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 WBON, West Hampton, New York

January 20, 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 WBON.

The antenna is the ERI model LP-2E-DA-HW configuration. The circular polarized system consists of two half-wavelength spaced bays using one driven circular polarized radiating element per bay, three horizontal parasitic elements per bay and two vertical parasitic elements interleaved between the bays. The antenna was mounted on the North 60 degrees East tower face with bracketry to provide an antenna orientation of North 65 degrees East. The antenna was tested on a 60" face tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 98.5 megahertz, which is the center of the FM broadcast channel assigned to WBON.

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
WBON, West Hampton, New York

(Continued)

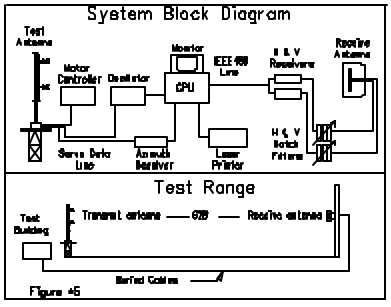
DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of a full scale model of the complete 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 1 5/8 inch o.d. rigid coaxial line was used to feed the test antenna, and a section of 1 5/8 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 60" 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 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 98.5 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.

(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 two half-wavelength spaced bays using one driven circular polarized radiating element per bay, three horizontal parasitic elements per bay and two vertical parasitic elements interleaved between the bays. 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 LP-2E-DA-HW array is to be mounted on the North 60 degrees East tower face of the 60" face tower at a bearing of North 65 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 0.95 kilowatts (-0.223 dBk).

The power at North 240-280 degrees East does not exceed 0.314 kilowatts (–5.031 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 that 85% of the filed composite pattern.

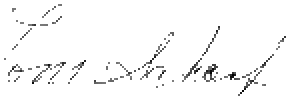
Directional Antenna System
For
WBON, West Hampton, New York

(Continued)

