STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

| | | |
|---|---|---|
| IN RE: | : | |
| | : | |
| A SUB-PETITION OF CELLCO | : | SUB-PETITION NO. 1133 |
| PARTNERSHIP D/B/A VERIZON WIRELESS | : | 15 ORCHARD PARK ROAD |
| FOR THE SHARED USE OF AN EXISTING | : | MADISON, CT |
| WIRELESS TELECOMMUNICATIONS | : | |
| FACILITY AT 15 ORCHARD PARK ROAD, | : | |
| MADISON, CONNECTICUT | : | JUNE 15, 2016 |

SUB-PETITION FOR DECLARATORY RULING:
ELIGIBLE FACILITIES REQUEST FOR MODIFICATIONS
THAT WILL NOT SUBSTANTIALLY CHANGE THE
PHYSICAL DIMENSIONS OF AN EXISTING BASE STATION

## I. Introduction

Pursuant to Section 6409(a) of the Middle Class Tax Relief and Job Creation Act of 2012, codified at 47 U.S.C. § 1455(a) ("Section 6409(a)") and the October 21, 2014 Report and Order (FCC-14-153) issued by the Federal Communications Commission ("FCC") (the "FCC Order"), Cellco Partnership d/b/a Verizon Wireless ("Cellco") hereby petitions the Connecticut Siting Council (the "Council") for a declaratory ruling ("Sub-Petition") that the installation of antennas and related telecommunications equipment at the existing wireless telecommunications base station at 15 Orchard Park Road in Madison, Connecticut (the "Property") constitutes an Eligible Facilities Request ("EFR") under the FCC Order. Cellco has designated this site as its "Madison 5 Facility".

## II. Factual Background

The Property is a 3.51-acre parcel zoned LI industrial and occupied by a self-storage facility. The Property is surrounded by commercial and industrial uses in the Orchard Park Commercial-Industrial Complex. *See* Attachment 1 – Site Vicinity Map and Site Schematic

(Aerial Photograph). On March 26, 2010, in Docket No. 390, the Council approved T-Mobile's request to construct the existing 98-foot tower at the Property. The tower currently supports T-Mobile antennas at the 96-foot and 95-foot levels and AT&T antennas at the 90-foot level. Equipment associated with the T-Mobile and AT&T antennas is located on the ground near the base of the tower within a fenced compound.

III. Cellco's Proposed Madison 5 Facility

Cellco is licensed to provide wireless telecommunications services in the 850 MHz, 1900 MHz, 700 MHz and 2100 MHz frequency ranges in Madison and throughout the State of Connecticut. The proposed Madison 5 Facility described in this filing will provide wireless service in Cellco's 700, 1900 and 2100 MHz frequency ranges and is designed to provide coverage and capacity relief to Cellco's existing network in southerly portions of Madison.

Cellco intends to install twelve (12) antennas and nine (9) remote radio heads ("RRHs") on a low-profile platform at the 76-foot level on the tower. Cellco will also install three equipment cabinets and a natural gas-fueled back-up generator on a 12' x 24' equipment platform with canopy roof within the limits of the existing fenced compound. Power and telephone service will extend from the existing utility backboard. Project Plans for the Madison 5 Facility are included in Attachment 2. Specifications for Cellco's antennas, RRHs, equipment cabinets and backup generator are included in Attachment 3. A Structural Analysis Report confirming that the tower can support Cellco's antennas and related equipment is included in Attachment 4.

IV. Discussion

A. The Proposed Modification Will Not Cause a Substantial Change to the Physical Dimensions of the Existing Tower and Base Station

Section 6409(a) provides, in relevant part, that "a State or local government may not

deny, and shall approve, any eligible facilities request for a modification of an existing wireless tower or base station that does not substantially change the physical dimensions of such tower or base station." Pursuant to the FCC Order, the proposed modification does not substantially change the physical dimensions of the base station if the following criteria are satisfied.

1. *The proposed modified facility will not increase the height of the tower by more than ten (10) percent of the height.* Cellco does not intend to increase the height of the existing tower. Cellco's antennas will be located at the 76-foot level on the existing 98-foot tower.

2. *The proposed facility modification will not protrude from the edge of the structure more than six (6) feet.* Cellco's antennas will not protrude more than six (6) feet from the face of the tower and will be installed on a low-profile antenna platform.

3. *The proposed facility does not involve installation of more than the standard number of new equipment cabinets for the technology involved, but not to exceed four cabinets.* Cellco intends to install three equipment cabinets on a equipment platform with a canopy roof, all within the existing fenced compound.

4. *The proposed facility does not entail any excavation or deployment outside the current site of the base station.* Cellco's proposed modification will remain within the limits of the existing fenced compound.

5. *The proposed facility does not defeat the existing concealment elements of the base station.* There are no concealment elements incorporated into the existing base station.

6. *The proposed facility complies with conditions associated with the prior approval of construction or modification of the base station.* The tower was approved by the Council in Docket No. 390. Cellco's proposed shared use of the existing facility is consistent

with the Council's Decision and Order.

B. FCC Compliance

Included in Attachment 5 is a cumulative worst-case General Power Density table for the existing and Cellco's proposed antennas confirming that the facility will continue to operate within the FCC safety standards for radio frequency emissions.

C. Notice to the Town, Property Owner and Abutting Landowners

On June 15, 2016, a copy of this Sub-Petition was sent to Madison's First Selectman, Thomas Banish; 15 Orchard Park Road LLC, the owner of the Property; and American Tower Corporation ("ATC"), the tower owner. Copies of the letter sent to Mr. Banish, 15 Orchard Park Road LLC and ATC are included in Attachment 6. A copy of this Sub-Petition was also sent to the owners of land that abuts the Property. A sample abutter's cover letter and the list of those abutting landowners who were sent notice of this filing is included in Attachment 7.

V. Conclusion

Based on the information provided above, Cellco respectfully submits that the proposed modification of the existing base station at the Property constitutes an "eligible facilities request" under Section 6409(a) and the FCC Order.

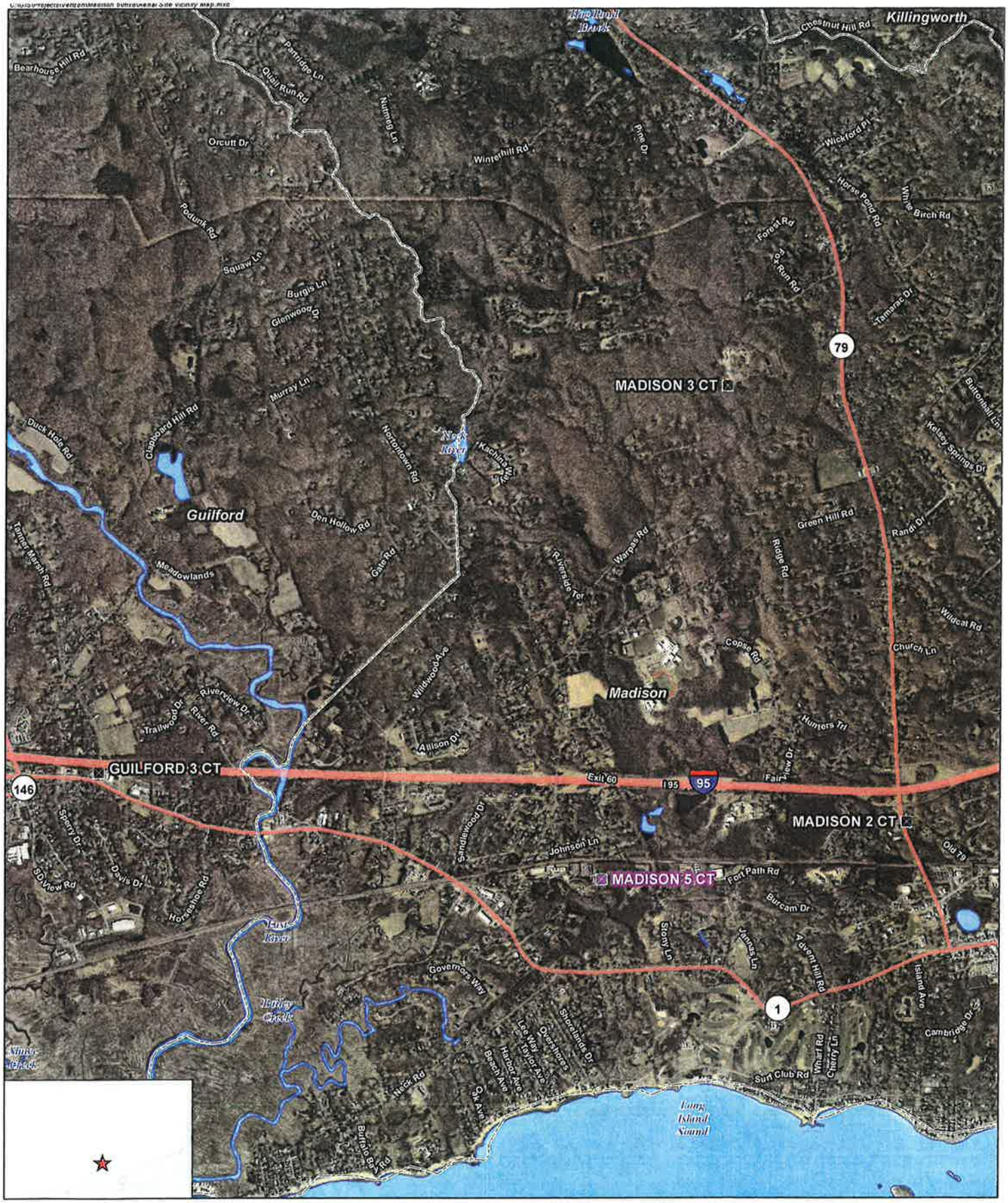
Respectfully submitted,

CELLCO PARTNERSHIP d/b/a VERIZON WIRELESS

By _____

Kenneth C. Baldwin, Esq.
Robinson & Cole LLP
280 Trumbull Street
Hartford, CT 06103-3597
(860) 275-8200
Its Attorneys

# ATTACHMENT 1




***Legend***

- Proposed Verizon Wireless Facility
- Surrounding Verizon Wireless Facilities
- Municipal Boundary
- Waterbody

**Site Vicinity Map**

Proposed Wireless Telecommunications Facility
Madison 5 CT
15 Orchard Park Road
Madison, Connecticut

verizon

*Base Map Source: 2012 Aerial Photograph (CTECO)*
*Map Scale:* 1 inch = 2,500 feet
*Map Date: May 2016*

2,500 1,250 0 2,500 Feet

ALL-POINTS TECHNOLOGY CORPORATION


***Legend***

- Approximate Subject Property
- Approximate Parcel Boundary (CTDEEP GIS)
- Existing 32'x45' Equipment Compound (by others)
- Proposed Lease Area for Equipment
- Wetland Flag
- Wetland Boundary
- Wetland Area

N W E S

200 100 0 200 Feet

*Map Notes:*
*Base Map Source: 2012 Aerial Photograph (CTECO)*
*Map Scale: 1 inch = 200 feet*

**Site Schematic**

Proposed Wireless Telecommunications Facility
Madison 5 CT
15 Orchard Park Road
Madison, Connecticut

verizon

ALL-POINTS TECHNOLOGY CORPORATION

# ATTACHMENT 2

# verizon

## *WIRELESS COMMUNICATIONS FACILITY*

# MADISON 5 CT
# 15 ORCHARD PARK ROAD
# MADISON, CT 06443

## SITE DIRECTIONS

**FROM:** 99 EAST RIVER DRIVE, EAST HARTFORD, CONNECTICUT **TO:** 15 ORCHARD PARK ROAD, MADISON, CONNECTICUT

| | |
|---|---|
| 1. Head South on E River Dr toward Pitkin St | 0.85 mi |
| 2. Stay straight to go onto E River Drive Ext | 0.34 mi |
| 3. Merge onto US-5 S/CT 5 Wilbur Cross Hwy S toward I-91 S/New Haven | 1.05 mi |
| 4. Merge onto I-91 via EXIT 86 toward New Haven/NY City | 8.88 mi |
| 4. Merge onto CT-9 S via EXIT 22S on to left toward Middletown/Old Saybrook | 13.89 mi |
| 5. Take the CT-81 exit, EXIT 9, toward Killingworth/Clinton | 0.24 mi |
| 6. Turn right on Killingworth Rd/CT-81 and proceed through 1 roundabout | 13.08 mi |
| 7. Merge onto I-95 S/Governor John Davis Lodge Tpke S toward New Haven | 4.95 mi |
| 8. Take the Mungertown Road exit, EXIT 60 | 0.20 mi |
| 9. Turn left onto Mungertown Rd | 0.43 mi |
| 10. Take the 3rd left onto Orchard Park Rd | 0.16 mi |

## GENERAL NOTES

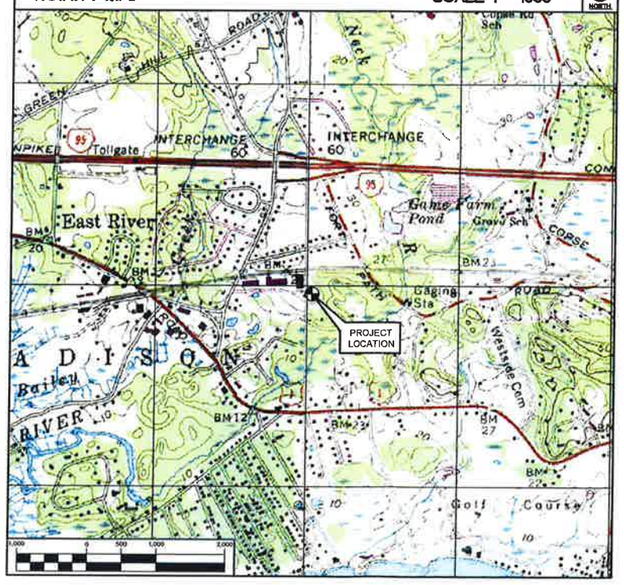
1. PROPOSED ANTENNA LOCATIONS AND HEIGHTS PROVIDED BY CELLCO PARTNERSHIP.

## PROJECT SCOPE

1. PROPOSED CELLCO PARTNERSHIP ANTENNA INSTALLATION TO CONSIST OF A TOTAL OF (12) ANTENNAS AND ASSOCIATED CABLES & APPURTENANCES. PROPOSED GROUND EQUIPMENT TO CONSIST OF PAD MOUNTED EQUIPMENT CABINETS WITH A NATURAL GAS FUELED DC POWER GENERATOR INSTALLED ON A PROPOSED RAISED STEEL PLATFORM WITHIN THE EXISTING FACILITY COMPOUND WITH STAND-ALONE ROOF.
2. POWER, TELCO AND NATURAL GAS UTILITIES DEPICTED HEREIN ARE TENTATIVE. FINAL ROUTING TO BE DETERMINED DURING THE CONSTRUCTION DOCUMENT PHASE OF PROJECT.
3. THE PROPOSED WIRELESS FACILITY INSTALLATION WILL BE DESIGNED IN ACCORDANCE WITH THE 2003 INTERNATIONAL BUILDING CODE AS MODIFIED BY THE 2009 CONNECTICUT SUPPLEMENT.

