



Propagation Systems, Inc.

Quality Broadcast Antenna Systems

Directional FM Antenna

KVIR

Calvary Chapel of Twin Falls, Inc.

Bullhead City, AZ

An existing PSIFMV antenna element was used in conjunction with the customer's Rohn SSV triangular tower to create the necessary directional radiation pattern. The final antenna consists of four vertically polarized radiating elements each secured to the tower with a custom-mounting bracket and support mast. The antenna bays are half-wave spaced and are fed from a 1-5/8" rigid inter-bay connection. 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 269.7 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 87.1% of the envelope RMS.

The antenna is to be mounted with the center of radiation at 14 meters (46 ft.) above ground level on the southeast tower face. At this elevation the antenna will be within the allowed +2m/-4m tolerance allowed by the FCC. The antenna is to be positioned at 133° True when installed according to the enclosed instructions. It is recommended that a broadcast engineer be present to supervise the installation of the antenna and that he or she certifies the antenna has been installed according to the enclosed instructions.

An input power level of 3.93 kW will be required at the antenna input in order to reach the licensed 18.0 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

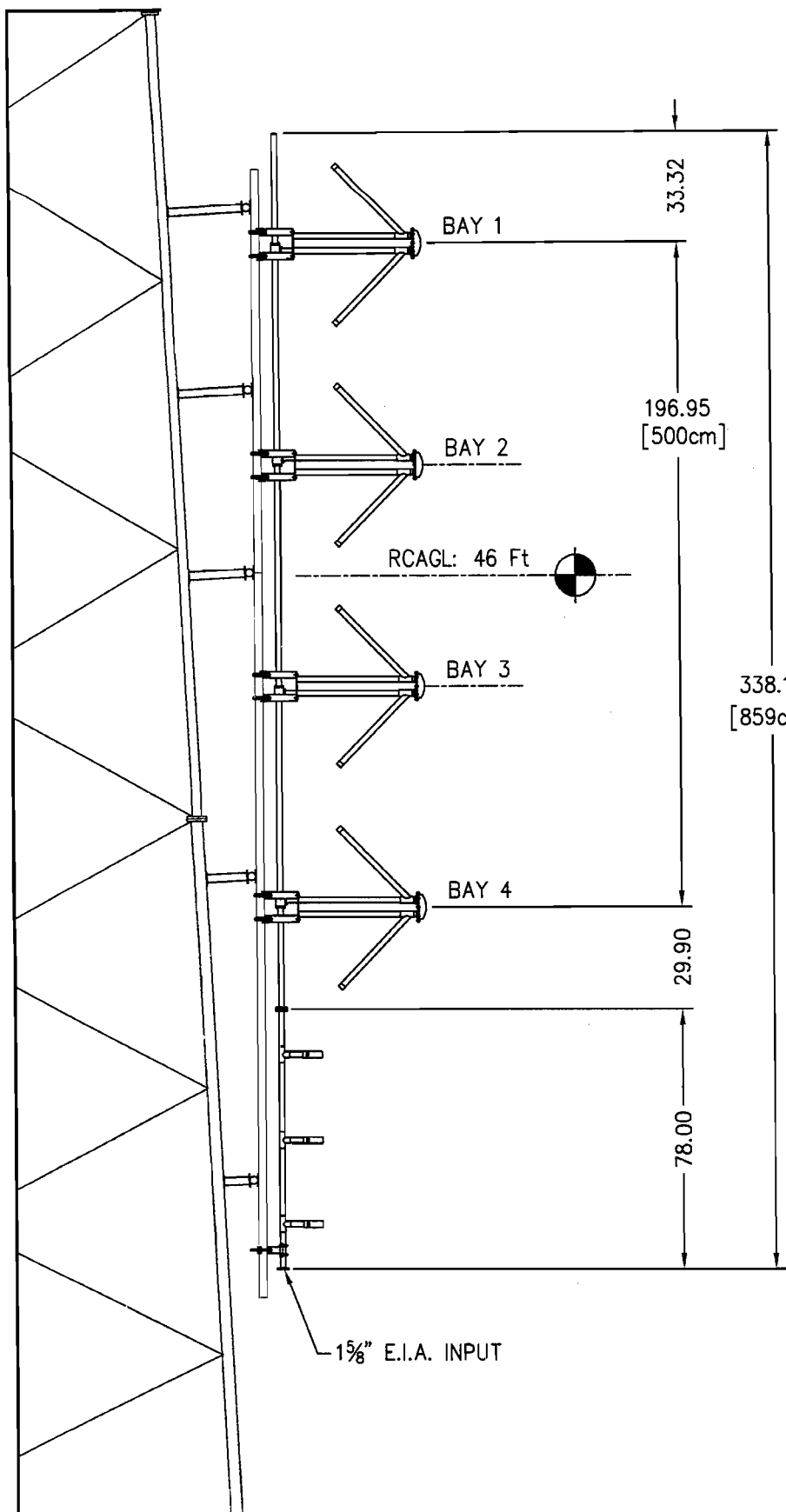
Antenna Model	PSIFMV-4-HWS-DA
Type	4-bay directional FM antenna
Bay Spacing	half wave spaced elements
Frequency	89.9 MHz
Polarization	Vertical
Envelope RMS	.824
Measured RMS	.718
Gain	4.58 (6.61 dB)
ERP	18.0 kW (12.55 dBk)
Input Power	3.93 kW
Input Type	1-5/8" EIA end fed
Power Rating	9 kW
Length	28.18 ft.
Weight	178 lbs.
Wind Area	14.98 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 station's construction permit.

