

S.O. 26221

Report of Test 6513BB-4-DA

for

NAVAJO MISSIONS, INC.

KNMI 88.9 MHz Farmington, NM

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6513BB-4-DA to meet the needs of KNMI and to comply with the requirements of the FCC construction permit, file number BPED-20070705AEU.

RESULTS:

The measured azimuth pattern for the 6513BB-4-DA is shown in Figure 1. Figure 1A shows the Tabulation of the Vertical Polarization. Figure 1B shows the Tabulation of the FCC Composite Pattern. The calculated elevation pattern of the antenna is shown in Figure 3. Construction permit file number BPED-20070705AEU indicates that the Vertical radiation component shall not exceed 27.0 kW at any azimuth and is restricted to the following values at the azimuths specified:

210 - 230 Degrees T: 6.0 kW

From Figure 1, the maximum radiation of the Vertical component occurs at 304 Degrees T to 327 Degrees T. At the restricted azimuth of 210 - 230 Degrees T the Vertical component is 6.7 dB down from the maximum of 27.0 kW, or 5.7 kW.

The R.M.S. of the Vertical component is 0.716. The total Vertical power gain is 8.371. See Figure 4 for calculations.

AMENDED FCC COMPOSITE PATTERN:

The R.M.S. of the measured composite pattern is 0.716. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.743. Therefore the measured pattern does not comply with the FCC requirement of 73.316(c)(ix)(A). In accordance with 73.1690(c)(2)(ii) an amended composite pattern with an R.M.S. value of 0.715 is attached as Figure 5. Figure 5A shows the tabulations of the amended composite pattern. This new composite pattern allows the above measured pattern to comply with the FCC requirement of 73.316(c)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6513BB-4-DA was mounted on a tower of precise scale to the Windcharger 16-1/2" face tower at the KNMI site. The spacing of the antenna to the tower was varied to achieve the vertical pattern shown in Figure 1. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BPED-20070705AEU, a single level of the 6513BB-4-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 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 unpadding 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:

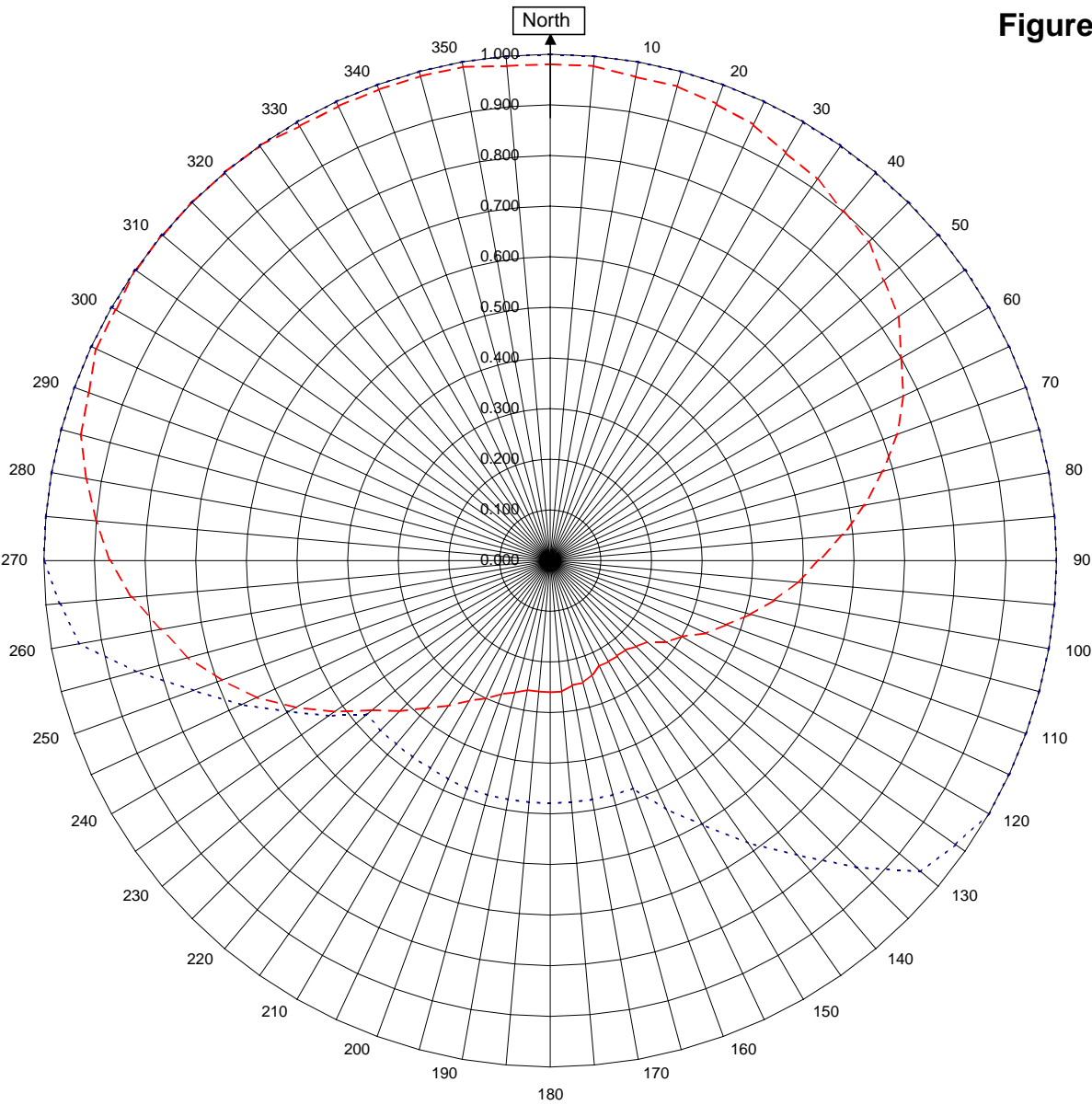


Robert A. Surette
Director of Sales Engineering
S/O 26221
December 7, 2007

Shively Labs

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

Figure 1



KNMI Farmington, NM

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Horizontal RMS	0.000	Frequency	88.9 / 400.05 mHz
Vertical RMS	0.716	Plot	Relative Field
H/V Composite RMS	0.716	Scale	4.5 : 1
FCC Composite RMS	0.874	See Figure 2 for Mechanical Details	

