



# Propagation Systems, Inc.

Quality Broadcast Antenna Systems

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## **Directional FM Antenna**

**KVCS**

**VCY America, Inc.**

**Spring Valley, MN**

A modified PSIFMP panel antenna with custom mounting brackets was used in conjunction with the customer's 5 ft. face triangular tower to create the necessary directional radiation pattern. The final antenna consists of two panels secured to the tower with custom-mounting brackets. The antenna panels are fed from a power divider network that provides the necessary power and phase to each panel to produce the desired directional radiation pattern.

Pattern testing was performed using a 1/3 scale model antenna 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 267.3 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 86.6% of the envelope RMS.

The antenna is to be mounted according to the enclosed drawings at the 137 meter (446.5 ft.) level above ground. At this elevation the antenna will be within the +2m/-4m deviation allowed from the 137 meter elevation specified in the construction permit. No other antenna can be installed within 10 ft of any radiating element. The antenna panels are to be positioned at 60° and 224°. 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 drawings.

An input power level of 9.92 kW will be necessary at the antenna input in order to reach the required 12 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	PSIFMP-1-DA
Type	1-bay directional FM panel antenna
Frequency	89.1 MHz
Polarization	Circular
Envelope RMS	.782
Composite RMS	.678
Gain (h-pol)	1.21 (.83 dB)
Gain (v-pol)	1.21 (.83 dB)
ERP	12 kW
Antenna input power	9.92 kW
Input	3-1/8" EIA center fed input
Power rating	20 kW
Length	11.59 ft.
Weight	672 lbs.
Wind Area	78.03 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.

ICE SHIELD, 224°  
J410FM-853-016

ICE SHIELD, 60°  
J410FM-853-026

36.00  
[91cm]

138.99  
[353cm]

446.5 FT. AGL

POWER DIVIDER,  $3\frac{1}{8}$ " x  $\frac{7}{8}$ " 4-WAY,  
41-00046

96.0  
[244cm]

$3\frac{1}{8}$ " 4-PROBE TUNER  
35-00007

$3\frac{1}{8}$ " E.I.A. 50Ω  
INPUT

#### ANTENNA SPECIFICATIONS

SPACING: 1.0λ

LENGTH: 11.59 FT [3.53m]

RATING: 20 kW

GAIN: 1.21 (.83 dB)

WEIGHT: 672 LB [304.8 Kg]

WINDAREA: 78.03 Ft<sup>2</sup>  
TIA-222-F (NO ICE)

