

EXHIBIT E-3  
DIRECTIONAL ANTENNA  
PROOF OF PERFORMANCE  
MEASUREMENTS & REPORT



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  
KCUV, Greenwood Village, Colorado*

May 7, 2007

Electronics Research Inc. is providing a proof of performance to add a station to an existing multiplexed directional antenna system that meets the FCC requirements and the general needs of radio station KCUV.

The antenna is the ERI model 1082-8CP-DA configuration. The circular polarized system consists of eight 92" spaced bays using two driven circular polarized radiating elements per bay. The antenna was tested on a 60" face ERI tower, which is the structure the stations use to support the existing array. All tests were performed on a frequency of 102.3 mhz, which is the center of the FM broadcast channel assigned to KCUV.

The other FM stations that were originally measured and planed to transmitting from this directional antenna are KDJM @ 92.5 MHz, KCTL @ 93.3 MHz, KRFX @ 103.5 MHz, KALC @ 105.9 MHz and KBPI @ 106.7 MHz, KFMD @ 95.7 MHz.

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 KCUV, Greenwood Village, Colorado

(Continued)

## DESCRIPTION OF THE TEST PROCEDURE

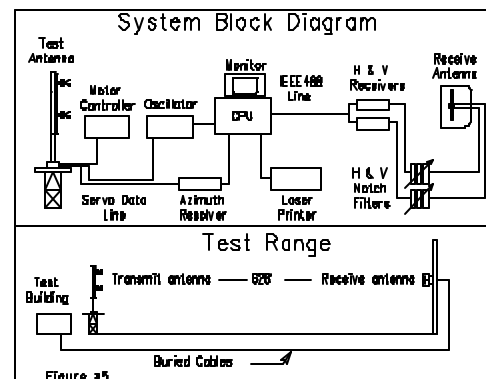
The test antenna consisted of one bay level of the circular polarized system. The elements and brackets that were used in this test are electrical equivalent to those that were supplied with the antenna. The lines were properly grounded during all tests.

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 ERI 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 HP8657D signal generator signal generator. The frequency of the signal source was set at 102.3 MHz and was constantly monitored by a Rohde & Schwarz ESVD 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 a Rohde & Schwarz ESVD measuring receiver.



Directional Antenna System  
For  
KCUV, Greenwood Village, Colorado

(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 coordinated graph paper in a clockwise direction. Both horizontal and vertical components were recorded separately.

### CONCLUSIONS

The circular polarized system consists of eight 92" spaced bays using two driven circular polarized radiating 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 1082-8CP-DA array is to be mounted on the 60" face ERI tower at a bearing of North 51 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. A calculated vertical plane relative field pattern is shown on Figure #3B attached. The power in the maximum will reach 1 kilowatt (0.00 dBk).

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

Directional Antenna System  
For  
KCUV, Greenwood Village, Colorado

(Continued)

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.

