Directional FM Antenna
KRGH
Grace Community Church of Amarillo
Holliday, TX

A model PSIFM5CLOG antenna with mounts was customized and used in conjunction with a duplicate of the customer's 41.5" face tower to create the necessary directional radiation pattern. The final antenna consists of eight radiating elements with special spacing and offsets. The antenna array is center fed. Each radiating element receives equal power and the necessary phase to achieve the final pattern.

Pattern testing was performed using a 1/3-scale model element and tower. The azimuth plane measurements were taken on a ground reflection test range. This type of test range utilizes the reflected signal and direct signal from the source antenna to form an interference pattern on the antenna under test. The antenna and tower under test were mounted to a turntable that allowed the structure to be rotated 360° in the azimuth plane. The source antenna was located approximately 75 ft. from the antenna under test. The source height above ground was adjusted to peak the first lobe of the interference pattern at the antenna under test.

The test antenna was mounted in the center of rotation of the turntable. The antenna and mounting structure were rotated clockwise while data was recorded in a counter clockwise direction. All feed cables to the antenna were secured and grounded during pattern measurements. A Hewlett Packard 8753E-network analyzer operating at 272.7 MHz was used as both the source and receiver. The level of the received signal was compared with a standard dipole to establish the directivity of the final pattern. The final pattern measured does not exceed the envelope pattern and is 85.6% of the envelope RMS.

The antenna is to be mounted 95 meters (312 ft.) above ground level per the construction permit. A deviation of +2/-4 meters from the approved center of radiation is allowed. No other antenna can be installed within 10 ft of any radiating element. The antenna is to be mounted to the northeast tower face using the supplied custom mounts. All antenna bays are to be positioned 62° True and certified by a licensed surveyor. It is recommended that a broadcast engineer is present to supervise the installation of the antenna and that he or she certifies the antenna has been installed according to the enclosed instructions.

An input power level of 2.32 kW will be required at the antenna input in order to reach the licensed 22 kW ERP. The transmitter output power requirements are dependent upon the transmission line size and length used to feed the antenna. The final length of transmission line must be determined after installation.

