

S.O. 25953

Report of Test 6810-1R-DA

for

STROH COMMUNICATIONS CORP.

NEW FM 103.5 MHz NEW HOPE, AL

## **OBJECTIVE:**

The objective of this test was to demonstrate the directional characteristics of a 6810-1R-DA to meet the needs of New FM and to comply with the requirements of the FCC construction permit, file number BMPH-20070614ABE.

## **RESULTS:**

The measured azimuth pattern for the 6810-1R-DA is shown in Figure 1. Figure 1A shows the Tabulation of the Horizontal Polarization. Figure 1B shows the Tabulation of the Vertical Polarization. Figure 1C shows the Tabulation of the FCC Composite Pattern. The calculated elevation pattern of the antenna is shown in Figure 3. Construction permit file number BMPH-20070614ABE indicates that the Horizontal radiation component shall not exceed 0.290 kW at any azimuth and is restricted to the following values at the azimuths specified:

280 Degrees T: 0.150 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 043 Degrees T to 055 Degrees T and at 090 Degrees T to 096 Degrees T. At the restricted azimuth of 280 Degrees T the Horizontal component is 3.324 dB down from the maximum of 0.290 kW, or 0.135 kW.

The R.M.S. of the Horizontal component is 0.738. The total Horizontal power gain is 0.887. The R.M.S. of the Vertical component is 0.703. The total Vertical power gain is 0.878. 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 0.816. 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 0.755 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:**

The 6810-1R-DA was mounted on a tower of precise scale to the 7 foot face tower at the New FM 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 BMPH-20070614ABE, a single level of the 6810-1R-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 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

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 465.75 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:

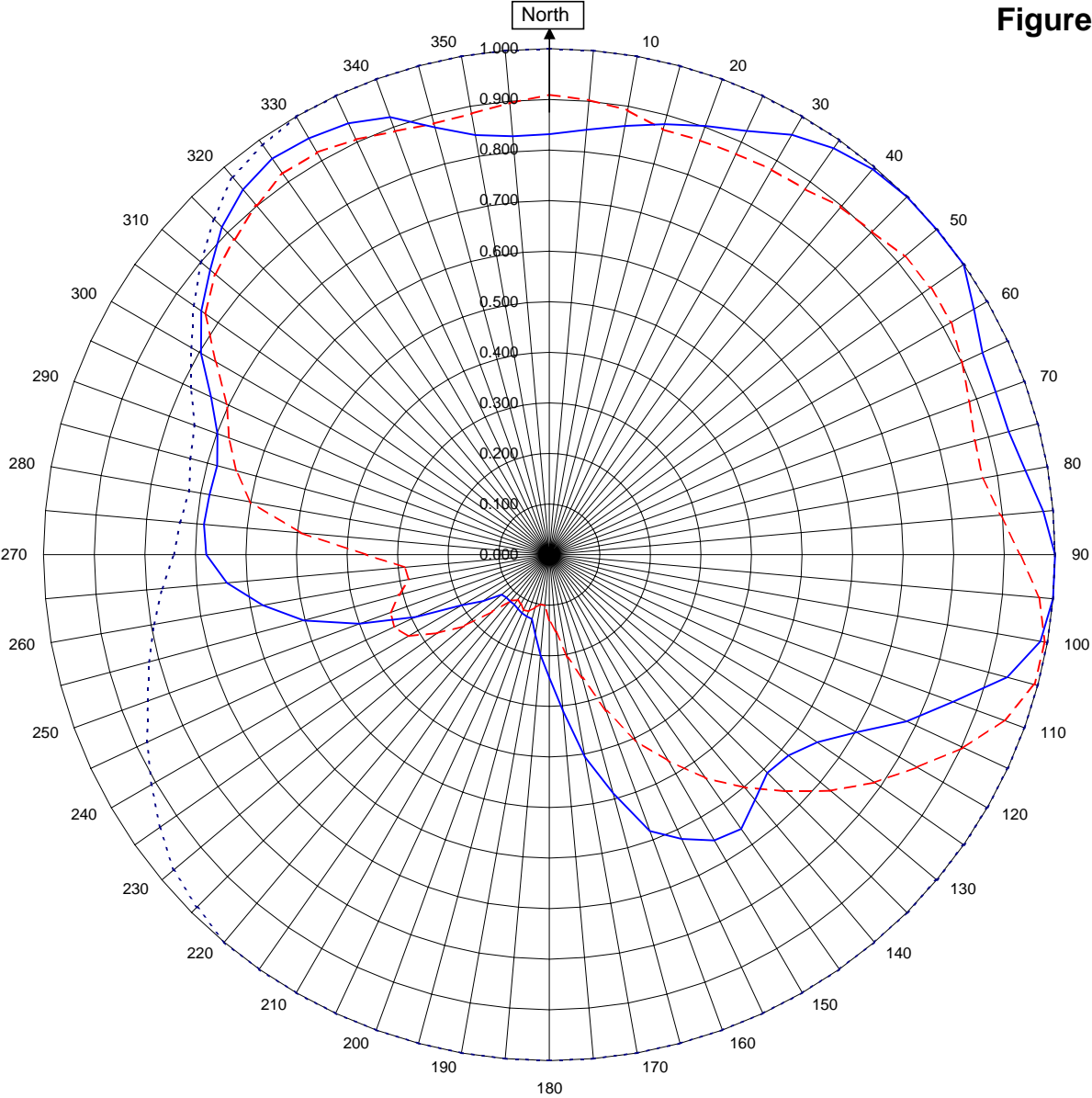
A handwritten signature in black ink, appearing to read "Robert A. Surette", with a stylized flourish at the end.

