Shively Labs
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S.O. 21,392

Report of Test 6814BB-5D-SS-DA

for

EMMIS LICENSE CORP. OF NEW YORK

WQHT NEW YORK, NY

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6814BB-5D-SS-DA to meet the needs WQHT and to comply with the requirements of the FCC construction permit, file number BXPH-200001011AAX.

RESULTS:

The measured azimuth pattern for the 6814BB-5D-SS-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 BXPH-200001011AAX indicates that the Horizontal radiation component shall not exceed 29.5 kW at any azimuth and is restricted to the following values at the azimuths specified:

250 Degrees T: 0.58 kW
290 Degrees T: 0.36 kW
340 Degrees T: 3.31 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 82 Degrees T to 128 Degrees T. At the restricted azimuth of 250 Degrees T the Horizontal component is 17.08 dB down from the maximum of 29.5 kW, or 0.578 kW.

At the restricted azimuth of 290 Degrees T, the Vertical component is 19.17 dB down from the maximum of 29.5 kW, or 0.357 kW. At the restricted azimuth of 340 Degrees T, the Horizontal component is 9.50 dB down from the maximum of 29.5 kW, or 3.31 kW.

The R.M.S. of the Horizontal component is 0.640. The total Horizontal power gain is 3.920. The R.M.S. of the Vertical component is 0.625. The total Vertical power gain is 3.612. See Figure Four for calculations. The R.M.S. of the FCC composite pattern is 0.650. Therefore this Pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

See Figure 5 for gains and combiner losses.

METHOD OF DIRECTIONALIZATION:

One bay of the 6814BB-5D-SS-DA was mounted on an outrigged vertical pole attached to a tapered tower section of exact scale to the tower at the West Orange, NJ site. The spacing of the antenna to the outrigged pole and the spacing of the outrigged pole to the tower were varied to achieve the vertical pattern shown in Figure 1. A horizontal parasitic element was attached to the interbay transmission line directly below the radiator. The position of this horizontal parasitic element was changed until the horizontal pattern shown in Figure 1 was achieved. Patterns were run at different positions on the tapered tower. These patterns indicated that there was no substantial change of the directional pattern in the aperture of the antenna. This is due to the fact that the outrigged pole and the horizontal parasitic element reduced the sensitivity of the antenna to the effects of the small changes in the taper of the self-supported tower. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BXPH-200001011AAX, a single level of the 6814BB-5D-SS-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.

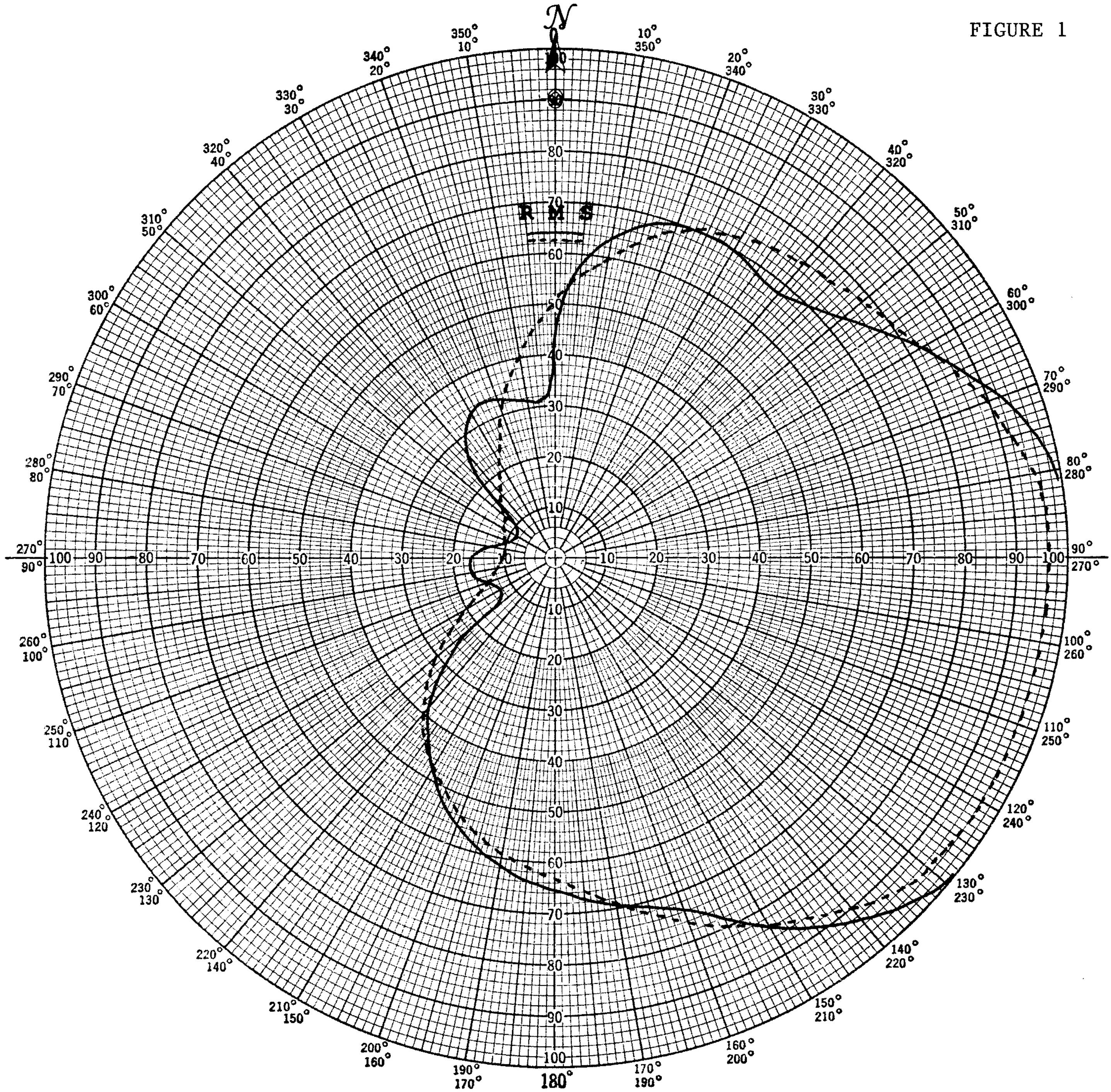
TEST PROCEDURES:

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 436.95 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 21,392
January 18, 2002

FIGURE 1



Shively Labs

PROJECT NAME WQHT NEW YORK, NY

PROJECT NUMBER 21392 DATE 01/11/02

MODEL (X) FULL SCALE ( ) FREQUENCY 436.95/97.1 MHz

POLARIZATION HORIZ (——); VERT (----)

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

OBSERVER RAS

ANTENNA TYPE 6814BB-5D-SS-DA

PATTERN TYPE DIRECTIONAL AZIMUTH

REMARKS: SEE FIGURE 2 FOR MECHANICAL DETAILS

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Figure 1A

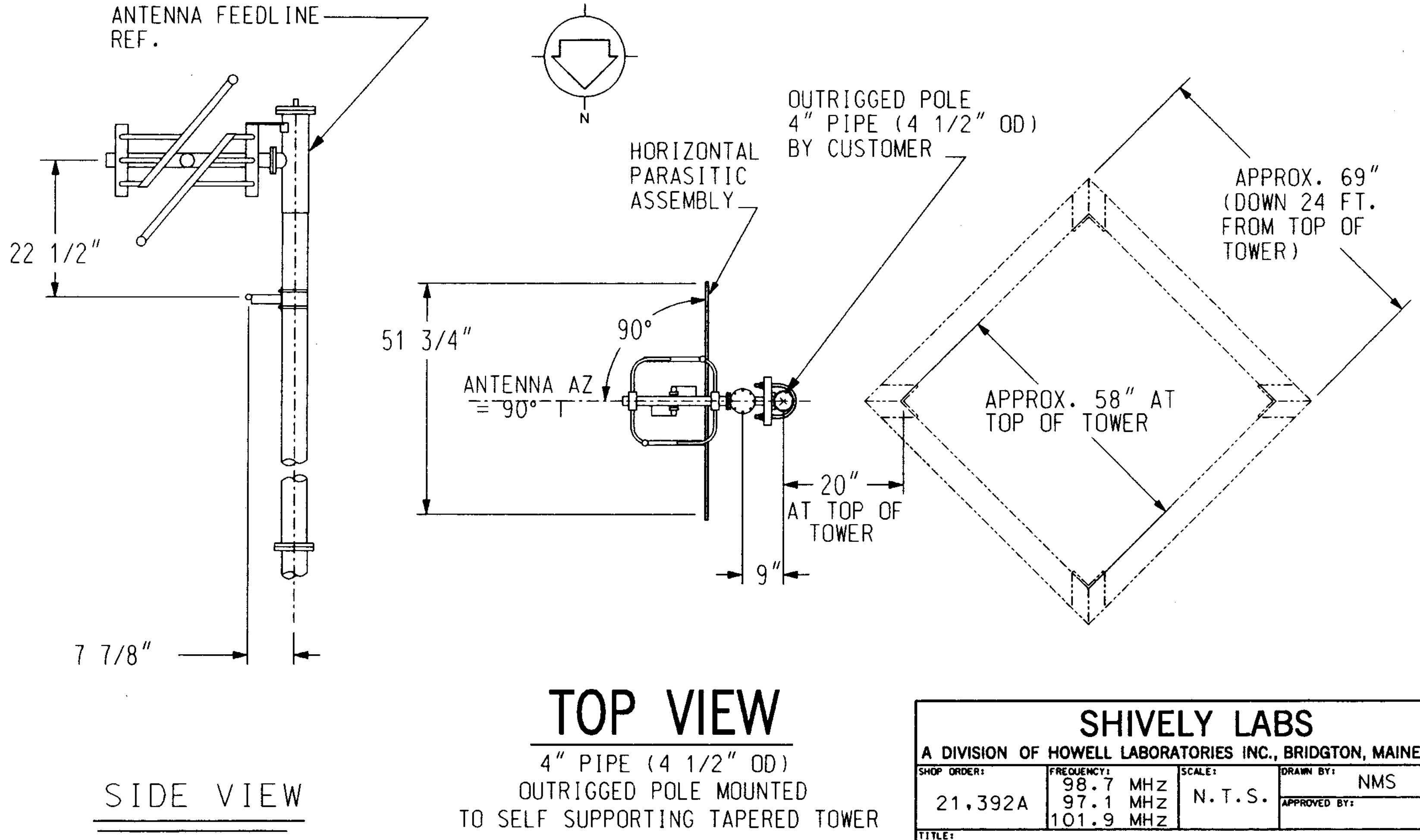
S/O 21,392
TABULATION OF HORIZONTAL POLARIZATION
WQHT NEW YORK, NY