 4/1/2014

Douglas A. Ross
President
Propagation Systems Inc.



SPECIFICATIONS	
SPACING:	0.5λ
LENGTH:	28.18 Ft [8.59m]
APERTURE:	16.41 Ft [5.0m]
RATING:	9 kW
GAIN:	4.58 (6.61 dB)
WEIGHT:	178.0 Lb [80.9 Kg]
WINDAREA:	14.98 Ft ² [1.39m ²]
TIA-222-F (NO ICE)	
NOTE:	

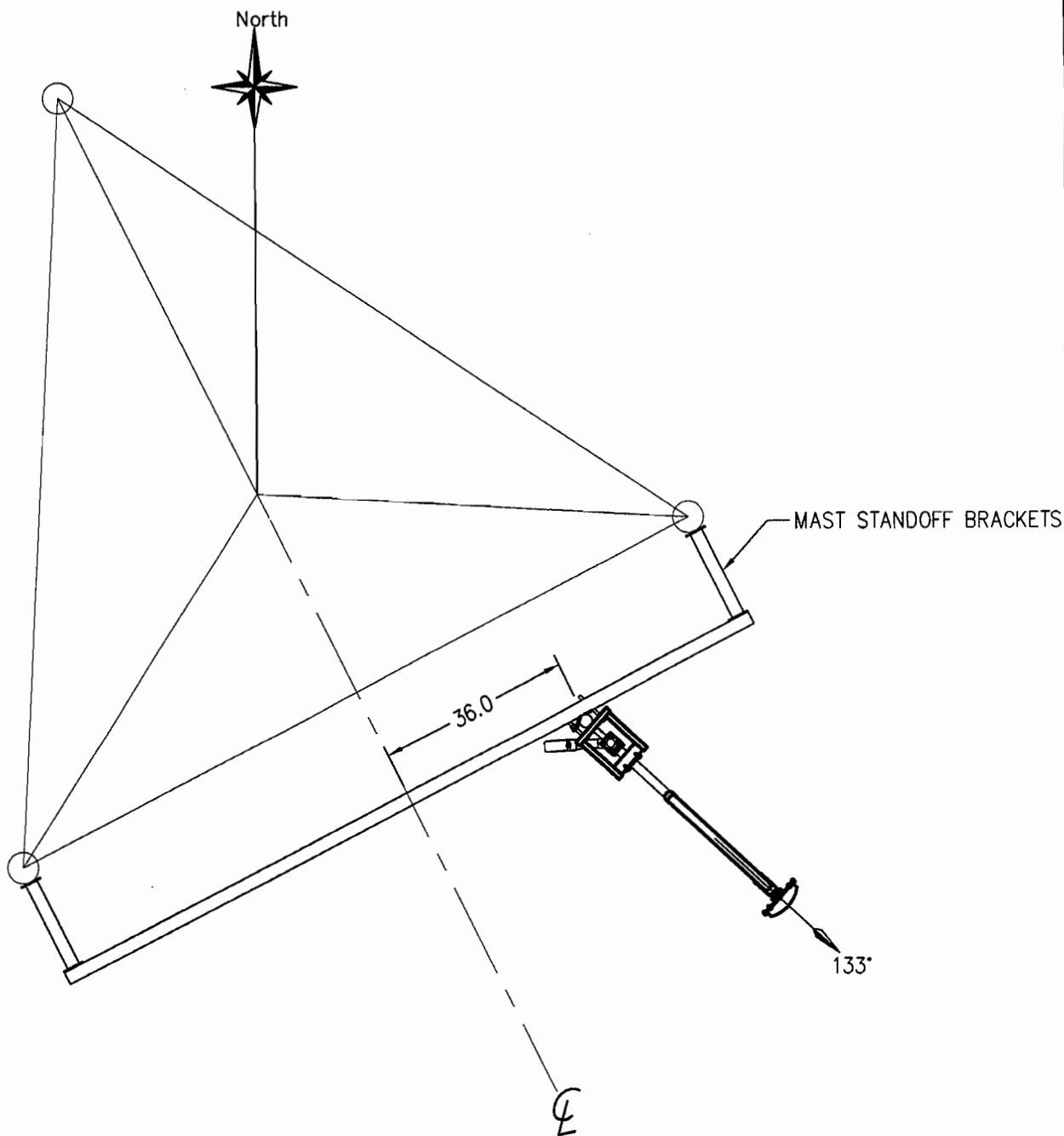
REV.	MADE BY	CHECKED BY	DATE	CHANGE
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				SIZE
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PROPAGATION SYSTEMS, INC.

