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 KRTU, San Antonio, Texas

November 18, 2016

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 KRTU.

The antenna is the ERI model LP-6E-DA configuration. The circular polarized system consists of 6 full-wavelength spaced bays using one driven circular polarized radiating element, two horizontal parasitic elements placed one quarter wave above and below each bay and two vertical parasitic elements per bay. The antenna was mounted on the North 173 degrees East tower leg with bracketry to provide an antenna orientation of North 180 degrees East. The antenna was tested on a 8' face tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 91.7 megahertz, which is the center of the FM broadcast channel assigned to KRTU.

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
KRTU, San Antonio, Texas

(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' 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.

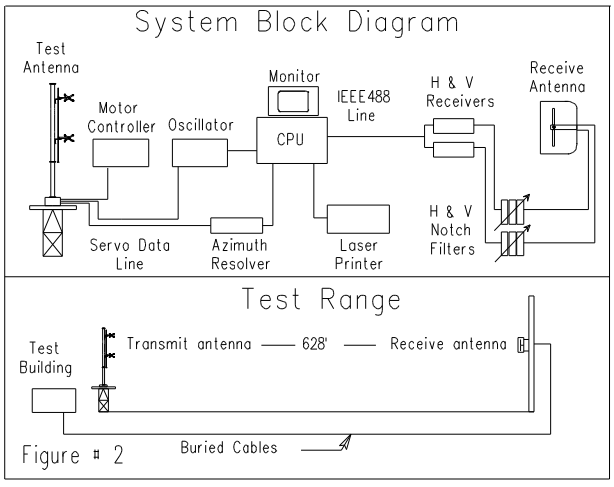

Figure # 2

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 91.7 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 6 full-wavelength spaced bays using one driven circular polarized radiating element, two horizontal parasitic elements placed one quarter wave above and below each bay and two vertical parasitic elements per bay. 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 LP-6E-DA array is to be mounted on the North 173 degrees East tower leg of the 8' face tower at a bearing of North 180 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 30 kilowatts (14.771 dBk).

The power at North 10-30 degrees East does not exceed 0.81 kilowatts (-.915 dBk).

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(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 69 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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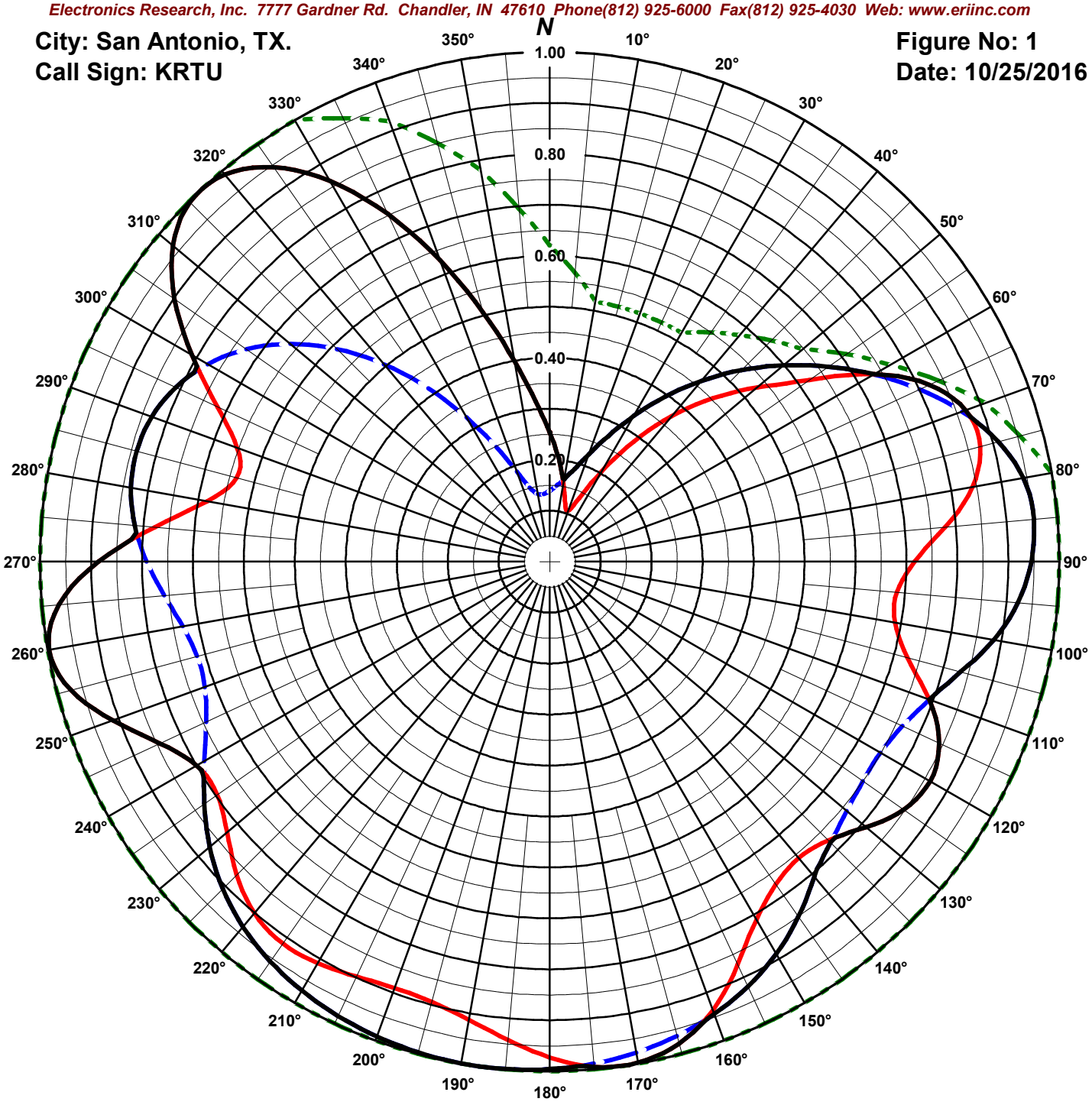
City: San Antonio, TX.
Call Sign: KRTU

