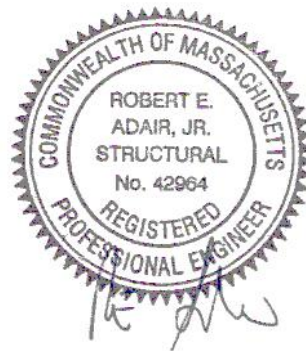# ALL-POINTS
TECHNOLOGY CORPORATION

STRUCTURAL ANALYSIS REPORT
95' SELF-SUPPORTING TOWER
WEST TISBURY, MASSACHUSETTS

Prepared for
Pyramid Network Services, LLC

SITE: RECC

May 23, 2019

COMMONWEALTH OF MASSACHUSETTS
ROBERT E. ADAIR, JR.
STRUCTURAL
No. 42964
REGISTERED
PROFESSIONAL ENGINEER

APT Project #MA2341490

STRUCTURAL ANALYSIS REPORT
95' SELF-SUPPORTING TOWER
DUKES COUNTY, MASSACHUSETTS
prepared for
Pyramid Network Services, LLC

EXECUTIVE SUMMARY:

All-Points Technology Corporation, P.C. (APT) performed a condition assessment and structural analysis of this 95' self-supporting tower. The analysis was performed for Dukes County/Motorola's proposed installation of six omnidirectional whips and two microwave dishes as detailed below. The omnidirectional whips are to be mounted on 6' sidearms and will be fed by four 1/2" lines and two 7/8" lines. The microwave dishes are to be located on leg-mounted pipes and shall be fed by one EW63 line each.

APT's analysis indicates the tower does **not** meet the requirements of the Massachusetts State Building Code and TIA-222 with the proposed equipment installations. <u>Diagonal bracing and diagonal bolts in one tower section were determined to be inadequately sized.</u> The tower base foundation was also evaluated and determined to be adequately sized under the proposed loading.

INTRODUCTION:

A condition assessment and structural analysis was performed on the above-mentioned communications tower by APT for Pyramid Network Services, LLC. The tower is located at 9 Flight Path Road in West Tisbury, Massachusetts.

APT visited the tower site on May 1, 2019 to record the existing inventory and assess the condition of the tower. The tower was climbed in its entirety to compile data necessary for performing the structural analysis. The analysis also relied on information provided by others, which included Valmont Structures tower and foundation drawings (drawing #245211, dated October 15, 2012) and a lease exhibit detailing the proposed equipment changes (dated April 11, 2019).

The structure is a 95-foot, galvanized steel self-supporting tower manufactured by Valmont Structures. The tower features pipe leg members with angle steel bracing members arranged in an X-braced configuration.

The analysis was performed in accordance with TIA-222-G using the following antenna inventory:

Pyramid Network Services, LLC
95' Self-Supporting Tower, West Tisbury, MA
Verizon Site: RECC

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Antenna	Leg	Elev.	Mount	Coax.
Lightning rod w/ camera	A	100'	10' x 2-3/8" pipe extension	-
8" x 6" camera	A	98'	On above pipe extension	1/4"
DS1F06F36U-D omnidirectional whip	A	95'	**6' sidearm**	**7/8"**
(2) 20' x 2-1/2" omnidirectional whips	B, C	85'	(2) 6' x 2-3/8" sidearms w/ 10' x 1-7/8" stabilizers	(2) 1/2"
ANT790F2, ANT150F2 omnidirectional whips	B, C	80'	**(2) 6' sidearms**	**(2) 1/2"**
30" high-performance dish, 12" x 10" x 3" panel	A	80', 78'	4' x 4-1/2" pipe on leg	3/8"
5' x 2-1/2" omnidirectional whip, 8' x 3" omnidirectional whip (inverted)	A	76', 75'	6' x 2-3/8" sidearm w/ 10' x 1-7/8" stabilizer	7/8", 1/2"
DS1F06F36U-D omnidirectional whip, SC3-W60A high-performance dish	A	70'	**6' sidearm, Pipe on leg**	**7/8", EW63**
(2) 20' x 2-1/2" omnidirectional whips	B, C	65'	(2) 6' x 2-3/8" sidearms w/ 10' x 1-7/8" stabilizers	7/8", 1/2"
ANT790F2, ANT150F2 omnidirectional whips	A, C	60'	**(2) 6' sidearms**	**(2) 1/2"**
SC3-W60A high-performance dish	B	55'	**Pipe on leg**	**EW63**
20' x 2-1/2" omnidirectional whip	B	46'	6' x 2-3/8" sidearm w/ 10' x 1-7/8" stabilizer	1/2"
Brace for wire feed	A	12'	3' L1-3/4" x 1/8" angle	N.A.
Vacant mount	C	5'	5' x 1" vertical on bracing	N.A.

