Electromagnetic Field (EMF) Strength Measurements
SITE: Rohrerstown Elementary School
March 10, 2023

Rohrerstown Elementary School – Hempfield School District
2200 Noll Drive
Lancaster, PA 17603

Millennium Engineering, P.C.
42 Old Barn Drive
West Chester, PA 19382

Cell: 610.220.3820
E-mail: pauldugan@comcast.net
www.millenniumeng.com

ELECTROMAGNETIC FIELD (EMF) STRENGTH MEASUREMENTS
SITE: Rohrerstown Elementary School
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TABLE OF CONTENTS

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42 Old Barn Drive
West Chester, Pennsylvania 19382

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March 10, 2023

Kim James, Director of Buildings and Grounds
Hempfield School District
200 Church Street
Landisville, PA 17538

Re: Electromagnetic Field (EMF) Measurements at Rohrerstown Elementary School
2200 Noll Drive, Lancaster, PA 17603

Dear Ms. James,

Our firm, Millennium Engineering, P.C., routinely provides independent determinations and certifications that communications facilities (existing and proposed) comply with Federal Communications Commission (FCC) exposure limits and guidelines for human exposure to radiofrequency electromagnetic fields (Code of Federal Regulation 47 CFR 1.1307 and 1.1310). As a registered professional engineer I am under the jurisdiction of the State Registration Boards in which I am licensed to hold paramount the safety, health, and welfare of the public and to issue all public statements in an objective and truthful manner.

On the school property there is an existing 100' Verizon Wireless monopole with an antenna platform at the top and ground equipment near the base of the monopole inside a locked chain link fence. I was contacted by representatives of Hempfield School District to inquire about having field strength measurements performed throughout the school property both indoor and outdoor to document the field strength versus the safety standard established by the Federal Communications Commission (FCC). The FCC sets the national standard for compliance with electromagnetic field safety. Millennium was retained to perform electromagnetic field (EMF) measurements throughout the entire school property to certify compliance with FCC safety standards.

On 3/10/2023, I visited the school property with my colleague Mohamed Ben Abdallah to perform EMF strength measurements at 192 locations inside the school building and in all outside areas of the school property including the roof which is a controlled access area. **The attached measurement data logs show that all whole body spatial average measurements are far below 1 % of the FCC general population exposure limits at all measured locations inside the school building. The highest readings were on the main roof at 5-7 % although the roof remains in compliance with the safety standard by a very large margin. The higher readings on the roof are expected due to the elevated level and being outdoor. All other outdoor ground level locations remain well below 3 % of the safety standard.** Please note that, for example, a reading of 0.01 in the data logs represents 0.01%, or 1/10,000th of the exposure limits. The data logs in the pages that follow include 6 sets of measurement locations in areas as noted in the logs and also below:

Ref. Points 1-48: Inside, First Floor (classrooms, hallways, stairwells, etc.)
Ref. Points 49-96: Inside, Second Floor (classrooms, hallways, stairwells, etc.)
Ref. Points 97-120: Main Roof
Ref. Points 121-144: Main Parking Lot – Front of School
Ref. Points 145-168: Around the Cell Tower/ Playgrounds and Basketball Court
Ref. Points 169-192: Soccer and Baseball Fields

All field strength measurements were performed with a calibrated Narda meter (Model #NBM-550 – Serial #H-1174) last calibrated on 3/24/2022 (expires 3/23/2024) and probe (Model #EA5091 – Serial #01067) last calibrated on 3/24/2022 (expires 3/24/2024). This particular meter and probe measures all transmitting frequencies in the environment in the 300 kHz to 50 GHz frequency range (which includes all licensed operating frequencies of Verizon Wireless and all other licensees in the environment).

Again, as shown from our field measurements, the exposure levels through the inside of the school are well below 1% of the safety standard which is the FCC general population exposure limits.; at all exterior ground level locations are well below 3 % of the safety standard; and the controlled access main roof reaches 7 % but is still in compliance by a substantial safety margin. Keep in mind that continuous exposure at 100 % of standard is considered by the scientific community as just as safe as 1 % of standard since the exposure limits themselves contain a large margin of safety.

