

HPC Wireless Services
46 Mill Plain Rd.

Floor 2

Danbury, CT, 06811

P.: 203.797.1112



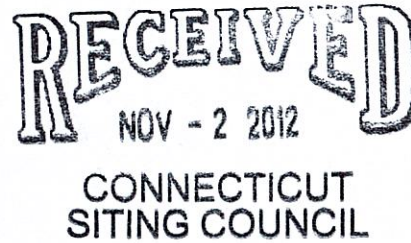
October 31, 2012

VIA OVERNIGHT DELIVERY

Connecticut Siting Council
10 Franklin Square
New Britain, Connecticut 06051

Attn: Ms. Linda Roberts, Executive Director

Re: New Cingular Wireless PCS, LLC – Exempt Modification
14 Canton Springs Road, Canton



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 14 Canton Springs Road, Canton, (coordinates 41°-49-22.39" N, 72°-53'-42.75" 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 relocate three (3) UMTS antennas, replace three (3) GSM antennas, add three (3) LTE panel antennas on existing mounts attached to the platform, and add one (1) surge arrester on an existing pipe mount attached to the platform and behind the LTE antennas, all at a centerline height of approximately 130'. Six (6) RRHS (remote radio units) will be added to existing pipe mounts also at a centerline height of approximately 130'. AT&T will also place DC power and fiber runs from the equipment to the antennas along the existing coaxial cable run.

Ms. Linda Roberts

October 31, 2012

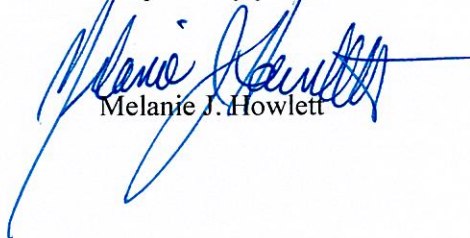
Page 2

These changes will not extend the height of the approximately 140' structure.

2. AT&T will place related equipment in the existing Equipment Shelter, and will also mount a new GPS antenna to 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 2.59%; the combined site operations will result in a total power density of approximately 46.65%.

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.

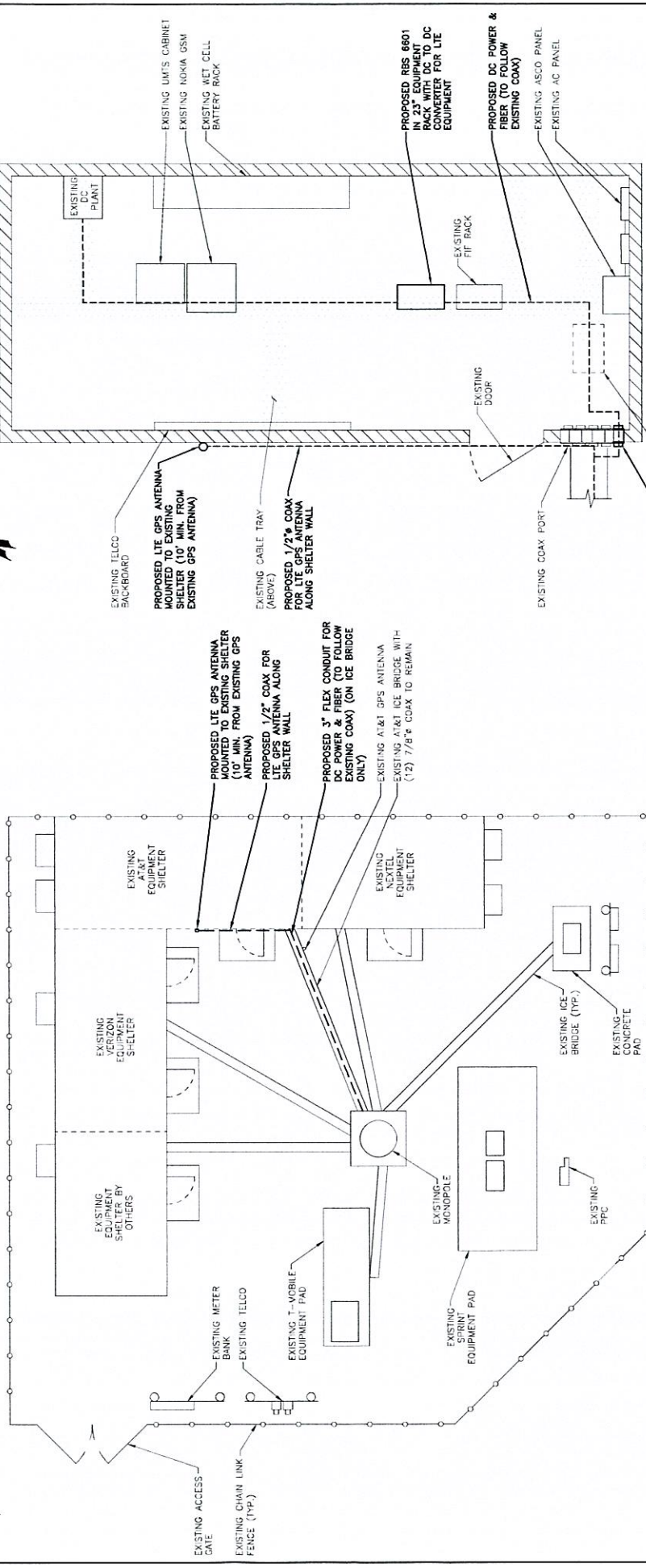
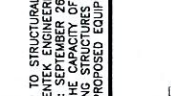
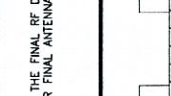
Respectfully yours,



Melanie J. Howlett

Attachments

cc: Honorable Richard Barlow, First Selectman, Town of Canton
Robert Skinner, Chief Administrative Officer, Town of Canton
Canton Fire Department (underlying property owner)



COMPOUND PLAN
SCALE: 3/16"=1'-0"

0 2'-8" 5'-4" 10'-8" 16'-0"

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

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

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

NOTE:
REFER TO STRUCTURAL ANALYSIS BY: CENTEK ENGINEERING, DATED: SEPTEMBER 26, 2012, FOR THE CAPACITY OF THE EXISTING SHELTER TO SUPPORT THE PROPOSED EQUIPMENT.

Hudson Design Group
1000 GOODRICH BLVD
BIRMINGHAM, AL 35203
TEL: 205-851-2222
FAX: 205-851-2222

NexLink
a United Global Services company
800 MARSHALL-PHELPS ROAD UNIT# 2A
WINSTON, CT 06093

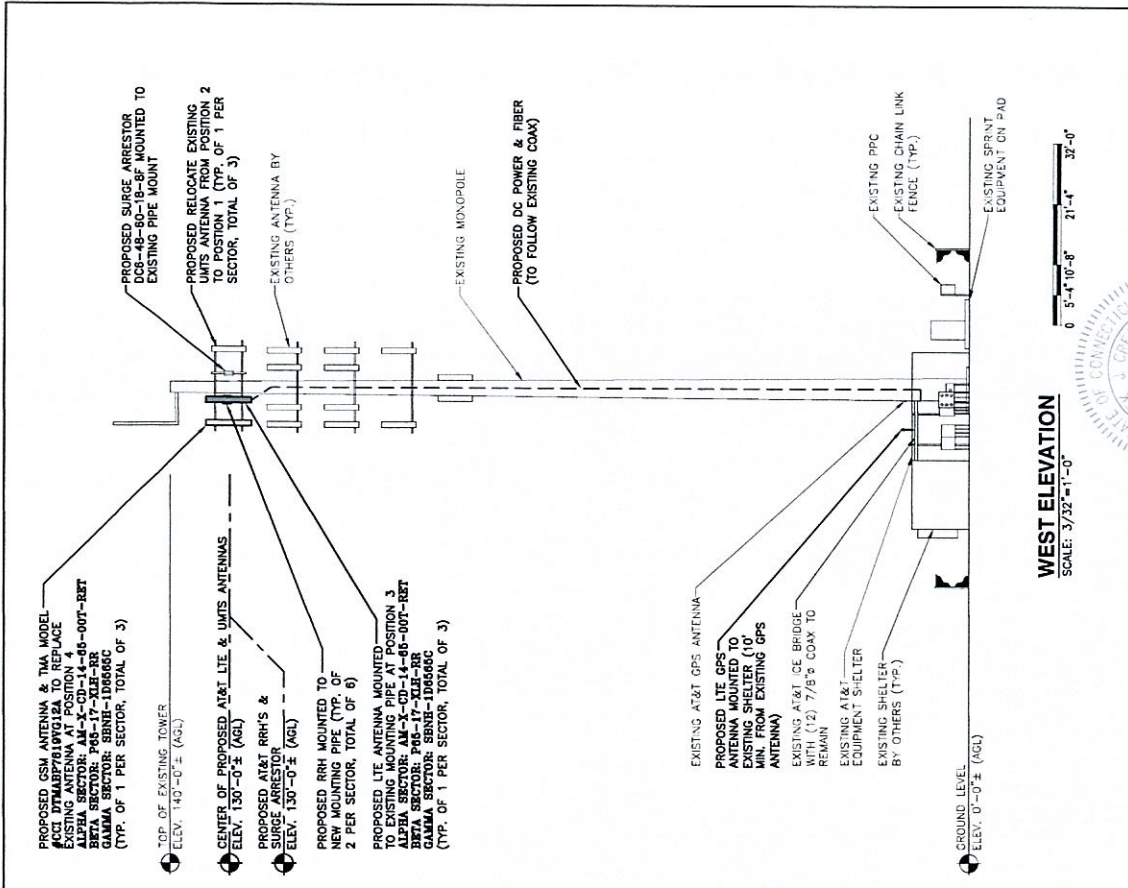
at&t
500 ENTERPRISE DRIVE, SUITE 3A
ROCKY HILL, CT 06067

SITE NUMBER: CT1022
SITE NAME: CANTON - FIRE DEPT
14 CANTON SPRINGS ROAD
CANTON, CT 06019
HARTFORD COUNTY

NO.	DATE	REVISIONS	BY	CHK	APP'D
1	10/24/12	ISSUED FOR PERMITTING	CS	DC	PHH
2	07/12/12	ISSUED FOR REVIEW	CS	DC	PHH

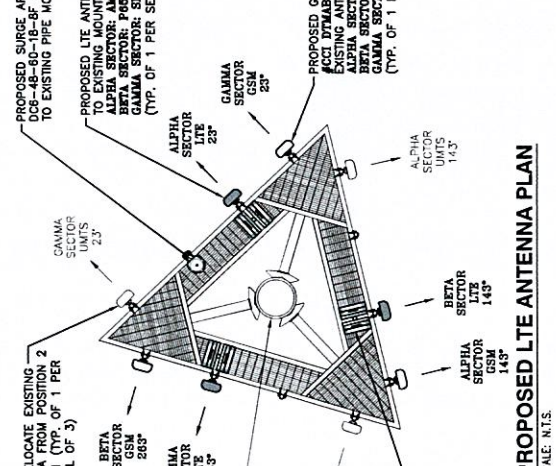
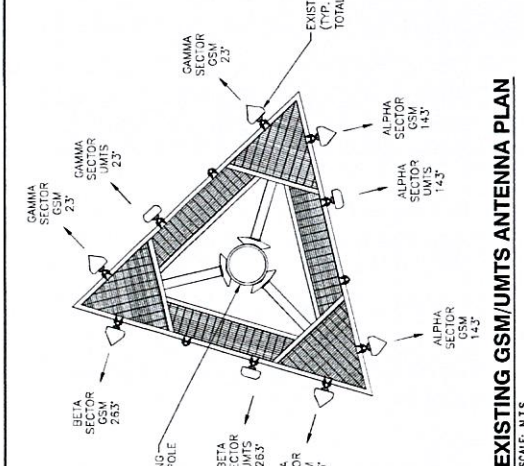
DESIGNED BY: DC
DRAWN BY: CS
SCALE: AS SHOWN

AT&T
COMPOUND PLAN & EQUIPMENT PLAN
(SITE)
SHEET NUMBER
1022.01
A-1
REV 1



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

NOTE:
REFER TO STRUCTURAL ANALYSIS
BY: CEMTEK ENGINEERING,
INC. MEMBER 261,112,
FOR THE CHAIN LINK FENCE
EXISTING STRUCTURES TO SUPPORT
THE PROPOSED EQUIPMENT.



140 DISCOURT
N. WINDSOR, CT 06095

at&t

500 ENTERPRISE DRIVE, SUITE 3A
ROCKY HILL, CT 06067

at&t

ANTENNA PLAN & ELEVATION
(LITE)

NO.	DATE	REVISIONS	BY	CHK	APP'D
1	10/24/12	ISSUED FOR PERMITTING	CS	CS	CS
2	07/12/12	ISSUED FOR REVIEW	CS	CS	CS

SCALE: AS SHOWN DESIGNED BY: DC DRAWN BY: CO

1022.01

REV. 1

A-2



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

Calculated Radio Frequency Emissions



CT1022

(Canton – Fire Dept)

14 Canton Springs Road, Canton, CT 06019

October 8, 2012

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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 14 Canton Springs Road in Canton, CT. The coordinates of the tower are 41° 49' 22.3" N, 72° 53' 42.6" W.

AT&T is proposing the following modifications:

- 1) Remove six dual-Band (850/1900 MHz) antennas;
- 2) Install three multi-band (700/850/1900/2100 MHz) antennas for their GSM/UMTS network (one per sector);
- 3) 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/cm²). 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:

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

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
<i>Cingular UMTS</i>	154	880	1	500	0.0076	0.5867	1.29%
<i>Cingular GSM</i>	154	880	2	296	0.0090	0.5867	1.53%
<i>Cingular GSM</i>	154	1900	1	427	0.0065	1.0000	0.65%
Verizon cellular	120	869	9	276	0.0620	0.5793	10.71%
Verizon PCS	120	1970	7	288	0.0503	1.0000	5.03%
Verizon AWS	120	2145	1	719	0.0180	1.0000	1.80%
Verizon LTE	120	698	2	722	0.0361	0.4653	7.75%
Pocket	83	2130	3	631	0.0988	1.0000	9.88%
Sprint	90	1962.5	11	844.54	0.0004	1.0000	0.04%
Canton FD	140	300	1	71	0.0013	0.2000	0.65%
Nextel	110	851	9	100	0.0267	0.5673	4.71%
T-Mobile	100	1935	8	121	0.0348	1.0000	3.48%
AT&T UMTS	130	880	2	565	0.0024	0.5867	0.41%
AT&T UMTS	130	1900	2	1077	0.0046	1.0000	0.46%
AT&T LTE	130	734	1	1615	0.0034	0.4893	0.70%
AT&T GSM	130	880	1	647	0.0014	0.5867	0.23%
AT&T GSM	130	1900	4	934	0.0079	1.0000	0.79%
						Total	46.65%

Table 1: Carrier Information^{1 2 3}

¹ The existing CSC filing for Cingular 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 Structural Analysis dated September 26, 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 **46.65% 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 8, 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 Exposure⁴

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 Exposure⁵

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.

