

ENGINEERING STATEMENT  
IN SUPPORT OF AN APPLICATION FOR  
LICENSE TO COVER CONSTRUCTION PERMIT  
(BXPB-20180323AAS)  
FOR AUXILIARY OPERATION  
WJKI-FM, BETHANY BEACH, DELAWARE  
CHANNEL 278A 3.2 KW 135.9 METERS

FEBRUARY 2019

This engineering statement has been prepared on behalf of The Voice Radio, LLC, licensee of FM broadcast station WJKI-FM, Bethany Beach, Delaware in support of an application for license to cover construction permit (BXPB-20180323AAS) for an auxiliary operation.

At present WJKI-FM, (Facility ID Number 30858), is licensed (BLH-19960611KA) to operate on Channel 278A (103.5 MHz) with 1.45 kW effective radiated power (ERP) and 146 meters antenna height above average terrain (HAAT). The present licensed facilities are equivalent to 3 kW ERP and 100 meters HAAT. WJKI-FM is also authorized a CP (BXPB-20180323AAS) to operate an auxiliary operation with 3.2 kW maximum ERP and 135.9 meters HAAT using a directional antenna. An application is being filed for license on the FCC Form 302-FM to cover construction permit (BXPB-20180323AAS)

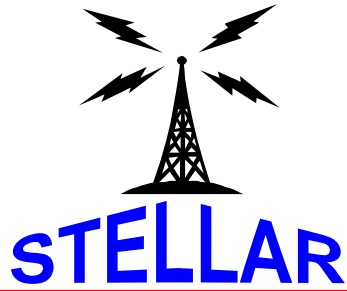
The following information provides pertinent data for the auxiliary construction permit (BXPB-20180323AAS).

Name of the Licensee:	The Voice Radio, LLC			
Station Location:	DE-Bethany Beach			
Channel:	278A (103.5 MHz)			
Hours of Operation:	Unlimited-for auxiliary purposes only			
Transmitter:	Type Accepted			
Antenna Type:	Directional, PSIFM-2C-DA			
Antenna Coordinates: (NAD-27)	North Latitude:	38 deg	37 min	34.sec
	West Longitude:	75 deg	14 min	02 sec

Transmitter output power:	As required to achieve authorized ERP
Effective Radiated Power (ERP):	3.2 kW 5.05 dBk
Elevation of the site above mean sea level:	7 meters
Overall Height of the Tower Above Ground:	140 meters
Height of Radiation Center Above Ground:	136.6 meters
Height of Radiation Center Above Mean Sea Level:	142.6 meters
Height of Radiation Center Above Average Terrain (HAAT):	135.9 meters
Antenna Structure Registration Number:	1065742

The WJKI-FM auxiliary facility has been constructed according to the terms and conditions of the granted construction permit (BXPB-20180323AAS). The directional antenna proof-of-performance has been provided by the manufacturer to establish the horizontal radiation patterns for both the horizontally and vertically polarized components.

Donald K Miller, a registered surveyor, has provided a certification that the FM antenna has been oriented at the azimuth specified in the directional antenna proof-of-performance. Also attached is an affidavit from Terry Dalton, a qualified engineer, stating that the directional FM antenna was installed according to the manufacturer's instructions.



Communication Systems, LLC

- RF Transmission System Planning, Installation and Maintenance •
- Communication Tower Installation and Maintenance •

## *Engineers Statement*

January 31, 2019

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The undersigned certifies that the Auxiliary directional antenna for WJKI Channel 278A Bethany Beach, Delaware was assembled and installed while under his direct supervision in a manner entirely consistent with Manufacturer's instructions.

A handwritten signature in black ink, appearing to read "Terry J. Dalton", is written over a horizontal line.

Terry J. Dalton  
Project Manager  
Stellar Communication Systems, LLC  
31003 Country Gardens, Suite L-1  
Dagsboro, DE 19939  
(302) 245-3550

# MILLER LEWIS, INC.

LAND SURVEYING

January 25, 2019

Terri J. Dalton

Project Manager

Stellar Communications

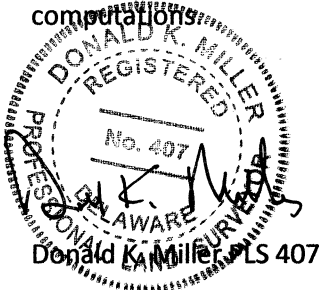
31003 Country Gardens, Suite L-1

Dagsboro, DE 19939

RE: MT. Joy Tower, Millsboro, DE

To whom it may concern:

I hereby certify that the new antenna direction is  $115^{\circ}$  east of true north. An initial baseline was set up near the tower using NGS control for GPS stations. Four stations were utilized for an accurate trigonometric analysis of the base line. Topcon's Program, Topcon Tools V8.2.3 was used for the computations.





