

## **S.O. 30856**

### **Report of Test 6025-1/2-DA**

**for**

**Redeemer Broadcasting, INC.**

**New FM 90.3 MHz Taylortown, NJ**

### **OBJECTIVE:**

The objective of this test was to demonstrate the directional characteristics of a 6025-1/2-DA to meet the needs of New FM and to comply with the requirements of the FCC construction permit, file number BNPED-20071022AYI. 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 BNPED-20071022AYI indicates that the Horizontal radiation component shall not exceed 0.060 kW at any azimuth and is restricted to the following values at the azimuths specified:

30 Degrees True: 0.0026 kilowatts

70 to 80 Degrees True: 0.0019 kilowatts

330 Degrees True: 0.0046 kilowatts

From Figure 1A, the maximum radiation of the Horizontal component occurs at 245 Degrees True to 250 Degrees True. At the restricted azimuth of 30 Degrees True the Horizontal component is 20.00 dB down from the maximum of 0.060 kW, or 0.0006 kW. . At the restricted azimuth of 70 to 80 Degrees True the Vertical component is 15.65 dB down from the maximum of 0.060 kW, or 0.0016 kW. At the restricted azimuth of 330 Degrees True the Vertical component is 19.172 dB down from the maximum of 0.060 kW, or 0.00073 kW

The R.M.S. of the Horizontal component is 0.489. The total Horizontal power gain is 2.397. The R.M.S. of the Vertical component is 0.469. The total Vertical power gain is 1.903. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.566. The R.M.S. of the measured composite pattern is 0.504. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.481. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

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

One bay of the 6025-1/2-DA was mounted on a set of poles of precise scale to the pole on top of the tower platform at the New FM site. The spacing of the antenna to the poles was varied to achieve the horizontal and vertical patterns shown in Figure 1A. See Figure 2 for mechanical details.

#### **METHOD OF MEASUREMENT:**

As allowed by the construction permit, file number BNPED-20071022AYI, a single level of the 6025-1/2-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 406.35 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:

