

Nu

ts-CL&P-168-130710



**Connecticut
Light & Power**

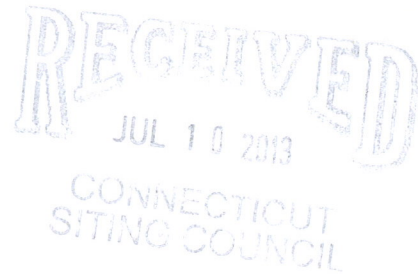
A Northeast Utilities Company

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 Woodbury, Connecticut 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 Woodbury has been informed of the requested approval of sharing this tower in Woodbury.

Sincerely,

John R. Morissette
Project Manager – Transmission Siting

Attachments: Request for Tower Sharing
Check

cc: Gerald Stomski
First Selectman
281 Main St. South
Woodbury, CT 06798

THE CONNECTICUT LIGHT AND POWER COMPANY

REQUEST FOR TOWER SHARING ON AN EXISTING TELECOMMUNICATIONS FACILITY IN THE TOWN OF WOODBURY, 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 202 Great Hollow Rd, Woodbury, 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 139 feet above ground level (“AGL”). CL&P is proposing to attach one antenna to the existing monopole at a mount height of 138 feet AGL.

C. Description of the “Project”:

CL&P proposes to attach one (1) 20-foot omnidirectional whip antenna to the existing monopole top mounted at a height of 138 feet above ground level. CL&P also proposes to expand a 42 linear foot section of the existing chain-link fence to include an approximately 195 square-foot area of the existing Property to accommodate the following equipment. CL&P proposes to install one (1) 10-foot by 12-foot equipment shelter on a concrete foundation, to add one (1) a 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. For elevation and location drawings of the proposed installation, please see Attachment 1: *Project Plans*, dated June 28, 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 16, 2013, stating CCUI's 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 installation of CL&P's antenna. A detailed structural analysis for the proposed tower modification is included as Attachment 3: *Structural Analysis Report*, dated May 23, 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 fenced compound and the approximately 195 square-foot expansion area.

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; the generator 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 in the area of this 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 planned 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 51.37% of the FCC limit. Please refer to Attachment 5: *Calculated Radio Frequency Emissions Report* dated May 28, 2013, for details of the analysis.

6) Visual

The Project would have minimal visual impact due to the dimensions and height of the proposed antenna on the existing monopole. The planned CL&P 10-foot by 12-foot equipment shelter, 15-kW generator and 1,000 gallon propane tank are to be located on concrete foundations within the proposed expanded fenced compound. For a visual comparison of the existing and planned compound configuration, please refer to Attachment 1: *Project Plans*, dated June 28, 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 proposed installations of the antenna and other equipment to 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



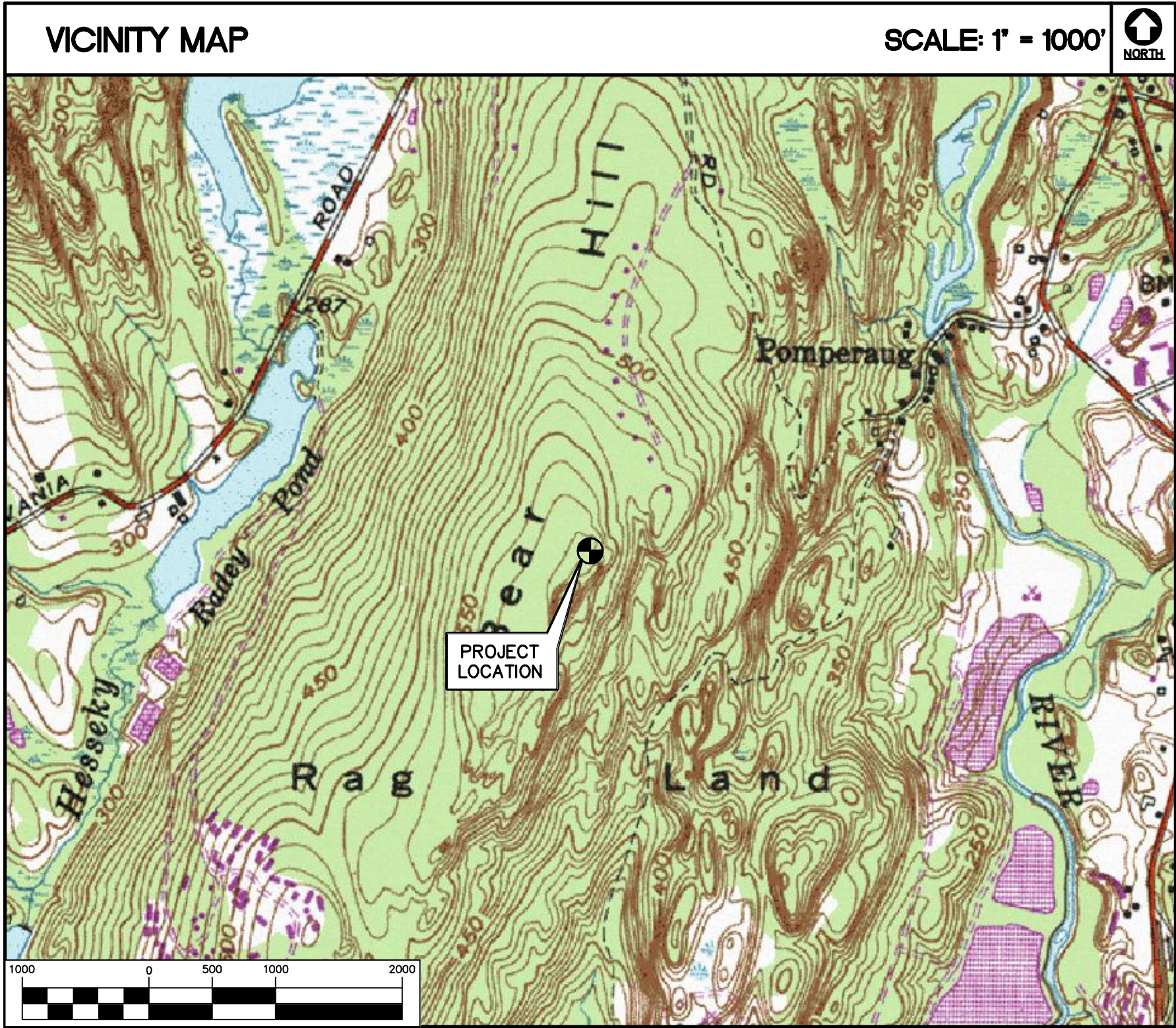
Northeast Utilities System

WOODBURY 202 GREAT HOLLOW ROAD WOODBURY, CT 06798

SITE DIRECTIONS		
FROM:	107 SELDEN STREET BERLIN, CONNECTICUT	TO: 202 GREAT HOLLOW ROAD WOODBURY, CONNECTICUT
1. Head northwest on Selden St toward CT-15 N/US-5 N/Berlin Turnpike		0.1 mi
2. Turn left onto CT-15 S/US-5 S/Berlin Turnpike		1.8 mi
3. Take the ramp to Connecticut 9 S/Middletown		0.1 mi
4. Keep right at the fork, follow signs for U.S. 5 S/Connecticut 15 S/New Haven and merge onto CT-15 S/US-5 S/Berlin Turnpike		3.4 mi
5. Turn right onto N Colony Rd		2.8 mi
6. Turn left to merge onto I-891 W toward I-84		6.0 mi
7. Take exit 1 on the left for I-84 W toward Waterbury/Danbury		1.0 mi
8. Merge onto I-84		9.5 mi
9. Take exit 17 to merge onto CT-64 W/Chase Pkwy toward CT-63/Middlebury/Watertown, Continue to follow CT-64 W		3.6 mi
10. Turn right onto CT-64 W/Middlebury Rd,Continue to follow CT-64 W		4.3 mi
11. Turn right onto US-6 E/Main St S		1.0 mi
12. Turn left onto Sycamore Ave		0.2 mi
13. Take the 1st right onto CT-317 W/Sycamore Ave		0.4 mi
14. Turn left onto Bear Hill Rd		0.3 mi
15. Turn left onto Great Hollow Rd		0.5 mi
16. Keep right to stay on Great Hollow Rd		0.7 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 COMMUNICATION FACILITY LEASE AREA..
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.



PROJECT SUMMARY	
SITE NAME:	WOODBURY
SITE ADDRESS:	202 GREAT HOLLOW ROAD WOODBURY, CT 06798
LESSEE/ TENANT:	NORTHEAST UTILITIES SYSTEM 107 SELDEN STREET BERLIN, CT 06037
CONTACT PERSON:	MIKE CARBARY NORTHEAST UTILITIES SYSTEM (860) 685-3825
TOWER COORDINATES:	LATITUDE: 41°-31'-19.2" LONGITUDE: 73°-13'-15.6" GROUND ELEVATION: ±595' AMSL COORDINATES REFERENCED FROM STUCTURAL ANALYSIS REPORT PREPARED BY FDH ENGINEERING INC. GROUND ELEVATION REFERENCED FROM AVAILABLE TOPOGRAPHIC MAPPING.

T-1	TITLE SHEET	2
C-1	COMPOUND PLAN AND ELEVATION	2

DESIGNED BY: CFC

DRAWN BY: DEB

CHK'D BY: CFC

REV.

2

06/28/13

CLT

REVISED CSC

1

05/30/13

CLT

DND

CSC

0

05/15/13

CLT

DND

CSC - ISSUED FOR CLIENT REVIEW

DATE

DRAWN BY

CHK'D BY

DESCRIPTION

PROFESSIONAL ENGINEER SEAL



Northeast Utilities System

CENTEK engineering

Centek on Solutions™

(203) 488-0360

(203) 488-8387 Fax

65 Elm Street, Suite 200, Berlin, CT 06037

NORTHEAST UTILITIES SYSTEM

WIRELESS COMMUNICATIONS FACILITY

WOODBURY

202 GREAT HOLLOW ROAD
WOODBURY, CT 06798

DATE: 05/09/13

SCALE: AS NOTED

JOB NO. 13087

TITLE SHEET

T-1

Sheet No. 1 of 2



ATTACHMENT 2



3530 Toringdon Way, Suite 300
Charlotte, NC 28277

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

April 16, 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# 876380
Site Address:	Great Hollow Rd, Woodbury, CT 06798	Crown Castle Site Name:	O&G WOODBURY

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 16, 2013

ATTACHMENT 3



Date: **May 23, 2013**

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

FDH Engineering, Inc.
6521 Meridien Drive
Raleigh, NC 27616
(919) 755-1012

Subject: Structural Analysis Report

Carrier Designation:	Northeast Utilities Co-Locate	
	Carrier Site Number:	N/A
	Carrier Site Name:	WOODBURY
Crown Castle Designation:	Crown Castle BU Number:	876380
	Crown Castle Site Name:	O&G WOODBURY
	Crown Castle JDE Job Number:	230752
	Crown Castle Work Order Number:	614121
	Crown Castle Application Number:	184343 Rev. 9
Engineering Firm Designation:	FDH Engineering, Inc. Project Number:	1335561400
Site Data:	Great Hollow Road, WOODBURY, Litchfield County, CT	
	Latitude 41° 31' 19.2", Longitude -73° 13' 15.6"	
	138.5 Foot - Monopole Tower	

Dear Patrick Byrum,

FDH Engineering, Inc. 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 549014, in accordance with application 184343, revision 9.

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 analysis has been performed in accordance with the TIA/EIA-222-F standard and 2005 CT State Building Code based upon a wind speed of 80 mph fastest mile.

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

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

Respectfully submitted by:

Reviewed by:

Will Hammond, EI
Project Engineer

Christopher M. Murphy, PE
President
CT PE License No. 25842

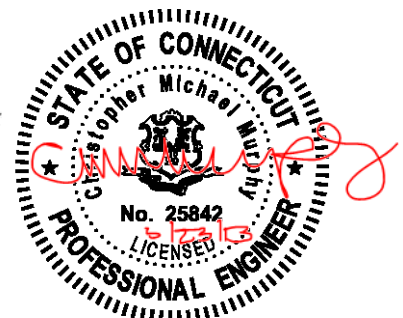


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1) INTRODUCTION

This tower is a 138.5 ft Monopole tower designed by ENGINEERED ENDEAVORS, INC. in April of 2003. The tower was originally designed for a wind speed of 85 mph per TIA/EIA-222-F. The tower was originally designed to be 150-ft but was only constructed to a height of 139 ft. The tower has been modified multiple times in the past to accommodate additional loading. The tower was modified per reinforcement drawings prepared by Semaan Engineering Solutions, Inc. in November of 2005. Reinforcement consists of base plate stiffeners. The tower was modified again per reinforcement drawings prepared by GPD Group in December of 2011. Reinforcement consists of additional anchor rods.

2) ANALYSIS CRITERIA

The structural analysis was performed for this tower in accordance with the requirements of TIA/EIA-222-F Structural Standards for Steel Antenna Towers and Antenna Supporting Structures using a fastest mile wind speed of 80 mph with no ice, 28.1 mph with 1 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
138.0	148.0	1	db spectra	DS9A09F36D-N	1 2	1/2 1-1/4	-
	138.0	1	bird technologies group	TTA-429-83H-08179			
		1	crown mounts	Side Arm Mount [SO 309-1]			

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
139.0	140.0	6	ericsson	RRUS-11	-	-	2
	139.0	1	crown mounts	Side Arm Mount[SO102-3]			
138.0	139.0	1	kathrein	800 10764 w/ Mount Pipe	2 1	7/16 3/8	2
		1	kmw communications	AM-X-CD-14-65-00T-RET w/ Mount Pipe			
		1	kmw communications	AM-X-CD-16-65-00T-RET w/ Mount Pipe			
		1	raycap	DC6-48-60-18-8F			
		6	css	XDUO1416-80 w/ Mount Pipe			
	138.0	6	powerwave technologies	LGP2140X	12	1-1/4	1
		1	crown mounts	Platform Mount [LP 303-1]			
		6	powerwave technologies	LGP21401			
		6	powerwave technologies	LGP21901			
137.0	147.0	1	telewave	ANT150F6	1	1/2	1

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
129.0	129.0	3	antel	BXA-171085-8BF-EDIN-2 w/ Mount Pipe	18	1-5/8	1
		3	antel	BXA-70063/6CF-2 w/ Mount Pipe			
		6	antel	LPA-80080/6CF w/ Mount Pipe			
		1	crown mounts	Platform Mount [LP 304-1]			
119.0	119.0	1	crown mounts	Platform Mount [LP 304-1]	12	1-5/8	1
		12	decibel	DB846G90A-XY w/ Mount Pipe			
104.0	108.0	6	decibel	DB980F90T2E-M w/ Mount Pipe	6	1-5/8	1
		3	alcatel lucent	800 EXTERNAL NOTCH FILTER	3	1-1/4	2
		9	rfs celwave	ACU-A20-N			
		3	rfs celwave	APXVSPP18-C-A20 w/ Mount Pipe			
	104.0	1	crown mounts	Miscellaneous [NA 507-1]	-	-	1
		1	crown mounts	Platform Mount [LP 712-1]			
102.0	102.0	3	alcatel lucent	1900MHz RRH (65MHz)	-	-	2
		3	alcatel lucent	800MHZ RRH			
		1	crown mounts	Side Arm Mount[SO102-3]			
87.0	87.0	12	airtech	KN-1870-15-4803	12	1-5/8	1
		1	crown mounts	Platform Mount [LP 305-1]			
		6	rfs celwave	APXV18-209014-C w/ Mount Pipe			
70.0	71.0	1	lucent	KS24019-L112A	1	1/2	1
	70.0	1	crown mounts	Side Arm Mount[SO701-1]			

Notes:

- 1) Existing Equipment
- 2) Reserved Equipment

Table 3 - Design 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)
150	150	12	decibel	DB980F90	-	-
140	140	12	decibel	DB980F90	-	-
130	130	12	decibel	DB980F90	-	-
120	120	12	decibel	DB980F90	-	-
109	109	12	decibel	DB980F90	-	-
100	100	12	decibel	DB980F90	-	-

3) ANALYSIS PROCEDURE

Table 4 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	Clarence Welti Assoc, Inc.	1531967	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	Engineered Endeavors, Inc.	2122534	CCISITES
4-TOWER MANUFACTURER DRAWINGS	Engineered Endeavors, Inc.	1533002	CCISITES
4-TOWER REINFORCEMENT DESIGN/DRAWINGS/DATA	Semaan Engineering Solutions	2055776	CCISITES
4-TOWER REINFORCEMENT DESIGN/DRAWINGS/DATA	GPD Group	3030835	CCISITES
4-POST-INSTALLATION INSPECTION	GPD Group	3420974	CCISITES

3.1) Analysis Method

tnxTower (version 6.0.4.0), 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) When applicable, transmission cables are considered as structural components for calculating wind loads as allowed by TIA/EIA-222-F.
- 5) Tower dimensions for elevation 108.5' to 138.5' was taken from Crown Castle Structural Analysis Report dated March 19, 2013 (Project No. 587330).

This analysis may be affected if any assumptions are not valid or have been made in error. FDH Engineering, Inc. should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 5 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
L1	138.5 - 108.5	Pole	TP24.5x17.375x0.1875	1	-6.79	752.20	77.8	Pass
L2	108.5 - 83.75	Pole	TP31.88x24.5x0.25	2	-11.54	1249.44	85.3	Pass
L3	83.75 - 43	Pole	TP43.42x30.0382x0.3125	3	-20.76	2131.32	86.4	Pass
L4	43 - 0	Pole	TP55.5x41.0206x0.3125	4	-33.00	2629.01	95.4	Pass
							Summary	
						Pole (L4)	95.4	Pass
						RATING =	95.4	Pass

Table 6 - Tower Component Stresses vs. Capacity – LC7

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	66.8	Pass
1	Base Plate	0	98.2	Pass
1	Base Foundation	0	75.5	Pass
1	Flange Bolts	108.5	44.2	Pass
1	Flange Plate	108.5	30.9	Pass

Structure Rating (max from all components) =	98.2%
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Notes:

- 1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.

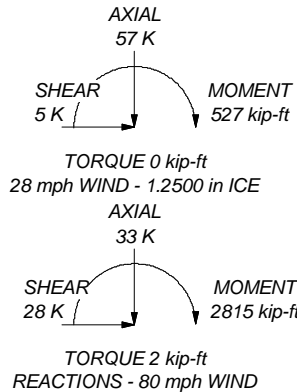
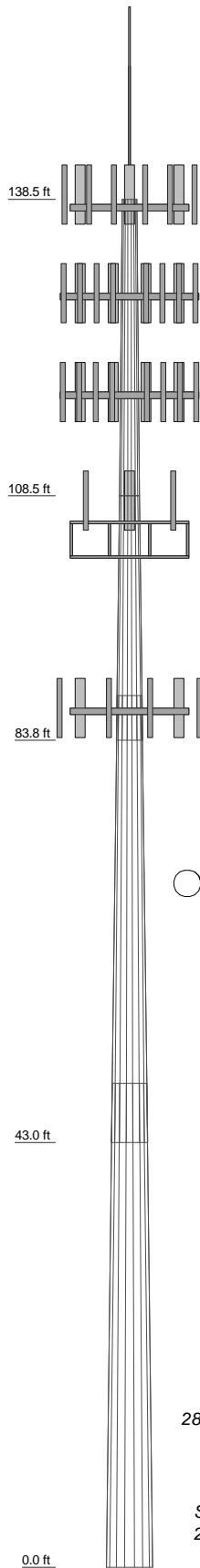
4.1) Recommendations

The tower and its foundation have sufficient capacity to carry the existing, reserved and proposed loading. No modifications are required at this time.

