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 KLVK, Fountain Hills, Arizona

April 27, 2010

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 KLVK.

The antenna is the ERI model 1094-1CP-DA configuration. The circular polarized system consists of 4 full-wavelength spaced bays using one driven circular polarized radiating element. The antenna was mounted on the North 165 degrees East tower leg with bracketry to provide an antenna orientation of North 126 degrees East. The antenna was tested on a 48" face tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 89.1 megahertz, which is the center of the FM broadcast channel assigned to KLVK.

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
KLVK, Fountain Hills, Arizona

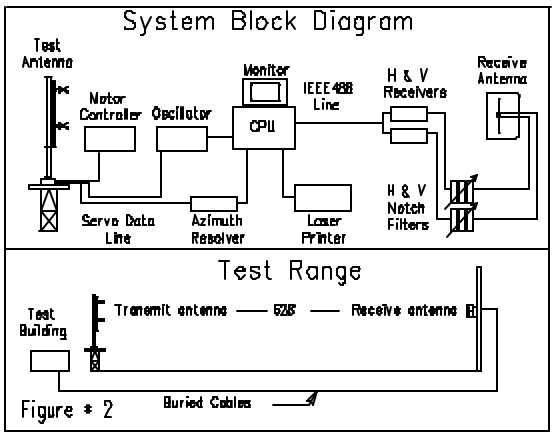
(Continued)

DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of two bay levels 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. 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 48" 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.



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 89.1 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 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 one driven circular polarized radiating element. 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 1094-1CP-DA array is to be mounted on the North 165 degrees East tower leg of the 48" face tower at a bearing of North 126 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 30 kilowatts (14.771 dBk).

The power at North 0 degrees East does not exceed 0.95 kilowatts (-0.223 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
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(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 53 feet.

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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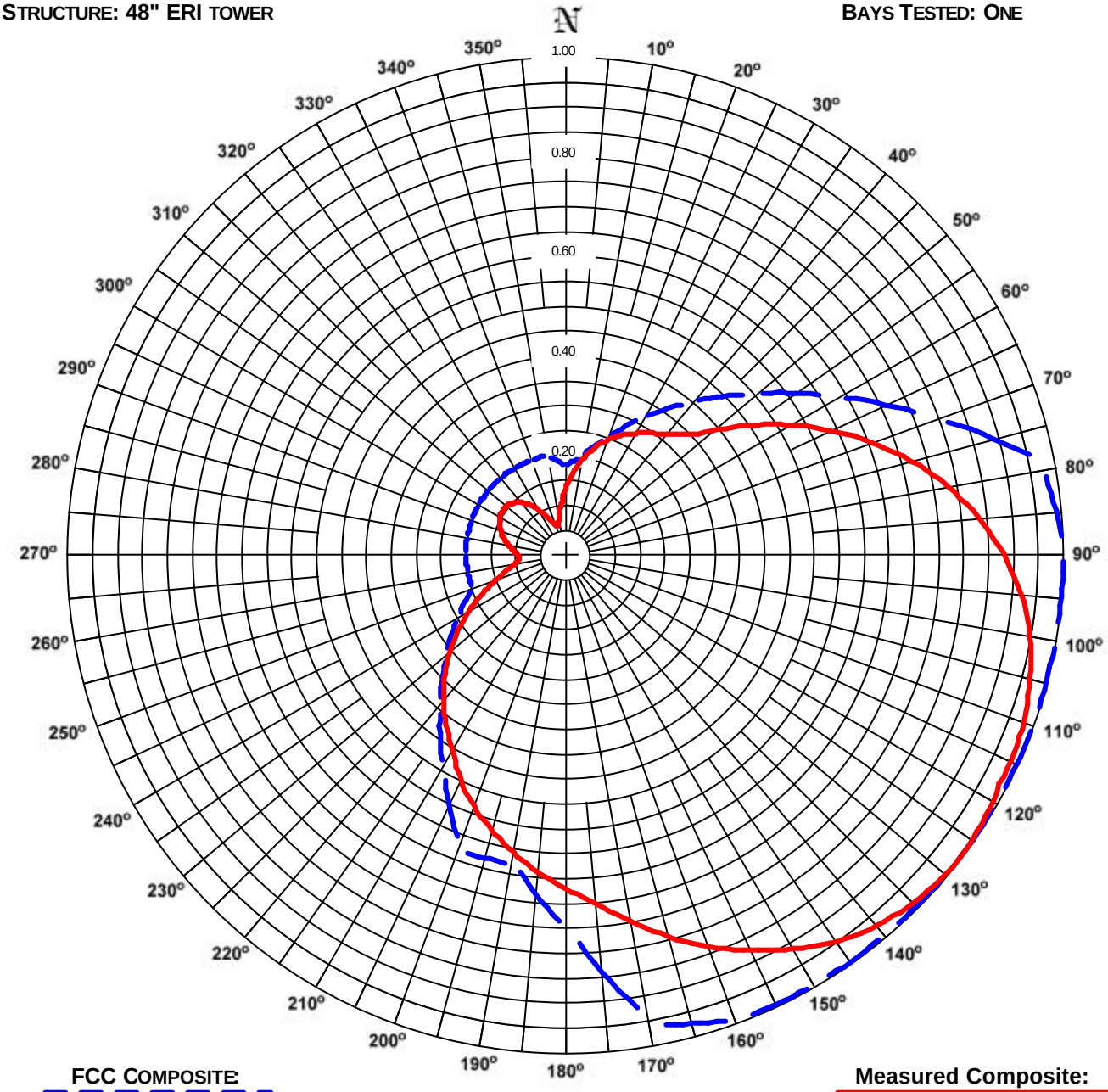
FIGURE NO: 1
STATION: KLVK
LOCATION: FOUNTAIN HILLS, AZ
ANTENNA: 1091-4CP-DA
STRUCTURE: 48" ERI TOWER

