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 KMUW, Wichita, Kansas

December 8, 2009

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 KMUW.

The antenna is the ERI model MP-6C-DA configuration. The circular polarized system consists of 6 full-wavelength spaced bays using one driven circular polarized radiating element and one horizontal parasitic element placed one-quarter wave above and below each bay. The antenna was mounted on the North 120 degrees East tower leg with bracketry to provide an antenna orientation of North 117 degrees East. The antenna was tested on a 6' face tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 89.1 megahertz, which is the center of the FM broadcast channel assigned to KMUW.

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
Proposed For
KMUW, Wichita, Kansas

(Continued)

DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of two bay levels of the circular polarized system with the associated horizontal parasitic element. 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 6' face 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 a US Digital angle position indicator. The resolution of this angle position indicator is one-hundredth of a degree.

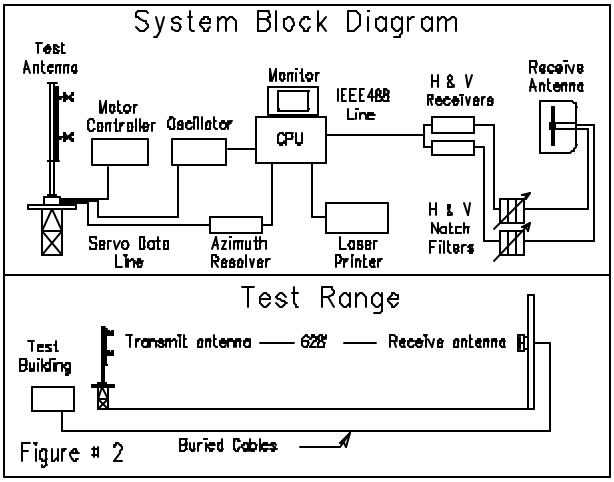


Figure # 2

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 89.1 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 6 full-wavelength spaced bays using one driven circular polarized radiating element and one horizontal parasitic element placed one-quarter wave above and below each 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-6C-DA array is to be mounted on the North 120 degrees East tower leg of the 6' face tower at a bearing of North 117 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 100.000 kilowatts (20.000 dBk).

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

(Continued)

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 75 ft.

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.

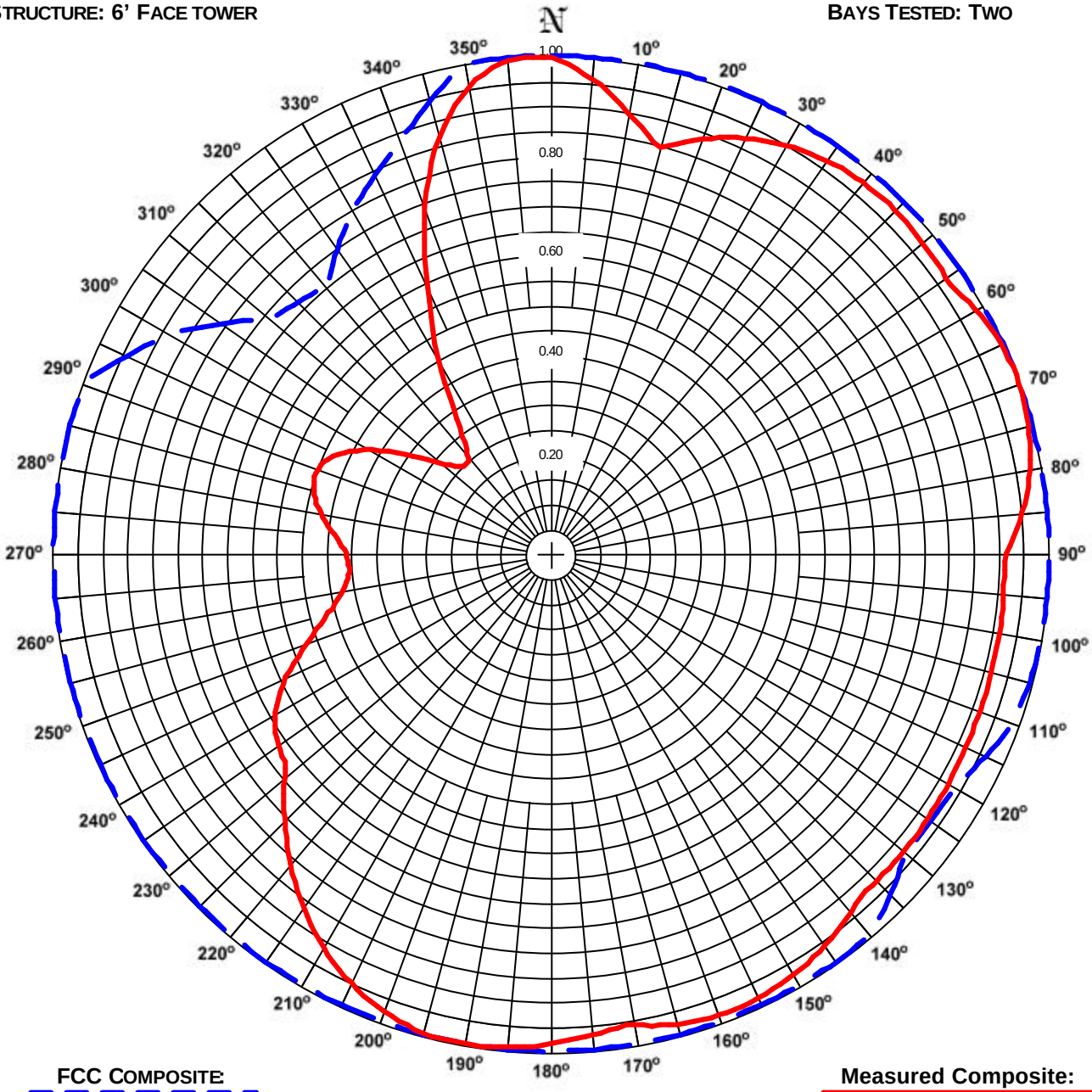
ELECTRONICS RESEARCH, INC.

