Shively Labs
a division of Howell Laboratories,Inc.

P. O. Box 389 Harrison Rd.,
Bridgton, Maine 04009 USA

- An Employee-Owned Company -

(207) 647-3327
888-SHIVELY
Fax: (207) 647-8273
E-mail: sales@shively.com
Web site: www.shively.com

S.O. 26501

Report of Test CA5-FM/CP/RM Yagi

for

EDUCATIONAL MEDIA FOUNDATION

KLTP 90.9 MHz San Angelo, TX

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a CA5-FM/CP/RM Yagi to meet the needs of KLTP and to comply with the requirements of the FCC construction permit, file number BMPED-20080228ACH.

RESULTS:

The measured azimuth pattern for the CA5-FM/CP/RM Yagi is shown in Figure 1. Figure 1A shows the Tabulation of the Horizontal Polarization. Figure 1B shows the Tabulation of the Vertical Polarization. Figure 1C shows the Tabulation of the FCC Composite Pattern. The calculated elevation pattern of the antenna is shown in Figure 3. Construction permit file number BMPED-20080228ACH indicates that the Horizontal radiation component shall not exceed 2.94 kW at any azimuth and is restricted to the following values at the azimuths specified:

160-200 and 250-280 Degrees T: 0.95 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 043 Degrees T to 047 Degrees T. At the restricted azimuth of 160 - 200 Degrees T and 250 - 280 Degrees T the Horizontal component is 15.92 dB down from the maximum of 2.94 kW, or 0.08 kW.

The R.M.S. of the Horizontal component is 0.395. The total Horizontal power gain is 15.216. The R.M.S. of the Vertical component is 0.394. The total Vertical power gain is 11.783. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.458. The R.M.S. of the measured composite pattern is 0.421. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.389. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the CA5-FM/CP/RM Yagi was mounted on a tower of precise scale to the 4 foot face tower at the KLTP site. The spacing of the antenna to the tower was varied to achieve the horizontal and vertical pattern shown in Figure 1. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BMPED-20080228ACH, a single level of the CA5-FM/CP/RM 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 and 10th Editions 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 409.05 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.

