

S.O. 23466

Report of Test SCALA YA7-FML/URM SLANT

for

EDUCATIONAL MEDIA FOUNDATION

KLHV 88.3 MHZ FORT COLLINS, CO

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a Scala YA7-FML/URM Slant to meet the needs of KLHV and to comply with the requirements of the FCC construction permit, file number BPED-19961112ME.

RESULTS:

The measured azimuth pattern for the Scala YA7-FML/URM Slant is shown in Figure 1. Figure 1A shows the Tabulation of the Vertical Polarization. The horizontal component of this antenna was developed by constructing the Scala YA7-FML/URM 6° off of vertical. The horizontal azimuth pattern of this antenna is certified to be contained completely within this vertical pattern. The calculated elevation pattern of the antenna is shown in Figure 3. Construction permit file number BPED-19961112ME indicates that the Vertical radiation component shall not exceed 0.09 kW at any azimuth and is restricted to the following values at the azimuths specified:

170 through 350 Degrees T: 0.008 kW

From Figure 1, the maximum radiation of the Vertical component occurs at 078 Degrees T to 082 Degrees T. At the restricted azimuth of 170 through 350 Degrees T the Vertical component is 13.979 dB down from the maximum of 0.09 kW, or 0.004 kW.

The total Horizontal power gain is 0.0821. The R.M.S. of the Vertical component is 0.435. The total Vertical power gain is 7.317. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.502. Therefore this Pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

The Scala YA7-FML/URM Slant was mounted on a tower of exact scale to the tower at KLHV's transmitter 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-19961112ME, the Scala YA7-FML/URM Slant 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 Edition 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:

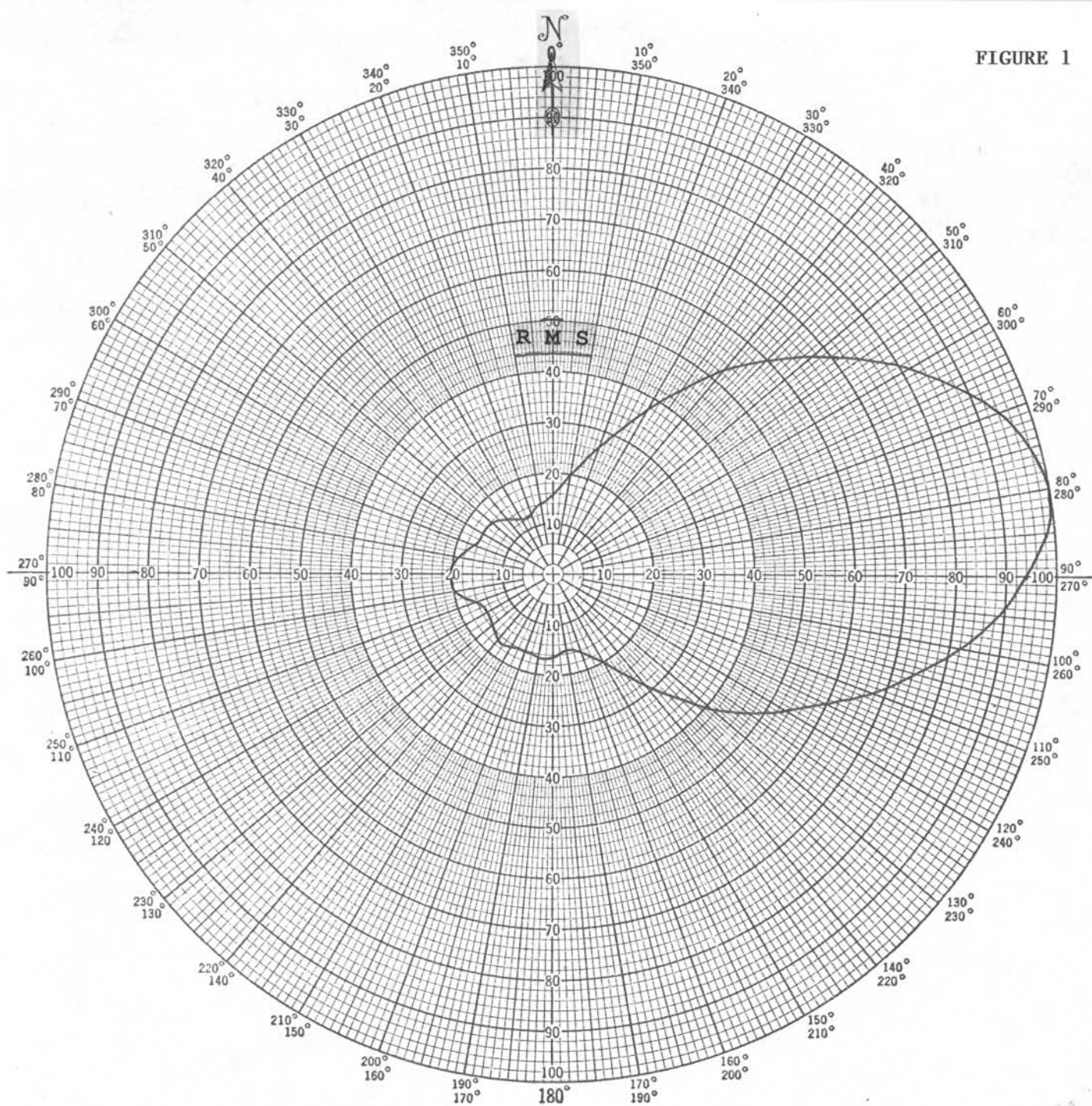
The corner reflector is mounted so that the horizontal and vertical azimuth patterns are measured independently by rotating the corner reflector by 90 degrees. The network analyzer was set to 397.35 MHz. Calibrated pads are used to check the linearity of the measuring system. For example, 6 dB padding 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
Manager of RF Engineering
S/O 23466
January 20, 2005

