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

December 8, 2015

Melanie A. Bachman
Acting Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **Notice of Exempt Modification – Facility Modification**
349R Mountain Street, Willimantic, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) wireless telecommunications antennas at the 185-foot level of the existing 196-foot tower at 349R Mountain Street in Willimantic, Connecticut (the "Property"). The tower and underlying property are owned by SBA Communications Corporation ("SBA"). The Council approved Cellco's use of the tower in 2000. As a part of this proposed modification, Cellco will remove nine (9) of its twelve (12) existing antennas and replace them with one (1) model SBNHH-1D45B, 700 MHz antenna; two (2) model SBNHH-1D65B, 700 MHz antennas; one (1) model SBNHH-1D45B, 1900 MHz antenna; two (2) model SBNHH-1D65B, 1900 MHz antennas; one (1) model SBNHH-1D45B, 2100 MHz antenna; and two (2) model SBNHH-1D65B, 2100 MHz antennas. The nine (9) replacement antennas will be installed at the 120-foot level on the tower. The three (3) remaining 850 MHz antennas will remain at the 185-foot level on the tower. Cellco also intends to replace three (3) remote radio heads ("RRHs") and install six (6) new RRHs and one (1) HYBRIFLEX™ fiber optic antenna cable. The RRHs will be located behind the antennas at the 120-foot level. Included in Attachment 1 are specifications for Cellco's replacement antennas, RRHs and HYBRIFLEX™ cable.

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 Ernie Eldridge, Mayor for the Town of Windham. A copy of this letter is also being sent to SBA, the Property owner and tower owner.

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. Following the proposed modifications, Cellco's antennas and RRHs will be located at the 120-foot and 185-foot levels on the 196-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 operation of the modified facility 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 included in Attachment 3).

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

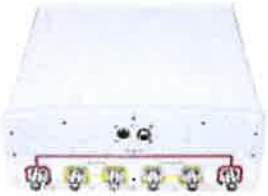
Enclosures
Copy to:
Ernie Eldridge, Windham Mayor
SBA
Tim Parks

ATTACHMENT 1

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.



SBNHH-1D45B

Andrew® Tri-band Antenna, 698–896 and 2x 1695–2360 MHz, 45° horizontal beamwidth, internal RETs.

- Interleaved dipole technology providing for attractive, low wind load mechanical package
- Three internal RETs for independent tilt on all three bands

Electrical Specifications

Frequency Band, MHz	698–806	806–896	1695–1880	1850–1990	1920–2180	2300–2360
Gain, dBi	16.9	17.6	19.6	20.1	20.5	21.0
Beamwidth, Horizontal, degrees	47	43	45	42	42	39
Beamwidth, Vertical, degrees	12.4	11.4	5.8	5.3	5.1	4.5
Beam Tilt, degrees	0–14	0–14	0–8	0–8	0–8	0–8
USLS, dB	19	22	18	17	17	16
Front-to-Back Ratio at 180°, dB	30	31	31	33	33	35
CPR at Boresight, dB	27	27	21	23	16	17
CPR at 10 dB Horizontal Beamwidth, dB	11	14	10	11	11	13
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	698–806	806–896	1695–1880	1850–1990	1920–2180	2300–2360
Gain by all Beam Tilts, average, dBi	16.6	17.3	19.2	19.8	20.1	20.8
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.3	±0.5	±0.4	±0.5	±0.4
Gain by Beam Tilt, average, dBi	0 ° | 16.6	0 ° | 17.3	0 ° | 19.3	0 ° | 19.9	0 ° | 20.1	0 ° | 20.7
	7 ° | 16.7	7 ° | 17.4	4 ° | 19.3	4 ° | 19.9	4 ° | 20.2	4 ° | 20.9
	14 ° | 16.4	14 ° | 17.1	8 ° | 19.0	8 ° | 19.6	8 ° | 20.0	8 ° | 20.4
Beamwidth, Horizontal Tolerance, degrees	±1.5	±2.8	±2.1	±1.7	±1	±1.7
Beamwidth, Vertical Tolerance, degrees	±0.8	±0.6	±0.3	±0.2	±0.4	±0.1
USLS, dB	19	23	16	15	16	16
Front-to-Back Total Power at 180° ± 30°, dB	24	24	28	30	31	30
CPR at Boresight, dB	28	29	23	24	20	19
CPR at 10 dB Horizontal Beamwidth, dB	13	17	13	13	13	13

* 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.

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol® multiband with internal RET
Band	Multiband
Brand	DualPol® | Teletilt®
Operating Frequency Band	1695 – 2360 MHz | 698 – 896 MHz
Performance Note	Outdoor usage

Product Specifications

SBNHH-1D45B

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Aluminum | Low loss circuit board
Radome Material	Fiberglass, UV resistant
Reflector Material	Aluminum
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	6
Wind Loading, maximum	1038.0 N @ 150 km/h 233.4 lbf @ 150 km/h
Wind Speed, maximum	241.4 km/h | 150.0 mph

Dimensions

Depth	178.0 mm | 7.0 in
Length	1829.0 mm | 72.0 in
Width	457.0 mm | 18.0 in
Net Weight	29.2 kg | 64.4 lb

Remote Electrical Tilt (RET) Information

Input Voltage	10–30 Vdc
Power Consumption, idle state, maximum	2.0 W
Power Consumption, normal conditions, maximum	13.0 W
Protocol	3GPP/AISG 2.0 (Multi-RET)
RET Interface	8-pin DIN Female | 8-pin DIN Male
RET Interface, quantity	1 female | 1 male
RET System	Teletilt®

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

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

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

SBNHH-1D65B

Andrew® Tri-band Antenna, 698–896 and 2x 1695–2360 MHz, 65° horizontal beamwidth, internal RET. Both high bands share the same electrical tilt.

- Interleaved dipole technology providing for attractive, low wind load mechanical package

Electrical Specifications

Frequency Band, MHz	698–806	806–896	1695–1880	1850–1990	1920–2200	2300–2360
Gain, dBi	14.9	14.7	17.7	18.2	18.6	18.6
Beamwidth, Horizontal, degrees	68	66	69	66	63	58
Beamwidth, Vertical, degrees	12.1	10.7	5.6	5.2	5.0	4.5
Beam Tilt, degrees	0–14	0–14	0–7	0–7	0–7	0–7
USLS (First Lobe), dB	14	13	15	15	15	13
Front-to-Back Ratio at 180°, dB	27	29	28	28	28	27
CPR at Boresight, dB	20	23	20	20	17	21
CPR at Sector, dB	14	10	12	10	9	1
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	698–806	806–896	1695–1880	1850–1990	1920–2200	2300–2360
Gain by all Beam Tilts, average, dBi	14.5	14.3	17.4	17.9	18.2	18.3
Gain by all Beam Tilts Tolerance, dB	±0.5	±0.8	±0.4	±0.3	±0.5	±0.3
Gain by Beam Tilt, average, dBi	0 ° | 14.6	0 ° | 14.5	0 ° | 17.4	0 ° | 17.8	0 ° | 18.1	0 ° | 18.2
	7 ° | 14.6	7 ° | 14.4	3 ° | 17.5	3 ° | 17.9	3 ° | 18.3	3 ° | 18.4
	14 ° | 14.2	14 ° | 13.6	7 ° | 17.4	7 ° | 17.9	7 ° | 18.2	7 ° | 18.4
Beamwidth, Horizontal Tolerance, degrees	±2.2	±3.4	±2	±4.6	±5.7	±4.3
Beamwidth, Vertical Tolerance, degrees	±0.8	±1	±0.3	±0.2	±0.3	±0.2
USLS, beampeak to 20° above beampeak, dB	16	14	16	16	16	15
Front-to-Back Total Power at 180° ± 30°, dB	25	26	27	26	26	26
CPR at Boresight, dB	22	23	21	20	20	22
CPR at Sector, dB	13	11	16	12	11	4

* 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.

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol® multiband with internal RET
Band	Multiband
Brand	DualPol® | Teletilt®
Operating Frequency Band	1695 – 2360 MHz | 698 – 896 MHz
Performance Note	Outdoor usage

Product Specifications

SBNHH-1D65B

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Aluminum | Low loss circuit board
Radome Material	Fiberglass, UV resistant
Reflector Material	Aluminum
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	6
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241 km/h | 150 mph

Dimensions

Depth	180.0 mm | 7.1 in
Length	1851.0 mm | 72.9 in
Width	301.0 mm | 11.9 in
Net Weight	18.4 kg | 40.6 lb

Remote Electrical Tilt (RET) Information

Input Voltage	10–30 Vdc
Power Consumption, idle state, maximum	2.0 W
Power Consumption, normal conditions, maximum	13.0 W
Protocol	3GPP/AISG 2.0 (Multi-RET)
RET Interface	8-pin DIN Female | 8-pin DIN Male
RET Interface, quantity	1 female | 1 male
RET System	Teletilt®

Packed Dimensions

Depth	299.0 mm | 11.8 in
Length	1970.0 mm | 77.6 in
Width	409.0 mm | 16.1 in
Shipping Weight	31.0 kg | 68.3 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

Included Products

Product Specifications

SBNHH-1D65B

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.

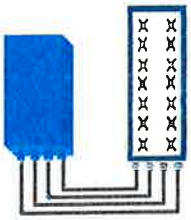
Its compactness and slim design makes the Alcatel-Lucent B13 RRH4x30-4R easy to install close to the antenna: operators can therefore locate this Remote Radio Head where RF design conditions are deemed ideal, minimizing trade-offs between available sites and RF optimum sites, together with reducing the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

PCS RF MODULES

RRH1900 2X60 - HW CHARACTERISTICS

LA6.0.1/13.3

	RRH2x60
RF Output Power	2x60W
Instantaneous Bandwidth	20MHz
Transmitter	2 TX
Receiver 1900 HW version	2 Branch RX – LA6.0.1
Receiver 1900A HW version	4 Branch RX – LR13.3
Features	AISG 2.0 for RET/TMA
	Internal Smart Bias-T
Power	-48VDC
CPRI Ports	2 CPRI Rate 3 Ports
External Alarms	4 External User Alarms
Monitor Ports	TX
Environmental	GR487 Compliance
RF Connectors	7/16 DIN (top mounted)

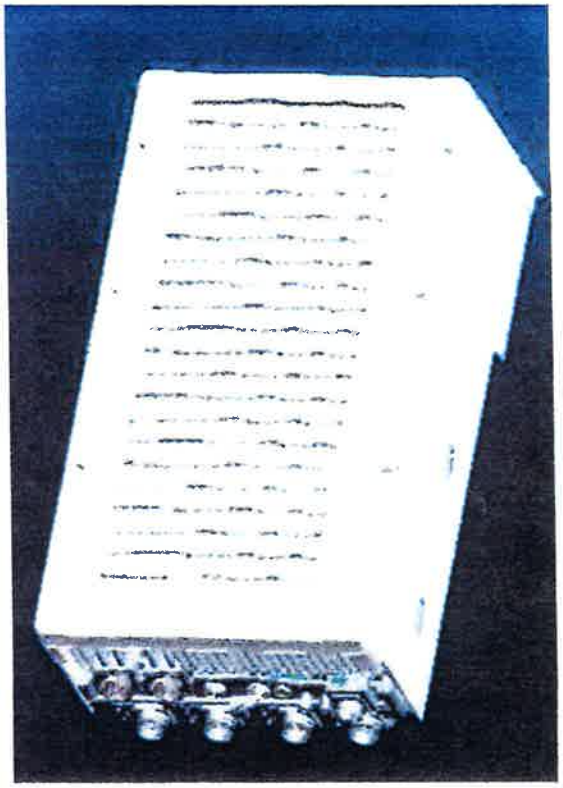
** Not a Verizon Wireless deployed product

NEW PCS RF MODULES FOR VZW

RRH2X60 - HW CHARACTERISTICS

LR14.3

	RRH2x60
RF Output Power	2x60W (4x30W HW Ready)
Instantaneous Bandwidth	60MHz
Target Reliability (Annual Return Rate)	<2%
Receiver	4 Branch Rx
Features	AISG 2.0 for RET/TMA
Power	-48VDC
	Internal Smart Bias-T
CPRI Ports	2 CPRI Rate 5 Ports
External Alarms	4 External User Alarms
Monitor Ports	TX, RX
Environmental	GR487 Compliance
RF Connectors	7/16 DIN (downward facing)
Dimensions	22"(h) x 12"(w)x 9.4" (d)**
Weight	55lb**

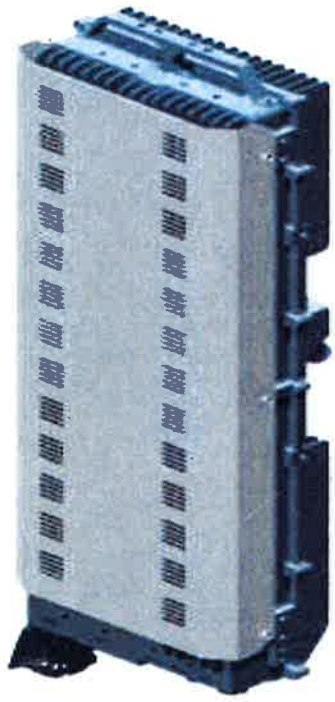


**- Includes solar shield but not mounting brackets (8 lbs.)

ALCATEL-LUCENT WIRELESS PRODUCT DATASHEET

RRH2X60-AWS FOR BAND 4 APPLICATIONS

The Alcatel-Lucent RRH2x60-AWS is a high power, small form factor Remote Radio Head operating in the AWS frequency band (3GPP Band 4) for LTE technology. It is designed with an eco-efficient approach, providing operators with the means to achieve high quality and high capacity coverage with minimum site requirements and efficient operation.



