

***Directional Antenna System
for
KOSO, Patterson, California***

October 1, 2002

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 KOSO.

The antenna is the ERI model MP-6E-DA configuration. The circular polarized system consists of 6 full-wavelength spaced bays using one driven circular polarized radiating element, one horizontal parasitic elements placed one quarter wave above and below each bay and two vertical parasitic elements per bay. The antenna was mounted on the North 85 degrees East tower leg with bracketry to provide an antenna orientation of North 96 degrees East. The antenna was tested on a 24" **ERI[®] λ MOUNTING SYSTEM**, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 93.1 megahertz, which is the center of the FM broadcast channel assigned to KOSO.

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
KOSO, Patterson, California

(Continued)

DESCRIPTION OF THE TEST PROCEDURE

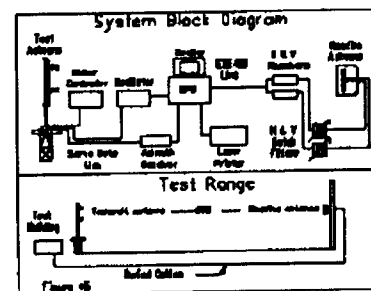
The test antenna consisted of two bay levels of the circular polarized system with the associated horizontal and vertical parasitic elements. The elements and brackets that were used in this test are electrically equivalent to those that will be supplied with the antenna. A section of 3 1/8 inch o.d. 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 24" **ERI** **MOUNTING SYSTEM**, 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 Wavetek Model 3000 signal generator. The frequency of the signal source was set at 93.1 MHz and was constantly monitored by an Anritsu Model ML521B 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 an Anritsu Model ML521B measuring receiver.



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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 6 full-wavelength spaced bays using one driven circular polarized radiating element, one horizontal parasitic elements placed one quarter wave above and below each bay and two 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 MP-6E-DA array is to be mounted on the North 85 degrees East tower leg of the 24" **ERI** *MOUNTING SYSTEM*, at a bearing of North 96 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 50 kilowatts (16.99 dBk).

The power at North 250 degrees East does not exceed 2.226 kilowatts (3.475 dBk).

The power at North 260 degrees East does not exceed 1.767 kilowatts (2.472 dBk).

The power at North 270 degrees East does not exceed 2.226 kilowatts (3.475 dBk).

Directional Antenna System
For
KOSO, Patterson, California

(Continued)

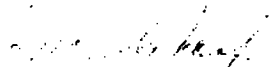
The RMS of the vertically polarized horizontal plane component does not exceed the RMS of the horizontally polarized horizontal plane component.

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 than 85% of the filed composite pattern.

The clear vertical length of the structure required to support the antenna is 68 feet if the antenna is to be top mounted.

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.