## VICINITY MAP

SCALE: 1" = 1000'




## PROJECT SUMMARY

| | |
|---|---|
| SITE NAME: | MADISON 5 CT |
| SITE ADDRESS: | 15 ORCHARD PARK ROAD<br>MADISON, CT 06443 |
| PROPERTY OWNER: | ORCHARD PARK RD LLC<br>15 ORCHARD PARK ROAD<br>MADISON, CT 06443 |
| LESSEE/TENANT: | CELLCO PARTNERSHIP<br>d.b.a. VERIZON WIRELESS<br>99 EAST RIVER DRIVE<br>EAST HARTFORD, CT 06108 |
| VERIZON SITE ACQUISITION CONTACT: | DOUGLAS TALMADGE<br>CELLCO PARTNERSHIP<br>(860) 549-6116 |
| LEGAL/REGULATORY COUNSEL: | KENNETH C. BALDWIN, ESQ.<br>ROBINSON & COLE LLP<br>(860) 275-8345 |
| TOWER COORDINATES: | LATITUDE: 41°-16'-59"N<br>LONGITUDE: 72°-37'-27.6"W<br>GROUND ELEVATION: ±40' AMSL<br><br>COORDINATES ARE REF. FROM THE CSC DATABASE & GROUND ELEVATION ARE REF. FROM TERRAIN NAVI. |

## SHEET INDEX

| SHT. NO. | DESCRIPTION | REV. NO. |
|---|---|---|
| T-1 | TITLE SHEET | 1 |
| | | |
| C-1 | ABUTTERS MAP | 1 |
| C-2 | PARTIAL SITE PLAN, ELEVATION AND ANTENNA CONFIG. | 1 |
| | | |
| | | |

| REV. | DATE | DRAWN BY | CHK'D BY | DESCRIPTION |
|---|---|---|---|---|
| 1 | 05/09/16 | KAWJR | DMD | ISSUED FOR CSC |
| 0 | 05/03/16 | KAWJR | DMD | ISSUED FOR CSC - CLIENT REVIEW |

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


Cellco Partnership d/b/a Verizon Wireless

WIRELESS COMMUNICATIONS FACILITY

MADISON 5 CT

15 ORCHARD PARK ROAD

MADISON, CT 06443

DATE: 05/26/16

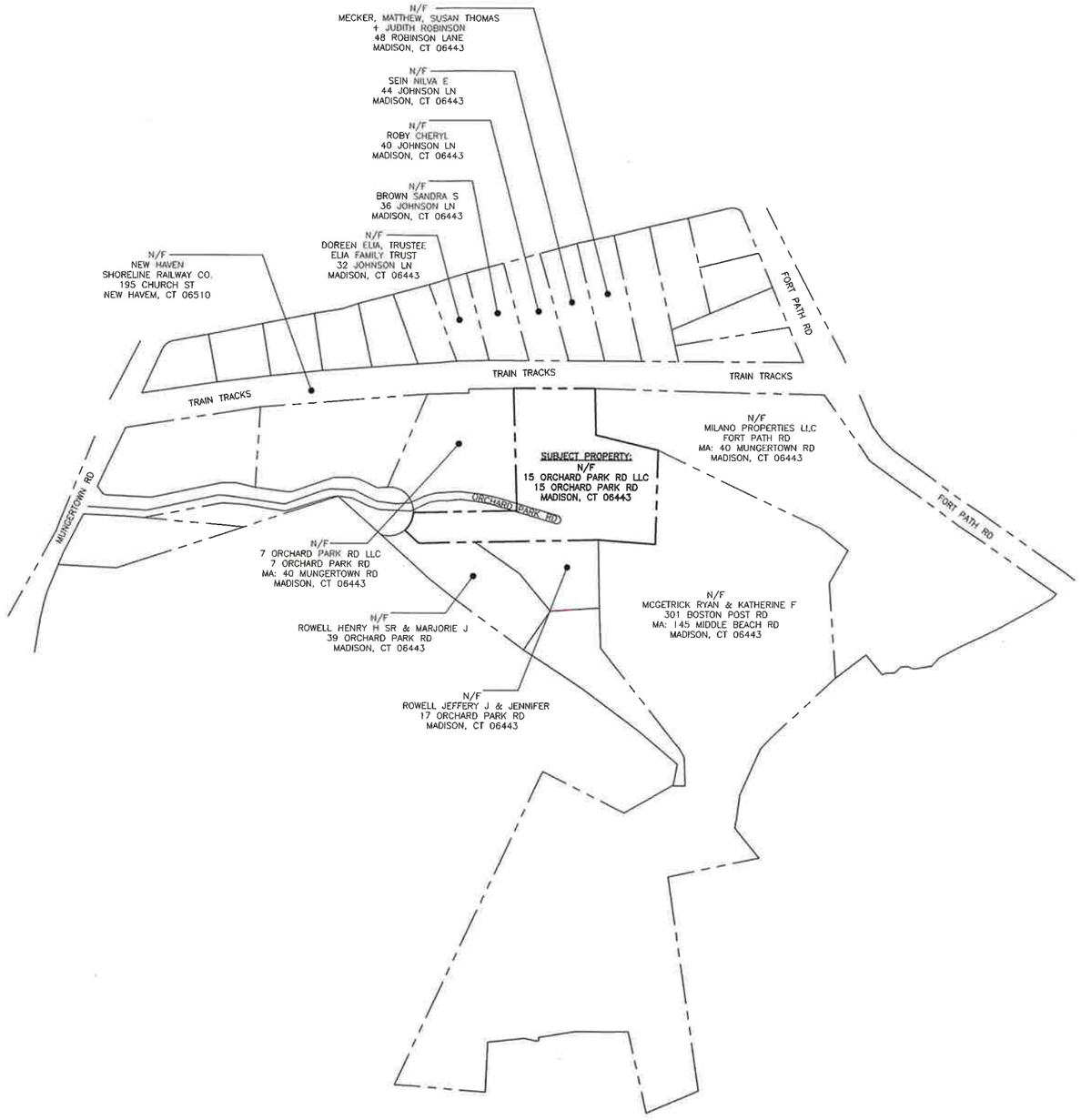
SCALE: AS NOTED

JOB NO. 14231.000

TITLE SHEET

T-1

Sheet No. 1 of 3



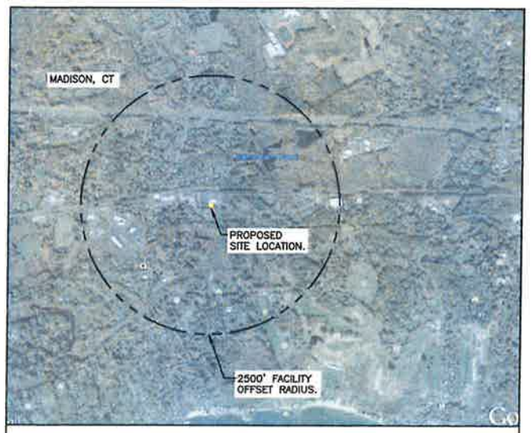

1 / C-1 **ABUTTERS MAP**
SCALE: 1" = 50'

APPROXIMATE NORTH

GRAPHIC SCALE
50 0 25 50 100 200
( IN FEET )
1 inch = 50 ft.

**MAP REFERENCE NOTE:**

PROPERTY LINES AND PROPERTY OWNERSHIP INFORMATION SHOWN HEREIN ARE REFERENCED FROM THE TOWN OF MADISON ON-LINE ASSESSORS MAPPING AND ASSESSORS DATABASE.




**MUNICIPALITY NOTIFICATION LIMIT MAP**

| REV. | DATE | DRAWN BY | CHK'D BY | DESCRIPTION |
|---|---|---|---|---|
| 1 | 06/09/16 | KAMUR | DMD | ISSUED FOR CSC |
| 0 | 06/03/16 | KAMUR | DMD | ISSUED FOR CSC - CLIENT REVIEW |

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Cellco Partnership d/b/a Verizon Wireless
WIRELESS COMMUNICATIONS FACILITY

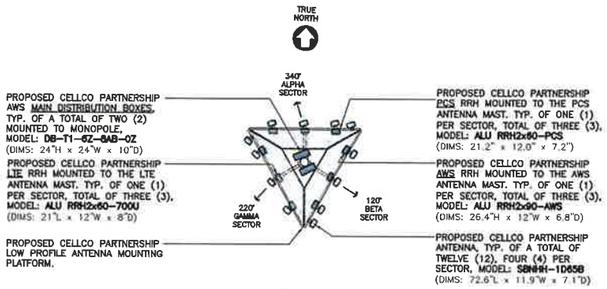
# MADISON 5 CT

15 ORCHARD PARK ROAD
MADISON, CT 06443

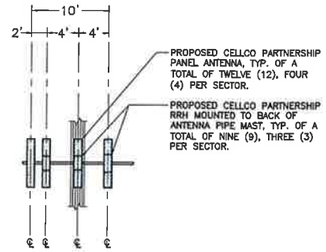
DATE: 05/26/16
SCALE: AS NOTED
JOB NO. 14231.000

ABUTTERS MAP

C-1

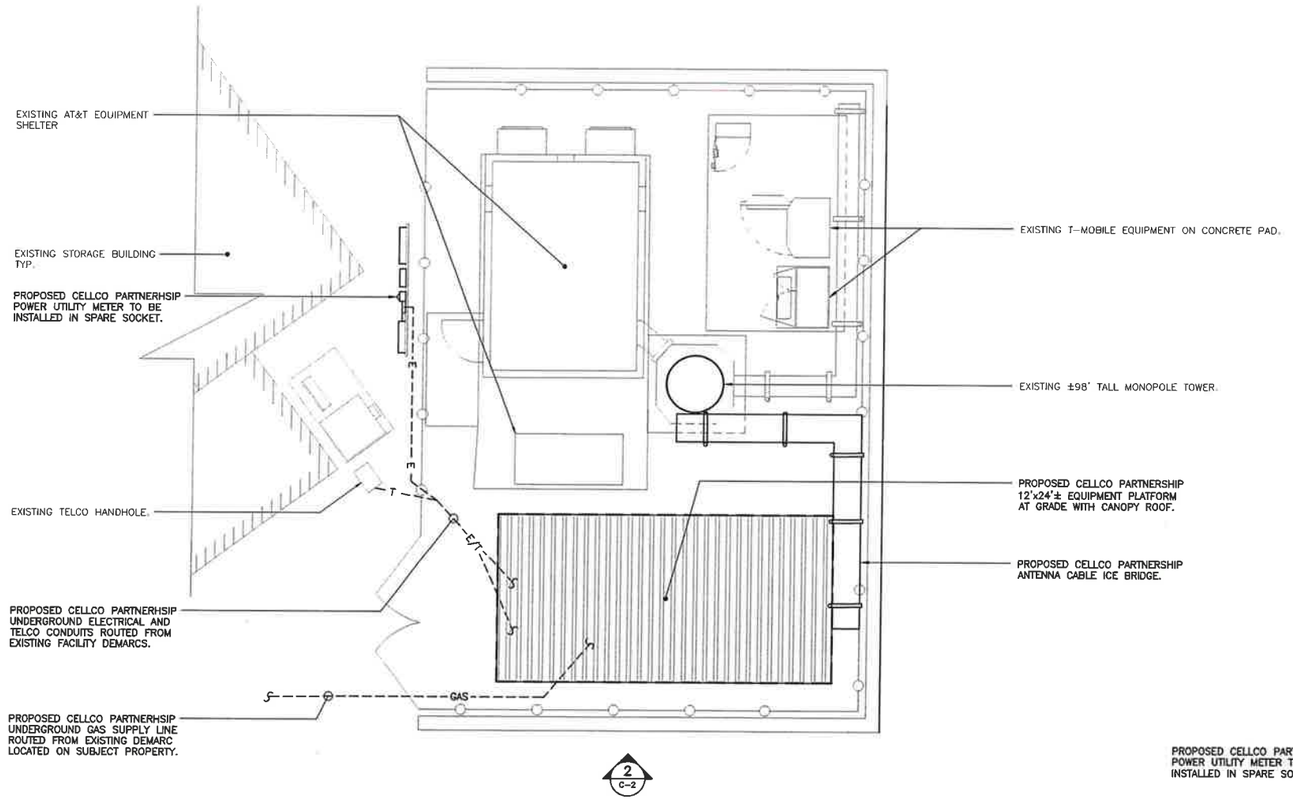



PLAN




ELEVATION

3 / C-2 **ANTENNA MOUNTING CONFIGURATION**
NOT TO SCALE

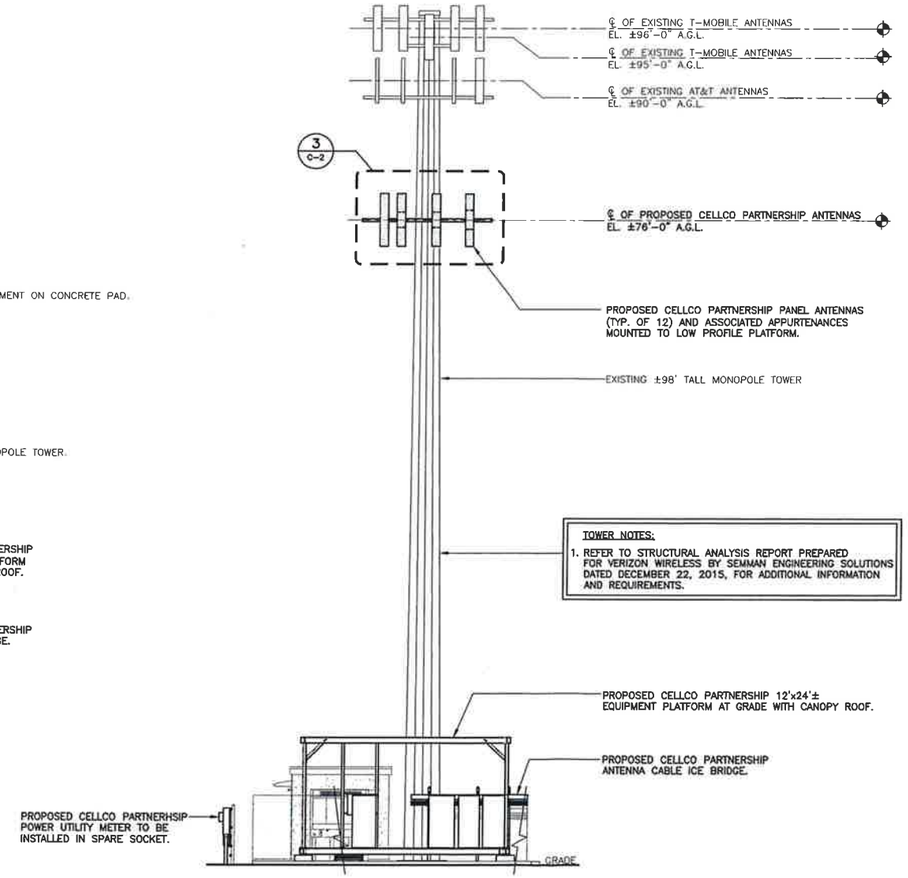



2 / C-2

1 / C-2 **PARTIAL SITE PLAN**
SCALE: 1" = 5'

APPROXIMATE NORTH

GRAPHIC SCALE
( IN FEET )
1 inch = 5 ft




2 / C-2 **SOUTH ELEVATION**
SCALE: 1/8" = 1'-0"

GRAPHIC SCALE
( IN FEET )
1 inch = 8 ft

| REV. | DATE | DRAWN BY | CHK'D BY | DESCRIPTION |
|---|---|---|---|---|
| 1 | 06/09/16 | KJMUR | DMD | ISSUED FOR CSC |
| 0 | 05/09/16 | KJMUR | DMD | ISSUED FOR CSC - CLIENT REVIEW |

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# MADISON 5 CT
15 ORCHARD PARK ROAD
MADISON, CT 06443

DATE: 05/26/16
SCALE: AS NOTED
JOB NO. 14231.000

PARTIAL SITE PLAN, ELEVATION & ANTENNA CONFIG.

