Shively Labs
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S.O. 27107

Report of Test 6810-4-DA

for

GROSS COMMUNICATIONS CORPORATION

WLOQ 103.1 MHz Windermere, FL

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-4-DA to meet the needs of WLOQ and to comply with the requirements of the FCC construction permit, file number BPH-20070416AAU.

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

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

Construction permit file number BPH-20070416AAU indicates that the Horizontal radiation component shall not exceed 22.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

N 30 Degrees T through N 40 Degrees T: 7.1 kW

N 140 Degrees T through N 150 Degrees T: 18.0 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 210 Degrees T to 211 Degrees T and at 244 Degrees T to 245 Degrees T. At the restricted azimuth of N 30 Degrees T through N 40 Degrees T the Horizontal component is 5.3 dB down from the maximum of 22.0 kW, or 6.5 kW. At the restricted azimuth of N 140 Degrees T through N 150 Degrees T the Horizontal component is 0.9 dB down from the maximum of 22.0 kW, or 17.9 kW.

The R.M.S. of the Horizontal component is 0.740. The total Horizontal power gain is 4.282. The R.M.S. of the Vertical component is 0.669. The total Vertical power gain is 4.130. See Figure 4 for calculations.

AMENDED FCC COMPOSITE PATTERN:

The R.M.S. of the measured composite pattern is 0.756. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.809. 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 0.889 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 6810-4-DA was mounted on a pole of precise scale to the Vertical Solutions top mounted pole at the WLOQ site. An adjacent tower located 14 ft. away at a bearing of 333° T was added since it runs through the aperture of the WLOQ antenna. 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 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 BPH-20070416AAU, a single level of the 6810-4-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 463.95 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 27107
February 5, 2009

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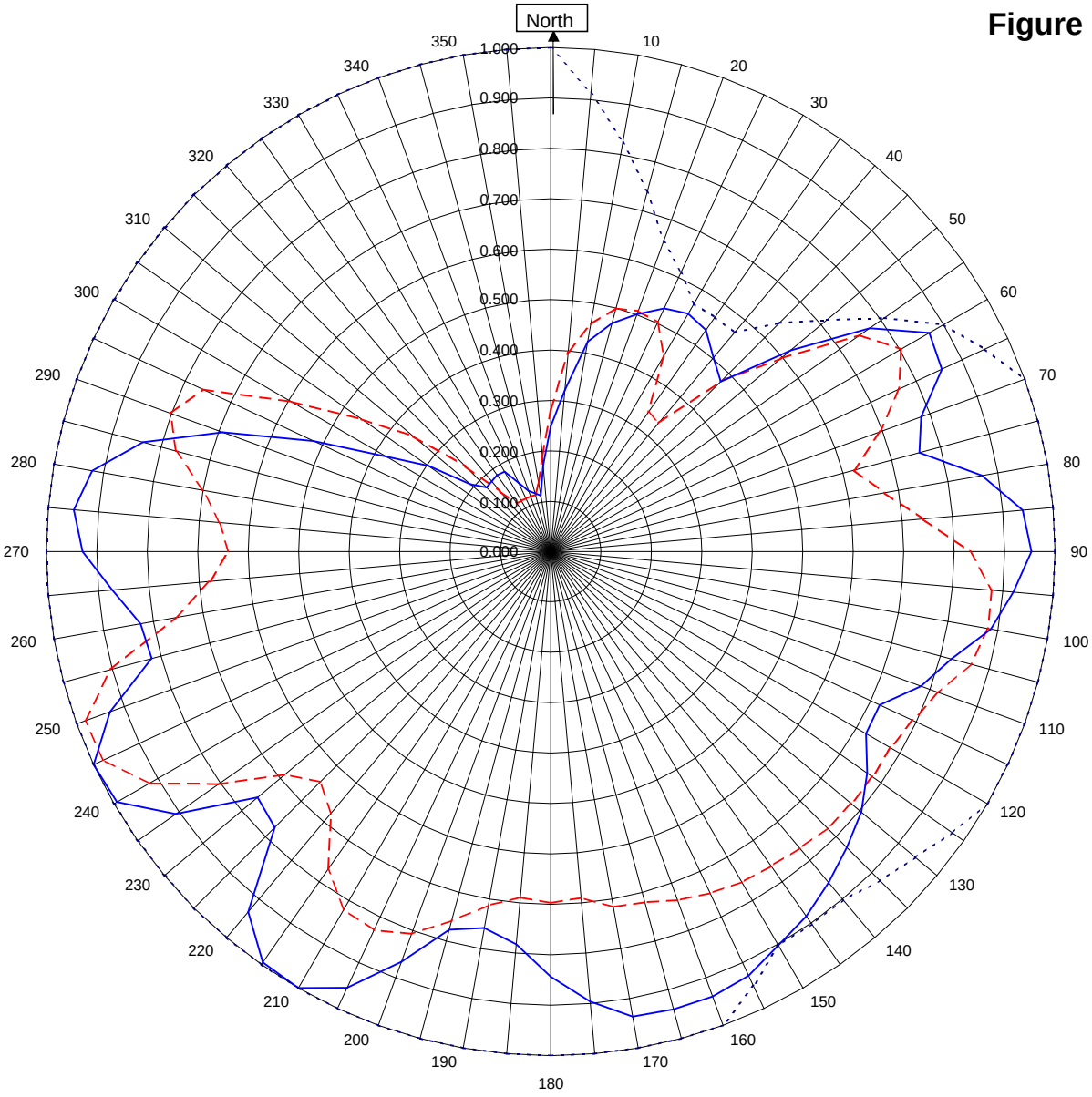
Figure 1A



