Robinson+Cole

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Also admitted in Massachusetts

April 1, 2015

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

Re: **Notice of Exempt Modification – Facility Modification**
8 Upper Meadow Road, Granby, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) antennas at the 147-foot level on the existing 151-foot tower at 8 Upper Meadow Road in Granby, Connecticut (the "Property"). The tower is owned by Cellco. The Council approved Cellco's shared use of this tower in 2007. Cellco now intends to modify its facility by replacing nine (9) of its existing antennas with three (3) model LNX-6514DS-VTM, 700 MHz antennas; three (3) model HBXX-6517DS-VTM, 1900 MHz antennas; and three (3) model HBXX-6517DS-VTM, 2100 MHz antennas, all at the same 147-foot level on the tower. Cellco also intends to install six (6) remote radio heads ("RRHs") behind its 1900 MHz and 2100 MHz antennas and two (2) HYBRIFLEX™ antenna cables inside the monopole tower. Included in Attachment 1 are specifications for Cellco's replacement antennas and RRHs.

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 William F. Smith, Jr., Town Manager for the Town of Granby. A copy of this letter is also being sent to Tower Meadow LLC, 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. Cellco's replacement antennas and RRHs will be installed on its existing antenna platform at the 147-foot level of the 151-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. A cumulative General Power Density table for Cellco's modified facility is included in Attachment 2.

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

6. The tower 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:
William F. Smith, Jr., Granby Town Manager
Tower Meadow LLC
Timothy Parks

ATTACHMENT 1

Product Specifications

COMMSCOPE®

LNX-6514DS-VTM

Andrew® Antenna, 698–896 MHz, 65° horizontal beamwidth, RET compatible

POWERED BY ANDREW.

Electrical Specifications

Frequency Band, MHz	698–806	806–896
Gain, dBi	15.7	16.3
Beamwidth, Horizontal, degrees	65	65
Beamwidth, Vertical, degrees	12.5	11.2
Beam Tilt, degrees	0–10	0–10
USLS, typical, dB	17	18
Front-to-Back Ratio at 180°, dB	32	30
CPR at Boresight, dB	20	20
CPR at Sector, dB	10	10
Isolation, dB	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153
Input Power per Port, maximum, watts	400	400
Polarization	±45°	±45°

Electrical Specifications, BASTA*

Frequency Band, MHz	698–806	806–896
Beamwidth, Horizontal Tolerance, degrees	±3	±3

* 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.

Mechanical Specifications

Color | Radome Material	Light gray | Fiberglass, UV resistant
Connector Interface | Location | Quantity	7-16 DIN Female | Bottom | 2
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph
Antenna Dimensions, L x W x D	1847.0 mm x 301.0 mm x 181.0 mm | 72.7 in x 11.9 in x 7.1 in
Net Weight	14.2 kg | 31.3 lb
Model with factory installed AISG 2.0 RET	LNX-6514DS-A1M

Product Specifications

COMMSCOPE®

HBXX-6517DS-VTM

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

POWERED BY ANDREW

Electrical Specifications

Frequency Band, MHz	1710–1880	1850–1990	1920–2180
Gain by all Beam Tilts, average, dBi	18.5	18.6	18.8
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.3	±0.4
Gain by Beam Tilt, average, dBi	0 ° | 18.4 3 ° | 18.7 6 ° | 18.4	0 ° | 18.4 3 ° | 18.7 6 ° | 18.5	0 ° | 18.7 3 ° | 18.9 6 ° | 18.6
Beamwidth, Horizontal, degrees	67	66	65
Beamwidth, Horizontal Tolerance, degrees	±2.4	±1.7	±2.9
Beamwidth, Vertical, degrees	5.0	4.7	4.4
Beamwidth, Vertical Tolerance, degrees	±0.3	±0.3	±0.3
Beam Tilt, degrees	0–6	0–6	0–6
USLS, dB	18	19	19
Front-to-Back Total Power at 180° ± 30°, dB	25	26	26
CPR at Boresight, dB	22	23	22
CPR at Sector, dB	10	10	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°

**Values calculated using NGMN Alliance N-P-BASTA v9.6*

Mechanical Specifications

Color | Radome Material	Light gray | PVC, UV resistant
Connector Interface | Location | Quantity	7-16 DIN Female | Bottom | 4
Wind Loading, maximum	668.0 N @ 150 km/h 150.2 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph
Antenna Dimensions, L x W x D	1903.0 mm x 305.0 mm x 166.0 mm | 74.9 in x 12.0 in x 6.5 in
Net Weight	19.5 kg | 43.0 lb
Model with factory installed AISG 2.0 RET	HBXX-6517DS-A2M

PCS RF MODULES

RRH1900 2X60 – HW CHARACTERISTICS

LA6.0.1/13.3

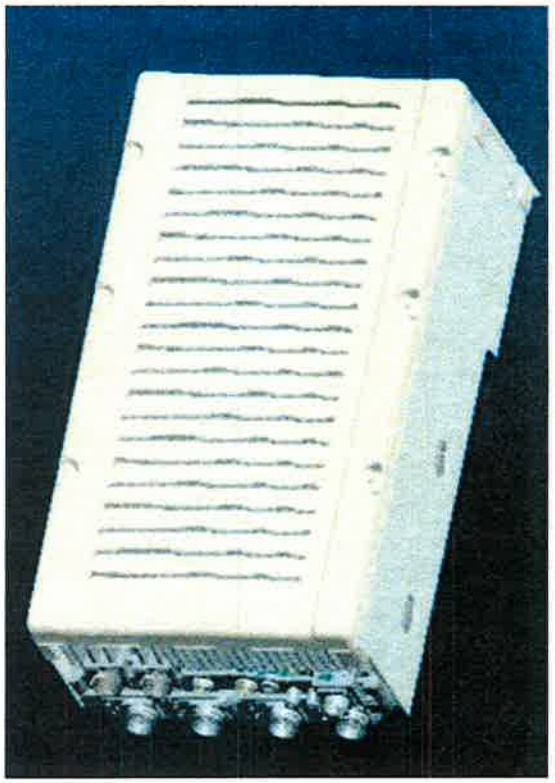
	RRH2x60
RF Output Power	2x60W
Instantaneous Bandwidth	20MHz
Transmitter	2 TX
Receiver 1900 HW version 1900A HW version	2 Branch RX – LA6.0.1 4 Branch RX – LR13.3
Features	AISG 2.0 for RET/TMA
	Internal Smart Bias-T
Power	-48VDC
CPRI Ports	2 CPRI Rate 3 Ports
External Alarms	4 External User Alarms
Monitor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

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).

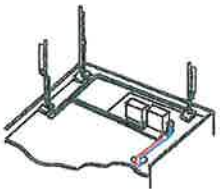
The Alcatel-Lucent RRH2x60-AWS is a very cost-effective solution to deploy LTE MIMO.

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.

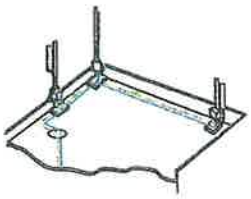
The Alcatel-Lucent RRH2x60-AWS is a zero-footprint solution and is convection cooled without fans for silent operation, simplifying negotiations with site property owners and minimizing environmental impacts.

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.

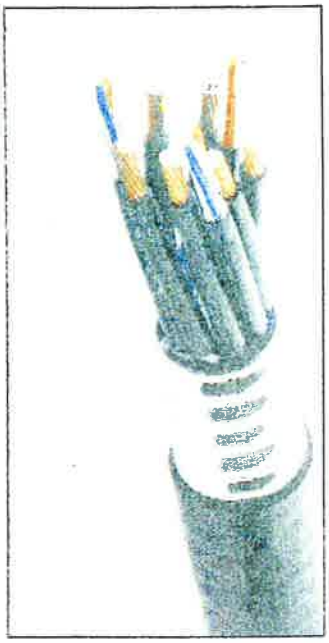


Figure 1: HYBRIFLEX Series

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)

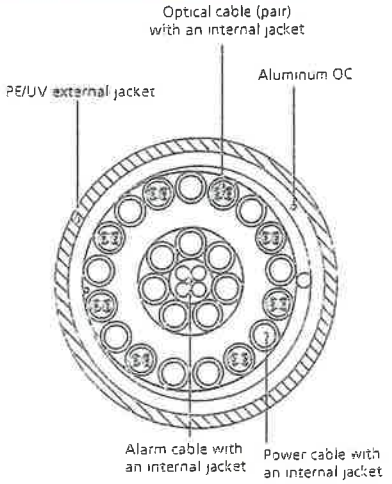


Figure 2: Construction Detail

- This data is provisional and subject to change

ATTACHMENT 2

Site Name: West Granby, CT
Cumulative Power Density

Operator	Operating Frequency	Number of Trans.	ERP Per Trans.	Total ERP	Distance to Target	Calculated Power Density	Maximum Permissable Exposure*	Fraction of MPE
	(MHz)		(watts)	(watts)	(feet)	(mW/cm^2)	(mW/cm^2)	(%)
VZW PCS	1970	11	411	4524.522	147	0.0753	1.0	7.53%
VZW Cellular	869	9	388	3488.281	147	0.0581	0.579333333	10.02%
VZW AWS	2145	1	1750	1750	147	0.0291	1.0	2.91%
VZW 700	746	1	1050	1050	147	0.0175	0.497333333	3.51%

Total Percentage of Maximum Permissible Exposure 23.98%

*Guidelines adopted by the FCC on August 1, 1996, 47 CFR Part 1 based on NCRP Report 86, 1986 and generally on ANSI/IEEE C95.1-1992

MHz = Megahertz
mW/cm^2 = milliwatts per square centimeter
ERP = Effective Radiated Power

Absolute worst case maximum values used.

ATTACHMENT 3

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

151-ft Existing EEI Monopole

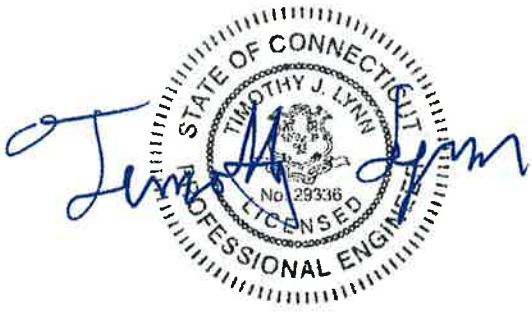
Proposed Verizon Wireless
Antenna Upgrade

Verizon Site Ref: West Granby

8 Upper Meadow Road
Granby, CT

CENTEK Project No. 15001.018

Date: February 26, 2015



Prepared for:

Verizon Wireless
99 East River Road, 9th Floor
East Hartford, CT 06108

63-2 North Branford Road, Branford, CT 06405 203.488.0580 Fax 203.488.8587 www.CentekEng.com

Table of Contents

CENTEK engineering, Inc.
Structural Analysis – 151' EEI Monopole
Verizon Wireless Antenna Upgrade – West Granby
Granby, CT
February 26, 2015

Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna upgrade proposed by Verizon Wireless on the existing monopole (tower) located in Granby, CT.

The host tower is a 151-ft tall, four-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors; project no. 14945 dated June 22, 2007. The tower geometry, structure member sizes and foundation system information were obtained from the aforementioned design documents.

Antenna and appurtenance information were obtained from visual verification from grade conducted by Centek personnel on February 18, 2015 and a Verizon RF data sheet.

The tower is made up of four (4) tapered vertical steel sections conforming to A572-65. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 26.73-in at the top and 68.00-in at the base.

Verizon Wireless proposes the removal of nine (9) panel antennas and the installation of nine (9) panel antennas, six (6) remote radio heads and two (2) distribution boxes mounted on the existing low profile platform. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

The existing, proposed and future loads considered in this analysis consist of the following:

- VERIZON (EXISTING TO REMAIN):
  Antennas: Four (4) Antel LPA-80063-6CF and two (2) Antel LPA-80080-6CF panel antennas mounted on a low profile platform with a RAD center elevation of 147-ft above grade.
  Coax Cables: Eighteen (18) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- VERIZON (EXISTING TO REMOVE):
  Antennas: Three (3) Antel BXA-70063-6CF and six (6) Antel LPA-171080-12CF panel antennas mounted on a low profile platform with a RAD center elevation of 147-ft above grade.
- **VERIZON (PROPOSED):**
  Antennas: Six (6) Andrew HBXX-6517DS panel antennas, three (3) Andrew LNX-6514DS panel antennas, three (3) Alcatel-Lucet RRH-2x60-AWS remote radio heads, three (3) Alcatel-Lucet RRH-2x60-PCS remote radio heads and two (2) RFS DB-T1-6Z-8AB main distribution boxes mounted on a low profile platform with a RAD center elevation of 147-ft above grade.
  Coax Cables: Two (2) 1-5/8" ∅ fiber cable running on the inside of the existing tower.

Primary Assumptions Used in the Analysis

- The tower structure's theoretical capacity not including any assessment of the condition of the tower.
- The tower carries the horizontal and vertical loads due to the weight of antennas, ice load and wind.
- Tower is properly installed and maintained.
- Tower is in plumb condition.
- Tower loading for antennas and mounts as listed in this report.
- All bolts are appropriately tightened providing the necessary connection continuity.
- All welds are fabricated with ER-70S-6 electrodes.
- All members are assumed to be as specified in the original tower design documents or reinforcement drawings.
- All members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
- All member protective coatings are in good condition.
- All tower members were properly designed, detailed, fabricated, installed and have been properly maintained since erection.
- Any deviation from the analyzed antenna loading will require a new analysis for verification of structural adequacy.
- All existing coax cables to be installed as indicated in this report.

Analysis

The existing tower was analyzed using a comprehensive computer program entitled tnxTower. The program analyzes the tower, considering the worst case loading condition. The tower is considered as loaded by concentric forces along the tower shaft, and the model assumes that the shaft members are subjected to bending, axial, and shear forces.

The existing tower was analyzed for the controlling basic wind speed (fastest mile) with no ice and a 75% reduction of wind force with ½ inch accumulative ice to determine stresses in members as per guidelines of TIA/EIA-222-F-96 entitled "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures", the American Institute of Steel Construction (AISC) and the Manual of Steel Construction; Allowable Stress Design (ASD).

