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S.O. 21,454

Report of Test 6810-4R-DA

for

DELMARVA EDUCATIONAL ASSOCIATION

WAZP CAPE CHARLES, VA

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-4R-DA to meet the needs WAZP and to comply with the requirements of the FCC construction permit, file number BMPED-20000309ABM.

RESULTS:

The measured azimuth pattern for the 6810-4R-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-20000309ABM indicates that the Horizontal radiation component shall not exceed 7.5 kW at any azimuth and is restricted to the following values at the azimuths specified:

280 Degrees T: 0.24 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 57 Degrees T to 159 Degrees T. At the restricted azimuth of 280 Degrees T the Horizontal component is 15.39 dB down from the maximum of 7.5 kW, or 0.22 kW.

The R.M.S. of the Horizontal component is 0.760. The total Horizontal power gain is 3.768. The R.M.S. of the Vertical component is 0.740. The total Vertical power gain is 3.696. See Figure Four for calculations. The R.M.S. of the FCC composite pattern is 0.810. Therefore this Pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-4R-DA was mounted on a tower of exact scale to a Rohn Model 80 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-20000309ABM, a single level of the 6810-4R-DA was set up on the Howell Laboratories scale model antenna pattern measuring range. A scale of 4.5:1 was used.

SUPERVISION:

The tests were carried out under the direction of Robert A. Surette, Manager of RF Engineering. 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 both full size and scale model pattern measurements since 1974 as an RF Engineer with Shively Labs and with Dielectric Communications (a unit of General Signal). He is currently an Associate Member of the Association of Federal Communications Consulting Engineers and a Member of IEEE.

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 8505 Network Analyzer
PC Based Controller
Hewlett Packard 7550A Graphics Plotter

The test equipment is calibrated to MIL-STD-45662.

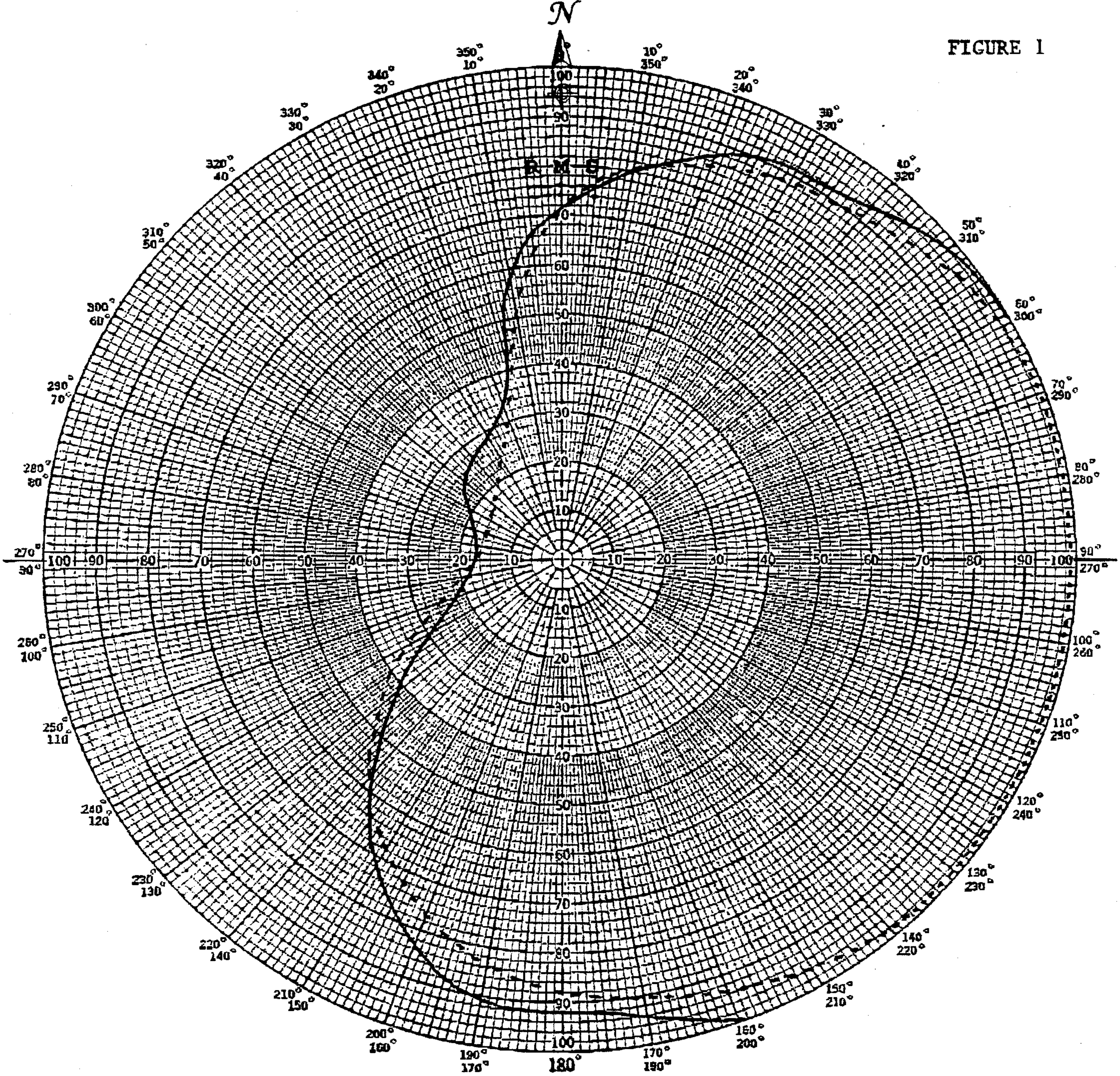
TEST PROCEDURES:

