Robinson+Cole

KENNETH C. BALDWIN

280 Trumbull Street
Hartford, CT 06103-3597
Main (860) 275-8200
Fax (860) 275-8299
kbaldwin@rc.com
Direct (860) 275-8345

Also admitted in Massachusetts

January 14, 2020

Melanie A. Bachman, Esq.
Executive Director/Staff Attorney
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **Notice of Exempt Modification – Facility Modification**
239 Middle Turnpike East, Manchester, Connecticut

Dear Attorney Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) antennas at the 113-foot level on the existing 185-foot tall Manchester Police Department tower, 239 Middle Turnpike East in Manchester, Connecticut (the "Property"). The tower and Property are owned by the Town of Manchester ("Town"). The Siting Council approved Cellco's shared use of the Town tower in 2014 (TS-VER-077-140911). Prior to making this filing, we reviewed the Town's on-line records data base and were unable to locate any permits or approvals for the Police Department tower. We also made several attempts to contact Town's Planning and Zoning staff regarding existing permits and received no response.

Cellco now intends to modify its facility by replacing six (6) of its existing antennas with six (6) new model antennas, remove nine (9) existing remote radio heads ("RRHs") and install six (6) new RRHs. A set of project plans showing the proposed facility modifications and specifications for Cellco's antennas and RRHs are included in Attachment 1.

Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to Manchester's Mayor, Jay Moran; Scott Shanley, Manchester's General Manager; and Gary Anderson, Manchester's Director of Planning and Economic Development.

The planned modifications to the facility fall squarely within those activities explicitly provided for in R.C.S.A. § 16-50j-72(b)(2).

1. The proposed modifications will not result in an increase in the height of the existing tower. Cellco's replacement antennas and RRHs will be installed at the 113-foot level on the 185-foot tower.

2. The proposed modifications will not involve any change to ground-mounted equipment and, therefore, will not require the extension of the site boundary.

3. The proposed modifications will not increase noise levels at the facility by six decibels or more, or to levels that exceed state and local criteria.

4. The installation of new antennas and RRHs will not increase radio frequency (RF) emissions at the facility to a level at or above the Federal Communications Commission (FCC) safety standard. A cumulative General Power Density table for Cellco's modified facility is included in Attachment 2.

5. The proposed modifications will not cause a change or alteration in the physical or environmental characteristics of the site.

6. The tower, its foundation and the antenna mounting brackets can support Cellco's proposed equipment modifications. (*See* Structural Analysis Report, prepared by Hudson Design Group, LLC and an Antenna Platform Structural Certification Letter, prepared by All-Points Technology Corporation, included in Attachment 3).

A copy of the parcel map and Property owner information is included in Attachment 4. A Certificate of Mailing verifying that this filing was sent to municipal officials is included in Attachment 5.

For the foregoing reasons, Cellco respectfully submits that the proposed modifications to the above-referenced telecommunications facility constitutes an exempt modification under R.C.S.A. § 16-50j-72(b)(2).

Sincerely,

Kenneth C. Baldwin

Enclosures
Copy to:
Jay Moran, Manchester Mayor
Scott Shanley, Manchester General Manager
Gary Anderson, Director of Planning and Economic Development
Tim Parks

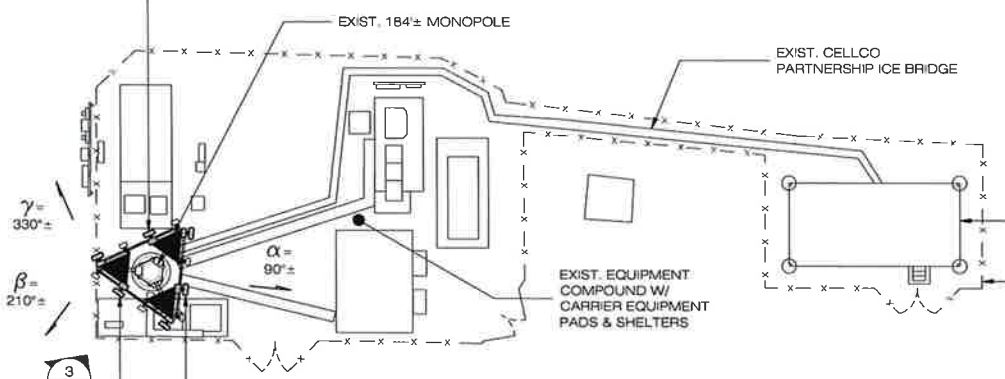
ATTACHMENT 1

NOTES:

1. DESIGN EXHIBIT DRAWINGS ARE DIAGRAMMATIC IN NATURE AND CONVEY GENERAL INFORMATION PERTAINING TO THE SIZE AND LOCATION OF THE PROPOSED WIRELESS EQUIPMENT UPGRADE.
2. REFER TO STRUCTURAL ANALYSIS PREPARED BY HUDSON DESIGN GROUP, LLC DATED APRIL 19, 2016 AVAILABLE UNDER SEPARATE COVER.
3. EXISTING PLATFORM REQUIRES REINFORCEMENT PRIOR TO THE INSTALLATION OF THE PROP. EQUIPMENT UPGRADE. REFER TO MOUNT CERTIFICATION LETTER PREPARED BY ALL POINTS TECHNOLOGY CORP., DATED JULY 20, 2018 AVAILABLE UNDER SEPARATE COVER.
4. BASE MAPPING FROM FIELD MEASUREMENTS TAKEN BY ALL-POINTS TECH. CORP., P.C. ON JULY 2, 2018

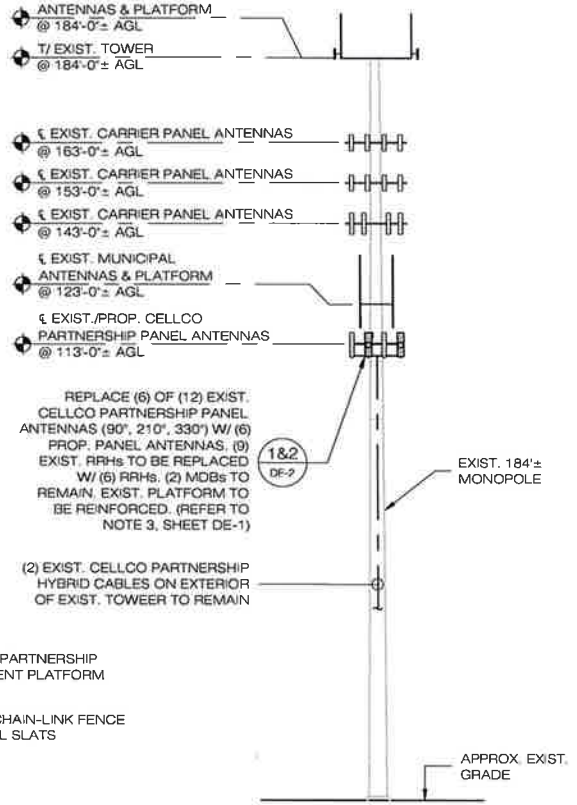
2 DE-1 COMPOUND PLAN

1 DE-1 LOCATION PLAN
SCALE: 1" = 500'-0"



2 DE-1 COMPOUND PLAN
SCALE: 1" = 20'-0"

(IN FEET) 1 inch = 20 ft.



3 DE-1 TOWER ELEVATION
SCALE: 1" = 30'-0"

REVISIONS:
-REV0: 07/20/18: FOR REVIEW: JRM
-REV1:
-REV2:
-REV3:
-REV4:
-REV5:

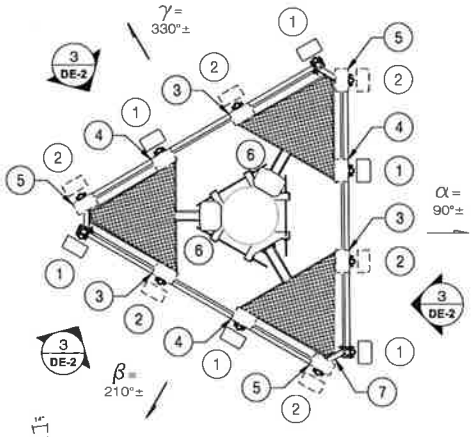
ALL-POINTS TECHNOLOGY CORPORATION
35 SADDLEBROOK DRIVE
KILLINGWORTH, CT 06419
WWW.ALLPOINTSTECH.COM
PHONE: (860)663-1697
FAX: (860)663-1935

SHEET NUMBER: DE-1

MANCHESTER GREEN CT
239 MIDDLE TURNPIKE EAST
MANCHESTER, CT 06040
VZW
VZW
VZW
PROJECT CODE: 20181836978 LC: 486026 CM: JO
VZW FUZE ID: 15240525

APT FILING NUMBER: CT141 EB10570
LOCATION PLAN, COMPOUND PLAN & TOWER ELEVATION
DATE OF DV: 07/02/18 DRAWN BY: DRA
DATE: 07/20/18 CHECKED BY: JRM

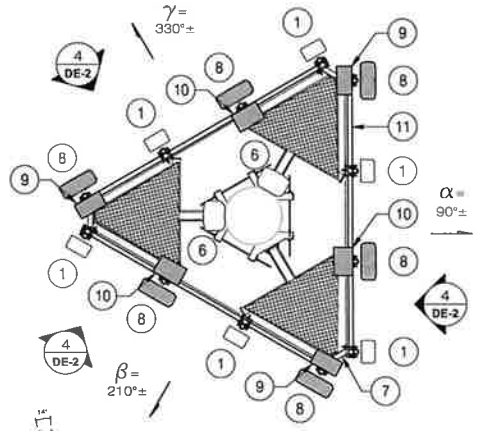
Cellco Partnership d/b/a verizon



1. EXIST. ANTENNA (TO REMAIN) MODEL: ANDREW LNX-6514DS-A1M
2. EXIST. ANTENNA (TO BE REPLACED) MODEL: ANDREW HBXX-6517-DS-A2M
3. EXIST. RRH (TO BE REPLACED) MODEL: ALU 2x60W 700U RRH
4. EXIST. RRH (TO BE REPLACED) MODEL: ALU 4x30W PCS RRH
5. EXIST. RRH (TO BE REPLACED) MODEL: ALU 2x60W AWS RRH
6. EXIST. MDB (TO REMAIN) MODEL: RAYCAP RxxDC3315-PF-48 (V.I.F.)
7. EXIST. LOW PROFILE PLATFORM (TO BE REINFORCED) (REFER TO NOTE 3, SHEET DE-1)

1 DE-2 EXISTING ANTENNA PLAN

SCALE : 3/16" = 1'-0"



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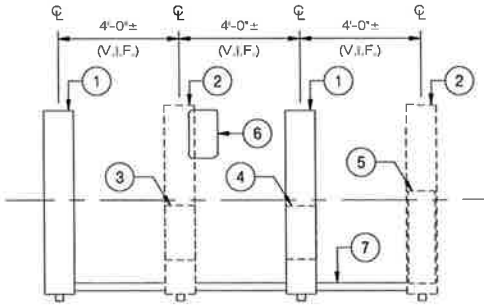
6. EXIST. MDB (TO REMAIN) MODEL: RAYCAP RxxDC3315-PF-48 (V.I.F.)
7. EXIST. LOW PROFILE PLATFORM (TO BE REINFORCED) (REFER TO NOTE 3, SHEET DE-1)
8. PROP. ANTENNA MODEL: COMMSCOPE NNHH-65B-R4
9. PROP. RRH MODEL: SAMSUNG B5/B13 4x40W (2x60W) 700/850 RRH
10. PROP. RRH MODEL: SAMSUNG B2/B66 4x60W (2x90W) PCS/AWS RRH
11. SITEPRO1 UNIVERSAL HANDRAIL KIT FOR 12' PLATFORM (P/N HRK12-U)

2 DE-2 PROPOSED ANTENNA PLAN

SCALE : 3/16" = 1'-0"



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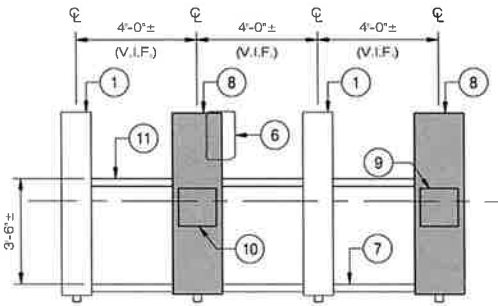
4. EXIST. RRH (TO BE REPLACED) MODEL: ALU 4x30W PCS RRH

℄ EXIST. ANTENNAS @ 113'-0"± AGL

5. EXIST. RRH (TO BE REPLACED) MODEL: ALU 2x60W AWS RRH
6. EXIST. MDB (TO REMAIN) (BETA & GAMMA SECTORS ONLY) MODEL: RAYCAP RxxDC3315-PF-48 (V.I.F.)
7. EXIST. LOW PROFILE PLATFORM (TO BE REINFORCED) (REFER TO NOTE 3, SHEET DE-1)

3 DE-2 TYPICAL MOUNTING CONFIGURATION - EXIST.

SCALE : 1/4" = 1'-0"