APPENDIX A

TNXTOWER OUTPUT

Section	1	2	3	4	
Length (ft)	30'	24'9"	45'3"	49'	
Number of Sides	18	18	18	18	
Thickness (in)	0.1875	0.2500	0.3125	0.3125	
Socket Length (ft)		46"	6'		
Top Dia (in)	17.3750	24.5000	30.0382	41.0206	
Bot Dia (in)	24.5000	31.8800	43.4200	55.5000	
Grade			A572-65		
Weight (K)	1.3	1.9	5.6	7.9	16.6



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Side Arm Mount [SO 102-3]	139	BXA-70063/6CF-2 W/Mount Pipe	129
(2) RRUS-11	139	BXA-70063/6CF-2 W/Mount Pipe	129
(2) RRUS-11	139	Platform Mount [LP 304-1]	119
(2) RRUS-11	139	(4) DB846G90A-XY w/ Mount Pipe	119
TTA-429-83H-08179	138	(4) DB846G90A-XY w/ Mount Pipe	119
DS9A09F36D-N	138	(4) DB846G90A-XY w/ Mount Pipe	119
Side Arm Mount [SO 309-1]	138	(2) DB980F90T2E-M w/ Mount Pipe	104
Platform Mount [LP 303-1]	138	(2) DB980F90T2E-M w/ Mount Pipe	104
(2) LGP21401	138	(2) DB980F90T2E-M w/ Mount Pipe	104
(2) LGP21401	138	(3) ACU-A20-N	104
(2) LGP21401	138	APXVSP18-C-A20 w/ Mount Pipe	104
(2) LGP2140X	138	(3) ACU-A20-N	104
(2) LGP2140X	138	APXVSP18-C-A20 w/ Mount Pipe	104
(2) LGP2140X	138	(3) ACU-A20-N	104
(2) LGP21901	138	APXVSP18-C-A20 w/ Mount Pipe	104
(2) LGP21901	138	Platform Mount [LP 712-1]	104
(2) LGP21901	138	Miscellaneous [NA 507-1]	104
(2) XDUO1416-80 w/ Mount Pipe	138	800 EXTERNAL NOTCH FILTER	104
(2) XDUO1416-80 w/ Mount Pipe	138	800 EXTERNAL NOTCH FILTER	104
(2) XDUO1416-80 w/ Mount Pipe	138	800 EXTERNAL NOTCH FILTER	104
AM-X-CD-16-65-00T-RET w/ Mount Pipe	138	1900MHz RRH (65MHz)	102
800 10764 w/ Mount Pipe	138	1900MHz RRH (65MHz)	102
AM-X-CD-14-65-00T-RET w/ Mount Pipe	138	800MHz RRH	102
DC6-48-60-18-8F	138	1900MHz RRH (65MHz)	102
ANT150F6	137	800MHz RRH	102
5' x 2' Pipe Mount	137	800MHz RRH	102
Platform Mount [LP 304-1]	129	800MHz RRH	102
(2) LPA-80080/6CF w/ Mount Pipe	129	800MHz RRH	102
(2) LPA-80080/6CF w/ Mount Pipe	129	800MHz RRH	102
(2) LPA-80080/6CF w/ Mount Pipe	129	800MHz RRH	102
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	Side Arm Mount [SO 102-3]	102
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	Platform Mount [LP 305-1]	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	(4) KN-1870-15-4803	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	(4) KN-1870-15-4803	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	(4) KN-1870-15-4803	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	(2) APXV18-209014-C w/ Mount Pipe	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	(2) APXV18-209014-C w/ Mount Pipe	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	(2) APXV18-209014-C w/ Mount Pipe	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	Empty Pipe Mount	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	Empty Pipe Mount	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	Empty Pipe Mount	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	Empty Pipe Mount	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	Side Arm Mount [SO 701-1]	70
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	KS24019-L112A	70

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Litchfield County, Connecticut.
2. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 28 mph basic wind with 1.25 in ice.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 95.4%



FDH Engineering, Inc.
6521 Meridian Drive
Raleigh, NC 27616
Phone: (919) 755-1012
FAX: (919) 755-1031

Job: **BU# 876380**

Project: **1335561400**

Client: **Crown Castle** Drawn by: **Will Hammond** App'd:

Code: **TIA/EIA-222-F** Date: **05/23/13** Scale: **NTS**

Path: Dwg No. **E-1**

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	Client Crown Castle	Designed by Will Hammond

Tower Input Data

There is a pole section.

This tower is designed using the TIA/EIA-222-F standard.

The following design criteria apply:

Tower is located in Litchfield County, Connecticut.

Basic wind speed of 80 mph.

Nominal ice thickness of 1.2500 in.

Ice density of 56 pcf.

A wind speed of 28 mph is used in combination with ice.

Temperature drop of 50 °F.

Deflections calculated using a wind speed of 50 mph.

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

Pressures are calculated at each section.

Stress ratio used in pole design is 1.333.

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

Options

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

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	138'6"-108'6"	30'	0'	18	17.3750	24.5000	0.1875	0.7500	A572-65 (65 ksi)
L2	108'6"-83'9"	24'9"	4'6"	18	24.5000	31.8800	0.2500	1.0000	A572-65 (65 ksi)
L3	83'9"-43'	45'3"	6'	18	30.0382	43.4200	0.3125	1.2500	A572-65 (65 ksi)
L4	43'-0'	49'		18	41.0206	55.5000	0.3125	1.2500	A572-65 (65 ksi)

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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	17.6430	10.2287	381.7542	6.1016	8.8265	43.2509	764.0106	5.1153	2.7280	14.549
	24.8780	14.4690	1080.5242	8.6309	12.4460	86.8170	2162.4702	7.2359	3.9820	21.237
L2	24.8780	19.2424	1429.6167	8.6088	12.4460	114.8656	2861.1145	9.6230	3.8720	15.488
	32.3718	25.0984	3172.3563	11.2287	16.1950	195.8844	6348.8868	12.5516	5.1709	20.684
L3	31.8529	29.4842	3291.4698	10.5526	15.2594	215.7012	6587.2705	14.7449	4.7367	15.158
	44.0898	42.7573	10038.1321	15.3032	22.0574	455.0922	20089.4726	21.3827	7.0919	22.694
L4	43.4538	40.3774	8453.5160	14.4514	20.8385	405.6687	16918.1554	20.1925	6.6696	21.343
	56.3562	54.7391	21062.8220	19.5916	28.1940	747.0675	42153.3590	27.3748	9.2180	29.498

Tower Elevation	Gusset Area (per face)	Gusset Thickness	Gusset Grade	Adjust. Factor A _f	Adjust. Factor A _r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
ft	ft ²	in						
L1 138'6"-108'6"				1	1	1		
L2 108'6"-83'9"				1	1	1		
L3 83'9"-43'				1	1	1		
L4 43'-0'				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number	C _A A _A ft ² /ft	Weight plf
138							
LDF6-50A(1-1/4")	A	No	Inside Pole	138' - 0'	6	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00
							0.66 0.66 0.66 0.66
LCF114-50J(1-1/4")	A	No	Inside Pole	138' - 0'	6	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00
							0.70 0.70 0.70 0.70
LDF4-50A(1/2")	A	No	CaAa (Out Of Face)	138' - 0'	1	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00
							0.15 0.84 2.14 6.58
LDF6-50A(1-1/4")	A	No	CaAa (Out Of Face)	138' - 0'	1	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00
							0.66 1.91 3.78 9.33
LDF6-50A(1-1/4")	A	No	CaAa (Out Of Face)	138' - 0'	1	No Ice 1/2" Ice 1" Ice 2" Ice	0.16 0.25 0.35 0.55
							0.66 1.91 3.78 9.33
137							
LDF4-50A(1/2")	A	No	Inside Pole	137' - 0'	1	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00
							0.15 0.15 0.15 0.15
129							
LDF7-50A(1-5/8")	A	No	Inside Pole	129' - 0'	12	No Ice	0.00
							0.82

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Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C _A A _A ft ² /ft	Weight plf
LDF7-50A(1-5/8")	A	No	Inside Pole	129' - 0'	6	1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
						2" Ice	0.00	0.82
						No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
						2" Ice	0.00	0.82
119								
LDF7-50A(1-5/8")	C	No	Inside Pole	119' - 0'	12	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
						2" Ice	0.00	0.82
104								
LDF7-50A(1-5/8")	B	No	Inside Pole	104' - 0'	6	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
						2" Ice	0.00	0.82
HB114-1-0813U4-M5J(1 1/4")	B	No	CaAa (Out Of Face)	104' - 0'	2	No Ice	0.00	1.20
						1/2" Ice	0.00	2.45
						1" Ice	0.00	4.30
						2" Ice	0.00	9.85
HB114-1-0813U4-M5J(1 1/4")	B	No	CaAa (Out Of Face)	104' - 0'	1	No Ice	0.15	1.20
						1/2" Ice	0.25	2.45
						1" Ice	0.35	4.30
						2" Ice	0.55	9.85
87								
LDF7-50A(1-5/8")	B	No	Inside Pole	87' - 0'	12	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
						2" Ice	0.00	0.82
70								
LDF4-50A(1/2")	B	No	Inside Pole	70' - 0'	1	No Ice	0.00	0.15
						1/2" Ice	0.00	0.15
						1" Ice	0.00	0.15
						2" Ice	0.00	0.15

Safety Line 3/8	C	No	CaAa (Out Of Face)	138'6" - 0'	1	No Ice	0.04	0.22
						1/2" Ice	0.14	0.75
						1" Ice	0.24	1.28
						2" Ice	0.44	2.34

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A _R ft ²	A _F ft ²	C _A A _A In Face ft ²	C _A A _A Out Face ft ²	Weight K
L1	138'6"-108'6"	A	0.000	0.000	0.000	4.573	0.59
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	1.125	0.11
L2	108'6"-83'9"	A	0.000	0.000	0.000	3.836	0.61
		B	0.000	0.000	0.000	3.118	0.20
		C	0.000	0.000	0.000	0.928	0.25
L3	83'9"-43'	A	0.000	0.000	0.000	6.316	1.00
		B	0.000	0.000	0.000	6.275	0.75
		C	0.000	0.000	0.000	1.528	0.41
L4	43'-0'	A	0.000	0.000	0.000	6.665	1.06
		B	0.000	0.000	0.000	6.622	0.80
		C	0.000	0.000	0.000	1.613	0.43

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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 _A A _A In Face ft ²	C _A A _A Out Face ft ²	Weight K
L1	138'6"-108'6"	A	1.250	0.000	0.000	0.000	11.947	0.95
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	8.625	0.15
L2	108'6"-83'9"	A	1.250	0.000	0.000	0.000	10.024	0.91
		B		0.000	0.000	0.000	8.181	0.48
		C		0.000	0.000	0.000	7.116	0.28
L3	83'9"-43'	A	1.250	0.000	0.000	0.000	16.504	1.49
		B		0.000	0.000	0.000	16.463	1.30
		C		0.000	0.000	0.000	11.716	0.46
L4	43'-0'	A	1.250	0.000	0.000	0.000	17.415	1.58
		B		0.000	0.000	0.000	17.372	1.38
		C		0.000	0.000	0.000	12.363	0.49

Feed Line Center of Pressure

Section	Elevation ft	CP _X in	CP _Z in	CP _X Ice in	CP _Z Ice in
L1	138'6"-108'6"	-0.0439	-0.1814	-0.2469	-0.2535
L2	108'6"-83'9"	0.1047	-0.0948	0.0434	-0.0906
L3	83'9"-43'	0.1362	-0.0800	0.1067	-0.0626
L4	43'-0'	0.1395	-0.0820	0.1148	-0.0674

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C _A A _A Front ft ²	C _A A _A Side ft ²	Weight K
139								
Side Arm Mount [SO 102-3]	C	None		0.0000	139'	No Ice	3.00	0.08
						1/2" Ice	3.48	0.11
						1" Ice	3.96	0.14
						2" Ice	4.92	0.20
(2) RRUS-11	A	From Leg	1.00 0' 1'	0.0000	139'	No Ice	2.94	0.06
						1/2" Ice	3.17	0.07
						1" Ice	3.41	0.10
						2" Ice	3.91	0.15
(2) RRUS-11	B	From Leg	1.00 0' 1'	0.0000	139'	No Ice	2.94	0.06
						1/2" Ice	3.17	0.07
						1" Ice	3.41	0.10
						2" Ice	3.91	0.15
(2) RRUS-11	C	From Leg	1.00 0'	0.0000	139'	No Ice	2.94	0.06
						1/2" Ice	3.17	0.07

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Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
			1'			1" Ice	3.41	1.59	0.10
						2" Ice	3.91	1.96	0.15
138									
TTA-429-83H-08179	A	From Leg	1.00 0' 0'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	1.05 1.21 1.38 1.74	1.05 1.21 1.38 1.74	0.02 0.03 0.04 0.07
DS9A09F36D-N	A	From Leg	1.00 0' 10'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	5.76 7.71 9.68 13.67	5.76 7.71 9.68 13.67	0.05 0.09 0.14 0.29
Side Arm Mount [SO 309-1]	A	From Leg	0.50 0' 0'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	2.82 4.07 5.32 7.82	2.20 3.16 4.12 6.04	0.04 0.06 0.08 0.13

Platform Mount [LP 303-1]	C	None		0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	14.66 18.87 23.08 31.50	14.66 18.87 23.08 31.50	1.25 1.48 1.71 2.18
(2) LGP21401	A	From Leg	4.00 0' 0'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.23 0.31 0.40 0.61	0.01 0.02 0.03 0.05
(2) LGP21401	B	From Leg	4.00 0' 0'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.23 0.31 0.40 0.61	0.01 0.02 0.03 0.05
(2) LGP21401	C	From Leg	4.00 0' 0'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.23 0.31 0.40 0.61	0.01 0.02 0.03 0.05
(2) LGP2140X	A	From Leg	4.00 0' 1'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.38 0.49 0.62 0.89	0.01 0.02 0.03 0.05
(2) LGP2140X	B	From Leg	4.00 0' 1'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.38 0.49 0.62 0.89	0.01 0.02 0.03 0.05
(2) LGP2140X	C	From Leg	4.00 0' 1'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.38 0.49 0.62 0.89	0.01 0.02 0.03 0.05
(2) LGP21901	A	From Leg	4.00 6' 0'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.18 0.25 0.32 0.49	0.01 0.01 0.01 0.02
(2) LGP21901	B	From Leg	4.00 6' 0'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.18 0.25 0.32 0.49	0.01 0.01 0.01 0.02
(2) LGP21901	C	From Leg	4.00 6' 0'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.18 0.25 0.32 0.49	0.01 0.01 0.01 0.02
(2) XDuo1416-80 w/ Mount	A	From Leg	4.00	0.0000	138'	No Ice	6.73	4.09	0.04

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Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
Pipe			0' 1'			1/2" Ice 7.21 1" Ice 7.69 2" Ice 8.69	4.74 5.38 6.80	0.09 0.15 0.28
(2) XDUO1416-80 w/ Mount Pipe	B	From Leg	4.00 0' 1'	0.0000	138'	No Ice 6.73 1/2" Ice 7.21 1" Ice 7.69 2" Ice 8.69	4.09 4.74 5.38 6.80	0.04 0.09 0.15 0.28
(2) XDUO1416-80 w/ Mount Pipe	C	From Leg	4.00 0' 1'	0.0000	138'	No Ice 6.73 1/2" Ice 7.21 1" Ice 7.69 2" Ice 8.69	4.09 4.74 5.38 6.80	0.04 0.09 0.15 0.28
AM-X-CD-16-65-00T-RET w/ Mount Pipe	A	From Leg	4.00 0' 1'	0.0000	138'	No Ice 8.50 1/2" Ice 9.15 1" Ice 9.77 2" Ice 11.03	6.30 7.48 8.37 10.18	0.07 0.14 0.21 0.38
800 10764 w/ Mount Pipe	B	From Leg	4.00 0' 1'	0.0000	138'	No Ice 6.20 1/2" Ice 6.69 1" Ice 7.18 2" Ice 8.19	4.29 4.99 5.66 7.10	0.06 0.11 0.16 0.30
AM-X-CD-14-65-00T-RET w/ Mount Pipe	C	From Leg	4.00 0' 1'	0.0000	138'	No Ice 5.74 1/2" Ice 6.20 1" Ice 6.66 2" Ice 7.62	4.02 4.63 5.28 6.68	0.03 0.08 0.13 0.25
DC6-48-60-18-8F	B	From Leg	4.00 0' 1'	0.0000	138'	No Ice 2.57 1/2" Ice 2.80 1" Ice 3.04 2" Ice 3.54	4.32 4.60 4.88 5.49	0.02 0.05 0.09 0.17
137 ANT150F6	A	From Leg	1.00 0' 10'	0.0000	137'	No Ice 4.80 1/2" Ice 6.83 1" Ice 8.87 2" Ice 13.01	4.80 6.83 8.87 13.01	0.03 0.07 0.11 0.25
5' x 2' Pipe Mount	A	From Leg	0.50 0' 0'	0.0000	137'	No Ice 1.00 1/2" Ice 1.39 1" Ice 1.70 2" Ice 2.35	1.00 1.39 1.70 2.35	0.03 0.04 0.05 0.08
129 Platform Mount [LP 304-1]	C	None		0.0000	129'	No Ice 17.46 1/2" Ice 22.44 1" Ice 27.42 2" Ice 37.38	17.46 22.44 27.42 37.38	1.35 1.62 1.90 2.45
(2) LPA-80080/6CF w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	129'	No Ice 4.56 1/2" Ice 5.11 1" Ice 5.61 2" Ice 6.65	10.73 11.99 12.97 14.98	0.05 0.11 0.19 0.36
(2) LPA-80080/6CF w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	129'	No Ice 4.56 1/2" Ice 5.11 1" Ice 5.61 2" Ice 6.65	10.73 11.99 12.97 14.98	0.05 0.11 0.19 0.36
(2) LPA-80080/6CF w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	129'	No Ice 4.56 1/2" Ice 5.11 1" Ice 5.61 2" Ice 6.65	10.73 11.99 12.97 14.98	0.05 0.11 0.19 0.36
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	129'	No Ice 3.18 1/2" Ice 3.56 1" Ice 3.96 2" Ice 4.85	3.35 3.97 4.60 5.89	0.03 0.06 0.10 0.19

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<i>Description</i>	<i>Face or Leg</i>	<i>Offset Type</i>	<i>Offsets: Horz Lateral Vert ft ft ft</i>	<i>Azimuth Adjustment °</i>	<i>Placement ft</i>	<i>C_{AA} Front ft²</i>	<i>C_{AA} Side ft²</i>	<i>Weight K</i>
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	129'	No Ice 3.18 1/2" Ice 3.56 1" Ice 3.96 2" Ice 4.85	3.35 3.97 4.60 5.89	0.03 0.06 0.10 0.19
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	129'	No Ice 3.18 1/2" Ice 3.56 1" Ice 3.96 2" Ice 4.85	3.35 3.97 4.60 5.89	0.03 0.06 0.10 0.19
BXA-70063/6CF-2 W/Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	129'	No Ice 7.75 1/2" Ice 8.29 1" Ice 8.85 2" Ice 9.97	5.18 6.11 6.92 8.59	0.04 0.09 0.16 0.31
BXA-70063/6CF-2 W/Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	129'	No Ice 7.75 1/2" Ice 8.29 1" Ice 8.85 2" Ice 9.97	5.18 6.11 6.92 8.59	0.04 0.09 0.16 0.31
BXA-70063/6CF-2 W/Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	129'	No Ice 7.75 1/2" Ice 8.29 1" Ice 8.85 2" Ice 9.97	5.18 6.11 6.92 8.59	0.04 0.09 0.16 0.31

Platform Mount [LP 304-1]	C	None		0.0000	119'	No Ice 17.46 1/2" Ice 22.44 1" Ice 27.42 2" Ice 37.38	17.46 22.44 27.42 37.38	1.35 1.62 1.90 2.45
(4) DB846G90A-XY w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	119'	No Ice 5.23 1/2" Ice 5.78 1" Ice 6.30 2" Ice 7.37	7.53 8.72 9.62 11.45	0.04 0.09 0.16 0.32
(4) DB846G90A-XY w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	119'	No Ice 5.23 1/2" Ice 5.78 1" Ice 6.30 2" Ice 7.37	7.53 8.72 9.62 11.45	0.04 0.09 0.16 0.32
(4) DB846G90A-XY w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	119'	No Ice 5.23 1/2" Ice 5.78 1" Ice 6.30 2" Ice 7.37	7.53 8.72 9.62 11.45	0.04 0.09 0.16 0.32

(2) DB980F90T2E-M w/ Mount Pipe	A	From Leg	4.00 0' 4'	0.0000	104'	No Ice 3.99 1/2" Ice 4.45 1" Ice 4.90 2" Ice 5.82	3.72 4.58 5.32 6.85	0.03 0.07 0.11 0.22
(2) DB980F90T2E-M w/ Mount Pipe	B	From Leg	4.00 0' 4'	0.0000	104'	No Ice 3.99 1/2" Ice 4.45 1" Ice 4.90 2" Ice 5.82	3.72 4.58 5.32 6.85	0.03 0.07 0.11 0.22
(2) DB980F90T2E-M w/ Mount Pipe	C	From Leg	4.00 0' 4'	0.0000	104'	No Ice 3.99 1/2" Ice 4.45 1" Ice 4.90 2" Ice 5.82	3.72 4.58 5.32 6.85	0.03 0.07 0.11 0.22
(3) ACU-A20-N	A	From Leg	4.00 0' 4'	0.0000	104'	No Ice 0.08 1/2" Ice 0.12 1" Ice 0.17 2" Ice 0.30	0.14 0.19 0.25 0.40	0.00 0.00 0.00 0.01
APXVSPP18-C-A20 w/ Mount Pipe	A	From Leg	4.00 0' 4'	0.0000	104'	No Ice 8.50 1/2" Ice 9.15 1" Ice 9.77	6.95 8.13 9.02	0.08 0.15 0.22

