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 WAZO, Southport, North Carolina

November 12, 2012

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 WAZO.

The antenna is the ERI model MP-6E-DA-HW configuration. The circular polarized system consists of 6 half-wavelength spaced bays using one driven circular polarized radiating element per bay, three horizontal parasitic elements per bay and four vertical parasitic elements interleaved between alternate bay pairs. The antenna was mounted on the North 147 degrees East tower face with bracketry to provide an antenna orientation of North 147 degrees East. The antenna was tested on a 36" face tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 107.5 megahertz, which is the center of the FM broadcast channel assigned to WAZO.

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
WAZO, Southport, North Carolina

(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 36" 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.

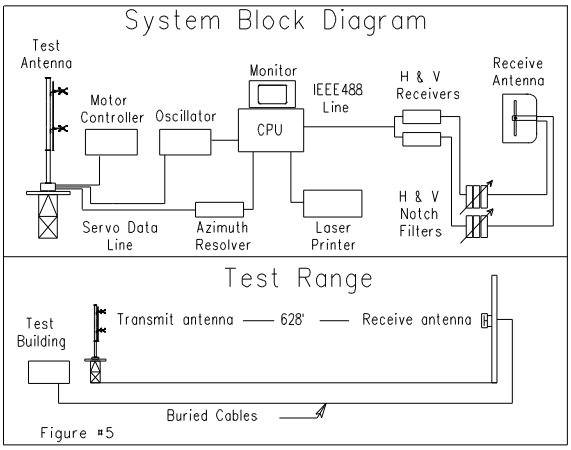

Figure #5

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 107.5 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 6 half-wavelength spaced bays using one driven circular polarized radiating element per bay, three horizontal parasitic elements per bay and four 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-6E-DA-HW array is to be mounted on the North 147 degrees East tower face of the 36" face tower at a bearing of North 147 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. 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).

(Continued)

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 42 feet 9 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

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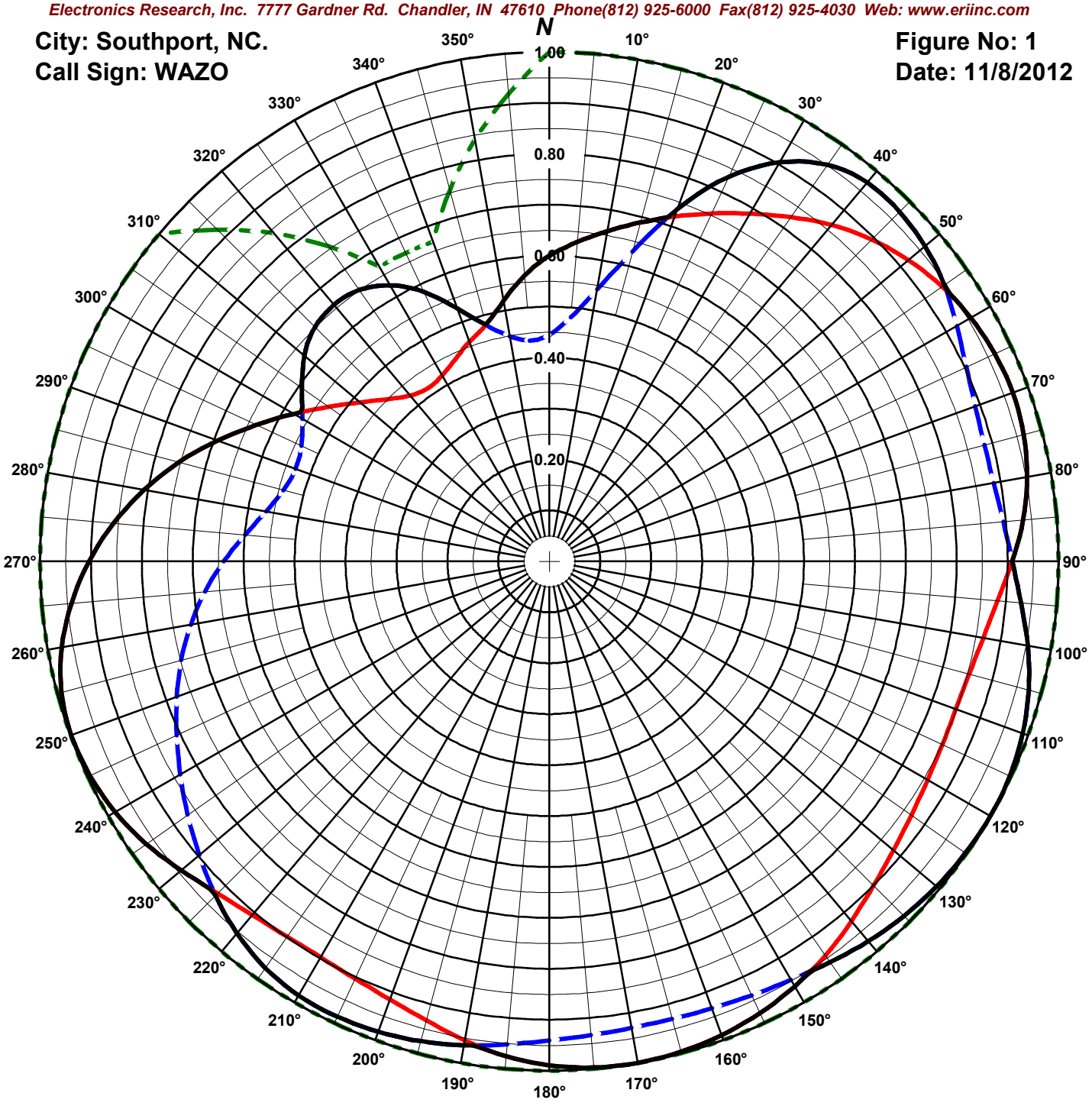
City: Southport, NC.
Call Sign: WAZO