Ebensburg, Pennsylvania USA 814-472-5540

ANTENNA ELEVATIONS AND SPECIFICATIONS

MODEL:	PSIFMV-4-HWS-DA	DRAWN BY:	B.K.SCHILLING	DATE:	3/31/14
CHANNEL/FREQUENCY:	89.9 MHz	APPROVED BY:		DATE:	
SCALE:	1:50	DRAWING NO.:	730-1-001	REV.	



REV.	MADE BY	DATE	CHANGE

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SIZE

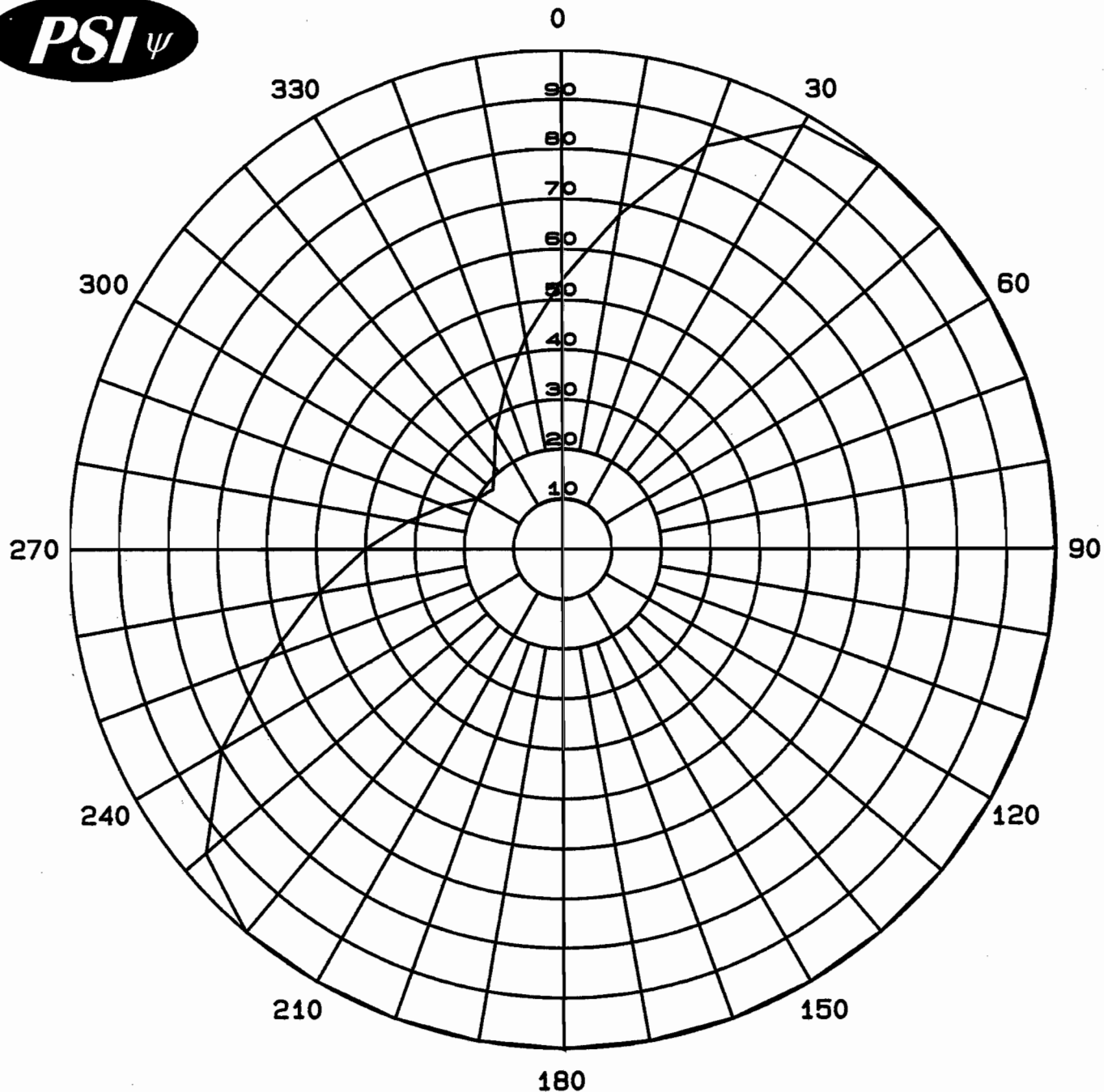
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Ebensburg, Pennsylvania USA 814-472-5540

ANTENNA PLAN VIEW AND ORIENTATION

MODEL: PSIFMV-4-HWS-DA	DRAWN BY: B.K.SCHILLING	DATE: 3/21/14
CHANNEL/FREQUENCY: 89.9 MHz	APPROVED BY:	DATE:
SCALE: 1:30	DRAWING NO.: 730-1-002	REV.



Maximum Envelope
Azimuth Plane Pattern
Antenna: PSIFMV-4-HWS-DA
Type: 4-Bay Directional FM Antenna
ERP: 18.0 kW (12.55 dBk)
RMS Envelope: .824
Frequency: 89.9 MHz
KVIR Bullhead City, AZ

