



## ***Propagation Systems, Inc.***

Quality Broadcast Antenna Systems

**Directional FM Antenna  
WCIG  
Family Life Ministries, Inc.  
Dallas, PA**

A standard model PSIFMR antenna with parasitic elements and radomes was used in conjunction with the customer's 46" face triangular tower to create the necessary directional radiation pattern. The final antenna consists of two radiating elements each secured to the tower with a custom-mounting bracket. The antenna bays are half-wave spaced and there are two vertical and one horizontal parasitic elements per bay. The antenna array is end fed from an existing 7/8" flexible transmission line.

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 was 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 8753A-network analyzer operating at 323.1 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 90.4% of the envelope RMS.

The antenna is to be mounted 19 meters (62.3 ft) above ground level on the northeast tower face and positioned 43° True. At this elevation the antenna will be within the allowed +2m/-4m tolerance. No other antenna can be installed within 10 ft of any radiating element. Any guy wires that pass within 10 ft. of any radiating element must be replaced with a non-metallic substitute. It is recommended that a broadcast engineer be present to supervise the installation of the antenna and that he or she certifies that the antenna has been installed according to the enclosed instructions.

An input power level of 1.96 kW will be necessary at the antenna input in order to reach the required 2.35 kW ERP. The transmitter output power requirements are dependent upon the transmission line size and length used to feed the antenna. For example, the length of 7/8" air dielectric transmission line feeding the antenna is estimated to be 115 ft. The efficiency for this length of line is 89.6% with a resulting transmitter output power of 2.19 kW. The final length of transmission line must be determined after installation.

### Antenna Specifications

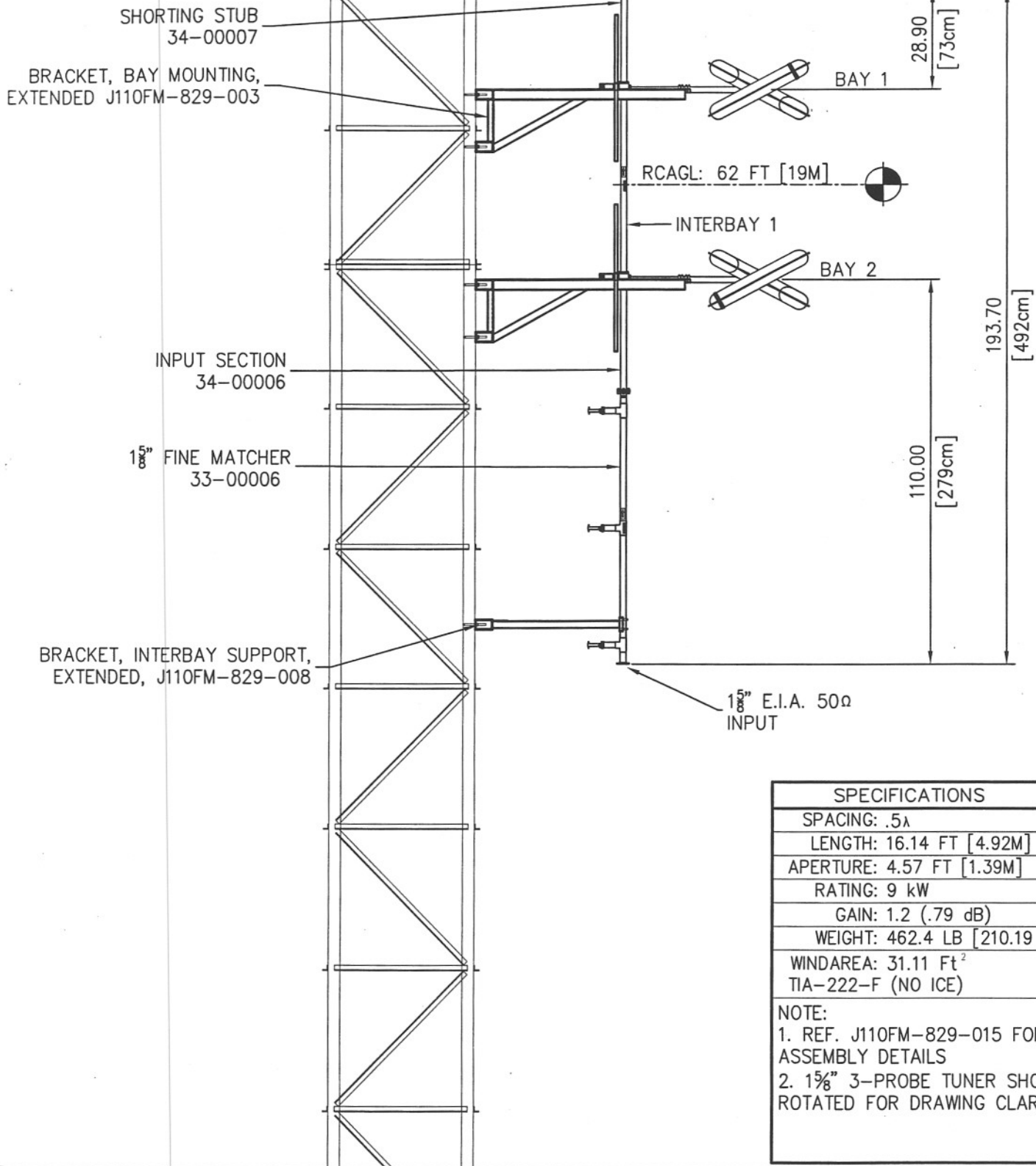
Antenna Model	PSIFMR-2-HWS-DA
Type	2-bay directional FM antenna
Bay Spacing	Half-wave spaced elements with radomes
Frequency	107.7 MHz
Polarization	Circular
Envelope RMS	.886
Composite RMS	.801
Gain (h-pol)	1.20 (.79 dB)
RMS (h-pol)	.743
Gain (v-pol)	1.20 (.79 dB)
RMS (v-pol)	.745
ERP	2.35 kW
Antenna input power	1.96 kW
Input	1-5/8" EIA end fed input
Power rating	9 kW
Length	16.14 ft.
Weight	462.4 lbs.
Wind Area	31.11 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.