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6. EXIST. MDB (TO REMAIN) (BETA & GAMMA SECTORS ONLY) MODEL: RAYCAP RxxDC3315-PF-48 (V.I.F.)
7. EXIST. LOW PROFILE PLATFORM (TO BE REINFORCED) (REFER TO NOTE 3, SHEET DE-1)
8. PROP. ANTENNA MODEL: COMMSCOPE NNHH-65B-R4

℄ EXIST./PROP. ANTENNAS @ 113'-0"± AGL

9. PROP. RRH MODEL: SAMSUNG B5/B13 4x40W (2x60W) 700/850 RRH
10. PROP. RRH MODEL: SAMSUNG B2/B66 4x60W (2x90W) PCS/AWS RRH
11. SITEPRO1 UNIVERSAL HANDRAIL KIT FOR 12' PLATFORM (P/N HRK12-U)

4 DE-2 TYPICAL MOUNTING CONFIGURATION - PROP.

SCALE : 1/4" = 1'-0"

REVISIONS:
-REV0: 07/20/18: FOR REVIEW: JRM
-REV1:
-REV2:
-REV3:
-REV4:
-REV5:

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KILLINGWORTH, CT 06419
WWW.ALLPOINTSTECH.COM
PHONE: (860)663-1697
FAX: (860)663-0935

SHEET NUMBER: DE-2

MANCHESTER GREEN CT
239 MIDDLE TURNPIKE EAST
MANCHESTER, CT 06040

VZW | VZW | VZW
PROJECT CODE: 20181836878 LC: 488026 CM: JO
VZW FUZE ID: 15240525

APT FILING NUMBER: CT141 EB10570

ANTENNA MOUNT PLANS & CONFIGURATION DETAILS

DATE OF DV: 07/02/18 | DRAWN BY: DRA
DATE: 07/20/18 | CHECKED BY: JRM

Cellco Partnership d/b/a verizon

NNHH-65B-R4

8-port sector antenna, 4x 698–896 and 4x 1695–2360 MHz, 65° HPBW, 4x RETs

- Array configuration provides capability for 4T4R (4x MIMO) on Low band and High band
- Optimized SPR performance across all operating bands
- Excellent wind loading characteristics

Electrical Specifications

Frequency Band, MHz	**698–806**	**806–896**	**1695–1880**	**1850–1990**	**1920–2180**	**2300–2360**
Gain, dBi	14.6	15.0	17.0	17.3	17.5	17.9
Beamwidth, Horizontal, degrees	66	64	58	61	63	59
Beamwidth, Vertical, degrees	11.9	10.3	7.4	6.9	6.4	5.7
Beam Tilt, degrees	2–14	2–14	2–12	2–12	2–12	2–12
USLS (First Lobe), dB	17	19	14	19	16	18
Front-to-Back Ratio at 180°, dB	30	31	35	38	37	34
Isolation, Cross Polarization, dB	25	25	25	25	25	25
Isolation, Inter-band, dB	25	25	25	25	25	25
VSWR | Return Loss, dB	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0
PIM, 3rd Order, 2 x 20 W, dBc	-150	-150	-150	-150	-150	-150
Input Power per Port at 50°C, maximum, watts	300	300	250	250	250	200
Polarization	±45°	±45°	±45°	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm

Electrical Specifications, BASTA*

Frequency Band, MHz	**698–806**	**806–896**	**1695–1880**	**1850–1990**	**1920–2180**	**2300–2360**
Gain by all Beam Tilts, average, dBi	14.2	14.7	16.4	16.9	17.0	17.5
Gain by all Beam Tilts Tolerance, dB	±0.5	±0.5	±0.9	±0.4	±0.5	±0.5
Gain by Beam Tilt, average, dBi	2 ° | 14.2 8 ° | 14.2 14 ° | 13.9	2 ° | 14.7 8 ° | 14.8 14 ° | 14.3	2 ° | 16.5 7 ° | 16.6 12 ° | 16.1	2 ° | 16.7 7 ° | 17.0 12 ° | 16.7	2 ° | 16.8 7 ° | 17.1 12 ° | 16.7	2 ° | 17.2 7 ° | 17.8 12 ° | 17.3
Beamwidth, Horizontal Tolerance, degrees	±3.3	±3.1	±6.4	±3	±3.5	±5.3
Beamwidth, Vertical Tolerance, degrees	±0.8	±0.8	±0.8	±0.4	±0.7	±0.2
USLS, beampeak to 20° above beampeak, dB	17	19	14	17	15	17
Front-to-Back Total Power at 180° ± 30°, dB	21	21	30	31	27	27
CPR at Boresight, dB	21	22	16	17	18	17
CPR at Sector, dB	9	6	9	9	8	12

* CommScope® supports NGMN recommendations on Base Station Antenna Standards (BASTA). To learn more about the benefits of BASTA, download the whitepaper Time to Raise the Bar on BSAs.

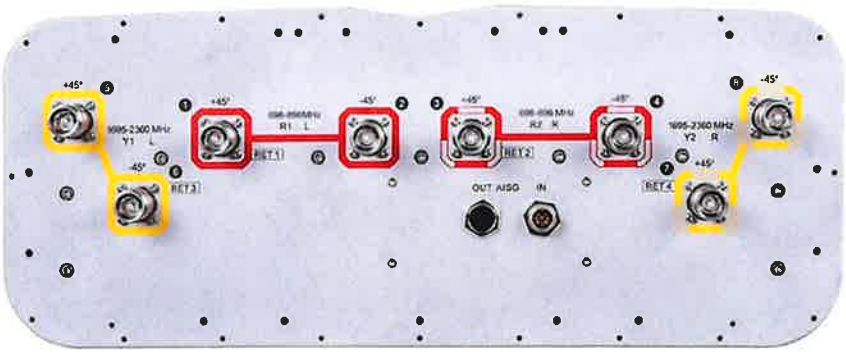
Array Layout

Left Right
Bottom

(Sizes of colored boxes are not true depictions of array sizes)

Array	Freq (MHz)	Conns	RET (MRET)	AISG RET UID
R1	698-896	1-2	1	CPxxxxxxxxxxxxxxxmm.1
R2	698-896	3-4	2	CPxxxxxxxxxxxxxxxmm.2
Y1	1695-2360	5-6	3	CPxxxxxxxxxxxxxxxmm.3
Y2	1695-2360	7-8	4	CPxxxxxxxxxxxxxxxmm.4

Port Configuration



General Specifications

Operating Frequency Band 1695 – 2360 MHz | 698 – 896 MHz

NNHH-65B-R4

Antenna Type	Sector
Band	Multiband
Performance Note	Outdoor usage | Wind loading figures are validated by wind tunnel measurements described in white paper WP-112534-EN
Total Input Power, maximum	900 W @ 50 °C

Mechanical Specifications

RF Connector Quantity, total	8
RF Connector Quantity, low band	4
RF Connector Quantity, high band	4
RF Connector Interface	4.3-10 Female
Color	Light gray
Grounding Type	RF connector inner conductor and body grounded to reflector and mounting bracket
Radiator Material	Aluminum | Low loss circuit board
Radome Material	Fiberglass, UV resistant
Reflector Material	Aluminum
RF Connector Location	Bottom
Wind Loading, frontal	154.0 lbf @ 150 km/h | 685.0 N @ 150 km/h
Wind Loading, lateral	232.0 N @ 150 km/h | 52.2 lbf @ 150 km/h
Wind Loading, maximum	199.9 lbf @ 150 km/h | 889.0 N @ 150 km/h
Effective Projected Area (EPA), frontal	0.64 m^2 | 6.89 ft^2
Effective Projected Area (EPA), lateral	0.22 m^2 | 2.37 ft^2
Wind Speed, maximum	241 km/h | 150 mph

Dimensions

Length	1828.0 mm | 72.0 in
Width	498.0 mm | 19.6 in
Depth	197.0 mm | 7.8 in
Net Weight, without mounting kit	35.6 kg | 78.5 lb

Remote Electrical Tilt (RET) Information

Input Voltage	10–30 Vdc
Internal RET	High band (2) | Low band (2)
Power Consumption, idle state, maximum	1 W
Power Consumption, normal conditions, maximum	8 W
Protocol	3GPP/AISG 2.0 (Multi-RET)
RET Hardware	CommRET v2
RET Interface	8-pin DIN Female | 8-pin DIN Male
RET Interface, quantity	1 female | 1 male

NNHH-65B-R4

Packed Dimensions

Length	2010.0 mm | 79.1 in
Width	608.0 mm | 23.9 in
Depth	352.0 mm | 13.9 in
Shipping Weight	49.5 kg | 109.1 lb

Regulatory Compliance/Certifications

Agency	**Classification**
RoHS 2011/65/EU	Compliant by Exemption
ISO 9001:2015	Designed, manufactured and/or distributed under this quality management system
China RoHS SJ/T 11364-2014	Above Maximum Concentration Value (MCV)

Included Products

BSAMNT-3 — Wide Profile Antenna Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Kit contains one scissor top bracket set and one bottom bracket set.

* Footnotes

Performance Note	Severe environmental conditions may degrade optimum performance

SAMSUNG

Dual-Band Radio Unit
700/850MHz (B13/B5)

RFV01U-D2A

Samsung's RFV01U-D2A is a compact remote Radio Unit (RU) designed for deployments that require flexibility in installation and rapid onlining, without compromising on coverage, capacity or operational expenses.

The RFV01U-D2A RU targets dual-band support across Band 13 (700MHz) and Band 5 (850MHz), making it an ideal product for broad coverage footprints across multiple common low-end, long-range frequencies.

The RU handles all Radio Frequency (RF) processing in a single, compact unit, and is designed to interface via CPRI with Samsung's CDU baseband offerings, in both distributed- and central-RAN configurations.

In addition to its minimal footprint and ease of installation, the RU is also designed to reduce cost of ownership through its integrated spectrum analyzer, which allows for remote RF monitoring, greatly reducing the need for on-site maintenance visits.

Features and Benefits

- Dual-band support for broad frequency coverage
- Minimal footprint reduces site costs
- Rapid, easy installation
- Flexibly deployable in any location
- Remote RF monitoring capability
- Convection cooled, silent operation

Key Technical Specifications

Duplex Type: FDD
Operating Frequencies:
B13: DL(746-756MHz)/UL(777-787MHz)
B5: DL(869-894MHz)/UL(824-849MHz)
Instantaneous Bandwidth: 10MHz(B13) + 25MHz(B5)
RF Chain: 4T4R/2T4R/2T2R
Output Power: Total 320W
DU-RU Interface: CPRI (10Gbps)
Dimensions: 380 x 380 x 207mm (29.9L)
Weight: 31.9kg
Input Power: -48V DC
Operating Temp.: -40 - 55°(w/o solar load)
Cooling: Natural convection

SAMSUNG

Dual-Band Radio Unit
AWS/PCS (B66/B2)
RFV01U-D1A

Samsung's RFV01U-D1A is a compact remote Radio Unit (RU) designed for deployments that require flexibility in installation and rapid onlining, without compromising on coverage, capacity or operational expenses.

The RFV01U-D1A RU targets dual-band support across Band 66 (AWS) and Band 2 (PCS), making it an ideal product for broad coverage footprints across multiple common mid-range frequencies.

The RU handles all Radio Frequency (RF) processing in a single, compact unit, and is designed to interface via CPRI with Samsung's CDU baseband offerings, in both distributed- and central-RAN configurations.

In addition to its minimal footprint and ease of installation, the RU is also designed to reduce cost of ownership through its integrated spectrum analyzer, which allows for remote RF monitoring, greatly reducing the need for on-site maintenance visits.