Figure No: 1
Date: 11/8/2012



Antenna Orientation: 147° True

Frequency: 107.5 MHz
Antenna Type: MP-6E-DA-HW

Antenna Mounting: Custom
Tower Type: 36" face tower

HORIZONTAL	VERTICAL	COMPOSITE	FCC ENVELOPE
RMS: .839	RMS: .829	RMS: .881	RMS: .976
Maximum: 1 @ 171°	Maximum: 1 @ 120°	Maximum: 1 @ 120°	Maximum: 1 @ 0°
Minimum: .415 @ 325°	Minimum: .435 @ 356°	Minimum: .481 @ 345°	Minimum: .668 @ 330°

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 BPH-20120920ABM.

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: 11/8/2012**
Station: WAZO **Antenna: MP-6E-DA-HW**
Location: Southport, NC. **Antenna Orientation: 147° True**
Frequency: 107.5 MHz **Number of Bays: 6**

Azimuth	Envelope			Polarization	Azimuth	Envelope			Polarization
	Field	kW	dBk	Maximum		Field	kW	dBk	Maximum
0°	0.600	7.562	8.787	Horizontal	180°	0.989	20.558	13.130	Horizontal
5°	0.629	8.312	9.197	Horizontal	185°	0.975	19.974	13.005	Horizontal
10°	0.658	9.098	9.589	Horizontal	190°	0.965	19.541	12.910	Vertical
15°	0.689	9.957	9.981	Horizontal	195°	0.975	19.977	13.005	Vertical
20°	0.737	11.395	10.567	Vertical	200°	0.983	20.272	13.069	Vertical
25°	0.833	14.562	11.632	Vertical	205°	0.986	20.420	13.101	Vertical
30°	0.904	17.174	12.349	Vertical	210°	0.984	20.344	13.084	Vertical
35°	0.950	18.968	12.780	Vertical	215°	0.974	19.905	12.990	Vertical
40°	0.971	19.797	12.966	Vertical	220°	0.954	19.103	12.811	Vertical
45°	0.972	19.826	12.972	Vertical	225°	0.927	18.058	12.567	Vertical
50°	0.963	19.470	12.894	Vertical	230°	0.943	18.692	12.716	Horizontal
55°	0.947	18.816	12.745	Vertical	235°	0.967	19.624	12.928	Horizontal
60°	0.956	19.189	12.831	Horizontal	240°	0.984	20.345	13.085	Horizontal
65°	0.965	19.559	12.914	Horizontal	245°	0.995	20.797	13.180	Horizontal
70°	0.968	19.690	12.942	Horizontal	250°	0.999	20.952	13.212	Horizontal
75°	0.964	19.520	12.905	Horizontal	255°	0.992	20.653	13.150	Horizontal
80°	0.953	19.059	12.801	Horizontal	260°	0.972	19.841	12.976	Horizontal
85°	0.934	18.322	12.630	Horizontal	265°	0.942	18.632	12.703	Horizontal
90°	0.909	17.364	12.397	Vertical	270°	0.904	17.152	12.343	Horizontal
95°	0.930	18.159	12.591	Vertical	275°	0.859	15.488	11.900	Horizontal
100°	0.954	19.121	12.815	Vertical	280°	0.808	13.717	11.373	Horizontal
105°	0.975	19.948	12.999	Vertical	285°	0.753	11.900	10.755	Horizontal
110°	0.989	20.547	13.127	Vertical	290°	0.693	10.078	10.034	Horizontal
115°	0.998	20.900	13.201	Vertical	295°	0.634	8.447	9.267	Horizontal
120°	1.000	21.000	13.222	Vertical	300°	0.579	7.044	8.478	Horizontal
125°	0.998	20.912	13.204	Vertical	305°	0.593	7.382	8.682	Vertical
130°	0.993	20.698	13.159	Vertical	310°	0.628	8.276	9.178	Vertical
135°	0.985	20.367	13.089	Vertical	315°	0.651	8.897	9.493	Vertical
140°	0.974	19.922	12.993	Vertical	320°	0.658	9.081	9.582	Vertical
145°	0.961	19.391	12.876	Vertical	325°	0.650	8.876	9.482	Vertical
150°	0.964	19.503	12.901	Horizontal	330°	0.626	8.222	9.150	Vertical
155°	0.979	20.115	13.035	Horizontal	335°	0.584	7.158	8.548	Vertical
160°	0.990	20.573	13.133	Horizontal	340°	0.528	5.857	7.676	Vertical
165°	0.997	20.869	13.195	Horizontal	345°	0.481	4.856	6.863	Horizontal
170°	1.000	20.999	13.222	Horizontal	350°	0.519	5.656	7.525	Horizontal
175°	0.998	20.902	13.202	Horizontal	355°	0.563	6.654	8.231	Horizontal

Horizontal Polarization:
Maximum: 2.611 (4.168 dB)
Horizontal Plane: 2.611 (4.168 dB)
Maximum ERP: 21.000 kW

Vertical Polarization:
Maximum: 2.611 (4.168 dB)
Horizontal Plane: 2.611 (4.168 dB)
Maximum ERP: 21.000 kW

Total Input Power: 8.043 kW
Reference: WAZO1M.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: 11/8/2012**
Station: WAZO | **Antenna: MP-6E-DA-HW**
Location: Southport, NC. | **Antenna Orientation: 147° True**
Frequency: 107.5 MHz | **Number of Bays: 6**

