Directional FM Antenna
WNTH
Board of Education, New Trier Township District 203
Winnetka, IL

A standard model PSIFML antenna with radome and parasitic elements was used in conjunction with the customer's Rohn 17" face triangular tower to create the necessary directional radiation pattern. The final antenna consists of one radiating element secured to the tower face with a custom mounting bracket and mast. There is a total of two horizontal parasitic elements and a support mast that provides a parasitic effect. The antenna is center fed from an existing flexible transmission line.

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 264.3 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 89.2% of the envelope RMS.

The antenna is to be mounted on the north tower face and positioned 345 degrees True. north tower face. No other antenna can be installed within 10 ft of ant radiating element. Any guy wire that passes within 20 ft. of a radiating element must be changed to the to the appropriate 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 .0675 kW will be required at the antenna input in order to reach the approved .054 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.

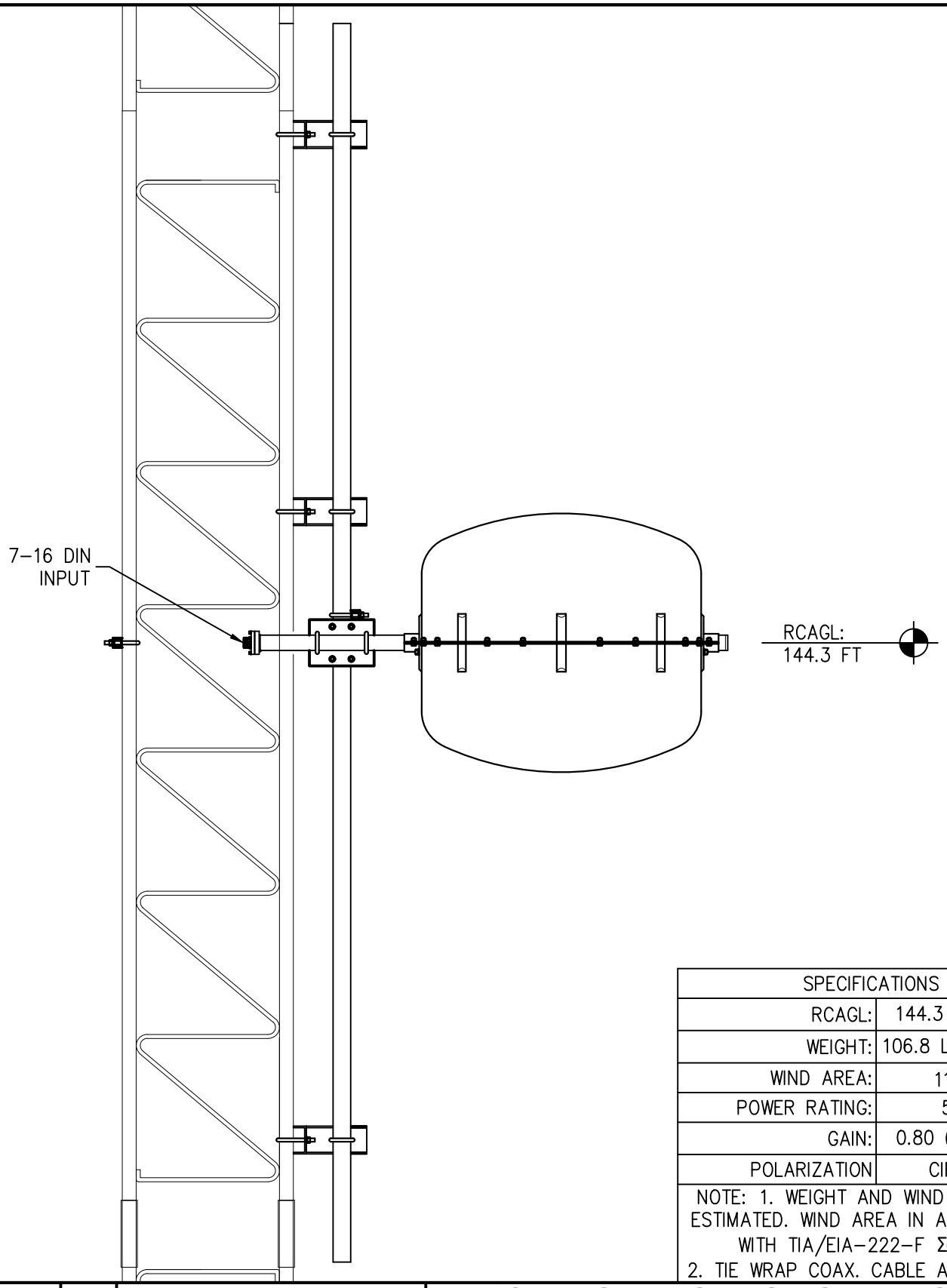
Antenna Specifications

Antenna Model	PSIFML-1C-HR-DA
Type	1-bay directional FM antenna
Frequency	88.1 MHz
Polarization	Circular
Envelope RMS	.850
Composite RMS	.758
Gain (h-pol)	.800 (-.97 dB)
Gain (v-pol)	.698 (-1.56 dB)
ERP	54 Watts
Antenna input power	67.5 Watts
Input	7-16 DIN female
Power rating	.50 kW
Length	11.2 ft.
Weight	106.8 lbs.
Wind Area	11.9 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	
RCAGL:	144.3 FT (44 M)
WEIGHT:	106.8 LB (48.4 Kg)
WIND AREA:	11.9 FT^2
POWER RATING:	500 W
GAIN:	0.80 (−0.97 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