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 408.15 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 21,454
October 26, 2000

FIGURE 1



Shively Labs

PROJECT NAME WAZP CAPE CHARLES, VA

PROJECT NUMBER 21,454 DATE 10/26/00

MODEL (X) FULL SCALE ( ) FREQUENCY 408.15/90.7 MHz

POLARIZATION HORIZ (——); VERT (----)

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

OBSERVER RAS

ANTENNA TYPE 6810-4R-DA

PATTERN TYPE DIRECTIONAL AZIMUTH

REMARKS: SEE FIGURE 2 FOR MECHANICAL DETAILS

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Figure 1A

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TABULATION OF HORIZONTAL POLARIZATION
WAZP CAPE CHARLES, VA

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.710	180	0.920
10	0.800	190	0.910
20	0.875	200	0.830
30	0.915	210	0.715
40	0.935	220	0.570
45	0.960	225	0.490
50	0.980	230	0.415
60	1.000	240	0.290
70	1.000	250	0.220
80	1.000	260	0.190
90	1.000	270	0.170
100	1.000	280	0.170
110	1.000	290	0.180
120	1.000	300	0.210
130	1.000	310	0.250
135	1.000	315	0.260
140	1.000	320	0.270
150	1.000	330	0.290
160	0.995	340	0.335
170	0.945	350	0.580