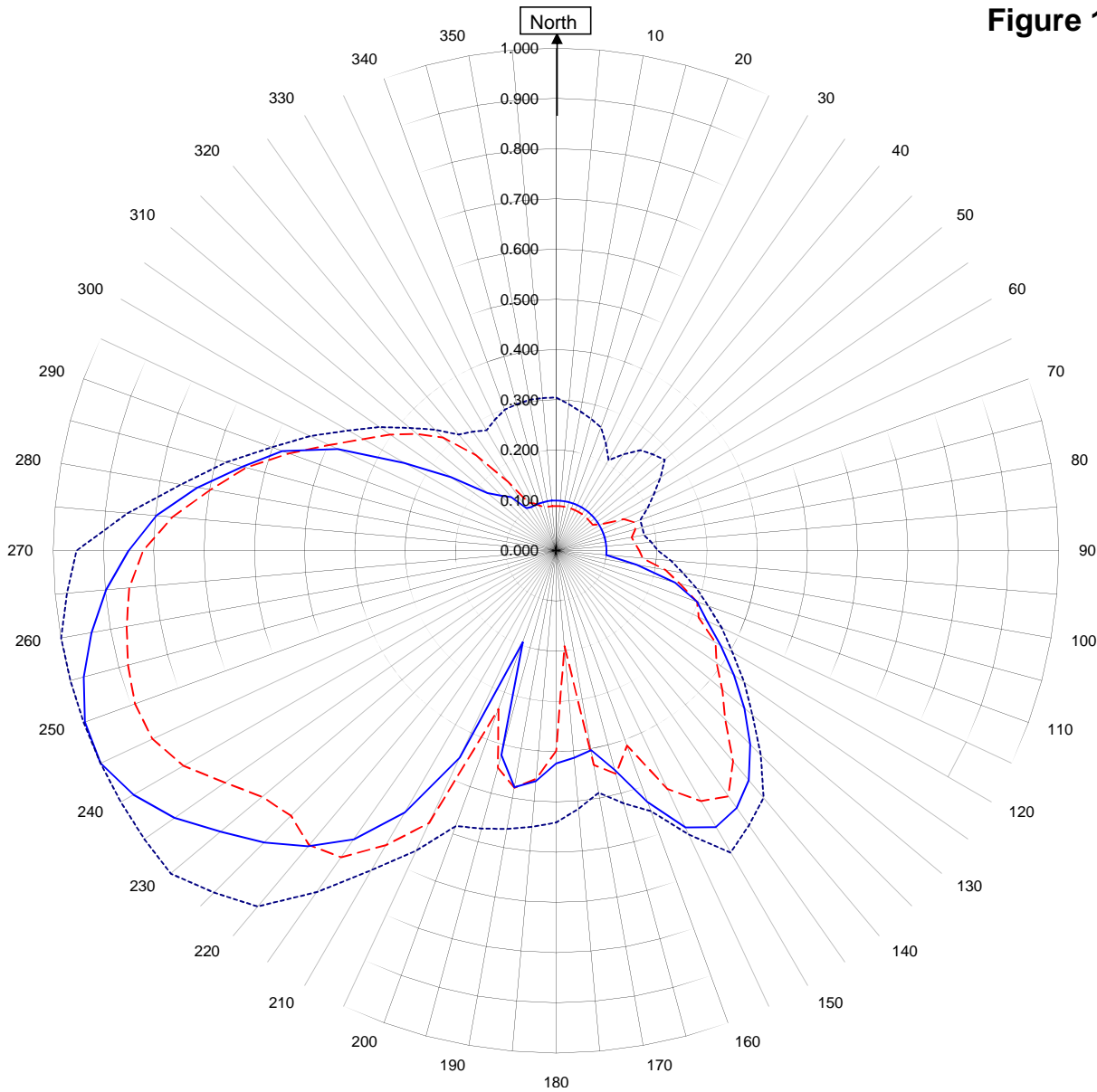


Robert A. Surette  
Director of Sales Engineering  
S/O 30856  
June 27, 2013

# Shively Labs

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

Figure 1A



**NEW-FM**                      **TAYLORTOWN, NJ.**  
30856  
June 27, 2013

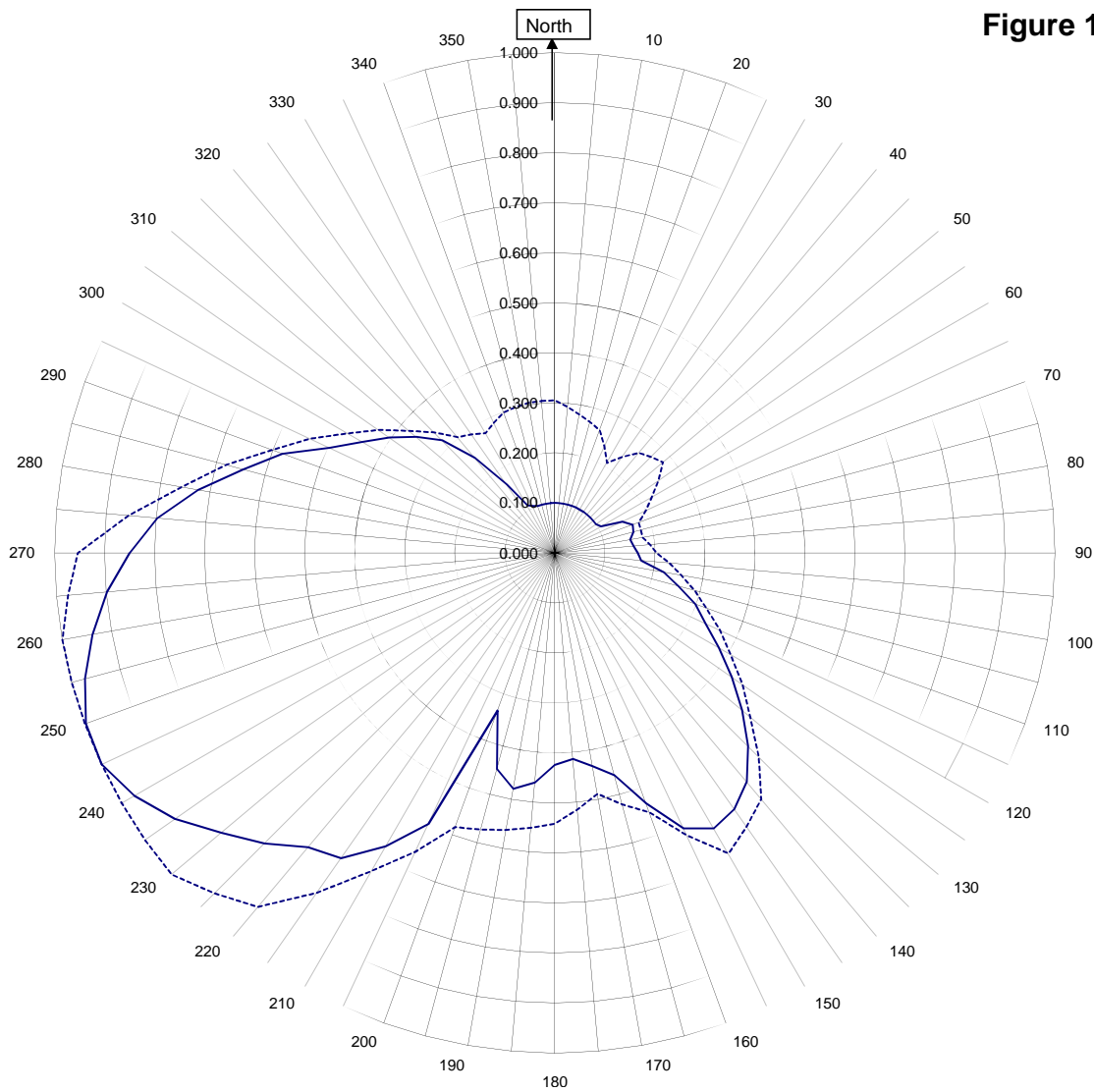
Horizontal RMS	0.489	Frequency	90.3 / 406.35 MHz
Vertical RMS	0.469	Plot	Relative Field
H/V Composite RMS	0.504	Scale	4.5 : 1
FCC Composite RMS	0.566	See Figure 2 for Mechanical Details	