The clear vertical length of the structure required to support the antenna is 20 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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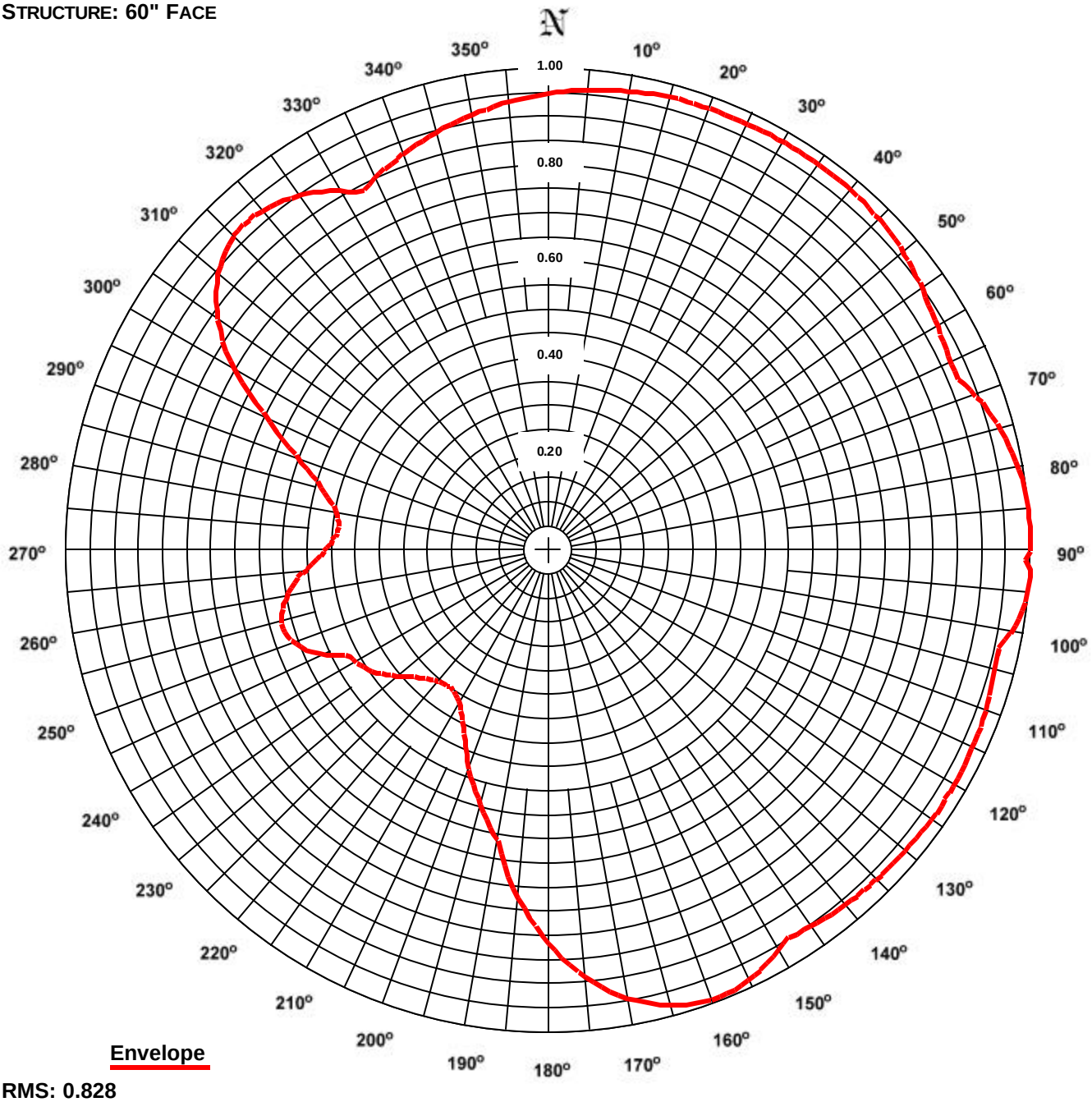
FIGURE: 1
STATION: WBON
LOCATION: WEST HAMPTON, NY.
ANTENNA TYPE: LP-2E-DA-HW
STRUCTURE: 60" FACE

DATE: 12/2/02
FREQUENCY: 98.5 MHZ
ORIENTATION: 65° TRUE
MOUNTING: CUSTOM



Envelope

RMS: 0.828
Maximum: 1.000 @ 86° True
Minimum: 0.346 @ 216° 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 BPH-20031114ADG.**

ERI® Horizontal Plane Relative Field List

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Station: WBON
Location: West Hampton, NY.
Frequency: 98.5 MHz

