



Propagation Systems, Inc.

Quality Broadcast Antenna Systems

**Directional FM Antenna
KJCC
Calvary Chapel of Twin Falls, Inc.
Carnegie, OK**

A standard model PSIFMR antenna with radomes and parasitic elements was used in conjunction with the customer's 36" 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 full-wave spaced and there is one horizontal parasitic element per bay. The antenna array is center fed from an existing 1-5/8" 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 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 268.5 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 91.5% of the envelope RMS.

The antenna is to be mounted 64 meters (210 ft.) above ground level on the northwest tower leg and positioned 330° True. At this elevation the antenna will be within the allowed +2m/-4m tolerance. No other antenna can be installed within 10 ft of any radiating element. Any guy wires that pass within 15 ft. of any radiating element must be replaced with a 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 7.253 kW will be necessary at the antenna input in order to reach the required 23.5 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

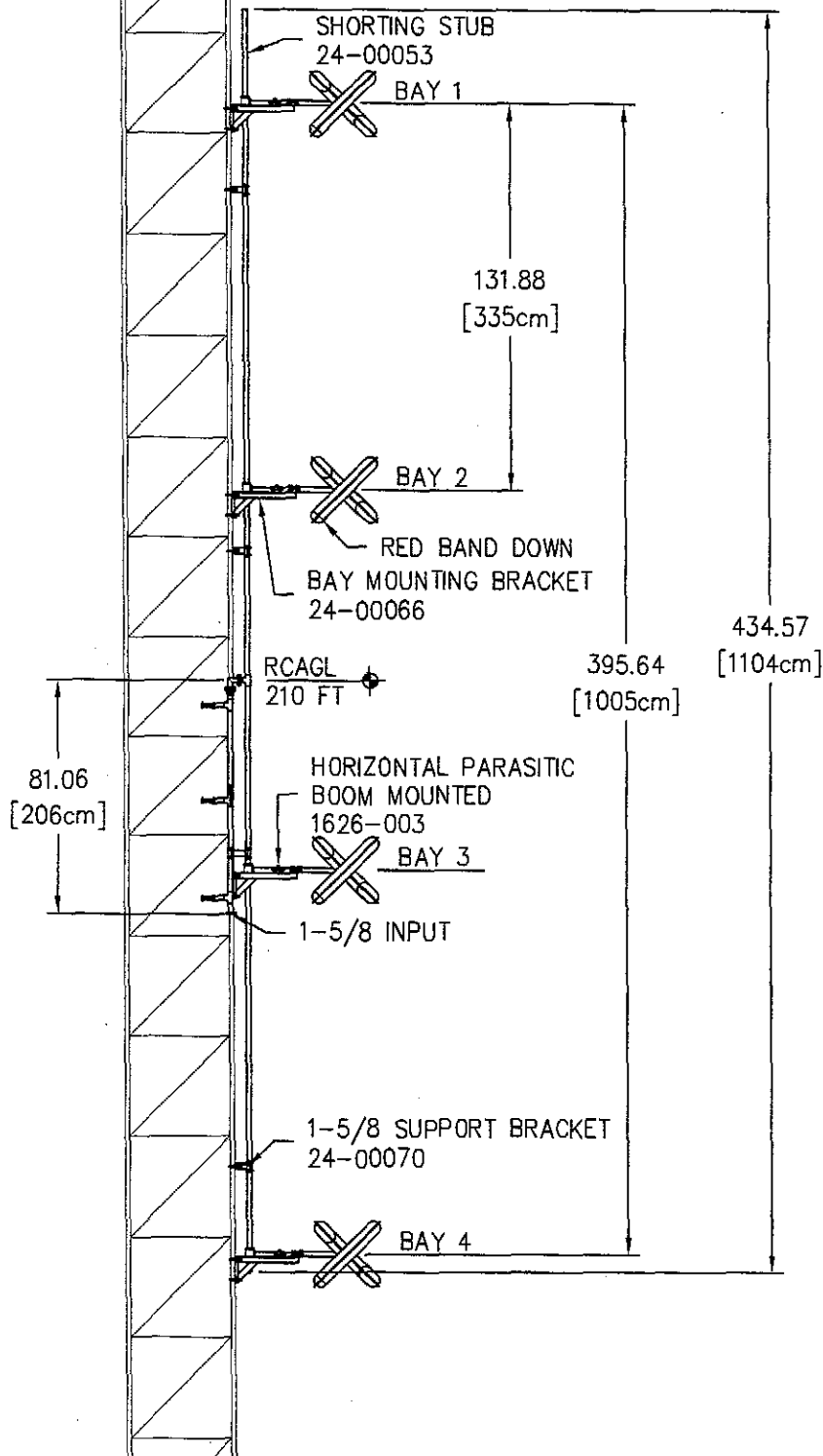
Antenna Model	PSIFMR-4C-R-DA
Type	4-bay directional FM antenna with radomes
Bay Spacing	Full-wave spaced elements
Frequency	89.5 MHz
Polarization	Circular
Envelope RMS	.867
Composite RMS	.794
Gain (h-pol)	3.24 (5.11 dB)
Gain (v-pol)	3.15 (4.98 dB)
ERP	23.5 kW
Antenna input power	7.253 kW
Input	1-5/8" EIA center fed input
Power rating	9 kW
Length	36.21 ft.
Weight	388 lbs.
Wind Area	24.8 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.

