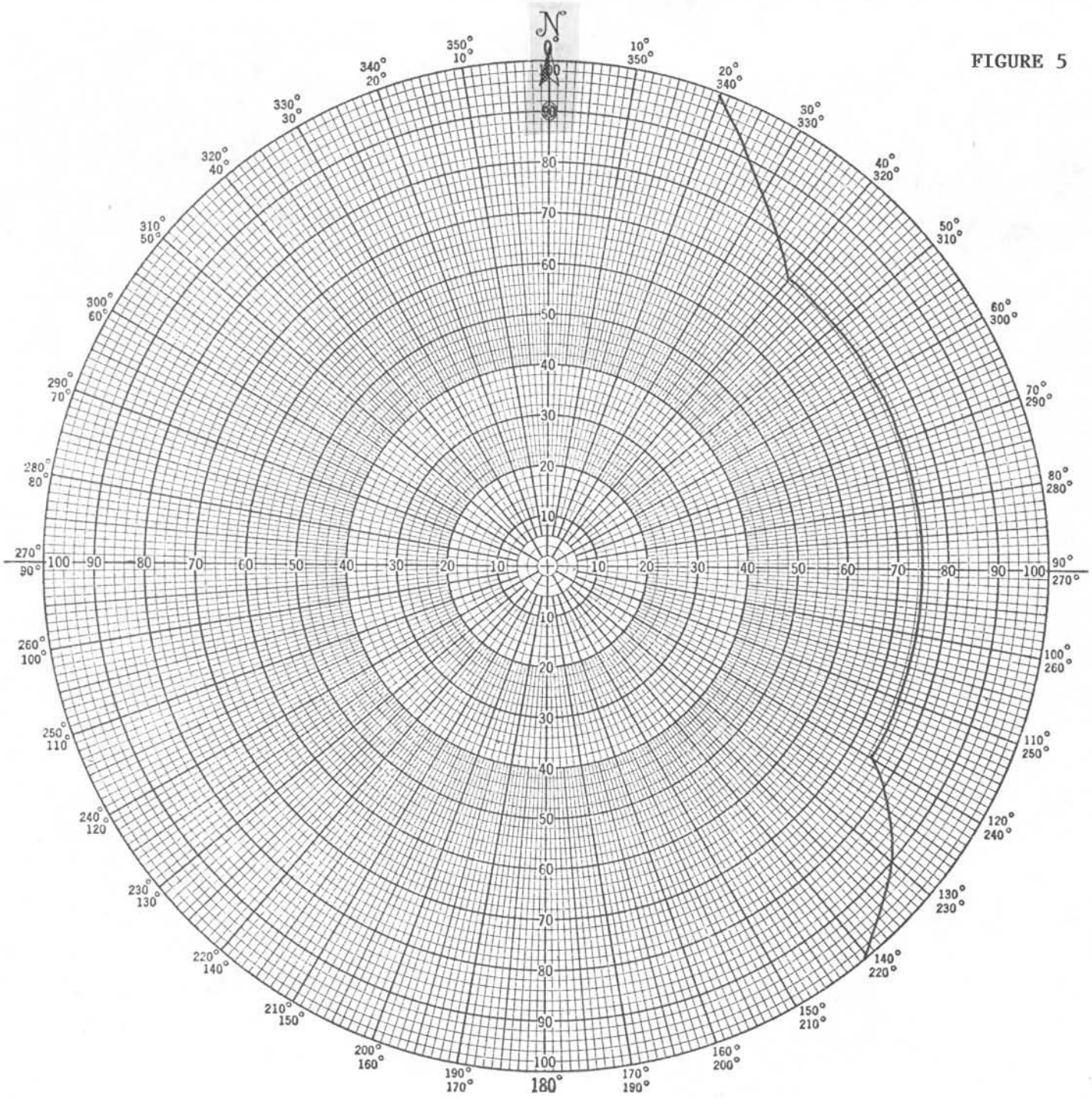
Figure 5A

S/O 23659
TABULATION OF COMPOSITE PATTERN
WMCQ MUSKEGON, MI

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	1.000	180	1.000
10	1.000	190	1.000
20	1.000	200	1.000
30	0.859	210	1.000
40	0.755	220	1.000
45	0.755	225	1.000
50	0.755	230	1.000
60	0.755	240	1.000
70	0.755	250	1.000
80	0.755	260	1.000
90	0.755	270	1.000
100	0.755	280	1.000
110	0.752	290	1.000
120	0.755	300	1.000
130	0.909	310	1.000
135	0.945	315	1.000
140	1.000	320	1.000
150	1.000	330	1.000
160	1.000	340	1.000
170	1.000	350	1.000

FIGURE 5



Shively Labs

PROJECT NAME WMCQ MUSKEGON, MI

PROJECT NUMBER 23659 DATE 3/24/05

MODEL (X) FULL SCALE ( ) FREQUENCY 412.65/91.7 MHz

POLARIZATION COMPOSITE

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

OBSERVER RAS

ANTENNA TYPE 6810-4R-DA

PATTERN TYPE DIRECTIONAL AZIMUTH

REMARKS:

S.O. 23659 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WMCQ MUSKEGON, MI

6810-4R-DA

Elevation Gain of Antenna 2.139

The RMS values are calculated utilizing the data of a planimeter

Horizontal RMS value divided by the Vertical RMS value equals the Horiz. - Vert. Ratio

H RMS 0.773 V RMS 0.746 H/V Ratio 1.036

Elevation Gain of Horizontal Component 2.216

Elevation Gain of Vertical Component 2.064

Horizontal Azimuth Gain equals 1/(RMS)SQ. 1.674

Vertical Azimuth Gain equals 1/(RMS/Max Vert)SQ. 1.761
Max. Vertical 0.99

***Total Horizontal Power Gain is the Elevation Gain Times the Azimuth Gain**

Total Horizontal Power Gain = **3.709**

***Total Vertical Power Gain is the Elevation Gain Times the Azimuth Gain**

Total Vertical Power Gain = **3.635**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

6 KW ERP Equals 1.618 KW Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

1.618 KW Times 3.635 KW Equals 5.881 KW ERP

Maximum Value of the Vertical Component squared times the Maximum ERP equals the Vertical ERP

