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 WDRC, Hartford, Connecticut

July 28, 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 WDRC.

The antenna is the ERI model LP-4E-DA configuration. The circular polarized system consists of 4 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 tested on a 10.75" o.d. pole, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 102.9 megahertz, which is the center of the FM broadcast channel assigned to WDRC.

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
WDRC, Hartford, Connecticut

(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 1 5/8 inch o.d. rigid coaxial line was used to feed the test antenna, and a section of 1 5/8 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 10.75" 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.

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 102.9 MHz and was constantly monitored by a Rohde & Schwarz ESVD measuring receiver.

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.

(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 4 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 LP-4E-DA array is to be mounted on the 10.75" o.d. pole at a bearing of North 8 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 19.500 kilowatts (12.900 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 43 feet 7 inches.

(Continued)

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.

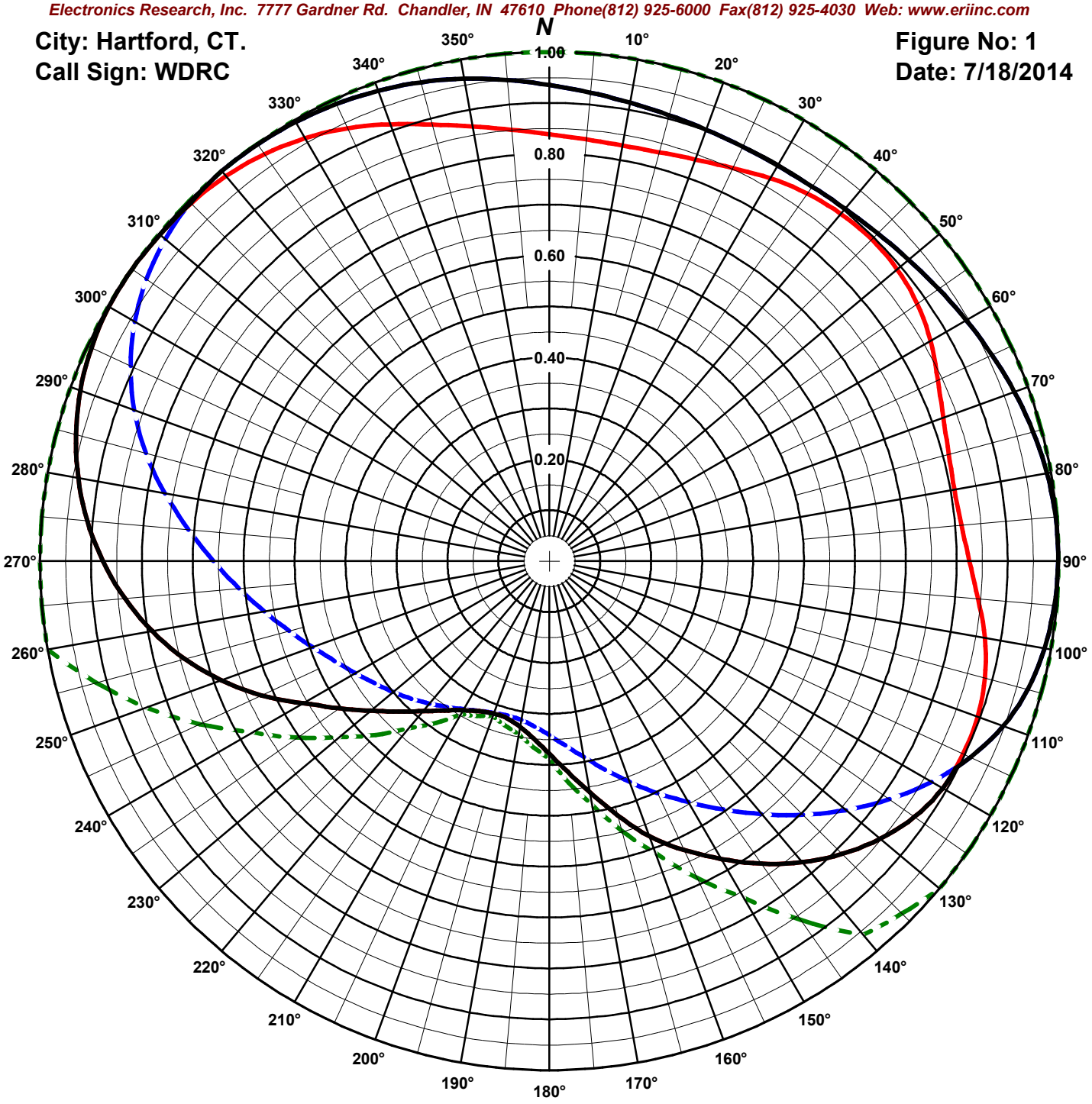
The Microsoft Word document on file electronically at Electronic Research, Inc. governs the specifications, scope, and configuration of the product described. All other representations whether verbal, printed, or electronic are subordinate to the master copy of this document on file at ERI.

