

S.O. 28513

Report of Test 6810-1D-DA

for

TEMPLE UNIVERSITY OF THE COMMONWEALTH SYSTEM

WJAZ 91.7 MHz Summerdale, PA

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-1D-DA to meet the needs of WJAZ and to comply with the requirements of the FCC construction permit, file number BPED-20070907AER.

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 BPED-20070907AER indicates that the Horizontal radiation component shall not exceed 1.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

80 - 90 Degrees T: 0.398 kW

120 Degrees T: 0.363 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 200 Degrees T to 291 Degrees T. At the restricted azimuth of 80 - 90 Degrees T the Horizontal component is 8.07 dB down from the maximum of 1.0 kW, or 0.156 kW. At the restricted azimuth of 120 Degrees T the Horizontal component is 9.00 dB down from the maximum of 1.0 kW, or 0.126 kW.

The R.M.S. of the Horizontal component is 0.747. The total Horizontal power gain is 0.822. The R.M.S. of the Vertical component is 0.739. The total Vertical power gain is 0.816. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.865. The R.M.S. of the measured composite pattern is 0.760. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.735. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

The 6810-1D-DA was mounted on a pole of precise scale to the 4.5-inch OD outriggered pole at the WJAZ site. The spacing of the antenna to the pole was varied and a vertical parasitic element was 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 BPED-20070907AER, a single level of the 6810-1D-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 412.65 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 1A.

Respectfully submitted by:

