ShivelyLabs
a division of Howell Laboratories,Inc.
- An Employee-Owned Company -

P. O. Box 389 Harrison Rd.,
Bridgton, Maine 04009 USA
(207) 647-3327
888-SHIVELY
Fax: (207) 647-8273
E-mail: sales@shively.com
Web site: www.shively.com

S.O. 27957

Report of Test 6014-6/2-DA

for

First Broadcasting Capital Partners, LLC

KMCQ 104.5 MHz Covington, WA

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6014-6/2-DA to meet the needs of KMCQ and to comply with the requirements of the FCC construction permit, file number BMPH-20090929ALM.

RESULTS:

The following Figures are the results of the measurements from our pattern range:

Figure 1A - Measured Azimuth Pattern with the FCC Composite
Figure 1B - Measured Composite Azimuth Pattern with the FCC Composite
Figure 1C - Tabulation of the Horizontal Polarization for the Measured Azimuth Pattern
Figure 1D - Tabulation of the Vertical Polarization for the Measured Azimuth Pattern
Figure 1E - Tabulation of the Measured Composite Azimuth Pattern
Figure 1F - Tabulation of the FCC Composite

The calculated elevation pattern of the antenna is shown in Figure 3.

Construction permit file number BMPH-20090929ALM indicates that the Horizontal radiation component shall not exceed 7.100 kW at any azimuth and is restricted to the following values at the azimuths specified:

80 - 110 Degrees T: 0.444 kW

APPENDIX B - ANTENNA MANUFACTURER

Mullaney Engineering, Inc.

This 6 bay panel antenna was originally built in 2000.

Use by KMCQ of a directional antenna is voluntary - **Not a Section 73.215.**

Operation by KMCQ required no outside construction.

From Figure 1A, the maximum radiation of the Horizontal component occurs at 208 Degrees T to 221 Degrees T, and at 338 Degrees T to 356 Degrees T. At the restricted azimuth of 80 - 110 Degrees T the Horizontal component is 13.51 dB down from the maximum of 7.100 kW, or 0.316 kW. The Vertical component does not exceed the horizontal component and therefore complies with the construction permit.

The R.M.S. of the Horizontal component is 0.729. The total Horizontal power gain is 6.073. The R.M.S. of the Vertical component is 0.698. The total Vertical power gain is 5.952. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.810. The R.M.S. of the measured composite pattern is 0.730. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.688. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6014-6/2-DA was mounted on a tower of precise scale to the tower at the KMCQ site. The spacing and alignment of the antenna to the tower was varied to achieve the horizontal and vertical patterns shown in Figure 1A. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BMPH-20090929ALM, a single level of the 6014-6/2-DA was set up on the Howell Laboratories scale model antenna pattern measuring range. A scale of 4.5:1 was used.

SUPERVISION:

Mr. Surette was graduated from Lowell Technological Institute, Lowell, Massachusetts in 1973 with the degree of Bachelor of Science in Electrical Engineering. He has been directly involved with design and development of broadcast antennas, filter systems and RF transmission components since 1974, as an RF Engineer for six years with the original Shively Labs in Raymond, ME and for a short period of time with Dielectric Communications. He is currently an Associate Member of the AFCCE and a Senior Member of IEEE. He has authored a chapter on filters and combining systems for the latest edition of the CRC Electronics Handbook and for the 9th and 10th Editions of the NAB Handbook.

EQUIPMENT:

The scale model pattern range consists of a wooden rotating pedestal equipped with a position indicator. The scale model bay is placed on the top of this pedestal and is used in the transmission mode at approximately 20 feet above ground level. The receiving corner reflector is spaced 50 feet away from the rotating pedestal at the same level above ground as the transmitting model. The transmitting and receiving signals are carried to a control building by means of RG-9/U double shielded coax cable.
The control building is equipped with:

Hewlett Packard Model 8753 Network Analyzer
PC Based Controller
Hewlett Packard 7550A Graphics Plotter

The test equipment is calibrated to ANSI/NCSL Z540-1-1994.

TEST PROCEDURES:

The corner reflector is mounted so that the horizontal and vertical azimuth patterns are measured independently by rotating the corner reflector by 90 degrees. The network analyzer was set to 470.25 MHz. Calibrated pads are used to check the linearity of the measuring system. For example, 6 dB padding yields a scale reading of 50 from an unpadded reading of 100 in voltage. From the recorded patterns, the R.M.S. values are calculated and recorded as shown in Figure 1A.

