Shively Labs
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S.O. 31127

Report of Test 6025-4/1-Slant (43°)-DA

for

Spirit Broadcasting group, Inc.

WKBR 88.9 MHz Summerville, SC

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6025-4/1-Slant (43°)-DA to meet the needs of WKBR and to comply with the requirements of the FCC construction permit, file number BMPED-20130401ABH. 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 BMPED-20130401ABH indicates that the Horizontal radiation component shall not exceed 70.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

190 Degrees True: 11.2 kilowatts

From Figure 1A, the maximum radiation of the Horizontal component occurs at 100 Degrees True to 106 Degrees True. At the restricted azimuth of 190 Degrees True the Vertical component is 10.173 dB down from the maximum of 70.0 kW, or 6.727 kW.

The R.M.S. of the Horizontal component is 0.514. The total Horizontal power gain is 8.954. The R.M.S. of the Vertical component is 0.530. The total Vertical power gain is 6.934. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.667 The R.M.S. of the measured composite pattern is 0.568. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.567. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6025-4/1-Slant (43°)-DA was mounted on a tower of precise scale to the Valmont 48" tower at the WKBR site. The spacing of the antenna to the tower was varied to achieve the horizontal and vertical patterns shown in Figure 1A. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BMPED-20130401ABH, a single level of the 6025-4/1-Slant (43°)-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 400.05 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 31127
October 24, 2013

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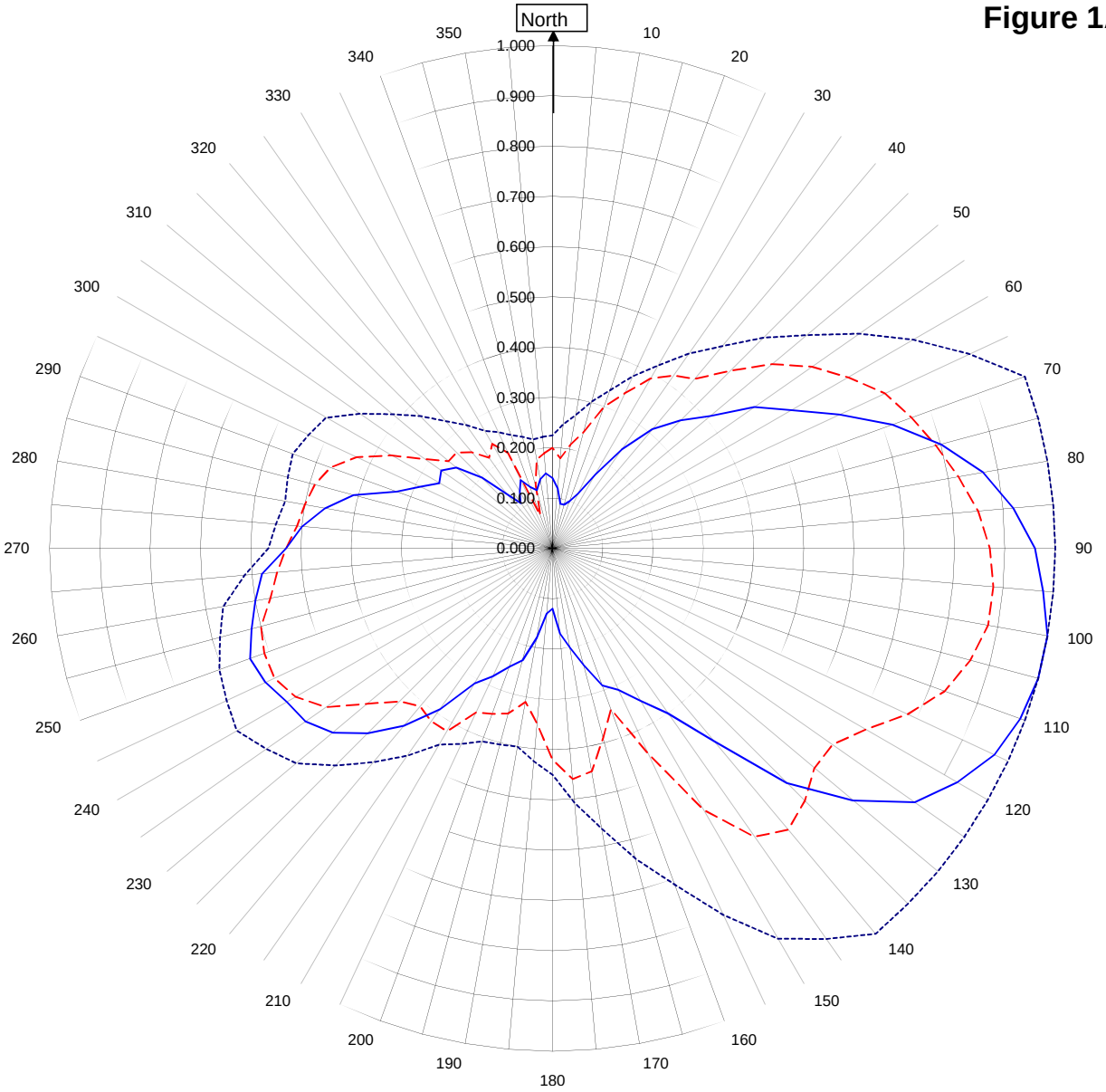
Figure 1A



