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 WEHP, Lawrence Park, Pennsylvania

September 6, 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 WEHP.

The antenna is the ERI model LP-4E-DA-HW configuration. The circular polarized system consists of 4 half-wavelength spaced bays using one driven circular polarized radiating element per bay, two horizontal parasitic elements per bay and two vertical parasitic elements interleaved between alternate bay pairs. The antenna was tested on an 8 5/8" o.d. pole, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 92.7 megahertz, which is the center of the FM broadcast channel assigned to WEHP.

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
WEHP, Lawrence Park, Pennsylvania

(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 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 8 5/8" 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.

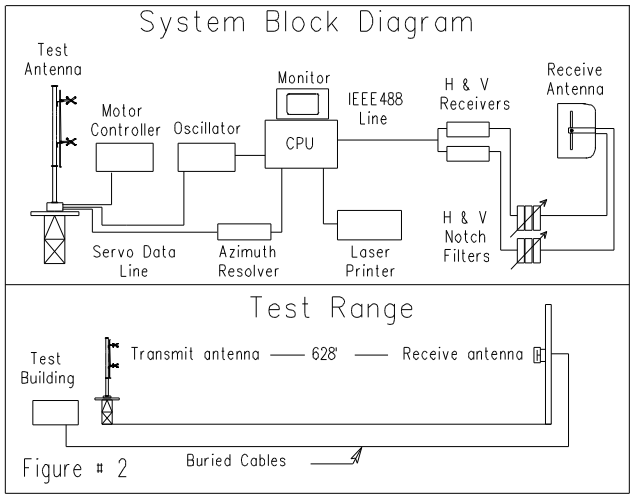

Figure # 2

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 92.7 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, two horizontal parasitic elements 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 LP-4E-DA-HW array is to be mounted on t the 8 5/8" o.d. pole at a bearing of North 150 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 6.00 kilowatts (7.782 dBk).

(Continued)

The power at North 330 degrees East does not exceed 0.240 kilowatts (-6.198 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 31 feet if the antenna is to be top mounted.

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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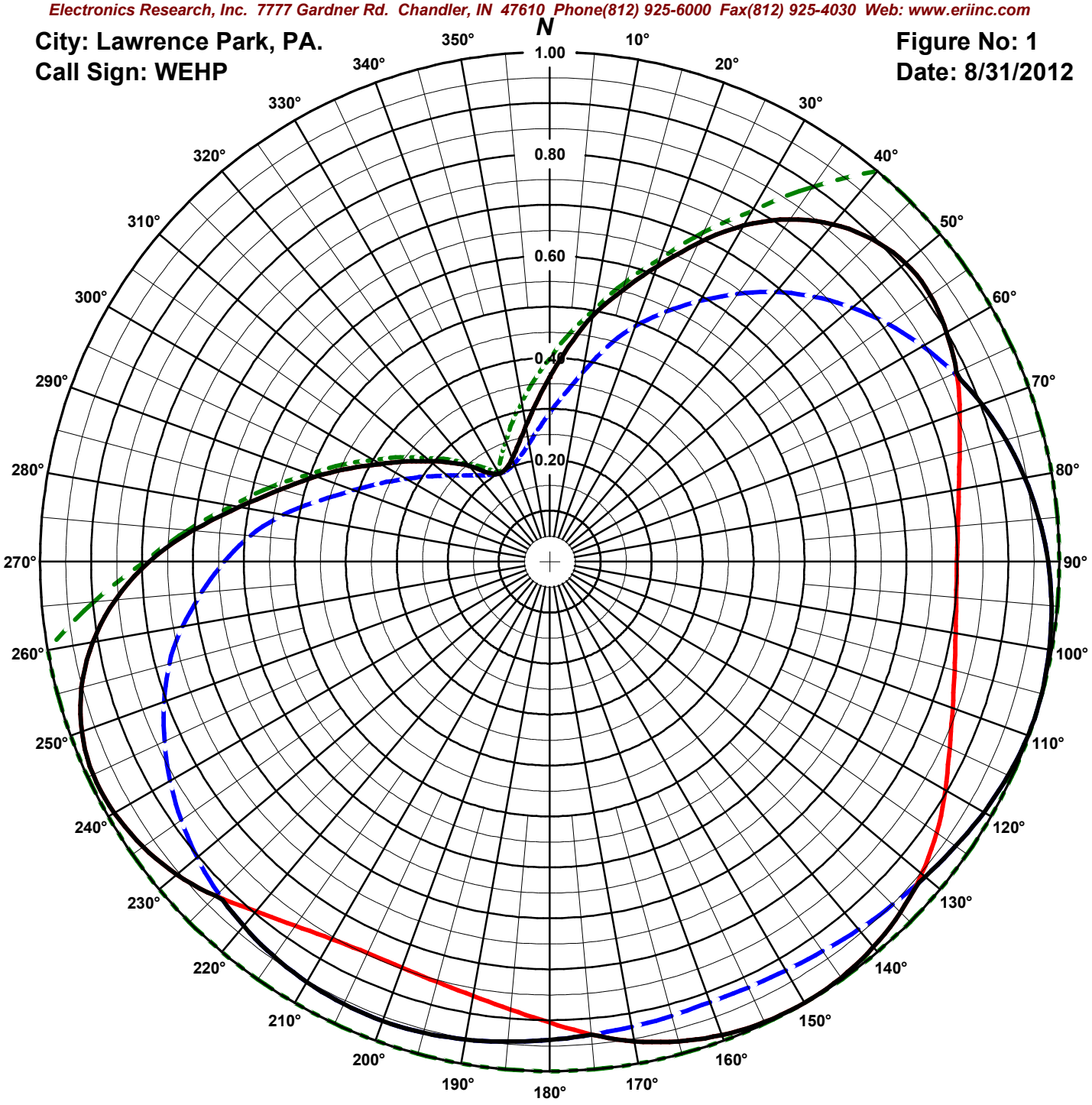
City: Lawrence Park, PA.
Call Sign: WEHP