C-2
Sheet No. 3 of 3

# ATTACHMENT 3

# Product Specifications

COMMSCOPE®

## SBNHH-1D65B

**Andrew® Tri-band Antenna, 698–896 and 2x 1695–2360 MHz, 65° horizontal beamwidth, internal RET. Both high bands share the same electrical tilt.**

- Interleaved dipole technology providing for attractive, low wind load mechanical package

## Electrical Specifications

| Frequency Band, MHz | 698–806 | 806–896 | 1695–1880 | 1850–1990 | 1920–2200 | 2300–2360 |
|---|---|---|---|---|---|---|
| Gain, dBi | 14.9 | 14.7 | 17.7 | 18.2 | 18.6 | 18.6 |
| Beamwidth, Horizontal, degrees | 68 | 66 | 69 | 66 | 63 | 58 |
| Beamwidth, Vertical, degrees | 12.1 | 10.7 | 5.6 | 5.2 | 5.0 | 4.5 |
| Beam Tilt, degrees | 0–14 | 0–14 | 0–7 | 0–7 | 0–7 | 0–7 |
| USLS (First Lobe), dB | 14 | 13 | 15 | 15 | 15 | 13 |
| Front-to-Back Ratio at 180°, dB | 27 | 29 | 28 | 28 | 28 | 27 |
| CPR at Boresight, dB | 20 | 23 | 20 | 20 | 17 | 21 |
| CPR at Sector, dB | 14 | 10 | 12 | 10 | 9 | 1 |
| Isolation, dB | 25 | 25 | 25 | 25 | 25 | 25 |
| Isolation, Intersystem, dB | 30 | 30 | 30 | 30 | 30 | 30 |
| VSWR \| Return Loss, dB | 1.5 \| 14.0 | 1.5 \| 14.0 | 1.5 \| 14.0 | 1.5 \| 14.0 | 1.5 \| 14.0 | 1.5 \| 14.0 |
| PIM, 3rd Order, 2 x 20 W, dBc | -153 | -153 | -153 | -153 | -153 | -153 |
| Input Power per Port, maximum, watts | 350 | 350 | 350 | 350 | 350 | 300 |
| Polarization | ±45° | ±45° | ±45° | ±45° | ±45° | ±45° |
| Impedance | 50 ohm | 50 ohm | 50 ohm | 50 ohm | 50 ohm | 50 ohm |

## Electrical Specifications, BASTA*

| Frequency Band, MHz | 698–806 | 806–896 | 1695–1880 | 1850–1990 | 1920–2200 | 2300–2360 |
|---|---|---|---|---|---|---|
| Gain by all Beam Tilts, average, dBi | 14.5 | 14.3 | 17.4 | 17.9 | 18.2 | 18.3 |
| Gain by all Beam Tilts Tolerance, dB | ±0.5 | ±0.8 | ±0.4 | ±0.3 | ±0.5 | ±0.3 |
| Gain by Beam Tilt, average, dBi | 0 ° \| 14.6 | 0 ° \| 14.5 | 0 ° \| 17.4 | 0 ° \| 17.8 | 0 ° \| 18.1 | 0 ° \| 18.2 |
| | 7 ° \| 14.6 | 7 ° \| 14.4 | 3 ° \| 17.5 | 3 ° \| 17.9 | 3 ° \| 18.3 | 3 ° \| 18.4 |
| | 14 ° \| 14.2 | 14 ° \| 13.6 | 7 ° \| 17.4 | 7 ° \| 17.9 | 7 ° \| 18.2 | 7 ° \| 18.4 |
| Beamwidth, Horizontal Tolerance, degrees | ±2.2 | ±3.4 | ±2 | ±4.6 | ±5.7 | ±4.3 |
| Beamwidth, Vertical Tolerance, degrees | ±0.8 | ±1 | ±0.3 | ±0.2 | ±0.3 | ±0.2 |
| USLS, beampeak to 20° above beampeak, dB | 16 | 14 | 16 | 16 | 16 | 15 |
| Front-to-Back Total Power at 180° ± 30°, dB | 25 | 26 | 27 | 26 | 26 | 26 |
| CPR at Boresight, dB | 22 | 23 | 21 | 20 | 20 | 22 |
| CPR at Sector, dB | 13 | 11 | 16 | 12 | 11 | 4 |

* CommScope® supports NGMN recommendations on Base Station Antenna Standards (BASTA). To learn more about the benefits of BASTA, download the whitepaper Time to Raise the Bar on BSAs.

## General Specifications

| | |
|---|---|
| Antenna Brand | Andrew® |
| Antenna Type | DualPol® multiband with internal RET |
| Band | Multiband |
| Brand | DualPol® |
| Operating Frequency Band | 1695 – 2360 MHz \| 698 – 896 MHz |
| Performance Note | Outdoor usage |

# Product Specifications

SBNHH-1D65B

## Mechanical Specifications

| | |
|---|---|
| Color | Light gray |
| Lightning Protection | dc Ground |
| Radiator Material | Aluminum \| Low loss circuit board |
| Radome Material | Fiberglass, UV resistant |
| Reflector Material | Aluminum |
| RF Connector Interface | 7-16 DIN Female |
| RF Connector Location | Bottom |
| RF Connector Quantity, total | 6 |
| Wind Loading, frontal | 618.0 N @ 150 km/h<br>138.9 lbf @ 150 km/h |
| Wind Loading, lateral | 197.0 N @ 150 km/h<br>44.3 lbf @ 150 km/h |
| Wind Loading, rear | 728.0 N @ 150 km/h<br>163.7 lbf @ 150 km/h |
| Wind Speed, maximum | 241 km/h \| 150 mph |

## Dimensions

| | |
|---|---|
| Depth | 180.0 mm \| 7.1 in |
| Length | 1851.0 mm \| 72.9 in |
| Width | 301.0 mm \| 11.9 in |
| Net Weight, without mounting kit | 18.4 kg \| 40.6 lb |

## Remote Electrical Tilt (RET) Information

| | |
|---|---|
| Input Voltage | 10–30 Vdc |
| Internal RET | High band (1) \| Low band (1) |
| Power Consumption, idle state, maximum | 2.0 W |
| Power Consumption, normal conditions, maximum | 13.0 W |
| Protocol | 3GPP/AISG 2.0 (Multi-RET) |
| RET Interface | 8-pin DIN Female \| 8-pin DIN Male |
| RET Interface, quantity | 1 female \| 1 male |

## Packed Dimensions

| | |
|---|---|
| Depth | 299.0 mm \| 11.8 in |
| Length | 1970.0 mm \| 77.6 in |
| Width | 409.0 mm \| 16.1 in |
| Shipping Weight | 31.0 kg \| 68.3 lb |

## Regulatory Compliance/Certifications

| Agency | Classification |
|---|---|
| RoHS 2011/65/EU | Compliant by Exemption |
| China RoHS SJ/T 11364-2006 | Above Maximum Concentration Value (MCV) |
| ISO 9001:2008 | Designed, manufactured and/or distributed under this quality management system |

# Product Specifications

SBNHH-1D65B

## Included Products

BSAMNT-1 — Wide Profile Antenna Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Kit contains one scissor top bracket set and one bottom bracket set.

## * Footnotes

| | |
|---|---|
| Performance Note | Severe environmental conditions may degrade optimum performance |

# ALCATEL-LUCENT B13 RRH4X30-4R

Alcatel-Lucent B13 Remote Radio Head 4x30-4R is the newest addition of Remote Radio Head to the extended product line of Alcatel-Lucent's distributed Base Station solutions, aimed at facilitating smooth RF site acquisition and related civil engineering.

**Supporting 2Tx/4Tx MIMO and 4-way Rx diversity**, Alcatel-Lucent B13 RRH4x30-4R allows operators to have a compact radio solution to deploy LTE in the 700U band (700 MHz, 3GPP band 13), providing them with the means to achieve high capacity, high quality and high coverage with minimum site requirements.

The Alcatel-Lucent B13 RRH4x30-4R product has four transmit RF paths, offering the possibility to **select, via software only, 2Tx or 4Tx MIMO configurations** with either 2x60 W or 4x30 W RF output power. It supports also 4-way Rx diversity and up to 10MHz instantaneous bandwidth.

The Alcatel-Lucent B13 RRH4x30-4R is a near zero-footprint solution and operates noise free, simplifying negotiations with site property owners and minimizing environmental impacts.

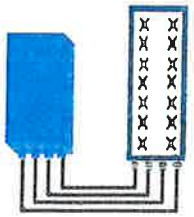
Its compactness and slim design makes the Alcatel-Lucent B13 RRH4x30-4R easy to install close to the antenna: operators can therefore locate this Remote Radio Head where RF design conditions are deemed ideal, minimizing trade-offs between available sites and RF optimum sites, together with reducing the RF feeder needs and installation costs.

## FEATURES

- Supporting LTE in 700 MHz band (700U, 3GPP band 13)
- LTE 2Tx or 4Tx MIMO (SW switchable)
- Output power: Up to 2x60W or 4x30W
- 10MHz LTE carrier with 4Rx Diversity
- Convection-cooled (fan-less)
- Supports AISG 2.0 ALD devices (RET, TMA) through RS485 or RF ports

## BENEFITS

- Compact to reduce additional footprint when adding LTE in 700U band
- MIMO scheme operation selection (2Tx or 4Tx) by software only
- Improves downlink spectral efficiency through MIMO4
- Increases LTE coverage thanks to 4Rx diversity capability and best in class Rx sensitivity
- Flexible mounting options: Pole or Wall



4x30W with 4T4R
or
2x60W with 2T4R

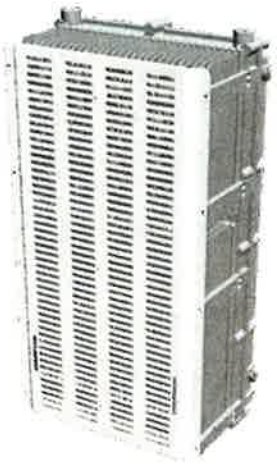
Can be switched between modes via SW w/o site visit

Alcatel·Lucent

| Features & performance | |
|---|---|
| Number of TX/RX paths | 4 duplexed (either 4T4R or 2T4R by SW) |
| Frequency band | U700 (C) (3GPP bands 13):<br>DL: 746 - 756 MHz / UL: 777 - 787 MHz |
| Instantaneous bandwidth - #carriers | 10MHz – 1 LTE carrier (in 10MHz occupied bandwidth) |
| LTE carrier bandwidth | 10 MHz |
| RF output power | 2x60W or 4x30W (by SW) |
| Noise figure – RX Diversity scheme | 2 dB typ. (<2.5 dB max) – 2 or 4 way Rx diversity |
| Sizes (HxWxD) in mm (in.)<br>Volume in L<br>Weight in kg (lb) (w/o mounting HW) | 550 x 305 x 230 (21.6" x 12.0" x 9") (with solar shield)<br>38 (with solar shield)<br>26 (57.2) (with solar shield) |
| DC voltage range<br>DC power consumption | -40.5 to -57V at full performance, -38 to -57V with relaxation on power consumption<br>550W typical @100% RF load ( in 2Tx or 4TX mode) |
| Environmental conditions<br><br>Wind load (@150km/h or 93mph) | -40°C (-40°F) /+55°C (+131°F)<br>IP65<br>Frontal: <200N / Lateral : <150N |
| Antenna ports | 4 ports 7/16 DIN female (50 ohms)<br>VSWR < 1.5 |
| CPRI ports | 2 CPRI ports (HW ready for Rate7, 9.8 Gbps)<br>SFP single mode dual fiber |
| AISG interfaces | 1 AISG2.0 output (RS485)<br>Integrated Smart Bias Tees (x2) |
| Misc. Interfaces | 4 external alarms (1 connector) – 4 RF Tx & 4 RF Rx monitor ports - 1 DC connector (2 pins) |
| Installation conditions | Pole and wall mounting |
| Regulatory compliance | 3GPP 36.141 / 3GPP 36.113 / GR-1089-CORE / GR-3108-CORE / UL 60950-1 / FCC Part 27 |

# ALCATEL-LUCENT B25 RRH4X30

Alcatel-Lucent Band 25 Remote Radio Head 4x30W is the new addition of Remote Radio Head to the extended product line of Alcatel-Lucent's distributed Base Station solutions, aimed at facilitating smooth RF site acquisition and related civil engineering.



**Supporting 2Tx/4Tx MIMO and 4-way Rx diversity**, Alcatel-Lucent B25 RRH4x30 allows operators to have a compact radio solution to deploy LTE in the PCS band (1.9 GHz, 3GPP band 25), providing them with the means to achieve high capacity, high quality and high coverage with minimum site requirements.