FIGURE 1



Shively Labs

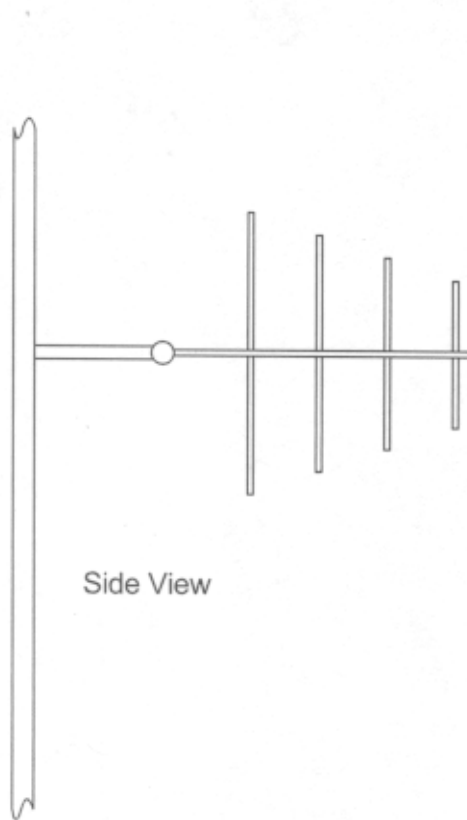
PROJECT NAME KLHV FORT COLLINS, CO
 PROJECT NUMBER 23466 DATE 1/4/05
 MODEL (☒) FULL SCALE (☐) FREQUENCY 397.35/88.3 MHz
 POLARIZATION VERTICAL
 CURVE PLOTTED IN: VOLTAGE (☒) POWER (☐) DB (☐)
 OBSERVER RAS

