



Propagation Systems, Inc.

Quality Broadcast Antenna Systems

**Directional FM Antenna
WRQV
Invisible Allies Ministries
Ridgway, PA**

A standard model PSIFML antenna with parasitic elements was used in conjunction with the customer's 3-1/2" diameter support mast to create the necessary directional radiation pattern. The final antenna consists of two radiating elements each secured to the mast with a standard mounting bracket. The antenna bays are half wave spaced and there are a total of two horizontal parasitic elements, one per bay. The antenna array is center fed and each radiating element receives equal power and phase.

Pattern testing was performed using a 1/3 scale model element and mast. 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° 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 93.3% of the envelope RMS.

The antenna is to be mounted 58 meters (190.2 ft.) +2/-4 meters above ground level on a the support mast above the tower top and positioned 300° True. No other antenna can be installed within 10 ft of any radiating element. Any guy wire that passes within 15 ft. of a radiating element must be changed to the appropriate 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 2.06 kW will be required at the antenna input in order to reach the approved 2.1 kW ERP. The final length of LDF5-50A transmission line used to feed the antenna is 215 ft. The resulting transmitter output power is 2.45 kW.

Antenna Specifications

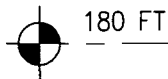
Antenna Model	PSIFML-2B-HWS-DA
Type	2-bay directional FM antenna
Bay Spacing	Half wave spaced elements
Frequency	88.1 MHz
Polarization	Circular
Envelope RMS	.912
Composite RMS	.851
Gain (h-pol)	1.02 (.09 dB)
Gain (v-pol)	1.02 (.09 dB)
ERP	2.1 kW
Antenna input power	2.06 kW
Transmission line	Andrew LDF5-50A (7/8" foam coaxial cable)
Line length	215 ft.
Line Efficiency	83.92%
Transmitter output power	2.45 kW
Input	7/8" EIA center fed input
Power rating	3 kW
Length	5.58 ft.
Weight	46 lbs.
Wind Area	4.4 sq. ft.

