ELECTRONICS RESEARCH, INC. ERI®

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 WPEG, Concord, North Carolina

April 20, 2012

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 WPEG.

The antenna is the ERI model 1014-4CP-DA configuration. Each bay consists of four flat panels with two vertical dipoles and two horizontal dipoles attached to each panel. The horizontal dipoles that are attached to each of the flat panels are spaced one half-wave length apart vertically. The antenna was tested on a 12" face tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 97.9 megahertz, which is the center of the FM broadcast channel assigned to WPEG.

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
WPEG, Concord, North Carolina

(Continued)

DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of one bay 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 12" 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.

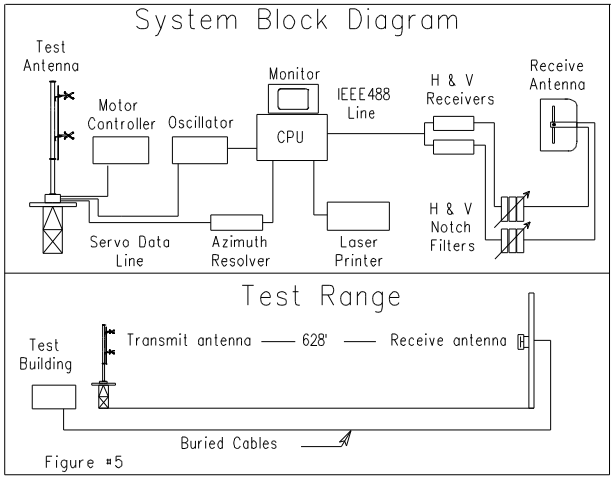

Figure #5

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 97.9 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 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 co-ordinated graph paper in a clockwise direction. Both horizontal and vertical components were recorded separately.

CONCLUSIONS

The circular polarized system consists of 4 full-wavelength spaced bays using four flat panels with two vertical dipoles and two horizontal dipoles attached to each panel. The horizontal dipoles that are attached to each of the flat panels are spaced one half-wave length apart vertically. 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 1014-4CP-DA array is to be mounted on the 12" face tower at a bearing of North 345 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 95 kilowatts (19.777 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
WPEG, Concord, North Carolina

(Continued)

The clear vertical length of the structure required to support the antenna is 46 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.

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ERI® Horizontal Plane Relative Field Pattern

