Propagation Systems, Inc.
Quality Broadcast Antenna Systems

Directional FM Antenna
WVMC
Mansfield Christian School
Mansfield, OH

A standard model PSIFML antenna with parasitic elements was used in conjunction with the customer's 18"-24" face triangular tower to create the necessary directional radiation pattern. The final antenna consists of four radiating elements each secured to the tower with a custom mounting bracket. The antenna bays are ¾-wavelength spaced and there are a total of two horizontal parasitic elements per bay. The antenna array is center fed from an existing flexible transmission line. 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 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 8753E-network analyzer operating at 272.1 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 98.4% of the envelope RMS.

The antenna is to be mounted 31.9 meters (104.8 ft.) +2/-4 meters above ground level on a the southwest tower leg and positioned 182° True. No other antenna can be installed within 10 ft of any radiating element. Any guy wire that passes within 20 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.

PO Box 113 • 719 Pensacola Rd • Ebensburg • PA • 15931 • Phone (814) 472-5540 • Fax (814) 472-5676
www.psibroadcast.com

An input power level of .536 kW will be required at the antenna input in order to reach the approved 1.55 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

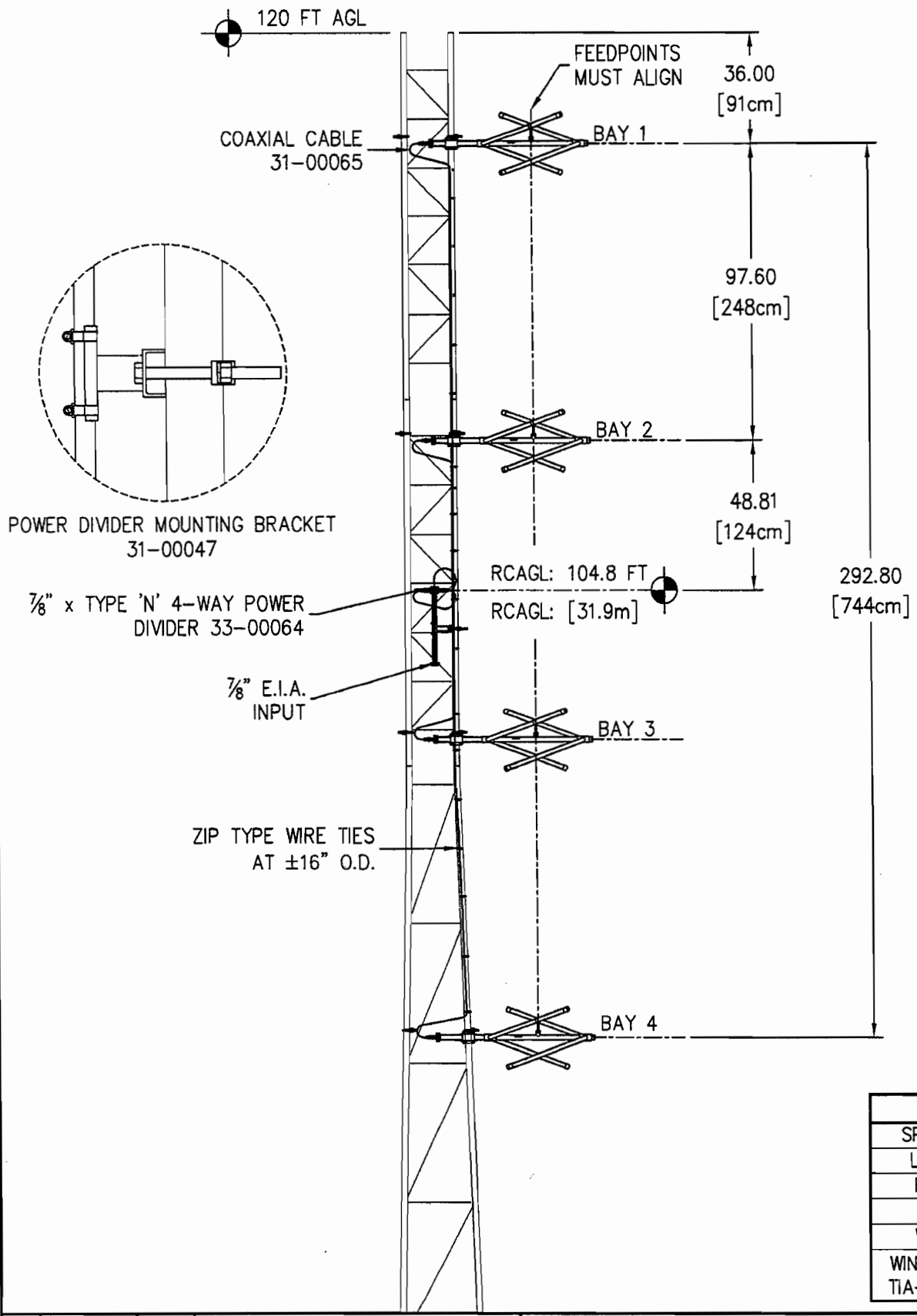
Antenna Model	PSIFML-4A-DA
Type	4-bay directional FM antenna
Bay Spacing	¾-wavelength spaced elements
Frequency	90.7 MHz
Polarization	Circular
Envelope RMS	.798
Composite RMS	.785
Gain (h-pol)	2.89 (4.61 dB)
Gain (v-pol)	2.89 (4.61 dB)
ERP	1.55 kW
Antenna input power	.536 kW
Input	7/8" EIA center fed input
Power rating	3 kW
Length	24.4 ft.
Weight	154 lbs.
Wind Area	12 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 10/17/2013

Douglas A. Ross
President
Propagation Systems Inc.



