Robinson+Cole

KENNETH C. BALDWIN

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Also admitted in Massachusetts

June 30, 2015

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

Re: **Notice of Exempt Modification – Facility Modification**
126 Ledge Road, Darien, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains fifteen (15) antennas at the 100-foot level of the existing 117-foot tower at 126 Ledge Road in Darien, Connecticut (the "Property"). The tower is owned by Crown Castle. The Council approved Cellco's use of this tower in 1992 (Docket No. 155). Cellco now intends to modify its facility by replacing nine (9) of its existing antennas with three (3) model 800 10735V01, 700 MHz antennas; three (3) model HBXX-6516DS-VTM, 1900 MHz antennas; and adding three (3) model HBXX-6516DS-VTM, 2100 MHz antennas, all at the same 100-foot level. Cellco also intends to replace three (3) existing remote radio heads ("RRHs"), one (1) each behind its 1900 MHz antennas and install six (6) new RRHs, one (1) each behind its 700 MHz and 2100 MHz antennas, and install two (2) HYBRIFLEX™ antenna cables inside the tower shaft. Included in Attachment 1 are specifications for Cellco's additional 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 Jayme Stevenson, First Selectman for the Town of Darien. The Town of Darien is the owner of the Property.

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. The replacement antennas and RRHs will be located at the 100-foot level on the 117-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 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. Far Field Approximation tables for each of Cellco's operating frequencies are included behind Attachment 2. The Far Field calculations demonstrate that Cellco's modified facility will operate well within the RF emissions limits established by the FCC.

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).

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:
Jayme Stevenson, Darien First Selectman
Tim Parks

ATTACHMENT 1

KATHREIN
SCALA DIVISION

800 10735V01

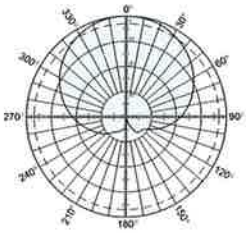
65° Single Band Panel Antenna, 6'

	Antenna
Single Band (MHz)	**698–894**
Dual Polarization	**X**
HPBW	**65°**
Adj. Electrical Downtilt Manual or optional remote control	**0°–10°**

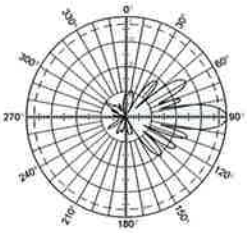
General specifications:

Frequency range	698–894 MHz
VSWR	<1.5:1
Impedance	50 ohms
Intermodulation (2x20w)	IM3: <-150 dBc
Polarization	+45° and -45°
Maximum input power	500 watts per input (at 50°C)
Connector	2 x 7-16 DIN female (long neck) (bottom mounted)
Isolation	>30 dB
Electrical downtilt	0–10 degrees (continuously adjustable)
See reverse for order information.	

698–894 MHz



Horizontal pattern
±45°- polarization



Vertical pattern
±45°- polarization
0°–10° electrical downtilt

Specifications:

	698–806 MHz	824–894 MHz
Gain	15.5 dBi	16 dBi
Front-to-back ratio	>30 dB (co-polar) 35 dB (average)	>30 dB (co-polar) 35 dB (average)
+45° and -45° polarization horizontal beamwidth	67° (half-power)	65° (half-power)
+45° and -45° polarization vertical beamwidth	11.3° (half-power)	10° (half-power)
Min. sidelobe suppression for first sidelobe above main beam average	0° 5° 10° T 16 17 17 dB 16 19 20 dB	0° 5° 10° T 18 17 16 dB 20 20 20 dB
Cross polar ratio Main direction 0° Sector ±60°	25 dB (typical) >11 dB, Average: 15 dB	25 dB (typical) >11 dB, Average: 15 dB

IRT specifications:

Logical interface ex factory[1]	3GPP/AISG 2.0
Protocols	AISG 1.1 and 3GPP/AISG 2.0 compliant
Hardware interface[2]	2 x 8 pin connector acc. IEC 60130-9; according to AISG: – IRT in (male): Control / Daisy chain in – IRT in (female): Daisy chain out
Power supply	10–30 V
Power consumption	<1 watt (standby) <8.5 watts (motor activated)
Adjustment time (full range)	40 sec.
Adjustment cycles	>50,000
Certification	FCC 15.107 Class B Computing Devices

[1] The protocol of the logical interface can be switched from 3GPP/AISG 2.0 to AISG 1.1 and vice versa with a vendor specific command. Start-up operation of the RCU 86010149 is possible in an RET system supporting AISG 1.1 or supporting 3GPP/AISG 2.0 after performing a layer 2 reset before address assignment. The protocol can also be changed as follows: AISG 1.1 to 3GPP: Enter "3GPP" into the additional data filed "Installer's ID" and perform a layer 7 reset or a power reset. 3GPP to AISG 1.1: Enter "AISG 1" into the additional datafield "Installer's ID" and perform a layer 2 reset or a power reset. After switching the protocol any other information can be entered into the "Installer's ID" field.

[2] The tightning torque for fixing the connector must be 0.5 – 1.0 Nm ('hand-tightened'). The connector should be tightened by hand only!

TÜV 11387-D
936.4273/a

RoHS Lead-Free Oct 19, 2012

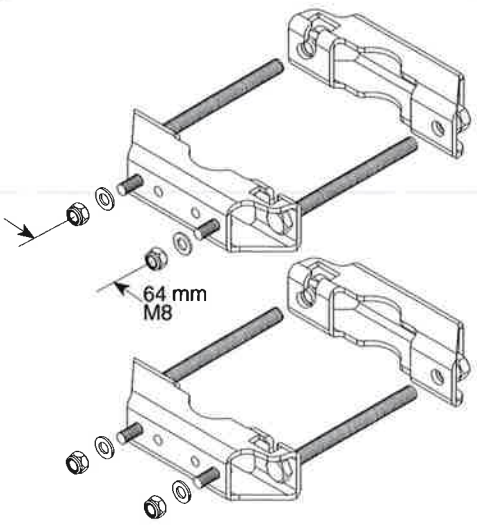
AISG Antenna Interface Standards Group

Kathrein Inc., Scala Division Post Office Box 4580 Medford, OR 97501 (USA) Phone: (541) 779-6500 Fax: (541) 779-3991
Email: communications@kathrein.com Internet: www.kathrein-scala.com

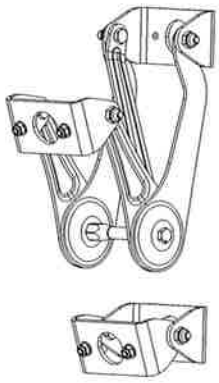
KATHREIN
SCALA DIVISION

800 10735V01

65° Single Band Panel Antenna, 6'



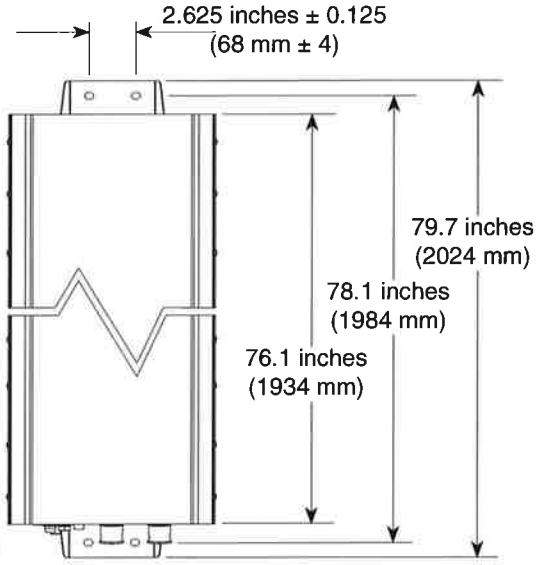
Mounting Brackets
for use with 2-point mount antennas
Mast dia. 2–4.5 inches (50–115 mm)
Weight: 4.4 lb (2 kg)



Mechanical Tilt Brackets
for use with 2-point mount antennas
Weight: 9.5 lb (4.3 kg)
(Model 850 10008)

Mechanical specifications:

Weight	30.9 lb (14 kg)	35.3 lb (16 kg) clamps included
Dimensions H x W x D	76.1 x 11.9 x 3.9 inches (1934 x 303 x 99 mm)	
Wind load Front/Side/Rear Mounting category	at 93 mph (150kph) 203 lbf / 70 lbf / 232 lbf (900 N / 310 N / 1030 N) H (Heavy)	
Wind survival rating*	150 mph (240 kph)	
Shipping dimensions	81.1 x 12.4 x 4.5 inches (2060 x 315 x 115 mm)	
Shipping weight	39.7 lb (18 kg)	
Mounting bracket	2-point hot-dip galvanized with stainless steel hardware for 2 to 4.5 inch (50 to 115 mm) OD masts.	

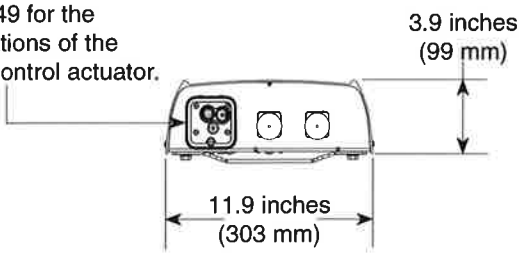


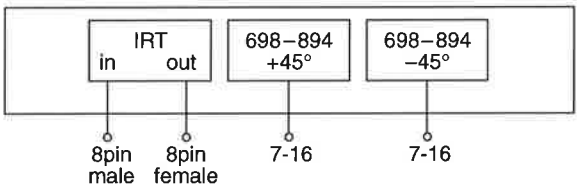
KATHREIN 860 10149

Tested To Comply With FCC Standards

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: Refer to part number 860 10149 for the specifications of the remote control actuator.





Order Information:

Model	Description
800 10735V01	Antenna with mounting bracket 0°–10° electrical downtilt
800 10735V01K	Antenna with mounting bracket and mechanical tilt bracket 0°–10° electrical downtilt

*Mechanical design is based on environmental conditions as stipulated in TIA-222-G-2 (December 2009) and/or ETS 300 019-1-4 which include the static mechanical load imposed on an antenna by wind at maximum velocity. See the Engineering Section of the catalog for further details.

All specifications are subject to change without notice. The latest specifications are available at www.kathrein-scala.com.

Kathrein Inc., Scala Division Post Office Box 4580 Medford, OR 97501 (USA) Phone: (541) 779-6500 Fax: (541) 779-3991
Email: communications@kathrein.com Internet: www.kathrein-scala.com

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

HBXX-6516DS-VTM

Andrew® Quad Port Antenna, 1710–2180 MHz, 65° horizontal beamwidth, RET compatible

- Each DualPol® array can be independently adjusted for greater flexibility
- Excellent gain, VSWR, front-to-back ratio, and PIM specifications for robust network performance
- Ideal choice for site collocations and tough zoning restrictions
- Great solution to maximize network coverage and capacity

Electrical Specifications

Frequency Band, MHz	**1710–1880**	**1850–1990**	**1920–2180**
Gain, dBi	17.7	18.0	18.0
Beamwidth, Horizontal, degrees	67	66	64
Beamwidth, Vertical, degrees	7.5	7.0	6.6
Beam Tilt, degrees	0–10	0–10	0–10
USLS, dB	18	18	18
Front-to-Back Ratio at 180°, dB	30	30	30
CPR at Boresight, dB	22	22	21
CPR at Sector, dB	8	9	9
Isolation, dB	30	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350
Polarization	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm

Electrical Specifications, BASTA*

Frequency Band, MHz	**1710–1880**	**1850–1990**	**1920–2180**
Gain by all Beam Tilts, average, dBi	17.2	17.2	17.5
Gain by all Beam Tilts Tolerance, dB	±0.3	±0.3	±0.5
Gain by Beam Tilt, average, dBi	0 ° | 17.0 5 ° | 17.3 10 ° | 17.0	0 ° | 17.1 5 ° | 17.4 10 ° | 17.0	0 ° | 17.4 5 ° | 17.7 10 ° | 17.2
Beamwidth, Horizontal Tolerance, degrees	±2.7	±2.3	±3.5
Beamwidth, Vertical Tolerance, degrees	±0.5	±0.4	±0.4
USLS, dB	18	19	19
Front-to-Back Total Power at 180° ± 30°, dB	26	26	26
CPR at Boresight, dB	22	22	22
CPR at Sector, dB	9	9	9

* 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® quad
Band	Single band
Brand	DualPol® | Teletilt®
Operating Frequency Band	1710 – 2180 MHz

Product Specifications

HBXX-6516DS-VTM

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Low loss circuit board
Radome Material	PVC, UV resistant
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	4
Wind Loading, maximum	419.0 N @ 150 km/h 94.2 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph

Dimensions

Depth	166.0 mm | 6.5 in
Length	1297.0 mm | 51.1 in
Width	305.0 mm | 12.0 in
Net Weight	13.9 kg | 30.6 lb

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 2.0 Actuator	HBXX-6516DS-A2M
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

600899A-2 — 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.

Alcatel-Lucent RRH2x40-07-U

REMOTE RADIO HEAD

The Alcatel-Lucent RRH2x40-07-U is a high-power, small form-factor Remote Radio Head (RRH) operating in the North American Digital Dividend / 700MHz frequency band (3GPP Band 13). The Alcatel-Lucent RRH2x40-07-U is designed with an eco-efficient approach, providing operators with the means to achieve high quality and capacity coverage with minimum site requirements.

A distributed eNodeB expands 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 an eNodeB to be installed separately, within the same site or several kilometres apart.

The Alcatel-Lucent RRH2x40-07-U 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. The Alcatel-Lucent RRH2x40-07-U has two transmit RF paths, 40 W RF output power per transmit path, and is designed to manage up to two-way receive diversity. The device is ideally suited to support macro coverage, with multiple-input multiple-output (MIMO) 2x2 operation in up to 10 MHz of bandwidth.

The Alcatel-Lucent RRH2x40-07-U is designed to make available all the benefits of a distributed eNodeB, with excellent RF characteristics, with low capital expenditures (CAPEX) and low operating expenditures (OPEX). The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment or require costly cranes to be employed, leaving coverage holes. However, many of these sites can host an Alcatel-Lucent RRH2x40-07-U installation, providing more flexible site selection and improved network quality along with greatly reduced installation time and costs.

Fast, low-cost installation and deployment

The Alcatel-Lucent RRH2x40-07-U is a zero-footprint solution and operates noise-free, simplifying negotiations with site property owners and minimizing environmental impacts. Installation can easily be done by a single person because the Alcatel-Lucent RRH2x40-07-U is compact and weights less than 23 kg (50 lb), 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 — a fraction of the time required for a traditional BTS.

Excellent RF performance

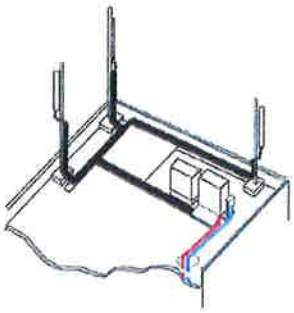
Because of its small size and weight, the Alcatel-Lucent RRH2x40-07-U can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-07-U where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation costs are reduced or eliminated, and there is no need for a Tower Mounted Amplifier (TMA) because losses introduced by the RF feeder are greatly reduced. The Alcatel-Lucent RRH2x40-07-U provides more RF power while at the same time consuming less electricity.

Features

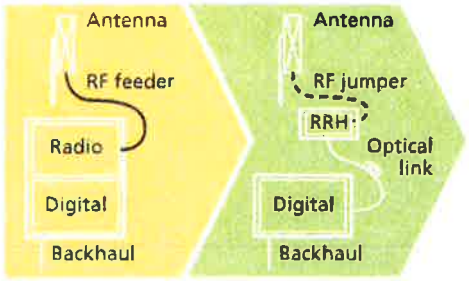
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless), noise-free, and heaterless unit
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

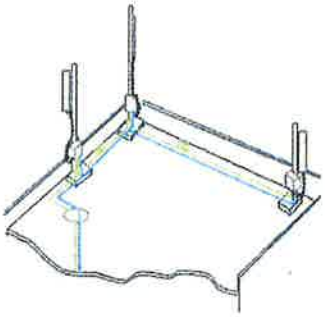
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility to network planning



Macro



RRH for space-constrained cell sites



Distributed

Technical specifications

Physical dimensions

- Height: 390 mm (15.4 in.)
- Width: 380 mm (15 in.)
- Depth: 210 mm (8.2 in.)
- Weight (without mounting kit): less than 23 kg (50 lb)

Power

- Power supply: -48V

Operating environment

- Outdoor temperature range:
  - ¬ With solar load: -40°C to +50°C (-40°F to +122°F)
  - ¬ Without solar load: -40°C to +55°C (-40°F to +131°F)
- Passive convection cooling (no fans)
- Enclosure protection
  - ¬ IP65 (International Protection rating)

RF characteristics

- Frequency band: 700 MHz; 3GPP Band 13
- Bandwidth: up to 10 MHz
- RF output power at antenna port:
  - ¬ 40 W nominal RF power for each Tx port
- Rx diversity: 2-way or 4-way
- Noise figure: below 2.5 dB typical
- ALD features
  - ¬ TMA
  - ¬ Remote electrical tilt (RET) support (AISG v2.0)

Optical characteristics

Type/number of fibers

- Up to 3.12 Gb/s line bit rate
- Single-mode variant
  - ¬ One SM fiber (9/125 µm) per RRH2x, carrying UL and DL using CWDM (at 1550/1310 nm)
- Multi-mode variant
  - ¬ Two MM fibers (50/125 µm) per RRH2x: one carrying UL, the other carrying DL (at 850 nm)

Optical fiber length

- Up to 500 m (0.31 mi), using MM fiber
- Up to 20 km (12.43 mi), using SM fiber

Alarms and ports

- Six external alarms
- Two optical ports to support daisy-chaining

Alcatel·Lucent

PCS RF MODULES

RRH1900 2X60 - HW CHARACTERISTICS

LA6.0.1/13.3

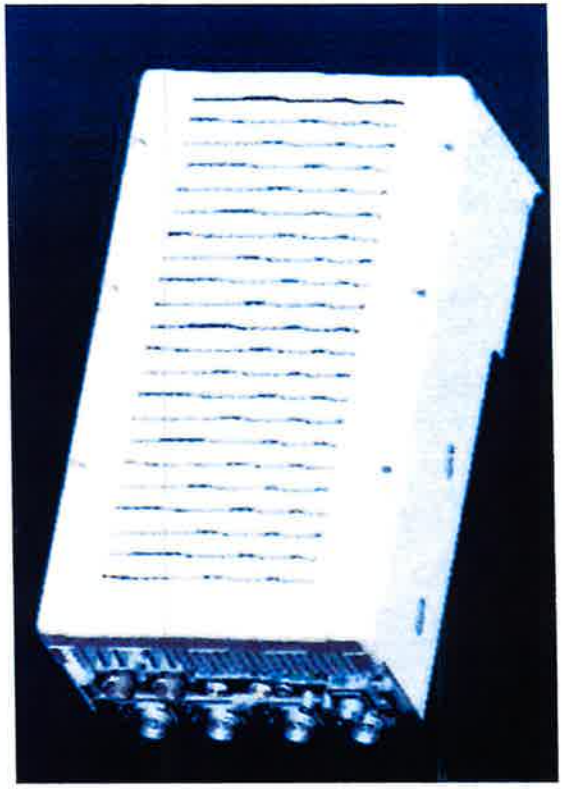
	RRH2x60
RF Output Power	2x60W
Instantaneous Bandwidth	20MHz
Transmitter	2 TX
Receiver 1900 HW version 1900A HW version	2 Branch RX – LA6.0.1 4 Branch RX – LR13.3
Features	AISG 2.0 for RET/TMA
	Internal Smart Bias-T
Power	-48VDC
CPRI Ports	2 CPRI Rate 3 Ports
External Alarms	4 External User Alarms
Monitor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

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.