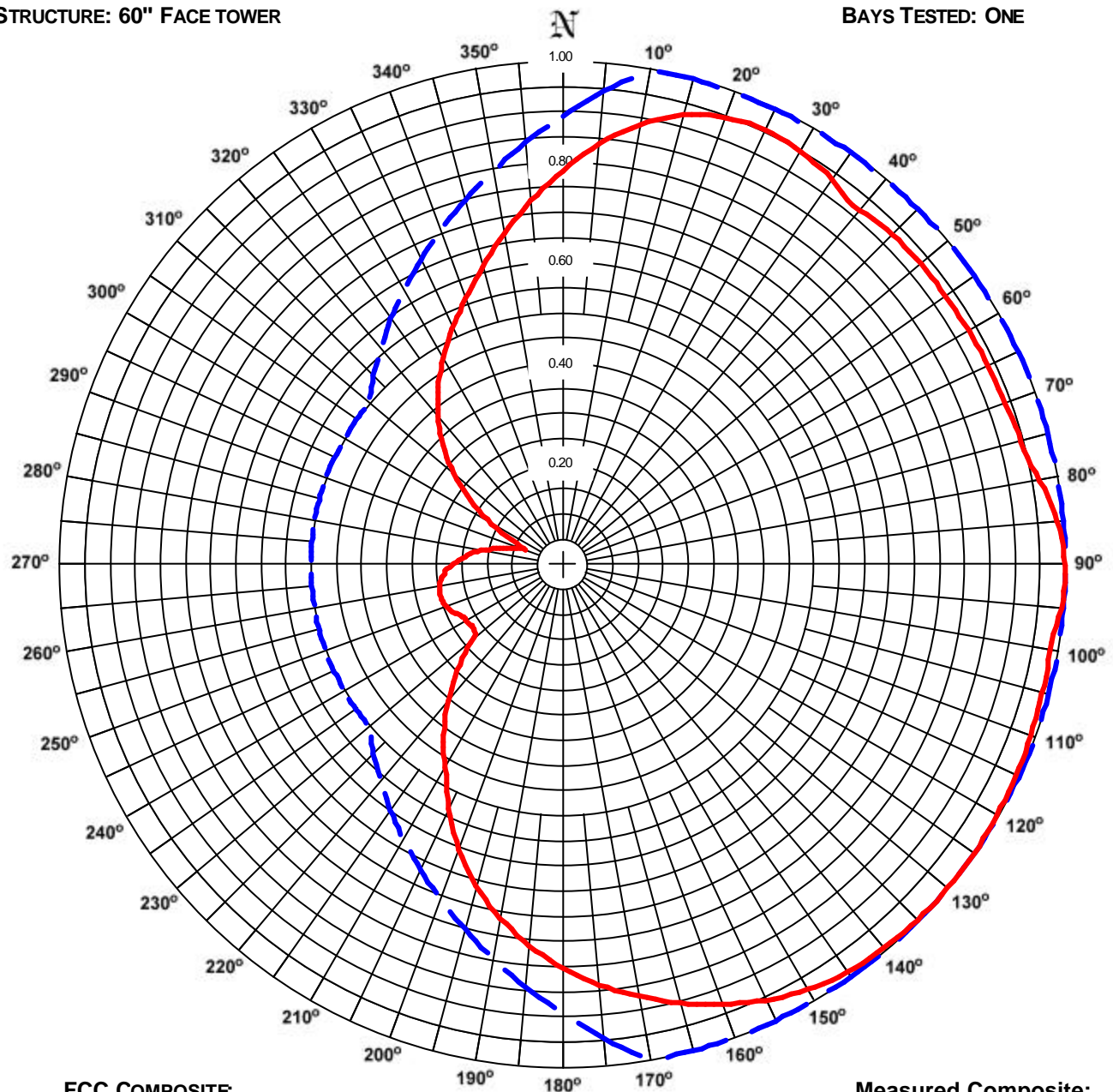
A handwritten signature in black ink, appearing to read "Tom Schaefer". The signature is written in a cursive, flowing style with a large initial "T" and a long, sweeping underline.

# **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: KCUV  
LOCATION: GREENWOOD VILLAGE, CO  
ANTENNA: 1082-8CP-DA  
STRUCTURE: 60" FACE TOWER

DATE: 5/4/2007  
FREQUENCY: 102.3 MHz  
ORIENTATION: 51° TRUE  
MOUNTING: CUSTOM  
BAYS TESTED: ONE



**FCC COMPOSITE**  
RMS: 0.825  
MAXIMUM: 1.000 @ 10° TRUE  
MINIMUM: 0.501 @ 230° TRUE

**Measured Composite:**  
RMS: 0.737  
Maximum: 1.000 @ 91° True  
Minimum: 0.079 @ 293° 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 BPH-20061002BTX.