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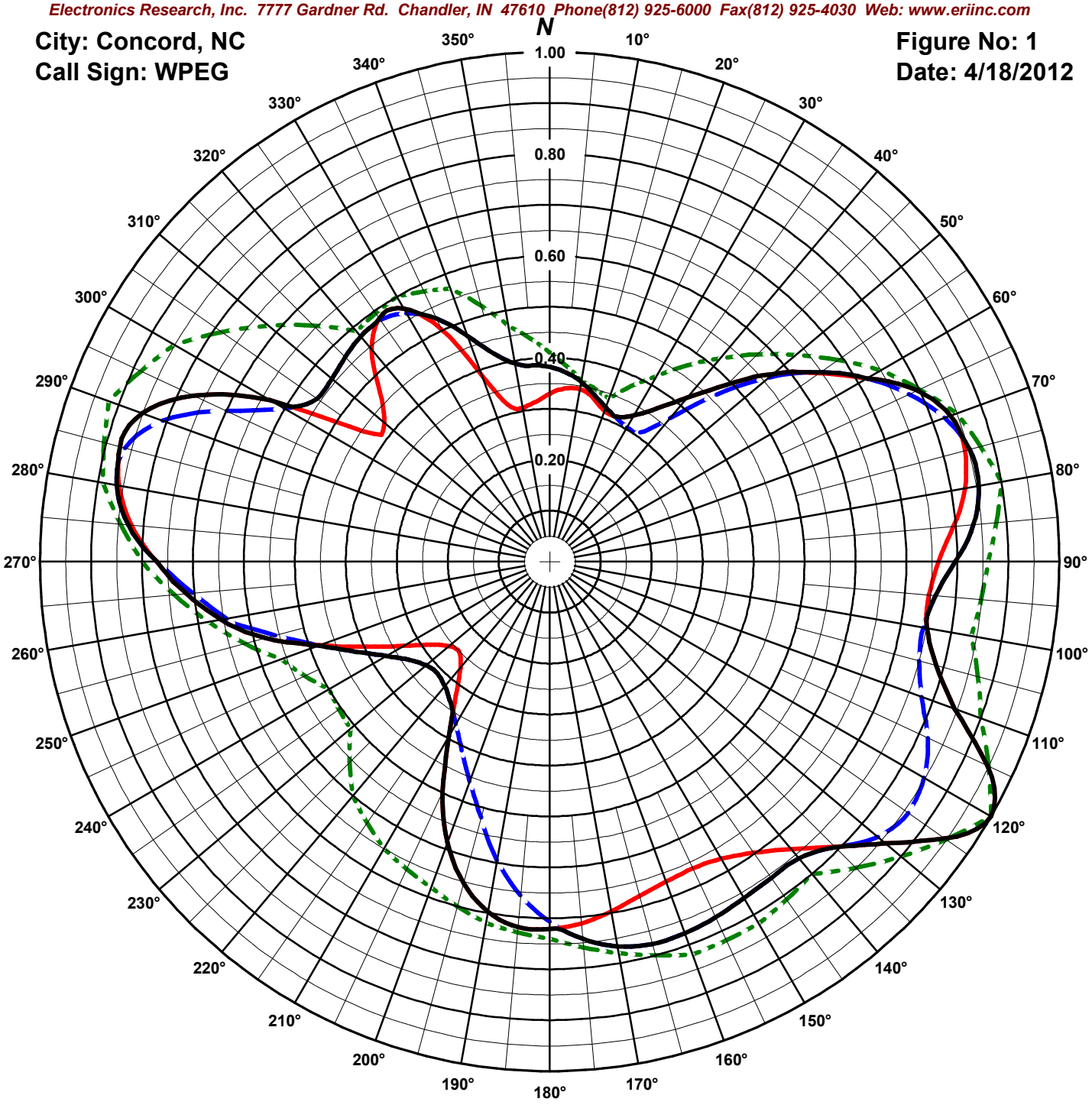
City: Concord, NC
Call Sign: WPEG

Figure No: 1
Date: 4/18/2012



Antenna Orientation: 345° True

Frequency: 97.9 MHz
Antenna Type: 1014-4CP-DA

Antenna Mounting: Custom
Tower Type: 12' face tower

HORIZONTAL	VERTICAL	COMPOSITE	FCC ENVELOPE
RMS: .63	RMS: .63	RMS: .652	RMS: .714
Maximum: 1 @ 120°	Maximum: .869 @ 283°	Maximum: 1 @ 120°	Maximum: 1 @ 120°
Minimum: .25 @ 226°	Minimum: .303 @ 33°	Minimum: .311 @ 226°	Minimum: .34 @ 20°

Measured patterns of the horizontal and vertical components. The composite pattern shows the maximum of either the H or V azimuth values. This patterns is greater than 85% of the FCC filed composite pattern BLH-19901207KC.