SPECIFICATIONS
SPACING: .75λ
LENGTH: 24.4 FT [7.44m]
RATING: 3.0 kW
GAIN: 2.89 (4.61 dB)
WEIGHT: 154 LB [69.7 Kg]
WINDAREA: 12 FT^2 TIA-222-F (NO ICE)

REV.	MADE BY / CHECKED BY	DATE	CHANGE

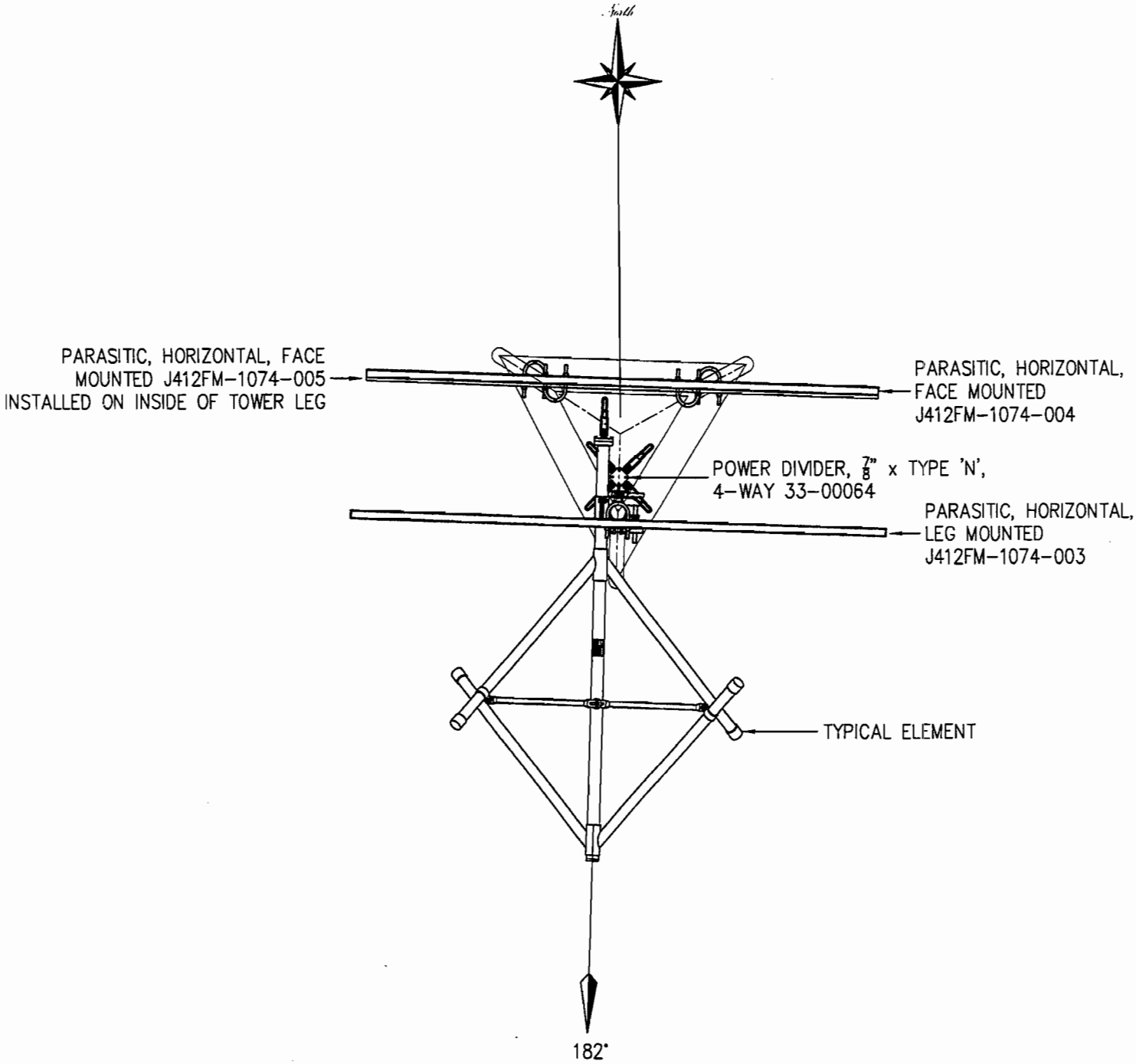
SIZE: A

PROPAGATION SYSTEMS, INC.

Ebensburg, Pennsylvania USA 814-472-5540

ANTENNA ELEVATIONS AND SPECIFICATIONS

MODEL:	DRAWN BY:	DATE:
PSIFML-4A-.75WS-DA	D.G. Kellar	5/1/12
CHANNEL/ FREQUENCY: 90.7 MHz	APPROVED BY:	DATE:
SCALE: 1:50	DRAWING NO.: J412FM-1074-001	REV.