The controlling wind speed is determined by evaluating the local available wind speed data as provided in Appendix K of the CSBC[1] and the wind speed data available in the TIA/EIA-222-F-96 Standard. The higher of the two wind speeds is utilized in preparation on the tower analysis.

Tower Loading

Tower loading was determined by the basic wind speed as applied to projected surface areas with modification factors per TIA/EIA-222-F, gravity loads of the tower structure and its components, and the application of ½" radial ice on the tower structure and its components.

Basic Wind Speed:	Hartford; v = 80 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Granby; v = 90 mph (3 second gust) equivalent to v = 75 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA-EIA-222-F wind speed controls.	
Load Cases:	Load Case 1; 80 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 69 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 69 mph wind speed velocity represents 75% of the wind pressure generated by the 80 mph wind speed.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 3; Seismic – not checked	*[Section 1614.5 of State Bldg. Code 2005] does not control in the design of this structure type*

[1] The 2005 Connecticut State Building Code as amended by the 2009 CT State Supplement. (CSBC)

Tower Capacity

Tower stresses were calculated utilizing the structural analysis software tnxTower. Allowable stresses were determined based on Table 5 of the TIA/EIA code with a 1/3 increase per Section 3.1.1.1 of the same code.

- Calculated stresses were found to be within allowable limits. In Load Case 1, per tnxTower "Section Capacity Table", this tower was found to be at **26.4%** of its total capacity.

Tower Section	Elevation (AGL)	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L1)	137.82'-152.00'	5.5%	**PASS**
Pole Shaft (L2)	95.08'-137.82'	20.7%	**PASS**
Pole Shaft (L3)	47.26'-95.08'	22.2%	**PASS**
Pole Shaft (L4)	1.00'-47.26'	26.4%	**PASS**

Foundation and Anchors

The existing foundation consists of a 8.0-ft square x 9.0-ft long reinforced concrete pier on a 28.0-ft square x 3.0-ft thick reinforce concrete pad. The base of the tower is connected to the foundation by means of (32) 2.25"Ø, ASTM A615-75 anchor bolts embedded approximately 7-ft into the concrete foundation structure.

- The tower base reactions developed from the governing Load Case 1 were used in the verification of the foundation and its anchors:

Location	Vector	Proposed Reactions
Base	Shear	20 kips
	Compression	45 kips
	Moment	1976 kip-ft

- The foundation was found to be within allowable limits.

Foundation	Design Limit	IBC 2003/2005 CT State Building Code Section 3108.4.2 (FS)[1]	Proposed Loading (FS)[1]	Result
Reinforced Concrete Pad and Pier	OTM[2]	2.0	8.38	**PASS**

Note 1: FS denotes Factor of Safety.
Note 2: OTM denotes Overturning Moment

- The anchor bolts and base plate were found to be within allowable limits.

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts	Combined Compression and Bending	20.7%	**PASS**
Base Plate	Bending	13.0%	**PASS**

Conclusion and Recommendations

This analysis shows that the subject tower **is adequate** to support the proposed modified antenna configuration with the below recommendations.

- **All coax cables routed as specified in Section 3 of this report.**

The analysis is based, in part, on the information provided to this office by Verizon Wireless. If the existing conditions are different than the information in this report, Centek Engineering, Inc. must be contacted for resolution of any potential issues.

Please feel free to call with any questions or comments.

Respectfully Submitted by:

Timothy J. Lynn, PE
Structural Engineer

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

All engineering services are performed on the basis that the information used is current and correct. This information may consist of, but is not necessarily limited to:

- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of CENTEK engineering, Inc. or generated by field inspections or measurements of the structure.
- It is the responsibility of the client to ensure that the information provide to CENTEK engineering, Inc. and used in the performance of our engineering services is correct and complete. In the absence of information to the contrary, we assume that all structures were constructed in accordance with the drawings and specifications and are in an un-corroded condition and have not deteriorated. It is therefore assumed that its capacity has not significantly changed from the "as new" condition.
- All services will be performed to the codes specified by the client, and we do not imply to meet any other codes or requirements unless explicitly agreed in writing. If wind and ice loads or other relevant parameters are to be different from the minimum values recommended by the codes, the client shall specify the exact requirement. In the absence of information to the contrary, all work will be performed in accordance with the latest revision of ANSI/ASCE10 & ANSI/EIA-222
- All services performed, results obtained, and recommendations made are in accordance with generally accepted engineering principles and practices. CENTEK engineering, Inc. is not responsible for the conclusions, opinions and recommendations made by others based on the information we supply.

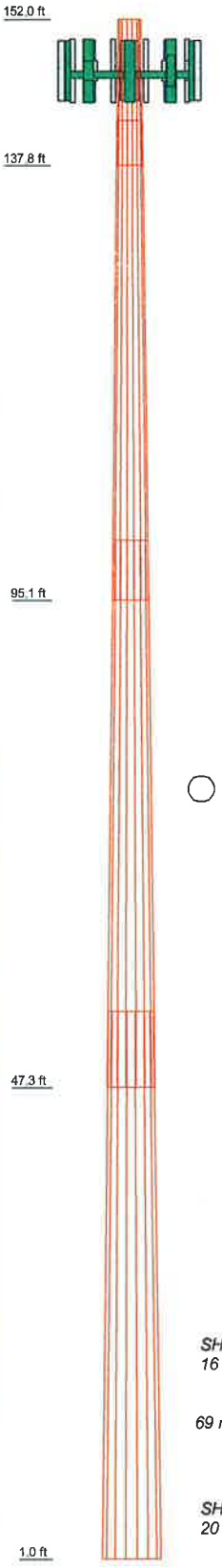
General Description of Structural Analysis Program

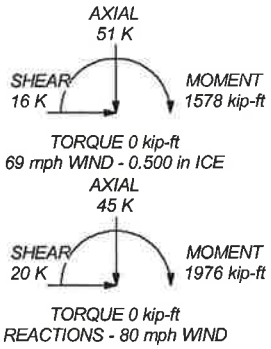
tnxTower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, tnxTower, formerly ERITower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

tnxTower Features:

- tnxTower can analyze and design 3- and 4-sided guyed towers, 3- and 4-sided self-supporting towers and either round or tapered ground mounted poles with or without guys.
- The program analyzes towers using the TIA-222-G (2005) standard or any of the previous TIA/EIA standards back to RS-222 (1959). Steel design is checked using the AISC ASD 9th Edition or the AISC LRFD specifications.
- Linear and non-linear (P-delta) analyses can be used in determining displacements and forces in the structure. Wind pressures and forces are automatically calculated.
- Extensive graphics plots include material take-off, shear-moment, leg compression, displacement, twist, feed line, guy anchor and stress plots.
- tnxTower contains unique features such as True Cable behavior, hog rod take-up, foundation stiffness and much more.

Section	Length (ft)	Number of Sides	Thickness (in)	Socket Length (ft)	Top Dia (in)	Bot Dia (in)	Grade	Weight (K)
1	14.177	18	0.250	4.350	26.730	30.830		1.1
2	47.093	18	0.375	5.833	29.072	42.660		6.8
3	53.650	18	0.500	7.466	40.227	55.720	A572-65	13.8
4	53.729	18	0.500		52.564	68.000		17.3
								39.0





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
LPA-80063/6CF (Verizon - Existing)	147	HBXX-6517DS (Verizon - Proposed)	147
HBXX-6517DS (Verizon - Proposed)	147	LPA-80080-6CF (Verizon - Existing)	147
LNX-6514DS-T4M (Verizon - Proposed)	147	RRH2x60-AWS (Verizon - Proposed)	147
HBXX-6517DS (Verizon - Proposed)	147	RRH2x60-AWS (Verizon - Proposed)	147
LPA-80063/6CF (Verizon - Existing)	147	RRH2x60-AWS (Verizon - Proposed)	147
LPA-80063/6CF (Verizon - Existing)	147	RRH2x60-PCS (Verizon - Proposed)	147
HBXX-6517DS (Verizon - Proposed)	147	RRH2x60-PCS (Verizon - Proposed)	147
LNX-6514DS-T4M (Verizon - Proposed)	147	RRH2x60-PCS (Verizon - Proposed)	147
HBXX-6517DS (Verizon - Proposed)	147	DB-T1-6Z-8AB-0Z (Verizon - Proposed)	147
LPA-80063/6CF (Verizon - Existing)	147	DB-T1-6Z-8AB-0Z (Verizon - Proposed)	147
LPA-80080-6CF (Verizon - Existing)	147	EEI Low Profile Platform (Verizon - Existing)	147
HBXX-6517DS (Verizon - Proposed)	147		
LNX-6514DS-T4M (Verizon - Proposed)	147		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 69 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Weld together tower sections have flange connections.
5. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
6. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
7. Welds are fabricated with ER-70S-6 electrodes.
8. TOWER RATING: 26.4%

Centek Engineering Inc.
63-2 North Branford Rd.
Branford, CT 06405
Phone: (203) 488-0580
FAX: (203) 488-8587

Job: 15001.018 - West Granby		
Project: 151' EEI Monopole - 8 Upper Meadow Rd., Granby, CT		
Client: Verizon Wireless	Drawn by: TJL	App'd:
Code: TIA/EIA-222-F	Date: 02/26/15	Scale: NTS
Path:		Dwg No. E-1

Tower Input Data

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

Basic wind speed of 80 mph.
Nominal ice thickness of 0.500 in.
Ice density of 56 pcf.
A wind speed of 69 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
Weld together tower sections have flange connections..
Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
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, feedline 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		

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	152.000-137.823	14.177	4.350	18	26.730	30.830	0.250	1.000	A572-65 (65 ksi)
L2	137.823-95.080	47.093	5.833	18	29.072	42.660	0.375	1.500	A572-65 (65 ksi)
L3	95.080-47.263	53.650	7.466	18	40.227	55.720	0.500	2.000	A572-65 (65 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
L4	47.263-1.000	53.729		18	52.564	68.000	0.500	2.000	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	27.142	21.012	1861.394	9.400	13.579	137.080	3725.237	10.508	4.264	17.058
	31.306	24.265	2866.796	10.856	15.662	183.046	5737.365	12.135	4.986	19.944
L2	30.795	34.157	3553.727	10.187	14.769	240.628	7112.130	17.082	4.457	11.884
	43.318	50.330	11369.324	15.011	21.671	524.626	22753.608	25.170	6.848	18.262
L3	42.558	63.047	12571.025	14.103	20.435	615.162	25158.592	31.529	6.200	12.4
	56.580	87.634	33760.089	19.603	28.306	1192.693	67564.601	43.825	8.927	17.853
L4	55.553	82.626	28296.078	18.483	26.702	1059.679	56629.389	41.321	8.371	16.743
	69.049	107.123	61663.148	23.962	34.544	1785.061	123407.435	53.571	11.088	22.176

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 152.000-137.823				1	1	1		
L2 137.823-95.080				1	1	1		
L3 95.080-47.263				1	1	1		
L4 47.263-1.000				1	1	1		

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 klf
1 5/8	C	No	Inside Pole	147.000 - 4.000	18	No Ice	0.000	0.001
(Verizon - Existing)						1/2" Ice	0.000	0.001
HYBRIFLEX 1-5/8"	C	No	Inside Pole	147.000 - 4.000	2	No Ice	0.000	0.002
(Verizon - Proposed)						1/2" Ice	0.000	0.002

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	152.000-137.823	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
		C	0.000	0.000	0.000	0.000	0.207
L2	137.823-95.080	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	0.963
L3	95.080-47.263	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	1.077
L4	47.263-1.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	0.974

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	152.000-137.823	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.207
L2	137.823-95.080	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.963
L3	95.080-47.263	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	1.077
L4	47.263-1.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	0.000	0.974

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
LPA-80063/6CF	A	From Face	3.000	0.000	147.000	No Ice	10.308	9.005	0.027
(Verizon - Existing)			-6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
HBXX-6517DS	A	From Face	3.000	0.000	147.000	No Ice	8.738	5.243	0.050
(Verizon - Proposed)			-4.000			1/2" Ice	9.306	5.709	0.100
			0.000						
LNX-6514DS-T4M	A	From Face	3.000	0.000	147.000	No Ice	8.411	5.405	0.038
(Verizon - Proposed)			0.000			1/2" Ice	8.964	5.863	0.089
			0.000						
HBXX-6517DS	A	From Face	3.000	0.000	147.000	No Ice	8.738	5.243	0.050
(Verizon - Proposed)			4.000			1/2" Ice	9.306	5.709	0.100
			0.000						
LPA-80063/6CF	A	From Face	3.000	0.000	147.000	No Ice	10.308	9.005	0.027
(Verizon - Existing)			6.000			1/2" Ice	10.868	9.554	0.101
			0.000						
LPA-80063/6CF	B	From Face	3.000	0.000	147.000	No Ice	10.308	9.005	0.027

