Shively Labs
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S.O. 24665

Report of Test 6810-6-DA

for

RADIO TRAINING NETWORK, INC.

WLFS 91.9 MHz Port Wentworth, GA

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-6-DA to meet the needs of WLFS and to comply with the requirements of the FCC construction permit, file number BPED-20060526AAO.

RESULTS:

The measured azimuth pattern for the 6810-6-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 BPED-20060526AAO indicates that the Horizontal radiation component shall not exceed 23.5 kW at any azimuth and is restricted to the following values at the azimuths specified:

290 - 310 Degrees T: 1.50 kW
315 Degrees T: 1.80 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 104 Degrees T to 151 Degrees T. At the restricted azimuth of 290 - 310 Degrees T the Horizontal component is 12.77 dB down from the maximum of 23.5 kW, or 1.24 kW. At the restricted azimuth of 315 Degrees T the Vertical component is 12.77 dB down from the maximum of 23.5 kW, or 1.24 kW.

EXHIBIT B

The R.M.S. of the Horizontal component is 0.755. The total Horizontal power gain is 5.762. The R.M.S. of the Vertical component is 0.754. The total Vertical power gain is 5.647. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.824. The R.M.S. of the measured composite pattern is 0.772. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.700. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-6-DA was mounted on a tower of precise scale to the Tower Innovations 4200 tower at the WLFS 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 BPED-20060526AAO, a single level of the 6810-6-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 9^{th} and 10^{th} 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 413.55 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.

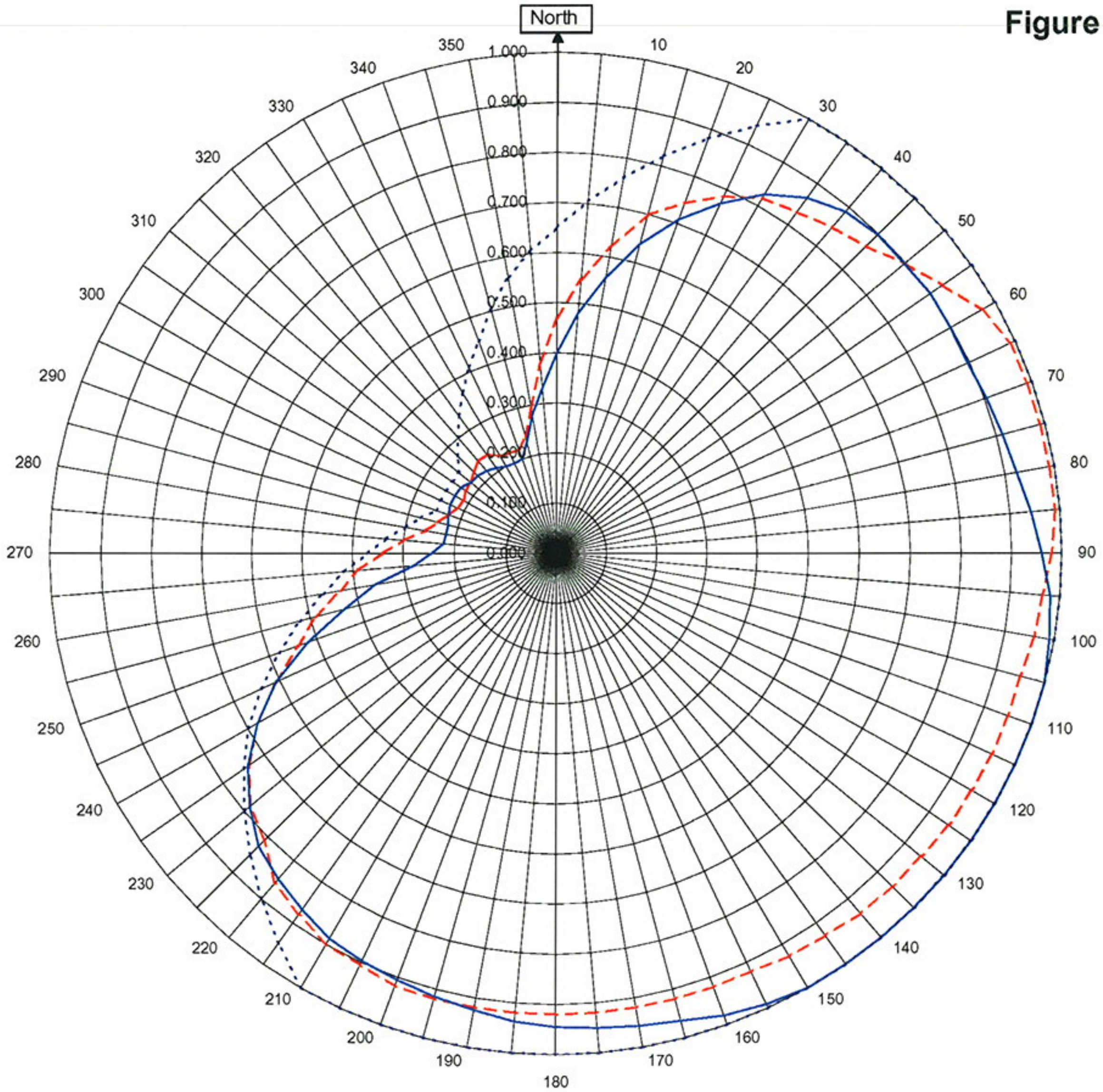
Respectfully submitted by:

Robert A. Surette
Director of Sales Engineering
S/O 24665
August 1, 2008

Shively Labs

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

Figure 1



WLFS Port Wentworth

24665

August 1, 2008

Horizontal RMS	0.755
Vertical RMS	0.754
H/V Composite RMS	0.772
..............FCC Composite RMS	0.824

Frequency	91.9 / 413.55 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-6-DA Pattern 07-A
Pattern Type	Directional Azimuth

Figure 1a

Tabulation of Horizontal Azimuth Pattern
WLFS Port Wentworth

Azimuth	Rel Field	Azimuth	Rel Field
0	0.400	180	0.945
10	0.558	190	0.925
20	0.709	200	0.905
30	0.827	210	0.887
40	0.889	220	0.849
45	0.898	225	0.826
50	0.897	230	0.786
60	0.898	240	0.678
70	0.904	250	0.520
80	0.924	260	0.360
90	0.960	270	0.245
100	0.990	280	0.220
110	1.000	290	0.225
120	1.000	300	0.230
130	1.000	310	0.220
135	1.000	315	0.219
140	1.000	320	0.215
150	1.000	330	0.200
160	0.981	340	0.200
170	0.957	350	0.280

Figure 1b

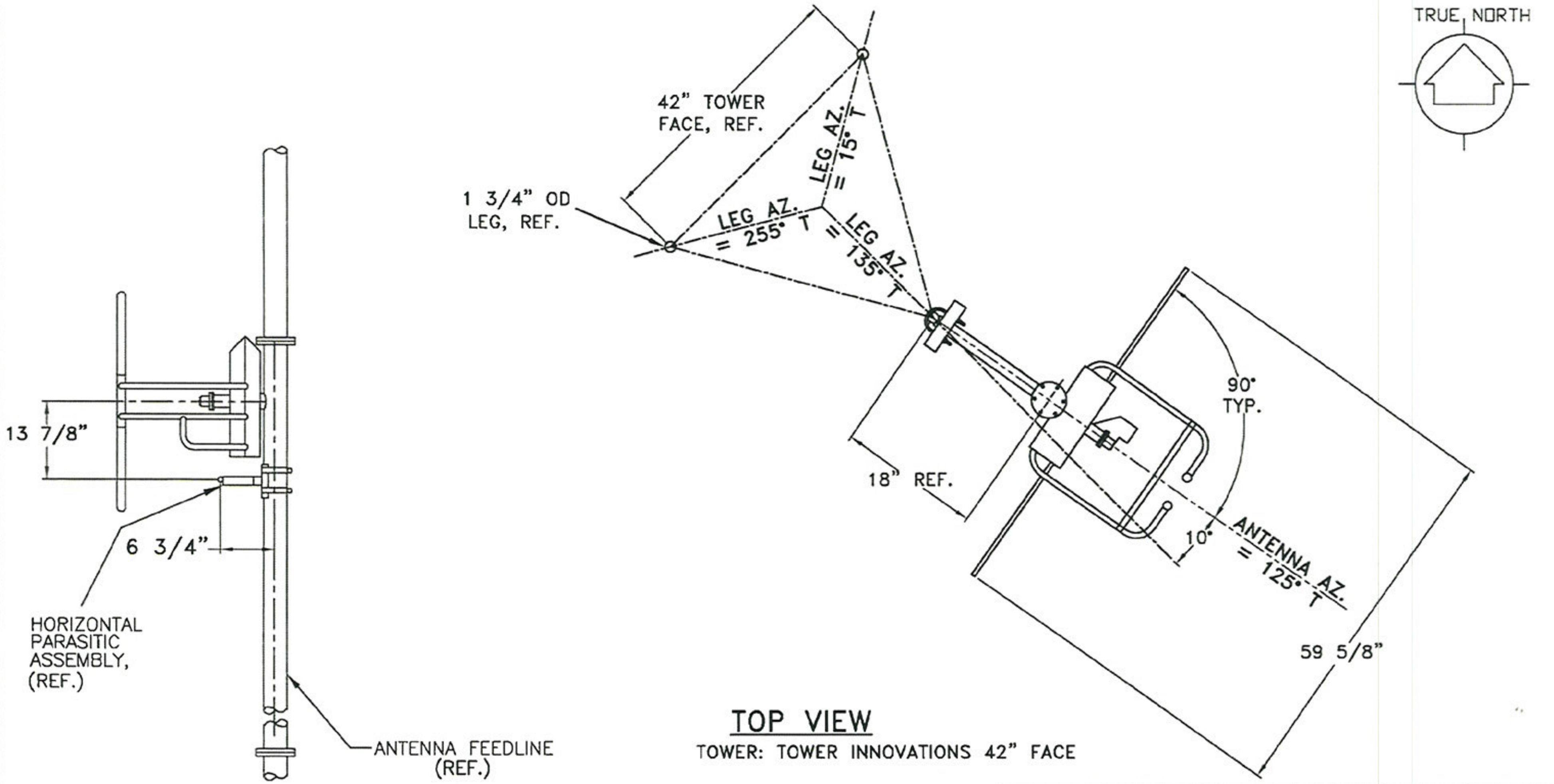
Tabulation of Vertical Azimuth Pattern
WLFS Port Wentworth

