



# Propagation Systems, Inc.

Quality Broadcast Antenna Systems

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**Directional FM Antenna  
WEFT  
Prairie Air, Inc.  
Champaign, IL**

A standard model PSIFMR antenna with parasitic elements was used in conjunction with a model of the customer's 48" triangular tower to create the necessary directional radiation pattern. The final antenna consists of three radiating elements full wavelength spaced, custom mounting brackets, one horizontal and two vertical parasitic elements per bay. The antenna array is end fed. 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 were 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 270.3 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 85.7% of the envelope RMS.

The antenna is to be mounted 87.8 meters (288 ft.) above ground level which is within the allowed tolerance of the approved 88 meters. No other antenna can be installed within 10 ft of any radiating element. The antenna is to be mounted to the northwest tower face and positioned 300 degrees and certified by a licensed surveyor. It is recommended that a broadcast engineer is present to supervise the installation of the



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antenna and that he or she certifies the antenna has been installed according to the enclosed instructions.

An input power level of 3.65 kW will be required at the antenna input in order to reach the licensed 10.0 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.

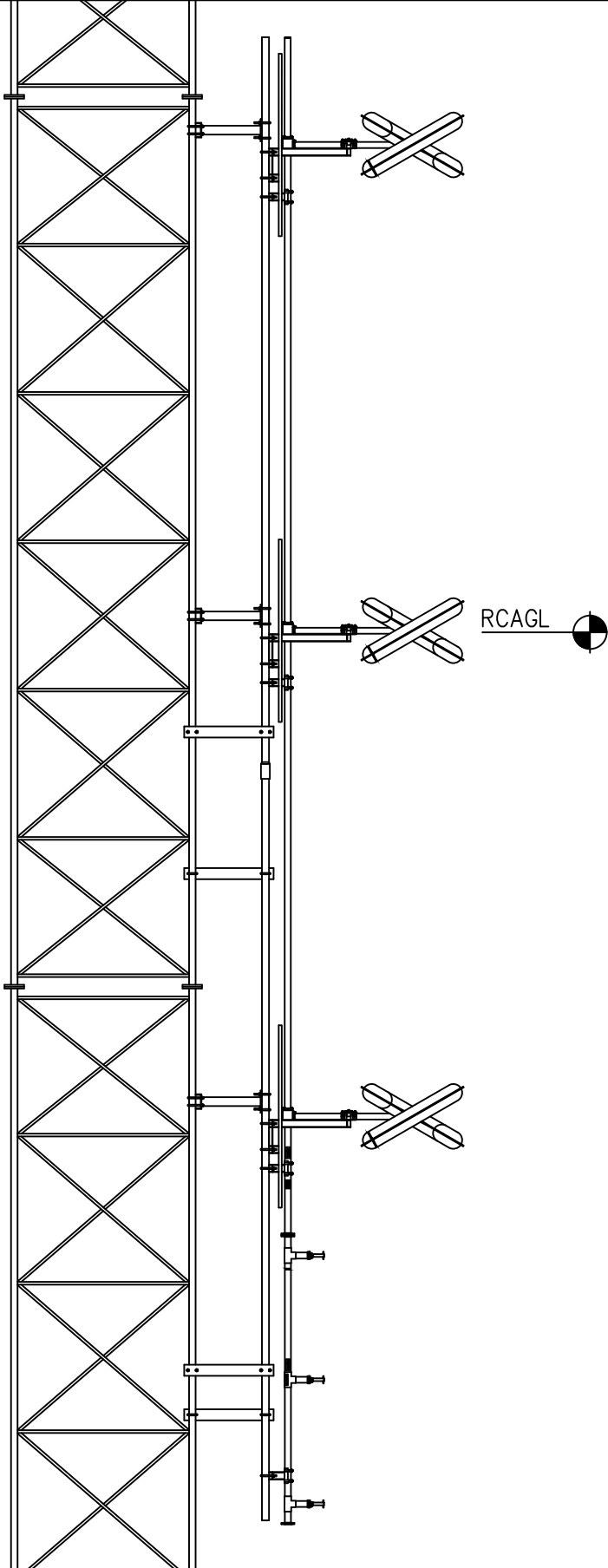
## Antenna Specifications

Antenna Model	PSIFMR-3E-R-DA
Type	3-bay directional FM antenna
Bay Spacing	Full wavelength spaced elements
Frequency	90.1 MHz
Polarization	Circular
Envelope RMS	.847
Composite RMS	.726
Gain (h-pol)	2.74 (4.38 dB)
Gain (v-pol)	2.74 (4.38 dB)
Input	1-5/8" EIA end fed input
Input power	3.65 kW
Power rating	9 kW
Length	33.42 ft.
Weight	508 lbs.
Wind Area	37.3 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.

