Shively Labs
a division of Howell Laboratories,Inc.

- An Employee-Owned Company -

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S.O. 21,392

Report of Test 6814BB-5D-SS-DA
for
EMMIS 101.9 FM RADIO CORP. OF NY
WQCD 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 WQCD and to comply with the requirements of the FCC construction permit, file number BXPH-200001011AAN.

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-200001011AAN 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:

290 Degrees T: 0.36 kW
320 Degrees T: 0.50 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 73 Degrees T to 84 Degrees T. At the restricted azimuth of 290 Degrees T the Horizontal component is 19.17 dB down from the maximum of 29.5 kW, or 0.357 kW.

At the restricted azimuth of 320 Degrees T, the Horizontal component is 17.72 dB down from the maximum of 29.5 kW, or 0.499 kW.

The R.M.S. of the Horizontal component is 0.630. The total Horizontal power gain is 4.198. The R.M.S. of the Vertical component is 0.620. The total Vertical power gain is 4.032. 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-200001011AAN, 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.

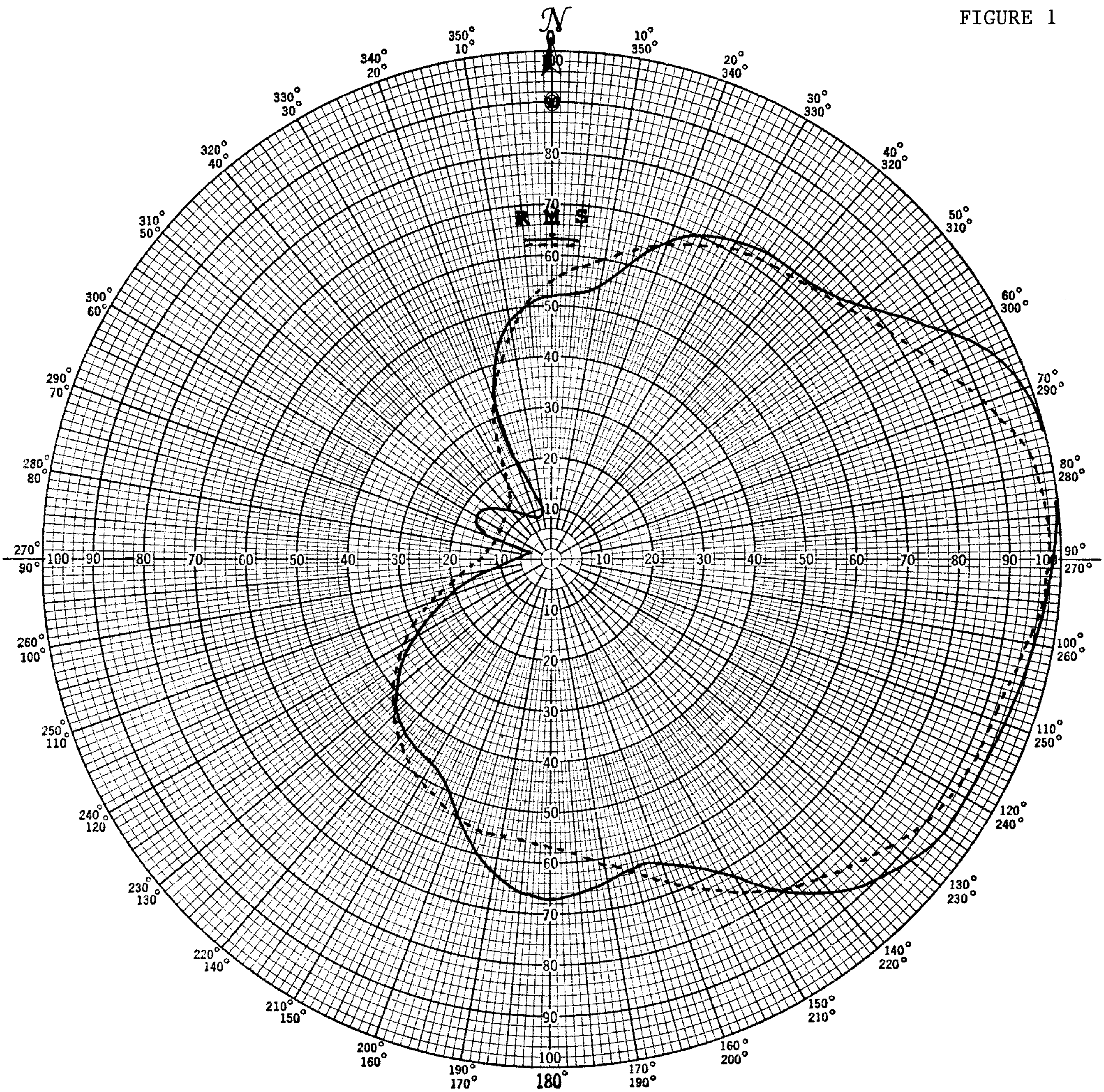
TEST PROCEDURES:

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 458.55 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 21,392
January 21, 2002

FIGURE 1



Shively Labs

PROJECT NAME WQCD NEW YORK, NY

PROJECT NUMBER 21392 DATE 1/11/02

MODEL (X) FULL SCALE ( ) FREQUENCY 458.55/101.9 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

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TABULATION OF HORIZONTAL POLARIZATION
WQCD NEW YORK, NY

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.520	180	0.675
10	0.545	190	0.630
20	0.670	200	0.540
30	0.725	210	0.470
40	0.740	220	0.450
45	0.750	225	0.435
50	0.780	230	0.400
60	0.900	240	0.310
70	0.980	250	0.210
80	1.000	260	0.120
90	0.990	270	0.007
100	0.965	280	0.005
110	0.950	290	0.110
120	0.940	300	0.170
130	0.925	310	0.160
135	0.895	315	0.150
140	0.860	320	0.130
150	0.725	330	0.100
160	0.640	340	0.300
170	0.650	350	0.475

Figure 1B

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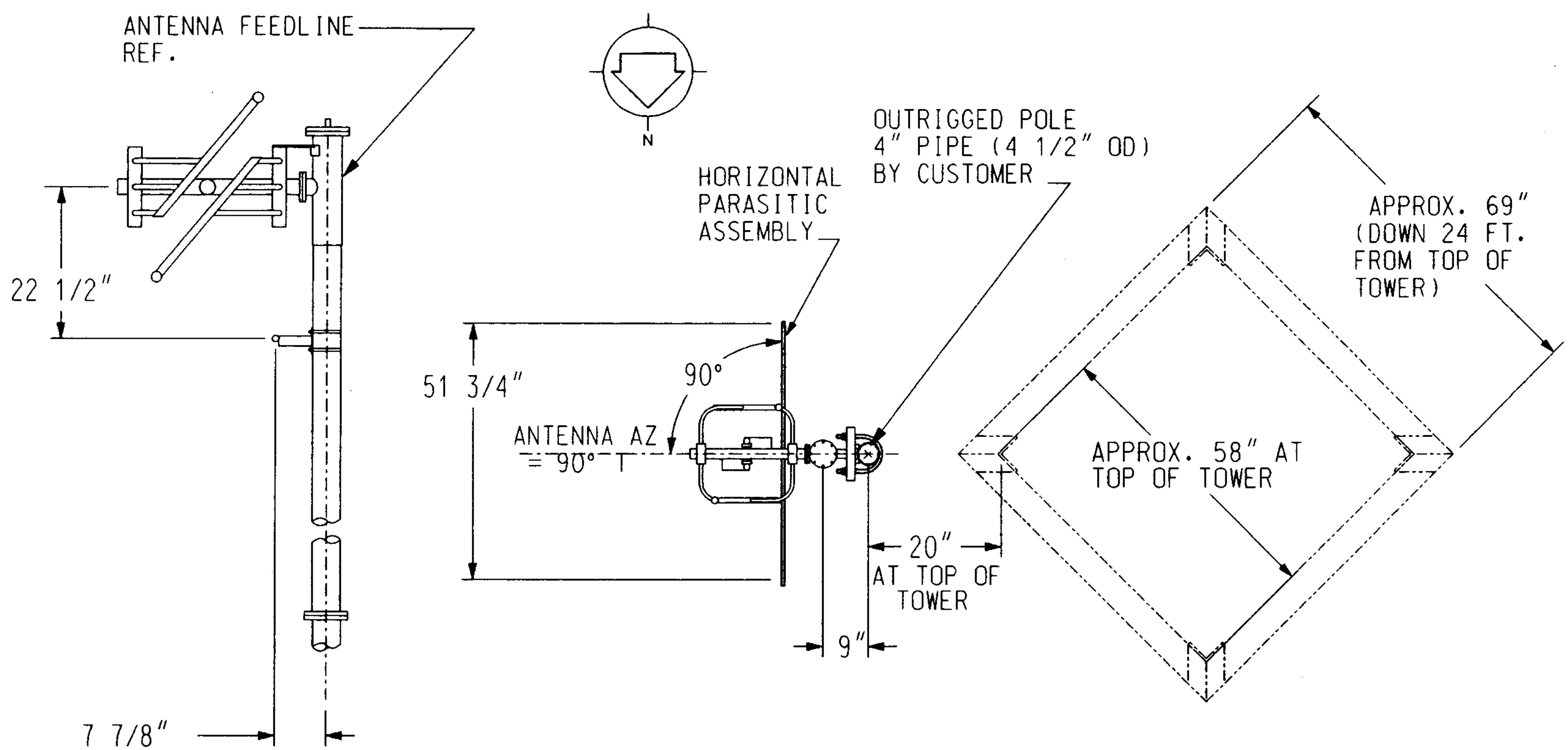
TABULATION OF VERTICAL POLARIZATION
WQCD NEW YORK, NY

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.550	180	0.570
10	0.600	190	0.560
20	0.660	200	0.540
30	0.705	210	0.510
40	0.730	220	0.460
45	0.740	225	0.435
50	0.760	230	0.400
60	0.830	240	0.330
70	0.905	250	0.250
80	0.970	260	0.180
90	0.980	270	0.140
100	0.950	280	0.125
110	0.925	290	0.110
120	0.920	300	0.110
130	0.880	310	0.120
135	0.850	315	0.120
140	0.820	320	0.130
150	0.760	330	0.150
160	0.680	340	0.20
170	0.610	350	0.460



