ERI® Electronics Research, Inc.
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
WKNNFM, Pascagoula, Mississippi

March 20, 2001

Electronics Research Inc. is providing a custom fabricated directional antenna system that is specially designed to meet the FCC requirements and the general needs of radio station WKNNFM. WKNNFM will be diplexed with radio station WMJY at 93.7 MHz.

The antenna is the ERI model SHP-10AC-DA-HW configuration. The circular polarized system consists of 10 half-wavelength spaced bays using one driven circular polarized radiating element per bay. The antenna was mounted on the North 280 degrees East tower leg with bracketry to provide an antenna orientation of North 280 degrees East. The antenna was tested on a 36" 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 99.1 megahertz which is the center of the FM broadcast channel assigned to WKNNFM.

Pattern measurements were made on a sixty-acre antenna pattern range which 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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WKNNFM, Pascagoula, Mississippi

(Continued)

DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of two bay levels of the circular polarized system. 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 36" ***ERI®λ 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 99.1 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. 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.

(Continued)

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 10 half-wavelength spaced bays using one driven circular polarized radiating 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 SHP-10AC-DA-HW array is to be mounted on the North 280 degrees East tower leg of the 36" ERI®λ *MOUNTING SYSTEM,* at a bearing of North 280 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 99 kilowatts (19.956 dBk).

The power at North 70 degrees East does not exceed 46 kilowatts (16.628 dBk).

The power at North 80 degrees East does not exceed 38 kilowatts (15.798 dBk).

The power at North 90 degrees East does not exceed 44 kilowatts (16.435 dBk).

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

Directional Antenna System
For
WKNNFM, Pascagoula, Mississippi

(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 60 feet if the antenna is to be top mounted.

The directional antenna should not be mounted on the top of an antenna tower which 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.

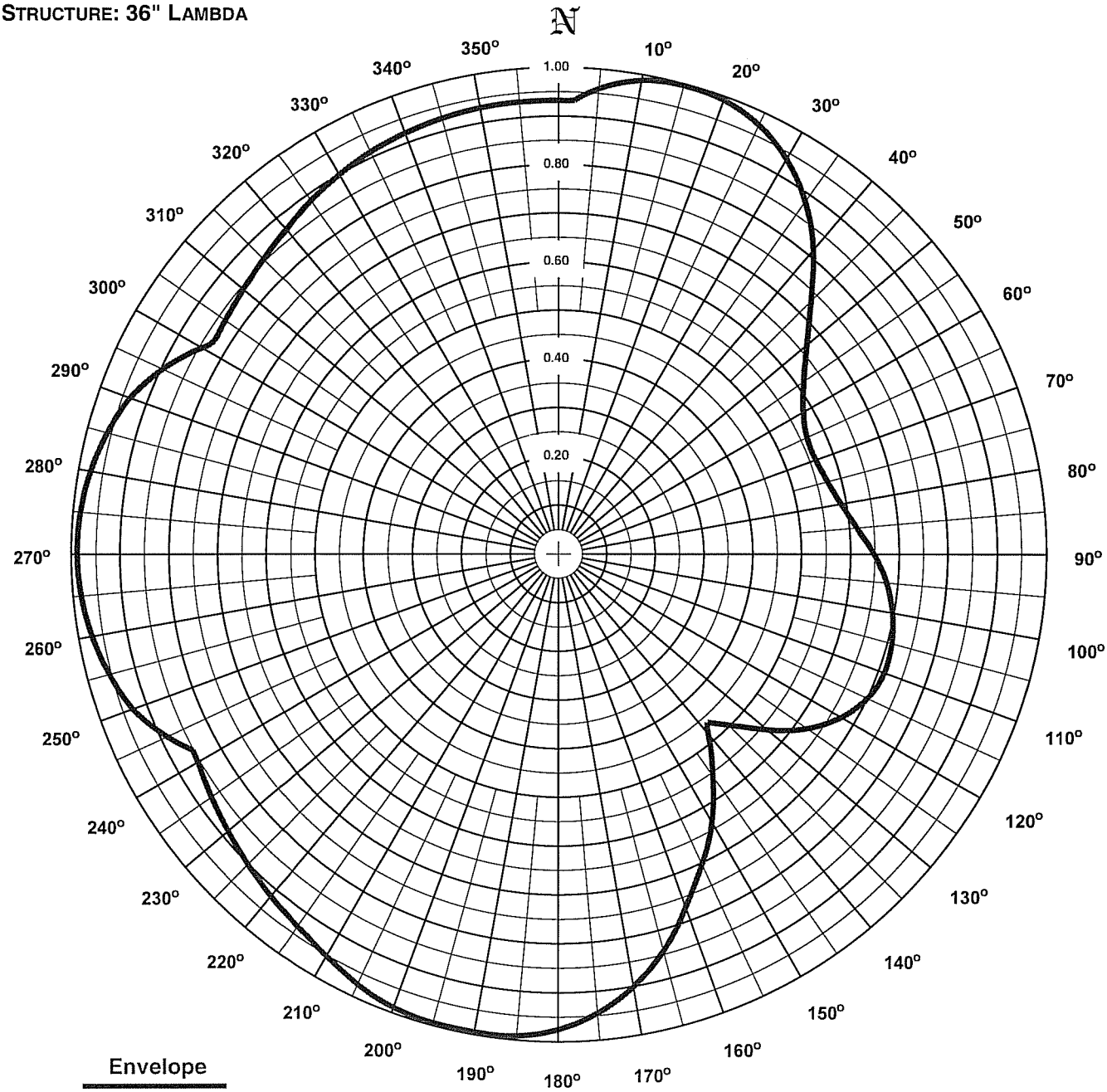
ELECTRONICS RESEARCH, INC.

