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 WLEY, Aurora, Illinois

November 10, 2014

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 WLEY.

The antenna is the ERI model SHP-4AC-DA-HW configuration. The circular polarized system consists of 4 half-wavelength spaced bays using one driven circular polarized radiating element per bay, three horizontal parasitic elements per bay and two vertical parasitic elements interleaved between alternate bay pairs and six conduits attached to the tower faces through the aperture of the antenna. The antenna was mounted on the North 180 degrees East tower leg with bracketry to provide an antenna orientation of North 168 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 107.9 megahertz, which is the center of the FM broadcast channel assigned to WLEY.

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
WLEY, Aurora, Illinois

(Continued)

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 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.

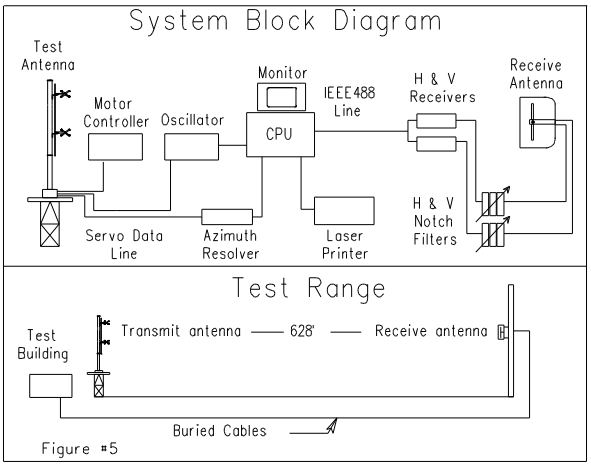

Figure #5

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 107.9 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 4 half-wavelength spaced bays using one driven circular polarized radiating element per bay, three horizontal parasitic elements per bay and two vertical parasitic elements interleaved between alternate bay pairs and six conduits attached to the tower faces through the aperture of the antenna. The power distribution and phase relationship will be fixed when the antenna is manufactured. Proper maintenance of the elements should be all that is required to maintain the pattern in adjustment.

The SHP-4AC-DA-HW array is to be mounted on the North 180 degrees East tower leg of the 6' face tower at a bearing of North 168 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 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 #1 & 1A respectively. The actual measured pattern does not exceed the authorized FCC composite pattern at any azimuth.

Directional Antenna System
For
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(Continued)

A calculated vertical plane relative field pattern is shown on Figure #3 attached. The power in the maximum will reach 21.000 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 28 feet 7 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.