# Propagation Systems, Inc.

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Quality Broadcast Antenna Systems

**Directional FM Antenna  
WJKI-Aux  
The Voice Radio, LLC  
Bethany Beach, DE**

A standard model PSIFM antenna with parasitic elements was used in conjunction with a model of the customer's 41" face Rohn 80 tower to create the necessary directional radiation pattern. The final antenna consists of two radiating elements full wavelength spaced with one horizontal and two vertical parasitic elements per bay. The antenna array is center 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 310.5 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 98.2% of the envelope RMS.

The antenna is to be mounted 136 meters (446.1 ft.) above ground level per the construction permit. A deviation of +2/-4 meters from the approved center of radiation is allowed. No other antenna can be installed within 10 ft of any radiating element. The antenna is to be mounted to a support mast that extends out from the southeast tower leg. The antenna bay is to be positioned 115° True and certified by a licensed surveyor. It is recommended that a broadcast engineer is present to supervise the installation of the antenna and that he or she certifies the antenna has been installed according to the enclosed instructions.



# Propagation Systems, Inc.

Quality Broadcast Antenna Systems

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An input power level of 1.13 kW will be required at the antenna input in order to reach the licensed 3.2 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.

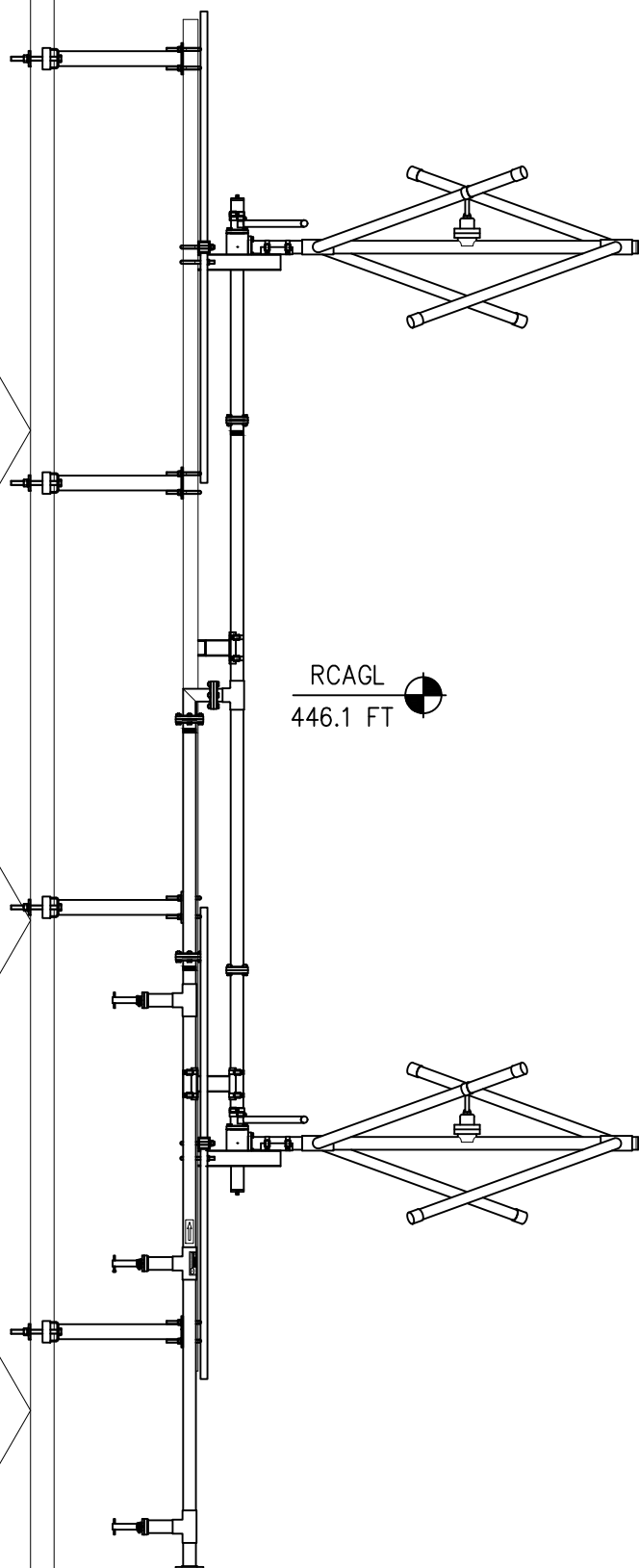
## Antenna Specifications

Antenna Model	PSIFM-2C-DA
Type	2-bay directional FM antenna
Bay Spacing	Full wavelength spaced elements
Frequency	103.5 MHz
Polarization	Circular
Envelope RMS	.598
Composite RMS	.587
Gain	
H-pol	2.82 (4.50 dB)
V-pol	2.55 (4.07 dB)
Input	1-5/8" EIA center fed input
Input power	1.13 kW
Power rating	6 kW
Length	16.53 ft.
Weight	164 lbs.
Wind Area	12.52 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'):	114.04 IN (289.7 CM)
APERTURE ('A'):	9.5 FT (2.9 M)
LENGTH ('L'):	16.53 FT (5.04 M)
RCAGL:	446.1 FT (136 M)
WEIGHT:	164 LB (74 Kg)
WIND AREA:	12.52 FT <sup>2</sup>
POWER RATING:	6 kW
GAIN:	2.82 (4.50 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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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