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.

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).

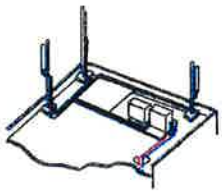
The Alcatel-Lucent RRH2x60-AWS is a very cost-effective solution to deploy LTE MIMO.

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.

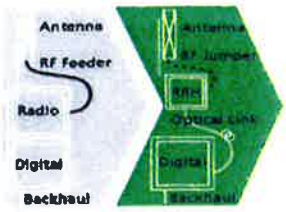
The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment. However, many of these sites can host an Alcatel-Lucent RRH2x60-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation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

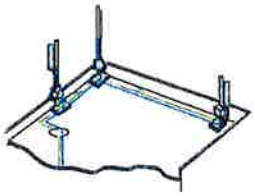
Installation can easily be done by a single person as the Alcatel-Lucent RRH2x60-AWS is compact and weighs about 20 kg, eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day.



Macro



RRH for space-constrained cell sites



Distributed

- 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

- 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.

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-99-689 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)

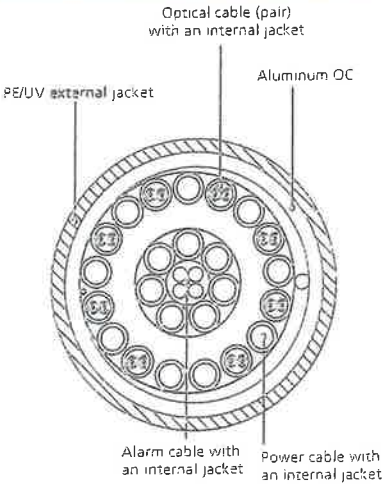


Figure 2: Construction Detail

* This data is provisional and subject to change

ATTACHMENT 2

Far Field Approximation
with downtilt variation

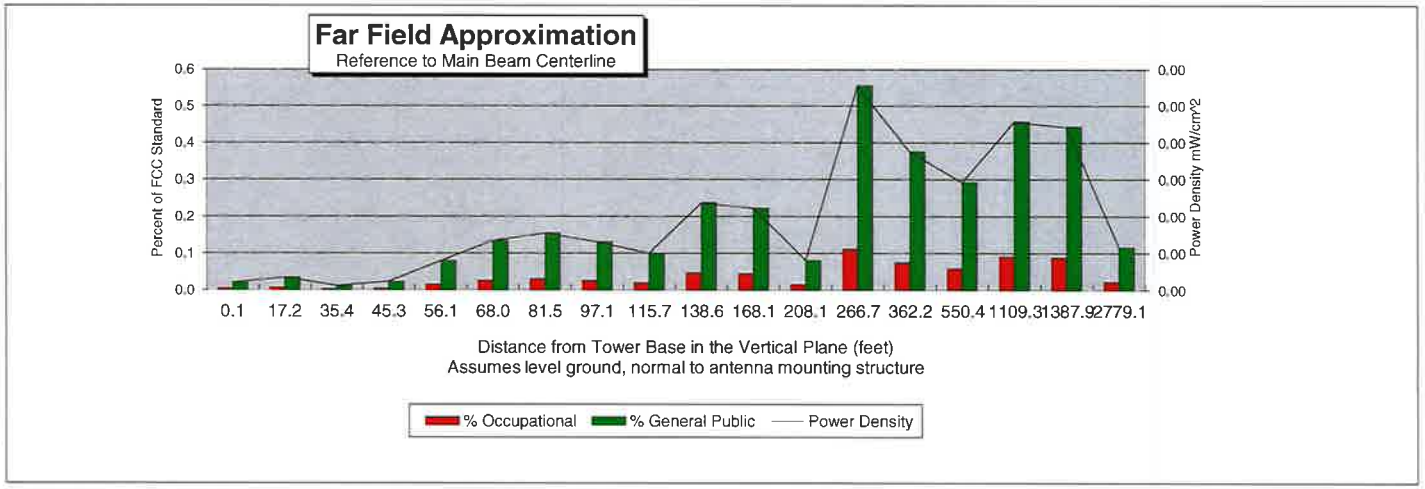
Estimated Radiated Emission

Single Emitter Far Field Model

Dipole / Wire/ Yagi Antenna Types

Location:	DARIEN, CT
Site #:	5-0073
Date:	06/30/15
Name:	Ryan Ulanday
File Name:	DARIEN, CT - FF Power

Operating Freq. (MHz)	**746.0**
Antenna Height (ft):	**100.0**
Antenna Gain (dBi):	**15.2**
Antenna Size (in.):	**76.1**
Downtilt (degrees):	**0.0**
Feedline Loss (dB):	**0.0**
Power @ J4 (w):	**613.0**
Number Channels:	**1.0**



This approximation is only valid in the far field, which begins at: 71.9 Feet

Enter Main Beam Distance in feet below:

Calc Angle	90.0	80.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0	10.0	5.0	4.0	2.0	
Solve for r, dx to antenna	97.0	98.5	103.2	107.1	112.0	118.5	126.7	137.2	151.0	169.2	194.1	229.6	283.7	375.0	558.9	1113.5	1391.3	2780.8	
Distance from Antenna Structure Base in Horizontal plane	0.1	17.2	35.4	45.3	56.1	68.0	81.5	97.1	115.7	138.6	168.1	208.1	266.7	362.2	550.4	1109.3	1387.9	2779.1	#NUM!
Angle from Main Beam (reference to horizontal plane)	90	80	70	65	60	55	50	45	40	35	30	25	20	15	10	5	4	2	0
dB down from centerline (referenced to centerline)	36.76	34.35	38.52	35.34	29.54	26.8	25.59	25.63	25.99	21.21	20.29	23.24	13.03	12.3	9.92	2	0.2	0	0
Reflection Coefficient (1 to 4, 2.56 typical)	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Power Density (mW/cm^2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#NUM!
Percent of Occupational Standard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	#NUM!
Percent of General Population Standard	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.2	0.2	0.1	0.6	0.4	0.3	0.5	0.4	0.1	#NUM!

Antenna Type 80010735V01
Max% 0.56%

Instructions:

1) Fill in Site Location, Site number, Date, Name of Person Responsible for Date, and enter File Name to ba saved as.
2) References to J4 refer to a point where the transmission line exits the equipment shelter and proceeds to the antenna(s). There is typically a connector located here where power measurements are made.
3) Enter Antenna Height (in feet to bottom of antenna), Antenna Gain (expressed as dBi, add 2.17 to dBd to obtain dBi), Antenna Size (vertical size in inches), Downtilt (in Degrees, enter zero if none), Feedline loss from J4 to Antenna, and J4 Pc
4) From manufacturer's plots, or data sheet, input Angle from mainbeam and dB below mainbeam centerline.
5) Enter Reflection coefficient (2.56 would be typical, 1 for free space)
6) Spreadsheet calculates actual power density, then relates as Occupational or General Population percentage of FCC Standard.
7) An odd distance may be entered in the rightmost column of the lower table.

Far Field Approximation
with downtilt variation

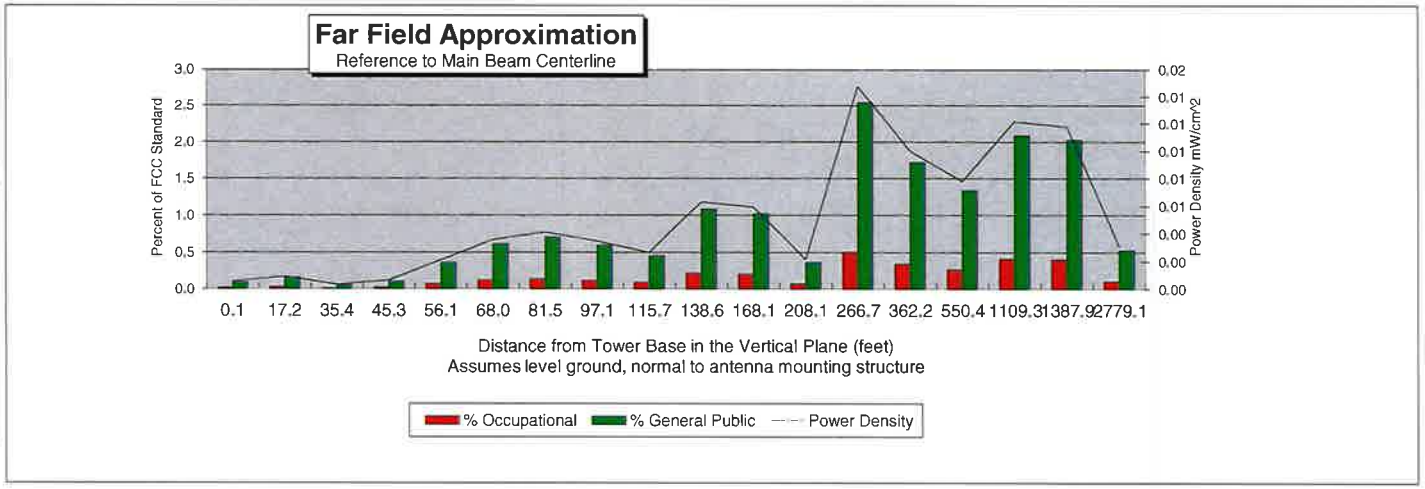
Estimated Radiated Emission

Single Emitter Far Field Model

Dipole / Wire/ Yagi Antenna Types

Location:	DARIEN, CT
Site #:	5-0073
Date:	06/30/15
Name:	Ryan Ulanday
File Name:	DARIEN, CT - FF Power

Operating Freq. (MHz)	**869.0**
Antenna Height (ft):	**100.0**
Antenna Gain (dBi):	**15.7**
Antenna Size (in.):	**48.0**
Downtilt (degrees):	**0.0**
Feedline Loss (dB):	**0.0**
Power @ J4 (w):	**2961.0**
Number of Channels:	**9.0**



This approximation is only valid in the far field, which begins at: 28.7 Feet

Enter Main Beam Distance in feet below:

Calc Angle	90.0	80.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0	10.0	5.0	4.0	2.0	
Solve for r, dx to antenna	97.0	98.5	103.2	107.1	112.0	118.5	126.7	137.2	151.0	169.2	194.1	229.6	283.7	375.0	558.9	1113.5	1391.3	2780.8	
Distance from Antenna Structure Base in Horizontal plane	0.1	17.2	35.4	45.3	56.1	68.0	81.5	97.1	115.7	138.6	168.1	208.1	266.7	362.2	550.4	1109.3	1387.9	2779.1	#NUM!
Angle from Main Beam (reference to horizontal plane)	90	80	70	65	60	55	50	45	40	35	30	25	20	15	10	5	4	2	0
dB down from centerline (referenced to centerline)	36.76	34.35	38.52	35.34	29.54	26.8	25.59	25.63	25.99	21.21	20.29	23.24	13.03	12.3	9.92	2	0.2	0	0
Reflection Coefficient (1 to 4, 2.56 typical)	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Power Density (mW/cm^2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.00	#NUM!
Percent of Occupational Standard	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.5	0.3	0.3	0.4	0.4	0.1	#NUM!
Percent of General Population Standard	0.1	0.2	0.1	0.1	0.4	0.6	0.7	0.6	0.5	1.1	1.0	0.4	2.5	1.7	1.3	2.1	2.0	0.5	#NUM!

Antenna Type DB844G65ZAXY
Max% 2.55%

Instructions:

1) Fill in Site Location, Site number, Date, Name of Person Responsible for Date, and enter File Name to ba saved as.
2) References to J4 refer to a point where the transmission line exits the equipment shelter and proceeds to the antenna(s). There is typically a connector located here where power measurements are made.
3) Enter Antenna Height (in feet to bottom of antenna), Antenna Gain (expressed as dBi, add 2.17 to dBd to obtain dBi), Antenna Size (vertical size in inches), Downtilt (in Degrees, enter zero if none), Feedline loss from J4 to Antenna, and J4 P(
4) From manufacturer's plots, or data sheet, input Angle from mainbeam and dB below mainbeam centerline.
5) Enter Reflection coefficient (2.56 would be typical, 1 for free space)
6) Spreadsheet calculates actual power density, then relates as Occupational or General Population percentage of FCC Standard.
7) An odd distance may be entered in the rightmost column of the lower table.

Far Field Approximation
with downtilt variation

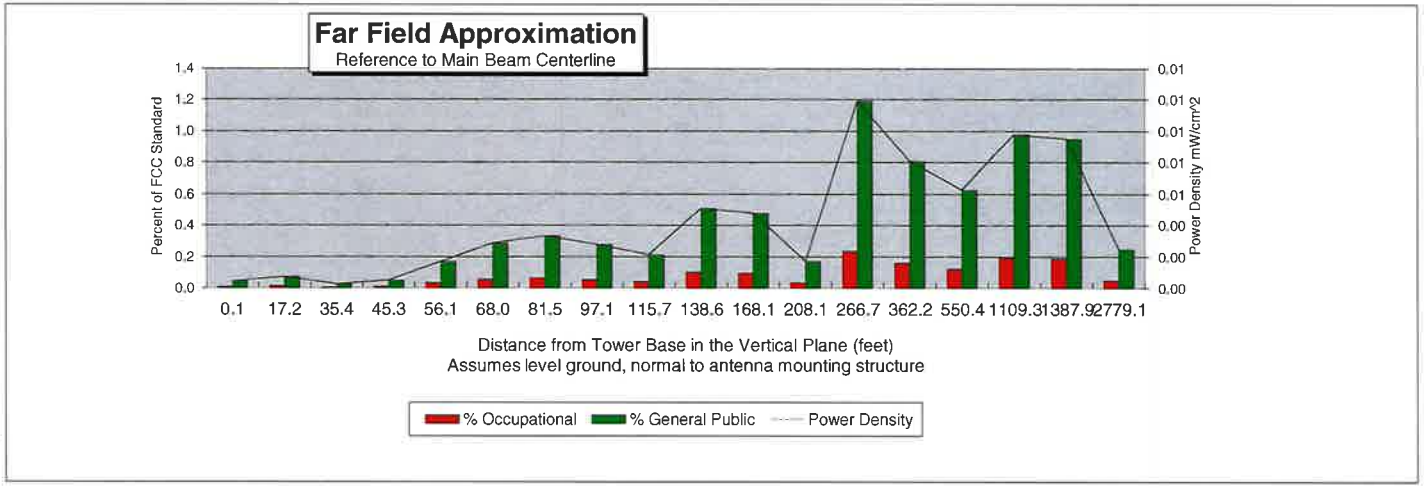
Estimated Radiated Emission

Single Emitter Far Field Model

Dipole / Wire/ Yagi Antenna Types

Location:	DARIEN, CT
Site #:	5-0073
Date:	06/30/15
Name:	Ryan Ulanday
File Name:	DARIEN, CT - FF Power

Operating Freq. (MHz)	**1971.0**
Antenna Height (ft):	**100.0**
Antenna Gain (dBi):	**17.2**
Antenna Size (in.):	**50.9**
Downtilt (degrees):	**0.0**
Feedline Loss (dB):	**0.0**
Power @ J4 (w):	**1691.0**
Number of Channels:	**1.0**



This approximation is only valid in the far field, which begins at: 32.2 Feet

Enter Main Beam Distance in feet below:

Calc Angle	90.0	80.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0	10.0	5.0	4.0	2.0	
Solve for r, dx to antenna	97.0	98.5	103.2	107.1	112.0	118.5	126.7	137.2	151.0	169.2	194.1	229.6	283.7	375.0	558.9	1113.5	1391.3	2780.8	
Distance from Antenna Structure Base in Horizontal plane	0.1	17.2	35.4	45.3	56.1	68.0	81.5	97.1	115.7	138.6	168.1	208.1	266.7	362.2	550.4	1109.3	1387.9	2779.1	#NUM!
Angle from Main Beam (reference to horizontal plane)	90	80	70	65	60	55	50	45	40	35	30	25	20	15	10	5	4	2	0
dB down from centerline (referenced to centerline)	36.76	34.35	38.52	35.34	29.54	26.8	25.59	25.63	25.99	21.21	20.29	23.24	13.03	12.3	9.92	2	0.2	0	0
Reflection Coefficient (1 to 4, 2.56 typical)	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Power Density (mW/cm^2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.00	#NUM!
Percent of Occupational Standard	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.2	0.2	0.1	0.2	0.2	0.0	#NUM!
Percent of General Population Standard	0.0	0.1	0.0	0.0	0.2	0.3	0.3	0.3	0.2	0.5	0.5	0.2	1.2	0.8	0.6	1.0	0.9	0.2	#NUM!

Antenna Type HBXX-6516DS-A2M
Max% 1.19%

Instructions:

1) Fill in Site Location, Site number, Date, Name of Person Responsible for Date, and enter File Name to ba saved as.
2) References to J4 refer to a point where the transmission line exits the equipment shelter and proceeds to the antenna(s). There is typically a connector located here where power measurements are made.
3) Enter Antenna Height (in feet to bottom of antenna), Antenna Gain (expressed as dBi, add 2.17 to dBd to obtain dBi), Antenna Size (vertical size in inches), Downtilt (in Degrees, enter zero if none), Feedline loss from J4 to Antenna, and J4 Pc
4) From manufacturer's plots, or data sheet, input Angle from mainbeam and dB below mainbeam centerline.
5) Enter Reflection coefficient (2.56 would be typical, 1 for free space)
6) Spreadsheet calculates actual power density, then relates as Occupational or General Population percentage of FCC Standard.
7) An odd distance may be entered in the rightmost column of the lower table.