DATE: 4/9/2010
FREQUENCY: 89.1 MHZ
ORIENTATION: 126° TRUE
MOUNTING: CUSTOM
BAYS TESTED: ONE



FCC COMPOSITE:

RMS: 0.620
MAXIMUM: 1.000 @ 89° TRUE
MINIMUM: 0.178 @ 0° TRUE

Measured Composite:

RMS: 0.557
Maximum: 1.000 @ 127° True
Minimum: 0.058 @ 343° 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.

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: KLVK
Location: Fountain Hills, AZ
Frequency: 89.1 MHz

Antenna: 1091-4CP-DA
Orientation: 126° True
Tower: 48" ERI tower

Figure: 1
Date: 4/9/2010
Reference: klvk1m.fig

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0º	0.130	0.51	-2.96	Horizontal	180º	0.673	13.60	11.34	Vertical
5º	0.161	0.78	-1.07	Horizontal	185º	0.643	12.39	10.93	Vertical
10º	0.191	1.10	0.40	Horizontal	190º	0.608	11.10	10.45	Vertical
15º	0.218	1.43	1.55	Horizontal	195º	0.574	9.89	9.95	Vertical
20º	0.241	1.75	2.43	Horizontal	200º	0.539	8.72	9.41	Vertical
25º	0.262	2.05	3.12	Horizontal	205º	0.500	7.49	8.75	Vertical
30º	0.279	2.33	3.67	Horizontal	210º	0.454	6.18	7.91	Vertical
35º	0.295	2.62	4.18	Horizontal	215º	0.419	5.26	7.21	Horizontal
40º	0.314	2.96	4.72	Horizontal	220º	0.382	4.38	6.41	Horizontal
45º	0.340	3.46	5.39	Horizontal	225º	0.342	3.50	5.45	Horizontal
50º	0.382	4.39	6.42	Vertical	230º	0.301	2.72	4.34	Horizontal
55º	0.448	6.03	7.80	Vertical	235º	0.259	2.02	3.05	Horizontal
60º	0.517	8.01	9.03	Vertical	240º	0.218	1.42	1.53	Horizontal
65º	0.586	10.30	10.13	Vertical	245º	0.178	0.96	-0.20	Horizontal
70º	0.654	12.82	11.08	Vertical	250º	0.144	0.62	-2.06	Horizontal
75º	0.718	15.46	11.89	Vertical	255º	0.117	0.41	-3.88	Horizontal
80º	0.779	18.20	12.60	Vertical	260º	0.100	0.30	-5.25	Horizontal
85º	0.832	20.79	13.18	Vertical	265º	0.095	0.27	-5.70	Horizontal
90º	0.879	23.18	13.65	Vertical	270º	0.099	0.29	-5.34	Horizontal
95º	0.918	25.30	14.03	Vertical	275º	0.108	0.35	-4.57	Horizontal
100º	0.947	26.88	14.29	Vertical	280º	0.119	0.42	-3.72	Horizontal
105º	0.966	28.02	14.47	Vertical	285º	0.130	0.51	-2.96	Horizontal
110º	0.980	28.80	14.59	Vertical	290º	0.139	0.58	-2.38	Horizontal
115º	0.987	29.20	14.65	Vertical	295º	0.146	0.64	-1.93	Horizontal
120º	0.992	29.50	14.70	Horizontal	300º	0.151	0.69	-1.63	Horizontal
125º	0.999	29.94	14.76	Horizontal	305º	0.153	0.70	-1.55	Horizontal
130º	0.999	29.93	14.76	Horizontal	310º	0.151	0.68	-1.66	Horizontal
135º	0.990	29.42	14.69	Horizontal	315º	0.144	0.63	-2.04	Horizontal
140º	0.975	28.52	14.55	Horizontal	320º	0.133	0.53	-2.77	Horizontal
145º	0.951	27.11	14.33	Horizontal	325º	0.117	0.41	-3.88	Horizontal
150º	0.918	25.26	14.02	Horizontal	330º	0.098	0.29	-5.44	Horizontal
155º	0.880	23.25	13.66	Horizontal	335º	0.077	0.18	-7.52	Horizontal
160º	0.840	21.18	13.26	Horizontal	340º	0.061	0.11	-9.54	Horizontal
165º	0.797	19.04	12.80	Horizontal	345º	0.059	0.10	-9.79	Horizontal
170º	0.750	16.88	12.27	Horizontal	350º	0.074	0.17	-7.79	Horizontal
175º	0.706	14.95	11.75	Vertical	355º	0.100	0.30	-5.26	Horizontal

