

**S.O. 29158 MOD**  
**Report of Test 6810-1-DA**  
**for**  
**Willamette Information, News, and Entertain**  
**KMUZ 88.5 MHz Turner, OR**

**OBJECTIVE:**

The objective of this test was to demonstrate the directional characteristics of a 6810-1-DA to meet the needs of KMUZ and to comply with the requirements of the FCC construction permit, file number BMPED-20111103AMC. This test characterizes only the radiation characteristics of the antenna when mounted on the tower as described. It does not represent or imply any guarantee of specific coverage which can be influenced by factors beyond the scope of this test.

**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-20111103AMC indicates that the Horizontal radiation component shall not exceed 0.0320 kW at any azimuth and is restricted to the following values at the azimuths specified:

000 Degrees T: 0.0115 kW

010 Degrees T: 0.0105 k

020 Degrees T: 0.0110 kW

215 Degrees T: 0.0170 kW

220 Degrees T: 0.0165 kW

230 Degrees T: 0.0170 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 129 Degrees T to 135 Degrees T and 287 Degrees T to 302 Degrees T. At the restricted azimuth of 000 Degrees T the Horizontal component is 4.408 dB down from the maximum of 0.0320 kW, or 0.0115 kW, at the restricted azimuth of 010 Degrees T the horizontal component is 5.083 dB down from the maximum of 0.0320 kW, or 0.0099 kW, at the restricted azimuth of 020 Degrees T the Horizontal component is 5.0518 dB down from the maximum of 0.0320 kW, or .0010 kW, at the restricted azimuth of 215 Degrees T the vertical component is 3.1728 dB down from the maximum of 0.0320 kW, or 0.0154 kW, at the restricted azimuth of 220 Degrees T the vertical component is 3.1603 dB down from the maximum of 0.0320 kW, or 0.0154 kW and at the restricted azimuth of 230 Degrees T the vertical component is 3.0234 dB down from the maximum of 0.0320 kW, or 0.0160 kW.

The R.M.S. of the Horizontal component is 0.804. The total Horizontal power gain is 0.740. The R.M.S. of the Vertical component is 0.773. The total Vertical power gain is 0.654. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.925. The R.M.S. of the measured composite pattern is 0.810. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.786. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

#### **METHOD OF DIRECTIONALIZATION:**

One bay of the 6810-1-DA was mounted on a pole of precise scale to the pole at the KMUZ 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-20111103AMC, a single level of the 6810-1-DA was set up on the Shively Labs 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<sup>th</sup> and 10<sup>th</sup> 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

All testing is carried out in strict accordance with approved procedures under our ISO9001:2008.

**TEST PROCEDURES:**

The receiving antenna system is mounted so that the horizontal and vertical azimuth patterns are measured independently. The network analyzer was set to 398.25 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 unpadding 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:

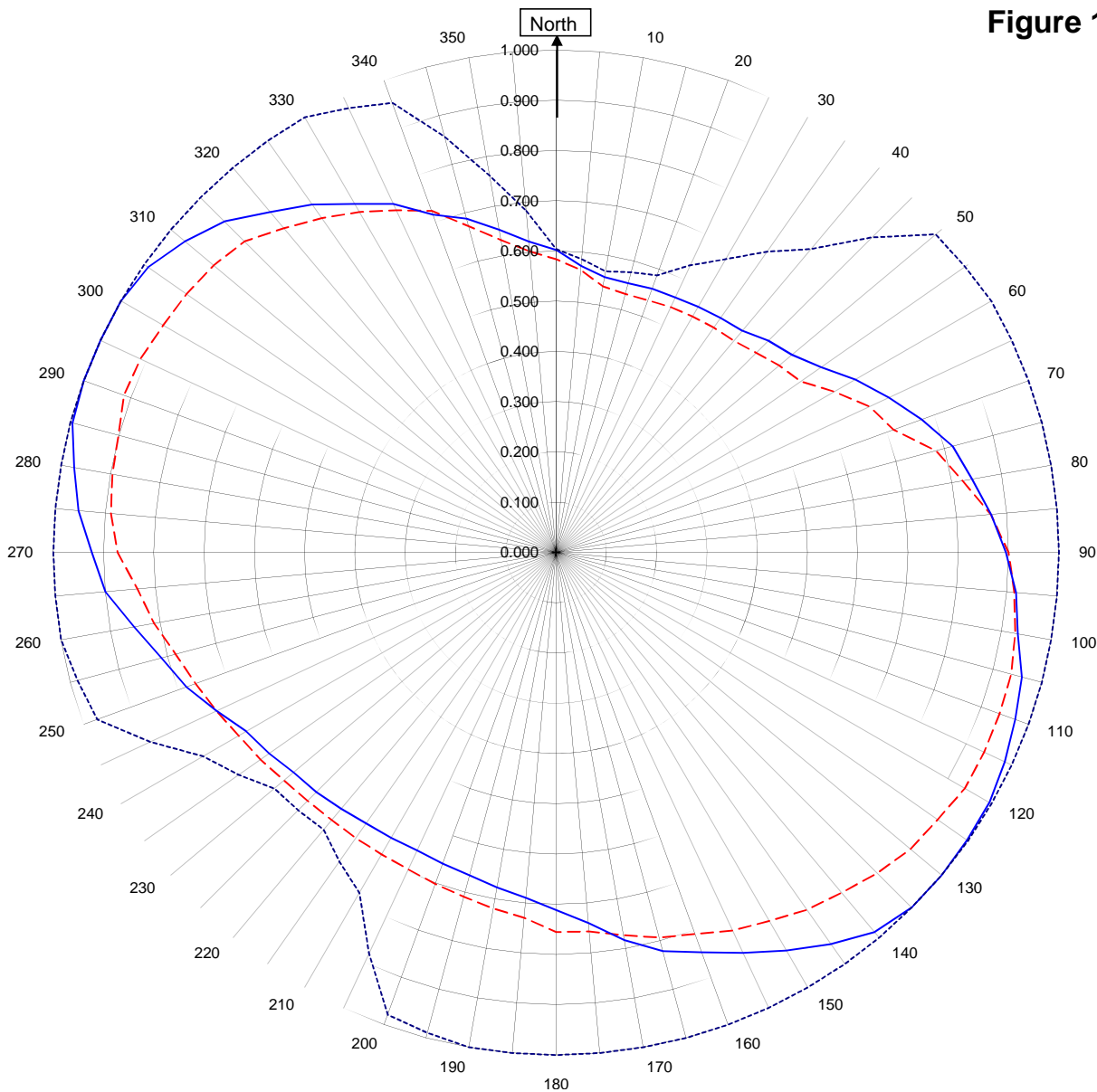


Robert A. Surette  
Director of Sales Engineering  
S/O 29158  
November 28, 2011

# Shively Labs

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

Figure 1A



**KMUZ Turner, OR**  
29158MOD  
November 28, 2011

Horizontal RMS	0.804
Vertical RMS	0.773
H/V Composite RMS	0.810
FCC Composite RMS	0.925