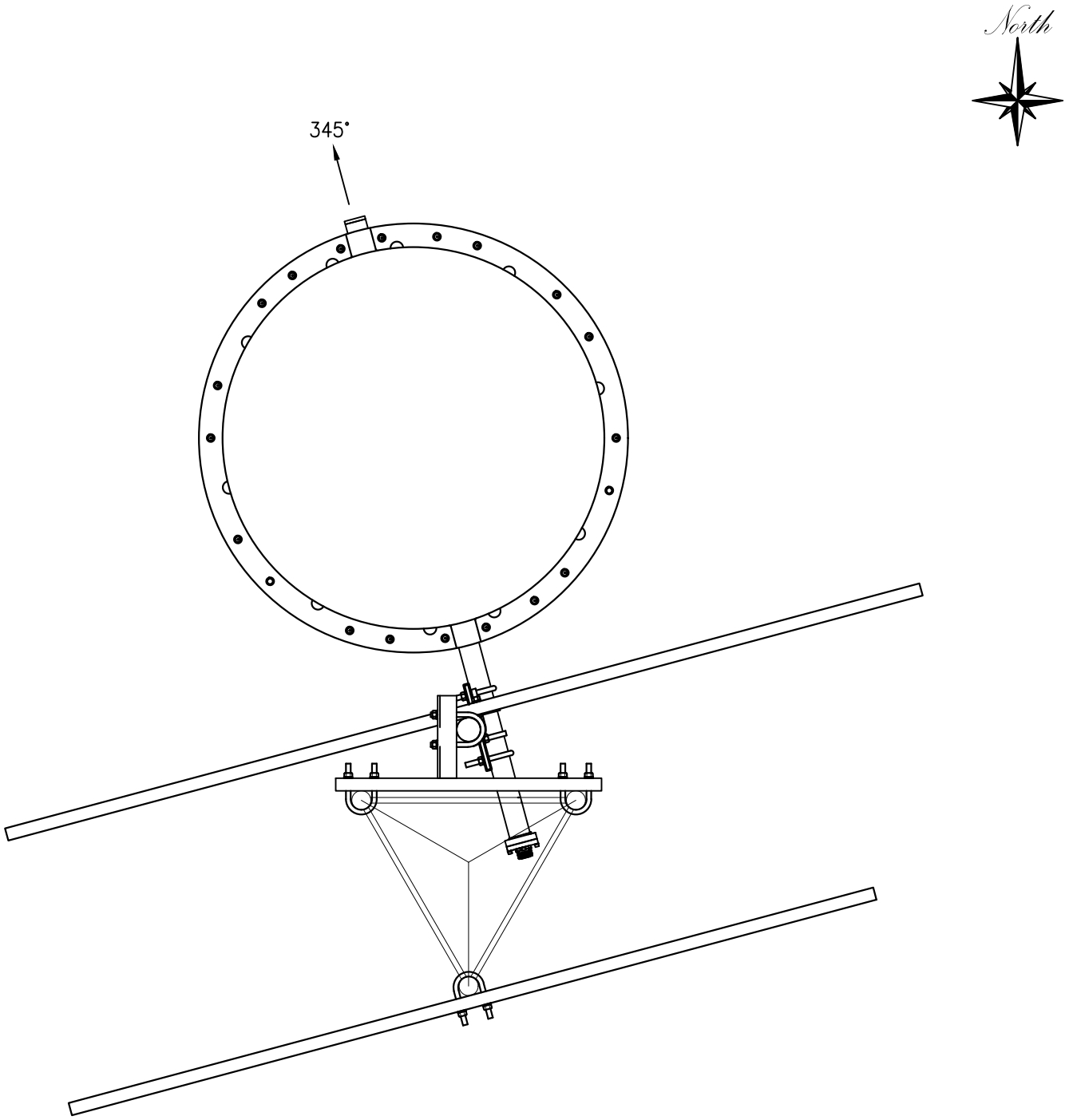
SIZE: A

PROPAGATION SYSTEMS, INC.

Ebensburg, Pennsylvania USA 814−472−5540

ANTENNA ELEVATION, SPECIFICATIONS, AND ORIENTATION

MODEL:	DRAWN BY:	DATE:
PSIFML−1C−HR−DA	M.MOCK	06/19/19