CONDITION ASSESSMENT:

- **General Observations:** The tower, a 3-legged galvanized steel structure, appeared to be in sound condition. No signs of movement or overstress of the tower were observed. Galvanizing appeared to be in good condition.

- **Climbing Facilities:** A 3/8" climber safety cable and climbing pegs are in place on the southeastern leg of the tower.

- **Leg Members:** Tower legs consist of pipe members, all of which appeared to be in good condition.

- **Lattice Bracing:** Bracing members are comprised of X-braced angle steel and appeared to be in sound condition. Bracing connections were visually observed to the maximum extent practicable, with no loose or missing bolts observed.

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- **Splice Connections:** Connections were checked by hand for tightness at climbing leg splice locations. No loose or missing splice bolts were observed.

- **Antenna Connections:** Antenna mounting hardware appeared to be in good condition, with corrosion resistant hardware and galvanized members prevalent.

STRUCTURAL ANALYSIS:

Methodology:

The structural analysis was done in accordance with the Massachusetts State Building Code and TIA-222, Revision G (TIA), <u>Structural Standard for Antenna Supporting Structures and Antennas</u>.

The analysis was conducted using a 3-second Ultimate gust wind speed of 155 miles per hour with no ice and 40-mph with ¾" radial ice in accordance with the TIA-222-G standard for Dukes County, Massachusetts. The following additional design criteria were used:

Structure Class: III
Topographic Category: 1
Exposure Category: C

Analysis Results:

Analysis of the tower was conducted in accordance with the criteria outlined herein. The following table summarizes the results of the analysis based on stresses of individual leg and bracing members:

Elevation	Legs	Bracing
80'-95'	15%	22%
60'-80'	80%	61%
40'-60'	90%	**123%**
20'-40'	83%	49%
0'-20'	97%	73%

Bracing, Splice and Anchor Bolts:

Connection bolts were evaluated under the proposed loading. <u>Diagonal bolts were found to be undersized from 40'-60', at a capacity of 141%.</u> All other bolts were found to be adequately sized to support the proposed loading.

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Base Foundation:

Evaluation of the base foundation was performed from original Valmont design drawings. The foundation was determined to be adequately sized under the proposed equipment loading. Factored base reactions imposed with the additional antennas were calculated as follows:

Reactions	Calculated
Compression (kips)	167.9
Uplift (kips)	156.2
Shear (kips)	14.6
Overturning Moment (ft-kips)	1281

CONCLUSIONS AND RECOMMENDATIONS:

APT's structural analysis indicates that the 95-foot self-supporting tower located at 9 Flight Path Road in West Tisbury, Massachusetts does **not** meet the requirements of the Massachusetts State Building Code and TIA-222 with Dukes County/Motorola's proposed equipment. Diagonal bracing and diagonal bolts in one tower section were determined to require upgrade.

The tower base foundation was also evaluated under the proposed loading and found to be adequately sized.

LIMITATIONS:

This report is based on the following:

1. Tower is properly installed and maintained.
2. All members are in an undeteriorated condition.
3. All required members are in place.
4. All bolts are in place and are properly tightened.
5. Tower is in plumb condition.
6. All tower members were properly designed, detailed, fabricated, and installed and have been properly maintained since erection.

All-Points Technology Corporation, P.C. (APT) is not responsible for modifications completed prior to or hereafter which APT is not or was not directly involved. Modifications include but are not limited to:

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1. Replacing or strengthening bracing members.
2. Reinforcing vertical members in any manner.
3. Adding or relocating torque arms or guys.
4. Installing antenna mounting gates or side arms.

