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S.O. 24320

Report of Test 6810-2D-DA

for

CSN INTERNATIONAL

WTMK 88.5 MHz LOWELL, IN

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-2D-DA to meet the needs of WTMK and to comply with the requirements of the FCC construction permit, file number BPED-19980417ME.

RESULTS:

The measured azimuth pattern for the 6810-2D-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 BPED-19980417ME indicates that the Horizontal radiation component shall not exceed 1.50 kW at any azimuth and is restricted to the following values at the azimuths specified:

60-120 Degrees T: 0.300 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 272 Degrees T to 330 Degrees T. At the restricted azimuth of 60-120 Degrees T the Vertical component is 7.46 dB down from the maximum of 1.50 kW, or 0.270 kW.

The R.M.S. of the Horizontal component is 0.771. The total Horizontal power gain is 1.671. The R.M.S. of the Vertical component is 0.770. The total Vertical power gain is 1.638. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.876. The R.M.S. of the measured composite pattern is 0.801. Eighty-five percent (85%) of the original authorized FCC composite pattern is .745. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-2D-DA was mounted on a tower of exact scale to a Pirod 30″ 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 BPED-19980417ME, a single level of the 6810-2D-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 398.25 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 24320
December 1, 2005

Shively Labs

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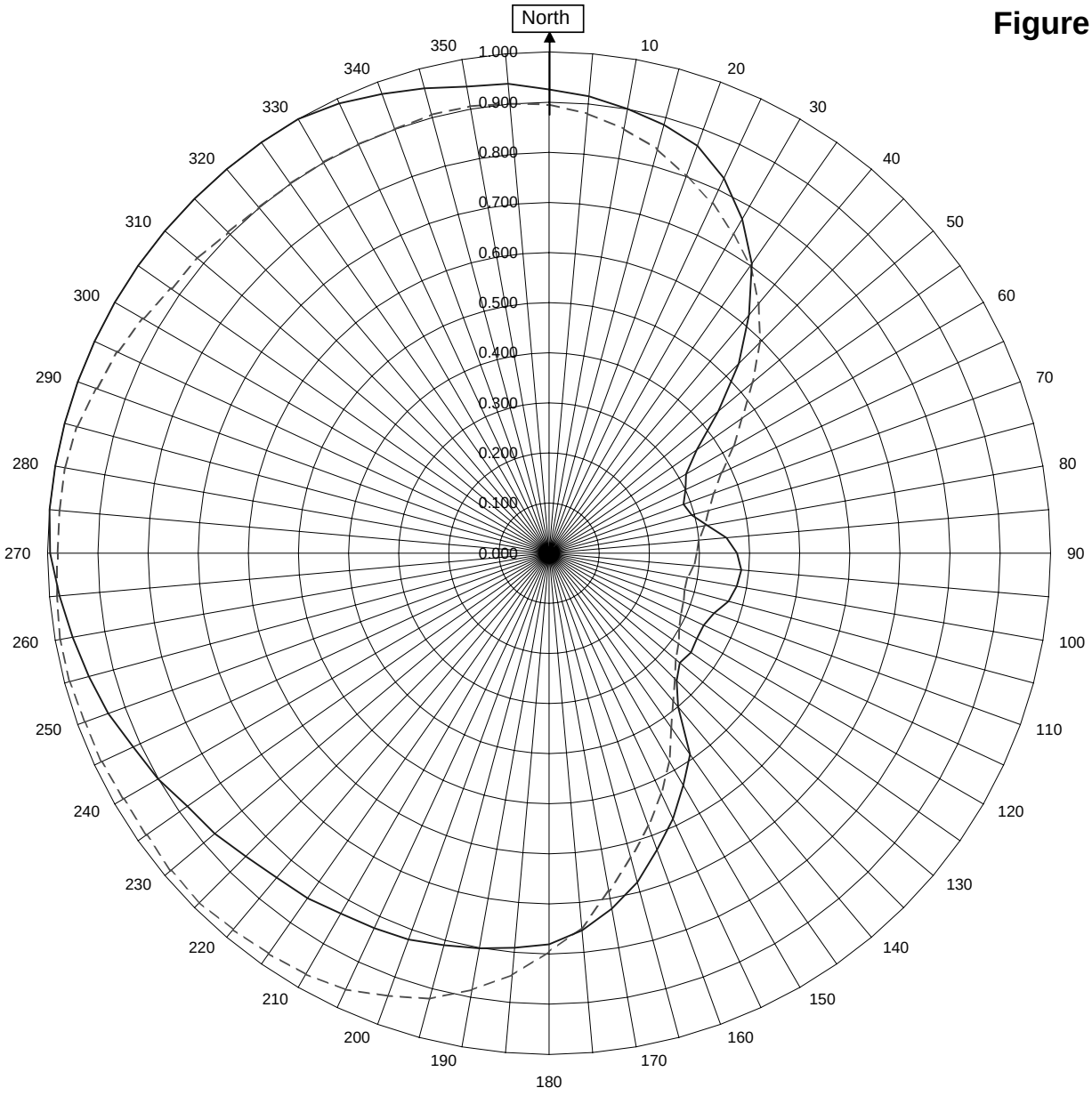
Figure 1



