

CIRCULAR POLARIZED DIRECTIONAL FM ANTENNA  
PROPOSED FOR STATION KZLA - LOS ANGELES, CALIFORNIA

Electronics Research, Inc. is providing an ERI Type 1082-CP-DA circular polarized directional FM that is designed to meet the requirements of KZLA and will conform to the following specifications.

General Description

The array consists of one (1) bay using two individual iris cells. Each cell is approximately 72 inches in diameter and 30 inches deep. A type 1080 wideband CP element is used for excitation of the cell. This element is precision machined of heavy wall brass tubing with an internal pressurized balun and feed point. Its inherently broadband nature coupled with its relative insensitivity to atmospheric conditions (icing, dense fog, etc) low Q 50 ohm input impedance, and high power handling makes it ideally suitable for years of maintenance free operation.

The amplitude and phase relationship of the r.f. energy feeding the driven elements will be fixed at the time of manufacture in order to achieve a directional horizontal plane radiation pattern for both the horizontal and vertical polarization components. The operating frequency is 93.9 MHz. The antenna array is designed to mount on a 10 ft. face triangular steel tower with a leg orientated at North 200 degrees E.

The antenna pattern measurements were made on an antenna pattern range which 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 both the Bachelor of Electrical Engineering and the Master of Electrical Engineering degrees from Cornell University and is also a registered professional engineer in the States of Indiana, Maryland and Minnesota.

Description of the Test Procedure

A full scale model of the array was set up on a full scale model tower on the antenna pattern range, which is a fifty-acre site in a remote area. The test tower consisted of an accurate replica of the tower on which the actual array will be mounted. This model was 30 feet tall. The test antenna was centered vertically on the test tower with bracketry that is electrically equivalent to the brackets that will be used to support the actual array. The tower



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Description of the Test Procedure  
(Continued)

and antenna were erected vertically on a pedestal turntable to facilitate the taking of measurements in the XY, or horizontal plane, for both the horizontal and vertical polarization components. The turntable is equipped with a motor drive and azimuth indicating servo mechanism, the resolution of this azimuth measuring servo system being approximately one-tenth of a degree.

The antenna model was tested at a height of twenty five (25) feet above ground and was operated in the transmitting mode, and fed from a Wavetek Model 3000 Signal Generator set at the frequency of 93.9 MHz.

A linear polarized broad-band dipole receiving antenna located approximately six hundred feet removed from the antenna under test, and mounted at the same height above average terrain as the radiation center of the antenna under test was used to receive the test signals.

The receiving antenna is rotatable in its mount to permit the measurement of either the horizontal or vertical polarization component of the antenna under test. The signal received by the dipole was fed back, via a buried 50 ohm Heliac cable, to an Anritsu Model ML521B measuring receiver. This data was interfaced to a Hewlett-Packard Model 9872C plotter by means of a Hewlett-Packard Model 86 computer system. Relative field strength was plotted as a function of azimuth.

The measurements were performed by rotating the antenna in the counterclockwise direction and plotting the received signal on polar co-ordinate graph paper in the clockwise direction. The horizontal polarized component and the vertically polarized component of the signal from the test antenna were recorded separately.

The directional horizontal plane radiation patterns were developed by experimentally adjusting the phase, amplitude and angular relationship of the two cross dipole system to achieve the desired patterns.

The measured horizontal plane relative field pattern, for both the horizontal and vertical polarization components, is shown on Figure #1 attached. The calculated vertical plane relative field pattern is shown on Figure #3 attached.