WLOQ Windermere, FL

27107

February 5, 2009

Horizontal RMS	0.740
Vertical RMS	0.669
H/V Composite RMS	0.756
FCC Composite RMS	0.952

Frequency	103.1 / 463.95 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-4-DA Patt 06-BB
Pattern Type	Directional Azimuth

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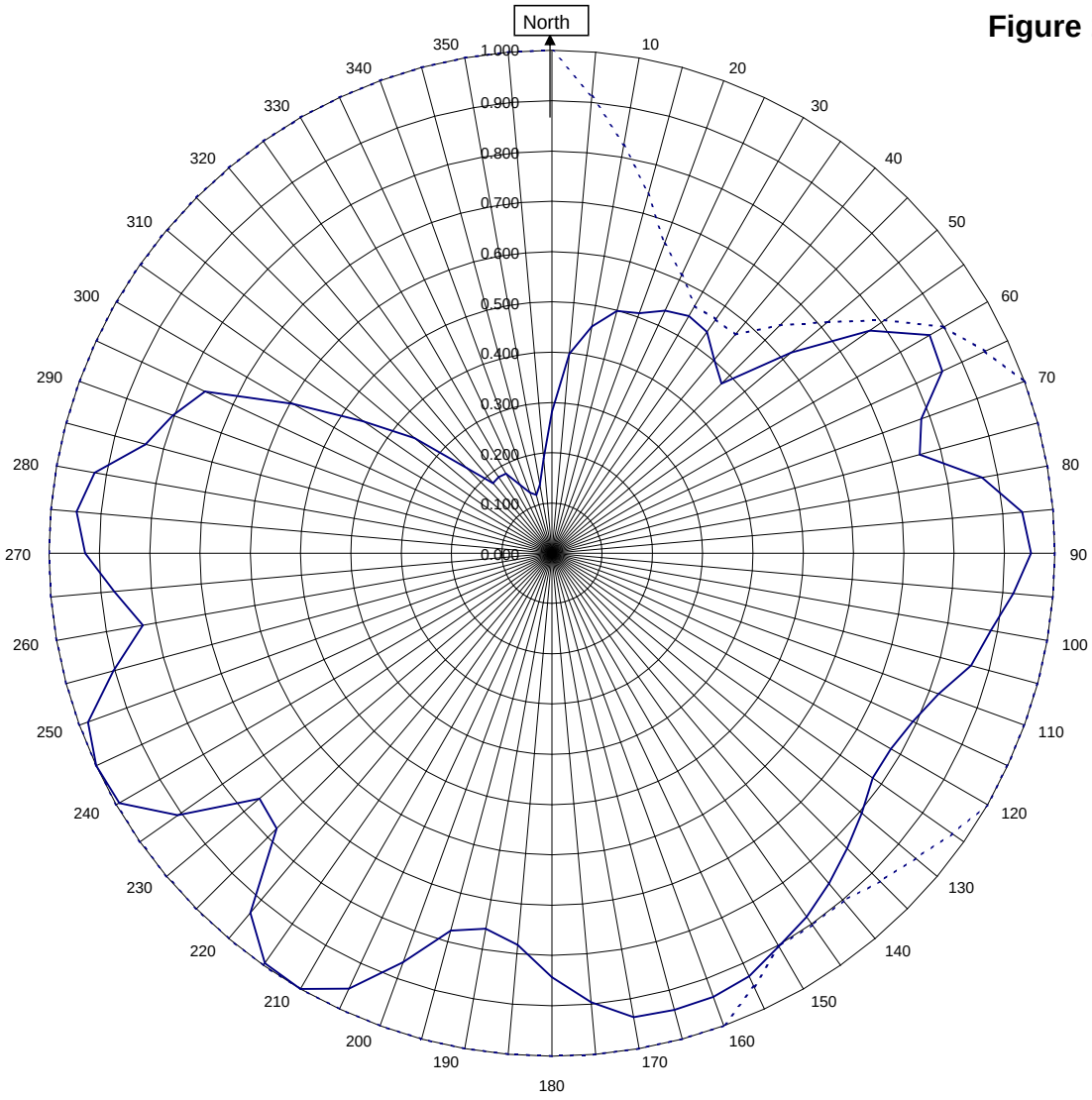
Figure 1B



