Robinson+Cole

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Also admitted in Massachusetts

February 1, 2018

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**
Route 80, Killingworth, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) antennas at the top of the existing 160-foot tower off Route 80 in Killingworth, Connecticut (the "Property"). The tower is owned by Crown Atlantic Company LLC ("Crown"). The Council approved Cellco's use of this tower in 1994 (Docket No. 69). Cellco now intends to replace six (6) of its existing antennas with three (3) model JAHH-65B-R3B, 700/850 MHz antennas and three (3) model JAHH-65B-R3B, 2100 MHz antennas, all at the same level on the tower. Cellco also intends to install nine (9) new remote radio heads ("RRHs") behind its replacement antennas and install two (2) HYBRIFLEX™ fiber optic antenna cables. Included in Attachment 1 are specifications for Cellco's replacement antennas, RRHs and HYBRIFLEX™ cables.

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 Killingworth's First Selectwoman, Catherine Iino; Cathie S. Jefferson, Killingworth's Zoning Enforcement Officer; 14 Route 80 LLC, the owner of the Property; and Crown, the owner of the tower.

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 RRH's will remain at the top of the 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 operation of the replacement antennas 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 behind 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 and its foundation can support Cellco's proposed modifications. (*See* Structural Analysis Report included in Attachment 3).

A copy of the parcel map and owner information for the Property is included in Attachment 4. A Certificate of Mailing verifying that this filing was sent to municipal officials and the owner of the Property 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:
Catherine Iino, Killingworth First Selectwoman
Cathie S. Jefferson, Killingworth Zoning Enforcement Officer
14 Route 80 LLC
Crown
Tim Parks

ATTACHMENT 1

Product Specifications

COMMSCOPE®

JAHH-65B-R3B

8-port sector antenna, 2x 698–787, 2x 824-894 and 4x 1695–2360 MHz, 65° HPBW, 3x RET and low bands have diplexers. Internal SBT's on first LB(Port 1) and first HB (Port 5).

- Internal SBT on low and high band allow remote RET control from the radio over the RF jumper cable
- One RET for 700MHz, one RET for 850MHz, and one RET for both high bands to ensure same tilt level for 4x Rx or 4x MIMO
- Internal filter on low band and interleaved dipole technology providing for attractive, low wind load mechanical package
- Separate RS-485 RET input/output for low and high band

Electrical Specifications

Frequency Band, MHz	698–787	824–894	1695–1880	1850–1990	1920–2200	2300–2360
Gain, dBi	14.5	15.8	18.0	18.4	18.5	18.8
Beamwidth, Horizontal, degrees	67	65	63	63	65	68
Beamwidth, Vertical, degrees	12.4	10.5	5.7	5.2	4.9	4.4
Beam Tilt, degrees	2–14	2–14	0–10	0–10	0–10	0–10
USLS (First Lobe), dB	18	18	20	20	21	23
Front-to-Back Ratio at 180°, dB	32	34	31	35	36	38
Isolation, dB	25	25	25	25	25	25
Isolation, Intersystem, dB	30	30	30	30	30	30
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	-153	-153	-153	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350	350	350	300
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	698–787	824–894	1695–1880	1850–1990	1920–2200	2300–2360
Gain by all Beam Tilts, average, dBi	14.3	14.9	17.6	18.1	18.2	18.5
Gain by all Beam Tilts Tolerance, dB	±0.3	±0.5	±0.6	±0.4	±0.5	±0.6
Gain by Beam Tilt, average, dBi	2 ° | 14.3	2 ° | 15.0	0 ° | 17.2	0 ° | 17.6	0 ° | 17.7	0 ° | 17.9
	8 ° | 14.3	8 ° | 14.9	5 ° | 17.6	5 ° | 18.2	5 ° | 18.3	5 ° | 18.7
	14 ° | 14.3	14 ° | 15.4	10 ° | 17.6	10 ° | 18.2	10 ° | 18.3	10 ° | 18.7
Beamwidth, Horizontal Tolerance, degrees	±1.2	±1.4	±4	±2.4	±2.9	±2.7
Beamwidth, Vertical Tolerance, degrees	±0.9	±0.5	±0.3	±0.2	±0.3	±0.1
USLS, beampeak to 20° above beampeak, dB	18	17	17	18	19	18
Front-to-Back Total Power at 180° ± 30°, dB	25	24	26	29	27	29
CPR at Boresight, dB	22	23	20	21	21	24
CPR at Sector, dB	11	12	11	11	11	8

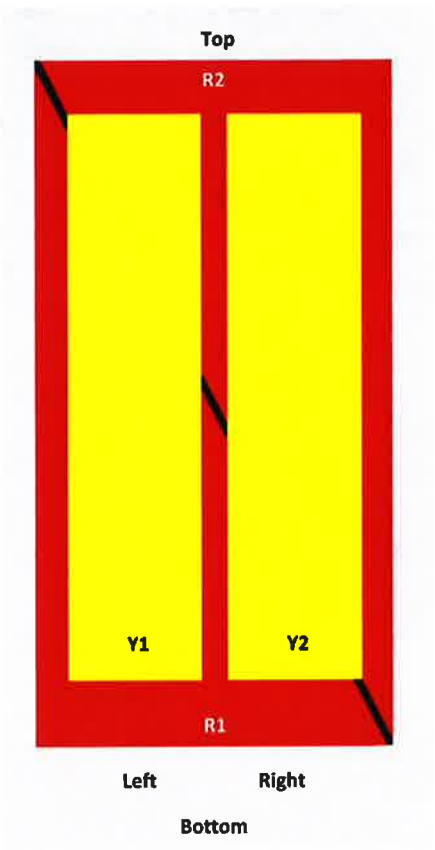
* CommScope® supports NGMN recommendations on Base Station Antenna Standards (BASTA). To learn more about the benefits of BASTA, download the whitepaper Time to Raise the Bar on BSAs.

Product Specifications

JAHH-65B-R3B

Array Layout

JAHH-65A-R3B JAHH-65B-R3B JAHH-65C-R3B



Array	Freq (MHz)	Conns	RET (SRET)	AISG RET UID
R1	698-798	1-2	1	ANxxxxxxxxxxxxxxx1
R2	824-894	3-4	2	ANxxxxxxxxxxxxxxx2
Y1	1695-2360	5-6	3	ANxxxxxxxxxxxxxxx3
Y2	1695-2360	7-8		

View from the front of the antenna

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

General Specifications

Operating Frequency Band	1695 – 2360 MHz | 698 – 787 MHz | 824 – 894 MHz
Antenna Type	Sector
Band	Multiband
Performance Note	Outdoor usage

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

Product Specifications

JAHH-65B-R3B

Color	Light gray
Grounding Type	RF connector 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	746.0 N @ 150 km/h 167.7 lbf @ 150 km/h
Wind Loading, lateral	243.0 N @ 150 km/h 54.6 lbf @ 150 km/h
Wind Loading, rear	776.0 N @ 150 km/h 174.5 lbf @ 150 km/h
Wind Speed, maximum	241 km/h | 150 mph

Dimensions

Length	1828.0 mm | 72.0 in
Width	350.0 mm | 13.8 in
Depth	208.0 mm | 8.2 in
Net Weight, without mounting kit	28.7 kg | 63.3 lb

Remote Electrical Tilt (RET) Information

Input Voltage	10–30 Vdc
Internal Bias Tee	Port 1 | Port 5
Internal RET	High band (1) | Low band (2)
Power Consumption, idle state, maximum	2 W
Power Consumption, normal conditions, maximum	13 W
Protocol	3GPP/AISG 2.0 (Single RET)
RET Interface	8-pin DIN Female | 8-pin DIN Male
RET Interface, quantity	2 female | 2 male

Packed Dimensions

Length	1975.0 mm | 77.8 in
Width	456.0 mm | 18.0 in
Depth	357.0 mm | 14.1 in
Shipping Weight	42.0 kg | 92.6 lb

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

Product Specifications

JAHH-65B-R3B

Included Products

BSAMNT-1 — 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

ALCATEL-LUCENT B13 RRH4X30-4R

Alcatel-Lucent B13 Remote Radio Head 4x30-4R is the newest addition of Remote Radio Head to the extended product line of Alcatel-Lucent's distributed Base Station solutions, aimed at facilitating smooth RF site acquisition and related civil engineering.

Supporting 2Tx/4Tx MIMO and 4-way Rx diversity, Alcatel-Lucent B13 RRH4x30-4R allows operators to have a compact radio solution to deploy LTE in the 700U band (700 MHz, 3GPP band 13), providing them with the means to achieve high capacity, high quality and high coverage with minimum site requirements.

The Alcatel-Lucent B13 RRH4x30-4R product has four transmit RF paths, offering the possibility to **select, via software only, 2Tx or 4Tx MIMO configurations** with either 2x60 W or 4x30 W RF output power. It supports also 4-way Rx diversity and up to 10MHz instantaneous bandwidth.

The Alcatel-Lucent B13 RRH4x30-4R is a near zero-footprint solution and operates noise free, simplifying negotiations with site property owners and minimizing environmental impacts.

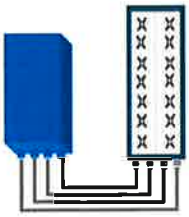
Its compactness and slim design makes the Alcatel-Lucent B13 RRH4x30-4R easy to install close to the antenna: operators can therefore locate this Remote Radio Head where RF design conditions are deemed ideal, minimizing trade-offs between available sites and RF optimum sites, together with reducing the RF feeder needs and installation costs.

FEATURES

- Supporting LTE in 700 MHz band (700U, 3GPP band 13)
- LTE 2Tx or 4Tx MIMO (SW switchable)
- Output power: Up to 2x60W or 4x30W
- 10MHz LTE carrier with 4Rx Diversity
- Convection-cooled (fan-less)
- Supports AISG 2.0 ALD devices (RET, TMA) through RS485 or RF ports

BENEFITS

- Compact to reduce additional footprint when adding LTE in 700U band
- MIMO scheme operation selection (2Tx or 4Tx) by software only
- Improves downlink spectral efficiency through MIMO4
- Increases LTE coverage thanks to 4Rx diversity capability and best in class Rx sensitivity
- Flexible mounting options: Pole or Wall



4x30W with 4T4R
or
2x60W with 2T4R

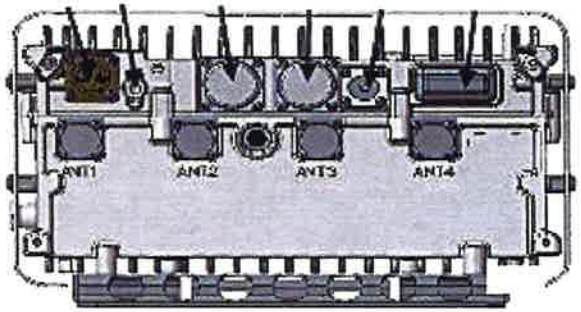
Can be switched between modes via SW w/o site visit