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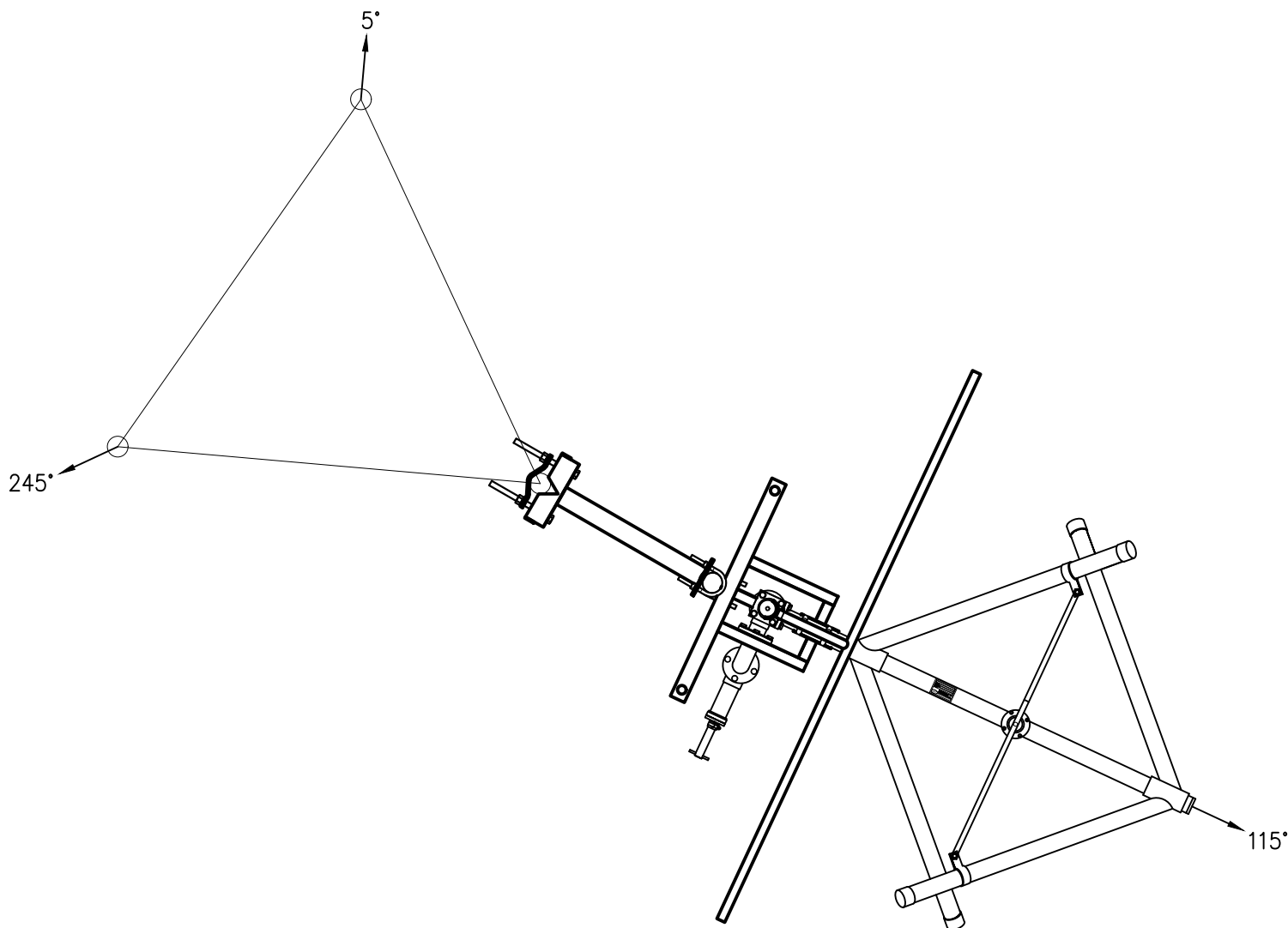
## PROPAGATION SYSTEMS, INC.

Ebensburg, Pennsylvania USA 814-472-5540

#### ANTENNA ELEVATION AND SPECIFICATIONS

MODEL: PSIFM-2C-DA	DRAWN BY: M.MOCK	DATE: 11/07/18
CHANNEL/ FREQUENCY: 103.5 MHz	APPROVED BY:	DATE:
SCALE: 1:40	DRAWING NO.: 1496-1-001	REV.





REV.	MADE BY	CHECKED BY	DATE	CHANGE

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SIZE

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# PROPAGATION SYSTEMS, INC.

