



Propagation Systems, Inc.

Quality Broadcast Antenna Systems

**Directional FM Antenna
Calvary Chapel of Twin Falls, Inc.
WUJC
St. Marks, FL**

A custom designed multi element vertically polarized FM antenna was used in conjunction with the customer's 44" face triangular tower to create the necessary directional radiation pattern. The final antenna consists of two bays of radiating elements with multiple reflectors and custom mounting brackets. The antenna bays are full-wave spaced. 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 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 tower 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 273.3 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 93.4% of the envelope RMS.

The antenna is to be mounted 114 meters (373.9 ft.) meters above ground level on the southwest tower leg and positioned 214° True. At this elevation the antenna will be within the allowed tolerance of +2/-4 meters from the approved 114 meter center of radiation. No other antenna can be installed within 10 ft. of any radiating element. 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 9.28 kW will be required at the antenna input in order to reach the approved 73.5 kW ERP. The transmitter output power requirements are dependent upon the transmission line size and length used to feed the antenna.

Antenna Specifications

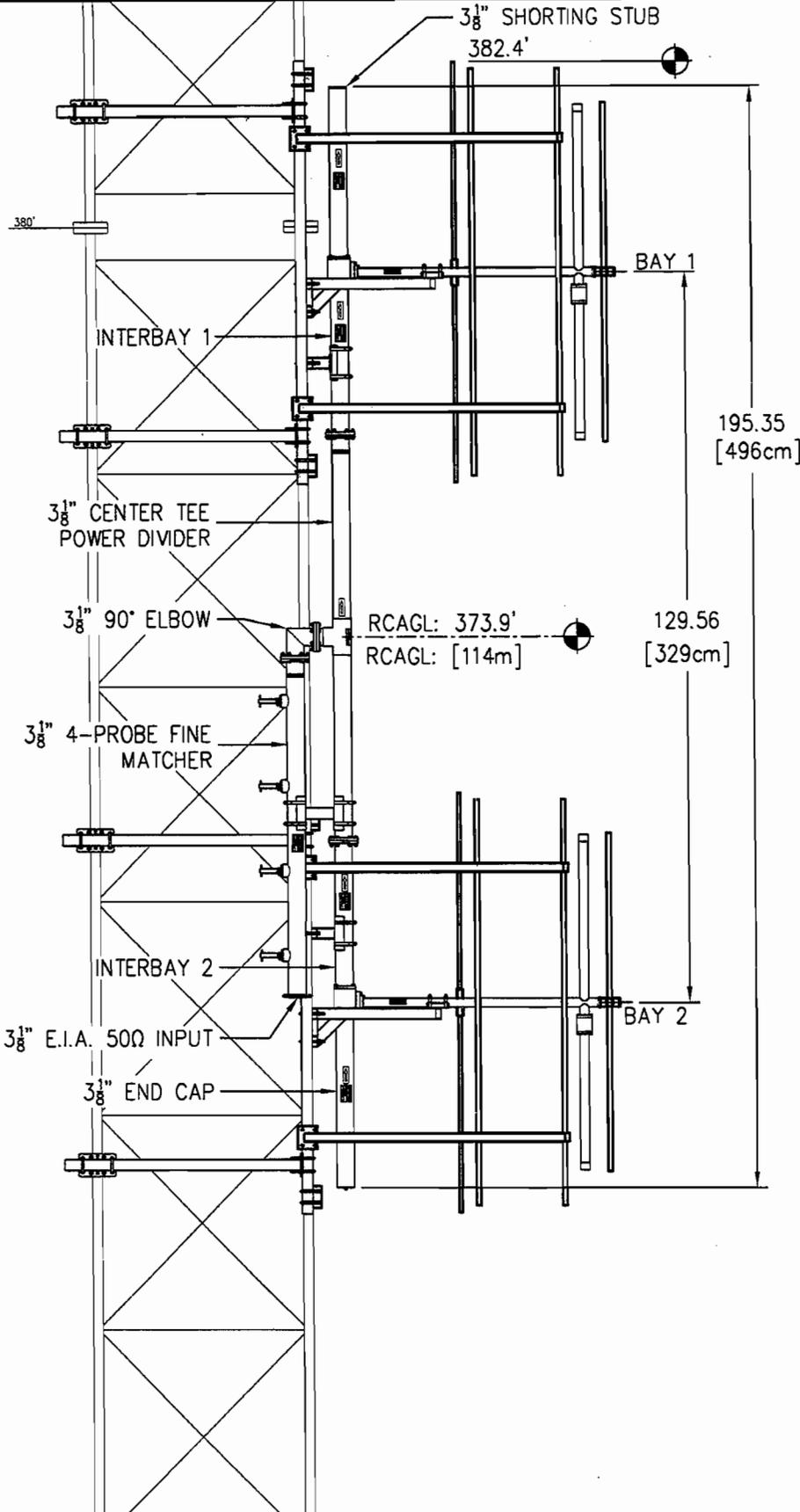
Antenna Model	PSIFHV-2C-DA
Type	2-bay directional FM antenna
Bay Spacing	Full-wave spaced elements
Frequency	91.1 MHz
Polarization	Vertical
Envelope RMS	.502
Composite RMS	.469
Gain (v-pol)	7.92 (8.99 dB)
Antenna Input	3-1/8" EIA center fed input
Power rating	20 kW
Length	16.28 ft.
Weight	665.7 lbs.
Wind Area	40.6 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.