0.99 Equals 5.881 KW Vertical ERP

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

Antenna Mfg.: Shively Labs **Date:** 3/24/2005

Antenna Type: 6810-4R-DA

Station: WMCQ **Beam Tilt** 0

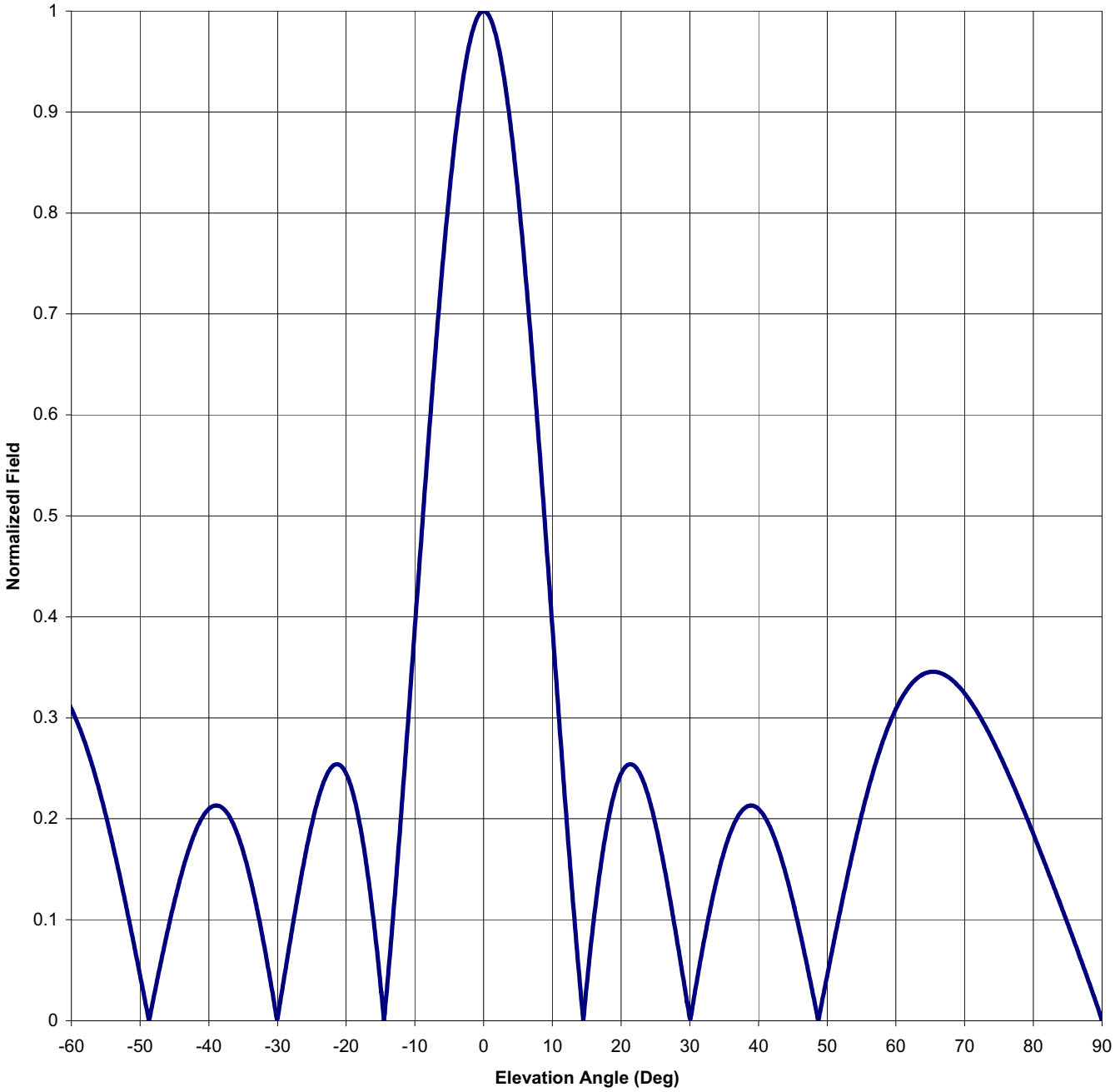
Frequency: 91.7 **Gain (Max)** 3.709 5.692 dB

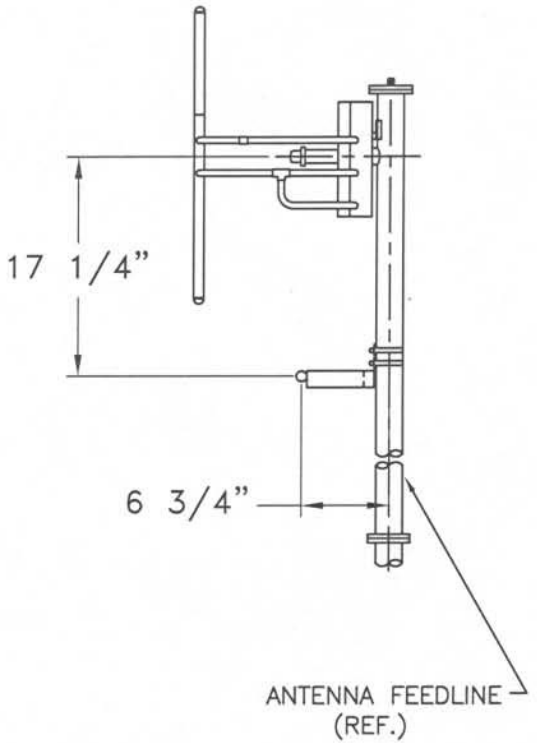
Channel #: 219 **Gain (Horizon)** 3.709 5.692 dB