CHANNEL/ FREQUENCY: 88.1 MHz	APPROVED BY:	DATE:
SCALE:	DRAWING NO.: 2039−001	REV. C



REV.	MADE BY / CHECKED BY	DATE	CHANGE

SIZE: A

PROPAGATION SYSTEMS, INC.

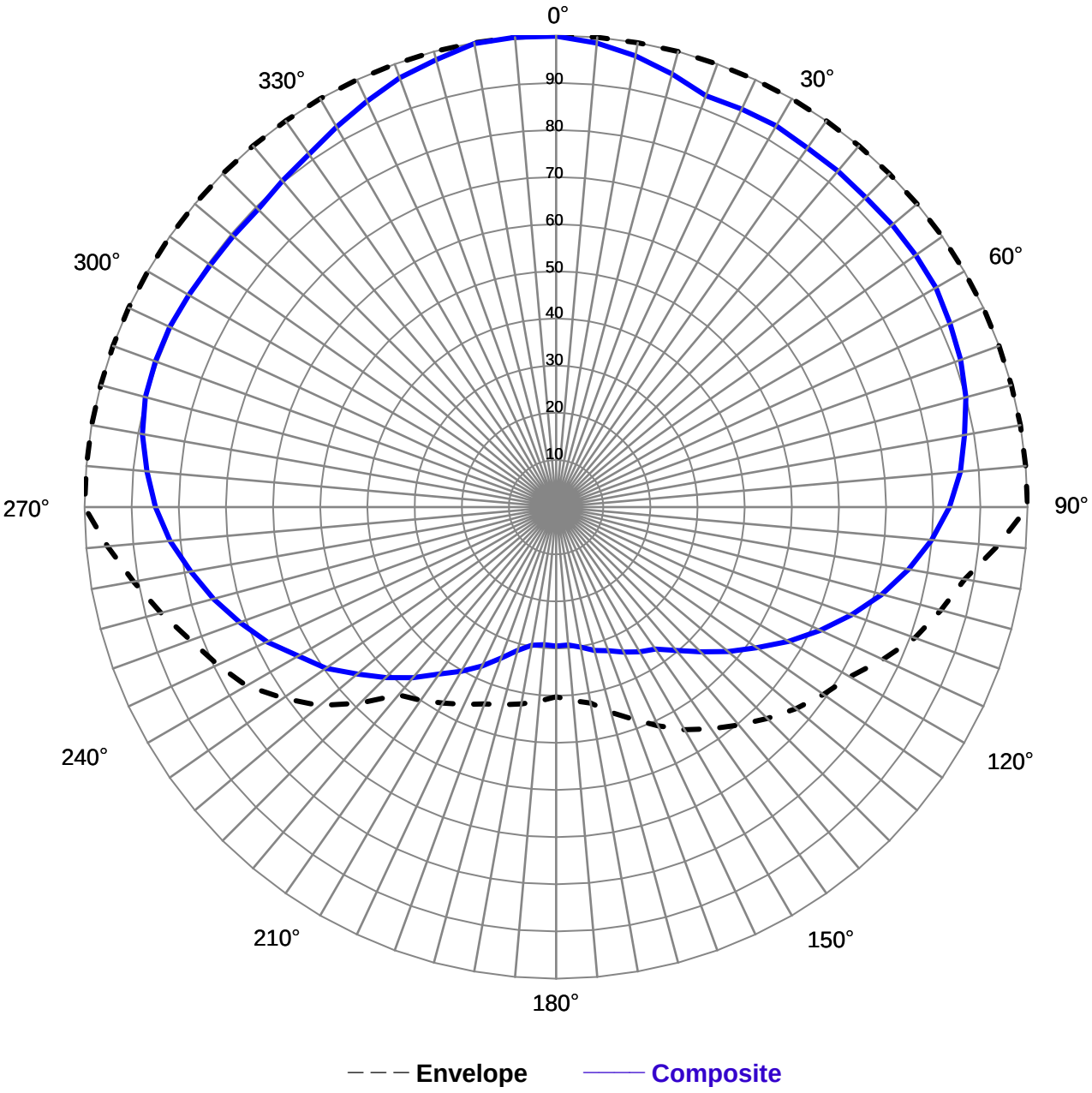
Ebensburg, Pennsylvania USA 814-472-5540

