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S.O. 29769

Report of Test 6513-5-DA

for

West Virginia Educational Broadcasting Auth

WVDM 88.5 MHz Bluefield, WV

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6513-5-DA to meet the needs of WVDM and to comply with the requirements of the FCC construction permit, file number BMPED-20110610ADG. 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 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-20110610ADG indicates that the Vertical radiation component shall not exceed 50 kW at any azimuth and is restricted to the following values at the azimuths specified:

050 Degrees T: 10.7 kW

130 - 150 Degrees T: 1.6 kW

350 Degrees T: 8.6 kW

From Figure 1A, the maximum radiation of the Vertical component occurs at 295 Degrees T to 302 Degrees T. At the restricted azimuth of 050 Degrees T the Vertical component is 13.07 dB down from the maximum of 50 kW, or 2.464 kW, at the restricted azimuth of 130 - 150 Degrees T the Vertical component is 16.478 dB down from the maximum of 50 kW, or 1.125 kW and at the restricted azimuth of 350 Degrees T the Vertical component is 7.989 dB down from the maximum of 50 kW, or 8 kW.

The R.M.S. of the Vertical component is 0.559. The total Vertical power gain is 17.281. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.639. The R.M.S. of the measured composite pattern is 0.559. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.543. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6513-5-DA was mounted on a tower of precise scale to the Blaw Knox SSV Square Tower at the WVDM site. The spacing of the antenna to the tower was varied and an array of vertical parasitic elements where used 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 BMPED-20110610ADG, a single level of the 6513-5-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 398.25 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 29769
March 22, 2012

Shively Labs

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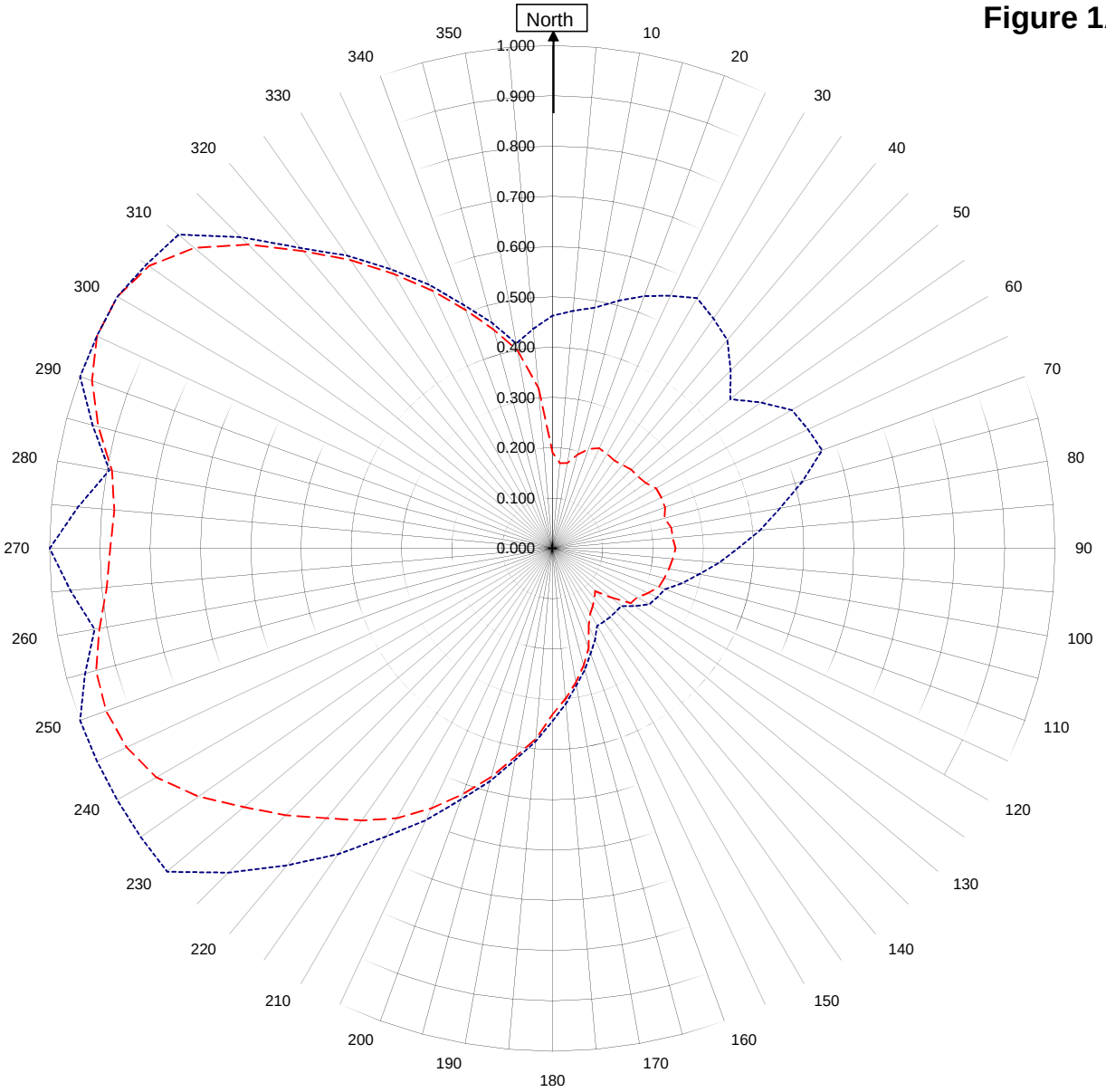
Figure 1A



