



Propagation Systems, Inc.

Quality Broadcast Antenna Systems

**Directional FM Antenna
WRRO
Our Lady of Guadalupe Radio, Inc.
Edon, OH**

A modified PSIFM antenna model with parasitic elements was used in conjunction with the customer's 40" face triangular tower to create the necessary directional radiation pattern. The final antenna consists of three radiating elements each secured to the tower with a pre-installed mounting bracket. The antenna bays are 7/8-wave spaced and there is one horizontal and one vertical parasitic element per bay. The antenna array is center fed from a power divider that provides equal power and phase to each radiating elements.

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 92.4% of the envelope RMS.

The antenna is to be mounted 94.5 meters (310 ft.) above ground level and positioned 80° True. At this elevation the antenna will be within the allowed +2m/-4m tolerance from the approved 96 meter elevation. 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.



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An input power level of 2.90 kW will be necessary at the antenna input in order to reach the required 15.0 kW ERP. The measured principal minimum at 160 degrees is 1.41 kW, from 260-270 degrees is equal to or less than 1.50 kW and .75 kW at 350 degrees. All minima do not exceed the approved values of 1.5 kW at 160 degrees, 1.7 kW between 260-270 degrees and 1.8 kW at 350 degrees. The transmitter output power requirements are dependent upon the transmission line size and length used to feed the antenna.