The Alcatel-Lucent B25 RRH4x30 product has four transmit RF paths, offering the possibility to **select, via software only, 2Tx or 4Tx MIMO configurations** with either 2x60 W or 4x30 W RF output power. It supports also 4-way Rx diversity, LTE carriers from 3 MHz up to 20 MHz and up to 65 MHz instantaneous bandwidth.

The Alcatel-Lucent B25 RRH4x30 is a near zero-footprint solution and operates noise free, simplifying negotiations with site property owners and minimizing environmental impacts.

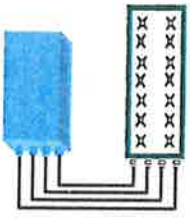
Its compactness and slim design makes the Alcatel-Lucent B25 RRH4x30 easy to install close to the antenna: operators can therefore locate this Remote Radio Head where RF design conditions are deemed ideal, minimizing trade-offs between available sites and RF optimum sites, together with reducing the RF feeder needs and installation costs.

## FEATURES

- Supporting LTE in 1.9 GHz band (PCS, 3GPP band 2 & 25)
- LTE 2Tx or 4Tx MIMO (SW switchable)
- Output power: Up to 2x60W or 4x30W
- Ready for 3, 5, 10, 15 or 20MHz LTE carrier operation with 4Rx Diversity
- Ready to support up to 4 carriers anywhere in 65MHz instantaneous bandwidth
- Convection-cooled (fan-less)
- Supports AISG 2.0 devices (RET, TMA) through RS485 or RF ports

## BENEFITS

- Compact to reduce additional footprint when adding LTE in PCS band
- MIMO scheme operation selection (2Tx or 4Tx) by software only
- Full flexibility for multiple carriers operation over entire PCS spectrum
- Improves downlink spectral efficiency and cell edge throughput through MIMO4
- Increases LTE coverage thanks to 4-way Rx diversity capability and best in class Rx sensitivity
- Flexible mounting options (Pole or Wall)



4x30W with 4T4R
or
2x60W with 2T4R

Can be switched between modes via SW w/o site visit

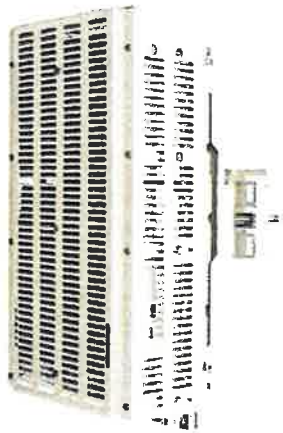
Alcatel·Lucent

| Features & performance | |
|---|---|
| Number of TX/RX paths | 4 duplexed (either 4T4R or 2T4R by SW) |
| Frequency band | 3GPP bands 2 & 25 (PCS-G)<br>DL: 1930 - 1995 MHz<br>UL: 1850 - 1915 MHz |
| Instantaneous bandwidth - #carriers | 65MHz – Up to 4 LTE carriers (in 40MHz occupied bandwidth) |
| LTE carrier bandwidth | 3, 5, 10, 15 or 20 MHz |
| RF output power | 2x60W or 4x30W (by SW) |
| Noise figure (3GPP band 2)<br>RX Diversity scheme | 2.0 dB typ. (<2.5 dB max)<br>2 or 4 way Rx diversity |
| Sizes (HxWxD)(w/ solar shield) in mm (in.)<br>Volume (w/ solar shield) in L<br>Weight (w/ solar shield) in kg (lb) | 538 x 304 x 182 (21.2" x 12.0" x 7.2")<br>30<br>24 (53) |
| DC voltage range<br>DC power consumption | -40.5 to -57V at full performance, -38 to -57V with relaxation on power consumption<br>580W typical @100% RF load |
| Environmental conditions<br><br>Wind load (@150km/h or 93mph) | -40°C (-40°F) /+55°C (+131°F)<br>IP65<br>Frontal:<200N / Lateral :<150N |
| Antenna ports | 4 ports 7/16 DIN female (50 ohms)<br>VSWR < 1.5 (> 14dB) |
| CPRI ports | 2 CPRI ports (HW ready for Rate7 / 9.8 Gbps) |
| AISG interfaces | 1 AISG2.0 output (RS485), +24V/2A DC power<br>Integrated Smart Bias Tees (x2) |
| Misc. Interfaces | 1 external alarms connector (4 alarms)<br>4 RF Tx & 4 RF Rx monitor ports<br>1 DC connector (2 pins) |
| Installation conditions | Pole and wall mounting |
| Regulatory compliance | 3GPP 36.141 / 3GPP 36.113 / GR-1089-CORE / GR-3108-CORE / UL 60950-1 / FCC Part 27 |

# B66A RRH 4X45 - PHYSICAL CHARACTERISTICS- TARGET 15.1

| B4 RRH4x45-4R (AWS-Extension Band) | |
|---|---|
| Frequency Band | LR15.1 – B4 / LR16.1 B66 (AWS 1 and 3 only) |
| RF Output Power | 2x90W/4x45W (SW configurable) |
| Operational range | 2110-2180 MHz, DL/ 1710-1780 MHz UL |
| Instantaneous Bandwidth | 70MHz |
| Configuration (HW readiness) | LTE: 2T2R, 2T4R, 4T4R |
| Carrier Bandwidths | 5, 10, 15 and 20 MHz |
| Interfaces | 2x CPRI Rate 7 Ports<br>Antenna Connectors 4.3-10 |
| AISG Support | AISG 2.0 for RET<br>Internal Smart Bias T |
| Monitor Ports | NA (Spec An to replace ports) |
| Environmental | GR487 Compliance / GR3178 Compliance (with exceptions) |
| Mounting options | Pole/Wall |
| Connectors location | All bottom |
| External Alarms | 4 |
| Annual Return Rate (Target) | <2% |
| Operating Temperature | -40 C to +55 C (without solar load) |

- Commercial Product Will include B66 support of AWS 1 and 3.
- Lower AWS 3 UL Not in 3GPP Band 66 Definition



| Physical Dimensions – Not to Exceed | | |
|---|---|---|
| | W/O Solar Shield | With Solar Shield |
| Dimensions HxWxD | H = 26in (H=660mm)<br>W = 11.4in (W=290mm)<br>D = 5.9in (D=150mm) | H = 26.6in (H=675mm)<br>W = 12in (W=304mm)<br>D = 6.8n (D=173mm) |
| Volume | 29l | 35.5l |
| Weight | | 64lbs / 29kg |

POLAR POWER INC.

"Fuel Powered Fully Automatic Battery Charger"

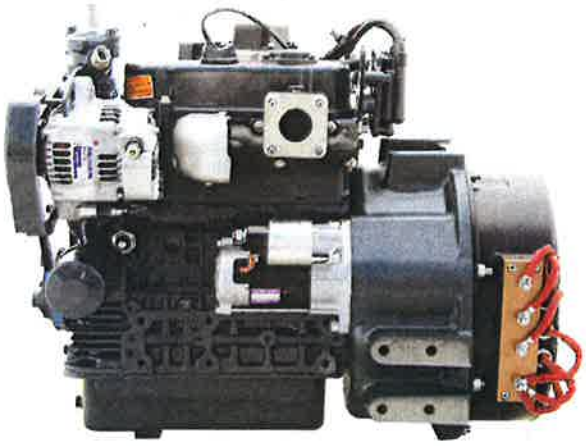
# 8220K-972
## Prime Power 10kW DC Generator

**The Most Efficient Means to Charge Batteries and Power Loads using Propane (LPG) or Natural Gas**

Telecommunications
Conventional Hybrid Power
Solar Hybrid Power
Rapid Electric Vehicle charging
Hybrid Electric Vehicle Series Drive
Oil Field

### Features

- Maximum continuous output is 10 kW at 2600 RPM
- Lower engine speed options available
- Variable speed with a typical 500 RPM span from full load to no load
- Available in all voltages from 24 to 500 Vdc
- 3 cylinder water cooled engine - quiet/low vibration
- Engine operational life is 30,000 to 40,000 hours based on selected engine RPM and load
- Temperature compensated battery charging
- Oil change at 200 hours standard with up to a 3,000 hour option
- Alternator exceeding 85% efficiency



Polar Power
249 E. Gardena Blvd
Carson, CA 90248 USA
Tel: (310) 830 - 9153
Fax: (310) 830 - 9825

POLAR POWER INC.

# 8220K-972
## 10 kW DC Generator

Why choose our prime power generator over a backup generator - for higher reliability with lower maintenance and operational cost. Small backup generators require oil maintenance as frequent as an 8 hour level check and 100 oil change. You never know when the generator will be called upon to run longer than the oil maintenance period. This is particularly true for Solar Hybrid.

## Description

Combining our lightweight 8220 alternator with the heavy duty Kubota 972 water cooled engine delivers a DC power solution that offers significant advantages over manufacturer's DC generators and AC generators with battery chargers.

This generator has the capacity to deliver 15 kW at 3600 RPM, but the ideal power range is between 4 to 10kW.

The 8220-972, properly configured, can reliably operate for 24 hours a day, 7 days a week. A realistic life expectancy for the Kubota 972 engine is between 30,000 to 40,000 hours depending on speed verses load selection and quality of maintenance.

The service life of the controller, wire harness, and alternator is well over 100,000 hours. At the end of engine life you replace the engine and not the whole generator (unlike AC generators)

**LPG Generators from other manufactures typically have only 2,000 to 6,000 hours in life expectancy. The large difference in engine service life is attributed to:**

• The 972 gas engine is derived from a diesel engine block. The injectors are removed and a gas carburetor, spark plugs and ignition are added along with reducing the compression ratio. The conversion and manufacturing is performed by Kubota. The heavy-duty diesel type engine block, bearings, crankshaft, cylinder, and pistons provide a very reliable and long life generator.

• There are 4 heavy duty bearings supporting the crankshaft in the 972 engine as opposed to 2 light duty aluminum bearings typical of our competitors' generators.

**The 972 engine has much lower maintenance, higher reliability, and lower fuel consumption due to its water/fluid cooling system:**

• In cold climates the water cooled engine can use its thermostat to regulate combustion temperatures improving fuel efficiency and reducing engine maintenance. Typical air cooled generator engines do not have the ability to regulate combustion temperatures.

• In hot and cold weather extremes the water cooled engine provides lower oil maintenance than the air cooled.

• In hot weather the water cooled engine's oil temperature is typically under 125°C whereas air cooled engines typically operate at temperatures above 150°C reducing the service life of the oil. In cold weather the oil temperatures can be too low to remove the absorbed water from the combustion process, this also reduces oil service life.

• The 972 has a larger oil capacity in the oil pan than conventional air cooled engines, reducing oil checks and changes.

• The 972 can make use of Polar's Electric Radiator option saving 10% to 15% in fuel.

**Polar's water cooled generator is significantly quieter than other AC or DC generators using air cooled engines:**

• For low noise requirements the water cooled engine can take advantage of its fluid lined cylinders for noise reduction at the source

• Sound traps inside the enclosure are more effective with water cooled engines than air cooled.

• Polar offers an electric radiator option that incorporates electrically driven fans that produce lower noise than belt or direct driven engine fans. The electric radiator can be mounted external to the sound attenuating enclosure allowing a more efficient means of sound attenuation.

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POLAR POWER INC.

# 8220K-972
## 10 kW DC Generator

**For integration into a shelter or enclosure the Model 8220K-972 offers numerous advantages:**

• The air cooled engine disperses the heat all over the shelter or enclosure, additional fans are typically required to scavenge the hot air and remove it from the enclosure. The fluid cooled generator can make use of the radiator and fan to direct the heat away from the enclosure. Enclosures for the 8220K-972 typically operates at 4-7°C over the ambient air temperature. Typical air cooled generators operate operate at 16-33°C over ambient, which greatly lowers the reliability of the batteries and control electronics.

• For sites with very cold weather conditions the problem with air cooled generators is that the air flow volume is not easily controllable and too much cold air is brought into the shelter. The 8220K-972 can have is radiator installed exterior to the shelter, so only a minimum volume of air needs to enter the shelter.

• Too much air flow into the shelter can be a maintenance problem in dusty and sandy environments, another advantage to installing the radiator outside the shelter.

• In hot weather if the electric radiator is installed inside the shelter the fans can cool the shelter without requiring additional fans. This is an advantage in removing the heat from the engine after it cycled off (thermal lag).

## Additional Information

The Kubota 972 engine service is readily available for throughout the world. Propane fueled generator sets are supplied with vapor withdraw carburetion. Liquid withdraw is available at an additional cost. Fuel tanks are not supplied and can be obtained from your local propane supplier.

To configure a DC Generator system we start with the DC generator then add the accessories as the application requires including: engine monitoring, load battery monitoring, communication options, enclosure or frame, cooling system, extended lubrication system, etc.

## Accessories

**Electric Solenoid Valve**

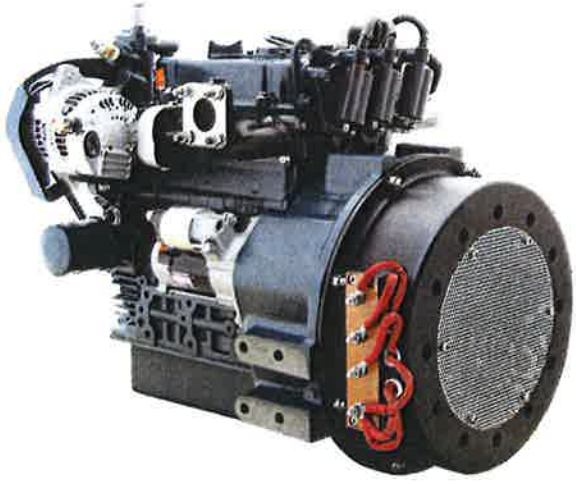
To shut down the generator we first turn off the fuel then the ignition; this helps to prevent backfire (unburned gas entering the hot muffler and exploding). We use one valve in the system and chose between a high pressure valve placed before the high to low pressure regulator or a low pressure valve placed after the high to low pressure regulator.

**Oil Refining Pack Filter (option)**

This is a bypass filter that processes a partial flow of oil to remove particles in the sub-micron level. This filter is also effective in removing moisture that the oil absorbs from the combustion process and marine air. This option can extend the standard oil sump maintenance interval from 200 hours to 400 hours using synthetic lubricants

**Extended Oil Sump (option)**

Polar manufactures a 16 liter Oil sump conversion extending the oil maintenance period to once a year or 3,000 hours whichever occurs first. With 16 L of oil the use of an automatic oil adder is not required and the lubrication system is simplified. The oil refining pack is recommended with the 16L sump to remove moisture from the oil due to the possibility of the oil operating at lower temperatures and retaining moisture.



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## 10 kW DC Generator

**Fluid Cooled Alternator**
This option allows the alternator to run more efficiently when installed inside compartments with poor air circulation. We recommend air cooling over fluid cooling because it makes a simpler system.

