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S.O. 29449

Report of Test Scala CL-FM Yagi

for

Horizon Christian Fellowship

WXEV 91.1 MHz Bradford, RI

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a Scala CL-FM Yagi to meet the needs of WXEV and to comply with the requirements of the FCC construction permit, file number BMPED-20111114AAA. 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-20111114AAA indicates that the Horizontal radiation component shall not exceed 0.430 kW at any azimuth and is restricted to the following values at the azimuths specified:

240 - 260 Degrees T: 0.025 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 357 Degrees T to 005 Degrees T and 138 Degrees T to 145 Degrees T. At the restricted azimuth of 240 - 260 Degrees T the Vertical component is 14.99 dB down from the maximum of 0.430 kW, or 0.014.

The R.M.S. of the Horizontal component is 0.599. The total Horizontal power gain is 1.477. The R.M.S. of the Vertical component is 0.622. The total Vertical power gain is 1.327. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.726. The R.M.S. of the measured composite pattern is 0.659. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.617. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the Scala CL-FM Yagi was mounted on an out rigged pole attached to a precise scale of the metal covered Smoke stack at the WXEV 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-20111114AAA, a single level of the Scala CL-FM Yagi 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 409.95 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 29449
November 21, 2011

Shively Labs

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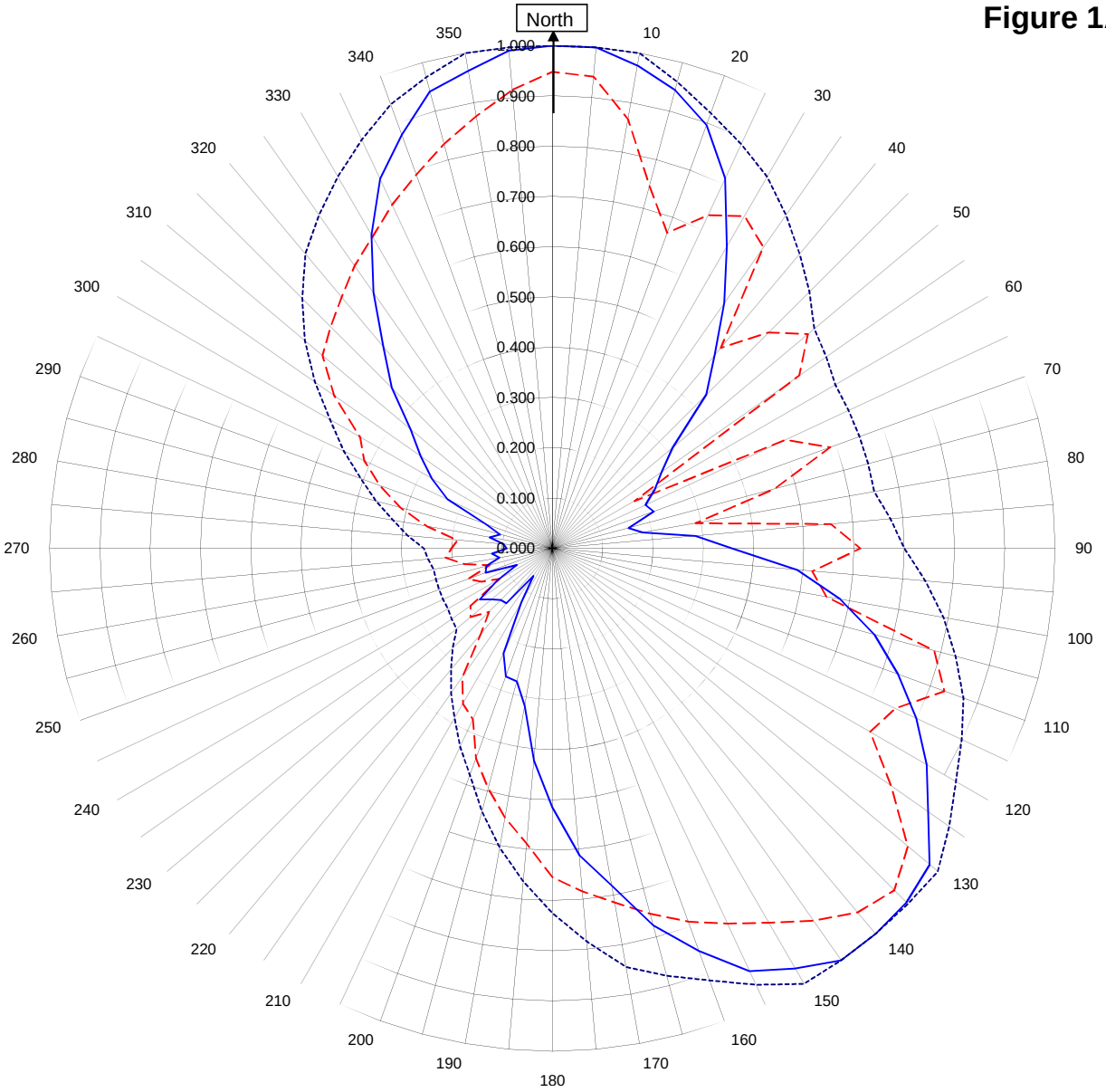
Figure 1A