Douglas A. Ross  
President  
Propagation Systems Inc.



SPECIFICATIONS	
SPACING:	$\lambda$
BAY SPACING ('S'):	131.00 IN (332.7cm)
APERTURE ('A'):	21.83 FT (6.7 M)
LENGTH ('L'):	33.42 FT (10.2 M)
RCAGL:	288 FT (87.8 M)
WEIGHT:	508 LB (230 Kg)
WIND AREA:	37.3 FT <sup>2</sup>
POWER RATING:	9 kW
GAIN:	2.74 (4.38 dB)
POLARIZATION:	CIRCULAR
NOTE: 1. WEIGHT AND WIND AREA ARE ESTIMATED. WIND AREA IN ACCORDANCE WITH TIA/EIA-222-F $\Sigma(CaAc)$	
2. TIE WRAP COAX. CABLE AT $\pm 16"$ O.C.	

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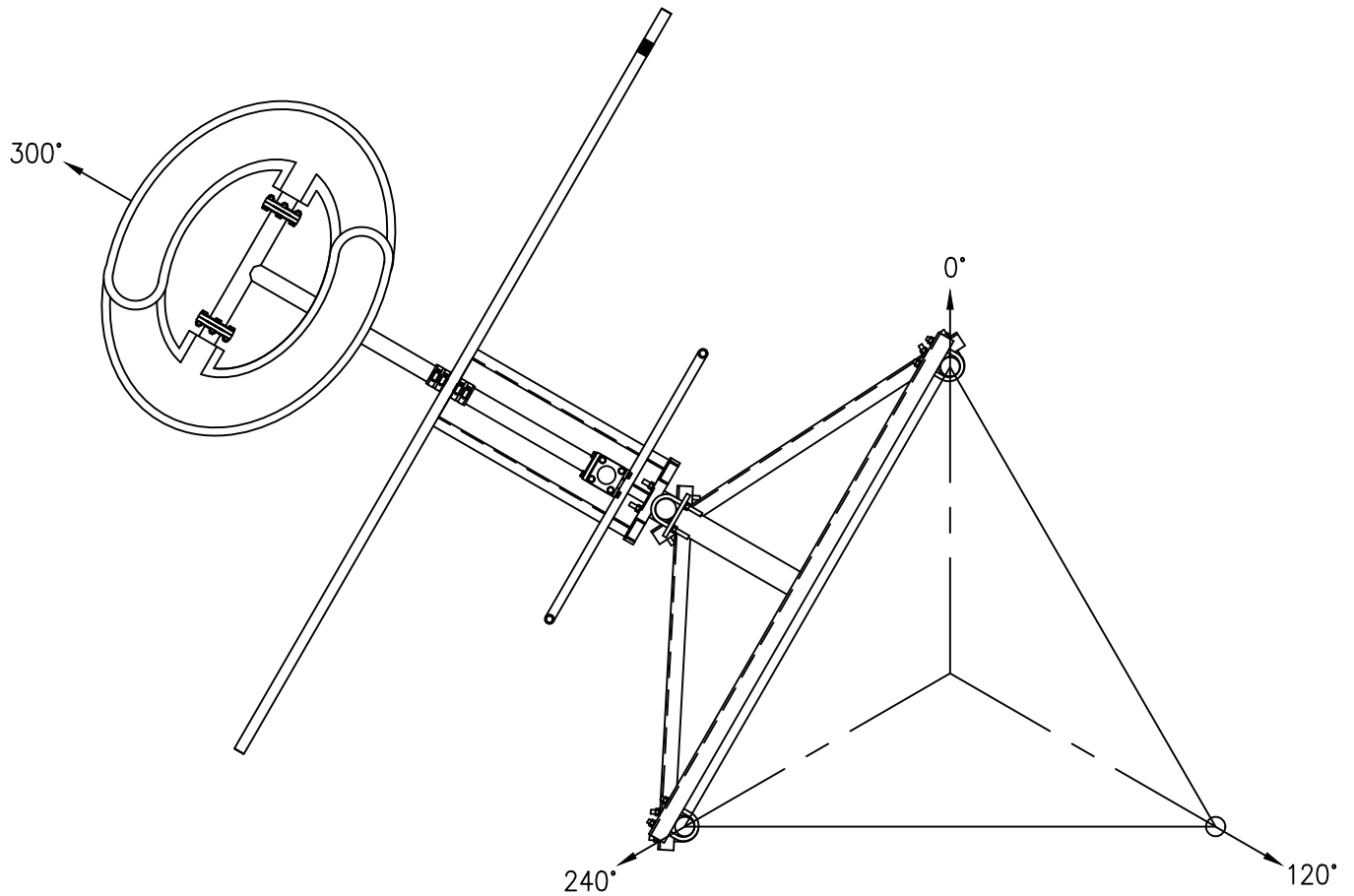
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## PROPAGATION SYSTEMS, INC.