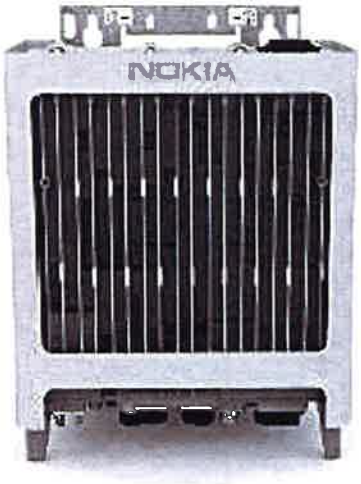
Alcatel·Lucent

Features & performance	
Number of TX/RX paths	4 duplexed (either 4T4R or 2T4R by SW)
Frequency band	U700 (C) (3GPP bands 13): DL: 746 - 756 MHz / UL: 777 - 787 MHz
Instantaneous bandwidth - #carriers	10MHz – 1 LTE carrier (in 10MHz occupied bandwidth)
LTE carrier bandwidth	10 MHz
RF output power	2x60W or 4x30W (by SW)
Noise figure – RX Diversity scheme	2 dB typ. (<2.5 dB max) – 2 or 4 way Rx diversity
Sizes (HxWxD) in mm (in.) Volume in L Weight in kg (lb) (w/o mounting HW)	550 x 305 x 230 (21.6" x 12.0" x 9") (with solar shield) 38 (with solar shield) 26 (57.2) (with solar shield)
DC voltage range DC power consumption	-40.5 to -57V at full performance, -38 to -57V with relaxation on power consumption 550W typical @100% RF load (in 2Tx or 4TX mode)
Environmental conditions Wind load (@150km/h or 93mph)	-40°C (-40°F) /+55°C (+131°F) IP65 Frontal:<200N / Lateral :<150N
Antenna ports	4 ports 7/16 DIN female (50 ohms) VSWR < 1.5
CPRI ports	2 CPRI ports (HW ready for Rate7, 9.8 Gbps) SFP single mode dual fiber
AISG interfaces	1 AISG2.0 output (RS485) Integrated Smart Bias Tees (x2)
Misc. Interfaces	4 external alarms (1 connector) – 4 RF Tx & 4 RF Rx monitor ports - 1 DC connector (2 pins)
Installation conditions	Pole and wall mounting
Regulatory compliance	3GPP 36.141 / 3GPP 36.113 / GR-1089-CORE / GR-3108-CORE / UL 60950-1 / FCC Part 27

AHCA AirScale RRH 4T4R B5 160W

Supported Frequency bands	3GPP band 5
Frequencies	DL 869-894MHz, UL 824-849MHz
Number of TX/RX paths/pipes	4TX/4RX
Instantaneous Bandwidth IBW	25MHz (Full Band)
Occupied Bandwidth OBW	25MHz (Full Band)
Output Power	4T4R @ 40W / 2T4R @ 60W
RF Sharing	LTE, WCDMA, LTE + NB-IoT supported
256 QAM Back Off	No backoff at 40W and 0.8dB at 60W.
Supply Voltage / Voltage Range	DC-48V / -36V to -60V
Typical Power Consumption	365W [50% ETSI Busy Hour Load at 4TX @ 40W]
	529W [100% RF Load at 4 TX @ 40W]
	574W [100% RF Load at 4 TX @ 40W with SBT and AISG ON]
Antenna Ports	4 Ports, 4.3-10+
Optical Ports	2x CPRI 9.8 Gbps
ALD Control Interfaces	AISG3.0 from ANT1,2, 3, 4 and RET (Power supply ANT1 and ANT3)
Other Interfaces	External Alarm MDR-26 Serial connector (4 inputs, 1 Output) DC Circular Power Connector





Operational Temperature Range	-40°C to 55°C (with solar cover)
Dimensions (mm) Height x width x depth	337 x 295 x 165 (radio only) 13.3" x 11.7" x 6.5" 428 x 324 x 208 (with bracket and enclosure) 16.9" x 12.8" x 8.2"
Volume (liters)	16.5
Weight (kg)	16/ 35.3 lb – w/o bracket
Ingress protection class	IP65
Installation options	Pole or Wall, Vertical or Horizontal Book Mount
Surge protection	Class II 5kA

NOKIA

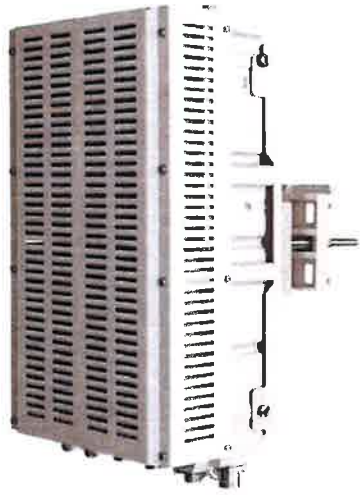
B66a RRH4x45W

Datasheet

Radio Technology	FDD-LTE

Feature description:

- Remote Radio Head 4x45W or 2x90W Switchable via SW



Power Output	4 x 45 W or 2x90W (SW Switchable) w/o fans
IBW	70MHz
OBW	60 MHz
RF Sharing	LTE
Mass/Volume	25.8kg/56.9 lb Weight 655H x 299W x 182D mm 25.8"x11.8"x7.2" 29.7L / 35.5L
Antenna Conf.	4Tx/4Rx
Temperature	-40 to 55 °C
IP class	IP65
Input Power	DC 48 V
Cooling	Natural Convection
Mounting	Wall, Pole mount
BBU connection	2x 9.8Gbps SFP(Rate 7 HW ready)

B66a RRH 4x45 – Interfaces

Power:

- Max power: 816W (add 58W for AISG)
- Breaker size: 25A
- Max distance with 6ga power feed and 5.5V drop: 284 feet

RF Interfaces:

- 4.3/10 Connectors
- No monitoring ports(Spectrum analyzer SW takes place of monitoring ports)

AISG:

- Two Smart Bias-T
- One AISG port

B66 Details

- Max power for a single carrier is:
  - 2x60W for 10,15,20 MHz carrier
  - 2x40W for 5 MHz carrier
- Multi- Carrier Support with AWS-1 carriers: 15.1
- Multi- Carrier Support with AWS-3 carriers: 16.2

Carrier power: Multi-carrier

- Assuming 2 Tx power can be assigned per carrier subject to 40W max for 5Mhz, 60W for larger in 2T, cut that power in half for 4T
- Example:B4 (20Mhz) and AWS3 (10MHz)
  - Power can be varied between those two carriers, can go 60W for 20 MHz carrier, 30W for 10 MHz carrier to use the 90W in 2T.
  - It could be 45/45 for 20Mhz/10Mhz if desired.

Product Data Sheet HB158-1-08U8-S8J18

HYBRIFLEX™ RRH Hybrid Feeder Cabling Solution, 1-5/8", Single-Mode Fiber

Product Description

RFS' HYBRIFLEX Remote Radio Head (RRH) hybrid feeder cabling solution combines optical fiber and DC power for RRHs in a single lightweight aluminum corrugated cable, making it the world's most innovative solution for RRH deployments.

It was developed to reduce installation complexity and costs at Cellular sites. HYBRIFLEX allows mobile operators deploying an RRH architecture to standardize the RRH installation process and eliminate the need for and cost of cable grounding. HYBRIFLEX combines optical fiber (multi-mode or single-mode) and power in a single corrugated cable. It eliminates the need for junction boxes and can connect multiple RRHs with a single feeder. Standard RFS CELLFLEX® accessories can be used with HYBRIFLEX cable. Both pre-connectorized and on-site options are available.

Figure 1: HYBRIFLEX Series

Features/Benefits

- Aluminum corrugated armor with outstanding bending characteristics – minimizes installation time and enables mechanical protection and shielding
- Same accessories as 1 5/8" coaxial cable
- Outer conductor grounding – Eliminates typical grounding requirements and saves on installation costs
- Lightweight solution and compact design – Decreases tower loading
- Robust cabling – Eliminates need for expensive cable trays and ducts
- Installation of tight bundled fiber optic cable pairs directly to the RRH – Reduces CAPEX and wind load by eliminating need for interconnection
- Optical fiber and power cables housed in single corrugated cable – Saves CAPEX by standardizing RRH cable installation and reducing installation requirements
- Outdoor polyethylene jacket – Ensures long-lasting cable protection

Technical Specifications

Outer Conductor Armor	Corrugated Aluminum	[mm (in)]	46.5 (1.83)
Jacket	Polyethylene, PE	[mm (in)]	50.3 (1.98)
UV-Protection	Individual and External Jacket		Yes
Weight, Approximate		[kg/m (lb/ft)]	1.9 (1.30)
Minimum Bending Radius, Single Bending		[mm (in)]	200 (8)
Minimum Bending Radius, Repeated Bending		[mm (in)]	500 (20)
Recommended/Maximum Clamp Spacing		[m (ft)]	1.0 / 1.2 (3.25 / 4.0)
DC-Resistance Outer Conductor Armor		[Ω/km (Ω/1000ft)]	068 (0.205)
DC-Resistance Power Cable, 8.4mm² (8AWG)		[Ω/km (Ω/1000ft)]	2.1 (0.307)
Version			Single-mode OM3
Quantity, Fiber Count			16 (8 pairs)
Core/Clad		[µm]	50/125
Primary Coating (Acrylate)		[µm]	245
Buffer Diameter, Nominal		[µm]	900
Secondary Protection, Jacket, Nominal		[mm (in)]	2.0 (0.08)
Minimum Bending Radius		[mm (in)]	104 (4.1)
Insertion Loss @ wavelength 850nm		dB/km	3.0
Insertion Loss @ wavelength 1310nm		dB/km	1.0
Standards (Meets or exceeds)			UL94-V0, UL1666 RoHS Compliant
Size (Power)		[mm² (AWG)]	8.4 (8)
Quantity, Wire Count (Power)			16 (8 pairs)
Size (Alarm)		[mm² (AWG)]	0.8 (18)
Quantity, Wire Count (Alarm)			4 (2 pairs)
Type			UV protected
Strands			19
Primary Jacket Diameter, Nominal		[mm (in)]	6.8 (0.27)
Standards (Meets or exceeds)			NFPA 130, ICEA S-95-658 UL Type XHHW-2, UL 44 UL-LS Limited Smoke, UL VW-1 IEEE-383 (1974), IEEE1202/FT4 RoHS Compliant
Installation Temperature		[°C (°F)]	-40 to +65 (-40 to149)
Operation Temperature		[°C (°F)]	-40 to +65 (-40 to149)

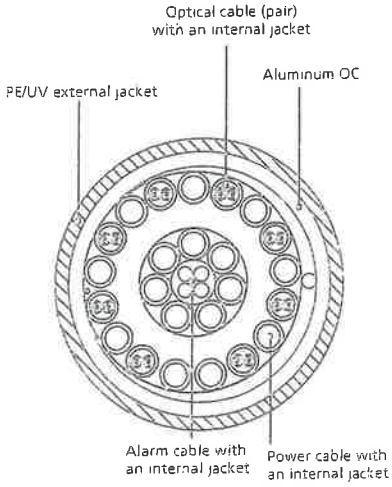


Figure 2: Construction Detail

* This data is provisional and subject to change

ATTACHMENT 2

	General	Power	Density					
Site Name: Killingworth								
Tower Height: 160'								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*AT&T	2	565	90	880	0.0576	0.5867	0.98%	
*AT&T	2	875	90	1900	0.0892	1.0000	0.89%	
*AT&T	1	283	90	880	0.0144	0.5867	0.25%	
*AT&T	4	525	90	1900	0.1070	1.0000	1.07%	
*AT&T	1	1313	90	734	0.0669	0.4893	1.37%	
*Nextel	9	100	120	851	0.0249	0.5673	0.44%	
*Sprint	11	122	140	1962.5	0.0269	1.0000	0.27%	
Verizon PCS	**0**	**0**	**157**	**0.0000**	**1970**	**1.0000**	**0.00%**	
Verizon Cellular	**3**	**345**	**157**	**0.0151**	**876**	**0.5840**	**2.59%**	
Verizon Cellular	**1**	**1451**	**157**	**0.0212**	**869**	**0.5793**	**3.65%**	
Verizon AWS	**1**	**3298**	**157**	**0.0481**	**2145**	**1.0000**	**4.81%**	
Verizon 700	**1**	**953**	**157**	**0.0139**	**746**	**0.4973**	**2.80%**	
								19.1%
* Source: Siting Council								

ATTACHMENT 3

PJF PAUL J. FORD & COMPANY

Date: **September 20, 2017**

Andrew Bazinet
Crown Castle
3 Corporate Park Drive Suite 101
Clifton Park, NY 12065
1-585-370-4766

Paul J Ford and Company
250 E Broad St Suite 600
Columbus, OH 43215
614-221-6679
jjacobs@pjfweb.com

Subject: **Structural Analysis Report**

Carrier Designation:	***Verizon Wireless* Co-Locate**	
	Carrier Site Number:	119720
	Carrier Site Name:	Killingworth CT
Crown Castle Designation:	**Crown Castle BU Number:**	806387
	Crown Castle Site Name:	HRT 088 943629
	Crown Castle JDE Job Number:	443602
	Crown Castle Work Order Number:	1460138
	Crown Castle Application Number:	394728 Rev. 1
Engineering Firm Designation:	**Paul J Ford and Company Project Number:**	37517-3262-001-8700
Site Data:	**#14 Route 80, KILLINGWORTH, Middlesex County, CT**	
	Latitude *41° 21' 26.43"*, Longitude *-72° 31' 11.83"*	
	160 Foot - Self Support Tower	

Dear Mr. Bazinet,

Paul J Ford and Company is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above mentioned tower. This analysis has been performed in accordance with the Crown Castle Structural 'Statement of Work' and the terms of Crown Castle Purchase Order Number 1082589, in accordance with application 394728, revision 1.