A distributed Node B expands the deployment options by using two components, a Base Band Unit (BBU) containing the digital assets and a separate RRH containing the radio-frequency (RF) elements. This modular design optimizes available space and allows the main components of a Node B to be installed separately, within the same site or several kilometers apart.

The Alcatel-Lucent RRH2x60-AWS is linked to the BBU by an optical-fiber connection carrying downlink and uplink digital radio signals along with operations, administration and maintenance (OA&M) information.

SUPERIOR RF PERFORMANCE

The Alcatel-Lucent RRH2x60-AWS integrates all the latest technologies. This allows to offer best-in-class characteristics.

It delivers an outstanding 120 watts of total RF power thanks to its two transmit RF paths of 60 W each.

It is ideally suited to support multiple-input multiple-output (MIMO) 2x2 operation.

It includes four RF receivers to natively support 4-way uplink reception diversity. This improves the radio uplink coverage and this can be used to extend the cell radius commensurate with 2x2MIMO 2x60 W for the downlink.

It supports multiple discontinuous LTE carriers within an instantaneous bandwidth of 45 MHz corresponding to the entire AWS B4 spectrum.

The latest generation power amplifiers (PA) used in this product achieve high efficiency (>40%), resulting in improved power consumption figures.

OPTIMIZED TCO

The Alcatel-Lucent RRH2x60-AWS is designed to make available all the benefits of a distributed Node B, with excellent RF characteristics, with low capital expenditures (CAPEX) and low operating expenditures (OPEX).

The Alcatel-Lucent RRH2x60-AWS is a very cost-effective solution to deploy LTE MIMO.

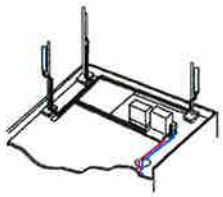
EASY INSTALLATION

The RRH2x60-AWS includes a reversible mounting bracket which allows for ease of installation behind an antenna, or on a rooftop knee wall while providing easy access to the mid body RF connectors.

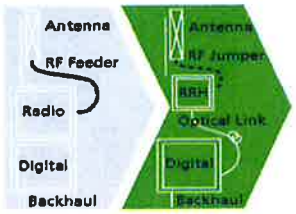
The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment. However, many of these sites can host an Alcatel-Lucent RRH2x60-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation time and costs.

The Alcatel-Lucent RRH2x60-AWS is a zero-footprint solution and is convection cooled without fans for silent operation, simplifying negotiations with site property owners and minimizing environmental impacts.

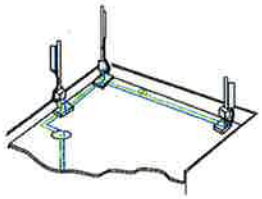
Installation can easily be done by a single person as the Alcatel–Lucent RRH2x60-AWS is compact and weighs about 20 kg, eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day.



Macro



RRH for space-constrained cell sites



Distributed

FEATURES

- RRH2x60-AWS integrates two power amplifiers of 60W rating (at each antenna connector)
- Support multiple carriers over the entire 3GPP band 4
- RRH2x60-AWS is optimized for LTE operation
- RRH2x60-AWS is a very compact and lightweight product
- Advanced power management techniques are embedded to provide power savings, such as PA bias control

BENEFITS

- MIMO LTE operation with only one single unit per sector
- Improved uplink coverage with built-in 4-way receive diversity capability
- RRH can be mounted close to the antenna, eliminating nearly all losses in RF cables and thus reducing power consumption by 50% compared to conventional solutions
- Distributed configurations provide easily deployable and cost-effective solutions, near zero footprint and silent solutions, with minimum impact on the neighborhood, which ease the deployment
- RETA and TMA support without additional hardware thanks to the AISG v2.0 port and the integrated Bias-Tees. Bias-Tees support AISG DC supply and signaling.

TECHNICAL SPECIFICATIONS

Specifications listed are hardware capabilities. Some capabilities depend on support in a specific software release or future release.

Dimensions and weights

- HxWxD : 510x285x186mm (27 l with solar shield)
- Weight : 20 kg (44 lbs)

Electrical Data

- Power Supply : -48V DC (-40.5 to -57V)
- Power Consumption (ETSI average traffic load reference) : 250W @2x60W

RF Characteristics

- Frequency band: 1710-1755, UL / 2110-2155 MHz, DL (3GPP band 4)
- Output power: 2x60W at antenna connectors
- Technology supported: LTE
- Instantaneous bandwidth: 45 MHz
- Rx diversity: 2-way and 4-way uplink reception
- Typical sensitivity without Rx diversity: -105 dBm for LTE

Connectivity

- Two CPRI optical ports for daisychaining and up to six RRHs per fiber
- Type of optical fiber: Single-Mode (SM) and Multi-Mode (MM) SFPs
- Optical fiber length: up to 500m using MM fiber, up to 20km using SM fiber
- TMA/RETA : AISG 2.0 (RS485 connector and internal Bias-Tee)
- Six external alarms
- Surge protection for all external ports (DC and RF)

Environmental specifications

- Operating temperature: -40°C to 55°C including solar load
- Operating relative humidity: 8% to 100%
- Environmental Conditions : ETS 300 019-1-4 class 4.1E
- Ingress Protection : IEC 60529 IP65
- Acoustic Noise : Noiseless (natural convection cooling)

Safety and Regulatory Data

- EMC : 3GPP 25113, EN 301 489-1, EN 301 489-23, GR 1089, GR 3108, OET-65
- Safety : IEC60950-1, EN 60825-1, UL, ANSI/NFPA 70, CAN/CSA-C22.2
- Regulatory : FCC Part 15 Class B, CE Mark – European Directive : 2002/95/EC (ROHS); 2002/96/EC (WEEE); 1999/5/EC (R&TTE)
- Health : EN 50385

Alcatel·Lucent

AT THE SPEED OF IDEAS™

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-93-658 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)

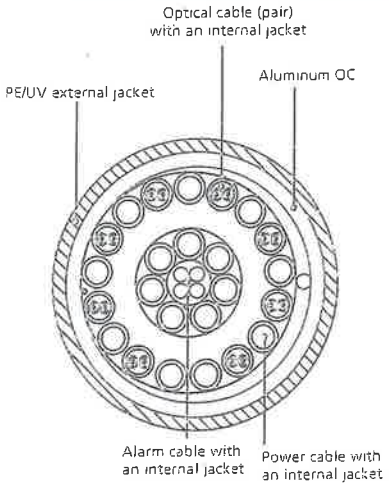


Figure 2: Construction Detail

* This data is provisional and subject to change

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)

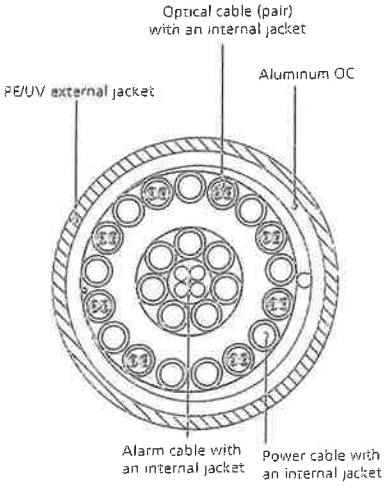


Figure 2: Construction Detail

* This data is provisional and subject to change

ATTACHMENT 2

	General	Power	Density					
Site Name: Willimantic								
Tower Height: 196'								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*T-Mobile LTE	2	2334	168	0.0640	2100	1.0000	0.64%	
*T-Mobile GSM/UMTS	4	1167	168	0.0640	190/2100	1.0000	0.64%	
*T-Mobile LTE	1	865	168	0.0119	700	1.0000	0.12%	
*CL&P	1	100	167	0.0014	37.62	0.2000	0.07%	
*CL&P	1	250	167	0.0035	451.675	0.3011	0.12%	
*CL&P	1	1000	140	0.0200	154.46375	0.2000	1.00%	
*CL&P	1	380	140	0.0076	173.25	0.2000	0.38%	
*CL&P	1	100	137	0.0021	37.48	0.2000	0.10%	
*CL&P	5	20	133	0.0022	217	0.2000	0.11%	
Verizon	**1**	**2353**	**120**	**0.0588**	**1970**	**1.0000**	**5.88%**	
Verizon	**9**	**241**	**185**	**0.0228**	**869**	**0.5793**	**3.93%**	
Verizon	**1**	**3794**	**120**	**0.0947**	**2145**	**1.0000**	**9.47%**	
Verizon	**1**	**1334**	**120**	**0.0333**	**746**	**0.4973**	**6.70%**	
								29.2%
* Source: Siting Council								

ATTACHMENT 3

FDH VELOCITEL

ENGINEERING INNOVATION

Structural Analysis for SBA Network Services, Inc.

196' Self-Support Tower (196' AGL)

SBA Site Name: Mountain Street
SBA Site ID: CT06462-A-09
Verizon Site Name: Willimantic
Site Address: 349 Mountain Street, Windham, CT 06226

FDH Velocitel Project Number 15CCME1400 (R.1)

Analysis Results

Tower Components	81.8%	Sufficient
Foundation	75.4%	Sufficient

Prepared By:

Matthew Layden, EI
Project Engineer I

Reviewed By:

Dennis D. Abel, PE
Director of Structural Engineering
CT License No. 23247

Velocitel, Inc., d.b.a. FDH Velocitel
6521 Meridien Drive
Raleigh, NC, 27616
(919) 755-1012

STATE OF CONNECTICUT DENNIS D. ABEL No. 23247 LICENSED PROFESSIONAL ENGINEER

November 04, 2015 11-04-2015

Prepared pursuant to the TIA/EIA-222-F Structural Standards for Steel Antenna Towers and Antenna Supporting Structures and 2005 Connecticut State Building Code

TABLE OF CONTENTS

EXECUTIVE SUMMARY

At the request of SBA Network Services, Inc., FDH Velocitel performed a structural analysis of the existing Self-Support Tower located in Windham, CT to determine whether the tower is structurally adequate to support the antenna configuration in place per **Table 1** pursuant to the *TIA/EIA-222-F Structural Standards for Steel Antenna Towers and Antenna Supporting Structures and 2005 Connecticut State Building Code*. Information pertaining to the antenna loading, current tower geometry, member sizes, and below grade parameters was obtained from:

Source	Document Type	Reference	Date
Rohn Industries, Inc.	Tower Drawings	Eng. File No. 49204TT	September 27, 2001
Rohn Industries, Inc.	Foundation Drawings	Eng. File No. 49204TT	August 31, 2001
FDH Engineering, Inc.	TIA Inspection	Job No. 1301611800	May 03, 2013
SBA Network Services, Inc.	-	-	-

The basic design wind speed per the *TIA/EIA-222-F standards and 2005 CSBC* is 85 mph without ice and 38 mph with 1" radial ice. Ice is considered to increase in thickness with height.