Ebensburg, Pennsylvania USA 814-472-5540

### ANTENNA ELEVATION AND SPECIFICATIONS

MODEL:	PSIFMR-3E-R-DA	DRAWN BY:	M.MOCK	DATE:	09/10/19
CHANNEL/ FREQUENCY:	90.1 MHz	APPROVED BY:		DATE:	
SCALE:		DRAWING NO.:	2064-001	REV.	



REV.	MADE BY CHECKED BY	DATE	CHANGE

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SIZE

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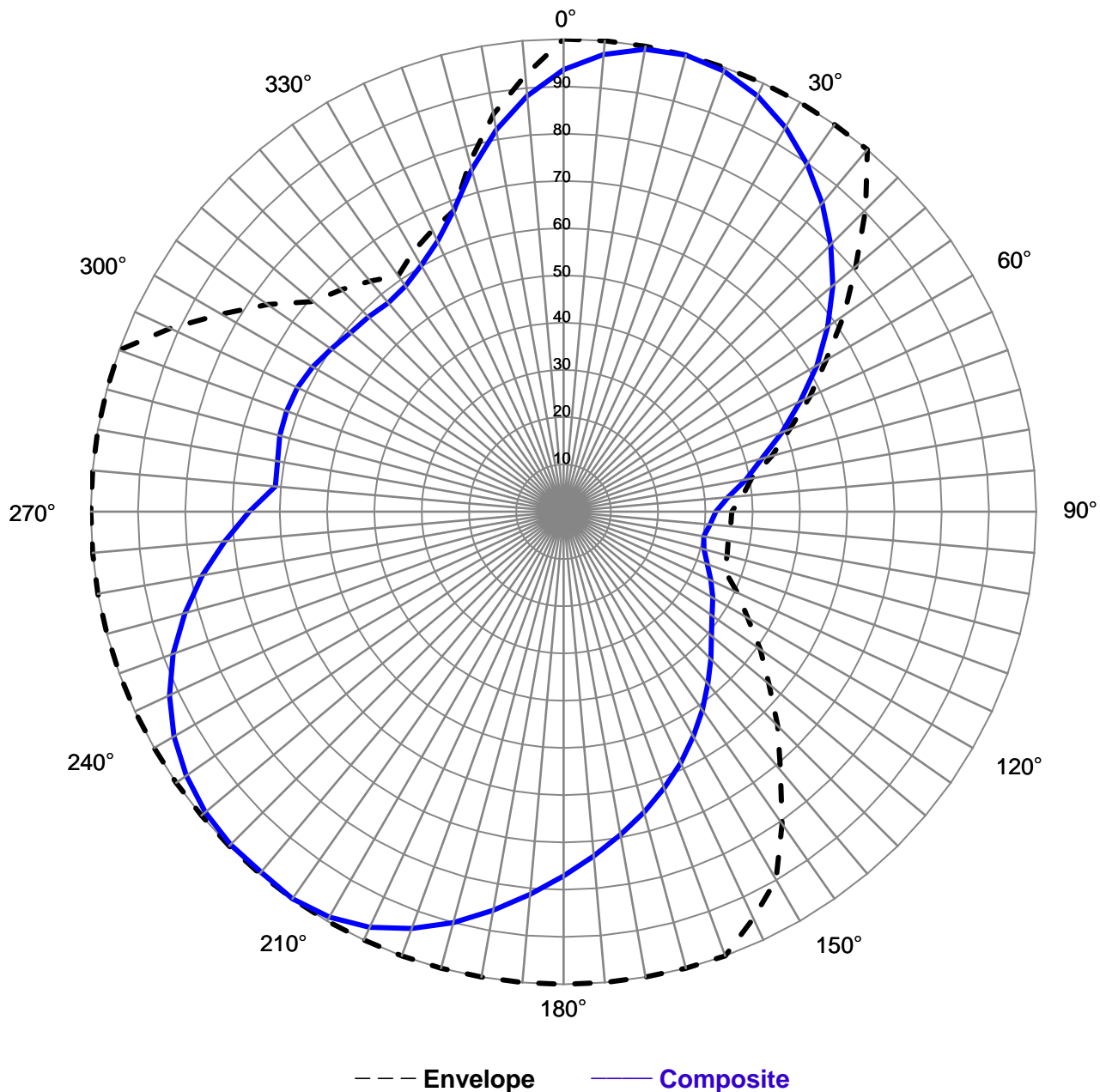
Ebensburg, Pennsylvania USA 814-472-5540

## ANTENNA ORIENTATION AND PLAN VIEW

MODEL: PSIFMR-3E-R-DA	DRAWN BY: M.MOCK	DATE: 09/10/19
CHANNEL/ FREQUENCY: 90.1 MHz	APPROVED BY:	DATE:
SCALE:	DRAWING NO.: 2064-002	REV.