Figure No: 1
Date: 8/31/2012



Antenna Orientation: 150° True

Frequency: 92.7 MHz
Antenna Type: LP-4E-DA-HW

Antenna Mounting: 20" Ell
Tower Type: 8 5/8" Pole

HORIZONTAL	VERTICAL	COMPOSITE	FCC ENVELOPE
RMS: .78	RMS: .765	RMS: .816	RMS: .853
Maximum: 1 @ 150°	Maximum: 1 @ 107°	Maximum: 1 @ 107°	Maximum: 1 @ 40°
Minimum: .199 @ 331°	Minimum: .197 @ 333°	Minimum: .199 @ 331°	Minimum: .2 @ 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 BNPH-20110624ABX.

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: 8/31/2012**
Station: WEHP **Antenna: LP-4E-DA-HW**
Location: Lawrence Park, PA. **Antenna Orientation: 150° True**
Frequency: 92.7 MHz **Number of Bays: 4**

Azimuth	Envelope			Polarization	Azimuth	Envelope			Polarization
	Field	kW	dBk	Maximum		Field	kW	dBk	Maximum
0°	0.362	0.787	-1.039	Horizontal	180°	0.939	5.285	7.231	Vertical
5°	0.423	1.073	0.306	Horizontal	185°	0.946	5.365	7.296	Vertical
10°	0.491	1.445	1.599	Horizontal	190°	0.952	5.439	7.355	Vertical
15°	0.551	1.821	2.603	Horizontal	195°	0.957	5.495	7.400	Vertical
20°	0.617	2.281	3.581	Horizontal	200°	0.959	5.519	7.419	Vertical
25°	0.690	2.856	4.557	Horizontal	205°	0.957	5.500	7.404	Vertical
30°	0.761	3.478	5.413	Horizontal	210°	0.953	5.445	7.360	Vertical
35°	0.820	4.032	6.055	Horizontal	215°	0.945	5.355	7.288	Vertical
40°	0.864	4.481	6.514	Horizontal	220°	0.934	5.232	7.187	Vertical
45°	0.895	4.804	6.816	Horizontal	225°	0.928	5.162	7.128	Horizontal
50°	0.911	4.984	6.976	Horizontal	230°	0.955	5.473	7.382	Horizontal
55°	0.912	4.986	6.977	Horizontal	235°	0.975	5.699	7.558	Horizontal
60°	0.899	4.853	6.860	Horizontal	240°	0.986	5.833	7.659	Horizontal
65°	0.881	4.654	6.678	Horizontal	245°	0.988	5.862	7.680	Horizontal
70°	0.903	4.890	6.893	Vertical	250°	0.977	5.726	7.578	Horizontal
75°	0.926	5.150	7.118	Vertical	255°	0.951	5.424	7.343	Horizontal
80°	0.947	5.380	7.308	Vertical	260°	0.910	4.971	6.964	Horizontal
85°	0.964	5.576	7.463	Vertical	265°	0.855	4.388	6.423	Horizontal
90°	0.978	5.737	7.587	Vertical	270°	0.786	3.703	5.686	Horizontal
95°	0.988	5.862	7.680	Vertical	275°	0.702	2.957	4.708	Horizontal
100°	0.996	5.948	7.744	Vertical	280°	0.618	2.293	3.604	Horizontal
105°	1.000	5.995	7.778	Vertical	285°	0.547	1.797	2.545	Horizontal
110°	0.999	5.985	7.771	Vertical	290°	0.488	1.431	1.558	Horizontal
115°	0.993	5.913	7.718	Vertical	295°	0.433	1.124	0.507	Horizontal
120°	0.984	5.808	7.640	Vertical	300°	0.383	0.881	-0.549	Horizontal
125°	0.973	5.679	7.542	Vertical	305°	0.343	0.705	-1.521	Horizontal
130°	0.962	5.552	7.445	Vertical	310°	0.307	0.565	-2.481	Horizontal
135°	0.973	5.683	7.546	Horizontal	315°	0.275	0.454	-3.430	Horizontal
140°	0.988	5.854	7.675	Horizontal	320°	0.245	0.361	-4.427	Horizontal
145°	0.997	5.961	7.753	Horizontal	325°	0.214	0.275	-5.614	Horizontal
150°	1.000	6.000	7.782	Horizontal	330°	0.199	0.238	-6.234	Horizontal
155°	0.997	5.963	7.755	Horizontal	335°	0.202	0.245	-6.116	Horizontal
160°	0.988	5.862	7.681	Horizontal	340°	0.215	0.278	-5.567	Horizontal
165°	0.975	5.700	7.559	Horizontal	345°	0.238	0.339	-4.696	Horizontal
170°	0.956	5.480	7.388	Horizontal	350°	0.270	0.437	-3.596	Horizontal
175°	0.932	5.213	7.171	Vertical	355°	0.311	0.582	-2.352	Horizontal

