



# Propagation Systems, Inc.

Quality Broadcast Antenna Systems

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## **Directional FM Antenna WJEE Bolivar, OH**

A standard model PSIFMLH antenna was modified and used in conjunction with the customer's wooden support mast to create the necessary directional radiation pattern. The final antenna consists of two radiating elements each secured to a support mast with custom-mounting brackets. The antenna bays are spaced  $9/10$  of a wavelength and 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 mast under test was mounted to a turntable that allowed the structure to be rotated  $360^\circ$  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 270.3 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 88.3% of the envelope RMS.

The antenna is to be mounted with the center of radiation at 14.7-meters (48.2 ft.) above ground level on a wooden support mast. At this elevation the antenna will be within the allowed  $+2m/-4m$  tolerance from the approved 14.7-meter height above ground level. No other antenna can be installed within 10 ft of any radiating element. The antenna is to be positioned  $0^\circ$  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 .830 kW will be required at the antenna input in order to reach the licensed 2.3 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**

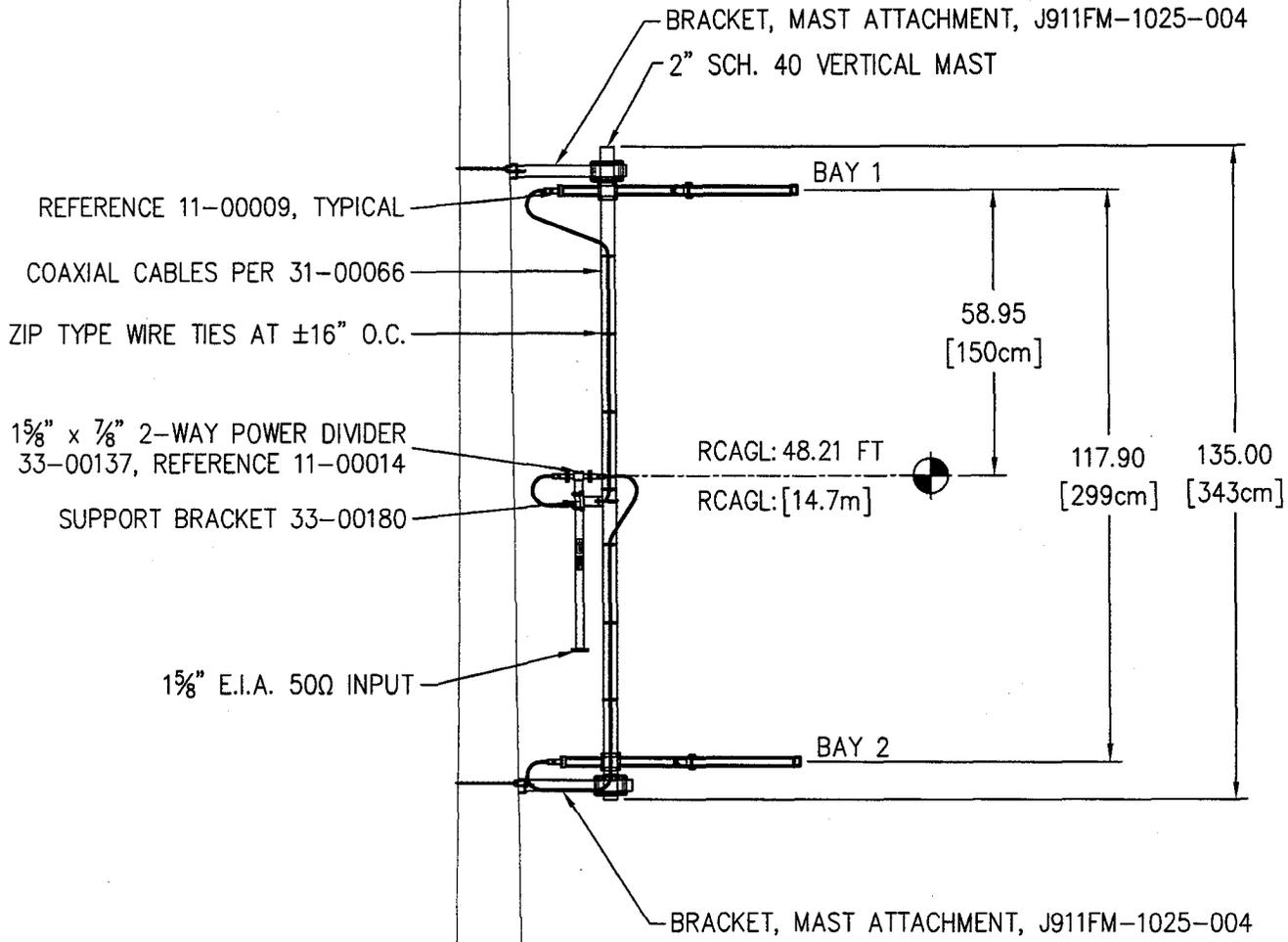
Antenna Model	PSIFMLH-2B-DA
Type	2-bay directional FM antenna
Bay Spacing	9/10-wave spaced elements
Frequency	90.1 MHz
Polarization	Horizontal
Envelope RMS	.931
Measured RMS	.822
Gain	2.77 (4.43 dB)
Antenna input power	.830 kW (-.807 dBk)
Input	1-5/8" EIA center fed input
Power rating	3 kW
Length	11.25 ft.
Weight	108.6 lbs.
Wind Area	7.8 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.