#### NOTE:

1. WEIGHTS AND WINDAREA ARE FOR  
ANTENNA ONLY

REV.	MADE BY	CHECKED BY	DATE	CHANGE

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

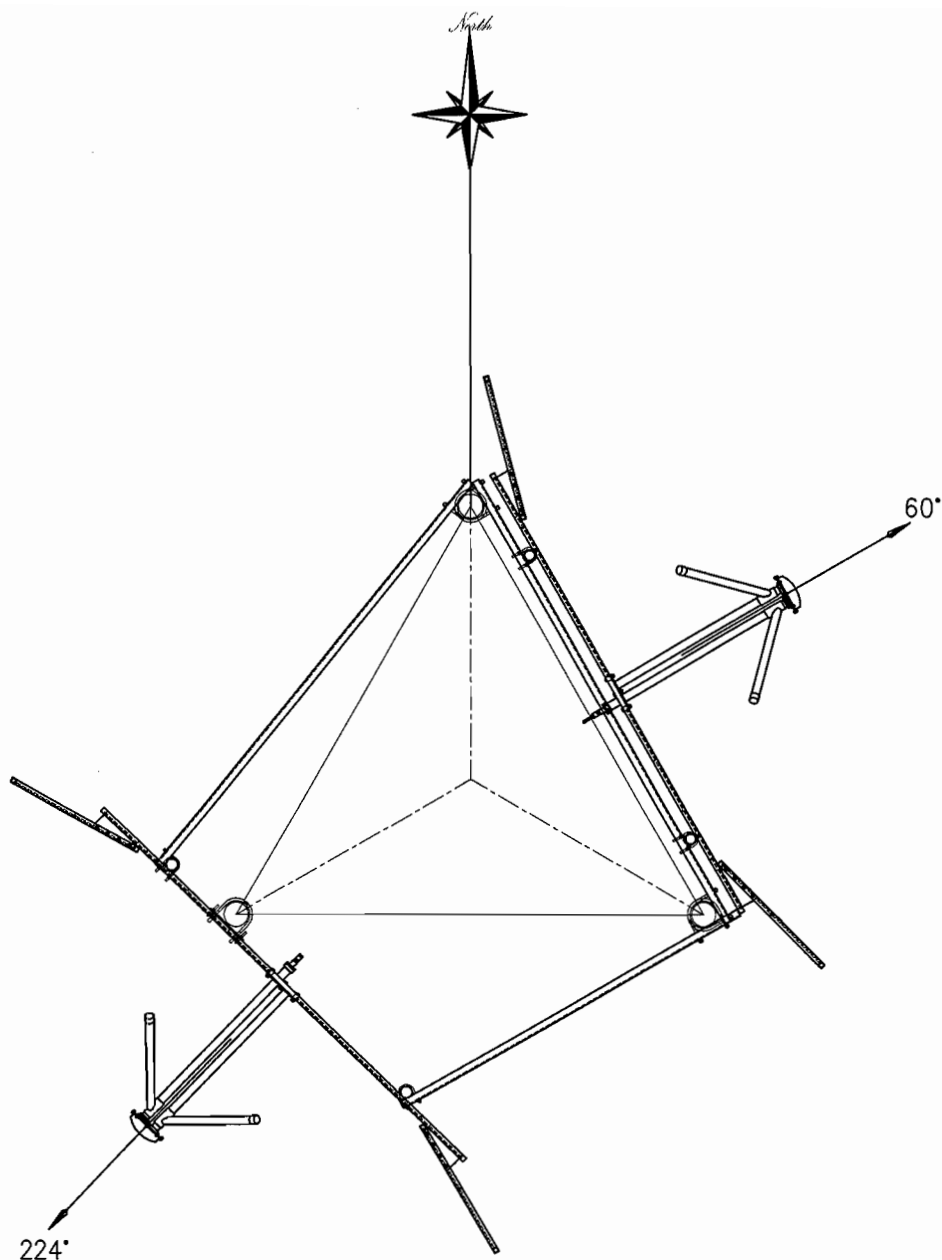
A

## PROPAGATION SYSTEMS, INC.

Ebensburg, Pennsylvania USA 814-472-5540

#### ANTENNA ELEVATIONS AND SPECIFICATIONS

MODEL:	PSIFMP-1-DA	DRAWN BY:	D.G. Kellar	DATE:	9/13/10
CHANNEL/ FREQUENCY:	89.1 MHz	APPROVED BY:		DATE:	
SCALE:	1:40	DRAWING NO.:	J410FM-853-001	REV.	



A	D.G. Kellar	12/08/10	CORRECT TOWER ORIENTATION AND SHOW CHANGES PER CUSTOMER/D. ROSS
REV.	MADE BY CHECKED BY	DATE	CHANGE

