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S.O. 30613

Report of Test 6810-1R-DA

for

Selby Gospel Broadcasting Corporation

KNOF 95.3 MHz St. Paul, MN

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-1R-DA to meet the needs of KNOF and to comply with the requirements of the FCC construction permit, file number BPH-20120320AFQ. 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 BPH-20120320AFQ indicates that the Horizontal radiation component shall not exceed 0.90 kW at any azimuth and is restricted to the following values at the azimuths specified:

230 - 250 Degrees True: 0.19 kilowatts

MEMBER: NAB BROADCASTERS · SOCIETY OF BROADCAST ENGINEERS · NRB NATIONAL RELIGIOUS BROADCASTERS · TAB TEXAS ASSOCIATION OF BROADCASTERS · NTA NATIONAL TRANSLATOR ASSOCIATION

From Figure 1A, the maximum radiation of the Horizontal component occurs at 90 Degrees True to 117 Degrees True. At the restricted azimuth of 230 – 250 Degrees True the Vertical component is 7.514 dB down from the maximum of 0.90 kW, or 0.16 kW

The R.M.S. of the Horizontal component is 0.702. The total Horizontal power gain is 0.972. The R.M.S. of the Vertical component is 0.674. The total Vertical power gain is 0.887. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.780. The R.M.S. of the measured composite pattern is 0.712. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.663. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-1R-DA was mounted on a pole of precise scale to the pole at the KNOF 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 BPH-20120320AFQ, a single level of the 6810-1R-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.

<u>EQUIPMENT</u>:

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.

<u>TEST PROCEDURES</u>:

The receiving antenna system is mounted so that the horizontal and vertical azimuth patterns are measured independently. The network analyzer was set to 428.85 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 30613
March 25, 2013

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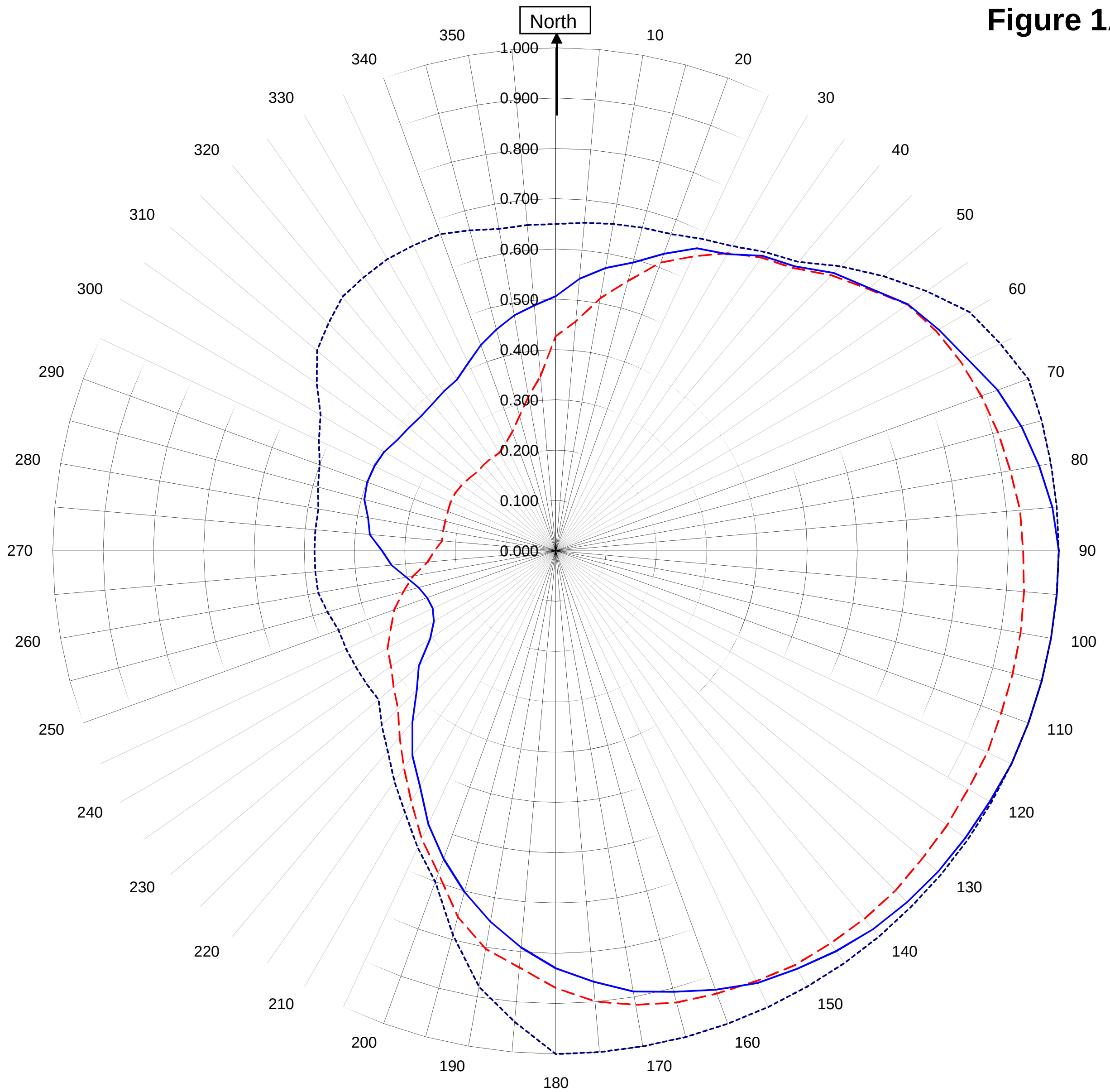
Figure 1A