Antenna: LP-2E-DA-HW
Orientation: 65° True
Tower: 60" Face

Figure: 1
Date: 1/20/04
Reference: wbon1m.fig

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0º	0.953	0.86	-0.65	Vertical	180º	0.813	0.63	-2.03	Horizontal
5º	0.964	0.88	-0.54	Vertical	185º	0.721	0.49	-3.07	Horizontal
10º	0.972	0.90	-0.47	Vertical	190º	0.610	0.35	-4.52	Horizontal
15º	0.978	0.91	-0.42	Vertical	195º	0.544	0.28	-5.51	Vertical
20º	0.980	0.91	-0.39	Vertical	200º	0.481	0.22	-6.58	Vertical
25º	0.981	0.91	-0.39	Vertical	205º	0.415	0.16	-7.87	Vertical
30º	0.981	0.91	-0.39	Vertical	210º	0.368	0.13	-8.91	Vertical
35º	0.981	0.91	-0.39	Vertical	215º	0.347	0.11	-9.41	Vertical
40º	0.980	0.91	-0.40	Vertical	220º	0.351	0.12	-9.31	Vertical
45º	0.974	0.90	-0.45	Vertical	225º	0.369	0.13	-8.87	Vertical
50º	0.964	0.88	-0.55	Vertical	230º	0.400	0.15	-8.18	Vertical
55º	0.948	0.85	-0.68	Vertical	235º	0.436	0.18	-7.44	Vertical
60º	0.933	0.83	-0.82	Vertical	240º	0.459	0.20	-6.99	Vertical
65º	0.923	0.81	-0.92	Vertical	245º	0.505	0.24	-6.16	Horizontal
70º	0.945	0.85	-0.71	Horizontal	250º	0.559	0.30	-5.28	Horizontal
75º	0.973	0.90	-0.46	Horizontal	255º	0.573	0.31	-5.06	Horizontal
80º	0.992	0.93	-0.30	Horizontal	260º	0.554	0.29	-5.35	Horizontal
85º	1.000	0.95	-0.23	Horizontal	265º	0.512	0.25	-6.04	Horizontal
90º	1.000	0.95	-0.22	Horizontal	270º	0.465	0.21	-6.87	Horizontal
95º	0.997	0.94	-0.25	Horizontal	275º	0.442	0.19	-7.32	Horizontal
100º	0.973	0.90	-0.46	Horizontal	280º	0.446	0.19	-7.24	Horizontal
105º	0.959	0.87	-0.59	Vertical	285º	0.481	0.22	-6.58	Horizontal
110º	0.965	0.88	-0.53	Vertical	290º	0.545	0.28	-5.49	Horizontal
115º	0.969	0.89	-0.49	Vertical	295º	0.638	0.39	-4.12	Horizontal
120º	0.971	0.90	-0.48	Vertical	300º	0.750	0.53	-2.72	Horizontal
125º	0.970	0.89	-0.48	Vertical	305º	0.838	0.67	-1.76	Horizontal
130º	0.968	0.89	-0.51	Vertical	310º	0.896	0.76	-1.18	Horizontal
135º	0.963	0.88	-0.55	Vertical	315º	0.925	0.81	-0.90	Horizontal
140º	0.957	0.87	-0.61	Vertical	320º	0.924	0.81	-0.91	Horizontal
145º	0.948	0.85	-0.68	Vertical	325º	0.904	0.78	-1.10	Horizontal
150º	0.957	0.87	-0.61	Horizontal	330º	0.866	0.71	-1.47	Horizontal
155º	0.982	0.92	-0.38	Horizontal	335º	0.854	0.69	-1.59	Vertical
160º	0.989	0.93	-0.32	Horizontal	340º	0.880	0.74	-1.33	Vertical
165º	0.973	0.90	-0.46	Horizontal	345º	0.902	0.77	-1.12	Vertical
170º	0.939	0.84	-0.77	Horizontal	350º	0.922	0.81	-0.93	Vertical
175º	0.885	0.74	-1.28	Horizontal	355º	0.939	0.84	-0.77	Vertical

Polarization: **Envelope**
Maximum Field: **1.000 @ 86° True**
Minimum Field: **0.346 @ 216° True**
RMS: **0.828**
Maximum ERP: **0.950 kW**
Maximum Power Gain: **1.094 (0.390 dB)**

