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S.O. 24069

Report of Test 6810-4R-SS-DA

for

ADDISON BROADCASTING COMPANY, INC.

WXAL-FM 93.7 MHZ ADDISON, VT

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-4R-SS-DA to meet the needs of WXAL-FM and to comply with the requirements of the FCC construction permit, file number BPH-20030429AAE.

RESULTS:

The measured azimuth pattern for the 6810-4R-SS-DA is shown in Figure 1. Figure 1A shows the Tabulation of the Horizontal Polarization. Figure 1B shows the Tabulation of the Vertical Polarization. The calculated elevation pattern of the antenna is shown in Figure 3. Construction permit file number BPH-20030429AAE indicates that the Horizontal radiation component shall not exceed 21.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

75 Degrees T: 2.357 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 248 Degrees T to 262 Degrees T. At the restricted azimuth of 75 Degrees T the Horizontal component is 10.20 dB down from the maximum of 21.0 kW, or 2.005 kW.

The R.M.S. of the Horizontal component is 0.785. The total Horizontal power gain is 2.127. The R.M.S. of the Vertical component is 0.790. The total Vertical power gain is 2.085. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.914. The R.M.S. of the measured composite pattern is 0.797. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.777. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-4R-SS-DA was mounted on a pole of exact scale to the 6″ (6 5/8″ OD) outrigged pole at the WXAL-FM site. The spacing of the antenna to the pole was varied and vertical parasitic elements were attached to the interbay feedline 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-20030429AAE, a single level of the 6810-4R-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 Edition 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 421.65 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.

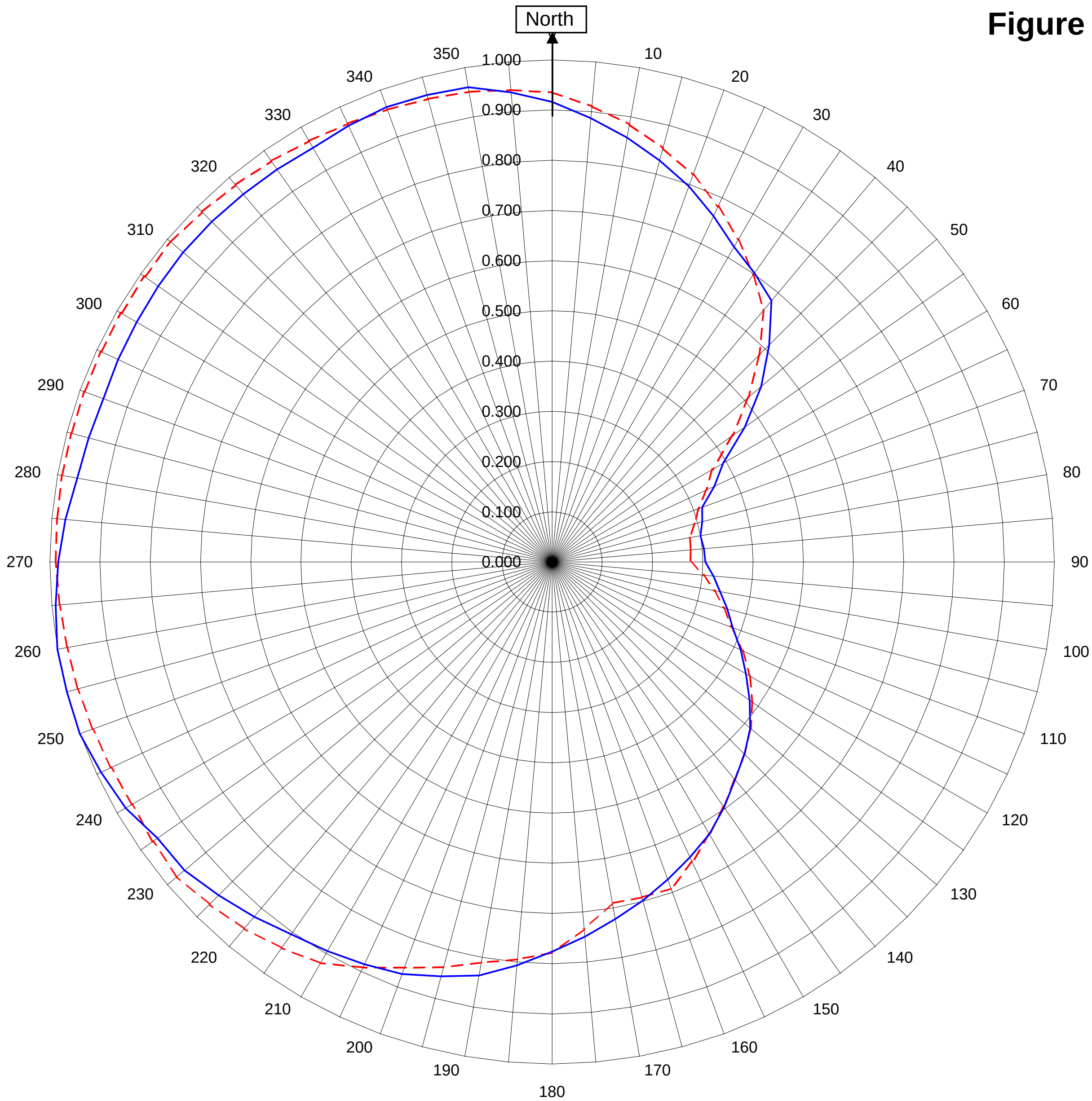
Respectfully submitted by:

Robert A. Surette
Manager of RF Engineering
S/O 24069
July 27, 2005

Shively Labs

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

Figure 1



WXAL Addison, VT

24069

July 8, 2005

Horizontal RMS	0.785
Vertical RMS	0.790
H/V Composite RMS	0.797

Frequency	93.7 / 421.65 mHz
Plot	Relative Field
Scale	4.5 : 1

Antenna Model	6810-4R-SS-DA
Pattern Type	Directional Azimuth

See Figure 2 for Mechanical Details

Figure 1a

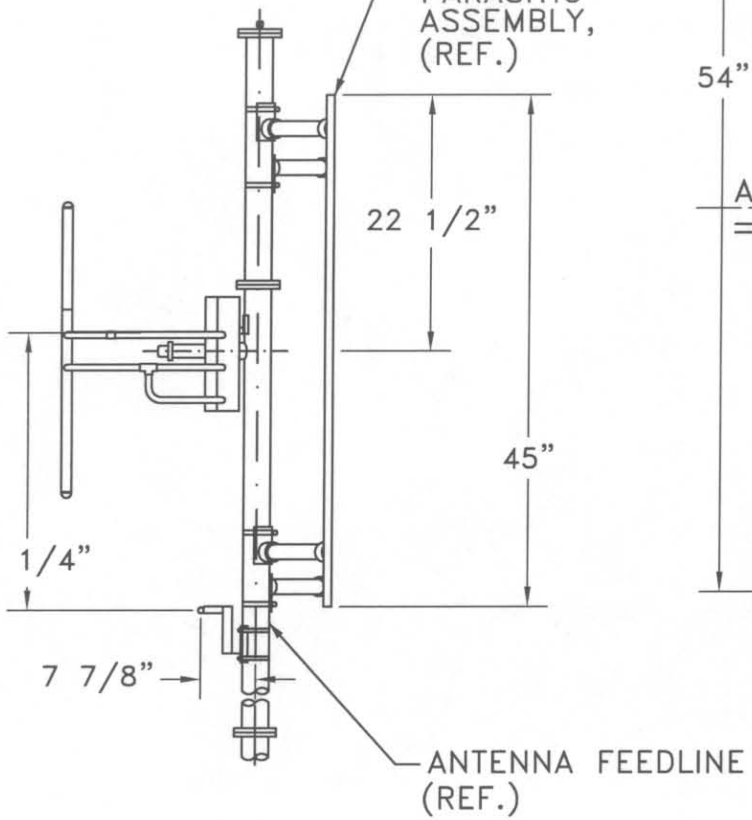
Tabulation of Horizontal Azimuth Pattern
WXAL Addison, VT

Azimuth	Rel Field	Azimuth	Rel Field
0	0.916	180	0.776
10	0.858	190	0.836
20	0.796	200	0.873
30	0.724	210	0.895
40	0.679	220	0.922
45	0.611	225	0.938
50	0.543	230	0.955
60	0.393	240	0.980
70	0.318	250	1.000
80	0.300	260	1.000
90	0.305	270	0.983
100	0.339	280	0.960
110	0.382	290	0.950
120	0.445	300	0.955
130	0.515	310	0.959
135	0.541	315	0.958
140	0.566	320	0.956
150	0.625	330	0.952
160	0.673	340	0.964
170	0.722	350	0.960