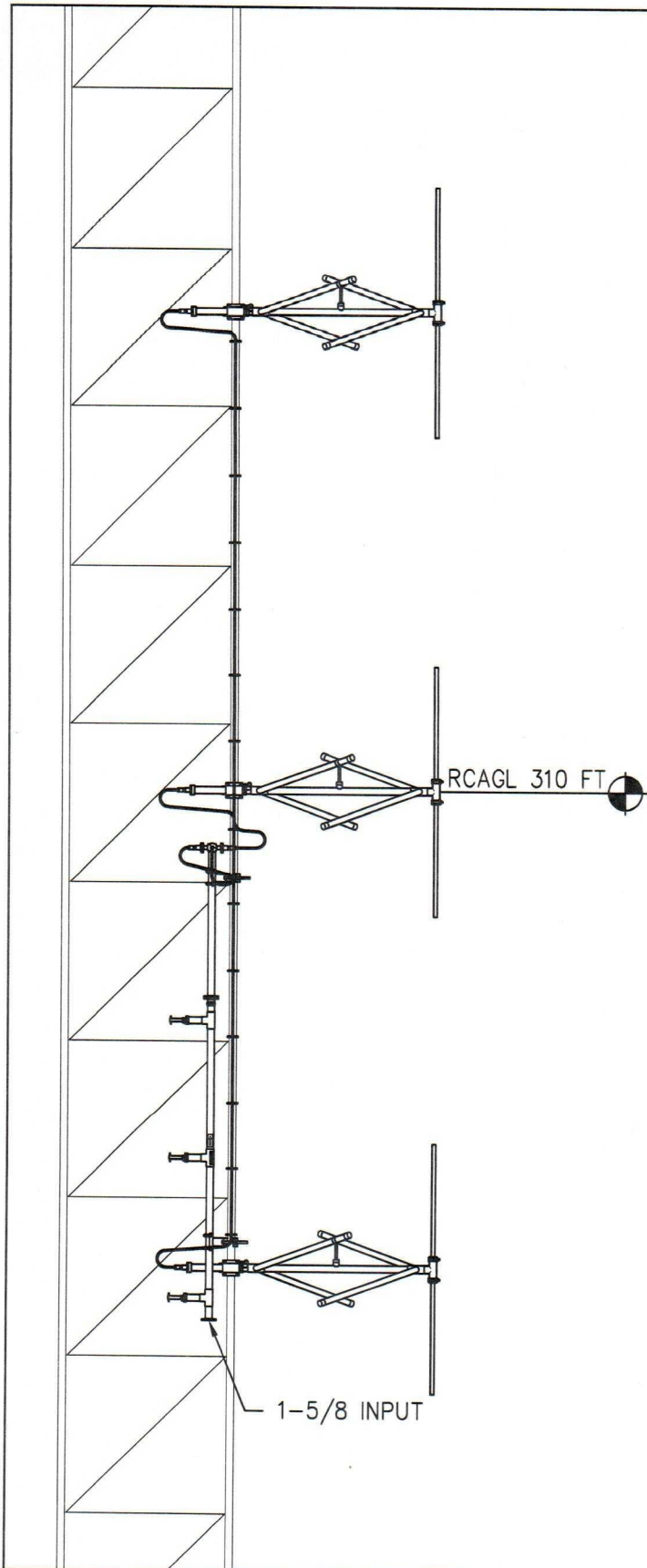
Antenna Specifications

Antenna Model	PSIFM-3C-875WS-DA
Type	3-bay directional FM antenna
Bay Spacing	7/8-wave spaced elements
Frequency	89.9 MHz
Polarization	Circular
Envelope RMS	.601
Composite RMS	.555
Gain (h-pol)	5.18 (7.14 dB)
Gain (v-pol)	4.10 (6.13 dB)
ERP	15 kW
Antenna input power	2.90 kW
Input	1-5/8" EIA input
Power rating	6 kW
Length	24.2 ft.
Aperture	19.17 ft.
Weight	145 lbs.
Wind Area	14.02 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.



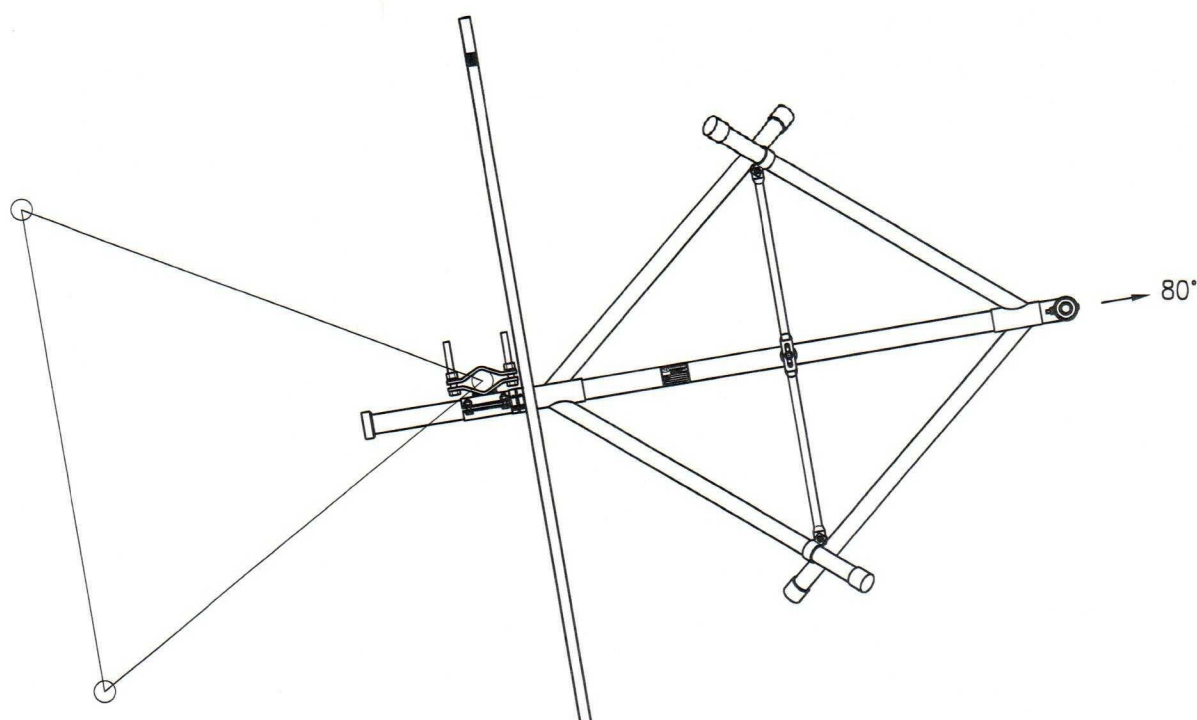
SPECIFICATIONS	
SPACING:	0.875λ
BAY SPACING ('S')	115.0 IN (292 cm)
APERTURE ('A')	19.17 FT (5.8 M)
LENGTH ('L')	24.17 FT (7.4 M)
RCAGL:	310 FT (94.5 M)
WEIGHT:	145 LB (65.8 kg)
WIND AREA:	14.02 FT ²
POWER RATING:	6 kW
GAIN:	5.18 (7.14 dB)
POLARIZATION	CIRCULAR

NOTE: 1. WEIGHT AND WIND AREA ARE ESTIMATED. WIND AREA IN ACCORDANCE WITH TIA/EIA-222-F Σ(CaAc)
2. TIE WRAP COAX. CABLE AT ±16" O.C.

REV.	MADE BY CHECKED BY	DATE	CHANGE

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.