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 NO: 1
STATION: KMUW
LOCATION: WICHITA, KS
ANTENNA: MP-6C-DA
STRUCTURE: 6' FACE TOWER

DATE: 12/3/2009
FREQUENCY: 89.1 MHZ
ORIENTATION: 117° TRUE
MOUNTING: STANDARD
BAYS TESTED: TWO



FCC COMPOSITE:

RMS: 0.971
MAXIMUM: 1.000 @ 0° TRUE
MINIMUM: 0.701 @ 320° TRUE

Measured Composite:

RMS: 0.827
Maximum: 1.000 @ 69° True
Minimum: 0.246 @ 316° True

COMMENTS: COMPOSITE PATTERN: THIS PATTERN SHOWS THE MAXIMUM OF EITHER THE H OR V AZIMUTH VALUES. THIS PATTERN IS GREATER THAT 85% OF THE FCC FILED COMPOSITE PATTERN BMLED-20080826ABN.

ERI® Horizontal Plane Relative Field List

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Station: KMUW
Location: Wichita, KS
Frequency: 89.1 MHz

Antenna: MP-6C-DA
Orientation: 117° True
Tower: 6' Face tower

Figure: 1
Date: 12/3/2009
Reference: kmuw1m.fig

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0º	0.995	98.99	19.96	Horizontal	180º	0.984	96.90	19.86	Vertical
5º	0.956	91.47	19.61	Horizontal	185º	0.996	99.25	19.97	Vertical
10º	0.898	80.71	19.07	Horizontal	190º	1.000	99.98	20.00	Vertical
15º	0.843	71.08	18.52	Vertical	195º	0.997	99.37	19.97	Vertical
20º	0.886	78.43	18.94	Vertical	200º	0.980	96.05	19.83	Vertical
25º	0.920	84.63	19.28	Vertical	205º	0.952	90.67	19.57	Vertical
30º	0.946	89.51	19.52	Vertical	210º	0.915	83.68	19.23	Vertical
35º	0.964	92.94	19.68	Vertical	215º	0.868	75.27	18.77	Vertical
40º	0.974	94.84	19.77	Vertical	220º	0.814	66.31	18.22	Vertical
45º	0.976	95.26	19.79	Vertical	225º	0.757	57.36	17.59	Vertical
50º	0.973	94.74	19.77	Vertical	230º	0.699	48.90	16.89	Vertical
55º	0.967	93.59	19.71	Vertical	235º	0.669	44.81	16.51	Horizontal
60º	0.983	96.57	19.85	Horizontal	240º	0.639	40.86	16.11	Horizontal
65º	0.996	99.29	19.97	Horizontal	245º	0.588	34.53	15.38	Horizontal
70º	1.000	99.96	20.00	Horizontal	250º	0.521	27.16	14.34	Horizontal
75º	0.993	98.54	19.94	Horizontal	255º	0.463	21.44	13.31	Horizontal
80º	0.976	95.27	19.79	Horizontal	260º	0.424	18.02	12.56	Horizontal
85º	0.950	90.28	19.56	Horizontal	265º	0.408	16.62	12.21	Horizontal
90º	0.916	83.93	19.24	Horizontal	270º	0.413	17.06	12.32	Horizontal
95º	0.912	83.22	19.20	Vertical	275º	0.437	19.11	12.81	Horizontal
100º	0.915	83.68	19.23	Vertical	280º	0.470	22.13	13.45	Horizontal
105º	0.917	84.02	19.24	Vertical	285º	0.494	24.38	13.87	Horizontal
110º	0.918	84.24	19.25	Vertical	290º	0.497	24.74	13.93	Horizontal
115º	0.919	84.54	19.27	Vertical	295º	0.472	22.27	13.48	Horizontal
120º	0.922	85.07	19.30	Vertical	300º	0.415	17.23	12.36	Horizontal
125º	0.925	85.55	19.32	Vertical	305º	0.339	11.50	10.61	Horizontal
130º	0.927	85.95	19.34	Vertical	310º	0.278	7.75	8.89	Horizontal
135º	0.928	86.10	19.35	Vertical	315º	0.248	6.13	7.88	Horizontal
140º	0.938	87.99	19.44	Horizontal	320º	0.261	6.84	8.35	Horizontal
145º	0.960	92.21	19.65	Horizontal	325º	0.332	11.02	10.42	Horizontal
150º	0.976	95.26	19.79	Horizontal	330º	0.454	20.58	13.13	Horizontal
155º	0.985	97.07	19.87	Horizontal	335º	0.589	34.73	15.41	Horizontal
160º	0.987	97.40	19.89	Horizontal	340º	0.741	54.85	17.39	Horizontal
165º	0.979	95.86	19.82	Horizontal	345º	0.866	75.02	18.75	Horizontal
170º	0.961	92.42	19.66	Horizontal	350º	0.951	90.39	19.56	Horizontal
175º	0.970	94.16	19.74	Vertical	355º	0.993	98.65	19.94	Horizontal

Polarization: **Envelope**
Maximum Field: **1.000 @ 69° True**
Minimum Field: **0.246 @ 316° True**
RMS: **0.827**
Maximum ERP: **100.000 kW**
Maximum Power Gain: **5.255 (7.206 dB)**

