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S.O. 25023

Report of Test 6810-5R-DA

for

RADIO FREE GEORGIA BROADCASTING FOUNDATION

WRFG 89.3 MHz ATLANTA, GA

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-5R-DA to meet the needs of WRFG and to comply with the requirements of the FCC construction permit, file number BPED-20030219ADT.

RESULTS:

The measured azimuth pattern for the 6810-5R-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 BPED-20030219ADT indicates that the Horizontal radiation component shall not exceed 65 kW at any azimuth and is restricted to the following values at the azimuths specified:

80 Degrees T: 4.063 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 192 Degrees T to 227 Degrees T. At the restricted azimuth of 80 Degrees T the Vertical component is 12.765 dB down from the maximum of 65 kW, or 3.439 kW.

The R.M.S. of the Horizontal component is 0.684. The total Horizontal power gain is 6.045. The R.M.S. of the Vertical component is 0.661. The total Vertical power gain is 5.805. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.757. The R.M.S. of the measured composite pattern is 0.700. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.643. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-5R-DA was mounted on a tower of exact scale to the LeBlanc LRM 3700 tower at the WRFG 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-20030219ADT, a single level of the 6810-5R-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 401.85 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.

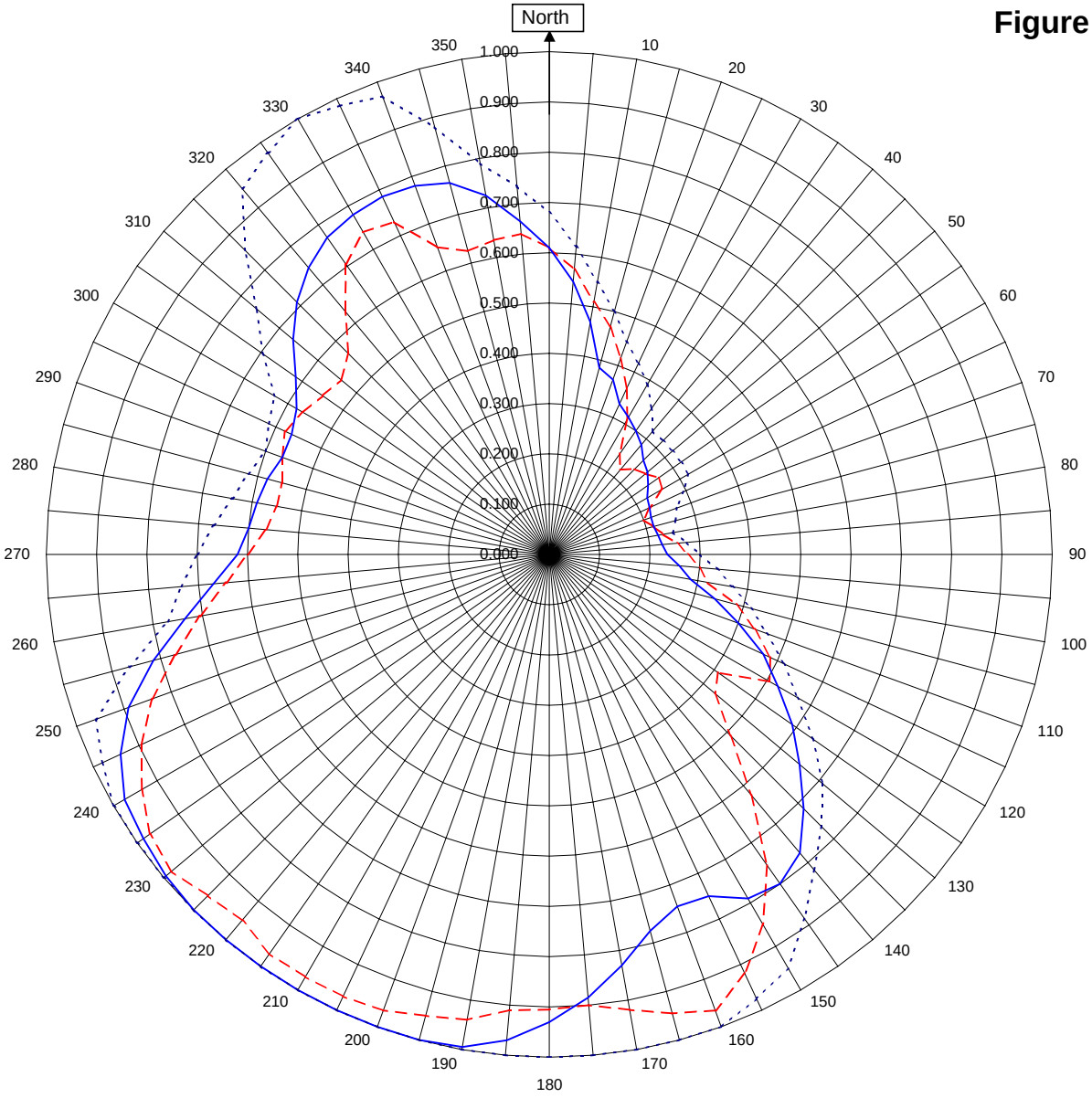
Respectfully submitted by:

Robert A. Surette
Director of Sales Engineering
S/O 25023
September 29, 2006

Shively Labs

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

Figure 1



WRFG Atlanta, GA

25023

September 29, 2006

Horizontal RMS	0.684
Vertical RMS	0.661
H/V Composite RMS	0.700
FCC Composite RMS	0.757

Frequency	89.3 / 401.85 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-5R-DA
Pattern Type	Directional Azimuth

Figure 1a

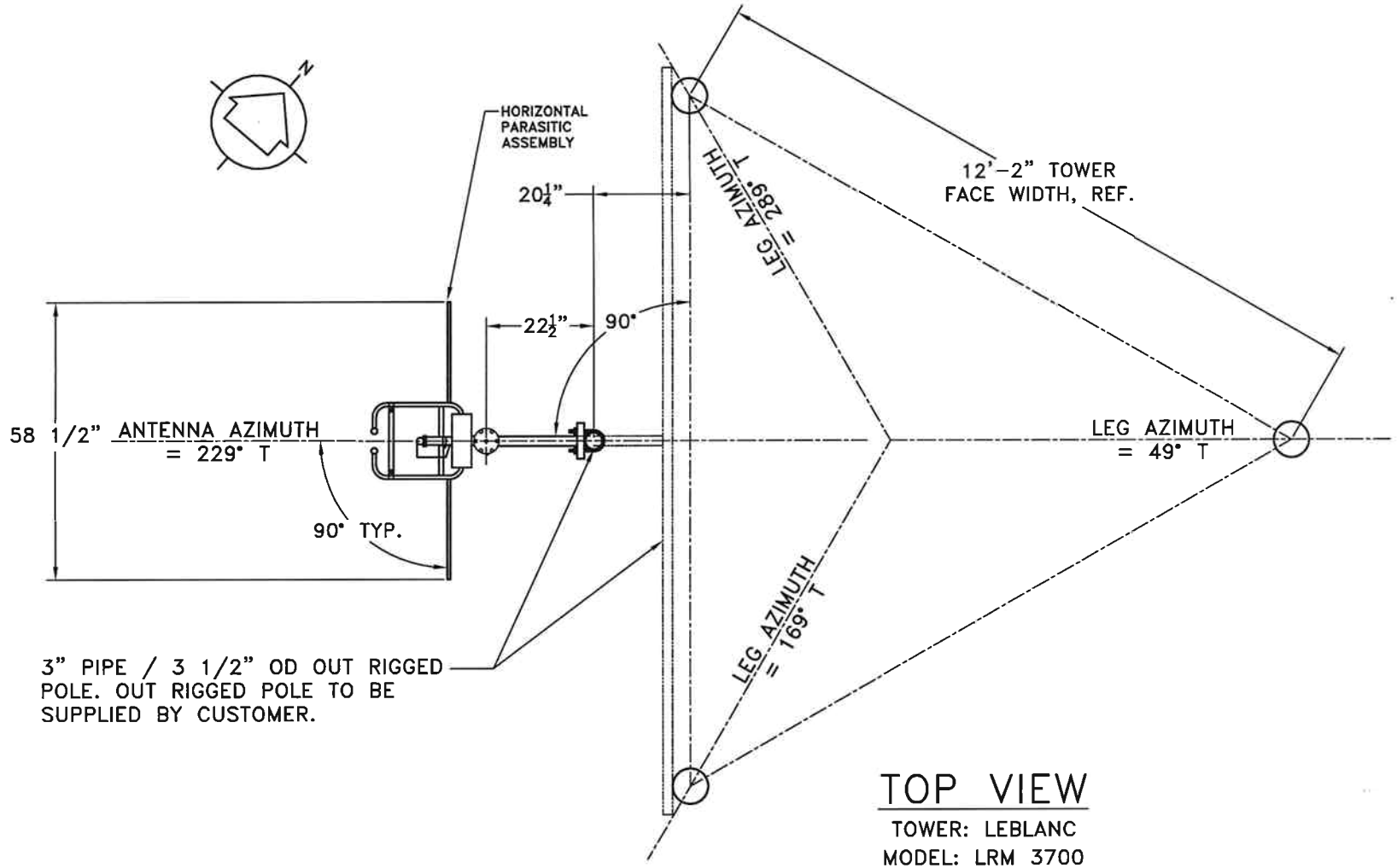
Tabulation of Horizontal Azimuth Pattern
WRFG Atlanta, GA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.610	180	0.930
10	0.470	190	0.995
20	0.370	200	1.000
30	0.315	210	1.000
40	0.285	220	1.000
45	0.265	225	1.000
50	0.255	230	0.995
60	0.225	240	0.975
70	0.215	250	0.890
80	0.220	260	0.735
90	0.235	270	0.620
100	0.285	280	0.590
110	0.400	290	0.565
120	0.525	300	0.580
130	0.650	310	0.665
135	0.715	315	0.710
140	0.775	320	0.745
150	0.790	330	0.780
160	0.745	340	0.780
170	0.830	350	0.725