Horizontal Polarization:
Maximum: 2.082 (3.185 dB)
Horizontal Plane: 2.082 (3.185 dB)
Maximum ERP: 6.000 kW

Vertical Polarization:
Maximum: 2.082 (3.185 dB)
Horizontal Plane: 2.082 (3.185 dB)
Maximum ERP: 6.000 kW

Total Input Power: 2.881 kW
Reference: WEHP1M.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: 8/31/2012**
Station: WEHP **Antenna: LP-4E-DA-HW**
Location: Lawrence Park, PA. **Antenna Orientation: 150° True**
Frequency: 92.7 MHz **Number of Bays: 4**

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.362	0.787	-1.039	0.292	0.511	-2.918	180°	0.905	4.911	6.911	0.939	5.285	7.231
5°	0.423	1.073	0.306	0.330	0.652	-1.855	185°	0.882	4.672	6.695	0.946	5.365	7.296
10°	0.491	1.445	1.599	0.378	0.856	-0.676	190°	0.866	4.495	6.527	0.952	5.439	7.355
15°	0.551	1.821	2.603	0.436	1.142	0.578	195°	0.854	4.375	6.410	0.957	5.495	7.400
20°	0.617	2.281	3.581	0.492	1.450	1.612	200°	0.848	4.310	6.345	0.959	5.519	7.419
25°	0.690	2.856	4.557	0.541	1.757	2.449	205°	0.847	4.308	6.343	0.957	5.500	7.404
30°	0.761	3.478	5.413	0.591	2.094	3.209	210°	0.856	4.391	6.426	0.953	5.445	7.360
35°	0.820	4.032	6.055	0.642	2.470	3.927	215°	0.872	4.560	6.590	0.945	5.355	7.288
40°	0.864	4.481	6.514	0.691	2.863	4.568	220°	0.896	4.819	6.830	0.934	5.232	7.187
45°	0.895	4.804	6.816	0.735	3.239	5.104	225°	0.928	5.162	7.128	0.920	5.077	7.056
50°	0.911	4.984	6.976	0.775	3.603	5.567	230°	0.955	5.473	7.382	0.903	4.892	6.895
55°	0.912	4.986	6.977	0.812	3.955	5.971	235°	0.975	5.699	7.558	0.883	4.678	6.700
60°	0.899	4.853	6.860	0.845	4.289	6.323	240°	0.986	5.833	7.659	0.860	4.437	6.471
65°	0.881	4.654	6.678	0.876	4.602	6.629	245°	0.988	5.862	7.680	0.834	4.172	6.204
70°	0.856	4.397	6.432	0.903	4.890	6.893	250°	0.977	5.726	7.578	0.805	3.887	5.896
75°	0.833	4.160	6.191	0.926	5.150	7.118	255°	0.951	5.424	7.343	0.773	3.581	5.540
80°	0.815	3.988	6.007	0.947	5.380	7.308	260°	0.910	4.971	6.964	0.731	3.208	5.063
85°	0.804	3.879	5.887	0.964	5.576	7.463	265°	0.855	4.388	6.423	0.685	2.814	4.494
90°	0.799	3.831	5.833	0.978	5.737	7.587	270°	0.786	3.703	5.686	0.638	2.444	3.881
95°	0.801	3.850	5.855	0.988	5.862	7.680	275°	0.702	2.957	4.708	0.589	2.082	3.184
100°	0.809	3.926	5.939	0.996	5.948	7.744	280°	0.618	2.293	3.604	0.530	1.688	2.275
105°	0.822	4.057	6.083	1.000	5.995	7.778	285°	0.547	1.797	2.545	0.466	1.300	1.141
110°	0.841	4.248	6.282	0.999	5.985	7.771	290°	0.488	1.431	1.558	0.410	1.007	0.031