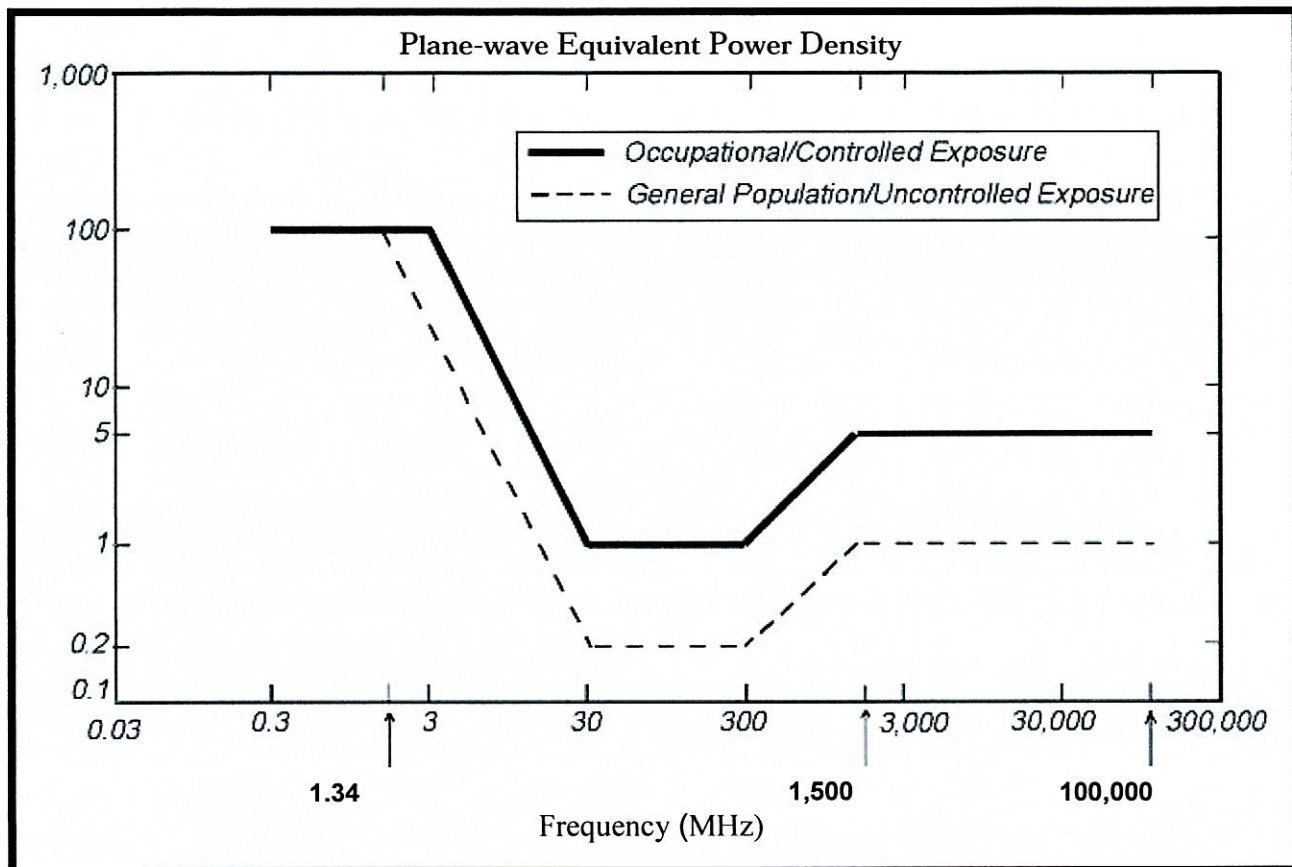
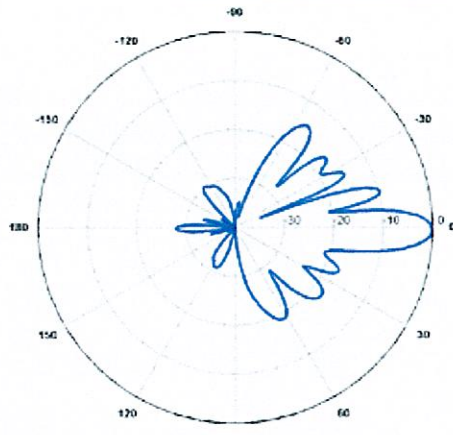
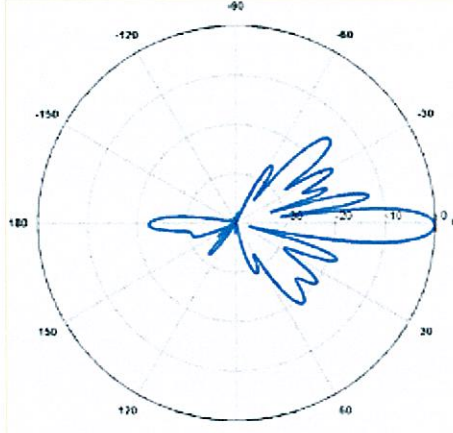
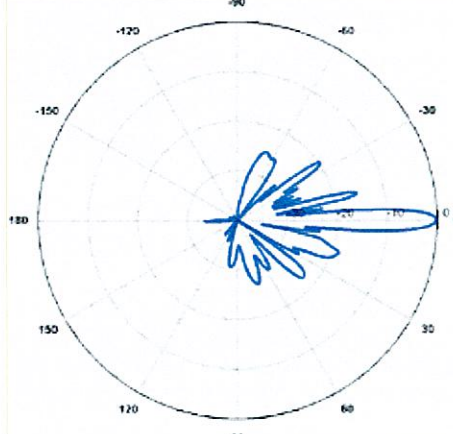


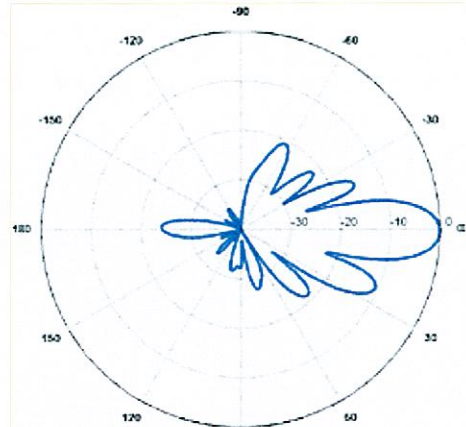
Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

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 $\pm 45^\circ$ Size L x W x D: 96.0" x 12.0" x 6.0"	
850 MHz GSM Manufacturer: Powerwave Model #: P65-17-XLH-RR Frequency Band: 806-894 MHz Gain: 15.1 dBd Vertical Beamwidth: 8.4° Horizontal Beamwidth: 63° Polarization: Dual Linear $\pm 45^\circ$ Size L x W x D: 96.0" x 12.0" x 6.0"	
1900 MHz GSM Manufacturer: Commscope Model #: SBNH-1D6565C Frequency Band: 1850-1990 MHz Gain: 15.9 dBd Vertical Beamwidth: 5.1° Horizontal Beamwidth: 57° Polarization: $\pm 45^\circ$ Size L x W x D: 96.42" x 11.85" x 7.1"	

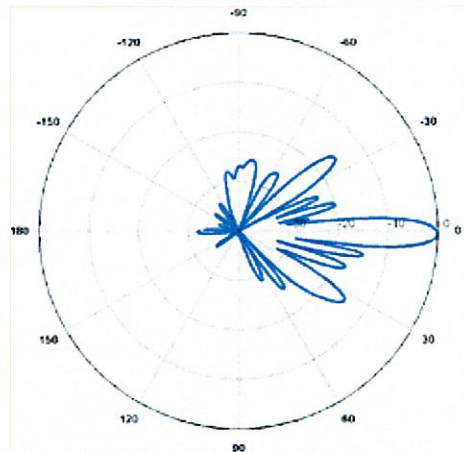
850 MHz UMTS

Manufacturer: Kathrein Scala
 Model #: 80010121
 Frequency Band: 824-896 MHz
 Gain: 11.5 dBd
 Vertical Beamwidth: 14.5°
 Horizontal Beamwidth: 86°
 Polarization: $\pm 45^\circ$
 Size L x W x D: 54.5" x 10.3" x 5.9"



1900 MHz UMTS

Manufacturer: Kathrein Scala
 Model #: 80010121
 Frequency Band: 1850-1990 MHz
 Gain: 14.3 dBd
 Vertical Beamwidth: 6.6°
 Horizontal Beamwidth: 85°
 Polarization: $\pm 45^\circ$
 Size L x W x D: 54.5" x 10.3" x 5.9"



Structural Analysis Report

140-ft Existing EEl Monopole

*Proposed AT&T Mobility
Antenna Upgrade*

AT&T Site Ref: CT1022

Verizon Site Ref: Canton

*14 Canton Springs Road
Canton, CT*

Centek Project No. 12044.CO8

Date: September 26, 2012



Prepared for:

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

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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 140-ft tall, four-section, eighteen sided, tapered monopole, originally designed and manufactured by EEI job no; 4960, dated May 13, 1999. The tower geometry, structure member sizes and foundation system information were obtained from a previous structural report prepared by Centek Engineering job no. 11074.CO28 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 four (4) 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 18.00-in at the top and 51.00-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 arrester 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:

- TOWN (Existing):
Antennas: One (1) 20-ft x 2" dia. Omni-directional whip antenna mounted on a 4-ft side arm with an elevation of 138-ft above exiting grade.
Coax Cables: Two (2) 7/8" $\varnothing$ coax cables running on the inside of the existing monopole.
- 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, three (3) RRH's one (1) GPS antenna mounted to a 13-ft platform w/ handrails with a RAD center elevation of 120-ft above grade.
Coax Cables: Twelve (12) 1-5/8" $\varnothing$ and one (1) 1/2" $\varnothing$ coax cables running on the inside of the existing tower. Six (6) 1-5/8" $\varnothing$ coax cables and one (1) 1-1/4" $\varnothing$ fiber cable banded to the exterior of the existing tower.
- NEXTEL (Existing):
Antennas: Twelve (12) Andrew DB844H90E-XY panel antennas and two (2) LMU's mounted on a 13-ft platform w/ handrails with a RAD center elevation of 112-ft above exiting grade.
Coax Cables: Twelve (12) 1-1/4" $\varnothing$ and two (2) 1/2" $\varnothing$ coax cables running on the inside of the existing monopole.

- T-MOBILE (Existing):
Antennas: Four (4) EMS RR90-17-02DP panel antennas mounted on a 14-ft low profile platform with a RAD center elevation of 100-ft above exiting grade.
Coax Cables: Eight (8) 1-5/8" Ø coax cables running on the inside of the existing monopole.
- SPRINT (Existing):
Antennas: Four (4) Andrew DB980F90T2E-M and two (2) Andrew DB978F30T2E-M panel antennas mounted on a 14-ft low profile platform with a RAD center elevation of 91-ft above exiting grade.
Coax Cables: Six (6) 1-1/4" Ø coax cables running on the inside of the existing monopole.
- METROPCS (Existing):
Antennas: Three (3) RFS APXV18-206517S panel antennas flush mounted with a RAD center elevation of 83-ft above exiting grade.
Coax Cables: Six (6) 1-5/8" Ø coax cables running on the inside of the existing monopole.
- AT&T (Existing):
Antennas: Six (6) CSS DUO1417-8686 panel antennas, three (3) Kathrein 800-10121 panel antennas, six (6) Cleargain 1900/800 TMA's, three (3) CSS combiners, three (3) Kathrein 782-10250 combiners and three (3) Kathrein Smart Bias-T mounted on a 13-ft platform w/ handrails with a RAD center elevation of 130-ft above exiting grade.
Coax Cables: Twelve (12) 7/8" Ø coax cables running on the inside of the existing monopole.
- AT&T (PROPOSED):
Antennas: One (1) KMW AM-X-CD-14-65-00T-RET panel antenna, one (1) Powerwave P65-17-XLH-RR panel antenna, one (1) Andrew SBNH-1D6565C panel antenna, six (6) Ericsson RRUS-11, one (1) Raycap DC6-48-60-18-8F surge arrester and one (1) Andrew ABT-DFDM-ADBH Bias Tee mounted on a 13-ft platform w/ handrails with a RAD center elevation of 130-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.

A n a l y s i s

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 CSBC¹ 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.

T o w e r L o a d i n g

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]
	<i>TIA/EIA-222-F wind speed controls.</i>	
Load Cases:	<u>Load Case 1</u> ; 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]
	<u>Load Case 2</u> ; 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]
	<u>Load Case 3</u> ; 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 **69.1%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L3)	40.26'-79.83'	69.1%	PASS

Foundation and Anchors

The existing foundation consists of a 6.5-ft Ø x 4.5-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 (20) 2.25"Ø, ASTM A615-75 anchor bolts embedded approximately 5-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	28 kips
	Compression	40 kips
	Moment	2853 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	2.16	PASS

Note 1: FS denotes Factor of Safety.

Note 2: OTM denotes Overturning Moment

CENTER Engineering, Inc.
Structural Analysis - 140-ft EEI Monopole
AT&T Antenna Upgrade – CT1022
Canton, CT
September 26, 2012

- 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	59.6%	PASS
Base Plate	Bending	70.5%	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

Prepared by:



Timothy J. Lynn, EIT
Structural Engineer

CEN TEK Engineering, Inc.
Structural Analysis - 140-ft EEI Monopole
AT&T Antenna Upgrade – CT1022
Canton, CT
September 26, 2012

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.

CEN TEK Engineering, Inc.
Structural Analysis - 140-ft EEI Monopole
AT&T Antenna Upgrade – CT1022
Canton, CT
September 26, 2012

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	4	
Length (ft)	24.64	39.06	44.16	45.54	
Number of Sides	18	18	18	18	
Thickness (in)	0.1875	0.3125	0.4375	0.5000	
Socket Length (ft)	3.53	4.59	5.28		
Top Dia (in)	18.0000	22.8814	30.9366	39.7436	
Bot Dia (in)	24.2521	32.7041	41.9334	51.0000	
Grade			A572-65		
Weight (K)	1.0	3.6	7.5	11.0	23.2

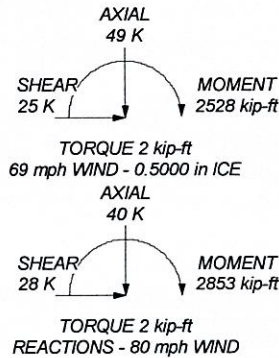
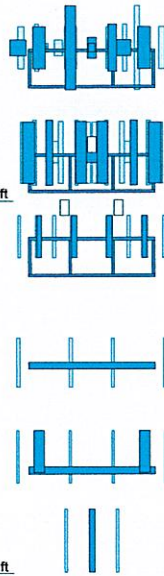
140.0 ft

115.4 ft

79.8 ft

40.3 ft

0.0 ft



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
20' x 2" Dia Omni (Town - Existing)	148	LPA-171063-12CF (Verizon - Reserved)	120
4' Side Mount Standoff (Town - Existing)	138	BXA-70063/6CF (Verizon - Reserved)	120
(2) DUO1417-8686 (ATI - Existing)	130	BXA-70063/6CF (Verizon - Reserved)	120
800 10121 (ATI - Existing)	130	LPA-171063-12CF (Verizon - Reserved)	120
(2) CG 1900/800-DB-FB TMA (ATI - Existing)	130	LPA-80063/6CF (Verizon - Reserved)	120
Combiner (ATI - Existing)	130	LPA-80063/6CF (Verizon - Reserved)	120
Smart Bias T (ATI - Existing)	130	LPA-171063-12CF (Verizon - Reserved)	120
782 10250 (ATI - Existing)	130	BXA-70063/6CF (Verizon - Reserved)	120
(2) DUO1417-8686 (ATI - Existing)	130	BXA-70063/6CF (Verizon - Reserved)	120
800 10121 (ATI - Existing)	130	LPA-171063-12CF (Verizon - Reserved)	120
(2) CG 1900/800-DB-FB TMA (ATI - Existing)	130	LPA-80063/6CF (Verizon - Reserved)	120
Combiner (ATI - Existing)	130	RRH (Verizon - Reserved)	120
Smart Bias T (ATI - Existing)	130	RRH (Verizon - Reserved)	120
782 10250 (ATI - Existing)	130	RRH (Verizon - Reserved)	120
(2) DUO1417-8686 (ATI - Existing)	130	GPS (Verizon - Existing)	120
800 10121 (ATI - Existing)	130	13' Platform w/rails (Verizon - Existing)	118
(2) CG 1900/800-DB-FB TMA (ATI - Existing)	130	LMU (Nexel - Existing)	114
Combiner (ATI - Existing)	130	LMU (Nexel - Existing)	114
Smart Bias T (ATI - Existing)	130	(4) DB844H90E-XY (Nexel - Existing)	112
782 10250 (ATI - Existing)	130	(4) DB844H90E-XY (Nexel - Existing)	112
AM-X-CD-14-65-00T-RET (ATI - Proposed)	130	13' Platform w/rails (Nexel - Existing)	110
P65-17-XLH-RR (ATI - Proposed)	130	14-ft Low Profile Platform (T-Mobile - Existing)	100
SBNH-1D6565C (ATI - Proposed)	130	(2) RR90-17-02DP (T-Mobile - Existing)	100
(2) RRUS-11 (ATI - Proposed)	130	(2) RR90-17-02DP (T-Mobile - Existing)	100
(2) RRUS-11 (ATI - Proposed)	130	(2) DB978F30T2E-M (Sprint - Existing)	91.5
(2) RRUS-11 (ATI - Proposed)	130	(2) DB980F90T2E-M (Sprint - Existing)	91
DC6-48-60-18-8F Surge Arrestor (ATI - Proposed)	130	(2) DB980F90T2E-M (Sprint - Existing)	91
13' Platform w/rails (ATI - Existing)	128	14-ft Low Profile Platform (Sprint - Existing)	90
LPA-80063/6CF (Verizon - Reserved)	120	Uni-Tri Bracket (MetroPCS - Existing)	83
LPA-171063-12CF (Verizon - Reserved)	120	APXV18-206517S (MetroPCS - Existing)	83
BXA-70063/6CF (Verizon - Reserved)	120	APXV18-206517S (MetroPCS - Existing)	83
BXA-70063/6CF (Verizon - Reserved)	120	APXV18-206517S (MetroPCS - Existing)	83
LPA-171063-12CF (Verizon - Reserved)	120		
LPA-80063/6CF (Verizon - Reserved)	120		
LPA-80063/6CF (Verizon - Reserved)	120		

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 members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
5. Welds are fabricated with ER-70S-6 electrodes.
6. TOWER RATING: 69.1%

Centek Engineering Inc.

