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S.O. 37899

Report of Test 6513-3-DA

for

EDUCATIONAL MEDIA FOUNDATION

WGCN 90.5 MHz NASHVILLE, GA

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6513-3-DA to meet the needs of WGCN and to comply with the requirements of the FCC construction permit, file number BPED-20190823AAZ. 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-20190823AAZ indicates that the vertical radiation component shall not exceed 9.2 kW at any azimuth and is restricted to the following values at the azimuths specified:

320 Degrees True: 2.25 kilowatts

From Figure 1A, the maximum radiation of the vertical component occurs at 105 Degrees True to 115 Degrees. At the restricted azimuth of 320 Degrees True the vertical component is 8.826 dB down from the maximum of 9.2 kW, or 1.206 kW.

The horizontal component is omnidirectional. The R.M.S. of the Vertical component is 0.795. The total Vertical power gain is 4.917. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.935. The R.M.S. of the measured composite pattern is 0.795. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.795. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6513-3-DA was mounted on a tower of precise scale to the 36.5" face tower at the WGCN 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-20190823AAZ, a single level of the 6513-3-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 parabolic 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 Hypercell Superflex and Cellflex lCF cabling respectively.

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.

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 407.25 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:

Sean C. Edwards
Director RF Engineering, Shively Labs

S/O: 37899
Date: July 14, 2021

Shively Labs

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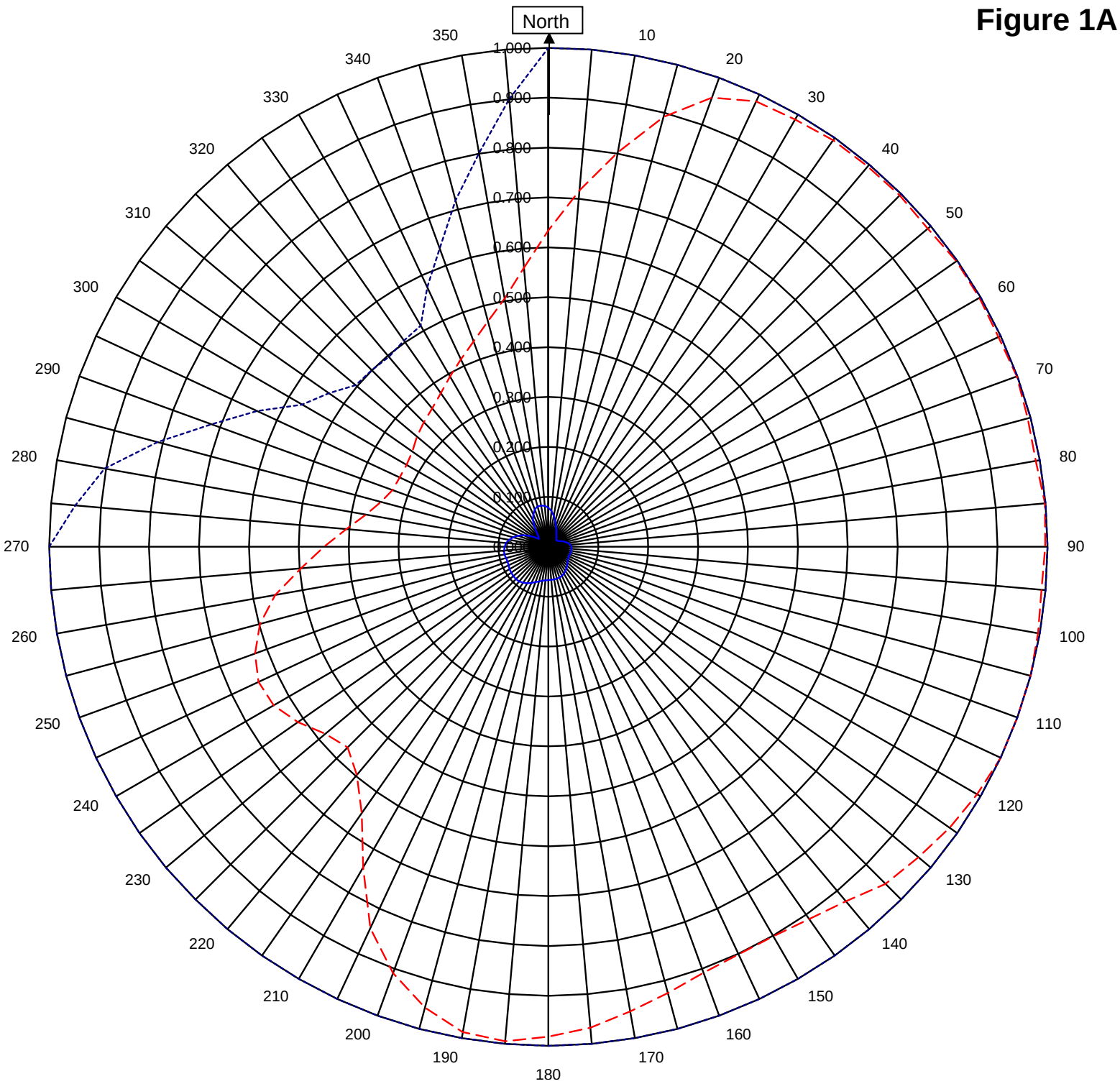
Figure 1A