Far Field Approximation
with downtilt variation

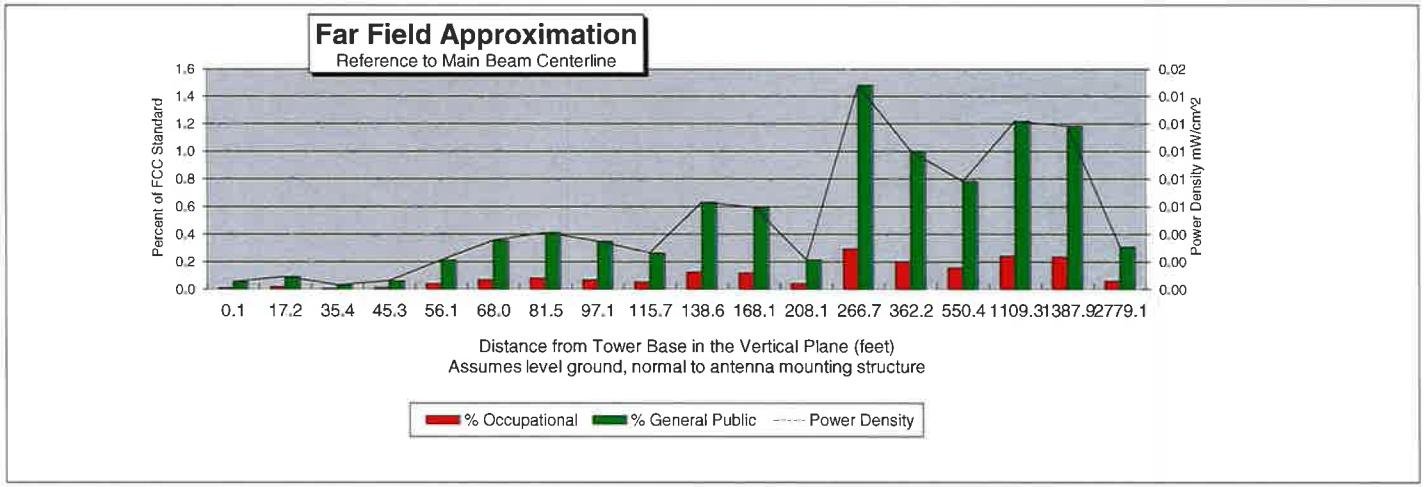
Estimated Radiated Emission

Single Emitter Far Field Model

Dipole / Wire/ Yagi Antenna Types

Location:	DARIEN, CT
Site #:	5-0073
Date:	06/30/15
Name:	Ryan Ulanday
File Name:	DARIEN, CT - FF Power

Operating Freq. (MHz)	**2110.0**
Antenna Height (ft):	**100.0**
Antenna Gain (dBi):	**18.0**
Antenna Size (in.):	**50.9**
Downtilt (degrees):	**0.0**
Feedline Loss (dB):	**0.0**
Power @ J4 (w):	**1750.0**
Number Channels:	**1**



This approximation is only valid in the far field, which begins at: 32.2 Feet

Enter Main Beam Distance in feet below:

Calc Angle	90.0	80.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0	10.0	5.0	4.0	2.0	
Solve for r, dx to antenna	97.0	98.5	103.2	107.1	112.0	118.5	126.7	137.2	151.0	169.2	194.1	229.6	283.7	375.0	558.9	1113.5	1391.3	2780.8	
Distance from Antenna Structure Base in Horizontal plane	0.1	17.2	35.4	45.3	56.1	68.0	81.5	97.1	115.7	138.6	168.1	208.1	266.7	362.2	550.4	1109.3	1387.9	2779.1	#NUM!
Angle from Main Beam (reference to horizontal plane)	90	80	70	65	60	55	50	45	40	35	30	25	20	15	10	5	4	2	0
dB down from centerline (referenced to centerline)	36.76	34.35	38.52	35.34	29.54	26.8	25.59	25.63	25.99	21.21	20.29	23.24	13.03	12.3	9.92	2	0.2	0	0
Reflection Coefficient (1 to 4, 2.56 typical)	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Power Density (mW/cm^2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.00	#NUM!
Percent of Occupational Standard	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.3	0.2	0.2	0.2	0.2	0.1	#NUM!
Percent of General Population Standard	0.1	0.1	0.0	0.1	0.2	0.4	0.4	0.3	0.3	0.6	0.6	0.2	1.5	1.0	0.8	1.2	1.2	0.3	#NUM!

Antenna Type HBXX-6516DS-A2M
Max% 1.48%

Instructions:

1) Fill in Site Location, Site number, Date, Name of Person Responsible for Date, and enter File Name to ba saved as.
2) References to J4 refer to a point where the transmission line exits the equipment shelter and proceeds to the antenna(s). There is typically a connector located here where power measurements are made.
3) Enter Antenna Height (in feet to bottom of antenna), Antenna Gain (expressed as dBi, add 2.17 to dBd to obtain dBi), Antenna Size (vertical size in inches), Downtilt (in Degrees, enter zero if none), Feedline loss from J4 to Antenna, and J4 Pc
4) From manufacturer's plots, or data sheet, input Angle from mainbeam and dB below mainbeam centerline.
5) Enter Reflection coefficient (2.56 would be typical, 1 for free space)
6) Spreadsheet calculates actual power density, then relates as Occupational or General Population percentage of FCC Standard.
7) An odd distance may be entered in the rightmost column of the lower table.

ATTACHMENT 3

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS
250 East Broad Street • Suite 600 • Columbus, Ohio 43215-3708

Date: **May 28, 2015**

Adam Winters
Crown Castle
3530 Toringdon Way Suite 300
Charlotte, NC 28277

Paul J Ford and Company
250 E. Broad Street, Suite 600
Columbus, OH 43215
614.221.6679

Subject: **Structural Analysis Report**

Carrier Designation:	***Verizon Wireless* Co-Locate**	
	Carrier Site Number:	/118143
	Carrier Site Name:	Darien CT
Crown Castle Designation:	**Crown Castle BU Number:**	806352
	Crown Castle Site Name:	BRG 302 943052
	Crown Castle JDE Job Number:	326553
	Crown Castle Work Order Number:	1067140
	Crown Castle Application Number:	286528 Rev. 5
Engineering Firm Designation:	**Paul J Ford and Company Project Number:**	37515-1078.003.7805
Site Data:	**126 Ledge Road, DARIEN, Fairfield County, CT** **Latitude *41° 4' 20.75"*, Longitude *-73° 28' 41.4"*** **117 Foot - Monopole Tower**	

Dear Adam Winters,

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 791253, in accordance with application 286528, revision 5.

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:

LC4.5: Existing + Proposed Equipment w/ Proposed Modifications **Sufficient Capacity**
Note: See Table I and Table II for the proposed and existing loading, respectively.

The structural analysis was performed for this tower in accordance with the requirements of the 2005 Connecticut Building Code with 2013 amendments and the TIA/EIA-222-F Structural Standards for Steel Antenna Towers and Antenna Supporting Structures using a fastest mile wind speed of 85 mph with no ice, 37.6 mph with 0.75 inch ice thickness and 50 mph under service loads.

All modifications and equipment proposed in this report shall be installed in accordance with the referenced drawings for the determined available structural capacity to be effective.

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.

Respectfully submitted by:

Kyle Thorpe, E.I.
Structural Designer

5-29-15

tnxTower Report - version 6.1.4.1

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 117 ft Monopole tower designed by VALMONT in May of 1992. The tower was originally designed for a wind speed of 90 mph per TIA/EIA-222-E. The tower has been modified multiple times in the past to accommodate additional loading.

2) ANALYSIS CRITERIA

The structural analysis was performed for this tower in accordance with the requirements of the 2005 Connecticut Building Code and the TIA/EIA-222-F Structural Standards for Steel Antenna Towers and Antenna Supporting Structures using a fastest mile wind speed of 85 mph with no ice, 37.6 mph with 0.75 inch ice thickness and 50 mph under service loads.

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)	Note
100.0	100.0	3	alcatel lucent	RRH2X40-07-U	2 (I)	1-5/8	1
		3	alcatel lucent	RRH2X60-AWS			
		3	alcatel lucent	RRH2X60-PCS			
		6	andrew	HBXX-6516DS-A2M w/ Mount Pipe			
		3	kathrein	800 10735V01 w/ Mount Pipe			
		1	rfs celwave	DB-T1-6Z-8AB-0Z			

Notes:
1) Proposed Equipment

Table 2 - Existing 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
117.0	118.0	3	rfs celwave	APXVSPP18-C-A20 w/ Mount Pipe	3 (I)	1-1/4	1
	117.0	3	alcatel lucent	800 EXTERNAL NOTCH FILTER			
		9	rfs celwave	ACU-A20-N			
		1	tower mounts	Pipe Mount [PM 601-3]			
115.0	115.0	3	alcatel lucent	TME-800MHZ RRH	-	-	1
		3	alcatel lucent	TME-PCS 1900MHz 4x45W-65MHz			
		1	tower mounts	Side Arm Mount [SO 102-3]			
110.0	110.0	3	ericsson	ERICSSON AIR 21 B2A B4P w/ Mount Pipe	12 (I) 1 (E)	1-1/4 1-1/4	1
		3	ericsson	KRY 112 144/1			
		1	tower mounts	Pipe Mount [PM 601-3]			

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
100.0	100.0	3	alcatel lucent	RRH2X40-AWS	1 (I)	1/2	2
		3	andrew	LNX-6514DS-T4M w/ Mount Pipe			
		3	rymsa wireless	MG D3-800TV w/ Mount Pipe			
		6	decibel	DB844G65ZAXY w/ Mount Pipe	12 (I) 1 (E)	7/8 1-1/4	1
		1	gps	GPS_A			
		1	rfs celwave	DB-T1-6Z-8AB-0Z			
		6	rfs celwave	FD9R6004/2C-3L			
		1	tower mounts	Platform Mount [LP 715-1]			
93.0	95.0	1	andrew	VHLP1-23	4 (E)	1/2	1
	94.0	1	andrew	VHLP2-11			
		1	andrew	VHLP2.5-11			
	93.0	1	tower mounts	Pipe Mount [PM 601-3]			
	92.0	1	andrew	VHLP1-23			
88.0	89.0	6	ericsson	RRUS-11	1 (C) 2 (C) 12 (I)	3/8 5/8 1-1/4	1
		6	powerwave technologies	7770.00 w/ Mount Pipe			
		6	powerwave technologies	LGP13519			
		6	powerwave technologies	LGP2140X			
		2	powerwave technologies	P65-16-XLH-RR w/ Mount Pipe			
		1	powerwave technologies	P65-17-XLH-RR w/ Mount Pipe			
		1	raycap	DC6-48-60-18-8F			
	88.0	1	tower mounts	Platform Mount [LP 715-1]			
81.0	81.0	3	kathrein	800 10504 w/ Mount Pipe	6 (E)	1-5/8	1
		1	tower mounts	Pipe Mount [PM 601-3]			
72.0	72.0	3	andrew	LBX-9012DS-VTM w/ Mount Pipe	-	-	1
		3	decibel	DB844H90E-XY w/ Mount Pipe			
		1	tower mounts	Platform Mount (LP 101-1)			

Notes:
1) Existing Equipment
2) Equipment to be Removed
(E) Coax mounted externally and exposed to the wind. See coax layout in Appendix B.
(I) Coax mounted internally and shielded from the wind. See coax layout in Appendix B.
(C) Coax mounted inside a conduit and is shielded from the wind. See coax layout in Appendix B.

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	FDH, 1307951600, 9/26/13	217769	CCISITES
4-POST-MODIFICATION INSPECTION	Sabre, 11-1114, 12/7/10	2785508	CCISITES
4-POST-MODIFICATION INSPECTION	TEP, 131001.806352, 11/7/13	4069331	CCISITES
4-POST-MODIFICATION INSPECTION	TEP, 25562, 5/12/14	5077215	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	FDH, 1308201500, 6/7/13	3907710	CCISITES
4-TOWER MANUFACTURER DRAWINGS	Valmont, 10844-92, 5/19/92	217772	CCISITES
4-POST-MODIFICATION INSPECTION	GPD, 2007278.24, 03/11/08	2218625	CCISITES
MONOPOLE PRE-MOD MAPPING	FDH, 146IQW1500, 1/9/2015	-	PJF
PROPOSED MODIFICATION DRAWINGS	PJF, 37515-1078.002.7700, 04/01/2015	5632030	CCISITES

3.1) Analysis Method

tnxTower (version 6.1.4.1), 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) Monopole was reinforced in conformance with the referenced modification drawings.
5) Monopole will be reinforced in conformance with the referenced proposed modification drawings.

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
L1	117 - 110	Pole	TP15.94x14.36x0.188	1	-0.89	495.73	10.5	Pass
L2	110 - 100	Pole	TP18.2x15.94x0.188	2	-1.77	566.85	28.1	Pass
L3	100 - 83.6667	Pole	TP21.8655x18.2x0.25	3	-8.40	904.60	73.9	Pass
L4	83.6667 - 71	Pole	TP24.7082x21.8655x0.3224	4	-11.95	1197.60	93.0	Pass
L5	71 - 68.0833	Pole	TP25.3627x24.7082x0.5162	5	-12.49	1451.26	85.4	Pass
L6	68.0833 - 63.5	Pole	TP26.3913x25.3627x0.685	6	-13.57	2115.62	67.0	Pass
L7	63.5 - 47.42	Pole	TP30x26.3913x0.8147	7	-16.82	2766.57	65.4	Pass
L8	47.42 - 38.0833	Pole	TP31.6377x27.3428x0.8045	8	-20.85	2837.18	76.1	Pass
L9	38.0833 - 35	Pole	TP32.339x31.6377x0.7403	9	-23.06	2792.31	83.2	Pass
L10	35 - 12.5	Pole	TP37.4568x32.339x0.7647	10	-30.62	3497.23	82.4	Pass
L11	12.5 - 2.5	Pole	TP39.7314x37.4568x0.7264	11	-34.15	3549.66	87.3	Pass
L12	2.5 - 0	Pole	TP40.3x39.7314x0.7719	12	-35.11	3966.50	79.6	Pass
							Summary	
						Pole (L4)	93.0	Pass
						RATING =	93.0	Pass

Table 5 - Tower Component Stresses vs. Capacity - LC4.5

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Flange	110	8.6	Pass
1	Flange	100	22.4	Pass
1, 2	Anchor Rods	0	92.6	Pass
1	Base Plate	0	62.7	Pass
1	Base Foundation Structural Steel	0	83.7	Pass
1, 3	Base Foundation Soil Interaction	0	65.2	Pass

Structure Rating (max from all components) =	93.0%

Notes:
1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.
2) Worst case scenario between existing and post installed anchors.
3) According to the procedures prescribed and agreed to by the Crown Castle Engineering Foundation Committee, held in January 2010, the existing caisson foundation was analyzed using the methodology in the software 'PLS-Caisson' (Version 8.10, or newer, by Power Line Systems, Inc.). Per the methods in PLS-Caisson, the soil reactions of cohesive soils are calculated using 8CD independent of the depth of the soil layer. The depth of soil to be ignored at the top of the caisson is the greater of the geotechnical report's recommendation, the frost depth of the site or half of the caisson diameter.

4.1) Recommendations

Reinforce the monopole in conformance with the referenced proposed modification drawings.

APPENDIX A

TNXTOWER OUTPUT

Tower Input Data

There is a pole section.
This tower is designed using the TIA/EIA-222-F standard.
The following design criteria apply:

Tower is located in Fairfield County, Connecticut.
Basic wind speed of 85 mph.
Nominal ice thickness of 0.7500 in.
Ice thickness is considered to increase with height.
Ice density of 56.00 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.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole 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		

Tapered Pole Section Geometry

Section	*Elevation* ft	*Section Length* ft	*Splice Length* ft	*Number of Sides*	*Top Diameter* in	*Bottom Diameter* in	*Wall Thickness* in	*Bend Radius* in	*Pole Grade*
L1	117.0000-110.0000	7.0000	0.00	12	14.3600	15.9400	0.1880	0.7520	A572-65 (65 ksi)
L2	110.0000-100.0000	10.0000	0.00	12	15.9400	18.2000	0.1880	0.7520	A572-65 (65 ksi)
L3	100.0000-83.6667	16.3333	0.00	12	18.2000	21.8655	0.2500	1.0000	A572-65 (65 ksi)
L4	83.6667-71.0000	12.6667	0.00	12	21.8655	24.7082	0.3224	1.2896	Reinf 59.15 ksi (59 ksi)
L5	71.0000-68.0833	2.9167	0.00	12	24.7082	25.3627	0.5162	2.0646	Reinf 43.94 ksi (44 ksi)
L6	68.0833-63.5000	4.5833	0.00	12	25.3627	26.3913	0.6850	2.7401	Reinf 46.65 ksi (47 ksi)
L7	63.5000-47.4200	16.0800	4.58	12	26.3913	30.0000	0.8147	3.2587	Reinf 46.83 ksi (47 ksi)

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L8	47.4200-38.0833	13.9167	0.00	12	27.3428	31.6377	0.8045	3.2178	Reinf 46.34 ksi (46 ksi)
L9	38.0833-35.0000	3.0833	0.00	12	31.6377	32.3390	0.7403	2.9612	Reinf 46.35 ksi (46 ksi)
L10	35.0000-12.5000	22.5000	0.00	12	32.3390	37.4568	0.7647	3.0586	Reinf 48.40 ksi (48 ksi)
L11	12.5000-2.5000	10.0000	0.00	12	37.4568	39.7314	0.7264	2.9054	Reinf 48.65 ksi (49 ksi)
L12	2.5000-0.0000	2.5000		12	39.7314	40.3000	0.7719	3.0875	Reinf 50.48 ksi (50 ksi)

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
LDF6-50A(1-1/4")	C	No	Inside Pole	117.0000 - 81.0000	3	No Ice	0.0000	0.66
						1/2" Ice	0.0000	0.66
						1" Ice	0.0000	0.66
						2" Ice	0.0000	0.66
						4" Ice	0.0000	0.66
***								
LDF6-50A(1-1/4")	C	No	Inside Pole	110.0000 - 0.0000	12	No Ice	0.0000	0.66
						1/2" Ice	0.0000	0.66
						1" Ice	0.0000	0.66
						2" Ice	0.0000	0.66
						4" Ice	0.0000	0.66
LDF6-50A(1-1/4")	C	No	CaAa (Out Of Face)	110.0000 - 0.0000	1	No Ice	0.1550	0.66
						1/2" Ice	0.2550	1.91
						1" Ice	0.3550	3.78
						2" Ice	0.5550	9.33
						4" Ice	0.9550	27.78
***								
LDF6-50A(1-1/4")	C	No	Inside Pole	100.0000 - 0.0000	1	No Ice	0.0000	0.66
						1/2" Ice	0.0000	0.66
						1" Ice	0.0000	0.66
						2" Ice	0.0000	0.66
						4" Ice	0.0000	0.66
LDF5-50A(7/8")	C	No	Inside Pole	100.0000 - 0.0000	12	No Ice	0.0000	0.33
						1/2" Ice	0.0000	0.33
						1" Ice	0.0000	0.33
						2" Ice	0.0000	0.33
						4" Ice	0.0000	0.33
HB158-1-08U8-S8J18(1-5/8)	C	No	Inside Pole	100.0000 - 0.0000	2	No Ice	0.0000	1.30
						1/2" Ice	0.0000	1.30
						1" Ice	0.0000	1.30
						2" Ice	0.0000	1.30
						4" Ice	0.0000	1.30
***								
7983A(1/2")	C	No	CaAa (Out Of Face)	93.0000 - 0.0000	3	No Ice	0.0000	0.08
						1/2" Ice	0.0000	0.74
						1" Ice	0.0000	2.01
						2" Ice	0.0000	6.39
						4" Ice	0.0000	22.47
7983A(1/2")	C	No	CaAa (Out Of Face)	81.0000 - 0.0000	1	No Ice	0.0000	0.08
						1/2" Ice	0.0000	0.74
						1" Ice	0.0000	2.01
						2" Ice	0.0000	6.39
						4" Ice	0.0000	22.47
7983A(1/2")	C	No	CaAa (Out Of Face)	93.0000 - 81.0000	1	No Ice	0.0580	0.08
						1/2" Ice	0.1580	0.74
						1" Ice	0.2580	2.01
						2" Ice	0.4580	6.39
						4" Ice	0.8580	22.47
***								
LDF6-50A(1-1/4")	C	No	Inside Pole	88.0000 - 0.0000	12	No Ice	0.0000	0.66

