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

Modifications to an Existing Directional Antenna System for KLVR, Middletown, California

May 19, 2021

Electronics Research Inc. is providing modifications to an existing antenna system that was designed for radio station KLVR.

The antenna is the ERI model LP-2E-DA-HW configuration. The circular polarized system consists of two half-wavelength spaced bays using one driven circular polarized radiating element per bay, one horizontal parasitic element per bay and two vertical parasitic elements interleaved between the bays. The antenna is mounted on the North 313.5 degrees East tower face with bracketry to provide an antenna orientation of North 313.5 degrees East. The antenna was tested on an 18" Lambda tower, which is the structure the station is to using to support the array. All tests were performed on a frequency of 91.9 megahertz, which is the center of the FM broadcast channel assigned to KLVR.

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.

Modifications to an Existing Directional Antenna System for KLVR, Middletown, California

DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of a full-scale model of the complete 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 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 an 18" Lambda 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 is 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.

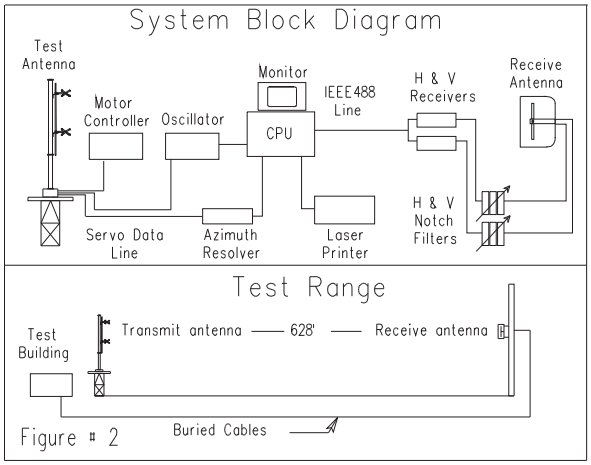


Figure # 2

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

Modifications to an Existing Directional Antenna System for KLVR, Middletown, California

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 two half-wavelength spaced bays using one driven circular polarized radiating element per bay, one horizontal parasitic element per bay and two vertical parasitic elements interleaved between the bays. The power distribution and phase relationship was fixed when the antenna was manufactured. Proper maintenance of the elements should be all that is required to maintain the pattern in adjustment.

The LP-2E-DA-HW array is mounted on the North 313.5 degrees East tower face of the 18" Lambda tower at a bearing of North 313.5 degrees East. Blue prints provided with the antenna show the proper antenna orientation alignment. The antenna alignment procedure should be directed by a licensed surveyor as prescribed by the FCC.

Figure # 2MR 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 #2MR & 2MRA respectively. The actual measured pattern does not exceed the authorized FCC composite pattern at any azimuth.

Modifications to an Existing Directional Antenna System
for
KLVR, Middletown, California

A calculated vertical plane relative field pattern is shown on Figure #3 attached. The power in the maximum will reach .800 kilowatts (-.969 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 # 2MR 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 20 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.

