

*Directional Antenna System  
for  
WVIA, Scranton, Pennsylvania*

October 2, 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 WVIA.

The antenna is the ERI model 1183-2CP-DA-SP configuration. The circular polarized system consists of two 92" bays using three driven circular polarized radiating element per bay. The antenna was mounted on the North 128 degrees East tower face with bracketry to provide an antenna orientation of North 128 degrees East. The antenna was tested on a 6' face tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 89.9 megahertz, which is the center of the FM broadcast channel assigned to WVIA.

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 WVIA, Scranton, Pennsylvania

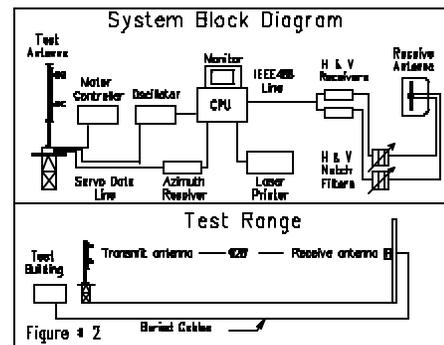
(Continued)

## DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of one bay level of the circular polarized system. The elements and brackets that were used in this test are electrically equivalent to those that will be supplied with the antenna.

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' face 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 89.9 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 Heliac 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.

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(Continued)

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 two 92" spaced bays using three driven circular polarized radiating element 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 1183-2CP-DA-SP array is to be mounted on the North 128 degrees East tower face of the 6' face tower at a bearing of North 128 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 7.400 kilowatts (8.692 dBk).

The power at North 10 degrees East does not exceed 6.442 kilowatts (8.09 dBk).

The power at North 150 degrees East does not exceed 5.875 kilowatts (7.69 dBk).

The power at North 275 degrees East does not exceed 5.122 kilowatts (7.094 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.

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(Continued)

The clear vertical length of the structure required to support the antenna is 35 feet 4 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 written in a cursive style with a large initial "T" and a long, sweeping underline.