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
						1/2" Ice	0.0000	0.66
						1" Ice	0.0000	0.66
						2" Ice	0.0000	0.66
						4" Ice	0.0000	0.66
FB-L98-002-XXX(3/8)	C	No	Inside Pole	88.0000 - 0.0000	1	No Ice	0.0000	0.06
						1/2" Ice	0.0000	0.06
						1" Ice	0.0000	0.06
						2" Ice	0.0000	0.06
						4" Ice	0.0000	0.06
WR-VG82ST-BRDA(5/8")	C	No	Inside Pole	88.0000 - 0.0000	2	No Ice	0.0000	0.31
						1/2" Ice	0.0000	0.31
						1" Ice	0.0000	0.31
						2" Ice	0.0000	0.31
						4" Ice	0.0000	0.31
2" Rigid Conduit	C	No	Inside Pole	88.0000 - 0.0000	1	No Ice	0.0000	2.80
						1/2" Ice	0.0000	2.80
						1" Ice	0.0000	2.80
						2" Ice	0.0000	2.80
						4" Ice	0.0000	2.80
***								
AVA7-50(1-5/8)	C	No	CaAa (Out Of Face)	81.0000 - 0.0000	2	No Ice	0.2010	0.70
						1/2" Ice	0.3010	2.23
						1" Ice	0.4010	4.38
						2" Ice	0.6010	10.50
						4" Ice	1.0010	30.07
AVA7-50(1-5/8)	C	No	CaAa (Out Of Face)	81.0000 - 0.0000	4	No Ice	0.0000	0.70
						1/2" Ice	0.0000	2.23
						1" Ice	0.0000	4.38
						2" Ice	0.0000	10.50
						4" Ice	0.0000	30.07
**********								
1" Flat Reinforcement	C	No	CaAa (Out Of Face)	72.5000 - 0.0000	1	No Ice	0.1667	0.00
						1/2" Ice	0.2778	0.00
						1" Ice	0.3889	0.00
						2" Ice	0.6111	0.00
						4" Ice	1.0556	0.00
***								
1" Flat Reinforcement	C	No	CaAa (Out Of Face)	85.7500 - 0.0000	1	No Ice	0.1667	0.00
						1/2" Ice	0.2778	0.00
						1" Ice	0.3889	0.00
						2" Ice	0.6111	0.00
						4" Ice	1.0556	0.00

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
APXVSPP18-C-A20 w/ Mount Pipe	A	From Face	4.0000 0.00 1.00	0.00	117.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	8.4975 9.1490 9.7672 11.0311 13.6786	6.9458 8.1266 9.0212 10.8440 14.8507	0.08 0.15 0.23 0.41 0.91
APXVSPP18-C-A20 w/ Mount Pipe	B	From Face	4.0000 0.00 1.00	0.00	117.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	8.4975 9.1490 9.7672 11.0311 13.6786	6.9458 8.1266 9.0212 10.8440 14.8507	0.08 0.15 0.23 0.41 0.91
APXVSPP18-C-A20 w/ Mount Pipe	C	From Face	4.0000 0.00 1.00	0.00	117.0000	No Ice 1/2" Ice	8.4975 9.1490 9.7672	6.9458 8.1266 9.0212	0.08 0.15 0.23

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
						1" Ice	11.0311	10.8440	0.41
						2" Ice	13.6786	14.8507	0.91
						4" Ice			
800 EXTERNAL NOTCH FILTER	A	From Face	4.0000 0.00 0.00	0.00	117.0000	No Ice	0.7701	0.3747	0.01
						1/2" Ice	0.8898	0.4647	0.02
						1" Ice	1.0181	0.5634	0.02
						2" Ice	1.3007	0.7868	0.04
						4" Ice	1.9696	1.3372	0.11
800 EXTERNAL NOTCH FILTER	B	From Face	4.0000 0.00 0.00	0.00	117.0000	No Ice	0.7701	0.3747	0.01
						1/2" Ice	0.8898	0.4647	0.02
						1" Ice	1.0181	0.5634	0.02
						2" Ice	1.3007	0.7868	0.04
						4" Ice	1.9696	1.3372	0.11
800 EXTERNAL NOTCH FILTER	C	From Face	4.0000 0.00 0.00	0.00	117.0000	No Ice	0.7701	0.3747	0.01
						1/2" Ice	0.8898	0.4647	0.02
						1" Ice	1.0181	0.5634	0.02
						2" Ice	1.3007	0.7868	0.04
						4" Ice	1.9696	1.3372	0.11
(3) ACU-A20-N	A	From Face	4.0000 0.00 0.00	0.00	117.0000	No Ice	0.0778	0.1361	0.00
						1/2" Ice	0.1210	0.1890	0.00
						1" Ice	0.1728	0.2506	0.00
						2" Ice	0.3025	0.3997	0.01
						4" Ice	0.6654	0.8015	0.04
(3) ACU-A20-N	B	From Face	4.0000 0.00 0.00	0.00	117.0000	No Ice	0.0778	0.1361	0.00
						1/2" Ice	0.1210	0.1890	0.00
						1" Ice	0.1728	0.2506	0.00
						2" Ice	0.3025	0.3997	0.01
						4" Ice	0.6654	0.8015	0.04
(3) ACU-A20-N	C	From Face	4.0000 0.00 0.00	0.00	117.0000	No Ice	0.0778	0.1361	0.00
						1/2" Ice	0.1210	0.1890	0.00
						1" Ice	0.1728	0.2506	0.00
						2" Ice	0.3025	0.3997	0.01
						4" Ice	0.6654	0.8015	0.04
Pipe Mount [PM 601-3]	C	None		0.00	117.0000	No Ice	4.3900	4.3900	0.20
						1/2" Ice	5.4800	5.4800	0.24
						1" Ice	6.5700	6.5700	0.28
						2" Ice	8.7500	8.7500	0.36
						4" Ice	13.1100	13.1100	0.53
***									
TME-PCS 1900MHz 4x45W-65MHz	A	From Face	2.0000 0.00 0.00	0.00	115.0000	No Ice	2.7087	2.6111	0.06
						1/2" Ice	2.9477	2.8475	0.08
						1" Ice	3.1953	3.0925	0.11
						2" Ice	3.7164	3.6084	0.17
						4" Ice	4.8623	4.7439	0.35
TME-PCS 1900MHz 4x45W-65MHz	B	From Face	2.0000 0.00 0.00	0.00	115.0000	No Ice	2.7087	2.6111	0.06
						1/2" Ice	2.9477	2.8475	0.08
						1" Ice	3.1953	3.0925	0.11
						2" Ice	3.7164	3.6084	0.17
						4" Ice	4.8623	4.7439	0.35
TME-PCS 1900MHz 4x45W-65MHz	C	From Face	2.0000 0.00 0.00	0.00	115.0000	No Ice	2.7087	2.6111	0.06
						1/2" Ice	2.9477	2.8475	0.08
						1" Ice	3.1953	3.0925	0.11
						2" Ice	3.7164	3.6084	0.17
						4" Ice	4.8623	4.7439	0.35
TME-800MHZ RRH	A	From Face	2.0000	0.00	115.0000	No Ice	2.4899	2.0685	0.05

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
			0.00 0.00			1/2" Ice 1" Ice 2" Ice 4" Ice	2.7061 2.9310 3.4068 4.4620	2.2705 2.4812 2.9284 3.9265	0.07 0.10 0.16 0.32
TME-800MHZ RRH	B	From Face	2.0000 0.00 0.00	0.00	115.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.4899 2.7061 2.9310 3.4068 4.4620	2.0685 2.2705 2.4812 2.9284 3.9265	0.05 0.07 0.10 0.16 0.32
TME-800MHZ RRH	C	From Face	2.0000 0.00 0.00	0.00	115.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.4899 2.7061 2.9310 3.4068 4.4620	2.0685 2.2705 2.4812 2.9284 3.9265	0.05 0.07 0.10 0.16 0.32
Side Arm Mount [SO 102-3]	C	None		0.00	115.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.0000 3.4800 3.9600 4.9200 6.8400	3.0000 3.4800 3.9600 4.9200 6.8400	0.08 0.11 0.14 0.20 0.32
***									
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	A	From Face	1.0000 0.00 0.00	0.00	110.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	6.8253 7.3471 7.8631 8.9261 11.1755	5.6424 6.4800 7.2567 8.8640 12.2932	0.11 0.17 0.23 0.38 0.81
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	B	From Face	1.0000 0.00 0.00	0.00	110.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	6.8253 7.3471 7.8631 8.9261 11.1755	5.6424 6.4800 7.2567 8.8640 12.2932	0.11 0.17 0.23 0.38 0.81
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	C	From Face	1.0000 0.00 0.00	0.00	110.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	6.8253 7.3471 7.8631 8.9261 11.1755	5.6424 6.4800 7.2567 8.8640 12.2932	0.11 0.17 0.23 0.38 0.81
KRY 112 144/1	A	From Face	1.0000 0.00 0.00	0.00	110.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.4083 0.4969 0.5941 0.8145 1.3590	0.2042 0.2733 0.3511 0.5326 0.9992	0.01 0.01 0.02 0.03 0.08
KRY 112 144/1	B	From Face	1.0000 0.00 0.00	0.00	110.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.4083 0.4969 0.5941 0.8145 1.3590	0.2042 0.2733 0.3511 0.5326 0.9992	0.01 0.01 0.02 0.03 0.08
KRY 112 144/1	B	From Face	1.0000 0.00 0.00	0.00	110.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.4083 0.4969 0.5941 0.8145 1.3590	0.2042 0.2733 0.3511 0.5326 0.9992	0.01 0.01 0.02 0.03 0.08
Pipe Mount [PM 601-3]	C	None		0.00	110.0000	No Ice 1/2" Ice 1" Ice 2" Ice	4.3900 5.4800 6.5700 8.7500 13.1100	4.3900 5.4800 6.5700 8.7500 13.1100	0.20 0.24 0.28 0.36 0.53

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
***						4" Ice			
(2) HBXX-6516DS-A2M w/ Mount Pipe	A	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	6.1758 6.6547 7.1374 8.1341 10.2560	4.5251 5.2049 5.8987 7.3732 10.5560	0.05 0.10 0.15 0.29 0.67
(2) HBXX-6516DS-A2M w/ Mount Pipe	B	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	6.1758 6.6547 7.1374 8.1341 10.2560	4.5251 5.2049 5.8987 7.3732 10.5560	0.05 0.10 0.15 0.29 0.67
(2) HBXX-6516DS-A2M w/ Mount Pipe	C	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	6.1758 6.6547 7.1374 8.1341 10.2560	4.5251 5.2049 5.8987 7.3732 10.5560	0.05 0.10 0.15 0.29 0.67
RRH2X60-AWS	A	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.1904 2.3976 2.6134 3.0710 4.0899	1.4290 1.6109 1.8015 2.2085 3.1263	0.04 0.06 0.08 0.13 0.26
RRH2X60-AWS	B	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.1904 2.3976 2.6134 3.0710 4.0899	1.4290 1.6109 1.8015 2.2085 3.1263	0.04 0.06 0.08 0.13 0.26
RRH2X60-AWS	C	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.1904 2.3976 2.6134 3.0710 4.0899	1.4290 1.6109 1.8015 2.2085 3.1263	0.04 0.06 0.08 0.13 0.26
RRH2X60-PCS	A	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.5667 2.7914 3.0247 3.5173 4.6062	2.0106 2.2184 2.4349 2.8938 3.9152	0.06 0.08 0.10 0.16 0.31
RRH2X60-PCS	B	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.5667 2.7914 3.0247 3.5173 4.6062	2.0106 2.2184 2.4349 2.8938 3.9152	0.06 0.08 0.10 0.16 0.31
RRH2X60-PCS	C	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	2.5667 2.7914 3.0247 3.5173 4.6062	2.0106 2.2184 2.4349 2.8938 3.9152	0.06 0.08 0.10 0.16 0.31
800 10735V01 w/ Mount Pipe	A	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	9.0418 9.7204 10.3733 11.6912 14.4457	5.4888 6.7103 7.6880 9.5633 13.5141	0.06 0.12 0.19 0.36 0.85
800 10735V01 w/ Mount Pipe	B	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice 1/2" Ice	9.0418 9.7204 10.3733	5.4888 6.7103 7.6880	0.06 0.12 0.19

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
						1" Ice	11.6912	9.5633	0.36
						2" Ice	14.4457	13.5141	0.85
						4" Ice			
800 10735V01 w/ Mount Pipe	C	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice	9.0418	5.4888	0.06
						1/2" Ice	9.7204	6.7103	0.12
						1" Ice	10.3733	7.6880	0.19
						2" Ice	11.6912	9.5633	0.36
						4" Ice	14.4457	13.5141	0.85
RRH2X40-07-U	A	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice	2.2458	1.2277	0.05
						1/2" Ice	2.4472	1.3850	0.07
						1" Ice	2.6572	1.5509	0.09
						2" Ice	3.1031	1.9087	0.13
						4" Ice	4.0987	2.7280	0.27
RRH2X40-07-U	B	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice	2.2458	1.2277	0.05
						1/2" Ice	2.4472	1.3850	0.07
						1" Ice	2.6572	1.5509	0.09
						2" Ice	3.1031	1.9087	0.13
						4" Ice	4.0987	2.7280	0.27
RRH2X40-07-U	C	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice	2.2458	1.2277	0.05
						1/2" Ice	2.4472	1.3850	0.07
						1" Ice	2.6572	1.5509	0.09
						2" Ice	3.1031	1.9087	0.13
						4" Ice	4.0987	2.7280	0.27
DB-T1-6Z-8AB-0Z	A	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice	5.6000	2.3333	0.04
						1/2" Ice	5.9154	2.5580	0.08
						1" Ice	6.2395	2.7914	0.12
						2" Ice	6.9136	3.2840	0.21
						4" Ice	8.3654	4.3728	0.45
(2) DB844G65ZAXY w/ Mount Pipe	A	From Leg	4.0000 0.00 0.00	0.00	100.0000	No Ice	4.9042	4.9208	0.03
						1/2" Ice	5.3460	5.5962	0.08
						1" Ice	5.7972	6.2837	0.13
						2" Ice	6.7311	7.7123	0.26
						4" Ice	8.7345	10.8330	0.62
(2) DB844G65ZAXY w/ Mount Pipe	B	From Leg	4.0000 0.00 0.00	0.00	100.0000	No Ice	4.9042	4.9208	0.03
						1/2" Ice	5.3460	5.5962	0.08
						1" Ice	5.7972	6.2837	0.13
						2" Ice	6.7311	7.7123	0.26
						4" Ice	8.7345	10.8330	0.62
(2) DB844G65ZAXY w/ Mount Pipe	C	From Leg	4.0000 0.00 0.00	0.00	100.0000	No Ice	4.9042	4.9208	0.03
						1/2" Ice	5.3460	5.5962	0.08
						1" Ice	5.7972	6.2837	0.13
						2" Ice	6.7311	7.7123	0.26
						4" Ice	8.7345	10.8330	0.62
GPS_A	C	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice	0.2975	0.2975	0.00
						1/2" Ice	0.3739	0.3739	0.00
						1" Ice	0.4589	0.4589	0.01
						2" Ice	0.6549	0.6549	0.02
						4" Ice	1.1506	1.1506	0.08
(2) FD9R6004/2C-3L	A	From Face	4.0000 0.00 0.00	0.00	100.0000	No Ice	0.3665	0.0846	0.00
						1/2" Ice	0.4506	0.1362	0.01
						1" Ice	0.5433	0.1965	0.01
						2" Ice	0.7546	0.3430	0.02
						4" Ice	1.2808	0.7396	0.06
(2) FD9R6004/2C-3L	B	From Face	4.0000 0.00	0.00	100.0000	No Ice	0.3665	0.0846	0.00
						1/2" Ice	0.4506	0.1362	0.01

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
			0.00				Ice	0.5433	0.1965	0.01
							1" Ice	0.7546	0.3430	0.02
							2" Ice	1.2808	0.7396	0.06
							4" Ice			
(2) FD9R6004/2C-3L	C	From Face	4.0000		0.00	100.0000	No Ice	0.3665	0.0846	0.00
			0.00				1/2"	0.4506	0.1362	0.01
			0.00				Ice	0.5433	0.1965	0.01
							1" Ice	0.7546	0.3430	0.02
							2" Ice	1.2808	0.7396	0.06
							4" Ice			
DB-T1-6Z-8AB-0Z	A	From Face	4.0000		0.00	100.0000	No Ice	5.6000	2.3333	0.04
			0.00				1/2"	5.9154	2.5580	0.08
			0.00				Ice	6.2395	2.7914	0.12
							1" Ice	6.9136	3.2840	0.21
							2" Ice	8.3654	4.3728	0.45
							4" Ice			
Platform Mount [LP 715-1]	C	None			0.00	100.0000	No Ice	44.2100	44.2100	1.77
							1/2"	53.9700	53.9700	2.32
							Ice	63.7300	63.7300	2.87
							1" Ice	83.2500	83.2500	3.97
							2" Ice	122.2900	122.2900	6.16
							4" Ice			
***										
Pipe Mount [PM 601-3]	C	None			0.00	93.0000	No Ice	4.3900	4.3900	0.20
							1/2"	5.4800	5.4800	0.24
							Ice	6.5700	6.5700	0.28
							1" Ice	8.7500	8.7500	0.36
							2" Ice	13.1100	13.1100	0.53
							4" Ice			
***										
P65-17-XLH-RR w/ Mount Pipe	A	From Face	4.0000		0.00	88.0000	No Ice	11.8229	9.0563	0.09
			0.00				1/2"	12.5940	10.6186	0.18
			1.00				Ice	13.3752	12.2051	0.28
							1" Ice	14.9400	14.6968	0.51
							2" Ice	18.3336	19.6430	1.14
							4" Ice			
P65-16-XLH-RR w/ Mount Pipe	B	From Face	4.0000		0.00	88.0000	No Ice	8.6375	6.3625	0.08
			0.00				1/2"	9.2903	7.5378	0.14
			1.00				Ice	9.9098	8.4270	0.22
							1" Ice	11.1763	10.2390	0.39
							2" Ice	13.8289	14.0988	0.89
							4" Ice			
P65-16-XLH-RR w/ Mount Pipe	C	From Face	4.0000		0.00	88.0000	No Ice	8.6375	6.3625	0.08
			0.00				1/2"	9.2903	7.5378	0.14
			1.00				Ice	9.9098	8.4270	0.22
							1" Ice	11.1763	10.2390	0.39
							2" Ice	13.8289	14.0988	0.89
							4" Ice			
(2) 7770.00 w/ Mount Pipe	A	From Face	4.0000		0.00	88.0000	No Ice	6.2208	4.8204	0.09
			0.00				1/2"	6.7144	5.5082	0.14
			1.00				Ice	7.2182	6.2127	0.21
							1" Ice	8.2568	7.6716	0.36
							2" Ice	10.4762	11.0613	0.76
							4" Ice			
(2) 7770.00 w/ Mount Pipe	B	From Face	4.0000		0.00	88.0000	No Ice	6.2208	4.8204	0.09
			0.00				1/2"	6.7144	5.5082	0.14
			1.00				Ice	7.2182	6.2127	0.21
							1" Ice	8.2568	7.6716	0.36
							2" Ice	10.4762	11.0613	0.76
							4" Ice			
(2) 7770.00 w/ Mount Pipe	C	From Face	4.0000		0.00	88.0000	No Ice	6.2208	4.8204	0.09
			0.00				1/2"	6.7144	5.5082	0.14
			1.00				Ice	7.2182	6.2127	0.21
							1" Ice	8.2568	7.6716	0.36
							2" Ice	10.4762	11.0613	0.76

