Shively Labs
a division of Howell Laboratories,Inc.

- An Employee-Owned Company -

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S.O. 27454

Report of Test 6513-5-DA

for

AMERICAN FAMILY ASSOCIATION

KVRS 90.3 MHz Lawton, OK

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6513-5-DA to meet the needs of KVRS and to comply with the requirements of the FCC construction permit, file number BMPED-20081021AAD.

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 Vertical Polarization for the Measured Azimuth Pattern
Figure 1D - Tabulation of the Measured Composite Azimuth Pattern
Figure 1E - Tabulation of the FCC Composite

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

Construction permit file number BMPED-20081021AAD indicates that the Vertical radiation component shall not exceed 9.8 kW at any azimuth and is restricted to the following values at the azimuths specified:

180 Degrees T: 1.250 kW

From Figure 1A, the maximum radiation of the Vertical component occurs at 019 Degrees T to 041 Degrees T and at 313 Degrees T to 337 Degrees T. At the restricted azimuth of 180 Degrees T the Vertical component is 17.72 dB down from the maximum of 9.8 kW, or 0.166 kW.

The R.M.S. of the Vertical component is 0.776. The total Vertical power gain is 8.967. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.894. The R.M.S. of the measured composite pattern is 0.776. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.759. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6513-5-DA was mounted on a tower of precise scale to the Allied-24 tower at the KVRS site. The spacing of the antenna to the tower was varied to achieve the vertical pattern shown in Figure 1A. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BMPED-20081021AAD, a single level of the 6513-5-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 406.35 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 27454
April 30, 2009

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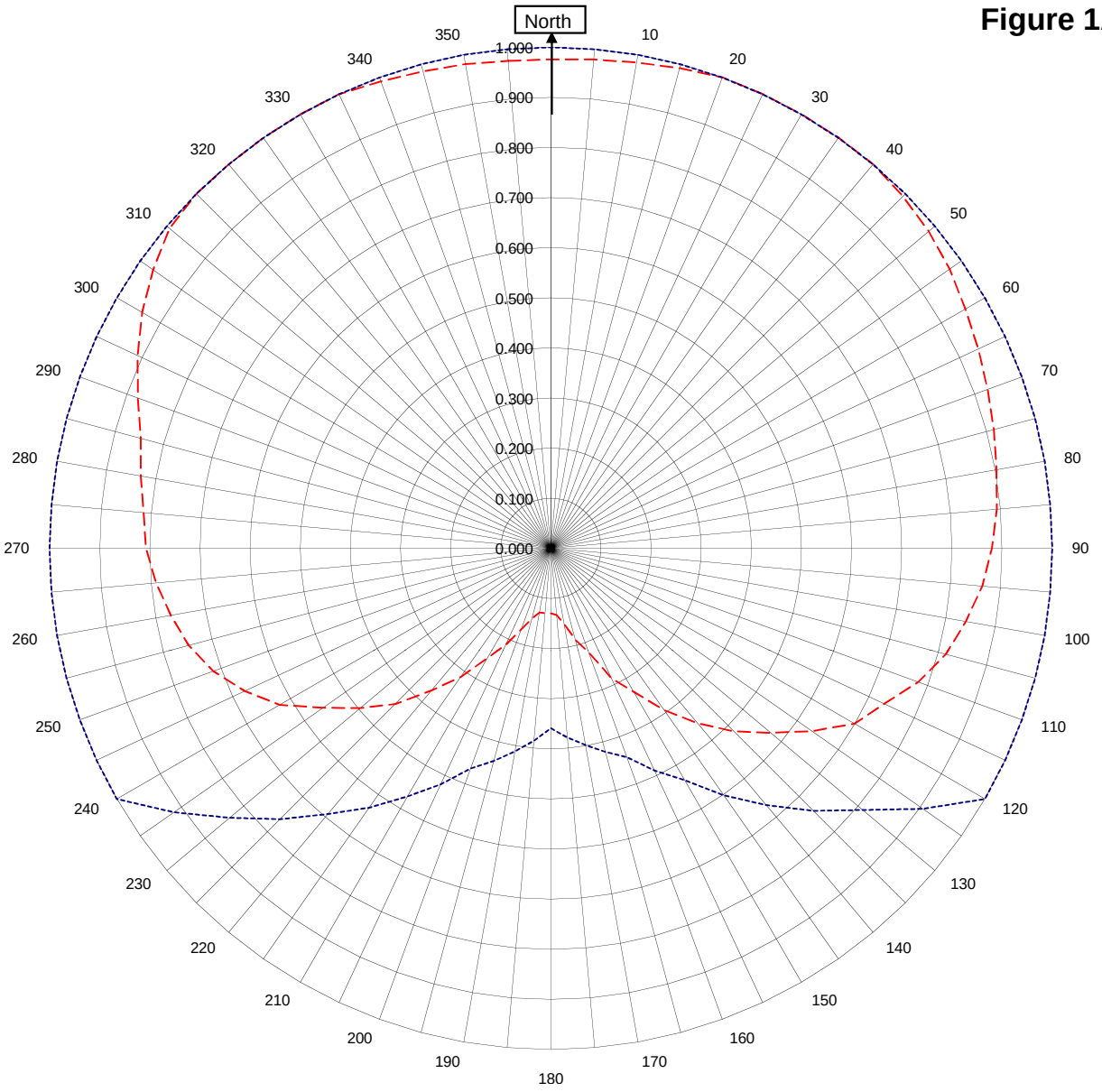
Figure 1A



