**Shively Labs**
a division of Howell Laboratories,Inc.

P. O. Box 389 Harrison Rd.,
Bridgton, Maine 04009 USA

*- An Employee-Owned Company -*

(207) 647-3327
888-SHIVELY
Fax: (207) 647-8273
E-mail: sales@shively.com
Web site: www.shively.com

**S.O. 22952**

**Report of Test 6510-8-DA**

**for**

**AMERICAN FAMILY ASSOCIATION**

**WQVI 90.5 MHZ FOREST, MS**

**OBJECTIVE:**

The objective of this test was to demonstrate the directional characteristics of a 6510-8-DA to meet the needs of WQVI and to comply with the requirements of the FCC construction permit, file number BMPED-20030519AEA.

**RESULTS:**

The measured azimuth pattern for the 6510-8-DA is shown in Figure 1. Figure 1A shows the Tabulation of the Vertical Polarization. The calculated elevation pattern of the antenna is shown in Figure 3. Construction permit file number BMPED-20030519AEA indicates that the Vertical radiation component shall not exceed 60 kW at any azimuth and is restricted to the following values at the azimuths specified:

000 Degrees T: 34.839 kW
050 Degrees T: 21.600 kW
200 Degrees T: 23.438 kW

From Figure 1, the maximum radiation of the Vertical component occurs at 106 Degrees T to 145 Degrees T. At the restricted azimuth of 000 Degrees T, the Vertical component is 2.557 dB down from the maximum of 60 kW, or 33.302 kW. At the restricted azimuth of 050 Degrees T, the Vertical component is 4.807 dB down from the maximum of 60 kW, or 19.878 kW. At the restricted azimuth of 200 Degrees T, the Vertical component is 4.657 dB down from the maximum of 60 kW, or 20.534 kW.

The R.M.S. of the Vertical component is 0.77. The total Vertical power gain is 15.05. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.83. Therefore this Pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

**METHOD OF DIRECTIONALIZATION:**

One bay of the 6510-8-DA was mounted on a tower of exact scale to an Allied SR 24 tower. The spacing of the antenna to the tower was varied and vertical parasitic elements were attached to the interbay feedline to achieve the vertical pattern shown in Figure 1. See Figure 2 for mechanical details.

**METHOD OF MEASUREMENT:**

As allowed by the construction permit, file number BMPED-20030519AEA, a single level of the 6510-8-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$^{th}$ Edition 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.

