

S.O. 32831
Report of Test 6513-4-SS(0.5)-DA
for
Lehigh Valley Community Broadcasters Association
WDIY 88.1 MHz Allentown, PA.

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6513-4-SS(0.5)-DA to meet the needs of WDIY and to comply with the requirements of the FCC construction permit, file number BPED-20140428ABW. 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 – N/A
- 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-20140428ABW indicates that the Vertical radiation component shall not exceed .300 kW at any azimuth and is restricted to the following values at the azimuths specified:

55 Degrees True: 0.190 kilowatts

205 Degrees True: 0.046 kilowatts

From Figure 1A, the maximum radiation of the Vertical component occurs at 332 Degrees True to 338 Degrees True. At the restricted azimuth of 55 Degrees True the Vertical component is 2.58 dB down from the maximum of 0.300 kW, or 0.166 kW and at the restricted azimuth of 205 Degrees True the Vertical component is 8.95 dB down from the maximum of 0.300 kW, or 0.038 kW.

The R.M.S. of the Vertical component is 0.714. The total Vertical power gain is 5.142. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.835. The R.M.S. of the measured composite pattern is 0.714. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.709. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6513-4-SS(0.5)-DA was mounted on a tower of precise scale to the 8-ft face tower at the WDIY site. The spacing of the antenna to the tower was varied to achieve the vertical pattern shown in Figure 1A. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BPED-20140428ABW, a single level of the 6513-4-SS(0.5)-DA was set up on the Shively Labs scale model antenna pattern measuring range. A scale of 4.5:1 was used.

EQUIPMENT:

The 4.5:1 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 dish 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 4395-A Network Analyzer

PC Based Controller

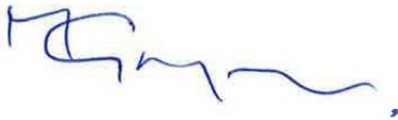
Output Standard Printer or 'pdf'

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:

A handwritten signature in blue ink, appearing to read 'Martyn Gregory', with a stylized, flowing script.