ANTENNA TYPE SCALA YA7-FML/URM SLANT
 PATTERN TYPE DIRECTIONAL AZIMUTH
 REMARKS: SEE FIGURE 2 FOR MECHANICAL
DETAILS

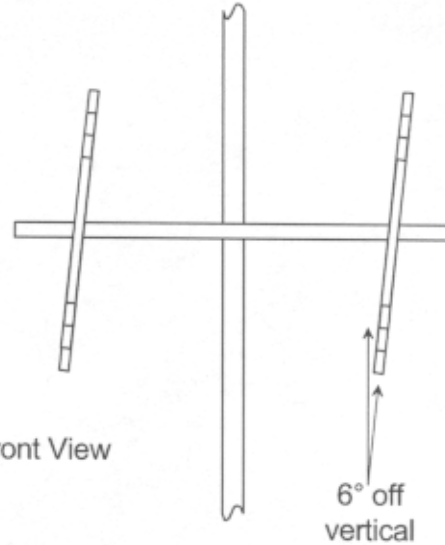
Figure 1A

S/O 23466
TABULATION OF VERTICAL POLARIZATION
KLHV FORT COLLINS, CO

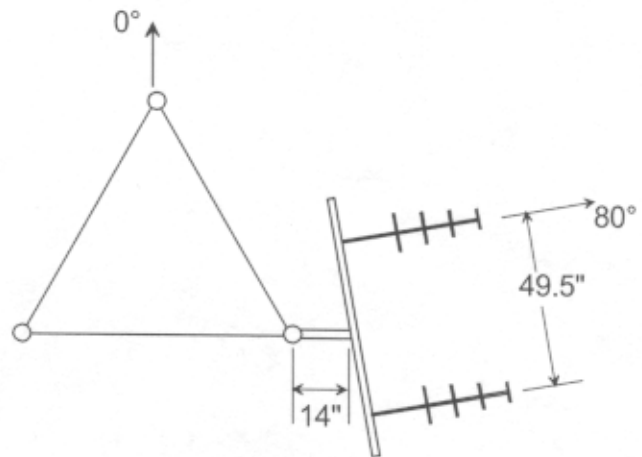
DEGREE	RELATIVE FIELD	DEGREE	RELATIVE FIELD
0	0.155	180	0.165
10	0.195	190	0.165
20	0.270	200	0.160
30	0.375	210	0.165
40	0.530	220	0.170
45	0.595	225	0.165
50	0.670	230	0.155
60	0.815	240	0.150
70	0.940	250	0.165
80	1.000	260	0.195
90	0.940	270	0.200
100	0.820	280	0.190
110	0.680	290	0.165
120	0.535	300	0.160
130	0.410	310	0.155
135	0.340	315	0.150
140	0.290	320	0.140
150	0.205	330	0.130
160	0.165	340	0.125
170	0.155	350	0.140