APT hereby states that this document represents the entire report and that it assumes no liability for any factual changes that may occur after the date of this report. All representations, recommendations, and conclusions are based upon the information contained and set forth herein. If you are aware of any information which is contrary to that which is contained herein, or you are aware of any defects arising from the original design, material, fabrication and erection deficiencies, you should disregard this report and immediately contact APT. APT disclaims all liability for any representation, recommendation, or conclusion not expressly stated herein.
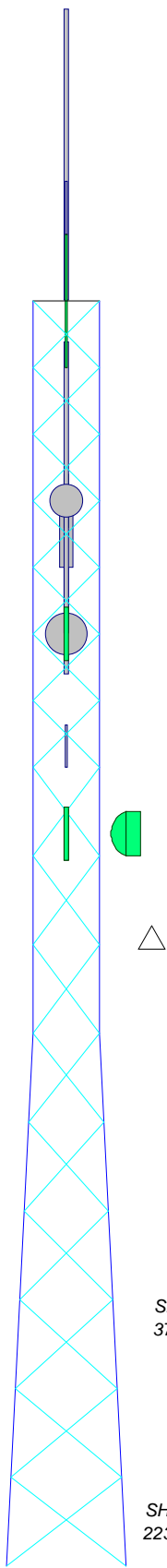
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Appendix A

Tower Schematic

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Generic Lightning Rod 4' copper	95	DS1F06F36U-D	70
8" fisheye camera	95	6' sidearm	70
10'x2 3/8" Pipe Mount	95	4'x4 1/2" Pipe Mount	70
DS1F06F36U-D	95	RFS SC3-W60A HP dish	70
6' sidearm	95	10'x1 7/8" sidearm stabilizer	65
10'x1 7/8" sidearm stabilizer	85	20' x 2.5" omni whip	65
20' x 2.5" omni whip	85	10'x1 7/8" sidearm stabilizer	65
6' sidearm	85	6' sidearm	65
10'x1 7/8" sidearm stabilizer	85	20' x 2.5" omni whip	65
20' x 2.5" omni whip	85	6' sidearm	65
6' sidearm	85	Telewave ANT150F2	60
4'x4 1/2" Pipe Mount	82 - 78	6' sidearm	60
Telewave ANT150F2	80	Telewave ANT790F2	60
6' sidearm	80	6' sidearm	60
Telewave ANT790F2	80	4'x4 1/2" Pipe Mount	55
6' sidearm	80	RFS SC3-W60A HP dish	55
2.5' HP dish	80	6' sidearm	46
12" x 10" x 3" panel	78	10'x1 7/8" sidearm stabilizer	46
5' x 2.5" omni whip	76	20' x 2" omni whip	46
6' sidearm	76 - 75	3' L1-3/4 x 1/8" angle	12
8' x 3" omni whip	75	5' x 1" vertical	5
10'x1 7/8" sidearm stabilizer	75		

MATERIAL STRENGTH

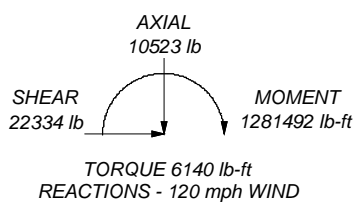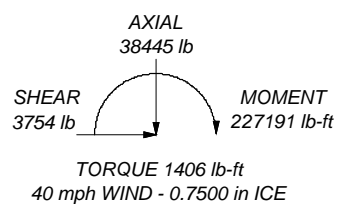| GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi	A36	36 ksi	58 ksi

ALL REACTIONS
ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
  DOWN: 167916 lb
  SHEAR: 14631 lb

  UPLIFT: -156231 lb
  SHEAR: 13738 lb

AXIAL
38445 lb

SHEAR
3754 lb

MOMENT
227191 lb-ft

TORQUE 1406 lb-ft
40 mph WIND - 0.7500 in ICE

AXIAL
10523 lb

SHEAR
22334 lb

MOMENT
1281492 lb-ft

TORQUE 6140 lb-ft
REACTIONS - 120 mph WIND

Tower Section Table

Section	T1	T2	T3	T4	T5
Legs	ROHN 2.5 STD		ROHN 4 STD		ROHN 5 STD
Leg Grade			A572-50		
Diagonals	L2x2x1/8				L2x2x3/16
Diagonal Grade			A36		
Top Girts	L2x2x1/8		N.A.		
Face Width (ft)	5				9
# Panels @ (ft)	7 @ 5		9 @ 6.66667		7
Weight (lb)	505.4	640.2	940.0	1336.3	1402.5

Total Weight (lb): 4824.4

Elevations: 95.0 ft, 80.0 ft, 60.0 ft, 40.0 ft, 20.0 ft, 0.0 ft

Appendix B

Photographs

Overview photos of 95' self-supporting tower

Photos of existing equipment on tower

Photos taken by All-Points Technology Corporation, P.C. on May 1, 2019.