WLOQ Windermere, FL

27107

February 5, 2009

_____H/VComposite RMS	0.756
……FCC Composite RMS	0.952

Frequency	103.1 / 463.95 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-4-DA Patt 06-BB
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WLOQ Windermere, FL

Azimuth	Rel Field	Azimuth	Rel Field
0	0.248	180	0.843
10	0.423	190	0.758
20	0.501	200	0.866
30	0.545	210	1.000
40	0.502	220	0.933
45	0.477	225	0.774
50	0.621	230	0.759
60	0.867	240	0.993
70	0.782	250	0.930
80	0.868	260	0.826
90	0.953	270	0.928
100	0.886	280	0.923
110	0.781	290	0.692
120	0.722	300	0.377
130	0.804	310	0.208
135	0.830	315	0.180
140	0.857	320	0.182
150	0.902	330	0.183
160	0.939	340	0.128
170	0.937	350	0.113

Figure 1D

Tabulation of Vertical Azimuth Pattern
WLOQ Windermere, FL

Azimuth	Rel Field	Azimuth	Rel Field
0	0.281	180	0.697
10	0.458	190	0.713
20	0.508	200	0.807
30	0.448	210	0.820
40	0.333	220	0.678
45	0.477	225	0.646
50	0.596	230	0.688
60	0.802	240	0.919
70	0.696	250	0.982
80	0.672	260	0.756
90	0.831	270	0.639
100	0.880	280	0.700
110	0.818	290	0.802
120	0.778	300	0.594
130	0.778	310	0.356
135	0.776	315	0.240
140	0.768	320	0.156
150	0.757	330	0.116
160	0.736	340	0.116
170	0.716	350	0.138

Figure 1E

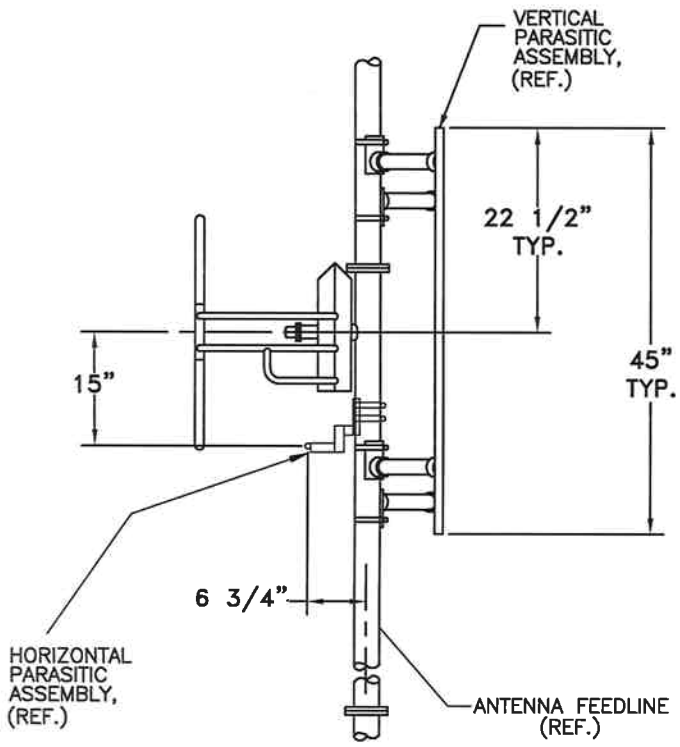
Tabulation of Composite Azimuth Pattern
WLOQ Windermere, FL