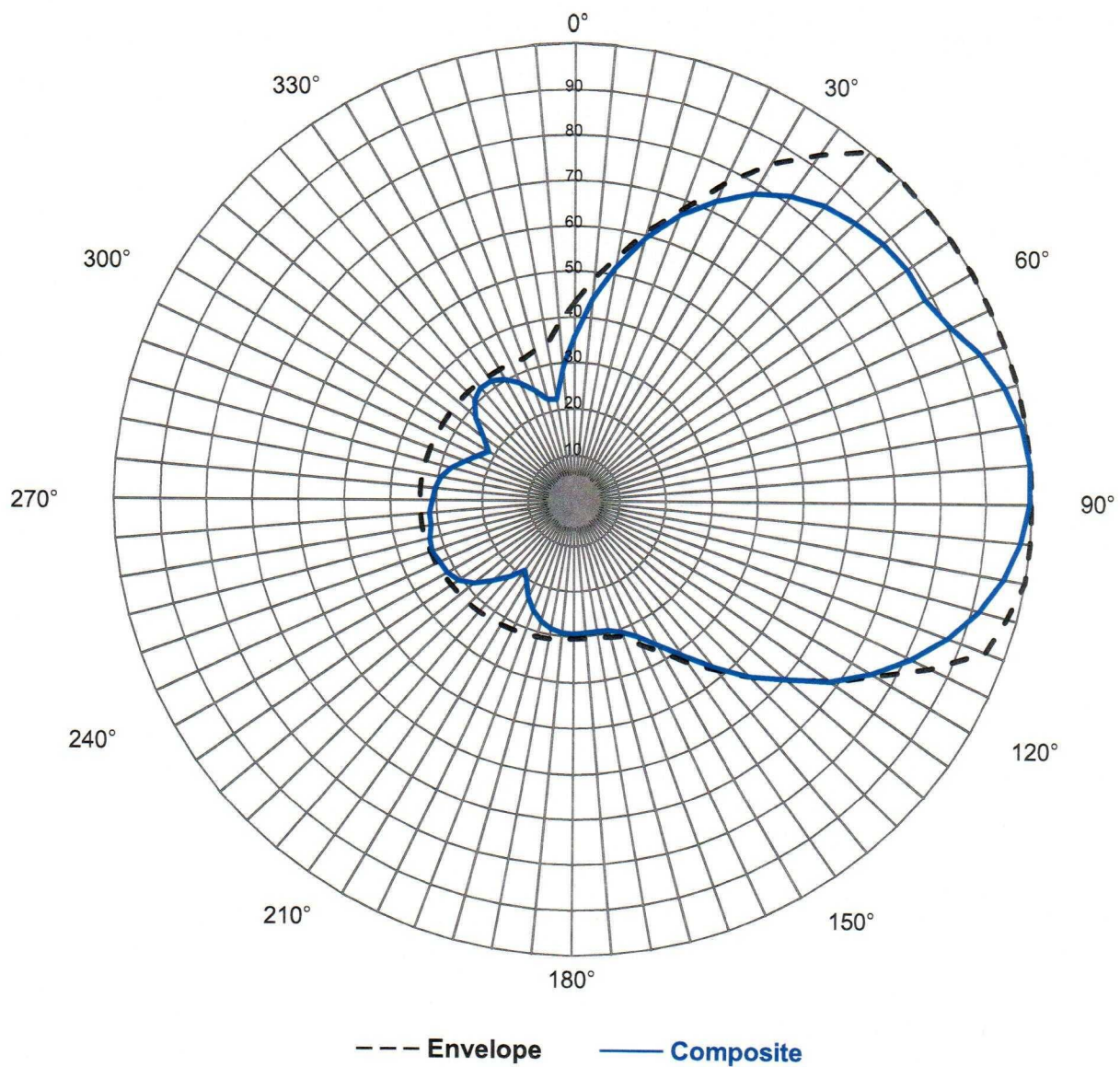
PROPAGATION SYSTEMS, INC.			
Ebensburg, Pennsylvania USA 814-472-5540			
ANTENNA ELEVATION AND SPECIFICATIONS			
MODEL:	PSIFM-3C-875WS-DA	DRAWN BY:	B.K.SCHILLING
CHANNEL/ FREQUENCY:	89.9 MHz	APPROVED BY:	
SCALE:		DRAWING NO.:	1757-001
			REV.



				PROPAGATION SYSTEMS, INC.							
				Ebensburg, Pennsylvania USA 814-472-5540							
				ANTENNA ORIENTATION AND PLAN VIEW							
REV.		MADE BY CHECKED BY		DATE		CHANGE					
<p>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.</p>				SIZE A		MODEL: PSIFM-3C-875WS-DA		DRAWN BY: B.K.SCHILLING		DATE: 2/27/17	
						CHANNEL/ FREQUENCY: 89.9 MHz		APPROVED BY:		DATE:	
						SCALE:		DRAWING NO.: 1757-002		REV.	