SIDE VIEW

TOP VIEW

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

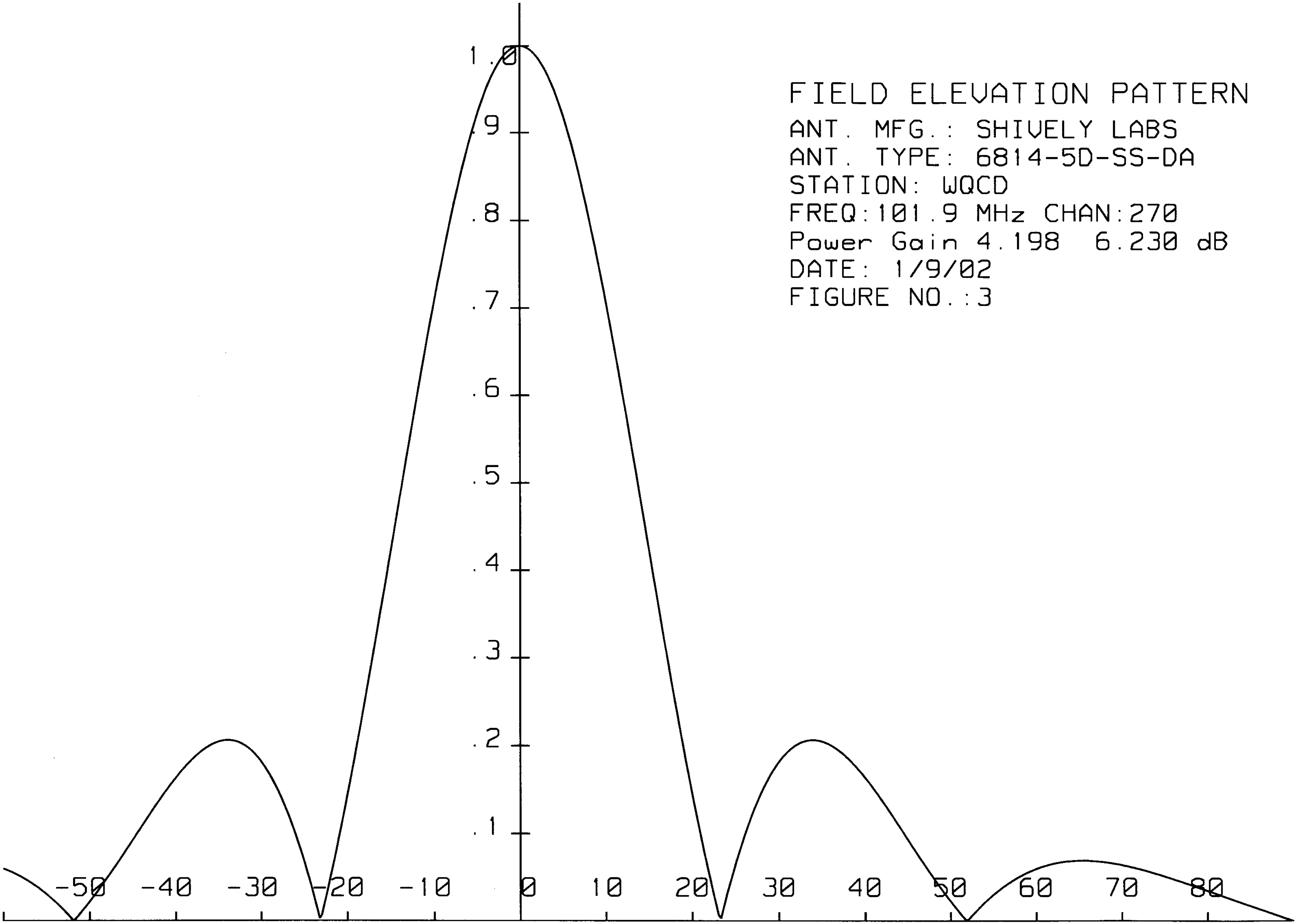
SHIVELY LABS

A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE, USA

SHOP ORDER:	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: WQCD
FREQ:101.9 MHz CHAN:270
Power Gain 4.198 6.230 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

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VALIDATION OF GAIN CALCULATION

WQCD   NEW YORK, NY

MODEL 6814BB-5D-SS-DA

Elevation Gain of 6814BB-5D-SS-DA equals 1.640

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

Horizontal RMS divided by Vertical RMS equals
0.630 ÷ 0.620 = 1.016

Elevation Gain of Horizontal Component equals
1.640 x 1.016 = 1.666

Elevation Gain of Vertical Component equals
1.640 x 0.984 = 1.614

Horizontal Azimuth Gain equals $1/(\text{RMS})^2$
$1/(0.630)^2 = 2.520$

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

* **Total Horizontal Gain is Elevation Gain times Azimuth Gain**
  1.666 x 2.520 = 4.198

* **Total Vertical Gain is Elevation Gain times Azimuth Gain**
  1.614 x 2.498 = 4.032

ERP divided by Horizontal Gain equals Antenna Input Power
29.5 kW ÷ 4.198 = 7.027

Antenna Input Power times Vertical Gain equals Vertical ERP
7.027 x 4.032 = 28.333

Maximum Value of the Vertical Component squared times the Maximum ERP equals the Vertical ERP
$(0.980)^2$ x 29.5 kW = 28.332

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