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 KHKZ, San Benito, Texas

July 22, 2020

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 KHKZ.

The antenna is the ERI model LP-8C-DA-HW configuration. The circular polarized system consists of 8 half-wavelength spaced bays using one driven circular polarized radiating element per bay, one horizontal parasitic element per bay and four vertical parasitic elements interleaved between alternate bay pairs. The antenna was mounted on the North 183 degrees East tower face with bracketry to provide an antenna orientation of North 183 degrees East. The antenna was tested on a 36" ERI®λ ***MOUNTING SYSTEM***, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 106.3 megahertz, which is the center of the FM broadcast channel assigned to KHKZ.

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.

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(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 36" ERI®λ ***MOUNTING SYSTEM***, 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.

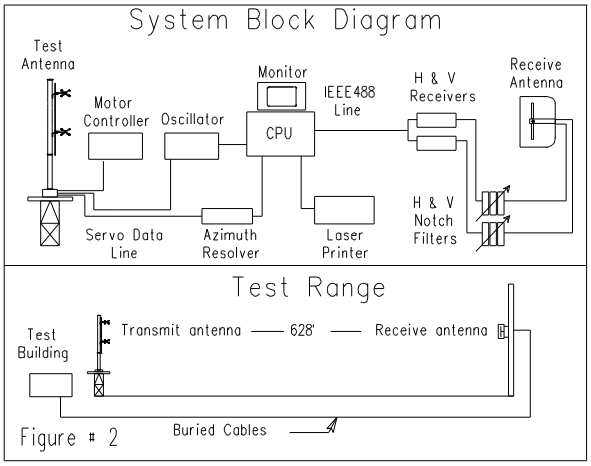

Figure # 2

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