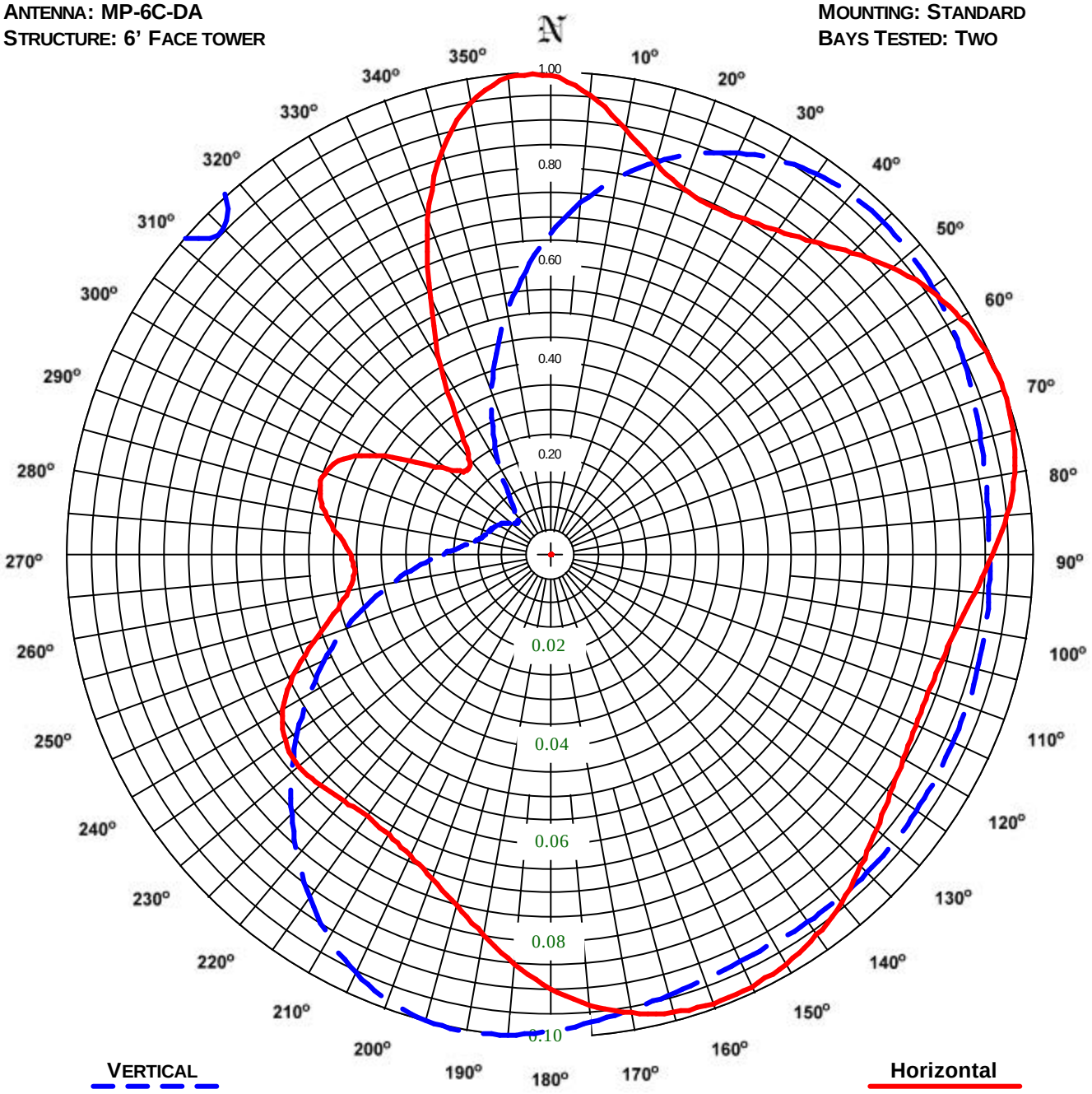
Total Input Power: 19.030 kW

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: KMUW
LOCATION: WICHITA, KS
ANTENNA: MP-6C-DA
STRUCTURE: 6' FACE TOWER

DATE: 12/3/2009
FREQUENCY: 89.1 MHZ
ORIENTATION: 117° TRUE
MOUNTING: STANDARD
BAYS TESTED: TWO



VERTICAL

RMS: 0.766
MAXIMUM: 1.000 @ 191° TRUE
MINIMUM: 0.096 @ 315° TRUE

10X Scale

Horizontal

RMS: 0.779
Maximum: 1.000 @ 69° True
Minimum: 0.246 @ 316° True

COMMENTS: MEASURED PATTERNS OF THE HORIZONTAL AND VERTICAL COMPONENTS.

ERI® Horizontal Plane Relative Field List

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Station: KMUW
Location: Wichita, KS
Frequency: 89.1 MHz