WVDM Bluefield, WV

29769

February 9, 2012

Horizontal RMS	0.000
Vertical RMS	0.559
H/V Composite RMS	0.559
FCC Composite RMS	0.639

Frequency	88.5 / 398.25 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6513-5-DA
Pattern Type	Directional Azimuth

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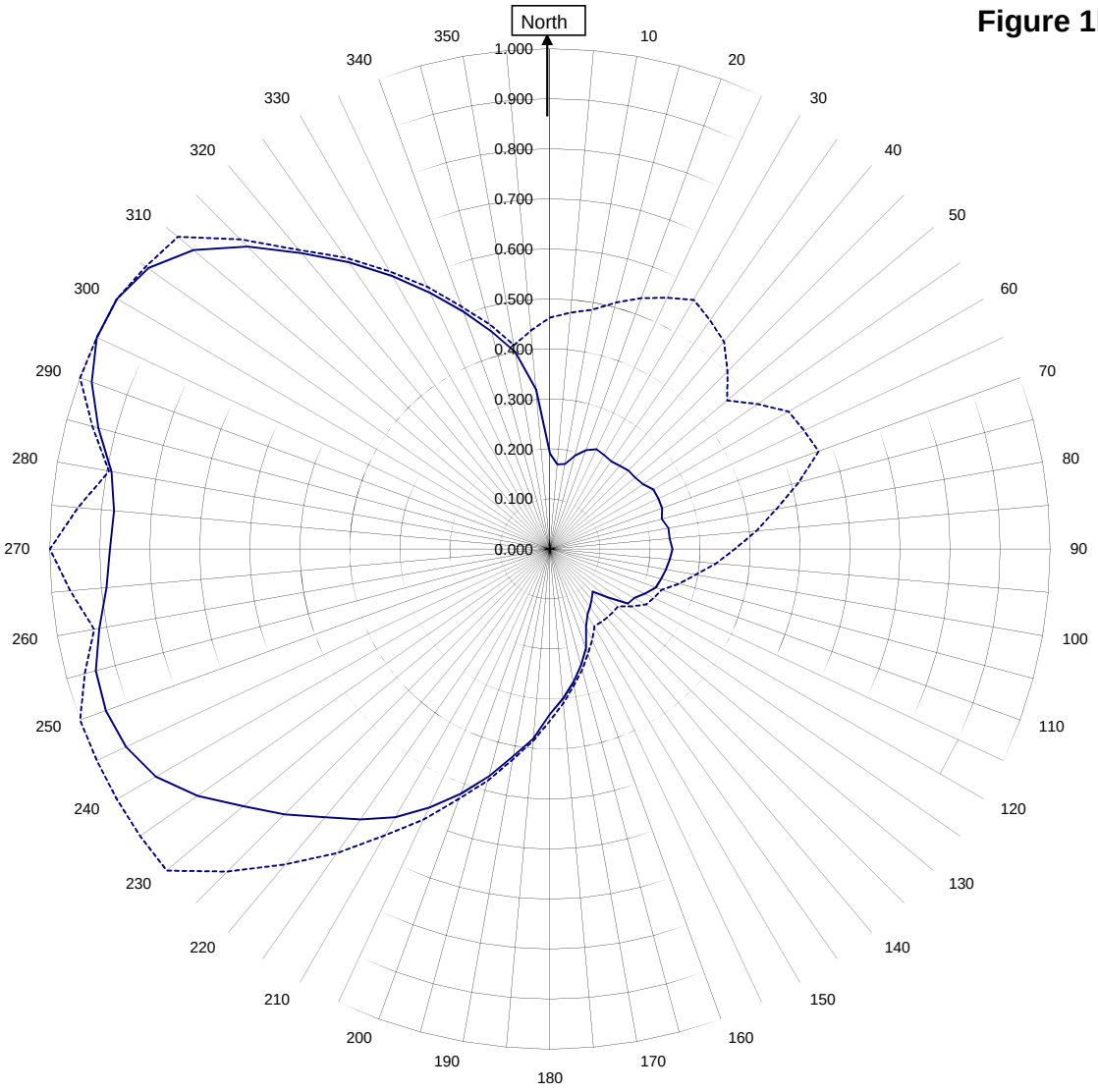
Figure 1B



