Shively Labs
a division of Howell Laboratories,Inc.

P. O. Box 389 Harrison Rd.,
Bridgton, Maine 04009 USA

- An Employee-Owned Company -

(207) 647-3327
888-SHIVELY
Fax: (207) 647-8273
E-mail: sales@shively.com
Web site: www.shively.com

S.O. 26942

Report of Test 6810-2R-SS-DA

for

VERMONT PUBLIC RADIO

WVTI 106.9 MHz Brighton, VT

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-2R-SS-DA to meet the needs of WVTI and to comply with the requirements of the FCC construction permit, file number BNPH-20060308AIL.

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
Figure 5 - Amended FCC Composite Azimuth Pattern
Figure 5A - Tabulation of Amended FCC Composite Azimuth Pattern

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

Construction permit file number BNPH-20060308AIL indicates that the Horizontal radiation component shall not exceed 1.40 kW at any azimuth and is restricted to the following values at the azimuths specified:

90 Degrees T: 0.135 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 304 Degrees T to 310 Degrees T. At the restricted azimuth of 90 Degrees T the Horizontal component is 11.06 dB down from the maximum of 1.40 kW, or 0.110 kW.

The R.M.S. of the Horizontal component is 0.691. The total Horizontal power gain is 1.697. The R.M.S. of the Vertical component is 0.597. The total Vertical power gain is 1.499. See Figure 4 for calculations.

AMENDED FCC COMPOSITE PATTERN:

The R.M.S. of the measured composite pattern is 0.704. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.759. Therefore the measured pattern does not comply with the FCC requirement of 73.316(c)(ix)(A). In accordance with 73.1690(c)(2)(ii) an amended composite pattern with an R.M.S. value of 0.828 is attached as Figure 5. Figure 5A shows the tabulations of the amended composite pattern. This new composite pattern allows the above measured pattern to comply with the FCC requirement of 73.316(c)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-2R-SS-DA was mounted on a pole of precise scale to the 4″ O.D. pole at the WVTI site. The spacing of the antenna to the pole was varied to achieve the vertical pattern shown in Figure 1A. 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 1A was achieved. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BNPH-20060308AIL, a single level of the 6810-2R-SS-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 481.05 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 26942
September 15, 2008