Polarization: **Envelope**
Maximum Field: **1.000 @ 127° True**
Minimum Field: **0.058 @ 343° True**
RMS: **0.557**
Maximum ERP: **30.000 kW**
Maximum Power Gain: **6.903 (8.390 dB)**

Total Input Power: 4.346 kW

ERI® Horizontal Plane Relative Field Pattern

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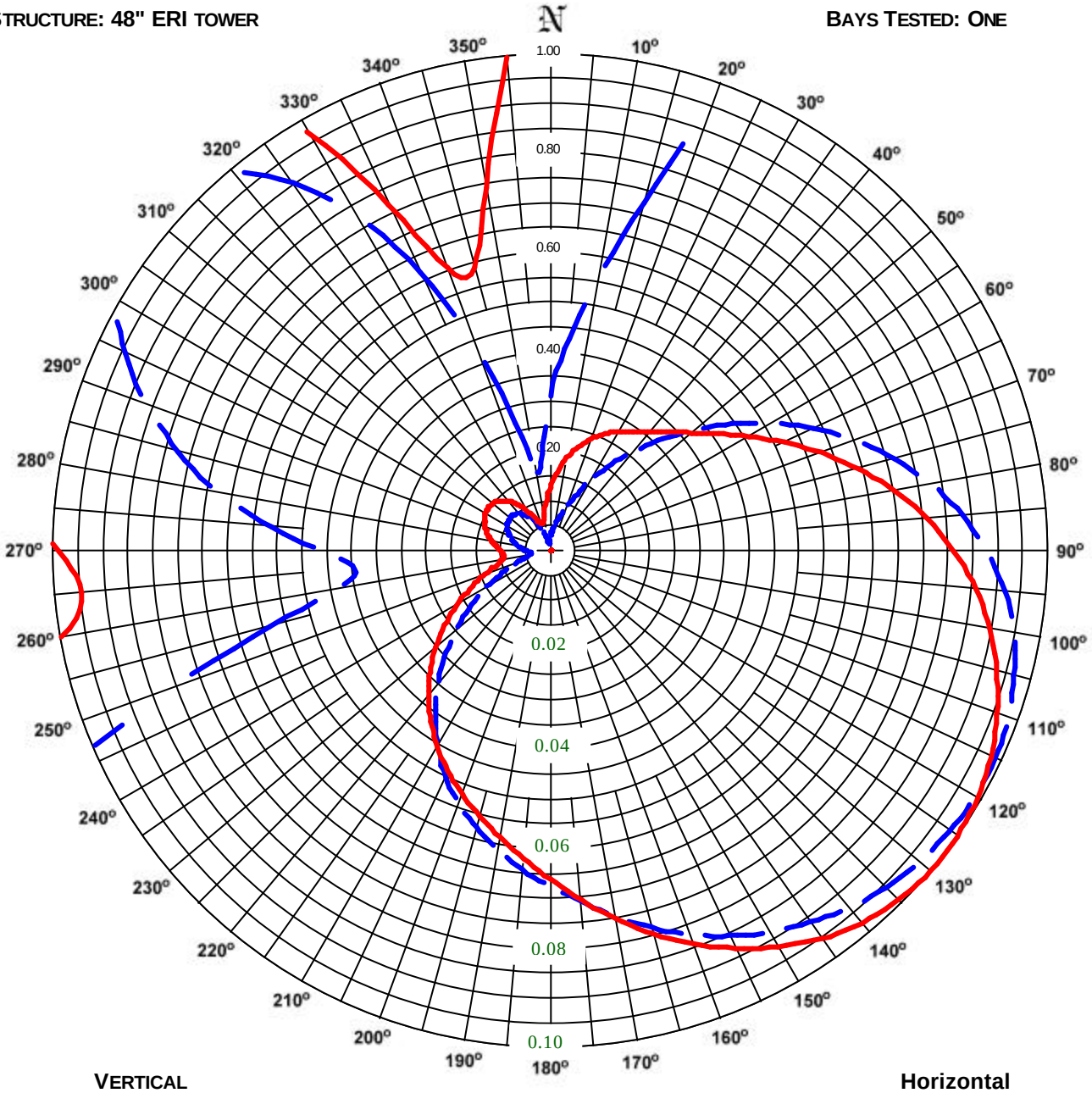
FIGURE NO: 2
STATION: KLVK
LOCATION: FOUNTAIN HILLS, AZ
ANTENNA: 1091-4CP-DA
STRUCTURE: 48" ERI TOWER