ERI® Horizontal Plane Relative Field Pattern

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Figure# 1 **Date: 4/18/2012**
Station: WPEG **Antenna: 1014-4CP-DA**
Location: Concord, NC **Antenna Orientation: 345° True**
Frequency: 97.9 MHz **Number of Bays: 4**

Azimuth	Envelope			Polarization	Azimuth	Envelope			Polarization
	Field	kW	dBk	Maximum		Field	kW	dBk	Maximum
0°	0.382	13.872	11.421	Max H (and or) V	180°	0.721	49.355	16.933	Max H (and or) V
5°	0.373	13.196	11.205	Max H (and or) V	185°	0.720	49.217	16.921	Max H (and or) V
10°	0.358	12.180	10.856	Max H (and or) V	190°	0.698	46.221	16.648	Max H (and or) V
15°	0.339	10.895	10.372	Max H (and or) V	195°	0.653	40.513	16.076	Max H (and or) V
20°	0.322	9.844	9.932	Max H (and or) V	200°	0.586	32.656	15.140	Max H (and or) V
25°	0.314	9.342	9.705	Max H (and or) V	205°	0.497	23.495	13.710	Max H (and or) V
30°	0.331	10.428	10.182	Max H (and or) V	210°	0.396	14.871	11.724	Max H (and or) V
35°	0.367	12.777	11.064	Max H (and or) V	215°	0.339	10.893	10.372	Max H (and or) V
40°	0.420	16.749	12.240	Max H (and or) V	220°	0.320	9.707	9.871	Max H (and or) V
45°	0.491	22.880	13.595	Max H (and or) V	225°	0.311	9.202	9.639	Max H (and or) V
50°	0.573	31.165	14.937	Max H (and or) V	230°	0.316	9.515	9.784	Max H (and or) V
55°	0.648	39.950	16.015	Max H (and or) V	235°	0.336	10.747	10.313	Max H (and or) V
60°	0.719	49.132	16.914	Max H (and or) V	240°	0.370	13.033	11.150	Max H (and or) V
65°	0.795	60.065	17.786	Max H (and or) V	245°	0.419	16.649	12.214	Max H (and or) V
70°	0.837	66.553	18.232	Max H (and or) V	250°	0.481	21.985	13.421	Max H (and or) V
75°	0.853	69.119	18.396	Max H (and or) V	255°	0.578	31.754	15.018	Max H (and or) V
80°	0.855	69.421	18.415	Max H (and or) V	260°	0.655	40.696	16.096	Max H (and or) V
85°	0.835	66.245	18.212	Max H (and or) V	265°	0.716	48.728	16.878	Max H (and or) V
90°	0.796	60.145	17.792	Max H (and or) V	270°	0.771	56.483	17.519	Max H (and or) V
95°	0.760	54.882	17.394	Max H (and or) V	275°	0.830	65.478	18.161	Max H (and or) V
100°	0.752	53.724	17.302	Max H (and or) V	280°	0.862	70.669	18.492	Max H (and or) V
105°	0.785	58.585	17.678	Max H (and or) V	285°	0.873	72.377	18.596	Max H (and or) V
110°	0.846	68.045	18.328	Max H (and or) V	290°	0.851	68.764	18.374	Max H (and or) V
115°	0.948	85.442	19.317	Max H (and or) V	295°	0.771	56.461	17.518	Max H (and or) V
120°	1.000	95.000	19.777	Max H (and or) V	300°	0.634	38.189	15.819	Max H (and or) V
125°	0.947	85.201	19.304	Max H (and or) V	305°	0.557	29.498	14.698	Max H (and or) V
130°	0.860	70.318	18.471	Max H (and or) V	310°	0.558	29.553	14.706	Max H (and or) V
135°	0.792	59.628	17.755	Max H (and or) V	315°	0.567	30.565	14.852	Max H (and or) V
140°	0.760	54.935	17.399	Max H (and or) V	320°	0.577	31.593	14.996	Max H (and or) V
145°	0.758	54.522	17.366	Max H (and or) V	325°	0.583	32.245	15.085	Max H (and or) V
150°	0.762	55.207	17.420	Max H (and or) V	330°	0.573	31.227	14.945	Max H (and or) V
155°	0.770	56.381	17.511	Max H (and or) V	335°	0.526	26.319	14.203	Max H (and or) V
160°	0.776	57.194	17.574	Max H (and or) V	340°	0.471	21.066	13.236	Max H (and or) V
165°	0.777	57.351	17.585	Max H (and or) V	345°	0.423	16.973	12.297	Max H (and or) V
170°	0.767	55.828	17.469	Max H (and or) V	350°	0.395	14.789	11.699	Max H (and or) V
175°	0.743	52.476	17.200	Max H (and or) V	355°	0.386	14.177	11.516	Max H (and or) V

