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S.O. 21,118

# Report of Test 6810-2R-DA

for

WELLS BROADCASTING CO., INC.

WRTT-FM HUNTSVILLE, AL

## OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-2R-DA to meet the needs of WRTT-FM and to comply with the requirements of the FCC construction permit, file number BPH-19991230ABC.

## RESULTS:

The measured azimuth pattern for the 6810-2R-DA is shown in Figure 1. Figure 1A shows the Tabulation of the Horizontal Polarization. Figure 1B shows the Tabulation of the Vertical Polarization. The calculated elevation pattern of the antenna is shown in Figure 3. Construction permit file number BPH-19991230ABC indicates that the Horizontal radiation component shall not exceed 12.000 kW at any azimuth and is restricted to the following values at the azimuths specified:

010 Degrees T: 4.177 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 167 Degrees T to 187 Degrees T from 238 Degrees T to 253 Degrees T. At the restricted azimuth of 010 Degrees T the Horizontal component is 5.272 dB down from the maximum of 12.000 kW, or 3.564 kW.

The R.M.S. of the Horizontal component is 0.820. The total Horizontal power gain is 1.550. The R.M.S. of the Vertical component is 0.780. The total Vertical power gain is 1.520. See Figure Four for calculations. The R.M.S. of the FCC composite pattern is 0.930. Therefore this Pattern complies with the FCC requirement of 73.316(c)(9).

**METHOD OF DIRECTIONALIZATION:**

The 6810-2R-DA was mounted on a tower of exact scale to a WESTERN 24" face tower. 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 BPH-19991230ABC, a single level of the 6810-2R-DA was set up on the Howell Laboratories scale model antenna pattern measuring range. A scale of 4.5:1 was used.

**SUPERVISION:**

The tests were carried out under the direction of Robert A. Surette, Manager of RF Engineering. 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 both full size and scale model pattern measurements since 1974 as an RF Engineer with Shively Labs and with Dielectric Communications (a unit of General Signal). He is currently an Associate Member of the Association of Federal Communications Consulting Engineers and a Member of IEEE.

**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 8505 Network Analyzer
PC Based Controller
Hewlett Packard 7550A Graphics Plotter

The test equipment is calibrated to MIL-STD-45662.