Additional photos of existing equipment and mounts

Photos taken by All-Points Technology Corporation, P.C. on May 1, 2019.

Photos of existing feed lines emerging from pipe conduit

Photos taken by All-Points Technology Corporation, P.C. on May 1, 2019.

Additional photos of existing feed lines emerging from pipe conduit

Photos of existing feed lines and feed line ladder on tower

Photos taken by All-Points Technology Corporation, P.C. on May 1, 2019.

Photos of lightning rod and camera (left), and microwave dish with panel (right)

Photo of existing equipment and mounts on tower

Photos taken by All-Points Technology Corporation, P.C. on May 1, 2019.

Additional photos of existing equipment and mounts

Photos taken by All-Points Technology Corporation, P.C. on May 1, 2019.

Additional equipment and mount photos

Photo of typical sidearm mount and stabilizer

Photos taken by All-Points Technology Corporation, P.C. on May 1, 2019.

Photos of typical splice connection

Photo of tower base, including anchor bolts and visible foundation concrete

Photos taken by All-Points Technology Corporation, P.C. on May 1, 2019.

Photos of typical leg connections to foundation concrete

Photos of base of tower leg, and safety climb connection to tower leg

Photos of safety climb and climbing pegs on tower

Photos taken by All-Points Technology Corporation, P.C. on May 1, 2019.

Photos of ground and surrounding compound from tower

Photos taken by All-Points Technology Corporation, P.C. on May 1, 2019.

Appendix C

Calculations

Tower Input Data

The main tower is a 3x free standing tower with an overall height of 95.00 ft above the ground line.
The base of the tower is set at an elevation of 0.00 ft above the ground line.
The face width of the tower is 5.00 ft at the top and 9.00 ft at the base.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

 ASCE 7-10 Wind Data is used (wind speeds converted to nominal values).
 Basic wind speed of 120 mph.
 Ultimate wind speed of 155 mph.
 Structure Class III.
 Exposure Category C.
 Topographic Category 1.
 Crest Height 0.00 ft.
 Nominal ice thickness of 0.7500 in.
 Ice thickness is considered to increase with height.
 Ice density of 56 pcf.
 A wind speed of 40 mph   is used in combination with ice.
 Temperature drop of 50 °F.
 Deflections calculated using a wind speed of 60 mph.
 A non-linear (P-delta) analysis was used.
 Pressures are calculated at each section.
 Stress ratio used in tower member design is 1.
 Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Feed Line/Linear Appurtenances

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
1/4	B	No	No	Ar (CaAa)	95.00 - 10.00	0.0000	-0.08	1	1	0.2500	0.2500		0.05
1/2	B	No	No	Ar (CaAa)	85.00 - 10.00	0.0000	0.07	1	1	0.5800	0.5800		0.25
1/2	B	No	No	Ar (CaAa)	85.00 - 10.00	0.0000	0.07	2	2	0.5800	0.5800		0.25
3/8	B	No	No	Ar (CaAa)	78.00 - 10.00	0.0000	-0.03	1	1	0.4400	0.4400		0.08
7/8	B	No	No	Ar (CaAa)	75.00 - 10.00	0.0000	-0.1	1	1	1.1100	1.1100		0.54
1/2	B	No	No	Ar (CaAa)	75.00 - 10.00	0.0000	0.01	1	1	0.5800	0.5800		0.25
7/8	B	No	No	Ar (CaAa)	65.00 - 10.00	0.0000	-0.08	1	1	1.1100	1.1100		0.54
1/2	B	No	No	Ar (CaAa)	65.00 - 10.00	0.0000	0.01	1	1	0.5800	0.5800		0.25
1/2	B	No	No	Ar (CaAa)	46.00 - 10.00	0.0000	0.01	1	1	0.5800	0.5800		0.25
Feedline Ladder (Af)	B	No	No	Af (CaAa)	95.00 - 6.00	0.0000	0	1	1	3.0000	3.0000		8.40
7/8	C	No	No	Ar (CaAa)	95.00 - 8.00	0.0000	-0.08	1	1	1.1100	1.1100		0.54
1/2	C	No	No	Ar (CaAa)	80.00 - 8.00	0.0000	-0.01	2	2	0.5800	0.5800		0.25
7/8	C	No	No	Ar (CaAa)	70.00 - 8.00	0.0000	-0.05	1	1	1.1100	1.1100		0.54