Figure: 3

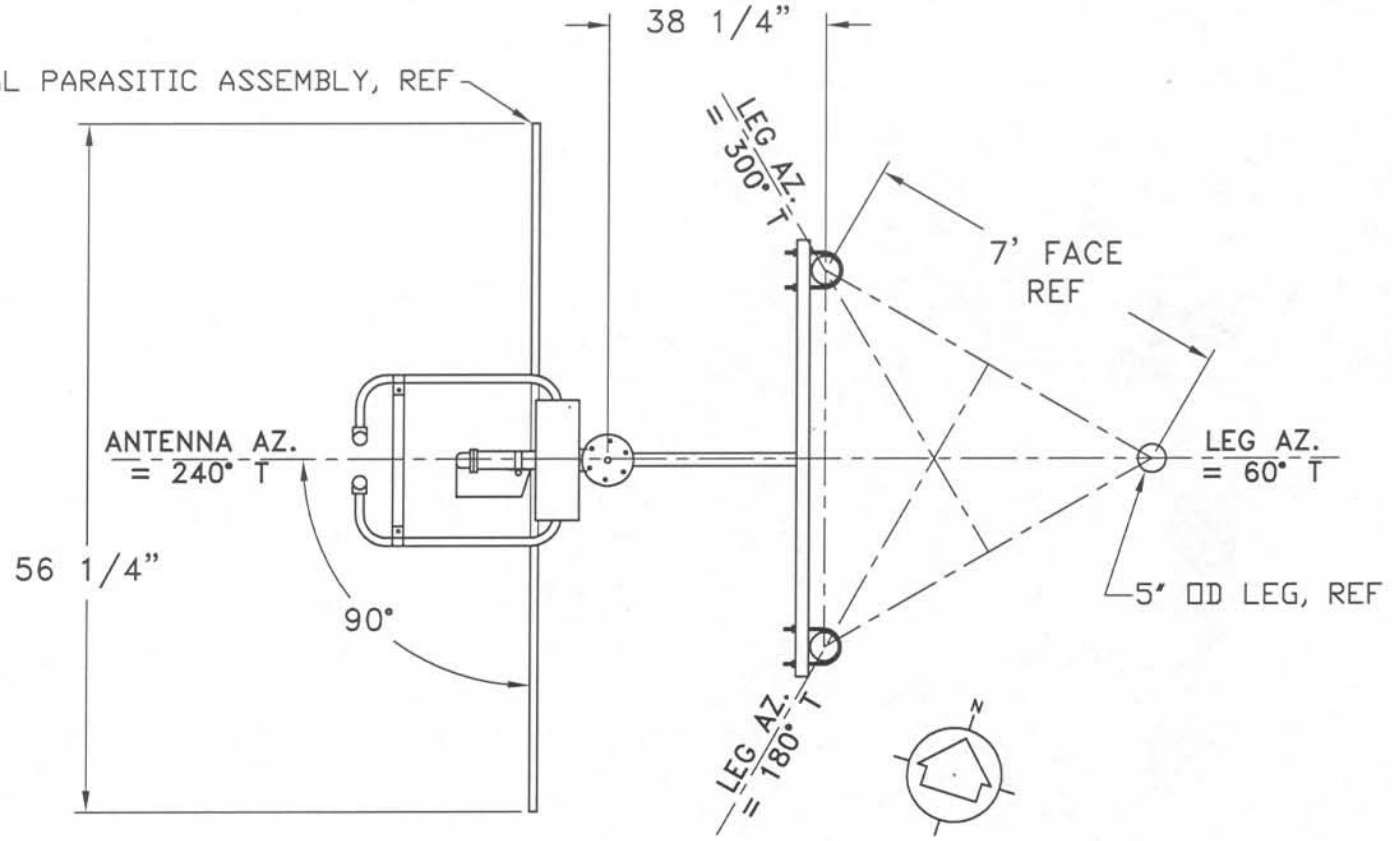
Angle of Depression (Deg)	Relative Field	Angle of Depression (Deg)	Relative Field	Angle of Depression (Deg)	Relative Field	Angle of Depression (Deg)	Relative Field
-90	0.000	-44	0.145	0	1.000	46	0.089
-89	0.021	-43	0.168	1	0.992	47	0.057
-88	0.040	-42	0.187	2	0.970	48	0.024
-87	0.059	-41	0.201	3	0.933	49	0.010
-86	0.078	-40	0.210	4	0.882	50	0.045
-85	0.096	-39	0.213	5	0.820	51	0.079
-84	0.114	-38	0.211	6	0.746	52	0.112
-83	0.132	-37	0.202	7	0.665	53	0.145
-82	0.150	-36	0.188	8	0.577	54	0.175
-81	0.168	-35	0.168	9	0.485	55	0.204
-80	0.185	-34	0.142	10	0.390	56	0.230
-79	0.202	-33	0.111	11	0.296	57	0.254
-78	0.218	-32	0.077	12	0.205	58	0.275
-77	0.234	-31	0.038	13	0.118	59	0.293
-76	0.250	-30	0.002	14	0.038	60	0.309
-75	0.265	-29	0.044	15	0.035	61	0.322
-74	0.279	-28	0.085	16	0.098	62	0.331
-73	0.292	-27	0.125	17	0.152	63	0.339
-72	0.304	-26	0.162	18	0.194	64	0.343
-71	0.315	-25	0.195	19	0.225	65	0.345
-70	0.324	-24	0.222	20	0.245	66	0.345
-69	0.332	-23	0.241	21	0.253	67	0.343
-68	0.338	-22	0.252	22	0.252	68	0.338