63-2 North Branford Rd.

Branford, CT 06405

Phone: (203) 488-0580

FAX: (203) 488-8587

Job: 12044.CO8 - CT1022

Project: 140' EEI Monopole - 14 Canton Springs Rd, Canton, CT

Client: AT&T Mobility

Drawn by: T.JL

App'd:

Code: TIA/EIA-222-F

Date: 09/26/12

Scale: NTS

Path:

J:\Jobs\1204400\WCD8 - AT&T CT1022\Calcs\EBR Files\140 EEI Monopole Canton.ctb

Dwg No. E-1

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12044.CO8 - CT1022	Page	1 of 22
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	Client	AT&T Mobility	Designed by	TJL

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.

Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..

Welds are fabricated with ER-70S-6 electrodes..

A non-linear (P-delta) analysis was used.

Pressures are calculated at each section.

Stress ratio used in pole design is 1.333.

Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	140.00-115.36	24.64	3.53	18	18.0000	24.2521	0.1875	0.7500	A572-65 (65 ksi)
L2	115.36-79.83	39.06	4.59	18	22.9814	32.7041	0.3125	1.2500	A572-65 (65 ksi)
L3	79.83-40.26	44.16	5.28	18	30.9366	41.9334	0.4375	1.7500	A572-65 (65 ksi)
L4	40.26-0.00	45.54		18	39.7436	51.0000	0.5000	2.0000	A572-65 (65 ksi)

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12044.CO8 - CT1022	Page 2 of 22
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	Client	AT&T Mobility	Designed by TJL

Tapered Pole Properties

Section	Tip Dia. in	Area in ²	I in ⁴	r in	C in	I/C in ³	J in ⁴	Iu/Q in ³	w in	w/t
L1	18.2777	10.6007	424.9328	6.3234	9.1440	46.4712	850.4248	5.3013	2.8380	15.136
	24.6262	14.3214	1047.8077	8.5429	12.3201	85.0489	2096.9941	7.1621	3.9384	21.005
L2	24.2282	22.4847	1459.7753	8.0475	11.6746	125.0391	2921.4715	11.2445	3.4947	11.183
	33.2086	32.1284	4258.8427	11.4990	16.6137	256.3455	8523.2892	16.0673	5.2059	16.659
L3	32.5745	42.3518	4977.1676	10.8272	15.7158	316.6988	9960.8842	21.1799	4.6748	10.685
	42.5803	57.6222	12535.3942	14.7310	21.3022	588.4563	25087.2828	28.8166	6.6103	15.109
L4	41.6819	62.2795	12117.6844	13.9315	20.1897	600.1905	24251.3135	31.1457	6.1149	12.23
	51.7868	80.1435	25821.9188	17.9275	25.9080	996.6774	51677.8148	40.0794	8.0960	16.192

Tower Elevation	Gusset Area (per face)	Gusset Thickness	Gusset Grade	Adjust. Factor A _f	Adjust. Factor A _r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontal in
ft	ft ²	in						
L1 140.00-115.36				1	1	1		
L2 115.36-79.83				1	1	1		
L3 79.83-40.26				1	1	1		
L4 40.26-0.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C _A A _A ft ² /ft	Weight plf
7/8 (Town - Existing)	A	No	Inside Pole	140.00 - 3.00	2	No Ice	0.00	0.54
7/8 (AT&T - Existing)	A	No	Inside Pole	130.00 - 3.00	12	1/2" Ice	0.00	0.54
1 5/8 (Verizon - Existing)	B	No	Inside Pole	120.00 - 3.00	12	No Ice	0.00	1.04
1/2 (Verizon - Existing)	B	No	Inside Pole	120.00 - 3.00	1	1/2" Ice	0.00	0.25
1 1/4 (Nextel - Existing)	C	No	Inside Pole	110.00 - 3.00	12	No Ice	0.00	0.66
1/2 (Nextel - Existing)	C	No	Inside Pole	110.00 - 3.00	2	1/2" Ice	0.00	0.25
1 5/8 (T-Mobile - Existing)	A	No	Inside Pole	100.00 - 3.00	8	No Ice	0.00	1.04
1 1/4 (Sprint - Existing)	B	No	Inside Pole	90.00 - 3.00	6	1/2" Ice	0.00	0.66
1 5/8 (MetroPCS - Existing)	C	No	Inside Pole	83.00 - 3.00	6	No Ice	0.00	1.04
1 5/8 (Verizon - Existing)	B	No	CaAa (Out Of Face)	120.00 - 3.00	1	No Ice	0.20	1.04
1 5/8 (Verizon - Existing)	B	No	CaAa (Out Of Face)	120.00 - 3.00	5	No Ice	0.30	2.55
HYBRIFLEX 1-1/4" (Verizon - Reserved)	C	No	CaAa (Out Of Face)	120.00 - 3.00	1	No Ice	0.00	1.04
RG6-Fiber (AT&T - Proposed)	C	No	CaAa (Out Of Face)	130.00 - 3.00	1	No Ice	0.15	2.55
						1/2" Ice	0.05	1.00
						1/2" Ice	0.15	1.61

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12044.CO8 - CT1022	Page	3 of 22
	Project	140' EEI Monopole - 14 Canton Springs Rd, Canton, CT	Date	11:11:54 09/26/12
	Client	AT&T Mobility	Designed by	TJL

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number	C _{AA}	Weight
#8 AWG Copper Wire (AT&T - Proposed)	C	No	CaAa (Out Of Face)	130.00 - 3.00	2	No Ice	0.01
						1/2" Ice	0.11
							plf
							0.05
							0.43

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A _R ft ²	A _F ft ²	C _{AA} In Face ft ²	C _{AA} Out Face ft ²	Weight K
L1	140.00-115.36	A	0.000	0.000	0.000	0.000	0.12
		B	0.000	0.000	0.000	0.919	0.09
		C	0.000	0.000	0.000	1.823	0.02
L2	115.36-79.83	A	0.000	0.000	0.000	0.000	0.44
		B	0.000	0.000	0.000	7.035	0.71
		C	0.000	0.000	0.000	8.161	0.36
L3	79.83-40.26	A	0.000	0.000	0.000	0.000	0.63
		B	0.000	0.000	0.000	7.835	0.91
		C	0.000	0.000	0.000	9.089	0.68
L4	40.26-0.00	A	0.000	0.000	0.000	0.000	0.59
		B	0.000	0.000	0.000	7.377	0.85
		C	0.000	0.000	0.000	8.558	0.64

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} In Face ft ²	C _{AA} Out Face ft ²	Weight K
L1	140.00-115.36	A	0.500	0.000	0.000	0.000	0.000	0.12
		B		0.000	0.000	0.000	1.383	0.13
		C		0.000	0.000	0.000	6.679	0.05
L2	115.36-79.83	A	0.500	0.000	0.000	0.000	0.000	0.44
		B		0.000	0.000	0.000	10.588	1.04
		C		0.000	0.000	0.000	22.373	0.45
L3	79.83-40.26	A	0.500	0.000	0.000	0.000	0.000	0.63
		B		0.000	0.000	0.000	11.792	1.27
		C		0.000	0.000	0.000	24.917	0.78
L4	40.26-0.00	A	0.500	0.000	0.000	0.000	0.000	0.59
		B		0.000	0.000	0.000	11.103	1.19
		C		0.000	0.000	0.000	23.463	0.73

Feed Line Center of Pressure

Section	Elevation ft	CP _X in	CP _Z in	CP _X Ice in	CP _Z Ice in
L1	140.00-115.36	-0.0469	0.0860	-0.2395	0.2147
L2	115.36-79.83	-0.0349	0.2715	-0.3015	0.4869
L3	79.83-40.26	-0.0362	0.2817	-0.3245	0.5240
L4	40.26-0.00	-0.0343	0.2669	-0.3176	0.5128

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	Client	AT&T Mobility	Designed by TJL

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _A A _A Front ft ²	C _A A _A Side ft ²	Weight K
4' Side Mount Standoff (Town - Existing)	C	From Face	2.00 0.00 0.00	0.0000	138.00	No Ice 1/2" Ice	2.72 4.91	2.72 4.91	0.05 0.09
20' x 2" Dia Omni (Town - Existing)	C	From Face	4.00 0.00 0.00	0.0000	148.00	No Ice 1/2" Ice	4.00 6.03	4.00 6.03	0.02 0.05
13' Platform w/rails (AT&T - Existing)	C	None		0.0000	128.00	No Ice 1/2" Ice	31.30 40.20	31.30 40.20	1.82 2.45
(2) DUO1417-8686 (AT&T - Existing)	A	From Face	4.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	6.53 6.94	4.20 4.57	0.02 0.06
800 10121 (AT&T - Existing)	A	From Face	4.00 -2.00 0.00	0.0000	130.00	No Ice 1/2" Ice	5.46 5.88	3.29 3.64	0.05 0.08
(2) CG 1900/800-DB-FB TMA (AT&T - Existing)	A	From Face	4.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	1.55 1.72	0.81 0.94	0.02 0.03
Combiner (AT&T - Existing)	A	From Face	4.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	0.68 0.80	0.19 0.28	0.00 0.00
Smart Bias T (AT&T - Existing)	A	From Face	4.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	0.16 0.21	0.08 0.12	0.00 0.00
782 10250 (AT&T - Existing)	A	From Face	4.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	0.52 0.63	0.27 0.36	0.01 0.01
(2) DUO1417-8686 (AT&T - Existing)	B	From Face	4.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	6.53 6.94	4.20 4.57	0.02 0.06
800 10121 (AT&T - Existing)	B	From Face	4.00 -2.00 0.00	0.0000	130.00	No Ice 1/2" Ice	5.46 5.88	3.29 3.64	0.05 0.08
(2) CG 1900/800-DB-FB TMA (AT&T - Existing)	B	From Face	4.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	1.55 1.72	0.81 0.94	0.02 0.03
Combiner (AT&T - Existing)	B	From Face	4.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	0.68 0.80	0.19 0.28	0.00 0.00
Smart Bias T (AT&T - Existing)	B	From Face	4.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	0.16 0.21	0.08 0.12	0.00 0.00
782 10250 (AT&T - Existing)	B	From Face	4.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	0.52 0.63	0.27 0.36	0.01 0.01
(2) DUO1417-8686 (AT&T - Existing)	C	From Face	4.00 0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	6.53 6.94	4.20 4.57	0.02 0.06
800 10121 (AT&T - Existing)	C	From Face	4.00 -2.00 0.00	0.0000	130.00	No Ice 1/2" Ice	5.46 5.88	3.29 3.64	0.05 0.08
(2) CG 1900/800-DB-FB TMA	C	From Face	4.00 0.00	0.0000	130.00	No Ice 1/2" Ice	1.55 1.72	0.81 0.94	0.02 0.03

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12044.CO8 - CT1022	Page	5 of 22
	Project	140' EEI Monopole - 14 Canton Springs Rd, Canton, CT	Date	11:11:54 09/26/12
	Client	AT&T Mobility	Designed by	TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _A A _A Front ft ²	C _A A _A Side ft ²	Weight K
(AT&T - Existing)			0.00						
Combiner	C	From Face	4.00	0.0000	130.00	No Ice	0.68	0.19	0.00
(AT&T - Existing)			0.00			1/2" Ice	0.80	0.28	0.00
			0.00						
Smart Bias T	C	From Face	4.00	0.0000	130.00	No Ice	0.16	0.08	0.00
(AT&T - Existing)			0.00			1/2" Ice	0.21	0.12	0.00
			0.00						
782 10250	C	From Face	4.00	0.0000	130.00	No Ice	0.52	0.27	0.01
(AT&T - Existing)			0.00			1/2" Ice	0.63	0.36	0.01
			0.00						
AM-X-CD-14-65-00T-RET	A	From Face	3.00	0.0000	130.00	No Ice	5.51	2.83	0.04
(AT&T - Proposed)			2.00			1/2" Ice	5.90	3.14	0.07
			0.00						
P65-17-XLH-RR	B	From Face	3.00	0.0000	130.00	No Ice	11.47	6.80	0.06
(AT&T - Proposed)			2.00			1/2" Ice	12.08	7.38	0.12
			0.00						
SBNH-1D6565C	C	From Face	3.00	0.0000	130.00	No Ice	11.41	7.70	0.06
(AT&T - Proposed)			2.00			1/2" Ice	12.03	8.29	0.13
			0.00						
(2) RRUS-11	A	From Face	1.00	0.0000	130.00	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	130.00	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	130.00	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	130.00	No Ice	2.23	2.23	0.02
Arrestor			0.00			1/2" Ice	2.45	2.45	0.04
			0.00						
(AT&T - Proposed)									
13' Platform w/rails	C	None		0.0000	118.00	No Ice	31.30	31.30	1.82
(Verizon - Existing)						1/2" Ice	40.20	40.20	2.45
LPA-80063/6CF	A	From Face	3.00	0.0000	120.00	No Ice	10.31	9.01	0.03
(Verizon - Reserved)			6.00			1/2" Ice	10.87	9.55	0.10
			0.00						
LPA-171063-12CF	A	From Face	3.00	0.0000	120.00	No Ice	5.99	6.05	0.01
(Verizon - Reserved)			4.00			1/2" Ice	6.46	6.52	0.06
			0.00						
BXA-70063/6CF	A	From Face	3.00	0.0000	120.00	No Ice	7.73	4.16	0.02
(Verizon - Reserved)			1.00			1/2" Ice	8.27	4.60	0.06
			0.00						
BXA-70063/6CF	A	From Face	3.00	0.0000	120.00	No Ice	7.73	4.16	0.02
(Verizon - Reserved)			-1.00			1/2" Ice	8.27	4.60	0.06
			0.00						
LPA-171063-12CF	A	From Face	3.00	0.0000	120.00	No Ice	5.99	6.05	0.01
(Verizon - Reserved)			-4.00			1/2" Ice	6.46	6.52	0.06
			0.00						
LPA-80063/6CF	A	From Face	3.00	0.0000	120.00	No Ice	10.31	9.01	0.03
(Verizon - Reserved)			-6.00			1/2" Ice	10.87	9.55	0.10
			0.00						
LPA-80063/6CF	B	From Face	3.00	0.0000	120.00	No Ice	10.31	9.01	0.03
(Verizon - Reserved)			6.00			1/2" Ice	10.87	9.55	0.10
			0.00						
LPA-171063-12CF	B	From Face	3.00	0.0000	120.00	No Ice	5.99	6.05	0.01
(Verizon - Reserved)			4.00			1/2" Ice	6.46	6.52	0.06
			0.00						

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12044.CO8 - CT1022	Page 6 of 22
	Project	140' EEI Monopole - 14 Canton Springs Rd, Canton, CT	Date 11:11:54 09/26/12
	Client	AT&T Mobility	Designed by TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _{MA} Front ft ²	C _{MA} Side ft ²	Weight K
BXA-70063/6CF (Verizon - Reserved)	B	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)	B	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)	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
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-80063/6CF (Verizon - Reserved)	C	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)	C	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)	C	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)	C	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)	C	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)	C	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
RRH (Verizon - Reserved)	A	From Face	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.92 3.16	2.19 2.41	0.05 0.07
RRH (Verizon - Reserved)	B	From Face	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.92 3.16	2.19 2.41	0.05 0.07
RRH (Verizon - Reserved)	C	From Face	3.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	2.92 3.16	2.19 2.41	0.05 0.07
GPS (Verizon - Existing)	C	From Face	2.00 0.00 0.00	0.0000	120.00	No Ice 1/2" Ice	1.00 1.50	1.00 1.50	0.01 0.01
13' Platform w/rails (Nextel - Existing)	C	None		0.0000	110.00	No Ice 1/2" Ice	31.30 40.20	31.30 40.20	1.82 2.45
LMU (Nextel - Existing)	A	From Face	2.00 0.00 0.00	0.0000	114.00	No Ice 1/2" Ice	1.00 1.50	1.00 1.50	0.01 0.01
LMU (Nextel - Existing)	B	From Face	2.00 0.00 0.00	0.0000	114.00	No Ice 1/2" Ice	1.00 1.50	1.00 1.50	0.01 0.01
(4) DB844H90E-XY (Nextel - Existing)	A	From Face	4.00 0.00 0.00	0.0000	112.00	No Ice 1/2" Ice	2.87 3.18	3.73 4.10	0.01 0.04
(4) DB844H90E-XY (Nextel - Existing)	B	From Face	4.00 0.00 0.00	0.0000	112.00	No Ice 1/2" Ice	2.87 3.18	3.73 4.10	0.01 0.04
(4) DB844H90E-XY	C	From Face	4.00	0.0000	112.00	No Ice	2.87	3.73	0.01