KNOF ST. PAUL, MN.

30613
March 25, 2013

____________Horizontal RMS	0.702
_ _ _ _ _ _ _ _ _ Vertical RMS	0.674
H/V Composite RMS	0.712
……………FCC Composite RMS	0.780

Frequency	95.3 / 428.85 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-1R-DA
Pattern Type	Directional Azimuth

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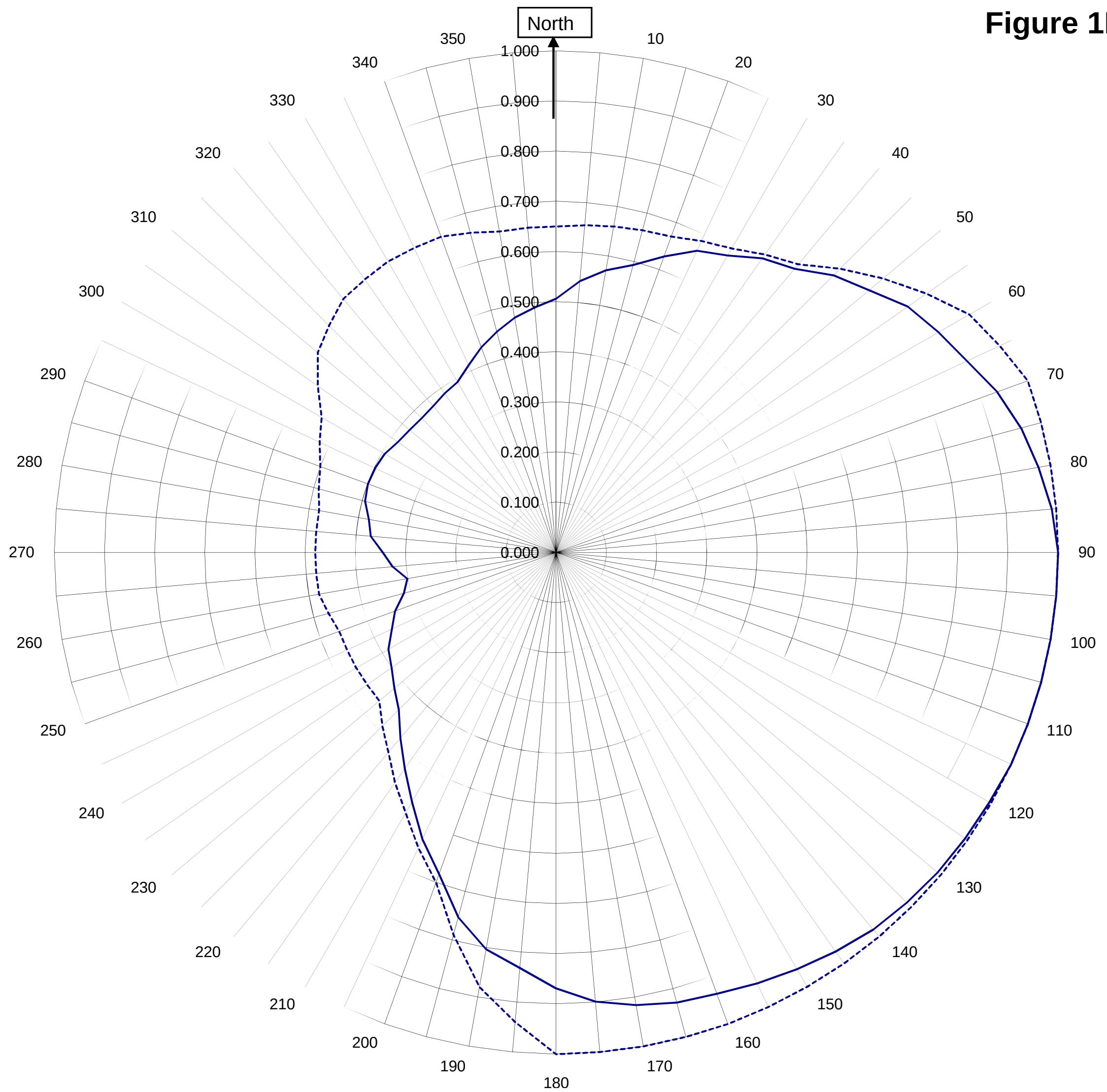
Figure 1B