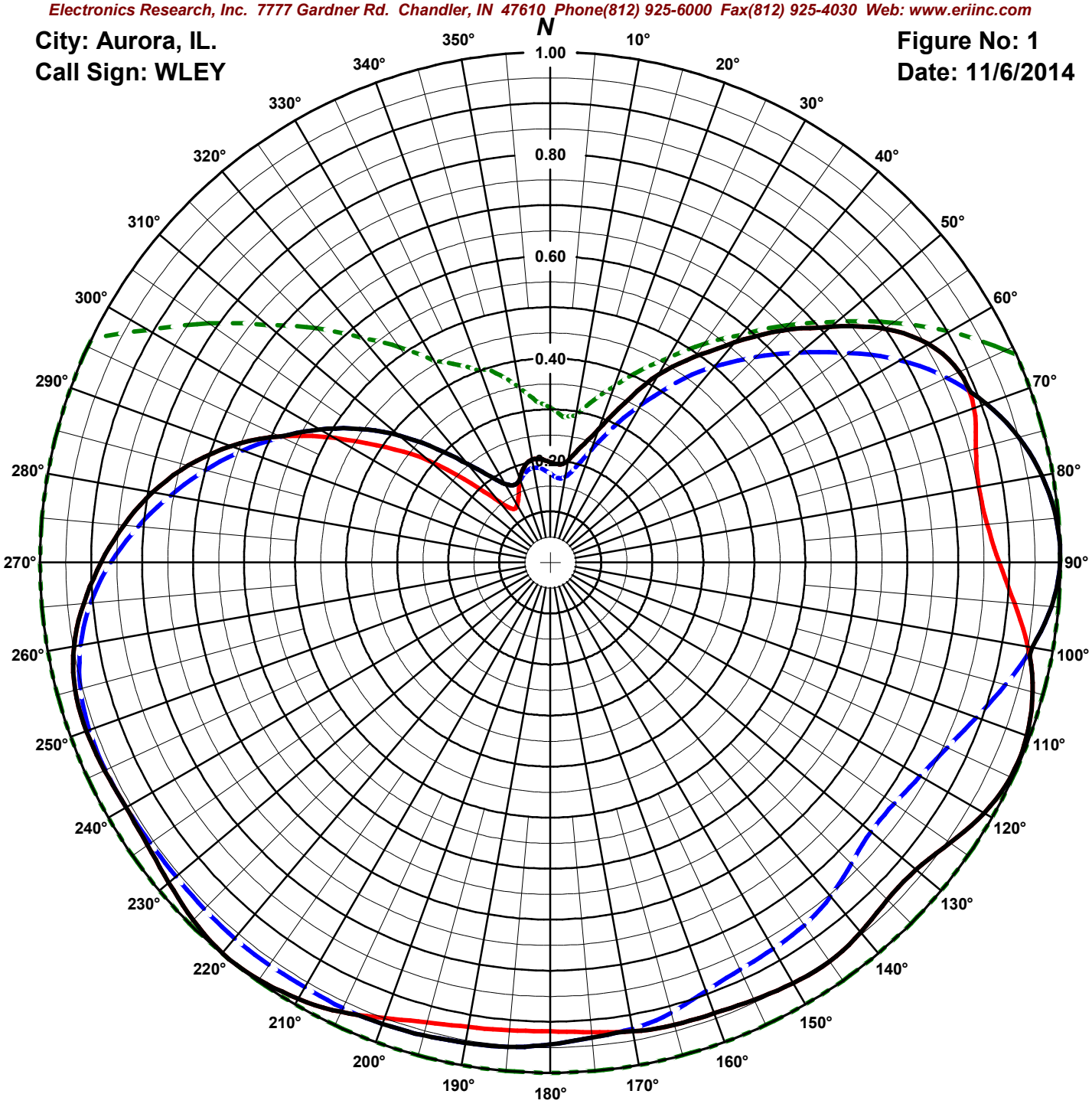
Tom Schaefer

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: Aurora, IL.
Call Sign: WLEY

Figure No: 1
Date: 11/6/2014



Antenna Orientation: 168° True

Frequency: 107.9 MHz
Antenna Type: SHP-4AC-DA-HW

Antenna Mounting: Standard
Tower Type: 6' Tower

HORIZONTAL	VERTICAL	COMPOSITE	FCC ENVELOPE
RMS: .783	RMS: .765	RMS: .797	RMS: .873
Maximum: 1 @ 219°	Maximum: 1 @ 89°	Maximum: 1 @ 89°	Maximum: 1 @ 66°
Minimum: .126 @ 327°	Minimum: .166 @ 6°	Minimum: .168 @ 336°	Minimum: .286 @ 5°

Measured patterns of the horizontal and vertical components, with the composite maximum of either the the H or V components and the filed FCC envelope pattern BLH-19910827KB.

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: 11/6/2014**
Station: WLEY **Antenna: SHP-4AC-DA-HW**
Location: Aurora, IL. **Antenna Orientation: 168° True**
Frequency: 107.9 MHz **Number of Bays: 4**

