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 KQXI, Granite Falls, Washington

January 18, 2013

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 KQXI.

The antenna is the ERI model LP-2E-DA-HW configuration. The circular polarized system consists of two half-wavelength spaced bays using one driven circular polarized radiating element per bay, two horizontal parasitic elements per bay and three vertical parasitic elements interleaved between the bays. The antenna was tested on a tapered pole, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 91.5 megahertz, which is the center of the FM broadcast channel assigned to KQXI.

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
KQXI, Granite Falls, Washington

(Continued)

DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of a full-scale model of the complete 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 tapered 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.

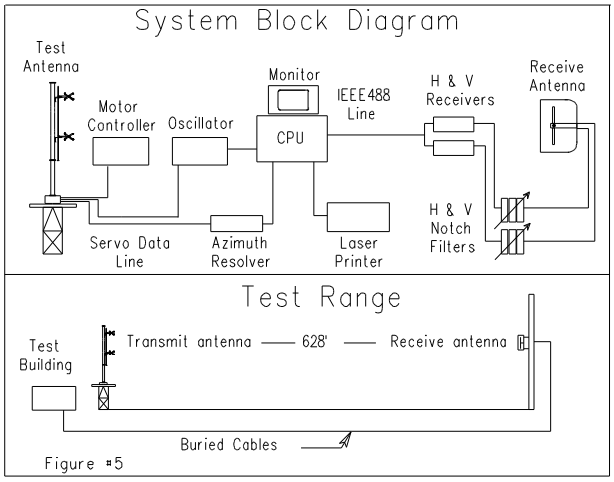

Figure #5

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 91.5 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 two half-wavelength spaced bays using one driven circular polarized radiating element per bay, two horizontal parasitic elements per bay and three vertical parasitic elements interleaved between the bays. 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-2E-DA-HW array is to be mounted on the tapered pole at a bearing of North 335 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. A calculated vertical plane relative field pattern is shown on Figure #3 attached. The power in the maximum will reach 1.6 kilowatts (2.041 dBk).

The power at North 60 degrees East does not exceed 0.560 kilowatts (-2.518 dBk).

Directional Antenna System
For
KQXI, Granite Falls, Washington

(Continued)

