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S.O. 29874

Report of Test Scala CA-2 Slant 47° Yagi

for

Quaboag Hills Public Radio, Inc

WJZZ 90.1 MHz North Salem, NY

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a Scala CA-2 Slant Yagi 47° to meet the needs of WJZZ and to comply with the requirements of the FCC construction permit, file number BMPED-20120313AAS. 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 BMPED-20120313AAS indicates that the Horizontal radiation component shall not exceed 0.440kW at any azimuth and is restricted to the following values at the azimuths specified:

1 - 41 Degrees T: 0.0140 kW

241 -281 Degrees T: 0.0140 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 141 Degrees T. At the restricted azimuth of 1 - 41 Degrees T the Vertical component is 15.60 dB down from the maximum of 0.440kW, or 0.0121. At the restricted azimuth of 241 - 281 Degrees T the Vertical component is 15.703 dB down from the maximum of 0.440 kW, or 0.0118.

The R.M.S. of the Horizontal component is 0.421. The total Horizontal power gain is 2.933. The R.M.S. of the Vertical component is 0.446. The total Vertical power gain is 2.402. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.498. The R.M.S. of the measured composite pattern is 0.465. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.423. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the Scala CA-2 Slant 47° Yagi was mounted on a pole of precise scale to the pole at the WJZZ 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 BMPED-20120313AAS, a single level of the Scala CA-2 Slant 47° 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 405.45 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 29874
May 11, 2012

Shively Labs

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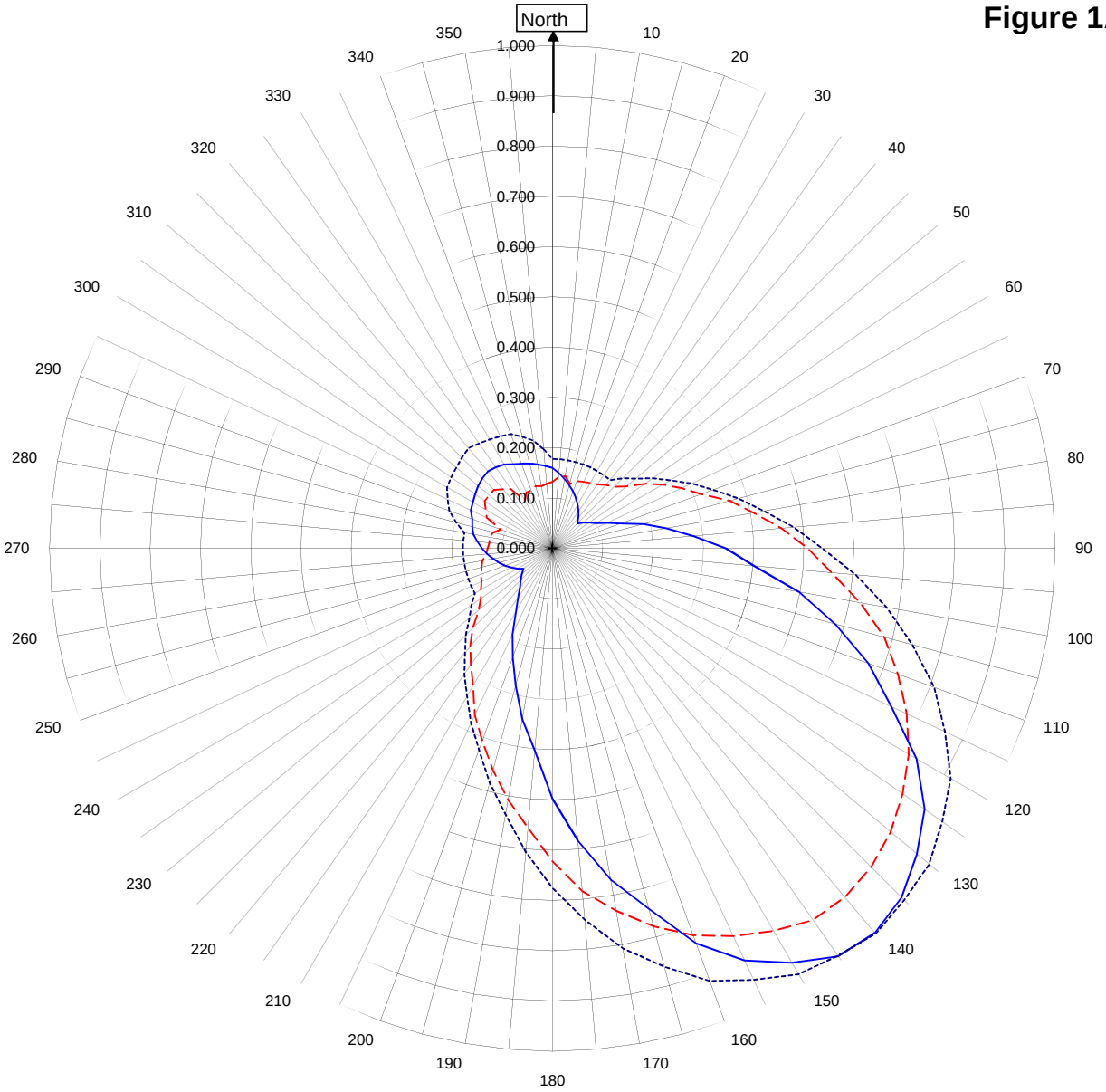
Figure 1A