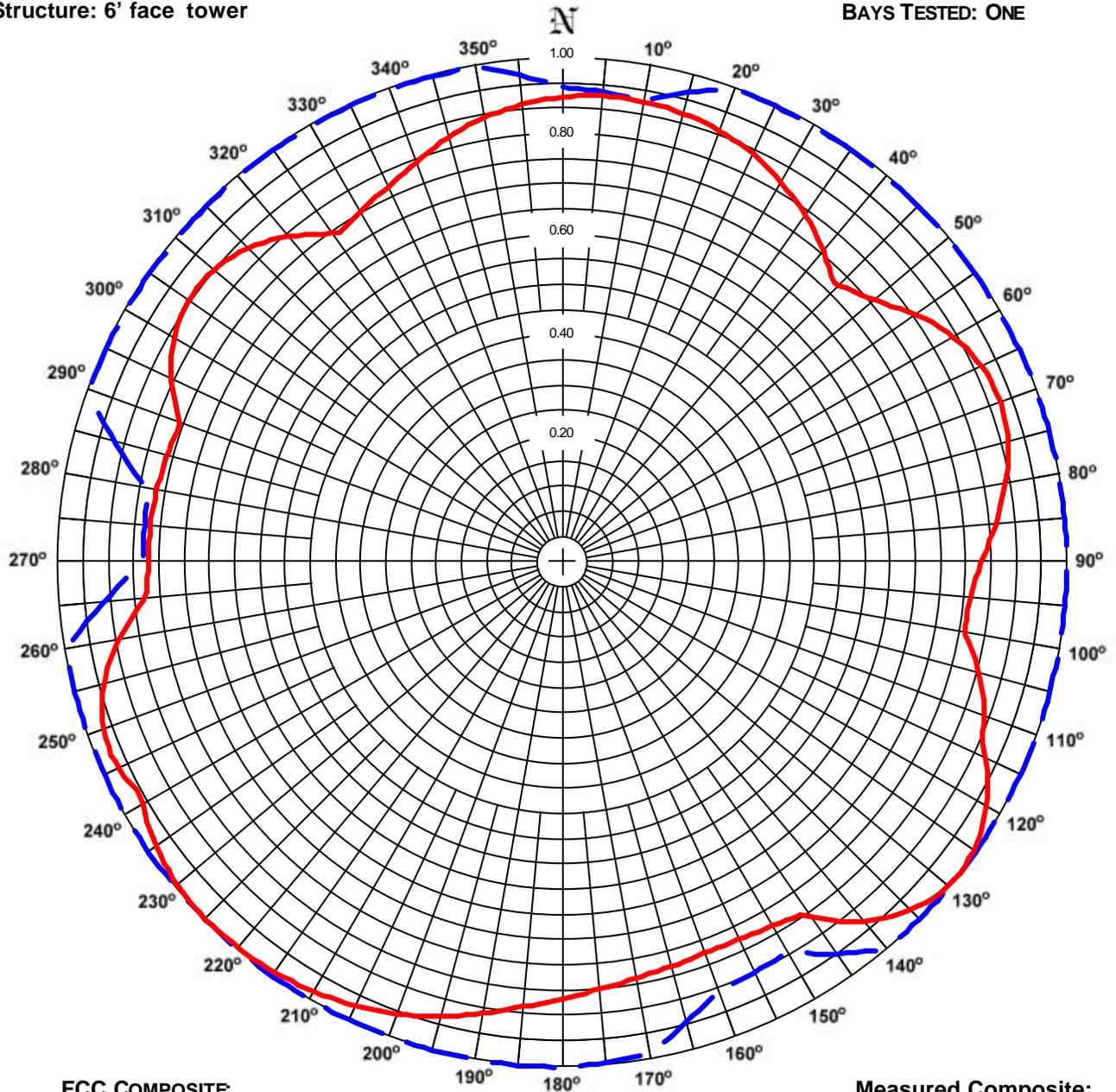
The Microsoft Word document on file electronically at Electronic Research, Inc. governs the specifications, scope, and configuration of the product described. All other representations whether verbal, printed, or electronic are subordinate to the master copy of this document on file at ERI.

# ERI<sup>®</sup> 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: 1  
STATION: WVIA  
LOCATION: SCRANTON, PA  
ANTENNA: 1183-2CP-DA-SP  
Structure: 6' face tower

DATE: 9/23/2008  
FREQUENCY: 89.9 MHz  
ORIENTATION: 128° TRUE  
MOUNTING: CUSTOM  
BAYS TESTED: ONE



FCC COMPOSITE  
RMS: 0.982  
MAXIMUM: 1.000 @ 20° TRUE  
MINIMUM: 0.832 @ 270° TRUE

Measured Composite:  
RMS: 0.892  
Maximum: 1.000 @ 128° True  
Minimum: 0.775 @ 44° True

COMMENTS: COMPOSITE PATTERN: THIS PATTERN SHOWS THE MAXIMUM OF EITHER THE H OR V AZIMUTH VALUES. THIS PATTERN IS GREATER THAN 85% OF THE FCC FILED COMPOSITE PATTERN BPED-20070907AGU.

# **ERI**® *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: WVIA**  
**Location: Scranton, PA**  
**Frequency: 89.9 MHz**

