STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL
Ten Franklin Square, New Britain, CT 06051
Phone: (860) 827-2935 Fax: (860) 827-2950
E-Mail: siting.council@ct.gov
www.ct.gov/csc

July 30, 2013

John R. Morissette
Manager – Transmission Siting and Permitting
Northeast Utilities Service Company
P.O. Box 270
Hartford, CT 06141-0270

RE: **TS-CL&P-019-130710** – The Connecticut Light and Power Company request for an order to approve the shared used of an existing telecommunications facility located at 116 Grant Hill Road, Brooklyn, Connecticut.

Dear Mr. Morissette:

At a public meeting held July 25, 2013, the Connecticut Siting Council (Council) ruled that the shared use of this existing tower site is technically, legally, environmentally, and economically feasible and meets public safety concerns, and therefore, in compliance with General Statutes § 16-50aa, the Council has ordered the shared use of this facility to avoid the unnecessary proliferation of tower structures with the following conditions:

- Any deviation from the proposed installation as specified in the original tower share request and supporting materials with the Council shall render this decision invalid;
- Any material changes to the proposed installation as specified in the original tower share request and supporting materials filed with the Council shall require an explicit request for modification to the Council pursuant to Connecticut General Statutes § 16-50aa, including all relevant information regarding the proposed change with cumulative worst-case modeling of radio frequency exposure at the closest point of uncontrolled access to the tower base, consistent with Federal Communications Commission, Office of Engineering and Technology, Bulletin 65;
- Not less than 45 days after completion of the proposed installation, the Council shall be notified in writing that the installation has been completed;
- The validity of this action shall expire one year from the date of this letter; and
- The applicant may file a request for an extension of time beyond the one year deadline provided that such request is submitted to the Council not less than 60 days prior to the expiration.

This decision is under the exclusive jurisdiction of the Council. This facility has been carefully modeled to ensure that radio frequency emissions are conservatively below State and federal standards applicable to the frequencies now used on this tower. Any deviation from this format may result in the Council implementing enforcement proceedings pursuant to General Statutes § 16-50u including, without limitation, imposition of expenses resulting from such failure and of civil penalties in an amount not less than one thousand dollars per day for each day of construction or operation in material violation.

This decision applies only to this request for tower sharing and is not applicable to any other request or construction. Please be advised that the validity of this action shall expire one year from the date of this letter.

The proposed shared use is to be implemented as specified in your letter dated July 10, 2013, including the placement of all necessary equipment and shelters within the tower compound.

Thank you for your attention and cooperation.

Very truly yours,

Robert Stein MHB
Robert Stein
Chairman

RS/CDM/jb

c: The Honorable Austin T. Tanner, First Selectman, Town of Brooklyn
Chester Dobrowski, Zoning Enforcement Officer, Town of Brooklyn
Crown Castle

CSC
CONNECTICUT SITING COUNCIL

Northeast Utilities

107 Selden Street, Berlin, CT 06037
Northeast Utilities Service Company
P.O. Box 270
Hartford, CT 06141-0270
(860) 665-2036

John R. Morissette
Project Manager
Transmission Siting

December 23, 2013

Robert Stein, Chairman
Connecticut Siting Council
Ten Franklin Square
New Britain, CT 06051

RE: TS-CL&P-019-130710
Notice of Completion

Dear Chairman Stein:

The Connecticut Light and Power Company ("CL&P") received approval from the Connecticut Siting Council ("Council") on July 25, 2013 for the Shared Use of an Existing Telecommunications Facility ("Tower Share") located at 116 Grant Hill Road, Brooklyn, Connecticut (TS-CL&P-019 -130710). In its July 30, 2013 letter approving this Tower Share, the Council included a condition regarding the associated installation work. CL&P submits this letter to provide notice that CL&P has complied with the Council's condition as follows:

- Not less than 45 days after completion of the proposed installation, the Council shall be notified in writing that the installation has been completed. CL&P completed its installation on December 2, 2013; this letter provides notice of completion of the installation.

If you have any questions or comments, please call me at 860-665-2036.

Sincerely,

John R. Morissette

JU

TS-CL&P-019-130710

Connecticut Light & Power
A Northeast Utilities Company

107 Selden Street, Berlin, CT 06037
Northeast Utilities Service Company
P.O. Box 270
Hartford, CT 06141-0270
(860) 665-2036

John R Morissette
Project Manager – Transmission Siting

July 10, 2013

Robert Stein, Chairman
Connecticut Siting Council
Ten Franklin Square
New Britain, CT 06051

Dear Chairman Stein:

Attached are an original and fifteen (15) copies of a Request for Tower Sharing submitted on behalf of The Connecticut Light and Power Company ("CL&P"). This filing requests that the Council approve the proposed tower sharing on an existing telecommunications tower in Brooklyn pursuant to the exemption provided under Sections 16-50j-88 to 16-50j-90 of the Regulations of Connecticut State Agencies.

Also attached is a check for the filing fee in the amount of $625.

The First Selectman of the Town of Brooklyn has been informed of the requested approval of sharing this tower in Brooklyn.

Sincerely,

John R. Morissette
Project Manager – Transmission Siting and Permitting

Attachments: Request for Tower Sharing
Check

cc: Austin Tanner
First Selectman
4 Wolf Den Rd.
Brooklyn, CT 06234

THE CONNECTICUT LIGHT AND POWER COMPANY

REQUEST FOR TOWER SHARING ON AN EXISTING TELECOMMUNICATIONS FACILITY IN THE TOWN OF BROOKLYN, CONNECTICUT

A. Introduction:

Pursuant to Regulations of Connecticut State Agencies ("RCSA") §§16-50j-88 to 16-50j-90, and Connecticut General Statutes ("CGS") §16-50k, Northeast Utilities Service Company ("NUSCo") as agent for its corporate affiliate, The Connecticut Light and Power Company ("CL&P"), hereby requests approval of the Connecticut Siting Council (the "Council") for tower sharing on an existing wireless telecommunications facility located at 116 Grant Hill Rd, Brooklyn, Connecticut (the "Property"). Specifically, CL&P proposes to collocate on an existing monopole that is owned and maintained by Crown Castle USA, Inc. ("CCUI"). NUSCo submits that no certificate of environmental compatibility and public need pursuant to CGS §16-50k ("Certificate") is required because the proposed tower sharing would satisfy the requirements set out in RCSA §§16-50j-88 to 16-50j-90 and therefore would qualify for exemption.

B. Background:

CL&P is in the process of expanding its 900 MHz Distribution Supervisory Control and Data Acquisition ("DSCADA") system throughout Connecticut. This system allows for a more reliable electrical distribution system and enhanced public safety by means of remotely operating line disconnect equipment where connected to reclosures/switching equipment. CCUI currently owns and operates a telecommunications tower, located on the property. The total height of the existing monopole is 150 feet above ground level ("AGL"). CL&P is proposing to attach one antenna to the existing monopole at a mount height of 90 feet AGL.

C. Description of the "Project":

CL&P proposes to attach one (1) 20-foot omnidirectional antenna to the existing monopole on a side-arm mount located at a height of 90 feet above ground level and install one (1) 10-foot by 12-foot equipment shelter on a concrete foundation within the existing chain-link fenced compound. CL&P also proposes to add one (1) 15 kW liquid propane generator mounted on a 4-foot by 7-foot concrete pad and one (1) 1,000 gallon propane tank mounted on a 4-foot by 16-foot concrete pad. All installations would be located within the existing chain-link fenced compound. For elevation and location drawings of the proposed installations, please see Attachment 1*: Project Plans*, dated May 30, 2013.

CCUI has agreed to CL&P's proposed installations and is entering into a lease agreement with CL&P to allow for such installations and to provide necessary

associated rights to CL&P to access the Property. Please see Attachment 2: *Letter of Authorization from Crown Castle USA, Inc.*, dated April 10, 2013, stating its agreement with CL&P's proposed shared use of its existing telecommunications tower on the Property.

An independent structural review and evaluation has been performed to ensure that the tower and foundation would be structurally capable of supporting the loading from the proposed installations. A detailed structural analysis for the proposed tower modifications is included as Attachment 3: *Structural Analysis Report*, dated April 05, 2013.

D. The proposed installations would not have a substantial environmental effect because:

1) Wetlands and Watercourses

There are no wetlands or watercourses located on or near the location of the proposed installations; therefore, the Project would not have an adverse effect on wetlands or watercourses.

2) Soil Erosion, Sediment Control, and Soil Remediation

To the extent needed during the Project, CL&P would apply soil erosion and sediment control practices pursuant to the *2002 Connecticut Guidelines for Soil Erosion and Sediment Control*.

3) Wildlife and Vegetation

The Project would not have a significant adverse effect on wildlife or vegetation as its scope is limited to the area within the existing chain link fence compound.

4) Noise

The proposed generator is designed for quiet operation and would not significantly increase the noise levels to the areas surrounding the facility during its operation. Further, CL&P would not operate the generator continuously; it would be operated only during power outages and daytime routine testing. Sound specifications for the generator can be seen in Attachment 4: *Generator Set Sound Data Sheet*.

5) Safety and Health

The proposed installations would not create any safety or health hazards to persons or property.

CL&P does not anticipate the need for specific traffic control measures during construction on the Property or equipment and materials delivery. Subsequent to completion of construction, the proposed installations would not generate any additional traffic to the area other than continued periodic maintenance visits.

The Project would have minimal impact on the air quality of the telecommunications facility. The proposed generator would run once a week for testing purposes and during times of power outages. The generator engine is certified by the Environmental Protection Agency ("EPA") for stationary emergency applications.

Radio-signal emissions from the proposed equipment, after installation on the Property, would not exceed the total radio-frequency ("RF") electromagnetic power density level permitted by the Federal Communications Commission ("FCC"). To ensure compliance with the applicable standard, CL&P commissioned C Squared Systems to perform a calculated power-density analysis for the proposed CL&P antenna installation using the methodology prescribed by the FCC's Office of Engineering and Technology Bulletin No. 65, Edition 97-01 (August 1997). The analysis verifies that after completion of the CL&P installations, composite emissions from the facility would be well below the maximum power density levels as outlined by the FCC in OET Bulletin 65 Ed. 97-01. The highest expected percent of Maximum Permissible Exposure, at ground level, is 55.10% of the FCC limit. Please refer to Attachment 5: *Calculated Radio Frequency Emissions Report* dated May 2, 2013, for details of the analysis.

6) Visual

The Project would have minimal visual impact due to the dimensions and heights of the proposed antennas on the existing monopole. The planned CL&P 10-foot by 12-foot equipment shelter is to be located on a concrete foundation within the compound. For a visual comparison of the existing and planned compound configuration, please refer to Attachment 1*: Project Plans*, dated May 30, 2013.

7) Forests and Parks

The Property contains no areas of recreation or public interest administered by any federal, state, local, or private agencies.

E. Schedule:

Construction of this modification would begin as soon as practical after issuance of the requested approval of the Council and would be less than eight months in duration. CL&P anticipates that construction would be completed by the fall of 2013.

F. Conclusion:

RCSA §16-50j-88 indicates that no Certificate is needed for proposed sharing of a telecommunications facility that the Council determines satisfies the criteria set out in RCSA §§16-50j-88 to 16-50j-90. Based on the factors set forth above, NUSCo respectfully submits that the installations of the antenna and other equipment at this existing telecommunications facility would be technically, legally, environmentally and economically feasible and would satisfy the criteria of RCSA §§16-50j-88 to 16-50j-90 for exemption from the requirement for a Certificate. Accordingly, NUSCo requests that the Council issue an order approving CL&P's proposed tower sharing pursuant to RCSA §16-50j-88.

G. Communications regarding this Request for Tower Sharing should be directed to:

Mr. John R. Morissette
Project Manager, Transmission Siting
Northeast Utilities Service Company
P.O. Box 270
Hartford, CT 06141-0270
Telephone: (860) 665-2036

NORTHEAST UTILITIES SERVICE COMPANY

By: _____
John R. Morissette
Project Manager, Transmission Siting

Attachments:

- Attachment 1: Project Plans
- Attachment 2: Letter of Authorization from Crown Castle USA, Inc.
- Attachment 3: Structural Analysis Report
- Attachment 4: Generator Set Sound Data Sheet
- Attachment 5: Radio Frequency Emissions Report

ATTACHMENT 1

Northeast Utilities System

BROOKLYN
116 GRANT HILL ROAD
BROOKLYN, CT 06234

SITE DIRECTIONS

FROM: 107 SELDEN STREET, BERLIN, CONNECTICUT **TO:** 116 GRANT HILL ROAD, BROOKLYN, CONNECTICUT

1. Head northwest on Selden St toward CT-15 N/US-5 N/Berlin Turnpike	0.1 mi
2. Take the 1st right onto US-5 N/Berlin Turnpike, Continue to follow US-5 N	8.6 mi
3. Continue onto CT-15 N	1.5 mi
4. Merge onto I-84 E	1.7 mi
5. Take exit 59 to merge onto I-384 E toward Providence	8.8 mi
6. Slight right onto US-6 E/Hop River Rd (signs for Providence/Willimantic), Continue to follow US-6 E	15.7 mi
7. Take the ramp to US-6 E/Boston Post Rd	0.5 mi
8. Keep right at the fork, follow signs for US-6/Providence	154 ft
9. Turn right onto US-6 E/Boston Post Rd, Continue to follow US-6 E	11.1 mi
10. Turn left onto Cherry Hill Rd	253 ft
11. Take the 1st left onto Grant Hill Rd, Destination will be on the right	0.3 mi

GENERAL NOTES

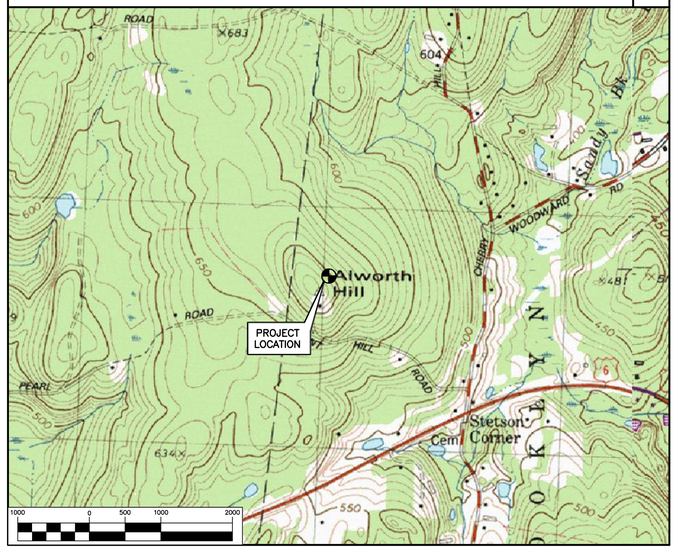
1. PROPOSED ANTENNA LOCATIONS AND HEIGHTS PROVIDED BY NORTHEAST UTILITIES SYSTEM.

PROJECT SCOPE

1. THE PROPOSED SCOPE OF WORK GENERALLY INCLUDES THE INSTALLATION OF A PREFABRICATED ±10' x ±12' EQUIPMENT SHELTER, 15 kW PROPANE FUELED GENERATOR AND 1000 gal. PROPANE TANK ON PROPOSED CONCRETE FOUNDATIONS WITHIN THE EXISTING FENCED COMPOUND.
2. ONE (1) OMINIDIRECTIONAL ANTENNA IS PROPOSED TO BE INSTALLED ON A SIDE ARM MOUNTED TO THE EXISTING TOWER.
3. NO CHANGES ARE PROPOSED TO THE EXISTING UTILITIES SERVICING THE COMPOUND AT THIS TIME.

VICINITY MAP

SCALE: 1" = 1000' NORTH



PROJECT SUMMARY

SITE NAME:	BROOKLYN
SITE ADDRESS:	116 GRANT HILL ROAD BROOKLYN, CT 06234
LESSEE/ TENANT:	NORTHEAST UTILITIES SYSTEM 107 SELDEN STREET BERLIN, CT 06037
CONTACT PERSON:	MIKE CARBARY NORTHEAST UTILITIES SYSTEM (860) 665-3825
TOWER COORDINATES:	LATITUDE: 41°-47'-30.53" LONGITUDE: 72°-00'-53.27" GROUND ELEVATION: ±730' AMSL COORDINATES REFERENCED FROM STUCTURAL ANALYSIS REPORT PREPARD BY PAUL J. FORD AND COMPANY. GROUND ELEVATION REFERENCED FROM AVAILABLE TOPOGRAPHIC MAPPING.

DESIGNED BY: CFC
DRAWN BY: DEB
CHK'D BY: CFC

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
1	05/30/13	CLT	DMD	CSC - ISSUED FOR CLIENT REVIEW
0	05/15/13	CLT	DMD	CSC - ISSUED FOR CLIENT REVIEW

PROFESSIONAL ENGINEER SEAL

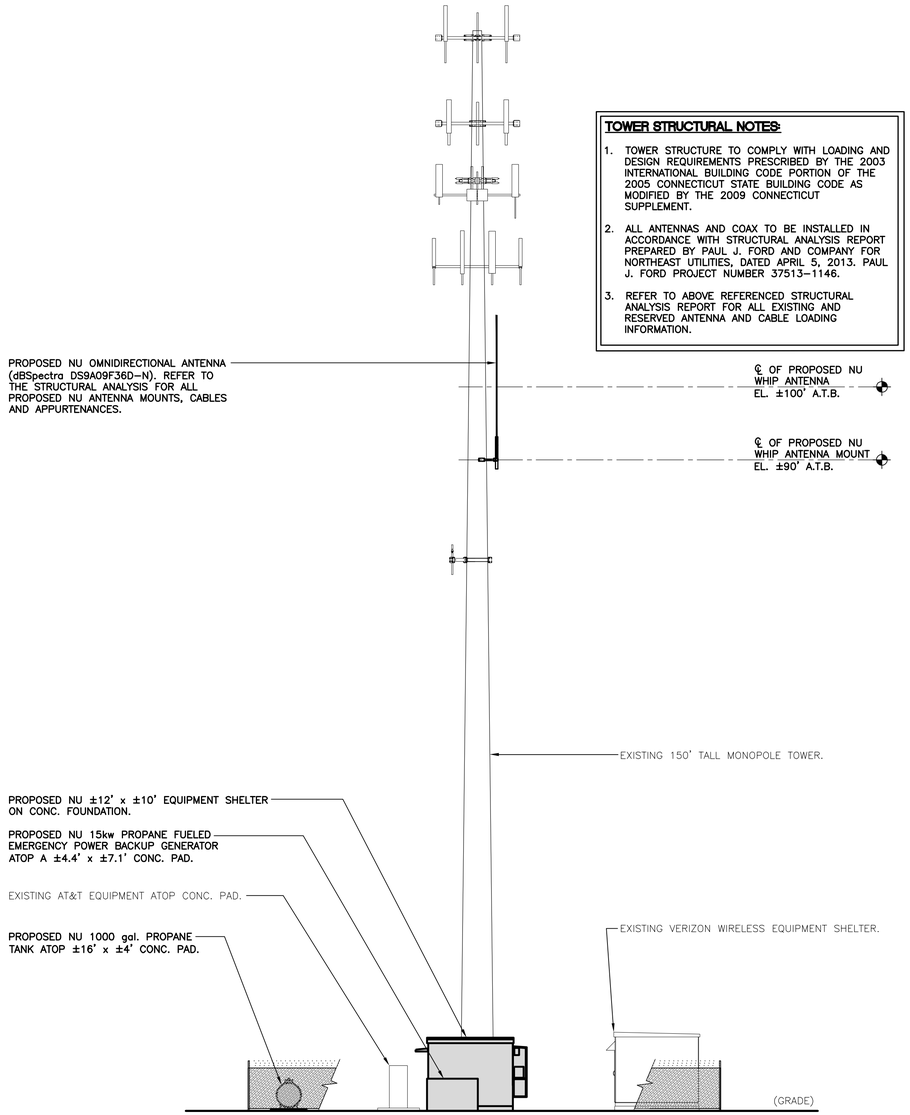
Northeast Utilities System
ENTEK engineering
Centered on Solutions℠
(203) 488-0580
(203) 488-8587 Fax
www.CentekEng.com
63-2 North Branford Road, Branford, CT 06405

NORTHEAST UTILITIES SYSTEM
WIRELESS COMMUNICATIONS FACILITY
BROOKLYN
116 GRANT HILL ROAD
BROOKLYN, CT 06234

DATE: 05/13/13
SCALE: AS NOTED
JOB NO. 13088

TITLE SHEET

T-1



TOWER STRUCTURAL NOTES:

1. TOWER STRUCTURE TO COMPLY WITH LOADING AND DESIGN REQUIREMENTS PRESCRIBED BY THE 2003 INTERNATIONAL BUILDING CODE PORTION OF THE 2005 CONNECTICUT STATE BUILDING CODE AS MODIFIED BY THE 2009 CONNECTICUT SUPPLEMENT.
2. ALL ANTENNAS AND COAX TO BE INSTALLED IN ACCORDANCE WITH STRUCTURAL ANALYSIS REPORT PREPARED BY PAUL J. FORD AND COMPANY FOR NORTHEAST UTILITIES, DATED APRIL 5, 2013. PAUL J. FORD PROJECT NUMBER 37513-1146.
3. REFER TO ABOVE REFERENCED STRUCTURAL ANALYSIS REPORT FOR ALL EXISTING AND RESERVED ANTENNA AND CABLE LOADING INFORMATION.

2 / C-1 EAST ELEVATION

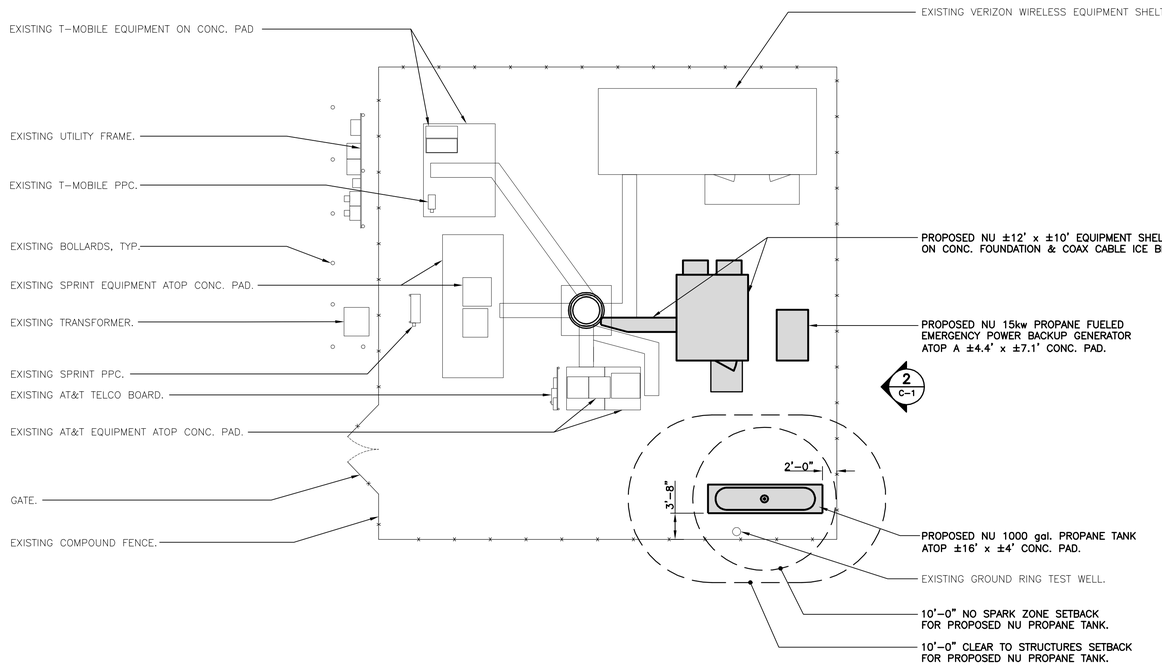
SCALE: 1" = 10'

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

NOTE:
COORDINATE POWER & TELCO SERVICE TO THE PROPOSED NU EQUIPMENT SHELTER WITH OWNER & LOCAL UTILITY COMPANIES.



