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 WBJC, Baltimore, Maryland

September 17, 2010

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 WBJC.

The antenna is the ERI model MP-8C-DA-HW configuration. The circular polarized system consists of 8 half-wavelength spaced bays using one driven circular polarized radiating element per bay and two vertical parasitic elements interleaved between alternate bay pairs. The antenna was tested on a 14" o.d. pole, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 91.5 megahertz, which is the center of the FM broadcast channel assigned to WBJC.

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.

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Proposed For
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(Continued)

DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of two bay levels of the circular polarized system with the associated 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 14" o.d. pole 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.

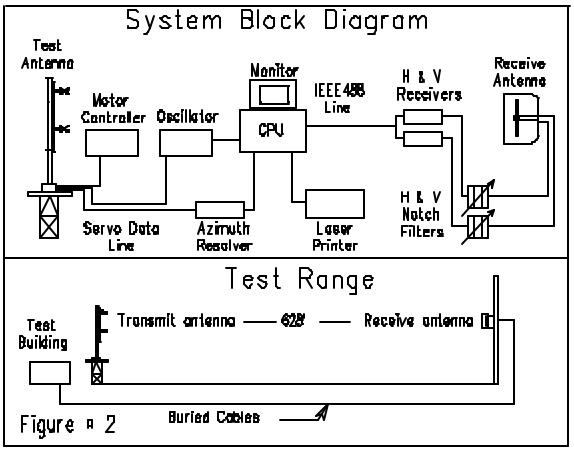

Figure # 2

