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 KDZA, Pueblo, Colorado

September 18, 2007

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 KDZA.

The antenna is the ERI model LP-8C-DA-HW-SP configuration. The circular polarized system consists of 8 half-wavelength spaced bays using one driven circular polarized radiating element per bay, two horizontal parasitic elements per bay and four vertical parasitic elements per bay. The antenna was mounted on the North 206 degrees East tower leg with bracketry to provide an antenna orientation of North 169 degrees East. The antenna was tested on a 4' 8 5/8" face tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 107.9 megahertz, which is the center of the FM broadcast channel assigned to KDZA.

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
KDZA, Pueblo, Colorado

(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 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 antenna system includes –2 degrees of beam tilt and 10% first null fill.

The proof-of-performance was accomplished using a 4' 8 5/8" 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.

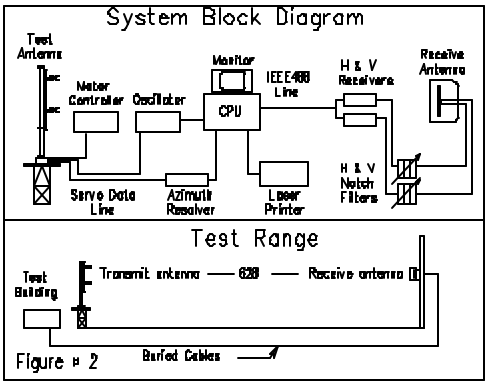


Figure # 2

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 107.9 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.

(Continued)

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 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 8 half-wavelength spaced bays using one driven circular polarized radiating element per bay, two horizontal parasitic elements per bay and four 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 LP-8C-DA-HW-SP array is to be mounted on the North 206 degrees East tower leg of the 4' 8 5/8" face tower at a bearing of North 169 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 32 kilowatts (15.052 dBk).

The power at North 30 degrees East does not exceed 1.10 kilowatts (0.414 dBk).

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

(Continued)

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 51feet 9 in.

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.

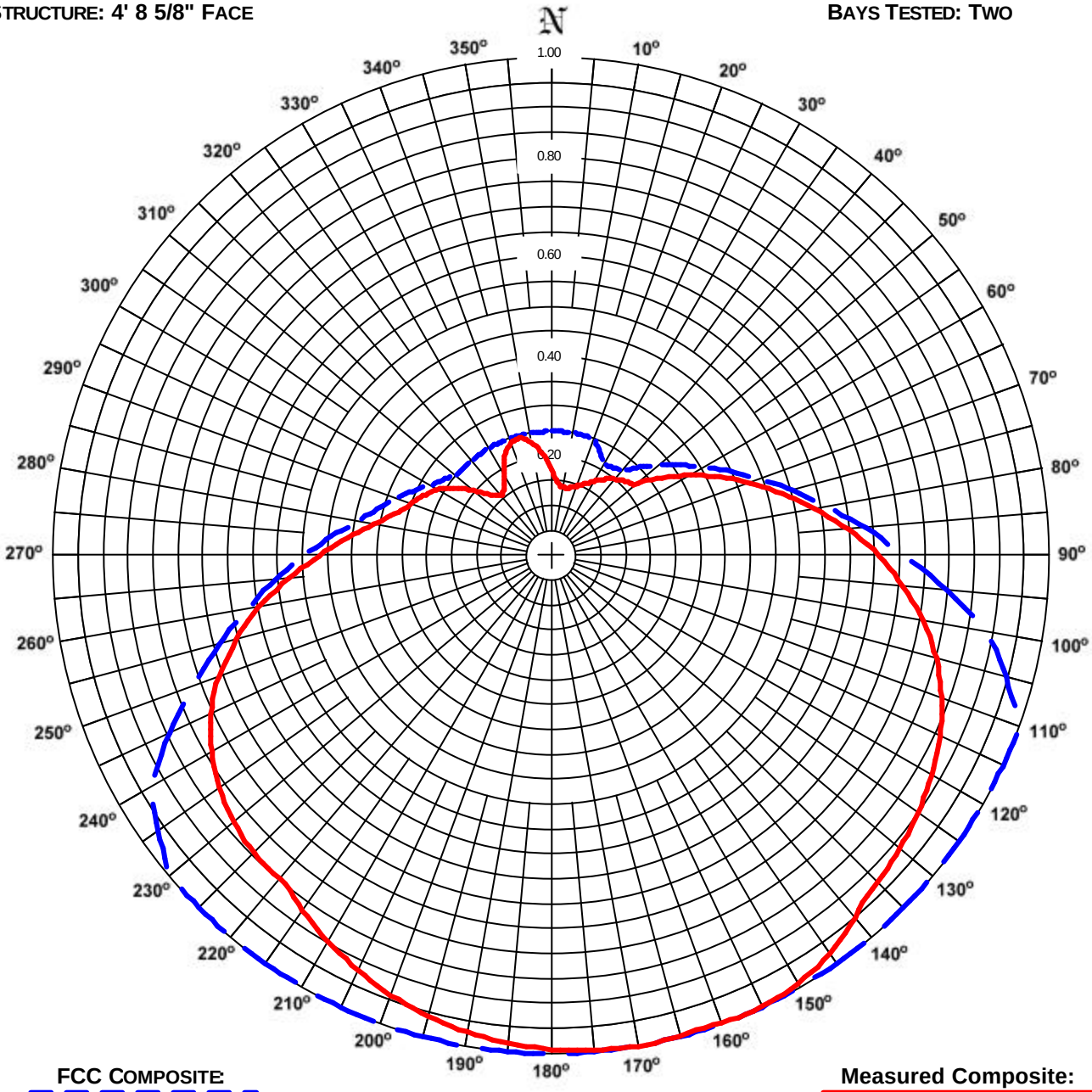
ELECTRONICS RESEARCH, INC.