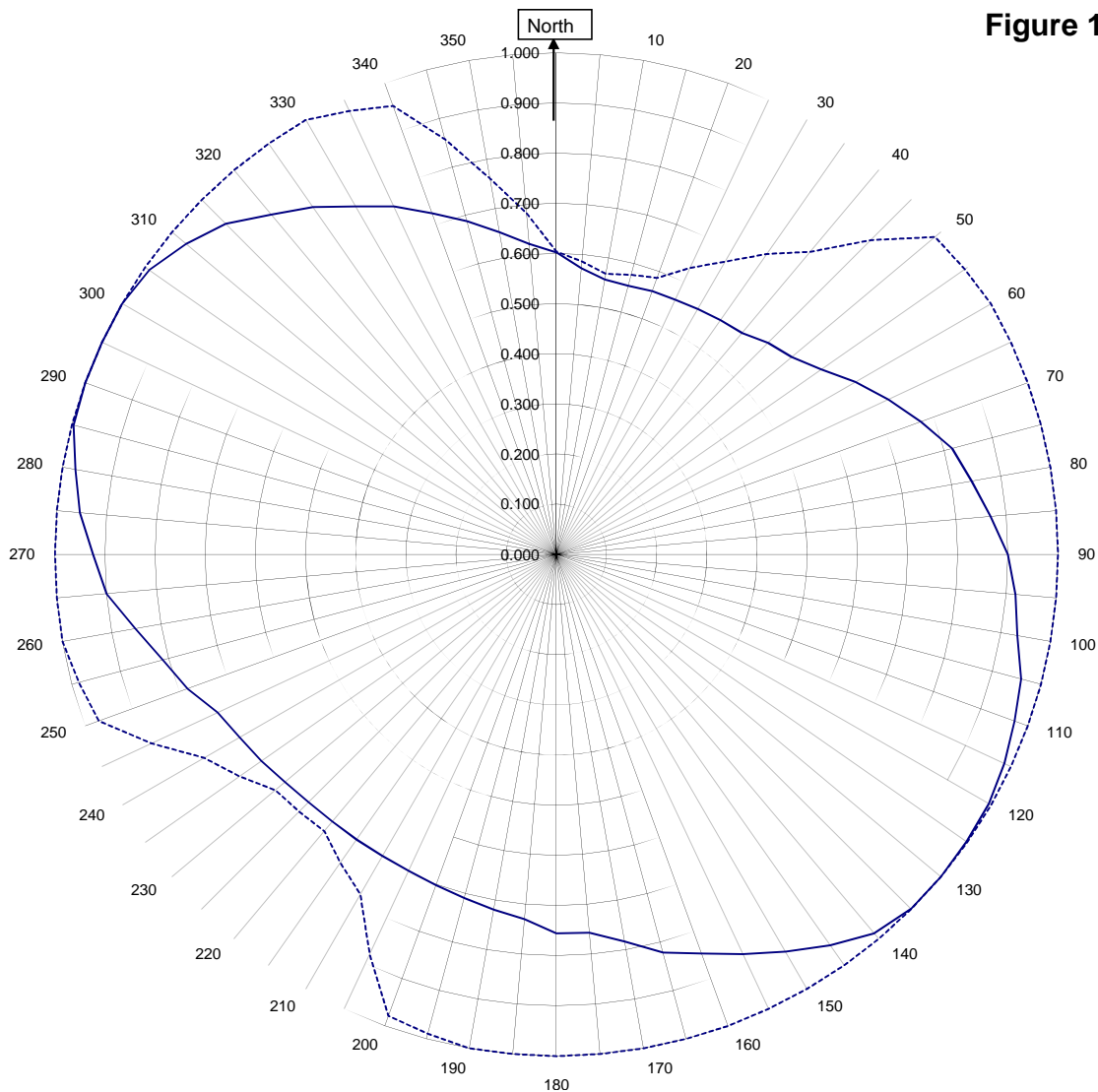
Frequency	88.5 / 398.25 mHz
Plot	Relative Field
Scale	4.5 : 1
See Figure 2 for Mechanical Details	

Antenna Model	6810-1-DA
Pattern Type	Directional Azimuth

# Shively Labs

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

Figure 1B



## KMUZ Turner, OR

29158MOD  
November 28, 2011

—————H/V Composite RMS	0.810
.....FCC Composite RMS	0.925

Frequency	88.5 / 398.25 mHz
Plot	Relative Field
Scale	4.5 : 1
See Figure 2 for Mechanical Details	

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

Figure 1C

Tabulation of Horizontal Azimuth Pattern  
KMUZ Turner, OR

Azimuth	Rel Field	Azimuth	Rel Field
0	0.602	180	0.711
10	0.557	190	0.677
20	0.559	200	0.659
30	0.565	210	0.656
40	0.576	220	0.665
45	0.596	225	0.675
50	0.612	230	0.681
60	0.688	240	0.712
70	0.774	250	0.782
80	0.840	260	0.852
90	0.895	270	0.924
100	0.933	280	0.974
110	0.972	290	1.000
120	0.995	300	1.000
130	1.000	310	0.964
135	1.000	315	0.932
140	0.986	320	0.885
150	0.915	330	0.801
160	0.847	340	0.716
170	0.784	350	0.652

Figure 1D

Tabulation of Vertical Azimuth Pattern  
KMUZ Turner, OR

Azimuth	Rel Field	Azimuth	Rel Field
0	0.584	180	0.755
10	0.538	190	0.719
20	0.534	200	0.702
30	0.542	210	0.694
40	0.550	220	0.695
45	0.562	225	0.699
50	0.579	230	0.706
60	0.640	240	0.729
70	0.715	250	0.764
80	0.821	260	0.812
90	0.900	270	0.873
100	0.927	280	0.896
110	0.938	290	0.915
120	0.938	300	0.903
130	0.919	310	0.889
135	0.902	315	0.876
140	0.884	320	0.842
150	0.847	330	0.783
160	0.808	340	0.724
170	0.774	350	0.632