WKBR Summerville, SC

31127

October 24, 2013

Horizontal RMS	0.514
Vertical RMS	0.530
H/V Composite RMS	0.568
FCC Composite RMS	0.667

Frequency	88.9 / 400.05 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6025-4/l-Slant (43°)-DA
Pattern Type	Directional Azimuth

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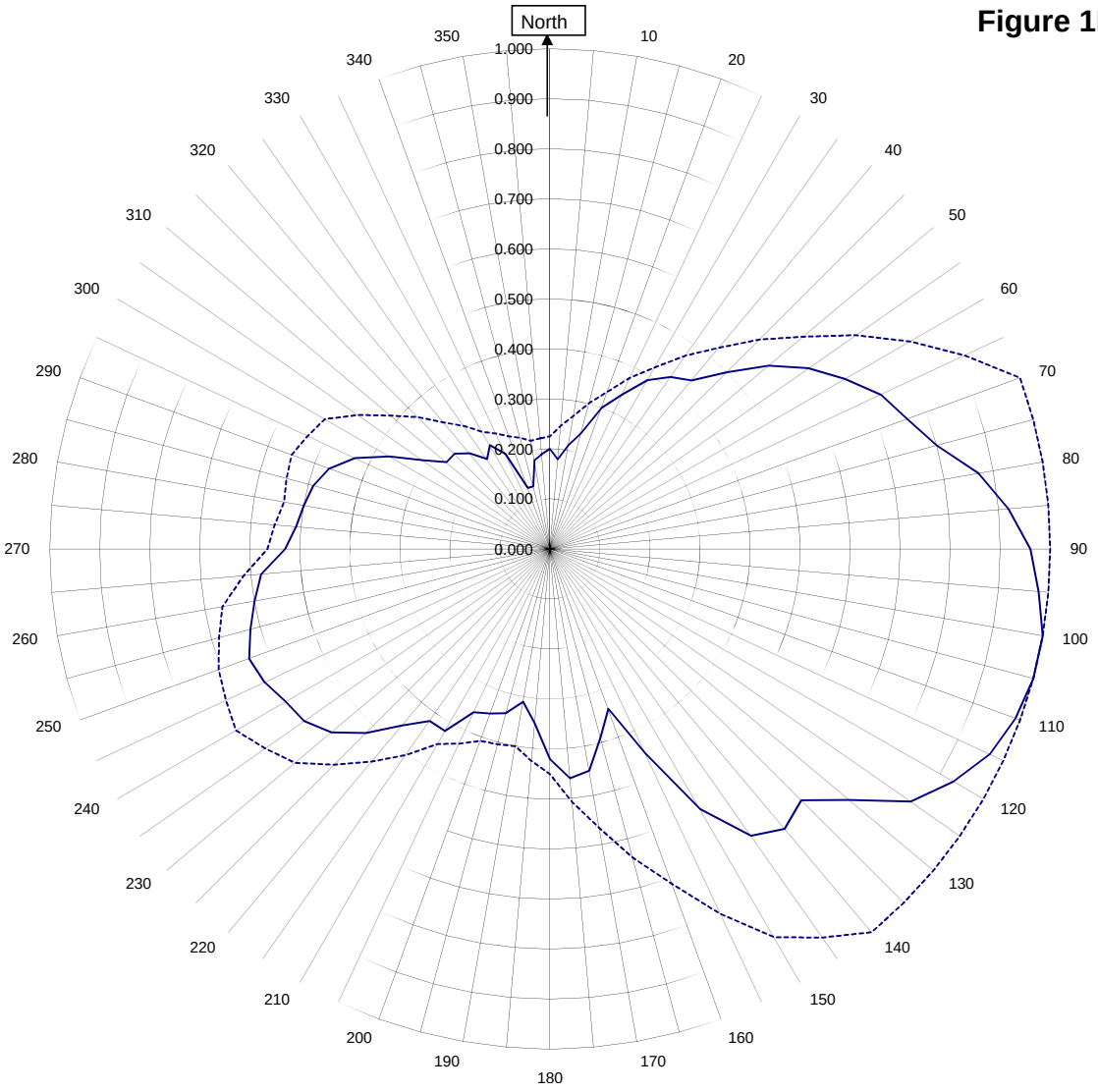
Figure 1B