In summary, electromagnetic field strength measurements were taken at 192 locations on the entire school property at 2200 Noll Drive, Lancaster, PA 17603. All measurements confirm that the current radiofrequency exposure levels at locations throughout the school property are in compliance with all applicable standards in proximity to a cell tower installation on the property.

Respectfully,

Paul Dugan, P.E.
Registered Professional Engineer
Pennsylvania License Number

Rohrerstown Electromagnetic (EMF) Field Strength Measurements

Storing Date: 3/10/2023
Storing Time: 10:37:19 AM
Device Product Name: NBM-550
Device Serial Number: H-1174
Probe Product Name: EA5091
Probe Serial Number: 01067
Standard Name: FCC96-326,occ
Unit: mW/cm²
Spatial AVG Mode: CONTINUOUS
Device Cal Due Date: 3/24/2024

REF #	% FCC General Population / Uncontrolled MPE Limit
1	0.000
2	0.000
3	0.000
4	0.000
5	0.000
6	0.000
7	0.000
8	0.000
9	0.000
10	0.000
11	0.000
12	0.000
13	0.000
14	0.000
15	0.000
16	0.000
17	0.000
18	0.000
19	0.000
20	0.000
21	0.000
22	0.000
23	0.000
24	0.000

REF #	% FCC General Population / Uncontrolled MPE Limit
25	0.001
26	0.000
27	0.000
28	0.000
29	0.000
30	0.000
31	0.000
32	0.000
33	0.000
34	0.000
35	0.000
36	0.000
37	0.000
38	0.000
39	0.001
40	0.000
41	0.000
42	0.000
43	0.000
44	0.000
45	0.000
46	0.002
47	0.002
48	0.003

Ref. Points 1-48: 1st floor

REF #	% FCC General Population / Uncontrolled MPE Limit
49	0.030
50	0.147
51	0.000
52	0.002
53	0.000
54	0.000
55	0.000
56	0.000
57	0.000
58	0.000
59	0.006
60	0.000
61	0.000
62	0.006
63	0.000
64	0.014
65	0.005
66	0.001
67	0.007
68	0.126
69	0.010
70	0.008
71	0.012
72	0.000

REF #	% FCC General Population / Uncontrolled MPE Limit
73	0.055
74	0.000
75	0.061
76	0.137
77	0.006
78	0.013
79	0.000
80	0.026
81	0.015
82	0.023
83	0.000
84	0.055
85	0.014
86	0.026
87	0.043
88	0.081
89	0.026
90	0.000
91	0.000
92	0.018
93	0.045
94	0.049
95	0.060
96	0.048

Ref. Points 49-96: 2nd floor

REF #	% FCC General Population / Uncontrolled MPE Limit
97	4.419
98	4.344
99	5.055
100	5.590
101	6.355
102	6.075
103	6.395
104	6.350
105	7.010
106	6.405
107	6.305
108	7.395
109	6.890
110	7.065
111	5.700
112	6.870
113	7.345
114	6.985
115	6.565
116	6.465
117	6.485
118	7.325
119	6.885
120	6.885

REF #	% FCC General Population / Uncontrolled MPE Limit
121	2.246
122	2.380
123	2.410
124	2.834
125	2.720
126	2.867
127	2.357
128	2.500
129	2.355
130	2.506
131	2.206
132	2.401
133	2.397
134	2.326
135	1.788
136	1.841
137	1.461
138	1.437
139	1.904
140	2.233
141	1.848
142	1.945
143	1.968
144	2.226

Ref. Points 97-120: Main Roof
Ref. Points 121-144: Main Parking Lot / Front of school

