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 KPCC, Pasadena, California

February 6, 2013

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 KPCC.

The antenna is the ERI model LP-4C-DA-HW configuration. The circular polarized system consists of 4 half-wavelength spaced bays using one driven circular polarized radiating element per bay and two horizontal parasitic elements per bay. The antenna was tested on a 14" o.d. pole, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 89.3 megahertz, which is the center of the FM broadcast channel assigned to KPCC.

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
KPCC, Pasadena, California

(Continued)

DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of two bay levels of the circular polarized system with the associated horizontal 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 14" o.d. pole 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.

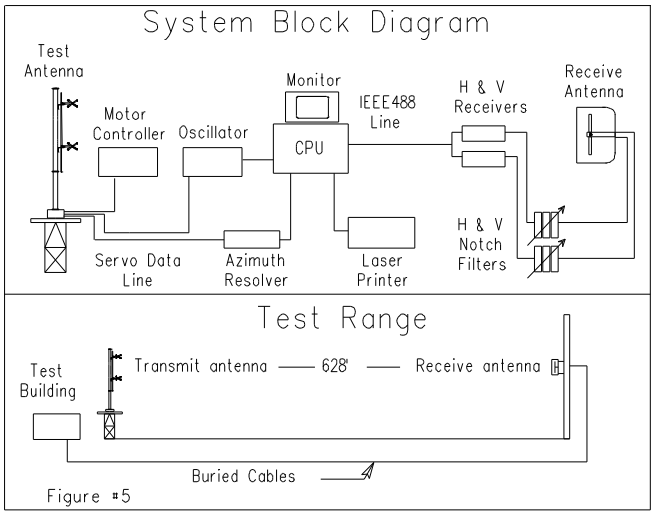

Figure #5

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 89.3 MHz and was constantly monitored by a Rohde & Schwarz ESVD measuring receiver.

(Continued)

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 half-wavelength spaced bays using one driven circular polarized radiating element per bay and two horizontal 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-4C-DA-HW array is to be mounted on the 14" o.d. pole at a bearing of North 72 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 measured individual horizontal and vertical components, the composite maximum of either the horizontal or vertical component at any azimuth and the FCC filed envelope pattern. The horizontal plane relative field list for the composite pattern and the individual H & V components are shown as Figure #1 & 1A respectively. 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 10.000 kilowatts (10.000 dBk).

Directional Antenna System
For
KPCC, Pasadena, California

(Continued)

The power at North 210-290 degrees East does not exceed 1.6 kilowatts (2.041 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.

The clear vertical length of the structure required to support the antenna is 36 feet 5 inches.