**Oil Cooler**
This option is used for generators installed in poorly ventilated compartments and provides additional cooling to the engine through oil.

**24 Vdc Generator Electrical System**
This option upgrades the starter to 24 Vdc.

**24 Vdc Starting Battery Alternator**
Standard alternator voltage is 12 Vdc. In special applications it may be desirable to upgrade the engine alternator to 24 Vdc for charging the starter battery. In most applications the starter battery charging is accomplished through a DC to DC power supply and the belt driven alternator is eliminated or serves as an idler pulley.

**Super Capacitor to replace Starting Battery.**
The starting battery is the number one failure point on generator starting. We see three problems with starting batteries:

- They are popular targets for theft.
- Upon replacement many operators choose an unreliable (but convenient) battery.
- Reliability is compromised at low and high temperatures

The super capacitor performs well at temperatures ranging from -40°C to 65°C. The super capacitor should provide a minimum of 10 years of service or a 500,000 start cycles. The super capacitor charged from the load battery using a DC-DC converter.

**Additional Information**
For details regarding engine, alternator, and battery monitoring and control options please see Polar Power's data sheets on the Supra Control System.

There are also specific data sheets on Output Power Filters, Electric Radiator, Frames and Enclosures, Lubrication, and Starting Accessories.

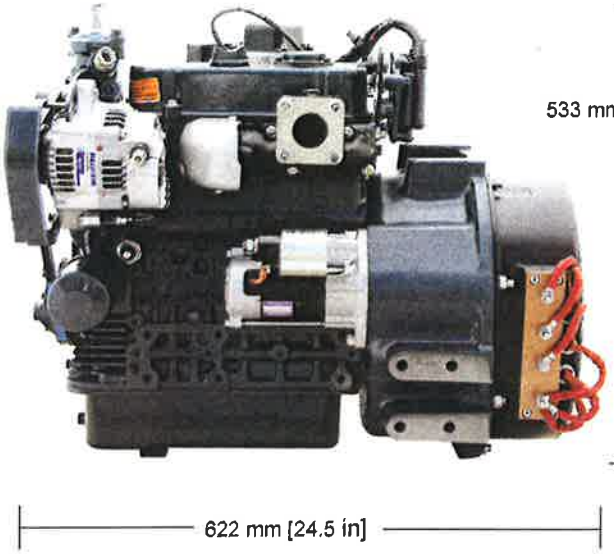
For engine speeds verses electrical loads please see Polar Power's Alternator data sheets.

Polar Power
249 E. Gardena Blvd
Carson, CA 90248 USA
Tel: (310) 830 - 9153
Fax: (310) 830 - 9825

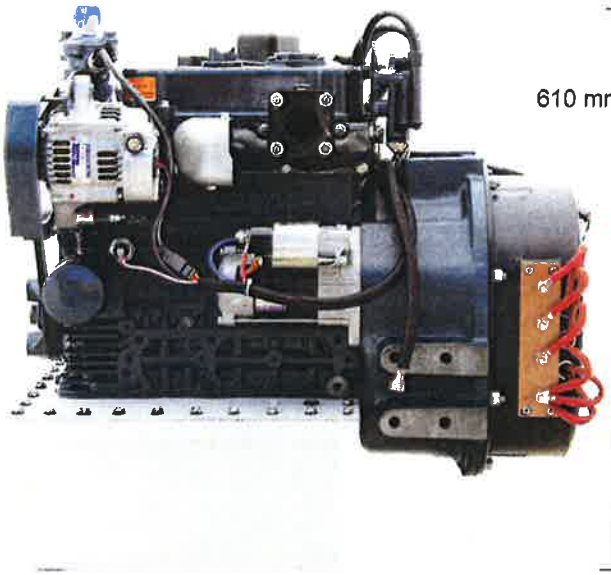
POLAR POWER INC.

# 8220K-972
## 10 kW DC Generator

### Engine Dimensions









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POLAR POWER INC.

# 8220K-972
## 10 kW DC Generator

## Engine Specifications

### 8220K-972

| | |
|---|---|
| **Ratings kW (continuous)** | **10 kW @ 2600 rpm** |
| **Output DC voltage** | **24 - 500** |
| **Engine** | **Kubota 972** |
| **Cylinders** | **3 in-line** |
| **Cylinder Volume** | **.972 Liter** |
| **Weight - 3.7 Liter Oil (dry)** | **126 kg [277 lb]** |
| **Weight - 16 Liter Oil (dry)** | **137 kg [302 lb]** |
| **Coolant Capacity** | **1.8 Liter** |
| **Oil Capacity** | **3.7 Liter (optional 16 Liter)** |
| **Operating Temperature (Ambient/Compartment)** | **-40C° to 72°C** |
| **Fuel Consumption, (apprx)** | **396g/kWhr** |
| **Dimensions - 3.7 Liter Oil** | **Length: 622 mm [24.5 in]**<br>**Width: 457 mm [18 in]**<br>**Height: 533 mm [21 in]** |
| **Dimensions - 16 Liter Oil** | **Length: 622 mm [24.5 in]**<br>**Width: 457 mm [18 in]**<br>**Height: 610 mm [24 in]** |

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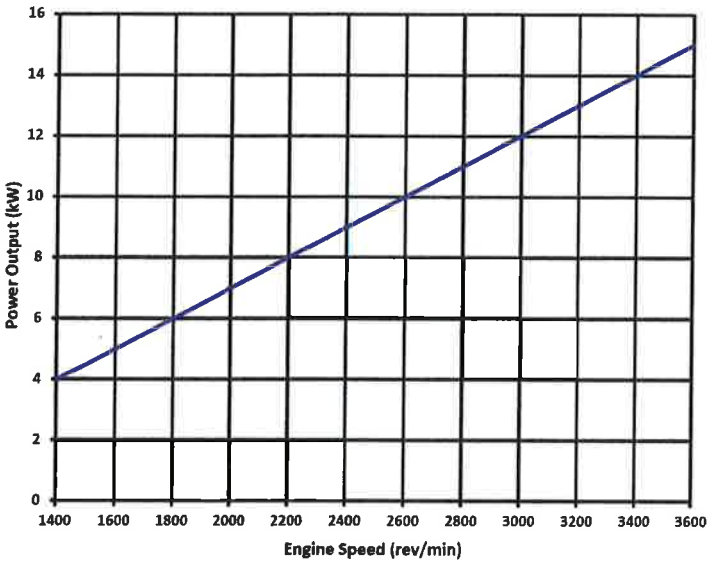
POLAR POWER INC.

# 8220K-972
## 10 kW DC Generator

## Engine Specifications (cont.)

- Fuel - Propane (LPG) or Natural Gas
- Engine Type - 4 cycle, 3 cylinder, in-line, liquid cooled
- Cylinder Head - Single piece casting, aluminum
- Cylinder Block and Camshaft - Mono-block, three cylinder, cast iron
- Camshaft - Carbon steel
- Connecting Rod - Carbon steel
- Piston Pin Bearing - Machined, piston pin, press fit
- Crankpin Bearing - Replaceable insert, aluminum
- Piston - Heat resistant aluminum alloy
- Compression ring - Two, chrome plated
- Oil Ring - One, combination type, chrome plated
- Lubricating Method - Pressure lube
- Oil Pump - Trochoid, gear drive
- Alternator - 40 Amp DC output, internally regulated
- Starter - 12 Volt, solenoid activated bendix drive
- Ignition - 12 Volt, transitorized




Generator must be derated for Fuel, Altitude and Temperature.

3% Derate for every 300 m (1000 ft ) above 91 m (300 ft )
1% Derate for every 5.6 C (10 F ) above 25 C (77 F ).

## Limited Warranty

Polar Power Inc. (hereinafter "Polar"), hereby warrants goods manufactured and sold by it to be free from defects in material and workmanship for 24 months after the date of shipment.

The warranty is limited to repair or replacement at 249 E. Gardena Blvd, Carson, CA 90248 or other point designated by Polar of such parts as they appear to Polar, upon inspection, to be defective in material or workmanship. This warranty is extended to the first user only and no warranty is made or authorized to be made assignable on resale by the first end user.

The above warranty includes a pass-through warranty from the engine and controller manufacturers for whatever period and warranty is in effect by the manufacturer at that time. The above warranty only extends to applications and installations which are approved by mutual agreement between Polar and the first end users.

To obtain performance of any obligation under this warranty, contact must be made with Polar in writing at 249 E. Gardena Blvd, Carson, CA 90248. Submission of a claim does not obligate Polar to accept such claim in full or in part.

No bills for service, labor or other expenses that have not been previously approved and authorized by Polar will be allowed.

No goods or materials may be returned until authorized in writing by Polar and, where the return of the material is authorized, it shall be F.O.B. to whatever point Polar designated within the U.S.A.

Repairs or alterations made to the goods without Polar written concurrence or the operation of the goods in excess of rated capacity will invalidate this warranty.

There is no implied warranty or condition of merchantability. There is no other warranty or condition expressed or implied, statutory or otherwise, except such as is expressly set forth herein. Neither Polar nor manufacturers will be liable for any general, consequential or incidental damages, including without limitation any damages for loss of use or loss of profits, for any breach of warranty or condition or for negligence; Polar's and manufacturer's liability and the buyer's exclusive remedy being expressly limited to the repair or replacement of the goods sold by polar as provided herein.

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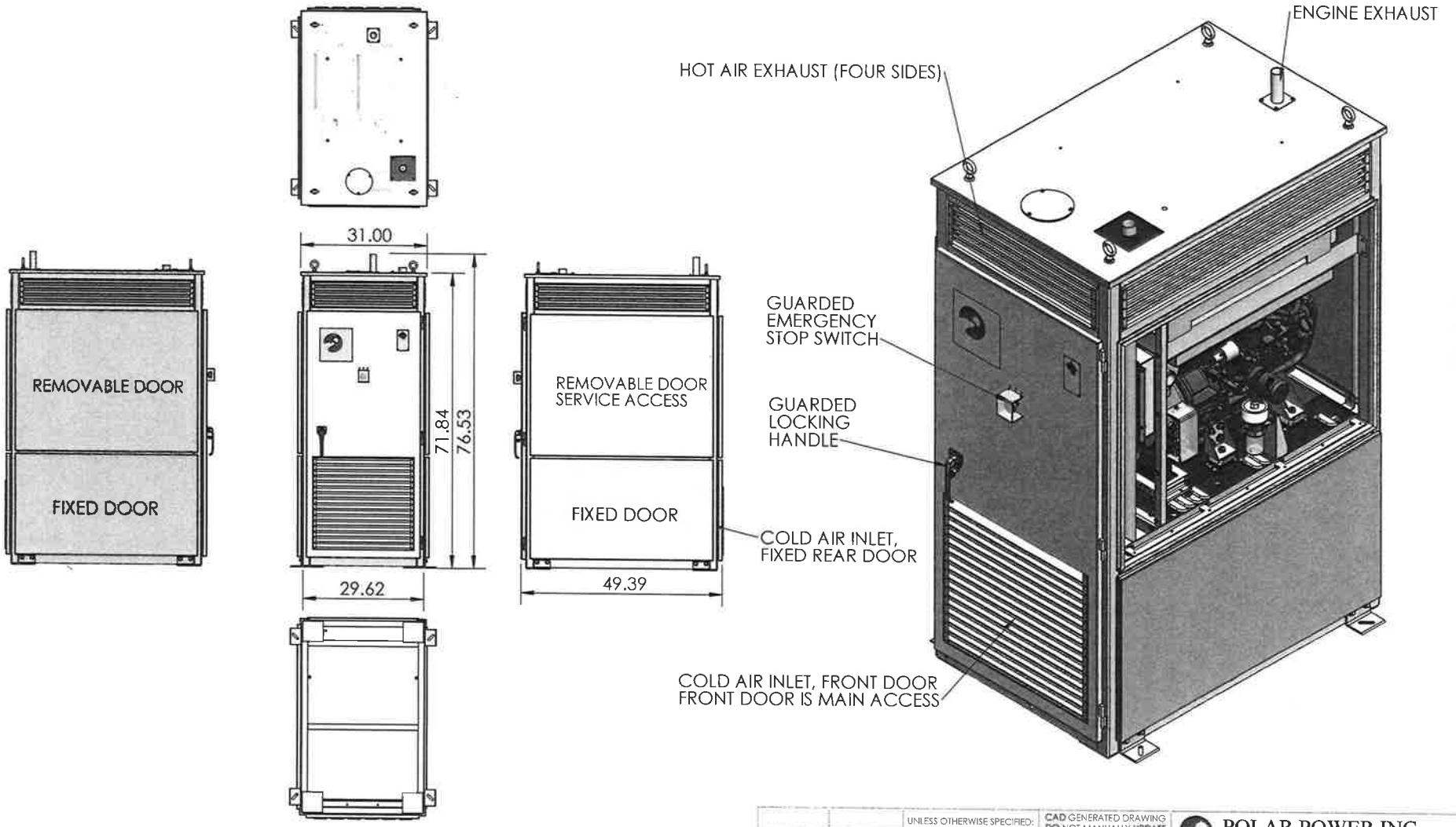


| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | COMMENTS: | | |
| | INITIAL RELEASE | -- | | | | | |
| REV | DESCRIPTION | ECO # | BY | DATE | PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF POLAR POWER INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF POLAR POWER INC. IS PROHIBITED. | | |

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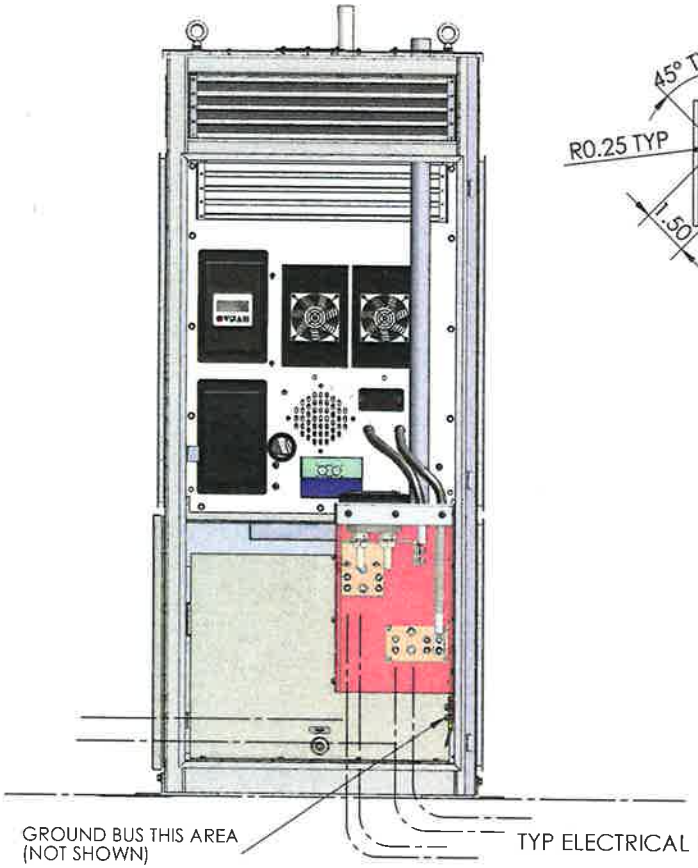
|---|---|---|---|---|---|---|---|
| | | | UNLESS OTHERWISE SPECIFIED: | | CAD GENERATED DRAWING DO NOT MANUALLY UPDATE | | |
| | | | DIMENSIONS ARE IN INCHES TOLERANCES ARE: | | APPROVALS | DATE | |
| | | | FRACTIONS ±1/32" DECIMALS X.X±0.1" X.XX±0.03" X.XXX±0.010" ANGLES ±1/2° | | DRAWN GLEESON | 1/22/2015 | |
| | | | | | CHECKED | | |
| | | | MATERIAL | | ENG APPR. | | |
| NEXT ASSY | USED ON | | FINISH | | MFG APPR. | | |
| APPLICATION | | | DO NOT SCALE DRAWING | | Q.A. | | |