Azimuth	Envelope			Polarization	Azimuth	Envelope			Polarization
	Field	kW	dBk	Maximum		Field	kW	dBk	Maximum
0°	0.197	0.811	-0.909	Horizontal	180°	0.944	18.730	12.725	Vertical
5°	0.194	0.788	-1.034	Horizontal	185°	0.953	19.059	12.801	Vertical
10°	0.204	0.874	-0.585	Horizontal	190°	0.956	19.187	12.830	Vertical
15°	0.235	1.160	0.645	Horizontal	195°	0.959	19.329	12.862	Vertical
20°	0.279	1.637	2.140	Horizontal	200°	0.962	19.447	12.889	Vertical
25°	0.346	2.511	3.999	Horizontal	205°	0.972	19.836	12.974	Horizontal
30°	0.424	3.778	5.772	Horizontal	210°	0.988	20.492	13.116	Horizontal
35°	0.491	5.062	7.043	Horizontal	215°	0.997	20.893	13.200	Horizontal
40°	0.563	6.660	8.235	Horizontal	220°	0.999	20.978	13.218	Horizontal
45°	0.643	8.679	9.385	Horizontal	225°	0.990	20.600	13.139	Horizontal
50°	0.719	10.860	10.358	Horizontal	230°	0.976	20.020	13.015	Horizontal
55°	0.798	13.377	11.264	Horizontal	235°	0.965	19.556	12.913	Horizontal
60°	0.855	15.361	11.864	Horizontal	240°	0.961	19.403	12.879	Horizontal
65°	0.884	16.411	12.151	Horizontal	245°	0.964	19.532	12.907	Horizontal
70°	0.909	17.370	12.398	Vertical	250°	0.968	19.661	12.936	Horizontal
75°	0.950	18.957	12.778	Vertical	255°	0.964	19.522	12.905	Horizontal
80°	0.979	20.120	13.036	Vertical	260°	0.948	18.860	12.755	Horizontal
85°	0.996	20.814	13.184	Vertical	265°	0.918	17.691	12.478	Horizontal
90°	1.000	20.979	13.218	Vertical	270°	0.881	16.282	12.117	Horizontal
95°	0.986	20.427	13.102	Vertical	275°	0.839	14.782	11.697	Horizontal
100°	0.959	19.321	12.860	Vertical	280°	0.791	13.145	11.188	Horizontal
105°	0.979	20.113	13.035	Horizontal	285°	0.734	11.313	10.536	Horizontal
110°	0.994	20.744	13.169	Horizontal	290°	0.666	9.313	9.691	Horizontal
115°	0.996	20.812	13.183	Horizontal	295°	0.584	7.154	8.546	Horizontal
120°	0.982	20.253	13.065	Horizontal	300°	0.521	5.702	7.560	Vertical
125°	0.958	19.264	12.847	Horizontal	305°	0.456	4.367	6.401	Vertical
130°	0.938	18.460	12.662	Horizontal	310°	0.387	3.138	4.966	Vertical
135°	0.936	18.385	12.645	Horizontal	315°	0.314	2.074	3.168	Vertical
140°	0.947	18.825	12.747	Horizontal	320°	0.252	1.330	1.238	Vertical
145°	0.955	19.138	12.819	Horizontal	325°	0.206	0.891	-0.500	Vertical
150°	0.952	19.048	12.798	Horizontal	330°	0.178	0.665	-1.775	Vertical
155°	0.946	18.788	12.739	Horizontal	335°	0.168	0.589	-2.296	Vertical
160°	0.941	18.584	12.691	Horizontal	340°	0.173	0.631	-2.003	Horizontal
165°	0.939	18.501	12.672	Horizontal	345°	0.194	0.794	-1.000	Horizontal
170°	0.933	18.292	12.623	Horizontal	350°	0.204	0.875	-0.579	Horizontal
175°	0.935	18.344	12.635	Vertical	355°	0.203	0.864	-0.633	Horizontal

Horizontal Polarization:
Maximum: 2.072 (3.164 dB)
Horizontal Plane: 2.072 (3.164 dB)
Maximum ERP: 21.000 kW

Vertical Polarization:
Maximum: 2.072 (3.164 dB)
Horizontal Plane: 2.072 (3.164 dB)
Maximum ERP: 21.000 kW

Total Input Power: 10.134 kW
Reference: WLEY3M.FIG

This list shows the the maximum azimuth values of either the horizontal or vertical components.