The purpose of the analysis is to determine acceptability of the tower stress level. Based on our analysis we have determined the tower stress level for the structure and foundation, under the following load case, to be:

LC5: Existing + Proposed Equipment **Sufficient Capacity***
Note: See Table I and Table II for the proposed and existing loading, respectively.

- *** Please see recommendations section regarding shielding the proposed TMAs.**

This analysis has been performed in accordance with the 2016 Connecticut State Building Code based upon an ultimate 3-second gust wind speed of 130 mph converted to a nominal 3-second gust wind speed of 101 mph per section 1609.3 and Appendix N as required for use in the TIA-222-G Standard per Exception #5 of Section 1609.1.1. Exposure Category B with a topographic category 1 and crest height of 0 feet, and Risk Category II were used in this analysis.

We at *Paul J Ford and Company* appreciate the opportunity of providing our continuing professional services to you and Crown Castle. If you have any questions or need further assistance on this or any other projects please give us a call.

Structural analysis prepared by:

Joseph Jacobs, PE, SE
Project Manager

tnxTower Report - version 7.0.5.1

STATE OF CONNECTICUT
JOSEPH PACHICARAH JACOBS
No. PEN 22731
LICENSED
PROFESSIONAL ENGINEER

SEP 20 2017

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1) INTRODUCTION

This tower is a 160 ft Self Support tower designed by ROHN
The tower was originally designed for a wind speed of 85 mph per TIA/EIA-222-F.

2) ANALYSIS CRITERIA

The structural analysis was performed for this tower in accordance with the requirements of TIA-222-G Structural Standards for Steel Antenna Towers and Antenna Supporting Structures using a 3-second gust wind speed of 100.7 mph with no ice, 50 mph with 0.75 inch ice thickness and 60 mph under service loads, exposure category B with topographic category 1 and crest height of 0 feet.

Table 1 - Proposed Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
157.0	157.0	3	Alcatel Lucent	B13 RRH 4X30	2	1 5/8
		3	Nokia	B5 4T4R RRH4X40 AIRSCALE		
		3	Alcatel Lucent	B66A RRH4X45		
		6	commscope	JAHH-65B-R3B w/ Mount Pipe		
		2	raycap	RC3DC-3315-PF-48		

Table 2 - Existing and Reserved Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
157.0	157.0	3	antel	BXA-171085-8BF-EDIN-2 w/ Mount Pipe	4	1 5/8	2
		3	antel	BXA-70063-6CF-2 w/ Mount Pipe			
		6	antel	LPA-80080/6CF w/ Mount Pipe	10	1 5/8	1
		6	rfs celwave	FD9R6004/2C-3L			2
		1	tower mounts	Sector Mount [SM 508-3]			1
144.0	144.0	6	decibel	DB978H90T2E-M w/ Mount Pipe	6	1 5/8	1
		1	tower mounts	Sector Mount [SM 506-3]			
118.0	118.0	12	decibel	DB844H90E-XY w/ Mount Pipe	-	-	1
		1	tower mounts	Sector Mount [SM 404-3]			
90.0	90.0	6	ericsson	RRUS-11	12 1 2	7/8 3/8 7/16	1
		2	kmw communications	AM-X-CD-16-65-00T-RET w/ Mount Pipe			
		6	powerwave technologies	7770.00 w/ Mount Pipe			
		6	powerwave	LGP21401			

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
			technologies				
		6	powerwave technologies	LGP21901			
		1	powerwave technologies	P45-16-XLH-RR w/ Mount Pipe			
		1	raycap	DC6-48-60-18-8F			
		1	tower mounts	Pipe Mount [PM 601-3]			
		1	tower mounts	Sector Mount [SM 802-3]			
50.0	50.0	1	lucent	KS24019-L112A	1	1/2	1
		1	tower mounts	Side Arm Mount [SO 306-1]			

Notes:
1) Existing Equipment
2) Equipment To Be Removed

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	JGI Eastern 05204G March 25, 2005	1237256	CCISITES
4-POST-MODIFICATION INSPECTION	PJF 37508-0397 JUNE 22, 2009	2450760	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	Rohn/ HEB Civil Engineers	821498	CCISITES

3.1) Analysis Method

tnxTower (version 7.0.5.1), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

3.2) Assumptions

1) Tower and structures were built in accordance with the manufacturer's specifications.
2) The tower and structures have been maintained in accordance with the manufacturer's specification.
3) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
4) The existing base plate grout was considered in this analysis. Grout must be maintained and inspected periodically, and must be replaced if damaged or cracked. Refer to crown document PRC-10012, Base Plate Grout Inspection & Classification.

This analysis may be affected if any assumptions are not valid or have been made in error. Paul J Ford and Company should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 4 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
T1	160 - 140	Leg	Rohn 2.375" x 0.218" (2 EH)	2	-19.36	49.90	38.8	Pass
		Diagonal	L 1.5 x 1.5 x 1/8	8	-3.52	4.33	81.4 100.0 (b)	Pass
		Top Girt	L 2 x 2 x 1/8	6	-0.42	3.21	13.0	Pass
T2	140 - 120	Leg	Rohn 2.875" x 0.276" (2.5 EH)	38	-44.22	74.43	59.4	Pass
		Diagonal	2L 1.5 x 1.5 x 1/8 (3/16)	46	-3.15	9.90	31.8 50.6 (b)	Pass
		Top Girt	L 2 x 2 x 1/8	42	-0.08	3.17	2.4	Pass
T3	120 - 100	Leg	Rohn 4" x 0.318" (3.5 EH)	68	-69.28	125.73	55.1	Pass
		Diagonal	2L 2 x 2 x 3/16 (3/16)	73	-4.49	21.96	20.5 59.4 (b)	Pass
T4	100 - 80	Leg	Rohn 4" x 0.318" (3.5 EH) (GR)	89	-96.59	148.29	65.1	Pass
		Diagonal	2L 2.5 x 2.5 x 3/16 (3/16)	94	-5.91	27.16	21.8 47.2 (b)	Pass
T5	80 - 60	Leg	ROHN 4 EH (GR)	110	-124.94	192.91	64.8	Pass
		Diagonal	2L 3 x 3 x 3/16 (1/4)	115	-6.20	38.73	16.0 49.7 (b)	Pass
T6	60 - 40	Leg	Rohn 5.563" x 0.375" (5 EH) (GR)	131	-150.49	246.97	60.9	Pass
		Diagonal	2L 3 x 3 x 3/16 (1/4)	136	-7.39	28.70	25.7 48.7 (b)	Pass
T7	40 - 20	Leg	Rohn 5.563" x 0.375" (5 EH) (GR)	146	-177.17	246.94	71.7	Pass
		Diagonal	2L 3 x 3 x 1/4 (1/4)	151	-7.53	35.24	21.4 49.9 (b)	Pass
T8	20 - 0	Leg	Rohn 6.625" x 0.432" (6 EH) (GR)	161	-203.53	381.11	53.4	Pass
		Diagonal	2L 3.5 x 3.5 x 1/4 (1/4)	166	-8.31	50.21	16.5 54.7 (b)	Pass
							Summary	
						Leg (T7)	71.7	Pass
						Diagonal (T1)	100.0	Pass
						Top Girt (T1)	13.0	Pass
						Bolt Checks	100.0	Pass
						Rating =	100.0	Pass

Table 5 - Tower Component Stresses vs. Capacity – LC5

Notes	Component	% Capacity	Pass / Fail
	Anchor Rods	65	Pass
	Base Foundation	42	Pass
	Base Foundation Soil Interaction	80	Pass

Structure Rating (max from all components) =	100%

Notes:
1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.

4.1) Recommendations

All the proposed TMAs must be shielded behind the existing/proposed antennas. However, the (2) Raycap RC3DC-3315-PF-48 may be installed unshielded.

APPENDIX A

TNXTOWER OUTPUT

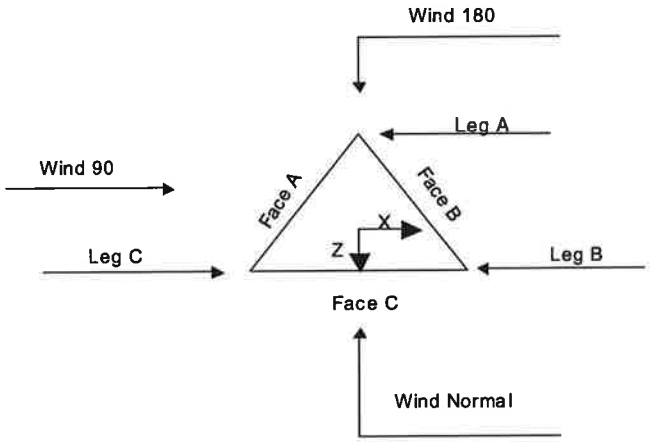
Tower Input Data

The main tower is a 3x free standing tower with an overall height of 160.00 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 6.52 ft at the top and 20.86 ft at the base.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

3) Tower is located in Middlesex County, Connecticut.
4) ASCE 7-10 Wind Data is used (wind speeds converted to nominal values).
5) Basic wind speed of 101 mph.
6) Structure Class II.
7) Exposure Category B.
8) Topographic Category 1.
9) Crest Height 0.00 ft.
10) Nominal ice thickness of 0.7500 in.
11) Ice thickness is considered to increase with height.
12) Ice density of 56 pcf.
13) A wind speed of 50 mph is used in combination with ice.
14) Deflections calculated using a wind speed of 60 mph.
15) Grouted pipe f'_c is 7 ksi.
16) Pressures are calculated at each section.
17) Stress ratio used in tower member design is 1.