tnxTower	Job: 15001.018 - West Granby	Page: 4 of 19
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Project: 151' EEI Monopole - 8 Upper Meadow Rd., Granby, CT	Date: 15:10:10 02/26/15
	Client: Verizon Wireless	Designed by: TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(Verizon - Existing)			-6.000 0.000			1/2" Ice	10.868	9.554	0.101
HBXX-6517DS	B	From Face	3.000	0.000	147.000	No Ice	8.738	5.243	0.050
(Verizon - Proposed)			-4.000 0.000			1/2" Ice	9.306	5.709	0.100
LNX-6514DS-T4M	B	From Face	3.000	0.000	147.000	No Ice	8.411	5.405	0.038
(Verizon - Proposed)			0.000 0.000			1/2" Ice	8.964	5.863	0.089
HBXX-6517DS	B	From Face	3.000	0.000	147.000	No Ice	8.738	5.243	0.050
(Verizon - Proposed)			4.000 0.000			1/2" Ice	9.306	5.709	0.100
LPA-80063/6CF	B	From Face	3.000	0.000	147.000	No Ice	10.308	9.005	0.027
(Verizon - Existing)			6.000 0.000			1/2" Ice	10.868	9.554	0.101
LPA-80080-6CF	C	From Face	3.000	0.000	147.000	No Ice	4.326	9.088	0.021
(Verizon - Existing)			-6.000 0.000			1/2" Ice	4.764	9.637	0.069
HBXX-6517DS	C	From Face	3.000	0.000	147.000	No Ice	8.738	5.243	0.050
(Verizon - Proposed)			-4.000 0.000			1/2" Ice	9.306	5.709	0.100
LNX-6514DS-T4M	C	From Face	3.000	0.000	147.000	No Ice	8.411	5.405	0.038
(Verizon - Proposed)			0.000 0.000			1/2" Ice	8.964	5.863	0.089
HBXX-6517DS	C	From Face	3.000	0.000	147.000	No Ice	8.738	5.243	0.050
(Verizon - Proposed)			4.000 0.000			1/2" Ice	9.306	5.709	0.100
LPA-80080-6CF	C	From Face	3.000	0.000	147.000	No Ice	4.326	9.088	0.021
(Verizon - Existing)			6.000 0.000			1/2" Ice	4.764	9.637	0.069
RRH2x60-AWS	A	From Face	3.000	0.000	147.000	No Ice	3.782	2.069	0.055
(Verizon - Proposed)			-4.000 0.000			1/2" Ice	4.093	2.349	0.078
RRH2x60-AWS	B	From Face	3.000	0.000	147.000	No Ice	3.782	2.069	0.055
(Verizon - Proposed)			-4.000 0.000			1/2" Ice	4.093	2.349	0.078
RRH2x60-AWS	C	From Face	3.000	0.000	147.000	No Ice	3.782	2.069	0.055
(Verizon - Proposed)			-4.000 0.000			1/2" Ice	4.093	2.349	0.078
RRH2x60-PCS	A	From Face	3.000	0.000	147.000	No Ice	2.508	1.547	0.055
(Verizon - Proposed)			4.000 0.000			1/2" Ice	2.730	1.738	0.073
RRH2x60-PCS	B	From Face	3.000	0.000	147.000	No Ice	2.508	1.547	0.055
(Verizon - Proposed)			4.000 0.000			1/2" Ice	2.730	1.738	0.073
RRH2x60-PCS	C	From Face	3.000	0.000	147.000	No Ice	2.508	1.547	0.055
(Verizon - Proposed)			4.000 0.000			1/2" Ice	2.730	1.738	0.073
DB-T1-6Z-8AB-0Z	A	From Face	3.000	0.000	147.000	No Ice	5.600	2.333	0.044
(Verizon - Proposed)			0.000 0.000			1/2" Ice	5.915	2.558	0.080
DB-T1-6Z-8AB-0Z	B	From Face	3.000	0.000	147.000	No Ice	5.600	2.333	0.044
(Verizon - Proposed)			0.000 0.000			1/2" Ice	5.915	2.558	0.080
EEI Low Profile Platform	A	None		0.000	147.000	No Ice	22.500	22.500	1.500
(Verizon - Existing)						1/2" Ice	28.200	28.200	2.250

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	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 152.000-137.823	144.743	1.526	0.025	34.001	A	0.000	34.001	34.001	100.00	0.000	0.000
					B	0.000	34.001		100.00	0.000	0.000
					C	0.000	34.001		100.00	0.000	0.000
L2 137.823-95.080	115.527	1.43	0.023	129.987	A	0.000	129.987	129.987	100.00	0.000	0.000
					B	0.000	129.987		100.00	0.000	0.000
					C	0.000	129.987		100.00	0.000	0.000
L3 95.080-47.263	70.623	1.243	0.020	194.518	A	0.000	194.518	194.518	100.00	0.000	0.000
					B	0.000	194.518		100.00	0.000	0.000
					C	0.000	194.518		100.00	0.000	0.000
L4 47.263-1.000	23.416	1	0.017	236.537	A	0.000	236.537	236.537	100.00	0.000	0.000
					B	0.000	236.537		100.00	0.000	0.000
					C	0.000	236.537		100.00	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	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 152.000-137.823	144.743	1.526	0.019	0.500	35.183	A	0.000	35.183	35.183	100.00	0.000	0.000
						B	0.000	35.183		100.00	0.000	0.000
						C	0.000	35.183		100.00	0.000	0.000
L2 137.823-95.080	115.527	1.43	0.018	0.500	133.549	A	0.000	133.549	133.549	100.00	0.000	0.000
						B	0.000	133.549		100.00	0.000	0.000
						C	0.000	133.549		100.00	0.000	0.000
L3 95.080-47.263	70.623	1.243	0.015	0.500	198.503	A	0.000	198.503	198.503	100.00	0.000	0.000
						B	0.000	198.503		100.00	0.000	0.000
						C	0.000	198.503		100.00	0.000	0.000
L4 47.263-1.000	23.416	1	0.012	0.500	240.392	A	0.000	240.392	240.392	100.00	0.000	0.000
						B	0.000	240.392		100.00	0.000	0.000
						C	0.000	240.392		100.00	0.000	0.000

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	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

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Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Project: 151' EEI Monopole - 8 Upper Meadow Rd., Granby, CT	Date: 15:10:10 02/26/15
	Client: Verizon Wireless	Designed by: TJL

Section Elevation ft	z ft	K_Z	q_z ksf	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	144.743	1.526	0.010	34.001	A	0.000	34.001	34.001	100.00	0.000	0.000
152.000-137.8					B	0.000	34.001		100.00	0.000	0.000
23					C	0.000	34.001		100.00	0.000	0.000
L2	115.527	1.43	0.009	129.987	A	0.000	129.987	129.987	100.00	0.000	0.000
137.823-95.08					B	0.000	129.987		100.00	0.000	0.000
0					C	0.000	129.987		100.00	0.000	0.000
L3	70.623	1.243	0.008	194.518	A	0.000	194.518	194.518	100.00	0.000	0.000
95.080-47.263					B	0.000	194.518		100.00	0.000	0.000
					C	0.000	194.518		100.00	0.000	0.000
L4	23.416	1	0.006	236.537	A	0.000	236.537	236.537	100.00	0.000	0.000
47.263-1.000					B	0.000	236.537		100.00	0.000	0.000
					C	0.000	236.537		100.00	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.207	1.092	A	1	0.65	1	1	1	34.001	0.934	0.066	C
152.000-137.8			B	1	0.65	1	1	1	34.001			
23			C	1	0.65	1	1	1	34.001			
L2	0.963	6.769	A	1	0.65	1	1	1	129.987	3.341	0.078	C
137.823-95.08			B	1	0.65	1	1	1	129.987			
0			C	1	0.65	1	1	1	129.987			
L3	1.077	13.754	A	1	0.65	1	1	1	194.518	4.328	0.091	C
95.080-47.263			B	1	0.65	1	1	1	194.518			
			C	1	0.65	1	1	1	194.518			
L4	0.974	17.346	A	1	0.65	1	1	1	236.537	4.299	0.093	C
47.263-1.000			B	1	0.65	1	1	1	236.537			
			C	1	0.65	1	1	1	236.537			
Sum Weight:	3.220	38.961						OTM	914.571 kip-ft	12.902		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.207	1.092	A	1	0.65	1	1	1	34.001	0.934	0.066	C
152.000-137.8			B	1	0.65	1	1	1	34.001			
23			C	1	0.65	1	1	1	34.001			
L2	0.963	6.769	A	1	0.65	1	1	1	129.987	3.341	0.078	C
137.823-95.08			B	1	0.65	1	1	1	129.987			
0			C	1	0.65	1	1	1	129.987			
L3	1.077	13.754	A	1	0.65	1	1	1	194.518	4.328	0.091	C
95.080-47.263			B	1	0.65	1	1	1	194.518			
			C	1	0.65	1	1	1	194.518			
L4	0.974	17.346	A	1	0.65	1	1	1	236.537	4.299	0.093	C
47.263-1.000			B	1	0.65	1	1	1	236.537			
			C	1	0.65	1	1	1	236.537			
Sum Weight:	3.220	38.961						OTM	914.571	12.902		

tnxTower	Job: 15001.018 - West Granby	Page: 7 of 19
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Project: 151' EEI Monopole - 8 Upper Meadow Rd., Granby, CT	Date: 15:10:10 02/26/15
	Client: Verizon Wireless	Designed by: TJL

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2 kip-ft	F K	w klf	Ctrl. Face

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	0.207	1.092	A	1	0.65	1	1	1	34.001	0.934	0.066	C
152.000-137.8			B	1	0.65	1	1	1	34.001			
23			C	1	0.65	1	1	1	34.001			
L2	0.963	6.769	A	1	0.65	1	1	1	129.987	3.341	0.078	C
137.823-95.08			B	1	0.65	1	1	1	129.987			
0			C	1	0.65	1	1	1	129.987			
L3	1.077	13.754	A	1	0.65	1	1	1	194.518	4.328	0.091	C
95.080-47.263			B	1	0.65	1	1	1	194.518			
			C	1	0.65	1	1	1	194.518			
L4	0.974	17.346	A	1	0.65	1	1	1	236.537	4.299	0.093	C
47.263-1.000			B	1	0.65	1	1	1	236.537			
			C	1	0.65	1	1	1	236.537			
Sum Weight:	3.220	38.961						OTM	914.571 kip-ft	12.902		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	0.207	1.092	A	1	0.65	1	1	1	34.001	0.934	0.066	C
152.000-137.8			B	1	0.65	1	1	1	34.001			
23			C	1	0.65	1	1	1	34.001			
L2	0.963	6.769	A	1	0.65	1	1	1	129.987	3.341	0.078	C
137.823-95.08			B	1	0.65	1	1	1	129.987			
0			C	1	0.65	1	1	1	129.987			
L3	1.077	13.754	A	1	0.65	1	1	1	194.518	4.328	0.091	C
95.080-47.263			B	1	0.65	1	1	1	194.518			
			C	1	0.65	1	1	1	194.518			
L4	0.974	17.346	A	1	0.65	1	1	1	236.537	4.299	0.093	C
47.263-1.000			B	1	0.65	1	1	1	236.537			
			C	1	0.65	1	1	1	236.537			
Sum Weight:	3.220	38.961						OTM	914.571 kip-ft	12.902		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.207	1.348	A	1	0.65	1	1	1	35.183	0.725	0.051	C
152.000-137.8			B	1	0.65	1	1	1	35.183			
23			C	1	0.65	1	1	1	35.183			
L2	0.963	7.745	A	1	0.65	1	1	1	133.549	2.575	0.060	C
137.823-95.08			B	1	0.65	1	1	1	133.549			
0			C	1	0.65	1	1	1	133.549			
L3	1.077	15.209	A	1	0.65	1	1	1	198.503	3.313	0.069	C
95.080-47.263			B	1	0.65	1	1	1	198.503			
			C	1	0.65	1	1	1	198.503			
L4	0.974	19.112	A	1	0.65	1	1	1	240.392	3.277	0.071	C
47.263-1.000			B	1	0.65	1	1	1	240.392			
			C	1	0.65	1	1	1	240.392			
Sum Weight:	3.220	43.415						OTM	703.097 kip-ft	9.889		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.207	1.348	A	1	0.65	1	1	1	35.183	0.725	0.051	C
152.000-137.8			B	1	0.65	1	1	1	35.183			
23			C	1	0.65	1	1	1	35.183			
L2	0.963	7.745	A	1	0.65	1	1	1	133.549	2.575	0.060	C
137.823-95.08			B	1	0.65	1	1	1	133.549			
0			C	1	0.65	1	1	1	133.549			
L3	1.077	15.209	A	1	0.65	1	1	1	198.503	3.313	0.069	C
95.080-47.263			B	1	0.65	1	1	1	198.503			
			C	1	0.65	1	1	1	198.503			
L4	0.974	19.112	A	1	0.65	1	1	1	240.392	3.277	0.071	C
47.263-1.000			B	1	0.65	1	1	1	240.392			
			C	1	0.65	1	1	1	240.392			
Sum Weight:	3.220	43.415						OTM	703.097 kip-ft	9.889		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.207	1.348	A	1	0.65	1	1	1	35.183	0.725	0.051	C
152.000-137.8			B	1	0.65	1	1	1	35.183			
23			C	1	0.65	1	1	1	35.183			
L2	0.963	7.745	A	1	0.65	1	1	1	133.549	2.575	0.060	C
137.823-95.08			B	1	0.65	1	1	1	133.549			
0			C	1	0.65	1	1	1	133.549			
L3	1.077	15.209	A	1	0.65	1	1	1	198.503	3.313	0.069	C
95.080-47.263			B	1	0.65	1	1	1	198.503			
			C	1	0.65	1	1	1	198.503			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L4	0.974	19.112	A	1	0.65	1	1	1	240.392	3.277	0.071	C
47.263-1.000			B	1	0.65	1	1	1	240.392			
			C	1	0.65	1	1	1	240.392			
Sum Weight:	3.220	43.415						OTM	703.097 kip-ft	9.889		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.207	1.348	A	1	0.65	1	1	1	35.183	0.725	0.051	C
152.000-137.8			B	1	0.65	1	1	1	35.183			
23			C	1	0.65	1	1	1	35.183			
L2	0.963	7.745	A	1	0.65	1	1	1	133.549	2.575	0.060	C
137.823-95.08			B	1	0.65	1	1	1	133.549			
0			C	1	0.65	1	1	1	133.549			
L3	1.077	15.209	A	1	0.65	1	1	1	198.503	3.313	0.069	C
95.080-47.263			B	1	0.65	1	1	1	198.503			
			C	1	0.65	1	1	1	198.503			
L4	0.974	19.112	A	1	0.65	1	1	1	240.392	3.277	0.071	C
47.263-1.000			B	1	0.65	1	1	1	240.392			
			C	1	0.65	1	1	1	240.392			
Sum Weight:	3.220	43.415						OTM	703.097 kip-ft	9.889		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.207	1.092	A	1	0.65	1	1	1	34.001	0.365	0.026	C
152.000-137.8			B	1	0.65	1	1	1	34.001			
23			C	1	0.65	1	1	1	34.001			
L2	0.963	6.769	A	1	0.65	1	1	1	129.987	1.305	0.031	C
137.823-95.08			B	1	0.65	1	1	1	129.987			
0			C	1	0.65	1	1	1	129.987			
L3	1.077	13.754	A	1	0.65	1	1	1	194.518	1.691	0.035	C
95.080-47.263			B	1	0.65	1	1	1	194.518			
			C	1	0.65	1	1	1	194.518			
L4	0.974	17.346	A	1	0.65	1	1	1	236.537	1.679	0.036	C
47.263-1.000			B	1	0.65	1	1	1	236.537			
			C	1	0.65	1	1	1	236.537			
Sum Weight:	3.220	38.961						OTM	357.254 kip-ft	5.040		

