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S.O. 37606

Report of Test 6810-2R-SS-EF-DA

for

EDUCATIONAL MEDIA FOUNDATION

WLJV 89.5 MHz SPOTSYLVANIA, VA

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-2R-SS-EF-DA to meet the needs of WLJV and to comply with the requirements of the FCC construction permit, file number 0000088427. 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 0000088427 indicates that the Horizontal radiation component shall not exceed 6.6 kW at any azimuth and is restricted to the following values at the azimuths specified:

20-40 Degrees True: 0.210 kilowatts

From Figure 1A, the maximum radiation of the Horizontal component occurs at 195-200 Degrees True. At the restricted azimuth of 20-40 Degrees True the highest Horizontal component is 14.991 dB down from the maximum of 6.6 kW, or 0.209 kW.

The R.M.S. of the Horizontal component is 0.659. The total Horizontal power gain is 2.132. The R.M.S. of the Vertical component is 0.505. The total Vertical power gain is 1.290. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.772. The R.M.S. of the measured composite pattern is 0.665. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.656. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-2R-SS-EF-DA was mounted on a tower of precise scale to the Rohn SS tower at the WLJV site. The spacing of the antenna to the tower was varied to achieve the vertical pattern shown in Figure 1A. A horizontal parasitic element was placed directly under the bay. The position of this horizontal parasitic element was changed until the horizontal pattern shown in Figure 1A was achieved. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number 0000088427, a single level of the 6810-2R-SS-EF-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 402.75 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: 37606
Date: February 2, 2021

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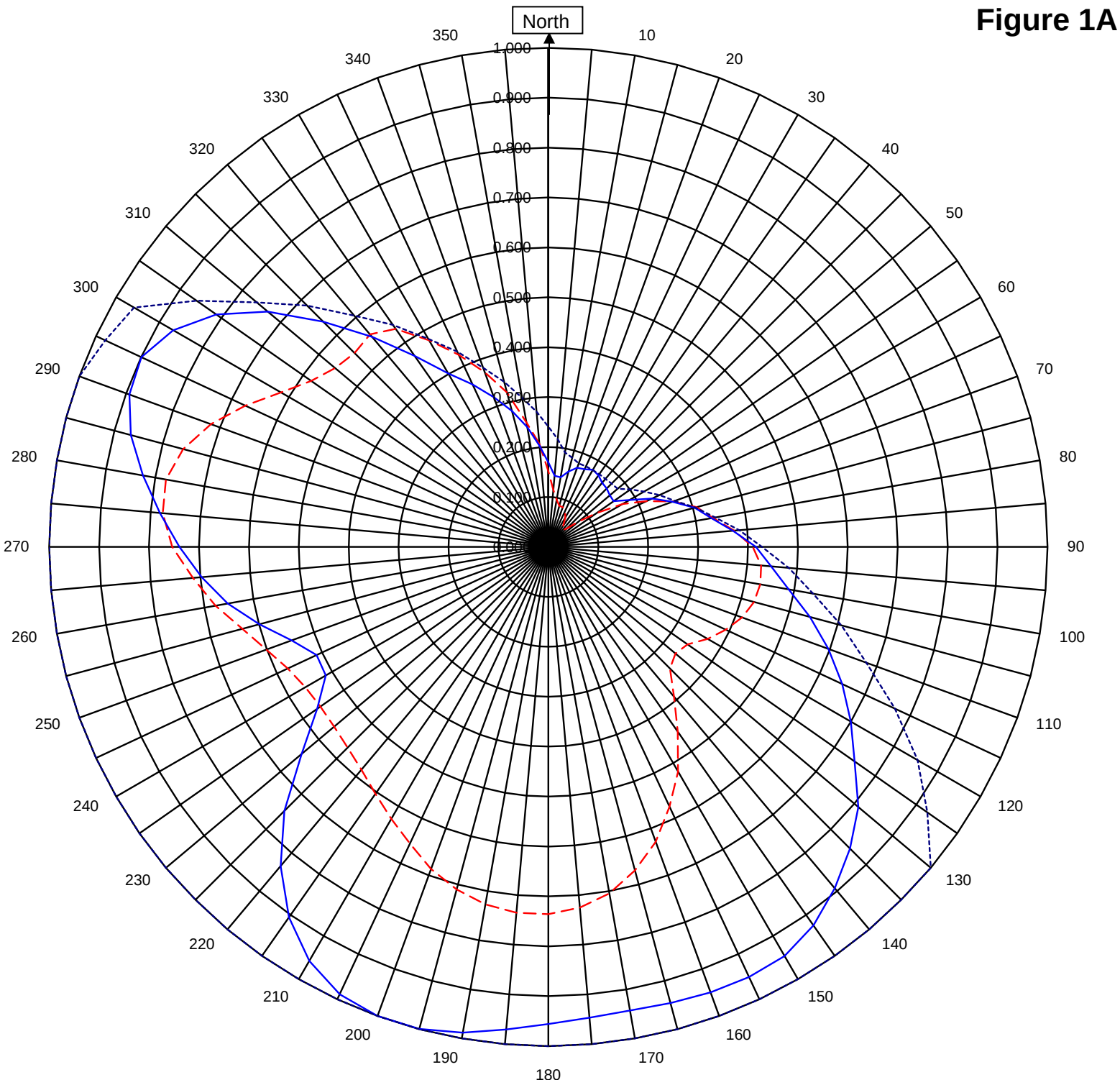
Figure 1A



