715	16.89	12.28	Vertical
160°	0.626	12.95	11.12	Horizontal	340°	0.762	19.14	12.82	Vertical
165°	0.574	10.86	10.36	Horizontal	345°	0.798	21.00	13.22	Vertical
170°	0.524	9.06	9.57	Horizontal	350°	0.845	23.54	13.72	Horizontal
175°	0.475	7.45	8.72	Horizontal	355°	0.898	26.59	14.25	Horizontal

**Polarization:**  
**Maximum Field:**  
**Minimum Field:**  
**RMS:**  
**Maximum ERP:**  
**Maximum Power Gain:**

**Envelope**  
**1.000 @ 16° True**  
**0.215 @ 264° True**  
**0.709**  
**33.000 kW**  
**3.149 (4.981 dB)**

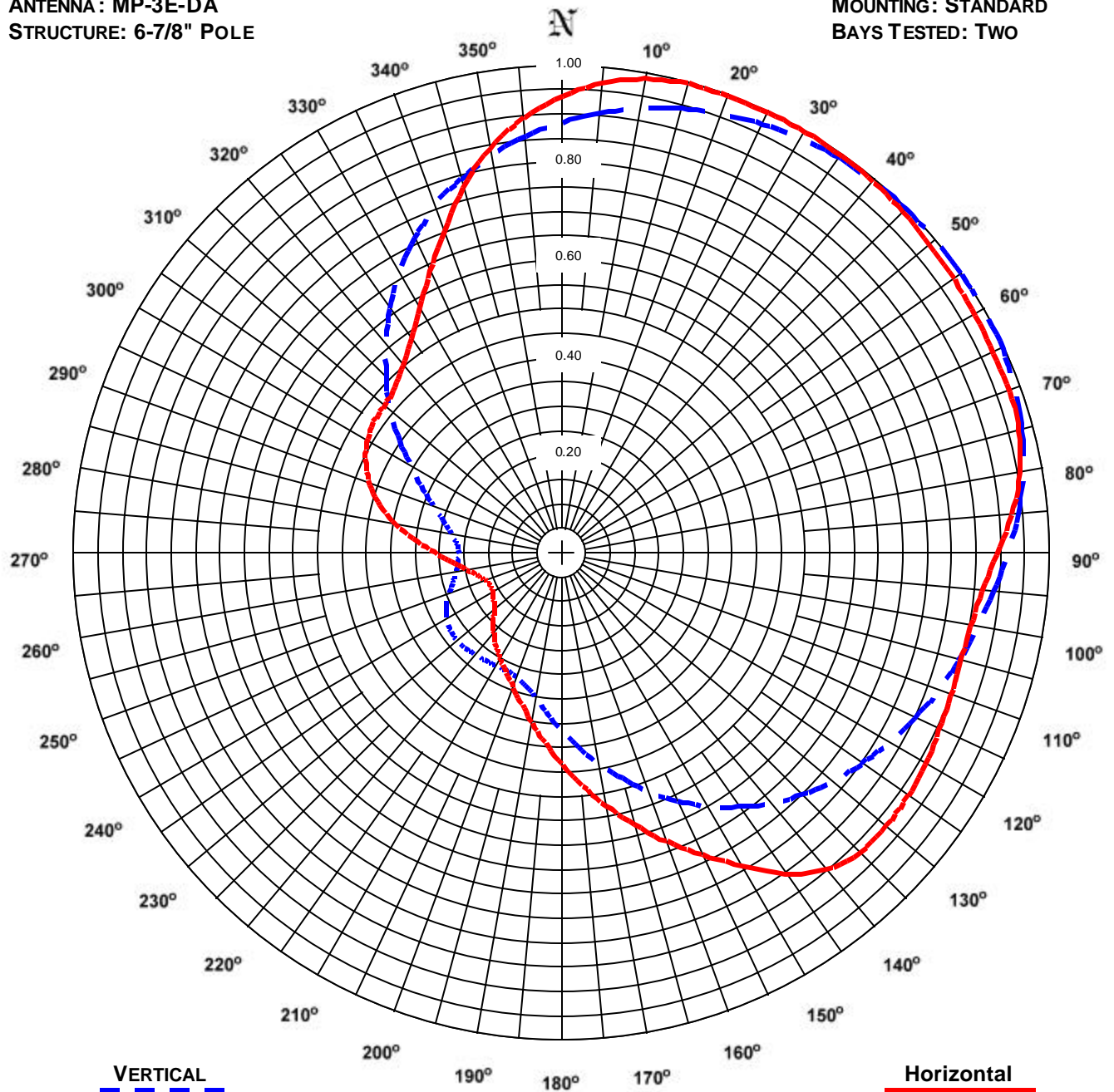
**Total Input Power: 10.481 kW**

# **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: WPLY  
LOCATION: MEDIA, PA  
ANTENNA: MP-3E-DA  
STRUCTURE: 6-7/8" POLE

DATE: 12/15/03  
FREQUENCY: 100.3 2 MHz  
ORIENTATION: 67° TRUE  
MOUNTING: STANDARD  
BAYS TESTED: TWO



VERTICAL

RMS: 0.673  
MAXIMUM: 1.000 @ 47° TRUE  
MINIMUM: 0.211 @ 270° TRUE

Horizontal

RMS: 0.698  
Maximum: 1.000 @ 16° True  
Minimum: 0.160 @ 246° True

COMMENTS: MEASURED PATTERNS OF THE HORIZONTAL AND VERTICAL COMPONENTS.

# ERI<sup>®</sup> 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: WPLY**  
**Location: Media, PA**  
**Frequency: 100.3 MHz**

**Antenna: MP-3E-DA**  
**Orientation: 67° True**  
**Tower: 6-7/8" Pole**

**Figure: 2**  
**Date: 12/15/03**  
**Reference: wply1m.fig**

Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.940	29.14	14.65	0.886	25.91	14.13	180°	0.431	6.13	7.87	0.363	4.35	6.38
