EM-CING-023-121108B

HPC Wireless Services
46 Mill Plain Rd.
Floor 2
Danbury, CT, 06811
P.: 203.797.1112

HPC WIRELESS SERVICES

November 6, 2012

VIA OVERNIGHT COURIER

Connecticut Siting Council
10 Franklin Square
New Britain, Connecticut 06051
Attn: Ms. Linda Roberts, Executive Director

Re: New Cingular Wireless PCS, LLC – Exempt Modification
650 Albany Turnpike, Canton, Connecticut

Dear Ms. Roberts:

This letter and attachments are submitted on behalf of New Cingular Wireless PCS, LLC ("AT&T"). AT&T is making modifications to certain existing sites in its Connecticut system in order to implement LTE technology. Please accept this letter and attachments as notification, pursuant to Section 16-50j-73 of the Regulations of Connecticut State Agencies ("R.S.C.A."), of construction that constitutes an exempt modification pursuant to R.C.S.A. Section 16-50j-72(b)(2). In compliance with R.C.S.A. Section 16-50j-73, a copy of this letter and attachments is being sent to the First Selectman of the Town of Canton.

AT&T plans to modify the existing wireless communications facility owned by Cellco Partnership d/b/a/ Verizon Wireless and located at 650 Albany Turnpike, Canton (coordinates 41° -51'-02.0" N, 72°-56'-55.4" W). Attached are a compound plan and elevation depicting the planned changes, and documentation of the structural sufficiency of the structure to accommodate the revised antenna configuration. Also included is a power density report reflecting the modification to AT&T's operations at the site.

The changes to the facility do not constitute a modification as defined in Connecticut General Statutes ("C.G.S.") Section 16-50i(d) because the general physical characteristics of the facility will not be significantly changed. Rather, the planned changes to the facility fall squarely within those activities explicitly provided for in R.C.S.A. Section 16-50j-72(b)(2).

1. AT&T will add three (3) LTE panel antennas on new pipe mounts, and six (6) RRHs behind the LTEs, all attached to the existing platform at a centerline height of approximately 110'. One (1) surge arrestor will also be mounted to the existing platform support arm also at a centerline height of approximately 110'. AT&T will also place DC

power and fiber runs along the existing coaxial cable run. These changes will not extend the height of the approximately 120' structure.

2. AT&T will place related equipment in an existing Equipment Shelter and mount a new GPS antenna on the existing Equipment Shelter. These changes will be within the existing compound and will have no effect on the site boundaries.

3. The proposed changes will not increase the noise level at the existing facility by six (6) decibels or more. The incremental effect of the proposed changes will be negligible.

4. The changes to the facility will not increase the calculated "worst case" power density for the combined operations at the site to a level at or above the applicable standard for uncontrolled environments as calculated for a mixed frequency site. As indicated on the attached report prepared by C Squared Systems, LLC, AT&T's operations at the site will result in a power density of approximately 3.41%; the combined site operations will result in a total power density of approximately 47.66%.

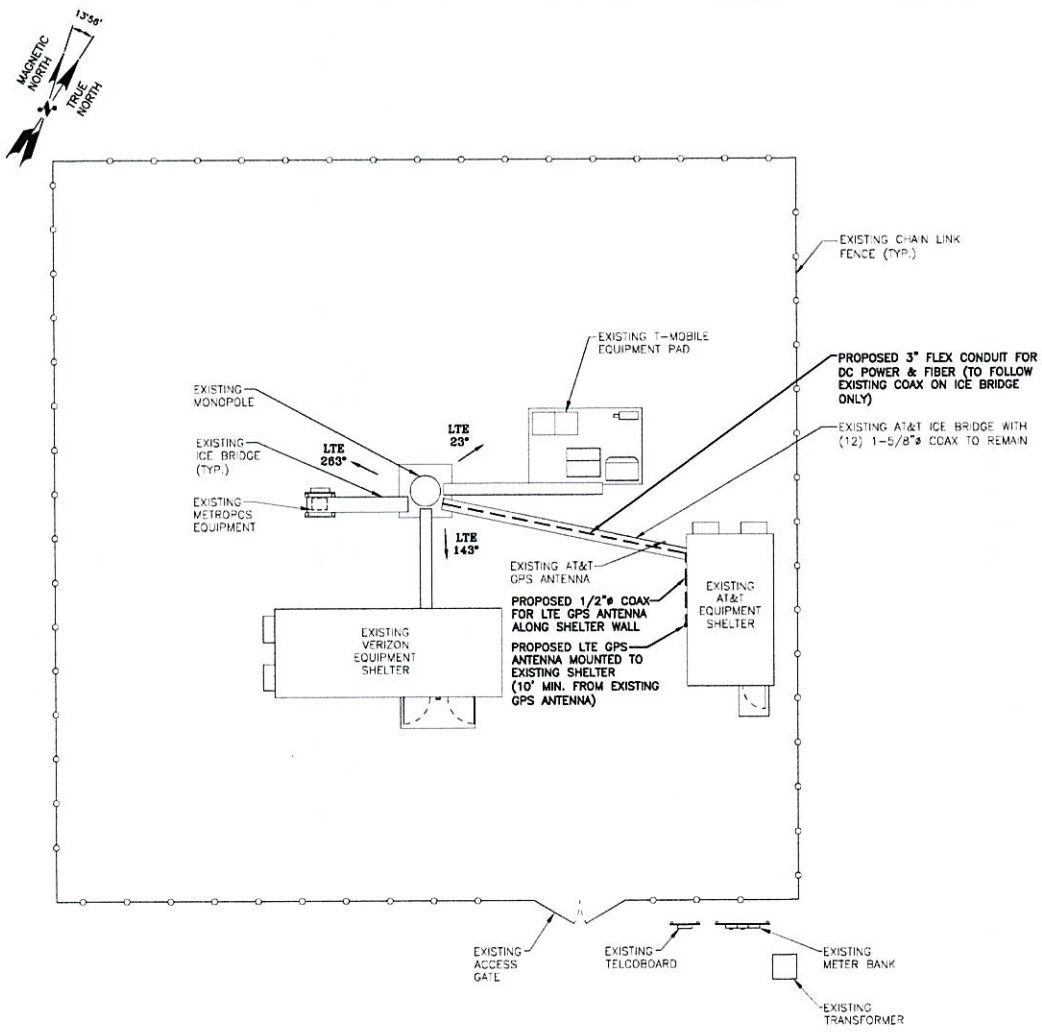
Please do not hesitate to contact me by phone at (203) 610-1071, or by e-mail at mjhowlett@optonline.net, if there are any questions concerning this matter. Thank you for your consideration.

Respectfully yours,

Melanie J. Howlett

Attachments

cc: Honorable Richard J. Bellow, First Selectman, Town of Canton
Andrew Chellman, (underlying property owner)



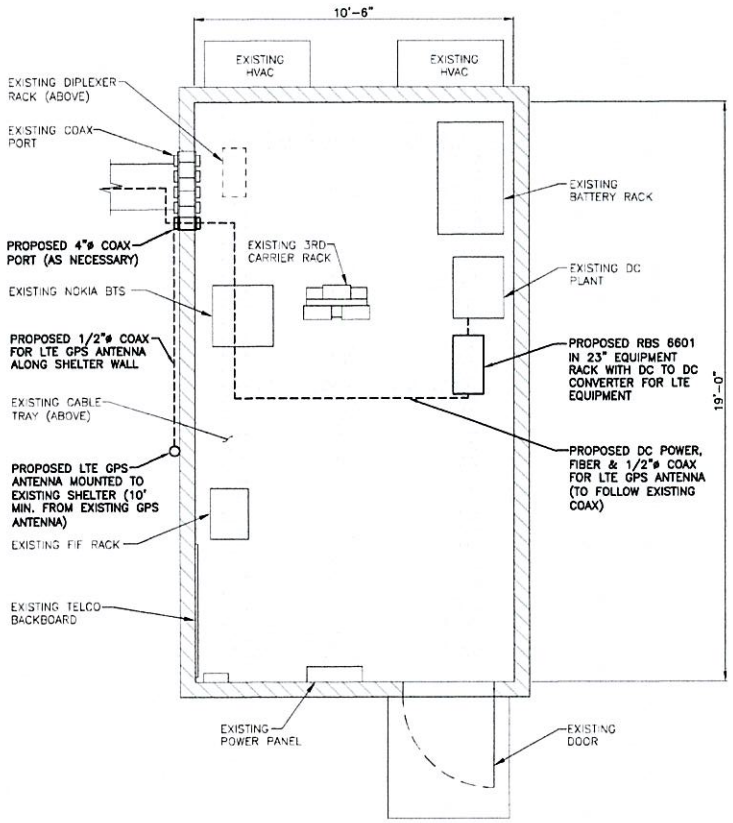
COMPOUND PLAN

SCALE: 1/8"=1'-0"

0 4'-0" 8'-0" 16'-0" 24'-0"

NOTE:
REFER TO THE FINAL RF DATA SHEET FOR FINAL ANTENNA SETTINGS.

NOTE:
REFER TO STRUCTURAL ANALYSIS BY: CENTEK ENGINEERING, DATED: SEPTEMBER 24, 2012, FOR THE CAPACITY OF THE EXISTING STRUCTURES TO SUPPORT THE PROPOSED EQUIPMENT.



EQUIPMENT PLAN

SCALE: 1/2"=1'-0"

0 1'-0" 2'-0" 4'-0" 6'-0"

Hudson Design Group LLC
1600 OSGOOD STREET
BUILDING 20 NORTH, SUITE 3090
N. ANDOVER, MA 01845
TEL: (978) 557-5553
FAX: (978) 336-5586

NEXLINK GLOBAL SERVICES
a UniTek GLOBAL SERVICES company
800 MARSHALL PHELPS ROAD UNIT#: 2A
WINDSOR, CT 06095

SITE NUMBER: CT1230
SITE NAME: C-38 CANTON
650 ALBANY TURNPIKE
CANTON, CT 06022
HARTFORD COUNTY

at&t
500 ENTERPRISE DRIVE, SUITE 3A
ROCKY HILL, CT 06067

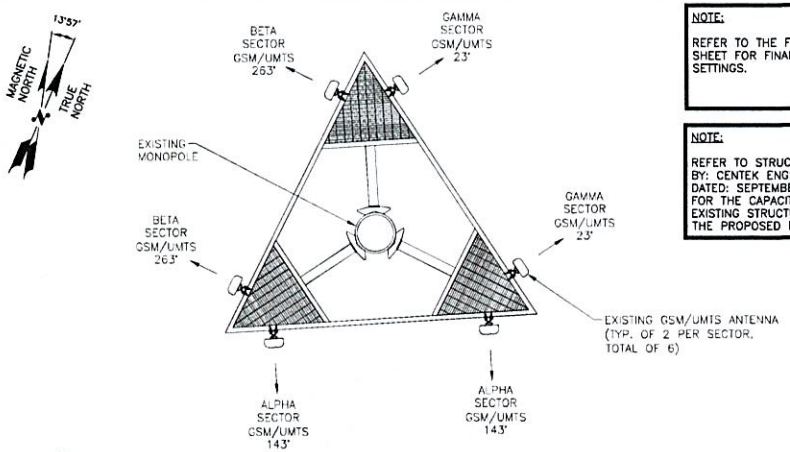
NO.	DATE	REVISIONS	BY	CHK	APP'D
1	10/24/12	ISSUED FOR PERMITTING	CG	DC	OPH
0	08/05/12	ISSUED FOR REVIEW	CG	DC	OPH

SCALE: AS SHOWN | DESIGNED BY: DC | DRAWN BY: CG

AT&T

COMPOUND PLAN & EQUIPMENT PLAN (LTE)

JOB NUMBER	DRAWING NUMBER	REV
1230.01	A-1	1



EXISTING GSM/UMTS ANTENNA PLAN

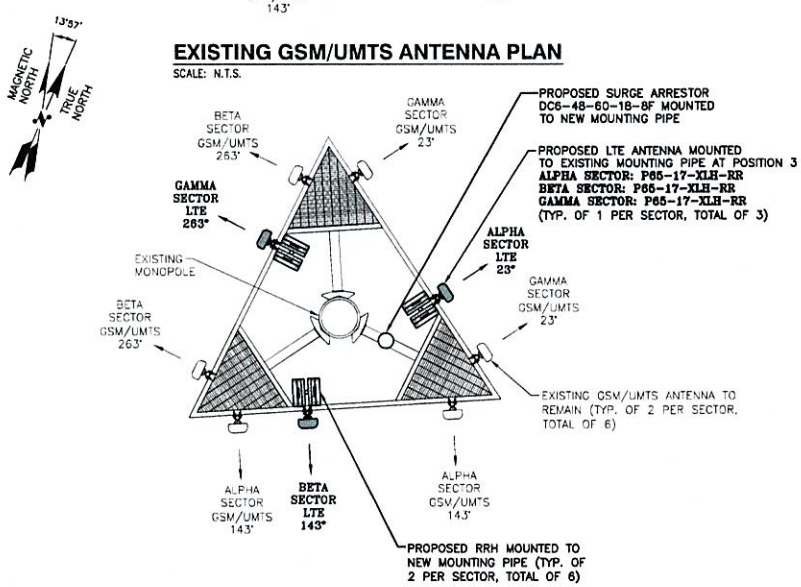
SCALE: N.T.S.

NOTE:

REFER TO THE FINAL RF DATA SHEET FOR FINAL ANTENNA SETTINGS.

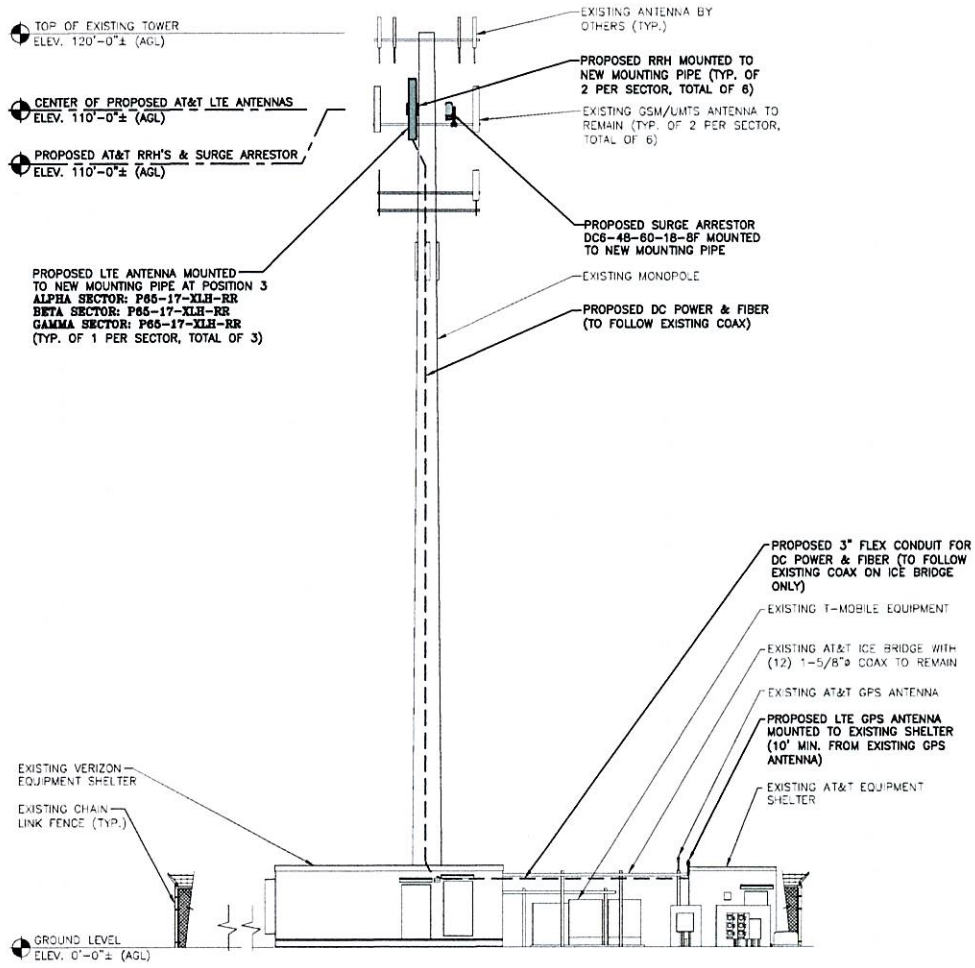
NOTE:

REFER TO STRUCTURAL ANALYSIS BY: CENTEK ENGINEERING, DATED: SEPTEMBER 24, 2012, FOR THE CAPACITY OF THE EXISTING STRUCTURES TO SUPPORT THE PROPOSED EQUIPMENT.