Martyn Gregory

Vice President, Shively Labs

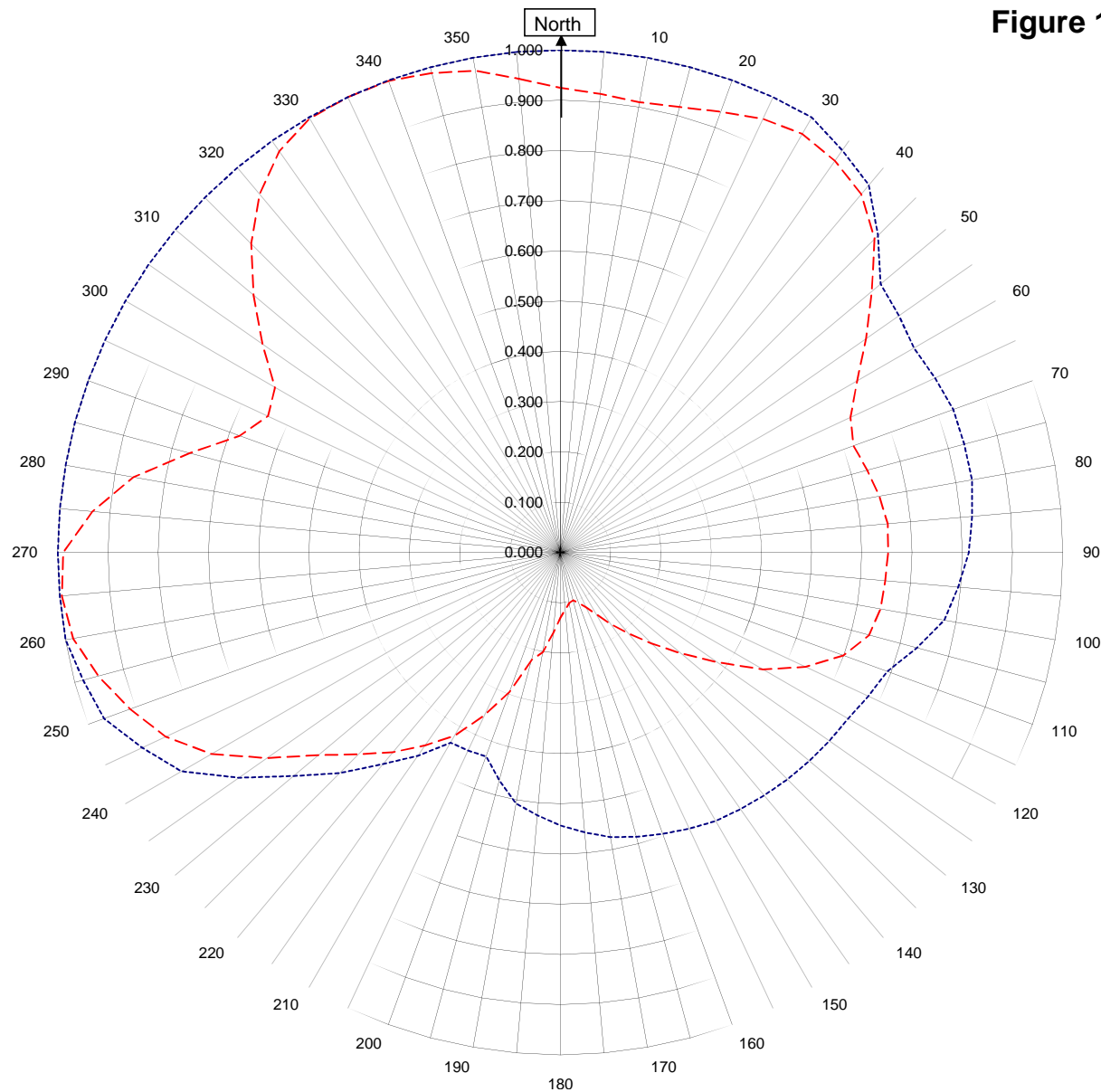
S/O: 32831

Date: August 25, 2015

Shively Labs

Shively Labs, a division of Howell Laboratories, Inc. Bridgton, ME (207)647-3327

Figure 1A



WDIY ALLENTOWN, PA.