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	Client: Verizon Wireless	Designed by: TJL

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.207	1.092	A	1	0.65	1	1	1	34.001	0.365	0.026	C
152.000-137.8			B	1	0.65	1	1	1	34.001			
23			C	1	0.65	1	1	1	34.001			
L2	0.963	6.769	A	1	0.65	1	1	1	129.987	1.305	0.031	C
137.823-95.08			B	1	0.65	1	1	1	129.987			
0			C	1	0.65	1	1	1	129.987			
L3	1.077	13.754	A	1	0.65	1	1	1	194.518	1.691	0.035	C
95.080-47.263			B	1	0.65	1	1	1	194.518			
			C	1	0.65	1	1	1	194.518			
L4	0.974	17.346	A	1	0.65	1	1	1	236.537	1.679	0.036	C
47.263-1.000			B	1	0.65	1	1	1	236.537			
			C	1	0.65	1	1	1	236.537			
Sum Weight:	3.220	38.961						OTM	357.254 kip-ft	5.040		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.207	1.092	A	1	0.65	1	1	1	34.001	0.365	0.026	C
152.000-137.8			B	1	0.65	1	1	1	34.001			
23			C	1	0.65	1	1	1	34.001			
L2	0.963	6.769	A	1	0.65	1	1	1	129.987	1.305	0.031	C
137.823-95.08			B	1	0.65	1	1	1	129.987			
0			C	1	0.65	1	1	1	129.987			
L3	1.077	13.754	A	1	0.65	1	1	1	194.518	1.691	0.035	C
95.080-47.263			B	1	0.65	1	1	1	194.518			
			C	1	0.65	1	1	1	194.518			
L4	0.974	17.346	A	1	0.65	1	1	1	236.537	1.679	0.036	C
47.263-1.000			B	1	0.65	1	1	1	236.537			
			C	1	0.65	1	1	1	236.537			
Sum Weight:	3.220	38.961						OTM	357.254 kip-ft	5.040		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.207	1.092	A	1	0.65	1	1	1	34.001	0.365	0.026	C
152.000-137.8			B	1	0.65	1	1	1	34.001			
23			C	1	0.65	1	1	1	34.001			
L2	0.963	6.769	A	1	0.65	1	1	1	129.987	1.305	0.031	C
137.823-95.08			B	1	0.65	1	1	1	129.987			
0			C	1	0.65	1	1	1	129.987			

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	Client: Verizon Wireless	Designed by: TJL

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L3	1.077	13.754	A	1	0.65	1	1	1	194.518	1.691	0.035	C
95.080-47.263			B	1	0.65	1	1	1	194.518			
			C	1	0.65	1	1	1	194.518			
L4	0.974	17.346	A	1	0.65	1	1	1	236.537	1.679	0.036	C
47.263-1.000			B	1	0.65	1	1	1	236.537			
			C	1	0.65	1	1	1	236.537			
Sum Weight:	3.220	38.961						OTM	357.254 kip-ft	5.040		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	38.961					
Bracing Weight	0.000					
Total Member Self-Weight	38.961			-0.234	0.000	
Total Weight	44.664			-0.234	0.000	
Wind 0 deg - No Ice		0.000	-19.365	-1858.316	0.000	0.000
Wind 30 deg - No Ice		10.009	-16.770	-1609.380	-976.725	-0.192
Wind 45 deg - No Ice		14.155	-13.693	-1314.096	-1381.298	-0.271
Wind 60 deg - No Ice		17.336	-9.682	-929.275	-1691.737	-0.333
Wind 90 deg - No Ice		20.018	0.000	-0.234	-1953.450	-0.384
Wind 120 deg - No Ice		17.336	9.682	928.807	-1691.737	-0.333
Wind 135 deg - No Ice		14.155	13.693	1313.629	-1381.298	-0.271
Wind 150 deg - No Ice		10.009	16.770	1608.913	-976.725	-0.192
Wind 180 deg - No Ice		0.000	19.365	1857.848	0.000	0.000
Wind 210 deg - No Ice		-10.009	16.770	1608.913	976.725	0.192
Wind 225 deg - No Ice		-14.155	13.693	1313.629	1381.298	0.271
Wind 240 deg - No Ice		-17.336	9.682	928.807	1691.737	0.333
Wind 270 deg - No Ice		-20.018	0.000	-0.234	1953.450	0.384
Wind 300 deg - No Ice		-17.336	-9.682	-929.275	1691.737	0.333
Wind 315 deg - No Ice		-14.155	-13.693	-1314.096	1381.298	0.271
Wind 330 deg - No Ice		-10.009	-16.770	-1609.380	976.725	0.192
Member Ice	4.453					
Total Weight Ice	50.909			-0.599	0.000	
Wind 0 deg - Ice		0.000	-15.226	-1482.876	0.000	0.000
Wind 30 deg - Ice		7.863	-13.186	-1284.289	-777.685	-0.159
Wind 45 deg - Ice		11.120	-10.766	-1048.727	-1099.812	-0.225
Wind 60 deg - Ice		13.619	-7.613	-741.738	-1346.990	-0.275
Wind 90 deg - Ice		15.726	0.000	-0.599	-1555.370	-0.318
Wind 120 deg - Ice		13.619	7.613	740.539	-1346.990	-0.275
Wind 135 deg - Ice		11.120	10.766	1047.529	-1099.812	-0.225
Wind 150 deg - Ice		7.863	13.186	1283.090	-777.685	-0.159
Wind 180 deg - Ice		0.000	15.226	1481.678	0.000	0.000
Wind 210 deg - Ice		-7.863	13.186	1283.090	777.685	0.159
Wind 225 deg - Ice		-11.120	10.766	1047.529	1099.812	0.225
Wind 240 deg - Ice		-13.619	7.613	740.539	1346.990	0.275
Wind 270 deg - Ice		-15.726	0.000	-0.599	1555.370	0.318
Wind 300 deg - Ice		-13.619	-7.613	-741.738	1346.990	0.275
Wind 315 deg - Ice		-11.120	-10.766	-1048.727	1099.812	0.225
Wind 330 deg - Ice		-7.863	-13.186	-1284.289	777.685	0.159
Total Weight	44.664			-0.234	0.000	
Wind 0 deg - Service		0.000	-7.564	-726.047	0.000	0.000
Wind 30 deg - Service		3.910	-6.551	-628.807	-381.533	-0.075

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 45 deg - Service		5.529	-5.349	-513.461	-539.569	-0.106
Wind 60 deg - Service		6.772	-3.782	-363.140	-660.835	-0.130
Wind 90 deg - Service		7.819	0.000	-0.234	-763.066	-0.150
Wind 120 deg - Service		6.772	3.782	362.673	-660.835	-0.130
Wind 135 deg - Service		5.529	5.349	512.994	-539.569	-0.106
Wind 150 deg - Service		3.910	6.551	628.339	-381.533	-0.075
Wind 180 deg - Service		0.000	7.564	725.580	0.000	0.000
Wind 210 deg - Service		-3.910	6.551	628.339	381.533	0.075
Wind 225 deg - Service		-5.529	5.349	512.994	539.569	0.106
Wind 240 deg - Service		-6.772	3.782	362.673	660.835	0.130
Wind 270 deg - Service		-7.819	0.000	-0.234	763.066	0.150
Wind 300 deg - Service		-6.772	-3.782	-363.140	660.835	0.130
Wind 315 deg - Service		-5.529	-5.349	-513.461	539.569	0.106
Wind 330 deg - Service		-3.910	-6.551	-628.807	381.533	0.075

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 45 deg - No Ice
5	Dead+Wind 60 deg - No Ice
6	Dead+Wind 90 deg - No Ice
7	Dead+Wind 120 deg - No Ice
8	Dead+Wind 135 deg - No Ice
9	Dead+Wind 150 deg - No Ice
10	Dead+Wind 180 deg - No Ice
11	Dead+Wind 210 deg - No Ice
12	Dead+Wind 225 deg - No Ice
13	Dead+Wind 240 deg - No Ice
14	Dead+Wind 270 deg - No Ice
15	Dead+Wind 300 deg - No Ice
16	Dead+Wind 315 deg - No Ice
17	Dead+Wind 330 deg - No Ice
18	Dead+Ice+Temp
19	Dead+Wind 0 deg+Ice+Temp
20	Dead+Wind 30 deg+Ice+Temp
21	Dead+Wind 45 deg+Ice+Temp
22	Dead+Wind 60 deg+Ice+Temp
23	Dead+Wind 90 deg+Ice+Temp
24	Dead+Wind 120 deg+Ice+Temp
25	Dead+Wind 135 deg+Ice+Temp
26	Dead+Wind 150 deg+Ice+Temp
27	Dead+Wind 180 deg+Ice+Temp
28	Dead+Wind 210 deg+Ice+Temp
29	Dead+Wind 225 deg+Ice+Temp
30	Dead+Wind 240 deg+Ice+Temp
31	Dead+Wind 270 deg+Ice+Temp
32	Dead+Wind 300 deg+Ice+Temp
33	Dead+Wind 315 deg+Ice+Temp
34	Dead+Wind 330 deg+Ice+Temp
35	Dead+Wind 0 deg - Service
36	Dead+Wind 30 deg - Service
37	Dead+Wind 45 deg - Service

Comb. No.	Description
38	Dead+Wind 60 deg - Service
39	Dead+Wind 90 deg - Service
40	Dead+Wind 120 deg - Service
41	Dead+Wind 135 deg - Service
42	Dead+Wind 150 deg - Service
43	Dead+Wind 180 deg - Service
44	Dead+Wind 210 deg - Service
45	Dead+Wind 225 deg - Service
46	Dead+Wind 240 deg - Service
47	Dead+Wind 270 deg - Service
48	Dead+Wind 300 deg - Service
49	Dead+Wind 315 deg - Service
50	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	152 - 137.823	Pole	Max Tension	23	0.000	0.000	-0.000
			Max. Compression	18	-5.331	0.000	0.599
			Max. Mx	14	-3.191	37.762	0.226
			Max. My	2	-3.216	0.000	34.821
			Max. Vy	14	-7.822	37.762	0.226
			Max. Vx	2	-7.165	0.000	34.821
			Max. Torque	14			-0.381
L2	137.823 - 95.08	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-13.274	0.000	0.599
			Max. Mx	14	-10.224	424.892	0.233
			Max. My	2	-10.245	0.000	394.681
			Max. Vy	14	-11.051	424.892	0.233
			Max. Vx	2	-10.388	0.000	394.681
			Max. Torque	6			0.381
L3	95.08 - 47.263	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-28.218	0.000	0.599
			Max. Mx	14	-23.862	1030.460	0.237
			Max. My	2	-23.874	0.000	969.552
			Max. Vy	14	-15.211	1030.460	0.237
			Max. Vx	2	-14.546	0.000	969.552
			Max. Torque	14			-0.381
L4	47.263 - 1	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-50.909	0.000	0.599
			Max. Mx	6	-44.660	-1976.230	0.239
			Max. My	2	-44.660	0.000	1879.837
			Max. Vy	14	-20.027	1976.230	0.239
			Max. Vx	2	-19.373	0.000	1879.837
			Max. Torque	6			0.381

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	23	50.909	-15.726	0.000

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
	Max. H_x	14	44.664	20.018	0.000
	Max. H_z	2	44.664	0.000	19.365
	Max. M_x	2	1879.837	0.000	19.365
	Max. M_z	6	1976.230	-20.018	0.000
	Max. Torsion	6	0.381	-20.018	0.000
	Min. Vert	39	44.664	-7.819	0.000
	Min. H_x	6	44.664	-20.018	0.000
	Min. H_z	10	44.664	0.000	-19.365
	Min. M_x	10	-1879.359	0.000	-19.365
	Min. M_z	14	-1976.230	20.018	0.000
	Min. Torsion	14	-0.381	20.018	0.000