PROPOSED LTE ANTENNA PLAN

SCALESCALES. N.T.S.



SOUTH ELEVATION

SCALE: 1/8"=1'-0"

0 4'-0" 8'-0" 16'-0" 24'-0"

Hudson Design Group LLC
1600 OSGOOD STREET
BUILDING 20 NORTH, SUITE 3090
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800 MARSHALL PHELPS ROAD UNIT#: 2A
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SITE NUMBER: CT1230
SITE NAME: C-38 CANTON
650 ALBANY TURNPIKE
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500 ENTERPRISE DRIVE, SUITE 3A
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NO.	DATE	REVISIONS	BY	CHK	APP'D
1	10/24/12	ISSUED FOR PERMITTING	CG	DC	DPH
0	08/05/12	ISSUED FOR REVIEW	CG	DC	DPH

SCALE: AS SHOWN | DESIGNED BY: DC | DRAWN BY: CG

AT&T

ANTENNA PLAN & ELEVATION (LTE)

JOB NUMBER	DRAWING NUMBER	REV
1230.01	A-2	1

C Squared Systems, LLC
65 Dartmouth Drive, Unit A3
Auburn, NH 03032
(603) 644-2800
support@csquaredsystems.com

Calculated Radio Frequency Emissions

at&t

CT1230

(C-38 Canton)

650 Albany Turnpike, Canton, CT 06022

October 12, 2012

Table of Contents

List of Tables

List of Figures

1. Introduction

The purpose of this report is to investigate compliance with applicable FCC regulations for the proposed modifications to the existing AT&T antenna arrays mounted on the monopole tower located at 650 Albany Turnpike in Canton, CT. The coordinates of the tower are 41° 51' 2.0" N, 72° 56' 55.4" W.

AT&T is proposing the following modifications:

1) Install three multi-band (700/850/1900/2100 MHz) antennas for their LTE network (one per sector).

2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

In 1985, the FCC established rules to regulate radio frequency (RF) exposure from FCC licensed antenna facilities. In 1996, the FCC updated these rules, which were further amended in August 1997 by OET Bulletin 65 Edition 97-01. These new rules include Maximum Permissible Exposure (MPE) limits for transmitters operating between 300 kHz and 100 GHz. The FCC MPE limits are based upon those recommended by the National Council on Radiation Protection and Measurements (NCRP), developed by the Institute of Electrical and Electronics Engineers, Inc., (IEEE) and adopted by the American National Standards Institute (ANSI).

The FCC general population/uncontrolled limits set the maximum exposure to which most people may be subjected. General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

Public exposure to radio frequencies is regulated and enforced in units of milliwatts per square centimeter (mW/cm^2). The general population exposure limits for the various frequency ranges are defined in the attached "FCC Limits for Maximum Permissible Exposure (MPE)" in Attachment B of this report.

Higher exposure limits are permitted under the occupational/controlled exposure category, but only for persons who are exposed as a consequence of their employment and who have been made fully aware of the potential for exposure, and they must be able to exercise control over their exposure. General population/uncontrolled limits are five times more stringent than the levels that are acceptable for occupational, or radio frequency trained individuals. Attachment B contains excerpts from OET Bulletin 65 and defines the Maximum Exposure Limit.

Finally, it should be noted that the MPE limits adopted by the FCC for both general population/uncontrolled exposure and for occupational/controlled exposure incorporate a substantial margin of safety and have been established to be well below levels generally accepted as having the potential to cause adverse health effects.

3. RF Exposure Prediction Methods

The emission field calculation results displayed in the following figures were generated using the following formula as outlined in FCC bulletin OET 65:

$$\text{Power Density} = \left(\frac{1.6^2 \times EIRP}{4\pi \times R^2} \right) \text{x Off Beam Loss}$$

Where:

EIRP = Effective Isotropic Radiated Power

R = Radial Distance = $\sqrt{(H^2 + V^2)}$

H = Horizontal Distance from antenna in meters

V = Vertical Distance from radiation center of antenna in meters

Ground reflection factor of 1.6

Off Beam Loss is determined by the selected antenna pattern

These calculations assume that the antennas are operating at 100 percent capacity and power, and that all channels are transmitting simultaneously. Obstructions (trees, buildings, etc.) that would normally attenuate the signal are not taken into account. The calculations assume even terrain in the area of study and do not take into account actual terrain elevations which could attenuate the signal. As a result, the predicted signal levels reported below are much higher than the actual signal levels will be from the finished modifications.

4. Calculation Results

Table 1 below outlines the power density information for the site. Because the proposed AT&T antennas are directional in nature, the majority of the RF power is focused out towards the horizon. As a result, there will be less RF power directed below the antennas relative to the horizon, and consequently lower power density levels around the base of the tower. Please refer to Attachment C for the vertical patterns of the proposed AT&T antennas. The calculated results for AT&T in Table 1 include a nominal 10 dB off-beam pattern loss to account for the lower relative gain below the antennas.

Carrier	Antenna Height (Feet)	Operating Frequency (MHz)	Number of Trans.	ERP Per Transmitter (Watts)	Power Density (mw/cm^2)	Limit	%MPE
AT&T GSM	*110*	*880*	*4*	*296*	*0.0352*	*0.5867*	*6.00%*
AT&T GSM	*110*	*1900*	*2*	*427*	*0.0254*	*1.0000*	*2.54%*
AT&T UMTS	*110*	*1900*	*1*	*500*	*0.0149*	*1.0000*	*1.49%*
AT&T UMTS	*110*	*880*	*1*	*500*	*0.0149*	*0.5867*	*2.53%*
Verizon PCS	120	1970	7	186	0.0325	1.0000	3.25%
Verizon cellular	120	869	9	276	0.0620	0.5793	10.71%
Verizon AWS	120	2145	1	464	0.0116	1.0000	1.16%
Verizon	120	698	2	722	0.0361	0.4653	7.75%
Pocket	90	2130	3	631	0.0840	1.0000	8.40%
T-Mobile	100	1945	8	173	0.0498	1.0000	4.98%
AT&T UMTS	110	880	2	728	0.0043	0.5867	0.74%
AT&T UMTS	110	1900	2	1154	0.0069	1.0000	0.69%
AT&T LTE	110	734	1	1615	0.0048	0.4893	0.98%
AT&T GSM	110	880	1	364	0.0011	0.5867	0.18%
AT&T GSM	110	1900	4	692	0.0082	1.0000	0.82%
						Total	**39.66%**

Table 1: Carrier Information[1] [2] [3]

[1] The existing CSC filing for AT&T should be removed and replaced with the updated AT&T technologies and values provided in Table 1. The power density information for carriers other than AT&T was taken directly from the CSC database dated 7/26/2012. Please note that %MPE values listed are rounded to two decimal points. The total %MPE listed is a summation of each unrounded contribution. Therefore, summing each rounded value may not reflect the total value listed in the table.

[2] In the case where antenna models are not uniform across all 3 sectors for the same frequency band, the antenna model with the highest gain was used for the calculations to present a worse-case scenario.

[3] Antenna height listed for AT&T is in reference to the Centek Engineering, Inc. Structural Analysis dated September 24, 2012.

5. Conclusion

The above analysis verifies that emissions from the existing site will be below the maximum power density levels as outlined by the FCC in the OET Bulletin 65 Ed. 97-01. Even when using conservative methods, the cumulative power density from the proposed transmit antennas at the existing facility is well below the limits for the general public. The highest expected percent of Maximum Permissible Exposure at ground level is **39.66% of the FCC limit**.

As noted previously, obstructions (trees, buildings, etc.) that would normally attenuate the signal are not taken into account. As a result, the predicted signal levels are more conservative (higher) than the actual signal levels will be from the finished modifications.

6. Statement of Certification

I certify to the best of my knowledge that the statements in this report are true and accurate. The calculations follow guidelines set forth in ANSI/IEEE Std. C95.3, ANSI/IEEE Std. C95.1 and FCC OET Bulletin 65 Edition 97-01.

Daniel L. Goulet
C Squared Systems, LLC

October 12, 2012
Date

Attachment A: References

OET Bulletin 65 - Edition 97-01 - August 1997 Federal Communications Commission Office of Engineering & Technology

ANSI C95.1-1982, American National Standard Safety Levels With Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300 kHz to 100 GHz. IEEE-SA Standards Board

IEEE Std C95.3-1991 (Reaff 1997), IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave. IEEE-SA Standards Board

Attachment B: FCC Limits for Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/Controlled Exposure[4]

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	($900/f^2$)*	6
30-300	61.4	0.163	1.0	6
300-1500	-	-	f/300	6
1500-100,000	-	-	5	6

(B) Limits for General Population/Uncontrolled Exposure[5]

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	($180/f^2$)*	30
30-300	27.5	0.073	0.2	30
300-1500	-	-	f/1500	30
1500-100,000	-	-	1.0	30

f = frequency in MHz * Plane-wave equivalent power density

Table 2: FCC Limits for Maximum Permissible Exposure (MPE)

[4] Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

[5] General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

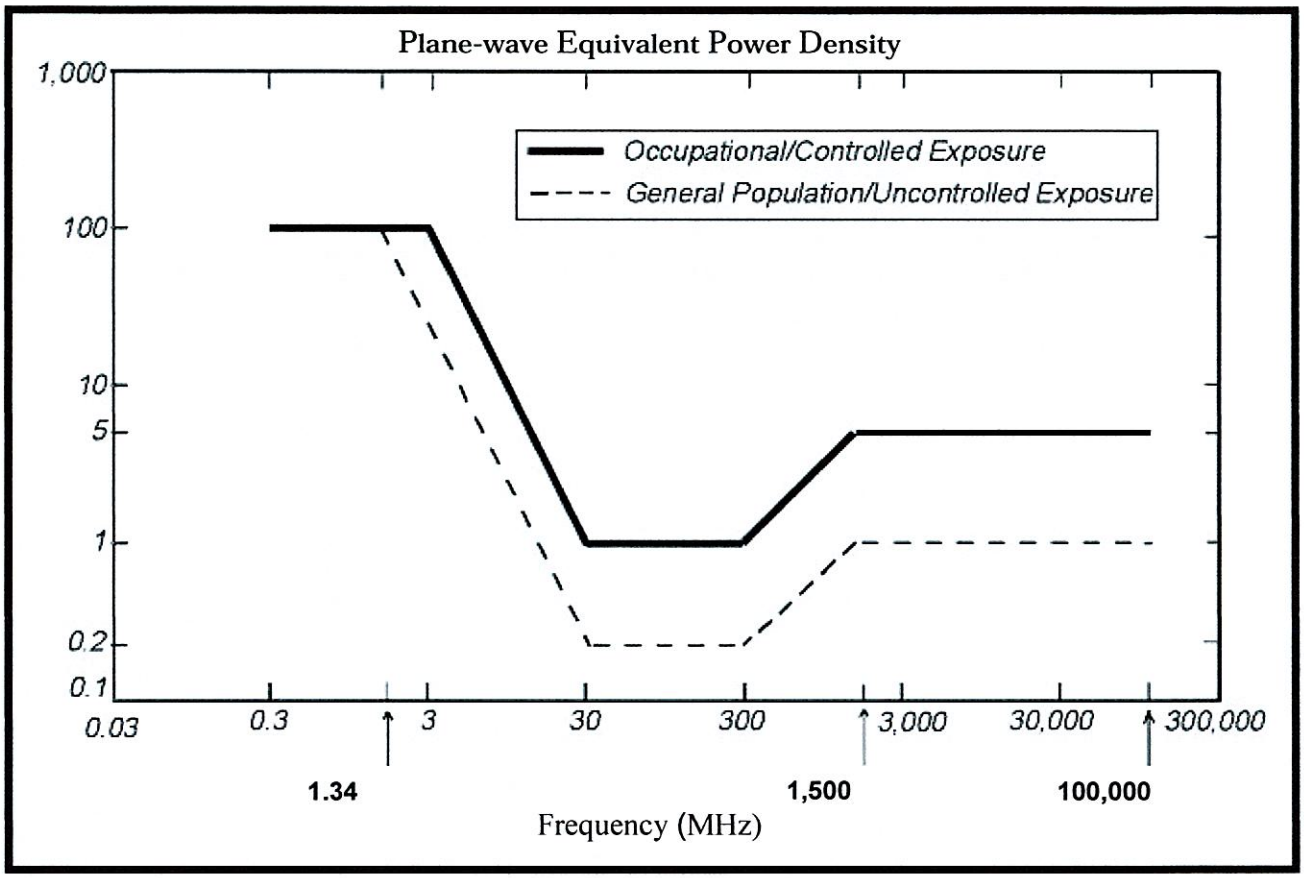
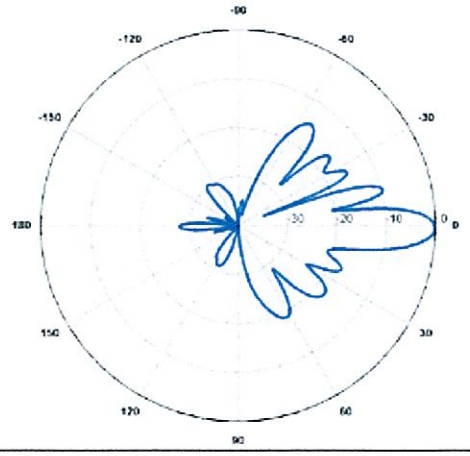


Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: AT&T Antenna Data Sheets and Electrical Patterns

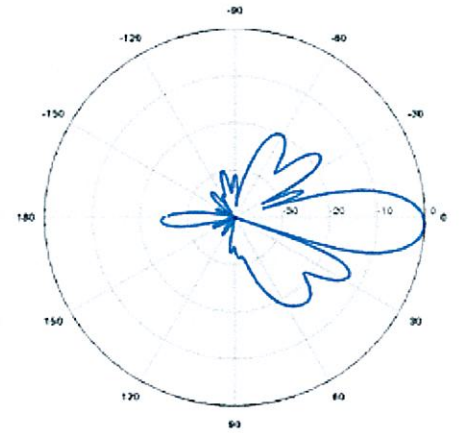
700 MHz

Manufacturer:	Powerwave
Model #:	P65-17-XLH-RR
Frequency Band:	698-806 MHz
Gain:	14.3 dBd
Vertical Beamwidth:	8.4°
Horizontal Beamwidth:	70°
Polarization:	Dual Linear ± 45°
Size L x W x D:	96.0" x 12.0" x 6.0"



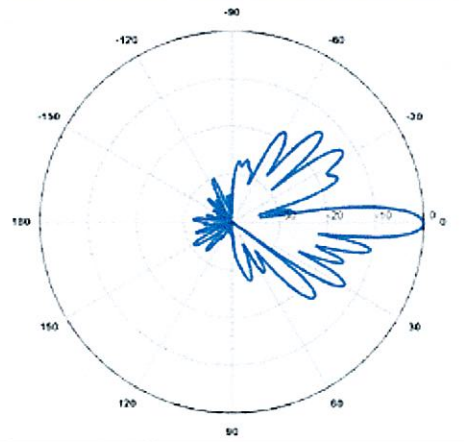
850 MHz

Manufacturer:	Powerwave
Model #:	P65-15-XLH-RR
Frequency Band:	806-894 MHz
Gain:	12.6 dBd
Vertical Beamwidth:	17°
Horizontal Beamwidth:	73°
Polarization:	Dual Linear ± 45°
Size L x W x D:	51.0" x 12.0" x 6.0"



1900 MHz

Manufacturer:	Powerwave
Model #:	P65-15-XLH-RR
Frequency Band:	1850-1990 MHz
Gain:	14.6 dBd
Vertical Beamwidth:	7.5°
Horizontal Beamwidth:	61°
Polarization:	Dual Linear ± 45°
Size L x W x D:	51.0" x 12.0" x 6.0"



CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

120-ft Existing EEI Monopole

Proposed AT&T Mobility
Antenna Upgrade

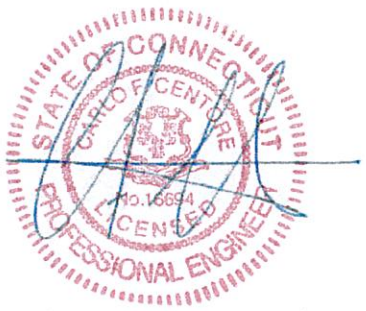
AT&T Site Ref: CT1230

Verizon Site Ref: Collinsville

650 Albany Turnpike
Canton, CT

Centek Project No. 12044.C07

Date: September 24, 2012



Prepared for:

AT&T Mobility
500 Enterprise Drive, Suite 3A
Rocky Hill, CT 06067

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

Table of Contents

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 AT&T Mobility on the existing monopole (tower) located in Canton, CT.