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: Hartford, CT.
Call Sign: WDRC

Figure No: 1
Date: 7/18/2014



Antenna Orientation: 8° True

Frequency: 102.9 MHz
Antenna Type: LP-4E-DA

Antenna Mounting: Standard
Tower Type: 10 3\4" o.d. Pole

HORIZONTAL	VERTICAL	COMPOSITE	FCC ENVELOPE
RMS: .785	RMS: .783	RMS: .825	RMS: .885
Maximum: 1 @ 305°	Maximum: 1 @ 321°	Maximum: 1 @ 305°	Maximum: 1 @ 0°
Minimum: .318 @ 198°	Minimum: .314 @ 195°	Minimum: .318 @ 198°	Minimum: .324 @ 200°

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-20140402AAL.

ERI® Horizontal Plane Relative Field Pattern

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Figure# 1 **Date: 7/18/2014**
Station: WDRC **Antenna: LP-4E-DA**
Location: Hartford, CT. **Antenna Orientation: 8° True**
Frequency: 102.9 MHz **Number of Bays: 4**

Azimuth	Envelope			Polarization	Azimuth	Envelope			Polarization
	Field	kW	dBk	Maximum		Field	kW	dBk	Maximum
0°	0.935	17.051	12.317	Vertical	180°	0.378	2.792	4.459	Horizontal
5°	0.924	16.636	12.210	Vertical	185°	0.350	2.389	3.782	Horizontal
10°	0.914	16.297	12.121	Vertical	190°	0.331	2.131	3.285	Horizontal
15°	0.907	16.035	12.051	Vertical	195°	0.320	1.996	3.001	Horizontal
20°	0.901	15.847	11.999	Vertical	200°	0.319	1.979	2.964	Horizontal
25°	0.898	15.732	11.968	Vertical	205°	0.325	2.061	3.141	Horizontal
30°	0.897	15.688	11.956	Vertical	210°	0.338	2.232	3.488	Horizontal
35°	0.899	15.745	11.972	Vertical	215°	0.358	2.502	3.983	Horizontal
40°	0.904	15.920	12.020	Vertical	220°	0.385	2.886	4.603	Horizontal
45°	0.911	16.185	12.091	Vertical	225°	0.418	3.404	5.320	Horizontal
50°	0.921	16.534	12.184	Vertical	230°	0.458	4.082	6.108	Horizontal
55°	0.933	16.960	12.294	Vertical	235°	0.504	4.950	6.946	Horizontal
60°	0.946	17.437	12.415	Vertical	240°	0.558	6.073	7.834	Horizontal
65°	0.959	17.933	12.537	Vertical	245°	0.623	7.580	8.797	Horizontal
70°	0.972	18.418	12.652	Vertical	250°	0.685	9.151	9.615	Horizontal
75°	0.983	18.854	12.754	Vertical	255°	0.741	10.711	10.298	Horizontal
80°	0.992	19.204	12.834	Vertical	260°	0.792	12.224	10.872	Horizontal
85°	0.998	19.423	12.883	Vertical	265°	0.837	13.656	11.353	Horizontal
90°	0.999	19.469	12.893	Vertical	270°	0.876	14.979	11.755	Horizontal
95°	0.996	19.325	12.861	Vertical	275°	0.911	16.167	12.086	Horizontal
100°	0.987	19.014	12.791	Vertical	280°	0.939	17.199	12.355	Horizontal
105°	0.973	18.457	12.662	Vertical	285°	0.962	18.056	12.566	Horizontal
110°	0.948	17.524	12.436	Vertical	290°	0.980	18.722	12.724	Horizontal
115°	0.912	16.217	12.100	Vertical	295°	0.992	19.187	12.830	Horizontal
120°	0.892	15.516	11.908	Horizontal	300°	0.999	19.444	12.888	Horizontal
125°	0.876	14.952	11.747	Horizontal	305°	1.000	19.500	12.900	Horizontal
130°	0.848	14.037	11.473	Horizontal	310°	0.998	19.408	12.880	Horizontal
135°	0.813	12.899	11.106	Horizontal	315°	0.996	19.333	12.863	Vertical
140°	0.772	11.627	10.655	Horizontal	320°	1.000	19.498	12.900	Vertical
145°	0.726	10.266	10.114	Horizontal	325°	0.999	19.460	12.891	Vertical
150°	0.675	8.896	9.492	Horizontal	330°	0.996	19.332	12.863	Vertical
155°	0.626	7.637	8.829	Horizontal	335°	0.990	19.126	12.816	Vertical
160°	0.575	6.448	8.094	Horizontal	340°	0.983	18.842	12.751	Vertical
165°	0.516	5.200	7.160	Horizontal	345°	0.974	18.481	12.667	Vertical
170°	0.462	4.156	6.187	Horizontal	350°	0.962	18.048	12.564	Vertical
175°	0.416	3.368	5.274	Horizontal	355°	0.949	17.545	12.442	Vertical