KVRS Lawton, OK

27454

April 30, 2009

_____Horizontal RMS	0.000
_ _ _ _ _ _ _ _ _ Vertical RMS	0.776
H/V Composite RMS	0.776
.....FCC Composite RMS	0.894

Frequency	90.3 / 406.35 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6513-5-DA Patt 02-A
Pattern Type	Directional Azimuth

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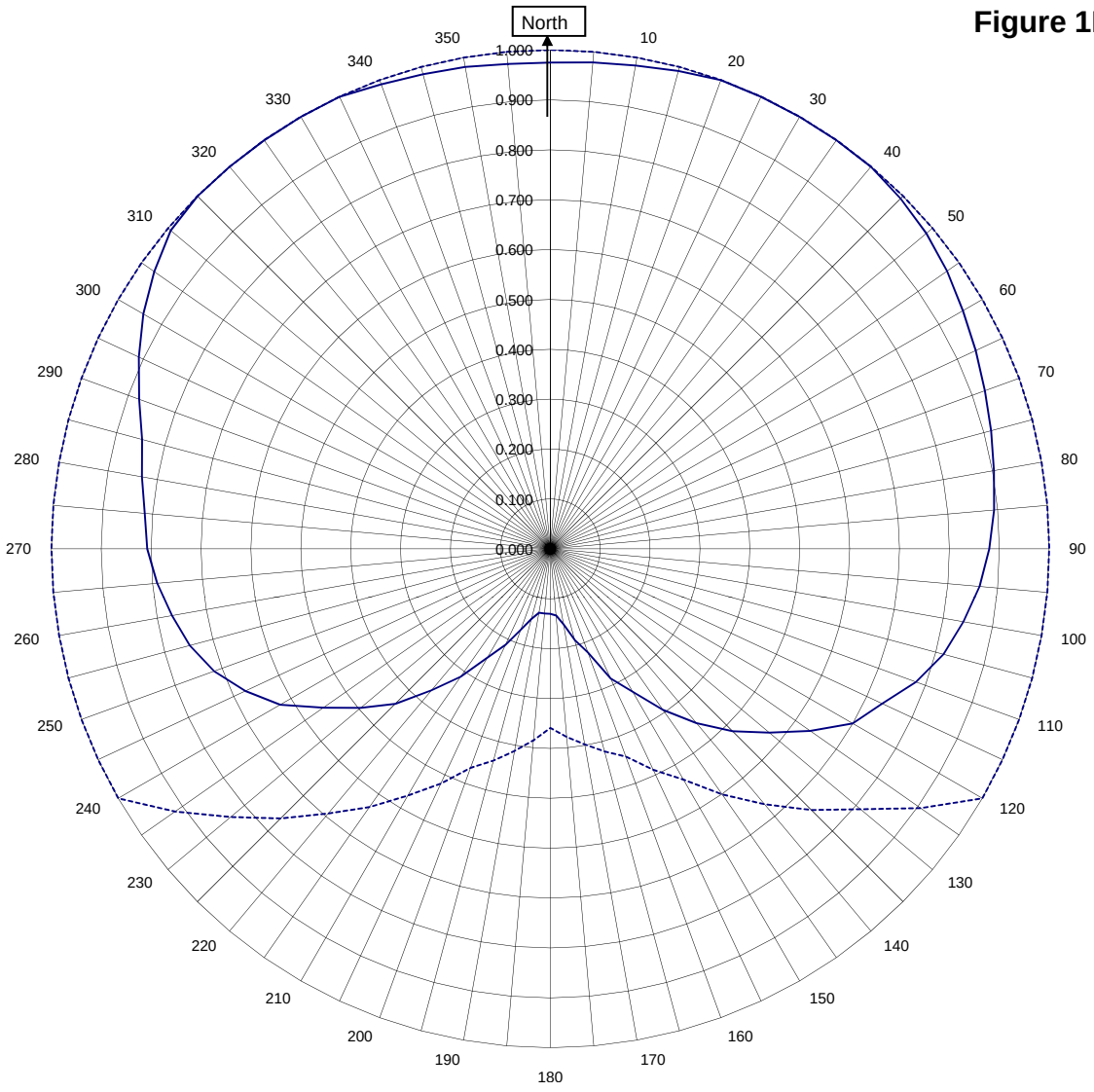
Figure 1B