Relative Field
Azimuth Plane Pattern



Pattern Type:	Measured Composite	Tower:	40" Face
Antenna Model:	PSIFM-3C-875WS-DA	Orientation:	80°
Polarization:	Circular	Frequency:	89.9 MHz
RMS (composite)	0.555	Station:	WRRO
RMS (envelope)	0.601	Date:	2/26/2018

Maximum Envelope Tabulation

Antenna: PSIFM-3C-875WS-DA
Our Lady of Guadalupe Radio, Inc.
Station: WRRO
Frequency: 89.9 MHz
Location: Edon, OH
Maximum ERP: 15 kW (11.76 dBk)

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.432	2.80	4.47
10	0.541	4.39	6.42
20	0.678	6.90	8.39
30	0.852	10.89	10.37
40	1.000	15.00	11.76
50	1.000	15.00	11.76
60	1.000	15.00	11.76
70	1.000	15.00	11.76
80	1.000	15.00	11.76
90	1.000	15.00	11.76
100	1.000	15.00	11.76
110	0.957	13.74	11.38
120	0.761	8.69	9.39
130	0.605	5.49	7.40
140	0.481	3.47	5.40
150	0.383	2.20	3.42
160	0.316	1.50	1.75
170	0.304	1.39	1.42
180	0.305	1.40	1.45
190	0.309	1.43	1.56
200	0.313	1.47	1.67
210	0.317	1.51	1.78
220	0.321	1.55	1.89
230	0.324	1.57	1.97
240	0.328	1.61	2.08
250	0.332	1.65	2.18
260	0.336	1.69	2.29
270	0.336	1.69	2.29
280	0.335	1.68	2.26
290	0.333	1.66	2.21
300	0.331	1.64	2.16
310	0.330	1.63	2.13
320	0.328	1.61	2.08
330	0.327	1.60	2.05
340	0.327	1.60	2.05
350	0.346	1.80	2.54