KNOF ST. PAUL, MN.

30613
March 25, 2013

__________H/VComposite RMS	0.712
……………FCC Composite RMS	0.780

Frequency	95.3 / 428.85 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-1R-DA
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
KNOF ST. PAUL, MN.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.506	180	0.830
10	0.571	190	0.748
20	0.628	200	0.652
30	0.681	210	0.540
40	0.739	220	0.444
45	0.781	225	0.391
50	0.813	230	0.356
60	0.879	240	0.280
70	0.935	250	0.272
80	0.976	260	0.302
90	1.000	270	0.345
100	1.000	280	0.379
110	1.000	290	0.399
120	0.996	300	0.394
130	0.992	310	0.381
135	0.988	315	0.379
140	0.982	320	0.381
150	0.959	330	0.393
160	0.928	340	0.436
170	0.889	350	0.476

Figure 1D

Tabulation of Vertical Azimuth Pattern
KNOF ST. PAUL, MN.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.427	180	0.869
10	0.510	190	0.803
20	0.610	200	0.683
30	0.684	210	0.575
40	0.735	220	0.484
45	0.775	225	0.444
50	0.810	230	0.421
60	0.873	240	0.386
70	0.900	250	0.342
80	0.918	260	0.289
90	0.930	270	0.241
100	0.938	280	0.228
110	0.943	290	0.229
120	0.947	300	0.231
130	0.951	310	0.225
135	0.955	315	0.222
140	0.954	320	0.224
150	0.950	330	0.225
160	0.936	340	0.252
170	0.916	350	0.312

Figure 1E

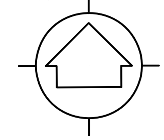
Tabulation of Composite Azimuth Pattern
KNOF ST. PAUL, MN.

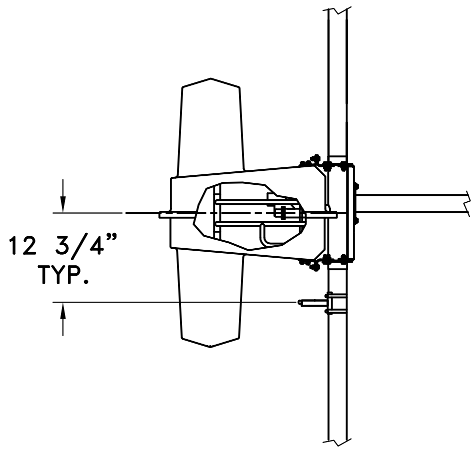
Azimuth	Rel Field	Azimuth	Rel Field
0	0.506	180	0.869
10	0.571	190	0.803
20	0.628	200	0.683
30	0.684	210	0.575
40	0.739	220	0.484
45	0.781	225	0.444
50	0.813	230	0.421
60	0.879	240	0.386
70	0.935	250	0.342
80	0.976	260	0.302
90	1.000	270	0.345
100	1.000	280	0.379
110	1.000	290	0.399
120	0.996	300	0.394
130	0.992	310	0.381
135	0.988	315	0.379
140	0.982	320	0.381
150	0.959	330	0.393
160	0.936	340	0.436
170	0.916	350	0.476