The host tower is a 120-ft tall, three-section, eighteen sided, tapered monopole extendable to 150-ft, originally designed and manufactured by EEI job no; 11936-E01, dated September 11, 2003. The tower geometry, structure member sizes and foundation system information were obtained from a previous structural report prepared by Centek Engineering job no. 11074.CO24 dated December 7, 2011. Antenna and appurtenance information were obtained from the aforementioned structural report and an AT&T tower site leasing form.

The tower is made up of three (3) tapered vertical sections consisting of A572-65 pole sections. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 26.90-in at the top and 49.00-in at the base.

AT&T Mobility proposes the installation of three (3) panel antennas, six (6) Remote Radio Units (RRU's) and one (1) surge arrestor mounted to 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 (RESERVED):
  Antennas: Six (6) Antel LPA-80063-6CF panel antennas, six (6) Antel BXA-70063-6CF panel antennas, six (6) LPA-171063-12CF panel antennas and three (3) RRH's mounted on a 13-ft low profile platform with a RAD center elevation of 120-ft above grade.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower. Six (6) 1-5/8" ∅ coax cables and one (1) 1-1/4" ∅ fiber cable banded to the exterior of the existing tower.
- T-MOBILE (EXISTING):
  Antennas: Three (3) RFS APX16DWV-16DWVS panel antennas, three (3) RFS ATM1900D-1CWA TMA's and three (3) RFS ATMAP1412D-1A20 TMA's mounted to three (3) T-Arms with a RAD center elevation of 100-ft above exiting grade.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing monopole.
- METROPCS (EXISTING):
  Antennas: Three (3) RFS APXV18-206517S flush mounted with a RAD center elevation of 91-ft above exiting grade.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the inside of the existing monopole.

- AT&T (EXISTING):
  Antennas: Six (6) Powerwave P65-15-XLH-RR panel antennas and six (6) TT19-08BP111-001 TMA's mounted on a 12-ft 6-in low profile platform with a RAD center elevation of 110-ft above exiting grade.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing monopole.
- AT&T (RESERVED):
  Antennas: Six (6) Powerwave TT19-08DB111-001 TMA's mounted on a 12-ft 6-in low profile platform with a RAD center elevation of 110-ft above exiting grade.
- **AT&T (PROPOSED):**
  Antennas: Three (3) Powerwave P65-17-XLH-RR panel antenna, six (6) Ericsson RRUS-11, one (1) Raycap DC6-48-60-18-8F surge arrestor and one (1) Andrew ABT-DFDM-ADBH Bias Tee mounted on a 12-ft 6-in low profile platform with a RAD center elevation of 110-ft above exiting grade.
  Coax Cables: One (1) fiber cable and two (2) dc control cables running within the interior of the existing monopole.

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 RISATower. 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]*
	Canton; v = 95 mph (3 second gust) equivalent to v = 77.5 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 RISATower. 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 RISATower "Section Capacity Table", this tower was found to be at **55.5%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L3)	0.00'-46.16'	55.5%	**PASS**

Foundation and Anchors

The existing foundation consists of a 7-ft Ø x 5-ft long reinforced concrete pier on a 24.0-ft square x 3-ft thick reinforce concrete pad. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned structural analysis report prepared by Centek Engineering. The base of the tower is connected to the foundation by means of (18) 2.25"∅, ASTM A615-75 anchor bolts embedded approximately 7-ft into the concrete foundation structure.

Review of the foundation and anchor design consisted of verification of applied loads obtained from the tower design calculations and code checks of allowable stresses:

- 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	21 kips
	Compression	31 kips
	Moment	1907 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	4.22	**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	Compression	45.9%	**PASS**
Base Plate	Bending	61.7%	**PASS**

Conclusion

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

The analysis is based, in part, on the information provided to this office by AT&T Mobility. 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:

Carlo F. Centore, PE
Principal ~ Structural Engineer

STATE OF CONNECTICUT
CARLO F. CENTORE
No.16694
LICENSED
PROFESSIONAL ENGINEER

Prepared by:

Timothy J. Lynn, EIT
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 provided 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

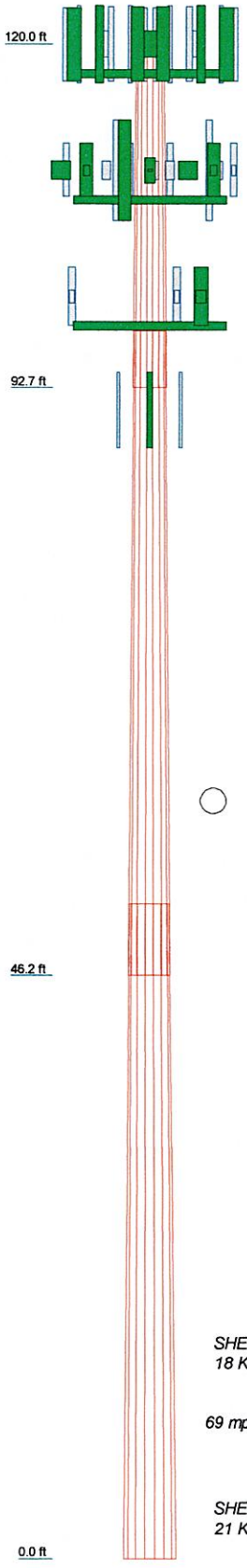
RISATower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, RISATower, formerly ERITower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

RISATower Features:

- RISATower 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.
- RISATower contains unique features such as True Cable behavior, hog rod take-up, foundation stiffness and much more.

Section	1	2	3
Length (ft)	27.29	51.13	51.83
Number of Sides	18	18	18
Thickness (in)	0.2500	0.3750	0.4375
Socket Length (ft)	4.58	5.67	
Top Dia (in)	26.9000	30.8688	38.9487
Bot Dia (in)	32.2700	40.8000	49.0000
Grade	A572-65		
Weight (K)	2.2	7.3	10.7

20.2



AXIAL
38 K
SHEAR
18 K
MOMENT
1606 kip-ft
TORQUE 0 kip-ft
69 mph WIND - 0.5000 in ICE
AXIAL
31 K
SHEAR
21 K
MOMENT
1907 kip-ft
TORQUE 0 kip-ft
REACTIONS - 80 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
LPA-80063/6CF (Verizon - Reserved)	120	(2) TT19-08BP111-001 TMA (ATI - Reserved)	110
LPA-171063-12CF (Verizon - Reserved)	120	(2) TT19-08BP111-001 TMA (ATI - Reserved)	110
BXA-70063/6CF (Verizon - Reserved)	120	P65-17-XLH-RR (ATI - Proposed)	110
BXA-70063/6CF (Verizon - Reserved)	120	P65-17-XLH-RR (ATI - Proposed)	110
LPA-171063-12CF (Verizon - Reserved)	120	P65-17-XLH-RR (ATI - Proposed)	110
LPA-80063/6CF (Verizon - Reserved)	120	(2) RRUS-11 (ATI - Proposed)	110
LPA-80063/6CF (Verizon - Reserved)	120	(2) RRUS-11 (ATI - Proposed)	110
LPA-171063-12CF (Verizon - Reserved)	120	(2) RRUS-11 (ATI - Proposed)	110
BXA-70063/6CF (Verizon - Reserved)	120	DC6-48-60-18-8F Surge Arrestor (ATI - Proposed)	110
BXA-70063/6CF (Verizon - Reserved)	120	ABT-DFDM-ADBH Bias Tee (ATI - Proposed)	110
LPA-171063-12CF (Verizon - Reserved)	120	Andrew 12'-6" Low Profile Platform (ATI - Existing)	108
LPA-80063/6CF (Verizon - Reserved)	120	APX16DWV-16DWVS-E-A20 (T-Mobile - Existing)	100
LPA-80063/6CF (Verizon - Reserved)	120	APX16DWV-16DWVS-E-A20 (T-Mobile - Existing)	100
LPA-171063-12CF (Verizon - Reserved)	120	APX16DWV-16DWVS-E-A20 (T-Mobile - Existing)	100
BXA-70063/6CF (Verizon - Reserved)	120	ATM1900D-1CWA (T-Mobile - Existing)	100
BXA-70063/6CF (Verizon - Reserved)	120	ATM1900D-1CWA (T-Mobile - Existing)	100
LPA-171063-12CF (Verizon - Reserved)	120	ATM1900D-1CWA (T-Mobile - Existing)	100
LPA-80063/6CF (Verizon - Reserved)	120	ATMAP1412D-1A20 (T-Mobile - Existing)	100
RRH (Verizon - Reserved)	120	ATMAP1412D-1A20 (T-Mobile - Existing)	100
RRH (Verizon - Reserved)	120	ATMAP1412D-1A20 (T-Mobile - Existing)	100
RRH (Verizon - Reserved)	120	Valmont T-Arm (3) (T-Mobile - Existing)	98
EEI 14-ft Low Profile Platform (Verizon - Existing)	118	Uni-Tri Bracket (MetroPCS - Existing)	91
(2) P65-15-XLH-RR (ATI - Existing)	110	APXV18-206517S (MetroPCS - Existing)	91
(2) P65-15-XLH-RR (ATI - Existing)	110	APXV18-206517S (MetroPCS - Existing)	91
(2) P65-15-XLH-RR (ATI - Existing)	110	APXV18-206517S (MetroPCS - Existing)	91
(2) TT19-08BP111-001 TMA (ATI - Existing)	110		
(2) TT19-08BP111-001 TMA (ATI - Existing)	110		
(2) TT19-08BP111-001 TMA (ATI - Existing)	110		
(2) TT19-08BP111-001 TMA (ATI - Reserved)	110		

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. TOWER RATING: 55.5%

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

Job:	***12044.CO7 - CT1230***		
Project:	***120' EEI Monopole - 650 Albany Turnpike - Canton, CT***		
Client: AT&T Mobility	Drawn by: TJL		App'd:
Code: TIA/EIA-222-F	Date: 09/24/12		Scale: NTS
Path: J:\jobs\12044\00.WC\37 - AT&T CT 1230\Cadd\ER Files\120' EEI Monopole Extendable to 150 Canton, CT.eri			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 0.5000 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.
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	120.00-92.71	27.29	4.58	18	26.9000	32.2700	0.2500	1.0000	A572-65 (65 ksi)
L2	92.71-46.16	51.13	5.67	18	30.8688	40.8000	0.3750	1.5000	A572-65 (65 ksi)
L3	46.16-0.00	51.83		18	38.9487	49.0000	0.4375	1.7500	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	27.3150	21.1468	1897.4748	9.4608	13.6652	138.8545	3797.4464	10.5754	4.2944	17.178
	32.7678	25.4079	3291.1552	11.3671	16.3932	200.7639	6586.6410	12.7063	5.2395	20.958
L2	32.2483	36.2952	4263.9191	10.8253	15.6813	271.9105	8533.4488	18.1511	4.7729	12.728
	41.4294	48.1159	9934.0359	14.3509	20.7264	479.2938	19881.1433	24.0625	6.5208	17.389
L3	40.6661	53.4776	10020.3566	13.6715	19.7859	506.4384	20053.8983	26.7439	6.0850	13.909
	49.7559	67.4351	20092.1096	17.2397	24.8920	807.1714	40210.6569	33.7240	7.8540	17.952

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 120.00-92.71				1	1	1		
L2 92.71-46.16				1	1	1		
L3 46.16-0.00				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 plf
1 5/8 (Verizon - Existing)	C	No	Inside Pole	120.00 - 3.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (AT&T - Existing)	C	No	Inside Pole	110.00 - 3.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (T-Mobile - Existing)	C	No	Inside Pole	100.00 - 3.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (MetroPCS - Existing)	C	No	Inside Pole	90.00 - 3.00	6	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Verizon - Existing)	C	No	CaAa (Out Of Face)	120.00 - 3.00	1	No Ice	0.20	1.04
						1/2" Ice	0.30	2.55
1 5/8 (Verizon - Existing)	C	No	CaAa (Out Of Face)	120.00 - 3.00	5	No Ice	0.00	1.04
						1/2" Ice	0.00	2.55
HYBRIFLEX 1-1/4" (Verizon - Resevred)	C	No	CaAa (Out Of Face)	120.00 - 3.00	1	No Ice	0.15	1.30
						1/2" Ice	0.25	2.55
RG6-Fiber (AT&T - Proposed)	C	No	Inside Pole	110.00 - 3.00	1	No Ice	0.00	1.00
						1/2" Ice	0.00	1.00
#8 AWG Copper WIre (AT&T - Proposed)	C	No	Inside Pole	110.00 - 3.00	2	No Ice	0.00	0.05
						1/2" Ice	0.00	0.05

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	120.00-92.71	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	9.606	0.87
L2	92.71-46.16	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	16.385	2.42
L3	46.16-0.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00

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	15.192	2.26

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	120.00-92.71	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	15.064	1.15
L2	92.71-46.16	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	25.696	2.90
L3	46.16-0.00	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	23.824	2.70

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
EEI 14-ft Low Profile Platform (Verizon - Existing)	C	None		0.0000	118.00	No Ice 1/2" Ice	16.50 20.00	16.50 20.00	1.55 1.80
LPA-80063/6CF (Verizon - Reserved)	A	From Face	3.00 6.00 0.00	0.0000	120.00	No Ice 1/2" Ice	10.31 10.87	9.01 9.55	0.03 0.10
LPA-171063-12CF (Verizon - Reserved)	A	From Face	3.00 4.00 0.00	0.0000	120.00	No Ice 1/2" Ice	5.99 6.46	6.05 6.52	0.01 0.06
BXA-70063/6CF (Verizon - Reserved)	A	From Face	3.00 1.00 0.00	0.0000	120.00	No Ice 1/2" Ice	7.73 8.27	4.16 4.60	0.02 0.06
BXA-70063/6CF (Verizon - Reserved)	A	From Face	3.00 -1.00 0.00	0.0000	120.00	No Ice 1/2" Ice	7.73 8.27	4.16 4.60	0.02 0.06
LPA-171063-12CF (Verizon - Reserved)	A	From Face	3.00 -4.00 0.00	0.0000	120.00	No Ice 1/2" Ice	5.99 6.46	6.05 6.52	0.01 0.06
LPA-80063/6CF (Verizon - Reserved)	A	From Face	3.00 -6.00 0.00	0.0000	120.00	No Ice 1/2" Ice	10.31 10.87	9.01 9.55	0.03 0.10
LPA-80063/6CF (Verizon - Reserved)	B	From Face	3.00 6.00 0.00	0.0000	120.00	No Ice 1/2" Ice	10.31 10.87	9.01 9.55	0.03 0.10
LPA-171063-12CF (Verizon - Reserved)	B	From Face	3.00 4.00 0.00	0.0000	120.00	No Ice 1/2" Ice	5.99 6.46	6.05 6.52	0.01 0.06
BXA-70063/6CF	B	From Face	3.00	0.0000	120.00	No Ice	7.73	4.16	0.02