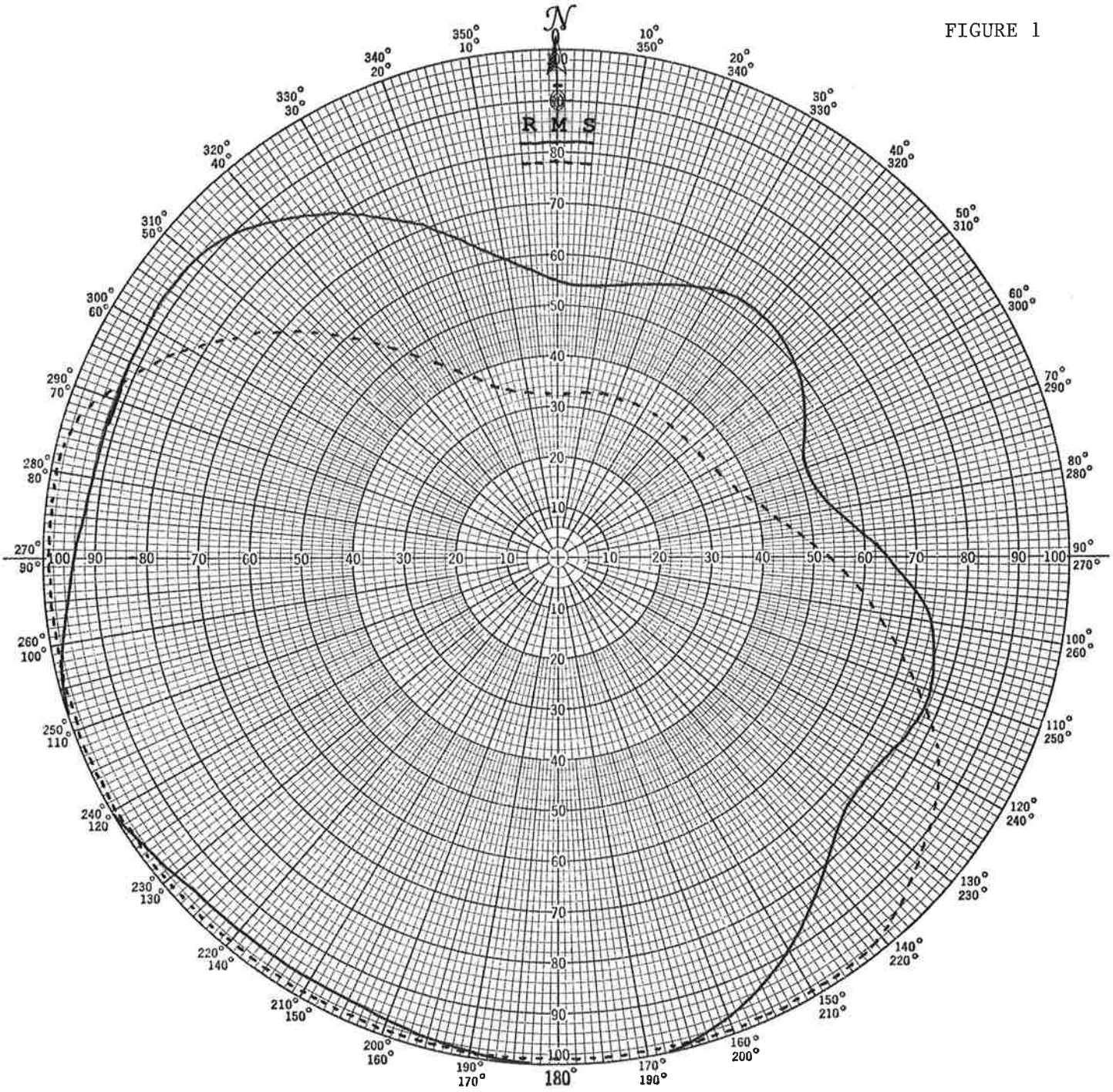
**TEST PROCEDURES:**

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 427.95 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 21118
May 5, 2000

FIGURE 1




# Shively Labs

PROJECT NAME WRTT-FM HUNTSVILLE, AL

PROJECT NUMBER 21,118 DATE 5/5/00

MODEL ( X ) FULL SCALE ( ) FREQUENCY 427.95/95.1 MHz

POLARIZATION HORIZ (——); VERT (----)

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

OBSERVER RAS

ANTENNA TYPE 6810-2R-DA

PATTERN TYPE DIRECTIONAL AZIMUTH

REMARKS: SEE FIGURE 2 FOR MECHANICAL DETAILS

**Figure 1A**

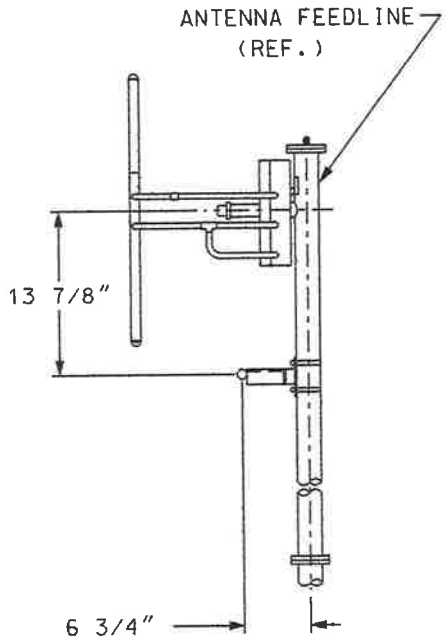
**S/O 21,118**
**TABULATION OF HORIZONTAL POLARIZATION**
**WRTT-FM Huntsville, AL**