Robert A. Surette  
Director of Sales Engineering  
S/O 25953  
September 13, 2007

# Shively Labs

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

Figure 1



## New FM New Hope, AL

25953

September 13, 2007

Horizontal RMS	0.738	Frequency	103.5 / 465.75 MHz
Vertical RMS	0.703	Plot	Relative Field
H/V Composite RMS	0.756	Scale	4.5 : 1
FCC Composite RMS	0.960	See Figure 2 for Mechanical Details	

Antenna Model	6810-1R-DA	Pattern 09-A
Pattern Type	Directional Azimuth	

Figure 1a

Tabulation of Horizontal Azimuth Pattern  
New FM New Hope, AL

Azimuth	Rel Field	Azimuth	Rel Field
0	0.831	180	0.243
10	0.860	190	0.159
20	0.902	200	0.130
30	0.958	210	0.124
40	0.995	220	0.120
45	1.000	225	0.120
50	1.000	230	0.123
60	0.970	240	0.200
70	0.939	250	0.400
80	0.956	260	0.575
90	1.000	270	0.678
100	0.986	280	0.682
110	0.850	290	0.698
120	0.702	300	0.795
130	0.617	310	0.875
135	0.610	315	0.916
140	0.633	320	0.942
150	0.652	330	0.950
160	0.581	340	0.920
170	0.406	350	0.842