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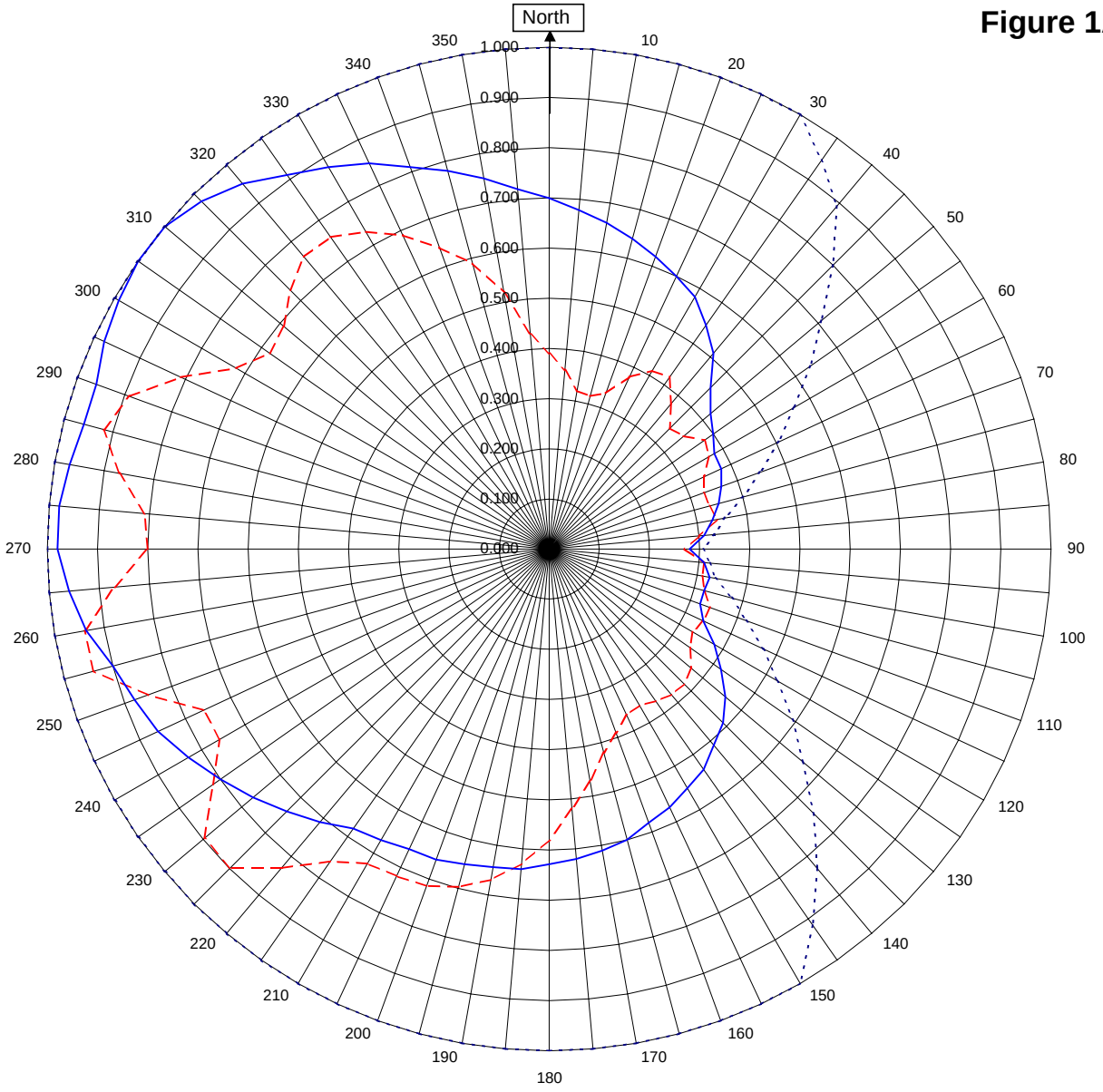
Figure 1A



WVTI Brighton, VT

26942

September 9, 2008

Horizontal RMS	0.691
Vertical RMS	0.597
H/V Composite RMS	0.704
FCC Composite RMS	0.893

Frequency	106.9 / 481.05 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-2R-SS-DA Pattern 11-B
Pattern Type	Directional Azimuth