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	Project	140' EEI Monopole - 14 Canton Springs Rd, Canton, CT	Date	11:11:54 09/26/12
	Client	AT&T Mobility	Designed by	TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
(Nextel - Existing)			0.00 0.00		1/2" Ice	3.18	4.10	0.04
14-ft Low Profile Platform	C	None		0.0000	100.00	No Ice	16.50	1.55
(T-Mobile - Existing)						1/2" Ice	20.00	1.80
(2) RR90-17-02DP	A	From Face	4.00	0.0000	100.00	No Ice	4.36	0.02
(T-Mobile - Existing)			0.00			1/2" Ice	4.77	0.04
			0.00					
(2) RR90-17-02DP	B	From Face	4.00	0.0000	100.00	No Ice	4.36	0.02
(T-Mobile - Existing)			0.00			1/2" Ice	4.77	0.04
			0.00					
14-ft Low Profile Platform	C	None		0.0000	90.00	No Ice	16.50	1.55
(Sprint - Existing)						1/2" Ice	20.00	1.80
(2) DB980F90T2E-M	A	From Face	4.00	0.0000	91.00	No Ice	3.90	0.01
(Sprint - Existing)			0.00			1/2" Ice	4.28	0.03
			0.00					
(2) DB980F90T2E-M	B	From Face	4.00	0.0000	91.00	No Ice	3.90	0.01
(Sprint - Existing)			0.00			1/2" Ice	4.28	0.03
			0.00					
(2) DB978F30T2E-M	C	From Face	4.00	0.0000	91.50	No Ice	5.60	0.02
(Sprint - Existing)			0.00			1/2" Ice	5.99	0.05
			0.00					
Uni-Tri Bracket	C	None		0.0000	83.00	No Ice	1.75	0.00
(MetroPCS - Existing)						1/2" Ice	1.94	0.00
APXV18-206517S	A	From Face	1.50	0.0000	83.00	No Ice	5.17	0.03
(MetroPCS - Existing)			0.00			1/2" Ice	5.62	0.05
			0.00					
APXV18-206517S	B	From Face	1.50	0.0000	83.00	No Ice	5.17	0.03
(MetroPCS - Existing)			0.00			1/2" Ice	5.62	0.05
			0.00					
APXV18-206517S	C	From Face	1.50	0.0000	83.00	No Ice	5.17	0.03
(MetroPCS - Existing)			0.00			1/2" Ice	5.62	0.05
			0.00					

Tower Pressures - No Ice

$$G_H = 1.690$$

Section Elevation	z	K _Z	q _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _{MA} In Face ft ²	C _{MA} Out Face ft ²
ft	ft		psf	ft ²		ft ²	ft ²	ft ²			
L1 140.00-115.36	127.07	1.47	24	43.379	A	0.000	43.379	43.379	100.00	0.000	0.000
					B	0.000	43.379		100.00	0.000	0.919
					C	0.000	43.379		100.00	0.000	1.823
L2 115.36-79.83	96.90	1.36	22	83.739	A	0.000	83.739	83.739	100.00	0.000	0.000
					B	0.000	83.739		100.00	0.000	7.035
					C	0.000	83.739		100.00	0.000	8.161
L3 79.83-40.26	59.64	1.184	19	122.029	A	0.000	122.029	122.029	100.00	0.000	0.000
					B	0.000	122.029		100.00	0.000	7.835
					C	0.000	122.029		100.00	0.000	9.089

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	Project	140' EEI Monopole - 14 Canton Springs Rd, Canton, CT	Date	11:11:54 09/26/12
	Client	AT&T Mobility	Designed by	TJL

Section Elevation	z	K _Z	q _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face	C _A A _A Out Face
ft	ft		psf	ft ²	e	ft ²	ft ²	ft ²		ft ²	ft ²
L4 40.26-0.00	19.40	1	16	154.412	A	0.000	154.412	154.412	100.00	0.000	0.000
					B	0.000	154.412		100.00	0.000	7.377
					C	0.000	154.412		100.00	0.000	8.558

Tower Pressure - With Ice

$$G_H = 1.690$$

Section Elevation	z	K _Z	q _z	t _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face	C _A A _A Out Face
ft	ft		psf	in	ft ²	e	ft ²	ft ²	ft ²		ft ²	ft ²
L1 140.00-115.36	127.07	1.47	18	0.5000	45.432	A	0.000	45.432	45.432	100.00	0.000	0.000
						B	0.000	45.432		100.00	0.000	1.383
						C	0.000	45.432		100.00	0.000	6.679
L2 115.36-79.83	96.90	1.36	17	0.5000	86.699	A	0.000	86.699	86.699	100.00	0.000	0.000
						B	0.000	86.699		100.00	0.000	10.588
						C	0.000	86.699		100.00	0.000	22.373
L3 79.83-40.26	59.64	1.184	14	0.5000	125.326	A	0.000	125.326	125.326	100.00	0.000	0.000
						B	0.000	125.326		100.00	0.000	11.792
						C	0.000	125.326		100.00	0.000	24.917
L4 40.26-0.00	19.40	1	12	0.5000	157.767	A	0.000	157.767	157.767	100.00	0.000	0.000
						B	0.000	157.767		100.00	0.000	11.103
						C	0.000	157.767		100.00	0.000	23.463

Tower Pressure - Service

$$G_H = 1.690$$

Section Elevation	z	K _Z	q _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face	C _A A _A Out Face
ft	ft		psf	ft ²	e	ft ²	ft ²	ft ²		ft ²	ft ²
L1 140.00-115.36	127.07	1.47	9	43.379	A	0.000	43.379	43.379	100.00	0.000	0.000
					B	0.000	43.379		100.00	0.000	0.919
					C	0.000	43.379		100.00	0.000	1.823
L2 115.36-79.83	96.90	1.36	9	83.739	A	0.000	83.739	83.739	100.00	0.000	0.000
					B	0.000	83.739		100.00	0.000	7.035
					C	0.000	83.739		100.00	0.000	8.161
L3 79.83-40.26	59.64	1.184	8	122.029	A	0.000	122.029	122.029	100.00	0.000	0.000
					B	0.000	122.029		100.00	0.000	7.835
					C	0.000	122.029		100.00	0.000	9.089
L4 40.26-0.00	19.40	1	6	154.412	A	0.000	154.412	154.412	100.00	0.000	0.000
					B	0.000	154.412		100.00	0.000	7.377
					C	0.000	154.412		100.00	0.000	8.558

Tower Forces - No Ice - Wind Normal To Face

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	Page
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	Project 140' EEI Monopole - 14 Canton Springs Rd, Canton, CT	Date 11:11:54 09/26/12
	Client AT&T Mobility	Designed by TJL

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 140.00-115.36	0.23	1.04	A	1	0.65	1	1	1	43.379	1.26	51.10	C
			B	1	0.65	1	1	1	43.379			
			C	1	0.65	1	1	1	43.379			
L2 115.36-79.83	1.51	3.63	A	1	0.65	1	1	1	83.739	2.62	73.70	C
			B	1	0.65	1	1	1	83.739			
			C	1	0.65	1	1	1	83.739			
L3 79.83-40.26	2.21	7.51	A	1	0.65	1	1	1	122.029	3.14	79.35	C
			B	1	0.65	1	1	1	122.029			
			C	1	0.65	1	1	1	122.029			
L4 40.26-0.00	2.08	11.04	A	1	0.65	1	1	1	154.412	3.22	79.99	C
			B	1	0.65	1	1	1	154.412			
			C	1	0.65	1	1	1	154.412			
Sum Weight:	6.03	23.22						OTM	663.48 kip-ft	10.24		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 140.00-115.36	0.23	1.04	A	1	0.65	1	1	1	43.379	1.26	51.10	C
			B	1	0.65	1	1	1	43.379			
			C	1	0.65	1	1	1	43.379			
L2 115.36-79.83	1.51	3.63	A	1	0.65	1	1	1	83.739	2.62	73.70	C
			B	1	0.65	1	1	1	83.739			
			C	1	0.65	1	1	1	83.739			
L3 79.83-40.26	2.21	7.51	A	1	0.65	1	1	1	122.029	3.14	79.35	C
			B	1	0.65	1	1	1	122.029			
			C	1	0.65	1	1	1	122.029			
L4 40.26-0.00	2.08	11.04	A	1	0.65	1	1	1	154.412	3.22	79.99	C
			B	1	0.65	1	1	1	154.412			
			C	1	0.65	1	1	1	154.412			
Sum Weight:	6.03	23.22						OTM	663.48 kip-ft	10.24		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 140.00-115.36	0.23	1.04	A	1	0.65	1	1	1	43.379	1.26	51.10	C
			B	1	0.65	1	1	1	43.379			
			C	1	0.65	1	1	1	43.379			
L2 115.36-79.83	1.51	3.63	A	1	0.65	1	1	1	83.739	2.62	73.70	C
			B	1	0.65	1	1	1	83.739			
			C	1	0.65	1	1	1	83.739			
L3 79.83-40.26	2.21	7.51	A	1	0.65	1	1	1	122.029	3.14	79.35	C
			B	1	0.65	1	1	1	122.029			
			C	1	0.65	1	1	1	122.029			

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	Client	AT&T Mobility	Designed by	TJL

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L4 40.26-0.00	2.08	11.04	A	1	0.65	1	1	1	154.412	3.22	79.99	C
			B	1	0.65	1	1	1	154.412			
			C	1	0.65	1	1	1	154.412			
Sum Weight:	6.03	23.22						OTM	663.48 kip-ft	10.24		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1	0.23	1.04	A	1	0.65	1	1	1	43.379	1.26	51.10	C
140.00-115.36			B	1	0.65	1	1	1	43.379			
			C	1	0.65	1	1	1	43.379			
L2	1.51	3.63	A	1	0.65	1	1	1	83.739	2.62	73.70	C
115.36-79.83			B	1	0.65	1	1	1	83.739			
			C	1	0.65	1	1	1	83.739			
L3	2.21	7.51	A	1	0.65	1	1	1	122.029	3.14	79.35	C
79.83-40.26			B	1	0.65	1	1	1	122.029			
			C	1	0.65	1	1	1	122.029			
L4 40.26-0.00	2.08	11.04	A	1	0.65	1	1	1	154.412	3.22	79.99	C
			B	1	0.65	1	1	1	154.412			
			C	1	0.65	1	1	1	154.412			
Sum Weight:	6.03	23.22						OTM	663.48 kip-ft	10.24		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1	0.30	1.37	A	1	0.65	1	1	1	45.432	1.15	46.57	C
140.00-115.36			B	1	0.65	1	1	1	45.432			
			C	1	0.65	1	1	1	45.432			
L2	1.92	4.26	A	1	0.65	1	1	1	86.699	2.52	70.91	C
115.36-79.83			B	1	0.65	1	1	1	86.699			
			C	1	0.65	1	1	1	86.699			
L3	2.67	8.43	A	1	0.65	1	1	1	125.326	2.89	73.07	C
79.83-40.26			B	1	0.65	1	1	1	125.326			
			C	1	0.65	1	1	1	125.326			
L4 40.26-0.00	2.52	12.19	A	1	0.65	1	1	1	157.767	2.85	70.73	C
			B	1	0.65	1	1	1	157.767			
			C	1	0.65	1	1	1	157.767			
Sum Weight:	7.41	26.25						OTM	617.63 kip-ft	9.41		

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Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	F a c e	e	C _F	R _R	D _F	D _R	A _E ft ²	F K	w plf	Ctrl. Face
L1 140.00-115.36	0.30	1.37	A	1	0.65	1	1	1	45.432	1.15	46.57	C
			B	1	0.65	1	1	1	45.432			
			C	1	0.65	1	1	1	45.432			
L2 115.36-79.83	1.92	4.26	A	1	0.65	1	1	1	86.699	2.52	70.91	C
			B	1	0.65	1	1	1	86.699			
			C	1	0.65	1	1	1	86.699			
L3 79.83-40.26	2.67	8.43	A	1	0.65	1	1	1	125.326	2.89	73.07	C
			B	1	0.65	1	1	1	125.326			
			C	1	0.65	1	1	1	125.326			
L4 40.26-0.00	2.52	12.19	A	1	0.65	1	1	1	157.767	2.85	70.73	C
			B	1	0.65	1	1	1	157.767			
			C	1	0.65	1	1	1	157.767			
Sum Weight:	7.41	26.25						OTM	617.63 kip-ft	9.41		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	F a c e	e	C _F	R _R	D _F	D _R	A _E ft ²	F K	w plf	Ctrl. Face
L1 140.00-115.36	0.30	1.37	A	1	0.65	1	1	1	45.432	1.15	46.57	C
			B	1	0.65	1	1	1	45.432			
			C	1	0.65	1	1	1	45.432			
L2 115.36-79.83	1.92	4.26	A	1	0.65	1	1	1	86.699	2.52	70.91	C
			B	1	0.65	1	1	1	86.699			
			C	1	0.65	1	1	1	86.699			
L3 79.83-40.26	2.67	8.43	A	1	0.65	1	1	1	125.326	2.89	73.07	C
			B	1	0.65	1	1	1	125.326			
			C	1	0.65	1	1	1	125.326			
L4 40.26-0.00	2.52	12.19	A	1	0.65	1	1	1	157.767	2.85	70.73	C
			B	1	0.65	1	1	1	157.767			
			C	1	0.65	1	1	1	157.767			
Sum Weight:	7.41	26.25						OTM	617.63 kip-ft	9.41		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	F a c e	e	C _F	R _R	D _F	D _R	A _E ft ²	F K	w plf	Ctrl. Face
L1 140.00-115.36	0.30	1.37	A	1	0.65	1	1	1	45.432	1.15	46.57	C
			B	1	0.65	1	1	1	45.432			
			C	1	0.65	1	1	1	45.432			
L2 115.36-79.83	1.92	4.26	A	1	0.65	1	1	1	86.699	2.52	70.91	C
			B	1	0.65	1	1	1	86.699			
			C	1	0.65	1	1	1	86.699			

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Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L3 79.83-40.26	2.67	8.43	A	1	0.65	1	1	1	125.326	2.89	73.07	C
			B	1	0.65	1	1	1	125.326			
			C	1	0.65	1	1	1	125.326			
L4 40.26-0.00	2.52	12.19	A	1	0.65	1	1	1	157.767	2.85	70.73	C
			B	1	0.65	1	1	1	157.767			
			C	1	0.65	1	1	1	157.767			
Sum Weight:	7.41	26.25						OTM	617.63 kip-ft	9.41		

Tower Forces - Service - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 140.00-115.36	0.23	1.04	A	1	0.65	1	1	1	43.379	0.49	19.96	C
			B	1	0.65	1	1	1	43.379			
			C	1	0.65	1	1	1	43.379			
L2 115.36-79.83	1.51	3.63	A	1	0.65	1	1	1	83.739	1.02	28.79	C
			B	1	0.65	1	1	1	83.739			
			C	1	0.65	1	1	1	83.739			
L3 79.83-40.26	2.21	7.51	A	1	0.65	1	1	1	122.029	1.23	30.99	C
			B	1	0.65	1	1	1	122.029			
			C	1	0.65	1	1	1	122.029			
L4 40.26-0.00	2.08	11.04	A	1	0.65	1	1	1	154.412	1.26	31.25	C
			B	1	0.65	1	1	1	154.412			
			C	1	0.65	1	1	1	154.412			
Sum Weight:	6.03	23.22						OTM	259.17 kip-ft	4.00		