Azimuth	Rel Field	Azimuth	Rel Field
0	0.470	180	0.920
10	0.620	190	0.920
20	0.743	200	0.918
30	0.818	210	0.900
40	0.848	220	0.860
45	0.865	225	0.810
50	0.898	230	0.785
60	0.970	240	0.678
70	0.990	250	0.540
80	0.990	260	0.430
90	0.980	270	0.340
100	0.960	280	0.260
110	0.950	290	0.225
120	0.947	300	0.210
130	0.942	310	0.220
135	0.940	315	0.230
140	0.938	320	0.240
150	0.928	330	0.224
160	0.920	340	0.220
170	0.920	350	0.295

Figure 1c

Tabulation of FCC Directional Composite
WLFS Port Wentworth

Azimuth	Rel Field	Azimuth	Rel Field
0	0.650	180	1.000
10	0.760	190	1.000
20	0.880	200	1.000
30	1.000	210	1.000
40	1.000	220	0.900
50	1.000	230	0.800
60	1.000	240	0.700
70	1.000	250	0.580
80	1.000	260	0.465
90	1.000	270	0.370
100	1.000	280	0.300
110	1.000	290	0.250
120	1.000	300	0.250
130	1.000	310	0.250
140	1.000	320	0.300
150	1.000	330	0.370
160	1.000	340	0.450
170	1.000	350	0.560



SIDE VIEW

SHIVELY LABS

A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE

SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY: ASP / APPROVED BY: DAB
24665	91.9 MHz.	N.T.S.	

