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S.O. 23263

Report of Test 6810-3R-DA

for

SKY HIGH BROADCASTING, INC.

KELP-FM 89.3 MHz MESQUITE, NM

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-3R-DA to meet the needs of KELP-FM and to comply with the requirements of the FCC construction permit, file number BMPED-20020319ABQ.

RESULTS:

The measured azimuth pattern for the 6810-3R-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-20020319ABQ indicates that the Horizontal radiation component shall not exceed 3.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

140 - 220 Degrees T: 0.097 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 346 Degrees T to 027 Degrees T. At the restricted azimuth of 140 - 220 Degrees T the Horizontal component is 15.918 dB down from the maximum of 3.0 kW, or 0.077 kW.

The R.M.S. of the Horizontal component is 0.638. The total Horizontal power gain is 3.956. The R.M.S. of the Vertical component is 0.614. The total Vertical power gain is 3.879. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.690. Therefore this Pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-3R-DA was mounted on a tower of exact scale to a Utility 380 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-20020319ABQ, a single level of the 6810-3R-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.

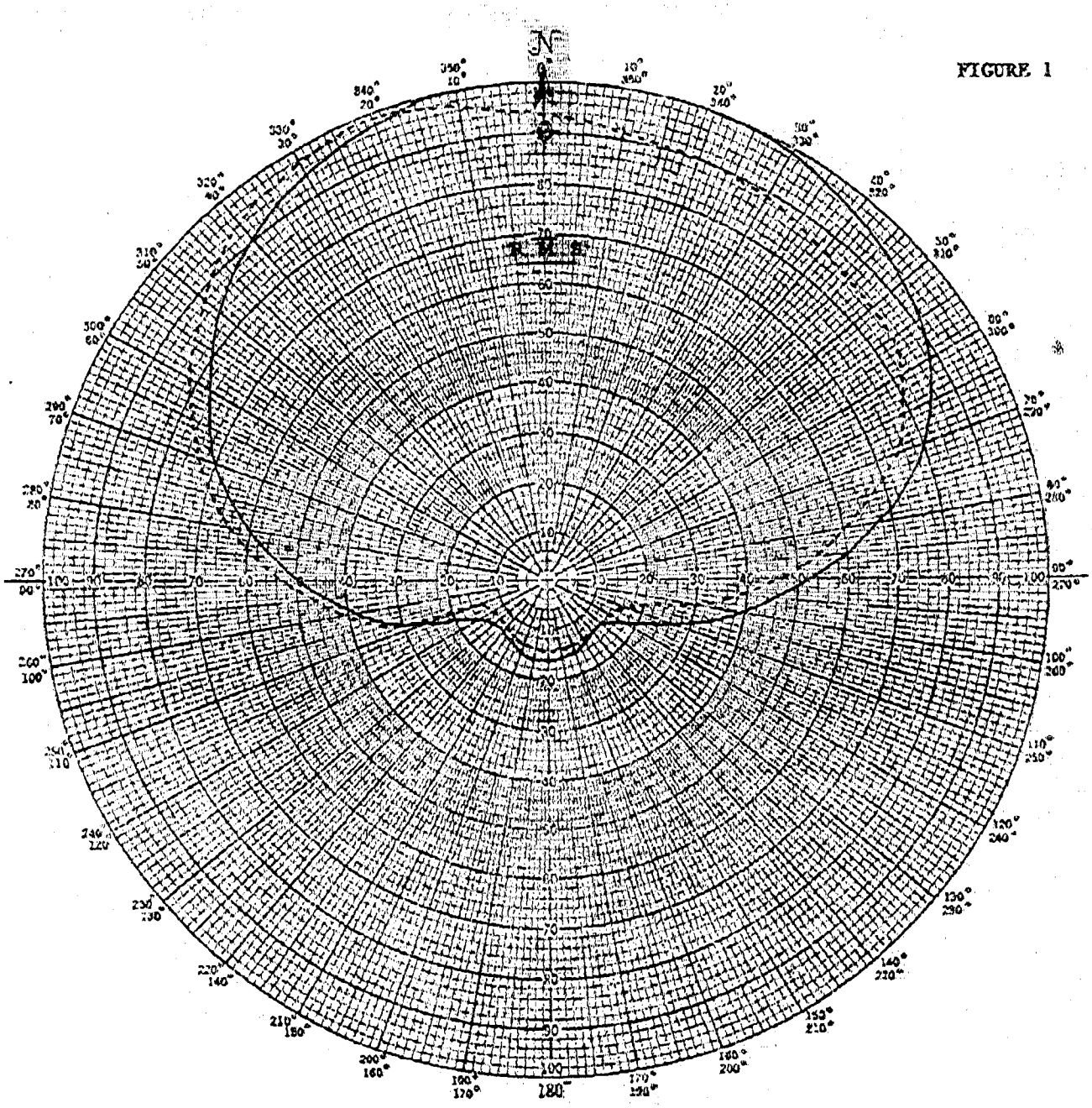
TEST PROCEDURES:

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 401.85 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 23263
January 28, 2004

FIGURE 1



Shively Labs

PROJECT NAME KELP-FM MESQUITE, NM

PROJECT NUMBER 23263 DATE 1/5/04

MODEL (X) FULL SCALE ( ) FREQUENCY 401.85/89.3 MHz

POLARIZATION HORIZ (——); VERT (- - - -)

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

OBSERVER RAS

ANTENNA TYPE 6810-3R-DA

PATTERN TYPE DIRECTIONAL AZIMUTH

REMARKS: SEE FIGURE 2 FOR MECHANICAL DETAILS

Figure 1A

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TABULATION OF HORIZONTAL POLARIZATION
KELP-FM MESQUITE, NM

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	1.000	180	0.160
10	1.000	190	0.160
20	1.000	200	0.160
30	0.990	210	0.145
40	0.960	220	0.140
45	0.950	225	0.135
50	0.930	230	0.140
60	0.885	240	0.160
70	0.800	250	0.260
80	0.670	260	0.390
90	0.530	270	0.495
100	0.395	280	0.600
110	0.270	290	0.700
120	0.180	300	0.770
130	0.140	310	0.845
135	0.140	315	0.875
140	0.140	320	0.900
150	0.150	330	0.945
160	0.155	340	0.975
170	0.160	350	1.000

Figure 1B

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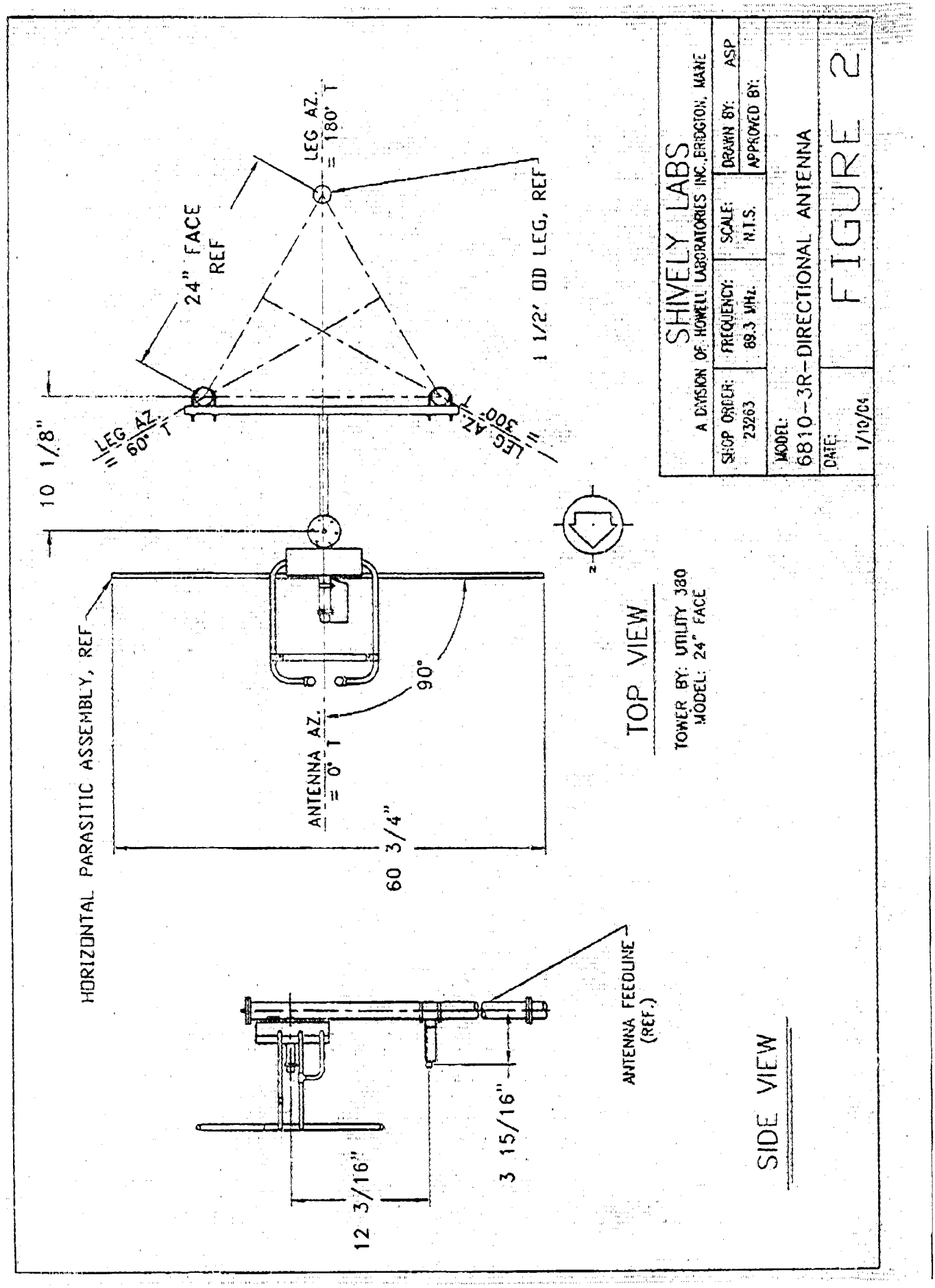
TABULATION OF VERTICAL POLARIZATION
KELP-FM MESQUITE, NM