Figure 1E

Tabulation of Composite Azimuth Pattern  
KMUZ Turner, OR

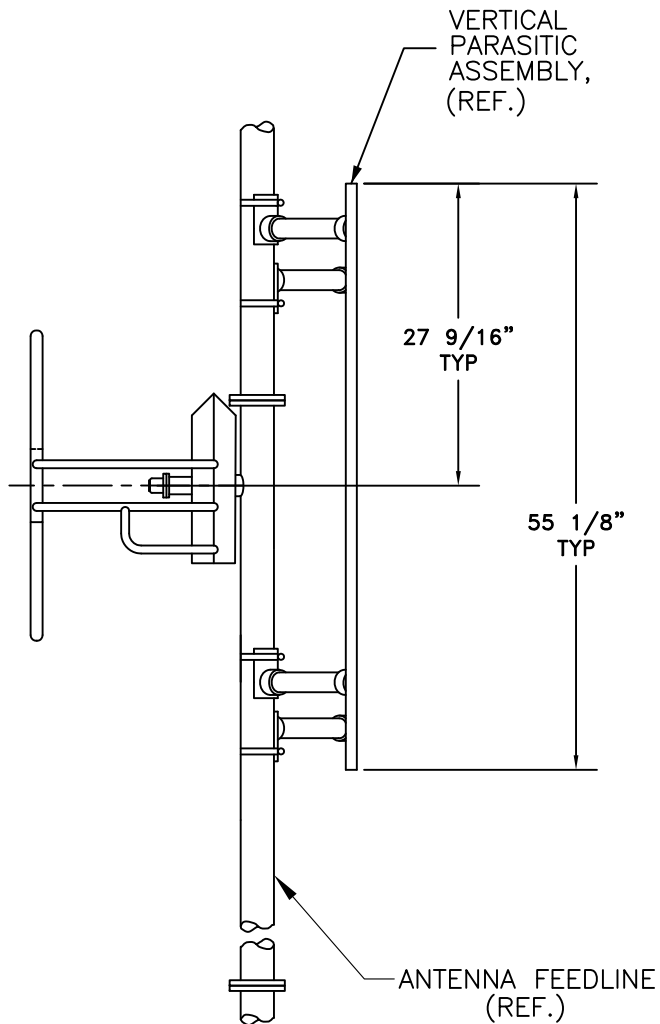
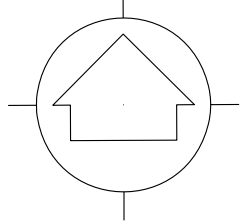
Azimuth	Rel Field	Azimuth	Rel Field
0	0.602	180	0.755
10	0.557	190	0.719
20	0.559	200	0.702
30	0.565	210	0.694
40	0.576	220	0.695
45	0.596	225	0.699
50	0.612	230	0.706
60	0.688	240	0.729
70	0.774	250	0.782
80	0.840	260	0.852
90	0.900	270	0.924
100	0.933	280	0.974
110	0.972	290	1.000
120	0.995	300	1.000
130	1.000	310	0.964
135	1.000	315	0.932
140	0.986	320	0.885
150	0.915	330	0.801
160	0.847	340	0.724
170	0.784	350	0.652