WLJV SPOTSYLVANIA, VA

37606

February 2, 2021

Horizontal RMS	0.659
Vertical RMS	0.505
H/V Composite RMS	0.665
FCC Composite RMS	0.772

Frequency	89.5 / 402.75 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-2R-SS-EF-DA
Pattern Type	Directional Azimuth

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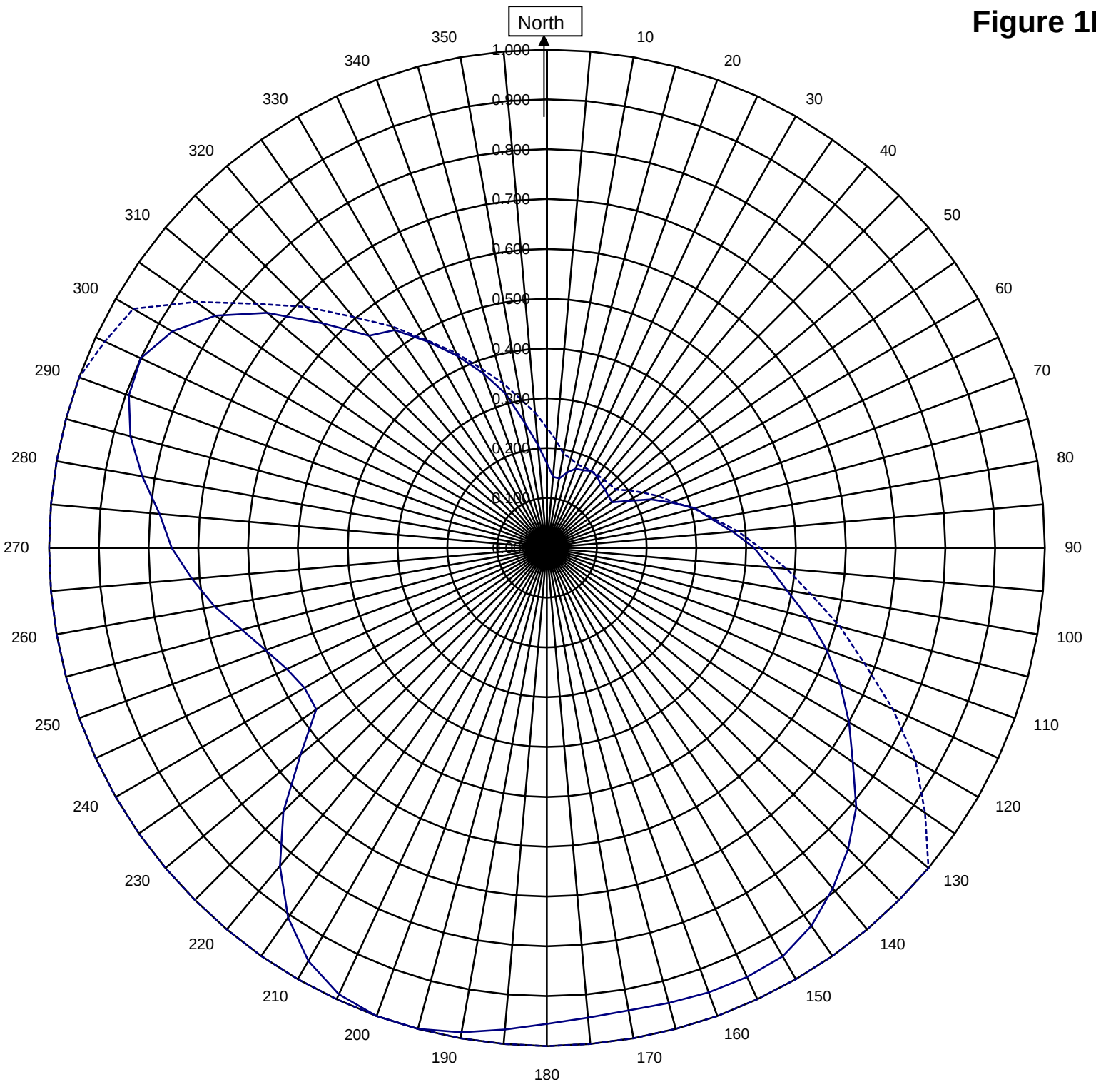
Figure 1B



