**Shively Labs**
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S.O. 23097

Report of Test 6810-4-H/V-DA

for

RADIO MARIA, INC.

KOJO 91.1 MHz LAKE CHARLES, LA

**OBJECTIVE:**

The objective of this test was to demonstrate the directional characteristics of a 6810-4-H/V-DA to meet the needs of KOJO and to comply with the requirements of the FCC construction permit, file number BMPED-20021028AAB.

**RESULTS:**

The measured azimuth pattern for the 6810-4-H/V-DA is shown in Figure 1. Figure 1A shows the Tabulation of the Vertical Polarization. The horizontal azimuth pattern of this antenna is omni-directional and therefore is not shown. The calculated elevation pattern of the antenna is shown in Figures 3 and 3A. Construction permit file number BMPED-20021028AAB indicates that the Vertical radiation component shall not exceed 14.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

80 clockwise to 100 Degrees T: 8.96 kW

270 Degrees T: 9.18 kW

From Figure 1, the maximum radiation of the Vertical component occurs at 345 Degrees T to 359 Degrees T. At the restricted azimuth of 80 to 100 Degrees T the Vertical component is 2.16 dB down from the maximum of 14.0 kW, or 8.51 kW. At the restricted azimuth of 270 Degrees T the Vertical component is 2.21 dB down from the maximum of 14.0 kW, or 8.42 kW.

**EXHIBIT B**

The R.M.S. of the Vertical component is 0.720. The total Vertical power gain is 5.270. See Figure 4 for calculations.

**AMENDED FCC COMPOSITE PATTERN:**

The R.M.S. of the measured pattern is 0.720. 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 is attached as Figure 5 that will allow the above measured pattern to comply with the FCC requirement of 73.316(c)(ix)(A). Figure 5a shows the tabulations of the amended composite Figure 5. Eighty five percent (85%) of the amended FCC composite pattern is 0.719. Therefore the RMS of the measured pattern will comply with the requirement of 73.316(c)(ix)(A).

**METHOD OF DIRECTIONALIZATION:**

One bay of the 6810-4-H/V-DA was mounted on a tower of exact scale to a LaRouge 36" face tower. The spacing of the antenna to the tower was varied 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-20021028AAB, a single level of the 6810-4-H/V-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 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.