Propagation Systems Inc.
PO Box 113
Ebensburg, PA 15931

Envelope Pattern

Antenna: PSIFMV-4-HWS-DA

Station: KVIR

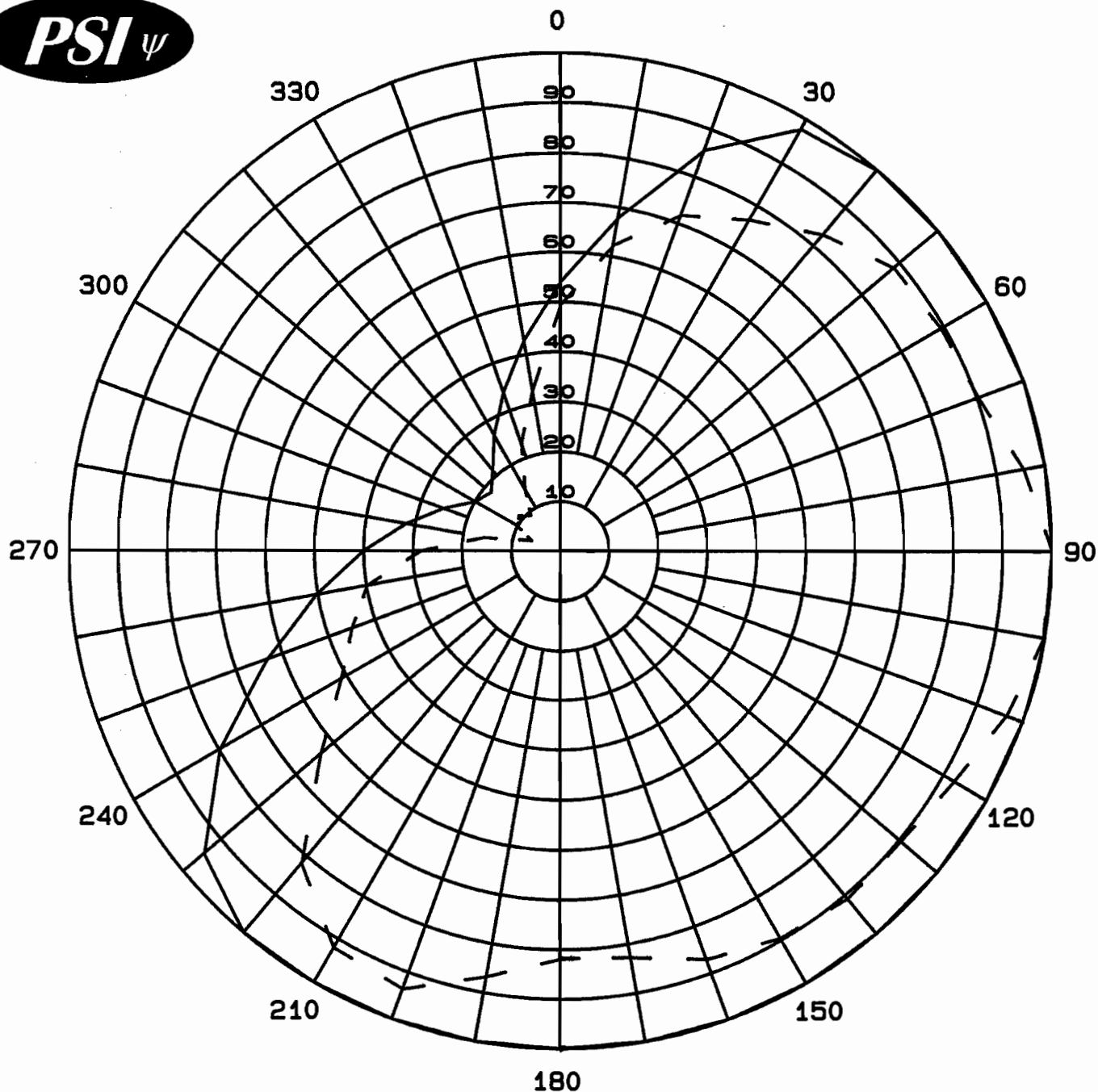
Frequency: 89.9 MHz

Location: Bullhead City, AZ

Maximum ERP: 18.0 kW (12.55 dBk)