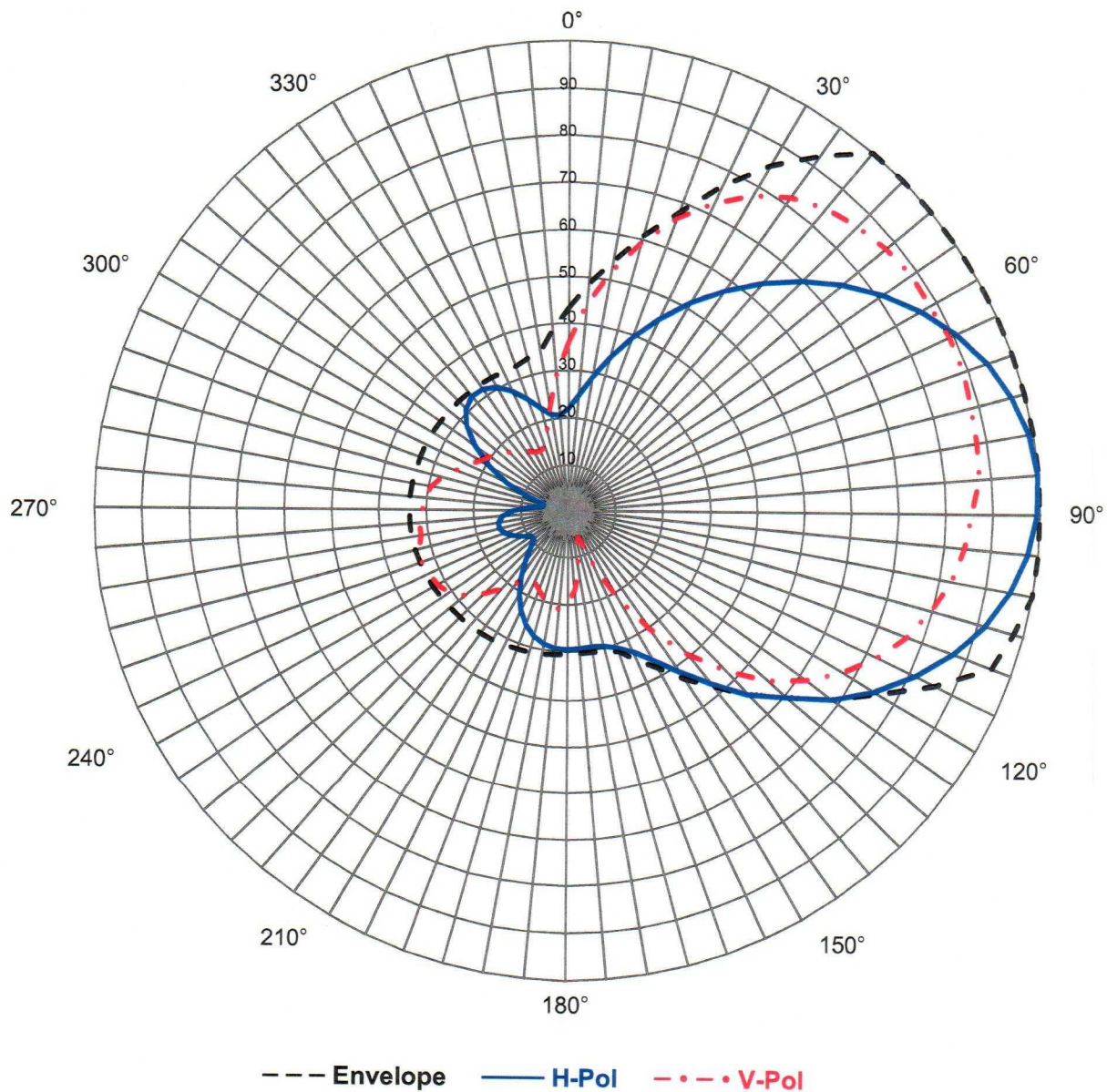
Composite Pattern Tabulation

Antenna: PSIFM-3C-875WS-DA
Our Lady of Guadalupe Radio, Inc.
Station: WRRO
Frequency: 89.9 MHz
Location: Edon, OH
Maximum ERP: 15 kW (11.76 dBk)

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.357	1.91	2.81
10	0.517	4.01	6.03
20	0.665	6.63	8.22
30	0.778	9.08	9.58
40	0.846	10.74	10.31
50	0.877	11.54	10.62
60	0.883	11.70	10.68
70	0.944	13.37	11.26
80	0.991	14.73	11.68
90	0.994	14.82	11.71
100	0.952	13.59	11.33
110	0.869	11.33	10.54
120	0.751	8.46	9.27
130	0.605	5.49	7.40
140	0.473	3.36	5.26
150	0.364	1.99	2.98
160	0.307	1.41	1.50
170	0.291	1.27	1.04
180	0.294	1.30	1.13
190	0.286	1.23	0.89
200	0.257	0.99	-0.04
210	0.205	0.63	-2.00
220	0.218	0.71	-1.47
230	0.283	1.20	0.80
240	0.318	1.52	1.81
250	0.328	1.61	2.08
260	0.316	1.50	1.75
270	0.308	1.42	1.53
280	0.294	1.30	1.13
290	0.253	0.96	-0.18
300	0.215	0.69	-1.59
310	0.281	1.18	0.74
320	0.318	1.52	1.81
330	0.304	1.39	1.42
340	0.255	0.98	-0.11
350	0.224	0.75	-1.23



Relative Field
Azimuth Plane Pattern



Pattern Type:	Measured Field	Tower:	40" Face
Antenna Model:	PSIFM-3C-875WS-DA	Orientation:	80°
Polarization:	Circular	Frequency:	89.9 MHz
Gain (H-pol):	5.18 (7.14 dB)	Station:	WRRO
Gain (V-pol):	4.10 (6.13 dB)	Date:	2/26/2018

Measured Relative Field Tabulation

Antenna: PSIFM-3C-875WS-DA
Our Lady of Guadalupe Radio, Inc.
Station: WRRO
Frequency: 89.9 MHz
Location: Edon, OH