Antenna Model	6025-1/2-DA
Pattern Type	Directional Azimuth

# Shively Labs

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Figure 1B



## NEW-FM TAYLORTOWN, NJ.

30856  
June 27, 2013

—————H/V Composite RMS	0.504
.....FCC Composite RMS	0.566

Frequency	90.3 / 406.35 mHz
Plot	Relative Field
Scale	4.5 : 1
See Figure 2 for Mechanical Details	

Antenna Model	6025-1/2-DA
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern  
NEW-FM TAYLORTOWN, NJ.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.100	180	0.424
10	0.100	190	0.478
20	0.100	200	0.193
30	0.100	210	0.601
40	0.100	220	0.768
45	0.100	225	0.821
50	0.100	230	0.870
60	0.100	240	0.971
70	0.100	250	0.998
80	0.100	260	0.938
90	0.100	270	0.850
100	0.164	280	0.724
110	0.299	290	0.580
120	0.378	300	0.349
130	0.489	310	0.178
135	0.546	315	0.155
140	0.596	320	0.139
150	0.635	330	0.100
160	0.533	340	0.100
170	0.403	350	0.100

Figure 1D

Tabulation of Vertical Azimuth Pattern  
NEW-FM TAYLORTOWN, NJ.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.089	180	0.399
10	0.089	190	0.479
20	0.089	200	0.335
30	0.089	210	0.677
40	0.089	220	0.765
45	0.089	225	0.746
50	0.089	230	0.762
60	0.106	240	0.857
70	0.165	250	0.891
80	0.153	260	0.868
90	0.165	270	0.822
100	0.221	280	0.698
110	0.299	290	0.566
120	0.366	300	0.444
130	0.432	310	0.361
135	0.476	315	0.319
140	0.547	320	0.248
150	0.576	330	0.110
160	0.412	340	0.096
170	0.433	350	0.089

Figure 1E

Tabulation of Composite Azimuth Pattern  
NEW-FM TAYLORTOWN, NJ.

