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S.O. 30134

Report of Test Aldena ALP.08.02.712 Slant Array

for

Religious Information Network

WAJC 88.1 MHz Newport, MN

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a ALP.08.02.712 Slant Array to meet the needs of WAJC and to comply with the requirements of the FCC construction permit, file number BMPED-20120531AGW. 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-20120531AGW indicates that the Horizontal radiation component shall not exceed 5.5 kW at any azimuth and is restricted to the following values at the azimuths specified:

200 - 229 Degrees T: 0.255 kW

From Figure 1A, the maximum radiation of the Horizontal component occurs at 329 Degrees T to 331 Degrees T. At the restricted azimuth of 200 – 220 Degrees T the Vertical component is 17.329 dB down from the maximum of 5.5 kW, or 0.102 kW

The R.M.S. of the Horizontal component is 0.409. The total Horizontal power gain is 5.043. The R.M.S. of the Vertical component is 0.472. The total Vertical power gain is 4.157. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.567. The R.M.S. of the measured composite pattern is 0.485. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.482. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the ALP.08.02.712 Slant Array was mounted on a Utility Pole of precise scale to the Utility pole at the WAJC site. The spacing of the antenna to the Utility pole 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-20120531AGW, a single level of the ALP.08.02.712 Slant Array 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 396.45 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 30134
March 21, 2013

Shively Labs

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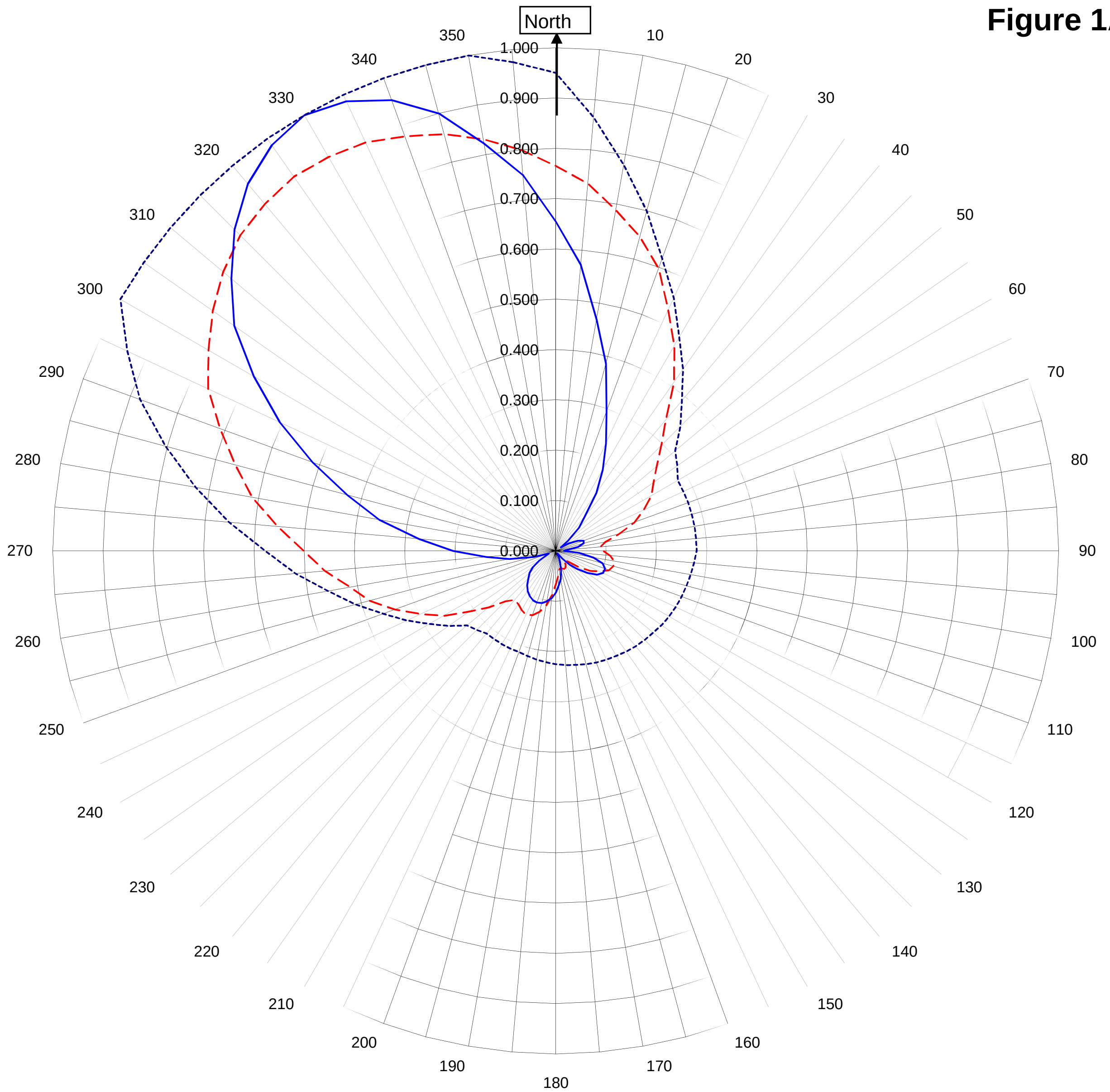
Figure 1A