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

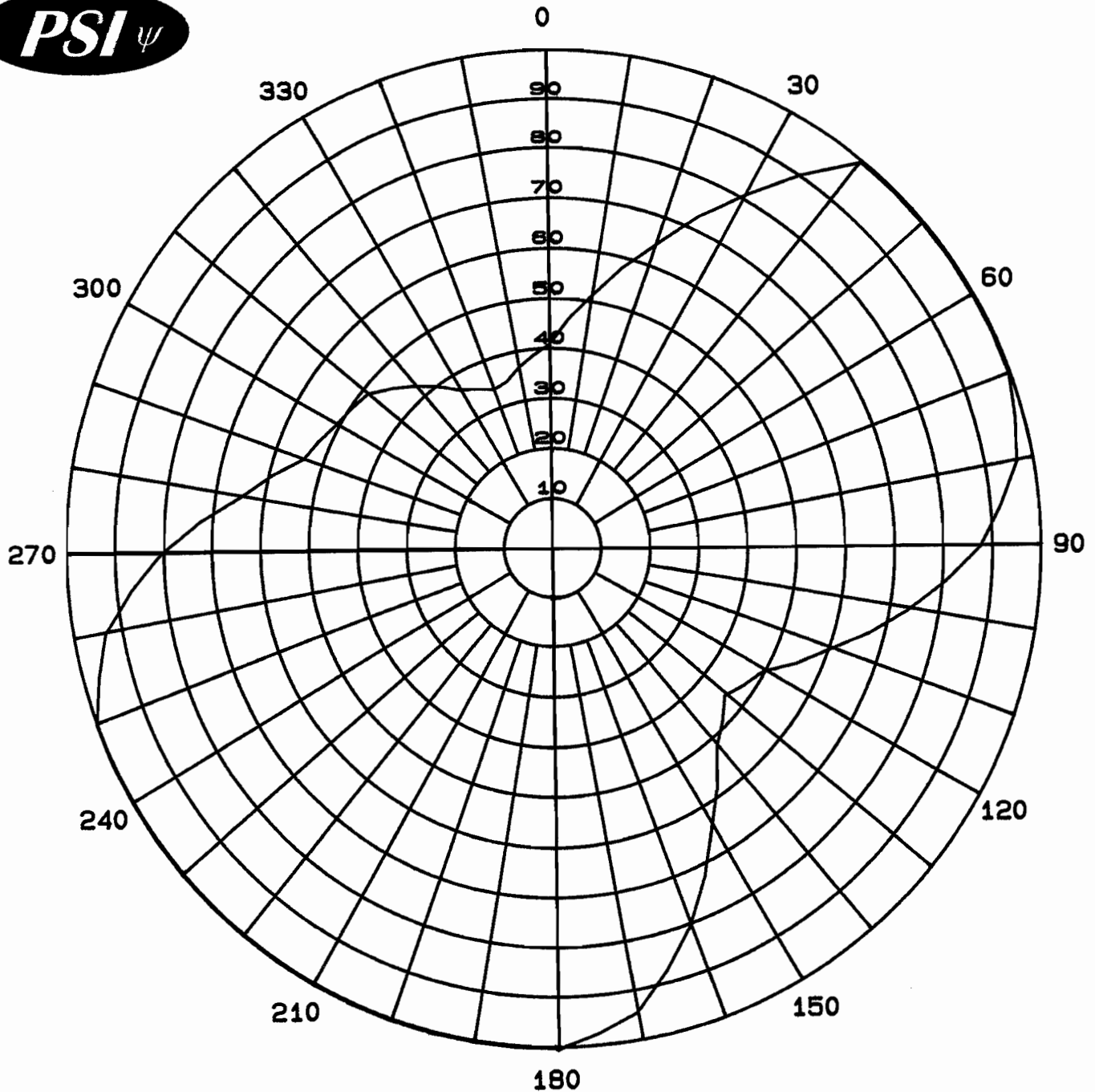
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# PROPAGATION SYSTEMS, INC.

Ebensburg, Pennsylvania USA 814-472-5540

## ANTENNA PLAN VIEW AND ORIENTATION

MODEL:	PSIFMP-1-DA	DRAWN BY:	D.G. Kellar	DATE:	8/20/10
CHANNEL/ FREQUENCY:	89.1 MHz	APPROVED BY:		DATE:	
SCALE:	1:40	DRAWING NO.:	J410FM-853-002	REV.	A



Maximum Envelope  
Azimuth Plane Pattern  
Antenna: PSIFMP-1-DA  
Type: 1-Bay Directional FM Antenna  
ERP: 12.0 kW (10.79 dBk)  
RMS Envelope: .782  
Frequency: 89.1 MHz  
KVCS Spring Valley, MN

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

## Maximum Envelope Tabulation

Antenna: PSIFMP-1-DA

VCY America, Inc.