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
EW63	C	No	No	Ar (CaAa)	70.00 - 8.00	0.0000	0.05	1	1	1.5742	1.5742		0.51
1/2	C	No	No	Ar (CaAa)	60.00 - 8.00	0.0000	0.01	2	2	0.5800	0.5800		0.25
EW63	C	No	No	Ar (CaAa)	55.00 - 8.00	0.0000	0.08	1	1	1.5742	1.5742		0.51
Feedline Ladder (Af)	C	No	No	Af (CaAa)	95.00 - 6.00	0.0000	0	1	1	3.0000	3.0000		8.40

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft²	C_AA_A Side ft²	Weight lb
Generic Lightning Rod 4' copper	A	From Leg	0.00 0.00 7.00	0.0000	95.00	No Ice 1/2" Ice 1" Ice	0.50 1.00 1.50	0.50 1.00 1.50	0.00 0.00 0.00
8" fisheye camera	A	From Leg	0.00 0.00 3.00	0.0000	95.00	No Ice 1/2" Ice 1" Ice	0.80 0.91 1.04	0.53 0.63 0.73	75.00 84.24 95.48
10'x2 3/8" Pipe Mount	A	None		0.0000	95.00	No Ice 1/2" Ice 1" Ice	2.38 3.40 4.45	2.38 3.40 4.45	36.50 54.35 78.71
20' x 2.5" omni whip	B	From Leg	6.00 0.00 10.00	0.0000	85.00	No Ice 1/2" Ice 1" Ice	5.00 7.03 9.07	5.00 7.03 9.07	50.00 86.96 136.55
6' sidearm	B	None		0.0000	85.00	No Ice 1/2" Ice 1" Ice	4.17 6.17 8.17	2.09 3.09 4.09	75.00 125.00 200.00
10'x1 7/8" sidearm stabilizer	B	None		0.0000	85.00	No Ice 1/2" Ice 1" Ice	1.88 2.90 3.94	1.88 2.90 3.94	27.20 41.92 63.09
20' x 2.5" omni whip	C	From Leg	6.00 0.00 10.00	0.0000	85.00	No Ice 1/2" Ice 1" Ice	5.00 7.03 9.07	5.00 7.03 9.07	50.00 86.96 136.55
6' sidearm	C	None		0.0000	85.00	No Ice 1/2" Ice 1" Ice	4.17 6.17 8.17	2.09 3.09 4.09	75.00 125.00 200.00
10'x1 7/8" sidearm stabilizer	C	None		0.0000	85.00	No Ice 1/2" Ice 1" Ice	1.88 2.90 3.94	1.88 2.90 3.94	27.20 41.92 63.09
12" x 10" x 3" panel	A	From Leg	1.00 0.00 0.00	0.0000	78.00	No Ice 1/2" Ice 1" Ice	1.00 1.13 1.26	0.32 0.40 0.49	25.00 31.87 40.56
4'x4 1/2" Pipe Mount	A	None		0.0000	82.00 - 78.00	No Ice 1/2" Ice 1" Ice	1.03 1.58 1.84	1.03 1.58 1.84	43.10 56.09 72.13
5' x 2.5" omni whip	A	From Leg	6.00 0.00 2.50	0.0000	76.00	No Ice 1/2" Ice 1" Ice	1.23 1.53 1.84	1.23 1.53 1.84	28.00 37.47 50.41
8' x 3" omni whip	A	From Leg	6.00 0.00 -4.00	0.0000	75.00	No Ice 1/2" Ice 1" Ice	2.34 3.19 3.67	2.34 3.19 3.67	50.00 67.51 90.37
6' sidearm	A	None		0.0000	76.00 - 75.00	No Ice 1/2" Ice 1" Ice	4.17 6.17 8.17	2.09 3.09 4.09	75.00 125.00 200.00

	Job		Page
tnxTower	95' Self-Supporting Tower		3 of 6
All-Points Technology 116 Grandview Rd. Conway, NH 03018 Phone: (603) 496-5853 FAX: (603) 447-2124	Project		Date
	MA2341490 RECC		16:00:14 05/23/19
	Client		Designed by
	Pyramid Network Services, LLC		REA