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: WKNNFM
LOCATION: PASCAGOULA, MS
ANTENNA TYPE: SHP-10AC-DA-HW
STRUCTURE: 36" LAMBDA

DATE: 3/20/01
FREQUENCY: 99.1 MHz
ORIENTATION: 280° TRUE
MOUNTING: CUSTOM



Envelope

RMS: 0.842
Maximum: 1.000 @ 14° True
Minimum: 0.460 @ 138° 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-20000428AAX.

ERI® Horizontal Plane Relative Field List

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Station: WKNNFM
Location: Pascagoula, MS
Frequency: 99.1 MHz

Antenna: SHP-10AC-DA-HW
Orientation: 280° True
Tower: 36" Lambda

Figure: 1
Date: 3/20/01
Reference: wknnfm1m.fig

Angle	Envelope			Polarization	Angle	Envelope			Polarization
	Field	kW	dBk			Field	kW	dBk	
0°	0.936	86.71	19.38	Vertical	180°	0.972	93.47	19.71	Vertical
5°	0.964	91.93	19.63	Horizontal	185°	0.988	96.65	19.85	Vertical
10°	0.992	97.41	19.89	Horizontal	190°	0.991	97.29	19.88	Vertical
15°	1.000	99.00	19.96	Horizontal	195°	0.991	97.29	19.88	Vertical
20°	0.996	98.20	19.92	Horizontal	200°	0.986	96.20	19.83	Vertical
25°	0.976	94.26	19.74	Horizontal	205°	0.971	93.32	19.70	Vertical
30°	0.939	87.24	19.41	Horizontal	210°	0.950	89.26	19.51	Vertical
35°	0.885	77.52	18.89	Horizontal	215°	0.930	85.72	19.33	Vertical
40°	0.814	65.62	18.17	Horizontal	220°	0.915	82.81	19.18	Vertical
45°	0.733	53.15	17.25	Horizontal	225°	0.899	80.00	19.03	Vertical
50°	0.665	43.83	16.42	Horizontal	230°	0.884	77.28	18.88	Vertical
55°	0.615	37.43	15.73	Horizontal	235°	0.868	74.66	18.73	Vertical
60°	0.581	33.44	15.24	Horizontal	240°	0.854	72.12	18.58	Vertical
65°	0.564	31.53	14.99	Horizontal	245°	0.883	77.23	18.88	Horizontal
70°	0.564	31.52	14.99	Horizontal	250°	0.927	85.11	19.30	Horizontal
75°	0.574	32.62	15.13	Horizontal	255°	0.952	89.81	19.53	Horizontal
80°	0.592	34.67	15.40	Horizontal	260°	0.971	93.35	19.70	Horizontal
85°	0.618	37.78	15.77	Horizontal	265°	0.983	95.66	19.81	Horizontal
90°	0.650	41.89	16.22	Horizontal	270°	0.988	96.69	19.85	Horizontal
95°	0.678	45.51	16.58	Horizontal	275°	0.986	96.22	19.83	Horizontal
100°	0.697	48.15	16.83	Horizontal	280°	0.977	94.41	19.75	Horizontal
105°	0.709	49.73	16.97	Horizontal	285°	0.961	91.34	19.61	Horizontal
110°	0.711	50.09	17.00	Horizontal	290°	0.938	87.07	19.40	Horizontal
115°	0.698	48.20	16.83	Horizontal	295°	0.900	80.18	19.04	Horizontal
120°	0.667	44.06	16.44	Horizontal	300°	0.849	71.43	18.54	Horizontal
125°	0.620	38.01	15.80	Horizontal	305°	0.837	69.33	18.41	Vertical
130°	0.555	30.50	14.84	Horizontal	310°	0.846	70.86	18.50	Vertical
135°	0.491	23.82	13.77	Horizontal	315°	0.858	72.84	18.62	Vertical
140°	0.483	23.13	13.64	Vertical	320°	0.872	75.29	18.77	Vertical
145°	0.557	30.77	14.88	Vertical	325°	0.888	78.12	18.93	Vertical
150°	0.634	39.85	16.00	Vertical	330°	0.903	80.66	19.07	Vertical
155°	0.702	48.76	16.88	Vertical	335°	0.914	82.78	19.18	Vertical
160°	0.770	58.62	17.68	Vertical	340°	0.924	84.45	19.27	Vertical
165°	0.841	69.94	18.45	Vertical	345°	0.930	85.67	19.33	Vertical
170°	0.898	79.82	19.02	Vertical	350°	0.934	86.43	19.37	Vertical
175°	0.942	87.78	19.43	Vertical	355°	0.936	86.71	19.38	Vertical