ERI® Horizontal Plane Relative Field Pattern

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: KDZA
LOCATION: PUEBLO, CO
ANTENNA: LP-8AC-DA-HW-SP
STRUCTURE: 4' 8 5/8" FACE

DATE: 9/15/2007
FREQUENCY: 107.9 MHZ
ORIENTATION: 169° TRUE
MOUNTING: CUSTOM
BAYS TESTED: TWO



FCC COMPOSITE:

RMS: 0.707
MAXIMUM: 1.000 @ 110° TRUE
MINIMUM: 0.211 @ 30° TRUE

Measured Composite:

RMS: 0.650
Maximum: 1.000 @ 157° True
Minimum: 0.140 @ 11° True

COMMENTS: COMPOSITE PATTERN: THIS PATTERN SHOWS THE MAXIMUM OF EITHER THE H OR V AZIMUTH VALUES. THIS PATTERN IS GREATER THAT 85% OF THE FCC FILED COMPOSITE PATTERN BMPH-20070828AAM.

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: KDZA
Location: Pueblo, CO
Frequency: 107.9 MHz

Antenna: LP-8AC-DA-HW-SP
Orientation: 169° True
Tower: 4' 8 5/8" Face

Figure: 1
Date: 9/15/2007
Reference: kdza1m.fig

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0º	0.173	0.75	-1.27	H (and/or) V	180º	0.992	24.59	13.91	H (and/or) V
5º	0.148	0.55	-2.60	H (and/or) V	185º	0.983	24.16	13.83	H (and/or) V
10º	0.140	0.49	-3.11	H (and/or) V	190º	0.971	23.59	13.73	H (and/or) V
15º	0.142	0.50	-2.99	H (and/or) V	195º	0.957	22.88	13.60	H (and/or) V
20º	0.149	0.55	-2.58	H (and/or) V	200º	0.939	22.05	13.43	H (and/or) V
25º	0.159	0.63	-1.99	H (and/or) V	205º	0.919	21.10	13.24	H (and/or) V
30º	0.173	0.75	-1.27	H (and/or) V	210º	0.895	20.04	13.02	H (and/or) V
35º	0.188	0.88	-0.56	H (and/or) V	215º	0.869	18.89	12.76	H (and/or) V
40º	0.201	1.01	0.04	H (and/or) V	220º	0.849	18.00	12.55	H (and/or) V
45º	0.211	1.12	0.48	H (and/or) V	225º	0.844	17.80	12.50	H (and/or) V
50º	0.226	1.28	1.07	H (and/or) V	230º	0.832	17.31	12.38	H (and/or) V
55º	0.274	1.88	2.73	H (and/or) V	235º	0.813	16.53	12.18	H (and/or) V
60º	0.323	2.61	4.17	H (and/or) V	240º	0.787	15.49	11.90	H (and/or) V
65º	0.374	3.49	5.43	H (and/or) V	245º	0.754	14.20	11.52	H (and/or) V
70º	0.426	4.53	6.56	H (and/or) V	250º	0.710	12.60	11.00	H (and/or) V
75º	0.480	5.76	7.61	H (and/or) V	255º	0.656	10.75	10.32	H (and/or) V
80º	0.537	7.22	8.58	H (and/or) V	260º	0.597	8.91	9.50	H (and/or) V
85º	0.598	8.95	9.52	H (and/or) V	265º	0.529	7.00	8.45	H (and/or) V
90º	0.660	10.89	10.37	H (and/or) V	270º	0.466	5.42	7.34	H (and/or) V
95º	0.710	12.61	11.01	H (and/or) V	275º	0.411	4.22	6.26	H (and/or) V
100º	0.760	14.42	11.59	H (and/or) V	280º	0.363	3.30	5.18	H (and/or) V
105º	0.801	16.04	12.05	H (and/or) V	285º	0.326	2.65	4.23	H (and/or) V
110º	0.834	17.41	12.41	H (and/or) V	290º	0.301	2.27	3.55	H (and/or) V
115º	0.861	18.55	12.68	H (and/or) V	295º	0.284	2.02	3.04	H (and/or) V
120º	0.882	19.46	12.89	H (and/or) V	300º	0.265	1.76	2.44	H (and/or) V
125º	0.899	20.21	13.06	H (and/or) V	305º	0.238	1.42	1.52	H (and/or) V
130º	0.914	20.87	13.20	H (and/or) V	310º	0.205	1.05	0.22	H (and/or) V
135º	0.928	21.52	13.33	H (and/or) V	315º	0.173	0.75	-1.23	H (and/or) V
140º	0.949	22.50	13.52	H (and/or) V	320º	0.158	0.62	-2.05	H (and/or) V
145º	0.975	23.77	13.76	H (and/or) V	325º	0.166	0.69	-1.60	H (and/or) V
150º	0.992	24.61	13.91	H (and/or) V	330º	0.192	0.92	-0.36	H (and/or) V
155º	1.000	24.98	13.98	H (and/or) V	335º	0.220	1.21	0.84	H (and/or) V
160º	0.998	24.92	13.97	H (and/or) V	340º	0.240	1.44	1.59	H (and/or) V
165º	0.999	24.94	13.97	H (and/or) V	345º	0.245	1.50	1.75	H (and/or) V
170º	1.000	25.00	13.98	H (and/or) V	350º	0.232	1.35	1.30	H (and/or) V
175º	0.997	24.87	13.96	H (and/or) V	355º	0.207	1.07	0.30	H (and/or) V

Polarization: **Envelope**
Maximum Field: **1.000 @ 157° True**
Minimum Field: **0.140 @ 11° True**
RMS: **0.650**
Maximum ERP: **32.000 kW**
Maximum Power Gain: **5.879 (7.693 dB)**
Horizontal Plane Gain: **5.491 (7.397 dB)**