KVRS Lawton, OK

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April 30, 2009

_____H/VComposite RMS	0.776
……..FCC Composite RMS	0.894

Frequency	90.3 / 406.35 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6513-5-DA Patt 02-A
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Vertical Azimuth Pattern
KVRS Lawton, OK

Azimuth	Rel Field	Azimuth	Rel Field
0	0.975	180	0.130
10	0.984	190	0.130
20	1.000	200	0.172
30	1.000	210	0.252
40	1.000	220	0.370
45	0.993	225	0.439
50	0.984	230	0.496
60	0.955	240	0.625
70	0.927	250	0.717
80	0.903	260	0.770
90	0.880	270	0.808
100	0.841	280	0.831
110	0.780	290	0.877
120	0.700	300	0.942
130	0.573	310	0.993
135	0.517	315	1.000
140	0.456	320	1.000
150	0.331	330	1.000
160	0.221	340	0.991
170	0.154	350	0.981

Figure 1D

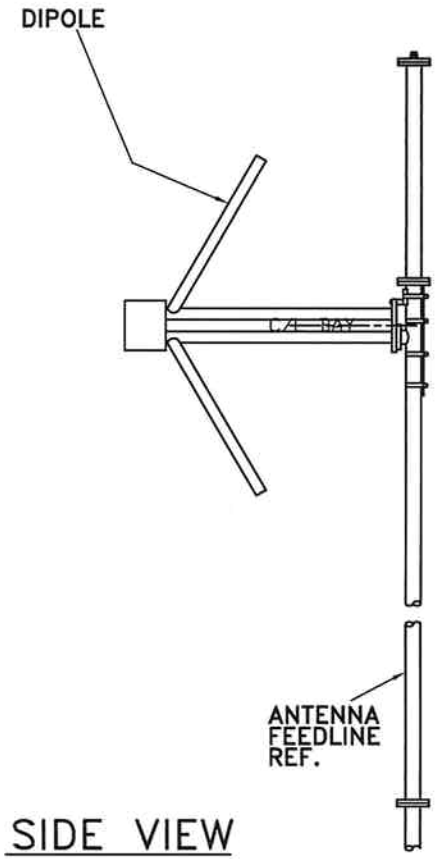
Tabulation of Composite Azimuth Pattern
KVRS Lawton, OK

Azimuth	Rel Field	Azimuth	Rel Field
0	0.975	180	0.130
10	0.984	190	0.130
20	1.000	200	0.172
30	1.000	210	0.252
40	1.000	220	0.370
45	0.993	225	0.439
50	0.984	230	0.496
60	0.955	240	0.625
70	0.927	250	0.717
80	0.903	260	0.770
90	0.880	270	0.808
100	0.841	280	0.831
110	0.780	290	0.877
120	0.700	300	0.942
130	0.573	310	0.993
135	0.517	315	1.000
140	0.456	320	1.000
150	0.331	330	1.000
160	0.221	340	0.991
170	0.154	350	0.981