Conclusions

With the antenna configuration in place per **Table 1** we have determined the tower stress level to be sufficient and the foundation(s) to be sufficient pursuant to the requirements stipulated by *TIA/EIA-222-F Structural Standards for Steel Antenna Towers and Antenna Supporting Structures and 2005 Connecticut State Building Code* provided the **Recommendations** listed below are satisfied. For a more detailed description of the analysis of the tower, see the **Results** section of this report.

Our structural analysis has been performed assuming all information provided to FDH Velocitel is accurate (i.e., the structure member information, tower layout, existing antenna loading, and proposed antenna loading) and that the tower has been properly erected and maintained per the original design drawings.

Recommendations

To ensure the requirements of the current analysis standards are met with the antenna configuration in place per **Table 1**, we have the following recommendations:

1. Feed lines must be installed as shown in **Figure 1**.
2. RRU/RRH Stipulation: The equipment may be installed in any arrangement as determined by the client.

APPURTENANCE LISTING

The antennas and equipment, with their corresponding feed lines, considered for this analysis are shown in **Table 1**. *If the actual layout determined in the field deviates from the layout, FDH Velocitel should be contacted to perform a revised analysis.*

Table 1 - Appurtenance Loading

Existing Loading:

Antenna Elevation (ft.)	Description	Feed Lines	Carrier	Mount Elevation (ft.)	Mount Type
180	(3) Antel BXA-70063-6CF-2 (3) Antel BXA-80080/4CF (3) Antel BXA-171085-8BF (3) Antel BXA-171063-8CF (6) RFS Celwave FD9R6004/2C-3L (3) Alcatel Lucent RRH2X40-AWS (1) RFS Celwave DB-T1-6Z-8AB-0Z	(12) 1-5/8" (1) 1-5/8" Fiber	Verizon	180	(3) 10' T-Frames
168	(3) Ericsson AIR 21 B2A/B4P (3) Ericsson AIR 21 B4A/B2P (3) Andrew LNX-6515DS-VTM (3) Ericsson S11B12 (3) Ericsson KRY 112 144/1	(12) 1-5/8" (1) 1-5/8" Fiber	T-Mobile	168	(3) 10' T-Frames
162	(1) RFS PD1142-2B	(6) 7/8"	Connecticut Light and Power	158	(1) 1.5' Standoff
157	(1) RFS 458-2N			152	(1) 4' Standoff
	(1) Telwave ANT450D6-9			151	(1) 4' Standoff
140	(1) RFS 220-7N			130	(3) 8' Standoffs
134.5	(1) RFS PD1142-2B				
132.5	(1) Telwave ANT450D6-9				

Proposed Carrier Final Loading:

Antenna Elevation (ft.)	Description	Feed Lines	Carrier	Mount Elevation (ft.)	Mount Type
185	(3) Antel BXA-80080/4FC (6) RFS Celwave FD9R6004/2C-3L	(3) 1-5/8"	Verizon	185	Direct
120	(3) Commscope SBNHH-1D45B (6) Commscope SBNHH-1D65B (3) Alcatel Lucent RRH2X60-AWS (3) Alcatel Lucent RRH2x60-700 (3) Alcatel Lucent RRH2X60-PCS (2) RFS Celwave DB-T1-6Z-8AB-0Z	(8) 1-5/8" (2) 1-5/8" Fiber		120	(3) 10' T-Frames

RESULTS

The following material grades for individual members were used for analysis:

Table 2 - Material Grade

Member Type	Material Grade
Legs	A572-50
Bracing	A36

Table 3 and **Table 4** display the summary of capacities for the analyzed structure and its additional components. Values greater than 100% indicate locations where the maximum force in the member exceeds its capacity.

If the assumptions outlined in this report differ from actual field conditions, FDH Velocitel should be contacted to perform a revised analysis. Furthermore, as no information pertaining to the allowable twist and sway requirements for the appurtenances was provided, deflection and rotation were not taken into consideration when performing this analysis.

See the **Appendix** for detailed modeling information.

Table 3 - Structure Member Capacities

Section No.	Elevation (ft.)	Component Type	Size	% Capacity[1]	Pass / Fail
T1	196 - 188	Leg	ROHN 3 STD	0.7	Pass
T2	188 - 168	Leg	ROHN 3 STD	10.2	Pass
T3	168 - 160	Leg	ROHN 3 STD	22.6	Pass
T4	160 - 140	Leg	ROHN 3 EH	42.3	Pass
T5	140 - 120	Leg	ROHN 4 EH	45.5	Pass
T6	120 - 100	Leg	ROHN 5 EH	47.0	Pass
T7	100 - 80	Leg	ROHN 6 EHS	54.0	Pass
T8	80 - 60	Leg	ROHN 6 EH	57.9	Pass
T9	60 - 40	Leg	ROHN 8 EHS	53.3	Pass
T10	40 - 20	Leg	ROHN 8 EHS	61.3	Pass
T11	20 - 0	Leg	ROHN 8 EH	53.8	Pass
T1	196 - 188	Diagonal	L1 3/4x1 3/4x3/16	2.5 3.8 (b)	Pass
T2	188 - 168	Diagonal	L2x2x1/4	9.9 16.4 (b)	Pass
T3	168 - 160	Diagonal	L2x2x1/4	20.6 35.3 (b)	Pass
T4	160 - 140	Diagonal	L2x2x3/16	48.5 53.7 (b)	Pass
T5	140 - 120	Diagonal	L2 1/2x2 1/2x1/4	40.3 50.4 (b)	Pass
T6	120 - 100	Diagonal	L2 1/2x2 1/2x1/4	72.3	Pass
T7	100 - 80	Diagonal	L3x3x1/4	56.9 61.1 (b)	Pass
T8	80 - 60	Diagonal	L3 1/2x3 1/2x1/4	58.0 66.7 (b)	Pass
T9	60 - 40	Diagonal	L3 1/2x3 1/2x1/4	75.0	Pass
T10	40 - 20	Diagonal	L4x4x1/4	62.7 77.8 (b)	Pass
T11	20 - 0	Diagonal	L4x4x1/4	77.6 81.8 (b)	Pass
T1	196 - 188	Top Girt	L1 3/4x1 3/4x3/16	1.4	Pass
T4	160 - 140	Top Girt	L1 3/4x1 3/4x3/16	3.0	Pass

1. Capacities include 1/3 allowable stress increase for wind, per TIA/EIA-222-F standards.

Table 4 – Additional Structure Component Capacities

Elevation (ft.)	Component	% Capacity	Pass / Fail	Notes
0	Anchor Rods	44.8	Pass	1
0	Base Foundation (Soil Interaction)	75.4	Pass	1

1. Capacities include 1/3 allowable stress increase for wind, per TIA/EIA-222-F standards.

GENERAL COMMENTS

This engineering analysis is based upon the theoretical capacity of the structure. It is not a condition assessment of the tower and its foundation. It is the responsibility of SBA Network Services, Inc. to verify that the tower modeled and analyzed is the correct structure (with accurate antenna loading information) modeled. If there are substantial modifications to be made or the assumptions made in this analysis are not accurate, FDH Velocitel should be notified immediately to perform a revised analysis.

LIMITATIONS

All opinions and conclusions are considered accurate to a reasonable degree of engineering certainty based upon the evidence available at the time of this report. All opinions and conclusions are subject to revision based upon receipt of new or additional/updated information. All services are provided exercising a level of care and diligence equivalent to the standard and care of our profession. No other warranty or guarantee, expressed or implied, is offered. Our services are confidential in nature and we will not release this report to any other party without the client's consent. The use of this engineering work is limited to the express purpose for which it was commissioned and it may not be reused, copied, or distributed for any other purpose without the written consent of FDH Velocitel.

APPENDIX

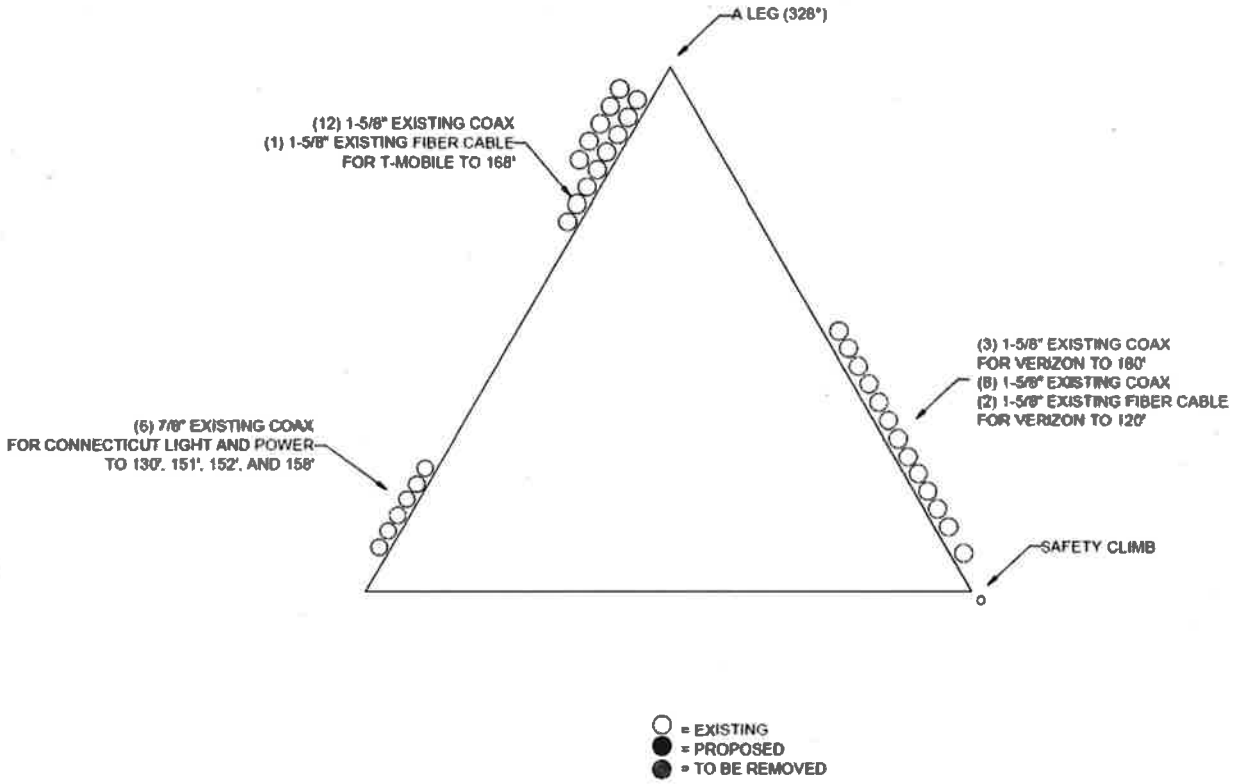
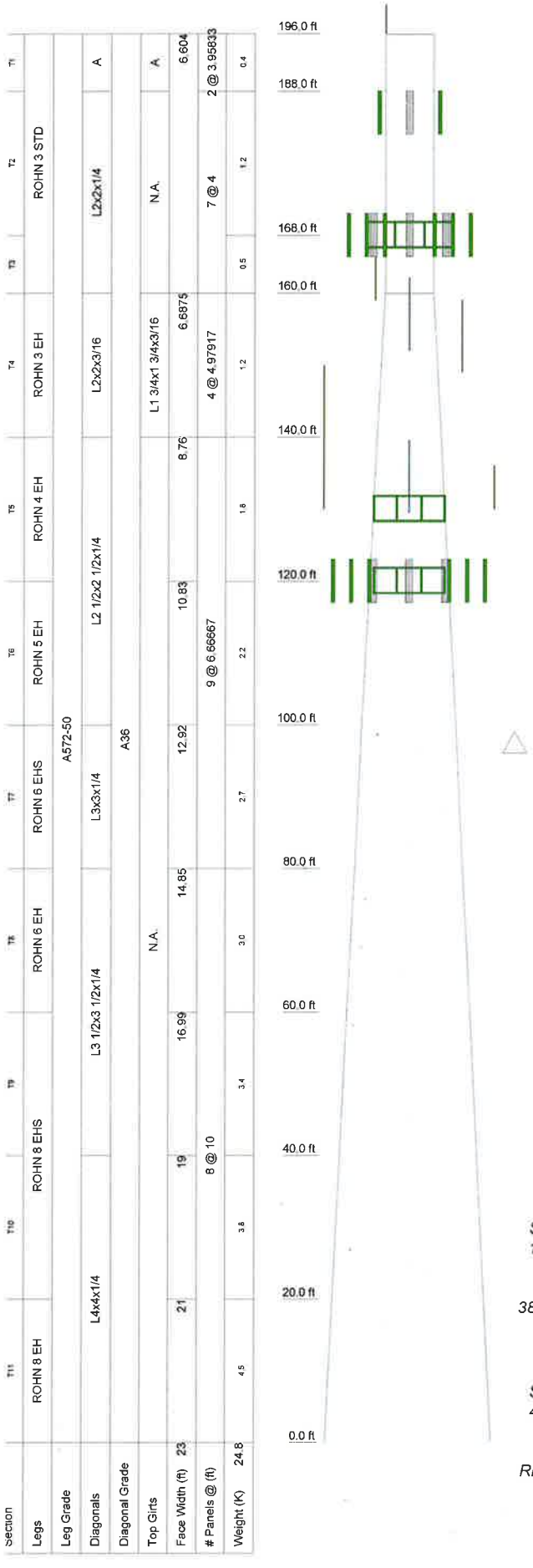