 3/22/10

Douglas A. Ross  
President  
Propagation Systems Inc.



SPECIFICATIONS	
SPACING:	.5λ
LENGTH:	16.14 FT [4.92M]
APERTURE:	4.57 FT [1.39M]
RATING:	9 kW
GAIN:	1.2 (.79 dB)
WEIGHT:	462.4 LB [210.19 Kg]
WINDAREA:	31.11 Ft <sup>2</sup>
TIA-222-F (NO ICE)	
NOTE:	
1. REF. J110FM-829-015 FOR ASSEMBLY DETAILS	
2. 1 5/8" 3-PROBE TUNER SHOWN ROTATED FOR DRAWING CLARITY	

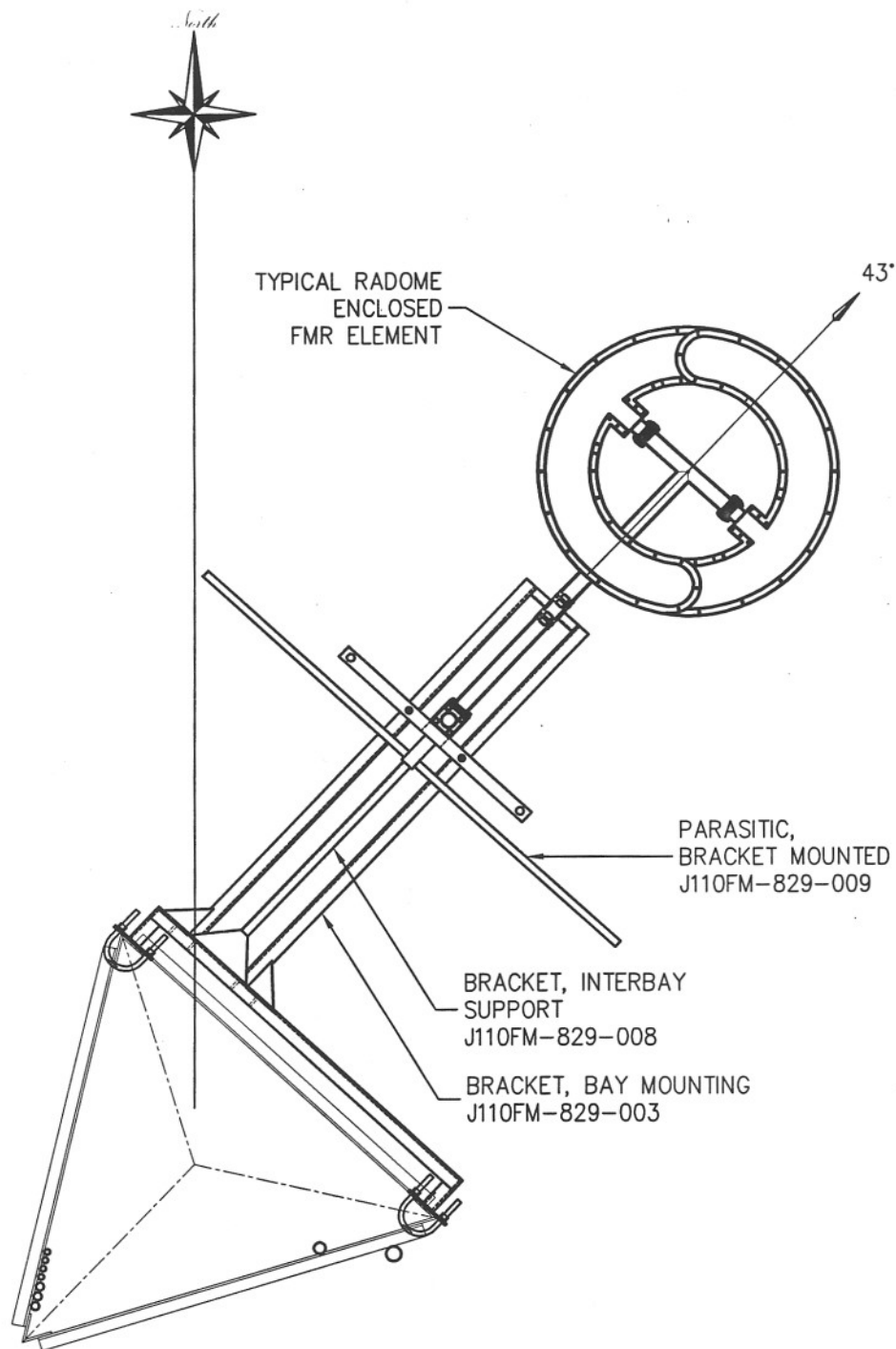
REV.	MADE BY CHECKED BY	DATE	CHANGE	SIZE
				A
This drawing is loaned subject to the express understanding and agreement that the drawing and information therein contained are, and shall remain the property of PSI, and will not be otherwise utilized or disposed of, directly or indirectly, and will not be used in whole or in part or assist in making or finish any information for the making of drawings, prints or other reproductions hereof, or for the design or making of any item, parts, object, apparatus or parts thereof, except upon the written permissions of PSI first obtained. The acceptance of this drawing will be construed as an acceptance of the forgoing agreement.				

