Shively Labs
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S.O. 31320

Report of Test 60251-1/1-Slant (45°)-DA

for

WPRR, Inc.

WXPZ 90.1 MHz Clyde Township, MI

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 60251-1/1-Slant (45°)-DA to meet the needs of WXPZ and to comply with the requirements of the FCC construction permit, file number BPED-20131115AFU. 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 BPED-20131115AFU indicates that the Horizontal radiation component shall not exceed 5.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

320 Degrees True: 0.29 kilowatt

From Figure 1A, the maximum radiation of the Horizontal component occurs at 205 Degrees True. At the restricted azimuth of 320 Degrees True the Vertical component is 14.471 dB down from the maximum of 5.0 kW, or 0.179 kW.

The R.M.S. of the Horizontal component is 0.472. The total Horizontal power gain is 2.455. The R.M.S. of the Vertical component is 0.474. The total Vertical power gain is 1.571. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.608. The R.M.S. of the measured composite pattern is 0.525. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.517. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:
One bay of the 60251-1/1-Slant (45°)-DA was mounted on a Pole of precise scale to the 18" Pole at the WXPZ 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 BPED-20131115AFU, a single level of the 60251-1/1-Slant (45°)-DA 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 31320
June 5, 2014

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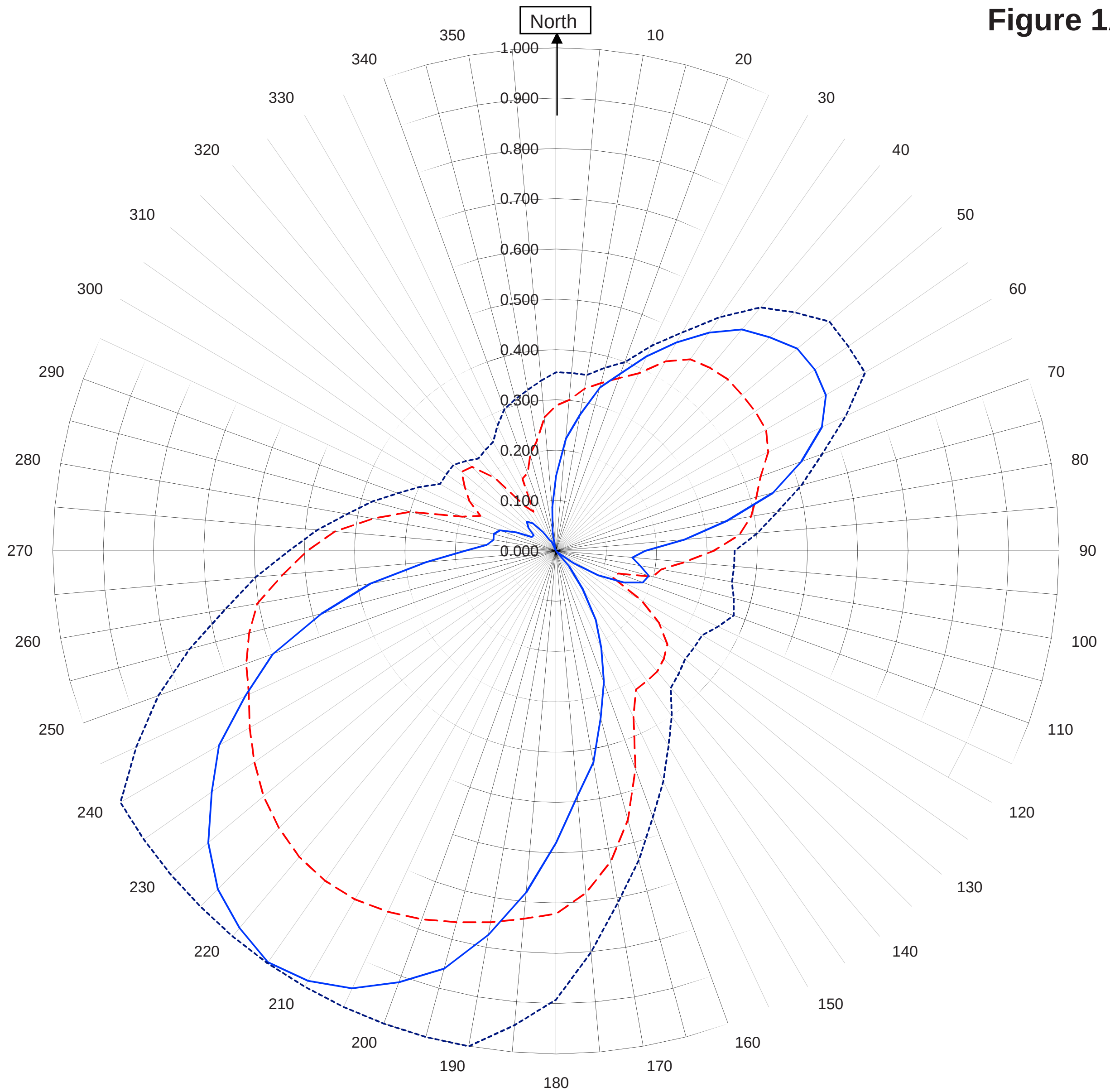
Figure 1A