 11/16/2011

Douglas A. Ross  
President  
Propagation Systems Inc.



ANTENNA SPECIFICATIONS	
SPACING:	.9λ
LENGTH:	11.25 FT [3.4m]
APERTURE:	9.83 FT [2.99m]
RATING:	3 kW
GAIN:	2.77 (4.43 dB)
WEIGHT:	108.6 LB [49.4 Kg]
WINDAREA:	7.8 FT <sup>2</sup>
TIA-222-F (NO ICE)	

TAPERED WOOD VERTICAL MAST →

REV.	MADE BY CHECKED BY	DATE	CHANGE

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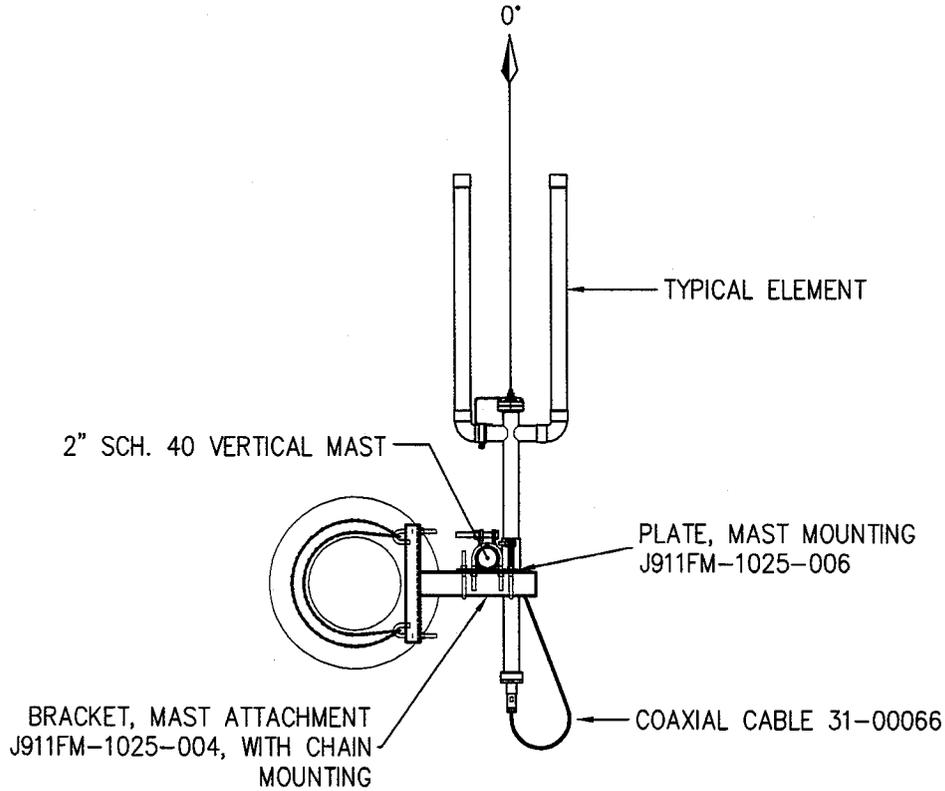
A