REV.	MADE BY / CHECKED BY	DATE	CHANGE

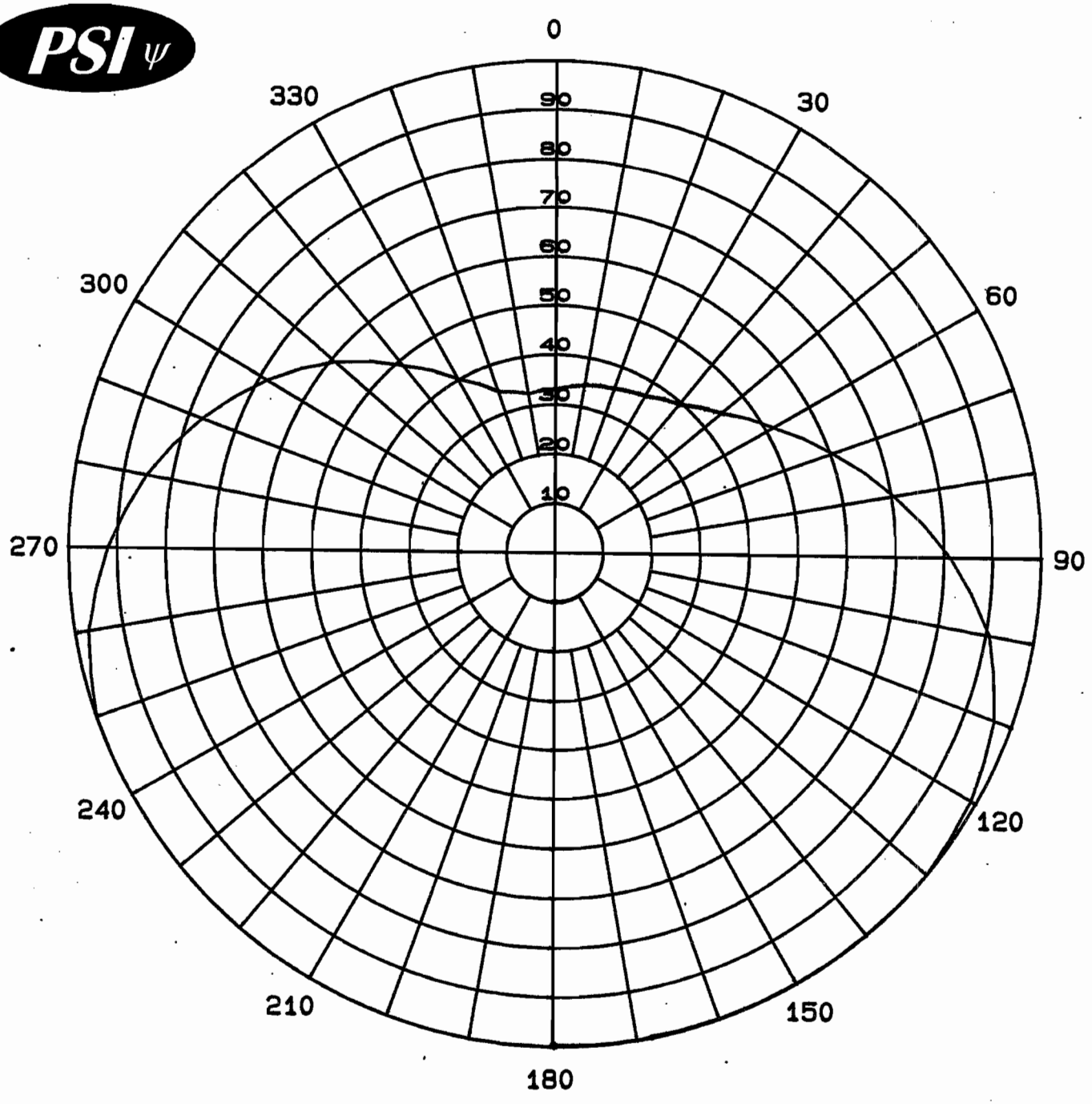
SIZE: A

PROPAGATION SYSTEMS, INC.

Ebensburg, Pennsylvania USA 814-472-5540

PLAN VIEW AND ORIENTATION

MODEL: PSIFML-4A-.75WS-DA	DRAWN BY: D.G. Kellar	DATE: 7/24/12	
CHANNEL/FREQUENCY: 90.7 MHz	APPROVED BY:	DATE:	
SCALE: 1:20	DRAWING NO.: J412FM-1074-002	REV.	



Maximum Envelope
Azimuth Plane Pattern
Antenna: PSIFML-4A-75WS-DA
Type:4-Bay Directional FM Antenna
ERP: 1.55 kW (1.90 dBk)
RMS Envelope: .798
Frequency: 90.7 MHz
WVMC Mansfield, OH

