



Propagation Systems, Inc.

Quality Broadcast Antenna Systems

**Directional FM Antenna
WLCU
Campbellsville University
Campbellsville, KY**

A standard model PSIFMR antenna with parasitic elements was used in conjunction with the customer's 24" face triangular tower to create the necessary directional radiation pattern. The final antenna consists of two radiating elements each secured to the tower with a custom mounting bracket. The antenna bays are full wave spaced and there are a total of two horizontal parasitic elements per bay and one vertical parasitic element per bay. The antenna array is end 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 8753A-network analyzer operating at 266.1 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 92% of the envelope RMS.

The antenna is to be mounted 50 meters (164 ft.) +2/-4 meters above ground level on a the southeast tower leg and positioned 145° 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.

An input power level of .537 kW will be required at the antenna input in order to reach the approved .80 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-2C-DA
Type	2-bay directional FM antenna
Bay Spacing	Full wave spaced elements
Frequency	88.7 MHz
Polarization	Circular
Envelope RMS	.814
Composite RMS	.748
Gain (h-pol)	1.49 (1.73 dB)
Gain (v-pol)	1.49 (1.73 dB)
ERP	.80 kW
Antenna input power	.537 kW
Input	1-5/8" EIA center fed input
Power rating	12 kW
Length	16.72 ft.
Weight	192 lbs.
Wind Area	8.8 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.

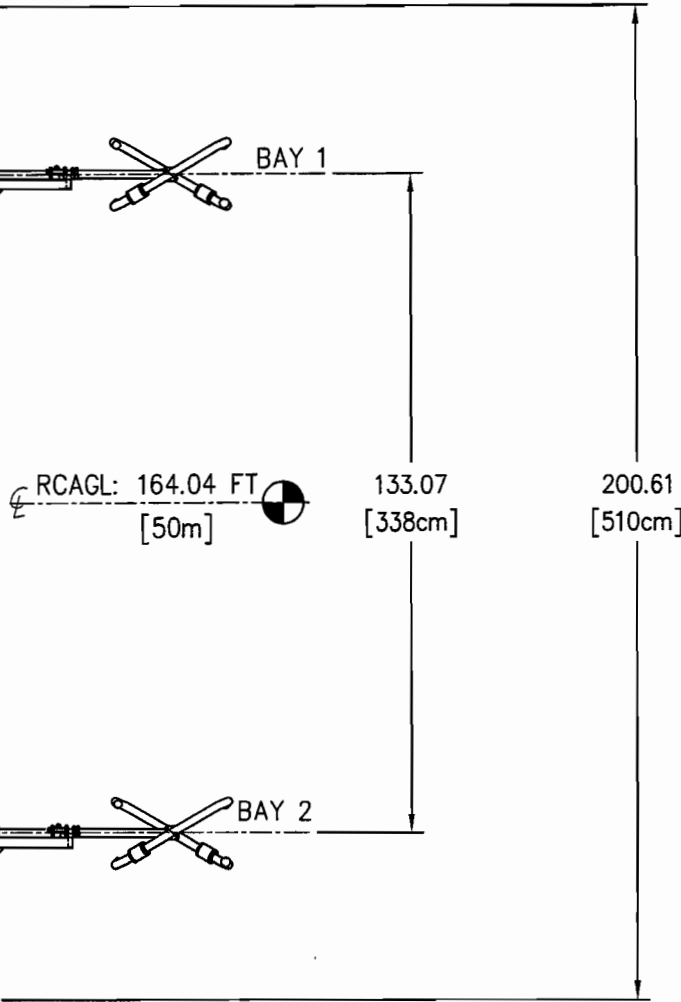
 1/17/11

Douglas A. Ross
President
Propagation Systems Inc.

