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S.O. 29551

Report of Test SCALA CA-5

For

SANTA MONICA COMMUNITY COLLEGE DISTRICT

KCRU 89.1 MHz OXNARD, CA.

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a Scala CA-5 to meet the needs of KCRU and to comply with the requirements of the FCC construction permit, file number BMXPED-20110203AAR. 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 BMXPED-20110203AAR indicates that the Horizontal radiation component shall not exceed .85 kW at any azimuth and is restricted to the following values at the azimuths specified:

80 Degrees T: 0.013 kW

160 Degrees T: 0.013 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 300 Degrees. At the restricted azimuth of 80 Degrees T the Horizontal component is 20 dB down from the maximum of .85 kW, or 0.009 kW and at the restricted azimuth of 160 Degrees T the vertical component is 21.51 dB down from the maximum of 0.085 kW, or 0.006 kW.

The R.M.S. of the Horizontal component is 0.396. The total Horizontal power gain is 3.707. The R.M.S. of the Vertical component is 0.375. The total Vertical power gain is 2.666. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.433. The R.M.S. of the measured composite pattern is 0.407. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.368. Therefore this pattern complies with the FCC requirement of 73.316(c) (2) (ix) (A).

METHOD OF DIRECTIONALIZATION:

One bay of the Scala CA-5 yagi was mounted on a tower of precise scale to the Rohn tower at the KCRU 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 BMXPED-20110203AAR, a single level of the Scala CA-5 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 400.95 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 29551
November 16, 2011

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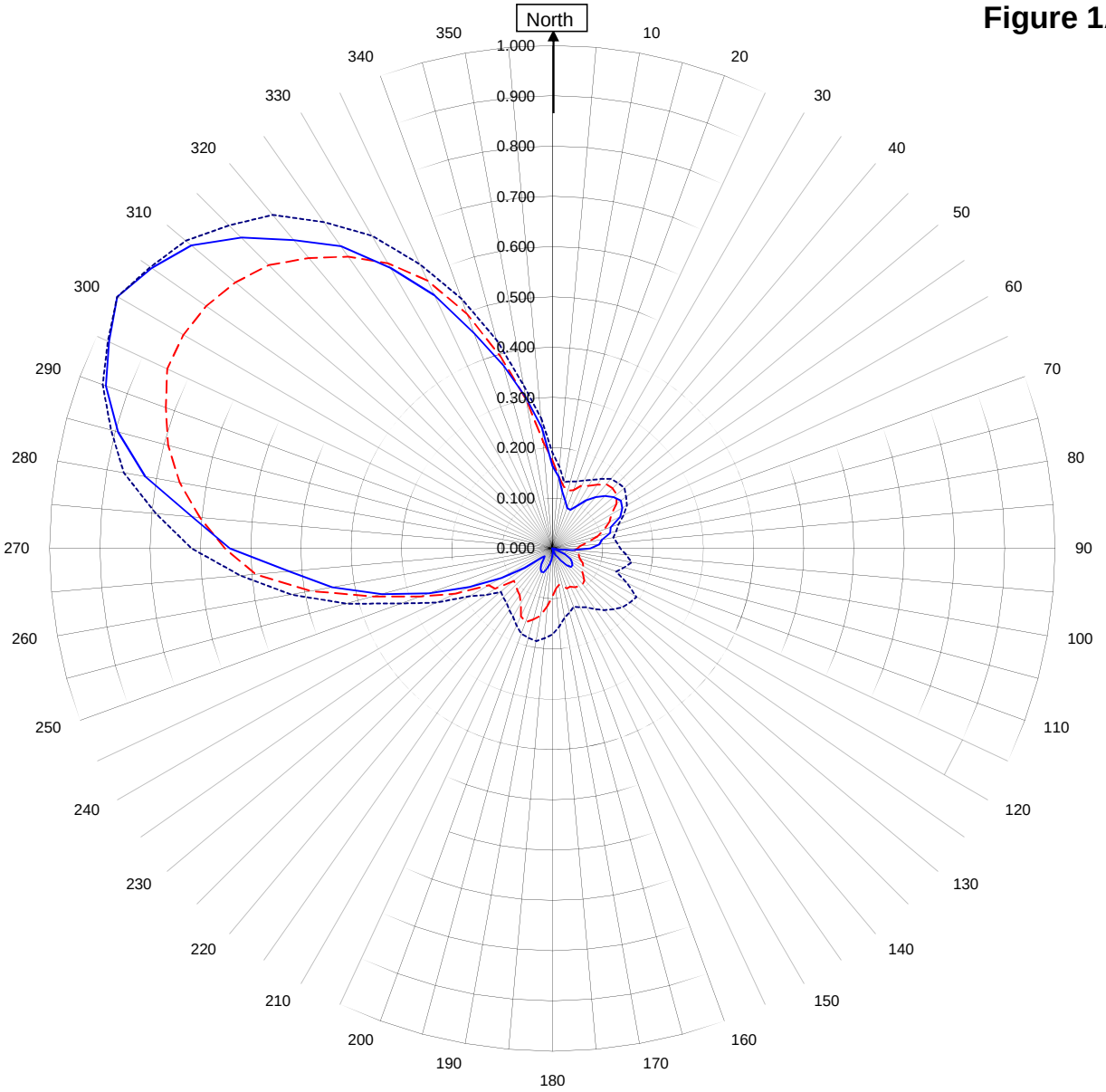
Figure 1A



