Shively Labs
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S.O. 26518

Report of Test 6014-8/2-0.90SS-DA

for

VOX COMMUNICATIONS GROUP, LLC

WAVK 97.7 MHz (See Table 1) MARATHON, FL

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6014-8/2-0.90SS-DA to meet the needs of WAVK and to comply with the requirements of the FCC construction permit, file number BMPH-20080613AAL.

The panel antenna's physical spacing of 0.90 wavelength (108 inches) is calculated at 98.1 MHz. Therefore, the electrical spacing is different for each station utilizing this antenna.

TABLE 1

Calls	Frequency	Electrical Spacing
WKWM	91.5	0.84λ
WAVK	**97.7**	**0.89λ**
WCNK	98.7	0.90λ
WKYZ	101.7	0.93λ
WWUS	104.1	0.95λ

RESULTS:

The measured azimuth pattern for the 6014-8/2-0.90SS-DA is shown in Figure 1. Figure 1A shows the Tabulation of the Horizontal Polarization. Figure 1B shows the Tabulation of the Vertical Polarization. Figure 1C shows the Tabulation of the FCC Composite Pattern. The calculated elevation pattern of the antenna is shown in Figure 3. Construction permit file number BMPH-20080613AAL indicates that the Horizontal radiation component shall not exceed 100.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

330 Degrees T: 11.6 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 069 Degrees T to 080 Degrees T and at 249 Degrees T to 256 Degrees T. At the restricted azimuth of 330 Degrees T the Horizontal component is 15.39 dB down from the maximum of 100.0 kW, or 2.9 kW.

The R.M.S. of the Horizontal component is 0.654. The total Horizontal power gain is 10.326. The R.M.S. of the Vertical component is 0.649. The total Vertical power gain is 8.364. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.729. The R.M.S. of the measured composite pattern is 0.682. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.620. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6014-8/2-0.90SS-DA was mounted on a tower of precise scale to the ERI 57" face tower at the WAVK site. The spacing of the panel antenna to the tower was varied to achieve the horizontal and vertical patterns shown in Figure 1. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BMPH-20080613AAL, a single level of the 6014-8/2-0.90SS-DA was set up on the Howell Laboratories 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

The test equipment is calibrated to ANSI/NCSL Z540-1-1994.

TEST PROCEDURES:

The corner reflector is mounted so that the horizontal and vertical azimuth patterns are measured independently by rotating the corner reflector by 90 degrees. The network analyzer was set to 439.65 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 1.

Respectfully submitted by:

Robert A. Surette
Director of Sales Engineering
S/O 26518
December 3, 2008

Shively Labs

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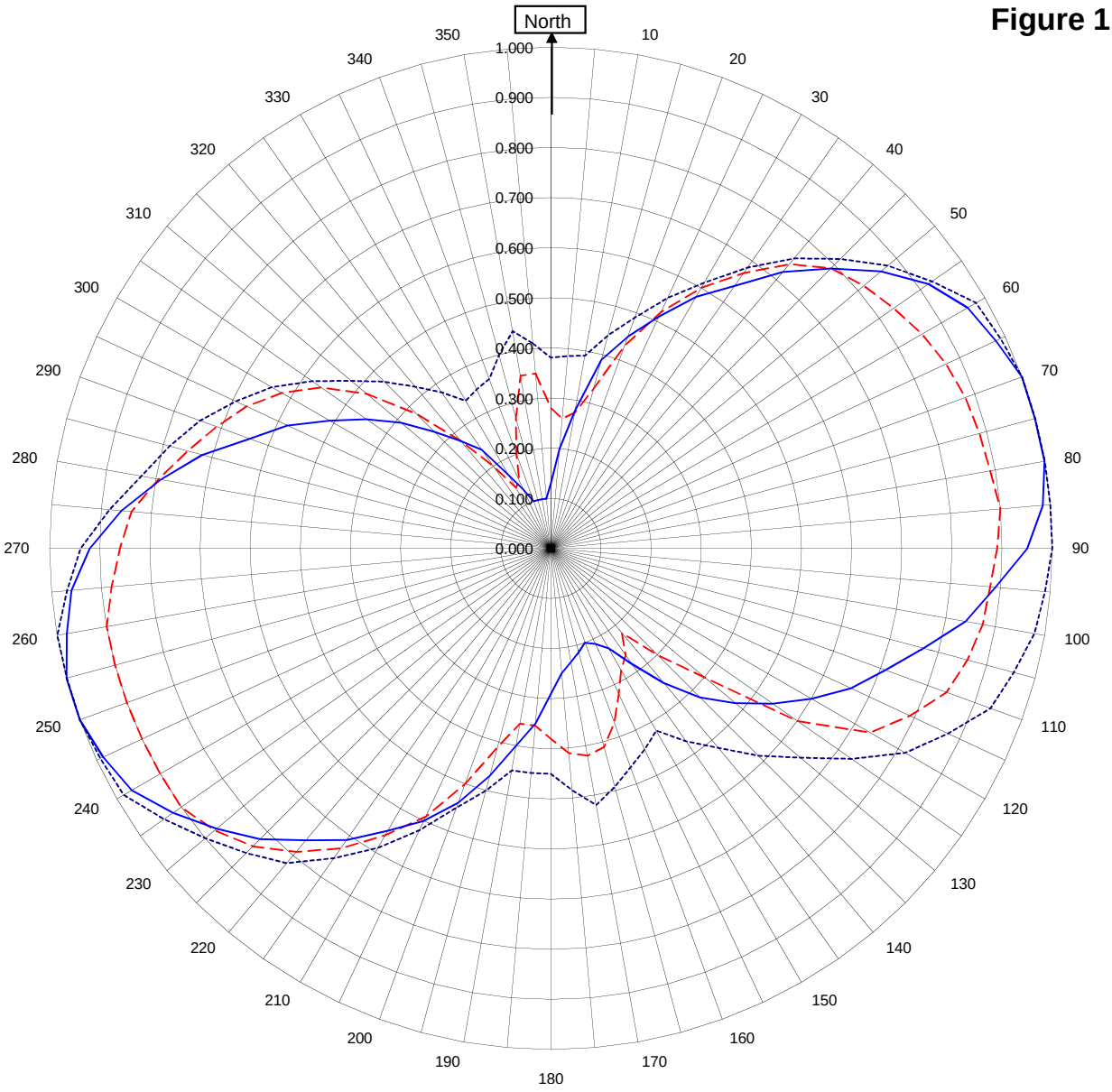
Figure 1



WAVK Marathon, FL

26518

December 2, 2008

Horizontal RMS	0.654
Vertical RMS	0.649
H/V Composite RMS	0.682
FCC Composite RMS	0.729

Frequency	97.7 / 439.65 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6014-8/2-0.90SS-DA
Pattern Type	Directional Azimuth

Figure 1A

Tabulation of Horizontal Azimuth Pattern
WAVK Marathon, FL

Azimuth	Rel Field	Azimuth	Rel Field
0	0.130	180	0.290
10	0.280	190	0.400
20	0.450	200	0.540
30	0.580	210	0.650
40	0.720	220	0.760
45	0.790	225	0.820
50	0.860	230	0.870
60	0.960	240	0.965
70	1.000	250	1.000
80	1.000	260	0.980
90	0.950	270	0.920
100	0.840	280	0.790
110	0.710	290	0.640
120	0.600	300	0.510
130	0.480	310	0.390
135	0.420	315	0.330
140	0.350	320	0.280
150	0.230	330	0.170
160	0.200	340	0.100
170	0.230	350	0.100

Figure 1B

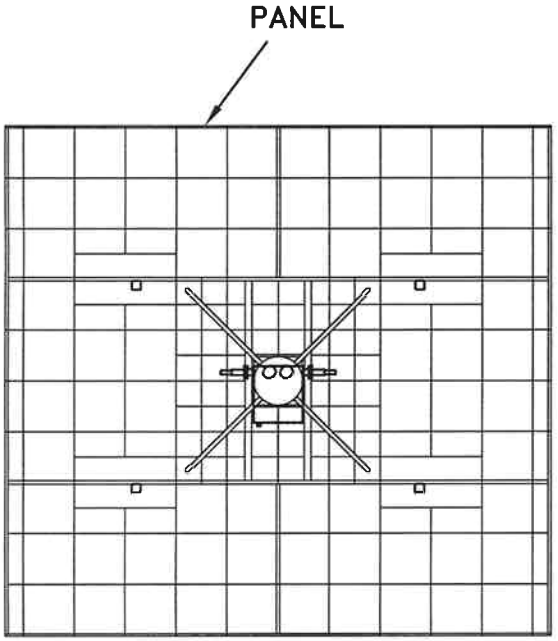
Tabulation of Vertical Azimuth Pattern
WAVK Marathon, FL