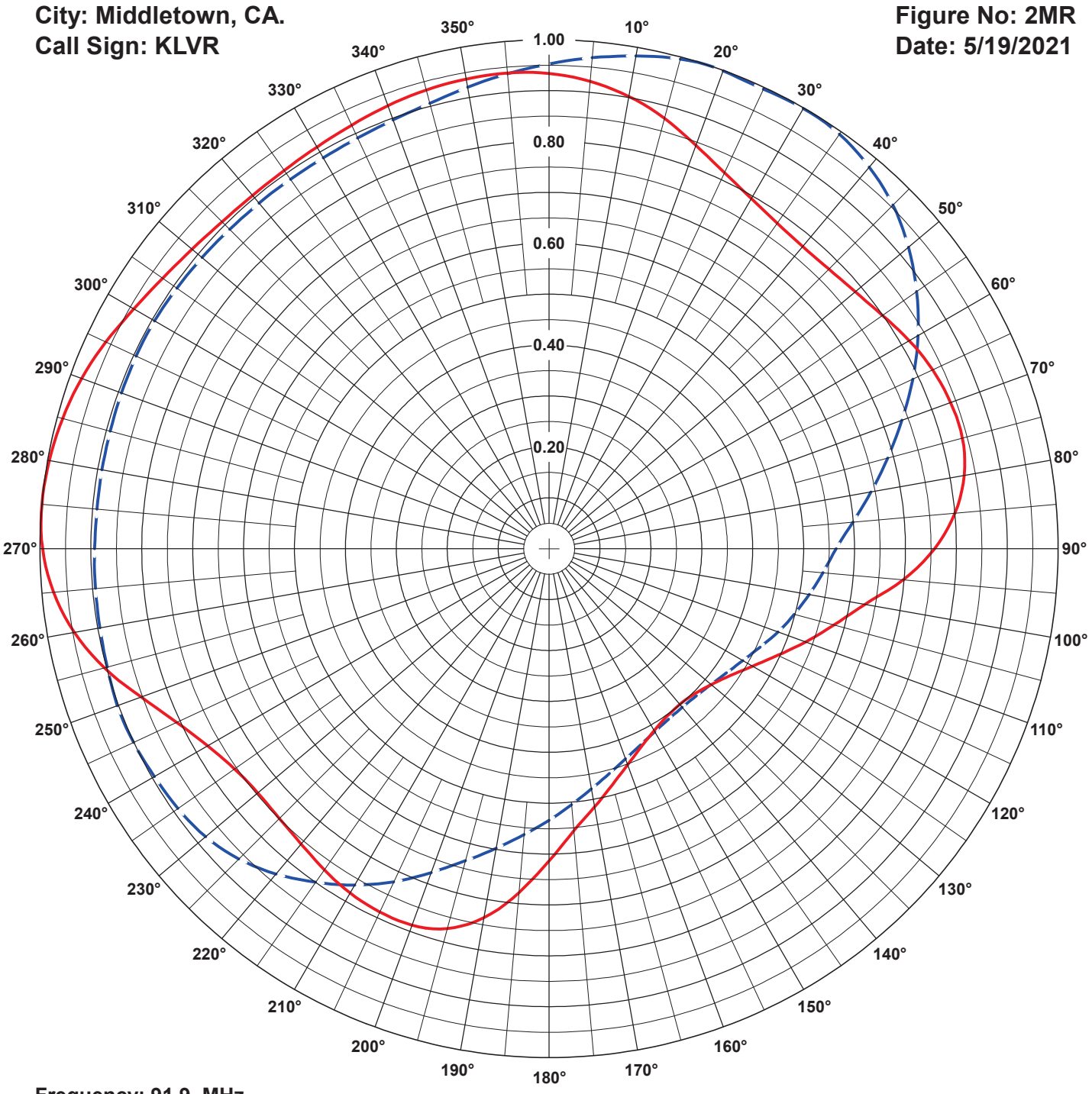
Dan Dowdle
ERI Test Range Director

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

City: Middletown, CA.
Call Sign: KLVR

Figure No: 2MR
Date: 5/19/2021



Frequency: 91.9 MHz
Antenna Type: LP-2E-DA-HW
Antenna Orientation: 313.5° True
Antenna Mounting: 20" Radome
Tower Type 18" Lambda

VERTICAL	HORIZONTAL
RMS: .783	RMS: .787
Maximum: 1 @ 19°	Maximum: 1 @ 275°
Minimum: .407 @ 140°	Minimum: .399 @ 140°