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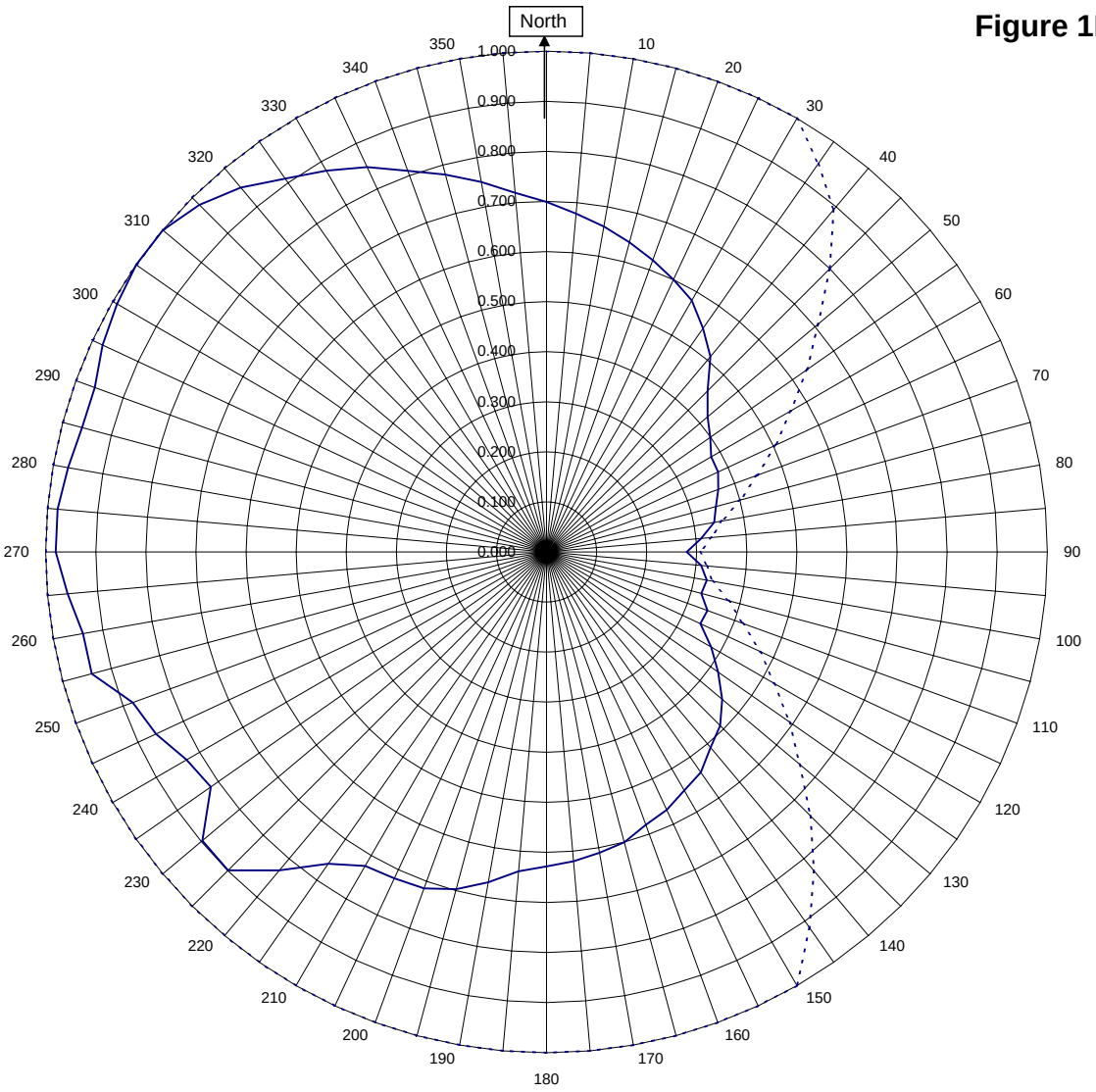
Figure 1B



WVTI Brighton, VT

26942

September 9, 2008

_____H/VComposite RMS	0.704
……..FCC Composite RMS	0.893

Frequency	106.9 / 481.05 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-2R-SS-DA Pattern 11-B
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WVTI Brighton, VT

Azimuth	Rel Field	Azimuth	Rel Field
0	0.699	180	0.628
10	0.660	190	0.644
20	0.620	200	0.659
30	0.580	210	0.670
40	0.509	220	0.710
45	0.455	225	0.740
50	0.420	230	0.770
60	0.380	240	0.830
70	0.365	250	0.879
80	0.330	260	0.937
90	0.280	270	0.980
100	0.325	280	0.970
110	0.320	290	0.960
120	0.380	300	0.990
130	0.458	310	1.000
135	0.490	315	0.980
140	0.510	320	0.950
150	0.550	330	0.879
160	0.580	340	0.810
170	0.610	350	0.750

Figure 1D

Tabulation of Vertical Azimuth Pattern
WVTI Brighton, VT

Azimuth	Rel Field	Azimuth	Rel Field
0	0.390	180	0.580
10	0.320	190	0.670
20	0.330	200	0.715
30	0.410	210	0.724
40	0.378	220	0.830
45	0.340	225	0.899
50	0.350	230	0.897
60	0.368	240	0.758
70	0.328	250	0.850
80	0.340	260	0.940
90	0.270	270	0.800
100	0.310	280	0.870
110	0.342	290	0.890
120	0.330	300	0.720
130	0.370	310	0.690
135	0.380	315	0.730
140	0.379	320	0.760
150	0.360	330	0.730
160	0.390	340	0.639
170	0.470	350	0.520