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.410	180	0.660
10	0.640	190	0.615
20	0.700	200	0.560
30	0.700	210	0.490
40	0.680	220	0.390
45	0.700	225	0.320
50	0.730	230	0.220
60	0.820	240	0.125
70	0.925	250	0.140
80	0.995	260	0.170
90	1.000	270	0.170
100	1.000	280	0.130
110	1.000	290	0.009
120	1.000	300	0.008
130	0.995	310	0.100
135	0.970	315	0.140
140	0.930	320	0.260
150	0.840	330	0.330
160	0.735	340	0.335
170	0.700	350	0.315

Figure 1B

S/O 21,392
TABULATION OF VERTICAL POLARIZATION
WQHT NEW YORK, NY

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.510	180	0.630
10	0.600	190	0.590
20	0.690	200	0.540
30	0.730	210	0.480
40	0.755	220	0.410
45	0.770	225	0.360
50	0.790	230	0.310
60	0.830	240	0.200
70	0.900	250	0.140
80	0.950	260	0.120
90	0.960	270	0.110
100	0.960	280	0.100
110	0.960	290	0.110
120	0.960	300	0.115
130	0.950	310	0.130
135	0.940	315	0.150
140	0.900	320	0.160
150	0.835	330	0.220
160	0.760	340	0.310
170	0.690	350	0.400



SHIVELY LABS

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SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY: / APPROVED BY:
21,392A	98.7 MHz 97.1 MHz 101.9 MHz	N.T.S.	NMS