 2/24/2017

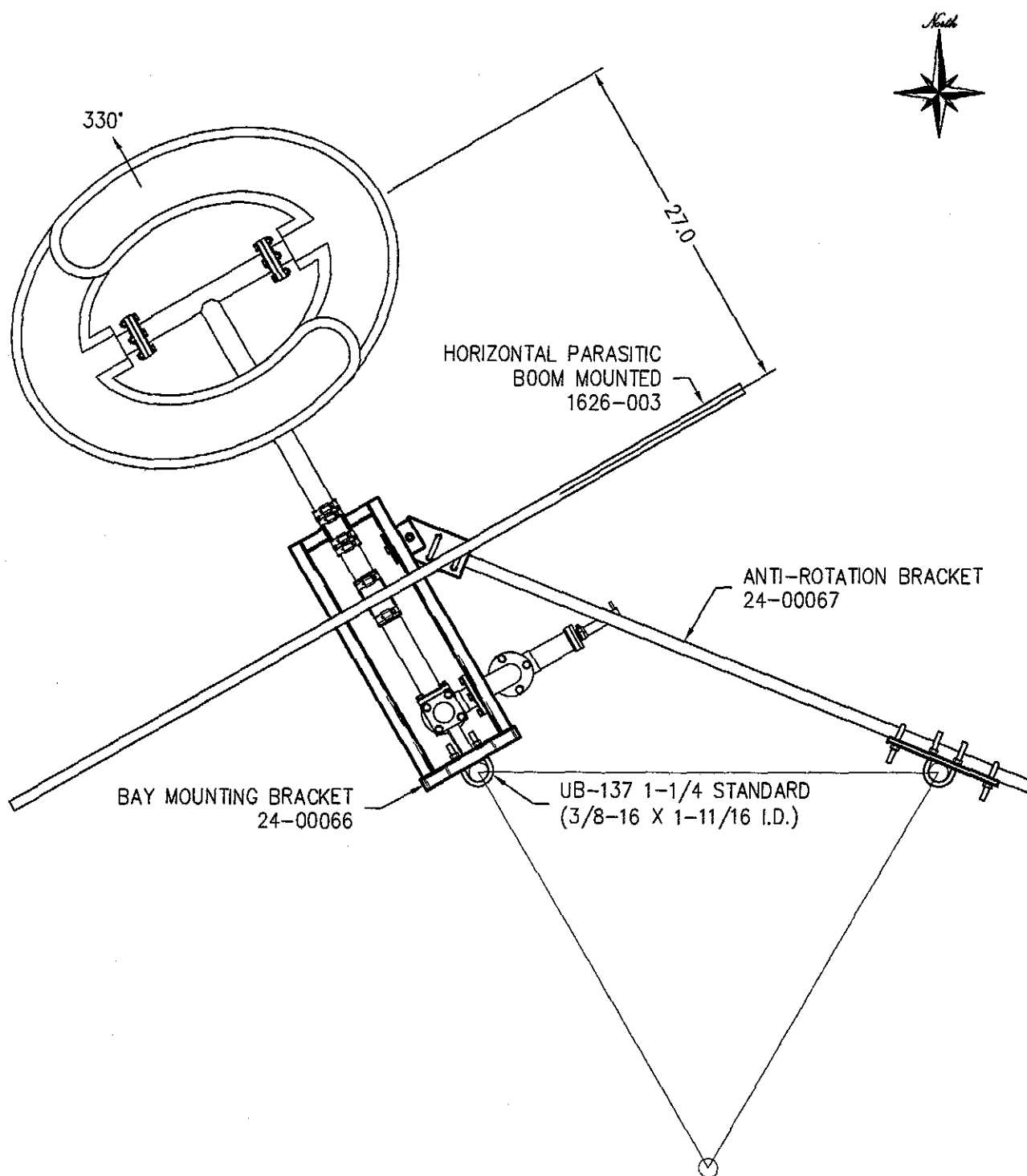
Douglas A. Ross
President
Propagation Systems Inc.