Figure 1E

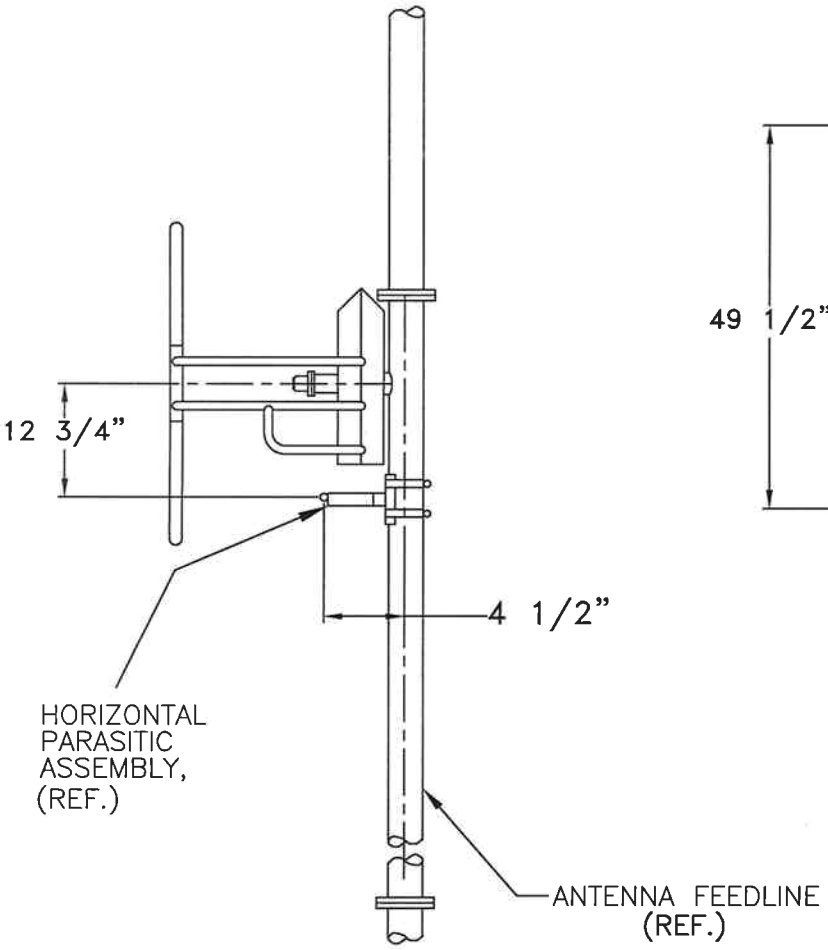
Tabulation of Composite Azimuth Pattern
WVTI Brighton, VT

Azimuth	Rel Field	Azimuth	Rel Field
0	0.699	180	0.628
10	0.660	190	0.670
20	0.620	200	0.715
30	0.580	210	0.724
40	0.509	220	0.830
45	0.455	225	0.899
50	0.365	230	0.897
60	0.380	240	0.830
70	0.365	250	0.879
80	0.340	260	0.940
90	0.280	270	0.980
100	0.325	280	0.970
110	0.342	290	0.960
120	0.380	300	0.990
130	0.458	310	1.000
135	0.490	315	0.980
140	0.510	320	0.950
150	0.550	330	0.879
160	0.580	340	0.810
170	0.610	350	0.750

