

***Directional Antenna System
for
KDDS, Elma, Washington***

August 3, 2005

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 KDDS.

The antenna is the ERI model MP-6AC-DA-HW configuration. The circular polarized system consists of six half-wavelength spaced bays using one driven circular polarized radiating element per bay, three horizontal parasitic elements per bay and one vertical parasitic element per bay. The antenna was mounted on the North 193 degrees East tower leg with bracketry to provide an antenna orientation of North 183 degrees East. The antenna was tested on a 48" ERI tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 99.3 megahertz, which is the center of the FM broadcast channel assigned to KDDS.

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 KDDS, Elma, Washington

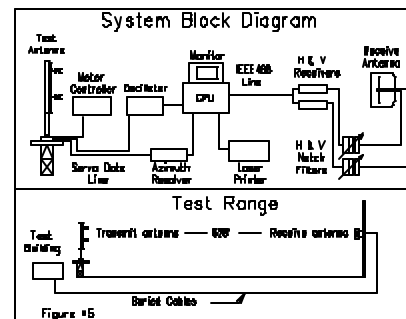
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DESCRIPTION OF THE TEST PROCEDURE

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 48" ERI 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 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 99.3 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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(Continued)

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 six half-wavelength spaced bays using one driven circular polarized radiating element per bay, three horizontal parasitic elements per bay and one vertical parasitic element 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-6AC-DA-HW array is to be mounted on the North 193 degrees East tower leg of the 48" ERI tower at a bearing of North 183 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 64 kilowatts (18.062 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 than 85% of the filed composite pattern.

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(Continued)

The clear vertical length of the structure required to support the antenna is 41 ft 11 in.

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.

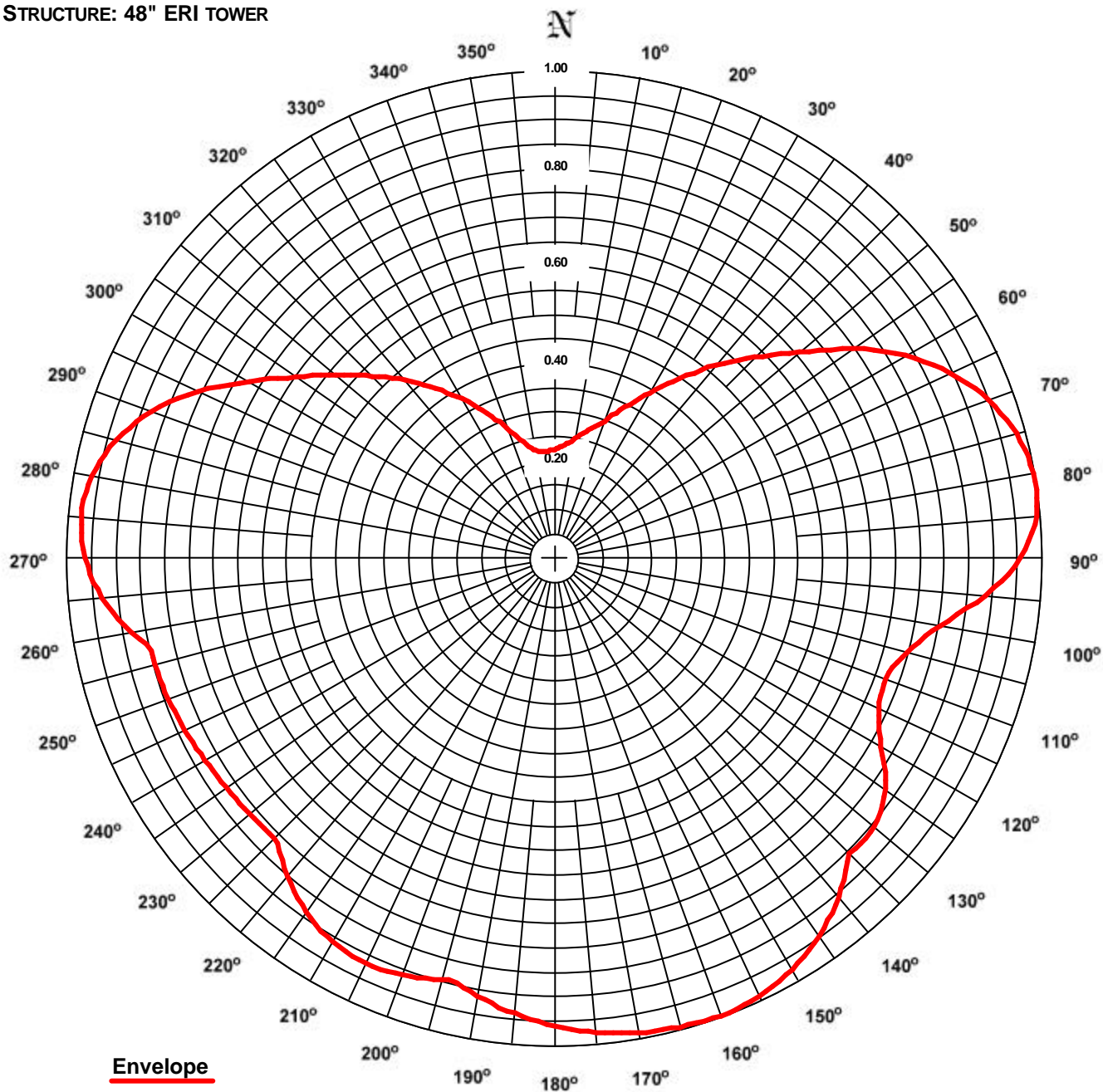
A handwritten signature in cursive script, appearing to read "Tom Sheaf".