Horizontal Polarization:
Maximum: 3.295 (5.179 dB)
Horizontal Plane: 3.295 (5.179 dB)
Maximum ERP: 19.500 kW

Vertical Polarization:
Maximum: 3.295 (5.179 dB)
Horizontal Plane: 3.295 (5.179 dB)
Maximum ERP: 19.500 kW

Total Input Power: 5.917 kW
Reference: WDRC1M.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: 7/18/2014**
Station: WDRC **Antenna: LP-4E-DA**
Location: Hartford, CT. **Antenna Orientation: 8° True**
Frequency: 102.9 MHz **Number of Bays: 4**

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.839	13.712	11.371	0.935	17.051	12.317	180°	0.378	2.792	4.459	0.342	2.280	3.580
5°	0.831	13.478	11.296	0.924	16.636	12.210	185°	0.350	2.389	3.782	0.326	2.075	3.171
10°	0.829	13.393	11.269	0.914	16.297	12.121	190°	0.331	2.131	3.285	0.317	1.960	2.923
15°	0.832	13.485	11.298	0.907	16.035	12.051	195°	0.320	1.996	3.001	0.314	1.926	2.847
20°	0.839	13.737	11.379	0.901	15.847	11.999	200°	0.319	1.979	2.964	0.317	1.962	2.928
25°	0.852	14.153	11.508	0.898	15.732	11.968	205°	0.325	2.061	3.141	0.325	2.057	3.133
30°	0.868	14.702	11.674	0.897	15.688	11.956	210°	0.338	2.232	3.488	0.336	2.200	3.425
35°	0.882	15.163	11.808	0.899	15.745	11.972	215°	0.358	2.502	3.983	0.350	2.385	3.774
40°	0.891	15.464	11.893	0.904	15.920	12.020	220°	0.385	2.886	4.603	0.365	2.605	4.158
45°	0.894	15.599	11.931	0.911	16.185	12.091	225°	0.418	3.404	5.320	0.382	2.852	4.552
50°	0.892	15.503	11.904	0.921	16.534	12.184	230°	0.458	4.082	6.108	0.400	3.120	4.941
55°	0.882	15.158	11.806	0.933	16.960	12.294	235°	0.504	4.950	6.946	0.419	3.417	5.336
60°	0.865	14.575	11.636	0.946	17.437	12.415	240°	0.558	6.073	7.834	0.440	3.770	5.763
65°	0.842	13.821	11.405	0.959	17.933	12.537	245°	0.623	7.580	8.797	0.465	4.210	6.242
70°	0.823	13.222	11.213	0.972	18.418	12.652	250°	0.685	9.151	9.615	0.494	4.768	6.783
75°	0.812	12.858	11.092	0.983	18.854	12.754	255°	0.741	10.711	10.298	0.529	5.462	7.373
80°	0.808	12.728	11.048	0.992	19.204	12.834	260°	0.792	12.224	10.872	0.568	6.299	7.993