SPECIFICATIONS	
SPACING:	1.0λ
LENGTH:	16.28 FT [4.96m]
APERTURE:	10.80 FT [3.29m]
RATING:	20 kW
GAIN:	7.92 (8.98 dB)
WEIGHT:	665.7 LB [Kg]
WINDAREA:	40.6 FT ² TIA-222-F (NO ICE)
NOTE:	
1. REF. J512FM-1087-015 FOR ASSEMBLY DETAILS AT BAY 1	
2. REF. J512FM-1087-016 FOR ASSEMBLY AT BAY 2	
3. FINE MATCHER AND ELBOW SHOWN ROTATED FOR DRAWING CLARITY	

REV.	MADE BY	CHECKED BY	DATE	CHANGE

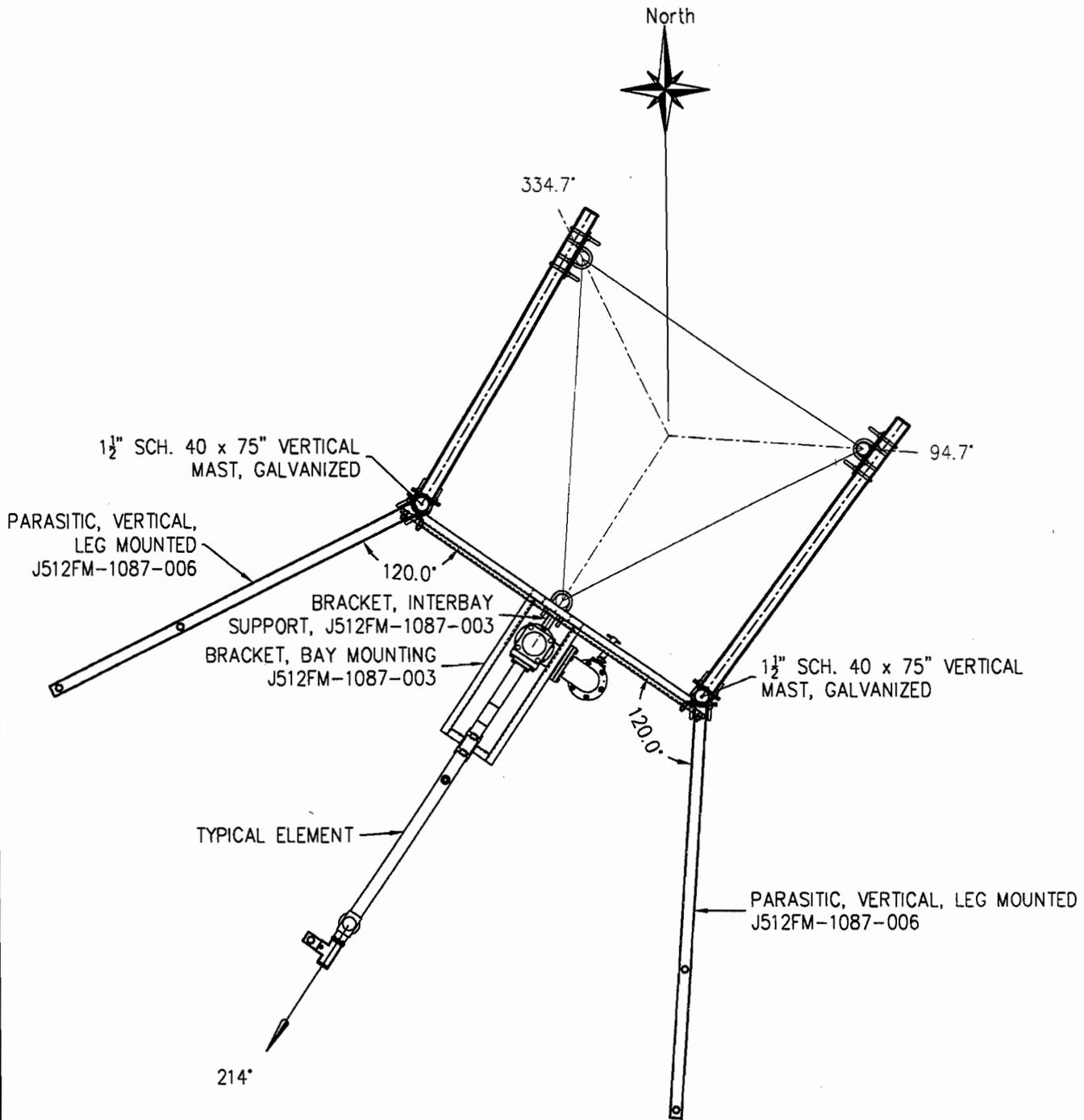
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SIZE: A