WAJC NEWPORT, MN.

30134

August 9, 2012

___________Horizontal RMS	0.409
_ _ _ _ _ _ _ _ _ Vertical RMS	0.472
H/V Composite RMS	0.485
……………FCC Composite RMS	0.567

Frequency	88.1 / 396.45 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	Aldina ALP.08.02.712
Pattern Type	Directional Azimuth

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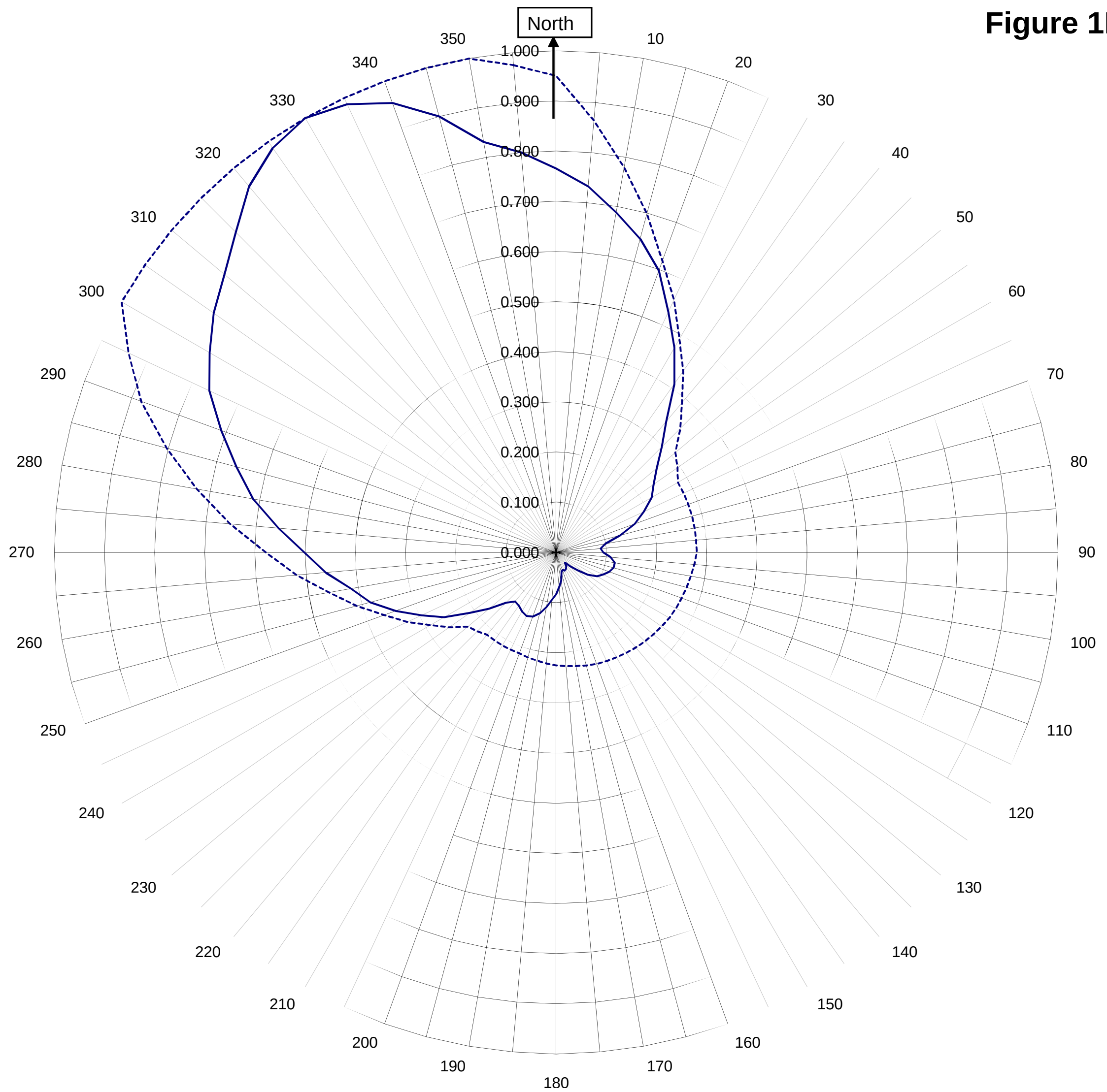
Figure 1B