5°	0.971	31.10	14.93	0.909	27.25	14.35	185°	0.389	5.00	6.99	0.328	3.55	5.50
10°	0.991	32.39	15.10	0.929	28.48	14.55	190°	0.352	4.08	6.11	0.301	2.98	4.74
15°	1.000	32.97	15.18	0.947	29.57	14.71	195°	0.318	3.33	5.23	0.281	2.60	4.15
20°	1.000	33.00	15.19	0.962	30.53	14.85	200°	0.292	2.81	4.48	0.269	2.38	3.77
25°	1.000	33.00	15.19	0.974	31.33	14.96	205°	0.268	2.38	3.76	0.264	2.30	3.62
30°	1.000	32.98	15.18	0.985	31.99	15.05	210°	0.251	2.08	3.19	0.265	2.32	3.65
35°	0.998	32.88	15.17	0.992	32.48	15.12	215°	0.234	1.81	2.59	0.267	2.36	3.73
40°	0.995	32.70	15.15	0.997	32.81	15.16	220°	0.218	1.56	1.93	0.272	2.43	3.86
45°	0.992	32.44	15.11	1.000	32.98	15.18	225°	0.199	1.30	1.15	0.275	2.50	3.98
50°	0.986	32.11	15.07	1.000	33.00	15.19	230°	0.183	1.10	0.43	0.277	2.54	4.05
55°	0.982	31.82	15.03	1.000	33.00	15.19	235°	0.171	0.97	-0.14	0.278	2.54	4.05
60°	0.979	31.61	15.00	1.000	32.99	15.18	240°	0.164	0.89	-0.53	0.272	2.45	3.88
65°	0.977	31.48	14.98	0.996	32.76	15.15	245°	0.160	0.85	-0.71	0.263	2.27	3.57
70°	0.976	31.44	14.97	0.988	32.24	15.08	250°	0.163	0.88	-0.55	0.248	2.04	3.09
75°	0.970	31.03	14.92	0.976	31.44	14.98	255°	0.174	1.00	0.02	0.233	1.79	2.52
80°	0.953	29.95	14.76	0.959	30.38	14.83	260°	0.193	1.23	0.91	0.221	1.61	2.08
85°	0.925	28.24	14.51	0.938	29.06	14.63	265°	0.220	1.60	2.04	0.214	1.51	1.80