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<i>Description</i>	<i>Face or Leg</i>	<i>Offset Type</i>	<i>Offsets: Horz Lateral Vert ft ft ft</i>	<i>Azimuth Adjustment °</i>	<i>Placement ft</i>		<i>C_{AA} Front ft²</i>	<i>C_{AA} Side ft²</i>	<i>Weight K</i>
(3) ACU-A20-N	B	From Leg	4.00 0' 4'	0.0000	104'	2" Ice No Ice 1/2" Ice 1" Ice 2" Ice	11.03 0.08 0.12 0.17 0.30	10.84 0.14 0.19 0.25 0.40	0.41 0.00 0.00 0.00 0.01
APXVSPP18-C-A20 w/ Mount Pipe	B	From Leg	4.00 0' 4'	0.0000	104'	No Ice 1/2" Ice 1" Ice 2" Ice	8.50 9.15 9.77 11.03	6.95 8.13 9.02 10.84	0.08 0.15 0.22 0.41
(3) ACU-A20-N	C	From Leg	4.00 0' 4'	0.0000	104'	No Ice 1/2" Ice 1" Ice 2" Ice	0.08 0.12 0.17 0.30	0.14 0.19 0.25 0.40	0.00 0.00 0.00 0.01
APXVSPP18-C-A20 w/ Mount Pipe	C	From Leg	4.00 0' 4'	0.0000	104'	No Ice 1/2" Ice 1" Ice 2" Ice	8.50 9.15 9.77 11.03	6.95 8.13 9.02 10.84	0.08 0.15 0.22 0.41
Platform Mount [LP 712-1]	C	None		0.0000	104'	No Ice 1/2" Ice 1" Ice 2" Ice	24.53 29.94 35.35 46.17	24.53 29.94 35.35 46.17	1.34 1.65 1.96 2.58
Miscellaneous [NA 507-1]	C	None		0.0000	104'	No Ice 1/2" Ice 1" Ice 2" Ice	4.80 6.70 8.60 12.40	4.80 6.70 8.60 12.40	0.25 0.29 0.34 0.44

1900MHz RRH (65MHz)	A	From Leg	1.00 0' 0'	0.0000	102'	No Ice 1/2" Ice 1" Ice 2" Ice	2.70 2.94 3.18 3.70	2.77 3.01 3.26 3.78	0.06 0.08 0.11 0.18
800 EXTERNAL NOTCH FILTER	A	From Leg	4.00 0' 4'	0.0000	104'	No Ice 1/2" Ice 1" Ice 2" Ice	0.77 0.89 1.02 1.30	0.37 0.46 0.56 0.79	0.01 0.02 0.02 0.04
800MHZ RRH	A	From Leg	1.00 0' 0'	0.0000	102'	No Ice 1/2" Ice 1" Ice 2" Ice	2.49 2.71 2.93 3.41	2.07 2.27 2.48 2.93	0.05 0.07 0.10 0.16
1900MHz RRH (65MHz)	B	From Leg	1.00 0' 0'	0.0000	102'	No Ice 1/2" Ice 1" Ice 2" Ice	2.70 2.94 3.18 3.70	2.77 3.01 3.26 3.78	0.06 0.08 0.11 0.18
800 EXTERNAL NOTCH FILTER	B	From Leg	4.00 0' 4'	0.0000	104'	No Ice 1/2" Ice 1" Ice 2" Ice	0.77 0.89 1.02 1.30	0.37 0.46 0.56 0.79	0.01 0.02 0.02 0.04
800MHZ RRH	B	From Leg	1.00 0' 0'	0.0000	102'	No Ice 1/2" Ice 1" Ice 2" Ice	2.49 2.71 2.93 3.41	2.07 2.27 2.48 2.93	0.05 0.07 0.10 0.16
1900MHz RRH (65MHz)	C	From Leg	1.00 0' 0'	0.0000	102'	No Ice 1/2" Ice 1" Ice 2" Ice	2.70 2.94 3.18 3.70	2.77 3.01 3.26 3.78	0.06 0.08 0.11 0.18
800 EXTERNAL NOTCH FILTER	C	From Leg	4.00 0' 4'	0.0000	104'	No Ice 1/2" Ice 1" Ice	0.77 0.89 1.02	0.37 0.46 0.56	0.01 0.02 0.02

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<i>Description</i>	<i>Face or Leg</i>	<i>Offset Type</i>	<i>Offsets: Horz Lateral Vert ft ft ft</i>	<i>Azimuth Adjustment °</i>	<i>Placement ft</i>	<i>C_{AA} Front ft²</i>	<i>C_{AA} Side ft²</i>	<i>Weight K</i>
800MHZ RRH	C	From Leg	1.00 0' 0'	0.0000	102'	2" Ice 1.30 No Ice 2.49 1/2" Ice 2.71 1" Ice 2.93 2" Ice 3.41	0.79 2.07 2.27 2.48 2.93	0.04 0.05 0.07 0.10 0.16
Side Arm Mount [SO 102-3]	C	None		0.0000	102'	No Ice 3.00 1/2" Ice 3.48 1" Ice 3.96 2" Ice 4.92	3.00 3.48 3.96 4.92	0.08 0.11 0.14 0.20

Platform Mount [LP 305-1]	C	None		0.0000	87'	No Ice 18.01 1/2" Ice 23.33 1" Ice 28.65 2" Ice 39.29	18.01 23.33 28.65 39.29	1.12 1.35 1.58 2.05
(4) KN-1870-15-4803	A	From Leg	4.00 0' 0'	0.0000	87'	No Ice 0.83 1/2" Ice 0.97 1" Ice 1.11 2" Ice 1.42	0.39 0.50 0.62 0.89	0.01 0.02 0.02 0.04
(4) KN-1870-15-4803	B	From Leg	4.00 0' 0'	0.0000	87'	No Ice 0.83 1/2" Ice 0.97 1" Ice 1.11 2" Ice 1.42	0.39 0.50 0.62 0.89	0.01 0.02 0.02 0.04
(4) KN-1870-15-4803	C	From Leg	4.00 0' 0'	0.0000	87'	No Ice 0.83 1/2" Ice 0.97 1" Ice 1.11 2" Ice 1.42	0.39 0.50 0.62 0.89	0.01 0.02 0.02 0.04
(2) APXV18-209014-C w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	87'	No Ice 3.72 1/2" Ice 4.13 1" Ice 4.56 2" Ice 5.51	3.31 4.02 4.68 6.07	0.04 0.07 0.11 0.21
(2) APXV18-209014-C w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	87'	No Ice 3.72 1/2" Ice 4.13 1" Ice 4.56 2" Ice 5.51	3.31 4.02 4.68 6.07	0.04 0.07 0.11 0.21
(2) APXV18-209014-C w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	87'	No Ice 3.72 1/2" Ice 4.13 1" Ice 4.56 2" Ice 5.51	3.31 4.02 4.68 6.07	0.04 0.07 0.11 0.21
Empty Pipe Mount	A	From Leg	4.00 0' 0'	0.0000	87'	No Ice 1.43 1/2" Ice 1.50 1" Ice 1.57 2" Ice 1.71	1.43 1.50 1.57 1.71	0.02 0.03 0.04 0.05
Empty Pipe Mount	B	From Leg	4.00 0' 0'	0.0000	87'	No Ice 1.43 1/2" Ice 1.50 1" Ice 1.57 2" Ice 1.71	1.43 1.50 1.57 1.71	0.02 0.03 0.04 0.05
Empty Pipe Mount	C	From Leg	4.00 0' 0'	0.0000	87'	No Ice 1.43 1/2" Ice 1.50 1" Ice 1.57 2" Ice 1.71	1.43 1.50 1.57 1.71	0.02 0.03 0.04 0.05

Side Arm Mount [SO 701-1]	A	From Leg	1.50 0' 0'	0.0000	70'	No Ice 0.85 1/2" Ice 1.14 1" Ice 1.43 2" Ice 2.01	1.67 2.34 3.01 4.35	0.07 0.08 0.09 0.12
KS24019-L112A	A	From Leg	3.00 0'	0.0000	70'	No Ice 0.16 1/2" Ice 0.22	0.16 0.22	0.01 0.01

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Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
			1'		1" Ice	0.30	0.30	0.01
					2" Ice	0.48	0.48	0.02
*								

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 Tower Deflections - Service Wind

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Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	138.5 - 108.5	37.018	28	2.5904	0.0121
L2	108.5 - 83.75	21.851	28	2.0947	0.0039
L3	88.25 - 43	14.016	28	1.5876	0.0021
L4	49 - 0	4.131	28	0.7961	0.0007

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
139'	Side Arm Mount [SO 102-3]	28	37.018	2.5904	0.0122	11568
138'	TTA-429-83H-08179	28	36.749	2.5836	0.0120	11568
137'	ANT150F6	28	36.213	2.5699	0.0117	11568
129'	Platform Mount [LP 304-1]	28	31.948	2.4579	0.0091	6088
119'	Platform Mount [LP 304-1]	28	26.808	2.3005	0.0063	2965
104'	(2) DB980F90T2E-M w/ Mount Pipe	28	19.919	1.9894	0.0033	2079
102'	1900MHz RRH (65MHz)	28	19.098	1.9399	0.0031	2155
87'	Platform Mount [LP 305-1]	28	13.598	1.5569	0.0020	2837
70'	Side Arm Mount [SO 701-1]	28	8.565	1.1822	0.0013	2698

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	138.5 - 108.5	94.297	2	6.5969	0.0305
L2	108.5 - 83.75	55.723	3	5.3425	0.0099
L3	88.25 - 43	35.767	3	4.0518	0.0052
L4	49 - 0	10.552	3	2.0333	0.0019

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
139'	Side Arm Mount [SO 102-3]	2	94.297	6.5969	0.0311	4652
138'	TTA-429-83H-08179	2	93.614	6.5797	0.0307	4652
137'	ANT150F6	2	92.250	6.5452	0.0299	4652
129'	Platform Mount [LP 304-1]	2	81.407	6.2627	0.0233	2447
119'	Platform Mount [LP 304-1]	2	68.335	5.8646	0.0160	1190
104'	(2) DB980F90T2E-M w/ Mount Pipe	3	50.805	5.0748	0.0085	830
102'	1900MHz RRH (65MHz)	3	48.715	4.9489	0.0079	859
87'	Platform Mount [LP 305-1]	3	34.700	3.9735	0.0052	1122
70'	Side Arm Mount [SO 701-1]	3	21.865	3.0183	0.0034	1063

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Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L _a ft	KL/r	F _a ksi	A in ²	Actual P K	Allow. P _a K	Ratio $\frac{P}{P_a}$
L1	138.5 - 108.5 (1)	TP24.5x17.375x0.1875	30'	0'	0.0	39.000	14.4690	-6.79	564.29	0.012
L2	108.5 - 83.75 (2)	TP31.88x24.5x0.25	24'9"	0'	0.0	39.000	24.0337	-11.54	937.31	0.012
L3	83.75 - 43 (3)	TP43.42x30.0382x0.3125	45'3"	0'	0.0	39.000	40.9973	-20.76	1598.89	0.013
L4	43 - 0 (4)	TP55.5x41.0206x0.3125	49'	0'	0.0	36.030	54.7391	-33.00	1972.25	0.017

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	138.5 - 108.5 (1)	TP24.5x17.375x0.1875	288.89	39.931	39.000	1.024	0.00	0.000	39.000	0.000
L2	108.5 - 83.75 (2)	TP31.88x24.5x0.25	655.80	43.829	39.000	1.124	0.00	0.000	39.000	0.000
L3	83.75 - 43 (3)	TP43.42x30.0382x0.3125	1547.54	44.398	39.000	1.138	0.00	0.000	39.000	0.000
L4	43 - 0 (4)	TP55.5x41.0206x0.3125	2815.22	45.220	36.030	1.255	0.00	0.000	36.030	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	138.5 - 108.5 (1)	TP24.5x17.375x0.1875	14.11	0.976	26.000	0.075	0.15	0.010	26.000	0.000
L2	108.5 - 83.75 (2)	TP31.88x24.5x0.25	19.37	0.806	26.000	0.062	0.15	0.005	26.000	0.000
L3	83.75 - 43 (3)	TP43.42x30.0382x0.3125	24.20	0.590	26.000	0.045	0.07	0.001	26.000	0.000
L4	43 - 0 (4)	TP55.5x41.0206x0.3125	27.55	0.503	26.000	0.039	0.10	0.001	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	138.5 - 108.5 (1)	0.012	1.024	0.000	0.075	0.000	1.037	1.333	H1-3+VT ✓

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Section No.	Elevation ft	Ratio P P_a	Ratio f_{bx} F_{bx}	Ratio f_{by} F_{by}	Ratio f_v F_v	Ratio f_{vt} F_{vt}	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L2	108.5 - 83.75 (2)	0.012	1.124	0.000	0.062	0.000	1.137 ✓	1.333	H1-3+VT ✓
L3	83.75 - 43 (3)	0.013	1.138	0.000	0.045	0.000	1.152 ✓	1.333	H1-3+VT ✓
L4	43 - 0 (4)	0.017	1.255	0.000	0.039	0.000	1.272 ✓	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	138.5 - 108.5	Pole	TP24.5x17.375x0.1875	1	-6.79	752.20	77.8	Pass
L2	108.5 - 83.75	Pole	TP31.88x24.5x0.25	2	-11.54	1249.44	85.3	Pass
L3	83.75 - 43	Pole	TP43.42x30.0382x0.3125	3	-20.76	2131.32	86.4	Pass
L4	43 - 0	Pole	TP55.5x41.0206x0.3125	4	-33.00	2629.01	95.4	Pass
							Summary	
							Pole (L4)	95.4
							RATING =	95.4
								Pass

APPENDIX B
BASE LEVEL DRAWING



(INSTALLED)
(18) 1-5/8" TO 129 FT LEVEL

(PROPOSED)
(1) 1/2" TO 138 FT LEVEL
(2) 1-1/4" TO 138 FT LEVEL

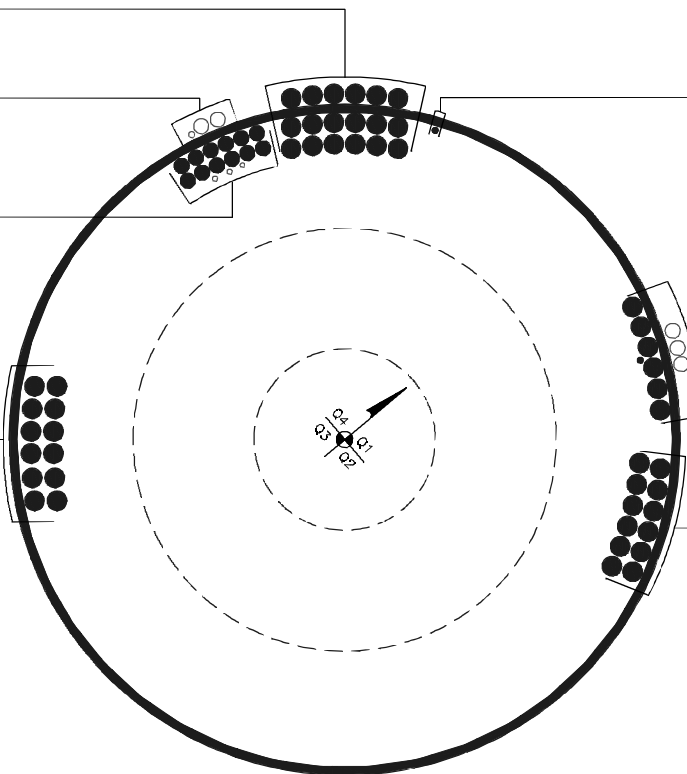
(RESERVED)
(2) 7/16" TO 138 FT LEVEL
(1) 3/8" TO 138 FT LEVEL
(INSTALLED)
(12) 1-1/4" TO 138 FT LEVEL

(INSTALLED)
(12) 1-5/8" TO 119 FT LEVEL

(INSTALLED)
(1) 1/2" TO 137 FT LEVEL

(RESERVED)
(3) 1-1/4" TO 104 FT LEVEL
(INSTALLED)
(6) 1-5/8" TO 104 FT LEVEL
(INSTALLED)
(1) 1/2" TO 70 FT LEVEL

(INSTALLED)
(12) 1-5/8" TO 87 FT LEVEL



APPENDIX C

ADDITIONAL CALCULATIONS

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

Site Data

BU#: 876380
Site Name: O&G Woodbury
App #:

Pole Manufacturer: Other

Bolt Data

Qty:	24	Bolt Fu:	120
Diameter (in.):	1	Bolt Fy:	92
Bolt Material:	A325	Bolt Fty:	44.00
N/A:	75	<-- Disregard	
N/A:	55	<-- Disregard	
Circle (in.):	28		

Plate Data

Diam:	31	in
Thick, t:	1.5	in
Grade (Fy):	60	ksi
Strength, Fu:	75	ksi
Single-Rod B-eff:	3.24	in

Stiffener Data (Welding at Both Sides)

Config:	0	*
Weld Type:	Fillet	
Groove Depth:	0.25	<-- Disregard
Groove Angle:	45	<-- Disregard
Fillet H. Weld:	0.25	in
Fillet V. Weld:	0.25	in
Width:	3	in
Height:	8	in
Thick:	0.5	in
Notch:	0.375	in
Grade:	36	ksi
Weld str.:	70	ksi

Pole Data

Diam:	24.5	in
Thick:	0.1875	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	
-------	-------	--

Reactions

Moment:	288.89	ft-kips
Axial:	6.79	kips
Shear:	14.11	kips
Elevation:	108.5	feet

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

Flange Bolt Results

Bolt Tension Capacity, B: 46.07 kips
Max Bolt directly applied T: 20.35 Kips
Min. PL "tc" for B cap. w/o Pry: 1.340 in
Min PL "treq" for actual T w/ Pry: 0.690 in
Min PL "t1" for actual T w/o Pry: 0.891 in
T allowable w/o Prying: 46.07 kips
Prying Force, Q: 0.00 kips
Total Bolt Tension=T+Q: 20.35 kips
Non-Prying Bolt Stress Ratio, T/B: 44.2% Pass

Rigid
Service, ASD
Fty*ASIF

Exterior Flange Plate Results

Flexural Check
Compression Side Plate Stress: 18.5 ksi
Allowable Plate Stress: 60.0 ksi
Compression Plate Stress Ratio: 30.9% Pass

Rigid
Service ASD
0.75*Fy*ASIF
Comp. Y.L. Length:
13.56

No Prying

Tension Side Stress Ratio, (treq/t)^2: 21.1% Pass

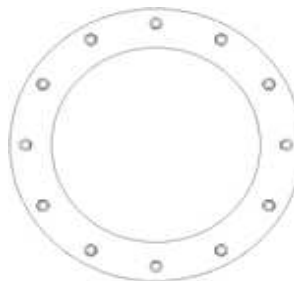
n/a

Stiffener Results

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

Pole Results

Pole Punching Shear Check: n/a



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

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



FDH Engineering, Inc., 6521 Meridian Dr. Raleigh, NC 27616, Ph. 919.755.1012, Fax 919.755.1031

Anchor Rod Design

Site Name:	O&G Woodbury
Job No. :	876380
Elevation:	0
	Input Cells in Blue

*Note: Use Anchor Rod Transfer Plate Design Spreadsheet in Conjunction

Code (F or G):	F	Pull Down
Anchor Bolts (Yes or No)	Yes	Pull Down
P (from RISA)	33	kips
V (from RISA)	28	kips
M (from RISA)	2815	ft-kips

Existing Rods		
y	32	in
No. Bolts	12	
BC	64	in
I	24453.12	in ⁴
Bolt Grade	A615-75	Pull Down
Thread Form	Non-Upset	-
d (in)	2.25	Pull Down
Ag	3.98	in ²
Ae	3.25	in ²
Fy	75	ksi
Fu	100	ksi

New Rods		
y new	32	in
No. Bolts new	4	
BC new	64	in
I new	8,151	in ⁴
Bolt Grade	A193 B7	Pull Down
Thread Form	Non-Upset	Pull Down
d new (in)	2.25	Pull Down
Ag new	3.98	in ²
Ae new	3.25	in ²
Fy new	105	ksi
Fu new	125	ksi

Req'd Embedment Length for New Rods		
f'c, caisson's concrete strength	4000	psi
f _y , rebar yield strength	60000	psi
d _{br} , diameter of vertical rebar	1	in
vertical rebar cage BC ø	73	in
vertical rebar top cover distance	3	in
τ, Ultimate Hilti Bond Resistance	2.2	ksi

Note For New Anchor Rods:	
Williams Bars (Upset)	
A722 (Fy=127.7 ksi, Fu=150 ksi)	
A615-75 (Fy=75 ksi, Fu=100 ksi)	

Itot	32604.16	in ⁴
T	129.890625	kips
V	1.75	kips

Tnew	129.890625	kips
Vnew	1.75	kips

% Capacity			
Tn/Q	194.5	kips	OK
Tn/Q, new	218.9	kips	OK
øTn	260	kips	
øTn, new	325	kips	

l _d (vertical rebar dev. Length)	47.4342	in
l _{dh} (Hilti dev. length)	62.6974	in
G/1.5	3.0000	in