Propagation Systems Inc.
PO Box 113
Ebensburg, PA 15931

Maximum Envelope Tabulation

Antenna: PSIFML-4A-75WS-DA

Mansfield Christian School

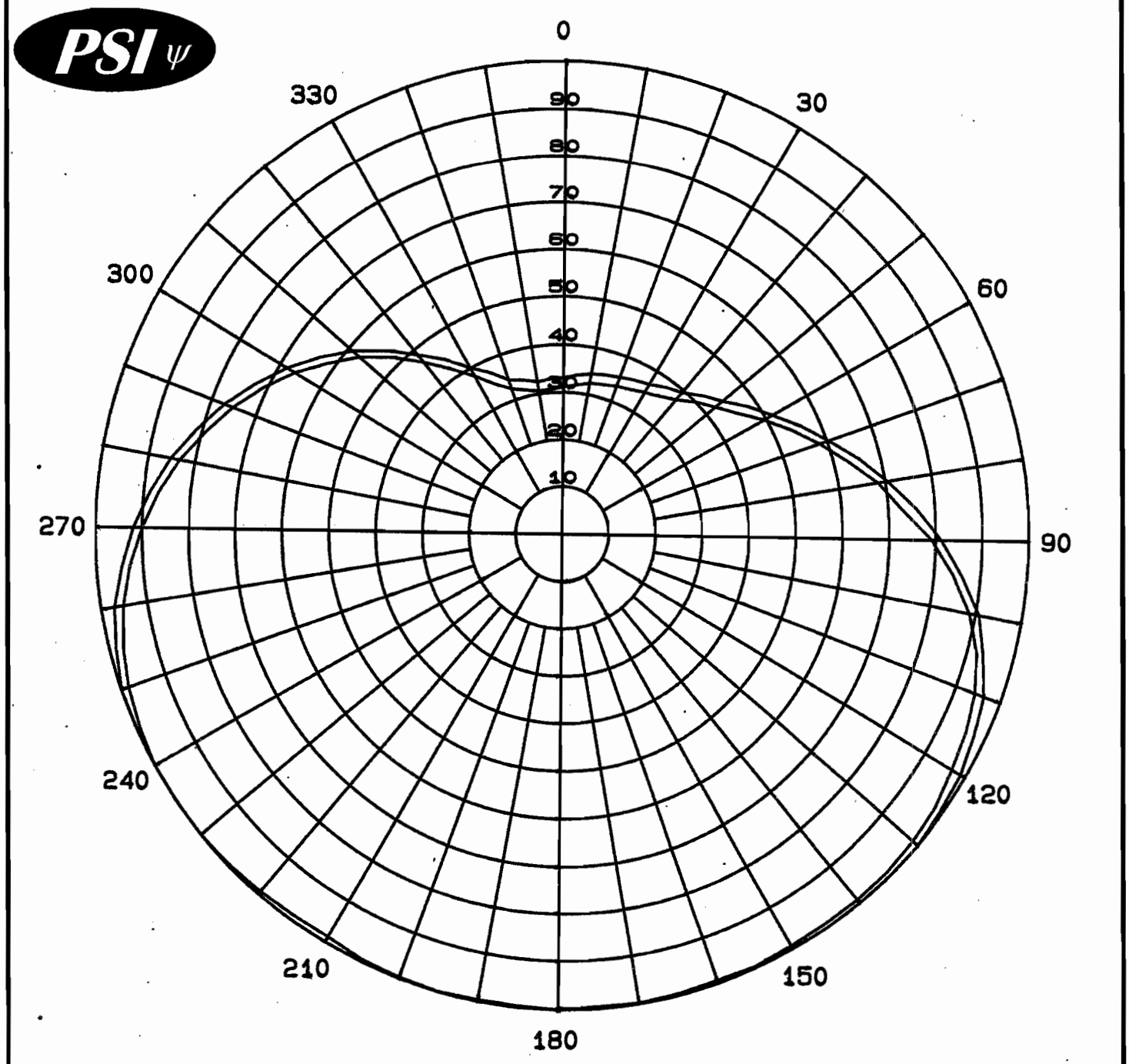
Station: WVMC

Frequency: 90.7 MHz

Location: Mansfield, OH

Maximum ERP: 1.55 kW (1.90 dBk)

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.331	0.170	-7.70
10	0.345	0.184	-7.34
20	0.355	0.195	-7.09
30	0.369	0.211	-6.76
40	0.396	0.243	-6.14
50	0.446	0.308	-5.11
60	0.517	0.414	-3.83
70	0.605	0.567	-2.46
80	0.705	0.770	-1.13
90	0.811	1.019	0.08
100	0.907	1.275	1.06
110	0.963	1.437	1.58
120	0.989	1.516	1.81
130	1.000	1.550	1.90
140	1.000	1.550	1.90
150	1.000	1.550	1.90
160	1.000	1.550	1.90
170	1.000	1.550	1.90
180	1.000	1.550	1.90
190	1.000	1.550	1.90
200	1.000	1.550	1.90
210	1.000	1.550	1.90
220	1.000	1.550	1.90
230	1.000	1.550	1.90
240	1.000	1.550	1.90
250	1.000	1.550	1.90
260	0.972	1.464	1.66
270	0.919	1.309	1.17
280	0.852	1.125	0.51
290	0.771	0.921	-0.36
300	0.683	0.723	-1.41
310	0.591	0.541	-2.66
320	0.488	0.369	-4.33
330	0.403	0.252	-5.99
340	0.345	0.184	-7.34
350	0.326	0.165	-7.83



Maximum Envelope and
Composite Pattern
Antenna: PSIFML-4A-75WS-DA
Type:4-Bay Directional FM Antenna
ERP: 1.55 kW (1.90 dBk)
RMS Envelope: .798
RMS Composite: .785
Frequency: 90.7 MHz