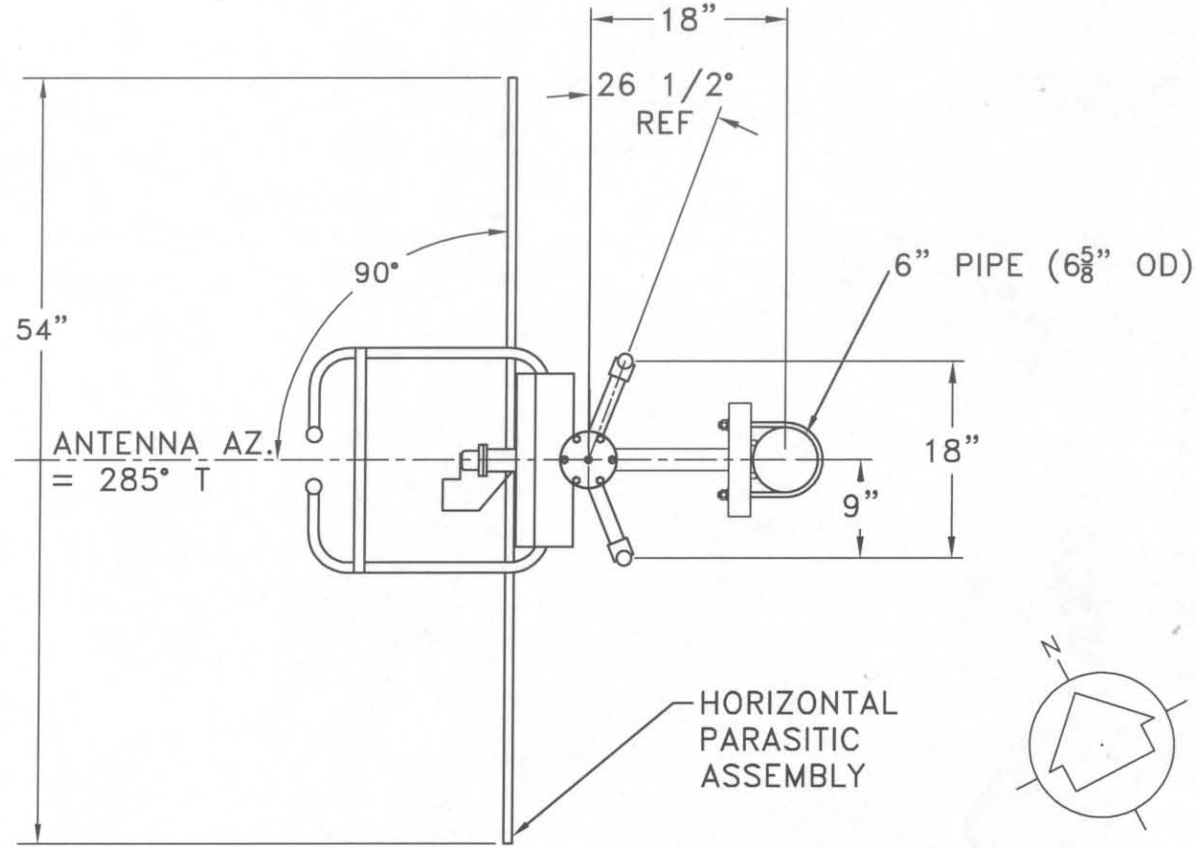
Figure 1b

Tabulation of Vertical Azimuth Pattern
WXAL Addison, VT

Azimuth	Rel Field	Azimuth	Rel Field
0	0.935	180	0.778
10	0.885	190	0.810
20	0.820	200	0.860
30	0.741	210	0.922
40	0.655	220	0.953
45	0.583	225	0.964
50	0.510	230	0.975
60	0.368	240	0.965
70	0.310	250	0.973
80	0.278	260	0.980
90	0.275	270	0.988
100	0.328	280	0.990
110	0.380	290	0.990
120	0.455	300	0.990
130	0.516	310	0.990
135	0.541	315	0.985
140	0.565	320	0.980
150	0.625	330	0.968
160	0.692	340	0.958
170	0.690	350	0.950