Figure No: 1
Date: 10/25/2016



Antenna Orientation: 180° True

Frequency: 91.7 MHz
Antenna Type: LP-6E-DA

Antenna Mounting: Custom
Tower Type: 8' Tower

HORIZONTAL	VERTICAL	COMPOSITE	FCC ENVELOPE
RMS: .774	RMS: .752	RMS: .819	RMS: .925
Maximum: 1 @ 317°	Maximum: 1 @ 188°	Maximum: 1 @ 188°	Maximum: 1 @ 80°
Minimum: .105 @ 19°	Minimum: .133 @ 353°	Minimum: .164 @ 10°	Minimum: .518 @ 10°

Measured patterns of the horizontal and vertical components. The composite pattern shows the maximum of either the H or V azimuth values. This patterns is greater than 85% of the FCC filed composite pattern BPED-20130516AOC.

ERI® Horizontal Plane Relative Field Pattern

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Figure# 1 **Date: 10/25/2016**
Station: KRTU **Antenna: LP-6E-DA**
Location: San Antonio, TX. **Antenna Orientation: 180° True**
Frequency: 91.7 MHz **Number of Bays: 6**

Azimuth	Envelope			Polarization	Azimuth	Envelope			Polarization
	Field	kW	dBk	Maximum		Field	kW	dBk	Maximum
0°	0.253	1.923	2.841	Horizontal	180°	0.996	29.754	14.735	Vertical
5°	0.203	1.241	0.938	Horizontal	185°	0.999	29.967	14.766	Vertical
10°	0.164	0.809	-0.922	Vertical	190°	1.000	29.984	14.769	Vertical
15°	0.188	1.061	0.258	Vertical	195°	0.997	29.819	14.745	Vertical
20°	0.224	1.503	1.770	Vertical	200°	0.991	29.492	14.697	Vertical
25°	0.272	2.218	3.460	Vertical	205°	0.983	29.006	14.625	Vertical
30°	0.330	3.270	5.146	Vertical	210°	0.972	28.347	14.525	Vertical
35°	0.395	4.679	6.702	Vertical	215°	0.957	27.464	14.388	Vertical
40°	0.463	6.423	8.077	Vertical	220°	0.936	26.270	14.195	Vertical
45°	0.531	8.463	9.275	Vertical	225°	0.907	24.692	13.926	Vertical
50°	0.599	10.772	10.323	Vertical	230°	0.870	22.732	13.566	Vertical
55°	0.667	13.350	11.255	Vertical	235°	0.827	20.526	13.123	Vertical
60°	0.735	16.226	12.102	Horizontal	240°	0.800	19.202	12.834	Horizontal
65°	0.822	20.247	13.064	Horizontal	245°	0.844	21.359	13.296	Horizontal
70°	0.869	22.639	13.549	Horizontal	250°	0.912	24.939	13.969	Horizontal
75°	0.911	24.899	13.962	Vertical	255°	0.973	28.408	14.534	Horizontal
80°	0.944	26.727	14.269	Vertical	260°	0.997	29.828	14.746	Horizontal
85°	0.954	27.283	14.359	Vertical	265°	0.967	28.038	14.477	Horizontal
90°	0.945	26.800	14.281	Vertical	270°	0.885	23.521	13.715	Horizontal
95°	0.922	25.514	14.068	Vertical	275°	0.817	20.043	13.020	Vertical
100°	0.885	23.490	13.709	Vertical	280°	0.834	20.872	13.196	Vertical
105°	0.835	20.933	13.208	Vertical	285°	0.839	21.104	13.244	Vertical
110°	0.793	18.844	12.752	Vertical	290°	0.831	20.700	13.160	Vertical
115°	0.843	21.328	13.290	Horizontal	295°	0.809	19.657	12.935	Vertical
120°	0.862	22.288	13.481	Horizontal	300°	0.810	19.689	12.942	Horizontal
125°	0.848	21.590	13.342	Horizontal	305°	0.898	24.214	13.841	Horizontal
130°	0.810	19.706	12.946	Horizontal	310°	0.965	27.927	14.460	Horizontal
135°	0.779	18.226	12.607	Vertical	315°	0.998	29.862	14.751	Horizontal
140°	0.807	19.551	12.912	Vertical	320°	0.991	29.480	14.695	Horizontal
145°	0.851	21.707	13.366	Vertical	325°	0.945	26.776	14.277	Horizontal
150°	0.889	23.706	13.749	Vertical	330°	0.862	22.303	13.484	Horizontal
155°	0.920	25.388	14.046	Vertical	335°	0.753	17.004	12.306	Horizontal
160°	0.944	26.759	14.275	Vertical	340°	0.630	11.891	10.752	Horizontal
165°	0.979	28.776	14.590	Horizontal	345°	0.507	7.722	8.877	Horizontal
170°	0.998	29.898	14.756	Horizontal	350°	0.400	4.802	6.814	Horizontal
175°	0.995	29.701	14.728	Horizontal	355°	0.316	2.995	4.763	Horizontal

Horizontal Polarization:
Maximum: 5.382 (7.310 dB)
Horizontal Plane: 5.382 (7.310 dB)
Maximum ERP: 30.000 kW

Vertical Polarization:
Maximum: 5.382 (7.310 dB)
Horizontal Plane: 5.382 (7.310 dB)
Maximum ERP: 30.000 kW

Total Input Power: 5.574 kW
Reference: KRTU1M.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: 10/25/2016**
Station: KRTU **Antenna: LP-6E-DA**
Location: San Antonio, TX. **Antenna Orientation: 180° True**
Frequency: 91.7 MHz **Number of Bays: 6**