Total Input Power: 0.869 kW

ERI® Horizontal Plane Relative Field Pattern

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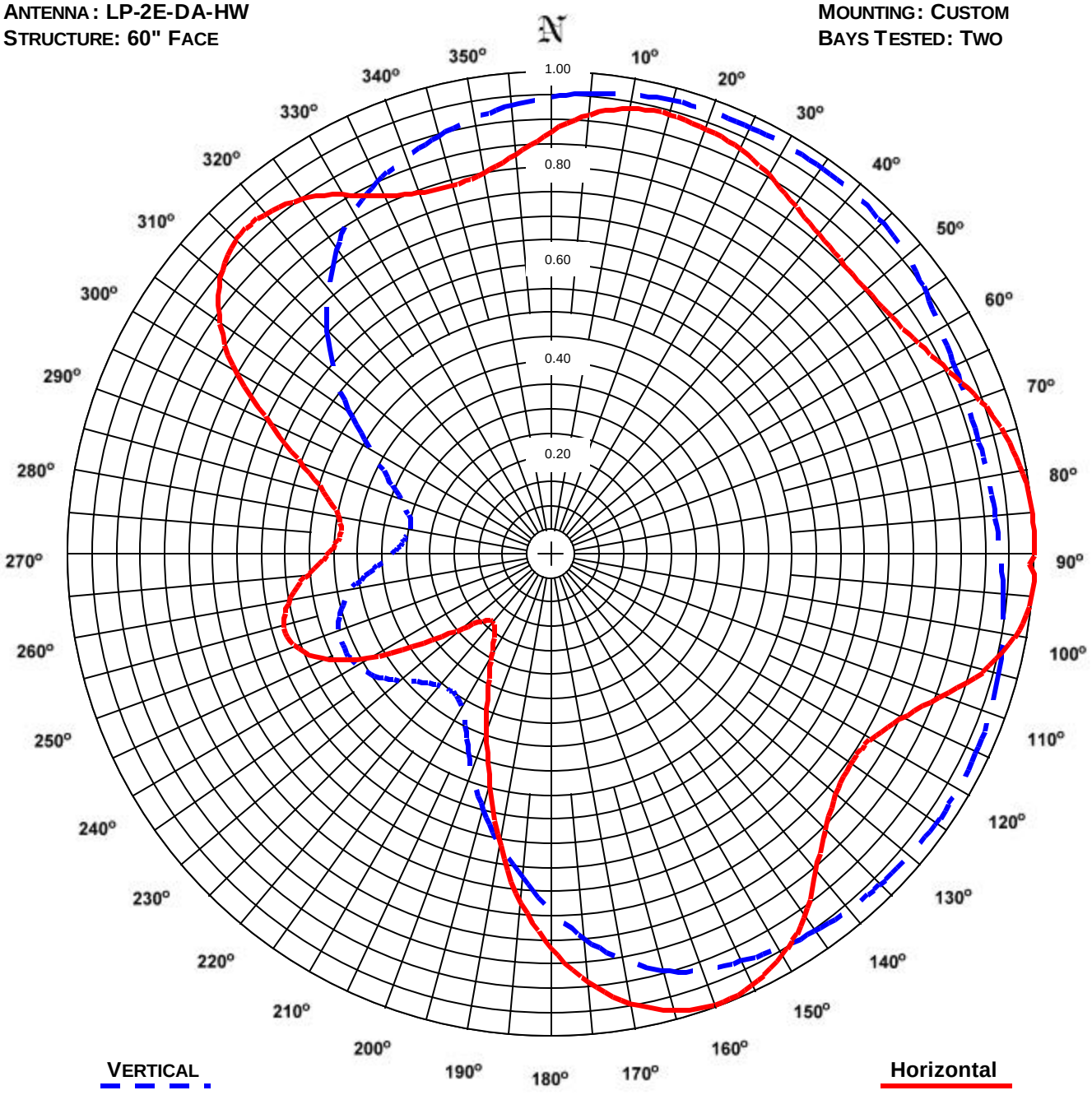
FIGURE NO: 2
STATION: WBON
LOCATION: WEST HAMPTON, NY.
ANTENNA: LP-2E-DA-HW
STRUCTURE: 60" FACE

DATE: 1/20/04
FREQUENCY: 98.5 MHZ
ORIENTATION: 65° TRUE
MOUNTING: CUSTOM
BAYS TESTED: TWO



VERTICAL

RMS: 0.781
MAXIMUM: 0.981 @ 22° TRUE
MINIMUM: 0.297 @ 281° TRUE

Horizontal

RMS: 0.781
Maximum: 1.000 @ 86° True
Minimum: 0.181 @ 223° 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: WBON
Location: West Hampton, NY.
Frequency: 98.5 MHz