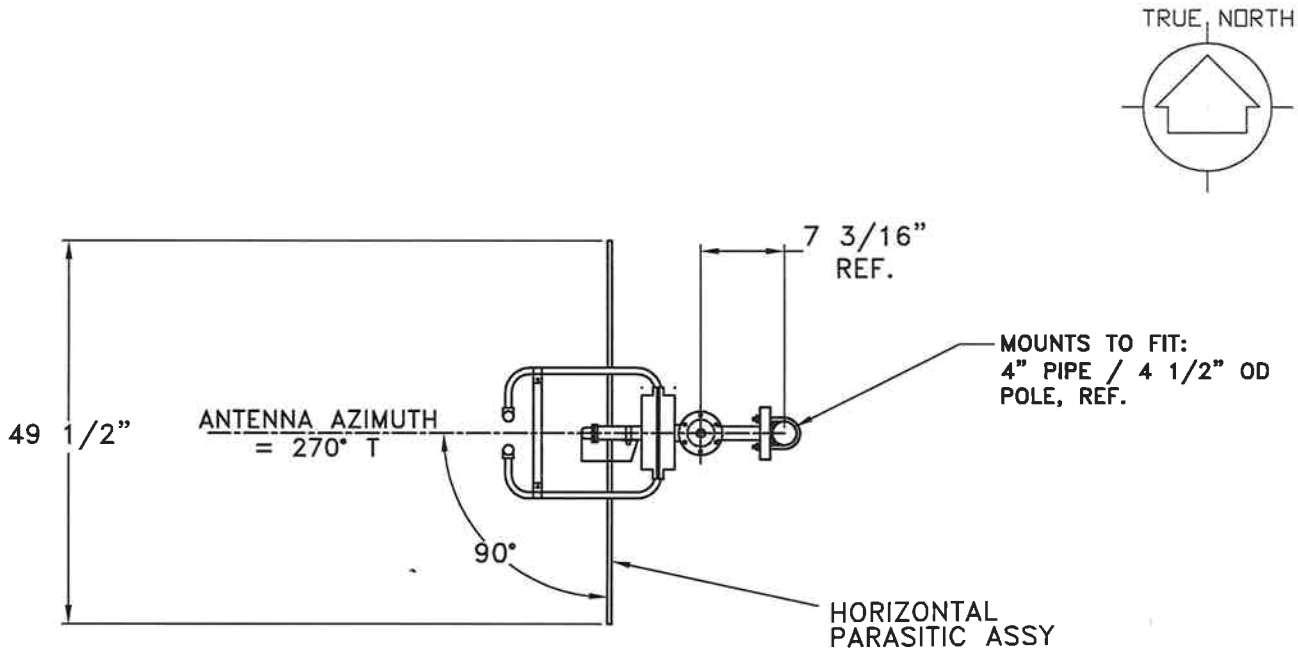
Figure 1F

Tabulation of FCC Directional Composite
WVTI Brighton, VT

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	1.000
10	1.000	190	1.000
20	1.000	200	1.000
30	1.000	210	1.000
40	0.892	220	1.000
50	0.708	230	1.000
60	0.563	240	1.000
70	0.447	250	1.000
80	0.355	260	1.000
90	0.307	270	1.000
100	0.336	280	1.000
110	0.417	290	1.000
120	0.525	300	1.000
130	0.660	310	1.000
140	0.831	320	1.000
150	1.000	330	1.000
160	1.000	340	1.000
170	1.000	350	1.000



