Shively Labs
a division of Howell Laboratories,Inc.

- An Employee-Owned Company -

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S.O. 27790

Report of Test 6810-2R-DA

for

NETWORK OF GLORY, INC.

WGBQ 91.9 MHz Lynchburg, TN

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-2R-DA to meet the needs of WGBQ and to comply with the requirements of the FCC construction permit, file number BMPED-20090122ABK.

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

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

Construction permit file number BMPED-20090122ABK indicates that the Horizontal radiation component shall not exceed 0.900 kW at any azimuth and is restricted to the following values at the azimuths specified:

190 Degrees T: 0.029 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 338 Degrees T to 021 Degrees T. At the restricted azimuth of 190 Degrees T the Horizontal component is 17.52 dB down from the maximum of 0.900 kW, or 0.016 kW.

The R.M.S. of the Horizontal component is 0.678. The total Horizontal power gain is 2.161. The R.M.S. of the Vertical component is 0.677. The total Vertical power gain is 2.153. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.753. The R.M.S. of the measured composite pattern is 0.688. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.640. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-2R-DA was mounted on a tower of precise scale to the World 36" face tower at the WGBQ site. The spacing of the antenna to the tower 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 BMPED-20090122ABK, a single level of the 6810-2R-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 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 1A.

Respectfully submitted by:

Robert A. Surette
Director of Sales Engineering
S/O 27790
August 30, 2010

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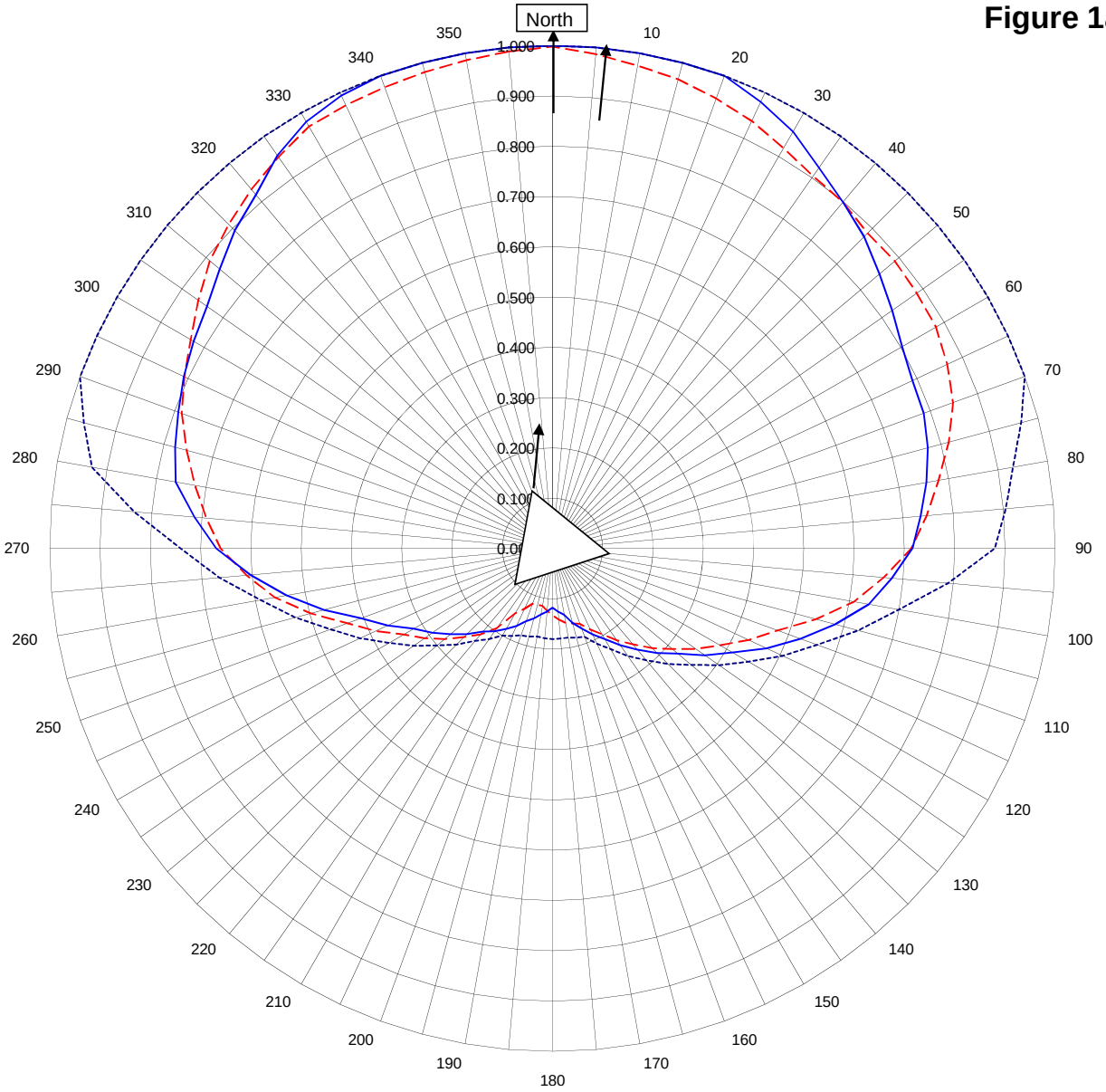
Figure 1a