Figure 1: Feed Line Layout



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Lightning Rod	196	(1) 1.5' Standoff	158
BXA-80080/4CF w/ Mount Pipe	185	RFS 458-2N	152
BXA-80080/4CF w/ Mount Pipe	185	(1) 4' Standoff	152
BXA-80080/4CF w/ Mount Pipe	185	Telwave ANT450D6-9	151
(2) FD9R6004/2C-3L	185	(1) 4' Standoff	151
(2) FD9R6004/2C-3L	185	RFS 220-7N	130
(2) FD9R6004/2C-3L	185	RFS PD1142-2B	130
AIR 21 B2A/B4P w/Mount Pipe	168	Telwave ANT450D6-9	130
AIR 21 B2A/B4P w/Mount Pipe	168	(3) 8' Standoffs	130
AIR 21 B2A/B4P w/Mount Pipe	168	RRH2X60-PCS	120
AIR 21 B4A/B2P w/Mount Pipe	168	DB-T1-6Z-8AB-0Z	120
AIR 21 B4A/B2P w/Mount Pipe	168	DB-T1-6Z-8AB-0Z	120
AIR 21 B4A/B2P w/Mount Pipe	168	(3) 10- T-Frames	120
LNX-6515DS-VTM w/ Mount Pipe	168	(3) SBNHH-1D45B w/ Mount Pipe	120
LNX-6515DS-VTM w/ Mount Pipe	168	(3) SBNHH-1D65B w/ Mount Pipe	120
LNX-6515DS-VTM w/ Mount Pipe	168	(3) SBNHH-1D65B w/ Mount Pipe	120
KRY 112 144/1	168	RRH2X60-AWS	120
KRY 112 144/1	168	RRH2X60-AWS	120
KRY 112 144/1	168	RRH2X60-AWS	120
S11B12	168	RRH2x60-700	120
S11B12	168	RRH2x60-700	120
S11B12	168	RRH2x60-700	120
(3) 10' T-Frames	168	RRH2X60-PCS	120
RFS PD1142-2B	158	RRH2X60-PCS	120

SYMBOL LIST

MARK	SIZE	MARK	SIZE
A	L1 3/4x1 3/4x3/16		

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 Windham County, Connecticut.
2. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 38 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 81.8%

MAX. CORNER REACTIONS AT BASE:
DOWN: 241 K
SHEAR: 27 K

UPLIFT: -198 K
SHEAR: 23 K

AXIAL
86 K

SHEAR
13 K

MOMENT
1417 kip-ft

TORQUE 3 kip-ft
38 mph WIND - 1.0000 in ICE

AXIAL
40 K

SHEAR
44 K

MOMENT
4527 kip-ft

TORQUE 16 kip-ft
REACTIONS - 85 mph WIND

FDH VELOCITEL ENGINEERING INNOVATION
Tower Analysis
FDH Velocitel
6521 Meridien Drive, Suite 107
Raleigh, North Carolina 27616
Phone: 9197551012
FAX: 9197551031

Job: **Mountain Street Tower #2, CT06462-A-09**			
Project: **15CCME1400**			
Client: SBA Network Services, Inc.	Drawn by: Matt Layden	App'd:	
Code: TIA/EIA-222-F	Date: 10/28/15	Scale: N	
Path:		Dwg No.	

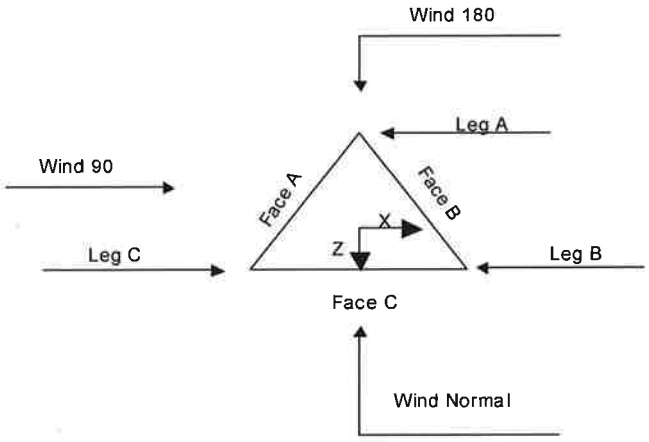
Tower Input Data

The main tower is a 3x free standing tower with an overall height of 196.00 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 6.60 ft at the top and 23.00 ft at the base.
This tower is designed using the TIA/EIA-222-F standard.
The following design criteria apply:

Tower is located in Windham County, Connecticut.
Basic wind speed of 85 mph.
Nominal ice thickness of 1.0000 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 38 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
Pressures are calculated at each section.
Stress ratio used in tower member design is 1.333.
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

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



Triangular Tower

Tower Section Geometry

Tower Section	Tower Elevation	Assembly Database	Description	Section Width	Number of Sections	Section Length
	ft			ft		ft
T1	196.00-188.00			6.60	1	8.00
T2	188.00-168.00			6.60	1	20.00
T3	168.00-160.00			6.60	1	8.00
T4	160.00-140.00			6.69	1	20.00
T5	140.00-120.00			8.76	1	20.00
T6	120.00-100.00			10.83	1	20.00
T7	100.00-80.00			12.92	1	20.00
T8	80.00-60.00			14.85	1	20.00
T9	60.00-40.00			16.99	1	20.00
T10	40.00-20.00			19.00	1	20.00
T11	20.00-0.00			21.00	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	196.00-188.00	3.96	X Brace	No	No	1.0000	0.0000
T2	188.00-168.00	4.00	X Brace	No	No	0.0000	0.0000
T3	168.00-160.00	4.00	X Brace	No	No	0.0000	0.0000
T4	160.00-140.00	4.98	X Brace	No	No	1.0000	0.0000

Tower Section	Tower Elevation ft	Diagonal Spacing ft	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset in	Bottom Girt Offset in
T5	140.00-120.00	6.67	X Brace	No	No	0.0000	0.0000
T6	120.00-100.00	6.67	X Brace	No	No	0.0000	0.0000
T7	100.00-80.00	6.67	X Brace	No	No	0.0000	0.0000
T8	80.00-60.00	10.00	X Brace	No	No	0.0000	0.0000
T9	60.00-40.00	10.00	X Brace	No	No	0.0000	0.0000
T10	40.00-20.00	10.00	X Brace	No	No	0.0000	0.0000
T11	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 196.00-188.00	Pipe	ROHN 3 STD	A572-50 (50 ksi)	Equal Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)
T2 188.00-168.00	Pipe	ROHN 3 STD	A572-50 (50 ksi)	Equal Angle	L2x2x1/4	A36 (36 ksi)
T3 168.00-160.00	Pipe	ROHN 3 STD	A572-50 (50 ksi)	Equal Angle	L2x2x1/4	A36 (36 ksi)
T4 160.00-140.00	Pipe	ROHN 3 EH	A572-50 (50 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T5 140.00-120.00	Pipe	ROHN 4 EH	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x1/4	A36 (36 ksi)
T6 120.00-100.00	Pipe	ROHN 5 EH	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x1/4	A36 (36 ksi)
T7 100.00-80.00	Pipe	ROHN 6 EHS	A572-50 (50 ksi)	Equal Angle	L3x3x1/4	A36 (36 ksi)
T8 80.00-60.00	Pipe	ROHN 6 EH	A572-50 (50 ksi)	Equal Angle	L3 1/2x3 1/2x1/4	A36 (36 ksi)
T9 60.00-40.00	Pipe	ROHN 8 EHS	A572-50 (50 ksi)	Equal Angle	L3 1/2x3 1/2x1/4	A36 (36 ksi)
T10 40.00-20.00	Pipe	ROHN 8 EHS	A572-50 (50 ksi)	Equal Angle	L4x4x1/4	A36 (36 ksi)
T11 20.00-0.00	Pipe	ROHN 8 EH	A572-50 (50 ksi)	Equal Angle	L4x4x1/4	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 196.00-188.00	Equal Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)	Solid Round		A36 (36 ksi)
T4 160.00-140.00	Equal Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)	Solid Round		A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft²	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
T1 196.00-188.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000
T2 188.00-168.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000
T3 168.00-160.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000
T4 160.00-140.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000
T5 140.00-120.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000
T6 120.00-100.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000
T7 100.00-80.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000
T8 80.00-60.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000
T9 60.00-40.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000
T10 40.00-20.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000
T11 20.00-0.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K Factors[1] 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 196.00-188.00	Yes	No	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T2 188.00-168.00	Yes	No	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T3 168.00-160.00	Yes	No	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T4 160.00-140.00	Yes	No	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T5 140.00-120.00	Yes	No	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T6 120.00-100.00	Yes	No	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T7 100.00-80.00	Yes	No	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T8 80.00-60.00	Yes	No	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T9 60.00-40.00	Yes	No	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T10 40.00-20.00	Yes	No	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T11 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 196.00-188.00	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 188.00-168.00	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 168.00-160.00	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 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
T5 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
T6 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
T7 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
T8 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
T9 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
T10 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
T11 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 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 196.00-188.00	Flange	0.7500 A325N	4	0.6250 A325N	1	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T2 188.00-168.00	Flange	0.8750 A325N	4	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T3 168.00-160.00	Flange	0.8750 A325N	4	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T4 160.00-140.00	Flange	0.8750 A325N	4	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T5 140.00-120.00	Flange	1.0000 A325N	4	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T6 120.00-100.00	Flange	1.0000 A325N	6	0.7500 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T7 100.00-80.00	Flange	1.0000 A325N	6	0.7500 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T8 80.00-60.00	Flange	1.0000 A325N	8	0.7500 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T9 60.00-40.00	Flange	1.0000 A325N	8	0.7500 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

Tower Elevation ft	Leg Connection Type	Leg Bolt Size in	Leg No.	Diagonal Bolt Size in	Diagonal No.	Top Girt Bolt Size in	Top Girt No.	Bottom Girt Bolt Size in	Bottom Girt No.	Mid Girt Bolt Size in	Mid Girt No.	Long Horizontal Bolt Size in	Long Horizontal No.	Short Horizontal Bolt Size in	Short Horizontal No.
T10 40.00-20.00	Flange	1.0000 A325N	8	0.7500 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T11 20.00-0.00	Flange	1.0000 A354-BC	10	0.7500 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