REF #	% FCC General Population / Uncontrolled MPE Limit
145	0.055
146	0.005
147	0.000
148	0.020
149	0.581
150	0.968
151	1.269
152	1.427
153	1.216
154	1.512
155	1.842
156	1.860
157	2.025
158	2.025
159	2.066
160	1.909
161	1.987
162	1.830
163	1.428
164	1.750
165	1.424
166	1.582
167	1.092
168	1.561

REF #	% FCC General Population / Uncontrolled MPE Limit
169	1.307
170	1.539
171	1.643
172	1.334
173	1.402
174	1.079
175	1.432
176	1.401
177	1.560
178	1.125
179	1.525
180	1.409
181	1.341
182	1.224
183	1.546
184	1.519
185	1.629
186	1.372
187	1.467
188	1.377
189	1.235
190	1.393
191	0.950
192	0.535

Ref. Points 145-168: Around the Cell Tower/ Playgrounds and Basketball Court
Ref. Points 169-192: Soccer and Baseball Fields

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CALIBRATION CERTIFICATE

ATEC Asset ID
39987

Work Order
2022001622

Certificate Number: 2022001622-Rev1

Asset ID	39987
Manufacturer	Narda
Model Number	NARD-NBM-550
Serial Number	H-1174
Description	Broadband Field Strength Meter (requires probes)

Initial Condition	In Tolerance
Final Condition	In Tolerance
Calibration Date	3/24/2022
Due Date	3/23/2024
Temperature C°	21
Humidity	40
Procedure	2401-8700-00A and ATE 990313 Rev. Revision

Customer Name: Millennium Engineering, P.C.
Customer Address: 42 Old Barn Drive West Chester , PA 19382
Comments:

This Calibration is traceable to the International System of Units (SI), through National Metrology Institutes (NIST, PTB, NRC, NPL, etc.), ratiometric techniques, or natural physical constants. This certificate applies only to the item identified and shall not be reproduced other than in full, without the specific written approval of Advanced Test Equipment Corporation (ATEC). The calibration has been completed in accordance with ATEC's Active Use Calibration System. ATEC conforms to the requirements of the Quality Management System registered to ISO 9001:2015 (QAS International; US2790).

Standards Used

Model	Manufacturer	Serial	Asset ID	Due Date
AGIL-34401A	Agilent Technologies	US36109164	23503	10/21/2022

2401-8700-00A and ATE 990313					
Manual Template	**Pass**		**Found / Left**		
TEST DESCRIPTION	TRUE VALUE	Lower Limit	TEST RESULT	Upper Limit	Status
Calibration Results					
Input Voltage: 2.400 V					
Channel X	2.376 V	2.352 V	2.370 V	2.400 V	Pass
Channel Y	2.376 V	2.352 V	2.370 V	2.400 V	Pass
Channel Z	2.376 V	2.352 V	2.370 V	2.400 V	Pass
Because of an internal voltage divider, the nominal indication is 2.376 V.					

-- End of measurement results--

Calibrated by: Tobi Adesokan

Approved by: Keo Nueca

ATEC Corporation
10401 Roselle St.
San Diego, CA 92121

Telephone
888-488-2832

Facsimile
858-588-6570

Internet
www.ATECorp.com

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CALIBRATION CERTIFICATE

ATEC Asset ID
39988

Work Order
2022001623

Certificate Number: 2022001623-Rev1

Asset ID	39988
Manufacturer	Narda
Model Number	NARD-EA5091
Serial Number	01067
Description	300kHz-50GHz Isotropic Probe, Shaped E-Field, FCC

Initial Condition	In Tolerance
Final Condition	In Tolerance
Calibration Date	3/24/2022
Due Date	3/23/2024
Temperature C°	21.7
Humidity	48
Procedure	Probe ATE Software 990313 Rev. Revision

Customer Name: Millennium Engineering, P.C.
Customer Address: 42 Old Barn Drive West Chester , PA 19382
Comments:

This Calibration is traceable to the International System of Units (SI), through National Metrology Institutes (NIST, PTB, NRC, NPL, etc.), ratiometric techniques, or natural physical constants. This certificate applies only to the item identified and shall not be reproduced other than in full, without the specific written approval of Advanced Test Equipment Corporation (ATEC). The calibration has been completed in accordance with ATEC's Active Use Calibration System. ATEC conforms to the requirements of the Quality Management System registered to ISO 9001:2015 (QAS International; US2790).