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	44.664	0.000	0.000	-0.234	0.000	0.000
Dead+Wind 0 deg - No Ice	44.664	0.000	-19.365	-1879.837	0.000	0.000
Dead+Wind 30 deg - No Ice	44.664	10.009	-16.770	-1628.015	-988.121	-0.191
Dead+Wind 45 deg - No Ice	44.664	14.155	-13.693	-1329.310	-1397.412	-0.269
Dead+Wind 60 deg - No Ice	44.664	17.336	-9.682	-940.032	-1711.469	-0.330
Dead+Wind 90 deg - No Ice	44.664	20.018	0.000	-0.239	-1976.230	-0.381
Dead+Wind 120 deg - No Ice	44.664	17.336	9.682	939.555	-1711.469	-0.330
Dead+Wind 135 deg - No Ice	44.664	14.155	13.693	1328.832	-1397.412	-0.270
Dead+Wind 150 deg - No Ice	44.664	10.009	16.770	1627.538	-988.121	-0.191
Dead+Wind 180 deg - No Ice	44.664	0.000	19.365	1879.359	0.000	0.000
Dead+Wind 210 deg - No Ice	44.664	-10.009	16.770	1627.538	988.121	0.191
Dead+Wind 225 deg - No Ice	44.664	-14.155	13.693	1328.832	1397.412	0.270
Dead+Wind 240 deg - No Ice	44.664	-17.336	9.682	939.555	1711.469	0.330
Dead+Wind 270 deg - No Ice	44.664	-20.018	0.000	-0.239	1976.230	0.381
Dead+Wind 300 deg - No Ice	44.664	-17.336	-9.682	-940.032	1711.469	0.330
Dead+Wind 315 deg - No Ice	44.664	-14.155	-13.693	-1329.310	1397.412	0.269
Dead+Wind 330 deg - No Ice	44.664	-10.009	-16.770	-1628.015	988.121	0.191
Dead+Ice+Temp	50.909	0.000	0.000	-0.599	0.000	0.000
Dead+Wind 0 deg+Ice+Temp	50.909	0.000	-15.226	-1504.280	0.000	0.000
Dead+Wind 30 deg+Ice+Temp	50.909	7.863	-13.186	-1302.825	-788.989	-0.156
Dead+Wind 45 deg+Ice+Temp	50.909	11.120	-10.766	-1063.864	-1115.797	-0.221
Dead+Wind 60 deg+Ice+Temp	50.909	13.619	-7.613	-752.445	-1366.565	-0.270
Dead+Wind 90 deg+Ice+Temp	50.909	15.726	0.000	-0.616	-1577.971	-0.312
Dead+Wind 120 deg+Ice+Temp	50.909	13.619	7.613	751.213	-1366.565	-0.271
Dead+Wind 135 deg+Ice+Temp	50.909	11.120	10.766	1062.632	-1115.797	-0.221
Dead+Wind 150 deg+Ice+Temp	50.909	7.863	13.186	1301.594	-788.989	-0.156
Dead+Wind 180 deg+Ice+Temp	50.909	0.000	15.226	1503.048	0.000	0.000
Dead+Wind 210 deg+Ice+Temp	50.909	-7.863	13.186	1301.594	788.989	0.156
Dead+Wind 225 deg+Ice+Temp	50.909	-11.120	10.766	1062.632	1115.797	0.221
Dead+Wind 240 deg+Ice+Temp	50.909	-13.619	7.613	751.213	1366.565	0.271
Dead+Wind 270 deg+Ice+Temp	50.909	-15.726	0.000	-0.616	1577.971	0.312
Dead+Wind 300 deg+Ice+Temp	50.909	-13.619	-7.613	-752.445	1366.565	0.270
Dead+Wind 315 deg+Ice+Temp	50.909	-11.120	-10.766	-1063.864	1115.797	0.221
Dead+Wind 330 deg+Ice+Temp	50.909	-7.863	-13.186	-1302.825	788.989	0.156
Dead+Wind 0 deg - Service	44.664	0.000	-7.564	-734.489	0.000	0.000
Dead+Wind 30 deg - Service	44.664	3.910	-6.551	-636.118	-386.003	-0.075
Dead+Wind 45 deg - Service	44.664	5.529	-5.349	-519.431	-545.890	-0.105
Dead+Wind 60 deg - Service	44.664	6.772	-3.782	-367.363	-668.576	-0.129
Dead+Wind 90 deg - Service	44.664	7.819	0.000	-0.239	-772.004	-0.149
Dead+Wind 120 deg - Service	44.664	6.772	3.782	366.886	-668.576	-0.129

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead+Wind 135 deg - Service	44.664	5.529	5.349	518.954	-545.890	-0.105
Dead+Wind 150 deg - Service	44.664	3.910	6.551	635.640	-386.003	-0.075
Dead+Wind 180 deg - Service	44.664	0.000	7.564	734.011	0.000	0.000
Dead+Wind 210 deg - Service	44.664	-3.910	6.551	635.640	386.003	0.075
Dead+Wind 225 deg - Service	44.664	-5.529	5.349	518.954	545.890	0.105
Dead+Wind 240 deg - Service	44.664	-6.772	3.782	366.886	668.576	0.129
Dead+Wind 270 deg - Service	44.664	-7.819	0.000	-0.239	772.004	0.149
Dead+Wind 300 deg - Service	44.664	-6.772	-3.782	-367.363	668.576	0.129
Dead+Wind 315 deg - Service	44.664	-5.529	-5.349	-519.431	545.890	0.105
Dead+Wind 330 deg - Service	44.664	-3.910	-6.551	-636.118	386.003	0.075

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
1	0.000	-44.664	0.000	0.000	44.664	0.000	0.000%
2	0.000	-44.664	-19.365	0.000	44.664	19.365	0.000%
3	10.009	-44.664	-16.770	-10.009	44.664	16.770	0.000%
4	14.155	-44.664	-13.693	-14.155	44.664	13.693	0.000%
5	17.336	-44.664	-9.682	-17.336	44.664	9.682	0.000%
6	20.018	-44.664	0.000	-20.018	44.664	0.000	0.000%
7	17.336	-44.664	9.682	-17.336	44.664	-9.682	0.000%
8	14.155	-44.664	13.693	-14.155	44.664	-13.693	0.000%
9	10.009	-44.664	16.770	-10.009	44.664	-16.770	0.000%
10	0.000	-44.664	19.365	0.000	44.664	-19.365	0.000%
11	-10.009	-44.664	16.770	10.009	44.664	-16.770	0.000%
12	-14.155	-44.664	13.693	14.155	44.664	-13.693	0.000%
13	-17.336	-44.664	9.682	17.336	44.664	-9.682	0.000%
14	-20.018	-44.664	0.000	20.018	44.664	0.000	0.000%
15	-17.336	-44.664	-9.682	17.336	44.664	9.682	0.000%
16	-14.155	-44.664	-13.693	14.155	44.664	13.693	0.000%
17	-10.009	-44.664	-16.770	10.009	44.664	16.770	0.000%
18	0.000	-50.909	0.000	0.000	50.909	0.000	0.000%
19	0.000	-50.909	-15.226	0.000	50.909	15.226	0.000%
20	7.863	-50.909	-13.186	-7.863	50.909	13.186	0.000%
21	11.120	-50.909	-10.766	-11.120	50.909	10.766	0.000%
22	13.619	-50.909	-7.613	-13.619	50.909	7.613	0.000%
23	15.726	-50.909	0.000	-15.726	50.909	0.000	0.000%
24	13.619	-50.909	7.613	-13.619	50.909	-7.613	0.000%
25	11.120	-50.909	10.766	-11.120	50.909	-10.766	0.000%
26	7.863	-50.909	13.186	-7.863	50.909	-13.186	0.000%
27	0.000	-50.909	15.226	0.000	50.909	-15.226	0.000%
28	-7.863	-50.909	13.186	7.863	50.909	-13.186	0.000%
29	-11.120	-50.909	10.766	11.120	50.909	-10.766	0.000%
30	-13.619	-50.909	7.613	13.619	50.909	-7.613	0.000%
31	-15.726	-50.909	0.000	15.726	50.909	0.000	0.000%
32	-13.619	-50.909	-7.613	13.619	50.909	7.613	0.000%
33	-11.120	-50.909	-10.766	11.120	50.909	10.766	0.000%
34	-7.863	-50.909	-13.186	7.863	50.909	13.186	0.000%
35	0.000	-44.664	-7.564	0.000	44.664	7.564	0.000%
36	3.910	-44.664	-6.551	-3.910	44.664	6.551	0.000%
37	5.529	-44.664	-5.349	-5.529	44.664	5.349	0.000%
38	6.772	-44.664	-3.782	-6.772	44.664	3.782	0.000%
39	7.819	-44.664	0.000	-7.819	44.664	0.000	0.000%
40	6.772	-44.664	3.782	-6.772	44.664	-3.782	0.000%
41	5.529	-44.664	5.349	-5.529	44.664	-5.349	0.000%
42	3.910	-44.664	6.551	-3.910	44.664	-6.551	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
43	0.000	-44.664	7.564	0.000	44.664	-7.564	0.000%
44	-3.910	-44.664	6.551	3.910	44.664	-6.551	0.000%
45	-5.529	-44.664	5.349	5.529	44.664	-5.349	0.000%
46	-6.772	-44.664	3.782	6.772	44.664	-3.782	0.000%
47	-7.819	-44.664	0.000	7.819	44.664	0.000	0.000%
48	-6.772	-44.664	-3.782	6.772	44.664	3.782	0.000%
49	-5.529	-44.664	-5.349	5.529	44.664	5.349	0.000%
50	-3.910	-44.664	-6.551	3.910	44.664	6.551	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00000404
3	Yes	4	0.00000001	0.00006983
4	Yes	4	0.00000001	0.00008391
5	Yes	4	0.00000001	0.00007752
6	Yes	4	0.00000001	0.00000947
7	Yes	4	0.00000001	0.00006981
8	Yes	4	0.00000001	0.00008304
9	Yes	4	0.00000001	0.00007323
10	Yes	4	0.00000001	0.00000404
11	Yes	4	0.00000001	0.00007323
12	Yes	4	0.00000001	0.00008304
13	Yes	4	0.00000001	0.00006981
14	Yes	4	0.00000001	0.00000947
15	Yes	4	0.00000001	0.00007752
16	Yes	4	0.00000001	0.00008391
17	Yes	4	0.00000001	0.00006983
18	Yes	4	0.00000001	0.00000001
19	Yes	4	0.00000001	0.00023544
20	Yes	4	0.00000001	0.00027944
21	Yes	4	0.00000001	0.00029482
22	Yes	4	0.00000001	0.00028579
23	Yes	4	0.00000001	0.00024750
24	Yes	4	0.00000001	0.00028383
25	Yes	4	0.00000001	0.00029411
26	Yes	4	0.00000001	0.00027957
27	Yes	4	0.00000001	0.00023502
28	Yes	4	0.00000001	0.00027957
29	Yes	4	0.00000001	0.00029411
30	Yes	4	0.00000001	0.00028383
31	Yes	4	0.00000001	0.00024750
32	Yes	4	0.00000001	0.00028579
33	Yes	4	0.00000001	0.00029482
34	Yes	4	0.00000001	0.00027944
35	Yes	4	0.00000001	0.00000001
36	Yes	4	0.00000001	0.00000564
37	Yes	4	0.00000001	0.00000690
38	Yes	4	0.00000001	0.00000667
39	Yes	4	0.00000001	0.00000001
40	Yes	4	0.00000001	0.00000555
41	Yes	4	0.00000001	0.00000677
42	Yes	4	0.00000001	0.00000613
43	Yes	4	0.00000001	0.00000001

44	Yes	4	0.00000001	0.00000613
45	Yes	4	0.00000001	0.00000677
46	Yes	4	0.00000001	0.00000555
47	Yes	4	0.00000001	0.00000001
48	Yes	4	0.00000001	0.00000667
49	Yes	4	0.00000001	0.00000690
50	Yes	4	0.00000001	0.00000564

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	152 - 137.823	8.670	39	0.506	0.001
L2	142.173 - 95.08	7.631	39	0.501	0.001
L3	100.913 - 47.263	3.809	39	0.358	0.000
L4	54.729 - 1	1.116	39	0.189	0.000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
147.000	LPA-80063/6CF	39	8.139	0.505	0.001	54348

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	152 - 137.823	22.192	6	1.294	0.002
L2	142.173 - 95.08	19.533	6	1.283	0.001
L3	100.913 - 47.263	9.750	6	0.917	0.000
L4	54.729 - 1	2.858	6	0.485	0.000

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
147.000	LPA-80063/6CF	6	20.832	1.291	0.002	21253

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	152 - 137.823 (1)	TP30.83x26.73x0.25	14.177	0.000	0.0	39.000	23.267	-3.191	907.413	0.004
L2	137.823 - 95.08 (2)	TP42.66x29.072x0.375	47.093	0.000	0.0	39.000	48.326	-10.224	1884.730	0.005
L3	95.08 - 47.263 (3)	TP55.72x40.227x0.5	53.650	0.000	0.0	39.000	84.213	-23.862	3284.290	0.007
L4	47.263 - 1 (4)	TP68x52.564x0.5	53.729	0.000	0.0	39.000	107.122	-44.660	4177.780	0.011

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	152 - 137.823 (1)	TP30.83x26.73x0.25	37.762	2.694	39.000	0.069	0.000	0.000	39.000	0.000
L2	137.823 - 95.08 (2)	TP42.66x29.072x0.375	424.892	10.545	39.000	0.270	0.000	0.000	39.000	0.000
L3	95.08 - 47.263 (3)	TP55.72x40.227x0.5	1030.458	11.231	39.000	0.288	0.000	0.000	39.000	0.000
L4	47.263 - 1 (4)	TP68x52.564x0.5	1976.233	13.285	39.000	0.341	0.000	0.000	39.000	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	152 - 137.823 (1)	TP30.83x26.73x0.25	7.822	0.336	26.000	0.026	0.381	0.013	26.000	0.001
L2	137.823 - 95.08 (2)	TP42.66x29.072x0.375	11.051	0.229	26.000	0.018	0.381	0.005	26.000	0.000
L3	95.08 - 47.263 (3)	TP55.72x40.227x0.5	15.211	0.181	26.000	0.014	0.381	0.002	26.000	0.000
L4	47.263 - 1 (4)	TP68x52.564x0.5	20.026	0.187	26.000	0.014	0.381	0.001	26.000	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	152 - 137.823 (1)	0.004	0.069	0.000	0.026	0.001	0.073	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 $\frac{f_w}{F_w}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L2	137.823 - 95.08 (2)	0.005	0.270	0.000	0.018	0.000	0.276 ✔	1.333	H1-3+VT ✔
L3	95.08 - 47.263 (3)	0.007	0.288	0.000	0.014	0.000	0.295 ✔	1.333	H1-3+VT ✔
L4	47.263 - 1 (4)	0.011	0.341	0.000	0.014	0.000	0.351 ✔	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	152 - 137.823	Pole	TP30.83x26.73x0.25	1	-3.191	1209.581	5.5	Pass
L2	137.823 - 95.08	Pole	TP42.66x29.072x0.375	2	-10.224	2512.345	20.7	Pass
L3	95.08 - 47.263	Pole	TP55.72x40.227x0.5	3	-23.862	4377.958	22.2	Pass
L4	47.263 - 1	Pole	TP68x52.564x0.5	4	-44.660	5568.981	26.4	Pass
							Summary	
						Pole (L4)	26.4	Pass
						RATING =	**26.4**	**Pass**

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Subject:		Anchor Bolt and Base Plate Anlaysis
Location:		151-ft EEI Monopole Granby, CT
Rev. 0: 2/26/15		Prepared by: T.J.L. Checked by: C.F.C. Job No. 15001.018

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 1976·ft·kips	(Input From tnxTower)
Shear Force =	Shear := 20·kips	(Input From tnxTower)
Axial Force =	Axial := 45·kips	(Input From tnxTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 32	(User Input)
Diameter of Bolt Circle =	D_{bc} := 76·in	(User Input)
Bolt "Column" Distance =	l := 3.0·in	(User Input)
Bolt Ultimate Strength =	F_u := 100·ksi	(User Input)
Bolt Yield Strength =	F_y := 75·ksi	(User Input)
Bolt Modulus =	E := 29000·ksi	(User Input)
Diameter of Anchor Bolts =	D := 2.25·in	(User Input)
Threads per Inch =	n := 4.5	(User Input)

Base Plate Data:

Use ASTM A572 60

Plate Yield Strength =	Fy_{bp} := 60·ksi	(User Input)
Base Plate Thickness =	t_{bp} := 3.25·in	(User Input)
Base Plate Diameter =	D_{bp} := 82·in	(User Input)
Outer Pole Diameter =	D_{pole} := 68·in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 38 \cdot in$

Distance to Bolts = $i := 1 .. N$

$$d_i := \left| \begin{array}{l} \theta \leftarrow 2 \cdot \pi \cdot \left(\frac{i}{N} \right) \\ d \leftarrow R_{bc} \cdot \sin(\theta) \end{array} \right.$$

$d_1 = 7.41 \cdot in$ $d_7 = 37.27 \cdot in$

$d_2 = 14.54 \cdot in$ $d_8 = 38.00 \cdot in$

$d_3 = 21.11 \cdot in$ $d_9 = 37.27 \cdot in$

$d_4 = 26.87 \cdot in$ $d_{10} = 35.11 \cdot in$

$d_5 = 31.60 \cdot in$ $d_{11} = 31.60 \cdot in$

$d_6 = 35.11 \cdot in$ etc.