Features and Benefits

- Dual-band support for broad frequency coverage
- Minimal footprint reduces site costs
- Rapid, easy installation
- Flexibly deployable in any location
- Remote RF monitoring capability
- Convection cooled, silent operation
- Built-in Broadcast Auxiliary Services (BAS) filter ensures compliant AWS operation without impacting footprint

Key Technical Specifications

Duplex Type: FDD
Operating Frequencies:
B66: DL(2,110-2,180MHz)/UL(1,710-1,780MHz)
B2: DL(1,930-1,990MHz)/UL(1,850-1,910MHz)
Instantaneous Bandwidth:
70MHz(B66) + 60MHz(B2)
RF Chain: 4T4R/2T4R/2T2R
Output Power: Total 320W
DU-RU Interface: CPRI (10Gbps)
Dimensions: 380 x 380 x 255mm (36.8L)
Weight: 38.3kg
Input Power: -48V DC
Operating Temp.: -40 ~ 55°(w/o solar load)
Cooling: Natural convection

ATTACHMENT 2

	General	Power	Density					
Site Name: Manchester Green								
Tower Height: 183'								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*Town MFRE	2	40	99	458.2125	0.0033	0.3055	0.11%	
*Town MPD - ch 1	1	40	190	465.125	0.0004	0.3101	0.01%	
*Town MPD - ch 2	1	40	177	465.4	0.0005	0.3103	0.02%	
*Town MFD	1	40	99	861.7125	0.0017	0.5745	0.03%	
*Town services intercity	1	40	99	452.55	0.0017	0.3017	0.06%	
*RAFS I/2	2	40	75	465.075	0.0060	0.3101	0.19%	
*Town public works	1	40	99	151.07	0.0017	0.2000	0.08%	
*Town Services EOC	1	40	99	153.935	0.0017	0.2000	0.08%	
*Town FD	1	40	99	154.355	0.0017	0.2000	0.08%	
*town SP hotline	1	40	86	45.86	0.0022	0.2000	0.11%	
*Town Vol FD	1	40	69	811.7125	0.0036	0.5411	0.07%	
*Town Service - School	1	40	170	469	0.0005	0.3127	0.02%	
*Htfd City FD	1	40	99	33.9	0.0017	0.2000	0.08%	
*Tolland MUT	1	40	99	33.94	0.0017	0.2000	0.08%	
*Sprint	1	438	153	850	0.0073	0.5667	0.13%	
*Sprint	2	438	153	850	0.0146	0.5667	0.26%	
*Sprint	5	623	153	1900	0.0518	1.0000	0.52%	
*Sprint	2	1556	153	1900	0.0518	1.0000	0.52%	
*Sprint	8	778	153	2500	0.1036	1.0000	1.04%	
*Clearwire	2	153	153	2496	0.0051	1.0000	0.05%	
*Clearwire	1	211	149	18 GHz	0.0037	1.0000	0.04%	
*T-Mobile	4	1556	163	1900	0.0908	1.0000	0.91%	
*T-Mobile	5	1556	163	2100	0.1135	1.0000	1.14%	
*T-Mobile	4	736	163	600	0.0430	0.4000	1.07%	
*T-Mobile	4	789	163	700	0.0460	0.4667	0.99%	
*T-Mobile	1	10	163	5000	0.0001	1.0000	0.00%	
*AT&T	2	419	143	850	0.0161	0.5667	0.28%	
*AT&T	2	817	143	1900	0.0313	1.0000	0.31%	
*AT&T	4	1250	143	2300	0.0958	1.0000	0.96%	
*AT&T	2	1016	143	850	0.0389	0.5667	0.69%	
*AT&T	4	1005	143	2100	0.0770	1.0000	0.77%	
*AT&T	4	720	143	700	0.0552	0.4667	1.18%	
*AT&T	4	1222	143	1900	0.0937	1.0000	0.94%	
VZW PCS	**1**	**4955**	**113**	**0.1396**	**0.15563961**	**1.0**	**13.96%**	
VZW Cellular LTE	**1**	**1440**	**113**	**0.0406**	**0.04523129**	**0.57933**	**7.00%**	
VZW Cellular	**3**	**408**	**113**	**0.0345**	**0.0384466**	**0.57933**	**5.95%**	
VZW AWS	**1**	**4680**	**113**	**0.1318**	**0.14700169**	**1.0**	**13.18%**	
VZW 700	**1**	**2450**	**113**	**0.0690**	**0.07695601**	**0.49733**	**13.87%**	
								66.8%
* Source: Siting Council								

ATTACHMENT 3

STRUCTURAL ANALYSIS REPORT

For

MANCHESTER GREEN CT

239 Middle Turnpike East
Manchester, CT 06045

Antennas Mounted to the Monopole

Prepared for:

verizon

20 Alexander Drive
Wallingford, CT 06492

Dated: October 31, 2019

Prepared by:

HUDSON Design Group LLC

45 Beechwood Drive
North Andover, MA 01845
(P) 978.557.5553 (F) 978.336.5586
www.hudsondesigngroupllc.com

STATE OF CONNECTICUT
GI KAI WANG
No. 28220
LICENSED
PROFESSIONAL ENGINEER
10/31/2019

HUDSON
Design Group LLC

SCOPE OF WORK:

Hudson Design Group LLC (HDG) has been authorized by VERIZON to conduct a structural evaluation of the 183' monopole supporting the proposed VERIZON's antennas located at elevation 113' above the ground level.

This report represents this office's findings, conclusions and recommendations pertaining to the support of VERIZON's existing and proposed antennas listed below.

Record drawings of the existing monopole prepared by Engineered Endeavors Inc., dated September 17, 2002, were available for our use. Structural analysis with monopole modification report prepared by this office, dated September 25, 2015, was used for monopole analysis.

Tower mapping report prepared by ProVertic LLC, dated October 15, 2019, was provided to this office.

CONCLUSION SUMMARY:

Based on our evaluation, we have determined that the existing monopole and foundation **are in conformance** with the ANSI/TIA-222-G Standard for the loading considered under the criteria listed in this report. The monopole structure is rated at **93.9%** - (Foundation Controlling).

HUDSON
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APPURTENANCES CONFIGURATION:

Tenant	Appurtenances	Elev.	Mount
	Lightning Rod	191'	Low Profile Platform
	(2) 2' Dishes	190'	Low Profile Platform
	(2) SODU 48VDC XALT	188'	Low Profile Platform
	(2) 20' Dipole	185'	Low Profile Platform
T-MOBILE	(3) AIR3246 Antennas	162'	Low Profile Platform
T-MOBILE	(3) AIR 32 Antennas	162'	Low Profile Platform
T-MOBILE	(3) APXVAA24-43-U-A20 Antennas	162'	Low Profile Platform
T-MOBILE	(3) KRY 112 144/1	162'	Low Profile Platform
T-MOBILE	(3) Radio 4449	163'	Low Profile Platform
Sprint	(3) APXVSPP18 Antennas	156'	Low Profile Platform
Sprint	(3) APXVTM14-C-120 Antennas	156'	Low Profile Platform
Sprint	(3) RRH8x20-25	159'	Low Profile Platform
Sprint	(3) RRH-800	156'	Low Profile Platform
Sprint	(3) RRH-1900	157'	Ring Mount
Sprint	(3) RRH-1900	156'	Ring Mount
	Panel Antenna	154'	Low Profile Platform
	(2) 2' Dishes	152'	Low Profile Platform
	3' Dish	151'	Low Profile Platform
AT&T	(3) 800-10121 Antennas	145'	Low Profile Platform
AT&T	(3) OPA-65R-LCUU-H6 Antennas	145'	Low Profile Platform
AT&T	(6) OPA-65R-LCUU-H8 Antennas	145'	Low Profile Platform
AT&T	(6) LGP21401	144'	Low Profile Platform
AT&T	(3) RRUS-11	148'	Low Profile Platform
AT&T	(9) RRUS-32	144'	Low Profile Platform
AT&T	(2) DC6-48-60-18-8F	143'	Low Profile Platform
	6' Omni	135'	Low Profile Platform
	6' Omni	129.5'	Low Profile Platform
	Dipole	128.5'	Low Profile Platform
	24" Yagi	128.5'	Low Profile Platform
	15" Yagi	125.5'	Low Profile Platform
	2.5' Yagi	121.5'	Low Profile Platform
VERIZON	(6) LNX 6514DS-VTM Antennas	***113'***	***Platform w/handrails***
VERIZON	(2) RxxDC-3315-PF-48	***113'***	***Platform w/handrails***
VERIZON	***(6) NNHH-65B-R4 Antennas***	***113'***	***Platform w/handrails***
VERIZON	***(3) B5/B13 RRH-BRO4C***	***113'***	***Platform w/handrails***
VERIZON	***(3) B2/B66A RRH-BRO49***	***113'***	***Platform w/handrails***
	GPS	54.5'	Side Mount Standoff

Proposed VERIZON Appurtenances shown in Bold.

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VERIZON EXISTING/PROPOSED COAX CABLES:

Tenant	Coax Cables	Elev.	Mount
VERIZON	(2) Fiber Cables	113'	Outside Monopole

Proposed VERIZON Coax Cables shown in Bold.

ANALYSIS RESULTS SUMMARY:

Component	Max. Stress Ratio	Elev. of Component (ft)	Pass/Fail	Comments
Pole Section-L1	14.8 %	166.5 – 184.0	PASS	
Pole Section-L2	69.8 %	133.1 – 166.5	PASS	
Pole Section-L3	77.2 %	113.0 – 133.1	PASS	
Pole Section-L4	86.6 %	88.0 – 113.0	PASS	
Pole Section-L5	89.5 %	43.9 – 88.0	PASS	
Pole Section-L6	85.0 %	1.0 – 43.9	PASS	
Base Plate	89.2 %	1.0	PASS	
Foundation	**93.9 %**	-	PASS	**Controlling**

HUDSON
Design Group LLC

DESIGN CRITERIA:

1. EIA/TIA-222-G Structural Standards for Steel Antenna Towers and Antenna Supporting Structures

2. 2018 Connecticut State Building Code

   County: Hartford
   City/Town: Manchester
   Wind Load: 97 mph
   Structural Class: III
   Exposure Category: B
   Topographic Category: 1
   Crest Height: 0 ft.
   Ice Thickness: 1.0 inch

3. Approximate height above grade to proposed antennas: 113'

ASSUMPTIONS:

1. The monopole dimensions, member sizes and strength of material are as indicated in the record drawings prepared by Engineered Endeavors Inc., dated September 17, 2002.

2. The appurtenances configuration is as stated in this report. All antennas, coax cables and waveguide cables are assumed to be properly installed and supported as per the manufacturer's requirements.

3. The monopole and foundation are properly constructed and maintained. All structural members and their connections are assumed to be in good condition and are free from defects with no deterioration to its member capacities.

4. All prior structural modification, if any, are assumed to be as per the data supplied (if available), and installed properly.

SUPPORT RECOMMENDATIONS:

HDG recommends that the proposed antennas and RRH be mounted on the proposed steel platform supported by the monopole.

HUDSON
Design Group LLC

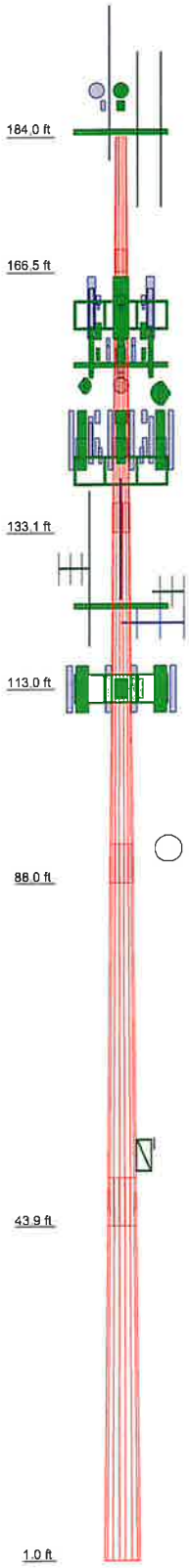
Photo 1: Photo illustrating the Monopole with Appurtenances shown.

HUDSON
Design Group LLC

CALCULATIONS

Section	1	2	3	4	5	6
Length (ft)	17.50	36.42	23.92	25.00	49.08	49.08
Number of Sides	18	18	18	18	18	18
Thickness (in)	0.1875	0.2500	0.3750	0.4150	0.4850	0.5400
Socket Length (ft)	3.00	3.83		5.00	6.17	
Top Dia (in)	15.5000	18.3556	25.0549	30.2850	33.9406	42.5549
Bot Dia (in)	19.3990	26.4010	30.2850	35.8920	44.9030	53.5000
Grade	A572-65					
Weight (lb)	611.7	2176.1	2644.3	3661.2	10010.3	13593.1

32696.6



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
HP2-102	190	3' Dish w/Radome	151
HP2-102	190	Ericsson RRUS-11	148
SODU 48VDC XALT	188	Ericsson RRUS-11	148
SODU 48VDC XALT	188	Ericsson RRUS-11	148
20'-4 Bay Dipole	185	Kathrein 800 10121 w/mount pipe	145
20'-4 Bay Dipole	185	Kathrein 800 10121 w/mount pipe	145
Lightning Rod w/Pipe Extension	185	Kathrein 800 10121 w/mount pipe	145
PiROD 13' Low Profile Platform	185	OPA-65R-LCUU-H6 w/mount pipe	145
4449 B71+B12	163	OPA-65R-LCUU-H6 w/mount pipe	145
4449 B71+B12	163	OPA-65R-LCUU-H6 w/mount pipe	145
4449 B71+B12	163	(2) OPA-65R-LCUU-H8 w/mount pipe	145
AIR 32 B66AA/B2P w/mount pipe	162	(2) OPA-65R-LCUU-H8 w/mount pipe	145
AIR 32 B66AA/B2P w/mount pipe	162	(2) OPA-65R-LCUU-H8 w/mount pipe	145
APXVAA24-43-U-A20 w/mount pipe	162	(2) Powerwave TMA LGP21401	144
APXVAA24-43-U-A20 w/mount pipe	162	(2) Powerwave TMA LGP21401	144
APXVAA24-43-U-A20 w/mount pipe	162	(2) Powerwave TMA LGP21401	144
KRY 112 144/1	162	(3) Ericsson RRUS-32	144
KRY 112 144/1	162	(3) Ericsson RRUS-32	144
KRY 112 144/1	162	(3) Ericsson RRUS-32	144
AIR3246 B66 w/mount pipe	162	DC6-48-60-18-8F	143
AIR3246 B66 w/mount pipe	162	DC6-48-60-18-8F	143
AIR 32 B66AA/B2P w/mount pipe	162	RMQP 12' Platform w/handrail (ATI)	141
AIR3246 B66 w/mount pipe	162	Omni 2"x6'	135
PiROD 12' Platform w / handrails (T-Mobile)	161	Omni 2"x6'	129.5
		20'-4 Bay Dipole	128.5
Ring Mount	160	24" Yagi	128.5
RRH 8x20-25	159	15" Yagi	125.5
RRH 8x20-25	159	PiROD 13' Low Profile Platform	124
RRH 8x20-25	159	2'-6" Yagi	121.5
RRH-1900	157	RMQP 12' Platform w/handrails (Verizon - proposed)	113
RRH-1900	157		
RRH-1900	157	(2) NNHH-65B-R4 w/ Mount Pipe	113
APXVTM14-C-120 w/mount pipe	156	(2) NNHH-65B-R4 w/ Mount Pipe	113
RRH-800	156	(2) NNHH-65B-R4 w/ Mount Pipe	113
RRH-800	156	B5/B13 RRH-BRO4C	113
RRH-800	156	B5/B13 RRH-BRO4C	113
APXVTM14-C-120 w/mount pipe	156	B5/B13 RRH-BRO4C	113
APXVSPP18-C w/mount pipe	156	B2/B66A RRH-BRO49	113
APXVTM14-C-120 w/mount pipe	156	B2/B66A RRH-BRO49	113
RRH-1900	156	B2/B66A RRH-BRO49	113
RRH-1900	156	(2) LNX 6514DS-VTM w/mount pipe (Verizon - existing)	113
RRH-1900	156		
APXVSPP18-C w/mount pipe	156	RxxDC-3315-PF-48	113
APXVSPP18-C w/mount pipe	156	(2) LNX 6514DS-VTM w/mount pipe	113
PiROD 13' Low Profile Platform (SPRINT)	155	(2) LNX 6514DS-VTM w/mount pipe	113
		RxxDC-3315-PF-48	113
Panel Antenna 1'X1'	154.3	GPS	54.5
Andrew VHLP2-11	152	3' Side Mount Standoff	53
Andrew VHLP2-11	152		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-65	65 ksi	80 ksi			