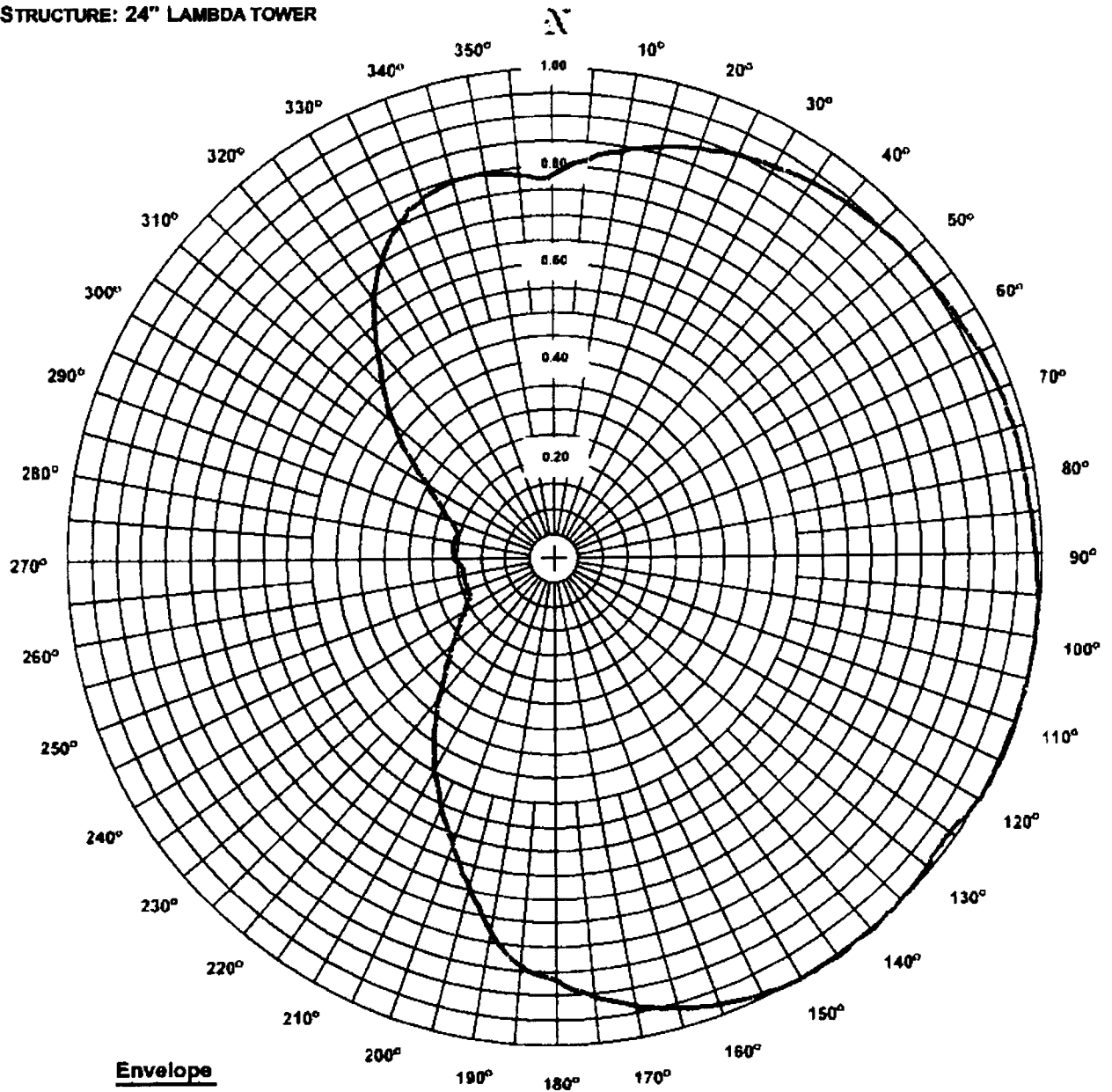


ERI [®] *Horizontal Plane Relative Field Pattern*

Electronics Research, Inc. 7777 Gardner Rd. Chandler, In 47610 Phone (812) 925-6000 Fax (812) 925-4030 <http://www.eriinc.com>

FIGURE: 1
STATION: KOSO
LOCATION: PATTERSON, CA
ANTENNA TYPE: MP-6E-DA
STRUCTURE: 24" LAMBDA TOWER

DATE: 9/30/2002
FREQUENCY: 93.1 MHz
ORIENTATION: 96° TRUE
MOUNTING: CUSTOM



RMS: 0.767
Maximum: 1.000 @ 106° True
Minimum: 0.189 @ 248° True

COMMENTS: COMPOSITE PATTERN: THIS PATTERN SHOWS THE MAXIMUM OF EITHER THE H OR V AZIMUTH VALUES. THIS PATTERN DOES NOT EXCEED THE FCC FILED COMPOSITE PATTERN AT ANY AZIMUTH. THE RMS OF THIS PATTERN IS GREATER THAN 85% OF THE FILED FCC COMPOSITE PATTERN BPH-20010409AAY.

ERI[®] Horizontal Plane Relative Field List

Electronics Research, Inc. 7777 Giambner Rd. Chandler, In 47610 Phone (812) 925-6000 Fax (812) 925-4030 <http://www.eriinc.com>

Station: KOSO
Location: Patterson, CA
Frequency: 93.1 MHz

Antenna: MP-6E-DA
Orientation: 96° True
Tower: 24" Lambda tower

Figure: 1
Date: 9/30/2002
Reference: koso1m.fig

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0°	0.788	31.02	14.92	Vertical	180°	0.866	37.51	15.74	Vertical
5°	0.821	33.67	15.27	Vertical	185°	0.838	35.14	15.46	Horizontal
10°	0.846	35.81	15.54	Vertical	190°	0.778	30.25	14.81	Horizontal
15°	0.869	37.76	15.77	Vertical	195°	0.697	24.27	13.85	Horizontal
20°	0.889	39.51	15.97	Vertical	200°	0.624	19.47	12.89	Horizontal
25°	0.906	41.04	16.13	Vertical	205°	0.559	15.62	11.94	Horizontal
30°	0.920	42.34	16.27	Vertical	210°	0.499	12.45	10.95	Horizontal
35°	0.932	43.39	16.37	Vertical	215°	0.437	9.53	9.79	Horizontal
40°	0.940	44.19	16.45	Vertical	220°	0.378	7.16	8.55	Horizontal
45°	0.949	45.00	16.53	Horizontal	225°	0.323	5.23	7.19	Vertical
50°	0.954	45.51	16.58	Horizontal	230°	0.282	3.98	5.99	Vertical
55°	0.956	45.65	16.59	Horizontal	235°	0.248	3.06	4.86	Vertical
60°	0.960	46.04	16.63	Horizontal	240°	0.220	2.41	3.82	Vertical
65°	0.966	46.68	16.69	Horizontal	245°	0.198	1.97	2.94	Vertical
70°	0.972	47.28	16.75	Horizontal	250°	0.189	1.79	2.53	Horizontal
75°	0.976	47.63	16.78	Horizontal	255°	0.190	1.80	2.56	Horizontal
80°	0.977	47.74	16.79	Horizontal	260°	0.190	1.81	2.58	Horizontal
85°	0.979	47.97	16.81	Horizontal	265°	0.190	1.81	2.57	Horizontal
90°	0.985	48.49	16.86	Horizontal	270°	0.202	2.05	3.11	Vertical
95°	0.992	49.23	16.92	Horizontal	275°	0.212	2.25	3.53	Vertical
100°	0.998	49.75	16.97	Horizontal	280°	0.213	2.26	3.54	Vertical
105°	1.000	49.99	16.99	Horizontal	285°	0.208	2.16	3.35	Vertical
110°	1.000	50.00	16.99	Horizontal	290°	0.223	2.49	3.97	Horizontal
115°	1.000	50.00	16.99	Horizontal	295°	0.256	3.27	5.15	Horizontal
120°	0.997	49.70	16.96	Horizontal	300°	0.299	4.46	6.49	Horizontal
125°	0.982	48.22	16.83	Horizontal	305°	0.361	6.52	8.14	Horizontal
130°	0.988	48.79	16.88	Vertical	310°	0.432	9.32	9.70	Horizontal
135°	0.996	49.56	16.95	Vertical	315°	0.498	12.42	10.94	Horizontal
140°	1.000	49.95	16.99	Vertical	320°	0.570	16.23	12.10	Horizontal
145°	1.000	50.00	16.99	Vertical	325°	0.647	20.91	13.20	Horizontal
150°	0.997	49.68	16.96	Vertical	330°	0.709	25.12	14.00	Horizontal
155°	0.988	48.84	16.89	Vertical	335°	0.755	28.54	14.55	Horizontal
160°	0.975	47.48	16.77	Vertical	340°	0.787	30.94	14.90	Horizontal
165°	0.955	45.64	16.59	Vertical	345°	0.802	32.17	15.07	Horizontal
170°	0.931	43.34	16.37	Vertical	350°	0.802	32.12	15.07	Horizontal
175°	0.901	40.61	16.09	Vertical	355°	0.789	31.15	14.94	Horizontal