WTMK Lowell, IN

24320

November 14, 2005

_____Horizontal RMS	0.771
_ _ _ _ _ _ _ _ _ Vertical RMS	0.770
H/V Composite RMS	0.801

Frequency	88.5 / 398.25 mHz
Plot	Relative Field
Scale	4.5 : 1

Antenna Model	6810-2D-DA
Pattern Type	Directional Azimuth

See Figure 2 for Mechanical Details

Figure 1a

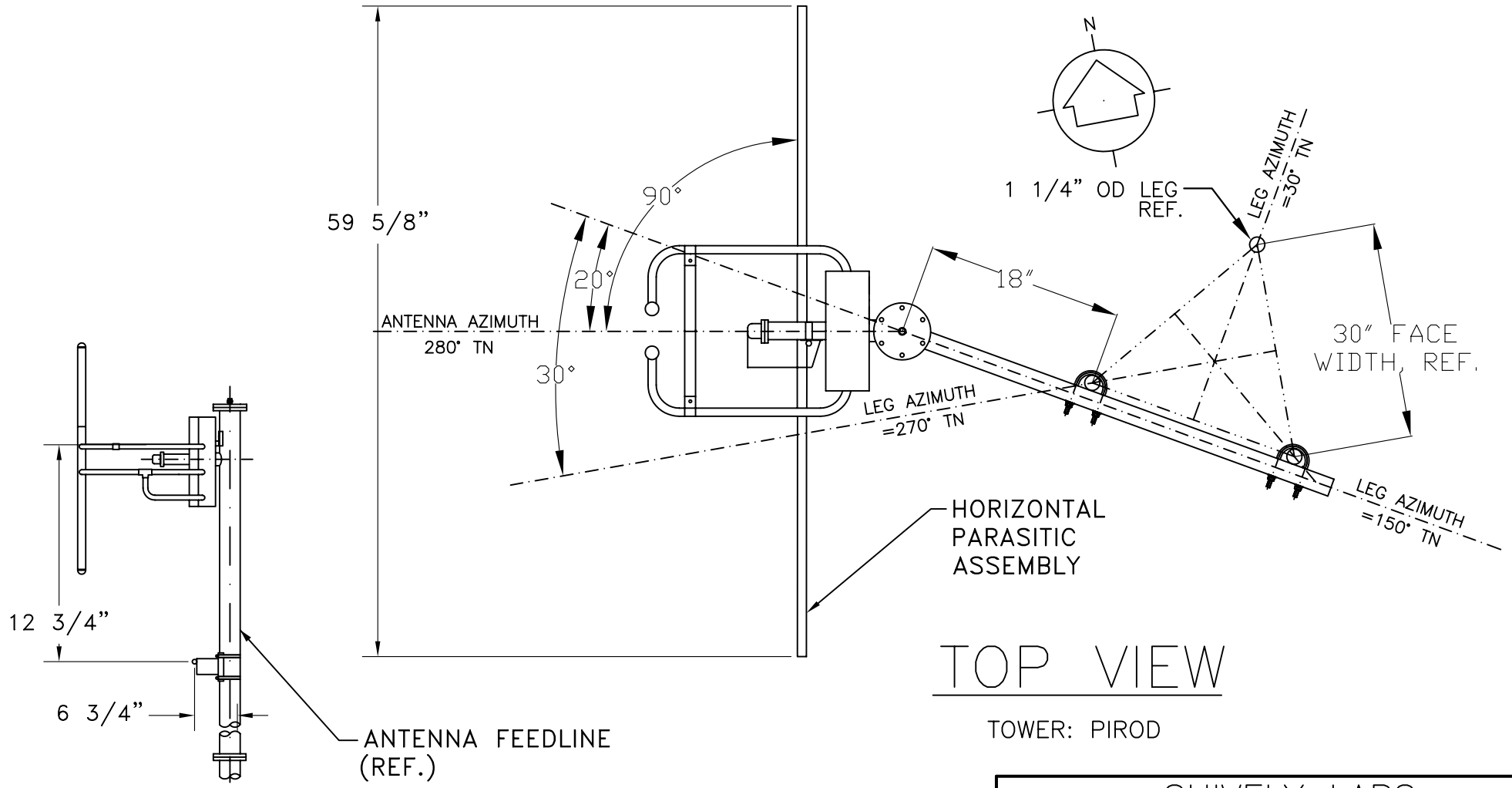
Tabulation of Horizontal Azimuth Pattern
WTMK Lowell, IN

