Shively Labs
a division of Howell Laboratories,Inc.
- An Employee-Owned Company -

P. O. Box 389 Harrison Rd.,
Bridgton, Maine 04009 USA
(207) 647-3327
888-SHIVELY
Fax: (207) 647-8273
E-mail: sales@shively.com
Web site: www.shively.com

S.O. 21,392

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

for

EMMIS RADIO LICENSE CORP. OF NEW YORK

WRKS-FM 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 WRKS-FM and to comply with the requirements of the FCC construction permit, file number BXPH-200001011AAM.

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-200001011AAM 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:

260 Degrees T: 0.360 kW
270 Degrees T: 0.430 kW
300 Degrees T: 0.430 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 76 Degrees T to 78 Degrees T and at 123 Degrees T to 127 Degrees T. At the restricted azimuth of 260 Degrees T the Horizontal component is 19.172 dB down from the maximum of 29.5 kW, or 0.357 kW.

At the restricted azimuth of 270 Degrees T, the Horizontal component is 18.416 dB down from the maximum of 29.5 kW, or 0.425 kW. At the restricted azimuth of 300 Degrees T, the Horizontal component is 18.42 dB down from the maximum of 29.5 kW, or 0.425 kW.

The R.M.S. of the Horizontal component is 0.640. The total Horizontal power gain is 4.011. The R.M.S. of the Vertical component is 0.620. The total Vertical power gain is 3.854. 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-200001011AAM, 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

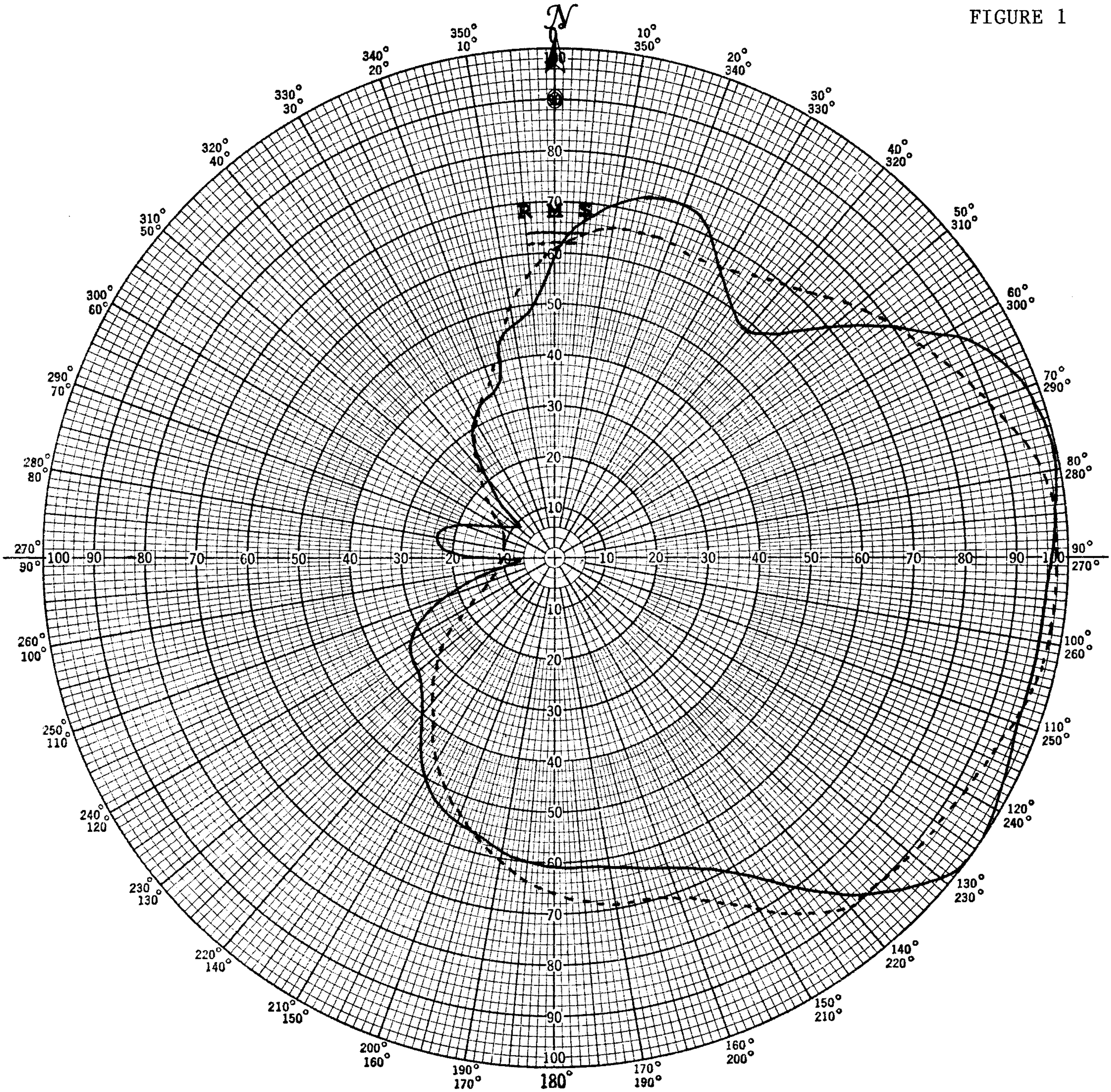
The test equipment is calibrated to ANSI/NCSL Z540-1-1994.