# PROPAGATION SYSTEMS, INC.

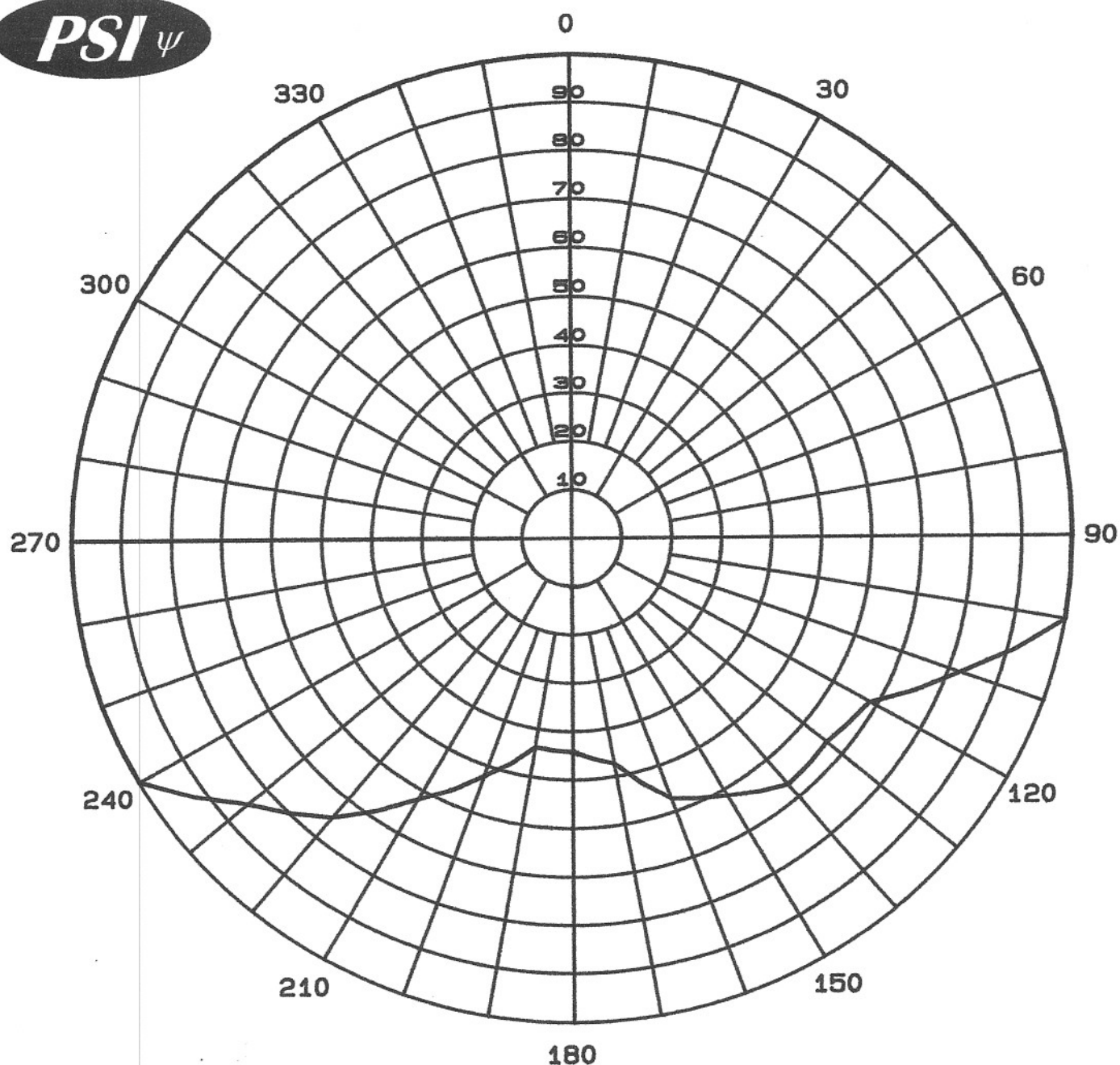
Ebensburg, Pennsylvania USA 814-472-5540

## ANTENNA ELEVATIONS AND SPECIFICATIONS

MODEL:	PSIFMR-2-HWS-DA	DRAWN BY:	D.G. Kellar	DATE:	3/03/10
CHANNEL/ FREQUENCY:	107.7 MHz	APPROVED BY:		DATE:	
SCALE:	1:40	DRAWING NO.:	J110FM-829-001	REV.	