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 - Reserved)			1.00 0.00			1/2" Ice	8.27	4.60	0.06
BXA-70063/6CF	B	From Face	3.00	0.0000	120.00	No Ice	7.73	4.16	0.02
(Verizon - Reserved)			-1.00 0.00			1/2" Ice	8.27	4.60	0.06
LPA-171063-12CF	B	From Face	3.00	0.0000	120.00	No Ice	5.99	6.05	0.01
(Verizon - Reserved)			-4.00 0.00			1/2" Ice	6.46	6.52	0.06
LPA-80063/6CF	B	From Face	3.00	0.0000	120.00	No Ice	10.31	9.01	0.03
(Verizon - Reserved)			-6.00 0.00			1/2" Ice	10.87	9.55	0.10
LPA-80063/6CF	C	From Face	3.00	0.0000	120.00	No Ice	10.31	9.01	0.03
(Verizon - Reserved)			6.00 0.00			1/2" Ice	10.87	9.55	0.10
LPA-171063-12CF	C	From Face	3.00	0.0000	120.00	No Ice	5.99	6.05	0.01
(Verizon - Reserved)			4.00 0.00			1/2" Ice	6.46	6.52	0.06
BXA-70063/6CF	C	From Face	3.00	0.0000	120.00	No Ice	7.73	4.16	0.02
(Verizon - Reserved)			1.00 0.00			1/2" Ice	8.27	4.60	0.06
BXA-70063/6CF	C	From Face	3.00	0.0000	120.00	No Ice	7.73	4.16	0.02
(Verizon - Reserved)			-1.00 0.00			1/2" Ice	8.27	4.60	0.06
LPA-171063-12CF	C	From Face	3.00	0.0000	120.00	No Ice	5.99	6.05	0.01
(Verizon - Reserved)			-4.00 0.00			1/2" Ice	6.46	6.52	0.06
LPA-80063/6CF	C	From Face	3.00	0.0000	120.00	No Ice	10.31	9.01	0.03
(Verizon - Reserved)			-6.00 0.00			1/2" Ice	10.87	9.55	0.10
RRH	A	From Face	3.00	0.0000	120.00	No Ice	2.92	2.19	0.05
(Verizon - Reserved)			0.00 0.00			1/2" Ice	3.16	2.41	0.07
RRH	B	From Face	3.00	0.0000	120.00	No Ice	2.92	2.19	0.05
(Verizon - Reserved)			0.00 0.00			1/2" Ice	3.16	2.41	0.07
RRH	C	From Face	3.00	0.0000	120.00	No Ice	2.92	2.19	0.05
(Verizon - Reserved)			0.00 0.00			1/2" Ice	3.16	2.41	0.07
Andrew 12'-6" Low Profile Platform	C	None		0.0000	108.00	No Ice	14.45	14.45	1.30
(AT&T - Existing)						1/2" Ice	19.00	19.00	1.69
(2) P65-15-XLH-RR	A	From Face	3.50	0.0000	110.00	No Ice	5.95	3.08	0.04
(AT&T - Existing)			0.00 0.00			1/2" Ice	6.36	3.41	0.08
(2) P65-15-XLH-RR	B	From Face	3.50	0.0000	110.00	No Ice	5.95	3.08	0.04
(AT&T - Existing)			0.00 0.00			1/2" Ice	6.36	3.41	0.08
(2) P65-15-XLH-RR	C	From Face	3.50	0.0000	110.00	No Ice	5.95	3.08	0.04
(AT&T - Existing)			0.00 0.00			1/2" Ice	6.36	3.41	0.08
(2) TT19-08BP111-001 TMA	A	From Face	3.50	0.0000	110.00	No Ice	0.64	0.52	0.02
(AT&T - Existing)			0.00 0.00			1/2" Ice	0.76	0.62	0.02
(2) TT19-08BP111-001 TMA	B	From Face	3.50	0.0000	110.00	No Ice	0.64	0.52	0.02
(AT&T - Existing)			0.00 0.00			1/2" Ice	0.76	0.62	0.02
(2) TT19-08BP111-001 TMA	C	From Face	3.50	0.0000	110.00	No Ice	0.64	0.52	0.02

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
(AT&T - Existing)			0.00			1/2" Ice	0.76	0.62	0.02
			0.00						
(2) TT19-08BP111-001 TMA	A	From Face	3.50	0.0000	110.00	No Ice	0.64	0.52	0.02
(AT&T - Reserved)			0.00			1/2" Ice	0.76	0.62	0.02
			0.00						
(2) TT19-08BP111-001 TMA	B	From Face	3.50	0.0000	110.00	No Ice	0.64	0.52	0.02
(AT&T - Reserved)			0.00			1/2" Ice	0.76	0.62	0.02
			0.00						
(2) TT19-08BP111-001 TMA	C	From Face	3.50	0.0000	110.00	No Ice	0.64	0.52	0.02
(AT&T - Reserved)			0.00			1/2" Ice	0.76	0.62	0.02
			0.00						
P65-17-XLH-RR	A	From Face	3.00	0.0000	110.00	No Ice	11.47	6.80	0.06
(AT&T - Proposed)			2.00			1/2" Ice	12.08	7.38	0.12
			0.00						
P65-17-XLH-RR	B	From Face	3.00	0.0000	110.00	No Ice	11.47	6.80	0.06
(AT&T - Proposed)			2.00			1/2" Ice	12.08	7.38	0.12
			0.00						
P65-17-XLH-RR	C	From Face	3.00	0.0000	110.00	No Ice	11.47	6.80	0.06
(AT&T - Proposed)			2.00			1/2" Ice	12.08	7.38	0.12
			0.00						
(2) RRUS-11	A	From Face	1.00	0.0000	110.00	No Ice	2.99	1.25	0.05
(AT&T - Proposed)			2.00			1/2" Ice	3.23	1.41	0.07
			0.00						
(2) RRUS-11	B	From Face	1.00	0.0000	110.00	No Ice	2.99	1.25	0.05
(AT&T - Proposed)			2.00			1/2" Ice	3.23	1.41	0.07
			0.00						
(2) RRUS-11	C	From Face	1.00	0.0000	110.00	No Ice	2.99	1.25	0.05
(AT&T - Proposed)			2.00			1/2" Ice	3.23	1.41	0.07
			0.00						
DC6-48-60-18-8F Surge	C	From Face	0.50	0.0000	110.00	No Ice	2.23	2.23	0.02
Arrestor			0.00			1/2" Ice	2.45	2.45	0.04
(AT&T - Proposed)			0.00						
ABT-DFDM-ADBH Bias	C	None		0.0000	110.00	No Ice	0.05	0.03	0.00
Tee						1/2" Ice	0.09	0.05	0.00
(AT&T - Proposed)									
Valmont T-Arm (3)	C	None		0.0000	98.00	No Ice	21.00	21.00	1.01
(T-Mobile - Existing)						1/2" Ice	29.00	29.00	1.24
APX16DWV-16DWVS-E-A	A	From Face	3.50	0.0000	100.00	No Ice	7.07	2.15	0.04
20			-4.00			1/2" Ice	7.52	2.49	0.07
(T-Mobile - Existing)			0.00						
APX16DWV-16DWVS-E-A	B	From Face	3.50	0.0000	100.00	No Ice	7.07	2.15	0.04
20			-4.00			1/2" Ice	7.52	2.49	0.07
(T-Mobile - Existing)			0.00						
APX16DWV-16DWVS-E-A	C	From Face	3.50	0.0000	100.00	No Ice	7.07	2.15	0.04
20			-4.00			1/2" Ice	7.52	2.49	0.07
(T-Mobile - Existing)			0.00						
ATM1900D-1CWA	A	From Face	3.50	0.0000	100.00	No Ice	0.85	0.27	0.01
(T-Mobile - Existing)			-4.00			1/2" Ice	0.98	0.36	0.01
			0.00						
ATM1900D-1CWA	B	From Face	3.50	0.0000	100.00	No Ice	0.85	0.27	0.01
(T-Mobile - Existing)			-4.00			1/2" Ice	0.98	0.36	0.01
			0.00						
ATM1900D-1CWA	C	From Face	3.50	0.0000	100.00	No Ice	0.85	0.27	0.01
(T-Mobile - Existing)			-4.00			1/2" Ice	0.98	0.36	0.01
			0.00						
ATMAP1412D-1A20	A	From Face	3.50	0.0000	100.00	No Ice	1.17	0.47	0.01
(T-Mobile - Existing)			-4.00			1/2" Ice	1.31	0.57	0.02

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0.00						
ATMAP1412D-1A20	B	From Face	3.50	0.0000	100.00	No Ice	1.17	0.47	0.01
(T-Mobile - Existing)			-4.00			1/2" Ice	1.31	0.57	0.02
			0.00						
ATMAP1412D-1A20	C	From Face	3.50	0.0000	100.00	No Ice	1.17	0.47	0.01
(T-Mobile - Existing)			-4.00			1/2" Ice	1.31	0.57	0.02
			0.00						
Uni-Tri Bracket	C	None		0.0000	91.00	No Ice	1.75	1.75	0.29
(MetroPCS - Existing)						1/2" Ice	1.94	1.94	0.31
APXV18-206517S	A	From Face	1.50	0.0000	91.00	No Ice	5.17	3.04	0.03
(MetroPCS - Existing)			0.00			1/2" Ice	5.62	3.47	0.05
			0.00						
APXV18-206517S	B	From Face	1.50	0.0000	91.00	No Ice	5.17	3.04	0.03
(MetroPCS - Existing)			0.00			1/2" Ice	5.62	3.47	0.05
			0.00						
APXV18-206517S	C	From Face	1.50	0.0000	91.00	No Ice	5.17	3.04	0.03
(MetroPCS - Existing)			0.00			1/2" Ice	5.62	3.47	0.05
			0.00						

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg % 	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1	105.94	1.396	23	67.281	A	0.000	67.281	67.281	100.00	0.000	0.000
120.00-92.71					B	0.000	67.281		100.00	0.000	0.000
					C	0.000	67.281		100.00	0.000	9.606
L2 92.71-46.16	69.03	1.235	20	140.733	A	0.000	140.733	140.733	100.00	0.000	0.000
					B	0.000	140.733		100.00	0.000	0.000
					C	0.000	140.733		100.00	0.000	16.385
L3 46.16-0.00	22.38	1	16	171.269	A	0.000	171.269	171.269	100.00	0.000	0.000
					B	0.000	171.269		100.00	0.000	0.000
					C	0.000	171.269		100.00	0.000	15.192

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg % 	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 120.00-92.71	105.94	1.396	17	0.5000	69.555	A	0.000	69.555	69.555	100.00	0.000	0.000
						B	0.000	69.555		100.00	0.000	0.000

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
						C	0.000	69.555		100.00	0.000	15.064
L2 92.71-46.16	69.03	1.235	15	0.5000	144.612	A	0.000	144.612	144.612	100.00	0.000	0.000
						B	0.000	144.612		100.00	0.000	0.000
						C	0.000	144.612		100.00	0.000	25.696
L3 46.16-0.00	22.38	1	12	0.5000	175.116	A	0.000	175.116	175.116	100.00	0.000	0.000
						B	0.000	175.116		100.00	0.000	0.000
						C	0.000	175.116		100.00	0.000	23.824

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1	105.94	1.396	9	67.281	A	0.000	67.281	67.281	100.00	0.000	0.000
120.00-92.71					B	0.000	67.281		100.00	0.000	0.000
					C	0.000	67.281		100.00	0.000	9.606
L2 92.71-46.16	69.03	1.235	8	140.733	A	0.000	140.733	140.733	100.00	0.000	0.000
					B	0.000	140.733		100.00	0.000	0.000
					C	0.000	140.733		100.00	0.000	16.385
L3 46.16-0.00	22.38	1	6	171.269	A	0.000	171.269	171.269	100.00	0.000	0.000
					B	0.000	171.269		100.00	0.000	0.000
					C	0.000	171.269		100.00	0.000	15.192

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 plf	Ctrl. Face
L1	0.87	2.16	A	1	0.65	1	1	1	67.281	2.06	75.52	C
120.00-92.71			B	1	0.65	1	1	1	67.281			
			C	1	0.65	1	1	1	67.281			
L2	2.42	7.34	A	1	0.65	1	1	1	140.733	3.67	78.80	C
92.71-46.16			B	1	0.65	1	1	1	140.733			
			C	1	0.65	1	1	1	140.733			
L3 46.16-0.00	2.26	10.66	A	1	0.65	1	1	1	171.269	3.52	76.33	C
			B	1	0.65	1	1	1	171.269			
			C	1	0.65	1	1	1	171.269			
Sum Weight:	5.55	20.17						OTM	550.41 kip-ft	9.25		

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 plf	Ctrl. Face
L1	0.87	2.16	A	1	0.65	1	1	1	67.281	2.06	75.52	C
120.00-92.71			B	1	0.65	1	1	1	67.281			
			C	1	0.65	1	1	1	67.281			
L2	2.42	7.34	A	1	0.65	1	1	1	140.733	3.67	78.80	C
92.71-46.16			B	1	0.65	1	1	1	140.733			
			C	1	0.65	1	1	1	140.733			
L3 46.16-0.00	2.26	10.66	A	1	0.65	1	1	1	171.269	3.52	76.33	C
			B	1	0.65	1	1	1	171.269			
			C	1	0.65	1	1	1	171.269			
Sum Weight:	5.55	20.17						OTM	550.41 kip-ft	9.25		

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 ft²	F K	w plf	Ctrl. Face
L1	0.87	2.16	A	1	0.65	1	1	1	67.281	2.06	75.52	C
120.00-92.71			B	1	0.65	1	1	1	67.281			
			C	1	0.65	1	1	1	67.281			
L2	2.42	7.34	A	1	0.65	1	1	1	140.733	3.67	78.80	C
92.71-46.16			B	1	0.65	1	1	1	140.733			
			C	1	0.65	1	1	1	140.733			
L3 46.16-0.00	2.26	10.66	A	1	0.65	1	1	1	171.269	3.52	76.33	C
			B	1	0.65	1	1	1	171.269			
			C	1	0.65	1	1	1	171.269			
Sum Weight:	5.55	20.17						OTM	550.41 kip-ft	9.25		

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 ft²	F K	w plf	Ctrl. Face
L1	0.87	2.16	A	1	0.65	1	1	1	67.281	2.06	75.52	C
120.00-92.71			B	1	0.65	1	1	1	67.281			
			C	1	0.65	1	1	1	67.281			
L2	2.42	7.34	A	1	0.65	1	1	1	140.733	3.67	78.80	C
92.71-46.16			B	1	0.65	1	1	1	140.733			
			C	1	0.65	1	1	1	140.733			
L3 46.16-0.00	2.26	10.66	A	1	0.65	1	1	1	171.269	3.52	76.33	C
			B	1	0.65	1	1	1	171.269			
			C	1	0.65	1	1	1	171.269			
Sum Weight:	5.55	20.17						OTM	550.41 kip-ft	9.25		

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 ft^2	∥∥ K	w plf	Ctrl. Face
L1	1.15	2.67	A	1	0.65	1	1	1	69.555	1.75	64.01	C
120.00-92.71			B	1	0.65	1	1	1	69.555			
			C	1	0.65	1	1	1	69.555			
L2	2.90	8.40	A	1	0.65	1	1	1	144.612	3.05	65.59	C
92.71-46.16			B	1	0.65	1	1	1	144.612			
			C	1	0.65	1	1	1	144.612			
L3 46.16-0.00	2.70	11.95	A	1	0.65	1	1	1	175.116	2.87	62.28	C
			B	1	0.65	1	1	1	175.116			
			C	1	0.65	1	1	1	175.116			
Sum Weight:	6.75	23.01						OTM	460.14 kip-ft	7.67		

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 ft^2	F K	w plf	Ctrl. Face
L1	1.15	2.67	A	1	0.65	1	1	1	69.555	1.75	64.01	C
120.00-92.71			B	1	0.65	1	1	1	69.555			
			C	1	0.65	1	1	1	69.555			
L2	2.90	8.40	A	1	0.65	1	1	1	144.612	3.05	65.59	C
92.71-46.16			B	1	0.65	1	1	1	144.612			
			C	1	0.65	1	1	1	144.612			
L3 46.16-0.00	2.70	11.95	A	1	0.65	1	1	1	175.116	2.87	62.28	C
			B	1	0.65	1	1	1	175.116			
			C	1	0.65	1	1	1	175.116			
Sum Weight:	6.75	23.01						OTM	460.14 kip-ft	7.67		

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 ft^2	F K	w plf	Ctrl. Face
L1	1.15	2.67	A	1	0.65	1	1	1	69.555	1.75	64.01	C
120.00-92.71			B	1	0.65	1	1	1	69.555			
			C	1	0.65	1	1	1	69.555			
L2	2.90	8.40	A	1	0.65	1	1	1	144.612	3.05	65.59	C
92.71-46.16			B	1	0.65	1	1	1	144.612			
			C	1	0.65	1	1	1	144.612			
L3 46.16-0.00	2.70	11.95	A	1	0.65	1	1	1	175.116	2.87	62.28	C
			B	1	0.65	1	1	1	175.116			
			C	1	0.65	1	1	1	175.116			
Sum Weight:	6.75	23.01						OTM	460.14 kip-ft	7.67		