**Antenna: 1183-2CP-DA-SP**  
**Orientation: 128° True**  
**Tower: 6' face tower**

**Figure: 1**  
**Date: 9/23/2008**  
**Reference: wvia1m.fig**

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0°	0.925	6.33	8.01	Horizontal	180°	0.864	5.52	7.42	Horizontal
5°	0.930	6.40	8.07	Horizontal	185°	0.883	5.77	7.62	Horizontal
10°	0.930	6.40	8.06	Horizontal	190°	0.906	6.08	7.84	Horizontal
15°	0.924	6.32	8.01	Horizontal	195°	0.931	6.41	8.07	Horizontal
20°	0.913	6.17	7.91	Horizontal	200°	0.952	6.70	8.26	Horizontal
25°	0.895	5.93	7.73	Horizontal	205°	0.969	6.94	8.42	Horizontal
30°	0.871	5.62	7.49	Horizontal	210°	0.982	7.14	8.54	Horizontal
35°	0.841	5.24	7.19	Horizontal	215°	0.992	7.28	8.62	Horizontal
40°	0.805	4.80	6.81	Horizontal	220°	0.998	7.37	8.67	Horizontal
45°	0.779	4.49	6.53	Vertical	225°	1.000	7.40	8.69	Horizontal
50°	0.811	4.87	6.88	Vertical	230°	0.995	7.33	8.65	Horizontal
55°	0.858	5.45	7.36	Vertical	235°	0.982	7.14	8.54	Horizontal
60°	0.897	5.95	7.75	Vertical	240°	0.961	6.84	8.35	Horizontal
65°	0.919	6.25	7.96	Vertical	245°	0.969	6.94	8.42	Vertical
70°	0.926	6.34	8.02	Vertical	250°	0.967	6.92	8.40	Vertical
75°	0.917	6.22	7.94	Vertical	255°	0.942	6.56	8.17	Vertical
80°	0.892	5.89	7.70	Vertical	260°	0.895	5.93	7.73	Vertical
85°	0.862	5.50	7.40	Vertical	265°	0.833	5.14	7.11	Vertical
90°	0.831	5.11	7.08	Vertical	270°	0.821	4.99	6.98	Horizontal
95°	0.812	4.88	6.88	Vertical	275°	0.820	4.98	6.97	Horizontal
100°	0.812	4.88	6.88	Horizontal	280°	0.818	4.95	6.94	Horizontal
105°	0.857	5.43	7.35	Horizontal	285°	0.813	4.89	6.89	Horizontal
110°	0.890	5.86	7.68	Horizontal	290°	0.809	4.84	6.85	Vertical
115°	0.928	6.37	8.04	Vertical	295°	0.855	5.41	7.33	Vertical
120°	0.971	6.98	8.44	Vertical	300°	0.888	5.84	7.67	Vertical
125°	0.995	7.33	8.65	Vertical	305°	0.905	6.06	7.83	Vertical
130°	0.997	7.36	8.67	Vertical	310°	0.903	6.04	7.81	Vertical
135°	0.974	7.01	8.46	Vertical	315°	0.883	5.77	7.61	Vertical
140°	0.927	6.35	8.03	Vertical	320°	0.846	5.30	7.24	Vertical
145°	0.857	5.43	7.35	Vertical	325°	0.798	4.72	6.74	Vertical
150°	0.831	5.11	7.08	Horizontal	330°	0.804	4.78	6.79	Horizontal
155°	0.824	5.02	7.01	Horizontal	335°	0.823	5.01	7.00	Horizontal
160°	0.824	5.02	7.01	Horizontal	340°	0.847	5.31	7.25	Horizontal
165°	0.828	5.08	7.06	Horizontal	345°	0.875	5.66	7.53	Horizontal
170°	0.837	5.18	7.14	Horizontal	350°	0.897	5.95	7.75	Horizontal
175°	0.848	5.33	7.26	Horizontal	355°	0.914	6.18	7.91	Horizontal

<b>Polarization:</b>	<b>Envelope</b>
<b>Maximum Field:</b>	<b>1.000 @ 128° True</b>
<b>Minimum Field:</b>	<b>0.775 @ 44° True</b>
<b>RMS:</b>	<b>0.892</b>
<b>Maximum ERP:</b>	<b>7.400 kW</b>
<b>Maximum Power Gain:</b>	<b>1.181 (0.724 dB)</b>