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 91.5 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 8 half-wavelength spaced bays using one driven circular polarized radiating element per bay and two vertical parasitic elements interleaved between alternate bay pairs. 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-8C-DA-HW array is to be mounted on the 14" o.d. pole at a bearing of North 215 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 50.00 kilowatts (16.99 dBk).

The power at North 5 degrees East does not exceed 21.00 kilowatts (13.222 dBk).

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(Continued)

The power at North 25 degrees East does not exceed 20.00 kilowatts (13.01 dBk).

The power at North 60 degrees East does not exceed 21.00 kilowatts (13.222 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 that 85% of the filed composite pattern.

The clear vertical length of the structure required to support the antenna is 52 feet 6 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.

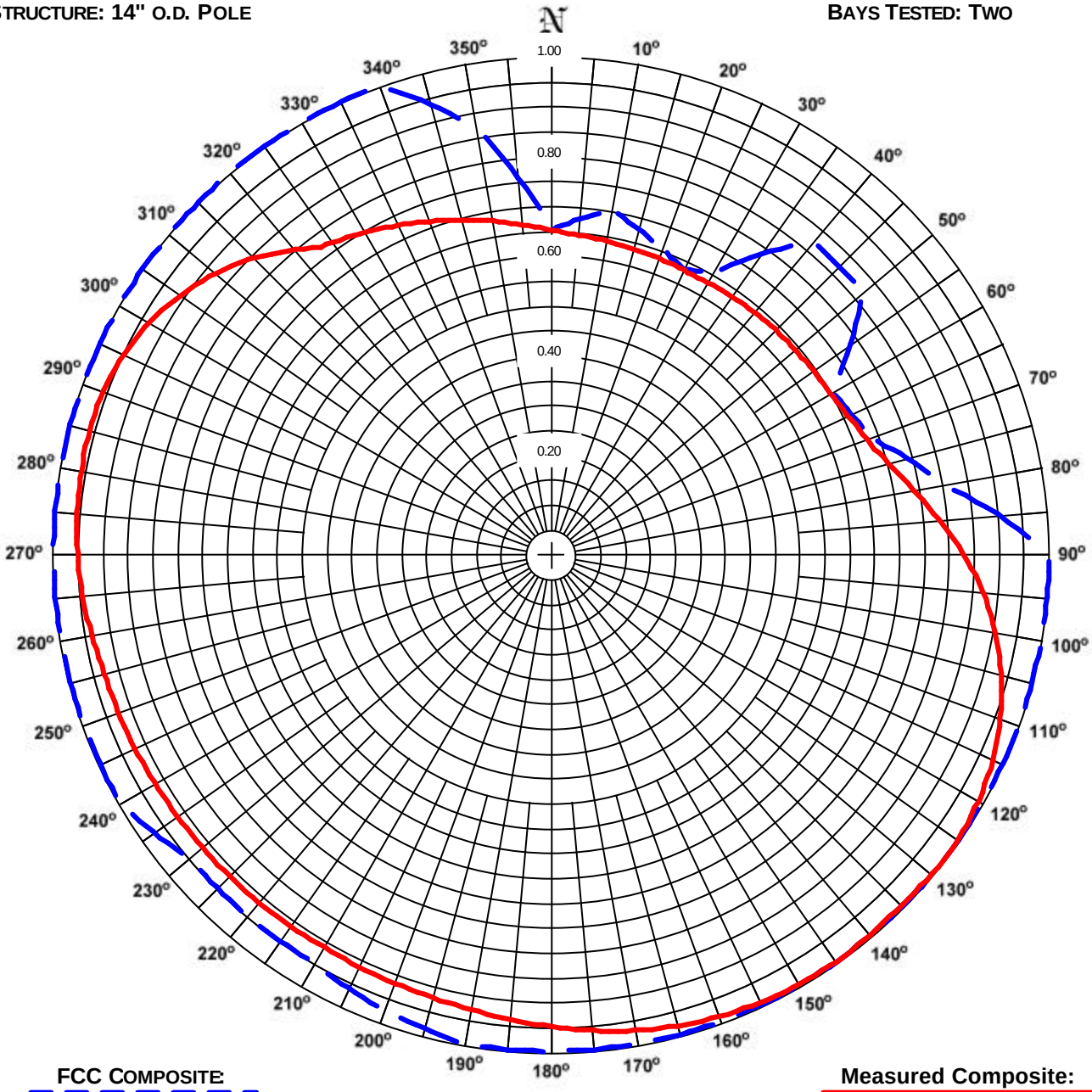
ELECTRONICS RESEARCH, INC.