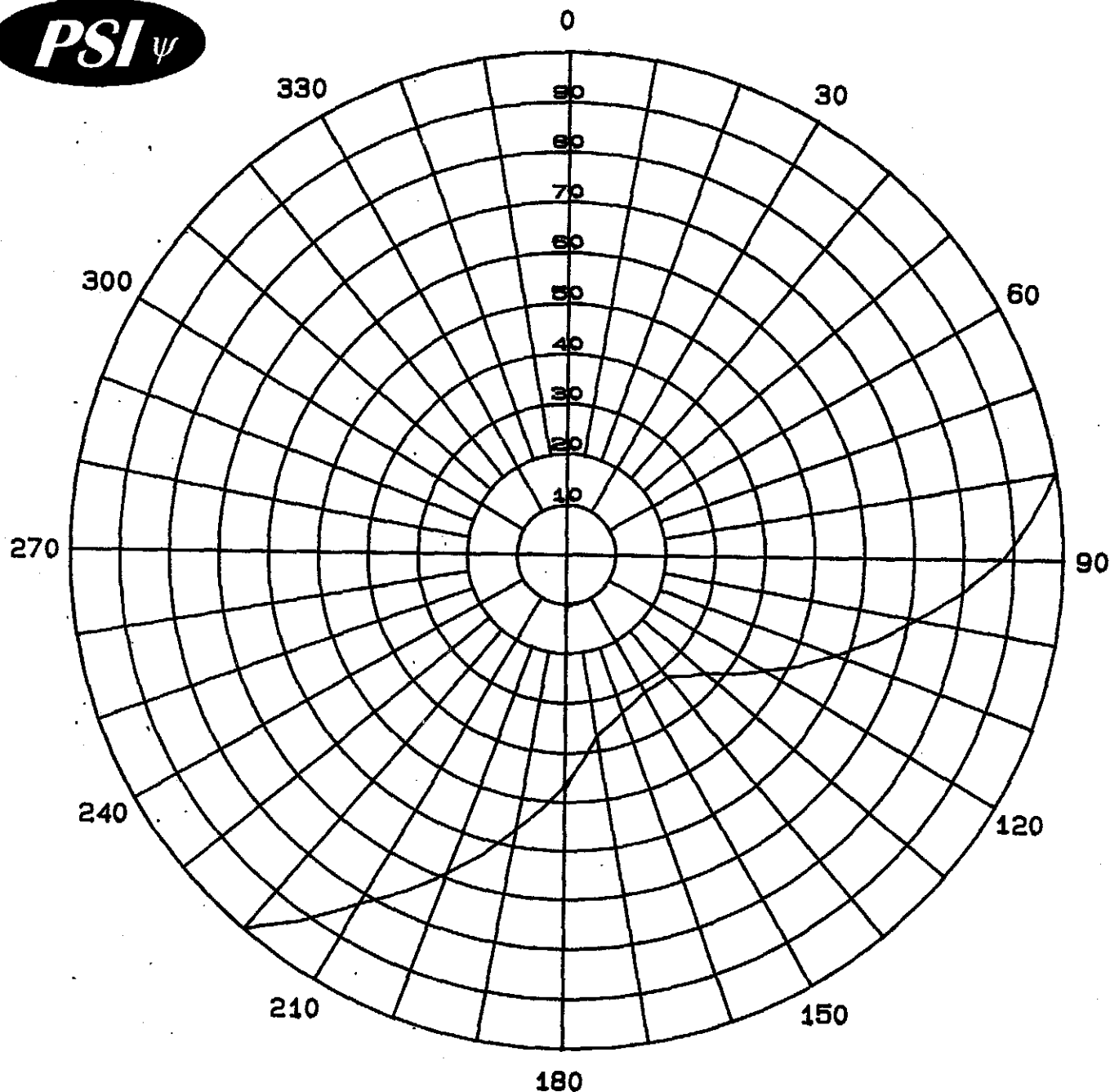
SPECIFICATIONS	
SPACING:	1.0λ
LENGTH:	36.21 FT [11.04m]
APERTURE:	32.97 FT [10.05m]
RATING:	9 kW
GAIN:	3.24 (5.11 dB)
WEIGHT:	388 LB [176 Kg]
WINDAREA:	24.8 FT ²
TIA-222-F (NO ICE)	

REV.	MADE BY CHECKED BY	DATE	CHANGE
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			SIZE A

PROPAGATION SYSTEMS, INC.			
Ebensburg, Pennsylvania USA 814-472-5540			
ANTENNA ELEVATION AND SPECIFICATIONS			
MODEL:	PSIFMR-4C-R-DA	DRAWN BY:	B.K.SCHILLING
CHANNEL/FREQUENCY:	89.5 MHz	APPROVED BY:	
SCALE:		DRAWING NO.:	1626-001
			DATE: 8/11/16
			REV.