Options

	Consider Moments - Legs		Distribute Leg Loads As Uniform		Use ASCE 10 X-Brace Ly Rules
	Consider Moments - Horizontals		Assume Legs Pinned	√	Calculate Redundant Bracing Forces
	Consider Moments - Diagonals		Assume Rigid Index Plate		Ignore Redundant Members in FEA
	Use Moment Magnification	√	Use Clear Spans For Wind Area		SR Leg Bolts Resist Compression
√	Use Code Stress Ratios	√	Use Clear Spans For KL/r		All Leg Panels Have Same Allowable
√	Use Code Safety Factors - Guys	√	Retension Guys To Initial Tension		Offset Girt At Foundation
	Escalate Ice		Bypass Mast Stability Checks	√	Consider Feed Line Torque
	Always Use Max Kz	√	Use Azimuth Dish Coefficients	√	Include Angle Block Shear Check
	Use Special Wind Profile	√	Project Wind Area of Appurt.		Use TIA-222-G Bracing Resist. Exemption
√	Include Bolts In Member Capacity		Autocalc Torque Arm Areas		Use TIA-222-G Tension Splice Exemption
	Leg Bolts Are At Top Of Section		Add IBC .6D+W Combination		Poles
√	Secondary Horizontal Braces Leg		Sort Capacity Reports By Component		Include Shear-Torsion Interaction
	Use Diamond Inner Bracing (4 Sided)	√	Triangulate Diamond Inner Bracing		Always Use Sub-Critical Flow
	SR Members Have Cut Ends		Treat Feed Line Bundles As Cylinder		Use Top Mounted Sockets
	SR Members Are Concentric				



Triangular Tower

Tower Section Geometry

Tower Section	Tower Elevation	Assembly Database	Description	Section Width	Number of Sections	Section Length
	ft			ft		ft
T1	160.00-140.00			6.52	1	20.00
T2	140.00-120.00			6.56	1	20.00
T3	120.00-100.00			8.60	1	20.00
T4	100.00-80.00			10.64	1	20.00
T5	80.00-60.00			12.68	1	20.00
T6	60.00-40.00			14.77	1	20.00
T7	40.00-20.00			16.77	1	20.00
T8	20.00-0.00			18.85	1	20.00

Tower Section Geometry *(cont'd)*

Tower Section	Tower Elevation	Diagonal Spacing	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset	Bottom Girt Offset
	ft	ft				in	in
T1	160.00-140.00	4.00	X Brace	No	No	0.0000	0.0000
T2	140.00-120.00	5.00	X Brace	No	No	0.0000	0.0000
T3	120.00-100.00	6.67	X Brace	No	No	0.0000	0.0000
T4	100.00-80.00	6.67	X Brace	No	No	0.0000	0.0000
T5	80.00-60.00	6.67	X Brace	No	No	0.0000	0.0000
T6	60.00-40.00	10.00	X Brace	No	No	0.0000	0.0000
T7	40.00-20.00	10.00	X Brace	No	No	0.0000	0.0000
T8	20.00-0.00	10.00	X Brace	No	No	0.0000	0.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 160.00-140.00	Pipe	Rohn 2.375" x 0.218" (2 EH)	A572-50 (50 ksi)	Single Angle	L 1.5 x 1.5 x 1/8	A36 (36 ksi)
T2 140.00-120.00	Pipe	Rohn 2.875" x 0.276" (2.5 EH)	A572-50 (50 ksi)	Double Angle	2L 1.5 x 1.5 x 1/8 (3/16)	A36 (36 ksi)
T3 120.00-100.00	Pipe	Rohn 4" x 0.318" (3.5 EH)	A572-50 (50 ksi)	Double Angle	2L 2 x 2 x 3/16 (3/16)	A36 (36 ksi)
T4 100.00-80.00	Grouted Pipe	Rohn 4" x 0.318" (3.5 EH)	A572-50 (50 ksi)	Double Angle	2L 2.5 x 2.5 x 3/16 (3/16)	A36 (36 ksi)
T5 80.00-60.00	Grouted Pipe	ROHN 4 EH	A572-50 (50 ksi)	Double Angle	2L 3 x 3 x 3/16 (1/4)	A36 (36 ksi)
T6 60.00-40.00	Grouted Pipe	Rohn 5.563" x 0.375" (5 EH)	A572-50 (50 ksi)	Double Angle	2L 3 x 3 x 3/16 (1/4)	A36 (36 ksi)
T7 40.00-20.00	Grouted Pipe	Rohn 5.563" x 0.375" (5 EH)	A572-50 (50 ksi)	Double Angle	2L 3 x 3 x 1/4 (1/4)	A36 (36 ksi)
T8 20.00-0.00	Grouted Pipe	Rohn 6.625" x 0.432" (6 EH)	A572-50 (50 ksi)	Double Angle	2L 3.5 x 3.5 x 1/4 (1/4)	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 160.00-140.00	Equal Angle	L 2 x 2 x 1/8	A36 (36 ksi)	Single Angle		A36 (36 ksi)
T2 140.00-120.00	Equal Angle	L 2 x 2 x 1/8	A36 (36 ksi)	Single Angle		A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in	Double Angle Stitch Bolt Spacing Redundants in
T1 160.00-140.00	0.00	0.1875	A36 (36 ksi)	1.03	1	1.05	30.0000	30.0000	36.0000
T2 140.00-120.00	0.00	0.1875	A36 (36 ksi)	1.03	1	1.05	30.0000	30.0000	36.0000
T3 120.00-100.00	0.00	0.1875	A36 (36 ksi)	1.03	1	1.05	36.0000	30.0000	36.0000
T4 100.00-80.00	0.00	0.4375	A36 (36 ksi)	1.03	1	1.05	48.0000	30.0000	36.0000
T5 80.00-60.00	0.00	0.4375	A36 (36 ksi)	1.03	1	1.05	48.0000	30.0000	36.0000
T6 60.00-40.00	0.00	0.2500	A36 (36 ksi)	1.03	1	1.05	60.0000	30.0000	36.0000
T7 40.00-20.00	0.00	0.2500	A36 (36 ksi)	1.03	1	1.05	60.0000	30.0000	36.0000
T8 20.00-0.00	0.00	0.2500	A36 (36 ksi)	1.03	1	1.05	60.0000	30.0000	36.0000

Tower Section Geometry *(cont'd)*

K Factors[1]

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1 160.00-140.00	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T2 140.00-120.00	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T3 120.00-100.00	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T4 100.00-80.00	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T5 80.00-60.00	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T6 60.00-40.00	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T7 40.00-20.00	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T8 20.00-0.00	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1

[1]*Note: K factors are applied to member segment lengths. K-braces without inner supporting members will have the K factor in the out-of-plane direction applied to the overall length.*

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U
T1 160.00-140.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T2 140.00-120.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T3 120.00-100.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T4 100.00-80.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T5 80.00-60.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T6 60.00-40.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T7 40.00-20.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T8 20.00-0.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75

Tower Section Geometry *(cont'd)*

Tower Elevation	Connection Offsets							
	Diagonal				K-Bracing			
	Vert. Top	Horiz. Top	Vert. Bot.	Horiz. Bot.	Vert. Top	Horiz. Top	Vert. Bot.	Horiz. Bot.
ft	in	in	in	in	in	in	in	in
T1 160.00-140.00	2.5000	3.5000	2.5000	3.5000	0.0000	0.0000	0.0000	0.0000
T2 140.00-120.00	2.5000	4.4000	2.5000	4.4000	0.0000	0.0000	0.0000	0.0000
T3 120.00-100.00	2.5000	4.9000	2.5000	4.9000	0.0000	0.0000	0.0000	0.0000

Tower Elevation	Connection Offsets							
	Diagonal				K-Bracing			
	Vert. Top	Horiz. Top	Vert. Bot.	Horiz. Bot.	Vert. Top	Horiz. Top	Vert. Bot.	Horiz. Bot.
ft	in	in	in	in	in	in	in	in
T4 100.00-80.00	2.5000	4.9000	2.5000	4.9000	0.0000	0.0000	0.0000	0.0000
T5 80.00-60.00	2.5000	4.8000	2.5000	4.8000	0.0000	0.0000	0.0000	0.0000
T6 60.00-40.00	2.5000	5.3000	2.5000	5.3000	0.0000	0.0000	0.0000	0.0000
T7 40.00-20.00	2.5000	5.4000	2.5000	5.4000	0.0000	0.0000	0.0000	0.0000
T8 20.00-0.00	2.5000	5.4000	2.5000	5.4000	0.0000	0.0000	0.0000	0.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T1 160.00-140.00	Flange	0.6250 A325N	4	0.5000 A325N	1	0.5000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T2 140.00-120.00	Flange	0.6250 A325N	4	0.5000 A325N	1	0.5000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T3 120.00-100.00	Flange	0.7500 A325N	4	0.5000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T4 100.00-80.00	Flange	0.8750 A325N	4	0.5000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.5000 A325N	1
T5 80.00-60.00	Flange	1.0000 A325N	6	0.5000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.5000 A325N	1
T6 60.00-40.00	Flange	1.0000 A325N	6	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T7 40.00-20.00	Flange	1.0000 A325N	6	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.5000 A325N	1
T8 20.00-0.00	Flange	1.0000 A449	6	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

Grouted Pipe Properties

Size	F_y ksi	A_s in^2	A_c in^2	Wt plf	E_c ksi	E_m ksi	F_{ym} ksi
Rohn 4" x 0.318" (3.5 EH) (GR)	50	3.6784	8.8880	31.033	4769	38218	64
ROHN 4 EH (GR)	50	4.4074	11.4969	38.949	4769	38952	66
Rohn 5.563" x 0.375" (5 EH) (GR)	50	6.1120	18.1937	58.701	4769	40357	68
Rohn 6.625" x 0.432" (6 EH) (GR)	50	8.4049	26.0667	82.906	4769	40832	68

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
FACE C												
LDF7-50A(1-5/8")	A	No	Ar (CaAa)	144.00 - 0.00	0.0000	0.42	6	6	1.0000 1.9800	1.9800		0.82
LDF4-50A(1/2")	A	No	Ar (CaAa)	50.00 - 0.00	0.0000	0.42	1	1	0.6300	0.6300		0.15
1.5" flat Cable Ladder Rail	A	No	Af (CaAa)	150.00 - 0.00	0.0000	0.42	2	2	12.0000 1.5000	1.5000		1.80
FACE B												
LDF7-50A(1-5/8") (INCLUDING PROPOSED)	B	No	Ar (CaAa)	157.00 - 0.00	0.0000	0.4	12	10	1.0000 0.5200	1.9800		0.82
1.5" flat Cable Ladder Rail	B	No	Af (CaAa)	160.00 - 0.00	0.0000	0.42	2	2	12.0000 1.5000	1.5000		1.80
FACE C												
LEG C												
LDF5-50A(7/8")	C	No	Ar (CaAa)	90.00 - 5.00	-2.0000	0.45	12	4	1.0900	1.0900		0.33
T-Brackets (Af)	C	No	Af (CaAa)	90.00 - 5.00	-2.0000	0.45	1	1	1.0000	1.0000		8.40
2" (Nominal) Conduit	C	No	Ar (CaAa)	90.00 - 5.00	-2.0000	0.45	1	1	2.3750	2.3750		0.72
FB-L98B-002-75000(3/8) (Installed)	C	No	Ar (CaAa)	90.00 - 0.00	-2.0000	0.45	1	1	0.3937	0.3937		0.06
WR-VG122ST-BRDA(7/16) (Installed)	C	No	Ar (CaAa)	90.00 - 0.00	-2.0000	0.45	2	2	0.4600	0.4600		0.14
Safety Line 3/8	B	No	Ar (CaAa)	160.00 - 0.00	0.0000	0.5	1	1	0.3750	0.3750		0.22

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 K
(2) LPA-80080/6CF w/ Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	4.56 5.11 5.61	10.26 11.43 12.31	0.05 0.11 0.19
(2) LPA-80080/6CF w/ Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	4.56 5.11 5.61	10.26 11.43 12.31	0.05 0.11 0.19
(2) LPA-80080/6CF w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	4.56 5.11 5.61	10.26 11.43 12.31	0.05 0.11 0.19
Sector Mount [SM 508-3]	C	None		0.0000	157.00	No Ice 1/2" Ice 1" Ice	36.69 52.22 67.75	36.69 52.22 67.75	1.78 2.41 3.04
*									
(2) DB978H90T2E-M w/ Mount Pipe	A	From Leg	4.00 0.00	0.0000	144.00	No Ice 1/2"	3.22 3.59	2.89 3.49	0.03 0.06