# ERI<sup>®</sup> *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: KCUV**

**Location: Greenwood Village, CO**

**Frequency: 102.3 MHz**

**Antenna: 1082-8CP-DA**

**Orientation: 51° True**

**Tower: 60" Face tower**

**Figure: 1**

**Date: 5/4/2007**

**Reference: kcu1m.fig**

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0°	0.784	0.62	-2.11	H (and/or) V	180°	0.802	0.64	-1.92	H (and/or) V
5°	0.840	0.71	-1.51	H (and/or) V	185°	0.760	0.58	-2.38	H (and/or) V
10°	0.889	0.79	-1.02	H (and/or) V	190°	0.713	0.51	-2.94	H (and/or) V
15°	0.925	0.86	-0.67	H (and/or) V	195°	0.662	0.44	-3.58	H (and/or) V
20°	0.947	0.90	-0.48	H (and/or) V	200°	0.602	0.36	-4.40	H (and/or) V
25°	0.954	0.91	-0.41	H (and/or) V	205°	0.534	0.29	-5.45	H (and/or) V
30°	0.949	0.90	-0.46	H (and/or) V	210°	0.467	0.22	-6.61	H (and/or) V
35°	0.935	0.87	-0.59	H (and/or) V	215°	0.412	0.17	-7.71	H (and/or) V
40°	0.921	0.85	-0.71	H (and/or) V	220°	0.355	0.13	-9.00	H (and/or) V
45°	0.929	0.86	-0.64	H (and/or) V	225°	0.297	0.09	-10.55	H (and/or) V
50°	0.930	0.86	-0.63	H (and/or) V	230°	0.239	0.06	-12.44	H (and/or) V
55°	0.931	0.87	-0.62	H (and/or) V	235°	0.217	0.05	-13.25	H (and/or) V
60°	0.933	0.87	-0.61	H (and/or) V	240°	0.221	0.05	-13.11	H (and/or) V
65°	0.934	0.87	-0.59	H (and/or) V	245°	0.231	0.05	-12.72	H (and/or) V
70°	0.938	0.88	-0.55	H (and/or) V	250°	0.247	0.06	-12.16	H (and/or) V
75°	0.945	0.89	-0.49	H (and/or) V	255°	0.250	0.06	-12.02	H (and/or) V
80°	0.964	0.93	-0.32	H (and/or) V	260°	0.248	0.06	-12.09	H (and/or) V
85°	0.987	0.97	-0.11	H (and/or) V	265°	0.239	0.06	-12.42	H (and/or) V
90°	1.000	1.00	0.00	H (and/or) V	270°	0.221	0.05	-13.12	H (and/or) V
95°	0.995	0.99	-0.04	H (and/or) V	275°	0.195	0.04	-14.19	H (and/or) V
100°	0.985	0.97	-0.13	H (and/or) V	280°	0.164	0.03	-15.73	H (and/or) V
105°	0.987	0.97	-0.11	H (and/or) V	285°	0.129	0.02	-17.79	H (and/or) V
110°	0.991	0.98	-0.08	H (and/or) V	290°	0.095	0.01	-20.45	H (and/or) V
115°	0.995	0.99	-0.05	H (and/or) V	295°	0.102	0.01	-19.82	H (and/or) V
120°	0.997	0.99	-0.02	H (and/or) V	300°	0.163	0.03	-15.76	H (and/or) V
125°	0.999	1.00	-0.01	H (and/or) V	305°	0.224	0.05	-13.01	H (and/or) V
130°	1.000	1.00	0.00	H (and/or) V	310°	0.282	0.08	-10.99	H (and/or) V
135°	0.999	1.00	-0.01	H (and/or) V	315°	0.336	0.11	-9.46	H (and/or) V
140°	0.995	0.99	-0.04	H (and/or) V	320°	0.386	0.15	-8.26	H (and/or) V
145°	0.988	0.98	-0.10	H (and/or) V	325°	0.431	0.19	-7.30	H (and/or) V
150°	0.975	0.95	-0.22	H (and/or) V	330°	0.475	0.23	-6.46	H (and/or) V
155°	0.955	0.91	-0.40	H (and/or) V	335°	0.518	0.27	-5.71	H (and/or) V
160°	0.930	0.87	-0.63	H (and/or) V	340°	0.563	0.32	-4.99	H (and/or) V
165°	0.902	0.81	-0.89	H (and/or) V	345°	0.614	0.38	-4.24	H (and/or) V
170°	0.872	0.76	-1.19	H (and/or) V	350°	0.669	0.45	-3.49	H (and/or) V
175°	0.839	0.70	-1.53	H (and/or) V	355°	0.726	0.53	-2.78	H (and/or) V