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: KDDS
LOCATION: ELMA WA
ANTENNA TYPE: MP-6AC-DA-HW
STRUCTURE: 48" ERI TOWER

DATE: 8/10/2005
FREQUENCY: 99.3 MHz
ORIENTATION: 183° TRUE
MOUNTING: CUSTOM"



RMS: 0.778
Maximum: 1.000 @ 82° True
Minimum: 0.218 @ 354° True

COMMENTS: COMPOSITE PATTERN: THIS PATTERN SHOWS THE MAXIMUM OF EITHER THE H OR V AZIMUTH VALUES. THIS PATTERN IS GREATER THAN 85% OF THE FCC FILED COMPOSITE PATTERN BPH-20050601AMD

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: KDDS
Location: Elma WA
Frequency: 99.3 MHz

Antenna: MP-6AC-DA-HW
Orientation: 183° True
Tower: 48" ERI

Figure: 1
Date: 8/10/2005
Reference: kdds1m.fig

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0°	0.223	3.17	5.01	Horizontal	180°	0.961	59.06	17.71	Vertical
5°	0.233	3.47	5.40	Horizontal	185°	0.939	56.44	17.52	Vertical
10°	0.249	3.96	5.98	Horizontal	190°	0.913	53.33	17.27	Vertical
15°	0.271	4.69	6.71	Horizontal	195°	0.896	51.37	17.11	Horizontal
20°	0.298	5.68	7.55	Horizontal	200°	0.912	53.23	17.26	Horizontal
25°	0.341	7.46	8.73	Horizontal	205°	0.918	53.93	17.32	Horizontal
30°	0.391	9.78	9.91	Horizontal	210°	0.910	52.99	17.24	Horizontal
35°	0.450	12.94	11.12	Horizontal	215°	0.888	50.51	17.03	Horizontal
40°	0.516	17.03	12.31	Horizontal	220°	0.853	46.61	16.69	Horizontal
45°	0.581	21.60	13.35	Horizontal	225°	0.815	42.46	16.28	Vertical
50°	0.656	27.51	14.40	Horizontal	230°	0.817	42.74	16.31	Vertical
55°	0.747	35.76	15.53	Horizontal	235°	0.822	43.25	16.36	Vertical
60°	0.831	44.23	16.46	Horizontal	240°	0.829	43.99	16.43	Vertical
65°	0.898	51.61	17.13	Horizontal	245°	0.838	44.89	16.52	Vertical
70°	0.948	57.52	17.60	Horizontal	250°	0.844	45.60	16.59	Vertical
75°	0.981	61.63	17.90	Horizontal	255°	0.849	46.08	16.64	Vertical
80°	0.998	63.74	18.04	Horizontal	260°	0.880	49.62	16.96	Horizontal
85°	0.993	63.06	18.00	Horizontal	265°	0.932	55.55	17.45	Horizontal
90°	0.956	58.45	17.67	Horizontal	270°	0.963	59.37	17.74	Horizontal
95°	0.888	50.45	17.03	Horizontal	275°	0.975	60.84	17.84	Horizontal
100°	0.804	41.41	16.17	Horizontal	280°	0.963	59.36	17.73	Horizontal
105°	0.749	35.89	15.55	Horizontal	285°	0.931	55.49	17.44	Horizontal
110°	0.724	33.57	15.26	Horizontal	290°	0.879	49.49	16.95	Horizontal
115°	0.734	34.52	15.38	Horizontal	295°	0.808	41.75	16.21	Horizontal
120°	0.774	38.38	15.84	Horizontal	300°	0.724	33.51	15.25	Horizontal
125°	0.829	43.98	16.43	Horizontal	305°	0.647	26.75	14.27	Horizontal
130°	0.858	47.07	16.73	Horizontal	310°	0.584	21.81	13.39	Horizontal
135°	0.857	46.96	16.72	Horizontal	315°	0.527	17.78	12.50	Horizontal
140°	0.907	52.64	17.21	Vertical	320°	0.476	14.50	11.61	Horizontal
145°	0.947	57.38	17.59	Vertical	325°	0.424	11.48	10.60	Horizontal
150°	0.976	60.92	17.85	Vertical	330°	0.377	9.10	9.59	Horizontal
155°	0.993	63.15	18.00	Vertical	335°	0.327	6.83	8.34	Horizontal
160°	1.000	64.00	18.06	Vertical	340°	0.283	5.13	7.10	Horizontal
165°	0.997	63.64	18.04	Vertical	345°	0.246	3.86	5.87	Horizontal
170°	0.990	62.69	17.97	Vertical	350°	0.224	3.21	5.07	Horizontal
175°	0.978	61.15	17.86	Vertical	355°	0.218	3.04	4.83	Horizontal