Azimuth	Rel Field	Azimuth	Rel Field
0	0.281	180	0.843
10	0.458	190	0.758
20	0.508	200	0.866
30	0.545	210	1.000
40	0.502	220	0.933
45	0.477	225	0.774
50	0.621	230	0.759
60	0.867	240	0.993
70	0.782	250	0.982
80	0.868	260	0.826
90	0.953	270	0.928
100	0.886	280	0.923
110	0.818	290	0.802
120	0.778	300	0.594
130	0.804	310	0.356
135	0.830	315	0.240
140	0.857	320	0.182
150	0.902	330	0.183
160	0.939	340	0.128
170	0.937	350	0.138

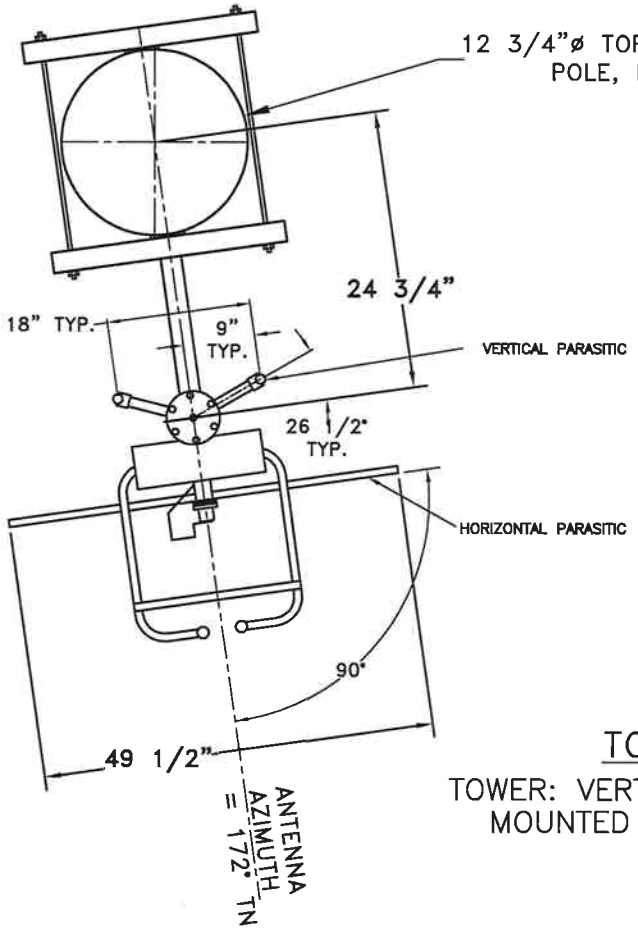
Figure 1F

Tabulation of FCC Directional Composite
WLOQ Windermere, FL

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	1.000
10	0.825	190	1.000
20	0.655	200	1.000
30	0.568	210	1.000
40	0.568	220	1.000
50	0.715	230	1.000
60	0.900	240	1.000
70	1.000	250	1.000
80	1.000	260	1.000
90	1.000	270	1.000
100	1.000	280	1.000
110	1.000	290	1.000
120	1.000	300	1.000
130	0.944	310	1.000
140	0.902	320	1.000
150	0.902	330	1.000
160	1.000	340	1.000
170	1.000	350	1.000