| DEGREE | RELATIVE FIELD | DEGREE | RELATIVE FIELD |
|---|---|---|---|
| 0 | 0.550 | 180 | 1.000 |
| 10 | 0.545 | 190 | 0.990 |
| 20 | 0.575 | 200 | 0.970 |
| 30 | 0.610 | 210 | 0.960 |
| 40 | 0.620 | 220 | 0.960 |
| 45 | 0.615 | 225 | 0.960 |
| 50 | 0.605 | 230 | 0.970 |
| 60 | 0.555 | 240 | 1.000 |
| 70 | 0.520 | 250 | 1.000 |
| 80 | 0.550 | 260 | 0.975 |
| 90 | 0.645 | 270 | 0.940 |
| 100 | 0.740 | 280 | 0.920 |
| 110 | 0.775 | 290 | 0.915 |
| 120 | 0.755 | 300 | 0.920 |
| 130 | 0.745 | 310 | 0.920 |
| 135 | 0.765 | 315 | 0.905 |
| 140 | 0.805 | 320 | 0.870 |
| 150 | 0.895 | 330 | 0.780 |
| 160 | 0.965 | 340 | 0.685 |
| 170 | 1.000 | 350 | 0.600 |

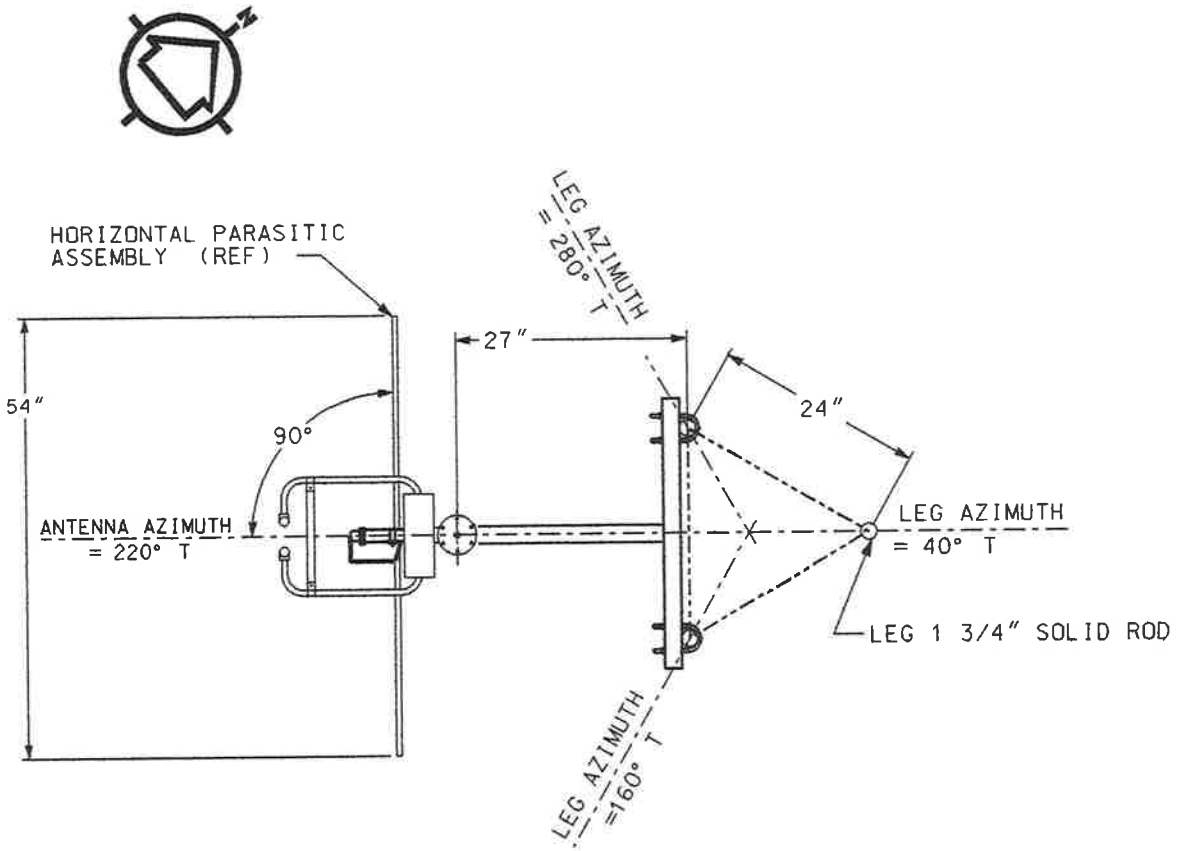
Figure 1B

S/O 21,118
TABULATION OF VERTICAL POLARIZATION
WRTT-FM Huntsville, AL

| DEGREE | RELATIVE FIELD | DEGREE | RELATIVE FIELD |
|---|---|---|---|
| 0 | 0.305 | 180 | 0.990 |