Polarization:
Maximum Field:
Minimum Field:
RMS:
Maximum ERP:
Maximum Power Gain:

Envelope
1.000 @ 82° True
0.218 @ 354° True
0.778
64.000 kW
3.346 (5.246 dB)

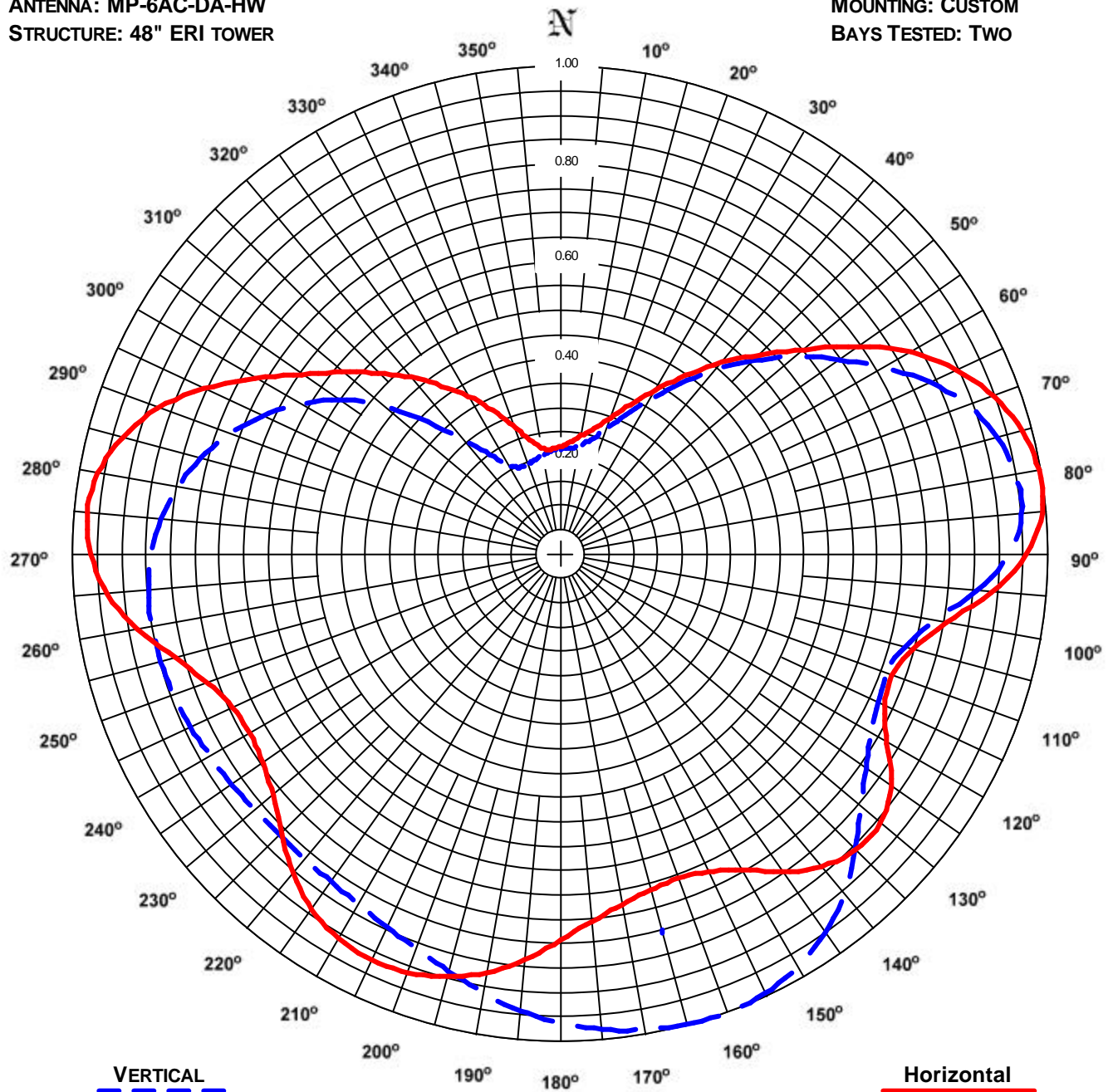
Total Input Power: 19.125 kW

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 NO: 2
STATION: KDDS
LOCATION: ELMA WA
ANTENNA: MP-6AC-DA-HW
STRUCTURE: 48" ERI TOWER

DATE: 8/10/2005
FREQUENCY: 99.3 MHz
ORIENTATION: 183° TRUE
MOUNTING: CUSTOM
BAYS TESTED: TWO



VERTICAL
RMS: 0.736
MAXIMUM: 1.000 @ 160° TRUE
MINIMUM: 0.197 @ 336° TRUE

Horizontal
RMS: 0.738
Maximum: 1.000 @ 82° True
Minimum: 0.218 @ 354° 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: KDDS
Location: Elma WA
Frequency: 99.3 MHz