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
						4" Ice			
(2) LGP2140X	A	From Face	4.0000 0.00 1.00	0.00	88.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.2600 1.4160 1.5806 1.9358 2.7499	0.3780 0.4932 0.6170 0.8905 1.5412	0.01 0.02 0.03 0.05 0.13
(2) LGP2140X	B	From Face	4.0000 0.00 1.00	0.00	88.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.2600 1.4160 1.5806 1.9358 2.7499	0.3780 0.4932 0.6170 0.8905 1.5412	0.01 0.02 0.03 0.05 0.13
(2) LGP2140X	C	From Face	4.0000 0.00 1.00	0.00	88.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.2600 1.4160 1.5806 1.9358 2.7499	0.3780 0.4932 0.6170 0.8905 1.5412	0.01 0.02 0.03 0.05 0.13
(2) LGP13519	A	From Face	4.0000 0.00 1.00	0.00	88.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.3379 0.4220 0.5147 0.7260 1.2523	0.2074 0.2804 0.3621 0.5513 1.0335	0.01 0.01 0.01 0.02 0.07
(2) LGP13519	B	From Face	4.0000 0.00 1.00	0.00	88.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.3379 0.4220 0.5147 0.7260 1.2523	0.2074 0.2804 0.3621 0.5513 1.0335	0.01 0.01 0.01 0.02 0.07
(2) LGP13519	C	From Face	4.0000 0.00 1.00	0.00	88.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.3379 0.4220 0.5147 0.7260 1.2523	0.2074 0.2804 0.3621 0.5513 1.0335	0.01 0.01 0.01 0.02 0.07
(2) RRUS-11	A	From Face	4.0000 0.00 1.00	0.00	88.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.2486 3.4905 3.7411 4.2682 5.4260	1.3726 1.5510 1.7380 2.1381 3.0418	0.05 0.07 0.09 0.15 0.31
(2) RRUS-11	B	From Face	4.0000 0.00 1.00	0.00	88.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.2486 3.4905 3.7411 4.2682 5.4260	1.3726 1.5510 1.7380 2.1381 3.0418	0.05 0.07 0.09 0.15 0.31
(2) RRUS-11	C	From Face	4.0000 0.00 1.00	0.00	88.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	3.2486 3.4905 3.7411 4.2682 5.4260	1.3726 1.5510 1.7380 2.1381 3.0418	0.05 0.07 0.09 0.15 0.31
DC6-48-60-18-8F	A	From Face	4.0000 0.00 1.00	0.00	88.0000	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.4667 1.6667 1.8778 2.3333 3.3778	1.4667 1.6667 1.8778 2.3333 3.3778	0.02 0.04 0.06 0.11 0.24
Platform Mount [LP 715-1]	C	None		0.00	88.0000	No Ice 1/2" Ice 1" Ice	44.2100 53.9700 63.7300 83.2500	44.2100 53.9700 63.7300 83.2500	1.77 2.32 2.87 3.97

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
						2" Ice	122.2900	122.2900	6.16
						4" Ice			
***									
800 10504 w/ Mount Pipe	A	From Face	1.0000	0.00	81.0000	No Ice	3.5887	3.1779	0.04
			0.00			1/2"	4.0069	3.9053	0.07
			0.00			Ice	4.4217	4.5808	0.11
						1" Ice	5.3391	5.9816	0.21
						2" Ice	7.3849	8.9834	0.51
						4" Ice			
800 10504 w/ Mount Pipe	B	From Face	1.0000	0.00	81.0000	No Ice	3.5887	3.1779	0.04
			0.00			1/2"	4.0069	3.9053	0.07
			0.00			Ice	4.4217	4.5808	0.11
						1" Ice	5.3391	5.9816	0.21
						2" Ice	7.3849	8.9834	0.51
						4" Ice			
800 10504 w/ Mount Pipe	C	From Face	1.0000	0.00	81.0000	No Ice	3.5887	3.1779	0.04
			0.00			1/2"	4.0069	3.9053	0.07
			0.00			Ice	4.4217	4.5808	0.11
						1" Ice	5.3391	5.9816	0.21
						2" Ice	7.3849	8.9834	0.51
						4" Ice			
Pipe Mount [PM 601-3]	C	None		0.00	81.0000	No Ice	4.3900	4.3900	0.20
						1/2"	5.4800	5.4800	0.24
						Ice	6.5700	6.5700	0.28
						1" Ice	8.7500	8.7500	0.36
						2" Ice	13.1100	13.1100	0.53
						4" Ice			
***									
LBX-9012DS-VTM w/ Mount Pipe	A	From Face	4.0000	0.00	72.0000	No Ice	5.4437	3.9976	0.05
			0.00			1/2"	5.9137	4.6725	0.09
			0.00			Ice	6.3874	5.3288	0.14
						1" Ice	7.3659	6.7088	0.26
						2" Ice	9.4512	9.8613	0.61
						4" Ice			
LBX-9012DS-VTM w/ Mount Pipe	B	From Face	4.0000	0.00	72.0000	No Ice	5.4437	3.9976	0.05
			0.00			1/2"	5.9137	4.6725	0.09
			0.00			Ice	6.3874	5.3288	0.14
						1" Ice	7.3659	6.7088	0.26
						2" Ice	9.4512	9.8613	0.61
						4" Ice			
LBX-9012DS-VTM w/ Mount Pipe	C	From Face	4.0000	0.00	72.0000	No Ice	5.4437	3.9976	0.05
			0.00			1/2"	5.9137	4.6725	0.09
			0.00			Ice	6.3874	5.3288	0.14
						1" Ice	7.3659	6.7088	0.26
						2" Ice	9.4512	9.8613	0.61
						4" Ice			
DB844H90E-XY w/ Mount Pipe	A	From Face	4.0000	0.00	72.0000	No Ice	3.2986	4.9208	0.03
			0.00			1/2"	3.6900	5.5962	0.07
			0.00			Ice	4.1185	6.2837	0.12
						1" Ice	5.0070	7.7123	0.23
						2" Ice	6.9197	10.8330	0.56
						4" Ice			
DB844H90E-XY w/ Mount Pipe	B	From Face	4.0000	0.00	72.0000	No Ice	3.2986	4.9208	0.03
			0.00			1/2"	3.6900	5.5962	0.07
			0.00			Ice	4.1185	6.2837	0.12
						1" Ice	5.0070	7.7123	0.23
						2" Ice	6.9197	10.8330	0.56
						4" Ice			
DB844H90E-XY w/ Mount Pipe	C	From Face	4.0000	0.00	72.0000	No Ice	3.2986	4.9208	0.03
			0.00			1/2"	3.6900	5.5962	0.07
			0.00			Ice	4.1185	6.2837	0.12
						1" Ice	5.0070	7.7123	0.23
						2" Ice	6.9197	10.8330	0.56
						4" Ice			
Platform Mount (LP 101-1)	C	None		0.00	72.0000	No Ice	36.2100	36.2100	1.50

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
						1/2" Ice	42.8200	42.8200	2.30
						49.4300	49.4300	3.10	
						1" Ice	62.6500	62.6500	4.70
						2" Ice	89.0900	89.0900	7.89
						4" Ice			
**********									
******									

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight K
VHLP2-11	A	Paraboloid w/o Radome	From Leg	2.0000 0.00 1.00	0.00		93.0000	2.1750	No Ice	3.7200	0.03
									1/2" Ice	4.0100	0.05
									1" Ice	4.3000	0.07
									2" Ice	4.8800	0.11
									4" Ice	6.0400	0.19
VHLP1-23	B	Paraboloid w/o Radome	From Leg	2.0000 0.00 2.00	0.00		93.0000	1.2750	No Ice	1.2800	0.01
									1/2" Ice	1.4500	0.02
									1" Ice	1.6200	0.03
									2" Ice	1.9700	0.04
									4" Ice	2.6600	0.07
VHLP1-23	C	Paraboloid w/o Radome	From Leg	2.0000 0.00 -1.00	0.00		93.0000	1.2750	No Ice	1.2800	0.01
									1/2" Ice	1.4500	0.02
									1" Ice	1.6200	0.03
									2" Ice	1.9700	0.04
									4" Ice	2.6600	0.07
VHLP2.5-11	C	Paraboloid w/Shroud (HP)	From Leg	2.0000 0.00 1.00	0.00		93.0000	2.9167	No Ice	6.6800	0.05
									1/2" Ice	7.0700	0.08
									1" Ice	7.4600	0.12
									2" Ice	8.2300	0.19
									4" Ice	9.7800	0.34

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 117.0000-110.0000	113.4392	1.423	26.320	8.838	A	0.000	8.838	8.838	100.00	0.000	0.000
					B	0.000	8.838		100.00	0.000	0.000
					C	0.000	8.838		100.00	0.000	0.000
L2 110.0000-100.0000	104.8897	1.392	25.738	14.225	A	0.000	14.225	14.225	100.00	0.000	0.000
					B	0.000	14.225		100.00	0.000	0.000
					C	0.000	14.225		100.00	0.000	1.550
L3 100.0000-83.6667	91.5843	1.339	24.759	27.267	A	0.000	27.267	27.267	100.00	0.000	0.000
					B	0.000	27.267		100.00	0.000	0.000
					C	0.000	27.267		100.00	0.000	3.420
L4 83.6667-71.0000	77.2045	1.275	23.580	24.581	A	0.000	24.581	24.581	100.00	0.000	0.000
					B	0.000	24.581		100.00	0.000	0.000
					C	0.000	24.581		100.00	0.000	8.499
L5 71.0000-68.0833	69.5353	1.237	22.886	6.085	A	0.000	6.085	6.085	100.00	0.000	0.000
					B	0.000	6.085		100.00	0.000	0.000
					C	0.000	6.085		100.00	0.000	2.597
L6 68.0833-63.5000	65.7765	1.218	22.525	9.884	A	0.000	9.884	9.884	100.00	0.000	0.000
					B	0.000	9.884		100.00	0.000	0.000

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
					C	0.000	9.884		100.00	0.000	4.081
L7 63.5000-47.4200	55.2885	1.159	21.434	37.782	A	0.000	37.782	37.782	100.00	0.000	0.000
					B	0.000	37.782		100.00	0.000	0.000
					C	0.000	37.782		100.00	0.000	14.317
L8 47.4200-38.0833	42.6774	1.076	19.906	23.495	A	0.000	23.495	23.495	100.00	0.000	0.000
					B	0.000	23.495		100.00	0.000	0.000
					C	0.000	23.495		100.00	0.000	8.313
L9 38.0833-35.0000	36.5360	1.03	19.042	8.219	A	0.000	8.219	8.219	100.00	0.000	0.000
					B	0.000	8.219		100.00	0.000	0.000
					C	0.000	8.219		100.00	0.000	2.745
L10 35.0000-12.5000	23.4750	1	18.496	65.434	A	0.000	65.434	65.434	100.00	0.000	0.000
					B	0.000	65.434		100.00	0.000	0.000
					C	0.000	65.434		100.00	0.000	20.033
L11 12.5000-2.5000	7.4509	1	18.496	32.162	A	0.000	32.162	32.162	100.00	0.000	0.000
					B	0.000	32.162		100.00	0.000	0.000
					C	0.000	32.162		100.00	0.000	8.903
L12 2.5000-0.0000	1.2470	1	18.496	8.337	A	0.000	8.337	8.337	100.00	0.000	0.000
					B	0.000	8.337		100.00	0.000	0.000
					C	0.000	8.337		100.00	0.000	2.226

Tower Pressure - With Ice

G_H = 1.690

Section Elevation ft	z ft	K_Z	q_z psf	t_z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 117.0000-110.0000	113.4392	1.423	5.150	0.8698	9.852	A	0.000	9.852	9.852	100.00	0.000	0.000
						B	0.000	9.852		100.00	0.000	0.000
						C	0.000	9.852		100.00	0.000	0.000
L2 110.0000-100.0000	104.8897	1.392	5.036	0.8616	15.661	A	0.000	15.661	15.661	100.00	0.000	0.000
						B	0.000	15.661		100.00	0.000	0.000
						C	0.000	15.661		100.00	0.000	3.273
L3 100.0000-83.6667	91.5843	1.339	4.845	0.8477	29.574	A	0.000	29.574	29.574	100.00	0.000	0.000
						B	0.000	29.574		100.00	0.000	0.000
						C	0.000	29.574		100.00	0.000	8.164
L4 83.6667-71.0000	77.2045	1.275	4.614	0.8305	26.334	A	0.000	26.334	26.334	100.00	0.000	0.000
						B	0.000	26.334		100.00	0.000	0.000
						C	0.000	26.334		100.00	0.000	16.983
L5 71.0000-68.0833	69.5353	1.237	4.478	0.8202	6.484	A	0.000	6.484	6.484	100.00	0.000	0.000
						B	0.000	6.484		100.00	0.000	0.000
						C	0.000	6.484		100.00	0.000	5.095
L6 68.0833-63.5000	65.7765	1.218	4.408	0.8147	10.506	A	0.000	10.506	10.506	100.00	0.000	0.000
						B	0.000	10.506		100.00	0.000	0.000
						C	0.000	10.506		100.00	0.000	7.981
L7 63.5000-47.4200	55.2885	1.159	4.194	0.7979	39.921	A	0.000	39.921	39.921	100.00	0.000	0.000
						B	0.000	39.921		100.00	0.000	0.000
						C	0.000	39.921		100.00	0.000	27.717
L8 47.4200-38.0833	42.6774	1.076	3.895	0.7735	24.737	A	0.000	24.737	24.737	100.00	0.000	0.000
						B	0.000	24.737		100.00	0.000	0.000
						C	0.000	24.737		100.00	0.000	16.094
L9 38.0833-35.0000	36.5360	1.03	3.726	0.7592	8.609	A	0.000	8.609	8.609	100.00	0.000	0.000
						B	0.000	8.609		100.00	0.000	0.000
						C	0.000	8.609		100.00	0.000	5.190
L10 35.0000-12.5000	23.4750	1	3.619	0.7500	68.246	A	0.000	68.246	68.246	100.00	0.000	0.000
						B	0.000	68.246		100.00	0.000	0.000
						C	0.000	68.246		100.00	0.000	37.657
L11 12.5000-2.5000	7.4509	1	3.619	0.7500	33.412	A	0.000	33.412	33.412	100.00	0.000	0.000
						B	0.000	33.412		100.00	0.000	0.000
						C	0.000	33.412		100.00	0.000	16.737
L12 2.5000-0.0000	1.2470	1	3.619	0.7500	8.649	A	0.000	8.649	8.649	100.00	0.000	0.000
						B	0.000	8.649		100.00	0.000	0.000
						C	0.000	8.649		100.00	0.000	4.184

Tower Pressure - Service

G_H = 1.690

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 117.0000-110.0000	113.4392	1.423	9.107	8.838	A	0.000	8.838	8.838	100.00	0.000	0.000
					B	0.000	8.838		100.00	0.000	0.000
					C	0.000	8.838		100.00	0.000	0.000
L2 110.0000-100.0000	104.8897	1.392	8.906	14.225	A	0.000	14.225	14.225	100.00	0.000	0.000
					B	0.000	14.225		100.00	0.000	0.000
					C	0.000	14.225		100.00	0.000	1.550
L3 100.0000-83.6667	91.5843	1.339	8.567	27.267	A	0.000	27.267	27.267	100.00	0.000	0.000
					B	0.000	27.267		100.00	0.000	0.000
					C	0.000	27.267		100.00	0.000	3.420
L4 83.6667-71.0000	77.2045	1.275	8.159	24.581	A	0.000	24.581	24.581	100.00	0.000	0.000
					B	0.000	24.581		100.00	0.000	0.000
					C	0.000	24.581		100.00	0.000	8.499
L5 71.0000-68.0833	69.5353	1.237	7.919	6.085	A	0.000	6.085	6.085	100.00	0.000	0.000
					B	0.000	6.085		100.00	0.000	0.000
					C	0.000	6.085		100.00	0.000	2.597
L6 68.0833-63.5000	65.7765	1.218	7.794	9.884	A	0.000	9.884	9.884	100.00	0.000	0.000
					B	0.000	9.884		100.00	0.000	0.000
					C	0.000	9.884		100.00	0.000	4.081
L7 63.5000-47.4200	55.2885	1.159	7.417	37.782	A	0.000	37.782	37.782	100.00	0.000	0.000
					B	0.000	37.782		100.00	0.000	0.000
					C	0.000	37.782		100.00	0.000	14.317
L8 47.4200-38.0833	42.6774	1.076	6.888	23.495	A	0.000	23.495	23.495	100.00	0.000	0.000
					B	0.000	23.495		100.00	0.000	0.000
					C	0.000	23.495		100.00	0.000	8.313
L9 38.0833-35.0000	36.5360	1.03	6.589	8.219	A	0.000	8.219	8.219	100.00	0.000	0.000
					B	0.000	8.219		100.00	0.000	0.000
					C	0.000	8.219		100.00	0.000	2.745
L10 35.0000-12.5000	23.4750	1	6.400	65.434	A	0.000	65.434	65.434	100.00	0.000	0.000
					B	0.000	65.434		100.00	0.000	0.000
					C	0.000	65.434		100.00	0.000	20.033
L11 12.5000-2.5000	7.4509	1	6.400	32.162	A	0.000	32.162	32.162	100.00	0.000	0.000
					B	0.000	32.162		100.00	0.000	0.000
					C	0.000	32.162		100.00	0.000	8.903
L12 2.5000-0.0000	1.2470	1	6.400	8.337	A	0.000	8.337	8.337	100.00	0.000	0.000
					B	0.000	8.337		100.00	0.000	0.000
					C	0.000	8.337		100.00	0.000	2.226