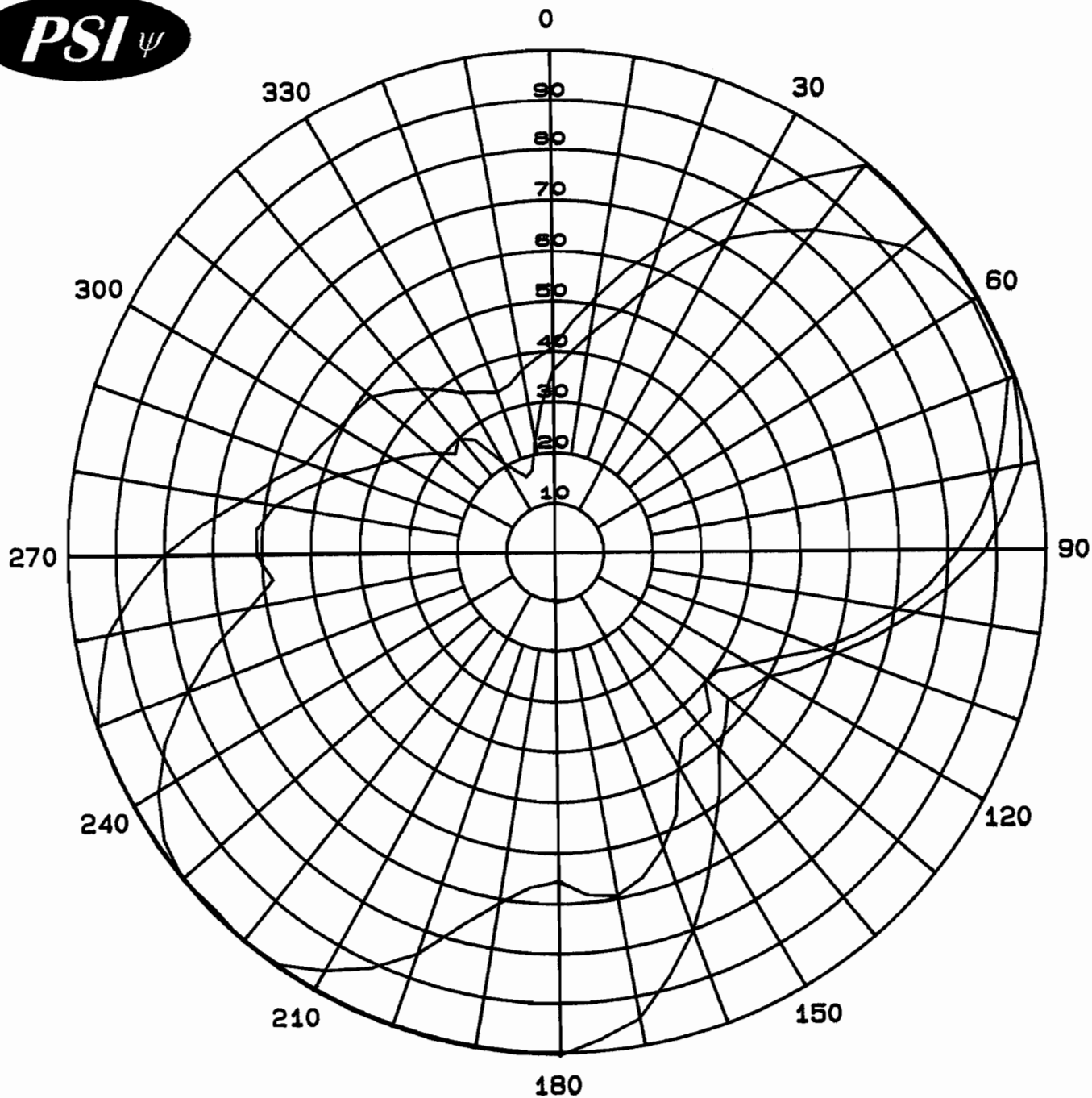
Station: KVCS

Frequency: 89.1 MHz

Location: Spring Valley, MN

Maximum ERP: 12 kW (10.79 dBk)