				PROPAGATION SYSTEMS, INC.			
				Ebensburg, Pennsylvania USA 814-472-5540			
				ANTENNA ORIENTATION AND PLAN VIEW			
REV.	MADE BY CHECKED BY	DATE	CHANGE	MODEL: PSIFMR-4C-R-DA	DRAWN BY: B.K.SCHILLING	DATE: 8/11/16	
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.				CHANNEL/ FREQUENCY: 89.5 MHz	APPROVED BY:	DATE:	
				SCALE:	DRAWING NO.: 1626-002	REV.	



Maximum Envelope
Azimuth Plane Pattern
Antenna: PSIFMR-4C-R-DA
Type: 4-Bay Directional FM Antenna
ERP: 23.5 kW (13.71 dBk)
RMS Envelope: .867
Frequency: 89.5 MHz
KJCC Carnegie, OK

Propagation Systems Inc.
PO Box 113
Ebensburg, PA 15931

Maximum Envelope Tabulation

Antenna: PSIFMR-4C-R-DA

Calvary Chapel of Twin Falls, Inc.

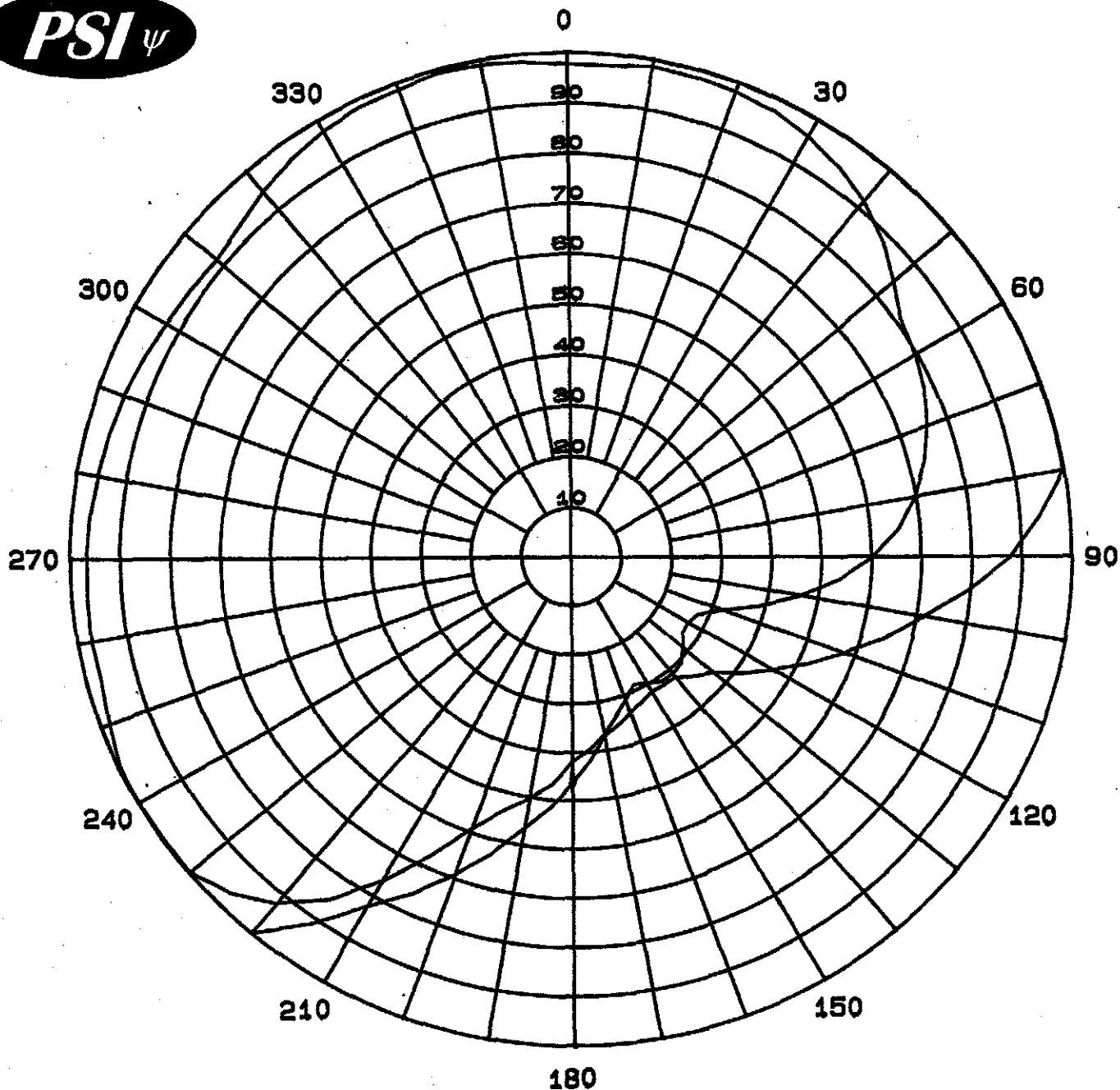
Station: KJCC

Frequency: 89.5 MHz

Location: Carnegie, OK

Maximum ERP: 23.5 kW (13.71 dBk)