SIDE VIEW

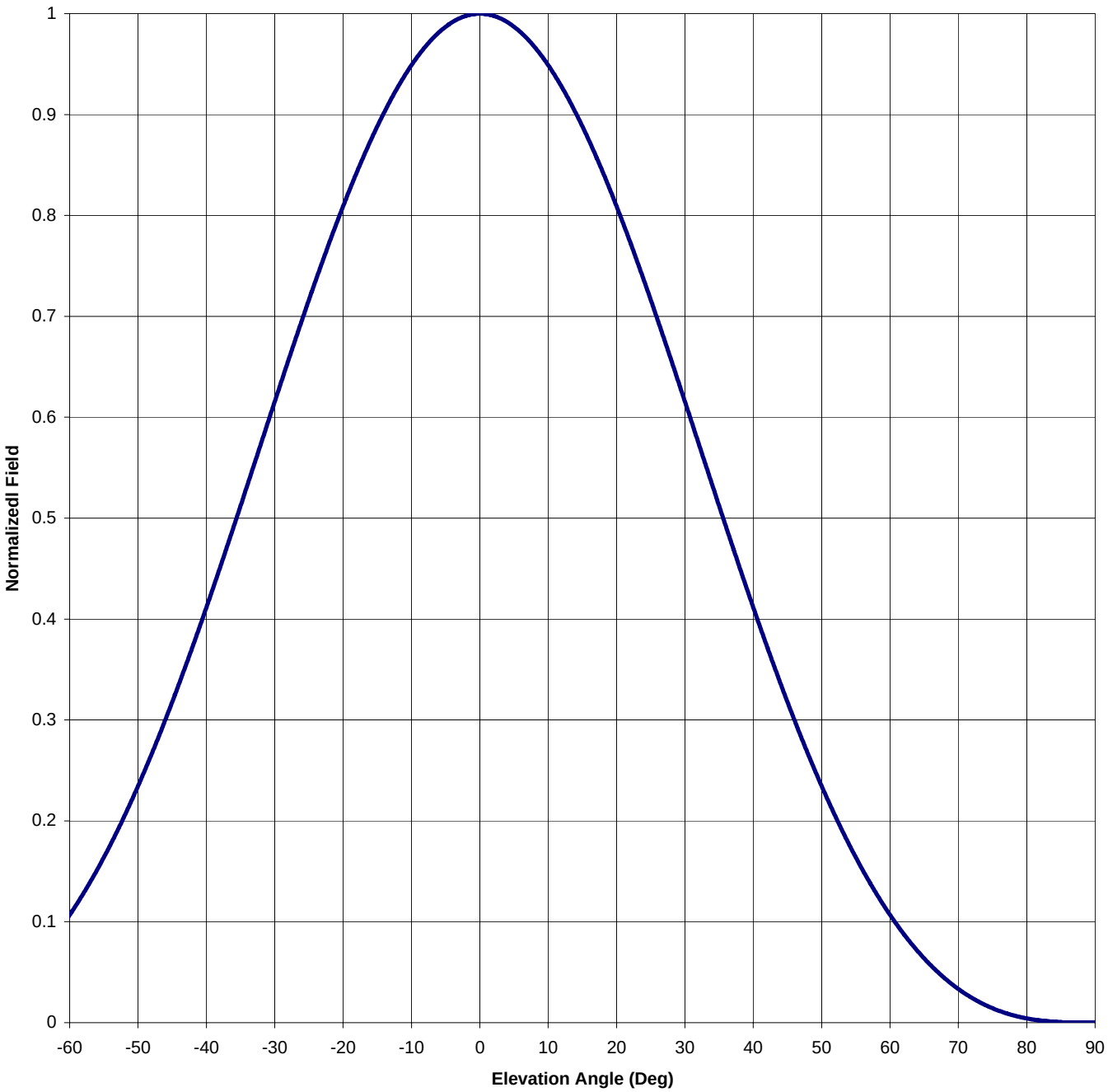


TOP VIEW
TOWER: POLE

ANTENNA HEADING 270° TRUE NORTH

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 26942	FREQUENCY: 106.9 MHz.	SCALE: N.T.S.	DRAWN BY: ASP APPROVED BY: DAB
TITLE: MODEL-6810-2R-SS-DIRECTIONAL ANTENNA			
DATE: 9/11/08	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date: 9/16/2008**
Antenna Type:	**6810-2R-SS-DA**			
Station:	**WVTI**	**Beam Tilt**	**0**	
Frequency:	**106.9**	**Gain (Max)**	**1.697**	**2.297 dB**
Channel #:	**202**	**Gain (Horizon)**	**1.697**	**2.297 dB**
Figure:	**3**			



Antenna Mfg.: Shively Labs
Antenna Type: 6810-2R-SS-DA
Station: WVTI
Frequency: 106.9
Channel #: 202
Figure: 3