WGBQ Lynchburg, TN

27790

August 30, 2010

Horizontal RMS	0.678
Vertical RMS	0.677
H/V Composite RMS	0.688
FCC Composite RMS	0.753

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

Antenna Model	6810-2R-DA
Pattern Type	Directional Azimuth

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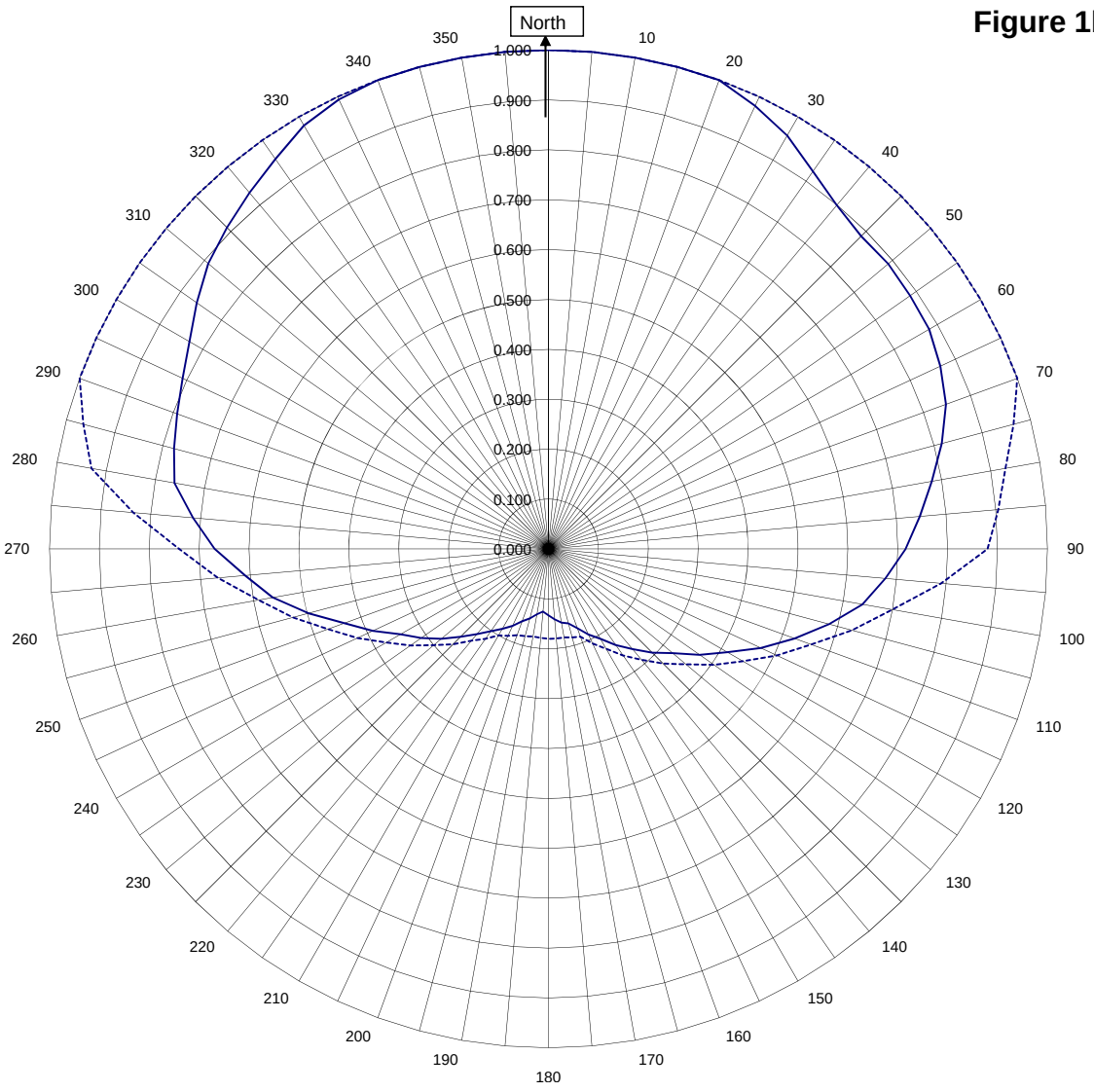
Figure 1b