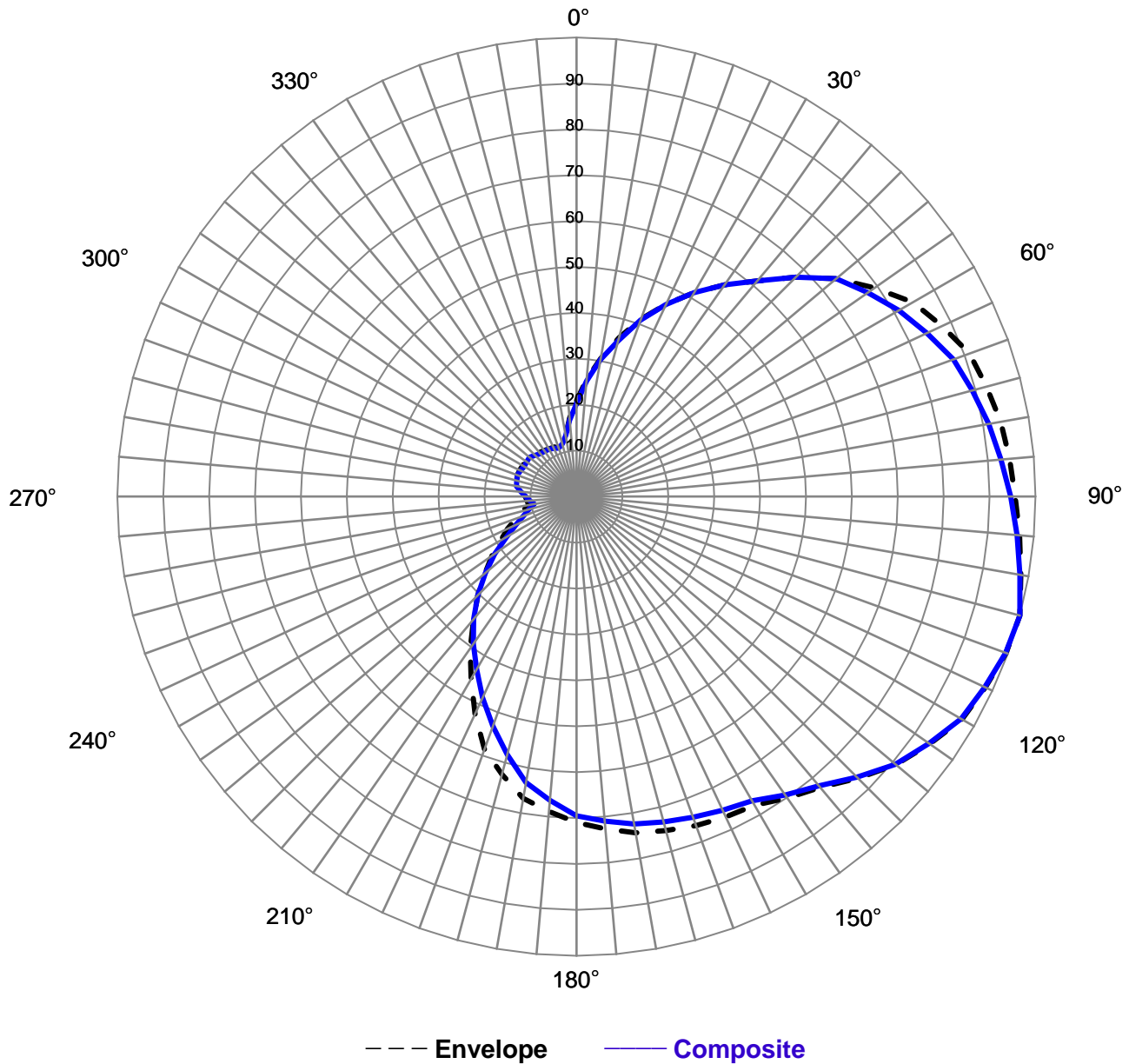
Ebensburg, Pennsylvania USA 814-472-5540

## ANTENNA ORIENTATION AND PLAN VIEW

MODEL: PSIFM-2C-DA	DRAWN BY: M.MOCK	DATE: 11/07/18
CHANNEL/FREQUENCY: 103.5 MHz	APPROVED BY:	DATE:
SCALE: 1:40	DRAWING NO.: 1496-1-002	REV.



## Relative Field Azimuth Plane Pattern



Pattern Type:	<b>Measured Composite</b>	Tower:	<b>41" Rohn 80</b>
Antenna Model:	<b>PSIFM-2C-DA</b>	Orientation:	<b>115°</b>
Polarization:	<b>Circular</b>	Frequency:	<b>103.5 MHz</b>
RMS (envelope)	<b>0.598</b>	Station:	<b>WJKI-Aux</b>
RMS (composite)	<b>0.587</b>	Date:	<b>11/5/2018</b>