# HORIZONTAL PLANE RELATIVE FIELD PATTERN

Call & Location:

KZLA

Los Angeles, Ca

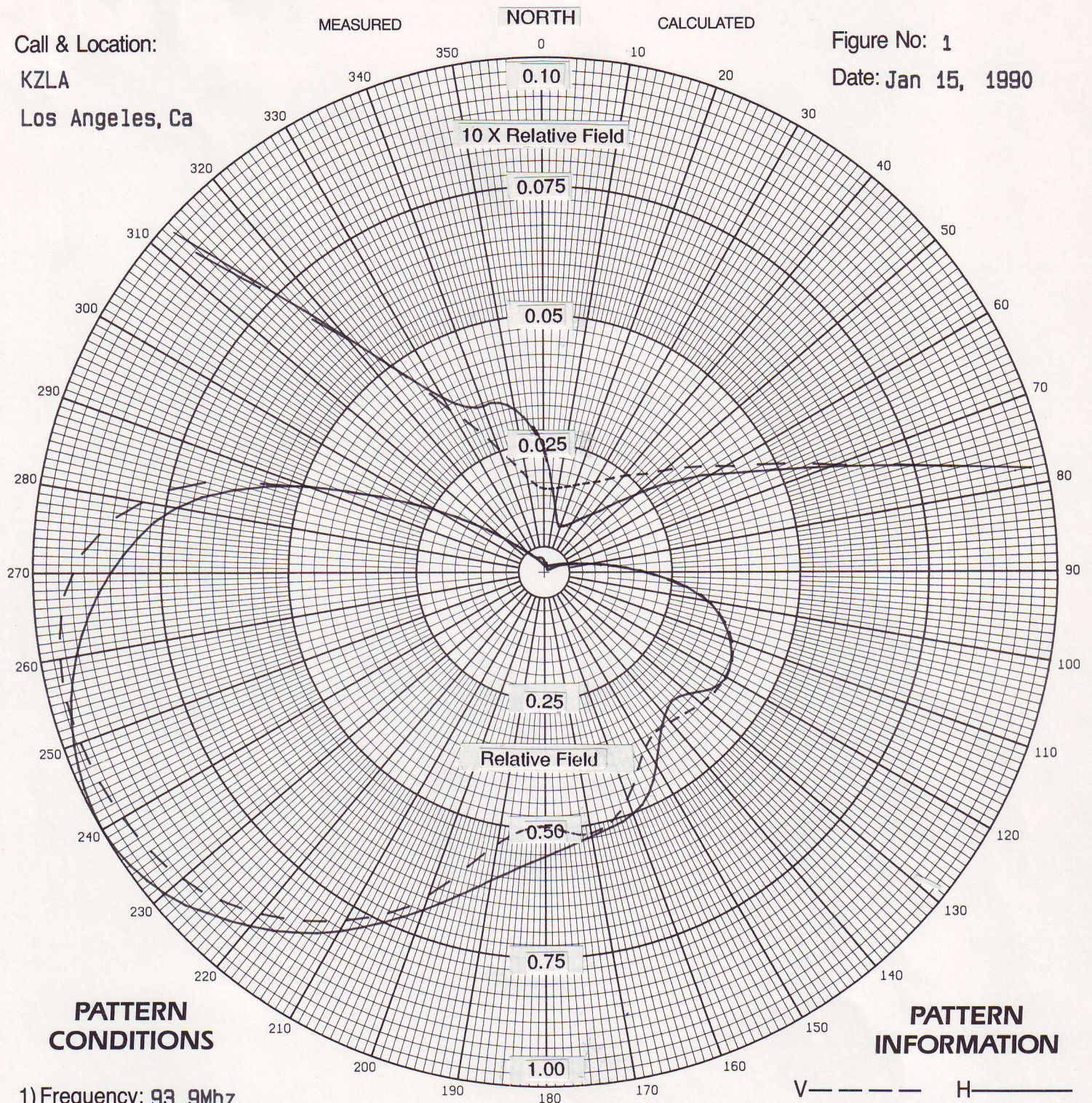
MEASURED

NORTH

CALCULATED

Figure No: 1

Date: Jan 15, 1990



1) Frequency: 93.9Mhz

2) Antenna Type: 1082-CP-DA Antenna

3) Antenna Orientation: North 176.47 Deg. East

4) Antenna Mounting: N 200 E tower leg

5) Tower Type: 10' Tower face

6) Comments:

## VERTICAL

Rms: .50547

Maximum: .97 @ N 255 E

Minimum: .0167 @ N 0 E

## HORIZONTAL

Rms: .51104

Maximum: 1 @ N 240 E

Minimum: .0098 @ N 15 E



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Conclusions

The antenna system is to be mounted on the tower with the apex of the "A" and "B" radiators orientated at North 176.47 degrees East. Fixed bracketry provided with the antenna will set the correct angular relationship between the "A" and "B" radiators. This bracket is to be mounted on the North 200 degree East tower leg. The correct orientation of the tower is to be accurately established by a qualified licensed surveyor and if the tower legs are orientated at N 80 degrees E, N 200 degrees E and N 320 degrees E, then the antenna radiation pattern will be as shown on Figure #1. The installation blueprint supplied with the antenna also shows the mounting positions of the array.

The calculated maximum horizontal polarized component power gain is 1.68 (2.26 db). The maximum calculated vertical polarized component power gain is 1.58 (1.99 db).

The required input power to the antenna input flange is calculated to be 11.128 kilowatts to provide a maximum horizontal ERP of 18.706 kilowatts (12.72 dbk) and a maximum vertical ERP of 17.60 kilowatts (12.46 dbk). The input flange to the antenna is 3-1/8 inch EIA 50 ohm female.