TITLE: MODEL-6810-6-DIRECTIONAL ANTENNA

DATE: 7/31/08

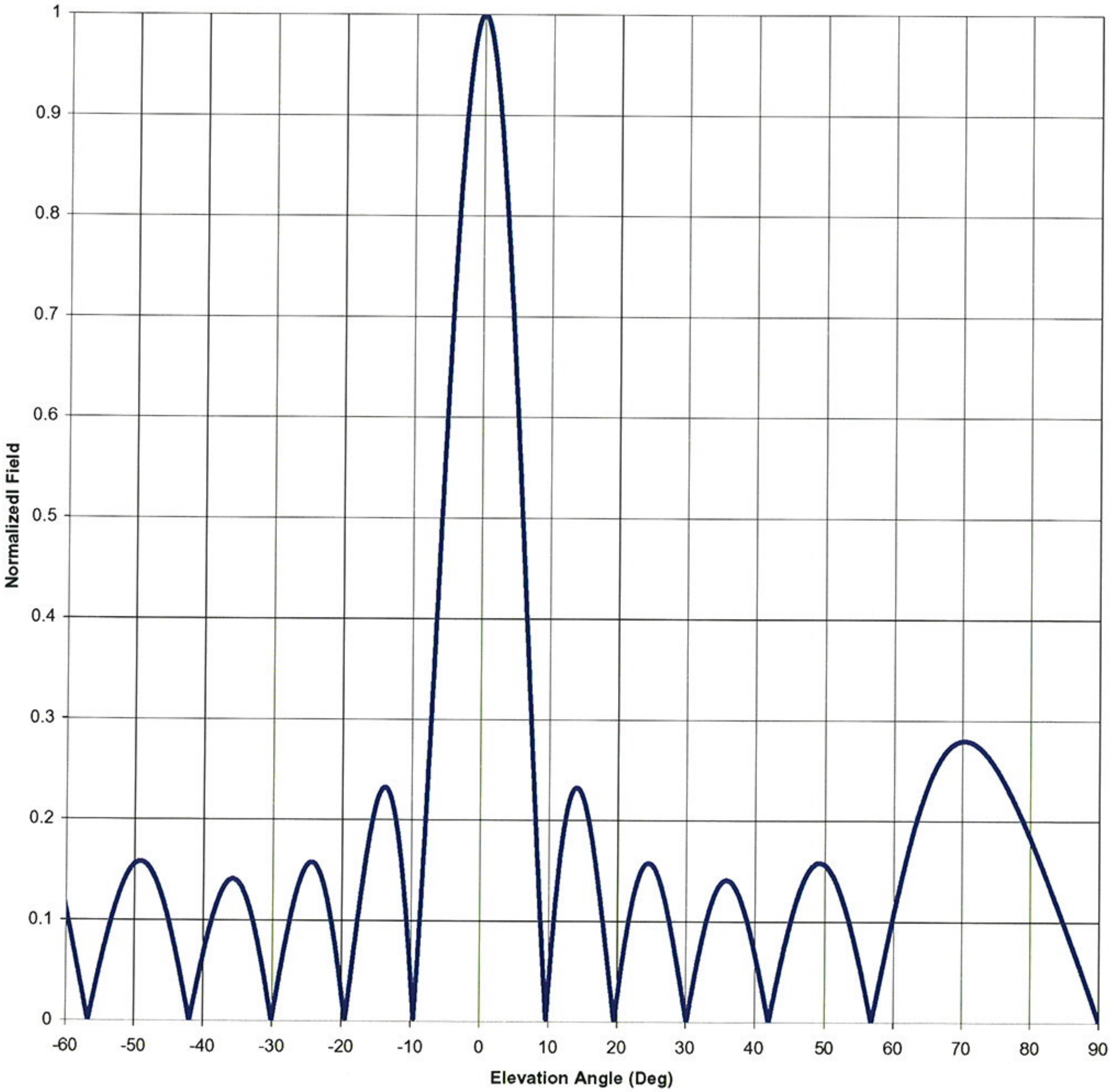
FIGURE 2

ANTENNA HEADING 125° TRUE NORTH

Antenna Mfg.: Shively Labs
Antenna Type: 6810-6-DA
Station: WLFS
Frequency: 91.9
Channel #: 220
Figure: 3

Date: 8/1/2008

Beam Tilt	0	
Gain (Max)	5.762	7.605 dB
Gain (Horizon)	5.762	7.605 dB



Antenna Mfg.: Shively Labs **Date:** 8/1/2008
Antenna Type: 6810-6-DA
Station: WLFS **Beam Tilt** 0
Frequency: 91.9 **Gain (Max)** 5.762 7.605 dB
Channel #: 220 **Gain (Horizon)** 5.762 7.605 dB
Figure: 3