-67	0.343	-21	0.253	23	0.241	69	0.332
-66	0.345	-20	0.245	24	0.222	70	0.324
-65	0.345	-19	0.225	25	0.195	71	0.315
-64	0.343	-18	0.194	26	0.162	72	0.304
-63	0.339	-17	0.152	27	0.125	73	0.292
-62	0.331	-16	0.098	28	0.085	74	0.279
-61	0.322	-15	0.035	29	0.044	75	0.265
-60	0.309	-14	0.038	30	0.002	76	0.250
-59	0.293	-13	0.118	31	0.038	77	0.234
-58	0.275	-12	0.205	32	0.077	78	0.218
-57	0.254	-11	0.296	33	0.111	79	0.202
-56	0.230	-10	0.390	34	0.142	80	0.185
-55	0.204	-9	0.485	35	0.168	81	0.168
-54	0.175	-8	0.577	36	0.188	82	0.150
-53	0.145	-7	0.665	37	0.202	83	0.132
-52	0.112	-6	0.746	38	0.211	84	0.114
-51	0.079	-5	0.820	39	0.213	85	0.096
-50	0.045	-4	0.882	40	0.210	86	0.078
-49	0.010	-3	0.933	41	0.201	87	0.059
-48	0.024	-2	0.970	42	0.187	88	0.040
-47	0.057	-1	0.992	43	0.168	89	0.021
-46	0.089	0	1.000	44	0.145	90	0.000
-45	0.118			45	0.118		

Antenna Mfg.:	**Shively Labs**			**Date: 3/24/2005**
Antenna Type:	**6810-4R-DA**			
Station:	**WMCQ**	**Beam Tilt**	**0**	
Frequency:	**91.7**	**Gain (Max)**	**3.709**	**5.692 dB**
Channel #:	**219**	**Gain (Horizon)**	**3.709**	**5.692 dB**
Figure:	**3**			