SHORTING STUB
34-00007

1½" 90° ELBOW

1½" E.I.A. 50Ω
INPUT



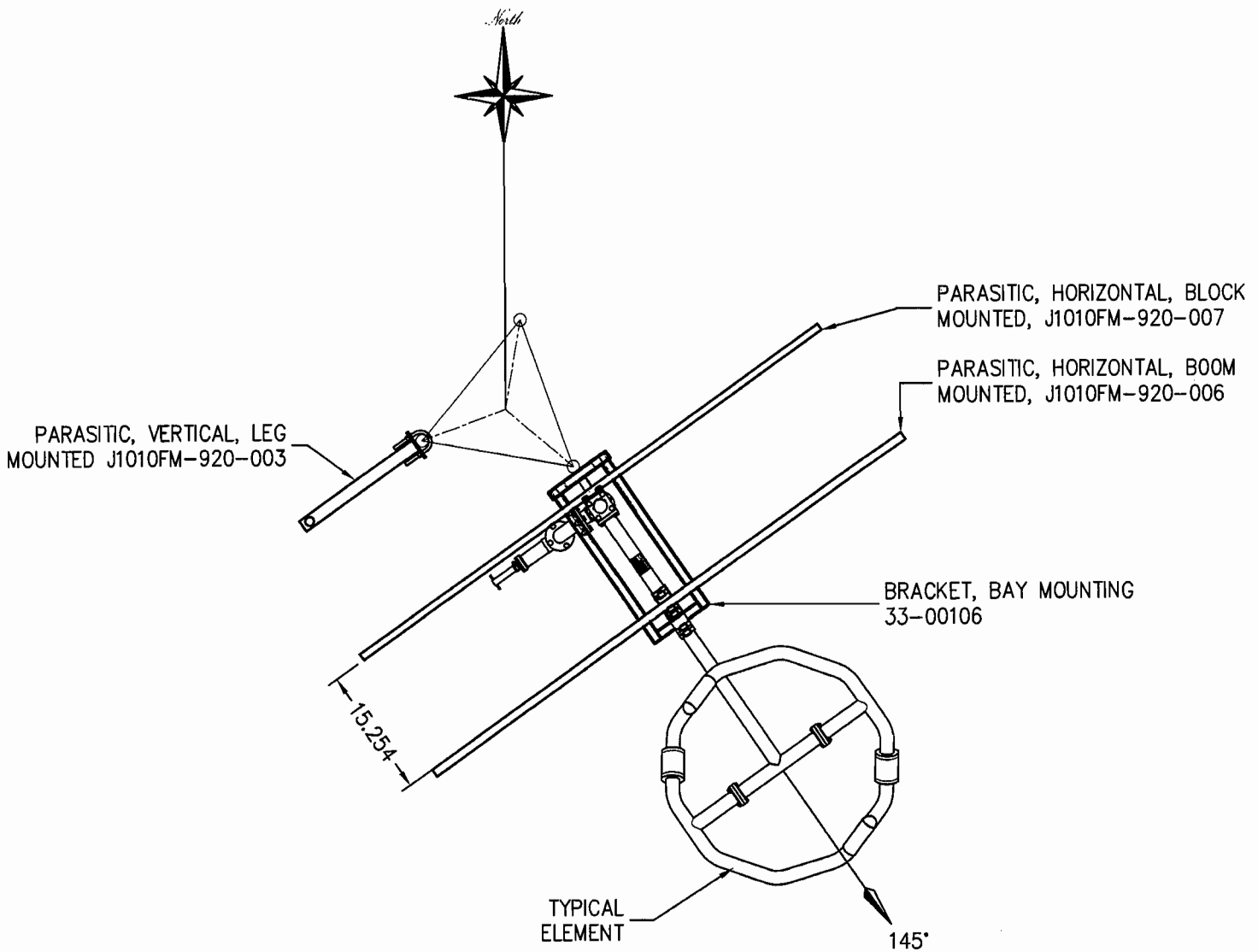
SPECIFICATIONS	
SPACING:	1.0λ
LENGTH:	16.72 Ft [5.1m]
APERTURE:	11.09 Ft [3.38m]
RATING:	12 kW
GAIN:	1.49 (1.73 dB)
WEIGHT:	192 LB [87 Kg]
WINDAREA:	8.8 Ft ²
TIA-222-F (NO ICE)	