SIDE VIEW



TOP VIEW

TOWER: VERTICAL SOLUTIONS TOP MOUNTED POLE

ANTENNA HEADING 172° TRUE NORTH

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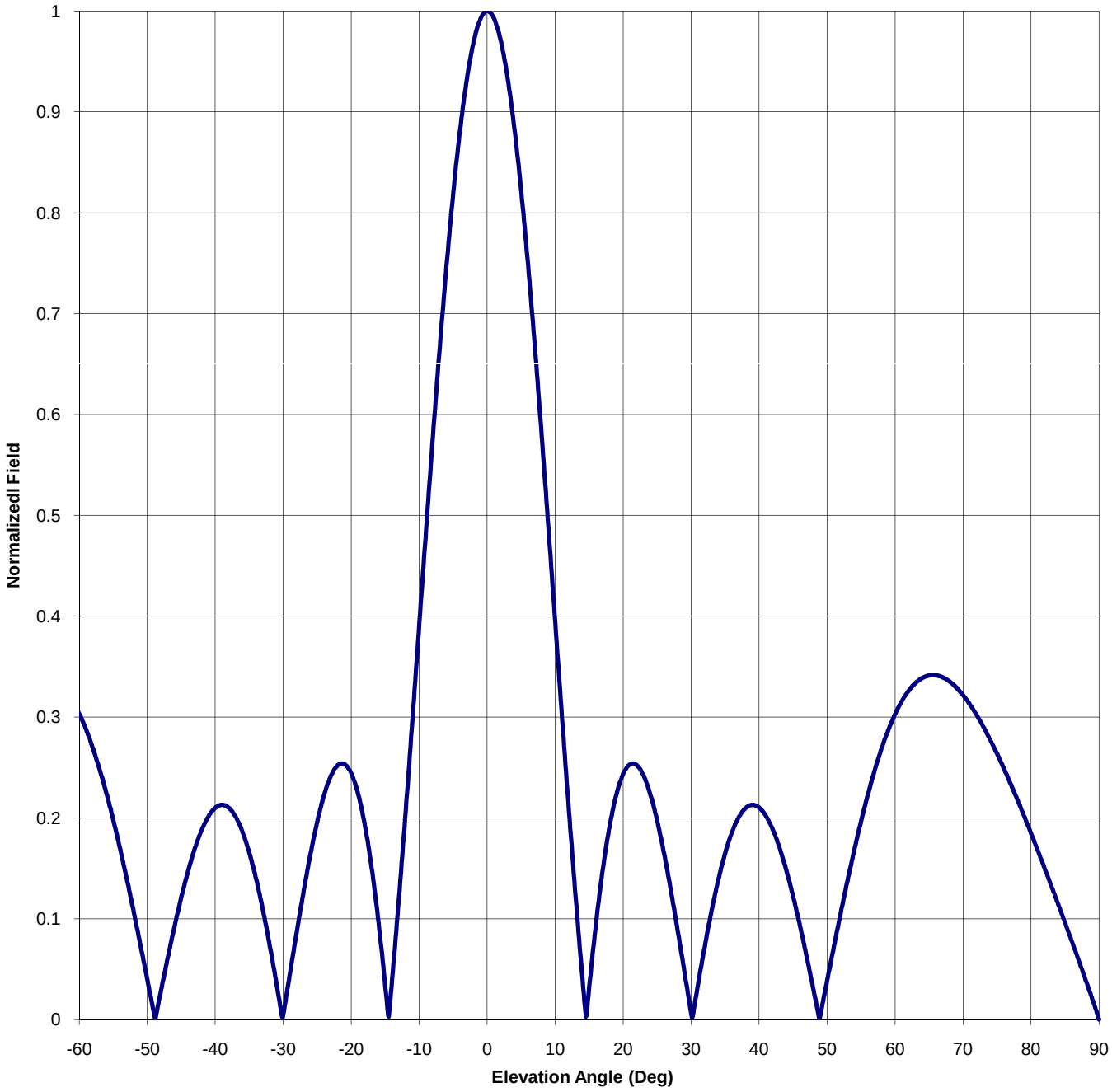
SHOP ORDER: 27107A	FREQUENCY: 103.1	SCALE: N.T.S.	DRAWN BY: ASP APPROVED BY: DAB
TITLE: MODEL-6810-4-DIRECTIONAL ANTENNA			
DATE: 2/5/09	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date: 2/5/2009**
Antenna Type:	**6810-4-DA**			
Station:	**WLOQ**	**Beam Tilt**	**0**	
Frequency:	**103.1**	**Gain (Max)**	**4.282**	**6.316 dB**
Channel #:	**202**	**Gain (Horizon)**	**4.282**	**6.316 dB**
Figure:	**3**			



Antenna Mfg.: Shively Labs
Antenna Type: 6810-4-DA
Station: WLOQ
Frequency: 103.1
Channel #: 202
Figure: 3

