



# Propagation Systems, Inc.

---

Quality Broadcast Antenna Systems

**Directional FM Antenna  
WKJL-FM  
He's Alive Incorporated  
Clarksburg, WV**

A standard model PSIFMR antenna was modified for elliptical polarization and was made directional with the use of parasitic elements and the customer's tower to create the necessary directional radiation pattern. The final antenna consists of four radiating elements each secured to the mast with a custom-mounting bracket. The antenna bays are full wavelength spaced and there are two horizontal and one vertical parasitic elements per bay. The antenna array is center fed. Each radiating element receives equal power and phase.

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 8753A-network analyzer operating at 264.3 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 87.5% of the envelope RMS.

The antenna is to be mounted 84 meters (275.5 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. Guy wires that pass through the aperture of the antenna will require a nonmetallic substitute. The antenna is to be mounted to the southwest tower leg and positioned 167° 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.

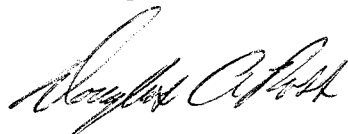
An input power level of 8.47 kW will be required at the antenna input in order to reach the licensed 32.0 kW ERP. The transmitter output power requirements are dependent upon the transmission line size and length used to feed the antenna. The final length of transmission line must be determined after installation.

### Antenna Specifications

Antenna Model	PSIFMR-4C-DA
Type	4-bay directional FM antenna
Bay Spacing	Full wavelength spaced elements
Frequency	88.1 MHz
Polarization	Elliptical
Envelope RMS	.869
Composite RMS	.761
Gain (h-pol)	2.244 (3.510 dB)
Gain (v-pol)	3.780 (5.775 dB)
Input	1-5/8" EIA center fed input
Input power	8.466 kW
ERP (h-pol)	19.0 kW (12.8 dBk)
ERP (v-pol)	32.0 kW (15.05 dBk)
Power rating	12 kW
Length	36.85 ft.
Weight	359 lbs.
Wind Area	29.7 sq. ft.