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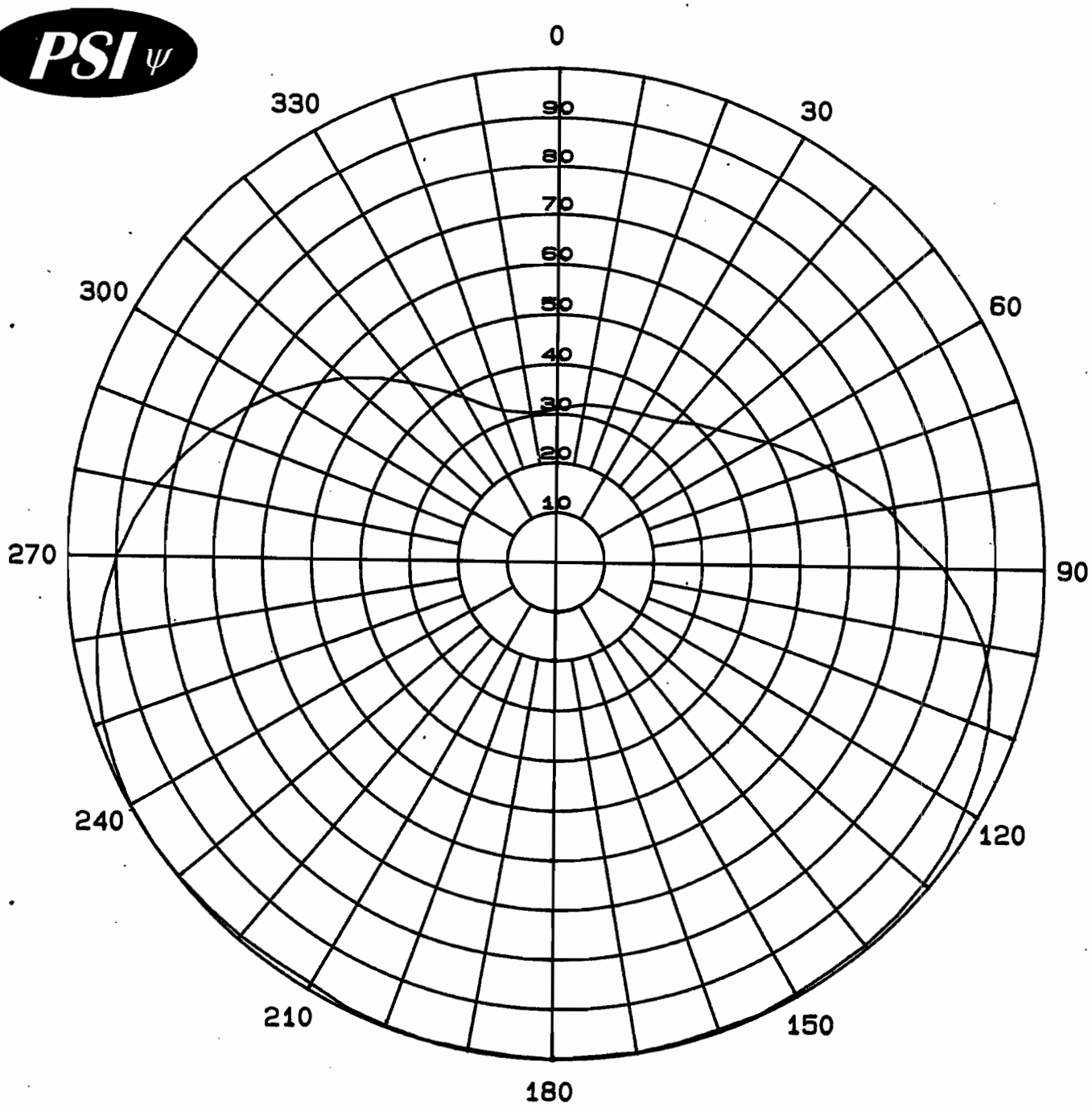
WVMC Mansfield, OH



Measured Composite
Azimuth Plane Pattern
Antenna: PSIFML-4A-75WS-DA
Type:4-Bay Directional FM Antenna
ERP: 1.55 kW (1.90 dBk)
RMS Composite: .785
Frequency: 90.7 MHz
WVMC Mansfield, OH