## Maximum Envelope Tabulation

Antenna Model: PSIFM-2C-DA

The Voice Radio, LLC

Station: WJKI-Aux

Frequency: 103.5 MHz

Location: Bethany Beach, DE

Maximum ERP: 3.2 kW

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.209	0.14	-8.55
10	0.306	0.30	-5.25
20	0.412	0.54	-2.66
30	0.513	0.84	-0.75
40	0.613	1.20	0.80
50	0.739	1.75	2.42
60	0.847	2.29	3.60
70	0.911	2.66	4.24
80	0.939	2.82	4.50
90	0.956	2.92	4.66
100	0.983	3.09	4.90
110	0.996	3.17	5.02
120	0.970	3.01	4.79
130	0.909	2.64	4.22
140	0.827	2.19	3.40
150	0.777	1.93	2.85
160	0.763	1.86	2.70
170	0.744	1.77	2.48
180	0.710	1.61	2.07
190	0.667	1.42	1.53
200	0.586	1.10	0.40
210	0.459	0.67	-1.72
220	0.348	0.39	-4.12
230	0.260	0.22	-6.67
240	0.190	0.12	-9.37
250	0.141	0.06	-11.99
260	0.105	0.04	-14.52
270	0.111	0.04	-14.04
280	0.133	0.06	-12.50
290	0.137	0.06	-12.21
300	0.136	0.06	-12.31
310	0.133	0.06	-12.50
320	0.126	0.05	-12.98
330	0.120	0.05	-13.36
340	0.117	0.04	-13.58
350	0.135	0.06	-12.34