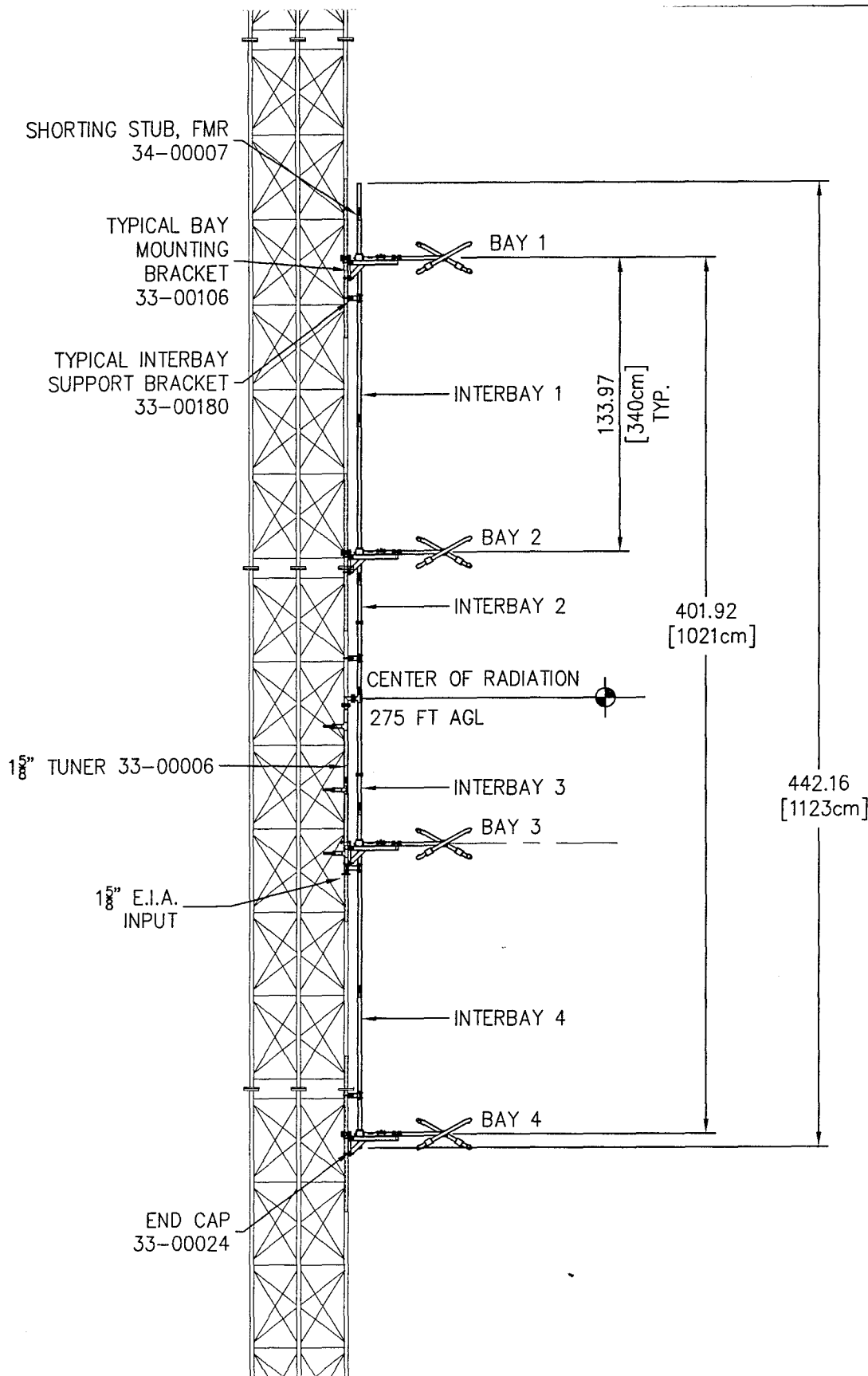
### Statement of Certification

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.



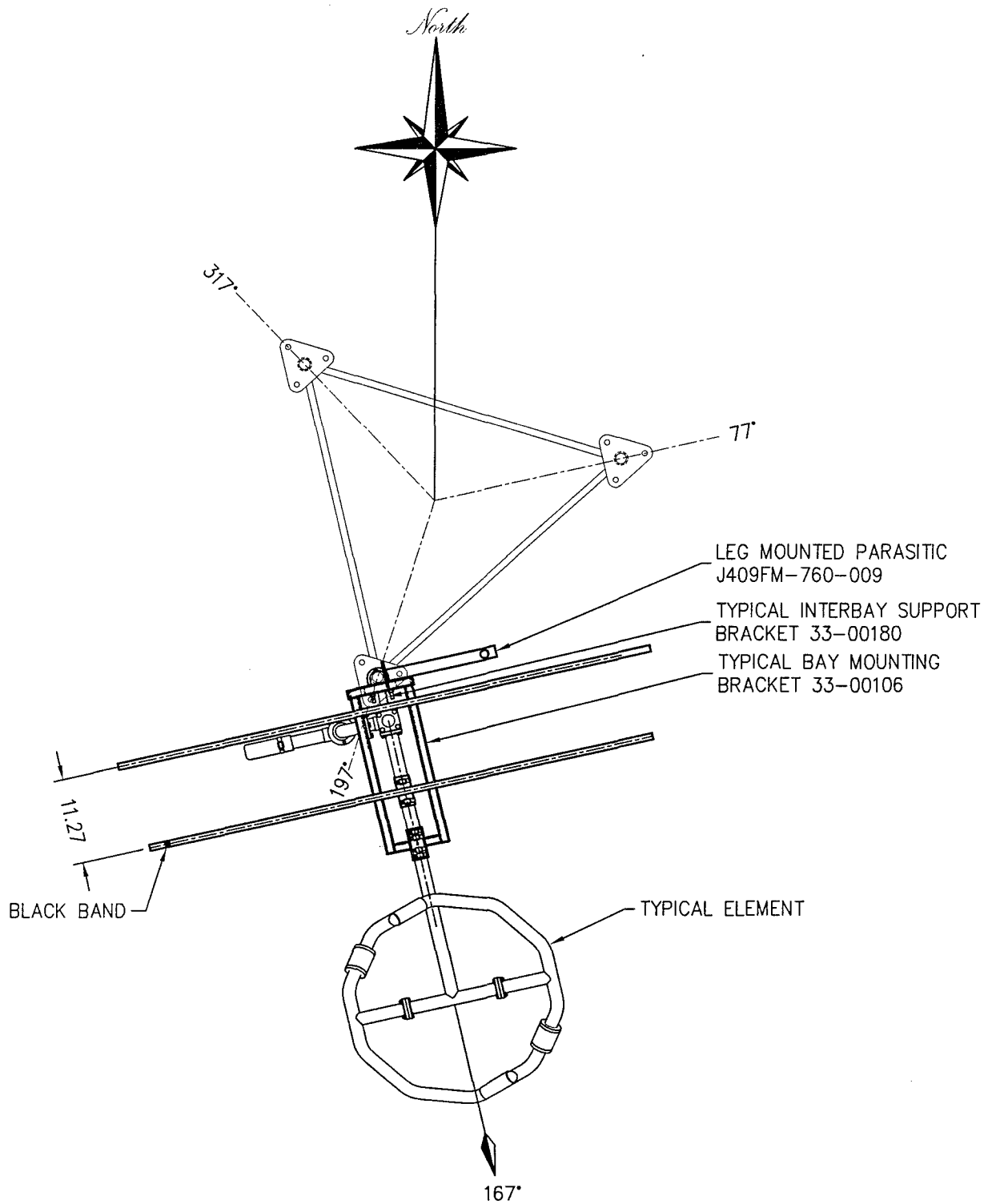
7/8/09

Douglas A. Ross  
President  
Propagation Systems Inc.