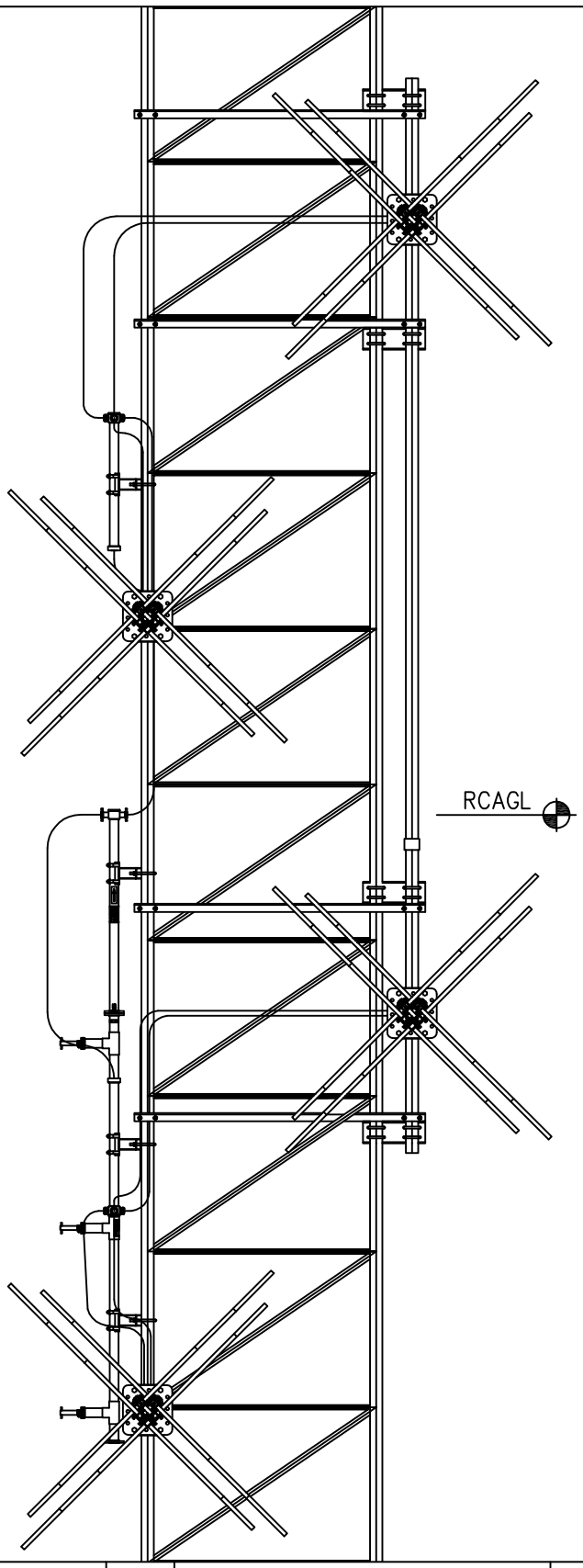
Antenna Specifications

Antenna Model	PSIFM5CLOG-4 Custom
Type	4-bay directional FM antenna
Bay Spacing	Custom bay spaced elements
Frequency	90.9 MHz
Polarization	Circular/Elliptical
Envelope RMS	.543
Composite RMS	.465
Gain (h-pol)	9.50 (9.78 dB)
Gain (v-pol)	5.51 (7.41 dB)
Input	1-5/8" EIA center fed input
Input power	2.32 kW
Power rating	5 kW
Length	22.25 ft.
Weight	358 lbs.
Wind Area	41 sq. ft.

Statement of Certification

This is to certify the antenna has been designed, fabricated and tested under my supervision and it meets the required envelope pattern limitations set forth in the stations construction permit.

Douglas A. Ross
President
Propagation Systems Inc.



SPECIFICATIONS	
BAY SPACING ('L')	72.000 IN
APERTURE ('A')	18 FT (5.5 M)
RCAGL:	311 FT (94.8 M)
WEIGHT:	358 LB (162 kg)
WIND AREA:	41 FT^2 (3.8 M^2)
POWER RATING:	5 kW
H–POL GAIN:	9.50 (9.78 dB)
V–POL GAIN:	5.51 (7.41 dB)
POLARIZATION	CIRCULAR

NOTE: 1. WEIGHT AND WIND AREA ARE ESTIMATED. WIND AREA IN ACCORDANCE WITH TIA/EIA–222–F Σ(CaAc)
2. TIE WRAP COAX. CABLE AT ±16" O.C.

REV.	MADE BY / CHECKED BY	DATE	CHANGE

SIZE: A

PROPAGATION SYSTEMS, INC.