WXPZ **CLYDE TOWNSHIP, MI**

31320

June 5, 2014

Horizontal RMS	0.472
Vertical RMS	0.474
H/V Composite RMS	0.525
……………FCC Composite RMS	0.608

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

Antenna Model	6025-1-1/1-Slant (45°)-DA
Pattern Type	Directional Azimuth

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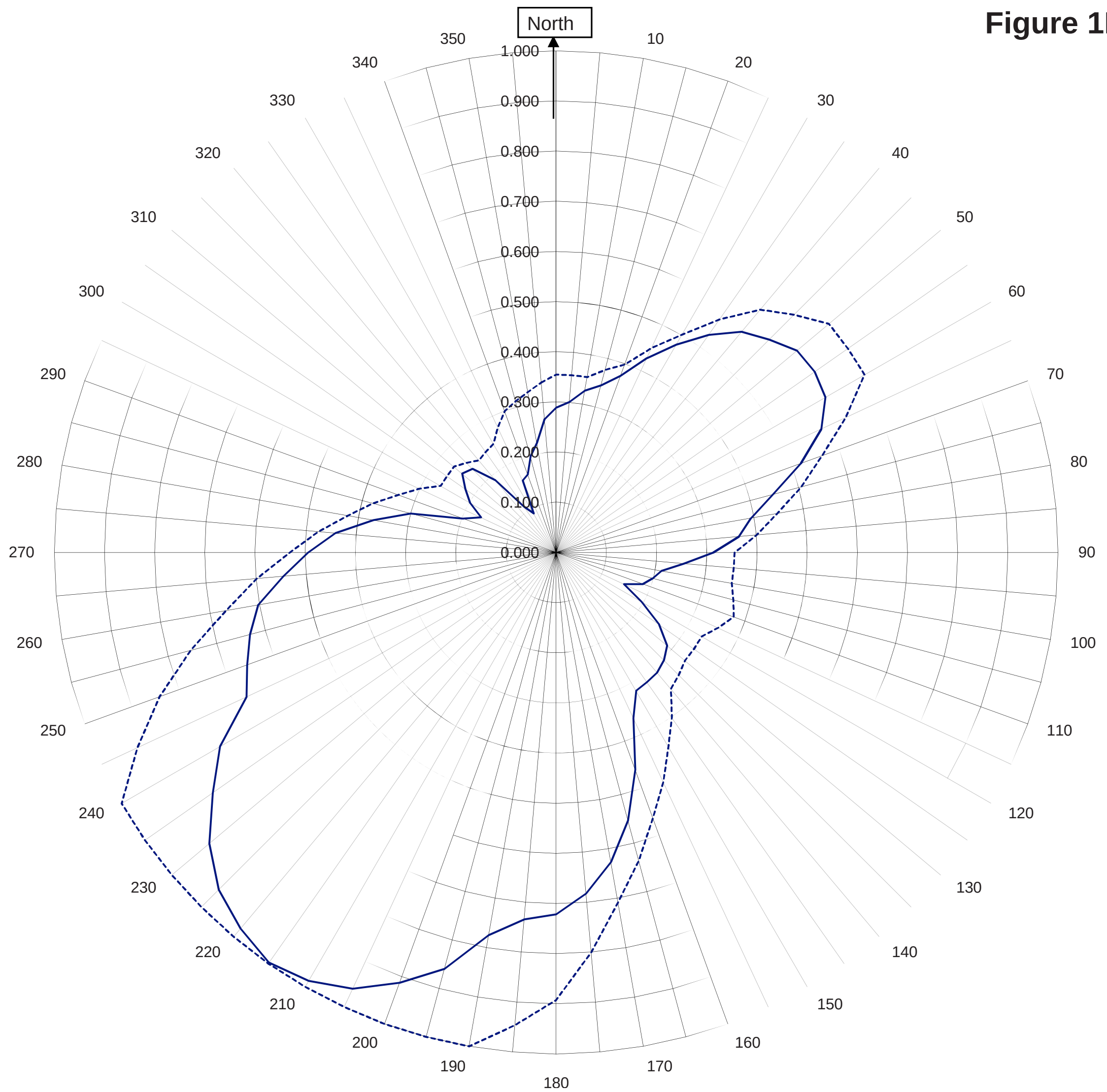
Figure 1B