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.600	7.562	8.787	0.444	4.148	6.178	180°	0.989	20.558	13.130	0.941	18.591	12.693
5°	0.629	8.312	9.197	0.481	4.853	6.860	185°	0.975	19.974	13.005	0.952	19.019	12.792
10°	0.658	9.098	9.589	0.542	6.173	7.905	190°	0.955	19.161	12.824	0.965	19.541	12.910
15°	0.689	9.957	9.981	0.629	8.314	9.198	195°	0.933	18.280	12.620	0.975	19.977	13.005
20°	0.720	10.896	10.373	0.737	11.395	10.567	200°	0.915	17.596	12.454	0.983	20.272	13.069
25°	0.754	11.924	10.764	0.833	14.562	11.632	205°	0.904	17.145	12.341	0.986	20.420	13.101
30°	0.788	13.050	11.156	0.904	17.174	12.349	210°	0.898	16.922	12.284	0.984	20.344	13.084
35°	0.825	14.293	11.551	0.950	18.968	12.780	215°	0.899	16.960	12.294	0.974	19.905	12.990
40°	0.862	15.602	11.932	0.971	19.797	12.966	220°	0.907	17.269	12.373	0.954	19.103	12.811
45°	0.894	16.784	12.249	0.972	19.826	12.972	225°	0.922	17.843	12.515	0.927	18.058	12.567
50°	0.920	17.789	12.501	0.963	19.470	12.894	230°	0.943	18.692	12.716	0.897	16.909	12.281
55°	0.941	18.595	12.694	0.947	18.816	12.745	235°	0.967	19.624	12.928	0.867	15.782	11.982
60°	0.956	19.189	12.831	0.924	17.925	12.535	240°	0.984	20.345	13.085	0.836	14.694	11.671
65°	0.965	19.559	12.914	0.904	17.145	12.341	245°	0.995	20.797	13.180	0.807	13.684	11.362
70°	0.968	19.690	12.942	0.890	16.643	12.212	250°	0.999	20.952	13.212	0.778	12.717	11.044
75°	0.964	19.520	12.905	0.884	16.425	12.155	255°	0.992	20.653	13.150	0.748	11.750	10.700
80°	0.953	19.059	12.801	0.886	16.498	12.174	260°	0.972	19.841	12.976	0.715	10.733	10.307
85°	0.934	18.322	12.630	0.895	16.814	12.257	265°	0.942	18.632	12.703	0.678	9.667	9.853
90°	0.909	17.338	12.390	0.909	17.364	12.397	270°	0.904	17.152	12.343	0.639	8.576	9.333
95°	0.884	16.397	12.148	0.930	18.159	12.591	275°	0.859	15.488	11.900	0.599	7.544	8.776
100°	0.865	15.715	11.963	0.954	19.121	12.815	280°	0.808	13.717	11.373	0.565	6.694	8.257
105°	0.854	15.301	11.847	0.975	19.948	12.999	285°	0.753	11.900	10.755	0.540	6.131	7.876
110°	0.849	15.151	11.804	0.989	20.547	13.127	290°	0.693	10.078	10.034	0.530	5.905	7.712
115°	0.851	15.224	11.825	0.998	20.900	13.201	295°	0.634	8.447	9.267	0.537	6.057	7.823
120°	0.858	15.450	11.889	1.000	21.000	13.222	300°	0.579	7.044	8.478	0.560	6.581	8.183
125°	0.868	15.822	11.993	0.998	20.912	13.204	305°	0.529	5.867	7.684	0.593	7.382	8.682
130°	0.882	16.345	12.134	0.993	20.698	13.159	310°	0.486	4.954	6.950	0.628	8.276	9.178
135°	0.900	17.025	12.311	0.985	20.367	13.089	315°	0.450	4.259	6.293	0.651	8.897	9.493
140°	0.922	17.868	12.521	0.974	19.922	12.993	320°	0.425	3.787	5.783	0.658	9.081	9.582
145°	0.945	18.745	12.729	0.961	19.391	12.876	325°	0.415	3.620	5.587	0.650	8.876	9.482
150°	0.964	19.503	12.901	0.949	18.916	12.768	330°	0.421	3.722	5.708	0.626	8.222	9.150
155°	0.979	20.115	13.035	0.940	18.555	12.685	335°	0.438	4.020	6.042	0.584	7.158	8.548
160°	0.990	20.573	13.133	0.934	18.309	12.627	340°	0.458	4.414	6.448	0.528	5.857	7.676
165°	0.997	20.869	13.195	0.930	18.175	12.595	345°	0.481	4.856	6.863	0.480	4.839	6.848
170°	1.000	20.999	13.222	0.930	18.168	12.593	350°	0.519	5.656	7.525	0.449	4.228	6.261
175°	0.998	20.902	13.202	0.934	18.308	12.626	355°	0.563	6.654	8.231	0.435	3.974	5.992