Antenna Model	6513BB-4-DA	Pattern 4
Pattern Type	Directional Azimuth	

Figure 1a

Tabulation of Vertical Azimuth Pattern
KNMI Farmington, NM

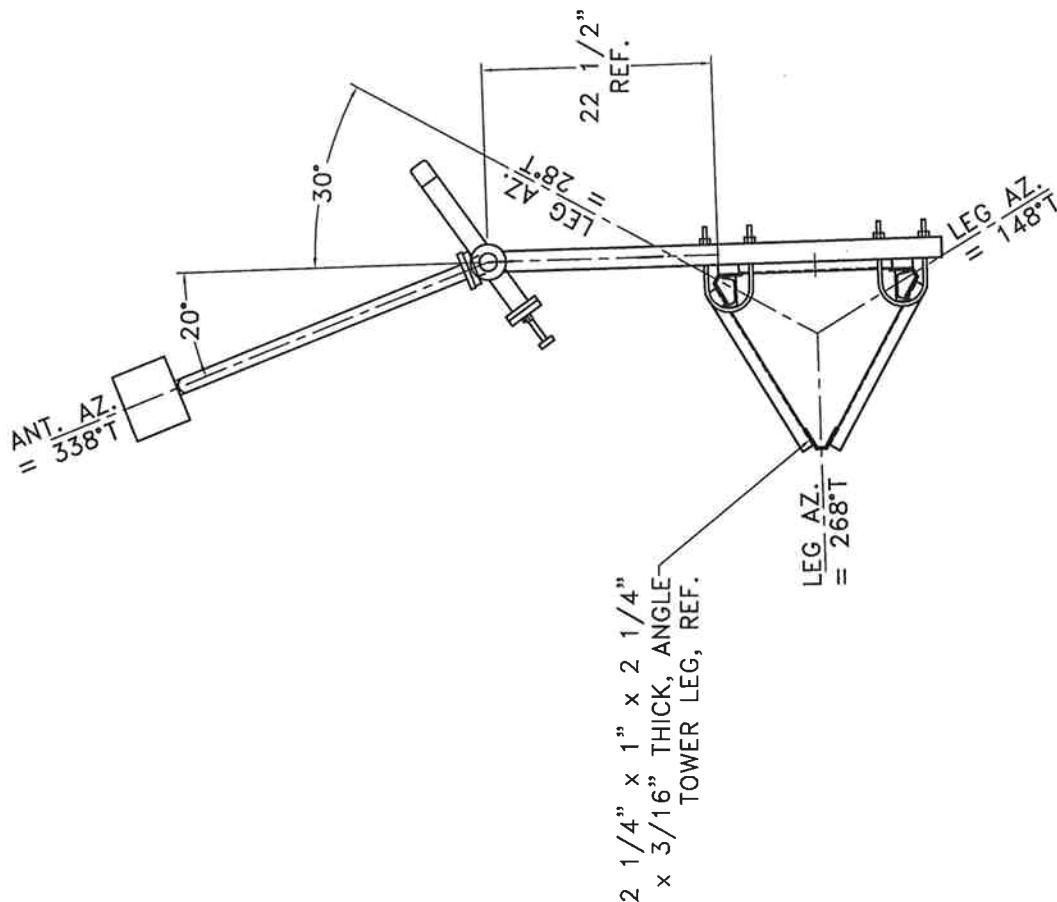
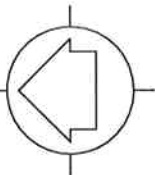
Azimuth	Rel Field	Azimuth	Rel Field
0	0.980	180	0.260
10	0.970	190	0.260
20	0.960	200	0.280
30	0.930	210	0.320
40	0.900	220	0.380
45	0.890	225	0.420
50	0.860	230	0.460
60	0.800	240	0.580
70	0.730	250	0.690
80	0.630	260	0.780
90	0.530	270	0.870
100	0.450	280	0.930
110	0.370	290	0.970
120	0.300	300	0.990
130	0.250	310	1.000
135	0.240	315	1.000
140	0.230	320	1.000
150	0.230	330	0.990
160	0.240	340	0.990
170	0.250	350	0.990

Figure 1b

Tabulation of FCC Directional Composite
KNMI Farmington, NM

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.479
10	1.000	190	0.479
20	1.000	200	0.479
30	1.000	210	0.473
40	1.000	220	0.473
50	1.000	230	0.473
60	1.000	240	0.596
70	1.000	250	0.750
80	1.000	260	0.944
90	1.000	270	1.000
100	1.000	280	1.000
110	1.000	290	1.000
120	1.000	300	1.000
130	0.955	310	1.000
140	0.759	320	1.000
150	0.603	330	1.000
160	0.479	340	1.000
170	0.479	350	1.000

TRUE NORTH



DIPOLE

ANTENNA
FEEDLINE
REF.

SIDE VIEW

TYP. ALL BAYS

TOP VIEW

TOWER: WINCHARGER 16 1/2"

SHIVELY LABS

A DIVISION OF HOWELL LABORATORIES INC., BRIDGTON, MAINE, USA

SHOP ORDER	FREQUENCY	SCALE	DESIGNER	APPROVED BY
26221	88.9	N.T.S.	ASP	DAB

TITLE	MODEL 6513-4-DIRECTIONAL ANTENNA FM STATION
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DATE	1/4/08
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ANTENNA HEADINGS: 338° TRUE NORTH

