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S.O. 29688

Report of Test Scala CA5FMCP-RM

for

Ithaca Community Radio, Inc.

WINO 89.9 MHz Odessa, NY

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a Scala CA5FMCP-RM to meet the needs of WINO and to comply with the requirements of the FCC construction permit, file number BNPED-20071018AFY. This test characterizes only the radiation characteristics of the antenna when mounted on the tower as described. It does not represent or imply any guarantee of specific coverage which can be influenced by factors beyond the scope of this test.

RESULTS:

The following Figures are the results of the measurements from our pattern range:

Figure 1A - Measured Azimuth Pattern with the FCC Composite
Figure 1B - Measured Composite Azimuth Pattern with the FCC Composite
Figure 1C - Tabulation of the Horizontal Polarization for the Measured Azimuth Pattern
Figure 1D - Tabulation of the Vertical Polarization for the Measured Azimuth Pattern
Figure 1E - Tabulation of the Measured Composite Azimuth Pattern
Figure 1F - Tabulation of the FCC Composite

The calculated elevation pattern of the antenna is shown in Figure 3.

Construction permit file number BNPED-20071018AFY indicates that the Horizontal radiation component shall not exceed 0.250 kW at any azimuth and is restricted to the following values at the azimuths specified:

185 Degrees T: 0.0110 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 265 Degrees T. At the restricted azimuth of 185 Degrees T the Horizontal component is 13.597 dB down from the maximum of 0.250 kW, or 0.0109 kW.

The R.M.S. of the Horizontal component is 0.441. The total Horizontal power gain is 2.968. The R.M.S. of the Vertical component is 0.420. The total Vertical power gain is 2.394. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.532. The R.M.S. of the measured composite pattern is 0.452. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.452. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the Scala CA5FMCP-RM was mounted on a tower of precise scale to the tower at the WINO site. The spacing of the antenna to the tower was varied to achieve the horizontal and vertical patterns shown in Figure 1A. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BNPED-20071018AFY, a single level of the Scala CA5FMCP-RM was set up on the Shively Labs 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

All testing is carried out in strict accordance with approved procedures under our ISO9001:2008.

TEST PROCEDURES:

The receiving antenna system is mounted so that the horizontal and vertical azimuth patterns are measured independently. The network analyzer was set to 404.55 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 1A.

Respectfully submitted by:

Robert A. Surette
Director of Sales Engineering
S/O 29688
January 10, 2012

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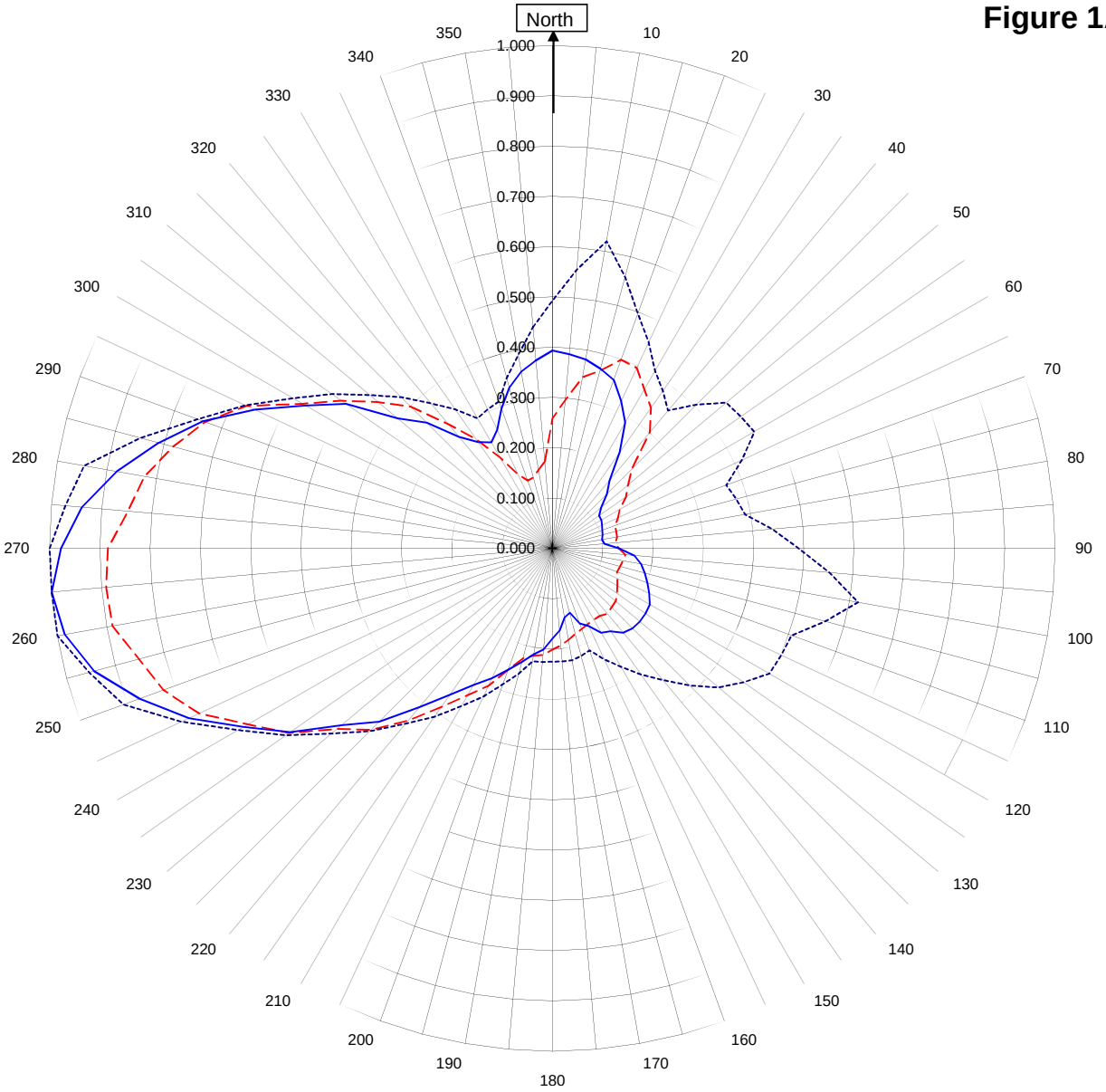
Figure 1A



WINO ODESSA, NY.

29688

January 10, 2012

_____Horizontal RMS	0.441
_ _ _ _ _ _ _ _ _ Vertical RMS	0.420
H/V Composite RMS	0.452
……..FCC Composite RMS	0.532

Frequency	89.9 / 404.55 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	SCALA CA-5
Pattern Type	Directional Azimuth