1 / C-1 COMPOUND PLAN

SCALE: 1" = 10'

NORTH

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

DESIGNED BY:	CFC
DRAWN BY:	CLT
CHK'D BY:	DMD

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
1	05/30/13	CLT	DMD	CSC - ISSUED FOR CLIENT REVIEW
0	05/15/13	CLT	DMD	CSC - ISSUED FOR CLIENT REVIEW

PROFESSIONAL ENGINEER SEAL

Northeast Utilities System

CENTEK engineering
Centered on Solutions℠
(203) 488-0580
(203) 488-8587 Fax
63-2 North Branford Road, Branford, CT 06405
www.CentekEng.com

NORTHEAST UTILITIES SYSTEM

WIRELESS COMMUNICATIONS FACILITY

BROOKLYN

116 GRANT HILL ROAD
BROOKLYN, CT 06234

DATE:	05/13/13
SCALE:	AS NOTED
JOB NO.	13088

COMPOUND PLAN AND ELEVATION

C-1

Sheet No. 2 of 2

ATTACHMENT 2

CROWN CASTLE

3530 Toringdon Way, Suite 300
Charlotte, NC 28277

Telephone: 704-405-6622
Fax: 724-416-4785

April 10, 2013

RE: Crown Castle Letter of Authorization (LOA)

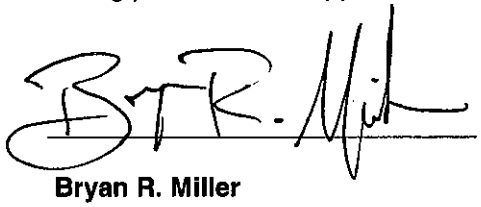
Global Signal Acquisitions II LLC ("Crown Castle"), does hereby authorize **Northeast Utilities ("NE Utilities")** and its authorized contractors/agents to act as "Applicant" in the processing of all applications, permits, research and other related activities associated with the processing, planning, design review, permitting, entitlement and construction of additional equipment, antennas and site improvements for the Crown Castle existing wireless communications facility described as follows:

Customer Site Name:	**N/A**	**Crown Castle Site ID Number:**	**BU# 876390**
Site Address:	**116 Grant Hill Rd, Brooklyn, CT 06234**	**Crown Castle Site Name:**	**HAMPTON/BERNIER**

This authorization is fully contingent upon **NE Utilities** authorized contractors/agents' compliance with the following conditions:

1. Crown Castle must review the application prior to submittal. Crown Castle must be provided all applications, narratives, drawings and attachments at least 72 hours in advance of their submittal to the locality. Use of email and electronic attachments is encouraged. A Crown Castle Zoning Subject Matter Expert (SME) will review and provide written comment to the customer within 48 hours of receipt of a complete set of application materials. If Crown Castle indicates that changes are required, submissions shall be altered in accordance with Crown Castle comments prior to submission to the locality. Verification of corrections should also be accomplished via emails and attachments.
2. In no event may **NE Utilities** encourage, suggest, participate in, or permit the imposition of any restrictions or additional obligations whatsoever on the tower site or Crown Castle's current or future use or ability to license space at the tower site as part of or in exchange for obtaining any approval, permit, exception or variance.
3. A copy of the final permit and/or a written summary of the zoning/entitlement decision rendered by the locality and any/all conditions placed on that decision shall be communicated in detail to Crown Castle well within the appeal period provided by the locality (typically 10-15 days).
4. All conditions of approval pertinent to the construction of the proposed project must be included in the construction drawings for the project. The conditions of approval pertinent to the construction of the project shall be copied verbatim from the zoning permit approval language, and shall be present in the drawings prior to submission for building permits and contractor bidding. Crown Castle shall verify the inclusion of appropriate conditions of approval in the construction drawing redline process.
5. Crown Castle will provide a Notice To Proceed (NTP) to construction to the customer upon receipt of the final approved zoning permit and the approved Building Permit.

By Crown Castle

Signature: 

Printed Name: **Bryan R. Miller**

Title: **Real Estate Specialist**

Date: **April 10, 2013**

ATTACHMENT 3

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS
250 East Broad Street • Suite 1500 • Columbus, Ohio 43215-3708

Date: **April 05, 2013**

Patrick Byrum
Crown Castle USA Inc.
3530 Toringdon Way Suite 300
Charlotte, NC 28277

Paul J Ford and Company
250 E. Broad Street Suite 1500
Columbus, OH 43215
614.221.6679
jwoolley@pjfweb.com

Subject: **Structural Analysis Report**

Carrier Designation:	***Northeast Utilities* Co-Locate**	
	Carrier Site Number:	N/A
	Carrier Site Name:	Brooklyn
Crown Castle Designation:	**Crown Castle BU Number:**	876390
	Crown Castle Site Name:	HAMPTON / BERNIER
	Crown Castle JDE Job Number:	230753
	Crown Castle Work Order Number:	595401
	Crown Castle Application Number:	184584 Rev. 2
Engineering Firm Designation:	**Paul J Ford and Company Project Number:**	37513-1146
Site Data:	**116 Grant Hill Rd., BROOKLYN, Windham County, CT**	
	Latitude *41° 47' 30.53"*, Longitude *-72° 0' 53.27"*	
	150 Foot - Monopole Tower	

Dear Patrick Byrum,

Paul J Ford and Company is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above mentioned tower. This analysis has been performed in accordance with the Crown Castle Structural 'Statement of Work' and the terms of Crown Castle Purchase Order Number 535301, in accordance with application 184584, revision 2.

The purpose of the analysis is to determine acceptability of the tower stress level. Based on our analysis we have determined the tower stress level for the structure and foundation, under the following load case, to be:

LC7: Existing + Reserved + Proposed Equipment **Sufficient Capacity**
Note: See Table I and Table II for the proposed and existing/reserved loading, respectively.

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

We at *Paul J Ford and Company* appreciate the opportunity of providing our continuing professional services to you and Crown Castle USA Inc.. If you have any questions or need further assistance on this or any other projects please give us a call.

Respectfully submitted by:

John J. Woolley, E.I
Structural Designer

STATE OF CONNECTICUT
JOSEPH PACHICARAH JACOBS
No. PEN 22731
LICENSED
PROFESSIONAL ENGINEER

tnxTower Report - version 6.0.3.0

APR 0 5 2013

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS
250 East Broad Street • Suite 1500 • Columbus, Ohio 43215-3708

Date: **April 05, 2013**

Patrick Byrum
Crown Castle USA Inc.
3530 Toringdon Way Suite 300
Charlotte, NC 28277

Paul J Ford and Company
250 E. Broad Street Suite 1500
Columbus, OH 43215
614.221.6679
jwoolley@pjfweb.com

Subject: Structural Analysis Report

Carrier Designation:	***Northeast Utilities* Co-Locate**	
	Carrier Site Number:	N/A
	Carrier Site Name:	Brooklyn
Crown Castle Designation:	**Crown Castle BU Number:**	876390
	Crown Castle Site Name:	HAMPTON / BERNIER
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Site Data:	**116 Grant Hill Rd., BROOKLYN, Windham County, CT** **Latitude *41° 47' 30.53"*, Longitude *-72° 0' 53.27"*** **150 Foot - Monopole Tower**	

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We at *Paul J Ford and Company* appreciate the opportunity of providing our continuing professional services to you and Crown Castle USA Inc.. If you have any questions or need further assistance on this or any other projects please give us a call.

Respectfully submitted by:

John J. Woolley, E.I.
Structural Designer

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 150 ft Monopole tower designed by ENGINEERED ENDEAVORS, INC. in February of 2000. The tower was originally designed for a wind speed of 90 mph per TIA/EIA-222-F.

2) ANALYSIS CRITERIA

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

Table 1 - Proposed Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
90.0	100.0	1	bird technologies group	TTA-429-94C-08179	1 2	1/2 1-1/4	-
		1	dbspectra	DS9A09F36D-N			
	90.0	1	tower mounts	Pipe Mount [PM 602-1]			

Table 2 - Existing and Reserved Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
149.0	151.0	6	decibel	DB980H90E-M w/ Mount Pipe	6	1-5/8	1
	149.0	1	tower mounts	Platform Mount [LP 601-1]			
137.0	138.0	3	ems wireless	RR90-17-02DP w/ Mount Pipe	6	1-5/8	1
		6	ericsson	KRY 112 71/2			
129.0	129.0	1	tower mounts	Side Arm Mount [SO 102-3]	-	-	2
	127.0	6	ericsson	TME-RRUS-11			
127.0	129.0	6	powerwave technologies	7770.00 w/ Mount Pipe	12	1-1/4	1
		6	powerwave technologies	LGP 17201			
		6	powerwave technologies	LGP13519			
		3	kmw communications	AM-X-CD-17-65-00T-RET w/ Mount Pipe	3	3/8	2
		1	raycap	DC6-48-60-18-8F			
	127.0	1	tower mounts	T-Arm Mount [TA 602-3]	-	-	1
117.0	119.0	3	antel	BXA-171085-12CF-EDIN-2 w/ Mount Pipe	18	1-5/8	1
		3	antel	BXA-70063-6CF-2 w/ Mount Pipe			
		6	antel	LPA-80080/4CF w/ Mount Pipe			
	117.0	1	tower mounts	Platform Mount [LP 303-1]			
76.0	77.0	1	lucent	KS24019-L112A	1	1/2	1
	76.0	1	tower mounts	Pipe Mount [PM 601-1]			

Notes:
1) Existing Equipment
2) Reserved Equipment

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	Criscuolo Shepard, 8/9/1999	1615347	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	EEI, 6459, 2/22/2000	1615410	CCISITES
4-TOWER MANUFACTURER DRAWINGS	EEI, 6459, 2/22/2000	1533003	CCISITES
4-TOWER REINFORCEMENT DESIGN/DRAWINGS/DATA	TEP, 072655, 5/15/08	2255030	CCISITES

3.1) Analysis Method

tnxTower (version 6.0.3.0), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

3.2) Assumptions

1) Tower and structures were built in accordance with the manufacturer's specifications.
2) The tower and structures have been maintained in accordance with the manufacturer's specification.
3) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
4) Modifications have been installed in conformance with the referenced modification drawings.
5) No specific horizontal welds were called out for the base plate stiffeners. 3/8" Groove weld was assumed.

This analysis may be affected if any assumptions are not valid or have been made in error. Paul J Ford and Company should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 4 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
L1	150 - 123.29	Pole	TP22.9x17x0.1875	1	-5.02	679.32	42.0	Pass
L2	123.29 - 88.88	Pole	TP30x21.7696x0.3125	2	-10.48	1483.15	78.0	Pass
L3	88.88 - 43.8	Pole	TP39.2x28.4504x0.375	3	-19.08	2329.31	90.0	Pass
L4	43.8 - 0	Pole	TP48x37.2689x0.4375	4	-32.30	3433.55	85.1	Pass
							Summary	
						Pole (L3)	90.0	Pass
						Rating =	90.0	Pass

Table 5 - Tower Component Stresses vs. Capacity

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	75.1	Pass
1	Base Plate	0	65.0	Pass
1	Base Foundation Structural Steel	0	87.8	Pass
1	Base Foundation Soil Interaction	0	77.0	Pass

Structure Rating (max from all components) =	90.0%

Notes:
1) See additional documentation in “Appendix C – Additional Calculations” for calculations supporting the % capacity consumed.

APPENDIX A

TNXTOWER OUTPUT

Tower Input Data

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

1) Tower is located in Windham County, Connecticut.
2) Basic wind speed of 85 mph.
3) Nominal ice thickness of 1.0000 in.
4) Ice density of 56 pcf.
5) A wind speed of 38 mph is used in combination with ice.
6) Temperature drop of 50 °F.
7) Deflections calculated using a wind speed of 50 mph.
8) A non-linear (P-delta) analysis was used.
9) Pressures are calculated at each section.
10) Stress ratio used in pole design is 1.333.
11) 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	150.00-123.29	26.71	3.42	18	17.0000	22.9000	0.1875	0.7500	A572-65 (65 ksi)
L2	123.29-88.88	37.83	4.25	18	21.7696	30.0000	0.3125	1.2500	A572-65 (65 ksi)
L3	88.88-43.80	49.33	5.42	18	28.4504	39.2000	0.3750	1.5000	A572-65 (65 ksi)
L4	43.80-0.00	49.22		18	37.2689	48.0000	0.4375	1.7500	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	17.2623	10.0055	357.3078	5.9684	8.6360	41.3742	715.0858	5.0037	2.6620	14.197
	23.2533	13.5168	880.9281	8.0629	11.6332	75.7253	1763.0154	6.7597	3.7004	19.735
L2	22.8609	21.2827	1237.9542	7.6173	11.0589	111.9416	2477.5374	10.6434	3.2814	10.501

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
	30.4628	29.4463	3278.8026	10.5391	15.2400	215.1445	6561.9196	14.7259	4.7300	15.136
L3	29.8297	33.4167	3327.7547	9.9668	14.4528	230.2502	6659.8882	16.7115	4.3473	11.593
	39.8047	46.2115	8800.5544	13.7829	19.9136	441.9369	17612.6889	23.1101	6.2392	16.638
L4	39.0438	51.1450	8765.5168	13.0752	18.9326	462.9852	17542.5674	25.5774	5.7893	13.233
	48.7405	66.0465	18876.2818	16.8847	24.3840	774.1257	37777.4015	33.0295	7.6780	17.55

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 150.00-123.29				1	1	1		
L2 123.29-88.88				1	1	1		
L3 88.88-43.80				1	1	1		
L4 43.80-0.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
LDF7-50A(1-5/8")	C	No	Inside Pole	149.00 - 0.00	6	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
LDF7-50A(1-5/8")	C	No	Inside Pole	137.00 - 0.00	6	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
LDF6-50A(1-1/4")	C	No	Inside Pole	127.00 - 0.00	12	No Ice	0.00	0.66
						1/2" Ice	0.00	0.66
						1" Ice	0.00	0.66
FB-L98B-002-75000(3/8")	C	No	CaAa (Out Of Face)	127.00 - 0.00	1	No Ice	0.04	0.06
						1/2" Ice	0.14	0.60
						1" Ice	0.24	1.76
WR-VG122ST-BRDA(3/8)	C	No	CaAa (Out Of Face)	127.00 - 0.00	2	No Ice	0.00	0.20
						1/2" Ice	0.00	0.74
						1" Ice	0.00	1.89
LDF7-50A(1-5/8")	C	No	CaAa (Out Of Face)	117.00 - 0.00	2	No Ice	0.20	0.82
						1/2" Ice	0.30	2.33
						1" Ice	0.40	4.46
LDF7-50A(1-5/8")	C	No	CaAa (Out Of Face)	117.00 - 0.00	10	No Ice	0.00	0.82
						1/2" Ice	0.00	2.33
						1" Ice	0.00	4.46
LDF7-50A(1-5/8")	C	No	CaAa (Out Of Face)	117.00 - 0.00	6	No Ice	0.00	0.82
						1/2" Ice	0.00	2.33
						1" Ice	0.00	4.46
LDF4-50A(1/2")	C	No	Inside Pole	76.00 - 0.00	1	No Ice	0.00	0.15
						1/2" Ice	0.00	0.15
						1" Ice	0.00	0.15
LDF4-50A(1/2")	C	No	Inside Pole	90.00 - 0.00	1	No Ice	0.00	0.15
						1/2" Ice	0.00	0.15
						1" Ice	0.00	0.15
LDF6-50A(1-1/4")	C	No	Inside Pole	90.00 - 0.00	2	No Ice	0.00	0.66
						1/2" Ice	0.00	0.66
						1" Ice	0.00	0.66

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	150.00-123.29	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.146	0.23
L2	123.29-88.88	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	12.490	1.04
L3	88.88-43.80	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	19.626	1.56
L4	43.80-0.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	19.069	1.52

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	150.00-123.29	A	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.888	0.24
L2	123.29-88.88	A	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	30.621	3.06
L3	88.88-43.80	A	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	46.675	4.74
L4	43.80-0.00	A	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	45.350	4.61

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	150.00-123.29	-0.0080	0.0046	-0.0435	0.0251
L2	123.29-88.88	-0.4138	0.2389	-0.7944	0.4587
L3	88.88-43.80	-0.4908	0.2834	-0.9467	0.5466
L4	43.80-0.00	-0.5046	0.2913	-1.0085	0.5822

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
*****								
(2) DB980H90E-M w/ Mount Pipe	A	From Leg	4.00 / 0.00 / 2.00	0.0000	149.00	No Ice	4.04	3.62	0.03
						1/2" Ice	4.50	4.48	0.06
						1" Ice	4.95	5.22	0.11
(2) DB980H90E-M w/ Mount Pipe	B	From Leg	4.00 / 0.00 / 2.00	0.0000	149.00	No Ice	4.04	3.62	0.03
						1/2" Ice	4.50	4.48	0.06
							4.95	5.22	0.11

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						1" Ice			
(2) DB980H90E-M w/ Mount Pipe	C	From Leg	4.00 0.00 2.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	4.04 4.50 4.95	3.62 4.48 5.22	0.03 0.06 0.11
Platform Mount [LP 601-1]	C	None		0.0000	149.00	No Ice 1/2" Ice 1" Ice	28.47 33.59 38.71	28.47 33.59 38.71	1.12 1.51 1.91
8-ft Ladder	C	From Leg	2.00 0.00 -1.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	7.07 9.73 11.19	7.07 9.73 11.19	0.04 0.07 0.08
6' x 2" Mount Pipe	A	From Leg	4.00 0.00 2.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	1.43 1.92 2.29	1.43 1.92 2.29	0.02 0.03 0.05
6' x 2" Mount Pipe	B	From Leg	4.00 0.00 2.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	1.43 1.92 2.29	1.43 1.92 2.29	0.02 0.03 0.05
6' x 2" Mount Pipe	C	From Leg	4.00 0.00 2.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	1.43 1.92 2.29	1.43 1.92 2.29	0.02 0.03 0.05
***									
RR90-17-02DP w/ Mount Pipe	A	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice 1" Ice	4.59 5.09 5.58	3.32 4.09 4.78	0.03 0.07 0.11
RR90-17-02DP w/ Mount Pipe	B	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice 1" Ice	4.59 5.09 5.58	3.32 4.09 4.78	0.03 0.07 0.11
RR90-17-02DP w/ Mount Pipe	C	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice 1" Ice	4.59 5.09 5.58	3.32 4.09 4.78	0.03 0.07 0.11
(2) KRY 112 71/2	A	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice 1" Ice	0.68 0.80 0.93	0.51 0.62 0.74	0.01 0.02 0.03
(2) KRY 112 71/2	B	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice 1" Ice	0.68 0.80 0.93	0.51 0.62 0.74	0.01 0.02 0.03
(2) KRY 112 71/2	C	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice 1" Ice	0.68 0.80 0.93	0.51 0.62 0.74	0.01 0.02 0.03
Platform Mount [LP 714-1]	C	None		0.0000	137.00	No Ice 1/2" Ice 1" Ice	37.47 44.23 50.99	37.47 44.23 50.99	1.60 2.04 2.48
6' x 2" Mount Pipe	A	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice 1" Ice	1.43 1.92 2.29	1.43 1.92 2.29	0.02 0.03 0.05
6' x 2" Mount Pipe	B	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice 1" Ice	1.43 1.92 2.29	1.43 1.92 2.29	0.02 0.03 0.05
6' x 2" Mount Pipe	C	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice	1.43 1.92 2.29	1.43 1.92 2.29	0.02 0.03 0.05

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft* *ft* *ft*	*Azimuth Adjustment* *°*	*Placement* *ft*		*C_AA_A Front* *ft^2*	*C_AA_A Side* *ft^2*	*Weight* *K*
						1" Ice			
***									
(2) RRUS-11	A	From Leg	2.00 0.00 -2.00	0.0000	129.00	No Ice 1/2" Ice 1" Ice	3.25 3.49 3.74	1.37 1.55 1.74	0.05 0.07 0.09
(2) RRUS-11	B	From Leg	2.00 0.00 -2.00	0.0000	129.00	No Ice 1/2" Ice 1" Ice	3.25 3.49 3.74	1.37 1.55 1.74	0.05 0.07 0.09
(2) RRUS-11	C	From Leg	2.00 0.00 -2.00	0.0000	129.00	No Ice 1/2" Ice 1" Ice	3.25 3.49 3.74	1.37 1.55 1.74	0.05 0.07 0.09
Side Arm Mount [SO 102-3]	C	None		0.0000	129.00	No Ice 1/2" Ice 1" Ice	3.00 3.48 3.96	3.00 3.48 3.96	0.08 0.11 0.14
***									
(2) 7770.00 w/ Mount Pipe	A	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	6.12 6.63 7.13	4.25 5.01 5.71	0.06 0.10 0.16
(2) 7770.00 w/ Mount Pipe	B	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	6.12 6.63 7.13	4.25 5.01 5.71	0.06 0.10 0.16
(2) 7770.00 w/ Mount Pipe	C	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	6.12 6.63 7.13	4.25 5.01 5.71	0.06 0.10 0.16
(2) LGP 17201	A	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	1.95 2.13 2.33	0.52 0.64 0.77	0.03 0.04 0.06
(2) LGP 17201	B	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	1.95 2.13 2.33	0.52 0.64 0.77	0.03 0.04 0.06
(2) LGP 17201	C	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	1.95 2.13 2.33	0.52 0.64 0.77	0.03 0.04 0.06
(2) LGP13519	A	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	0.34 0.42 0.51	0.21 0.28 0.36	0.01 0.01 0.01
(2) LGP13519	B	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	0.34 0.42 0.51	0.21 0.28 0.36	0.01 0.01 0.01
(2) LGP13519	C	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	0.34 0.42 0.51	0.21 0.28 0.36	0.01 0.01 0.01
AM-X-CD-17-65-00T-RET w/ Mount Pipe	A	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	11.55 12.27 13.00	8.94 10.45 11.99	0.09 0.17 0.27
AM-X-CD-17-65-00T-RET w/ Mount Pipe	B	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	11.55 12.27 13.00	8.94 10.45 11.99	0.09 0.17 0.27
AM-X-CD-17-65-00T-RET w/ Mount Pipe	C	From Leg	4.00 0.00	0.0000	127.00	No Ice 1/2"	11.55 12.27	8.94 10.45	0.09 0.17

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft* *ft* *ft*	*Azimuth Adjustment* *°*	*Placement* *ft*		*C_AA_A Front* *ft^2*	*C_AA_A Side* *ft^2*	*Weight* *K*
			2.00			Ice	13.00	11.99	0.27
						1" Ice			
DC6-48-60-18-8F	B	From Leg	4.00	0.0000	127.00	No Ice	1.47	1.47	0.02
			0.00			1/2"	1.67	1.67	0.04
			2.00			Ice	1.88	1.88	0.06
						1" Ice			
T-Arm Mount [TA 602-3]	C	None		0.0000	127.00	No Ice	11.59	11.59	0.77
						1/2"	15.44	15.44	0.99
						Ice	19.29	19.29	1.21
						1" Ice			
***									
(2) LPA-80080/4CF w/ Mount Pipe	A	From Leg	4.00	0.0000	117.00	No Ice	2.86	7.23	0.03
			0.00			1/2"	3.22	7.92	0.07
			2.00			Ice	3.59	8.63	0.13
						1" Ice			
(2) LPA-80080/4CF w/ Mount Pipe	B	From Leg	4.00	0.0000	117.00	No Ice	2.86	7.23	0.03
			0.00			1/2"	3.22	7.92	0.07
			2.00			Ice	3.59	8.63	0.13
						1" Ice			
(2) LPA-80080/4CF w/ Mount Pipe	C	From Leg	4.00	0.0000	117.00	No Ice	2.86	7.23	0.03
			0.00			1/2"	3.22	7.92	0.07
			2.00			Ice	3.59	8.63	0.13
						1" Ice			
BXA-70063-6CF-2 w/ Mount Pipe	A	From Leg	4.00	0.0000	117.00	No Ice	7.97	5.80	0.04
			0.00			1/2"	8.61	6.95	0.10
			2.00			Ice	9.22	7.82	0.17
						1" Ice			
BXA-70063-6CF-2 w/ Mount Pipe	B	From Leg	4.00	0.0000	117.00	No Ice	7.97	5.80	0.04
			0.00			1/2"	8.61	6.95	0.10
			2.00			Ice	9.22	7.82	0.17
						1" Ice			
BXA-70063-6CF-2 w/ Mount Pipe	C	From Leg	4.00	0.0000	117.00	No Ice	7.97	5.80	0.04
			0.00			1/2"	8.61	6.95	0.10
			2.00			Ice	9.22	7.82	0.17
						1" Ice			
BXA-171085-12CF-EDIN-2 w/ Mount Pipe	A	From Leg	4.00	0.0000	117.00	No Ice	5.34	5.60	0.05
			0.00			1/2"	6.03	6.90	0.09
			2.00			Ice	6.69	8.11	0.15
						1" Ice			
BXA-171085-12CF-EDIN-2 w/ Mount Pipe	B	From Leg	4.00	0.0000	117.00	No Ice	5.34	5.60	0.05
			0.00			1/2"	6.03	6.90	0.09
			2.00			Ice	6.69	8.11	0.15
						1" Ice			
BXA-171085-12CF-EDIN-2 w/ Mount Pipe	C	From Leg	4.00	0.0000	117.00	No Ice	5.34	5.60	0.05
			0.00			1/2"	6.03	6.90	0.09
			2.00			Ice	6.69	8.11	0.15
						1" Ice			
Platform Mount [LP 303-1]	C	None		0.0000	117.00	No Ice	14.66	14.66	1.25
						1/2"	18.87	18.87	1.48
						Ice	23.08	23.08	1.71
						1" Ice			
***									
Pipe Mount [PM 601-1]	C	None		0.0000	76.00	No Ice	3.00	0.90	0.07
						1/2"	3.74	1.12	0.08
						Ice	4.48	1.34	0.09
						1" Ice			
KS24019-L112A	C	From Leg	4.00	0.0000	76.00	No Ice	0.16	0.16	0.01
			0.00			1/2"	0.22	0.22	0.01
			1.00			Ice	0.30	0.30	0.01
						1" Ice			
***									
Pipe Mount [PM 602-1]	C	None		0.0000	90.00	No Ice	5.25	1.58	0.09
						1/2"	6.50	1.95	0.12
						Ice	7.75	2.32	0.14
						1" Ice			

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Offsets: Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
TTA-429-94C-08179	A	From Leg	4.00	0.00	0.0000	90.00	No Ice	1.17	1.17	0.01
			0.00				1/2" Ice	1.34	1.34	0.02
			10.00				1" Ice	1.52	1.52	0.04
DS9A09F36D-N	A	From Leg	4.00	0.00	0.0000	90.00	No Ice	5.76	5.76	0.05
			0.00				1/2" Ice	7.71	7.71	0.09
			10.00				1" Ice	9.68	9.68	0.14