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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 8 half-wavelength spaced bays using one driven circular polarized radiating element per bay, one horizontal parasitic element per bay and four vertical parasitic elements interleaved between alternate bay pairs. 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-8C-DA-HW array is to be mounted on the North 183 degrees East tower face of the 36" ERI®λ ***MOUNTING SYSTEM,*** at a bearing of North 183 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

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(Continued)

field pattern is shown on Figure #3 attached. The power in the maximum will reach 25 kilowatts (13.979 dBk).

The power at North 20 degrees East does not exceed 9 kilowatts (9.542 dBk).

The power at North 340-350 degrees East does not exceed 9 kilowatts (9.542 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 than 85% of the filed composite pattern.

The clear vertical length of the structure required to support the antenna is 47 feet 3 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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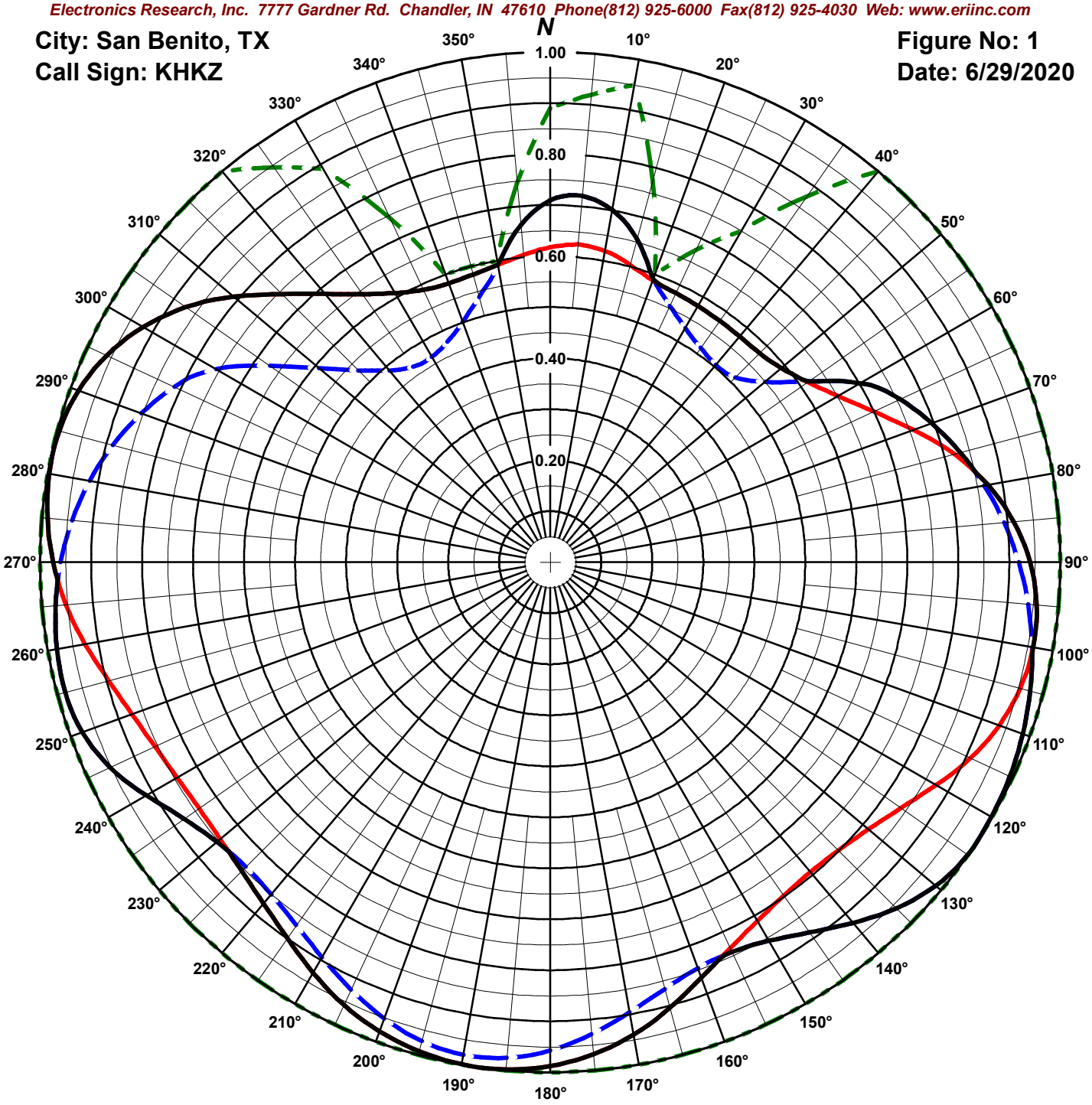
City: San Benito, TX
Call Sign: KHKZ