WJZZ NORTH SALEM, NY

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Horizontal RMS	0.421
Vertical RMS	0.446
H/V Composite RMS	0.465
FCC Composite RMS	0.498

Frequency	90.1 / 405.45 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	SCALA CA-2 Slant 47° Yagi
Pattern Type	Directional Azimuth

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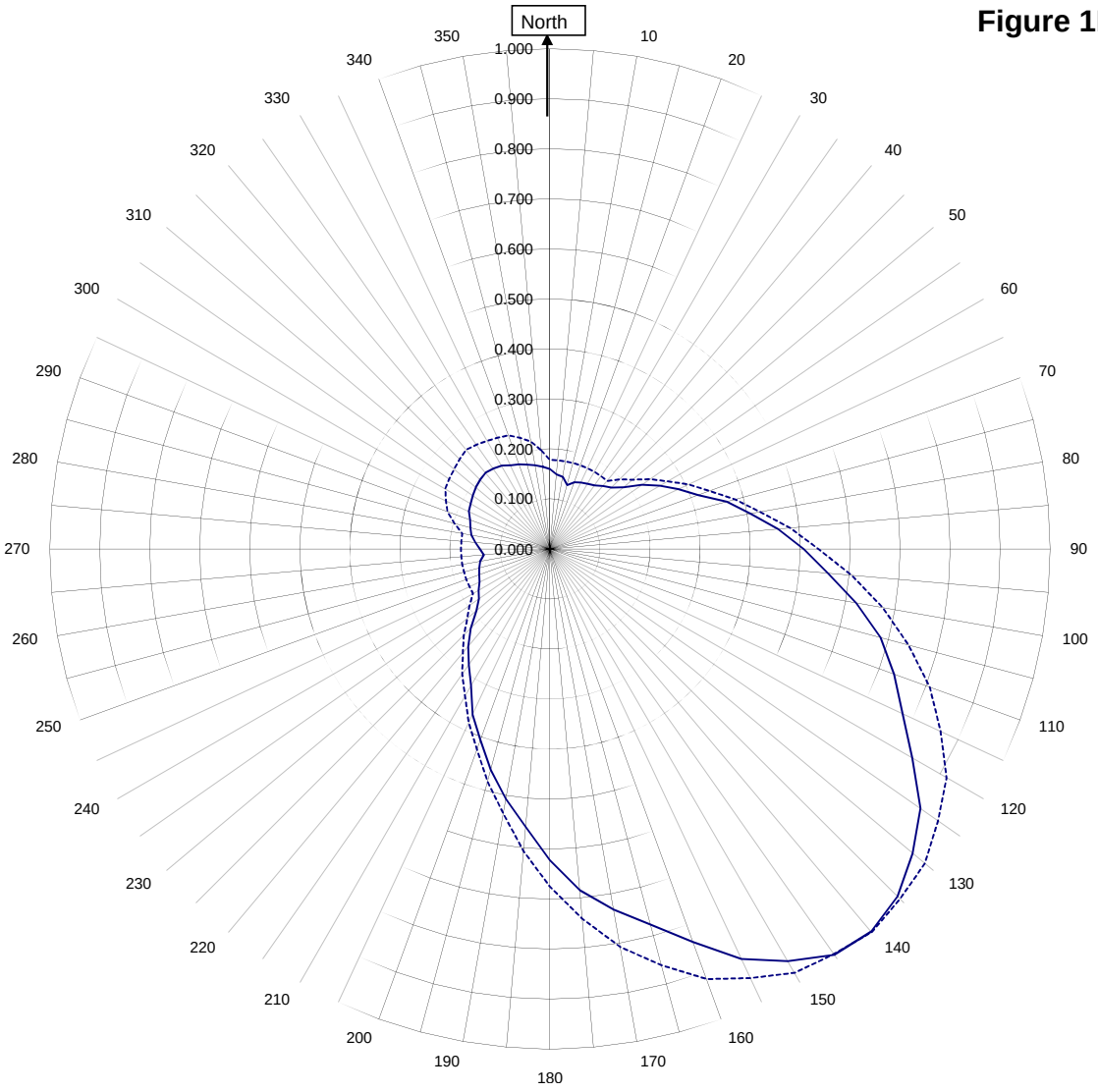
Figure 1B