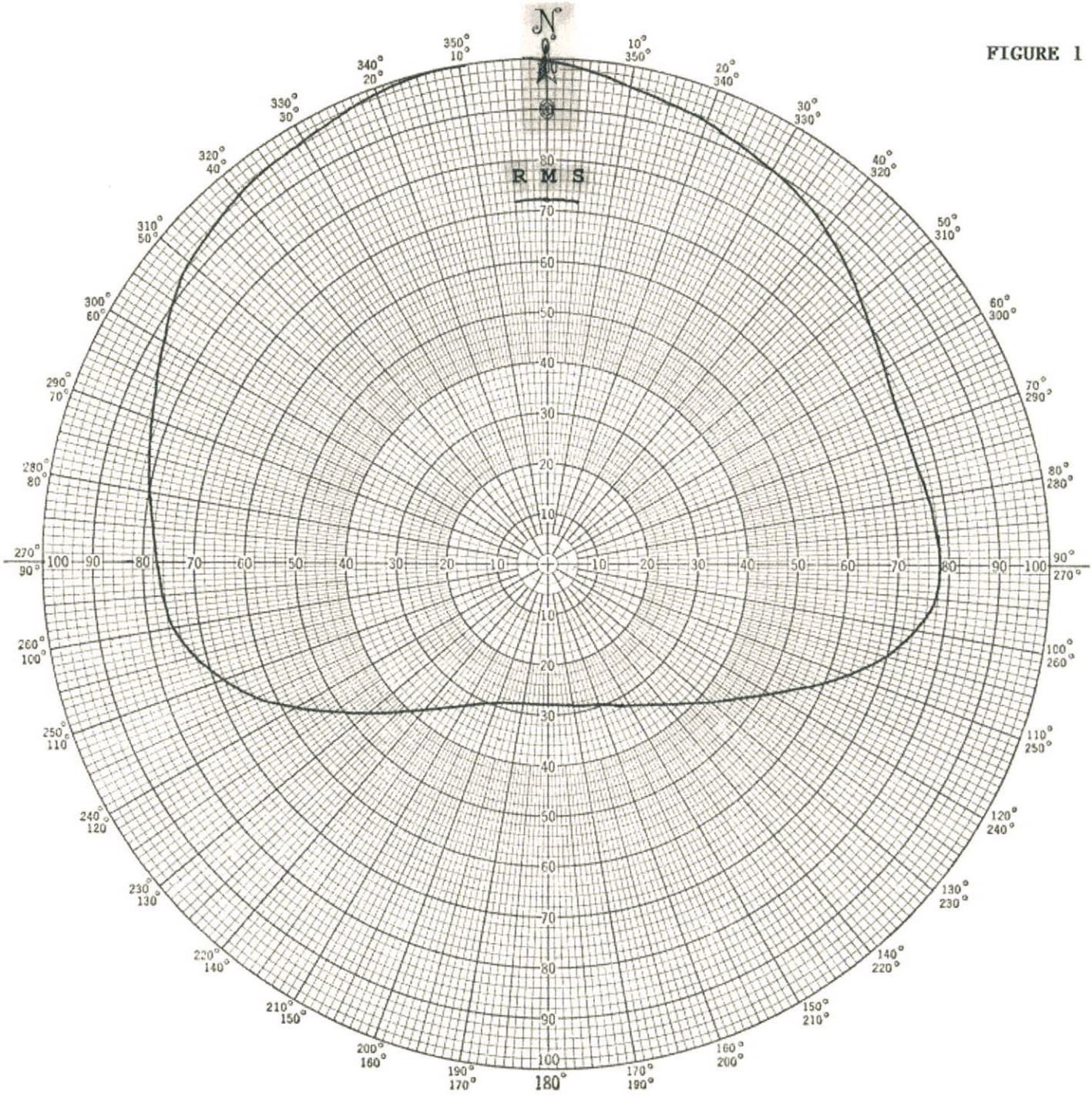
**TEST PROCEDURES:**

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 409.95 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 23097
October 21, 2003