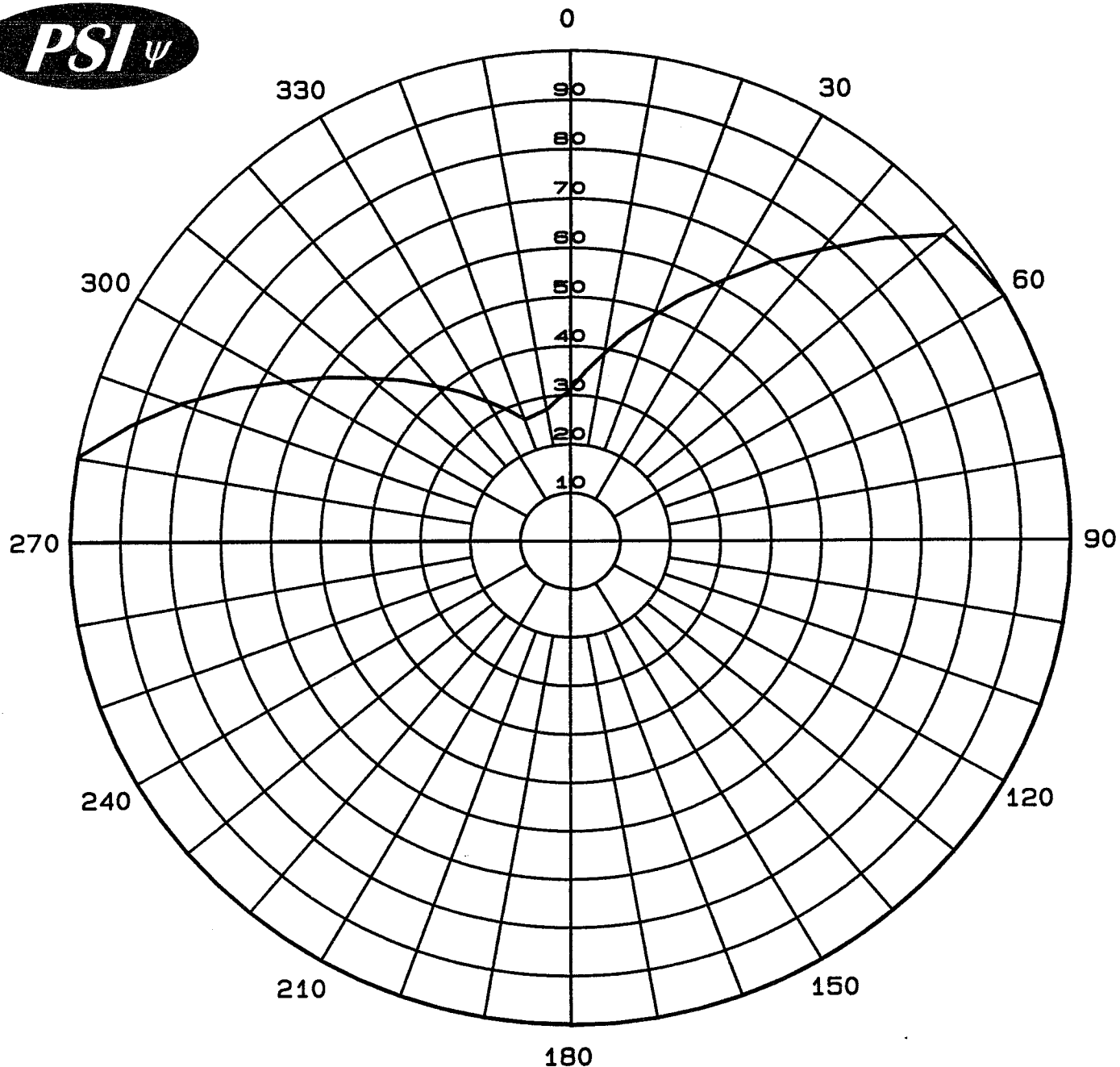


SPECIFICATIONS	
SPACING:	1.0λ
LENGTH:	36.85 Ft [11.23m]
APERTURE:	33.49 Ft. [10.21m]
RATING:	12 kW
H-POL. GAIN:	2.244 (3.51 dB)
V-POL. GAIN:	3.780 (5.775 dB)
WEIGHT:	359 Lbs [163.6 Kg]
WIND AREA:	29.7 Ft <sup>2</sup> [2.76m <sup>2</sup> ]
TIA-222-F (NO ICE)	
NOTES:	
1. REFERENCE DRAWING J409FM-760-012 FOR ASSEMBLY DETAILS AT BAYS 1 AND 2	
2. REFERENCE DRAWING J409FM-760-013 FOR ASSEMBLY DETAILS AT INPUT	
3. REFERENCE DRAWING J409FM-760-012 FOR ASSEMBLY DETAILS AT BAY 4	

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.		SIZE  A	<h1>PROPAGATION SYSTEMS, INC.</h1> <p>Ebensburg, Pennsylvania USA 814-472-5540</p> <h2>ANTENNA ELEVATIONS AND SPECIFICATIONS</h2>	
REV.	MADE BY CHECKED BY	DATE	CHANGE	
MODEL: PSIFMR-4C-DA		DRAWN BY: D.G. Kellar		DATE: 5/14/09
CHANNEL/FREQUENCY: 88.1 MHz		APPROVED BY:		DATE:
SCALE: 1:70		DRAWING NO.: J409FM-760-001		REV.