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 K
			0.00					Ice	3.96	4.10	0.09
								1" Ice			
(2) DB978H90T2E-M w/ Mount Pipe	B	From Leg	4.00			0.0000	144.00	No Ice	3.22	2.89	0.03
			0.00					1/2"	3.59	3.49	0.06
			0.00					Ice	3.96	4.10	0.09
								1" Ice			
(2) DB978H90T2E-M w/ Mount Pipe	C	From Leg	4.00			0.0000	144.00	No Ice	3.22	2.89	0.03
			0.00					1/2"	3.59	3.49	0.06
			0.00					Ice	3.96	4.10	0.09
								1" Ice			
Sector Mount [SM 506-3]	C	None				0.0000	144.00	No Ice	35.47	35.47	1.74
								1/2"	50.60	50.60	2.35
								Ice	65.73	65.73	2.95
								1" Ice			
(2) 4' x 2" Pipe Mount	A	From Leg	4.00			0.0000	144.00	No Ice	0.79	0.79	0.03
			0.00					1/2"	1.03	1.03	0.04
			0.00					Ice	1.28	1.28	0.04
								1" Ice			
(2) 4' x 2" Pipe Mount	B	From Leg	4.00			0.0000	144.00	No Ice	0.79	0.79	0.03
			0.00					1/2"	1.03	1.03	0.04
			0.00					Ice	1.28	1.28	0.04
								1" Ice			
(2) 4' x 2" Pipe Mount	C	From Leg	4.00			0.0000	144.00	No Ice	0.79	0.79	0.03
			0.00					1/2"	1.03	1.03	0.04
			0.00					Ice	1.28	1.28	0.04
								1" Ice			
*											
*											
*											
(4) DB844H90E-XY w/ Mount Pipe (ABANDONED)	A	From Leg	4.00			0.0000	118.00	No Ice	3.30	4.80	0.03
			0.00					1/2"	3.67	5.42	0.07
			0.00					Ice	4.03	6.04	0.12
								1" Ice			
(4) DB844H90E-XY w/ Mount Pipe (ABANDONED)	B	From Leg	4.00			0.0000	118.00	No Ice	3.30	4.80	0.03
			0.00					1/2"	3.67	5.42	0.07
			0.00					Ice	4.03	6.04	0.12
								1" Ice			
(4) DB844H90E-XY w/ Mount Pipe (ABANDONED)	C	From Leg	4.00			0.0000	118.00	No Ice	3.30	4.80	0.03
			0.00					1/2"	3.67	5.42	0.07
			0.00					Ice	4.03	6.04	0.12
								1" Ice			
Sector Mount [SM 404-3] (ABANDONED)	C	None				0.0000	118.00	No Ice	20.47	20.47	0.92
								1/2"	28.97	28.97	1.34
								Ice	37.47	37.47	1.75
								1" Ice			
*											
*											
*											
(2) 7770.00 w/ Mount Pipe (x)	A	From Leg	4.00			0.0000	90.00	No Ice	5.75	4.25	0.06
			0.00					1/2"	6.18	5.01	0.10
			0.00					Ice	6.61	5.71	0.16
								1" Ice			
(2) LGP21401	A	From Leg	4.00			0.0000	90.00	No Ice	1.10	0.35	0.01
			0.00					1/2"	1.24	0.44	0.02
			0.00					Ice	1.38	0.54	0.03
								1" Ice			
(2) LGP21901	A	From Leg	4.00			0.0000	90.00	No Ice	0.23	0.16	0.01
			0.00					1/2"	0.29	0.21	0.01
			0.00					Ice	0.36	0.28	0.01
								1" Ice			
(2) 7770.00 w/ Mount Pipe (x)	B	From Leg	4.00			0.0000	90.00	No Ice	5.75	4.25	0.06
			0.00					1/2"	6.18	5.01	0.10
			0.00					Ice	6.61	5.71	0.16
								1" Ice			
(2) LGP21401	B	From Leg	4.00			0.0000	90.00	No Ice	1.10	0.35	0.01

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 K
			0.00 0.00			1/2" Ice 1" Ice	1.24 1.38	0.44 0.54	0.02 0.03
(2) LGP21901	B	From Leg	4.00 0.00 0.00	0.0000	90.00	No Ice 1/2" Ice 1" Ice	0.23 0.29 0.36	0.16 0.21 0.28	0.01 0.01 0.01
(2) 7770.00 w/ Mount Pipe (x)	C	From Leg	4.00 0.00 0.00	0.0000	90.00	No Ice 1/2" Ice 1" Ice	5.75 6.18 6.61	4.25 5.01 5.71	0.06 0.10 0.16
(2) LGP21401	C	From Leg	4.00 0.00 0.00	0.0000	90.00	No Ice 1/2" Ice 1" Ice	1.10 1.24 1.38	0.35 0.44 0.54	0.01 0.02 0.03
(2) LGP21901	C	From Leg	4.00 0.00 0.00	0.0000	90.00	No Ice 1/2" Ice 1" Ice	0.23 0.29 0.36	0.16 0.21 0.28	0.01 0.01 0.01
Sector Mount [SM 802-3]	C	None		0.0000	90.00	No Ice 1/2" Ice 1" Ice	24.41 31.39 38.37	24.41 31.39 38.37	0.93 1.36 1.79
*									
*									
KS24019-L112A (x)	B	From Leg	4.00 0.00 0.00	0.0000	50.00	No Ice 1/2" Ice 1" Ice	0.14 0.20 0.26	0.14 0.20 0.26	0.01 0.01 0.01
Side Arm Mount [SO 306-1] (x)	B	From Leg	2.00 0.00 0.00	0.0000	50.00	No Ice 1/2" Ice 1" Ice	0.98 1.70 2.42	2.18 3.80 5.42	0.04 0.06 0.08
(2) RRUS-11 (Proposed)	A	From Leg	4.00 0.00 0.00	0.0000	90.00	No Ice 1/2" Ice 1" Ice	2.79 3.00 3.21	1.19 1.34 1.50	0.05 0.07 0.09
P45-16-XLH-RR w/ Mount Pipe (Proposed)	A	From Leg	4.00 0.00 0.00	0.0000	90.00	No Ice 1/2" Ice 1" Ice	8.24 8.70 9.16	4.83 5.57 6.27	0.04 0.10 0.17
(2) RRUS-11 (Proposed)	B	From Leg	4.00 0.00 0.00	0.0000	90.00	No Ice 1/2" Ice 1" Ice	2.79 3.00 3.21	1.19 1.34 1.50	0.05 0.07 0.09
AM-X-CD-16-65-00T-RET w/ Mount Pipe (Proposed)	B	From Leg	4.00 0.00 0.00	0.0000	90.00	No Ice 1/2" Ice 1" Ice	8.26 8.82 9.35	6.30 7.48 8.37	0.07 0.14 0.21
DC6-48-60-18-8F (Proposed)	B	From Leg	4.00 0.00 0.00	0.0000	90.00	No Ice 1/2" Ice 1" Ice	0.92 1.46 1.64	0.92 1.46 1.64	0.02 0.04 0.06
Pipe Mount [PM 601-3] (x)	B	None		0.0000	90.00	No Ice 1/2" Ice 1" Ice	4.39 5.48 6.57	4.39 5.48 6.57	0.20 0.24 0.28
(2) RRUS-11 (Proposed)	C	From Leg	4.00 0.00 0.00	0.0000	90.00	No Ice 1/2" Ice 1" Ice	2.79 3.00 3.21	1.19 1.34 1.50	0.05 0.07 0.09
AM-X-CD-16-65-00T-RET w/ Mount Pipe (Proposed)	C	From Leg	4.00 0.00 0.00	0.0000	90.00	No Ice 1/2" Ice 1" Ice	8.26 8.82 9.35	6.30 7.48 8.37	0.07 0.14 0.21

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 K
***									
B13 RRH 4X30 (Proposed/ shielded)	A	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	1.32 1.48 1.64	0.06 0.07 0.09
B66A RRH4X45 (Proposed/ shielded)	A	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	1.63 1.81 2.00	0.07 0.09 0.11
(2) JAHH-65B-R3B w/ Mount Pipe (Proposed)	A	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	12.57 13.19 13.79	11.82 13.09 14.14	0.09 0.20 0.32
B5 4T4R RRH4X40 AIRSCALE (Proposed/ shielded)	A	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	0.75 0.86 0.98	0.05 0.06 0.07
B13 RRH 4X30 (Proposed/ shielded)	B	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	1.32 1.48 1.64	0.06 0.07 0.09
B66A RRH4X45 (Proposed/ shielded)	B	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	1.63 1.81 2.00	0.07 0.09 0.11
(2) JAHH-65B-R3B w/ Mount Pipe (Proposed)	B	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	12.57 13.19 13.79	11.82 13.09 14.14	0.09 0.20 0.32
B5 4T4R RRH4X40 AIRSCALE (Proposed/ shielded)	B	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	0.75 0.86 0.98	0.05 0.06 0.07
B13 RRH 4X30 (Proposed/ shielded)	C	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	1.32 1.48 1.64	0.06 0.07 0.09
B66A RRH4X45 (Proposed/ shielded)	C	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	1.63 1.81 2.00	0.07 0.09 0.11
(2) JAHH-65B-R3B w/ Mount Pipe (Proposed)	C	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	12.57 13.19 13.79	11.82 13.09 14.14	0.09 0.20 0.32
B5 4T4R RRH4X40 AIRSCALE (Proposed/ shielded)	C	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	0.75 0.86 0.98	0.05 0.06 0.07
RC3DC-3315-PF-48 (Proposed/ not shielded)	B	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	3.79 4.04 4.30	2.51 2.72 2.94	0.03 0.06 0.10
RC3DC-3315-PF-48 (Proposed/ not shielded)	C	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice 1" Ice	3.79 4.04 4.30	2.51 2.72 2.94	0.03 0.06 0.10

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	160 - 140	2.690	43	0.1609	0.0069
T2	140 - 120	2.007	43	0.1486	0.0049
T3	120 - 100	1.423	43	0.1206	0.0034
T4	100 - 80	0.956	43	0.0967	0.0025
T5	80 - 60	0.591	43	0.0721	0.0018
T6	60 - 40	0.324	43	0.0493	0.0012
T7	40 - 20	0.142	43	0.0319	0.0007
T8	20 - 0	0.037	43	0.0136	0.0003

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
157.00	(2) LPA-80080/6CF w/ Mount Pipe	43	2.585	0.1597	0.0066	160665
144.00	(2) DB978H90T2E-M w/ Mount Pipe	43	2.138	0.1523	0.0052	50229
118.00	(4) DB844H90E-XY w/ Mount Pipe	43	1.372	0.1179	0.0033	41053
90.00	(2) 7770.00 w/ Mount Pipe	43	0.760	0.0847	0.0022	47637
50.00	KS24019-L112A	43	0.223	0.0404	0.0009	61122

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	160 - 140	12.089	10	0.7203	0.0313
T2	140 - 120	9.028	10	0.6660	0.0223
T3	120 - 100	6.408	10	0.5416	0.0155
T4	100 - 80	4.305	10	0.4348	0.0116
T5	80 - 60	2.662	10	0.3247	0.0082
T6	60 - 40	1.462	10	0.2220	0.0055
T7	40 - 20	0.641	10	0.1440	0.0031
T8	20 - 0	0.169	10	0.0613	0.0014

