Shively Labs
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- An Employee-Owned Company -

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S.O. 24732

Report of Test 6810-3-DA

for

RADIO LICENSE HOLDING V, LLC

WZZN-FM 94.7 MHz Chicago, IL

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6810-3-DA to meet the needs of WZZN-FM and to comply with the requirements of the FCC construction permit, file number BXPH-20070420ABT.

RESULTS:

The measured azimuth pattern for the 6810-3-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 BXPH-20070420ABT indicates that the Horizontal radiation component shall not exceed 20.5 kW at any azimuth and is restricted to the following values at the azimuths specified:

240 Degrees T: 0.430 kW

From Figure 1, the maximum radiation of the Horizontal component occurs at 089 Degrees T to 127 Degrees T. At the restricted azimuth of 240 Degrees T the Vertical component is 16.88 dB down from the maximum of 20.5 kW, or 0.425 kW.

The R.M.S. of the Horizontal component is 0.703. The total Horizontal power gain is 3.221. The R.M.S. of the Vertical component is 0.689. The total Vertical power gain is 3.221. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.721. The R.M.S. of the measured composite pattern is 0.721. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.613. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6810-3-DA was mounted on a tower of precise scale to the Valmont #36 tower at the WZZN site. The spacing of the antenna to the tower was varied to achieve the vertical pattern shown in Figure 1. 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 1 was achieved. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BXPH-20070420ABT, a single level of the 6810-3-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 426.15 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.

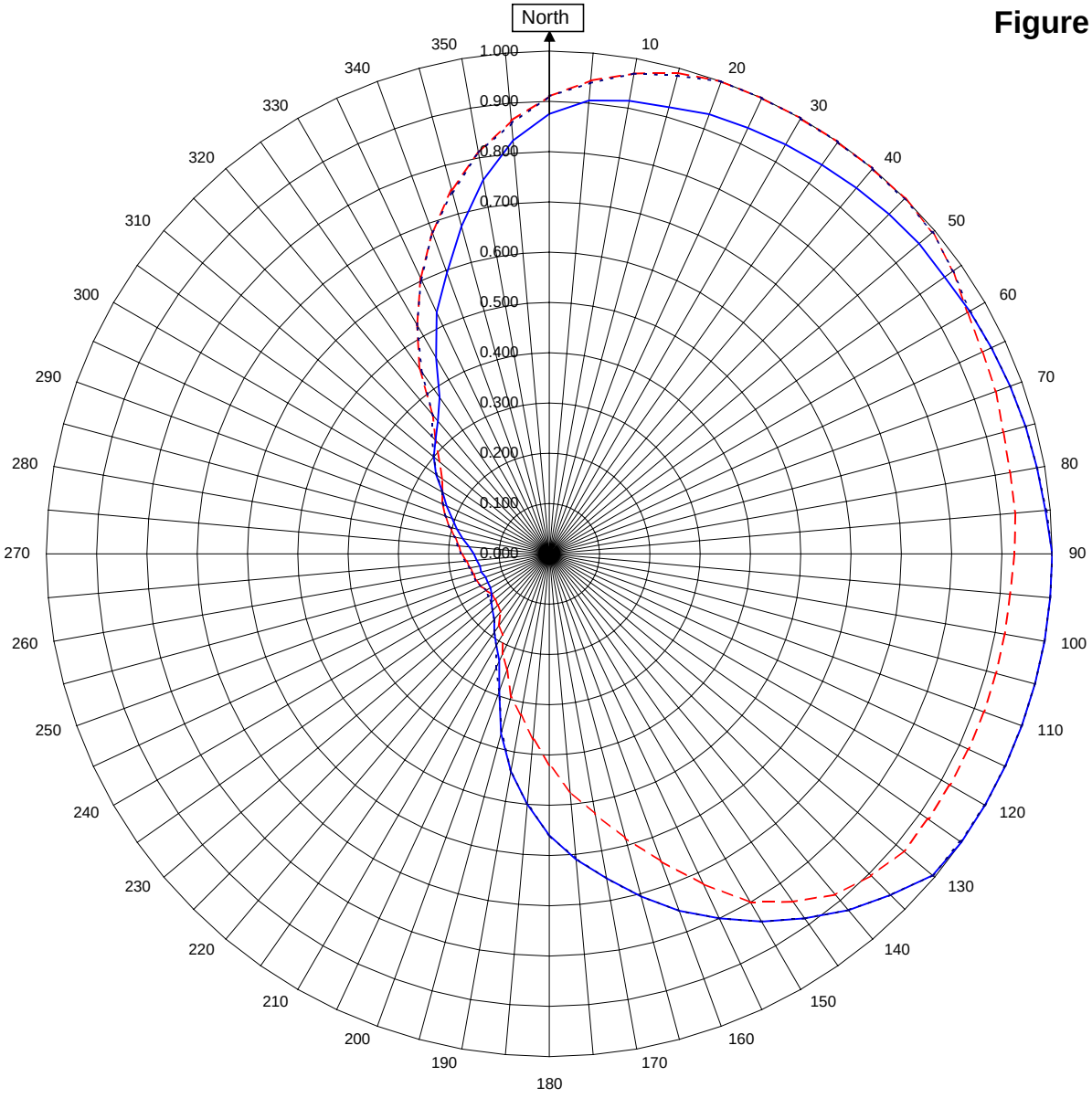
Respectfully submitted by:

Robert A. Surette
Director of Sales Engineering
S/O 24732
July 24, 2007

Shively Labs

Shively Labs, a division of Howell Laboratories, Inc. Bridgton, ME (207)647-3327

Figure 1



WZZN-FM Chicago, IL

24732

July 24, 2007

_____Horizontal RMS	0.703
_ _ _ _ _ _ _ _ _ Vertical RMS	0.689
H/V Composite RMS	0.721
.....FCC Composite RMS	0.721

Frequency	94.7 / 426.15 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	6810-3-DA
Pattern Type	Directional Azimuth

Figure 1a

Tabulation of Horizontal Azimuth Pattern
WZZN-FM Chicago, IL

Azimuth	Rel Field	Azimuth	Rel Field
0	0.875	180	0.560
10	0.915	190	0.440
20	0.930	200	0.290
30	0.940	210	0.210
40	0.950	220	0.170
45	0.955	225	0.160
50	0.960	230	0.150
60	0.965	240	0.135
70	0.975	250	0.135
80	0.985	260	0.140
90	1.000	270	0.150
100	1.000	280	0.175
110	1.000	290	0.205
120	1.000	300	0.245
130	0.995	310	0.300
135	0.960	315	0.320
140	0.925	320	0.345
150	0.845	330	0.450
160	0.755	340	0.595
170	0.655	350	0.755

Figure 1b

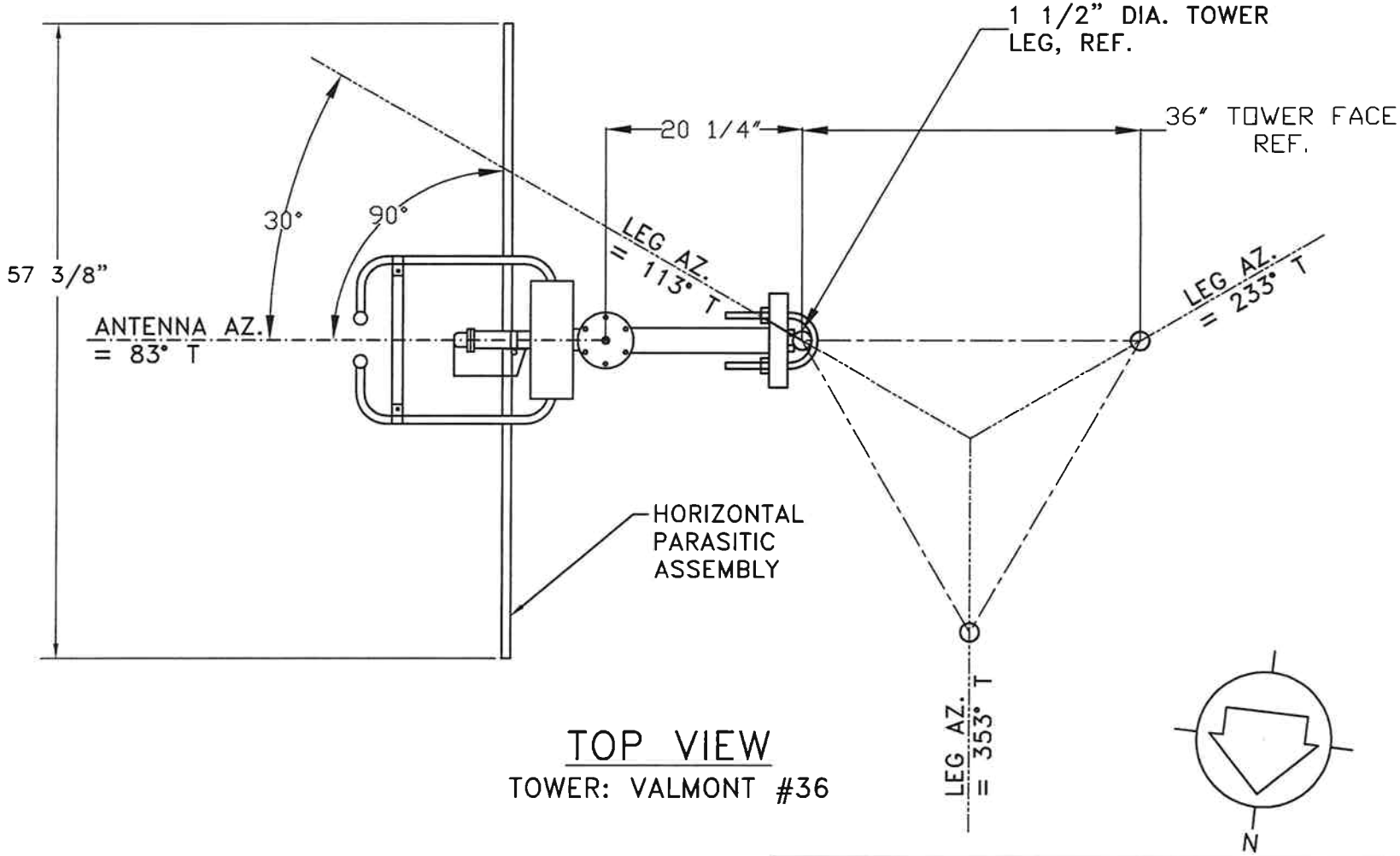
Tabulation of Vertical Azimuth Pattern
WZZN-FM Chicago, IL