				<b>PROPAGATION SYSTEMS, INC.</b>			
				Ebensburg, Pennsylvania USA 814-472-5540			
				ANTENNA PLAN VIEW AND ORIENTATION			
REV.	MADE BY	DATE	CHANGE	MODEL:	DRAWN BY:	DATE:	
	CHECKED BY			PSIFMR-2-HWS-DA	D.G. Kellar	3/03/10	
This drawing is loaned subject to the express understanding and agreement that the drawing and information therein contained are, and shall remain the property of PSI, and will not be otherwise utilized or disposed of, directly or indirectly, and will not be used in whole or in part or assist in making or finish any reproductions hereof, or for the design or making of any item, parts, object, apparatus or parts thereof, except upon the written permissions of PSI first obtained. The acceptance of this drawing will be construed as an acceptance of the forgoing agreement.				CHANNEL/FREQUENCY:	APPROVED BY:	DATE:	
				107.7 MHz			
				SCALE:	DRAWING NO.:	REV.	
A				1:20	J110FM-829-002		



Maximum Envelope  
Azimuth Plane Pattern  
Antenna: PSIFMR-2-HWS-DA  
Type: 2-Bay Directional FM Antenna  
ERP: 2.35 kW (3.71 dBk)  
RMS Envelope: .886  
Frequency: 107.7 MHz  
WCIG Dallas, PA

**Propagation Systems Inc.**  
**PO Box 113**  
**Ebensburg, PA 15931**

### Maximum Envelope Tabulation

Antenna: PSIFMR-2-HWS-DA

Family Life Ministries, Inc.