ERI® Horizontal Plane Relative Field Pattern

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Figure# 1A **Date: 11/6/2014**
Station: WLEY **Antenna: SHP-4AC-DA-HW**
Location: Aurora, IL. **Antenna Orientation: 168° True**
Frequency: 107.9 MHz **Number of Bays: 4**

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.197	0.811	-0.909	0.174	0.633	-1.986	180°	0.920	17.760	12.494	0.944	18.730	12.725
5°	0.194	0.788	-1.034	0.166	0.581	-2.359	185°	0.921	17.803	12.505	0.953	19.059	12.801
10°	0.204	0.874	-0.585	0.171	0.612	-2.134	190°	0.925	17.959	12.543	0.956	19.187	12.830
15°	0.235	1.160	0.645	0.193	0.781	-1.075	195°	0.934	18.310	12.627	0.959	19.329	12.862
20°	0.279	1.637	2.140	0.234	1.153	0.618	200°	0.950	18.970	12.781	0.962	19.447	12.889
25°	0.346	2.511	3.999	0.291	1.784	2.514	205°	0.972	19.836	12.974	0.963	19.477	12.895
30°	0.424	3.778	5.772	0.357	2.675	4.273	210°	0.988	20.492	13.116	0.961	19.404	12.879
35°	0.491	5.062	7.043	0.429	3.870	5.877	215°	0.997	20.893	13.200	0.962	19.427	12.884
40°	0.563	6.660	8.235	0.501	5.281	7.227	220°	0.999	20.978	13.218	0.962	19.424	12.883
45°	0.643	8.679	9.385	0.569	6.792	8.320	225°	0.990	20.600	13.139	0.959	19.333	12.863
50°	0.719	10.860	10.358	0.640	8.597	9.343	230°	0.976	20.020	13.015	0.958	19.256	12.846
55°	0.798	13.377	11.264	0.715	10.748	10.313	235°	0.965	19.556	12.913	0.958	19.259	12.846
60°	0.855	15.361	11.864	0.792	13.178	11.199	240°	0.961	19.403	12.879	0.960	19.344	12.866
65°	0.884	16.411	12.151	0.857	15.418	11.880	245°	0.964	19.532	12.907	0.962	19.441	12.887
70°	0.883	16.388	12.145	0.909	17.370	12.398	250°	0.968	19.661	12.936	0.961	19.399	12.878
75°	0.865	15.699	11.959	0.950	18.957	12.778	255°	0.964	19.522	12.905	0.953	19.086	12.807
80°	0.854	15.323	11.854	0.979	20.120	13.036	260°	0.948	18.860	12.755	0.935	18.349	12.636
85°	0.861	15.561	11.920	0.996	20.814	13.184	265°	0.918	17.691	12.478	0.904	17.156	12.344
90°	0.881	16.303	12.123	1.000	20.979	13.218	270°	0.881	16.282	12.117	0.862	15.590	11.929
95°	0.914	17.543	12.441	0.986	20.427	13.102	275°	0.839	14.782	11.697	0.811	13.797	11.398
100°	0.951	18.992	12.786	0.959	19.321	12.860	280°	0.791	13.145	11.188	0.756	11.994	10.790
105°	0.979	20.113	13.035	0.924	17.942	12.539	285°	0.734	11.313	10.536	0.699	10.269	10.115
110°	0.994	20.744	13.169	0.889	16.582	12.196	290°	0.666	9.313	9.691	0.641	8.635	9.363
115°	0.996	20.812	13.183	0.859	15.480	11.898	295°	0.584	7.154	8.546	0.582	7.118	8.524
120°	0.982	20.253	13.065	0.837	14.726	11.681	300°	0.487	4.986	6.977	0.521	5.702	7.560
125°	0.958	19.264	12.847	0.823	14.235	11.534	305°	0.394	3.259	5.131	0.456	4.367	6.401
130°	0.938	18.460	12.662	0.821	14.147	11.507	310°	0.309	2.000	3.011	0.387	3.138	4.966
135°	0.936	18.385	12.645	0.835	14.631	11.653	315°	0.220	1.013	0.057	0.314	2.074	3.168
140°	0.947	18.825	12.747	0.855	15.337	11.857	320°	0.157	0.519	-2.850	0.252	1.330	1.238
145°	0.955	19.138	12.819	0.868	15.820	11.992	325°	0.129	0.351	-4.552	0.206	0.891	-0.500
150°	0.952	19.048	12.798	0.874	16.050	12.055	330°	0.130	0.356	-4.485	0.178	0.665	-1.775
155°	0.946	18.788	12.739	0.880	16.279	12.116	335°	0.147	0.454	-3.430	0.168	0.589	-2.296
160°	0.941	18.584	12.691	0.894	16.767	12.245	340°	0.173	0.631	-2.003	0.172	0.623	-2.056
165°	0.939	18.501	12.672	0.914	17.540	12.440	345°	0.194	0.794	-1.000	0.183	0.706	-1.514
170°	0.933	18.292	12.623	0.928	18.083	12.573	350°	0.204	0.875	-0.579	0.188	0.745	-1.278
175°	0.924	17.942	12.539	0.935	18.344	12.635	355°	0.203	0.864	-0.633	0.184	0.712	-1.475