Horizontal Polarization:
Maximum: 2.611 (4.168 dB)
Horizontal Plane: 2.611 (4.168 dB)
Maximum ERP: 21.000 kW

Vertical Polarization:
Maximum: 2.611 (4.168 dB)
Horizontal Plane: 2.611 (4.168 dB)
Maximum ERP: 21.000 kW

Total Input Power: 8.043 kW
Reference: WAZO1M.FIG

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

ERI® Vertical Plane Relative Field Pattern

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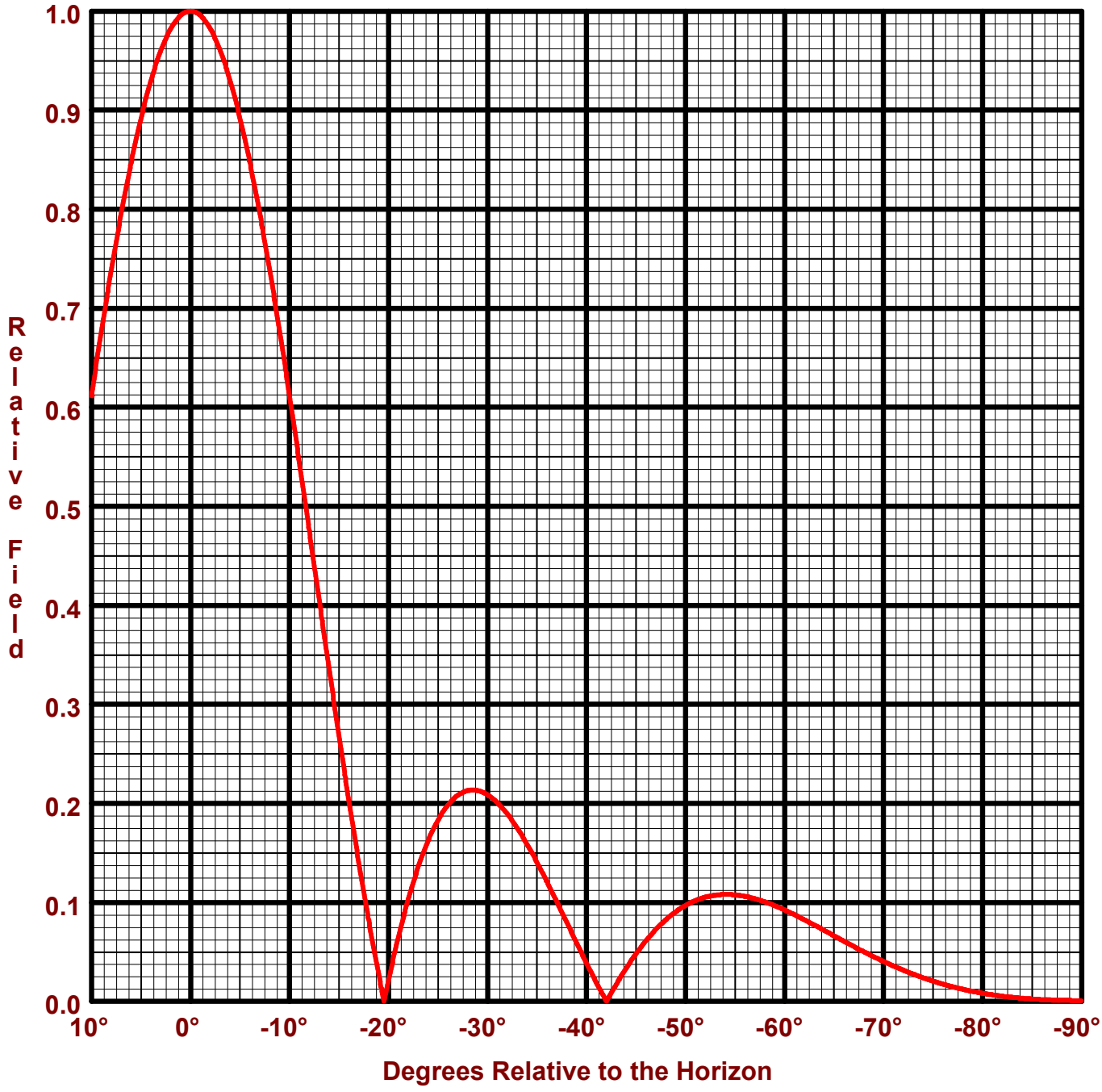
Figure No: 3
Call Sign: WAZO
Location: Southport, NC.
Frequency: 107.5 MHz
6 bay MP-6E-DA-HW antenna