Vertical Component

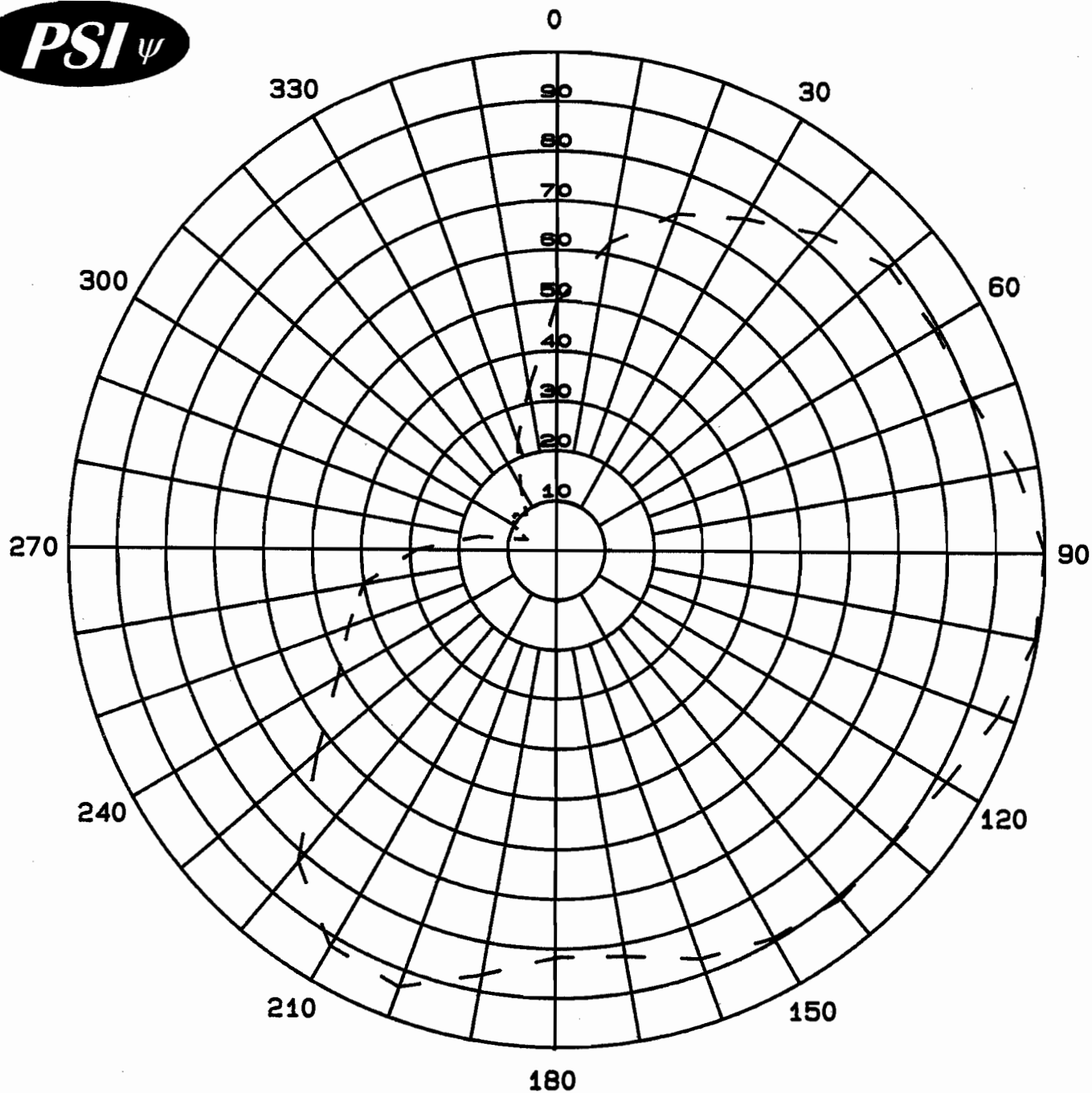
Angle	Relative Field	ERP kW	ERP dBk
0	0.541	5.27	7.22
10	0.680	8.32	9.20
20	0.857	13.22	11.21
30	0.978	17.22	12.36
40	1.000	18.00	12.55
50	1.000	18.00	12.55
60	1.000	18.00	12.55
70	1.000	18.00	12.55
80	1.000	18.00	12.55
90	1.000	18.00	12.55
100	1.000	18.00	12.55
110	1.000	18.00	12.55
120	1.000	18.00	12.55
130	1.000	18.00	12.55
140	1.000	18.00	12.55
150	1.000	18.00	12.55
160	1.000	18.00	12.55
170	1.000	18.00	12.55
180	1.000	18.00	12.55
190	1.000	18.00	12.55
200	1.000	18.00	12.55
210	1.000	18.00	12.55
220	1.000	18.00	12.55
230	0.946	16.11	12.07
240	0.800	11.52	10.61
250	0.635	7.26	8.61
260	0.505	4.59	6.62
270	0.401	2.89	4.62
280	0.319	1.83	2.63
290	0.253	1.15	0.62
300	0.201	0.73	-1.38
310	0.185	0.62	-2.10
320	0.216	0.84	-0.76
330	0.271	1.32	1.21
340	0.341	2.09	3.21
350	0.430	3.33	5.22



Maximum Envelope and
Measured Pattern
Antenna: PSIFMV-4-HWS-DA
Type: 4-Bay Directional FM Antenna
ERP: 18.0 kW (12.55 dBk)
RMS Envelope: .824
RMS Measured: .718
Frequency: 89.9 MHz