				<b>PROPAGATION SYSTEMS, INC.</b>			
				Ebensburg, Pennsylvania USA 814-472-5540			
				ANTENNA PLANVIEW AND ORIENTATION			
REV.	MADE BY	CHECKED BY	DATE	CHANGE	MODEL:	DRAWN BY:	DATE:
					PSIFMR-4C-DA	D. G. Kellar	5/14/09
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.				SIZE	CHANNEL/FREQUENCY:	APPROVED BY:	DATE:
				A	88.1 MHz		
					SCALE:	DRAWING NO.:	REV.
				1:20	J409FM-760-002		



Maximum Envelope  
Azimuth Plane Pattern  
Antenna: PSIFMR-4C-DA  
Type: 4-Bay Directional FM Antenna  
ERP (h-pol): 19.0 kW (12.8 dBk)  
ERP (v-pol): 32.0 kW (15.05 dBk)  
Station: WKJL  
Location: Clarksburg, WV

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

### Maximum Envelope Tabulation

Antenna: PSIFMR-4C-DA

He's Alive, Incorporated

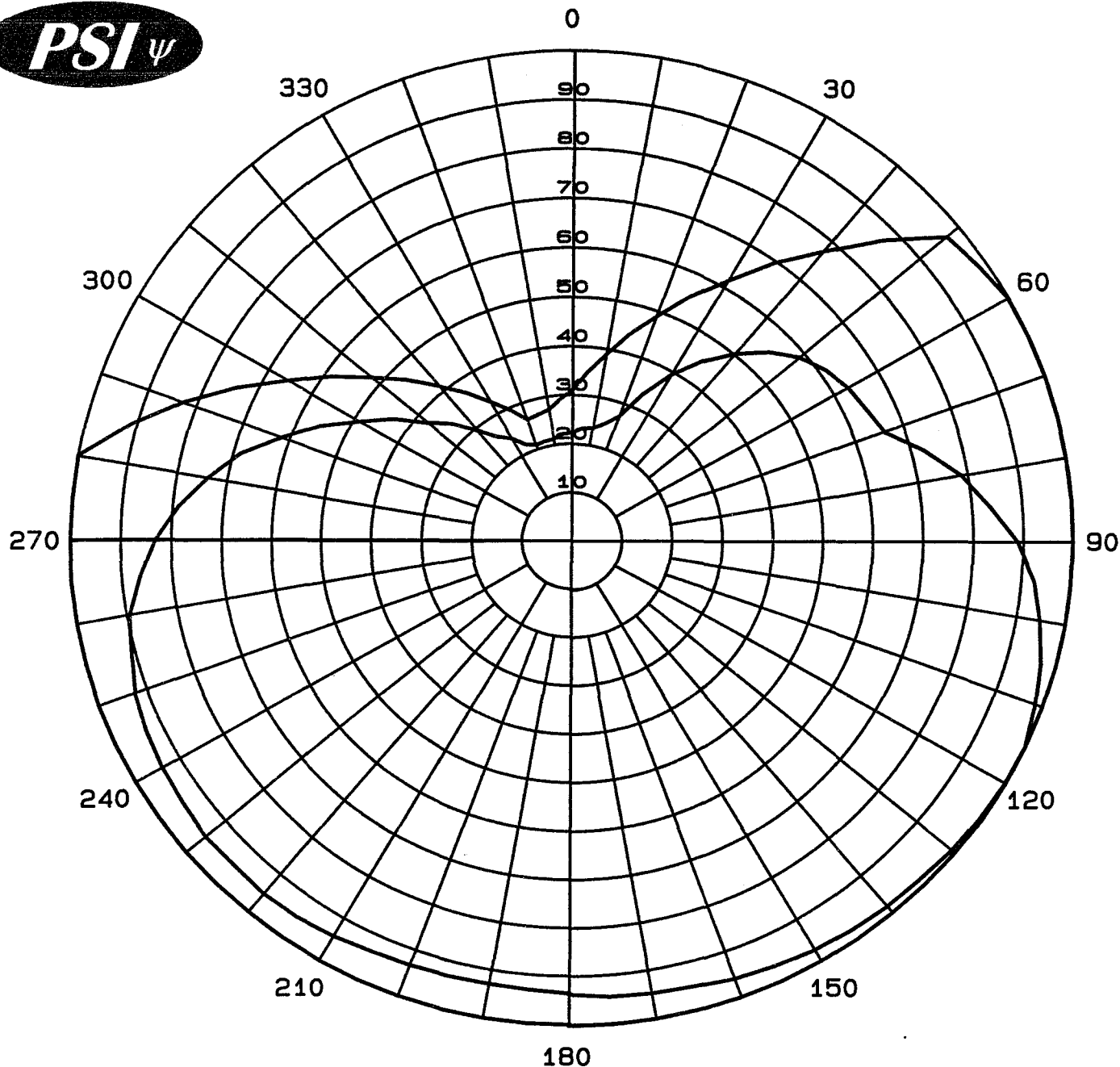
Station: WKJL

Frequency: 88.1 MHz

Location: Clarksburg, WV

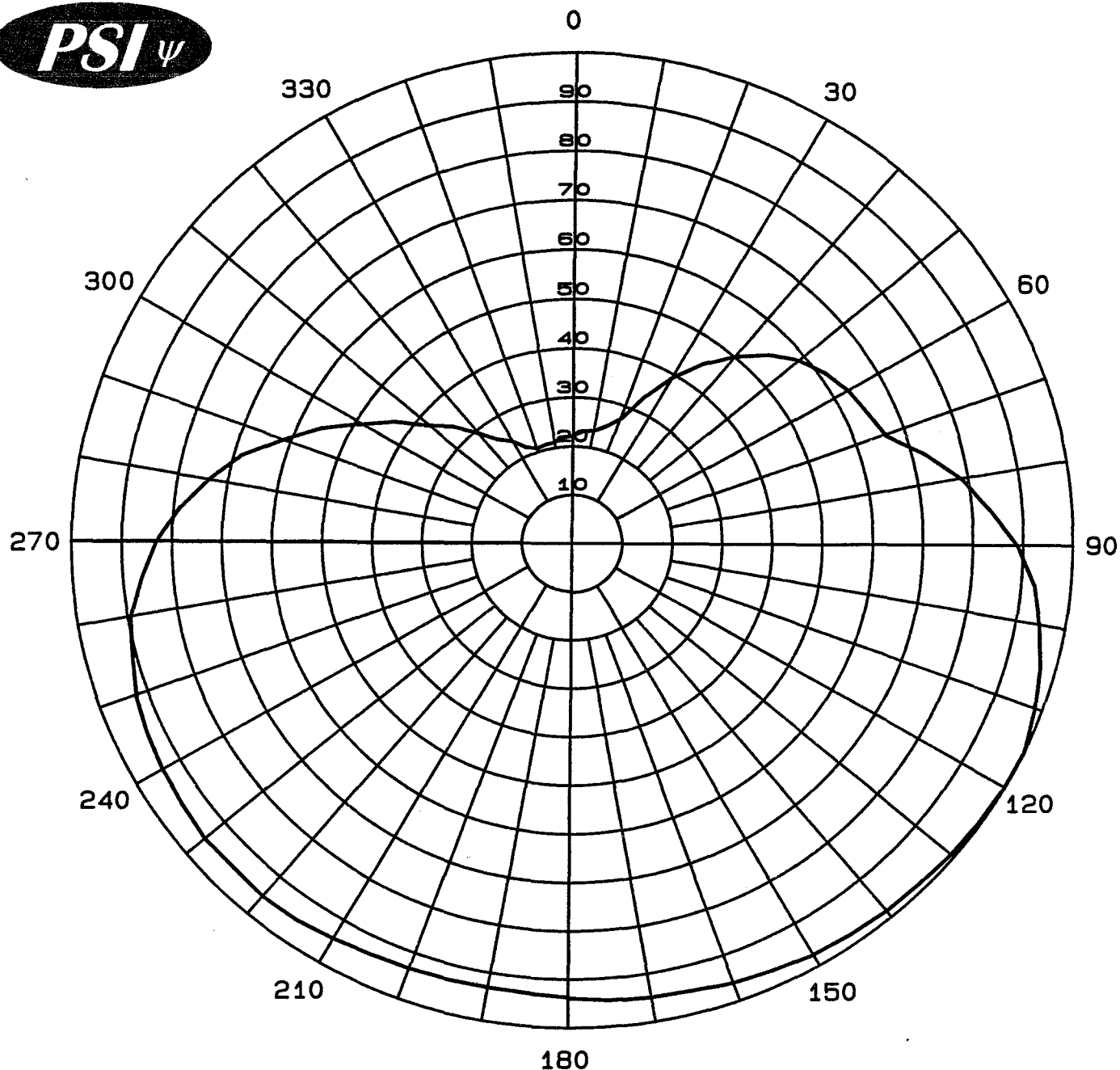
Maximum ERP: 32 kW (15.05 dBk)