WXEV BRADFORD, RI.

29449

November 21, 2011

Horizontal RMS	0.599
Vertical RMS	0.622
H/V Composite RMS	0.659
FCC Composite RMS	0.726

Frequency	91.1 / 409.95 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	SCALA CL-FM
Pattern Type	Directional Azimuth

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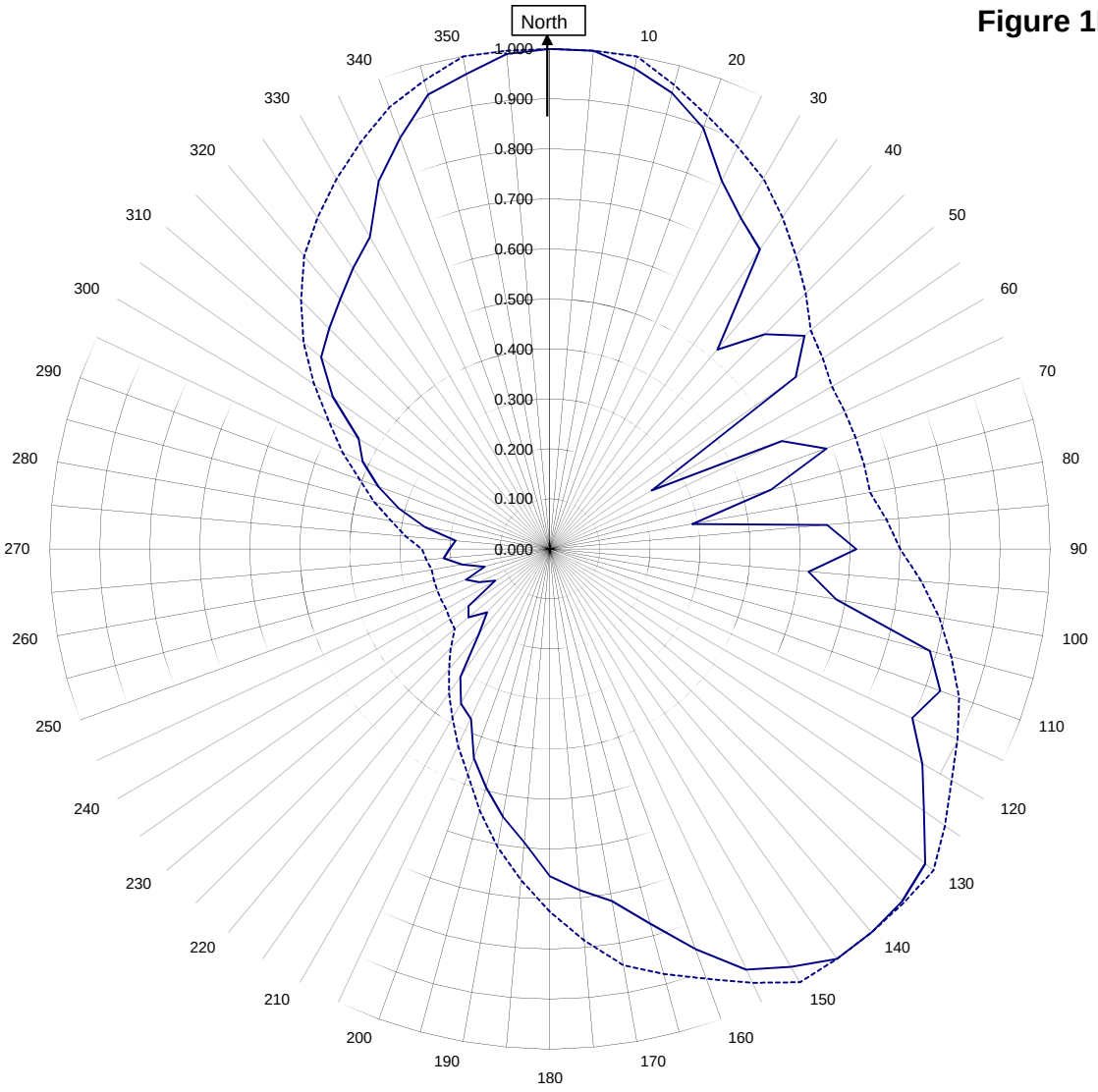
Figure 1B