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 plf	Ctrl. Face
L1	1.15	2.67	A	1	0.65	1	1	1	69.555	1.75	64.01	C
120.00-92.71			B	1	0.65	1	1	1	69.555			
			C	1	0.65	1	1	1	69.555			
L2	2.90	8.40	A	1	0.65	1	1	1	144.612	3.05	65.59	C
92.71-46.16			B	1	0.65	1	1	1	144.612			
			C	1	0.65	1	1	1	144.612			
L3 46.16-0.00	2.70	11.95	A	1	0.65	1	1	1	175.116	2.87	62.28	C
			B	1	0.65	1	1	1	175.116			
			C	1	0.65	1	1	1	175.116			
Sum Weight:	6.75	23.01						OTM	460.14 kip-ft	7.67		

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 plf	Ctrl. Face
L1	0.87	2.16	A	1	0.65	1	1	1	67.281	0.81	29.50	C
120.00-92.71			B	1	0.65	1	1	1	67.281			
			C	1	0.65	1	1	1	67.281			
L2	2.42	7.34	A	1	0.65	1	1	1	140.733	1.43	30.78	C
92.71-46.16			B	1	0.65	1	1	1	140.733			
			C	1	0.65	1	1	1	140.733			
L3 46.16-0.00	2.26	10.66	A	1	0.65	1	1	1	171.269	1.38	29.82	C
			B	1	0.65	1	1	1	171.269			
			C	1	0.65	1	1	1	171.269			
Sum Weight:	5.55	20.17						OTM	215.00 kip-ft	3.61		

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 plf	Ctrl. Face
L1	0.87	2.16	A	1	0.65	1	1	1	67.281	0.81	29.50	C
120.00-92.71			B	1	0.65	1	1	1	67.281			
			C	1	0.65	1	1	1	67.281			
L2	2.42	7.34	A	1	0.65	1	1	1	140.733	1.43	30.78	C
92.71-46.16			B	1	0.65	1	1	1	140.733			
			C	1	0.65	1	1	1	140.733			
L3 46.16-0.00	2.26	10.66	A	1	0.65	1	1	1	171.269	1.38	29.82	C
			B	1	0.65	1	1	1	171.269			
			C	1	0.65	1	1	1	171.269			
Sum Weight:	5.55	20.17						OTM	215.00	3.61		

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 plf	Ctrl. Face
									kip-ft			

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 ft^2	F K	w plf	Ctrl. Face
L1	0.87	2.16	A	1	0.65	1	1	1	67.281	0.81	29.50	C
120.00-92.71			B	1	0.65	1	1	1	67.281			
			C	1	0.65	1	1	1	67.281			
L2	2.42	7.34	A	1	0.65	1	1	1	140.733	1.43	30.78	C
92.71-46.16			B	1	0.65	1	1	1	140.733			
			C	1	0.65	1	1	1	140.733			
L3 46.16-0.00	2.26	10.66	A	1	0.65	1	1	1	171.269	1.38	29.82	C
			B	1	0.65	1	1	1	171.269			
			C	1	0.65	1	1	1	171.269			
Sum Weight:	5.55	20.17						OTM	215.00 kip-ft	3.61		

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 ft^2	F K	w plf	Ctrl. Face
L1	0.87	2.16	A	1	0.65	1	1	1	67.281	0.81	29.50	C
120.00-92.71			B	1	0.65	1	1	1	67.281			
			C	1	0.65	1	1	1	67.281			
L2	2.42	7.34	A	1	0.65	1	1	1	140.733	1.43	30.78	C
92.71-46.16			B	1	0.65	1	1	1	140.733			
			C	1	0.65	1	1	1	140.733			
L3 46.16-0.00	2.26	10.66	A	1	0.65	1	1	1	171.269	1.38	29.82	C
			B	1	0.65	1	1	1	171.269			
			C	1	0.65	1	1	1	171.269			
Sum Weight:	5.55	20.17						OTM	215.00 kip-ft	3.61		

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	20.17					
Bracing Weight	0.00					
Total Member Self-Weight	20.17			0.03	0.00	

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
Total Weight	31.62			0.03	0.00	
Wind 0 deg - No Ice		0.00	-20.96	-1870.78	0.00	0.00
Wind 30 deg - No Ice		10.48	-18.15	-1620.13	-935.40	0.07
Wind 45 deg - No Ice		14.82	-14.82	-1322.83	-1322.86	0.10
Wind 60 deg - No Ice		18.15	-10.48	-935.37	-1620.17	0.13
Wind 90 deg - No Ice		20.96	0.00	0.03	-1870.81	0.15
Wind 120 deg - No Ice		18.15	10.48	935.44	-1620.17	0.13
Wind 135 deg - No Ice		14.82	14.82	1322.90	-1322.86	0.10
Wind 150 deg - No Ice		10.48	18.15	1620.20	-935.40	0.07
Wind 180 deg - No Ice		0.00	20.96	1870.84	0.00	0.00
Wind 210 deg - No Ice		-10.48	18.15	1620.20	935.40	-0.07
Wind 225 deg - No Ice		-14.82	14.82	1322.90	1322.86	-0.10
Wind 240 deg - No Ice		-18.15	10.48	935.44	1620.17	-0.13
Wind 270 deg - No Ice		-20.96	0.00	0.03	1870.81	-0.15
Wind 300 deg - No Ice		-18.15	-10.48	-935.37	1620.17	-0.13
Wind 315 deg - No Ice		-14.82	-14.82	-1322.83	1322.86	-0.10
Wind 330 deg - No Ice		-10.48	-18.15	-1620.13	935.40	-0.07
Member Ice	2.85					
Total Weight Ice	38.34			0.07	0.00	
Wind 0 deg - Ice		0.00	-17.50	-1565.45	0.00	0.00
Wind 30 deg - Ice		8.75	-15.16	-1355.71	-782.76	0.06
Wind 45 deg - Ice		12.38	-12.38	-1106.92	-1106.99	0.09
Wind 60 deg - Ice		15.16	-8.75	-782.69	-1355.78	0.11
Wind 90 deg - Ice		17.50	0.00	0.07	-1565.52	0.12
Wind 120 deg - Ice		15.16	8.75	782.82	-1355.78	0.11
Wind 135 deg - Ice		12.38	12.38	1107.05	-1106.99	0.09
Wind 150 deg - Ice		8.75	15.16	1355.84	-782.76	0.06
Wind 180 deg - Ice		0.00	17.50	1565.58	0.00	0.00
Wind 210 deg - Ice		-8.75	15.16	1355.84	782.76	-0.06
Wind 225 deg - Ice		-12.38	12.38	1107.05	1106.99	-0.09
Wind 240 deg - Ice		-15.16	8.75	782.82	1355.78	-0.11
Wind 270 deg - Ice		-17.50	0.00	0.07	1565.52	-0.12
Wind 300 deg - Ice		-15.16	-8.75	-782.69	1355.78	-0.11
Wind 315 deg - Ice		-12.38	-12.38	-1106.92	1106.99	-0.09
Wind 330 deg - Ice		-8.75	-15.16	-1355.71	782.76	-0.06
Total Weight	31.62			0.03	0.00	
Wind 0 deg - Service		0.00	-8.19	-730.75	0.00	0.00
Wind 30 deg - Service		4.09	-7.09	-632.84	-365.39	0.03
Wind 45 deg - Service		5.79	-5.79	-516.71	-516.74	0.04
Wind 60 deg - Service		7.09	-4.09	-365.36	-632.88	0.05
Wind 90 deg - Service		8.19	0.00	0.03	-730.78	0.06
Wind 120 deg - Service		7.09	4.09	365.43	-632.88	0.05
Wind 135 deg - Service		5.79	5.79	516.78	-516.74	0.04
Wind 150 deg - Service		4.09	7.09	632.91	-365.39	0.03
Wind 180 deg - Service		0.00	8.19	730.82	0.00	0.00
Wind 210 deg - Service		-4.09	7.09	632.91	365.39	-0.03
Wind 225 deg - Service		-5.79	5.79	516.78	516.74	-0.04
Wind 240 deg - Service		-7.09	4.09	365.43	632.88	-0.05
Wind 270 deg - Service		-8.19	0.00	0.03	730.78	-0.06
Wind 300 deg - Service		-7.09	-4.09	-365.36	632.88	-0.05
Wind 315 deg - Service		-5.79	-5.79	-516.71	516.74	-0.04
Wind 330 deg - Service		-4.09	-7.09	-632.84	365.39	-0.03

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
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	120 - 92.71	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-11.25	0.00	-0.07
			Max. Mx	6	-7.49	-207.71	-0.03

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. My	10	-7.49	0.00	-207.75
			Max. Vy	6	13.19	-207.71	-0.03
			Max. Vx	10	13.19	0.00	-207.75
			Max. Torque	6			-0.15
L2	92.71 - 46.16	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-22.28	0.00	-0.07
			Max. Mx	6	-17.08	-912.23	-0.03
			Max. My	10	-17.08	0.00	-912.27
			Max. Vy	6	17.38	-912.23	-0.03
			Max. Vx	10	17.38	0.00	-912.27
			Max. Torque	6			-0.15
L3	46.16 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-38.34	0.00	-0.07
			Max. Mx	6	-31.61	-1907.52	-0.03
			Max. My	10	-31.61	0.00	-1907.55
			Max. Vy	6	20.98	-1907.52	-0.03
			Max. Vx	10	20.98	0.00	-1907.55
			Max. Torque	6			-0.15

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	27	38.34	0.00	-17.50
	Max. H_x	14	31.62	20.96	0.00
	Max. H_z	2	31.62	0.00	20.96
	Max. M_x	2	1907.48	0.00	20.96
	Max. M_z	6	1907.52	-20.96	0.00
	Max. Torsion	14	0.15	20.96	0.00
	Min. Vert	1	31.62	0.00	0.00
	Min. H_x	6	31.62	-20.96	0.00
	Min. H_z	10	31.62	0.00	-20.96
	Min. M_x	10	-1907.55	0.00	-20.96
	Min. M_z	14	-1907.52	20.96	0.00
	Min. Torsion	6	-0.15	-20.96	0.00

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	31.62	0.00	0.00	0.03	0.00	0.00
Dead+Wind 0 deg - No Ice	31.62	0.00	-20.96	-1907.48	0.00	0.00
Dead+Wind 30 deg - No Ice	31.62	10.48	-18.15	-1651.92	-953.76	0.07
Dead+Wind 45 deg - No Ice	31.62	14.82	-14.82	-1348.78	-1348.82	0.10
Dead+Wind 60 deg - No Ice	31.62	18.15	-10.48	-953.72	-1651.96	0.13
Dead+Wind 90 deg - No Ice	31.62	20.96	0.00	0.03	-1907.52	0.15
Dead+Wind 120 deg - No Ice	31.62	18.15	10.48	953.79	-1651.96	0.13
Dead+Wind 135 deg - No Ice	31.62	14.82	14.82	1348.85	-1348.82	0.10
Dead+Wind 150 deg - No Ice	31.62	10.48	18.15	1651.99	-953.76	0.07
Dead+Wind 180 deg - No Ice	31.62	0.00	20.96	1907.55	0.00	0.00
Dead+Wind 210 deg - No Ice	31.62	-10.48	18.15	1651.99	953.76	-0.07

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 225 deg - No Ice	31.62	-14.82	14.82	1348.85	1348.82	-0.10
Dead+Wind 240 deg - No Ice	31.62	-18.15	10.48	953.79	1651.96	-0.13
Dead+Wind 270 deg - No Ice	31.62	-20.96	0.00	0.03	1907.52	-0.15
Dead+Wind 300 deg - No Ice	31.62	-18.15	-10.48	-953.72	1651.96	-0.13
Dead+Wind 315 deg - No Ice	31.62	-14.82	-14.82	-1348.78	1348.82	-0.10
Dead+Wind 330 deg - No Ice	31.62	-10.48	-18.15	-1651.92	953.76	-0.07
Dead+Ice+Temp	38.34	0.00	0.00	0.07	0.00	0.00
Dead+Wind 0 deg+Ice+Temp	38.34	0.00	-17.50	-1606.19	0.00	0.00
Dead+Wind 30 deg+Ice+Temp	38.34	8.75	-15.16	-1390.99	-803.13	0.06
Dead+Wind 45 deg+Ice+Temp	38.34	12.38	-12.38	-1135.73	-1135.80	0.09
Dead+Wind 60 deg+Ice+Temp	38.34	15.16	-8.75	-803.06	-1391.06	0.10
Dead+Wind 90 deg+Ice+Temp	38.34	17.50	0.00	0.07	-1606.26	0.12
Dead+Wind 120 deg+Ice+Temp	38.34	15.16	8.75	803.20	-1391.06	0.10
Dead+Wind 135 deg+Ice+Temp	38.34	12.38	12.38	1135.87	-1135.80	0.09
Dead+Wind 150 deg+Ice+Temp	38.34	8.75	15.16	1391.13	-803.13	0.06
Dead+Wind 180 deg+Ice+Temp	38.34	0.00	17.50	1606.33	0.00	0.00
Dead+Wind 210 deg+Ice+Temp	38.34	-8.75	15.16	1391.13	803.13	-0.06
Dead+Wind 225 deg+Ice+Temp	38.34	-12.38	12.38	1135.87	1135.80	-0.09
Dead+Wind 240 deg+Ice+Temp	38.34	-15.16	8.75	803.20	1391.06	-0.10
Dead+Wind 270 deg+Ice+Temp	38.34	-17.50	0.00	0.07	1606.26	-0.12
Dead+Wind 300 deg+Ice+Temp	38.34	-15.16	-8.75	-803.06	1391.06	-0.10
Dead+Wind 315 deg+Ice+Temp	38.34	-12.38	-12.38	-1135.73	1135.80	-0.09
Dead+Wind 330 deg+Ice+Temp	38.34	-8.75	-15.16	-1390.99	803.13	-0.06
Dead+Wind 0 deg - Service	31.62	0.00	-8.19	-745.32	0.00	0.00
Dead+Wind 30 deg - Service	31.62	4.09	-7.09	-645.46	-372.68	0.03
Dead+Wind 45 deg - Service	31.62	5.79	-5.79	-527.01	-527.04	0.04
Dead+Wind 60 deg - Service	31.62	7.09	-4.09	-372.64	-645.49	0.05
Dead+Wind 90 deg - Service	31.62	8.19	0.00	0.04	-745.35	0.06
Dead+Wind 120 deg - Service	31.62	7.09	4.09	372.71	-645.49	0.05
Dead+Wind 135 deg - Service	31.62	5.79	5.79	527.08	-527.04	0.04
Dead+Wind 150 deg - Service	31.62	4.09	7.09	645.53	-372.68	0.03
Dead+Wind 180 deg - Service	31.62	0.00	8.19	745.39	0.00	0.00
Dead+Wind 210 deg - Service	31.62	-4.09	7.09	645.53	372.68	-0.03
Dead+Wind 225 deg - Service	31.62	-5.79	5.79	527.08	527.04	-0.04
Dead+Wind 240 deg - Service	31.62	-7.09	4.09	372.71	645.49	-0.05
Dead+Wind 270 deg - Service	31.62	-8.19	0.00	0.04	745.35	-0.06
Dead+Wind 300 deg - Service	31.62	-7.09	-4.09	-372.64	645.49	-0.05
Dead+Wind 315 deg - Service	31.62	-5.79	-5.79	-527.01	527.04	-0.04
Dead+Wind 330 deg - Service	31.62	-4.09	-7.09	-645.46	372.68	-0.03