DATE: 4/9/2010
FREQUENCY: 89.1 MHZ
ORIENTATION: 126° TRUE
MOUNTING: CUSTOM
BAYS TESTED: ONE



VERTICAL

RMS: 0.542
MAXIMUM: 0.987 @ 117° TRUE
MINIMUM: 0.016 @ 351° TRUE

10X Scale

Horizontal

RMS: 0.542
Maximum: 1.000 @ 127° True
Minimum: 0.058 @ 343° 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: KLVK
Location: Fountain Hills, AZ
Frequency: 89.1 MHz

Antenna: 1091-4CP-DA
Orientation: 126° True
Tower: 48" ERI tower

Figure: 2
Date: 4/9/2010
Reference: klvk1m.fig

Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.130	0.51	-2.96	0.031	0.03	-15.30	180°	0.659	13.03	11.15	0.673	13.60	11.34
5°	0.161	0.78	-1.07	0.043	0.06	-12.53	185°	0.619	11.49	10.60	0.643	12.39	10.93
10°	0.191	1.10	0.40	0.056	0.09	-10.33	190°	0.583	10.20	10.08	0.608	11.10	10.45
15°	0.218	1.43	1.55	0.073	0.16	-8.01	195°	0.550	9.08	9.58	0.574	9.89	9.95
20°	0.241	1.75	2.43	0.097	0.28	-5.50	200°	0.519	8.08	9.08	0.539	8.72	9.41
25°	0.262	2.05	3.12	0.128	0.49	-3.07	205°	0.487	7.12	8.53	0.500	7.49	8.75
30°	0.279	2.33	3.67	0.168	0.85	-0.72	210°	0.454	6.17	7.91	0.454	6.18	7.91
35°	0.295	2.62	4.18	0.214	1.38	1.40	215°	0.419	5.26	7.21	0.404	4.90	6.90
40°	0.314	2.96	4.72	0.265	2.11	3.25	220°	0.382	4.38	6.41	0.353	3.75	5.74
45°	0.340	3.46	5.39	0.321	3.08	4.89	225°	0.342	3.50	5.45	0.301	2.73	4.36
50°	0.372	4.15	6.18	0.382	4.39	6.42	230°	0.301	2.72	4.34	0.248	1.85	2.68
55°	0.413	5.11	7.09	0.448	6.03	7.80	235°	0.259	2.02	3.05	0.200	1.20	0.80
60°	0.462	6.41	8.07	0.517	8.01	9.03	240°	0.218	1.42	1.53	0.154	0.72	-1.45
65°	0.519	8.07	9.07	0.586	10.30	10.13	245°	0.178	0.96	-0.20	0.113	0.39	-4.13
70°	0.580	10.09	10.04	0.654	12.82	11.08	250°	0.144	0.62	-2.06	0.081	0.20	-7.01
75°	0.643	12.39	10.93	0.718	15.46	11.89	255°	0.117	0.41	-3.88	0.058	0.10	-9.92
80°	0.704	14.87	11.72	0.779	18.20	12.60	260°	0.100	0.30	-5.25	0.044	0.06	-12.41