Horizontal Polarization				Vertical Polarization			
Angle	Relative Field	Power Gain	Gain (dB)	Angle	Relative Field	Power Gain	Gain (dB)
0	0.220	0.251	-6.01	0	0.357	0.660	-1.80
10	0.291	0.439	-3.58	10	0.517	1.385	1.41
20	0.396	0.812	-0.90	20	0.665	2.291	3.60
30	0.515	1.374	1.38	30	0.778	3.135	4.96
40	0.638	2.108	3.24	40	0.846	3.707	5.69
50	0.757	2.968	4.73	50	0.877	3.984	6.00
60	0.861	3.840	5.84	60	0.883	4.039	6.06
70	0.944	4.616	6.64	70	0.890	4.103	6.13
80	0.991	5.087	7.06	80	0.880	4.011	6.03
90	0.994	5.118	7.09	90	0.855	3.787	5.78
100	0.952	4.695	6.72	100	0.826	3.534	5.48
110	0.869	3.912	5.92	110	0.798	3.299	5.18
120	0.751	2.922	4.66	120	0.674	2.353	3.72
130	0.605	1.896	2.78	130	0.555	1.596	2.03
140	0.473	1.159	0.64	140	0.394	0.804	-0.95
150	0.364	0.686	-1.63	150	0.215	0.239	-6.21
160	0.307	0.488	-3.11	160	0.059	0.018	-17.44
170	0.291	0.439	-3.58	170	0.126	0.082	-10.85
180	0.294	0.448	-3.49	180	0.196	0.199	-7.01
190	0.286	0.424	-3.73	190	0.206	0.220	-6.58
200	0.257	0.342	-4.66	200	0.179	0.166	-7.80
210	0.205	0.218	-6.62	210	0.169	0.148	-8.30
220	0.139	0.100	-10.00	220	0.218	0.246	-6.09
230	0.094	0.046	-13.39	230	0.283	0.415	-3.82
240	0.108	0.060	-12.19	240	0.318	0.524	-2.81
250	0.142	0.104	-9.81	250	0.328	0.557	-2.54
260	0.150	0.117	-9.33	260	0.316	0.517	-2.86
270	0.116	0.070	-11.57	270	0.308	0.491	-3.09
280	0.055	0.016	-18.05	280	0.294	0.448	-3.49
290	0.091	0.043	-13.68	290	0.253	0.332	-4.79
300	0.192	0.191	-7.19	300	0.215	0.239	-6.21
310	0.281	0.409	-3.88	310	0.191	0.189	-7.24
320	0.318	0.524	-2.81	320	0.167	0.144	-8.40
330	0.304	0.479	-3.20	330	0.146	0.110	-9.57
340	0.255	0.337	-4.73	340	0.147	0.112	-9.51
350	0.211	0.231	-6.37	350	0.224	0.260	-5.85
Maximum Value				Maximum Value			
Field		1.000		Field		0.890	
Gain		5.18 (7.14 dB)		Gain		4.103 (6.13 dB)	
Azimuth Bearing		85 degrees		Azimuth Bearing		70 degrees	
Minimum Field				Minimum Field			
Field		0.054		Field		0.059	
Gain		.015 (-18.21 dB)		Gain		.018 (-17.44 dB)	
Azimuth Bearing		285 degrees		Azimuth Bearing		160 degrees	