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
157.00	(2) LPA-80080/6CF w/ Mount Pipe	10	11.617	0.7151	0.0299	36364
144.00	(2) DB978H90T2E-M w/ Mount Pipe	10	9.615	0.6827	0.0238	11368
118.00	(4) DB844H90E-XY w/ Mount Pipe	10	6.175	0.5295	0.0149	9176
90.00	(2) 7770.00 w/ Mount Pipe	10	3.427	0.3807	0.0099	10632
50.00	KS24019-L112A	10	1.007	0.1821	0.0042	13580

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load K	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	160	Leg	A325N	0.6250	4	3.68	20.71	0.178 ✔	1	Bolt Tension
		Diagonal	A325N	0.5000	1	3.47	3.47	1.000 ✔	1	Member Block Shear
		Top Girt	A325N	0.5000	1	0.42	4.13	0.103 ✔	1	Member Bearing
T2	140	Leg	A325N	0.6250	4	9.47	20.71	0.457 ✔	1	Bolt Tension
		Diagonal	A325N	0.5000	1	3.17	6.25	0.506 ✔	1	Member Block Shear
		Top Girt	A325N	0.5000	1	0.08	6.96	0.011 ✔	1	Member Bearing
T3	120	Leg	A325N	0.7500	4	14.98	29.82	0.502 ✔	1	Bolt Tension
		Diagonal	A325N	0.5000	1	4.46	7.50	0.594 ✔	1	Gusset Bearing
T4	100	Leg	A325N	0.8750	4	20.64	40.59	0.508 ✔	1	Bolt Tension
		Diagonal	A325N	0.5000	1	5.85	12.40	0.472 ✔	1	Member Bearing
T5	80	Leg	A325N	1.0000	6	17.79	53.01	0.336 ✔	1	Bolt Tension
		Diagonal	A325N	0.5000	1	6.17	12.40	0.497 ✔	1	Member Bearing
T6	60	Leg	A325N	1.0000	6	21.34	53.01	0.403 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	1	7.21	14.79	0.487 ✔	1	Gusset Bearing
T7	40	Leg	A325N	1.0000	6	24.92	53.01	0.470 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	1	7.38	14.79	0.499 ✔	1	Gusset Bearing
T8	20	Leg	A449	1.0000	6	28.29	53.01	0.534 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	1	8.08	14.79	0.547 ✔	1	Gusset Bearing

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	160 - 140	Rohn 2.375" x 0.218" (2 EH)	20.00	4.00	62.6 K=1.00	1.4773	-19.36	49.90	0.388 [1] ✔
T2	140 - 120	Rohn 2.875" x 0.276" (2.5 EH)	20.03	5.01	65.0 K=1.00	2.2535	-44.22	74.43	0.594 [1] ✔
T3	120 - 100	Rohn 4" x 0.318" (3.5 EH)	20.03	6.68	61.3 K=1.00	3.6784	-69.28	125.73	0.551 [1] ✔
T4	100 - 80	Rohn 4" x 0.318" (3.5 EH) (GR)	20.03	6.68	61.3 K=1.00	3.6784	-96.59	148.29	0.651 [1] ✔
T5	80 - 60	ROHN 4 EH (GR)	20.04	6.68	54.3 K=1.00	4.4074	-124.94	192.91	0.648 [1] ✔
T6	60 - 40	Rohn 5.563" x 0.375" (5 EH) (GR)	20.03	10.02	65.4 K=1.00	6.1120	-150.49	246.97	0.609 [1] ✔
T7	40 - 20	Rohn 5.563" x 0.375" (5 EH) (GR)	20.04	10.02	65.4 K=1.00	6.1120	-177.17	246.94	0.717 [1] ✔
T8	20 - 0	Rohn 6.625" x 0.432" (6 EH) (GR)	20.03	10.02	54.8 K=1.00	8.4049	-203.53	381.11	0.534 [1] ✔

[1] P_u / ϕP_n controls

Diagonal Design Data (Compression)

Section No.	Elevation	Size	L	L_u	Kl/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	K	K	
T1	160 - 140	L 1.5 x 1.5 x 1/8	6.97	3.38	137.0 K=1.00	0.3594	-3.52	4.33	0.814 [1] ✔
T2	140 - 120	2L 1.5 x 1.5 x 1/8 (3/16)	8.89	4.48	127.5 K=1.00	0.7188	-3.15	9.90	0.318 [1] ✔
T3	120 - 100	2L 'a' > 25.6524 in - 46 2L 2 x 2 x 3/16 (3/16)	11.36	5.76	119.1 K=1.00	1.4297	-4.49	21.96	0.205 [1] ✔
T4	100 - 80	2L 'a' > 33.0734 in - 73 2L 2.5 x 2.5 x 3/16 (3/16)	13.11	6.63	120.7 K=1.00	1.8047	-5.91	27.16	0.218 [1] ✔
T5	80 - 60	2L 'a' > 37.9460 in - 94 2L 3 x 3 x 3/16 (1/4)	14.99	7.57	105.5 K=1.00	2.1797	-6.20	38.73	0.160 [1] ✔
T6	60 - 40	2L 'a' > 43.2580 in - 115 2L 3 x 3 x 3/16 (1/4)	18.13	9.22	130.5 K=1.00	2.1797	-7.39	28.70	0.257 [1] ✔
T7	40 - 20	2L 'a' > 52.6982 in - 136 2L 3 x 3 x 1/4 (1/4)	19.90	10.11	135.8 K=1.00	2.8750	-7.53	35.24	0.214 [1] ✔
T8	20 - 0	2L 'a' > 57.9396 in - 151 2L 3.5 x 3.5 x 1/4 (1/4)	21.70	11.00	121.6 K=1.00	3.3750	-8.31	50.21	0.165 [1] ✔

[1] P_u / ϕP_n controls

Top Girt Design Data (Compression)

Section No.	Elevation	Size	L	L_u	Kl/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	K	K	
T1	160 - 140	L 2 x 2 x 1/8	6.52	6.11	184.6 K=1.00	0.4844	-0.42	3.21	0.130 [1] ✔
T2	140 - 120	L 2 x 2 x 1/8	6.56	6.16	185.8 K=1.00	0.4844	-0.08	3.17	0.024 [1] ✔

[1] P_u / ϕP_n controls

Tension Checks

Leg Design Data (Tension)

Section No.	Elevation	Size	L	L_u	Kl/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	K	K	
T1	160 - 140	Rohn 2.375" x 0.218" (2 EH)	20.00	4.00	62.6	1.4773	14.72	66.48	0.221 [1] ✔

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T2	140 - 120	Rohn 2.875" x 0.276" (2.5 EH)	20.03	5.01	65.0	2.2535	37.89	101.41	0.374 [1] ✔
T3	120 - 100	Rohn 4" x 0.318" (3.5 EH)	20.03	6.68	61.3	3.6784	59.94	165.53	0.362 [1] ✔
T4	100 - 80	Rohn 4" x 0.318" (3.5 EH) (GR)	20.03	6.68	61.3	3.6784	82.55	165.53	0.499 [1] ✔
T5	80 - 60	ROHN 4 EH (GR)	20.04	6.68	54.3	4.4074	106.74	198.34	0.538 [1] ✔
T6	60 - 40	Rohn 5.563" x 0.375" (5 EH) (GR)	20.03	10.02	65.4	6.1120	128.04	275.04	0.466 [1] ✔
T7	40 - 20	Rohn 5.563" x 0.375" (5 EH) (GR)	20.04	10.02	65.4	6.1120	149.55	275.04	0.544 [1] ✔
T8	20 - 0	Rohn 6.625" x 0.432" (6 EH) (GR)	20.03	10.02	54.8	8.4049	169.76	378.22	0.449 [1] ✔

[1] $P_u / \phi P_n$ controls

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	160 - 140	L 1.5 x 1.5 x 1/8	6.97	3.38	89.9	0.2109	3.47	9.18	0.378 [1] ✔
T2	140 - 120	2L 1.5 x 1.5 x 1/8 (3/16)	8.89	4.48	118.2	0.4219	3.17	18.35	0.173 [1] ✔
T3	120 - 100	2L 'a' > 25.6524 in - 45 2L 2 x 2 x 3/16 (3/16)	10.80	5.48	108.6	0.8965	4.46	39.00	0.114 [1] ✔
T4	100 - 80	2L 'a' > 31.4884 in - 78 2L 2.5 x 2.5 x 3/16 (3/16)	13.11	6.63	103.8	1.1777	5.85	51.23	0.114 [1] ✔
T5	80 - 60	2L 'a' > 37.9460 in - 93 2L 3 x 3 x 3/16 (1/4)	14.99	7.57	98.1	1.4590	6.17	63.47	0.097 [1] ✔
T6	60 - 40	2L 'a' > 43.2580 in - 114 2L 3 x 3 x 3/16 (1/4)	18.13	9.22	119.4	1.4238	7.21	61.94	0.116 [1] ✔
T7	40 - 20	2L 'a' > 52.6982 in - 135 2L 3 x 3 x 1/4 (1/4)	19.90	10.11	132.0	1.8750	7.38	81.56	0.090 [1] ✔
T8	20 - 0	2L 'a' > 57.9396 in - 150 2L 3.5 x 3.5 x 1/4 (1/4)	21.70	11.00	122.2	2.2500	8.08	97.88	0.083 [1] ✔

[1] $P_u / \phi P_n$ controls

Top Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	160 - 140	L 2 x 2 x 1/8	6.52	6.11	121.2	0.3047	0.42	13.25	0.032 [1] ✔