TOWER DESIGN NOTES

1. Tower is located in Hartford County, Connecticut.
2. Tower designed for Exposure B to the TIA-222-G Standard.
3. Tower designed for a 97.0 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 50.0 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60.0 mph wind.
6. Tower Structure Class III.
7. Topographic Category 1 with Crest Height of 0.00 ft

Hudson Design Group LLC
45 Beechwood Drive
North Andover, MA 01845
Phone: (978) 557-5553
FAX: (978) 336-5586

Job: ***MANCHESTER GREEN CT***		
Project: ***183 ft Monopole***		
Client: VERIZON	Drawn by: kw	App'd:
Code: TIA-222-G	Date: 10/30/19	Scale: NTS
Path:		Dwg No. E-1

tnxTower	Job	Page
	MANCHESTER GREEN CT	1 of 11
Hudson Design Group LLC 45 Beechwood Drive North Andover, MA 01845 Phone: (978) 557-5553 FAX: (978) 336-5586	**Project** 183 ft Monopole	**Date** 15:30:10 10/30/19
	Client VERIZON	**Designed by** kw

Tower Input Data

The tower is a monopole.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

Tower is located in Hartford County, Connecticut.
Basic wind speed of 97.0 mph.
Structure Class III.
Exposure Category B.
Topographic Category 1.
Crest Height 0.00 ft.
Nominal ice thickness of 1.0000 in.
Ice thickness is considered to increase with height.
Ice density of 56.0 pcf.
A wind speed of 50.0 mph is used in combination with ice.
Temperature drop of 50.0 °F.
Deflections calculated using a wind speed of 60.0 mph.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	184.00-166.50	17.50	3.00	18	15.5000	19.3990	0.1875	0.7500	A572-65 (65 ksi)
L2	166.50-133.08	36.42	3.83	18	18.3556	26.4010	0.2500	1.0000	A572-65 (65 ksi)
L3	133.08-112.99	23.92	0.00	18	25.0549	30.2850	0.3750	1.5000	A572-65 (65 ksi)
L4	112.99-87.99	25.00	5.00	18	30.2850	35.8920	0.4150	1.6600	A572-65 (65 ksi)
L5	87.99-43.91	49.08	6.17	18	33.9406	44.9030	0.4850	1.9400	A572-65 (65 ksi)
L6	43.91-1.00	49.08		18	42.5549	53.5000	0.5400	2.1600	A572-65 (65 ksi)

Monopole Base Plate Data

Base Plate Data	
Base plate is square	
Base plate is grouted	√
Anchor bolt grade	A615-75
Anchor bolt size	2.2500 in
Number of bolts	18
Embedment length	84.0000 in

Base Plate Data	
f'_c	4.0 ksi
Grout space	3.0000 in
Base plate grade	A572-60
Base plate thickness	2.0000 in
Bolt circle diameter	62.0000 in
Outer diameter	68.0000 in
Inner diameter	43.0000 in
Base plate type	Stiffened Plate
Bolts per stiffener	1
Stiffener thickness	0.7500 in
Stiffener height	12.0000 in

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Sector	Exclude From Torque Calculation	Component Type	Placement ft	Total Number	Number Per Row	Start/End Position	Width or Diameter in	Perimeter in	Weight plf
1/2 (CLEARWIRE)	A	No	Surface Ar (CaAa)	156.00 - 6.00	3	3	0.000 0.000	0.5800		0.25
2 1/2 (CLEARWIRE)	A	No	Surface Af (CaAa)	156.00 - 6.00	2	1	0.000 0.000	2.3800	7.4770	1.16
**********										
1 5/8 Fiber Cable (VERIZON)	B	No	Surface Ar (CaAa)	113.00 - 6.00	2	2	0.000 0.000	1.9800		1.04

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
7/8	B	No	No	Inside Pole	184.00 - 6.00	4	No Ice	0.00	0.54
							1/2" Ice	0.00	0.54
							1" Ice	0.00	0.54
3/8	B	No	No	Inside Pole	184.00 - 6.00	2	No Ice	0.00	0.25
							1/2" Ice	0.00	0.25
							1" Ice	0.00	0.25
**********									
1 5/8 (T-MOBILE)	C	No	No	Inside Pole	162.00 - 6.00	15	No Ice	0.00	1.04
							1/2" Ice	0.00	1.04
							1" Ice	0.00	1.04
2 (T-MOBILE)	C	No	No	Inside Pole	162.00 - 6.00	1	No Ice	0.00	1.16
							1/2" Ice	0.00	1.16
							1" Ice	0.00	1.16
1 1/2 (T-MOBILE)	C	No	No	Inside Pole	162.00 - 6.00	3	No Ice	0.00	1.04
							1/2" Ice	0.00	1.04
							1" Ice	0.00	1.04
Cat 5 (T-MOBILE)	C	No	No	Inside Pole	162.00 - 6.00	2	No Ice	0.00	0.21
							1/2" Ice	0.00	0.21
							1" Ice	0.00	0.21
**********									
1 1/4 (SPRINT)	A	No	No	Inside Pole	156.00 - 6.00	4	No Ice	0.00	0.66
							1/2" Ice	0.00	0.66
							1" Ice	0.00	0.66
1/2	A	No	No	Inside Pole	156.00 - 1.00	1	No Ice	0.00	0.25

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
(SPRINT)							1/2" Ice	0.00	0.25
							1" Ice	0.00	0.25
**********									
1 5/8 (AT&T)	B	No	No	Inside Pole	143.00 - 6.00	6	No Ice	0.00	1.04
							1/2" Ice	0.00	1.04
							1" Ice	0.00	1.04
2 1/2 (AT&T)	B	No	No	Inside Pole	143.00 - 6.00	2	No Ice	0.00	1.16
							1/2" Ice	0.00	1.16
							1" Ice	0.00	1.16
**********									
1/2	B	No	No	Inside Pole	125.00 - 6.00	8	No Ice	0.00	0.25
							1/2" Ice	0.00	0.25
							1" Ice	0.00	0.25
3/8	B	No	No	Inside Pole	125.00 - 6.00	2	No Ice	0.00	0.25
							1/2" Ice	0.00	0.25
							1" Ice	0.00	0.25
Cat 5	B	No	No	Inside Pole	125.00 - 6.00	2	No Ice	0.00	0.21
							1/2" Ice	0.00	0.21
							1" Ice	0.00	0.21
7/8	B	No	No	Inside Pole	125.00 - 6.00	4	No Ice	0.00	0.54
							1/2" Ice	0.00	0.54
							1" Ice	0.00	0.54
**********									
1/2	A	No	No	Inside Pole	54.00 - 1.00	1	No Ice	0.00	0.25
							1/2" Ice	0.00	0.25
							1" Ice	0.00	0.25

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
Lightning Rod w/Pipe Extension	A	From Face	1.00 0.00 6.00	0.0000	185.00	No Ice 1/2" Ice 1" Ice	2.58 4.02 5.39	2.58 4.02 5.39	51.50 80.31 114.25
PiROD 13' Low Profile Platform	A	None		0.0000	185.00	No Ice 1/2" Ice 1" Ice	15.70 20.10 24.50	15.70 20.10 24.50	1300.00 1765.00 2230.00
20'-4 Bay Dipole	B	From Leg	3.50 3.00 0.00	0.0000	185.00	No Ice 1/2" Ice 1" Ice	4.75 6.25 7.75	4.75 6.25 7.75	50.00 80.00 110.00
20'-4 Bay Dipole	B	From Leg	3.50 -3.00 0.00	0.0000	185.00	No Ice 1/2" Ice 1" Ice	4.75 6.25 7.75	4.75 6.25 7.75	50.00 80.00 110.00
SODU 48VDC XALT	A	From Face	2.00 0.00 0.00	0.0000	188.00	No Ice 1/2" Ice 1" Ice	1.50 1.65 1.81	1.13 1.26 1.41	15.00 29.91 47.34
SODU 48VDC XALT	C	From Face	2.00 0.00 0.00	0.0000	188.00	No Ice 1/2" Ice 1" Ice	1.50 1.65 1.81	1.13 1.26 1.41	15.00 29.91 47.34
**********									
PiROD 12' Platform w /	A	None		0.0000	161.00	No Ice	26.30	26.30	1920.00

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
handrails						1/2" Ice	35.60	35.60	2340.00
(T-Mobile)						1" Ice	44.90	44.90	2760.00
AIR3246 B66 w/mount pipe	A	From Face	3.50 0.00 0.00	0.0000	162.00	No Ice 1/2" Ice 1" Ice	8.21 8.71 9.19	6.60 7.46 8.21	201.90 272.56 350.48
AIR3246 B66 w/mount pipe	B	From Face	3.50 0.00 0.00	0.0000	162.00	No Ice 1/2" Ice 1" Ice	8.21 8.71 9.19	6.60 7.46 8.21	201.90 272.56 350.48
AIR3246 B66 w/mount pipe	C	From Face	3.50 0.00 0.00	0.0000	162.00	No Ice 1/2" Ice 1" Ice	8.21 8.71 9.19	6.60 7.46 8.21	201.90 272.56 350.48
AIR 32 B66AA/B2P w/mount pipe	A	From Face	3.50 0.00 0.00	0.0000	162.00	No Ice 1/2" Ice 1" Ice	7.12 7.60 8.07	6.41 7.28 8.03	153.90 217.59 288.39
AIR 32 B66AA/B2P w/mount pipe	B	From Face	3.50 0.00 0.00	0.0000	162.00	No Ice 1/2" Ice 1" Ice	7.12 7.60 8.07	6.41 7.28 8.03	153.90 217.59 288.39
AIR 32 B66AA/B2P w/mount pipe	C	From Face	3.50 0.00 0.00	0.0000	162.00	No Ice 1/2" Ice 1" Ice	7.12 7.60 8.07	6.41 7.28 8.03	153.90 217.59 288.39
APXVAA24-43-U-A20 w/mount pipe	A	From Face	3.50 0.00 0.00	0.0000	162.00	No Ice 1/2" Ice 1" Ice	20.50 21.26 22.02	10.88 12.41 13.96	134.25 269.87 416.30
APXVAA24-43-U-A20 w/mount pipe	B	From Face	3.50 0.00 0.00	0.0000	162.00	No Ice 1/2" Ice 1" Ice	20.50 21.26 22.02	10.88 12.41 13.96	134.25 269.87 416.30
APXVAA24-43-U-A20 w/mount pipe	C	From Face	3.50 0.00 0.00	0.0000	162.00	No Ice 1/2" Ice 1" Ice	20.50 21.26 22.02	10.88 12.41 13.96	134.25 269.87 416.30
KRY 112 144/1	A	From Face	2.50 0.00 0.00	0.0000	162.00	No Ice 1/2" Ice 1" Ice	0.35 0.43 0.51	0.17 0.23 0.30	15.00 18.18 22.58
KRY 112 144/1	B	From Face	2.50 0.00 0.00	0.0000	162.00	No Ice 1/2" Ice 1" Ice	0.35 0.43 0.51	0.17 0.23 0.30	15.00 18.18 22.58
KRY 112 144/1	C	From Face	2.50 0.00 0.00	0.0000	162.00	No Ice 1/2" Ice 1" Ice	0.35 0.43 0.51	0.17 0.23 0.30	15.00 18.18 22.58
4449 B71+B12	A	From Face	2.50 0.00 0.00	0.0000	163.00	No Ice 1/2" Ice 1" Ice	1.64 1.80 1.97	1.14 1.28 1.42	74.00 89.99 108.60
4449 B71+B12	B	From Face	2.50 0.00 0.00	0.0000	163.00	No Ice 1/2" Ice 1" Ice	1.64 1.80 1.97	1.14 1.28 1.42	74.00 89.99 108.60
4449 B71+B12	C	From Face	2.50 0.00 0.00	0.0000	163.00	No Ice 1/2" Ice 1" Ice	1.64 1.80 1.97	1.14 1.28 1.42	74.00 89.99 108.60
**********									
PiROD 13' Low Profile Platform	A	None		0.0000	155.00	No Ice 1/2" Ice 1" Ice	15.70 20.10 24.50	15.70 20.10 24.50	1300.00 1765.00 2230.00
(SPRINT)									
APXVSPP18-C w/mount pipe	A	From Leg	3.50 0.00 0.00	0.0000	156.00	No Ice 1/2" Ice 1" Ice	8.26 8.82 9.35	7.47 8.66 9.56	87.55 158.03 236.54
APXVSPP18-C w/mount pipe	B	From Leg	3.50 0.00 0.00	0.0000	156.00	No Ice 1/2" Ice 1" Ice	8.26 8.82 9.35	7.47 8.66 9.56	87.55 158.03 236.54

tnxTower	Job: MANCHESTER GREEN CT	Page: 5 of 11
Hudson Design Group LLC 45 Beechwood Drive North Andover, MA 01845 Phone: (978) 557-5553 FAX: (978) 336-5586	Project: 183 ft Monopole	Date: 15:30:10 10/30/19
	Client: VERIZON	Designed by: kw