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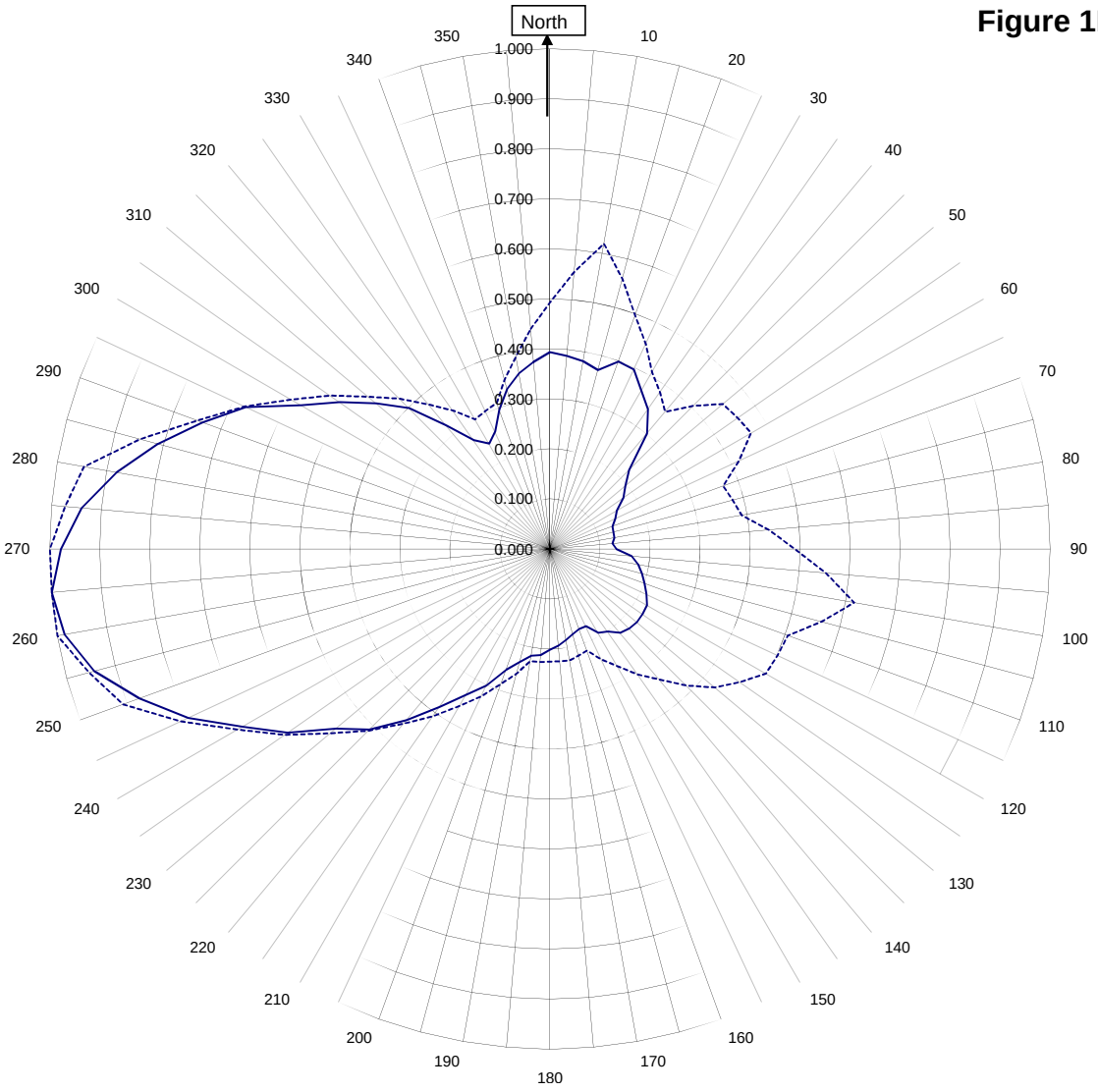
Figure 1B



WINO ODESSA, NY.

29688

January 10, 2012

_____H/VComposite RMS	0.452
……FCC Composite RMS	0.532

Frequency	89.9 / 404.55 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	SCALA CA-5
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WINO ODESSA, NY.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.393	180	0.179
10	0.382	190	0.214
20	0.356	200	0.257
30	0.290	210	0.313
40	0.176	220	0.412
45	0.153	225	0.488
50	0.126	230	0.547
60	0.112	240	0.710
70	0.105	250	0.874
80	0.100	260	0.985
90	0.133	270	0.978
100	0.179	280	0.880
110	0.201	290	0.740
120	0.224	300	0.569
130	0.227	310	0.402
135	0.225	315	0.354
140	0.219	320	0.290
150	0.194	330	0.243
160	0.159	340	0.297
170	0.139	350	0.357

Figure 1D

Tabulation of Vertical Azimuth Pattern
WINO ODESSA, NY.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.259	180	0.201
10	0.346	190	0.216
20	0.399	200	0.256
30	0.366	210	0.337
40	0.302	220	0.447
45	0.224	225	0.510
50	0.196	230	0.559
60	0.155	240	0.700
70	0.133	250	0.824
80	0.130	260	0.889
90	0.132	270	0.885
100	0.142	280	0.825
110	0.137	290	0.736
120	0.149	300	0.575
130	0.164	310	0.453
135	0.166	315	0.399
140	0.170	320	0.323
150	0.163	330	0.209
160	0.170	340	0.144
170	0.184	350	0.159