TITLE: MODEL 6814BB-5D-1/2SS-DIRECTIONAL ANTENNA

DATE: 10-10-00

FIGURE 2

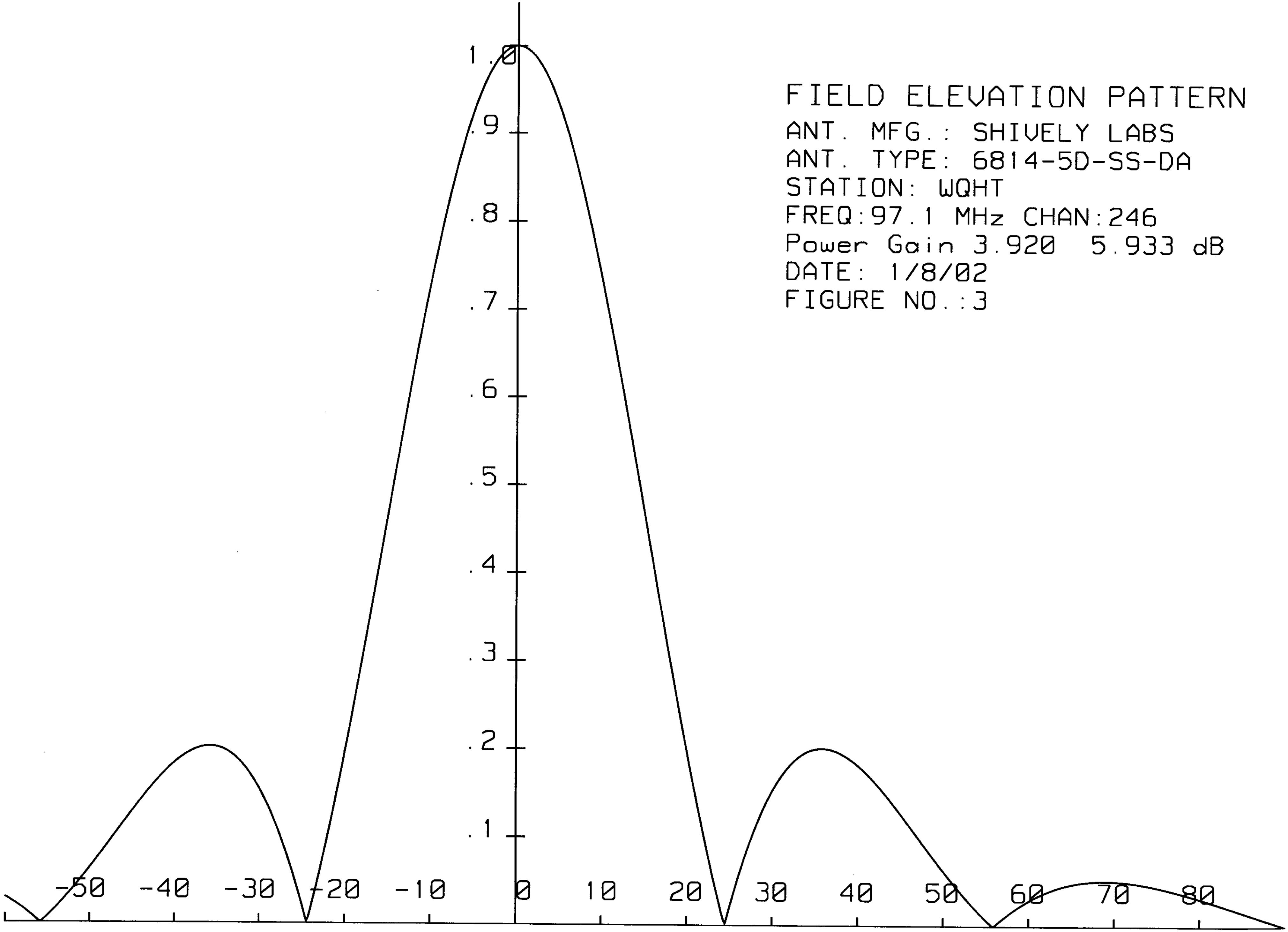
FIELD ELEVATION PATTERN
ANT. MFG.: SHIVELY LABS
ANT. TYPE: 6814-5D-SS-DA
STATION: WQHT
FREQ:97.1 MHz CHAN:246
Power Gain 3.920 5.933 dB
DATE: 1/8/02
FIGURE NO.:3
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
-50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80

FIGURE 4

S.O. 21,392

VALIDATION OF GAIN CALCULATION

WQHT NEW YORK, NY

MODEL 6814BB-5D-SS-DA

Elevation Gain of 6814BB-5D-SS-DA equals 1.568

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

Horizontal RMS divided by Vertical RMS equals
0.640 ÷ 0.625 = 1.024

Elevation Gain of Horizontal Component equals
1.568 x 1.024 = 1.606

Elevation Gain of Vertical Component equals
1.568 x 0.976 = 1.531

Horizontal Azimuth Gain equals $1/(\text{RMS})^2$
$1/(0.640)^2 = 2.441$

Vertical Azimuth Gain equals $1/(\text{RMS} \div \text{Max Vert})^2$
$1/(0.625 \div 0.960)^2 = 2.359$

* **Total Horizontal Gain is Elevation Gain times Azimuth Gain**
1.606 x 2.441 = 3.920

* **Total Vertical Gain is Elevation Gain times Azimuth Gain**
1.531 x 2.359 = 3.612

ERP divided by Horizontal Gain equals Antenna Input Power
29.5 kW ÷ 3.920 = 7.526

Antenna Input Power times Vertical Gain equals Vertical ERP
7.526 x 3.612 = 27.182

Maximum Value of the Vertical Component squared times the Maximum ERP equals the Vertical ERP
$(0.960)^2 \times 29.50$ kW = 27.187

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

FIGURE 5

Being a multi-station antenna system, the following table of antenna gains and combiner losses for each frequency can be used to determine transmitter power output (TPO).

		COMBINER LOSS	ANTENNA GAIN
WQHT	97.1 MHz	0.213	3.920
WRKS-FM	98.7 MHz	0.250	4.011
WQCD	101.9 MHz	0.180	4.198