

S.O. 22336
Report of Test 6810-6-DA
for
AMERICAN FAMILY ASSOCIATION
WBKG MACON, GA

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-6-DA to meet the needs of WBKG and to comply with the requirements of the FCC construction permit, file number BMPED-20000112ABE.

RESULTS:

The measured azimuth pattern for the 6810-6-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 BMPED-20000112ABE indicates that the Horizontal radiation component shall not exceed 5.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

260 to 290 Degrees T: 0.313 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 089 Degrees T to 124 Degrees T. At the restricted azimuth of 260 to 290 Degrees T the Horizontal component is 14.20 dB down from the maximum of 5.0 kW, or 0.190 kW.

The R.M.S. of the Horizontal component is 0.660. The total Horizontal power gain is 8.018. The R.M.S. of the Vertical component is 0.620. The total Vertical power gain is 7.542. See Figure Four for calculations. The R.M.S. of the FCC composite pattern is 0.725. Therefore this Pattern complies with the FCC requirement of 73.316(c) (2) (ix) (A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-6-DA was mounted on a tower of exact scale to a Rohn 90 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 BMPED-20000112ABE, a single level of the 6810-6-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:

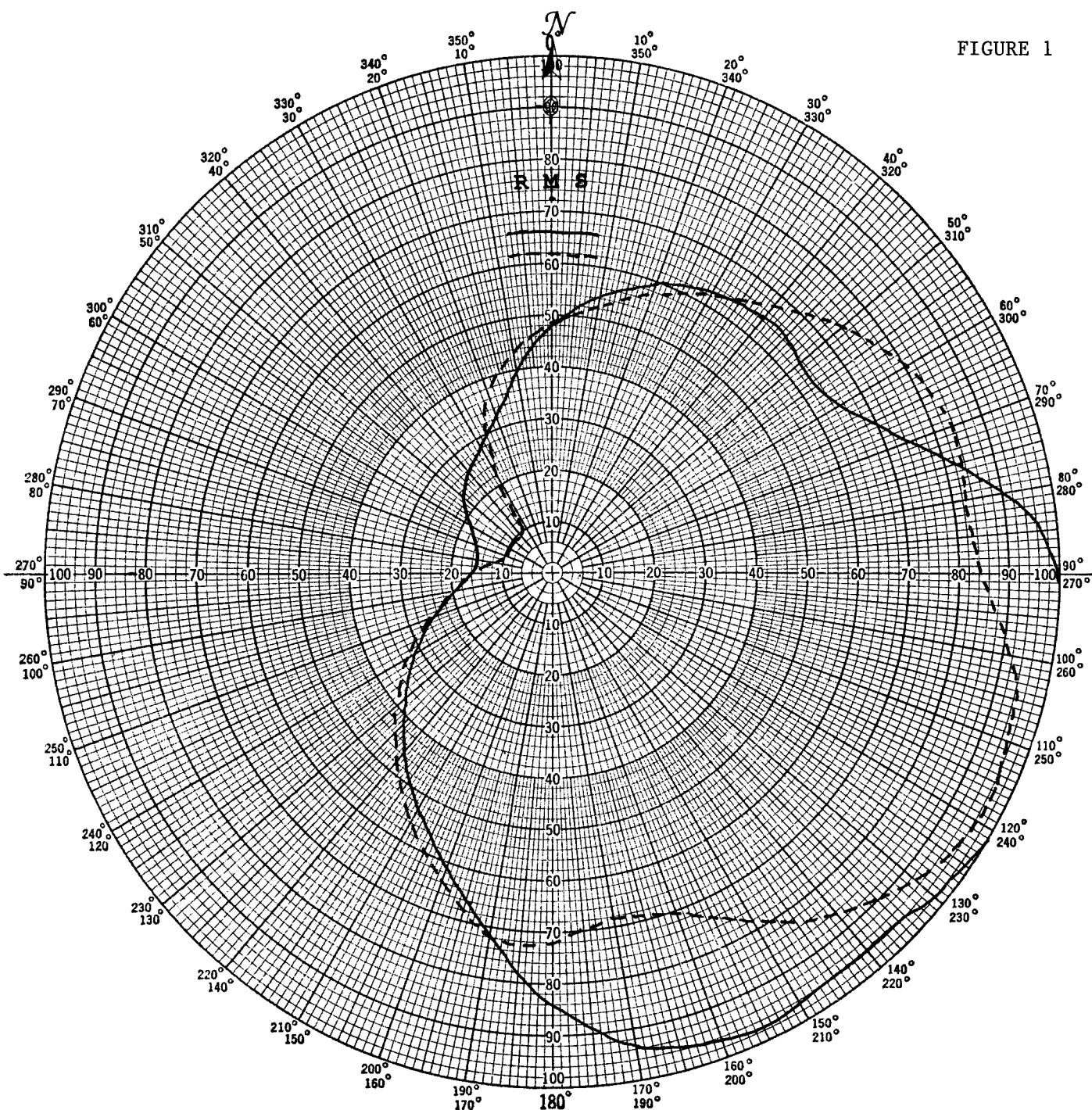
The corner reflector is mounted so that the horizontal and vertical azimuth patterns are measured independently by rotating the corner reflector by 90 degrees. The network analyzer was set to 400.05 MHz. Calibrated pads are used to check the linearity of the measuring system. For example, 6 dB padding 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 22336
March 27, 2002