WKBR Summerville, SC

31127

October 24, 2013

_____H/VComposite RMS	0.568
……FCC Composite RMS	0.667

Frequency	88.9 / 400.05 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6025-4/I-Slant (43°)-DA
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
WKBR Summerville, SC

Azimuth	Rel Field	Azimuth	Rel Field
0	0.140	180	0.120
10	0.090	190	0.180
20	0.100	200	0.250
30	0.170	210	0.310
40	0.310	220	0.460
45	0.360	225	0.520
50	0.410	230	0.570
60	0.550	240	0.610
70	0.720	250	0.640
80	0.870	260	0.600
90	0.960	270	0.530
100	1.000	280	0.460
110	0.990	290	0.330
120	0.930	300	0.260
130	0.780	310	0.250
135	0.660	315	0.200
140	0.500	320	0.140
150	0.350	330	0.130
160	0.290	340	0.130
170	0.200	350	0.140

Figure 1D

Tabulation of Vertical Azimuth Pattern
WKBR Summerville, SC

Azimuth	Rel Field	Azimuth	Rel Field
0	0.200	180	0.420
10	0.210	190	0.310
20	0.300	200	0.350
30	0.390	210	0.420
40	0.440	220	0.410
45	0.500	225	0.430
50	0.570	230	0.480
60	0.680	240	0.590
70	0.760	250	0.610
80	0.820	260	0.570
90	0.870	270	0.530
100	0.880	280	0.500
110	0.830	290	0.470
120	0.720	300	0.370
130	0.680	310	0.270
135	0.710	315	0.270
140	0.730	320	0.250
150	0.600	330	0.240
160	0.340	340	0.070
170	0.450	350	0.180

Figure 1E

Tabulation of Composite Azimuth Pattern
WKBR Summerville, SC

Azimuth	Rel Field	Azimuth	Rel Field
0	0.200	180	0.420
10	0.210	190	0.310
20	0.300	200	0.350
30	0.390	210	0.420
40	0.440	220	0.460
45	0.500	225	0.520
50	0.570	230	0.570
60	0.680	240	0.610
70	0.760	250	0.640
80	0.870	260	0.600
90	0.960	270	0.530
100	1.000	280	0.500
110	0.990	290	0.470
120	0.930	300	0.370
130	0.780	310	0.270
135	0.710	315	0.270
140	0.730	320	0.250
150	0.600	330	0.240
160	0.340	340	0.130
170	0.450	350	0.180

Figure 1F

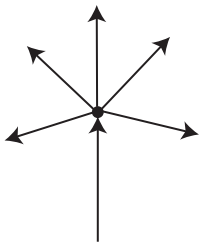
Tabulation of FCC Directional Composite
WKBR Summerville, SC

Azimuth	Rel Field	Azimuth	Rel Field
0	0.225	180	0.450
10	0.270	190	0.400
20	0.335	200	0.408
30	0.420	210	0.450
40	0.525	220	0.555
50	0.660	230	0.665
60	0.830	240	0.725
70	1.000	250	0.705
80	1.000	260	0.665
90	1.000	270	0.565
100	1.000	280	0.540
110	1.000	290	0.550
120	1.000	300	0.520
130	1.000	310	0.415
140	1.000	320	0.330
150	0.896	330	0.270
160	0.712	340	0.240
170	0.566	350	0.220