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
APXVSPP18-C w/mount pipe	C	From Leg	3.50	0.0000	156.00	No Ice	8.26	7.47	87.55
			0.00			1/2" Ice	8.82	8.66	158.03
			0.00			1" Ice	9.35	9.56	236.54
APXVTM14-C-120 w/mount pipe	A	From Leg	3.50	0.0000	156.00	No Ice	6.65	5.03	91.90
			0.00			1/2" Ice	7.14	5.89	147.31
			0.00			1" Ice	7.60	6.63	209.47
APXVTM14-C-120 w/mount pipe	B	From Leg	3.50	0.0000	156.00	No Ice	6.65	5.03	91.90
			0.00			1/2" Ice	7.14	5.89	147.31
			0.00			1" Ice	7.60	6.63	209.47
APXVTM14-C-120 w/mount pipe	C	From Leg	3.50	0.0000	156.00	No Ice	6.65	5.03	91.90
			0.00			1/2" Ice	7.14	5.89	147.31
			0.00			1" Ice	7.60	6.63	209.47
RRH 8x20-25	A	From Leg	2.50	0.0000	159.00	No Ice	4.05	1.53	70.00
			0.00			1/2" Ice	4.30	1.71	97.14
			0.00			1" Ice	4.56	1.90	127.80
RRH 8x20-25	B	From Leg	2.50	0.0000	159.00	No Ice	4.05	1.53	70.00
			0.00			1/2" Ice	4.30	1.71	97.14
			0.00			1" Ice	4.56	1.90	127.80
RRH 8x20-25	C	From Leg	2.50	0.0000	159.00	No Ice	4.05	1.53	70.00
			0.00			1/2" Ice	4.30	1.71	97.14
			0.00			1" Ice	4.56	1.90	127.80
RRH-800	A	From Leg	2.50	0.0000	156.00	No Ice	2.13	2.76	64.00
			0.00			1/2" Ice	2.32	2.96	91.74
			0.00			1" Ice	2.51	3.18	122.88
RRH-800	B	From Leg	2.50	0.0000	156.00	No Ice	2.13	2.76	64.00
			0.00			1/2" Ice	2.32	2.96	91.74
			0.00			1" Ice	2.51	3.18	122.88
RRH-800	C	From Leg	2.50	0.0000	156.00	No Ice	2.13	2.76	64.00
			0.00			1/2" Ice	2.32	2.96	91.74
			0.00			1" Ice	2.51	3.18	122.88
**********									
RRH-1900	A	From Face	1.00	0.0000	157.00	No Ice	2.32	3.14	60.00
			0.00			1/2" Ice	2.53	3.36	88.32
			0.00			1" Ice	2.74	3.60	120.15
RRH-1900	B	From Face	1.00	0.0000	157.00	No Ice	2.32	3.14	60.00
			0.00			1/2" Ice	2.53	3.36	88.32
			0.00			1" Ice	2.74	3.60	120.15
RRH-1900	C	From Face	1.00	0.0000	157.00	No Ice	2.32	3.14	60.00
			0.00			1/2" Ice	2.53	3.36	88.32
			0.00			1" Ice	2.74	3.60	120.15
RRH-1900	A	From Face	1.00	0.0000	156.00	No Ice	2.32	3.14	60.00
			0.00			1/2" Ice	2.53	3.36	88.32
			0.00			1" Ice	2.74	3.60	120.15
RRH-1900	B	From Face	1.00	0.0000	156.00	No Ice	2.32	3.14	60.00
			0.00			1/2" Ice	2.53	3.36	88.32
			0.00			1" Ice	2.74	3.60	120.15
RRH-1900	C	From Face	1.00	0.0000	156.00	No Ice	2.32	3.14	60.00
			0.00			1/2" Ice	2.53	3.36	88.32
			0.00			1" Ice	2.74	3.60	120.15
Ring Mount	C	None		0.0000	160.00	No Ice	1.40	1.40	90.00
						1/2" Ice	2.40	2.40	130.00
						1" Ice	3.40	3.40	170.00
**********									
Panel Antenna 1'X1'	A	From Leg	3.50	0.0000	154.30	No Ice	1.20	0.32	10.00
			0.00			1/2" Ice	1.34	0.40	17.91
			0.00			1" Ice	1.48	0.49	27.76
**********									

tnxTower	Job: MANCHESTER GREEN CT	Page: 6 of 11
Hudson Design Group LLC 45 Beechwood Drive North Andover, MA 01845 Phone: (978) 557-5553 FAX: (978) 336-5586	Project: 183 ft Monopole	Date: 15:30:10 10/30/19
	Client: VERIZON	Designed by: kw

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
PiROD 13' Low Profile Platform	A	None		0.0000	124.00	No Ice	15.70	15.70	1300.00
						1/2" Ice	20.10	20.10	1765.00
						1" Ice	24.50	24.50	2230.00
20'-4 Bay Dipole	C	From Leg	3.50	0.0000	128.50	No Ice	4.75	4.75	50.00
			0.00			1/2" Ice	6.25	6.25	80.00
			0.00			1" Ice	7.75	7.75	110.00
Omni 2"x6'	A	From Leg	3.50	0.0000	135.00	No Ice	1.20	1.20	25.00
			0.00			1/2" Ice	1.80	1.80	34.39
			0.00			1" Ice	2.17	2.17	47.81
Omni 2"x6'	A	From Leg	3.50	0.0000	129.50	No Ice	1.20	1.20	25.00
			0.00			1/2" Ice	1.80	1.80	34.39
			0.00			1" Ice	2.17	2.17	47.81
24" Yagi	C	From Leg	3.50	0.0000	128.50	No Ice	1.50	1.50	10.00
			0.00			1/2" Ice	2.25	2.25	20.00
			0.00			1" Ice	3.00	3.00	30.00
15" Yagi	B	From Leg	3.50	0.0000	125.50	No Ice	0.75	0.75	5.00
			0.00			1/2" Ice	1.25	1.25	8.00
			0.00			1" Ice	1.75	1.75	11.00
2'-6" Yagi	A	From Leg	3.50	0.0000	121.50	No Ice	1.50	1.50	12.00
			0.00			1/2" Ice	2.25	2.25	22.00
			0.00			1" Ice	3.00	3.00	32.00
**********									
RMQP 12' Platform w/handrail (AT&T)	A	None		0.0000	141.00	No Ice	32.00	32.00	1343.00
						1/2" Ice	38.70	38.70	1800.00
						1" Ice	45.40	45.40	2257.00
Kathrein 800 10121 w/mount pipe	A	From Face	3.50	0.0000	145.00	No Ice	5.40	4.77	64.55
			0.00			1/2" Ice	5.78	5.43	112.69
			0.00			1" Ice	6.17	6.10	167.17
Kathrein 800 10121 w/mount pipe	B	From Face	3.50	0.0000	145.00	No Ice	5.40	4.77	64.55
			0.00			1/2" Ice	5.78	5.43	112.69
			0.00			1" Ice	6.17	6.10	167.17
Kathrein 800 10121 w/mount pipe	C	From Face	3.50	0.0000	145.00	No Ice	5.40	4.77	64.55
			0.00			1/2" Ice	5.78	5.43	112.69
			0.00			1" Ice	6.17	6.10	167.17
OPA-65R-LCUU-H6 w/mount pipe	A	From Face	3.50	0.0000	145.00	No Ice	9.95	7.53	112.53
			0.00			1/2" Ice	10.50	8.56	192.76
			0.00			1" Ice	11.04	9.45	282.09
OPA-65R-LCUU-H6 w/mount pipe	B	From Face	3.50	0.0000	145.00	No Ice	9.95	7.53	112.53
			0.00			1/2" Ice	10.50	8.56	192.76
			0.00			1" Ice	11.04	9.45	282.09
OPA-65R-LCUU-H6 w/mount pipe	C	From Face	3.50	0.0000	145.00	No Ice	9.95	7.53	112.53
			0.00			1/2" Ice	10.50	8.56	192.76
			0.00			1" Ice	11.04	9.45	282.09
(2) OPA-65R-LCUU-H8 w/mount pipe	A	From Face	3.50	0.0000	145.00	No Ice	13.11	9.83	140.11
			0.00			1/2" Ice	13.83	11.34	239.33
			0.00			1" Ice	14.52	12.66	349.58
(2) OPA-65R-LCUU-H8 w/mount pipe	B	From Face	3.50	0.0000	145.00	No Ice	13.11	9.83	140.11
			0.00			1/2" Ice	13.83	11.34	239.33
			0.00			1" Ice	14.52	12.66	349.58
(2) OPA-65R-LCUU-H8 w/mount pipe	C	From Face	3.50	0.0000	145.00	No Ice	13.11	9.83	140.11
			0.00			1/2" Ice	13.83	11.34	239.33
			0.00			1" Ice	14.52	12.66	349.58
(2) Powerwave TMA LGP21401	A	From Face	2.50	0.0000	144.00	No Ice	1.05	0.38	14.10
			0.00			1/2" Ice	1.18	0.47	21.29
			0.00			1" Ice	1.32	0.57	30.37
(2) Powerwave TMA LGP21401	B	From Face	2.50	0.0000	144.00	No Ice	1.05	0.38	14.10
			0.00			1/2" Ice	1.18	0.47	21.29