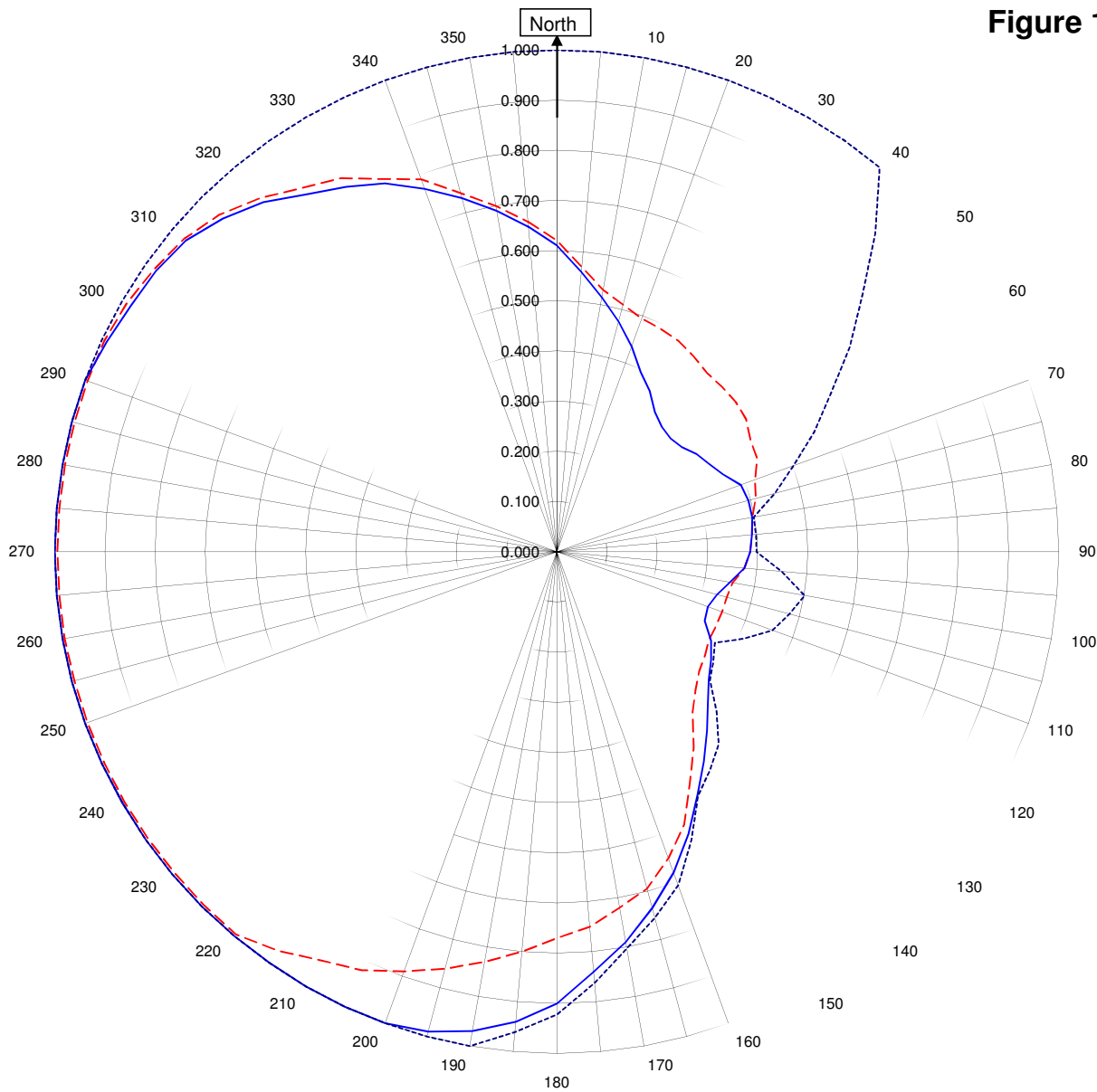


Robert A. Surette
Director of Sales Engineering
S/O 28513
October 4, 2010

Shively Labs

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

Figure 1a



WJAZ Summerdale, PA

28513
October 4, 2010

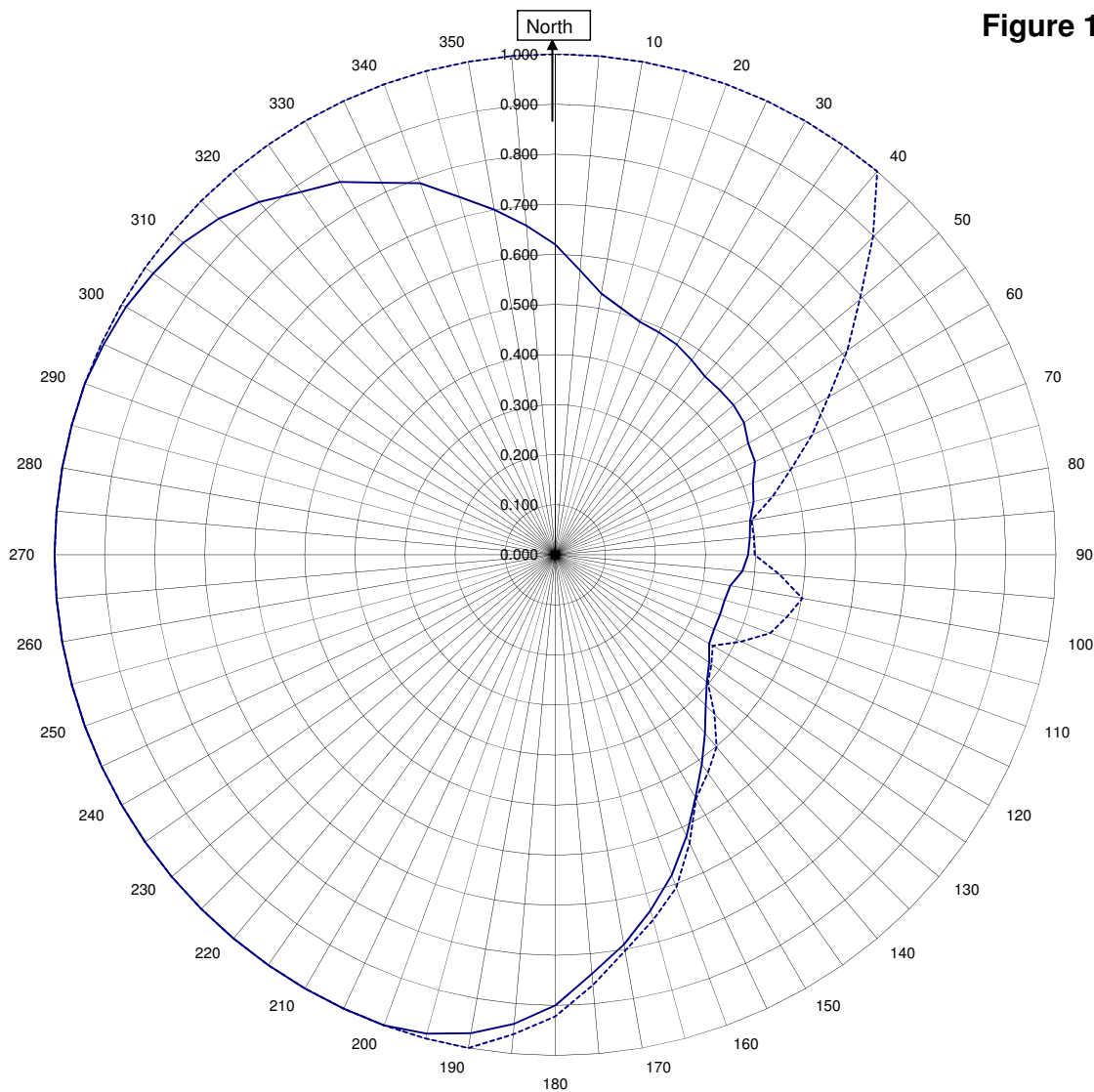
Horizontal RMS	0.747	Frequency	91.7 / 412.65 MHz
Vertical RMS	0.739	Plot	Relative Field
H/V Composite RMS	0.760	Scale	4.5 : 1
FCC Composite RMS	0.865	See Figure 2 for Mechanical Details	