Date: 11/8/2012
H/V Power Ratio: 1
.5 Wave-length Spacing
0° Beam Tilt
0% First Null Fill



Horizontal Polarization:
Maximum: 2.611 (4.168 dB)
Horizontal Plane: 2.611 (4.168 dB)
Maximum ERP: 21.000 kW

Vertical Polarization:
Maximum: 2.611 (4.168 dB)
Horizontal Plane: 2.611 (4.168 dB)
Maximum ERP: 21.000 kW

Directional Antenna System
for
WAZO, Southport, North Carolina

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	MP-6E-DA-HW
Frequency:	107.5 MHz
Number of Bays:	Six

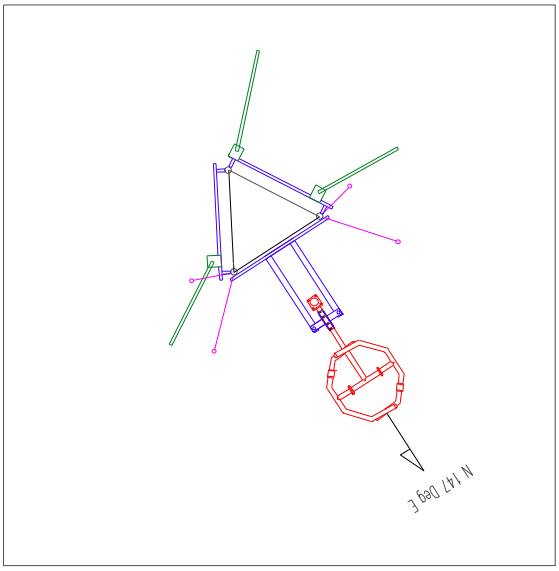
MECHANICAL SPECIFICATIONS

Mounting:	Custom
System length:	31 ft 3 in
Aperture length required:	42 ft 9 in
Orientation:	147 ° 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:	2.611 (4.168 dB)
Maximum vertical ERP:	21.000. kW (13.222 dBk)
Vertical maximum power gain:	2.611 (4.168 dB)
Total input power:	8.043 kW (9.054 dBk)



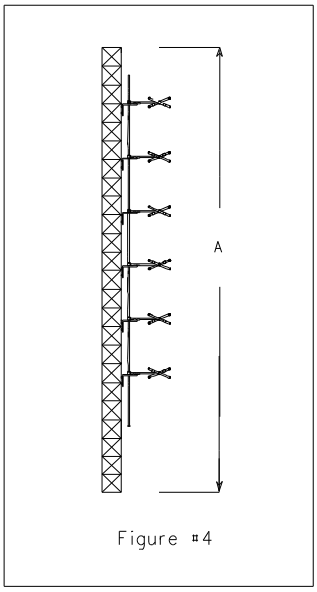


Figure #4