Polarization:
Maximum Field: 1.000 @ 106° True
Minimum Field: 0.189 @ 248° True
RMS: 0.767
Maximum ERP: 50.000 kW
Maximum Power Gain: 5.845 (7.668 dB)

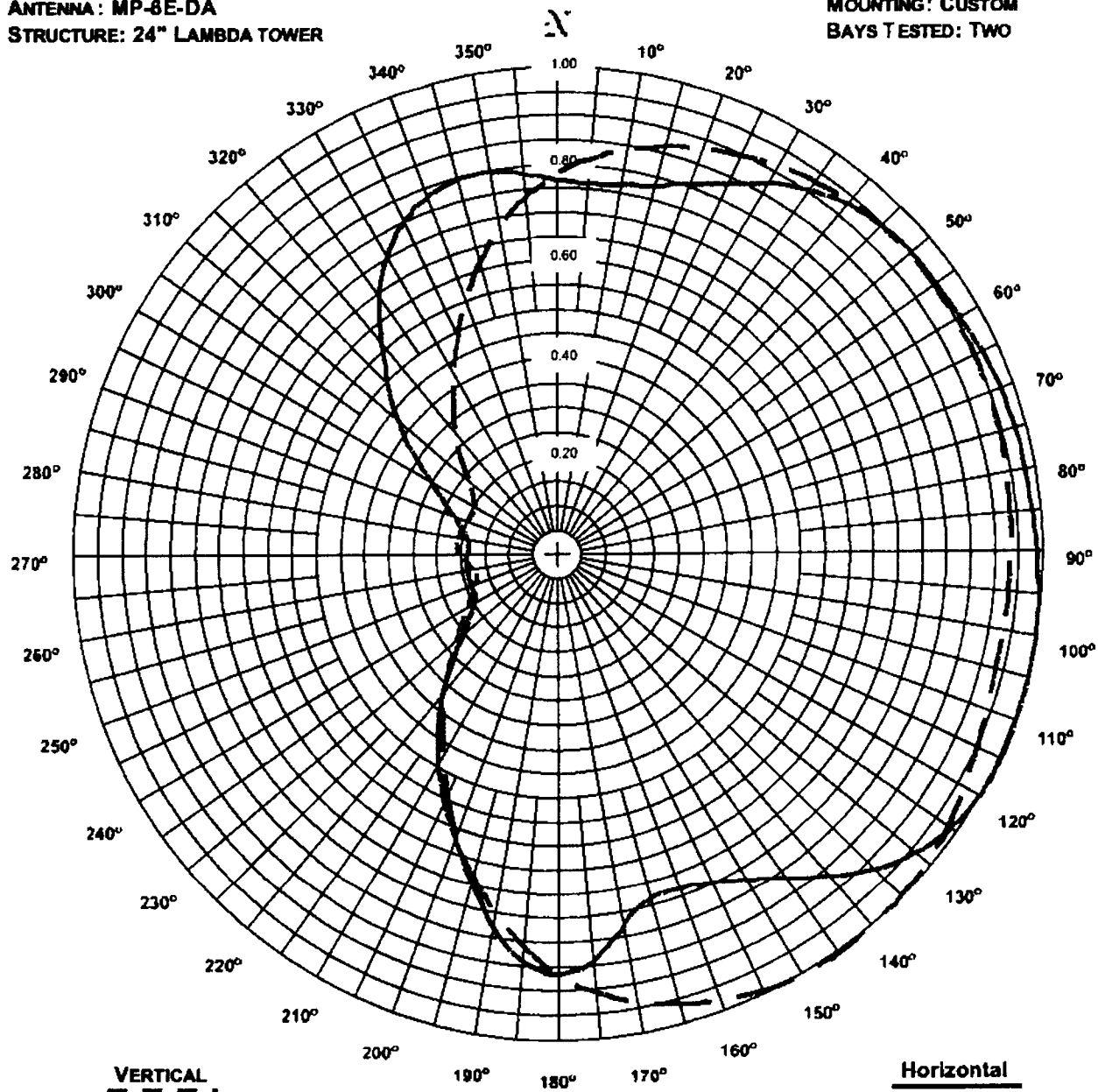
Total Input Power: 8.554 kW

ERI[®] Horizontal Plane Relative Field Pattern

Electronics Research, Inc. 7777 Gardner Rd. Chandler, In 47610 Phone (812) 925-6000 Fax (812) 925-4030 WWW.ERI-INC.COM

