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 WABE, Atlanta, Georgia

September 21, 2004

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 WABE.

The antenna is the ERI model MP-12C-DA-HW-SP configuration. The circular polarized system consists of 12 half-wavelength spaced bays using one driven circular polarized radiating element per bay, two horizontal parasitic elements per bay and four vertical parasitic elements interleaved between alternate bay pairs. The antenna was mounted on the North 51° 25' 15" degrees East tower face with bracketry to provide an antenna orientation of North 51° 25' 15" degrees East. The antenna was tested on a 30" ERI® λ *MOUNTING SYSTEM*, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 90.1 megahertz, which is the center of the FM broadcast channel assigned to WABE.

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
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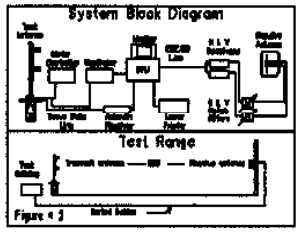
(Continued)

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 30" ERI® *MOUNTING SYSTEM*, 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 90.1 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 12 half-wavelength spaced bays using one driven circular polarized radiating element per bay, two horizontal parasitic elements 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-12C-DA-HW-SP array is to be mounted on the North 51° 25' 15" degrees East tower face of the 30" ***ERI®λ MOUNTING SYSTEM***, at a bearing of North 51° 25' 15" 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 96 kilowatts (19.823 dBk).

The power at North 20-70 degrees East does not exceed 33 kilowatts (15.185 dBk).

Directional Antenna System
For
WABE, Atlanta, Georgia

(Continued)

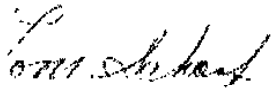
The RMS of the vertically polarized horizontal plane component does not exceed the RMS of the horizontally polarized horizontal plane component.

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 that 85% of the filed composite pattern.

The clear vertical length of the structure required to support the antenna is 74 ft 9 in 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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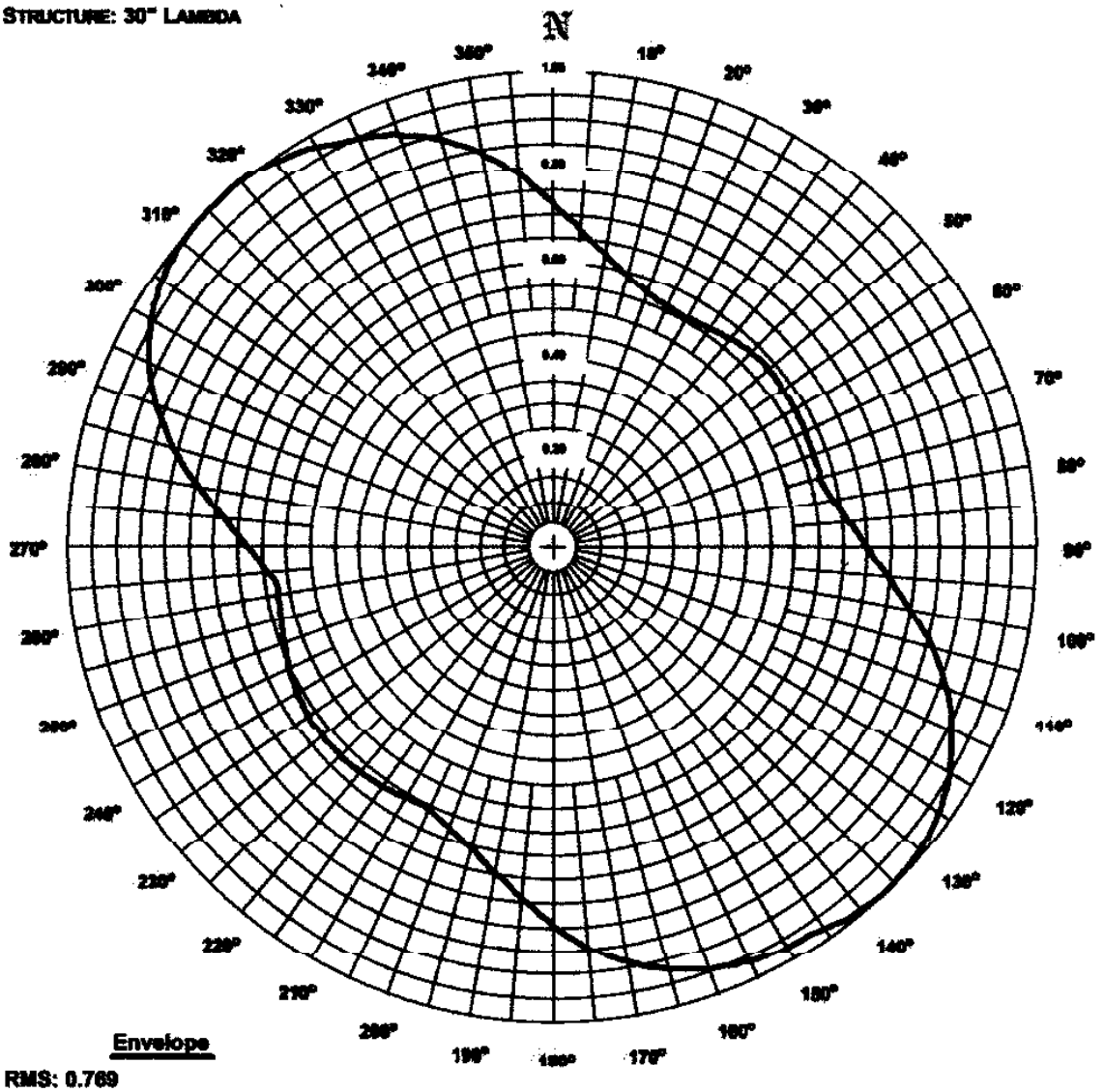
FIGURE: 1
STATION: WABE
LOCATION: ATLANTA, GA
ANTENNA TYPE: MP-12C-DA-HW-SP
STRUCTURE: 30° LAMBDA