WVDM Bluefield, WV

29769

February 9, 2012

_____H/VComposite RMS	0.559
……FCC Composite RMS	0.639

Frequency	88.5 / 398.25 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6513-5-DA
Pattern Type	Directional H/V Composite

Figure 1D

Tabulation of Vertical Azimuth Pattern
WVDM Bluefield, WV

Azimuth	Rel Field	Azimuth	Rel Field
0	0.192	180	0.330
10	0.172	190	0.420
20	0.210	200	0.520
30	0.217	210	0.619
40	0.217	220	0.700
45	0.222	225	0.750
50	0.222	230	0.800
60	0.238	240	0.910
70	0.238	250	0.945
80	0.240	260	0.915
90	0.245	270	0.880
100	0.235	280	0.890
110	0.225	290	0.975
120	0.195	300	1.000
130	0.150	310	0.930
135	0.120	315	0.860
140	0.130	320	0.772
150	0.150	330	0.630
160	0.210	340	0.505
170	0.270	350	0.400

Figure 1E

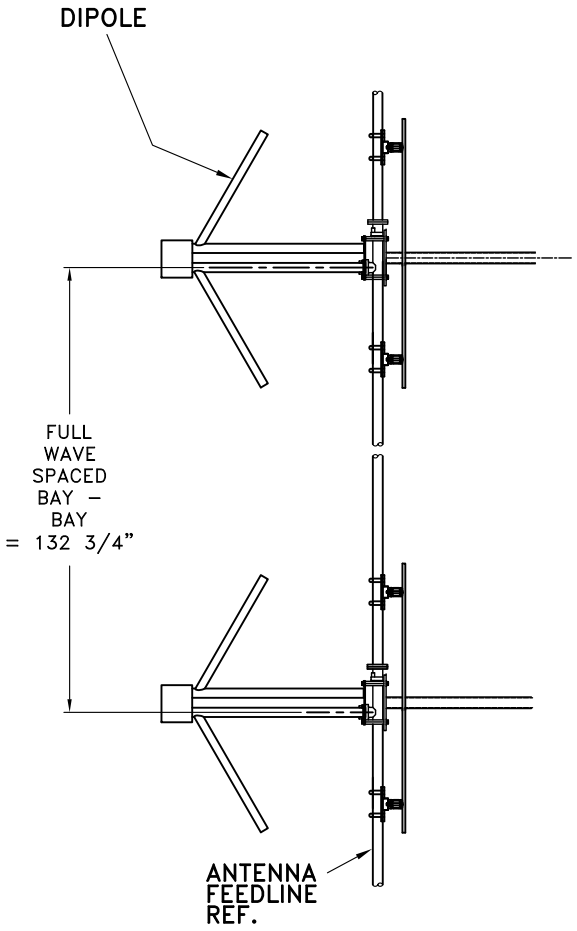
Tabulation of Composite Azimuth Pattern
WVDM Bluefield, WV

Azimuth	Rel Field	Azimuth	Rel Field
0	0.192	180	0.330
10	0.172	190	0.420
20	0.210	200	0.520
30	0.217	210	0.619
40	0.217	220	0.700
45	0.222	225	0.750
50	0.222	230	0.800
60	0.238	240	0.910
70	0.238	250	0.945
80	0.240	260	0.915
90	0.245	270	0.880
100	0.235	280	0.890
110	0.225	290	0.975
120	0.195	300	1.000
130	0.150	310	0.930
135	0.120	315	0.860
140	0.130	320	0.772
150	0.150	330	0.630
160	0.210	340	0.505
170	0.270	350	0.400