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: WBJC
LOCATION: BALTIMORE, MD.
ANTENNA: MP-8C-DA-HW
STRUCTURE: 14" O.D. POLE

DATE: 9/13/2010
FREQUENCY: 91.5 MHZ
ORIENTATION: 215° TRUE
MOUNTING: STANDARD
BAYS TESTED: TWO



FCC COMPOSITE:
RMS: 0.928
MAXIMUM: 1.000 @ 90° TRUE
MINIMUM: 0.630 @ 25° TRUE

Measured Composite:
RMS: 0.857
Maximum: 1.000 @ 129° True
Minimum: 0.628 @ 27° 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 BPED-20070823ADT.

Horizontal Plane Relative Field List

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Station: WBJC
Location: Baltimore, MD.
Frequency: 91.5 MHz

Antenna: MP-8C-DA-HW
Orientation: 215° True
Tower: 14'' o.d. Pole

Figure: 1
Date: 9/13/2010
Reference: wbjc1m.fig

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0º	0.650	21.12	13.25	Horizontal	180º	0.950	45.12	16.54	Horizontal
5º	0.642	20.58	13.13	Horizontal	185º	0.939	44.12	16.45	Horizontal
10º	0.637	20.31	13.08	Horizontal	190º	0.931	43.30	16.37	Horizontal
15º	0.634	20.10	13.03	Horizontal	195º	0.924	42.66	16.30	Horizontal
20º	0.631	19.91	12.99	Horizontal	200º	0.919	42.18	16.25	Horizontal
25º	0.628	19.73	12.95	Horizontal	205º	0.915	41.88	16.22	Horizontal
30º	0.629	19.76	12.96	Horizontal	210º	0.914	41.75	16.21	Horizontal
35º	0.631	19.90	12.99	Horizontal	215º	0.914	41.74	16.21	Horizontal
40º	0.633	20.05	13.02	Horizontal	220º	0.914	41.79	16.21	Horizontal
45º	0.636	20.22	13.06	Horizontal	225º	0.915	41.88	16.22	Horizontal
50º	0.638	20.38	13.09	Horizontal	230º	0.917	42.01	16.23	Horizontal
55º	0.641	20.54	13.13	Horizontal	235º	0.918	42.18	16.25	Horizontal
60º	0.646	20.88	13.20	Horizontal	240º	0.921	42.39	16.27	Horizontal
65º	0.658	21.62	13.35	Horizontal	245º	0.923	42.63	16.30	Horizontal
70º	0.675	22.76	13.57	Horizontal	250º	0.926	42.90	16.32	Horizontal
75º	0.702	24.61	13.91	Vertical	255º	0.929	43.14	16.35	Horizontal
80º	0.739	27.29	14.36	Vertical	260º	0.938	43.95	16.43	Vertical
85º	0.782	30.57	14.85	Vertical	265º	0.945	44.66	16.50	Vertical
90º	0.828	34.26	15.35	Vertical	270º	0.951	45.23	16.55	Vertical
95º	0.870	37.81	15.78	Vertical	275º	0.956	45.66	16.60	Vertical
100º	0.906	41.01	16.13	Vertical	280º	0.958	45.93	16.62	Vertical
105º	0.936	43.79	16.41	Vertical	285º	0.960	46.04	16.63	Vertical
110º	0.960	46.11	16.64	Vertical	290º	0.957	45.76	16.60	Vertical
115º	0.979	47.91	16.80	Vertical	295º	0.947	44.84	16.52	Vertical
120º	0.992	49.17	16.92	Vertical	300º	0.931	43.31	16.37	Vertical
125º	0.999	49.86	16.98	Vertical	305º	0.907	41.17	16.15	Vertical
130º	1.000	49.99	16.99	Vertical	310º	0.877	38.49	15.85	Vertical
135º	0.997	49.72	16.97	Vertical	315º	0.841	35.32	15.48	Vertical
140º	0.999	49.88	16.98	Horizontal	320º	0.797	31.76	15.02	Vertical
145º	1.000	49.99	16.99	Horizontal	325º	0.764	29.15	14.65	Horizontal
150º	0.998	49.83	16.97	Horizontal	330º	0.745	27.77	14.44	Horizontal
155º	0.995	49.46	16.94	Horizontal	335º	0.727	26.46	14.23	Horizontal
160º	0.989	48.92	16.89	Horizontal	340º	0.710	25.21	14.02	Horizontal
165º	0.982	48.20	16.83	Horizontal	345º	0.694	24.06	13.81	Horizontal
170º	0.973	47.30	16.75	Horizontal	350º	0.678	22.99	13.62	Horizontal
175º	0.962	46.24	16.65	Horizontal	355º	0.663	21.97	13.42	Horizontal

Polarization: **Envelope**
Maximum Field: **1.000 @ 129° True**
Minimum Field: **0.628 @ 27° True**
RMS: **0.857**
Maximum ERP: **50.000 kW**
Maximum Power Gain: **3.411 (5.329 dB)**