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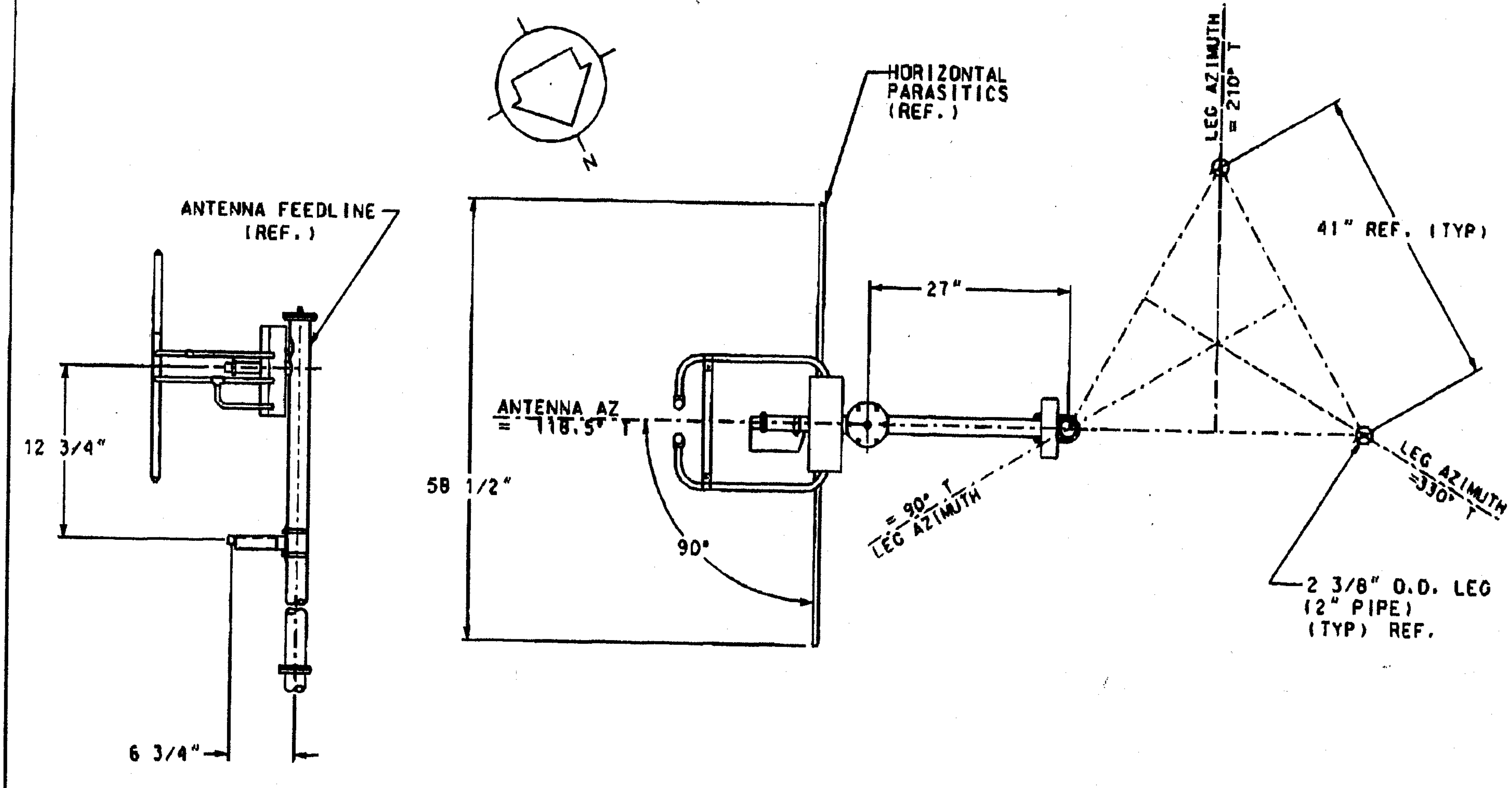
TABULATION OF VERTICAL POLARIZATION
WAZP CAPE CHARLES, VA

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.710	180	0.880
10	0.805	190	0.835
20	0.850	200	0.770
30	0.885	210	0.680
40	0.910	220	0.575
45	0.925	225	0.520
50	0.945	230	0.460
60	0.980	240	0.350
70	0.990	250	0.250
80	0.990	260	0.200
90	0.990	270	0.170
100	0.990	280	0.155
110	0.990	290	0.155
120	0.990	300	0.160
130	0.990	310	0.170
135	0.990	315	0.180
140	0.985	320	0.195
150	0.960	330	0.240
160	0.935	340	0.320
170	0.905	350	0.510