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
			0.00			1" Ice	1.32	0.57	30.37
(2) Powerwave TMA LGP21401	C	From Face	2.50	0.0000	144.00	No Ice	1.05	0.38	14.10
			0.00			1/2" Ice	1.18	0.47	21.29
			0.00			1" Ice	1.32	0.57	30.37
Ericsson RRUS-11	A	From Face	2.50	0.0000	148.00	No Ice	2.79	1.19	50.70
			0.00			1/2" Ice	3.00	1.34	71.57
			0.00			1" Ice	3.21	1.50	95.48
Ericsson RRUS-11	B	From Face	2.50	0.0000	148.00	No Ice	2.79	1.19	50.70
			0.00			1/2" Ice	3.00	1.34	71.57
			0.00			1" Ice	3.21	1.50	95.48
Ericsson RRUS-11	C	From Face	2.50	0.0000	148.00	No Ice	2.79	1.19	50.70
			0.00			1/2" Ice	3.00	1.34	71.57
			0.00			1" Ice	3.21	1.50	95.48
(3) Ericsson RRUS-32	A	From Face	2.50	0.0000	144.00	No Ice	3.31	2.42	77.00
			0.00			1/2" Ice	3.56	2.64	104.93
			0.00			1" Ice	3.81	2.86	136.47
(3) Ericsson RRUS-32	B	From Face	2.50	0.0000	144.00	No Ice	3.31	2.42	77.00
			0.00			1/2" Ice	3.56	2.64	104.93
			0.00			1" Ice	3.81	2.86	136.47
(3) Ericsson RRUS-32	C	From Face	2.50	0.0000	144.00	No Ice	3.31	2.42	77.00
			0.00			1/2" Ice	3.56	2.64	104.93
			0.00			1" Ice	3.81	2.86	136.47
DC6-48-60-18-8F	A	From Face	2.00	0.0000	143.00	No Ice	0.79	0.79	20.00
			0.00			1/2" Ice	1.27	1.27	35.12
			0.00			1" Ice	1.45	1.45	52.57
DC6-48-60-18-8F	B	From Face	2.00	0.0000	143.00	No Ice	0.79	0.79	20.00
			0.00			1/2" Ice	1.27	1.27	35.12
			0.00			1" Ice	1.45	1.45	52.57
**********									
(2) LNX 6514DS-VTM w/mount pipe (Verizon - existing)	A	From Face	3.50	0.0000	113.00	No Ice	8.63	7.07	64.55
			0.00			1/2" Ice	9.29	8.25	133.55
			0.00			1" Ice	9.90	9.15	210.57
(2) LNX 6514DS-VTM w/mount pipe	B	From Face	3.50	0.0000	113.00	No Ice	8.63	7.07	64.55
			0.00			1/2" Ice	9.29	8.25	133.55
			0.00			1" Ice	9.90	9.15	210.57
(2) LNX 6514DS-VTM w/mount pipe	C	From Face	3.50	0.0000	113.00	No Ice	8.63	7.07	64.55
			0.00			1/2" Ice	9.29	8.25	133.55
			0.00			1" Ice	9.90	9.15	210.57
RxxDC-3315-PF-48	B	From Face	1.50	0.0000	113.00	No Ice	4.59	2.52	32.00
			0.00			1/2" Ice	4.86	2.73	67.82
			0.00			1" Ice	5.14	2.95	107.61
RxxDC-3315-PF-48	C	From Face	1.50	0.0000	113.00	No Ice	4.59	2.52	32.00
			0.00			1/2" Ice	4.86	2.73	67.82
			0.00			1" Ice	5.14	2.95	107.61
**********									
RMQP 12' Platform w/handrails (Verizon - proposed)	A	None		0.0000	113.00	No Ice	26.30	26.30	1920.00
						1/2" Ice	35.60	35.60	2340.00
						1" Ice	44.90	44.90	2760.00
(2) NNHH-65B-R4 w/ Mount Pipe	A	From Face	3.50	0.0000	113.00	No Ice	12.75	7.65	106.60
			0.00			1/2" Ice	13.45	8.94	199.84
			0.00			1" Ice	14.12	10.07	301.80
(2) NNHH-65B-R4 w/ Mount Pipe	B	From Face	3.50	0.0000	113.00	No Ice	12.75	7.65	106.60
			0.00			1/2" Ice	13.45	8.94	199.84
			0.00			1" Ice	14.12	10.07	301.80
(2) NNHH-65B-R4 w/ Mount Pipe	C	From Face	3.50	0.0000	113.00	No Ice	12.75	7.65	106.60
			0.00			1/2" Ice	13.45	8.94	199.84
			0.00			1" Ice	14.12	10.07	301.80

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
B5/B13 RRH-BRO4C	A	From Face	2.50	0.0000	113.00	No Ice	1.88	1.01	82.00
			0.00			1/2" Ice	2.05	1.14	98.43
			0.00			1" Ice	2.22	1.28	117.53
B5/B13 RRH-BRO4C	B	From Face	2.50	0.0000	113.00	No Ice	1.88	1.01	82.00
			0.00			1/2" Ice	2.05	1.14	98.43
			0.00			1" Ice	2.22	1.28	117.53
B5/B13 RRH-BRO4C	C	From Face	2.50	0.0000	113.00	No Ice	1.88	1.01	82.00
			0.00			1/2" Ice	2.05	1.14	98.43
			0.00			1" Ice	2.22	1.28	117.53
B2/B66A RRH-BRO49	A	From Face	2.50	0.0000	113.00	No Ice	1.88	1.25	97.50
			0.00			1/2" Ice	2.05	1.39	115.84
			0.00			1" Ice	2.22	1.54	136.97
B2/B66A RRH-BRO49	B	From Face	2.50	0.0000	113.00	No Ice	1.88	1.25	97.50
			0.00			1/2" Ice	2.05	1.39	115.84
			0.00			1" Ice	2.22	1.54	136.97
B2/B66A RRH-BRO49	C	From Face	2.50	0.0000	113.00	No Ice	1.88	1.25	97.50
			0.00			1/2" Ice	2.05	1.39	115.84
			0.00			1" Ice	2.22	1.54	136.97
**********									
3' Side Mount Standoff	B	From Leg	1.50	0.0000	53.00	No Ice	1.50	1.50	45.00
			0.00			1/2" Ice	2.20	2.20	70.00
			0.00			1" Ice	2.90	2.90	95.00
GPS	B	From Leg	3.00	0.0000	54.50	No Ice	0.21	0.21	5.00
			0.00			1/2" Ice	0.31	0.31	7.52
			0.00			1" Ice	0.42	0.42	11.31

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight lb
HP2-102	A	Paraboloid w/Shroud (HP)	From Face	3.00	0.0000		190.00	2.00	No Ice	3.14	25.00
				0.00					1/2" Ice	3.41	42.49
				0.00					1" Ice	3.67	59.98
HP2-102	C	Paraboloid w/Shroud (HP)	From Face	3.00	0.0000		190.00	2.00	No Ice	3.14	25.00
				0.00					1/2" Ice	3.41	42.49
				0.00					1" Ice	3.67	59.98
3' Dish w/Radome	B	Paraboloid w/Radome	From Leg	3.50	0.0000		151.00	3.00	No Ice	7.10	50.00
				0.00					1/2" Ice	7.90	80.00
				0.00					1" Ice	8.70	110.00
Andrew VHLP2-11	A	Paraboloid w/Radome	From Leg	3.50	0.0000		152.00	2.00	No Ice	3.14	31.00
				0.00					1/2" Ice	3.41	41.00
				0.00					1" Ice	3.69	51.00
Andrew VHLP2-11	C	Paraboloid w/Radome	From Leg	3.50	0.0000		152.00	2.00	No Ice	3.14	31.00
				0.00					1/2" Ice	3.41	41.00
				0.00					1" Ice	3.69	51.00

Tower Mast Reaction Summary

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	lb	lb	lb	lb-ft	lb-ft	lb-ft
Dead Only	55957.42	0.00	0.00	-429.68	80.42	0.00
1.2 Dead+1.6 Wind 0 deg - No Ice	67148.90	-57.72	-44390.02	-5879316.54	14676.87	1071.43
0.9 Dead+1.6 Wind 0 deg - No Ice	50361.68	-57.72	-44390.01	-5774662.47	14272.04	1065.99
1.2 Dead+1.6 Wind 30 deg - No Ice	67148.90	22907.63	-40007.59	-5266927.70	-3004610.26	1384.22
0.9 Dead+1.6 Wind 30 deg - No Ice	50361.68	22907.63	-40007.59	-5173704.90	-2951691.45	1373.90
1.2 Dead+1.6 Wind 60 deg - No Ice	67148.90	38209.22	-22139.53	-2927777.95	-5051267.47	1888.15
0.9 Dead+1.6 Wind 60 deg - No Ice	50361.68	38209.22	-22139.53	-2875634.65	-4961565.93	1873.98
1.2 Dead+1.6 Wind 90 deg - No Ice	67148.90	44219.12	80.52	18540.83	-5851382.21	1896.07
0.9 Dead+1.6 Wind 90 deg - No Ice	50361.68	44219.12	80.52	18224.17	-5747394.13	1882.00
1.2 Dead+1.6 Wind 120 deg - No Ice	67148.90	38309.48	22230.28	2949130.25	-5070571.22	827.13
0.9 Dead+1.6 Wind 120 deg - No Ice	50361.68	38309.48	22230.28	2896732.69	-4980454.51	818.71
1.2 Dead+1.6 Wind 150 deg - No Ice	67148.90	22139.33	38393.27	5084095.02	-2933859.68	-495.33
0.9 Dead+1.6 Wind 150 deg - No Ice	50361.68	22139.33	38393.27	4993807.59	-2881675.60	-494.37
1.2 Dead+1.6 Wind 180 deg - No Ice	67148.90	69.57	44248.50	5854277.83	-18173.59	-1345.28
0.9 Dead+1.6 Wind 180 deg - No Ice	50361.68	69.57	44248.51	5750354.03	-17736.78	-1333.84
1.2 Dead+1.6 Wind 210 deg - No Ice	67148.90	-23013.56	39896.76	5245278.22	3023016.24	-1539.80
0.9 Dead+1.6 Wind 210 deg - No Ice	50361.68	-23013.56	39896.76	5152783.61	2969649.01	-1524.81
1.2 Dead+1.6 Wind 240 deg - No Ice	67148.90	-38301.19	22158.84	2929238.01	5065470.66	-1900.15
0.9 Dead+1.6 Wind 240 deg - No Ice	50361.68	-38301.19	22158.84	2877365.13	4975453.11	-1886.21
1.2 Dead+1.6 Wind 270 deg - No Ice	67148.90	-44232.72	12.01	-2511.59	5851798.89	-1742.48
0.9 Dead+1.6 Wind 270 deg - No Ice	50361.68	-44232.71	12.01	-2255.99	5747804.30	-1732.87
1.2 Dead+1.6 Wind 300 deg - No Ice	67148.90	-38242.32	-22238.98	-2952513.59	5057764.40	-541.35
0.9 Dead+1.6 Wind 300 deg - No Ice	50361.68	-38242.32	-22238.98	-2899765.76	4967889.43	-538.86
1.2 Dead+1.6 Wind 330 deg - No Ice	67148.90	-22108.82	-38476.27	-5098983.90	2928040.67	492.49
0.9 Dead+1.6 Wind 330 deg - No Ice	50361.68	-22108.82	-38476.27	-5008157.61	2875936.80	491.59
1.2 Dead+1.0 Ice+1.0 Temp	152314.29	-0.03	-0.03	-11183.72	9487.44	-0.28
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	152314.29	-13.77	-12523.62	-1954157.34	13727.37	488.11
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	152314.29	6742.24	-11745.95	-1805674.50	-1017211.53	663.25
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	152314.29	10797.90	-6248.47	-979455.15	-1663012.11	759.10

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	lb	lb	lb	lb-ft	lb-ft	lb-ft
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	152314.29	12490.97	17.97	-6307.23	-1926718.97	660.01
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	152314.29	10821.46	6270.17	962918.46	-1668432.67	274.64
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	152314.29	6252.77	10835.68	1669698.04	-960930.81	-184.06
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	152314.29	15.36	12493.20	1925149.90	4808.59	-516.27
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	152314.29	-6765.18	11722.61	1777579.05	1041317.24	-675.78
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	152314.29	-10818.43	6252.52	957263.49	1686095.42	-763.93
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp	152314.29	-12495.31	0.95	-12220.11	1946276.63	-649.80
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp	152314.29	-10808.48	-6272.32	-986345.22	1684564.26	-242.87
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp	152314.29	-6247.24	-10853.96	-1696102.34	978878.37	184.14
Dead+Wind 0 deg - Service	55957.42	-10.74	-8258.91	-1085765.80	2763.23	219.47
Dead+Wind 30 deg - Service	55957.42	4262.03	-7443.53	-972943.35	-554785.53	282.97
Dead+Wind 60 deg - Service	55957.42	7108.94	-4119.13	-540826.14	-932438.38	362.61
Dead+Wind 90 deg - Service	55957.42	8227.11	14.98	3079.44	-1080144.91	348.28
Dead+Wind 120 deg - Service	55957.42	7127.59	4136.01	544111.89	-936048.14	145.91
Dead+Wind 150 deg - Service	55957.42	4119.09	7143.18	938268.65	-541580.22	-93.52
Dead+Wind 180 deg - Service	55957.42	12.94	8232.58	1080401.81	-3290.10	-238.95
Dead+Wind 210 deg - Service	55957.42	-4281.74	7422.91	968243.62	558286.41	-288.49
Dead+Wind 240 deg - Service	55957.42	-7126.05	4122.72	540430.32	935198.12	-365.42
Dead+Wind 270 deg - Service	55957.42	-8229.64	2.24	-798.09	1080351.12	-342.87
Dead+Wind 300 deg - Service	55957.42	-7115.10	-4137.63	-545412.51	933801.79	-123.55
Dead+Wind 330 deg - Service	55957.42	-4113.41	-7158.62	-941727.73	540640.78	93.53

Maximum Tower Deflections - Service Wind

Section No.	Elevation	Horz. Deflection	Gov. Load Comb.	Tilt	Twist
	ft	in		°	°
L1	184 - 166.5	42.1617	40	2.0617	0.0105
L2	169.5 - 133.08	35.9559	40	2.0175	0.0058
L3	136.91 - 112.99	22.9312	40	1.7162	0.0020
L4	112.99 - 87.99	15.0842	40	1.3853	0.0012
L5	92.99 - 43.91	9.9193	40	1.0774	0.0007
L6	50.08 - 1	2.6905	40	0.5123	0.0003

Critical Deflections and Radius of Curvature - Service Wind

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
190.00	HP2-102	40	42.1617	2.0617	0.0105	38644
188.00	SODU 48VDC XALT	40	42.1617	2.0617	0.0105	38644
185.00	Lightning Rod w/Pipe Extension	40	42.1617	2.0617	0.0105	38644
163.00	4449 B71+B12	40	33.2199	1.9795	0.0044	9332
162.00	AIR3246 B66 w/mount pipe	40	32.8031	1.9724	0.0043	8921

tnxTower	Job: MANCHESTER GREEN CT	Page: 11 of 11
Hudson Design Group LLC 45 Beechwood Drive North Andover, MA 01845 Phone: (978) 557-5553 FAX: (978) 336-5586	Project: 183 ft Monopole	Date: 15:30:10 10/30/19
	Client: VERIZON	Designed by: kw