POLAR POWER INC.
249 E GARDENA AVE, GARDENA CA. 90248

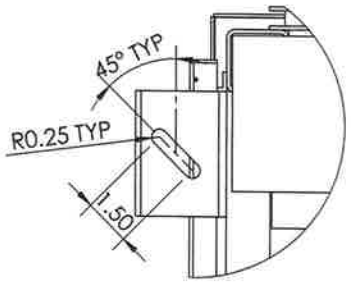
TITLE: ALUMINUM VERTICAL ENCLOSURE, 72 IN

| SIZE | DWG. NO. | REV |
|---|---|---|
| B | 88-25-0603 | A-1 |

SCALE: 1:24 | WEIGHT: | SHEET 1 OF 4

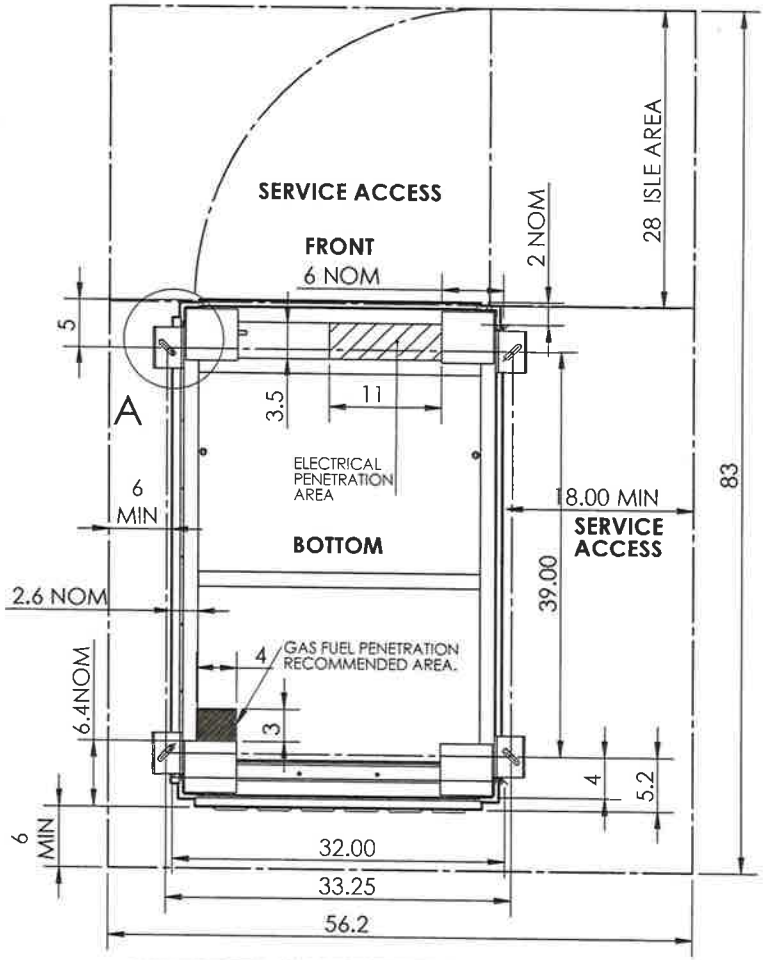



**FRONT DOOR REMOVED FOR CLARITY**




DETAIL A
SCALE 1 : 4

## INSTALLATION FOOTPRINT, BOTTOM VIEW




| REV | DESCRIPTION | ECO# | BY | DATE |
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| | INITIAL RELEASE | -- | | |

COMMENTS:



NEXT ASSY | USED ON
APPLICATION

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ±1/32" DECIMALS X.X±0.1" X.XX±0.03" X.XXX±0.010" ANGLES ±1/2°
MATERIAL
FINISH
DO NOT SCALE DRAWING

CAD GENERATED DRAWING DO NOT MANUALLY UPDATE

| APPROVALS | DATE |
|---|---|
| DRAWN GLEESON | 1/22/2015 |
| CHECKED | |
| ENG APPR. | |
| MFG APPR. | |
| Q.A. | |

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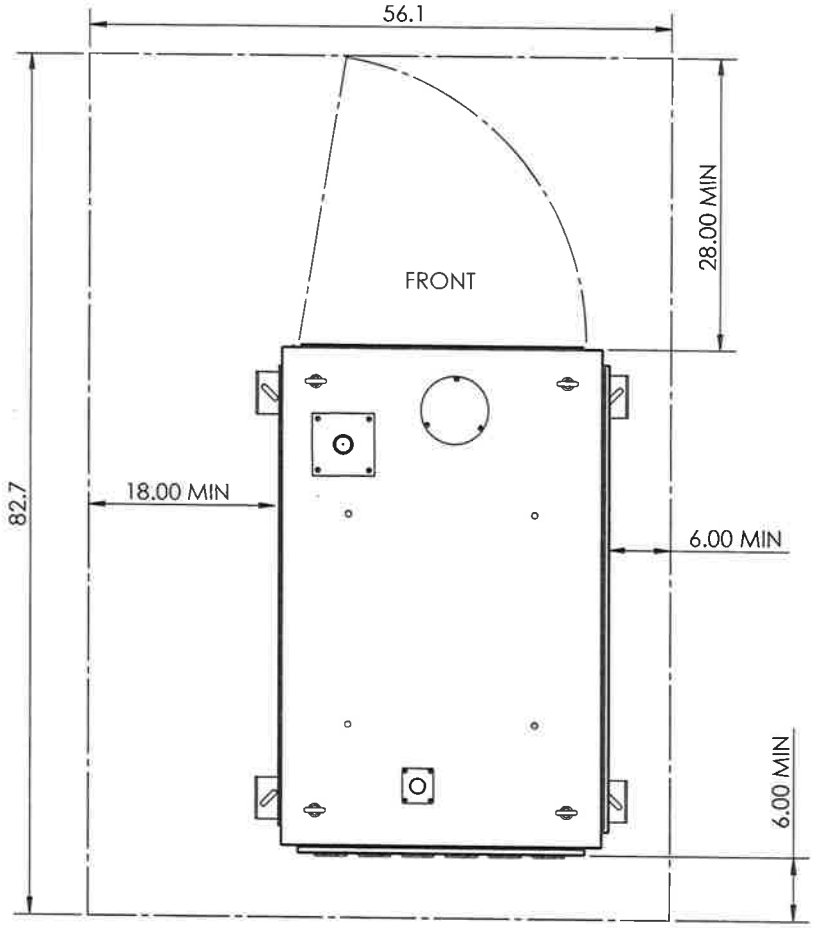
TITLE: ALUMINUM VERTICAL ENCLOSURE, 72 IN

| SIZE | DWG. NO. | REV |
|---|---|---|
| B | 88-25-0603 | A-1 |

SCALE: 1:24 | WEIGHT: | SHEET 2 OF 4

# INSTALLATION FOOTPRINT, PLAN VIEW




| REV | DESCRIPTION | ECO# | BY | DATE |
|---|---|---|---|---|
| | INITIAL RELEASE | – | | |

COMMENTS:



NEXT ASSY | USED ON

APPLICATION

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ±1/32" DECIMALS X.X±0.1" X.XX±0.03" X.XXX±0.010" ANGLES ±1/2°
MATERIAL
FINISH
DO NOT SCALE DRAWING

CAD GENERATED DRAWING
DO NOT MANUALLY UPDATE

| APPROVALS | DATE |
|---|---|
| DRAWN GLEESON | 1/22/2015 |
| CHECKED | |
| ENG APPR. | |
| MFG APPR. | |
| Q.A. | |

POLAR POWER INC.
249 E GARDENA AVE, GARDENA CA. 90248

TITLE: ALUMINUM VERTICAL ENCLOSURE, 72 IN

| SIZE | DWG. NO. | REV |
|---|---|---|
| B | 88-25-0603 | A-1 |

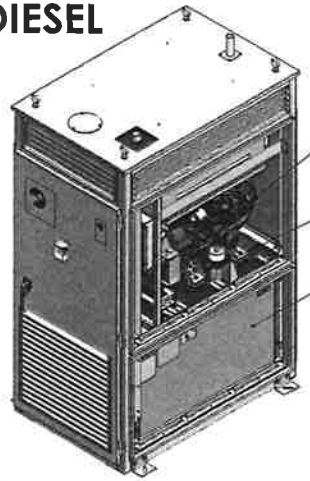
SCALE: 1:24 | WEIGHT: | SHEET 3 OF 4

# CONFIGURATIONS

## DIESEL

**8220I-3CA1-101**
6 KW DIESEL

**8220I-3CA1-102**
10 KW DIESEL



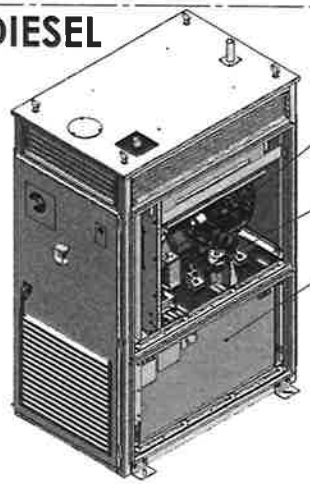
ISUZU 3CJ1
(SINGLE DIODE BRIDGE)

FUEL PUMP ASSY

54 GALLON FUEL TANK

## DIESEL

**8220Y-3TNV88-101**
15 KW DIESEL



YANMAR 3TNV88
(DUAL DIODE BRIDGE)

FUEL PUMP ASSY

54 GALLON FUEL TANK

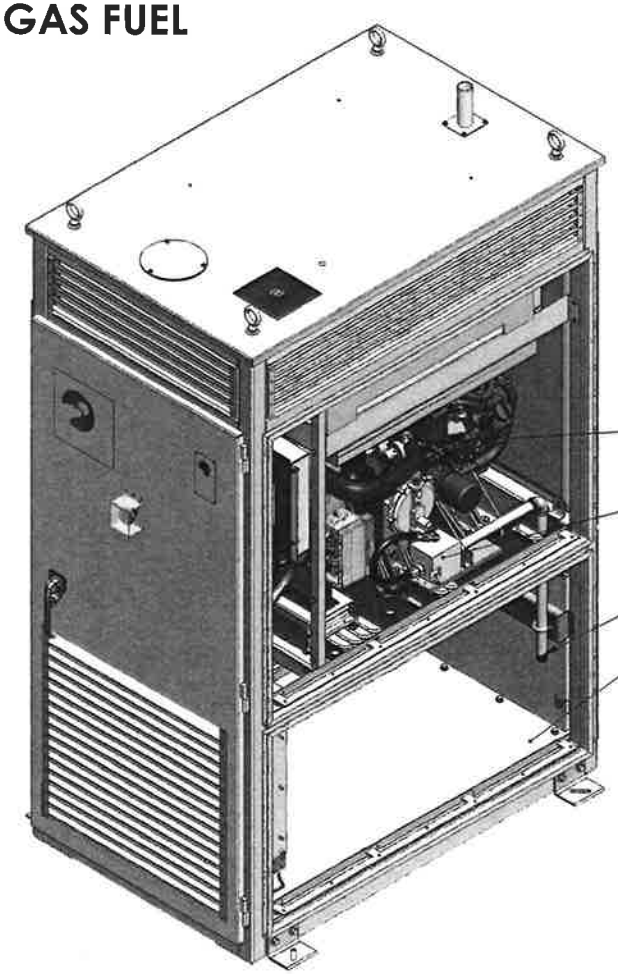
## GAS FUEL

**8220K-DG972-101**
6 KW NATURAL GAS

**8220K-DG972-102**
10 KW NATURAL GAS

**8220K-WG972-101**
6 KW PROPANE

**8220K-WG972-102**
10 KW PROPANE



KUBOTA DG OR WG 972
(SINGLE DIODE BRIDGE)

GAS FUEL ASSEMBLY.
HOSES FOR LPG OR
PROPANE

GAS FUEL STUB OUT

GAS FUEL
PENETRATION
AREA

| REV | DESCRIPTION | ECO# | BY | DATE |
|---|---|---|---|---|
| - | INITIAL RELEASE | | | |

COMMENTS:



NEXT ASSY | USED ON

APPLICATION

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ±1/32" DECIMALS X ±0.1 X.XX±0.03" X.XXX±0.010" ANGLES ±1/2°
MATERIAL
FINISH
DO NOT SCALE DRAWING

CAD GENERATED DRAWING
DO NOT MANUALLY UPDATE

| APPROVALS | DATE |
|---|---|
| DRAWN GLEESON | 1/22/2015 |
| CHECKED | |
| ENG APPR. | |
| MFG APPR. | |
| Q.A. | |

POLAR POWER INC.
249 E GARDENA BLVD, GARDENA, CA 90248

TITLE: ALUMINUM VERTICAL ENCLOSURE, 72 IN

| SIZE | DWG. NO. | REV |
|---|---|---|
| B | 88-25-0603 | A-1 |

SCALE: 1:24 | WEIGHT: | SHEET 4 OF 4

# ATTACHMENT 4

AMERICAN TOWER®
CORPORATION

This report was prepared for American Tower Corporation by

SEMAAN
ENGINEERING SOLUTIONS

# Structural Analysis Report

| | | |
|---|---|---|
| **Structure** | : | **98 ft Monopole** |
| **ATC Site Name** | : | **Madison CT, CT** |
| **ATC Site Number** | : | **283421** |
| **Engineering Number** | : | **61586923** |
| **Proposed Carrier** | : | **Verizon Wireless** |
| **Carrier Site Name** | : | **Madison 5** |
| **Carrier Site Number** | : | **300033** |
| **Site Location** | : | **15 Orchard Park Road**<br>**Madison, CT 06443-2268**<br>**41.28308, -72.62308** |
| **County** | : | **New Haven** |
| **Date** | : | **December 22, 2015** |
| **Max Usage** | : | **87%** |
| **Result** | : | **Pass** |

Courtney Fuhrer
SES Structural Engineer

STATE OF CONNECTICUT
THOMAS L. [illegible]
28150
LICENSED
PROFESSIONAL ENGINEER

12.22.15

SEMAAN
ENGINEERING SOLUTIONS

## Table of Contents

SEMAAN ENGINEERING SOLUTIONS

## Introduction

The purpose of this report is to summarize results of a structural analysis performed on the 98 ft monopole to reflect the change in loading by Verizon Wireless.