WAJC NEWPORT, MN.

30134

August 9, 2012

___________H/VComposite RMS	0.485
……………FCC Composite RMS	0.567

Frequency	88.1 / 396.45 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	Aldina ALP.08.02.712
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WAJC NEWPORT, MN.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.655	180	0.083
10	0.466	190	0.102
20	0.294	200	0.109
30	0.187	210	0.104
40	0.090	220	0.089
45	0.065	225	0.078
50	0.032	230	0.069
60	0.030	240	0.039
70	0.059	250	0.015
80	0.046	260	0.094
90	0.016	270	0.205
100	0.076	280	0.356
110	0.105	290	0.515
120	0.094	300	0.693
130	0.055	310	0.842
135	0.039	315	0.903
140	0.020	320	0.953
150	0.007	330	1.000
160	0.026	340	0.953
170	0.057	350	0.822

Figure 1D

Tabulation of Vertical Azimuth Pattern
WAJC NEWPORT, MN.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.765	180	0.066
10	0.688	190	0.110
20	0.597	200	0.136
30	0.471	210	0.136
40	0.341	220	0.127
45	0.297	225	0.142
50	0.261	230	0.175
60	0.220	240	0.258
70	0.166	250	0.341
80	0.099	260	0.415
90	0.094	270	0.501
100	0.118	280	0.613
110	0.112	290	0.710
120	0.079	300	0.798
130	0.035	310	0.863
135	0.024	315	0.887
140	0.027	320	0.900
150	0.038	330	0.904
160	0.037	340	0.877
170	0.038	350	0.831

Figure 1E

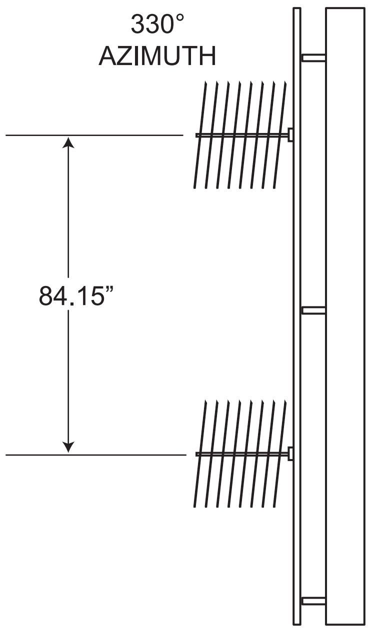
Tabulation of Composite Azimuth Pattern
WAJC NEWPORT, MN.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.765	180	0.083
10	0.688	190	0.110
20	0.597	200	0.136
30	0.471	210	0.136
40	0.341	220	0.127
45	0.297	225	0.142
50	0.261	230	0.175
60	0.220	240	0.258
70	0.166	250	0.341
80	0.099	260	0.415
90	0.094	270	0.501
100	0.118	280	0.613
110	0.112	290	0.710
120	0.094	300	0.798
130	0.055	310	0.863
135	0.039	315	0.903
140	0.027	320	0.953
150	0.038	330	1.000
160	0.037	340	0.953
170	0.057	350	0.831