**Polarization:**

**Maximum Field:**

**Minimum Field:**

**RMS:**

**Maximum ERP:**

**Maximum Power Gain:**

**Envelope**

**1.000 @ 91° True**

**0.079 @ 293° True**

**0.737**

**1.000 kW**

**7.422 (8.7058 dB)**

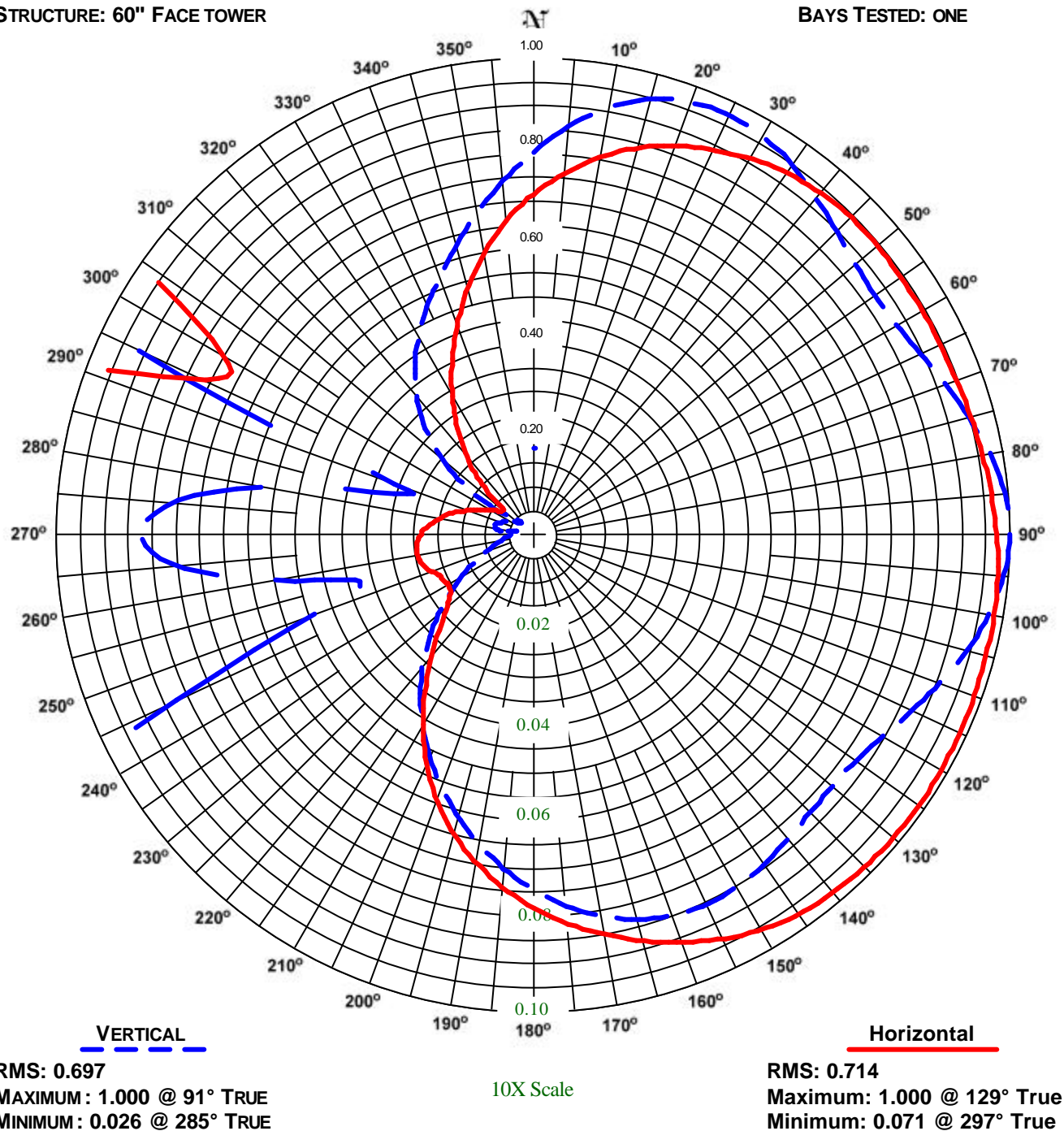
**Total Input Power: 0.135 kW**

# **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: KCUV  
LOCATION: GREENWOOD VILLAGE, CO  
ANTENNA: 1082-8CP-DA  
STRUCTURE: 60" FACE TOWER

DATE: 5/4/2007  
FREQUENCY: 102.3 MHz  
ORIENTATION: 51° TRUE  
MOUNTING: CUSTOM  
BAYS TESTED: ONE



COMMENTS: MEASURED PATTERNS OF THE HORIZONTAL AND VERTICAL COMPONENTS.

# ERI<sup>®</sup> *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: KCUV**

**Location: Greenwood Village, CO**

**Frequency: 102.3 MHz**

**Antenna: 1082-8CP-DA**

**Orientation: 51° True**

**Tower: 60" Face tower**

**Figure: 2**

**Date: 5/4/2007**

**Reference: kcuvm1m.fig**

Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.695	0.48	-3.16	0.784	0.62	-2.11	180°	0.802	0.64	-1.92	0.764	0.58	-2.34
5°	0.742	0.55	-2.59	0.840	0.71	-1.51	185°	0.760	0.58	-2.38	0.722	0.52	-2.83
10°	0.784	0.61	-2.12	0.889	0.79	-1.02	190°	0.713	0.51	-2.94	0.675	0.46	-3.42
15°	0.819	0.67	-1.73	0.925	0.86	-0.67	195°	0.662	0.44	-3.58	0.625	0.39	-4.08