85°	0.762	17.41	12.41	0.832	20.79	13.18	265°	0.095	0.27	-5.70	0.040	0.05	-13.29
90°	0.814	19.87	12.98	0.879	23.18	13.65	270°	0.099	0.29	-5.34	0.046	0.06	-12.02
95°	0.859	22.15	13.45	0.918	25.30	14.03	275°	0.108	0.35	-4.57	0.056	0.09	-10.23
100°	0.897	24.16	13.83	0.947	26.88	14.29	280°	0.119	0.42	-3.72	0.068	0.14	-8.63
105°	0.930	25.92	14.14	0.966	28.02	14.47	285°	0.130	0.51	-2.96	0.078	0.18	-7.44
110°	0.956	27.44	14.38	0.980	28.80	14.59	290°	0.139	0.58	-2.38	0.086	0.22	-6.51
115°	0.978	28.67	14.57	0.987	29.20	14.65	295°	0.146	0.64	-1.93	0.094	0.27	-5.74
120°	0.992	29.50	14.70	0.986	29.17	14.65	300°	0.151	0.69	-1.63	0.101	0.30	-5.16
125°	0.999	29.94	14.76	0.980	28.84	14.60	305°	0.153	0.70	-1.55	0.104	0.33	-4.88
130°	0.999	29.93	14.76	0.969	28.18	14.50	310°	0.151	0.68	-1.66	0.106	0.34	-4.70
135°	0.990	29.42	14.69	0.955	27.35	14.37	315°	0.144	0.63	-2.04	0.105	0.33	-4.82
140°	0.975	28.52	14.55	0.936	26.25	14.19	320°	0.133	0.53	-2.77	0.099	0.30	-5.28
145°	0.951	27.11	14.33	0.910	24.87	13.96	325°	0.117	0.41	-3.88	0.090	0.25	-6.11
150°	0.918	25.26	14.02	0.884	23.45	13.70	330°	0.098	0.29	-5.44	0.078	0.18	-7.38
155°	0.880	23.25	13.66	0.853	21.83	13.39	335°	0.077	0.18	-7.52	0.062	0.11	-9.39
160°	0.840	21.18	13.26	0.820	20.18	13.05	340°	0.061	0.11	-9.54	0.044	0.06	-12.36
165°	0.797	19.04	12.80	0.783	18.39	12.65	345°	0.059	0.10	-9.79	0.027	0.02	-16.67
170°	0.750	16.88	12.27	0.745	16.63	12.21	350°	0.074	0.17	-7.79	0.016	0.01	-20.90
175°	0.703	14.84	11.72	0.706	14.95	11.75	355°	0.100	0.30	-5.26	0.020	0.01	-19.33

Polarization:	**Horizontal**	**Vertical**
Maximum Field:	**1.000 @ 127° True**	**0.987 @ 117° True**
Minimum Field:	**0.058 @ 343° True**	**0.016 @ 351° True**
RMS:	**0.542**	**0.542**
Maximum ERP:	**30.000 kW**	**29.234 kW**
Maximum Power Gain:	**6.903 (8.390 dB)**	**6.754 (8.290 dB)**