WXEV BRADFORD, RI.

29449

November 21, 2011

_____H/VComposite RMS	0.659
……FCC Composite RMS	0.726

Frequency	91.1 / 409.95 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	SCALA CL-FM
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WXEV BRADFORD, RI.

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.515
10	0.975	190	0.317
20	0.896	200	0.271
30	0.693	210	0.123
40	0.502	220	0.142
45	0.433	225	0.145
50	0.312	230	0.158
60	0.235	240	0.126
70	0.214	250	0.142
80	0.182	260	0.107
90	0.357	270	0.091
100	0.581	280	0.127
110	0.731	290	0.140
120	0.860	300	0.277
130	0.979	310	0.369
135	0.996	315	0.453
140	1.000	320	0.523
150	0.965	330	0.720
160	0.852	340	0.876
170	0.681	350	0.965

Figure 1D

Tabulation of Vertical Azimuth Pattern
WXEV BRADFORD, RI.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.948	180	0.654
10	0.866	190	0.543
20	0.668	200	0.445
30	0.764	210	0.356
40	0.521	220	0.221
45	0.607	225	0.178
50	0.664	230	0.213
60	0.188	240	0.121
70	0.588	250	0.179
80	0.289	260	0.178
90	0.612	270	0.201
100	0.553	280	0.254
110	0.830	290	0.365
120	0.730	300	0.442
130	0.923	310	0.597
135	0.962	315	0.624
140	0.945	320	0.652
150	0.860	330	0.716
160	0.790	340	0.791
170	0.715	350	0.873

Figure 1E

Tabulation of Composite Azimuth Pattern
WXEV BRADFORD, RI.

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.654
10	0.975	190	0.543
20	0.896	200	0.445
30	0.764	210	0.356
40	0.521	220	0.221
45	0.607	225	0.178
50	0.664	230	0.213
60	0.235	240	0.126
70	0.588	250	0.179
80	0.289	260	0.178
90	0.612	270	0.201
100	0.581	280	0.254
110	0.830	290	0.365
120	0.860	300	0.442
130	0.979	310	0.597
135	0.996	315	0.624
140	1.000	320	0.652
150	0.965	330	0.720
160	0.852	340	0.876
170	0.715	350	0.965