ANTENNA ORIENTATION AND PLAN VIEW

MODEL: PSIFML-1C-HR-DA	DRAWN BY: H.POTTS	DATE: 07/03/19	
CHANNEL/FREQUENCY: 88.1 MHz	APPROVED BY:	DATE:	
SCALE:	DRAWING NO.: 2039-002	REV. B	

Propagation Systems, Inc.

Relative Field
Azimuth Plane Pattern



Pattern Type:	**Measured Composite**	Tower:	**Rohn 55**
Antenna Model:	**PSIFML-1C-HR-DA**	Orientation:	**345°**
Polarization:	**Circular**	Frequency:	**88.1 MHz**
RMS (envelope)	**0.850**	Station:	**WNTH**
RMS (composite)	**0.758**	Date:	**9/9/2020**

Maximum Envelope Tabulation

Antenna Model: PSIFML-1C-HR-DA

Board of Education, New Trier Township Distrct 203

Station: WNTH

Frequency: 88.1 MHz

Location: Winnetka, IL

Maximum ERP: .054 kW

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	1.000	0.054	-12.68
10	1.000	0.054	-12.68
20	1.000	0.054	-12.68
30	1.000	0.054	-12.68
40	1.000	0.054	-12.68
50	1.000	0.054	-12.68
60	1.000	0.054	-12.68
70	1.000	0.054	-12.68
80	1.000	0.054	-12.68
90	1.000	0.054	-12.68
100	0.880	0.042	-13.79
110	0.810	0.035	-14.51
120	0.720	0.028	-15.53
130	0.665	0.024	-16.22
140	0.603	0.020	-17.07
150	0.545	0.016	-17.95
160	0.479	0.012	-19.07
170	0.422	0.010	-20.17
180	0.402	0.009	-20.59
190	0.424	0.010	-20.13
200	0.444	0.011	-19.73
210	0.480	0.012	-19.05
220	0.520	0.015	-18.36
230	0.655	0.023	-16.35
240	0.758	0.031	-15.08
250	0.825	0.037	-14.35
260	0.910	0.045	-13.50
270	1.000	0.054	-12.68
280	1.000	0.054	-12.68
290	1.000	0.054	-12.68
300	1.000	0.054	-12.68
310	1.000	0.054	-12.68
320	1.000	0.054	-12.68
330	1.000	0.054	-12.68
340	1.000	0.054	-12.68
350	1.000	0.054	-12.68