Azimuth	Rel Field	Azimuth	Rel Field
0	0.280	180	0.380
10	0.275	190	0.355
20	0.430	200	0.500
30	0.600	210	0.660
40	0.740	220	0.790
45	0.790	225	0.840
50	0.815	230	0.875
60	0.855	240	0.900
70	0.880	250	0.900
80	0.890	260	0.900
90	0.890	270	0.860
100	0.875	280	0.795
110	0.840	290	0.710
120	0.735	300	0.620
130	0.400	310	0.480
135	0.300	315	0.380
140	0.220	320	0.280
150	0.280	330	0.140
160	0.370	340	0.200
170	0.420	350	0.350

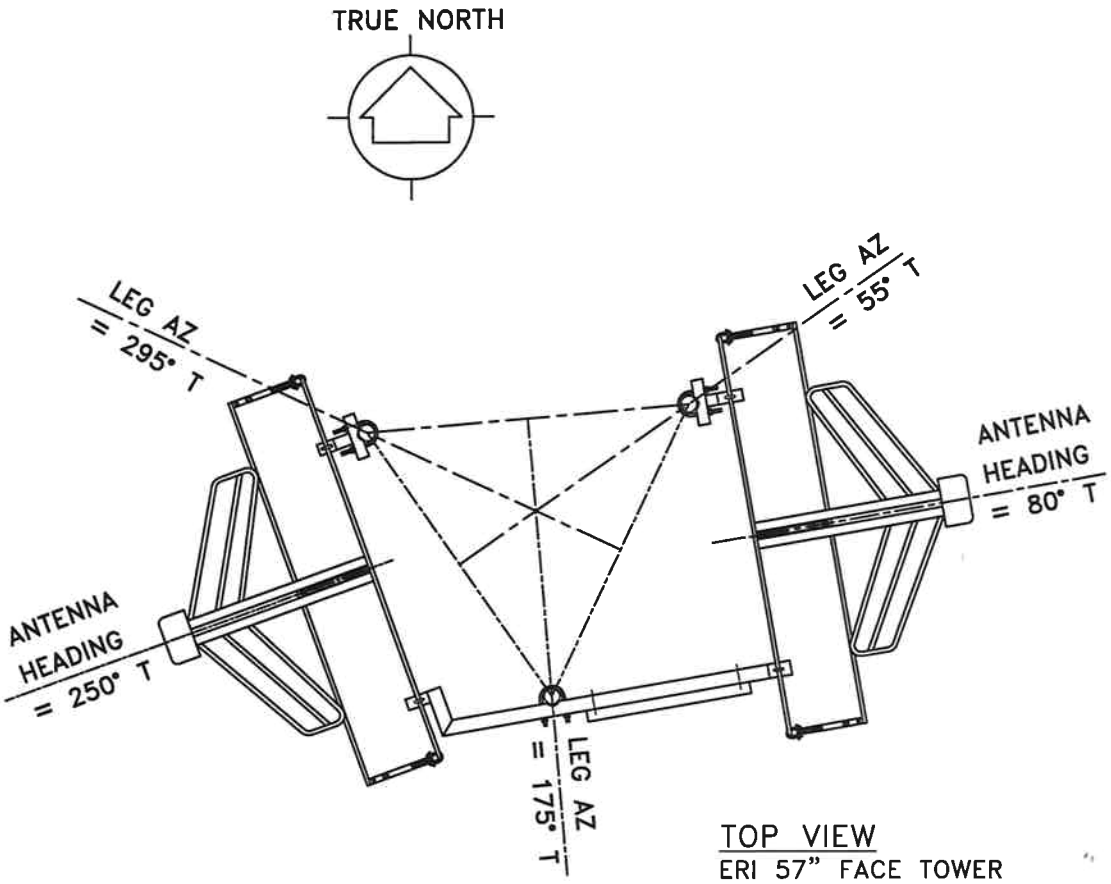
Figure 1C

Tabulation of FCC Directional Composite
WAVK Marathon, FL

Azimuth	Rel Field	Azimuth	Rel Field
0	0.380	180	0.450
10	0.390	190	0.450
20	0.490	200	0.551
30	0.612	210	0.690
40	0.755	220	0.820
50	0.877	230	0.900
60	0.979	240	0.984
70	1.000	250	1.000
80	1.000	260	1.000
90	1.000	270	0.938
100	0.979	280	0.830
110	0.933	290	0.745
120	0.816	300	0.643
130	0.650	310	0.520
140	0.520	320	0.420
150	0.420	330	0.340
160	0.465	340	0.360
170	0.520	350	0.440