WGBQ Lynchburg, TN

27790

August 30, 2010

_____H/VComposite RMS	0.688
……..FCC Composite RMS	0.753

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

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

Figure 1c

Tabulation of Horizontal Azimuth
WGBQ Lynchburg, TN

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.118
10	1.000	190	0.133
20	1.000	200	0.154
30	0.957	210	0.185
40	0.899	220	0.216
45	0.877	225	0.241
50	0.849	230	0.265
60	0.803	240	0.319
70	0.786	250	0.405
80	0.755	260	0.537
90	0.716	270	0.669
100	0.639	280	0.761
110	0.525	290	0.792
120	0.414	300	0.824
130	0.325	310	0.864
135	0.294	315	0.894
140	0.262	320	0.918
150	0.208	330	0.980
160	0.169	340	1.000
170	0.134	350	1.000

Figure 1d

Tabulation of Vertical Azimuth
WGBQ Lynchburg, TN

Azimuth	Rel Field	Azimuth	Rel Field
0	0.998	180	0.133
10	0.975	190	0.116
20	0.952	200	0.117
30	0.919	210	0.149
40	0.899	220	0.223
45	0.887	225	0.249
50	0.889	230	0.280
60	0.881	240	0.342
70	0.848	250	0.435
80	0.780	260	0.561
90	0.714	270	0.660
100	0.609	280	0.722
110	0.477	290	0.785
120	0.385	300	0.831
130	0.311	310	0.890
135	0.280	315	0.911
140	0.249	320	0.932
150	0.197	330	0.969
160	0.159	340	0.976
170	0.150	350	0.986