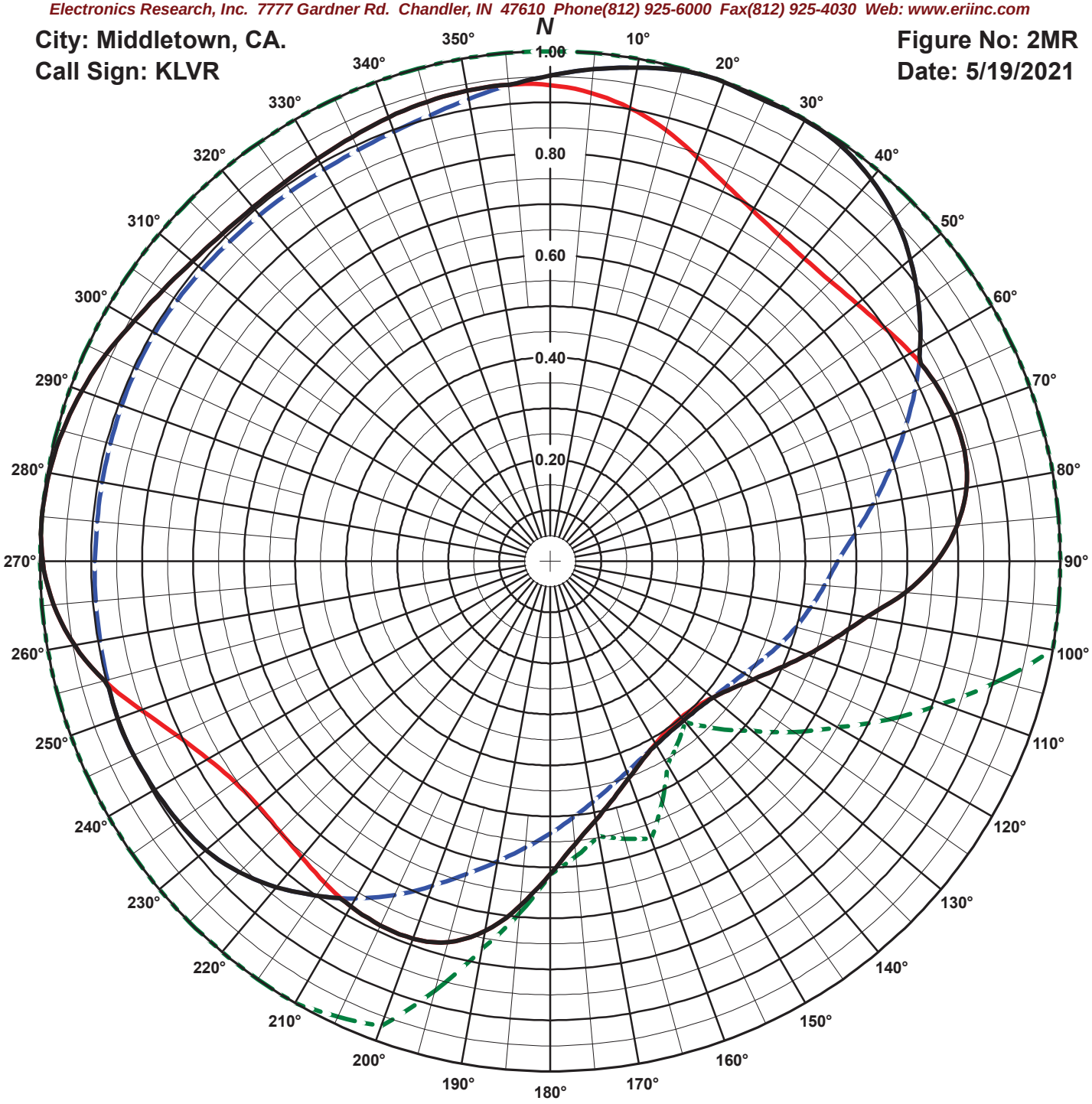
Measured patterns of the horizontal and vertical components.

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

City: Middletown, CA.
Call Sign: KLVR

Figure No: 2MR
Date: 5/19/2021



Antenna Orientation: 313.5° True

Frequency: 91.9 MHz
Antenna Type: LP-2E-DA-HW

Antenna Mounting: 20" Radome
Tower Type: 18" Lambda

HORIZONTAL	VERTICAL	COMPOSITE	FCC ENVELOPE
RMS: .787	RMS: .783	RMS: .823	RMS: .917
Maximum: 1 @ 275°	Maximum: 1 @ 19°	Maximum: 1 @ 19°	Maximum: 1 @ 0°
Minimum: .399 @ 140°	Minimum: .407 @ 140°	Minimum: .407 @ 140°	Minimum: .411 @ 140°

Measured patterns of the horizontal and vertical components.