Beam Tilt 0
Gain (Max) 1.697 **2.297 dB**
Gain (Horizon) 1.697 **2.297 dB**

Date: 9/16/2008

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	0.336	0	1.000	46	0.300
-89	0.000	-43	0.354	1	0.999	47	0.283
-88	0.000	-42	0.373	2	0.998	48	0.266
-87	0.000	-41	0.392	3	0.995	49	0.250
-86	0.000	-40	0.411	4	0.992	50	0.234
-85	0.000	-39	0.431	5	0.987	51	0.219
-84	0.001	-38	0.451	6	0.981	52	0.205
-83	0.001	-37	0.471	7	0.975	53	0.190
-82	0.002	-36	0.492	8	0.967	54	0.177
-81	0.003	-35	0.512	9	0.958	55	0.164
-80	0.004	-34	0.533	10	0.949	56	0.151
-79	0.006	-33	0.553	11	0.938	57	0.139
-78	0.007	-32	0.574	12	0.927	58	0.128
-77	0.009	-31	0.595	13	0.915	59	0.117
-76	0.012	-30	0.616	14	0.902	60	0.107
-75	0.014	-29	0.636	15	0.888	61	0.097
-74	0.017	-28	0.656	16	0.874	62	0.088
-73	0.021	-27	0.677	17	0.859	63	0.079
-72	0.024	-26	0.697	18	0.843	64	0.071
-71	0.029	-25	0.716	19	0.826	65	0.064
-70	0.033	-24	0.736	20	0.809	66	0.057
-69	0.038	-23	0.755	21	0.791	67	0.050
-68	0.044	-22	0.773	22	0.773	68	0.044
-67	0.050	-21	0.791	23	0.755	69	0.038
-66	0.057	-20	0.809	24	0.736	70	0.033
-65	0.064	-19	0.826	25	0.716	71	0.029
-64	0.071	-18	0.843	26	0.697	72	0.024
-63	0.079	-17	0.859	27	0.677	73	0.021
-62	0.088	-16	0.874	28	0.656	74	0.017
-61	0.097	-15	0.888	29	0.636	75	0.014
-60	0.107	-14	0.902	30	0.616	76	0.012
-59	0.117	-13	0.915	31	0.595	77	0.009
-58	0.128	-12	0.927	32	0.574	78	0.007
-57	0.139	-11	0.938	33	0.553	79	0.006
-56	0.151	-10	0.949	34	0.533	80	0.004
-55	0.164	-9	0.958	35	0.512	81	0.003
-54	0.177	-8	0.967	36	0.492	82	0.002
-53	0.190	-7	0.975	37	0.471	83	0.001
-52	0.205	-6	0.981	38	0.451	84	0.001
-51	0.219	-5	0.987	39	0.431	85	0.000
-50	0.234	-4	0.992	40	0.411	86	0.000
-49	0.250	-3	0.995	41	0.392	87	0.000
-48	0.266	-2	0.998	42	0.373	88	0.000
-47	0.283	-1	0.999	43	0.354	89	0.000
-46	0.300	0	1.000	44	0.336	90	0.000
-45	0.318			45	0.318		

S.O. 26942 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WVTI 106.9 MHz Brighton, VT

6810-2R-SS-DA

Elevation Gain of Antenna 0.7

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

H RMS 0.691 V RMS 0.597 H/V Ratio 1.157

Elevation Gain of Horizontal Component 0.810

Elevation Gain of Vertical Component 0.605

Horizontal Azimuth Gain equals $1/(RMS)^2$. 2.094

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 2.479

Max. Vertical 0.94

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

Total Horizontal Power Gain = **1.697**

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

Total Vertical Power Gain = **1.499**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

1.4 kW ERP Divided by H Gain 1.697 equals 0.83 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