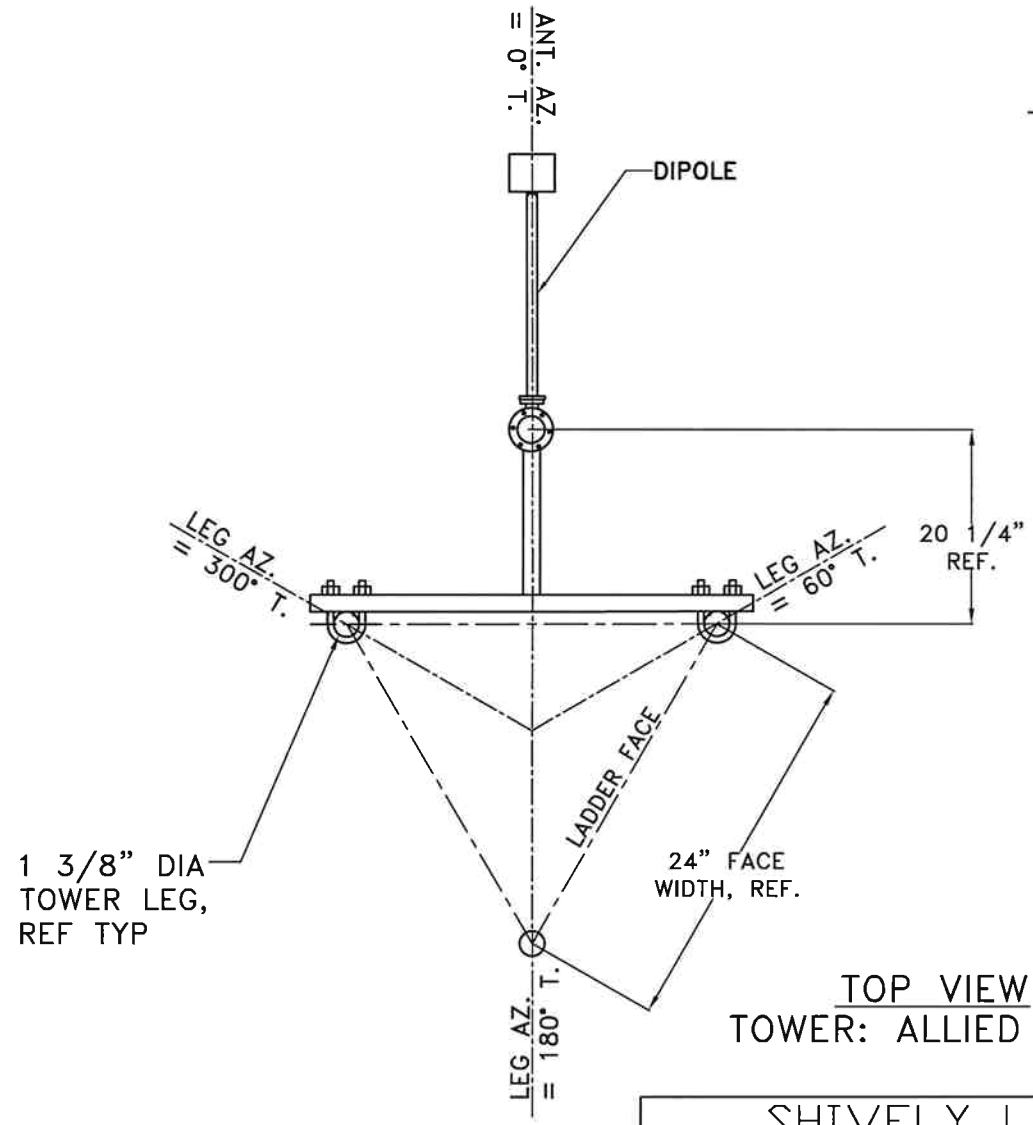
Figure 1E

Tabulation of FCC Directional Composite
KVRS Lawton, OK

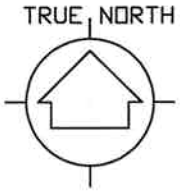
Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.359
10	1.000	190	0.411
20	1.000	200	0.467
30	1.000	210	0.571
40	1.000	220	0.692
50	1.000	230	0.836
60	1.000	240	1.000
70	1.000	250	1.000
80	1.000	260	1.000
90	1.000	270	1.000
100	1.000	280	1.000
110	1.000	290	1.000
120	1.000	300	1.000
130	0.812	310	1.000
140	0.668	320	1.000
150	0.534	330	1.000
160	0.443	340	1.000
170	0.398	350	1.000