Total Embed. Length of New Bolts	69.11	in
	5.76	ft

Equations:

$$T = (M \cdot y \cdot Ag) / (I_{tot} \cdot P \cdot (Ag / A_{total}))$$

$$Tn/Q = 0.33 \cdot Fu \cdot Ag \cdot (4/3)$$

$$\phi Tn = 0.8 \cdot Fu \cdot Ae \text{ (anchor bolts only)}$$

$$\phi Tn = 0.75 \cdot Fu \cdot Ae \text{ (non anchor bolts)}$$

$$I = (No. Bolts/8) \cdot BC^2 \cdot Ag$$

$$l_d = [(f_y \cdot \psi_t \cdot \psi_e \cdot \lambda) / (20 \cdot \sqrt{f'_c})] \cdot d_{br} \quad \text{PER ACI 12.2.2}$$

$$l_{dh} = (\phi Tn \cdot FS) / (\tau \cdot p \cdot l' \cdot d_{new})$$

See Worksheet "New (Design Procedure)" for diagram

Notes:

*Ag and Ae are taken from AISC 13th Ed. Manual (pg. 7-83)

*I calc. will only work for symmetric bolt group, otherwise use CAD

Interaction Equation Checks per Rev. G: See section 4.9.9

(works for Rev F also)

Detail Type (see sheet 2)	c	Pull Down (see sheet 2 for Detail Type)
η	0.55	
l _{an} , for Detail Type d only	2.25	in (length from top of concrete to bottom of leveling nut)

øRnt	194.5	kips
øRnv	119.4	kips
øRnm	94.921875	kip-in
Mu	2.559375	kip-in

(Pu+Vu/η)/øRnt	0.684177086	<1?	OK
----------------	-------------	-----	----

(Vu/øRnv) ² + ((Pu/øRnt)+(Mu/øRnm)) ²	NA	(only applicable for Detail Type d)
---	----	-------------------------------------

Bearing Strength Check of Anchor Rod Pipe Sleeve		
New Anchor Rod Diameter	2.25	in
Selected Pipe Sleeve Area		in ²
Selected Pipe Sleeve Fy		ksi
Rn/Q (Rev F) or øRn (Rev G)	0.00	k
% Capacity	#DIV/0!	No Good

a
b
c
d

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

TIA Rev F

Site Data

BU#:	876380
Site Name:	O&G Woodbury
App#:	
Pole Manufacturer:	Other

Anchor Rod Data

*Qty:	24	
Diam:	2.25	in
Rod Material:	A615-J	
Strength (Fu):	100	ksi
Yield (Fy):	75	ksi
Bolt Circle:	64	in

Plate Data

Diam:	70	in
Thick:	1.5	in
Grade:	60	ksi
Single-Rod B-eff:	7.34	in

Stiffener Data (Welding at both sides)

Config:	1	*
Weld Type:	Fillet	
Groove Depth:	0.25	<-- Disregard
Groove Angle:	45	<-- Disregard
Fillet H. Weld:	0.375	in
Fillet V. Weld:	0.25	in
Width:	7	in
Height:	16	in
Thick:	0.5	in
Notch:	0.75	in
Grade:	50	ksi
Weld str.:	70	ksi

Pole Data

Diam:	55.5	in
Thick:	0.3125	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	
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Reactions

*Moment:	4200	ft-kips
Axial:	33	kips
Shear:	28	kips

*Anchor Rod quantity and Moment are modified due to consideration of modifications.

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

Anchor Rod Results

Maximum Rod Tension:	129.9 Kips
Allowable Tension:	195.0 Kips
Anchor Rod Stress Ratio:	66.6% Pass

Stiffened

Service, ASD
Fty*ASIF

Base Plate Results

Base Plate Stress:	57.3 ksi
Allowable Plate Stress:	60.0 ksi
Base Plate Stress Ratio:	95.6% Pass

Flexural Check

Stiffened

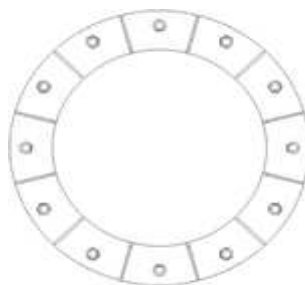
Service, ASD
0.75*Fy*ASIF
Y.L. Length:
N/A, Roark

Stiffener Results

Horizontal Weld :	98.2% Pass
Vertical Weld:	69.1% Pass
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	37.2% Pass
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	82.5% Pass
Plate Comp. (AISC Bracket):	94.2% Pass

Pole Results

Pole Punching Shear Check:	18.0% Pass
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* 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

(Bearing and Stability Checks) Tool for TIA Rev F or G - Application (MP, SST with unitbase)**Site Data**

BU#: 876380
Site Name: O&G Woodbury
App #:

Enter Load Factors Below:

For P (DL)	1.2	<---- Enter Factor
For P,V, and M (WL)	1.35	<---- Enter Factor

Pad & Pier Data

Base PL Dist. Above Pier:	0	in
Pier Dist. Above Grade:	12	in
Pad Bearing Depth, D:	6.5	ft
Pad Thickness, T:	3	ft
Pad Width=Length, L:	23	ft
Pier Cross Section Shape:	Square	<--Pull Down
Enter Pier Side Width:	7	ft
Concrete Density:	150.0	pcf
Pier Cross Section Area:	49.00	ft^2
Pier Height:	4.50	ft
Soil (above pad) Height:	3.50	ft

Soil Parameters

Unit Weight, γ :	125.0	pcf
Ultimate Bearing Capacity, q_n :	12.00	ksf
Strength Reduct. factor, ϕ :	0.75	
Angle of Friction, Φ :	34.0	degrees
Undrained Shear Strength, C_u :	0.00	ksf
Allowable Bearing: $\phi*q_n$:	9.00	ksf
Passive Pres. Coeff., K_p :	3.54	

Forces/Moments due to Wind and Lateral Soil

Minimum of (ϕ *Ultimate Pad Passive Force, V_u):	37.8	kips
Pad Force Location Above D:	1.35	ft
ϕ (Passive Pressure Moment):	51.03	ft-kips
Factored O.T. M(WL), "1.6W":	4083.8	ft-kips
Factored OT (MW-Msoil), M1	4032.72	ft-kips

Resistance due to Foundation Gravity

Soil Wedge Projection grade, a:	2.36	ft
Sum of Soil Wedges Wt:	29.67	kips
Soil Wedges ecc, K1:	7.60	ft
Ftg+Soil above Pad wt:	481.1	kips
Unfactored (Total ftg-soil Wt):	510.79	kips
1.2D. No Soil Wedges.	616.95	kips
0.9D. With Soil Wedges	489.41	kips

Resistance due to Cohesion (Vertical)

$\phi*(1/2*C_u)$ (Total Vert. Planes)	0.00	kips
Cohesion Force Eccentricity, K2	0.00	ft

Monopole Base Reaction Forces

TIA Revision:	F	<--Pull Down
Unfactored DL Axial, PD:	33	kips
Unfactored WL Axial, PW:	0	kips
Unfactored WL Shear, V:	28	kips
Unfactored WL Moment, M:	2815	ft-kips

Load Factor**Shaft Factored Loads**

1.20	1.2D+1.6W, Pu:	39.6	kips
0.90	0.9D+1.6W, Pu:	29.7	kips
1.35	Vu:	37.8	kips
	Mu:	3800.25	ft-kips

1.2D+1.6W Load Combination, Bearing Results:

(No Soil Wedges) [Reaction+Conc+Soil]	616.95	P1="1.2D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil), M1	4032.72	ft-kips

Orthogonal Direction:

$$\begin{aligned} \text{ecc1} = M1/P1 &= 6.54 \text{ ft} \\ \text{Orthogonal } q_u &= 2.70 \text{ ksf} \\ q_u/\phi*q_n \text{ Ratio} &= \mathbf{30.02\%} \quad \mathbf{Pass} \end{aligned}$$

Diagonal Direction:

$$\begin{aligned} \text{ecc2} = (0.707M1)/P1 &= 4.62 \text{ ft} \\ \text{Diagonal } q_u &= 3.26 \text{ ksf} \\ q_u/\phi*q_n \text{ Ratio} &= \mathbf{36.22\%} \quad \mathbf{Pass} \end{aligned}$$

Run

<-- Press Upon Completing All Input

Overturning Stability Check**0.9D+1.6W Load Combination, Bearing Results:**

(w/ Soil Wedges) [Reaction+Conc+Soil]	489.41	P2="0.9D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil) - 0.9(M of Wedge + M of Cohesion), M2	3829.79	ft-kips

$$\begin{aligned} \text{Orthogonal ecc3} = M2/P2 &= 7.83 \text{ ft} \\ \text{Ortho Non Bearing Length, NBL} &= 15.65 \text{ ft} \\ \text{Orthogonal } q_u &= 2.90 \text{ ksf} \\ \text{Diagonal } q_u &= 3.44 \text{ ksf} \end{aligned}$$

Max Reaction Moment (ft-kips) so that $q_u = \phi*q_n = 100\%$ Capacity Rating

Actual M:	2815.00		
M Orthogonal:	3727.14	75.53%	Pass
M Diagonal:	3727.14	75.53%	Pass

ATTACHMENT 4



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 $\pm 1.5\%$ 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

Model	Alternator	Voltage	Ph	Hz	Standby Ratings *			
					Natural Gas		LP Gas	
					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 drip-proof 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, m³/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 ₂ O)	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/m³ (Btu/ft³), 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 ₂ O)	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/m³ 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

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

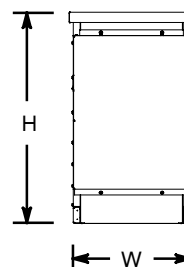
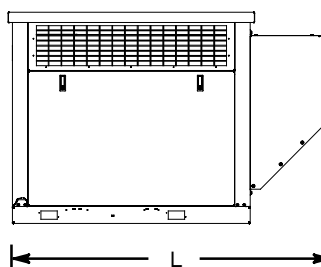
With Weather Enclosure and Sound Kit

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)



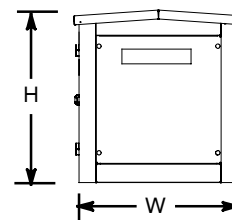
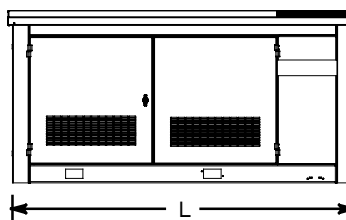
With Sound Enclosure

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**

Woodbury

Great Hollow Road, Woodbury, CT 06798

May 28, 2013

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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 off Great Hollow Road in Woodbury, CT. The coordinates of the tower are 41° 31' 19.2" N, 73° 13' 15.6" 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/cm²). The general population exposure limits for the various frequency ranges are defined in the attached "FCC Limits for Maximum Permissible Exposure (MPE)" in Attachment B of this report.

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

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

3. RF Exposure Prediction Methods

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

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

Where:

EIRP = Effective Isotropic Radiated Power

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

H = Horizontal Distance from antenna in meters

V = Vertical Distance from radiation center of antenna in meters

Ground reflection factor of 1.6

Off Beam Loss is determined by the selected antenna pattern

These calculations assume that the antennas are operating at 100 percent capacity and power, and that all channels are transmitting simultaneously. Obstructions (trees, buildings, etc.) that would normally attenuate the signal are not taken into account. The calculations assume even terrain in the area of study and do not take into account actual terrain elevations which could attenuate the signal. As a result, the predicted signal levels reported below are much higher than the actual signal levels will be from the finished 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 that 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 CDMA/LTE	110	1962.5	2	778	0.0462	1.0000	4.62%
Sprint CDMA/LTE	110	850	1	438	0.0130	0.5667	2.30%
AT&T UMTS	139	880	2	565	0.0210	0.5867	3.58%
AT&T UMTS	139	1900	2	875	0.0326	1.0000	3.26%
AT&T GSM	139	880	1	283	0.0053	0.5867	0.90%
AT&T GSM	139	1900	4	525	0.0391	1.0000	3.91%
AT&T LTE	139	734	1	1313	0.0244	0.4893	4.99%
Verizon PCS	129	1970	7	256	0.0387	1.0000	3.87%
Verizon Cellular	129	869	9	261	0.0508	0.5793	8.76%
Verizon AWS	129	2145	1	621	0.0134	1.0000	1.34%
Verizon LTE	129	698	1	852	0.0184	0.4653	3.96%
Nextel	120	851	12	100	0.0300	0.5673	5.28%
T-Mobile	90	1935	8	126	0.0447	1.0000	4.47%
Northeast Utilities	148	938	2	240	0.0008	0.6253	0.13%
						Total	51.37%

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 FDH Engineering, Inc. Structural Analysis dated May 23, 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 with 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 **51.37% 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 28, 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 Exposure³

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 Exposure⁴

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

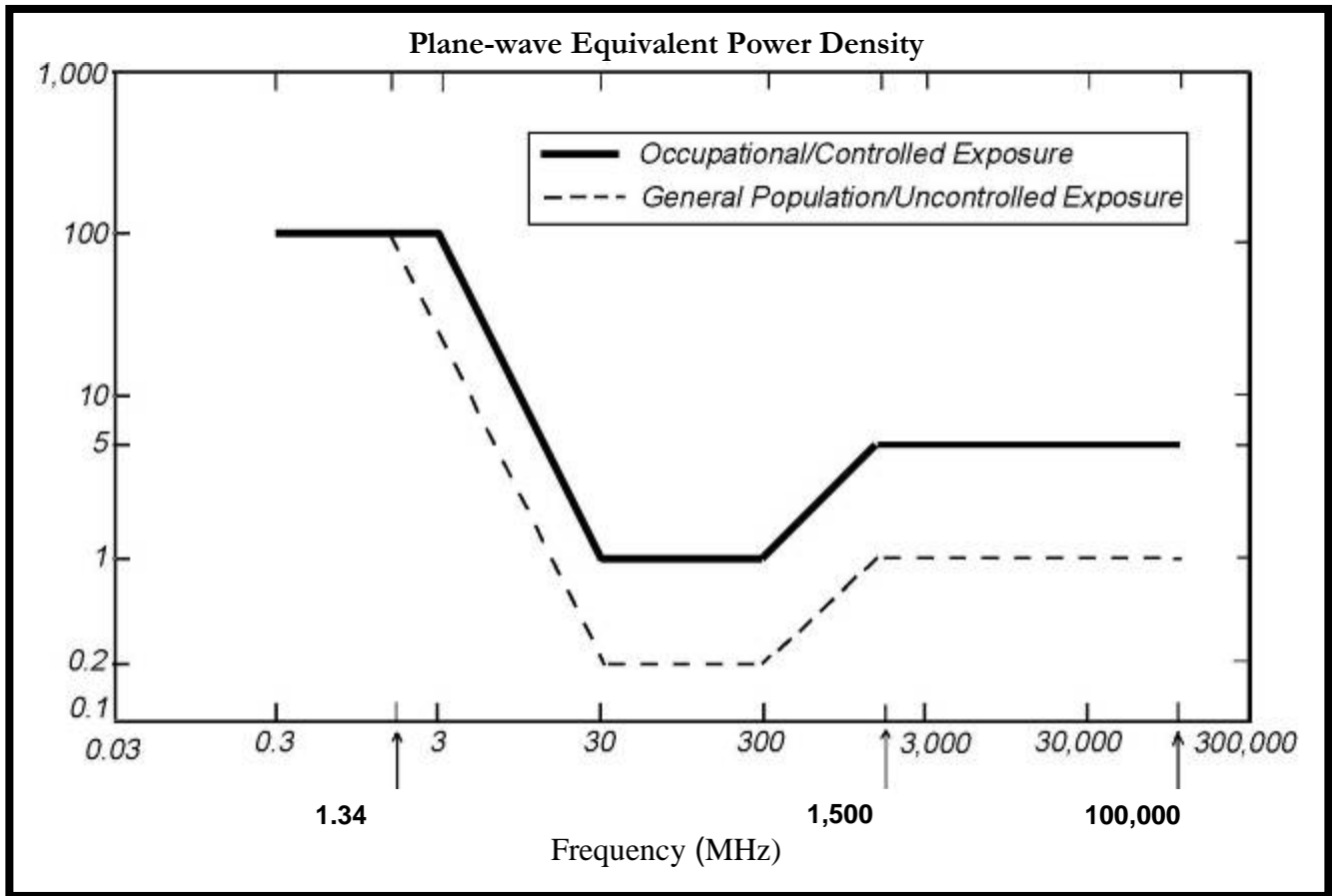
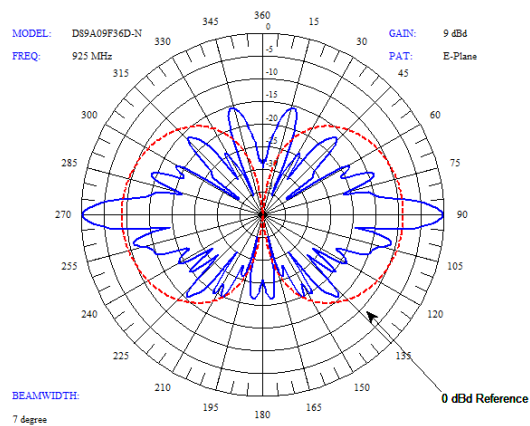


Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

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



PROJECT SUMMARY	
SITE NAME:	WOODBURY
SITE ADDRESS:	202 GREAT HOLLOW ROAD WOODBURY, CT 06798
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°-31'-19.2" LONGITUDE: 73°-13'-15.6" GROUND ELEVATION: ±595' AMSL COORDINATES REFERENCED FROM STRUCTURAL ANALYSIS REPORT PREPARED BY FDH ENGINEERING INC. GROUND ELEVATION REFERENCED FROM AVAILABLE TOPOGRAPHIC MAPPING.