## PROPAGATION SYSTEMS, INC.

Ebensburg, Pennsylvania USA 814-472-5540

### ELEVATIONS AND SPECIFICATIONS

MODEL:	PSIFMLH-2B-DA	DRAWN BY:	D.G. Kellar	DATE:	9/24/11
CHANNEL/ FREQUENCY:	90.1 MHz	APPROVED BY:		DATE:	
SCALE:	1:40	DRAWING NO.:	J911FM-1025-001	REV.	



A	D.G. Keller	10/31/11	CHANGE MAST SIZE PER CUSTOMER
REV.	MADE BY CHECKED BY	DATE	CHANGE

# PROPAGATION SYSTEMS, INC.

Ebensburg, Pennsylvania USA 814-472-5540

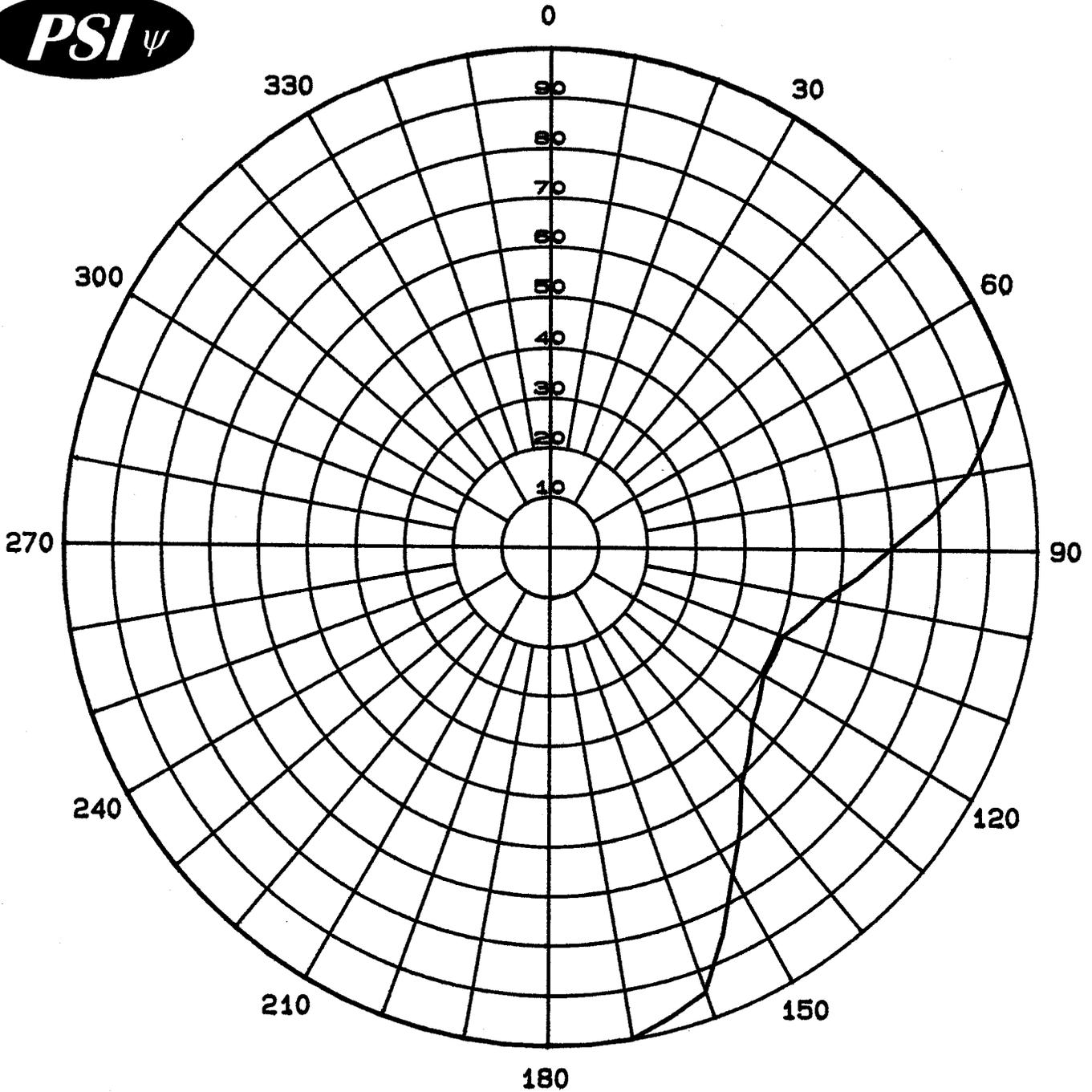
## PLAN VIEW AND OREINTATION

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SIZE  
**A**

MODEL: PSIFMLH-2B-DA	DRAWN BY: D.G. Keller	DATE: 9/24/11
CHANNEL/ FREQUENCY: 90.1 MHz	APPROVED BY:	DATE:
SCALE: 1:20	DRAWING NO.:	REV. A

J911FM-1025-002



Maximum Envelope  
Azimuth Plane Pattern  
Antenna: PSIFMLH-2B-DA  
Type: 2-Bay Directional FM Antenna  
ERP: 2.3 kW (3.62 dBk)  
RMS Envelope: .931  
Frequency: 90.1 MHz  
WJEE Bolivar, OH