WLJV SPOTSYLVANIA, VA

37606

February 2, 2021

_____H/VComposite RMS	0.665
……..FCC Composite RMS	0.772

Frequency	89.5 / 402.75 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-2R-SS-EF-DA
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WLJV SPOTSYLVANIA, VA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.170	180	0.956
10	0.142	190	0.988
20	0.169	200	1.000
30	0.178	210	0.958
40	0.168	220	0.834
45	0.165	225	0.748
50	0.161	230	0.645
60	0.188	240	0.515
70	0.264	250	0.548
80	0.332	260	0.652
90	0.416	270	0.739
100	0.489	280	0.825
110	0.597	290	0.893
120	0.700	300	0.868
130	0.811	310	0.734
135	0.855	315	0.638
140	0.893	320	0.549
150	0.947	330	0.401
160	0.950	340	0.319
170	0.943	350	0.243

Figure 1D

Tabulation of Vertical Azimuth Pattern
WLJV SPOTSYLVANIA, VA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.151	180	0.736
10	0.096	190	0.727
20	0.085	200	0.687
30	0.068	210	0.629
40	0.044	220	0.583
45	0.052	225	0.569
50	0.079	230	0.560
60	0.172	240	0.562
70	0.266	250	0.602
80	0.335	260	0.678
90	0.410	270	0.753
100	0.431	280	0.778
110	0.413	290	0.719
120	0.369	300	0.619
130	0.332	310	0.558
135	0.345	315	0.549
140	0.392	320	0.556
150	0.520	330	0.477
160	0.629	340	0.372
170	0.705	350	0.254