FIGURE NO: 2
STATION: KOSO
LOCATION: PATTERSON, CA
ANTENNA: MP-8E-DA
STRUCTURE: 24" LAMBDA TOWER

DATE: 9/30/2002
FREQUENCY: 93.1 MHz
ORIENTATION: 96° TRUE
MOUNTING: CUSTOM
BAYS TESTED: TWO



RMS: 0.732
MAXIMUM: 1.000 @ 142° TRUE
MINIMUM: 0.174 @ 258° TRUE

RMS: 0.733
Maximum: 1.002 @ 106° True
Minimum: 0.186 @ 277° True

COMMENTS: MEASURED PAATTERN 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: KOSO
Location: Patterson, CA
Frequency: 93.1 MHz

Antenna: MP-6E-DA
Orientation: 96° True
Tower: 24" Lambda tower

Figure: 1
Date: 9/30/2002
Reference: kosolm.fig

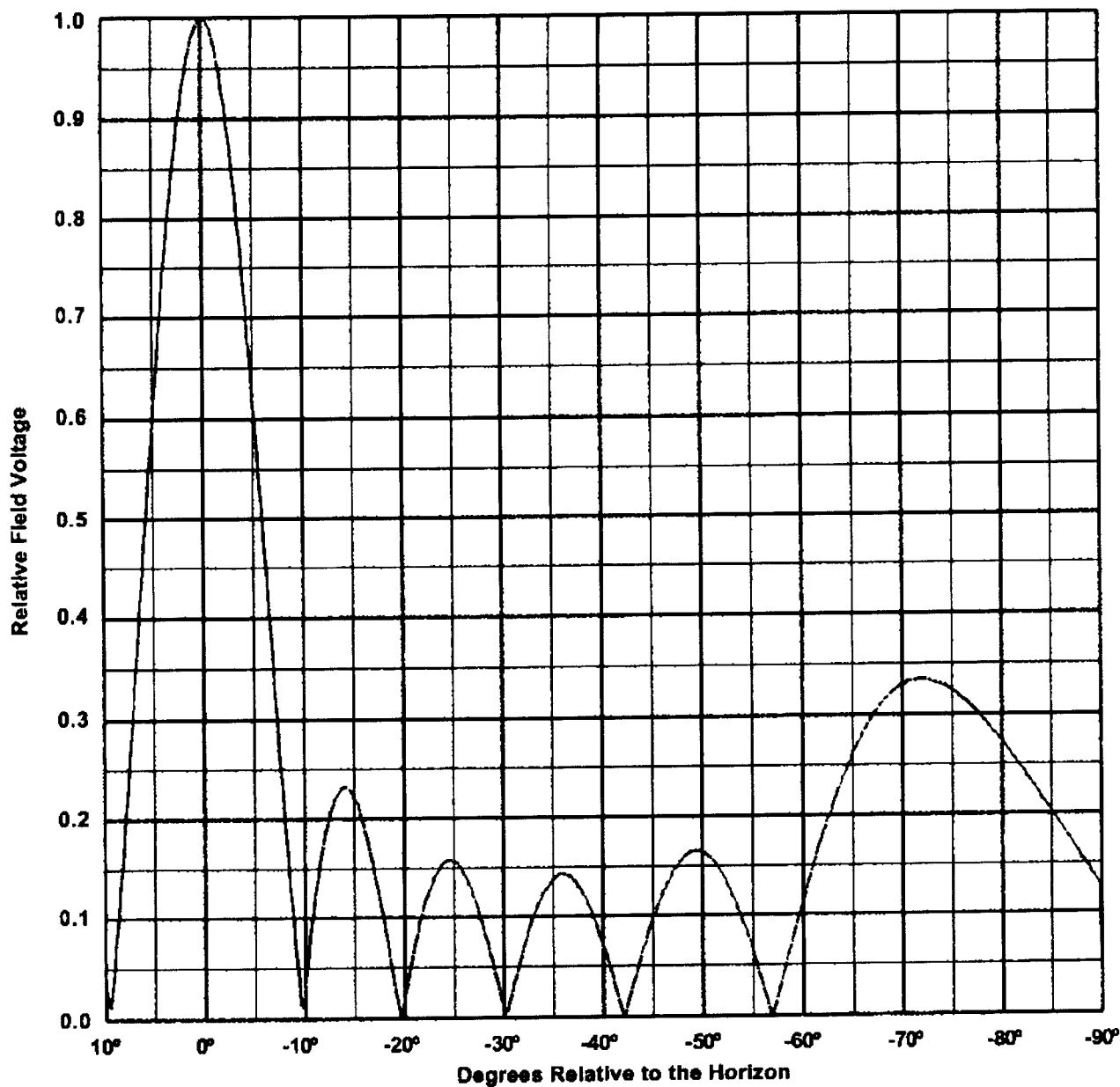
Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.774	29.92	14.76	0.788	31.02	14.92	180°	0.861	37.07	15.69	0.866	37.51	15.74
5°	0.767	29.45	14.69	0.821	33.67	15.27	185°	0.838	35.14	15.46	0.809	32.74	15.15
10°	0.773	29.85	14.75	0.846	35.81	15.54	190°	0.778	30.25	14.81	0.749	28.06	14.48
15°	0.787	30.95	14.91	0.869	37.76	15.77	195°	0.697	24.27	13.85	0.683	23.32	13.68
20°	0.810	32.78	15.16	0.889	39.51	15.97	200°	0.624	19.47	12.89	0.620	19.20	12.83
25°	0.842	35.41	15.49	0.906	41.04	16.13	205°	0.559	15.62	11.94	0.546	14.93	11.74
30°	0.880	38.71	15.88	0.920	42.34	16.27	210°	0.499	12.45	10.95	0.477	11.38	10.56
35°	0.912	41.56	16.19	0.932	43.39	16.37	215°	0.437	9.53	9.79	0.421	8.85	9.47
40°	0.935	43.67	16.40	0.940	44.19	16.45	220°	0.378	7.16	8.55	0.371	6.88	8.38
45°	0.949	45.00	16.53	0.946	44.73	16.51	225°	0.318	5.06	7.04	0.323	5.23	7.19
50°	0.954	45.51	16.58	0.949	45.00	16.53	230°	0.267	3.57	5.53	0.282	3.98	5.99
55°	0.956	45.65	16.59	0.949	45.03	16.54	235°	0.229	2.62	4.19	0.248	3.06	4.86
60°	0.960	46.04	16.63	0.949	45.02	16.53	240°	0.203	2.07	3.16	0.220	2.41	3.82
65°	0.966	46.68	16.69	0.948	44.91	16.52	245°	0.191	1.82	2.60	0.198	1.97	2.94
70°	0.972	47.28	16.75	0.945	44.69	16.50	250°	0.189	1.79	2.53	0.184	1.69	2.28