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	0.00	-31.62	0.00	0.00	31.62	0.00	0.000%
2	0.00	-31.62	-20.96	0.00	31.62	20.96	0.000%
3	10.48	-31.62	-18.15	-10.48	31.62	18.15	0.000%
4	14.82	-31.62	-14.82	-14.82	31.62	14.82	0.000%
5	18.15	-31.62	-10.48	-18.15	31.62	10.48	0.000%
6	20.96	-31.62	0.00	-20.96	31.62	0.00	0.000%
7	18.15	-31.62	10.48	-18.15	31.62	-10.48	0.000%
8	14.82	-31.62	14.82	-14.82	31.62	-14.82	0.000%
9	10.48	-31.62	18.15	-10.48	31.62	-18.15	0.000%
10	0.00	-31.62	20.96	0.00	31.62	-20.96	0.000%
11	-10.48	-31.62	18.15	10.48	31.62	-18.15	0.000%
12	-14.82	-31.62	14.82	14.82	31.62	-14.82	0.000%
13	-18.15	-31.62	10.48	18.15	31.62	-10.48	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
14	-20.96	-31.62	0.00	20.96	31.62	0.00	0.000%
15	-18.15	-31.62	-10.48	18.15	31.62	10.48	0.000%
16	-14.82	-31.62	-14.82	14.82	31.62	14.82	0.000%
17	-10.48	-31.62	-18.15	10.48	31.62	18.15	0.000%
18	0.00	-38.34	0.00	0.00	38.34	0.00	0.000%
19	0.00	-38.34	-17.50	0.00	38.34	17.50	0.000%
20	8.75	-38.34	-15.16	-8.75	38.34	15.16	0.000%
21	12.38	-38.34	-12.38	-12.38	38.34	12.38	0.000%
22	15.16	-38.34	-8.75	-15.16	38.34	8.75	0.000%
23	17.50	-38.34	0.00	-17.50	38.34	0.00	0.000%
24	15.16	-38.34	8.75	-15.16	38.34	-8.75	0.000%
25	12.38	-38.34	12.38	-12.38	38.34	-12.38	0.000%
26	8.75	-38.34	15.16	-8.75	38.34	-15.16	0.000%
27	0.00	-38.34	17.50	0.00	38.34	-17.50	0.000%
28	-8.75	-38.34	15.16	8.75	38.34	-15.16	0.000%
29	-12.38	-38.34	12.38	12.38	38.34	-12.38	0.000%
30	-15.16	-38.34	8.75	15.16	38.34	-8.75	0.000%
31	-17.50	-38.34	0.00	17.50	38.34	0.00	0.000%
32	-15.16	-38.34	-8.75	15.16	38.34	8.75	0.000%
33	-12.38	-38.34	-12.38	12.38	38.34	12.38	0.000%
34	-8.75	-38.34	-15.16	8.75	38.34	15.16	0.000%
35	0.00	-31.62	-8.19	0.00	31.62	8.19	0.000%
36	4.09	-31.62	-7.09	-4.09	31.62	7.09	0.000%
37	5.79	-31.62	-5.79	-5.79	31.62	5.79	0.000%
38	7.09	-31.62	-4.09	-7.09	31.62	4.09	0.000%
39	8.19	-31.62	0.00	-8.19	31.62	0.00	0.000%
40	7.09	-31.62	4.09	-7.09	31.62	-4.09	0.000%
41	5.79	-31.62	5.79	-5.79	31.62	-5.79	0.000%
42	4.09	-31.62	7.09	-4.09	31.62	-7.09	0.000%
43	0.00	-31.62	8.19	0.00	31.62	-8.19	0.000%
44	-4.09	-31.62	7.09	4.09	31.62	-7.09	0.000%
45	-5.79	-31.62	5.79	5.79	31.62	-5.79	0.000%
46	-7.09	-31.62	4.09	7.09	31.62	-4.09	0.000%
47	-8.19	-31.62	0.00	8.19	31.62	0.00	0.000%
48	-7.09	-31.62	-4.09	7.09	31.62	4.09	0.000%
49	-5.79	-31.62	-5.79	5.79	31.62	5.79	0.000%
50	-4.09	-31.62	-7.09	4.09	31.62	7.09	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	0.00001751
3	Yes	5	0.00000001	0.00004135
4	Yes	5	0.00000001	0.00004664
5	Yes	5	0.00000001	0.00004088
6	Yes	4	0.00000001	0.00003472
7	Yes	5	0.00000001	0.00004149
8	Yes	5	0.00000001	0.00004665
9	Yes	5	0.00000001	0.00004101
10	Yes	4	0.00000001	0.00001751
11	Yes	5	0.00000001	0.00004101
12	Yes	5	0.00000001	0.00004665
13	Yes	5	0.00000001	0.00004149
14	Yes	4	0.00000001	0.00003472

15	Yes	5	0.00000001	0.00004088
16	Yes	5	0.00000001	0.00004664
17	Yes	5	0.00000001	0.00004135
18	Yes	4	0.00000001	0.00000001
19	Yes	5	0.00000001	0.00003784
20	Yes	5	0.00000001	0.00008868
21	Yes	5	0.00000001	0.00009944
22	Yes	5	0.00000001	0.00008824
23	Yes	5	0.00000001	0.00003786
24	Yes	5	0.00000001	0.00008882
25	Yes	5	0.00000001	0.00009947
26	Yes	5	0.00000001	0.00008838
27	Yes	5	0.00000001	0.00003784
28	Yes	5	0.00000001	0.00008838
29	Yes	5	0.00000001	0.00009947
30	Yes	5	0.00000001	0.00008882
31	Yes	5	0.00000001	0.00003786
32	Yes	5	0.00000001	0.00008824
33	Yes	5	0.00000001	0.00009944
34	Yes	5	0.00000001	0.00008868
35	Yes	4	0.00000001	0.00000937
36	Yes	4	0.00000001	0.00016026
37	Yes	4	0.00000001	0.00018303
38	Yes	4	0.00000001	0.00015634
39	Yes	4	0.00000001	0.00001118
40	Yes	4	0.00000001	0.00016144
41	Yes	4	0.00000001	0.00018312
42	Yes	4	0.00000001	0.00015743
43	Yes	4	0.00000001	0.00000938
44	Yes	4	0.00000001	0.00015743
45	Yes	4	0.00000001	0.00018312
46	Yes	4	0.00000001	0.00016144
47	Yes	4	0.00000001	0.00001118
48	Yes	4	0.00000001	0.00015634
49	Yes	4	0.00000001	0.00018303
50	Yes	4	0.00000001	0.00016026

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	120 - 92.71	14.681	43	1.0016	0.0003
L2	97.29 - 46.16	10.050	43	0.9163	0.0002
L3	51.83 - 0	2.969	43	0.5192	0.0001

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
120.00	LPA-80063/6CF	43	14.681	1.0016	0.0003	45433
118.00	EEI 14-ft Low Profile Platform	43	14.264	0.9958	0.0003	45433
110.00	(2) P65-15-XLH-RR	43	12.605	0.9709	0.0003	22716
108.00	Andrew 12'-6" Low Profile Platform	43	12.195	0.9639	0.0003	18930
100.00	APX16DWV-16DWVS-E-A20	43	10.583	0.9303	0.0002	11374

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
98.00	Valmont T-Arm (3)	43	10.189	0.9202	0.0002	10413
91.00	Uni-Tri Bracket	43	8.850	0.8779	0.0002	8481

Maximum Tower Deflections - Design Wind

Section No.	Elevation	Horz. Deflection	Gov. Load Comb.	Tilt	Twist
	ft	in		°	°
L1	120 - 92.71	37.557	10	2.5625	0.0008
L2	97.29 - 46.16	25.713	10	2.3445	0.0006
L3	51.83 - 0	7.598	10	1.3285	0.0002

Critical Deflections and Radius of Curvature - Design Wind

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
120.00	LPA-80063/6CF	10	37.557	2.5625	0.0008	17829
118.00	EEI 14-ft Low Profile Platform	10	36.491	2.5476	0.0008	17829
110.00	(2) P65-15-XLH-RR	10	32.248	2.4839	0.0007	8914
108.00	Andrew 12'-6" Low Profile Platform	10	31.198	2.4660	0.0007	7428
100.00	APX16DWV-16DWVS-E-A20	10	27.074	2.3802	0.0006	4462
98.00	Valmont T-Arm (3)	10	26.067	2.3542	0.0006	4085
91.00	Uni-Tri Bracket	10	22.642	2.2461	0.0005	3325

Compression Checks

Pole Design Data

Section No.	Elevation	Size	L	L_u	Kl/r	F_a	A	Actual P	Allow. P_a	Ratio $\frac{P}{P_a}$
	ft		ft	ft		ksi	in^2	K	K	
L1	120 - 92.71 (1)	TP32.27x26.9x0.25	27.29	0.00	0.0	39.000	24.6927	-7.49	963.02	0.008
L2	92.71 - 46.16 (2)	TP40.8x30.8688x0.375	51.13	0.00	0.0	39.000	46.8050	-17.08	1825.40	0.009
L3	46.16 - 0 (3)	TP49x38.9487x0.4375	51.83	0.00	0.0	39.000	67.4351	-31.61	2629.97	0.012

Pole Bending Design Data

Section No.	Elevation	Size	Actual M_x	Actual f_{bx}	Allow. F_{bx}	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y	Actual f_{by}	Allow. F_{by}	Ratio $\frac{f_{by}}{F_{by}}$
	ft		kip-ft	ksi	ksi		kip-ft	ksi	ksi	
L1	120 - 92.71 (1)	TP32.27x26.9x0.25	207.75	13.150	39.000	0.337	0.00	0.000	39.000	0.000

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 $\frac{f_{by}}{F_{by}}$
L2	92.71 - 46.16 (2)	TP40.8x30.8688x0.375	912.27	24.144	39.000	0.619	0.00	0.000	39.000	0.000
L3	46.16 - 0 (3)	TP49x38.9487x0.4375	1907.55	28.359	39.000	0.727	0.00	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	120 - 92.71 (1)	TP32.27x26.9x0.25	13.19	0.534	26.000	0.041	0.00	0.000	26.000	0.000
L2	92.71 - 46.16 (2)	TP40.8x30.8688x0.375	17.38	0.371	26.000	0.029	0.00	0.000	26.000	0.000
L3	46.16 - 0 (3)	TP49x38.9487x0.4375	20.98	0.311	26.000	0.024	0.00	0.000	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	120 - 92.71 (1)	0.008	0.337	0.000	0.041	0.000	0.345 ✔	1.333	H1-3+VT ✔
L2	92.71 - 46.16 (2)	0.009	0.619	0.000	0.029	0.000	0.629 ✔	1.333	H1-3+VT ✔
L3	46.16 - 0 (3)	0.012	0.727	0.000	0.024	0.000	0.739 ✔	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	120 - 92.71	Pole	TP32.27x26.9x0.25	1	-7.49	1283.70	25.9	Pass
L2	92.71 - 46.16	Pole	TP40.8x30.8688x0.375	2	-17.08	2433.26	47.2	Pass
L3	46.16 - 0	Pole	TP49x38.9487x0.4375	3	-31.61	3505.75	55.5	Pass
							Summary	
						Pole (L3)	55.5	Pass
						RATING =	**55.5**	**Pass**

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Subject:		Anchor Bolt and Baseplate Analysis
Location:		120-ft Monopole Canton, CT
Rev. 0: 9/24/12		Prepared by: T.J.L. Checked by: C.F.C. Job No. 12044.CO7

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 1907·ft·kips	(Input From RisaTower)
Shear Force =	Shear := 21·kips	(Input From RisaTower)
Axial Force =	Axial := 31·kips	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 18	(User Input)
Diameter of Bolt Circle =	D_{bc} := 58.0·in	(User Input)
Bolt "Column" Distance =	l := 3.0·in	(User Input)
Bolt Ultimate Strenght =	F_u := 100·ksi	(User Input)
Bolt Yield Strenght =	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 Grade 60

Plate Yield Strength =	Fy_{bp} := 60·ksi	(User Input)
Base Plate Thickness =	t_{bp} := 2.0·in	(User Input)
Base Plate Diameter =	D_{bp} := 64.0·in	(User Input)
Outer Pole Diameter =	D_{pole} := 49.0·in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 29 \cdot in$

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

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

$d_1 = 9.92 \cdot in$ $d_9 = 0.00 \cdot in$

$d_2 = 18.64 \cdot in$ $d_{10} = -9.92 \cdot in$

$d_3 = 25.11 \cdot in$ $d_{11} = -18.64 \cdot in$

$d_4 = 28.56 \cdot in$ $d_{12} = -25.11 \cdot in$

$d_5 = 28.56 \cdot in$ $d_{13} = -28.56 \cdot in$

$d_6 = 25.11 \cdot in$ $d_{14} = -28.56 \cdot in$

$d_7 = 18.64 \cdot in$ $d_{15} = -25.11 \cdot in$

$d_8 = 9.92 \cdot in$ $d_{16} = -18.64 \cdot in$

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 24.5 \cdot in$

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

$MA_1 = 0.00 \cdot in$ $MA_9 = 0.00 \cdot in$

$MA_2 = 0.00 \cdot in$ $MA_{10} = 0.00 \cdot in$

$MA_3 = 0.61 \cdot in$ $MA_{11} = 0.00 \cdot in$

$MA_4 = 4.06 \cdot in$ $MA_{12} = 0.00 \cdot in$

$MA_5 = 4.06 \cdot in$ $MA_{13} = 0.00 \cdot in$

$MA_6 = 0.61 \cdot in$ $MA_{14} = 0.00 \cdot in$

$MA_7 = 0.00 \cdot in$ $MA_{15} = 0.00 \cdot in$

$MA_8 = 0.00 \cdot in$ $MA_{16} = 0.00 \cdot in$

Effective Width of Baseplate for Bending = $B_{eff} := 0.8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 32.9 \cdot in$

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Subject:		Anchor Bolt and Baseplate Analysis
Location:		120-ft Monopole Canton, CT
Rev. 0: 9/24/12		Prepared by: T.J.L. Checked by: C.F.C. Job No. 12044.CO7

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 7.569 \times 10^3 \cdot in^2$

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 = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 86 \cdot kips$

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 = $\frac{T_{Max}}{T_{ALL.Net}} = 44.1 \cdot \%$ 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 = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.292 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 4.2 \cdot ksi$

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.

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

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

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 89.4 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 27.5 \cdot ksi$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

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

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 45.9 \cdot \%$$

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

$C_1 = 31.7 \cdot kips$	$C_9 = 1.7 \cdot kips$
$C_2 = 58.1 \cdot kips$	$C_{10} = -28.3 \cdot kips$
$C_3 = 77.7 \cdot kips$	$C_{11} = -54.6 \cdot kips$
$C_4 = 88.1 \cdot kips$	$C_{12} = -74.2 \cdot kips$
$C_5 = 88.1 \cdot kips$	$C_{13} = -84.6 \cdot kips$
$C_6 = 77.7 \cdot kips$	$C_{14} = -84.6 \cdot kips$
$C_7 = 58.1 \cdot kips$	$C_{15} = -74.2 \cdot kips$
$C_8 = 31.7 \cdot kips$	$C_{16} = -54.6 \cdot kips$

Maximum Bending Stress in Plate = $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} \cdot t_{bp}^2\right)} = 36.9 \cdot ksi$

Allowable Bending Stress in Plate = $F_{bp} := 1.33 \cdot 0.75 \cdot Fy_{bp} = 59.9 \cdot ksi$

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} = 61.7 \cdot \%$

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

Condition3 = "Ok"

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Subject:	Foundation Analysis
Location:	120-ft Monopole Canton, CT
Rev. 0: 9/24/12	Prepared by: T.J.L. Checked by: C.F.C. Job No. 12044.CO7

Standard Monopole Foundation:

Input Data:

Tower Data

Overturning Moment =	$OM := 1907 \cdot ft \cdot kips$	(User Input from RISATower)	
Shear Force =	$Shear := 21 \cdot kip$	(User Input from RISATower)	
Axial Force =	$Axial := 31 \cdot kip$	(User Input from RISATower)	
Tower Height =	$H_t := 120 \cdot ft$	(User Input)	

Footing Data:

Overall Depth of Footing =	$D_f := 8.0 \cdot ft$	(User Input)	
Length of Pier =	$L_p := 5.0 \cdot ft$	(User Input)	
Extension of Pier Above Grade =	$L_{pag} := 1.0 \cdot ft$	(User Input)	
Diameter of Pier =	$d_p := 7.0 \cdot ft$	(User Input)	
Thickness of Footing =	$T_f := 3.0 \cdot ft$	(User Input)	
Width of Footing =	$W_f := 24.0 \cdot ft$	(User Input)	

Anchor Bolt Data:

Length of Anchor Bolts =	$L_{st} := 96 \cdot in$	(User Input)	
Projection of Anchor Bolts Above Pier =	$A_{BP} := 12.0 \cdot in$	(User Input)	
Anchor Bolt Diameter =	$d_{anchor} := 2.25 \cdot in$	(User Input)	
Base Plate Bolt Circle =	$MP := 58.0 \cdot in$	(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 =	$\Phi_s := 33 \cdot deg$	(User Input)	
Allowable Soil Bearing Capacity =	$q_s := 5000 \cdot psf$	(User Input)	
Unit Weight of Soil =	$\gamma_{soil} := 125 \cdot pcf$	(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 =	$BS_{pier} := 9$	(User Input)	
Bar Diameter =	$d_{bpier} := 1.128 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 30$	(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 =	$BS_{top} := 9$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 1.128 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 20$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 9$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 1.128 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 36$	(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 =

$$A_{bpier} := \frac{\pi \cdot d_{bpier}^{2}}{4} = 0.999 \cdot in^2$$

Pad Top Reinforcement Bar Area =

$$A_{btop} := \frac{\pi \cdot d_{btop}^{2}}{4} = 0.999 \cdot in^2$$

Pad Bottom Reinforcement Bar Area =

$$A_{bbot} := \frac{\pi \cdot d_{bbot}^{2}}{4} = 0.999 \cdot in^2$$

Coefficient of Lateral Soil Pressure =

$$K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 3.392$$

Load Factor =

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

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 =

$\gamma_s := if(Bouyancy = 1, \gamma_{soil} - 62.4pcf, \gamma_{soil}) = 125 \cdot pcf$