Tower Pressures - No Ice

G_H = 1.690

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 150.00-123.29	135.99	1.499	27.72	44.405	A	0.000	44.405	44.405	100.00	0.000	0.000
					B	0.000	44.405		100.00	0.000	0.000
					C	0.000	44.405		100.00	0.000	0.146
L2 123.29-88.88	105.47	1.394	25.75	75.291	A	0.000	75.291	75.291	100.00	0.000	0.000
					B	0.000	75.291		100.00	0.000	0.000
					C	0.000	75.291		100.00	0.000	12.490
L3 88.88-43.80	65.82	1.218	22.41	128.809	A	0.000	128.809	128.809	100.00	0.000	0.000
					B	0.000	128.809		100.00	0.000	0.000
					C	0.000	128.809		100.00	0.000	19.626
L4 43.80-0.00	21.09	1	18.50	157.772	A	0.000	157.772	157.772	100.00	0.000	0.000
					B	0.000	157.772		100.00	0.000	0.000
					C	0.000	157.772		100.00	0.000	19.069

Tower Pressure - With Ice

G_H = 1.690

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 150.00-123.29	135.99	1.499	5.42	1.0000	48.857	A	0.000	48.857	48.857	100.00	0.000	0.000
						B	0.000	48.857		100.00	0.000	0.000
						C	0.000	48.857		100.00	0.000	0.888
L2 123.29-88.88	105.47	1.394	5.04	1.0000	81.026	A	0.000	81.026	81.026	100.00	0.000	0.000
						B	0.000	81.026		100.00	0.000	0.000
						C	0.000	81.026		100.00	0.000	30.621
L3 88.88-43.80	65.82	1.218	4.38	1.0000	136.323	A	0.000	136.323	136.323	100.00	0.000	0.000
						B	0.000	136.323		100.00	0.000	0.000
						C	0.000	136.323		100.00	0.000	46.675
L4 43.80-0.00	21.09	1	3.62	1.0000	165.072	A	0.000	165.072	165.072	100.00	0.000	0.000
						B	0.000	165.072		100.00	0.000	0.000
						C	0.000	165.072		100.00	0.000	45.350

Tower Pressure - Service

G_H = 1.690

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 150.00-123.29	135.99	1.499	9.59	44.405	A	0.000	44.405	44.405	100.00	0.000	0.000
					B	0.000	44.405		100.00	0.000	0.000
					C	0.000	44.405		100.00	0.000	0.146
L2 123.29-88.88	105.47	1.394	8.91	75.291	A	0.000	75.291	75.291	100.00	0.000	0.000
					B	0.000	75.291		100.00	0.000	0.000
					C	0.000	75.291		100.00	0.000	12.490
L3 88.88-43.80	65.82	1.218	7.75	128.809	A	0.000	128.809	128.809	100.00	0.000	0.000
					B	0.000	128.809		100.00	0.000	0.000
					C	0.000	128.809		100.00	0.000	19.626
L4 43.80-0.00	21.09	1	6.40	157.772	A	0.000	157.772	157.772	100.00	0.000	0.000
					B	0.000	157.772		100.00	0.000	0.000
					C	0.000	157.772		100.00	0.000	19.069

Load Combinations

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

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	150 - 123.29	Pole	Max Tension	5	0.00	0.00	0.00
			Max. Compression	14	-11.72	0.02	-0.29
			Max. Mx	11	-5.02	125.99	-0.03
			Max. My	8	-5.02	-0.03	-126.09
			Max. Vy	11	-12.15	125.99	-0.03
			Max. Vx	8	12.15	-0.03	-126.09
			Max. Torque	13			0.92
L2	123.29 - 88.88	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-21.97	2.32	-1.60
			Max. Mx	11	-10.48	675.51	-0.23
			Max. My	8	-10.48	0.38	-675.44
			Max. Vy	11	-18.64	675.51	-0.23
			Max. Vx	8	18.64	0.38	-675.44
			Max. Torque	4			1.02
L3	88.88 - 43.8	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-35.06	7.18	-3.45
			Max. Mx	11	-19.08	1602.92	-0.50
			Max. My	8	-19.08	1.24	-1602.18
			Max. Vy	11	-22.90	1602.92	-0.50
			Max. Vx	8	22.90	1.24	-1602.18
			Max. Torque	4			1.05
L4	43.8 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-53.55	13.72	-7.22
			Max. Mx	11	-32.30	2819.89	-1.17
			Max. My	8	-32.30	2.40	-2818.65
			Max. Vy	11	-26.46	2819.89	-1.17
			Max. Vx	8	26.46	2.40	-2818.65
			Max. Torque	3			1.15

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	14	53.55	-0.00	0.00
	Max. H_x	11	32.32	26.43	0.00
	Max. H_z	2	32.32	0.00	26.43
	Max. M_x	2	2816.32	0.00	26.43
	Max. M_z	5	2815.08	-26.43	0.00
	Max. Torsion	3	1.15	-13.22	22.90
	Min. Vert	11	32.32	26.43	0.00
	Min. H_x	5	32.32	-26.43	0.00
	Min. H_z	8	32.32	0.00	-26.43
	Min. M_x	8	-2818.65	0.00	-26.43
	Min. M_z	11	-2819.89	26.43	0.00
	Min. Torsion	9	-1.15	13.22	-22.90

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	32.32	0.00	-0.00	1.13	2.33	0.00
Dead+Wind 0 deg - No Ice	32.32	-0.00	-26.43	-2816.32	2.40	-0.94
Dead+Wind 30 deg - No Ice	32.32	13.22	-22.90	-2439.22	-1406.55	-1.15
Dead+Wind 60 deg - No Ice	32.32	22.90	-13.22	-1407.79	-2437.98	-1.05
Dead+Wind 90 deg - No Ice	32.32	26.43	-0.00	1.17	-2815.08	-0.67
Dead+Wind 120 deg - No Ice	32.32	22.90	13.22	1410.12	-2437.97	-0.11
Dead+Wind 150 deg - No Ice	32.32	13.22	22.90	2441.54	-1406.55	0.48

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead+Wind 180 deg - No Ice	32.32	-0.00	26.43	2818.65	2.40	0.94
Dead+Wind 210 deg - No Ice	32.32	-13.22	22.90	2441.54	1411.35	1.15
Dead+Wind 240 deg - No Ice	32.32	-22.90	13.22	1410.12	2442.78	1.05
Dead+Wind 270 deg - No Ice	32.32	-26.43	-0.00	1.17	2819.89	0.67
Dead+Wind 300 deg - No Ice	32.32	-22.90	-13.22	-1407.79	2442.78	0.11
Dead+Wind 330 deg - No Ice	32.32	-13.22	-22.90	-2439.22	1411.36	-0.48
Dead+Ice+Temp	53.55	0.00	-0.00	7.22	13.72	-0.00
Dead+Wind 0 deg+Ice+Temp	53.55	0.00	-6.80	-745.71	13.86	-0.39
Dead+Wind 30 deg+Ice+Temp	53.55	3.40	-5.89	-644.83	-362.64	-0.43
Dead+Wind 60 deg+Ice+Temp	53.55	5.89	-3.40	-369.21	-638.26	-0.35
Dead+Wind 90 deg+Ice+Temp	53.55	6.80	-0.00	7.29	-739.14	-0.18
Dead+Wind 120 deg+Ice+Temp	53.55	5.89	3.40	383.79	-638.26	0.04
Dead+Wind 150 deg+Ice+Temp	53.55	3.40	5.89	659.41	-362.64	0.25
Dead+Wind 180 deg+Ice+Temp	53.55	0.00	6.80	760.29	13.86	0.39
Dead+Wind 210 deg+Ice+Temp	53.55	-3.40	5.89	659.41	390.36	0.43
Dead+Wind 240 deg+Ice+Temp	53.55	-5.89	3.40	383.79	665.98	0.35
Dead+Wind 270 deg+Ice+Temp	53.55	-6.80	-0.00	7.29	766.86	0.18
Dead+Wind 300 deg+Ice+Temp	53.55	-5.89	-3.40	-369.21	665.98	-0.04
Dead+Wind 330 deg+Ice+Temp	53.55	-3.40	-5.89	-644.83	390.36	-0.25
Dead+Wind 0 deg - Service	32.32	0.00	-9.15	-975.45	2.41	-0.33
Dead+Wind 30 deg - Service	32.32	4.57	-7.92	-844.61	-485.90	-0.40
Dead+Wind 60 deg - Service	32.32	7.92	-4.57	-487.18	-843.43	-0.37
Dead+Wind 90 deg - Service	32.32	9.15	-0.00	1.17	-974.20	-0.23
Dead+Wind 120 deg - Service	32.32	7.92	4.57	489.51	-843.43	-0.04
Dead+Wind 150 deg - Service	32.32	4.57	7.92	846.94	-485.89	0.17
Dead+Wind 180 deg - Service	32.32	0.00	9.15	977.78	2.41	0.33
Dead+Wind 210 deg - Service	32.32	-4.57	7.92	847.01	490.76	0.40
Dead+Wind 240 deg - Service	32.32	-7.92	4.57	489.47	848.18	0.37
Dead+Wind 270 deg - Service	32.32	-9.15	-0.00	1.17	979.03	0.23
Dead+Wind 300 deg - Service	32.32	-7.92	-4.57	-487.14	848.18	0.04
Dead+Wind 330 deg - Service	32.32	-4.57	-7.92	-844.68	490.76	-0.17

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	K	K	K	K	K	K	
1	0.00	-32.32	0.00	-0.00	32.32	0.00	0.000%
2	0.00	-32.32	-26.44	0.00	32.32	26.43	0.008%
3	13.22	-32.32	-22.90	-13.22	32.32	22.90	0.000%
4	22.90	-32.32	-13.22	-22.90	32.32	13.22	0.000%
5	26.44	-32.32	0.00	-26.43	32.32	0.00	0.008%
6	22.90	-32.32	13.22	-22.90	32.32	-13.22	0.000%
7	13.22	-32.32	22.90	-13.22	32.32	-22.90	0.000%
8	0.00	-32.32	26.44	0.00	32.32	-26.43	0.008%
9	-13.22	-32.32	22.90	13.22	32.32	-22.90	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
10	-22.90	-32.32	13.22	22.90	32.32	-13.22	0.000%
11	-26.44	-32.32	0.00	26.43	32.32	0.00	0.008%
12	-22.90	-32.32	-13.22	22.90	32.32	13.22	0.000%
13	-13.22	-32.32	-22.90	13.22	32.32	22.90	0.000%
14	0.00	-53.55	0.00	-0.00	53.55	0.00	0.001%
15	0.00	-53.55	-6.80	-0.00	53.55	6.80	0.002%
16	3.40	-53.55	-5.89	-3.40	53.55	5.89	0.002%
17	5.89	-53.55	-3.40	-5.89	53.55	3.40	0.002%
18	6.80	-53.55	0.00	-6.80	53.55	0.00	0.002%
19	5.89	-53.55	3.40	-5.89	53.55	-3.40	0.002%
20	3.40	-53.55	5.89	-3.40	53.55	-5.89	0.002%
21	0.00	-53.55	6.80	-0.00	53.55	-6.80	0.002%
22	-3.40	-53.55	5.89	3.40	53.55	-5.89	0.002%
23	-5.89	-53.55	3.40	5.89	53.55	-3.40	0.002%
24	-6.80	-53.55	0.00	6.80	53.55	0.00	0.002%
25	-5.89	-53.55	-3.40	5.89	53.55	3.40	0.002%
26	-3.40	-53.55	-5.89	3.40	53.55	5.89	0.002%
27	0.00	-32.32	-9.15	-0.00	32.32	9.15	0.004%
28	4.57	-32.32	-7.92	-4.57	32.32	7.92	0.004%
29	7.92	-32.32	-4.57	-7.92	32.32	4.57	0.002%
30	9.15	-32.32	0.00	-9.15	32.32	0.00	0.004%
31	7.92	-32.32	4.57	-7.92	32.32	-4.57	0.002%
32	4.57	-32.32	7.92	-4.57	32.32	-7.92	0.004%
33	0.00	-32.32	9.15	-0.00	32.32	-9.15	0.004%
34	-4.57	-32.32	7.92	4.57	32.32	-7.92	0.002%
35	-7.92	-32.32	4.57	7.92	32.32	-4.57	0.004%
36	-9.15	-32.32	0.00	9.15	32.32	0.00	0.004%
37	-7.92	-32.32	-4.57	7.92	32.32	4.57	0.004%
38	-4.57	-32.32	-7.92	4.57	32.32	7.92	0.002%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.00000001	0.00000001
2	Yes	16	0.00008103	0.00012986
3	Yes	21	0.00000001	0.00009295
4	Yes	21	0.00000001	0.00009482
5	Yes	16	0.00008103	0.00010874
6	Yes	21	0.00000001	0.00009490
7	Yes	21	0.00000001	0.00009312
8	Yes	16	0.00008102	0.00012994
9	Yes	21	0.00000001	0.00009572
10	Yes	21	0.00000001	0.00009383
11	Yes	16	0.00008101	0.00010889
12	Yes	21	0.00000001	0.00009376
13	Yes	21	0.00000001	0.00009556
14	Yes	11	0.00000001	0.00000899
15	Yes	17	0.00010719	0.00004989
16	Yes	17	0.00010701	0.00009528
17	Yes	17	0.00010702	0.00009830
18	Yes	17	0.00010721	0.00004864
19	Yes	17	0.00010699	0.00010111
20	Yes	17	0.00010698	0.00009738
21	Yes	17	0.00010715	0.00005071
22	Yes	17	0.00010692	0.00010674
23	Yes	17	0.00010692	0.00010341
24	Yes	17	0.00010713	0.00005022
25	Yes	17	0.00010695	0.00010048
26	Yes	17	0.00010695	0.00010439
27	Yes	16	0.00008690	0.00005394
28	Yes	16	0.00008656	0.00014148
29	Yes	17	0.00000001	0.00008169
30	Yes	16	0.00008690	0.00005240
31	Yes	17	0.00000001	0.00008193

32	Yes	16	0.00008656	0.00014241
33	Yes	16	0.00008689	0.00005405
34	Yes	17	0.00000001	0.00008426
35	Yes	16	0.00008655	0.00014597
36	Yes	16	0.00008689	0.00005263
37	Yes	16	0.00008655	0.00014567
38	Yes	17	0.00000001	0.00008382

Maximum Tower Deflections - Service Wind

Section No.	*Elevation*	*Horz. Deflection*	*Gov. Load*	*Tilt*	*Twist*
	ft	*in*	*Comb.*	*°*	*°*
L1	150 - 123.29	40.153	35	2.3787	0.0069
L2	126.71 - 88.88	28.845	35	2.2028	0.0022
L3	93.13 - 43.8	15.107	35	1.6212	0.0015
L4	49.22 - 0	4.000	35	0.7620	0.0005

Critical Deflections and Radius of Curvature - Service Wind

Elevation	*Appurtenance*	*Gov. Load*	*Deflection*	*Tilt*	*Twist*	*Radius of Curvature*
ft		*Comb.*	*in*	*°*	*°*	*ft*
149.00	(2) DB980H90E-M w/ Mount Pipe	35	39.656	2.3731	0.0067	19952
137.00	RR90-17-02DP w/ Mount Pipe	35	33.743	2.2983	0.0039	7673
129.00	(2) RRUS-11	35	29.914	2.2279	0.0025	4769
127.00	(2) 7770.00 w/ Mount Pipe	35	28.979	2.2062	0.0023	4426
117.00	(2) LPA-80080/4CF w/ Mount Pipe	35	24.480	2.0692	0.0014	3763
90.00	Pipe Mount [PM 602-1]	35	14.042	1.5575	0.0015	2878
76.00	Pipe Mount [PM 601-1]	35	9.780	1.2735	0.0013	2790

Maximum Tower Deflections - Design Wind

Section No.	*Elevation*	*Horz. Deflection*	*Gov. Load*	*Tilt*	*Twist*
	ft	*in*	*Comb.*	*°*	*°*
L1	150 - 123.29	115.364	11	6.8379	0.0198
L2	126.71 - 88.88	82.914	11	6.3350	0.0064
L3	93.13 - 43.8	43.458	11	4.6645	0.0042
L4	49.22 - 0	11.514	10	2.1937	0.0014

Critical Deflections and Radius of Curvature - Design Wind

Elevation	*Appurtenance*	*Gov. Load*	*Deflection*	*Tilt*	*Twist*	*Radius of Curvature*
ft		*Comb.*	*in*	*°*	*°*	*ft*
149.00	(2) DB980H90E-M w/ Mount Pipe	11	113.940	6.8220	0.0191	7126
137.00	RR90-17-02DP w/ Mount Pipe	11	96.973	6.6083	0.0113	2739
129.00	(2) RRUS-11	11	85.983	6.4069	0.0072	1700
127.00	(2) 7770.00 w/ Mount Pipe	11	83.301	6.3445	0.0065	1577
117.00	(2) LPA-80080/4CF w/ Mount Pipe	11	70.384	5.9514	0.0041	1336
90.00	Pipe Mount [PM 602-1]	11	40.395	4.4814	0.0042	1013
76.00	Pipe Mount [PM 601-1]	11	28.141	3.6648	0.0036	978

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
L1	150 - 123.29 (1)	TP22.9x17x0.1875	26.71	0.00	0.0	39.000	13.0672	-5.02	509.62	0.010
L2	123.29 - 88.88 (2)	TP30x21.7696x0.3125	37.83	0.00	0.0	39.000	28.5292	-10.48	1112.64	0.009
L3	88.88 - 43.8 (3)	TP39.2x28.4504x0.375	49.33	0.00	0.0	39.000	44.8057	-19.08	1747.42	0.011
L4	43.8 - 0 (4)	TP48x37.2689x0.4375	49.22	0.00	0.0	39.000	66.0465	-32.30	2575.81	0.013

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	150 - 123.29 (1)	TP22.9x17x0.1875	126.10	21.387	39.000	0.548	0.00	0.000	39.000	0.000
L2	123.29 - 88.88 (2)	TP30x21.7696x0.3125	675.73	40.165	39.000	1.030	0.00	0.000	39.000	0.000
L3	88.88 - 43.8 (3)	TP39.2x28.4504x0.375	1603.26	46.322	39.000	1.188	0.00	0.000	39.000	0.000
L4	43.8 - 0 (4)	TP48x37.2689x0.4375	2820.57	43.723	39.000	1.121	0.00	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	150 - 123.29 (1)	TP22.9x17x0.1875	12.15	0.930	26.000	0.072	0.92	0.076	26.000	0.003
L2	123.29 - 88.88 (2)	TP30x21.7696x0.3125	18.65	0.654	26.000	0.050	0.29	0.008	26.000	0.000
L3	88.88 - 43.8 (3)	TP39.2x28.4504x0.375	22.91	0.511	26.000	0.039	1.05	0.015	26.000	0.001
L4	43.8 - 0 (4)	TP48x37.2689x0.4375	26.47	0.401	26.000	0.031	1.05	0.008	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	150 - 123.29 (1)	0.010	0.548	0.000	0.072	0.003	0.560 ✔	1.333	H1-3+VT ✔
L2	123.29 - 88.88 (2)	0.009	1.030	0.000	0.050	0.000	1.040	1.333	H1-3+VT ✔

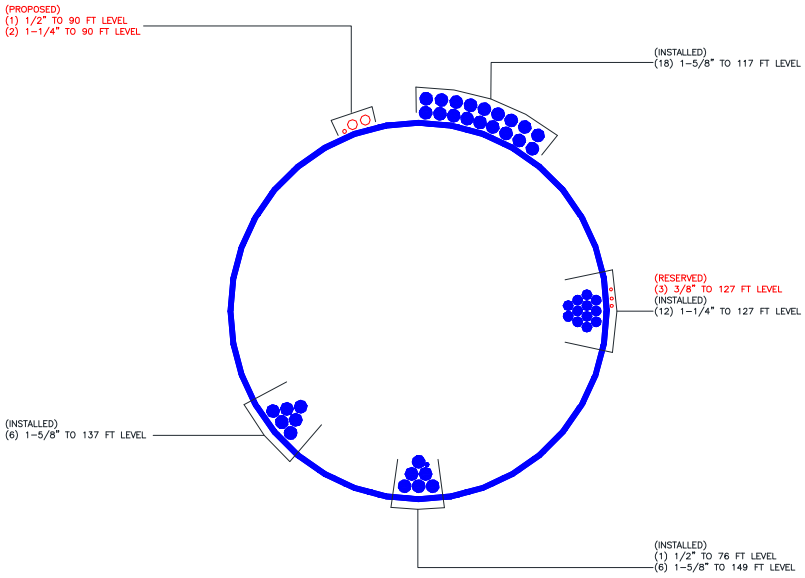
Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L3	88.88 - 43.8 (3)	0.011	1.188	0.000	0.039	0.001	1.199 ✔	1.333	H1-3+VT ✔
L4	43.8 - 0 (4)	0.013	1.121	0.000	0.031	0.000	1.134 ✔	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	150 - 123.29	Pole	TP22.9x17x0.1875	1	-5.02	679.32	42.0	Pass
L2	123.29 - 88.88	Pole	TP30x21.7696x0.3125	2	-10.48	1483.15	78.0	Pass
L3	88.88 - 43.8	Pole	TP39.2x28.4504x0.375	3	-19.08	2329.31	90.0	Pass
L4	43.8 - 0	Pole	TP48x37.2689x0.4375	4	-32.30	3433.55	85.1	Pass
							Summary	
						Pole (L3)	90.0	Pass
						RATING =	**90.0**	**Pass**

APPENDIX B

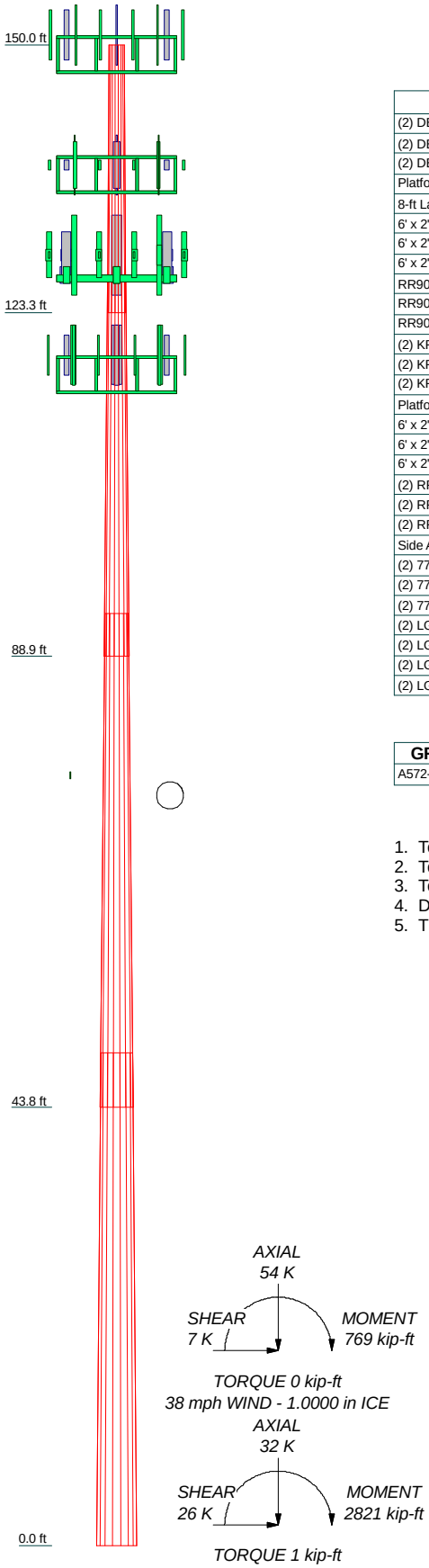
BASE LEVEL DRAWING


(PROPOSED)
(1) 1/2" TO 90 FT LEVEL
(2) 1-1/4" TO 90 FT LEVEL
(INSTALLED)
(18) 1-5/8" TO 117 FT LEVEL
(RESERVED)
(3) 3/8" TO 127 FT LEVEL
(INSTALLED)
(12) 1-1/4" TO 127 FT LEVEL
(INSTALLED)
(6) 1-5/8" TO 137 FT LEVEL
(INSTALLED)
(1) 1/2" TO 76 FT LEVEL
(6) 1-5/8" TO 149 FT LEVEL

APPENDIX C

ADDITIONAL CALCULATIONS

Section	Length (ft)	Number of Sides	Thickness (in)	Socket Length (ft)	Top Dia (in)	Bot Dia (in)	Grade	Weight (K)
1	26.71	18	0.1875	3.42	17.0000	22.9000	A572-65	1.1
2	37.83	18	0.3125	4.25	21.7696	30.0000		3.3
3	49.33	18	0.3750	5.42	28.4504	39.2000		6.7
4	49.22	18	0.4375		37.2689	48.0000		9.8