Figure 1F

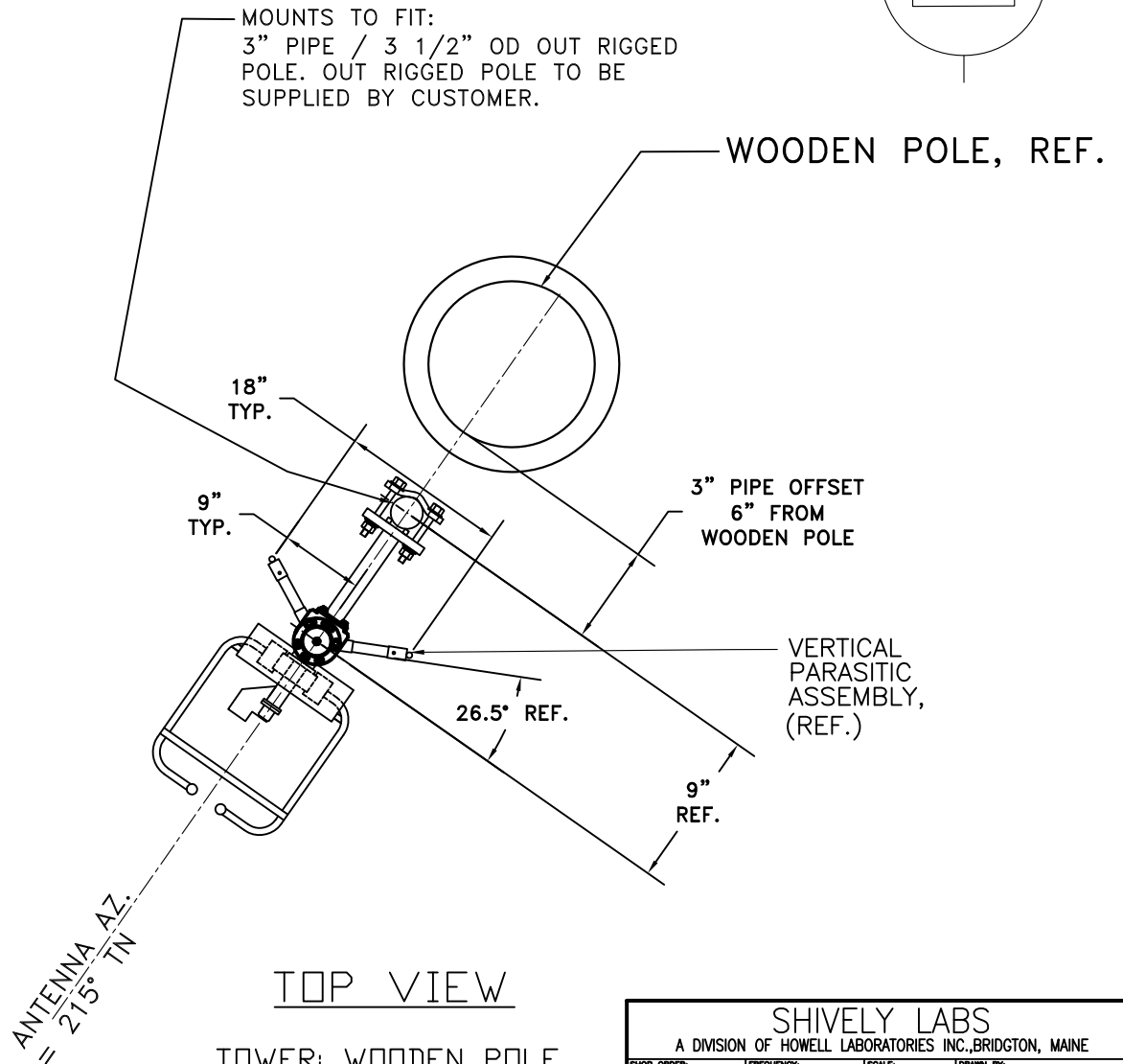
Tabulation of FCC Directional Composite  
KMUZ Turner, OR

Azimuth	Rel Field	Azimuth	Rel Field
0	0.604	180	1.000
10	0.568	190	1.000
20	0.587	200	0.979
30	0.674	210	0.782
40	0.788	220	0.720
50	0.985	230	0.731
60	1.000	240	0.811
70	1.000	250	0.971
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	1.000	310	1.000
140	1.000	320	1.000
150	1.000	330	1.000
160	1.000	340	0.952
170	1.000	350	0.761

TRUE NORTH



SIDE VIEW



TOP VIEW

TOWER: WOODEN POLE  
WITH 3" OUT-RIGGED  
PIPE

ANTENNA HEADING 215° TRUE NORTH

SHIVELY LABS			
A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE			
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY:
29158	88.5	N.T.S.	ASP
TITLE:		APPROVED BY:	
MODEL-6810-1-DIRECTIONAL ANTENNA		DAB	
DATE:			
7/22/11	FIGURE 2		