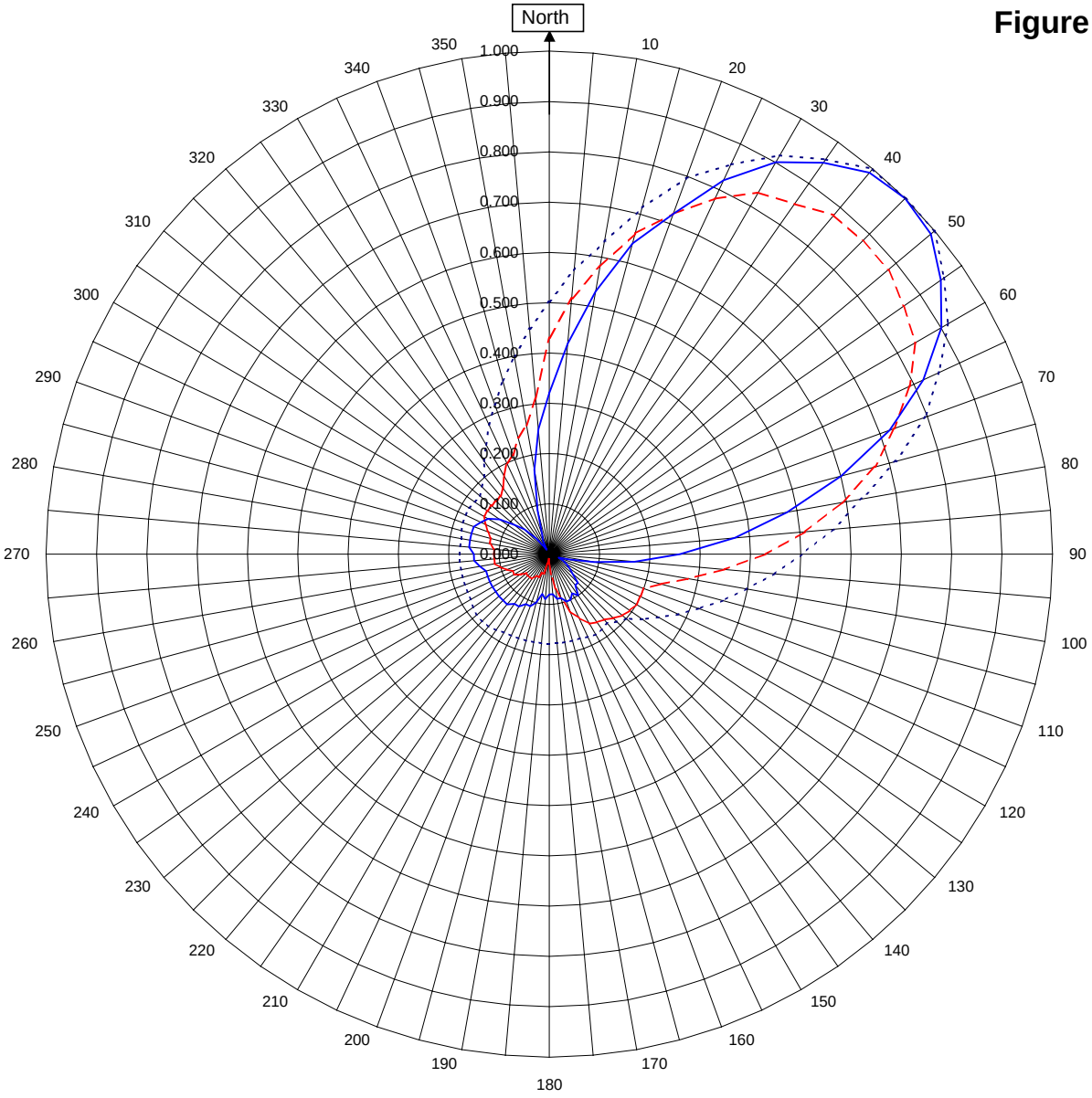
Respectfully submitted by:

Robert A. Surette
Director of Sales Engineering
S/O 26501
March 21, 2008

Shively Labs

Shively Labs, a division of Howell Laboratories, Inc. Bridgton, ME (207)647-3327

Figure 1



KLTP San Angelo, TX

26501

March 21, 2008

_____Horizontal RMS	0.395
_ _ _ _ _ _ _ _ _ Vertical RMS	0.394
H/V Composite RMS	0.421
.....FCC Composite RMS	0.458

Frequency	90.9 / 409.05 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	CA5-FM/CP/RM Pattern 2-A
Pattern Type	Directional Azimuth

Figure 1a

Tabulation of Horizontal Azimuth Pattern
KLTP San Angelo, TX

Azimuth	Rel Field	Azimuth	Rel Field
0	0.320	180	0.080
10	0.530	190	0.080
20	0.720	200	0.110
30	0.900	210	0.120
40	0.990	220	0.130
45	1.000	225	0.130
50	0.990	230	0.130
60	0.900	240	0.130
70	0.720	250	0.130
80	0.480	260	0.140
90	0.260	270	0.150
100	0.090	280	0.160
110	0.020	290	0.160
120	0.040	300	0.140
130	0.060	310	0.090
135	0.080	315	0.070
140	0.080	320	0.040
150	0.090	330	0.010
160	0.100	340	0.040
170	0.090	350	0.170