| 10 | 0.330 | 190 | 0.990 |
| 20 | 0.335 | 200 | 0.990 |
| 30 | 0.340 | 210 | 0.990 |
| 40 | 0.340 | 220 | 0.990 |
| 45 | 0.340 | 225 | 0.990 |
| 50 | 0.340 | 230 | 0.990 |
| 60 | 0.350 | 240 | 0.990 |
| 70 | 0.375 | 250 | 0.990 |
| 80 | 0.435 | 260 | 0.990 |
| 90 | 0.530 | 270 | 0.990 |
| 100 | 0.630 | 280 | 0.990 |
| 110 | 0.740 | 290 | 0.940 |
| 120 | 0.855 | 300 | 0.830 |
| 130 | 0.920 | 310 | 0.70 |
| 135 | 0.955 | 315 | 0.625 |
| 140 | 0.980 | 320 | 0.560 |
| 150 | 0.990 | 330 | 0.440 |
| 160 | 0.990 | 340 | 0.360 |
| 170 | 0.990 | 350 | 0.335 |




SIDE VIEW




TOP VIEW

TOWER BY: WESTERN

| SHIVELY LABS<br>A DIVISION OF HOWELL LABORATORIES INC..BRIDGTON, MAINE | | | |
|---|---|---|---|
| SHOP ORDER: 21,118 | FREQUENCY: 95.1 MHz. | SCALE: N.T.S. | DRAWN BY: NMS<br>APPROVED BY: |
| TITLE: MODEL-6810-2R-DIRECTIONAL ANTENNA | | | |
| DATE: 2-23-00 | **FIGURE 2** | | |