Figure 1b

Tabulation of Vertical Azimuth Pattern
WRFG Atlanta, GA

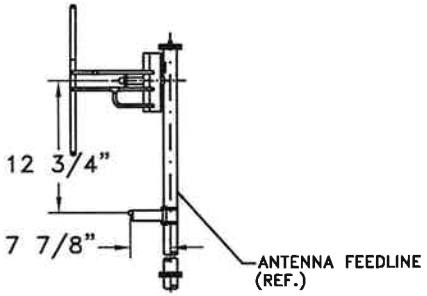
Azimuth	Rel Field	Azimuth	Rel Field
0	0.610	180	0.905
10	0.510	190	0.940
20	0.415	200	0.965
30	0.310	210	0.970
40	0.220	220	0.950
45	0.240	225	0.960
50	0.250	230	0.980
60	0.260	240	0.935
70	0.200	250	0.840
80	0.230	260	0.705
90	0.275	270	0.600
100	0.320	280	0.550
110	0.435	290	0.565
120	0.505	300	0.565
130	0.430	310	0.540
135	0.510	315	0.565
140	0.625	320	0.630
150	0.850	330	0.740
160	0.965	340	0.650
170	0.920	350	0.635



TOP VIEW

TOWER: LEBLANC

MODEL: LRM 3700



SIDE VIEW