WGCN NASHVILLE, GA

37899

July 14, 2021

_____Horizontal RMS	0.064
_ _ _ _ _ _ _ _ _ Vertical RMS	0.795
H/V Composite RMS	0.795
.....FCC Composite RMS	0.935

Frequency	90.5 / 407.25 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6513-3-DA
Pattern Type	Directional Azimuth

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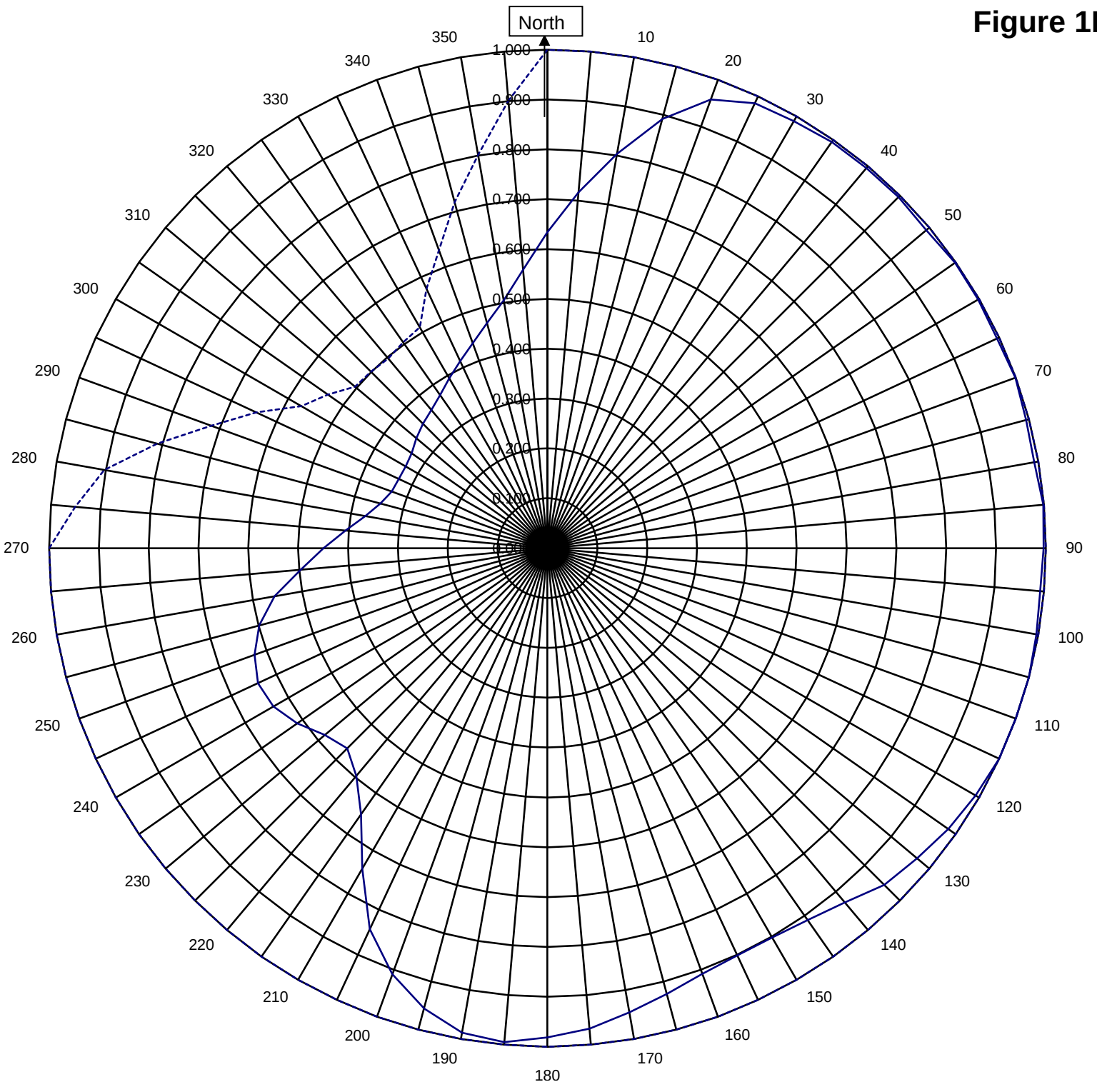
Figure 1B