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

# Envelope Pattern

Antenna: PSIFMLH-2B-DA

Station: WJEE

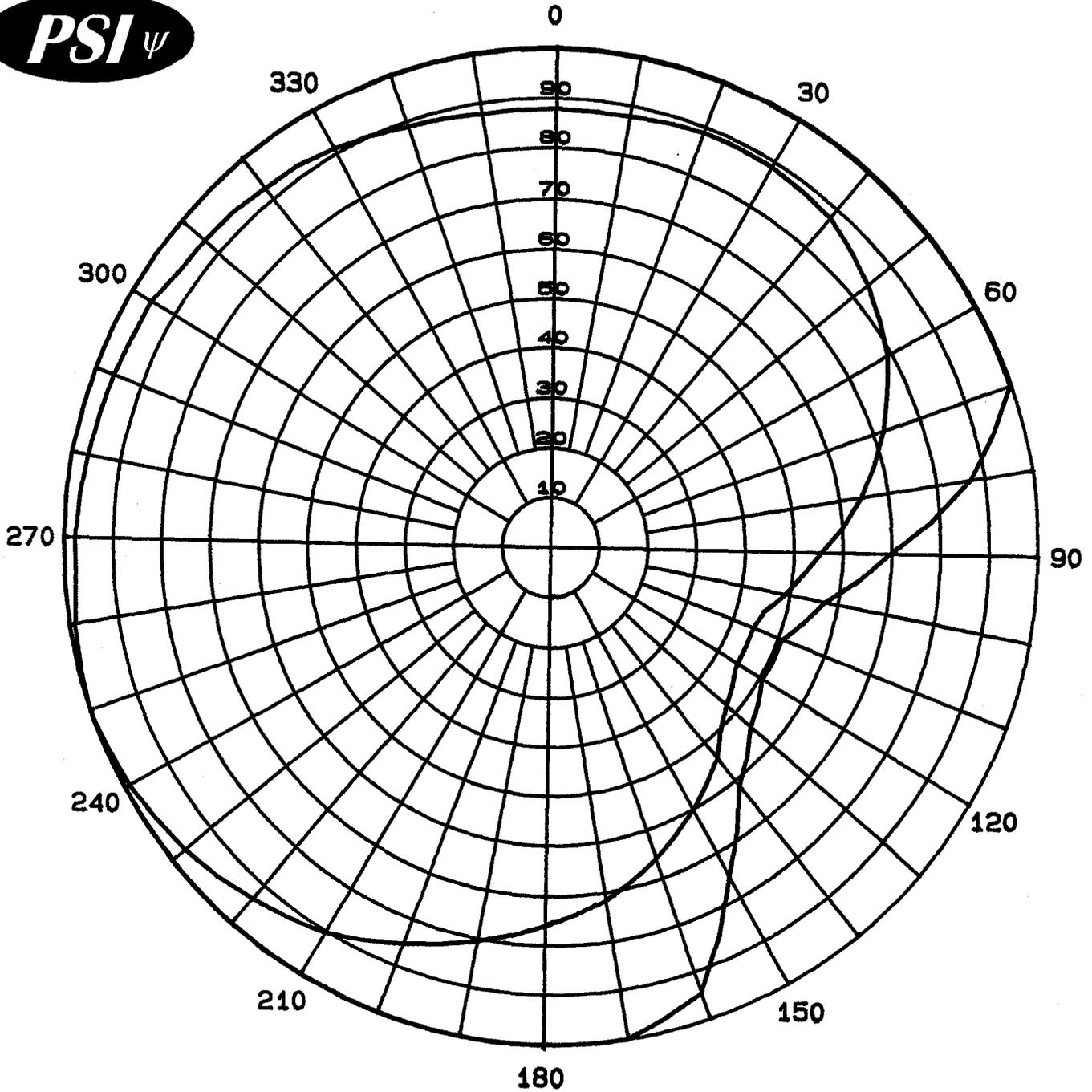
Frequency: 90.1 MHz

Location: Bolivar, OH

Maximum ERP: 2.3 kW

Horizontal Component

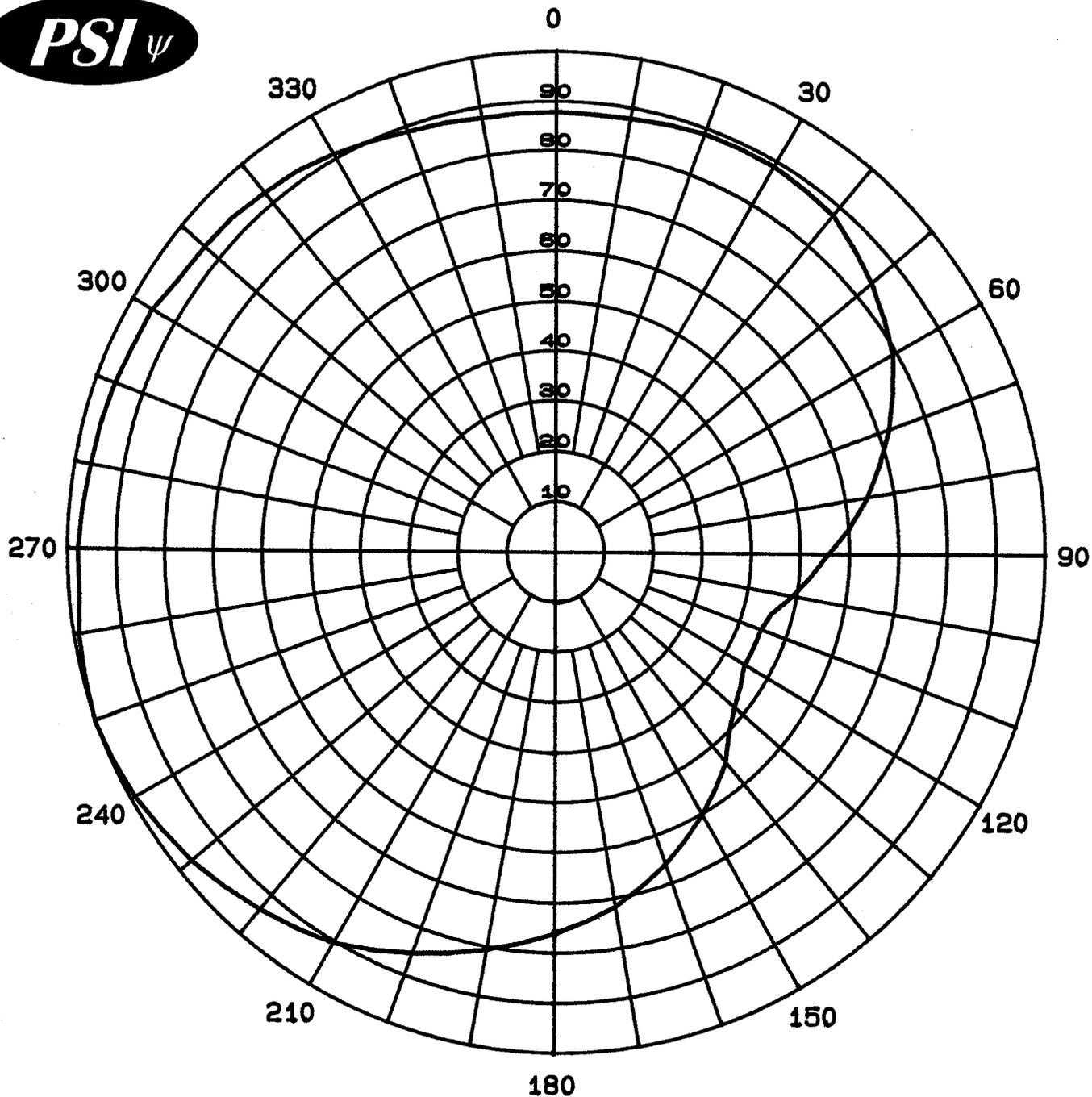
Angle	Relative Field	ERP kW	ERP dBk
0	1.000	2.30	3.62
10	1.000	2.30	3.62
20	1.000	2.30	3.62
30	1.000	2.30	3.62
40	1.000	2.30	3.62
50	1.000	2.30	3.62
60	1.000	2.30	3.62
70	1.000	2.30	3.62
80	0.872	1.75	2.43