Standards Used

Model	Manufacturer	Serial	Asset ID	Due Date
AGIL-N8481A	Agilent Technologies	MY50430005	13987	7/27/2022
AGIL-8482A	Agilent Technologies	MY41091935	15442	4/13/2022
MCL-BW-N20W5	MCL	1124	19024	3/19/2022
KEIT-2000	Keithley	1187328	23498	9/27/2022
NARD-769-30	Narda	07190	23694	11/11/2022
NARD-766-6	Narda	0308	23695	11/11/2022
AGIL-E4419B	Agilent Technologies	GB40202079	23698	1/27/2023
AGIL-8648C-H09	Agilent Technologies	3623A03016	23699	11/12/2022
AGIL-8482A	Agilent Technologies	3318A26724	24512	2/2/2023
NARD-3042-30	Narda	04019	24515	1/28/2023
NARD-3042B-30	Narda	11351	24516	1/28/2023
NARD-771-10	Narda	61	24517	1/28/2023
NARD-777C-20	Narda	36155	24600	3/19/2022
AGIL-N1913A	Agilent Technologies	MY50000389	24977	2/19/2023
AGIL-N1913A	Agilent Technologies	MY50000422	24978	2/19/2023
AGIL-N1913A	Agilent Technologies	MY50000388	24979	2/19/2023
AGIL-N1914A	Agilent Technologies	MY50000397	24980	2/10/2023
AGIL-N1914A	Agilent Technologies	MY50000398	24983	2/19/2023
AGIL-N1914A	Agilent Technologies	MY50000399	24984	2/16/2023
AGIL-N8481A	Agilent Technologies	MY50340007	24985	2/2/2023
AGIL-N8481A	Agilent Technologies	MY50340002	24986	2/2/2023
AGIL-N8481A	Agilent Technologies	MY50340012	24987	2/2/2023
AGIL-N8481A	Agilent Technologies	MY50340010	24988	2/2/2023
AGIL-N8481A	Agilent Technologies	MY50340008	24991	2/2/2023
AGIL-N8481A	Agilent Technologies	MY50340001	24992	2/2/2023
AGIL-N8481A	Agilent Technologies	MY50340011	24993	8/19/2022
AGIL-R8486A	Agilent Technologies	2703A00606	24996	9/24/2022
MILL-CL3-22-R2000	Millitech	256	25005	3/9/2022
NARD-1079	Narda	20115	25010	3/25/2022
NARD-3022	Narda	50484	25011	3/22/2022
NARD-3075	Narda	SD038433	25014	3/19/2022
NARD-757-10	Narda	34408	25025	3/22/2022
NARD-773-20	Narda	SD038434	25026	3/22/2022
AGIL-N1914A	Agilent Technologies	MY50001230	25841	2/16/2023
AGIL-8648D-1EA	Agilent Technologies	3613A00446	26186	8/24/2022
AGIL-N8486AQ	Agilent Technologies	MY50350003	26473	10/25/2022
AGIL-N8481A	Agilent Technologies	MY50110017	29073	7/27/2022

AHSY-PAM-1840VH	AH Systems	165	31581	
NARD-779-10	Narda	04988	31802	3/19/2022
AGIL-R752D	Unknown	1109	32945	3/25/2022
AGIL-E4419B	Agilent Technologies	GB43311925	33347	2/8/2023
AGIL-N1914A	Agilent Technologies	MY50000400	33419	2/16/2023
NARD-779-10	Narda	03054	33648	3/22/2022
NARD-3024	Narda	61242	33649	3/22/2022
NARD-3024	Narda	50157	33650	3/22/2022

Calibrated by: Nathan Missig

Approved by: Keo Nueca

Advanced Test Equipment Corporation
10401 Roselle Street San Diego, CA 92121
Phone: 858-558-6500 · Fax: 858-558-6570
E-mail: calibrationrequest@atecorp.com
www.atecorp.com

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Part No. EA5091 Electric Field Probe - 2402/07B
Serial No. 01067

Calibration Results: Test Results WITHIN Specification

Frequency response and Ellipticity

The frequency response is measured with instrument setting: Apply Correction Frequency = OFF.