90°	0.891	26.18	14.18	0.913	27.51	14.39	270°	0.255	2.14	3.31	0.211	1.47	1.69
95°	0.865	24.70	13.93	0.888	26.00	14.15	275°	0.297	2.92	4.65	0.216	1.54	1.88
100°	0.850	23.86	13.78	0.863	24.58	13.91	280°	0.345	3.93	5.94	0.229	1.72	2.37
105°	0.846	23.62	13.73	0.842	23.41	13.69	285°	0.386	4.92	6.92	0.249	2.05	3.11
110°	0.848	23.75	13.76	0.822	22.30	13.48	290°	0.419	5.80	7.63	0.277	2.53	4.04
115°	0.853	24.02	13.81	0.798	21.00	13.22	295°	0.444	6.51	8.14	0.313	3.24	5.10
120°	0.860	24.43	13.88	0.774	19.77	12.96	300°	0.462	7.03	8.47	0.357	4.21	6.24
125°	0.866	24.74	13.93	0.750	18.57	12.69	305°	0.471	7.32	8.65	0.406	5.44	7.36
130°	0.869	24.90	13.96	0.725	17.37	12.40	310°	0.474	7.42	8.71	0.461	7.00	8.45
135°	0.865	24.68	13.92	0.697	16.03	12.05	315°	0.485	7.78	8.91	0.510	8.58	9.34
140°	0.844	23.49	13.71	0.667	14.68	11.67	320°	0.508	8.50	9.29	0.563	10.46	10.20
145°	0.799	21.07	13.24	0.632	13.16	11.19	325°	0.541	9.65	9.85	0.615	12.49	10.96
150°	0.737	17.94	12.54	0.596	11.73	10.69	330°	0.585	11.30	10.53	0.669	14.75	11.69
155°	0.679	15.21	11.82	0.557	10.22	10.10	335°	0.640	13.53	11.31	0.715	16.89	12.28
160°	0.626	12.95	11.12	0.517	8.83	9.46	340°	0.707	16.49	12.17	0.762	19.14	12.82
165°	0.574	10.86	10.36	0.476	7.47	8.73	345°	0.780	20.09	13.03	0.798	21.00	13.22
170°	0.524	9.06	9.57	0.437	6.30	7.99	350°	0.845	23.54	13.72	0.833	22.90	13.60
175°	0.475	7.45	8.72	0.398	5.23	7.19	355°	0.898	26.59	14.25	0.861	24.45	13.88