Polarization: Envelope
Maximum Field: 1.000 @ 14° True
Minimum Field: 0.460 @ 138° True
RMS: 0.842
Maximum ERP: 99.000 kW
Maximum Power Gain: 5.379 (7.307 dB)

Total Input Power: 18.405 kW

ERI® Horizontal Plane Relative Field Pattern

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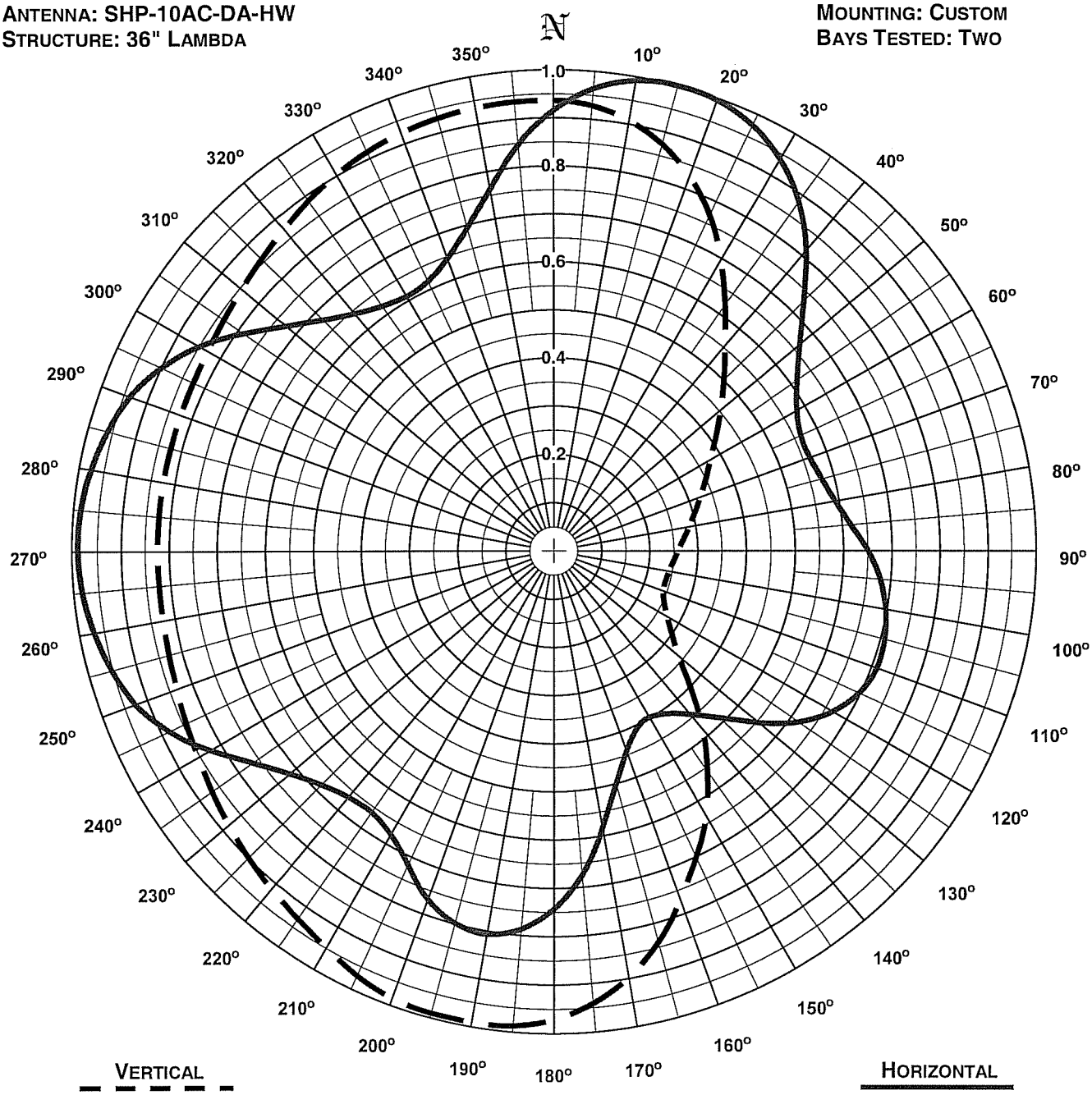
FIGURE NO: 2
STATION: WKNNFM
LOCATION: PASCAGOULA, MS
ANTENNA: SHP-10AC-DA-HW
STRUCTURE: 36" LAMBDA