Figure 1b

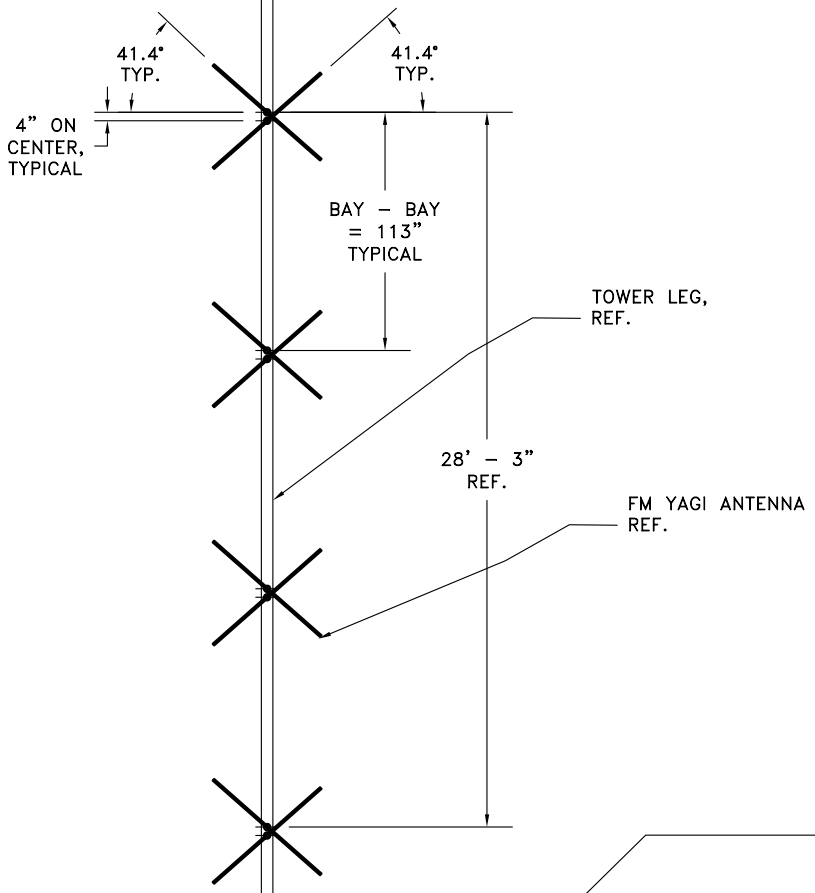
Tabulation of Vertical Azimuth Pattern
KLTP San Angelo, TX

Azimuth	Rel Field	Azimuth	Rel Field
0	0.430	180	0.020
10	0.580	190	0.020
20	0.720	200	0.040
30	0.830	210	0.050
40	0.880	220	0.060
45	0.880	225	0.060
50	0.880	230	0.060
60	0.840	240	0.080
70	0.730	250	0.090
80	0.590	260	0.110
90	0.430	270	0.110
100	0.280	280	0.120
110	0.200	290	0.130
120	0.200	300	0.150
130	0.190	310	0.150
135	0.180	315	0.150
140	0.170	320	0.150
150	0.160	330	0.180
160	0.120	340	0.210
170	0.070	350	0.260