## Relative Field Azimuth Plane Pattern



Pattern Type:	<b>Measured Composite</b>
Antenna Model:	<b>PSIFMR-3E-R-DA</b>
Polarization:	<b>Circular</b>
RMS (envelope)	<b>0.847</b>
RMS (composite)	<b>0.726</b>

Tower:	<b>Triangular 48" Face</b>
Orientation:	<b>300°</b>
Frequency:	<b>90.1 MHz</b>
Station:	<b>WEFT</b>
Date:	<b>10/30/2019</b>

## Maximum Envelope Tabulation

Antenna Model: PSIFMR-3E-R-DA

Prairie Air Inc.

Station: WEFT

Frequency: 90.1 MHz

Location: Champaign, IL

Maximum ERP: 10.0 kW

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	1.000	10.00	10.00
10	1.000	10.00	10.00
20	1.000	10.00	10.00
30	1.000	10.00	10.00
40	1.000	10.00	10.00
50	0.807	6.51	8.14
60	0.641	4.11	6.14
70	0.509	2.59	4.13
80	0.404	1.63	2.13
90	0.356	1.27	1.03
100	0.354	1.25	0.98
110	0.363	1.32	1.20
120	0.450	2.03	3.06
130	0.567	3.21	5.07
140	0.714	5.10	7.07
150	0.899	8.08	9.08
160	1.000	10.00	10.00
170	1.000	10.00	10.00
180	1.000	10.00	10.00
190	1.000	10.00	10.00
200	1.000	10.00	10.00
210	1.000	10.00	10.00
220	1.000	10.00	10.00
230	1.000	10.00	10.00
240	1.000	10.00	10.00
250	1.000	10.00	10.00
260	1.000	10.00	10.00
270	1.000	10.00	10.00
280	1.000	10.00	10.00
290	1.000	10.00	10.00
300	0.836	6.99	8.44
310	0.692	4.79	6.80
320	0.637	4.06	6.08
330	0.636	4.04	6.07
340	0.678	4.60	6.62
350	0.854	7.29	8.63

## Composite Pattern Tabulation

Antenna Model: PSIFMR-3E-R-DA

Prairie Air Inc.