WJZZ NORTH SALEM, NY.

29874

May 11, 2012

_____H/VComposite RMS	0.465
……FCC Composite RMS	0.498

Frequency	90.1 / 405.45 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	SCALA CA-2 Slant 47° Yagi
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WJZZ NORTH SALEM, NY.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.160	180	0.498
10	0.140	190	0.345
20	0.120	200	0.231
30	0.100	210	0.145
40	0.080	220	0.100
45	0.070	225	0.090
50	0.080	230	0.080
60	0.100	240	0.080
70	0.145	250	0.100
80	0.231	260	0.120
90	0.345	270	0.140
100	0.498	280	0.160
110	0.669	290	0.170
120	0.836	300	0.183
130	0.946	310	0.193
135	0.982	315	0.197
140	0.998	320	0.200
150	0.951	330	0.193
160	0.836	340	0.180
170	0.669	350	0.170
141	1.000		

Figure 1D

Tabulation of Vertical Azimuth Pattern
WJZZ NORTH SALEM, NY.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.132	180	0.622
10	0.146	190	0.508
20	0.142	200	0.407
30	0.151	210	0.316
40	0.165	220	0.254
45	0.174	225	0.224
50	0.192	230	0.192
60	0.254	240	0.165
70	0.316	250	0.151
80	0.407	260	0.142
90	0.508	270	0.129
100	0.622	280	0.128
110	0.732	290	0.110
120	0.819	300	0.154
130	0.878	310	0.165
135	0.896	315	0.165
140	0.905	320	0.154
150	0.878	330	0.110
160	0.819	340	0.123
170	0.732	350	0.126

Figure 1E

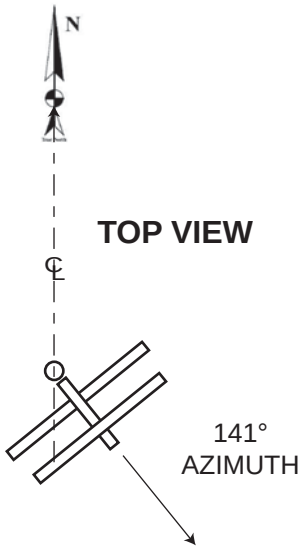
Tabulation of Composite Azimuth Pattern
WJZZ NORTH SALEM, NY.