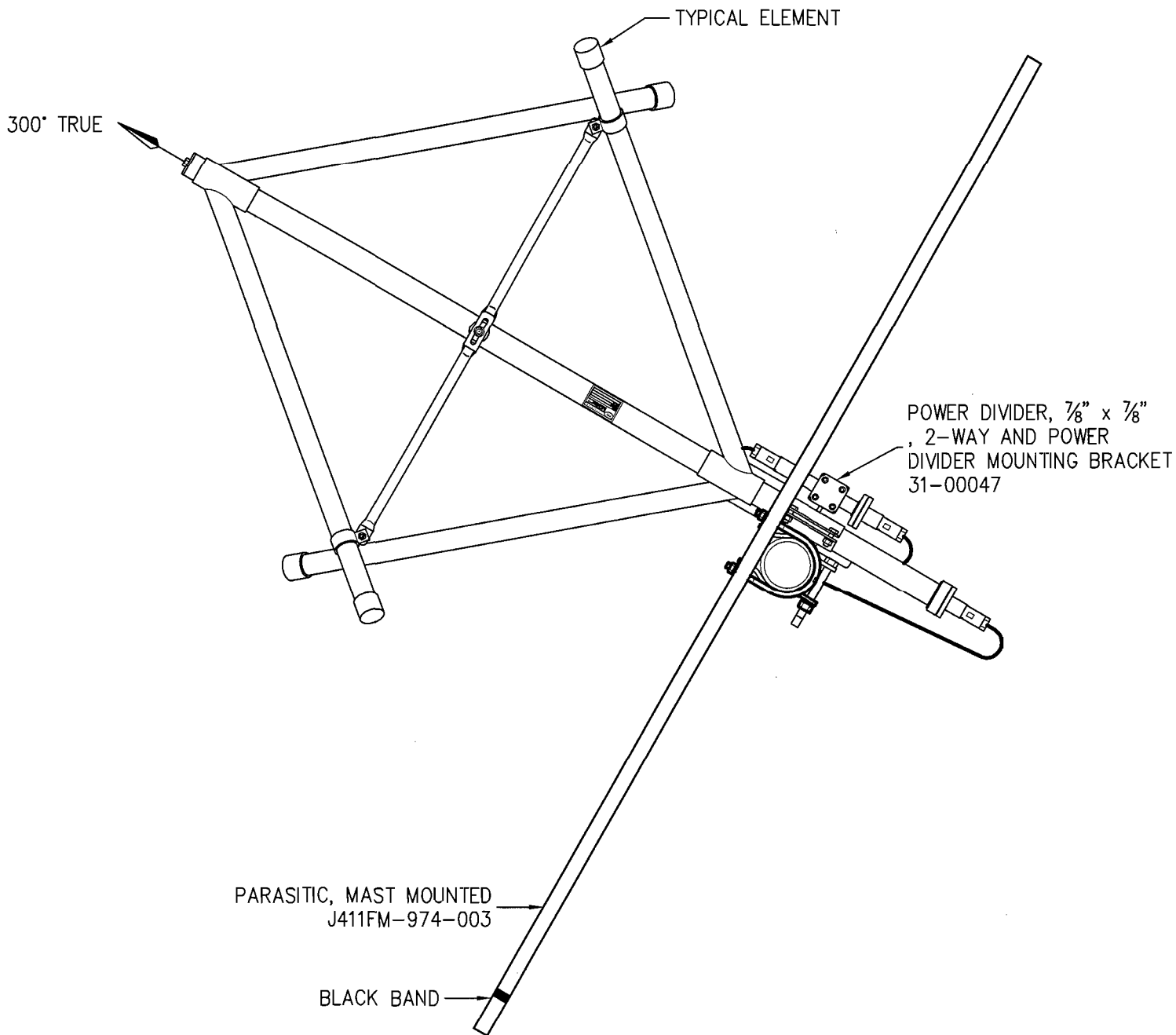
Statement of Certification

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.