WGCN NASHVILLE, GA

37899

July 14, 2021

_____H/VComposite RMS	0.795
……..FCC Composite RMS	0.935

Frequency	90.5 / 407.25 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6513-3-DA
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WGCN NASHVILLE, GA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.078	180	0.067
10	0.063	190	0.069
20	0.045	200	0.075
30	0.032	210	0.085
40	0.025	220	0.091
45	0.023	225	0.092
50	0.021	230	0.091
60	0.023	240	0.090
70	0.032	250	0.087
80	0.041	260	0.089
90	0.046	270	0.088
100	0.046	280	0.080
110	0.045	290	0.065
120	0.046	300	0.044
130	0.050	310	0.025
135	0.053	315	0.028
140	0.056	320	0.036
150	0.062	330	0.062
160	0.066	340	0.080
170	0.067	350	0.084

Figure 1D

Tabulation of Vertical Azimuth Pattern
WGCN NASHVILLE, GA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.634	180	0.982
10	0.803	190	0.987
20	0.958	200	0.909
30	0.989	210	0.742
40	0.995	220	0.597
45	0.996	225	0.568
50	0.992	230	0.583
60	0.998	240	0.635
70	0.999	250	0.626
80	0.992	260	0.556
90	0.995	270	0.450
100	0.996	280	0.371
110	1.000	290	0.333
120	0.992	300	0.328
130	0.968	310	0.343
135	0.955	315	0.353
140	0.928	320	0.362
150	0.902	330	0.394
160	0.909	340	0.438
170	0.945	350	0.505