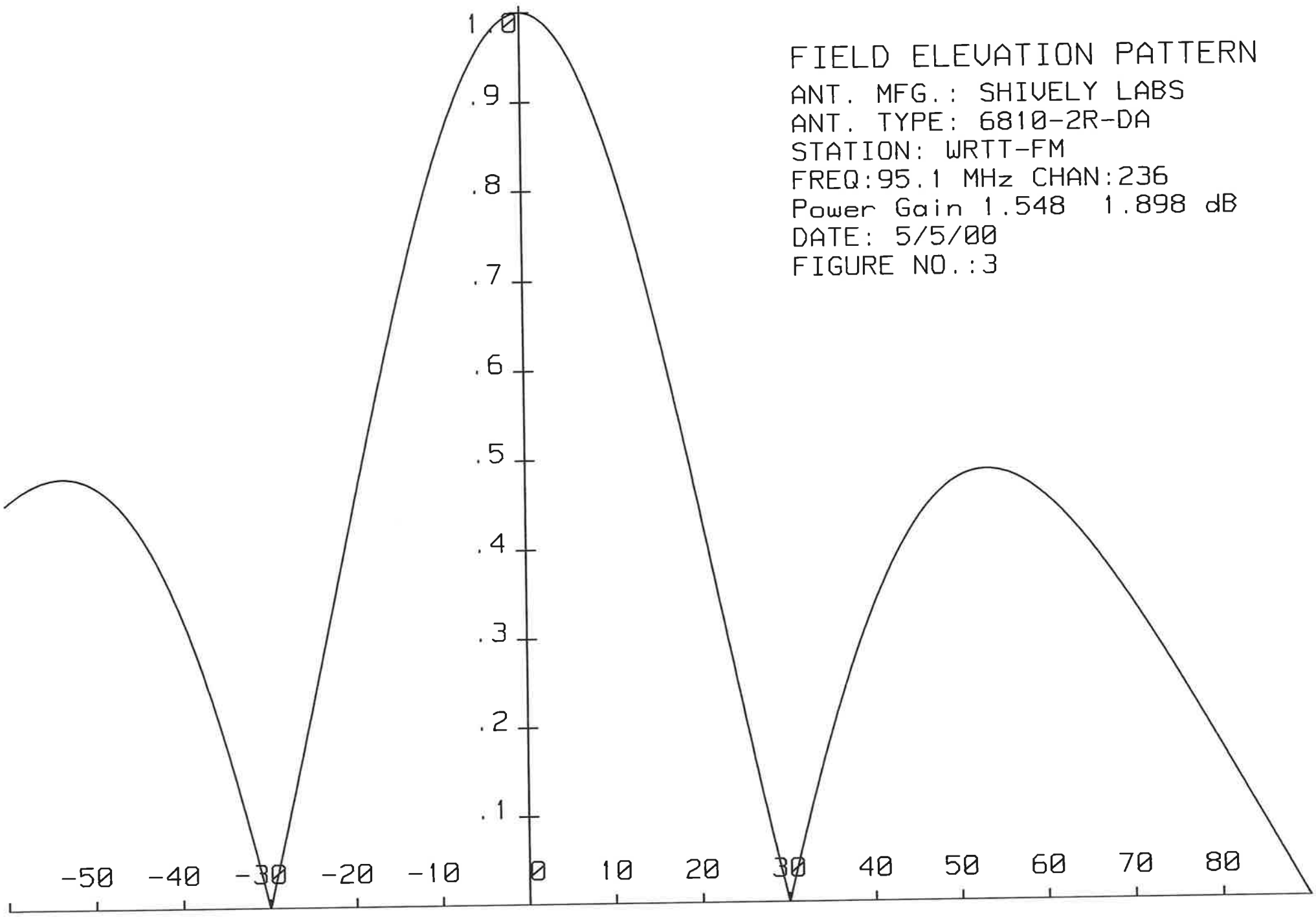

FIELD ELEVATION PATTERN
ANT. MFG.: SHIVELY LABS
ANT. TYPE: 6810-2R-DA
STATION: WRTT-FM
FREQ:95.1 MHz CHAN:236
Power Gain 1.548 1.898 dB
DATE: 5/5/00
FIGURE NO.:3
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
-50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80

**FIGURE 4**

**S.O. 21118**

**VALIDATION OF GAIN CALCULATION**

**WRTT-FM HUNTSVILLE, AL**

**MODEL 6810-2R-DA**

Elevation Gain of 6810-2R-DA equals 0.990

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

Horizontal RMS divided by Vertical RMS equals
$0.820 \div 0.780 = 1.0513$

Elevation Gain of Horizontal Component equals
$0.990 \times 1.0513 = 1.0408$

Elevation Gain of Vertical Component equals
$0.990 \times 0.951 = 0.9417$

Horizontal Azimuth Gain equals $1/(\text{RMS})^2$
$1/( 0.820 )^2 = 1.487$

Vertical Azimuth Gain equals $1/(\text{RMS} \div \text{Max Vert})^2$
$1/( 0.780 \div 0.990 )^2 = 1.611$

*** Total Horizontal Gain is Elevation Gain times Azimuth Gain**
**$1.0408 \times 1.487 = 1.548$**

*** Total Vertical Gain is Elevation Gain times Azimuth Gain**
**$0.9417 \times 1.611 = 1.517$**

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ERP divided by Horizontal Gain equals Antenna Input Power
$12.00 \text{ kW} \div 1.548 = 7.752$

Antenna Input Power times Vertical Gain equals Vertical ERP
$7.752 \times 1.517 = 11.76$

Maximum Value of the Vertical Component squared times the Maximum ERP equals the Vertical ERP
$( 0.99 )^2 \times 12.00 \text{ kW} = 11.76$

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

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May 12, 2000

Mr. Tom Panucci
WAHR/WNDA Radio
2714 Lawrence Ave.
Huntsville, AL 35805

SUBJECT: WRTT-FM - Huntsville, AL (S/O 21,118)

Enclosed for your records is a package of information for your antenna project. This package includes:

Data Sheet
Test Data
Report of Test
Shadow Map
Installation Manual
Installation Drawing

If you have any questions or require additional information, please call.

Regards,

Bob Surette
Manager, RF Engineering

RAS/slh
Enc.