## Supporting Documents

| | |
|---|---|
| **Tower Drawings** | Sabre Drawing #30257-MM REV1, dated January 18, 2011 |
| **Foundation Drawing** | Sabre Drawing #30257-F2 REV1, dated March 23, 2011 |
| **Geotechnical Report** | Terracon Project #J2095225, dated December 21, 2009 |

## Analysis

The tower was analyzed using American Tower Corporation's tower analysis software. This program considers an elastic three-dimensional model and second-order effects per ANSI/EIA-222.

| | |
|---|---|
| **Basic Wind Speed:** | 105 mph (Fastest Mile) |
| **Basic Wind Speed w/ Ice:** | 91 mph (Fastest Mile)w/ 1/2" radial ice concurrent |
| **Code:** | ANSI/TIA/EIA-222-F / 2003 IBC , Sec. 1609.1.1, Exception (5) & Sec. 3108.4 w/ 2005 CT Supplement & 2013 CT Amendment |

## Conclusion

Based on the analysis results, the structure meets the requirements per the applicable codes listed above. The tower and foundation can support the equipment as described in this report.

If you have any questions or require additional information, please contact American Tower via email at Engineering@americantower.com. Please include the American Tower site name, site number, and engineering number in the subject line for any questions.

SEMAAN ENGINEERING SOLUTIONS

## Existing and Reserved Equipment

| Elevation[1] (ft) | | Qty | Antenna | Mount Type | Lines | Carrier |
|---|---|---|---|---|---|---|
| Mount | RAD | | | | | |
| 97.0 | 96.0 | 3 | Ericsson KRY 112 71 | T-Arms | (12) 1 5/8" Coax<br>(1) 1 5/8" Hybriflex | T-Mobile |
| | | 3 | Ericsson RRUS 11 (Band 12) | | | |
| | | 6 | Ericsson AIR 21 | | | |
| 94.0 | 95.0 | 3 | 92" x 12" Panel | | | |
| 90.0 | 90.0 | 4 | Raycap DC6-48-60-18-8F | Platform w/ Handrails | (3) 3/8" Coax<br>(8) 0.78" 8 AWG 6<br>(2) 0.40" Fiber<br>(5) 3" Conduit | AT&T Mobility |
| | | 6 | Ericsson RRUS A2 | | | |
| | | 3 | Ericsson RRUS 32 | | | |
| | | 6 | Ericsson RRUS 12 | | | |
| | | 3 | Ericsson RRUS E2 B29 | | | |
| | | 9 | Ericsson RRUS-11 | | | |
| | | 12 | CCI HPA-65R-BUU-H8 | | | |

## Equipment to be Removed

| Elevation[1] (ft) | | Qty | Antenna | Mount Type | Lines | Carrier |
|---|---|---|---|---|---|---|
| Mount | RAD | | | | | |
| No loading considered as to be removed | | | | | | |

## Proposed Equipment

| Elevation[1] (ft) | | Qty | Antenna | Mount Type | Lines | Carrier |
|---|---|---|---|---|---|---|
| Mount | RAD | | | | | |
| 76.0 | 76.0 | 3 | Alcatel-Lucent B13 RRH4x30-4R 700U | Low Profile Platform w/ Collar Mount | (2) 1 5/8" Hybriflex | Verizon Wireless |
| | | 3 | Alcatel-Lucent 1900MHz 4X45 RRH | | | |
| | | 3 | Alcatel-Lucent RRH4x45-B66 w/o Solar Shield | | | |
| | | 2 | Raycap RxxDC-3315-PF-48 | | | |
| | | 12 | Andrew SBNHH-1D65B | | | |

**[1]Mount elevation is defined as height above bottom of steel structure to the bottom of mount, RAD elevation is defined as center of antenna above ground level (AGL).**

Install proposed coax outside the pole shaft. Stacking coax is not allowed.

SEMAAN ENGINEERING SOLUTIONS

## Structure Usages

| Structural Component | Controlling Usage | Pass/Fail |
|---|---|---|
| Anchor Bolts | 85% | Pass |
| Shaft | 87% | Pass |
| Base Plate | 66% | Pass |

## Foundations

| Reaction Component | Analysis Reactions | % of Usage |
|---|---|---|
| Moment (Kips-Ft) | 2,984.6 | 81% |
| Axial (Kips) | 35.8 | 36% |
| Shear (Kips) | 39.1 | 35% |

The structure base reactions resulting from this analysis were found to be acceptable through analysis based on geotechnical and foundation information, therefore no modification or reinforcement of the foundation will be required.

## Deflection and Sway*

| Antenna Elevation (ft) | Antenna | Carrier | Deflection (ft) | Sway (Rotation) (°) |
|---|---|---|---|---|
| 76.0 | Alcatel-Lucent B13 RRH4x30-4R 700U | Verizon Wireless | 0.463 | 0.665 |
| | Alcatel-Lucent 1900 MHz 4X45 RRH | | | |
| | Raycap RxxDC-3315-PF-48 | | | |
| | Alcatel-Lucent RRH4x45-B66 w/o Solar Shield | | | |
| | Andrew SBNHH-1D65B | | | |

***Deflection and Sway was evaluated considering a design wind speed of 50 mph (Fastest Mile) per ANSI/TIA/EIA-222-F.**

SEMAAN
ENGINEERING SOLUTIONS

## Standard Conditions

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

-- Information supplied by the client regarding the structure itself, antenna, mounts and feed line loading on the structure and its components, or other relevant information.

-- Information from drawings in the possession of Semaan Engineering Solutions, or generated by field inspections or measurements of the structure.

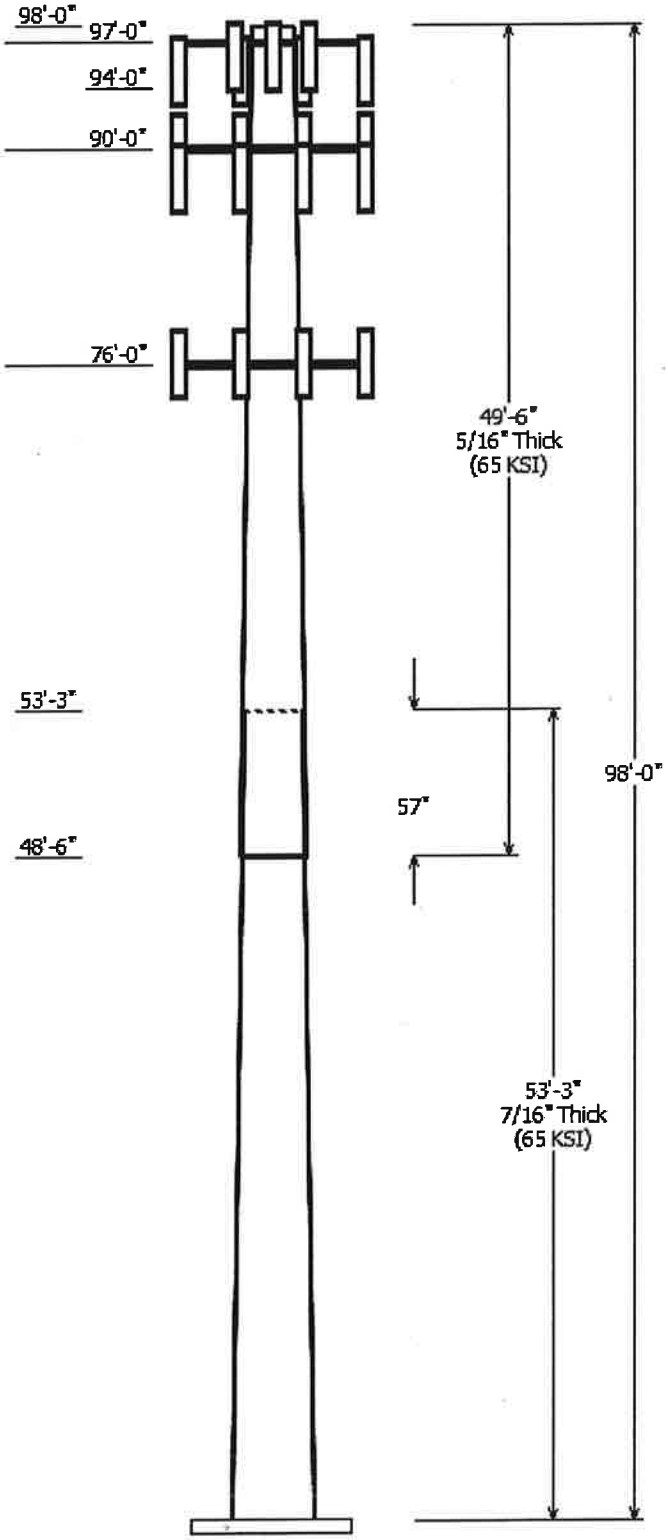
It is the responsibility of the client to ensure that the information provided to Semaan Engineering Solutions Holdings and used in the performance of our engineering services is correct and complete. In the absence of information to the contrary, we assume that all structures were constructed in accordance with the drawings and specifications and that their capacity has not significantly changed from the "as new" condition.

Unless explicitly agreed by both the client and Semaan Engineering Solutions, all services will be performed in accordance with the current revision of ANSI/TIA -222. The design basic wind speed will be determined based on the minimum basic wind speed as prescribed in ANSI/TIA-222. Although every effort is taken to ensure that the loading considered is adequate to meet the requirements of all applicable regulatory entities, we can provide no assurance to meet any other local and state codes or requirements. If wind and ice loads or other relevant parameters are to be different from the minimum values recommended by the codes, the client shall specify the exact requirement.

All services are performed, results obtained, and recommendations made in accordance with generally accepted engineering principles and practices. Semaan Engineering Solutions Holdings is not responsible for the conclusions, opinions and recommendations made by others based on the information we supply.

**SEMAAN ENGINEERING SOLUTIONS, LLC**
1079 N.205th Street
Elkhorn, NE 68022
Phone: 402-289-1888
Fax: 402-289-1861






## Job Information

| | |
|---|---|
| Pole : | 283421 |
| Description : | |
| Client : | Verizon Wireless |
| Location : | Madison CT, CT |
| Shape : | 18 Sides |
| Height : | 98.00 (ft) |
| Base Elev (ft): | 0.00 |
| Taper: | 0.224949 (in/ft) |

Code: TIA/EIA-222-F

## Sections Properties

| Shaft Section | Length (ft) | Diameter (in) Accross Flats Top | Bottom | Thick (in) | Joint Type | Overlap Length (in) | Taper (in/ft) | Steel Grade (ksi) |
|---|---|---|---|---|---|---|---|---|
| 1 | 53.250 | 36.69 | 48.67 | 0.438 | | 0.000 | 0.224949 | 65 |
| 2 | 49.500 | 27.25 | 38.38 | 0.313 | Slip Joint | 57.000 | 0.224949 | 65 |

## Discrete Appurtenance

| Attach Elev (ft) | Force Elev (ft) | Qty | Description |
|---|---|---|---|
| 97.000 | 96.000 | 6 | Ericsson AIR 21 |
| 97.000 | 96.000 | 3 | Ericsson RRUS 11 (Band 12) |
| 97.000 | 96.000 | 3 | Ericsson KRY 112 71 |
| 97.000 | 97.000 | 3 | Round T-Arm |
| 94.000 | 95.000 | 3 | 92" x 12" Panel |
| 90.000 | 87.000 | 12 | CCI HPA-65R-BUU-H8 |
| 90.000 | 90.000 | 9 | Ericsson RRUS-11 |
| 90.000 | 90.000 | 3 | Ericsson RRUS E2 B29 |
| 90.000 | 90.000 | 6 | Ericsson RRUS 12 |
| 90.000 | 90.000 | 3 | Ericsson RRUS 32 |
| 90.000 | 90.000 | 6 | Ericsson RRUS A2 |
| 90.000 | 90.000 | 4 | Raycap DC6-48-60-18-8F |
| 90.000 | 90.000 | 1 | Round Platform w/ Handrails |
| 76.000 | 76.000 | 1 | Collar Mount |
| 76.000 | 76.000 | 12 | Andrew SBNHH-1D65B |
| 76.000 | 76.000 | 3 | Alcatel-Lucent RRH4x45-B66 |
| 76.000 | 76.000 | 2 | Raycap RxxDC-3315-PF-48 |
| 76.000 | 76.000 | 3 | Alcatel-Lucent 1900 MHz 4X45 |
| 76.000 | 76.000 | 3 | Alcatel-Lucent B13 RRH4x30- |
| 76.000 | 76.000 | 1 | Round Low Profile Platform |