0.825 kW Times V Gain 1.499 equals 1.237 kW V ERP

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

(0.94)^2 Times 1.40 Equals 1.237 kW Vertical ERP

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

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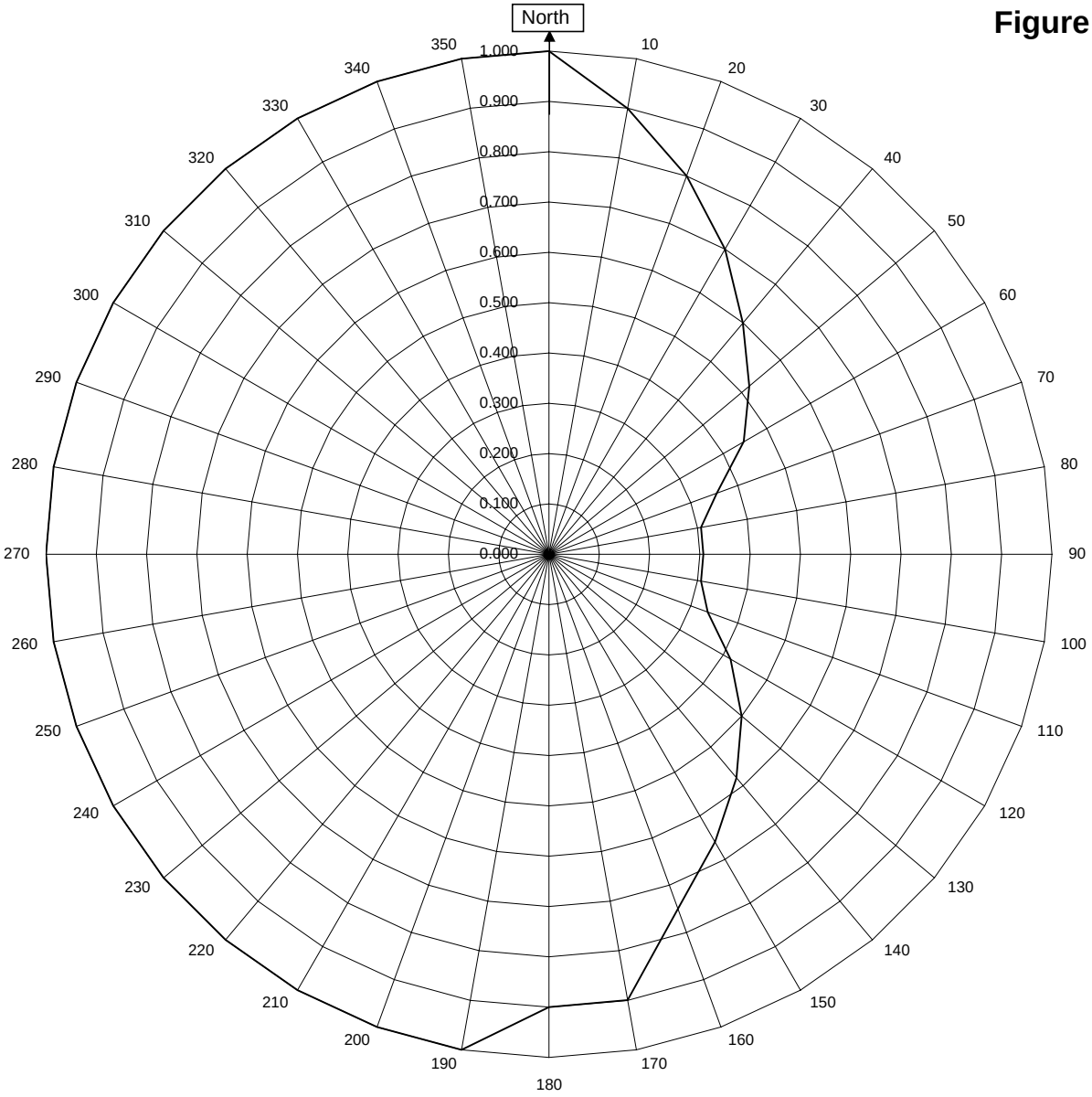
Figure 5



WVTI Brighton, VT

26942

September 10, 2008

Amended Composite RMS	0.828
85% Amended Composite RMS	0.704

Frequency	106.9 / 481.05 mHz
Plot	Relative Field

Antenna Model	6810-2R-SS-DA Pattern 11-B
Pattern Type	Amended FCC Composite

Figure 5a

Tabulation of Amended Composite Pattern
WVTI Brighton, VT

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.900
10	0.900	190	1.000
20	0.800	200	1.000
30	0.700	210	1.000
40	0.600	220	1.000
50	0.520	230	1.000
60	0.447	240	1.000
70	0.355	250	1.000
80	0.307	260	1.000
90	0.307	270	1.000
100	0.307	280	1.000
110	0.336	290	1.000
120	0.417	300	1.000
130	0.500	310	1.000
140	0.580	320	1.000
150	0.660	330	1.000
160	0.750	340	1.000
170	0.900	350	1.000