REV.	MADE BY	CHECKED BY	DATE	CHANGE

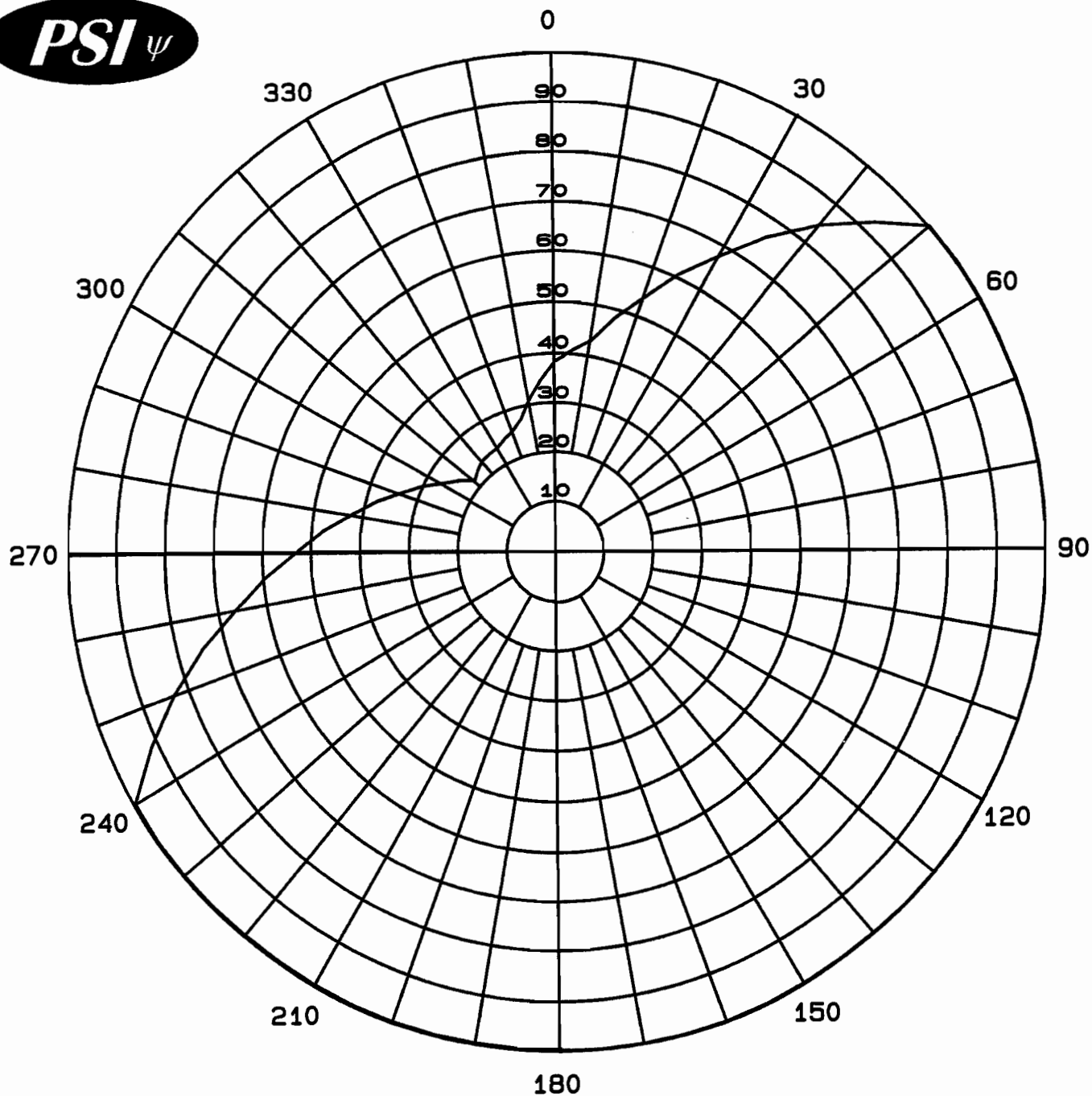
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SIZE
A

PROPAGATION SYSTEMS, INC.			
Ebensburg, Pennsylvania USA 814-472-5540			
ANTENNA ELEVATIONS AND SPECIFICATIONS			
MODEL:	PSIFMR-2C-DA	DRAWN BY:	D.G. Kellar
CHANNEL/ FREQUENCY:	88.7 MHz	APPROVED BY:	
SCALE:	1:40	DRAWING NO.:	J1010FM-920-001
			REV.



				PROPAGATION SYSTEMS, INC.			
				Ebensburg, Pennsylvania USA 814-472-5540			
				ANTENNA PLAN VIEW AND ORIENTATION			
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		MODEL: PSIFMR-2C-DA CHANNEL/FREQUENCY: 88.7 MHz SCALE: 1:20	
				DRAWN BY: D.G. Kellar APPROVED BY: DRAWING NO.: J1010FM-920-002		DATE: 12/21/10 REV.:	



Maximum Envelope
Azimuth Plane Pattern
Antenna: PSIFMR-2C-DA
Type: 2-Bay Directional FM Antenna
ERP: .80 kW (-.97 dBk)
RMS Envelope: .814
Frequency: 88.7 MHz
WLCU Campbellsville, KY