Azimuth	Rel Field	Azimuth	Rel Field
0	0.925	180	0.780
10	0.900	190	0.800
20	0.865	200	0.820
30	0.770	210	0.830
40	0.620	220	0.845
45	0.535	225	0.855
50	0.440	230	0.870
60	0.315	240	0.900
70	0.285	250	0.935
80	0.320	260	0.965
90	0.375	270	0.995
100	0.380	280	1.000
110	0.350	290	1.000
120	0.340	300	1.000
130	0.340	310	1.000
135	0.360	315	1.000
140	0.400	320	1.000
150	0.535	330	1.000
160	0.630	340	0.975
170	0.720	350	0.945

Figure 1b

Tabulation of Vertical Azimuth Pattern
WTMK Lowell, IN

Azimuth	Rel Field	Azimuth	Rel Field
0	0.895	180	0.795
10	0.860	190	0.885
20	0.800	200	0.940
30	0.735	210	0.970
40	0.650	220	0.980
45	0.595	225	0.985
50	0.530	230	0.985
60	0.425	240	0.980
70	0.350	250	0.985
80	0.315	260	0.990
90	0.295	270	0.980
100	0.280	280	0.980
110	0.285	290	0.960
120	0.300	300	0.935
130	0.330	310	0.915
135	0.355	315	0.905
140	0.385	320	0.900
150	0.480	330	0.900
160	0.580	340	0.900
170	0.685	350	0.905