KCRU OXNARD, CA.

29551

November 16, 2011

Horizontal RMS	0.396
Vertical RMS	0.375
H/V Composite RMS	0.406
FCC Composite RMS	0.433

Frequency	89.1 / 400.95 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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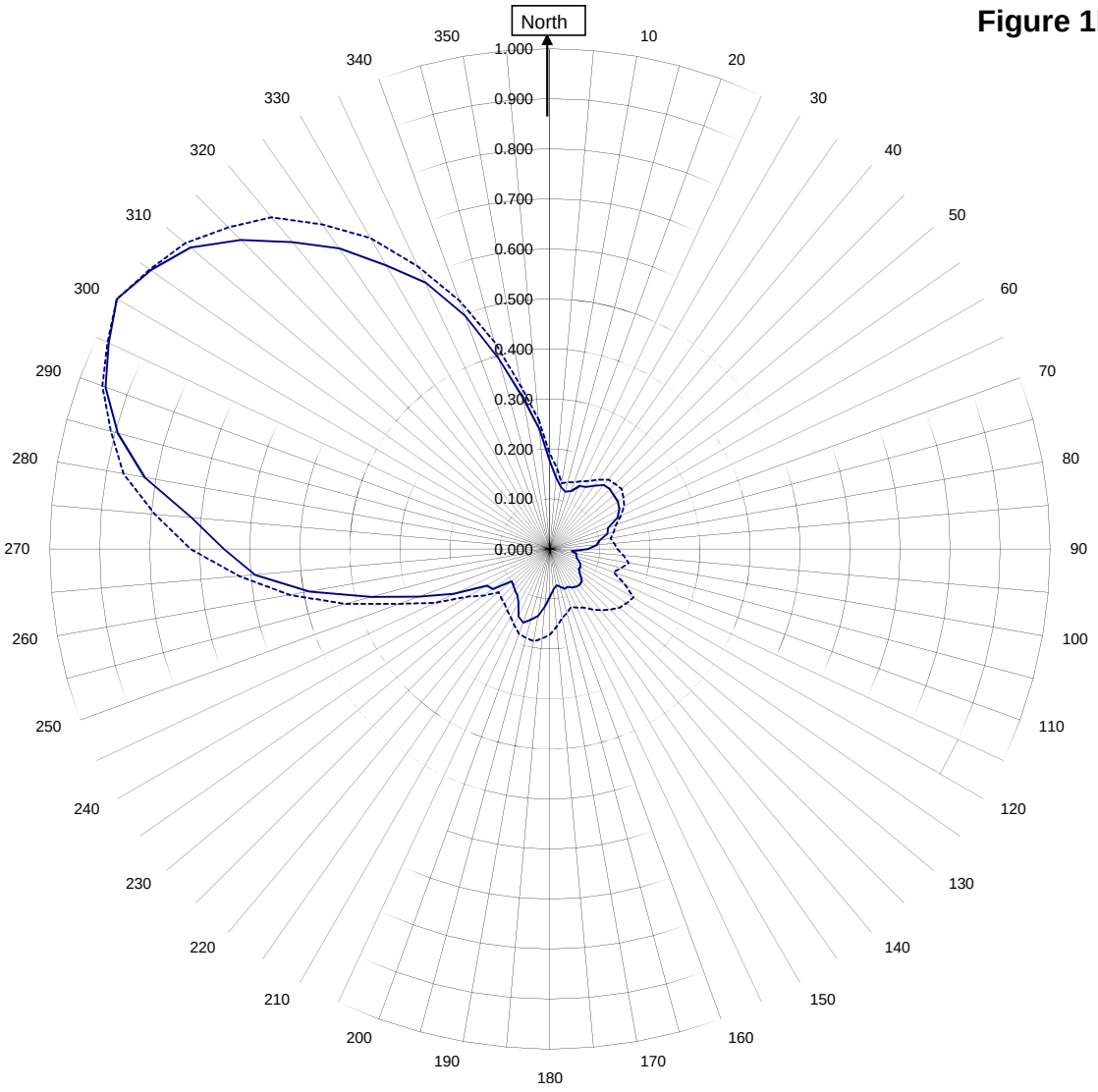
Figure 1B