The power at North 210 degrees East does not exceed 0.185 kilowatts (-7.328 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 20 feet 4 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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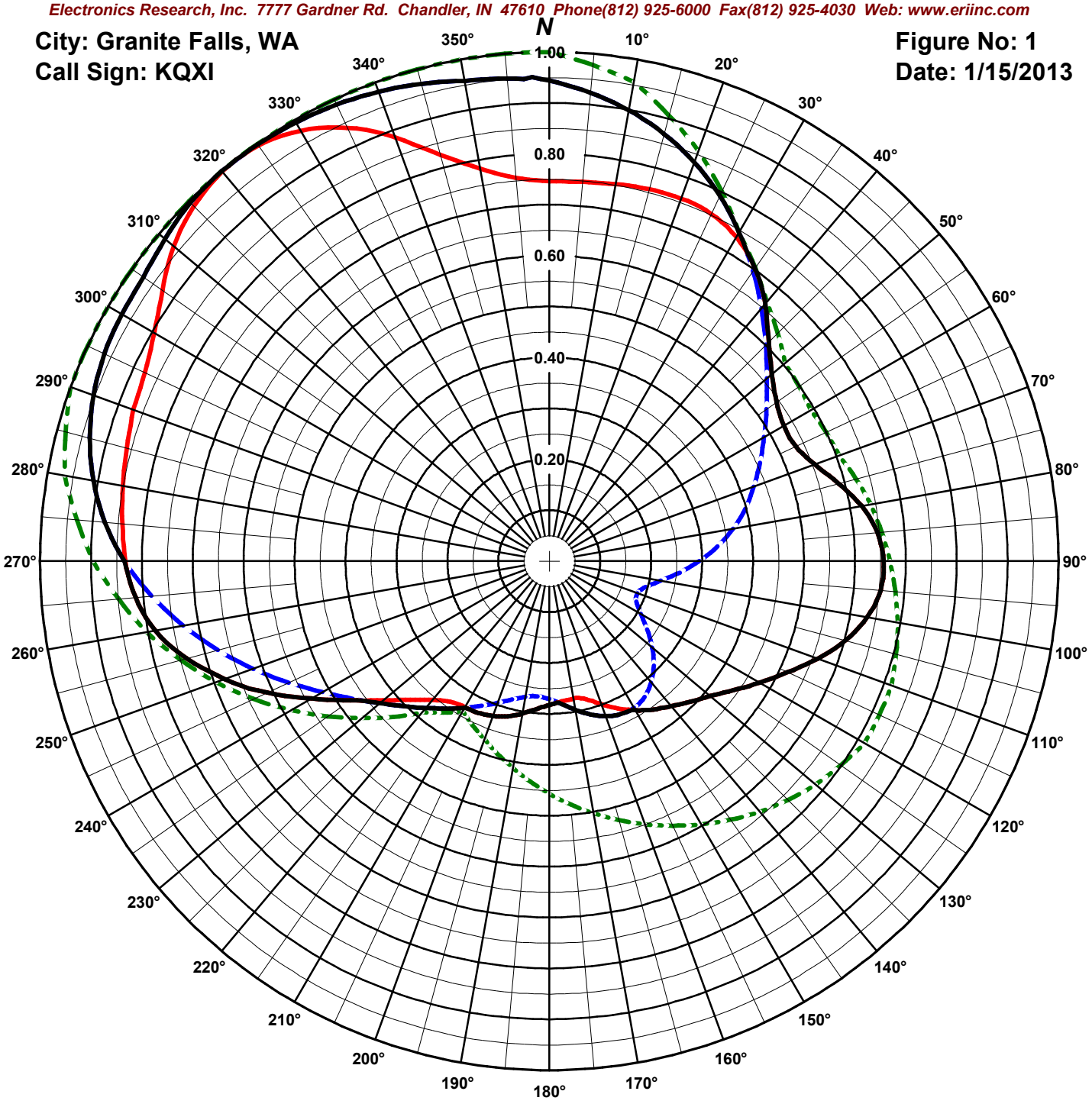
City: Granite Falls, WA
Call Sign: KQXI

Figure No: 1
Date: 1/15/2013



Antenna Orientation: 335° True

Frequency: 91.5 MHz
Antenna Type: LP-2E-DA-HW

Antenna Mounting: Standard
Tower Type: Tapered pole

HORIZONTAL	VERTICAL	COMPOSITE	FCC ENVELOPE
RMS: .651	RMS: .645	RMS: .687	RMS: .747
Maximum: 1 @ 322°	Maximum: 1 @ 320°	Maximum: 1 @ 320°	Maximum: 1 @ 0°
Minimum: .274 @ 169°	Minimum: .184 @ 111°	Minimum: .279 @ 177°	Minimum: .34 @ 210°

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 BMPED-20110531AKV.

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: 1/15/2013**
Station: KQXI **Antenna: LP-2E-DA-HW**
Location: Granite Falls, WA **Antenna Orientation: 335° True**
Frequency: 91.5 MHz **Number of Bays: 2**