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.253	1.923	2.841	0.139	0.581	-2.359	180°	0.973	28.397	14.533	0.996	29.754	14.735
5°	0.203	1.241	0.938	0.149	0.668	-1.751	185°	0.942	26.620	14.252	0.999	29.967	14.766
10°	0.156	0.734	-1.345	0.164	0.809	-0.922	190°	0.913	25.004	13.980	1.000	29.984	14.769
15°	0.118	0.416	-3.808	0.188	1.061	0.258	195°	0.894	23.998	13.802	0.997	29.819	14.745
20°	0.106	0.337	-4.721	0.224	1.503	1.770	200°	0.890	23.779	13.762	0.991	29.492	14.697
25°	0.138	0.569	-2.448	0.272	2.218	3.460	205°	0.898	24.206	13.839	0.983	29.006	14.625
30°	0.205	1.255	0.987	0.330	3.270	5.146	210°	0.910	24.847	13.953	0.972	28.347	14.525
35°	0.288	2.483	3.949	0.395	4.679	6.702	215°	0.914	25.080	13.993	0.957	27.464	14.388
40°	0.372	4.161	6.192	0.463	6.423	8.077	220°	0.901	24.362	13.867	0.936	26.270	14.195
45°	0.453	6.170	7.903	0.531	8.463	9.275	225°	0.868	22.621	13.545	0.907	24.692	13.926
50°	0.532	8.496	9.292	0.599	10.772	10.323	230°	0.826	20.484	13.114	0.870	22.732	13.566
55°	0.622	11.615	10.650	0.667	13.350	11.255	235°	0.796	19.027	12.794	0.827	20.526	13.123
60°	0.735	16.226	12.102	0.735	16.188	12.092	240°	0.800	19.202	12.834	0.782	18.359	12.639
65°	0.822	20.247	13.064	0.800	19.217	12.837	245°	0.844	21.359	13.296	0.744	16.599	12.201
70°	0.869	22.639	13.549	0.861	22.238	13.471	250°	0.912	24.939	13.969	0.720	15.557	11.919
75°	0.874	22.933	13.605	0.911	24.899	13.962	255°	0.973	28.408	14.534	0.716	15.388	11.872
80°	0.842	21.289	13.282	0.944	26.727	14.269	260°	0.997	29.828	14.746	0.731	16.046	12.054
85°	0.779	18.195	12.599	0.954	27.283	14.359	265°	0.967	28.038	14.477	0.759	17.294	12.379
90°	0.716	15.395	11.874	0.945	26.800	14.281	270°	0.885	23.521	13.715	0.791	18.756	12.731
95°	0.684	14.047	11.476	0.922	25.514	14.068	275°	0.778	18.145	12.588	0.817	20.043	13.020
100°	0.688	14.209	11.526	0.885	23.490	13.709	280°	0.682	13.966	11.451	0.834	20.872	13.196
105°	0.727	15.840	11.998	0.835	20.933	13.208	285°	0.636	12.124	10.836	0.839	21.104	13.244
110°	0.792	18.841	12.751	0.793	18.844	12.752	290°	0.652	12.763	11.059	0.831	20.700	13.160
115°	0.843	21.328	13.290	0.764	17.504	12.431	295°	0.719	15.522	11.910	0.809	19.657	12.935
120°	0.862	22.288	13.481	0.749	16.852	12.267	300°	0.810	19.689	12.942	0.775	18.004	12.554
125°	0.848	21.590	13.342	0.750	16.890	12.276	305°	0.898	24.214	13.841	0.726	15.822	11.993
130°	0.810	19.706	12.946	0.761	17.374	12.399	310°	0.965	27.927	14.460	0.664	13.240	11.219
135°	0.773	17.949	12.540	0.779	18.226	12.607	315°	0.998	29.862	14.751	0.590	10.441	10.187
140°	0.760	17.311	12.383	0.807	19.551	12.912	320°	0.991	29.480	14.695	0.505	7.665	8.845
145°	0.773	17.942	12.539	0.851	21.707	13.366	325°	0.945	26.776	14.277	0.416	5.180	7.143
150°	0.811	19.740	12.954	0.889	23.706	13.749	330°	0.862	22.303	13.484	0.327	3.207	5.061
155°	0.873	22.841	13.587	0.920	25.388	14.046	335°	0.753	17.004	12.306	0.248	1.849	2.669
160°	0.937	26.331	14.205	0.944	26.759	14.275	340°	0.630	11.891	10.752	0.188	1.059	0.248
165°	0.979	28.776	14.590	0.964	27.859	14.450	345°	0.507	7.722	8.877	0.151	0.680	-1.673
170°	0.998	29.898	14.756	0.978	28.713	14.581	350°	0.400	4.802	6.814	0.135	0.544	-2.642
175°	0.995	29.701	14.728	0.989	29.339	14.674	355°	0.316	2.995	4.763	0.133	0.533	-2.732

Horizontal Polarization:
Maximum: 5.382 (7.310 dB)
Horizontal Plane: 5.382 (7.310 dB)
Maximum ERP: 30.000 kW

Vertical Polarization:
Maximum: 5.382 (7.310 dB)
Horizontal Plane: 5.382 (7.310 dB)
Maximum ERP: 30.000 kW

Total Input Power: 5.574 kW
Reference: KRTU1M.FIG
This list shows the azimuth values for the horizontal and vertical components.