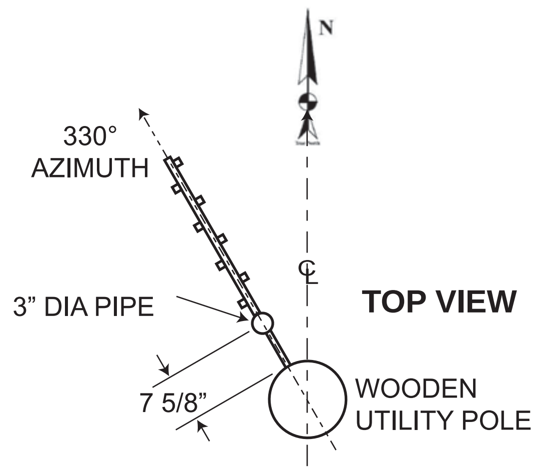
Figure 1F

Tabulation of FCC Directional Composite
WAJC NEWPORT, MN.

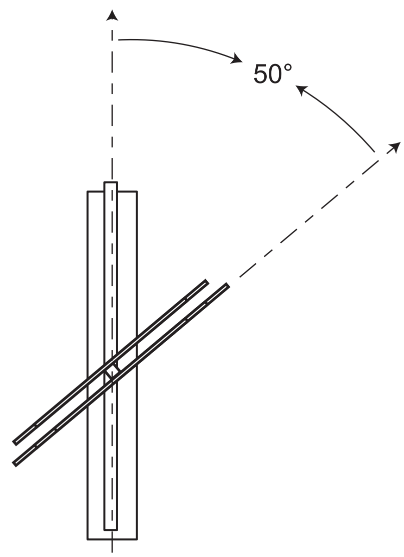
Azimuth	Rel Field	Azimuth	Rel Field
0	0.950	180	0.225
10	0.779	190	0.219
20	0.619	200	0.214
30	0.491	210	0.214
40	0.390	220	0.214
50	0.310	230	0.230
60	0.280	240	0.290
70	0.280	250	0.365
80	0.280	260	0.459
90	0.280	270	0.578
100	0.272	280	0.727
110	0.266	290	0.880
120	0.260	300	1.000
130	0.253	310	1.000
140	0.247	320	1.000
150	0.241	330	1.000
160	0.236	340	1.000
170	0.230	350	1.000