ANTENNA HEADING: 229° TRUE NORTH

SHIVELY LABS

A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE

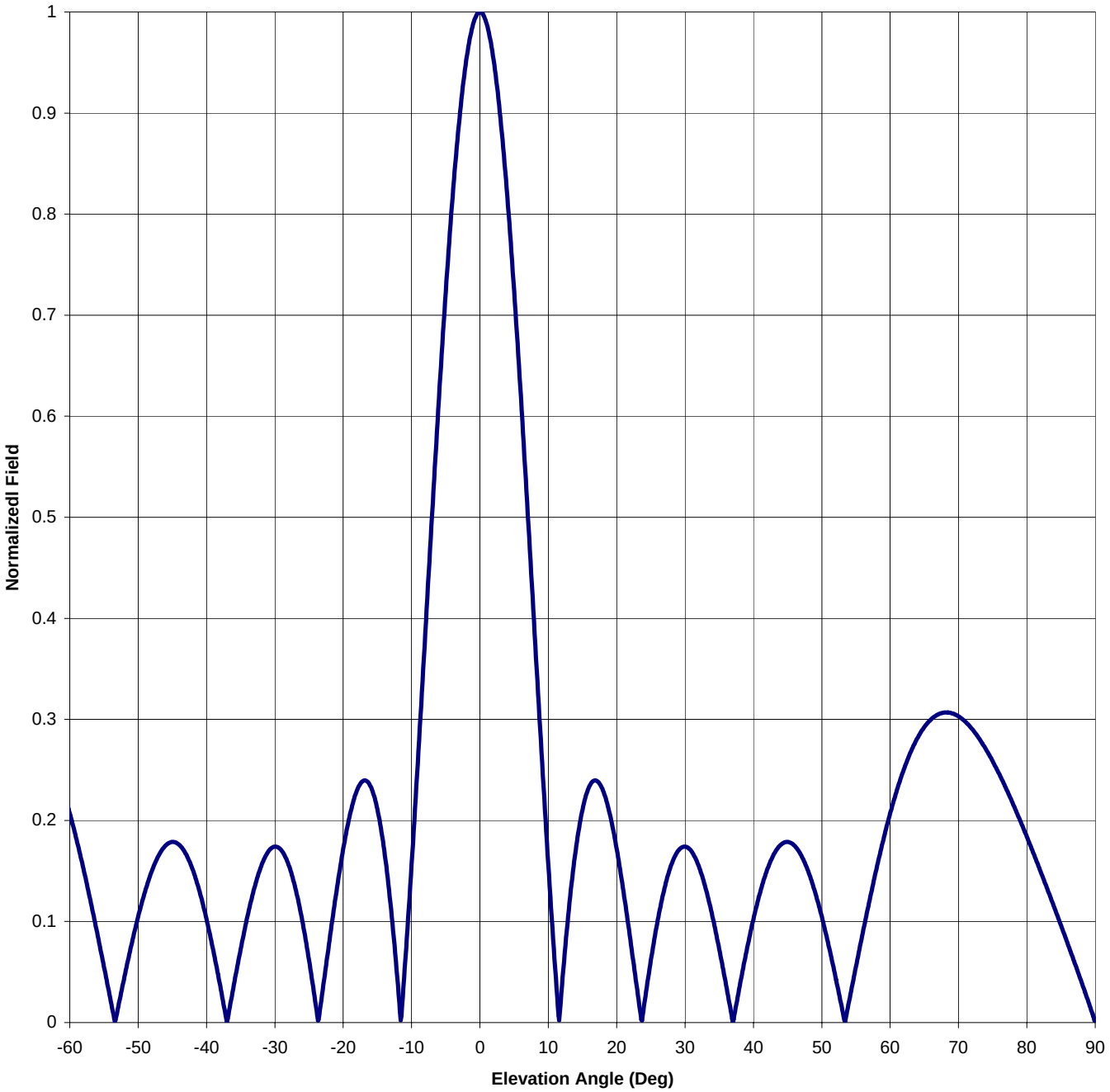
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY: ASP
25023	89.3	N.T.S.	APPROVED BY: DAB

TITLE: MODEL-6810-5R-DIRECTIONAL ANTENNA

DATE: 9/25/06

FIGURE 2

Antenna Mfg.:	**Shively Labs**			**Date:**	**9/29/2006**
Antenna Type:	**6810-5R-DA**				
Station:	**WRFG**	**Beam Tilt**	**0**		
Frequency:	**89.3**	**Gain (Max)**	**6.045**	**7.814**	**dB**
Channel #:	**207**	**Gain (Horizon)**	**6.045**	**7.814**	**dB**
Figure:	**3**				