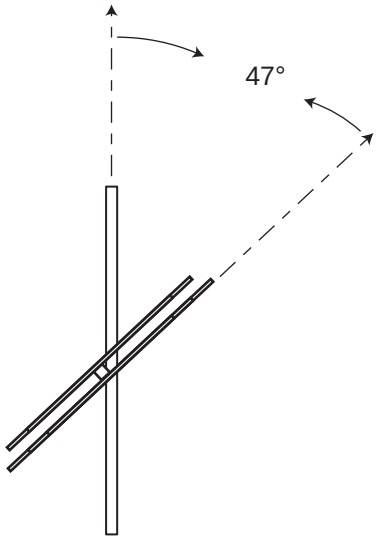
Azimuth	Rel Field	Azimuth	Rel Field
0	0.160	180	0.622
10	0.146	190	0.508
20	0.142	200	0.407
30	0.151	210	0.316
40	0.165	220	0.254
45	0.174	225	0.224
50	0.192	230	0.192
60	0.254	240	0.165
70	0.316	250	0.151
80	0.407	260	0.142
90	0.508	270	0.140
100	0.622	280	0.160
110	0.732	290	0.170
120	0.836	300	0.183
130	0.946	310	0.193
135	0.982	315	0.197
140	0.998	320	0.200
150	0.951	330	0.193
160	0.836	340	0.180
170	0.732	350	0.170

Figure 1F

Tabulation of FCC Directional Composite
WJZZ NORTH SALEM, NY.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.178	180	0.675
10	0.178	190	0.537
20	0.178	200	0.427
30	0.178	210	0.340
40	0.178	220	0.271
50	0.216	230	0.216
60	0.271	240	0.178
70	0.340	250	0.178
80	0.427	260	0.178
90	0.537	270	0.178
100	0.675	280	0.178
110	0.808	290	0.218
120	0.915	300	0.242
130	0.978	310	0.250
140	1.000	320	0.260
150	0.978	330	0.250
160	0.915	340	0.242
170	0.808	350	0.218