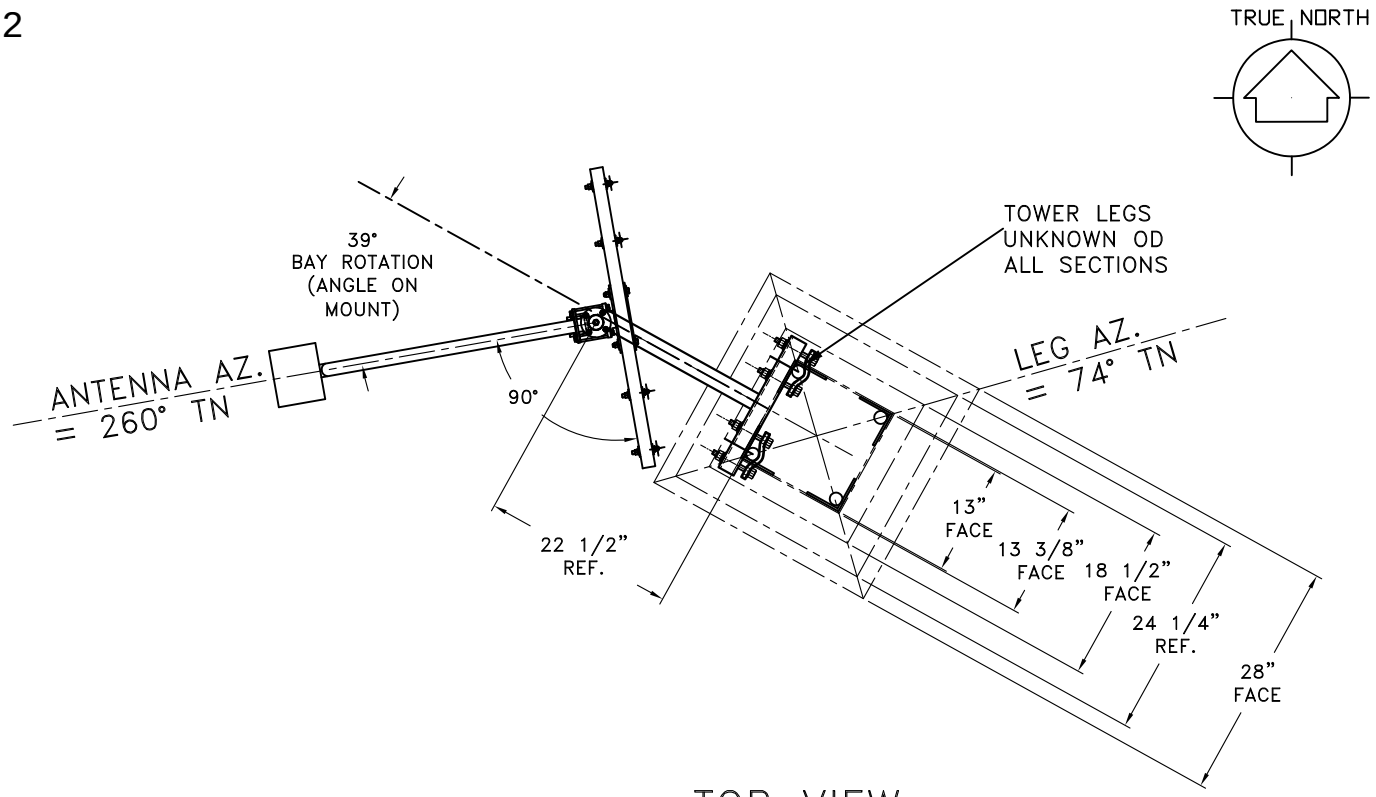
Figure 1F

Tabulation of FCC Directional Composite
WVDM Bluefield, WV

Azimuth	Rel Field	Azimuth	Rel Field
0	0.463	180	0.343
10	0.486	190	0.427
20	0.534	200	0.531
30	0.575	210	0.661
40	0.541	220	0.823
50	0.462	230	1.000
60	0.550	240	1.000
70	0.571	250	1.000
80	0.459	260	0.925
90	0.369	270	1.000
100	0.296	280	0.895
110	0.238	290	1.000
120	0.222	300	1.000
130	0.178	310	0.971
140	0.178	320	0.780
150	0.178	330	0.641
160	0.222	340	0.515
170	0.276	350	0.414