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
LDF7-50A(1-5/8")	A	Yes	Ar (CfAe)	168.00 - 10.00	0.0000	0.35	13	8	0.5000	1.9800		0.82
Feedline Ladder (Af) ***	A	Yes	Af (CfAe)	168.00 - 10.00	0.0000	0.35	1	1	0.5000	3.0000	12.0000	8.40
LDF7-50A(1-5/8")	B	Yes	Ar (CfAe)	120.00 - 10.00	0.0000	0.35	13	13	0.5000	1.9800		0.82
Feedline Ladder (Af) ***	B	Yes	Af (CfAe)	180.00 - 10.00	0.0000	0.35	1	1	0.5000	3.0000	12.0000	8.40
LDF5-50A(7/8")	A	Yes	Ar (CfAe)	130.00 - 10.00	0.0000	-0.4	6	6	0.5000	1.0900		0.33
LDF5-50A(7/8")	A	Yes	Ar (CfAe)	151.00 - 130.00	0.0000	-0.4	3	3	0.5000	1.0900		0.33
LDF5-50A(7/8")	A	Yes	Ar (CfAe)	152.00 - 151.00	0.0000	-0.4	2	2	0.5000	1.0900		0.33
LDF5-50A(7/8")	A	Yes	Ar (CfAe)	158.00 - 152.00	0.0000	-0.4	1	1	0.5000	1.0900		0.33
Feedline Ladder (Af) ***	A	Yes	Af (CfAe)	160.00 - 10.00	0.0000	-0.4	1	1	0.5000	3.0000	12.0000	8.40
Safety Line 3/8 ***	B	Yes	Ar (CfAe)	196.00 - 10.00	0.0000	0.5	1	1	0.3750	0.3750		0.22
LDF7-50A(1-5/8")	B	Yes	Ar (CfAe)	185.00 - 120.00	0.0000	0.35	3	3	0.5000	1.9800		0.82

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	196.00-188.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.250	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T2	188.00-168.00	A	0.000	0.000	0.000	0.000	0.00
		B	9.040	3.000	0.000	0.000	0.15
		C	0.000	0.000	0.000	0.000	0.00
T3	168.00-160.00	A	10.560	2.000	0.000	0.000	0.15
		B	4.210	2.000	0.000	0.000	0.09

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
		C	0.000	0.000	0.000	0.000	0.00
T4	160.00-140.00	A	30.124	10.000	0.000	0.000	0.56
		B	10.525	5.000	0.000	0.000	0.22
		C	0.000	0.000	0.000	0.000	0.00
T5	140.00-120.00	A	34.575	10.000	0.000	0.000	0.58
		B	10.525	5.000	0.000	0.000	0.22
		C	0.000	0.000	0.000	0.000	0.00
T6	120.00-100.00	A	37.300	10.000	0.000	0.000	0.59
		B	43.525	5.000	0.000	0.000	0.39
		C	0.000	0.000	0.000	0.000	0.00
T7	100.00-80.00	A	37.300	10.000	0.000	0.000	0.59
		B	43.525	5.000	0.000	0.000	0.39
		C	0.000	0.000	0.000	0.000	0.00
T8	80.00-60.00	A	37.300	10.000	0.000	0.000	0.59
		B	43.525	5.000	0.000	0.000	0.39
		C	0.000	0.000	0.000	0.000	0.00
T9	60.00-40.00	A	37.300	10.000	0.000	0.000	0.59
		B	43.525	5.000	0.000	0.000	0.39
		C	0.000	0.000	0.000	0.000	0.00
T10	40.00-20.00	A	37.300	10.000	0.000	0.000	0.59
		B	43.525	5.000	0.000	0.000	0.39
		C	0.000	0.000	0.000	0.000	0.00
T11	20.00-0.00	A	18.650	5.000	0.000	0.000	0.29
		B	21.762	2.500	0.000	0.000	0.19
		C	0.000	0.000	0.000	0.000	0.00

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	196.00-188.00	A	1.235	0.000	0.000	0.000	0.000	0.00
		B		1.897	0.000	0.000	0.000	0.02
		C		0.000	0.000	0.000	0.000	0.00
T2	188.00-168.00	A	1.224	0.000	0.000	0.000	0.000	0.00
		B		10.979	11.659	0.000	0.000	0.48
		C		0.000	0.000	0.000	0.000	0.00
T3	168.00-160.00	A	1.212	2.936	14.651	0.000	0.000	0.48
		B		4.802	6.384	0.000	0.000	0.26
		C		0.000	0.000	0.000	0.000	0.00
T4	160.00-140.00	A	1.199	12.530	47.311	0.000	0.000	1.64
		B		11.920	15.932	0.000	0.000	0.64
		C		0.000	0.000	0.000	0.000	0.00
T5	140.00-120.00	A	1.179	12.976	53.448	0.000	0.000	1.73
		B		11.784	15.886	0.000	0.000	0.63
		C		0.000	0.000	0.000	0.000	0.00
T6	120.00-100.00	A	1.155	12.820	57.319	0.000	0.000	1.77
		B		11.628	57.168	0.000	0.000	1.37
		C		0.000	0.000	0.000	0.000	0.00
T7	100.00-80.00	A	1.128	12.636	57.196	0.000	0.000	1.74
		B		11.445	57.107	0.000	0.000	1.35
		C		0.000	0.000	0.000	0.000	0.00
T8	80.00-60.00	A	1.094	12.413	57.047	0.000	0.000	1.71
		B		11.221	57.032	0.000	0.000	1.32
		C		0.000	0.000	0.000	0.000	0.00
T9	60.00-40.00	A	1.051	12.124	56.855	0.000	0.000	1.67
		B		10.933	56.936	0.000	0.000	1.29
		C		0.000	0.000	0.000	0.000	0.00

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T10	40.00-20.00	A	1.000	11.783	56.628	0.000	0.000	1.62
		B		10.592	56.822	0.000	0.000	1.25
		C		0.000	0.000	0.000	0.000	0.00
T11	20.00-0.00	A	1.000	5.892	28.314	0.000	0.000	0.81
		B		5.296	28.411	0.000	0.000	0.62
		C		0.000	0.000	0.000	0.000	0.00

Feed Line Shielding

Section	Elevation ft	Face	A_R ft^2	A_R Ice ft^2	A_F ft^2	A_F Ice ft^2
T1	196.00-188.00	A	0.000	0.000	0.000	0.000
		B	0.000	0.277	0.026	0.196
		C	0.000	0.000	0.000	0.000
T2	188.00-168.00	A	0.000	0.000	0.000	0.000
		B	0.000	2.797	1.173	2.285
		C	0.000	0.000	0.000	0.000
T3	168.00-160.00	A	0.000	2.137	1.222	1.763
		B	0.000	1.382	0.604	1.140
		C	0.000	0.000	0.000	0.000
T4	160.00-140.00	A	0.000	6.582	3.482	5.424
		B	0.000	3.073	1.347	2.532
		C	0.000	0.000	0.000	0.000
T5	140.00-120.00	A	0.000	4.929	3.375	5.227
		B	0.000	2.069	1.175	2.194
		C	0.000	0.000	0.000	0.000
T6	120.00-100.00	A	0.000	4.820	3.393	5.215
		B	0.000	4.646	3.481	5.027
		C	0.000	0.000	0.000	0.000
T7	100.00-80.00	A	0.000	4.527	3.937	6.021
		B	0.000	4.369	4.039	5.810
		C	0.000	0.000	0.000	0.000
T8	80.00-60.00	A	0.000	3.098	3.260	4.954
		B	0.000	2.994	3.344	4.787
		C	0.000	0.000	0.000	0.000
T9	60.00-40.00	A	0.000	2.859	3.157	4.760
		B	0.000	2.768	3.239	4.608
		C	0.000	0.000	0.000	0.000
T10	40.00-20.00	A	0.000	2.633	3.526	5.266
		B	0.000	2.554	3.617	5.108
		C	0.000	0.000	0.000	0.000
T11	20.00-0.00	A	0.000	1.293	1.732	2.587
		B	0.000	1.255	1.777	2.509
		C	0.000	0.000	0.000	0.000

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	196.00-188.00	0.2987	0.1710	0.8993	0.5150

Section	Elevation	CP_X	CP_Z	CP_X Ice	CP_Z Ice
	ft	in	in	in	in
T2	188.00-168.00	4.5849	1.6516	2.5802	1.0993
T3	168.00-160.00	2.3643	-7.5671	1.5747	-3.9299
T4	160.00-140.00	-0.1676	-6.9681	-0.0341	-3.5704
T5	140.00-120.00	-1.6301	-6.9827	-0.8182	-4.0432
T6	120.00-100.00	7.4925	-2.3933	5.9881	-0.8898
T7	100.00-80.00	7.6123	-2.3801	6.2754	-0.9042
T8	80.00-60.00	8.9495	-2.7528	7.6947	-1.1216
T9	60.00-40.00	9.0300	-2.7416	8.0013	-1.1680
T10	40.00-20.00	9.3513	-2.8106	8.4169	-1.2337
T11	20.00-0.00	5.8951	-1.7605	5.2796	-0.7662

Discrete Tower Loads

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 K
Lightning Rod	C	From Leg	0.00	0.00	0.0000	196.00	No Ice	0.25	0.25	0.03
			0.00				1/2" Ice	0.66	0.66	0.03
			2.00				1" Ice	0.97	0.97	0.04
							2" Ice	1.49	1.49	0.06
							4" Ice	2.68	2.68	0.14
****										
BXA-80080/4CF w/ Mount Pipe	A	From Leg	1.00	0.00	0.0000	185.00	No Ice	5.49	4.03	0.03
			0.00				1/2" Ice	5.94	4.65	0.08
			0.00				1" Ice	6.40	5.30	0.13
							2" Ice	7.35	6.70	0.25
							4" Ice	9.39	9.78	0.60
BXA-80080/4CF w/ Mount Pipe	B	From Leg	1.00	0.00	0.0000	185.00	No Ice	5.49	4.03	0.03
			0.00				1/2" Ice	5.94	4.65	0.08
			0.00				1" Ice	6.40	5.30	0.13
							2" Ice	7.35	6.70	0.25
							4" Ice	9.39	9.78	0.60
BXA-80080/4CF w/ Mount Pipe	C	From Leg	1.00	0.00	0.0000	185.00	No Ice	5.49	4.03	0.03
			0.00				1/2" Ice	5.94	4.65	0.08
			0.00				1" Ice	6.40	5.30	0.13
							2" Ice	7.35	6.70	0.25
							4" Ice	9.39	9.78	0.60
(2) FD9R6004/2C-3L	A	From Leg	1.00	0.00	0.0000	185.00	No Ice	0.37	0.08	0.00
			0.00				1/2" Ice	0.45	0.14	0.01
			0.00				1" Ice	0.54	0.20	0.01
							2" Ice	0.75	0.34	0.02
							4" Ice	1.28	0.74	0.06
(2) FD9R6004/2C-3L	B	From Leg	1.00	0.00	0.0000	185.00	No Ice	0.37	0.08	0.00
			0.00				1/2" Ice	0.45	0.14	0.01
			0.00				1" Ice	0.54	0.20	0.01
							2" Ice	0.75	0.34	0.02
							4" Ice	1.28	0.74	0.06
(2) FD9R6004/2C-3L	C	From Leg	1.00	0.00	0.0000	185.00	No Ice	0.37	0.08	0.00
			0.00				1/2" Ice	0.45	0.14	0.01
			0.00				1" Ice	0.54	0.20	0.01
							2" Ice	0.75	0.34	0.02
							4" Ice	1.28	0.74	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
***									
(3) SBNHH-1D45B w/ Mount Pipe	A	From Leg	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	12.60 13.19 13.78 15.00 17.54	6.47 7.23 8.00 9.60 13.19	0.64 0.71 0.80 1.00 1.54
(3) SBNHH-1D65B w/ Mount Pipe	B	From Leg	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	8.53 9.18 9.80 11.07 13.72	7.00 8.19 9.08 10.90 14.93	0.08 0.14 0.22 0.40 0.91
(3) SBNHH-1D65B w/ Mount Pipe	C	From Leg	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	8.53 9.18 9.80 11.07 13.72	7.00 8.19 9.08 10.90 14.93	0.08 0.14 0.22 0.40 0.91
RRH2X60-AWS	A	From Leg	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.19 2.40 2.61 3.07 4.09	1.43 1.61 1.80 2.21 3.13	0.04 0.06 0.08 0.13 0.26
RRH2X60-AWS	B	From Leg	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.19 2.40 2.61 3.07 4.09	1.43 1.61 1.80 2.21 3.13	0.04 0.06 0.08 0.13 0.26
RRH2X60-AWS	C	From Leg	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.19 2.40 2.61 3.07 4.09	1.43 1.61 1.80 2.21 3.13	0.04 0.06 0.08 0.13 0.26
RRH2x60-700	A	From Leg	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.96 4.27 4.60 5.27 6.72	1.82 2.08 2.36 2.96 4.25	0.06 0.08 0.11 0.17 0.35
RRH2x60-700	B	From Leg	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.96 4.27 4.60 5.27 6.72	1.82 2.08 2.36 2.96 4.25	0.06 0.08 0.11 0.17 0.35
RRH2x60-700	C	From Leg	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.96 4.27 4.60 5.27 6.72	1.82 2.08 2.36 2.96 4.25	0.06 0.08 0.11 0.17 0.35
RRH2X60-PCS	A	From Leg	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.57 2.79 3.02 3.52 4.61	1.93 2.13 2.34 2.80 3.81	0.05 0.07 0.09 0.14 0.30
RRH2X60-PCS	B	From Leg	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.57 2.79 3.02 3.52 4.61	1.93 2.13 2.34 2.80 3.81	0.05 0.07 0.09 0.14 0.30
RRH2X60-PCS	C	From Leg	3.00	0.0000	120.00	No Ice	2.57	1.93	0.05