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
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

Comb. No.	Description
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 Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	117 - 110	Pole	Max Tension	36	0.00	-0.00	-0.00
			Max. Compression	14	-2.06	0.00	0.00
			Max. Mx	5	-0.89	-16.40	0.00
			Max. My	2	-0.89	0.01	16.40
			Max. Vy	5	2.64	-16.40	0.00
			Max. Vx	2	-2.64	0.01	16.40
			Max. Torque	13			-0.00
L2	110 - 100	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-3.70	0.00	0.03
			Max. Mx	5	-1.77	-57.53	0.07
			Max. My	2	-1.77	-0.03	57.40
			Max. Vy	5	4.49	-57.53	0.07
			Max. Vx	2	-4.47	-0.03	57.40
			Max. Torque	12			-0.03
L3	100 - 83.6667	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-16.91	1.72	0.67
			Max. Mx	11	-8.40	288.00	1.74
			Max. My	2	-8.42	0.81	285.63
			Max. Vy	5	18.80	-287.49	-0.17
			Max. Vx	8	18.65	-0.30	-285.31
			Max. Torque	3			2.09
L4	83.6667 - 71	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-22.97	2.03	0.51
			Max. Mx	5	-11.96	-542.08	0.19
			Max. My	2	-11.97	0.22	538.11
			Max. Vy	5	23.21	-542.08	0.19
			Max. Vx	8	23.06	-0.41	-538.08
			Max. Torque	3			2.13
L5	71 - 68.0833	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-23.62	2.12	0.46
			Max. Mx	5	-12.50	-610.23	0.27
			Max. My	8	-12.51	-0.44	-605.82
			Max. Vy	5	23.55	-610.23	0.27
			Max. Vx	8	23.40	-0.44	-605.82
			Max. Torque	3			2.14
L6	68.0833 - 63.5	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-24.88	2.25	0.39
			Max. Mx	5	-13.57	-719.34	0.40
			Max. My	8	-13.59	-0.48	-714.27
			Max. Vy	5	24.09	-719.34	0.40
			Max. Vx	8	23.94	-0.48	-714.27
			Max. Torque	3			2.16

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L7	63.5 - 47.42	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-28.62	2.59	0.18
			Max. Mx	5	-16.83	-1003.96	0.71
			Max. My	8	-16.84	-0.57	-997.27
			Max. Vy	5	25.45	-1003.96	0.71
			Max. Vx	8	25.30	-0.57	-997.27
			Max. Torque	8			-2.25
L8	47.42 - 38.0833	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-34.65	3.02	-0.08
			Max. Mx	5	-22.13	-1369.99	1.09
			Max. My	8	-22.14	-0.69	-1361.34
			Max. Vy	5	27.11	-1369.99	1.09
			Max. Vx	8	26.96	-0.69	-1361.34
			Max. Torque	8			-2.37
L9	38.0833 - 35	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-35.70	3.12	-0.14
			Max. Mx	5	-23.06	-1454.04	1.17
			Max. My	8	-23.07	-0.72	-1444.96
			Max. Vy	5	27.44	-1454.04	1.17
			Max. Vx	8	27.29	-0.72	-1444.96
			Max. Torque	8			-2.40
L10	35 - 12.5	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-44.12	3.89	-0.61
			Max. Mx	5	-30.62	-2097.98	1.75
			Max. My	8	-30.62	-0.90	-2085.79
			Max. Vy	5	29.87	-2097.98	1.75
			Max. Vx	8	29.72	-0.90	-2085.79
			Max. Torque	8			-2.60
L11	12.5 - 2.5	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-48.05	4.27	-0.83
			Max. Mx	5	-34.15	-2401.98	2.01
			Max. My	8	-34.15	-0.98	-2388.43
			Max. Vy	5	30.98	-2401.98	2.01
			Max. Vx	8	30.83	-0.98	-2388.43
			Max. Torque	8			-2.69
L12	2.5 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-49.11	4.37	-0.89
			Max. Mx	5	-35.11	-2479.73	2.07
			Max. My	8	-35.11	-1.00	-2465.84
			Max. Vy	5	31.26	-2479.73	2.07
			Max. Vx	8	31.12	-1.00	-2465.84
			Max. Torque	8			-2.72

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	14	49.11	-0.00	-0.00
	Max. H_x	11	35.12	31.18	0.08
	Max. H_z	2	35.12	-0.05	31.08
	Max. M_x	2	2464.10	-0.05	31.08
	Max. M_z	5	2479.73	-31.25	0.03
	Max. Torsion	2	2.57	-0.05	31.08
	Min. Vert	5	35.12	-31.25	0.03
	Min. H_x	5	35.12	-31.25	0.03
	Min. H_z	8	35.12	-0.01	-31.10
	Min. M_x	8	-2465.84	-0.01	-31.10
	Min. M_z	11	-2475.27	31.18	0.08
	Min. Torsion	8	-2.72	-0.01	-31.10

Tower Mast Reaction Summary

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead Only	35.12	0.00	0.00	0.01	1.05	0.00
Dead+Wind 0 deg - No Ice	35.12	0.05	-31.08	-2464.10	-3.03	-2.57
Dead+Wind 30 deg - No Ice	35.12	15.67	-26.83	-2124.96	-1243.26	-2.49
Dead+Wind 60 deg - No Ice	35.12	27.05	-15.48	-1225.77	-2146.06	-1.70
Dead+Wind 90 deg - No Ice	35.12	31.25	-0.03	-2.07	-2479.73	-0.44
Dead+Wind 120 deg - No Ice	35.12	27.15	15.61	1239.49	-2155.69	1.00
Dead+Wind 150 deg - No Ice	35.12	15.57	27.02	2143.78	-1235.22	2.36
Dead+Wind 180 deg - No Ice	35.12	0.01	31.10	2465.84	-1.00	2.72
Dead+Wind 210 deg - No Ice	35.12	-15.50	26.90	2131.88	1229.34	2.37
Dead+Wind 240 deg - No Ice	35.12	-26.99	15.58	1235.05	2141.93	1.57
Dead+Wind 270 deg - No Ice	35.12	-31.18	-0.08	-8.10	2475.27	0.39
Dead+Wind 300 deg - No Ice	35.12	-27.11	-15.53	-1231.60	2154.17	-1.02
Dead+Wind 330 deg - No Ice	35.12	-15.74	-26.87	-2129.13	1253.63	-2.19
Dead+Ice+Temp	49.11	0.00	0.00	0.89	4.37	0.00
Dead+Wind 0 deg+Ice+Temp	49.11	0.01	-7.62	-611.66	3.34	-0.72
Dead+Wind 30 deg+Ice+Temp	49.11	3.84	-6.58	-527.68	-304.54	-0.66
Dead+Wind 60 deg+Ice+Temp	49.11	6.63	-3.80	-304.30	-528.59	-0.42
Dead+Wind 90 deg+Ice+Temp	49.11	7.65	-0.01	-0.02	-611.21	-0.05
Dead+Wind 120 deg+Ice+Temp	49.11	6.64	3.82	308.45	-530.39	0.34
Dead+Wind 150 deg+Ice+Temp	49.11	3.81	6.62	533.29	-302.02	0.68
Dead+Wind 180 deg+Ice+Temp	49.11	-0.00	7.62	613.75	4.47	0.76
Dead+Wind 210 deg+Ice+Temp	49.11	-3.80	6.60	531.03	310.02	0.64
Dead+Wind 240 deg+Ice+Temp	49.11	-6.61	3.82	308.07	536.42	0.39
Dead+Wind 270 deg+Ice+Temp	49.11	-7.64	-0.01	-0.64	618.92	0.04
Dead+Wind 300 deg+Ice+Temp	49.11	-6.63	-3.80	-304.97	538.70	-0.34
Dead+Wind 330 deg+Ice+Temp	49.11	-3.85	-6.59	-528.24	314.88	-0.64
Dead+Wind 0 deg - Service	35.12	0.02	-10.75	-853.08	-0.33	-0.89
Dead+Wind 30 deg - Service	35.12	5.42	-9.28	-735.65	-429.70	-0.87
Dead+Wind 60 deg - Service	35.12	9.36	-5.36	-424.40	-742.33	-0.59
Dead+Wind 90 deg - Service	35.12	10.81	-0.01	-0.71	-857.83	-0.15
Dead+Wind 120 deg - Service	35.12	9.39	5.40	429.12	-745.60	0.35
Dead+Wind 150 deg - Service	35.12	5.39	9.35	742.18	-426.92	0.82
Dead+Wind 180 deg - Service	35.12	0.01	10.76	853.69	0.37	0.95
Dead+Wind 210 deg - Service	35.12	-5.36	9.31	738.13	426.36	0.83
Dead+Wind 240 deg - Service	35.12	-9.34	5.39	427.58	742.25	0.55
Dead+Wind 270 deg - Service	35.12	-10.79	-0.03	-2.80	857.71	0.14
Dead+Wind 300 deg - Service	35.12	-9.38	-5.37	-426.38	746.49	-0.35
Dead+Wind 330 deg - Service	35.12	-5.45	-9.30	-737.18	434.77	-0.76

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	K	K	K	K	K	K	
1	0.00	-35.12	0.00	-0.00	35.12	-0.00	0.000%
2	0.05	-35.12	-31.09	-0.05	35.12	31.08	0.001%
3	15.67	-35.12	-26.83	-15.67	35.12	26.83	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
4	27.05	-35.12	-15.48	-27.05	35.12	15.48	0.000%
5	31.25	-35.12	-0.03	-31.25	35.12	0.03	0.003%
6	27.15	-35.12	15.61	-27.15	35.12	-15.61	0.000%
7	15.57	-35.12	27.02	-15.57	35.12	-27.02	0.000%
8	0.01	-35.12	31.10	-0.01	35.12	-31.10	0.001%
9	-15.50	-35.12	26.90	15.50	35.12	-26.90	0.000%
10	-26.99	-35.12	15.58	26.99	35.12	-15.58	0.000%
11	-31.18	-35.12	-0.08	31.18	35.12	0.08	0.003%
12	-27.11	-35.12	-15.53	27.11	35.12	15.53	0.000%
13	-15.74	-35.12	-26.87	15.74	35.12	26.87	0.000%
14	0.00	-49.11	0.00	-0.00	49.11	-0.00	0.002%
15	0.01	-49.11	-7.62	-0.01	49.11	7.62	0.000%
16	3.84	-49.11	-6.58	-3.84	49.11	6.58	0.000%
17	6.63	-49.11	-3.80	-6.63	49.11	3.80	0.000%
18	7.65	-49.11	-0.01	-7.65	49.11	0.01	0.000%
19	6.64	-49.11	3.82	-6.64	49.11	-3.82	0.000%
20	3.81	-49.11	6.62	-3.81	49.11	-6.62	0.000%
21	-0.00	-49.11	7.62	0.00	49.11	-7.62	0.000%
22	-3.80	-49.11	6.60	3.80	49.11	-6.60	0.000%
23	-6.61	-49.11	3.82	6.61	49.11	-3.82	0.000%
24	-7.64	-49.11	-0.01	7.64	49.11	0.01	0.000%
25	-6.63	-49.11	-3.80	6.63	49.11	3.80	0.000%
26	-3.85	-49.11	-6.59	3.85	49.11	6.59	0.000%
27	0.02	-35.12	-10.76	-0.02	35.12	10.75	0.004%
28	5.42	-35.12	-9.28	-5.42	35.12	9.28	0.004%
29	9.36	-35.12	-5.36	-9.36	35.12	5.36	0.002%
30	10.81	-35.12	-0.01	-10.81	35.12	0.01	0.004%
31	9.39	-35.12	5.40	-9.39	35.12	-5.40	0.004%
32	5.39	-35.12	9.35	-5.39	35.12	-9.35	0.004%
33	0.01	-35.12	10.76	-0.01	35.12	-10.76	0.004%
34	-5.36	-35.12	9.31	5.36	35.12	-9.31	0.002%
35	-9.34	-35.12	5.39	9.34	35.12	-5.39	0.004%
36	-10.79	-35.12	-0.03	10.79	35.12	0.03	0.004%
37	-9.38	-35.12	-5.37	9.38	35.12	5.37	0.004%
38	-5.45	-35.12	-9.30	5.45	35.12	9.30	0.002%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.00000001	0.00000001
2	Yes	14	0.00000001	0.00006767
3	Yes	16	0.00000001	0.00007319
4	Yes	16	0.00000001	0.00008227
5	Yes	13	0.00004360	0.00008190
6	Yes	16	0.00000001	0.00008063
7	Yes	16	0.00000001	0.00007432
8	Yes	14	0.00000001	0.00007231
9	Yes	16	0.00000001	0.00008291
10	Yes	16	0.00000001	0.00007469
11	Yes	13	0.00004361	0.00008586
12	Yes	16	0.00000001	0.00007756
13	Yes	16	0.00000001	0.00008338
14	Yes	6	0.00000001	0.00003949
15	Yes	14	0.00000001	0.00010847
16	Yes	14	0.00000001	0.00011761
17	Yes	14	0.00000001	0.00011843
18	Yes	14	0.00000001	0.00010746
19	Yes	14	0.00000001	0.00011870
20	Yes	14	0.00000001	0.00011781
21	Yes	14	0.00000001	0.00010833
22	Yes	14	0.00000001	0.00012016
23	Yes	14	0.00000001	0.00011999
24	Yes	14	0.00000001	0.00010964
25	Yes	14	0.00000001	0.00012059
26	Yes	14	0.00000001	0.00012089
27	Yes	12	0.00011626	0.00009611

28	Yes	12	0.00011597	0.00010596
29	Yes	13	0.00000001	0.00007764
30	Yes	12	0.00011624	0.00007948
31	Yes	12	0.00011595	0.00014506
32	Yes	12	0.00011596	0.00010915
33	Yes	12	0.00011625	0.00009862
34	Yes	13	0.00000001	0.00008109
35	Yes	12	0.00011597	0.00011197
36	Yes	12	0.00011626	0.00007964
37	Yes	12	0.00011598	0.00012686
38	Yes	13	0.00000001	0.00007815

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	117 - 110	21.16	37	1.71	0.01
L2	110 - 100	18.66	37	1.69	0.01
L3	100 - 83.6667	15.20	37	1.60	0.01
L4	83.6667 - 71	10.18	37	1.29	0.00
L5	71 - 68.0833	7.17	31	0.97	0.00
L6	68.0833 - 63.5	6.60	31	0.92	0.00
L7	63.5 - 47.42	5.75	31	0.85	0.00
L8	52 - 38.0833	3.89	31	0.70	0.00
L9	38.0833 - 35	2.07	31	0.53	0.00
L10	35 - 12.5	1.74	31	0.48	0.00
L11	12.5 - 2.5	0.22	31	0.17	0.00
L12	2.5 - 0	0.01	31	0.03	0.00

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
117.0000	APXVSPP18-C-A20 w/ Mount Pipe	37	21.16	1.71	0.01	13531
115.0000	TME-PCS 1900MHz 4x45W-65MHz	37	20.45	1.71	0.01	13531
110.0000	ERICSSON AIR 21 B2A B4P w/ Mount Pipe	37	18.66	1.69	0.01	9917
100.0000	(2) HBXX-6516DS-A2M w/ Mount Pipe	37	15.20	1.60	0.01	4656
95.0000	VHLP1-23	37	13.56	1.53	0.01	3536
94.0000	VHLP2-11	37	13.24	1.51	0.01	3367
93.0000	Pipe Mount [PM 601-3]	37	12.92	1.49	0.01	3214
92.0000	VHLP1-23	37	12.61	1.47	0.01	3074
88.0000	P65-17-XLH-RR w/ Mount Pipe	37	11.40	1.39	0.01	2618
81.0000	800 10504 w/ Mount Pipe	37	9.48	1.22	0.00	2263
72.0000	LBX-9012DS-VTM w/ Mount Pipe	31	7.38	0.99	0.00	2406

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	117 - 110	60.98	6	4.93	0.02
L2	110 - 100	53.79	6	4.88	0.02
L3	100 - 83.6667	43.84	6	4.61	0.02
L4	83.6667 - 71	29.40	6	3.72	0.01
L5	71 - 68.0833	20.72	6	2.80	0.01
L6	68.0833 - 63.5	19.06	6	2.64	0.01
L7	63.5 - 47.42	16.61	6	2.45	0.01

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L8	52 - 38.0833	11.23	6	2.02	0.00
L9	38.0833 - 35	5.97	6	1.53	0.00
L10	35 - 12.5	5.03	6	1.39	0.00
L11	12.5 - 2.5	0.63	6	0.49	0.00
L12	2.5 - 0	0.02	6	0.09	0.00

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
117.0000	APXVSPP18-C-A20 w/ Mount Pipe	6	60.98	4.93	0.02	4772
115.0000	TME-PCS 1900MHz 4x45W-65MHz	6	58.92	4.92	0.02	4772
110.0000	ERICSSON AIR 21 B2A B4P w/ Mount Pipe	6	53.79	4.88	0.02	3494
100.0000	(2) HBXX-6516DS-A2M w/ Mount Pipe	6	43.84	4.61	0.02	1644
95.0000	VHLP1-23	6	39.12	4.39	0.02	1248
94.0000	VHLP2-11	6	38.20	4.34	0.02	1188
93.0000	Pipe Mount [PM 601-3]	6	37.30	4.29	0.02	1134
92.0000	VHLP1-23	6	36.40	4.24	0.02	1084
88.0000	P65-17-XLH-RR w/ Mount Pipe	6	32.93	4.01	0.02	922
81.0000	800 10504 w/ Mount Pipe	6	27.37	3.52	0.01	794
72.0000	LBX-9012DS-VTM w/ Mount Pipe	6	21.32	2.86	0.01	840