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
10'x1 7/8" sidearm stabilizer	A	None		0.0000	75.00	No Ice	1.88	1.88	27.20
						1/2" Ice	2.90	2.90	41.92
						1" Ice	3.94	3.94	63.09
20' x 2.5" omni whip	B	From Leg	6.00 0.00 10.00	0.0000	65.00	No Ice	5.00	5.00	50.00
						1/2" Ice	7.03	7.03	86.96
						1" Ice	9.07	9.07	136.55
6' sidearm	B	None		0.0000	65.00	No Ice	4.17	2.09	75.00
						1/2" Ice	6.17	3.09	125.00
						1" Ice	8.17	4.09	200.00
10'x1 7/8" sidearm stabilizer	B	None		0.0000	65.00	No Ice	1.88	1.88	27.20
						1/2" Ice	2.90	2.90	41.92
						1" Ice	3.94	3.94	63.09
20' x 2.5" omni whip	C	From Leg	6.00 0.00 10.00	0.0000	65.00	No Ice	5.00	5.00	50.00
						1/2" Ice	7.03	7.03	86.96
						1" Ice	9.07	9.07	136.55
6' sidearm	C	None		0.0000	65.00	No Ice	4.17	2.09	75.00
						1/2" Ice	6.17	3.09	125.00
						1" Ice	8.17	4.09	200.00
10'x1 7/8" sidearm stabilizer	C	None		0.0000	65.00	No Ice	1.88	1.88	27.20
						1/2" Ice	2.90	2.90	41.92
						1" Ice	3.94	3.94	63.09
20' x 2" omni whip	B	From Leg	6.00 0.00 10.00	0.0000	46.00	No Ice	4.00	4.00	45.00
						1/2" Ice	6.03	6.03	75.77
						1" Ice	8.07	8.07	119.12
6' sidearm	B	None		0.0000	46.00	No Ice	4.17	2.09	75.00
						1/2" Ice	6.17	3.09	125.00
						1" Ice	8.17	4.09	200.00
10'x1 7/8" sidearm stabilizer	B	None		0.0000	46.00	No Ice	1.88	1.88	27.20
						1/2" Ice	2.90	2.90	41.92
						1" Ice	3.94	3.94	63.09
3' L1-3/4 x 1/8" angle	A	None		0.0000	12.00	No Ice	0.60	0.03	16.50
						1/2" Ice	0.81	0.06	22.63
						1" Ice	1.04	0.09	31.54
5' x 1" vertical	C	None		0.0000	5.00	No Ice	0.95	0.95	13.60
						1/2" Ice	1.37	1.37	21.14
						1" Ice	1.68	1.68	32.09
DS1F06F36U-D	A	From Leg	6.00 0.00 11.00	0.0000	95.00	No Ice	6.26	6.26	75.00
						1/2" Ice	8.79	8.79	122.23
						1" Ice	11.03	11.03	183.30
6' sidearm	A	None		0.0000	95.00	No Ice	4.17	2.09	75.00
						1/2" Ice	6.17	3.09	125.00
						1" Ice	8.17	4.09	200.00
Telewave ANT150F2	C	From Leg	6.00 0.00 2.50	0.0000	80.00	No Ice	1.29	1.29	15.00
						1/2" Ice	1.60	1.60	25.28
						1" Ice	1.91	1.91	39.06
6' sidearm	C	None		0.0000	80.00	No Ice	4.17	2.09	75.00
						1/2" Ice	6.17	3.09	125.00
						1" Ice	8.17	4.09	200.00
Telewave ANT790F2	B	From Leg	6.00 0.00 1.58	0.0000	80.00	No Ice	0.69	0.69	10.00
						1/2" Ice	0.89	0.89	16.64
						1" Ice	1.10	1.10	25.66
6' sidearm	B	None		0.0000	80.00	No Ice	4.17	2.09	75.00
						1/2" Ice	6.17	3.09	125.00
						1" Ice	8.17	4.09	200.00
DS1F06F36U-D	A	From Leg	6.00 0.00 11.00	0.0000	70.00	No Ice	6.46	6.46	75.00
						1/2" Ice	8.79	8.79	122.23
						1" Ice	11.03	11.03	183.30