Station: WEFT

Frequency: 90.1 MHz

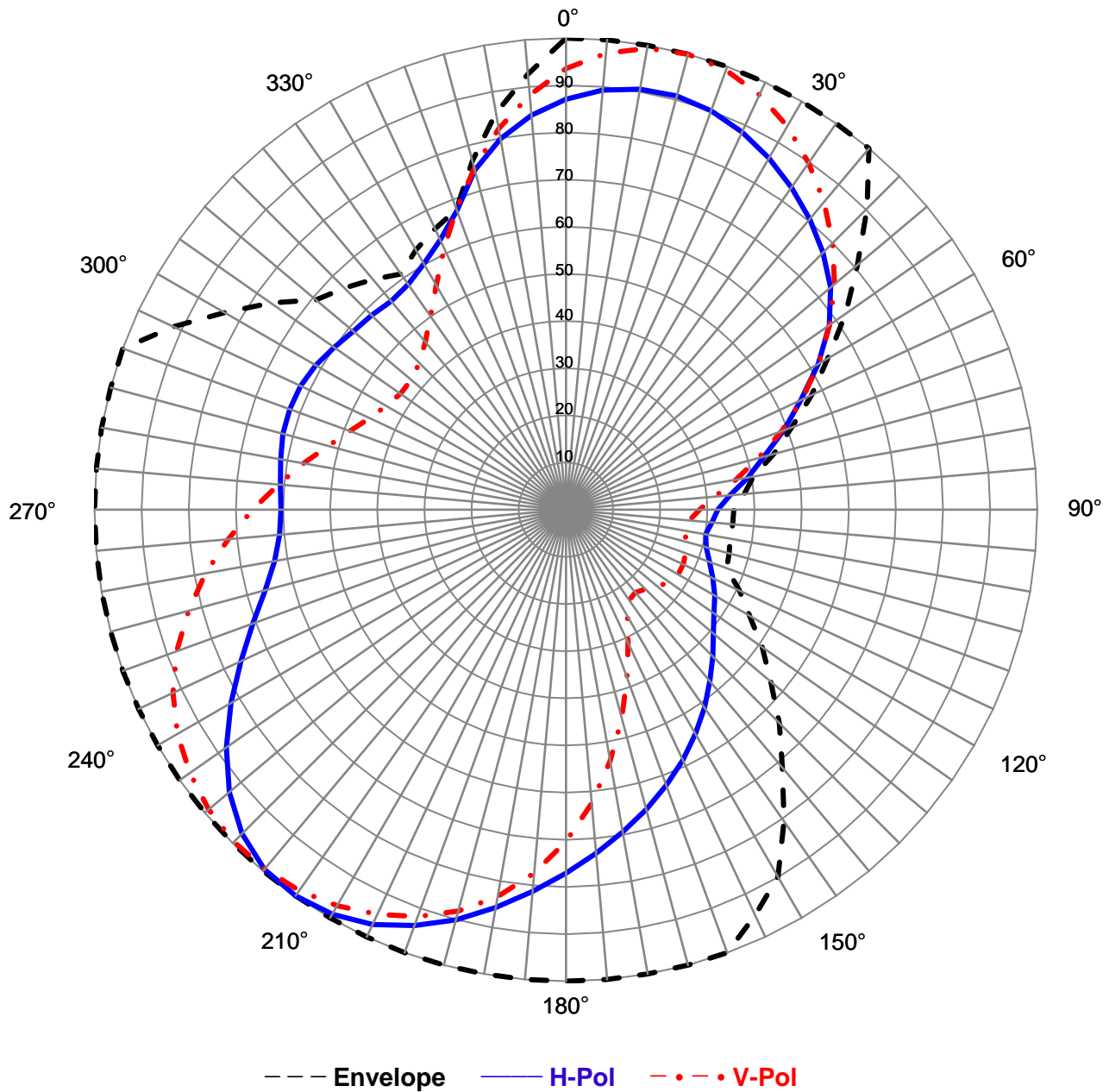
Location: Champaign, IL

Maximum ERP: 10.0 kW

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.935	8.75	9.42
10	0.994	9.87	9.94
20	0.992	9.84	9.93
30	0.939	8.82	9.45
40	0.852	7.25	8.61
50	0.744	5.53	7.43
60	0.619	3.83	5.84
70	0.492	2.42	3.84
80	0.392	1.54	1.87
90	0.322	1.04	0.16
100	0.301	0.91	-0.43
110	0.324	1.05	0.21
120	0.365	1.33	1.24
130	0.409	1.67	2.23
140	0.475	2.26	3.54
150	0.549	3.01	4.79
160	0.622	3.87	5.88
170	0.694	4.82	6.83
180	0.771	5.94	7.74
190	0.856	7.33	8.65
200	0.939	8.81	9.45
210	0.991	9.81	9.92
220	0.995	9.91	9.96
230	0.989	9.79	9.91
240	0.951	9.05	9.57
250	0.879	7.72	8.88
260	0.776	6.02	7.80
270	0.665	4.42	6.45
280	0.614	3.77	5.77
290	0.623	3.88	5.89
300	0.613	3.75	5.74
310	0.589	3.46	5.40
320	0.577	3.33	5.22
330	0.602	3.62	5.59
340	0.678	4.60	6.63
350	0.821	6.73	8.28



### Relative Field Azimuth Plane Pattern



Pattern Type:	<b>Measured Field</b>
Antenna Model:	<b>PSIFMR-3E-R-DA</b>
Polarization:	<b>Circular</b>
Gain (H-pol):	<b>2.74 (4.38 dB)</b>
Gain (V-pol):	<b>2.74 (4.38 dB)</b>

Tower:	<b>Triangular 48" Face</b>
Orientation:	<b>300°</b>
Configuration:	<b>90.1 MHz</b>
Station:	<b>WEFT</b>
Date:	<b>10/30/2019</b>



## Measured Relative Field Tabulation

Antenna Model: PSIFMR-3E-R-DA

Prairie Air Inc.