32831
August 25, 2015

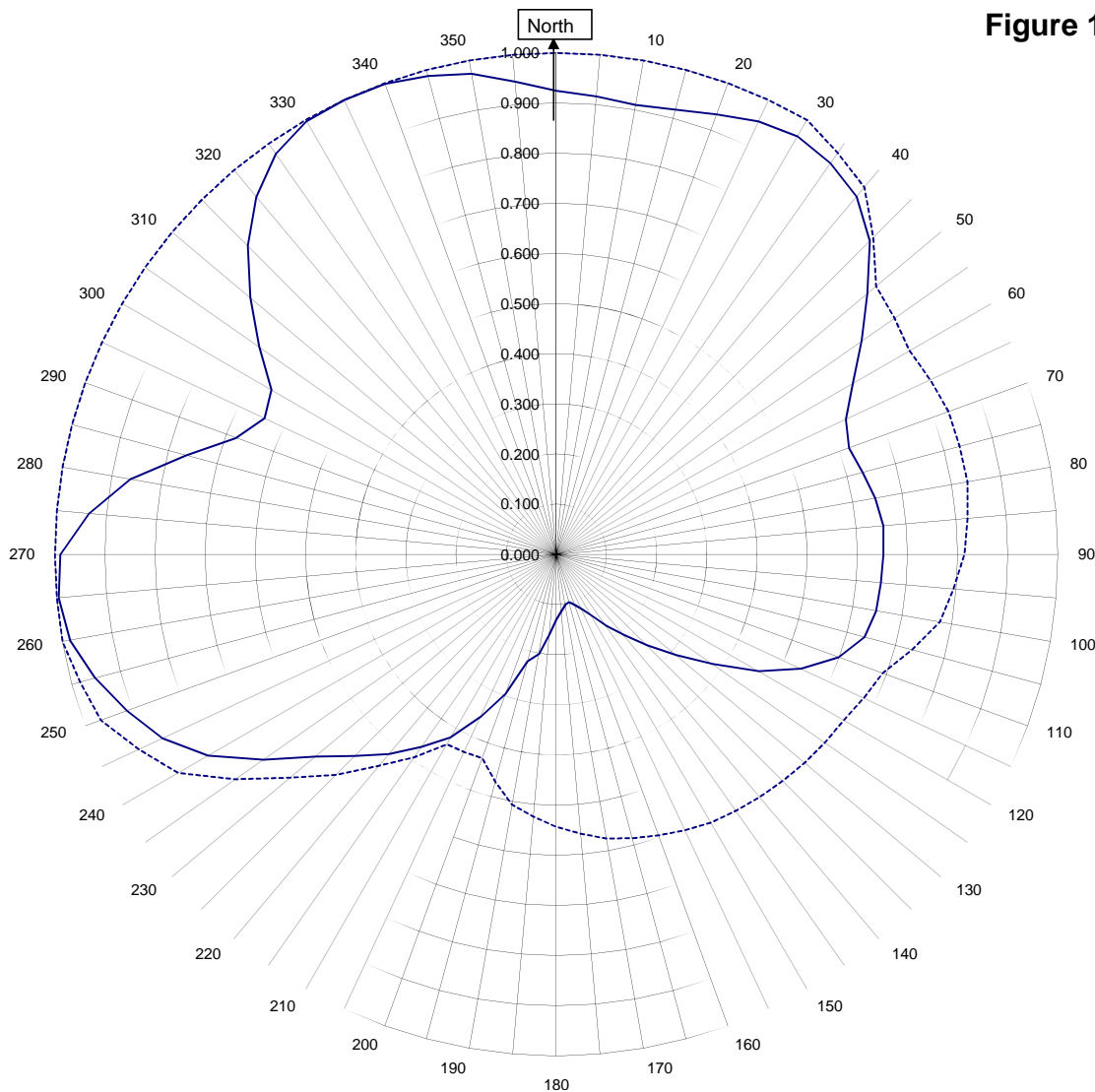
Horizontal RMS	0.000	Frequency	88.1 / 396.45 mHz
Vertical RMS	0.714	Plot	Relative Field
H/V Composite RMS	0.714	Scale	4.5 : 1
FCC Composite RMS	0.835	See Figure 2 for Mechanical Details	