Figure 1E

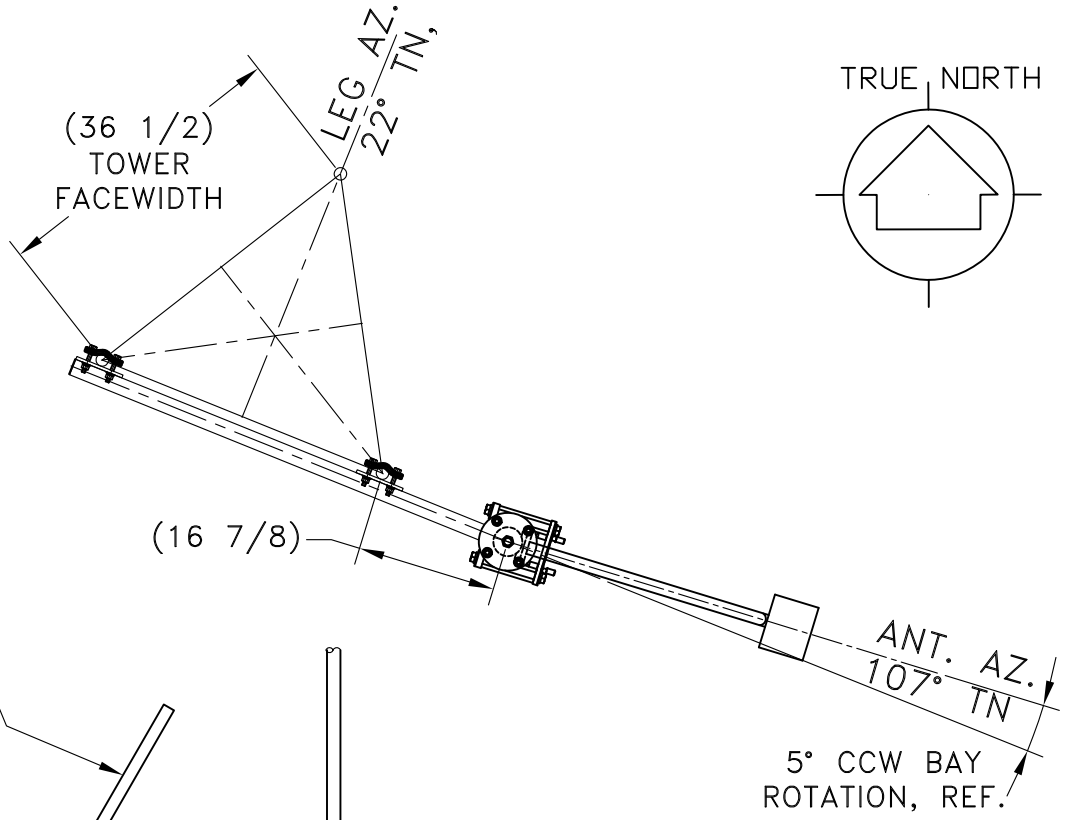
Tabulation of Composite Azimuth Pattern
WGCN NASHVILLE, GA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.634	180	0.982
10	0.803	190	0.987
20	0.958	200	0.909
30	0.989	210	0.742
40	0.995	220	0.597
45	0.996	225	0.568
50	0.992	230	0.583
60	0.998	240	0.635
70	0.999	250	0.626
80	0.992	260	0.556
90	0.995	270	0.450
100	0.996	280	0.371
110	1.000	290	0.333
120	0.992	300	0.328
130	0.968	310	0.343
135	0.955	315	0.353
140	0.928	320	0.362
150	0.902	330	0.394
160	0.909	340	0.438
170	0.945	350	0.505