SIDE VIEW



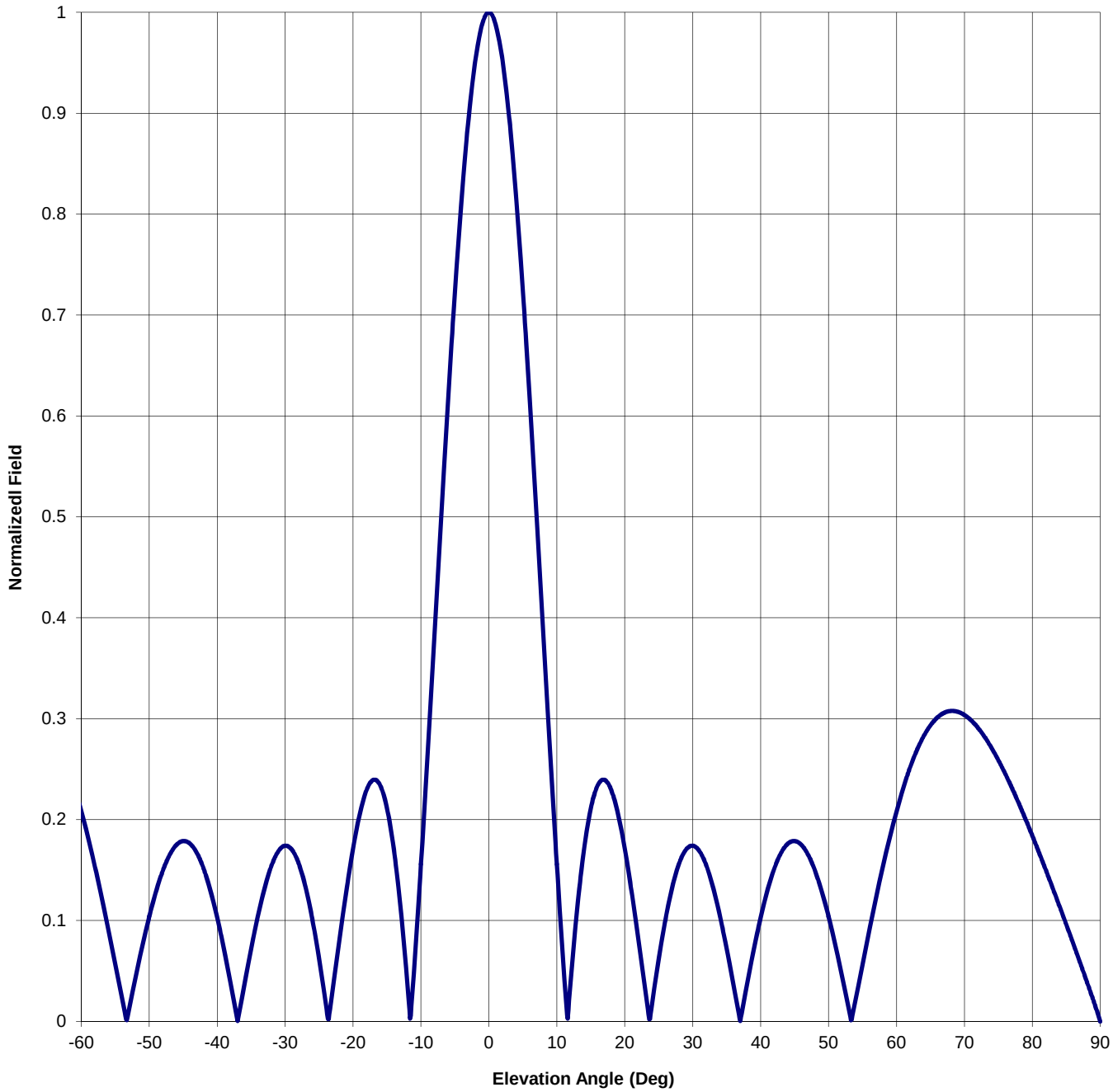
TOP VIEW

TOWER: BLAW KNOX SSV SQUARE TOWER

ANTENNA HEADING: 260° TRUE NORTH

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE, USA			
SHOP ORDER: 29769	FREQUENCY: 88.5	SCALE: N.T.S.	DRAWN BY: ASP APPROVED BY: DAB
TITLE: MODEL 6513-5-DIRECTIONAL ANTENNA FM STATION			
DATE: 3-22-12	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date: 3/22/2012**
Antenna Type:	**6513-5-DA**			
Station:	**WVDM**	**Beam Tilt**	**0**	
Frequency:	**88.5**	**Gain (Max)**	**17.281**	**12.376 dB**
Channel #:	**203**	**Gain (Horizon)**	**17.281**	**12.376 dB**
Figure:	**Figure 3**			