Vertical Plane Relative Field Pattern

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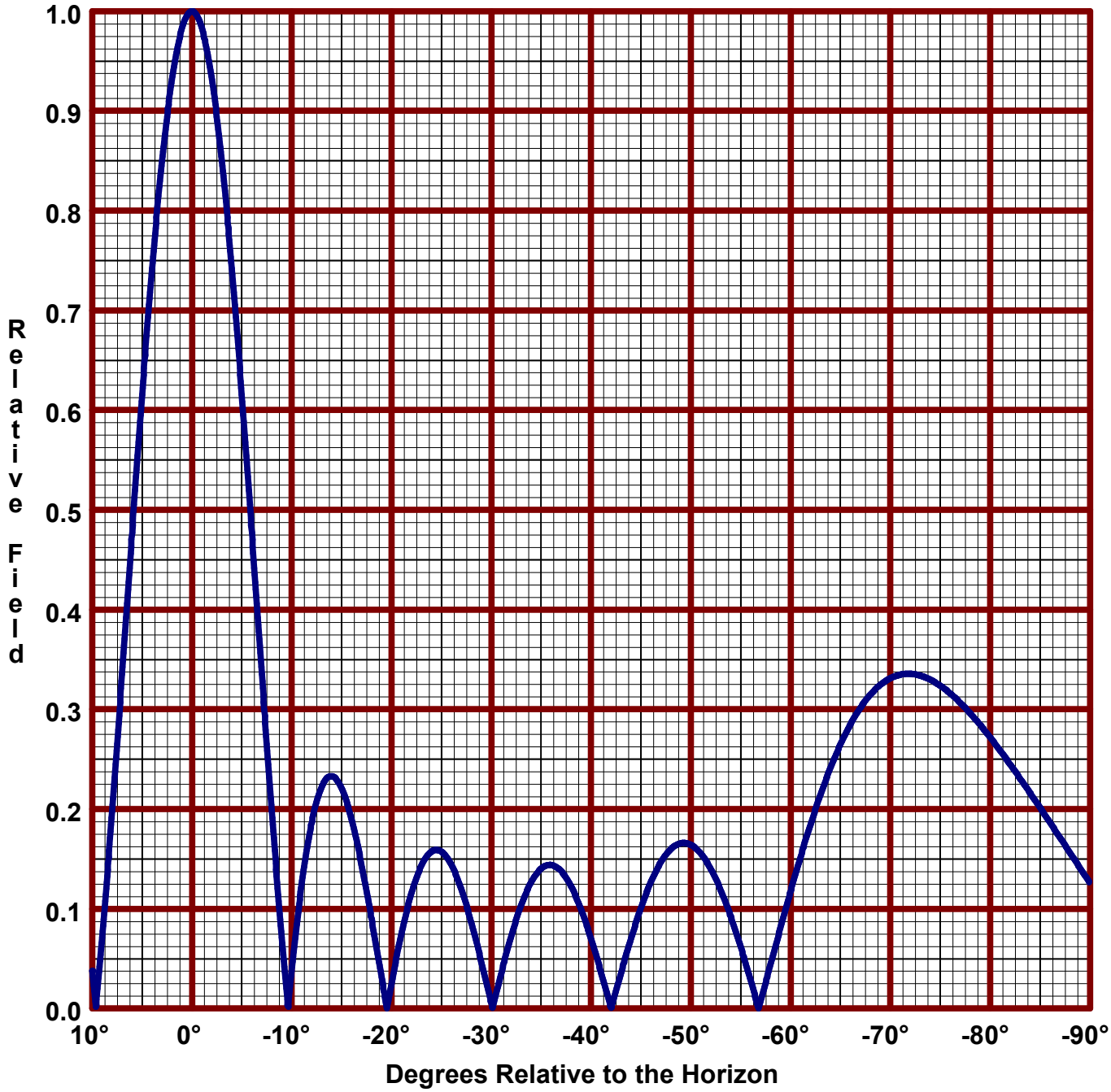
Figure No: 3
Call Sign: KRTU
Location: San Antonio, TX.
Frequency: 91.7 MHz
Antenna: 6 bay LP-6E-DA

Date: 10/25/2016
H/V Power Ratio: 1
1 Wave-length Spacing
0° Beam Tilt
0% First Null Fill



Horizontal Polarization:
Maximum: 5.382 (7.310 dB)
Horizontal Plane: 5.382 (7.310 dB)
Maximum ERP: 30.000 kW

Vertical Polarization:
Maximum: 5.382 (7.310 dB)
Horizontal Plane: 5.382 (7.310 dB)
Maximum ERP: 30.000 kW

Directional Antenna System
for
KRTU, San Antonio, Texas

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	LP-6E-DA
Frequency:	91.7 MHz
Number of Bays:	Six

MECHANICAL SPECIFICATIONS

Mounting:	Custom
System length:	62 ft 3 in
Aperture length required:	73 ft 6 in
Orientation:	180° true

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

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	30.000 kW (14.771 dBk)
Horizontal maximum power gain:	5.382 (7.310 dB)
Maximum vertical ERP:	30.000 kW (14.771 dBk)
Vertical maximum power gain:	5.382 (7.310 dB)
Total input power:	5.574 kW (7.462 dBk)