Antenna Model	6513-4-SS-DA
Pattern Type	Directional Azimuth

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Figure 1B



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32831
August 25, 2015

—————H/V Composite RMS	0.714
.....FCC Composite RMS	0.835

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

Antenna Model	6513-4-SS-DA
Pattern Type	Directional H/V Composite

Figure 1D

Tabulation of Vertical Azimuth Pattern
WDIY ALLENTOWN, PA.

		Azimuth	Rel Field	Azimuth	Rel Field
		0	0.925	180	0.130
		10	0.910	190	0.202
		20	0.933	200	0.295
		30	0.962	210	0.421
		40	0.931	220	0.519
		45	0.884	225	0.568
		50	0.809	230	0.627
		60	0.682	240	0.802
		70	0.621	250	0.911
		80	0.645	260	0.984
		90	0.652	270	0.989
		100	0.647	280	0.863
		110	0.599	290	0.679
		120	0.466	300	0.656
		130	0.312	310	0.797
		135	0.256	315	0.871
		140	0.210	320	0.931
		150	0.141	330	0.997
		160	0.107	340	0.999
		170	0.102	350	0.973
Additional					
Azimuths					
55	0.743				
205	0.357				

Figure 1E

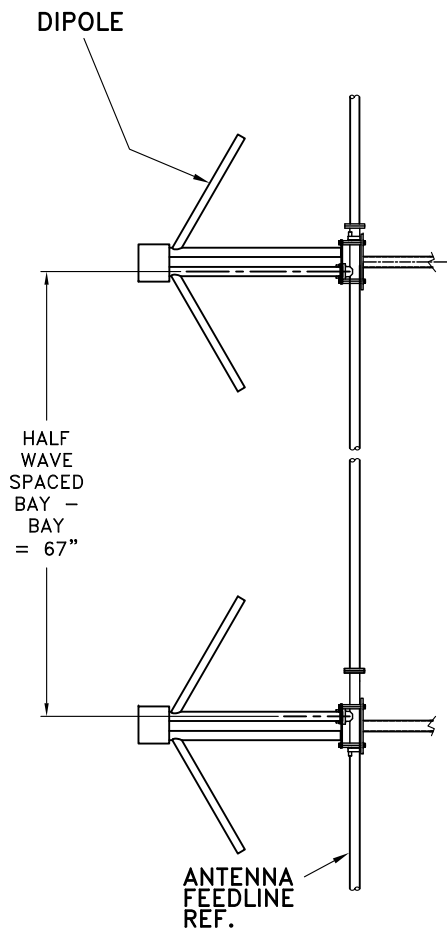
Tabulation of Composite Azimuth Pattern
WDIY ALLENTOWN, PA.