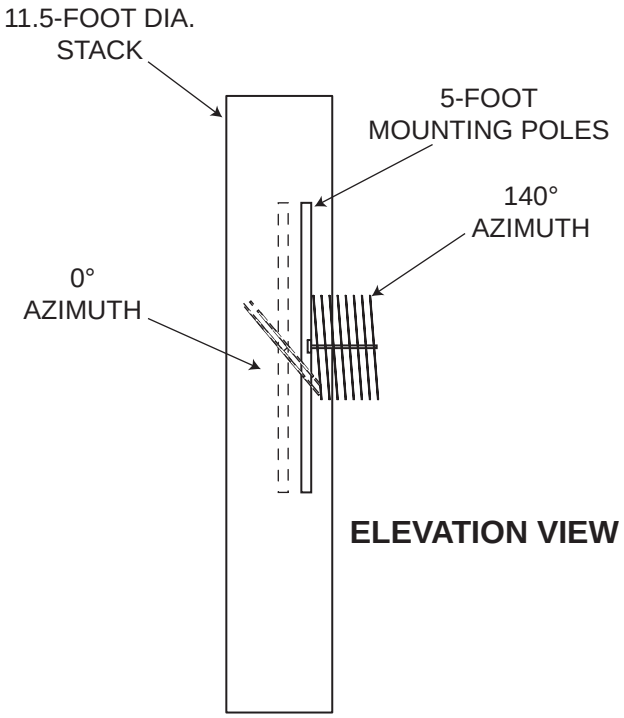
Figure 1F

Tabulation of FCC Directional Composite
WXEV BRADFORD, RI.

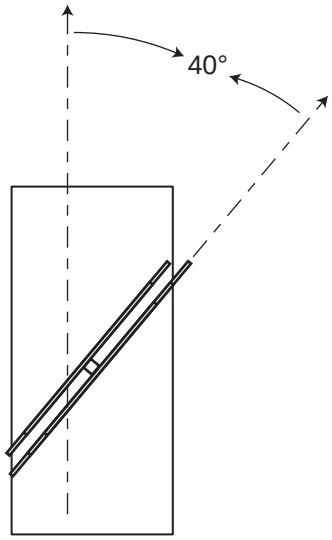
Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.725
10	1.000	190	0.604
20	0.921	200	0.480
30	0.854	210	0.390
40	0.765	220	0.314
50	0.680	230	0.249
60	0.650	240	0.240
70	0.650	250	0.240
80	0.650	260	0.240
90	0.700	270	0.256
100	0.790	280	0.322
110	0.870	290	0.405
120	0.927	300	0.510
130	1.000	310	0.643
140	1.000	320	0.765
150	1.000	330	0.854
160	0.914	340	0.940
170	0.845	350	1.000