Figure 1e

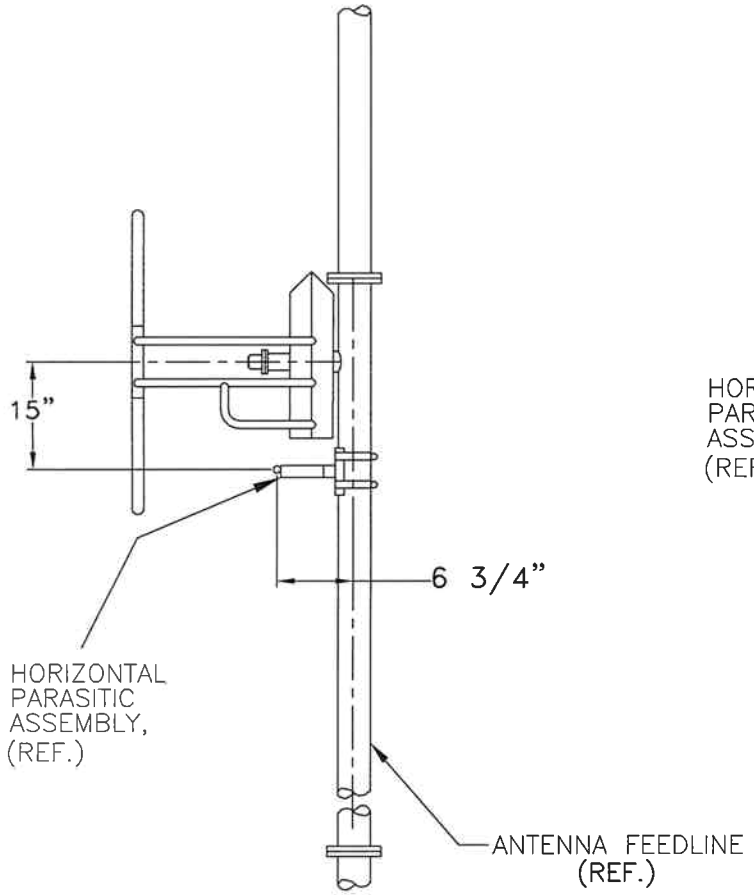
Tabulation of Composite Azimuth
WGBQ Lynchburg, TN

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.133
10	1.000	190	0.133
20	1.000	200	0.154
30	0.957	210	0.185
40	0.899	220	0.223
45	0.887	225	0.249
50	0.889	230	0.280
60	0.881	240	0.342
70	0.848	250	0.435
80	0.780	260	0.561
90	0.716	270	0.669
100	0.639	280	0.761
110	0.525	290	0.792
120	0.414	300	0.831
130	0.325	310	0.890
135	0.294	315	0.911
140	0.262	320	0.932
150	0.208	330	0.980
160	0.169	340	1.000
170	0.150	350	1.000