Azimuth	Envelope			Polarization	Azimuth	Envelope			Polarization
	Field	kW	dBk	Maximum		Field	kW	dBk	Maximum
0°	0.944	1.424	1.536	Vertical	180°	0.283	0.128	-8.935	Horizontal
5°	0.924	1.365	1.352	Vertical	185°	0.292	0.136	-8.661	Horizontal
10°	0.899	1.293	1.117	Vertical	190°	0.304	0.148	-8.305	Horizontal
15°	0.869	1.208	0.822	Vertical	195°	0.315	0.159	-7.979	Horizontal
20°	0.833	1.111	0.457	Vertical	200°	0.324	0.168	-7.752	Horizontal
25°	0.792	1.003	0.014	Vertical	205°	0.329	0.173	-7.614	Horizontal
30°	0.745	0.888	-0.516	Vertical	210°	0.333	0.177	-7.513	Vertical
35°	0.704	0.792	-1.012	Horizontal	215°	0.354	0.200	-6.988	Vertical
40°	0.660	0.696	-1.571	Horizontal	220°	0.377	0.227	-6.439	Vertical
45°	0.609	0.594	-2.263	Horizontal	225°	0.403	0.260	-5.848	Vertical
50°	0.571	0.521	-2.833	Horizontal	230°	0.434	0.302	-5.205	Vertical
55°	0.545	0.475	-3.235	Horizontal	235°	0.477	0.364	-4.385	Horizontal
60°	0.532	0.453	-3.444	Horizontal	240°	0.540	0.467	-3.308	Horizontal
65°	0.534	0.456	-3.415	Horizontal	245°	0.611	0.597	-2.238	Horizontal
70°	0.555	0.492	-3.078	Horizontal	250°	0.677	0.734	-1.341	Horizontal
75°	0.588	0.553	-2.570	Horizontal	255°	0.737	0.870	-0.607	Horizontal
80°	0.623	0.620	-2.073	Horizontal	260°	0.785	0.987	-0.058	Horizontal
85°	0.647	0.669	-1.747	Horizontal	265°	0.816	1.065	0.272	Horizontal
90°	0.656	0.689	-1.618	Horizontal	270°	0.834	1.112	0.462	Vertical
95°	0.653	0.682	-1.661	Horizontal	275°	0.876	1.228	0.890	Vertical
100°	0.634	0.643	-1.919	Horizontal	280°	0.909	1.321	1.210	Vertical
105°	0.602	0.580	-2.367	Horizontal	285°	0.934	1.396	1.447	Vertical
110°	0.560	0.503	-2.987	Horizontal	290°	0.952	1.451	1.616	Vertical
115°	0.517	0.427	-3.697	Horizontal	295°	0.964	1.486	1.720	Vertical
120°	0.477	0.364	-4.387	Horizontal	300°	0.969	1.503	1.769	Vertical
125°	0.442	0.313	-5.051	Horizontal	305°	0.973	1.516	1.806	Vertical
130°	0.412	0.272	-5.654	Horizontal	310°	0.985	1.551	1.906	Vertical
135°	0.391	0.244	-6.122	Horizontal	315°	0.996	1.587	2.005	Vertical
140°	0.372	0.221	-6.547	Horizontal	320°	1.000	1.600	2.041	Vertical
145°	0.356	0.202	-6.936	Horizontal	325°	0.999	1.596	2.029	Vertical
150°	0.338	0.183	-7.371	Horizontal	330°	0.995	1.584	1.998	Vertical
155°	0.332	0.176	-7.547	Vertical	335°	0.989	1.565	1.946	Vertical
160°	0.324	0.168	-7.744	Vertical	340°	0.981	1.539	1.874	Vertical
165°	0.312	0.156	-8.078	Vertical	345°	0.970	1.507	1.780	Vertical
170°	0.297	0.141	-8.511	Vertical	350°	0.958	1.467	1.666	Vertical
175°	0.282	0.127	-8.955	Vertical	355°	0.951	1.448	1.609	Vertical

Horizontal Polarization:
Maximum: 1.589 (2.013 dB)
Horizontal Plane: 1.589 (2.013 dB)
Maximum ERP: 1.600 kW

Vertical Polarization:
Maximum: 1.589 (2.013 dB)
Horizontal Plane: 1.589 (2.013 dB)
Maximum ERP: 1.600 kW

Total Input Power: 1.007 kW
Reference: KQXI2M.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: 1/15/2013**
Station: KQXI **Antenna: LP-2E-DA-HW**
Location: Granite Falls, WA **Antenna Orientation: 335° True**
Frequency: 91.5 MHz **Number of Bays: 2**