FIGURE 1



Shively Labs

PROJECT NAME WBKG MACON, GA

PROJECT NUMBER 22336 DATE 3/25/02

MODEL (X) FULL SCALE () FREQUENCY 400.05/88.9 MHz

POLARIZATION HORIZ (—); VERT (----)

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

OBSERVER RAS

ANTENNA TYPE 6810-6-DA

PATTERN TYPE DIRECTIONAL AZIMUTH

REMARKS: SEE FIGURE 2 FOR MECHANICAL

DETAILS

Figure 1A

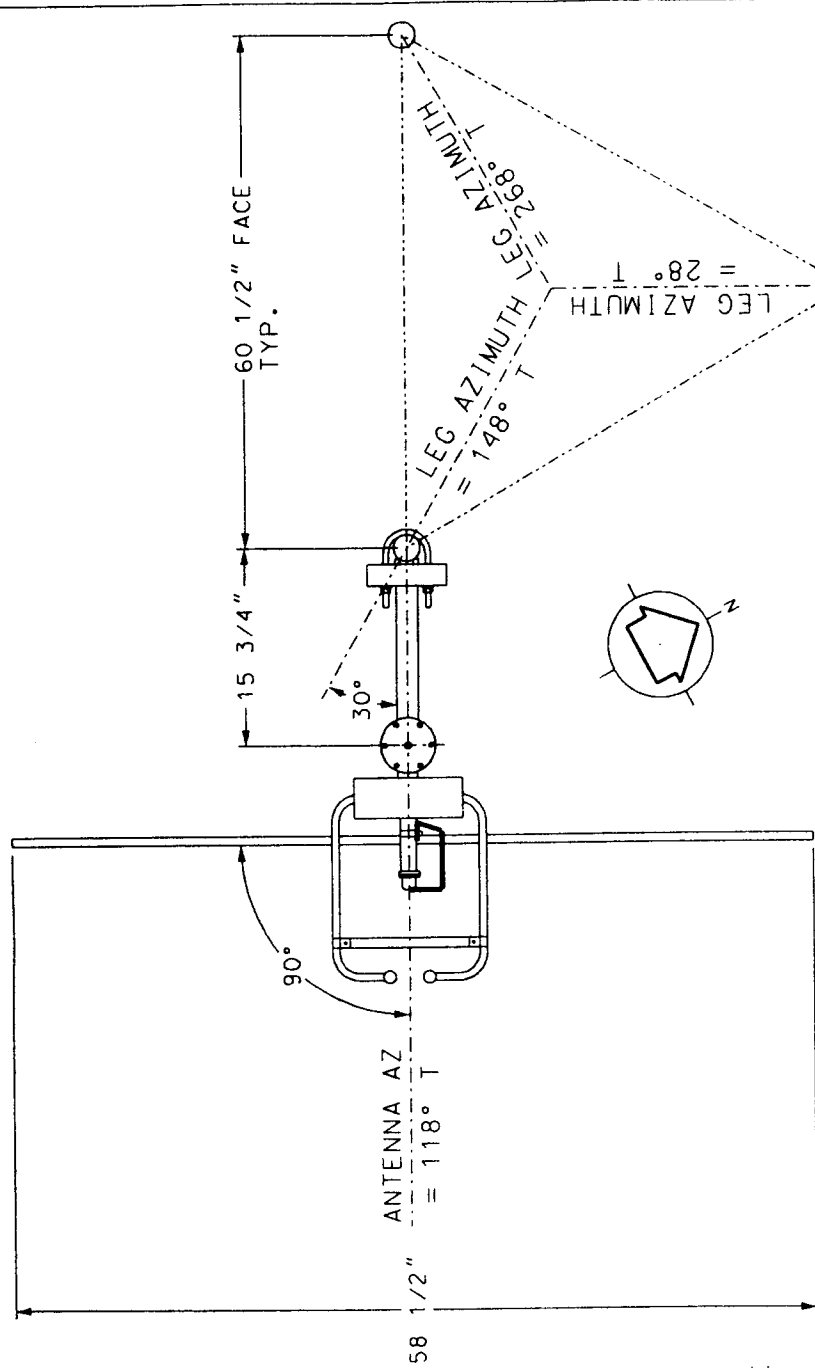
S/O 22336
TABULATION OF HORIZONTAL POLARIZATION
WBKG MACON, GA