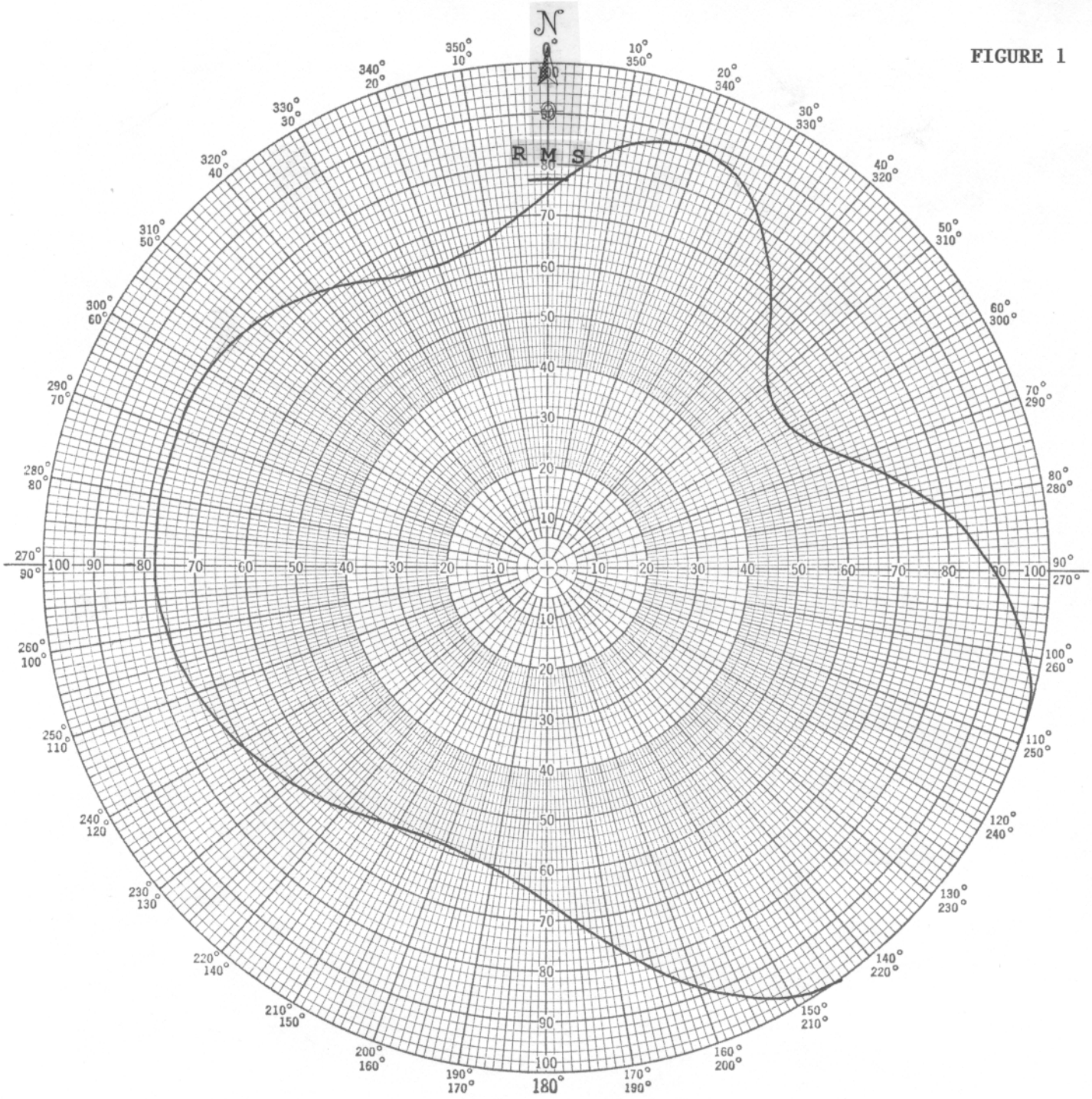
**TEST PROCEDURES:**

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 407.25 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 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:

Robert A. Surette
Manager of RF Engineering
S/O 22952
April 21, 2004

FIGURE 1




# Shively Labs

PROJECT NAME WQVI FOREST, MS

PROJECT NUMBER 22952 DATE 12/30/03

MODEL ( X ) FULL SCALE ( ) FREQUENCY 407.25/90.5 MHz

POLARIZATION VERTICAL

CURVE PLOTTED IN: VOLTAGE ( X ) POWER( ) DB( )