Respectfully submitted by:

Robert A. Surette
Director of Sales Engineering
S/O 27957
Date January 12, 2010

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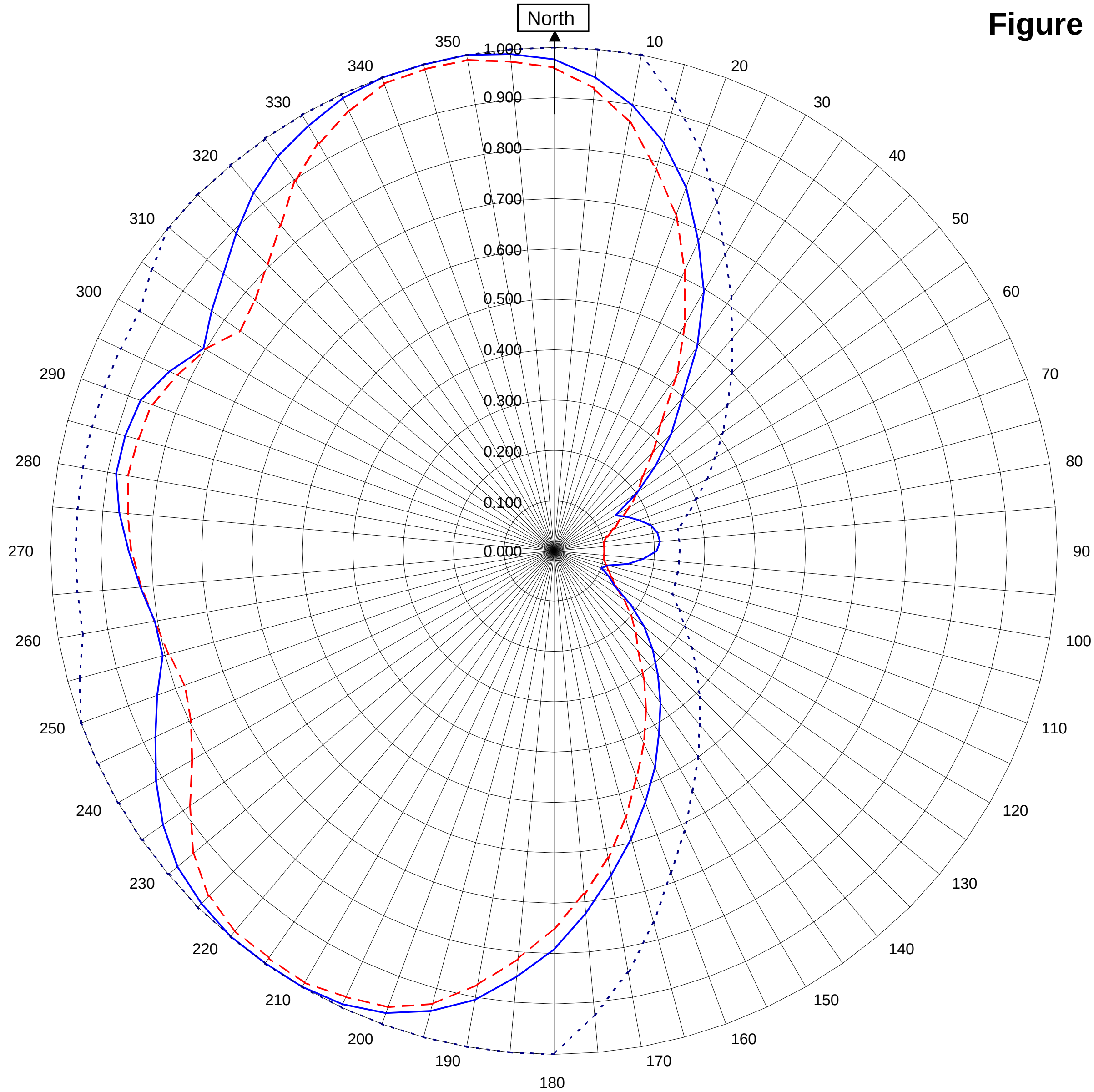
Figure 1a