ELEVATION VIEW



TOP VIEW



PARTIAL FRONT VIEW

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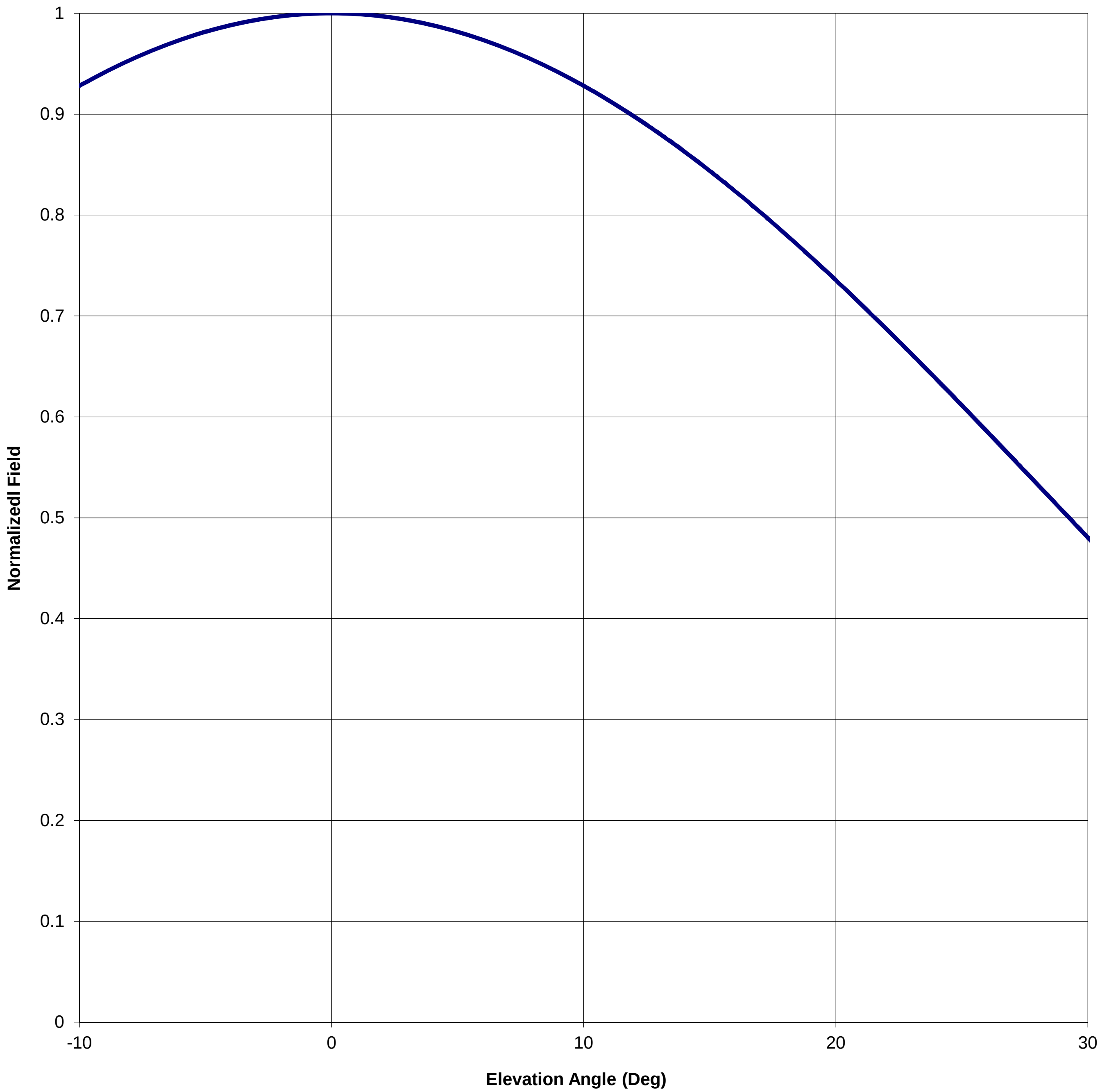
FIGURE 2, 88.1 MHz
WAJC
ALDENA SLANT (50°) ARRAY

SIZE	CODE IDENT. NO.	DRAWING NO.	REV
A	26750	AGF120808-001	—

SCALE			SHEET
NONE	S/O 30134		1 OF 1

Antenna Mfg.:	**Shively Labs**			**Date:**	**3/21/2013**
Antenna Type:	**Aldena ALP.80.02.712**				
Station:	**WAJC**	**Beam Tilt**	**0**		
Frequency:	**88.1**	**Gain (Max)**	**5.043**	**7.027**	**dB**
Channel #:	**201**	**Gain (Horizon)**	**5.043**	**7.027**	**dB**
Figure:	**Figure 3**				