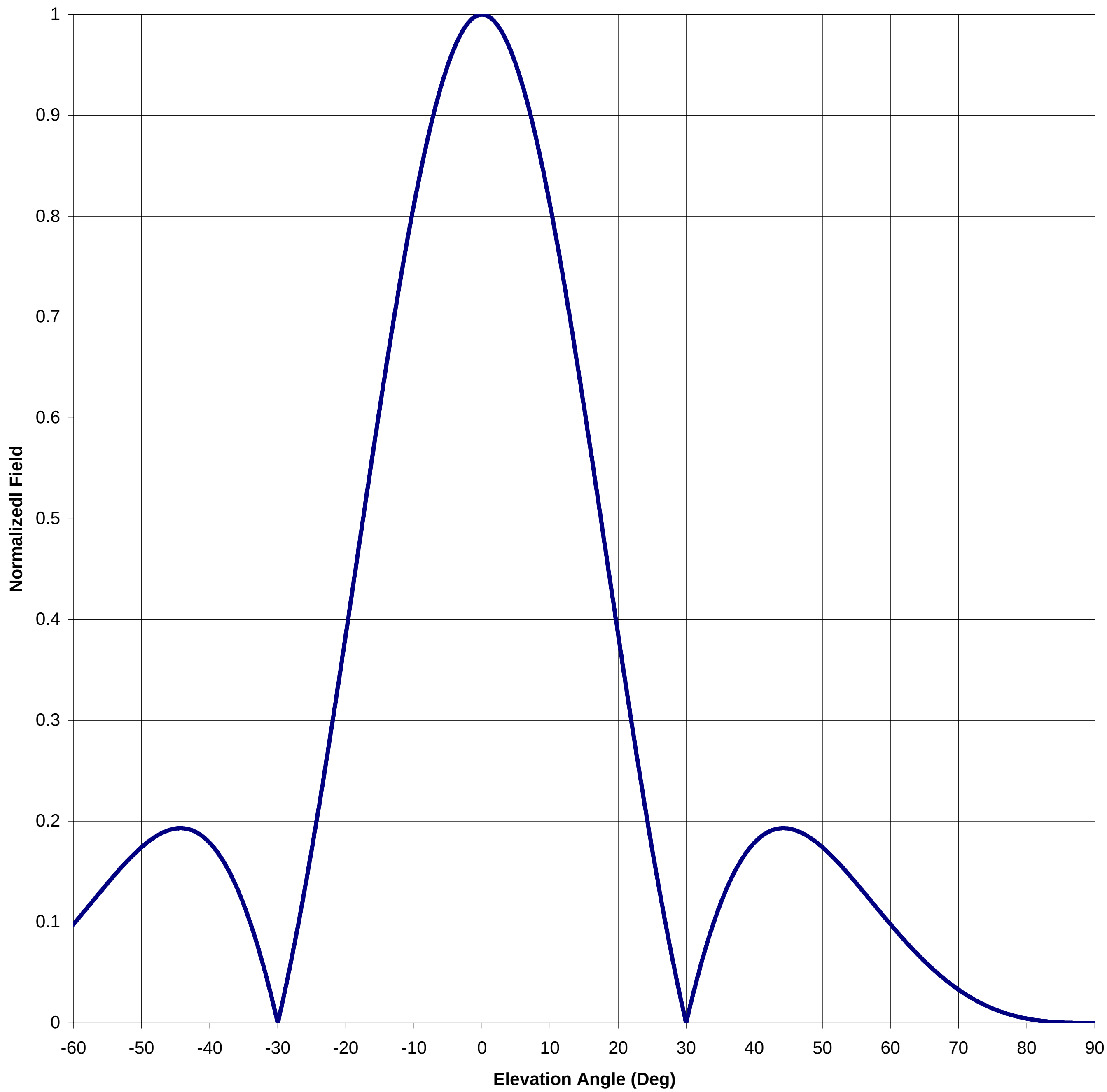
SIDE VIEW



TOP VIEW
OUTRIGGED POLE
6" PIPE (6 ⅝" OD)

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE			
SHOP ORDER: 24069	FREQUENCY: 93.7 MHz.	SCALE: N.T.S.	DRAWN BY: AMG APPROVED BY:
TITLE: MODEL-6810-4R-SS-DIRECTIONAL ANTENNA			
DATE: 6/30/05	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date:**	**7/27/2005**
Antenna Type:	**6810-4R-SS-DA**				
Station:	**WXAL-FM**	**Beam Tilt**	**0**		
Frequency:	**93.7**	**Gain (Max)**	**2.127**	**3.278**	**dB**
Channel #:	**229**	**Gain (Horizon)**	**2.127**	**3.278**	**dB**
Figure:	**3**				