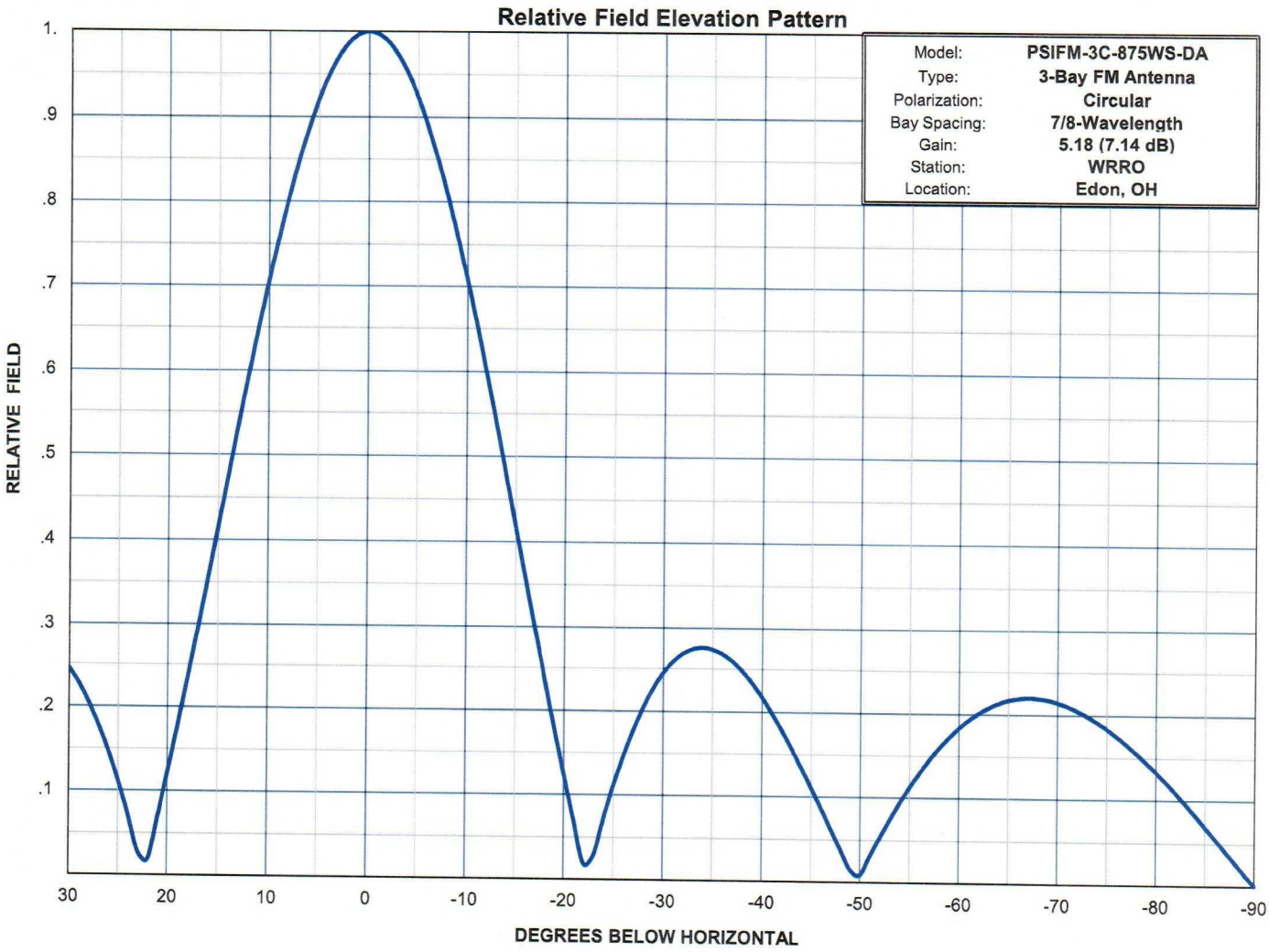
ERP Tabulation

Antenna: PSIFM-3C-875WS-DA
Our Lady of Guadalupe Radio, Inc.
Station: WRRO
Frequency: 89.9 MHz
Location: Edon, OH
Maximum ERP: 15 kW (11.76 dBk)

Horizontal Polarization				Vertical Polarization			
Angle	Relative Field	ERP (kW)	ERP (dBk)	Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.220	0.73	-1.39	0	0.357	1.91	2.81
10	0.291	1.27	1.04	10	0.517	4.01	6.03
20	0.396	2.35	3.71	20	0.665	6.63	8.22
30	0.515	3.98	6.00	30	0.778	9.08	9.58
40	0.638	6.11	7.86	40	0.846	10.74	10.31
50	0.757	8.60	9.34	50	0.877	11.54	10.62
60	0.861	11.12	10.46	60	0.883	11.70	10.68
70	0.944	13.37	11.26	70	0.890	11.88	10.75
80	0.991	14.73	11.68	80	0.880	11.62	10.65
90	0.994	14.82	11.71	90	0.855	10.97	10.40
100	0.952	13.59	11.33	100	0.826	10.23	10.10
110	0.869	11.33	10.54	110	0.798	9.55	9.80
120	0.751	8.46	9.27	120	0.674	6.81	8.33
130	0.605	5.49	7.40	130	0.555	4.62	6.65
140	0.473	3.36	5.26	140	0.394	2.33	3.67
150	0.364	1.99	2.98	150	0.215	0.69	-1.59
160	0.307	1.41	1.50	160	0.059	0.05	-12.82
170	0.291	1.27	1.04	170	0.126	0.24	-6.23
180	0.294	1.30	1.13	180	0.196	0.58	-2.39
190	0.286	1.23	0.89	190	0.206	0.64	-1.96
200	0.257	0.99	-0.04	200	0.179	0.48	-3.18
210	0.205	0.63	-2.00	210	0.169	0.43	-3.68
220	0.139	0.29	-5.38	220	0.218	0.71	-1.47
230	0.094	0.13	-8.78	230	0.283	1.20	0.80
240	0.108	0.17	-7.57	240	0.318	1.52	1.81
250	0.142	0.30	-5.19	250	0.328	1.61	2.08
260	0.150	0.34	-4.72	260	0.316	1.50	1.75
270	0.116	0.20	-6.95	270	0.308	1.42	1.53
280	0.055	0.05	-13.43	280	0.294	1.30	1.13
290	0.091	0.12	-9.06	290	0.253	0.96	-0.18
300	0.192	0.55	-2.57	300	0.215	0.69	-1.59
310	0.281	1.18	0.74	310	0.191	0.55	-2.62
320	0.318	1.52	1.81	320	0.167	0.42	-3.78
330	0.304	1.39	1.42	330	0.146	0.32	-4.95
340	0.255	0.98	-0.11	340	0.147	0.32	-4.89
350	0.211	0.67	-1.75	350	0.224	0.75	-1.23
Maximum Value (H-pol)				Maximum Value (V-pol)			
Field	1.000			Field	0.890		
ERP	15 kW (11.76 dBk)			ERP	11.88 kW (10.75 dBk)		
Azimuth Bearing	85 degrees			Azimuth Bearing	70 degrees		
Minimum Field (H-pol)				Minimum Field (V-pol)			
Field	0.054			Field	0.059		
ERP	.044 kW (-13.59 dBk)			ERP	.05 kW (-12.82 dBk)		
Azimuth Bearing	285 degrees			Azimuth Bearing	160 degrees		