Passive Pressure =

$P_{pn} := K_p \cdot \gamma_s \cdot n + c \cdot 2 \cdot \sqrt{K_p} = 0.424 \cdot ksf$

$P_{pt} := K_p \cdot \gamma_s \cdot (D_f - T_f) + c \cdot 2 \cdot \sqrt{K_p} = 2.12 \cdot ksf$

$P_{top} := if[n < (D_f - T_f), P_{pt}, P_{pn}] = 2.12 \cdot ksf$

$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p} = 3.392 \cdot ksf$

$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 2.756 \cdot ksf$

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

$A_p := W_f \cdot T_p = 72$

Ultimate Shear =

$S_u := P_{ave} \cdot A_p = 198.439 \cdot kip$

Weight of Concrete Pad =

$WT_c := \left[\left(W_f^2 \cdot T_f\right) + \frac{d_p^2 \cdot \pi}{4} L_p\right] \cdot \gamma_c = 288.063 \cdot kip$

Weight of Soil Above Footing =

$WT_{s1} := \left[\left(W_f^2 - \frac{d_p^2 \cdot \pi}{4}\right) \cdot \left(\left|L_p - L_{pag} - n\right|\right)\right] \cdot \gamma_s = 201.57 \cdot kip$

Weight of Soil Wedge at Back Face =

$WT_{s2} := \left(\frac{D_f^2 \cdot \tan(\Phi_s)}{2} \cdot W_f\right) \cdot \gamma_s = 62.343 \cdot kip$

Weight of Soil Wedge at back face Corners =

$WT_{s3} := 2 \cdot \left[(D_f)^3 \cdot \frac{\tan(\Phi_s)}{3}\right] \cdot \gamma_s = 27.708 \cdot kips$

Total Weight =

$WT_{tot} := WT_c + WT_{s1} + Axial = 520.632 \cdot kip$

Resisting Moment =

$M_r := (WT_{tot}) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + \left[(WT_{s2} + WT_{s3}) \cdot \left(W_f + \frac{D_f \cdot \tan(\Phi_s)}{3}\right)\right] = 8763 \cdot kip \cdot ft$

Overturning Moment =

$M_{ot} := OM + Shear \cdot (L_p + T_f) = 2075 \cdot kip \cdot ft$

Factor of Safety Actual =

$FS := \frac{M_r}{M_{ot}} = 4.22$

Factor of Safety Required =

$FS_{req} := 2$

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

OverTurning_Moment_Check = "Okay"

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Subject:	Foundation Analysis
Location:	120-ft Monopole Canton, CT
Rev. 0: 9/24/12	Prepared by: T.J.L. Checked by: C.F.C. Job No. 12044.CO7

Shear Capacity in Pier:

Shear Resistance of Pier = $S_p := \frac{\mu \cdot WT_{tot}}{FS_{req}} = 117.142 \cdot kips$

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

Shear_Check = "Okay"

Bearing Pressure Caused by Footing:

Area of the Mat = $A_{mat} := W_f^2 = 576$

Section Modulus of Mat = $S := \frac{W_f^3}{6} = 2304 \cdot ft^3$

Maximum Pressure in Mat = $P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S} = 1.804 \cdot ksf$

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

Max_Pressure_Check = "Okay"

Minimum Pressure in Mat = $P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S} = 3.267 \times 10^{-3} \cdot ksf$

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

Min_Pressure_Check = "Okay"

Distance to Resultant of Pressure Distribution = $X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 8.015$

Distance to Kern = $X_k := \frac{W_f}{6} = 4$

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

Eccentricity = $e := \frac{M_{ot}}{WT_{tot}} = 3.986$

Adjusted Soil Pressure = $P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)} = 1.804 \cdot ksf$

$q_{adj} := if(P_{min} < 0, P_a, P_{max}) = 1.804 \cdot ksf$

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

Pressure_Check = "Okay"

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Subject:	Foundation Analysis
Location:	120-ft Monopole Canton, CT
Rev. 0: 9/24/12	Prepared by: T.J.L. Checked by: C.F.C. Job No. 12044.CO7

Concrete Bearing Capacity:

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

Bearing Strength Between Pier and Pad = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 1.225 \times 10^4 \cdot kips$ (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)

$d := T_f - Cvr_{pad} - d_{bbot} = 31.872 \cdot in$

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

$d_2 := d_1 - d$

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

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

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

$V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f_c \cdot psi} \cdot W_f \cdot d$ (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 = $b_o := \left(d_p + d\right) \cdot \pi = 30.3$

Area Included Inside Perimeter = $A_{bo} := \frac{\pi \cdot \left(d_p + d\right)^2}{4} = 73.2$

Area Outside of Perimeter = $A_{out} := A_{mat} - A_{bo} = 502.8$

Guess Value = $v_u := 1ksf$

(From "Foundation Analysis and design", By Joseph Bowles, Eq. 8-9)

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

$v_u := \text{Find}(v_u) = 6.5 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f = 411.9 \cdot kips$

Required Shear Strength = $V_{req} := LF \cdot V_u = 549.1 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 2494.9 \cdot kip$ (ACI-2008 11.11.2.1)

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

Punching_Shear_Check = "Okay"

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

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

$q_b := q_{adj} - d_1 \cdot Slope = 1.167 \cdot ksf$

Maximum Bending at Face of Pier = $M_n := \frac{1}{LF \cdot \phi_m} \cdot \left[\left(q_{adj} - q_b \right) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 1150.4 \cdot kip \cdot ft$

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

(ACI-200810.2.7.3)

$R_u := \frac{M_n}{\phi_m \cdot W_f \cdot d^2} = 7.5 \cdot ksf$

$\rho := \frac{0.85 \cdot f_c}{f_y} \left(1 - \sqrt{1 - \frac{2 \cdot R_u}{0.85 \cdot f_c}} \right) = 0.0009$

$\rho_{min} := 1.333 \cdot \rho = 0.00117$

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:

$$As := \max(\rho, \rho_{min}, \rho_{sh}) \cdot W_f \cdot d = 16.5 \cdot in^2$$

$$As_{prov} := A_{bbot} \cdot NB_{bot} = 36 \cdot in^2$$

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

Pad_Reinforcement_Bot = "Okay"

Check top Bars:

$$As := \rho_{sh} \cdot (W_f \cdot d) = 16.5 \cdot in^2$$

$$As_{prov} := A_{btop} \cdot NB_{top} = 20 \cdot in^2$$

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

Pad_Reinforcement_Top = "Okay"

Developement Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 6.9 \cdot in$$

Spacing or Cover Dimension =

$$c := if\left(Cvr_{pad} < \frac{B_{sPad}}{2}, Cvr_{pad}, \frac{B_{sPad}}{2}\right) = 3 \cdot in$$

Transverse Reinforcement Index =

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

$$L_{dbt} := \frac{3 \cdot f_y \cdot \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 30.2 \cdot in$$

Minimum Development Length =

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

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

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad} = 99 \cdot in$$

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

Lpad_Check = "Okay"

Steel Reinforcement in Pier:

Area of Pier = $A_p := \frac{\pi \cdot d_p^2}{4} = 5541.77 \cdot in^2$

$A_{smin} := 0.01 \cdot 0.05 \cdot A_p = 2.77 \cdot in^2$ (ACI-2008 10.8.4 & 10.9.1)

$A_{sprov} := NB_{pier} \cdot A_{bpier} = 29.98 \cdot in^2$

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

Steel_Area_Check = "Okay"

Bar Spacing In Pier = $B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 7.668 \cdot in$

Diameter of Reinforcement Cage = $Diam_{cage} := d_p - 2 \cdot Cvr_{pier} = 78 \cdot in$

Maximum Moment in Pier = $M_p := \left[OM + Shear \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF = 32351.9 \cdot in \cdot kips$

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

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

$(D \; N \; n \; P_u \; M_{xu}) = (84 \; 30 \; 9 \; 41.323 \; 3.235 \times 10^4)$

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

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

$(\phi P_n \; \phi M_{xn} \; f_{sp} \; \rho) = (75.477 \; 5.909 \times 10^4 \; -60 \; 5.413 \times 10^{-3})$

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

Axial_Load_Check = "Okay"

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

Bending_Check = "Okay"

Development Length Pier Reinforcement:

Available Length in Foundation:

$L_{pier} := L_p - Cvr_{pier} = 57 \cdot in$

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

Tension: (ACI-2008 12.2.3)

Spacing or Cover Dimension =

$c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right) = 3 \cdot in$

Transverse Reinforcement =

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

$L_{dbt} := \frac{3 \cdot f_y \alpha_{pier} \cdot \beta_{pier} \cdot \gamma_{pier} \cdot \lambda_{pier}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \left(\frac{c + k_{tr}}{d_{bpier}}\right)} \cdot d_{bpier} = 30.18 \cdot in$

Minimum Development Length =

$L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f_c}{psi}}} \cdot .7 = 14.982 \cdot in$ (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)

$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot f_y}{\sqrt{f_c \cdot psi}} = 21.402 \cdot in$

$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot \left(d_{bpier} \cdot f_y\right) = 20.304 \cdot in$

$L_{dbc} := if\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right) = 21.402 \cdot in$

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

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

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)

$s_{lim1} := 16 \cdot d_{bpier} \cdot z = 18.048 \cdot in$

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

$s_{lim3} := D_f \cdot z = 96 \cdot in$

$s_{lim4} := 18in$

Maximum Spacing =

$$s_{tie} := \min\left(\begin{pmatrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{pmatrix}\right) = 18 \cdot in$$

Number of Ties Required =

$$n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 = 4$$

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

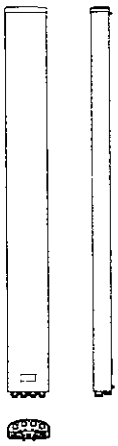
P65-17-XLH-RR

Dual Broadband Antennas

POLARIZATION: Dual linear ±45°
FREQUENCY (MHz): 698-894, 1710-2170
HORIZONTAL BEAM WIDTH (°): 65, 65
GAIN (dBi dBd): 17.2/15.1 17.5/15.4
TILT: 0-7, 0-8
LENGTH: 96"

Frequency range (MHz)	698-894		1710-2170		
Frequency band (MHz)	698-806	806-894	1710-1880	1850-1990	1900-2170
Gain (dBi/dBd)	16.4/14.3	17.2/15.1	16.9/14.8	17.2/15.1	17.5/15.4
Polarization	Dual Linear +/- 45		Dual Linear +/- 45		
Nominal Impedance (Ω)	50		50		
VSWR	< 1.5:1		< 1.5:1		
Horizontal beam width, -3 dB (°)	70	63	60	63	60
Vertical beam width, -3 dB (°)	8.4		6.5		
Electrical down tilt (°)	0 to 7		0 to 8		
Side lobe suppression, vertical 1st upper (dB)	> 16		> 16		
Isolation between inputs (dB)	> 30		> 30		
Inter band Isolation (dB)	> 40				
Tracking, horizontal plane ±60° (dB)	< 2		< 2		
Vertical beam squint (°)	< 0.5		< 0.5		
Front to back ratio (dB) 180° ±30° copolar	> 25		> 30		
Front to back ratio (dB) 180° ±30° total power	> 22		> 25		
Cross polar discrimination (XPD) 0° (dB)	> 15		> 15		
Cross polar discrimination (XPD) ±60° (dB)	10		10		
IM3, 2xTx&43dBm (dBc)	<-153		<-153		
Power handling, average per input (W)	500		300		
Power handling, average total (W)	1000		600		

Connector	4 x 7/16 DIN Female, IP67, 4 x AISG [2 x i-RET 8510.40]
Connector position	Bottom
Dimensions, HxWxD, mm(ft)	2445x312x148(96"x12"x6")
Mounting	Pre-mounted Tilt Brackets
Weight, with brackets, kg (lbs)	28.2 (62)
Weight, without brackets, kg (lbs)	22.7 (50)
Wind load, frontal/lateral/rear side 42 m/s Cd=1.6 (N)	1006 / 147 / 1273
Maximum operational wind speed, m/s (mph)	45 (100)
Survival wind speed, m/s (mph)	67 (150)
Lightning protection	DC Ground
Operating Temperature	-40°C to +60°C
Radome Material	PVC, IP55
Radome colour	Light Grey
Packing size, HxWxD, mm (ft)	2610 x 427 x 275 (102.8" x 17" x 11")
Shipping weight, kg (lbs)	37 (81)
RET	iRET AISGv1.1, MET and AISGv2.0 Available
Brackets	7256.00, 7454.00A



*All specifications subject to change without notice. Please contact your Powerwave representative for complete performance data.

For detailed patterns visit http://www.powerwave.com/rpa/.

P65-15-XLH-RR | Dual Broadband Antennas

POLARIZATION: Dual linear ±45°
FREQUENCY (MHz): 698-894, 1710-2170
HORIZONTAL BEAM WIDTH (°): 65, 65
GAIN (dBi/dBd): 13.5/11.4, 16.3/14.2
TILT: 2-15, 0-10
LENGTH: 51"

Frequency range (MHz)	698-894			1710-2170			
Frequency band (MHz)	698-806		806-894	1710-1880		1850-1990	1900-2170
Gain (dBi/dBd)	13/10.9		13.5/11.4	15.5/13.4		16/13.9	16.3/14.2
Polarization	Dual Linear +/- 45			Dual Linear +/- 45			
Nominal Impedance (Ω)	50			50			
VSWR	< 1.4:1			< 1.4:1			
Horizontal beam width, -3 dB (°)	73		63	65		57	56
Vertical beam width, -3 dB (°)	17			7.5			
Electrical down tilt (°)	2-15			0-10			
Side lobe suppression, vertical 1st upper (dB)	> 14			>20			
Isolation between inputs (dB)	>30			> 30			
Inter band Isolation (dB)	> 40			> 40			
Tracking, horizontal plane ±60° (dB)	< 2			< 2			
Vertical beam squint (°)	<1.25			< 0.5			
Front to back ratio (dB)	> 25			> 28			
Front to back ratio, total power (dB)	> 25			> 25			
Cross polar discrimination (XPD) 0° (dB)	> 15			> 15			
Cross polar discrimination (XPD) ±60° (dB)	> 10			> 10			
IM3, 2xTx@43dBm (dBc)	-153			-153			
Power handling, average per input (W)	500			300			
Power handling, average total (W)	1000			600			

Connector	4 X 7/16 DIN Female, IP67
Connector position	Bottom
Dimensions, HxWxD, in (mm)	51" x 12" x 6" (1295 x 305 x 152)
Mounting	Pre-mounted Tilt Brackets
Weight, with brackets, lbs (kg)	41 (19)
Weight, without brackets, lbs (kg)	30 (14)
Wind load, frontal/lateral/rear side 42 m/s Cd=1.0 (N)	920
Maximum operational wind speed, mph (m/s)	100 (45)
Survival wind speed, mph (m/s)	150 (67)
Lightning protection	DC Ground
Operating Temperature	-40C to +60C
Radome material	PVC, IP55
Packet size, HxWxD, in (mm)	60" x 16" x 10" (1524 x 400 x 255)
Radome colour	Light Grey
Shipping weight, lbs (kg)	52 (24)
RET	iRET AISGv1.1, MET and AISGv2.0
Brackets	7256.00, 7454.00, 2210.00

*All specifications subject to change without notice. Please contact your Powerwave representative for complete performance data.

For detailed patterns visit http://www.powerwave.com/rpa/.