FIGURE 1




# Shively Labs

PROJECT NAME KOJO LAKE CHARLES, LA

PROJECT NUMBER 23097 DATE 10/16/03

MODEL ( X ) FULL SCALE ( ) FREQUENCY 409.95/91.1 MHz

POLARIZATION VERTICAL

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

OBSERVER RAS

ANTENNA TYPE 6810-4-H/V-DA

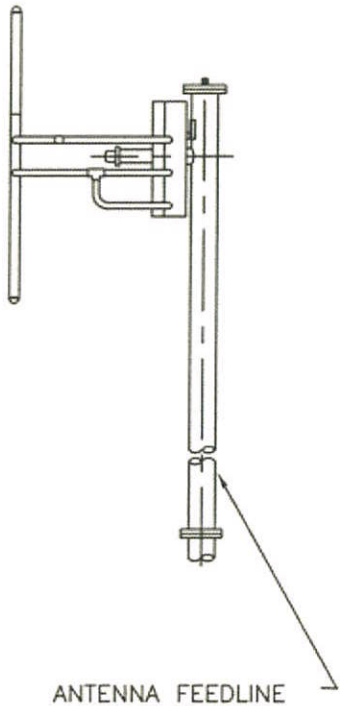
PATTERN TYPE DIRECTIONAL AZIMUTH

REMARKS: SEE FIGURE 2 FOR MECHANICAL DETAILS

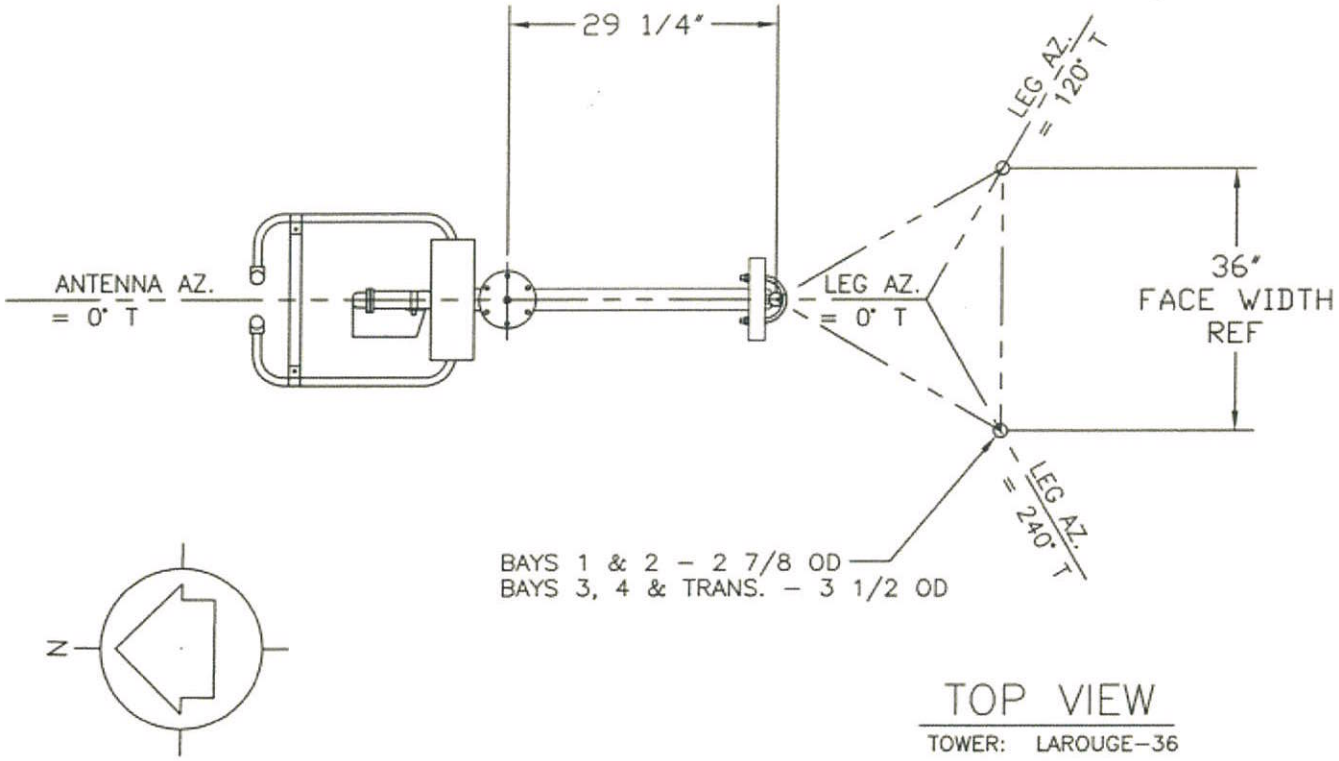
Figure 1A

S/O 23097
TABULATION OF VERTICAL POLARIZATION
KOJO LAKE CHARLES, LA

| DEGREE | RELATIVE FIELD | DEGREE | RELATIVE FIELD |
|---|---|---|---|
| 0 | 0.995 | 180 | 0.280 |
| 10 | 0.960 | 190 | 0.280 |
| 20 | 0.930 | 200 | 0.290 |
| 30 | 0.900 | 210 | 0.330 |
| 40 | 0.865 | 220 | 0.380 |
| 45 | 0.840 | 225 | 0.420 |
| 50 | 0.815 | 230 | 0.465 |
| 60 | 0.780 | 240 | 0.575 |
| 70 | 0.760 | 250 | 0.685 |
| 80 | 0.770 | 260 | 0.750 |
| 90 | 0.780 | 270 | 0.770 |
| 100 | 0.745 | 280 | 0.800 |
| 110 | 0.640 | 290 | 0.830 |
| 120 | 0.510 | 300 | 0.875 |
| 130 | 0.430 | 310 | 0.920 |
| 135 | 0.390 | 315 | 0.940 |
| 140 | 0.360 | 320 | 0.950 |
| 150 | 0.325 | 330 | 0.965 |
| 160 | 0.295 | 340 | 0.990 |
| 170 | 0.285 | 350 | 1.000 |