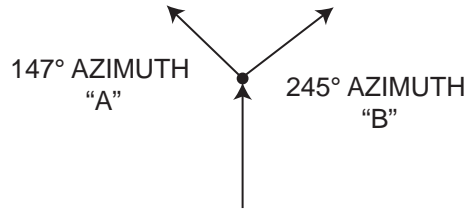
Azimuth	Rel Field	Azimuth	Rel Field
0	0.100	180	0.424
10	0.100	190	0.479
20	0.100	200	0.335
30	0.100	210	0.677
40	0.100	220	0.768
45	0.100	225	0.821
50	0.100	230	0.870
60	0.106	240	0.971
70	0.165	250	0.998
80	0.153	260	0.938
90	0.165	270	0.850
100	0.221	280	0.724
110	0.299	290	0.580
120	0.378	300	0.444
130	0.489	310	0.361
135	0.546	315	0.319
140	0.596	320	0.248
150	0.635	330	0.110
160	0.533	340	0.100
170	0.433	350	0.100

Figure 1F

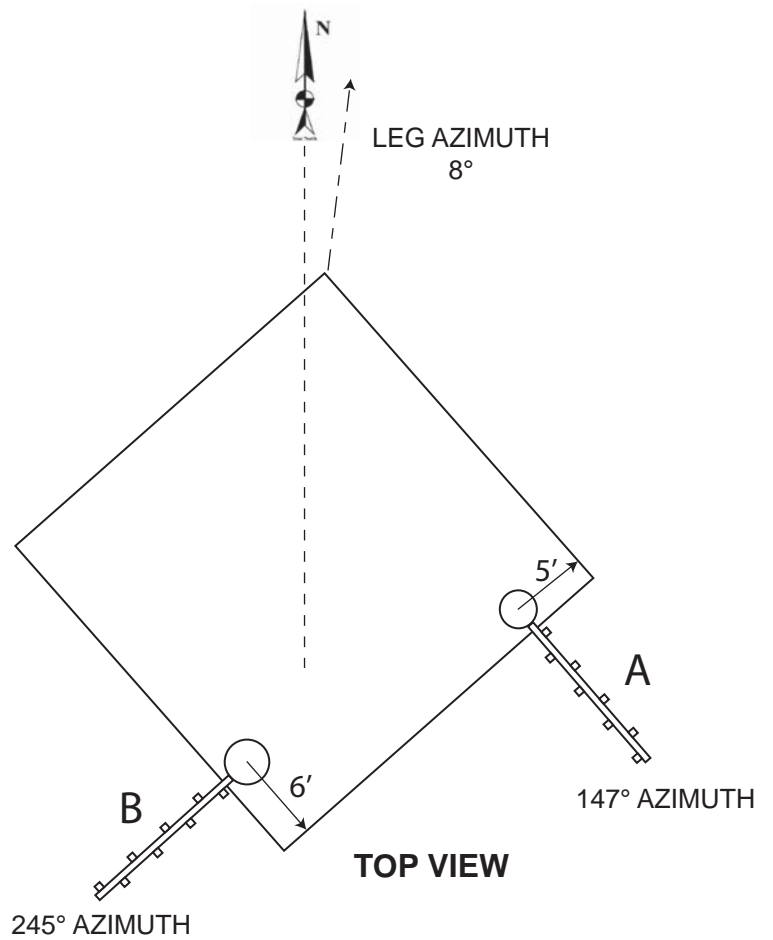
Tabulation of FCC Directional Composite  
NEW-FM TAYLORTOWN, NJ.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.305	180	0.541
10	0.281	190	0.562
20	0.261	200	0.583
30	0.208	210	0.734
40	0.261	220	0.924
50	0.282	230	1.000
60	0.224	240	1.000
70	0.178	250	1.000
80	0.178	260	1.000
90	0.203	270	0.954
100	0.256	280	0.758
110	0.322	290	0.602
120	0.405	300	0.478
130	0.510	310	0.380
140	0.642	320	0.302
150	0.694	330	0.277
160	0.552	340	0.299
170	0.489	350	0.305