KMCQ Covington, WA

27957

January 12, 2010

____________Horizontal RMS	0.729
_ _ _ _ _ _ _ _ _ Vertical RMS	0.698
H/V Composite RMS	0.730
……………FCC Composite RMS	0.810

Frequency	104.5 / 470.25 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	Model 6014-6/2-DA
Pattern Type	Directional Azimuth

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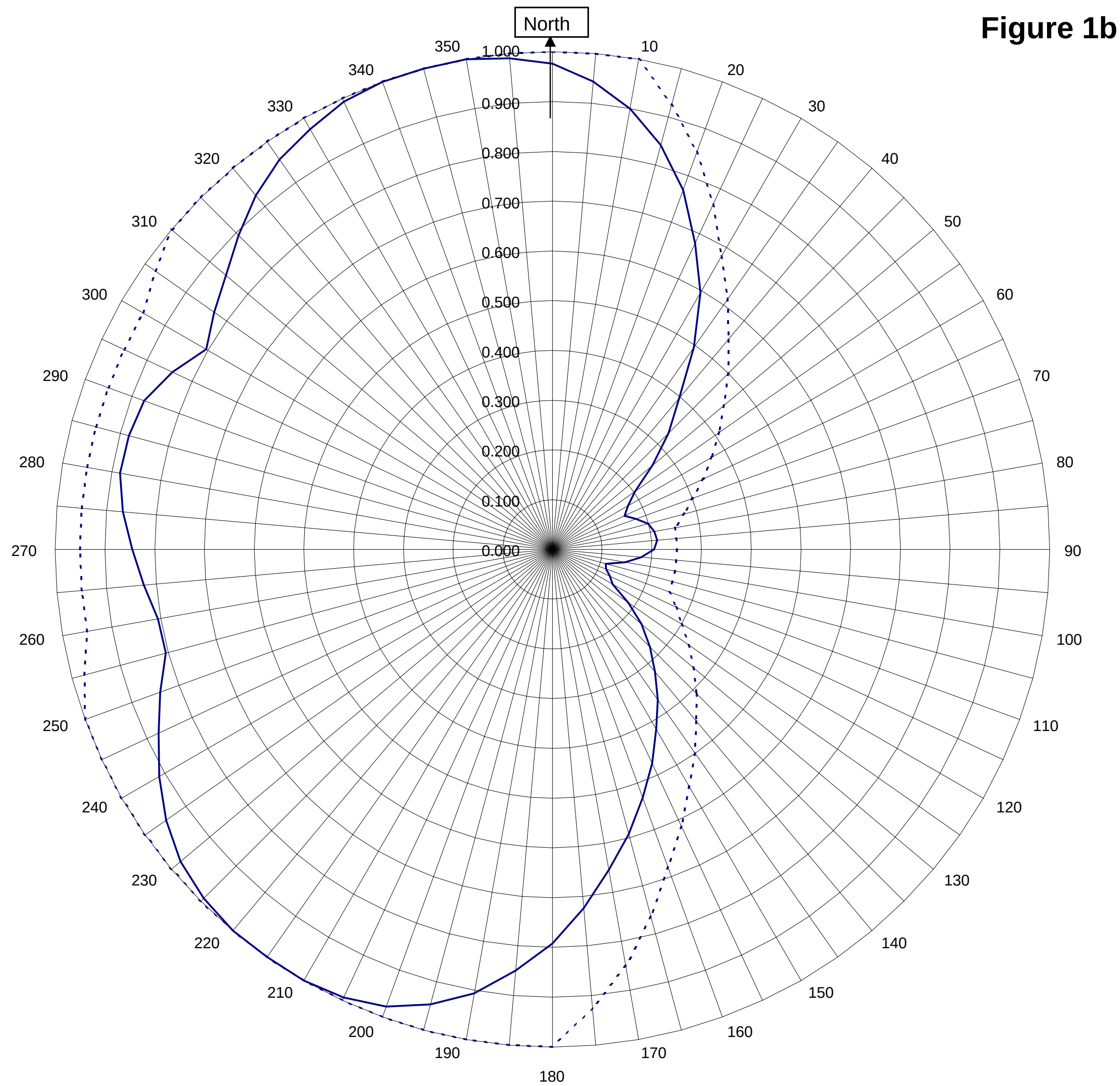
Figure 1b