Azimuth	Rel Field	Azimuth	Rel Field
0	0.910	180	0.420
10	0.970	190	0.325
20	1.000	200	0.245
30	1.000	210	0.185
40	1.000	220	0.150
45	1.000	225	0.145
50	0.995	230	0.140
60	0.960	240	0.144
70	0.945	250	0.155
80	0.930	260	0.160
90	0.925	270	0.175
100	0.920	280	0.190
110	0.920	290	0.220
120	0.920	300	0.245
130	0.920	310	0.285
135	0.905	315	0.320
140	0.885	320	0.360
150	0.800	330	0.525
160	0.650	340	0.680
170	0.525	350	0.810

Figure 1c

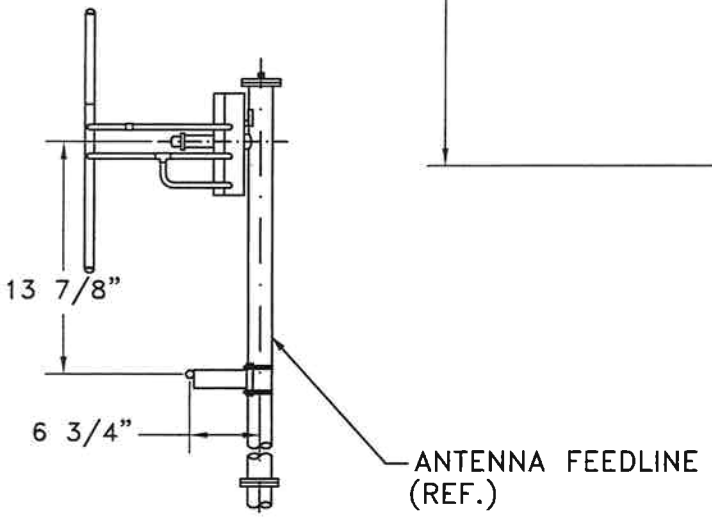
Tabulation of FCC Directional Composite
WZZN-FM Chicago, IL

Azimuth	Rel Field	Azimuth	Rel Field
0	0.910	180	0.560
10	0.970	190	0.440
20	1.000	200	0.290
30	1.000	210	0.210
40	1.000	220	0.170
50	0.995	230	0.150
60	0.965	240	0.145
70	0.975	250	0.155
80	0.985	260	0.160
90	1.000	270	0.175
100	1.000	280	0.190
110	1.000	290	0.220
120	1.000	300	0.245
130	0.995	310	0.300
140	0.925	320	0.360
150	0.845	330	0.525
160	0.755	340	0.680
170	0.655	350	0.810