OBSERVER RAS

ANTENNA TYPE 6510-8-DA

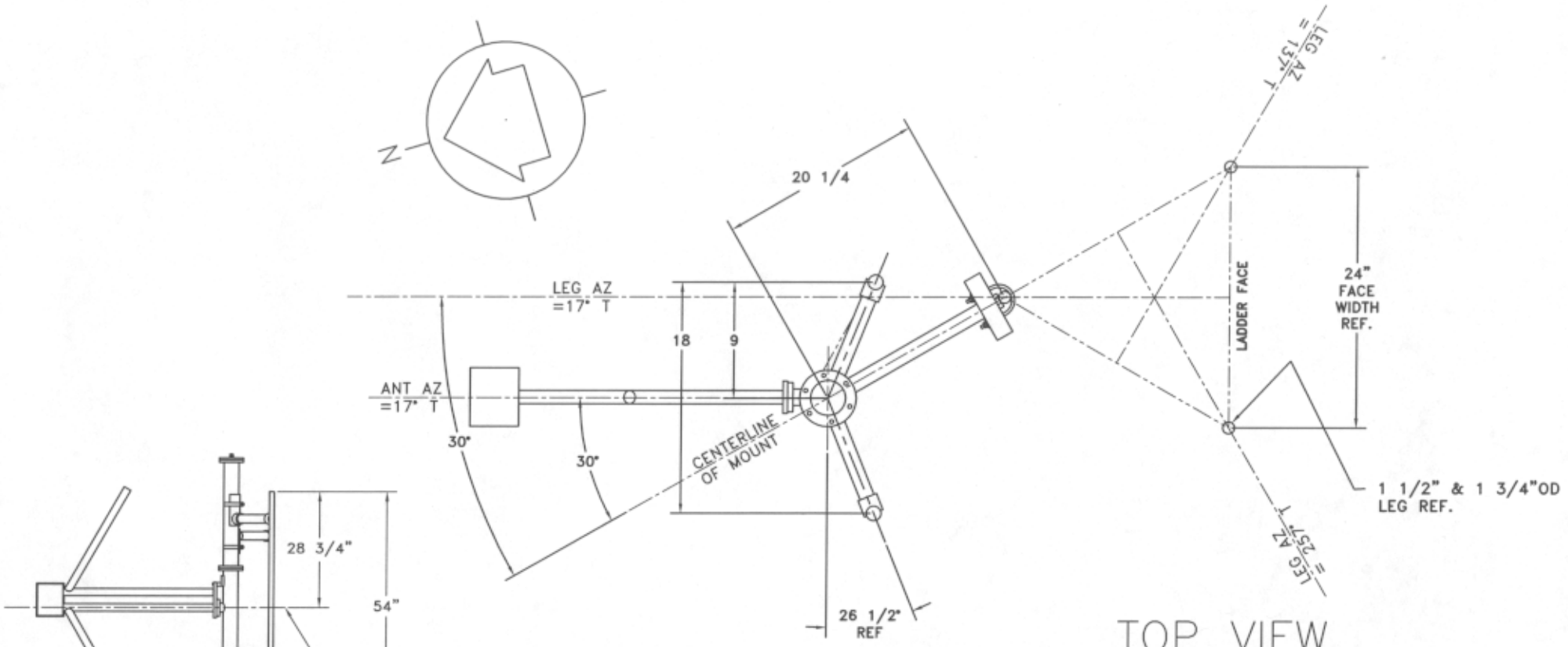
PATTERN TYPE DIRECTIONAL AZIMUTH

REMARKS: SEE FIGURE 2 FOR MECHANICAL DETAILS

**Figure 1A**

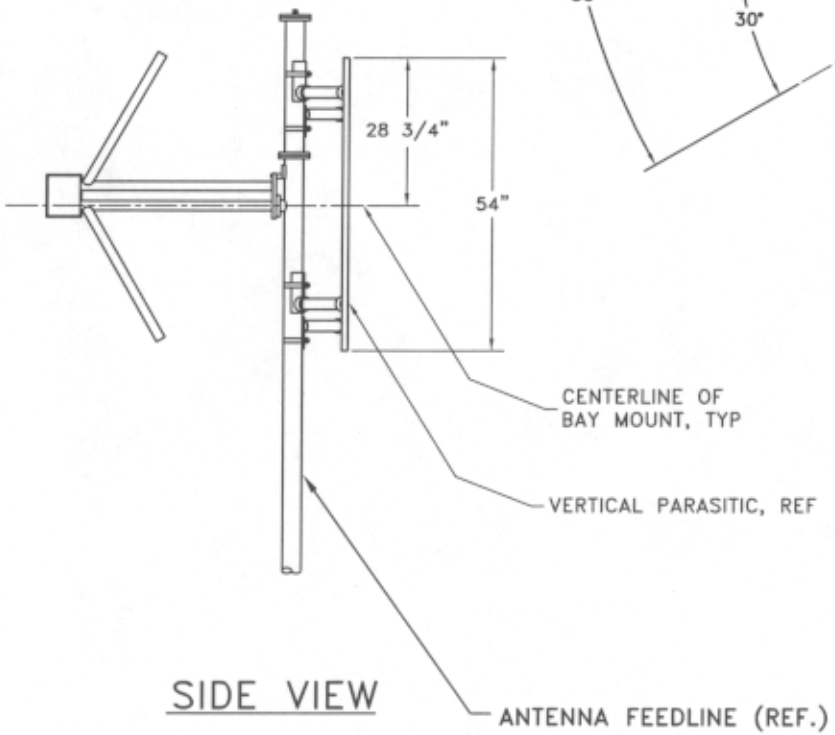
**S/O 22952**
**TABULATION OF VERTICAL POLARIZATION**
**WQVI FOREST, MS**

| DEGREE | RELATIVE FIELD | DEGREE | RELATIVE FIELD |
|---|---|---|---|
| 0 | 0.745 | 180 | 0.660 |
| 10 | 0.850 | 190 | 0.610 |
| 20 | 0.880 | 200 | 0.585 |
| 30 | 0.830 | 210 | 0.595 |
| 40 | 0.695 | 220 | 0.630 |
| 45 | 0.620 | 225 | 0.650 |
| 50 | 0.575 | 230 | 0.665 |
| 60 | 0.560 | 240 | 0.705 |
| 70 | 0.640 | 250 | 0.740 |
| 80 | 0.775 | 260 | 0.765 |
| 90 | 0.890 | 270 | 0.780 |
| 100 | 0.970 | 280 | 0.780 |
| 110 | 1.000 | 290 | 0.780 |
| 120 | 1.000 | 300 | 0.780 |
| 130 | 1.000 | 310 | 0.755 |
| 135 | 1.000 | 315 | 0.735 |
| 140 | 1.000 | 320 | 0.710 |
| 150 | 0.980 | 330 | 0.660 |
| 160 | 0.880 | 340 | 0.640 |
| 170 | 0.760 | 350 | 0.665 |