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 444.15 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 21, 2002



Shively Labs

PROJECT NAME WRKS-FM NEW YORK, NY

PROJECT NUMBER 21392 DATE 1/11/02

MODEL (X) FULL SCALE ( ) FREQUENCY 444.15/98.7 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

Figure 1A

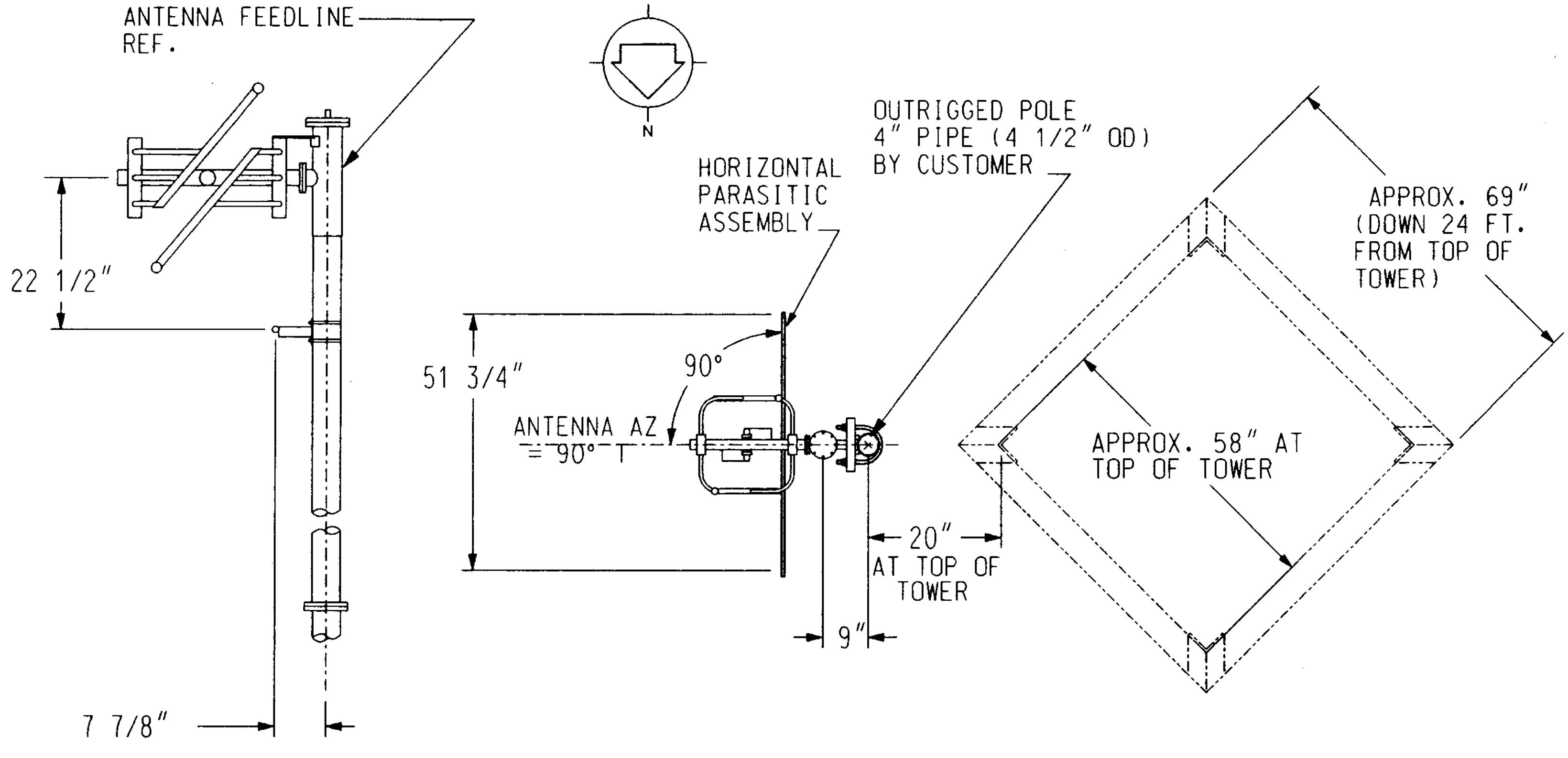
S/O 21,392
TABULATION OF HORIZONTAL POLARIZATION
WRKS-FM NEW YORK, NY

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.600	180	0.610
10	0.705	190	0.590
20	0.740	200	0.560
30	0.650	210	0.505
40	0.580	220	0.400
45	0.620	225	0.370
50	0.700	230	0.355
60	0.890	240	0.330
70	0.980	250	0.230
80	0.990	260	0.110
90	0.970	270	0.120
100	0.960	280	0.240
110	0.960	290	0.200
120	0.990	300	0.120
130	0.980	310	0.100
135	0.935	315	0.160
140	0.865	320	0.220
150	0.720	330	0.315
160	0.650	340	0.345
170	0.620	350	0.465

Figure 1B

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

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.610	180	0.660
10	0.660	190	0.610
20	0.660	200	0.540
30	0.660	210	0.460
40	0.700	220	0.370
45	0.730	225	0.330
50	0.770	230	0.290
60	0.830	240	0.190
70	0.900	250	0.130
80	0.965	260	0.110
90	0.980	270	0.100
100	0.980	280	0.100
110	0.950	290	0.100
120	0.920	300	0.120
130	0.910	310	0.170
135	0.900	315	0.200
140	0.895	320	0.230
150	0.800	330	0.315
160	0.710	340	0.370
170	0.690	350	0.500



SIDE VIEW

TOP VIEW

4" PIPE (4 1/2" OD)
OUTRIGGED POLE MOUNTED
TO SELF SUPPORTING TAPERED TOWER

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE, USA			
SHOP ORDER: 21,392A	FREQUENCY: 98.7 MHz 97.1 MHz 101.9 MHz	SCALE: N.T.S.	DRAWN BY: NMS APPROVED BY:
TITLE: MODEL 6814BB-5D-1/2SS-DIRECTIONAL ANTENNA			
DATE: 10-10-00	FIGURE 2		