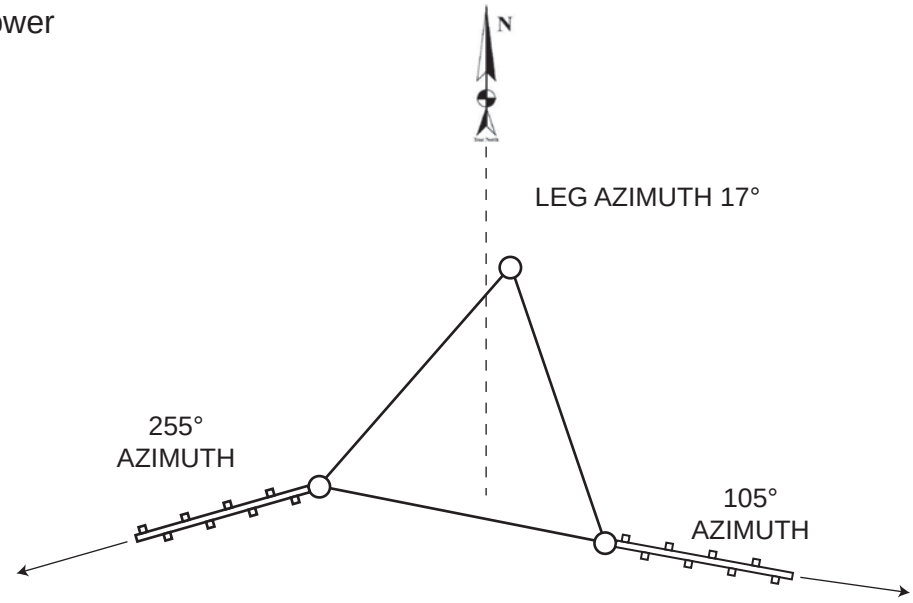
COAX SYSTEM

All Antennas Equal Power

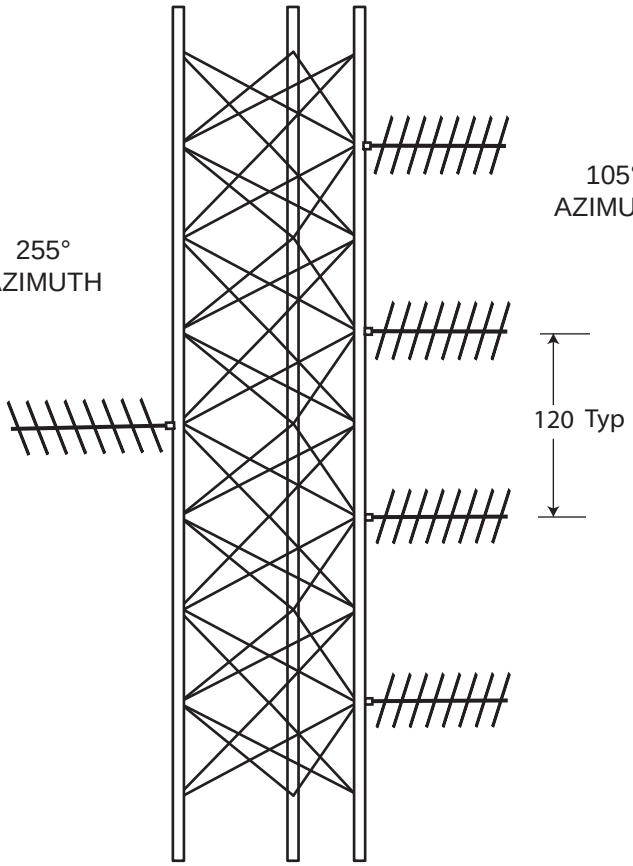
Equal Phasing



SCHEMATIC VIEW

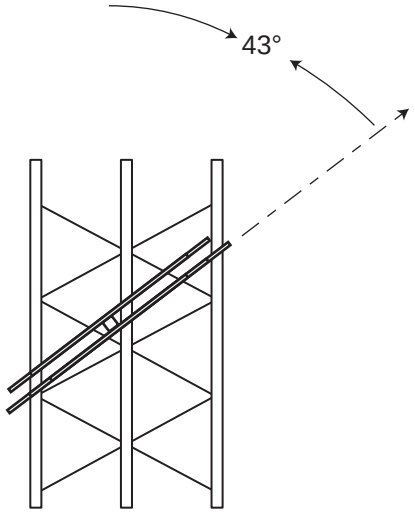


TOP VIEW



Valmont 48″ Tower

ELEVATION VIEW



PARTIAL FRONT VIEW

SHIVELY LABS

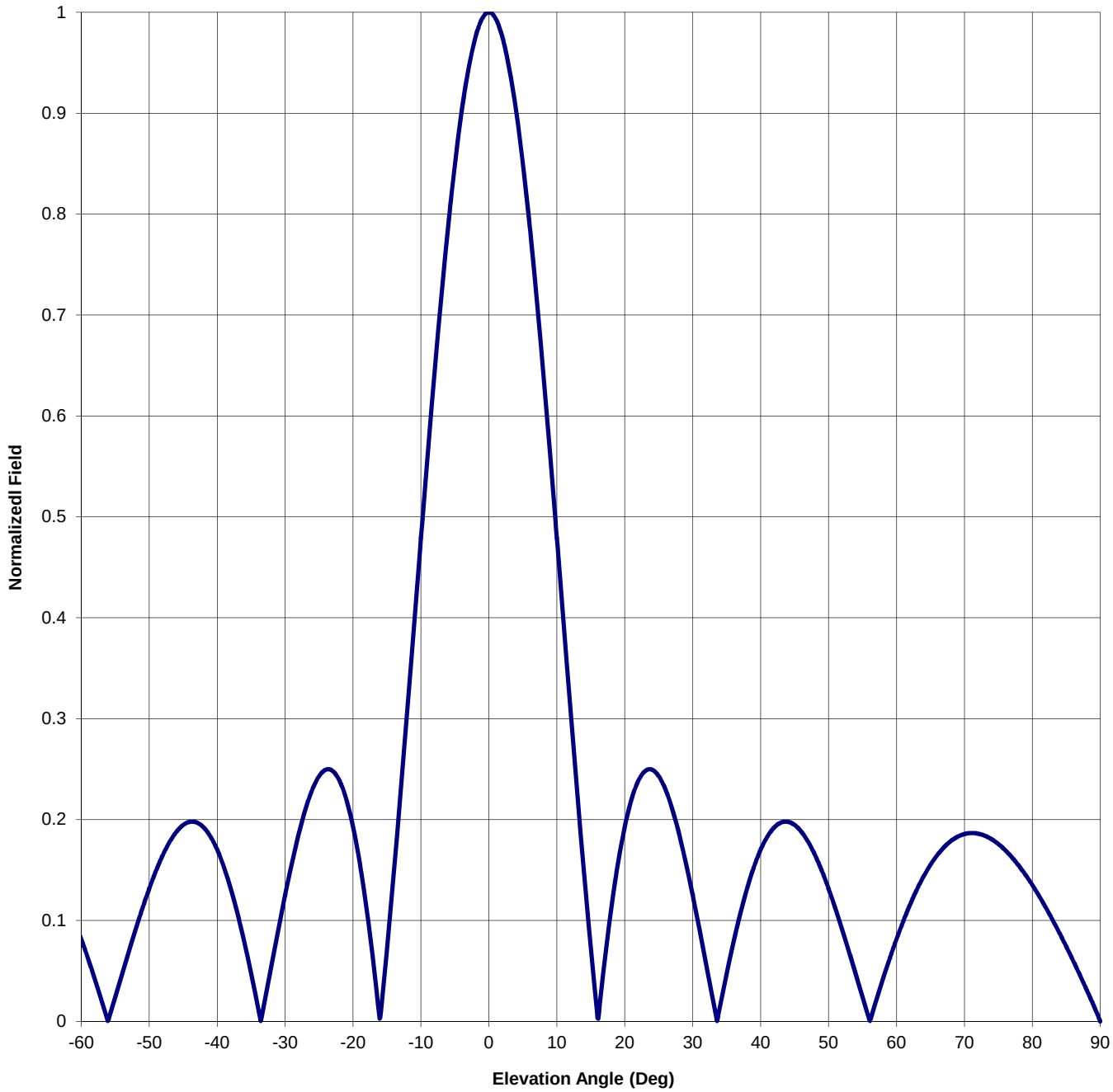
DIV. HOWELL LABS — BRIDGTON, MAINE USA

FIGURE 2, 88.9 MHz
WKBR Sommerville, SC.
6025-4/1-SLANT (43°)-DA

SIZE	CODE IDENT. NO.	DRAWING NO.	REV
A	26750	RAS101713	A

SCALE		SHEET
NONE	S/O 31127	1 OF 1

Antenna Mfg.:	**Shively Labs**			**Date:**	**10/24/2013**
Antenna Type:	**6025-4/1-Slant (43°)-DA**				
Station:	**WKBR**	**Beam Tilt**	**0**		
Frequency:	**88.9**	**Gain (Max)**	**8.954**	**9.520**	**dB**
Channel #:	**205**	**Gain (Horizon)**	**8.954**	**9.520**	**dB**
Figure:	**Figure 3**				