DATE: 3/20/01
FREQUENCY: 99.1 MHz
ORIENTATION: 280° TRUE
MOUNTING: CUSTOM
BAYS TESTED: TWO



VERTICAL

RMS: 0.753
MAXIMUM: 0.991 @ 188° TRUE
MINIMUM: 0.241 @ 107° TRUE

HORIZONTAL

RMS: 0.753
MAXIMUM: 1.000 @ 14° TRUE
MINIMUM: 0.398 @ 151° TRUE

COMMENTS: MEASURED PATTERN OF THE HORIZONTAL AND VERTICAL COMPONENTS.

ERI® Horizontal Plane Relative Field List

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Station: WKNNFM
Location: Pascagoula, MS
Frequency: 99.1 MHz

Antenna: SHP-10AC-DA-HW
Orientation: 280° True
Tower: 36" Lambda

Figure: 2
Date: 3/20/01
Reference: wknnfm1m.fig

Angle	Horizontal			Vertical			Angle	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.915	82.91	19.19	0.936	86.71	19.38	180°	0.744	54.74	17.38	0.972	93.47	19.71
5°	0.964	91.93	19.63	0.928	85.29	19.31	185°	0.788	61.40	17.88	0.988	96.65	19.85
10°	0.992	97.41	19.89	0.908	81.55	19.11	190°	0.807	64.48	18.09	0.991	97.29	19.88
15°	1.000	99.00	19.96	0.874	75.66	18.79	195°	0.799	63.24	18.01	0.991	97.29	19.88
20°	0.996	98.20	19.92	0.828	67.87	18.32	200°	0.769	58.50	17.67	0.986	96.20	19.83
25°	0.976	94.26	19.74	0.769	58.54	17.67	205°	0.718	51.08	17.08	0.971	93.32	19.70
30°	0.939	87.24	19.41	0.697	48.10	16.82	210°	0.679	45.65	16.59	0.950	89.26	19.51
35°	0.885	77.52	18.89	0.622	38.32	15.83	215°	0.662	43.33	16.37	0.930	85.72	19.33
40°	0.814	65.62	18.17	0.555	30.55	14.85	220°	0.666	43.94	16.43	0.915	82.81	19.18
45°	0.733	53.15	17.25	0.501	24.85	13.95	225°	0.685	46.51	16.68	0.899	80.00	19.03
50°	0.665	43.83	16.42	0.454	20.39	13.09	230°	0.718	51.10	17.08	0.884	77.28	18.88
55°	0.615	37.43	15.73	0.412	16.84	12.26	235°	0.765	57.96	17.63	0.868	74.66	18.73
60°	0.581	33.44	15.24	0.376	14.02	11.47	240°	0.825	67.46	18.29	0.854	72.12	18.58
65°	0.564	31.53	14.99	0.349	12.07	10.82	245°	0.883	77.23	18.88	0.844	70.48	18.48
70°	0.564	31.52	14.99	0.325	10.47	10.20	250°	0.927	85.11	19.30	0.834	68.88	18.38
75°	0.574	32.62	15.13	0.304	9.15	9.62	255°	0.952	89.81	19.53	0.829	68.09	18.33