PROPAGATION SYSTEMS, INC.

Ebensburg, Pennsylvania USA 814-472-5540

ELEVATIONS AND SPECIFICATIONS			
MODEL:	PSIFHV-2C-DA	DRAWN BY:	D.G. Kellar
CHANNEL/FREQUENCY:	91.1 MHz	APPROVED BY:	
SCALE:	1:30	DRAWING NO.:	J512FM-1087-001
		DATE:	6/28/12



A	D.G. Kellar	4/26/13	CHANGE TOWER ORIENTATION PER CUSTOMER
REV.	MADE BY	CHECKED BY	DATE
			CHANGE

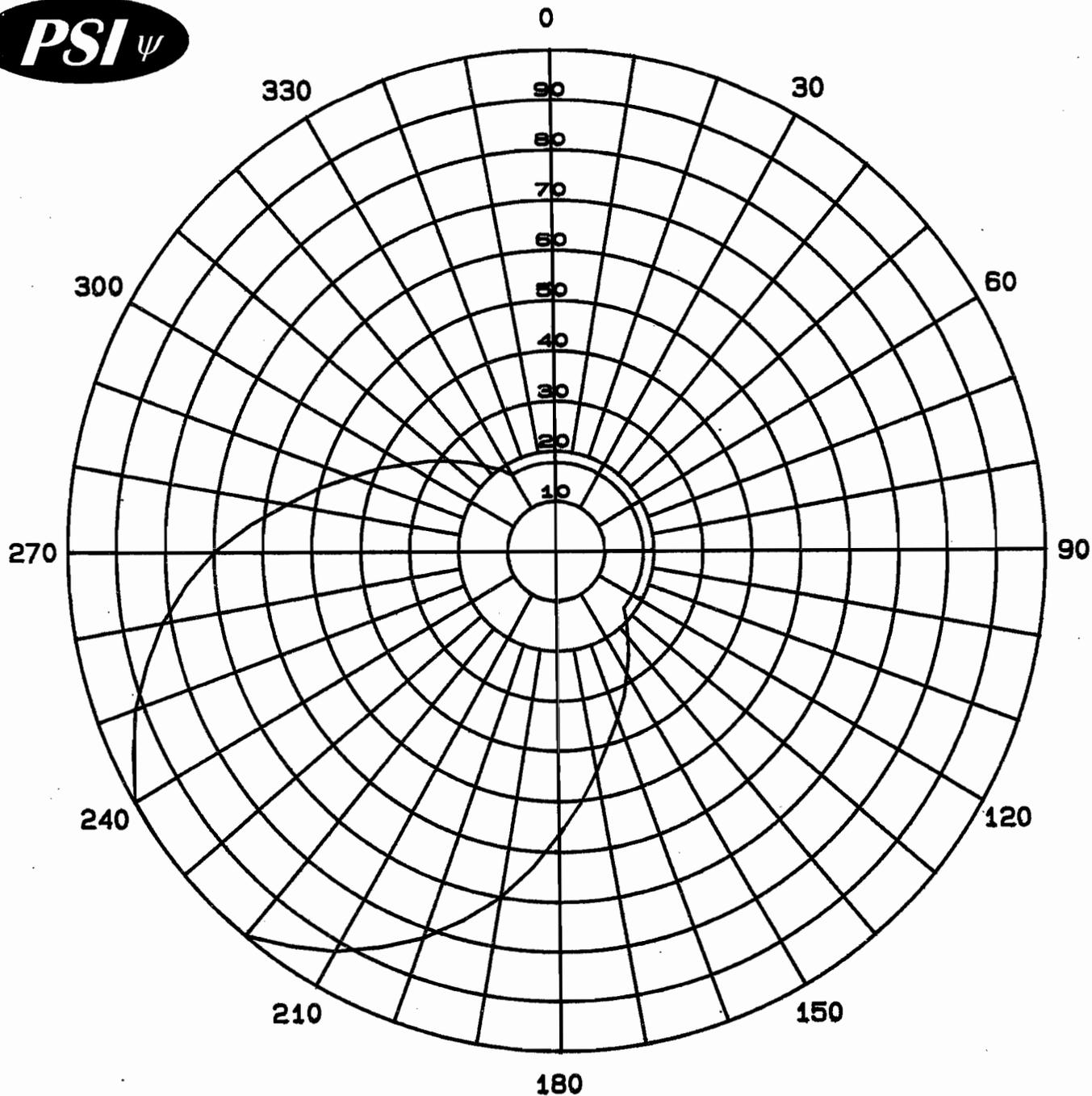
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Ebensburg, Pennsylvania USA 814-472-5540