SIDE VIEW



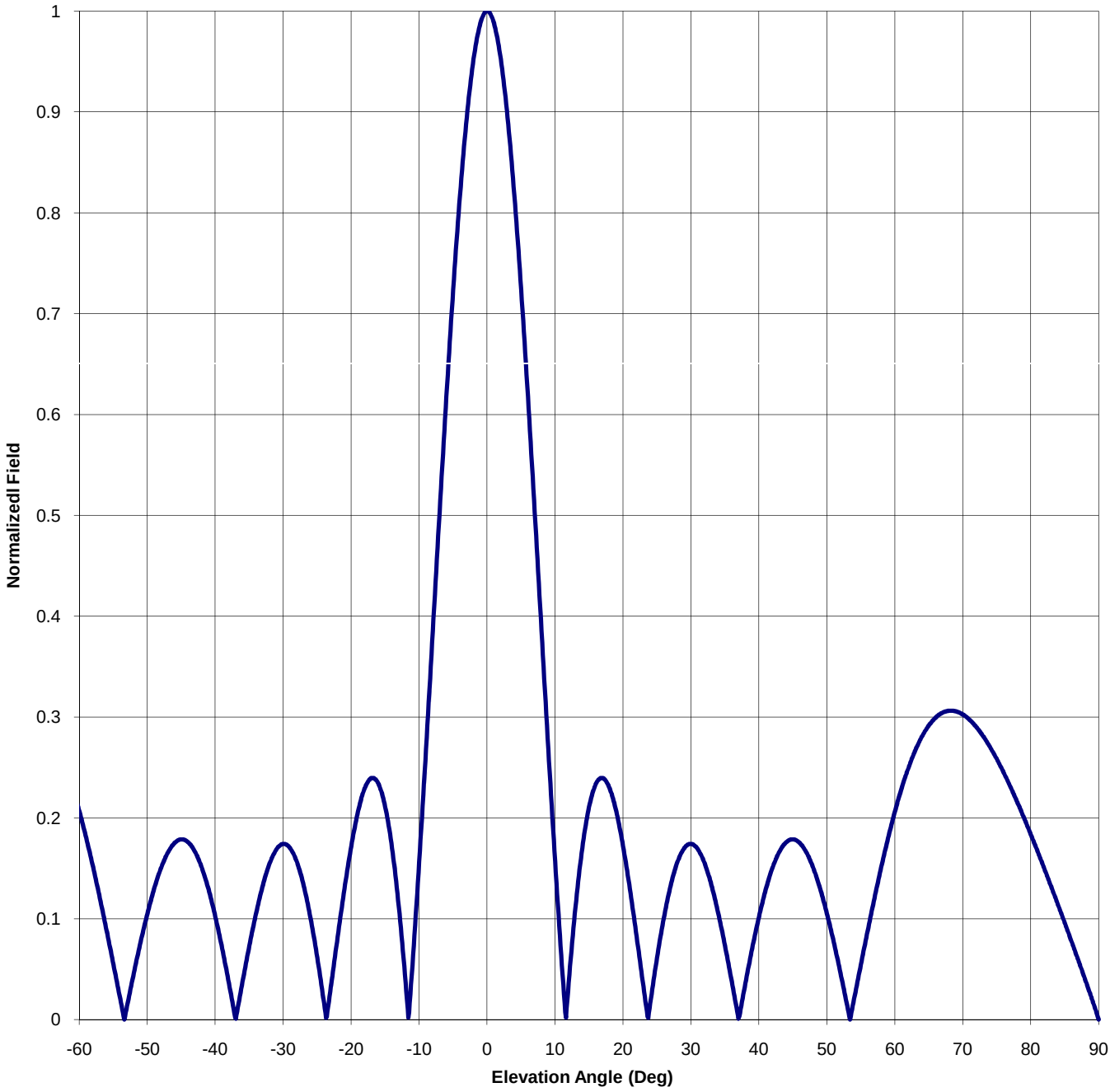
TOP VIEW
TOWER: ALLIED 24SR



ANTENNA HEADING: 0° TRUE NORTH

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE, USA			
SHOP ORDER: 27454	FREQUENCY: 90.3	SCALE: N.T.S.	DRAWN BY: ASP APPROVED BY: DAB
TITLE: MODEL 6513-5-DIRECTIONAL ANTENNA FM STATION			
DATE: 4/30/09	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date: 4/30/2009**
Antenna Type:	**6513-5-DA**			
Station:	**KVRS**	**Beam Tilt**	**0**	
Frequency:	**90.3**	**Gain (Max)**	**8.967**	**9.526 dB**
Channel #:	**202**	**Gain (Horizon)**	**8.967**	**9.526 dB**
Figure:	**3**			