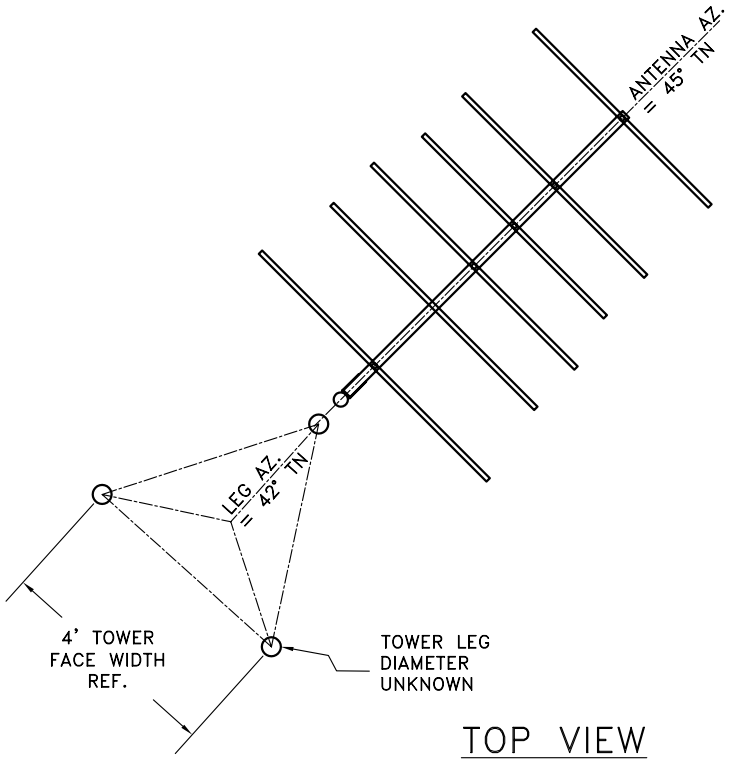
Figure 1c

Tabulation of FCC Directional Composite
KLTP San Angelo, TX

Azimuth	Rel Field	Azimuth	Rel Field
0	0.502	180	0.178
10	0.631	190	0.178
20	0.795	200	0.178
30	0.915	210	0.180
40	1.000	220	0.188
50	1.000	230	0.188
60	0.915	240	0.180
70	0.795	250	0.178
80	0.631	260	0.178
90	0.502	270	0.178
100	0.398	280	0.178
110	0.316	290	0.183
120	0.251	300	0.184
130	0.200	310	0.180
140	0.180	320	0.200
150	0.184	330	0.251
160	0.178	340	0.316
170	0.178	350	0.398