Station: WEFT

Frequency: 90.1 MHz

Location: Champaign, IL

### Horizontal Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.871	2.077	3.17
10	0.906	2.247	3.52
20	0.900	2.221	3.47
30	0.861	2.031	3.08
40	0.805	1.774	2.49
50	0.733	1.472	1.68
60	0.618	1.046	0.20
70	0.492	0.663	-1.78
80	0.392	0.421	-3.76
90	0.322	0.284	-5.47
100	0.301	0.248	-6.05
110	0.324	0.288	-5.41
120	0.365	0.364	-4.38
130	0.409	0.458	-3.40
140	0.475	0.618	-2.09
150	0.549	0.826	-0.83
160	0.622	1.061	0.26
170	0.694	1.320	1.20
180	0.771	1.628	2.12
190	0.856	2.009	3.03
200	0.939	2.414	3.83
210	0.991	2.689	4.30
220	0.995	2.714	4.34
230	0.932	2.381	3.77
240	0.820	1.843	2.65
250	0.707	1.369	1.36
260	0.627	1.078	0.33
270	0.604	1.001	0.00
280	0.614	1.034	0.15
290	0.623	1.064	0.27
300	0.613	1.028	0.12
310	0.589	0.949	-0.23
320	0.577	0.912	-0.40
330	0.602	0.993	-0.03
340	0.675	1.248	0.96
350	0.799	1.750	2.43

#### Maximum Value

Field 1.00  
Gain 2.74 (4.38 dB)  
Azimuth Bearing 215 degrees

#### Minimum Field

Field 0.301  
Gain .248 (-6.05 dB)  
Azimuth Bearing 100 degrees

### Vertical Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.935	2.397	3.80
10	0.994	2.705	4.32
20	0.992	2.697	4.31
30	0.939	2.416	3.83
40	0.852	1.988	2.98
50	0.744	1.516	1.81
60	0.619	1.050	0.21
70	0.487	0.651	-1.87
80	0.366	0.367	-4.35
90	0.284	0.220	-6.57
100	0.259	0.183	-7.37
110	0.270	0.199	-7.00
120	0.275	0.207	-6.85
130	0.254	0.176	-7.54
140	0.229	0.144	-8.42
150	0.262	0.188	-7.27
160	0.379	0.394	-4.04
170	0.541	0.802	-0.96
180	0.703	1.356	1.32
190	0.833	1.903	2.80
200	0.918	2.311	3.64
210	0.970	2.578	4.11
220	0.994	2.709	4.33
230	0.989	2.681	4.28
240	0.951	2.479	3.94
250	0.879	2.115	3.25
260	0.776	1.649	2.17
270	0.665	1.210	0.83
280	0.565	0.874	-0.58
290	0.487	0.651	-1.87
300	0.440	0.531	-2.75
310	0.428	0.503	-2.99
320	0.464	0.589	-2.30
330	0.550	0.829	-0.81
340	0.678	1.261	1.01
350	0.821	1.845	2.66

#### Maximum Value

Field 1.00  
Gain 2.74 (4.38 dB)  
Azimuth Bearing 15 degrees

#### Minimum Field

Field 0.229  
Gain .144 (-8.42 dB)  
Azimuth Bearing 140 degrees

## ERP Tabulation

Antenna Model: PSIFMR-3E-R-DA

Prairie Air Inc.

Station: WEFT

Frequency: 90.1 MHz

Location: Champaign, IL

Maximum ERP: 10.0 kW

### Horizontal Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.871	7.58	8.80
10	0.906	8.20	9.14
20	0.900	8.11	9.09
30	0.861	7.41	8.70
40	0.805	6.47	8.11
50	0.733	5.37	7.30
60	0.618	3.82	5.82
70	0.492	2.42	3.84
80	0.392	1.54	1.87
90	0.322	1.04	0.16
100	0.301	0.91	-0.43
110	0.324	1.05	0.21
120	0.365	1.33	1.24
130	0.409	1.67	2.23
140	0.475	2.26	3.54
150	0.549	3.01	4.79
160	0.622	3.87	5.88
170	0.694	4.82	6.83
180	0.771	5.94	7.74
190	0.856	7.33	8.65
200	0.939	8.81	9.45
210	0.991	9.81	9.92
220	0.995	9.91	9.96
230	0.932	8.69	9.39
240	0.820	6.73	8.28
250	0.707	4.99	6.99
260	0.627	3.94	5.95
270	0.604	3.65	5.63
280	0.614	3.77	5.77
290	0.623	3.88	5.89
300	0.613	3.75	5.74
310	0.589	3.46	5.40
320	0.577	3.33	5.22
330	0.602	3.62	5.59
340	0.675	4.56	6.59
350	0.799	6.39	8.05

#### Maximum Value (H-pol)

Field 1.00  
ERP 10.0 kW (10.0 dBk)

Azimuth Bearing 215 degrees

#### Minimum Field (H-pol)

Field 0.301  
ERP .91 kW (-.43 dBk)

