Shively Labs
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- An Employee-Owned Company -

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S.O. 25969

Report of Test 6810-6R-DA

for

IRON RANGE BROADCASTING, INC.

WEVE-FM 97.9 MHz EVELETH, MN

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-6R-DA to meet the needs of WEVE-FM and to comply with the requirements of the FCC construction permit, file number BPH-20071016AIW.

RESULTS:

The measured azimuth pattern for the 6810-6R-DA is shown in Figure 1. Figure 1A shows the Tabulation of the Horizontal Polarization. Figure 1B shows the Tabulation of the Vertical Polarization. Figure 1C shows the Tabulation of the FCC Composite Pattern. The calculated elevation pattern of the antenna is shown in Figure 3. Construction permit file number BPH-20071016AIW indicates that the Horizontal radiation component shall not exceed 100 kW at any azimuth and is restricted to the following values at the azimuths specified:

80 Degrees T: 11.0 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 229 Degrees T to 249 Degrees T. At the restricted azimuth of 80 Degrees T the Horizontal component is 10.17 dB down from the maximum of 100 kW, or 9.6 kW.

EXHIBIT #B1
APPL FOR STATION LICENSE
IRON RANGE BROADCASTING
WEVE-FM RADIO STATION
CH 250C1 - 100.0 KW DA
EVELETH, MINNESOTA
January 2008

The R.M.S. of the Horizontal component is 0.777. The total Horizontal power gain is 5.533. The R.M.S. of the Vertical component is 0.763. The total Vertical power gain is 5.422. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.813. The R.M.S. of the measured composite pattern is 0.801. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.691. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-6R-DA was mounted on a tower of precise scale to the Pi-Rod 24 tower at the WEVE-FM site. The spacing of the antenna to the tower was varied to achieve the vertical pattern shown in Figure 1. A horizontal parasitic element was placed directly under the bay. The position of this horizontal parasitic element was changed until the horizontal pattern shown in Figure 1 was achieved. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BPH-20071016AIW, a single level of the 6810-6R-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 440.55 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 1.

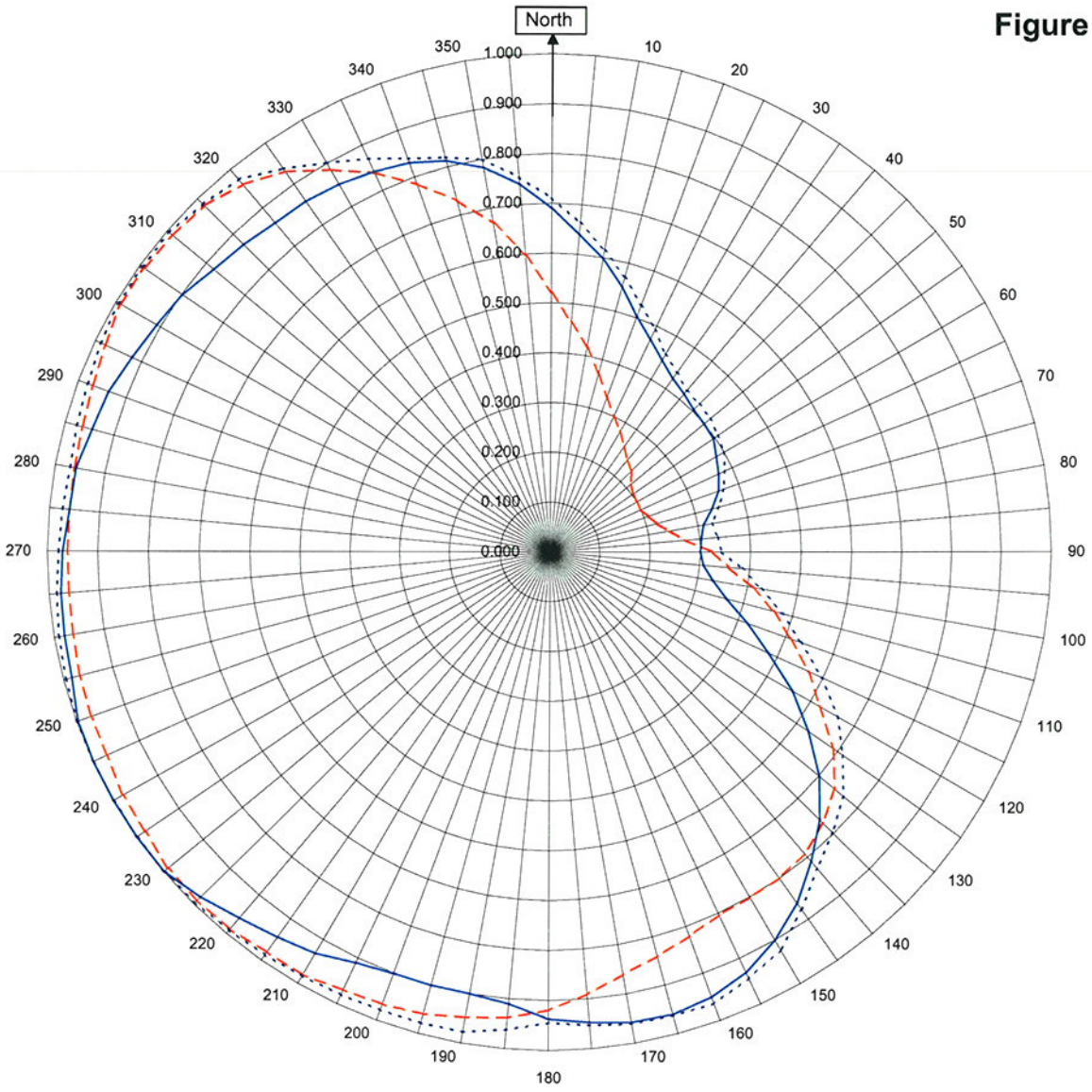
Respectfully submitted by:

Robert A. Surette
Director of Sales Engineering
S/O 25969
November 27, 2007

Shively Labs

Shively Labs, a division of Howell Laboratories, Inc. Bridgton, ME (207)647-3327

Figure 1



WEVE-FM Eveleth, MN

25969

November 27, 2007

Horizontal RMS	0.777
Vertical RMS	0.763
H/V Composite RMS	0.801
FCC Composite RMS	0.813

Frequency	97.9 / 440.55 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-6R-DA
Pattern Type	Directional Azimuth

Figure 1a

Tabulation of Horizontal Azimuth Pattern
WEVE-FM Eveleth, MN

Azimuth	Rel Field	Azimuth	Rel Field
0	0.690	180	0.937
10	0.598	190	0.900
20	0.502	200	0.900
30	0.444	210	0.930
40	0.414	220	0.960
45	0.403	225	0.981
50	0.400	230	1.000
60	0.382	240	1.000
70	0.357	250	0.997
80	0.310	260	0.980
90	0.300	270	0.970
100	0.330	280	0.958
110	0.419	290	0.936
120	0.558	300	0.907
130	0.700	310	0.880
135	0.760	315	0.870
140	0.810	320	0.860
150	0.899	330	0.850
160	0.950	340	0.830
170	0.958	350	0.782

Figure 1b

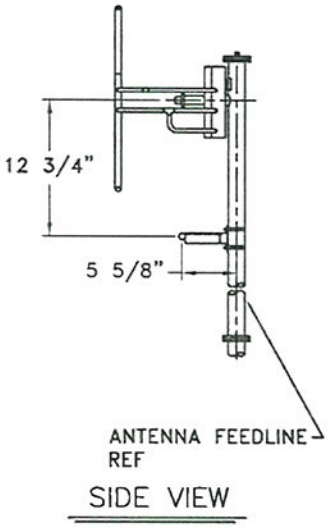
Tabulation of Vertical Azimuth Pattern
WEVE-FM Eveleth, MN