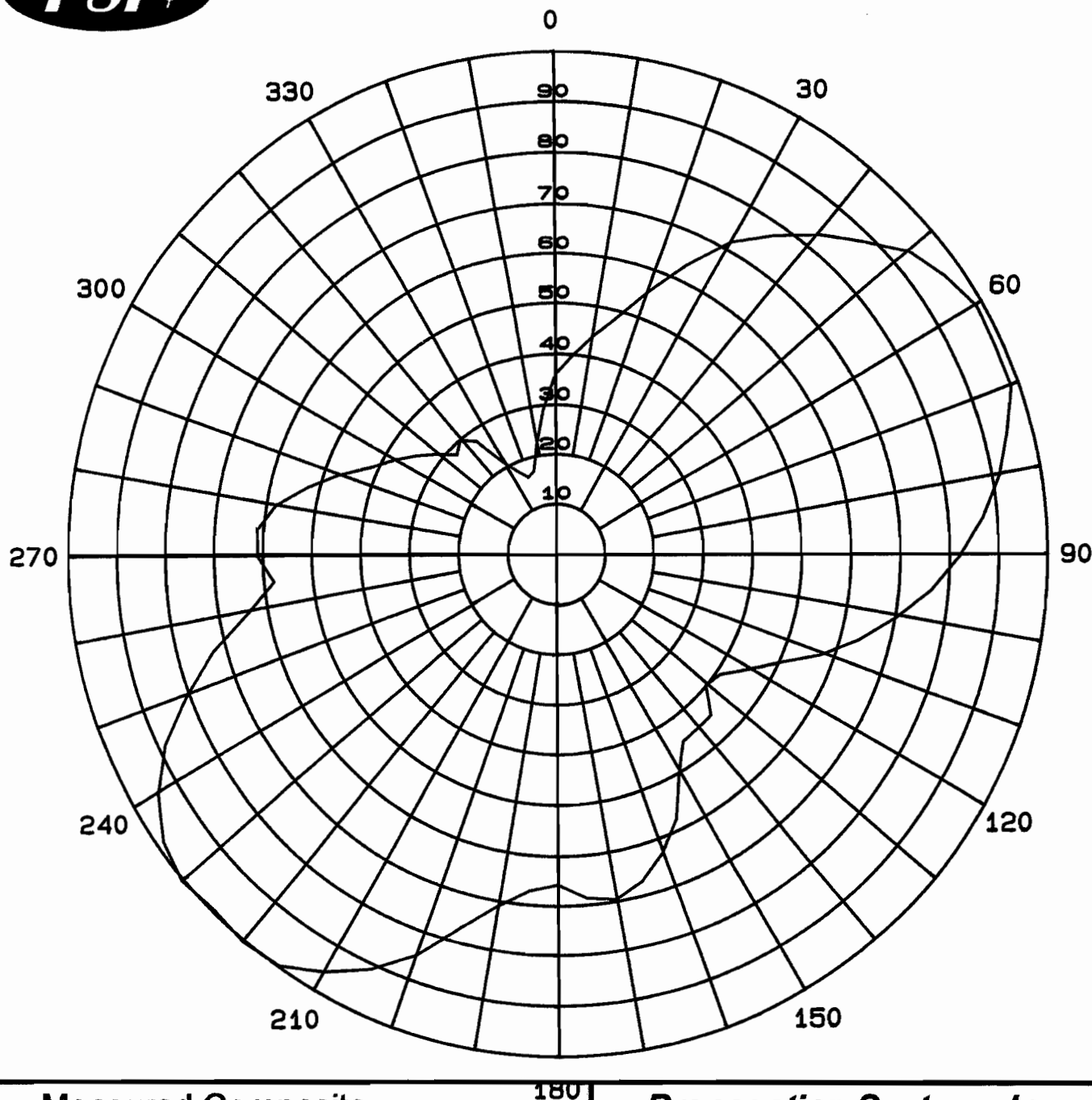
Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.409	2.01	3.03
10	0.515	3.18	5.03
20	0.645	4.99	6.98
30	0.810	7.87	8.96
40	1.000	12.00	10.79
50	1.000	12.00	10.79
60	1.000	12.00	10.79
70	1.000	12.00	10.79
80	0.969	11.27	10.52
90	0.876	9.21	9.64
100	0.737	6.52	8.14
110	0.601	4.33	6.37
120	0.496	2.95	4.70
130	0.458	2.52	4.01
140	0.518	3.22	5.08
150	0.642	4.95	6.94
160	0.802	7.72	8.88
170	0.941	10.63	10.26
180	1.000	12.00	10.79
190	1.000	12.00	10.79
200	1.000	12.00	10.79
210	1.000	12.00	10.79
220	1.000	12.00	10.79
230	1.000	12.00	10.79
240	1.000	12.00	10.79
250	1.000	12.00	10.79
260	0.934	10.47	10.20
270	0.803	7.74	8.89
280	0.646	5.01	7.00
290	0.540	3.50	5.44
300	0.507	3.08	4.89
310	0.488	2.86	4.56
320	0.437	2.29	3.60
330	0.369	1.63	2.13
340	0.340	1.39	1.42
350	0.369	1.63	2.13



Maximum Envelope and  
Composite Pattern  
Antenna: PSIFMP-1-DA  
Type: 1-Bay Directional FM Antenna  
ERP: 12.0 kW (10.79 dBk)  
RMS Envelope: .782  
RMS Composite: .678  
Frequency: 89.1 MHz

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**KVCS Spring Valley, MN**



Measured Composite  
Azimuth Plane Pattern  
Antenna: PSIFMP-1-DA  
Type: 1-Bay Directional FM Antenna  
ERP: 12.0 kW (10.79 dBk)  
RMS Composite: .678  
Frequency: 89.1 MHz  
KVCS Spring Valley, MN

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## Composite Pattern Tabulation

Antenna: PSIFMP-1-DA

VCY America, Inc.