*Thomas B. Sullivan*

Electronics Research, Inc.  
108 Market Street  
Newburgh, Indiana 47630

January 17, 1990



JANUARY 15 1989  
HORIZONTAL PLANE RELATIVE FIELD & DBK LIST  
FOR RADIO STATION KZLA 93.9MHz

AZIMUTH	H POL RELATIVE FIELD	H POL DBK	H POL POWER KW	V POL RELATIVE FIELD	V POL DBK	V POL POWER KW	AZIMUTH	H POL RELATIVE FIELD	H POL DBK	H POL POWER KW	V POL RELATIVE FIELD	V POL DBK	V POL POWER KW
0.0	.024	-19.84	.01	.017	-22.83	.01	180.0	.551	7.54	5.68	.496	6.62	4.59
5.0	.016	-23.00	.01	.017	-22.74	.01	185.0	.574	7.89	6.16	.500	6.71	4.68
10.0	.012	-25.85	.00	.017	-22.54	.01	190.0	.605	8.36	6.85	.532	7.24	5.30
15.0	.010	-27.43	.00	.018	-22.24	.01	195.0	.647	8.94	7.83	.590	8.13	6.51
20.0	.010	-27.13	.00	.019	-21.85	.01	200.0	.696	9.57	9.06	.664	9.16	8.24
25.0	.011	-26.46	.00	.020	-21.38	.01	205.0	.748	10.20	10.48	.728	9.97	9.92
30.0	.012	-25.51	.00	.021	-20.84	.01	210.0	.803	10.82	12.07	.779	10.55	11.34
35.0	.014	-24.36	.00	.023	-20.02	.01	215.0	.852	11.33	13.57	.824	11.04	12.70
40.0	.016	-23.09	.00	.025	-19.21	.01	220.0	.895	11.76	14.98	.864	11.45	13.97
45.0	.020	-21.17	.01	.028	-18.40	.01	225.0	.933	12.12	16.28	.899	11.80	15.12
50.0	.026	-19.03	.01	.032	-17.18	.02	230.0	.970	12.45	17.58	.925	12.05	16.02
55.0	.032	-17.10	.02	.037	-15.97	.03	235.0	.991	12.64	18.37	.943	12.21	16.64
60.0	.039	-15.38	.03	.042	-14.75	.03	240.0	1.000	12.72	18.71	.954	12.31	17.03
65.0	.048	-13.58	.04	.051	-13.07	.05	245.0	.994	12.67	18.49	.963	12.39	17.33
70.0	.062	-11.42	.07	.062	-11.39	.07	250.0	.981	12.55	18.00	.968	12.44	17.52
75.0	.082	-8.98	.13	.082	-9.02	.13	255.0	.960	12.37	17.24	.970	12.46	17.60
80.0	.113	-6.21	.24	.107	-6.65	.22	260.0	.932	12.10	16.24	.965	12.41	17.40
85.0	.154	-3.52	.44	.153	-3.60	.44	265.0	.896	11.76	15.00	.952	12.29	16.95
90.0	.209	-.86	.82	.209	-.90	.81	270.0	.852	11.33	13.58	.925	12.05	16.02
95.0	.274	1.46	1.40	.267	1.25	1.33	275.0	.801	10.79	11.99	.877	11.58	14.40
100.0	.326	2.98	1.99	.324	2.93	1.97	280.0	.735	10.04	10.10	.802	10.81	12.04
105.0	.358	3.81	2.40	.360	3.84	2.42	285.0	.632	8.73	7.47	.690	9.50	8.92
110.0	.382	4.37	2.73	.384	4.41	2.76	290.0	.501	6.72	4.70	.494	6.60	4.57
115.0	.397	4.71	2.96	.398	4.71	2.96	295.0	.357	3.77	2.38	.354	3.70	2.35
120.0	.404	4.85	3.05	.401	4.77	3.00	300.0	.254	.82	1.21	.254	.80	1.20
125.0	.390	4.53	2.84	.399	4.73	2.97	305.0	.174	-2.48	.56	.169	-2.70	.54
130.0	.361	3.87	2.44	.392	4.58	2.87	310.0	.119	-5.78	.26	.113	-6.21	.24
135.0	.347	3.52	2.25	.382	4.36	2.73	315.0	.081	-9.08	.12	.079	-9.35	.12
140.0	.358	3.81	2.40	.375	4.20	2.63	320.0	.060	-11.70	.07	.060	-11.79	.07
145.0	.385	4.44	2.78	.372	4.13	2.59	325.0	.047	-13.82	.04	.047	-13.86	.04
150.0	.428	5.35	3.43	.386	4.45	2.79	330.0	.040	-15.33	.03	.037	-15.94	.03
155.0	.470	6.17	4.14	.419	5.16	3.28	335.0	.036	-16.18	.02	.031	-17.46	.02
160.0	.497	6.65	4.63	.466	6.08	4.06	340.0	.035	-16.45	.02	.026	-18.98	.01
165.0	.509	6.85	4.85	.499	6.67	4.65	345.0	.035	-16.51	.02	.022	-20.38	.01
170.0	.519	7.02	5.04	.513	6.91	4.91	350.0	.033	-17.04	.02	.019	-21.58	.01
175.0	.533	7.25	5.31	.503	6.75	4.73	355.0	.029	-18.08	.02	.017	-22.43	.01

CITY OF LICENSE: LOS ANGELES, CALIFORNIA

MOUNTING STRUCTURE: 10' TOWER FACE

ANTENNA TYPE: 1082-CP-DA NUMBER OF BAYS: 1

HORIZONTAL MAXIMUM RELATIVE FIELD= 1 AZIMUTH 240

HORIZONTAL MINIMUM RELATIVE FIELD= 9.82857142858E-3 AZIMUTH 15

VERTICAL MAXIMUM RELATIVE FIELD= .970 AZIMUTH 255

VERTICAL MINIMUM RELATIVE FIELD= .0167 AZIMUTH 0

HORIZONTAL R.M.S.=.51104 VERTICAL R.M.S.=.50547

MAXIMUM HORIZONTAL E.R.P.= 18.7060KW MAXIMUM VERTICAL E.R.P.= 17.6005KW

HORIZONTAL POWER INPUT= 5.6250KW VERTICAL POWER INPUT= 5.5031KW

TOTAL POWER INPUT=11.1281KW

MAXIMUM HORIZONTAL POWER GAIN OF COMPLETE ARRAY= 1.68 ( 2.26 db)

MAXIMUM VERTICAL POWER GAIN OF COMPLETE ARRAY= 1.58 ( 1.99 db)

ANTENNA ORIENTATION: NORTH 176.47 DEGREES EAST