Antenna Mfg.: Shively Labs
Antenna Type: 6513-5-DA
Station: WVDM
Frequency: 88.5
Channel #: 203
Figure: Figure 3

Date: 3/22/2012

Beam Tilt	**0**		
Gain (Max)	**17.281**	**12.376**	**dB**
Gain (Horizon)	**17.281**	**12.376**	**dB**

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	0.176	0	1.000	46	0.175
-89	0.021	-43	0.167	1	0.988	47	0.165
-88	0.040	-42	0.151	2	0.952	48	0.149
-87	0.059	-41	0.130	3	0.895	49	0.129
-86	0.078	-40	0.103	4	0.817	50	0.104
-85	0.096	-39	0.072	5	0.723	51	0.076
-84	0.114	-38	0.037	6	0.617	52	0.044
-83	0.132	-37	0.000	7	0.503	53	0.011
-82	0.150	-36	0.036	8	0.385	54	0.022
-81	0.167	-35	0.072	9	0.268	55	0.057
-80	0.184	-34	0.105	10	0.156	56	0.090
-79	0.200	-33	0.133	11	0.053	57	0.123
-78	0.216	-32	0.155	12	0.037	58	0.154
-77	0.231	-31	0.169	13	0.112	59	0.182
-76	0.246	-30	0.174	14	0.171	60	0.208
-75	0.259	-29	0.170	15	0.211	61	0.232
-74	0.271	-28	0.157	16	0.234	62	0.252
-73	0.282	-27	0.133	17	0.239	63	0.269
-72	0.291	-26	0.101	18	0.229	64	0.283
-71	0.298	-25	0.062	19	0.206	65	0.293
-70	0.304	-24	0.017	20	0.171	66	0.301
-69	0.307	-23	0.032	21	0.129	67	0.306
-68	0.308	-22	0.081	22	0.081	68	0.308
-67	0.306	-21	0.129	23	0.032	69	0.307
-66	0.301	-20	0.171	24	0.017	70	0.304
-65	0.293	-19	0.206	25	0.062	71	0.298
-64	0.283	-18	0.229	26	0.101	72	0.291
-63	0.269	-17	0.239	27	0.133	73	0.282
-62	0.252	-16	0.234	28	0.157	74	0.271
-61	0.232	-15	0.211	29	0.170	75	0.259
-60	0.208	-14	0.171	30	0.174	76	0.246
-59	0.182	-13	0.112	31	0.169	77	0.231
-58	0.154	-12	0.037	32	0.155	78	0.216
-57	0.123	-11	0.053	33	0.133	79	0.200
-56	0.090	-10	0.156	34	0.105	80	0.184
-55	0.057	-9	0.268	35	0.072	81	0.167
-54	0.022	-8	0.385	36	0.036	82	0.150
-53	0.011	-7	0.503	37	0.000	83	0.132
-52	0.044	-6	0.617	38	0.037	84	0.114
-51	0.076	-5	0.723	39	0.072	85	0.096
-50	0.104	-4	0.817	40	0.103	86	0.078
-49	0.129	-3	0.895	41	0.130	87	0.059
-48	0.149	-2	0.952	42	0.151	88	0.040
-47	0.165	-1	0.988	43	0.167	89	0.021
-46	0.175	0	1.000	44	0.176	90	0.000
-45	0.179			45	0.179		

S.O. 29769

VALIDATION OF TOTAL POWER GAIN CALCULATION

WVDM Bluefield, WV

6513-5-DA

Elevation Gain of Antenna 5.4

V RMS 0.559

Vertical Azimuth Gain equals $1/(RMS)^2$ 3.200

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

Total Vertical Power Gain **17.281**

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ERP divided by Vertical Power Gain equals Antenna Input Power

50 kW ERP Divided by V Gain 17.281 Equals **2.893** kW Antenna Input Pow