Figure 1E

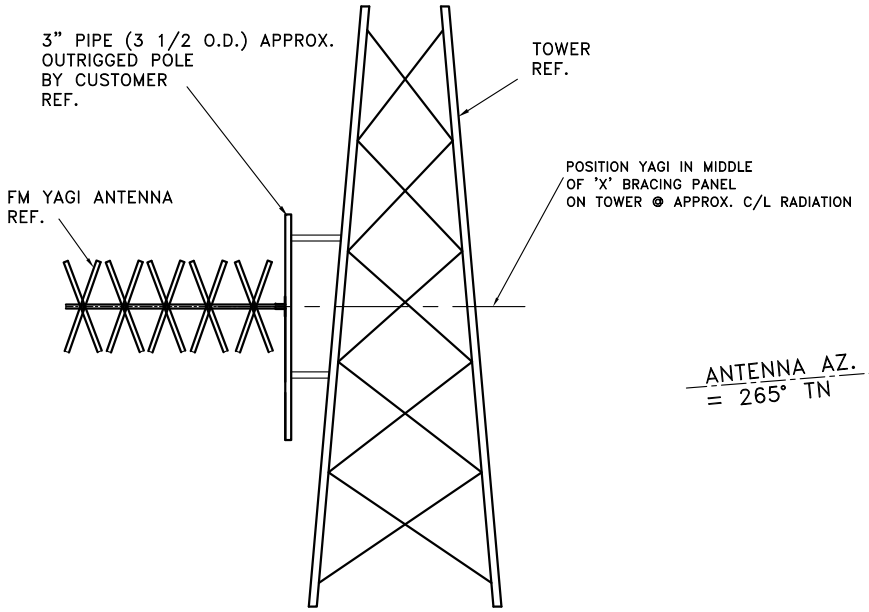
Tabulation of Composite Azimuth Pattern
WINO ODESSA, NY.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.393	180	0.201
10	0.382	190	0.216
20	0.399	200	0.257
30	0.366	210	0.337
40	0.302	220	0.447
45	0.224	225	0.510
50	0.196	230	0.559
60	0.155	240	0.710
70	0.133	250	0.874
80	0.130	260	0.985
90	0.133	270	0.978
100	0.179	280	0.880
110	0.201	290	0.740
120	0.224	300	0.575
130	0.227	310	0.453
135	0.225	315	0.399
140	0.219	320	0.323
150	0.194	330	0.243
160	0.170	340	0.297
170	0.184	350	0.357