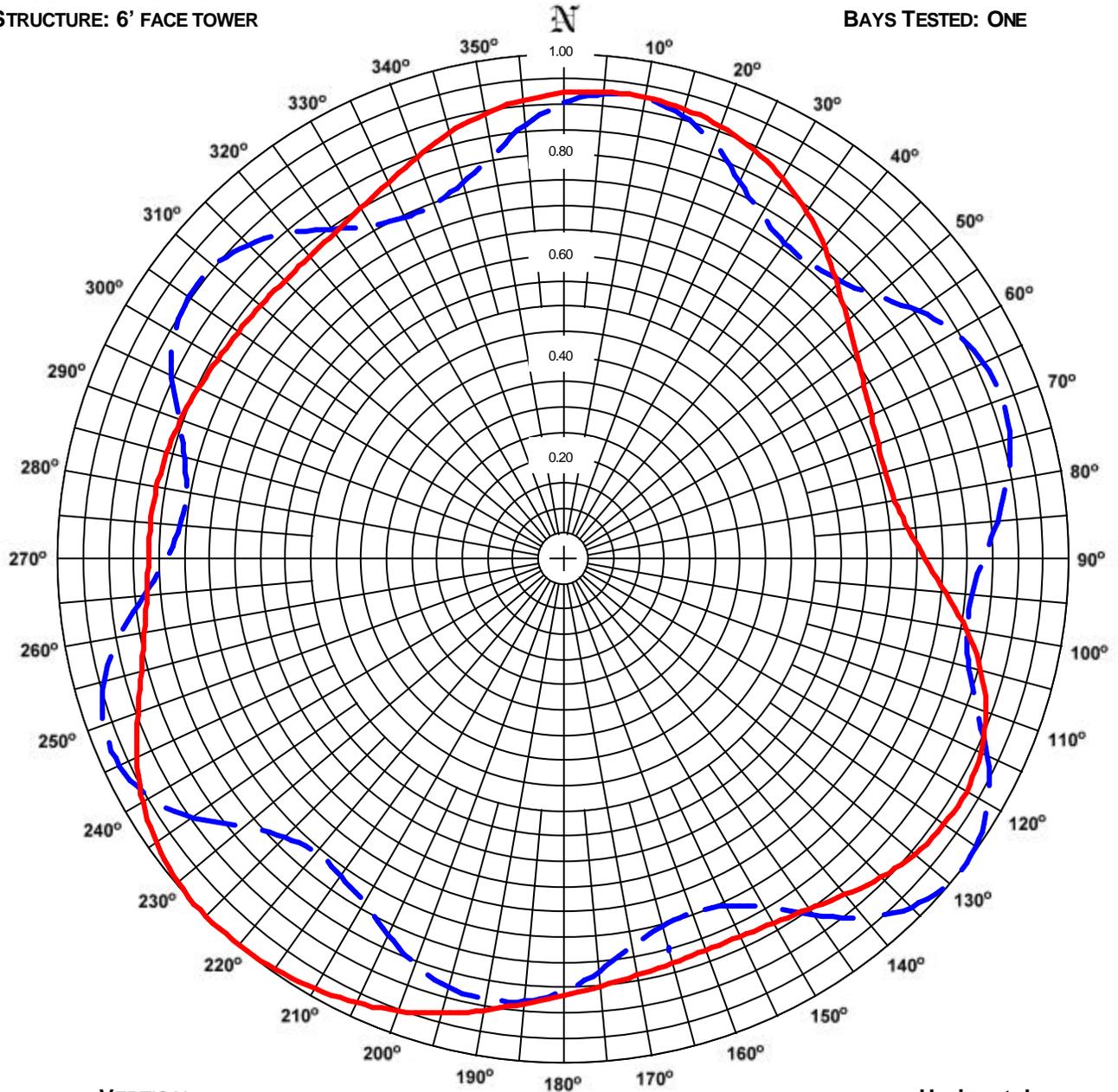
**Total Input Power: 6.264 kW**

# ERI<sup>®</sup> 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: WVIA  
LOCATION: SCRANTON, PA  
ANTENNA: 1183-2CP-DA-SP  
STRUCTURE: 6' FACE TOWER