20°	0.848	0.72	-1.43	0.947	0.90	-0.48	200°	0.602	0.36	-4.40	0.574	0.33	-4.82
25°	0.872	0.76	-1.19	0.954	0.91	-0.41	205°	0.534	0.29	-5.45	0.522	0.27	-5.65
30°	0.893	0.80	-0.99	0.949	0.90	-0.46	210°	0.462	0.21	-6.71	0.467	0.22	-6.61
35°	0.909	0.83	-0.83	0.935	0.87	-0.59	215°	0.389	0.15	-8.20	0.412	0.17	-7.71
40°	0.921	0.85	-0.71	0.913	0.83	-0.79	220°	0.321	0.10	-9.87	0.355	0.13	-9.00
45°	0.929	0.86	-0.64	0.891	0.79	-1.01	225°	0.264	0.07	-11.56	0.297	0.09	-10.55
50°	0.930	0.86	-0.63	0.874	0.76	-1.17	230°	0.228	0.05	-12.83	0.239	0.06	-12.44
55°	0.931	0.87	-0.62	0.865	0.75	-1.26	235°	0.217	0.05	-13.25	0.182	0.03	-14.81
60°	0.933	0.87	-0.61	0.868	0.75	-1.22	240°	0.221	0.05	-13.11	0.126	0.02	-17.99
65°	0.934	0.87	-0.59	0.883	0.78	-1.08	245°	0.231	0.05	-12.72	0.073	0.01	-22.69
70°	0.938	0.88	-0.55	0.909	0.83	-0.83	250°	0.247	0.06	-12.16	0.041	0.00	-27.83
75°	0.945	0.89	-0.49	0.936	0.88	-0.57	255°	0.250	0.06	-12.02	0.044	0.00	-27.15
80°	0.953	0.91	-0.42	0.964	0.93	-0.32	260°	0.248	0.06	-12.09	0.063	0.00	-23.96
85°	0.962	0.92	-0.34	0.987	0.97	-0.11	265°	0.239	0.06	-12.42	0.079	0.01	-22.10
90°	0.971	0.94	-0.26	1.000	1.00	0.00	270°	0.221	0.05	-13.12	0.082	0.01	-21.73
95°	0.979	0.96	-0.18	0.995	0.99	-0.04	275°	0.195	0.04	-14.19	0.071	0.01	-22.94