KMCQ Covington, WA

27957

January 12, 2010

__________H/VComposite RMS	0.730
……………FCC Composite RMS	0.810

Frequency	104.5 / 470.25 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	Model 6014-6/2-DA
Pattern Type	Directional H/V Composite

Figure 1c

Tabulation of Horizontal Azimuth Pattern
KMCQ Covington, WA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.976	180	0.792
10	0.899	190	0.906
20	0.768	200	0.977
30	0.595	210	1.000
40	0.396	220	1.000
45	0.330	225	0.991
50	0.263	230	0.976
60	0.141	240	0.913
70	0.179	250	0.839
80	0.208	260	0.805
90	0.204	270	0.845
100	0.149	280	0.883
110	0.100	290	0.874
120	0.139	300	0.804
130	0.234	310	0.857
135	0.278	315	0.893
140	0.321	320	0.928
150	0.417	330	0.975
160	0.531	340	1.000
170	0.654	350	1.000

Figure 1d

Tabulation of Vertical Azimuth Pattern
KMCQ Covington, WA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.960	180	0.750
10	0.865	190	0.875
20	0.710	200	0.965
30	0.520	210	0.990
40	0.330	220	0.985
45	0.280	225	0.970
50	0.230	230	0.935
60	0.175	240	0.830
70	0.126	250	0.780
80	0.100	260	0.805
90	0.100	270	0.840
100	0.100	280	0.860
110	0.115	290	0.850
120	0.140	300	0.800
130	0.200	310	0.775
135	0.230	315	0.805
140	0.260	320	0.845
150	0.365	330	0.935
160	0.480	340	0.987
170	0.620	350	0.990

Figure 1e

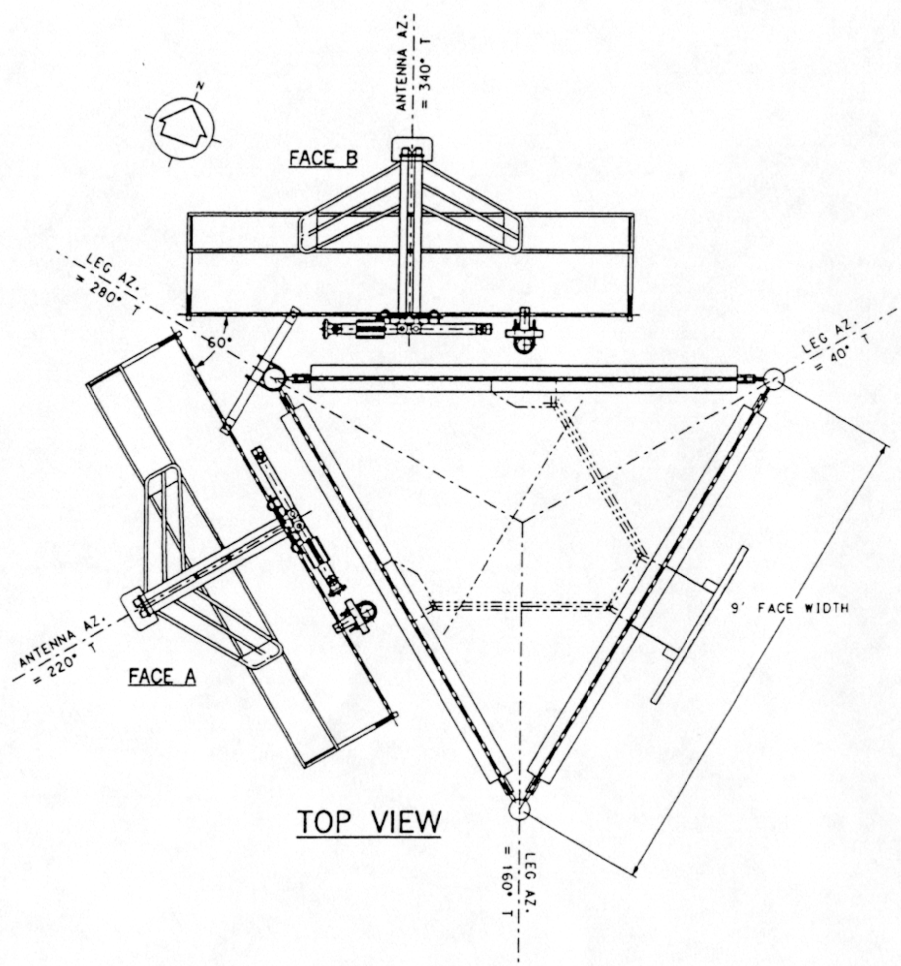
Tabulation of Composite Azimuth Pattern
KMCQ Covington, WA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.976	180	0.792
10	0.899	190	0.906
20	0.768	200	0.977
30	0.595	210	1.000
40	0.396	220	1.000
45	0.330	225	0.991
50	0.263	230	0.976
60	0.175	240	0.913
70	0.179	250	0.839
80	0.208	260	0.805
90	0.204	270	0.845
100	0.149	280	0.883
110	0.115	290	0.874
120	0.140	300	0.804
130	0.234	310	0.857
135	0.278	315	0.893
140	0.321	320	0.928
150	0.417	330	0.975
160	0.531	340	1.000
170	0.654	350	1.000

