

S.O. 22643

Report of Test 6016-1/3-DA

for

GLEN IRIS BAPTIST SCHOOL

WGIB 91.9 MHZ BIRMINGHAM, AL

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6016-1/3-DA to meet the needs of WGIB and to comply with the requirements of the FCC construction permit, file number BPED-20000622AFR.

RESULTS:

The measured azimuth pattern for the 6016-1/3-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 BPED-20000622AFR indicates that the Horizontal radiation component shall not exceed 3.50 kW at any azimuth and is restricted to the following values at the azimuths specified:

50 Degrees T: 0.111 kW

210 Clockwise to 220 Degrees T: 0.925 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 149 Degrees T to 151 Degrees T, 268 Degrees T to 270 Degrees T and 319 Degrees T to 321 Degrees T. At the restricted azimuth of 50 Degrees T the Horizontal component is 16.48 dB down from the maximum of 3.50 kW, or 0.079 kW. At the restricted azimuth of 210 Clockwise to 220 Degrees T the Horizontal component is 6.108 dB down from the maximum of 3.50 kW, or 0.858 kW.

The R.M.S. of the Horizontal component is 0.675. The total Horizontal power gain is 1.57. The R.M.S. of the Vertical component is 0.66. The total Vertical power gain is 1.54. See Figure Four for calculations. The R.M.S. of the FCC composite pattern is 0.75. Therefore this Pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6016-1/3-DA was mounted on a tower of exact scale to a World tower. The spacing of the antenna to the tower was varied to achieve both the horizontal and vertical pattern shown in Figure 1. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BPED-20000622AFR, a single level of the 6016-1/3-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:

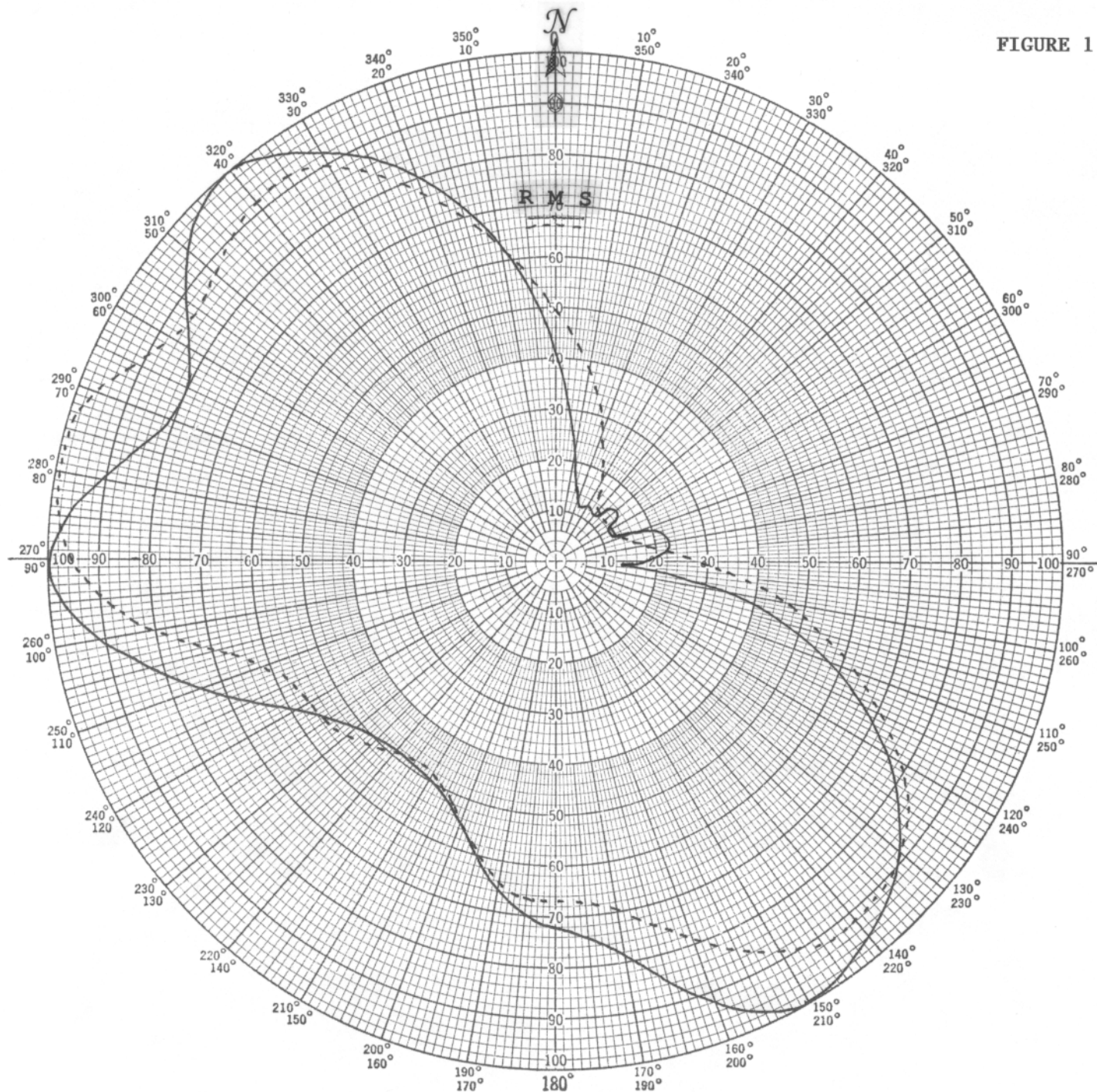
The corner reflector is mounted so that the horizontal and vertical azimuth patterns are measured independently by rotating the corner reflector by 90 degrees. The network analyzer was set to 413.55 MHz. Calibrated pads are used to check the linearity of the measuring system. For example, 6 dB padding 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 22643
January 3, 2003