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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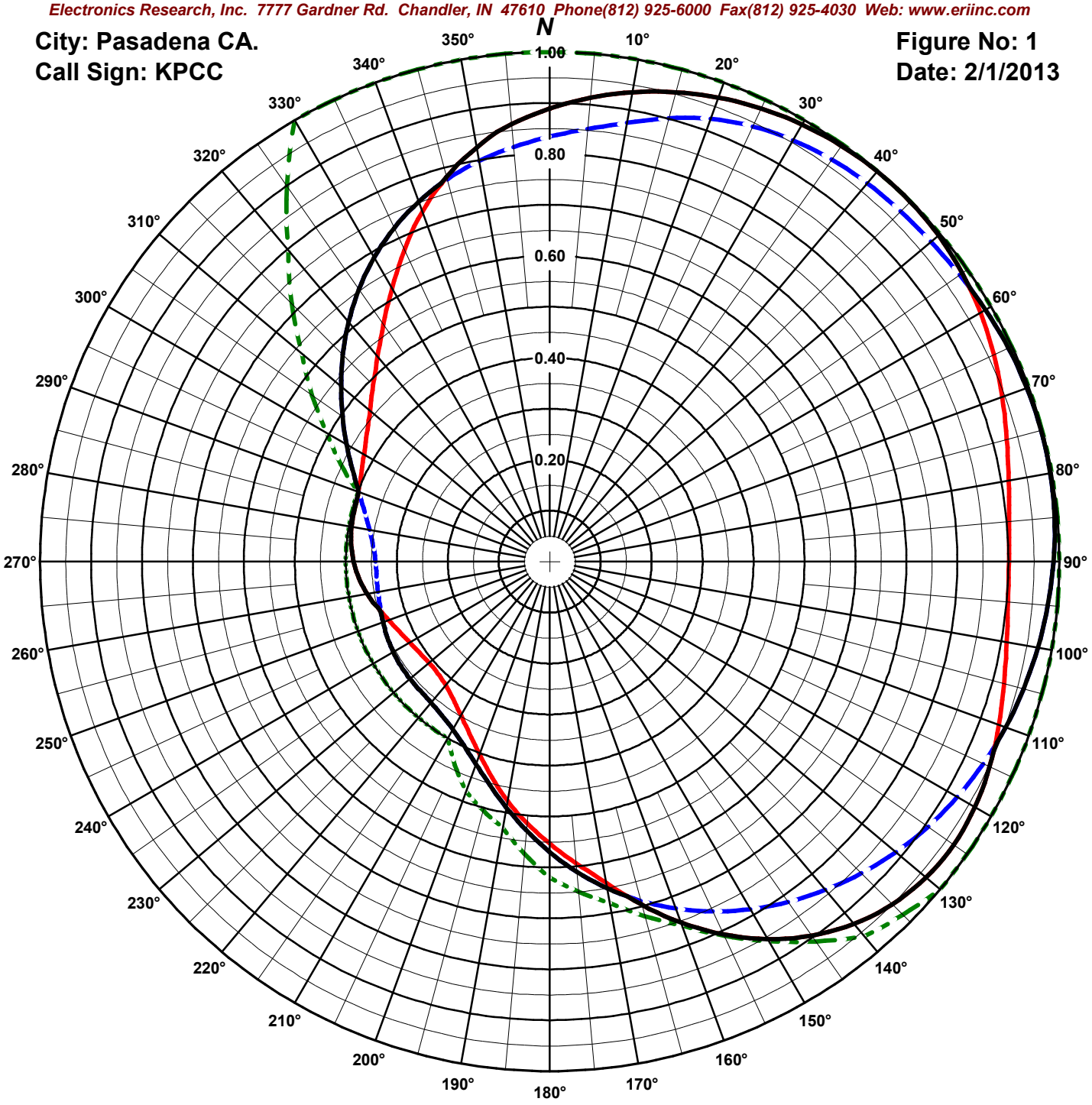
City: Pasadena CA.
Call Sign: KPCC

Figure No: 1
Date: 2/1/2013



Antenna Orientation: 72° True

Frequency: 89.3 MHz
Antenna Type: LP-4C-DA-HW

Antenna Mounting: Custom 20" ELL
Tower Type: 14" POLE

HORIZONTAL	VERTICAL	COMPOSITE	FCC ENVELOPE
RMS: .732	RMS: .732	RMS: .753	RMS: .805
Maximum: 1 @ 42°	Maximum: .998 @ 76°	Maximum: 1 @ 42°	Maximum: 1 @ 0°
Minimum: .309 @ 228°	Minimum: .341 @ 266°	Minimum: .346 @ 253°	Minimum: .4 @ 210°

Measured patterns of the horizontal and vertical components, with the composite maximum of either the the H or V components and the filed FCC envelope pattern BMXPED-20120410AAE.

ERI® Horizontal Plane Relative Field Pattern

Electronics Research, Inc. 7777 Gardner Rd. Chandler, IN 47610 Phone(812) 925-6000 Fax(812) 925-4030 Web: www.eriinc.com

Figure# 1 **Date: 2/1/2013**
Station: KPCC **Antenna: LP-4C-DA-HW**
Location: Pasadena CA. **Antenna Orientation: 72° True**
Frequency: 89.3 MHz **Number of Bays: 4**