DATE: 9/21/2004
FREQUENCY: 90.1 MHz
ORIENTATION: 51.4208° TRUE
MOUNTING: STANDARD



Envelope

RMS: 0.769
Maximum: 1.000 @ 136° True
Minimum: 0.557 @ 28° 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-20040607AAR.

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: WABE
Location: Atlanta, GA
Frequency: 90.1 MHz

Antenna: MP-12C-DA-HW-SP
Orientation: 51.4208° True
Tower: 30" Lambda

Figure: 1
Date: 9/21/2004
Reference: wabe2m.fig

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0°	0.724	50.36	17.02	Vertical	180°	0.794	60.49	17.82	Horizontal
5°	0.671	43.19	16.35	Vertical	185°	0.739	52.50	17.20	Horizontal
10°	0.628	37.80	15.78	Vertical	190°	0.693	46.16	16.64	Horizontal
15°	0.595	33.94	15.31	Vertical	195°	0.656	41.29	16.16	Horizontal
20°	0.572	31.40	14.97	Vertical	200°	0.627	37.72	15.77	Horizontal
25°	0.560	30.06	14.78	Vertical	205°	0.606	35.30	15.48	Horizontal
30°	0.558	29.86	14.75	Vertical	210°	0.608	35.54	15.51	Vertical
35°	0.563	30.41	14.83	Vertical	215°	0.615	36.27	15.60	Vertical
40°	0.573	31.49	14.98	Vertical	220°	0.619	36.74	15.65	Vertical
45°	0.581	32.40	15.10	Vertical	225°	0.620	36.95	15.68	Vertical
50°	0.584	32.74	15.15	Vertical	230°	0.619	36.83	15.66	Vertical
55°	0.581	32.40	15.10	Vertical	235°	0.615	36.35	15.61	Vertical
60°	0.579	32.15	15.07	Horizontal	240°	0.609	35.55	15.51	Vertical
65°	0.578	32.02	15.05	Horizontal	245°	0.599	34.43	15.37	Vertical
70°	0.576	31.81	15.03	Horizontal	250°	0.588	33.17	15.21	Vertical
75°	0.574	31.60	15.00	Horizontal	255°	0.579	32.21	15.08	Vertical
80°	0.589	33.26	15.22	Vertical	260°	0.574	31.58	14.99	Vertical
85°	0.615	36.32	15.60	Vertical	265°	0.590	33.38	15.24	Horizontal
90°	0.651	40.68	16.09	Vertical	270°	0.629	38.00	15.80	Horizontal
95°	0.696	46.53	16.68	Vertical	275°	0.680	44.33	16.47	Horizontal
100°	0.751	54.14	17.34	Vertical	280°	0.741	52.70	17.22	Horizontal
105°	0.813	63.42	18.02	Vertical	285°	0.809	62.88	17.99	Horizontal
110°	0.868	72.25	18.59	Vertical	290°	0.868	72.41	18.60	Horizontal
115°	0.913	79.99	19.03	Vertical	295°	0.917	80.67	19.07	Horizontal
120°	0.949	86.40	19.36	Vertical	300°	0.954	87.37	19.41	Horizontal
125°	0.975	91.28	19.60	Vertical	305°	0.980	92.25	19.65	Horizontal
130°	0.992	94.48	19.75	Vertical	310°	0.996	95.16	19.78	Horizontal
135°	1.000	95.93	19.82	Vertical	315°	1.000	96.00	19.82	Horizontal
140°	0.996	95.14	19.78	Vertical	320°	1.000	95.91	19.82	Horizontal
145°	0.980	92.18	19.65	Vertical	325°	0.991	94.19	19.74	Horizontal
150°	0.973	90.88	19.58	Horizontal	330°	0.970	90.37	19.56	Horizontal
155°	0.964	89.29	19.51	Horizontal	335°	0.947	86.11	19.35	Vertical
160°	0.947	86.16	19.35	Horizontal	340°	0.922	81.68	19.12	Vertical
165°	0.922	81.57	19.12	Horizontal	345°	0.887	75.60	18.79	Vertical
170°	0.888	75.64	18.79	Horizontal	350°	0.842	68.08	18.33	Vertical
175°	0.845	68.54	18.36	Horizontal	355°	0.786	59.38	17.74	Vertical

Polarization: Envelope
Maximum Field: 1.000 @ 136° True
Minimum Field: 0.557 @ 28° True
RMS: 0.769
Maximum ERP: 96.000 kW
Maximum Power Gain: 6.456 (8.100 dB)