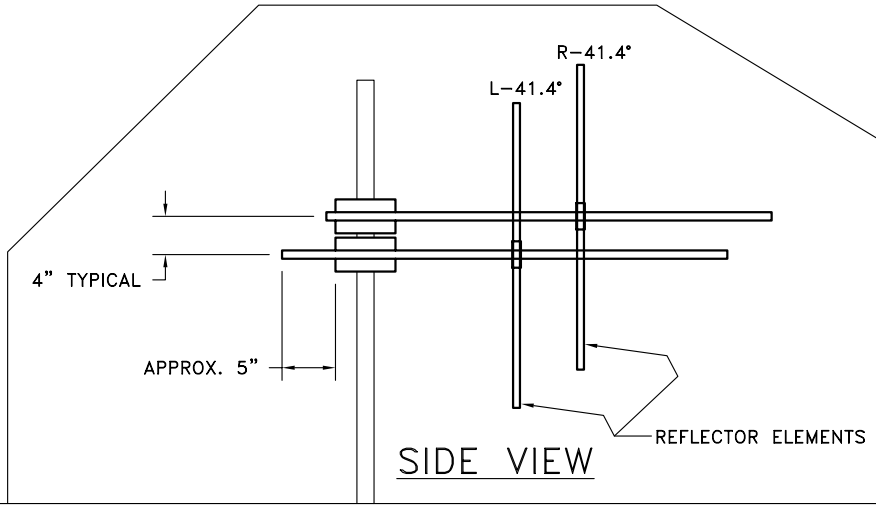


FRONT VIEW



TOP VIEW

TOWER MAKE: UNKNOWN



SIDE VIEW

SHIVELY LABS

A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE

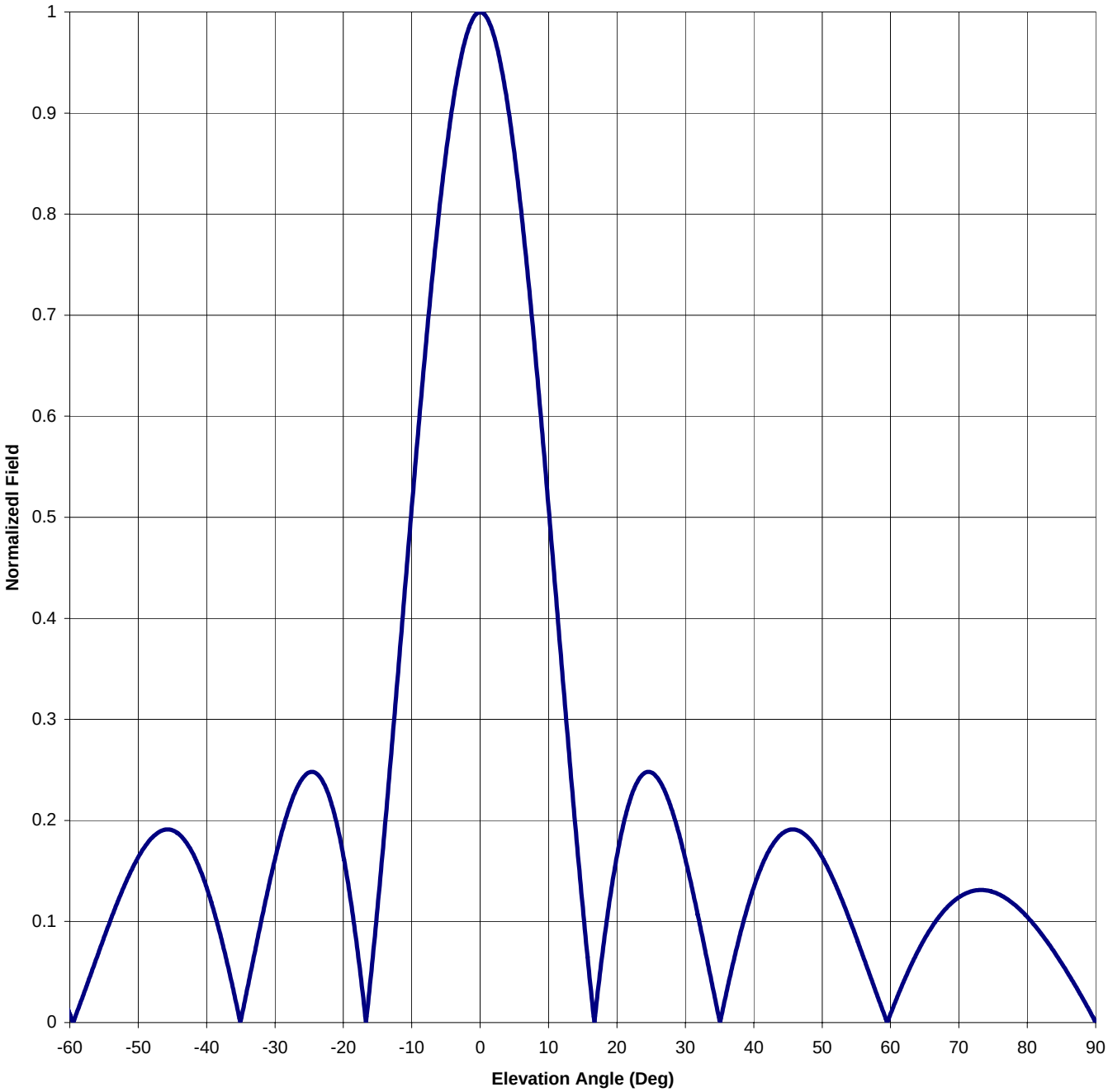
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY:
26501	90.9 MHz	N.T.S.	ASP
			APPROVED BY:

TITLE: SCALA YAGI ANTENNA SYSTEM

DATE: 3/24/08

FIGURE 2

Antenna Mfg.:	**Shively Labs**			**Date:**	**3/21/2008**
Antenna Type:	**CA5-FM/CP/RM Yagi**				
Station:	**KLTP**	**Beam Tilt**	**0**		
Frequency:	**90.9**	**Gain (Max)**	**15.216**	**11.823**	**dB**
Channel #:	**215**	**Gain (Horizon)**	**15.216**	**11.823**	**dB**
Figure:	**3**				