Antenna: MP-6AC-DA-HW
Orientation: 183° True
Tower: 48" ERI

Figure: 2
Date: 8/10/2005
Reference: kdds1m.fig

Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.223	3.17	5.01	0.217	3.02	4.81	180°	0.790	39.96	16.02	0.961	59.06	17.71
5°	0.233	3.47	5.40	0.219	3.07	4.87	185°	0.834	44.49	16.48	0.939	56.44	17.52
10°	0.249	3.96	5.98	0.228	3.33	5.22	190°	0.870	48.43	16.85	0.913	53.33	17.27
15°	0.271	4.69	6.71	0.246	3.87	5.88	195°	0.896	51.37	17.11	0.885	50.11	17.00
20°	0.298	5.68	7.55	0.273	4.77	6.79	200°	0.912	53.23	17.26	0.861	47.49	16.77
25°	0.341	7.46	8.73	0.317	6.45	8.09	205°	0.918	53.93	17.32	0.843	45.45	16.58
30°	0.391	9.78	9.91	0.369	8.71	9.40	210°	0.910	52.99	17.24	0.829	43.94	16.43
35°	0.450	12.94	11.12	0.429	11.76	10.71	215°	0.888	50.51	17.03	0.819	42.95	16.33
40°	0.516	17.03	12.31	0.498	15.88	12.01	220°	0.853	46.61	16.69	0.815	42.46	16.28
45°	0.581	21.60	13.35	0.563	20.31	13.08	225°	0.807	41.70	16.20	0.815	42.46	16.28
50°	0.656	27.51	14.40	0.637	25.97	14.14	230°	0.770	37.90	15.79	0.817	42.74	16.31
55°	0.747	35.76	15.53	0.699	31.27	14.95	235°	0.745	35.55	15.51	0.822	43.25	16.36
60°	0.831	44.23	16.46	0.767	37.65	15.76	240°	0.735	34.53	15.38	0.829	43.99	16.43
65°	0.898	51.61	17.13	0.838	44.96	16.53	245°	0.742	35.22	15.47	0.838	44.89	16.52
70°	0.948	57.52	17.60	0.892	50.96	17.07	250°	0.769	37.89	15.79	0.844	45.60	16.59
75°	0.981	61.63	17.90	0.930	55.31	17.43	255°	0.817	42.69	16.30	0.849	46.08	16.64
80°	0.998	63.74	18.04	0.950	57.75	17.62	260°	0.880	49.62	16.96	0.851	46.32	16.66
85°	0.993	63.06	18.00	0.950	57.80	17.62	265°	0.932	55.55	17.45	0.849	46.14	16.64
90°	0.956	58.45	17.67	0.919	54.10	17.33	270°	0.963	59.37	17.74	0.840	45.13	16.54
95°	0.888	50.45	17.03	0.858	47.07	16.73	275°	0.975	60.84	17.84	0.822	43.30	16.36
100°	0.804	41.41	16.17	0.780	38.94	15.90	280°	0.963	59.36	17.73	0.797	40.70	16.10
105°	0.749	35.89	15.55	0.731	34.16	15.33	285°	0.931	55.49	17.44	0.765	37.41	15.73
110°	0.724	33.57	15.26	0.712	32.44	15.11	290°	0.879	49.49	16.95	0.724	33.53	15.25
115°	0.734	34.52	15.38	0.719	33.05	15.19	295°	0.808	41.75	16.21	0.675	29.18	14.65
120°	0.774	38.38	15.84	0.736	34.70	15.40	300°	0.724	33.51	15.25	0.619	24.51	13.89
125°	0.829	43.98	16.43	0.765	37.47	15.74	305°	0.647	26.75	14.27	0.555	19.69	12.94
130°	0.858	47.07	16.73	0.805	41.48	16.18	310°	0.584	21.81	13.39	0.476	14.50	11.61
135°	0.857	46.96	16.72	0.856	46.90	16.71	315°	0.527	17.78	12.50	0.385	9.49	9.77
140°	0.834	44.56	16.49	0.907	52.64	17.21	320°	0.476	14.50	11.61	0.308	6.07	7.83
145°	0.794	40.33	16.06	0.947	57.38	17.59	325°	0.424	11.48	10.60	0.251	4.03	6.05
150°	0.747	35.67	15.52	0.976	60.92	17.85	330°	0.377	9.10	9.59	0.214	2.94	4.69
155°	0.717	32.91	15.17	0.993	63.15	18.00	335°	0.327	6.83	8.34	0.198	2.51	4.00
160°	0.706	31.90	15.04	1.000	64.00	18.06	340°	0.283	5.13	7.10	0.198	2.52	4.01
165°	0.712	32.45	15.11	0.997	63.64	18.04	345°	0.246	3.86	5.87	0.202	2.61	4.17
170°	0.728	33.92	15.31	0.990	62.69	17.97	350°	0.224	3.21	5.07	0.208	2.78	4.44
175°	0.754	36.40	15.61	0.978	61.15	17.86	355°	0.218	3.04	4.83	0.214	2.94	4.68

Polarization:	Horizontal	Vertical
Maximum Field:	1.000 @ 82° True	1.000 @ 160° True
Minimum Field:	0.218 @ 354° True	0.197 @ 336° True
RMS:	0.738	0.736
Maximum ERP:	64.000 kW	64.000 kW
Maximum Power Gain:	3.346 (5.246 dB)	3.346 (5.246 dB)