TOP VIEW

TOWER: ALLIED TOWER
MODEL 24 SR




SIDE VIEW

SHIVELY LABS
A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE

| SHOP ORDER: | FREQUENCY: | SCALE: | DRAWN BY: AMG |
|---|---|---|---|
| 22952 | 90.5 MHz. | N.T.S. | APPROVED BY: |

TITLE:
MODEL-6510-8-DIRECTIONAL ANTENNA

DATE: 4/20/04

FIGURE 2

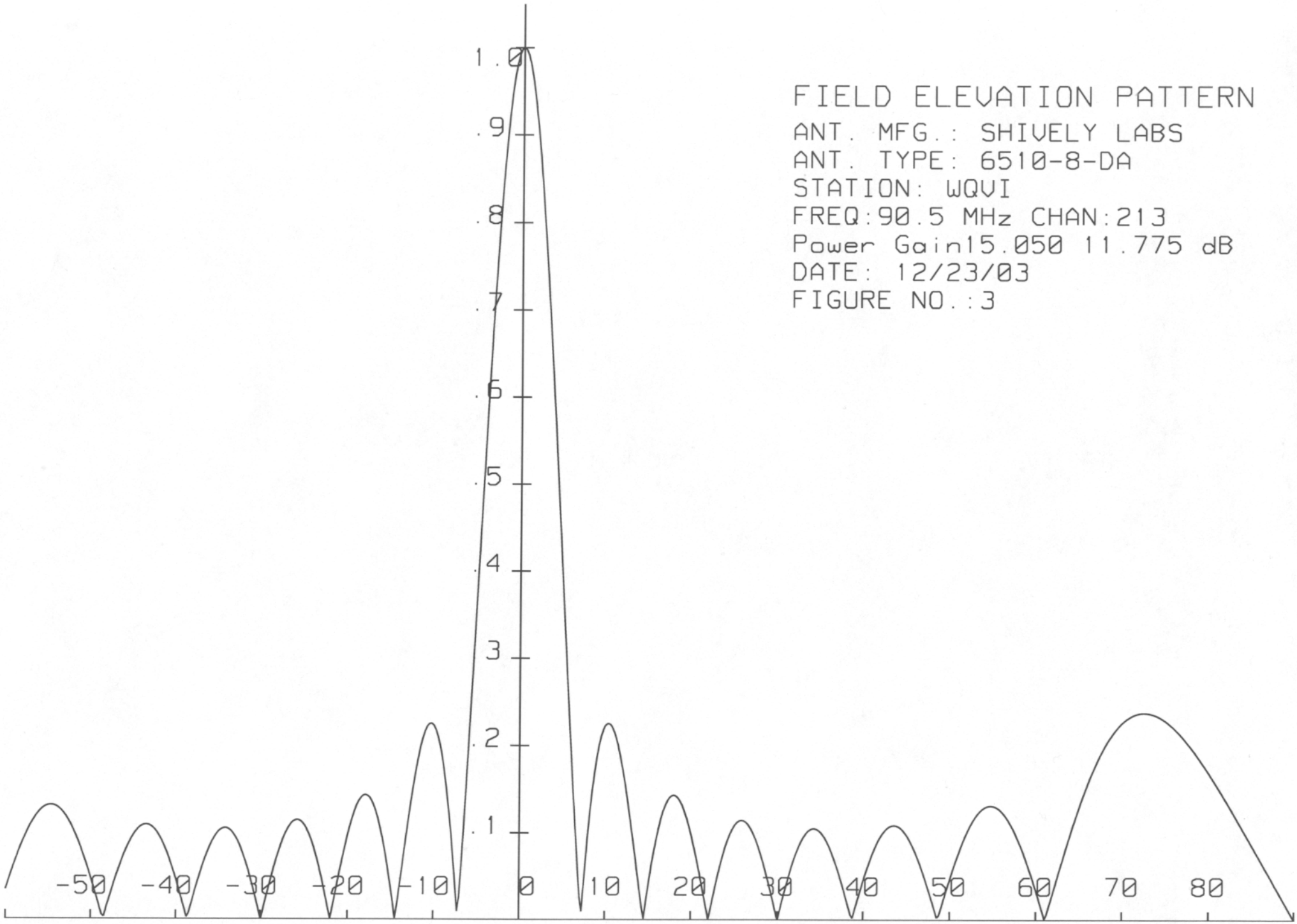

FIELD ELEVATION PATTERN
ANT. MFG.: SHIVELY LABS
ANT. TYPE: 6510-8-DA
STATION: WQVI
FREQ:90.5 MHz CHAN:213
Power Gain15.050 11.775 dB
DATE: 12/23/03
FIGURE NO.:3
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
-50
-40
-30
-20
-10
0
10
20
30
40
50
60
70
80

**FIGURE 4**

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**VALIDATION OF GAIN CALCULATION**

**WQVI FOREST, MS**

**MODEL 6510-8-DA**

Elevation Gain of 6510-8-DA equals 8.92

**The RMS values are calculated utilizing the data of a planimeter.**

Vertical Azimuth Gain equals $1/(RMS)^2$
$1/(0.77)^2 = 1.687$

*** Total Vertical Gain is Elevation Gain times Azimuth Gain**
**8.92 x 1.687 = 15.05**

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ERP divided by Horizontal Gain equals Antenna Input Power
60.0 kW ÷ 15.05 = 3.99 kW