KCRU OXNARD, CA.

29551

November 16, 2011

_____H/VComposite RMS	0.406
……FCC Composite RMS	0.433

Frequency	89.1 / 400.95 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
KCRU OXNARD, CA.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.164	180	0.012
10	0.114	190	0.033
20	0.086	200	0.050
30	0.097	210	0.047
40	0.133	220	0.028
45	0.148	225	0.022
50	0.159	230	0.027
60	0.160	240	0.117
70	0.124	250	0.261
80	0.100	260	0.445
90	0.075	270	0.642
100	0.009	280	0.823
110	0.005	290	0.946
120	0.041	300	1.000
130	0.052	310	0.938
135	0.052	315	0.874
140	0.044	320	0.801
150	0.019	330	0.644
160	0.006	340	0.455
170	0.002	350	0.305

Figure 1D

Tabulation of Vertical Azimuth Pattern
KCRU OXNARD, CA.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.175	180	0.095
10	0.126	190	0.136
20	0.124	200	0.156
30	0.144	210	0.126
40	0.167	220	0.109
45	0.169	225	0.104
50	0.167	230	0.100
60	0.136	240	0.146
70	0.109	250	0.279
80	0.072	260	0.489
90	0.050	270	0.652
100	0.054	280	0.753
110	0.058	290	0.818
120	0.070	300	0.848
130	0.079	310	0.823
135	0.090	315	0.797
140	0.093	320	0.754
150	0.089	330	0.655
160	0.084	340	0.496
170	0.073	350	0.301

Figure 1E

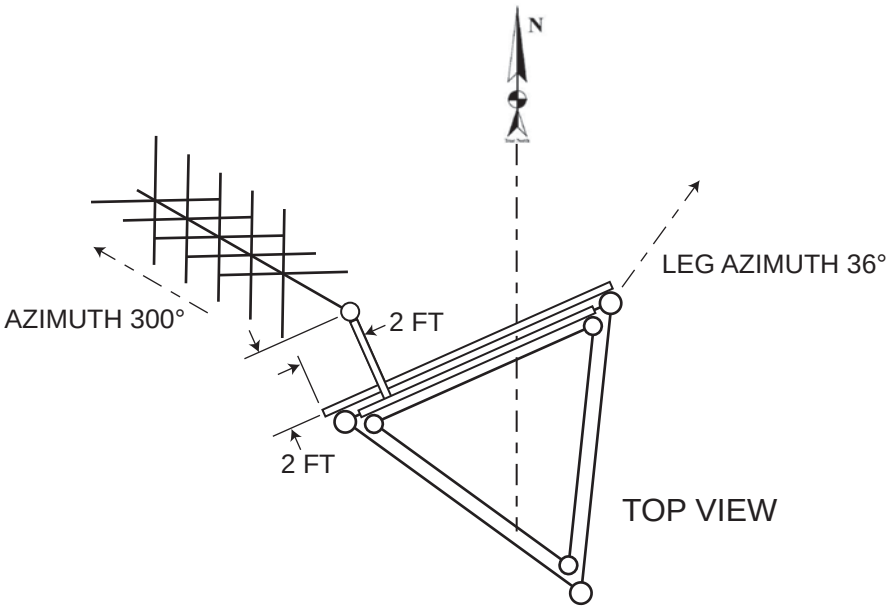
Tabulation of Composite Azimuth Pattern
KCRU OXNARD, CA.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.175	180	0.095
10	0.126	190	0.136
20	0.124	200	0.156
30	0.144	210	0.126
40	0.167	220	0.109
45	0.169	225	0.104
50	0.167	230	0.100
60	0.160	240	0.146
70	0.124	250	0.279
80	0.100	260	0.489
90	0.075	270	0.652
100	0.054	280	0.823
110	0.058	290	0.946
120	0.070	300	1.000
130	0.079	310	0.938
135	0.090	315	0.874
140	0.093	320	0.801
150	0.089	330	0.655
160	0.084	340	0.496
170	0.073	350	0.305