TOP VIEW

TOWER: VALMONT #36



SIDE VIEW

ANTENNA HEADING: 83° TRUE NORTH

SHIVELY LABS

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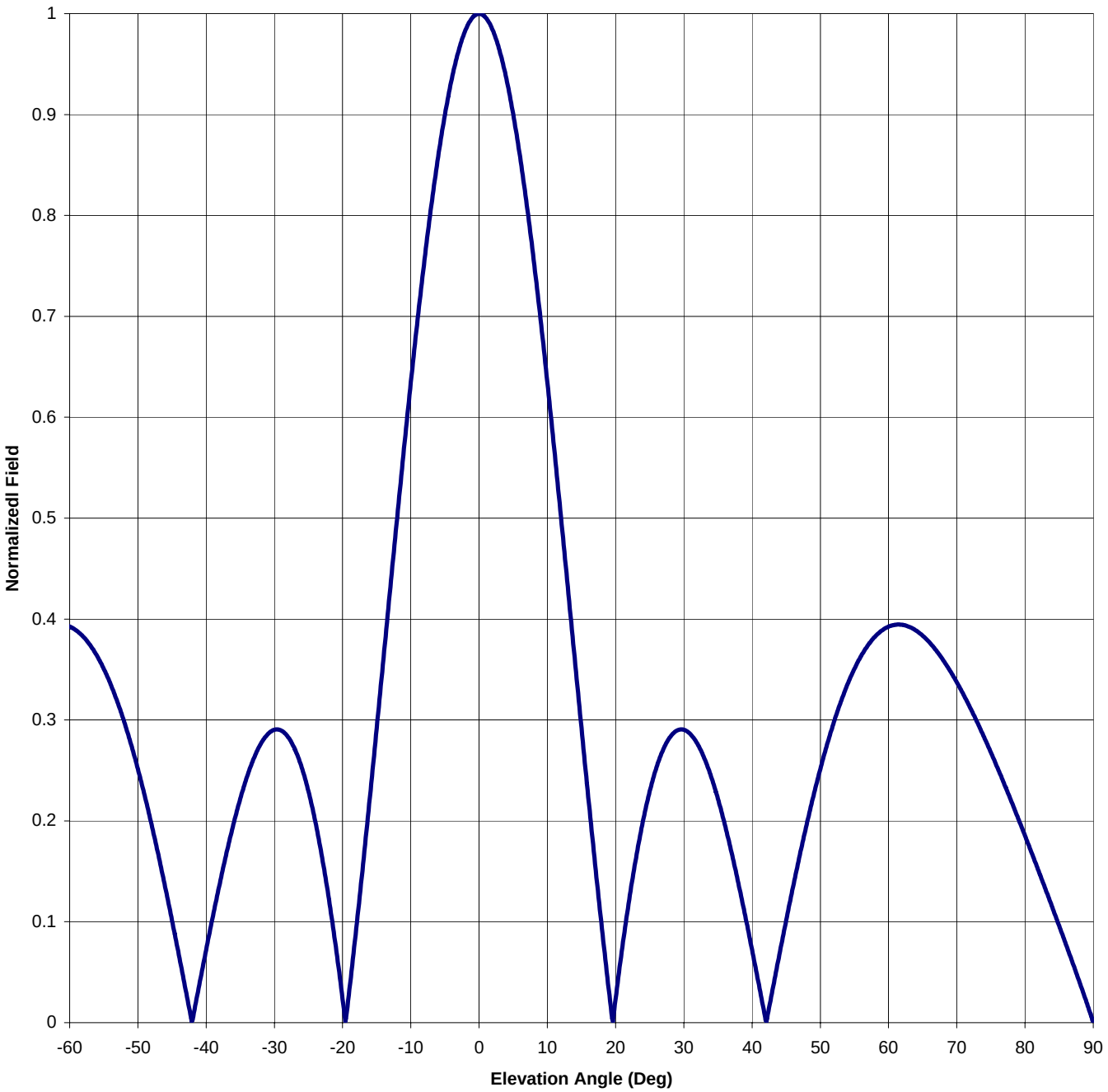
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY:
24732	94.7	N.T.S.	ASP
			APPROVED BY: DAB

TITLE: MODEL--6810--3--DIRECTIONAL ANTENNA

DATE: 5/31/07

FIGURE 2

Antenna Mfg.:	**Shively Labs**			**Date: 7/24/2007**
Antenna Type:	**6810-3-DA**			
Station:	**WZZN**	**Beam Tilt**	**0**	
Frequency:	**94.7**	**Gain (Max)**	**3.221**	**5.080 dB**
Channel #:	**234**	**Gain (Horizon)**	**3.221**	**5.080 dB**
Figure:	**3**			