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			1/2" Ice	2.79	2.13	0.07
			0.00			1" Ice	3.02	2.34	0.09
						2" Ice	3.52	2.80	0.14
						4" Ice	4.61	3.81	0.30
DB-T1-6Z-8AB-0Z	A	From Leg	3.00	0.0000	120.00	No Ice	5.60	2.33	0.04
			0.00			1/2" Ice	5.92	2.56	0.08
			0.00			1" Ice	6.24	2.79	0.12
						2" Ice	6.91	3.28	0.21
						4" Ice	8.37	4.37	0.45
DB-T1-6Z-8AB-0Z	A	From Leg	3.00	0.0000	120.00	No Ice	5.60	2.33	0.04
			0.00			1/2" Ice	5.92	2.56	0.08
			0.00			1" Ice	6.24	2.79	0.12
						2" Ice	6.91	3.28	0.21
						4" Ice	8.37	4.37	0.45
(3) 10- T-Frames	C	None		0.0000	120.00	No Ice	33.02	33.02	1.67
						1/2" Ice	47.36	47.36	2.22
						1" Ice	61.70	61.70	2.77
						2" Ice	90.38	90.38	3.88
						4" Ice	147.74	147.74	6.08
****									
AIR 21 B2A/B4P w/Mount Pipe	A	From Leg	3.00	0.0000	168.00	No Ice	7.09	6.02	0.12
			0.00			1/2" Ice	7.78	7.17	0.18
			0.00			1" Ice	8.37	8.03	0.25
						2" Ice	9.60	9.79	0.40
						4" Ice	12.20	13.53	0.86
AIR 21 B2A/B4P w/Mount Pipe	B	From Leg	3.00	0.0000	168.00	No Ice	7.09	6.02	0.12
			0.00			1/2" Ice	7.78	7.17	0.18
			0.00			1" Ice	8.37	8.03	0.25
						2" Ice	9.60	9.79	0.40
						4" Ice	12.20	13.53	0.86
AIR 21 B2A/B4P w/Mount Pipe	C	From Leg	3.00	0.0000	168.00	No Ice	7.09	6.02	0.12
			0.00			1/2" Ice	7.78	7.17	0.18
			0.00			1" Ice	8.37	8.03	0.25
						2" Ice	9.60	9.79	0.40
						4" Ice	12.20	13.53	0.86
AIR 21 B4A/B2P w/Mount Pipe	A	From Leg	3.00	0.0000	168.00	No Ice	7.09	6.02	0.12
			0.00			1/2" Ice	7.78	7.17	0.18
			0.00			1" Ice	8.37	8.03	0.24
						2" Ice	9.60	9.79	0.40
						4" Ice	12.20	13.53	0.86
AIR 21 B4A/B2P w/Mount Pipe	B	From Leg	3.00	0.0000	168.00	No Ice	7.09	6.02	0.12
			0.00			1/2" Ice	7.78	7.17	0.18
			0.00			1" Ice	8.37	8.03	0.24
						2" Ice	9.60	9.79	0.40
						4" Ice	12.20	13.53	0.86
AIR 21 B4A/B2P w/Mount Pipe	C	From Leg	3.00	0.0000	168.00	No Ice	7.09	6.02	0.12
			0.00			1/2" Ice	7.78	7.17	0.18
			0.00			1" Ice	8.37	8.03	0.24
						2" Ice	9.60	9.79	0.40
						4" Ice	12.20	13.53	0.86
LNX-6515DS-VTM w/ Mount Pipe	A	From Leg	3.00	0.0000	168.00	No Ice	11.63	9.79	0.07
			0.00			1/2" Ice	12.35	11.31	0.16
			0.00			1" Ice	13.07	12.85	0.26
						2" Ice	14.54	15.19	0.49
						4" Ice	17.81	20.05	1.14
LNX-6515DS-VTM w/ Mount Pipe	B	From Leg	3.00	0.0000	168.00	No Ice	11.63	9.79	0.07
			0.00			1/2" Ice	12.35	11.31	0.16

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			1" Ice	13.07	12.85	0.26
						2" Ice	14.54	15.19	0.49
						4" Ice	17.81	20.05	1.14
LNX-6515DS-VTM w/ Mount Pipe	C	From Leg	3.00 0.00 0.00	0.0000	168.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	11.63 12.35 13.07 14.54 17.81	9.79 11.31 12.85 15.19 20.05	0.07 0.16 0.26 0.49 1.14
KRY 112 144/1	A	From Leg	3.00 0.00 0.00	0.0000	168.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.41 0.50 0.60 0.82 1.36	0.19 0.26 0.33 0.51 0.97	0.01 0.01 0.02 0.03 0.08
KRY 112 144/1	B	From Leg	3.00 0.00 0.00	0.0000	168.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.41 0.50 0.60 0.82 1.36	0.19 0.26 0.33 0.51 0.97	0.01 0.01 0.02 0.03 0.08
KRY 112 144/1	C	From Leg	3.00 0.00 0.00	0.0000	168.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.41 0.50 0.60 0.82 1.36	0.19 0.26 0.33 0.51 0.97	0.01 0.01 0.02 0.03 0.08
S11B12	A	From Leg	3.00 0.00 0.00	0.0000	168.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.31 3.55 3.80 4.33 5.50	1.36 1.54 1.73 2.13 3.04	0.05 0.07 0.10 0.15 0.31
S11B12	B	From Leg	3.00 0.00 0.00	0.0000	168.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.31 3.55 3.80 4.33 5.50	1.36 1.54 1.73 2.13 3.04	0.05 0.07 0.10 0.15 0.31
S11B12	C	From Leg	3.00 0.00 0.00	0.0000	168.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.31 3.55 3.80 4.33 5.50	1.36 1.54 1.73 2.13 3.04	0.05 0.07 0.10 0.15 0.31
(3) 10' T-Frames	A	None		0.0000	168.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	18.73 27.19 35.65 52.57 86.41	18.73 27.19 35.65 52.57 86.41	0.86 1.26 1.66 2.47 4.07
***									
RFS PD1142-2B	C	From Leg	1.50 0.00 4.00	0.0000	158.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.32 3.75 5.18 8.11 12.39	2.32 3.75 5.18 8.11 12.39	0.01 0.03 0.06 0.14 0.42
(1) 1.5' Standoff	C	None		0.0000	158.00	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.72 4.11 5.50 8.28 13.84	12.93 17.82 22.71 32.49 52.05	0.15 0.22 0.30 0.46 0.77
***									
RFS 458-2N	A	From Leg	4.00 0.00	0.0000	152.00	No Ice 1/2" Ice	3.00 4.03	3.00 4.03	0.02 0.04

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
			5.00			1" Ice	5.03	5.03	0.07
						2" Ice	6.26	6.26	0.15
						4" Ice	8.83	8.83	0.39
(1) 4' Standoff	A	None		0.0000	152.00	No Ice	2.72	12.93	0.15
						1/2" Ice	4.11	17.82	0.22
						1" Ice	5.50	22.71	0.30
						2" Ice	8.28	32.49	0.46
						4" Ice	13.84	52.05	0.77
****									
Telwave ANT450D6-9	B	From Leg	4.00	0.0000	151.00	No Ice	0.50	0.50	0.02
			0.00			1/2" Ice	0.90	0.90	0.02
			3.00			1" Ice	1.30	1.30	0.03
						2" Ice	2.10	2.10	0.04
						4" Ice	3.70	3.70	0.06
(1) 4' Standoff	B	None		0.0000	151.00	No Ice	2.72	12.93	0.15
						1/2" Ice	4.11	17.82	0.22
						1" Ice	5.50	22.71	0.30
						2" Ice	8.28	32.49	0.46
						4" Ice	13.84	52.05	0.77
***									
RFS 220-7N	C	From Leg	8.00	0.0000	130.00	No Ice	4.28	4.28	0.02
			0.00			1/2" Ice	6.20	6.20	0.05
			10.00			1" Ice	8.15	8.15	0.10
						2" Ice	12.08	12.08	0.22
						4" Ice	19.42	19.42	0.62
RFS PD1142-2B	A	From Leg	8.00	0.0000	130.00	No Ice	2.32	2.32	0.01
			0.00			1/2" Ice	3.75	3.75	0.03
			4.50			1" Ice	5.18	5.18	0.06
						2" Ice	8.11	8.11	0.14
						4" Ice	12.39	12.39	0.42
Telwave ANT450D6-9	B	From Leg	8.00	0.0000	130.00	No Ice	0.50	0.50	0.02
			0.00			1/2" Ice	0.90	0.90	0.02
			3.00			1" Ice	1.30	1.30	0.03
						2" Ice	2.10	2.10	0.04
						4" Ice	3.70	3.70	0.06
(3) 8' Standoffs	C	None		0.0000	130.00	No Ice	17.61	17.61	0.44
						1/2" Ice	24.67	24.67	0.67
						1" Ice	31.73	31.73	0.90
						2" Ice	45.85	45.85	1.37
						4" Ice	74.09	74.09	2.30
****									

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice
3	Dead+Wind 30 deg - No Ice
4	Dead+Wind 60 deg - No Ice
5	Dead+Wind 90 deg - No Ice

Comb. No.	Description
6	Dead+Wind 120 deg - No Ice
7	Dead+Wind 150 deg - No Ice
8	Dead+Wind 180 deg - No Ice
9	Dead+Wind 210 deg - No Ice
10	Dead+Wind 240 deg - No Ice
11	Dead+Wind 270 deg - No Ice
12	Dead+Wind 300 deg - No Ice
13	Dead+Wind 330 deg - No Ice
14	Dead+Ice+Temp
15	Dead+Wind 0 deg+Ice+Temp
16	Dead+Wind 30 deg+Ice+Temp
17	Dead+Wind 60 deg+Ice+Temp
18	Dead+Wind 90 deg+Ice+Temp
19	Dead+Wind 120 deg+Ice+Temp
20	Dead+Wind 150 deg+Ice+Temp
21	Dead+Wind 180 deg+Ice+Temp
22	Dead+Wind 210 deg+Ice+Temp
23	Dead+Wind 240 deg+Ice+Temp
24	Dead+Wind 270 deg+Ice+Temp
25	Dead+Wind 300 deg+Ice+Temp
26	Dead+Wind 330 deg+Ice+Temp
27	Dead+Wind 0 deg - Service
28	Dead+Wind 30 deg - Service
29	Dead+Wind 60 deg - Service
30	Dead+Wind 90 deg - Service
31	Dead+Wind 120 deg - Service
32	Dead+Wind 150 deg - Service
33	Dead+Wind 180 deg - Service
34	Dead+Wind 210 deg - Service
35	Dead+Wind 240 deg - Service
36	Dead+Wind 270 deg - Service
37	Dead+Wind 300 deg - Service
38	Dead+Wind 330 deg - Service