Frequency in MHz	*E*_actual in V/M	Meas. Uncertainty in dB	Applied *%STD actual*	Displayed *%STD mean*	Correction Factor *K* (*)	Ellipse Ratio in dB
0.3	307.00	0.80	25.00	25.98	0.981	1.53
3	307.00	0.80	25.00	40.36	0.787	0.89
10	92.10	0.80	25.00	29.41	0.922	0.33
30	30.70	0.80	25.00	17.02	1.212	0.28
100	30.70	0.80	25.00	20.93	1.093	0.39
300	30.70	1.00	25.00	15.48	1.271	0.30
750	48.54	1.00	24.88	26.33	0.972	0.17
1000	56.05	1.00	24.93	27.05	0.960	0.19
1800	68.65	0.90	25.00	27.53	0.953	0.47
2450	68.65	0.90	25.00	22.38	1.057	0.58
4000	68.65	0.90	25.00	18.68	1.157	0.45
8200	68.65	0.90	25.00	22.29	1.059	0.66
10000	68.65	0.90	25.00	25.10	0.998	0.46
18000	68.65	0.90	25.00	23.57	1.030	0.70
26500	68.65	0.90	25.00	33.96	0.858	0.93
40000	68.65	0.90	25.00	26.30	0.975	0.58
45500	68.65	0.90	25.00	18.42	1.165	0.74

Flatness (1800 - 40000 MHz): +/-1.30 dB **Pass**

Flatness (.3 - 45500 MHz): +/-2.08 dB **Pass**

Max. Ellipse Ratio (.3 - 45500 MHz): +/-1.53 dB **Pass**

(*) The frequency response correction data is stored in the probe memory. When the probe is connected to a NBM-550 Field Meter the implemented frequency response correction may be enabled. This is done by selecting the desired frequency and the setting: Apply Correction Frequency = ON.

Adjustment (informative):

This probe has two sensor modules, one for high frequency (HF) and one for low frequency (LF).