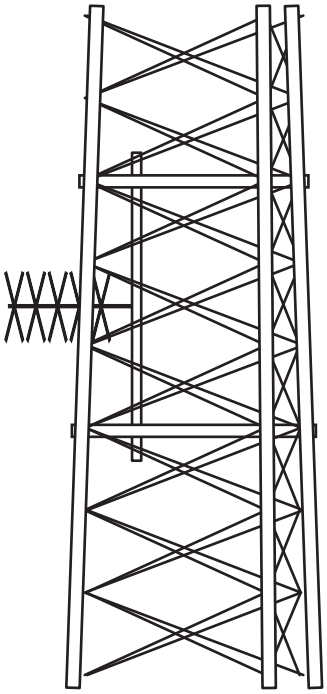
Figure 1F

Tabulation of FCC Directional Composite
KCRU OXNARD, CA.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.190	180	0.171
10	0.134	190	0.187
20	0.142	200	0.181
30	0.157	210	0.157
40	0.181	220	0.142
50	0.187	230	0.134
60	0.171	240	0.190
70	0.140	250	0.320
80	0.123	260	0.528
90	0.135	270	0.718
100	0.160	280	0.866
110	0.135	290	0.952
120	0.193	300	1.000
130	0.182	310	0.952
140	0.160	320	0.866
150	0.135	330	0.718
160	0.123	340	0.528
170	0.140	350	0.329