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.309	3.06	4.85
10	0.388	4.82	6.83
20	0.488	7.62	8.82
30	0.614	12.06	10.81
40	0.772	19.07	12.80
50	0.970	30.11	14.79
60	1.000	32.00	15.05
70	1.000	32.00	15.05
80	1.000	32.00	15.05
90	1.000	32.00	15.05
100	1.000	32.00	15.05
110	1.000	32.00	15.05
120	1.000	32.00	15.05
130	1.000	32.00	15.05
140	1.000	32.00	15.05
150	1.000	32.00	15.05
160	1.000	32.00	15.05
165	1.000	32.00	15.05
170	1.000	32.00	15.05
180	1.000	32.00	15.05
190	1.000	32.00	15.05
200	1.000	32.00	15.05
210	1.000	32.00	15.05
220	1.000	32.00	15.05
230	1.000	32.00	15.05
240	1.000	32.00	15.05
250	1.000	32.00	15.05
255	1.000	32.00	15.05
260	1.000	32.00	15.05
270	1.000	32.00	15.05
280	0.999	31.94	15.04
290	0.826	21.83	13.39
300	0.656	13.77	11.39
310	0.522	8.72	9.40
320	0.415	5.51	7.41
330	0.330	3.48	5.42
340	0.263	2.21	3.45
350	0.272	2.37	3.74



Measured Composite and  
Maximum Envelope Pattern  
Antenna: PSIFMR-4C-DA  
Type: 4-Bay Directional FM Antenna  
RMS Envelope: .869  
RMS Composite: .761  
Station: WKJL  
Location: Clarksburg, WV

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



Measured Composite Pattern  
Azimuth Plane Pattern  
Antenna: PSIFMR-4C-DA  
Type: 4-Bay Directional FM Antenna  
ERP (h-pol): 19.0 kW (12.8 dBK)  
ERP (v-pol): 32.0 kW (15.05 dBK)  
Station: WKJL  
Location: Clarksburg, WV