Antenna Model	6810-1D-DA
Pattern Type	Directional Azimuth

Shively Labs

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

Figure 1b



WJAZ Summerdale, PA

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October 4, 2010

 H/V Composite RMS	0.760
 FCC Composite RMS	0.865

Frequency	91.7 / 412.65 MHz
Plot	Relative Field
Scale	4.5 : 1
See Figure 2 for Mechanical Details	

Antenna Model	6810-1D-DA
Pattern Type	Directional H/V Composite

Figure 1c

Tabulation of Horizontal Azimuth Pattern
WJAZ Summerdale, PA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.610	180	0.900
10	0.515	190	0.970
20	0.435	200	1.000
30	0.370	210	1.000
40	0.325	220	1.000
45	0.320	225	1.000
50	0.325	230	1.000
60	0.350	240	1.000
70	0.390	250	1.000
80	0.395	260	1.000
90	0.385	270	1.000
100	0.350	280	1.000
110	0.320	290	1.000
120	0.355	300	0.980
130	0.395	310	0.965
135	0.425	315	0.940
140	0.465	320	0.910
150	0.560	330	0.840
160	0.680	340	0.770
170	0.790	350	0.690

Figure 1d

Tabulation of Vertical Azimuth Pattern
WJAZ Summerdale, PA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.620	180	0.770
10	0.530	190	0.830
20	0.495	200	0.890
30	0.485	210	0.940
40	0.465	220	0.995
45	0.465	225	0.995
50	0.465	230	0.995
60	0.445	240	0.995
70	0.420	250	0.995
80	0.395	260	0.996
90	0.385	270	0.995
100	0.355	280	0.995
110	0.350	290	0.995
120	0.350	300	0.990
130	0.370	310	0.970
135	0.390	315	0.950
140	0.420	320	0.920
150	0.530	330	0.860
160	0.650	340	0.790
170	0.720	350	0.700