Composite Pattern Tabulation

Antenna Model: PSIFML-1C-HR-DA

Board of Education, New Trier Township Distrct 203

Station: WNTH

Frequency: 88.1 MHz

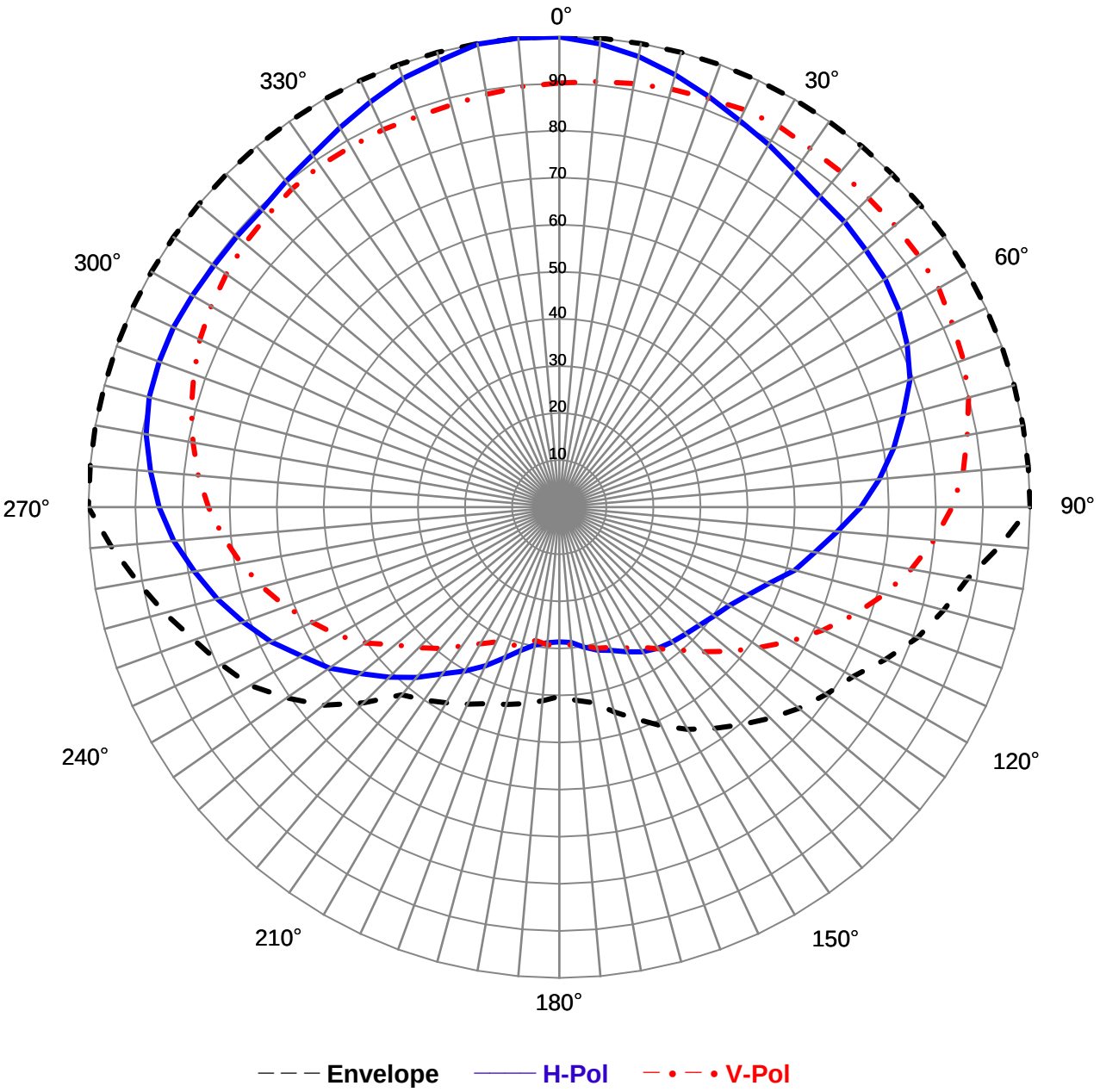
Location: Winnetka, IL

Maximum ERP: .054 kW

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.999	0.054	-12.69
10	0.972	0.051	-12.93
20	0.928	0.047	-13.32
30	0.934	0.047	-13.27
40	0.930	0.047	-13.31
50	0.931	0.047	-13.30
60	0.931	0.047	-13.30
70	0.913	0.045	-13.46
80	0.880	0.042	-13.79
90	0.834	0.038	-14.25
100	0.759	0.031	-15.07
110	0.667	0.024	-16.20
120	0.569	0.018	-17.57
130	0.477	0.012	-19.11
140	0.397	0.008	-20.71
150	0.355	0.007	-21.68
160	0.324	0.006	-22.46
170	0.302	0.005	-23.08
180	0.295	0.005	-23.29
190	0.297	0.005	-23.21
200	0.341	0.006	-22.03
210	0.402	0.009	-20.59
220	0.472	0.012	-19.19
230	0.550	0.016	-17.86
240	0.632	0.022	-16.67
250	0.714	0.028	-15.60
260	0.787	0.033	-14.76
270	0.850	0.039	-14.09
280	0.891	0.043	-13.68
290	0.904	0.044	-13.55
300	0.899	0.044	-13.60
310	0.894	0.043	-13.65
320	0.903	0.044	-13.56
330	0.931	0.047	-13.30
340	0.969	0.051	-12.95
350	0.998	0.054	-12.69

Propagation Systems, Inc.

Relative Field
Azimuth Plane Pattern



Pattern Type:	**Measured Field**	Tower:	**Rohn 55**
Antenna Model:	**PSIFML-1C-HR-DA**	Orientation:	**345°**
Polarization:	**Circular**	Frequency:	**88.1 MHz**
Gain (H-pol):	**.800 (-.97 dB)**	Station:	**WNTH**
Gain (V-pol):	**.698 (-1.56 dB)**	Date:	**9/9/2020**

ERP Tabulation

Antenna Model: PSIFML-1C-HR-DA

Board of Education, New Trier Township Distrct 203

Station: WNTH

Frequency: 88.1 MHz

Location: Winnetka, IL

Maximum ERP: .054 kW

Horizontal Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.999	0.054	-12.69
10	0.972	0.051	-12.93
20	0.928	0.047	-13.32
30	0.890	0.043	-13.69
40	0.861	0.040	-13.98