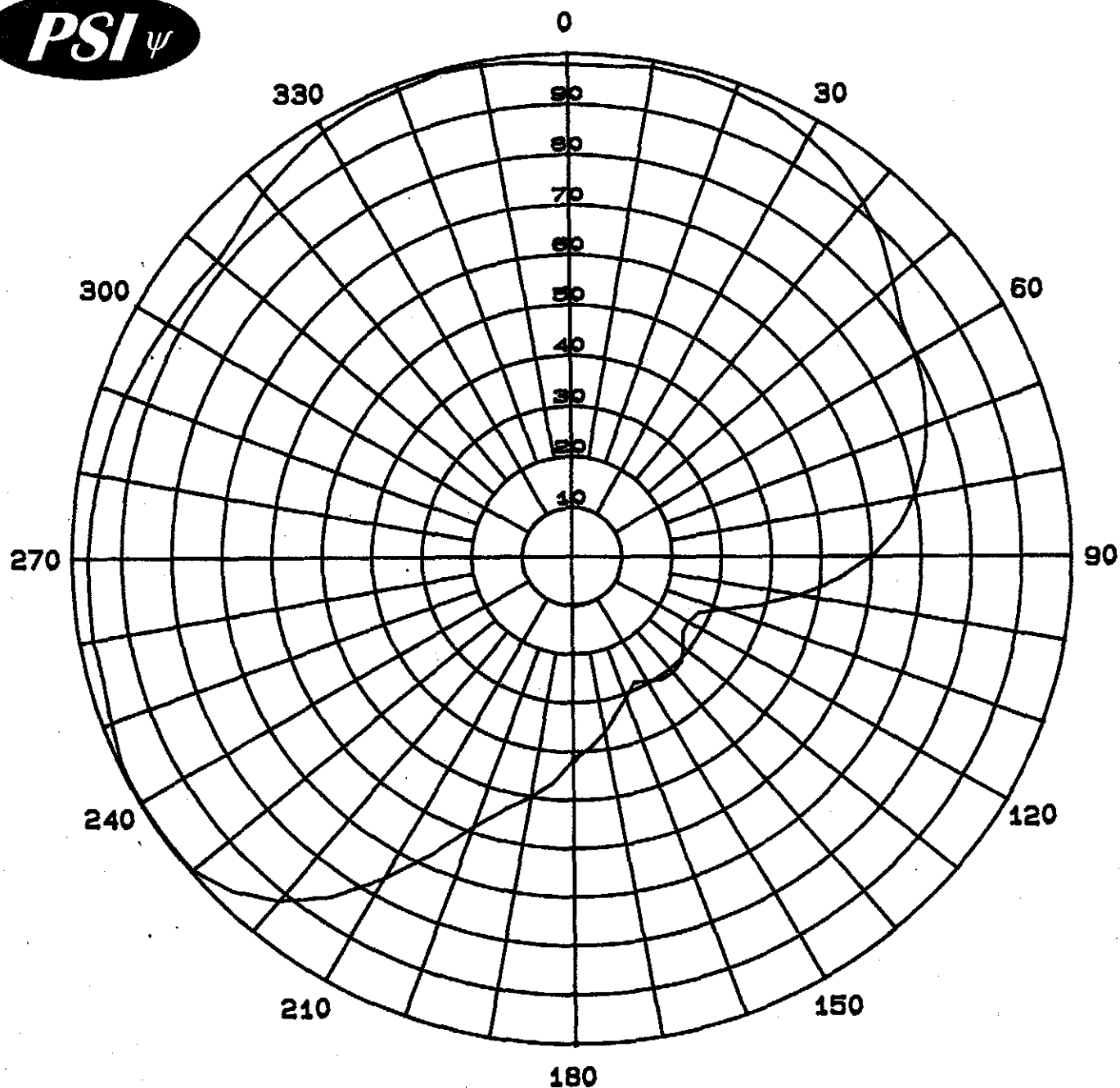
Angle	Relative Field	ERP (kW)	ERP (dBk)
0	1.000	23.50	13.71
10	1.000	23.50	13.71
20	1.000	23.50	13.71
30	1.000	23.50	13.71
40	1.000	23.50	13.71
50	1.000	23.50	13.71
60	1.000	23.50	13.71
70	1.000	23.50	13.71
80	1.000	23.50	13.71
90	0.879	18.16	12.59
100	0.715	12.01	10.80
110	0.577	7.82	8.93
120	0.461	4.99	6.98
130	0.367	3.17	5.00
140	0.320	2.41	3.81
150	0.318	2.38	3.76
160	0.338	2.68	4.29
170	0.370	3.22	5.07
180	0.466	5.10	7.08
190	0.566	7.53	8.77
200	0.691	11.22	10.50
210	0.823	15.92	12.02
220	1.000	23.50	13.71
230	1.000	23.50	13.71
240	1.000	23.50	13.71
250	1.000	23.50	13.71
260	1.000	23.50	13.71
270	1.000	23.50	13.71
280	1.000	23.50	13.71
290	1.000	23.50	13.71
300	1.000	23.50	13.71
310	1.000	23.50	13.71
320	1.000	23.50	13.71
330	1.000	23.50	13.71
340	1.000	23.50	13.71
350	1.000	23.50	13.71