Figure 1f

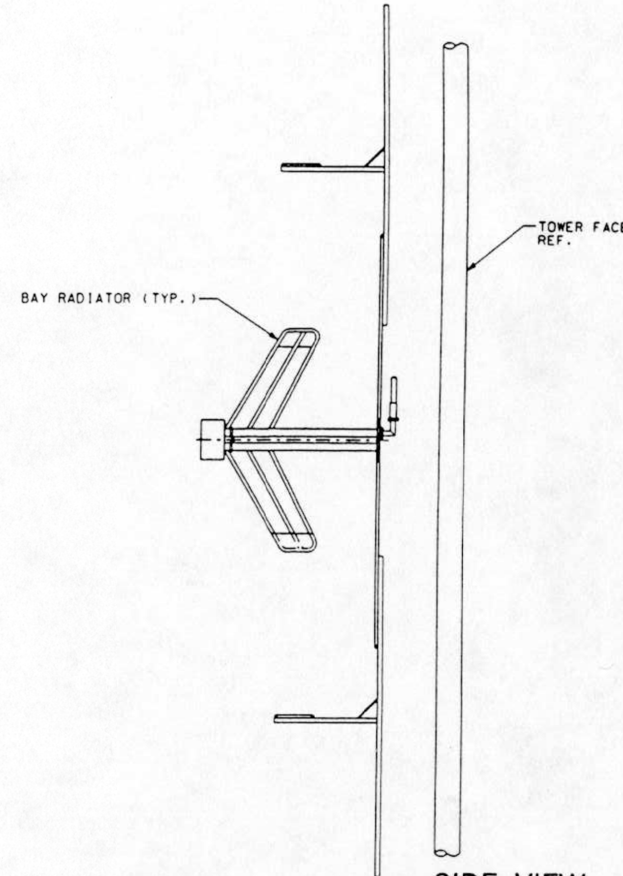
Tabulation of FCC Directional Composite
KMCQ Covington, WA

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	1.000
10	1.000	190	1.000
20	0.850	200	1.000
30	0.680	210	1.000
40	0.550	220	1.000
50	0.450	230	1.000
60	0.370	240	1.000
70	0.300	250	1.000
80	0.250	260	0.950
90	0.250	270	0.950
100	0.250	280	0.950
110	0.250	290	0.950
120	0.300	300	0.950
130	0.370	310	1.000
140	0.450	320	1.000
150	0.550	330	1.000
160	0.680	340	1.000
170	0.850	350	1.000