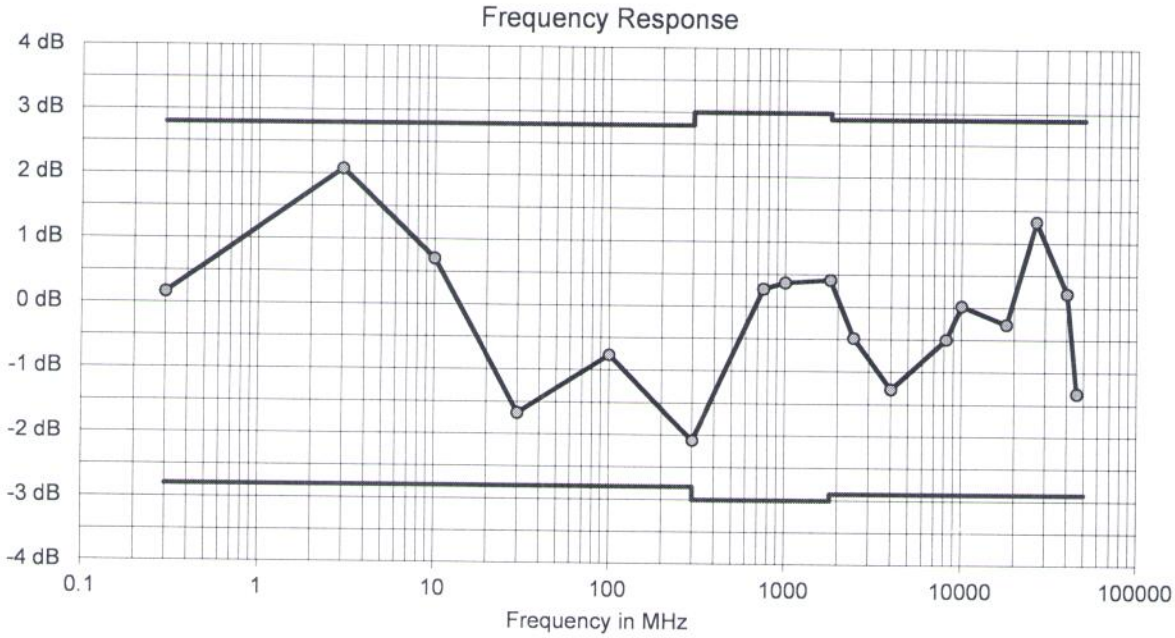
LF Gain multiplier = $K_{0,LF}$= 0.7661

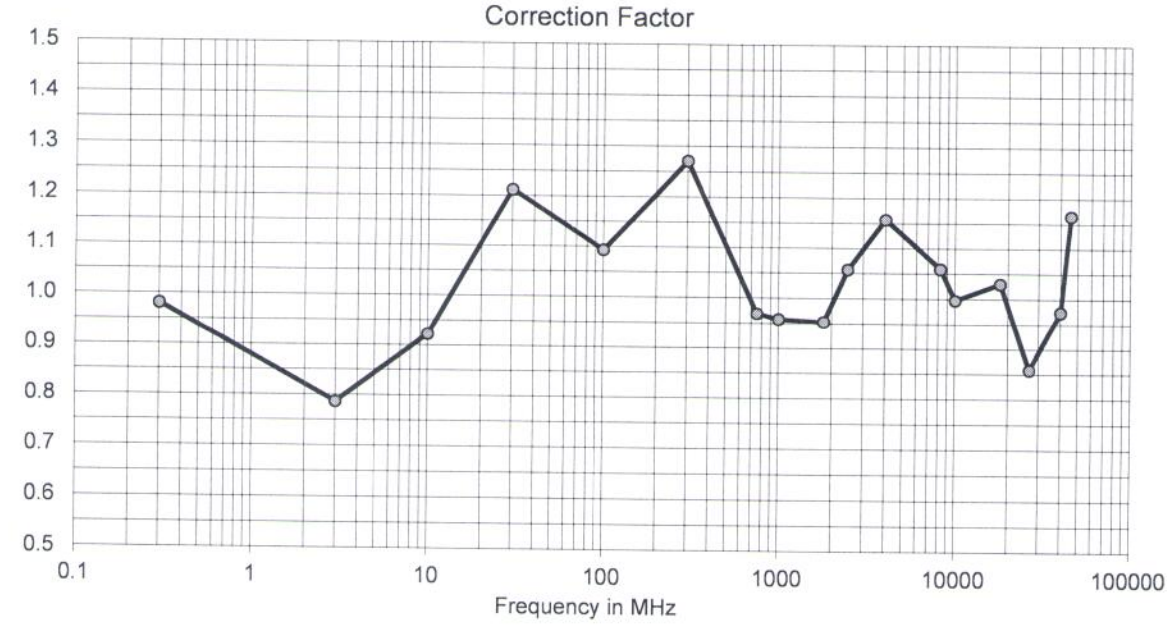
HF Gain multiplier = $K_{0,HF}$= 1.1348

Advanced Test Equipment Corporation
10401 Roselle Street San Diego, CA 92121
Phone: 858-558-6500 · Fax: 858-558-6570
E-mail: calibrationrequest@atecorp.com
www.atecorp.com

Frequency Response Graph

Frequency response data with setting: Apply Correction Frequency = OFF. Solid specification line includes uncertainty.