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.746	0.890	-0.504	0.944	1.424	1.536	180°	0.283	0.128	-8.935	0.271	0.117	-9.301
5°	0.748	0.894	-0.485	0.924	1.365	1.352	185°	0.292	0.136	-8.661	0.267	0.114	-9.438
10°	0.752	0.905	-0.436	0.899	1.293	1.117	190°	0.304	0.148	-8.305	0.271	0.117	-9.313
15°	0.756	0.915	-0.386	0.869	1.208	0.822	195°	0.315	0.159	-7.979	0.281	0.127	-8.973
20°	0.758	0.919	-0.368	0.833	1.111	0.457	200°	0.324	0.168	-7.752	0.296	0.141	-8.519
25°	0.753	0.906	-0.426	0.792	1.003	0.014	205°	0.329	0.173	-7.614	0.314	0.158	-8.024
30°	0.735	0.863	-0.638	0.745	0.888	-0.516	210°	0.331	0.175	-7.563	0.333	0.177	-7.513
35°	0.704	0.792	-1.012	0.697	0.777	-1.095	215°	0.338	0.182	-7.388	0.354	0.200	-6.988
40°	0.660	0.696	-1.571	0.648	0.672	-1.726	220°	0.356	0.202	-6.937	0.377	0.227	-6.439
45°	0.609	0.594	-2.263	0.601	0.578	-2.378	225°	0.385	0.237	-6.251	0.403	0.260	-5.848
50°	0.571	0.521	-2.833	0.558	0.498	-3.024	230°	0.425	0.290	-5.382	0.434	0.302	-5.205
55°	0.545	0.475	-3.235	0.520	0.433	-3.631	235°	0.477	0.364	-4.385	0.471	0.355	-4.496
60°	0.532	0.453	-3.444	0.487	0.380	-4.206	240°	0.540	0.467	-3.308	0.515	0.424	-3.725
65°	0.534	0.456	-3.415	0.456	0.333	-4.773	245°	0.611	0.597	-2.238	0.565	0.510	-2.923
70°	0.555	0.492	-3.078	0.427	0.292	-5.343	250°	0.677	0.734	-1.341	0.619	0.612	-2.131
75°	0.588	0.553	-2.570	0.398	0.254	-5.952	255°	0.737	0.870	-0.607	0.674	0.727	-1.385
80°	0.623	0.620	-2.073	0.367	0.215	-6.669	260°	0.785	0.987	-0.058	0.730	0.852	-0.697
85°	0.647	0.669	-1.747	0.332	0.176	-7.541	265°	0.816	1.065	0.272	0.784	0.983	-0.073
90°	0.656	0.689	-1.618	0.294	0.139	-8.578	270°	0.833	1.109	0.450	0.834	1.112	0.462
95°	0.653	0.682	-1.661	0.257	0.106	-9.760	275°	0.841	1.133	0.541	0.876	1.228	0.890
100°	0.634	0.643	-1.919	0.222	0.079	-11.013	280°	0.850	1.157	0.632	0.909	1.321	1.210
105°	0.602	0.580	-2.367	0.196	0.062	-12.106	285°	0.859	1.181	0.722	0.934	1.396	1.447
110°	0.560	0.503	-2.987	0.184	0.054	-12.663	290°	0.869	1.209	0.824	0.952	1.451	1.616
115°	0.517	0.427	-3.697	0.188	0.057	-12.457	295°	0.876	1.229	0.896	0.964	1.486	1.720
120°	0.477	0.364	-4.387	0.207	0.069	-11.624	300°	0.896	1.284	1.084	0.969	1.503	1.769
125°	0.442	0.313	-5.051	0.235	0.088	-10.548	305°	0.927	1.375	1.382	0.973	1.516	1.806
130°	0.412	0.272	-5.654	0.264	0.111	-9.538	310°	0.963	1.482	1.709	0.985	1.551	1.906
135°	0.391	0.244	-6.122	0.290	0.134	-8.713	315°	0.987	1.557	1.924	0.996	1.587	2.005
140°	0.372	0.221	-6.547	0.311	0.155	-8.098	320°	0.999	1.595	2.029	1.000	1.600	2.041
145°	0.356	0.202	-6.936	0.326	0.170	-7.695	325°	0.996	1.587	2.006	0.999	1.596	2.029
150°	0.338	0.183	-7.371	0.333	0.177	-7.516	330°	0.976	1.524	1.830	0.995	1.584	1.998
155°	0.319	0.163	-7.872	0.332	0.176	-7.547	335°	0.939	1.411	1.496	0.989	1.565	1.946
160°	0.299	0.143	-8.440	0.324	0.168	-7.744	340°	0.886	1.255	0.987	0.981	1.539	1.874
165°	0.281	0.126	-8.988	0.312	0.156	-8.078	345°	0.826	1.092	0.383	0.970	1.507	1.780
170°	0.274	0.120	-9.196	0.297	0.141	-8.511	350°	0.783	0.980	-0.086	0.958	1.467	1.666
175°	0.277	0.123	-9.115	0.282	0.127	-8.955	355°	0.756	0.915	-0.388	0.951	1.448	1.609