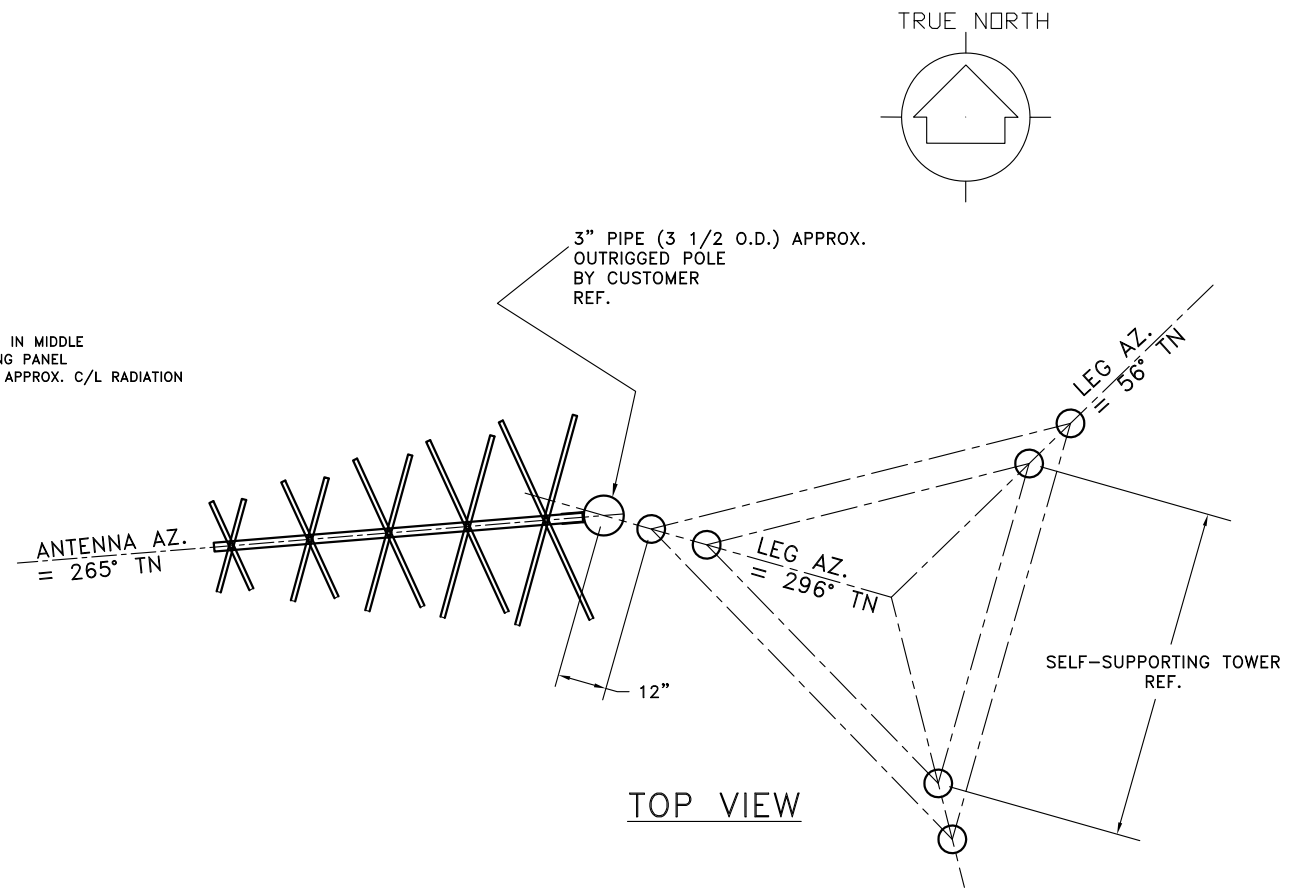
Figure 1F

Tabulation of FCC Directional Composite
WINO ODESSA, NY.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.493	180	0.225
10	0.620	190	0.228
20	0.497	200	0.287
30	0.408	210	0.362
40	0.358	220	0.455
50	0.451	230	0.573
60	0.464	240	0.722
70	0.368	250	0.908
80	0.389	260	1.000
90	0.490	270	1.000
100	0.617	280	0.946
110	0.506	290	0.751
120	0.498	300	0.597
130	0.430	310	0.474
140	0.341	320	0.377
150	0.271	330	0.299
160	0.216	340	0.311
170	0.226	350	0.391