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: 5/19/2021**
Station: KLVR **Antenna: LP-2E-DA-HW**
Location: Middletown, CA. **Antenna Orientation: 313.5° True**
Frequency: 91.9 MHz **Number of Bays: 2**

Azimuth	Envelope			Polarization	Azimuth	Envelope			Polarization
	Field	kW	dBk	Maximum		Field	kW	dBk	Maximum
0°	0.952	0.726	-1.393	Vertical	180°	0.614	0.301	-5.211	Horizontal
5°	0.968	0.750	-1.249	Vertical	185°	0.679	0.368	-4.337	Horizontal
10°	0.983	0.773	-1.118	Vertical	190°	0.736	0.434	-3.628	Horizontal
15°	0.996	0.794	-1.004	Vertical	195°	0.773	0.478	-3.207	Horizontal
20°	0.999	0.799	-0.975	Vertical	200°	0.787	0.496	-3.047	Horizontal
25°	0.996	0.794	-1.001	Vertical	205°	0.787	0.496	-3.044	Horizontal
30°	0.999	0.798	-0.980	Vertical	210°	0.781	0.488	-3.112	Horizontal
35°	0.994	0.791	-1.020	Vertical	215°	0.800	0.512	-2.906	Vertical
40°	0.979	0.766	-1.158	Vertical	220°	0.834	0.557	-2.542	Vertical
45°	0.955	0.730	-1.369	Vertical	225°	0.862	0.594	-2.259	Vertical
50°	0.922	0.679	-1.679	Vertical	230°	0.881	0.620	-2.074	Vertical
55°	0.881	0.622	-2.065	Vertical	235°	0.890	0.634	-1.982	Vertical
60°	0.837	0.560	-2.515	Vertical	240°	0.895	0.641	-1.928	Vertical
65°	0.831	0.553	-2.575	Horizontal	245°	0.900	0.649	-1.880	Vertical
70°	0.839	0.564	-2.489	Horizontal	250°	0.902	0.651	-1.862	Vertical
75°	0.841	0.565	-2.478	Horizontal	255°	0.904	0.654	-1.842	Horizontal
80°	0.828	0.549	-2.607	Horizontal	260°	0.947	0.717	-1.442	Horizontal
85°	0.800	0.512	-2.903	Horizontal	265°	0.977	0.764	-1.169	Horizontal
90°	0.757	0.459	-3.384	Horizontal	270°	0.995	0.792	-1.014	Horizontal
95°	0.699	0.391	-4.083	Horizontal	275°	1.000	0.800	-0.969	Horizontal
100°	0.630	0.318	-4.980	Horizontal	280°	0.997	0.795	-0.996	Horizontal
105°	0.579	0.268	-5.711	Horizontal	285°	0.989	0.783	-1.064	Horizontal
110°	0.536	0.230	-6.381	Horizontal	290°	0.977	0.764	-1.171	Horizontal
115°	0.496	0.197	-7.065	Horizontal	295°	0.961	0.738	-1.318	Horizontal
120°	0.462	0.170	-7.684	Horizontal	300°	0.942	0.710	-1.487	Horizontal
125°	0.435	0.151	-8.202	Horizontal	305°	0.927	0.687	-1.631	Horizontal
130°	0.416	0.138	-8.596	Horizontal	310°	0.915	0.670	-1.737	Horizontal
135°	0.409	0.134	-8.733	Vertical	315°	0.908	0.660	-1.803	Horizontal
140°	0.407	0.132	-8.780	Vertical	320°	0.906	0.657	-1.827	Horizontal
145°	0.409	0.134	-8.733	Vertical	325°	0.907	0.659	-1.814	Horizontal
150°	0.415	0.138	-8.602	Vertical	330°	0.911	0.664	-1.775	Horizontal
155°	0.429	0.147	-8.317	Horizontal	335°	0.918	0.674	-1.712	Horizontal
160°	0.452	0.163	-7.873	Horizontal	340°	0.926	0.686	-1.635	Horizontal
165°	0.480	0.185	-7.337	Horizontal	345°	0.933	0.696	-1.573	Horizontal
170°	0.515	0.212	-6.729	Horizontal	350°	0.937	0.702	-1.535	Horizontal
175°	0.557	0.248	-6.059	Horizontal	355°	0.938	0.704	-1.523	Horizontal

Horizontal Polarization:
Maximum: 1.083 (0.346 dB)
Horizontal Plane: 1.083 (0.346 dB)
Maximum ERP: 0.800 kW

Vertical Polarization:
Maximum: 1.083 (0.346 dB)
Horizontal Plane: 1.083 (0.346 dB)
Maximum ERP: 0.800 kW

Total Input Power: 0.739 kW
Reference: KLVR2MR.FIG
Measured patterns of the horizontal and vertical components.