75°	0.976	47.63	16.78	0.942	44.37	16.47	255°	0.190	1.80	2.56	0.176	1.55	1.89
80°	0.977	47.74	16.79	0.938	43.95	16.43	260°	0.190	1.81	2.58	0.175	1.54	1.87
85°	0.979	47.97	16.81	0.933	43.57	16.39	265°	0.190	1.81	2.57	0.185	1.72	2.35
90°	0.985	48.49	16.86	0.931	43.29	16.36	270°	0.188	1.77	2.48	0.202	2.05	3.11
95°	0.992	49.23	16.92	0.929	43.12	16.35	275°	0.186	1.74	2.40	0.212	2.25	3.53
100°	0.998	49.75	16.97	0.928	43.06	16.34	280°	0.189	1.78	2.50	0.213	2.26	3.54
105°	1.000	49.99	16.99	0.930	43.28	16.36	285°	0.201	2.02	3.05	0.208	2.16	3.35
110°	1.000	50.00	16.99	0.937	43.86	16.42	290°	0.223	2.49	3.97	0.201	2.02	3.06
115°	1.000	50.00	16.99	0.947	44.81	16.51	295°	0.256	3.27	5.15	0.197	1.95	2.90
120°	0.997	49.70	16.96	0.961	46.15	16.64	300°	0.299	4.46	6.49	0.200	2.00	3.01
125°	0.982	48.22	16.83	0.976	47.64	16.78	305°	0.361	6.52	8.14	0.215	2.31	3.63
130°	0.955	45.55	16.59	0.988	48.79	16.88	310°	0.432	9.32	9.70	0.242	2.93	4.67
135°	0.915	41.82	16.21	0.996	49.56	16.95	315°	0.498	12.42	10.94	0.282	3.97	5.99
140°	0.862	37.15	15.70	1.000	49.95	16.99	320°	0.570	16.23	12.10	0.331	5.49	7.39
145°	0.810	32.76	15.15	1.000	50.00	16.99	325°	0.647	20.91	13.20	0.380	7.23	8.59
150°	0.770	29.61	14.71	0.997	49.68	16.96	330°	0.709	25.12	14.00	0.433	9.37	9.72
155°	0.742	27.53	14.40	0.988	48.84	16.89	335°	0.755	28.54	14.55	0.493	12.17	10.85
160°	0.727	26.43	14.22	0.975	47.48	16.77	340°	0.787	30.94	14.90	0.561	15.71	11.96
165°	0.729	26.58	14.25	0.955	45.64	16.59	345°	0.802	32.17	15.07	0.623	19.42	12.88
170°	0.772	29.76	14.74	0.931	43.34	16.37	350°	0.802	32.12	15.07	0.686	23.56	13.72
175°	0.836	34.91	15.43	0.901	40.61	16.09	355°	0.789	31.15	14.94	0.740	27.40	14.38

Polarization:	Horizontal	Vertical
Maximum Field:	1.000 @ 106° True	1.000 @ 142° True
Minimum Field:	0.186 @ 277° True	0.174 @ 258° True
RMS:	0.733	0.732
Maximum ERP:	50.000 kW	50.000 kW
Maximum Power Gain:	5.845 (7.668 dB)	5.845 (7.668 dB)