Antenna Mfg.: Shively Labs
Antenna Type: 6810-5R-DA
Station: WRFG
Frequency: 89.3
Channel #: 207
Figure: 3

Beam Tilt 0
Gain (Max) 6.045 — 7.814 dB
Gain (Horizon) 6.045 — 7.814 dB

Date: 9/29/2006

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	0.167	1	0.988	47	0.165
-88	0.040	-42	0.151	2	0.952	48	0.150
-87	0.059	-41	0.129	3	0.895	49	0.129
-86	0.077	-40	0.102	4	0.817	50	0.105
-85	0.096	-39	0.071	5	0.724	51	0.076
-84	0.114	-38	0.036	6	0.617	52	0.045
-83	0.132	-37	0.000	7	0.503	53	0.013
-82	0.150	-36	0.037	8	0.385	54	0.021
-81	0.167	-35	0.073	9	0.268	55	0.055
-80	0.184	-34	0.105	10	0.156	56	0.089
-79	0.200	-33	0.133	11	0.054	57	0.121
-78	0.216	-32	0.155	12	0.037	58	0.152
-77	0.231	-31	0.169	13	0.112	59	0.181
-76	0.245	-30	0.174	14	0.170	60	0.207
-75	0.259	-29	0.170	15	0.211	61	0.230
-74	0.271	-28	0.156	16	0.234	62	0.250
-73	0.281	-27	0.133	17	0.239	63	0.268
-72	0.290	-26	0.101	18	0.230	64	0.282
-71	0.298	-25	0.062	19	0.206	65	0.292
-70	0.303	-24	0.016	20	0.172	66	0.300
-69	0.306	-23	0.032	21	0.129	67	0.305
-68	0.307	-22	0.082	22	0.082	68	0.307
-67	0.305	-21	0.129	23	0.032	69	0.306
-66	0.300	-20	0.172	24	0.016	70	0.303
-65	0.292	-19	0.206	25	0.062	71	0.298
-64	0.282	-18	0.230	26	0.101	72	0.290
-63	0.268	-17	0.239	27	0.133	73	0.281
-62	0.250	-16	0.234	28	0.156	74	0.271
-61	0.230	-15	0.211	29	0.170	75	0.259
-60	0.207	-14	0.170	30	0.174	76	0.245
-59	0.181	-13	0.112	31	0.169	77	0.231
-58	0.152	-12	0.037	32	0.155	78	0.216
-57	0.121	-11	0.054	33	0.133	79	0.200
-56	0.089	-10	0.156	34	0.105	80	0.184
-55	0.055	-9	0.268	35	0.073	81	0.167
-54	0.021	-8	0.385	36	0.037	82	0.150
-53	0.013	-7	0.503	37	0.000	83	0.132
-52	0.045	-6	0.617	38	0.036	84	0.114
-51	0.076	-5	0.724	39	0.071	85	0.096
-50	0.105	-4	0.817	40	0.102	86	0.077
-49	0.129	-3	0.895	41	0.129	87	0.059
-48	0.150	-2	0.952	42	0.151	88	0.040
-47	0.165	-1	0.988	43	0.167	89	0.021
-46	0.175	0	1.000	44	0.176	90	0.000
-45	0.179			45	0.179		

S.O. 25023 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WRFG 89.3 MHz ATLANTA, GA

MODEL 6810-5R-DA

Elevation Gain of Antenna 2.733

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 0.684 V RMS 0.661 H/V Ratio 1.035

Elevation Gain of Horizontal Component 2.828

Elevation Gain of Vertical Component 2.641

Horizontal Azimuth Gain equals 1/(RMS)SQ. 2.137

Vertical Azimuth Gain equals 1/(RMS/Max Vert)SQ. 2.198
Max. Vertical 0.98

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

Total Horizontal Power Gain = **6.045**

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

Total Vertical Power Gain = **5.805**

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ERP divided by Horizontal Power Gain equals Antenna Input Power

65 KW ERP Equals 10.753 KW Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

10.753 KW Times 5.805 KW Equals 62.426 KW ERP

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

0.98 Equals 62.426 KW Vertical ERP

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