Total Input Power: 14.869 kW

ERI® Horizontal Plane Relative Field Pattern

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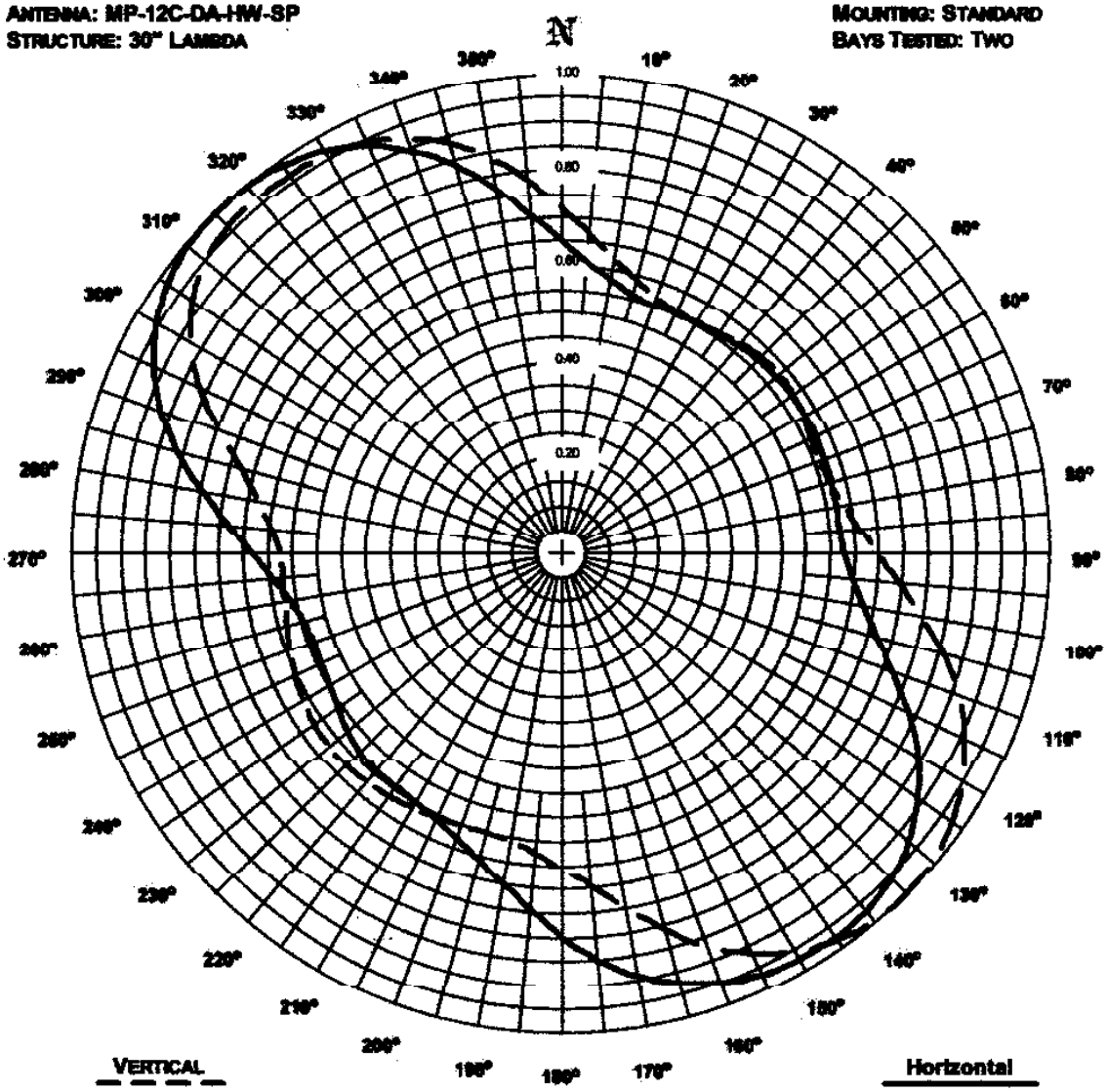
FIGURE NO: 2
STATION: WABE
LOCATION: ATLANTA, GA
ANTENNA: MP-12C-DA-HW-SP
STRUCTURE: 30" LAMBDA

DATE: 9/21/2004
FREQUENCY: 90.1 MHz
ORIENTATION: 51.4208° TRUE
MOUNTING: STANDARD
BAYS TESTED: TWO



VERTICAL
RMS: 0.740
MAXIMUM: 1.000 @ 136° TRUE
MINIMUM: 0.557 @ 28° TRUE

Horizontal
RMS: 0.742
Maximum: 1.000 @ 314° True
Minimum: 0.537 @ 250° True

COMMENTS: MEASURED PATERNS OF THE HORIZONTAL ANDVERTICAL COMPONENTS.

ERI® *Horizontal Plane Relative Field List*

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Station: WABE
Location: Atlanta, GA
Frequency: 90.1 MHz

