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S.O. 26897

Report of Test Scala CA-2CP-DA 4 Level Yagi

for

COCHISE BROADCASTING, LLC

New FM 103.7 MHz Vail, AZ

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a Scala CA-2CP-DA 4 Level Yagi to meet the needs of New FM and to comply with the requirements of the FCC construction permit, file number BMPH-20041201CAN.

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.

From Figure 1A, the maximum radiation of the Horizontal component occurs at 319 Degrees T to 346 Degrees T.

The R.M.S. of the Horizontal component is 0.636. The total Horizontal power gain is 4.168. The R.M.S. of the Vertical component is 0.636. The total Vertical power gain is 4.127. See Figure 4 for calculations.

METHOD OF DIRECTIONALIZATION:

The Scala CA-2CP-DA 4 Level Yagi was mounted on a tower of precise scale to the Rohn 25G tower at the New FM 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 BMPH-20041201CAN, a single level of the Scala CA-2CP-DA 4 Level Yagi 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 466.65 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 1A.

Respectfully submitted by:

Robert A. Surette
Director of Sales Engineering
S/O 26897
September 10, 2008

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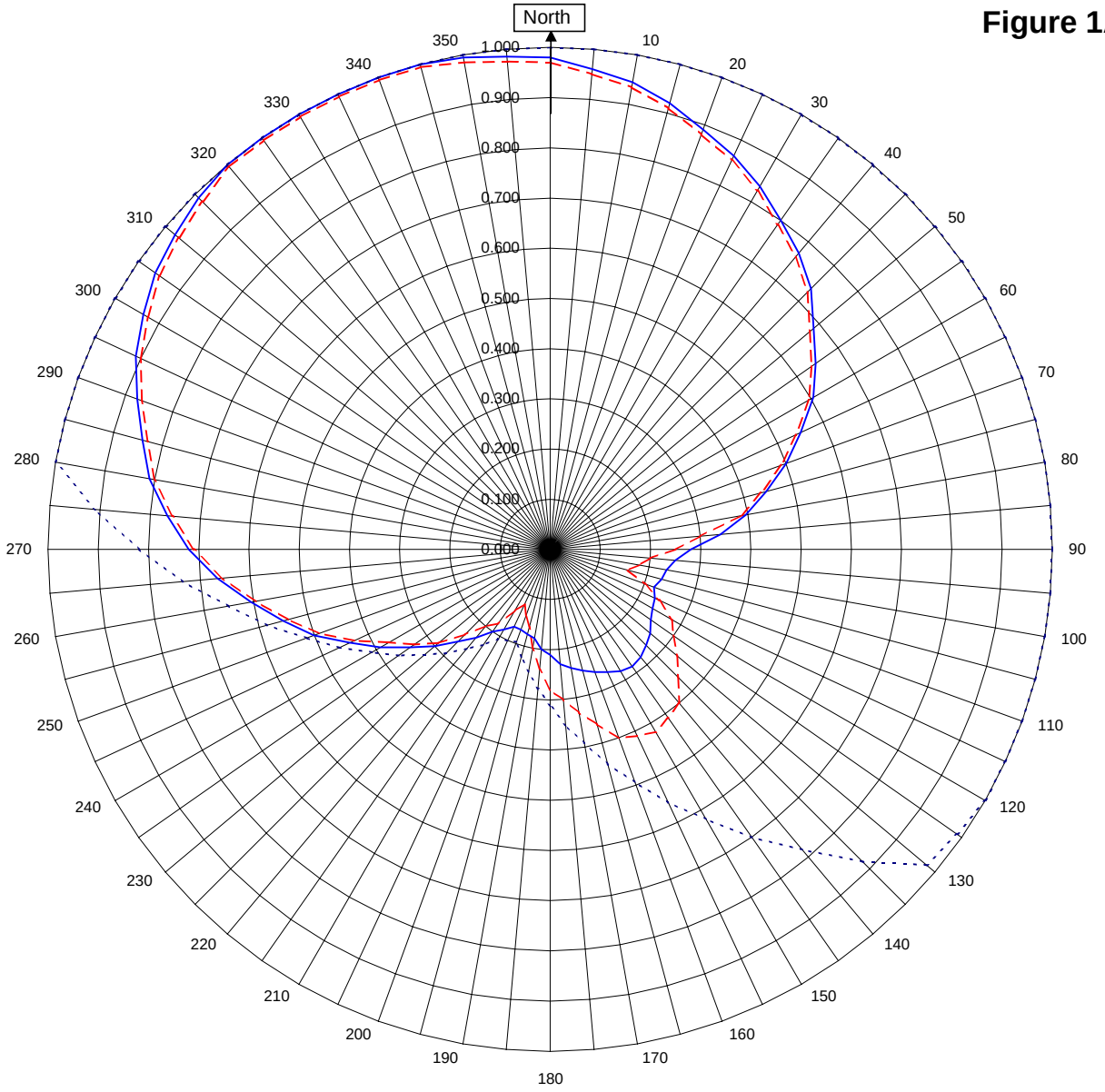
Figure 1A