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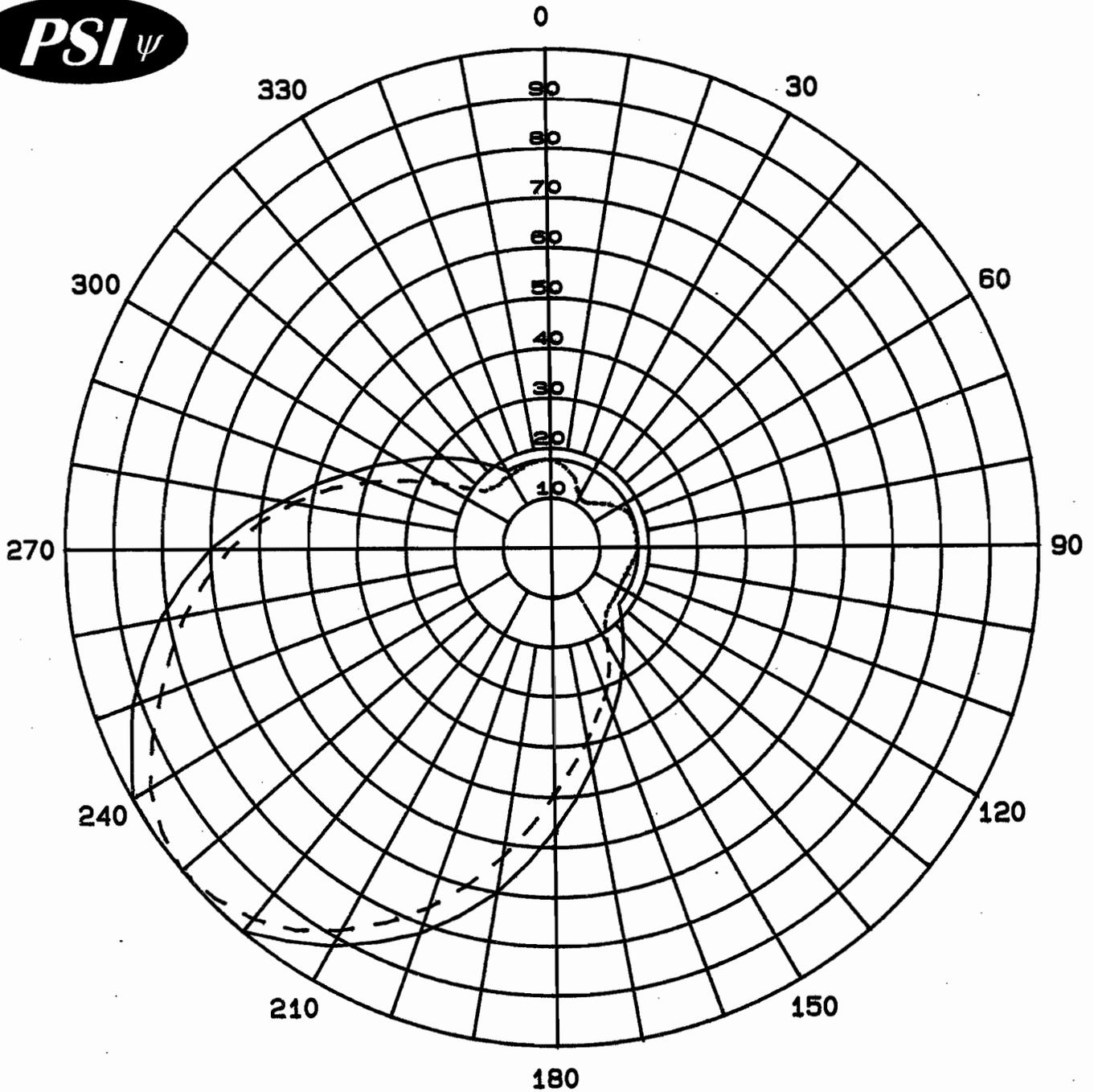
PLAN VIEW AND ORIENTATION			
MODEL:	PSIFHV-2C-DA	DRAWN BY:	D.G. Kellar
CHANNEL/ FREQUENCY:	91.1 MHz	APPROVED BY:	
SCALE:	1:20	DRAWING NO.:	J512FM-1087-002
		DATE:	6/28/12
		REV.	A

A



Maximum Envelope
Azimuth Plane Pattern
Antenna: PSIFHV-2C-DA
Type: 2-Bay Directional FM Antenna
ERP: 73.5 kW (18.66 dBk)
RMS Envelope: .502
Frequency: 91.1 MHz
WUJC St. Marks, FL

Propagation Systems Inc.
PO Box 113
Ebensburg, PA 15931



Maximum Envelope and
Measured Pattern
Antenna: PSIFHV-2C-DA
Type: 2-Bay Directional FM Antenna
ERP: 73.5 kW (18.66 dBk)
RMS Envelope: .502
RMS Measured: .469
Frequency: 91.1 MHz

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PO Box 113
Ebensburg, PA 15931

WUJC St. Marks, FL

Maximum Envelope Tabulation

Antenna: PSIFHV-2C-DA

Calvary Chapel of Twin Falls, Inc.