DATE: 9/23/2008  
FREQUENCY: 89.9 MHz  
ORIENTATION: 128° TRUE  
MOUNTING: CUSTOM  
BAYS TESTED: ONE



VERTICAL

RMS: 0.853  
MAXIMUM: 1.000 @ 128° TRUE  
MINIMUM: 0.744 @ 160° TRUE

Horizontal

RMS: 0.853  
Maximum: 1.000 @ 225° True  
Minimum: 0.660 @ 75° True

COMMENTS: MEASURED PATTERNS OF THE HORIZONTAL AND VERTICAL COMPONENTS.

# **ERI**® *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: WVIA**  
**Location: Scranton, PA**  
**Frequency: 89.9 MHz**

**Antenna: 1183-2CP-DA-SP**  
**Orientation: 128° True**  
**Tower: 6' face tower**

**Figure: 2**  
**Date: 9/23/2008**  
**Reference: wvia1m.fig**

Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.925	6.33	8.01	0.904	6.05	7.82	180°	0.864	5.52	7.42	0.856	5.43	7.34
5°	0.930	6.40	8.07	0.926	6.35	8.02	185°	0.883	5.77	7.62	0.878	5.71	7.56
10°	0.930	6.40	8.06	0.928	6.38	8.05	190°	0.906	6.08	7.84	0.884	5.79	7.62
15°	0.924	6.32	8.01	0.911	6.14	7.88	195°	0.931	6.41	8.07	0.878	5.70	7.56
20°	0.913	6.17	7.91	0.875	5.67	7.54	200°	0.952	6.70	8.26	0.854	5.39	7.32
25°	0.895	5.93	7.73	0.825	5.04	7.03	205°	0.969	6.94	8.42	0.820	4.97	6.97
30°	0.871	5.62	7.49	0.787	4.58	6.61	210°	0.982	7.14	8.54	0.787	4.59	6.61
35°	0.841	5.24	7.19	0.766	4.34	6.37	215°	0.992	7.28	8.62	0.766	4.34	6.38
40°	0.805	4.80	6.81	0.763	4.31	6.35	220°	0.998	7.37	8.67	0.758	4.25	6.29
45°	0.767	4.36	6.39	0.779	4.49	6.53	225°	1.000	7.40	8.69	0.779	4.49	6.52
50°	0.735	4.00	6.02	0.811	4.87	6.88	230°	0.995	7.33	8.65	0.825	5.03	7.02
55°	0.709	3.71	5.70	0.858	5.45	7.36	235°	0.982	7.14	8.54	0.892	5.89	7.70
60°	0.688	3.50	5.44	0.897	5.95	7.75	240°	0.961	6.84	8.35	0.943	6.58	8.18
65°	0.673	3.35	5.25	0.919	6.25	7.96	245°	0.932	6.43	8.08	0.969	6.94	8.42
70°	0.663	3.26	5.13	0.926	6.34	8.02	250°	0.896	5.94	7.74	0.967	6.92	8.40
75°	0.660	3.22	5.08	0.917	6.22	7.94	255°	0.865	5.54	7.43	0.942	6.56	8.17
80°	0.667	3.29	5.18	0.892	5.89	7.70	260°	0.842	5.25	7.20	0.895	5.93	7.73
85°	0.686	3.48	5.42	0.862	5.50	7.40	265°	0.828	5.07	7.05	0.833	5.14	7.11
90°	0.717	3.80	5.80	0.831	5.11	7.08	270°	0.821	4.99	6.98	0.787	4.59	6.61
95°	0.759	4.27	6.30	0.812	4.88	6.88	275°	0.820	4.98	6.97	0.762	4.30	6.33
100°	0.812	4.88	6.88	0.811	4.87	6.88	280°	0.818	4.95	6.94	0.759	4.26	6.30
105°	0.857	5.43	7.35	0.831	5.11	7.09	285°	0.813	4.89	6.89	0.776	4.45	6.49
110°	0.890	5.86	7.68	0.871	5.61	7.49	290°	0.806	4.81	6.82	0.809	4.84	6.85
115°	0.911	6.14	7.88	0.928	6.37	8.04	295°	0.798	4.71	6.73	0.855	5.41	7.33
120°	0.921	6.27	7.97	0.971	6.98	8.44	300°	0.791	4.63	6.65	0.888	5.84	7.67
125°	0.918	6.24	7.95	0.995	7.33	8.65	305°	0.785	4.56	6.59	0.905	6.06	7.83
130°	0.908	6.10	7.86	0.997	7.36	8.67	310°	0.782	4.52	6.56	0.903	6.04	7.81
135°	0.891	5.87	7.69	0.974	7.01	8.46	315°	0.780	4.51	6.54	0.883	5.77	7.61
140°	0.867	5.56	7.45	0.927	6.35	8.03	320°	0.783	4.53	6.56	0.846	5.30	7.24
145°	0.845	5.29	7.23	0.857	5.43	7.35	325°	0.790	4.62	6.65	0.798	4.72	6.74
150°	0.831	5.11	7.08	0.796	4.68	6.71	330°	0.804	4.78	6.79	0.765	4.33	6.36
155°	0.824	5.02	7.01	0.758	4.25	6.28	335°	0.823	5.01	7.00	0.748	4.14	6.17
160°	0.824	5.02	7.01	0.744	4.09	6.12	340°	0.847	5.31	7.25	0.750	4.17	6.20
165°	0.828	5.08	7.06	0.753	4.20	6.23	345°	0.875	5.66	7.53	0.772	4.41	6.44
170°	0.837	5.18	7.14	0.778	4.48	6.51	350°	0.897	5.95	7.75	0.812	4.87	6.88
175°	0.848	5.33	7.26	0.819	4.96	6.95	355°	0.914	6.18	7.91	0.865	5.53	7.43