Ebensburg, Pennsylvania USA 814–472–5540

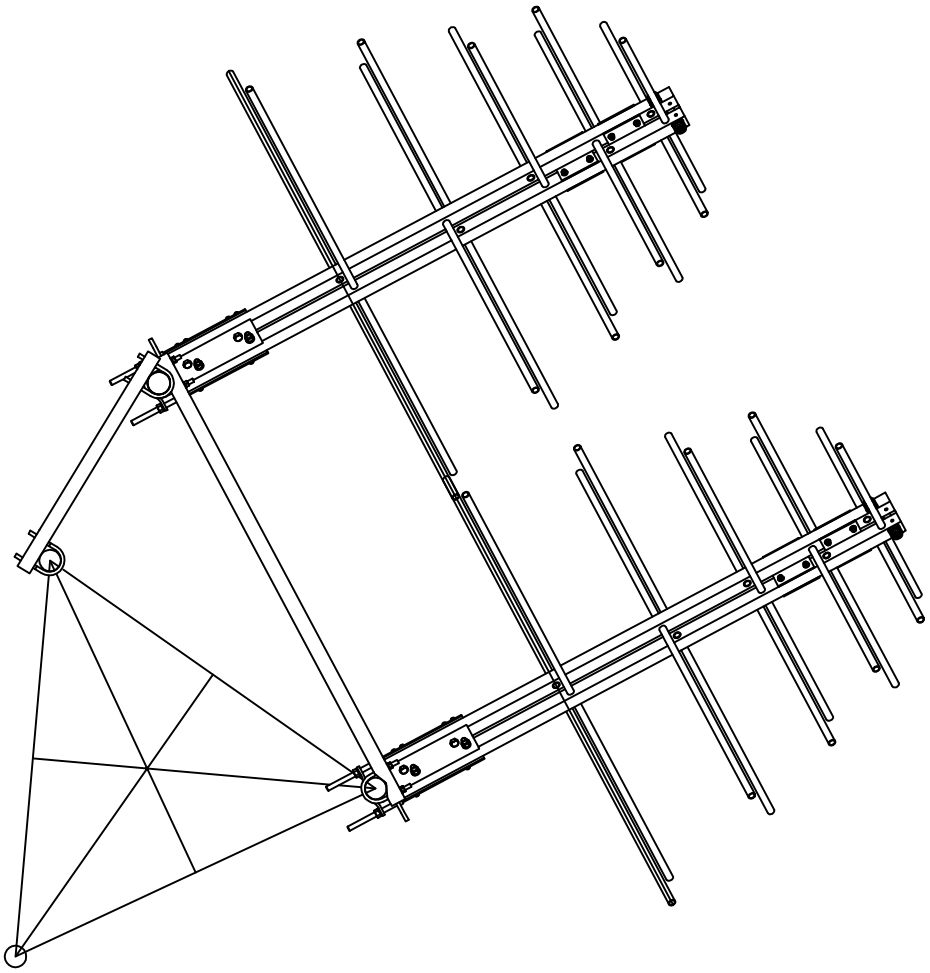
ANTENNA ELEVATION AND SPECIFICATIONS

MODEL:	DRAWN BY:	DATE:
PSIFM5CLOG–4 Custom	G. LINK	3/13/23
CHANNEL/ FREQUENCY: 90.9 MHz	APPROVED BY:	DATE:
SCALE:	DRAWING NO.: 2483–001	REV.

North

62°

335°



REV.	MADE BY / CHECKED BY	DATE	CHANGE

SIZE: A

PROPAGATION SYSTEMS, INC.

Ebensburg, Pennsylvania USA 814-472-5540

ANTENNA ORIENTATION DETAIL

MODEL:	DRAWN BY:	DATE:
PSIFM5CLOG-4 Custom	G. LINK	3/13/23
CHANNEL/ FREQUENCY: 90.9 MHz	APPROVED BY:	DATE:
SCALE:	DRAWING NO.: 2483-002	REV.

Maximum Envelope Tabulation

Antenna Model: PSIFM5CLOG-4 Custom
Grace Community Church of Amarillo
Station: KRGH
Frequency: 90.9 MHz
Location: Holliday, TX
Maximum ERP: 22 kW

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.431	4.09	6.11
10	0.542	6.46	8.10
20	0.662	9.64	9.84
30	0.761	12.74	11.05
40	0.876	16.88	12.27
50	0.958	20.19	13.05
60	0.994	21.74	13.37
62	1.000	22.00	13.42
70	0.977	21.00	13.22
80	0.914	18.38	12.64
90	0.800	14.08	11.49
100	0.704	10.90	10.38
110	0.590	7.66	8.84
120	0.473	4.92	6.92
130	0.376	3.11	4.93
140	0.358	2.82	4.50
150	0.358	2.82	4.50
160	0.358	2.82	4.50
170	0.358	2.82	4.50
180	0.358	2.82	4.50
190	0.358	2.82	4.50
200	0.358	2.82	4.50
210	0.358	2.82	4.50
220	0.358	2.82	4.50
230	0.358	2.82	4.50
240	0.358	2.82	4.50
250	0.358	2.82	4.50
260	0.358	2.82	4.50
270	0.358	2.82	4.50
280	0.358	2.82	4.50
290	0.358	2.82	4.50
300	0.358	2.82	4.50
310	0.358	2.82	4.50
320	0.358	2.82	4.50
330	0.358	2.82	4.50
340	0.358	2.82	4.50
350	0.358	2.82	4.50