Figure 1F

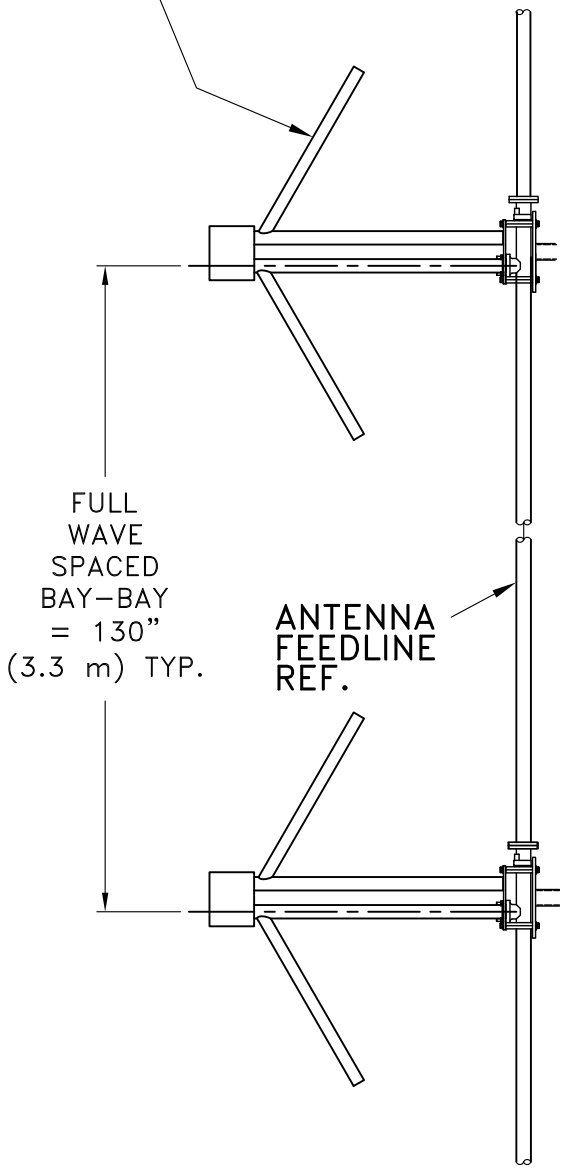
Tabulation of FCC Directional Composite
WGCN NASHVILLE, GA

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	1.000
10	1.000	190	1.000
20	1.000	200	1.000
30	1.000	210	1.000
40	1.000	220	1.000
50	1.000	230	1.000
60	1.000	240	1.000
70	1.000	250	1.000
80	1.000	260	1.000
90	1.000	270	1.000
100	1.000	280	0.903
110	1.000	290	0.718
120	1.000	300	0.570
130	1.000	310	0.504
140	1.000	320	0.497
150	1.000	330	0.512
160	1.000	340	0.636
170	1.000	350	0.801