<b>Polarization:</b>	<b>Horizontal</b>	<b>Vertical</b>
<b>Maximum Field:</b>	<b>1.000 @ 225° True</b>	<b>1.000 @ 128° True</b>
<b>Minimum Field:</b>	<b>0.660 @ 75° True</b>	<b>0.744 @ 160° True</b>
<b>RMS:</b>	<b>0.853</b>	<b>0.853</b>
<b>Maximum ERP:</b>	<b>7.400 kW</b>	<b>7.400 kW</b>
<b>Maximum Power Gain:</b>	<b>1.181 (0.724 dB)</b>	<b>1.181 (0.724 dB)</b>

**Total Input Power: 6.264 kW**

ELECTRONICS RESEARCH, INC.  
7777 GARDNER ROAD  
CHANDLER, IN. 47610

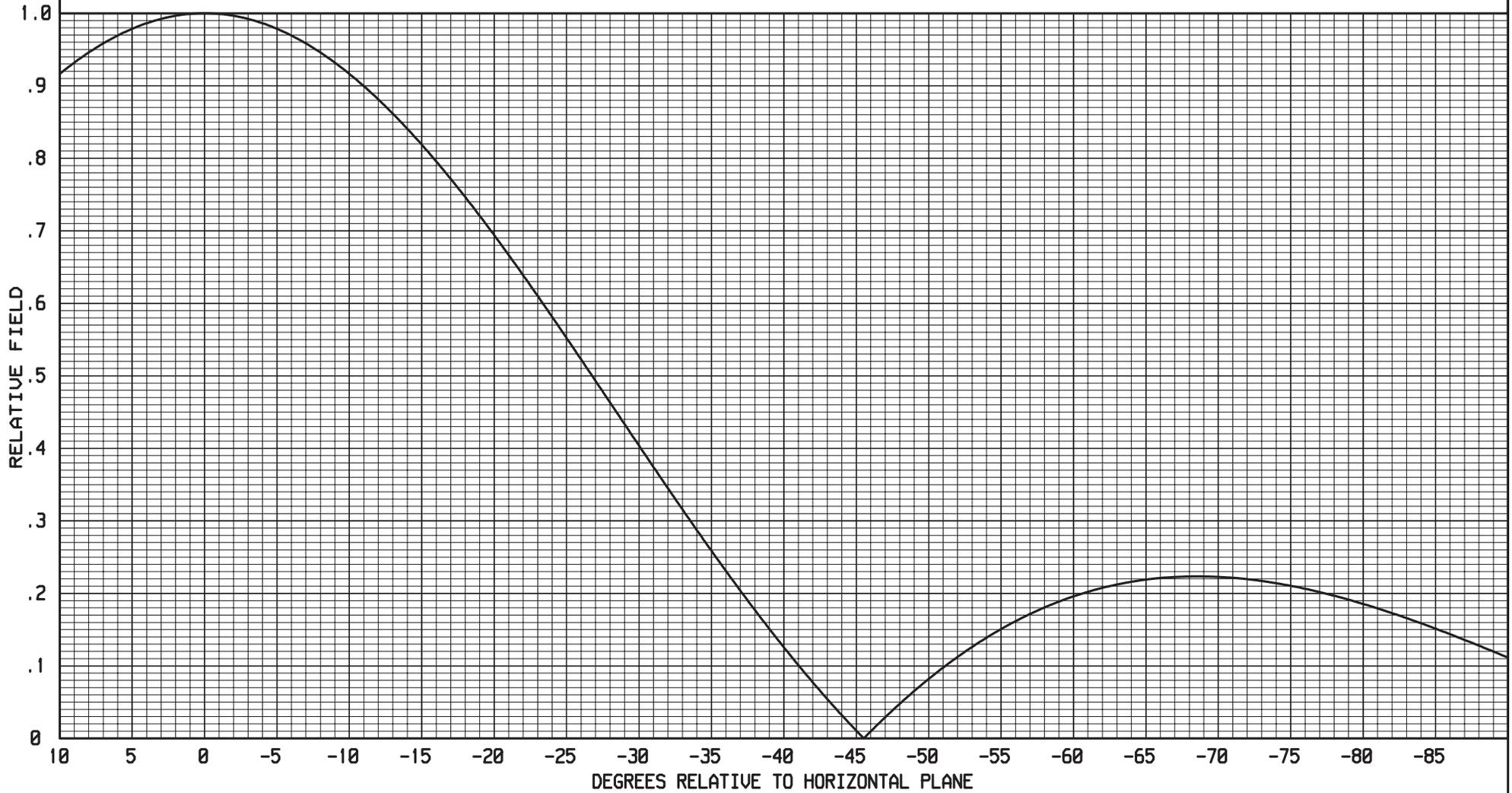
FIGURE 3

----THEORETICAL----  
VERTICAL PLANE RELATIVE FIELD

2 LEVELS ERI MODEL 1180 ELEMENTS  
0 DEGREE(S) BEAM TILT  
0 PERCENT NULL FILL

89.9 MHz.

BAY SPACING:  
92.00 INCHES



# Directional Antenna System for WVIA, Scranton, Pennsylvania

(Continued)

## ANTENNA SPECIFICATIONS

Antenna Type:	1183-2CP-DA-SP
Frequency:	89.9 MHz
Number of Bays:	Two

## MECHANICAL SPECIFICATIONS

Mounting:	Custom
System length:	15 ft 4 in
Aperture length required:	35 ft 4 in
Orientation:	128° true

Input flange to the antenna 3 1/8" female.

## ELECTRICAL SPECIFICATIONS

(For directional use)

Maximum horizontal ERP:	7.400 kW (8.692 dBk)
Horizontal maximum power gain:	1.181 (.724 dB)
Maximum vertical ERP:	7.400 kW (8.692 dBk)
Vertical maximum power gain:	1.181 (.724 dB)
Total input power:	6.264 kW (7.968 dBk)