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# 2MR | **Date: 5/19/2021**
Station: KLVR | **Antenna: LP-2E-DA-HW**
Location: Middletown, CA. | **Antenna Orientation: 313.5° True**
Frequency: 91.9 MHz | **Number of Bays: 2**

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.934	0.697	-1.567	0.952	0.726	-1.393	180°	0.614	0.301	-5.211	0.534	0.228	-6.420
5°	0.922	0.680	-1.677	0.968	0.750	-1.249	185°	0.679	0.368	-4.337	0.564	0.254	-5.945
10°	0.902	0.651	-1.862	0.983	0.773	-1.118	190°	0.736	0.434	-3.628	0.598	0.286	-5.440
15°	0.875	0.613	-2.124	0.996	0.794	-1.004	195°	0.773	0.478	-3.207	0.635	0.323	-4.915
20°	0.843	0.569	-2.449	0.999	0.799	-0.975	200°	0.787	0.496	-3.047	0.677	0.367	-4.354
25°	0.815	0.532	-2.744	0.996	0.794	-1.001	205°	0.787	0.496	-3.044	0.722	0.417	-3.796
30°	0.794	0.505	-2.969	0.999	0.798	-0.980	210°	0.781	0.488	-3.112	0.763	0.466	-3.316
35°	0.781	0.488	-3.117	0.994	0.791	-1.020	215°	0.770	0.474	-3.239	0.800	0.512	-2.906
40°	0.775	0.481	-3.183	0.979	0.766	-1.158	220°	0.758	0.459	-3.381	0.834	0.557	-2.542
45°	0.777	0.483	-3.161	0.955	0.730	-1.369	225°	0.749	0.449	-3.476	0.862	0.594	-2.259
50°	0.785	0.493	-3.070	0.922	0.679	-1.679	230°	0.747	0.446	-3.506	0.881	0.620	-2.074
55°	0.799	0.511	-2.914	0.881	0.622	-2.065	235°	0.754	0.455	-3.417	0.890	0.634	-1.982
60°	0.817	0.534	-2.723	0.837	0.560	-2.515	240°	0.775	0.480	-3.188	0.895	0.641	-1.928
65°	0.831	0.553	-2.575	0.788	0.497	-3.033	245°	0.807	0.521	-2.828	0.900	0.649	-1.880
70°	0.839	0.564	-2.489	0.738	0.435	-3.613	250°	0.853	0.582	-2.353	0.902	0.651	-1.862
75°	0.841	0.565	-2.478	0.689	0.379	-4.209	255°	0.904	0.654	-1.842	0.899	0.646	-1.897
80°	0.828	0.549	-2.607	0.642	0.330	-4.818	260°	0.947	0.717	-1.442	0.896	0.642	-1.923
85°	0.800	0.512	-2.903	0.599	0.287	-5.418	265°	0.977	0.764	-1.169	0.894	0.640	-1.938
90°	0.757	0.459	-3.384	0.564	0.254	-5.947	270°	0.995	0.792	-1.014	0.893	0.638	-1.955
95°	0.699	0.391	-4.083	0.540	0.233	-6.321	275°	1.000	0.800	-0.969	0.891	0.635	-1.970
100°	0.630	0.318	-4.980	0.519	0.215	-6.669	280°	0.997	0.795	-0.996	0.892	0.636	-1.964
105°	0.579	0.268	-5.711	0.499	0.199	-7.014	285°	0.989	0.783	-1.064	0.892	0.637	-1.958
110°	0.536	0.230	-6.381	0.479	0.183	-7.371	290°	0.977	0.764	-1.171	0.894	0.639	-1.945
115°	0.496	0.197	-7.065	0.457	0.167	-7.762	295°	0.961	0.738	-1.318	0.895	0.641	-1.933
120°	0.462	0.170	-7.684	0.440	0.155	-8.109	300°	0.942	0.710	-1.487	0.895	0.641	-1.933
125°	0.435	0.151	-8.202	0.425	0.145	-8.391	305°	0.927	0.687	-1.631	0.892	0.637	-1.958
130°	0.416	0.138	-8.596	0.415	0.138	-8.601	310°	0.915	0.670	-1.737	0.890	0.633	-1.984
135°	0.404	0.130	-8.848	0.409	0.134	-8.733	315°	0.908	0.660	-1.803	0.887	0.630	-2.007
140°	0.399	0.128	-8.941	0.407	0.132	-8.780	320°	0.906	0.657	-1.827	0.886	0.628	-2.019
145°	0.403	0.130	-8.865	0.409	0.134	-8.733	325°	0.907	0.659	-1.814	0.886	0.628	-2.022
150°	0.413	0.136	-8.652	0.415	0.138	-8.602	330°	0.911	0.664	-1.775	0.887	0.629	-2.014
155°	0.429	0.147	-8.317	0.425	0.145	-8.393	335°	0.918	0.674	-1.712	0.890	0.634	-1.981
160°	0.452	0.163	-7.873	0.439	0.154	-8.111	340°	0.926	0.686	-1.635	0.896	0.643	-1.921
165°	0.480	0.185	-7.337	0.457	0.167	-7.764	345°	0.933	0.696	-1.573	0.906	0.657	-1.827
170°	0.515	0.212	-6.729	0.479	0.184	-7.359	350°	0.937	0.702	-1.535	0.921	0.678	-1.688
175°	0.557	0.248	-6.059	0.505	0.204	-6.905	355°	0.938	0.704	-1.523	0.937	0.702	-1.538