WXPZ CLYDE TOWNSHIP,

31320

June 5, 2014

___________H/VComposite RMS	0.525
……………FCC Composite RMS	0.608

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

Antenna Model	6025-1-1/1-Slant (45°)-DA
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WXPZ CLYDE TOWNSHIP, MI

Azimuth	Rel Field	Azimuth	Rel Field
0	0.149	180	0.580
10	0.275	190	0.774
20	0.375	200	0.912
30	0.479	210	0.986
40	0.575	220	0.978
45	0.601	225	0.951
50	0.626	230	0.902
60	0.619	240	0.774
70	0.518	250	0.599
80	0.345	260	0.375
90	0.177	270	0.182
100	0.170	280	0.126
110	0.183	290	0.119
120	0.097	300	0.056
130	0.008	310	0.071
135	0.001	315	0.082
140	0.040	320	0.072
150	0.158	330	0.023
160	0.277	340	0.002
170	0.427	350	0.039
		205	1.000

Figure 1D

Tabulation of Vertical Azimuth Pattern
WXPZ CLYDE TOWNSHIP, MI

Azimuth	Rel Field	Azimuth	Rel Field
0	0.289	180	0.721
10	0.328	190	0.749
20	0.366	200	0.779
30	0.435	210	0.800
40	0.475	220	0.794
45	0.482	225	0.779
50	0.483	230	0.759
60	0.482	240	0.703
70	0.433	250	0.656
80	0.394	260	0.603
90	0.313	270	0.495
100	0.213	280	0.370
110	0.132	290	0.198
120	0.197	300	0.199
130	0.289	310	0.245
135	0.303	315	0.236
140	0.313	320	0.189
150	0.318	330	0.090
160	0.461	340	0.165
170	0.626	350	0.222