80°	0.592	34.67	15.40	0.286	8.10	9.08	260°	0.971	93.35	19.70	0.826	67.54	18.30
85°	0.618	37.78	15.77	0.271	7.27	8.62	265°	0.983	95.66	19.81	0.825	67.31	18.28
90°	0.650	41.89	16.22	0.259	6.64	8.22	270°	0.988	96.69	19.85	0.825	67.31	18.28
95°	0.678	45.51	16.58	0.250	6.18	7.91	275°	0.986	96.22	19.83	0.825	67.31	18.28
100°	0.697	48.15	16.83	0.244	5.89	7.70	280°	0.977	94.41	19.75	0.825	67.31	18.28
105°	0.709	49.73	16.97	0.241	5.75	7.59	285°	0.961	91.34	19.61	0.825	67.31	18.28
110°	0.711	50.09	17.00	0.243	5.83	7.66	290°	0.938	87.07	19.40	0.825	67.31	18.28
115°	0.698	48.20	16.83	0.253	6.34	8.02	295°	0.900	80.18	19.04	0.826	67.56	18.30
120°	0.667	44.06	16.44	0.272	7.32	8.65	300°	0.849	71.43	18.54	0.830	68.23	18.34
125°	0.620	38.01	15.80	0.300	8.89	9.49	305°	0.786	61.22	17.87	0.837	69.33	18.41
130°	0.555	30.50	14.84	0.340	11.45	10.59	310°	0.726	52.14	17.17	0.846	70.86	18.50
135°	0.491	23.82	13.77	0.404	16.15	12.08	315°	0.678	45.47	16.58	0.858	72.84	18.62
140°	0.443	19.42	12.88	0.483	23.13	13.64	320°	0.642	40.85	16.11	0.872	75.29	18.77
145°	0.412	16.83	12.26	0.557	30.77	14.88	325°	0.620	38.01	15.80	0.888	78.12	18.93
150°	0.399	15.74	11.97	0.634	39.85	16.00	330°	0.610	36.78	15.66	0.903	80.66	19.07
155°	0.408	16.47	12.17	0.702	48.76	16.88	335°	0.617	37.70	15.76	0.914	82.78	19.18
160°	0.442	19.34	12.87	0.770	58.62	17.68	340°	0.645	41.23	16.15	0.924	84.45	19.27
165°	0.501	24.81	13.95	0.841	69.94	18.45	345°	0.694	47.66	16.78	0.930	85.67	19.33
170°	0.584	33.71	15.28	0.898	79.82	19.02	350°	0.763	57.57	17.60	0.934	86.43	19.37
175°	0.675	45.14	16.55	0.942	87.78	19.43	355°	0.846	70.93	18.51	0.936	86.71	19.38

Polarization:	**Horizontal**	**Vertical**
Maximum Field:	**1.000 @ 14° True**	**0.991 @ 188° True**
Minimum Field:	**0.398 @ 151° True**	**0.241 @ 107° True**
RMS:	**0.753**	**0.753**
Maximum ERP:	**99.000 kW**	**97.289 kW**
Maximum Power Gain:	**5.379 (7.307 dB)**	**5.286 (7.231 dB)**