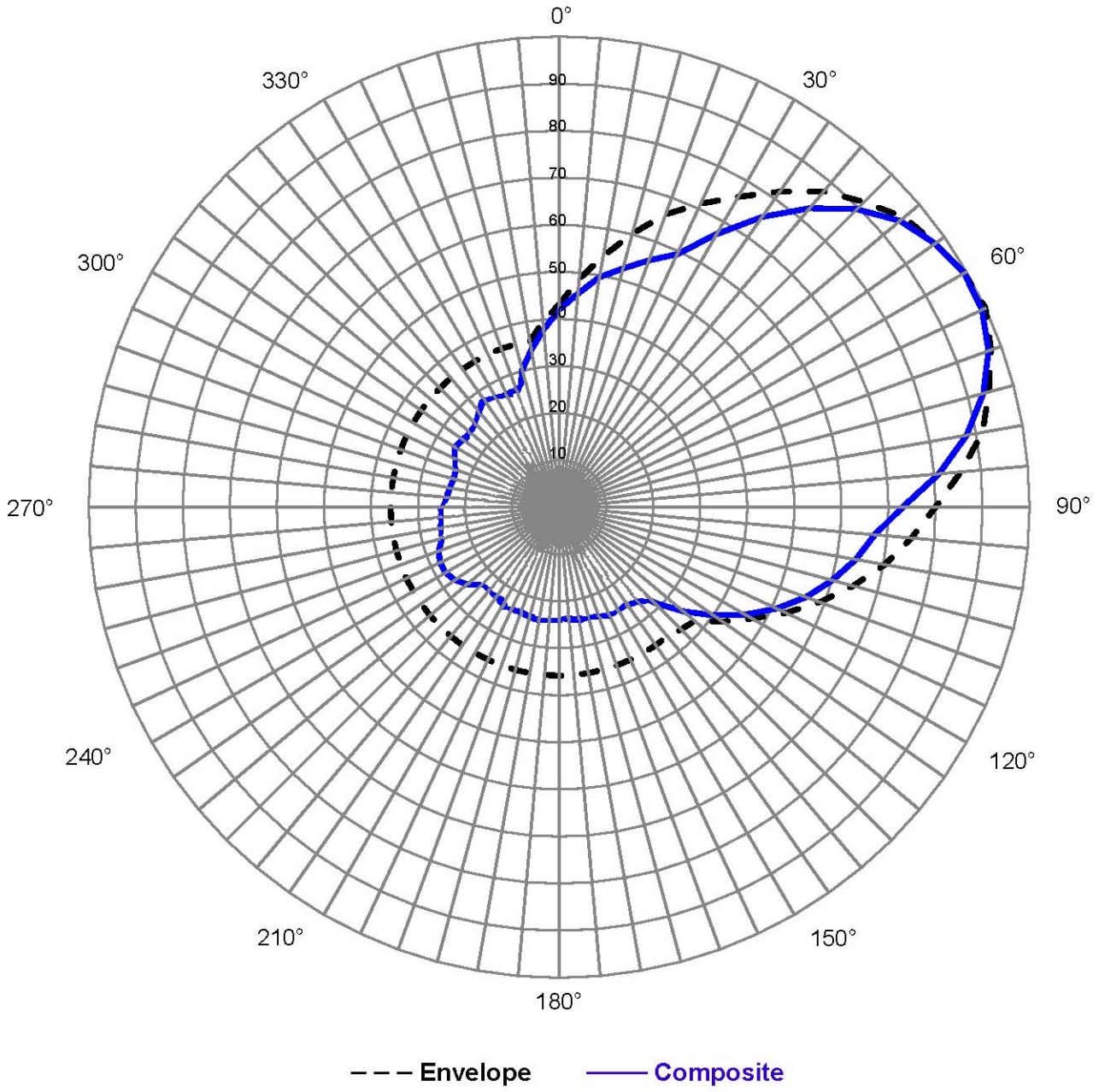
Composite Pattern Tabulation

Antenna Model: PSIFM5CLOG-4 Custom
Grace Community Church of Amarillo
Station: KRGH
Frequency: 90.9 MHz
Location: Holliday, TX
Maximum ERP: 22 kW