Figure 1E

Tabulation of Composite Azimuth Pattern
WXPZ CLYDE TOWNSHIP, MI

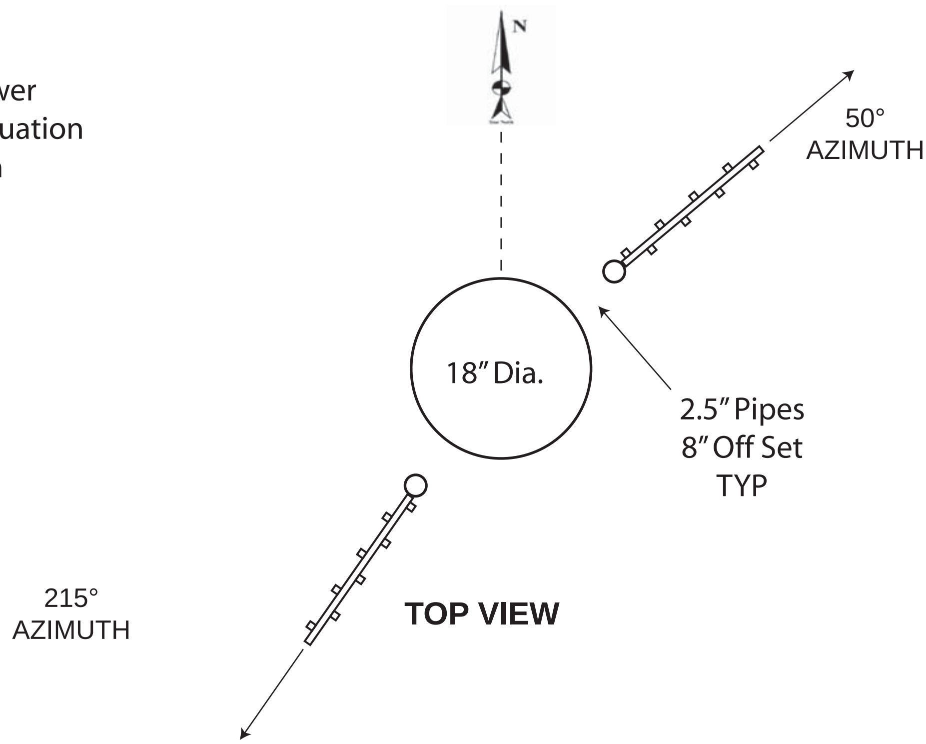
Azimuth	Rel Field	Azimuth	Rel Field
0	0.289	180	0.721
10	0.328	190	0.774
20	0.375	200	0.912
30	0.479	210	0.986
40	0.575	220	0.978
45	0.601	225	0.951
50	0.626	230	0.902
60	0.619	240	0.774
70	0.518	250	0.656
80	0.394	260	0.603
90	0.313	270	0.495
100	0.213	280	0.370
110	0.183	290	0.198
120	0.197	300	0.199
130	0.289	310	0.245
135	0.303	315	0.236
140	0.313	320	0.189
150	0.318	330	0.090
160	0.461	340	0.165
170	0.626	350	0.222

Figure 1F

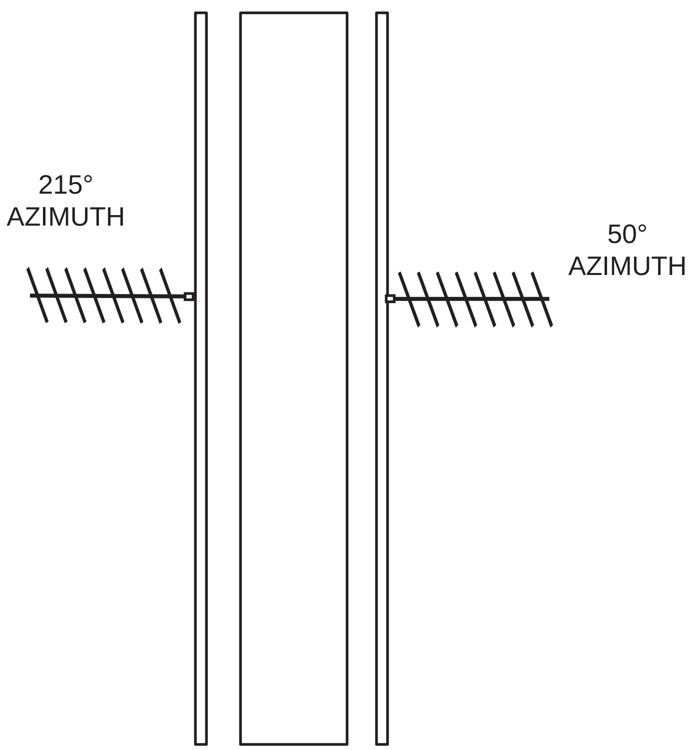
Tabulation of FCC Directional Composite
WXPZ CLYDE TOWNSHIP, MI