Antenna Mfg.: Shively Labs

Antenna Type: 6810-1-DA

Station: KMUZ

Frequency: 88.5

Channel #: 203

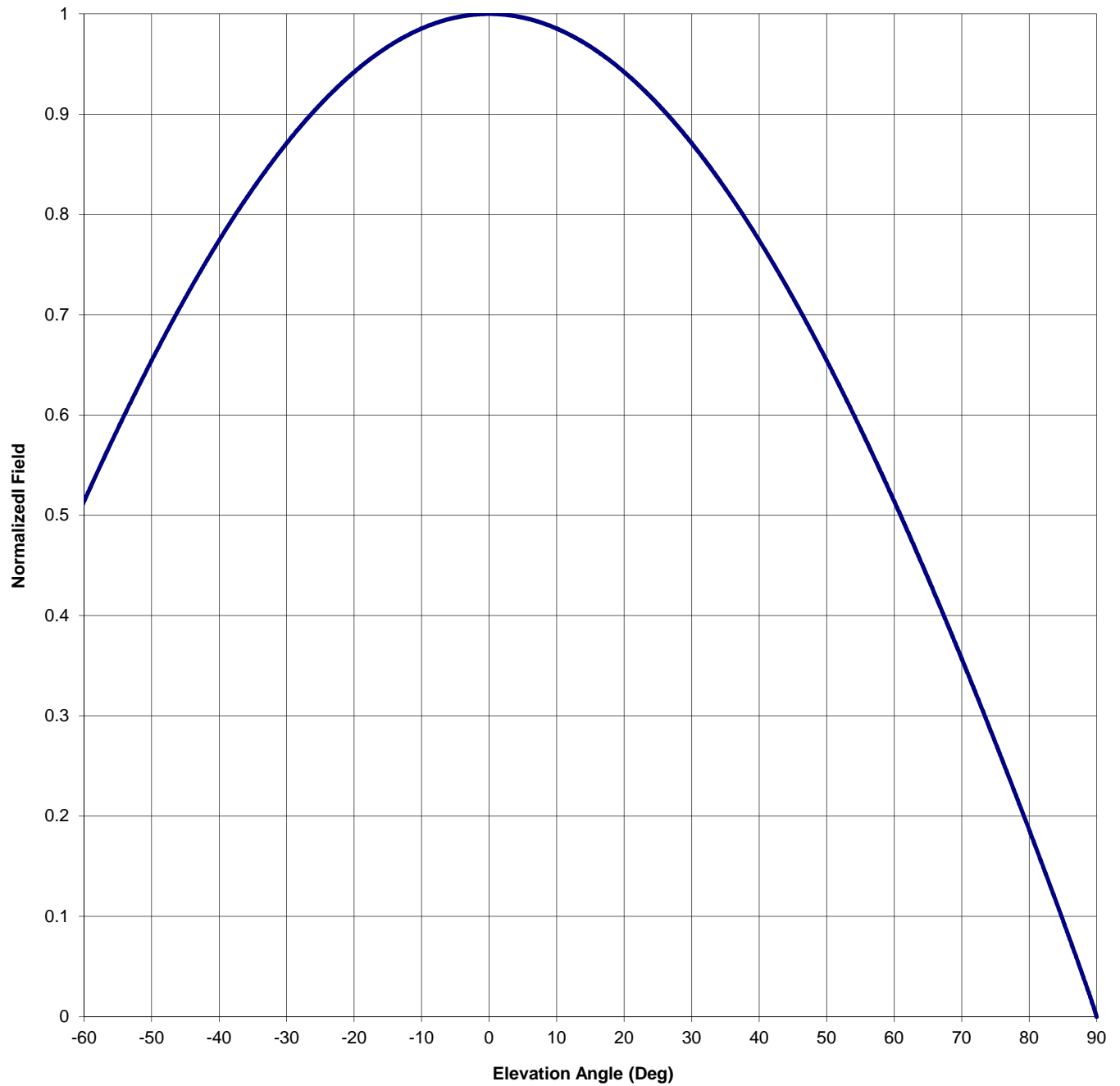
Figure: Figure 3

Date: 11/28/2011

Beam Tilt 0

Gain (Max) 0.740 -1.306 dB

Gain (Horizon) 0.740 -1.306 dB



Antenna Mfg.: Shively Labs

Date: 11/28/2011

Antenna Type: 6810-1-DA

Station: KMUZ

Beam Tilt 0

Frequency: 88.5

Gain (Max) 0.740

-1.306 dB

Channel #: 203

Gain (Horizon) 0.740

-1.306 dB

Figure: 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

KMUZ	Turner, OR
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MODEL	6810-1-DA
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Elevation Gain of Antenna

0.46

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

H RMS

0.803547

V RMS

0.773419

H/V Ratio

1.039

Elevation Gain of Horizontal Component

0.478

Elevation Gain of Vertical Component

0.443

Horizontal Azimuth Gain equals  $1/(\text{RMS})^2$ .

1.549

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

1.477

Max. Vertical

0.94

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

Total Horizontal Power Gain =

0.740

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

Total Vertical Power Gain =

0.654

ERP divided by Horizontal Power Gain equals Antenna Input Power

0.032

kW ERP

Divided by H Gain

0.740

equals

0.043

kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

0.043 kW

Times V Gain

0.654

equals

0.028

kW V ERP

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

 $(0.94)^2$ 

Times

0.03

Equals

0.028

kW Vertical ERP

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