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft²	C_AA_A Side ft²	Weight lb
6' sidearm	A	None		0.0000	70.00	No Ice	4.17	2.09	75.00
						1/2" Ice	6.17	3.09	125.00
						1" Ice	8.17	4.09	200.00
4'x4 1/2" Pipe Mount	A	None		0.0000	70.00	No Ice	1.04	1.04	43.10
						1/2" Ice	1.58	1.58	56.09
						1" Ice	1.84	1.84	72.13
Telewave ANT150F2	C	From Leg	6.00 0.00 2.50	0.0000	60.00	No Ice	1.29	1.29	15.00
						1/2" Ice	1.60	1.60	25.28
						1" Ice	1.91	1.91	39.06
6' sidearm	C	None		0.0000	60.00	No Ice	4.17	2.09	75.00
						1/2" Ice	6.17	3.09	125.00
						1" Ice	8.17	4.09	200.00
Telewave ANT790F2	A	From Leg	6.00 0.00 1.58	0.0000	60.00	No Ice	0.69	0.69	10.00
						1/2" Ice	0.89	0.89	16.64
						1" Ice	1.10	1.10	25.66
6' sidearm	A	None		0.0000	60.00	No Ice	4.17	2.09	75.00
						1/2" Ice	6.17	3.09	125.00
						1" Ice	8.17	4.09	200.00
4'x4 1/2" Pipe Mount	B	None		0.0000	55.00	No Ice	1.06	1.06	43.10
						1/2" Ice	1.58	1.58	56.09
						1" Ice	1.84	1.84	72.13

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft²	Weight lb
2.5' HP dish	A	Paraboloid w/Shroud (HP)	From Leg	1.00 0.00 0.00	0.0000		80.00	2.50	No Ice	4.91	50.00
									1/2" Ice	5.24	26.91
									1" Ice	5.57	38.82
RFS SC3-W60A HP dish	A	Paraboloid w/Shroud (HP)	From Leg	1.00 0.00 0.00	0.0000		70.00	3.28	No Ice	8.45	75.00
									1/2" Ice	8.88	120.58
									1" Ice	9.32	166.17
RFS SC3-W60A HP dish	B	Paraboloid w/Shroud (HP)	From Leg	1.00 0.00 0.00	0.0000		55.00	3.28	No Ice	8.45	75.00
									1/2" Ice	8.88	120.58
									1" Ice	9.32	166.17

Solution Summary

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	95 - 80	2.412	63	0.1981	0.0327
T2	80 - 60	1.791	63	0.1932	0.0282
T3	60 - 40	1.019	63	0.1563	0.0207
T4	40 - 20	0.426	63	0.1006	0.0114
T5	20 - 0	0.107	63	0.0472	0.0042

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
95.00	Generic Lightning Rod 4' copper	63	2.412	0.1981	0.0327	306668
85.00	20' x 2.5" omni whip	63	1.996	0.1965	0.0298	153334
82.00	4'x4 1/2" Pipe Mount	63	1.873	0.1948	0.0289	116168
80.00	2.5' HP dish	63	1.791	0.1932	0.0282	96298
78.00	12" x 10" x 3" panel	63	1.709	0.1911	0.0275	78981
76.00	5' x 2.5" omni whip	63	1.628	0.1886	0.0268	65424
75.50	6' sidearm	63	1.608	0.1879	0.0266	62626
75.00	8' x 3" omni whip	63	1.588	0.1872	0.0265	60044
70.00	RFS SC3-W60A HP dish	63	1.391	0.1788	0.0244	42506
65.00	20' x 2.5" omni whip	63	1.201	0.1683	0.0228	32897
60.00	Telewave ANT150F2	63	1.019	0.1563	0.0207	26866
55.00	RFS SC3-W60A HP dish	63	0.849	0.1431	0.0183	22805
46.00	20' x 2" omni whip	63	0.578	0.1177	0.0142	17955
12.00	3' L1-3/4 x 1/8" angle	63	0.048	0.0278	0.0023	32934
5.00	5' x 1" vertical	63	0.017	0.0115	0.0009	79043