FIGURE 2

Antenna Mfg.: Shively Labs
Antenna Type: 6513BB-4-DA

Date: 12/7/2007

Station: KNMI

Beam Tilt 0

Frequency: 88.9

Gain (Max) 8.371

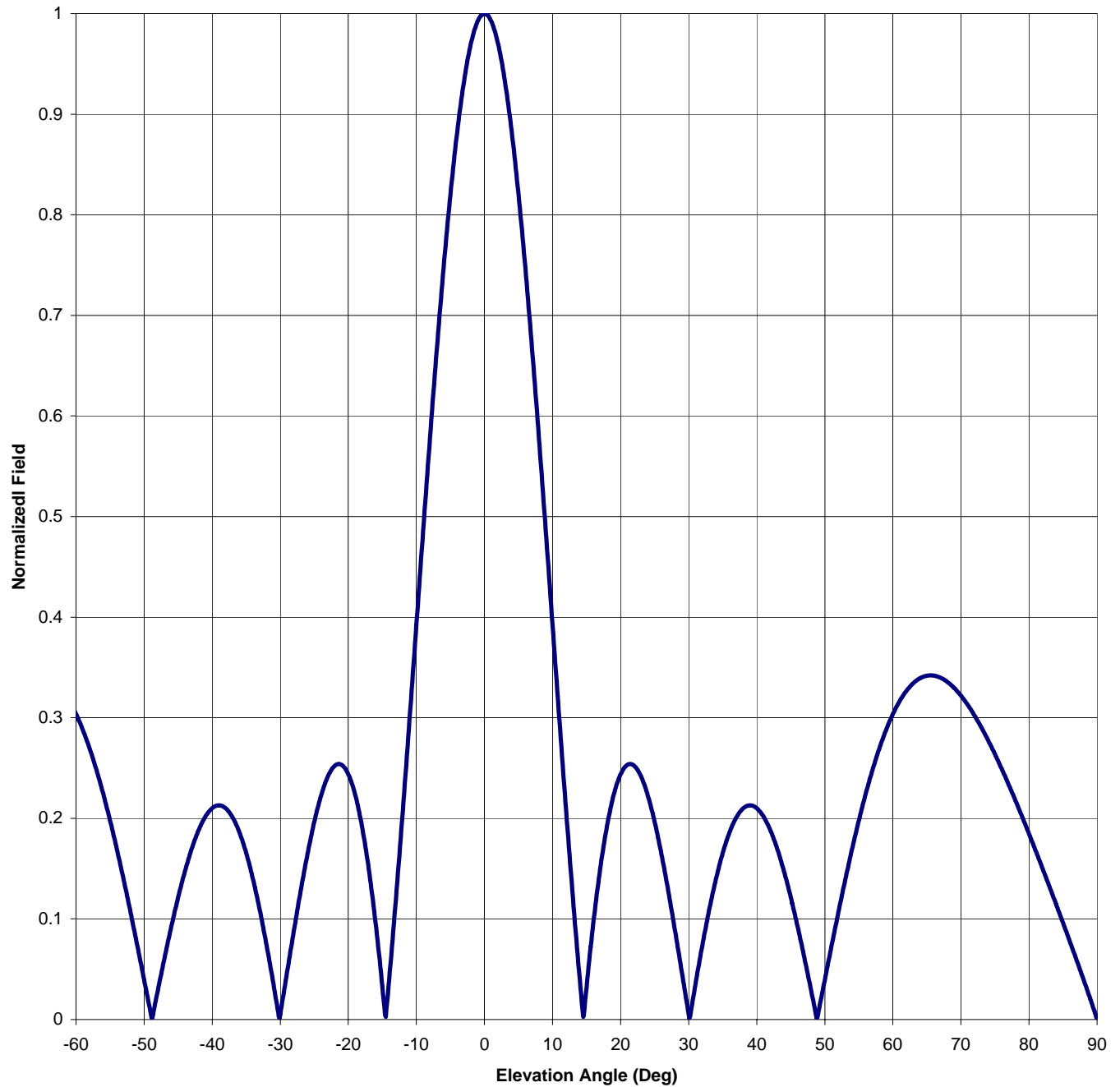
9.228 dB

Channel #: 205

Gain (Horizon) 8.371

9.228 dB

Figure: 3



Antenna Mfg.: Shively Labs
Antenna Type: 6513BB-4-DA

Date: 12/7/2007

Station: KNMI

Beam Tilt 0

Frequency: 88.9

Gain (Max) 8.371

9.228 dB

Channel #: 205

Gain (Horizon) 8.371

9.228 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	0.147	0	1.000	46	0.093
-89	0.021	-43	0.170	1	0.992	47	0.061
-88	0.040	-42	0.188	2	0.970	48	0.028
-87	0.059	-41	0.202	3	0.933	49	0.005
-86	0.078	-40	0.210	4	0.883	50	0.039
-85	0.096	-39	0.213	5	0.820	51	0.073
-84	0.114	-38	0.210	6	0.747	52	0.107
-83	0.132	-37	0.201	7	0.666	53	0.139
-82	0.150	-36	0.186	8	0.578	54	0.169
-81	0.167	-35	0.165	9	0.486	55	0.198
-80	0.185	-34	0.139	10	0.392	56	0.224
-79	0.201	-33	0.109	11	0.299	57	0.248
-78	0.218	-32	0.073	12	0.207	58	0.269
-77	0.234	-31	0.035	13	0.121	59	0.288
-76	0.249	-30	0.005	14	0.040	60	0.304
-75	0.264	-29	0.047	15	0.033	61	0.317
-74	0.277	-28	0.088	16	0.096	62	0.327
-73	0.290	-27	0.128	17	0.150	63	0.334