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 34 \cdot in$

Moment Arms of Bolts about Neutral Axis = $MA_i := if\left(d_i \geq R_{pole}, d_i - R_{pole}, 0in\right)$

$MA_1 = 0.00 \cdot in$ $MA_7 = 3.27 \cdot in$

$MA_2 = 0.00 \cdot in$ $MA_8 = 4.00 \cdot in$

$MA_3 = 0.00 \cdot in$ $MA_9 = 3.27 \cdot in$

$MA_4 = 0.00 \cdot in$ $MA_{10} = 1.11 \cdot in$

$MA_5 = 0.00 \cdot in$ $MA_{11} = 0.00 \cdot in$

$MA_6 = 1.11 \cdot in$ etc

Effective Width of Baseplate for Bending = $B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 36.7 \cdot in$

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 2.31 \times 10^4 \cdot in^2$

Gross Area of Bolt = $A_g := \frac{\pi}{4} \cdot D^2 = 3.976 \cdot in^2$

Net Area of Bolt = $A_n := \frac{\pi}{4} \cdot \left(D - \frac{0.9743 \cdot in}{n}\right)^2 = 3.248 \cdot in^2$

Net Diameter = $D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} = 2.033 \cdot in$

Radius of Gyration of Bolt = $r := \frac{D_n}{4} = 0.508 \cdot in$

Section Modulus of Bolt = $S_x := \frac{\pi \cdot D_n^3}{32} = 0.826 \cdot in^3$

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 37.6 \cdot kips$

Allowable Tensile Force = $T_{ALL.Gross} := 1.333 \cdot \left(0.33 \cdot A_g \cdot F_u\right) = 174.9 \cdot kips$ (1.333 increase allowed per TIA/EIA)

$T_{ALL.Net} := 1.333 \cdot \left(0.60 \cdot A_n \cdot F_y\right) = 194.812 \cdot kips$ (1.333 increase allowed per TIA/EIA)

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} \cdot 100 = 19$ Bolts are "upset bolts". Use net area per AISC

Condition1 = $Condition1 := if\left(\frac{T_{Max}}{T_{ALL.Net}} \le 1.00, "OK", "Overstressed"\right)$

Condition1 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.156 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 2.3 \cdot ksi$

Allowable Bending Stress = $F_{bx} := 1.333 \cdot 0.6 \cdot F_y = 60 \cdot ksi$ (1.333 increase allowed per TIA/EIA)

Check Combined Stress Requirement:

Per ASCE Manual 72: "If the clearance between the base plate and concrete does not exceed two times the bolt diameter a bending stress analysis of the bolts is NOT normally required.

$$l := \begin{cases} l & \text{if } l > 2 \cdot D_n = 0 \cdot in \\ 0 & \text{otherwise} \end{cases}$$

$$f_{bx} := \begin{cases} f_{bx} & \text{if } l > 2 \cdot D_n = 0 \cdot ksi \\ 0 & \text{otherwise} \end{cases}$$

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 40.4 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 12.4 \cdot ksi$$

$$K := 0.65$$

$$C_c := \sqrt{\frac{2 \cdot \pi^2 \cdot E}{F_y}} = 87.364$$

$$F_a := \begin{cases} \dfrac{\left[1 - \dfrac{\left(\frac{K \cdot l}{r}\right)^2}{2 \cdot C_c^2}\right] \cdot F_y}{\dfrac{5}{3} + \dfrac{3 \cdot \left(\frac{K \cdot l}{r}\right)}{8 \cdot C_c} - \dfrac{\left(\frac{K \cdot l}{r}\right)^3}{8 \cdot C_c^3}} & \text{if } \dfrac{K \cdot l}{r} \le C_c = 45 \cdot ksi \\ \dfrac{12 \cdot \pi^2 \cdot E}{23 \cdot \left(\frac{K \cdot l}{r}\right)^2} & \text{if } \dfrac{K \cdot l}{r} > C_c \end{cases}$$

Allowable Compressive Stress =

$$F_a := 1.333 \cdot F_a = 60 \cdot ksi$$

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) \cdot 100 = 20.7$$

Condition 2 =

$$Condition2 := if\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \le 1.00, \text{"OK"}, \text{"Overstressed"}\right)$$

Condition2 = "OK"

Base Plate Analysis:

Force from Bolts =

$$C_i := \frac{OM \cdot d_i}{I_p} + \frac{Axial}{N}$$

$C_1 = 9.0 \cdot kips$ $C_7 = 39.7 \cdot kips$

$C_2 = 16.3 \cdot kips$ $C_8 = 40.4 \cdot kips$

$C_3 = 23.1 \cdot kips$ $C_9 = 39.7 \cdot kips$

$C_4 = 29.0 \cdot kips$ $C_{10} = 37.4 \cdot kips$

$C_5 = 33.8 \cdot kips$ $C_{11} = 33.8 \cdot kips$

$C_6 = 37.4 \cdot kips$ etc.

Maximum Bending Stress in Plate =

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} \cdot t_{bp}^2\right)} = 7.8 \cdot ksi$$

Allowable Bending Stress in Plate =

$$F_{bp} := 1.33 \cdot 0.75 \cdot Fy_{bp} = 59.9 \cdot ksi$$

Plate Bending Stress % of Capacity =

$$\frac{f_{bp}}{F_{bp}} \cdot 100 = 13$$

Condition3 =

$$Condition3 := if\left(\frac{f_{bp}}{F_{bp}} < 1.00, "Ok", "Overstressed"\right)$$

Condition3 = "Ok"

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Subject:		Foundation Analysis
Location:		151-ft EEI Monopole Granby, CT
Rev. 0: 2/26/15		Prepared by: T.J.L. Checked by: C.F.C. Job No. 15001.018

Standard Monopole Foundation:

Input Data:

Tower Data			
Overturning Moment =	$OM := 1976 \cdot ft \cdot kips$	(User Input from tnxTower)	
Shear Force =	$Shear := 20 \cdot kip$	(User Input from tnxTower)	
Axial Force =	$Axial := 45 \cdot kip$	(User Input from tnxTower)	
Tower Height =	$H_t := 151 \cdot ft$	(User Input)	
Footing Data:			
Overall Depth of Footing =	$D_f := 11.0 \cdot ft$	(User Input)	
Length of Pier =	$L_p := 9.0 \cdot ft$	(User Input)	
Extension of Pier Above Grade =	$L_{pag} := 1.0 \cdot ft$	(User Input)	
Diameter of Pier =	$d_p := 8.0 \cdot ft$	(User Input)	
Thickness of Footing =	$T_f := 3.0 \cdot ft$	(User Input)	
Width of Footing =	$W_f := 28.0 \cdot ft$	(User Input)	
Anchor Bolt Data:			
Length of Anchor Bolts =	$L_{st} := 96 \cdot in$	(User Input)	
Projection of Anchor Bolts Above Pier =	$A_{BP} := 12.00 \cdot in$	(User Input)	
Anchor Bolt Diameter =	$d_{anchor} := 2.25 \cdot in$	(User Input)	
Base Plate Bolt Circle =	$MP := 76 \cdot in$	(User Input)	
Material Properties:			
Concrete Compressive Strength =	$f_c := 4000 \cdot psi$	(User Input)	
Steel Reinforcment Yield Strength =	$f_y := 60000 \cdot psi$	(User Input)	
Anchor Bolt Yield Strength =	$f_{ya} := 75000 \cdot psi$	(User Input)	
Internal Friction Angle of Soil =	$\Phi_s := 30 \cdot deg$	(User Input)	
Allowable Soil Bearing Capacity =	$q_s := 3000 \cdot psf$	(User Input)	
Unit Weight of Soil =	$\gamma_{soil} := 100 \cdot pcf$	(User Input)	
Unit Weight of Concrete =	$\gamma_{conc} := 150 \cdot pcf$	(User Input)	
Foundation Bouyancy =	$Bouyancy := 0$	(User Input)	(Yes=1 / No=0)
Depth to Neglect =	$n := 1 \cdot ft$	(User Input)	
Cohesion of Clay Type Soil =	$c := 0 \cdot ksf$	(User Input)	(Use 0 for Sandy Soil)
Seismic Zone Factor =	$Z := 2$	(User Input)	(UBC-1997 Fig 23-2)
Coefficient of Friction Between Concrete =	$\mu := 0.45$	(User Input)	

Pier Reinforcement:

Bar Size =	$BS_{pier} := 8$	(User Input)	
Bar Diameter =	$d_{bpier} := 1.00 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 60$	(User Input)	
Clear Cover of Reinforcement =	$Cvr_{pier} := 3 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Diameter of Tie =	$d_{Tie} := 0.5 \cdot in$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{top} := 8$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 1.00 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 80$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 8$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 1.00 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 80$	(User Input)	(Bottom of Pad)
Clear Cover of Reinforcement =	$Cvr_{pad} := 3.0 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)

Calculated Factors:

Pier Reinforcement Bar Area =

$$A_{bpier} := \frac{\pi \cdot d_{bpier}^2}{4} = 0.785 \cdot in^2$$

Pad Top Reinforcement Bar Area =

$$A_{btop} := \frac{\pi \cdot d_{btop}^2}{4} = 0.785 \cdot in^2$$

Pad Bottom Reinforcement Bar Area =

$$A_{bbot} := \frac{\pi \cdot d_{bbot}^2}{4} = 0.785 \cdot in^2$$

Coefficient of Lateral Soil Pressure =

$$K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 3$$

Load Factor =

$$LF := \begin{cases} 1.333 & \text{if } H_t \le 700 \cdot ft \\ 1.7 & \text{if } H_t \ge 1200 \cdot ft \\ 1.333 + \left(\frac{H_t - 700ft}{1200ft - 700ft}\right) \cdot 0.4 & \text{otherwise} \end{cases} = 1.333$$

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Subject:	Foundation Analysis
Location:	151-ft EEI Monopole Granby, CT
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Stability of Footing:

Adjusted Concrete Unit Weight = $\gamma_c := if(Bouyancy = 1, \gamma_{conc} - 62.4pcf, \gamma_{conc}) = 150 \cdot pcf$

Adjusted Soil Unit Weight = $\gamma_s := if(Bouyancy = 1, \gamma_{soil} - 62.4pcf, \gamma_{soil}) = 100 \cdot pcf$

Passive Pressure = $P_{pn} := K_p \cdot \gamma_s \cdot n + c \cdot 2 \cdot \sqrt{K_p} = 0.3 \cdot ksf$

$P_{pt} := K_p \cdot \gamma_s \cdot (D_f - T_f) + c \cdot 2 \cdot \sqrt{K_p} = 2.4 \cdot ksf$

$P_{top} := if[n < (D_f - T_f), P_{pt}, P_{pn}] = 2.4 \cdot ksf$

$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p} = 3.3 \cdot ksf$

$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 2.85 \cdot ksf$

$T_p := if[n < (D_f - T_f), T_f, (D_f - n)] = 3$

$A_p := W_f \cdot T_p = 84$

Ultimate Shear = $S_u := P_{ave} \cdot A_p = 239.4 \cdot kip$

Weight of Concrete Pad = $WT_c := \left[\left(W_f^2 \cdot T_f\right) + d_p^2 \cdot L_p\right] \cdot \gamma_c = 439.2 \cdot kip$

Weight of Soil Above Footing = $WT_{s1} := \left[\left(W_f^2 - d_p^2\right) \cdot \begin{cases} (L_p - L_{pag} - n) & \text{if } (L_p - L_{pag} - n) \geq 0 \\ 0 & \text{if } (L_p - L_{pag} - n) \leq 0 \end{cases}\right] \cdot \gamma_s = 504 \cdot kip$

Weight of Soil Wedge at Back Face = $WT_{s2} := \left(\frac{D_f^2 \cdot \tan(\Phi_s)}{2} \cdot W_f\right) \cdot \gamma_s = 97.803 \cdot kip$

Weight of Soil Wedge at back face Corners = $WT_{s3} := 2 \cdot \left[(D_f)^3 \cdot \frac{\tan(\Phi_s)}{3}\right] \cdot \gamma_s = 51.23 \cdot kips$

Total Weight = $WT_{tot} := WT_c + WT_{s1} + Axial = 988.2 \cdot kip$

Resisting Moment = $M_r := (WT_{tot}) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + \left[(WT_{s2} + WT_{s3}) \cdot \left(W_f + \frac{D_f \cdot \tan(\Phi_s)}{3}\right)\right] = 18563 \cdot kip \cdot ft$

Overturning Moment = $M_{ot} := OM + Shear \cdot (L_p + T_f) = 2216 \cdot kip \cdot ft$

Factor of Safety Actual = $FS := \frac{M_r}{M_{ot}} = 8.38$

Factor of Safety Required = $FS_{req} := 2$

$OverTurning\_Moment\_Check := if(FS \geq FS_{req}, "Okay", "No Good")$

OverTurning_Moment_Check = "Okay"

Shear Capacity in Pier:

Shear Resistance of Pier =

$$S_p := \frac{\mu \cdot WT_{tot}}{FS_{req}} = 222.345 \cdot kips$$

$$Shear\_Check := if\left(S_p > Shear, "Okay", "No Good"\right)$$

Shear_Check = "Okay"

Bearing Pressure Caused by Footing:

Area of the Mat =

$$A_{mat} := W_f^{\,2} = 784$$

Section Modulus of Mat =

$$S := \frac{W_f^{\,3}}{6} = 3658.67 \cdot ft^3$$

Maximum Pressure in Mat =

$$P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S} = 1.866 \cdot ksf$$

$$Max\_Pressure\_Check := if\left(P_{max} < q_s, "Okay", "No Good"\right)$$

Max_Pressure_Check = "Okay"

Minimum Pressure in Mat =

$$P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S} = 0.655 \cdot ksf$$

$$Min\_Pressure\_Check := if\left[\left(P_{min} \geq 0\right) \cdot \left(P_{min} < q_s\right), "Okay", "No Good"\right]$$

Min_Pressure_Check = "Okay"

Distance to Resultant of Pressure Distribution =

$$X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 14.378$$

Distance to Kern =

$$X_k := \frac{W_f}{6} = 4.667$$

Since Resultant Force is Not in Kern, Area to which Pressure is Applied Must be Reduced.