PARTIAL FRONT VIEW

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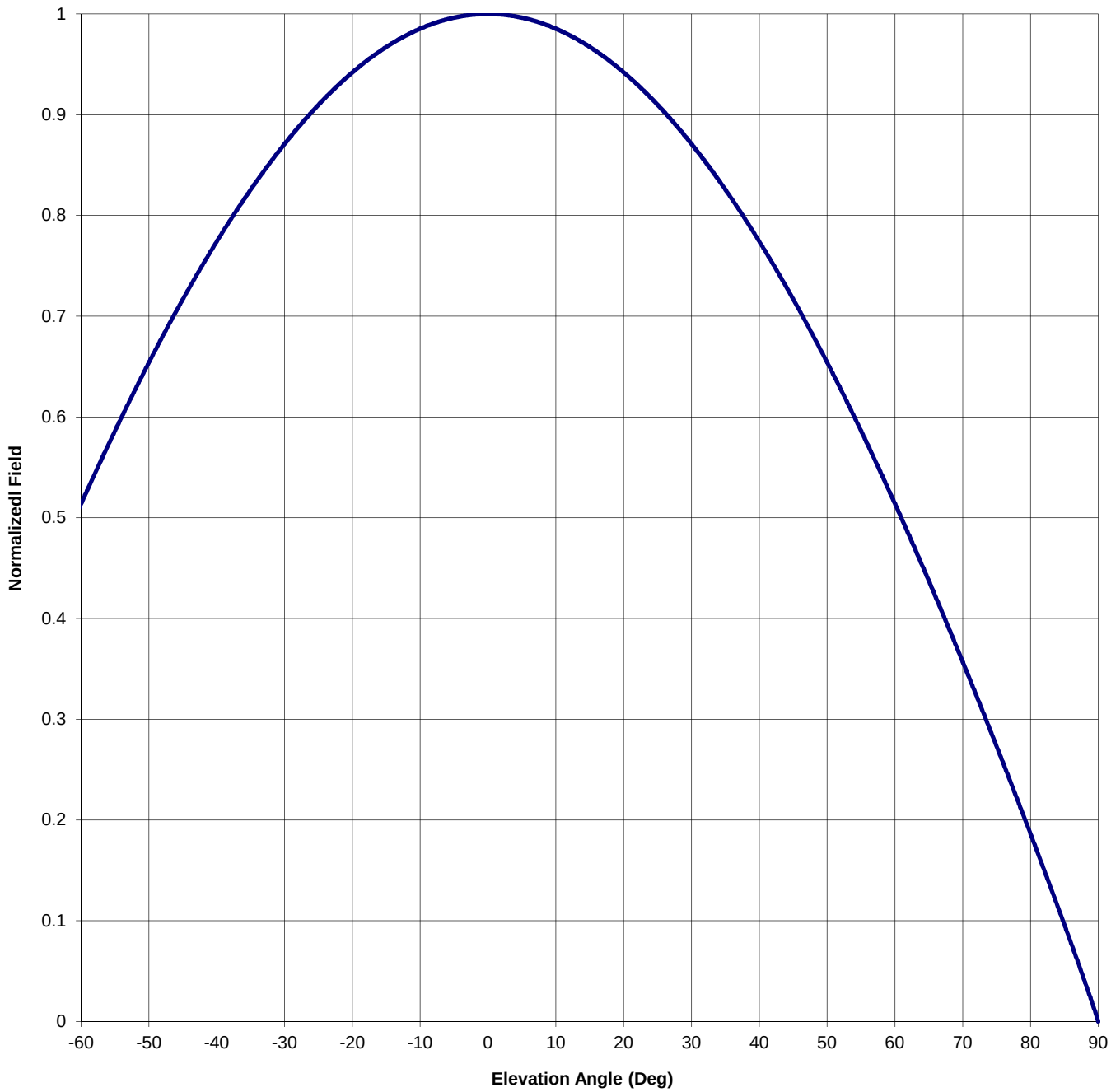
FIGURE 2
SCALA CA-2 SLANT (47°) YAGI, 90.1 MHz
WJZZ, NORTH SALEM, NY

SIZE	CODE IDENT. NO.	DRAWING NO.	REV
A	26750	AGF120511-001	—

SCALE		SHEET
NONE	S/O 29874	1 OF 1

Antenna Mfg.:	**Shively Labs**			**Date:**	**5/11/2012**
Antenna Type:	**Scala CA-2 Slant 47°Yagi**				
Station:	**WJZZ**	**Beam Tilt**	**0**		
Frequency:	**90.1**	**Gain (Max)**	**2.933**	**4.673**	**dB**
Channel #:	**211**	**Gain (Horizon)**	**2.933**	**4.673**	**dB**
Figure:	**Figure 3**				



Antenna Mfg.: Shively Labs **Date:** 5/11/2012

Antenna Type: Scala CA-2 Slant 47°Yagi

Station: WJZZ **Beam Tilt** 0

Frequency: 90.1 **Gain (Max)** 2.933 4.673 dB

Channel #: 211 **Gain (Horizon)** 2.933 4.673 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. 29874 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WJZZ NORTH SALEM, NY.

MODEL SCALA CA-2 Slant 47° Yagi

Elevation Gain of Antenna 0.55

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

H RMS 0.420808 V RMS 0.445591 H/V Ratio 0.944

Elevation Gain of Horizontal Component 0.519

Elevation Gain of Vertical Component 0.582

Horizontal Azimuth Gain equals $1/(RMS)^2$. 5.647

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 4.125

Max. Vertical 0.905

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

Total Horizontal Power Gain = **2.933**

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

Total Vertical Power Gain = **2.402**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

0.44 kW ERP Divided by H Gain 2.933 equals 0.150 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

0.150 kW Times V Gain 2.402 equals 0.360 kW V ERP

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

(0.905)^2 Times 0.44 Equals 0.360 kW Vertical ERP

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