New FM Vail, AZ

26897

September 10, 2008

_____Horizontal RMS	0.636
_ _ _ _ _ _ _ _ _ Vertical RMS	0.636
H/V Composite RMS	0.645
.....FCC Composite RMS	0.838

Frequency	103.7 / 466.65 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	Scala CA -2CP-DA 4 Level Yagi
Pattern Type	Directional Azimuth

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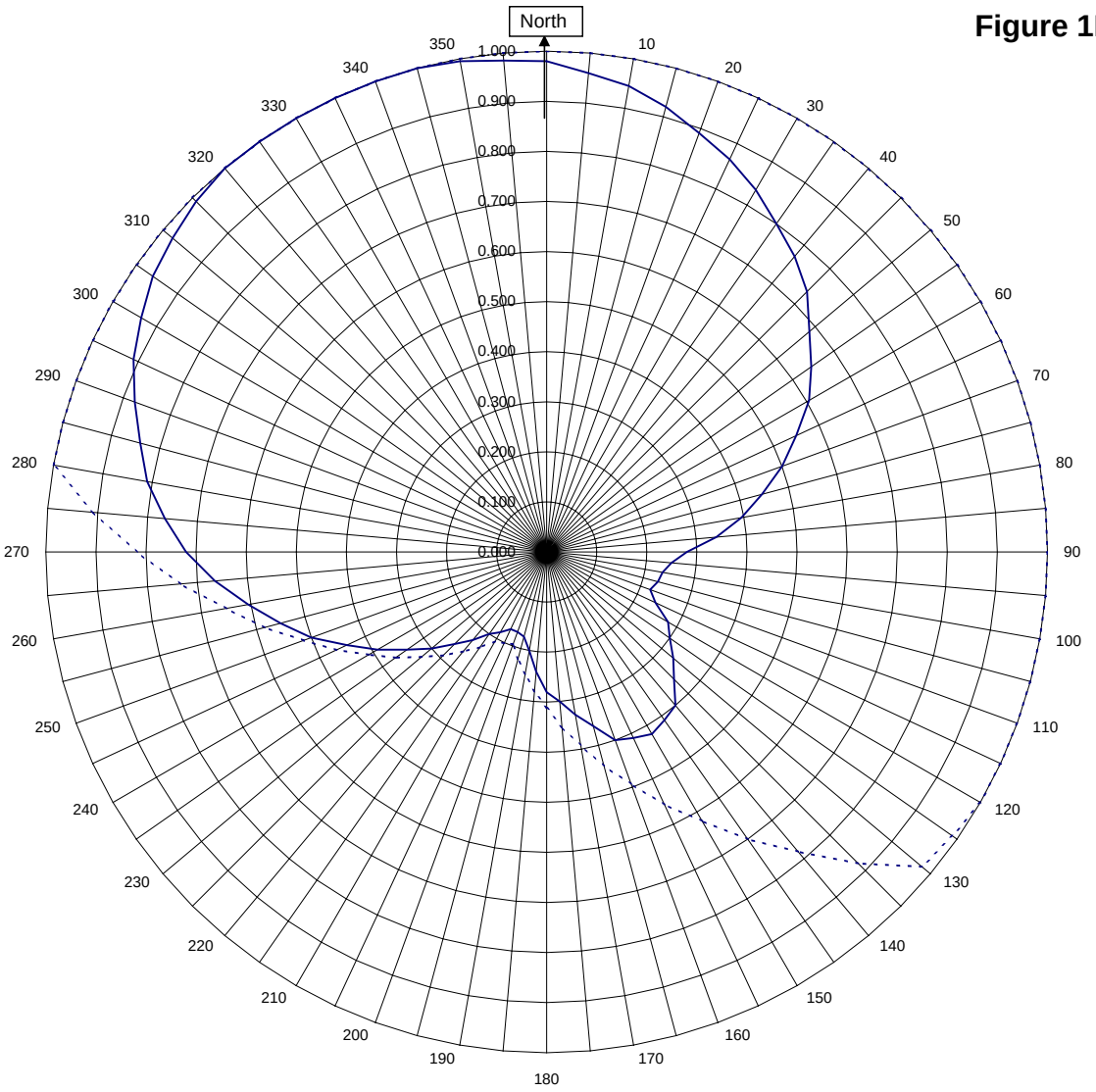
Figure 1B