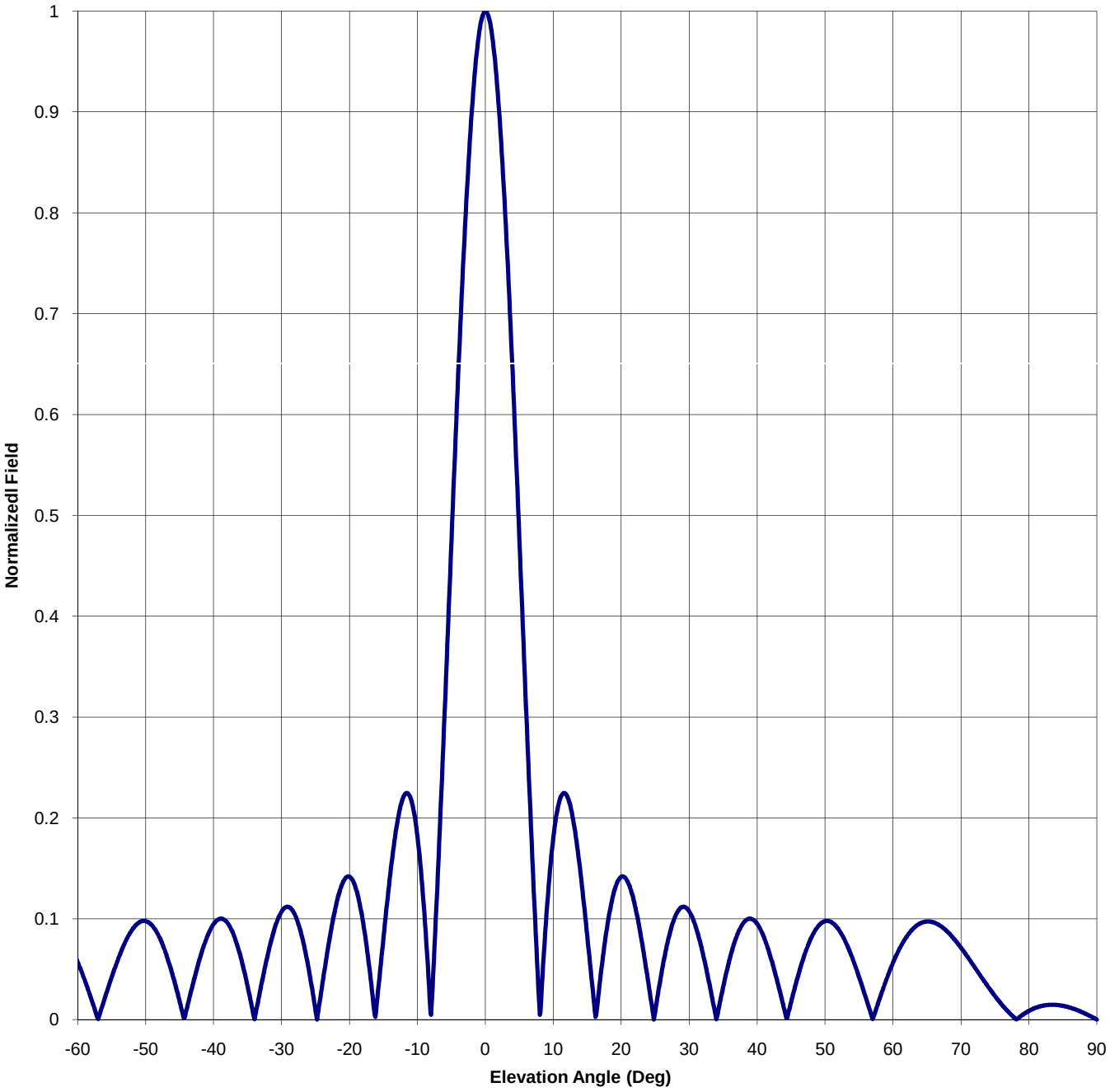
FRONT VIEW



TOP VIEW
ERI 57" FACE TOWER

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 26518-A	FREQUENCY: 88-108	SCALE: N.T.S.	DRAWN BY: DAB APPROVED BY: RAS
TITLE: MODEL-6014-8/2-.9SS DIRECTIONAL ANTENNA			
DATE: 7/24/08	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date:**	**12/3/2008**
Antenna Type:	**6014-8/2-0.90SS-DA**				
Station:	**WAVK**	**Beam Tilt**	**0**		
Frequency:	**97.7**	**Gain (Max)**	**10.326**	**10.140**	**dB**
Channel #:	**249**	**Gain (Horizon)**	**10.326**	**10.140**	**dB**
Figure:	**3**				