Azimuth	Rel Field	Azimuth	Rel Field
0	0.520	180	0.919
10	0.418	190	0.948
20	0.330	200	0.966
30	0.279	210	0.980
40	0.240	220	0.989
45	0.230	225	0.990
50	0.210	230	0.990
60	0.200	240	0.979
70	0.209	250	0.970
80	0.242	260	0.962
90	0.324	270	0.960
100	0.410	280	0.961
110	0.510	290	0.970
120	0.620	300	0.990
130	0.740	310	0.985
135	0.770	315	0.980
140	0.790	320	0.960
150	0.800	330	0.884
160	0.820	340	0.784
170	0.860	350	0.670

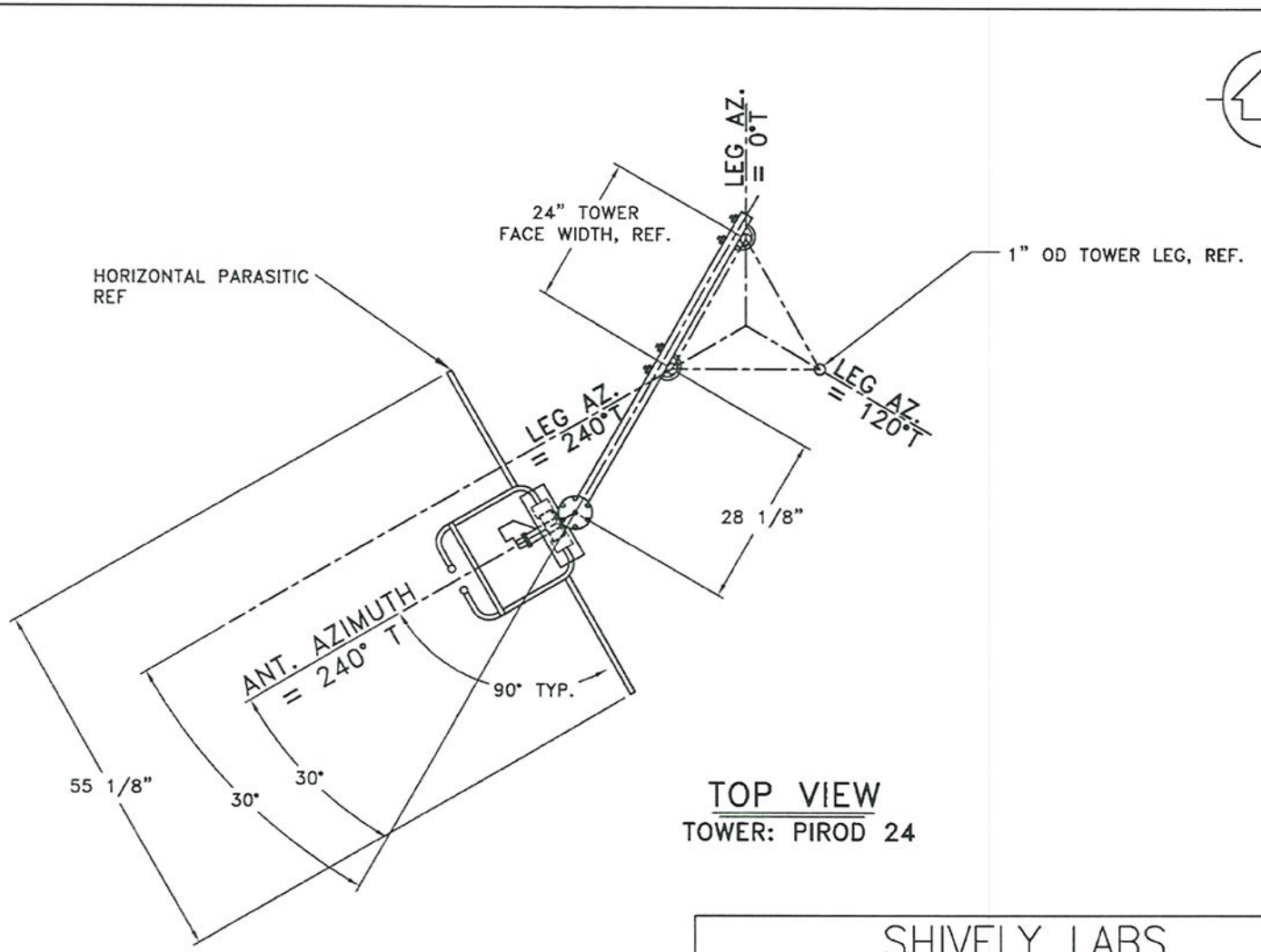
Figure 1c

Tabulation of FCC Directional Composite
WEVE-FM Eveleth, MN

Azimuth	Rel Field	Azimuth	Rel Field
0	0.710	180	0.945
10	0.614	190	0.978
20	0.526	200	0.978
30	0.457	210	0.983
40	0.422	220	0.992
50	0.416	230	1.000
60	0.399	240	1.000
70	0.368	250	1.000
80	0.328	260	0.991
90	0.342	270	0.978
100	0.427	280	0.970
110	0.531	290	0.981
120	0.661	300	0.995
130	0.763	310	0.995
140	0.829	320	0.974
150	0.922	330	0.900
160	0.964	340	0.839
170	0.961	350	0.799