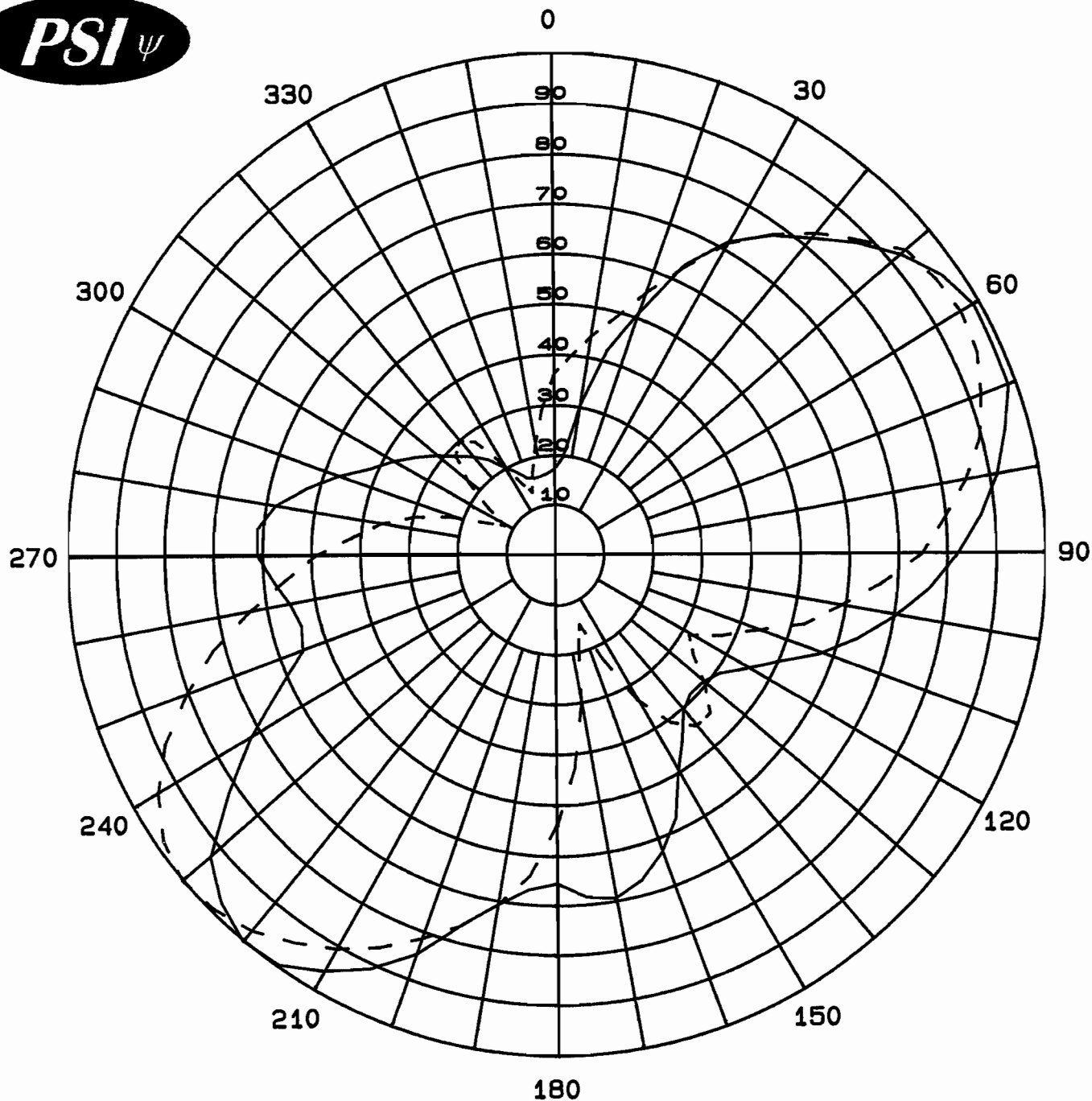
Station: KVCS

Frequency: 89.1 MHz

Location: Spring Valley, MN

Maximum ERP: 12 kW (10.79 dBk)