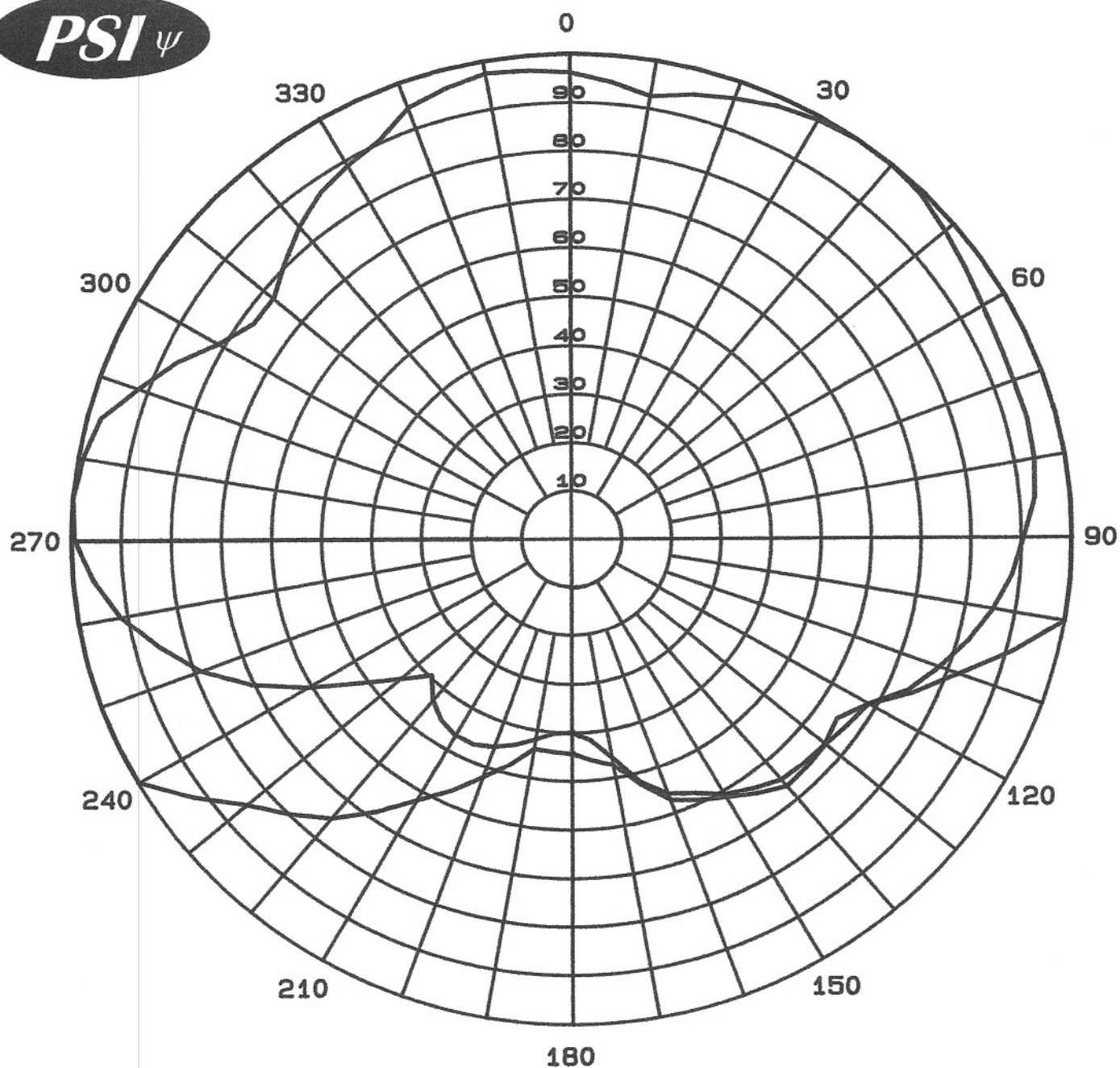
Station: WCIG

Frequency: 107.7 MHz

Location: Dallas, PA

Maximum ERP: 2.35 kW (3.71 dBk)

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	1.000	2.350	3.71
10	1.000	2.350	3.71
20	1.000	2.350	3.71
30	1.000	2.350	3.71
40	1.000	2.350	3.71
50	1.000	2.350	3.71
60	1.000	2.350	3.71
70	1.000	2.350	3.71
80	1.000	2.350	3.71
90	1.000	2.350	3.71
100	1.000	2.350	3.71
110	0.822	1.588	2.01
120	0.684	1.099	0.41
130	0.661	1.027	0.11
140	0.668	1.049	0.21
150	0.617	0.895	-0.48
160	0.575	0.777	-1.10
170	0.474	0.528	-2.77
180	0.442	0.459	-3.38
190	0.437	0.449	-3.48
200	0.520	0.635	-1.97
210	0.620	0.903	-0.44
220	0.750	1.322	1.21
230	0.850	1.698	2.30
240	1.000	2.350	3.71
250	1.000	2.350	3.71
260	1.000	2.350	3.71
270	1.000	2.350	3.71
280	1.000	2.350	3.71
290	1.000	2.350	3.71
300	1.000	2.350	3.71
310	1.000	2.350	3.71
320	1.000	2.350	3.71
330	1.000	2.350	3.71
340	1.000	2.350	3.71
350	1.000	2.350	3.71