SIDE VIEW

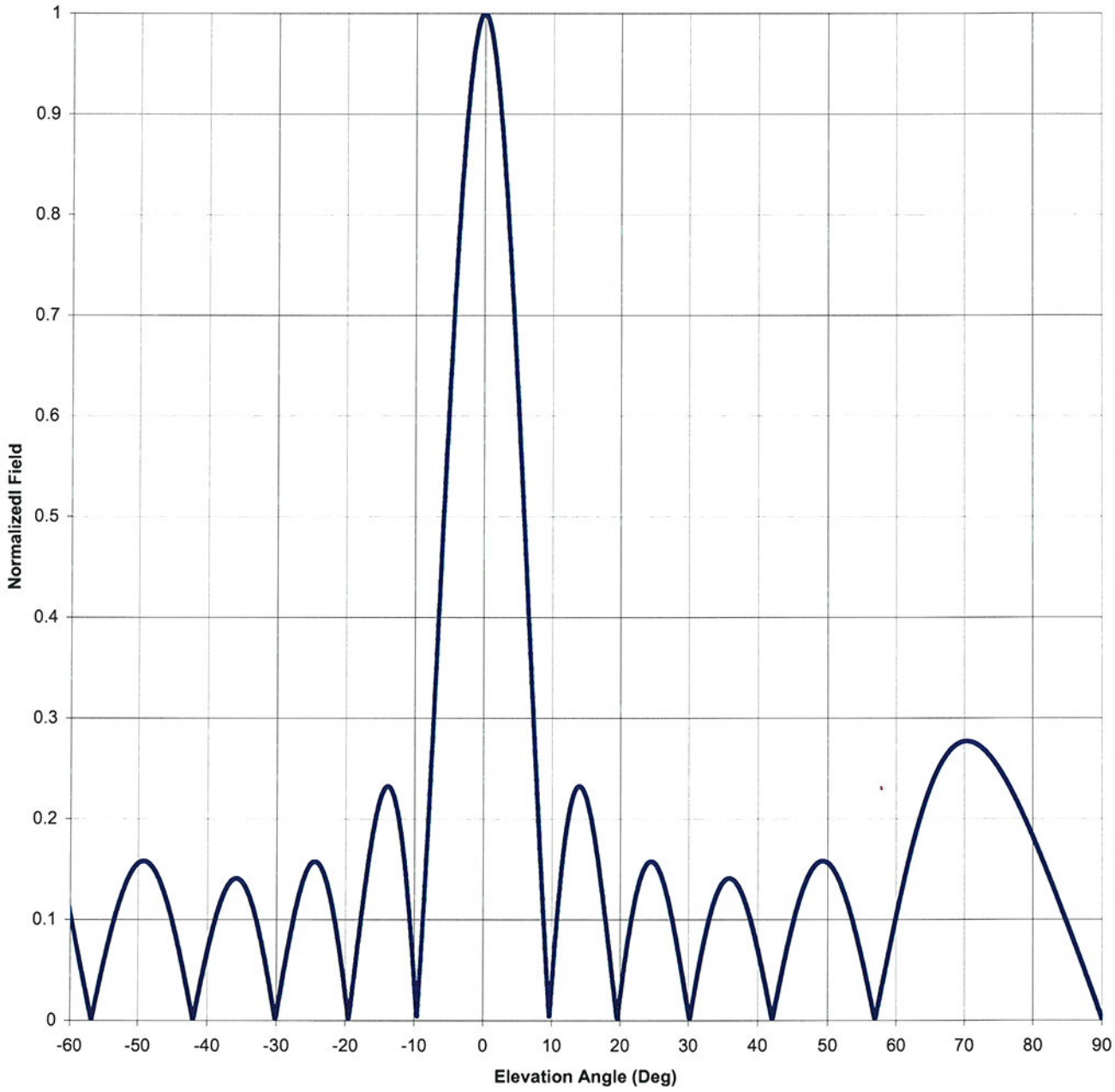


TOP VIEW
TOWER: PIROD 24

ANTENNA HEADING: 240° TRUE NORTH

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 25969	FREQUENCY: 97.9 MHz.	SCALE: N.T.S.	DRAWN BY: ASP APPROVED BY:
MODEL: 6810–6R–DIRECTIONAL ANTENNA			
DATE: 10/3/07	FIGURE 2		

Antenna Mfg.:	Shively Labs			Date: 11/27/2007
Antenna Type:	6810-6R-DA			
Station:	WEVE-FM	Beam Tilt	0	
Frequency:	97.9	Gain (Max)	5.533	7.429 dB
Channel #:	250	Gain (Horizon)	5.533	7.429 dB
Figure:	3			



Antenna Mfg.: Shively Labs
Antenna Type: 6810-6R-DA
Station: WEVE-FM
Frequency: 97.9
Channel #: 250
Figure: 3

Date: 11/27/2007

Beam Tilt	**0**	
Gain (Max)	**5.533**	**7.429 dB**
Gain (Horizon)	**5.533**	**7.429 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	0.066	0	1.000	46	0.121
-89	0.020	-43	0.033	1	0.983	47	0.140
-88	0.040	-42	0.002	2	0.931	48	0.152
-87	0.059	-41	0.037	3	0.850	49	0.158
-86	0.077	-40	0.069	4	0.742	50	0.156
-85	0.096	-39	0.098	5	0.616	51	0.148
-84	0.114	-38	0.120	6	0.478	52	0.133
-83	0.131	-37	0.135	7	0.336	53	0.113
-82	0.149	-36	0.141	8	0.198	54	0.088
-81	0.166	-35	0.137	9	0.072	55	0.059
-80	0.182	-34	0.124	10	0.037	56	0.028
-79	0.198	-33	0.101	11	0.124	57	0.005
-78	0.213	-32	0.071	12	0.186	58	0.039