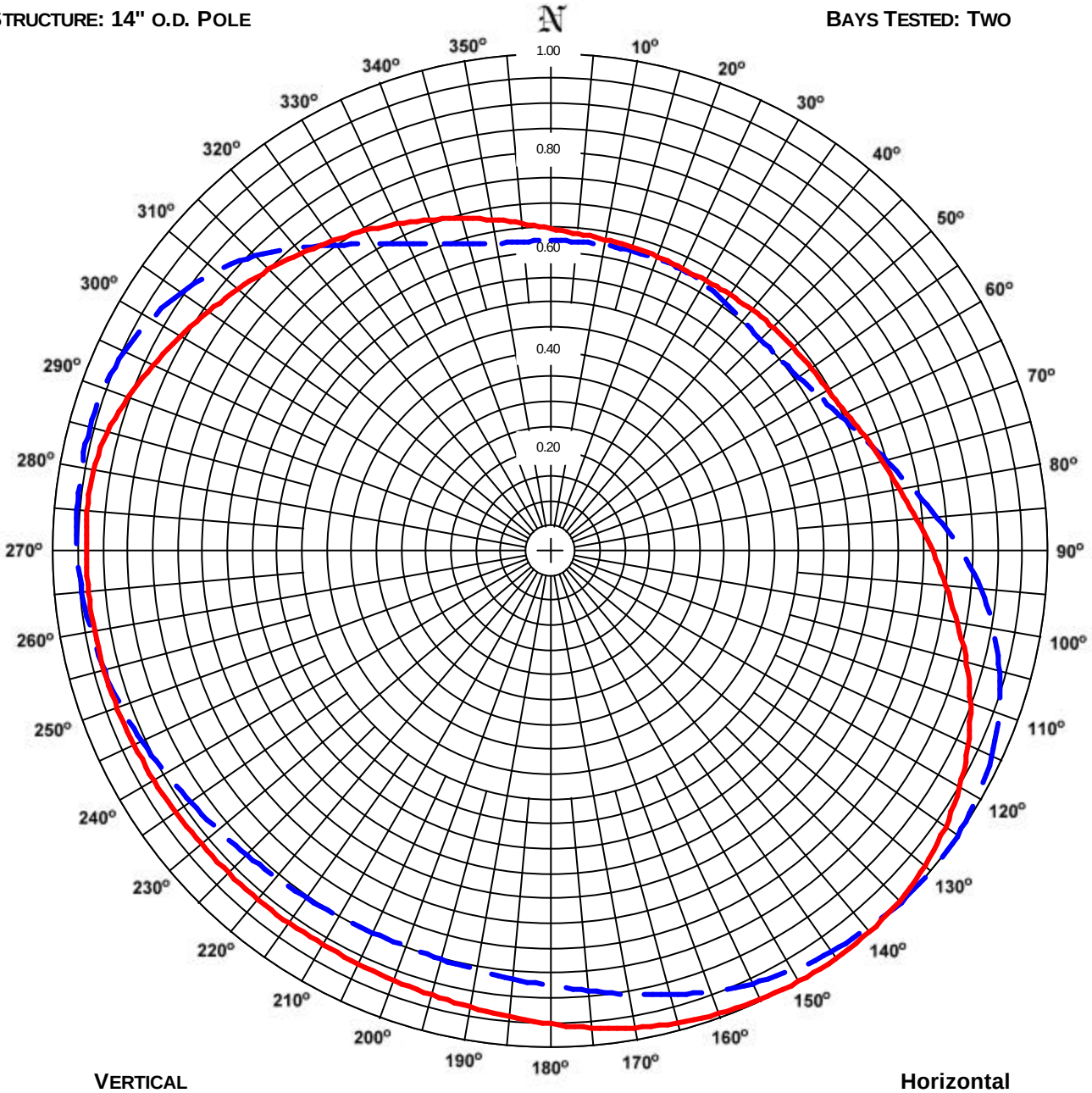
Total Input Power: 14.658 kW

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: WBJC
LOCATION: BALTIMORE, MD.
ANTENNA: MP-8C-DA-HW
STRUCTURE: 14" O.D. POLE

DATE: 9/13/2010
FREQUENCY: 91.5 MHZ
ORIENTATION: 215° TRUE
MOUNTING: STANDARD
BAYS TESTED: TWO



VERTICAL

RMS: 0.834
MAXIMUM: 1.000 @ 129° TRUE
MINIMUM: 0.601 @ 46° TRUE

Horizontal

RMS: 0.842
Maximum: 1.000 @ 144° True
Minimum: 0.628 @ 27° True

COMMENTS: MEASURED PATTERNS OF THE HORIZONTAL AND VERTICAL COMPONENTS.

ERI® Horizontal Plane Relative Field List

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Station: WBJC
Location: Baltimore, MD.
Frequency: 91.5 MHz