Antenna Mfg.: Shively Labs
Antenna Type: 6810-4R-SS-DA
Station: WXAL-FM
Frequency: 93.7
Channel #: 229
Figure: 3

Date: 7/27/2005

Beam Tilt	0	
Gain (Max)	2.127	3.278 dB
Gain (Horizon)	2.127	3.278 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	0.193	0	1.000	46	0.191
-89	0.000	-43	0.192	1	0.998	47	0.188
-88	0.000	-42	0.189	2	0.992	48	0.185
-87	0.000	-41	0.185	3	0.982	49	0.180
-86	0.000	-40	0.179	4	0.968	50	0.174
-85	0.001	-39	0.171	5	0.950	51	0.168
-84	0.001	-38	0.161	6	0.929	52	0.161
-83	0.001	-37	0.149	7	0.904	53	0.154
-82	0.002	-36	0.134	8	0.876	54	0.146
-81	0.003	-35	0.118	9	0.845	55	0.138
-80	0.004	-34	0.099	10	0.811	56	0.130
-79	0.006	-33	0.078	11	0.775	57	0.122
-78	0.007	-32	0.054	12	0.736	58	0.114
-77	0.009	-31	0.028	13	0.696	59	0.106
-76	0.012	-30	0.000	14	0.654	60	0.098
-75	0.014	-29	0.030	15	0.610	61	0.090
-74	0.017	-28	0.063	16	0.566	62	0.082
-73	0.021	-27	0.097	17	0.521	63	0.075
-72	0.024	-26	0.134	18	0.476	64	0.068
-71	0.029	-25	0.172	19	0.430	65	0.061
-70	0.033	-24	0.212	20	0.385	66	0.055
-69	0.038	-23	0.254	21	0.340	67	0.049
-68	0.043	-22	0.297	22	0.297	68	0.043
-67	0.049	-21	0.340	23	0.254	69	0.038
-66	0.055	-20	0.385	24	0.212	70	0.033
-65	0.061	-19	0.430	25	0.172	71	0.029
-64	0.068	-18	0.476	26	0.134	72	0.024
-63	0.075	-17	0.521	27	0.097	73	0.021
-62	0.082	-16	0.566	28	0.063	74	0.017
-61	0.090	-15	0.610	29	0.030	75	0.014
-60	0.098	-14	0.654	30	0.000	76	0.012
-59	0.106	-13	0.696	31	0.028	77	0.009
-58	0.114	-12	0.736	32	0.054	78	0.007
-57	0.122	-11	0.775	33	0.078	79	0.006
-56	0.130	-10	0.811	34	0.099	80	0.004
-55	0.138	-9	0.845	35	0.118	81	0.003
-54	0.146	-8	0.876	36	0.134	82	0.002
-53	0.154	-7	0.904	37	0.149	83	0.001
-52	0.161	-6	0.929	38	0.161	84	0.001
-51	0.168	-5	0.950	39	0.171	85	0.001
-50	0.174	-4	0.968	40	0.179	86	0.000
-49	0.180	-3	0.982	41	0.185	87	0.000
-48	0.185	-2	0.992	42	0.189	88	0.000
-47	0.188	-1	0.998	43	0.192	89	0.000
-46	0.191	0	1.000	44	0.193	90	0.000
-45	0.193			45	0.193		

S.O. 24069 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WXAL-FM 93.7 MHz ADDISON, VT

MODEL 6810-4R-SS-DA

Elevation Gain of Antenna 1.319

The RMS values are calculated utilizing the data of a planimeter

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

H RMS 0.785 V RMS 0.79 H/V Ratio 0.994

Elevation Gain of Horizontal Component 1.311

Elevation Gain of Vertical Component 1.327

Horizontal Azimuth Gain equals 1/(RMS)SQ. 1.623

Vertical Azimuth Gain equals 1/(RMS/Max Vert)SQ. 1.570
Max. Vertical 0.99

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

Total Horizontal Power Gain = **2.127**

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

Total Vertical Power Gain = **2.085**

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ERP divided by Horizontal Power Gain equals Antenna Input Power

21 KW ERP Equals 9.874 KW Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

9.874 KW Times 2.085 KW Equals 20.582 KW ERP

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

0.99 Equals 20.582 KW Vertical ERP

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