AXIAL
54 K

SHEAR
7 K

MOMENT
769 kip-ft

TORQUE 0 kip-ft
38 mph WIND - 1.0000 in ICE

AXIAL
32 K

SHEAR
26 K

MOMENT
2821 kip-ft

TORQUE 1 kip-ft
REACTIONS - 85 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
(2) DB980H90E-M w/ Mount Pipe	149	(2) LGP13519	127
(2) DB980H90E-M w/ Mount Pipe	149	(2) LGP13519	127
(2) DB980H90E-M w/ Mount Pipe	149	AM-X-CD-17-65-00T-RET w/ Mount Pipe	127
Platform Mount [LP 601-1]	149	AM-X-CD-17-65-00T-RET w/ Mount Pipe	127
8-ft Ladder	149	AM-X-CD-17-65-00T-RET w/ Mount Pipe	127
6' x 2" Mount Pipe	149	DC6-48-60-18-8F	127
6' x 2" Mount Pipe	149	T-Arm Mount [TA 602-3]	127
6' x 2" Mount Pipe	149	(2) LPA-80080/4CF w/ Mount Pipe	117
RR90-17-02DP w/ Mount Pipe	137	(2) LPA-80080/4CF w/ Mount Pipe	117
RR90-17-02DP w/ Mount Pipe	137	(2) LPA-80080/4CF w/ Mount Pipe	117
RR90-17-02DP w/ Mount Pipe	137	BXA-70063-6CF-2 w/ Mount Pipe	117
(2) KRY 112 71/2	137	BXA-70063-6CF-2 w/ Mount Pipe	117
(2) KRY 112 71/2	137	BXA-70063-6CF-2 w/ Mount Pipe	117
(2) KRY 112 71/2	137	BXA-171085-12CF-EDIN-2 w/ Mount Pipe	117
Platform Mount [LP 714-1]	137	BXA-171085-12CF-EDIN-2 w/ Mount Pipe	117
6' x 2" Mount Pipe	137	BXA-171085-12CF-EDIN-2 w/ Mount Pipe	117
6' x 2" Mount Pipe	137	Platform Mount [LP 303-1]	117
6' x 2" Mount Pipe	137	Pipe Mount [PM 602-1]	90
(2) RRUS-11	129	TTA-429-94C-08179	90
(2) RRUS-11	129	DS9A09F36D-N	90
(2) RRUS-11	129	KS24019-L112A	76
Side Arm Mount [SO 102-3]	129	Pipe Mount [PM 601-1]	76
(2) 7770.00 w/ Mount Pipe	127		
(2) 7770.00 w/ Mount Pipe	127		
(2) 7770.00 w/ Mount Pipe	127		
(2) LGP 17201	127		
(2) LGP 17201	127		
(2) LGP 17201	127		
(2) LGP13519	127		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Windham County, Connecticut.
2. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 38 mph basic wind with 1.00 in ice.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 90%

Paul J Ford and Company
250 E. Broad Street Suite 1500
Columbus, OH 43215
Phone: 614.221.6679
FAX: 614.448.4105

Job:	***150' Monopole / Hampton Bernier***		
Project:	***PJF 37513-1146 / BU 876390***		
Client: Crown Castle	Drawn by: John J Woolley	App'd:	
Code: TIA/EIA-222-F	Date: 04/05/13	Scale: NTS	
Path: G:\TOWER\375_Crown_Castle\2013\37513-1146 BU 876390\37513-1146.eri		Dwg No. E-1	

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

TIA Rev F

Site Data

BU#:	*879390*
Site Name:	
App #:	
Pole Manufacturer:	*Other*

Reactions		
Moment:	2821	ft-kips
Axial:	32	kips
Shear:	26	kips

Anchor Rod Data		
Qty:	16	
Diam:	2.25	in
Rod Material:	A615-J	
Strength (Fu):	100	ksi
Yield (Fy):	75	ksi
Bolt Circle:	57	in

Plate Data		
Diam:	63	in
Thick:	2	in
Grade:	60	ksi
Single-Rod B-eff:	9.52	in

Stiffener Data (Welding at both sides)		
Config:	1	*
Weld Type:	Groove	
Groove Depth:	0.375	in **
Groove Angle:	45	degrees
Fillet H. Weld:	0.3125	<-- Disregard
Fillet V. Weld:	0.375	in
Width:	7	in
Height:	18	in
Thick:	0.75	in
Notch:	0.75	in
Grade:	50	ksi
Weld str.:	70	ksi

Pole Data		
Diam:	48	in
Thick:	0.4375	in
Grade:	65	ksi
# of Sides:	18	"0" IF Round
Fu	80	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	

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

Anchor Rod Results

		Stiffened
Maximum Rod Tension:	146.5 Kips	Service, ASD
Allowable Tension:	195.0 Kips	Fty*ASIF
Anchor Rod Stress Ratio:	75.1% **Pass**	

Base Plate Results

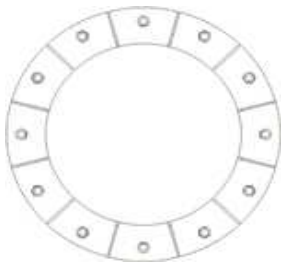
	Flexural Check	Stiffened
Base Plate Stress:	39.0 ksi	Service, ASD
Allowable Plate Stress:	60.0 ksi	0.75*Fy*ASIF
Base Plate Stress Ratio:	65.0% **Pass**	Y.L. Length: N/A, Roark

Stiffener Results

Horizontal Weld :	54.8% **Pass**
Vertical Weld:	42.7% **Pass**
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	18.4% **Pass**
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	55.3% **Pass**
Plate Comp. (AISC Bracket):	62.2% **Pass**

Pole Results

Pole Punching Shear Check:	11.0% **Pass**



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

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

Foundation Loads:

Pole weight or tower leg compression =	**32**	(kips)
Horizontal load at top of pier =	**26**	(kips)
Overturning moment at top of pier=	**2821**	(ft-kips)

Design criteria:

Safety factor against overturning =	**1.5**	

Soil Properties:

Soil density =	**125**	(pcf)
Allowable soil bearing =	**3**	(ksf)
Depth to water table =	**4**	(ft)

Dimensions:

Pier shape (round or square)	**S**	("R" or "S")
Pier width =	**6.5**	(ft)
Pier height above grade =	**1**	(ft)
depth to bottom of footing =	**5**	(ft)
Footing thickness =	**3**	(ft)
Footing width =	**25.25**	(ft)
Footing length =	**25.25**	(ft)

Concrete:

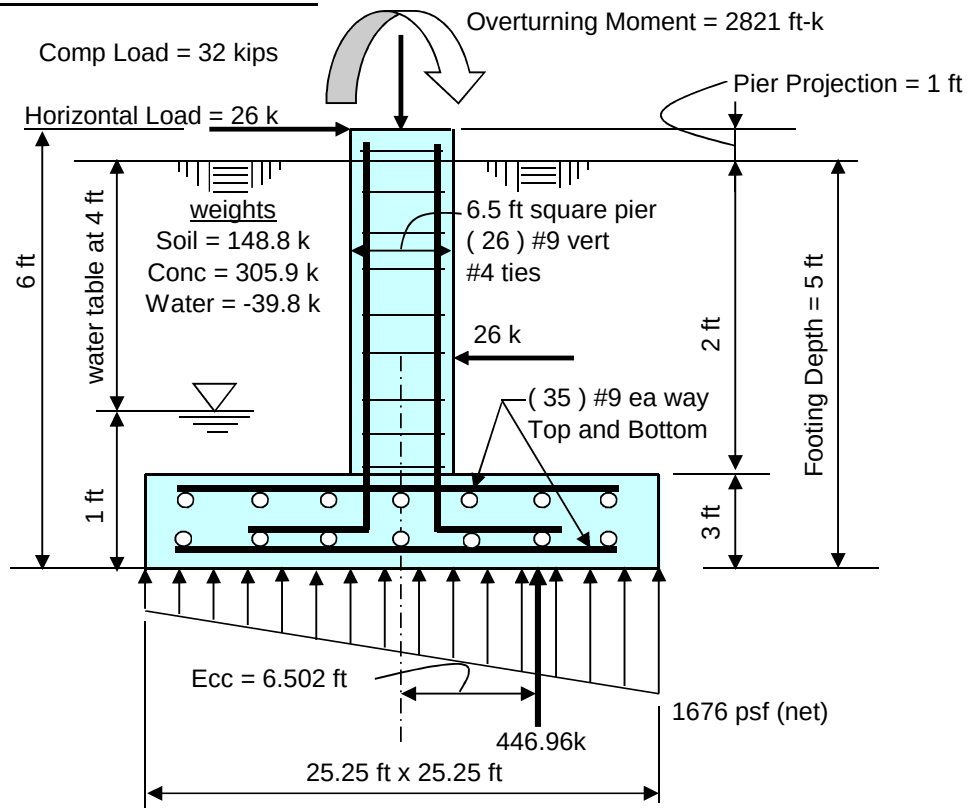
Concrete strength =	**4**	(ksi)
Rebar strength =	**60**	(ksi)
ultimate load factor =	**1.3**	

Reinforcing Steel:

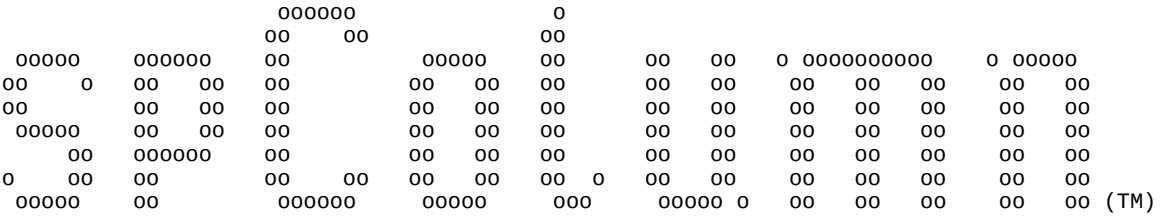
	Pad	
minimum cover over rebar =	**3**	inches
size of pad rebar =	**#9**	bar
quantity of pad rebar =	**35**	(ea direction)

Reinforcing Steel:

	Pier	
size of vert rebar in pier=	**#9**	bar
vertical rebar quantity =	**26**	
size of pier ties =	**#4**	bar
minimum cover over rebar =	**3**	inches
Total volume of concrete =	75.5	cu yd



Summary of analysis results	
Maximum Net Soil Bearing = 1.676 ksf Allowable Net Soil Bearing = 3 ksf **Soil Bearing Stress Ratio = 0.56 Okay**	Ult Bending Shear Capacity = 126 psi Ult Bending Shear Stress = 28 psi **Bending Shear Stress Ratio = 0.22 Okay**
Ftg Overturning Resistance = 5643 ft-kips Overturning Moment = 2906 ft-kips Required Overturning Safety Factor = 1.5 Overturning Safety Factor = 1.942 **Ratio = 0.77 Okay**	Pad Bending Moment Capacity= 4771 ft-k Pad Bending Moment = 1387 ft-k **Bending Moment Stress Ratio = 0.29 OK**



General Information:
==========
File Name: g:\tower\375_crown_castle\2013\37513-1146 bu 876390\37512-2182.col
Project:
Column: Engineer:
Code: ACI 318-11 Units: English

Run Option: Investigation Slenderness: Not considered
Run Axis: X-axis Column Type: Architectural

Material Properties:
==========
f'c = 4 ksi fy = 60 ksi
Ec = 3605 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========
Rectangular: Width = 78 in Depth = 78 in

Gross section area, Ag = 6084 in^2
Ix = 3.08459e+006 in^4 Iy = 3.08459e+006 in^4
rx = 22.5167 in ry = 22.5167 in
Xo = 0 in Yo = 0 in

Reinforcement:
==========
Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #3 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Circular
Pattern: All Sides Equal (Cover to transverse reinforcement)
Total steel area: As = 27.00 in^2 at rho = 0.44% (Note: rho < 0.50%)
Minimum clear spacing = 7.01 in

27 #9 Cover = 3 in

Factored Loads and Moments with Corresponding Capacities:
==========

No.	Pu kip	Mux k-ft	PhiMnx k-ft	PhiMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	32.00	3667.30	4176.55	1.139	10.58	73.82	0.01799	0.900

*** End of output ***

ATTACHMENT 4

Model: 15RESA

KOHLER. Power Systems

Residential Gas

ISO 9001 KOHLER POWER SYSTEMS NATIONALLY REGISTERED

Sound Enclosure

Weather Enclosure with Sound Kit

Standard Features

- Kohler Co. provides one-source responsibility for the generating system and accessories.
- The generator set and its components are prototype-tested, factory-built, and production-tested.
- The 60 Hz generator set is UL 2200 listed.
- The 60 Hz generator set engine is certified by the Environmental Protection Agency (EPA) to conform to the New Source Performance Standard (NSPS) for stationary spark-ignited emissions.
- Residential generator sets are approved for outdoor installation in stationary standby applications served by a reliable utility source.
- The generator set has a five-year limited warranty.
- Engine features:
  - Natural gas or LP gas fueled
  - Electronic engine controls for optimized fuel and spark performance
  - Four cylinder, four cycle engine
  - An electronic, isochronous governor for precise frequency regulation
  - High silicon content pistons for improved durability
- ADC 2100 digital controller features:
  - LED display provides diagnostic capability
  - Digital voltage regulator with ±1.5% no-load to full-load regulation
  - Superior electronics protection from corrosion and vibration
- Enclosure features:
  - Model 15RESA generator sets are available with weather enclosure and sound kit or sound enclosure
  - Enclosures reduce sound levels and protect the generator set from the elements, animal intrusion, and unwanted entry.
  - Fade-, scratch-, and corrosion-resistant Kohler® cream beige finish
  - Internal silencer
  - Lockable door latches
  - Sound enclosure additional features:
    - Acoustic insulation that meets UL 94 HF1 flammability classification
    - Low profile with pitched roof to minimize water accumulation
    - Sound-attenuating design to reduce noise levels
    - Hinged, removable doors to allow maximum access
    - Factory-installed

Generator Set Ratings

					Standby Ratings *			
					Natural Gas		LP Gas	
Model	Alternator	Voltage	Ph	Hz	kW/kVA	Amps	kW/kVA	Amps
15RESA	4H7	120/240	1	60	13.0/13.0	54	15.0/15.0	63

* RATINGS: *Standby Ratings:* Standby ratings apply to installations served by a reliable utility source. The standby rating is applicable to varying loads for the duration of a power outage. There is no overload capability for this rating. Ratings are in accordance with ISO-3046/1, BS 5514, AS 2789, and DIN 6271. Obtain the technical information bulletin on ratings guidelines (TIB-101) for complete ratings definitions. The generator set manufacturer reserves the right to change the design or specifications without notice and without any obligation or liability whatsoever. GENERAL GUIDELINES FOR DERATING: *Altitude:* Derate 1.5% per 305 m (1000 ft.) elevation above 1006 m (3300 ft.). *Temperature:* Derate 2.0% per 5.5°C (10°F) temperature above 21°C (70°F).

Alternator Specifications

Specifications	Alternator
Manufacturer	Kohler
Type	4-Pole, Brush Type
Leads: quantity	4 Lead
Voltage regulator	Digital
Insulation:	NEMA MG1-1.66
Material	Class H
Temperature rise	130°C, Standby
Bearing: quantity, type	1, Sealed
Coupling	Flexible Disc
Amortisseur windings	Full
Voltage regulation, no-load to full-load RMS	±1.5%
Unbalanced load capability	100% of Rated Standby Current
Peak motor starting kVA:	35% dip for voltages below
240V 4H7 (4 lead)	32

- NEMA MG1, IEEE, and ANSI standards compliance for temperature rise and motor starting.
- Sustained short-circuit current of up to 300% of the rated current for up to 10 seconds.
- Sustained short-circuit current enabling downstream circuit breakers to trip without collapsing the alternator field.
- Self-ventilated and dripproof construction.
- Vacuum-impregnated windings with fungus-resistant epoxy varnish for dependability and long life.
- Superior voltage waveform from a two-thirds pitch stator and skewed rotor.
- Digital voltage regulator with ±1.5% no-load to full-load regulation.

Application Data

Engine

Engine Specifications	60 Hz	50 Hz
Manufacturer	GM	
Engine: model, type	GM 1.6L OHC	
Cylinder arrangement	4, Inline	
Displacement, L (cu. in.)	1.6 (98)	
Bore and stroke, mm (in.)	79 (3.11) x 81.5 (3.21)	
Compression ratio	9.4:1	
Piston speed, m/min. (ft./min.)	293 (963)	
Main bearings: quantity, type	5, Replaceable Inserts	
Rated rpm	1800	
Max. power at rated rpm, kWm (BHP)		
Natural Gas	16.3 (21.8)	
LP Gas	18.8 (25.3)	
Cylinder head material	Aluminum	
Crankshaft material	Cast Iron	
Valve (exhaust) material	High Alloy Steel	
Governor type	Electronic	
Frequency regulation, no load to full load	Isochronous	
Frequency regulation, steady state	±0.5%	
Air cleaner type, all models	Dry	

Engine Electrical

Engine Electrical System	
Ignition system	Electronic
Battery charging alternator:	
Ground (negative/positive)	Negative
Volts (DC)	12
Ampere rating	70
Starter motor rated voltage (DC)	12
Battery, recommended cold cranking amps (CCA):	525
Battery voltage (DC)	12

Exhaust

Exhaust System	60 Hz	50 Hz
Exhaust manifold type	Dry	
Exhaust flow at rated kW, m^3/min. (cfm)	3.7 (131)	
Exhaust temperature at rated kW, dry exhaust, °C (°F)	649 (1200)	
Maximum allowable back pressure, kPa (in. Hg)	10.2 (3.0)	
Exhaust outlet size at engine hookup, mm (in.)	50.8 (2.0)	

Fuel

Fuel System	
Fuel type	LP Gas or Natural Gas
Fuel supply inlet	3/4 NPT
Fuel supply pressure, kPa (in. H_2O)	1.74–2.74 (7–11)

Fuel Composition Limits *	Nat. Gas	LP Gas
Methane, % by volume	90 min.	—
Ethane, % by volume	4.0 max.	—
Propane, % by volume	1.0 max.	85 min.
Propene, % by volume	0.1 max.	5.0 max.
C_4 and higher, % by volume	0.3 max.	2.5 max.
Sulfur, ppm mass	25 max.	
Lower heating value, MJ/m^3 (Btu/ft^3), min.	33.2 (890)	84.2 (2260)

* Fuels with other compositions may be acceptable. If your fuel is outside the listed specifications, contact your local distributor for further analysis and advice.

Lubrication

Lubricating System	
Type	Full Pressure
Oil pan capacity, L (qt.)	3.2 (3.4)
Oil pan capacity with filter, L (qt.)	3.5 (3.7)
Oil filter: quantity, type	1, Cartridge

Application Data

Cooling (Standard Radiator)

Cooling System	60 Hz	50 Hz
Ambient temperature °C (°F)	50 (122)	
Engine jacket water capacity, L (gal.)	3.3 (0.9)	
Engine jacket water flow, Lpm (gpm)	37.8 (10.0)	
Radiator system capacity, including engine, L (gal.)	11.5 (3.0)	
Heat rejected to cooling water at rated kW, dry exhaust, kW (Btu/min.)	15.76 (895)	
Water pump type	Centrifugal	
Fan diameter, including blades, mm (in.)	390 (15.35)	
Fan, kWm (HP)	1.2 (1.6)	
Max. restriction of cooling air, intake and discharge side of radiator, kPa (in. H_2O)	0.13 (0.5)	

Operation Requirements

Air Requirements	
Radiator-cooled cooling air, m^3/min. (scfm)*	85 (3000)
Combustion air, m^3/min. (cfm)	0.7 (25)
Heat rejected to ambient air:	
Engine, kW (Btu/min.)	4.9 (283)
Alternator, kW (Btu/min.)	2.9 (165)

* Air density = 1.20 kg/m^3 or 0.075 lbm/$ft.^3$

Fuel Consumption at % rated load		
Natural Gas	**m^3/hr. (cfh)**	
100%	5.7	(200)
75%	4.5	(160)
50%	3.5	(125)
25%	2.5	(90)
LP Gas	**m^3/hr. (cfh)**	**kg/hr. (lb./hr.)**
100%	2.4 (85)	4.5 (10.0)
75%	1.8 (65)	3.4 (7.6)
50%	1.4 (51)	2.6 (5.9)
25%	1.0 (37)	1.9 (4.3)

Nominal fuel rating: Natural gas: 37 MJ/m^3 (1000 Btu/$ft.^3$)
LP gas: 93 MJ/m^3 (2500 Btu/$ft.^3$)

LP gas conversion factors: 8.58 $ft.^3$ = 1 lb.
0.535 m^3 = 1 kg
36.39 $ft.^3$ = 1 gal.

Sound

Average Sound Levels at 7 m(23 ft.) (no load)	dB(A)
With Weather Enclosure w/Sound Upfit Kit	65
With Sound Enclosure	60

Controller

Advanced Digital Control Features

- Compact controller
- Integrally mounted to the generator set
- LED display:
  - Runtime hours
  - Crank cycle status
  - Diagnostics
  - Application software version
- LED display communicates faults:
  - Auxiliary fault
  - High battery voltage
  - High engine temperature
  - Low battery voltage
  - Low oil pressure
  - Overcrank safety
  - Overspeed
  - Overfrequency
  - Overvoltage
  - Underfrequency
  - Undervoltage
- Membrane keypad for configuration and adjustment
  - Password-protected user access to menus
  - Voltage, gain, and speed adjustment
  - System configuration: system voltage, phase, and frequency settings, battery voltage, and generator set model
- Master switch: Run/Off-Reset/Auto
- Remote two-wire start/stop capability
- Superior electronics protection from corrosion and vibration
  - Potted electronics
  - Sealed connections
- Digital voltage regulation: ±1.5% RMS no-load to full-load
- Automatic start with programmed cranking cycle

KOHLER CO., Kohler, Wisconsin 53044 USA
Phone 920-457-4441, Fax 920-459-1646
For the nearest sales and service outlet in the
US and Canada, phone 1-800-544-2444
KOHLERPower.com

Kohler Power Systems
Asia Pacific Headquarters
7 Jurong Pier Road
Singapore 619159
Phone (65) 6264-6422, Fax (65) 6264-6455

Standard Features

- ADC 2100 Digital Controller
- Base Frame with Steel Skid
- Battery Rack and Cables
- Customer Connection Box with Field-Connection Terminal Blocks
- Electronic, Isochronous Governor
- Engine Shutdowns for High Engine Temperature and Low Oil Pressure
- Flexible Fuel Line
- Gas Fuel System (includes two fuel solenoid valves, fuel mixer, and electronic secondary gas regulator)
- Integral Vibration Isolation
- Line Circuit Breaker, 70 amps
- Oil Drain Extension
- Operation and Installation Literature
- Unit-Mounted Radiator System
- Warranty, Five-Year Limited

Available Accessories

Communication Accessories

❑ OnCue™ Home Generator Management System

Enclosure (must select sound or weather enclosure)

❑ Sound Enclosure with Silencer
❑ Weather Enclosure with Sound Kit and Silencer
❑ High Wind Kit for Sound Enclosure

Fuel System

❑ Natural Gas Strainer

Electrical System

❑ Battery
❑ Battery Charger, Equalize/Float Type
❑ Battery Heater

Engine and Alternator

❑ Air Cleaner Restriction Indicator
❑ Block Heater (recommended for ambient temperatures below 0°C (32°F)
❑ Engine Coolant (installed)
❑ Rodent Guards

Controller

❑ Relay Kit, Includes Run Relay and Common Fault Relay

Maintenance and Literature

❑ General Maintenance Literature Kit
❑ Overhaul Literature Kit
❑ Production Literature Kit
❑ Maintenance Kit (includes air filter, oil filter, and belt)

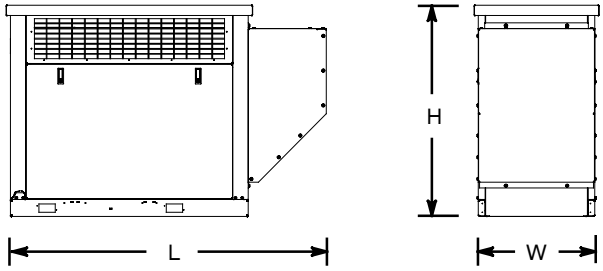
Miscellaneous Accessories

❑ _____
❑ _____
❑ _____
❑ _____

Dimensions and Weights

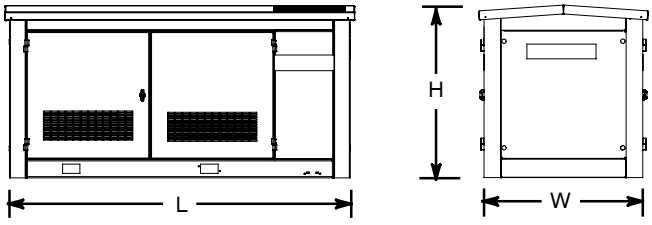
With Weather Enclosure and Sound Kit

Overall Size, L x W x H, mm (in.):	1886 x 778 x 1228 (74.3 x 30.6 x 48.4)
Weight, wet, kg (lb.):	490 (1080)



With Sound Enclosure

Overall Size, L x W x H, mm (in.):	1850 x 919 x 935 (72.8 x 36.2 x 36.8)
Weight, wet, kg (lb.):	465 (1026)



NOTE: These drawings are provided for reference only and should not be used for planning installation. Contact your local distributor for more detailed information.

DISTRIBUTED BY:

ATTACHMENT 5

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

Calculated Radio Frequency Emissions

Northeast Utilities

Brooklyn

116 Grant Hill Road, Brooklyn, CT 06234

May 2, 2013

Table of Contents

List of Tables

List of Figures

1. Introduction

The purpose of this report is to investigate compliance with applicable FCC regulations for Northeast Utilities' proposed additions to the existing monopole tower located at 116 Grant Hill Road in Brooklyn, CT. The coordinates of the tower are 41° 47' 30.53" N, 72° 00' 53.27" W.

Northeast Utilities is proposing the following:

1) Install one 896-960 MHz omnidirectional antenna;
2) Install one 896-901 MHz tower top amplifier;

2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

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

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

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

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

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

3. RF Exposure Prediction Methods

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

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

Where:

EIRP = Effective Isotropic Radiated Power

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

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 installation.