Total Input Power: 19.125 kW



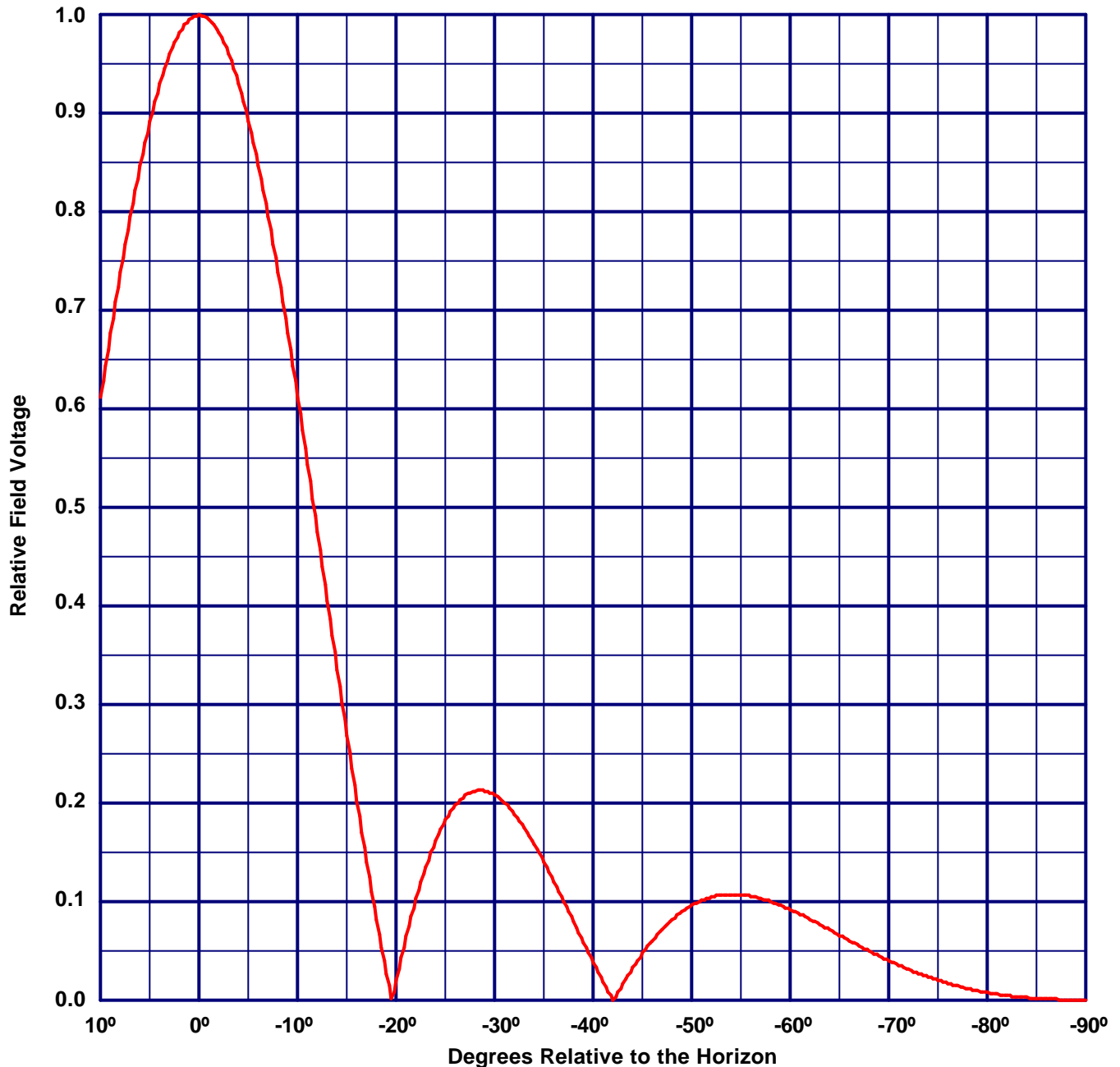
Vertical Plane Relative Field Pattern

KDDS, Elma WA, 99.3 MHz

Figure#: 3

Date: 8/10/2005

A 6 level, .5 wave-length spaced MP-6AC-DA-HW directional antenna with 0° beam tilt, 0% null fill and a H/V maximum power ratio of 1.000



Vertical Polarization Gain:

Maximum: 3.346 (5.246 dB)

Horizontal Plane: 3.346 (5.246 dB)

Horizontal Polarization Gain:

Maximum: 3.346 (5.246 dB)

Horizontal Plane: 3.346 (5.246 dB)

Directional Antenna System for KDDS, Elma, Washington

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type: MP-6AC-DA-HW
Frequency: 99.3 MHz
Number of Bays: six

MECHANICAL SPECIFICATIONS

Mounting: Custom
System length: 30 ft 10 in
Aperture length required: 41 ft. 11 in
Orientation: 183° true
Input flange to the antenna 3 1/8 inch female

ELECTRICAL SPECIFICATIONS

(For directional use)

Maximum horizontal ERP: 64 kW (18.062 dBk)
Horizontal maximum power gain: 3.346 (5.246 dB)
Maximum vertical ERP: 64 kW (18.062 dBk)
Vertical maximum power gain: 3.346 (5.246 dB)
Total input power: 19.125 kW (12.816 dBk)