Horizontal Polarization:
Maximum: 1.589 (2.013 dB)
Horizontal Plane: 1.589 (2.013 dB)
Maximum ERP: 1.600 kW

Vertical Polarization:
Maximum: 1.589 (2.013 dB)
Horizontal Plane: 1.589 (2.013 dB)
Maximum ERP: 1.600 kW

Total Input Power: 1.007 kW
Reference: KQXI2M.FIG

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

ERI® Vertical Plane Relative Field Pattern

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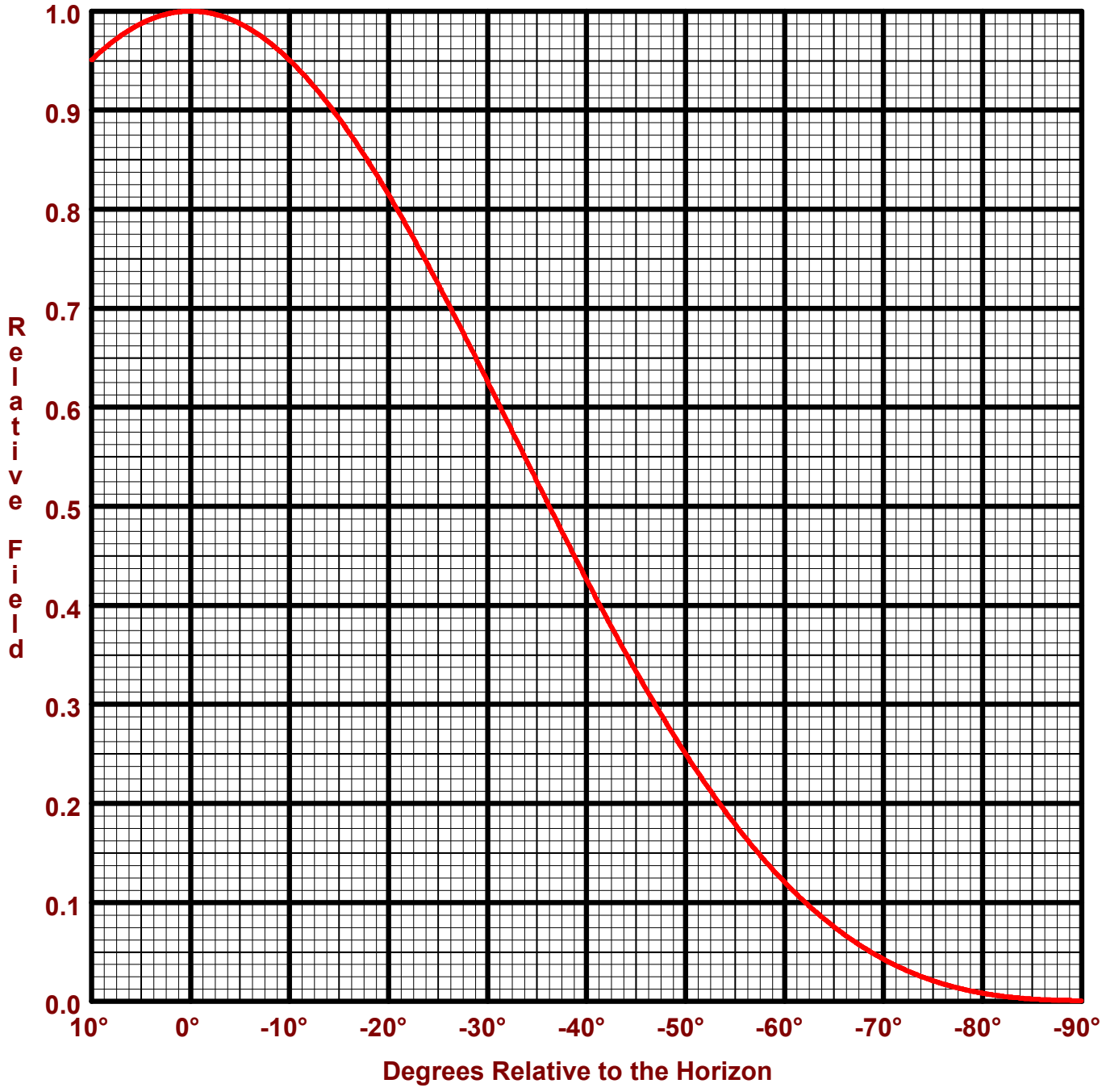
Figure No: 3
Call Sign: KQXI
Location: Granite Falls, WA
Frequency: 91.5 MHz
2 bay LP-2E-DA-HW antenna