<b>Polarization:</b>	<b>Horizontal</b>	<b>Vertical</b>
<b>Maximum Field:</b>	<b>1.000 @ 16° True</b>	<b>1.000 @ 47° True</b>
<b>Minimum Field:</b>	<b>0.160 @ 246° True</b>	<b>0.211 @ 270° True</b>
<b>RMS:</b>	<b>0.698</b>	<b>0.673</b>
<b>Maximum ERP:</b>	<b>33.000 kW</b>	<b>33.000 kW</b>
<b>Maximum Power Gain:</b>	<b>3.149 (4.981 dB)</b>	<b>3.149 (4.981 dB)</b>

**Total Input Power: 10.481 kW**





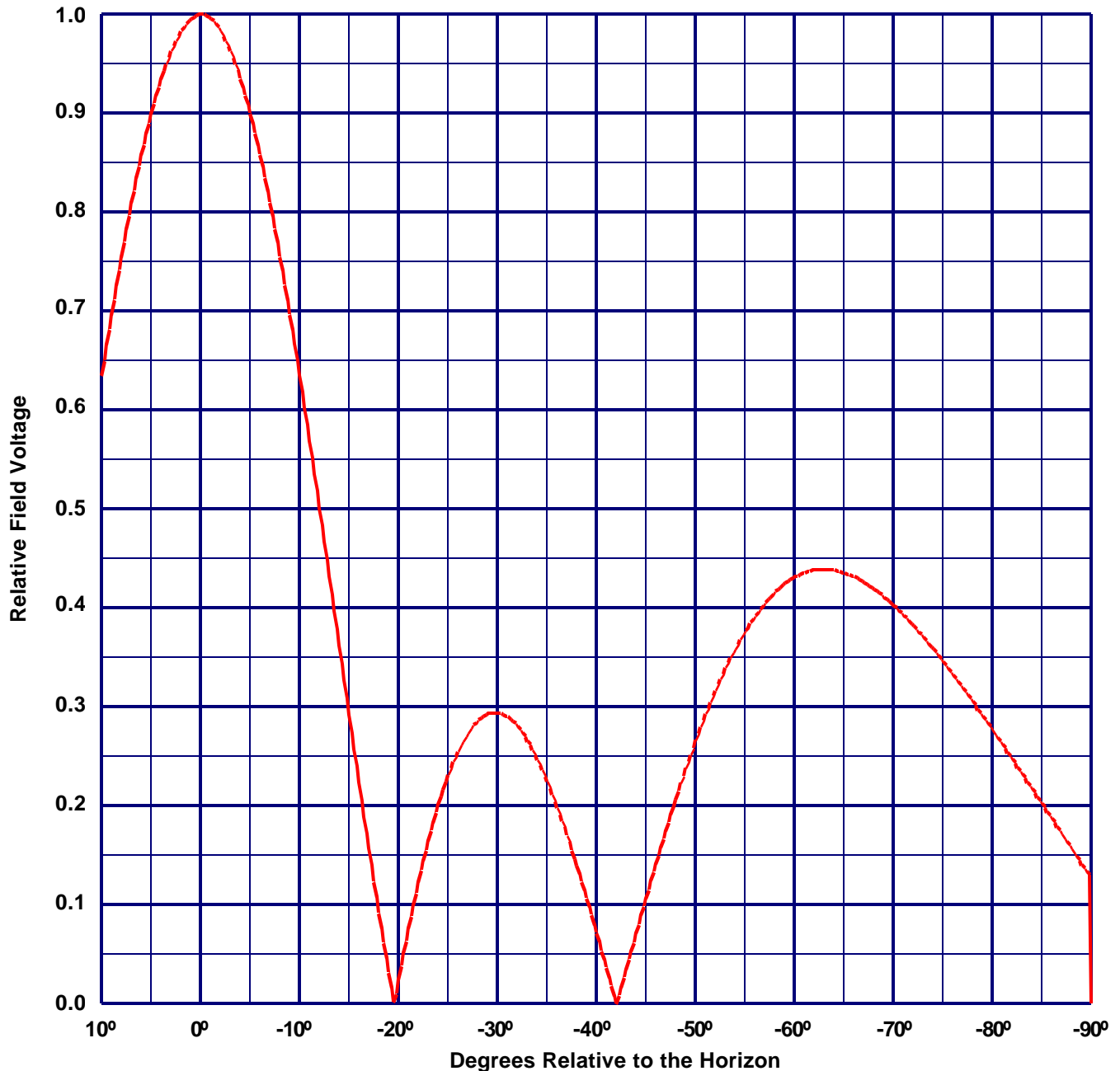
## Vertical Plane Relative Field Pattern

WPLY, Media, PA, 100.3 MHz

Figure#: 3

Date: 12/15/03

A 3 level, 1 wave-length spaced MP-3E-DA directional antenna  
with 0° beam tilt, 0% null fill and a H/V maximum power ratio of 1.000



Vertical Polarization Gain:

Maximum: 3.149 (4.981 dB)

Horizontal Plane: 3.149 (4.981 dB)

Horizontal Polarization Gain:

Maximum: 3.149 (4.981 dB)

Horizontal Plane: 3.149 (4.981 dB)

# Directional Antenna System for WPLY, Media, Pennsylvania

(Continued)

## ANTENNA SPECIFICATIONS

Antenna Type: MP-3E-DA  
Frequency: 100.3 MHz  
Number of Bays: 3

## MECHANICAL SPECIFICATIONS

Mounting: Standard  
System length: 27 ft.11 in  
Aperture length required: 35 ft.  
Orientation: 67° true  
Input flange to the antenna 3 1/8 inch female

## ELECTRICAL SPECIFICATIONS

(For directional use)

Maximum horizontal ERP: 33 kW (15.185 dBk)  
Horizontal maximum power gain: 3.149 (4.981 dB)  
Maximum vertical ERP: 33 kW (15.185 dBk)  
Vertical maximum power gain: 3.149 (4.981 dB)  
Total input power: 10.481 kW (10.204 dBk)