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.940	180	0.140
10	0.915	190	0.140
20	0.900	200	0.140
30	0.890	210	0.130
40	0.860	220	0.125
45	0.855	225	0.120
50	0.850	230	0.120
60	0.820	240	0.125
70	0.745	250	0.140
80	0.605	260	0.415
90	0.470	270	0.530
100	0.300	280	0.640
110	0.170	290	0.735
120	0.145	300	0.815
130	0.140	310	0.885
135	0.140	315	0.915
140	0.140	320	0.940
150	0.140	330	0.975
160	0.140	340	0.990
170	0.140	350	0.970


SHIVELY LABS
A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE
SHOP ORDER: 23263
FREQUENCY: 89.3 MHz.
SCALE: N.T.S.
DRAWN BY: ASP
APPROVED BY:
MODEL: 6810-3R-DIRECTIONAL ANTENNA
DATE: 1/10/04
FIGURE 2
TOP VIEW
TOWER BY: UTILITY 380
MODEL: 24" FACE
SIDE VIEW
LEG AZ. = 180° T
24" FACE REF
1 1/2" OD LEG, REF
LEG AZ. = 60° T
LEG AZ. = 300° T
10 1/8"
HORIZONTAL PARASITIC ASSEMBLY, REF
ANTENNA AZ. = 0° T
90°
60 3/4"
ANTENNA FEEDLINE (REF.)
3 15/16"
12 3/16"