Propagation Systems Inc.
PO Box 113
Ebensburg, PA 15931

KVIR Bullhead City, AZ



Measured Relative Field
Azimuth Plane Pattern
Antenna: PSIFMV-4-HWS-DA
Type: 4-Bay Directional FM Antenna
Gain V-pol (dash): 4.58 (6.61 dB)
RMS: .718
Frequency: 89.9 MHz
KVIR Bullhead City, AZ

Propagation Systems Inc.
PO Box 113
Ebensburg, PA 15931

Measured Relative Field Tabulation

Antenna: PSIFMV-4-HWS-DA

Station: KVIR

Frequency: 89.9 MHz

Location: Bullhead City, AZ

Vertical Component Measured Relative Field

Angle	Relative Field	Power Gain	Gain dB
0	0.495	1.12	0.50
10	0.623	1.78	2.50
20	0.717	2.36	3.72
30	0.768	2.70	4.31
40	0.829	3.15	4.98
50	0.885	3.58	5.54
60	0.893	3.65	5.62
70	0.902	3.73	5.72
80	0.955	4.18	6.21
90	1.000	4.58	6.61
100	0.997	4.55	6.58
110	0.964	4.26	6.29
120	0.924	3.91	5.92
130	0.903	3.74	5.72
140	0.909	3.78	5.78
150	0.896	3.67	5.65
160	0.871	3.47	5.41
170	0.827	3.13	4.96
180	0.818	3.06	4.86
190	0.866	3.44	5.36
200	0.935	4.01	6.03
210	0.919	3.87	5.88
220	0.819	3.07	4.87
230	0.637	1.86	2.69
240	0.515	1.22	0.85
250	0.452	0.94	-0.28
260	0.400	0.73	-1.34
270	0.285	0.37	-4.29
280	0.159	0.12	-9.37
290	0.063	0.02	-17.38
300	0.102	0.05	-13.19
310	0.111	0.06	-12.47
320	0.095	0.04	-13.87
330	0.146	0.10	-10.13
340	0.234	0.25	-5.99
350	0.329	0.50	-3.04

Maximum Field (V-pol)

Field 1.00

Gain 4.58 (6.61 dB)

Azimuth Bearing 90 degrees

Minimum Field (V-pol)

Field 0.063

Gain .02 (-17.38 dB)

Azimuth Bearing 290 degrees

ERP Tabulation

Antenna: PSIFMV-4-HWS-DA

Station: KVIR

Frequency: 89.9 MHz

Location: Bullhead City, AZ

Maximum ERP: 18.0 kW (12.55 dBk)

Vertical Component

Angle	Relative Field	ERP kW	ERP dBk
0	0.495	4.41	6.44
10	0.623	6.99	8.44
20	0.717	9.27	9.67
30	0.768	10.61	10.26
40	0.829	12.38	10.93
50	0.885	14.09	11.49
60	0.893	14.35	11.57
70	0.902	14.66	11.66
80	0.955	16.43	12.16
90	1.000	18.00	12.55
100	0.997	17.90	12.53
110	0.964	16.73	12.24
120	0.924	15.38	11.87
130	0.903	14.68	11.67
140	0.909	14.86	11.72
150	0.896	14.44	11.60
160	0.871	13.65	11.35
170	0.827	12.31	10.90
180	0.818	12.03	10.80
190	0.866	13.51	11.31
200	0.935	15.75	11.97
210	0.919	15.21	11.82
220	0.819	12.07	10.82
230	0.637	7.31	8.64
240	0.515	4.78	6.80
250	0.452	3.68	5.66
260	0.400	2.89	4.60
270	0.285	1.46	1.65
280	0.159	0.45	-3.42
290	0.063	0.07	-11.44
300	0.102	0.19	-7.24
310	0.111	0.22	-6.52
320	0.095	0.16	-7.92
330	0.146	0.38	-4.18
340	0.234	0.99	-0.05
350	0.329	1.95	2.90

Maximum ERP (V-pol)

Field 1.00

ERP 18.0 kW (12.55 dBk)