Horizontal Polarization:
Maximum: 5.654 (7.523 dB)
Horizontal Plane: 5.654 (7.523 dB)
Maximum ERP: 95.000 kW

Vertical Polarization:
Maximum: 4.269 (6.303 dB)
Horizontal Plane: 4.269 (6.303 dB)
Maximum ERP: 71.731 kW

Total Input Power: 16.804 kW
Reference: WPEG1M.FIG

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

ERI® Horizontal Plane Relative Field Pattern

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Figure# 1A | **Date: 4/18/2012**
Station: WPEG | **Antenna: 1014-4CP-DA**
Location: Concord, NC | **Antenna Orientation: 345° True**
Frequency: 97.9 MHz | **Number of Bays: 4**

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.330	10.332	10.142	0.382	13.872	11.421	180°	0.721	49.355	16.933	0.707	47.468	16.764
5°	0.341	11.040	10.430	0.373	13.196	11.205	185°	0.720	49.217	16.921	0.658	41.073	16.136
10°	0.343	11.208	10.495	0.358	12.180	10.856	190°	0.698	46.221	16.648	0.595	33.656	15.271
15°	0.332	10.461	10.196	0.339	10.895	10.372	195°	0.653	40.513	16.076	0.520	25.679	14.096
20°	0.315	9.424	9.742	0.322	9.844	9.932	200°	0.586	32.656	15.140	0.459	19.995	13.009
25°	0.314	9.342	9.705	0.310	9.153	9.616	205°	0.497	23.495	13.710	0.408	15.829	11.994
30°	0.331	10.428	10.182	0.304	8.786	9.438	210°	0.396	14.871	11.724	0.368	12.875	11.097
35°	0.367	12.777	11.064	0.309	9.074	9.578	215°	0.321	9.773	9.900	0.339	10.893	10.372
40°	0.420	16.749	12.240	0.367	12.827	11.081	220°	0.273	7.059	8.487	0.320	9.707	9.871
45°	0.491	22.880	13.595	0.463	20.380	13.092	225°	0.251	5.994	7.777	0.311	9.202	9.639
50°	0.573	31.165	14.937	0.563	30.076	14.782	230°	0.258	6.313	8.002	0.316	9.515	9.784
55°	0.645	39.540	15.970	0.648	39.950	16.015	235°	0.285	7.695	8.862	0.336	10.747	10.313
60°	0.718	49.033	16.905	0.719	49.132	16.914	240°	0.331	10.383	10.163	0.370	13.033	11.150
65°	0.795	60.065	17.786	0.778	57.476	17.595	245°	0.396	14.878	11.725	0.419	16.649	12.214
70°	0.837	66.553	18.232	0.824	64.562	18.100	250°	0.480	21.892	13.403	0.481	21.985	13.421