100°	0.985	0.97	-0.13	0.978	0.96	-0.19	280°	0.164	0.03	-15.73	0.046	0.00	-26.68
105°	0.987	0.97	-0.11	0.953	0.91	-0.42	285°	0.129	0.02	-17.79	0.026	0.00	-31.65
110°	0.991	0.98	-0.08	0.922	0.85	-0.70	290°	0.095	0.01	-20.45	0.050	0.00	-26.01
115°	0.995	0.99	-0.05	0.889	0.79	-1.02	295°	0.073	0.01	-22.76	0.102	0.01	-19.82
120°	0.997	0.99	-0.02	0.862	0.74	-1.29	300°	0.078	0.01	-22.16	0.163	0.03	-15.76
125°	0.999	1.00	-0.01	0.842	0.71	-1.50	305°	0.107	0.01	-19.40	0.224	0.05	-13.01
130°	1.000	1.00	0.00	0.832	0.69	-1.60	310°	0.147	0.02	-16.67	0.282	0.08	-10.99
135°	0.999	1.00	-0.01	0.835	0.70	-1.57	315°	0.191	0.04	-14.36	0.336	0.11	-9.46
140°	0.995	0.99	-0.04	0.845	0.71	-1.47	320°	0.238	0.06	-12.47	0.386	0.15	-8.26
145°	0.988	0.98	-0.10	0.858	0.74	-1.33	325°	0.288	0.08	-10.81	0.431	0.19	-7.30
150°	0.975	0.95	-0.22	0.869	0.75	-1.22	330°	0.342	0.12	-9.32	0.475	0.23	-6.46
155°	0.955	0.91	-0.40	0.873	0.76	-1.18	335°	0.400	0.16	-7.97	0.518	0.27	-5.71
160°	0.930	0.87	-0.63	0.869	0.76	-1.22	340°	0.460	0.21	-6.74	0.563	0.32	-4.99
165°	0.902	0.81	-0.89	0.855	0.73	-1.36	345°	0.522	0.27	-5.64	0.614	0.38	-4.24
170°	0.872	0.76	-1.19	0.832	0.69	-1.59	350°	0.584	0.34	-4.68	0.669	0.45	-3.49
175°	0.839	0.70	-1.53	0.801	0.64	-1.93	355°	0.642	0.41	-3.85	0.726	0.53	-2.78