Azimuth Bearing 90 degrees

Minimum ERP

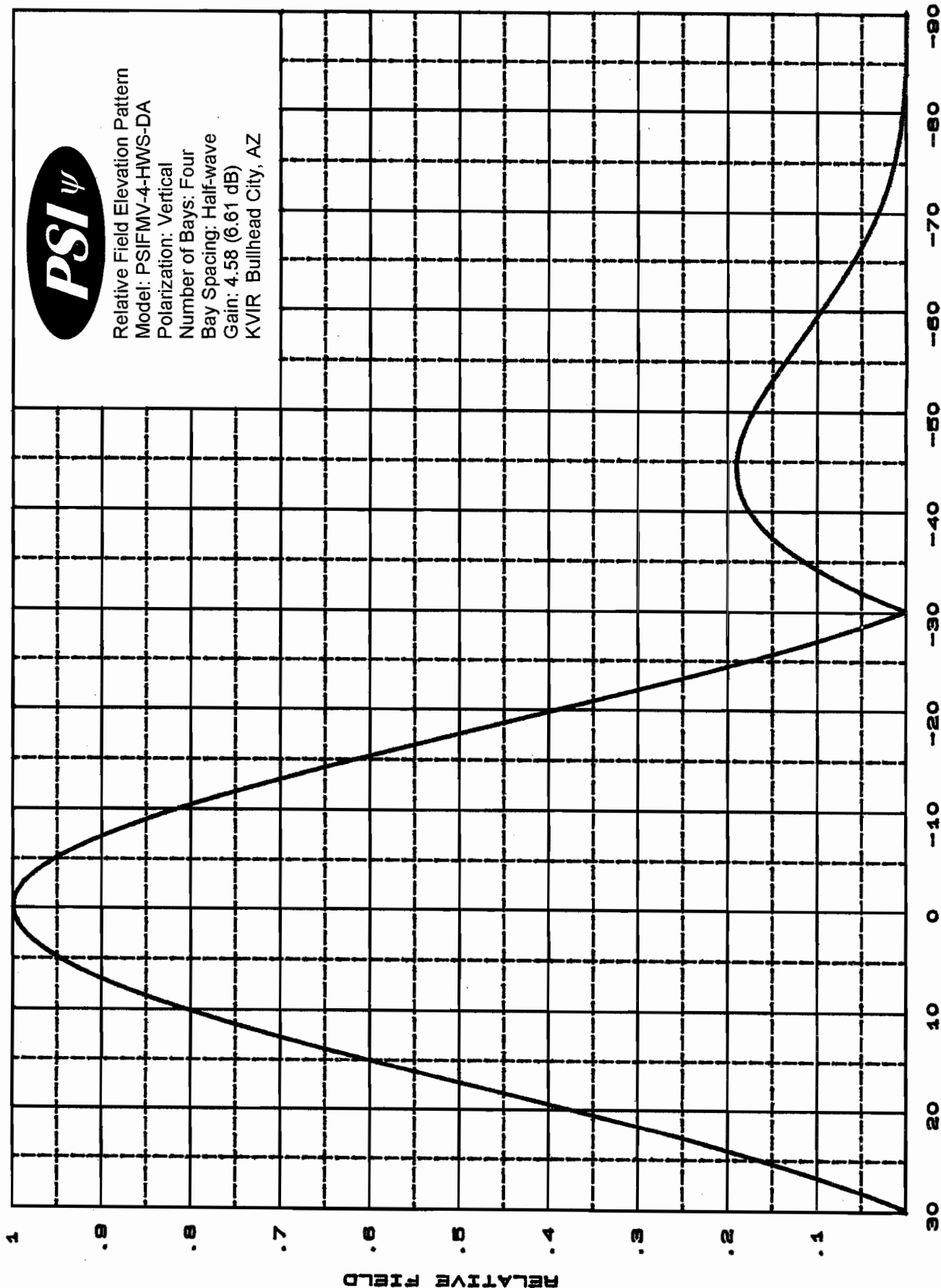
Field 0.063

ERP .07 kW (-11.44 dBk)

Azimuth Bearing 290 degrees



Relative Field Elevation Pattern
Model: PSIFMV-4-HWS-DA
Polarization: Vertical
Number of Bays: Four
Bay Spacing: Half-wave
Gain: 4.58 (6.61 dB)
KVIR Bullhead City, AZ



DEGREES BELOW HORIZONTAL