SIDE VIEW




TOP VIEW

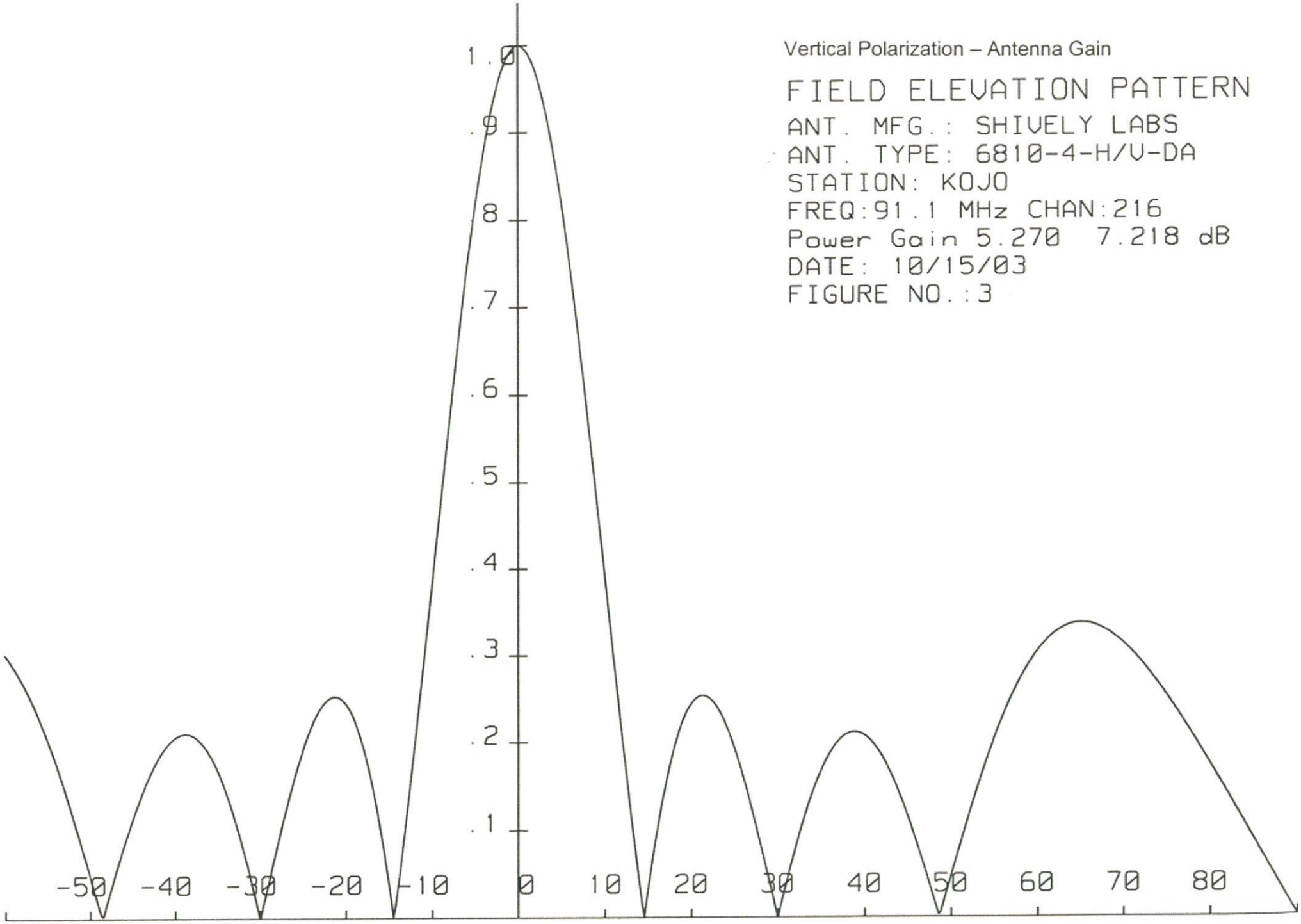
TOWER: LAROUGE-36

| SHIVELY LABS<br>A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE | | | |
|---|---|---|---|
| SHOP ORDER: 23097 | FREQUENCY: 91.1 MHz. | SCALE: N.T.S. | DRAWN BY: ASP<br>APPROVED BY: |
| MODEL: 6810-4-H/V-DIRECTIONAL ANTENNA | | | |
| DATE: 10/20/03 | FIGURE 2 | | |

Vertical Polarization – Antenna Gain

# FIELD ELEVATION PATTERN

ANT. MFG.: SHIVELY LABS
ANT. TYPE: 6810-4-H/V-DA
STATION: KOJO
FREQ:91.1 MHz CHAN:216
Power Gain 5.270 7.218 dB
DATE: 10/15/03
FIGURE NO.:3



Horizontal Polarization – Antenna Gain

# FIELD ELEVATION PATTERN

ANT. MFG.: SHIVELY LABS
ANT. TYPE: 6810-4-H/V-DA
STATION: KOJO
FREQ:91.1 MHz CHAN:216
Power Gain 1.510 1.790 dB
DATE: 10/15/03
FIGURE NO.:3A