50	0.850	0.039	-14.09
60	0.834	0.038	-14.26
70	0.793	0.034	-14.69
80	0.721	0.028	-15.51
90	0.641	0.022	-16.54
100	0.551	0.016	-17.85
110	0.473	0.012	-19.17
120	0.417	0.009	-20.26
130	0.390	0.008	-20.86
140	0.373	0.008	-21.23
150	0.355	0.007	-21.68
160	0.324	0.006	-22.46
170	0.302	0.005	-23.08
180	0.286	0.004	-23.54
190	0.297	0.005	-23.21
200	0.341	0.006	-22.03
210	0.402	0.009	-20.59
220	0.472	0.012	-19.19
230	0.550	0.016	-17.86
240	0.632	0.022	-16.67
250	0.714	0.028	-15.60
260	0.787	0.033	-14.76
270	0.850	0.039	-14.09
280	0.891	0.043	-13.68
290	0.904	0.044	-13.55
300	0.899	0.044	-13.60
310	0.894	0.043	-13.65
320	0.903	0.044	-13.56
330	0.931	0.047	-13.30
340	0.969	0.051	-12.95
350	0.998	0.054	-12.69

Maximum Value (H-pol)

Field 1.000

ERP .054 kW (-12.68 dBk)

Azimuth Bearing 355 degrees

Minimum Field (H-pol)

Field 0.286

ERP .004 kW (-23.54 dBk)

Azimuth Bearing 180 degrees

Vertical Polarization

Angle	Relative Field	ERP (kW)	ERP (dBk)
0	0.901	0.044	-13.58
10	0.914	0.045	-13.46
20	0.924	0.046	-13.37
30	0.934	0.047	-13.27
40	0.930	0.047	-13.31
50	0.931	0.047	-13.30
60	0.931	0.047	-13.30
70	0.913	0.045	-13.46
80	0.880	0.042	-13.79
90	0.834	0.038	-14.25
100	0.759	0.031	-15.07
110	0.667	0.024	-16.20
120	0.569	0.018	-17.57
130	0.477	0.012	-19.11
140	0.397	0.008	-20.71
150	0.344	0.006	-21.95
160	0.317	0.005	-22.66
170	0.300	0.005	-23.15
180	0.295	0.005	-23.29
190	0.288	0.004	-23.49
200	0.314	0.005	-22.74
210	0.335	0.006	-22.17
220	0.392	0.008	-20.82
230	0.455	0.011	-19.51
240	0.544	0.016	-17.96
250	0.618	0.021	-16.85
260	0.687	0.025	-15.94
270	0.745	0.030	-15.23
280	0.790	0.034	-14.73
290	0.826	0.037	-14.34
300	0.854	0.039	-14.05
310	0.872	0.041	-13.87
320	0.883	0.042	-13.76
330	0.884	0.042	-13.74
340	0.882	0.042	-13.76
350	0.890	0.043	-13.68