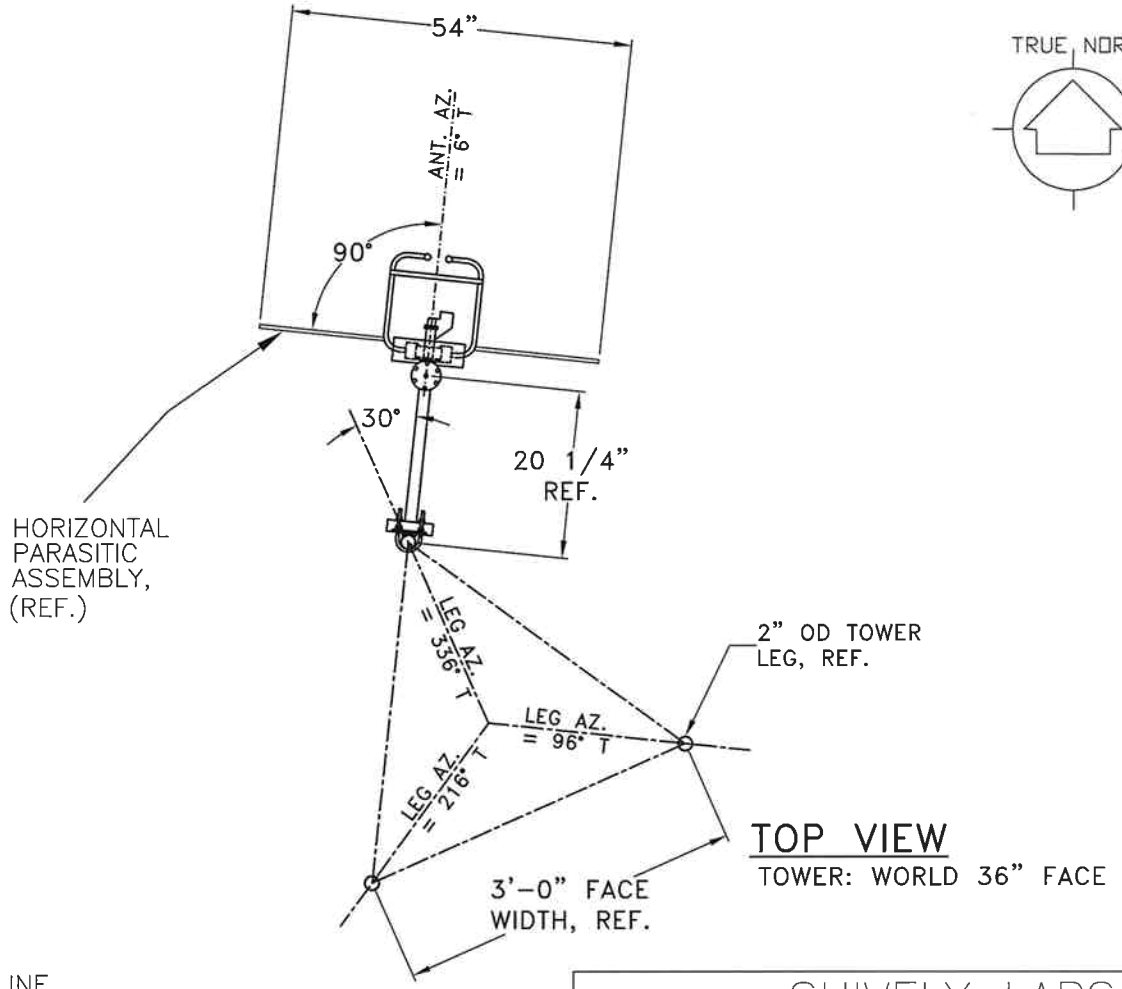
Figure 1f

Tabulation of FCC Directional Composite
WGBQ Lynchburg, TN

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.180
10	1.000	190	0.178
20	1.000	200	0.184
30	1.000	210	0.200
40	1.000	220	0.240
50	1.000	230	0.300
60	1.000	240	0.375
70	1.000	250	0.470
80	0.930	260	0.590
90	0.880	270	0.740
100	0.700	280	0.930
110	0.560	290	1.000
120	0.450	300	1.000
130	0.360	310	1.000
140	0.290	320	1.000
150	0.231	330	1.000
160	0.187	340	1.000
170	0.180	350	1.000