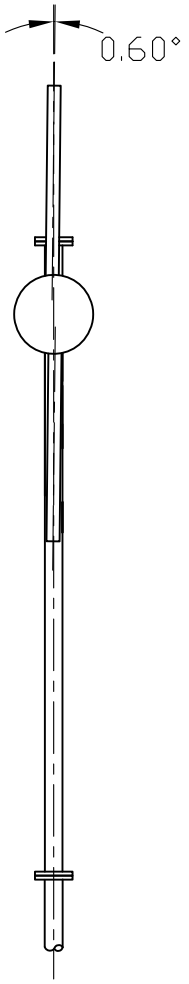


TOP VIEW

TOWER MAKE:
UNKNOWN $36\frac{1}{2}$"
GUYED TOWER



SIDE VIEW

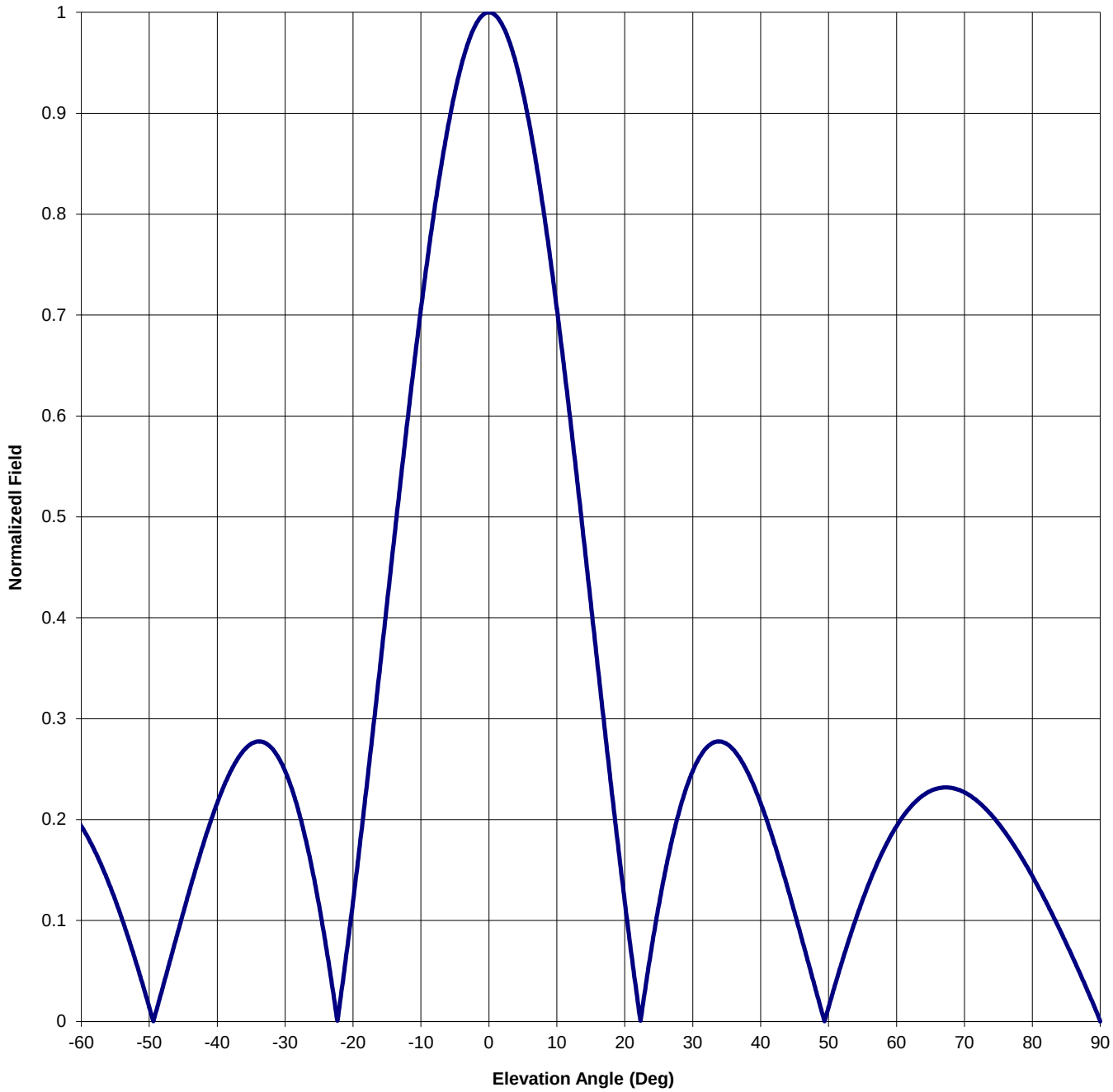


FRONT VIEW

ANTENNA HEADING
= 107° TRUE NORTH

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE, USA			
SHOP ORDER: 37899	FREQUENCY: 90.5 MHz	SCALE: N.T.S.	DRAWN BY: JHFF APPROVED BY: ASP
TITLE: MODEL 6513–3–DIRECTIONAL ANTENNA FM STATION			
DATE: 7–9–21	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date: 7/15/2021**
Antenna Type:	**6513-3-DA**			
Station:	**WGCN**	**Beam Tilt**	**0**	
Frequency:	**90.5**	**Gain (Max)**	**4.908**	**6.909 dB**
Channel #:	**213**	**Gain (Horizon)**	**4.908**	**6.909 dB**
Figure:	**Figure 3**			