-72	0.302	-26	0.164	18	0.192	64	0.339
-71	0.313	-25	0.197	19	0.224	65	0.342
-70	0.322	-24	0.223	20	0.244	66	0.342
-69	0.330	-23	0.242	21	0.253	67	0.340
-68	0.336	-22	0.252	22	0.252	68	0.336
-67	0.340	-21	0.253	23	0.242	69	0.330
-66	0.342	-20	0.244	24	0.223	70	0.322
-65	0.342	-19	0.224	25	0.197	71	0.313
-64	0.339	-18	0.192	26	0.164	72	0.302
-63	0.334	-17	0.150	27	0.128	73	0.290
-62	0.327	-16	0.096	28	0.088	74	0.277
-61	0.317	-15	0.033	29	0.047	75	0.264
-60	0.304	-14	0.040	30	0.005	76	0.249
-59	0.288	-13	0.121	31	0.035	77	0.234
-58	0.269	-12	0.207	32	0.073	78	0.218
-57	0.248	-11	0.299	33	0.109	79	0.201
-56	0.224	-10	0.392	34	0.139	80	0.185
-55	0.198	-9	0.486	35	0.165	81	0.167
-54	0.169	-8	0.578	36	0.186	82	0.150
-53	0.139	-7	0.666	37	0.201	83	0.132
-52	0.107	-6	0.747	38	0.210	84	0.114
-51	0.073	-5	0.820	39	0.213	85	0.096
-50	0.039	-4	0.883	40	0.210	86	0.078
-49	0.005	-3	0.933	41	0.202	87	0.059
-48	0.028	-2	0.970	42	0.188	88	0.040
-47	0.061	-1	0.992	43	0.170	89	0.021
-46	0.093	0	1.000	44	0.147	90	0.000
-45	0.121			45	0.121		

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VALIDATION OF GAIN CALCULATION