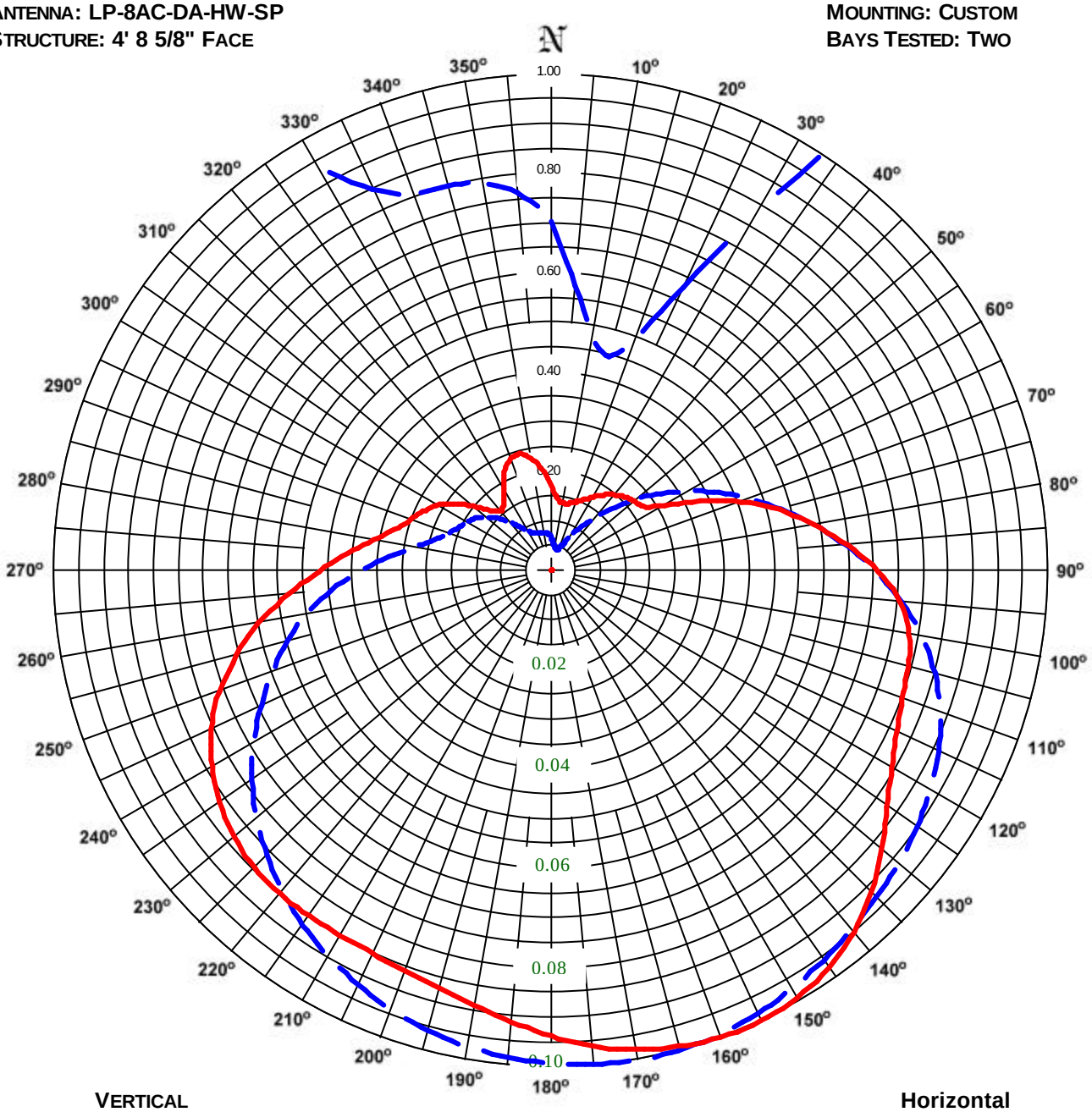
Total Input Power: 5.443kW

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: KDZA
LOCATION: PUEBLO, CO
ANTENNA: LP-8AC-DA-HW-SP
STRUCTURE: 4' 8 5/8" FACE