Horizontal Polarization:
Maximum: 2.072 (3.164 dB)
Horizontal Plane: 2.072 (3.164 dB)
Maximum ERP: 21.000 kW

Vertical Polarization:
Maximum: 2.072 (3.164 dB)
Horizontal Plane: 2.072 (3.164 dB)
Maximum ERP: 21.000 kW

Total Input Power: 10.134 kW
Reference: WLEY3M.FIG

This list shows the azimuth values for the horizontal and vertical components.

ERI® Vertical Plane Relative Field Pattern

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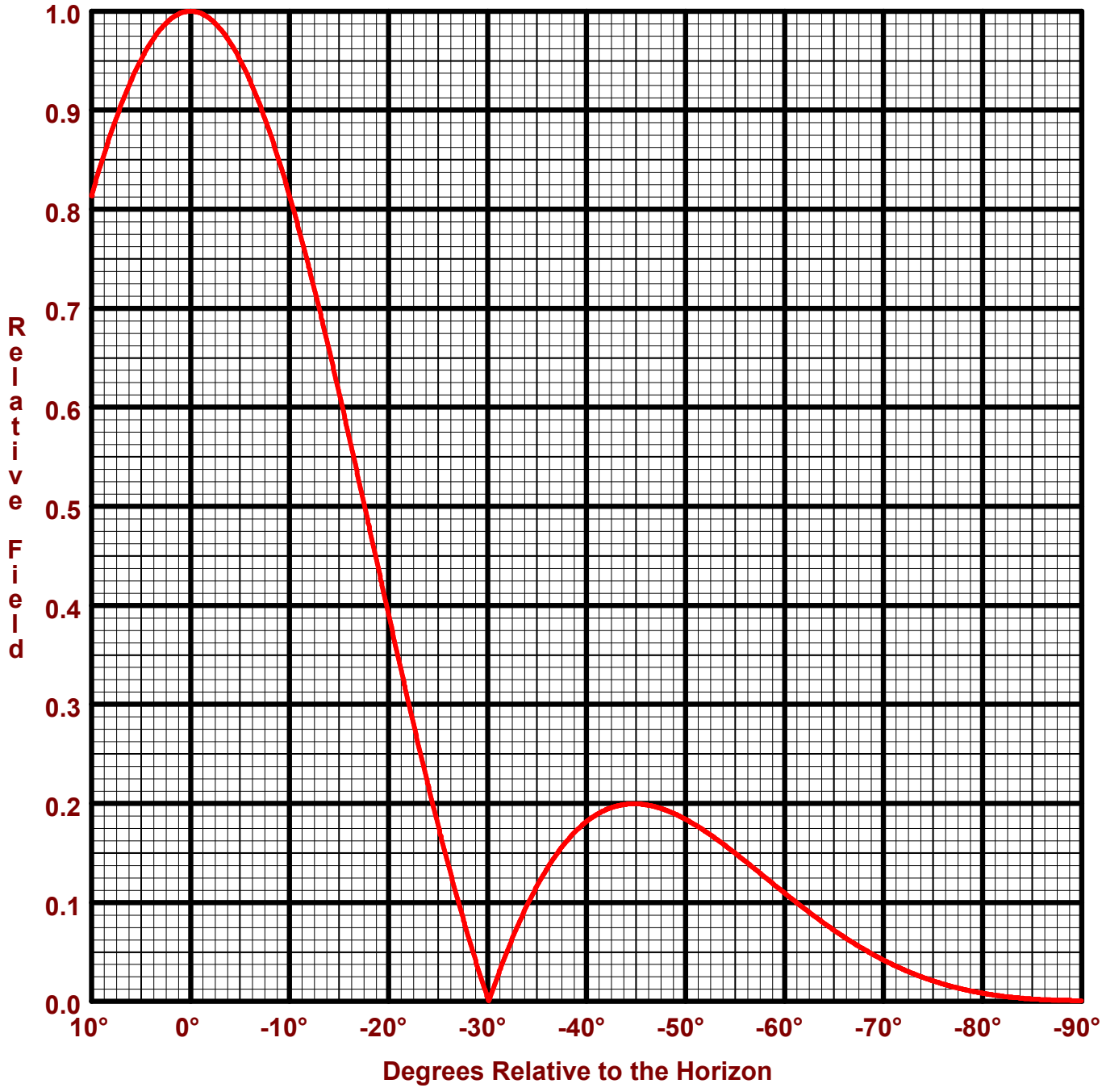
Figure No: 3
Call Sign: WLEY
Location: Aurora, IL.
Frequency: 107.9 MHz
4 bay SHP-4AC-DA-HW antenna