Maximum Envelope and
Composite Pattern
Antenna: PSIFMR-4C-R-DA
Type: 4-Bay Directional FM Antenna
ERP: 23.5 kW (13.71 dBk)
RMS Envelope: .867
RMS Composite: .794
Frequency: 89.5 MHz

Propagation Systems Inc.
PO Box 113
Ebensburg, PA 15931

KJCC Carnegie, OK



Maximum Envelope and
Composite Pattern
Antenna: PSIFMR-4C-R-DA
Type: 4-Bay Directional FM Antenna
ERP: 23.5 kW (13.71 dBk)
RMS Envelope: .867
RMS Composite: .794
Frequency: 89.5 MHz

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KJCC Carnegie, OK

Composite Pattern Tabulation

Antenna: PSIFMR-4C-R-DA

Calvary Chapel of Twin Falls, Inc.

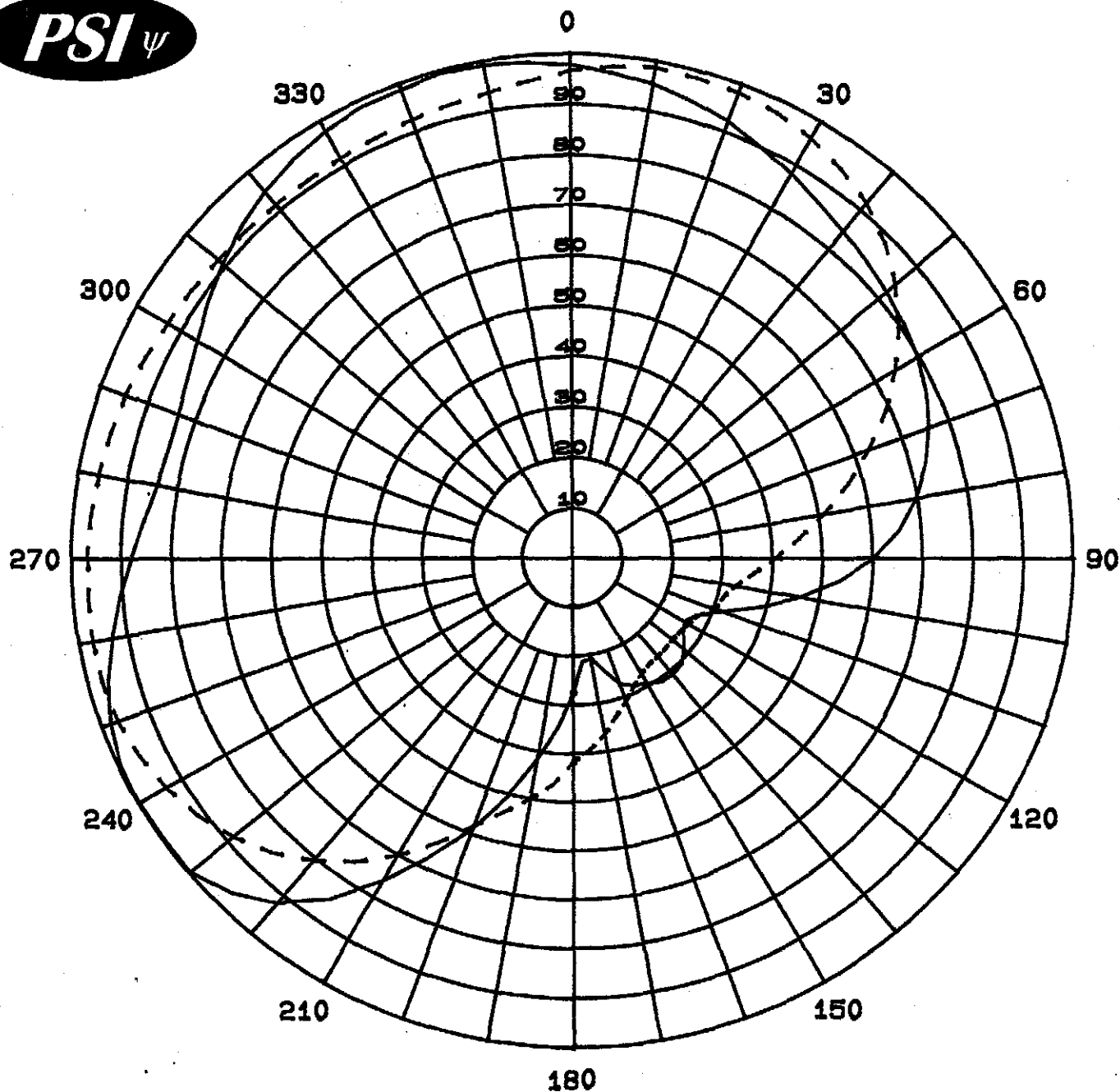
Station: KJCC

Frequency: 89.5 MHz

Location: Carnegie, OK

Maximum ERP: 23.5 kW (13.71 dBk)

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.977	22.43	13.51
10	0.986	22.85	13.59
20	0.981	22.62	13.54
30	0.961	21.70	13.37
40	0.917	19.76	12.96
50	0.844	16.74	12.24
60	0.797	14.93	11.74
70	0.758	13.50	11.30
80	0.698	11.45	10.59
90	0.602	8.52	9.30
100	0.463	5.04	7.02
110	0.321	2.42	3.84
120	0.269	1.70	2.31
130	0.288	1.95	2.90
140	0.311	2.27	3.57
150	0.297	2.07	3.17
160	0.310	2.26	3.54
170	0.366	3.15	4.98
180	0.418	4.11	6.13
190	0.502	5.92	7.72
200	0.590	8.18	9.13
210	0.762	13.65	11.35
220	0.921	19.93	13.00
230	0.998	23.41	13.69
240	1.000	23.50	13.71
250	0.983	22.71	13.56
260	0.973	22.25	13.47
270	0.968	22.02	13.43
280	0.959	21.61	13.35