Figure 1E

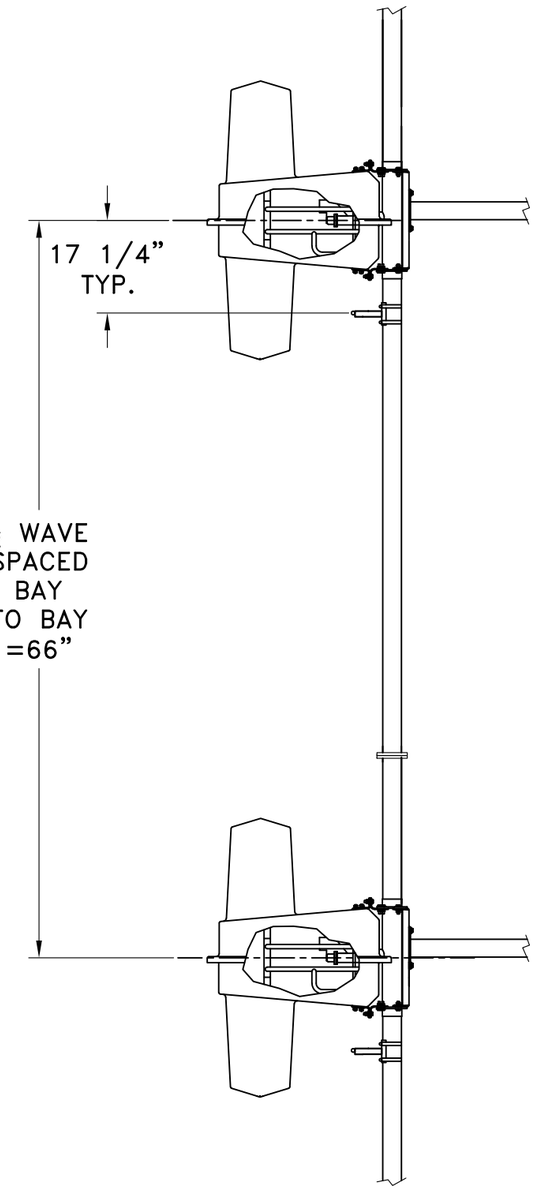
Tabulation of Composite Azimuth Pattern
WLJV SPOTSYLVANIA, VA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.170	180	0.956
10	0.142	190	0.988
20	0.169	200	1.000
30	0.178	210	0.958
40	0.168	220	0.834
45	0.165	225	0.748
50	0.161	230	0.645
60	0.188	240	0.562
70	0.266	250	0.602
80	0.335	260	0.678
90	0.416	270	0.753
100	0.489	280	0.825
110	0.597	290	0.893
120	0.700	300	0.868
130	0.811	310	0.734
135	0.855	315	0.638
140	0.893	320	0.556
150	0.947	330	0.477
160	0.950	340	0.372
170	0.943	350	0.254