4. Calculation Results

Table 1 below outlines the power density information for the site. The proposed Northeast Utilities antenna is omnidirectional in nature so the majority of the RF power is focused out towards the horizon, with respect to the vertical plane. As a result, there will be less RF power directed below the antenna relative to the horizon, and consequently lower power density levels around the base of the tower. Please refer to Attachment C for the vertical pattern of the proposed Northeast Utilities antenna. The calculated results for Northeast Utilities 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
Sprint	147	1960	11	250	0.0458	1.0000	4.58%
Voicestream	137	1970	8	246	0.0377	1.0000	3.77%
Verizon Cellular	117	869	9	266	0.0629	0.5793	10.85%
Verizon PCS	117	1970	11	264	0.0763	1.0000	7.63%
Verizon AWS	117	2145	1	670	0.0176	1.0000	1.76%
Verizon LTE	117	698	1	867	0.0228	0.4653	4.89%
AT&T UMTS	129	880	2	565	0.0244	0.5867	4.16%
AT&T UMTS	129	1900	2	875	0.0378	1.0000	3.78%
AT&T LTE	129	734	1	1771	0.0383	0.4893	7.82%
AT&T GSM	129	880	1	283	0.0061	0.5867	1.04%
AT&T GSM	129	1900	4	525	0.0454	1.0000	4.54%
Northeast Utilities	100	935	2	240	0.0017	0.6233	0.28%
						Total	**55.10%**

Table 1: Carrier Information[1] [2]

[1] The power density information for carriers other than Northeast Utilities was taken directly from the CSC database dated 5/1/2013. 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] Antenna height listed for Northeast Utilities is in reference to the Paul J. Ford & Company Structural Analysis dated April 5, 2013.

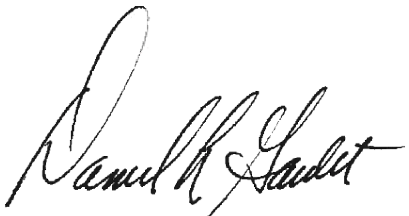
5. Conclusion

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 **55.10% 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 installation.

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

May 2, 2013
Date

Attachment A: References

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

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

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

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

(A) Limits for Occupational/Controlled Exposure[3]

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

(B) Limits for General Population/Uncontrolled Exposure[4]

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-1.34	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)

[3] 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.

[4] 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.

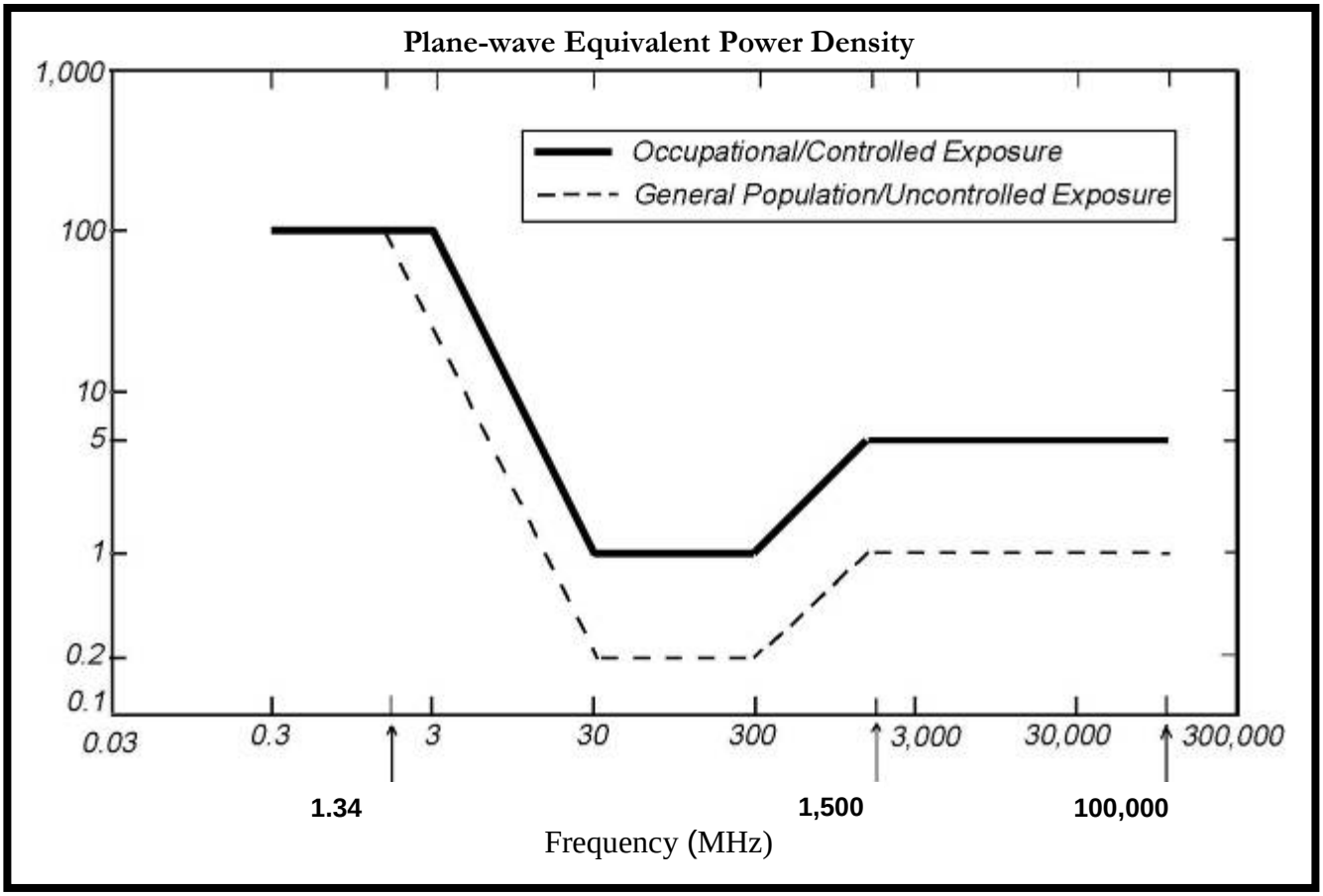
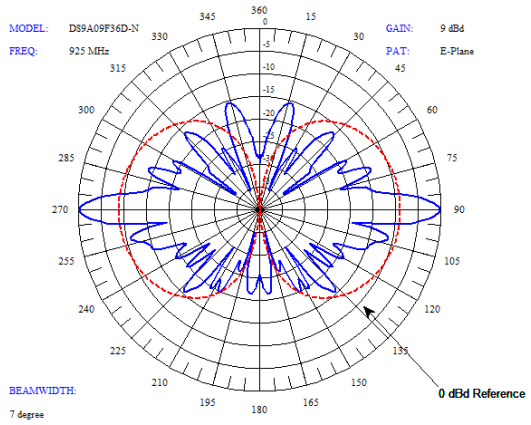


Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: Antenna Data Sheets and Electrical Patterns

900 MHz

Manufacturer:	dbSpectra
Model #:	DS9A09F36D-N
Frequency Band:	896-960 MHz
Gain:	9.0 dBd
Vertical Beamwidth:	8°
Horizontal Beamwidth:	360°
Polarization:	Omnidirectional
Length:	253.0”



ATTACHMENT 1

Northeast Utilities System

BROOKLYN
116 GRANT HILL ROAD
BROOKLYN, CT 06234

SITE DIRECTIONS

FROM: 107 SELDEN STREET, BERLIN, CONNECTICUT **TO:** 116 GRANT HILL ROAD, BROOKLYN, CONNECTICUT

1. Head northwest on Selden St toward CT-15 N/US-5 N/Berlin Turnpike	0.1 mi
2. Take the 1st right onto US-5 N/Berlin Turnpike, Continue to follow US-5 N	8.6 mi
3. Continue onto CT-15 N	1.5 mi
4. Merge onto I-84 E	1.7 mi
5. Take exit 59 to merge onto I-384 E toward Providence	8.8 mi
6. Slight right onto US-6 E/Hop River Rd (signs for Providence/Willimantic), Continue to follow US-6 E	15.7 mi
7. Take the ramp to US-6 E/Boston Post Rd	0.5 mi
8. Keep right at the fork, follow signs for US-6/Providence	154 ft
9. Turn right onto US-6 E/Boston Post Rd, Continue to follow US-6 E	11.1 mi
10. Turn left onto Cherry Hill Rd	253 ft
11. Take the 1st left onto Grant Hill Rd, Destination will be on the right	0.3 mi

GENERAL NOTES

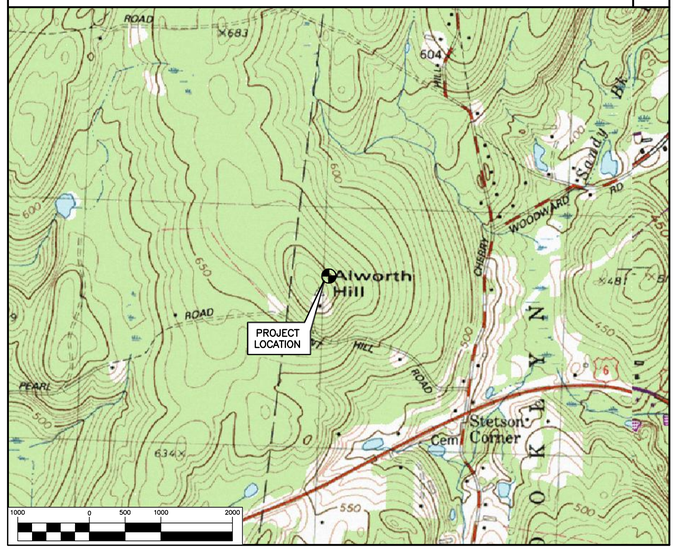
1. PROPOSED ANTENNA LOCATIONS AND HEIGHTS PROVIDED BY NORTHEAST UTILITIES SYSTEM.

PROJECT SCOPE

1. THE PROPOSED SCOPE OF WORK GENERALLY INCLUDES THE INSTALLATION OF A PREFABRICATED ±10' x ±12' EQUIPMENT SHELTER, 15 kW PROPANE FUELED GENERATOR AND 1000 gal. PROPANE TANK ON PROPOSED CONCRETE FOUNDATIONS WITHIN THE EXISTING FENCED COMPOUND.
2. ONE (1) OMINIDIRECTIONAL ANTENNA IS PROPOSED TO BE INSTALLED ON A SIDE ARM MOUNTED TO THE EXISTING TOWER.
3. NO CHANGES ARE PROPOSED TO THE EXISTING UTILITIES SERVICING THE COMPOUND AT THIS TIME.

VICINITY MAP

SCALE: 1" = 1000' NORTH



PROJECT SUMMARY

SITE NAME:	BROOKLYN
SITE ADDRESS:	116 GRANT HILL ROAD BROOKLYN, CT 06234
LESSEE/ TENANT:	NORTHEAST UTILITIES SYSTEM 107 SELDEN STREET BERLIN, CT 06037
CONTACT PERSON:	MIKE CARBARY NORTHEAST UTILITIES SYSTEM (860) 665-3825
TOWER COORDINATES:	LATITUDE: 41°-47'-30.53" LONGITUDE: 72°-00'-53.27" GROUND ELEVATION: ±730' AMSL COORDINATES REFERENCED FROM STUCTURAL ANALYSIS REPORT PREPARD BY PAUL J. FORD AND COMPANY. GROUND ELEVATION REFERENCED FROM AVAILABLE TOPOGRAPHIC MAPPING.

DESIGNED BY: CFC
DRAWN BY: DEB
CHK'D BY: CFC

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
1	05/30/13	CLT	DMD	CSC - ISSUED FOR CLIENT REVIEW
0	05/15/13	CLT	DMD	CSC - ISSUED FOR CLIENT REVIEW

PROFESSIONAL ENGINEER SEAL

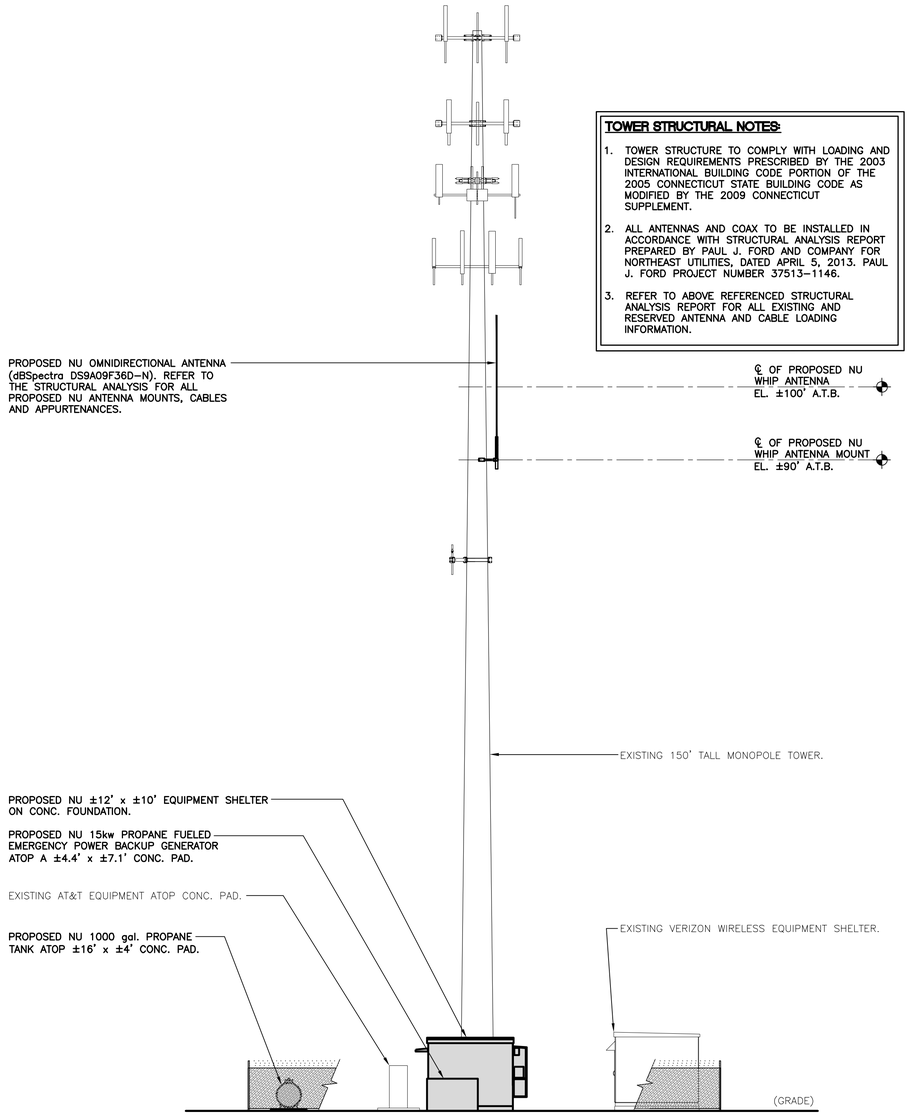
Northeast Utilities System
ENTEK engineering
Centered on Solutions℠
(203) 488-0580
(203) 488-8587 Fax
www.CentekEng.com
63-2 North Branford Road, Branford, CT 06405

NORTHEAST UTILITIES SYSTEM
WIRELESS COMMUNICATIONS FACILITY
BROOKLYN
116 GRANT HILL ROAD
BROOKLYN, CT 06234

DATE: 05/13/13
SCALE: AS NOTED
JOB NO. 13088

TITLE SHEET

T-1



TOWER STRUCTURAL NOTES:

1. TOWER STRUCTURE TO COMPLY WITH LOADING AND DESIGN REQUIREMENTS PRESCRIBED BY THE 2003 INTERNATIONAL BUILDING CODE PORTION OF THE 2005 CONNECTICUT STATE BUILDING CODE AS MODIFIED BY THE 2009 CONNECTICUT SUPPLEMENT.
2. ALL ANTENNAS AND COAX TO BE INSTALLED IN ACCORDANCE WITH STRUCTURAL ANALYSIS REPORT PREPARED BY PAUL J. FORD AND COMPANY FOR NORTHEAST UTILITIES, DATED APRIL 5, 2013. PAUL J. FORD PROJECT NUMBER 37513-1146.
3. REFER TO ABOVE REFERENCED STRUCTURAL ANALYSIS REPORT FOR ALL EXISTING AND RESERVED ANTENNA AND CABLE LOADING INFORMATION.

2 / C-1 EAST ELEVATION

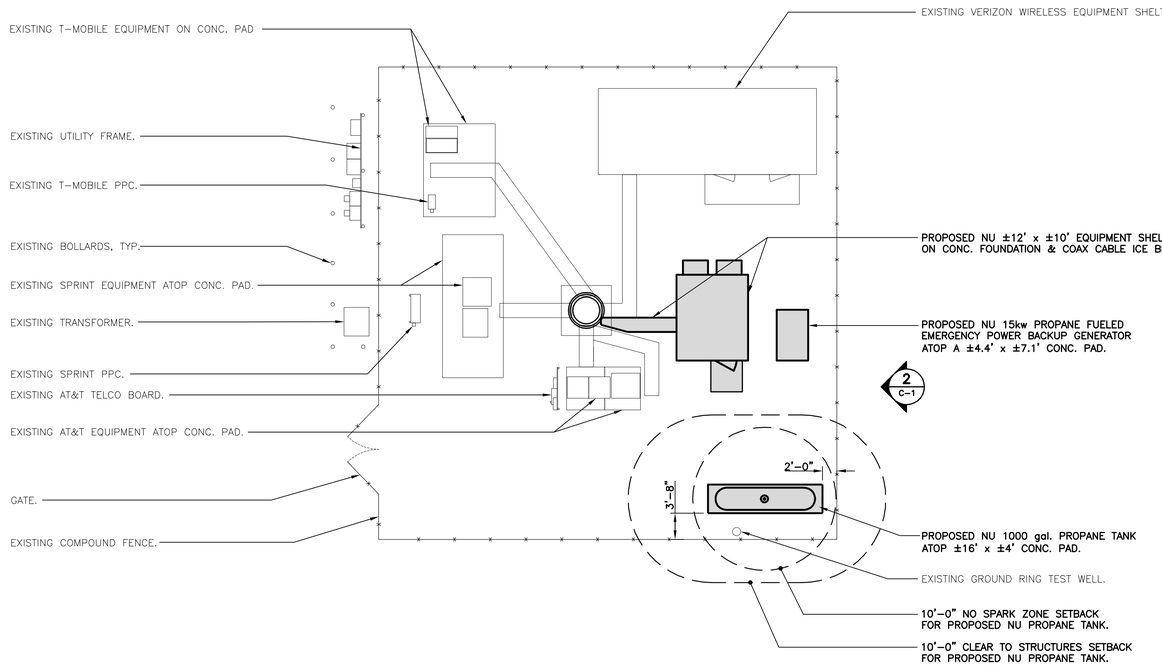
SCALE: 1" = 10'

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

NOTE:
COORDINATE POWER & TELCO SERVICE TO THE PROPOSED NU EQUIPMENT SHELTER WITH OWNER & LOCAL UTILITY COMPANIES.



1 / C-1 COMPOUND PLAN

SCALE: 1" = 10'

NORTH

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

DESIGNED BY:	CFC
DRAWN BY:	CLT
CHK'D BY:	DMD

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
1	05/30/13	CLT	DMD	CSC - ISSUED FOR CLIENT REVIEW
0	05/15/13	CLT	DMD	CSC - ISSUED FOR CLIENT REVIEW

PROFESSIONAL ENGINEER SEAL

Northeast Utilities System

CENTEK engineering
Centered on Solutions℠
(203) 488-0580
(203) 488-8587 Fax
63-2 North Branford Road, Branford, CT 06405
www.CentekEng.com

NORTHEAST UTILITIES SYSTEM

WIRELESS COMMUNICATIONS FACILITY

BROOKLYN

116 GRANT HILL ROAD
BROOKLYN, CT 06234

DATE:	05/13/13
SCALE:	AS NOTED
JOB NO.	13088

COMPOUND PLAN AND ELEVATION

C-1

Sheet No. 2 of 2

ATTACHMENT 2

CROWN CASTLE

3530 Toringdon Way, Suite 300
Charlotte, NC 28277

Telephone: 704-405-6622
Fax: 724-416-4785

April 10, 2013

RE: Crown Castle Letter of Authorization (LOA)

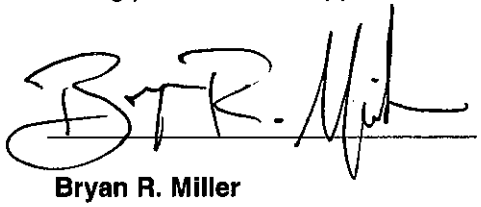
Global Signal Acquisitions II LLC ("Crown Castle"), does hereby authorize **Northeast Utilities ("NE Utilities")** and its authorized contractors/agents to act as "Applicant" in the processing of all applications, permits, research and other related activities associated with the processing, planning, design review, permitting, entitlement and construction of additional equipment, antennas and site improvements for the Crown Castle existing wireless communications facility described as follows:

Customer Site Name:	**N/A**	**Crown Castle Site ID Number:**	**BU# 876390**
Site Address:	**116 Grant Hill Rd, Brooklyn, CT 06234**	**Crown Castle Site Name:**	**HAMPTON/BERNIER**

This authorization is fully contingent upon **NE Utilities** authorized contractors/agents' compliance with the following conditions:

1. Crown Castle must review the application prior to submittal. Crown Castle must be provided all applications, narratives, drawings and attachments at least 72 hours in advance of their submittal to the locality. Use of email and electronic attachments is encouraged. A Crown Castle Zoning Subject Matter Expert (SME) will review and provide written comment to the customer within 48 hours of receipt of a complete set of application materials. If Crown Castle indicates that changes are required, submissions shall be altered in accordance with Crown Castle comments prior to submission to the locality. Verification of corrections should also be accomplished via emails and attachments.
2. In no event may **NE Utilities** encourage, suggest, participate in, or permit the imposition of any restrictions or additional obligations whatsoever on the tower site or Crown Castle's current or future use or ability to license space at the tower site as part of or in exchange for obtaining any approval, permit, exception or variance.
3. A copy of the final permit and/or a written summary of the zoning/entitlement decision rendered by the locality and any/all conditions placed on that decision shall be communicated in detail to Crown Castle well within the appeal period provided by the locality (typically 10-15 days).
4. All conditions of approval pertinent to the construction of the proposed project must be included in the construction drawings for the project. The conditions of approval pertinent to the construction of the project shall be copied verbatim from the zoning permit approval language, and shall be present in the drawings prior to submission for building permits and contractor bidding. Crown Castle shall verify the inclusion of appropriate conditions of approval in the construction drawing redline process.
5. Crown Castle will provide a Notice To Proceed (NTP) to construction to the customer upon receipt of the final approved zoning permit and the approved Building Permit.

By Crown Castle

Signature: 

Printed Name: **Bryan R. Miller**

Title: **Real Estate Specialist**

Date: **April 10, 2013**

ATTACHMENT 3

PAUL J. FORD AND COMPANY
STRUCTURAL ENGINEERS
250 East Broad Street • Suite 1500 • Columbus, Ohio 43215-3708

Date: **April 05, 2013**

Patrick Byrum
Crown Castle USA Inc.
3530 Toringdon Way Suite 300
Charlotte, NC 28277

Paul J Ford and Company
250 E. Broad Street Suite 1500
Columbus, OH 43215
614.221.6679
jwoolley@pjfweb.com

Subject: **Structural Analysis Report**

Carrier Designation:	***Northeast Utilities* Co-Locate**	
	Carrier Site Number:	N/A
	Carrier Site Name:	Brooklyn
Crown Castle Designation:	**Crown Castle BU Number:**	876390
	Crown Castle Site Name:	HAMPTON / BERNIER
	Crown Castle JDE Job Number:	230753
	Crown Castle Work Order Number:	595401
	Crown Castle Application Number:	184584 Rev. 2
Engineering Firm Designation:	**Paul J Ford and Company Project Number:**	37513-1146
Site Data:	**116 Grant Hill Rd., BROOKLYN, Windham County, CT**	
	Latitude *41° 47' 30.53"*, Longitude *-72° 0' 53.27"*	
	150 Foot - Monopole Tower	

Dear Patrick Byrum,

Paul J Ford and Company is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above mentioned tower. This analysis has been performed in accordance with the Crown Castle Structural 'Statement of Work' and the terms of Crown Castle Purchase Order Number 535301, in accordance with application 184584, revision 2.

The purpose of the analysis is to determine acceptability of the tower stress level. Based on our analysis we have determined the tower stress level for the structure and foundation, under the following load case, to be:

LC7: Existing + Reserved + Proposed Equipment **Sufficient Capacity**
Note: See Table I and Table II for the proposed and existing/reserved loading, respectively.

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

We at *Paul J Ford and Company* appreciate the opportunity of providing our continuing professional services to you and Crown Castle USA Inc.. If you have any questions or need further assistance on this or any other projects please give us a call.

Respectfully submitted by:

John J. Woolley, E.I
Structural Designer

STATE OF CONNECTICUT
JOSEPH PACHICARAH JACOBS
No. PEN 22731
LICENSED
PROFESSIONAL ENGINEER

tnxTower Report - version 6.0.3.0

APR 0 5 2013

PAUL J. FORD AND COMPANY
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Respectfully submitted by:

John J. Woolley, E.I.
Structural Designer

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 150 ft Monopole tower designed by ENGINEERED ENDEAVORS, INC. in February of 2000. The tower was originally designed for a wind speed of 90 mph per TIA/EIA-222-F.