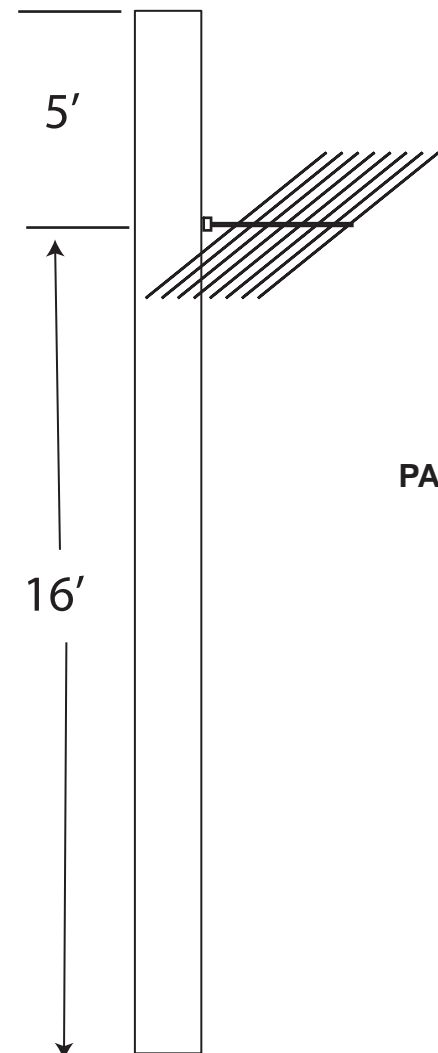
COAX SYSTEM FOR  
Antenna "A" @ 147°, ATTENUATED 3 dB  
Antenna "B" @ 245°, FULL POWER  
EQUAL PHASING