Propagation Systems Inc.
PO Box 113
Ebensburg, PA 15931

Maximum Envelope Tabulation

Antenna: PSIFMR-2C-DA

Campbellsville University

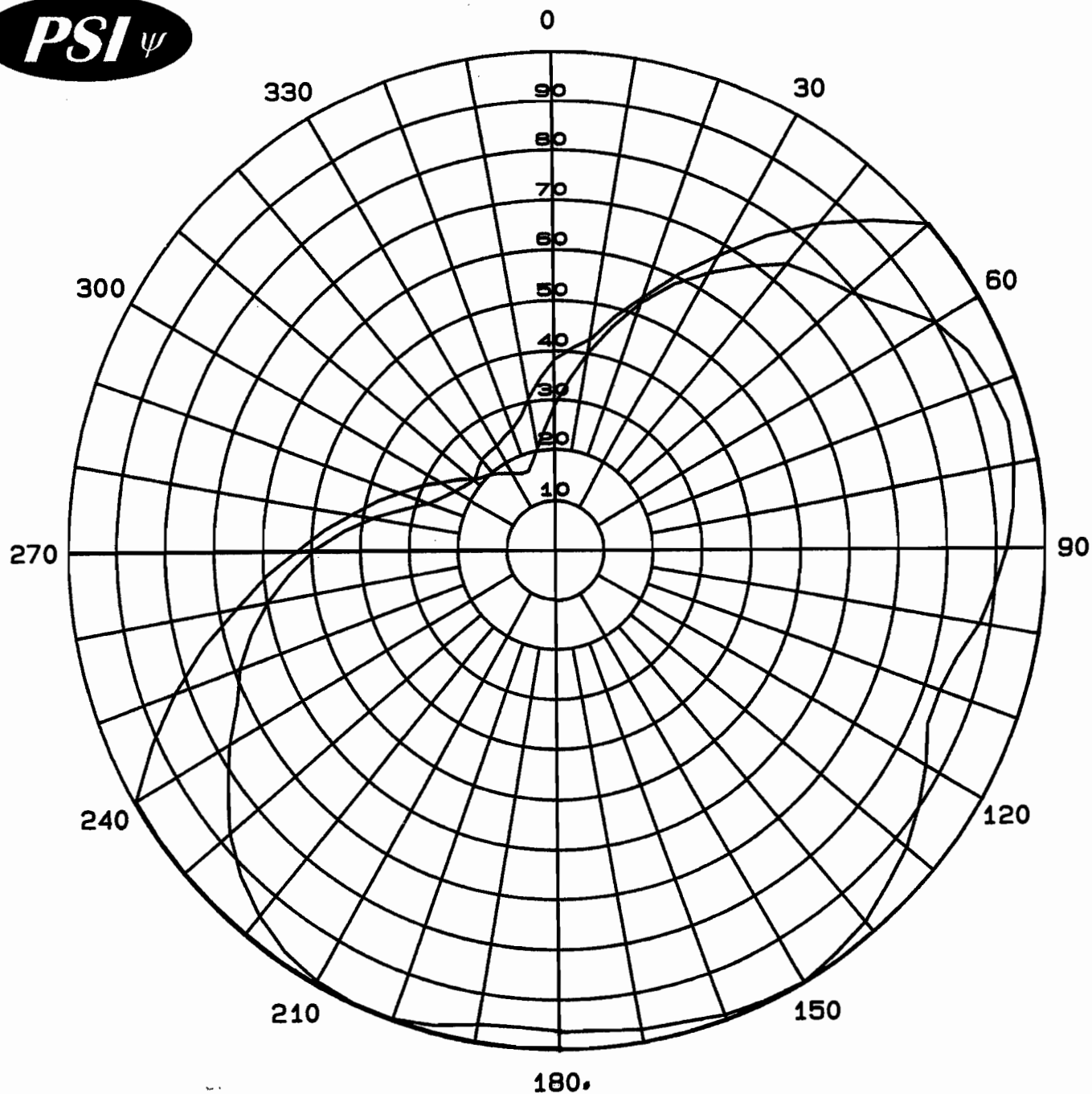
Station: WLCU

Frequency: 88.7 MHz

Location: Campbellsville, KY

Maximum ERP: .80 kW (-97 dBk)