Angle of Depression (Deg)	Relative Field
-90	0.000
-89	0.021
-88	0.040
-87	0.059
-86	0.077
-85	0.096
-84	0.114
-83	0.132
-82	0.149
-81	0.166
-80	0.183
-79	0.198
-78	0.213
-77	0.227
-76	0.240
-75	0.252
-74	0.262
-73	0.270
-72	0.275
-71	0.279
-70	0.280
-69	0.277
-68	0.272
-67	0.264
-66	0.251
-65	0.236
-64	0.217
-63	0.194
-62	0.169
-61	0.140
-60	0.109
-59	0.077
-58	0.043
-57	0.009
-56	0.024
-55	0.056
-54	0.085
-53	0.111
-52	0.132
-51	0.147
-50	0.156
-49	0.158
-48	0.153
-47	0.141
-46	0.123
-45	0.098

Angle of Depression (Deg)	Relative Field
-44	0.069
-43	0.036
-42	0.001
-41	0.034
-40	0.067
-39	0.096
-38	0.119
-37	0.134
-36	0.141
-35	0.138
-34	0.125
-33	0.103
-32	0.072
-31	0.036
-30	0.005
-29	0.046
-28	0.085
-27	0.118
-26	0.142
-25	0.156
-24	0.156
-23	0.143
-22	0.115
-21	0.075
-20	0.025
-19	0.031
-18	0.089
-17	0.143
-16	0.189
-15	0.220
-14	0.232
-13	0.222
-12	0.186
-11	0.125
-10	0.038
-9	0.071
-8	0.197
-7	0.334
-6	0.476
-5	0.615
-4	0.742
-3	0.849
-2	0.931
-1	0.983
0	1.000

Angle of Depression (Deg)	Relative Field
0	1.000
1	0.983
2	0.931
3	0.849
4	0.742
5	0.615
6	0.476
7	0.334
8	0.197
9	0.071
10	0.038
11	0.125
12	0.186
13	0.222
14	0.232
15	0.220
16	0.189
17	0.143
18	0.089
19	0.031
20	0.025
21	0.075
22	0.115
23	0.143
24	0.156
25	0.156
26	0.142
27	0.118
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30	0.005
31	0.036
32	0.072
33	0.103
34	0.125
35	0.138
36	0.141
37	0.134
38	0.119
39	0.096
40	0.067
41	0.034
42	0.001
43	0.036
44	0.069
45	0.098

Angle of Depression (Deg)	Relative Field
46	0.123
47	0.141
48	0.153
49	0.158
50	0.156
51	0.147
52	0.132
53	0.111
54	0.085
55	0.056
56	0.024
57	0.009
58	0.043
59	0.077
60	0.109
61	0.140
62	0.169
63	0.194
64	0.217
65	0.236
66	0.251
67	0.264
68	0.272
69	0.277
70	0.280
71	0.279
72	0.275
73	0.270
74	0.262
75	0.252
76	0.240
77	0.227
78	0.213
79	0.198
80	0.183
81	0.166
82	0.149
83	0.132
84	0.114
85	0.096
86	0.077
87	0.059
88	0.040
89	0.021
90	0.000

S.O. 24665 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WLFS 91.9 MHz Port Wentworth, GA

Model 6810-6-DA

Elevation Gain of Antenna 3.28

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

H RMS 0.755 V RMS 0.754 H/V Ratio 1.001

Elevation Gain of Horizontal Component 3.284

Elevation Gain of Vertical Component 3.276

Horizontal Azimuth Gain equals $1/(RMS)^2$. 1.754

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 1.724
Max. Vertical 0.99

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

Total Horizontal Power Gain = **5.762**

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

Total Vertical Power Gain = **5.647**

==

ERP divided by Horizontal Power Gain equals Antenna Input Power

23.5 kW ERP Divided by H Gain 5.762 equals 4.08 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

4.08 kW Times V Gain 5.647 equals 23.03 kW V ERP

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

(0.99)^2 Times 23.50 Equals 23.03 kW Vertical ERP

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