Beam Tilt 0
Gain (Max) 4.282
Gain (Horizon) 4.282

Date: 2/5/2009
6.316 dB
6.316 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	0.148	0	1.000	46	0.093
-89	0.021	-43	0.170	1	0.992	47	0.062
-88	0.040	-42	0.188	2	0.970	48	0.029
-87	0.059	-41	0.202	3	0.933	49	0.005
-86	0.078	-40	0.210	4	0.883	50	0.039
-85	0.096	-39	0.213	5	0.820	51	0.073
-84	0.114	-38	0.210	6	0.748	52	0.106
-83	0.132	-37	0.201	7	0.666	53	0.138
-82	0.150	-36	0.186	8	0.579	54	0.168
-81	0.167	-35	0.165	9	0.487	55	0.197
-80	0.185	-34	0.139	10	0.393	56	0.223
-79	0.201	-33	0.108	11	0.299	57	0.247
-78	0.218	-32	0.073	12	0.208	58	0.269
-77	0.234	-31	0.035	13	0.121	59	0.287
-76	0.249	-30	0.006	14	0.040	60	0.303
-75	0.263	-29	0.047	15	0.032	61	0.316
-74	0.277	-28	0.089	16	0.096	62	0.326
-73	0.290	-27	0.128	17	0.149	63	0.334
-72	0.302	-26	0.165	18	0.192	64	0.339
-71	0.312	-25	0.197	19	0.223	65	0.341
-70	0.322	-24	0.223	20	0.244	66	0.341
-69	0.329	-23	0.242	21	0.253	67	0.339
-68	0.335	-22	0.252	22	0.252	68	0.335
-67	0.339	-21	0.253	23	0.242	69	0.329
-66	0.341	-20	0.244	24	0.223	70	0.322
-65	0.341	-19	0.223	25	0.197	71	0.312
-64	0.339	-18	0.192	26	0.165	72	0.302
-63	0.334	-17	0.149	27	0.128	73	0.290
-62	0.326	-16	0.096	28	0.089	74	0.277
-61	0.316	-15	0.032	29	0.047	75	0.263
-60	0.303	-14	0.040	30	0.006	76	0.249
-59	0.287	-13	0.121	31	0.035	77	0.234
-58	0.269	-12	0.208	32	0.073	78	0.218
-57	0.247	-11	0.299	33	0.108	79	0.201
-56	0.223	-10	0.393	34	0.139	80	0.185
-55	0.197	-9	0.487	35	0.165	81	0.167
-54	0.168	-8	0.579	36	0.186	82	0.150
-53	0.138	-7	0.666	37	0.201	83	0.132
-52	0.106	-6	0.748	38	0.210	84	0.114
-51	0.073	-5	0.820	39	0.213	85	0.096
-50	0.039	-4	0.883	40	0.210	86	0.078
-49	0.005	-3	0.933	41	0.202	87	0.059
-48	0.029	-2	0.970	42	0.188	88	0.040
-47	0.062	-1	0.992	43	0.170	89	0.021
-46	0.093	0	1.000	44	0.148	90	0.000
-45	0.122			45	0.122		

S.O. 27107 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WLOQ 103.1 MHz Windermere, FL

6810-4-DA Pattern 06-BB

Elevation Gain of Antenna 2.12

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

H RMS 0.74 V RMS 0.669 H/V Ratio 1.106

Elevation Gain of Horizontal Component 2.345

Elevation Gain of Vertical Component 1.917

Horizontal Azimuth Gain equals $1/(RMS)^2$. 1.826

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 2.155

Max. Vertical 0.982

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

Total Horizontal Power Gain = **4.282**

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

Total Vertical Power Gain = **4.130**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

22 kW ERP Divided by H Gain 4.282 equals 5.14 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