TOP VIEW

140°
AZIMUTH



ELEVATION VIEW



PARTIAL FRONT VIEW

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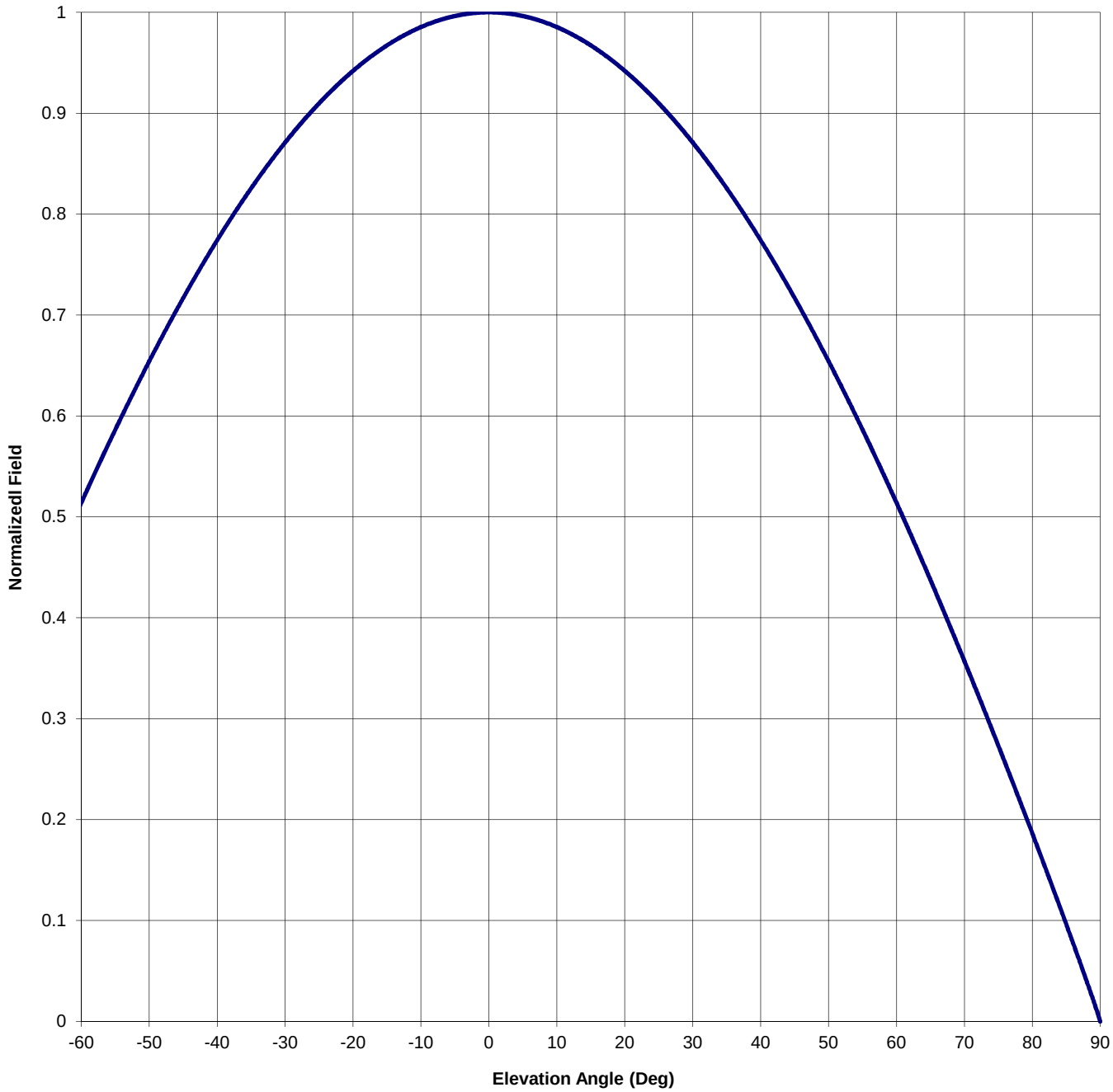
FIGURE 2, 91.1 MHz
WXEV, BRADFORD, MA
ALDENA SLANT (40°) YAGI ARRAY

SIZE	CODE IDENT. NO.	DRAWING NO.	REV
A	26750	AGF111121-001	—

SCALE		SHEET
NONE	S/O 29449	1 OF 1

Antenna Mfg.:	**Shively Labs**			**Date: 11/21/2011**
Antenna Type:	**Scala CL-FM Yagi**			
Station:	**WXEV**	**Beam Tilt**	**0**	
Frequency:	**91.1**	**Gain (Max)**	**1.477**	**1.694 dB**
Channel #:	**216**	**Gain (Horizon)**	**1.477**	**1.694 dB**
Figure:	**Figure 3**			



Antenna Mfg.: Shively Labs **Date:** 11/21/2011

Antenna Type: Scala CL-FM Yagi

Station: WXEV **Beam Tilt** 0

Frequency: 91.1 **Gain (Max)** 1.477 1.694 dB

Channel #: 216 **Gain (Horizon)** 1.477 1.694 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. 29449 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WXEV BRADFORD, RI.

MODEL SCALA CL-FM

Elevation Gain of Antenna 0.55

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

H RMS 0.59876 V RMS 0.6219 H/V Ratio 0.963

Elevation Gain of Horizontal Component 0.530

Elevation Gain of Vertical Component 0.571

Horizontal Azimuth Gain equals $1/(RMS)^2$. 2.789

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 2.324

Max. Vertical 0.948

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

Total Horizontal Power Gain = **1.477**

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

Total Vertical Power Gain = **1.327**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

0.430 kW ERP Divided by H Gain 1.477 equals 0.291 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

0.291 kW Times V Gain 1.327 equals 0.386 kW V ERP

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

(0.948)^2 Times 0.43 Equals 0.386 kW Vertical ERP

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