Figure 1b

Tabulation of Vertical Azimuth Pattern  
New FM New Hope, AL

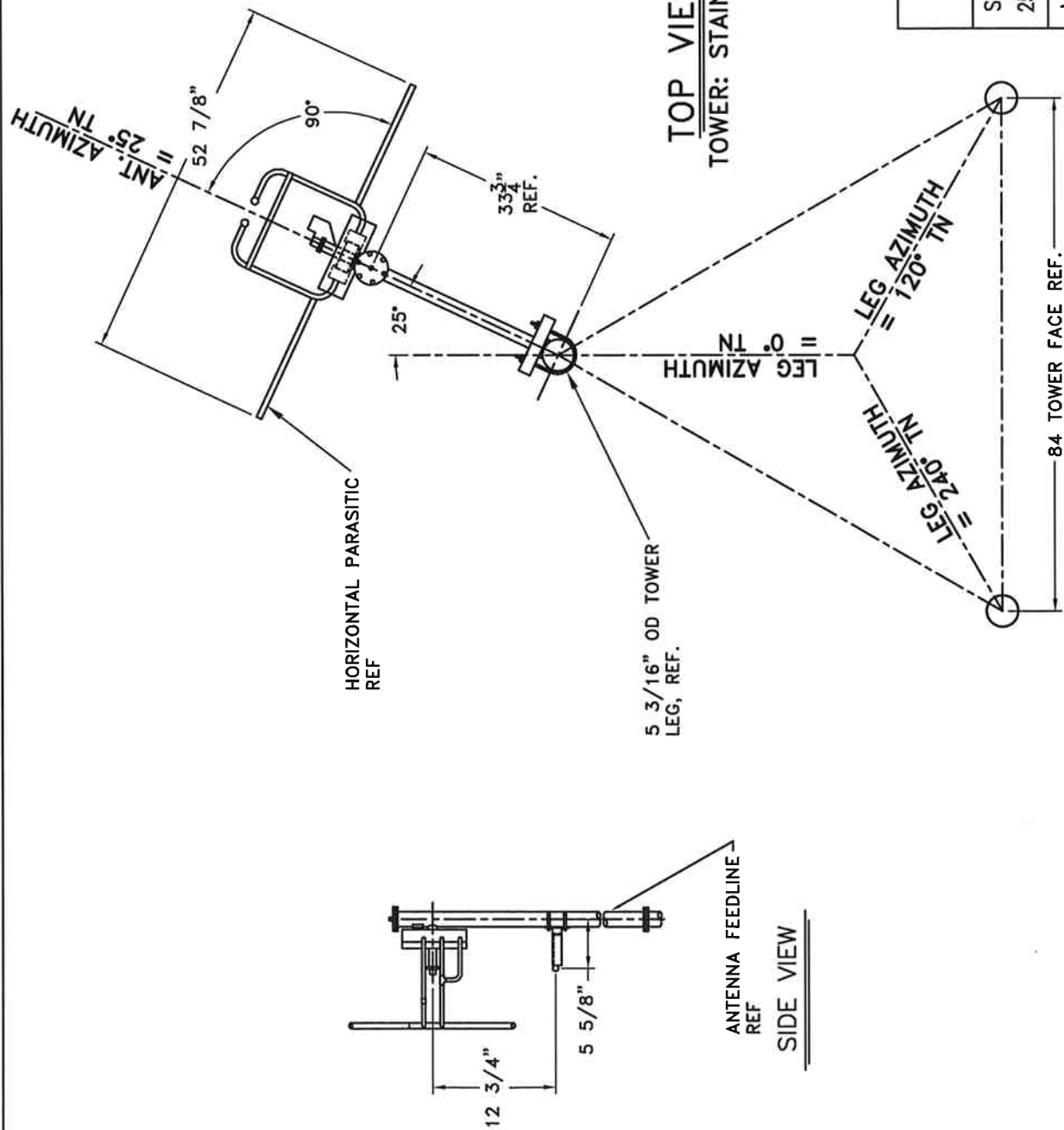
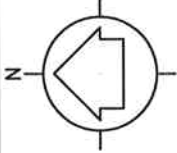
Azimuth	Rel Field	Azimuth	Rel Field
0	0.909	180	0.130
10	0.892	190	0.100
20	0.871	200	0.119
30	0.879	210	0.112
40	0.897	220	0.118
45	0.903	225	0.160
50	0.917	230	0.221
60	0.918	240	0.322
70	0.884	250	0.334
80	0.870	260	0.282
90	0.931	270	0.362
100	0.995	280	0.600
110	0.957	290	0.674
120	0.840	300	0.762
130	0.726	310	0.862
135	0.662	315	0.881
140	0.601	320	0.901
150	0.470	330	0.918
160	0.329	340	0.890
170	0.207	350	0.885

Figure 1c

Tabulation of FCC Directional Composite  
New FM New Hope, AL

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	1.000
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	1.000	230	0.970
60	1.000	240	0.909
70	1.000	250	0.845
80	1.000	260	0.794
90	1.000	270	0.742
100	1.000	280	0.723
110	1.000	290	0.746
120	1.000	300	0.817
130	1.000	310	0.899
140	1.000	320	0.975
150	1.000	330	1.000
160	1.000	340	1.000
170	1.000	350	1.000





# SHIVELY LABS

A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE

SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY:
25953	103.5 MHz.	N.T.S.	ASP
			APPROVED BY:

MODEL:

6810-1R-DIRECTIONAL ANTENNA

DATE:

9/6/07

ANTENNA HEADING: 25° TRUE NORTH

## FIGURE 2

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

Date: 9/13/2007

Station: NEW FM

Frequency: 103.5

Channel #: 278

Figure: 3

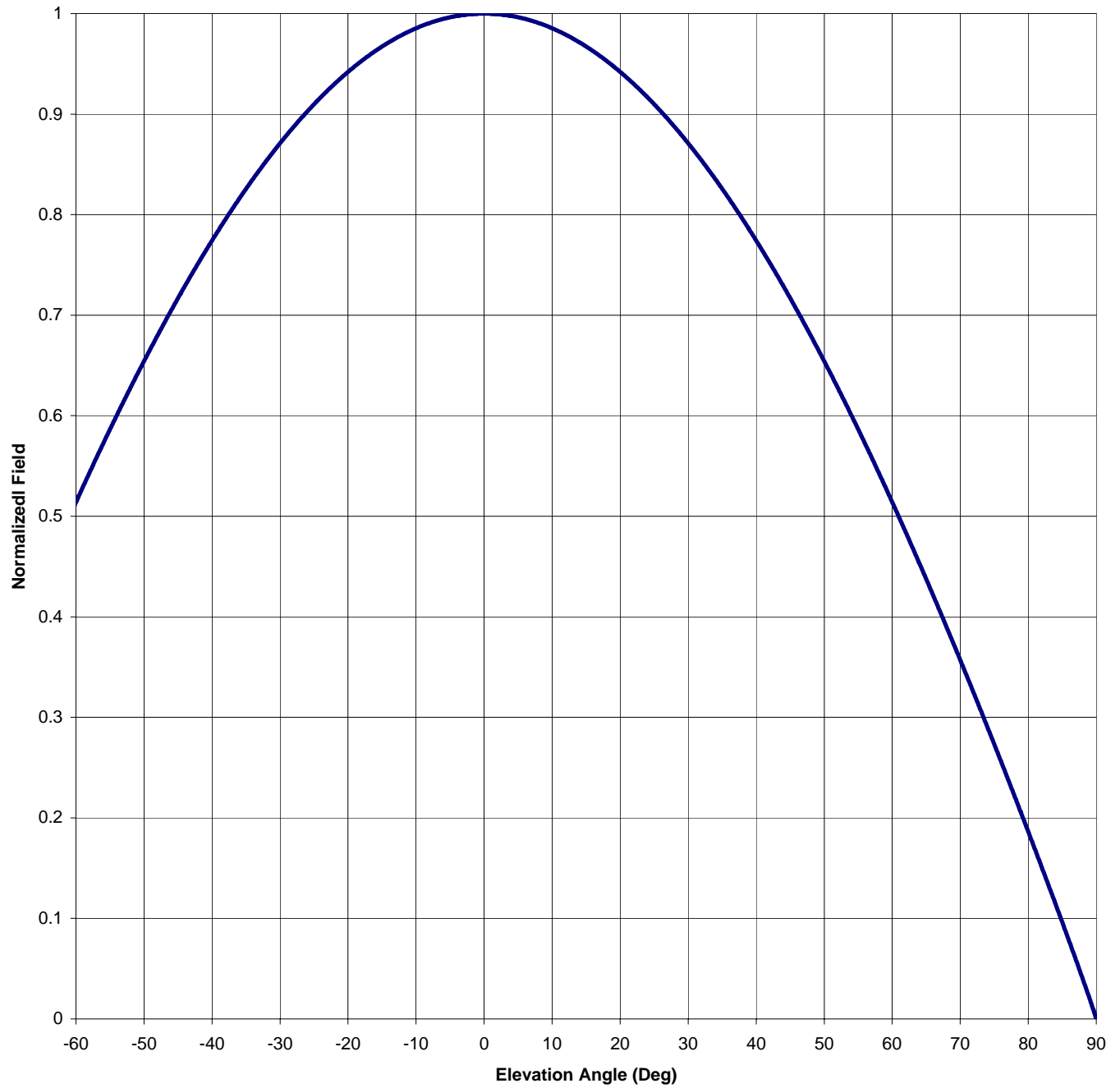
Beam Tilt 0

Gain (Max) 0.887

Gain (Horizon) 0.887

-0.522 dB

-0.522 dB



Antenna Mfg.: Shively Labs  
 Antenna Type: 6810-1R-DA  
 Station: NEW FM  
 Frequency: 103.5  
 Channel #: 278  
 Figure: 3

Date: 9/13/2007

Beam Tilt 0  
 Gain (Max) 0.887 -0.522 dB  
 Gain (Horizon) 0.887 -0.522 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	0.729	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

NEW FM 103.5 MHz NEW HOPE, AL

MODEL 6810-1R-DA

Elevation Gain of Antenna 0.46

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

H RMS	0.738	V RMS	0.703	H/V Ratio	1.050
-------	-------	-------	-------	-----------	-------