## Composite Pattern Tabulation

Antenna Model: PSIFM-2C-DA

The Voice Radio, LLC

Station: WJKI-Aux

Frequency: 103.5 MHz

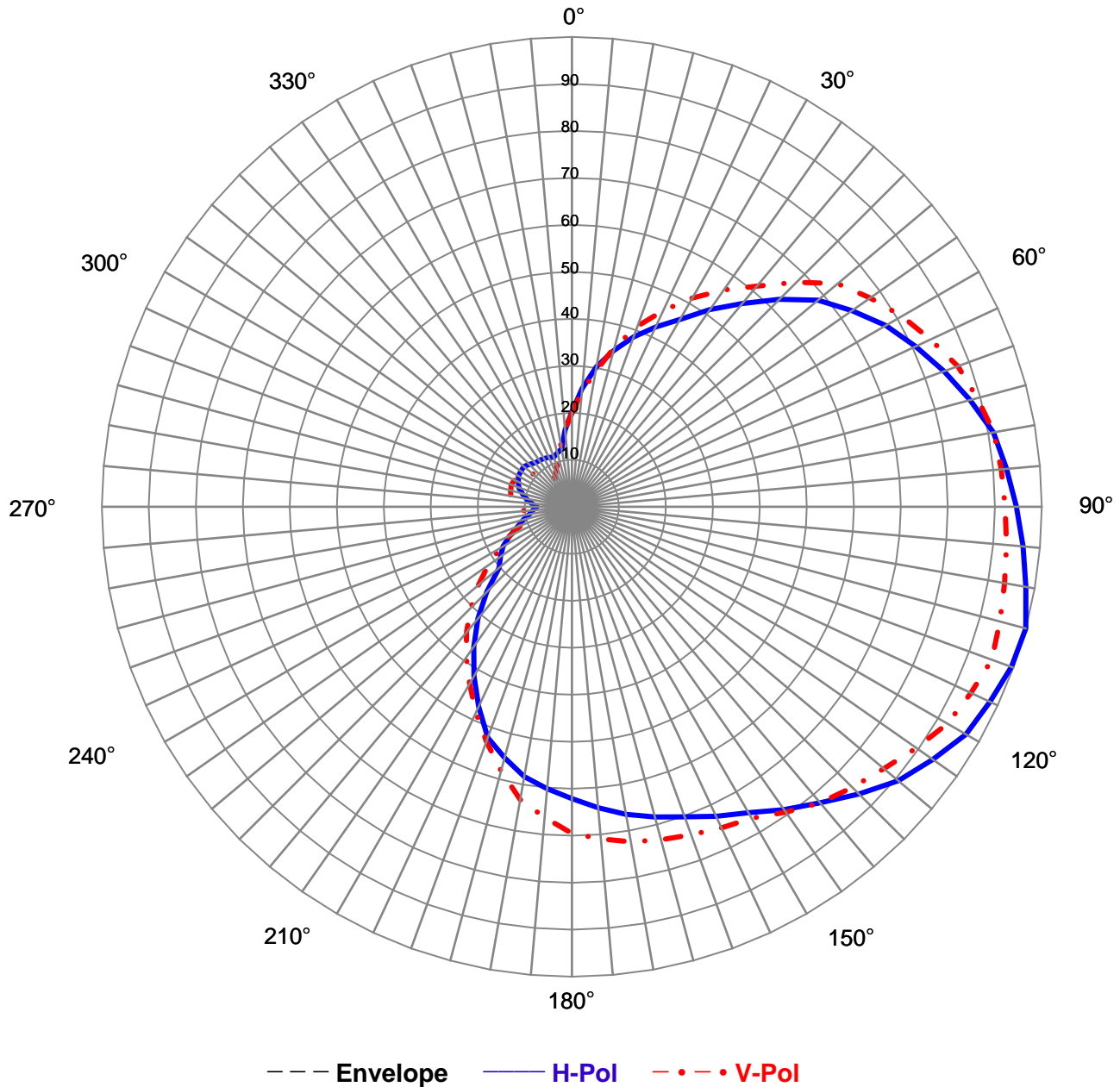
Location: Bethany Beach, DE

Maximum ERP: 3.2 kW

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.203	0.13	-8.82
10	0.303	0.29	-5.32
20	0.409	0.54	-2.71
30	0.513	0.84	-0.74
40	0.613	1.20	0.80
50	0.739	1.75	2.42
60	0.811	2.10	3.23
70	0.874	2.44	3.88
80	0.912	2.66	4.25
90	0.946	2.86	4.57
100	0.981	3.08	4.88
110	0.995	3.17	5.01
120	0.968	3.00	4.77
130	0.907	2.63	4.20
140	0.822	2.16	3.35
150	0.765	1.87	2.72
160	0.743	1.77	2.47
170	0.724	1.68	2.25
180	0.695	1.55	1.89
190	0.632	1.28	1.07
200	0.532	0.90	-0.44
210	0.435	0.60	-2.18
220	0.348	0.39	-4.11
230	0.259	0.22	-6.67
240	0.175	0.10	-10.07
250	0.122	0.05	-13.22
260	0.093	0.03	-15.57
270	0.111	0.04	-14.08
280	0.132	0.06	-12.52
290	0.137	0.06	-12.21
300	0.131	0.06	-12.58
310	0.133	0.06	-12.47
320	0.122	0.05	-13.22
330	0.119	0.05	-13.44
340	0.113	0.04	-13.93
350	0.135	0.06	-12.33



## Relative Field Azimuth Plane Pattern



Pattern Type:	<b>Measured Field</b>	Tower:	<b>41" Rohn 80</b>
Antenna Model:	<b>PSIFM-2C-DA</b>	Orientation:	<b>115°</b>
Polarization:	<b>Circular</b>	Frequency:	<b>103.5 MHz</b>
Gain (H-pol):	<b>2.82 (4.50 dB)</b>	Station:	<b>WJKI-Aux</b>
Gain (V-pol):	<b>2.55 (4.07 dB)</b>	Date:	<b>11/5/2018</b>

## Measured Relative Field Tabulation

Antenna Model: PSIFM-2C-DA

The Voice Radio, LLC

Station: WJKI-Aux

Frequency: 103.5 MHz

Location: Bethany Beach, DE

### Horizontal Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.203	0.116	-9.37
10	0.303	0.259	-5.87
20	0.385	0.418	-3.79
30	0.460	0.597	-2.24
40	0.565	0.900	-0.46
50	0.684	1.319	1.20
60	0.772	1.681	2.25
70	0.843	2.004	3.02
80	0.911	2.340	3.69
90	0.946	2.524	4.02
100	0.981	2.714	4.34
110	0.995	2.794	4.46
120	0.968	2.642	4.22
130	0.907	2.320	3.65
140	0.822	1.905	2.80
150	0.752	1.595	2.03
160	0.702	1.390	1.43
170	0.665	1.246	0.96
180	0.621	1.088	0.36
190	0.583	0.958	-0.18
200	0.523	0.771	-1.13
210	0.416	0.488	-3.12
220	0.311	0.273	-5.64
230	0.202	0.115	-9.39
240	0.169	0.081	-10.94
250	0.122	0.042	-13.77
260	0.091	0.024	-16.27
270	0.074	0.016	-18.08
280	0.098	0.027	-15.69
290	0.120	0.041	-13.91
300	0.131	0.049	-13.14
310	0.133	0.050	-13.02
320	0.122	0.042	-13.77
330	0.119	0.040	-13.99
340	0.113	0.036	-14.47
350	0.125	0.044	-13.56

#### Maximum Value

Field     1.000  
Gain     2.82 (4.50 dB)  
Azimuth Bearing     105 degrees

#### Minimum Field

Field     0.074  
Gain     .016 (-18.08 dB)  
Azimuth Bearing     270 degrees

### Vertical Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.199	0.112	-9.52
10	0.293	0.242	-6.16
20	0.409	0.472	-3.26
30	0.513	0.743	-1.29
40	0.613	1.060	0.25
50	0.739	1.539	1.87
60	0.811	1.855	2.68
70	0.874	2.154	3.33
80	0.912	2.346	3.70
90	0.922	2.397	3.80
100	0.935	2.465	3.92
110	0.951	2.550	4.07
120	0.923	2.402	3.81
130	0.867	2.120	3.26
140	0.822	1.905	2.80
150	0.765	1.650	2.18
160	0.743	1.557	1.92
170	0.724	1.478	1.70
180	0.695	1.362	1.34
190	0.632	1.127	0.52
200	0.532	0.797	-0.99
210	0.435	0.533	-2.73
220	0.348	0.342	-4.66
230	0.259	0.190	-7.22
240	0.175	0.087	-10.62
250	0.114	0.037	-14.33
260	0.093	0.024	-16.12
270	0.111	0.034	-14.63
280	0.132	0.049	-13.07
290	0.137	0.053	-12.76
300	0.131	0.049	-13.13
310	0.109	0.033	-14.77
320	0.080	0.018	-17.40
330	0.070	0.014	-18.60
340	0.093	0.024	-16.16
350	0.135	0.051	-12.88