SIDE VIEW

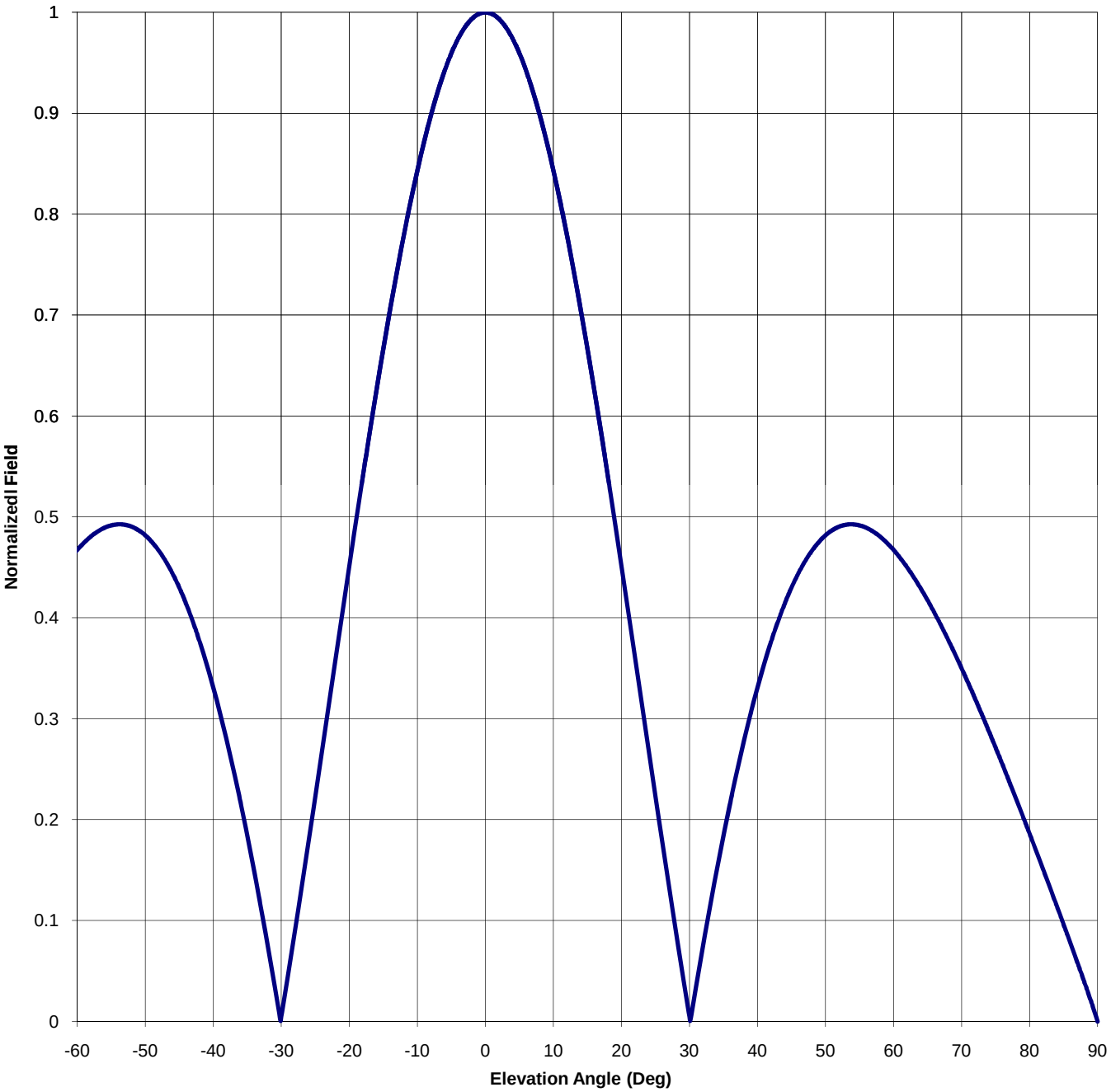


TOP VIEW
TOWER: WORLD 36" FACE

ANTENNA HEADING 6° TRUE NORTH

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 27790	FREQUENCY: 91.9 MHz.	SCALE: N.T.S.	DRAWN BY: ASP APPROVED BY: DAB
TITLE: MODEL-6810-2R-DIRECTIONAL ANTENNA			
DATE: 8/20/10	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date: 8/30/2010**
Antenna Type:	**6810-2R-DA**			
Station:	**WGBQ**	**Beam Tilt**	**0**	
Frequency:	**91.9**	**Gain (Max)**	**2.161**	**3.346 dB**
Channel #:	**220**	**Gain (Horizon)**	**2.161**	**3.346 dB**
Figure:	**3**			



Antenna Mfg.: Shively Labs
Antenna Type: 6810-2R-DA
Station: WGBQ
Frequency: 91.9
Channel #: 220
Figure: 3