Figure 1F

Tabulation of FCC Directional Composite
WLJV SPOTSYLVANIA, VA

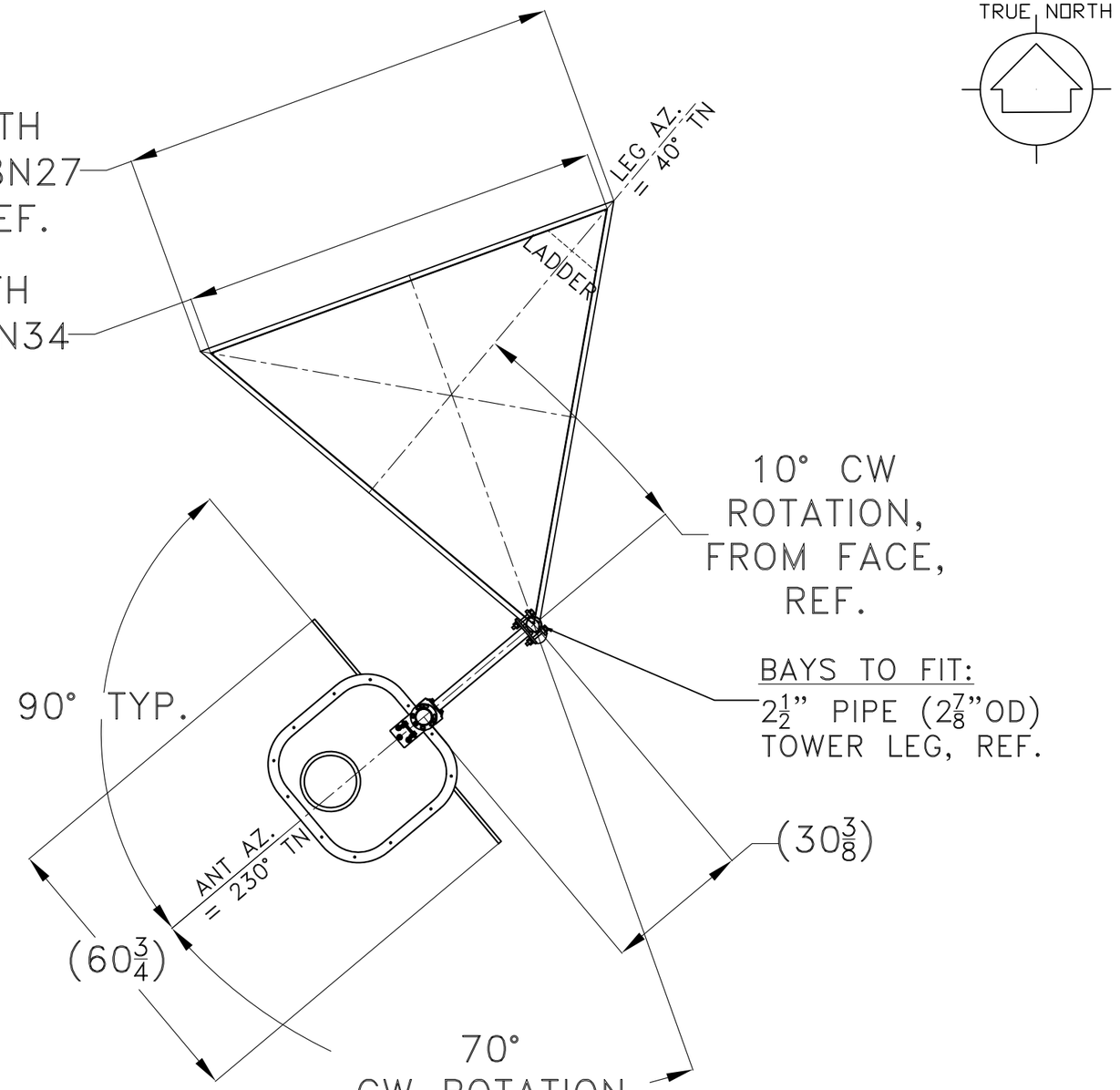
Azimuth	Rel Field	Azimuth	Rel Field
0	0.241	180	1.000
10	0.192	190	1.000
20	0.178	200	1.000
30	0.178	210	1.000
40	0.178	220	1.000
50	0.181	230	1.000
60	0.222	240	1.000
70	0.270	250	1.000
80	0.340	260	1.000
90	0.428	270	1.000
100	0.539	280	1.000
110	0.678	290	1.000
120	0.854	300	0.959
130	1.000	310	0.762
140	1.000	320	0.605
150	1.000	330	0.481
160	1.000	340	0.382
170	1.000	350	0.303



SIDE VIEW

(8'–8⅝") FACE WIDTH
220' AGL, SECTION 8N27
BOTTOM SPREAD, REF.

(6'–7¾") FACE WIDTH
260' AGL, SECTION 7N34
TOP SPREAD, REF.