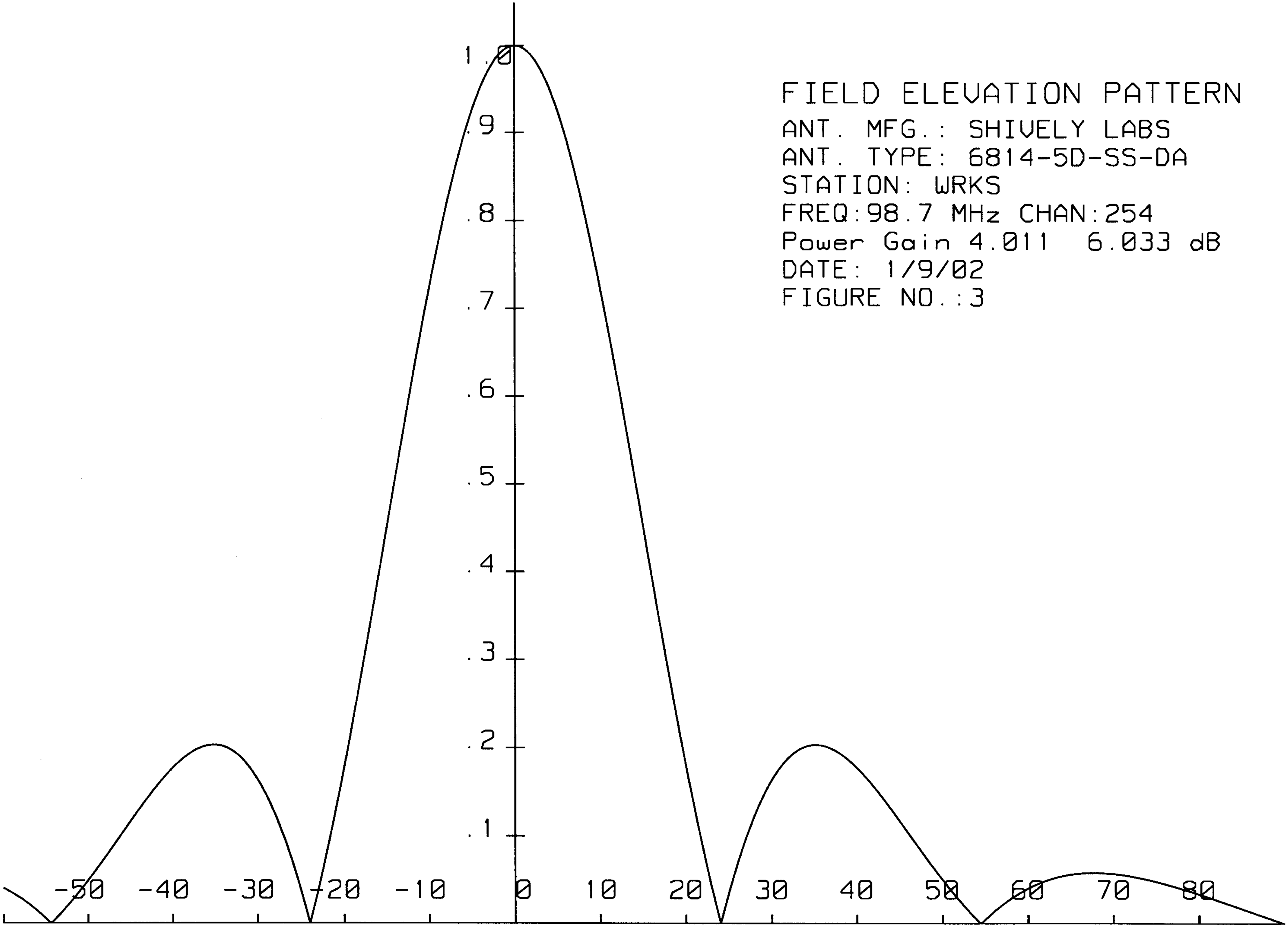

FIELD ELEVATION PATTERN
ANT. MFG.: SHIVELY LABS
ANT. TYPE: 6814-5D-SS-DA
STATION: WRKS
FREQ:98.7 MHz CHAN:254
Power Gain 4.011 6.033 dB
DATE: 1/9/02
FIGURE NO.:3
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
-50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80

FIGURE 4

S.O. 21,392

VALIDATION OF GAIN CALCULATION

WRKS-FM NEW YORK, NY

MODEL 6814BB-5D-SS-DA

Elevation Gain of 6814BB-5D-SS-DA equals 1.592

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

Horizontal RMS divided by Vertical RMS equals
0.640 ÷ 0.620 = 1.032

Elevation Gain of Horizontal Component equals
1.592 x 1.032 = 1.643

Elevation Gain of Vertical Component equals
1.592 x 0.969 = 1.543

Horizontal Azimuth Gain equals $1/(RMS)^2$
$1/(0.640)^2 = 2.441$

Vertical Azimuth Gain equals $1/(RMS \div Max\ Vert)^2$
$1/(0.620 \div 0.980)^2 = 2.498$

* **Total Horizontal Gain is Elevation Gain times Azimuth Gain**
  1.643 x 2.441 = 4.011

* **Total Vertical Gain is Elevation Gain times Azimuth Gain**
  1.543 x 2.498 = 3.854

ERP divided by Horizontal Gain equals Antenna Input Power
29.5 kW ÷ 4.011 = 7.355

Antenna Input Power times Vertical Gain equals Vertical ERP
7.355 x 3.854 = 28.34

Maximum Value of the Vertical Component squared times the Maximum ERP equals the Vertical ERP
$(0.980)^2$ x 29.50 kW = 28.33

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

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