SIDE VIEW



TOP VIEW

ANTENNA HEADING 265° TRUE NORTH

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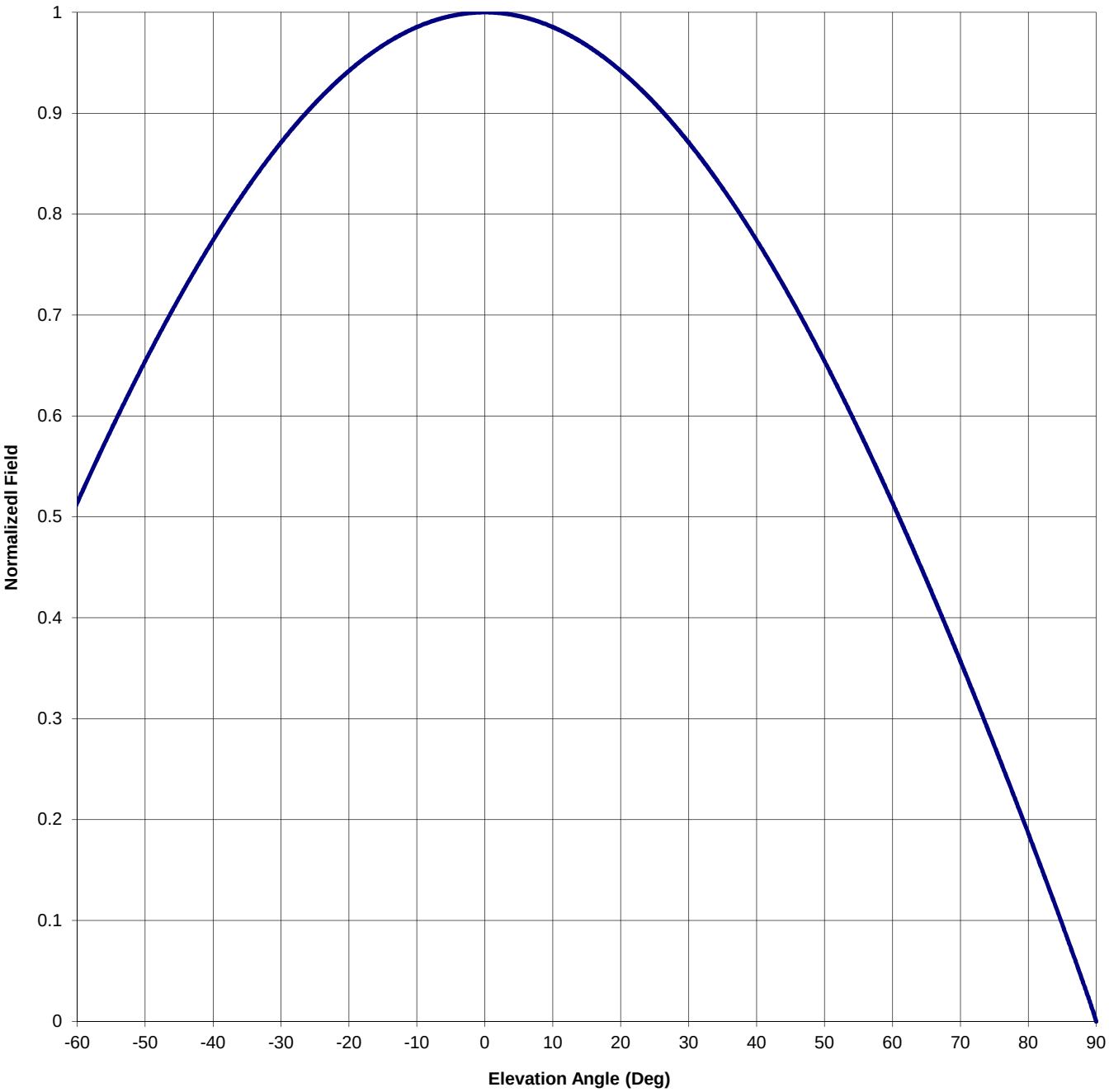
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY:
29688	89.9	N.T.S.	DAB
			APPROVED BY: RAS

TITLE: SCALA CA5FMCP-RM YAGI
WINO BINGHAMTON N.Y.