5.137 kW Times V Gain 4.130 equals 21.215 kW V ERP

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

(0.982)^2 Times 22.00 Equals 21.215 kW Vertical ERP

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

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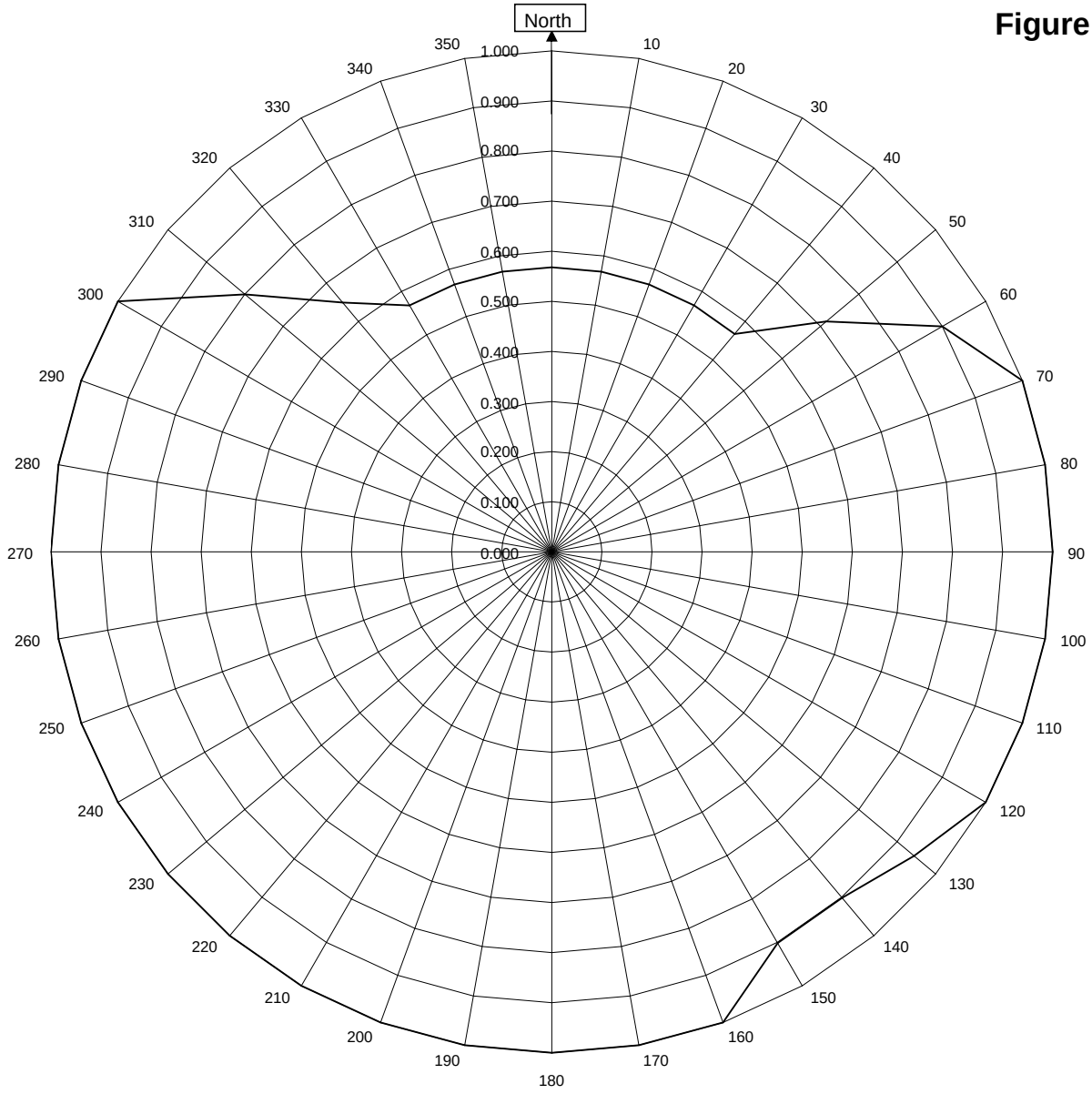
Figure 5



WLOQ Windemere, FL

27107

February 5, 2009

Amended Composite RMS	0.889
85% Amended Composite RMS	0.756

Frequency	103.1 / 463.95 mHz
Plot	Relative Field

Antenna Model	6810-4-DA Patt 06-BB
Pattern Type	Amended FCC Composite

Figure 5a

Tabulation of Amended Composite Pattern
WLOQ Windemere, FL

Azimuth	Rel Field	Azimuth	Rel Field
0	0.568	180	1.000
10	0.568	190	1.000
20	0.568	200	1.000
30	0.568	210	1.000
40	0.568	220	1.000
50	0.715	230	1.000
60	0.900	240	1.000
70	1.000	250	1.000
80	1.000	260	1.000
90	1.000	270	1.000
100	1.000	280	1.000
110	1.000	290	1.000
120	1.000	300	1.000
130	0.944	310	0.800
140	0.902	320	0.650
150	0.902	330	0.568
160	1.000	340	0.568
170	1.000	350	0.568