Antenna: MP-12C-DA-HW-SP
Orientation: 51.4208° True
Tower: 30" Lambda

Figure: 2
Date: 9/21/2004
Reference: wabe2m.fig

Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.657	41.41	16.17	0.724	50.36	17.02	180°	0.794	60.49	17.82	0.651	40.74	16.10
5°	0.614	36.18	15.59	0.671	43.19	16.35	185°	0.739	52.50	17.20	0.622	37.19	15.70
10°	0.582	32.56	15.13	0.628	37.80	15.78	190°	0.693	46.16	16.64	0.605	35.08	15.45
15°	0.562	30.33	14.82	0.595	33.94	15.31	195°	0.656	41.29	16.16	0.598	34.31	15.35
20°	0.553	29.36	14.68	0.572	31.40	14.97	200°	0.627	37.72	15.77	0.599	34.46	15.37
25°	0.553	29.40	14.68	0.560	30.06	14.78	205°	0.606	35.30	15.48	0.603	34.87	15.42
30°	0.556	29.71	14.73	0.558	29.86	14.75	210°	0.594	33.92	15.30	0.608	35.54	15.51
35°	0.561	30.23	14.80	0.563	30.41	14.83	215°	0.591	33.51	15.25	0.615	36.27	15.60
40°	0.568	30.96	14.91	0.573	31.49	14.98	220°	0.588	33.16	15.21	0.619	36.74	15.65
45°	0.574	31.59	15.00	0.581	32.40	15.10	225°	0.581	32.36	15.10	0.620	36.95	15.68
50°	0.577	31.99	15.05	0.584	32.74	15.15	230°	0.570	31.14	14.93	0.619	36.83	15.66
55°	0.579	32.17	15.08	0.581	32.40	15.10	235°	0.556	29.68	14.72	0.615	36.35	15.61
60°	0.579	32.15	15.07	0.573	31.50	14.98	240°	0.546	28.59	14.56	0.609	35.55	15.51
65°	0.578	32.02	15.05	0.566	30.73	14.88	245°	0.539	27.94	14.46	0.599	34.43	15.37
70°	0.576	31.81	15.03	0.564	30.55	14.85	250°	0.537	27.69	14.42	0.588	33.17	15.21
75°	0.574	31.60	15.00	0.572	31.37	14.97	255°	0.544	28.38	14.53	0.579	32.21	15.08
80°	0.573	31.48	14.98	0.589	33.26	15.22	260°	0.561	30.24	14.81	0.574	31.58	14.99
85°	0.573	31.49	14.98	0.615	36.32	15.60	265°	0.590	33.38	15.24	0.571	31.27	14.95
90°	0.581	32.45	15.11	0.651	40.68	16.09	270°	0.629	38.00	15.80	0.574	31.63	15.00
95°	0.601	34.65	15.40	0.696	46.53	16.68	275°	0.680	44.33	16.47	0.592	33.68	15.27
100°	0.631	38.23	15.82	0.751	54.14	17.34	280°	0.741	52.70	17.22	0.626	37.59	15.75
105°	0.672	43.36	16.37	0.813	63.42	18.02	285°	0.809	62.88	17.99	0.674	43.66	16.40
110°	0.724	50.31	17.02	0.868	72.25	18.59	290°	0.868	72.41	18.60	0.738	52.32	17.19
115°	0.786	59.32	17.73	0.913	79.99	19.03	295°	0.917	80.67	19.07	0.812	63.27	18.01
120°	0.844	68.45	18.35	0.949	86.40	19.36	300°	0.954	87.37	19.41	0.873	73.10	18.64
125°	0.892	76.37	18.83	0.975	91.28	19.60	305°	0.980	92.25	19.65	0.918	80.94	19.08
130°	0.929	82.79	19.18	0.992	94.48	19.75	310°	0.996	95.16	19.78	0.949	86.39	19.36
135°	0.955	87.47	19.42	1.000	95.93	19.82	315°	1.000	96.00	19.82	0.964	89.18	19.50
140°	0.970	90.27	19.56	0.996	95.14	19.78	320°	1.000	95.91	19.82	0.966	89.52	19.52
145°	0.974	91.07	19.59	0.980	92.18	19.65	325°	0.991	94.19	19.74	0.966	89.52	19.52
150°	0.973	90.88	19.58	0.953	87.20	19.41	330°	0.970	90.37	19.56	0.962	88.76	19.48
155°	0.964	89.29	19.51	0.915	80.39	19.05	335°	0.939	84.58	19.27	0.947	86.11	19.35
160°	0.947	86.16	19.35	0.866	71.98	18.57	340°	0.896	77.04	18.87	0.922	81.68	19.12
165°	0.922	81.57	19.12	0.806	62.30	17.94	345°	0.842	68.01	18.33	0.887	75.60	18.79
170°	0.888	75.64	18.79	0.743	53.01	17.24	350°	0.776	57.85	17.62	0.842	68.08	18.33
175°	0.845	68.54	18.36	0.692	45.93	16.62	355°	0.711	48.52	16.86	0.786	59.38	17.74

Polarization:	**Horizontal**	**Vertical**
Maximum Field:	**1.000 @ 314° True**	**1.000 @ 136° True**
Minimum Field:	**0.537 @ 250° True**	**0.557 @ 28° True**
RMS:	**0.742**	**0.740**
Maximum ERP:	**96.000 kW**	**96.000 kW**
Maximum Power Gain:	**6.456 (8.100 dB)**	**6.456 (8.100 dB)**