Antenna: MP-6C-DA
Orientation: 117° True
Tower: 6' Face tower

Figure: 2
Date: 12/3/2009
Reference: kmuw1m.fig

Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0º	0.995	98.99	19.96	0.668	44.61	16.49	180º	0.896	80.37	19.05	0.984	96.90	19.86
5º	0.956	91.47	19.61	0.734	53.84	17.31	185º	0.849	72.14	18.58	0.996	99.25	19.97
10º	0.898	80.71	19.07	0.792	62.80	17.98	190º	0.797	63.56	18.03	1.000	99.98	20.00
15º	0.843	71.01	18.51	0.843	71.08	18.52	195º	0.751	56.34	17.51	0.997	99.37	19.97
20º	0.808	65.28	18.15	0.886	78.43	18.94	200º	0.713	50.88	17.07	0.980	96.05	19.83
25º	0.797	63.59	18.03	0.920	84.63	19.28	205º	0.686	47.03	16.72	0.952	90.67	19.57
30º	0.804	64.63	18.10	0.946	89.51	19.52	210º	0.668	44.63	16.50	0.915	83.68	19.23
35º	0.821	67.48	18.29	0.964	92.94	19.68	215º	0.660	43.62	16.40	0.868	75.27	18.77
40º	0.849	72.08	18.58	0.974	94.84	19.77	220º	0.663	44.01	16.44	0.814	66.31	18.22
45º	0.886	78.52	18.95	0.976	95.26	19.79	225º	0.673	45.33	16.56	0.757	57.36	17.59
50º	0.926	85.75	19.33	0.973	94.74	19.77	230º	0.679	46.10	16.64	0.699	48.90	16.89
55º	0.959	91.99	19.64	0.967	93.59	19.71	235º	0.669	44.81	16.51	0.638	40.76	16.10
60º	0.983	96.57	19.85	0.959	91.88	19.63	240º	0.639	40.86	16.11	0.577	33.29	15.22
65º	0.996	99.29	19.97	0.947	89.64	19.52	245º	0.588	34.53	15.38	0.517	26.72	14.27
70º	1.000	99.96	20.00	0.934	87.26	19.41	250º	0.521	27.16	14.34	0.456	20.75	13.17
75º	0.993	98.54	19.94	0.924	85.30	19.31	255º	0.463	21.44	13.31	0.394	15.56	11.92
80º	0.976	95.27	19.79	0.916	83.89	19.24	260º	0.424	18.02	12.56	0.335	11.21	10.50
85º	0.950	90.28	19.56	0.911	83.02	19.19	265º	0.408	16.62	12.21	0.279	7.80	8.92
90º	0.916	83.93	19.24	0.910	82.82	19.18	270º	0.413	17.06	12.32	0.231	5.32	7.26
95º	0.883	77.92	18.92	0.912	83.22	19.20	275º	0.437	19.11	12.81	0.191	3.65	5.62
100º	0.857	73.44	18.66	0.915	83.68	19.23	280º	0.470	22.13	13.45	0.163	2.66	4.24
105º	0.840	70.62	18.49	0.917	84.02	19.24	285º	0.494	24.38	13.87	0.146	2.14	3.30
110º	0.833	69.40	18.41	0.918	84.24	19.25	290º	0.497	24.74	13.93	0.138	1.91	2.82
115º	0.835	69.70	18.43	0.919	84.54	19.27	295º	0.472	22.27	13.48	0.133	1.77	2.47
120º	0.844	71.23	18.53	0.922	85.07	19.30	300º	0.415	17.23	12.36	0.126	1.59	2.01
125º	0.860	73.92	18.69	0.925	85.55	19.32	305º	0.339	11.50	10.61	0.115	1.33	1.25
130º	0.882	77.81	18.91	0.927	85.95	19.34	310º	0.278	7.75	8.89	0.102	1.05	0.20
135º	0.910	82.86	19.18	0.928	86.10	19.35	315º	0.248	6.13	7.88	0.096	0.91	-0.39
140º	0.938	87.99	19.44	0.928	86.07	19.35	320º	0.261	6.84	8.35	0.109	1.19	0.75
145º	0.960	92.21	19.65	0.927	85.91	19.34	325º	0.332	11.02	10.42	0.148	2.19	3.40
150º	0.976	95.26	19.79	0.926	85.80	19.33	330º	0.454	20.58	13.13	0.208	4.31	6.35
155º	0.985	97.07	19.87	0.928	86.12	19.35	335º	0.589	34.73	15.41	0.279	7.78	8.91
160º	0.987	97.40	19.89	0.934	87.26	19.41	340º	0.741	54.85	17.39	0.355	12.63	11.01
165º	0.979	95.86	19.82	0.943	88.94	19.49	345º	0.866	75.02	18.75	0.433	18.75	12.73
170º	0.961	92.42	19.66	0.955	91.20	19.60	350º	0.951	90.39	19.56	0.511	26.15	14.17
175º	0.934	87.21	19.41	0.970	94.16	19.74	355º	0.993	98.65	19.94	0.592	35.02	15.44

Polarization:	**Horizontal**	**Vertical**
Maximum Field:	**1.000 @ 69° True**	**1.000 @ 191° True**
Minimum Field:	**0.246 @ 316° True**	**0.096 @ 315° True**
RMS:	**0.779**	**0.766**
Maximum ERP:	**100.000 kW**	**100.000 kW**
Maximum Power Gain:	**5.255 (7.206 dB)**	**5.255 (7.206 dB)**