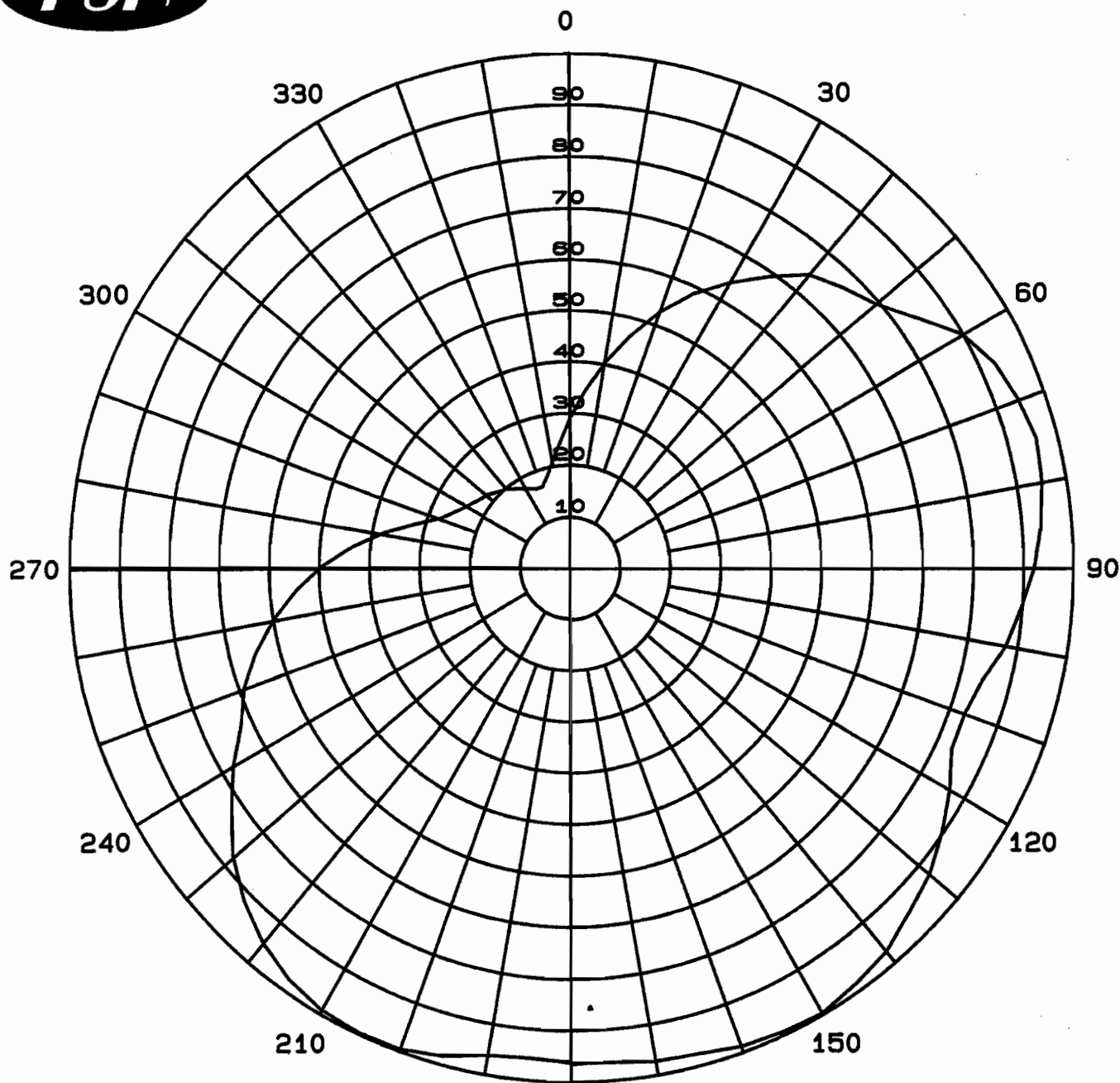
Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.379	0.115	-9.40
10	0.425	0.145	-8.40
20	0.533	0.227	-6.43
30	0.671	0.360	-4.43
40	0.842	0.567	-2.46
50	1.000	0.800	-0.97
60	1.000	0.800	-0.97
70	1.000	0.800	-0.97
80	1.000	0.800	-0.97
90	1.000	0.800	-0.97
100	1.000	0.800	-0.97
110	1.000	0.800	-0.97
120	1.000	0.800	-0.97
130	1.000	0.800	-0.97
140	1.000	0.800	-0.97
150	1.000	0.800	-0.97
160	1.000	0.800	-0.97
170	1.000	0.800	-0.97
180	1.000	0.800	-0.97
190	1.000	0.800	-0.97
200	1.000	0.800	-0.97
210	1.000	0.800	-0.97
220	1.000	0.800	-0.97
230	1.000	0.800	-0.97
240	1.000	0.800	-0.97
250	0.834	0.556	-2.55
260	0.665	0.354	-4.51
270	0.528	0.223	-6.52
280	0.421	0.142	-8.48
290	0.335	0.090	-10.47
300	0.266	0.057	-12.47
310	0.216	0.037	-14.28
320	0.233	0.043	-13.62
330	0.237	0.045	-13.47
340	0.254	0.052	-12.87
350	0.307	0.075	-11.23