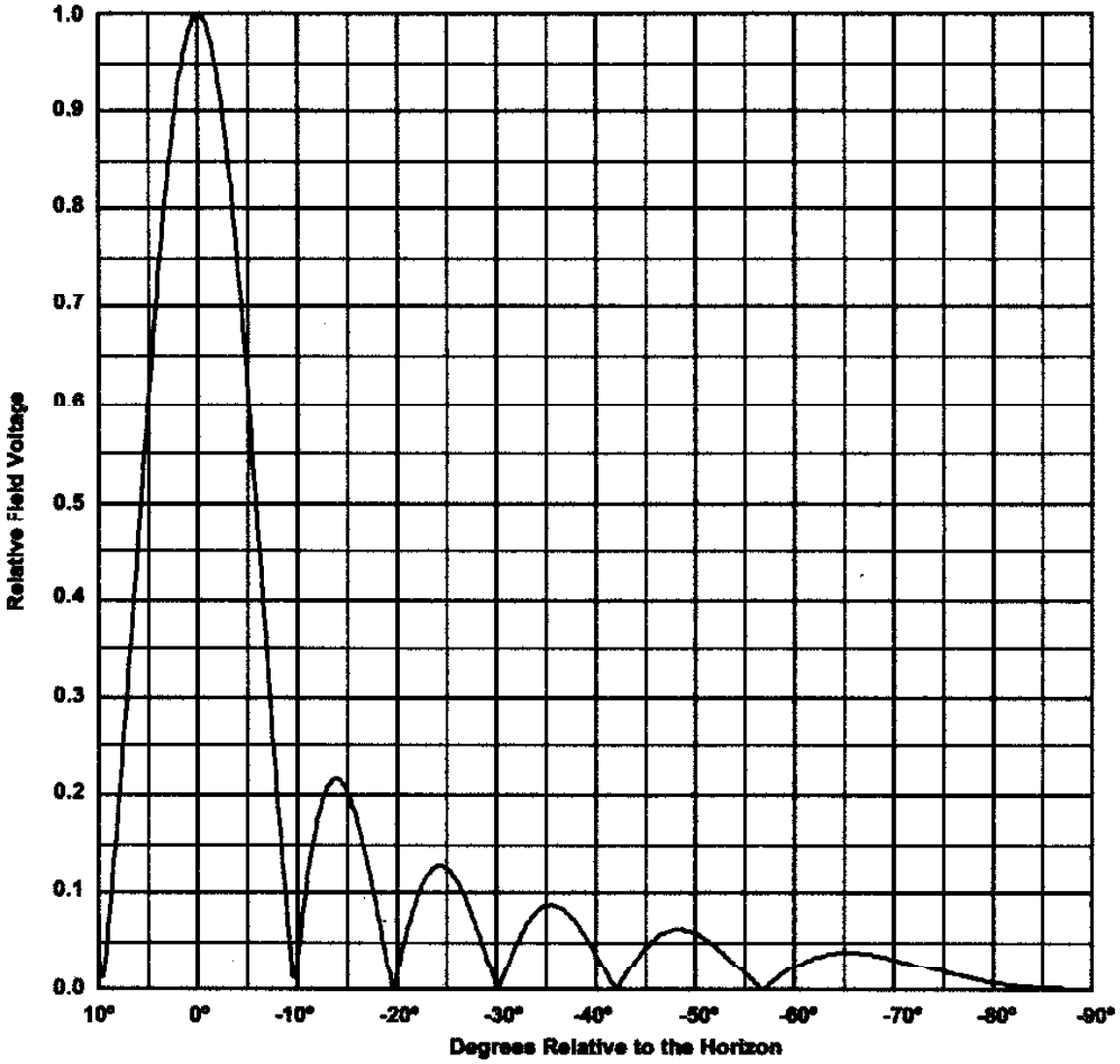
Total Input Power: 14.869 kW

ERI® Vertical Plane Relative Field Pattern

WABE, Atlanta, GA, 90.1 MHz

Figure#: 3 **Date: 9/21/2004**

A 12 level, .5 wave-length spaced MP-12C-DA-HW-SP 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: 6.456 (8.100 dB)	Maximum: 6.456 (8.100 dB)
Horizontal Plane: 6.456 (8.100 dB)	Horizontal Plane: 6.456 (8.100 dB)

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