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.362	1.57	1.97
10	0.442	2.34	3.70
20	0.555	3.70	5.68
30	0.721	6.24	7.95
40	0.836	8.39	9.24
50	0.941	10.63	10.26
60	0.990	11.76	10.70
70	0.987	11.69	10.68
80	0.917	10.09	10.04
90	0.821	8.09	9.08
100	0.701	5.90	7.71
110	0.571	3.91	5.92
120	0.448	2.41	3.82
130	0.397	1.89	2.77
140	0.446	2.39	3.78
150	0.498	2.98	4.74
160	0.626	4.70	6.72
170	0.692	5.75	7.59
180	0.651	5.09	7.06
190	0.704	5.95	7.74
200	0.844	8.55	9.32
210	0.955	10.94	10.39
220	1.000	12.00	10.79
230	1.000	12.00	10.79
240	0.942	10.65	10.27
250	0.805	7.78	8.91
260	0.638	4.88	6.89
270	0.609	4.45	6.48
280	0.581	4.05	6.08
290	0.471	2.66	4.25
300	0.382	1.75	2.43
310	0.316	1.20	0.79
320	0.303	1.10	0.42
330	0.216	0.56	-2.52
340	0.165	0.33	-4.86
350	0.225	0.61	-2.16



Measured Relative Field  
Azimuth Plane Pattern  
Antenna: PSIFMP-1-DA  
Type: 1-Bay Directional FM Antenna  
Gain H-pol (solid): 1.21 (.83 dB)  
Gain V-pol (dash): 1.21 (.83 dB)  
Frequency: 89.1 MHz  
KVCS Spring Valley, MN

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**PO Box 113**  
**Ebensburg, PA 15931**

# Measured Relative Field Tabulation

Antenna: PSIFMP-1-DA

VCY America, Inc.

Station: KVCS

Frequency: 89.1 MHz

Location: Spring Valley, MN

## Horizontal Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.173	0.036	-14.41
10	0.305	0.113	-9.49
20	0.513	0.318	-4.97
30	0.721	0.629	-2.01
40	0.823	0.820	-0.86
50	0.928	1.042	0.18
60	0.990	1.186	0.74
70	0.987	1.179	0.71
80	0.917	1.017	0.08
90	0.821	0.816	-0.89
100	0.701	0.595	-2.26
110	0.571	0.395	-4.04
120	0.448	0.243	-6.15
130	0.391	0.185	-7.33
140	0.405	0.198	-7.02
150	0.498	0.300	-5.23
160	0.626	0.474	-3.24
170	0.692	0.579	-2.37
180	0.651	0.513	-2.90
190	0.704	0.600	-2.22
200	0.844	0.862	-0.65
210	0.955	1.104	0.43
220	1.000	1.210	0.83
230	0.926	1.038	0.16
240	0.723	0.633	-1.99
250	0.550	0.366	-4.36
260	0.550	0.366	-4.36
270	0.609	0.449	-3.48
280	0.581	0.408	-3.89
290	0.471	0.268	-5.71
300	0.382	0.177	-7.53
310	0.316	0.121	-9.18
320	0.262	0.083	-10.81
330	0.205	0.051	-12.94
340	0.165	0.033	-14.82
350	0.161	0.031	-15.04

### Maximum Value

Field 1.00  
Gain 1.21 (.83 dB)  
Azimuth Bearing 220 degrees

### Minimum Field

Field 0.160  
Gain .031 (-15.09 dB)  
Azimuth Bearing 345 degrees

## Vertical Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.362	0.159	-8.00
10	0.442	0.236	-6.26
20	0.555	0.373	-4.29
30	0.716	0.620	-2.07
40	0.836	0.846	-0.73
50	0.941	1.071	0.30
60	0.960	1.115	0.47
70	0.927	1.040	0.17
80	0.851	0.876	-0.57
90	0.748	0.677	-1.69
100	0.586	0.416	-3.81
110	0.432	0.226	-6.46
120	0.314	0.119	-9.23
130	0.397	0.191	-7.20
140	0.446	0.241	-6.19
150	0.333	0.134	-8.72
160	0.144	0.025	-16.00
170	0.300	0.109	-9.63
180	0.536	0.348	-4.59
190	0.704	0.600	-2.22
200	0.811	0.796	-0.99
210	0.904	0.989	-0.05
220	0.973	1.146	0.59
230	1.000	1.210	0.83
240	0.942	1.074	0.31
250	0.805	0.784	-1.06
260	0.638	0.493	-3.08
270	0.490	0.291	-5.37
280	0.632	0.483	-3.16
290	0.225	0.061	-12.13
300	0.117	0.017	-17.81
310	0.228	0.063	-12.01
320	0.303	0.111	-9.54
330	0.216	0.056	-12.48
340	0.134	0.022	-16.63
350	0.225	0.061	-12.13