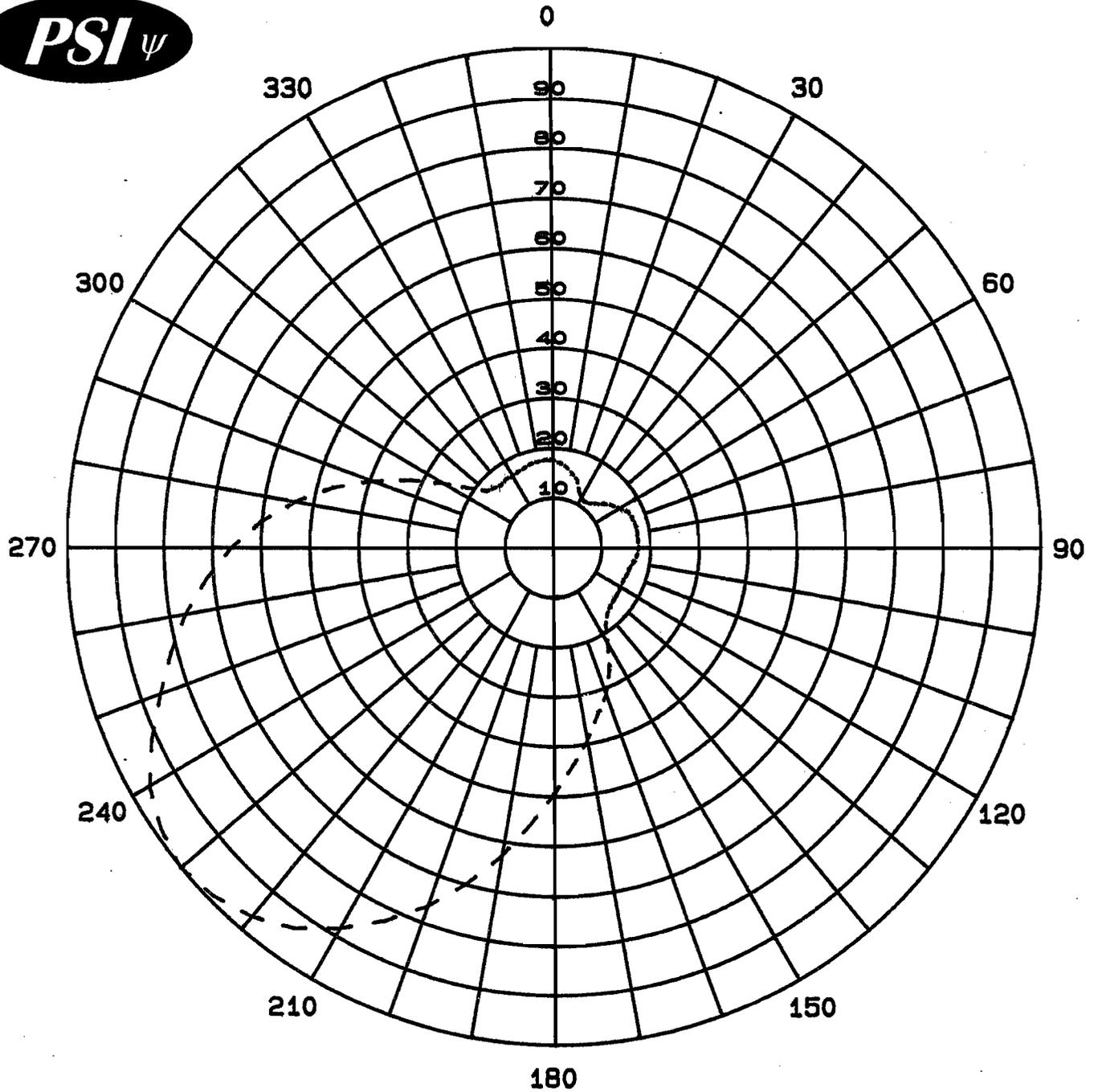
Station: WUJC

Frequency: 91.1 MHz

Location: St. Marks, FL

Maximum ERP: 73.5 kW (18.66 dBk)

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.178	2.33	3.67
10	0.178	2.33	3.67
20	0.178	2.33	3.67
30	0.178	2.33	3.67
40	0.178	2.33	3.67
50	0.178	2.33	3.67
60	0.178	2.33	3.67
70	0.178	2.33	3.67
80	0.178	2.33	3.67
90	0.178	2.33	3.67
100	0.178	2.33	3.67
110	0.178	2.33	3.67
120	0.178	2.33	3.67
130	0.178	2.33	3.67
140	0.224	3.69	5.67
150	0.283	5.89	7.70
160	0.356	9.32	9.69
170	0.448	14.75	11.69
180	0.564	23.38	13.69
190	0.700	36.02	15.56
200	0.820	49.42	16.94
210	0.920	62.21	17.94
220	1.000	73.50	18.66
230	1.000	73.50	18.66
240	1.000	73.50	18.66
250	0.920	62.21	17.94
260	0.820	49.42	16.94
270	0.700	36.02	15.56
280	0.556	22.72	13.56
290	0.442	14.36	11.57
300	0.350	9.00	9.54
310	0.283	5.89	7.70
320	0.224	3.69	5.67
330	0.178	2.33	3.67
340	0.178	2.33	3.67
350	0.178	2.33	3.67