Total Input Power: 8.554 kW

KOSO, Patterson, CA, 93.1 MHz**Figure#: 3****Date: 9/30/2002**

**A 6 level, 1 wave-length spaced MP-6E-DA directional antenna
with 0° beam tilt, 0% null fill and a H/V maximum power ratio of 1.000**

**Vertical Polarization Gain:****Maximum: 5.845 (7.668 dB)****Horizontal Plane: 5.845 (7.668 dB)****Horizontal Polarization Gain:****Maximum: 5.845 (7.668 dB)****Horizontal Plane: 5.845 (7.668 dB)**

Directional Antenna System for KOSO, Patterson, California

(Continued)

ANTENNA SPECIFICATIONS

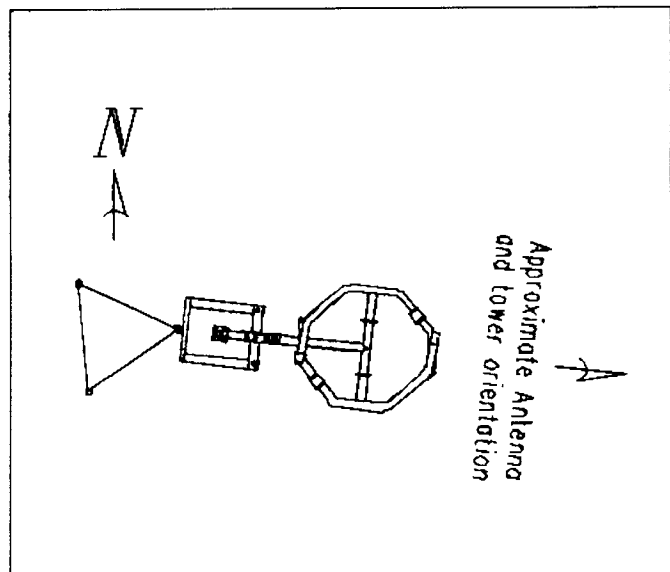
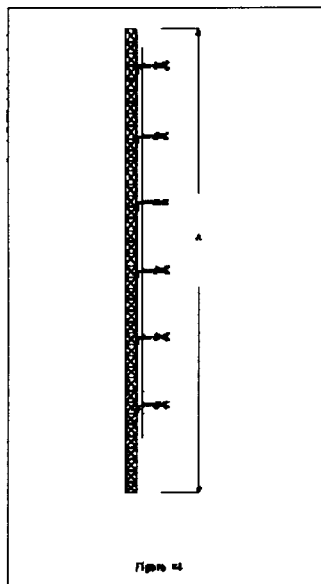
Antenna Type:	MP-6E-DA
Frequency:	93.1 MHz
Number of Bays:	6

MECHANICAL SPECIFICATIONS

Mounting:	Custom
System length:	61 ft 5 in
Aperture length required:	68 ft.
Orientation:	96° true
Input flange to the antenna 3 1/8 inch female	

ELECTRICAL SPECIFICATIONS (For directional use)

Maximum horizontal ERP:	50 kW (16.99 dBk)
Horizontal maximum power gain:	5.845 (7.668 dB)
Maximum vertical ERP:	50 kW (16.99 dBk)
Vertical maximum power gain:	5.845 (7.668 dB)
Total input power:	8.554 kW (9.322 dBk)



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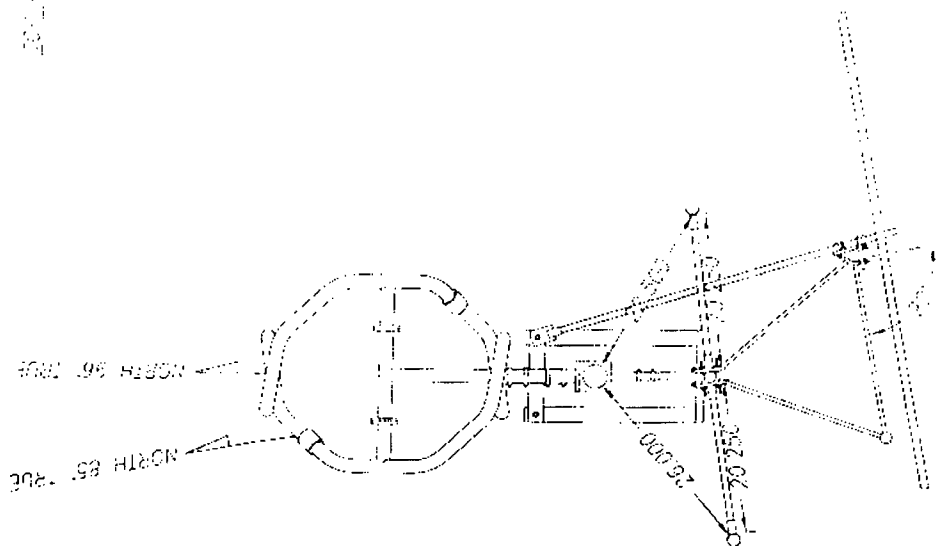
-VERTICAL PARASITIC RAILS
1 5/8 O.D. BRASS
PARASITIC RAILS EXTEND
5' ABOVE TOP BAY &
5' BELOW BOTTOM BAY

HORIZONTAL PARASITES
CENTERED 31 9/16"
ABOVE AND BELOW
EACH DAY -

COAXIAL SLEEVE USED TO HOLD
10' RAIL SECTIONS TOGETHER
SECURE WITH HOSE CLAMPS

SUPPORTING TOWER
(TOWER INNER MEMBERS
FROM ELEVATION VIEW
FOR CLARITY)

VERTICAL PARASITE BRACKETS
TO BE PLACED APP. 20" FROM
EACH END OF 10' RAIL SECTION
AND SECURED WITH HOSE CLAMPS



ELECTRONICS RESEARCH, INC.