Figure 1F

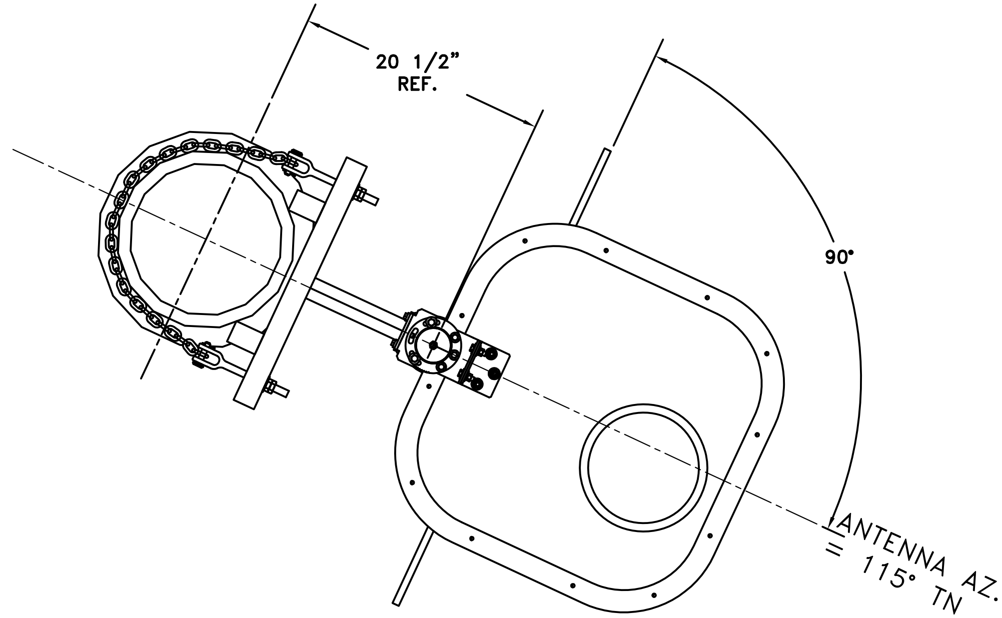
Tabulation of FCC Directional Composite
KNOF ST. PAUL, MN.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.650	180	1.000
10	0.660	190	0.880
20	0.670	200	0.700
30	0.700	210	0.600
40	0.750	220	0.520
50	0.850	230	0.460
60	0.950	240	0.460
70	1.000	250	0.460
80	1.000	260	0.480
90	1.000	270	0.480
100	1.000	280	0.480
110	1.000	290	0.500
120	1.000	300	0.540
130	1.000	310	0.620
140	1.000	320	0.660
150	1.000	330	0.670
160	1.000	340	0.670
170	1.000	350	0.650