TOP VIEW

TOWER BY: VALMONT-MICROFLECT
MODEL: 300 FT. SELF-SUPPORTING



SIDE VIEW

SHIVELY LABS

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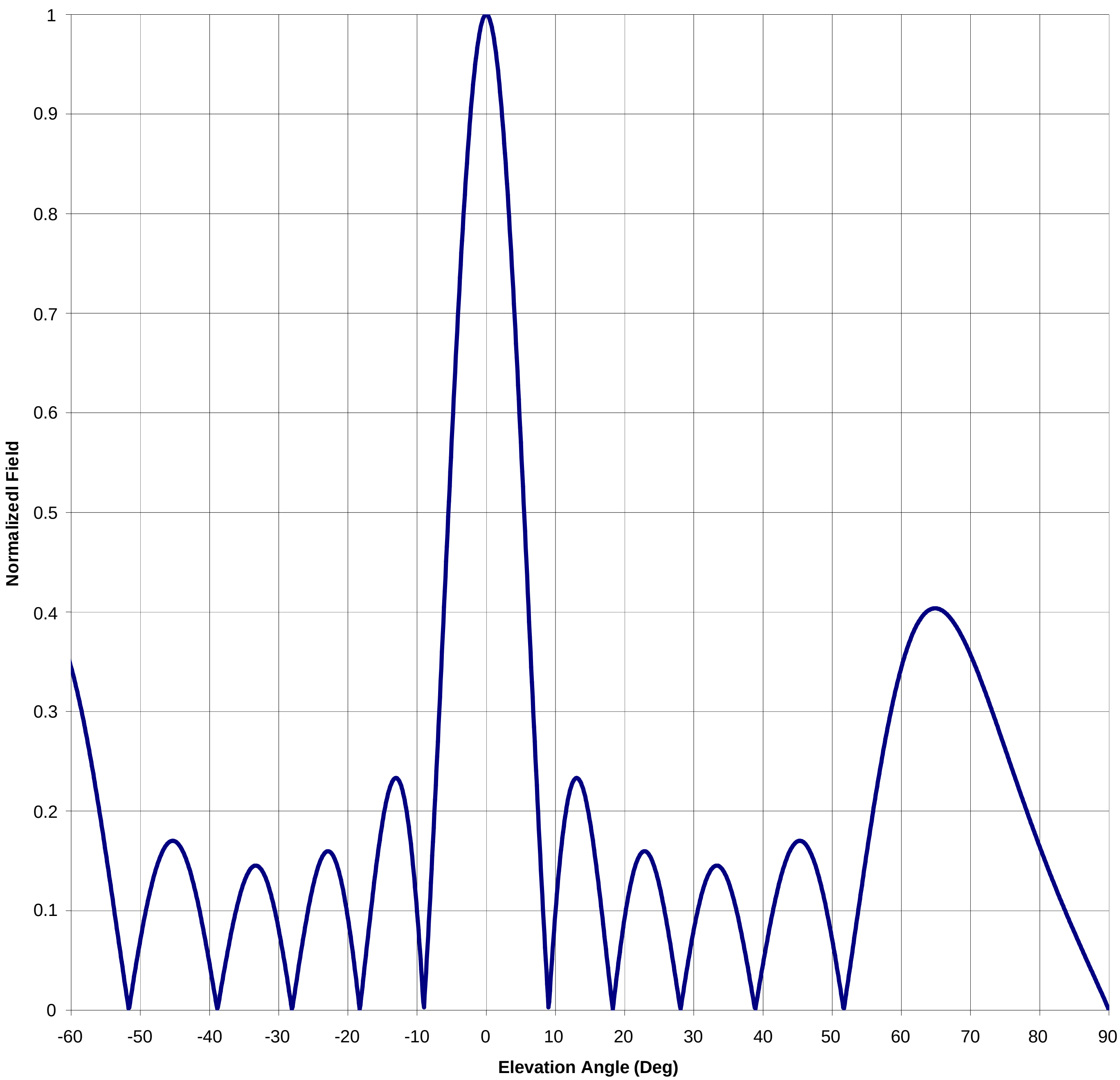
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY:
20723A	88 - 108 MHz	N. T. S.	ASP
			APPROVED BY:

TITLE:
MODEL-6014-6/2-DIRECTIONAL ANTENNA

DATE: 9-29-99

FIGURE 2

Antenna Mfg.:	Shively Labs			Date:	1/12/2010
Antenna Type:	Model 6014-6/2-DA				
Station:	KMCQ	Beam Til	0		
Frequency:	104.5	Gain (Max)	6.073	7.834	dB
Channel #:	283	Gain (Horizon)	6.073	7.834	dB
Figure:	FIGURE 3				