TOP VIEW

TOWER: PIROD

SIDE VIEW

ANTENNA HEADING: 280° TRUE NORTH

SHIVELY LABS
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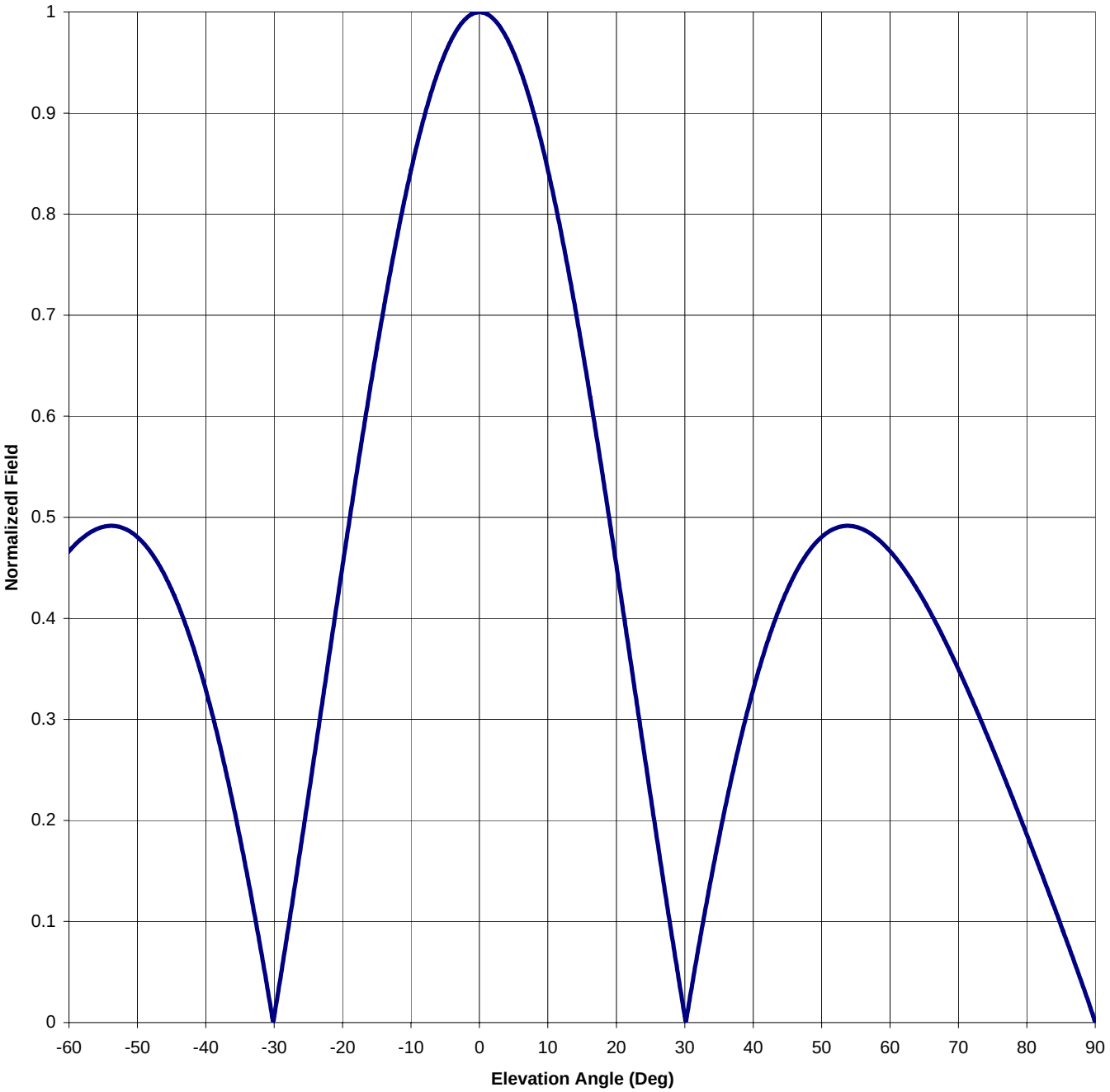
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY:
24320	88.5	N.T.S.	LRA
			APPROVED BY:

TITLE: MODEL-6810-2D-DIRECTIONAL ANTENNA

DATE: 11/23/05

FIGURE 2

Antenna Mfg.:	**Shively Labs**			**Date:**	**11/29/2005**
Antenna Type:	**6810-2D-DA**				
Station:	**WTMK**	**Beam Tilt**	**0**		
Frequency:	**88.5**	**Gain (Max)**	**1.671**	**2.230**	**dB**
Channel #:	**203**	**Gain (Horizon)**	**1.671**	**2.230**	**dB**
Figure:	**3**				