-77	0.226	-31	0.034	13	0.222	59	0.072
-76	0.239	-30	0.006	14	0.232	60	0.105
-75	0.250	-29	0.047	15	0.220	61	0.136
-74	0.260	-28	0.086	16	0.189	62	0.164
-73	0.268	-27	0.119	17	0.144	63	0.190
-72	0.273	-26	0.143	18	0.090	64	0.213
-71	0.276	-25	0.156	19	0.032	65	0.232
-70	0.277	-24	0.156	20	0.024	66	0.248
-69	0.274	-23	0.142	21	0.074	67	0.260
-68	0.269	-22	0.114	22	0.114	68	0.269
-67	0.260	-21	0.074	23	0.142	69	0.274
-66	0.248	-20	0.024	24	0.156	70	0.277
-65	0.232	-19	0.032	25	0.156	71	0.276
-64	0.213	-18	0.090	26	0.143	72	0.273
-63	0.190	-17	0.144	27	0.119	73	0.268
-62	0.164	-16	0.189	28	0.086	74	0.260
-61	0.136	-15	0.220	29	0.047	75	0.250
-60	0.105	-14	0.232	30	0.006	76	0.239
-59	0.072	-13	0.222	31	0.034	77	0.226
-58	0.039	-12	0.186	32	0.071	78	0.213
-57	0.005	-11	0.124	33	0.101	79	0.198
-56	0.028	-10	0.037	34	0.124	80	0.182
-55	0.059	-9	0.072	35	0.137	81	0.166
-54	0.088	-8	0.198	36	0.141	82	0.149
-53	0.113	-7	0.336	37	0.135	83	0.131
-52	0.133	-6	0.478	38	0.120	84	0.114
-51	0.148	-5	0.616	39	0.098	85	0.096
-50	0.156	-4	0.742	40	0.069	86	0.077
-49	0.158	-3	0.850	41	0.037	87	0.059
-48	0.152	-2	0.931	42	0.002	88	0.040
-47	0.140	-1	0.983	43	0.033	89	0.020
-46	0.121	0	1.000	44	0.066	90	0.000
-45	0.096			45	0.096		