FIGURE 1



Shively Labs

PROJECT NAME WGIB BIRMINGHAM, AL

PROJECT NUMBER 22643 DATE 9/18/02

MODEL (☒) FULL SCALE () FREQUENCY 413.55/91.9 MHz

POLARIZATION HORIZ (—); VERT (----

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

OBSERVER RAS

ANTENNA TYPE 6016-1/3-DA

PATTERN TYPE DIRECTIONAL AZIMUTH

REMARKS: SEE FIGURE 2 FOR MECHANICAL
DETAILS

Figure 1A

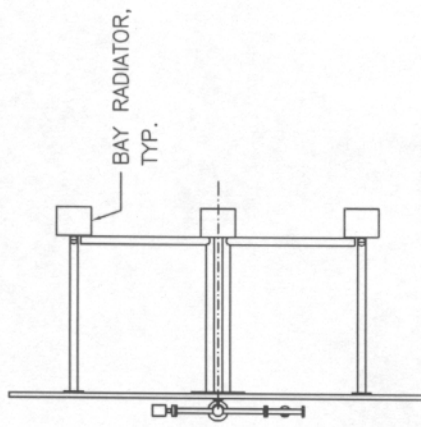
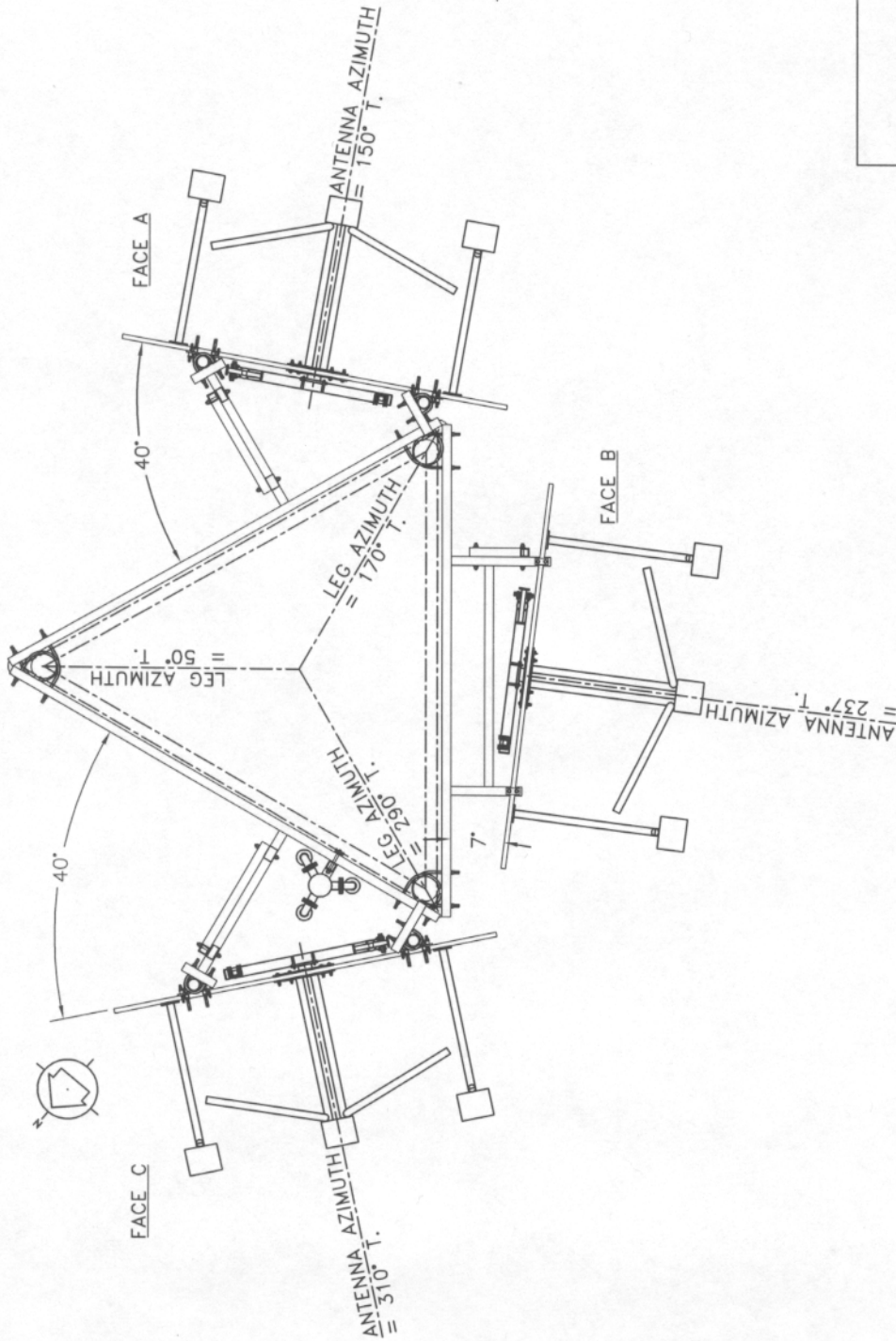
S/O 22643
 TABULATION OF HORIZONTAL POLARIZATION
 WGIB BIRMINGHAM, AL