SIDE VIEW



TOP VIEW

TOWER BY: STAINLESS G-7
MODEL: 7' FACE

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 23659	FREQUENCY: 91.7 MHz.	SCALE: N.T.S.	DRAWN BY: AMG APPROVED BY:
MODEL: 6810-4R-DA-DIRECTIONAL ANTENNA			
DATE: 11/19/04	FIGURE 2		

Figure 1B

S/O 23659
TABULATION OF VERTICAL POLARIZATION
WMCQ MUSKEGON, MI

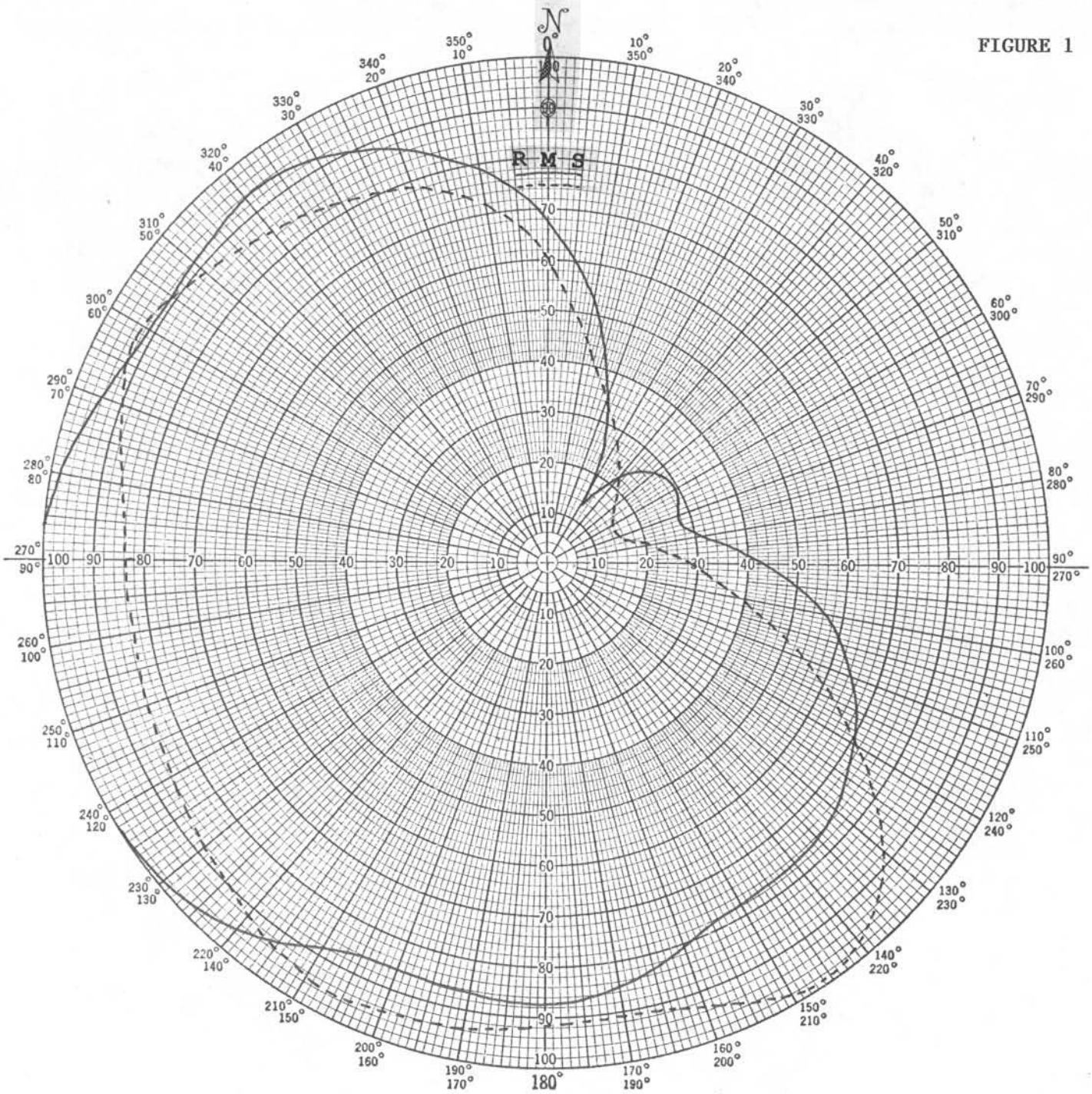
DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.605	180	0.920
10	0.450	190	0.940
20	0.350	200	0.945
30	0.280	210	0.945
40	0.220	220	0.920
45	0.200	225	0.900
50	0.175	230	0.885
60	0.150	240	0.855
70	0.155	250	0.840
80	0.205	260	0.830
90	0.285	270	0.840
100	0.390	280	0.855
110	0.550	290	0.900
120	0.710	300	0.925
130	0.875	310	0.885
135	0.935	315	0.870
140	0.975	320	0.855
150	0.980	330	0.820
160	0.930	340	0.790
170	0.910	350	0.720