S.O. 25969 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WEVE-FM 97.9 MHz Eveleth, MN

MODEL 6810-6R-DA

Elevation Gain of Antenna 3.28

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

H RMS 0.777 V RMS 0.763 H/V Ratio 1.018

Elevation Gain of Horizontal Component 3.340

Elevation Gain of Vertical Component 3.221

Horizontal Azimuth Gain equals 1/(RMS)SQ. 1.656

Vertical Azimuth Gain equals 1/(RMS/Max Vert)SQ. 1.684
Max. Vertical 0.99

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

Total Horizontal Power Gain = **5.533**

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

Total Vertical Power Gain = **5.422**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

100 KW ERP Equals 18.075 KW Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

18.075 KW Times 5.422 KW Equals 98.010 KW ERP

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

0.99 Equals 98.010 KW Vertical ERP

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

AFFIDAVIT

January 14, 2008,

Federal Communications Commission
Audio Services Division

RE: WEVE-FM, Eveleth, Minnesota

To Whom It May Concern:

In compliance with Special Operating Condition number 3 of Permit Number BPH-20071016AIW, I hereby sumbit the following:

The antenna, a Shively 6810-6R-DA, was installed according to the manufacturer's instructions as outlined in the attached blueprints, by Lacrescent Erection Company, which has over 30 years experience.

I, David Huston, have been involved continuously in the field of Broadcast Engineering since September, 1975. I am holder of FCC (First Class P1-19-36803) General Radio Telephone License number PG-19-5797. I have made numerous submissions to the Commission during those years, and have been associated with WEVE on a contract basis since 1993.

I, David Huston, hereby state the above to be true and correct this 14th day of January, 2008.

David Huston

David Huston Electronic Services
P.O. Box 631
Ely, MN 55731

EXHIBIT #B2
APPL FOR STATION LICENSE
IRON RANGE BROADCASTING
WEVE-FM RADIO STATION
CH 250C1 - 100.0 KW DA
EVELETH, MINNESOTA
January 2008

AFFIDAVIT OF SURVEYOR

I, Bruce R. Chernak, A Registered Surveyor in the State of Minnesota, License No. 23683 of Bear Island Surveying, Inc. of Ely, Minnesota, do state the following:

1. I have surveyed an existing directional antenna for WEVE (FM), Eveleth, MN. The given coordinates of said antenna are:
   North Latitude: 47° 35' 53"
   West Longitude: 92° 13' 26"

2. Based on the assumption that the Southwest guy anchor of the antenna tower has an azimuth of 236° 13' 40", I have determined that the mean Azimuth of the six antennae on the directional antenna array to be 240° 00' 00".

Further affiant sayeth not.

January 14, 2008
Dated

B. R. Ch
Bruce R. Chernak

Signed and affirmed this 14th day of January, 2008.

Marcia A. Mahoney
Notary Public

This instrument drafted by:
Bear Island Surveying
943 E. Sheridan Street
Ely, MN 55731
218-365-6893

MARCIA A. MAHONEY
NOTARY PUBLIC - MINNESOTA
My Comm. Exp. Jan. 31, 2010

EXHIBIT #B3
APPL FOR STATION LICENSE
IRON RANGE BROADCASTING
WEVE-FM RADIO STATION
CH 250C1 - 100.0 KW DA
EVELETH, MINNESOTA
January 2008