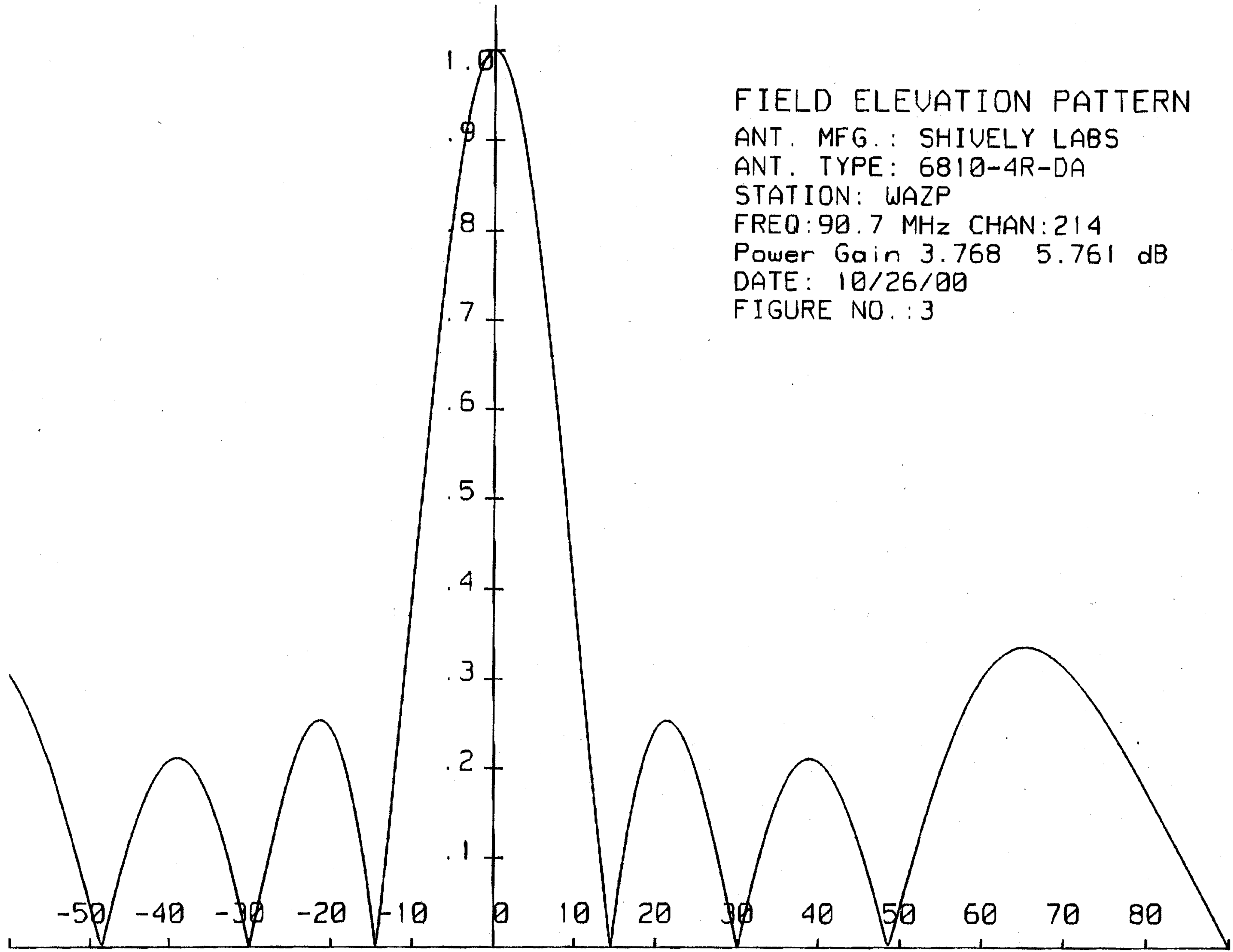


SIDE VIEW

TOP VIEW

TOWER: ROHN MODEL 80

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE			
SHOP ORDER: 21,454	FREQUENCY: 90.7 MHz.	SCALE: N.T.S.	DRAWN BY: NMS APPROVED BY:
TITLE: MODEL-6810-4R-DIRECTIONAL ANTENNA			
DATE: 8-28-00	FIGURE 2		


FIELD ELEVATION PATTERN
ANT. MFG.: SHIVELY LABS
ANT. TYPE: 6810-4R-DA
STATION: WAZP
FREQ:90.7 MHz CHAN:214
Power Gain 3.768 5.761 dB
DATE: 10/26/00
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

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VALIDATION OF GAIN CALCULATION

WAZP CAPE CHARLES, VA

MODEL 6810-4R-DA

Elevation Gain of 6810-4R-DA equals 2.12

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

Horizontal RMS divided by Vertical RMS equals
$0.760 \div 0.740 = 1.027$

Elevation Gain of Horizontal Component equals
$2.12 \times 1.027 = 2.177$

Elevation Gain of Vertical Component equals
$2.12 \times 0.974 = 2.065$

Horizontal Azimuth Gain equals $1/(RMS)^2$
$1/(0.760)^2 = 1.731$

Vertical Azimuth Gain equals $1/(RMS \div Max\ Vert)^2$
$1/(0.740 \div 0.990)^2 = 1.790$

* **Total Horizontal Gain is Elevation Gain times Azimuth Gain**
$2.177 \times 1.731 = 3.768$

* **Total Vertical Gain is Elevation Gain times Azimuth Gain**
$2.065 \times 1.790 = 3.696$

ERP divided by Horizontal Gain equals Antenna Input Power
7.5 kW $\div 3.768 = 1.990$ kW

Antenna Input Power times Vertical Gain equals Vertical ERP
$1.990 \times 3.696 = 7.355$

Maximum Value of the Vertical Component squared times the Maximum ERP equals the Vertical ERP
$(0.990)^2 \times 7.5$ kW $= 7.351$

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