Date: 1/15/2013
H/V Power Ratio: 1
.5 Wave-length Spacing
0° Beam Tilt
0% First Null Fill



Horizontal Polarization:
Maximum: 1.589 (2.013 dB)
Horizontal Plane: 1.589 (2.013 dB)
Maximum ERP: 1.600 kW

Vertical Polarization:
Maximum: 1.589 (2.013 dB)
Horizontal Plane: 1.589 (2.013 dB)
Maximum ERP: 1.600 kW

Directional Antenna System
for
KQXI, Granite Falls, Washington

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	LP-2E-DA-HW
Frequency:	91.5 MHz
Number of Bays:	Two

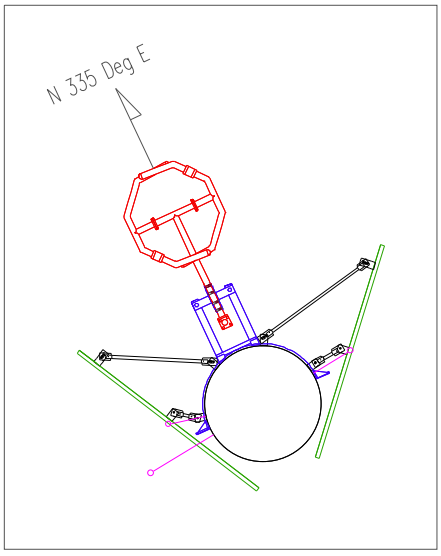
MECHANICAL SPECIFICATIONS

Mounting:	Custom
System length:	14 ft 2 in
Aperture length required:	20 ft 4 in [1]
Orientation:	335 ° true

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

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	1.600 kW (2.041 dBk)
Horizontal maximum power gain:	1.589 (2.013 dB)
Maximum vertical ERP:	1.600 kW (2.043 dBk)
Vertical maximum power gain:	1.589 (2.011 dB)
Total input power:	1.007 kW (0.030 dBk)



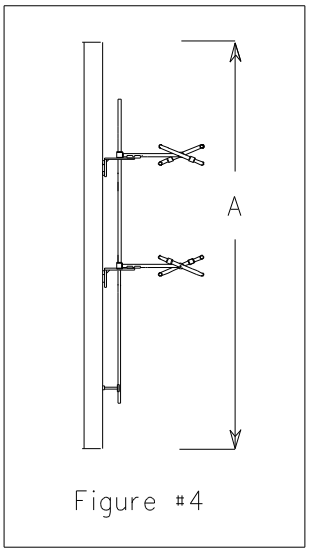


Figure #4