Maximum Envelope and
Composite Pattern
Antenna: PSIFMR-2C-DA
Type: 2-Bay Directional FM Antenna
ERP: .80 kW (-.97 dBk)
RMS Envelope: .814
RMS Composite: .748
Frequency: 88.7 MHz

Propagation Systems Inc.
PO Box 113
Ebensburg, PA 15931

WLCU Campbellsville, KY



Measured Composite
Azimuth Plane Pattern
Antenna: PSIFMR-2C-DA
Type: 2-Bay Directional FM Antenna
ERP: .80 kW (-.97 dBk)
RMS Composite: .748
Frequency: 88.7 MHz
WLCU Campbellsville, KY

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Composite Pattern Tabulation

Antenna: PSIFMR-2C-DA

Campbellsville University

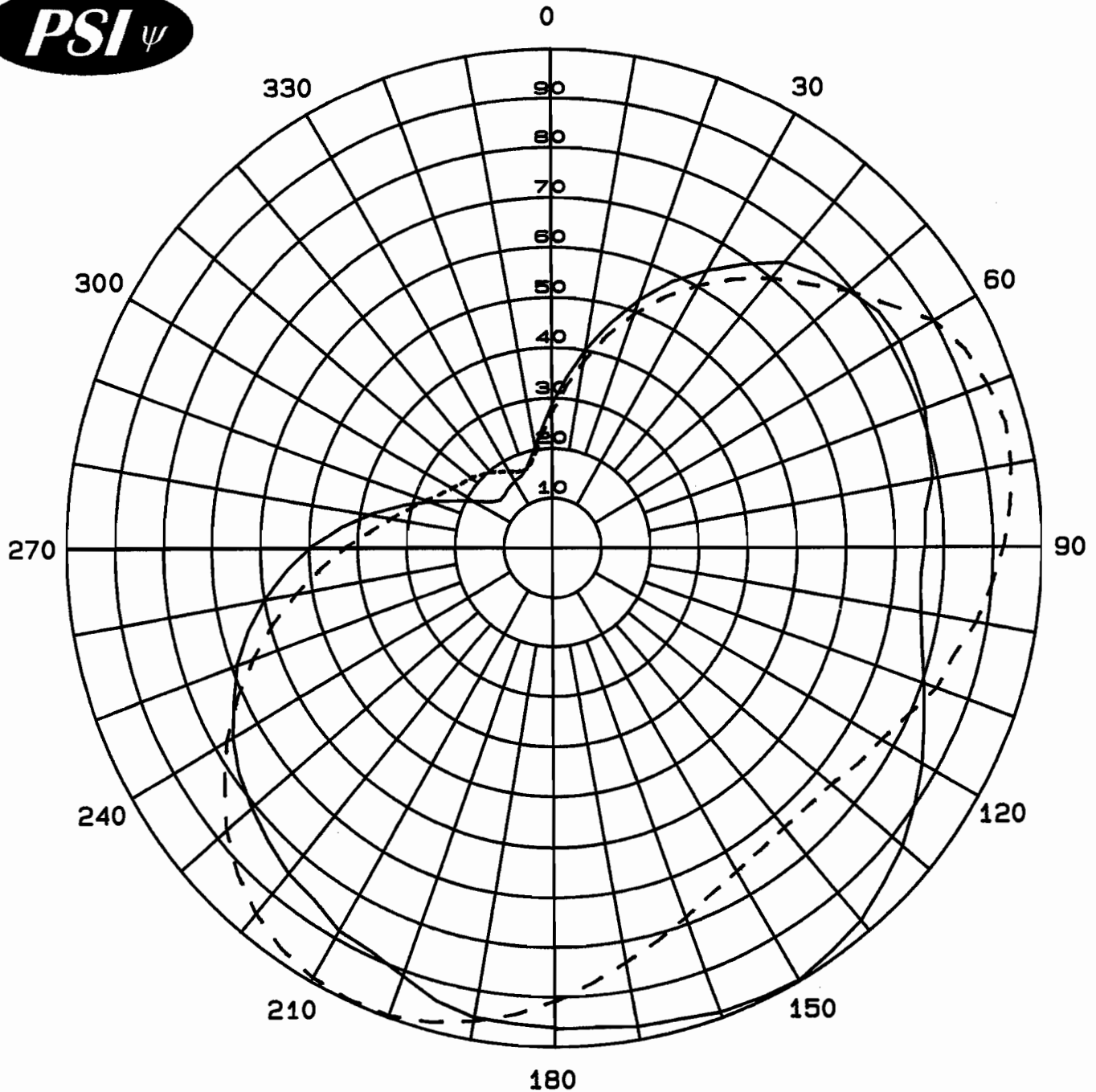
Station: WLCU

Frequency: 88.7 MHz

Location: Campbellsville, KY

Maximum ERP: .80 kW (-97 dBk)