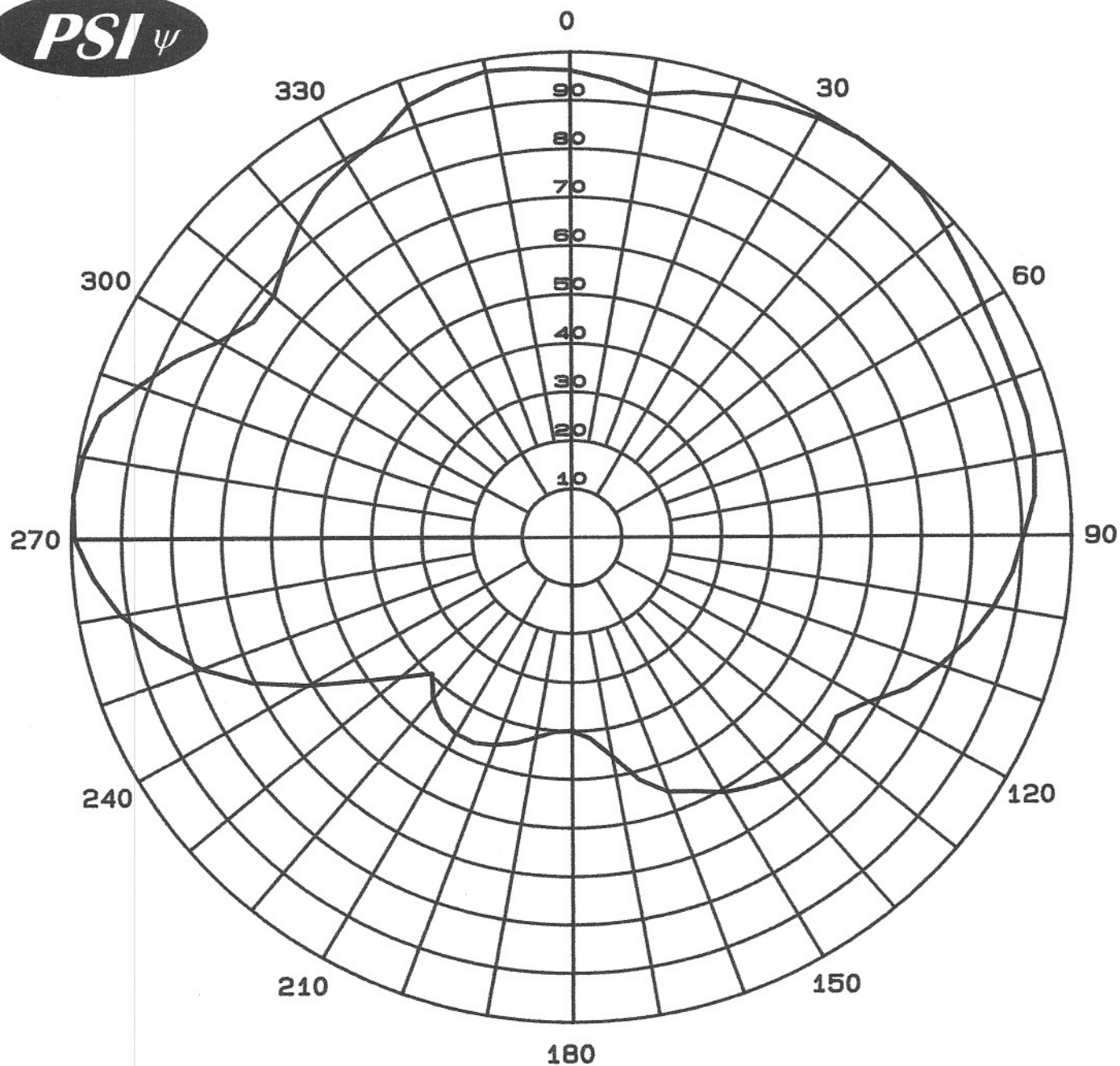


Maximum Envelope and  
Composite Pattern  
Antenna: PSIFMR-2-HWS-DA  
Type: 2-Bay Directional FM Antenna  
ERP: 2.35 kW (3.71 dBk)  
RMS Envelope: .886  
RMS Composite: .801  
Frequency: 107.7 MHz

**Propagation Systems Inc.**  
**PO Box 113**  
**Ebensburg, PA 15931**

WCIG Dallas, PA





Measured Composite  
Azimuth Plane Pattern  
Antenna: PSIFMR-2-HWS-DA  
Type: 2-Bay Directional FM Antenna  
ERP: 2.35 kW (3.71 dBk)  
RMS Composite: .801  
Frequency: 107.7 MHz  
WCIG Dallas, PA

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# Composite Pattern Tabulation

Antenna: PSIFMR-2-HWS-DA

Family Life Ministries, Inc.