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.420	3.874	5.88
10	0.497	5.425	7.34
20	0.558	6.856	8.36
30	0.670	9.872	9.94
40	0.829	15.127	11.80
50	0.946	19.704	12.95
60	1.000	22.737	13.42
70	0.971	20.758	13.17
80	0.880	17.022	12.31
90	0.730	11.728	10.69
100	0.640	9.022	9.55
110	0.559	6.876	8.37
120	0.457	4.588	6.62
130	0.382	3.210	5.07
140	0.275	1.664	1.35
150	0.224	1.104	0.43
160	0.184	0.745	-1.28
170	0.199	0.871	-0.59
180	0.184	0.745	-1.28
190	0.204	0.916	-0.38
200	0.199	0.871	-0.59
210	0.179	0.705	-1.52
220	0.206	0.932	-0.31
230	0.255	1.428	1.55
240	0.279	1.707	2.32
250	0.272	1.628	2.12
260	0.238	1.242	0.96
270	0.199	0.871	-0.61
280	0.192	0.827	-0.92
290	0.197	0.854	-0.69
300	0.188	0.778	-1.12
310	0.178	0.697	-1.57
320	0.178	0.697	-1.57
330	0.218	1.046	0.19
340	0.273	1.635	2.14
350	0.340	2.538	4.05

Propagation Systems, Inc.

Relative Field
Azimuth Plane Pattern



Pattern Type:	**Measured Composite**	Tower:	**Eastpoint Tower 41.5" Face**
Antenna Model:	**PSIFM5CLOG-4 Custom**	Orientation:	**62°**
Polarization:	**Circular**	Frequency:	**90.9 MHz**
RMS (envelope)	**0.543**	Station:	**KRGH**
RMS (composite)	**0.465**	Date:	**6/28/2023**

Measured Relative Field Tabulation

Antenna Model: PSIFM5CLOG-4 Custom

Grace Community Church of Amarillo

Station: KRGH

Frequency: 90.9 MHz

Location: Holliday, TX

Horizontal Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.420	1.673	2.24
10	0.425	1.713	2.34
20	0.534	2.705	4.32
30	0.670	4.256	6.29
40	0.829	6.517	8.14
50	0.946	8.464	9.27
60	0.994	9.369	9.72
70	0.971	8.824	9.46
80	0.880	7.350	8.67
90	0.730	5.064	7.05
100	0.549	2.867	4.57
110	0.471	1.306	1.16
120	0.377	0.471	-3.27
130	0.304	0.125	-9.03
140	0.244	0.565	-2.479
150	0.210	0.418	-3.788
160	0.184	0.321	-4.935
170	0.199	0.375	-4.260
180	0.178	0.301	-5.214
190	0.196	0.364	-4.389
200	0.199	0.375	-4.260
210	0.179	0.304	-5.17
220	0.206	0.402	-3.95
230	0.255	0.617	-2.10
240	0.279	0.737	-1.33
250	0.272	0.703	-1.53
260	0.238	0.536	-2.70
270	0.186	0.341	-4.67
280	0.178	0.300	-5.23
290	0.187	0.331	-4.80
300	0.188	0.336	-8.88
310	0.178	0.300	-5.23
320	0.177	0.335	-4.75
330	0.177	0.335	-4.75
340	0.220	0.459	-3.38
350	0.270	0.691	-1.605

Maximum Value

Field	1.000
Gain	9.50 (9.78 dB)
Azimuth Bearing	62 degrees

Minimum Field

Field	0.178
Gain	.036 (-1.57 dB)
Azimuth Bearing	280 degrees

Vertical Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.420	1.673	2.23
10	0.497	2.342	3.70
20	0.558	2.961	4.71
30	0.634	3.814	5.81
40	0.695	4.583	6.61
50	0.740	5.195	7.16
60	0.753	5.390	7.32
70	0.761	5.505	7.41
80	0.747	5.294	7.24
90	0.704	4.707	6.73
100	0.640	3.896	5.91
110	0.559	2.969	4.73
120	0.457	1.981	2.97
130	0.382	1.384	1.41
140	0.294	0.819	-0.87
150	0.224	0.476	-3.22
160	0.183	0.318	-4.976
170	0.178	0.300	-5.229
180	0.188	0.335	-4.750
190	0.204	0.395	-4.034
200	0.199	0.375	-4.260
210	0.179	0.304	-5.171
220	0.188	0.335	-4.750
230	0.184	0.321	-4.935
240	0.194	0.357	-4.473
250	0.179	0.304	-5.171
260	0.186	0.328	-4.841
270	0.199	0.375	-4.260
280	0.192	0.350	-4.559
290	0.197	0.368	-4.342
300	0.181	0.311	-5.072
310	0.194	0.357	-4.473
320	0.178	0.300	-5.229
330	0.218	0.451	-3.46
340	0.273	0.707	-1.51
350	0.340	1.096	0.40