New FM Vail, AZ

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_____H/VComposite RMS	0.645
……..FCC Composite RMS	0.838

Frequency	103.7 / 466.65 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	Scala CA -2CP-DA 4 Level Yagi
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
New FM Vail, AZ

Azimuth	Rel Field	Azimuth	Rel Field
0	0.980	180	0.210
10	0.945	190	0.180
20	0.890	200	0.170
30	0.835	210	0.185
40	0.770	220	0.230
45	0.735	225	0.260
50	0.685	230	0.300
60	0.605	240	0.390
70	0.500	250	0.500
80	0.395	260	0.605
90	0.280	270	0.720
100	0.235	280	0.810
110	0.220	290	0.875
120	0.235	300	0.935
130	0.260	310	0.975
135	0.270	315	0.990
140	0.280	320	1.000
150	0.280	330	1.000
160	0.260	340	1.000
170	0.240	350	0.995

Figure 1D

Tabulation of Vertical Azimuth Pattern
New FM Vail, AZ

Azimuth	Rel Field	Azimuth	Rel Field
0	0.970	180	0.280
10	0.935	190	0.200
20	0.880	200	0.140
30	0.825	210	0.140
40	0.760	220	0.200
45	0.725	225	0.240
50	0.675	230	0.290
60	0.595	240	0.370
70	0.490	250	0.490
80	0.385	260	0.595
90	0.250	270	0.710
100	0.180	280	0.800
110	0.200	290	0.865
120	0.280	300	0.925
130	0.330	310	0.965
135	0.360	315	0.980
140	0.400	320	0.995
150	0.420	330	0.995
160	0.400	340	0.995
170	0.330	350	0.985