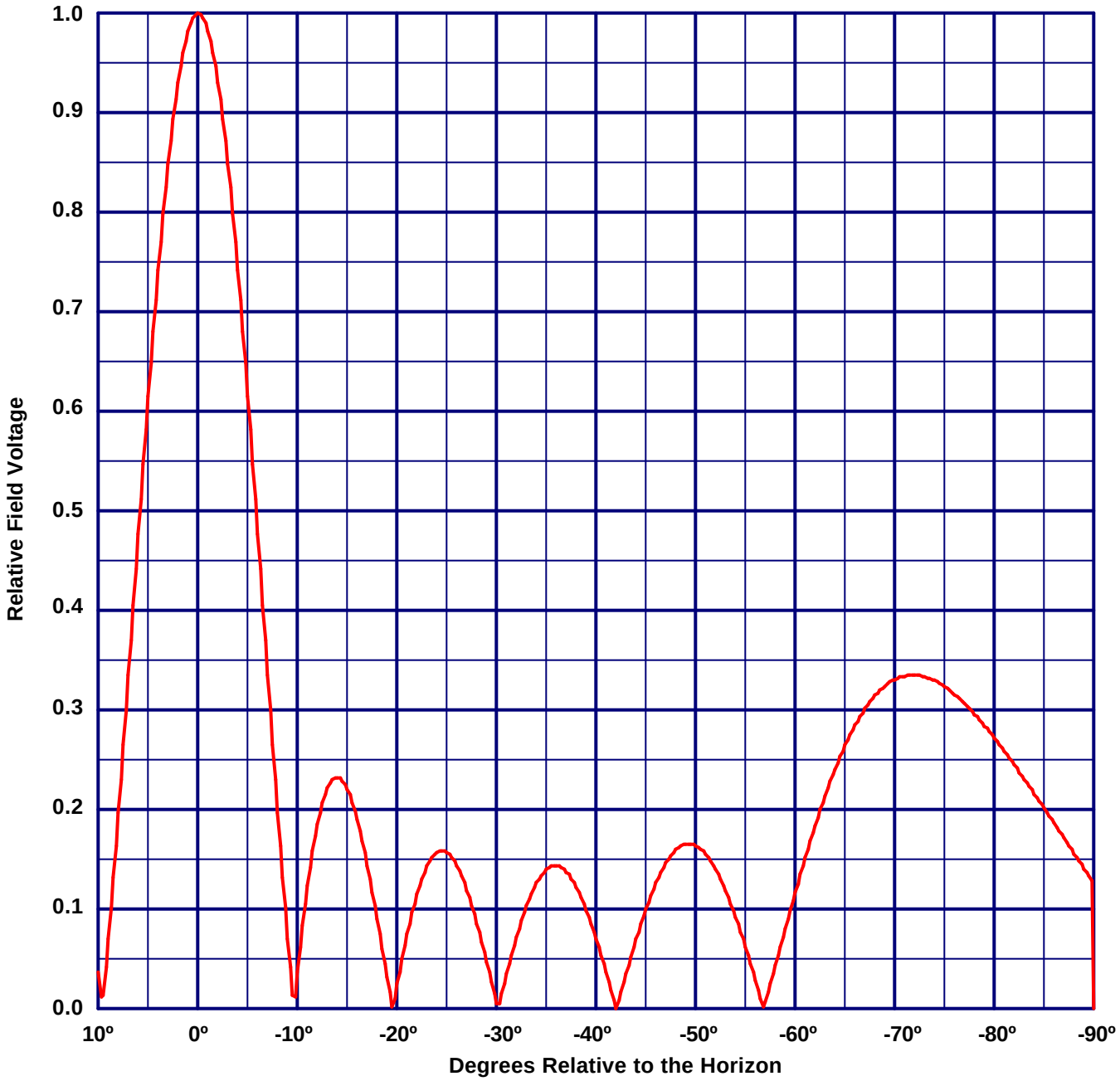
Total Input Power: 19.030 kW

Vertical Plane Relative Field Pattern

KMUW, Wichita, KS, 89.1 MHz

Figure#: 3 Date: 12/3/2009

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



Vertical Polarization Gain:	Horizontal Polarization Gain:
Maximum: 5.255 (7.206 dB)	Maximum: 5.255 (7.206 dB)
Horizontal Plane: 5.255 (7.206 dB)	Horizontal Plane: 5.255 (7.206 dB)

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Directional Antenna System
for
KMUW, Wichita, Kansas

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	MP-6C-DA
Frequency:	89.1MHz
Number of Bays:	Six

MECHANICAL SPECIFICATIONS

(All Specifications are Approximate)

Mounting:	Standard
System length:	59 ft 2 in
Aperture length required:	75 ft
The approximate weight:	765 lbs.
The approximate windload:	44.037 ft^2CaAa
Orientation:	117° true

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

ELECTRICAL SPECIFICATIONS

(For directional use)

Maximum horizontal ERP:	100.00 kW (20.000 dBk)
Horizontal maximum power gain:	5.255 (7.206 dB)
Maximum vertical ERP:	100.00 kW (20.000 dBk)
Vertical maximum power gain:	5.255 (7.206 dB)
Total input power:	19.030 kW (12.794 dBk)