Figure No: 1
Date: 6/29/2020



Antenna Orientation: 183° True

Frequency: 106.3 MHz
Antenna Type: LP-8C-DA-HW

Antenna Mounting: Custom
Tower Type: 36" Lambda

HORIZONTAL	VERTICAL	COMPOSITE	FCC ENVELOPE
RMS: .825	RMS: .819	RMS: .853	RMS: .958
Maximum: 1 @ 188°	Maximum: 1 @ 123°	Maximum: 1 @ 123°	Maximum: 1 @ 40°
Minimum: .577 @ 41°	Minimum: .464 @ 328°	Minimum: .577 @ 41°	Minimum: .6 @ 20°

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 BPH-20190402AAC

ERI® Horizontal Plane Relative Field Pattern

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Figure# 1 **Date: 6/29/2020**
Station: KHKZ **Antenna: LP-8C-DA-HW**
Location: San Benito, TX **Antenna Orientation: 183° True**
Frequency: 106.3 MHz **Number of Bays: 8**

Azimuth	Envelope			Polarization	Azimuth	Envelope			Polarization
	Field	kW	dBk	Maximum		Field	kW	dBk	Maximum
0°	0.709	12.580	10.997	Vertical	180°	0.988	24.387	13.872	Horizontal
5°	0.721	12.983	11.134	Vertical	185°	0.998	24.907	13.963	Horizontal
10°	0.701	12.285	10.894	Vertical	190°	0.999	24.971	13.974	Horizontal
15°	0.656	10.757	10.317	Vertical	195°	0.993	24.629	13.914	Horizontal
20°	0.591	8.725	9.408	Vertical	200°	0.979	23.937	13.791	Horizontal
25°	0.582	8.477	9.283	Horizontal	205°	0.957	22.916	13.601	Horizontal
30°	0.580	8.406	9.246	Horizontal	210°	0.929	21.595	13.343	Horizontal
35°	0.578	8.361	9.223	Horizontal	215°	0.899	20.210	13.056	Horizontal
40°	0.577	8.337	9.210	Horizontal	220°	0.874	19.096	12.809	Horizontal
45°	0.580	8.406	9.246	Horizontal	225°	0.856	18.306	12.626	Horizontal
50°	0.592	8.761	9.425	Horizontal	230°	0.853	18.188	12.598	Vertical
55°	0.617	9.526	9.789	Vertical	235°	0.876	19.206	12.834	Vertical
60°	0.701	12.292	10.896	Vertical	240°	0.914	20.906	13.203	Vertical
65°	0.757	14.312	11.557	Vertical	245°	0.952	22.652	13.551	Vertical
70°	0.796	15.847	11.999	Vertical	250°	0.975	23.785	13.763	Vertical
75°	0.832	17.301	12.381	Vertical	255°	0.984	24.213	13.840	Vertical
80°	0.872	18.990	12.785	Horizontal	260°	0.981	24.082	13.817	Vertical
85°	0.912	20.792	13.179	Horizontal	265°	0.973	23.673	13.743	Vertical
90°	0.940	22.113	13.446	Horizontal	270°	0.974	23.732	13.753	Horizontal
95°	0.957	22.902	13.599	Horizontal	275°	0.989	24.452	13.883	Horizontal
100°	0.961	23.107	13.637	Horizontal	280°	0.997	24.849	13.953	Horizontal
105°	0.974	23.719	13.751	Vertical	285°	0.996	24.821	13.948	Horizontal
110°	0.986	24.291	13.854	Vertical	290°	0.984	24.202	13.839	Horizontal
115°	0.994	24.699	13.927	Vertical	295°	0.959	22.991	13.616	Horizontal
120°	0.999	24.938	13.969	Vertical	300°	0.922	21.234	13.270	Horizontal
125°	0.999	24.965	13.973	Vertical	305°	0.872	18.999	12.787	Horizontal
130°	0.987	24.336	13.863	Vertical	310°	0.810	16.386	12.145	Horizontal
135°	0.959	23.009	13.619	Vertical	315°	0.743	13.817	11.404	Horizontal
140°	0.923	21.303	13.284	Vertical	320°	0.686	11.779	10.711	Horizontal
145°	0.886	19.629	12.929	Vertical	325°	0.642	10.290	10.124	Horizontal
150°	0.857	18.365	12.640	Vertical	330°	0.609	9.277	9.674	Horizontal
155°	0.843	17.764	12.495	Vertical	335°	0.589	8.679	9.385	Horizontal
160°	0.866	18.756	12.731	Horizontal	340°	0.582	8.461	9.274	Horizontal
165°	0.905	20.463	13.110	Horizontal	345°	0.584	8.525	9.307	Horizontal
170°	0.941	22.118	13.447	Horizontal	350°	0.592	8.761	9.426	Horizontal
175°	0.968	23.448	13.701	Horizontal	355°	0.663	11.001	10.414	Vertical

Horizontal Polarization:
Maximum: 3.546 (5.497 dB)
Horizontal Plane: 3.546 (5.497 dB)
Maximum ERP: 25.000 kW

Vertical Polarization:
Maximum: 3.546 (5.497 dB)
Horizontal Plane: 3.546 (5.497 dB)
Maximum ERP: 25.000 kW

Total Input Power: 7.051 kW
Reference: KHKZ1M.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: 6/29/2020**
Station: KHKZ **Antenna: LP-8C-DA-HW**
Location: San Benito, TX **Antenna Orientation: 183° True**
Frequency: 106.3 MHz **Number of Bays: 8**