Antenna: MP-8C-DA-HW
Orientation: 215° True
Tower: 14'' o.d. Pole

Figure: 2
Date: 9/13/2010
Reference: wbjc1m.fig

Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.650	21.12	13.25	0.625	19.56	12.91	180°	0.950	45.12	16.54	0.874	38.17	15.82
5°	0.642	20.58	13.13	0.626	19.59	12.92	185°	0.939	44.12	16.45	0.863	37.21	15.71
10°	0.637	20.31	13.08	0.627	19.63	12.93	190°	0.931	43.30	16.37	0.854	36.50	15.62
15°	0.634	20.10	13.03	0.627	19.66	12.94	195°	0.924	42.66	16.30	0.849	36.03	15.57
20°	0.631	19.91	12.99	0.627	19.67	12.94	200°	0.919	42.18	16.25	0.846	35.80	15.54
25°	0.628	19.73	12.95	0.626	19.59	12.92	205°	0.915	41.88	16.22	0.846	35.80	15.54
30°	0.629	19.76	12.96	0.621	19.26	12.85	210°	0.914	41.75	16.21	0.848	35.96	15.56
35°	0.631	19.90	12.99	0.612	18.70	12.72	215°	0.914	41.74	16.21	0.852	36.25	15.59
40°	0.633	20.05	13.02	0.604	18.24	12.61	220°	0.914	41.79	16.21	0.857	36.69	15.64
45°	0.636	20.22	13.06	0.601	18.04	12.56	225°	0.915	41.88	16.22	0.863	37.26	15.71
50°	0.638	20.38	13.09	0.603	18.17	12.59	230°	0.917	42.01	16.23	0.871	37.97	15.79
55°	0.641	20.54	13.13	0.611	18.66	12.71	235°	0.918	42.18	16.25	0.881	38.83	15.89
60°	0.646	20.88	13.20	0.625	19.52	12.91	240°	0.921	42.39	16.27	0.893	39.84	16.00
65°	0.658	21.62	13.35	0.645	20.78	13.18	245°	0.923	42.63	16.30	0.905	40.99	16.13
70°	0.675	22.76	13.57	0.670	22.46	13.51	250°	0.926	42.90	16.32	0.918	42.10	16.24
75°	0.694	24.06	13.81	0.702	24.61	13.91	255°	0.929	43.14	16.35	0.928	43.09	16.34
80°	0.715	25.53	14.07	0.739	27.29	14.36	260°	0.931	43.34	16.37	0.938	43.95	16.43
85°	0.741	27.48	14.39	0.782	30.57	14.85	265°	0.933	43.50	16.39	0.945	44.66	16.50
90°	0.770	29.65	14.72	0.828	34.26	15.35	270°	0.934	43.63	16.40	0.951	45.23	16.55
95°	0.800	32.00	15.05	0.870	37.81	15.78	275°	0.935	43.71	16.41	0.956	45.66	16.60
100°	0.832	34.61	15.39	0.906	41.01	16.13	280°	0.933	43.53	16.39	0.958	45.93	16.62
105°	0.867	37.61	15.75	0.936	43.79	16.41	285°	0.923	42.58	16.29	0.960	46.04	16.63
110°	0.899	40.45	16.07	0.960	46.11	16.64	290°	0.904	40.87	16.11	0.957	45.76	16.60
115°	0.927	42.99	16.33	0.979	47.91	16.80	295°	0.883	38.98	15.91	0.947	44.84	16.52
120°	0.951	45.17	16.55	0.992	49.17	16.92	300°	0.862	37.14	15.70	0.931	43.31	16.37
125°	0.969	46.98	16.72	0.999	49.86	16.98	305°	0.841	35.38	15.49	0.907	41.17	16.15
130°	0.984	48.38	16.85	1.000	49.99	16.99	310°	0.821	33.71	15.28	0.877	38.49	15.85
135°	0.993	49.35	16.93	0.997	49.72	16.97	315°	0.801	32.11	15.07	0.841	35.32	15.48
140°	0.999	49.88	16.98	0.992	49.17	16.92	320°	0.782	30.60	14.86	0.797	31.76	15.02
145°	1.000	49.99	16.99	0.983	48.36	16.84	325°	0.764	29.15	14.65	0.753	28.34	14.52
150°	0.998	49.83	16.97	0.972	47.28	16.75	330°	0.745	27.77	14.44	0.715	25.54	14.07
155°	0.995	49.46	16.94	0.959	45.95	16.62	335°	0.727	26.46	14.23	0.683	23.34	13.68
160°	0.989	48.92	16.89	0.942	44.38	16.47	340°	0.710	25.21	14.02	0.659	21.69	13.36
165°	0.982	48.20	16.83	0.923	42.59	16.29	345°	0.694	24.06	13.81	0.641	20.54	13.13
170°	0.973	47.30	16.75	0.904	40.86	16.11	350°	0.678	22.99	13.62	0.630	19.84	12.98
175°	0.962	46.24	16.65	0.887	39.38	15.95	355°	0.663	21.97	13.42	0.626	19.58	12.92

Polarization:	**Horizontal**	**Vertical**
Maximum Field:	**1.000 @ 144° True**	**1.000 @ 129° True**
Minimum Field:	**0.628 @ 27° True**	**0.601 @ 46° True**
RMS:	**0.842**	**0.834**
Maximum ERP:	**50.000 kW**	**50.000 kW**
Maximum Power Gain:	**3.411 (5.329 dB)**	**3.411 (5.329 dB)**