SIDE VIEW



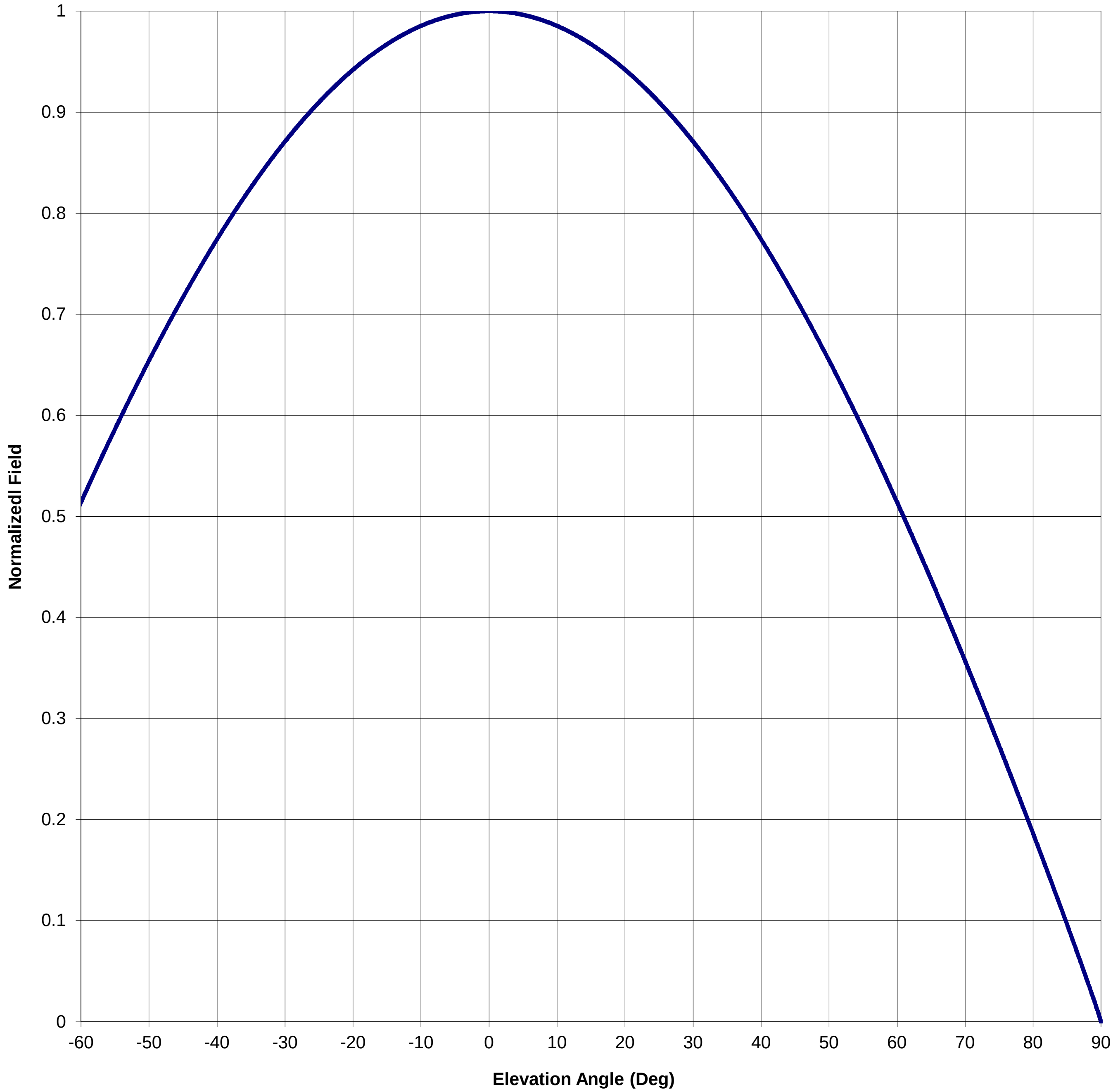
TOP VIEW

TOWER MAKE: IDS MONOPOLE

ANTENNA HEADING 115° TRUE NORTH

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 30613	FREQUENCY: 95.3	SCALE: N.T.S.	DRAWN BY: ASP APPROVED BY: DAB
TITLE: MODEL–6810–1R–DIRECTIONAL ANTENNA			
DATE: 4–16–13	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date:**	**4/16/2013**
Antenna Type:	**KNOF**				
Station:	**6810-1R-DA**	**Beam Tilt**	**0**		
Frequency:	**95.3**	**Gain (Max)**	**0.972**	**-0.124**	**dB**
Channel #:	**237**	**Gain (Horizon)**	**0.972**	**-0.124**	**dB**
Figure:	**Figure 3**				



Antenna Mfg.: **Shively Labs** **Date:** **4/16/2013**
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Channel #: **237** **Gain (Horizon)** **0.972** **-0.124 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. 30613 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

KNOF ST. PAUL, MN.

MODEL 6810-1R-DA

Elevation Gain of Antenna 0.46

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

H RMS 0.702175 V RMS 0.673745 H/V Ratio 1.042

Elevation Gain of Horizontal Component 0.479

Elevation Gain of Vertical Component 0.441

Horizontal Azimuth Gain equals $1/(RMS)^2$. 2.028

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 2.009

Max. Vertical 0.955

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

Total Horizontal Power Gain = **0.972**

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

Total Vertical Power Gain = **0.887**

===

ERP divided by Horizontal Power Gain equals Antenna Input Power

0.90 kW ERP Divided by H Gain 0.972 equals 0.926 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

0.926 kW Times V Gain 0.887 equals 0.821 kW V ERP

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

(0.955)^2 Times 0.90 Equals 0.821 kW Vertical ERP

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