85°	0.812	12.871	11.096	0.998	19.423	12.883	265°	0.837	13.656	11.353	0.612	7.297	8.632
90°	0.825	13.267	11.228	0.999	19.469	12.893	270°	0.876	14.979	11.755	0.659	8.481	9.284
95°	0.845	13.923	11.437	0.996	19.325	12.861	275°	0.911	16.167	12.086	0.711	9.867	9.942
100°	0.869	14.709	11.676	0.987	19.014	12.791	280°	0.939	17.199	12.355	0.766	11.454	10.590
105°	0.886	15.291	11.844	0.973	18.457	12.662	285°	0.962	18.056	12.566	0.820	13.119	11.179
110°	0.895	15.614	11.935	0.948	17.524	12.436	290°	0.980	18.722	12.724	0.867	14.668	11.664
115°	0.896	15.663	11.949	0.912	16.217	12.100	295°	0.992	19.187	12.830	0.907	16.050	12.055
120°	0.892	15.516	11.908	0.867	14.655	11.660	300°	0.999	19.444	12.888	0.940	17.233	12.364
125°	0.876	14.952	11.747	0.816	12.970	11.129	305°	1.000	19.500	12.900	0.966	18.187	12.598
130°	0.848	14.037	11.473	0.761	11.286	10.526	310°	0.998	19.408	12.880	0.984	18.893	12.763
135°	0.813	12.899	11.106	0.705	9.686	9.861	315°	0.994	19.283	12.852	0.996	19.333	12.863
140°	0.772	11.627	10.655	0.649	8.208	9.142	320°	0.987	19.001	12.788	1.000	19.498	12.900
145°	0.726	10.266	10.114	0.595	6.913	8.397	325°	0.975	18.550	12.683	0.999	19.460	12.891
150°	0.675	8.896	9.492	0.547	5.829	7.656	330°	0.959	17.934	12.537	0.996	19.332	12.863
155°	0.626	7.637	8.829	0.503	4.927	6.926	335°	0.938	17.161	12.346	0.990	19.126	12.816
160°	0.575	6.448	8.094	0.462	4.160	6.191	340°	0.913	16.247	12.108	0.983	18.842	12.751
165°	0.516	5.200	7.160	0.424	3.509	5.452	345°	0.888	15.364	11.865	0.974	18.481	12.667
170°	0.462	4.156	6.187	0.391	2.982	4.746	350°	0.867	14.650	11.659	0.962	18.048	12.564
175°	0.416	3.368	5.274	0.364	2.579	4.114	355°	0.850	14.103	11.493	0.949	17.545	12.442

Horizontal Polarization:
Maximum: 3.295 (5.179 dB)
Horizontal Plane: 3.295 (5.179 dB)
Maximum ERP: 19.500 kW

Vertical Polarization:
Maximum: 3.295 (5.179 dB)
Horizontal Plane: 3.295 (5.179 dB)
Maximum ERP: 19.500 kW