School Sign

Front of School

Narda Meter and Probe

Narda Meter Display

Monopole with Cell Antenna Installation

Verizon Wireless Antenna Sectors

DECLARATION OF ENGINEER

Paul Dugan, P.E., declares and states that he is a graduate telecommunications consulting engineer (BSE/ME Widener University 1984/1988), whose qualifications are a matter of record with the Federal Communications Commission (FCC). His firm, Millennium Engineering, P.C., has been retained by Hempfield School District to perform power density measurements or calculations for an existing or proposed communications facility and analyze the data for compliance with FCC exposure limits and guidelines for human exposure to radiofrequency electromagnetic fields.

Mr. Dugan also states that the calculations or measurements made in the evaluation were made by himself or his technical associates under his direct supervision, and the summary letter certification of FCC compliance associated with the foregoing document was made or prepared by him personally. Mr. Dugan is a registered professional engineer in the Jurisdictions of Pennsylvania, New Jersey, Delaware, Maryland, Virginia, New York, Connecticut, District of Columbia, West Virginia and Puerto Rico with over 30 years of engineering experience. Mr. Dugan is also an active member of the Association of Federal Communications Consulting Engineers, the National Council of Examiners for Engineering, the National Society of Professionals Engineers, the Pennsylvania Society of Professional Engineers, and the Radio Club of America. Mr. Dugan further states that all facts and statements contained herein are true and accurate to the best of his own knowledge, except where stated to be in information or belief, and, as to those facts, he believes them to be true. He believes under penalty of perjury the foregoing is true and correct.

Paul Dugan, P.E.

Executed this the 10th day of March, 2023.

PAUL DUGAN, P.E.
42 Old Barn Drive
West Chester, PA 19382

Cell: 610-220-3820
Email: pdugan@millenniumeng.com
Web Page: www.millenniumeng.com

EDUCATION:

Widener University, Chester, Pennsylvania
Master of Business Administration, July 1991
Master of Electrical Engineering, December 1988
Bachelor of Science, Electrical Engineering, May 1984

PROFESSIONAL ASSOCIATIONS:

Registered Professional Engineer in the following jurisdictions:

Pennsylvania, License Number PE-045711-E
New Jersey, License Number GE41731
Maryland, License Number 24211
Delaware, License Number 11797
Virginia, License Number 36239
West Virginia, License Number 20258
Connecticut, License Number 22566
New York, License Number 079144
District of Columbia, License Number PE-900355
Puerto Rico, License Number 18946

Full member of **The Association of Federal Communications Consulting Engineers** (www.afcce.org) January 1999 to Present
Elected and served on the Board of Directors for five year term 2006-2011

Full member of **The National Society of Professional Engineers** (www.nspe.org) and the **Pennsylvania Society of Professional Engineers** (www.pspe.org) June 2003 to Present
Currently serving as PSPE State Director and Past President on the Board of Directors of the Valley Forge Chapter and the South East Region Vice-Chair for the "Professional Engineers in Private Practice" Executive Committee. Actively participated in NSPE Annual Conferences 7/2005 to Present.

Actively participate in **Chester County ARES/RACES Amateur Radio** (CCAR www.w3eoc.org) which prepares and provides emergency backup communications for Chester County Department of Emergency Services, March 2005 to Present

Full member of **The National Council of Examiners for Engineering** (www.ncees.org) May 2001 to Present

Full Member of **The Radio Club of America** (www.radio-club-of-america.org) December 2003 to Present

Pennsylvania Real Estate License Number RS347405 Keller Williams 2/2019 to Present

PROFESSIONAL EXPERIENCE:

Millennium Engineering, P.C., West Chester, Pennsylvania
Position: **President**, August 1999 to Present (www.millenniumeng.com)

Verizon Wireless, Plymouth Meeting, Pennsylvania
Position: **Cellular RF System Design/Performance Engineer**, April 1990 to August 1999

Communications Test Design, Inc., West Chester, Pennsylvania
Position: **Electrical Engineer,** May 1984 to April 1990

PERSONAL:

Date/place of birth: November 21, 1961, West Chester, Pennsylvania; United States Citizen