Figure 1e

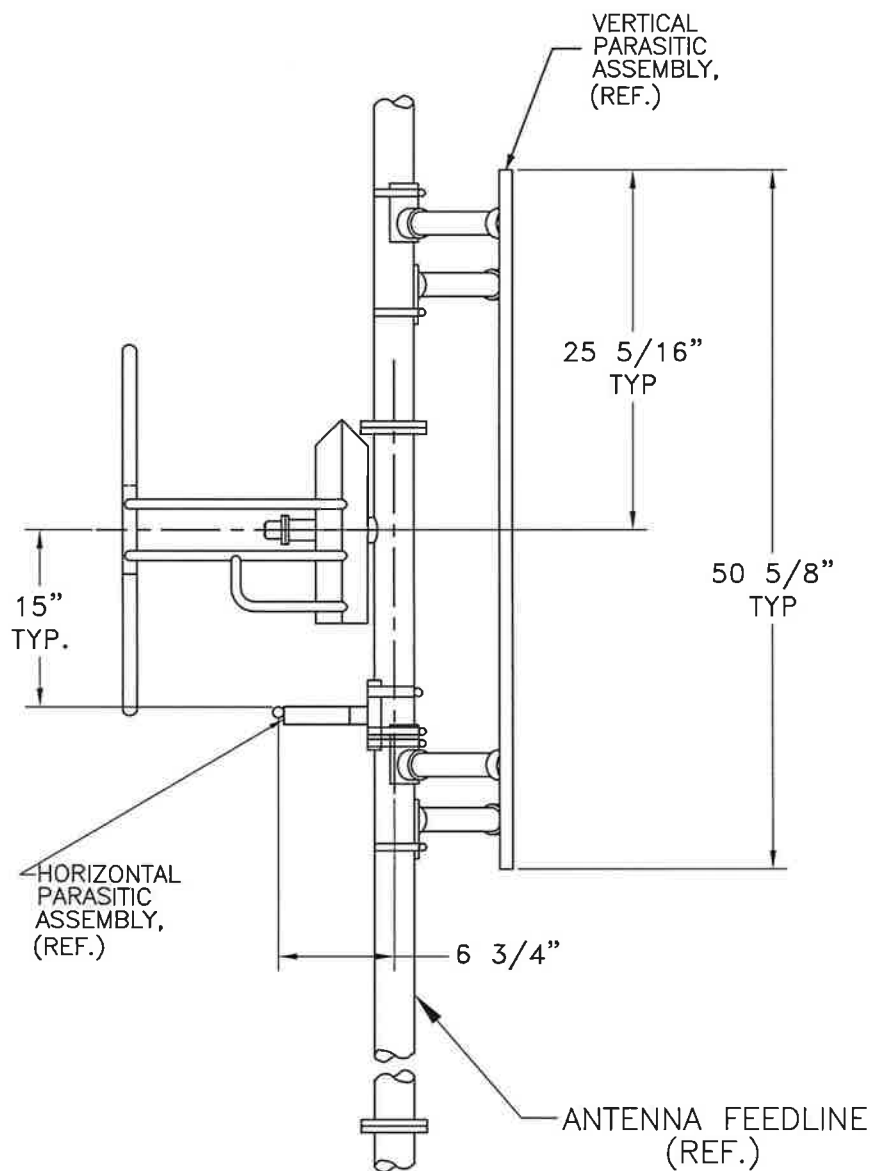
Tabulation of Composite Azimuth Pattern
WJAZ Summerdale, PA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.620	180	0.900
10	0.530	190	0.970
20	0.495	200	1.000
30	0.485	210	1.000
40	0.465	220	1.000
45	0.465	225	1.000
50	0.465	230	1.000
60	0.445	240	1.000
70	0.420	250	1.000
80	0.395	260	1.000
90	0.385	270	1.000
100	0.355	280	1.000
110	0.350	290	1.000
120	0.355	300	0.990
130	0.395	310	0.970
135	0.425	315	0.950
140	0.465	320	0.920
150	0.560	330	0.860
160	0.680	340	0.790
170	0.790	350	0.700