KNMI 88.9 MHz FARMINGTON, NM

MODEL 6513BB-4-DA

Elevation Gain of 6513BB-4-DA equals 4.284

Vertical Azimuth Gain equals $1/(\text{RMS})^2$
 $1/(\text{.7164})^2 = 1.954$

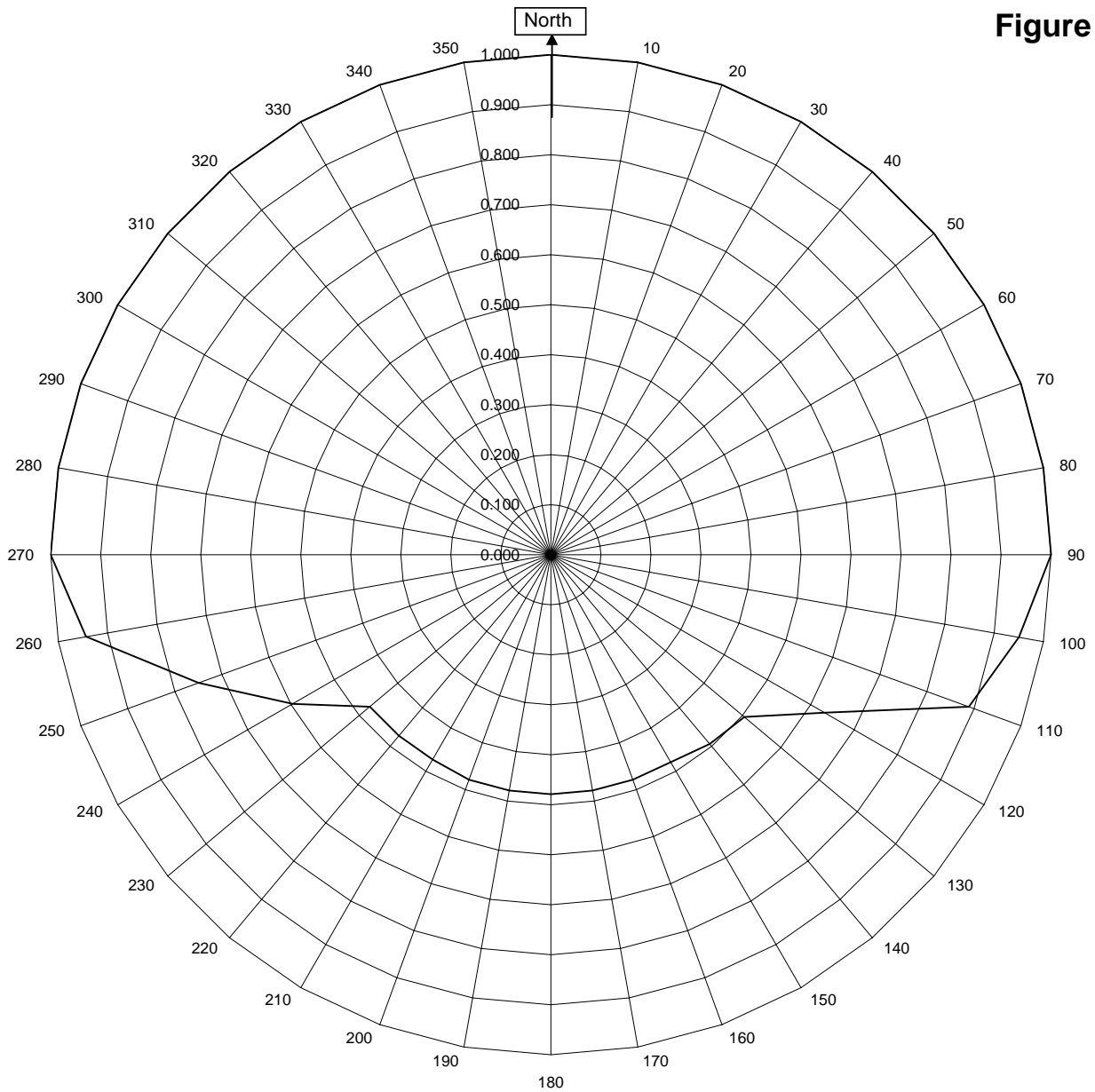
*** Total Vertical Gain is Elevation Gain times Azimuth Gain**
4.284 x 1.954 = 8.371

ERP divided by Vertical Gain equals Antenna Input Power
 $27.0 \text{ kW} \div 8.371 = 3.225 \text{ kW}$

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Figure 5



KNMI Farmington, NM

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Amended Composite RMS	0.841
85% Amended Composite RMS	0.715

Frequency	88.9 / 400.05 mHz
Plot	Relative Field

Antenna Model	6513BB-4-DA Pattern 4
Pattern Type	Amended FCC Composite

Figure 5a

Tabulation of Amended Composite Pattern
KNMI Farmington, NM

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.479
10	1.000	190	0.479
20	1.000	200	0.479
30	1.000	210	0.473
40	1.000	220	0.473
45	1.000	225	0.473
50	1.000	230	0.473
60	1.000	240	0.596
70	1.000	250	0.750
80	1.000	260	0.944
90	1.000	270	1.000
100	0.950	280	1.000
110	0.889	290	1.000
120	0.632	300	1.000
130	0.505	310	1.000
135	0.857	315	1.000
140	0.494	320	1.000
150	0.479	330	1.000
160	0.479	340	1.000
170	0.479	350	1.000