Figure 1E

Tabulation of Composite Azimuth Pattern
New FM Vail, AZ

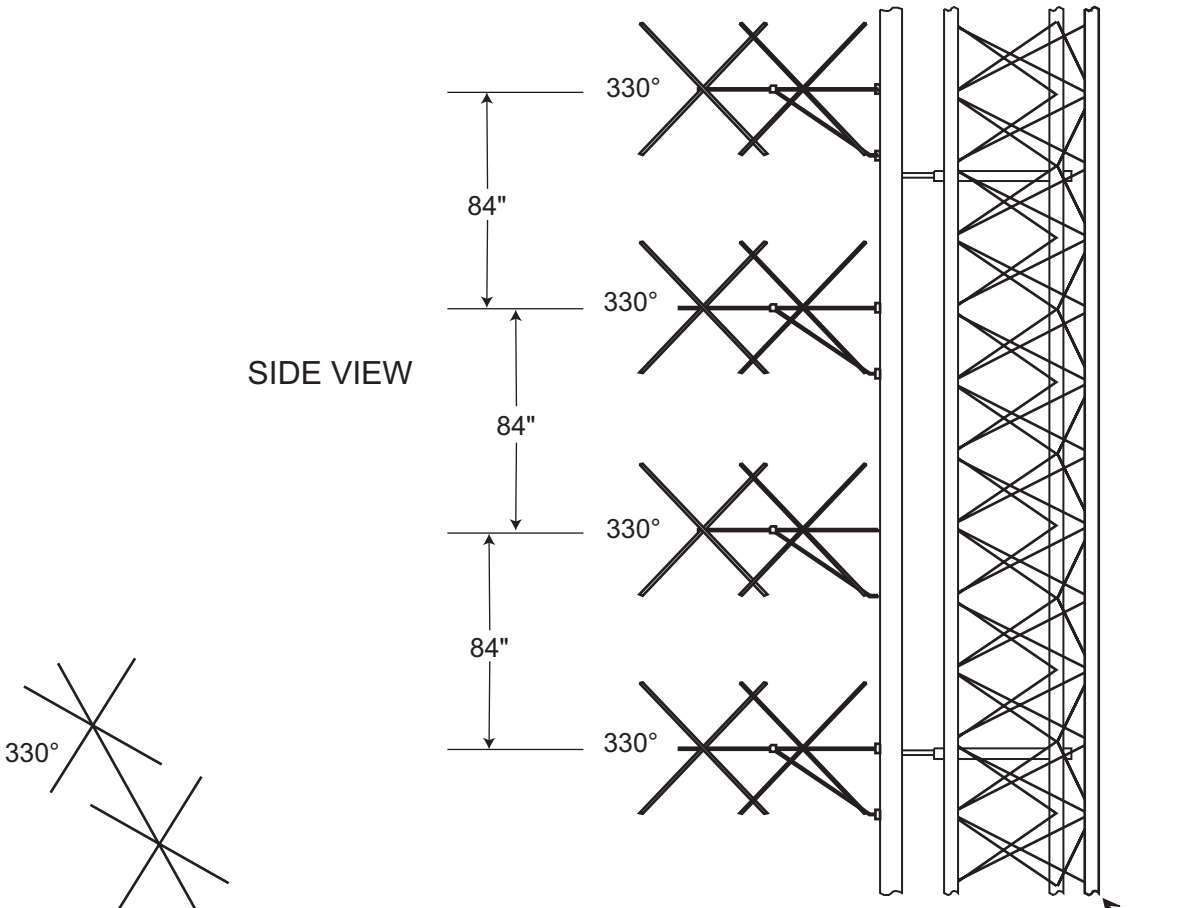
Azimuth	Rel Field	Azimuth	Rel Field
0	0.980	180	0.280
10	0.945	190	0.200
20	0.890	200	0.170
30	0.835	210	0.185
40	0.770	220	0.230
45	0.735	225	0.260
50	0.500	230	0.300
60	0.605	240	0.390
70	0.500	250	0.500
80	0.395	260	0.605
90	0.280	270	0.720
100	0.235	280	0.810
110	0.220	290	0.875
120	0.280	300	0.935
130	0.330	310	0.975
135	0.360	315	0.990
140	0.400	320	1.000
150	0.420	330	1.000
160	0.400	340	1.000
170	0.330	350	0.995

Figure 1F

Tabulation of FCC Directional Composite
New FM Vail, AZ

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.311
10	1.000	190	0.247
20	1.000	200	0.196
30	1.000	210	0.206
40	1.000	220	0.259
50	1.000	230	0.326
60	1.000	240	0.410
70	1.000	250	0.516
80	1.000	260	0.650
90	1.000	270	0.818
100	1.000	280	1.000
110	1.000	290	1.000
120	1.000	300	1.000
130	0.978	310	1.000
140	0.781	320	1.000
150	0.620	330	1.000
160	0.493	340	1.000
170	0.392	350	1.000