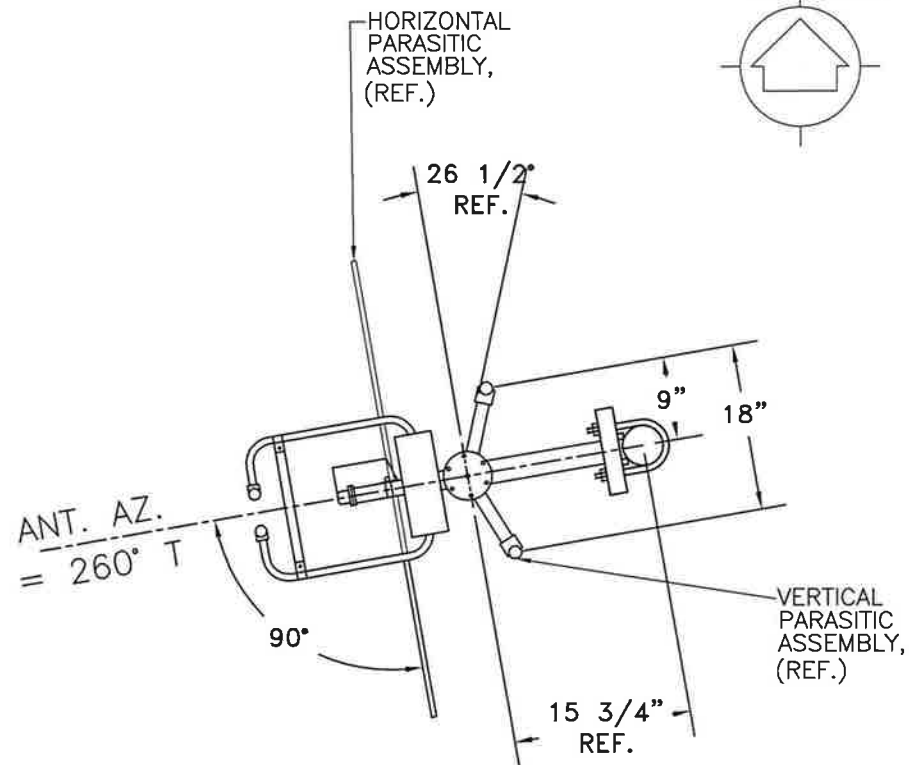
Figure 1f

Tabulation of FCC Directional Composite
WJAZ Summerdale, PA

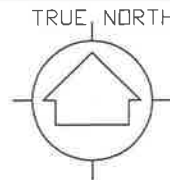
Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.922
10	1.000	190	1.000
20	1.000	200	1.000
30	1.000	210	1.000
40	1.000	220	1.000
50	0.794	230	1.000
60	0.630	240	1.000
70	0.501	250	1.000
80	0.398	260	1.000
90	0.398	270	1.000
100	0.501	280	1.000
110	0.457	290	1.000
120	0.363	300	1.000
130	0.398	310	1.000
140	0.501	320	1.000
150	0.562	330	1.000
160	0.707	340	1.000
170	0.803	350	1.000



SIDE VIEW



TOP VIEW
TOWER: OUT-RIGGED POLE



ANTENNA HEADING 260° TRUE NORTH

SHIVELY LABS			
A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE			
WORK ORDER:	PROJECT:	SCALE:	DESIGNED BY:
28513	91.7	N.T.S.	ASP
TITLE:			APPROVED BY:
MODEL-6810-1D-DIRECTIONAL ANTENNA			DAB
DATE:		FIGURE 2	
10/12/10			