Antenna Mfg.: Shively Labs
Antenna Type: 6810-3-DA
Station: WZZN
Frequency: 94.7
Channel #: 234
Figure: 3

Beam Tilt 0
Gain (Max) 3.221 **5.080 dB**
Gain (Horizon) 3.221 **5.080 dB**

Date: 7/24/2007

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	0.067	0	1.000	46	0.134
-89	0.021	-43	0.033	1	0.996	47	0.166
-88	0.040	-42	0.003	2	0.984	48	0.196
-87	0.059	-41	0.038	3	0.963	49	0.225
-86	0.078	-40	0.072	4	0.935	50	0.251
-85	0.096	-39	0.106	5	0.900	51	0.276
-84	0.114	-38	0.138	6	0.858	52	0.298
-83	0.132	-37	0.168	7	0.810	53	0.318
-82	0.150	-36	0.197	8	0.756	54	0.335
-81	0.168	-35	0.222	9	0.697	55	0.351
-80	0.185	-34	0.244	10	0.635	56	0.364
-79	0.202	-33	0.262	11	0.569	57	0.374
-78	0.219	-32	0.276	12	0.501	58	0.382
-77	0.236	-31	0.286	13	0.432	59	0.389
-76	0.252	-30	0.290	14	0.362	60	0.392
-75	0.268	-29	0.290	15	0.292	61	0.394
-74	0.283	-28	0.283	16	0.224	62	0.394
-73	0.298	-27	0.271	17	0.157	63	0.392
-72	0.312	-26	0.253	18	0.093	64	0.389
-71	0.325	-25	0.229	19	0.033	65	0.384
-70	0.337	-24	0.199	20	0.023	66	0.377
-69	0.349	-23	0.163	21	0.075	67	0.369
-68	0.359	-22	0.122	22	0.122	68	0.359
-67	0.369	-21	0.075	23	0.163	69	0.349
-66	0.377	-20	0.023	24	0.199	70	0.337
-65	0.384	-19	0.033	25	0.229	71	0.325
-64	0.389	-18	0.093	26	0.253	72	0.312
-63	0.392	-17	0.157	27	0.271	73	0.298
-62	0.394	-16	0.224	28	0.283	74	0.283
-61	0.394	-15	0.292	29	0.290	75	0.268
-60	0.392	-14	0.362	30	0.290	76	0.252
-59	0.389	-13	0.432	31	0.286	77	0.236
-58	0.382	-12	0.501	32	0.276	78	0.219
-57	0.374	-11	0.569	33	0.262	79	0.202
-56	0.364	-10	0.635	34	0.244	80	0.185
-55	0.351	-9	0.697	35	0.222	81	0.168
-54	0.335	-8	0.756	36	0.197	82	0.150
-53	0.318	-7	0.810	37	0.168	83	0.132
-52	0.298	-6	0.858	38	0.138	84	0.114
-51	0.276	-5	0.900	39	0.106	85	0.096
-50	0.251	-4	0.935	40	0.072	86	0.078
-49	0.225	-3	0.963	41	0.038	87	0.059
-48	0.196	-2	0.984	42	0.003	88	0.040
-47	0.166	-1	0.996	43	0.033	89	0.021
-46	0.134	0	1.000	44	0.067	90	0.000
-45	0.101			45	0.101		

S.O. 24732 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

WZZN CHICAGO, IL

MODEL 6810-3-DA

Elevation Gain of Antenna 1.56

The RMS values are calculated utilizing the data of a planimeter

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

H RMS 0.703 V RMS 0.689 H/V Ratio 1.020

Elevation Gain of Horizontal Component 1.592

Elevation Gain of Vertical Component 1.529

Horizontal Azimuth Gain equals 1/(RMS)SQ. 2.023

Vertical Azimuth Gain equals 1/(RMS/Max Vert)SQ. 2.107
Max. Vertical 1

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

Total Horizontal Power Gain = **3.221**

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

Total Vertical Power Gain = **3.221**

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ERP divided by Horizontal Power Gain equals Antenna Input Power

20.5 KW ERP Equals 6.365 KW Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

6.365 KW Times 3.221 KW Equals 20.500 KW ERP

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

1 Equals 20.500 KW Vertical ERP

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