75°	0.843	67.582	18.298	0.853	69.119	18.396	255°	0.578	31.754	15.018	0.558	29.545	14.705
80°	0.827	65.038	18.132	0.855	69.421	18.415	260°	0.655	40.696	16.096	0.644	39.367	15.951
85°	0.795	60.096	17.788	0.835	66.245	18.212	265°	0.716	48.728	16.878	0.704	47.063	16.727
90°	0.763	55.350	17.431	0.796	60.145	17.792	270°	0.771	56.483	17.519	0.771	56.474	17.519
95°	0.747	53.050	17.247	0.760	54.882	17.394	275°	0.824	64.479	18.094	0.830	65.478	18.161
100°	0.752	53.724	17.302	0.744	52.620	17.211	280°	0.858	69.898	18.445	0.862	70.669	18.492
105°	0.785	58.585	17.678	0.751	53.563	17.289	285°	0.873	72.377	18.596	0.862	70.653	18.491
110°	0.846	68.045	18.328	0.777	57.338	17.584	290°	0.851	68.764	18.374	0.808	61.992	17.923
115°	0.948	85.442	19.317	0.819	63.646	18.038	295°	0.771	56.461	17.518	0.699	46.439	16.669
120°	1.000	95.000	19.777	0.848	68.353	18.348	300°	0.634	38.189	15.819	0.601	34.303	15.353
125°	0.947	85.201	19.304	0.859	70.162	18.461	305°	0.446	18.912	12.767	0.557	29.498	14.698
130°	0.860	70.318	18.471	0.840	67.079	18.266	310°	0.424	17.039	12.314	0.558	29.553	14.706
135°	0.791	59.433	17.740	0.792	59.628	17.755	315°	0.471	21.053	13.233	0.567	30.565	14.852
140°	0.737	51.552	17.122	0.760	54.935	17.399	320°	0.543	28.033	14.477	0.577	31.593	14.996
145°	0.697	46.209	16.647	0.758	54.522	17.366	325°	0.583	32.245	15.085	0.579	31.801	15.024
150°	0.673	43.067	16.341	0.762	55.207	17.420	330°	0.573	31.227	14.945	0.563	30.059	14.780
155°	0.664	41.917	16.224	0.770	56.381	17.511	335°	0.503	24.072	13.815	0.526	26.319	14.203
160°	0.668	42.443	16.278	0.776	57.194	17.574	340°	0.390	14.428	11.592	0.471	21.066	13.236
165°	0.679	43.862	16.421	0.777	57.351	17.585	345°	0.320	9.713	9.873	0.423	16.973	12.297
170°	0.697	46.182	16.645	0.767	55.828	17.469	350°	0.307	8.937	9.512	0.395	14.789	11.699
175°	0.712	48.223	16.833	0.743	52.476	17.200	355°	0.315	9.405	9.734	0.386	14.177	11.516