DATE: 9/15/2007
FREQUENCY: 107.9 MHZ
ORIENTATION: 169° TRUE
MOUNTING: CUSTOM
BAYS TESTED: TWO



VERTICAL

RMS: 0.627
MAXIMUM: 1.000 @ 169° TRUE
MINIMUM: 0.045 @ 15° TRUE

10X Scale

Horizontal

RMS: 0.628
Maximum: 1.000 @ 157° True
Minimum: 0.140 @ 11° True

COMMENTS: MEASURED PATTERNS OF THE HORIZONTAL AND VERTICAL COMPONENTS.

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: KDZA
Location: Pueblo, CO
Frequency: 107.9 MHz

Antenna: LP-8AC-DA-HW-SP
Orientation: 169° True
Tower: 4' 8 5/8" Face

Figure: 2
Date: 9/15/2007
Reference: kdza1m.fig

Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0º	0.173	0.75	-1.27	0.070	0.12	-9.07	180º	0.937	21.94	13.41	0.992	24.59	13.91
5º	0.148	0.55	-2.60	0.058	0.08	-10.82	185º	0.911	20.74	13.17	0.983	24.16	13.83
10º	0.140	0.49	-3.11	0.048	0.06	-12.37	190º	0.888	19.70	12.94	0.971	23.59	13.73
15º	0.142	0.50	-2.99	0.045	0.05	-12.98	195º	0.870	18.90	12.77	0.957	22.88	13.60
20º	0.149	0.55	-2.58	0.050	0.06	-12.08	200º	0.857	18.35	12.64	0.939	22.05	13.43
25º	0.159	0.63	-1.99	0.063	0.10	-10.00	205º	0.849	18.03	12.56	0.919	21.10	13.24
30º	0.173	0.75	-1.27	0.084	0.18	-7.53	210º	0.847	17.94	12.54	0.895	20.04	13.02
35º	0.188	0.88	-0.56	0.111	0.31	-5.13	215º	0.848	17.98	12.55	0.869	18.89	12.76
40º	0.201	1.01	0.04	0.144	0.52	-2.87	220º	0.849	18.00	12.55	0.840	17.64	12.46
45º	0.211	1.12	0.48	0.183	0.83	-0.79	225º	0.844	17.80	12.50	0.808	16.32	12.13
50º	0.219	1.19	0.77	0.226	1.28	1.07	230º	0.832	17.31	12.38	0.773	14.93	11.74
55º	0.227	1.29	1.12	0.274	1.88	2.73	235º	0.813	16.53	12.18	0.734	13.47	11.29
60º	0.265	1.76	2.45	0.323	2.61	4.17	240º	0.787	15.49	11.90	0.691	11.92	10.76
65º	0.332	2.76	4.41	0.374	3.49	5.43	245º	0.754	14.20	11.52	0.644	10.36	10.15