REVISION HISTORY			
REV	DESCRIPTION	DATE	APPROVED



SIDE VIEW

TOP VIEW

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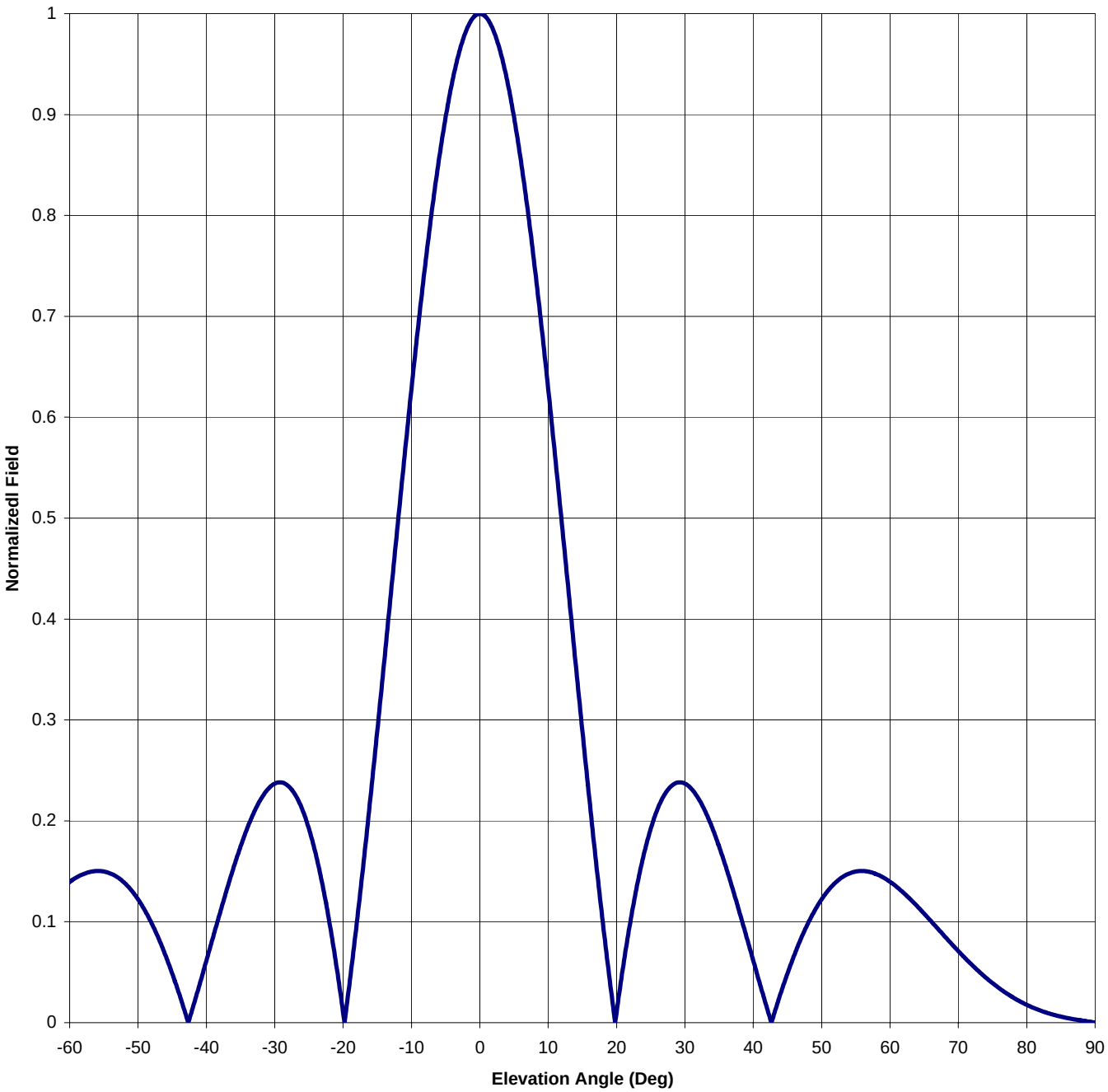
DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED. TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONAL: ± 1/32 ANGLES: ± 1/2 2 PL DECIMAL: ± .02 3 PL DECIMAL: ± .005 SURFACE FINISH 63 FILLETS .015 MAX		FIGURE 2 NEW FM
ANGLE PROJECTION		
MATERIAL		

	APPROVED BY	DATE
MFG. APPROVAL		
ENG. APPROVAL		
CHECKED		
DRAWN BY	AGF	09/10/08

SIZE	CAGE CODE	DWG NO	REV
B	26750	AGF080910-001	--

SCALE			SHEET
NONE	26897		1 OF 1

Antenna Mfg.:	**Shively Labs**			**Date:**	**9/10/2008**
Antenna Type:	**Scala CA-2CP-DA 4 Level Yagi**				
Station:	**New FM**	**Beam Tilt**	**0**		
Frequency:	**103.7**	**Gain (Max)**	**4.168**	**6.199**	**dB**
Channel #:	**202**	**Gain (Horizon)**	**4.168**	**6.199**	**dB**
Figure:	**3**				