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
161.00	PiROD 12' Platform w / handrails	40	32.3876	1.9651	0.0041	8544
160.00	Ring Mount	40	31.9735	1.9574	0.0039	8198
159.00	RRH 8x20-25	40	31.5608	1.9495	0.0038	7879
157.00	RRH-1900	40	30.7398	1.9328	0.0035	7310
156.00	APXVSPP18-C w/mount pipe	40	30.3317	1.9241	0.0034	7055
155.00	PiROD 13' Low Profile Platform	40	29.9252	1.9151	0.0033	6817
154.30	Panel Antenna 1'X1'	40	29.6418	1.9086	0.0032	6660
152.00	Andrew VHLP2-11	40	28.7165	1.8866	0.0029	6192
151.00	3' Dish w/Radome	40	28.3173	1.8767	0.0029	6008
148.00	Ericsson RRUS-11	40	27.1318	1.8455	0.0026	5516
145.00	Kathrein 800 10121 w/mount pipe	40	25.9657	1.8126	0.0024	5099
144.00	(2) Powerwave TMA LGP21401	40	25.5817	1.8012	0.0024	4974
143.00	DC6-48-60-18-8F	40	25.2000	1.7897	0.0023	4854
141.00	RMQP 12' Platform w/handrail	40	24.4441	1.7662	0.0022	4632
135.00	Omni 2"x6'	40	22.2407	1.6921	0.0019	4166
129.50	Omni 2"x6'	40	20.3119	1.6204	0.0017	3987
128.50	20'-4 Bay Dipole	40	19.9709	1.6070	0.0017	3958
125.50	15" Yagi	40	18.9662	1.5661	0.0016	3873
124.00	PiROD 13' Low Profile Platform	40	18.4742	1.5453	0.0015	3832
121.50	2'-6" Yagi	40	17.6701	1.5101	0.0014	3765
113.00	(2) LNX 6514DS-VTM w/mount pipe	40	15.0871	1.3854	0.0012	3605
54.50	GPS	40	3.1853	0.5638	0.0003	3950
53.00	3' Side Mount Standoff	40	3.0107	0.5462	0.0003	3938

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
L1	184 - 166.5	Pole	TP19.399x15.5x0.1875	1	-1921.14	819880.00	14.8	Pass
L2	166.5 - 133.08	Pole	TP26.401x18.3556x0.25	2	-13777.70	1487470.00	69.8	Pass
L3	133.08 - 112.99	Pole	TP30.285x25.0549x0.375	3	-23724.60	2644930.00	77.2	Pass
L4	112.99 - 87.99	Pole	TP35.892x30.285x0.415	4	-29145.00	3362110.00	86.6	Pass
L5	87.99 - 43.91	Pole	TP44.903x33.9406x0.485	5	-44634.30	4922430.00	89.5	Pass
L6	43.91 - 1	Pole	TP53.5x42.5549x0.54	6	-53343.20	5845990.00	85.0	Pass
							Summary	
						Pole (L5)	89.5	Pass
						Base Plate	89.2	Pass
						RATING =	**89.5**	**Pass**

CCI Foundation Tool Suite - Monopole Pier

CCIFTS 1.1.103.14128 - Phase 1 Date: 10/31/2019

BU:	MANCHESTER GREEN CT
Site Name:	
App Number:	N/A
Work Order:	

Monopole Drilled Pier

Input

Criteria

TIA Revision:	G
ACI 318 Revision:	2008
Seismic Category:	B

Forces

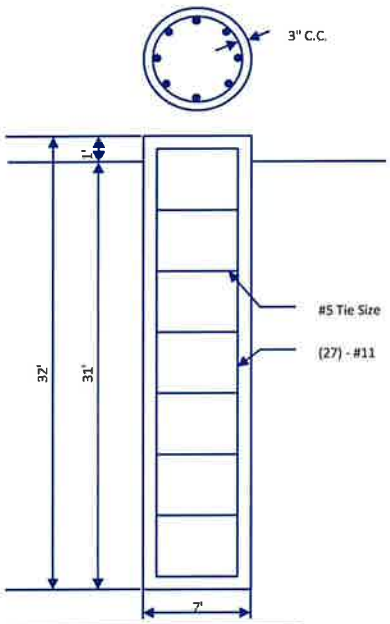
Compression	67.1 kips
Shear	46.1 kips
Moment	6064 k-ft
Swelling Force	0 kips

Foundation Dimensions

Pier Diameter:	7 ft
Ext. above grade:	1 ft
Depth below grade:	31 ft

Material Properties

Number of Rebar:	27
Rebar Size:	11
Tie Size	5
Rebar tensile strength:	60 ksi
Concrete Strength:	4000 psi
Ultimate Concrete Strain	0.003 in/in
Clear Cover to Ties:	3 in



Soil Profile: Profile 1

Layer	Thickness (ft)	From (ft)	To (ft)	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (deg)	Ultimate Uplift Skin Friction (ksf)	Ultimate Compression Friction (ksf)	Ultimate Bearing Capacity (ksf)	SPT 'N' Counts
1	3.5	0	3.5	130	0	0				
2	1.5	3.5	5	130	0	38				
3	10	5	15	70	0	38				
4	16	15	31	70	0	38				

Analysis Results

Soil Lateral Capacity

Depth to Zero Shear:	6.00 ft
Max Moment, Mu:	6339.96 k-ft
Soil Safety Factor:	3.30
Safety Factor Req'd:	1.33
RATING:	40.3%

Soil Axial Capacity

Skin Friction (k):	320.00 kips
End Bearing (k):	0.00 kips
Comp. Capacity (k), ϕCn:	320.00 kips
Comp. (k), Cu:	67.10 kips
RATING:	21.0%

Concrete/Steel Check

Mu (from soil analysis)	6339.96 k-ft
ϕMn	6752.88 k-ft
RATING:	93.9%

rho provided	0.76
rho required	0.33 OK
Rebar Spacing	7.36
Spacing required	22.56 OK
Dev. Length required	24.75
Dev. Length provided	.

Overall Foundation Rating: 93.9%

ALL-POINTS
TECHNOLOGY CORPORATION

July 20, 2018

Verizon Wireless
20 Alexander Drive
Wallingford, CT 06492

Attn: Mr. James O'Donnell

Re: Antenna Platform Structural Certification Letter
Verizon Wireless Site I.D.: Manchester Green CT
239 Middle Turnpike East
Manchester, CT 06045

Project/Location Code:	201815240525/268181
VZW FUZE Project I.D.:	15240525
APT Filing No.	CT141EB10570

Dear Mr. O'Donnell,

All-Points Technology Corp. (APT), a professional engineering corporation licensed in the State of Connecticut, has been retained by Verizon Wireless (VZW) to assess the structural adequacy of the existing VZW antenna mount assembly to support the proposed antenna and appurtenance modification on the above noted tower structure. This review was limited to a structural evaluation of the existing antenna mounting assembly and its connection to the host tower structure.

The proposed VZW antenna and appurtenance modification consists of the replacement of six (6) existing panel antennas with six (6) proposed panel antennas and nine (9) existing Remote Radios Heads (RRHs) with six (6) proposed RRHs. Additionally, the modification includes the installation of one (1) proposed SitePRO1 HRK12-U Universal Handrail Kit. Reference is made to Design Exhibit Drawings prepared by this office, marked Rev 0, dated 07/20/18.

The structural review has been prepared in accordance with the following design standards:

ANSI/TIA-222-G-2009 - Structural Standards for Steel Antenna Towers and Antenna Supporting Structures

ASCE/SEI 7-10 – Minimum Design Loads for Buildings and Other Structures

AISC - American Institute of Steel Construction Manual of Steel Construction, 14th Ed.

IBC 2012 - as amended by the 2016 Connecticut State Building Code.

Antenna, appurtenance and mount assembly loads were evaluated utilizing the ANSI TIA-222-G standard.

- Load Case 1: 105 mph (3-second gust,), 0in ice (Nominal Survival Wind)
- Load Case 2: 50 mph (3-second gust) with 1.00in ice thickness
- Load Case 3: 60 mph (3-second gust) (Service Load)
- Structure Class III
- Exposure Category B
- Topographic Category 1.

Note:
1. Based upon IBC 2012/2016 Connecticut State Building Code maximum ultimate wind speed for site location of 135 mph (3-sec gust), equivalent to a nominal design speed of 105 mph (3-sec gust) per Appendix N and exception #5, Section 1609.1.1.

The existing and proposed VZW antenna/appurtenance and mount assembly loading consists of the following equipment (proposed equipment shown in **bold** text):

Antenna and Appurtenance Make/Model	Quantity	Status	Mount Type	Elevation
Commscope NNHH-65B-R4 panel antennas	**6**	**P**	One (1) Existing SitePRO1 RMQP-4xx Antenna Mounting Platform Assembly **Reinforced w/ one (1) proposed SitePRO1 Universal Handrail Kit (P/N HRK12-U)**	113 ft± AGL
Andrew LNX-6514DS-A1M panel antennas	6	ETR		
Samsung B5/B13 RRH 4x40W(2x60W) Remote Radio Heads (RRHs)	**3**	**P**		
Samsung B2/B66a RRH 4x60W(2x90W) Remote Radio Heads (RRHs)	**3**	**P**		
Raycap RxxDC-3315-PF-48 Main Distribution Boxes (MDBs)	2	ETR	Strapped to Monopole	115 ft± AGL
Hybrid Fiber Cables (Exterior)	2	ETR	n/a	n/a

Notes:
1. ETR = Existing to Remain/to be Relocated; P = Proposed.
2. Antennas and appurtenances shall be centered on mount assembly at the above specified elevation with no vertical eccentricity.

The findings of this review are based upon a comparative review of the proposed equipment loading and a mount classification letter for the SitePRO1 RMQP-xxxx + HK12 12' Low Profile Platform with Handrail System dated March 2, 2018.

In conclusion, we find that the existing Verizon antenna mount assembly is structurally adequate to support the proposed antenna/appurtenance modification **with the proposed reinforcement**.

This letter assumes that the mounting assembly structural components and connections are in good condition and have been properly maintained since erection. The contractor shall inspect the condition of the existing mount assembly in its entirety prior to the installation of the proposed antenna and appurtenance modification.

If there are any further questions regarding this project or if we may of further assistance, please do not hesitate to call.

Sincerely,
All Points Technology Corp. P.C.

Robert Adair, P.E.
Principal

Prepared By:
All Points Technology Corp., P.C.

Michael S. Trodden, P.E.
Sr. Structural Engineer

ALL-POINTS
TECHNOLOGY CORPORATION

July 20, 2018

Verizon Wireless
20 Alexander Drive
Wallingford, CT 06492

Attn: Mr. James O'Donnell

Re: Antenna Platform Structural Certification Letter
Verizon Wireless Site I.D.: Manchester Green CT
239 Middle Turnpike East
Manchester, CT 06045

Project/Location Code:	201815240525/268181
VZW FUZE Project I.D.:	15240525
APT Filing No.	CT141EB10570

Dear Mr. O'Donnell,

All-Points Technology Corp. (APT), a professional engineering corporation licensed in the State of Connecticut, has been retained by Verizon Wireless (VZW) to assess the structural adequacy of the existing VZW antenna mount assembly to support the proposed antenna and appurtenance modification on the above noted tower structure. This review was limited to a structural evaluation of the existing antenna mounting assembly and its connection to the host tower structure.

The proposed VZW antenna and appurtenance modification consists of the replacement of six (6) existing panel antennas with six (6) proposed panel antennas and nine (9) existing Remote Radios Heads (RRHs) with six (6) proposed RRHs. Additionally, the modification includes the installation of one (1) proposed SitePRO1 HRK12-U Universal Handrail Kit. Reference is made to Design Exhibit Drawings prepared by this office, marked Rev 0, dated 07/20/18.

The structural review has been prepared in accordance with the following design standards:

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ASCE/SEI 7-10 – Minimum Design Loads for Buildings and Other Structures

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- Load Case 2: 50 mph (3-second gust) with 1.00in ice thickness
- Load Case 3: 60 mph (3-second gust) (Service Load)
- Structure Class III
- Exposure Category B
- Topographic Category 1.

Note:
1. Based upon IBC 2012/2016 Connecticut State Building Code maximum ultimate wind speed for site location of 135 mph (3-sec gust), equivalent to a nominal design speed of 105 mph (3-sec gust) per Appendix N and exception #5, Section 1609.1.1.

The existing and proposed VZW antenna/appurtenance and mount assembly loading consists of the following equipment (proposed equipment shown in **bold** text):

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Raycap RxxDC-3315-PF-48 Main Distribution Boxes (MDBs)	2	ETR	Strapped to Monopole	115 ft± AGL
Hybrid Fiber Cables (Exterior)	2	ETR	n/a	n/a

Notes:
1. ETR = Existing to Remain/to be Relocated; P = Proposed.
2. Antennas and appurtenances shall be centered on mount assembly at the above specified elevation with no vertical eccentricity.