Total Input Power: 5.917 kW
Reference: WDRC1M.FIG

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

ERI® Vertical Plane Relative Field Pattern

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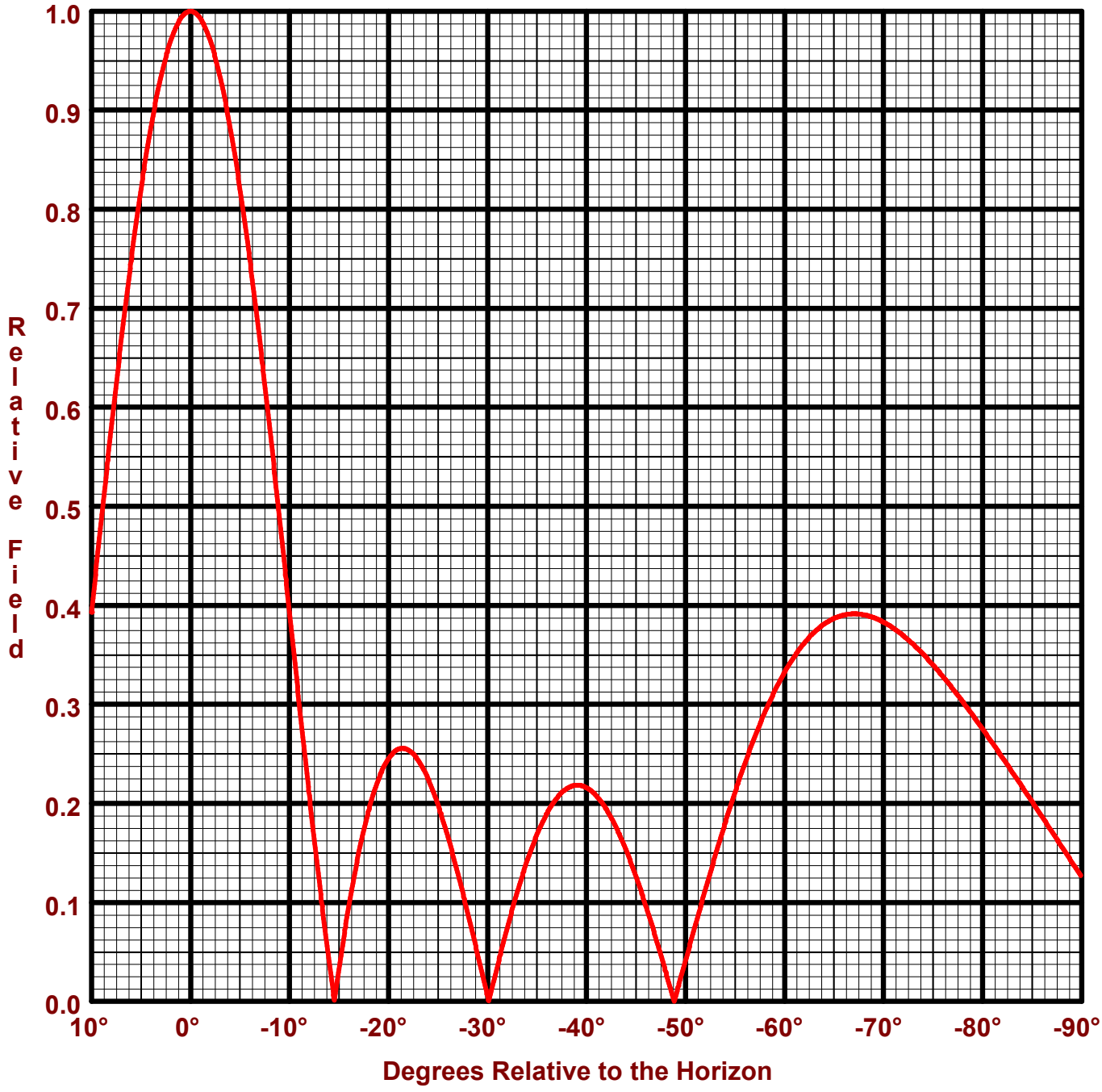
Figure No: 3
Call Sign: WDRC
Location: Hartford, CT.
Frequency: 102.9 MHz
4 bay LP-4E-DA antenna

Date: 7/18/2014
H/V Power Ratio: 1
1 Wave-length Spacing
0° Beam Tilt
0% First Null Fill



Horizontal Polarization:
Maximum: 3.295 (5.179 dB)
Horizontal Plane: 3.295 (5.179 dB)
Maximum ERP: 19.500 kW

Vertical Polarization:
Maximum: 3.295 (5.179 dB)
Horizontal Plane: 3.295 (5.179 dB)
Maximum ERP: 19.500 kW

Directional Antenna System
for
WDRC, Hartford, Connecticut

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	LP-4E-DA
Frequency:	102.9 MHz
Number of Bays:	Four