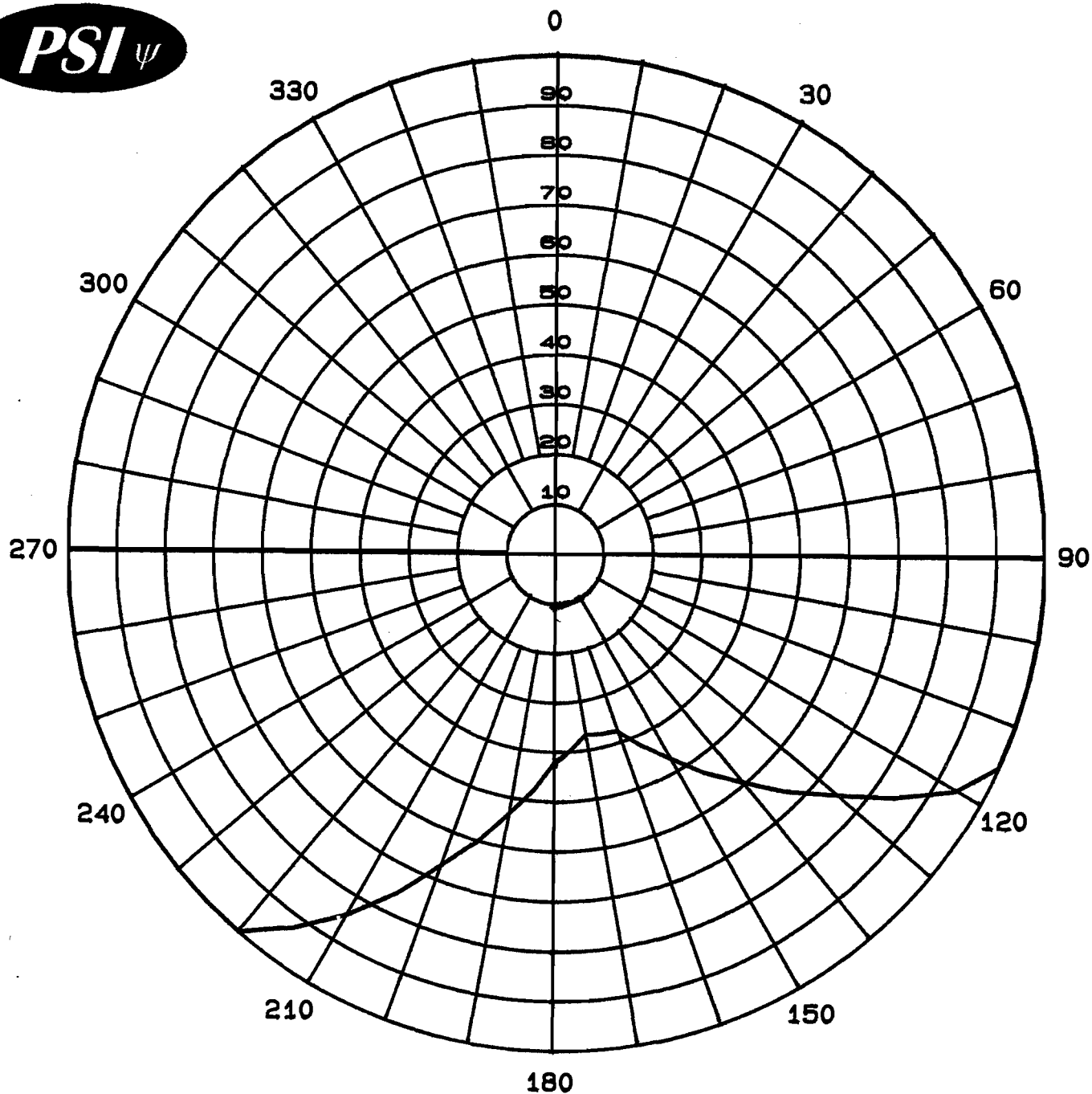
 7/29/2011

Douglas A. Ross
President
Propagation Systems Inc.