Tower Forces - Service - Wind 45 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 140.00-115.36	0.23	1.04	A	1	0.65	1	1	1	43.379	0.49	19.96	C
			B	1	0.65	1	1	1	43.379			
			C	1	0.65	1	1	1	43.379			
L2 115.36-79.83	1.51	3.63	A	1	0.65	1	1	1	83.739	1.02	28.79	C
			B	1	0.65	1	1	1	83.739			
			C	1	0.65	1	1	1	83.739			
L3 79.83-40.26	2.21	7.51	A	1	0.65	1	1	1	122.029	1.23	30.99	C
			B	1	0.65	1	1	1	122.029			
			C	1	0.65	1	1	1	122.029			
L4 40.26-0.00	2.08	11.04	A	1	0.65	1	1	1	154.412	1.26	31.25	C
			B	1	0.65	1	1	1	154.412			
			C	1	0.65	1	1	1	154.412			
Sum Weight:	6.03	23.22						OTM	259.17 kip-ft	4.00		

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Tower Forces - Service - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 140.00-115.36	0.23	1.04	A	1	0.65	1	1	1	43.379	0.49	19.96	C
			B	1	0.65	1	1	1	43.379			
			C	1	0.65	1	1	1	43.379			
L2 115.36-79.83	1.51	3.63	A	1	0.65	1	1	1	83.739	1.02	28.79	C
			B	1	0.65	1	1	1	83.739			
			C	1	0.65	1	1	1	83.739			
L3 79.83-40.26	2.21	7.51	A	1	0.65	1	1	1	122.029	1.23	30.99	C
			B	1	0.65	1	1	1	122.029			
			C	1	0.65	1	1	1	122.029			
L4 40.26-0.00	2.08	11.04	A	1	0.65	1	1	1	154.412	1.26	31.25	C
			B	1	0.65	1	1	1	154.412			
			C	1	0.65	1	1	1	154.412			
Sum Weight:	6.03	23.22						OTM	259.17 kip-ft	4.00		

Tower Forces - Service - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 140.00-115.36	0.23	1.04	A	1	0.65	1	1	1	43.379	0.49	19.96	C
			B	1	0.65	1	1	1	43.379			
			C	1	0.65	1	1	1	43.379			
L2 115.36-79.83	1.51	3.63	A	1	0.65	1	1	1	83.739	1.02	28.79	C
			B	1	0.65	1	1	1	83.739			
			C	1	0.65	1	1	1	83.739			
L3 79.83-40.26	2.21	7.51	A	1	0.65	1	1	1	122.029	1.23	30.99	C
			B	1	0.65	1	1	1	122.029			
			C	1	0.65	1	1	1	122.029			
L4 40.26-0.00	2.08	11.04	A	1	0.65	1	1	1	154.412	1.26	31.25	C
			B	1	0.65	1	1	1	154.412			
			C	1	0.65	1	1	1	154.412			
Sum Weight:	6.03	23.22						OTM	259.17 kip-ft	4.00		

Force Totals

Load Case	Vertical Forces	Sum of Forces X	Sum of Forces Z	Sum of Overturning Moments, M _x	Sum of Overturning Moments, M _z	Sum of Torques
	K	K	K	kip-ft	kip-ft	kip-ft
Leg Weight	23.22					
Bracing Weight	0.00					
Total Member Self-Weight	23.22			1.02	-0.63	
Total Weight	39.69			1.02	-0.63	

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Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 0 deg - No Ice		0.04	-28.20	-2764.94	-5.22	0.27
Wind 30 deg - No Ice		14.19	-24.44	-2396.66	-1393.33	1.17
Wind 45 deg - No Ice		20.04	-19.97	-1958.05	-1967.83	1.51
Wind 60 deg - No Ice		24.54	-14.13	-1385.93	-2408.27	1.75
Wind 90 deg - No Ice		28.31	-0.04	-3.56	-2778.08	1.86
Wind 120 deg - No Ice		24.50	14.07	1380.03	-2403.68	1.48
Wind 135 deg - No Ice		19.99	19.92	1953.61	-1961.34	1.13
Wind 150 deg - No Ice		14.13	24.41	2394.12	-1385.39	0.70
Wind 180 deg - No Ice		-0.04	28.20	2766.98	3.95	-0.27
Wind 210 deg - No Ice		-14.19	24.44	2398.71	1392.06	-1.17
Wind 225 deg - No Ice		-20.04	19.97	1960.09	1966.56	-1.51
Wind 240 deg - No Ice		-24.54	14.13	1387.97	2407.00	-1.75
Wind 270 deg - No Ice		-28.31	0.04	5.61	2776.82	-1.86
Wind 300 deg - No Ice		-24.50	-14.07	-1377.99	2402.42	-1.48
Wind 315 deg - No Ice		-19.99	-19.92	-1951.56	1960.08	-1.13
Wind 330 deg - No Ice		-14.13	-24.41	-2392.08	1384.12	-0.70
Member Ice	3.03					
Total Weight Ice	48.94			2.41	-1.69	
Wind 0 deg - Ice		0.03	-24.86	-2424.00	-5.04	0.01
Wind 30 deg - Ice		12.49	-21.54	-2100.60	-1222.29	1.03
Wind 45 deg - Ice		17.66	-17.60	-1715.69	-1726.14	1.45
Wind 60 deg - Ice		21.61	-12.45	-1213.70	-2112.47	1.77
Wind 90 deg - Ice		24.94	-0.03	-0.94	-2437.08	2.03
Wind 120 deg - Ice		21.59	12.41	1212.71	-2109.12	1.76
Wind 135 deg - Ice		17.62	17.56	1715.77	-1721.40	1.43
Wind 150 deg - Ice		12.45	21.51	2102.07	-1216.48	1.01
Wind 180 deg - Ice		-0.03	24.86	2428.82	1.66	-0.01
Wind 210 deg - Ice		-12.49	21.54	2105.42	1218.90	-1.03
Wind 225 deg - Ice		-17.66	17.60	1720.51	1722.76	-1.45
Wind 240 deg - Ice		-21.61	12.45	1218.52	2109.09	-1.77
Wind 270 deg - Ice		-24.94	0.03	5.76	2433.69	-2.03
Wind 300 deg - Ice		-21.59	-12.41	-1207.89	2105.74	-1.76
Wind 315 deg - Ice		-17.62	-17.56	-1710.95	1718.01	-1.43
Wind 330 deg - Ice		-12.45	-21.51	-2097.25	1213.10	-1.01
Total Weight	39.69			1.02	-0.63	
Wind 0 deg - Service		0.01	-11.02	-1080.21	-1.84	0.11
Wind 30 deg - Service		5.54	-9.55	-936.35	-544.07	0.46
Wind 45 deg - Service		7.83	-7.80	-765.01	-768.48	0.59
Wind 60 deg - Service		9.58	-5.52	-541.53	-940.53	0.68
Wind 90 deg - Service		11.06	-0.01	-1.54	-1084.99	0.73
Wind 120 deg - Service		9.57	5.50	538.92	-938.74	0.58
Wind 135 deg - Service		7.81	7.78	762.98	-765.95	0.44
Wind 150 deg - Service		5.52	9.53	935.05	-540.97	0.27
Wind 180 deg - Service		-0.01	11.02	1080.70	1.74	-0.11
Wind 210 deg - Service		-5.54	9.55	936.84	543.97	-0.46
Wind 225 deg - Service		-7.83	7.80	765.51	768.39	-0.59
Wind 240 deg - Service		-9.58	5.52	542.02	940.44	-0.68
Wind 270 deg - Service		-11.06	0.01	2.04	1084.89	-0.73
Wind 300 deg - Service		-9.57	-5.50	-538.43	938.64	-0.58
Wind 315 deg - Service		-7.81	-7.78	-762.48	765.86	-0.44
Wind 330 deg - Service		-5.52	-9.53	-934.56	540.87	-0.27

Load Combinations

Comb. No.	Description
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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	140 - 115.36	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-7.17	-0.15	-0.85
			Max. Mx	6	-3.46	-80.77	0.16

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Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L2	115.36 - 79.83	Pole	Max. My	10	-3.46	0.36	-81.12
			Max. Vy	6	12.27	-80.77	0.16
			Max. Vx	10	12.27	0.36	-81.12
			Max. Torque	23			-2.31
			Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-22.13	-0.48	-1.04
			Max. Mx	6	-14.92	-701.95	1.25
			Max. My	10	-14.93	1.49	-699.93
			Max. Vy	6	21.91	-701.95	1.25
			Max. Vx	10	21.79	1.49	-699.93
L3	79.83 - 40.26	Pole	Max. Torque	6			-2.59
			Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-32.72	-1.00	-1.63
			Max. Mx	6	-24.59	-1630.32	2.39
			Max. My	10	-24.60	2.71	-1623.97
			Max. Vy	6	25.32	-1630.32	2.39
			Max. Vx	10	25.20	2.71	-1623.97
			Max. Torque	23			-1.92
			Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-48.94	-1.70	-2.43
L4	40.26 - 0	Pole	Max. Mx	6	-39.67	-2852.87	3.68
			Max. My	10	-39.67	4.08	-2841.51
			Max. Vy	6	28.34	-2852.87	3.68
			Max. Vx	10	28.23	4.08	-2841.51
			Max. Torque	23			-2.05

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	23	48.94	-24.94	0.03
	Max. H _x	14	39.69	28.31	-0.04
	Max. H _z	2	39.69	-0.04	28.20
	Max. M _x	2	2839.40	-0.04	28.20
	Max. M _z	6	2852.87	-28.31	0.04
	Max. Torsion	31	2.05	24.94	-0.03
	Min. Vert	1	39.69	0.00	0.00
	Min. H _x	6	39.69	-28.31	0.04
	Min. H _z	10	39.69	0.04	-28.20
	Min. M _x	10	-2841.51	0.04	-28.20
	Min. M _z	14	-2851.58	28.31	-0.04
	Min. Torsion	23	-2.05	-24.94	0.03

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	39.69	0.00	0.00	1.02	-0.63	0.00
Dead+ Wind 0 deg - No Ice	39.69	0.04	-28.20	-2839.40	-5.37	0.27
Dead+ Wind 30 deg - No Ice	39.69	14.19	-24.44	-2461.21	-1430.85	1.17
Dead+ Wind 45 deg - No Ice	39.69	20.04	-19.97	-2010.79	-2020.82	1.51

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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 60 deg - No Ice	39.69	24.54	-14.13	-1423.26	-2473.11	1.75
Dead+Wind 90 deg - No Ice	39.69	28.31	-0.04	-3.68	-2852.87	1.86
Dead+Wind 120 deg - No Ice	39.69	24.50	14.07	1417.19	-2468.40	1.48
Dead+Wind 135 deg - No Ice	39.69	19.99	19.92	2006.22	-2014.15	1.12
Dead+Wind 150 deg - No Ice	39.69	14.13	24.41	2458.61	-1422.68	0.69
Dead+Wind 180 deg - No Ice	39.69	-0.04	28.20	2841.51	4.08	-0.27
Dead+Wind 210 deg - No Ice	39.69	-14.19	24.44	2463.32	1429.56	-1.17
Dead+Wind 225 deg - No Ice	39.69	-20.04	19.97	2012.89	2019.53	-1.51
Dead+Wind 240 deg - No Ice	39.69	-24.54	14.13	1425.36	2471.82	-1.75
Dead+Wind 270 deg - No Ice	39.69	-28.31	0.04	5.77	2851.58	-1.86
Dead+Wind 300 deg - No Ice	39.69	-24.50	-14.07	-1415.09	2467.10	-1.48
Dead+Wind 315 deg - No Ice	39.69	-19.99	-19.92	-2004.12	2012.85	-1.12
Dead+Wind 330 deg - No Ice	39.69	-14.13	-24.41	-2456.50	1421.38	-0.69
Dead+Ice+Temp	48.94	0.00	0.00	2.43	-1.70	-0.00
Dead+Wind 0 deg+Ice+Temp	48.94	0.03	-24.86	-2514.84	-5.25	0.02
Dead+Wind 30 deg+Ice+Temp	48.94	12.49	-21.54	-2179.32	-1268.11	1.04
Dead+Wind 45 deg+Ice+Temp	48.94	17.66	-17.60	-1779.99	-1790.83	1.46
Dead+Wind 60 deg+Ice+Temp	48.94	21.61	-12.45	-1259.19	-2191.64	1.79
Dead+Wind 90 deg+Ice+Temp	48.94	24.94	-0.03	-0.98	-2528.40	2.05
Dead+Wind 120 deg+Ice+Temp	48.94	21.59	12.41	1258.16	-2188.16	1.77
Dead+Wind 135 deg+Ice+Temp	48.94	17.62	17.56	1780.09	-1785.90	1.44
Dead+Wind 150 deg+Ice+Temp	48.94	12.45	21.51	2180.87	-1262.06	1.01
Dead+Wind 180 deg+Ice+Temp	48.94	-0.03	24.86	2519.88	1.74	-0.02
Dead+Wind 210 deg+Ice+Temp	48.94	-12.49	21.54	2184.36	1264.60	-1.04
Dead+Wind 225 deg+Ice+Temp	48.94	-17.66	17.60	1785.03	1787.33	-1.46
Dead+Wind 240 deg+Ice+Temp	48.94	-21.61	12.45	1264.22	2188.13	-1.79
Dead+Wind 270 deg+Ice+Temp	48.94	-24.94	0.03	6.01	2524.89	-2.05
Dead+Wind 300 deg+Ice+Temp	48.94	-21.59	-12.41	-1253.14	2184.64	-1.77
Dead+Wind 315 deg+Ice+Temp	48.94	-17.62	-17.56	-1775.06	1782.38	-1.44
Dead+Wind 330 deg+Ice+Temp	48.94	-12.45	-21.51	-2175.84	1258.54	-1.01
Dead+Wind 0 deg - Service	39.69	0.01	-11.02	-1109.33	-2.50	0.11
Dead+Wind 30 deg - Service	39.69	5.54	-9.55	-961.49	-559.74	0.46
Dead+Wind 45 deg - Service	39.69	7.83	-7.80	-785.41	-790.37	0.59
Dead+Wind 60 deg - Service	39.69	9.58	-5.52	-555.73	-967.18	0.69
Dead+Wind 90 deg - Service	39.69	11.06	-0.01	-0.79	-1115.64	0.73
Dead+Wind 120 deg - Service	39.69	9.57	5.50	554.65	-965.34	0.58
Dead+Wind 135 deg - Service	39.69	7.81	7.78	784.91	-787.76	0.44
Dead+Wind 150 deg - Service	39.69	5.52	9.53	961.76	-556.55	0.27
Dead+Wind 180 deg - Service	39.69	-0.01	11.02	1111.44	1.20	-0.11
Dead+Wind 210 deg - Service	39.69	-5.54	9.55	963.60	558.45	-0.46
Dead+Wind 225 deg - Service	39.69	-7.83	7.80	787.52	789.07	-0.59
Dead+Wind 240 deg - Service	39.69	-9.58	5.52	557.85	965.88	-0.69
Dead+Wind 270 deg - Service	39.69	-11.06	0.01	2.90	1114.34	-0.73
Dead+Wind 300 deg - Service	39.69	-9.57	-5.50	-552.53	964.04	-0.58
Dead+Wind 315 deg - Service	39.69	-7.81	-7.78	-782.80	786.46	-0.44
Dead+Wind 330 deg - Service	39.69	-5.52	-9.53	-959.64	555.25	-0.27

Solution Summary

Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
1	0.00	-39.69	0.00	0.00	39.69	0.00	0.000%
2	0.04	-39.69	-28.20	-0.04	39.69	28.20	0.000%
3	14.19	-39.69	-24.44	-14.19	39.69	24.44	0.000%
4	20.04	-39.69	-19.97	-20.04	39.69	19.97	0.000%
5	24.54	-39.69	-14.13	-24.54	39.69	14.13	0.000%
6	28.31	-39.69	-0.04	-28.31	39.69	0.04	0.000%