Antenna Mfg.: Shively Labs **Date:** 12/3/2008

Antenna Type: 6014-8/2-0.90SS-DA

Station: WAVK **Beam Tilt** 0

Frequency: 97.7 **Gain (Max)** 10.326 10.140 dB

Channel #: 249 **Gain (Horizon)** 10.326 10.140 dB

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	0.010	0	1.000	46	0.043
-89	0.004	-43	0.037	1	0.975	47	0.065
-88	0.007	-42	0.062	2	0.902	48	0.082
-87	0.010	-41	0.082	3	0.787	49	0.093
-86	0.012	-40	0.095	4	0.641	50	0.098
-85	0.014	-39	0.100	5	0.476	51	0.096
-84	0.015	-38	0.096	6	0.306	52	0.089
-83	0.015	-37	0.083	7	0.145	53	0.077
-82	0.014	-36	0.061	8	0.005	54	0.061
-81	0.012	-35	0.033	9	0.106	55	0.042
-80	0.009	-34	0.000	10	0.181	56	0.022
-79	0.004	-33	0.034	11	0.219	57	0.001
-78	0.001	-32	0.066	12	0.222	58	0.020
-77	0.007	-31	0.091	13	0.194	59	0.039
-76	0.015	-30	0.107	14	0.145	60	0.056
-75	0.023	-29	0.112	15	0.082	61	0.071
-74	0.033	-28	0.103	16	0.015	62	0.082
-73	0.042	-27	0.082	17	0.046	63	0.090
-72	0.052	-26	0.049	18	0.096	64	0.095
-71	0.062	-25	0.009	19	0.128	65	0.097
-70	0.071	-24	0.036	20	0.142	66	0.096
-69	0.080	-23	0.078	21	0.136	67	0.093
-68	0.087	-22	0.113	22	0.113	68	0.087
-67	0.093	-21	0.136	23	0.078	69	0.080
-66	0.096	-20	0.142	24	0.036	70	0.071
-65	0.097	-19	0.128	25	0.009	71	0.062
-64	0.095	-18	0.096	26	0.049	72	0.052
-63	0.090	-17	0.046	27	0.082	73	0.042
-62	0.082	-16	0.015	28	0.103	74	0.033
-61	0.071	-15	0.082	29	0.112	75	0.023
-60	0.056	-14	0.145	30	0.107	76	0.015
-59	0.039	-13	0.194	31	0.091	77	0.007
-58	0.020	-12	0.222	32	0.066	78	0.001
-57	0.001	-11	0.219	33	0.034	79	0.004
-56	0.022	-10	0.181	34	0.000	80	0.009
-55	0.042	-9	0.106	35	0.033	81	0.012
-54	0.061	-8	0.005	36	0.061	82	0.014
-53	0.077	-7	0.145	37	0.083	83	0.015
-52	0.089	-6	0.306	38	0.096	84	0.015
-51	0.096	-5	0.476	39	0.100	85	0.014
-50	0.098	-4	0.641	40	0.095	86	0.012
-49	0.093	-3	0.787	41	0.082	87	0.010
-48	0.082	-2	0.902	42	0.062	88	0.007
-47	0.065	-1	0.975	43	0.037	89	0.004
-46	0.043	0	1.000	44	0.010	90	0.000
-45	0.017			45	0.017		

S.O. 26518 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WAVK 97.7 MHz Marathon, FL

6014-8/2-0.90SS-DA

Elevation Gain of Antenna 4.383

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

H RMS 0.654 V RMS 0.649 H/V Ratio 1.008

Elevation Gain of Horizontal Component 4.417

Elevation Gain of Vertical Component 4.349

Horizontal Azimuth Gain equals $1/(RMS)^2$. 2.338

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 1.923

Max. Vertical 0.9

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

Total Horizontal Power Gain = **10.326**

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

Total Vertical Power Gain = **8.364**

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ERP divided by Horizontal Power Gain equals Antenna Input Power

100 kW ERP Divided by H Gain 10.326 equals 9.68 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

9.684 kW Times V Gain 8.364 equals 81.000 kW V ERP

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

(0.9)^2 Times 100.00 Equals 81.000 kW Vertical ERP

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