Antenna Mfg.: Shively Labs **Date:** 3/21/2008

Antenna Type: CA5-FM/CP/RM Yagi

Station: KLTP **Beam Tilt** 0

Frequency: 90.9 **Gain (Max)** 15.216 11.823 dB

Channel #: 215 **Gain (Horizon)** 15.216 11.823 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	0.186	0	1.000	46	0.191
-89	0.013	-43	0.178	1	0.994	47	0.188
-88	0.025	-42	0.167	2	0.977	48	0.183
-87	0.037	-41	0.152	3	0.948	49	0.174
-86	0.048	-40	0.134	4	0.909	50	0.164
-85	0.059	-39	0.112	5	0.860	51	0.151
-84	0.069	-38	0.087	6	0.803	52	0.136
-83	0.079	-37	0.059	7	0.738	53	0.120
-82	0.088	-36	0.029	8	0.666	54	0.102
-81	0.097	-35	0.002	9	0.590	55	0.084
-80	0.105	-34	0.035	10	0.510	56	0.065
-79	0.111	-33	0.068	11	0.429	57	0.047
-78	0.117	-32	0.101	12	0.347	58	0.028
-77	0.122	-31	0.132	13	0.266	59	0.009
-76	0.126	-30	0.162	14	0.188	60	0.008
-75	0.129	-29	0.188	15	0.114	61	0.026
-74	0.131	-28	0.211	16	0.045	62	0.042
-73	0.131	-27	0.229	17	0.019	63	0.057
-72	0.130	-26	0.241	18	0.075	64	0.071
-71	0.128	-25	0.248	19	0.124	65	0.083
-70	0.124	-24	0.247	20	0.165	66	0.094
-69	0.119	-23	0.238	21	0.198	67	0.104
-68	0.112	-22	0.222	22	0.222	68	0.112
-67	0.104	-21	0.198	23	0.238	69	0.119
-66	0.094	-20	0.165	24	0.247	70	0.124
-65	0.083	-19	0.124	25	0.248	71	0.128
-64	0.071	-18	0.075	26	0.241	72	0.130
-63	0.057	-17	0.019	27	0.229	73	0.131
-62	0.042	-16	0.045	28	0.211	74	0.131
-61	0.026	-15	0.114	29	0.188	75	0.129
-60	0.008	-14	0.188	30	0.162	76	0.126
-59	0.009	-13	0.266	31	0.132	77	0.122
-58	0.028	-12	0.347	32	0.101	78	0.117
-57	0.047	-11	0.429	33	0.068	79	0.111
-56	0.065	-10	0.510	34	0.035	80	0.105
-55	0.084	-9	0.590	35	0.002	81	0.097
-54	0.102	-8	0.666	36	0.029	82	0.088
-53	0.120	-7	0.738	37	0.059	83	0.079
-52	0.136	-6	0.803	38	0.087	84	0.069
-51	0.151	-5	0.860	39	0.112	85	0.059
-50	0.164	-4	0.909	40	0.134	86	0.048
-49	0.174	-3	0.948	41	0.152	87	0.037
-48	0.183	-2	0.977	42	0.167	88	0.025
-47	0.188	-1	0.994	43	0.178	89	0.013
-46	0.191	0	1.000	44	0.186	90	0.000
-45	0.190			45	0.190		

S.O. 26501 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

KLTP 90.9 MHz San Angelo, TX

CA5-FM/CP/RM Yagi

Elevation Gain of Antenna 2.368

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

H RMS 0.395 V RMS 0.394 H/V Ratio 1.003

Elevation Gain of Horizontal Component 2.374

Elevation Gain of Vertical Component 2.362

Horizontal Azimuth Gain equals $1/(RMS)^2$. 6.409

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 4.989
Max. Vertical 0.88

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

Total Horizontal Power Gain = **15.216**

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

Total Vertical Power Gain = **11.783**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

2.94 KW ERP Equals **0.193** KW Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

0.193 KW Times 11.783 KW Equals 2.277 KW ERP

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

0.88 Equals 2.277 KW Vertical ERP

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