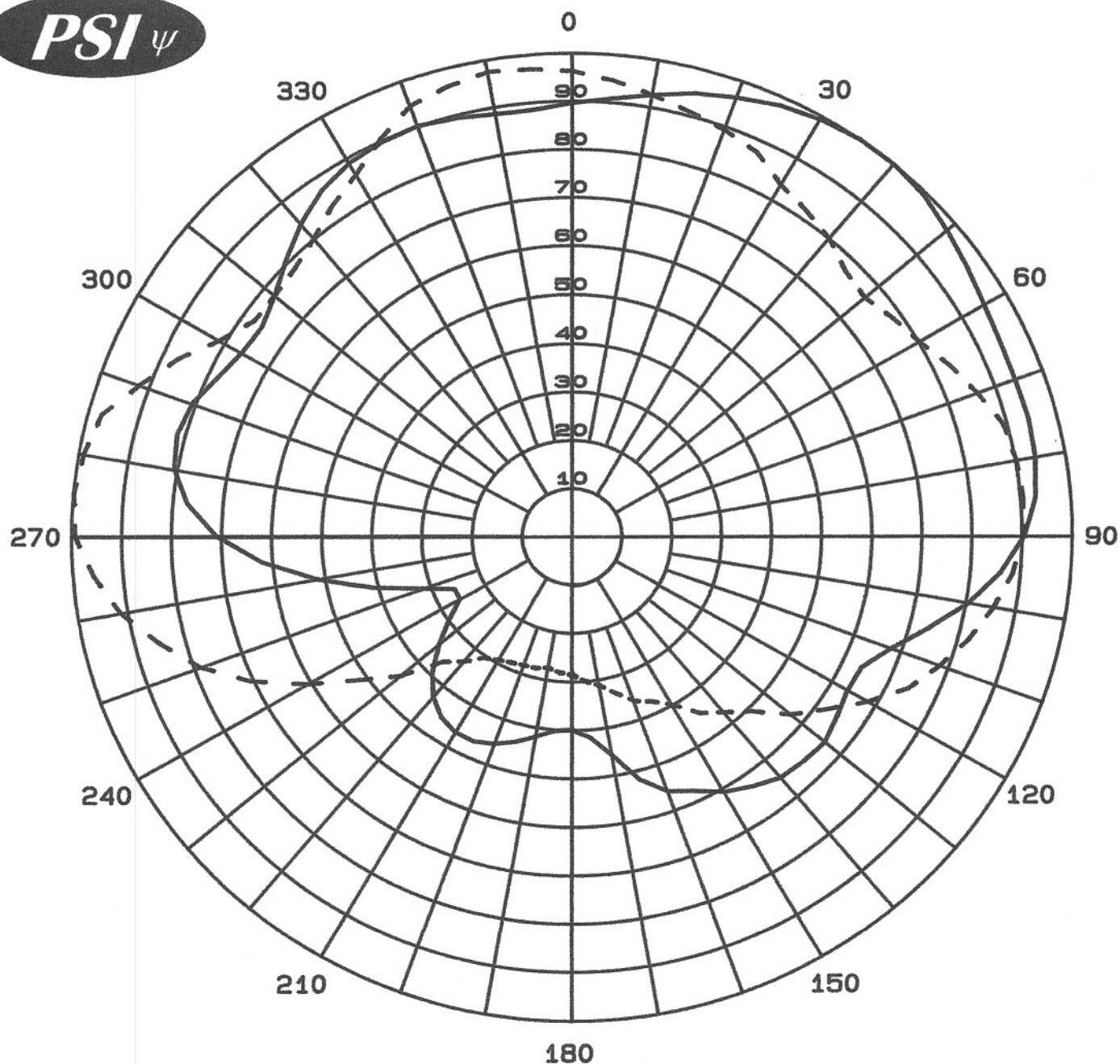
Station: WCIG

Frequency: 107.7 MHz

Location: Dallas, PA

Maximum ERP: 2.35 kW (3.71 dBk)

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.962	2.175	3.37
10	0.925	2.011	3.03
20	0.963	2.179	3.38
30	0.992	2.313	3.64
40	1.000	2.350	3.71
50	0.978	2.248	3.52
60	0.950	2.121	3.27
70	0.942	2.085	3.19
80	0.940	2.076	3.17
90	0.904	1.920	2.83
100	0.855	1.718	2.35
110	0.782	1.437	1.57
120	0.683	1.096	0.40
130	0.660	1.024	0.10
140	0.650	0.993	-0.03
150	0.610	0.874	-0.58
160	0.560	0.737	-1.33
170	0.459	0.495	-3.05
180	0.399	0.374	-4.27
190	0.419	0.413	-3.85
200	0.456	0.489	-3.11
210	0.466	0.510	-2.92
220	0.433	0.441	-3.56
230	0.446	0.467	-3.30
240	0.610	0.874	-0.58
250	0.789	1.463	1.65
260	0.915	1.967	2.94
270	0.994	2.322	3.66
280	0.990	2.303	3.62
290	0.918	1.980	2.97
300	0.811	1.546	1.89
310	0.774	1.408	1.49
320	0.841	1.662	2.21
330	0.889	1.857	2.69
340	0.945	2.099	3.22
350	0.975	2.234	3.49



Measured Relative Field  
Azimuth Plane Pattern  
Antenna: PSIFMR-2-HWS-DA  
Type: 2-Bay Directional FM Antenna  
Gain H-pol (solid): 1.20 (.79 dB)  
Gain V-pol (dash): 1.20 (.79 dB)  
Frequency: 107.7 MHz  
WCIG Dallas, PA

**Propagation Systems Inc.**  
**PO Box 113**  
**Ebensburg, PA 15931**

## Measured Relative Field Tabulation

Antenna: PSIFMR-2-HWS-DA

Family Life Ministries, Inc.

Station: WCIG

Frequency: 107.7 MHz

Location: Dallas, PA

### Horizontal Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.894	0.959	-0.18
10	0.925	1.027	0.11
20	0.963	1.113	0.46
30	0.992	1.181	0.72
40	1.000	1.200	0.79
50	0.978	1.148	0.60
60	0.950	1.083	0.35
70	0.942	1.065	0.27
80	0.940	1.060	0.25
90	0.904	0.981	-0.08
100	0.803	0.774	-1.11
110	0.677	0.550	-2.60
120	0.636	0.485	-3.14
130	0.660	0.523	-2.82
140	0.650	0.507	-2.95
150	0.610	0.447	-3.50
160	0.560	0.376	-4.24
170	0.459	0.253	-5.97
180	0.399	0.191	-7.19
190	0.419	0.211	-6.76
200	0.456	0.250	-6.03
210	0.466	0.261	-5.84
220	0.433	0.225	-6.48
230	0.348	0.145	-8.38
240	0.258	0.080	-10.98
250	0.317	0.121	-9.19
260	0.517	0.321	-4.94
270	0.710	0.605	-2.18
280	0.807	0.781	-1.07
290	0.807	0.781	-1.07
300	0.761	0.695	-1.58
310	0.774	0.719	-1.43
320	0.841	0.849	-0.71
330	0.889	0.948	-0.23
340	0.901	0.974	-0.11
350	0.884	0.938	-0.28