Total Input Power: 4.346 kW

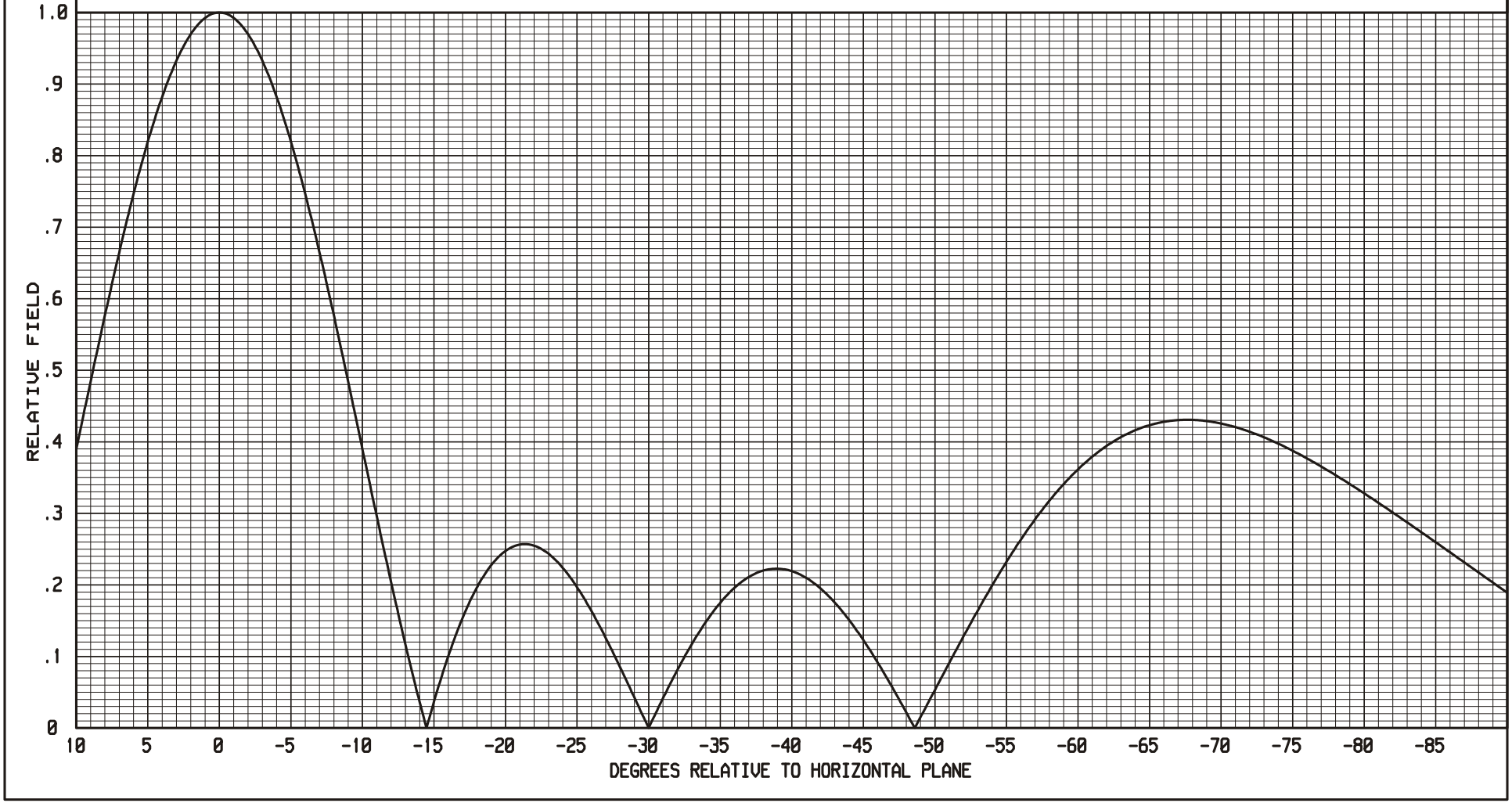
ELECTRONICS RESEARCH,INC.
7777 GARDNER ROAD
CHANDLER, IN. 47610

FIGURE 3

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

ERI TYPE 1091-4CP-DA BROADCAST ANTENNA
+0.00 DEGREE(S) BEAM TILT
0 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL

BAY SPACING:
FULL-WAVE



Directional Antenna System
for
KLVK, Fountain Hills, Arizona

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	1091-4CP-DA
Frequency:	89.1 MHz
Number of Bays:	Four

MECHANICAL SPECIFICATIONS

Mounting:	Custom
System length:	44 ft
Aperture length required:	53 ft
Orientation:	126° true

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

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	30.000 kW (14.771 dBk)
Horizontal maximum power gain:	6.903 (8.39 dB)
Maximum vertical ERP:	29.354 kW (14.677 dBk)
Vertical maximum power gain:	6.754 (8.296 dB)
Total input power:	4.346 kW (6.381 dBk)