T-1	TITLE SHEET	2
C-1	COMPOUND PLAN AND ELEVATION	2

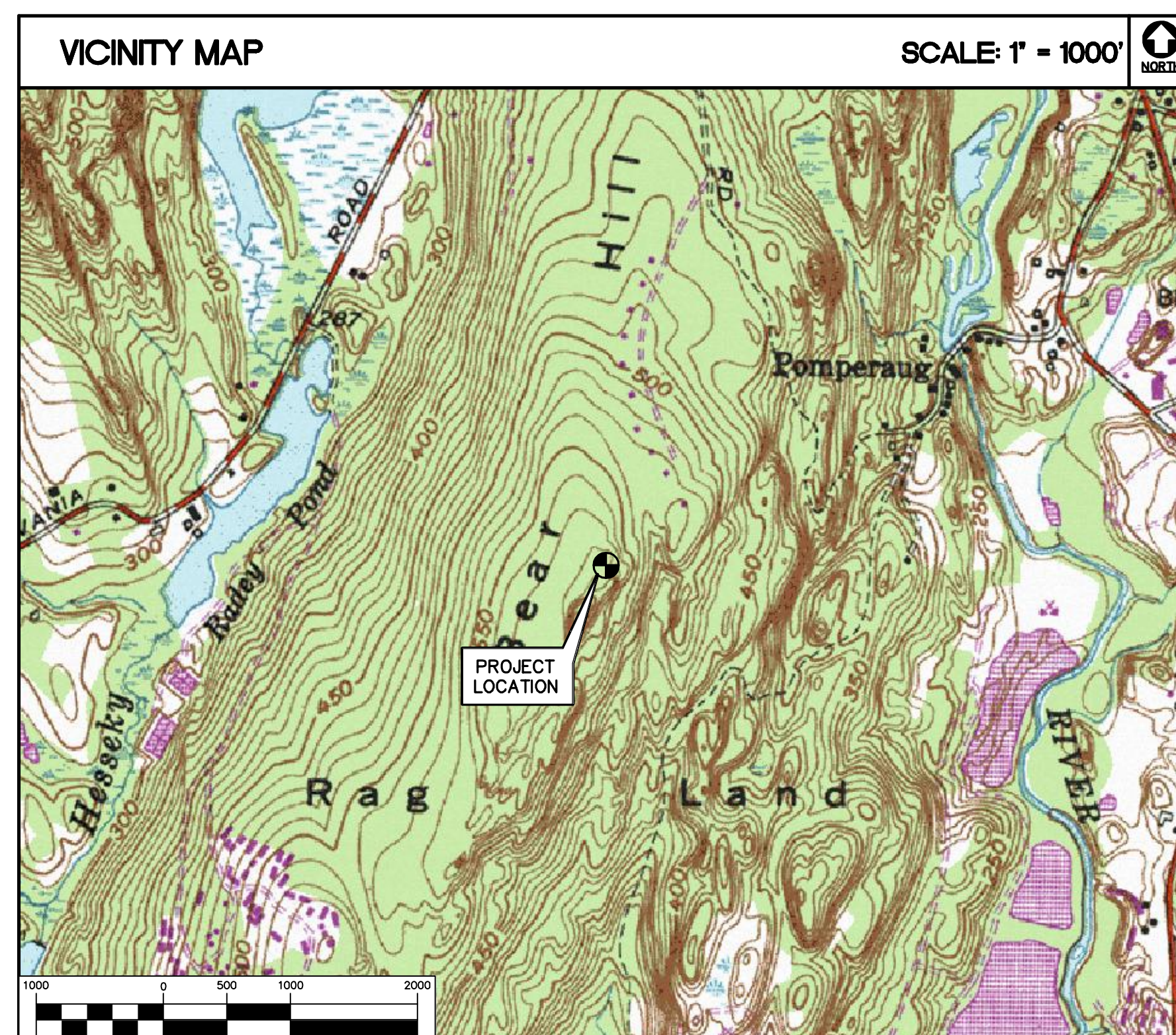
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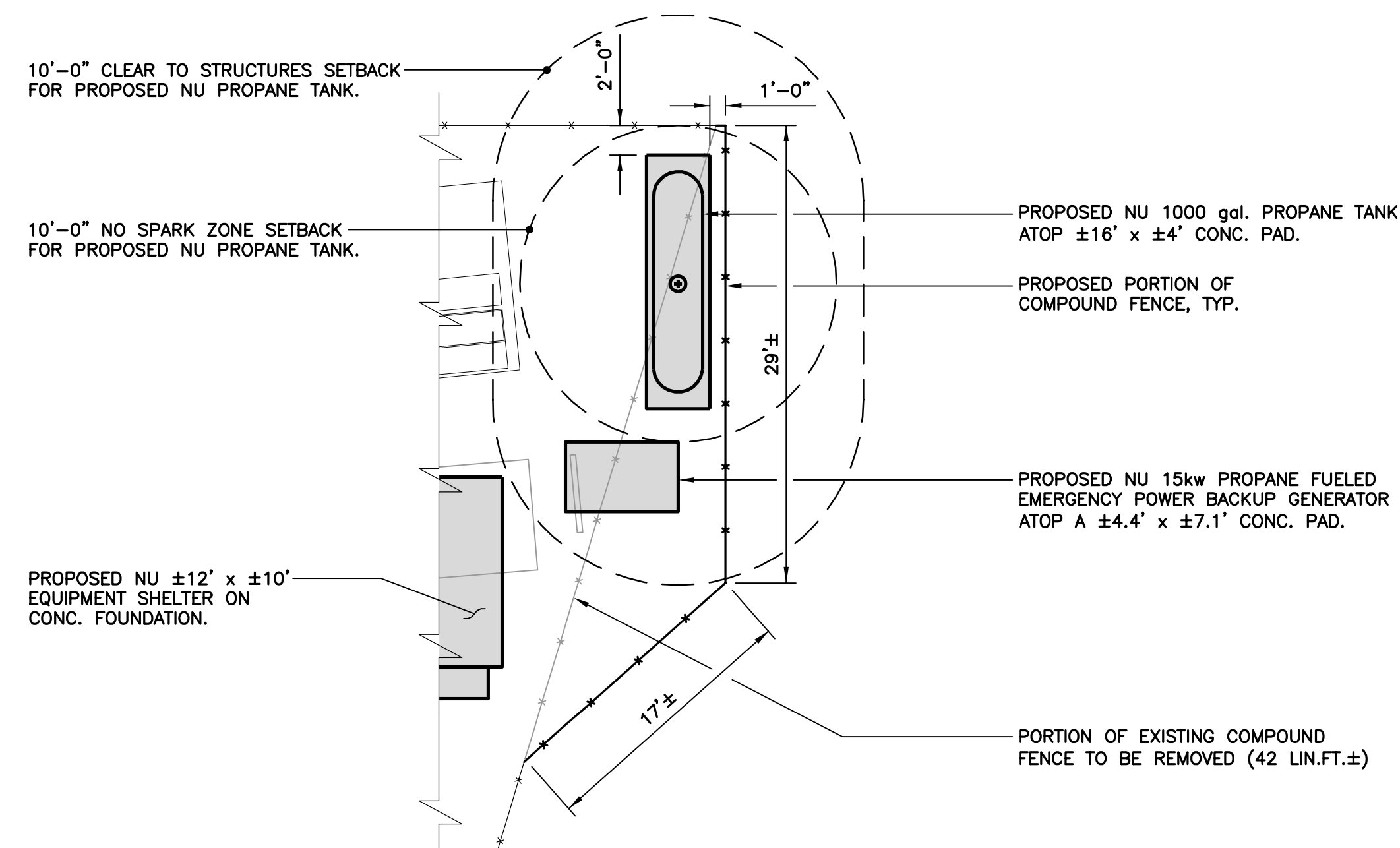
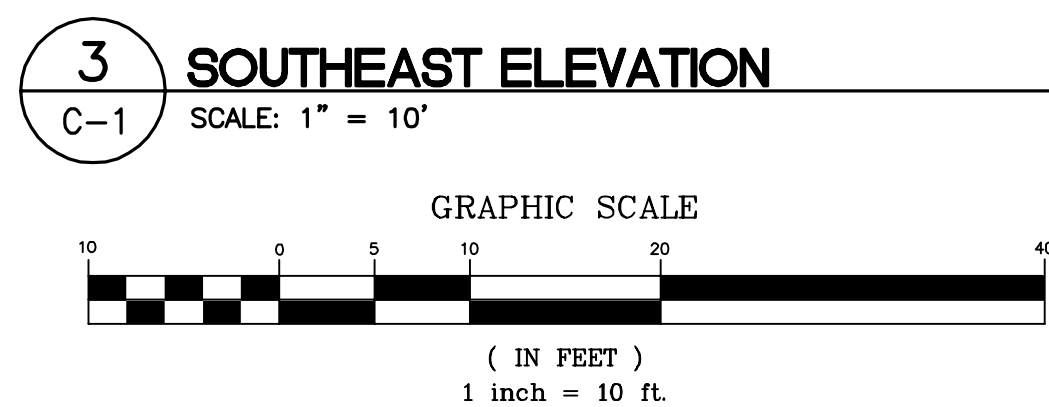
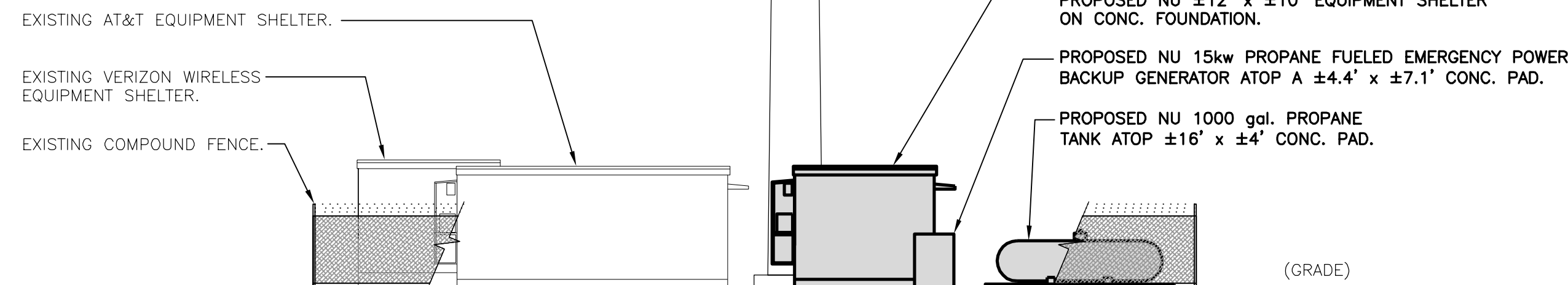
SITE DIRECTIONS		
FROM:	107 SELDEN STREET BERLIN, CONNECTICUT	TO: 202 GREAT HOLLOW ROAD WOODBURY, CONNECTICUT
1. Head northwest on Selden St toward CT-15 N/US-5 N/Berlin Turnpike		0.1 mi
2. Turn left onto CT-15 S/US-5 S/Berlin Turnpike		1.8 mi
3. Take the ramp to Connecticut 9 S/Middletown		0.1 mi
4. Keep right at the fork, follow signs for U.S. 5 S/Connecticut 15 S/New Haven and merge onto CT-15 S/US-5 S/Berlin Turnpike		3.4 mi
5. Turn right onto N Colony Rd		2.8 mi
6. Turn left to merge onto I-691 W toward I-84		6.0 mi
7. Take exit 1 on the left for I-84 W toward Waterbury/Danbury		1.0 mi
8. Merge onto I-84		9.5 mi
9. Take exit 17 to merge onto CT-64 W/Chase Pkwy toward CT-63/Middlebury/Watertown, Continue to follow CT-64 W		3.6 mi
10. Turn right onto CT-64 W/Middlebury Rd,Continue to follow CT-64 W		4.3 mi
11. Turn right onto US-6 E/Main St S		1.0 mi
12. Turn left onto Sycamore Ave		0.2 mi
13. Take the 1st right onto CT-317 W/Sycamore Ave		0.4 mi
14. Turn left onto Bear Hill Rd		0.3 mi
15. Turn left onto Great Hollow Rd		0.5 mi
16. Keep right to stay on Great Hollow Rd		0.7 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 $\pm 10'$ x $\pm 12'$ EQUIPMENT SHELTER, 15 KW PROPANE FUELED GENERATOR AND 1000 gal. PROPANE TANK ON PROPOSED CONCRETE FOUNDATIONS WITHIN THE EXISTING COMMUNICATION FACILITY LEASE AREA..
2. ONE (1) OMNIDIRECTIONAL 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.






2


C-1

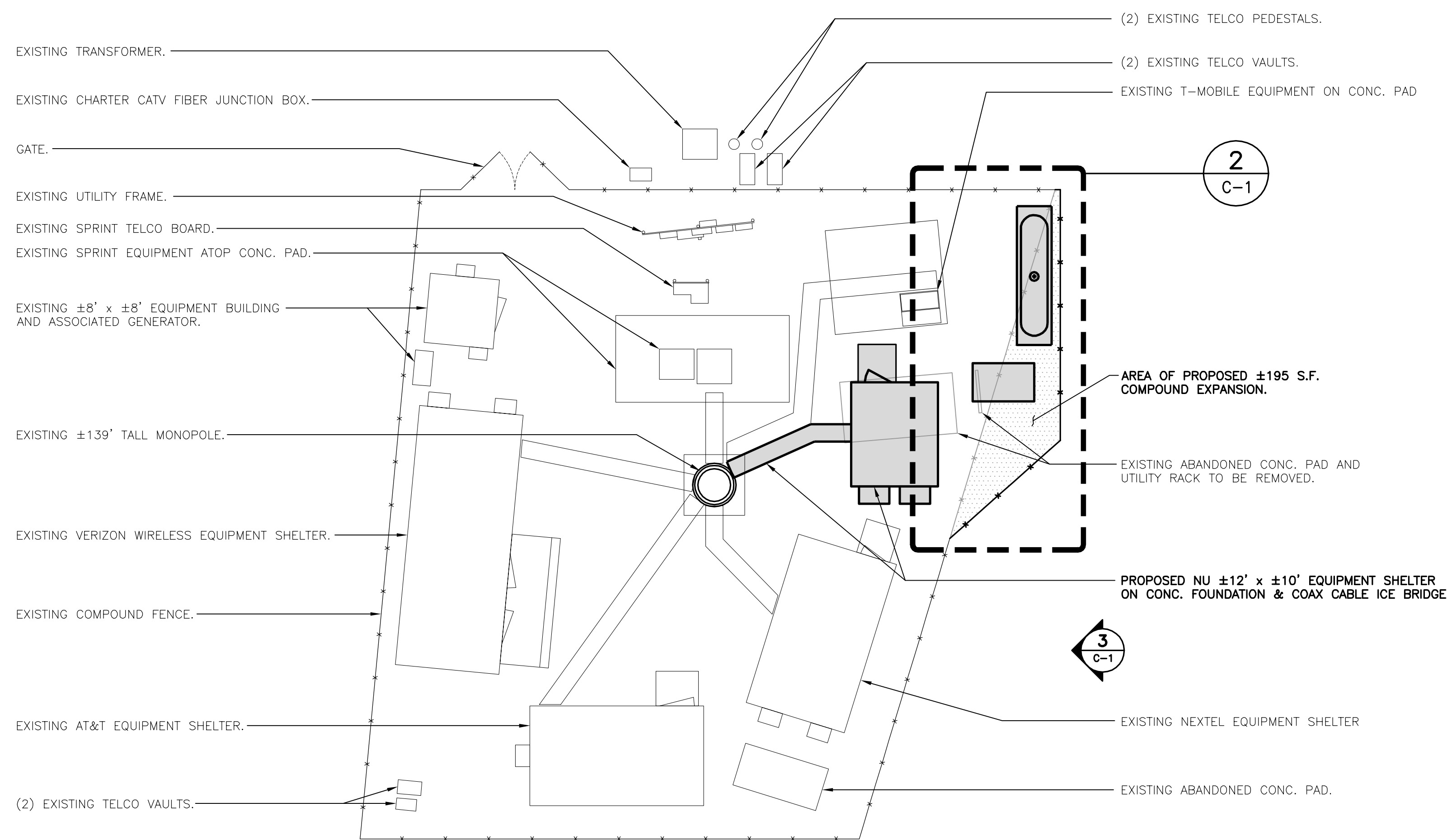
PARTIAL COMPOUND PLAN

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



GRAPHIC SCALE






1

C-1


COMPOUND PLAN

SCALE: 1" = 10'



NORTH

GRAPHIC SCALE



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

[illegible]

ATTACHMENT 2



3530 Toringdon Way, Suite 300
Charlotte, NC 28277

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

April 16, 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# 876380
Site Address:	Great Hollow Rd, Woodbury, CT 06798	Crown Castle Site Name:	O&G WOODBURY

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 16, 2013

ATTACHMENT 3



Date: **May 23, 2013**

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

FDH Engineering, Inc.
6521 Meridien Drive
Raleigh, NC 27616
(919) 755-1012

Subject: Structural Analysis Report

Carrier Designation:	Northeast Utilities Co-Locate	
	Carrier Site Number:	N/A
	Carrier Site Name:	WOODBURY
Crown Castle Designation:	Crown Castle BU Number:	876380
	Crown Castle Site Name:	O&G WOODBURY
	Crown Castle JDE Job Number:	230752
	Crown Castle Work Order Number:	614121
	Crown Castle Application Number:	184343 Rev. 9
Engineering Firm Designation:	FDH Engineering, Inc. Project Number:	1335561400
Site Data:	Great Hollow Road, WOODBURY, Litchfield County, CT Latitude 41° 31' 19.2", Longitude -73° 13' 15.6" 138.5 Foot - Monopole Tower	

Dear Patrick Byrum,

FDH Engineering, Inc. 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 549014, in accordance with application 184343, revision 9.

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 analysis has been performed in accordance with the TIA/EIA-222-F standard and 2005 CT State Building Code based upon a wind speed of 80 mph fastest mile.

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

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

Respectfully submitted by:

Reviewed by:

Will Hammond, EI
Project Engineer

Christopher M. Murphy, PE
President
CT PE License No. 25842

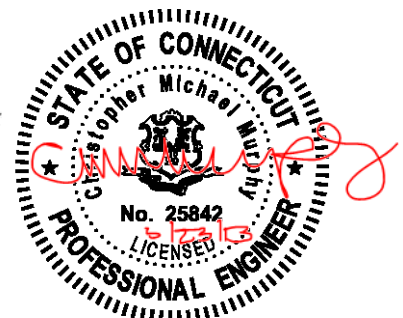


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7) APPENDIX C

Additional Calculations

1) INTRODUCTION

This tower is a 138.5 ft Monopole tower designed by ENGINEERED ENDEAVORS, INC. in April of 2003. The tower was originally designed for a wind speed of 85 mph per TIA/EIA-222-F. The tower was originally designed to be 150-ft but was only constructed to a height of 139 ft. The tower has been modified multiple times in the past to accommodate additional loading. The tower was modified per reinforcement drawings prepared by Semaan Engineering Solutions, Inc. in November of 2005. Reinforcement consists of base plate stiffeners. The tower was modified again per reinforcement drawings prepared by GPD Group in December of 2011. Reinforcement consists of additional anchor rods.

2) ANALYSIS CRITERIA

The structural analysis was performed for this tower in accordance with the requirements of TIA/EIA-222-F Structural Standards for Steel Antenna Towers and Antenna Supporting Structures using a fastest mile wind speed of 80 mph with no ice, 28.1 mph with 1 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
138.0	148.0	1	db spectra	DS9A09F36D-N	1 2	1/2 1-1/4	-
	138.0	1	bird technologies group	TTA-429-83H-08179			
		1	crown mounts	Side Arm Mount [SO 309-1]			

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
139.0	140.0	6	ericsson	RRUS-11	-	-	2
	139.0	1	crown mounts	Side Arm Mount[SO102-3]			
138.0	139.0	1	kathrein	800 10764 w/ Mount Pipe	2 1	7/16 3/8	2
		1	kmw communications	AM-X-CD-14-65-00T-RET w/ Mount Pipe			
		1	kmw communications	AM-X-CD-16-65-00T-RET w/ Mount Pipe			
		1	raycap	DC6-48-60-18-8F			
		6	css	XDUO1416-80 w/ Mount Pipe	12	1-1/4	1
	138.0	6	powerwave technologies	LGP2140X			
		1	crown mounts	Platform Mount [LP 303-1]			
		6	powerwave technologies	LGP21401			
		6	powerwave technologies	LGP21901			
137.0	147.0	1	telewave	ANT150F6	1	1/2	1

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
129.0	129.0	3	antel	BXA-171085-8BF-EDIN-2 w/ Mount Pipe	18	1-5/8	1
		3	antel	BXA-70063/6CF-2 w/ Mount Pipe			
		6	antel	LPA-80080/6CF w/ Mount Pipe			
		1	crown mounts	Platform Mount [LP 304-1]			
119.0	119.0	1	crown mounts	Platform Mount [LP 304-1]	12	1-5/8	1
		12	decibel	DB846G90A-XY w/ Mount Pipe			
104.0	108.0	6	decibel	DB980F90T2E-M w/ Mount Pipe	6	1-5/8	1
		3	alcatel lucent	800 EXTERNAL NOTCH FILTER	3	1-1/4	2
		9	rfs celwave	ACU-A20-N			
		3	rfs celwave	APXVSPP18-C-A20 w/ Mount Pipe			
	104.0	1	crown mounts	Miscellaneous [NA 507-1]	-	-	1
		1	crown mounts	Platform Mount [LP 712-1]			
102.0	102.0	3	alcatel lucent	1900MHz RRH (65MHz)	-	-	2
		3	alcatel lucent	800MHZ RRH			
		1	crown mounts	Side Arm Mount[SO102-3]			
87.0	87.0	12	airtech	KN-1870-15-4803	12	1-5/8	1
		1	crown mounts	Platform Mount [LP 305-1]			
		6	rfs celwave	APXV18-209014-C w/ Mount Pipe			
70.0	71.0	1	lucent	KS24019-L112A	1	1/2	1
	70.0	1	crown mounts	Side Arm Mount[SO701-1]			

Notes:

- 1) Existing Equipment
- 2) Reserved Equipment

Table 3 - Design 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)
150	150	12	decibel	DB980F90	-	-
140	140	12	decibel	DB980F90	-	-
130	130	12	decibel	DB980F90	-	-
120	120	12	decibel	DB980F90	-	-
109	109	12	decibel	DB980F90	-	-
100	100	12	decibel	DB980F90	-	-

3) ANALYSIS PROCEDURE

Table 4 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	Clarence Welti Assoc, Inc.	1531967	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	Engineered Endeavors, Inc.	2122534	CCISITES
4-TOWER MANUFACTURER DRAWINGS	Engineered Endeavors, Inc.	1533002	CCISITES
4-TOWER REINFORCEMENT DESIGN/DRAWINGS/DATA	Semaan Engineering Solutions	2055776	CCISITES
4-TOWER REINFORCEMENT DESIGN/DRAWINGS/DATA	GPD Group	3030835	CCISITES
4-POST-INSTALLATION INSPECTION	GPD Group	3420974	CCISITES

3.1) Analysis Method

tnxTower (version 6.0.4.0), 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) When applicable, transmission cables are considered as structural components for calculating wind loads as allowed by TIA/EIA-222-F.
- 5) Tower dimensions for elevation 108.5' to 138.5' was taken from Crown Castle Structural Analysis Report dated March 19, 2013 (Project No. 587330).

This analysis may be affected if any assumptions are not valid or have been made in error. FDH Engineering, Inc. should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 5 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
L1	138.5 - 108.5	Pole	TP24.5x17.375x0.1875	1	-6.79	752.20	77.8	Pass
L2	108.5 - 83.75	Pole	TP31.88x24.5x0.25	2	-11.54	1249.44	85.3	Pass
L3	83.75 - 43	Pole	TP43.42x30.0382x0.3125	3	-20.76	2131.32	86.4	Pass
L4	43 - 0	Pole	TP55.5x41.0206x0.3125	4	-33.00	2629.01	95.4	Pass
							Summary	
						Pole (L4)	95.4	Pass
						RATING =	95.4	Pass

Table 6 - Tower Component Stresses vs. Capacity – LC7

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	66.8	Pass
1	Base Plate	0	98.2	Pass
1	Base Foundation	0	75.5	Pass
1	Flange Bolts	108.5	44.2	Pass
1	Flange Plate	108.5	30.9	Pass

Structure Rating (max from all components) =	98.2%
---	--------------

Notes:

- 1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.