**SCHEMATIC VIEW**

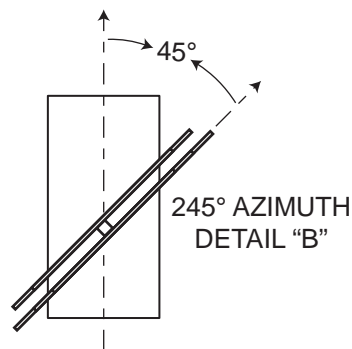


**TOP VIEW**

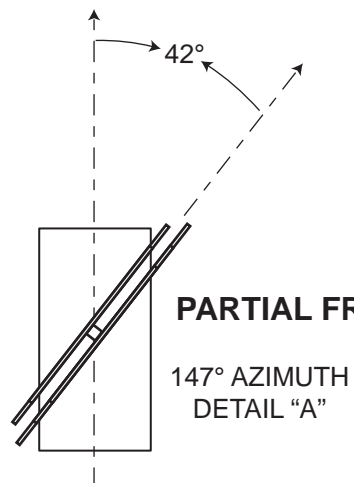


**TYPICAL ELEVATION VIEW**

**PARTIAL FRONT VIEW**



**PARTIAL FRONT VIEW**



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## SHIVELY LABS

DIV. HOWELL LABS

BRIDGTON, MAINE USA

FIGURE 2, New FM 90.3 MHz  
MODEL 6025-1/2 SLANT (42° & 45°) DA

SIZE	CODE IDENT. NO.	DRAWING NO.	REV
A	26750	RAS06272013	—
SCALE	NONE	QUOTE 30856	SHEET 1 OF 1

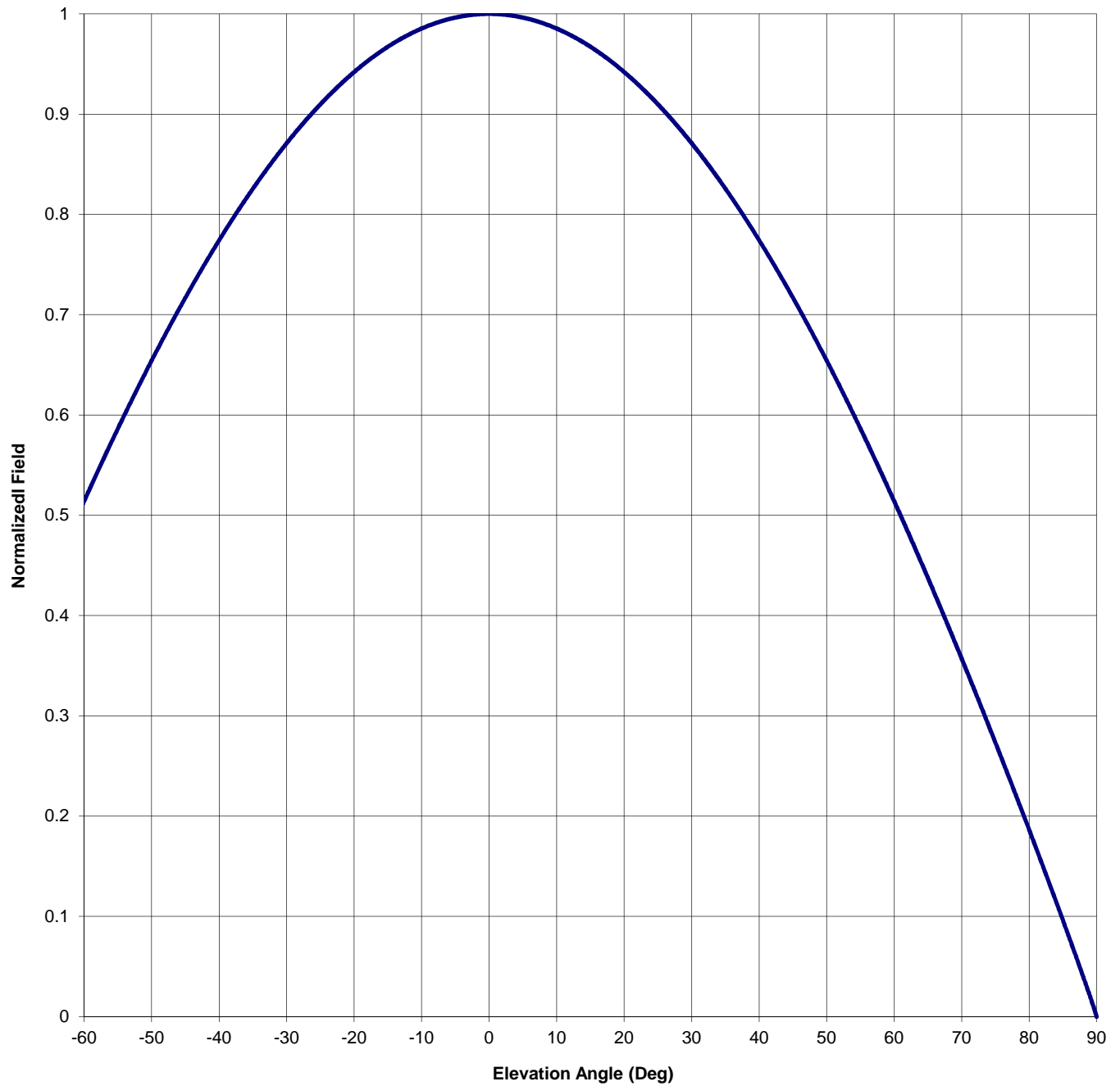
Antenna Mfg.: Shively Labs  
Antenna Type: 6025-1/2-DA

Date: 6/27/2013

Station: New FM  
Frequency: 90.3  
Channel #: 212

Beam Tilt	0	
Gain (Max)	2.397	3.798 dB
Gain (Horizon)	2.397	3.798 dB

Figure: Figure 3



Antenna Mfg.: Shively Labs

Date: 6/27/2013

Antenna Type: 6025-1/2-DA

Station: New FM

Beam Tilt 0

Frequency: 90.3

Gain (Max) 2.397

3.798 dB

Channel #: 212

Gain (Horizon) 2.397

3.798 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

NEW-FM TAYLORTOWN, NJ.

MODEL 6025-1/2-DA

Elevation Gain of Antenna

0.55

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

H RMS

0.48933

V RMS

0.468945

H/V Ratio

1.043

Elevation Gain of Horizontal Component

0.574

Elevation Gain of Vertical Component

0.527

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

4.176

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

3.610

Max. Vertical

0.891

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

Total Horizontal Power Gain =

2.397

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

Total Vertical Power Gain =

1.903

ERP divided by Horizontal Power Gain equals Antenna Input Power

0.060

kW ERP

Divided by H Gain

2.397

equals

0.025

kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

0.025 kW

Times V Gain

1.903

equals

0.048

kW V ERP

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

 $(0.891)^2$  Times 0.06 Equals 0.048 kW Vertical ERP

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