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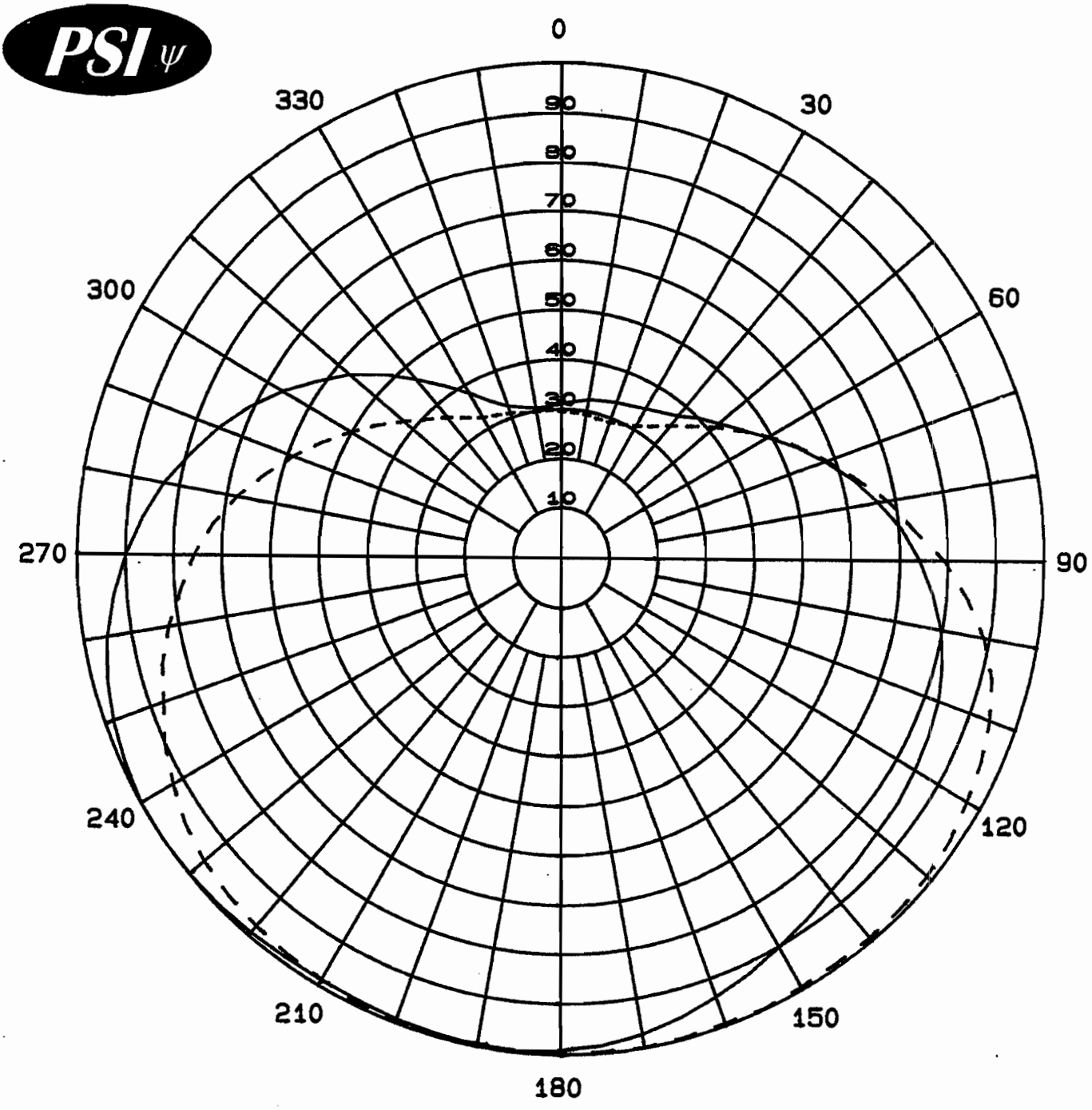
Composite Pattern Tabulation

Antenna: PSIFML-4A-75WS-DA
Mansfield Christian School
Station: WVMC
Frequency: 90.7 MHz
Location: Mansfield, OH
Maximum ERP: 1.55 kW (1.90 dBk)

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.311	0.150	-8.24
10	0.325	0.164	-7.86
20	0.335	0.174	-7.60
30	0.349	0.189	-7.24
40	0.376	0.219	-6.59
50	0.426	0.281	-5.51
60	0.497	0.383	-4.17
70	0.585	0.530	-2.75
80	0.685	0.727	-1.38
90	0.791	0.970	-0.13
100	0.887	1.219	0.86
110	0.943	1.378	1.39
120	0.969	1.455	1.63
130	0.987	1.510	1.79
140	0.992	1.525	1.83
150	0.994	1.531	1.85
160	0.995	1.535	1.86
170	0.999	1.547	1.89
180	1.000	1.550	1.90
190	0.996	1.538	1.87
200	0.997	1.541	1.88
210	0.987	1.510	1.79
220	0.992	1.525	1.83
230	0.999	1.547	1.89
240	0.999	1.547	1.89
250	0.983	1.498	1.75
260	0.952	1.405	1.48
270	0.899	1.253	0.98
280	0.832	1.073	0.31
290	0.751	0.874	-0.58
300	0.663	0.681	-1.67
310	0.571	0.505	-2.96
320	0.468	0.339	-4.69
330	0.383	0.227	-6.43
340	0.325	0.164	-7.86
350	0.306	0.145	-8.38



Measured Relative Field
Azimuth Plane Pattern
Antenna: PSIFML-4A-75WS-DA
Type:4-Bay Directional FM Antenna
Gain H-pol (solid): 2.89 (4.61 dB)
Gain V-pol (dash): 2.89 (4.61 dB)
Frequency: 90.7 MHz
WVMC Mansfield, OH

Propagation Systems Inc.
PO Box 113
Ebensburg, PA 15931

Measured Relative Field Tabulation

Antenna: PSIFML-4A-75WS-DA
Mansfield Christian School
Station: WVMC
Frequency: 90.7 MHz
Location: Mansfield, OH