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.475	180	0.835
10	0.550	190	0.700
20	0.600	200	0.600
30	0.635	210	0.520
40	0.650	220	0.445
45	0.655	225	0.410
50	0.640	230	0.380
60	0.660	240	0.310
70	0.760	250	0.245
80	0.910	260	0.195
90	1.000	270	0.150
100	1.000	280	0.150
110	1.000	290	0.155
120	1.000	300	0.190
130	0.975	310	0.230
135	0.960	315	0.245
140	0.960	320	0.260
150	0.970	330	0.280
160	0.965	340	0.320
170	0.930	350	0.390

Figure 1B

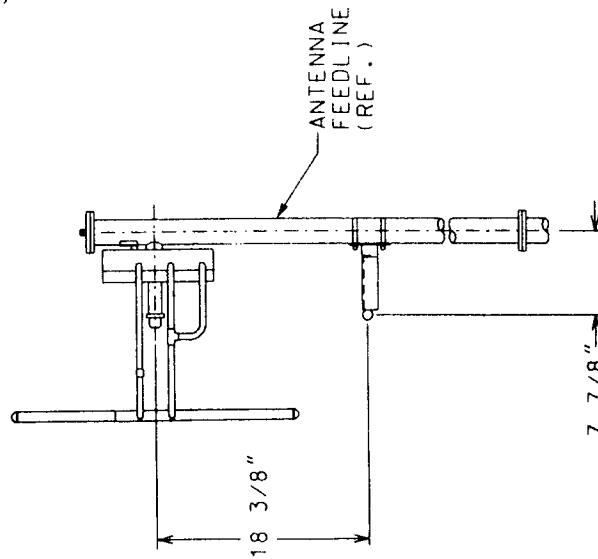
S/O 22336
TABULATION OF VERTICAL POLARIZATION
WBKG MACON, GA

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.480	180	0.720
10	0.525	190	0.710
20	0.575	200	0.630
30	0.630	210	0.550
40	0.680	220	0.465
45	0.715	225	0.430
50	0.750	230	0.395
60	0.810	240	0.330
70	0.840	250	0.250
80	0.835	260	0.195
90	0.850	270	0.150
100	0.920	280	0.120
110	0.955	290	0.100
120	0.965	300	0.095
130	0.930	310	0.095
135	0.895	315	0.095
140	0.865	320	0.095
150	0.780	330	0.170
160	0.710	340	0.360
170	0.690	350	0.430



TOP VIEW

TOWER: ROHN 90



SIDE VIEW

SHIVELY LABS			
A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE			
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY:
22,336	88.9 MHZ.	N.T.S.	APL
TITLE:			
MODEL -6810-6-DIRECTIONAL ANTENNA			
DATE:	APPROVED BY:		
03-18-02			