REV.		MADE BY		CHECKED BY		DATE		CHANGE	
<p>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.</p>									
SIZE		<p>PROPAGATION SYSTEMS, INC. Ebensburg, Pennsylvania USA 814-472-5540</p>							
A		<p>PLAN VIEW AND ORIENTATION</p>							
MODEL:		PSIFML-2B-HWS-DA				DRAWN BY:		D.G. Kellar	
CHANNEL/FREQUENCY:		88.1 MHz				APPROVED BY:		DATE: 6/17/11	
SCALE:		1:10				DRAWING NO.:		J411FM-974-002	
						REV.			



Maximum Envelope
Azimuth Plane Pattern
Antenna: PSIFML-2B-HWS-DA
Type: 2-Bay Directional FM Antenna
ERP: 2.1 kW (3.22 dBk)
RMS Envelope: .912
Frequency: 88.1 MHz
WRQV Ridgway, PA

Propagation Systems Inc.
PO Box 113
Ebensburg, PA 15931

Maximum Envelope Tabulation

Antenna: PSIFML-2B-HWS-DA

Invisible Allies Ministries

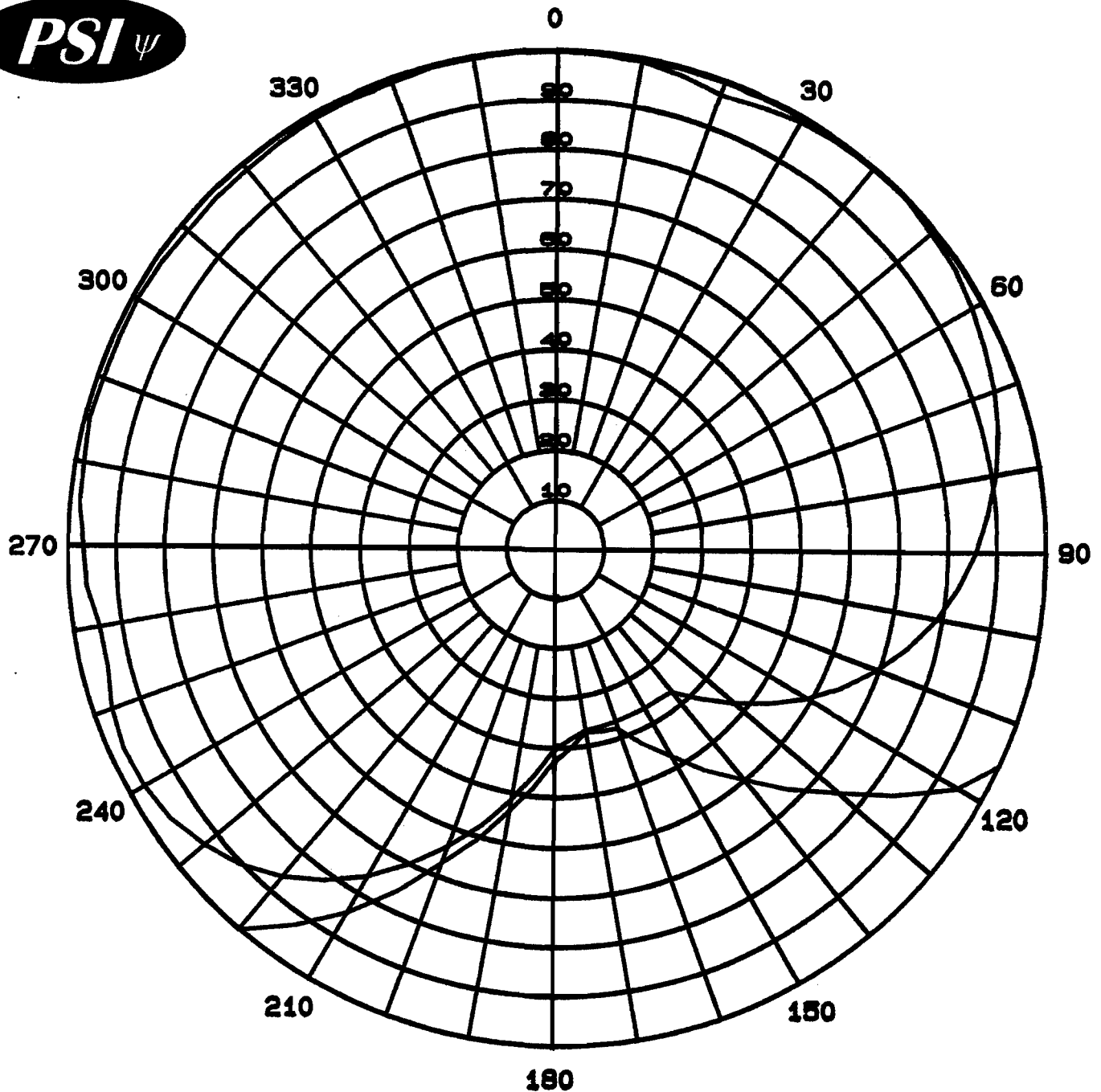
Station: WRQV

Frequency: 88.1 MHz

Location: Ridgway, PA

Maximum ERP: 2.1 kW (3.22 dBk)

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	1.000	2.10	3.22
10	1.000	2.10	3.22
20	1.000	2.10	3.22
30	1.000	2.10	3.22
40	1.000	2.10	3.22
50	1.000	2.10	3.22
60	1.000	2.10	3.22
70	1.000	2.10	3.22
80	1.000	2.10	3.22
90	1.000	2.10	3.22
100	1.000	2.10	3.22
110	1.000	2.10	3.22
120	0.944	1.87	2.72
130	0.750	1.18	0.72
140	0.596	0.75	-1.27
150	0.473	0.47	-3.28
160	0.376	0.30	-5.27
170	0.367	0.28	-5.48
180	0.422	0.37	-4.27
190	0.531	0.59	-2.28
200	0.668	0.94	-0.28
210	0.841	1.49	1.72
220	1.000	2.10	3.22
230	1.000	2.10	3.22
240	1.000	2.10	3.22
250	1.000	2.10	3.22
260	1.000	2.10	3.22
270	1.000	2.10	3.22
280	1.000	2.10	3.22
290	1.000	2.10	3.22
300	1.000	2.10	3.22
310	1.000	2.10	3.22
320	1.000	2.10	3.22
330	1.000	2.10	3.22
340	1.000	2.10	3.22
350	1.000	2.10	3.22



Maximum Envelope and
Composite Pattern

Antenna: PSIFML-2B-HWS-DA

Type: 2-Bay Directional FM Antenna

ERP: 2.1 kW (3.22 dBk)