2) ANALYSIS CRITERIA

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

Table 1 - Proposed Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
90.0	100.0	1	bird technologies group	TTA-429-94C-08179	1 2	1/2 1-1/4	-
		1	dbspectra	DS9A09F36D-N			
	90.0	1	tower mounts	Pipe Mount [PM 602-1]			

Table 2 - Existing and Reserved Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
149.0	151.0	6	decibel	DB980H90E-M w/ Mount Pipe	6	1-5/8	1
	149.0	1	tower mounts	Platform Mount [LP 601-1]			
137.0	138.0	3	ems wireless	RR90-17-02DP w/ Mount Pipe	6	1-5/8	1
		6	ericsson	KRY 112 71/2			
129.0	129.0	1	tower mounts	Side Arm Mount [SO 102-3]	-	-	2
	127.0	6	ericsson	TME-RRUS-11			
127.0	129.0	6	powerwave technologies	7770.00 w/ Mount Pipe	12	1-1/4	1
		6	powerwave technologies	LGP 17201			
		6	powerwave technologies	LGP13519			
		3	kmw communications	AM-X-CD-17-65-00T-RET w/ Mount Pipe	3	3/8	2
		1	raycap	DC6-48-60-18-8F			
	127.0	1	tower mounts	T-Arm Mount [TA 602-3]	-	-	1
117.0	119.0	3	antel	BXA-171085-12CF-EDIN-2 w/ Mount Pipe	18	1-5/8	1
		3	antel	BXA-70063-6CF-2 w/ Mount Pipe			
		6	antel	LPA-80080/4CF w/ Mount Pipe			
	117.0	1	tower mounts	Platform Mount [LP 303-1]			
76.0	77.0	1	lucent	KS24019-L112A	1	1/2	1
	76.0	1	tower mounts	Pipe Mount [PM 601-1]			

Notes:
1) Existing Equipment
2) Reserved Equipment

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	Criscuolo Shepard, 8/9/1999	1615347	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	EEI, 6459, 2/22/2000	1615410	CCISITES
4-TOWER MANUFACTURER DRAWINGS	EEI, 6459, 2/22/2000	1533003	CCISITES
4-TOWER REINFORCEMENT DESIGN/DRAWINGS/DATA	TEP, 072655, 5/15/08	2255030	CCISITES

3.1) Analysis Method

tnxTower (version 6.0.3.0), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

3.2) Assumptions

1) Tower and structures were built in accordance with the manufacturer's specifications.
2) The tower and structures have been maintained in accordance with the manufacturer's specification.
3) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
4) Modifications have been installed in conformance with the referenced modification drawings.
5) No specific horizontal welds were called out for the base plate stiffeners. 3/8" Groove weld was assumed.

This analysis may be affected if any assumptions are not valid or have been made in error. Paul J Ford and Company should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 4 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
L1	150 - 123.29	Pole	TP22.9x17x0.1875	1	-5.02	679.32	42.0	Pass
L2	123.29 - 88.88	Pole	TP30x21.7696x0.3125	2	-10.48	1483.15	78.0	Pass
L3	88.88 - 43.8	Pole	TP39.2x28.4504x0.375	3	-19.08	2329.31	90.0	Pass
L4	43.8 - 0	Pole	TP48x37.2689x0.4375	4	-32.30	3433.55	85.1	Pass
							Summary	
						Pole (L3)	90.0	Pass
						Rating =	90.0	Pass

Table 5 - Tower Component Stresses vs. Capacity

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	75.1	Pass
1	Base Plate	0	65.0	Pass
1	Base Foundation Structural Steel	0	87.8	Pass
1	Base Foundation Soil Interaction	0	77.0	Pass

Structure Rating (max from all components) =	90.0%

Notes:
1) See additional documentation in “Appendix C – Additional Calculations” for calculations supporting the % capacity consumed.

APPENDIX A

TNXTOWER OUTPUT

Tower Input Data

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

1) Tower is located in Windham County, Connecticut.
2) Basic wind speed of 85 mph.
3) Nominal ice thickness of 1.0000 in.
4) Ice density of 56 pcf.
5) A wind speed of 38 mph is used in combination with ice.
6) Temperature drop of 50 °F.
7) Deflections calculated using a wind speed of 50 mph.
8) A non-linear (P-delta) analysis was used.
9) Pressures are calculated at each section.
10) Stress ratio used in pole design is 1.333.
11) 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	150.00-123.29	26.71	3.42	18	17.0000	22.9000	0.1875	0.7500	A572-65 (65 ksi)
L2	123.29-88.88	37.83	4.25	18	21.7696	30.0000	0.3125	1.2500	A572-65 (65 ksi)
L3	88.88-43.80	49.33	5.42	18	28.4504	39.2000	0.3750	1.5000	A572-65 (65 ksi)
L4	43.80-0.00	49.22		18	37.2689	48.0000	0.4375	1.7500	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	17.2623	10.0055	357.3078	5.9684	8.6360	41.3742	715.0858	5.0037	2.6620	14.197
	23.2533	13.5168	880.9281	8.0629	11.6332	75.7253	1763.0154	6.7597	3.7004	19.735
L2	22.8609	21.2827	1237.9542	7.6173	11.0589	111.9416	2477.5374	10.6434	3.2814	10.501

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
	30.4628	29.4463	3278.8026	10.5391	15.2400	215.1445	6561.9196	14.7259	4.7300	15.136
L3	29.8297	33.4167	3327.7547	9.9668	14.4528	230.2502	6659.8882	16.7115	4.3473	11.593
	39.8047	46.2115	8800.5544	13.7829	19.9136	441.9369	17612.6889	23.1101	6.2392	16.638
L4	39.0438	51.1450	8765.5168	13.0752	18.9326	462.9852	17542.5674	25.5774	5.7893	13.233
	48.7405	66.0465	18876.2818	16.8847	24.3840	774.1257	37777.4015	33.0295	7.6780	17.55

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 150.00-123.29				1	1	1		
L2 123.29-88.88				1	1	1		
L3 88.88-43.80				1	1	1		
L4 43.80-0.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
LDF7-50A(1-5/8")	C	No	Inside Pole	149.00 - 0.00	6	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
LDF7-50A(1-5/8")	C	No	Inside Pole	137.00 - 0.00	6	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
LDF6-50A(1-1/4")	C	No	Inside Pole	127.00 - 0.00	12	No Ice	0.00	0.66
						1/2" Ice	0.00	0.66
						1" Ice	0.00	0.66
FB-L98B-002-75000(3/8")	C	No	CaAa (Out Of Face)	127.00 - 0.00	1	No Ice	0.04	0.06
						1/2" Ice	0.14	0.60
						1" Ice	0.24	1.76
WR-VG122ST-BRDA(3/8)	C	No	CaAa (Out Of Face)	127.00 - 0.00	2	No Ice	0.00	0.20
						1/2" Ice	0.00	0.74
						1" Ice	0.00	1.89
LDF7-50A(1-5/8")	C	No	CaAa (Out Of Face)	117.00 - 0.00	2	No Ice	0.20	0.82
						1/2" Ice	0.30	2.33
						1" Ice	0.40	4.46
LDF7-50A(1-5/8")	C	No	CaAa (Out Of Face)	117.00 - 0.00	10	No Ice	0.00	0.82
						1/2" Ice	0.00	2.33
						1" Ice	0.00	4.46
LDF7-50A(1-5/8")	C	No	CaAa (Out Of Face)	117.00 - 0.00	6	No Ice	0.00	0.82
						1/2" Ice	0.00	2.33
						1" Ice	0.00	4.46
LDF4-50A(1/2")	C	No	Inside Pole	76.00 - 0.00	1	No Ice	0.00	0.15
						1/2" Ice	0.00	0.15
						1" Ice	0.00	0.15
LDF4-50A(1/2")	C	No	Inside Pole	90.00 - 0.00	1	No Ice	0.00	0.15
						1/2" Ice	0.00	0.15
						1" Ice	0.00	0.15
LDF6-50A(1-1/4")	C	No	Inside Pole	90.00 - 0.00	2	No Ice	0.00	0.66
						1/2" Ice	0.00	0.66
						1" Ice	0.00	0.66

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	150.00-123.29	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.146	0.23
L2	123.29-88.88	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	12.490	1.04
L3	88.88-43.80	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	19.626	1.56
L4	43.80-0.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	19.069	1.52

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	150.00-123.29	A	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.888	0.24
L2	123.29-88.88	A	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	30.621	3.06
L3	88.88-43.80	A	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	46.675	4.74
L4	43.80-0.00	A	1.000	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	45.350	4.61

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	150.00-123.29	-0.0080	0.0046	-0.0435	0.0251
L2	123.29-88.88	-0.4138	0.2389	-0.7944	0.4587
L3	88.88-43.80	-0.4908	0.2834	-0.9467	0.5466
L4	43.80-0.00	-0.5046	0.2913	-1.0085	0.5822

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
*****								
(2) DB980H90E-M w/ Mount Pipe	A	From Leg	4.00 / 0.00 / 2.00	0.0000	149.00	No Ice	4.04	3.62	0.03
						1/2" Ice	4.50	4.48	0.06
						1" Ice	4.95	5.22	0.11
(2) DB980H90E-M w/ Mount Pipe	B	From Leg	4.00 / 0.00 / 2.00	0.0000	149.00	No Ice	4.04	3.62	0.03
						1/2" Ice	4.50	4.48	0.06
							4.95	5.22	0.11

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						1" Ice			
(2) DB980H90E-M w/ Mount Pipe	C	From Leg	4.00 0.00 2.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	4.04 4.50 4.95	3.62 4.48 5.22	0.03 0.06 0.11
Platform Mount [LP 601-1]	C	None		0.0000	149.00	No Ice 1/2" Ice 1" Ice	28.47 33.59 38.71	28.47 33.59 38.71	1.12 1.51 1.91
8-ft Ladder	C	From Leg	2.00 0.00 -1.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	7.07 9.73 11.19	7.07 9.73 11.19	0.04 0.07 0.08
6' x 2" Mount Pipe	A	From Leg	4.00 0.00 2.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	1.43 1.92 2.29	1.43 1.92 2.29	0.02 0.03 0.05
6' x 2" Mount Pipe	B	From Leg	4.00 0.00 2.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	1.43 1.92 2.29	1.43 1.92 2.29	0.02 0.03 0.05
6' x 2" Mount Pipe	C	From Leg	4.00 0.00 2.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	1.43 1.92 2.29	1.43 1.92 2.29	0.02 0.03 0.05
***									
RR90-17-02DP w/ Mount Pipe	A	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice 1" Ice	4.59 5.09 5.58	3.32 4.09 4.78	0.03 0.07 0.11
RR90-17-02DP w/ Mount Pipe	B	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice 1" Ice	4.59 5.09 5.58	3.32 4.09 4.78	0.03 0.07 0.11
RR90-17-02DP w/ Mount Pipe	C	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice 1" Ice	4.59 5.09 5.58	3.32 4.09 4.78	0.03 0.07 0.11
(2) KRY 112 71/2	A	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice 1" Ice	0.68 0.80 0.93	0.51 0.62 0.74	0.01 0.02 0.03
(2) KRY 112 71/2	B	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice 1" Ice	0.68 0.80 0.93	0.51 0.62 0.74	0.01 0.02 0.03
(2) KRY 112 71/2	C	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice 1" Ice	0.68 0.80 0.93	0.51 0.62 0.74	0.01 0.02 0.03
Platform Mount [LP 714-1]	C	None		0.0000	137.00	No Ice 1/2" Ice 1" Ice	37.47 44.23 50.99	37.47 44.23 50.99	1.60 2.04 2.48
6' x 2" Mount Pipe	A	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice 1" Ice	1.43 1.92 2.29	1.43 1.92 2.29	0.02 0.03 0.05
6' x 2" Mount Pipe	B	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice 1" Ice	1.43 1.92 2.29	1.43 1.92 2.29	0.02 0.03 0.05
6' x 2" Mount Pipe	C	From Leg	4.00 0.00 1.00	0.0000	137.00	No Ice 1/2" Ice	1.43 1.92 2.29	1.43 1.92 2.29	0.02 0.03 0.05

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft* *ft* *ft*	*Azimuth Adjustment* *°*	*Placement* *ft*		*C_AA_A Front* *ft^2*	*C_AA_A Side* *ft^2*	*Weight* *K*
						1" Ice			
***									
(2) RRUS-11	A	From Leg	2.00 0.00 -2.00	0.0000	129.00	No Ice 1/2" Ice 1" Ice	3.25 3.49 3.74	1.37 1.55 1.74	0.05 0.07 0.09
(2) RRUS-11	B	From Leg	2.00 0.00 -2.00	0.0000	129.00	No Ice 1/2" Ice 1" Ice	3.25 3.49 3.74	1.37 1.55 1.74	0.05 0.07 0.09
(2) RRUS-11	C	From Leg	2.00 0.00 -2.00	0.0000	129.00	No Ice 1/2" Ice 1" Ice	3.25 3.49 3.74	1.37 1.55 1.74	0.05 0.07 0.09
Side Arm Mount [SO 102-3]	C	None		0.0000	129.00	No Ice 1/2" Ice 1" Ice	3.00 3.48 3.96	3.00 3.48 3.96	0.08 0.11 0.14
***									
(2) 7770.00 w/ Mount Pipe	A	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	6.12 6.63 7.13	4.25 5.01 5.71	0.06 0.10 0.16
(2) 7770.00 w/ Mount Pipe	B	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	6.12 6.63 7.13	4.25 5.01 5.71	0.06 0.10 0.16
(2) 7770.00 w/ Mount Pipe	C	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	6.12 6.63 7.13	4.25 5.01 5.71	0.06 0.10 0.16
(2) LGP 17201	A	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	1.95 2.13 2.33	0.52 0.64 0.77	0.03 0.04 0.06
(2) LGP 17201	B	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	1.95 2.13 2.33	0.52 0.64 0.77	0.03 0.04 0.06
(2) LGP 17201	C	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	1.95 2.13 2.33	0.52 0.64 0.77	0.03 0.04 0.06
(2) LGP13519	A	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	0.34 0.42 0.51	0.21 0.28 0.36	0.01 0.01 0.01
(2) LGP13519	B	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	0.34 0.42 0.51	0.21 0.28 0.36	0.01 0.01 0.01
(2) LGP13519	C	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	0.34 0.42 0.51	0.21 0.28 0.36	0.01 0.01 0.01
AM-X-CD-17-65-00T-RET w/ Mount Pipe	A	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	11.55 12.27 13.00	8.94 10.45 11.99	0.09 0.17 0.27
AM-X-CD-17-65-00T-RET w/ Mount Pipe	B	From Leg	4.00 0.00 2.00	0.0000	127.00	No Ice 1/2" Ice 1" Ice	11.55 12.27 13.00	8.94 10.45 11.99	0.09 0.17 0.27
AM-X-CD-17-65-00T-RET w/ Mount Pipe	C	From Leg	4.00 0.00	0.0000	127.00	No Ice 1/2"	11.55 12.27	8.94 10.45	0.09 0.17

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft* *ft* *ft*	*Azimuth Adjustment* *°*	*Placement* *ft*		*C_AA_A Front* *ft^2*	*C_AA_A Side* *ft^2*	*Weight* *K*
			2.00			Ice	13.00	11.99	0.27
						1" Ice			
DC6-48-60-18-8F	B	From Leg	4.00	0.0000	127.00	No Ice	1.47	1.47	0.02
			0.00			1/2"	1.67	1.67	0.04
			2.00			Ice	1.88	1.88	0.06
						1" Ice			
T-Arm Mount [TA 602-3]	C	None		0.0000	127.00	No Ice	11.59	11.59	0.77
						1/2"	15.44	15.44	0.99
						Ice	19.29	19.29	1.21
						1" Ice			
***									
(2) LPA-80080/4CF w/ Mount Pipe	A	From Leg	4.00	0.0000	117.00	No Ice	2.86	7.23	0.03
			0.00			1/2"	3.22	7.92	0.07
			2.00			Ice	3.59	8.63	0.13
						1" Ice			
(2) LPA-80080/4CF w/ Mount Pipe	B	From Leg	4.00	0.0000	117.00	No Ice	2.86	7.23	0.03
			0.00			1/2"	3.22	7.92	0.07
			2.00			Ice	3.59	8.63	0.13
						1" Ice			
(2) LPA-80080/4CF w/ Mount Pipe	C	From Leg	4.00	0.0000	117.00	No Ice	2.86	7.23	0.03
			0.00			1/2"	3.22	7.92	0.07
			2.00			Ice	3.59	8.63	0.13
						1" Ice			
BXA-70063-6CF-2 w/ Mount Pipe	A	From Leg	4.00	0.0000	117.00	No Ice	7.97	5.80	0.04
			0.00			1/2"	8.61	6.95	0.10
			2.00			Ice	9.22	7.82	0.17
						1" Ice			
BXA-70063-6CF-2 w/ Mount Pipe	B	From Leg	4.00	0.0000	117.00	No Ice	7.97	5.80	0.04
			0.00			1/2"	8.61	6.95	0.10
			2.00			Ice	9.22	7.82	0.17
						1" Ice			
BXA-70063-6CF-2 w/ Mount Pipe	C	From Leg	4.00	0.0000	117.00	No Ice	7.97	5.80	0.04
			0.00			1/2"	8.61	6.95	0.10
			2.00			Ice	9.22	7.82	0.17
						1" Ice			
BXA-171085-12CF-EDIN-2 w/ Mount Pipe	A	From Leg	4.00	0.0000	117.00	No Ice	5.34	5.60	0.05
			0.00			1/2"	6.03	6.90	0.09
			2.00			Ice	6.69	8.11	0.15
						1" Ice			
BXA-171085-12CF-EDIN-2 w/ Mount Pipe	B	From Leg	4.00	0.0000	117.00	No Ice	5.34	5.60	0.05
			0.00			1/2"	6.03	6.90	0.09
			2.00			Ice	6.69	8.11	0.15
						1" Ice			
BXA-171085-12CF-EDIN-2 w/ Mount Pipe	C	From Leg	4.00	0.0000	117.00	No Ice	5.34	5.60	0.05
			0.00			1/2"	6.03	6.90	0.09
			2.00			Ice	6.69	8.11	0.15
						1" Ice			
Platform Mount [LP 303-1]	C	None		0.0000	117.00	No Ice	14.66	14.66	1.25
						1/2"	18.87	18.87	1.48
						Ice	23.08	23.08	1.71
						1" Ice			
***									
Pipe Mount [PM 601-1]	C	None		0.0000	76.00	No Ice	3.00	0.90	0.07
						1/2"	3.74	1.12	0.08
						Ice	4.48	1.34	0.09
						1" Ice			
KS24019-L112A	C	From Leg	4.00	0.0000	76.00	No Ice	0.16	0.16	0.01
			0.00			1/2"	0.22	0.22	0.01
			1.00			Ice	0.30	0.30	0.01
						1" Ice			
***									
Pipe Mount [PM 602-1]	C	None		0.0000	90.00	No Ice	5.25	1.58	0.09
						1/2"	6.50	1.95	0.12
						Ice	7.75	2.32	0.14
						1" Ice			

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Offsets: Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
TTA-429-94C-08179	A	From Leg	4.00	0.00	0.0000	90.00	No Ice	1.17	1.17	0.01
			0.00				1/2" Ice	1.34	1.34	0.02
			10.00				1" Ice	1.52	1.52	0.04
DS9A09F36D-N	A	From Leg	4.00	0.00	0.0000	90.00	No Ice	5.76	5.76	0.05
			0.00				1/2" Ice	7.71	7.71	0.09
			10.00				1" Ice	9.68	9.68	0.14

Tower Pressures - No Ice

G_H = 1.690

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 150.00-123.29	135.99	1.499	27.72	44.405	A	0.000	44.405	44.405	100.00	0.000	0.000
					B	0.000	44.405		100.00	0.000	0.000
					C	0.000	44.405		100.00	0.000	0.146
L2 123.29-88.88	105.47	1.394	25.75	75.291	A	0.000	75.291	75.291	100.00	0.000	0.000
					B	0.000	75.291		100.00	0.000	0.000
					C	0.000	75.291		100.00	0.000	12.490
L3 88.88-43.80	65.82	1.218	22.41	128.809	A	0.000	128.809	128.809	100.00	0.000	0.000
					B	0.000	128.809		100.00	0.000	0.000
					C	0.000	128.809		100.00	0.000	19.626
L4 43.80-0.00	21.09	1	18.50	157.772	A	0.000	157.772	157.772	100.00	0.000	0.000
					B	0.000	157.772		100.00	0.000	0.000
					C	0.000	157.772		100.00	0.000	19.069

Tower Pressure - With Ice

G_H = 1.690

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 150.00-123.29	135.99	1.499	5.42	1.0000	48.857	A	0.000	48.857	48.857	100.00	0.000	0.000
						B	0.000	48.857		100.00	0.000	0.000
						C	0.000	48.857		100.00	0.000	0.888
L2 123.29-88.88	105.47	1.394	5.04	1.0000	81.026	A	0.000	81.026	81.026	100.00	0.000	0.000
						B	0.000	81.026		100.00	0.000	0.000
						C	0.000	81.026		100.00	0.000	30.621
L3 88.88-43.80	65.82	1.218	4.38	1.0000	136.323	A	0.000	136.323	136.323	100.00	0.000	0.000
						B	0.000	136.323		100.00	0.000	0.000
						C	0.000	136.323		100.00	0.000	46.675
L4 43.80-0.00	21.09	1	3.62	1.0000	165.072	A	0.000	165.072	165.072	100.00	0.000	0.000
						B	0.000	165.072		100.00	0.000	0.000
						C	0.000	165.072		100.00	0.000	45.350

Tower Pressure - Service

G_H = 1.690

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 150.00-123.29	135.99	1.499	9.59	44.405	A	0.000	44.405	44.405	100.00	0.000	0.000
					B	0.000	44.405		100.00	0.000	0.000
					C	0.000	44.405		100.00	0.000	0.146
L2 123.29-88.88	105.47	1.394	8.91	75.291	A	0.000	75.291	75.291	100.00	0.000	0.000
					B	0.000	75.291		100.00	0.000	0.000
					C	0.000	75.291		100.00	0.000	12.490
L3 88.88-43.80	65.82	1.218	7.75	128.809	A	0.000	128.809	128.809	100.00	0.000	0.000
					B	0.000	128.809		100.00	0.000	0.000
					C	0.000	128.809		100.00	0.000	19.626
L4 43.80-0.00	21.09	1	6.40	157.772	A	0.000	157.772	157.772	100.00	0.000	0.000
					B	0.000	157.772		100.00	0.000	0.000
					C	0.000	157.772		100.00	0.000	19.069

Load Combinations

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

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	150 - 123.29	Pole	Max Tension	5	0.00	0.00	0.00
			Max. Compression	14	-11.72	0.02	-0.29
			Max. Mx	11	-5.02	125.99	-0.03
			Max. My	8	-5.02	-0.03	-126.09
			Max. Vy	11	-12.15	125.99	-0.03
			Max. Vx	8	12.15	-0.03	-126.09
			Max. Torque	13			0.92
L2	123.29 - 88.88	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-21.97	2.32	-1.60
			Max. Mx	11	-10.48	675.51	-0.23
			Max. My	8	-10.48	0.38	-675.44
			Max. Vy	11	-18.64	675.51	-0.23
			Max. Vx	8	18.64	0.38	-675.44
			Max. Torque	4			1.02
L3	88.88 - 43.8	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-35.06	7.18	-3.45
			Max. Mx	11	-19.08	1602.92	-0.50
			Max. My	8	-19.08	1.24	-1602.18
			Max. Vy	11	-22.90	1602.92	-0.50
			Max. Vx	8	22.90	1.24	-1602.18
			Max. Torque	4			1.05
L4	43.8 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-53.55	13.72	-7.22
			Max. Mx	11	-32.30	2819.89	-1.17
			Max. My	8	-32.30	2.40	-2818.65
			Max. Vy	11	-26.46	2819.89	-1.17
			Max. Vx	8	26.46	2.40	-2818.65
			Max. Torque	3			1.15

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	14	53.55	-0.00	0.00
	Max. H_x	11	32.32	26.43	0.00
	Max. H_z	2	32.32	0.00	26.43
	Max. M_x	2	2816.32	0.00	26.43
	Max. M_z	5	2815.08	-26.43	0.00
	Max. Torsion	3	1.15	-13.22	22.90
	Min. Vert	11	32.32	26.43	0.00
	Min. H_x	5	32.32	-26.43	0.00
	Min. H_z	8	32.32	0.00	-26.43
	Min. M_x	8	-2818.65	0.00	-26.43
	Min. M_z	11	-2819.89	26.43	0.00
	Min. Torsion	9	-1.15	13.22	-22.90

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	32.32	0.00	-0.00	1.13	2.33	0.00
Dead+Wind 0 deg - No Ice	32.32	-0.00	-26.43	-2816.32	2.40	-0.94
Dead+Wind 30 deg - No Ice	32.32	13.22	-22.90	-2439.22	-1406.55	-1.15
Dead+Wind 60 deg - No Ice	32.32	22.90	-13.22	-1407.79	-2437.98	-1.05
Dead+Wind 90 deg - No Ice	32.32	26.43	-0.00	1.17	-2815.08	-0.67
Dead+Wind 120 deg - No Ice	32.32	22.90	13.22	1410.12	-2437.97	-0.11
Dead+Wind 150 deg - No Ice	32.32	13.22	22.90	2441.54	-1406.55	0.48