Horizontal Polarization:
Maximum: 1.083 (0.346 dB)
Horizontal Plane: 1.083 (0.346 dB)
Maximum ERP: 0.800 kW

Vertical Polarization:
Maximum: 1.083 (0.346 dB)
Horizontal Plane: 1.083 (0.346 dB)
Maximum ERP: 0.800 kW

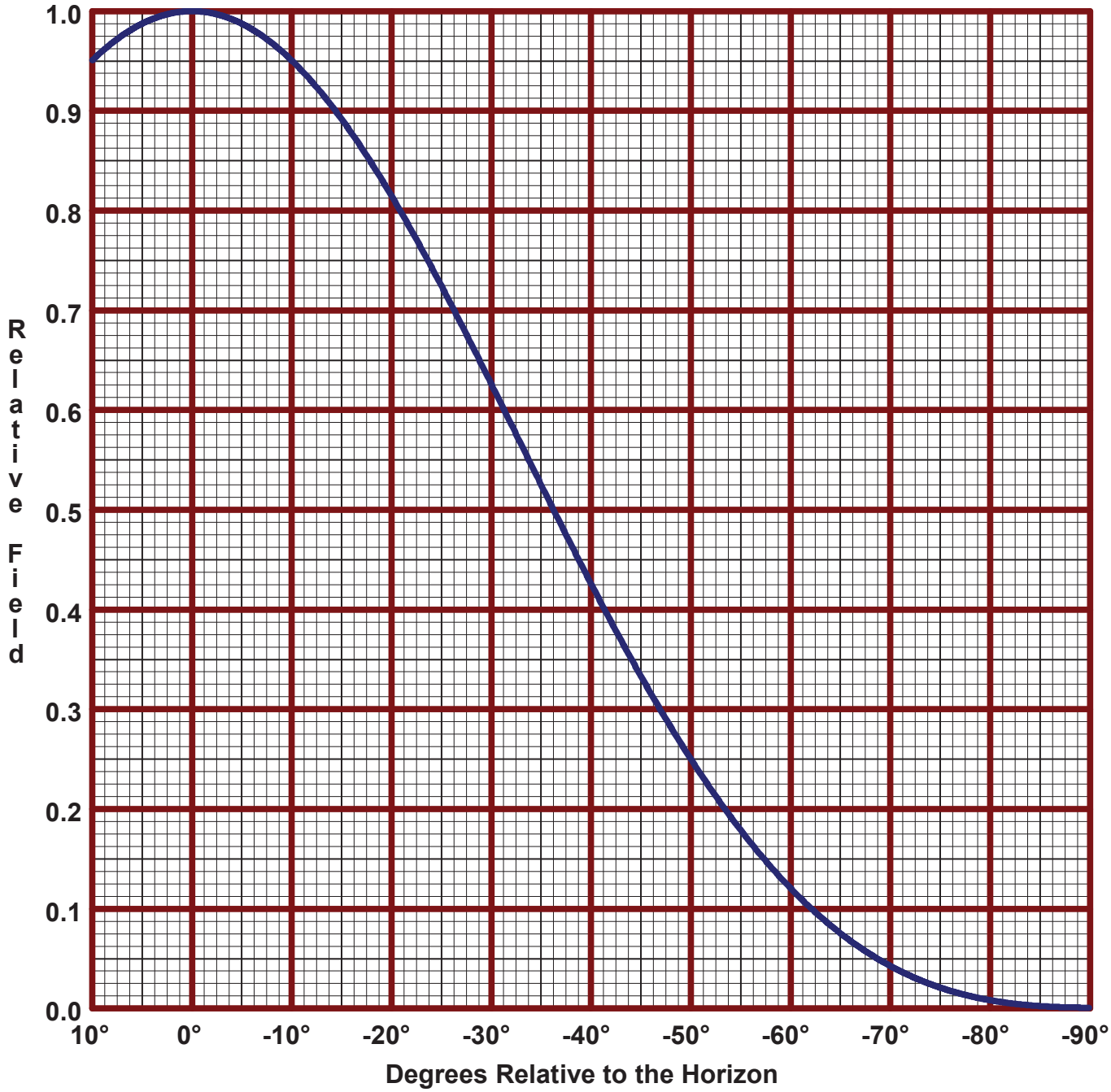
Total Input Power: 0.739 kW
Reference: KLVR2MR.FIG
Measured patterns of the horizontal and vertical components.