RMS Envelope: .912

RMS Composite: .851

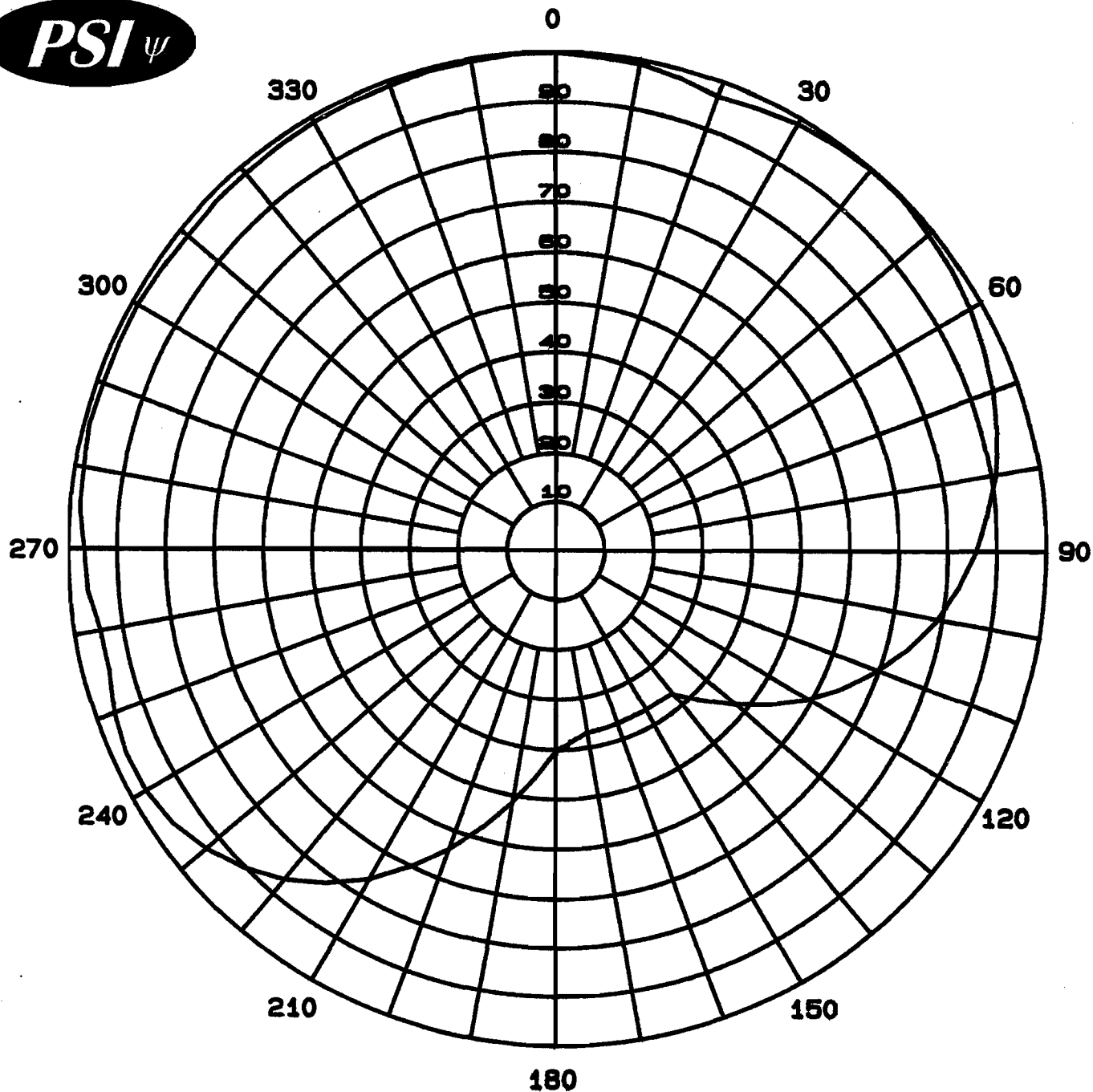
Frequency: 88.1 MHz

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Ebensburg, PA 15931

WRQV Ridgway, PA



Measured Composite
Azimuth Plane Pattern
Antenna: PSIFML-2B-HWS-DA
Type: 2-Bay Directional FM Antenna
ERP: 2.1 kW (3.22 dBk)
RMS Composite: .851
Frequency: 88.1 MHz
WRQV Ridgway, PA