Antenna Mfg.: **Shively Labs** **Date:** **1/12/2010**

Antenna Type: **Model 6014-6/2-DA**

Station: **KMCQ** **Beam Tilt** **0**

Frequency: **104.5** **Gain (Max)** **6.073** **7.834 dB**

Channel #: **283** **Gain (Horizon)** **6.073** **7.834 dB**

Figure: **FIGURE 3**

Angle of Depression (Deg)	Relative Field	Angle of Depression (Deg)	Relative Field	Angle of Depression (Deg)	Relative Field	Angle of Depression (Deg)	Relative Field
-90	0.000	-44	0.162	0	1.000	46	0.168
-89	0.016	-43	0.144	1	0.980	47	0.156
-88	0.032	-42	0.118	2	0.922	48	0.136
-87	0.047	-41	0.085	3	0.830	49	0.107
-86	0.063	-40	0.046	4	0.710	50	0.071
-85	0.078	-39	0.006	5	0.570	51	0.029
-84	0.094	-38	0.035	6	0.420	52	0.016
-83	0.111	-37	0.073	7	0.270	53	0.063
-82	0.128	-36	0.105	8	0.128	54	0.111
-81	0.146	-35	0.129	9	0.003	55	0.158
-80	0.164	-34	0.143	10	0.099	56	0.203
-79	0.183	-33	0.145	11	0.173	57	0.245
-78	0.202	-32	0.135	12	0.218	58	0.283
-77	0.222	-31	0.113	13	0.233	59	0.316
-76	0.242	-30	0.081	14	0.222	60	0.344
-75	0.262	-29	0.041	15	0.189	61	0.367
-74	0.283	-28	0.003	16	0.139	62	0.384
-73	0.303	-27	0.049	17	0.080	63	0.395
-72	0.322	-26	0.091	18	0.017	64	0.402
-71	0.340	-25	0.126	19	0.042	65	0.404
-70	0.357	-24	0.150	20	0.093	66	0.401
-69	0.372	-23	0.159	21	0.131	67	0.394
-68	0.385	-22	0.153	22	0.153	68	0.385
-67	0.394	-21	0.131	23	0.159	69	0.372
-66	0.401	-20	0.093	24	0.150	70	0.357
-65	0.404	-19	0.042	25	0.126	71	0.340
-64	0.402	-18	0.017	26	0.091	72	0.322
-63	0.395	-17	0.080	27	0.049	73	0.303
-62	0.384	-16	0.139	28	0.003	74	0.283
-61	0.367	-15	0.189	29	0.041	75	0.262
-60	0.344	-14	0.222	30	0.081	76	0.242
-59	0.316	-13	0.233	31	0.113	77	0.222
-58	0.283	-12	0.218	32	0.135	78	0.202
-57	0.245	-11	0.173	33	0.145	79	0.183
-56	0.203	-10	0.099	34	0.143	80	0.164
-55	0.158	-9	0.003	35	0.129	81	0.146
-54	0.111	-8	0.128	36	0.105	82	0.128
-53	0.063	-7	0.270	37	0.073	83	0.111
-52	0.016	-6	0.420	38	0.035	84	0.094
-51	0.029	-5	0.570	39	0.006	85	0.078
-50	0.071	-4	0.710	40	0.046	86	0.063
-49	0.107	-3	0.830	41	0.085	87	0.047
-48	0.136	-2	0.922	42	0.118	88	0.032
-47	0.156	-1	0.980	43	0.144	89	0.016
-46	0.168	0	1.000	44	0.162	90	0.000
-45	0.170			45	0.170		

S.O. 27957 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

KMCQ Covington, WA

Model 6014-6/2-DA

Elevation Gain of Antenna 3.090

Horizontal RMS value divided by the Vertical RMS value equals the Horiz. - Vert. Ratio

H RMS 0.729 V RMS 0.698 H/V Ratio 1.044

Elevation Gain of Horizontal Component 3.227

Elevation Gain of Vertical Component 2.959

Horizontal Azimuth Gain equals $1/(RMS)^2$. 1.882

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 2.012
Max. Vertical 0.99

***Total Horizontal Power Gain is the Elevation Gain Times the Azimuth Gain**

Total Horizontal Power Gain = **6.073**

***Total Vertical Power Gain is the Elevation Gain Times the Azimuth Gain**

Total Vertical Power Gain = **5.952**

===

ERP divided by Horizontal Power Gain equals Antenna Input Power

7.1 kW ERP Divided by H Gain 6.073 equals 1.17 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

1.17 kW Times V Gain 5.952 equals 6.96 kW V ERP

Maximum Value of the Vertical Component squared times the Maximum ERP equals the Vertical ERP

(0.99)^2 Times 7.10 Equals 6.96 kW Vertical ERP

NOTE: Calculating the ERP of the Vertical Component by two methods validates the total power gain calculations