Date: 11/6/2014
H/V Power Ratio: 1
.5 Wave-length Spacing
0° Beam Tilt
0% First Null Fill



Horizontal Polarization:
Maximum: 2.072 (3.164 dB)
Horizontal Plane: 2.072 (3.164 dB)
Maximum ERP: 21.000 kW

Vertical Polarization:
Maximum: 2.072 (3.164 dB)
Horizontal Plane: 2.072 (3.164 dB)
Maximum ERP: 21.000 kW

Directional Antenna System
for
WLEY, Aurora, Illinois

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	SHP-4AC-DA-HW
Frequency:	107.9 MHz
Number of Bays:	Four

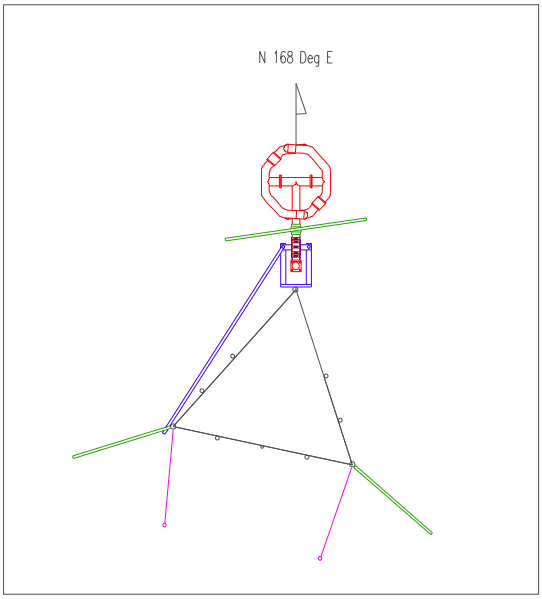
MECHANICAL SPECIFICATIONS

Mounting:	Standard
System length:	17 ft 3 in
Aperture length required:	28 ft 7 in [1]
Orientation:	168° true

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

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	21.000 kW (13.222 dBk)
Horizontal maximum power gain:	2.072 (3.164 dB)
Maximum vertical ERP:	21.000 kW (13.222 dBk)
Vertical maximum power gain:	2.072 (3.164 dB)
Total input power:	10.134 kW (10.058 dBk)



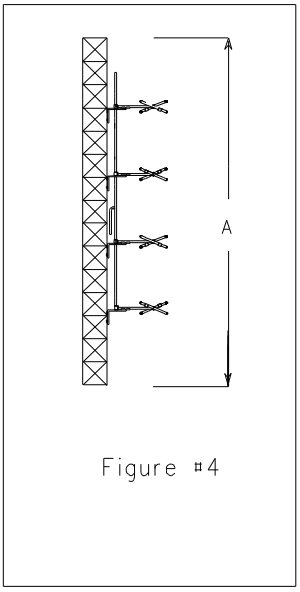


Figure #4