70º	0.409	4.18	6.21	0.426	4.53	6.56	250º	0.710	12.60	11.00	0.597	8.91	9.50
75º	0.476	5.67	7.54	0.480	5.76	7.61	255º	0.656	10.75	10.32	0.550	7.56	8.79
80º	0.537	7.21	8.58	0.537	7.22	8.58	260º	0.597	8.91	9.50	0.499	6.23	7.94
85º	0.598	8.95	9.52	0.596	8.89	9.49	265º	0.529	7.00	8.45	0.443	4.91	6.91
90º	0.660	10.89	10.37	0.655	10.72	10.30	270º	0.466	5.42	7.34	0.385	3.70	5.68
95º	0.706	12.45	10.95	0.710	12.61	11.01	275º	0.411	4.22	6.26	0.328	2.69	4.30
100º	0.733	13.44	11.28	0.760	14.42	11.59	280º	0.363	3.30	5.18	0.280	1.95	2.91
105º	0.745	13.87	11.42	0.801	16.04	12.05	285º	0.326	2.65	4.23	0.243	1.48	1.71
110º	0.753	14.18	11.52	0.834	17.41	12.41	290º	0.301	2.27	3.55	0.220	1.22	0.85
115º	0.768	14.76	11.69	0.861	18.55	12.68	295º	0.284	2.02	3.04	0.207	1.07	0.30
120º	0.793	15.72	11.97	0.882	19.46	12.89	300º	0.265	1.76	2.44	0.197	0.97	-0.12
125º	0.827	17.10	12.33	0.899	20.21	13.06	305º	0.238	1.42	1.52	0.186	0.87	-0.62
130º	0.870	18.91	12.77	0.914	20.87	13.20	310º	0.205	1.05	0.22	0.171	0.73	-1.37
135º	0.913	20.84	13.19	0.928	21.52	13.33	315º	0.173	0.75	-1.23	0.151	0.57	-2.44
140º	0.949	22.50	13.52	0.942	22.20	13.46	320º	0.158	0.62	-2.05	0.130	0.42	-3.77
145º	0.975	23.77	13.76	0.957	22.89	13.60	325º	0.166	0.69	-1.60	0.110	0.30	-5.21
150º	0.992	24.61	13.91	0.971	23.57	13.72	330º	0.192	0.92	-0.36	0.094	0.22	-6.52
155º	1.000	24.98	13.98	0.984	24.19	13.84	335º	0.220	1.21	0.84	0.085	0.18	-7.44
160º	0.998	24.92	13.97	0.993	24.66	13.92	340º	0.240	1.44	1.59	0.081	0.16	-7.85
165º	0.991	24.56	13.90	0.999	24.94	13.97	345º	0.245	1.50	1.75	0.080	0.16	-7.93
170º	0.978	23.93	13.79	1.000	25.00	13.98	350º	0.232	1.35	1.30	0.079	0.16	-8.02
175º	0.960	23.05	13.63	0.997	24.87	13.96	355º	0.207	1.07	0.30	0.076	0.15	-8.36