ERI® Vertical 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 No: 3
Call Sign: KLVR
Location: Middletown, CA.
Frequency: 91.9 MHz
Antenna: 2 bay LP-2E-DA-HW

Date: 5/19/2021
H/V Power Ratio: 1
.5 Wave-length Spacing
0° Beam Tilt
0% First Null Fill



Horizontal Polarization:
Maximum: 1.083 (0.346 dB)
Horizontal Plane: 1.083 (0.346 dB)
Maximum ERP: 0.800 kW

Vertical Polarization:
Maximum: 1.083 (0.346 dB)
Horizontal Plane: 1.083 (0.346 dB)
Maximum ERP: 0.800 kW

Measured patterns of the horizontal and vertical components.

Modifications to an Existing Directional Antenna System for KLVR, Middletown, California

(continued)

ANTENNA SPECIFICATIONS

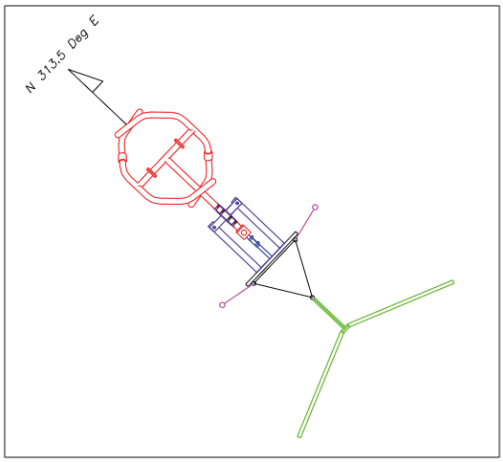
Antenna Type:	LP-2E-DA-HW
Frequency:	91.9 MHz
Number of Bays:	Two

MECHANICAL SPECIFICATIONS

Mounting:	Standard
System length:	14 ft 2 in
Aperture length required:	20 ft 5 in
Orientation:	313.5° true
Input flange to the antenna	1 5/8” female.

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	0.800 kW (-0.969 dBk)
Horizontal maximum power gain:	1.083 (0.346 dB)
Maximum vertical ERP:	0.800 kW (-0.969 dBk)
Vertical maximum power gain:	1.083 (0.346 dB)
Total input power:	0.739kW (-1.314 dBk)



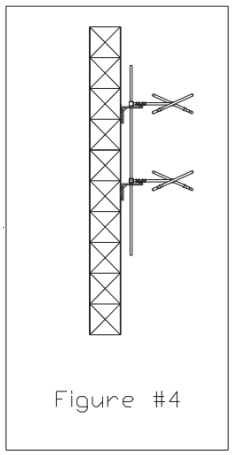


Figure #4