#### Maximum Value

Field     0.951  
Gain     2.55 (4.07 dB)  
Azimuth Bearing     110 degrees

#### Minimum Field

Field     0.070  
Gain     .014 (-18.60 dB)  
Azimuth Bearing     330 degrees

## ERP Tabulation

Antenna Model: PSIFM-2C-DA

The Voice Radio, LLC

Station: WJKI-Aux

Frequency: 103.5 MHz

Location: Bethany Beach, DE

Maximum ERP: 3.2 kW

### Horizontal Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.203	0.13	-8.82
10	0.303	0.29	-5.32
20	0.385	0.47	-3.24
30	0.460	0.68	-1.69
40	0.565	1.02	0.09
50	0.684	1.50	1.75
60	0.772	1.91	2.80
70	0.843	2.27	3.57
80	0.911	2.66	4.24
90	0.946	2.86	4.57
100	0.981	3.08	4.88
110	0.995	3.17	5.01
120	0.968	3.00	4.77
130	0.907	2.63	4.20
140	0.822	2.16	3.35
150	0.752	1.81	2.58
160	0.702	1.58	1.98
170	0.665	1.41	1.51
180	0.621	1.23	0.91
190	0.583	1.09	0.36
200	0.523	0.88	-0.58
210	0.416	0.55	-2.57
220	0.311	0.31	-5.09
230	0.202	0.13	-8.84
240	0.169	0.09	-10.39
250	0.122	0.05	-13.22
260	0.091	0.03	-15.72
270	0.074	0.02	-17.53
280	0.098	0.03	-15.14
290	0.120	0.05	-13.36
300	0.131	0.06	-12.59
310	0.133	0.06	-12.47
320	0.122	0.05	-13.22
330	0.119	0.05	-13.44
340	0.113	0.04	-13.93
350	0.125	0.05	-13.01

#### Maximum Value (H-pol)

Field 1.000

ERP 3.2 kW (5.05 dBk)

Azimuth Bearing 105 degrees

#### Minimum Field (H-pol)

Field 0.074

ERP .02 kW (-17.53 dBk)

Azimuth Bearing 270 degrees

### Vertical Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.199	0.13	-8.97
10	0.293	0.27	-5.61
20	0.409	0.54	-2.71
30	0.513	0.84	-0.74
40	0.613	1.20	0.80
50	0.739	1.75	2.42
60	0.811	2.10	3.23
70	0.874	2.44	3.88
80	0.912	2.66	4.25
90	0.922	2.72	4.35
100	0.935	2.80	4.47
110	0.951	2.89	4.62
120	0.923	2.73	4.36
130	0.867	2.41	3.81
140	0.822	2.16	3.35
150	0.765	1.87	2.72
160	0.743	1.77	2.47
170	0.724	1.68	2.25
180	0.695	1.55	1.89
190	0.632	1.28	1.07
200	0.532	0.90	-0.44
210	0.435	0.60	-2.18
220	0.348	0.39	-4.11
230	0.259	0.22	-6.67
240	0.175	0.10	-10.07
250	0.114	0.04	-13.78
260	0.093	0.03	-15.57
270	0.111	0.04	-14.08
280	0.132	0.06	-12.52
290	0.137	0.06	-12.21
300	0.131	0.06	-12.58
310	0.109	0.04	-14.23
320	0.080	0.02	-16.85
330	0.070	0.02	-18.06
340	0.093	0.03	-15.62
350	0.135	0.06	-12.33

#### Maximum Value (V-pol)

Field 0.951

ERP 2.89 kW (4.62 dBk)