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.286	0.065	-11.84
10	0.398	0.127	-8.97
20	0.521	0.217	-6.63
30	0.634	0.322	-4.93
40	0.739	0.437	-3.60
50	0.791	0.501	-3.01
60	0.897	0.644	-1.91
70	0.945	0.714	-1.46
80	0.951	0.724	-1.41
90	0.921	0.679	-1.68
100	0.877	0.615	-2.11
110	0.832	0.554	-2.57
120	0.868	0.603	-2.20
130	0.929	0.690	-1.61
140	0.975	0.761	-1.19
150	1.000	0.800	-0.97
160	0.991	0.786	-1.05
170	0.975	0.761	-1.19
180	0.965	0.745	-1.28
190	0.965	0.745	-1.28
200	0.999	0.798	-0.98
210	0.994	0.790	-1.02
220	0.954	0.728	-1.38
230	0.878	0.617	-2.10
240	0.776	0.482	-3.17
250	0.692	0.383	-4.17
260	0.601	0.289	-5.39
270	0.495	0.196	-7.08
280	0.376	0.113	-9.47
290	0.273	0.060	-12.25
300	0.235	0.044	-13.55
310	0.215	0.037	-14.32
320	0.194	0.030	-15.21
330	0.172	0.024	-16.26
340	0.163	0.021	-16.73
350	0.205	0.034	-14.73



Measured Relative Field
Azimuth Plane Pattern
Antenna: PSIFMR-2C-DA
Type: 2-Bay Directional FM Antenna
Gain H-pol (solid): 1.49 (1.73 dB)
Gain V-pol (dash): 1.49 (1.73 dB)
Frequency: 88.7 MHz
WLCU Campbellsville, KY

Propagation Systems Inc.
PO Box 113
Ebensburg, PA 15931

Measured Relative Field Tabulation

Antenna: PSIFMR-2C-DA

Campbellsville University

Station: WLCU

Frequency: 88.7 MHz

Location: Campbellsville, KY

Horizontal Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.286	0.122	-9.14
10	0.398	0.236	-6.27
20	0.521	0.404	-3.93
30	0.634	0.599	-2.23
40	0.739	0.814	-0.90
50	0.791	0.932	-0.30
60	0.818	0.997	-0.01
70	0.809	0.975	-0.11
80	0.788	0.925	-0.34
90	0.759	0.858	-0.66
100	0.762	0.865	-0.63
110	0.804	0.963	-0.16
120	0.868	1.123	0.50
130	0.929	1.286	1.09
140	0.975	1.416	1.51
150	1.000	1.490	1.73
160	0.991	1.463	1.65
170	0.975	1.416	1.51
180	0.965	1.388	1.42
190	0.958	1.367	1.36
200	0.914	1.245	0.95
210	0.886	1.170	0.68
220	0.849	1.074	0.31
230	0.811	0.980	-0.09
240	0.761	0.863	-0.64
250	0.692	0.714	-1.47
260	0.601	0.538	-2.69
270	0.495	0.365	-4.38
280	0.376	0.211	-6.76
290	0.261	0.102	-9.94
300	0.176	0.046	-13.36
310	0.142	0.030	-15.22
320	0.146	0.032	-14.98
330	0.152	0.034	-14.63
340	0.163	0.040	-14.02
350	0.205	0.063	-12.03

Maximum Value

Field 1.00
Gain 1.49 (1.73 dB)

Azimuth Bearing 150 degrees

Minimum Field

Field 0.142
Gain .030 (-15.22 dB)

Azimuth Bearing 310 degrees

Vertical Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.269	0.108	-9.67
10	0.375	0.210	-6.79
20	0.491	0.359	-4.45
30	0.601	0.538	-2.69
40	0.698	0.726	-1.39
50	0.791	0.932	-0.30
60	0.897	1.199	0.79
70	0.945	1.331	1.24
80	0.951	1.348	1.30
90	0.921	1.264	1.02
100	0.877	1.146	0.59
110	0.832	1.031	0.13
120	0.773	0.890	-0.50
130	0.740	0.816	-0.88
140	0.733	0.801	-0.97
150	0.747	0.831	-0.80
160	0.787	0.923	-0.35
170	0.843	1.059	0.25
180	0.909	1.231	0.90
190	0.965	1.388	1.42
200	0.999	1.487	1.72
210	0.994	1.472	1.68
220	0.954	1.356	1.32
230	0.878	1.149	0.60
240	0.776	0.897	-0.47
250	0.656	0.641	-1.93
260	0.534	0.425	-3.72
270	0.423	0.267	-5.74
280	0.333	0.165	-7.82
290	0.273	0.111	-9.54
300	0.235	0.082	-10.85
310	0.215	0.069	-11.62
320	0.194	0.056	-12.51
330	0.172	0.044	-13.56
340	0.163	0.040	-14.02
350	0.194	0.056	-12.51