Horizontal Polarization:
Maximum: 5.654 (7.523 dB)
Horizontal Plane: 5.654 (7.523 dB)
Maximum ERP: 95.000 kW

Vertical Polarization:
Maximum: 4.269 (6.303 dB)
Horizontal Plane: 4.269 (6.303 dB)
Maximum ERP: 71.731 kW

Total Input Power: 16.804 kW
Reference: WPEG1M.FIG

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

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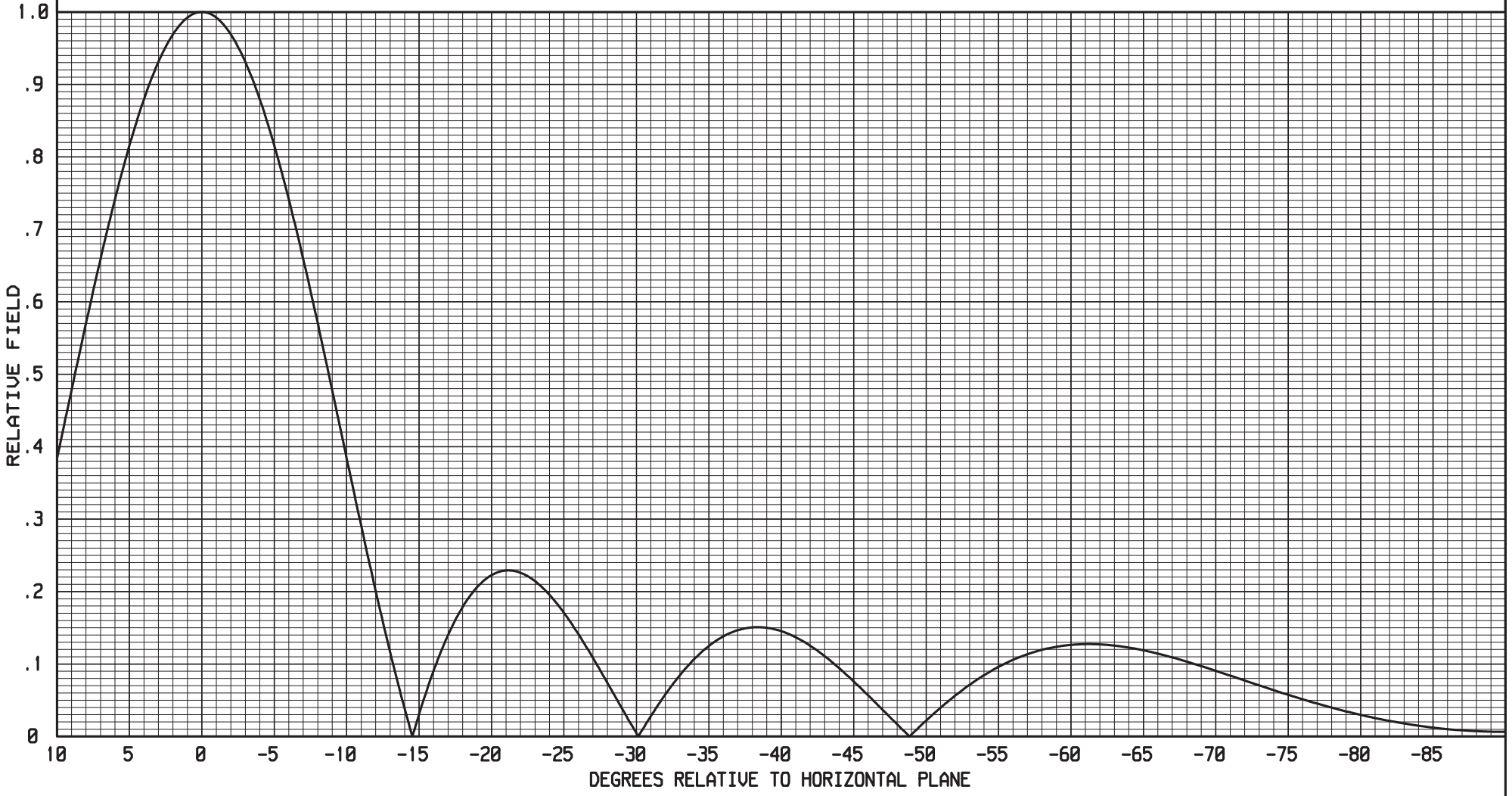
FIGURE 8L

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

8 LEVELS ERI HORIZONTALLY POLARIZED ELEMENTS
0 DEGREE(S) ELECTRICAL BEAM TILT
0 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL

ELEMENT SPACING:
0.5 WAVELENGTH



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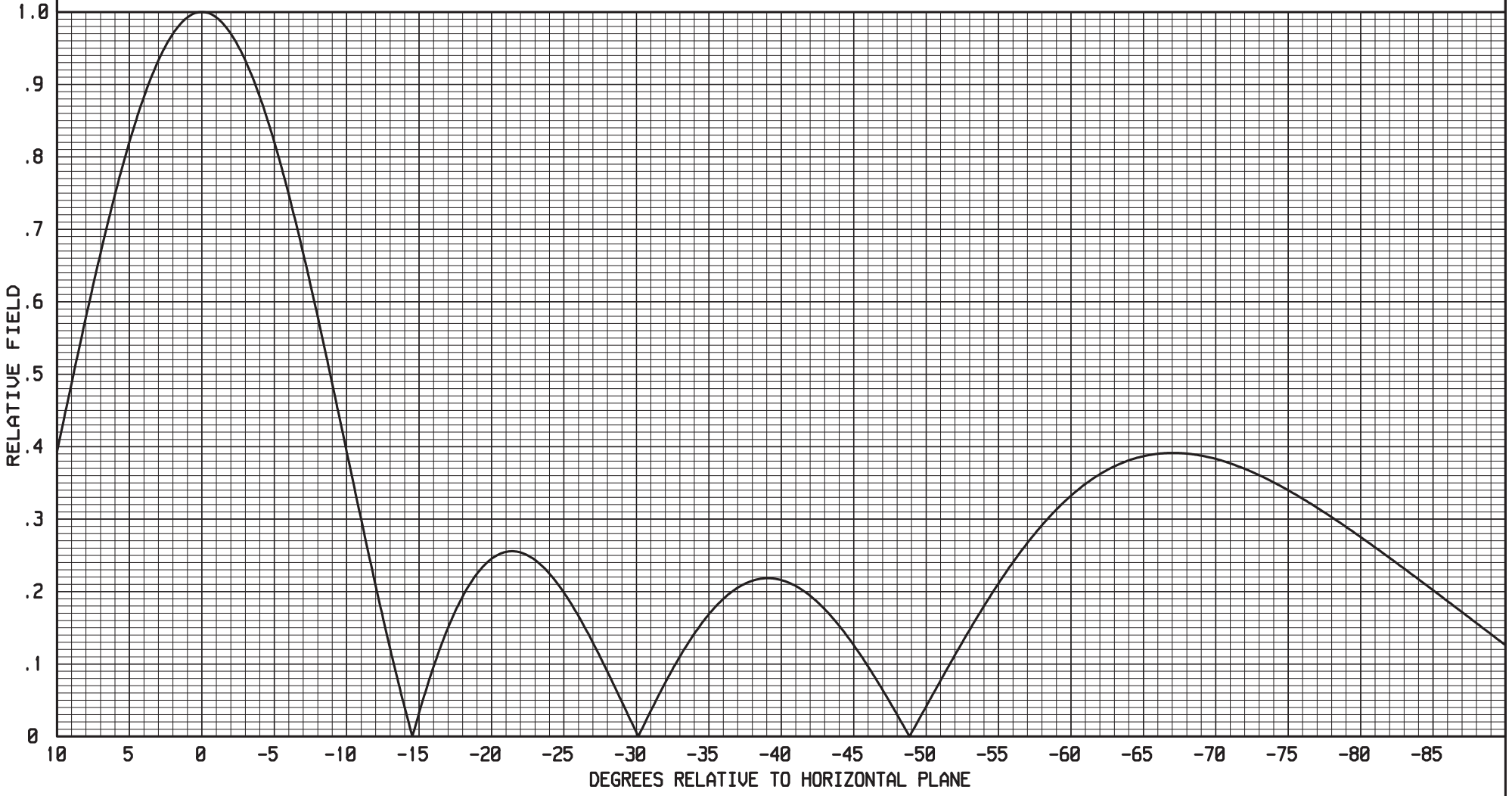
CHANDLER, IN. 47610

FIGURE 4V

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

4 LEVELS ERI VERTICALLY POLARIZED ELEMENTS
0 DEGREE(S) ELECTRICAL BEAM TILT
0 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL

ELEMENT SPACING:
1.0 WAVELENGTH



Directional Antenna System
for
WPEG, Concord, North Carolina

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	1014-4CP-DA
Frequency:	97.9 MHz
Number of Bays:	Four

MECHANICAL SPECIFICATIONS

Mounting:	Standard
System length:	37 ft 3 in
Aperture length required:	47 ft 3 in
Orientation:	345° true

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

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	95.000 kW (19.777 dBk)
Horizontal maximum power gain:	5.654 (7.523 dB)
Maximum vertical ERP:	71.731 kW (18.557 dBk)
Vertical maximum power gain:	4.269 (6.303 dB)
Total input power:	16.804 kW (12.254 dBk)