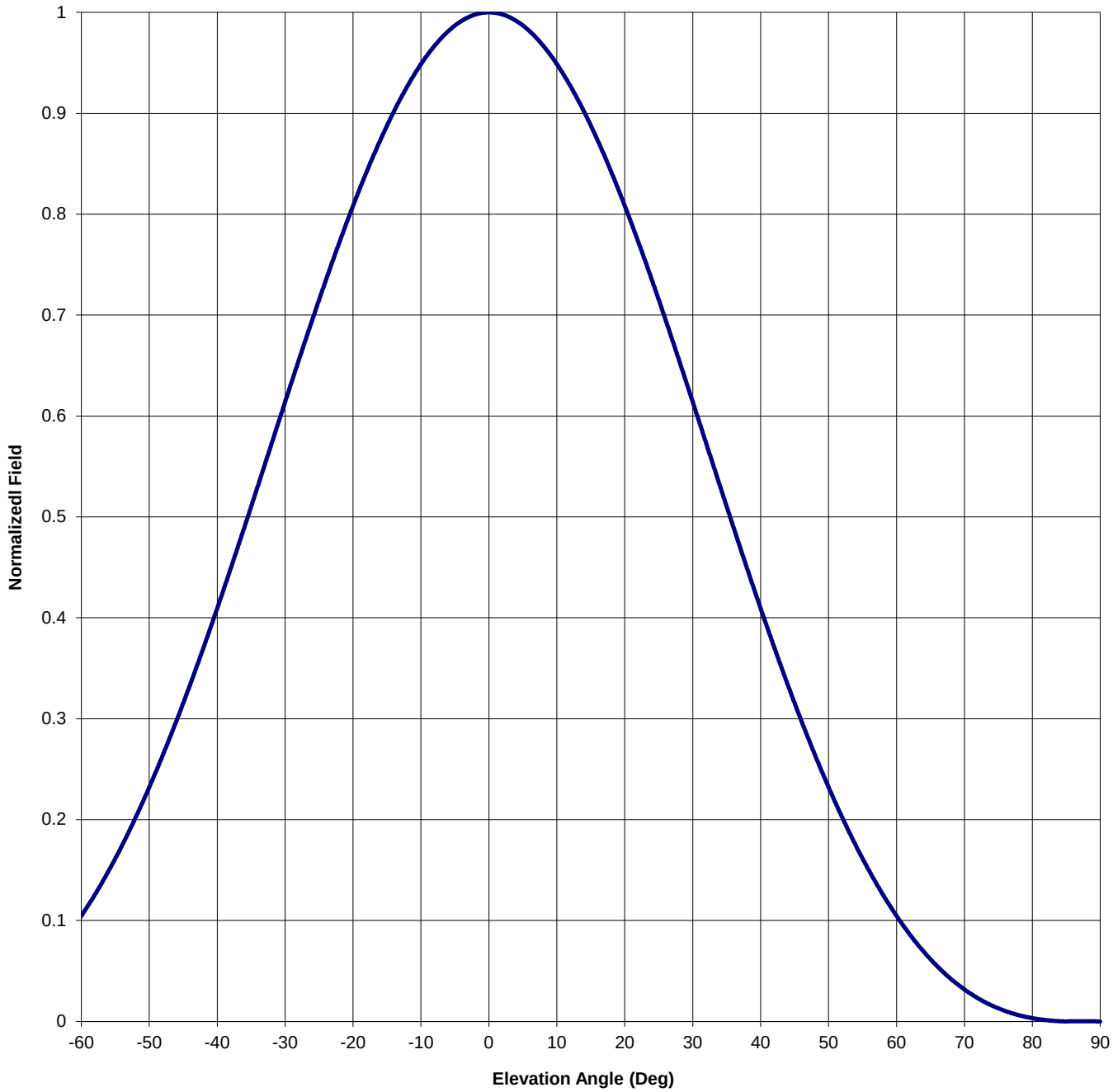
TOP VIEW

TOWER MAKE: ROHN 280' SSVMW

ANTENNA HEADING 230° TRUE NORTH

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 37606	FREQUENCY: 89.5	SCALE: N.T.S.	DRAWN BY: JHFF APPROVED BY: ASP
TITLE: MODEL–6810–2R–SS–DIRECTIONAL ANTENNA			
DATE: 2–5–21	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date:**	**2/2/2021**
Antenna Type:	**6810-2R-SS-EF-DA**				
Station:	**WLJV**	**Beam Tilt**	**0**		
Frequency:	**89.5**	**Gain (Max)**	**2.132**	**3.288**	**dB**
Channel #:	**208**	**Gain (Horizon)**	**2.132**	**3.288**	**dB**
Figure:	**Figure 3**				