Azimuth Bearing 100 degrees

### Vertical Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.935	8.75	9.42
10	0.994	9.87	9.94
20	0.992	9.84	9.93
30	0.939	8.82	9.45
40	0.852	7.25	8.61
50	0.744	5.53	7.43
60	0.619	3.83	5.84
70	0.487	2.37	3.76
80	0.366	1.34	1.27
90	0.284	0.80	-0.95
100	0.259	0.67	-1.75
110	0.270	0.73	-1.38
120	0.275	0.75	-1.23
130	0.254	0.64	-1.92
140	0.229	0.52	-2.80
150	0.262	0.68	-1.64
160	0.379	1.44	1.58
170	0.541	2.93	4.67
180	0.703	4.95	6.94
190	0.833	6.95	8.42
200	0.918	8.43	9.26
210	0.970	9.41	9.74
220	0.994	9.89	9.95
230	0.989	9.79	9.91
240	0.951	9.05	9.57
250	0.879	7.72	8.88
260	0.776	6.02	7.80
270	0.665	4.42	6.45
280	0.565	3.19	5.04
290	0.487	2.37	3.76
300	0.440	1.94	2.88
310	0.428	1.83	2.63
320	0.464	2.15	3.32
330	0.550	3.03	4.81
340	0.678	4.60	6.63
350	0.821	6.73	8.28

#### Maximum Value (V-pol)

Field 1.00  
ERP 10.0 kW (10.0 dBk)

Azimuth Bearing 15 degrees

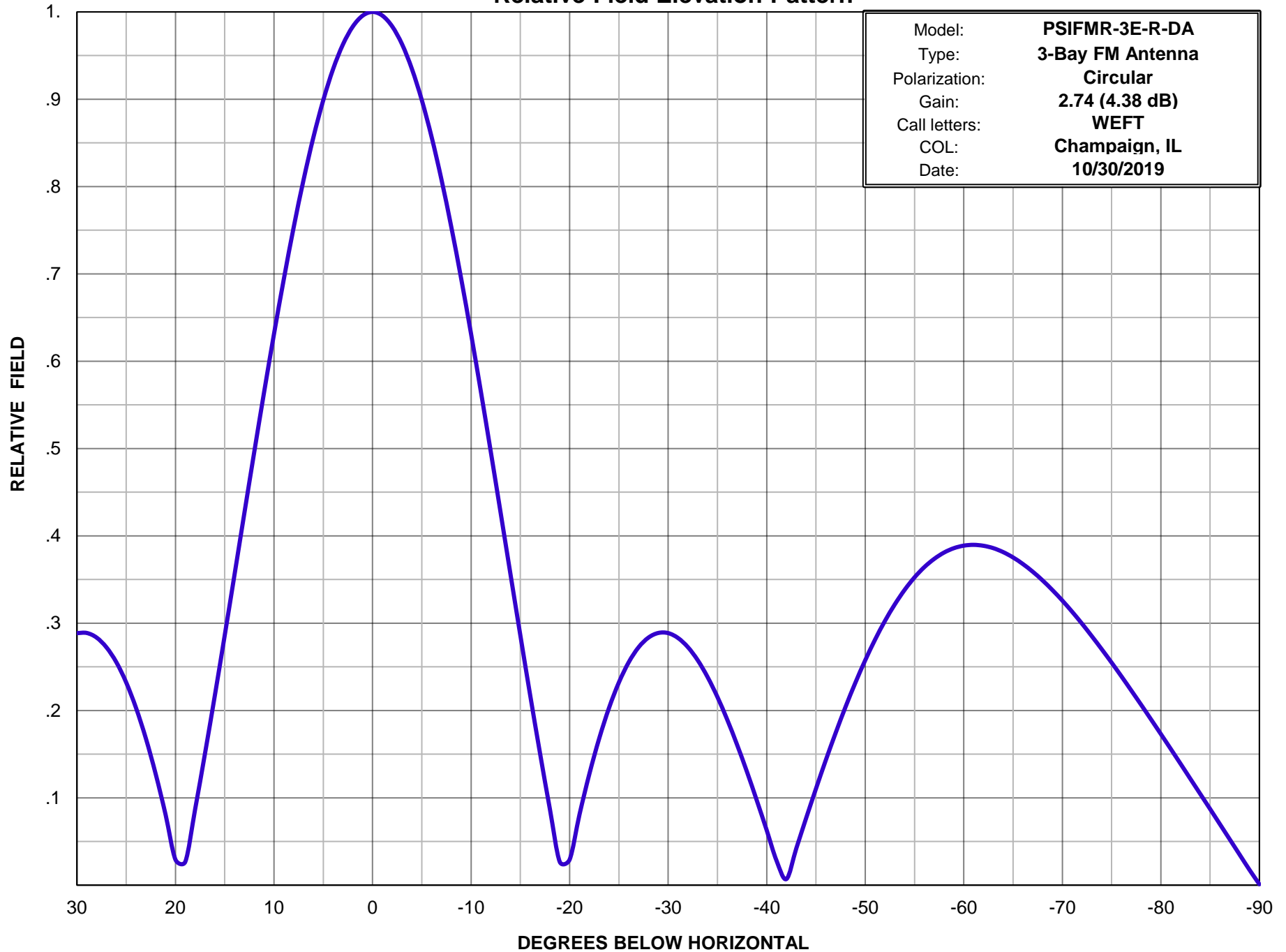
#### Minimum Field (V-pol)