Established : 943

7777 GARDNER RD.
CHANDLER, IN. 47610-9637
PHONE: (812) 925-6000
FAX: (812) 925-4026



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NAME _____

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PURPOSE _____

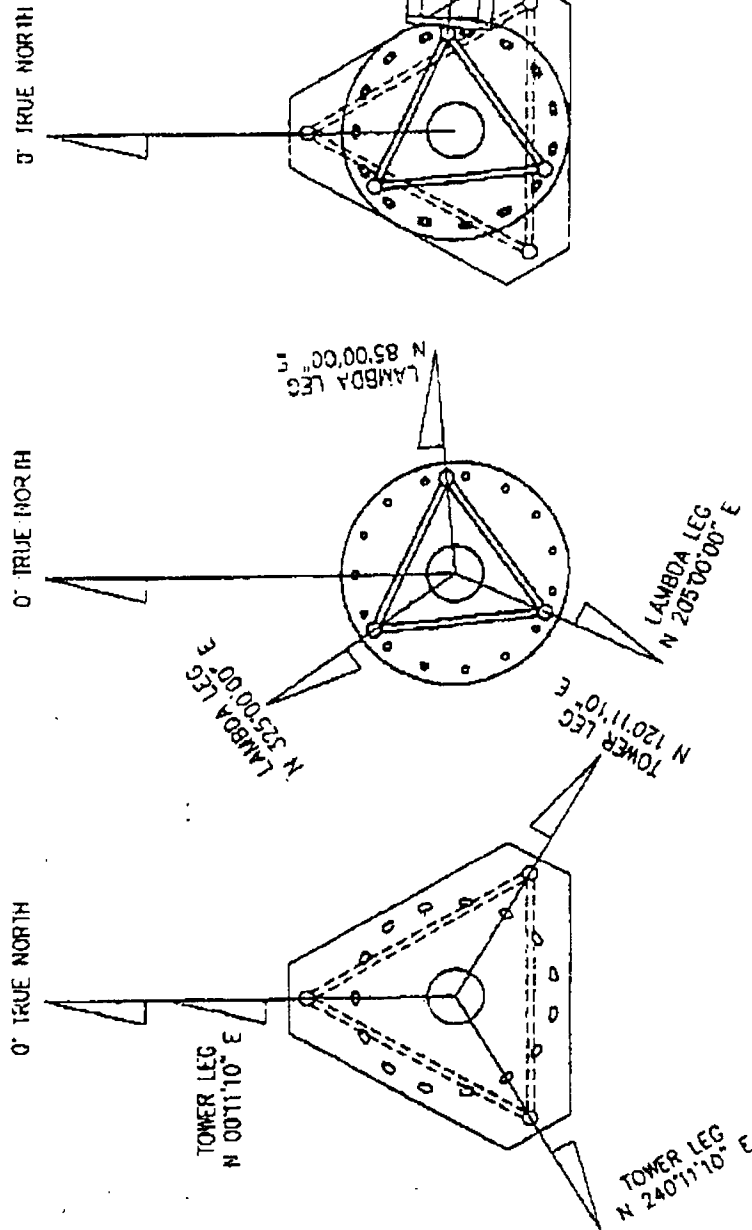
DATE _____ TIME _____

FULL NAME _____ ADDRESS _____

CITY _____ STATE _____ ZIP _____

DATE OF BIRTH _____ MONTH _____ DAY _____

APPROVAL _____



COMBINED VIEW OF TOWER AND LAMBDA
(LOOKING FROM TOP DOWN)

BOTTOM OF LAMBDA MOUNT
(LOOKING FROM TOP DOWN)

TOP VIEW OF BASE TOWER

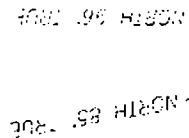
ORIENTATION OF FM ANTENNA AND LAMBDA MOUNT SHOULD BE AS SHOWN. IT IS THE RESPONSIBILITY OF THE OWNER'S DESIGNATED REPRESENTATIVE TO VERIFY THE CORRECT ORIENTATION OF THE BASE TOWER, AND FINAL POSITIONING OF THE LAMBDA MOUNT AND ANTENNA ORIENTATION. THE PROPER LAYOUT OF THE BASE TOWER SHOULD BE CONFIRMED TO FBI PRIOR TO ERECTION OF THE TOWER.