Beam Tilt 0
Gain (Max) 2.161 — 3.346 dB
Gain (Horizon) 2.161 — 3.346 dB

Date: 8/30/2010

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	0.414	0	1.000	46	0.444
-89	0.021	-43	0.396	1	0.998	47	0.456
-88	0.040	-42	0.376	2	0.993	48	0.466
-87	0.059	-41	0.355	3	0.985	49	0.475
-86	0.078	-40	0.331	4	0.974	50	0.482
-85	0.096	-39	0.305	5	0.959	51	0.487
-84	0.114	-38	0.278	6	0.942	52	0.490
-83	0.132	-37	0.249	7	0.921	53	0.492
-82	0.150	-36	0.217	8	0.898	54	0.493
-81	0.168	-35	0.184	9	0.872	55	0.492
-80	0.186	-34	0.150	10	0.843	56	0.489
-79	0.203	-33	0.113	11	0.812	57	0.485
-78	0.221	-32	0.075	12	0.779	58	0.481
-77	0.238	-31	0.036	13	0.743	59	0.474
-76	0.255	-30	0.005	14	0.706	60	0.467
-75	0.271	-29	0.046	15	0.667	61	0.459
-74	0.288	-28	0.089	16	0.626	62	0.450
-73	0.304	-27	0.133	17	0.584	63	0.440
-72	0.320	-26	0.178	18	0.541	64	0.429
-71	0.335	-25	0.223	19	0.496	65	0.417
-70	0.350	-24	0.269	20	0.452	66	0.405
-69	0.365	-23	0.314	21	0.406	67	0.392
-68	0.379	-22	0.360	22	0.360	68	0.379
-67	0.392	-21	0.406	23	0.314	69	0.365
-66	0.405	-20	0.452	24	0.269	70	0.350
-65	0.417	-19	0.496	25	0.223	71	0.335
-64	0.429	-18	0.541	26	0.178	72	0.320
-63	0.440	-17	0.584	27	0.133	73	0.304
-62	0.450	-16	0.626	28	0.089	74	0.288
-61	0.459	-15	0.667	29	0.046	75	0.271
-60	0.467	-14	0.706	30	0.005	76	0.255
-59	0.474	-13	0.743	31	0.036	77	0.238
-58	0.481	-12	0.779	32	0.075	78	0.221
-57	0.485	-11	0.812	33	0.113	79	0.203
-56	0.489	-10	0.843	34	0.150	80	0.186
-55	0.492	-9	0.872	35	0.184	81	0.168
-54	0.493	-8	0.898	36	0.217	82	0.150
-53	0.492	-7	0.921	37	0.249	83	0.132
-52	0.490	-6	0.942	38	0.278	84	0.114
-51	0.487	-5	0.959	39	0.305	85	0.096
-50	0.482	-4	0.974	40	0.331	86	0.078
-49	0.475	-3	0.985	41	0.355	87	0.059
-48	0.466	-2	0.993	42	0.376	88	0.040
-47	0.456	-1	0.998	43	0.396	89	0.021
-46	0.444	0	1.000	44	0.414	90	0.000
-45	0.430			45	0.430		

S.O. 27790 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WGBQ 91.9 MHz Lynchburg, TN

Model 6810-2R-DA

Elevation Gain of Antenna 0.992

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

H RMS 0.678 V RMS 0.677 H/V Ratio 1.001

Elevation Gain of Horizontal Component 0.993

Elevation Gain of Vertical Component 0.991

Horizontal Azimuth Gain equals $1/(RMS)^2$. 2.175

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 2.173
Max. Vertical 0.998

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

Total Horizontal Power Gain = **2.161**

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

Total Vertical Power Gain = **2.153**

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ERP divided by Horizontal Power Gain equals Antenna Input Power

0.9 kW ERP Divided by H Gain 2.161 equals 0.42 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

0.42 kW Times V Gain 2.153 equals 0.90 kW V ERP

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

(0.998)^2 Times 0.90 Equals 0.90 kW Vertical ERP

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