90	0.697	1.12	0.48
100	0.572	0.75	-1.23
110	0.509	0.60	-2.25
120	0.508	0.59	-2.27
130	0.545	0.68	-1.65
140	0.616	0.87	-0.59
150	0.756	1.31	1.19
160	0.946	2.06	3.14
170	1.000	2.30	3.62
180	1.000	2.30	3.62
190	1.000	2.30	3.62
200	1.000	2.30	3.62
210	1.000	2.30	3.62
220	1.000	2.30	3.62
230	1.000	2.30	3.62
240	1.000	2.30	3.62
250	1.000	2.30	3.62
260	1.000	2.30	3.62
270	1.000	2.30	3.62
280	1.000	2.30	3.62
290	1.000	2.30	3.62
300	1.000	2.30	3.62
310	1.000	2.30	3.62
320	1.000	2.30	3.62
330	1.000	2.30	3.62
340	1.000	2.30	3.62
350	1.000	2.30	3.62



Maximum Envelope and Measured Pattern  
Antenna: PSIFMLH-2B-DA  
Type: 2-Bay Directional FM Antenna  
ERP: 2.3 kW (3.62 dBk)  
RMS Envelope: .931  
RMS Measured: .822  
Frequency: 90.1 MHz

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WJEE Bolivar, OH



Measured Relative Field  
Azimuth Plane Pattern  
Antenna: PSIFMLH-2B-DA  
Type: 2-Bay Directional FM Antenna  
Gain H-pol: 2.77 (4.43 dB)  
RMS: .822  
Frequency: 90.1 MHz  
WJEE Bolivar, OH