Azimuth	Envelope			Polarization	Azimuth	Envelope			Polarization
	Field	kW	dBk	Maximum		Field	kW	dBk	Maximum
0°	0.889	7.906	8.980	Horizontal	180°	0.570	3.248	5.116	Vertical
5°	0.914	8.349	9.216	Horizontal	185°	0.529	2.799	4.469	Vertical
10°	0.935	8.746	9.418	Horizontal	190°	0.490	2.399	3.800	Vertical
15°	0.954	9.094	9.587	Horizontal	195°	0.454	2.060	3.138	Vertical
20°	0.969	9.389	9.726	Horizontal	200°	0.423	1.788	2.525	Vertical
25°	0.981	9.628	9.835	Horizontal	205°	0.398	1.586	2.003	Vertical
30°	0.990	9.809	9.916	Horizontal	210°	0.380	1.446	1.602	Vertical
35°	0.997	9.931	9.970	Horizontal	215°	0.368	1.357	1.327	Vertical
40°	1.000	9.993	9.997	Horizontal	220°	0.362	1.308	1.165	Vertical
45°	1.000	9.992	9.996	Horizontal	225°	0.359	1.286	1.094	Vertical
50°	0.996	9.917	9.964	Horizontal	230°	0.358	1.280	1.073	Vertical
55°	0.988	9.761	9.895	Horizontal	235°	0.357	1.272	1.045	Vertical
60°	0.988	9.752	9.891	Vertical	240°	0.355	1.257	0.994	Vertical
65°	0.993	9.856	9.937	Vertical	245°	0.351	1.235	0.918	Vertical
70°	0.996	9.927	9.968	Vertical	250°	0.348	1.209	0.823	Vertical
75°	0.998	9.960	9.982	Vertical	255°	0.349	1.220	0.864	Horizontal
80°	0.997	9.949	9.978	Vertical	260°	0.364	1.323	1.214	Horizontal
85°	0.994	9.889	9.951	Vertical	265°	0.375	1.410	1.491	Horizontal
90°	0.989	9.778	9.903	Vertical	270°	0.385	1.479	1.700	Horizontal
95°	0.981	9.628	9.836	Vertical	275°	0.391	1.529	1.844	Horizontal
100°	0.972	9.457	9.758	Vertical	280°	0.395	1.558	1.927	Horizontal
105°	0.963	9.269	9.671	Vertical	285°	0.396	1.568	1.954	Horizontal
110°	0.952	9.057	9.570	Vertical	290°	0.400	1.597	2.034	Horizontal
115°	0.952	9.069	9.576	Horizontal	295°	0.427	1.822	2.604	Vertical
120°	0.963	9.279	9.675	Horizontal	300°	0.460	2.117	3.258	Vertical
125°	0.968	9.368	9.716	Horizontal	305°	0.496	2.460	3.910	Vertical
130°	0.964	9.296	9.683	Horizontal	310°	0.534	2.855	4.556	Vertical
135°	0.951	9.044	9.564	Horizontal	315°	0.574	3.295	5.178	Vertical
140°	0.928	8.615	9.353	Horizontal	320°	0.614	3.766	5.759	Vertical
145°	0.896	8.028	9.046	Horizontal	325°	0.652	4.255	6.289	Vertical
150°	0.855	7.314	8.641	Horizontal	330°	0.689	4.743	6.760	Vertical
155°	0.807	6.516	8.140	Horizontal	335°	0.722	5.212	7.170	Vertical
160°	0.754	5.682	7.545	Horizontal	340°	0.751	5.646	7.517	Vertical
165°	0.697	4.856	6.863	Horizontal	345°	0.781	6.100	7.853	Horizontal
170°	0.651	4.239	6.273	Vertical	350°	0.825	6.805	8.328	Horizontal
175°	0.611	3.734	5.722	Vertical	355°	0.862	7.423	8.706	Horizontal

Horizontal Polarization:
Maximum: 2.317 (3.649 dB)
Horizontal Plane: 2.317 (3.649 dB)
Maximum ERP: 10.000 kW

Vertical Polarization:
Maximum: 2.308 (3.632 dB)
Horizontal Plane: 2.308 (3.632 dB)
Maximum ERP: 9.961 kW

Total Input Power: 4.316 kW
Reference: KPCC2M.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: 2/1/2013**
Station: KPCC | **Antenna: LP-4C-DA-HW**
Location: Pasadena CA. | **Antenna Orientation: 72° True**
Frequency: 89.3 MHz | **Number of Bays: 4**