The findings of this review are based upon a comparative review of the proposed equipment loading and a mount classification letter for the SitePRO1 RMQP-xxxx + HK12 12' Low Profile Platform with Handrail System dated March 2, 2018.

In conclusion, we find that the existing Verizon antenna mount assembly is structurally adequate to support the proposed antenna/appurtenance modification **with the proposed reinforcement**. Under the proposed loading as referenced above, the maximum usage of the reinforced platform is 60.9%.

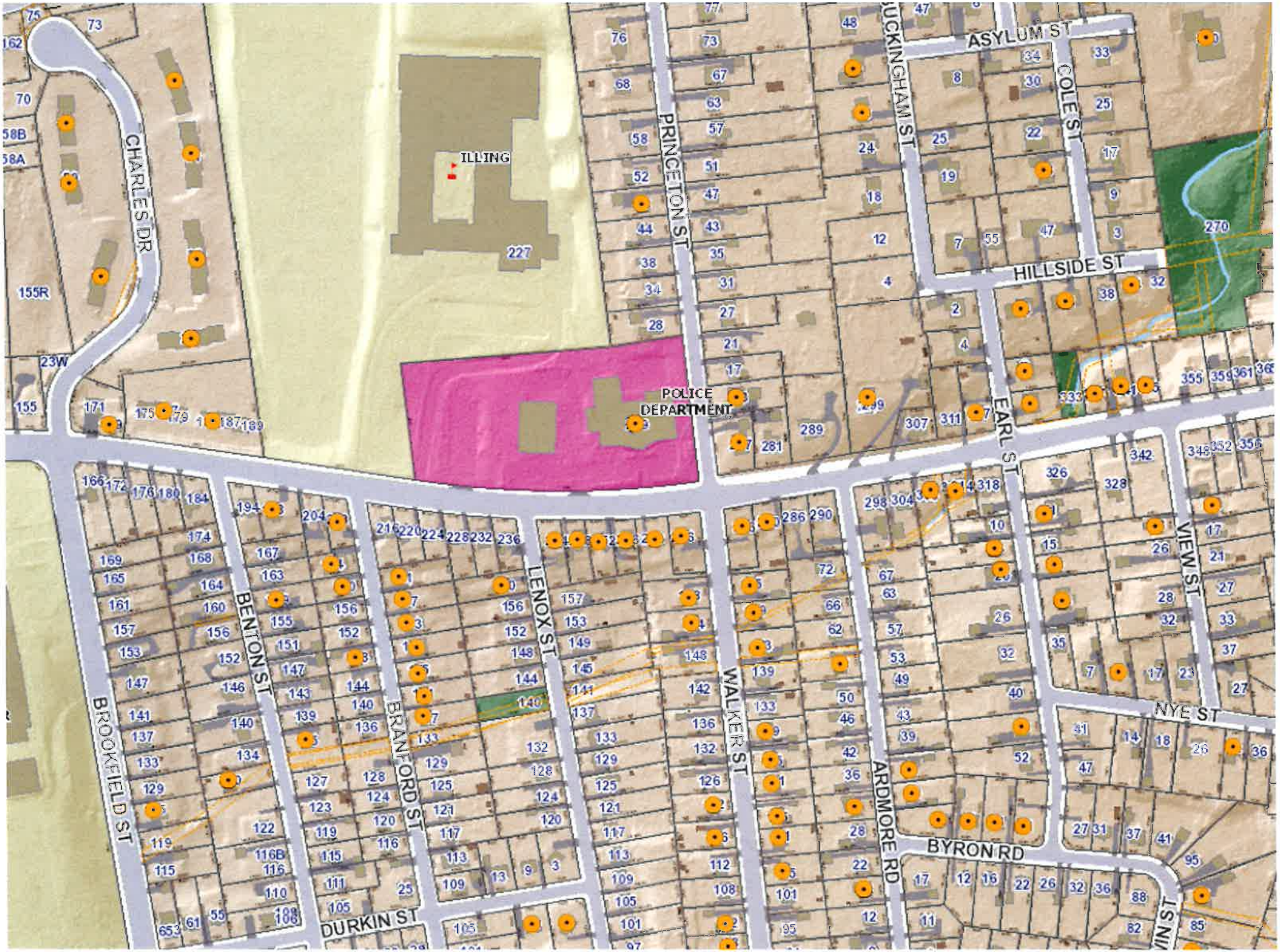
This letter assumes that the mounting assembly structural components and connections are in good condition and have been properly maintained since erection. The contractor shall inspect the condition of the existing mount assembly in its entirety prior to the installation of the proposed antenna and appurtenance modification.

If there are any further questions regarding this project or if we may of further assistance, please do not hesitate to call.

Sincerely,
All-Points Technology Corp. P.C.

Michael S. Trodden, P.E.
Sr. Structural Engineer

ATTACHMENT 4


ILLING
POLICE DEPARTMENT
CHARLES DR
PRINCETON ST
BUCKINGHAM ST
ASYLUM ST
COLE ST
HILLSIDE ST
EARL ST
VIEW ST
NYE ST
BYRON RD
ARDMORE RD
WALKER ST
LENOX ST
BRANFORD ST
BENTON ST
BROOKFIELD ST
DURKIN ST

239 MIDDLE TURNPIKE EAST

Location	239 MIDDLE TURNPIKE EAST	**Mblu**	92/ 3950/ 239/ /
Acct#	395000239	**Owner**	MANCHESTER TOWN OF
Assessment	$4,243,700	**Appraisal**	$6,062,100
PID	10705	**Building Count**	2
DISTRICT	X	**CONCRETE**	

Current Value

Appraisal			
Valuation Year	**Improvements**	**Land**	**Total**
2016	$5,573,900	$488,200	$6,062,100
Assessment			
Valuation Year	**Improvements**	**Land**	**Total**
2016	$3,901,900	$341,800	$4,243,700

Owner of Record

Owner MANCHESTER TOWN OF
Address 41 CENTER ST
MANCHESTER, CT 06040-5096

Sale Price $0
Certificate C
Book & Page
Sale Date

Ownership History

Ownership History				
Owner	**Sale Price**	**Certificate**	**Book & Page**	**Sale Date**
MANCHESTER TOWN OF	$0	C		

Building Information

Building 1 : Section 1

Year Built: 1995
Living Area: 46,701
Replacement Cost: $6,306,043
Replacement Cost Less Depreciation: $5,044,800

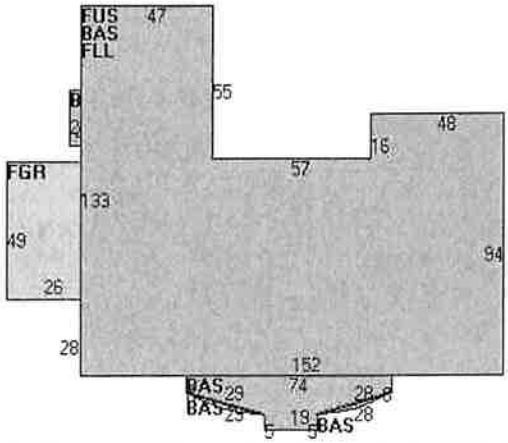
Building Attributes	
Field	**Description**

STYLE	Other Municip
MODEL	Ind/Comm
Grade	Average +10
Stories:	2
Occupancy	1
Exterior Wall 1	Brick Veneer
Exterior Wall 2	Stucco/Masonry
Roof Structure	Flat
Roof Cover	Tar + Gravel
Interior Wall 1	Minim/Masonry
Interior Wall 2	Drywall/Sheetr
Interior Floor 1	Carpet
Interior Floor 2	Tile/Vinyl Cmp
Heating Fuel	Gas
Heating Type	Forced Air-Duc
AC Type	Central
Bldg Use	Municipal 96
Total Rooms	
Total Bedrms	00
Total Baths	0
1st Floor Use:	901I
Heat/AC	Heat/AC Packag
Frame Type	Steel
Baths/Plumbing	Average
Ceiling/Wall	Susp Ceil & Wl
Rooms/Prtns	Average
Wall Height	10
% Comn Wall	0

Building Photo

(http://images.vgsi.com/photos2/ManchesterCTPhotos//\00\03\2

Building Layout



(http://images.vgsi.com/photos2/ManchesterCTPhotos//Sketches

Building Sub-Areas (sq ft)			Legend
Code	Description	Gross Area	Living Area
BAS	First Floor	16,283	16,283
FLL	Finished Lower Level	15,209	15,209
FUS	Upper Story, Finished	15,209	15,209
FGR	Garage	1,274	0
		47,975	46,701

Building 2 : Section 1

Year Built: 1975
Living Area: 7,000
Replacement Cost: $506,690
Replacement Cost Less Depreciation: $309,100

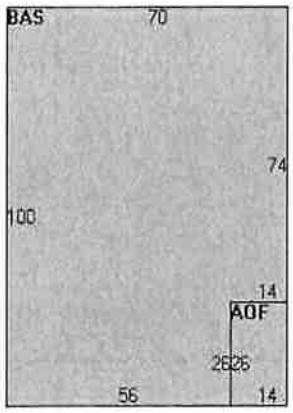
Building Attributes : Bldg 2 of 2	
Field	Description
STYLE	Service Shop

MODEL	Ind/Comm
Grade	Average
Stories:	1
Occupancy	1
Exterior Wall 1	Brick Veneer
Exterior Wall 2	
Roof Structure	Gable/Hip
Roof Cover	Asphalt Shingl
Interior Wall 1	Minim/Masonry
Interior Wall 2	
Interior Floor 1	Concr-Finished
Interior Floor 2	
Heating Fuel	Gas
Heating Type	Forced Air-Duc
AC Type	None
Bldg Use	Municipal 96
Total Rooms	
Total Bedrms	00
Total Baths	0
1st Floor Use:	901I
Heat/AC	Heat/AC Packag
Frame Type	Masonry
Baths/Plumbing	Average
Ceiling/Wall	Ceil & Min Wl
Rooms/Prtns	Average
Wall Height	19
% Comn Wall	0

Building Photo

(http://images.vgsi.com/photos2/ManchesterCTPhotos//\00\03\2

Building Layout



(http://images.vgsi.com/photos2/ManchesterCTPhotos//Sketches

Building Sub-Areas (sq ft)			Legend
Code	Description	Gross Area	Living Area
BAS	First Floor	6,636	6,636
AOF	Office, (Average)	364	364
		7,000	7,000

Extra Features

Extra Features				Legend
Code	Description	Size	Value	Bldg #
MEZ1	Mezzanine-Unfin	1900 S.F.	$13,300	2
SPR1	Sprinklers-Wet	47975 S.F.	$54,000	1

Land

Land Use

Use Code 901I

Land Line Valuation

Size (Acres) 3.97

Description	Municipal 96	**Frontage**	0
Zone	RA	**Depth**	0
Neighborhood	4000	**Assessed Value**	$341,800
Alt Land Appr	No	**Appraised Value**	$488,200
Category			

Outbuildings

Outbuildings						Legend
Code	**Description**	**Sub Code**	**Sub Description**	**Size**	**Value**	**Bldg #**
PAV1	Paving Asphalt			97700 S.F.	$122,100	1
FN4	Fence 8' Chain			128 L.F.	$1,900	1
LT1	Lights 1Fix			15 UNITS	$12,900	1
CNP1	Canopy Ave			360 S.F.	$7,800	1
SHD2	Shed W/Imp			120 S.F.	$1,300	1
SHD1	Shed			168 S.F.	$1,500	1
FN3	Fence 6' Chain			160 L.F.	$3,700	1
SHD2	Shed W/Imp			140 S.F.	$1,500	1

Valuation History

Appraisal			
Valuation Year	**Improvements**	**Land**	**Total**
2015	$4,365,100	$488,200	$4,853,300
2010	$4,125,100	$423,400	$4,548,500
2005	$3,622,600	$380,200	$4,002,800

Assessment			
Valuation Year	**Improvements**	**Land**	**Total**
2015	$3,055,600	$341,800	$3,397,400
2010	$2,887,500	$296,400	$3,183,900
2005	$2,535,800	$266,200	$2,802,000

ATTACHMENT 5

UNITED STATES POSTAL SERVICE®

Certificate of Mailing — Firm

Name and Address of Sender	TOTAL NO. of Pieces Listed by Sender	TOTAL NO. of Pieces Received at Post Office™	Affix Stamp Here *Postmark with Date*
Kenneth C. Baldwin, Esq. Robinson & Cole LLP 280 Trumbull Street Hartford, CT 06103		Postmaster, per *(name of receiving employee)*	neopost 01/14/2020 US POSTAGE $002.79⁰ ZIP 06103 041L12203937

USPS® Tracking Number / Firm-specific Identifier	Address (Name, Street, City, State, and ZIP Code™)	Postage	Fee	Special Handling	Parcel Airlift
1.	Jay Moran, Mayor Town of Manchester 41 Center Street Manchester, CT 06040				
2.	Scott Shanley, General Manager Town of Manchester 41 Center Street Manchester, CT 06040				
3.	Gary Anderson, AICP Director of Planning and Economic Development Town of Manchester 41 Center Street Manchester, CT 06040				
4.					
5.					
6.					