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



## Composite Pattern Tabulation

Antenna: PSIFMR-4C-DA

He's Alive, Incorporated

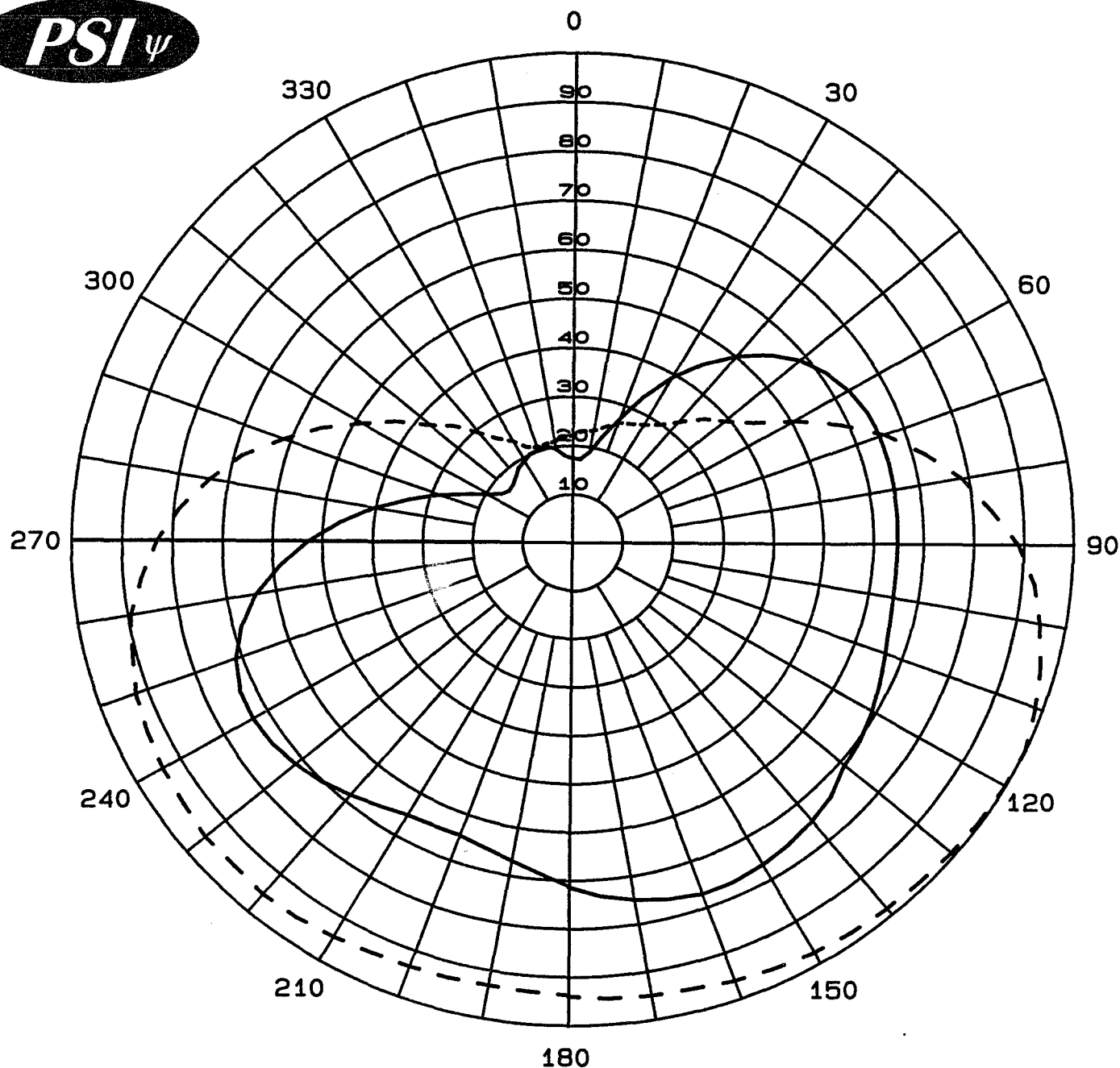
Station: WKJL

Frequency: 88.1 MHz

Location: Clarksburg, WV

Maximum ERP: 32 kW (15.05 dBk)

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.221	1.56	1.94
10	0.235	1.77	2.47
20	0.271	2.35	3.71
30	0.393	4.94	6.94
40	0.504	8.13	9.10
50	0.589	11.10	10.45
60	0.633	12.82	11.08
70	0.662	14.02	11.47
80	0.788	19.87	12.98
90	0.889	25.29	14.03
100	0.949	28.82	14.60
110	0.986	31.11	14.93
120	0.999	31.94	15.04
130	0.992	31.49	14.98
140	0.983	30.92	14.90
150	0.974	30.36	14.82
160	0.960	29.49	14.70
170	0.947	28.70	14.58
180	0.936	28.04	14.48
190	0.929	27.62	14.41
200	0.932	27.80	14.44
210	0.942	28.40	14.53
220	0.951	28.94	14.62
230	0.950	28.88	14.61
240	0.939	28.22	14.50
250	0.924	27.32	14.36
260	0.894	25.58	14.08
270	0.830	22.04	13.43
280	0.737	17.38	12.40
290	0.615	12.10	10.83
300	0.489	7.65	8.84
310	0.377	4.55	6.58
320	0.297	2.82	4.51
330	0.242	1.87	2.73
340	0.208	1.38	1.41
350	0.211	1.42	1.54



Measured Relative Field  
Azimuth Plane Pattern  
Antenna: PSIFMR-4C-DA  
Type: 4-Bay Directional FM Antenna  
Gain (h-pol): 2.24 (3.51 dB)  
Gain (v-pol): 3.78 (5.77 dB)  
Station: WKJL  
Location: Clarksburg, WV

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

## Measured Relative Field Tabulation

Antenna: PSIFMR-4C-DA

He's Alive, Incorporated

Station: WKJL

Frequency: 88.1 MHz

Location: Clarksburg, WV

### Horizontal Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.175	0.116	-9.36
10	0.190	0.136	-8.65
20	0.271	0.278	-5.57
30	0.393	0.584	-2.34
40	0.504	0.960	-0.18
50	0.589	1.311	1.18
60	0.633	1.515	1.80
70	0.651	1.602	2.05
80	0.651	1.602	2.05
90	0.649	1.592	2.02
100	0.651	1.602	2.05
110	0.667	1.682	2.26
120	0.693	1.815	2.59
130	0.712	1.916	2.82
140	0.748	2.115	3.25
150	0.765	2.212	3.45
160	0.771	2.244	3.51
170	0.748	2.115	3.25
180	0.710	1.905	2.80
190	0.666	1.677	2.24
200	0.643	1.563	1.94
210	0.650	1.597	2.03
220	0.682	1.758	2.45
230	0.715	1.932	2.86
240	0.731	2.020	3.05
250	0.713	1.922	2.84
260	0.642	1.558	1.93
270	0.528	1.054	0.23
280	0.403	0.614	-2.12
290	0.286	0.309	-5.10
300	0.197	0.147	-8.34
310	0.166	0.104	-9.82
320	0.177	0.118	-9.27
330	0.194	0.142	-8.47
340	0.203	0.156	-8.08
350	0.196	0.145	-8.38

#### Maximum Value

Field 0.77

Gain 2.24 (3.51 dB)

Azimuth Bearing 155-160 degrees

#### Minimum Field

Field 0.166

Gain .104 (-9.82 dB)