Propagation Systems Inc.
PO Box 113
Ebensburg, PA 15931

Composite Pattern Tabulation

Antenna: PSIFML-2B-HWS-DA

Invisible Allies Ministries

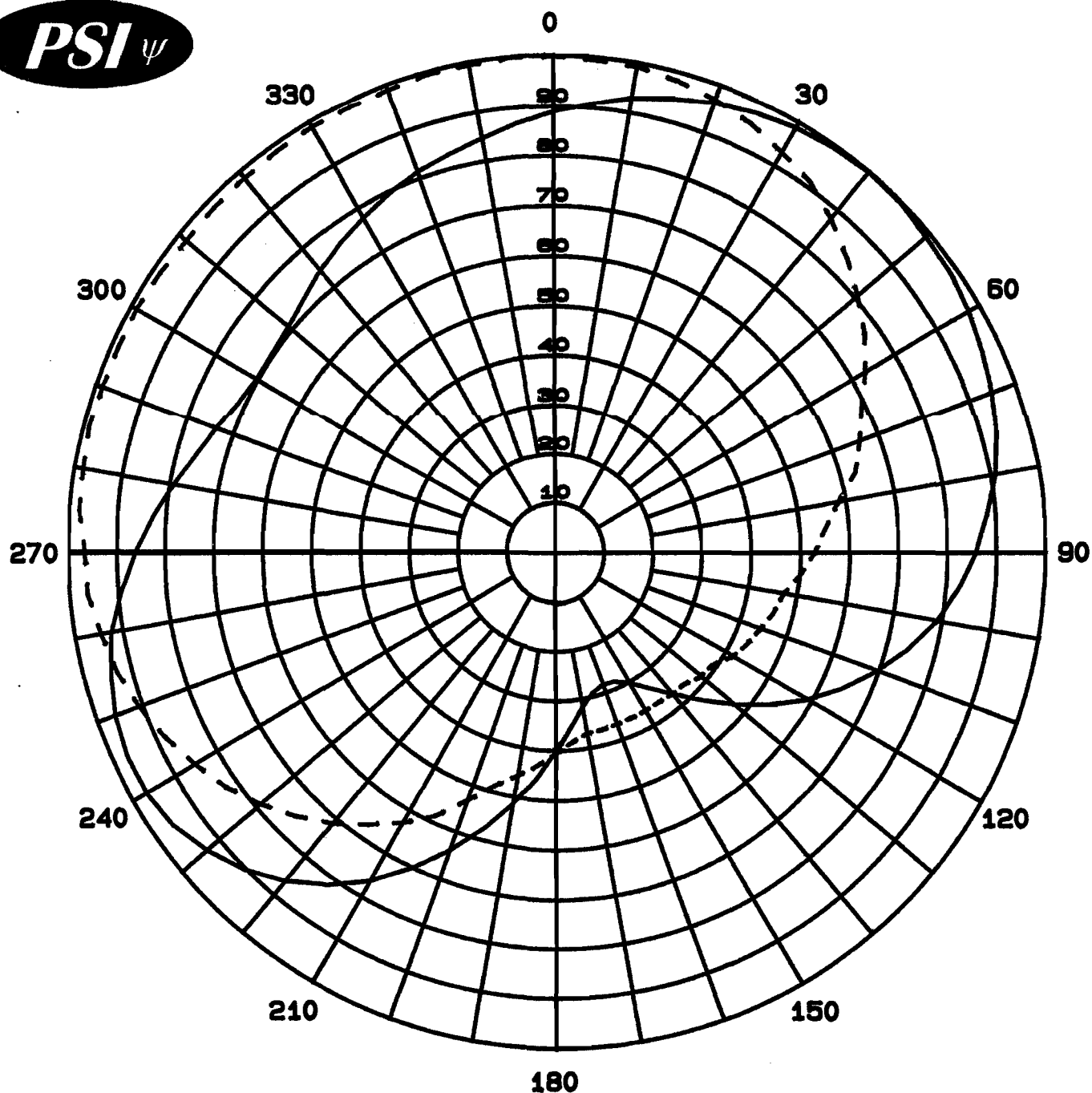
Station: WRQV

Frequency: 88.1 MHz

Location: Ridgway, PA

Maximum ERP: 2.1 kW (3.22 dBk)

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	1.000	2.10	3.22
10	0.994	2.07	3.17
20	0.971	1.98	2.97
30	0.990	2.06	3.13
40	1.000	2.10	3.22
50	0.991	2.06	3.14
60	0.976	2.00	3.01
70	0.950	1.90	2.78
80	0.911	1.74	2.41
90	0.858	1.55	1.89
100	0.788	1.30	1.15
110	0.694	1.01	0.05
120	0.590	0.73	-1.36
130	0.474	0.47	-3.26
140	0.369	0.29	-5.44
150	0.365	0.28	-5.53
160	0.365	0.28	-5.53
170	0.367	0.28	-5.48
180	0.402	0.34	-4.69
190	0.512	0.55	-2.59
200	0.635	0.85	-0.72
210	0.761	1.22	0.85
220	0.863	1.56	1.94
230	0.932	1.82	2.61
240	0.967	1.96	2.93
250	0.961	1.94	2.88
260	0.945	1.88	2.73
270	0.966	1.96	2.92
280	0.981	2.02	3.06
290	0.986	2.04	3.10
300	0.988	2.05	3.12
310	0.981	2.02	3.06
320	0.984	2.03	3.08
330	0.989	2.05	3.13
340	0.990	2.06	3.13
350	0.996	2.08	3.19



Measured Relative Field
Azimuth Plane Pattern
Antenna: PSIFML-2B-HWS-DA
Type: 2-Bay Directional FM Antenna
Gain H-pol (solid): 1.02 (.09 dB)
Gain V-pol (dash): 1.02 (.09 dB)
Frequency: 88.1 MHz
WRQV Ridgway, PA

Propagation Systems Inc.
PO Box 113
Ebensburg, PA 15931

Measured Relative Field Tabulation

Antenna: PSIFML-2B-HWS-DA

Invisible Allies Ministries

Station: WRQV

Frequency: 88.1 MHz

Location: Ridgway, PA

Horizontal Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.889	0.806	-0.94
10	0.931	0.884	-0.54
20	0.965	0.950	-0.22
30	0.990	1.000	0.00
40	1.000	1.020	0.09
50	0.991	1.002	0.01
60	0.976	0.972	-0.13
70	0.950	0.921	-0.36
80	0.911	0.847	-0.72
90	0.858	0.751	-1.24
100	0.788	0.633	-1.98
110	0.694	0.491	-3.09
120	0.590	0.355	-4.50
130	0.474	0.229	-6.40
140	0.369	0.139	-8.57
150	0.299	0.091	-10.40
160	0.280	0.080	-10.97
170	0.314	0.101	-9.98
180	0.399	0.162	-7.89
190	0.512	0.267	-5.73
200	0.635	0.411	-3.86
210	0.761	0.591	-2.29
220	0.863	0.760	-1.19
230	0.932	0.886	-0.53
240	0.967	0.954	-0.21
250	0.961	0.942	-0.26
260	0.925	0.873	-0.59
270	0.861	0.756	-1.21
280	0.791	0.638	-1.95
290	0.737	0.554	-2.56
300	0.704	0.506	-2.96
310	0.710	0.514	-2.89
320	0.744	0.565	-2.48
330	0.779	0.619	-2.08
340	0.815	0.678	-1.69
350	0.846	0.730	-1.37