Antenna Mfg.: Shively Labs **Date:** 10/24/2013

Antenna Type: 6025-4/1-Slant (43°)-DA

Station: WKBR **Beam Tilt** 0

Frequency: 88.9 **Gain (Max)** 8.954 9.520 dB

Channel #: 205 **Gain (Horizon)** 8.954 9.520 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	0.198	0	1.000	46	0.188
-89	0.016	-43	0.197	1	0.994	47	0.178
-88	0.031	-42	0.192	2	0.975	48	0.165
-87	0.046	-41	0.183	3	0.944	49	0.149
-86	0.060	-40	0.170	4	0.902	50	0.132
-85	0.074	-39	0.153	5	0.850	51	0.112
-84	0.087	-38	0.132	6	0.789	52	0.091
-83	0.100	-37	0.107	7	0.719	53	0.069
-82	0.113	-36	0.078	8	0.643	54	0.047
-81	0.124	-35	0.047	9	0.563	55	0.024
-80	0.135	-34	0.014	10	0.479	56	0.002
-79	0.145	-33	0.020	11	0.394	57	0.020
-78	0.154	-32	0.056	12	0.309	58	0.042
-77	0.163	-31	0.091	13	0.226	59	0.062
-76	0.170	-30	0.125	14	0.147	60	0.082
-75	0.176	-29	0.157	15	0.072	61	0.099
-74	0.181	-28	0.186	16	0.004	62	0.116
-73	0.184	-27	0.210	17	0.058	63	0.131
-72	0.186	-26	0.230	18	0.112	64	0.144
-71	0.187	-25	0.243	19	0.157	65	0.155
-70	0.186	-24	0.249	20	0.193	66	0.165
-69	0.183	-23	0.248	21	0.220	67	0.173
-68	0.179	-22	0.239	22	0.239	68	0.179
-67	0.173	-21	0.220	23	0.248	69	0.183
-66	0.165	-20	0.193	24	0.249	70	0.186
-65	0.155	-19	0.157	25	0.243	71	0.187
-64	0.144	-18	0.112	26	0.230	72	0.186
-63	0.131	-17	0.058	27	0.210	73	0.184
-62	0.116	-16	0.004	28	0.186	74	0.181
-61	0.099	-15	0.072	29	0.157	75	0.176
-60	0.082	-14	0.147	30	0.125	76	0.170
-59	0.062	-13	0.226	31	0.091	77	0.163
-58	0.042	-12	0.309	32	0.056	78	0.154
-57	0.020	-11	0.394	33	0.020	79	0.145
-56	0.002	-10	0.479	34	0.014	80	0.135
-55	0.024	-9	0.563	35	0.047	81	0.124
-54	0.047	-8	0.643	36	0.078	82	0.113
-53	0.069	-7	0.719	37	0.107	83	0.100
-52	0.091	-6	0.789	38	0.132	84	0.087
-51	0.112	-5	0.850	39	0.153	85	0.074
-50	0.132	-4	0.902	40	0.170	86	0.060
-49	0.149	-3	0.944	41	0.183	87	0.046
-48	0.165	-2	0.975	42	0.192	88	0.031
-47	0.178	-1	0.994	43	0.197	89	0.016
-46	0.188	0	1.000	44	0.198	90	0.000
-45	0.195			45	0.195		

S.O. 31127 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WKBR Summerville, SC

MODEL 6025-4/I-Slant (43°)-DA

Elevation Gain of Antenna 2.438

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

H RMS 0.513765 V RMS 0.529967 H/V Ratio 0.969

Elevation Gain of Horizontal Component 2.363

Elevation Gain of Vertical Component 2.515

Horizontal Azimuth Gain equals $1/(RMS)^2$. 3.789

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 2.757

Max. Vertical 0.88

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

Total Horizontal Power Gain = **8.954**

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

Total Vertical Power Gain = **6.934**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

70.0 kW ERP Divided by H Gain 8.954 equals 7.818 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

7.818 kW Times V Gain 6.934 equals 54.208 kW V ERP

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

(0.88)^2 Times 70.00 Equals 54.208 kW Vertical ERP

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