Antenna Mfg.: Shively Labs
Antenna Type: 6513-5-DA
Station: KVRS
Frequency: 90.3
Channel #: 202
Figure: 3

Beam Tilt 0
Gain (Max) 8.967
Gain (Horizon) 8.967

Date: 4/30/2009
9.526 dB
9.526 dB

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	0.176	0	1.000	46	0.175
-89	0.021	-43	0.166	1	0.988	47	0.166
-88	0.040	-42	0.151	2	0.952	48	0.150
-87	0.059	-41	0.129	3	0.895	49	0.130
-86	0.077	-40	0.102	4	0.817	50	0.105
-85	0.096	-39	0.070	5	0.724	51	0.077
-84	0.114	-38	0.036	6	0.618	52	0.046
-83	0.132	-37	0.001	7	0.503	53	0.013
-82	0.150	-36	0.038	8	0.385	54	0.020
-81	0.167	-35	0.073	9	0.268	55	0.054
-80	0.184	-34	0.106	10	0.157	56	0.088
-79	0.200	-33	0.133	11	0.054	57	0.120
-78	0.216	-32	0.155	12	0.036	58	0.151
-77	0.231	-31	0.169	13	0.112	59	0.180
-76	0.245	-30	0.174	14	0.170	60	0.206
-75	0.258	-29	0.170	15	0.211	61	0.229
-74	0.270	-28	0.156	16	0.234	62	0.250
-73	0.281	-27	0.133	17	0.239	63	0.267
-72	0.290	-26	0.101	18	0.230	64	0.281
-71	0.297	-25	0.061	19	0.206	65	0.292
-70	0.303	-24	0.016	20	0.172	66	0.299
-69	0.306	-23	0.033	21	0.130	67	0.304
-68	0.306	-22	0.082	22	0.082	68	0.306
-67	0.304	-21	0.130	23	0.033	69	0.306
-66	0.299	-20	0.172	24	0.016	70	0.303
-65	0.292	-19	0.206	25	0.061	71	0.297
-64	0.281	-18	0.230	26	0.101	72	0.290
-63	0.267	-17	0.239	27	0.133	73	0.281
-62	0.250	-16	0.234	28	0.156	74	0.270
-61	0.229	-15	0.211	29	0.170	75	0.258
-60	0.206	-14	0.170	30	0.174	76	0.245
-59	0.180	-13	0.112	31	0.169	77	0.231
-58	0.151	-12	0.036	32	0.155	78	0.216
-57	0.120	-11	0.054	33	0.133	79	0.200
-56	0.088	-10	0.157	34	0.106	80	0.184
-55	0.054	-9	0.268	35	0.073	81	0.167
-54	0.020	-8	0.385	36	0.038	82	0.150
-53	0.013	-7	0.503	37	0.001	83	0.132
-52	0.046	-6	0.618	38	0.036	84	0.114
-51	0.077	-5	0.724	39	0.070	85	0.096
-50	0.105	-4	0.817	40	0.102	86	0.077
-49	0.130	-3	0.895	41	0.129	87	0.059
-48	0.150	-2	0.952	42	0.151	88	0.040
-47	0.166	-1	0.988	43	0.166	89	0.021
-46	0.175	0	1.000	44	0.176	90	0.000
-45	0.179			45	0.179		

S.O. 27454 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

KVRS 90.3 MHz LAWTON, OK

MODEL 6513-5-DA

Elevation Gain of Antenna 5.4

V RMS 0.776

Vertical Azimuth Gain equals $1/(RMS)^2$ 1.661

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

Total Vertical Power Gain **8.967**

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ERP divided by Vertical Power Gain equals Antenna Input Power

9.8	kW ERP	Divided by V Gain	8.967	Equals	**1.093**	kW Antenna Input Power