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.889	7.906	8.980	0.834	6.960	8.426	180°	0.553	3.059	4.855	0.570	3.248	5.116
5°	0.914	8.349	9.216	0.852	7.261	8.610	185°	0.515	2.650	4.232	0.529	2.799	4.469
10°	0.935	8.746	9.418	0.875	7.648	8.835	190°	0.476	2.270	3.561	0.490	2.399	3.800
15°	0.954	9.094	9.587	0.901	8.112	9.091	195°	0.438	1.916	2.825	0.454	2.060	3.138
20°	0.969	9.389	9.726	0.925	8.547	9.318	200°	0.402	1.617	2.087	0.423	1.788	2.525
25°	0.981	9.628	9.835	0.942	8.880	9.484	205°	0.372	1.386	1.416	0.398	1.586	2.003
30°	0.990	9.809	9.916	0.955	9.116	9.598	210°	0.348	1.212	0.834	0.380	1.446	1.602
35°	0.997	9.931	9.970	0.963	9.282	9.677	215°	0.330	1.087	0.362	0.368	1.357	1.327
40°	1.000	9.993	9.997	0.969	9.393	9.728	220°	0.317	1.005	0.023	0.362	1.308	1.165
45°	1.000	9.992	9.996	0.973	9.467	9.762	225°	0.310	0.962	-0.168	0.359	1.286	1.094
50°	0.996	9.917	9.964	0.977	9.540	9.795	230°	0.309	0.955	-0.198	0.358	1.280	1.073
55°	0.988	9.761	9.895	0.982	9.638	9.840	235°	0.312	0.972	-0.123	0.357	1.272	1.045
60°	0.976	9.529	9.791	0.988	9.752	9.891	240°	0.317	1.006	0.025	0.355	1.257	0.994
65°	0.961	9.241	9.657	0.993	9.856	9.937	245°	0.325	1.057	0.243	0.351	1.235	0.918
70°	0.945	8.928	9.508	0.996	9.927	9.968	250°	0.336	1.128	0.524	0.348	1.209	0.823
75°	0.929	8.625	9.357	0.998	9.960	9.982	255°	0.349	1.220	0.864	0.344	1.186	0.741
80°	0.915	8.368	9.226	0.997	9.949	9.978	260°	0.364	1.323	1.214	0.342	1.170	0.683
85°	0.905	8.191	9.133	0.994	9.889	9.951	265°	0.375	1.410	1.491	0.341	1.162	0.651
90°	0.901	8.116	9.094	0.989	9.778	9.903	270°	0.385	1.479	1.700	0.342	1.168	0.674
95°	0.903	8.153	9.113	0.981	9.628	9.836	275°	0.391	1.529	1.844	0.347	1.208	0.819
100°	0.911	8.294	9.188	0.972	9.457	9.758	280°	0.395	1.558	1.927	0.359	1.288	1.098
105°	0.923	8.520	9.305	0.963	9.269	9.671	285°	0.396	1.568	1.954	0.376	1.412	1.500
110°	0.938	8.796	9.443	0.952	9.057	9.570	290°	0.400	1.597	2.034	0.398	1.588	2.008
115°	0.952	9.069	9.576	0.939	8.813	9.451	295°	0.408	1.664	2.210	0.427	1.822	2.604
120°	0.963	9.279	9.675	0.924	8.534	9.312	300°	0.421	1.769	2.478	0.460	2.117	3.258
125°	0.968	9.368	9.716	0.907	8.218	9.148	305°	0.438	1.918	2.828	0.496	2.460	3.910
130°	0.964	9.296	9.683	0.887	7.866	8.958	310°	0.460	2.114	3.251	0.534	2.855	4.556
135°	0.951	9.044	9.564	0.865	7.482	8.740	315°	0.490	2.401	3.803	0.574	3.295	5.178
140°	0.928	8.615	9.353	0.841	7.076	8.498	320°	0.525	2.760	4.409	0.614	3.766	5.759
145°	0.896	8.028	9.046	0.815	6.649	8.227	325°	0.569	3.233	5.095	0.652	4.255	6.289
150°	0.855	7.314	8.641	0.788	6.202	7.926	330°	0.619	3.833	5.835	0.689	4.743	6.760
155°	0.807	6.516	8.140	0.757	5.736	7.586	335°	0.674	4.545	6.575	0.722	5.212	7.170
160°	0.754	5.682	7.545	0.725	5.250	7.201	340°	0.731	5.341	7.276	0.751	5.646	7.517
165°	0.697	4.856	6.863	0.689	4.748	6.765	345°	0.781	6.100	7.853	0.777	6.034	7.806
170°	0.641	4.105	6.133	0.651	4.239	6.273	350°	0.825	6.805	8.328	0.798	6.372	8.043
175°	0.594	3.531	5.478	0.611	3.734	5.722	355°	0.862	7.423	8.706	0.817	6.668	8.240