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.410	180	0.720
10	0.220	190	0.655
20	0.130	200	0.550
30	0.125	210	0.495
40	0.120	220	0.485
45	0.150	225	0.495
50	0.150	230	0.515
60	0.120	240	0.590
70	0.170	250	0.745
80	0.225	260	0.910
90	0.185	270	1.000
100	0.330	280	0.905
110	0.580	290	0.810
120	0.755	300	0.835
130	0.890	310	0.950
135	0.930	315	0.985
140	0.960	320	1.000
150	1.000	330	0.925
160	0.920	340	0.810
170	0.785	350	0.630

Figure 1B

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 TABULATION OF VERTICAL POLARIZATION
 WGIB BIRMINGHAM, AL

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.490	180	0.670
10	0.385	190	0.640
20	0.280	200	0.550
30	0.190	210	0.485
40	0.130	220	0.490
45	0.125	225	0.520
50	0.125	230	0.540
60	0.125	240	0.560
70	0.140	250	0.610
80	0.185	260	0.800
90	0.270	270	0.955
100	0.455	280	0.990
110	0.630	290	0.965
120	0.790	300	0.770
130	0.885	310	0.775
135	0.910	315	0.900
140	0.920	320	0.920
150	0.885	330	0.900
160	0.790	340	0.770
170	0.695	350	0.635



SIDE VIEW OF PANEL

TOP VIEW

SHIVELY LABS			
A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE			
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY:
22643	91.9 MHz	N.T.S.	APL
TITLE:		APPROVED BY:	
MODEL-6016-1/3-DIRECTIONAL ANTENNA			
DATE:			
11-07-02		FIGURE 2	