115°	0.866	4.500	6.533	0.993	5.913	7.718	295°	0.433	1.124	0.507	0.364	0.797	-0.986
120°	0.896	4.820	6.831	0.984	5.808	7.640	300°	0.383	0.881	-0.549	0.325	0.635	-1.972
125°	0.927	5.159	7.125	0.973	5.679	7.542	305°	0.343	0.705	-1.521	0.291	0.510	-2.927
130°	0.953	5.449	7.364	0.962	5.552	7.445	310°	0.307	0.565	-2.481	0.263	0.414	-3.829
135°	0.973	5.683	7.546	0.952	5.438	7.355	315°	0.275	0.454	-3.430	0.239	0.343	-4.646
140°	0.988	5.854	7.675	0.943	5.332	7.269	320°	0.245	0.361	-4.427	0.221	0.292	-5.345
145°	0.997	5.961	7.753	0.933	5.224	7.180	325°	0.214	0.275	-5.614	0.207	0.258	-5.887
150°	1.000	6.000	7.782	0.926	5.149	7.117	330°	0.199	0.238	-6.234	0.199	0.238	-6.236
155°	0.997	5.963	7.755	0.922	5.102	7.077	335°	0.202	0.245	-6.116	0.198	0.235	-6.293
160°	0.988	5.862	7.681	0.920	5.078	7.057	340°	0.215	0.278	-5.567	0.204	0.249	-6.031
165°	0.975	5.700	7.559	0.923	5.109	7.083	345°	0.238	0.339	-4.696	0.216	0.281	-5.512
170°	0.956	5.480	7.388	0.927	5.156	7.123	350°	0.270	0.437	-3.596	0.235	0.332	-4.786
175°	0.931	5.204	7.163	0.932	5.213	7.171	355°	0.311	0.582	-2.352	0.261	0.407	-3.902

Horizontal Polarization:
Maximum: 2.082 (3.185 dB)
Horizontal Plane: 2.082 (3.185 dB)
Maximum ERP: 6.000 kW

Vertical Polarization:
Maximum: 2.082 (3.185 dB)
Horizontal Plane: 2.082 (3.185 dB)
Maximum ERP: 6.000 kW

Total Input Power: 2.881 kW
Reference: WEHP1M.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: WEHP
Location: Lawrence Park, PA.
Frequency: 92.7 MHz
4 bay LP-4E-DA-HW antenna

Date: 8/31/2012
H/V Power Ratio: 1
.5 Wave-length Spacing
0° Beam Tilt
0% First Null Fill

Horizontal Polarization:
Maximum: 2.082 (3.185 dB)
Horizontal Plane: 2.082 (3.185 dB)
Maximum ERP: 6.000 kW

Vertical Polarization:
Maximum: 2.082 (3.185 dB)
Horizontal Plane: 2.082 (3.185 dB)
Maximum ERP: 6.000 kW

Directional Antenna System
for
WEHP, Lawrence Park, Pennsylvania

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	LP-4E-DA-HW
Frequency:	92.7 MHz
Number of Bays:	Four

MECHANICAL SPECIFICATIONS

Mounting:	Standard
System length:	24 ft 8 in
Aperture length required:	30 ft 10 in
Orientation:	150° true

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

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	6.000 kW (7.782 dBk)
Horizontal maximum power gain:	2.082 (3.185 dB)
Maximum vertical ERP:	6.000 kW (7.782 dBk)
Vertical maximum power gain:	2.082 (3.185 dB)
Total input power:	2.881 kW (4.596 dBk)