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Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
7	24.50	-39.69	14.07	-24.50	39.69	-14.07	0.000%
8	19.99	-39.69	19.92	-19.99	39.69	-19.92	0.000%
9	14.13	-39.69	24.41	-14.13	39.69	-24.41	0.000%
10	-0.04	-39.69	28.20	0.04	39.69	-28.20	0.000%
11	-14.19	-39.69	24.44	14.19	39.69	-24.44	0.000%
12	-20.04	-39.69	19.97	20.04	39.69	-19.97	0.000%
13	-24.54	-39.69	14.13	24.54	39.69	-14.13	0.000%
14	-28.31	-39.69	0.04	28.31	39.69	-0.04	0.000%
15	-24.50	-39.69	-14.07	24.50	39.69	14.07	0.000%
16	-19.99	-39.69	-19.92	19.99	39.69	19.92	0.000%
17	-14.13	-39.69	-24.41	14.13	39.69	24.41	0.000%
18	0.00	-48.94	0.00	0.00	48.94	0.00	0.000%
19	0.03	-48.94	-24.86	-0.03	48.94	24.86	0.000%
20	12.49	-48.94	-21.54	-12.49	48.94	21.54	0.000%
21	17.66	-48.94	-17.60	-17.66	48.94	17.60	0.000%
22	21.61	-48.94	-12.45	-21.61	48.94	12.45	0.000%
23	24.94	-48.94	-0.03	-24.94	48.94	0.03	0.000%
24	21.59	-48.94	12.41	-21.59	48.94	-12.41	0.000%
25	17.62	-48.94	17.56	-17.62	48.94	-17.56	0.000%
26	12.45	-48.94	21.51	-12.45	48.94	-21.51	0.000%
27	-0.03	-48.94	24.86	0.03	48.94	-24.86	0.000%
28	-12.49	-48.94	21.54	12.49	48.94	-21.54	0.000%
29	-17.66	-48.94	17.60	17.66	48.94	-17.60	0.000%
30	-21.61	-48.94	12.45	21.61	48.94	-12.45	0.000%
31	-24.94	-48.94	0.03	24.94	48.94	-0.03	0.000%
32	-21.59	-48.94	-12.41	21.59	48.94	12.41	0.000%
33	-17.62	-48.94	-17.56	17.62	48.94	17.56	0.000%
34	-12.45	-48.94	-21.51	12.45	48.94	21.51	0.000%
35	0.01	-39.69	-11.02	-0.01	39.69	11.02	0.000%
36	5.54	-39.69	-9.55	-5.54	39.69	9.55	0.000%
37	7.83	-39.69	-7.80	-7.83	39.69	7.80	0.000%
38	9.58	-39.69	-5.52	-9.58	39.69	5.52	0.000%
39	11.06	-39.69	-0.01	-11.06	39.69	0.01	0.000%
40	9.57	-39.69	5.50	-9.57	39.69	-5.50	0.000%
41	7.81	-39.69	7.78	-7.81	39.69	-7.78	0.000%
42	5.52	-39.69	9.53	-5.52	39.69	-9.53	0.000%
43	-0.01	-39.69	11.02	0.01	39.69	-11.02	0.000%
44	-5.54	-39.69	9.55	5.54	39.69	-9.55	0.000%
45	-7.83	-39.69	7.80	7.83	39.69	-7.80	0.000%
46	-9.58	-39.69	5.52	9.58	39.69	-5.52	0.000%
47	-11.06	-39.69	0.01	11.06	39.69	-0.01	0.000%
48	-9.57	-39.69	-5.50	9.57	39.69	5.50	0.000%
49	-7.81	-39.69	-7.78	7.81	39.69	7.78	0.000%
50	-5.52	-39.69	-9.53	5.52	39.69	9.53	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	0.00016508
3	Yes	5	0.00000001	0.00020936
4	Yes	5	0.00000001	0.00022342
5	Yes	5	0.00000001	0.00018878
6	Yes	4	0.00000001	0.00081952
7	Yes	5	0.00000001	0.00021073

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8	Yes	5	0.00000001	0.00022174
9	Yes	5	0.00000001	0.00019413
10	Yes	4	0.00000001	0.00011137
11	Yes	5	0.00000001	0.00019253
12	Yes	5	0.00000001	0.00022382
13	Yes	5	0.00000001	0.00021463
14	Yes	4	0.00000001	0.00087626
15	Yes	5	0.00000001	0.00018848
16	Yes	5	0.00000001	0.00022101
17	Yes	5	0.00000001	0.00020355
18	Yes	4	0.00000001	0.00000001
19	Yes	5	0.00000001	0.00011919
20	Yes	5	0.00000001	0.00048314
21	Yes	5	0.00000001	0.00053008
22	Yes	5	0.00000001	0.00044713
23	Yes	5	0.00000001	0.00013593
24	Yes	5	0.00000001	0.00049009
25	Yes	5	0.00000001	0.00052869
26	Yes	5	0.00000001	0.00045595
27	Yes	5	0.00000001	0.00011930
28	Yes	5	0.00000001	0.00045491
29	Yes	5	0.00000001	0.00053172
30	Yes	5	0.00000001	0.00049519
31	Yes	5	0.00000001	0.00013709
32	Yes	5	0.00000001	0.00044405
33	Yes	5	0.00000001	0.00052444
34	Yes	5	0.00000001	0.00047383
35	Yes	4	0.00000001	0.00004068
36	Yes	4	0.00000001	0.00066113
37	Yes	4	0.00000001	0.00070716
38	Yes	4	0.00000001	0.00054454
39	Yes	4	0.00000001	0.00018421
40	Yes	4	0.00000001	0.00067723
41	Yes	4	0.00000001	0.00069743
42	Yes	4	0.00000001	0.00057017
43	Yes	4	0.00000001	0.00003725
44	Yes	4	0.00000001	0.00056018
45	Yes	4	0.00000001	0.00071060
46	Yes	4	0.00000001	0.00069985
47	Yes	4	0.00000001	0.00018879
48	Yes	4	0.00000001	0.00054171
49	Yes	4	0.00000001	0.00069056
50	Yes	4	0.00000001	0.00062549

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	140 - 115.36	28.639	46	1.7665	0.0131
L2	118.89 - 79.83	20.909	46	1.6984	0.0058
L3	84.42 - 40.26	10.174	39	1.1871	0.0018
L4	45.54 - 0	2.848	39	0.5840	0.0006

Critical Deflections and Radius of Curvature - Service Wind

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Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
148.00	20' x 2" Dia Omni	46	28.639	1.7665	0.0131	27668
138.00	4' Side Mount Standoff	46	27.894	1.7647	0.0123	27668
130.00	(2) DUO1417-8686	46	24.928	1.7522	0.0093	13834
128.00	13' Platform w/rails	46	24.193	1.7466	0.0086	11528
120.00	LPA-80063/6CF	46	21.303	1.7067	0.0060	6971
118.00	13' Platform w/rails	46	20.596	1.6911	0.0055	6445
114.00	LMU	46	19.204	1.6525	0.0046	5750
112.00	(4) DB844H90E-XY	46	18.521	1.6298	0.0042	5475
110.00	13' Platform w/rails	46	17.847	1.6050	0.0039	5226
100.00	14-ft Low Profile Platform	39	14.620	1.4570	0.0027	4257
91.50	(2) DB978F30T2E-M	39	12.097	1.3115	0.0021	3675
91.00	(2) DB980F90T2E-M	39	11.955	1.3027	0.0021	3646
90.00	14-ft Low Profile Platform	39	11.675	1.2851	0.0021	3588
83.00	Uni-Tri Bracket	39	9.809	1.1625	0.0018	3312

Maximum Tower Deflections - Design Wind

Section No.	Elevation	Horz. Deflection	Gov. Load Comb.	Tilt	Twist
	ft	in		°	°
L1	140 - 115.36	73.139	13	4.5114	0.0355
L2	118.89 - 79.83	53.419	13	4.3405	0.0153
L3	84.42 - 40.26	26.006	13	3.0350	0.0050
L4	45.54 - 0	7.282	5	1.4935	0.0017

Critical Deflections and Radius of Curvature - Design Wind

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
148.00	20' x 2" Dia Omni	13	73.139	4.5114	0.0355	11039
138.00	4' Side Mount Standoff	13	71.239	4.5070	0.0334	11039
130.00	(2) DUO1417-8686	13	63.672	4.4766	0.0250	5519
128.00	13' Platform w/rails	13	61.797	4.4626	0.0230	4598
120.00	LPA-80063/6CF	13	54.423	4.3617	0.0161	2779
118.00	13' Platform w/rails	13	52.618	4.3220	0.0147	2568
114.00	LMU	13	49.068	4.2235	0.0123	2287
112.00	(4) DB844H90E-XY	13	47.324	4.1655	0.0112	2175
110.00	13' Platform w/rails	13	45.602	4.1023	0.0103	2075
100.00	14-ft Low Profile Platform	13	37.363	3.7245	0.0071	1684
91.50	(2) DB978F30T2E-M	13	30.918	3.3530	0.0058	1450
91.00	(2) DB980F90T2E-M	13	30.557	3.3305	0.0057	1438
90.00	14-ft Low Profile Platform	13	29.841	3.2854	0.0056	1415
83.00	Uni-Tri Bracket	13	25.075	2.9722	0.0049	1304

Compression Checks

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Pole Design Data

Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	F _a ksi	A in ²	Actual P K	Allow. P _a K	Ratio P P _a
L1	140 - 115.36 (1)	TP24.2521x18x0.1875	24.64	0.00	0.0	39.000	13.7884	-3.46	537.75	0.006
L2	115.36 - 79.83 (2)	TP32.7041x22.9814x0.3125	39.06	0.00	0.0	39.000	30.9952	-14.92	1208.81	0.012
L3	79.83 - 40.26 (3)	TP41.9334x30.9366x0.4375	44.16	0.00	0.0	39.000	55.7964	-24.59	2176.06	0.011
L4	40.26 - 0 (4)	TP51x39.7436x0.5	45.54	0.00	0.0	39.000	80.1435	-39.67	3125.60	0.013

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M _e kip-ft	Actual f _{bx} ksi	Allow. F _{bx} ksi	Ratio f _{bx} F _{bx}	Actual M _y kip-ft	Actual f _{by} ksi	Allow. F _{by} ksi	Ratio f _{by} F _{by}
L1	140 - 115.36 (1)	TP24.2521x18x0.1875	81.36	12.387	39.000	0.318	0.00	0.000	39.000	0.000
L2	115.36 - 79.83 (2)	TP32.7041x22.9814x0.3125	702.69	35.356	39.000	0.907	0.00	0.000	39.000	0.000
L3	79.83 - 40.26 (3)	TP41.9334x30.9366x0.4375	1630.96	35.483	39.000	0.910	0.00	0.000	39.000	0.000
L4	40.26 - 0 (4)	TP51x39.7436x0.5	2853.41	34.355	39.000	0.881	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 f _v F _v	Actual T kip-ft	Actual f _{vt} ksi	Allow. F _{vt} ksi	Ratio f _{vt} F _{vt}
L1	140 - 115.36 (1)	TP24.2521x18x0.1875	12.30	0.892	26.000	0.069	1.81	0.135	26.000	0.005
L2	115.36 - 79.83 (2)	TP32.7041x22.9814x0.3125	21.91	0.707	26.000	0.054	1.63	0.040	26.000	0.002
L3	79.83 - 40.26 (3)	TP41.9334x30.9366x0.4375	25.32	0.454	26.000	0.035	1.69	0.018	26.000	0.001
L4	40.26 - 0 (4)	TP51x39.7436x0.5	28.34	0.354	26.000	0.027	1.75	0.010	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio P P _a	Ratio f _{bx} F _{bx}	Ratio f _{by} F _{by}	Ratio f _v F _v	Ratio f _{vt} F _{vt}	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	140 - 115.36 (1)	0.006	0.318	0.000	0.069	0.005	0.326	1.333	H1-3+VT ✓
L2	115.36 - 79.83 (2)	0.012	0.907	0.000	0.054	0.002	0.920	1.333	H1-3+VT ✓
L3	79.83 - 40.26 (3)	0.011	0.910	0.000	0.035	0.001	0.921	1.333	H1-3+VT ✓

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12044.CO8 - CT1022	Page	22 of 22
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	Client	AT&T Mobility	Designed by	TJL

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
L4	40.26 - 0 (4)	0.013	0.881	0.000	0.027	0.000	0.894 ✓	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	140 - 115.36	Pole	TP24.2521x18x0.1875	1	-3.46	716.82	24.4	Pass
L2	115.36 - 79.83	Pole	TP32.7041x22.9814x0.3125	2	-14.92	1611.34	69.0	Pass
L3	79.83 - 40.26	Pole	TP41.9334x30.9366x0.4375	3	-24.59	2900.69	69.1	Pass
L4	40.26 - 0	Pole	TP51x39.7436x0.5	4	-39.67	4166.42	67.1	Pass
							Summary	
							Pole (L3)	69.1 Pass
							RATING =	69.1 Pass

Subject:

Anchor Bolt and Baseplate Analysis

Location:

140-ft Monopole
 Canton, CT

Rev. 0: 9/26/12

Prepared by: T.J.L. Checked by: C.F.C.
 Job No. 12044.CO8

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 2853-ft-kips	(Input From RisaTower)
Shear Force =	Shear := 28-kips	(Input From RisaTower)
Axial Force =	Axial := 40-kips	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 20	(User Input)
Diameter of Bolt Circle =	D _{bc} := 60.0-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 =	F _{ybp} := 60-ksi	(User Input)
Base Plate Thickness =	t _{bp} := 2.25-in	(User Input)
Base Plate Diameter =	D _{bp} := 66.0-in	(User Input)
Outer Pole Diameter =	D _{pole} := 51.0-in	(User Input)

Subject:

Anchor Bolt and Baseplate Analysis

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140-ft Monopole
 Canton, CT

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Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =:

$$R_{bc} := \frac{D_{bc}}{2} = 30\text{-in}$$

Distance to Bolts =

$i := 1..N$

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

$$d_1 = 9.27\text{-in}$$

$$d_9 = 9.27\text{-in}$$

$$d_2 = 17.63\text{-in}$$

$$d_{10} = 0.00\text{-in}$$

$$d_3 = 24.27\text{-in}$$

$$d_{11} = -9.27\text{-in}$$

$$d_4 = 28.53\text{-in}$$

$$d_{12} = -17.63\text{-in}$$

$$d_5 = 30.00\text{-in}$$

$$d_{13} = -24.27\text{-in}$$

$$d_6 = 28.53\text{-in}$$

$$d_{14} = -28.53\text{-in}$$

$$d_7 = 24.27\text{-in}$$

$$d_{15} = -30.00\text{-in}$$

$$d_8 = 17.63\text{-in}$$

$$d_{16} = -28.53\text{-in}$$

Critical Distances For Bending in Plate:

Outer Pole Radius =

$$R_{pole} := \frac{D_{pole}}{2} = 25.5\text{-in}$$

Moment Arms of Bolts about Neutral Axis =

$$MA_i := \text{if}(d_i \geq R_{pole}, d_i - R_{pole}, 0\text{in})$$

$$MA_1 = 0.00\text{-in}$$

$$MA_9 = 0.00\text{-in}$$

$$MA_2 = 0.00\text{-in}$$

$$MA_{10} = 0.00\text{-in}$$

$$MA_3 = 0.00\text{-in}$$

$$MA_{11} = 0.00\text{-in}$$

$$MA_4 = 3.03\text{-in}$$

$$MA_{12} = 0.00\text{-in}$$

$$MA_5 = 4.50\text{-in}$$

$$MA_{13} = 0.00\text{-in}$$

$$MA_6 = 3.03\text{-in}$$

$$MA_{14} = 0.00\text{-in}$$

$$MA_7 = 0.00\text{-in}$$

$$MA_{15} = 0.00\text{-in}$$

$$MA_8 = 0.00\text{-in}$$

$$MA_{16} = 0.00\text{-in}$$

Effective Width of Baseplate for Bending =

$$B_{eff} := 0.8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 33.5\text{-in}$$

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia =

$$I_p := \sum_i (d_i)^2 = 9 \times 10^3 \cdot \text{in}^2$$

Gross Area of Bolt =

$$A_g := \frac{\pi}{4} \cdot D^2 = 3.976 \cdot \text{in}^2$$

Net Area of Bolt =

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

Net Diameter =

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

Radius of Gyration of Bolt =

$$r := \frac{D_n}{4} = 0.508 \cdot \text{in}$$

Section Modulus of Bolt =

$$S_x := \frac{\pi \cdot D_n^3}{32} = 0.826 \cdot \text{in}^3$$

Check Anchor Bolt Tension Force:

Maximum Tensile Force =

$$T_{\text{Max}} := \text{OM} \cdot \frac{R_{bc}}{I_p} - \frac{\text{Axial}}{N} = 112.1 \cdot \text{kips}$$

Allowable Tensile Force =

$$T_{\text{ALL.Gross}} := 1.333 \cdot (0.33 \cdot A_g \cdot F_u) = 174.9 \cdot \text{kips} \quad (1.333 \text{ increase allowed per TIA/EIA})$$

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

Bolt Tension % of Capacity =

$$\frac{T_{\text{Max}}}{T_{\text{ALL.Net}}} = 57.6\% \quad \text{Bolts are "upset bolts". Use net area per AISC}$$

Condition1 =

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

Condition1 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment =

$$M_x := \left(\frac{\text{Shear}}{N} \right) \cdot l = 0.35 \cdot \text{ft-kips}$$

Maximum Bending Stress =

$$f_{bx} := \frac{M_x}{S_x} = 5.1 \cdot \text{ksi}$$

Allowable Bending Stress =

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

Subject:

Anchor Bolt and Baseplate Analysis

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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."