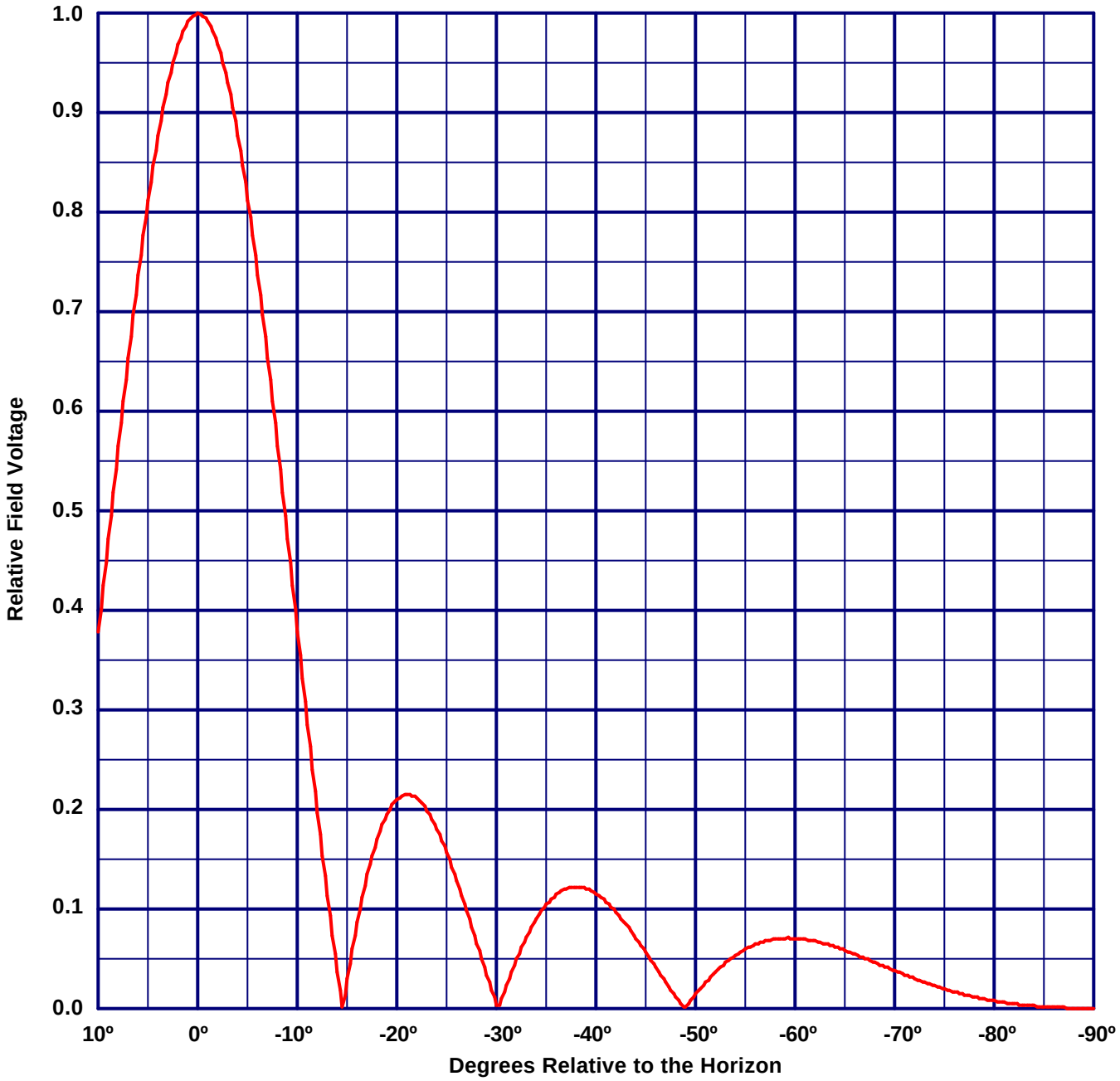
Total Input Power: 14.658 kW

Vertical Plane Relative Field Pattern

WBJC, Baltimore, MD, 91.5 MHz

Figure#: 3 Date: 9/13/2010

An 8 level, .5 wave-length spaced MP-8C-DA-HW 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: 3.411 (5.329 dB)	Maximum: 3.411 (5.329 dB)
Horizontal Plane: 3.411 (5.329 dB)	Horizontal Plane: 3.411 (5.329 dB)

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Directional Antenna System
for
WBJC, Baltimore, Maryland

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	MP-8C-DA-HW
Frequency:	91.5 MHz
Number of Bays:	Eight

MECHANICAL SPECIFICATIONS

Mounting:	Standard
System length:	41 ft 5 in
Aperture length required:	52 ft 6 in
Orientation:	215° true

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

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	50.000 kW (16.99 dBk)
Horizontal maximum power gain:	3.411 (5.329 dB)
Maximum vertical ERP:	50.000 kW (16.99 dBk)
Vertical maximum power gain:	3.411 (5.329 dB)
Total input power:	14.658 kW (11.661 dBk)