DATE: 1/6/12

FIGURE 2

Antenna Mfg.:	**Shively Labs**			**Date:**	**1/10/2012**
Antenna Type:	**Scala CA5FMCP-RM**				
Station:	**WINO**	**Beam Tilt**	**0**		
Frequency:	**89.9**	**Gain (Max)**	**2.967**	**4.724**	**dB**
Channel #:	**210**	**Gain (Horizon)**	**2.967**	**4.724**	**dB**
Figure:	**Figure 3**				



Antenna Mfg.: Shively Labs **Date:** 1/10/2012

Antenna Type: Scala CA5FMCP-RM

Station: WINO **Beam Tilt** 0

Frequency: 89.9 **Gain (Max)** 2.967 4.724 dB

Channel #: 210 **Gain (Horizon)** 2.967 4.724 dB

Figure: 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	0.729	0	1.000	46	0.705
-89	0.021	-43	0.741	1	1.000	47	0.693
-88	0.040	-42	0.752	2	0.999	48	0.680
-87	0.059	-41	0.763	3	0.999	49	0.667
-86	0.078	-40	0.774	4	0.998	50	0.654
-85	0.096	-39	0.785	5	0.996	51	0.641
-84	0.114	-38	0.796	6	0.995	52	0.628
-83	0.133	-37	0.806	7	0.993	53	0.614
-82	0.151	-36	0.816	8	0.991	54	0.600
-81	0.168	-35	0.826	9	0.988	55	0.586
-80	0.186	-34	0.835	10	0.985	56	0.572
-79	0.204	-33	0.845	11	0.982	57	0.558
-78	0.221	-32	0.854	12	0.979	58	0.544
-77	0.239	-31	0.862	13	0.975	59	0.529
-76	0.256	-30	0.871	14	0.971	60	0.514
-75	0.273	-29	0.879	15	0.967	61	0.499
-74	0.290	-28	0.887	16	0.963	62	0.484
-73	0.307	-27	0.895	17	0.958	63	0.469
-72	0.324	-26	0.903	18	0.953	64	0.453
-71	0.341	-25	0.910	19	0.948	65	0.437
-70	0.357	-24	0.917	20	0.942	66	0.422
-69	0.373	-23	0.924	21	0.936	67	0.406
-68	0.390	-22	0.930	22	0.930	68	0.390
-67	0.406	-21	0.936	23	0.924	69	0.373
-66	0.422	-20	0.942	24	0.917	70	0.357
-65	0.437	-19	0.948	25	0.910	71	0.341
-64	0.453	-18	0.953	26	0.903	72	0.324
-63	0.469	-17	0.958	27	0.895	73	0.307
-62	0.484	-16	0.963	28	0.887	74	0.290
-61	0.499	-15	0.967	29	0.879	75	0.273
-60	0.514	-14	0.971	30	0.871	76	0.256
-59	0.529	-13	0.975	31	0.862	77	0.239
-58	0.544	-12	0.979	32	0.854	78	0.221
-57	0.558	-11	0.982	33	0.845	79	0.204
-56	0.572	-10	0.985	34	0.835	80	0.186
-55	0.586	-9	0.988	35	0.826	81	0.168
-54	0.600	-8	0.991	36	0.816	82	0.151
-53	0.614	-7	0.993	37	0.806	83	0.133
-52	0.628	-6	0.995	38	0.796	84	0.114
-51	0.641	-5	0.996	39	0.785	85	0.096
-50	0.654	-4	0.998	40	0.774	86	0.078
-49	0.667	-3	0.999	41	0.763	87	0.059
-48	0.680	-2	0.999	42	0.752	88	0.040
-47	0.693	-1	1.000	43	0.741	89	0.021
-46	0.705	0	1.000	44	0.729	90	0.000
-45	0.717			45	0.717		

S.O. 29688 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WINO ODESSA, NY.

MODEL SCALA CA-5

Elevation Gain of Antenna 0.55

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

H RMS 0.441347 V RMS 0.420033 H/V Ratio 1.051

Elevation Gain of Horizontal Component 0.578

Elevation Gain of Vertical Component 0.523

Horizontal Azimuth Gain equals $1/(RMS)^2$. 5.134

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 4.572

Max. Vertical 0.8981

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

Total Horizontal Power Gain = **2.967**

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

Total Vertical Power Gain = **2.393**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

0.250 kW ERP Divided by H Gain 2.967 equals 0.084 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

0.084 kW Times V Gain 2.393 equals 0.202 kW V ERP

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

(0.8981)^2 Times 0.25 Equals 0.202 kW Vertical ERP

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