Compression Checks

Pole Design Data

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 $\frac{P}{P_a}$
L1	117 - 110 (1)	TP15.94x14.36x0.188	7.0000	0.0000	0.0	39.00	9.5356	-0.89	371.89	0.002
L2	110 - 100 (2)	TP18.2x15.94x0.188	10.0000	0.0000	0.0	39.00	10.9037	-1.77	425.25	0.004
L3	100 - 83.6667 (3)	TP21.8655x18.2x0.25	16.3333	0.0000	0.0	39.00	17.4005	-8.40	678.62	0.012
L4	83.6667 - 71 (4)	TP24.7082x21.8655x0.3224	12.6667	0.0000	0.0	35.49	25.3148	-11.95	898.42	0.013
L5	71 - 68.0833 (5)	TP25.3627x24.7082x0.5162	2.9167	0.0000	0.0	26.36	41.2959	-12.49	1088.72	0.011
L6	68.0833 - 63.5 (6)	TP26.3913x25.3627x0.685	4.5833	0.0000	0.0	27.99	56.7029	-13.57	1587.11	0.009
L7	63.5 - 47.42 (7)	TP30x26.3913x0.8147	16.0800	0.0000	0.0	28.10	73.8647	-16.82	2075.45	0.008
L8	47.42 - 38.0833 (8)	TP31.6377x27.3428x0.8045	13.9167	0.0000	0.0	27.80	76.5509	-20.85	2128.42	0.010
L9	38.0833 - 35 (9)	TP32.339x31.6377x0.7403	3.0833	0.0000	0.0	27.81	75.3239	-23.06	2094.76	0.011
L10	35 - 12.5 (10)	TP37.4568x32.339x0.7647	22.5000	0.0000	0.0	29.04	90.3435	-30.62	2623.58	0.012
L11	12.5 - 2.5 (11)	TP39.7314x37.4568x0.7264	10.0000	0.0000	0.0	29.19	91.2268	-34.15	2662.91	0.013
L12	2.5 - 0 (12)	TP40.3x39.7314x0.7719	2.5000	0.0000	0.0	30.29	98.2441	-35.11	2975.62	0.012

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	117 - 110 (1)	TP15.94x14.36x0.188	16.40	5.38	39.00	0.138	0.00	0.00	39.00	0.000
L2	110 - 100 (2)	TP18.2x15.94x0.188	57.54	14.42	39.00	0.370	0.00	0.00	39.00	0.000
L3	100 - 83.6667 (3)	TP21.8655x18.2x0.25	289.04	37.86	39.00	0.971	0.00	0.00	39.00	0.000
L4	83.6667 - 71 (4)	TP24.7082x21.8655x0.3224	543.96	43.48	35.49	1.225	0.00	0.00	35.49	0.000
L5	71 - 68.0833 (5)	TP25.3627x24.7082x0.5162	612.32	29.67	26.36	1.125	0.00	0.00	26.36	0.000
L6	68.0833 - 63.5 (6)	TP26.3913x25.3627x0.685	721.75	24.76	27.99	0.884	0.00	0.00	27.99	0.000
L7	63.5 - 47.42 (7)	TP30x26.3913x0.8147	1007.18	24.27	28.10	0.864	0.00	0.00	28.10	0.000
L8	47.42 - 38.0833 (8)	TP31.6377x27.3428x0.8045	1262.45	27.92	27.80	1.004	0.00	0.00	27.80	0.000
L9	38.0833 - 35 (9)	TP32.339x31.6377x0.7403	1458.47	30.54	27.81	1.098	0.00	0.00	27.81	0.000
L10	35 - 12.5 (10)	TP37.4568x32.339x0.7647	2104.01	31.55	29.04	1.087	0.00	0.00	29.04	0.000
L11	12.5 - 2.5 (11)	TP39.7314x37.4568x0.7264	2408.71	33.58	29.19	1.150	0.00	0.00	29.19	0.000
L12	2.5 - 0 (12)	TP40.3x39.7314x0.7719	2486.63	31.79	30.29	1.050	0.00	0.00	30.29	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	117 - 110 (1)	TP15.94x14.36x0.188	2.65	0.28	26.00	0.022	0.00	0.00	26.00	0.000
L2	110 - 100 (2)	TP18.2x15.94x0.188	4.49	0.41	26.00	0.032	0.01	0.00	26.00	0.000
L3	100 - 83.6667 (3)	TP21.8655x18.2x0.25	18.79	1.08	26.00	0.084	0.32	0.02	26.00	0.001
L4	83.6667 - 71 (4)	TP24.7082x21.8655x0.3224	23.28	0.92	23.66	0.079	0.37	0.01	23.66	0.001
L5	71 - 68.0833 (5)	TP25.3627x24.7082x0.5162	23.62	0.57	17.58	0.066	0.40	0.01	17.58	0.001
L6	68.0833 - 63.5 (6)	TP26.3913x25.3627x0.685	24.16	0.43	18.66	0.046	0.43	0.01	18.66	0.000
L7	63.5 - 47.42 (7)	TP30x26.3913x0.8147	25.52	0.35	18.73	0.037	0.53	0.01	18.73	0.000
L8	47.42 - 38.0833 (8)	TP31.6377x27.3428x0.8045	26.83	0.35	18.54	0.038	0.62	0.01	18.54	0.000
L9	38.0833 - 35 (9)	TP32.339x31.6377x0.7403	27.51	0.37	18.54	0.040	0.67	0.01	18.54	0.000
L10	35 - 12.5 (10)	TP37.4568x32.339x0.7647	29.94	0.33	19.36	0.035	0.87	0.01	19.36	0.000
L11	12.5 - 2.5 (11)	TP39.7314x37.4568x0.7264	31.04	0.34	19.46	0.036	0.97	0.01	19.46	0.000
L12	2.5 - 0 (12)	TP40.3x39.7314x0.7719	31.33	0.32	20.19	0.032	1.00	0.01	20.19	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	117 - 110 (1)	0.002	0.138	0.000	0.022	0.000	0.140 ✔	1.333	H1-3+VT ✔
L2	110 - 100 (2)	0.004	0.370	0.000	0.032	0.000	0.374 ✔	1.333	H1-3+VT ✔

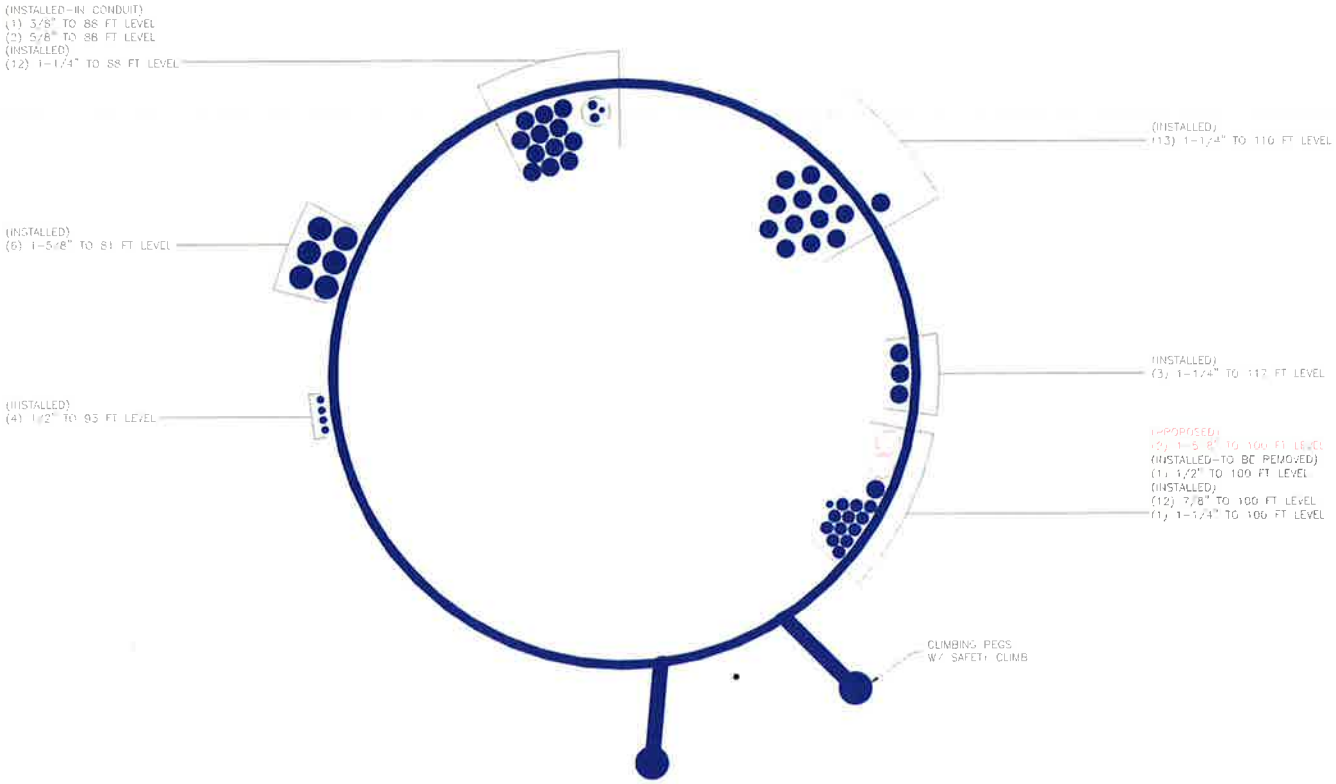
Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L3	100 - 83.6667 (3)	0.012	0.971	0.000	0.084	0.001	0.985 ✔	1.333	H1-3+VT ✔
L4	83.6667 - 71 (4)	0.013	1.225	0.000	0.079	0.001	1.240 ✔	1.333	H1-3+VT ✔
L5	71 - 68.0833 (5)	0.011	1.125	0.000	0.066	0.001	1.138 ✔	1.333	H1-3+VT ✔
L6	68.0833 - 63.5 (6)	0.009	0.884	0.000	0.046	0.000	0.894 ✔	1.333	H1-3+VT ✔
L7	63.5 - 47.42 (7)	0.008	0.864	0.000	0.037	0.000	0.872 ✔	1.333	H1-3+VT ✔
L8	47.42 - 38.0833 (8)	0.010	1.004	0.000	0.038	0.000	1.014 ✔	1.333	H1-3+VT ✔
L9	38.0833 - 35 (9)	0.011	1.098	0.000	0.040	0.000	1.110 ✔	1.333	H1-3+VT ✔
L10	35 - 12.5 (10)	0.012	1.087	0.000	0.035	0.000	1.099 ✔	1.333	H1-3+VT ✔
L11	12.5 - 2.5 (11)	0.013	1.150	0.000	0.036	0.000	1.164 ✔	1.333	H1-3+VT ✔
L12	2.5 - 0 (12)	0.012	1.050	0.000	0.032	0.000	1.062 ✔	1.333	H1-3+VT ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	117 - 110	Pole	TP15.94x14.36x0.188	1	-0.89	495.73	10.5	Pass
L2	110 - 100	Pole	TP18.2x15.94x0.188	2	-1.77	566.85	28.1	Pass
L3	100 - 83.6667	Pole	TP21.8655x18.2x0.25	3	-8.40	904.60	73.9	Pass
L4	83.6667 - 71	Pole	TP24.7082x21.8655x0.3224	4	-11.95	1197.60	93.0	Pass
L5	71 - 68.0833	Pole	TP25.3627x24.7082x0.5162	5	-12.49	1451.26	85.4	Pass
L6	68.0833 - 63.5	Pole	TP26.3913x25.3627x0.685	6	-13.57	2115.62	67.0	Pass
L7	63.5 - 47.42	Pole	TP30x26.3913x0.8147	7	-16.82	2766.57	65.4	Pass
L8	47.42 - 38.0833	Pole	TP31.6377x27.3428x0.8045	8	-20.85	2837.18	76.1	Pass
L9	38.0833 - 35	Pole	TP32.339x31.6377x0.7403	9	-23.06	2792.31	83.2	Pass
L10	35 - 12.5	Pole	TP37.4568x32.339x0.7647	10	-30.62	3497.23	82.4	Pass
L11	12.5 - 2.5	Pole	TP39.7314x37.4568x0.7264	11	-34.15	3549.66	87.3	Pass
L12	2.5 - 0	Pole	TP40.3x39.7314x0.7719	12	-35.11	3966.50	79.6	Pass
							Summary	
						Pole (L4)	93.0	Pass
						RATING =	**93.0**	**Pass**

APPENDIX B

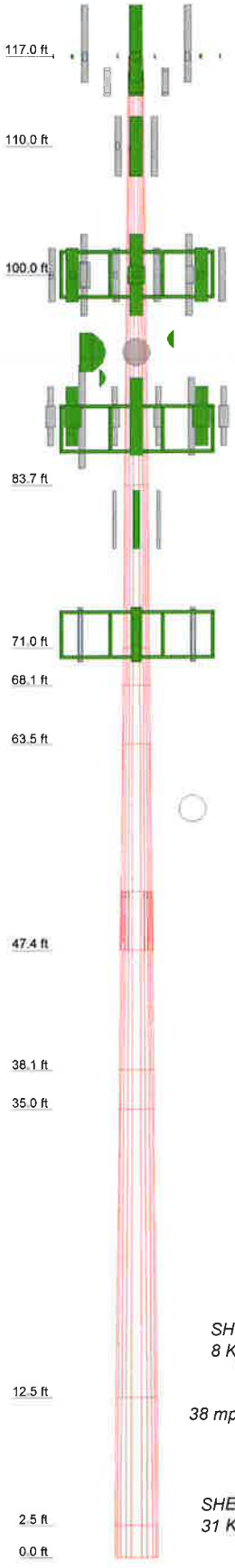
BASE LEVEL DRAWING

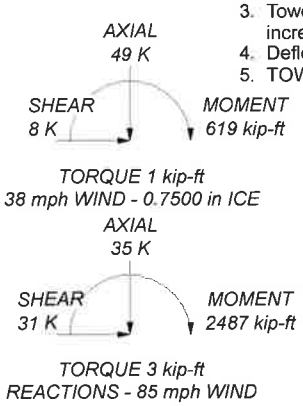


APPENDIX C

ADDITIONAL CALCULATIONS

Section	1	2	3	4	5	6	7	8	9	10	11	12
Length (ft)	7.0000	10.0000	16.3333	12.6667	2.9167	4.5833	16.0800	13.9167	3.0833	22.5000	10.0000	2.5000
Number of Sides	12	12	12	12	12	12	12	12	12	12	12	12
Thickness (in)	0.1880	0.1880	0.2500	0.3224	0.5162	0.6850	0.8147	0.8045	0.7403	0.7647	0.7264	0.7719
Socket Length (ft)							4.5800					
Top Dia (in)	14.3600	15.9400	18.2000	21.8655	24.7082	25.3627	26.3913	27.3428	31.6377	32.3390	37.4568	39.7314
Bot Dia (in)	15.9400	18.2000	21.8655	24.7082	25.3627	26.3913	30.0000	31.6377	32.3390	37.4568	39.7314	40.3000
Grade	A572-65				Reinf 59.15 ksi	Reinf 43.94 ksi	Reinf 46.65 ksi	Reinf 46.34 ksi	Reinf 46.83 ksi	Reinf 46.35 ksi	Reinf 48.40 ksi	Reinf 46.65 ksi
Weight (K)	0.2	0.3	0.9	1.0	0.4	0.9	3.9	3.5	0.8	6.4	3.0	0.8





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
APXVSPP18-C-A20 w/ Mount Pipe	117	(2) DB844G65ZAXY w/ Mount Pipe	100
APXVSPP18-C-A20 w/ Mount Pipe	117	(2) DB844G65ZAXY w/ Mount Pipe	100
APXVSPP18-C-A20 w/ Mount Pipe	117	(2) DB844G65ZAXY w/ Mount Pipe	100
800 EXTERNAL NOTCH FILTER	117	GPS_A	100
800 EXTERNAL NOTCH FILTER	117	(2) FD9R6004/2C-3L	100
800 EXTERNAL NOTCH FILTER	117	(2) FD9R6004/2C-3L	100
(3) ACU-A20-N	117	(2) FD9R6004/2C-3L	100
(3) ACU-A20-N	117	DB-T1-6Z-8AB-0Z	100
(3) ACU-A20-N	117	Platform Mount [LP 715-1]	100
Pipe Mount [PM 601-3]	117	Pipe Mount [PM 601-3]	93
TME-PCS 1900MHz 4x45W-65MHz	115	VHLP2-11	93
TME-PCS 1900MHz 4x45W-65MHz	115	VHLP1-23	93
TME-PCS 1900MHz 4x45W-65MHz	115	VHLP1-23	93
TME-800MHZ RRH	115	VHLP2.5-11	93
TME-800MHZ RRH	115	(2) 7770.00 w/ Mount Pipe	88
TME-800MHZ RRH	115	(2) 7770.00 w/ Mount Pipe	88
Side Arm Mount [SO 102-3]	115	(2) LGP2140X	88
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	110	(2) LGP2140X	88
		(2) LGP2140X	88
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	110	(2) LGP13519	88
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	110	(2) LGP13519	88
		(2) LGP13519	88
KRY 112 144/1	110	(2) RRUS-11	88
KRY 112 144/1	110	(2) RRUS-11	88
KRY 112 144/1	110	(2) RRUS-11	88
Pipe Mount [PM 601-3]	110	DC6-48-60-18-8F	88
(2) HBXX-6516DS-A2M w/ Mount Pipe	100	Platform Mount [LP 715-1]	88
(2) HBXX-6516DS-A2M w/ Mount Pipe	100	P65-17-XLH-RR w/ Mount Pipe	88
(2) HBXX-6516DS-A2M w/ Mount Pipe	100	P65-16-XLH-RR w/ Mount Pipe	88
RRH2X60-AWS	100	P65-16-XLH-RR w/ Mount Pipe	88
RRH2X60-AWS	100	(2) 7770.00 w/ Mount Pipe	88
RRH2X60-AWS	100	800 10504 w/ Mount Pipe	81
RRH2X60-PCS	100	800 10504 w/ Mount Pipe	81
RRH2X60-PCS	100	800 10504 w/ Mount Pipe	81
RRH2X60-PCS	100	Pipe Mount [PM 601-3]	81
800 10735V01 w/ Mount Pipe	100	DB844H90E-XY w/ Mount Pipe	72
800 10735V01 w/ Mount Pipe	100	DB844H90E-XY w/ Mount Pipe	72
800 10735V01 w/ Mount Pipe	100	Platform Mount [LP 101-1]	72
RRH2X40-07-U	100	LBX-9012DS-VTM w/ Mount Pipe	72
RRH2X40-07-U	100	LBX-9012DS-VTM w/ Mount Pipe	72
RRH2X40-07-U	100	LBX-9012DS-VTM w/ Mount Pipe	72
DB-T1-6Z-8AB-0Z	100	DB844H90E-XY w/ Mount Pipe	72

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-65	65 ksi	80 ksi	Reinf 46.34 ksi	46 ksi	58 ksi
Reinf 59.15 ksi	59 ksi	74 ksi	Reinf 46.35 ksi	46 ksi	58 ksi
Reinf 43.94 ksi	44 ksi	55 ksi	Reinf 48.40 ksi	48 ksi	61 ksi
Reinf 46.65 ksi	47 ksi	59 ksi	Reinf 48.65 ksi	49 ksi	61 ksi
Reinf 46.83 ksi	47 ksi	59 ksi	Reinf 50.48 ksi	50 ksi	64 ksi

TOWER DESIGN NOTES

1. Tower is located in Fairfield 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 0.75 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 93%

Paul J Ford and Company
250 E. Broad Street Suite 600
Columbus, OH 43215
Phone: 614.221.6679
FAX: 614.448.4105

Job: 117' Monopole / Darien, CT			
Project: 37515-1078.003.7805 / BU 806352			
Client: Crown Castle	Drawn by: Kyle Thorpe	App'd:	
Code: TIA/EIA-222-F	Date: 05/28/15	Scale: N	
Path:		Dwg No.	

Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Rev F

Site Data

BU#: *806352*
Site Name:
App #:

Pole Manufacturer:	Other

Reactions		
Moment:	16.4	ft-kips
Axial:	0.89	kips
Shear:	2.65	kips
Elevation:	110	feet

If No stiffeners, Criteria: AISC ASD <-Only Applcable to Unstiffened Cases

Bolt Data			
Qty:	10		
Diameter (in.):	1	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:		<-- Disregard	Bolt Fty:
N/A:		<-- Disregard	44.00
Circle (in.):	19.5		

Plate Data		
Diam:	22	in
Thick, t:	1.5	in
Grade (Fy):	36	ksi
Strength, Fu:	58	ksi
Single-Rod B-eff:	5.13	in

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:	Fillet	
Groove Depth:		<-- Disregard
Groove Angle:		<-- Disregard
Fillet H. Weld:		in
Fillet V. Weld:		in
Width:		in
Height:		in
Thick:		in
Notch:		in
Grade:		ksi
Weld str.:		ksi

Pole Data		
Diam:	15.94	in
Thick:	0.188	in
Grade:	65	ksi
# of Sides:	12	"0" IF Round
Fu	80	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	

Flange Bolt Results

Bolt Tension Capacity, **B**:	46.07	kips	Rigid
Max Bolt directly applied T:	3.95	Kips	Service, ASD
Min. PL "tc" for **B** cap. **w/o** Pry:	1.401	in	Fty*ASIF
Min PL "treq" for actual **T w/ Pry:**	0.307	in	
Min PL "t1" for actual **T w/o Pry:**	0.410	in	
T allowable w/o Prying:	46.07	kips	α'<0 case
Prying Force, Q:	0.00	kips	
Total Bolt Tension=T+Q:	3.95	kips	
Non-Prying Bolt Stress Ratio, T/B:	8.6%	Pass	

Exterior Flange Plate Results Flexural Check

Compression Side Plate Stress:	2.4	ksi	Rigid
Allowable Plate Stress:	36.0	ksi	Service ASD
Compression Plate Stress Ratio:	6.8%	Pass	0.75*Fy*ASIF
No Prying			Comp. Y.L. Length:
Tension Side Stress Ratio, (treq/t)^2:	4.2%	Pass	11.23

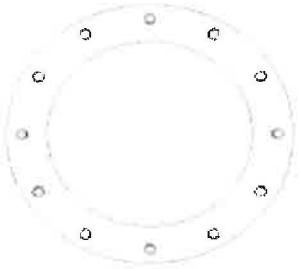
n/a

Stiffener Results

Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check: n/a



* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Rev F

Site Data

BU#: *806352*
Site Name:
App #:

Pole Manufacturer:	Other

Bolt Data			
Qty:	12		
Diameter (in.):	1	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:		<-- Disregard	Bolt Fty: 44.00
N/A:		<-- Disregard	
Circle (in.):	22		

Plate Data		
Diam:	24	in
Thick, t:	1.5	in
Grade (Fy):	36	ksi
Strength, Fu:	58	ksi
Single-Rod B-eff:	4.88	in

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:	Fillet	
Groove Depth:		<-- Disregard
Groove Angle:		<-- Disregard
Fillet H. Weld:		in
Fillet V. Weld:		in
Width:		in
Height:		in
Thick:		in
Notch:		in
Grade:		ksi
Weld str.:		ksi

Pole Data		
Diam:	18.2	in
Thick:	0.188	in
Grade:	65	ksi
# of Sides:	12	"0" IF Round
Fu	80	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	

Reactions		
Moment:	57.54	ft-kips
Axial:	1.77	kips
Shear:	4.49	kips
Elevation:	100	feet

If No stiffeners, Criteria: AISC ASD <-Only Applcable to Unstiffened Cases

Flange Bolt Results

		Rigid
Bolt Tension Capacity, B:	46.07 kips	Service, ASD
Max Bolt directly applied T:	10.31 Kips	Fty*ASIF
Min. PL "tc" for B cap. w/o Pry:	1.502 in	
Min PL "treq" for actual T w/ Pry:	0.533 in	
Min PL "t1" for actual T w/o Pry:	0.711 in	
T allowable with Prying:	46.00 kips	0≤α'≤1 case
Prying Force, Q:	0.00 kips	
Total Bolt Tension=T+Q:	10.31 kips	
Prying Bolt Stress Ratio=(T+Q)/(B):	22.4% Pass	

Exterior Flange Plate Results	Flexural Check	Rigid
Compression Side Plate Stress:	6.7 ksi	Service ASD
Allowable Plate Stress:	36.0 ksi	0.75*Fy*ASIF
Compression Plate Stress Ratio:	18.7% Pass	Comp. Y.L. Length: 12.36
No Prying		
Tension Side Stress Ratio, (treq/t)^2:	12.6% Pass	

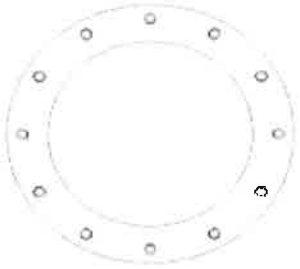
n/a

Stiffener Results

Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check: n/a



* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS

v4.4 - Effective 7-12-13

Date: 5/28/2015
PJF Project: 37515-1078.003.7805
Client Ref. # BU 806352
Site Name: BRG 302 943052
Description: 100-ft Tapered Pole w/ 10-ft and 7-ft Extensions
Owner: Crown Castle
Engineer: KAT

Asymmetric Anchor Rod Analysis

Moment =	2487	k-ft	TIA Ref.	F	Location =	Base Plate	
Axial =	35.0	kips	ASIF =	1.3333	η =	N/A	for BP, Rev. G Sect. 4.9.9
Shear =	31.0	kips	Max Ratio =	100.0%	Threads =	N/A	for FP, Rev. G
Anchor Qty =	15						

**** For Post Installed Anchors: Check anchors for embedment, epoxy/grout bond, and capacity based on proof load. ****

Item	Nominal Anchor Dia, in	Spec	Fy, ksi	Fu, ksi	Location, degrees	Anchor Circle, in	Area Override, in^2	Area, in^2	Max Net Compression, kips	Max Net Tension, kips	Load for Capacity Calc, kips	Capacity Override, kips	Capacity, kips	Capacity Ratio
1	2.250	#18J A615 Gr 75	75	100	0.0	48.22	0.00	3.98	171.08	166.01	166.01	0.00	195.00	85.1%
2	2.250	#18J A615 Gr 75	75	100	30.0	48.22	0.00	3.98	171.08	166.01	166.01	0.00	195.00	85.1%
3	2.250	#18J A615 Gr 75	75	100	60.0	48.22	0.00	3.98	171.08	166.01	166.01	0.00	195.00	85.1%
4	2.250	#18J A615 Gr 75	75	100	90.0	48.22	0.00	3.98	171.08	166.01	166.01	0.00	195.00	85.1%
5	2.250	#18J A615 Gr 75	75	100	120.0	48.22	0.00	3.98	171.08	166.01	166.01	0.00	195.00	85.1%
6	2.250	#18J A615 Gr 75	75	100	150.0	48.22	0.00	3.98	171.08	166.01	166.01	0.00	195.00	85.1%
7	2.250	#18J A615 Gr 75	75	100	180.0	48.22	0.00	3.98	171.08	166.01	166.01	0.00	195.00	85.1%
8	2.250	#18J A615 Gr 75	75	100	210.0	48.22	0.00	3.98	171.08	166.01	166.01	0.00	195.00	85.1%
9	2.250	#18J A615 Gr 75	75	100	240.0	48.22	0.00	3.98	171.08	166.01	166.01	0.00	195.00	85.1%
10	2.250	#18J A615 Gr 75	75	100	270.0	48.22	0.00	3.98	171.08	166.01	166.01	0.00	195.00	85.1%
11	2.250	#18J A615 Gr 75	75	100	300.0	48.22	0.00	3.98	171.08	166.01	166.01	0.00	195.00	85.1%
12	2.250	#18J A615 Gr 75	75	100	330.0	48.22	0.00	3.98	171.08	166.01	166.01	0.00	195.00	85.1%
13	1.750	A193 Gr B7	105	125	105.0	58.72	0.00	2.41	125.57	122.51	122.51	0.00	132.29	92.6%
14	1.750	A193 Gr B7	105	125	225.0	58.72	0.00	2.41	125.57	122.51	122.51	0.00	132.29	92.6%
15	1.750	A193 Gr B7	105	125	345.0	58.72	0.00	2.41	125.57	122.51	122.51	0.00	132.29	92.6%
								54.98						

Stiffened or Unstiffened, Ungrouted, Circular Base Plate - Any Rod Material

TIA Rev F

Site Data

BU#: *806352*
Site Name:
App #:

Pole Manufacturer:	*Other*

Reactions		
Moment:	2031.8	ft-kips
Axial:	30.4	kips
Shear:	26.9	kips

Reactions adjusted to account for additional anchor rods.

If No stiffeners, Criteria:	AISC ASD	<-Only Applcable to Unstiffened Cases

Anchor Rod Data		
Qty:	12	
Diam:	2.25	in
Rod Material:	A615-J	
Strength (Fu):	100	ksi
Yield (Fy):	75	ksi
Bolt Circle:	48.22	in

Plate Data		
Diam:	54.22	in
Thick:	2.5	in
Grade:	60	ksi
Single-Rod B-eff:	10.80	in

Stiffener Data (Welding at both sides)		
Config:	0	*
Weld Type:	Both	
Groove Depth:		in **
Groove Angle:		degrees
Fillet H. Weld:		in
Fillet V. Weld:		in
Width:		in
Height:		in
Thick:		in
Notch:		in
Grade:		ksi
Weld str.:		ksi

Pole Data		
Diam:	40.3	in
Thick:	0.344	in
Grade:	65	ksi
# of Sides:	12	"0" IF Round
Fu	80	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	

Anchor Rod Results

Maximum Rod Tension:	166.0 Kips	Rigid
Allowable Tension:	195.0 Kips	Service, ASD
Anchor Rod Stress Ratio:	85.2% Pass	Fty*ASIF

Base Plate Results

	Flexural Check	Rigid
Base Plate Stress:	37.6 ksi	Service ASD
Allowable Plate Stress:	60.0 ksi	0.75*Fy*ASIF
Base Plate Stress Ratio:	62.7% Pass	Y.L. Length: 26.48

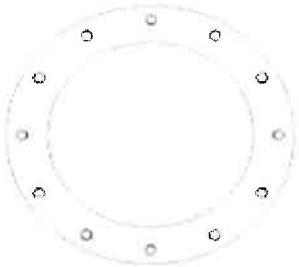
n/a

Stiffener Results

Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check: n/a



* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

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Job Number: 37515-1078.003.7805
Site Number: 806352
Site Name: BRG 302 943052

By: KAT
Date: 5/28/2015

DRILLED PIER SOIL AND STEEL ANALYSIS - TIA/EIA-222-F

Unfactored Base Reactions from RISA

	Comp. (+)	Tension (-)	
Moment, M =	2487.0		k-ft
Shear, V =	31.0		kips
Axial Load, P =	35.0		kips
OTM =	2493.2	0.0	k-ft @ Ground

Safety Factors / Load Factors / Φ Factors

Tower Type =	Monopole DP
ACI Code =	ACI 318-02
Seismic Design Category =	D
Reference Standard =	TIA/EIA-222-F
Use 1.3 Load Factor?	Yes
Load Factor =	1.30

Drilled Pier Parameters

Diameter =	6.5 ft
Height Above Grade =	0.2 ft
Depth Below Grade =	16.4 ft
fc' =	3 ksi
εc =	0.003 in/in
Mat Ftdn. Cap Width =	ft
Mat Ftdn. Cap Length =	ft
Depth Below Grade =	ft

	Safety Factor	Φ Factor
Soil Lateral Resistance =	2.00	0.75
Skin Friction =	2.00	0.75
End Bearing =	2.00	0.75
Concrete Wt. Resist Uplift =	1.25	

Load Combinations Checked per TIA/EIA-222-F

1. Ult. Skin Friction/2.00 + Ult. End Bearing/2.00 + Effective Soil Wt. - Buoyant Conc. Wt. ≥ Comp.
2. Ult. Skin Friction/2.00 + Buoyant Conc. Wt./1.25 ≥ Uplift
3. Ult. Skin Friction/1.50 + Buoyant Conc. Wt./1.50 ≥ Uplift

Steel Parameters

Number of Bars =	22
Rebar Size =	#10
Rebar Fy =	60 ksi
Rebar MOE =	29000 ksi
Tie Size =	#6
Side Clear Cover to Ties =	5 in

Soil Parameters

Water Table Depth =	99.00 ft
Depth to Ignore Soil =	4.00 ft
Depth to Full Cohesion =	0 ft
Full Cohesion Starts at?	Ground

Above Full Cohesion Lateral Resistance = 4(Cohesion)(Dia)(H)
Below Full Cohesion Lateral Resistance = 8(Cohesion)(Dia)(H)

Direct Embed Pole Shaft Parameters

Dia @ Grade =	in
Dia @ Depth Below Grade =	in
Number of Sides =	
Thickness =	in
Fy =	ksi
Backfill Condition =	

Maximum Capacity Ratios

Maximum Soil Ratio =	100.0%
Maximum Steel Ratio =	100.0%

Define Soil Layers

Note: Cohesion = Undrained Shear Strength = Unconfined Compressive Strength / 2

Layer	Thickness ft	Unit Weight pcf	Cohesion psf	Friction Angle degrees	Soil Type	Ultimate End Bearing psf	Comp. Ult. Skin Friction psf	Tension Ult. Skin Friction psf	Depth ft
1	4	115		30	Sand				4
2	2	120		39	Sand	23000	420		6
3	5	135		45	Sand	30900	2150		11
4	5.4	155	14000		Clay	36900	4740		16.4
5									
6									
7									
8									
9									
10									
11									
12									

Soil Results: Overturning

Depth to COR =	13.29	ft, from Grade	
Bending Moment, M =	2905.25	k-ft, from COR	
Resisting Moment, Ma =	4455.67	k-ft, from COR	
MOMENT RATIO =	**65.2%**	**OK**	
Shear, V =	31.00	kips	
Resisting Shear, Va =	47.54	kips	
SHEAR RATIO =	**65.2%**	**OK**	

Soil Results: Uplift

Uplift, T =	0.00	kips
Allowable Uplift Cap., Ta =	66.10	kips
UPLIFT RATIO =	**0.0%**	**OK**

Soil Results: Compression

Compression, C =	35.00	kips
Allowable Comp. Cap., Ca =	982.68	kips
COMPRESSION RATIO =	**3.6%**	**OK**

Steel Results (ACI 318-02):

Minimum Steel Area =	15.93	sq in
Actual Steel Area =	27.94	sq in
Allowable Min Axial, Pa =	-1160.58	kips, Where Ma = 0 k-ft
Allowable Max Axial, Pa =	5515.99	kips, Where Ma = 0 k-ft
Axial Load, P =	61.38	kips @ 5.50 ft Below Grade
Moment, M =	2647.35	k-ft @ 5.50 ft Below Grade
Allowable Moment, Ma =	3161.19	k-ft
MOMENT RATIO =	**83.7%**	**OK**

Moment Capacity of Drilled Concrete Shaft (Caisson) for TIA Rev F or G

Note: Shaft assumed to have ties, not spiral, transverse reinforcing

Site Data

BU#: *806352*
Site Name: *BRG 302 943052*
App #:

Maximum Shaft Superimposed Forces		
TIA Revision:	F	
Max. Service Shaft M:	2647.35	ft-kips (* Note)
Max. Service Shaft P:	61.38	kips
Max Axial Force Type:	Comp.	

(*) Note: Max Shaft Superimposed Moment does not necessarily equal to the shaft top reaction moment

Enter Load Factors Below:		
For M (WL)	1.3	<---- Enter Factor
For P (DL)	1.3	<---- Enter Factor

Load Factor	Shaft Factored Loads		
1.30	Mu:	3441.555	ft-kips
1.30	Pu:	79.794	kips

Pier Properties		
Concrete:		
Pier Diameter =	6.5	ft
Concrete Area =	4778.4	in^2
Reinforcement:		
Clear Cover to **Tie**=	5.00	in
Horiz. **Tie** Bar Size=	6	
Vert. Cage Diameter =	5.44	ft
Vert. Cage Diameter =	65.23	in
Vertical Bar Size =	10	
Bar Diameter =	1.27	in
Bar Area =	1.27	in^2
Number of Bars =	22	
As Total=	27.94	in^2
A s/ Aconc, Rho:	0.0058	0.58%

Material Properties		
Concrete Comp. strength, f'c =	3000	psi
Reinforcement yield strength, Fy =	60	ksi
Reinforcing Modulus of Elasticity, E =	29000	ksi
Reinforcement yield strain =	0.00207	
Limiting compressive strain =	0.003	
ACI 318 Code		
Select Analysis ACI Code=	2002	
Seismic Properties		
Seismic Design Category =	D	
Seismic Risk =	**High**	

Solve (Run) <-- Press Upon Completing All Input

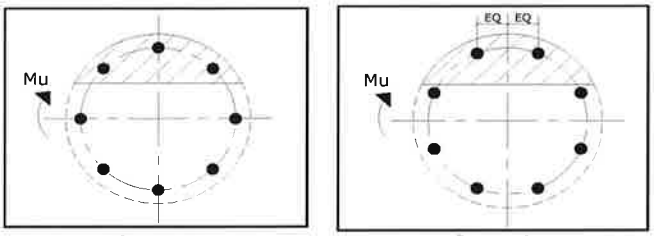
ACI 10.5 , ACI 21.10.4, and IBC 1810.

Min As for Flexural, Tension Controlled, Shafts:

(3)*(Sqrt(f'c)/Fy:	0.0027
200 / Fy:	0.0033

Results:

Governing Orientation Case: **2**



Case 1 Case 2

Dist. From Edge to Neutral Axis: **13.60** in
Extreme Steel Strain, εt: **0.0127**
εt > 0.0050, Tension Controlled
Reduction Factor,φ: **0.900**

Minimum Rho Check:

Actual Req'd Min. Rho:	0.33%	Flexural
Provided Rho:	0.58%	OK

Ref. Shaft Max Axial Capacities, ϕ Max(Pn or Tn):		
Max Pu = (φ=0.65) Pn.		
Pn per ACI 318 (10-2)	7170.79	kips
at Mu=(ϕ=0.65)Mn=	3988.84	ft-kips
Max Tu, (φ=0.9) Tn =	1508.76	kips
at Mu=ϕ=(0.90)Mn=	0.00	ft-kips

Output Note: Negative Pu=Tension

For Axial Compression, φ Pn = Pu:	79.79	kips
Drilled Shaft Moment Capacity, φMn:	**4109.55**	ft-kips
Drilled Shaft Superimposed Mu:	**3441.56**	ft-kips

(Mu/φMn, Drilled Shaft Flexure CSR:	**83.7%**