Antenna: LP-2E-DA-HW
Orientation: 65° True
Tower: 60" Face

Figure: 2
Date: 1/20/04
Reference: wbon1m.fig

Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0º	0.881	0.74	-1.32	0.953	0.86	-0.65	180º	0.813	0.63	-2.03	0.734	0.51	-2.91
5º	0.920	0.80	-0.95	0.964	0.88	-0.54	185º	0.721	0.49	-3.07	0.669	0.43	-3.71
10º	0.942	0.84	-0.74	0.972	0.90	-0.47	190º	0.610	0.35	-4.52	0.609	0.35	-4.53
15º	0.948	0.85	-0.69	0.978	0.91	-0.42	195º	0.492	0.23	-6.39	0.544	0.28	-5.51
20º	0.942	0.84	-0.74	0.980	0.91	-0.39	200º	0.392	0.15	-8.35	0.481	0.22	-6.58
25º	0.929	0.82	-0.86	0.981	0.91	-0.39	205º	0.312	0.09	-10.34	0.415	0.16	-7.87
30º	0.909	0.78	-1.05	0.981	0.91	-0.39	210º	0.251	0.06	-12.24	0.368	0.13	-8.91
35º	0.885	0.74	-1.29	0.981	0.91	-0.39	215º	0.209	0.04	-13.84	0.347	0.11	-9.41
40º	0.867	0.71	-1.46	0.980	0.91	-0.40	220º	0.186	0.03	-14.85	0.351	0.12	-9.31
45º	0.857	0.70	-1.56	0.974	0.90	-0.45	225º	0.186	0.03	-14.85	0.369	0.13	-8.87
50º	0.854	0.69	-1.59	0.964	0.88	-0.55	230º	0.224	0.05	-13.22	0.400	0.15	-8.18
55º	0.862	0.71	-1.51	0.948	0.85	-0.68	235º	0.301	0.09	-10.66	0.436	0.18	-7.44
60º	0.881	0.74	-1.33	0.933	0.83	-0.82	240º	0.413	0.16	-7.91	0.459	0.20	-6.99
65º	0.909	0.79	-1.05	0.923	0.81	-0.92	245º	0.505	0.24	-6.16	0.469	0.21	-6.79
70º	0.945	0.85	-0.71	0.917	0.80	-0.97	250º	0.559	0.30	-5.28	0.468	0.21	-6.82
75º	0.973	0.90	-0.46	0.916	0.80	-0.98	255º	0.573	0.31	-5.06	0.453	0.19	-7.10
80º	0.992	0.93	-0.30	0.919	0.80	-0.96	260º	0.554	0.29	-5.35	0.423	0.17	-7.69
85º	1.000	0.95	-0.23	0.923	0.81	-0.92	265º	0.512	0.25	-6.04	0.378	0.14	-8.66
90º	1.000	0.95	-0.22	0.930	0.82	-0.85	270º	0.465	0.21	-6.87	0.337	0.11	-9.68
95º	0.997	0.94	-0.25	0.939	0.84	-0.77	275º	0.442	0.19	-7.32	0.310	0.09	-10.40
100º	0.973	0.90	-0.46	0.950	0.86	-0.67	280º	0.446	0.19	-7.24	0.298	0.08	-10.75
105º	0.925	0.81	-0.90	0.959	0.87	-0.59	285º	0.481	0.22	-6.58	0.304	0.09	-10.56
110º	0.854	0.69	-1.59	0.965	0.88	-0.53	290º	0.545	0.28	-5.49	0.328	0.10	-9.90
115º	0.796	0.60	-2.20	0.969	0.89	-0.49	295º	0.638	0.39	-4.12	0.369	0.13	-8.87
120º	0.763	0.55	-2.58	0.971	0.90	-0.48	300º	0.750	0.53	-2.72	0.428	0.17	-7.60
125º	0.754	0.54	-2.68	0.970	0.89	-0.48	305º	0.838	0.67	-1.76	0.503	0.24	-6.18
130º	0.768	0.56	-2.51	0.968	0.89	-0.51	310º	0.896	0.76	-1.18	0.587	0.33	-4.85
135º	0.801	0.61	-2.15	0.963	0.88	-0.55	315º	0.925	0.81	-0.90	0.657	0.41	-3.87
140º	0.852	0.69	-1.61	0.957	0.87	-0.61	320º	0.924	0.81	-0.91	0.719	0.49	-3.09
145º	0.913	0.79	-1.02	0.948	0.85	-0.68	325º	0.904	0.78	-1.10	0.775	0.57	-2.44
150º	0.957	0.87	-0.61	0.938	0.84	-0.78	330º	0.866	0.71	-1.47	0.821	0.64	-1.93
155º	0.982	0.92	-0.38	0.926	0.81	-0.89	335º	0.825	0.65	-1.89	0.854	0.69	-1.59
160º	0.989	0.93	-0.32	0.912	0.79	-1.02	340º	0.801	0.61	-2.15	0.880	0.74	-1.33
165º	0.973	0.90	-0.46	0.888	0.75	-1.26	345º	0.795	0.60	-2.21	0.902	0.77	-1.12
170º	0.939	0.84	-0.77	0.846	0.68	-1.67	350º	0.808	0.62	-2.07	0.922	0.81	-0.93
175º	0.885	0.74	-1.28	0.796	0.60	-2.21	355º	0.837	0.67	-1.77	0.939	0.84	-0.77