### Maximum Value

Field 1.00  
Gain 1.21 (.83 dB)  
Azimuth Bearing 230 degrees

### Minimum Field

Field 0.144  
Gain .025 (-16.0 dB)  
Azimuth Bearing 160 degrees

# ERP Tabulation

Antenna: PSIFMP-1-DA

VCY America, Inc.

Station: KVCS

Frequency: 89.1 MHz

Location: Spring Valley, MN

Maximum ERP: 12 kW (10.79 dBk)

## Horizontal Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.173	0.36	-4.45
10	0.305	1.12	0.48
20	0.513	3.16	4.99
30	0.721	6.24	7.95
40	0.823	8.13	9.10
50	0.928	10.33	10.14
60	0.990	11.76	10.70
70	0.987	11.69	10.68
80	0.917	10.09	10.04
90	0.821	8.09	9.08
100	0.701	5.90	7.71
110	0.571	3.91	5.92
120	0.448	2.41	3.82
130	0.391	1.83	2.64
140	0.405	1.97	2.94
150	0.498	2.98	4.74
160	0.626	4.70	6.72
170	0.692	5.75	7.59
180	0.651	5.09	7.06
190	0.704	5.95	7.74
200	0.844	8.55	9.32
210	0.955	10.94	10.39
220	1.000	12.00	10.79
230	0.926	10.29	10.12
240	0.723	6.27	7.97
250	0.550	3.63	5.60
260	0.550	3.63	5.60
270	0.609	4.45	6.48
280	0.581	4.05	6.08
290	0.471	2.66	4.25
300	0.382	1.75	2.43
310	0.316	1.20	0.79
320	0.262	0.82	-0.84
330	0.205	0.50	-2.97
340	0.165	0.33	-4.86
350	0.161	0.31	-5.07

### Maximum Value (H-pol)

Field 1.00  
ERP 12.0 kW (10.79 dBk)  
Azimuth Bearing 220 degrees

### Minimum Field (H-pol)

Field 0.160  
ERP .31 kW (-5.13 dBk)  
Azimuth Bearing 345 degrees

## Vertical Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.362	1.57	1.97
10	0.442	2.34	3.70
20	0.555	3.70	5.68
30	0.716	6.15	7.89
40	0.836	8.39	9.24
50	0.941	10.63	10.26
60	0.960	11.06	10.44
70	0.927	10.31	10.13
80	0.851	8.69	9.39
90	0.748	6.71	8.27
100	0.586	4.12	6.15
110	0.432	2.24	3.50
120	0.314	1.18	0.73
130	0.397	1.89	2.77
140	0.446	2.39	3.78
150	0.333	1.33	1.24
160	0.144	0.25	-6.04
170	0.300	1.08	0.33
180	0.536	3.45	5.38
190	0.704	5.95	7.74
200	0.811	7.89	8.97
210	0.904	9.81	9.92
220	0.973	11.36	10.55
230	1.000	12.00	10.79
240	0.942	10.65	10.27
250	0.805	7.78	8.91
260	0.638	4.88	6.89
270	0.490	2.88	4.60
280	0.632	4.79	6.81
290	0.225	0.61	-2.16
300	0.117	0.16	-7.84
310	0.228	0.62	-2.05
320	0.303	1.10	0.42
330	0.216	0.56	-2.52
340	0.134	0.22	-6.67
350	0.225	0.61	-2.16

### Maximum Value (V-pol)

Field 1.00  
ERP 12.0 kW (10.79 dBk)  
Azimuth Bearing 230 degrees

### Minimum Field (V-pol)

Field 0.144  
ERP .25 kW (-6.04 dBk)  
Azimuth Bearing 160 degrees



Relative Field Elevation Pattern  
Model: PSIFMP-1-DA  
Type: 1-Bay FM Antenna  
Polarization: Circular  
Gain: 1.21 (83 dB)  
Station: KVCS  
Spring Valley, MN