Measured Relative Field
Azimuth Plane Pattern
Antenna: PSIFHV-2C-DA
Type: 2-Bay Directional FM Antenna
Gain V-pol (dash): 7.92 (8.99 dB)
RMS: .469
Frequency: 91.1 MHz
WUJC St. Marks, FL

Propagation Systems Inc.
PO Box 113
Ebensburg, PA 15931

Measured Relative Field Tabulation

Antenna: PSIFHV-2C-DA

Calvary Chapel of Twin Falls, Inc.

Station: WUJC

Frequency: 91.1 MHz

Location: St. Marks, FL

Vertical Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.177	0.25	-6.05
10	0.165	0.22	-6.66
20	0.146	0.17	-7.73
30	0.117	0.11	-9.65
40	0.117	0.11	-9.65
50	0.137	0.15	-8.28
60	0.159	0.20	-6.98
70	0.174	0.24	-6.20
80	0.177	0.25	-6.05
90	0.176	0.25	-6.10
100	0.168	0.22	-6.51
110	0.161	0.21	-6.88
120	0.160	0.20	-6.93
130	0.163	0.21	-6.77
140	0.172	0.23	-6.30
150	0.225	0.40	-3.97
160	0.315	0.79	-1.05
170	0.395	1.24	0.92
180	0.495	1.94	2.88
190	0.629	3.13	4.96
200	0.764	4.62	6.65
210	0.882	6.16	7.90
220	0.966	7.39	8.69
230	1.000	7.92	8.99
240	0.959	7.28	8.62
250	0.859	5.84	7.67
260	0.767	4.66	6.68
270	0.660	3.45	5.38
280	0.535	2.27	3.55
290	0.393	1.22	0.88
300	0.260	0.54	-2.71
310	0.177	0.25	-6.05
320	0.165	0.22	-6.66
330	0.166	0.22	-6.61
340	0.171	0.23	-6.35
350	0.176	0.25	-6.10

Maximum Value

Field 1.00

Gain 7.92 (8.99 dB)

Azimuth Bearing 228-231 degrees

Minimum Field

Field 0.114

Gain .103 (-9.87 dB)

Azimuth Bearing 36 degrees

ERP Tabulation

Antenna: PSIFHV-2C-DA

Calvary Chapel of Twin Falls, Inc.

Station: WUJC

Frequency: 91.1 MHz

Location: St. Marks, FL

Maximum ERP: 73.5 kW (18.66 dBk)

Vertical Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.177	2.30	3.62
10	0.165	2.00	3.01
20	0.146	1.57	1.95
30	0.117	1.01	0.03
40	0.117	1.01	0.03
50	0.137	1.38	1.40
60	0.159	1.86	2.69
70	0.174	2.23	3.47
80	0.177	2.30	3.62
90	0.176	2.28	3.57
100	0.168	2.07	3.17
110	0.161	1.91	2.80
120	0.160	1.88	2.75
130	0.163	1.95	2.91
140	0.172	2.17	3.37
150	0.225	3.72	5.71
160	0.315	7.29	8.63
170	0.395	11.47	10.59
180	0.495	18.01	12.55
190	0.629	29.08	14.64
200	0.764	42.90	16.32
210	0.882	57.18	17.57
220	0.966	68.59	18.36
230	1.000	73.50	18.66
240	0.959	67.60	18.30
250	0.859	54.23	17.34
260	0.767	43.24	16.36
270	0.660	32.02	15.05
280	0.535	21.04	13.23
290	0.393	11.35	10.55
300	0.260	4.97	6.96
310	0.177	2.30	3.62
320	0.165	2.00	3.01
330	0.166	2.03	3.07
340	0.171	2.15	3.32
350	0.176	2.28	3.57

Maximum Value (H-pol)

Field 1.00

ERP 73.5 kW (18.66 dBk)

Azimuth Bearing 228-231 degrees

Minimum Field (H-pol)