Antenna Mfg.: Shively Labs **Date:** 2/2/2021

Antenna Type: 6810-2R-SS-EF-DA

Station: WLJV **Beam Tilt** 0

Frequency: 89.5 **Gain (Max)** 2.132 3.288 dB

Channel #: 208 **Gain (Horizon)** 2.132 3.288 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	0.334	0	1.000	46	0.298
-89	0.000	-43	0.352	1	0.999	47	0.281
-88	0.000	-42	0.371	2	0.998	48	0.264
-87	0.000	-41	0.390	3	0.995	49	0.248
-86	0.000	-40	0.409	4	0.992	50	0.232
-85	0.000	-39	0.429	5	0.987	51	0.217
-84	0.000	-38	0.449	6	0.981	52	0.202
-83	0.001	-37	0.469	7	0.975	53	0.188
-82	0.001	-36	0.490	8	0.967	54	0.175
-81	0.002	-35	0.510	9	0.958	55	0.161
-80	0.003	-34	0.531	10	0.949	56	0.149
-79	0.005	-33	0.552	11	0.938	57	0.137
-78	0.006	-32	0.573	12	0.927	58	0.126
-77	0.008	-31	0.593	13	0.915	59	0.115
-76	0.010	-30	0.614	14	0.902	60	0.105
-75	0.013	-29	0.635	15	0.888	61	0.095
-74	0.016	-28	0.655	16	0.873	62	0.086
-73	0.019	-27	0.675	17	0.858	63	0.077
-72	0.023	-26	0.695	18	0.842	64	0.069
-71	0.027	-25	0.715	19	0.825	65	0.062
-70	0.032	-24	0.735	20	0.808	66	0.055
-69	0.037	-23	0.754	21	0.791	67	0.048
-68	0.042	-22	0.772	22	0.772	68	0.042
-67	0.048	-21	0.791	23	0.754	69	0.037
-66	0.055	-20	0.808	24	0.735	70	0.032
-65	0.062	-19	0.825	25	0.715	71	0.027
-64	0.069	-18	0.842	26	0.695	72	0.023
-63	0.077	-17	0.858	27	0.675	73	0.019
-62	0.086	-16	0.873	28	0.655	74	0.016
-61	0.095	-15	0.888	29	0.635	75	0.013
-60	0.105	-14	0.902	30	0.614	76	0.010
-59	0.115	-13	0.915	31	0.593	77	0.008
-58	0.126	-12	0.927	32	0.573	78	0.006
-57	0.137	-11	0.938	33	0.552	79	0.005
-56	0.149	-10	0.949	34	0.531	80	0.003
-55	0.161	-9	0.958	35	0.510	81	0.002
-54	0.175	-8	0.967	36	0.490	82	0.001
-53	0.188	-7	0.975	37	0.469	83	0.001
-52	0.202	-6	0.981	38	0.449	84	0.000
-51	0.217	-5	0.987	39	0.429	85	0.000
-50	0.232	-4	0.992	40	0.409	86	0.000
-49	0.248	-3	0.995	41	0.390	87	0.000
-48	0.264	-2	0.998	42	0.371	88	0.000
-47	0.281	-1	0.999	43	0.352	89	0.000
-46	0.298	0	1.000	44	0.334	90	0.000
-45	0.316			45	0.316		

S.O. 37606 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WLJV SPOTSYLVANIA, VA

MODEL 6810-2R-SS-EF-DA

Elevation Gain of Antenna 0.71

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

H RMS 0.658962 V RMS 0.505398 H/V Ratio 1.304

Elevation Gain of Horizontal Component 0.926

Elevation Gain of Vertical Component 0.545

Horizontal Azimuth Gain equals $1/(RMS)^2$. 2.303

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 2.370

Max. Vertical 0.778

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

Total Horizontal Power Gain = **2.132**

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

Total Vertical Power Gain = **1.290**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

6.6 kW ERP Divided by H Gain 2.132 equals 3.096 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

3.096 kW Times V Gain 1.290 equals 3.995 kW V ERP

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

(0.778)^2 Times 6.60 Equals 3.995 kW Vertical ERP

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