Azimuth	Rel Field	Azimuth	Rel Field
0	0.355	180	0.892
10	0.355	190	1.000
20	0.399	200	1.000
30	0.502	210	1.000
40	0.632	220	1.000
50	0.709	230	1.000
60	0.709	240	1.000
70	0.563	250	0.841
80	0.447	260	0.668
90	0.355	270	0.531
100	0.355	280	0.422
110	0.376	290	0.335
120	0.335	300	0.266
130	0.335	310	0.266
140	0.355	320	0.240
150	0.447	330	0.250
160	0.563	340	0.300
170	0.709	350	0.325

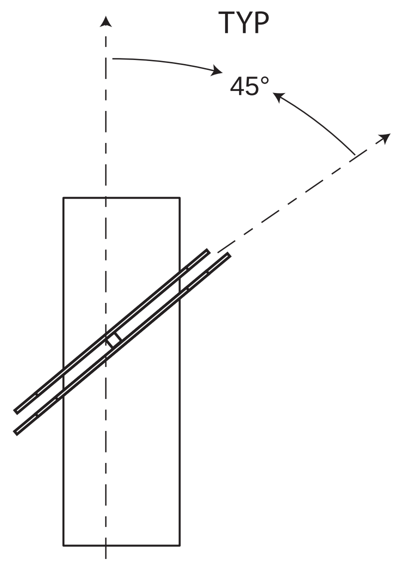
Feed System
215° Antenna Full Power
50° Antenna 4.5 dB Attenuation
Equal Phase to both