290	0.947	21.08	13.24
300	0.930	20.33	13.08
310	0.919	19.85	12.98
320	0.949	21.16	13.26
330	0.977	22.43	13.51
340	0.987	22.89	13.60
350	0.991	23.08	13.63



Measured Relative Field
Azimuth Plane Pattern
Antenna: PSIFMR-4C-R-DA
Type: 4-Bay Directional FM Antenna
Gain H-pol (solid): 3.24 (5.11 dB)
Gain V-pol (dash): 3.15 (4.98 dB)
Frequency: 89.5 MHz
KJCC Carnegie, OK

Propagation Systems Inc.
PO Box 113
Ebensburg, PA 15931

Measured Relative Field Tabulation

Antenna: PSIFMR-4C-R-DA
Calvary Chapel of Twin Falls, Inc.
Station: KJCC
Frequency: 89.5 MHz
Location: Carnegie, OK

Horizontal Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.977	3.093	4.90
10	0.953	2.943	4.69
20	0.920	2.742	4.38
30	0.879	2.503	3.99
40	0.845	2.313	3.64
50	0.820	2.179	3.38
60	0.797	2.058	3.13
70	0.758	1.862	2.70
80	0.698	1.579	1.98
90	0.602	1.174	0.70
100	0.463	0.695	-1.58
110	0.321	0.334	-4.76
120	0.258	0.216	-6.66
130	0.288	0.269	-5.71
140	0.311	0.313	-5.04
150	0.297	0.286	-5.44
160	0.275	0.245	-6.11
170	0.209	0.142	-8.49
180	0.278	0.250	-6.01
190	0.420	0.572	-2.43
200	0.590	1.128	0.52
210	0.762	1.881	2.74
220	0.921	2.748	4.39
230	0.998	3.227	5.09
240	1.000	3.240	5.11
250	0.983	3.131	4.96
260	0.934	2.826	4.51
270	0.880	2.509	4.00
280	0.841	2.292	3.60
290	0.836	2.264	3.55
300	0.863	2.413	3.83
310	0.908	2.671	4.27
320	0.949	2.918	4.65
330	0.977	3.093	4.90
340	0.987	3.156	4.99
350	0.991	3.182	5.03