Antenna Mfg.: Shively Labs **Date:** 7/15/2021

Antenna Type: 6513-3-DA

Station: WGCN **Beam Tilt** 0

Frequency: 90.5 **Gain (Max)** 4.908 6.909 dB

Channel #: 213 **Gain (Horizon)** 4.908 6.909 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	0.132	0	1.000	46	0.083
-89	0.017	-43	0.155	1	0.997	47	0.059
-88	0.032	-42	0.177	2	0.987	48	0.034
-87	0.048	-41	0.198	3	0.971	49	0.010
-86	0.063	-40	0.216	4	0.949	50	0.014
-85	0.077	-39	0.233	5	0.921	51	0.037
-84	0.091	-38	0.248	6	0.888	52	0.060
-83	0.105	-37	0.260	7	0.849	53	0.081
-82	0.119	-36	0.269	8	0.805	54	0.101
-81	0.132	-35	0.275	9	0.758	55	0.120
-80	0.144	-34	0.278	10	0.706	56	0.138
-79	0.156	-33	0.276	11	0.652	57	0.154
-78	0.167	-32	0.271	12	0.595	58	0.169
-77	0.178	-31	0.262	13	0.536	59	0.182
-76	0.187	-30	0.248	14	0.475	60	0.194
-75	0.196	-29	0.230	15	0.414	61	0.204
-74	0.204	-28	0.208	16	0.353	62	0.212
-73	0.212	-27	0.181	17	0.293	63	0.219
-72	0.218	-26	0.150	18	0.233	64	0.224
-71	0.223	-25	0.115	19	0.175	65	0.228
-70	0.227	-24	0.075	20	0.119	66	0.231
-69	0.230	-23	0.032	21	0.066	67	0.232
-68	0.232	-22	0.015	22	0.015	68	0.232
-67	0.232	-21	0.066	23	0.032	69	0.230
-66	0.231	-20	0.119	24	0.075	70	0.227
-65	0.228	-19	0.175	25	0.115	71	0.223
-64	0.224	-18	0.233	26	0.150	72	0.218
-63	0.219	-17	0.293	27	0.181	73	0.212
-62	0.212	-16	0.353	28	0.208	74	0.204
-61	0.204	-15	0.414	29	0.230	75	0.196
-60	0.194	-14	0.475	30	0.248	76	0.187
-59	0.182	-13	0.536	31	0.262	77	0.178
-58	0.169	-12	0.595	32	0.271	78	0.167
-57	0.154	-11	0.652	33	0.276	79	0.156
-56	0.138	-10	0.706	34	0.278	80	0.144
-55	0.120	-9	0.758	35	0.275	81	0.132
-54	0.101	-8	0.805	36	0.269	82	0.119
-53	0.081	-7	0.849	37	0.260	83	0.105
-52	0.060	-6	0.888	38	0.248	84	0.091
-51	0.037	-5	0.921	39	0.233	85	0.077
-50	0.014	-4	0.949	40	0.216	86	0.063
-49	0.010	-3	0.971	41	0.198	87	0.048
-48	0.034	-2	0.987	42	0.177	88	0.032
-47	0.059	-1	0.997	43	0.155	89	0.017
-46	0.083	0	1.000	44	0.132	90	0.000
-45	0.108			45	0.108		

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VALIDATION OF TOTAL POWER GAIN CALCULATION

WGCN	NASHVILLE, GA
MODEL	6513-3-DA

Elevation Gain of Antenna 3.1

V RMS 0.794721

Vertical Azimuth Gain equals $1/(RMS)^2$ 1.583

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

Total Vertical Power Gain **4.91650**

==========

ERP divided by Vertical Power Gain equals Antenna Input Power

9.2 kW ERP Divided by V Gain 4.9165 Equals **1.87125** kW Antenna Input

Antenna Input Power times Horizontal Power Gain equals Horizontal ERP

1.87453 kW Times H Gain 0.000534 equals 0.001 kW H ERP