Horizontal Polarization:
Maximum: 2.317 (3.649 dB)
Horizontal Plane: 2.317 (3.649 dB)
Maximum ERP: 10.000 kW

Vertical Polarization:
Maximum: 2.308 (3.632 dB)
Horizontal Plane: 2.308 (3.632 dB)
Maximum ERP: 9.961 kW

Total Input Power: 4.316 kW
Reference: KPCC2M.FIG

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

ERI® Vertical Plane Relative Field Pattern

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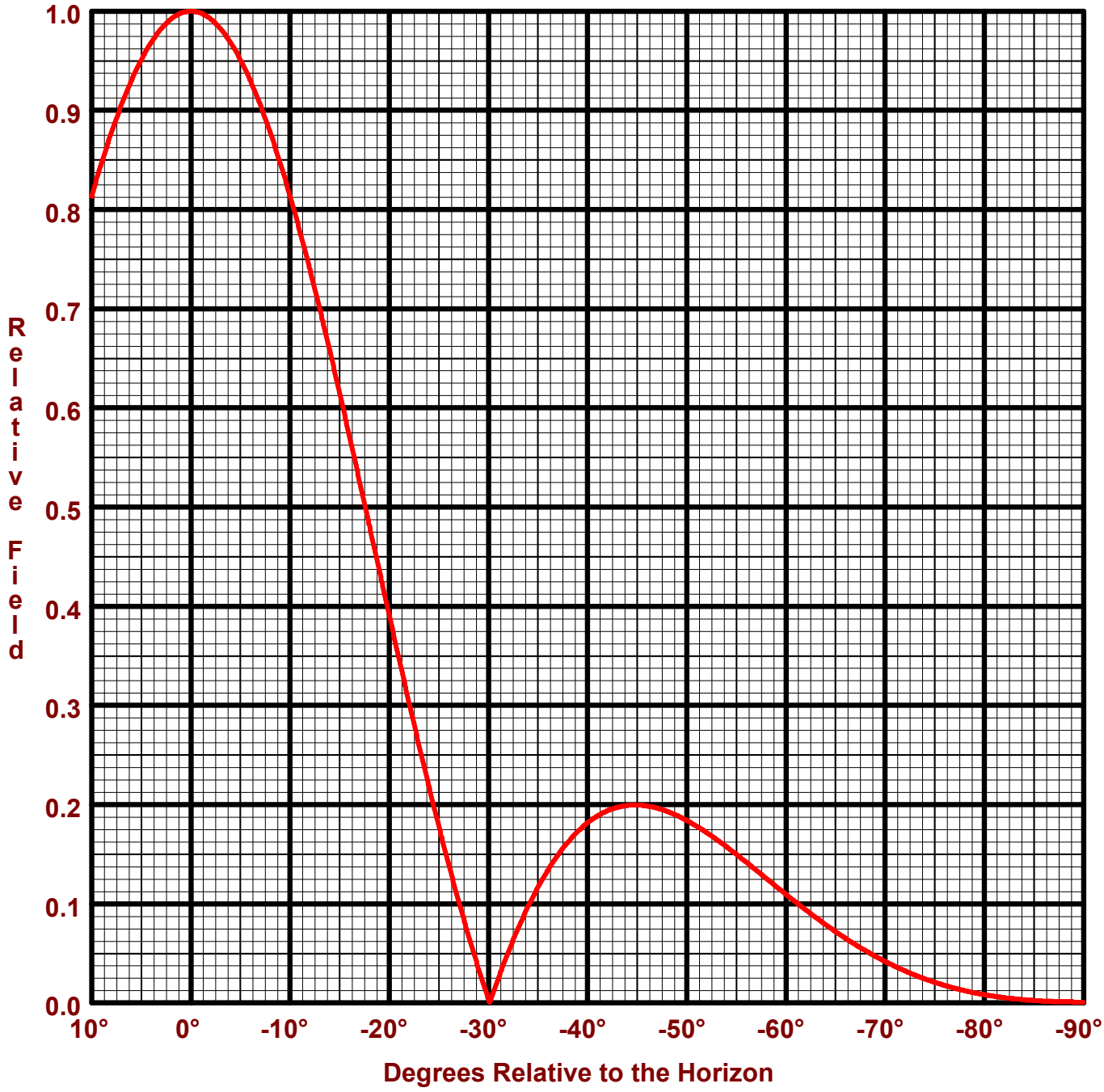
Figure No: 3
Call Sign: KPCC
Location: Pasadena CA.
Frequency: 89.3 MHz
4 bay LP-4C-DA-HW antenna