Maximum Value

Field 1.000
Gain 3.24 (5.11 dB)
Azimuth Bearing 240 degrees

Minimum Field

Field 0.209
Gain .142 (-8.49 dB)
Azimuth Bearing 170 degrees

Vertical Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.965	3.017	4.80
10	0.986	3.150	4.98
20	0.981	3.118	4.94
30	0.961	2.992	4.76
40	0.917	2.724	4.35
50	0.844	2.308	3.63
60	0.746	1.803	2.56
70	0.631	1.290	1.11
80	0.512	0.849	-0.71
90	0.406	0.534	-2.72
100	0.331	0.355	-4.50
110	0.305	0.301	-5.21
120	0.269	0.234	-6.30
130	0.259	0.217	-6.63
140	0.263	0.224	-6.50
150	0.273	0.241	-6.17
160	0.310	0.311	-5.07
170	0.366	0.434	-3.62
180	0.418	0.566	-2.47
190	0.502	0.816	-0.88
200	0.584	1.105	0.43
210	0.703	1.601	2.04
220	0.808	2.115	3.25
230	0.886	2.543	4.05
240	0.937	2.845	4.54
250	0.966	3.023	4.80
260	0.973	3.067	4.87
270	0.968	3.036	4.82
280	0.959	2.980	4.74
290	0.947	2.906	4.63
300	0.930	2.802	4.48
310	0.919	2.736	4.37
320	0.914	2.707	4.32
330	0.916	2.719	4.34
340	0.924	2.766	4.42
350	0.936	2.839	4.53

Maximum Value

Field 0.986
Gain 3.150 (4.98 dB)
Azimuth Bearing 10 degrees

Minimum Field

Field 0.259
Gain .217 (-6.63 dB)
Azimuth Bearing 130 degrees

ERP Tabulation

Antenna: PSIFMR-4C-R-DA
 Calvary Chapel of Twin Falls, Inc.
 Station: KJCC
 Frequency: 89.5 MHz
 Location: Carnegie, OK
 Maximum ERP: 23.5 kW (13.71 dBk)

Horizontal Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.977	22.43	13.51
10	0.953	21.34	13.29
20	0.920	19.89	12.99
30	0.879	18.16	12.59
40	0.845	16.78	12.25
50	0.820	15.80	11.99
60	0.797	14.93	11.74
70	0.758	13.50	11.30
80	0.698	11.45	10.59
90	0.602	8.52	9.30
100	0.463	5.04	7.02
110	0.321	2.42	3.84
120	0.258	1.56	1.94
130	0.288	1.95	2.90
140	0.311	2.27	3.57
150	0.297	2.07	3.17
160	0.275	1.78	2.50
170	0.209	1.03	0.11
180	0.278	1.82	2.59
190	0.420	4.15	6.18
200	0.590	8.18	9.13
210	0.762	13.65	11.35
220	0.921	19.93	13.00
230	0.998	23.41	13.69
240	1.000	23.50	13.71
250	0.983	22.71	13.56
260	0.934	20.50	13.12
270	0.880	18.20	12.60
280	0.841	16.62	12.21
290	0.836	16.42	12.15
300	0.863	17.50	12.43
310	0.908	19.37	12.87
320	0.949	21.16	13.26
330	0.977	22.43	13.51
340	0.987	22.89	13.60
350	0.991	23.08	13.63

Maximum Value (H-pol)

Field 1.000
 ERP 23.5 kW (13.71 dBk)
 Azimuth Bearing 240 degrees

Minimum Field (H-pol)

Field 0.209
 ERP 1.03 kW (1.11 dBk)
 Azimuth Bearing 170 degrees

Vertical Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.965	21.88	13.40
10	0.986	22.85	13.59
20	0.981	22.62	13.54
30	0.961	21.70	13.37
40	0.917	19.76	12.96
50	0.844	16.74	12.24
60	0.746	13.08	11.17
70	0.631	9.36	9.71
80	0.512	6.16	7.90
90	0.406	3.87	5.88
100	0.331	2.57	4.11
110	0.305	2.19	3.40
120	0.269	1.70	2.31
130	0.259	1.58	1.98
140	0.263	1.63	2.11
150	0.273	1.75	2.43
160	0.310	2.26	3.54
170	0.366	3.15	4.98
180	0.418	4.11	6.13
190	0.502	5.92	7.72
200	0.584	8.01	9.04
210	0.703	11.61	10.65
220	0.808	15.34	11.86
230	0.886	18.45	12.66
240	0.937	20.63	13.15
250	0.966	21.93	13.41
260	0.973	22.25	13.47
270	0.968	22.02	13.43
280	0.959	21.61	13.35
290	0.947	21.08	13.24
300	0.930	20.33	13.08
310	0.919	19.85	12.98
320	0.914	19.63	12.93
330	0.916	19.72	12.95
340	0.924	20.06	13.02
350	0.936	20.59	13.14

Maximum Value (V-pol)

Field 0.986
 ERP 22.85 kW (13.59 dBk)
 Azimuth Bearing 10 degrees

Minimum Field (V-pol)

Field 0.259
 ERP 1.58 kW (1.98 dBk)
 Azimuth Bearing 130 degrees



Relative Field Elevation Pattern
Model: PSIFMR-4C-R-DA
Type: Directional FM Antenna
Polarization: Circular
Bay Spacing: Full-wave
Gain: 3.24 (5.11 dB)
Station: KJCC