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	196 - 188	4.853	27	0.2106	0.0148
T2	188 - 168	4.499	27	0.2105	0.0149
T3	168 - 160	3.620	27	0.2046	0.0148
T4	160 - 140	3.276	27	0.1963	0.0145
T5	140 - 120	2.480	27	0.1679	0.0118
T6	120 - 100	1.815	27	0.1400	0.0099
T7	100 - 80	1.249	27	0.1137	0.0077
T8	80 - 60	0.798	27	0.0858	0.0057
T9	60 - 40	0.462	27	0.0616	0.0042
T10	40 - 20	0.219	27	0.0401	0.0027
T11	20 - 0	0.069	27	0.0177	0.0013

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
196.00	Lightning Rod	27	4.853	0.2106	0.0148	Inf
185.00	BXA-80080/4CF w/ Mount Pipe	27	4.367	0.2104	0.0149	Inf
168.00	AIR 21 B2A/B4P w/Mount Pipe	27	3.620	0.2046	0.0148	143964
158.00	RFS PD1142-2B	27	3.191	0.1937	0.0143	53585
152.00	RFS 458-2N	27	2.944	0.1856	0.0136	43165
151.00	Telwave ANT450D6-9	27	2.903	0.1841	0.0134	41849
130.00	RFS 220-7N	27	2.133	0.1536	0.0108	41003
120.00	(3) SBNHH-1D45B w/ Mount Pipe	27	1.815	0.1400	0.0099	56038

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	196 - 188	13.784	2	0.5980	0.0429
T2	188 - 168	12.780	2	0.5977	0.0430
T3	168 - 160	10.283	2	0.5807	0.0427
T4	160 - 140	9.306	2	0.5565	0.0418
T5	140 - 120	7.052	2	0.4750	0.0342
T6	120 - 100	5.169	2	0.3949	0.0286
T7	100 - 80	3.565	2	0.3222	0.0222
T8	80 - 60	2.282	2	0.2440	0.0165
T9	60 - 40	1.325	2	0.1755	0.0121
T10	40 - 20	0.630	2	0.1144	0.0077
T11	20 - 0	0.198	2	0.0504	0.0038

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
196.00	Lightning Rod	2	13.784	0.5980	0.0429	Inf
185.00	BXA-80080/4CF w/ Mount Pipe	2	12.404	0.5975	0.0430	423973
168.00	AIR 21 B2A/B4P w/Mount Pipe	2	10.283	0.5807	0.0427	51127
158.00	RFS PD1142-2B	2	9.066	0.5492	0.0413	18674
152.00	RFS 458-2N	2	8.364	0.5257	0.0392	15004
151.00	Telwave ANT450D6-9	2	8.250	0.5216	0.0388	14540
130.00	RFS 220-7N	2	6.069	0.4337	0.0311	14442
120.00	(3) SBNHH-1D45B w/ Mount Pipe	2	5.169	0.3949	0.0286	20315

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	196	Leg	A325N	0.7500	4	0.04	19.44	0.002 ✔	1.333	Bolt Tension

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
		Diagonal	A325N	0.6250	1	0.20	3.87	0.050 ✔	1.333	Member Block Shear
		Top Girt	A325N	0.6250	1	0.03	6.44	0.004 ✔	1	Bolt Shear
T2	188	Leg	A325N	0.8750	4	1.48	26.46	0.056 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.6250	1	1.41	6.44	0.219 ✔	1.333	Bolt Shear
T3	168	Leg	A325N	0.8750	4	3.29	26.46	0.125 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.6250	1	2.86	6.07	0.470 ✔	1.333	Member Block Shear
T4	160	Leg	A325N	0.8750	4	8.47	26.46	0.320 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.6250	1	3.26	4.55	0.716 ✔	1.333	Member Block Shear
T5	140	Leg	A325N	1.0000	4	13.35	34.56	0.386 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.6250	1	4.33	6.44	0.672 ✔	1.333	Bolt Shear
T6	120	Leg	A325N	1.0000	6	13.18	34.56	0.381 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.7500	1	5.98	7.97	0.750 ✔	1.333	Member Block Shear
T7	100	Leg	A325N	1.0000	6	17.50	34.56	0.506 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.7500	1	6.64	8.16	0.814 ✔	1.333	Member Bearing
T8	80	Leg	A325N	1.0000	8	15.82	34.56	0.458 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.7500	1	7.26	8.16	0.890 ✔	1.333	Member Bearing
T9	60	Leg	A325N	1.0000	8	18.63	34.56	0.539 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.7500	1	7.96	8.16	0.976 ✔	1.333	Member Bearing
T10	40	Leg	A325N	1.0000	8	21.44	34.56	0.620 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.7500	1	8.46	8.16	1.038 ✔	1.333	Member Bearing
T11	20	Leg	A354-BC	1.0000	10	19.30	32.40	0.596 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.7500	1	8.89	8.16	1.090 ✔	1.333	Member Bearing

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio P / P_a
T1	196 - 188	ROHN 3 STD	8.00	3.96	40.8 K=1.00	25.716	2.2285	-0.39	57.31	0.007 ✔
T2	188 - 168	ROHN 3 STD	20.00	4.00	41.3 K=1.00	25.655	2.2285	-7.78	57.17	0.136 ✔
T3	168 - 160	ROHN 3 STD	8.00	4.00	41.3 K=1.00	25.655	2.2285	-17.23	57.17	0.301 ✔
T4	160 - 140	ROHN 3 EH	20.04	4.99	52.7 K=1.00	23.928	3.0159	-40.71	72.17	0.564 ✔

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T5	140 - 120	ROHN 4 EH	20.04	6.68	54.3 K=1.00	23.671	4.4074	-63.30	104.33	0.607 ✔
T6	120 - 100	ROHN 5 EH	20.04	6.68	43.6 K=1.00	25.320	6.1120	-96.97	154.75	0.627 ✔
T7	100 - 80	ROHN 6 EHS	20.03	6.68	36.0 K=1.00	26.380	6.7133	-127.38	177.09	0.719 ✔
T8	80 - 60	ROHN 6 EH	20.04	10.02	54.8 K=1.00	23.589	8.4049	-153.13	198.26	0.772 ✔
T9	60 - 40	ROHN 8 EHS	20.03	10.02	40.6 K=1.00	25.754	9.8666	-180.42	254.10	0.710 ✔
T10	40 - 20	ROHN 8 EHS	20.03	10.02	40.6 K=1.00	25.754	9.8666	-207.62	254.10	0.817 ✔
T11	20 - 0	ROHN 8 EH	20.03	10.02	41.8 K=1.00	25.582	12.7627	-234.07	326.50	0.717 ✔

* DL controls

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	196 - 188	L1 3/4x1 3/4x3/16	7.70	3.56	124.4 K=1.00	9.646	0.6211	-0.20	5.99	0.033 ✔
T2	188 - 168	L2x2x1/4	7.72	3.57	112.2 K=1.02	11.377	0.9380	-1.41	10.67	0.132 ✔
T3	168 - 160	L2x2x1/4	7.77	3.61	113.1 K=1.02	11.252	0.9380	-2.89	10.55	0.274 ✔
T4	160 - 140	L2x2x3/16	9.85	4.79	145.8 K=1.00	7.023	0.7150	-3.25	5.02	0.646 ✔
T5	140 - 120	L2 1/2x2 1/2x1/4	12.43	6.08	148.5 K=1.00	6.773	1.1900	-4.33	8.06	0.537 ✔
T6	120 - 100	L2 1/2x2 1/2x1/4	14.23	6.92	169.0 K=1.00	5.228	1.1900	-5.99	6.22	0.964 ✔
T7	100 - 80	L3x3x1/4	15.99	7.73	156.7 K=1.00	6.081	1.4400	-6.64	8.76	0.759 ✔
T8	80 - 60	L3 1/2x3 1/2x1/4	19.26	9.48	164.0 K=1.00	5.553	1.6900	-7.26	9.39	0.774 ✔
T9	60 - 40	L3 1/2x3 1/2x1/4	21.03	10.25	177.2 K=1.00	4.753	1.6900	-8.03	8.03	0.999 ✔
T10	40 - 20	L4x4x1/4	22.81	11.14	168.2 K=1.00	5.279	1.9400	-8.56	10.24	0.836 ✔
T11	20 - 0	L4x4x1/4	24.62	12.06	182.0 K=1.00	4.509	1.9400	-9.05	8.75	1.035 ✔

Top Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	196 - 188	L1 3/4x1 3/4x3/16	6.60	6.07	212.2 K=1.00	3.317	0.6211	-0.03	2.06	0.014* ✔
T4	160 - 140	KL/R > 200 (C) - 5 L1 3/4x1 3/4x3/16	6.70	6.40	183.8 K=0.82	4.419	0.6211	-0.11	2.74	0.040 ✔

* DL controls

Tension Checks

Leg Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	196 - 188	ROHN 3 STD	8.00	3.96	40.8	30.000	2.2285	0.17	66.85	0.003 ✔
T2	188 - 168	ROHN 3 STD	20.00	4.00	41.3	30.000	2.2285	5.90	66.85	0.088 ✔
T3	168 - 160	ROHN 3 STD	8.00	4.00	41.3	30.000	2.2285	13.18	66.85	0.197 ✔
T4	160 - 140	ROHN 3 EH	20.04	4.99	52.7	30.000	3.0159	33.87	90.48	0.374 ✔
T5	140 - 120	ROHN 4 EH	20.04	6.68	54.3	30.000	4.4074	53.41	132.22	0.404 ✔
T6	120 - 100	ROHN 5 EH	20.04	6.68	43.6	30.000	6.1120	79.10	183.36	0.431 ✔
T7	100 - 80	ROHN 6 EHS	20.03	6.68	36.0	30.000	6.7133	105.00	201.40	0.521 ✔
T8	80 - 60	ROHN 6 EH	20.04	10.02	54.8	30.000	8.4049	126.53	252.15	0.502 ✔
T9	60 - 40	ROHN 8 EHS	20.03	10.02	40.6	30.000	9.8666	149.05	296.00	0.504 ✔
T10	40 - 20	ROHN 8 EHS	20.03	10.02	40.6	30.000	9.8666	171.50	296.00	0.579 ✔
T11	20 - 0	ROHN 8 EH	20.03	10.02	41.8	30.000	12.7627	193.03	382.88	0.504 ✔

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	196 - 188	L1 3/4x1 3/4x3/16	7.70	3.56	82.2	29.000	0.3604	0.20	10.45	0.019 ✔

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T2	188 - 168	L2x2x1/4	7.72	3.57	72.7	29.000	0.5629	1.27	16.32	0.078 ✓
T3	168 - 160	L2x2x1/4	7.77	3.61	73.5	29.000	0.5629	2.86	16.32	0.175 ✓
T4	160 - 140	L2x2x3/16	9.85	4.79	95.4	29.000	0.4308	3.26	12.49	0.261 ✓
T5	140 - 120	L2 1/2x2 1/2x1/4	12.43	6.08	96.7	29.000	0.7519	4.27	21.80	0.196 ✓
T6	120 - 100	L2 1/2x2 1/2x1/4	13.62	6.61	105.3	29.000	0.7284	5.98	21.12	0.283 ✓
T7	100 - 80	L3x3x1/4	15.99	7.73	101.5	29.000	0.9159	6.64	26.56	0.250 ✓
T8	80 - 60	L3 1/2x3 1/2x1/4	19.26	9.48	105.9	29.000	1.1034	7.26	32.00	0.227 ✓
T9	60 - 40	L3 1/2x3 1/2x1/4	21.03	10.25	114.3	29.000	1.1034	7.96	32.00	0.249 ✓
T10	40 - 20	L4x4x1/4	22.81	11.14	108.3	29.000	1.2909	8.46	37.44	0.226 ✓
T11	20 - 0	L4x4x1/4	24.62	12.06	117.0	29.000	1.2909	8.89	37.44	0.237 ✓

Top Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T4	160 - 140	L1 3/4x1 3/4x3/16	6.70	6.40	143.1	21.600	0.6211	0.10	13.42	0.007 ✓