FIELD ELEVATION PATTERN

ANT. MFG.: SHIVELY LABS

ANT. TYPE: 6016-1/3-DA

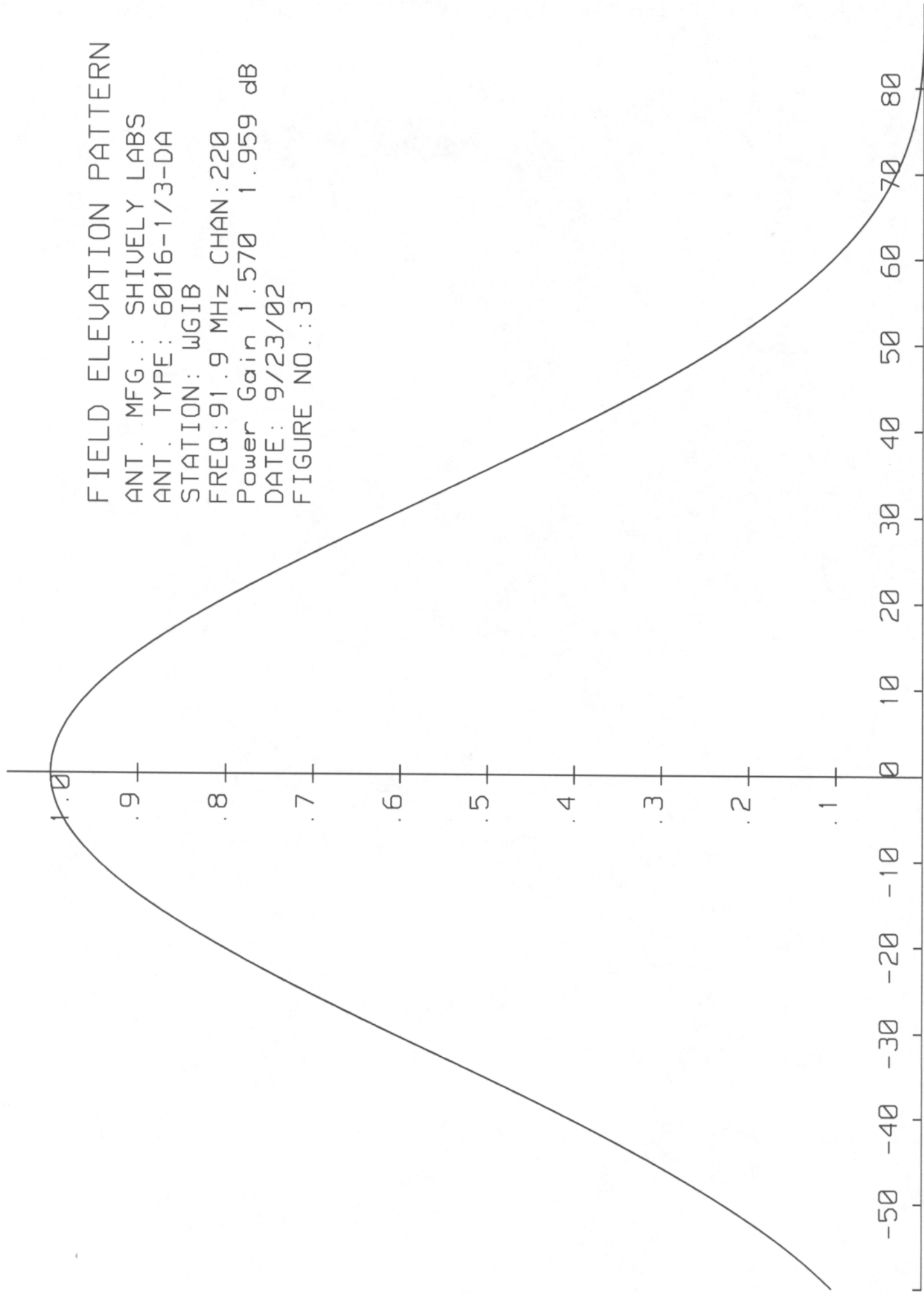
STATION: WGIB

FREQ: 91.9 MHz CHAN: 220

Power Gain 1.570 1.959 dB

DATE: 9/23/02

FIGURE NO.: 3



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VALIDATION OF GAIN CALCULATION

WGIB BIRMINGHAM, AL

MODEL 6016-1/3-DA

Elevation Gain of 6016-1/3-DA equals 0.70

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

Horizontal RMS divided by Vertical RMS equals
 $0.675 \div 0.660 = 1.023$

Elevation Gain of Horizontal Component equals
 $0.700 \times 1.023 = 0.716$

Elevation Gain of Vertical Component equals
 $0.700 \times 0.977 = 0.684$

Horizontal Azimuth Gain equals $1/(\text{RMS})^2$
 $1/(0.675)^2 = 2.195$

Vertical Azimuth Gain equals $1/(\text{RMS} \div \text{Max Vert})^2$
 $1/(0.660 \div 0.99)^2 = 2.25$

*** Total Horizontal Gain is Elevation Gain times Azimuth Gain**
 $0.716 \times 2.195 = 1.57$

*** Total Vertical Gain is Elevation Gain times Azimuth Gain**
 $0.684 \times 2.25 = 1.54$

ERP divided by Horizontal Gain equals Antenna Input Power
 $3.50 \text{ kW} \div 1.57 = 2.229 \text{ kW}$

Antenna Input Power times Vertical Gain equals Vertical ERP
 $2.229 \times 1.54 = 3.43 \text{ kW}$

Maximum Value of the Vertical Component squared times the
 Maximum ERP equals the Vertical ERP
 $(0.99)^2 \times 3.50 \text{ kW} = 3.43 \text{ kW}$

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