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# Measured Relative Field Tabulation

Antenna: PSIFMLH-2B-DA

Station: WJEE

Frequency: 90.1 MHz

Location: Bolivar, OH

## Horizontal Component Measured Relative Field

Angle	Relative Field	Power Gain	Gain dB
0	0.881	2.15	3.32
10	0.881	2.15	3.32
20	0.891	2.20	3.43
30	0.891	2.20	3.43
40	0.881	2.15	3.32
50	0.841	1.96	2.92
60	0.794	1.75	2.42
70	0.724	1.45	1.62
80	0.646	1.15	0.63
90	0.556	0.86	-0.68
100	0.490	0.66	-1.77
110	0.447	0.55	-2.57
120	0.447	0.55	-2.57
130	0.479	0.63	-1.98
140	0.543	0.82	-0.87
150	0.603	1.01	0.03
160	0.661	1.21	0.82
170	0.716	1.42	1.52
180	0.759	1.59	2.03
190	0.804	1.79	2.52
200	0.851	2.01	3.02
210	0.902	2.25	3.53
220	0.933	2.41	3.83
230	0.966	2.59	4.13
240	0.989	2.71	4.33
250	1.000	2.77	4.42
260	0.989	2.71	4.33
270	0.977	2.65	4.22
280	0.966	2.59	4.13
290	0.961	2.56	4.07
300	0.955	2.53	4.02
310	0.939	2.44	3.87
320	0.928	2.38	3.77
330	0.912	2.30	3.62
340	0.891	2.20	3.43
350	0.880	2.15	3.31

### Maximum Field (H-pol)

Field 1.00

Gain 2.77 (4.42 dB)

Azimuth Bearing 250 degrees

### Minimum Field (H-pol)

Field 0.447

Gain .55 (-2.57 dB)

Azimuth Bearing 115 degrees

## ERP Tabulation

Antenna: PSIFMLH-2B-DA

Station: WJEE

Frequency: 90.1 MHz

Location: Bolivar, OH

Maximum ERP: 2.3 kW

Horizontal Component

Angle	Relative Field	ERP kW	ERP dBk
0	0.881	1.79	2.52
10	0.881	1.79	2.52
20	0.891	1.83	2.62
30	0.891	1.83	2.62
40	0.881	1.79	2.52
50	0.841	1.63	2.12
60	0.794	1.45	1.62
70	0.724	1.21	0.82
80	0.646	0.96	-0.18
90	0.556	0.71	-1.48
100	0.490	0.55	-2.58
110	0.447	0.46	-3.38
120	0.447	0.46	-3.38
130	0.479	0.53	-2.78
140	0.543	0.68	-1.68
150	0.603	0.84	-0.78
160	0.661	1.00	0.02
170	0.716	1.18	0.72
180	0.759	1.32	1.22
190	0.804	1.48	1.72
200	0.851	1.67	2.22
210	0.902	1.87	2.72
220	0.933	2.00	3.02
230	0.966	2.15	3.32
240	0.989	2.25	3.52
250	1.000	2.30	3.62
260	0.989	2.25	3.52
270	0.977	2.20	3.42
280	0.966	2.15	3.32
290	0.961	2.12	3.27
300	0.955	2.10	3.22
310	0.939	2.03	3.07
320	0.928	1.98	2.97
330	0.912	1.91	2.82
340	0.891	1.83	2.62
350	0.880	1.78	2.51

Maximum ERP (H-pol)

Field 1.00

ERP 2.3 kW (3.62 dBk)