Maximum Value (V-pol)

Field 0.934

ERP .047 kW (13.27 dBk)

Azimuth Bearing 30 degrees

Minimum Field (V-pol)

Field 0.288

ERP .004 kW (-23.49 dBk)

Azimuth Bearing 190 degrees

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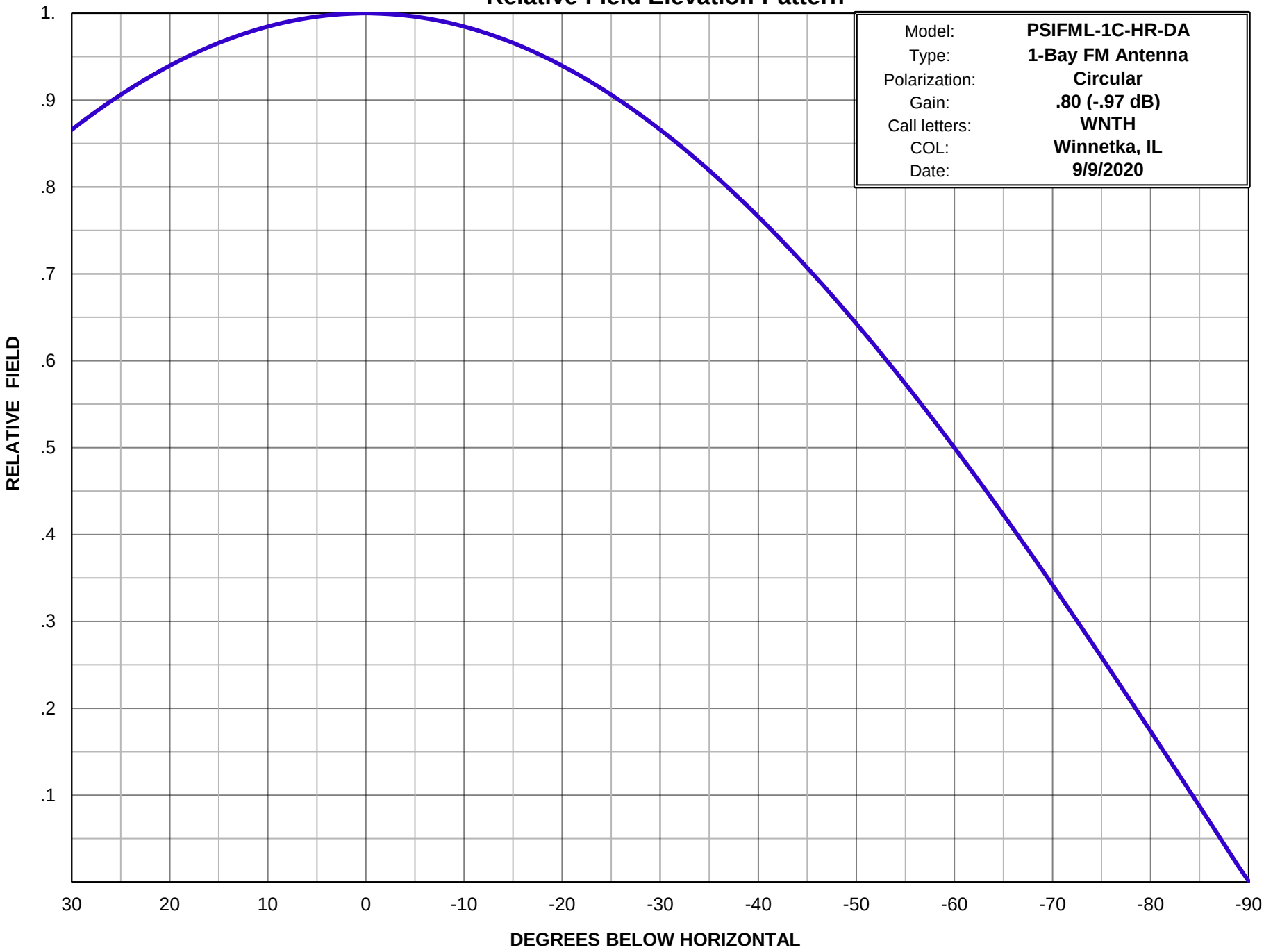
Relative Field Elevation Pattern



Propagation Systems Inc.