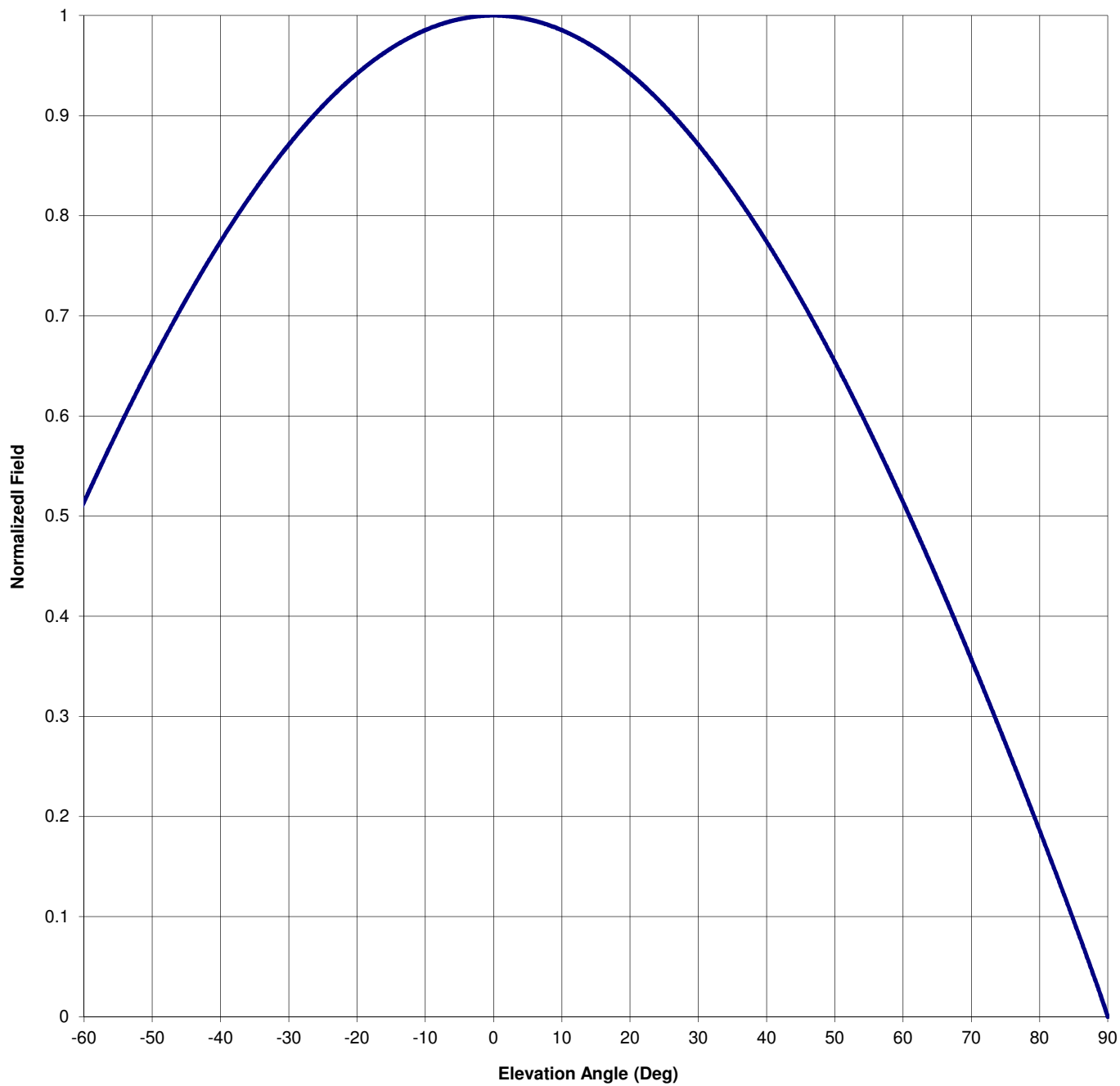
Antenna Mfg.: Shively Labs
Antenna Type: 6810-1D-DA