Antenna Mfg.: Shively Labs **Date:** 9/10/2008

Antenna Type: Scala CA-2CP-DA 4 Level Yagi

Station: New FM **Beam Tilt** 0

Frequency: 103.7 **Gain (Max)** 4.168 6.199 dB

Channel #: 202 **Gain (Horizon)** 4.168 6.199 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	0.029	0	1.000	46	0.067
-89	0.001	-43	0.008	1	0.996	47	0.084
-88	0.002	-42	0.015	2	0.983	48	0.098
-87	0.003	-41	0.038	3	0.962	49	0.111
-86	0.005	-40	0.061	4	0.934	50	0.122
-85	0.006	-39	0.085	5	0.897	51	0.131
-84	0.008	-38	0.109	6	0.854	52	0.139
-83	0.010	-37	0.132	7	0.805	53	0.144
-82	0.012	-36	0.154	8	0.751	54	0.148
-81	0.015	-35	0.175	9	0.691	55	0.150
-80	0.018	-34	0.193	10	0.628	56	0.150
-79	0.021	-33	0.209	11	0.562	57	0.149
-78	0.025	-32	0.222	12	0.495	58	0.147
-77	0.029	-31	0.231	13	0.426	59	0.144
-76	0.034	-30	0.237	14	0.357	60	0.140
-75	0.039	-29	0.238	15	0.289	61	0.134
-74	0.045	-28	0.234	16	0.223	62	0.129
-73	0.051	-27	0.226	17	0.159	63	0.122
-72	0.057	-26	0.212	18	0.099	64	0.115
-71	0.064	-25	0.192	19	0.042	65	0.108
-70	0.071	-24	0.167	20	0.010	66	0.101
-69	0.078	-23	0.136	21	0.057	67	0.093
-68	0.086	-22	0.099	22	0.099	68	0.086
-67	0.093	-21	0.057	23	0.136	69	0.078
-66	0.101	-20	0.010	24	0.167	70	0.071
-65	0.108	-19	0.042	25	0.192	71	0.064
-64	0.115	-18	0.099	26	0.212	72	0.057
-63	0.122	-17	0.159	27	0.226	73	0.051
-62	0.129	-16	0.223	28	0.234	74	0.045
-61	0.134	-15	0.289	29	0.238	75	0.039
-60	0.140	-14	0.357	30	0.237	76	0.034
-59	0.144	-13	0.426	31	0.231	77	0.029
-58	0.147	-12	0.495	32	0.222	78	0.025
-57	0.149	-11	0.562	33	0.209	79	0.021
-56	0.150	-10	0.628	34	0.193	80	0.018
-55	0.150	-9	0.691	35	0.175	81	0.015
-54	0.148	-8	0.751	36	0.154	82	0.012
-53	0.144	-7	0.805	37	0.132	83	0.010
-52	0.139	-6	0.854	38	0.109	84	0.008
-51	0.131	-5	0.897	39	0.085	85	0.006
-50	0.122	-4	0.934	40	0.061	86	0.005
-49	0.111	-3	0.962	41	0.038	87	0.003
-48	0.098	-2	0.983	42	0.015	88	0.002
-47	0.084	-1	0.996	43	0.008	89	0.001
-46	0.067	0	1.000	44	0.029	90	0.000
-45	0.049			45	0.049		

S.O. 26897 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

New FM 103.7 MHz Vail, AZ

Scala CA-2CP-DA 4 Level Yagi

Elevation Gain of Antenna 1.686

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

H RMS 0.636 V RMS 0.636 H/V Ratio 1.000

Elevation Gain of Horizontal Component 1.686

Elevation Gain of Vertical Component 1.686

Horizontal Azimuth Gain equals $1/(RMS)^2$. 2.472

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 2.448
Max. Vertical 0.995

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

Total Horizontal Power Gain = **4.168**

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

Total Vertical Power Gain = **4.127**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

0.79 kW ERP Divided by H Gain 4.168 equals 0.19 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

0.190 kW Times V Gain 4.127 equals 0.782 kW V ERP

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

(0.995)^2 Times 0.79 Equals 0.782 kW Vertical ERP

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