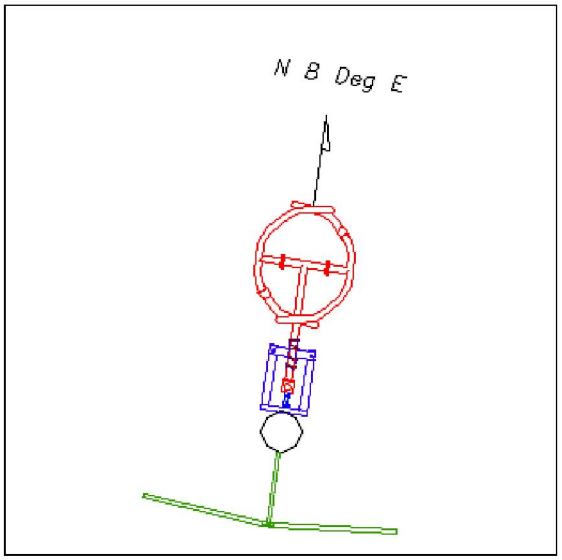
MECHANICAL SPECIFICATIONS

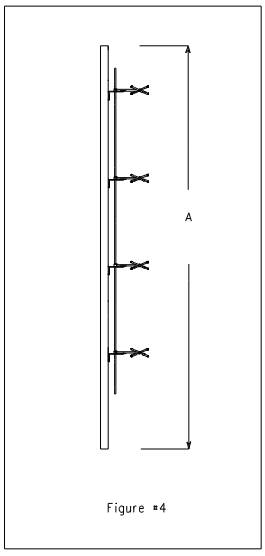
Mounting:	Standard
System length:	37 ft 1 in
Aperture length required:	43 ft 7 in [1]
Orientation:	8° true

Input flange to the antenna 1 5/8” female.

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	19.500 kW (12.9 dBk)
Horizontal maximum power gain:	3.295 (5.179 dB)
Maximum vertical ERP:	19.500 kW (12.9 dBk)
Vertical maximum power gain:	3.295 (5.179 dB)
Total input power:	5.917 kW (7.721 dBk)





HODGE, LLC

PROFESSIONAL LAND SURVEYORS & CIVIL ENGINEERS

Connoisseur Media, LLC
Scott Baron
Chief Engineer - Hartford
869 Blue Hills Ave.
Bloomfield Ct. 06002

Re: WDRC Tower – West Peak Drive - Meriden, CT

Dear Mr. Baron,

On August 28, 2014 Hodge, LLC field located the new antenna and determined the angle from true North to be North 08 degrees 51 minutes 16 seconds East. The bearing was determined using the following methods:

1) Control was established using GPS. The readings were taken multiple times on three separate days. The control coordinates are based on Connecticut State Plane Coordinate system NAD83.
2) Multiple measurements were then taken using a Total Station to locate the new antenna in order to compute the direction.

The accuracy conforms to A2 standards.

Adam Hoffman, L.S.
License #15168

1783 Farmington Avenue Unionville, CT 06085 | PH: 860.673.0444 | FAX: 860.675.7429
www.hodgellc.com

WDRC Directional Antenna installation.

This is to certify that the directional antenna for WDRC manufactured by ERI model number **LP-4E-DA** was installed on August 29, 2014.

The antenna was assembled with strict adherence to manufacturer specification set forth in the manufacturers directions in order to properly comply with the directional pattern set forth in the construction permit and described in FCC file number BPH-20140402AAL.

I worked with the tower crew and surveyor team to insure that the antenna was placed at the correct azimuth of 8 degrees true north. Transmitter TPO was adjusted to 6 KW in order to accommodate the new antenna gain and ERP.

The antenna was assembled by myself, Fred A. Francis Jr. a broadcast engineer with over 20 years experience in both radio and television engineering. I specialize in RF systems with an emphasis on antennas. My experience includes the installation of numerous directional radio and television antenna systems as well as countless non-directional antenna systems.

Fred A. Francis Jr.
Owner Xenirad Broadcast Engineering

COMPLIANCE WITH SECTION 73.315

FM STATION WDRC-FM
HARTFORD, CONNECTICUT
CH 275B 19.5 KW (DA) 247 M

du Treil, Lundin & Rackley, Inc. Sarasota, Florida