Elevation Gain of Horizontal Component 0.483

Elevation Gain of Vertical Component 0.438

Horizontal Azimuth Gain equals 1/(RMS)SQ. 1.836

Vertical Azimuth Gain equals 1/(RMS/Max Vert)SQ. 2.003

Max. Vertical 0.995

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

Total Horizontal Power Gain = 0.887

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

Total Vertical Power Gain = 0.878

=====

ERP divided by Horizontal Power Gain equals Antenna Input Power

0.29 KW ERP Equals 0.327 KW Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

0.327 KW Times 0.878 KW Equals 0.287 KW ERP

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

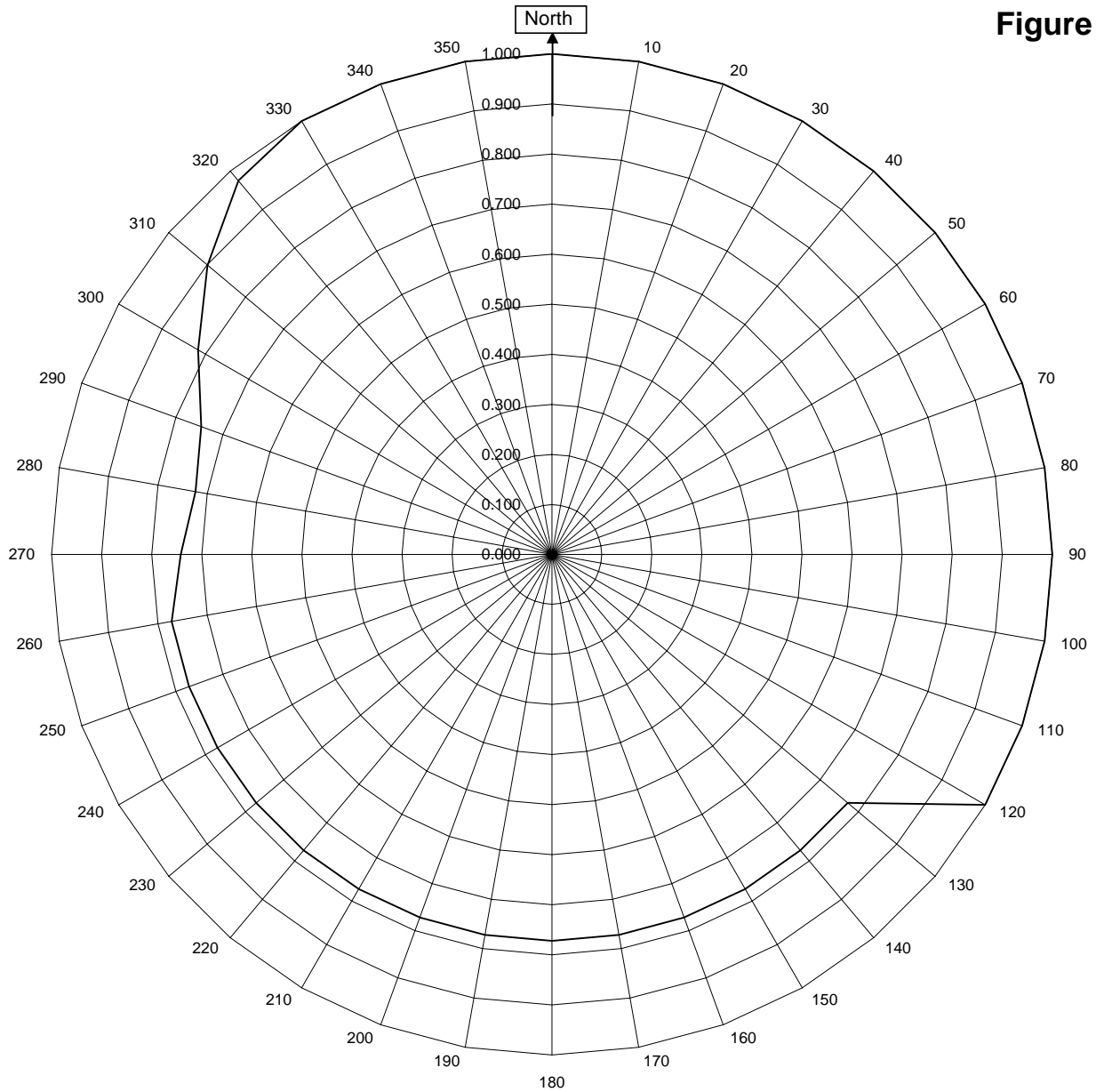
0.995 Equals 0.287 KW Vertical ERP

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

# Shively Labs

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

**Figure 5**



## New FM New Hope, AL

25953

September 13, 2007

Amended Composite RMS	0.888
85% Amended Composite RMS	0.755

Frequency	103.5 / 465.75 mHz
Plot	Relative Field

Antenna Model	6810-1R-DA	Pattern 09-A
Pattern Type	Amended FCC Composite	

Figure 5a

Tabulation of Amended Composite Pattern  
New FM New Hope, AL

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.772
10	1.000	190	0.772
20	1.000	200	0.772
30	1.000	210	0.772
40	1.000	220	0.772
45	1.000	225	0.772
50	1.000	230	0.772
60	1.000	240	0.772
70	1.000	250	0.772
80	1.000	260	0.772
90	1.000	270	0.742
100	1.000	280	0.723
110	1.000	290	0.746
120	1.000	300	0.817
130	0.772	310	0.899
135	0.772	315	0.937
140	0.772	320	0.975
150	0.772	330	1.000
160	0.772	340	1.000
170	0.772	350	1.000