Antenna Mfg.: Shively Labs **Date:** 11/29/2005

Antenna Type: 6810-2D-DA

Station: WTMK **Beam Tilt** 0

Frequency: 88.5 **Gain (Max)** 1.671 2.230 dB

Channel #: 203 **Gain (Horizon)** 1.671 2.230 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	0.412	0	1.000	46	0.442
-89	0.021	-43	0.395	1	0.998	47	0.455
-88	0.040	-42	0.375	2	0.993	48	0.465
-87	0.059	-41	0.353	3	0.985	49	0.474
-86	0.078	-40	0.329	4	0.974	50	0.480
-85	0.096	-39	0.304	5	0.960	51	0.486
-84	0.114	-38	0.276	6	0.942	52	0.489
-83	0.132	-37	0.247	7	0.922	53	0.491
-82	0.150	-36	0.215	8	0.898	54	0.492
-81	0.168	-35	0.182	9	0.872	55	0.491
-80	0.186	-34	0.148	10	0.844	56	0.488
-79	0.203	-33	0.111	11	0.813	57	0.485
-78	0.221	-32	0.074	12	0.779	58	0.480
-77	0.238	-31	0.034	13	0.744	59	0.474
-76	0.255	-30	0.006	14	0.706	60	0.467
-75	0.271	-29	0.048	15	0.667	61	0.458
-74	0.288	-28	0.091	16	0.627	62	0.449
-73	0.304	-27	0.135	17	0.585	63	0.439
-72	0.319	-26	0.179	18	0.542	64	0.428
-71	0.335	-25	0.224	19	0.498	65	0.417
-70	0.350	-24	0.270	20	0.453	66	0.405
-69	0.364	-23	0.316	21	0.407	67	0.392
-68	0.378	-22	0.362	22	0.362	68	0.378
-67	0.392	-21	0.407	23	0.316	69	0.364
-66	0.405	-20	0.453	24	0.270	70	0.350
-65	0.417	-19	0.498	25	0.224	71	0.335
-64	0.428	-18	0.542	26	0.179	72	0.319
-63	0.439	-17	0.585	27	0.135	73	0.304
-62	0.449	-16	0.627	28	0.091	74	0.288
-61	0.458	-15	0.667	29	0.048	75	0.271
-60	0.467	-14	0.706	30	0.006	76	0.255
-59	0.474	-13	0.744	31	0.034	77	0.238
-58	0.480	-12	0.779	32	0.074	78	0.221
-57	0.485	-11	0.813	33	0.111	79	0.203
-56	0.488	-10	0.844	34	0.148	80	0.186
-55	0.491	-9	0.872	35	0.182	81	0.168
-54	0.492	-8	0.898	36	0.215	82	0.150
-53	0.491	-7	0.922	37	0.247	83	0.132
-52	0.489	-6	0.942	38	0.276	84	0.114
-51	0.486	-5	0.960	39	0.304	85	0.096
-50	0.480	-4	0.974	40	0.329	86	0.078
-49	0.474	-3	0.985	41	0.353	87	0.059
-48	0.465	-2	0.993	42	0.375	88	0.040
-47	0.455	-1	0.998	43	0.395	89	0.021
-46	0.442	0	1.000	44	0.412	90	0.000
-45	0.428			45	0.428		

S.O. 24320 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WTMK Lowell, IN

6810-2D-DA

Elevation Gain of Antenna 0.992

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 0.771 V RMS 0.77 H/V Ratio 1.001

Elevation Gain of Horizontal Component 0.993

Elevation Gain of Vertical Component 0.991

Horizontal Azimuth Gain equals 1/(RMS)SQ. 1.682

Vertical Azimuth Gain equals 1/(RMS/Max Vert)SQ. 1.653
Max. Vertical 0.99

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

Total Horizontal Power Gain = **1.671**

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

Total Vertical Power Gain = **1.638**

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ERP divided by Horizontal Power Gain equals Antenna Input Power

1.5 KW ERP Equals 0.898 KW Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

0.898 KW Times 1.638 KW Equals 1.470 KW ERP

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

0.99 Equals 1.470 KW Vertical ERP

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