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.617	9.524	9.788	0.709	12.580	10.997	180°	0.988	24.387	13.872	0.957	22.894	13.597
5°	0.625	9.772	9.900	0.721	12.983	11.134	185°	0.998	24.907	13.963	0.975	23.776	13.761
10°	0.619	9.590	9.818	0.701	12.285	10.894	190°	0.999	24.971	13.974	0.980	24.026	13.807
15°	0.604	9.113	9.597	0.656	10.757	10.317	195°	0.993	24.629	13.914	0.972	23.616	13.732
20°	0.588	8.649	9.369	0.591	8.725	9.408	200°	0.979	23.937	13.791	0.952	22.652	13.551
25°	0.582	8.477	9.283	0.555	7.688	8.858	205°	0.957	22.916	13.601	0.924	21.349	13.294
30°	0.580	8.406	9.246	0.530	7.019	8.463	210°	0.929	21.595	13.343	0.894	19.987	13.007
35°	0.578	8.361	9.223	0.513	6.591	8.190	215°	0.899	20.210	13.056	0.868	18.831	12.749
40°	0.577	8.337	9.210	0.505	6.383	8.050	220°	0.874	19.096	12.809	0.850	18.071	12.570
45°	0.580	8.406	9.246	0.513	6.568	8.174	225°	0.856	18.306	12.626	0.844	17.816	12.508
50°	0.592	8.761	9.425	0.550	7.550	8.779	230°	0.844	17.829	12.511	0.853	18.188	12.598
55°	0.616	9.479	9.768	0.617	9.526	9.789	235°	0.841	17.661	12.470	0.876	19.206	12.834
60°	0.651	10.608	10.257	0.701	12.292	10.896	240°	0.844	17.818	12.509	0.914	20.906	13.203
65°	0.699	12.214	10.868	0.757	14.312	11.557	245°	0.855	18.271	12.618	0.952	22.652	13.551
70°	0.758	14.366	11.573	0.796	15.847	11.999	250°	0.872	19.019	12.792	0.975	23.785	13.763
75°	0.819	16.789	12.250	0.832	17.301	12.381	255°	0.896	20.079	13.027	0.984	24.213	13.840
80°	0.872	18.990	12.785	0.864	18.670	12.711	260°	0.926	21.420	13.308	0.981	24.082	13.817
85°	0.912	20.792	13.179	0.893	19.937	12.997	265°	0.953	22.707	13.562	0.973	23.673	13.743
90°	0.940	22.113	13.446	0.918	21.087	13.240	270°	0.974	23.732	13.753	0.960	23.016	13.620
95°	0.957	22.902	13.599	0.940	22.108	13.446	275°	0.989	24.452	13.883	0.941	22.122	13.448
100°	0.961	23.107	13.637	0.959	22.989	13.615	280°	0.997	24.849	13.953	0.917	21.005	13.223
105°	0.954	22.750	13.570	0.974	23.719	13.751	285°	0.996	24.821	13.948	0.887	19.684	12.941
110°	0.936	21.924	13.409	0.986	24.291	13.854	290°	0.984	24.202	13.839	0.853	18.182	12.596
115°	0.909	20.667	13.153	0.994	24.699	13.927	295°	0.959	22.991	13.616	0.813	16.526	12.182
120°	0.873	19.075	12.805	0.999	24.938	13.969	300°	0.922	21.234	13.270	0.756	14.287	11.549
125°	0.840	17.623	12.461	0.999	24.965	13.973	305°	0.872	18.999	12.787	0.671	11.247	10.511
130°	0.814	16.580	12.196	0.987	24.336	13.863	310°	0.810	16.386	12.145	0.592	8.764	9.427
135°	0.799	15.953	12.028	0.959	23.009	13.619	315°	0.743	13.817	11.404	0.532	7.072	8.495
140°	0.793	15.733	11.968	0.923	21.303	13.284	320°	0.686	11.779	10.711	0.490	6.014	7.791
145°	0.798	15.925	12.021	0.886	19.629	12.929	325°	0.642	10.290	10.124	0.468	5.472	7.382
150°	0.812	16.486	12.171	0.857	18.365	12.640	330°	0.609	9.277	9.674	0.465	5.398	7.322
155°	0.835	17.420	12.411	0.843	17.764	12.495	335°	0.589	8.679	9.385	0.477	5.683	7.546
160°	0.866	18.756	12.731	0.847	17.915	12.532	340°	0.582	8.461	9.274	0.501	6.282	7.981
165°	0.905	20.463	13.110	0.866	18.750	12.730	345°	0.584	8.525	9.307	0.538	7.236	8.595
170°	0.941	22.118	13.447	0.896	20.064	13.024	350°	0.592	8.761	9.426	0.590	8.715	9.403
175°	0.968	23.448	13.701	0.929	21.558	13.336	355°	0.605	9.142	9.611	0.663	11.001	10.414

Horizontal Polarization:
Maximum: 3.546 (5.497 dB)
Horizontal Plane: 3.546 (5.497 dB)
Maximum ERP: 25.000 kW

Vertical Polarization:
Maximum: 3.546 (5.497 dB)
Horizontal Plane: 3.546 (5.497 dB)
Maximum ERP: 25.000 kW

Total Input Power: 7.051 kW
Reference: KHKZ1M.FIG
This list shows the azimuth values for the horizontal and vertical components.