Azimuth Bearing 310 degrees

### Vertical Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.221	0.185	-7.34
10	0.235	0.209	-6.80
20	0.265	0.265	-5.76
30	0.283	0.303	-5.19
40	0.327	0.404	-3.93
50	0.394	0.587	-2.32
60	0.510	0.983	-0.07
70	0.662	1.657	2.19
80	0.788	2.347	3.71
90	0.889	2.987	4.75
100	0.949	3.404	5.32
110	0.986	3.675	5.65
120	0.999	3.772	5.77
130	0.992	3.720	5.71
140	0.983	3.653	5.63
150	0.974	3.586	5.55
160	0.960	3.484	5.42
170	0.947	3.390	5.30
180	0.936	3.312	5.20
190	0.929	3.262	5.14
200	0.932	3.283	5.16
210	0.942	3.354	5.26
220	0.951	3.419	5.34
230	0.950	3.411	5.33
240	0.939	3.333	5.23
250	0.924	3.227	5.09
260	0.894	3.021	4.80
270	0.830	2.604	4.16
280	0.737	2.053	3.12
290	0.615	1.430	1.55
300	0.489	0.904	-0.44
310	0.377	0.537	-2.70
320	0.297	0.333	-4.77
330	0.242	0.221	-6.55
340	0.208	0.164	-7.86
350	0.211	0.168	-7.74

#### Maximum Value

Field 1.00

Gain 3.78 (5.77 dB)

Azimuth Bearing 115 degrees

#### Minimum Field

Field 0.208

Gain .164 (-7.86 dB)

Azimuth Bearing 340 degrees

## ERP Tabulation

Antenna: PSIFMR-4C-DA

He's Alive, Incorporated

Station: WKJL

Frequency: 88.1 MHz

Location: Clarksburg, WV

Maximum ERP: 32.0 kW (15.05 dBk)

### Horizontal Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.175	0.98	-0.09
10	0.190	1.16	0.63
20	0.271	2.35	3.71
30	0.393	4.94	6.94
40	0.504	8.13	9.10
50	0.589	11.10	10.45
60	0.633	12.82	11.08
70	0.651	13.56	11.32
80	0.651	13.56	11.32
90	0.649	13.48	11.30
100	0.651	13.56	11.32
110	0.667	14.24	11.53
120	0.693	15.37	11.87
130	0.712	16.22	12.10
140	0.748	17.90	12.53
150	0.765	18.73	12.72
160	0.771	19.00	12.79
170	0.748	17.90	12.53
180	0.710	16.13	12.08
190	0.666	14.19	11.52
200	0.643	13.23	11.22
210	0.650	13.52	11.31
220	0.682	14.88	11.73
230	0.715	16.36	12.14
240	0.731	17.10	12.33
250	0.713	16.27	12.11
260	0.642	13.19	11.20
270	0.528	8.92	9.50
280	0.403	5.20	7.16
290	0.286	2.62	4.18
300	0.197	1.24	0.94
310	0.166	0.88	-0.55
320	0.177	1.00	0.01
330	0.194	1.20	0.81
340	0.203	1.32	1.20
350	0.196	1.23	0.90

#### Maximum Value (H-pol)

Field 0.77  
ERP 19.0 kW (12.8 dBk)

Azimuth Bearing 155-160 degrees

#### Minimum Field (H-pol)

Field 0.166  
ERP .88 kW (-.55 dBk)

Azimuth Bearing 310 degrees

### Vertical Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.221	1.56	1.94
10	0.235	1.77	2.47
20	0.265	2.25	3.52
30	0.283	2.56	4.09
40	0.327	3.42	5.34
50	0.394	4.97	6.96
60	0.510	8.32	9.20
70	0.662	14.02	11.47
80	0.788	19.87	12.98
90	0.889	25.29	14.03
100	0.949	28.82	14.60
110	0.986	31.11	14.93
120	0.999	31.94	15.04
130	0.992	31.49	14.98
140	0.983	30.92	14.90
150	0.974	30.36	14.82
160	0.960	29.49	14.70
170	0.947	28.70	14.58
180	0.936	28.04	14.48
190	0.929	27.62	14.41
200	0.932	27.80	14.44
210	0.942	28.40	14.53
220	0.951	28.94	14.62
230	0.950	28.88	14.61
240	0.939	28.22	14.50
250	0.924	27.32	14.36
260	0.894	25.58	14.08
270	0.830	22.04	13.43
280	0.737	17.38	12.40
290	0.615	12.10	10.83
300	0.489	7.65	8.84
310	0.377	4.55	6.58
320	0.297	2.82	4.51
330	0.242	1.87	2.73
340	0.208	1.38	1.41
350	0.211	1.42	1.54

#### Maximum Value (V-pol)

Field 1.00  
ERP 32.0 kW (15.05 dBk)

Azimuth Bearing 115 degrees

#### Minimum Field (V-pol)

Field 0.208  
ERP 1.38 kW (1.41 dBk)

Azimuth Bearing 340 degrees



Relative Field Elevation Pattern  
Model: PSIFMR-4C-DA  
Type: 4-Bay Directional FM Antenna  
Polarization: Elliptical  
Directivity: 2.1 (3.2 dB)  
Call Letters: WKJL  
Clarksburg, WV