		Azimuth	Rel Field	Azimuth	Rel Field
		0	0.925	180	0.130
		10	0.910	190	0.202
		20	0.933	200	0.295
		30	0.962	210	0.421
		40	0.931	220	0.519
		45	0.884	225	0.568
		50	0.809	230	0.627
		60	0.682	240	0.802
		70	0.621	250	0.911
		80	0.645	260	0.984
		90	0.652	270	0.989
		100	0.647	280	0.863
		110	0.599	290	0.679
		120	0.466	300	0.656
		130	0.312	310	0.797
		135	0.256	315	0.871
		140	0.210	320	0.931
		150	0.141	330	0.997
		160	0.107	340	0.999
		170	0.102	350	0.973
Additional					
Azimuths					
55	0.743				
205	0.357				

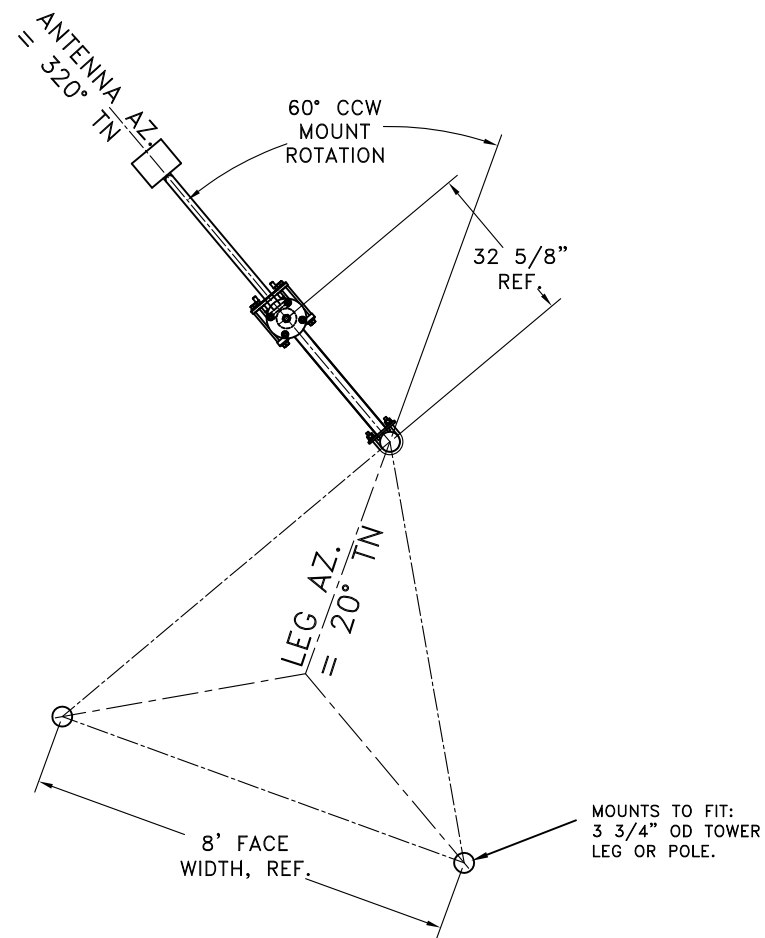
Figure 1F

Tabulation of FCC Directional Composite
WDIY ALLENTOWN, PA.

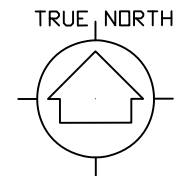
		Azimuth	Rel Field	Azimuth	Rel Field
		0	1.000	180	0.543
		10	1.000	190	0.507
		20	1.000	200	0.432
		30	1.000	210	0.437
		40	0.955	220	0.550
		50	0.832	230	0.692
		60	0.813	240	0.871
		70	0.832	250	0.966
		80	0.832	260	1.000
		90	0.813	270	1.000
		100	0.776	280	1.000
		110	0.692	290	1.000
		120	0.661	300	1.000
		130	0.646	310	1.000
		140	0.631	320	1.000
		150	0.617	330	1.000
		160	0.596	340	1.000
		170	0.575	350	1.000
Additional Azimuths					
55	0.794				
205	0.39				