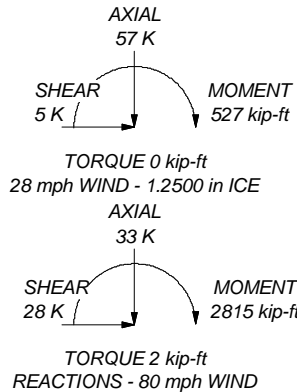
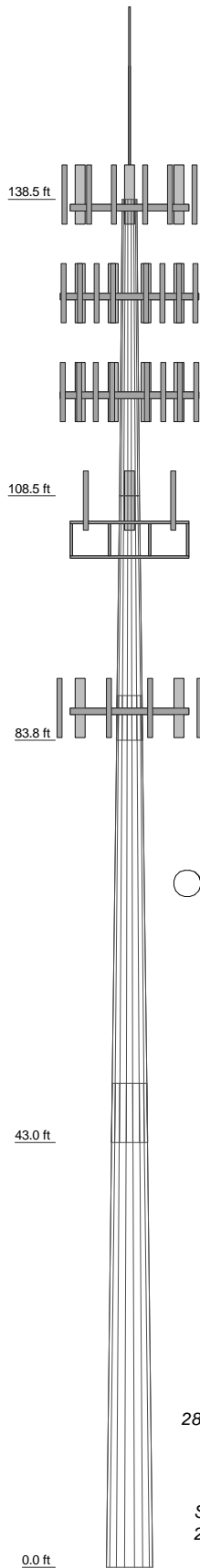
4.1) Recommendations

The tower and its foundation have sufficient capacity to carry the existing, reserved and proposed loading. No modifications are required at this time.

APPENDIX A

TNXTOWER OUTPUT

Section	1	2	3	4	
Length (ft)	30'	24'9"	45'3"	49'	
Number of Sides	18	18	18	18	
Thickness (in)	0.1875	0.2500	0.3125	0.3125	
Socket Length (ft)		46"	6'		
Top Dia (in)	17.3750	24.5000	30.0382	41.0206	
Bot Dia (in)	24.5000	31.8800	43.4200	55.5000	
Grade			A572-65		
Weight (K)	1.3	1.9	5.6	7.9	16.6



DESIGNED APPURTENANCE LOADING


TYPE	ELEVATION	TYPE	ELEVATION
Side Arm Mount [SO 102-3]	139	BXA-70063/6CF-2 W/Mount Pipe	129
(2) RRUS-11	139	BXA-70063/6CF-2 W/Mount Pipe	129
(2) RRUS-11	139	Platform Mount [LP 304-1]	119
(2) RRUS-11	139	(4) DB846G90A-XY w/ Mount Pipe	119
TTA-429-83H-08179	138	(4) DB846G90A-XY w/ Mount Pipe	119
DS9A09F36D-N	138	(4) DB846G90A-XY w/ Mount Pipe	119
Side Arm Mount [SO 309-1]	138	(2) DB980F90T2E-M w/ Mount Pipe	104
Platform Mount [LP 303-1]	138	(2) DB980F90T2E-M w/ Mount Pipe	104
(2) LGP21401	138	(2) DB980F90T2E-M w/ Mount Pipe	104
(2) LGP21401	138	(3) ACU-A20-N	104
(2) LGP21401	138	APXVSP18-C-A20 w/ Mount Pipe	104
(2) LGP2140X	138	(3) ACU-A20-N	104
(2) LGP2140X	138	APXVSP18-C-A20 w/ Mount Pipe	104
(2) LGP2140X	138	(3) ACU-A20-N	104
(2) LGP21901	138	APXVSP18-C-A20 w/ Mount Pipe	104
(2) LGP21901	138	Platform Mount [LP 712-1]	104
(2) LGP21901	138	Miscellaneous [NA 507-1]	104
(2) XDUO1416-80 w/ Mount Pipe	138	800 EXTERNAL NOTCH FILTER	104
(2) XDUO1416-80 w/ Mount Pipe	138	800 EXTERNAL NOTCH FILTER	104
(2) XDUO1416-80 w/ Mount Pipe	138	800 EXTERNAL NOTCH FILTER	104
AM-X-CD-16-65-00T-RET w/ Mount Pipe	138	1900MHz RRH (65MHz)	102
800 10764 w/ Mount Pipe	138	1900MHz RRH (65MHz)	102
AM-X-CD-14-65-00T-RET w/ Mount Pipe	138	800MHz RRH	102
DC6-48-60-18-8F	138	1900MHz RRH (65MHz)	102
ANT150F6	137	800MHz RRH	102
5' x 2' Pipe Mount	137	800MHz RRH	102
Platform Mount [LP 304-1]	129	800MHz RRH	102
(2) LPA-80080/6CF w/ Mount Pipe	129	800MHz RRH	102
(2) LPA-80080/6CF w/ Mount Pipe	129	800MHz RRH	102
(2) LPA-80080/6CF w/ Mount Pipe	129	800MHz RRH	102
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	Side Arm Mount [SO 102-3]	102
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	Platform Mount [LP 305-1]	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	(4) KN-1870-15-4803	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	(4) KN-1870-15-4803	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	(4) KN-1870-15-4803	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	(2) APXV18-209014-C w/ Mount Pipe	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	(2) APXV18-209014-C w/ Mount Pipe	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	(2) APXV18-209014-C w/ Mount Pipe	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	Empty Pipe Mount	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	Empty Pipe Mount	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	Empty Pipe Mount	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	Empty Pipe Mount	87
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	Side Arm Mount [SO 701-1]	70
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	129	KS24019-L112A	70

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Litchfield County, Connecticut.
2. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 28 mph basic wind with 1.25 in ice.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 95.4%

	FDH Engineering, Inc. 6521 Meridien Drive Raleigh, NC 27616 Phone: (919) 755-1012 FAX: (919) 755-1031		Job: BU# 876380 Project: 1335561400 Client: Crown Castle Code: TIA/EIA-222-F Path:	Drawn by: Will Hammond Date: 05/23/13 Scale: NTS Dwg No. E-1

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Tower Input Data

There is a pole section.

This tower is designed using the TIA/EIA-222-F standard.

The following design criteria apply:

Tower is located in Litchfield County, Connecticut.

Basic wind speed of 80 mph.

Nominal ice thickness of 1.2500 in.

Ice density of 56 pcf.

A wind speed of 28 mph is used in combination with ice.

Temperature drop of 50 °F.

Deflections calculated using a wind speed of 50 mph.

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

Pressures are calculated at each section.

Stress ratio used in pole design is 1.333.

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

Options

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

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	138'6"-108'6"	30'	0'	18	17.3750	24.5000	0.1875	0.7500	A572-65 (65 ksi)
L2	108'6"-83'9"	24'9"	4'6"	18	24.5000	31.8800	0.2500	1.0000	A572-65 (65 ksi)
L3	83'9"-43'	45'3"	6'	18	30.0382	43.4200	0.3125	1.2500	A572-65 (65 ksi)
L4	43'-0'	49'		18	41.0206	55.5000	0.3125	1.2500	A572-65 (65 ksi)

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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	17.6430	10.2287	381.7542	6.1016	8.8265	43.2509	764.0106	5.1153	2.7280	14.549
	24.8780	14.4690	1080.5242	8.6309	12.4460	86.8170	2162.4702	7.2359	3.9820	21.237
L2	24.8780	19.2424	1429.6167	8.6088	12.4460	114.8656	2861.1145	9.6230	3.8720	15.488
	32.3718	25.0984	3172.3563	11.2287	16.1950	195.8844	6348.8868	12.5516	5.1709	20.684
L3	31.8529	29.4842	3291.4698	10.5526	15.2594	215.7012	6587.2705	14.7449	4.7367	15.158
	44.0898	42.7573	10038.1321	15.3032	22.0574	455.0922	20089.4726	21.3827	7.0919	22.694
L4	43.4538	40.3774	8453.5160	14.4514	20.8385	405.6687	16918.1554	20.1925	6.6696	21.343
	56.3562	54.7391	21062.8220	19.5916	28.1940	747.0675	42153.3590	27.3748	9.2180	29.498

Tower Elevation	Gusset Area (per face)	Gusset Thickness	Gusset Grade	Adjust. Factor A _f	Adjust. Factor A _r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
ft	ft ²	in						
L1 138'6"-108'6"				1	1	1		
L2 108'6"-83'9"				1	1	1		
L3 83'9"-43'				1	1	1		
L4 43'-0'				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C _A A _A ft ² /ft	Weight plf
138								
LDF6-50A(1-1/4")	A	No	Inside Pole	138' - 0'	6	No Ice	0.00	0.66
						1/2" Ice	0.00	0.66
						1" Ice	0.00	0.66
						2" Ice	0.00	0.66
LCF114-50J(1-1/4")	A	No	Inside Pole	138' - 0'	6	No Ice	0.00	0.70
						1/2" Ice	0.00	0.70
						1" Ice	0.00	0.70
						2" Ice	0.00	0.70
LDF4-50A(1/2")	A	No	CaAa (Out Of Face)	138' - 0'	1	No Ice	0.00	0.15
						1/2" Ice	0.00	0.84
						1" Ice	0.00	2.14
						2" Ice	0.00	6.58
LDF6-50A(1-1/4")	A	No	CaAa (Out Of Face)	138' - 0'	1	No Ice	0.00	0.66
						1/2" Ice	0.00	1.91
						1" Ice	0.00	3.78
						2" Ice	0.00	9.33
LDF6-50A(1-1/4")	A	No	CaAa (Out Of Face)	138' - 0'	1	No Ice	0.16	0.66
						1/2" Ice	0.25	1.91
						1" Ice	0.35	3.78
						2" Ice	0.55	9.33
137								
LDF4-50A(1/2")	A	No	Inside Pole	137' - 0'	1	No Ice	0.00	0.15
						1/2" Ice	0.00	0.15
						1" Ice	0.00	0.15
						2" Ice	0.00	0.15
129								
LDF7-50A(1-5/8")	A	No	Inside Pole	129' - 0'	12	No Ice	0.00	0.82

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Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C _A A _A ft ² /ft	Weight plf
LDF7-50A(1-5/8")	A	No	Inside Pole	129' - 0'	6	1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
						2" Ice	0.00	0.82
						No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
						2" Ice	0.00	0.82
119								
LDF7-50A(1-5/8")	C	No	Inside Pole	119' - 0'	12	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
						2" Ice	0.00	0.82
104								
LDF7-50A(1-5/8")	B	No	Inside Pole	104' - 0'	6	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
						2" Ice	0.00	0.82
HB114-1-0813U4-M5J(1 1/4")	B	No	CaAa (Out Of Face)	104' - 0'	2	No Ice	0.00	1.20
						1/2" Ice	0.00	2.45
						1" Ice	0.00	4.30
						2" Ice	0.00	9.85
HB114-1-0813U4-M5J(1 1/4")	B	No	CaAa (Out Of Face)	104' - 0'	1	No Ice	0.15	1.20
						1/2" Ice	0.25	2.45
						1" Ice	0.35	4.30
						2" Ice	0.55	9.85
87								
LDF7-50A(1-5/8")	B	No	Inside Pole	87' - 0'	12	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
						2" Ice	0.00	0.82
70								
LDF4-50A(1/2")	B	No	Inside Pole	70' - 0'	1	No Ice	0.00	0.15
						1/2" Ice	0.00	0.15
						1" Ice	0.00	0.15
						2" Ice	0.00	0.15

Safety Line 3/8	C	No	CaAa (Out Of Face)	138'6" - 0'	1	No Ice	0.04	0.22
						1/2" Ice	0.14	0.75
						1" Ice	0.24	1.28
						2" Ice	0.44	2.34

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A _R ft ²	A _F ft ²	C _A A _A In Face ft ²	C _A A _A Out Face ft ²	Weight K
L1	138'6"-108'6"	A	0.000	0.000	0.000	4.573	0.59
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	1.125	0.11
L2	108'6"-83'9"	A	0.000	0.000	0.000	3.836	0.61
		B	0.000	0.000	0.000	3.118	0.20
		C	0.000	0.000	0.000	0.928	0.25
L3	83'9"-43'	A	0.000	0.000	0.000	6.316	1.00
		B	0.000	0.000	0.000	6.275	0.75
		C	0.000	0.000	0.000	1.528	0.41
L4	43'-0'	A	0.000	0.000	0.000	6.665	1.06
		B	0.000	0.000	0.000	6.622	0.80
		C	0.000	0.000	0.000	1.613	0.43

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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 _A A _A In Face ft ²	C _A A _A Out Face ft ²	Weight K
L1	138'6"-108'6"	A	1.250	0.000	0.000	0.000	11.947	0.95
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	8.625	0.15
L2	108'6"-83'9"	A	1.250	0.000	0.000	0.000	10.024	0.91
		B		0.000	0.000	0.000	8.181	0.48
		C		0.000	0.000	0.000	7.116	0.28
L3	83'9"-43'	A	1.250	0.000	0.000	0.000	16.504	1.49
		B		0.000	0.000	0.000	16.463	1.30
		C		0.000	0.000	0.000	11.716	0.46
L4	43'-0"	A	1.250	0.000	0.000	0.000	17.415	1.58
		B		0.000	0.000	0.000	17.372	1.38
		C		0.000	0.000	0.000	12.363	0.49

Feed Line Center of Pressure

Section	Elevation ft	CP _X in	CP _Z in	CP _X Ice in	CP _Z Ice in
L1	138'6"-108'6"	-0.0439	-0.1814	-0.2469	-0.2535
L2	108'6"-83'9"	0.1047	-0.0948	0.0434	-0.0906
L3	83'9"-43'	0.1362	-0.0800	0.1067	-0.0626
L4	43'-0"	0.1395	-0.0820	0.1148	-0.0674

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C _A A _A Front ft ²	C _A A _A Side ft ²	Weight K
139								
Side Arm Mount [SO 102-3]	C	None		0.0000	139'	No Ice	3.00	0.08
						1/2" Ice	3.48	0.11
						1" Ice	3.96	0.14
						2" Ice	4.92	0.20
(2) RRUS-11	A	From Leg	1.00 0' 1'	0.0000	139'	No Ice	2.94	0.06
						1/2" Ice	3.17	0.07
						1" Ice	3.41	0.10
						2" Ice	3.91	0.15
(2) RRUS-11	B	From Leg	1.00 0' 1'	0.0000	139'	No Ice	2.94	0.06
						1/2" Ice	3.17	0.07
						1" Ice	3.41	0.10
						2" Ice	3.91	0.15
(2) RRUS-11	C	From Leg	1.00 0'	0.0000	139'	No Ice	2.94	0.06
						1/2" Ice	3.17	0.07

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	Client	Crown Castle	Designed by	Will Hammond

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
			1'			1" Ice	3.41	1.59	0.10
						2" Ice	3.91	1.96	0.15
138									
TTA-429-83H-08179	A	From Leg	1.00 0' 0'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	1.05 1.21 1.38 1.74	1.05 1.21 1.38 1.74	0.02 0.03 0.04 0.07
DS9A09F36D-N	A	From Leg	1.00 0' 10'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	5.76 7.71 9.68 13.67	5.76 7.71 9.68 13.67	0.05 0.09 0.14 0.29
Side Arm Mount [SO 309-1]	A	From Leg	0.50 0' 0'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	2.82 4.07 5.32 7.82	2.20 3.16 4.12 6.04	0.04 0.06 0.08 0.13

Platform Mount [LP 303-1]	C	None		0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	14.66 18.87 23.08 31.50	14.66 18.87 23.08 31.50	1.25 1.48 1.71 2.18
(2) LGP21401	A	From Leg	4.00 0' 0'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.23 0.31 0.40 0.61	0.01 0.02 0.03 0.05
(2) LGP21401	B	From Leg	4.00 0' 0'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.23 0.31 0.40 0.61	0.01 0.02 0.03 0.05
(2) LGP21401	C	From Leg	4.00 0' 0'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.23 0.31 0.40 0.61	0.01 0.02 0.03 0.05
(2) LGP2140X	A	From Leg	4.00 0' 1'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.38 0.49 0.62 0.89	0.01 0.02 0.03 0.05
(2) LGP2140X	B	From Leg	4.00 0' 1'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.38 0.49 0.62 0.89	0.01 0.02 0.03 0.05
(2) LGP2140X	C	From Leg	4.00 0' 1'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.38 0.49 0.62 0.89	0.01 0.02 0.03 0.05
(2) LGP21901	A	From Leg	4.00 6' 0'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.18 0.25 0.32 0.49	0.01 0.01 0.01 0.02
(2) LGP21901	B	From Leg	4.00 6' 0'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.18 0.25 0.32 0.49	0.01 0.01 0.01 0.02
(2) LGP21901	C	From Leg	4.00 6' 0'	0.0000	138'	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.18 0.25 0.32 0.49	0.01 0.01 0.01 0.02
(2) XDUO1416-80 w/ Mount	A	From Leg	4.00	0.0000	138'	No Ice	6.73	4.09	0.04

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	Client		Designed by
	Crown Castle		Will Hammond

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
Pipe			0' 1'			1/2" Ice 7.21 1" Ice 7.69 2" Ice 8.69	4.74 5.38 6.80	0.09 0.15 0.28
(2) XDUO1416-80 w/ Mount Pipe	B	From Leg	4.00 0' 1'	0.0000	138'	No Ice 6.73 1/2" Ice 7.21 1" Ice 7.69 2" Ice 8.69	4.09 4.74 5.38 6.80	0.04 0.09 0.15 0.28
(2) XDUO1416-80 w/ Mount Pipe	C	From Leg	4.00 0' 1'	0.0000	138'	No Ice 6.73 1/2" Ice 7.21 1" Ice 7.69 2" Ice 8.69	4.09 4.74 5.38 6.80	0.04 0.09 0.15 0.28
AM-X-CD-16-65-00T-RET w/ Mount Pipe	A	From Leg	4.00 0' 1'	0.0000	138'	No Ice 8.50 1/2" Ice 9.15 1" Ice 9.77 2" Ice 11.03	6.30 7.48 8.37 10.18	0.07 0.14 0.21 0.38
800 10764 w/ Mount Pipe	B	From Leg	4.00 0' 1'	0.0000	138'	No Ice 6.20 1/2" Ice 6.69 1" Ice 7.18 2" Ice 8.19	4.29 4.99 5.66 7.10	0.06 0.11 0.16 0.30
AM-X-CD-14-65-00T-RET w/ Mount Pipe	C	From Leg	4.00 0' 1'	0.0000	138'	No Ice 5.74 1/2" Ice 6.20 1" Ice 6.66 2" Ice 7.62	4.02 4.63 5.28 6.68	0.03 0.08 0.13 0.25
DC6-48-60-18-8F	B	From Leg	4.00 0' 1'	0.0000	138'	No Ice 2.57 1/2" Ice 2.80 1" Ice 3.04 2" Ice 3.54	4.32 4.60 4.88 5.49	0.02 0.05 0.09 0.17
137 ANT150F6	A	From Leg	1.00 0' 10'	0.0000	137'	No Ice 4.80 1/2" Ice 6.83 1" Ice 8.87 2" Ice 13.01	4.80 6.83 8.87 13.01	0.03 0.07 0.11 0.25
5' x 2' Pipe Mount	A	From Leg	0.50 0' 0'	0.0000	137'	No Ice 1.00 1/2" Ice 1.39 1" Ice 1.70 2" Ice 2.35	1.00 1.39 1.70 2.35	0.03 0.04 0.05 0.08
129 Platform Mount [LP 304-1]	C	None		0.0000	129'	No Ice 17.46 1/2" Ice 22.44 1" Ice 27.42 2" Ice 37.38	17.46 22.44 27.42 37.38	1.35 1.62 1.90 2.45
(2) LPA-80080/6CF w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	129'	No Ice 4.56 1/2" Ice 5.11 1" Ice 5.61 2" Ice 6.65	10.73 11.99 12.97 14.98	0.05 0.11 0.19 0.36
(2) LPA-80080/6CF w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	129'	No Ice 4.56 1/2" Ice 5.11 1" Ice 5.61 2" Ice 6.65	10.73 11.99 12.97 14.98	0.05 0.11 0.19 0.36
(2) LPA-80080/6CF w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	129'	No Ice 4.56 1/2" Ice 5.11 1" Ice 5.61 2" Ice 6.65	10.73 11.99 12.97 14.98	0.05 0.11 0.19 0.36
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	129'	No Ice 3.18 1/2" Ice 3.56 1" Ice 3.96 2" Ice 4.85	3.35 3.97 4.60 5.89	0.03 0.06 0.10 0.19