TOP VIEW



ELEVATION VIEW

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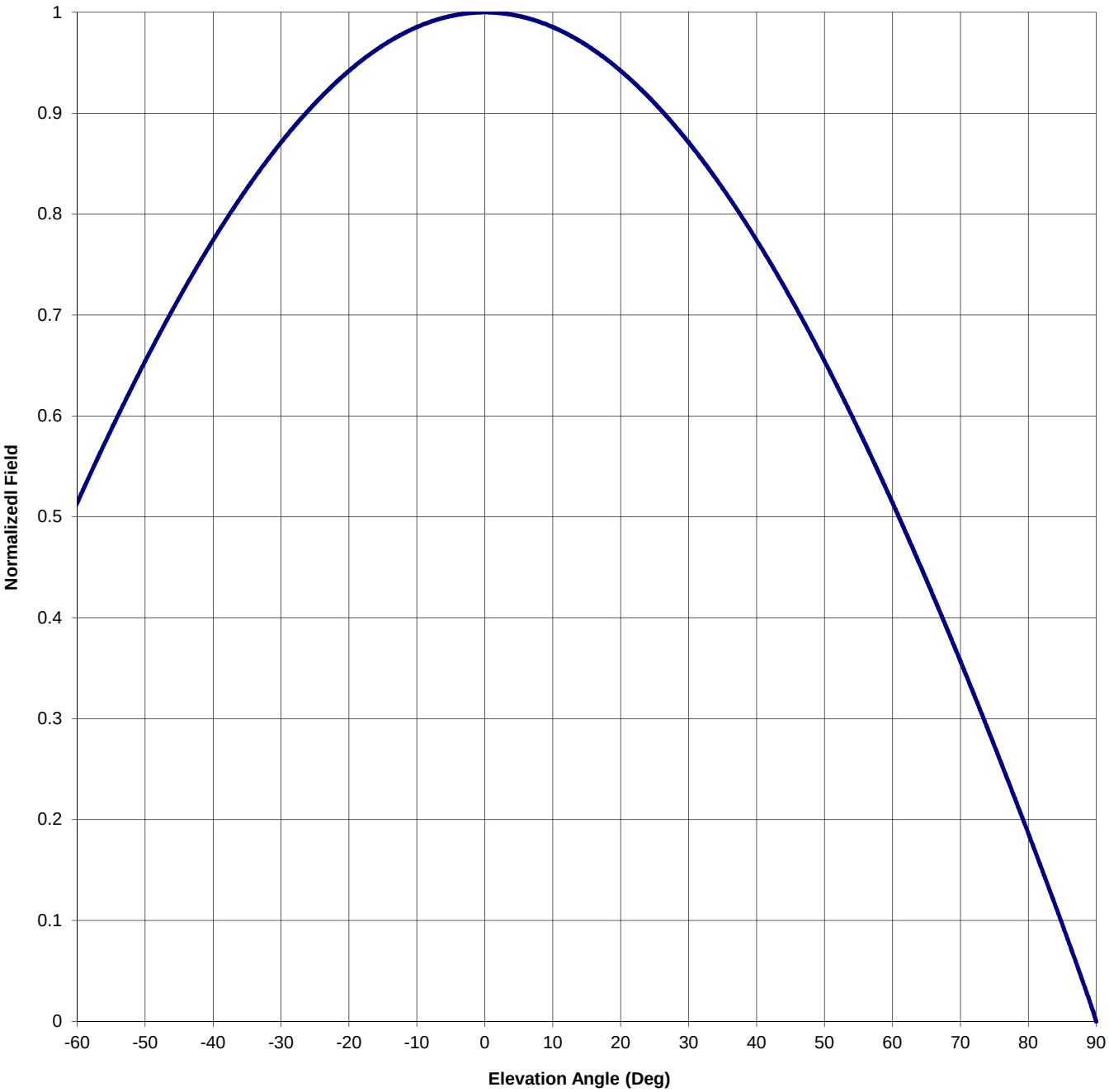
FIGURE 2, SCALA CA5 YAGI,
KCRU, 89.1 MHz
SANTA MONICA, CA

SIZE	CODE IDENT. NO.	DRAWING NO.	REV
A	26750	AGF111115-002	_

SCALE		SHEET
NONE	S/O 29551	1 OF 1

Antenna Mfg.:	**Shively Labs**			**Date:**	**11/16/2011**
Antenna Type:	**Scala CA-5**				
Station:	**KCRU**	**Beam Tilt**	**0**		
Frequency:	**89.1**	**Gain (Max)**	**3.707**	**5.690**	**dB**
Channel #:	**206**	**Gain (Horizon)**	**3.707**	**5.690**	**dB**
Figure:	**Figure 3**				



Antenna Mfg.: Shively Labs **Date:** 11/16/2011

Antenna Type: Scala CA-5

Station: KCRU **Beam Tilt** 0

Frequency: 89.1 **Gain (Max)** 3.707 5.690 dB

Channel #: 206 **Gain (Horizon)** 3.707 5.690 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. 29551 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

KCRU OXNARD, CA.

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 0.39595 V RMS 0.37467 H/V Ratio 1.057

Elevation Gain of Horizontal Component 0.581

Elevation Gain of Vertical Component 0.520

Horizontal Azimuth Gain equals $1/(RMS)^2$. 6.379

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 5.123

Max. Vertical 0.848

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

Total Horizontal Power Gain = **3.707**

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

Total Vertical Power Gain = **2.666**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

0.85 kW ERP Divided by H Gain 3.707 equals 0.229 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

0.229 kW Times V Gain 2.666 equals 0.611 kW V ERP

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

(0.848)^2 Times 0.85 Equals 0.611 kW Vertical ERP

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