**Polarization:**

**Maximum Field:**

**Minimum Field:**

**RMS:**

**Maximum ERP:**

**Maximum Power Gain:**

**Horizontal**

**1.000 @ 129° True**

**0.071 @ 297° True**

**0.714**

**1.000 kW**

**7.422 (8.7058 dB)**

**Vertical**

**1.000 @ 91° True**

**0.026 @ 285° True**

**0.697**

**1.000 kW**

**7.422 (8.7058 dB)**

**Total Input Power: 0.135 kW**



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

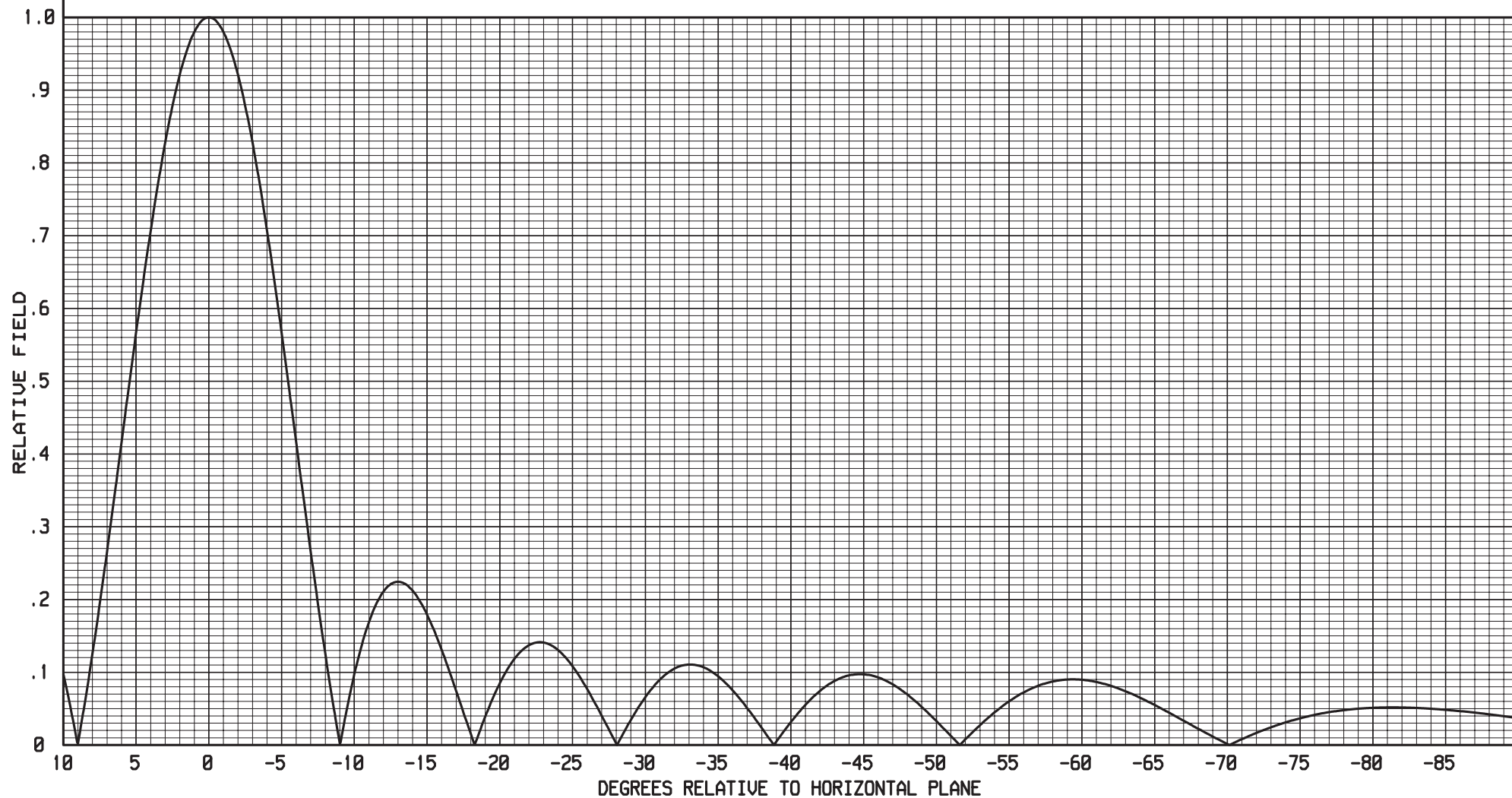
FIGURE 3

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

ERI TYPE 1082-8CP-DA ANTENNA  
0 DEGREE BEAM TILT  
0 PERCENT NULL FILL

102.3 MHz.

BAY SPACING:  
92.00 INCHES



# Directional Antenna System for KCUV, Greenwood Village, Colorado

(Continued)

## ANTENNA SPECIFICATIONS

Antenna Type:	1082-8CP-DA
Frequency:	102.3 MHz
Number of Bays:	eight

## MECHANICAL SPECIFICATIONS

Mounting:	Custom
System length:	61.33 ft
Orientation:	51° true
Input flange to the antenna	6 1/8 inch female

## ELECTRICAL SPECIFICATIONS

(For directional use)

Maximum horizontal ERP:	1 kW (0.00 dBk)
Horizontal maximum power gain:	7.422 (8.7058 dB)
Maximum vertical ERP:	1 kW (0.00 dBk)
Vertical maximum power gain:	7.422 (8.7058 dB)
Total input power:	0.135 kW (-8.705 dBk)