Field 0.229  
ERP .52 kW (-2.80 dBk)

Azimuth Bearing 140 degrees



Relative Field Elevation Pattern



**Propagation Systems Inc.**

Relative Field Tabulation Elevation Pattern

Antenna Model: PSIFMR-3E-R-DA

Gain: 2.74 (4.38 dBd)

Station: WEFT

Angle	Field	dB	Angle	Field	dB	Angle	Field	dB
-90	0.001	-60.00	-50	0.258	-11.78	-10	0.631	-4.00
-89	0.017	-35.18	-49	0.232	-12.70	-9	0.694	-3.17
-88	0.035	-29.16	-48	0.204	-13.80	-8	0.753	-2.46
-87	0.052	-25.63	-47	0.174	-15.17	-7	0.808	-1.85
-86	0.070	-23.14	-46	0.143	-16.88	-6	0.857	-1.35
-85	0.087	-21.20	-45	0.110	-19.14	-5	0.899	-0.93
-84	0.104	-19.63	-44	0.077	-22.31	-4	0.935	-0.59
-83	0.122	-18.30	-43	0.042	-27.54	-3	0.963	-0.33
-82	0.139	-17.14	-42	0.007	-43.14	-2	0.983	-0.15
-81	0.156	-16.13	-41	0.028	-31.05	-1	0.996	-0.04
-80	0.173	-15.24	-40	0.063	-24.03	0	1.000	0.00
-79	0.190	-14.43	-39	0.097	-20.28	1	0.996	-0.04
-78	0.207	-13.70	-38	0.130	-17.74	2	0.983	-0.15
-77	0.223	-13.04	-37	0.161	-15.88	3	0.963	-0.33
-76	0.239	-12.43	-36	0.189	-14.45	4	0.935	-0.59
-75	0.255	-11.87	-35	0.215	-13.33	5	0.899	-0.93
-74	0.270	-11.37	-34	0.238	-12.46	6	0.857	-1.35
-73	0.285	-10.90	-33	0.258	-11.78	7	0.808	-1.85
-72	0.299	-10.48	-32	0.273	-11.29	8	0.753	-2.46
-71	0.313	-10.09	-31	0.283	-10.96	9	0.694	-3.17
-70	0.326	-9.74	-30	0.289	-10.79	10	0.631	-4.00
-69	0.338	-9.42	-29	0.289	-10.79	11	0.565	-4.96
-68	0.349	-9.14	-28	0.283	-10.95	12	0.496	-6.08
-67	0.359	-8.90	-27	0.272	-11.30	13	0.427	-7.40
-66	0.368	-8.69	-26	0.255	-11.86	14	0.356	-8.97
-65	0.375	-8.51	-25	0.232	-12.69	15	0.286	-10.87
-64	0.381	-8.37	-24	0.203	-13.85	16	0.217	-13.25
-63	0.386	-8.27	-23	0.168	-15.50	17	0.151	-16.43
-62	0.389	-8.21	-22	0.127	-17.92	18	0.087	-21.20
-61	0.390	-8.19	-21	0.081	-21.86	19	0.027	-31.43
-60	0.389	-8.21	-20	0.029	-30.68	20	0.029	-30.68
-59	0.386	-8.27	-19	0.027	-31.48	21	0.081	-21.87
-58	0.381	-8.38	-18	0.087	-21.21	22	0.127	-17.93
-57	0.374	-8.55	-17	0.151	-16.43	23	0.168	-15.50
-56	0.364	-8.77	-16	0.217	-13.26	24	0.203	-13.86
-55	0.352	-9.06	-15	0.286	-10.87	25	0.232	-12.69
-54	0.338	-9.42	-14	0.356	-8.97	26	0.255	-11.86
-53	0.322	-9.86	-13	0.426	-7.40	27	0.272	-11.30
-52	0.303	-10.38	-12	0.496	-6.09	28	0.283	-10.95
-51	0.281	-11.02	-11	0.565	-4.96	29	0.289	-10.79