Relative Field Tabulation Elevation Pattern
Antenna Model: PSIFML-1C-HR-DA
Gain: .80 (-.97 dBd)
Station: WNTH

Angle	Field	dB	Angle	Field	dB	Angle	Field	dB
-90	0.001	-60.00	-50	0.643	-3.84	-10	0.985	-0.13
-89	0.017	-35.18	-49	0.656	-3.66	-9	0.988	-0.11
-88	0.035	-29.16	-48	0.669	-3.49	-8	0.990	-0.09
-87	0.052	-25.63	-47	0.682	-3.32	-7	0.992	-0.07
-86	0.070	-23.14	-46	0.695	-3.17	-6	0.994	-0.05
-85	0.087	-21.20	-45	0.707	-3.01	-5	0.996	-0.03
-84	0.104	-19.63	-44	0.719	-2.86	-4	0.997	-0.02
-83	0.122	-18.29	-43	0.731	-2.72	-3	0.998	-0.01
-82	0.139	-17.13	-42	0.743	-2.58	-2	0.999	-0.01
-81	0.156	-16.12	-41	0.755	-2.44	-1	1.000	0.00
-80	0.174	-15.21	-40	0.766	-2.32	0	1.000	0.00
-79	0.191	-14.39	-39	0.777	-2.19	1	1.000	0.00
-78	0.208	-13.64	-38	0.788	-2.07	2	0.999	-0.01
-77	0.225	-12.96	-37	0.798	-1.95	3	0.998	-0.01
-76	0.242	-12.33	-36	0.809	-1.84	4	0.997	-0.02
-75	0.259	-11.74	-35	0.819	-1.73	5	0.996	-0.03
-74	0.276	-11.19	-34	0.829	-1.63	6	0.994	-0.05
-73	0.292	-10.68	-33	0.839	-1.53	7	0.992	-0.07
-72	0.309	-10.20	-32	0.848	-1.43	8	0.990	-0.09
-71	0.325	-9.75	-31	0.857	-1.34	9	0.988	-0.11
-70	0.342	-9.32	-30	0.866	-1.25	10	0.985	-0.13
-69	0.358	-8.91	-29	0.875	-1.16	11	0.982	-0.16
-68	0.375	-8.53	-28	0.883	-1.08	12	0.978	-0.19
-67	0.391	-8.17	-27	0.891	-1.00	13	0.974	-0.23
-66	0.407	-7.82	-26	0.899	-0.93	14	0.970	-0.26
-65	0.423	-7.48	-25	0.906	-0.86	15	0.966	-0.30
-64	0.438	-7.16	-24	0.913	-0.79	16	0.961	-0.34
-63	0.454	-6.86	-23	0.920	-0.72	17	0.956	-0.39
-62	0.469	-6.57	-22	0.927	-0.66	18	0.951	-0.44
-61	0.485	-6.29	-21	0.933	-0.60	19	0.945	-0.49
-60	0.500	-6.02	-20	0.940	-0.54	20	0.940	-0.54
-59	0.515	-5.76	-19	0.945	-0.49	21	0.933	-0.60
-58	0.530	-5.52	-18	0.951	-0.44	22	0.927	-0.66
-57	0.545	-5.28	-17	0.956	-0.39	23	0.920	-0.72
-56	0.559	-5.05	-16	0.961	-0.34	24	0.913	-0.79
-55	0.573	-4.83	-15	0.966	-0.30	25	0.906	-0.86
-54	0.588	-4.62	-14	0.970	-0.26	26	0.899	-0.93
-53	0.602	-4.41	-13	0.974	-0.23	27	0.891	-1.00
-52	0.616	-4.21	-12	0.978	-0.19	28	0.883	-1.08
-51	0.629	-4.02	-11	0.982	-0.16	29	0.875	-1.16