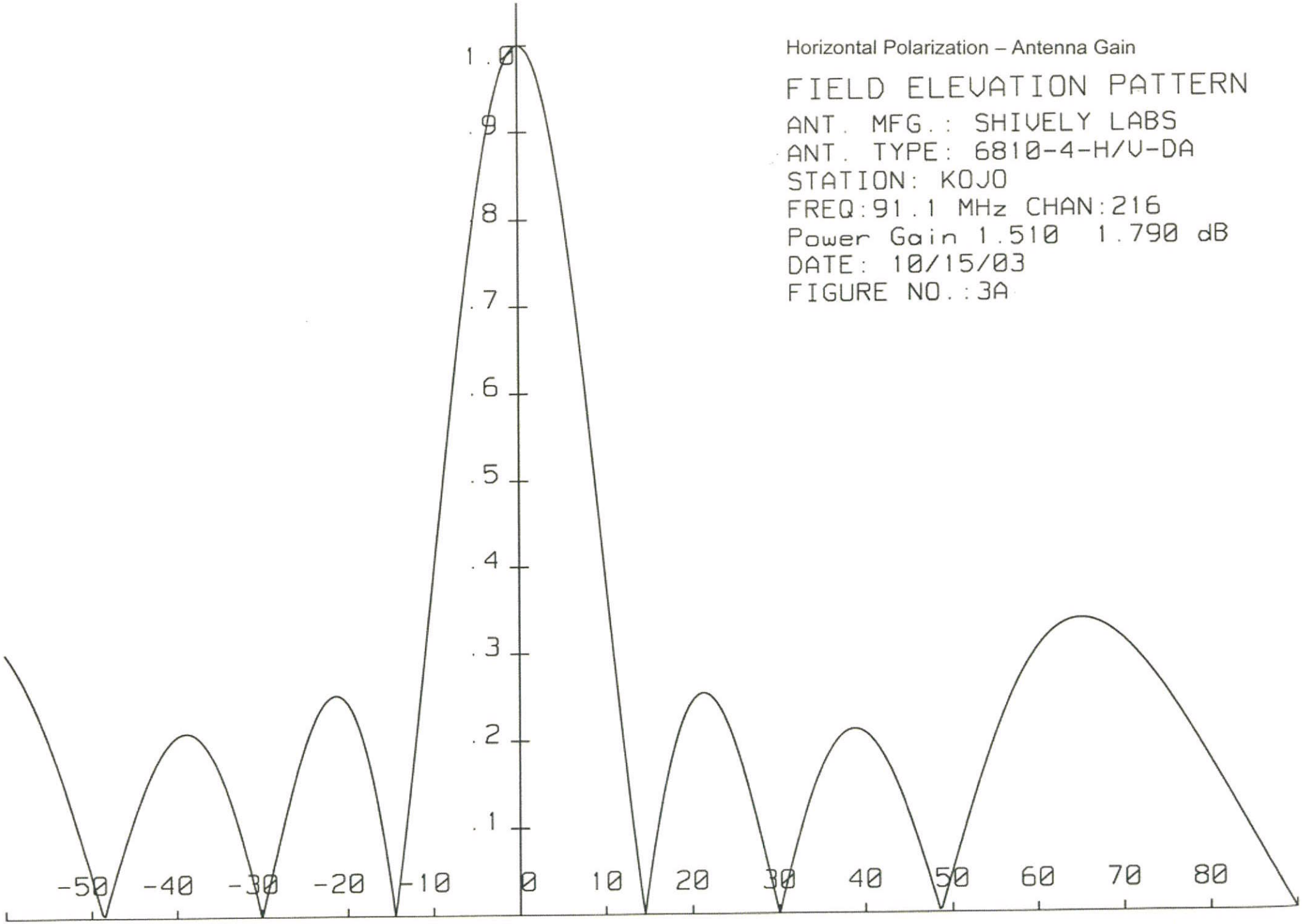


**FIGURE 4**

**S.O. 23097**

**VALIDATION OF GAIN CALCULATION**

**KOJO LAKE CHARLES, LA**

**MODEL 6810-4-H/V-DA**

Vertical Elevation Gain of 6810-4-H/V-DA equals 1.51H/2.73V

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

The H/V Ratio = 0.356H/0.644V

Elevation Gain of Horizontal Component equals 1.51

Elevation Gain of Vertical Component equals 2.73

Vertical Azimuth Gain equals $1/(RMS)^2$
$1/(0.72)^2 = 1.93$

- **Total Horizontal Gain is Elevation Gain times Azimuth Gain = 1.51**

* **Total Vertical Gain is Elevation Gain times Azimuth Gain 2.73 x 1.93 = 5.27**