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead+Wind 180 deg - No Ice	32.32	-0.00	26.43	2818.65	2.40	0.94
Dead+Wind 210 deg - No Ice	32.32	-13.22	22.90	2441.54	1411.35	1.15
Dead+Wind 240 deg - No Ice	32.32	-22.90	13.22	1410.12	2442.78	1.05
Dead+Wind 270 deg - No Ice	32.32	-26.43	-0.00	1.17	2819.89	0.67
Dead+Wind 300 deg - No Ice	32.32	-22.90	-13.22	-1407.79	2442.78	0.11
Dead+Wind 330 deg - No Ice	32.32	-13.22	-22.90	-2439.22	1411.36	-0.48
Dead+Ice+Temp	53.55	0.00	-0.00	7.22	13.72	-0.00
Dead+Wind 0 deg+Ice+Temp	53.55	0.00	-6.80	-745.71	13.86	-0.39
Dead+Wind 30 deg+Ice+Temp	53.55	3.40	-5.89	-644.83	-362.64	-0.43
Dead+Wind 60 deg+Ice+Temp	53.55	5.89	-3.40	-369.21	-638.26	-0.35
Dead+Wind 90 deg+Ice+Temp	53.55	6.80	-0.00	7.29	-739.14	-0.18
Dead+Wind 120 deg+Ice+Temp	53.55	5.89	3.40	383.79	-638.26	0.04
Dead+Wind 150 deg+Ice+Temp	53.55	3.40	5.89	659.41	-362.64	0.25
Dead+Wind 180 deg+Ice+Temp	53.55	0.00	6.80	760.29	13.86	0.39
Dead+Wind 210 deg+Ice+Temp	53.55	-3.40	5.89	659.41	390.36	0.43
Dead+Wind 240 deg+Ice+Temp	53.55	-5.89	3.40	383.79	665.98	0.35
Dead+Wind 270 deg+Ice+Temp	53.55	-6.80	-0.00	7.29	766.86	0.18
Dead+Wind 300 deg+Ice+Temp	53.55	-5.89	-3.40	-369.21	665.98	-0.04
Dead+Wind 330 deg+Ice+Temp	53.55	-3.40	-5.89	-644.83	390.36	-0.25
Dead+Wind 0 deg - Service	32.32	0.00	-9.15	-975.45	2.41	-0.33
Dead+Wind 30 deg - Service	32.32	4.57	-7.92	-844.61	-485.90	-0.40
Dead+Wind 60 deg - Service	32.32	7.92	-4.57	-487.18	-843.43	-0.37
Dead+Wind 90 deg - Service	32.32	9.15	-0.00	1.17	-974.20	-0.23
Dead+Wind 120 deg - Service	32.32	7.92	4.57	489.51	-843.43	-0.04
Dead+Wind 150 deg - Service	32.32	4.57	7.92	846.94	-485.89	0.17
Dead+Wind 180 deg - Service	32.32	0.00	9.15	977.78	2.41	0.33
Dead+Wind 210 deg - Service	32.32	-4.57	7.92	847.01	490.76	0.40
Dead+Wind 240 deg - Service	32.32	-7.92	4.57	489.47	848.18	0.37
Dead+Wind 270 deg - Service	32.32	-9.15	-0.00	1.17	979.03	0.23
Dead+Wind 300 deg - Service	32.32	-7.92	-4.57	-487.14	848.18	0.04
Dead+Wind 330 deg - Service	32.32	-4.57	-7.92	-844.68	490.76	-0.17

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	K	K	K	K	K	K	
1	0.00	-32.32	0.00	-0.00	32.32	0.00	0.000%
2	0.00	-32.32	-26.44	0.00	32.32	26.43	0.008%
3	13.22	-32.32	-22.90	-13.22	32.32	22.90	0.000%
4	22.90	-32.32	-13.22	-22.90	32.32	13.22	0.000%
5	26.44	-32.32	0.00	-26.43	32.32	0.00	0.008%
6	22.90	-32.32	13.22	-22.90	32.32	-13.22	0.000%
7	13.22	-32.32	22.90	-13.22	32.32	-22.90	0.000%
8	0.00	-32.32	26.44	0.00	32.32	-26.43	0.008%
9	-13.22	-32.32	22.90	13.22	32.32	-22.90	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
10	-22.90	-32.32	13.22	22.90	32.32	-13.22	0.000%
11	-26.44	-32.32	0.00	26.43	32.32	0.00	0.008%
12	-22.90	-32.32	-13.22	22.90	32.32	13.22	0.000%
13	-13.22	-32.32	-22.90	13.22	32.32	22.90	0.000%
14	0.00	-53.55	0.00	-0.00	53.55	0.00	0.001%
15	0.00	-53.55	-6.80	-0.00	53.55	6.80	0.002%
16	3.40	-53.55	-5.89	-3.40	53.55	5.89	0.002%
17	5.89	-53.55	-3.40	-5.89	53.55	3.40	0.002%
18	6.80	-53.55	0.00	-6.80	53.55	0.00	0.002%
19	5.89	-53.55	3.40	-5.89	53.55	-3.40	0.002%
20	3.40	-53.55	5.89	-3.40	53.55	-5.89	0.002%
21	0.00	-53.55	6.80	-0.00	53.55	-6.80	0.002%
22	-3.40	-53.55	5.89	3.40	53.55	-5.89	0.002%
23	-5.89	-53.55	3.40	5.89	53.55	-3.40	0.002%
24	-6.80	-53.55	0.00	6.80	53.55	0.00	0.002%
25	-5.89	-53.55	-3.40	5.89	53.55	3.40	0.002%
26	-3.40	-53.55	-5.89	3.40	53.55	5.89	0.002%
27	0.00	-32.32	-9.15	-0.00	32.32	9.15	0.004%
28	4.57	-32.32	-7.92	-4.57	32.32	7.92	0.004%
29	7.92	-32.32	-4.57	-7.92	32.32	4.57	0.002%
30	9.15	-32.32	0.00	-9.15	32.32	0.00	0.004%
31	7.92	-32.32	4.57	-7.92	32.32	-4.57	0.002%
32	4.57	-32.32	7.92	-4.57	32.32	-7.92	0.004%
33	0.00	-32.32	9.15	-0.00	32.32	-9.15	0.004%
34	-4.57	-32.32	7.92	4.57	32.32	-7.92	0.002%
35	-7.92	-32.32	4.57	7.92	32.32	-4.57	0.004%
36	-9.15	-32.32	0.00	9.15	32.32	0.00	0.004%
37	-7.92	-32.32	-4.57	7.92	32.32	4.57	0.004%
38	-4.57	-32.32	-7.92	4.57	32.32	7.92	0.002%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.00000001	0.00000001
2	Yes	16	0.00008103	0.00012986
3	Yes	21	0.00000001	0.00009295
4	Yes	21	0.00000001	0.00009482
5	Yes	16	0.00008103	0.00010874
6	Yes	21	0.00000001	0.00009490
7	Yes	21	0.00000001	0.00009312
8	Yes	16	0.00008102	0.00012994
9	Yes	21	0.00000001	0.00009572
10	Yes	21	0.00000001	0.00009383
11	Yes	16	0.00008101	0.00010889
12	Yes	21	0.00000001	0.00009376
13	Yes	21	0.00000001	0.00009556
14	Yes	11	0.00000001	0.00000899
15	Yes	17	0.00010719	0.00004989
16	Yes	17	0.00010701	0.00009528
17	Yes	17	0.00010702	0.00009830
18	Yes	17	0.00010721	0.00004864
19	Yes	17	0.00010699	0.00010111
20	Yes	17	0.00010698	0.00009738
21	Yes	17	0.00010715	0.00005071
22	Yes	17	0.00010692	0.00010674
23	Yes	17	0.00010692	0.00010341
24	Yes	17	0.00010713	0.00005022
25	Yes	17	0.00010695	0.00010048
26	Yes	17	0.00010695	0.00010439
27	Yes	16	0.00008690	0.00005394
28	Yes	16	0.00008656	0.00014148
29	Yes	17	0.00000001	0.00008169
30	Yes	16	0.00008690	0.00005240
31	Yes	17	0.00000001	0.00008193

32	Yes	16	0.00008656	0.00014241
33	Yes	16	0.00008689	0.00005405
34	Yes	17	0.00000001	0.00008426
35	Yes	16	0.00008655	0.00014597
36	Yes	16	0.00008689	0.00005263
37	Yes	16	0.00008655	0.00014567
38	Yes	17	0.00000001	0.00008382

Maximum Tower Deflections - Service Wind

Section No.	*Elevation*	*Horz. Deflection*	*Gov. Load*	*Tilt*	*Twist*
	ft	*in*	*Comb.*	*°*	*°*
L1	150 - 123.29	40.153	35	2.3787	0.0069
L2	126.71 - 88.88	28.845	35	2.2028	0.0022
L3	93.13 - 43.8	15.107	35	1.6212	0.0015
L4	49.22 - 0	4.000	35	0.7620	0.0005

Critical Deflections and Radius of Curvature - Service Wind

Elevation	*Appurtenance*	*Gov. Load*	*Deflection*	*Tilt*	*Twist*	*Radius of Curvature*
ft		*Comb.*	*in*	*°*	*°*	*ft*
149.00	(2) DB980H90E-M w/ Mount Pipe	35	39.656	2.3731	0.0067	19952
137.00	RR90-17-02DP w/ Mount Pipe	35	33.743	2.2983	0.0039	7673
129.00	(2) RRUS-11	35	29.914	2.2279	0.0025	4769
127.00	(2) 7770.00 w/ Mount Pipe	35	28.979	2.2062	0.0023	4426
117.00	(2) LPA-80080/4CF w/ Mount Pipe	35	24.480	2.0692	0.0014	3763
90.00	Pipe Mount [PM 602-1]	35	14.042	1.5575	0.0015	2878
76.00	Pipe Mount [PM 601-1]	35	9.780	1.2735	0.0013	2790

Maximum Tower Deflections - Design Wind

Section No.	*Elevation*	*Horz. Deflection*	*Gov. Load*	*Tilt*	*Twist*
	ft	*in*	*Comb.*	*°*	*°*
L1	150 - 123.29	115.364	11	6.8379	0.0198
L2	126.71 - 88.88	82.914	11	6.3350	0.0064
L3	93.13 - 43.8	43.458	11	4.6645	0.0042
L4	49.22 - 0	11.514	10	2.1937	0.0014

Critical Deflections and Radius of Curvature - Design Wind

Elevation	*Appurtenance*	*Gov. Load*	*Deflection*	*Tilt*	*Twist*	*Radius of Curvature*
ft		*Comb.*	*in*	*°*	*°*	*ft*
149.00	(2) DB980H90E-M w/ Mount Pipe	11	113.940	6.8220	0.0191	7126
137.00	RR90-17-02DP w/ Mount Pipe	11	96.973	6.6083	0.0113	2739
129.00	(2) RRUS-11	11	85.983	6.4069	0.0072	1700
127.00	(2) 7770.00 w/ Mount Pipe	11	83.301	6.3445	0.0065	1577
117.00	(2) LPA-80080/4CF w/ Mount Pipe	11	70.384	5.9514	0.0041	1336
90.00	Pipe Mount [PM 602-1]	11	40.395	4.4814	0.0042	1013
76.00	Pipe Mount [PM 601-1]	11	28.141	3.6648	0.0036	978

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
L1	150 - 123.29 (1)	TP22.9x17x0.1875	26.71	0.00	0.0	39.000	13.0672	-5.02	509.62	0.010
L2	123.29 - 88.88 (2)	TP30x21.7696x0.3125	37.83	0.00	0.0	39.000	28.5292	-10.48	1112.64	0.009
L3	88.88 - 43.8 (3)	TP39.2x28.4504x0.375	49.33	0.00	0.0	39.000	44.8057	-19.08	1747.42	0.011
L4	43.8 - 0 (4)	TP48x37.2689x0.4375	49.22	0.00	0.0	39.000	66.0465	-32.30	2575.81	0.013

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	150 - 123.29 (1)	TP22.9x17x0.1875	126.10	21.387	39.000	0.548	0.00	0.000	39.000	0.000
L2	123.29 - 88.88 (2)	TP30x21.7696x0.3125	675.73	40.165	39.000	1.030	0.00	0.000	39.000	0.000
L3	88.88 - 43.8 (3)	TP39.2x28.4504x0.375	1603.26	46.322	39.000	1.188	0.00	0.000	39.000	0.000
L4	43.8 - 0 (4)	TP48x37.2689x0.4375	2820.57	43.723	39.000	1.121	0.00	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	150 - 123.29 (1)	TP22.9x17x0.1875	12.15	0.930	26.000	0.072	0.92	0.076	26.000	0.003
L2	123.29 - 88.88 (2)	TP30x21.7696x0.3125	18.65	0.654	26.000	0.050	0.29	0.008	26.000	0.000
L3	88.88 - 43.8 (3)	TP39.2x28.4504x0.375	22.91	0.511	26.000	0.039	1.05	0.015	26.000	0.001
L4	43.8 - 0 (4)	TP48x37.2689x0.4375	26.47	0.401	26.000	0.031	1.05	0.008	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	150 - 123.29 (1)	0.010	0.548	0.000	0.072	0.003	0.560 ✔	1.333	H1-3+VT ✔
L2	123.29 - 88.88 (2)	0.009	1.030	0.000	0.050	0.000	1.040	1.333	H1-3+VT ✔

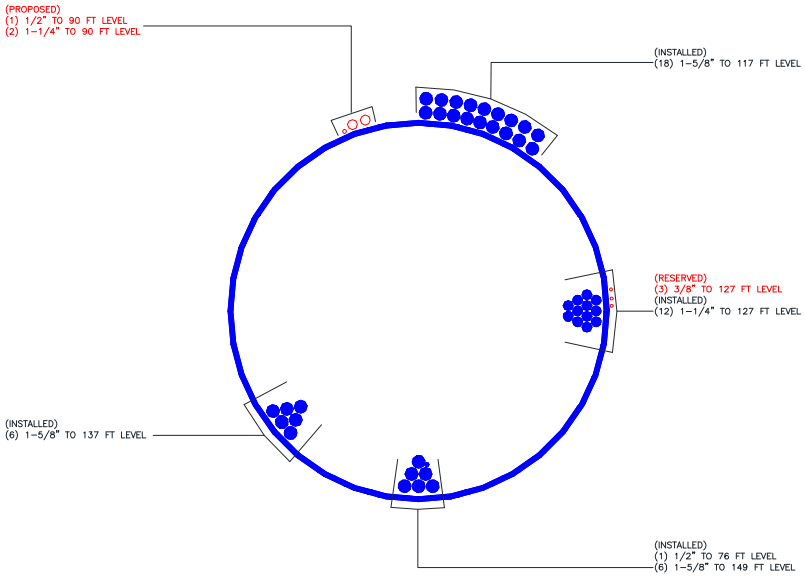
Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L3	88.88 - 43.8 (3)	0.011	1.188	0.000	0.039	0.001	1.199 ✔	1.333	H1-3+VT ✔
L4	43.8 - 0 (4)	0.013	1.121	0.000	0.031	0.000	1.134 ✔	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	150 - 123.29	Pole	TP22.9x17x0.1875	1	-5.02	679.32	42.0	Pass
L2	123.29 - 88.88	Pole	TP30x21.7696x0.3125	2	-10.48	1483.15	78.0	Pass
L3	88.88 - 43.8	Pole	TP39.2x28.4504x0.375	3	-19.08	2329.31	90.0	Pass
L4	43.8 - 0	Pole	TP48x37.2689x0.4375	4	-32.30	3433.55	85.1	Pass
							Summary	
						Pole (L3)	90.0	Pass
						RATING =	**90.0**	**Pass**

APPENDIX B

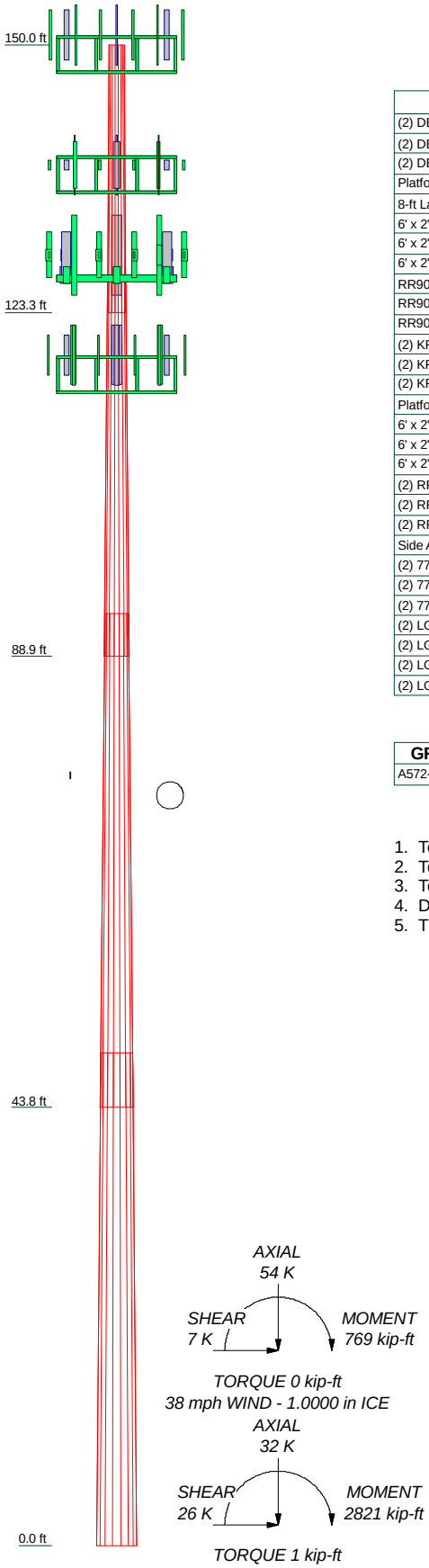
BASE LEVEL DRAWING


(PROPOSED)
(1) 1/2" TO 90 FT LEVEL
(2) 1-1/4" TO 90 FT LEVEL
(INSTALLED)
(18) 1-5/8" TO 117 FT LEVEL
(RESERVED)
(3) 3/8" TO 127 FT LEVEL
(INSTALLED)
(12) 1-1/4" TO 127 FT LEVEL
(INSTALLED)
(6) 1-5/8" TO 137 FT LEVEL
(INSTALLED)
(1) 1/2" TO 76 FT LEVEL
(6) 1-5/8" TO 149 FT LEVEL

APPENDIX C

ADDITIONAL CALCULATIONS

Section	Length (ft)	Number of Sides	Thickness (in)	Socket Length (ft)	Top Dia (in)	Bot Dia (in)	Grade	Weight (K)
1	26.71	18	0.1875	3.42	17.0000	22.9000	A572-65	1.1
2	37.83	18	0.3125	4.25	21.7696	30.0000		3.3
3	49.33	18	0.3750	5.42	28.4504	39.2000		6.7
4	49.22	18	0.4375		37.2689	48.0000		9.8



AXIAL
54 K

SHEAR
7 K

MOMENT
769 kip-ft

TORQUE 0 kip-ft
38 mph WIND - 1.0000 in ICE

AXIAL
32 K

SHEAR
26 K

MOMENT
2821 kip-ft

TORQUE 1 kip-ft
REACTIONS - 85 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
(2) DB980H90E-M w/ Mount Pipe	149	(2) LGP13519	127
(2) DB980H90E-M w/ Mount Pipe	149	(2) LGP13519	127
(2) DB980H90E-M w/ Mount Pipe	149	AM-X-CD-17-65-00T-RET w/ Mount Pipe	127
Platform Mount [LP 601-1]	149	AM-X-CD-17-65-00T-RET w/ Mount Pipe	127
8-ft Ladder	149	AM-X-CD-17-65-00T-RET w/ Mount Pipe	127
6' x 2" Mount Pipe	149	DC6-48-60-18-8F	127
6' x 2" Mount Pipe	149	T-Arm Mount [TA 602-3]	127
6' x 2" Mount Pipe	149	(2) LPA-80080/4CF w/ Mount Pipe	117
RR90-17-02DP w/ Mount Pipe	137	(2) LPA-80080/4CF w/ Mount Pipe	117
RR90-17-02DP w/ Mount Pipe	137	(2) LPA-80080/4CF w/ Mount Pipe	117
RR90-17-02DP w/ Mount Pipe	137	BXA-70063-6CF-2 w/ Mount Pipe	117
(2) KRY 112 71/2	137	BXA-70063-6CF-2 w/ Mount Pipe	117
(2) KRY 112 71/2	137	BXA-70063-6CF-2 w/ Mount Pipe	117
(2) KRY 112 71/2	137	BXA-171085-12CF-EDIN-2 w/ Mount Pipe	117
Platform Mount [LP 714-1]	137	BXA-171085-12CF-EDIN-2 w/ Mount Pipe	117
6' x 2" Mount Pipe	137	BXA-171085-12CF-EDIN-2 w/ Mount Pipe	117
6' x 2" Mount Pipe	137	Platform Mount [LP 303-1]	117
6' x 2" Mount Pipe	137	Pipe Mount [PM 602-1]	90
(2) RRUS-11	129	TTA-429-94C-08179	90
(2) RRUS-11	129	DS9A09F36D-N	90
(2) RRUS-11	129	KS24019-L112A	76
Side Arm Mount [SO 102-3]	129	Pipe Mount [PM 601-1]	76
(2) 7770.00 w/ Mount Pipe	127		
(2) 7770.00 w/ Mount Pipe	127		
(2) 7770.00 w/ Mount Pipe	127		
(2) LGP 17201	127		
(2) LGP 17201	127		
(2) LGP 17201	127		
(2) LGP13519	127		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Windham County, Connecticut.
2. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 38 mph basic wind with 1.00 in ice.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 90%

Paul J Ford and Company
250 E. Broad Street Suite 1500
Columbus, OH 43215
Phone: 614.221.6679
FAX: 614.448.4105

Job:	***150' Monopole / Hampton Bernier***		
Project:	***PJF 37513-1146 / BU 876390***		
Client: Crown Castle	Drawn by: John J Woolley	App'd:	
Code: TIA/EIA-222-F	Date: 04/05/13	Scale: NTS	
Path: G:\TOWER\375_Crown_Castle\2013\37513-1146 BU 876390\37513-1146.eri		Dwg No. E-1	

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

TIA Rev F

Site Data

BU#:	*879390*
Site Name:	
App #:	
Pole Manufacturer:	*Other*

Reactions		
Moment:	2821	ft-kips
Axial:	32	kips
Shear:	26	kips

Anchor Rod Data		
Qty:	16	
Diam:	2.25	in
Rod Material:	A615-J	
Strength (Fu):	100	ksi
Yield (Fy):	75	ksi
Bolt Circle:	57	in

Plate Data		
Diam:	63	in
Thick:	2	in
Grade:	60	ksi
Single-Rod B-eff:	9.52	in

Stiffener Data (Welding at both sides)		
Config:	1	*
Weld Type:	Groove	
Groove Depth:	0.375	in **
Groove Angle:	45	degrees
Fillet H. Weld:	0.3125	<-- Disregard
Fillet V. Weld:	0.375	in
Width:	7	in
Height:	18	in
Thick:	0.75	in
Notch:	0.75	in
Grade:	50	ksi
Weld str.:	70	ksi

Pole Data		
Diam:	48	in
Thick:	0.4375	in
Grade:	65	ksi
# of Sides:	18	"0" IF Round
Fu	80	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	

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

Anchor Rod Results

		Stiffened
Maximum Rod Tension:	146.5 Kips	Service, ASD
Allowable Tension:	195.0 Kips	Fty*ASIF
Anchor Rod Stress Ratio:	75.1% **Pass**	

Base Plate Results

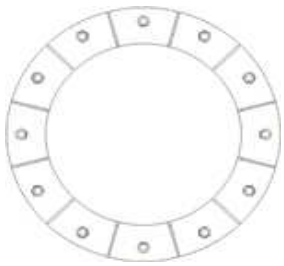
	Flexural Check	Stiffened
Base Plate Stress:	39.0 ksi	Service, ASD
Allowable Plate Stress:	60.0 ksi	0.75*Fy*ASIF
Base Plate Stress Ratio:	65.0% **Pass**	Y.L. Length: N/A, Roark

Stiffener Results

Horizontal Weld :	54.8% **Pass**
Vertical Weld:	42.7% **Pass**
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	18.4% **Pass**
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	55.3% **Pass**
Plate Comp. (AISC Bracket):	62.2% **Pass**

Pole Results

Pole Punching Shear Check:	11.0% **Pass**



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

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

Foundation Loads:

Pole weight or tower leg compression =	**32**	(kips)
Horizontal load at top of pier =	**26**	(kips)
Overturning moment at top of pier=	**2821**	(ft-kips)

Design criteria:

Safety factor against overturning =	**1.5**	

Soil Properties:

Soil density =	**125**	(pcf)
Allowable soil bearing =	**3**	(ksf)
Depth to water table =	**4**	(ft)

Dimensions:

Pier shape (round or square)	**S**	("R" or "S")
Pier width =	**6.5**	(ft)
Pier height above grade =	**1**	(ft)
depth to bottom of footing =	**5**	(ft)
Footing thickness =	**3**	(ft)
Footing width =	**25.25**	(ft)
Footing length =	**25.25**	(ft)

Concrete:

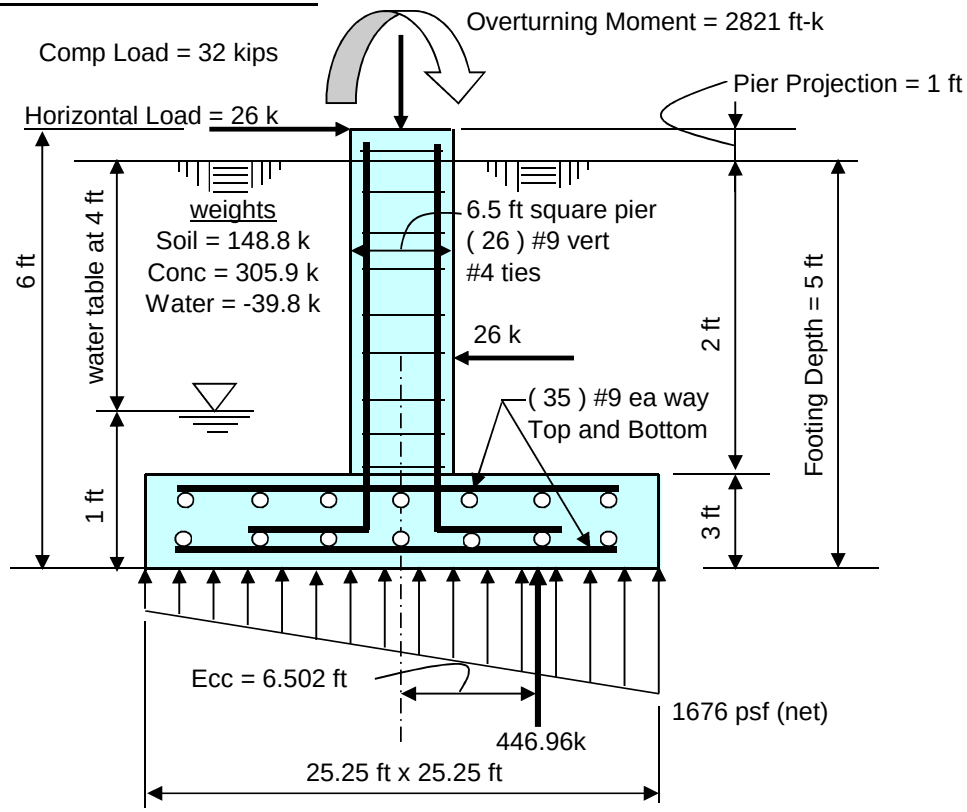
Concrete strength =	**4**	(ksi)
Rebar strength =	**60**	(ksi)
ultimate load factor =	**1.3**	

Reinforcing Steel:

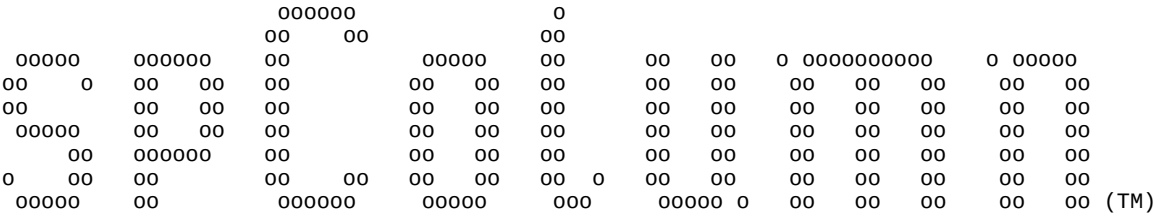
	Pad	
minimum cover over rebar =	**3**	inches
size of pad rebar =	**#9**	bar
quantity of pad rebar =	**35**	(ea direction)

Reinforcing Steel:

	Pier	
size of vert rebar in pier=	**#9**	bar
vertical rebar quantity =	**26**	
size of pier ties =	**#4**	bar
minimum cover over rebar =	**3**	inches
Total volume of concrete =	75.5	cu yd



Summary of analysis results	
Maximum Net Soil Bearing = 1.676 ksf Allowable Net Soil Bearing = 3 ksf **Soil Bearing Stress Ratio = 0.56 Okay**	Ult Bending Shear Capacity = 126 psi Ult Bending Shear Stress = 28 psi **Bending Shear Stress Ratio = 0.22 Okay**
Ftg Overturning Resistance = 5643 ft-kips Overturning Moment = 2906 ft-kips Required Overturning Safety Factor = 1.5 Overturning Safety Factor = 1.942 **Ratio = 0.77 Okay**	Pad Bending Moment Capacity= 4771 ft-k Pad Bending Moment = 1387 ft-k **Bending Moment Stress Ratio = 0.29 OK**



General Information:
==========
File Name: g:\tower\375_crown_castle\2013\37513-1146 bu 876390\37512-2182.col
Project:
Column: Engineer:
Code: ACI 318-11 Units: English

Run Option: Investigation Slenderness: Not considered
Run Axis: X-axis Column Type: Architectural

Material Properties:
==========
f'c = 4 ksi fy = 60 ksi
Ec = 3605 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========
Rectangular: Width = 78 in Depth = 78 in

Gross section area, Ag = 6084 in^2
Ix = 3.08459e+006 in^4 Iy = 3.08459e+006 in^4
rx = 22.5167 in ry = 22.5167 in
Xo = 0 in Yo = 0 in

Reinforcement:
==========
Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #3 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Circular
Pattern: All Sides Equal (Cover to transverse reinforcement)
Total steel area: As = 27.00 in^2 at rho = 0.44% (Note: rho < 0.50%)
Minimum clear spacing = 7.01 in

27 #9 Cover = 3 in

Factored Loads and Moments with Corresponding Capacities:
==========

No.	Pu kip	Mux k-ft	PhiMnx k-ft	PhiMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	32.00	3667.30	4176.55	1.139	10.58	73.82	0.01799	0.900

*** End of output ***

ATTACHMENT 4

Model: 15RESA

KOHLER. Power Systems

Residential Gas

ISO 9001 KOHLER POWER SYSTEMS NATIONALLY REGISTERED

Sound Enclosure

Weather Enclosure with Sound Kit

Standard Features

- Kohler Co. provides one-source responsibility for the generating system and accessories.
- The generator set and its components are prototype-tested, factory-built, and production-tested.
- The 60 Hz generator set is UL 2200 listed.
- The 60 Hz generator set engine is certified by the Environmental Protection Agency (EPA) to conform to the New Source Performance Standard (NSPS) for stationary spark-ignited emissions.
- Residential generator sets are approved for outdoor installation in stationary standby applications served by a reliable utility source.
- The generator set has a five-year limited warranty.
- Engine features:
  - Natural gas or LP gas fueled
  - Electronic engine controls for optimized fuel and spark performance
  - Four cylinder, four cycle engine
  - An electronic, isochronous governor for precise frequency regulation
  - High silicon content pistons for improved durability
- ADC 2100 digital controller features:
  - LED display provides diagnostic capability
  - Digital voltage regulator with ±1.5% no-load to full-load regulation
  - Superior electronics protection from corrosion and vibration
- Enclosure features:
  - Model 15RESA generator sets are available with weather enclosure and sound kit or sound enclosure
  - Enclosures reduce sound levels and protect the generator set from the elements, animal intrusion, and unwanted entry.
  - Fade-, scratch-, and corrosion-resistant Kohler® cream beige finish
  - Internal silencer
  - Lockable door latches
  - Sound enclosure additional features:
    - Acoustic insulation that meets UL 94 HF1 flammability classification
    - Low profile with pitched roof to minimize water accumulation
    - Sound-attenuating design to reduce noise levels
    - Hinged, removable doors to allow maximum access
    - Factory-installed

Generator Set Ratings

					Standby Ratings *			
					Natural Gas		LP Gas	
Model	Alternator	Voltage	Ph	Hz	kW/kVA	Amps	kW/kVA	Amps
15RESA	4H7	120/240	1	60	13.0/13.0	54	15.0/15.0	63

* RATINGS: *Standby Ratings:* Standby ratings apply to installations served by a reliable utility source. The standby rating is applicable to varying loads for the duration of a power outage. There is no overload capability for this rating. Ratings are in accordance with ISO-3046/1, BS 5514, AS 2789, and DIN 6271. Obtain the technical information bulletin on ratings guidelines (TIB-101) for complete ratings definitions. The generator set manufacturer reserves the right to change the design or specifications without notice and without any obligation or liability whatsoever. GENERAL GUIDELINES FOR DERATING: *Altitude:* Derate 1.5% per 305 m (1000 ft.) elevation above 1006 m (3300 ft.). *Temperature:* Derate 2.0% per 5.5°C (10°F) temperature above 21°C (70°F).

Alternator Specifications

Specifications	Alternator
Manufacturer	Kohler
Type	4-Pole, Brush Type
Leads: quantity	4 Lead
Voltage regulator	Digital
Insulation:	NEMA MG1-1.66
Material	Class H
Temperature rise	130°C, Standby
Bearing: quantity, type	1, Sealed
Coupling	Flexible Disc
Amortisseur windings	Full
Voltage regulation, no-load to full-load RMS	±1.5%
Unbalanced load capability	100% of Rated Standby Current
Peak motor starting kVA:	35% dip for voltages below
240V 4H7 (4 lead)	32

- NEMA MG1, IEEE, and ANSI standards compliance for temperature rise and motor starting.
- Sustained short-circuit current of up to 300% of the rated current for up to 10 seconds.
- Sustained short-circuit current enabling downstream circuit breakers to trip without collapsing the alternator field.
- Self-ventilated and dripproof construction.
- Vacuum-impregnated windings with fungus-resistant epoxy varnish for dependability and long life.
- Superior voltage waveform from a two-thirds pitch stator and skewed rotor.
- Digital voltage regulator with ±1.5% no-load to full-load regulation.

Application Data

Engine

Engine Specifications	60 Hz	50 Hz
Manufacturer	GM	
Engine: model, type	GM 1.6L OHC	
Cylinder arrangement	4, Inline	
Displacement, L (cu. in.)	1.6 (98)	
Bore and stroke, mm (in.)	79 (3.11) x 81.5 (3.21)	
Compression ratio	9.4:1	
Piston speed, m/min. (ft./min.)	293 (963)	
Main bearings: quantity, type	5, Replaceable Inserts	
Rated rpm	1800	
Max. power at rated rpm, kWm (BHP)		
Natural Gas	16.3 (21.8)	
LP Gas	18.8 (25.3)	
Cylinder head material	Aluminum	
Crankshaft material	Cast Iron	
Valve (exhaust) material	High Alloy Steel	
Governor type	Electronic	
Frequency regulation, no load to full load	Isochronous	
Frequency regulation, steady state	±0.5%	
Air cleaner type, all models	Dry	

Engine Electrical

Engine Electrical System	
Ignition system	Electronic
Battery charging alternator:	
Ground (negative/positive)	Negative
Volts (DC)	12
Ampere rating	70
Starter motor rated voltage (DC)	12
Battery, recommended cold cranking amps (CCA):	525
Battery voltage (DC)	12

Exhaust

Exhaust System	60 Hz	50 Hz
Exhaust manifold type	Dry	
Exhaust flow at rated kW, m^3/min. (cfm)	3.7 (131)	
Exhaust temperature at rated kW, dry exhaust, °C (°F)	649 (1200)	
Maximum allowable back pressure, kPa (in. Hg)	10.2 (3.0)	
Exhaust outlet size at engine hookup, mm (in.)	50.8 (2.0)	

Fuel

Fuel System	
Fuel type	LP Gas or Natural Gas
Fuel supply inlet	3/4 NPT
Fuel supply pressure, kPa (in. H_2O)	1.74–2.74 (7–11)

Fuel Composition Limits *	Nat. Gas	LP Gas
Methane, % by volume	90 min.	—
Ethane, % by volume	4.0 max.	—
Propane, % by volume	1.0 max.	85 min.
Propene, % by volume	0.1 max.	5.0 max.
C_4 and higher, % by volume	0.3 max.	2.5 max.
Sulfur, ppm mass	25 max.	
Lower heating value, MJ/m^3 (Btu/ft^3), min.	33.2 (890)	84.2 (2260)

* Fuels with other compositions may be acceptable. If your fuel is outside the listed specifications, contact your local distributor for further analysis and advice.

Lubrication

Lubricating System	
Type	Full Pressure
Oil pan capacity, L (qt.)	3.2 (3.4)
Oil pan capacity with filter, L (qt.)	3.5 (3.7)
Oil filter: quantity, type	1, Cartridge

Application Data

Cooling (Standard Radiator)

Cooling System	60 Hz	50 Hz
Ambient temperature °C (°F)	50 (122)	
Engine jacket water capacity, L (gal.)	3.3 (0.9)	
Engine jacket water flow, Lpm (gpm)	37.8 (10.0)	
Radiator system capacity, including engine, L (gal.)	11.5 (3.0)	
Heat rejected to cooling water at rated kW, dry exhaust, kW (Btu/min.)	15.76 (895)	
Water pump type	Centrifugal	
Fan diameter, including blades, mm (in.)	390 (15.35)	
Fan, kWm (HP)	1.2 (1.6)	
Max. restriction of cooling air, intake and discharge side of radiator, kPa (in. H_2O)	0.13 (0.5)	

Operation Requirements

Air Requirements	
Radiator-cooled cooling air, m^3/min. (scfm)*	85 (3000)
Combustion air, m^3/min. (cfm)	0.7 (25)
Heat rejected to ambient air:	
Engine, kW (Btu/min.)	4.9 (283)
Alternator, kW (Btu/min.)	2.9 (165)

* Air density = 1.20 kg/m^3 or 0.075 lbm/$ft.^3$

Fuel Consumption at % rated load		
Natural Gas	**m^3/hr. (cfh)**	
100%	5.7	(200)
75%	4.5	(160)
50%	3.5	(125)
25%	2.5	(90)
LP Gas	**m^3/hr. (cfh)**	**kg/hr. (lb./hr.)**
100%	2.4 (85)	4.5 (10.0)
75%	1.8 (65)	3.4 (7.6)
50%	1.4 (51)	2.6 (5.9)
25%	1.0 (37)	1.9 (4.3)

Nominal fuel rating: Natural gas: 37 MJ/m^3 (1000 Btu/$ft.^3$)
LP gas: 93 MJ/m^3 (2500 Btu/$ft.^3$)

LP gas conversion factors: 8.58 $ft.^3$ = 1 lb.
0.535 m^3 = 1 kg
36.39 $ft.^3$ = 1 gal.

Sound

Average Sound Levels at 7 m(23 ft.) (no load)	dB(A)
With Weather Enclosure w/Sound Upfit Kit	65
With Sound Enclosure	60

Controller

Advanced Digital Control Features

- Compact controller
- Integrally mounted to the generator set
- LED display:
  - Runtime hours
  - Crank cycle status
  - Diagnostics
  - Application software version
- LED display communicates faults:
  - Auxiliary fault
  - High battery voltage
  - High engine temperature
  - Low battery voltage
  - Low oil pressure
  - Overcrank safety
  - Overspeed
  - Overfrequency
  - Overvoltage
  - Underfrequency
  - Undervoltage
- Membrane keypad for configuration and adjustment
  - Password-protected user access to menus
  - Voltage, gain, and speed adjustment
  - System configuration: system voltage, phase, and frequency settings, battery voltage, and generator set model
- Master switch: Run/Off-Reset/Auto
- Remote two-wire start/stop capability
- Superior electronics protection from corrosion and vibration
  - Potted electronics
  - Sealed connections
- Digital voltage regulation: ±1.5% RMS no-load to full-load
- Automatic start with programmed cranking cycle

KOHLER CO., Kohler, Wisconsin 53044 USA
Phone 920-457-4441, Fax 920-459-1646
For the nearest sales and service outlet in the
US and Canada, phone 1-800-544-2444
KOHLERPower.com

Kohler Power Systems
Asia Pacific Headquarters
7 Jurong Pier Road
Singapore 619159
Phone (65) 6264-6422, Fax (65) 6264-6455

Standard Features

- ADC 2100 Digital Controller
- Base Frame with Steel Skid
- Battery Rack and Cables
- Customer Connection Box with Field-Connection Terminal Blocks
- Electronic, Isochronous Governor
- Engine Shutdowns for High Engine Temperature and Low Oil Pressure
- Flexible Fuel Line
- Gas Fuel System (includes two fuel solenoid valves, fuel mixer, and electronic secondary gas regulator)
- Integral Vibration Isolation
- Line Circuit Breaker, 70 amps
- Oil Drain Extension
- Operation and Installation Literature
- Unit-Mounted Radiator System
- Warranty, Five-Year Limited

Available Accessories

Communication Accessories

❑ OnCue™ Home Generator Management System

Enclosure (must select sound or weather enclosure)

❑ Sound Enclosure with Silencer
❑ Weather Enclosure with Sound Kit and Silencer
❑ High Wind Kit for Sound Enclosure

Fuel System

❑ Natural Gas Strainer

Electrical System

❑ Battery
❑ Battery Charger, Equalize/Float Type
❑ Battery Heater

Engine and Alternator

❑ Air Cleaner Restriction Indicator
❑ Block Heater (recommended for ambient temperatures below 0°C (32°F)
❑ Engine Coolant (installed)
❑ Rodent Guards

Controller

❑ Relay Kit, Includes Run Relay and Common Fault Relay

Maintenance and Literature

❑ General Maintenance Literature Kit
❑ Overhaul Literature Kit
❑ Production Literature Kit
❑ Maintenance Kit (includes air filter, oil filter, and belt)

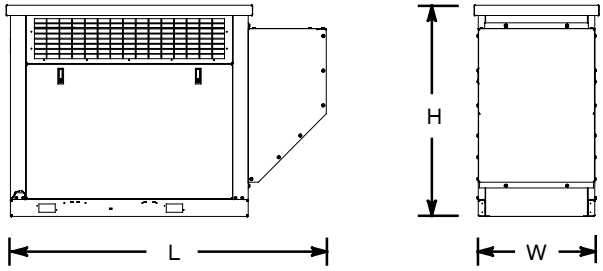
Miscellaneous Accessories

❑ _____
❑ _____
❑ _____
❑ _____

Dimensions and Weights

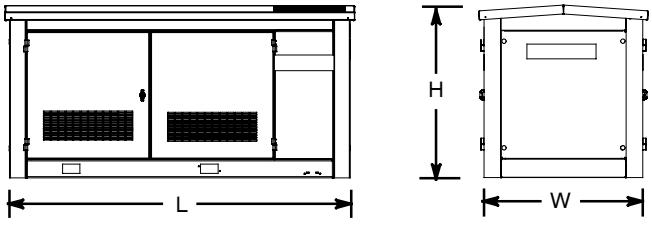
With Weather Enclosure and Sound Kit

Overall Size, L x W x H, mm (in.):	1886 x 778 x 1228 (74.3 x 30.6 x 48.4)
Weight, wet, kg (lb.):	490 (1080)



With Sound Enclosure

Overall Size, L x W x H, mm (in.):	1850 x 919 x 935 (72.8 x 36.2 x 36.8)
Weight, wet, kg (lb.):	465 (1026)



NOTE: These drawings are provided for reference only and should not be used for planning installation. Contact your local distributor for more detailed information.

DISTRIBUTED BY:

ATTACHMENT 5

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

Calculated Radio Frequency Emissions

Northeast Utilities

Brooklyn

116 Grant Hill Road, Brooklyn, CT 06234

May 2, 2013

Table of Contents

List of Tables

List of Figures

1. Introduction

The purpose of this report is to investigate compliance with applicable FCC regulations for Northeast Utilities' proposed additions to the existing monopole tower located at 116 Grant Hill Road in Brooklyn, CT. The coordinates of the tower are 41° 47' 30.53" N, 72° 00' 53.27" W.

Northeast Utilities is proposing the following:

1) Install one 896-960 MHz omnidirectional antenna;
2) Install one 896-901 MHz tower top amplifier;

2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

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

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

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

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

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

3. RF Exposure Prediction Methods

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

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

Where:

EIRP = Effective Isotropic Radiated Power

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

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 installation.

4. Calculation Results

Table 1 below outlines the power density information for the site. The proposed Northeast Utilities antenna is omnidirectional in nature so the majority of the RF power is focused out towards the horizon, with respect to the vertical plane. As a result, there will be less RF power directed below the antenna relative to the horizon, and consequently lower power density levels around the base of the tower. Please refer to Attachment C for the vertical pattern of the proposed Northeast Utilities antenna. The calculated results for Northeast Utilities 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
Sprint	147	1960	11	250	0.0458	1.0000	4.58%
Voicestream	137	1970	8	246	0.0377	1.0000	3.77%
Verizon Cellular	117	869	9	266	0.0629	0.5793	10.85%
Verizon PCS	117	1970	11	264	0.0763	1.0000	7.63%
Verizon AWS	117	2145	1	670	0.0176	1.0000	1.76%
Verizon LTE	117	698	1	867	0.0228	0.4653	4.89%
AT&T UMTS	129	880	2	565	0.0244	0.5867	4.16%
AT&T UMTS	129	1900	2	875	0.0378	1.0000	3.78%
AT&T LTE	129	734	1	1771	0.0383	0.4893	7.82%
AT&T GSM	129	880	1	283	0.0061	0.5867	1.04%
AT&T GSM	129	1900	4	525	0.0454	1.0000	4.54%
Northeast Utilities	100	935	2	240	0.0017	0.6233	0.28%
						Total	**55.10%**

Table 1: Carrier Information[1] [2]

[1] The power density information for carriers other than Northeast Utilities was taken directly from the CSC database dated 5/1/2013. 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] Antenna height listed for Northeast Utilities is in reference to the Paul J. Ford & Company Structural Analysis dated April 5, 2013.

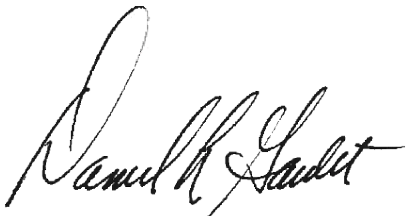
5. Conclusion

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 **55.10% 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 installation.

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

May 2, 2013
Date

Attachment A: References

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

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

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

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

(A) Limits for Occupational/Controlled Exposure[3]

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

(B) Limits for General Population/Uncontrolled Exposure[4]

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-1.34	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)

[3] 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.

[4] 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.

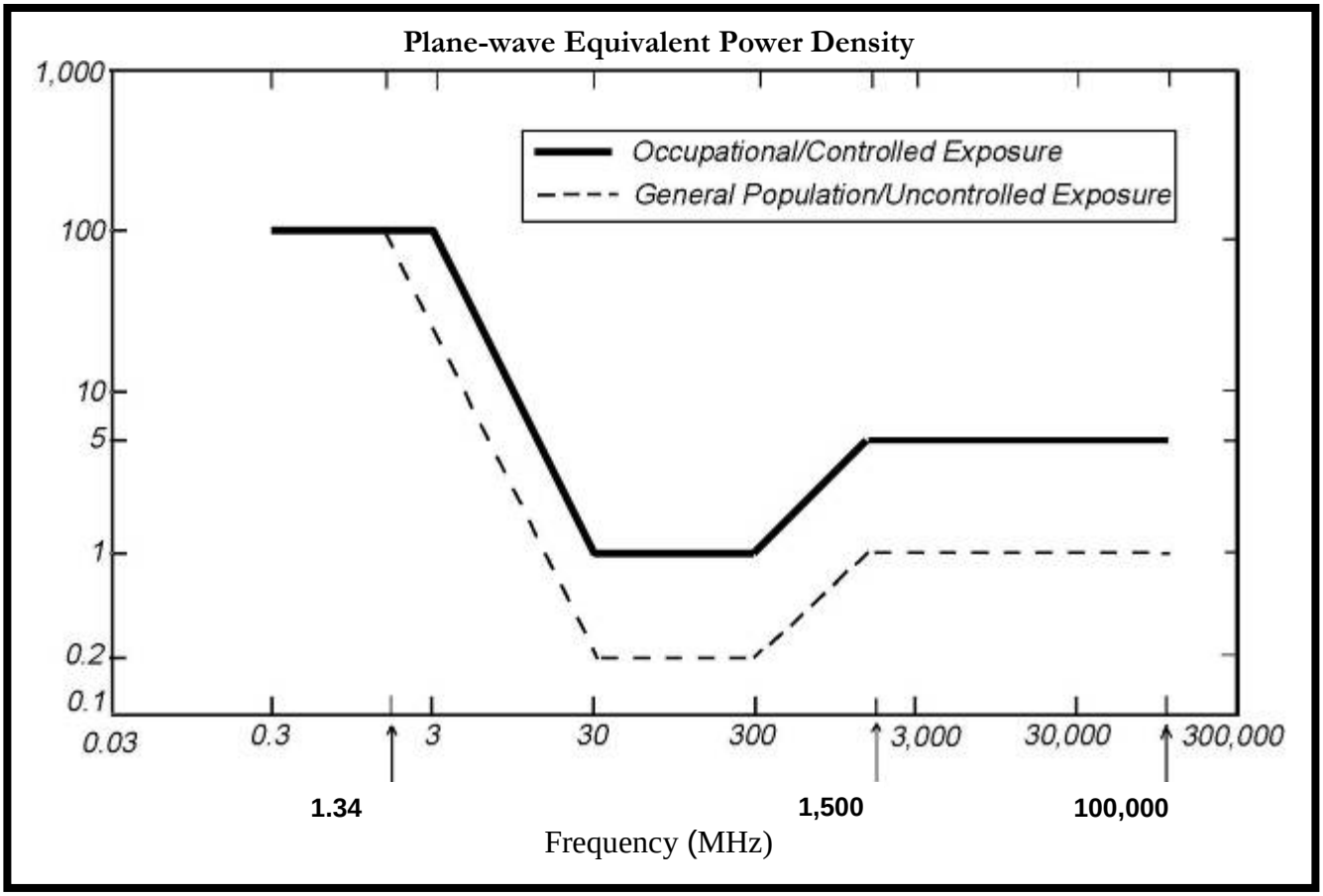


Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: Antenna Data Sheets and Electrical Patterns

900 MHz

Manufacturer:	dbSpectra
Model #:	DS9A09F36D-N
Frequency Band:	896-960 MHz
Gain:	9.0 dBd
Vertical Beamwidth:	8°
Horizontal Beamwidth:	360°
Polarization:	Omnidirectional
Length:	253.0”