Azimuth Bearing 110 degrees

#### Minimum Field (V-pol)

Field 0.070

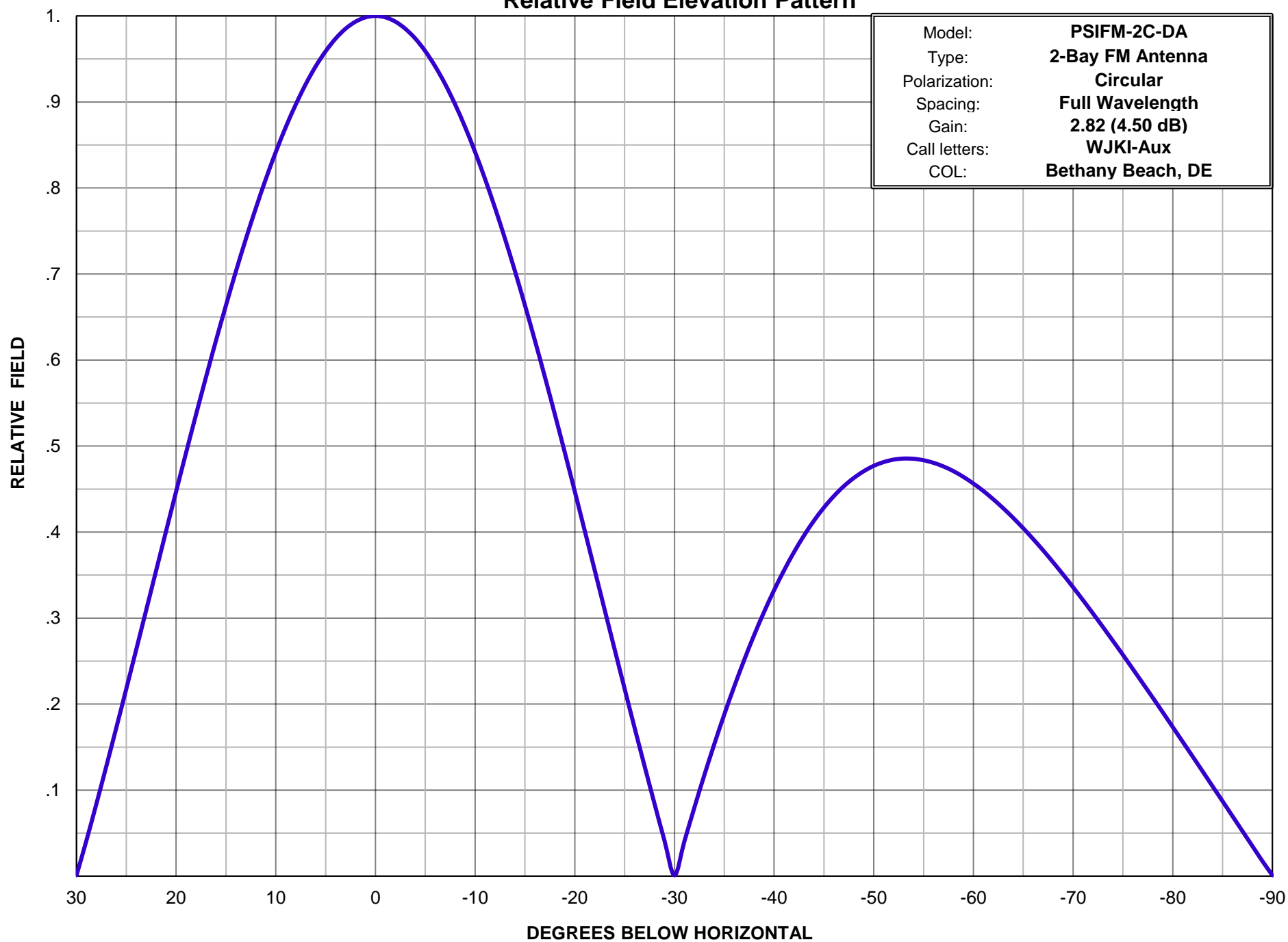
ERP .02 kW (-18.06 dBk)

Azimuth Bearing 330 degrees



**Propagation Systems, Inc.**

**Relative Field Elevation Pattern**





## Maximum Envelope Tabulation

Antenna Model: PSIFM-2C-DA

The Voice Radio, LLC

Station: WJKI-Aux

Frequency: 103.5 MHz

Location: Bethany Beach, DE

Maximum ERP: 3.2 kW

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.209	0.14	-8.55
10	0.306	0.30	-5.25
20	0.412	0.54	-2.66
30	0.513	0.84	-0.75
40	0.613	1.20	0.80
50	0.739	1.75	2.42
60	0.847	2.29	3.60
70	0.911	2.66	4.24
80	0.939	2.82	4.50
90	0.956	2.92	4.66
100	0.983	3.09	4.90
110	0.996	3.17	5.02
120	0.970	3.01	4.79
130	0.909	2.64	4.22
140	0.827	2.19	3.40
150	0.777	1.93	2.85
160	0.763	1.86	2.70
170	0.744	1.77	2.48
180	0.710	1.61	2.07
190	0.667	1.42	1.53
200	0.586	1.10	0.40
210	0.459	0.67	-1.72
220	0.348	0.39	-4.12
230	0.260	0.22	-6.67
240	0.190	0.12	-9.37
250	0.141	0.06	-11.99
260	0.105	0.04	-14.52
270	0.111	0.04	-14.04
280	0.133	0.06	-12.50
290	0.137	0.06	-12.21
300	0.136	0.06	-12.31
310	0.133	0.06	-12.50
320	0.126	0.05	-12.98
330	0.120	0.05	-13.36
340	0.117	0.04	-13.58
350	0.135	0.06	-12.34