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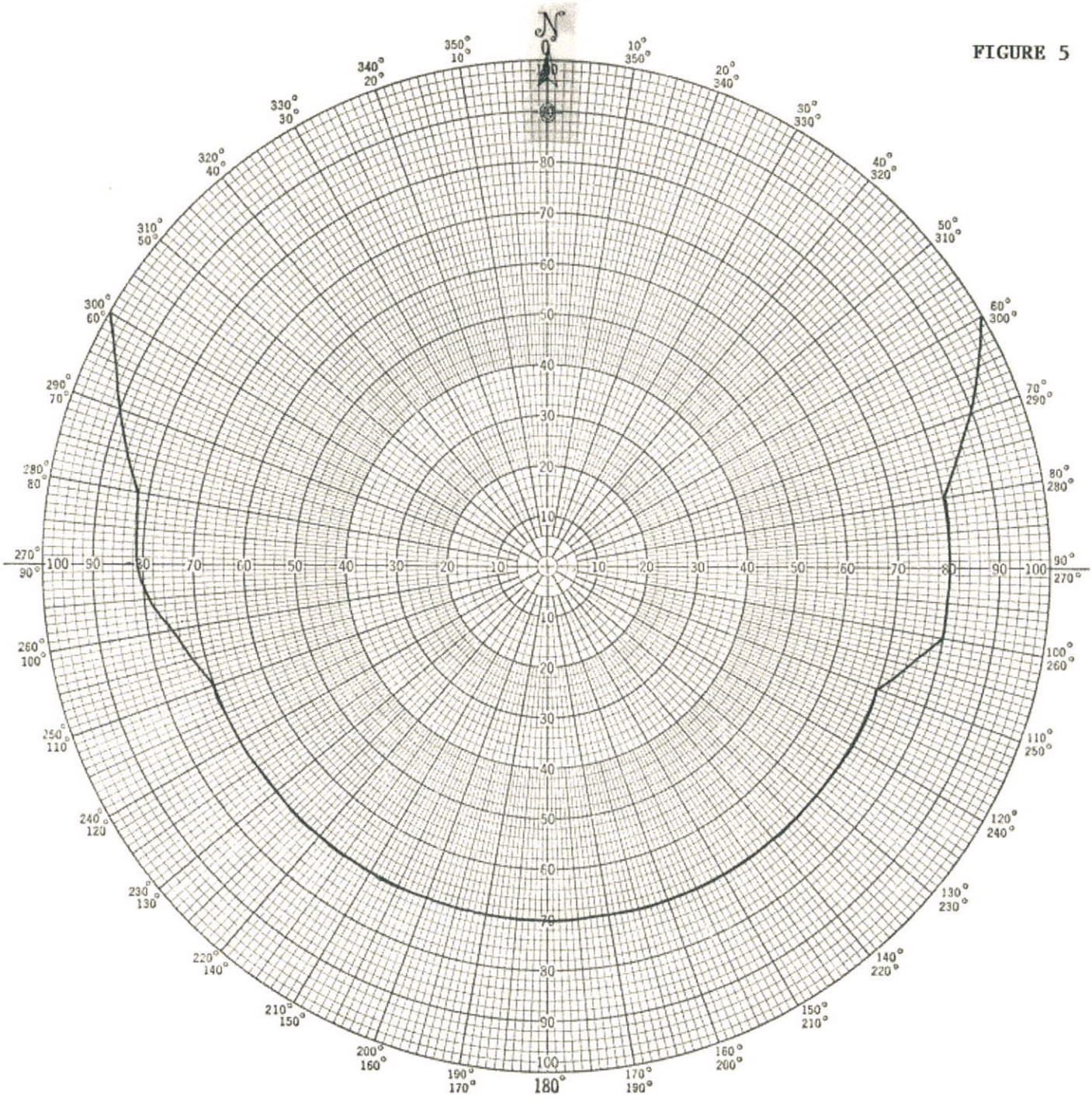
ERP divided by Vertical Gain equals Antenna Input Power
14.0 kW ÷ 5.27 = 2.657 kW

Antenna Input Power times Vertical Gain equals Vertical ERP
2.657 x 1.51 = 4.0 kW

FIGURE 5

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PROJECT NAME KOJO LAKE CHARLES, LA

PROJECT NUMBER 23097 DATE 10/16/03

MODEL ( X ) FULL SCALE ( ) FREQUENCY 409.95/91.1 MHz

POLARIZATION COMPOSITE

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

OBSERVER RAS

ANTENNA TYPE 6810-4-H/V-DA

PATTERN TYPE DIRECTIONAL AZIMUTH

REMARKS:

Figure 5A

S/O 23097
TABULATION OF COMPOSITE POLARIZATION
KOJO LAKE CHARLES, LA

| DEGREE | RELATIVE FIELD | DEGREE | RELATIVE FIELD |
|---|---|---|---|
| 0 | 1.000 | 180 | 0.700 |
| 10 | 1.000 | 190 | 0.700 |
| 20 | 1.000 | 200 | 0.700 |
| 30 | 1.000 | 210 | 0.700 |
| 40 | 1.000 | 220 | 0.700 |
| 45 | 1.000 | 225 | 0.700 |
| 50 | 1.000 | 230 | 0.700 |
| 60 | 1.000 | 240 | 0.700 |
| 70 | 0.900 | 250 | 0.700 |
| 80 | 0.800 | 260 | 0.750 |
| 90 | 0.800 | 270 | 0.810 |
| 100 | 0.800 | 280 | 0.820 |
| 110 | 0.700 | 290 | 0.900 |
| 120 | 0.700 | 300 | 1.000 |
| 130 | 0.700 | 310 | 1.000 |
| 135 | 0.700 | 315 | 1.000 |
| 140 | 0.700 | 320 | 1.000 |
| 150 | 0.700 | 330 | 1.000 |
| 160 | 0.700 | 340 | 1.000 |
| 170 | 0.700 | 350 | 1.000 |