TT19-08BP111-001 | TMA Twin 1900 with 850 Bypass 12 dB AISG 1.1

UL Frequency Range (MHz)	1850-1910 with 824-894 bypass
UL Rejection	>77 dB
UL Gain (dB)	12
UL Return Loss	>18
UL Noise Figure	<1.7 dB, Typical
UL Output 3rd Order Intercept Point (dBm)	>+23
UL Bypass Loss (dB)	2.5, Typical
UL Max Input Power (dBm)	+14 dBm
DL Frequency Range (MHz)	1930-1990 with 824-894 bypass
DL Return Loss	>18
DL Insertion Loss (dB)	850 MHz, <0.3; 1900 MHz, <0.5
Intermodulation	@ 2 x +43 dBm TX carriers, in receive band, <160 dBc, reffered to antenna port
Input Voltage (V)	AISG Mode: 10-30; Current alarm mode: 8 -17
Alarm Functionality	AISG compatible or in case of no AISG command received, current alarm mode 170-190 mA
Power Consumption	<1.1W @12V
Power Handling, RMS	850: >57 dBm; 1900: >55 dBm
AISG Compatibility	AISG 1.1 fully upgreadable to AISG 2.0 (AISG version only dependent on loaded SW version) TT19-08BP112-001 has AISG 2.0 loaded from factory

Dimensions HxWxD mm(ft)	250x169x137 mm (9.9"x6.7"x5.4")
Weight (lbs)	<16
Colors	Off white (NCS 1502-R)
RF Connectors	DIN 7/16 female, long neck
Mounting Kit	Mounting kit for pole and wall is included

Temperature Range	-40° C to +65° C (-40° F to +149° F)
Operational	ETS 300 019-1-4
Transportation	ETS 300 019-1-2
Storage	ETS 300 019-1-1
Lightning Protection	3 kA 10/350 µs; 20 kA (Shield)
Housing	Aluminum
MTBF	>1 million hours per TMA
Ingress Protection	IP65 and IP68

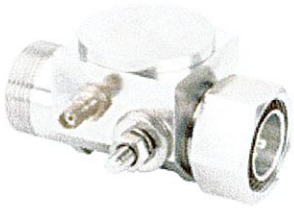
Safety	EN60950
EMC	3GPP: TS 25.113

*All specifications subject to change without notice. Please contact your Powerwave representative for complete performance data.

Product Specifications

ABT-DFDM-ADBH

Dual Band Bias Tee Surge Arrestor, 698–960 MHz and 1710–2170 MHz, with interface types DIN Female and DIN Male



CHARACTERISTICS

General Specifications

Interface	7-16 DIN Female
Interface 2	7-16 DIN Male
Interface Port	Antenna
Interface 2 Port	BTS
Injector Port Interface	SMA Female
Antenna Interface Signal	dc | RF
BTS Interface Signal	dc Blocked | RF
Injector Port Interface Signal	dc

Electrical Specifications

Operating Frequency Band	1710 – 2000 MHz | 2000 – 2170 MHz | 698 – 960 MHz
3rd Order IMD	-116.0 dB
3rd Order IMD Test Method	Two +43 dBm carriers
Average Power	500 W @ 883 MHz and 350 W @ 1940 MHZ (Combined)
Connector Impedance	50 ohm
Injector Port to Antenna Isolation, minimum	-70 dB
Lightning Surge Capability	10 times @ 6 kA
Lightning Surge Current Waveform	8/20 waveform
Peak Power, maximum	12.00 kW
Insertion Loss, typical	0.10 dB

Mechanical Specifications

Attachment Durability	25 cycles
Coupling Nut Proof Torque	24.86 N-m | 220.00 in lb
Coupling Nut Retention Force	1000.85 N | 225.00 lbf
Coupling Nut Retention Force Method	MIL-C-39012C-3.25, 4.6.22
dc Injector Port Inner Contact Plating	Gold

Product Specifications

ABT-DFDM-ADBH

Inner Contact Plating	Silver
Interface Durability	500 cycles
Interface Durability Method	IEC 61169-16:9.5
Outer Contact Plating	Trimetal
Pressurizable	No

Dimensions

Height	41.91 mm | 1.65 in
Length	82.04 mm | 3.23 in
Weight	0.52 kg | 1.14 lb
Width	39.88 mm | 1.57 in

Environmental Specifications

Corrosion Test Method	MIL-STD-202, Method 101, Test Condition B
Immersion Depth	1 m
Immersion Test Mating	Mated
Immersion Test Method	IEC 60529:2001, IP68
Mechanical Shock Test Method	MIL-STD-202F, Method 213B, Test Condition C
Moisture Resistance Test Method	MIL-STD-202, Method 106
Operating Temperature	-40 °C to +85 °C (-40 °F to +185 °F)
Storage Temperature	-40 °C to +85 °C (-40 °F to +185 °F)
Thermal Shock Test Method	MIL-STD-202, Method 107, Test Condition A-1, Low Temperature -55 °C
Water Jetting Test Mating	Mated
Water Jetting Test Method	IEC 60529:2001, IP66

Power Supply

Throughput Current, typical	1 A
Voltage Range	-30 V to 30 V

Standard Conditions

Attenuation, Ambient Temperature	20 °C | 68 °F
Average Power, Ambient Temperature	40 °C | 104 °F

Return Loss/VSWR

Frequency Band	VSWR	Return Loss (dB)
698–960 MHz	1.13	24.00
1710–2000 MHz	1.13	24.00
2000–2170 MHz	1.13	24.00

Regulatory Compliance/Certifications

Agency	Classification
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

RRUS 11

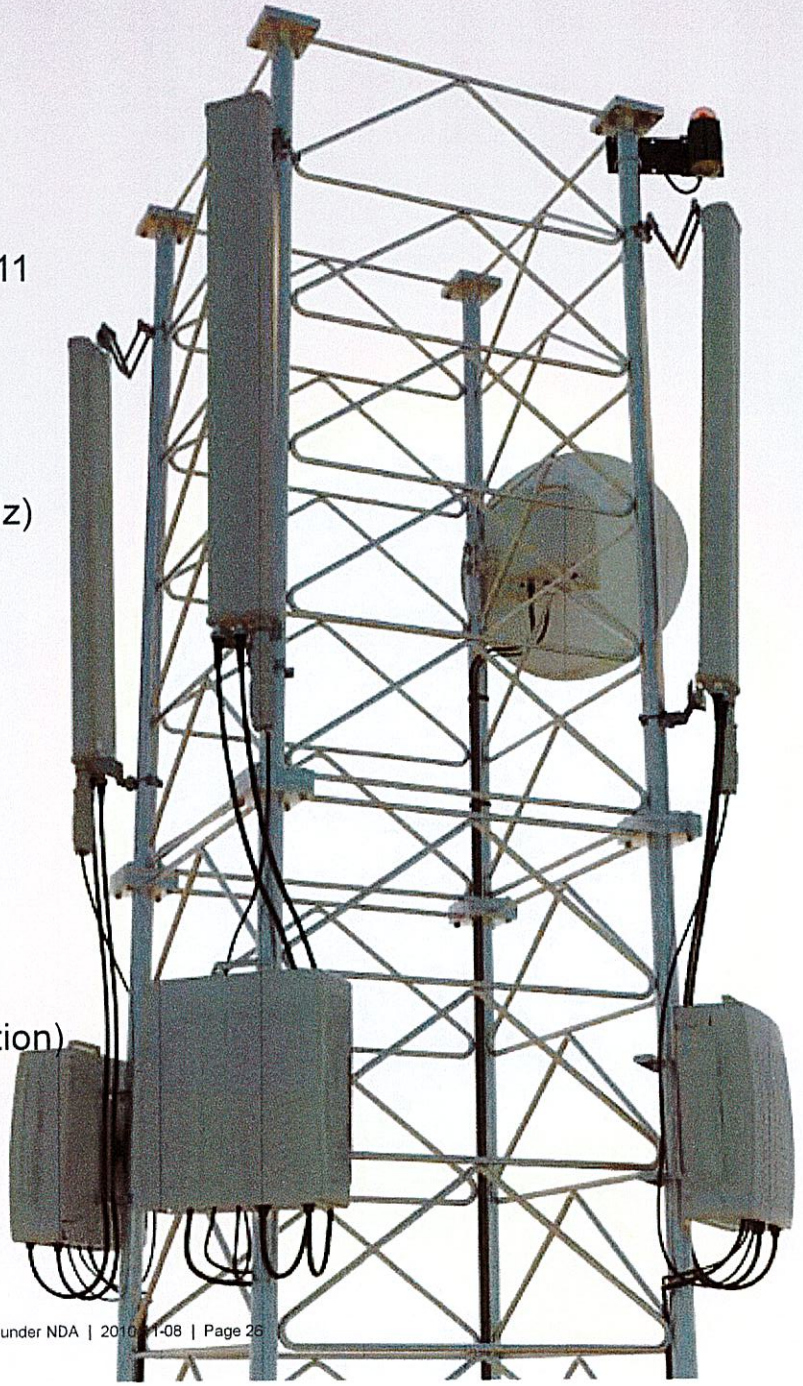
Frequency (AT&T)
- ✓ Band 12 (Lower 700 MHz)
- ✓ Band 4 (AWS, 17/2100 MHz) — 2Q2011

RF Characteristics
- ✓ Output power: 2x30 Watts
- ✓ 2x2 MIMO Capable
- ✓ IBW of 20 MHz
- ✓ Rx Sens.: Better than -105 dBm (5 MHz)

RET/TMA Support
- ✓ AISG 2.0 Compatible
- ✓ Via RET Port and Centre Conductor
- ✓ Cascading
- ✓ 30 VDC Bias

Environmental
- ✓ Self Convection
- ✓ Temperature -40 to 131 F

Power
- ✓ Input voltage: -48 VDC or AC (exemption)
- ✓ Fuse size: 13 – 32 A
  - Recommended: 25 A
- ✓ Power Consumption:
  - Typical 200 Watts
  - Max 310 Watts
  - Excl. RET and TMA load



RRUS 11 Mechanics

Wall and pole mounting brackets
- Reused from RRUW and RRU22
- Vertical Mount Only

Clearing distances:
- Above >= 16 in.
- Below >= 12 in.
- Side >= 0 mm

DC connector
- Bayonet
- Screw terminals in connector plug
- Supported outer cable diameter: 6-18 mm

CPRI connector
- LCD with proprietary cover
- Separate cover available from 1Q2011

Size & Weight
- Band 4: 44 lbs
- Band 12: 50 lbs
- 17.8" x 17.3" x 7.2" incl. sun shield

ERICSSON

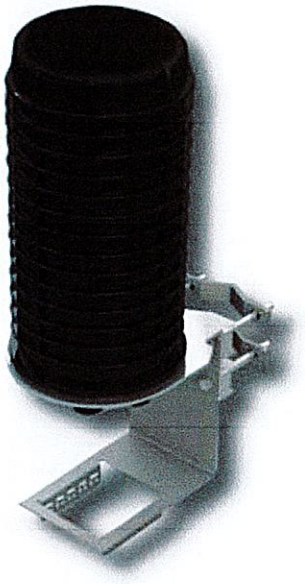
DC6-48-60-18-8F

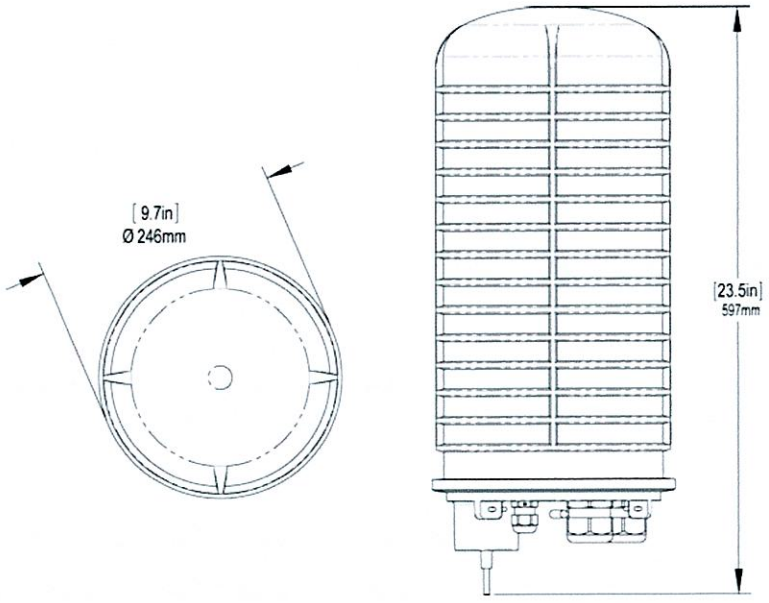
DC Surge Suppression Solution

The DC6-48-60-18 is a dual chambered, DC surge suppression system for use in multi-circuit, Distributed Antenna Systems. The system will protect up to 6 Remote Radio Heads from voltage surges and lightning, and connect up to 18 fiber pairs. The system is enclosed in a NEMA 4 rated, waterproof enclosure.

FEATURES

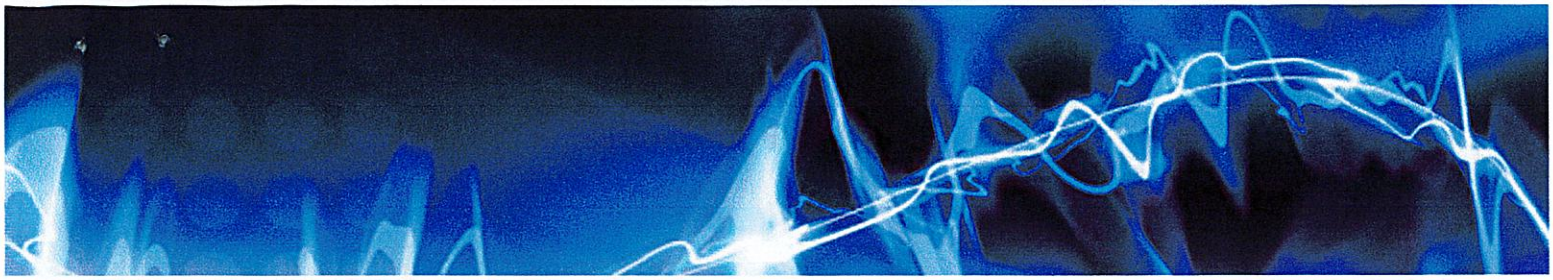
- Protects up to 6 Remote Radio Heads, each with its own protection circuit.
- Flexible design allows for installation at the top of a tower for Remote Radio Head protection.
- Includes fiber connections for up to 18 pairs of fiber.
- LED indicators on individual circuits provide visual indication of suppressor status.
- Form 'C' relays allow for remote monitoring of the suppressor status.
- Patented Strikesorb technology provides over 60 kA of surge current capacity per circuit.
- Strikesorb suppression modules are fully recognized to UL 1449-3rd Edition Safety Standard, meeting all intermediate and high current fault requirements to facilitate use in OEM applications.
- Raycap recommends that DC protection system be installed within 2 meters or 6 feet of the radio.
- Dome design is lightweight and aerodynamic providing maximum flexibility for installation on top of towers.





Raycap

Phone 208.777.1166 Toll Free 800.890.2569 Fax 208.777.4466 www.raycapsurgeprotection.com



DC6-48-60-18-8F

DC Power Surge Protection

Electrical Specifications	
Model Number	DC6-48-60-18-8F
Nominal Operating Voltage	48 VDC
Nominal Discharge Current (I_n)	20 kA 8/20 µs
Maximum Discharge Current (I_{max}) per NEMA LS-1	60 kA 8/20 µs
Maximum Continuous Operating Voltage (U_c)	75 VDC
Voltage Protection Rating	400 V

Mechanical Specifications	
Suppression Connection Method	Compression lug, #2-#14 AWG Copper, #2-#12 Aluminum
Fiber Connection Method	LC-LC Single mode duplex
Environmental Rating	IP 68, 7m 72hrs
Operating Temperature	-40° C to + 80° C
Storage Temperature	-70° C to + 80° C
Cold Temperature Cycling	IEC 61300-2-22e -30° C to + 60° C 200 hrs @ 5 psi
Resistance to Aggressive Materials	CEI IEC 61073-2 including acids and bases
UV Protection	ISO 4892-2 Method A Xenon-Arc 2160 hrs
Weight	20 lbs without Mounting Bracket

STANDARDS

Strikesorb modules are compliant to the following Surge Protection Device (SPD) Standards:

- ANSI/UL 1449 – 3rd Edition
- IEEE C62.41
- NEMA LS-1, IEC 61643-1:2005 2nd Edition:2005
- IEC 61643-12
- EN 61643-11:2002 (including A11:2007)

GS-07F-0435V

Certified to ISO 9001:2000

TÜV Rheinland of North America

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