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
T1	196 - 188	Leg	ROHN 3 STD	1	-0.39	57.31	0.7	Pass
T2	188 - 168	Leg	ROHN 3 STD	20	-7.78	76.21	10.2	Pass
T3	168 - 160	Leg	ROHN 3 STD	53	-17.23	76.21	22.6	Pass
T4	160 - 140	Leg	ROHN 3 EH	69	-40.71	96.20	42.3	Pass
T5	140 - 120	Leg	ROHN 4 EH	99	-63.30	139.07	45.5	Pass
T6	120 - 100	Leg	ROHN 5 EH	120	-96.97	206.28	47.0	Pass
T7	100 - 80	Leg	ROHN 6 EHS	141	-127.38	236.06	54.0	Pass
T8	80 - 60	Leg	ROHN 6 EH	162	-153.13	264.29	57.9	Pass
T9	60 - 40	Leg	ROHN 8 EHS	177	-180.42	338.72	53.3	Pass
T10	40 - 20	Leg	ROHN 8 EHS	192	-207.62	338.72	61.3	Pass
T11	20 - 0	Leg	ROHN 8 EH	207	-234.07	435.22	53.8	Pass
T1	196 - 188	Diagonal	L1 3/4x1 3/4x3/16	8	-0.20	7.99	2.5 3.8 (b)	Pass
T2	188 - 168	Diagonal	L2x2x1/4	25	-1.41	14.22	9.9 16.4 (b)	Pass
T3	168 - 160	Diagonal	L2x2x1/4	57	-2.89	14.07	20.6	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
							35.3 (b)	
T4	160 - 140	Diagonal	L2x2x3/16	75	-3.25	6.69	48.5	Pass
							53.7 (b)	
T5	140 - 120	Diagonal	L2 1/2x2 1/2x1/4	104	-4.33	10.74	40.3	Pass
							50.4 (b)	
T6	120 - 100	Diagonal	L2 1/2x2 1/2x1/4	123	-5.99	8.29	72.3	Pass
T7	100 - 80	Diagonal	L3x3x1/4	144	-6.64	11.67	56.9	Pass
							61.1 (b)	
T8	80 - 60	Diagonal	L3 1/2x3 1/2x1/4	165	-7.26	12.51	58.0	Pass
							66.7 (b)	
T9	60 - 40	Diagonal	L3 1/2x3 1/2x1/4	180	-8.03	10.71	75.0	Pass
T10	40 - 20	Diagonal	L4x4x1/4	195	-8.56	13.65	62.7	Pass
							77.8 (b)	
T11	20 - 0	Diagonal	L4x4x1/4	210	-9.05	11.66	77.6	Pass
							81.8 (b)	
T1	196 - 188	Top Girt	L1 3/4x1 3/4x3/16	5	-0.03	2.06	1.4	Pass
T4	160 - 140	Top Girt	L1 3/4x1 3/4x3/16	72	-0.11	3.66	3.0	Pass
							Summary	
						Leg (T10)	61.3	Pass
						Diagonal (T11)	81.8	Pass
						Top Girt (T4)	3.0	Pass
						Bolt Checks	**81.8**	Pass
						RATING =	**81.8**	**Pass**

FDH Engineering, Inc.
6521 Meridien Drive
Raleigh, NC 27616
919-755-1012
www.fdh-inc.com

Combined Foundation (Mat with Raised Piers)

v2.00 (04/29/2015)

Project Data		
Project Number:	*Project*	15CCME1400
Site Name:	*SiteName*	Mountain Street
Site Number:	*SiteNumber*	CT06426-A

Tower & Leg Reactions			
Tower Shear:	*TwrV*	44.0	kip
Tower Moment:	*TwrM*	4527.0	ft-kip
Tower Weight:	*TwrWt*	40.0	kip
Leg Compression:	*LegC*	241.0	kip
Leg Shear (leg in compression):	*LegVcomp*	27.0	kip
Uplift:	*LegU*	198.0	kip
Leg Shear (leg in tension):	*LegVup*	23.0	kip

Code & Design Parameters			
Standard:	*Standard*	TIA/EIA-222-F	
Maximum Stress Ratio:	*SRmaxSoil*	110%	
	SRmaxStr	105%	

Site Details			
Frost Depth:	*Frost*	3.333333333	ft
Water Depth:	*Water*		ft
Depth Neglected:	*Neglect*		ft
Seismic Design Category:	*SDC*	C	

Soil Parameters			
Bearing Pressure Capacity	*Bc*	2,000	psf
Ultimate or Allowable	*BcUltAll*	Ultimate	
Bearing Pressure Type:	*BcType*	Net	
Unit Weight:	*gamma*	120	pcf
Angle of Internal Friction:	*phi*	32	deg
Cohesion:	*cohesion*		psf
Sliding Friction Coefficient:	*mu*	0.5	
Passive Pressure Coefficient:	*Kp*	3.60	
Passive Pressure Coeff. Override:	*KpOver*	3.60	

Material Specifications			
Concrete Strength:	*fc*	3000	psi
Concrete Weight:	*ConcUnitWt*	150	pcf
Rebar Yield Strength:	*Fy*	60	ksi
Clear Cover:	*cc*	3	in

Design Dimensions			
Tower Width:	*TwrW*	23	ft
Number of Tower Legs:	*Legs*	3	
Tower/Foundation Offset:	*Offset*	FALSE	TRUE/FALSE
Bearing Depth:	*D*	3.5	ft
Pad Width:	*W*	36	ft
Pad Thickness:	*T*	4	ft
Pier Diameter/Width:	*Dp*	0	ft
Pier Shape:	*Shape*	Square	
Pier Extension:	*Ext*	0	ft

Reinforcement			
Pad Reinforcement Quantity:	*PadQty*	40	
Pad Reinforcement Size:	*PadSize*	7	
Pier Reinforcement Quantity:	*PierQty*	0	
Pier Reinforcement Size:	*PierSize*	0	
Pier Reinforcement Hook:	*PierHook*	FALSE	TRUE/FALSE
Tie Reinforcement Size:	*TieSize*	0	
Tie Reinforcement Spacing:	*TieSp*	0	in

Anchor Embedment			
Anchor Bolt Diameter:	*ABDia*	0	in
Anchor Bolt Length:	*ABL*	0	in
Anchor Bolt Exposed:	*ABExp*	0	in
Embedment Plate Diameter:	*ABPlateD*	0	in
Embedment Plate Thickness:	*ABPlateT*	0	in
Anchor Bolt Embedment Length:	*ABEmbed*	0	in

Checks		
Lateral:	*=LatRatio*	23.2%
Overturning:	*=OTRatio*	50.4%
Bearing:	*=QRatio*	75.4%
Pad One-Way Shear:	*=V1Ratio*	10.1%
Pad Two-Way Shear:	*=V2Ratio*	27.0%
Pad Flexure:	*=FlexRatio*	32.9%
Pad Minimum Reinforcement:	*=MinPadCheck*	OK
Pad Reinforcement Development:	*=DevPadCheck*	OK
Pier Compression:	*=CompRatio*	#DIV/0!
Pier Tension & Bending:	*=PierStrRatio*	NOT CHECKED
Pier Minimum Reinforcement:	*=MinPierCheck*	NOT CHECKED
Pier Reinforcement Development:	*=DevPierCCheck1*	NOT CHECKED
Pier Reinforcement Development:	*=DevPierTCheck1*	NOT CHECKED
Pier Reinforcement Development:	*=DevPierTCheck2*	NOT CHECKED
Pier Hook Development:	*=DevHookCheck*	NOT CHECKED
Anchor Embedment:	*=ABCheck*	NOT CHECKED
Soil Stress Ratio:		75.4%
Structure Stress Ratio:		#DIV/0!

SOLVE

Notes:
1. This sheet is a supplement to the BSPSQP Pad Pier sheet, which should be used to calculate actual overturning and bearing capacities.
2. If pier appears to be overstressed in bending and tension, use the Drilled Shaft Moment Capacity sheet to calculate a less conservative capacity.
3. Enter 0 for rebar quantity and 0 for anchor bolt length if unknown.
4. Buoyant weights for concrete and soil must be entered directly in the "ConcUnitWt" and "gamma" cells.

(Bearing and Stability Checks) Tool for TIA Rev F or G - Application (MP, SST with unitbase)

Site Data

Site ID:
Site Name:
Job No.:

Enter Load Factors Below:		
For P (DL)	1.2	<---- Enter Factor
For P,V, and M (WL)	1.35	<---- Enter Factor

Pad & Pier Data		
Base PL Dist. Above Pier:	0	in
Pier Dist. Above Grade:	0	in
Pad Bearing Depth, D:	3.5	ft
Pad Thickness, T:	4	ft
Pad Width=Length, L:	36	ft
Pier Cross Section Shape:	Round	<--Pull Down
Enter Pier Diameter:	0	ft
Concrete Density:	150.0	pcf
Pier Cross Section Area:	0.00	ft^2
Pier Height:	0.00	ft
Soil (above pad) Height:	0.00	ft

Soil Parameters		
Unit Weight, γ:	120.0	pcf
Ultimate Bearing Capacity, qn:	2.42	ksf
Strength Reduct. factor, ϕ:	0.75	
Angle of Friction, Φ:	32.0	degrees
Undrained Shear Strength, Cu:		ksf
Allowable Bearing: ϕ*qn:	1.82	ksf
Passive Pres. Coeff., Kp	3.25	

Forces/Moments due to Wind and Lateral Soil		
Minimum of (φ*Ultimate Pad Passive Force, Vu):	59.4	kips
Pad Force Location Above D:	1.33	ft
ϕ(Passive Pressure Moment):	79.20	ft-kips
Factored O.T. M(WL), "1.6W":	6319.4	ft-kips
Factored OT (MW-Msoil), M1	6240.15	ft-kips

Resistance due to Foundation Gravity		
Soil Wedge Projection grade, a:	0.00	ft
Sum of Soil Wedges Wt:	0.00	kips
Soil Wedges ecc, K1:	0.00	ft
Ftg+Soil above Pad wt:	777.6	kips
Unfactored (Total ftg-soil Wt):	777.60	kips
1.2D. **No Soil Wedges**.	981.12	kips
0.9D. **With Soil Wedges**	735.84	kips

Resistance due to Cohesion (Vertical)		
ϕ*(1/2*Cu)(Total Vert. Planes)	0.00	kips
Cohesion Force Eccentricity, K2	0.00	ft

Monopole Base Reaction Forces		
TIA Revision:	F	<--Pull Down
Unfactored DL Axial, PD:	40	kips
Unfactored WL Axial, PW:		kips
Unfactored WL Shear, V:	44	kips
Unfactored WL Moment, M:	4527	ft-kips

Load Factor	Shaft Factored Loads		
1.20	1.2D+1.6W, Pu:	48	kips
0.90	0.9D+1.6W, Pu:	36	kips
1.35	Vu:	59.4	kips
	Mu:	6111.45	ft-kips

1.2D+1.6W Load Combination, Bearing Results:

(**No Soil Wedges**) [Reaction+Conc+Soil]	981.12	P1="1.2D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil), M1	6240.15	ft-kips

Orthogonal Direction:

ecc1 = M1/P1 =	6.36	ft
Orthogonal qu=	1.29	ksf
qu/ϕ*qn Ratio=	**71.19%**	**Pass**

Diagonal Direction:

ecc2 = (0.707M1)/P1 =	4.50	ft
Diagonal qu=	1.35	ksf
qu/ϕ*qn Ratio=	**74.11%**	**Pass**

Run <-- Press Upon Completing All Input

Overturning Stability Check

0.9D+1.6W Load Combination, Bearing Results:

(**w/ Soil Wedges**) [Reaction+Conc+Soil]	735.84	P2="0.9D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil) - 0.9(M of Wedge + M of Cohesion), M2	6240.15	ft-kips

Orthogonal ecc3 = M2/P2 =	8.48	ft
Ortho Non Bearing Length,NBL=	16.96	ft
Orthogonal qu=	1.10	ksf
Diagonal qu=	1.28	ksf

Max Reaction Moment (ft-kips) so that qu=φ*qn = 100% Capacity Rating			
Actual M:	4527.00		
M Orthogonal:	6646.68	**68.11%**	**Pass**
M Diagonal:	6019.33	**75.21%**	**Pass**