	Horizontal	Vertical
Polarization:		
Maximum Field:	**1.000 @ 86° True**	**0.981 @ 22° True**
Minimum Field:	**0.181 @ 223° True**	**0.297 @ 281° True**
RMS:	**0.781**	**0.781**
Maximum ERP:	**0.950 kW**	**0.914 kW**
Maximum Power Gain:	**1.094 (0.390 dB)**	**1.052 (0.221 dB)**

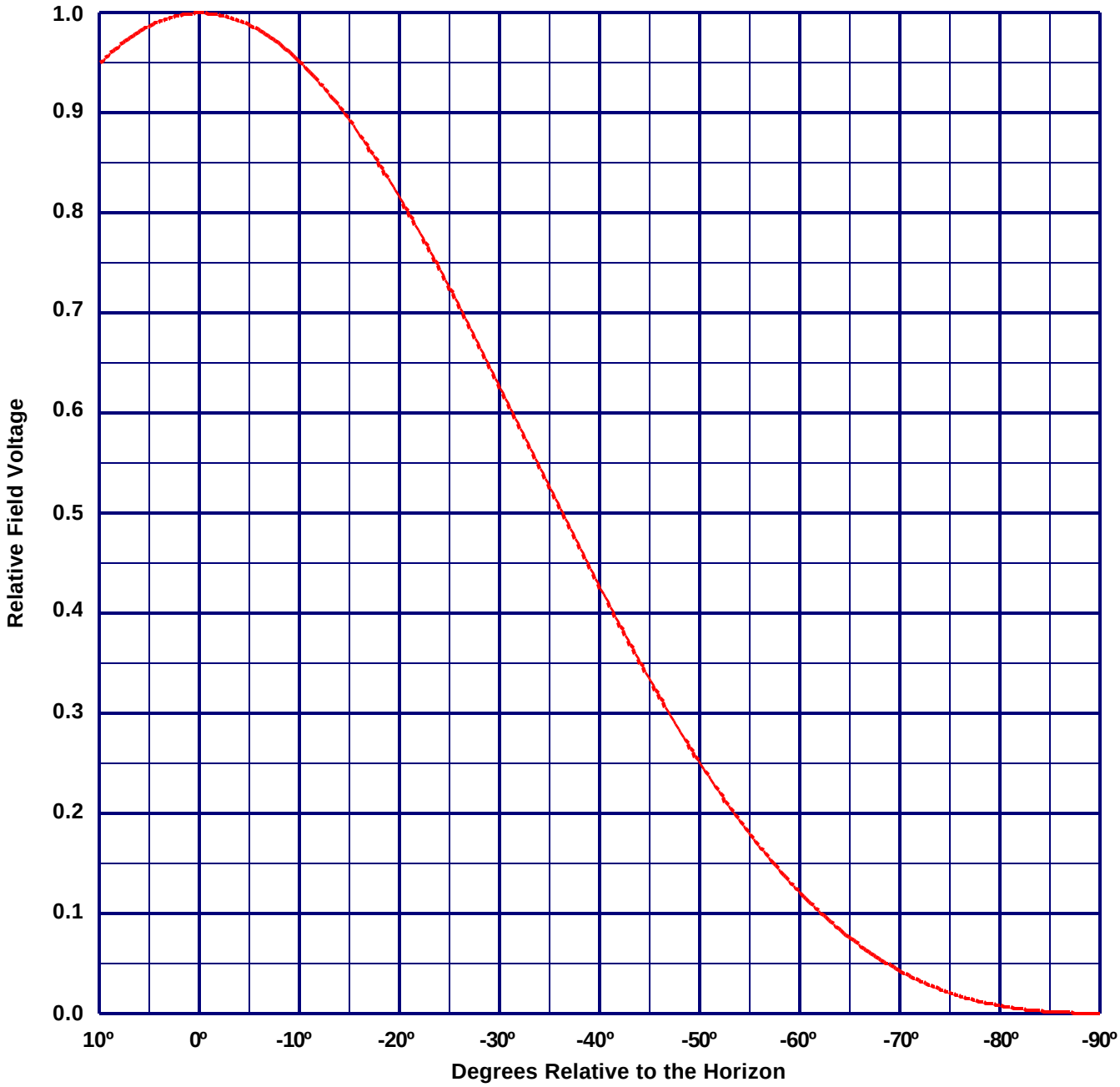
Total Input Power: 0.869 kW

Vertical Plane Relative Field Pattern

WBON, West Hampton, NY., 98.5 MHz

Figure#: 3 Date: 1/20/04

A 2 level, .5 wave-length spaced LP-2E-DA-HW directional antenna with 0° beam tilt, 0% null fill and a H/V maximum power ratio of 1.040



Vertical Polarization Gain:	Horizontal Polarization Gain:
Maximum: 1.052 (0.221 dB)	Maximum: 1.094 (0.390 dB)
Horizontal Plane: 1.052 (0.221 dB)	Horizontal Plane: 1.094 (0.390 dB)

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Directional Antenna System
for
WBON, West Hampton, New York

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	LP-2E-DA-HW
Frequency:	98.5 MHz
Number of Bays:	2

MECHANICAL SPECIFICATIONS

Mounting:	Custom
System length:	13 ft 7 in
Aperture length required:	20 ft.
Orientation:	65° true

Input flange to the antenna 1 5/8 inch female

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	0.950 kW (-0.223 dBk)
Horizontal maximum power gain:	1.094 (0.390 dB)
Maximum vertical ERP:	0.950 kW (-0.223 dBk)
Vertical maximum power gain:	1.052 (0.221 dB)
Total input power:	0.869 kW (-0.6010 dBk)

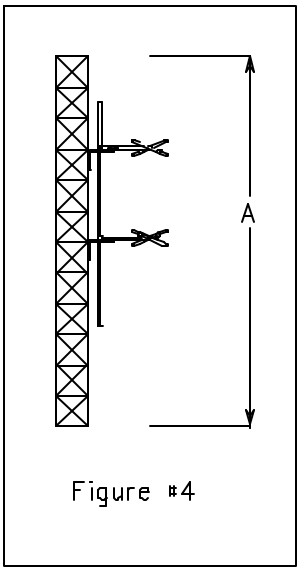

Figure #4