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

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

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{l_p} + \frac{Axial}{N} = 116.1 \text{ kips}$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 35.8 \text{ ksi}$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

$$F_a := 1.333 \cdot F_a = 60 \text{ ksi} \quad (1.333 \text{ increase allowed per TIA/EIA})$$

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \right) = 59.6 \%$$

Condition 2 =

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

Condition2 = "OK"

Subject:

Anchor Bolt and Baseplate Analysis

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Base Plate Analysis:

Force from Bolts =

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

$$C_1 = 37.3\text{-kips}$$

$$C_9 = 37.3\text{-kips}$$

$$C_2 = 69.1\text{-kips}$$

$$C_{10} = 2.0\text{-kips}$$

$$C_3 = 94.3\text{-kips}$$

$$C_{11} = -33.3\text{-kips}$$

$$C_4 = 110.5\text{-kips}$$

$$C_{12} = -65.1\text{-kips}$$

$$C_5 = 116.1\text{-kips}$$

$$C_{13} = -90.3\text{-kips}$$

$$C_6 = 110.5\text{-kips}$$

$$C_{14} = -106.5\text{-kips}$$

$$C_7 = 94.3\text{-kips}$$

$$C_{15} = -112.1\text{-kips}$$

$$C_8 = 69.1\text{-kips}$$

$$C_{16} = -106.5\text{-kips}$$

Maximum Bending Stress in Plate =

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot M A_i}{(B_{eff} t_{bp})^2} = 42.2\text{-ksi}$$

Allowable Bending Stress in Plate =

$$F_{bp} := 1.33 \cdot 0.75 \cdot F_y = 59.9\text{-ksi}$$

Plate Bending Stress % of Capacity =

$$\frac{f_{bp}}{F_{bp}} = 70.5\%$$

Condition3 =

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

Condition3 = "Ok"

Standard Monopole Foundation:

Input Data:

Tower Data

Overturning Moment =	OM := 2853-ft-kips	(User Input from RISATower)
Shear Force =	Shear := 28-kip	(User Input from RISATower)
Axial Force =	Axial := 40-kip	(User Input from RISATower)
Tower Height =	H _t := 140-ft	(User Input)

Footing Data:

Overall Depth of Footing =	D _f := 6.5-ft	(User Input)
Length of Pier =	L _p := 4.5-ft	(User Input)
Extension of Pier Above Grade =	L _{pag} := 1.0-ft	(User Input)
Diameter of Pier =	d _p := 6.5-ft	(User Input)
Thickness of Footing =	T _f := 3.0-ft	(User Input)
Width of Footing =	W _f := 24.0-ft	(User Input)

Anchor Bolt Data:

Length of Anchor Bolts =	L _{st} := 72-in	(User Input)
Projection of Anchor Bolts Above Pier =	A _{BP} := 12.0-in	(User Input)
Anchor Bolt Diameter =	d _{anchor} := 2.25-in	(User Input)
Base Plate Bolt Circle =	MP := 60.0-in	(User Input)

Material Properties:

Concrete Compressive Strength =	f _c := 4000-psi	(User Input)
Steel Reinforcement Yield Strength =	f _y := 60000-psi	(User Input)
Anchor Bolt Yield Strength =	f _{ya} := 75000-psi	(User Input)
Internal Friction Angle of Soil =	Φ _s := 30-deg	(User Input)
Allowable Soil Bearing Capacity =	q _s := 4000-psf	(User Input)
Unit Weight of Soil =	γ _{soil} := 100-pcf	(User Input)
Unit Weight of Concrete =	γ _{conc} := 150-pcf	(User Input)
Foundation Bouyancy =	Bouyancy := 0	(User Input) (Yes=1 / No=0)
Depth to Neglect =	n := 1-ft	(User Input)
Cohesion of Clay Type Soil =	c := 0-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 =	μ := 0.45	(User Input)

Subject:

Foundation Analysis

Location:

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Pier Reinforcement:

Bar Size =	$BS_{pier} := 8$	(User Input)	
Bar Diameter =	$d_{bpier} := 1.0\text{-in}$	(User Input)	
Number of Bars =	$NB_{pier} := 44$	(User Input)	
Clear Cover of Reinforcement =	$Cvr_{pier} := 3\text{-in}$	(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 =	$d_{Tie} := 0.5\text{-in}$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{top} := 8$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 1.0\text{-in}$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 28$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 8$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 1.0\text{-in}$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 40$	(User Input)	(Bottom of Pad)
Clear Cover of Reinforcement =	$Cvr_{pad} := 3.0\text{-in}$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)

Calculated Factors:

Pier Reinforcement Bar Area =	$A_{bpier} := \frac{\pi \cdot d_{bpier}^2}{4} = 0.785\text{-in}^2$	
Pad Top Reinforcement Bar Area =	$A_{btop} := \frac{\pi \cdot d_{btop}^2}{4} = 0.785\text{-in}^2$	
Pad Bottom Reinforcement Bar Area =	$A_{bbot} := \frac{\pi \cdot d_{bbot}^2}{4} = 0.785\text{-in}^2$	
Coefficient of Lateral Soil Pressure =	$K_p := \frac{1 + \sin(\phi_s)}{1 - \sin(\phi_s)} = 3$	
Load Factor =	$LF := \begin{cases} 1.333 & \text{if } H_t \leq 700\text{-ft} \\ 1.7 & \text{if } H_t \geq 1200\text{-ft} \\ 1.333 + \left(\frac{H_t - 700\text{ft}}{1200\text{ft} - 700\text{ft}} \right) \cdot 0.4 & \text{otherwise} \end{cases}$	= 1.333

Stability of Footing:

Adjusted Concrete Unit Weight =

$$\gamma_c := \text{if}(\text{Bouyancy} = 1, \gamma_{\text{conc}} - 62.4 \text{pcf}, \gamma_{\text{conc}}) = 150 \text{pcf}$$

Adjusted Soil Unit Weight =

$$\gamma_s := \text{if}(\text{Bouyancy} = 1, \gamma_{\text{soil}} - 62.4 \text{pcf}, \gamma_{\text{soil}}) = 100 \text{pcf}$$

Passive Pressure =

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

$$P_{pt} := K_p \cdot \gamma_s \cdot (D_f - T_f) + c \cdot 2 \cdot \sqrt{K_p} = 1.05 \text{ksf}$$

$$P_{top} := \text{if}(n < (D_f - T_f), P_{pt}, P_{pn}) = 1.05 \text{ksf}$$

$$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p} = 1.95 \text{ksf}$$

$$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 1.5 \text{ksf}$$

$$T_p := \text{if}(n < (D_f - T_f), T_f, (D_f - n)) = 3$$

$$A_p := W_f \cdot T_p = 72$$

Ultimate Shear =

$$S_u := P_{ave} \cdot A_p = 108 \text{kip}$$

Weight of Concrete Pad =

$$WT_c := \left[(W_f^2 \cdot T_f) + \frac{d_p^2 \cdot \pi}{4} \cdot L_p \right] \cdot \gamma_c = 281.599 \text{kip}$$

Weight of Soil Above Footing =

$$WT_{s1} := \left[\left(W_f^2 - \frac{d_p^2 \cdot \pi}{4} \right) \cdot (L_p - L_{pag} - n) \right] \cdot \gamma_s = 135.7 \text{kip}$$

Weight of Soil Wedge at Back Face =

$$WT_{s2} := \left(\frac{D_f^2 \cdot \tan(\Phi_s)}{2} \cdot W_f \right) \cdot \gamma_s = 29.272 \text{kip}$$

Weight of Soil Wedge at back face Corners =

$$WT_{s3} := 2 \cdot \left[(D_f)^3 \cdot \frac{\tan(\Phi_s)}{3} \right] \cdot \gamma_s = 10.57 \text{kips}$$

Total Weight =

$$WT_{tot} := WT_c + WT_{s1} + \text{Axial} = 457.303 \text{kip}$$

Resisting Moment =

$$M_r := (WT_{tot}) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + \left[(WT_{s2} + WT_{s3}) \cdot \left(W_f + \frac{D_f \cdot \tan(\Phi_s)}{3} \right) \right] = 6602 \text{kip-ft}$$

Overtuning Moment =

$$M_{ot} := OM + \text{Shear} \cdot (L_p + T_f) = 3063 \text{kip-ft}$$

Factor of Safety Actual =

$$FS := \frac{M_r}{M_{ot}} = 2.16$$

Factor of Safety Required =

$$FS_{req} := 2$$

$$\text{OverTurning_Moment_Check} := \text{if}(FS \geq FS_{req}, \text{"Okay"}, \text{"No Good"})$$

$$\text{OverTurning_Moment_Check} = \text{"Okay"}$$

Shear Capacity in Pier:

Shear Resistance of Pier =

$$S_p := \frac{\mu \cdot W_{T_{tot}}}{FS_{req}} = 102.893 \cdot \text{kips}$$

$$\text{Shear_Check} := \text{if}(S_p > \text{Shear}, \text{"Okay"}, \text{"No Good"})$$

$$\text{Shear_Check} = \text{"Okay"}$$

Bearing Pressure Caused by Footing:

Area of the Mat =

$$A_{mat} := W_f^2 = 576$$

Section Modulus of Mat =

$$S := \frac{W_f^3}{6} = 2304 \cdot \text{ft}^3$$

Maximum Pressure in Mat =

$$P_{max} := \frac{W_{T_{tot}}}{A_{mat}} + \frac{M_{ot}}{S} = 2.123 \cdot \text{ksf}$$

$$\text{Max_Pressure_Check} := \text{if}(P_{max} < q_s, \text{"Okay"}, \text{"No Good"})$$

$$\text{Max_Pressure_Check} = \text{"Okay"}$$

Minimum Pressure in Mat =

$$P_{min} := \frac{W_{T_{tot}}}{A_{mat}} - \frac{M_{ot}}{S} = -0.535 \cdot \text{ksf}$$

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

$$\text{Min_Pressure_Check} = \text{"No Good"}$$

Distance to Resultant of Pressure Distribution =

$$X_p := \frac{\frac{P_{max}}{P_{max} - P_{min}} \cdot \frac{1}{3}}{\frac{W_f}{W_f}} = 6.389$$

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 =

$$e := \frac{M_{ot}}{W_{T_{tot}}} = 6.698$$

Adjusted Soil Pressure =

$$P_a := \frac{2 \cdot W_{T_{tot}}}{3 \cdot W_f \left(\frac{W_f}{2} - e \right)} = 2.396 \cdot \text{ksf}$$

$$q_{adj} := \text{if}(P_{min} < 0, P_a, P_{max}) = 2.396 \cdot \text{ksf}$$

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

$$\text{Pressure_Check} = \text{"Okay"}$$

Concrete Bearing Capacity:

Strength Reduction Factor =

$$\Phi_C := 0.65 \quad (\text{ACI-2008 9.3.2.2})$$

Bearing Strength Between Pier and Pad =

$$P_b := \Phi_C \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 1.056 \times 10^4 \cdot \text{kips} \quad (\text{ACI-2008 10.14})$$

$$\text{Bearing_Check} := \text{if}(P_b > \text{LF} \cdot \text{Axial}, \text{"Okay"}, \text{"No Good"})$$

$$\text{Bearing_Check} = \text{"Okay"}$$

Shear Strength of Concrete:

Beam Shear:

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

$$\phi_C := 0.85 \quad (\text{ACI 9.3.2.5})$$

$$d := T_f - C_{vr_{pad}} - d_{bbot} = 32 \cdot \text{in}$$

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

$$d_2 := d_1 - d$$

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

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

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

$$V_{Avail} := \phi_C \cdot 2 \cdot \sqrt{f_c \cdot \psi_i} \cdot W_f \cdot d \quad (\text{ACI-2008 11.2.1.1})$$

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

$$\text{Beam_Shear_Check} = \text{"Okay"}$$

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 =

$$b_o := (d_p + d) \cdot \pi = 28.8$$

Area Included Inside Perimeter =

$$A_{bo} := \frac{\pi \cdot (d_p + d)^2}{4} = 66$$

Area Outside of Perimeter =

$$A_{out} := A_{mat} - A_{bo} = 510$$

Subject:

Foundation Analysis

Location:

140-ft Monopole
 Canton, CT

Rev. 0: 9/26/12

Prepared by: T.J.L. Checked by: C.F.C.
 Job No. 12044.CO8

Guess Value =

$$v_u := 1 \text{ ksf}$$

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

Given

$$d^2 + d_p d = \frac{W_{T_{tot}}}{\pi \cdot v_u}$$

$$v_u := \text{Find}(v_u) = 6 \text{ ksf}$$

$$V_u := v_u \cdot d \cdot W_f = 381.1 \text{ kips}$$

Required Shear Strength =

$$V_{req} := LF \cdot V_u = 508 \text{ kips}$$

Available Shear Strength =

$$V_{avail} := \phi_c \cdot 4 \cdot \sqrt{f_c} \cdot \psi_i \cdot b_o \cdot d = 2377.9 \text{ kip} \quad (\text{ACI-2008 11.11.2.1})$$

$$\text{Punching_Shear_Check} := \text{if}(V_{req} < V_{avail}, \text{"Okay"}, \text{"No Good"})$$

$$\text{Punching_Shear_Check} = \text{"Okay"}$$

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

Strength Reduction Factor =

$$\phi_m := .90$$

(ACI-2008 9.3.2.1)

$$q_b := q_{adj} - d_1 \cdot \text{Slope} = 1.078 \text{ ksf}$$

Maximum Bending at Face of Pier =

$$M_n := \frac{1}{LF \cdot \phi_m} \left[(q_{adj} - q_b) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 1498.3 \text{ kip-ft}$$

$$\beta := \begin{cases} 0.85 & \text{if } 2500 \text{ psi} \leq f_c \leq 4000 \text{ psi} \\ 0.65 & \text{if } f_c > 8000 \text{ psi} \\ \left[0.85 - \left[\frac{\left(\frac{f_c}{\text{psi}} - 4000 \right)}{1000} \right] \cdot 0.5 \right] & \text{otherwise} \end{cases} = 0.85 \quad (\text{ACI-2008 10.2.7.3})$$

$$R_u := \frac{M_n}{\phi_m \cdot W_f \cdot d^2} = 9.8 \text{ ksf}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \left(1 - \sqrt{1 - \frac{2 \cdot R_u}{0.85 \cdot f_c}} \right) = 0.0011$$

$$\rho_{min} := 1.333 \cdot \rho = 0.00152$$

Subject:

Foundation Analysis

Location:

140-ft Monopole
 Canton, CT

Rev. 0: 9/26/12

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Required Reinforcement for Temperature and Shrinkage:

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

Check Bottom Bars:

$$A_s := \max(\rho, \rho_{min}, \rho_{sh}) \cdot W_f d = 16.6 \text{ in}^2$$

$$A_{sprov} := A_{bbot} \cdot NB_{bot} = 31.4 \text{ in}^2$$

$$Pad_Reinforcement_Bot := \text{if}(A_{sprov} > A_s, \text{"Okay"}, \text{"No Good"})$$

$$Pad_Reinforcement_Bot = \text{"Okay"}$$

Check top Bars:

$$A_s := \rho_{sh} (W_f d) = 16.6 \text{ in}^2$$

$$A_{sprov} := A_{btop} \cdot NB_{top} = 22 \text{ in}^2$$

$$Pad_Reinforcement_Top := \text{if}(A_{sprov} > A_s, \text{"Okay"}, \text{"No Good"})$$

$$Pad_Reinforcement_Top = \text{"Okay"}$$

Development Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2 \cdot C_{vrpad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 6.21 \text{ in}$$

Spacing or Cover Dimension =

$$c := \text{if}\left(C_{vrpad} < \frac{B_{sPad}}{2}, C_{vrpad}, \frac{B_{sPad}}{2}\right) = 3 \text{ in}$$

Transverse Reinforcement Index =

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

$$L_{dbt} := \frac{3 \cdot f_y \cdot \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f_c \text{ psi}} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 23.7 \text{ in}$$

Minimum Development Length =

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

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

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - C_{vrpad} = 102 \text{ in}$$

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

$$L_{pad_Check} = \text{"Okay"}$$

Steel Reinforcement in Pier:

Area of Pier =

$$A_p := \frac{\pi \cdot d_p^2}{4} = 4778.36 \cdot \text{in}^2$$

$$A_{smin} := 0.01 \cdot 0.05 \cdot A_p = 2.39 \cdot \text{in}^2 \quad (\text{ACI-2008 10.8.4 \& 10.9.1})$$

$$A_{sprov} := NB_{pier} \cdot A_{bpier} = 34.56 \cdot \text{in}^2$$

$$\text{Steel_Area_Check} := \text{if}(A_{sprov} > A_{smin}, \text{"Okay"}, \text{"No Good"})$$

$$\text{Steel_Area_Check} = \text{"Okay"}$$

Bar Spacing In Pier =

$$B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 4.569 \cdot \text{in}$$

Diameter of Reinforcement Cage =

$$\text{Diam}_{cage} := d_p - 2 \cdot C_{vr_{pier}} = 72 \cdot \text{in}$$

Maximum Moment in Pier =

$$M_p := \left[OM + \text{Shear} \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF = 47876 \cdot \text{in-kips}$$

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

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

$$(D \ N \ n \ P_u \ M_{xu}) = (78 \ 44 \ 8 \ 53.32 \ 4.788 \times 10^4)$$

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

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

$$(\phi P_n \ \phi M_{xn} \ f_{sp} \ \rho) = (68.108 \ 6.115 \times 10^4 \ -60 \ 7.274 \times 10^{-3})$$

$$\text{Axial_Load_Check} := \text{if}(\phi P_n \geq P_u, \text{"Okay"}, \text{"No Good"})$$

$$\text{Axial_Load_Check} = \text{"Okay"}$$

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

$$\text{Bending_Check} = \text{"Okay"}$$

Development Length Pier Reinforcement:

Available Length in Foundation:

$$L_{\text{pier}} := L_p - C_{\text{vr}}_{\text{pier}} = 51 \cdot \text{in}$$

$$L_{\text{pad}} := T_f - C_{\text{vr}}_{\text{pad}} = 33 \cdot \text{in}$$

Tension:

(ACI-2008 12.2.3)

Spacing or Cover Dimension =

$$c := \text{if} \left(C_{\text{vr}}_{\text{pier}} < \frac{B_{\text{SPier}}}{2}, C_{\text{vr}}_{\text{pier}}, \frac{B_{\text{SPier}}}{2} \right) = 2.285 \cdot \text{in}$$

Transverse Reinforcement =

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

$$L_{\text{dbt}} := \frac{3 \cdot f_y \cdot \alpha_{\text{pier}} \cdot \beta_{\text{pier}} \cdot \gamma_{\text{pier}} \cdot \lambda_{\text{pier}}}{40 \cdot \sqrt{f_c \cdot \text{psi}} \cdot \left(\frac{c + k_{\text{tr}}}{d_{\text{bpier}}} \right)} \cdot d_{\text{bpier}} = 31.14 \cdot \text{in}$$

Minimum Development Length =

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

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

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

$$L_{\text{tension_Check}} := \text{if}(L_{\text{pier}} + L_{\text{pad}} > L_{\text{dbt}}, \text{"Okay"}, \text{"No Good"})$$

$$L_{\text{tension_Check}} = \text{"Okay"}$$

Compression:

(ACI-2008 12.3.2)

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

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

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

$$L_{\text{compression_Check}} := \text{if}(L_{\text{pier}} + L_{\text{pad}} > L_{\text{dbc}}, \text{"Okay"}, \text{"No Good"})$$

$$L_{\text{compression_Check}} = \text{"Okay"}$$

Subject:

Foundation Analysis

Location:

140-ft Monopole
 Canton, CT

Rev. 0: 9/26/12

Prepared by: T.J.L. Checked by: C.F.C.
 Job No. 12044.CO8

Tie Size and Spacing in Column:

Minimum Tie Size =

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

Used #4 Ties

Seismic Factor =

$$z := \text{if}(Z \leq 2, 1, 0.5) = 1$$

(ACI-2008 21.10.5)

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

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

$$s_{lim3} := D_f \cdot z = 78 \cdot \text{in}$$

$$s_{lim4} := 18 \cdot \text{in}$$

Maximum Spacing =

$$s_{tie} := \min \begin{pmatrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{pmatrix} = 16 \cdot \text{in}$$

Number of Ties Required =

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

Check Anchor Steel Embedment:

Depth Available =

$$D_{ab} := L_{st} - A_{BP} = 5 \cdot \text{ft}$$

Length of Anchor Bolt =

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

$$\text{Depth_Check} := \text{if}(D_{ab} \geq L_{anchor}, \text{"Okay"}, \text{"No Good"})$$

Depth_Check = "No Good"

Note: Anchor plate is provided

AM-X-CD-14-65-00T-RET (4' 65° Dual Broadband Antenna)

Dual Band Electrical DownTilt Antenna

698 ~ 894MHz, X-pol., H65° / V17.0°**1710 ~ 2170MHz, X-pol., H65° / V8.5°****Electrical Specification**

Frequency Range	698~894MHz	1710~2170MHz
Impedance	50Ω	
Polarization	Dual, Slant ±45°	
Gain	14.0dBi / 11.85dBd @ 698-806MHz 14.8dBi / 12.65dBd @ 824-894MHz	16.1dBi / 13.95dBd @1710-1755MHz 16.3dBi / 14.15dBd @1850-1900MHz 16.0dBi / 13.85dBd @2110-2155MHz
Beamwidth	Horizontal	67° @ 698-806MHz 65° @ 824-894MHz
	Vertical	60° @ 1710-1755MHz 61° @ 1850-1900MHz 64° @ 2110-2155MHz
	Horizontal	17.5 @ 698-806MHz 16.5° @ 824-894MHz
	Vertical	8.8° @ 1710-1755MHz 8.5° @ 1850-1900MHz 8.0° @ 2110-2155MHz
VSWR	≤1.5:1	
Front-to-Back Ratio	≥28 dB	
Electrical Downtilt Range	2° ~ 16°	0° ~ 10°
Isolation Between Ports	≥30 dB	
Isolation Between Ports of Different Frequency Elements	≥35 dB	
Cross Pole Discrimination	10.0 dB @ ±60° 15.0 dBi @ 0°	
First Upper Side Lobe Suppression	16dB	
Side Lobe Suppression	> 16 dB @ 0-6° Tilt > 18 dB @ 7-12° Tilt (Up to 15° from Boresight)	> 16 dB @ 0-6° Tilt > 18 dB @ 7-10° Tilt (Up to 15° from Boresight)
Passive Intermodulation	≤ -150 dBc @ 2x20w	
Input Maximum CW Power	500 W	300 W
Environmental Compliance	IP65 for Radome IP67 for Connectors	
RET Motor Configuration	Field Replaceable RET Electronic Control Module / RET Motor is internal to antenna & not field replaceable	
Compliant with AISG 1.1 and 2.0	AISG 1.1 and 2.0	

Mechanical Specification

Dimension (W×D×H)	11.8×5.9×48 inches (300×150×1219mm)
Weight (Without clamp)	36.4 lbs (16.5 kg)
Connector	4 x 7/16 DIN(F), Long Neck
Max Wind Speed	150 mph
Wind Load (@150 mph)	1260 N

P65-17-XLH-RR

Dual Broadband Antennas

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

	698-894		1710-2170		
Frequency range (MHz)	698-894		1710-1880	1850-1990	1900-2170
Frequency band (MHz)	698-806	806-894			
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 ($^\circ$)	70	63	60	63	60
Vertical beam width, -3 dB ($^\circ$)	8.4		6.5		
Electrical down tilt ($^\circ$)	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		> 40		
Tracking, horizontal plane $\pm 60^\circ$ (dB)	< 2		< 2		
Vertical beam squint ($^\circ$)	< 0.5		< 0.5		
Front to back ratio (dB) $180^\circ \pm 30^\circ$ copolar	> 25		> 30		
Front to back ratio (dB) $180^\circ \pm 30^\circ$ total power	> 22		> 25		
Cross polar discrimination (XPD) 0° (dB)	> 15		> 15		
Cross polar discrimination (XPD) $\pm 60^\circ$ (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/>.



Andrew Solutions

SBNH-1D6565C

DualPol® Dual Band Teletilt® Antenna, 698–896 and 1710–2180 MHz, 65° horizontal beamwidth, RET compatible

- Interleaved dipole technology providing for attractive, low wind load mechanical package
- Internal next generation actuator eliminates field installation and defines new standards for reliability

Electrical Specifications

Frequency Band, MHz	698–806	806–896	1710–1880	1850–1990	1920–2180
Gain, dBi	15.7	16.4	18.0	18.0	18.0
Beamwidth, Horizontal, degrees	71	67	58	57	59
Beamwidth, Vertical, degrees	8.6	7.8	5.5	5.1	4.8
Beam Tilt, degrees	0–11	0–11	0–7	0–7	0–7
USLS, typical, dB	15	15	16	16	16
Front-to-Back Ratio at 180°, dB	25	28	34	31	31
Front-to-Back Total Power at 180° ± 20°, dB	21	22	30	27	26
CPR at Boresight, dB	24	21	17	17	17
CPR at Sector, dB	11	8	9	8	9
Isolation, dB	30	30	30	30	30
Isolation, Intersystem, dB	35	35	35	35	35
VSWR Return Loss, dB	1.5:1 14.0	1.5:1 14.0	1.5:1 14.0	1.5:1 14.0	1.5:1 14.0
PIM, 3rd Order, 2 x 20 W, dBc	-150	-150	-150	-150	-150
Input Power per Port, maximum, watts	400	400	300	300	300
Polarization	±45°	±45°	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm
Lightning Protection	dc Ground	dc Ground	dc Ground	dc Ground	dc Ground

Mechanical Specifications

Color Radome Material	Light gray Fiberglass, UV resistant
Connector Interface Location Quantity	7-16 DIN Female Bottom 4
Wind Loading, maximum	879.0 N @ 150 km/h 197.6 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h 149.8 mph

Dimensions

Depth	181.0 mm 7.1 in
Length	2449.00 mm 96.42 in
Width	301.00 mm 11.85 in
Net Weight	27.60 kg 60.85 lb

Remote Electrical Tilt (RET) Information

Adjustment Time, full range, maximum	30 s
Annual Failure Rate, maximum	0.01%
Power Consumption, during motor movements, maximum	11.0 W
Power Consumption, idle state, maximum	2.0 W

RRUS11

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

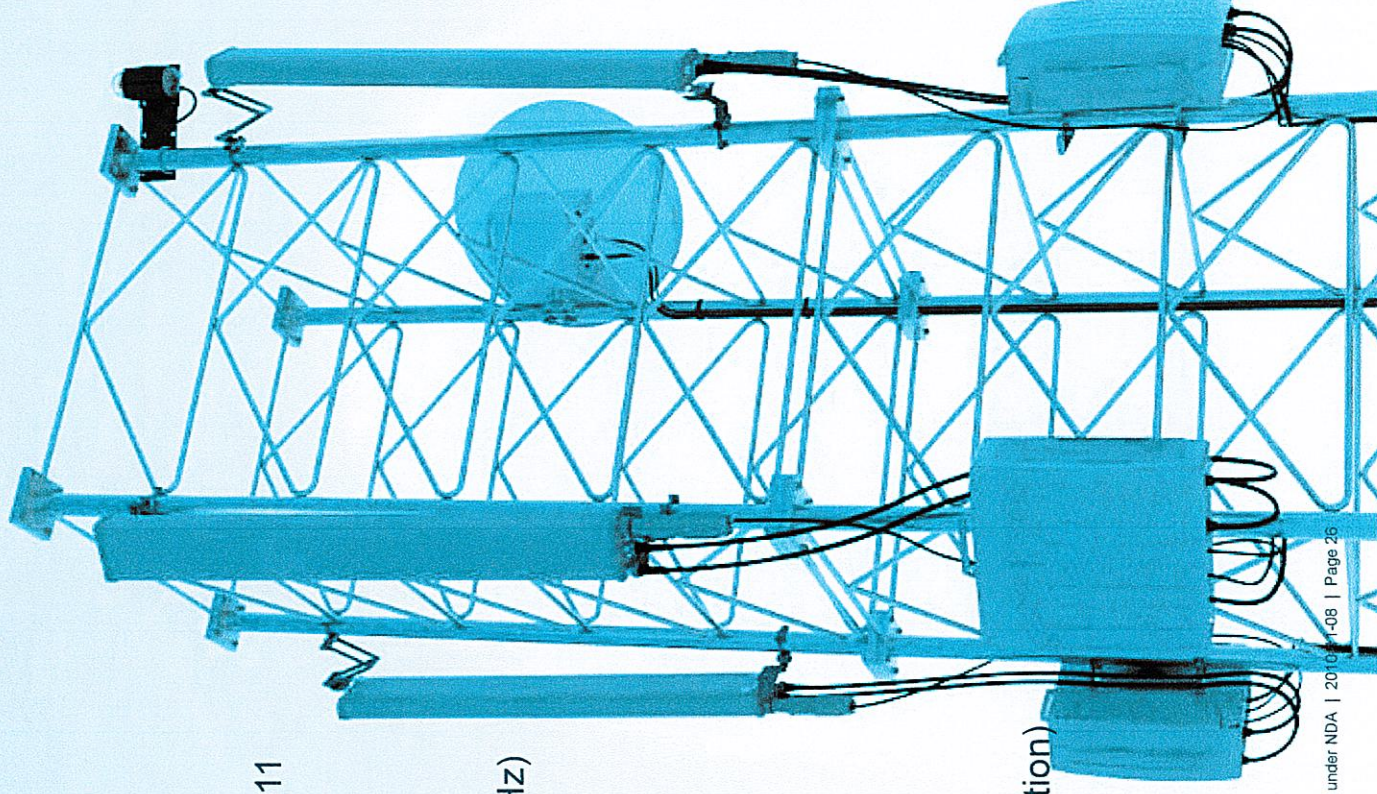
- ✓ AISG 2.0 Compatible
- ✓ Via RET Port and Centre Conductor
- ✓ Cascading
- ✓ 30 VDC Bias

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

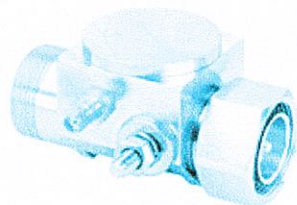
ERICSSON



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

www.commscope.com/andrew

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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

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POWER

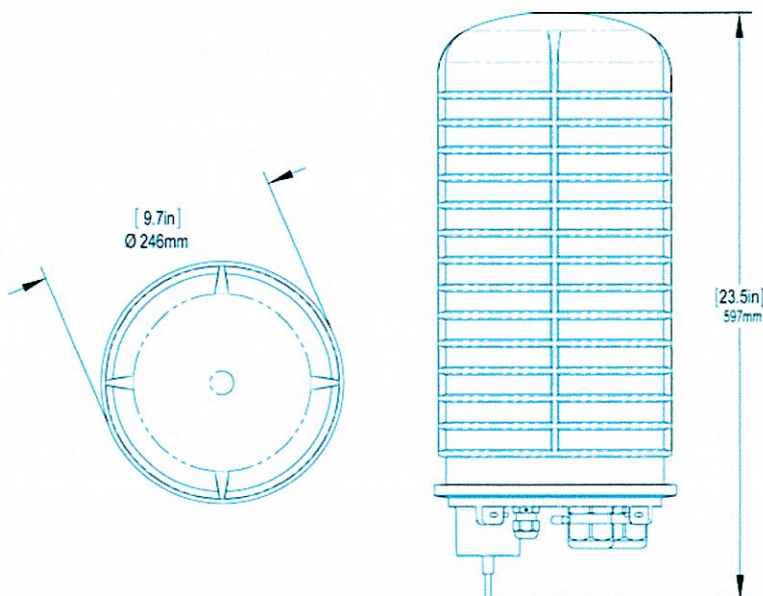
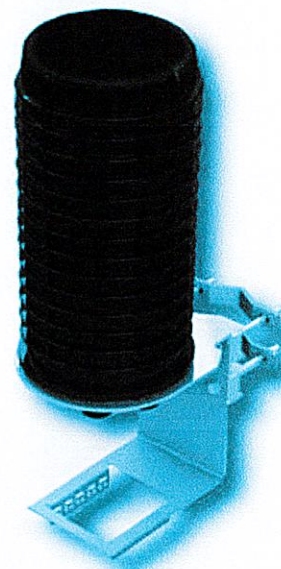
DC6-48-60-18-8F

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.



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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 μ s
Maximum Discharge Current (I_{max}) per NEMA LS-1	60 kA 8/20 μ s
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)



Raycap

G02-00-068 REV 050610



GS-07F-0435V



Certified to
ISO 9001:2000



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