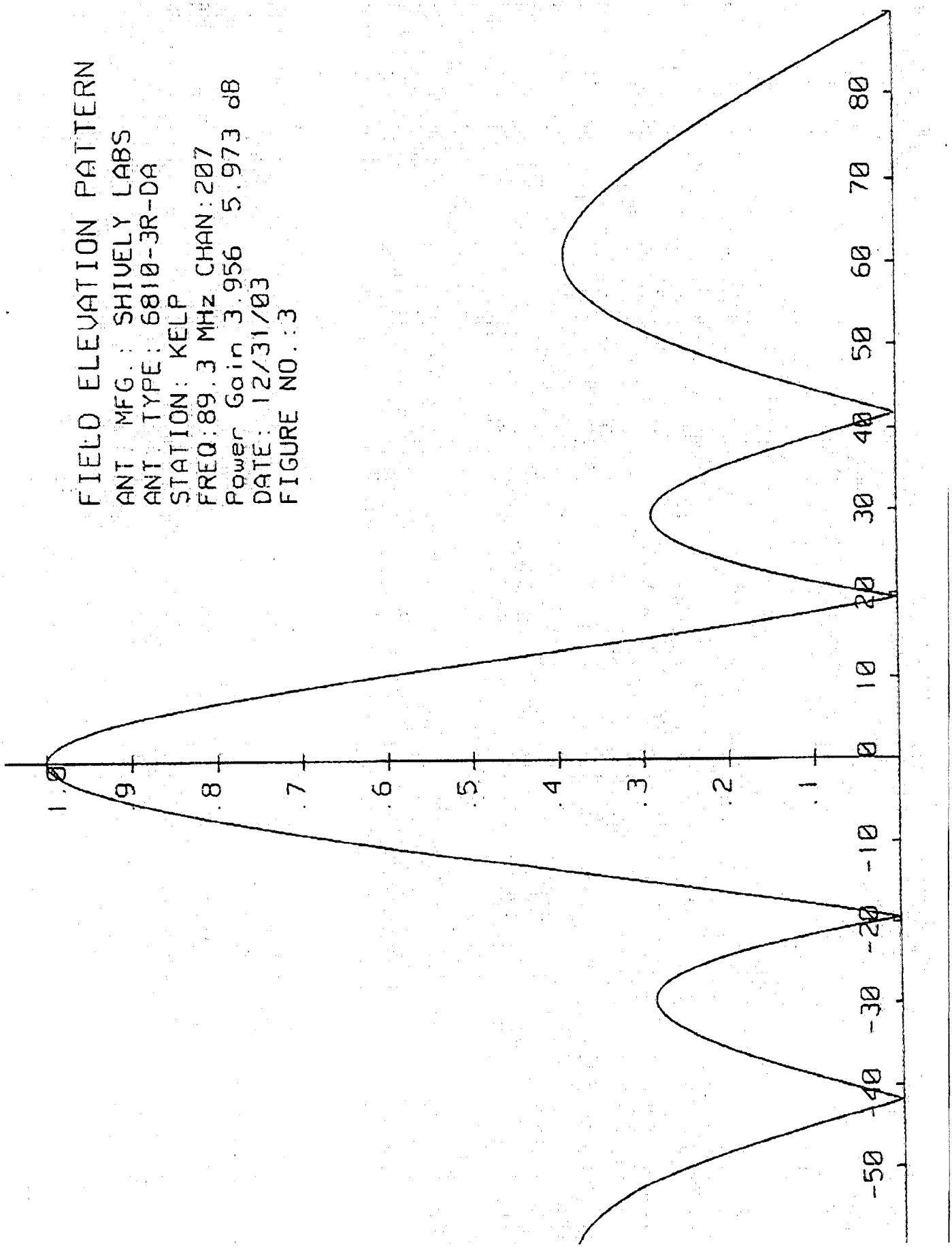

FIELD ELEVATION PATTERN
ANT. MFG.: SHIVELY LABS
ANT. TYPE: 6810-3R-DA
STATION: KELP
FREQ:89.3 MHz CHAN:207
Power Gain 3.956 5.973 dB
DATE: 12/31/03
FIGURE NO.:3
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
10
20
30
40
50
60
70
80
-10
-20
-30
-40
-50

FIGURE 4

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VALIDATION OF GAIN CALCULATION

KELP-FM MESQUITE, NM

MODEL 6810-3R-DA

Elevation Gain of 6810-3R-DA equals 1.55

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

Horizontal RMS divided by Vertical RMS equals
$0.638 \div 0.614 = 1.039$

Elevation Gain of Horizontal Component equals
$1.55 \times 1.039 = 1.610$

Elevation Gain of Vertical Component equals
$1.55 \times 0.962 = 1.492$

Horizontal Azimuth Gain equals $1/(\text{RMS})^2$
$1/(0.638)^2 = 2.457$

Vertical Azimuth Gain equals $1/(\text{RMS} \div \text{Max Vert})^2$
$1/(0.614 \div 0.99)^2 = 2.60$

* **Total Horizontal Gain is Elevation Gain times Azimuth Gain**
  $1.610 \times 2.457 = 3.956$

* **Total Vertical Gain is Elevation Gain times Azimuth Gain**
  $1.492 \times 2.60 = 3.879$

ERP divided by Horizontal Gain equals Antenna Input Power
$3.00 \text{ kW} \div 3.956 = 0.758 \text{ kW}$

Antenna Input Power times Vertical Gain equals Vertical ERP
$0.758 \times 3.879 = 2.94 \text{ kW}$

Maximum Value of the Vertical Component squared times the Maximum ERP equals the Vertical ERP
$(0.99)^2 \times 3.00 \text{ kW} = 2.94 \text{ kW}$

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