Maximum Value

Field 1.00
Gain 1.49 (1.73 dB)

Azimuth Bearing 205 degrees

Minimum Field

Field 0.163
Gain .040 (-14.02 dB)

Azimuth Bearing 340 degrees

ERP Tabulation

Antenna: PSIFMR-2C-DA

Campbellsville University

Station: WLCU

Frequency: 88.7 MHz

Location: Cambellsville, KY

Maximum ERP: .80 kW (-97 dBk)

Horizontal Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.286	0.065	-11.84
10	0.398	0.127	-8.97
20	0.521	0.217	-6.63
30	0.634	0.322	-4.93
40	0.739	0.437	-3.60
50	0.791	0.501	-3.01
60	0.818	0.535	-2.71
70	0.809	0.524	-2.81
80	0.788	0.497	-3.04
90	0.759	0.461	-3.36
100	0.762	0.465	-3.33
110	0.804	0.517	-2.86
120	0.868	0.603	-2.20
130	0.929	0.690	-1.61
140	0.975	0.761	-1.19
150	1.000	0.800	-0.97
160	0.991	0.786	-1.05
170	0.975	0.761	-1.19
180	0.965	0.745	-1.28
190	0.958	0.734	-1.34
200	0.914	0.668	-1.75
210	0.886	0.628	-2.02
220	0.849	0.577	-2.39
230	0.811	0.526	-2.79
240	0.761	0.463	-3.34
250	0.692	0.383	-4.17
260	0.601	0.289	-5.39
270	0.495	0.196	-7.08
280	0.376	0.113	-9.47
290	0.261	0.054	-12.64
300	0.176	0.025	-16.06
310	0.142	0.016	-17.92
320	0.146	0.017	-17.68
330	0.152	0.018	-17.33
340	0.163	0.021	-16.73
350	0.205	0.034	-14.73

Maximum Value (H-pol)

Field 1.00
ERP .80 kW (-97 dBk)
Azimuth Bearing 150 degrees

Minimum Field (H-pol)

Field 0.142
ERP .016 kW (-17.92 dBk)
Azimuth Bearing 310 degrees

Vertical Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.269	0.058	-12.37
10	0.375	0.113	-9.49
20	0.491	0.193	-7.15
30	0.601	0.289	-5.39
40	0.698	0.390	-4.09
50	0.791	0.501	-3.01
60	0.897	0.644	-1.91
70	0.945	0.714	-1.46
80	0.951	0.724	-1.41
90	0.921	0.679	-1.68
100	0.877	0.615	-2.11
110	0.832	0.554	-2.57
120	0.773	0.478	-3.21
130	0.740	0.438	-3.58
140	0.733	0.430	-3.67
150	0.747	0.446	-3.50
160	0.787	0.495	-3.05
170	0.843	0.569	-2.45
180	0.909	0.661	-1.80
190	0.965	0.745	-1.28
200	0.999	0.798	-0.98
210	0.994	0.790	-1.02
220	0.954	0.728	-1.38
230	0.878	0.617	-2.10
240	0.776	0.482	-3.17
250	0.656	0.344	-4.63
260	0.534	0.228	-6.42
270	0.423	0.143	-8.44
280	0.333	0.089	-10.52
290	0.273	0.060	-12.25
300	0.235	0.044	-13.55
310	0.215	0.037	-14.32
320	0.194	0.030	-15.21
330	0.172	0.024	-16.26
340	0.163	0.021	-16.73
350	0.194	0.030	-15.21

Maximum Value (V-pol)

Field 1.00
ERP .80 kW (-97 dBk)
Azimuth Bearing 205 degrees

Minimum Field (V-pol)

Field 0.163
ERP .021 kW (-16.73 dBk)
Azimuth Bearing 340 degrees



Relative Field Elevation Pattern
Model: PSIFMR-2C-DA
Type: 2-Bay FM Antenna
Polarization: Circular
Gain: 1.49 (1.73 dB)
Station: WLCU
Campbellsville, KY