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	Crown Castle	Will Hammond

<i>Description</i>	<i>Face or Leg</i>	<i>Offset Type</i>	<i>Offsets: Horz Lateral Vert ft ft ft</i>	<i>Azimuth Adjustment °</i>	<i>Placement ft</i>	<i>C_{AA} Front ft²</i>	<i>C_{AA} Side ft²</i>	<i>Weight K</i>
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	129'	No Ice 3.18 1/2" Ice 3.56 1" Ice 3.96 2" Ice 4.85	3.35 3.97 4.60 5.89	0.03 0.06 0.10 0.19
BXA-171085-8BF-EDIN-2 w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	129'	No Ice 3.18 1/2" Ice 3.56 1" Ice 3.96 2" Ice 4.85	3.35 3.97 4.60 5.89	0.03 0.06 0.10 0.19
BXA-70063/6CF-2 W/Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	129'	No Ice 7.75 1/2" Ice 8.29 1" Ice 8.85 2" Ice 9.97	5.18 6.11 6.92 8.59	0.04 0.09 0.16 0.31
BXA-70063/6CF-2 W/Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	129'	No Ice 7.75 1/2" Ice 8.29 1" Ice 8.85 2" Ice 9.97	5.18 6.11 6.92 8.59	0.04 0.09 0.16 0.31
BXA-70063/6CF-2 W/Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	129'	No Ice 7.75 1/2" Ice 8.29 1" Ice 8.85 2" Ice 9.97	5.18 6.11 6.92 8.59	0.04 0.09 0.16 0.31

Platform Mount [LP 304-1]	C	None		0.0000	119'	No Ice 17.46 1/2" Ice 22.44 1" Ice 27.42 2" Ice 37.38	17.46 22.44 27.42 37.38	1.35 1.62 1.90 2.45
(4) DB846G90A-XY w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	119'	No Ice 5.23 1/2" Ice 5.78 1" Ice 6.30 2" Ice 7.37	7.53 8.72 9.62 11.45	0.04 0.09 0.16 0.32
(4) DB846G90A-XY w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	119'	No Ice 5.23 1/2" Ice 5.78 1" Ice 6.30 2" Ice 7.37	7.53 8.72 9.62 11.45	0.04 0.09 0.16 0.32
(4) DB846G90A-XY w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	119'	No Ice 5.23 1/2" Ice 5.78 1" Ice 6.30 2" Ice 7.37	7.53 8.72 9.62 11.45	0.04 0.09 0.16 0.32

(2) DB980F90T2E-M w/ Mount Pipe	A	From Leg	4.00 0' 4'	0.0000	104'	No Ice 3.99 1/2" Ice 4.45 1" Ice 4.90 2" Ice 5.82	3.72 4.58 5.32 6.85	0.03 0.07 0.11 0.22
(2) DB980F90T2E-M w/ Mount Pipe	B	From Leg	4.00 0' 4'	0.0000	104'	No Ice 3.99 1/2" Ice 4.45 1" Ice 4.90 2" Ice 5.82	3.72 4.58 5.32 6.85	0.03 0.07 0.11 0.22
(2) DB980F90T2E-M w/ Mount Pipe	C	From Leg	4.00 0' 4'	0.0000	104'	No Ice 3.99 1/2" Ice 4.45 1" Ice 4.90 2" Ice 5.82	3.72 4.58 5.32 6.85	0.03 0.07 0.11 0.22
(3) ACU-A20-N	A	From Leg	4.00 0' 4'	0.0000	104'	No Ice 0.08 1/2" Ice 0.12 1" Ice 0.17 2" Ice 0.30	0.14 0.19 0.25 0.40	0.00 0.00 0.00 0.01
APXVSPP18-C-A20 w/ Mount Pipe	A	From Leg	4.00 0' 4'	0.0000	104'	No Ice 8.50 1/2" Ice 9.15 1" Ice 9.77	6.95 8.13 9.02	0.08 0.15 0.22

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<i>Description</i>	<i>Face or Leg</i>	<i>Offset Type</i>	<i>Offsets: Horz Lateral Vert ft ft ft</i>	<i>Azimuth Adjustment °</i>	<i>Placement ft</i>		<i>C_{AA} Front ft²</i>	<i>C_{AA} Side ft²</i>	<i>Weight K</i>
(3) ACU-A20-N	B	From Leg	4.00 0' 4'	0.0000	104'	2" Ice No Ice 1/2" Ice 1" Ice 2" Ice	11.03 0.08 0.12 0.17 0.30	10.84 0.14 0.19 0.25 0.40	0.41 0.00 0.00 0.00 0.01
APXVSPP18-C-A20 w/ Mount Pipe	B	From Leg	4.00 0' 4'	0.0000	104'	No Ice 1/2" Ice 1" Ice 2" Ice	8.50 9.15 9.77 11.03	6.95 8.13 9.02 10.84	0.08 0.15 0.22 0.41
(3) ACU-A20-N	C	From Leg	4.00 0' 4'	0.0000	104'	No Ice 1/2" Ice 1" Ice 2" Ice	0.08 0.12 0.17 0.30	0.14 0.19 0.25 0.40	0.00 0.00 0.00 0.01
APXVSPP18-C-A20 w/ Mount Pipe	C	From Leg	4.00 0' 4'	0.0000	104'	No Ice 1/2" Ice 1" Ice 2" Ice	8.50 9.15 9.77 11.03	6.95 8.13 9.02 10.84	0.08 0.15 0.22 0.41
Platform Mount [LP 712-1]	C	None		0.0000	104'	No Ice 1/2" Ice 1" Ice 2" Ice	24.53 29.94 35.35 46.17	24.53 29.94 35.35 46.17	1.34 1.65 1.96 2.58
Miscellaneous [NA 507-1]	C	None		0.0000	104'	No Ice 1/2" Ice 1" Ice 2" Ice	4.80 6.70 8.60 12.40	4.80 6.70 8.60 12.40	0.25 0.29 0.34 0.44

1900MHz RRH (65MHz)	A	From Leg	1.00 0' 0'	0.0000	102'	No Ice 1/2" Ice 1" Ice 2" Ice	2.70 2.94 3.18 3.70	2.77 3.01 3.26 3.78	0.06 0.08 0.11 0.18
800 EXTERNAL NOTCH FILTER	A	From Leg	4.00 0' 4'	0.0000	104'	No Ice 1/2" Ice 1" Ice 2" Ice	0.77 0.89 1.02 1.30	0.37 0.46 0.56 0.79	0.01 0.02 0.02 0.04
800MHZ RRH	A	From Leg	1.00 0' 0'	0.0000	102'	No Ice 1/2" Ice 1" Ice 2" Ice	2.49 2.71 2.93 3.41	2.07 2.27 2.48 2.93	0.05 0.07 0.10 0.16
1900MHz RRH (65MHz)	B	From Leg	1.00 0' 0'	0.0000	102'	No Ice 1/2" Ice 1" Ice 2" Ice	2.70 2.94 3.18 3.70	2.77 3.01 3.26 3.78	0.06 0.08 0.11 0.18
800 EXTERNAL NOTCH FILTER	B	From Leg	4.00 0' 4'	0.0000	104'	No Ice 1/2" Ice 1" Ice 2" Ice	0.77 0.89 1.02 1.30	0.37 0.46 0.56 0.79	0.01 0.02 0.02 0.04
800MHZ RRH	B	From Leg	1.00 0' 0'	0.0000	102'	No Ice 1/2" Ice 1" Ice 2" Ice	2.49 2.71 2.93 3.41	2.07 2.27 2.48 2.93	0.05 0.07 0.10 0.16
1900MHz RRH (65MHz)	C	From Leg	1.00 0' 0'	0.0000	102'	No Ice 1/2" Ice 1" Ice 2" Ice	2.70 2.94 3.18 3.70	2.77 3.01 3.26 3.78	0.06 0.08 0.11 0.18
800 EXTERNAL NOTCH FILTER	C	From Leg	4.00 0' 4'	0.0000	104'	No Ice 1/2" Ice 1" Ice	0.77 0.89 1.02	0.37 0.46 0.56	0.01 0.02 0.02

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<i>Description</i>	<i>Face or Leg</i>	<i>Offset Type</i>	<i>Offsets: Horz Lateral Vert ft ft ft</i>	<i>Azimuth Adjustment °</i>	<i>Placement ft</i>	<i>C_AA_A Front ft²</i>	<i>C_AA_A Side ft²</i>	<i>Weight K</i>
800MHZ RRH	C	From Leg	1.00 0' 0'	0.0000	102'	2" Ice 1.30 No Ice 2.49 1/2" Ice 2.71 1" Ice 2.93 2" Ice 3.41	0.79 2.07 2.27 2.48 2.93	0.04 0.05 0.07 0.10 0.16
Side Arm Mount [SO 102-3]	C	None		0.0000	102'	No Ice 3.00 1/2" Ice 3.48 1" Ice 3.96 2" Ice 4.92	3.00 3.48 3.96 4.92	0.08 0.11 0.14 0.20

Platform Mount [LP 305-1]	C	None		0.0000	87'	No Ice 18.01 1/2" Ice 23.33 1" Ice 28.65 2" Ice 39.29	18.01 23.33 28.65 39.29	1.12 1.35 1.58 2.05
(4) KN-1870-15-4803	A	From Leg	4.00 0' 0'	0.0000	87'	No Ice 0.83 1/2" Ice 0.97 1" Ice 1.11 2" Ice 1.42	0.39 0.50 0.62 0.89	0.01 0.02 0.02 0.04
(4) KN-1870-15-4803	B	From Leg	4.00 0' 0'	0.0000	87'	No Ice 0.83 1/2" Ice 0.97 1" Ice 1.11 2" Ice 1.42	0.39 0.50 0.62 0.89	0.01 0.02 0.02 0.04
(4) KN-1870-15-4803	C	From Leg	4.00 0' 0'	0.0000	87'	No Ice 0.83 1/2" Ice 0.97 1" Ice 1.11 2" Ice 1.42	0.39 0.50 0.62 0.89	0.01 0.02 0.02 0.04
(2) APXV18-209014-C w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	87'	No Ice 3.72 1/2" Ice 4.13 1" Ice 4.56 2" Ice 5.51	3.31 4.02 4.68 6.07	0.04 0.07 0.11 0.21
(2) APXV18-209014-C w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.0000	87'	No Ice 3.72 1/2" Ice 4.13 1" Ice 4.56 2" Ice 5.51	3.31 4.02 4.68 6.07	0.04 0.07 0.11 0.21
(2) APXV18-209014-C w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	87'	No Ice 3.72 1/2" Ice 4.13 1" Ice 4.56 2" Ice 5.51	3.31 4.02 4.68 6.07	0.04 0.07 0.11 0.21
Empty Pipe Mount	A	From Leg	4.00 0' 0'	0.0000	87'	No Ice 1.43 1/2" Ice 1.50 1" Ice 1.57 2" Ice 1.71	1.43 1.50 1.57 1.71	0.02 0.03 0.04 0.05
Empty Pipe Mount	B	From Leg	4.00 0' 0'	0.0000	87'	No Ice 1.43 1/2" Ice 1.50 1" Ice 1.57 2" Ice 1.71	1.43 1.50 1.57 1.71	0.02 0.03 0.04 0.05
Empty Pipe Mount	C	From Leg	4.00 0' 0'	0.0000	87'	No Ice 1.43 1/2" Ice 1.50 1" Ice 1.57 2" Ice 1.71	1.43 1.50 1.57 1.71	0.02 0.03 0.04 0.05

Side Arm Mount [SO 701-1]	A	From Leg	1.50 0' 0'	0.0000	70'	No Ice 0.85 1/2" Ice 1.14 1" Ice 1.43 2" Ice 2.01	1.67 2.34 3.01 4.35	0.07 0.08 0.09 0.12
KS24019-L112A	A	From Leg	3.00 0'	0.0000	70'	No Ice 0.16 1/2" Ice 0.22	0.16 0.22	0.01 0.01

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Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert	Azimuth Adjustment	Placement	C _{AA} Front	C _{AA} Side	Weight
			ft ft ft	°	ft	ft ²	ft ²	K
			1'		1" Ice	0.30	0.30	0.01
					2" Ice	0.48	0.48	0.02
*								

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 Tower Deflections - Service Wind

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Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	138.5 - 108.5	37.018	28	2.5904	0.0121
L2	108.5 - 83.75	21.851	28	2.0947	0.0039
L3	88.25 - 43	14.016	28	1.5876	0.0021
L4	49 - 0	4.131	28	0.7961	0.0007

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
139'	Side Arm Mount [SO 102-3]	28	37.018	2.5904	0.0122	11568
138'	TTA-429-83H-08179	28	36.749	2.5836	0.0120	11568
137'	ANT150F6	28	36.213	2.5699	0.0117	11568
129'	Platform Mount [LP 304-1]	28	31.948	2.4579	0.0091	6088
119'	Platform Mount [LP 304-1]	28	26.808	2.3005	0.0063	2965
104'	(2) DB980F90T2E-M w/ Mount Pipe	28	19.919	1.9894	0.0033	2079
102'	1900MHz RRH (65MHz)	28	19.098	1.9399	0.0031	2155
87'	Platform Mount [LP 305-1]	28	13.598	1.5569	0.0020	2837
70'	Side Arm Mount [SO 701-1]	28	8.565	1.1822	0.0013	2698

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	138.5 - 108.5	94.297	2	6.5969	0.0305
L2	108.5 - 83.75	55.723	3	5.3425	0.0099
L3	88.25 - 43	35.767	3	4.0518	0.0052
L4	49 - 0	10.552	3	2.0333	0.0019

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
139'	Side Arm Mount [SO 102-3]	2	94.297	6.5969	0.0311	4652
138'	TTA-429-83H-08179	2	93.614	6.5797	0.0307	4652
137'	ANT150F6	2	92.250	6.5452	0.0299	4652
129'	Platform Mount [LP 304-1]	2	81.407	6.2627	0.0233	2447
119'	Platform Mount [LP 304-1]	2	68.335	5.8646	0.0160	1190
104'	(2) DB980F90T2E-M w/ Mount Pipe	3	50.805	5.0748	0.0085	830
102'	1900MHz RRH (65MHz)	3	48.715	4.9489	0.0079	859
87'	Platform Mount [LP 305-1]	3	34.700	3.9735	0.0052	1122
70'	Side Arm Mount [SO 701-1]	3	21.865	3.0183	0.0034	1063

tnxTower FDH Engineering, Inc. 6521 Meridien Drive Raleigh, NC 27616 Phone: (919) 755-1012 FAX: (919) 755-1031	Job	BU# 876380	Page	12 of 13
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	Client	Crown Castle	Designed by	Will Hammond

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L _a ft	KL/r	F _a ksi	A in ²	Actual P K	Allow. P _a K	Ratio $\frac{P}{P_a}$
L1	138.5 - 108.5 (1)	TP24.5x17.375x0.1875	30'	0'	0.0	39.000	14.4690	-6.79	564.29	0.012
L2	108.5 - 83.75 (2)	TP31.88x24.5x0.25	24'9"	0'	0.0	39.000	24.0337	-11.54	937.31	0.012
L3	83.75 - 43 (3)	TP43.42x30.0382x0.3125	45'3"	0'	0.0	39.000	40.9973	-20.76	1598.89	0.013
L4	43 - 0 (4)	TP55.5x41.0206x0.3125	49'	0'	0.0	36.030	54.7391	-33.00	1972.25	0.017

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	138.5 - 108.5 (1)	TP24.5x17.375x0.1875	288.89	39.931	39.000	1.024	0.00	0.000	39.000	0.000
L2	108.5 - 83.75 (2)	TP31.88x24.5x0.25	655.80	43.829	39.000	1.124	0.00	0.000	39.000	0.000
L3	83.75 - 43 (3)	TP43.42x30.0382x0.3125	1547.54	44.398	39.000	1.138	0.00	0.000	39.000	0.000
L4	43 - 0 (4)	TP55.5x41.0206x0.3125	2815.22	45.220	36.030	1.255	0.00	0.000	36.030	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	138.5 - 108.5 (1)	TP24.5x17.375x0.1875	14.11	0.976	26.000	0.075	0.15	0.010	26.000	0.000
L2	108.5 - 83.75 (2)	TP31.88x24.5x0.25	19.37	0.806	26.000	0.062	0.15	0.005	26.000	0.000
L3	83.75 - 43 (3)	TP43.42x30.0382x0.3125	24.20	0.590	26.000	0.045	0.07	0.001	26.000	0.000
L4	43 - 0 (4)	TP55.5x41.0206x0.3125	27.55	0.503	26.000	0.039	0.10	0.001	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	138.5 - 108.5 (1)	0.012	1.024	0.000	0.075	0.000	1.037 ✓	1.333	H1-3+VT ✓

tnxTower FDH Engineering, Inc. 6521 Meridien Drive Raleigh, NC 27616 Phone: (919) 755-1012 FAX: (919) 755-1031	Job	BU# 876380	Page	13 of 13
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	Client	Crown Castle	Designed by	Will Hammond

Section No.	Elevation ft	Ratio P P_a	Ratio f_{bx} F_{bx}	Ratio f_{by} F_{by}	Ratio f_v F_v	Ratio f_{vt} F_{vt}	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L2	108.5 - 83.75 (2)	0.012	1.124	0.000	0.062	0.000	1.137 ✓	1.333	H1-3+VT ✓
L3	83.75 - 43 (3)	0.013	1.138	0.000	0.045	0.000	1.152 ✓	1.333	H1-3+VT ✓
L4	43 - 0 (4)	0.017	1.255	0.000	0.039	0.000	1.272 ✓	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	138.5 - 108.5	Pole	TP24.5x17.375x0.1875	1	-6.79	752.20	77.8	Pass
L2	108.5 - 83.75	Pole	TP31.88x24.5x0.25	2	-11.54	1249.44	85.3	Pass
L3	83.75 - 43	Pole	TP43.42x30.0382x0.3125	3	-20.76	2131.32	86.4	Pass
L4	43 - 0	Pole	TP55.5x41.0206x0.3125	4	-33.00	2629.01	95.4	Pass
							Summary	
							Pole (L4)	95.4
							RATING =	95.4
								Pass

APPENDIX B
BASE LEVEL DRAWING



(INSTALLED)
(18) 1-5/8" TO 129 FT LEVEL

(PROPOSED)
(1) 1/2" TO 138 FT LEVEL
(2) 1-1/4" TO 138 FT LEVEL

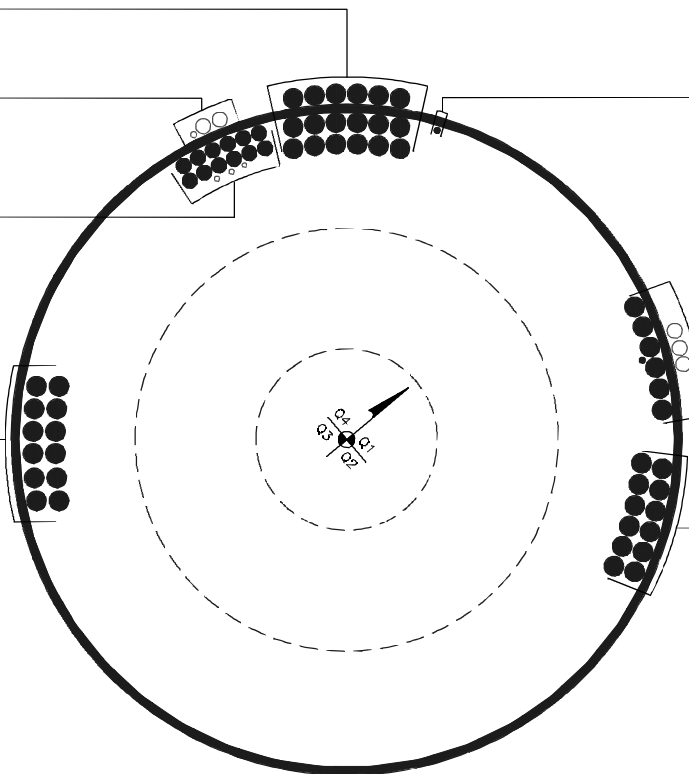
(RESERVED)
(2) 7/16" TO 138 FT LEVEL
(1) 3/8" TO 138 FT LEVEL
(INSTALLED)
(12) 1-1/4" TO 138 FT LEVEL

(INSTALLED)
(12) 1-5/8" TO 119 FT LEVEL

(INSTALLED)
(1) 1/2" TO 137 FT LEVEL

(RESERVED)
(3) 1-1/4" TO 104 FT LEVEL
(INSTALLED)
(6) 1-5/8" TO 104 FT LEVEL
(INSTALLED)
(1) 1/2" TO 70 FT LEVEL

(INSTALLED)
(12) 1-5/8" TO 87 FT LEVEL



APPENDIX C

ADDITIONAL CALCULATIONS

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

Site Data

BU#: 876380
Site Name: O&G Woodbury
App #:

Pole Manufacturer: Other

Bolt Data

Qty:	24	Bolt Fu:	120
Diameter (in.):	1	Bolt Fy:	92
Bolt Material:	A325	Bolt Fty:	44.00
N/A:	75	<-- Disregard	
N/A:	55	<-- Disregard	
Circle (in.):	28		