Field 0.114

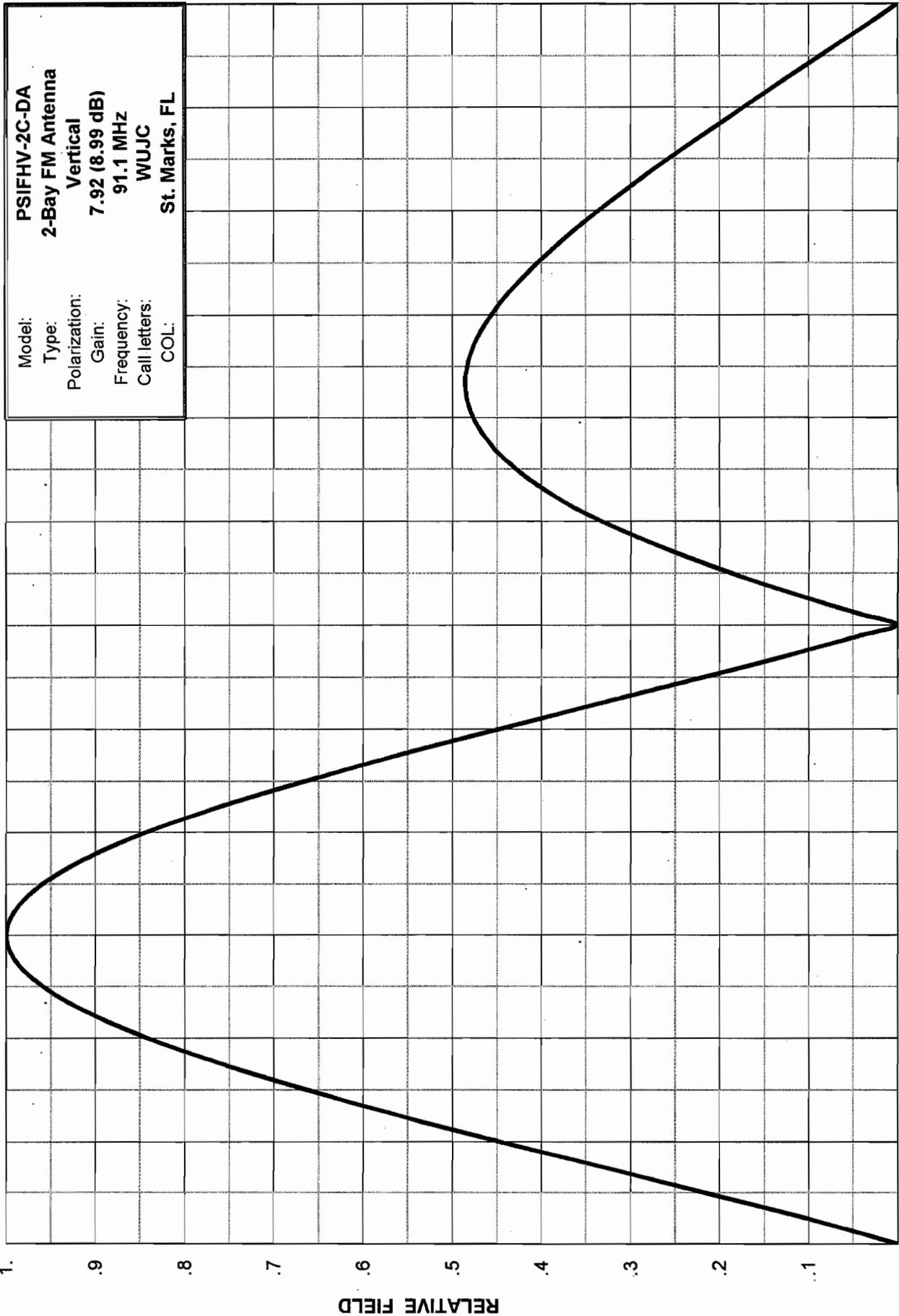
ERP .955 kW (-.199 dBk)

Azimuth Bearing 36 degrees



Propagation Systems, Inc.

Relative Field Elevation Pattern



Model:	PSIFHV-2C-DA
Type:	2-Bay FM Antenna
Polarization:	Vertical
Gain:	7.92 (8.99 dB)
Frequency:	91.1 MHz
Call letters:	WUJC
COL:	St. Marks, FL

DEGREES BELOW HORIZONTAL