Horizontal Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.311	0.280	-5.54
10	0.325	0.305	-5.15
20	0.335	0.324	-4.89
30	0.349	0.352	-4.53
40	0.376	0.409	-3.89
50	0.426	0.524	-2.80
60	0.493	0.702	-1.53
70	0.580	0.972	-0.12
80	0.664	1.274	1.05
90	0.740	1.583	1.99
100	0.797	1.836	2.64
110	0.830	1.991	2.99
120	0.844	2.059	3.14
130	0.853	2.103	3.23
140	0.869	2.182	3.39
150	0.902	2.351	3.71
160	0.940	2.554	4.07
170	0.974	2.742	4.38
180	0.992	2.844	4.54
190	0.996	2.867	4.57
200	0.992	2.844	4.54
210	0.987	2.815	4.50
220	0.992	2.844	4.54
230	0.999	2.884	4.60
240	0.999	2.884	4.60
250	0.983	2.793	4.46
260	0.952	2.619	4.18
270	0.899	2.336	3.68
280	0.832	2.001	3.01
290	0.751	1.630	2.12
300	0.663	1.270	1.04
310	0.571	0.942	-0.26
320	0.468	0.633	-1.99
330	0.383	0.424	-3.73
340	0.325	0.305	-5.15
350	0.306	0.271	-5.68

Maximum Value

Field	1.00
Gain	2.89 (4.61 dB)
Azimuth Bearing	235 degrees

Minimum Field

Field	0.306
Gain	.271 (-5.68 dB)
Azimuth Bearing	350 degrees

Vertical Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.296	0.253	-5.97
10	0.294	0.250	-6.02
20	0.293	0.248	-6.05
30	0.310	0.278	-5.56
40	0.351	0.356	-4.48
50	0.416	0.500	-3.01
60	0.497	0.714	-1.46
70	0.585	0.989	-0.05
80	0.685	1.356	1.32
90	0.791	1.808	2.57
100	0.887	2.274	3.57
110	0.943	2.570	4.10
120	0.969	2.714	4.34
130	0.987	2.815	4.50
140	0.992	2.844	4.54
150	0.994	2.855	4.56
160	0.995	2.861	4.57
170	0.999	2.884	4.60
180	1.000	2.890	4.61
190	0.993	2.850	4.55
200	0.997	2.873	4.58
210	0.985	2.804	4.48
220	0.975	2.747	4.39
230	0.959	2.658	4.25
240	0.923	2.462	3.91
250	0.873	2.203	3.43
260	0.823	1.957	2.92
270	0.759	1.665	2.21
280	0.679	1.332	1.25
290	0.589	1.003	0.01
300	0.502	0.728	-1.38
310	0.425	0.522	-2.82
320	0.368	0.391	-4.07
330	0.326	0.307	-5.13
340	0.311	0.280	-5.54
350	0.299	0.258	-5.88

Maximum Value

Field	1.00
Gain	2.89 (4.61 dB)
Azimuth Bearing	180 degrees

Minimum Field

Field	0.292
Gain	.246 (-5.08 dB)
Azimuth Bearing	15 degrees

ERP Tabulation

Antenna: PSIFML-4A-75WS-DA
Mansfield Christian School
Station: WVMC
Frequency: 90.7 MHz
Location: Mansfield, OH
Maximum ERP: 1.55 kW (1.90 dBk)

Horizontal Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.311	0.150	-8.24
10	0.325	0.164	-7.86
20	0.335	0.174	-7.60
30	0.349	0.189	-7.24
40	0.376	0.219	-6.59
50	0.426	0.281	-5.51
60	0.493	0.377	-4.24
70	0.580	0.521	-2.83
80	0.664	0.683	-1.65
90	0.740	0.849	-0.71
100	0.797	0.985	-0.07
110	0.830	1.068	0.28
120	0.844	1.104	0.43
130	0.853	1.128	0.52
140	0.869	1.170	0.68
150	0.902	1.261	1.01
160	0.940	1.370	1.37
170	0.974	1.470	1.67
180	0.992	1.525	1.83
190	0.996	1.538	1.87
200	0.992	1.525	1.83
210	0.987	1.510	1.79
220	0.992	1.525	1.83
230	0.999	1.547	1.89
240	0.999	1.547	1.89
250	0.983	1.498	1.75
260	0.952	1.405	1.48
270	0.899	1.253	0.98
280	0.832	1.073	0.31
290	0.751	0.874	-0.58
300	0.663	0.681	-1.67
310	0.571	0.505	-2.96
320	0.468	0.339	-4.69
330	0.383	0.227	-6.43
340	0.325	0.164	-7.86
350	0.306	0.145	-8.38

Maximum Value (H-pol)

Field	1.00
ERP	1.55 kW (1.90 dBk)
Azimuth Bearing	235 degrees

Minimum Field (H-pol)