Polarization:	**Horizontal**	**Vertical**
Maximum Field:	**1.000 @ 157° True**	**1.000 @ 169° True**
Minimum Field:	**0.140 @ 11° True**	**0.045 @ 15° True**
RMS:	**0.628**	**0.627**
Maximum ERP:	**32.000 kW**	**32.000 kW**
Maximum Power Gain:	**5.879 (7.693 dB)**	**5.879 (7.693 dB)**
Horizontal Plane Gain:	**5.491 (7.397 dB)**	**5.491 (7.397 dB)**

Total Input Power: 5.443 kW

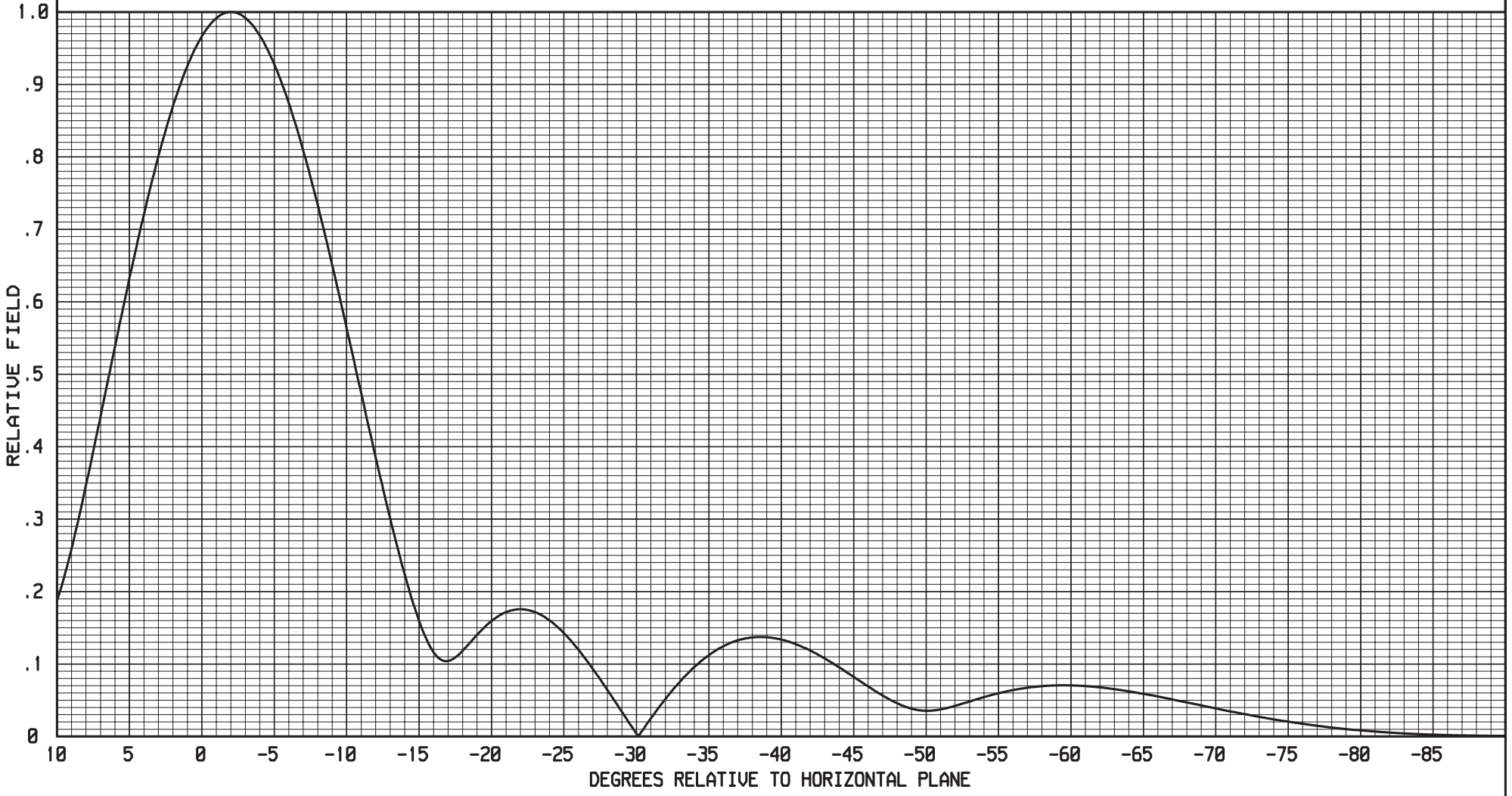
ELECTRONICS RESEARCH,INC.
7777 GARDNER ROAD
CHANDLER, IN. 47610

FIGURE 3

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

8 ERI CENTER FED ROTOTILLER(TM) ELEMENTS
-2.00 DEGREE(S) ELECTRICAL BEAM TILT
10 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL

ELEMENT SPACING:
HALF-WAVE



Directional Antenna System
for
KDZA, Pueblo, Colorado

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	LP-8C-DA-HW-SP
Frequency:	107.9 MHZ
Number of Bays:	eight

MECHANICAL SPECIFICATIONS

Mounting:	Custom
System length:	35 ft 4 in
Aperture length required:	51 ft 9 in
Orientation:	169° true

Input flange to the antenna 1 5/8“ female.

ELECTRICAL SPECIFICATIONS

(For directional use)
(-2 degrees beam tilt & 10% 1st null fill)

Maximum horizontal ERP:	32 kW (15.051 dBk)
Horizontal maximum power gain:	5.879 (7.693 dB)
H pol horizontal plane gain:	5.491 (7.397 dB)
Maximum vertical ERP:	32 kW (15.051 dBk)
Vertical maximum power gain:	5.879 (7.693 dB)
V pol horizontal plane gain:	5.491 (7.397 dB)
Total input power:	5.443 kW (7.350 dBk)