Date: 10/13/2010

Station: WJAZ
Frequency: 91.7
Channel #: 219

Beam Tilt	0	
Gain (Max)	0.822	-0.849 dB
Gain (Horizon)	0.822	-0.849 dB

Figure: 3



Antenna Mfg.: Shively Labs

Date: 10/13/2010

Antenna Type: 6810-1D-DA

Station: WJAZ

Beam Tilt 0

Frequency: 91.7

Gain (Max) 0.822

-0.849 dB

Channel #: 219

Gain (Horizon) 0.822

-0.849 dB

Figure: 3

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	0.729	0	1.000	46	0.705
-89	0.021	-43	0.741	1	1.000	47	0.693
-88	0.040	-42	0.752	2	0.999	48	0.680
-87	0.059	-41	0.763	3	0.999	49	0.667
-86	0.078	-40	0.774	4	0.998	50	0.654
-85	0.096	-39	0.785	5	0.996	51	0.641
-84	0.114	-38	0.796	6	0.995	52	0.628
-83	0.133	-37	0.806	7	0.993	53	0.614
-82	0.151	-36	0.816	8	0.991	54	0.600
-81	0.168	-35	0.826	9	0.988	55	0.586
-80	0.186	-34	0.835	10	0.985	56	0.572
-79	0.204	-33	0.845	11	0.982	57	0.558
-78	0.221	-32	0.854	12	0.979	58	0.544
-77	0.239	-31	0.862	13	0.975	59	0.529
-76	0.256	-30	0.871	14	0.971	60	0.514
-75	0.273	-29	0.879	15	0.967	61	0.499
-74	0.290	-28	0.887	16	0.963	62	0.484
-73	0.307	-27	0.895	17	0.958	63	0.469
-72	0.324	-26	0.903	18	0.953	64	0.453
-71	0.341	-25	0.910	19	0.948	65	0.437
-70	0.357	-24	0.917	20	0.942	66	0.422
-69	0.373	-23	0.924	21	0.936	67	0.406
-68	0.390	-22	0.930	22	0.930	68	0.390
-67	0.406	-21	0.936	23	0.924	69	0.373
-66	0.422	-20	0.942	24	0.917	70	0.357
-65	0.437	-19	0.948	25	0.910	71	0.341
-64	0.453	-18	0.953	26	0.903	72	0.324
-63	0.469	-17	0.958	27	0.895	73	0.307
-62	0.484	-16	0.963	28	0.887	74	0.290
-61	0.499	-15	0.967	29	0.879	75	0.273
-60	0.514	-14	0.971	30	0.871	76	0.256
-59	0.529	-13	0.975	31	0.862	77	0.239
-58	0.544	-12	0.979	32	0.854	78	0.221
-57	0.558	-11	0.982	33	0.845	79	0.204
-56	0.572	-10	0.985	34	0.835	80	0.186
-55	0.586	-9	0.988	35	0.826	81	0.168
-54	0.600	-8	0.991	36	0.816	82	0.151
-53	0.614	-7	0.993	37	0.806	83	0.133
-52	0.628	-6	0.995	38	0.796	84	0.114
-51	0.641	-5	0.996	39	0.785	85	0.096
-50	0.654	-4	0.998	40	0.774	86	0.078
-49	0.667	-3	0.999	41	0.763	87	0.059
-48	0.680	-2	0.999	42	0.752	88	0.040
-47	0.693	-1	1.000	43	0.741	89	0.021
-46	0.705	0	1.000	44	0.729	90	0.000
-45	0.717			45	0.717		

VALIDATION OF TOTAL POWER GAIN CALCULATION

WJAZ 91.7 MHz Summerdale, PA

Model 6810-1D-DA

Elevation Gain of Antenna

0.454

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

H RMS 0.747

V RMS 0.739

H/V Ratio 1.011

Elevation Gain of Horizontal Component 0.459

Elevation Gain of Vertical Component 0.449

Horizontal Azimuth Gain equals $1/(\text{RMS})^2$. 1.792Vertical Azimuth Gain equals $1/(\text{RMS}/\text{Max Vert})^2$. 1.816

Max. Vertical

0.996

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

Total Horizontal Power Gain = 0.822

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

Total Vertical Power Gain = 0.816

=====

ERP divided by Horizontal Power Gain equals Antenna Input Power

1

kW ERP Divided by H Gain 0.822 equals 1.22 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

1.22 kW Times V Gain 0.816 equals 0.99 kW V ERP

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

(0.996)^2 Times 1.00 Equals 0.99 kW Vertical ERP

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