SIDE VIEW



TOP VIEW
TOWER: UNKNOWN 8' FACE



ANTENNA HEADING: 320° TRUE NORTH

SHIVELY LABS			
A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE, USA			
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY:
32831	88.1	N.T.S.	ASP
TITLE:			APPROVED BY:
MODEL 6513-4-SS-DIRECTIONAL ANTENNA			DAB
DATE:			
8-21-15			

FIGURE 2

Antenna Mfg.: Shively Labs
Antenna Type: 6513-4-SS-DA

Date: 8/25/2015

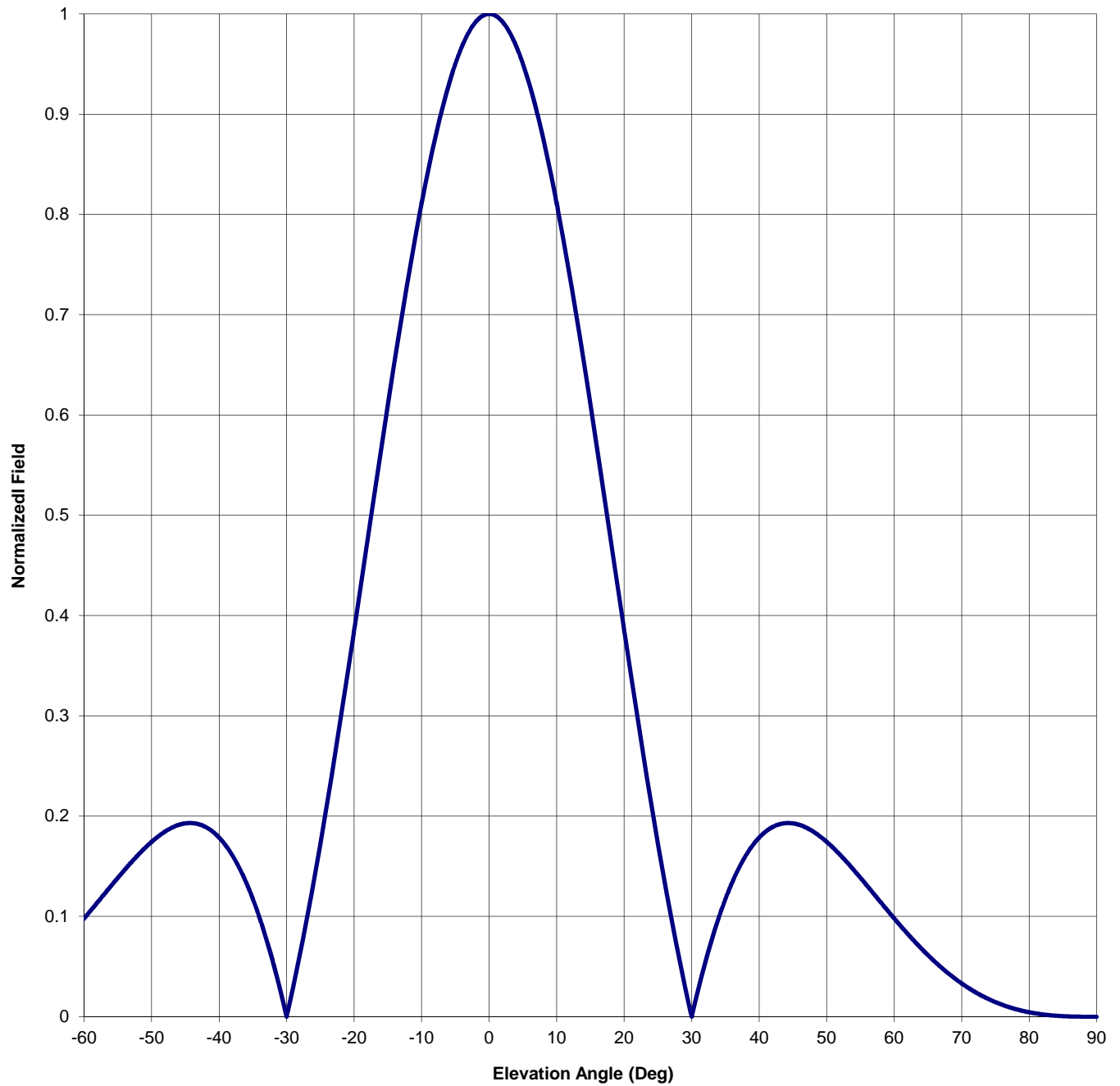
Station: WDIY

Frequency: 88.1

Channel #: 201

Figure: Figure 3

Beam Tilt	0	
Gain (Max)	5.142	7.111 dB
Gain (Horizon)	5.142	7.111 dB



Antenna Mfg.: Shively Labs
Antenna Type: 6513-4-SS-DA

Date: 8/25/2015

Station: WDIY

Beam Tilt 0

Frequency: 88.1

Gain (Max) 5.142 7.111 dB

Channel #: 201

Gain (Horizon) 5.142 7.111 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	0.193	0	1.000	46	0.191
-89	0.000	-43	0.192	1	0.998	47	0.188
-88	0.000	-42	0.189	2	0.992	48	0.185
-87	0.000	-41	0.185	3	0.982	49	0.180
-86	0.000	-40	0.179	4	0.968	50	0.174
-85	0.001	-39	0.171	5	0.950	51	0.168
-84	0.001	-38	0.160	6	0.929	52	0.161
-83	0.002	-37	0.148	7	0.904	53	0.154
-82	0.002	-36	0.134	8	0.876	54	0.146
-81	0.003	-35	0.117	9	0.845	55	0.139
-80	0.004	-34	0.099	10	0.811	56	0.131
-79	0.006	-33	0.077	11	0.775	57	0.122
-78	0.008	-32	0.054	12	0.736	58	0.114
-77	0.010	-31	0.028	13	0.696	59	0.106
-76	0.012	-30	0.000	14	0.654	60	0.098
-75	0.015	-29	0.030	15	0.611	61	0.090
-74	0.018	-28	0.063	16	0.566	62	0.083
-73	0.021	-27	0.098	17	0.521	63	0.075
-72	0.025	-26	0.134	18	0.476	64	0.068
-71	0.029	-25	0.173	19	0.431	65	0.061
-70	0.033	-24	0.213	20	0.385	66	0.055
-69	0.038	-23	0.254	21	0.341	67	0.049
-68	0.043	-22	0.297	22	0.297	68	0.043
-67	0.049	-21	0.341	23	0.254	69	0.038
-66	0.055	-20	0.385	24	0.213	70	0.033
-65	0.061	-19	0.431	25	0.173	71	0.029
-64	0.068	-18	0.476	26	0.134	72	0.025
-63	0.075	-17	0.521	27	0.098	73	0.021
-62	0.083	-16	0.566	28	0.063	74	0.018
-61	0.090	-15	0.611	29	0.030	75	0.015
-60	0.098	-14	0.654	30	0.000	76	0.012
-59	0.106	-13	0.696	31	0.028	77	0.010
-58	0.114	-12	0.736	32	0.054	78	0.008
-57	0.122	-11	0.775	33	0.077	79	0.006
-56	0.131	-10	0.811	34	0.099	80	0.004
-55	0.139	-9	0.845	35	0.117	81	0.003
-54	0.146	-8	0.876	36	0.134	82	0.002
-53	0.154	-7	0.904	37	0.148	83	0.002
-52	0.161	-6	0.929	38	0.160	84	0.001
-51	0.168	-5	0.950	39	0.171	85	0.001
-50	0.174	-4	0.968	40	0.179	86	0.000
-49	0.180	-3	0.982	41	0.185	87	0.000
-48	0.185	-2	0.992	42	0.189	88	0.000
-47	0.188	-1	0.998	43	0.192	89	0.000
-46	0.191	0	1.000	44	0.193	90	0.000
-45	0.193			45	0.193		

S.O. 32831

Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WDIY ALLENTOWN, PA.

MODEL 6513-4-SS-DA

Elevation Gain of Antenna 2.62

V RMS 0.713801

Vertical Azimuth Gain equals $1/(\text{RMS})^2$ 1.963

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

Total Vertical Power Gain 5.142

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ERP divided by Vertical Power Gain equals Antenna Input Power

0.3 kW ERP Divided by V Gain 5.142 Equals 0.058 kW Antenna Input Power