Eccentricity =

$$e := \frac{M_{ot}}{WT_{tot}} = 2.242$$

Adjusted Soil Pressure =

$$P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \left(\frac{W_f}{2} - e\right)} = 2.001 \cdot ksf$$

$$q_{adj} := if\left(P_{min} < 0, P_a, P_{max}\right) = 1.866 \cdot ksf$$

$$Pressure\_Check := if\left(q_{adj} < q_s, "Okay", "No Good"\right)$$

Pressure_Check = "Okay"

Concrete Bearing Capacity:

Strength Reduction Factor = $\Phi_c := 0.65$ (ACI-2008 9.3.2.2)

Bearing Strength Between Pier and Pad = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 1.6 \times 10^4 \cdot kips$ (ACI-2008 10.14)

$Bearing\_Check := if(P_b > LF \cdot Axial, "Okay", "No Good")$

Bearing_Check = "Okay"

Shear Strength of Concrete:

Beam Shear: (Critical section located at a distance d from the face of Pier) (ACI 11.3.1.1)

$\phi_c := 0.85$ (ACI 9.3.2.5)

$d := T_f - Cvr_{pad} - d_{bbot} = 32 \cdot in$

$d_1 := \frac{W_f}{2} - \frac{d_p}{2}$

$d_2 := d_1 - d$

$L := \left(\frac{W_f}{2} - e\right) \cdot 3$

$Slope := if\left(L > W_f, \frac{P_{max} - P_{min}}{W_f}, \frac{q_{adj}}{L}\right)$

$V_{req} := LF \cdot \left[\left(q_{adj} - Slope \cdot d_1\right) + \left(\frac{Slope \cdot d_1}{2}\right)\right] \cdot W_f \cdot d_1$

$V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f_c \cdot psi} \cdot W_f \cdot d$ (ACI-2008 11.2.1.1)

$Beam\_Shear\_Check := if(V_{req} < V_{Avail}, "Okay", "No Good")$

Beam_Shear_Check = "Okay"

Punching Shear: (Critical Section Located at a distance of d/2 from the face of pier) (ACI 11.11.1.2)

Critical Perimeter of Punching Shear = $b_o := \left(d_p + d\right) \cdot \pi = 33.5$

Area Included Inside Perimeter = $A_{bo} := \frac{\pi \cdot \left(d_p + d\right)^2}{4} = 89.4$

Area Outside of Perimeter = $A_{out} := A_{mat} - A_{bo} = 694.6$

Guess Value = $v_u := 1ksf$ (From "Foundation Analysis and design", By Joseph Bowles, Eq. 8-9)

Given $d^2 + d_p \cdot d = \frac{WT_{tot}}{\pi \cdot v_u}$

$v_u := \text{Find}(v_u) = 11.1 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f = 825.7 \cdot kips$

Required Shear Strength = $V_{req} := LF \cdot V_u = 1.1 \times 10^3 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 2767.1 \cdot kip$ (ACI-2008 11.11.2.1)

$Punching\_Shear\_Check := if(V_{req} < V_{Avail}, "Okay", "No Good")$

$Punching\_Shear\_Check = "Okay"$

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

Strength Reduction Factor = $\phi_m := .90$ (ACI-2008 9.3.2.1)

$q_b := q_{adj} - d_1 \cdot Slope = 1.434 \cdot ksf$

Maximum Bending at Face of Pier = $M_u := LF \cdot \left[\left(q_{adj} - q_b \right) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 3213.5 \cdot kip \cdot ft$

$$\beta := \begin{cases} 0.85 & \text{if } 2500 \cdot psi \le f_c \le 4000 \cdot psi \\ 0.65 & \text{if } f_c > 8000 \cdot psi \\ \left[0.85 - \left[\frac{\left(\frac{f_c}{psi} - 4000 \right)}{1000} \right] \cdot 0.5 \right] & \text{otherwise} \end{cases} = 0.85$$

(ACI-200810.2.7.3)

$R_n := \frac{M_u}{\phi_m \cdot W_f \cdot d^2} = 124.5 \cdot psi$

$\rho := \frac{0.85 \cdot f_c}{f_y} \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) = 0.0021$

$\rho_{min} := \rho = 0.00211$

Required Reinforcement for Temperature and Shrinkage:

$$\rho_{sh} := \begin{cases} .0018 & \text{if } f_y \geq 60000 \cdot psi \\ .0020 & \text{otherwise} \end{cases}$$ (ACI -2008 7.12.2.1)

Check Bottom Bars:

$$As := \begin{cases} \rho_{min} \cdot W_f \cdot d & \text{if } \rho_{min} > \frac{\rho_{sh}}{2} \\ \rho_{sh} \cdot W_f \cdot \frac{d}{2} & \text{otherwise} \end{cases} = 22.74 \cdot in^2$$

$$As_{prov} := A_{bbot} \cdot NB_{bot} = 62.8 \cdot in^2$$

$$Pad\_Reinforcement\_Bot := if\left(As_{prov} > As, "Okay", "No Good"\right)$$

Pad_Reinforcement_Bot = "Okay"

Check top Bars:

$$As := \rho_{sh} \cdot \left(W_f \cdot \frac{d}{2}\right) = 9.7 \cdot in^2$$

$$As_{prov} := A_{btop} \cdot NB_{top} = 62.8 \cdot in^2$$

$$Pad\_Reinforcement\_Top := if\left(As_{prov} > As, "Okay", "No Good"\right)$$

Pad_Reinforcement_Top = "Okay"

Developement Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 3.16 \cdot in$$

Spacing or Cover Dimension =

$$c := if\left(Cvr_{pad} < \frac{B_{sPad}}{2}, Cvr_{pad}, \frac{B_{sPad}}{2}\right) = 1.582 \cdot in$$

Transverse Reinforcement Index =

$$k_{tr} := 0$$ (ACI-2008 12.2.3)

$$L_{dbt} := \frac{3 \cdot f_y \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 45 \cdot in$$

Minimum Development Length =

$$L_{dbmin} := 12 \cdot in$$ (ACI-2008 12.2.1)

$$L_{dbtCheck} := if\left(L_{dbt} \geq L_{dbmin}, "Use\ L.dbt", "Use\ L.dbmin"\right)$$

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad} = 117 \cdot in$$

$$Lpad\_Check := if\left(L_{Pad} > L_{dbt}, "Okay", "No Good"\right)$$

Lpad_Check = "Okay"

Steel Reinforcement in Pier:

Area of Pier =

$$A_p := \frac{\pi \cdot d_p^{\,2}}{4} = 7238.23 \cdot in^2$$

$$A_{smin} := 0.01 \cdot 0.5 \cdot A_p = 36.19 \cdot in^2$$ (ACI-2008 10.8.4 & 10.9.1)

$$A_{sprov} := NB_{pier} \cdot A_{bpier} = 47.12 \cdot in^2$$

$$Steel\_Area\_Check := if\left(A_{sprov} > A_{smin}, "Okay", "No Good"\right)$$

Steel_Area_Check = "Okay"

Bar Spacing In Pier =

$$B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 4.027 \cdot in$$

Diameter of Reinforcement Cage =

$$Diam_{cage} := d_p - 2 \cdot Cvr_{pier} = 90 \cdot in$$

Maximum Moment in Pier =

$$M_p := \left[OM + Shear \cdot \left(L_p + \frac{A_{BP}}{2}\right)\right] \cdot LF = 34647.3 \cdot in \cdot kips$$

Pier Check evaluated from outside program and results are listed below;

$$\left(D \;\; N \;\; n \;\; P_u \;\; M_{xu}\right) := \left(d_p \cdot 12 \;\; NB_{pier} \;\; BS_{pier} \;\; \frac{Axial \cdot 1.333}{kips} \;\; \frac{M_p}{in \cdot kips}\right)$$

$$\left(D \;\; N \;\; n \;\; P_u \;\; M_{xu}\right) = \left(96 \;\; 60 \;\; 8 \;\; 59.985 \;\; 3.465 \times 10^4\right)$$

$$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) := (0 \;\; 0 \;\; 0 \;\; 0)$$

$$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) := \phi P'_n\left(D, N, n, P_u, M_{xu}\right)^T$$

$$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) = \left(185.16 \;\; 1.069 \times 10^5 \;\; -60 \;\; 6.549 \times 10^{-3}\right)$$

$$Axial\_Load\_Check := if\left(\phi P_n \geq P_u, "Okay", "No Good"\right)$$

Axial_Load_Check = "Okay"

$$Bending\_Check := if\left(\phi M_{xn} \geq M_{xu}, "Okay", "No Good"\right)$$

Bending_Check = "Okay"

Development Length Pier Reinforcement:

Available Length in Foundation:

$L_{pier} := L_p - Cvr_{pier} = 105 \cdot in$

$L_{pad} := T_f - Cvr_{pad} = 33 \cdot in$

Tension: (ACI-2008 12.2.3)

Spacing or Cover Dimension =

$c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right) = 2.013 \cdot in$

Transverse Reinforcement =

$k_{tr} := 0$ (ACI-2008 12.2.3)

$L_{dbt} := \frac{3 \cdot f_y \alpha_{pier} \cdot \beta_{pier} \cdot \gamma_{pier} \cdot \lambda_{pier}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \left(\frac{c + k_{tr}}{d_{bpier}}\right)} \cdot d_{bpier} = 35.34 \cdot in$

Minimum Development Length =

$L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f_c}{psi}}} \cdot .7 = 13.282 \cdot in$ (ACI 12.2.1)

Pier reinforcement bars are standard 90 degree hooks and therefore developement in the pad is computed as follows:

$L_{db} := \max\left(L_{dbt}, L_{dbmin}\right)$

$L_{tension\_Check} := if\left(L_{pier} + L_{pad} > L_{dbt}, "Okay", "No Good"\right)$

$L_{tension\_Check} = "Okay"$

Compression: (ACI-2008 12.3.2)

$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot f_y}{\sqrt{f_c \cdot psi}} = 18.974 \cdot in$

$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot \left(d_{bpier} \cdot f_y\right) = 18 \cdot in$

$L_{dbc} := if\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right) = 18.974 \cdot in$

$L_{compression\_Check} := if\left(L_{pier} + L_{pad} > L_{dbc}, "Okay", "No Good"\right)$

$L_{compression\_Check} = "Okay"$

Tie Size and Spacing in Column:

Minimum Tie Size =

$Tie_{min} := if(BS_{pier} \le 10, 3, 4) = 3$

Used #4 Ties

Seismic Factor =

$z := if(Z \le 2, 1, 0.5) = 1$ (ACI-2008 21.10.5)

$s_{lim1} := 16 \cdot d_{bpier} \cdot z = 16 \cdot in$

$s_{lim2} := 48 \cdot d_{Tie} \cdot z = 24 \cdot in$

$s_{lim3} := D_f \cdot z = 132 \cdot in$

$s_{lim4} := 18in$

Maximum Spacing =

$$s_{tie} := \min\left(\begin{pmatrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{pmatrix}\right) = 16 \cdot in$$

Number of Ties Required =

$$n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 = 7.375$$

Check Anchor Steel Embedment:

Depth Available =

$D_{ab} := L_{st} - A_{BP} = 7 \cdot ft$

Length of Anchor Bolt =

$$L_{anchor} := \frac{(0.11 \cdot f_{ya}) \cdot in}{\sqrt{f_c \cdot psi}} = 10.87 \cdot ft$$

$Depth\_Check := if(D_{ab} \ge L_{anchor}, "Okay", "No Good")$

Depth_Check = "No Good"

Note: Anchor plate is provided

SITE NAME	WEST GRANBY CT	ECP - CELL #	8	88
LATITUDE	41-57-11.88 N	LONGITUDE	72-49-47.43 W	
Additional Comments: 2015 AWS ADD.		SAVE BUTTON		
		STRUCTURE TYPE	Monopole	