APPROVED BY STEPHEN MINISTALL
11-11-2002

11-11-2002

[Handwritten signature]

ELECTRONICS RESEARCH, INC.		CRI	
BIRMINGHAM 16113			
7777 GARDNER RD. CHANDLER, IN 47610-9637 PHONE: (812) 925-6000 FAX: (812) 925-4020			
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NO	REVISION	AUT'D	DATE
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NAME		ORIENTATION DETAIL	
FOR		PATTERSON, CA	
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NAME _____

STATUS _____

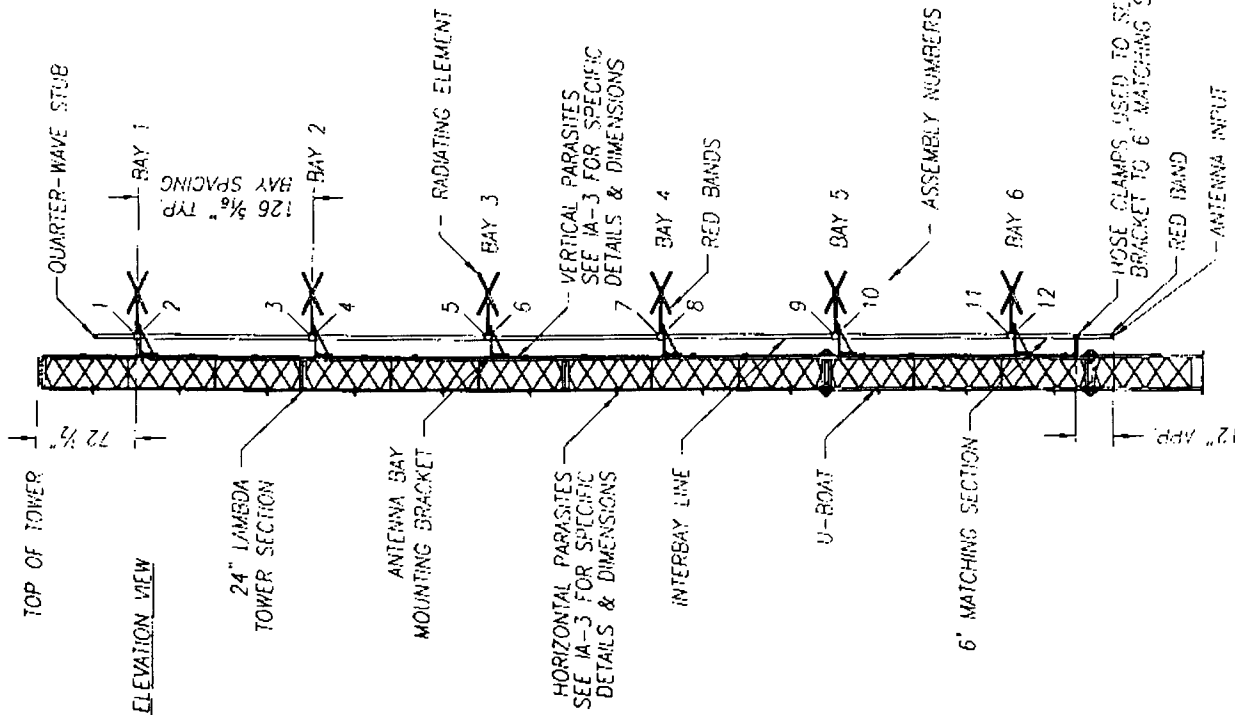
PRESIDENCY _____

TITLE _____

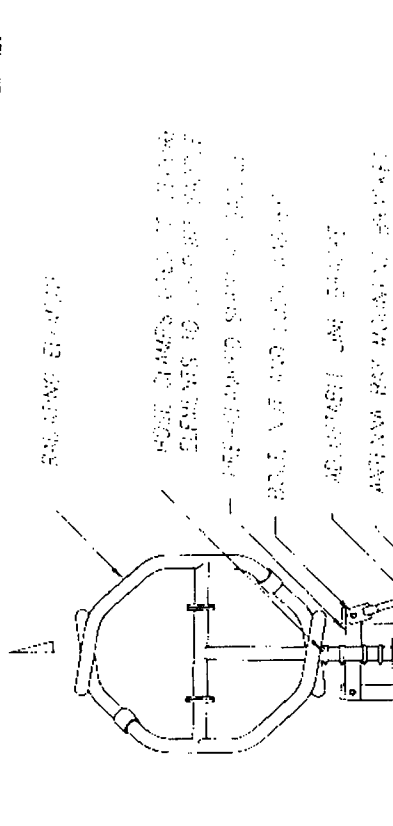
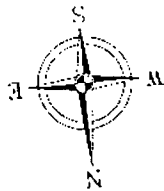
BIRTH DATE _____ BIRTH PLACE _____

FAVORABLE RECOMMENDATION _____

APPROVAL SIGNATURE _____



NORTH 96° TRUE



NOTES:

1. ALL RED BANDS DESIGNATE SIZE TO BE MOLDED LAMINATED
2. ASSEMBLE ANTENNA SYSTEM BY VARIOUS COMPONENT NUMBERS
3. OVERALL LENGTH OF ANTENNA SYSTEM 7' 10" 1/2" (7' 10" 1/2" LONG)
4. ENSURE TO PLUMB ANTENNA PARASITES & INTERBAY LINES
5. CLAMPS ON PRE-PLANNED CLAMPING POINTS ONLY
6. LINE BRACKETS
7. ANT-RADIATION BRACKETS ARE USED TO PLUMB ANTENNA PARASITES
8. U-BOLTS USED TO SECURE BRACKETS TO TOWER LUGS
9. FROM ORIENTATION TO BE DETERMINED BY FIELD SURVEY

ELECTRONICS RESEARCH, INC.

Established 1943

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