Figure 1A

S/O 23659
TABULATION OF HORIZONTAL POLARIZATION
WMCQ MUSKEGON, MI

DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.675	180	0.875
10	0.530	190	0.865
20	0.350	200	0.860
30	0.170	210	0.885
40	0.220	220	0.955
45	0.260	225	0.975
50	0.275	230	0.990
60	0.295	240	1.000
70	0.280	250	1.000
80	0.310	260	1.000
90	0.430	270	1.000
100	0.565	280	0.980
110	0.645	290	0.940
120	0.705	300	0.915
130	0.755	310	0.920
135	0.765	315	0.925
140	0.770	320	0.935
150	0.780	330	0.920
160	0.805	340	0.865
170	0.850	350	0.790

FIGURE 1



Shively Labs

PROJECT NAME WMCQ MUSKEGON, MI

PROJECT NUMBER 23659 DATE 3/24/05

MODEL (X) FULL SCALE ( ) FREQUENCY 412.65/91.7 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

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 412.65 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 23659
March 24, 2005

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.

The R.M.S. of the Horizontal component is 0.773. The total Horizontal power gain is 3.709. The R.M.S. of the Vertical component is 0.746. The total Vertical power gain is 3.635. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.980. Therefore this Pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

AMENDED FCC COMPOSITE PATTERN:

The R.M.S. of the measured pattern is 0.800. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.833. Therefore the measured pattern does not comply with the FCC requirement of 73.316(c)(ix)(A). In accordance with 73.1690(c)(2)(ii) an amended composite pattern is attached as Figure 5 that will allow the above measured pattern to comply with the FCC requirement of 73.316(c)(ix)(A). Figure 5a shows the tabulations of the amended composite Figure 5. Eighty five percent (85%) of the amended FCC composite pattern is 0.800. Therefore the RMS of the measured pattern will comply with the requirement of 73.316(c)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-4R-DA was mounted on a tower of exact scale to a Stainless G-7 tower at the WMCQ site. 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-20040524ABA, 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.

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S.O. 23659

Report of Test 6810-4R-DA

for

AMERICAN FAMILY ASSOCIATION

WMCQ 91.7 MHz MUSKEGON, MI

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-4R-DA to meet the needs of WMCQ and to comply with the requirements of the FCC construction permit, file number BMPED-20040524ABA.

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-20040524ABA indicates that the Horizontal radiation component shall not exceed 6.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

110 Degrees T: 3.4 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 236 Degrees T to 279 Degrees T. At the restricted azimuth of 110 Degrees T the Horizontal component is 3.809 dB down from the maximum of 6.0 kW, or 2.5 kW.