Vertical Plane Relative Field Pattern

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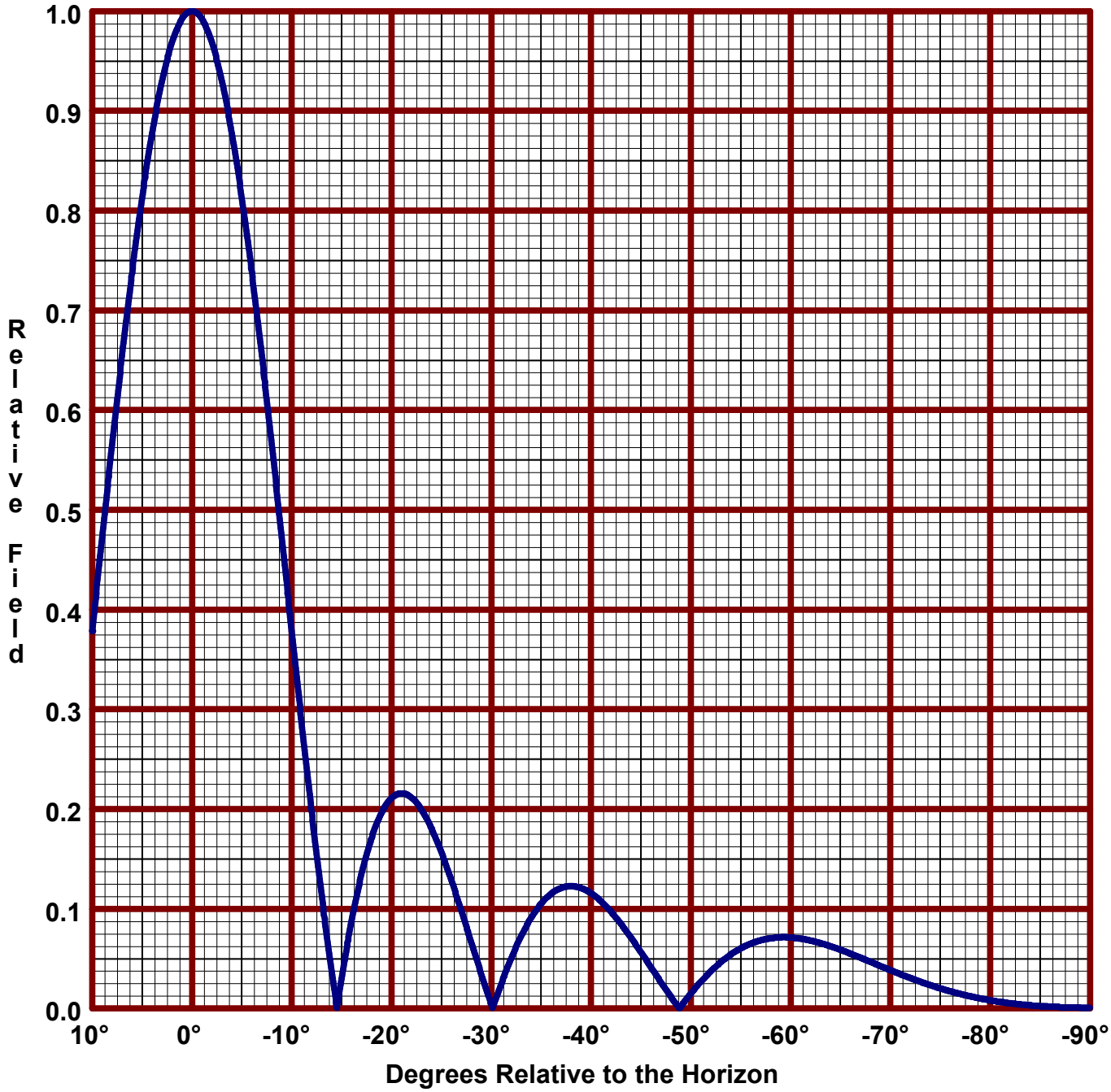
Figure No: 3
Call Sign: KHKZ
Location: San Benito, TX
Frequency: 106.3 MHz
Antenna: 8 bay LP-8C-DA-HW

Date: 6/29/2020
H/V Power Ratio: 1
.5 Wave-length Spacing
0° Beam Tilt
0% First Null Fill



Horizontal Polarization:
Maximum: 3.546 (5.497 dB)
Horizontal Plane: 3.546 (5.497 dB)
Maximum ERP: 25.000 kW

Vertical Polarization:
Maximum: 3.546 (5.497 dB)
Horizontal Plane: 3.546 (5.497 dB)
Maximum ERP: 25.000 kW

Directional Antenna System
for
KHKZ, San Benito, Texas

(continued)

ANTENNA SPECIFICATIONS

Antenna Type:	LP-8C-DA-HW
Frequency:	106.3 MHz
Number of Bays:	Eight

MECHANICAL SPECIFICATIONS

Mounting:	Custom
System length:	35 ft 10 in
Aperture length required:	47 ft 3 in
Orientation:	183° true

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

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	25.000 kW (13.979 dBk)
Horizontal maximum power gain:	3.546 (5.497 dB)
Maximum vertical ERP:	25.000 kW (13.979 dBk)
Vertical maximum power gain:	3.546 (5.497 dB)
Total input power:	7.051 kW (8.483 dBk)