Side View



Front View



Top View

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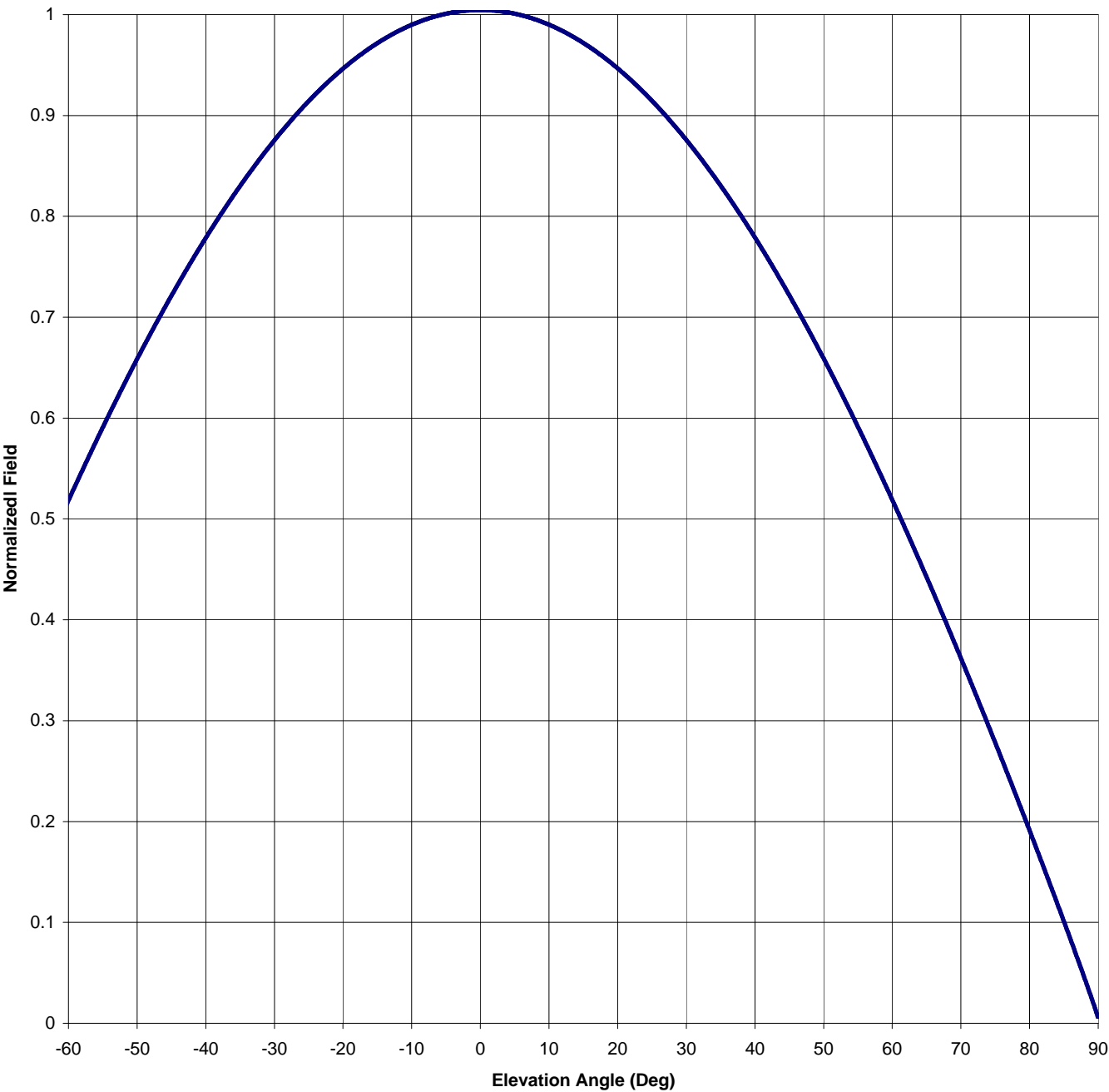
Figure 2 for KLHV, 88.3 MHz Scala Yagi Array

SIZE	CODE IDENT. NO.	DRAWING NO.	REV
A	26750	AGF040707-001	
SCALE		23466	SHEET

Antenna Mfg.: Shively Labs
Antenna Type: Scala YA7-FML/URM Slant
Station: KLHV
Frequency: 88.3
Channel #: 202
Figure: 3

Date: 7/6/2004

Beam Tilt	0	
Gain (Max)	7.317	8.643 dB
Gain (Horizon)	7.317	8.643 dB



Antenna Mfg.: Shively Labs

Date: 7/6/2004

Antenna Type: Scala YA7-FML/URM Slant

Station: KLHV

Beam Tilt 0

Frequency: 88.3

Gain (Max) 7.317

8.643 dB

Channel #: 202

Gain (Horizon) 7.317

8.643 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	0.729	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		

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VALIDATION OF GAIN CALCULATION

KLHV FORT COLLINS, CO

MODEL SCALA YA7-FML/URM

Elevation Gain of Scala YA7-FML/URM equals $1.3845/0.0821$

The RMS values are calculated utilizing the data of a planimeter.

Elevation Gain of Horizontal Component equals 0.0821

Elevation Gain of Vertical Component equals 1.3845

Vertical Azimuth Gain equals $1/(\text{RMS})^2$
 $1/(0.435)^2 = 5.285$

* Total Vertical Gain is Elevation Gain times Azimuth Gain
 $1.3845 \times 5.285 = 7.317$

ERP divided by Vertical Gain equals Antenna Input Power
 $0.09 \text{ kW} \div 7.317 = 0.0123 \text{ kW}$

Antenna Input Power times Horizontal Gain equals Horizontal ERP
 $0.0123 \times 0.0821 = 0.0010 \text{ kW}$