Maximum Value

Field 1.00
Gain 1.02 (.09 dB)

Azimuth Bearing 40 degrees

Minimum Field

Field 0.280
Gain .08 (-10.97 dB)

Azimuth Bearing 160 degrees

Vertical Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	1.000	1.020	0.09
10	0.994	1.008	0.03
20	0.971	0.962	-0.17
30	0.932	0.886	-0.53
40	0.879	0.788	-1.03
50	0.808	0.666	-1.77
60	0.732	0.547	-2.62
70	0.661	0.446	-3.51
80	0.584	0.348	-4.59
90	0.528	0.284	-5.46
100	0.472	0.227	-6.44
110	0.443	0.200	-6.99
120	0.415	0.176	-7.55
130	0.386	0.152	-8.18
140	0.369	0.139	-8.57
150	0.365	0.136	-8.67
160	0.365	0.136	-8.67
170	0.367	0.137	-8.62
180	0.402	0.165	-7.83
190	0.453	0.209	-6.79
200	0.528	0.284	-5.46
210	0.628	0.402	-3.95
220	0.711	0.516	-2.88
230	0.788	0.633	-1.98
240	0.852	0.740	-1.31
250	0.907	0.839	-0.76
260	0.945	0.911	-0.41
270	0.966	0.952	-0.21
280	0.981	0.982	-0.08
290	0.986	0.992	-0.04
300	0.988	0.996	-0.02
310	0.981	0.982	-0.08
320	0.984	0.988	-0.05
330	0.989	0.998	-0.01
340	0.990	1.000	0.00
350	0.996	1.012	0.05

Maximum Value

Field 1.00
Gain 1.02 (.09 dB)

Azimuth Bearing 0 degrees

Minimum Field

Field 0.365
Gain .136 (-8.67 dB)

Azimuth Bearing 155 degrees

ERP Tabulation

Antenna: PSIFML-2B-HWS-DA

Invisible Allies Ministries

Station: WRQV

Frequency: 88.1 MHz

Location: Ridgway, PA

Maximum ERP: 2.1 kW (3.22 dBk)

Horizontal Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.889	1.66	2.20
10	0.931	1.82	2.60
20	0.965	1.96	2.91
30	0.990	2.06	3.13
40	1.000	2.10	3.22
50	0.991	2.06	3.14
60	0.976	2.00	3.01
70	0.950	1.90	2.78
80	0.911	1.74	2.41
90	0.858	1.55	1.89
100	0.788	1.30	1.15
110	0.694	1.01	0.05
120	0.590	0.73	-1.36
130	0.474	0.47	-3.26
140	0.369	0.29	-5.44
150	0.299	0.19	-7.26
160	0.280	0.16	-7.83
170	0.314	0.21	-6.84
180	0.399	0.33	-4.76
190	0.512	0.55	-2.59
200	0.635	0.85	-0.72
210	0.761	1.22	0.85
220	0.863	1.56	1.94
230	0.932	1.82	2.61
240	0.967	1.96	2.93
250	0.961	1.94	2.88
260	0.925	1.80	2.55
270	0.861	1.56	1.92
280	0.791	1.31	1.19
290	0.737	1.14	0.57
300	0.704	1.04	0.17
310	0.710	1.06	0.25
320	0.744	1.16	0.65
330	0.779	1.27	1.05
340	0.815	1.39	1.45
350	0.846	1.50	1.77

Maximum Value (H-pol)

Field 1.00
ERP 2.1 kW (3.22 dBk)
Azimuth Bearing 40 degrees

Minimum Field (H-pol)

Field 0.280
ERP .16 kW (-7.83 dBk)
Azimuth Bearing 160 degrees

Vertical Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	1.000	2.10	3.22
10	0.994	2.07	3.17
20	0.971	1.98	2.97
30	0.932	1.82	2.61
40	0.879	1.62	2.10
50	0.808	1.37	1.37
60	0.732	1.13	0.51
70	0.661	0.92	-0.37
80	0.584	0.72	-1.45
90	0.528	0.59	-2.33
100	0.472	0.47	-3.30
110	0.443	0.41	-3.85
120	0.415	0.36	-4.42
130	0.386	0.31	-5.05
140	0.369	0.29	-5.44
150	0.365	0.28	-5.53
160	0.365	0.28	-5.53
170	0.367	0.28	-5.48
180	0.402	0.34	-4.69
190	0.453	0.43	-3.66
200	0.528	0.59	-2.33
210	0.628	0.83	-0.82
220	0.711	1.06	0.26
230	0.788	1.30	1.15
240	0.852	1.52	1.83
250	0.907	1.73	2.37
260	0.945	1.88	2.73
270	0.966	1.96	2.92
280	0.981	2.02	3.06
290	0.986	2.04	3.10
300	0.988	2.05	3.12
310	0.981	2.02	3.06
320	0.984	2.03	3.08
330	0.989	2.05	3.13
340	0.990	2.06	3.13
350	0.996	2.08	3.19