Propagation Systems, Inc.



Propagation Systems Inc.
Relative Field Tabulation Elevation Pattern
Antenna Model: PSIFM-3C-875WS-DA
Gain: 5.18 (7.14 dBd)
WRRO

Angle	Field	dB	Angle	Field	dB	Angle	Field	dB
-90	0.001	-60.00	-50	0.009	-41.12	-10	0.707	-3.01
-89	0.014	-37.12	-49	0.014	-36.84	-9	0.759	-2.40
-88	0.028	-31.05	-48	0.038	-28.36	-8	0.806	-1.87
-87	0.042	-27.57	-47	0.062	-24.11	-7	0.849	-1.42
-86	0.056	-25.10	-46	0.086	-21.27	-6	0.888	-1.03
-85	0.069	-23.19	-45	0.110	-19.16	-5	0.921	-0.71
-84	0.083	-21.66	-44	0.133	-17.49	-4	0.949	-0.45
-83	0.096	-20.39	-43	0.156	-16.13	-3	0.971	-0.25
-82	0.108	-19.30	-42	0.178	-15.00	-2	0.987	-0.11
-81	0.121	-18.36	-41	0.198	-14.07	-1	0.997	-0.03
-80	0.133	-17.55	-40	0.216	-13.30	0	1.000	0.00
-79	0.144	-16.83	-39	0.233	-12.66	1	0.997	-0.03
-78	0.155	-16.20	-38	0.247	-12.15	2	0.987	-0.11
-77	0.165	-15.64	-37	0.259	-11.75	3	0.971	-0.25
-76	0.175	-15.15	-36	0.267	-11.46	4	0.949	-0.45
-75	0.183	-14.73	-35	0.273	-11.28	5	0.921	-0.71
-74	0.192	-14.36	-34	0.275	-11.21	6	0.888	-1.03
-73	0.199	-14.04	-33	0.273	-11.26	7	0.849	-1.42
-72	0.205	-13.77	-32	0.268	-11.44	8	0.806	-1.87
-71	0.210	-13.56	-31	0.258	-11.75	9	0.759	-2.40
-70	0.214	-13.39	-30	0.245	-12.22	10	0.708	-3.00
-69	0.217	-13.27	-29	0.227	-12.89	11	0.653	-3.70
-68	0.219	-13.20	-28	0.204	-13.79	12	0.596	-4.49
-67	0.219	-13.18	-27	0.178	-15.01	13	0.538	-5.39
-66	0.218	-13.21	-26	0.147	-16.68	14	0.477	-6.42
-65	0.216	-13.30	-25	0.111	-19.09	15	0.417	-7.60
-64	0.213	-13.44	-24	0.072	-22.89	16	0.356	-8.98
-63	0.208	-13.66	-23	0.028	-30.95	17	0.295	-10.60
-62	0.201	-13.93	-22	0.018	-34.66	18	0.236	-12.55
-61	0.193	-14.29	-21	0.069	-23.25	19	0.178	-15.00
-60	0.183	-14.74	-20	0.122	-18.27	20	0.122	-18.26
-59	0.172	-15.29	-19	0.178	-15.00	21	0.069	-23.23
-58	0.159	-15.96	-18	0.236	-12.56	22	0.019	-34.59
-57	0.145	-16.77	-17	0.295	-10.60	23	0.028	-31.00
-56	0.129	-17.77	-16	0.356	-8.98	24	0.072	-22.91
-55	0.112	-19.01	-15	0.417	-7.61	25	0.111	-19.09
-54	0.094	-20.56	-14	0.477	-6.42	26	0.146	-16.69
-53	0.074	-22.60	-13	0.537	-5.39	27	0.178	-15.01
-52	0.053	-25.48	-12	0.596	-4.49	28	0.204	-13.80
-51	0.031	-30.07	-11	0.653	-3.70	29	0.227	-12.89