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt lb	Allowable Load per Bolt lb	Ratio Load Allowable	Allowable Ratio	Criteria
T1	95	Leg	A325N	0.7500	4	1841.18	29820.60	0.062 ✔	1	Bolt Tension
		Diagonal	A325N	0.7500	1	1982.13	6307.50	0.314 ✔	1	Member Bearing
		Top Girt	A325N	0.7500	1	173.31	6307.50	0.027 ✔	1	Member Bearing
T2	80	Leg	A325N	0.7500	4	10361.60	29820.60	0.347 ✔	1	Bolt Tension
		Diagonal	A325N	0.7500	1	5434.04	6307.50	0.862 ✔	1	Member Bearing
T3	60	Leg	A325N	0.7500	6	16339.20	29820.60	0.548 ✔	1	Bolt Tension
		Diagonal	A325N	0.7500	1	8909.87	6307.50	1.413 ✘	1	Member Bearing
T4	40	Leg	A325N	0.7500	8	16431.70	29820.60	0.551 ✔	1	Bolt Tension
		Diagonal	A325N	0.7500	1	4215.98	9461.25	0.446 ✔	1	Member Bearing
T5	20	Leg	A325N	0.7500	8	19054.60	29820.60	0.639 ✔	1	Bolt Tension
		Diagonal	A325N	0.7500	1	3935.05	9461.25	0.416 ✔	1	Member Bearing

	Job		**Page**
tnxTower	95' Self-Supporting Tower		6 of 6
All-Points Technology *116 Grandview Rd.*	**Project**		**Date**
Conway, NH 03018	MA2341490 RECC		16:00:14 05/23/19
Phone: (603) 496-5853 *FAX: (603) 447-2124*	**Client**		**Designed by**
	Pyramid Network Services, LLC		REA

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	φP$_{allow}$ lb	% Capacity	Pass Fail
T1	95 - 80	Leg	ROHN 2.5 STD	3	-8526.53	57192.30	14.9	Pass
		Diagonal	L2x2x1/8	10	-1950.38	8968.45	21.7	Pass
							31.4 (b)	
		Top Girt	L2x2x1/8	5	-197.62	5299.51	3.7	Pass
T2	80 - 60	Leg	ROHN 2.5 STD	27	-45601.50	57192.30	79.7	Pass
		Diagonal	L2x2x1/8	30	-5504.16	8968.45	61.4	Pass
							86.2 (b)	
T3	60 - 40	Leg	ROHN 4 STD	54	-104269.00	116316.00	89.6	Pass
		Diagonal	L2x2x1/8	58	-9364.48	7617.18	122.9	Fail ✖
							141.3 (b)	
T4	40 - 20	Leg	ROHN 5 STD	75	-140093.00	169372.00	82.7	Pass
		Diagonal	L2x2x3/16	79	-4013.34	8147.41	49.3	Pass
T5	20 - 0	Leg	ROHN 5 STD	96	-163401.00	169372.00	96.5	Pass
		Diagonal	L2x2x3/16	100	-4394.84	6003.06	73.2	Pass
						Summary		
						Leg (T5)	96.5	Pass
						Diagonal (T3)	141.3	Fail ✖
						Top Girt (T1)	3.7	Pass
						Bolt Checks	141.3	Fail ✖
						RATING =	**141.3**	**Fail** ✖

All-Points Technology Corp., P.C.
116 Grandview Road
Conway, NH   03818
(603) 496-5853

Client:	**Pyramid Network Services, LLC**	Site:	**RECC**
Job:	**West Tisbury, MA**	Job No.:	**MA2341490**
Calculated By:	**R. Adair**	Date:	**23-May-19**

Program assumes:
Mat is square in plan view.
Water table is below bottom of mat.
Unit weight of concrete =   150 pcf
Unit weight of soil =   100 pcf
Self-supporting tower with 3 piers

Information to be provided:
Pier is round or square in plan dimension ("R" or "S")	Shape =	R
OTM = Overturning Moment to be resisted	OTM =	1281 ft-kips
H = Height from ground surface to top of mat (if buried)	H =	3.0 ft.
P_M = Projection of pier above mat	P_M =	3.5 ft.
y = Thickness of mat	y =	1.50 ft.
x = Width of mat	x =	18.00 ft.
d = Diameter of round pier	d =	2.5 ft.
S = Size of tension bars	S =	7

Mass of tower and appurtenances (below)

Results:

Component	Mass	Moment Arm	Moment Resist.
Pier	2.6 kips	9 ft.	23.2 ft-kips
Overburden	116.2 kips	9 ft.	1046.0 ft-kips
Mat	72.9 kips	9 ft.	656.1 ft-kips

Overturning Moment Resistance =   1725.27 ft-kips
Factor of Safety =   1.35   <u>SATISFACTORY</u>
Concrete Quantity =   19.9 c.y.