#### Maximum Value

Field 1.00  
Gain 1.20 (.79 dB)  
Azimuth Bearing 35-40 degrees

#### Minimum Field

Field 0.258  
Gain .080 (-10.98 dB)  
Azimuth Bearing 240 degrees

### Vertical Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.962	1.111	0.46
10	0.925	1.027	0.11
20	0.892	0.955	-0.20
30	0.835	0.837	-0.77
40	0.799	0.766	-1.16
50	0.763	0.699	-1.56
60	0.801	0.770	-1.14
70	0.861	0.890	-0.51
80	0.901	0.974	-0.11
90	0.902	0.976	-0.10
100	0.855	0.877	-0.57
110	0.782	0.734	-1.34
120	0.683	0.560	-2.52
130	0.573	0.394	-4.05
140	0.475	0.271	-5.67
150	0.402	0.194	-7.12
160	0.362	0.157	-8.03
170	0.312	0.117	-9.33
180	0.286	0.098	-10.08
190	0.275	0.091	-10.42
200	0.282	0.095	-10.20
210	0.293	0.103	-9.87
220	0.335	0.135	-8.71
230	0.446	0.239	-6.22
240	0.610	0.447	-3.50
250	0.789	0.747	-1.27
260	0.915	1.005	0.02
270	0.994	1.186	0.74
280	0.990	1.176	0.70
290	0.918	1.011	0.05
300	0.811	0.789	-1.03
310	0.774	0.719	-1.43
320	0.802	0.772	-1.12
330	0.862	0.892	-0.50
340	0.945	1.072	0.30
350	0.975	1.141	0.57

#### Maximum Value

Field 1.00  
Gain 1.20 (.79 dB)  
Azimuth Bearing 275 degrees

#### Minimum Field

Field 0.275  
Gain .091 (-10.42 dB)  
Azimuth Bearing 190 degrees

## ERP Tabulation

Antenna: PSIFMR-2-HWS-DA

Family Life Ministries, Inc.

Station: WCIG

Frequency: 107.7 MHz

Location: Dallas, PA

Maximum ERP: 2.35 kW (3.71 dBk)

### Horizontal Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.894	1.878	2.74
10	0.925	2.011	3.03
20	0.963	2.179	3.38
30	0.992	2.313	3.64
40	1.000	2.350	3.71
50	0.978	2.248	3.52
60	0.950	2.121	3.27
70	0.942	2.085	3.19
80	0.940	2.076	3.17
90	0.904	1.920	2.83
100	0.803	1.515	1.80
110	0.677	1.077	0.32
120	0.636	0.951	-0.22
130	0.660	1.024	0.10
140	0.650	0.993	-0.03
150	0.610	0.874	-0.58
160	0.560	0.737	-1.33
170	0.459	0.495	-3.05
180	0.399	0.374	-4.27
190	0.419	0.413	-3.85
200	0.456	0.489	-3.11
210	0.466	0.510	-2.92
220	0.433	0.441	-3.56
230	0.348	0.285	-5.46
240	0.258	0.156	-8.06
250	0.317	0.236	-6.27
260	0.517	0.628	-2.02
270	0.710	1.185	0.74
280	0.807	1.530	1.85
290	0.807	1.530	1.85
300	0.761	1.361	1.34
310	0.774	1.408	1.49
320	0.841	1.662	2.21
330	0.889	1.857	2.69
340	0.901	1.908	2.81
350	0.884	1.836	2.64

#### Maximum Value (H-pol)

Field 1.00  
ERP 2.35 kW (3.71 dBk)

Azimuth Bearing 35-40 degrees

#### Minimum Field (H-pol)

Field 0.258  
ERP .156 kW (-8.06 dBk)

Azimuth Bearing 240 degrees

### Vertical Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.962	2.175	3.37
10	0.925	2.011	3.03
20	0.892	1.870	2.72
30	0.835	1.638	2.14
40	0.799	1.500	1.76
50	0.763	1.368	1.36
60	0.801	1.508	1.78
70	0.861	1.742	2.41
80	0.901	1.908	2.81
90	0.902	1.912	2.81
100	0.855	1.718	2.35
110	0.782	1.437	1.57
120	0.683	1.096	0.40
130	0.573	0.772	-1.13
140	0.475	0.530	-2.76
150	0.402	0.380	-4.20
160	0.362	0.308	-5.12
170	0.312	0.229	-6.41
180	0.286	0.192	-7.16
190	0.275	0.178	-7.50
200	0.282	0.187	-7.28
210	0.293	0.202	-6.95
220	0.335	0.264	-5.79
230	0.446	0.467	-3.30
240	0.610	0.874	-0.58
250	0.789	1.463	1.65
260	0.915	1.967	2.94
270	0.994	2.322	3.66
280	0.990	2.303	3.62
290	0.918	1.980	2.97
300	0.811	1.546	1.89
310	0.774	1.408	1.49
320	0.802	1.512	1.79
330	0.862	1.746	2.42
340	0.945	2.099	3.22
350	0.975	2.234	3.49

#### Maximum Value (V-pol)

Field 1.00  
ERP 2.35 kW (3.71 dBk)

Azimuth Bearing 275 degrees

#### Minimum Field (V-pol)

Field 0.275  
ERP .178 kW (-7.50 dBk)

Azimuth Bearing 190 degrees



Relative Field Elevation Pattern  
Model: PSIFMR-2-HWS-DA  
Type: 2-Bay FM Directional Antenna  
Polarization: Circular  
Gain: 1.2 (.79 dB)  
Station: WCIG  
Dallas, PA