FIGURE 2

FIELD ELEVATION PATTERN

ANT. MFG.: SHIVELY LABS

ANT. TYPE: 6810-6-DA

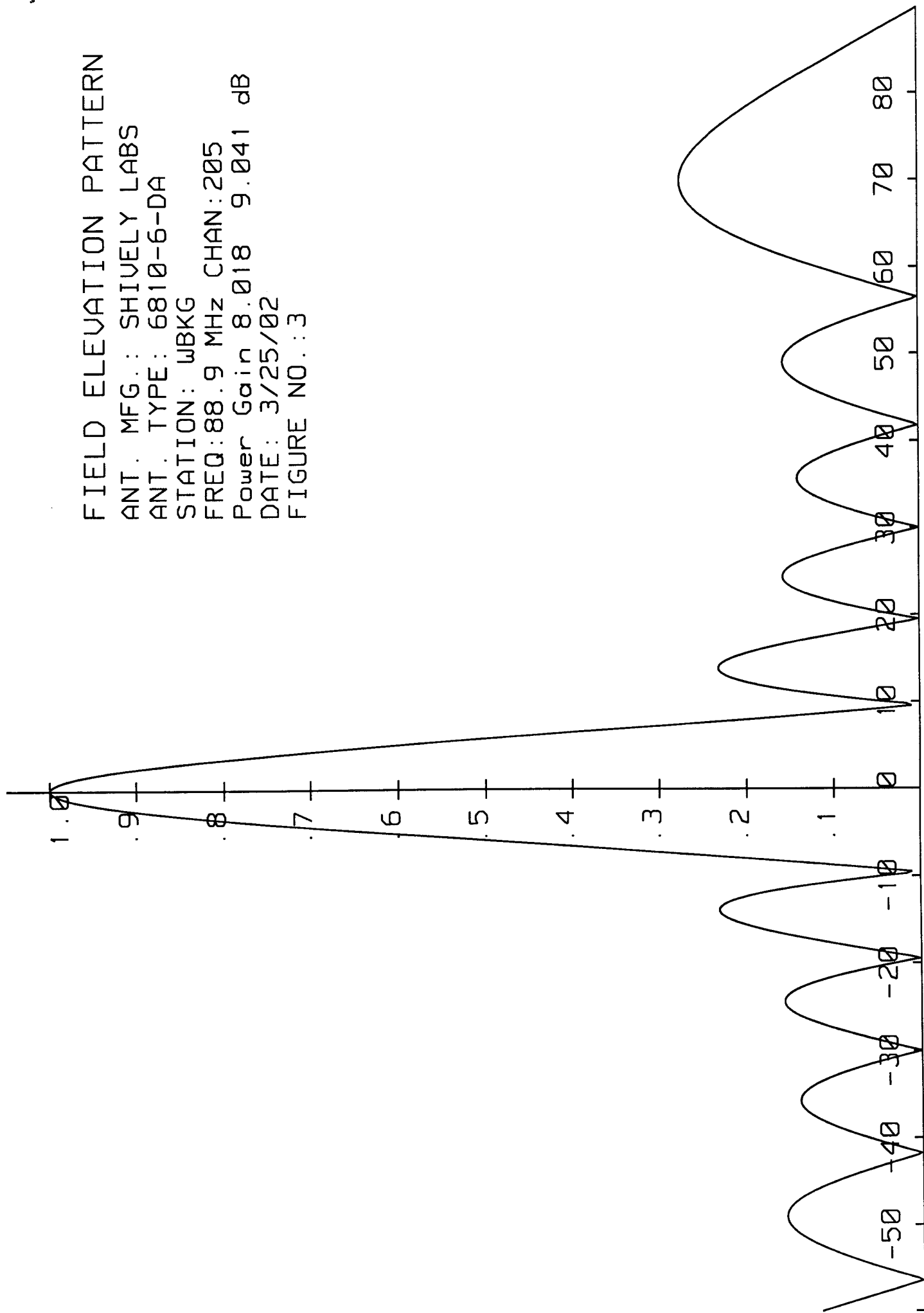
STATION: WBKG

FREQ: 88.9 MHz CHAN: 205

Power Gain 8.018 9.041 dB

DATE: 3/25/02

FIGURE NO.: 3



S.O. 22336

VALIDATION OF GAIN CALCULATION

WBKG MACON, GA

MODEL 6810-6-DA

Elevation Gain of 6810-6-DA equals 3.28

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

Horizontal RMS divided by Vertical RMS equals

$$0.660 \div 0.620 = 1.0645$$

Elevation Gain of Horizontal Component equals

$$3.28 \times 1.0645 = 3.492$$

Elevation Gain of Vertical Component equals

$$3.28 \times 0.9394 = 3.081$$

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

$$1/(0.660)^2 = 2.296$$

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

$$1/(0.62 \div 0.97)^2 = 2.448$$

*** Total Horizontal Gain is Elevation Gain times Azimuth Gain**

$$3.492 \times 2.296 = 8.018$$

*** Total Vertical Gain is Elevation Gain times Azimuth Gain**

$$3.081 \times 2.448 = 7.542$$

ERP divided by Horizontal Gain equals Antenna Input Power

$$5.0 \text{ kW} \div 8.018 = 0.624$$

Antenna Input Power times Vertical Gain equals Vertical ERP

$$0.624 \times 7.542 = 4.706$$

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

$$(0.97)^2 \times 5.0 \text{ kW} = 4.7045$$

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