Maximum Value (V-pol)

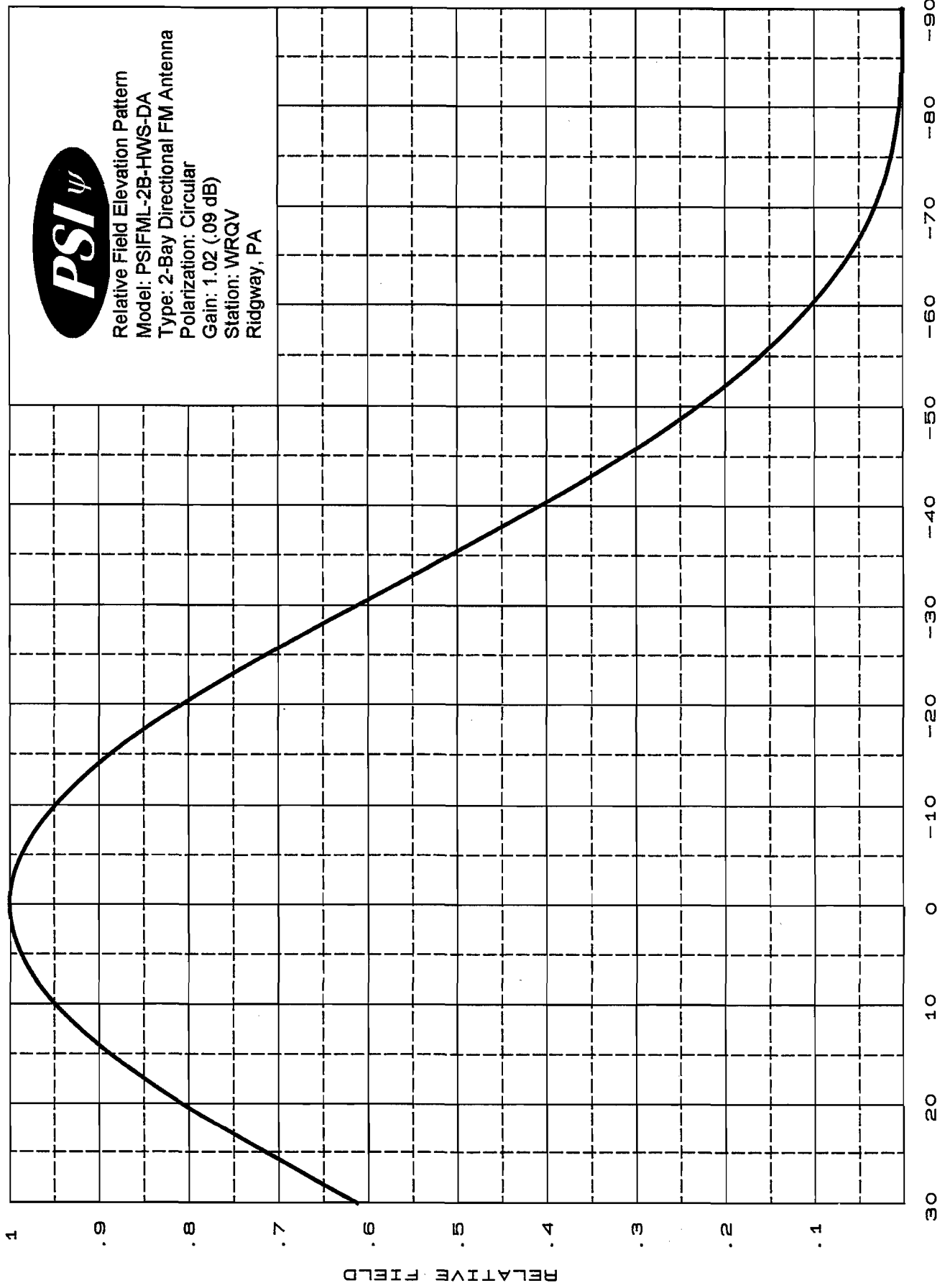
Field 1.00
ERP 2.1 kW (3.22 dBk)
Azimuth Bearing 0 degrees

Minimum Field (V-pol)

Field 0.365
ERP .28 kW (-5.53 dBk)
Azimuth Bearing 155 degrees



Relative Field Elevation Pattern
Model: PSIFML-2B-HWS-DA
Type: 2-Bay Directional FM Antenna
Polarization: Circular
Gain: 1.02 (.09 dB)
Station: WRQV
Ridgway, PA



DEGREES BELOW HORIZONTAL