Azimuth Bearing 250 degrees

Minimum ERP

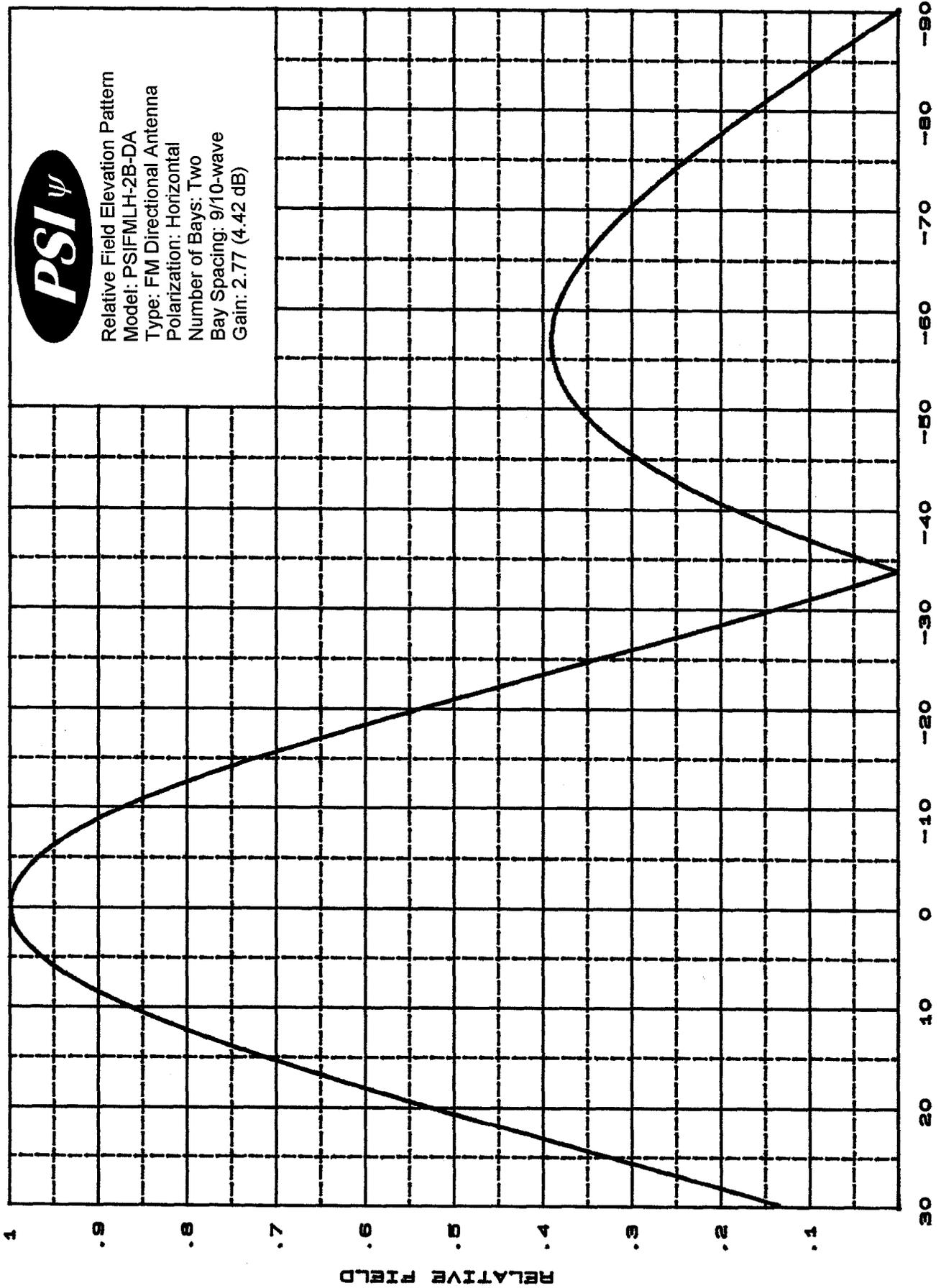
Field 0.447

ERP .46 kW (-3.38 dBk)

Azimuth Bearing 115 degrees



Relative Field Elevation Pattern  
Model: PSIFMLH-2B-DA  
Type: FM Directional Antenna  
Polarization: Horizontal  
Number of Bays: Two  
Bay Spacing: 9/10-wave  
Gain: 2.77 (4.42 dB)



DEGREES BELOW HORIZONTAL