Date: 2/1/2013
H/V Power Ratio: 0.996
.5 Wave-length Spacing
0° Beam Tilt
0% First Null Fill



Horizontal Polarization:
Maximum: 2.317 (3.649 dB)
Horizontal Plane: 2.317 (3.649 dB)
Maximum ERP: 10.000 kW

Vertical Polarization:
Maximum: 2.308 (3.632 dB)
Horizontal Plane: 2.308 (3.632 dB)
Maximum ERP: 9.961 kW

Directional Antenna System
for
KPCC, Pasadena, California

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	LP-4C-DA-HW
Frequency:	89.3 MHz
Number of Bays:	Four

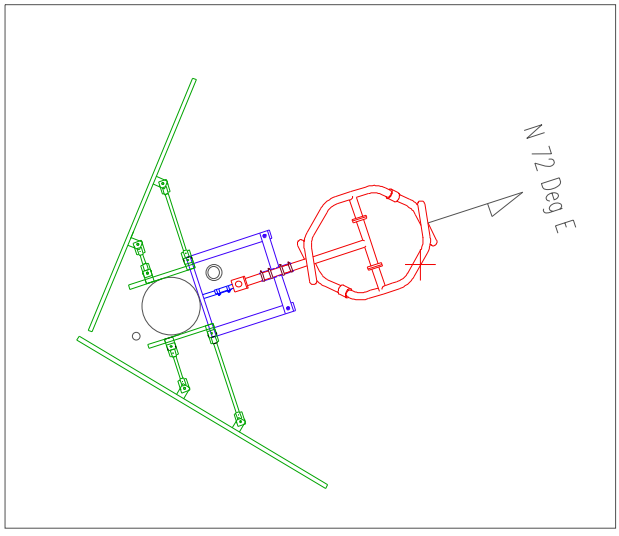
MECHANICAL SPECIFICATIONS

Mounting:	Standard
System length:	20 ft 5 in
Aperture length required:	36 ft 5 in [1]
Orientation:	72° true

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

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	10.000 kW (10.000 dBk)
Horizontal maximum power gain:	2.317 (3.649 dB)
Maximum vertical ERP:	9.961 kW (9.983 dBk)
Vertical maximum power gain:	2.308 (3.632 dB)
Total input power:	4.316 kW (6.351 dBk)



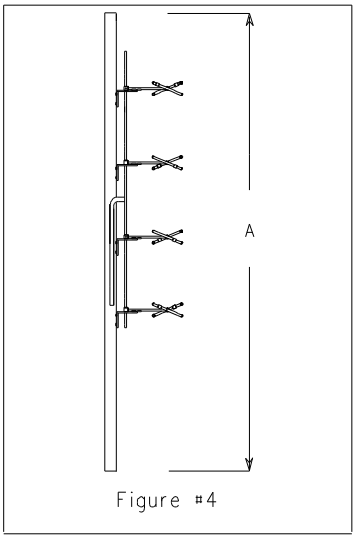


Figure #4