Maximum Value

Field	0.761
Gain	5.51 (7.41 dB)
Azimuth Bearing	70 degrees

Minimum Field

Field	0.179
Gain	0.304 (-5.1710 dB)
Azimuth Bearing	250 degrees

ERP Tabulation

Antenna Model: PSIFM5CLOG-4 Custom

Grace Community Church of Amarillo

Station: KRGH

Frequency: 90.9 MHz

Location: Holliday, TX

Maximum ERP: 22 kW (H)

Horizontal Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.420	3.874	5.88
10	0.425	3.974	5.96
20	0.534	6.271	7.96
30	0.670	9.872	9.94
40	0.829	15.127	11.80
50	0.946	19.704	12.95
60	0.994	21.737	13.37
70	0.971	20.758	13.17
80	0.880	17.022	12.31
90	0.730	11.728	10.69
100	0.549	6.640	8.22
110	0.471	4.881	6.81
120	0.377	3.127	4.95
130	0.304	2.033	3.082
140	0.244	1.310	1.172
150	0.210	0.970	-0.131
160	0.184	0.745	-1.280
170	0.199	0.764	-0.642
180	0.178	0.697	-1.567
190	0.196	0.845	-0.731
200	0.199	0.794	-1.001
210	0.179	0.705	-1.327
220	0.206	0.932	-0.311
230	0.255	1.428	1.55
240	0.279	1.707	2.32
250	0.272	1.628	2.12
260	0.238	1.242	0.94
270	0.186	0.760	-1.19
280	0.178	0.697	-1.57
290	0.187	0.769	-1.14
300	0.188	0.737	-1.33
310	0.178	0.705	-1.47
320	0.177	0.689	-1.47
330	0.177	0.689	-1.32
340	0.220	1.065	0.27
350	0.270	1.604	4.28

Maximum Value (H-pol)

Field 1.000

ERP 22 kW (13.42 dB)

Azimuth Bearing 62 degrees

Minimum Field (H-pol)

Field 0.178

ERP .697 kW (-1.57 dBk)

Azimuth Bearing 280 degrees

Vertical Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.420	3.874	5.88
10	0.497	5.425	7.34
20	0.558	6.856	8.36
30	0.634	8.833	9.46
40	0.695	10.614	10.26
50	0.740	12.031	10.80
60	0.753	12.482	10.96
70	0.761	12.748	11.05
80	0.747	12.261	10.89
90	0.704	10.901	10.37
100	0.640	9.011	9.55
110	0.559	6.876	8.37
120	0.457	4.588	6.62
130	0.382	2.930	4.67
140	0.294	1.902	2.79
150	0.224	1.104	0.43
160	0.183	0.741	-1.001
170	0.178	0.697	-1.567
180	0.188	0.778	-0.038
190	0.204	0.916	-0.910
200	0.181	0.721	-1.422
210	0.179	0.705	-0.910
220	0.188	0.778	-1.093
230	0.184	0.745	-1.279
240	0.194	0.828	-0.820
250	0.179	0.705	-1.519
260	0.186	0.761	-1.186
270	0.199	0.794	-1.001
280	0.192	0.745	-1.279
290	0.197	0.811	-0.910
300	0.181	0.721	-1.422
310	0.178	0.705	-0.820
320	0.178	0.705	-0.820
330	0.218	1.026	0.12
340	0.273	1.616	2.08
350	0.340	2.538	4.05

Maximum Value (V-pol)

Field 0.761

ERP 12.75 kW (11.05 dBk)

Azimuth Bearing 70 degrees

Minimum Field (V-pol)

Field 0.179

ERP 0.790 kW (-1.509 dBk)

Azimuth Bearing 250 degrees