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$

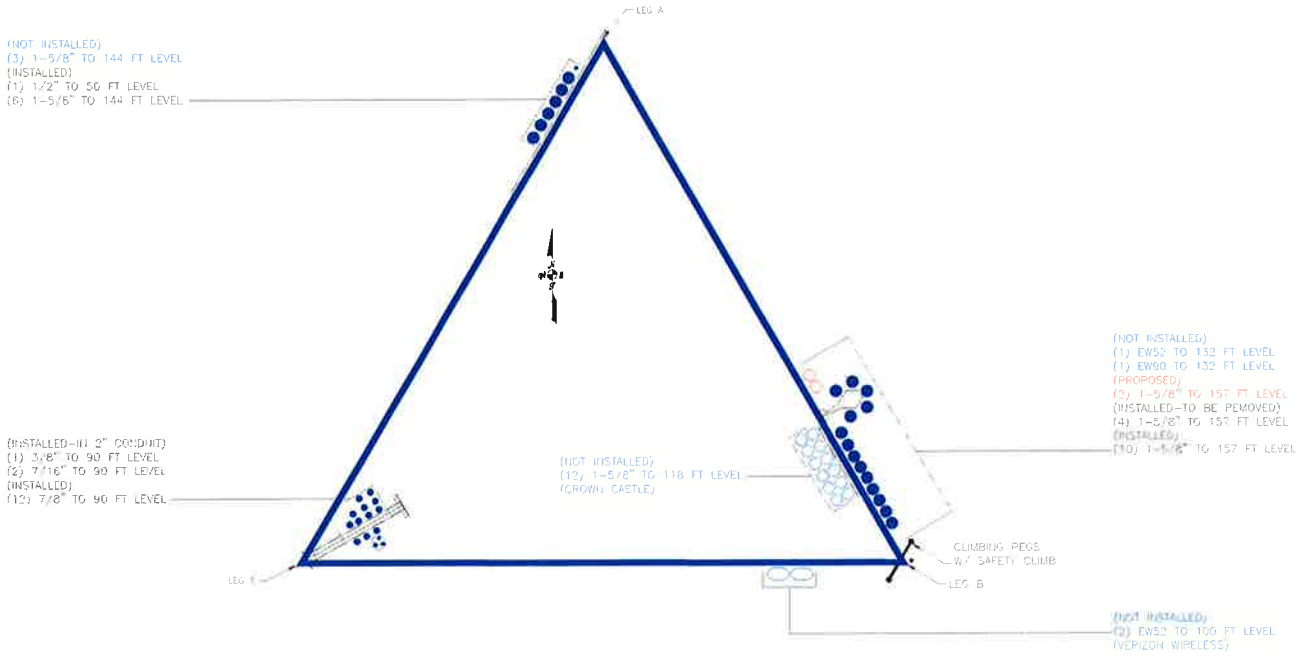
[1] P_u / ϕP_n controls

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
T1	160 - 140	Leg	Rohn 2.375" x 0.218" (2 EH)	2	-19.36	49.90	38.8	Pass
		Diagonal	L 1.5 x 1.5 x 1/8	8	-3.52	4.33	81.4 100.0 (b)	Pass
		Top Girt	L 2 x 2 x 1/8	6	-0.42	3.21	13.0	Pass
T2	140 - 120	Leg	Rohn 2.875" x 0.276" (2.5 EH)	38	-44.22	74.43	59.4	Pass
		Diagonal	2L 1.5 x 1.5 x 1/8 (3/16)	46	-3.15	9.90	31.8 50.6 (b)	Pass
		Top Girt	L 2 x 2 x 1/8	42	-0.08	3.17	2.4	Pass
T3	120 - 100	Leg	Rohn 4" x 0.318" (3.5 EH)	68	-69.28	125.73	55.1	Pass
		Diagonal	2L 2 x 2 x 3/16 (3/16)	73	-4.49	21.96	20.5 59.4 (b)	Pass
T4	100 - 80	Leg	Rohn 4" x 0.318" (3.5 EH) (GR)	89	-96.59	148.29	65.1	Pass
		Diagonal	2L 2.5 x 2.5 x 3/16 (3/16)	94	-5.91	27.16	21.8 47.2 (b)	Pass
T5	80 - 60	Leg	ROHN 4 EH (GR)	110	-124.94	192.91	64.8	Pass
		Diagonal	2L 3 x 3 x 3/16 (1/4)	115	-6.20	38.73	16.0 49.7 (b)	Pass
T6	60 - 40	Leg	Rohn 5.563" x 0.375" (5 EH) (GR)	131	-150.49	246.97	60.9	Pass
		Diagonal	2L 3 x 3 x 3/16 (1/4)	136	-7.39	28.70	25.7 48.7 (b)	Pass
T7	40 - 20	Leg	Rohn 5.563" x 0.375" (5 EH) (GR)	146	-177.17	246.94	71.7	Pass
		Diagonal	2L 3 x 3 x 1/4 (1/4)	151	-7.53	35.24	21.4 49.9 (b)	Pass
T8	20 - 0	Leg	Rohn 6.625" x 0.432" (6 EH) (GR)	161	-203.53	381.11	53.4	Pass
		Diagonal	2L 3.5 x 3.5 x 1/4 (1/4)	166	-8.31	50.21	16.5 54.7 (b)	Pass
						Summary		
						Leg (T7)	71.7	Pass
						Diagonal (T1)	100.0	Pass
						Top Girt (T1)	13.0	Pass
						Bolt Checks	100.0	Pass
						RATING =	**100.0**	**Pass**

APPENDIX B

BASE LEVEL DRAWING



APPENDIX C

ADDITIONAL CALCULATIONS

PJF Job No. **37517-3262** Project Name: _____ Engineer: _____

Factored Foundation Loads:

	Comp	Uplift	
Factored Axial Load (+Comp, -Ten) =	**220**	**-185**	kips
Factored Horiz. Load at Top of Pier =	**30**	**25**	kips
Factored OTM at Top of Pier =	**0**	**0**	k-ft

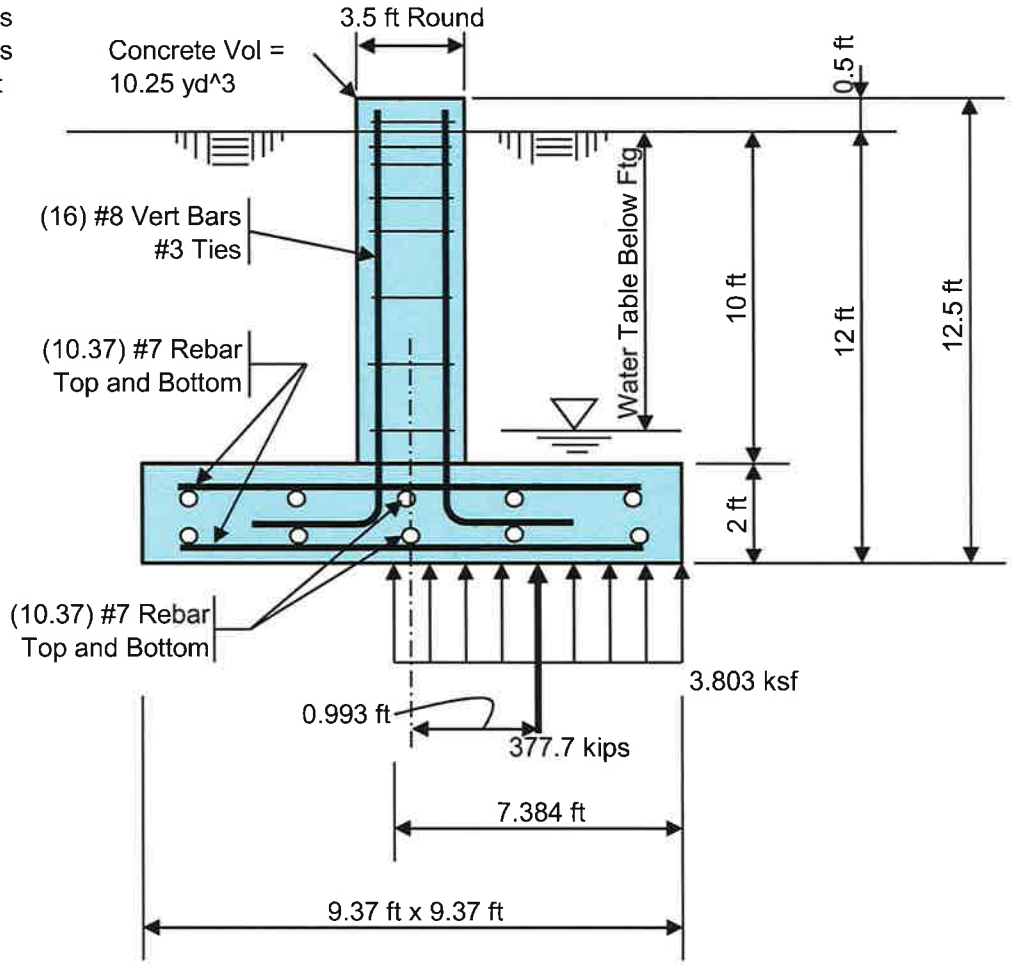
LRFD Resistance and Load Factors:

	Φ	Dead Load Factors	
Soil Bearing =	**0.75**		
Soil Weight =	**0.75**	1.2	0.9
Concrete Weight =	**0.75**	1.2	0.9

Soil Properties:

Depth to Water Table =	**99**	ft
Uplift Cone from	**Top**	of footing
Depth to Ignore for Uplift and PP =	**0**	ft

Layer Thk ft	Soil Density pcf	Cohesion ksf	Friction Angle degrees	Ult Bearing ksf	Depth ft
13	**115**	**0**	**30**	**16**	**13.00**



Dimensions:

Pier Shape =	**Round**	
Pier Width =	**3.5**	ft Diameter
Pier Height above Grade =	**0.5**	ft
Depth to Bottom of Footing =	**12**	ft
Footing Thickness =	**2**	ft
Footing Width, B =	**9.37**	ft
Footing Length, L =	**9.37**	ft

Concrete:

Concrete Strength =	**3**	ksi
Rebar Strength =	**60**	ksi

Total Pad Reinf Stl =	**12.44**	in^2 >= 4.86 in^2 = Min Stl, OK
Total Pier Reinf Stl =	**12.64**	in^2 >= 6.93 in^2 = Min Stl, OK
Footing Thickness =	**2.00**	ft >= 1.53 ft = Min Ftg Thk, OK

Summary Results:

	Required		Available			
Maximum Net Soil Bearing =	**3.803**	ksf	**12.000**	ksf	Stress Ratio =	**31.7%** in Soil Bearing
Uplift =	**185.0**	kips	**230.2**	kips	Stress Ratio =	**80.4%** in Uplift
Punching Shear Stress =	**0.055**	ksi	**0.164**	ksi	Stress Ratio =	**33.6%** in Punching Shear
Bending Shear Stress =	**59.7**	kips	**181.9**	kips	Stress Ratio =	**32.8%** in Bending Shear
Bending Moment =	**222.18**	k-ft	**533.0**	k-ft	Stress Ratio =	**41.7%** in Bending Moment
Conc Pier Reinforcing Steel =	**262.5**	k-ft	**746.1**	k-ft	Stress Ratio =	**35.2%** in Pier Rebar

Anchor Rod Check for Self Supporting Towers

TIA-222-G, Section 4.9.9

Site Data	
BU#:	
Site Name:	
App #:	

Anchor Rod Data		
Qty:	6	
Diam:	1	in
Rod Material:	A449 (1/4 to 1 Incl.)	
Strength (Fu):	120	ksi
Yield (Fy):	92	ksi

* Rod Circle:		in
* e:		in
* # of Rods		1 or 2

Mu= Pu x e:		ft-kips

** Enter rod circle, offset (e) and number of anchor rods at the extreme fiber to consider if eccentric load due to leg reinforcement exists.*

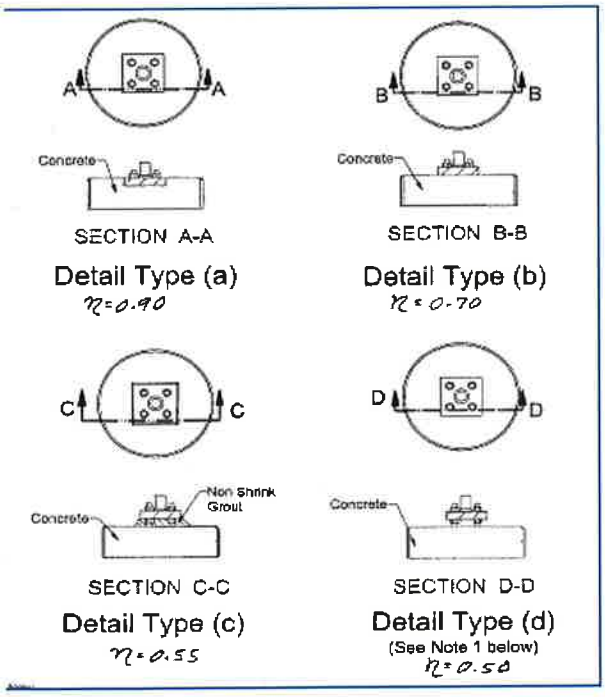


Figure 4-4 of TIA-222-G

Reactions		
Eta Factor, η	0.55	Detail Type
Uplift, Pu:	180	kips
Shear, Vu:	25	kips

l_{ar}:	0	in
Mu = 0.65*l_{ar}*V_u		ft-kips

Anchor Rod Results:

Max Rod (Cu+ Vu/ń):	37.6	Kips
Allowable Axial, Φ*Fu*Anet:	58.2	Kips
Anchor Rod Stress Ratio:	64.6%	

If Applicable;

Anchor Rod Results with Bending Considered:

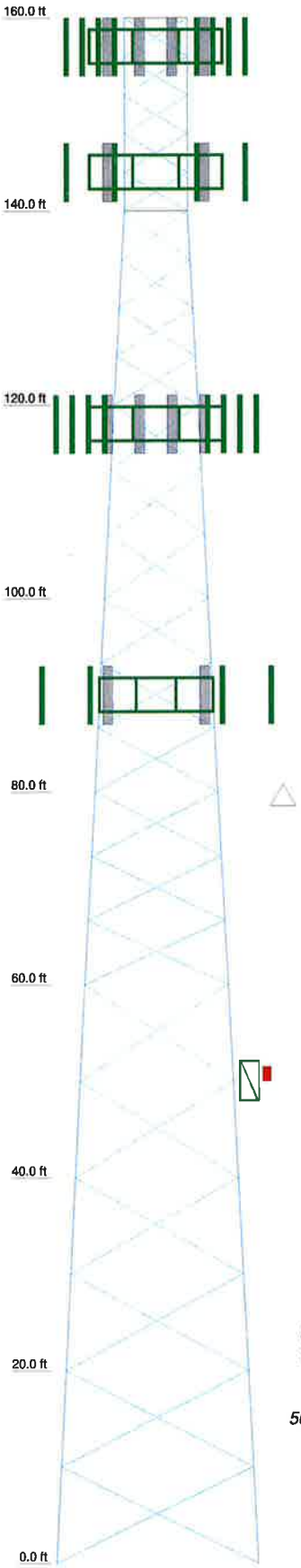
When the clear distance from the top of concrete to the bottom of level nut exceeds 1.0 times the diameter of the anchor rod, the following interaction equation shall also be satisfied (see Figure 4-4 of Rev. G):

$$(V_u/\phi R_{nv})^2 + [(P_u/\phi R_{nt}) + (M_u/\phi R_{nm})]^2 <= 1$$

$\phi R_{nv}=\phi*0.45*F_{ub}*A_b=$		kips
$\phi R_{nt}=\phi*F_u*A_{net}=$		kips
$\phi R_{nm}=\phi*F_y*Z=$		ft-kips

Maximum Acceptable Ratio:	105	%
Governing Stress Ratio:	64.6%	**Pass**

Section	T1	T2	T3	T4	T5	T6	T7	T8
Legs	Rohn 2.375" x 0.218" (2 EH)	Rohn 2.875" x 0.276" (2.5 EH)	Rohn 4" x 0.316" (3.5 EH)	Rohn 4" x 0.318" (3.5 EH) (GR)	ROHN 4 EH (GR)		Rohn 5.563" x 0.375" (5 EH) (GR)	A
Leg Grade	A572-50							
Diagonals	L 1.5 x 1.5 x 1/8	2L 1.5 x 1.5 x 1/8 (3/16)	2L 2 x 2 x 3/16 (3/16)	2L 2.5 x 2.5 x 3/16 (3/16)	2L 3 x 3 x 3/16 (1/4)		2L 3 x 3 x 1/4 (1/4)	2L 3.5 x 3.5 x 1/4 (1/4)
Diagonal Grade	A36							
Top Girts	L 2 x 2 x 1/8				N.A.			
Face Width (ft)	6.52083	6.5625	8.60417	10.6354	12.6771	14.7708	16.7708	18.8542
# Panels @ (ft)	5 @ 4	4 @ 5	9 @ 6.66667				6 @ 10	
Weight (K)	0.8	1.0	1.8	2.8	3.7	4.2	4.9	6.6
								25.6



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
(2) LPA-80080/6CF w/ Mount Pipe	157	(2) 4' x 2" Pipe Mount	144
(2) LPA-80080/6CF w/ Mount Pipe	157	(4) DB844H90E-XY w/ Mount Pipe (ABANDONED)	118
(2) LPA-80080/6CF w/ Mount Pipe	157		
Sector Mount [SM 508-3]	157	(4) DB844H90E-XY w/ Mount Pipe (ABANDONED)	118
B13 RRH 4X30 (Proposed/ shielded)	157		
B66A RRH4X45 (Proposed/ shielded)	157	(4) DB844H90E-XY w/ Mount Pipe (ABANDONED)	118
(2) JAHH-65B-R3B w/ Mount Pipe (Proposed)	157	Sector Mount [SM 404-3] (ABANDONED)	118
B5 4T4R RRH4X40 AIRSCALE (Proposed/ shielded)	157	(2) RRUS-11 (Proposed)	90
B13 RRH 4X30 (Proposed/ shielded)	157	AM-X-CD-16-65-00T-RET w/ Mount Pipe (Proposed)	90
B66A RRH4X45 (Proposed/ shielded)	157	DC6-48-60-18-8F (Proposed)	90
(2) JAHH-65B-R3B w/ Mount Pipe (Proposed)	157	Pipe Mount [PM 601-3] (x)	90
B5 4T4R RRH4X40 AIRSCALE (Proposed/ shielded)	157	(2) RRUS-11 (Proposed)	90
B13 RRH 4X30 (Proposed/ shielded)	157	AM-X-CD-16-65-00T-RET w/ Mount Pipe (Proposed)	90
B66A RRH4X45 (Proposed/ shielded)	157	(2) 7770.00 w/ Mount Pipe (x)	90
(2) JAHH-65B-R3B w/ Mount Pipe (Proposed)	157	(2) LGP21401	90
B5 4T4R RRH4X40 AIRSCALE (Proposed/ shielded)	157	(2) LGP21901	90
RC3DC-3315-PF-48 (Proposed/ not shielded)	157	(2) 7770.00 w/ Mount Pipe (x)	90
RC3DC-3315-PF-48 (Proposed/ not shielded)	157	(2) LGP21401	90
(2) DB978H90T2E-M w/ Mount Pipe	144	(2) LGP21901	90
(2) DB978H90T2E-M w/ Mount Pipe	144	Sector Mount [SM 802-3]	90
(2) DB978H90T2E-M w/ Mount Pipe	144	(2) RRUS-11 (Proposed)	90
Sector Mount [SM 506-3]	144	P45-16-XLH-RR w/ Mount Pipe (Proposed)	90
(2) 4' x 2" Pipe Mount	144	(2) 7770.00 w/ Mount Pipe (x)	90
(2) 4' x 2" Pipe Mount	144	(2) LGP21401	90
		(2) LGP21901	90
		Side Arm Mount [SO 306-1] (x)	50
		KS24019-L112A (x)	50

SYMBOL LIST

MARK	SIZE	MARK	SIZE
A	Rohn 6.625" x 0.432" (6 EH) (GR)		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Middlesex County, Connecticut.
2. Tower designed for Exposure B to the TIA-222-G Standard.
3. Tower designed for a 101 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 50 mph basic wind with 0.75 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Structure Class II.
7. Topographic Category 1 with Crest Height of 0.00 ft
8. Grouted pipe f'c is 7 ksi
9. TOWER RATING: 100%

ALL REAC
ARE FAC
MAX. C
DOV
SHE

UPLIFT: -175 K
SHEAR: 21 K

AXIAL
117 K

SHEAR
10 K

MOMENT
972 kip-ft

TORQUE 3 kip-ft
50 mph WIND - 0.7500 in ICE

AXIAL
47 K

SHEAR
38 K

MOMENT
3517 kip-ft

TORQUE 10 kip-ft
REACTIONS - 101 mph WIND

PJF
HKEY_CURRENT_USER
Paul J Ford and Company
250 E Broad St Suite 600
Columbus, OH 43215
Phone: Software\TNX\Settings
FAX:

Job: *HRT 088, CT BU#806387*			
Project: *PJF JOB #37517-3262-001-8700*			
Client: Crown Castle	Drawn by: Joseph Jacobs	App'd:	
Code: TIA-222-G	Date: 09/20/17	Scale: N	
Path:		Dwg No.	

ATTACHMENT 4


36A
3.00 AC
36B
2.00 AC
36C
2.40 AC
36D
2.60 AC
37
1.92 AC
32
3.90 AC
29
7.80 AC
14
18
24
26
8
39
85.10
124.20
295.90
220.10
191.00
201.00
140.50
376.81
316.94
289.02
482.35
297.81
253.00
525.63
222.98
202.50
200.87
140.48
390.48
241.00
104.14
60.44
145.08
232.65
66.55
68.45
33.48
70.58

The Assessor's office is responsible for the maintenance of records on the ownership of properties. Assessments are computed at 70% of the estimated market value of real property at the time of the last revaluation which was 2016.

Information on the Property Records for the Municipality of Killingworth was last updated on 1/20/2018.

Parcel Information

Location:	14 ROUTE 80	Property Use:	Industrial	Primary Use:	Light Industrial
Unique ID:	00218500	Map Block Lot:	34-36A	Acres:	2.00
490 Acres:	0.00	Zone:	ID	Volume / Page:	0225/0110
Developers Map / Lot:		Census:	6401		

Value Information

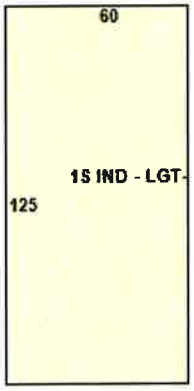
	Appraised Value	70% Assessed Value
Land	200,000	140,000
Buildings	252,719	176,900
Detached Outbuildings	251,459	176,020
Total	704,178	492,920

Owner's Information

Owner's Data

14 ROUTE 80 LLC
93A GLENWOOD RD
CLINTON CT 06413

Building 1



Category:	Industrial	Use:	Light Industrial	GLA:	7,508
Stories:	1.00	Construction:	Average	Year Built:	1969
Heating:	Susp. Space	Fuel:	Oil	Cooling Percent:	0%
Siding:	Metal	Roof Material:	Arch Shingles	Beds/Units:	0

Special Features

Attached Components

Detached Outbuildings

Type:	Year Built:	Length:	Width:	Area:
Fencing	1999	9	234	2,106
Concrete/Masonry Patio	1999			432

Type:	Year Built:	Length:	Width:	Area:
Concrete/Masonry Patio	1999	8	20	160
Cell Tower	2000			1

Owner History - Sales

Owner Name	Volume	Page	Sale Date	Deed Type	Valid Sale	Sale Price
14 ROUTE 80 LLC	0225	0110	06/14/2007	Quit Claim	No	$0

Building Permits

Permit Number	Permit Type	Date Opened	Date Closed	Permit Status	Reason
		11/07/2017			
12-410	Commercial	04/12/2013		Closed	CELL TOWER MAINTENANCE
12-394	Comm Renovations	12/11/2012		Closed	CELL TOWER MAINTENANCE
11-C006	Commercial	12/22/2011		Needs Visit	ANTENNA REPLACEMENT
08-E018		04/13/2008		Closed	ELECTRICAL SERVICE PANEL INSTALLATION; ELECTRICAL SERVICE PANEL INSTALLATION;
99-099		04/01/1999		Closed	TELECOMMUNICATIONS-UTILITY BLDG,TOWER;

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 of Receipt.*
Kenneth C. Baldwin, Esq. Robinson & Cole LLP 280 Trumbull Street Hartford, CT 06103		3	OLD STATE HOUSE STATION 06103 FEB 01 2016 USPS neopost 02/01/2016 US POSTAGE $002.38 ZIP 06103 041L122038
	Postmaster, per *(name of receiving employee)*		

USPS® Tracking Number / Firm-specific Identifier	Address (Name, Street, City, State, and ZIP Code™)	Postage	Fee	Special Handling	Parcel Airlift
1.	Catherine Iino, First Selectwoman Town of Killingworth 323 Route 81 Killingworth, CT 06419				
2.	Cathie S. Jefferson, Zoning Enforcement Officer Town of Killingworth 323 Route 81 Killingworth, CT 06419				
3.	14 Route 80 LLC 93A Glenwood Road Clinton, CT 06413				
4.					
5.					
6.					