Antenna Mfg.: **Shively Labs** **Date:** **3/21/2013**
Antenna Type: **Aldena ALP.80.02.712**
Station: **WAJC** **Beam Tilt** **0**
Frequency: **88.1** **Gain (Max)** **5.043** **7.027 dB**
Channel #: **201** **Gain (Horizon)** **5.043** **7.027 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	0.145	0	1.000	46	0.106
-89	0.008	-43	0.165	1	0.999	47	0.088
-88	0.016	-42	0.186	2	0.997	48	0.071
-87	0.023	-41	0.208	3	0.993	49	0.054
-86	0.030	-40	0.231	4	0.988	50	0.039
-85	0.037	-39	0.254	5	0.982	51	0.024
-84	0.044	-38	0.277	6	0.974	52	0.010
-83	0.050	-37	0.301	7	0.964	53	0.003
-82	0.056	-36	0.326	8	0.954	54	0.015
-81	0.062	-35	0.351	9	0.941	55	0.027
-80	0.068	-34	0.376	10	0.928	56	0.037
-79	0.073	-33	0.402	11	0.914	57	0.047
-78	0.078	-32	0.428	12	0.898	58	0.056
-77	0.082	-31	0.454	13	0.881	59	0.064
-76	0.086	-30	0.480	14	0.863	60	0.071
-75	0.090	-29	0.507	15	0.844	61	0.077
-74	0.093	-28	0.533	16	0.824	62	0.083
-73	0.096	-27	0.559	17	0.803	63	0.087
-72	0.098	-26	0.585	18	0.781	64	0.091
-71	0.099	-25	0.611	19	0.759	65	0.094
-70	0.100	-24	0.637	20	0.736	66	0.097
-69	0.100	-23	0.662	21	0.712	67	0.099
-68	0.100	-22	0.687	22	0.687	68	0.100
-67	0.099	-21	0.712	23	0.662	69	0.100
-66	0.097	-20	0.736	24	0.637	70	0.100
-65	0.094	-19	0.759	25	0.611	71	0.099
-64	0.091	-18	0.781	26	0.585	72	0.098
-63	0.087	-17	0.803	27	0.559	73	0.096
-62	0.083	-16	0.824	28	0.533	74	0.093
-61	0.077	-15	0.844	29	0.507	75	0.090
-60	0.071	-14	0.863	30	0.480	76	0.086
-59	0.064	-13	0.881	31	0.454	77	0.082
-58	0.056	-12	0.898	32	0.428	78	0.078
-57	0.047	-11	0.914	33	0.402	79	0.073
-56	0.037	-10	0.928	34	0.376	80	0.068
-55	0.027	-9	0.941	35	0.351	81	0.062
-54	0.015	-8	0.954	36	0.326	82	0.056
-53	0.003	-7	0.964	37	0.301	83	0.050
-52	0.010	-6	0.974	38	0.277	84	0.044
-51	0.024	-5	0.982	39	0.254	85	0.037
-50	0.039	-4	0.988	40	0.231	86	0.030
-49	0.054	-3	0.993	41	0.208	87	0.023
-48	0.071	-2	0.997	42	0.186	88	0.016
-47	0.088	-1	0.999	43	0.165	89	0.008
-46	0.106	0	1.000	44	0.145	90	0.000
-45	0.125			45	0.125		

S.O. 30134 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WAJC NEWPORT, MN.

MODEL Aldina ALP.08.02.712

Elevation Gain of Antenna 0.973

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

H RMS 0.408725 V RMS 0.472093 H/V Ratio 0.866

Elevation Gain of Horizontal Component 0.842

Elevation Gain of Vertical Component 1.124

Horizontal Azimuth Gain equals $1/(RMS)^2$. 5.986

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 3.699

Max. Vertical 0.908

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

Total Horizontal Power Gain = **5.043**

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

Total Vertical Power Gain = **4.157**

==

ERP divided by Horizontal Power Gain equals Antenna Input Power

5.5 kW ERP Divided by H Gain 5.043 equals 1.091 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

1.091 kW Times V Gain 4.157 equals 4.535 kW V ERP

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

(0.908)^2 Times 5.50 Equals 4.535 kW Vertical ERP

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