Plate Data

Diam:	31	in
Thick, t:	1.5	in
Grade (Fy):	60	ksi
Strength, Fu:	75	ksi
Single-Rod B-eff:	3.24	in

Stiffener Data (Welding at Both Sides)

Config:	0	*
Weld Type:	Fillet	
Groove Depth:	0.25	<-- Disregard
Groove Angle:	45	<-- Disregard
Fillet H. Weld:	0.25	in
Fillet V. Weld:	0.25	in
Width:	3	in
Height:	8	in
Thick:	0.5	in
Notch:	0.375	in
Grade:	36	ksi
Weld str.:	70	ksi

Pole Data

Diam:	24.5	in
Thick:	0.1875	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	
-------	-------	--

Reactions

Moment:	288.89	ft-kips
Axial:	6.79	kips
Shear:	14.11	kips
Elevation:	108.5	feet

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

Flange Bolt Results

Bolt Tension Capacity, B: 46.07 kips
Max Bolt directly applied T: 20.35 Kips
Min. PL "tc" for B cap. w/o Pry: 1.340 in
Min PL "treq" for actual T w/ Pry: 0.690 in
Min PL "t1" for actual T w/o Pry: 0.891 in
T allowable w/o Prying: 46.07 kips
Prying Force, Q: 0.00 kips
Total Bolt Tension=T+Q: 20.35 kips
Non-Prying Bolt Stress Ratio, T/B: 44.2% Pass

Rigid
Service, ASD
Fty*ASIF

Exterior Flange Plate Results

Flexural Check
Compression Side Plate Stress: 18.5 ksi
Allowable Plate Stress: 60.0 ksi
Compression Plate Stress Ratio: 30.9% Pass

Rigid
Service ASD
0.75*Fy*ASIF
Comp. Y.L. Length:
13.56

No Prying

Tension Side Stress Ratio, (treq/t)^2: 21.1% Pass

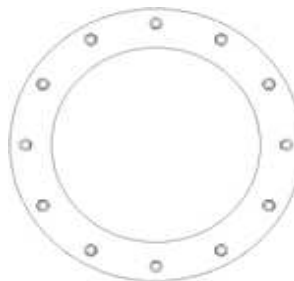
n/a

Stiffener Results

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

Pole Results

Pole Punching Shear Check: n/a



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

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



FDH Engineering, Inc., 6521 Meridian Dr. Raleigh, NC 27616, Ph. 919.755.1012, Fax 919.755.1031

Anchor Rod Design

Site Name:	O&G Woodbury
Job No. :	876380
Elevation:	0
	Input Cells in Blue

*Note: Use Anchor Rod Transfer Plate Design Spreadsheet in Conjunction

Code (F or G):	F	Pull Down
Anchor Bolts (Yes or No)	Yes	Pull Down
P (from RISA)	33	kips
V (from RISA)	28	kips
M (from RISA)	2815	ft-kips

Existing Rods		
y	32	in
No. Bolts	12	
BC	64	in
I	24453.12	in ⁴
Bolt Grade	A615-75	Pull Down
Thread Form	Non-Upset	-
d (in)	2.25	Pull Down
Ag	3.98	in ²
Ae	3.25	in ²
Fy	75	ksi
Fu	100	ksi

New Rods		
y new	32	in
No. Bolts new	4	
BC new	64	in
I new	8,151	in ⁴
Bolt Grade	A193 B7	Pull Down
Thread Form	Non-Upset	Pull Down
d new (in)	2.25	Pull Down
Ag new	3.98	in ²
Ae new	3.25	in ²
Fy new	105	ksi
Fu new	125	ksi

Req'd Embedment Length for New Rods		
f'c, caisson's concrete strength	4000	psi
fy, rebar yield strength	60000	psi
db, diameter of vertical rebar	1	in
vertical rebar cage BC ø	73	in
vertical rebar top cover distance	3	in
τ, Ultimate Hilti Bond Resistance	2.2	ksi

Note For New Anchor Rods:	
Williams Bars (Upset)	
A722 (Fy=127.7 ksi, Fu=150 ksi)	
A615-75 (Fy=75 ksi, Fu=100 ksi)	

Itot	32604.16	in ⁴
T	129.890625	kips
V	1.75	kips

Tnew	129.890625	kips
Vnew	1.75	kips

% Capacity			
Tn/Q	194.5	kips	OK
Tn/Q, new	218.9	kips	OK
øTn	260	kips	
øTn, new	325	kips	

ld (vertical rebar dev. Length)	47.4342	in
ldH (Hilti dev. length)	62.6974	in
G/1.5	3.0000	in

Total Embed. Length of New Bolts	69.11	in
	5.76	ft

Equations:

$$T = (M \cdot y \cdot Ag) / (I_{tot} \cdot P \cdot (Ag / A_{total}))$$

$$Tn/Q = 0.33 \cdot Fu \cdot Ag \cdot (4/3)$$

$$\phi Tn = 0.8 \cdot Fu \cdot Ae \text{ (anchor bolts only)}$$

$$\phi Tn = 0.75 \cdot Fu \cdot Ae \text{ (non anchor bolts)}$$

$$I = (No. Bolts/8) \cdot BC^2 \cdot Ag$$

$$ld = [(fy \cdot \psi_s \cdot \psi_e \cdot \lambda) / (20 \cdot \sqrt{f'c})] \cdot db \quad \text{PER ACI 12.2.2}$$

$$ldH = (\phi Tn \cdot FS) / (\tau \cdot pl \cdot d_{new})$$

See Worksheet "New (Design Procedure)" for diagram

Notes:

*Ag and Ae are taken from AISC 13th Ed. Manual (pg. 7-83)

*I calc. will only work for symmetric bolt group, otherwise use CAD

Interaction Equation Checks per Rev. G: See section 4.9.9

(works for Rev F also)

Detail Type (see sheet 2)	c	Pull Down (see sheet 2 for Detail Type)
η	0.55	
ldH, for Detail Type d only	2.25	in (length from top of concrete to bottom of leveling nut)

øRnt	194.5	kips
øRnv	119.4	kips
øRnm	94.921875	kip-in
Mu	2.559375	kip-in

(Pu+Vu/η)/øRnt	0.684177086	<1?	OK
----------------	-------------	-----	----

(Vu/øRnv) ² + ((Pu/øRnt)+(Mu/øRnm)) ²	NA	(only applicable for Detail Type d)
---	----	-------------------------------------

Bearing Strength Check of Anchor Rod Pipe Sleeve		
New Anchor Rod Diameter	2.25	in
Selected Pipe Sleeve Area		in ²
Selected Pipe Sleeve Fy		ksi
Rn/Q (Rev F) or øRn (Rev G)	0.00	k
% Capacity	#DIV/0!	No Good

a
b
c
d

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

TIA Rev F

Site Data

BU#:	876380
Site Name:	O&G Woodbury
App#:	
Pole Manufacturer:	Other

Anchor Rod Data

*Qty:	24	
Diam:	2.25	in
Rod Material:	A615-J	
Strength (Fu):	100	ksi
Yield (Fy):	75	ksi
Bolt Circle:	64	in

Plate Data

Diam:	70	in
Thick:	1.5	in
Grade:	60	ksi
Single-Rod B-eff:	7.34	in

Stiffener Data (Welding at both sides)

Config:	1	*
Weld Type:	Fillet	
Groove Depth:	0.25	<-- Disregard
Groove Angle:	45	<-- Disregard
Fillet H. Weld:	0.375	in
Fillet V. Weld:	0.25	in
Width:	7	in
Height:	16	in
Thick:	0.5	in
Notch:	0.75	in
Grade:	50	ksi
Weld str.:	70	ksi

Pole Data

Diam:	55.5	in
Thick:	0.3125	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	
-------	-------	--

Reactions

*Moment:	4200	ft-kips
Axial:	33	kips
Shear:	28	kips

*Anchor Rod quantity and Moment are modified due to consideration of modifications.

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

Anchor Rod Results

Maximum Rod Tension:	129.9 Kips
Allowable Tension:	195.0 Kips
Anchor Rod Stress Ratio:	66.6% Pass

Stiffened

Service, ASD
Fty*ASIF

Base Plate Results

Base Plate Stress:	57.3 ksi
Allowable Plate Stress:	60.0 ksi
Base Plate Stress Ratio:	95.6% Pass

Flexural Check

Stiffened

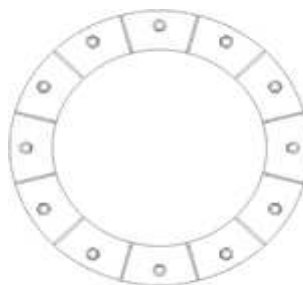
Service, ASD
0.75*Fy*ASIF
Y.L. Length:
N/A, Roark

Stiffener Results

Horizontal Weld :	98.2% Pass
Vertical Weld:	69.1% Pass
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	37.2% Pass
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	82.5% Pass
Plate Comp. (AISC Bracket):	94.2% Pass

Pole Results

Pole Punching Shear Check:	18.0% Pass
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* 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

(Bearing and Stability Checks) Tool for TIA Rev F or G - Application (MP, SST with unitbase)**Site Data**

BU#: 876380
Site Name: O&G Woodbury
App #:

Enter Load Factors Below:

For P (DL)	1.2	<---- Enter Factor
For P,V, and M (WL)	1.35	<---- Enter Factor

Pad & Pier Data

Base PL Dist. Above Pier:	0	in
Pier Dist. Above Grade:	12	in
Pad Bearing Depth, D:	6.5	ft
Pad Thickness, T:	3	ft
Pad Width=Length, L:	23	ft
Pier Cross Section Shape:	Square	<--Pull Down
Enter Pier Side Width:	7	ft
Concrete Density:	150.0	pcf
Pier Cross Section Area:	49.00	ft^2
Pier Height:	4.50	ft
Soil (above pad) Height:	3.50	ft

Soil Parameters

Unit Weight, γ :	125.0	pcf
Ultimate Bearing Capacity, q_n :	12.00	ksf
Strength Reduct. factor, ϕ :	0.75	
Angle of Friction, Φ :	34.0	degrees
Undrained Shear Strength, C_u :	0.00	ksf
Allowable Bearing: $\phi*q_n$:	9.00	ksf
Passive Pres. Coeff., K_p :	3.54	

Forces/Moments due to Wind and Lateral Soil

Minimum of (ϕ *Ultimate Pad Passive Force, V_u):	37.8	kips
Pad Force Location Above D:	1.35	ft
ϕ (Passive Pressure Moment):	51.03	ft-kips
Factored O.T. M(WL), "1.6W":	4083.8	ft-kips
Factored OT (MW-Msoil), M1	4032.72	ft-kips

Resistance due to Foundation Gravity

Soil Wedge Projection grade, a:	2.36	ft
Sum of Soil Wedges Wt:	29.67	kips
Soil Wedges ecc, K1:	7.60	ft
Ftg+Soil above Pad wt:	481.1	kips
Unfactored (Total ftg-soil Wt):	510.79	kips
1.2D. No Soil Wedges.	616.95	kips
0.9D. With Soil Wedges	489.41	kips

Resistance due to Cohesion (Vertical)

$\phi*(1/2*C_u)$ (Total Vert. Planes)	0.00	kips
Cohesion Force Eccentricity, K2	0.00	ft

Monopole Base Reaction Forces

TIA Revision:	F	<--Pull Down
Unfactored DL Axial, PD:	33	kips
Unfactored WL Axial, PW:	0	kips
Unfactored WL Shear, V:	28	kips
Unfactored WL Moment, M:	2815	ft-kips

Load Factor**Shaft Factored Loads**

1.20	1.2D+1.6W, Pu:	39.6	kips
0.90	0.9D+1.6W, Pu:	29.7	kips
1.35	Vu:	37.8	kips
	Mu:	3800.25	ft-kips

1.2D+1.6W Load Combination, Bearing Results:

(No Soil Wedges) [Reaction+Conc+Soil]	616.95	P1="1.2D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil), M1	4032.72	ft-kips

Orthogonal Direction:

$$\begin{aligned} \text{ecc1} = M1/P1 &= 6.54 \text{ ft} \\ \text{Orthogonal } q_u &= 2.70 \text{ ksf} \\ q_u/\phi*q_n \text{ Ratio} &= \mathbf{30.02\%} \quad \mathbf{Pass} \end{aligned}$$

Diagonal Direction:

$$\begin{aligned} \text{ecc2} = (0.707M1)/P1 &= 4.62 \text{ ft} \\ \text{Diagonal } q_u &= 3.26 \text{ ksf} \\ q_u/\phi*q_n \text{ Ratio} &= \mathbf{36.22\%} \quad \mathbf{Pass} \end{aligned}$$

Run

<-- Press Upon Completing All Input

Overturning Stability Check**0.9D+1.6W Load Combination, Bearing Results:**

(w/ Soil Wedges) [Reaction+Conc+Soil]	489.41	P2="0.9D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil) - 0.9(M of Wedge + M of Cohesion), M2	3829.79	ft-kips

$$\begin{aligned} \text{Orthogonal ecc3} = M2/P2 &= 7.83 \text{ ft} \\ \text{Ortho Non Bearing Length, NBL} &= 15.65 \text{ ft} \\ \text{Orthogonal } q_u &= 2.90 \text{ ksf} \\ \text{Diagonal } q_u &= 3.44 \text{ ksf} \end{aligned}$$

Max Reaction Moment (ft-kips) so that $q_u = \phi*q_n = 100\%$ Capacity Rating

Actual M:	2815.00		
M Orthogonal:	3727.14	75.53%	Pass
M Diagonal:	3727.14	75.53%	Pass

ATTACHMENT 4



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 $\pm 1.5\%$ 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

Model	Alternator	Voltage	Ph	Hz	Standby Ratings *			
					Natural Gas		LP Gas	
					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, m³/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 ₂ O)	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/m³ (Btu/ft³), 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 ₂ O)	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/m³ 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

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

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

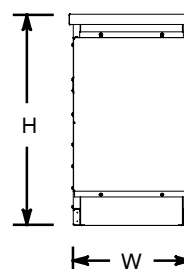
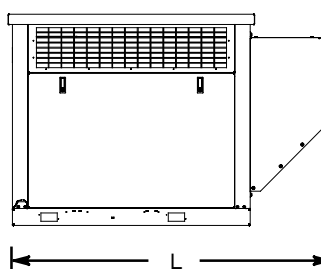
With Weather Enclosure and Sound Kit

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)



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

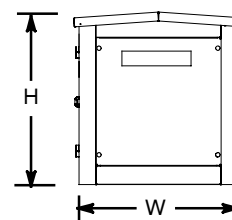
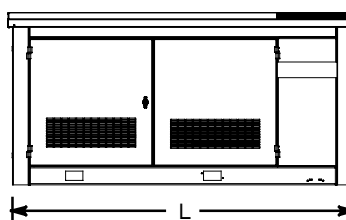
With Sound Enclosure

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
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Auburn, NH 03032
(603) 644-2800
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Calculated Radio Frequency Emissions



**Northeast
Utilities**

Woodbury

Great Hollow Road, Woodbury, CT 06798

May 28, 2013

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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 off Great Hollow Road in Woodbury, CT. The coordinates of the tower are 41° 31' 19.2" N, 73° 13' 15.6" 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/cm²). The general population exposure limits for the various frequency ranges are defined in the attached "FCC Limits for Maximum Permissible Exposure (MPE)" in Attachment B of this report.

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

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

3. RF Exposure Prediction Methods

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

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

Where:

EIRP = Effective Isotropic Radiated Power

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

H = Horizontal Distance from antenna in meters

V = Vertical Distance from radiation center of antenna in meters

Ground reflection factor of 1.6

Off Beam Loss is determined by the selected antenna pattern

These calculations assume that the antennas are operating at 100 percent capacity and power, and that all channels are transmitting simultaneously. Obstructions (trees, buildings, etc.) that would normally attenuate the signal are not taken into account. The calculations assume even terrain in the area of study and do not take into account actual terrain elevations which could attenuate the signal. As a result, the predicted signal levels reported below are much higher than the actual signal levels will be from the finished 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 that 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 CDMA/LTE	110	1962.5	2	778	0.0462	1.0000	4.62%
Sprint CDMA/LTE	110	850	1	438	0.0130	0.5667	2.30%
AT&T UMTS	139	880	2	565	0.0210	0.5867	3.58%
AT&T UMTS	139	1900	2	875	0.0326	1.0000	3.26%
AT&T GSM	139	880	1	283	0.0053	0.5867	0.90%
AT&T GSM	139	1900	4	525	0.0391	1.0000	3.91%
AT&T LTE	139	734	1	1313	0.0244	0.4893	4.99%
Verizon PCS	129	1970	7	256	0.0387	1.0000	3.87%
Verizon Cellular	129	869	9	261	0.0508	0.5793	8.76%
Verizon AWS	129	2145	1	621	0.0134	1.0000	1.34%
Verizon LTE	129	698	1	852	0.0184	0.4653	3.96%
Nextel	120	851	12	100	0.0300	0.5673	5.28%
T-Mobile	90	1935	8	126	0.0447	1.0000	4.47%
Northeast Utilities	148	938	2	240	0.0008	0.6253	0.13%
						Total	51.37%

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 FDH Engineering, Inc. Structural Analysis dated May 23, 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 with 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 **51.37% 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 28, 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 Exposure³

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 Exposure⁴

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

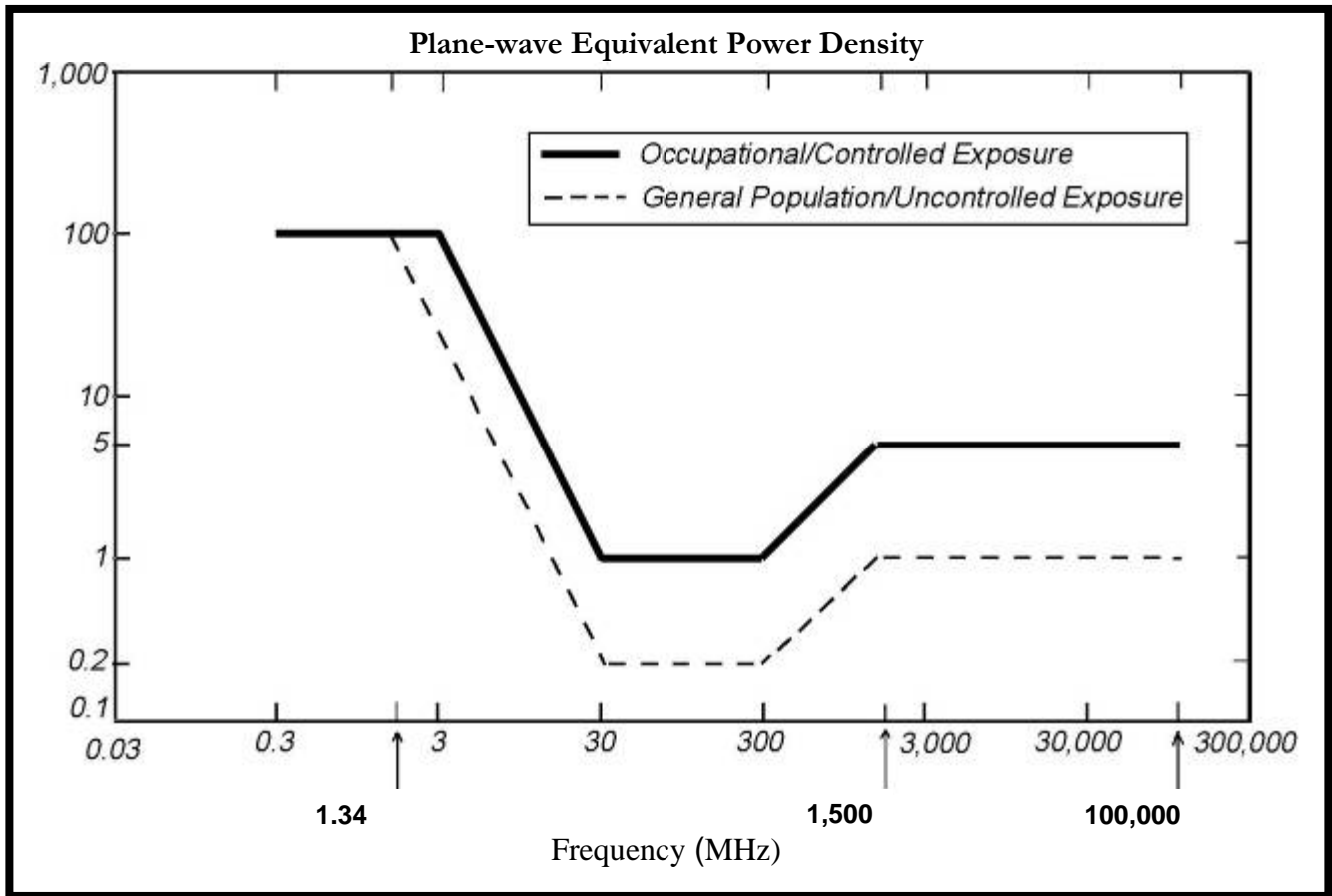


Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

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"