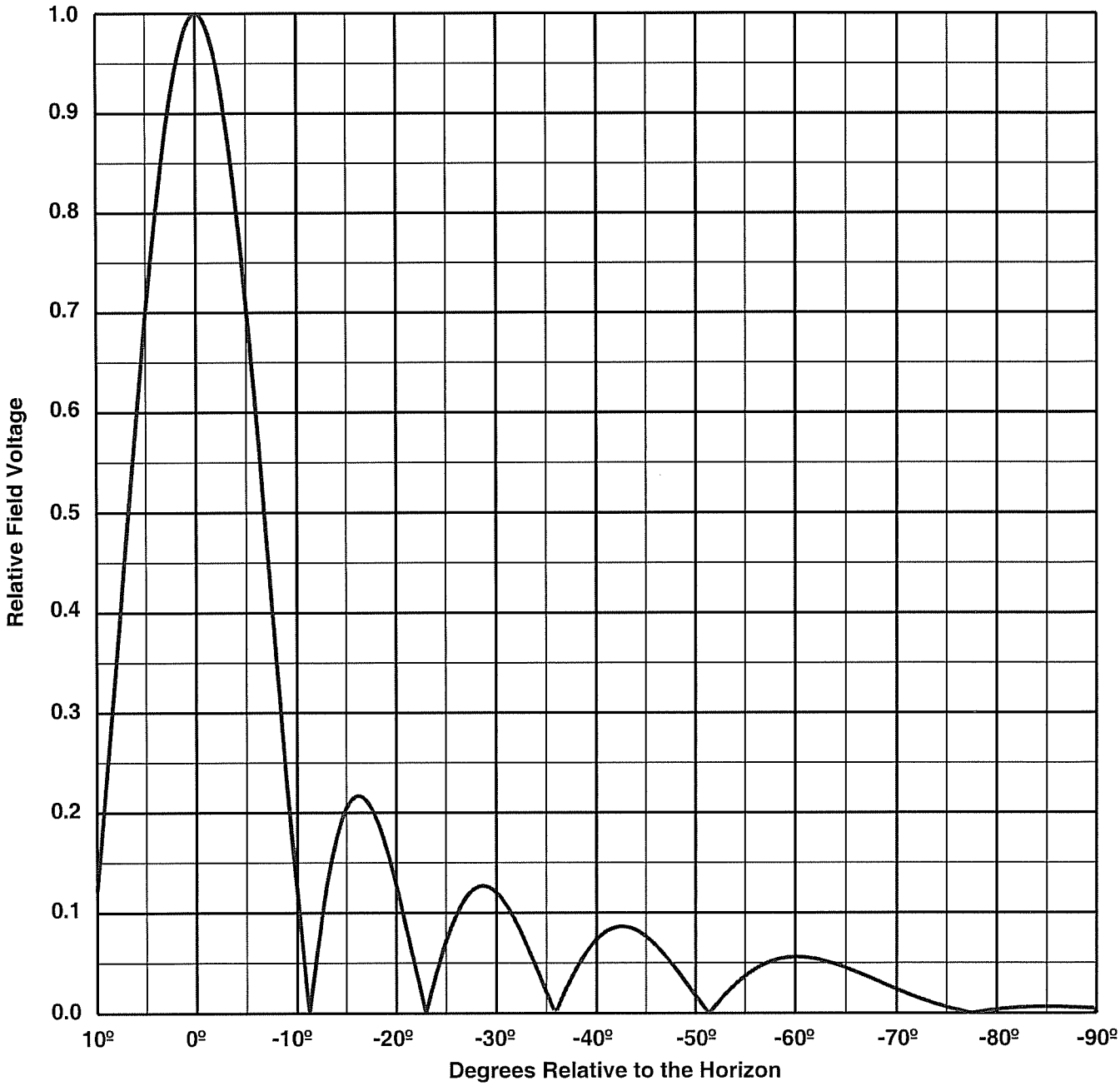
Total Input Power: 18.405 kW

ERI® Vertical Plane Relative Field Pattern

WKNNFM, Pascagoula, MS, 99.1 MHz

Figure#: 3 **Date: 3/20/01**

A 10 level, .514 wave-length spaced SHP-10AC-DA-HW directional antenna with 0° beam tilt, 0% null fill and a H/V maximum power ratio of 1.018



Vertical Polarization Gain:	Horizontal Polarization Gain:
Maximum: 5.286 (7.231 dB)	Maximum: 5.379 (7.307 dB)
Horizontal Plane: 5.286 (7.231 dB)	Horizontal Plane: 5.379 (7.307 dB)

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Directional Antenna System
For
WKNNFM, Pascagoula, Mississippi

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	SHP-10AC-DA-HW
Frequency:	99.1 MHz
Number of Bays:	10

MECHANICAL SPECIFICATIONS

Mounting:	Custom
System length:	49 ft 5 in
Aperture length required:	60 ft.
Orientation:	280 true

Input flange to the antenna 3 1/8 inch female

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	99 kW (19.956 dBk)
Horizontal maximum power gain:	5.379 (7.307 dB)
Maximum vertical ERP:	97.289 kW (19.881 dBk)
Vertical maximum power gain:	5.286 (7.231 dB)
Total input power:	18.405 kW (12.649 dBk)