Field	0.306
ERP	.145 kW (-8.38 dBk)
Azimuth Bearing	350 degrees

Vertical Polarization

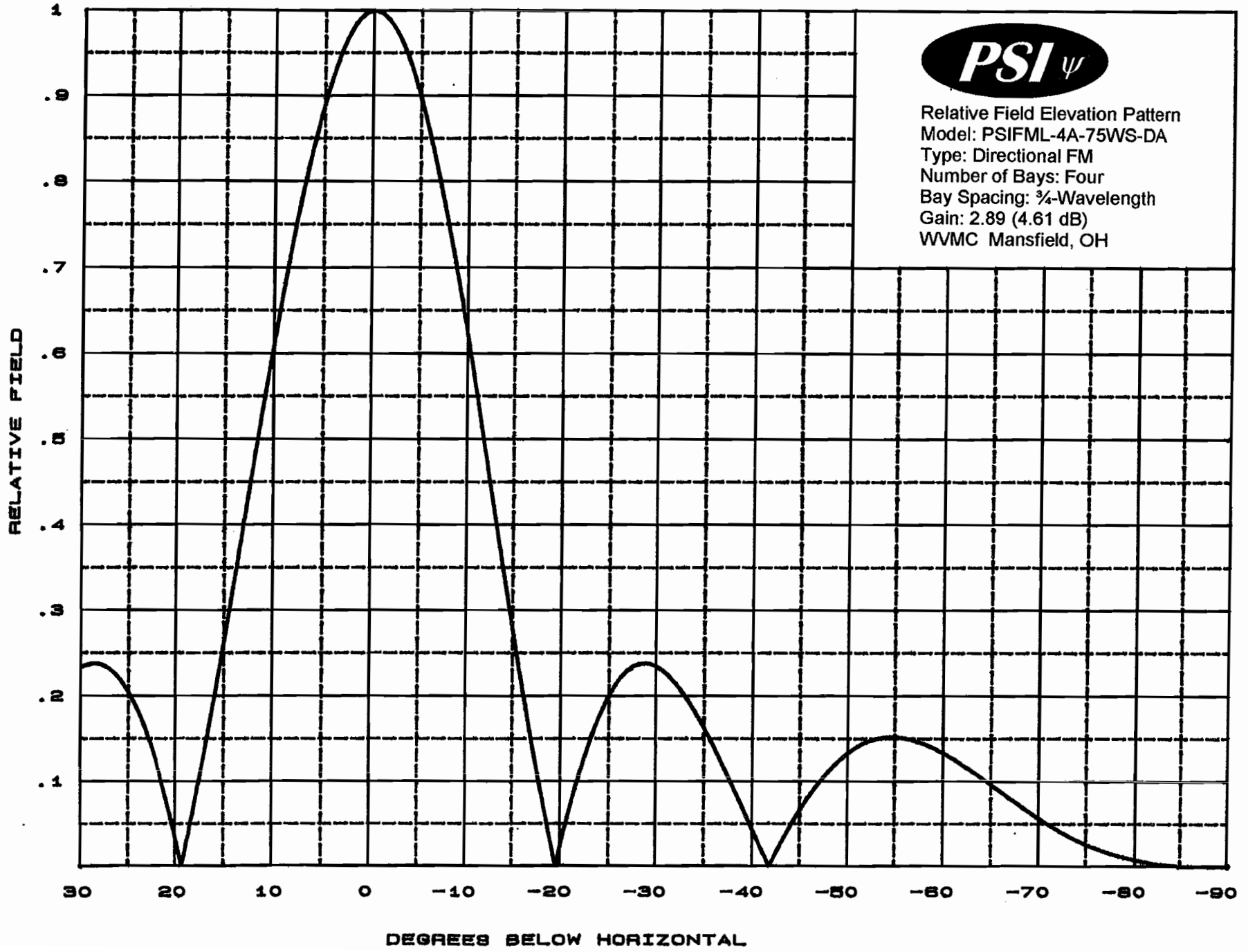
Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.296	0.136	-8.67
10	0.294	0.134	-8.73
20	0.293	0.133	-8.76
30	0.310	0.149	-8.27
40	0.351	0.191	-7.19
50	0.416	0.268	-5.71
60	0.497	0.383	-4.17
70	0.585	0.530	-2.75
80	0.685	0.727	-1.38
90	0.791	0.970	-0.13
100	0.887	1.219	0.86
110	0.943	1.378	1.39
120	0.969	1.455	1.63
130	0.987	1.510	1.79
140	0.992	1.525	1.83
150	0.994	1.531	1.85
160	0.995	1.535	1.86
170	0.999	1.547	1.89
180	1.000	1.550	1.90
190	0.993	1.528	1.84
200	0.997	1.541	1.88
210	0.985	1.504	1.77
220	0.975	1.473	1.68
230	0.959	1.426	1.54
240	0.923	1.320	1.21
250	0.873	1.181	0.72
260	0.823	1.050	0.21
270	0.759	0.893	-0.49
280	0.679	0.715	-1.46
290	0.589	0.538	-2.69
300	0.502	0.391	-4.08
310	0.425	0.280	-5.53
320	0.368	0.210	-6.78
330	0.326	0.165	-7.83
340	0.311	0.150	-8.24
350	0.299	0.139	-8.58

Maximum Value (V-pol)

Field	1.00
ERP	1.55 kW (1.90 dBk)
Azimuth Bearing	180 degrees

Minimum Field (V-pol)

Field	0.292
ERP	.132 kW (-8.79 dBk)
Azimuth Bearing	15 degrees


PSI ψ
Relative Field Elevation Pattern
Model: PSIFML-4A-75WS-DA
Type: Directional FM
Number of Bays: Four
Bay Spacing: ¾-Wavelength
Gain: 2.89 (4.61 dB)
WVMC Mansfield, OH
RELATIVE FIELD
1
.9
.8
.7
.6
.5
.4
.3
.2
.1
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
DEGREES BELOW HORIZONTAL