AWS - LTE ANTENNA ADD	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	2100 MHz BBU	2100 MHz BBU	2100 MHz BBU
ANTENNA TYPE	HBXX-6517DS-VTM	HBXX-6517DS-VTM	HBXX-6517DS-VTM
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	0	110	240
DOWN TILT (MECH/ELEC)	0M/6E	0M/5E	0M/3E
RAD CTR (FT AGL)	147	147	147
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
RRH - QTY/MODEL	1 ALU RH_2X60-AWS	1 ALU RH_2X60-AWS	1 ALU RH_2X60-AWS
SECTOR DISTRIBUTION BOX			
MAIN DISTRIBUTION BOX	2	DB-T1-6Z-8AB-0Z	

700 Mhz - LTE Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	eNodeB	eNodeB	eNodeB
ANTENNA TYPE	BXA-70063-6CF_2	BXA-70063-6CF_2	BXA-70063-6CF_2
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	0	110	240
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	147	147	147
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

700 Mhz - LTE Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	eNodeB	eNodeB	eNodeB
ANTENNA TYPE	LNX-6514DS-VTM	LNX-6514DS-VTM	LNX-6514DS-VTM
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	0	110	240
DOWN TILT (MECH/DEG)	0M/4E	0M/4E	0M/2E
RAD CTR (FT AGL)	147	147	147
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

850 Celluar - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Modcell 4.0B	Cellular Modcell 4.0B	Cellular Modcell 4.0B
ANTENNA TYPE	LPA-80063/6CF	LPA-80063/6CF_5	LPA-80080/6CF
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	0	110	240
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	147	147	147
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

850 Celluar - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Modcell 4.0B	Cellular Modcell 4.0B	Cellular Modcell 4.0B
ANTENNA TYPE	LPA-80063/6CF	LPA-80063/6CF_5	LPA-80080/6CF
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	0	110	240
DOWN TILT (MECH/ELEC)	0	0	0
RAD CTR (FT AGL)	147	147	147
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEX WITH LTE CABLE			

1900 PCS - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0B	PCS Modcell 4.0B	PCS Modcell 4.0B
ANTENNA TYPE	LPA-171080-12CF_2	LPA-171080-12CF_2	LPA-171080-12CF_2
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	0	110	240
DOWN TILT (MECH/DEG)	0	3	0
RAD CTR (FT AGL)	147	147	147
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

1900 PCS - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0B	PCS Modcell 4.0B	PCS Modcell 4.0B
ANTENNA TYPE	HBXX-6517DS-VTM	HBXX-6517DS-VTM	HBXX-6517DS-VTM
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	0	110	240
DOWN TILT (MECH/DEG)	0M/3E	0M/3E	0M/4E
RAD CTR (FT AGL)	147	147	147
RRH - QTY/MODEL	1 ALU RRH_2X60-PCS	1 ALU RRH_2X60-PCS	1 ALU RRH_2X60-PCS
TMA - QTY / MODEL			
DIPLEX WITH CELLULAR CABLE			

NUMBER OF CABLE'S NEEDED					ESTIMATED CABLE LENGTH			
MAINLINE SIZE	1 5/8"	TOTAL # OF MAINLINES		18	MAINLINE (FT)			
JUMPER SIZE	1/2 "	TOTAL # OF TOP JUMPERS		18	TOP JUMPER (FT)			12
Equipment Cable Ordering		MAIN CABLE #	18 +	0	TOP JUMPER #	18	+	0
FIBER LINE SIZE	1 5/8"	TOTAL # OF FIBER LINES		2	FIBER LINE MODEL #			HB158-1-08U8-S8J18
JUMPER SIZE	5/8"	TOTAL # OF TOP JUMPERS		3	TOP JUMPER MODEL #			HB058-1-08U1-S1J18
Fiber Cable Ordering		FIBER CABLE	0 +	2	TOP JUMPER #	0	+	3

TX / RX FREQUENCIES			TX POWER OUTPUT	
Cellular A-Band	PCS F / AWS-Band	700 Mhz C - B	Cellular (Watts)	20
TX - 869-880,890-891.5 MHz	TX - 1970-1975 / 2145-21	TX - 746-757	PCS (Watts)	16
RX - 824-835,845-846.5 MHz	RX - 1890-1895 / 1745-17	RX - 776-787	LTE (Watts)	60

ALPHA				BETA				GAMMA			
Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code
A1	800	Tx1/Rx0	RED	A7	800	Tx2/Rx0	BLUE	A13	800	Tx3/Rx0	GREEN
A2	1900	Tx1/Rx0	RED/ WHITE	A8	1900	Tx2/Rx0	BLUE/ WHITE	A14	1900	Tx3/Rx0	GREEN/WHITE
A3	700	Tx1/Rx0	RED/ ORANGE	A9	700	Tx2/Rx0	BLUE/ ORANGE	A15	700	Tx3/Rx0	GREEN/ORANGE
A4	700	Tx4/Rx1	RED/RED/ ORANGE	A10	700	Tx5/Rx1	BLUE/BLUE/ ORANGE	A16	700	Tx6/Rx1	GREEN/GREEN/ ORANGE
A5	1900	Tx4/Rx1	RED/RED/ WHITE	A11	1900	Tx5/Rx1	BLUE/BLUE/ WHITE	A17	1900	Tx6/Rx1	GREEN/GREEN/ WHITE
A6	800	Tx4/Rx1	RED/RED	A12	800	Tx5/Rx1	BLUE/BLUE	A18	800	Tx6/Rx1	GREEN/GREEN

RF ENGINEER	RF MANAGER	INITIALS	DATE
Prepared By: Mark Brauer	Rob Hesselbach	MB	2/26/2015

Site Configuration

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

HBXX-6517DS-VTM

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

- Superior azimuth tracking and pattern symmetry with excellent passive intermodulation suppression
- The values presented on this datasheet have been calculated based on N-P-BASTA White Paper version 9.6 by the NGMN Alliance

Electrical Specifications

Frequency Band, MHz	**1710–1880**	**1850–1990**	**1920–2180**
Gain by all Beam Tilts, average, dBi	18.5	18.6	18.8
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.3	±0.4
Gain by Beam Tilt, average, dBi	0 ° | 18.4 3 ° | 18.7 6 ° | 18.4	0 ° | 18.4 3 ° | 18.7 6 ° | 18.5	0 ° | 18.7 3 ° | 18.9 6 ° | 18.6
Beamwidth, Horizontal, degrees	67	66	65
Beamwidth, Horizontal Tolerance, degrees	±2.4	±1.7	±2.9
Beamwidth, Vertical, degrees	5.0	4.7	4.4
Beamwidth, Vertical Tolerance, degrees	±0.3	±0.3	±0.3
Beam Tilt, degrees	0–6	0–6	0–6
USLS, dB	18	19	19
Front-to-Back Total Power at 180° ± 30°, dB	25	26	26
CPR at Boresight, dB	22	23	22
CPR at Sector, dB	10	10	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

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol® single band, quad
Band	Single band
Brand	DualPol® | Teletilt®
Operating Frequency Band	1710 – 2180 MHz
Number of Ports, all types	4

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

Product Specifications

HBXX-6517DS-VTM

RF Connector Quantity, total	4
Wind Loading, maximum	668.0 N @ 150 km/h 150.2 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph

Dimensions

Depth	166.0 mm | 6.5 in
Length	1903.0 mm | 74.9 in
Width	305.0 mm | 12.0 in
Net Weight	19.5 kg | 43.0 lb

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 1.1 Actuator	HBXX-6517DS-R2M
Model with Factory Installed AISG 2.0 Actuator	HBXX-6517DS-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.

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

LNX-6514DS-VTM

Andrew® Antenna, 698–896 MHz, 65° horizontal beamwidth, RET compatible

- Great solution to maximize network coverage and capacity
- Excellent gain, VSWR, front-to-back ratio, and PIM specifications for robust network performance
- Ideal choice for site collocations and tough zoning restrictions
- Excellent solution for site sharing and maximizing capacity
- Fully compatible with Andrew remote electrical tilt system for greater OpEx savings
- The RF connectors are designed for IP67 rating and the radome for IP56 rating

Electrical Specifications

Frequency Band, MHz	**698–806**	**806–896**
Gain, dBi	15.7	16.3
Beamwidth, Horizontal, degrees	65	65
Beamwidth, Horizontal Tolerance, degrees	±3	±3
Beamwidth, Vertical, degrees	12.5	11.2
Beam Tilt, degrees	0–10	0–10
USLS, typical, dB	17	18
Front-to-Back Ratio at 180°, dB	32	30
CPR at Boresight, dB	20	20
CPR at Sector, dB	10	10
Isolation, dB	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153
Input Power per Port, maximum, watts	400	400
Polarization	±45°	±45°
Impedance	50 ohm	50 ohm

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol®
Band	Single band
Brand	DualPol® | Teletilt®
Operating Frequency Band	698 – 896 MHz

Mechanical Specifications

Color	Light gray
Connector Interface	7-16 DIN Female
Connector Location	Bottom
Connector Quantity, total	2
Lightning Protection	dc Ground
Radiator Material	Aluminum
Radome Material	Fiberglass, UV resistant
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph

Product Specifications

LNX-6514DS-VTM

Dimensions

Depth	181.0 mm | 7.1 in
Length	1847.0 mm | 72.7 in
Width	301.0 mm | 11.9 in
Net Weight	17.6 kg | 38.8 lb

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 1.1 Actuator	LNX-6514DS-R2M
Model with Factory Installed AISG 2.0 Actuator	LNX-6514DS-A1M
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

DB380 — Pipe Mounting Kit for 2.4"-4.5" (60-115mm) OD round members on wide panel antennas. Includes 2 clamp sets and double nuts.

DB5083 — Downtilt Mounting Kit for 2.4"-4.5" (60 - 115 mm) OD round members. Includes a heavy-duty, galvanized steel downtilt mounting bracket assembly and associated hardware. This kit is compatible with the DB380 pipe mount kit for panel antennas that are equipped with two mounting brackets.

ALCATEL-LUCENT WIRELESS PRODUCT DATASHEET

RRH2X60-AWS FOR BAND 4 APPLICATIONS

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

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

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

SUPERIOR RF PERFORMANCE

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

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

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

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

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

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

OPTIMIZED TCO

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

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

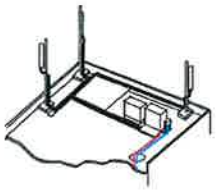
EASY INSTALLATION

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

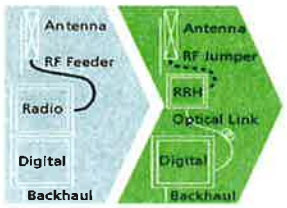
The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment. However, many of these sites can host an Alcatel-Lucent RRH2x60-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation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

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

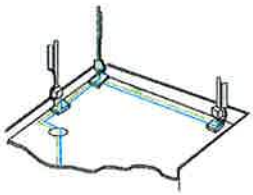
Installation can easily be done by a single person as the Alcatel–Lucent RRH2x60-AWS is compact and weighs about 20 kg, eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day.



Macro



RRH for space-constrained cell sites



Distributed

FEATURES

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

BENEFITS

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

TECHNICAL SPECIFICATIONS

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

Dimensions and weights

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

Electrical Data

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

RF Characteristics

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

Connectivity

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

Environmental specifications

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

Safety and Regulatory Data

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

Alcatel·Lucent

AT THE SPEED OF IDEAS™

Product Data Sheet DB-B1 and DB-T1 Series

DC and Fiber Management Distribution Boxes for HYBRIFLEX™ Cable

Product Description

The RFS Distribution Box design comes with the option for pluggable over voltage protection (OVP) for up to 6 remote radios and the connection for 6 pairs of optical fiber with LC optical fiber cable management. There is a hybrid cable input with a jumper configuration for power and optical fiber to the remote radio heads (RRHs). A custom wall, a 2-inch pole, and an H-Frame mounting bracket are included. Both the compact and standard design are available with lightening protection.

Features/Benefits

- Designed to accommodate varying diameters of HYBRIFLEX™ (combined power and fiber optic) cables – up to 2 inches
- Supports Single- and Multi-Mode Optical fiber
- NEMA 4x rated enclosure – allows **flexibility for indoor or outdoor installation** on a roof or tower top
- Weatherproof enclosure and ports – **improves system reliability**
- Modular design – makes replacement or addition of OVP easy without removal of other components within the box
- Strikesorb OVP technology – protects equipment from damaging surges up to 60 kA on an 8/20 waveform and up to 5 kA on a 10/350 waveform (certain models only)
- Low residual voltage and high impedance – **ideally suited for RRH technology** – won't shut down the RRH the way spark gap technology does (certain models only)

Technical Specifications

Mechanical Specifications

Model Number	DB-B1-6C-8AB-0Z	DB-T1-6Z-8AB-0Z
Enclosure Design	Standard, 6 OVP's	Standard without OVP
Dimensions - H x W x D, mm (in)	610 x 610 x 254 (24 x 24 x 10)	610 x 610 x 254 (24 x 24 x 10)
Weight, kg (lb)	20 (44)	20 (44)
Suppression Connection Method	Compression lug, #2-#14 AWG Copper, #2-#12 Aluminum	
Fiber Connection Method	LC-LC Single- or Multi-mode duplex	
Environmental Rating	NEMA 4x	
Operating Temperature, °C (°F)	-40 to +80 (-40 to +176)	
UV Protection	ISO 4892-2 Method A Xenon-Arc 2160 hrs	

Electrical Specifications

Nominal Operating Voltage	48 VDC	
Nominal Discharge Current (I_n) per UL 1449 3rd Ed	20 kA 8/20 µs	N/A
Maximum Discharge Current (I_{max}) per NEMA LS-1	60 kA 8/20 µs	N/A
Maximum Impulse (Lightning) Current (I_{imp}) per IEC 61643-1	5 kA 10/350 µs	N/A
Maximum Continuous Operating Voltage (U_c)	75 VDC	N/A
Voltage Protection Rating per UL1449 3rd Ed	400 V	N/A
Protection Class as per IEC 61643-1	Class 1	N/A
Strikesorb OVP Compliance	ANSI/UL 1449-3rd Ed	N/A
	IEEE C62.41	N/A
	NEMA LS-1	N/A
	IEC 61643-1	N/A
	IEC 61643-12	N/A
	EN 61643-11	N/A

* This data is provisional and subject to change.