TOP VIEW



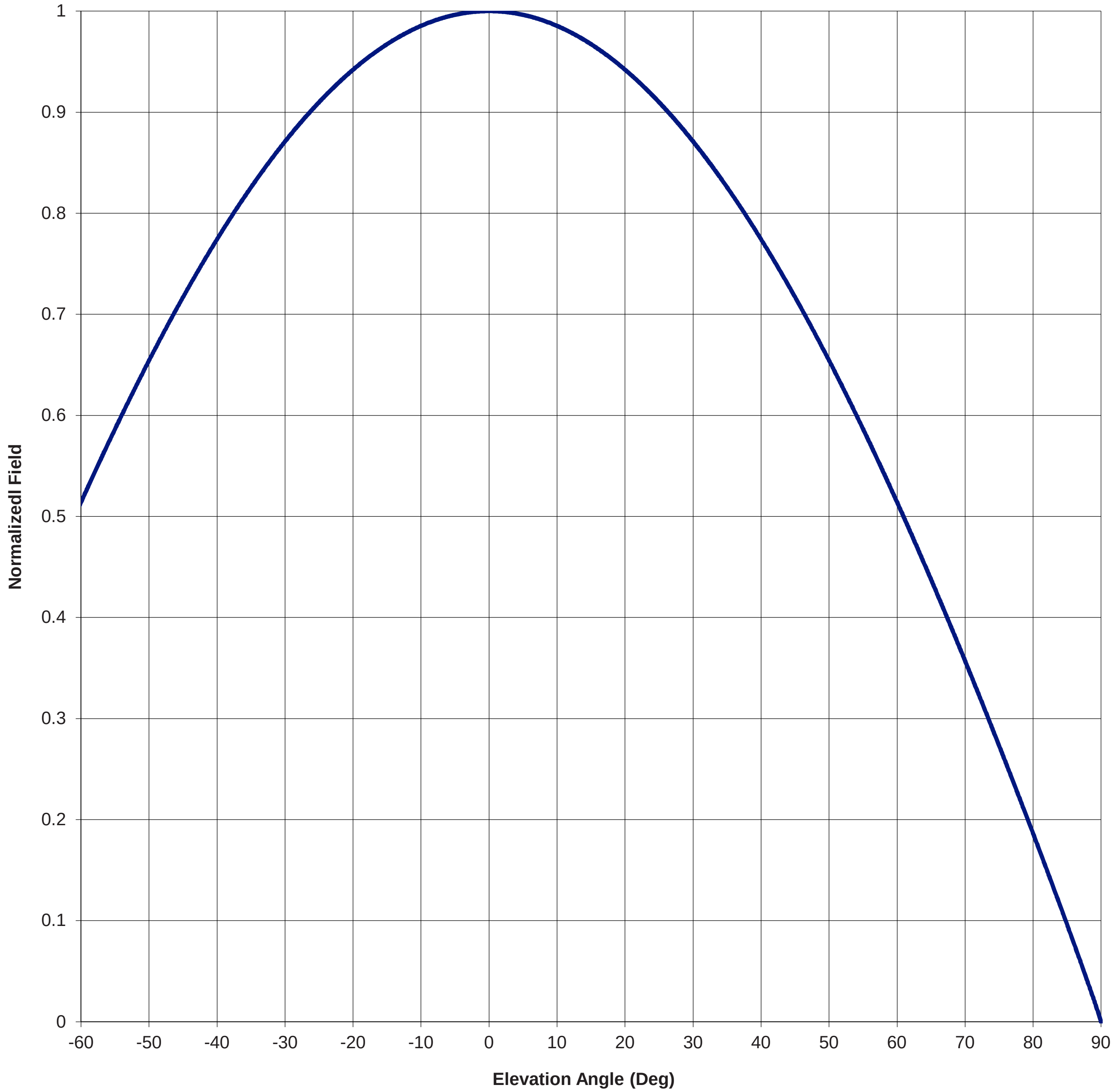
ELEVATION VIEW



PARTIAL FRONT VIEW

SHIVELY LABS			
DIV. HOWELL LABS		BRIDGTON, MAINE USA	
FIGURE 2, 90.1 MHz WXPZ Clyde Township, MI 6025-1-1/1-Slant 45°-DA			
SIZE A	CODE IDENT. NO. 26750	DRAWING NO. RAS0652014	REV A
SCALE NONE	S/O 31320	SHEET 1 OF 1	

Antenna Mfg.:	Shively Labs				Date: 6/5/2014
Antenna Type:	6025-1-1/1-Slant (45°)-DA				
Station:	WXPZ	Beam Tilt	0		
Frequency:	90.1	Gain (Max)	2.455	3.900 dB	
Channel #:	211	Gain (Horizon)	2.455	3.900 dB	
Figure:	Figure 3				



Antenna Mfg.:	**Shively Labs**			**Date:**	**6/5/2014**
Antenna Type:	**6025-1-1/1-Slant (45°)-DA**				
Station:	**WXPZ**	**Beam Tilt**	**0**		
Frequency:	**90.1**	**Gain (Max)**	**2.455**	**3.900**	**dB**
Channel #:	**211**	**Gain (Horizon)**	**2.455**	**3.900**	**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. 31320 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WXPZ CLYDE TOWNSHIP, MI

MODEL 6025-1-1/1-Slant (45°)-DA

Elevation Gain of Antenna 0.55

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

H RMS 0.47242 V RMS 0.474143 H/V Ratio 0.996

Elevation Gain of Horizontal Component 0.548

Elevation Gain of Vertical Component 0.552

Horizontal Azimuth Gain equals $1/(RMS)^2$. 4.481

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 2.847
Max. Vertical 0.8

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

Total Horizontal Power Gain = **2.455**

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

Total Vertical Power Gain = **1.571**

===

ERP divided by Horizontal Power Gain equals Antenna Input Power

5.0 kW ERP Divided by H Gain 2.455 equals 2.036 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

2.036 kW Times V Gain 1.571 equals 3.200 kW V ERP

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

(0.8)^2 Times 5.00 Equals 3.200 kW Vertical ERP

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