## Linear Appurtenance

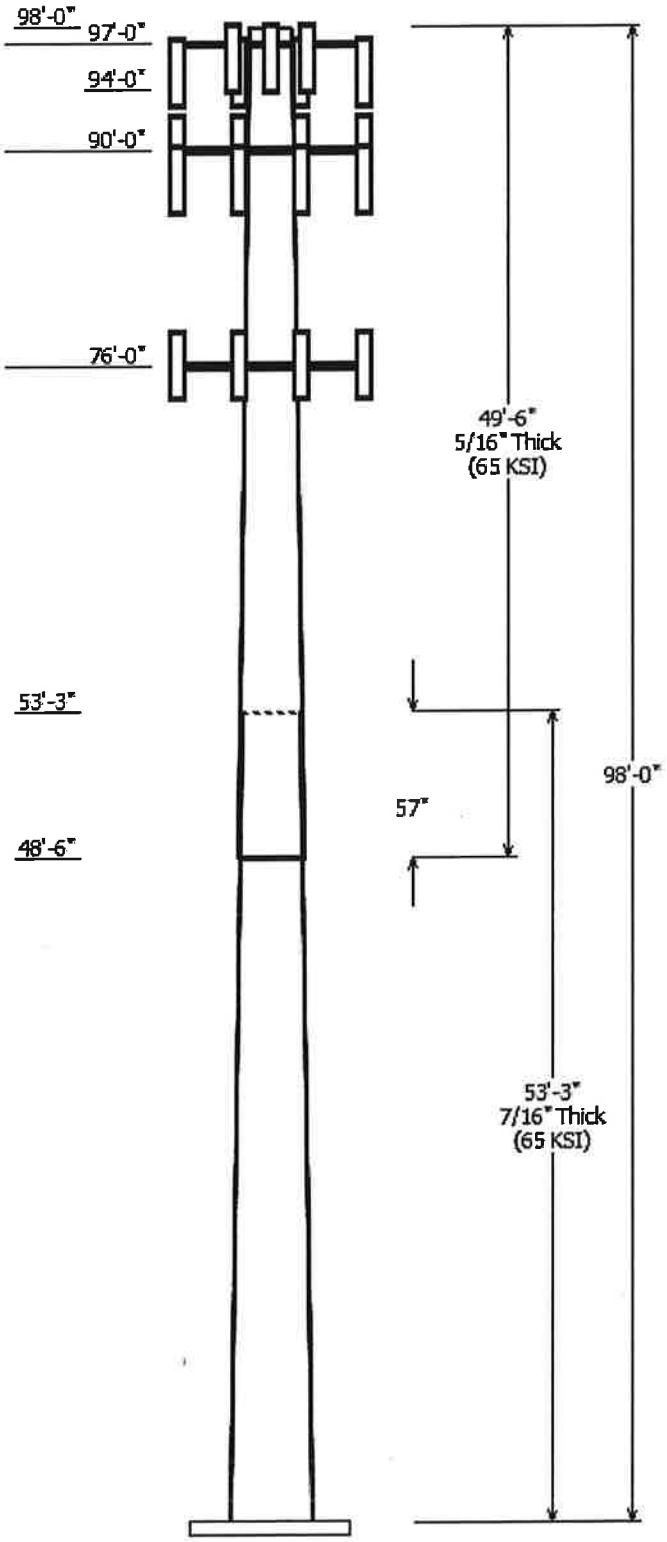
| Elev (ft) From | To | Description | Exposed To Wind |
|---|---|---|---|
| 0.000 | 76.000 | 1 5/8" Hybriflex | Yes |
| 0.000 | 90.000 | 0.40" Fiber Cable | No |
| 0.000 | 90.000 | 0.78" 8 AWG 6 | No |
| 0.000 | 90.000 | 3" Conduit | No |
| 0.000 | 90.000 | 3/8" Coax | No |
| 0.000 | 95.000 | 1 5/8" Coax | No |
| 0.000 | 97.000 | 1 5/8" Coax | No |
| 0.000 | 97.000 | 1 5/8" Hybriflex | No |

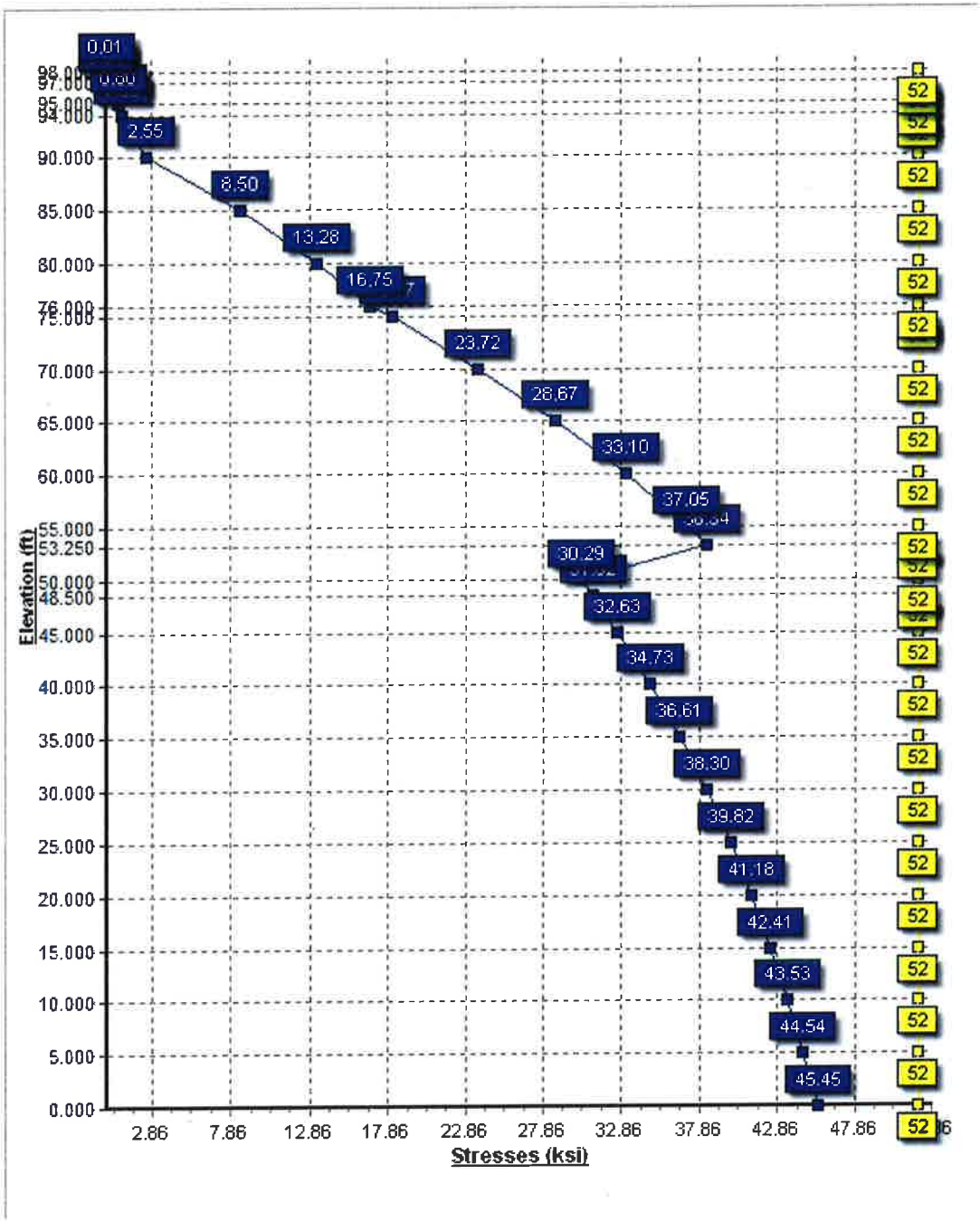
## Load Cases

| | |
|---|---|
| No Ice | 105.00 mph Wind with No Ice |
| Ice | 90.93 mph Wind with Ice |
| Twist/Sway | 50.00 mph Wind with No Ice |

| Reactions | | | |
|---|---|---|---|
| Load Case | Moment (kip-ft) | Shear (kip) | Axial (kip) |
| No Ice | 2984.57 | 39.05 | 29.79 |
| Ice | 2463.11 | 31.29 | 35.83 |
| Twist/Sway | 677.11 | 8.86 | 29.86 |

| Dish Deflections | | | |
|---|---|---|---|
| Load Case | Attach Elev (ft) | Deflection (in) | Rotation (deg) |
| | 0.00 | 0.000 | 0.000 |




0.01
2.55
8.50
13.28
16.75
23.72
28.67
33.10
37.05
30.29
32.63
34.73
36.61
38.30
39.82
41.18
42.41
43.53
44.54
45.45
52
Elevation (ft)
90.000
85.000
80.000
70.000
65.000
60.000
55.000
53.250
50.000
48.500
45.000
40.000
35.000
30.000
25.000
20.000
15.000
10.000
5.000
0.000
2.86
7.86
12.86
17.86
22.86
27.86
32.86
37.86
42.86
47.86
Stresses (ksi)

| | | | |
|---|---|---|---|
| **Site Number:** | **283421** | **Code: TIA/EIA-222-F** |  |
| **Site Name:** | **Madison CT, CT** | **Engineering Number: 61586923** | **12/22/2015 10:48:55 AM** |
| **Customer:** | **Verizon Wireless** | | |

## Analysis Parameters

| | | | |
|---|---|---|---|
| **Location:** | **New Haven County, CT** | | |
| **Code:** | **TIA/EIA-222-F** | **Height (ft):** | **98** |
| **Shape:** | **18 Sides** | **Base Diameter (in):** | **48.67** |
| **Pole Type:** | **Taper** | **Top Diameter (in):** | **27.25** |
| **Pole Manfacturer:** | **Sabre** | **Taper (in/ft) :** | **0.225** |

## Load Cases

| | |
|---|---|
| **No Ice** | **105.00 mph Wind with No Ice** |
| **Ice** | **90.93 mph Wind with Ice** |
| **Twist/Sway** | **50.00 mph Wind with No Ice** |

Site Number: 283421 | Code: TIA/EIA-222-F | 

Site Name: Madison CT, CT | Engineering Number: 61586923 | 12/22/2015 10:48:55 AM

Customer: Verizon Wireless

## Shaft Section Properties

| Sect Info | Length (ft) | Thick (in) | Fy (ksi) | Slip Joint Type | Slip Joint Len (in) | Weight (lb) | Bottom Dia (in) | Bottom Elev (ft) | Bottom Area (in²) | Bottom Ix (in⁴) | Bottom W/t Ratio | Bottom D/t Ratio | Top Dia (in) | Top Elev (ft) | Top Area (in²) | Top Ix (in⁴) | Top W/t Ratio | Top D/t Ratio | Taper (in/ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-18 | 53.250 | 0.4375 | 65 | | 0.00 | 10,629 | 48.67 | 0.00 | 66.97 | 19685.2 | 18.20 | 111.25 | 36.69 | 53.25 | 50.34 | 8359.6 | 13.38 | 83.87 | 0.224949 |
| 2-18 | 49.500 | 0.3125 | 65 | Slip | 57.00 | 5,430 | 38.38 | 48.50 | 37.76 | 6915.5 | 20.25 | 122.83 | 27.25 | 98.00 | 26.72 | 2449.4 | 13.97 | 87.20 | 0.224949 |
| | | | | | Shaft Weight | 16,059 | | | | | | | | | | | | | |

## Discrete Appurtenance Properties

| Attach Elev (ft) | Description | Qty | No Ice Weight (lb) | No Ice EPAa (sf) | No Ice Orientation Factor | Ice Weight (lb) | Ice EPAa (sf) | Ice Orientation Factor | Distance From Face (ft) | Vert Ecc (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| 97.00 | Ericsson AIR 21 | 6 | 91.00 | 6.530 | 0.86 | 132.60 | 7.200 | 0.86 | 0.000 | -1.000 |
| 97.00 | Ericsson KRY 112 71 | 3 | 13.20 | 0.680 | 0.50 | 18.25 | 0.840 | 0.50 | 0.000 | -1.000 |
| 97.00 | Ericsson RRUS 11 (Band 12) | 3 | 50.00 | 2.990 | 0.67 | 72.90 | 3.620 | 0.67 | 0.000 | -1.000 |
| 97.00 | Round T-Arm | 3 | 250.00 | 9.700 | 0.67 | 314.00 | 12.100 | 0.67 | 0.000 | 0.000 |
| 94.00 | 92" x 12" Panel | 3 | 50.00 | 10.900 | 0.80 | 107.00 | 12.390 | 0.80 | 0.000 | 1.000 |
| 90.00 | CCI HPA-65R-BUU-H8 | 12 | 68.00 | 13.290 | 0.79 | 141.77 | 14.350 | 0.79 | 0.000 | -3.000 |
| 90.00 | Ericsson RRUS 12 | 6 | 50.00 | 3.670 | 0.67 | 80.99 | 4.060 | 0.67 | 0.000 | 0.000 |
| 90.00 | Ericsson RRUS 32 | 3 | 50.80 | 3.140 | 0.67 | 104.90 | 4.300 | 0.67 | 0.000 | 0.000 |
| 90.00 | Ericsson RRUS A2 | 6 | 15.00 | 1.870 | 0.67 | 25.40 | 2.150 | 0.67 | 0.000 | 0.000 |
| 90.00 | Ericsson RRUS E2 B29 | 3 | 60.00 | 3.670 | 0.67 | 81.20 | 4.060 | 0.67 | 0.000 | 0.000 |
| 90.00 | Ericsson RRUS-11 | 9 | 55.00 | 4.420 | 0.67 | 80.70 | 4.850 | 0.67 | 0.000 | 0.000 |
| 90.00 | Raycap DC6-48-60-18-8F | 4 | 20.00 | 1.260 | 0.67 | 35.10 | 1.460 | 0.67 | 0.000 | 0.000 |
| 90.00 | Round Platform w/ Handrails | 1 | 2000.00 | 27.200 | 1.00 | 2,400.00 | 34.200 | 1.00 | 0.000 | 0.000 |
| 76.00 | Alcatel-Lucent 1900 MHz | 3 | 60.00 | 2.710 | 0.67 | 83.10 | 3.070 | 0.67 | 0.000 | 0.000 |
| 76.00 | Alcatel-Lucent B13 RRH4x30- | 3 | 57.20 | 2.530 | 0.67 | 96.20 | 4.110 | 0.67 | 0.000 | 0.000 |
| 76.00 | Alcatel-Lucent RRH4x45-B66 | 3 | 63.30 | 2.890 | 0.67 | 83.90 | 3.150 | 0.67 | 0.000 | 0.000 |
| 76.00 | Andrew SBNHH-1D65B | 12 | 50.70 | 8.380 | 0.83 | 101.00 | 9.210 | 0.83 | 0.000 | 0.000 |
| 76.00 | Collar Mount | 1 | 200.00 | 3.500 | 1.00 | 300.00 | 4.500 | 1.00 | 0.000 | 0.000 |
| 76.00 | Raycap RxxDC-3315-PF-48 | 2 | 32.00 | 2.930 | 0.67 | 41.60 | 3.280 | 0.67 | 0.000 | 0.000 |
| 76.00 | Round Low Profile Platform | 1 | 1500.00 | 21.700 | 1.00 | 1,700.00 | 27.200 | 1.00 | 0.000 | 0.000 |
| | Totals | 87 | 8662.90 | | | 12,581.43 | | | Number of Loadings : | 20 |

## Linear Appurtenance Properties

| Elev From (ft) | Elev To (ft) | Qty | Description | No Ice Weight (lb/ft) | No Ice CaAa (sf/ft) | Ice Weight (lb/ft) | Ice CaAa (sf/ft) | Exposed To Wind |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 97.00 | 6 | 1 5/8" Coax | 4.92 | 0.00 | 0.00 | 0.00 | N |
| 0.00 | 97.00 | 1 | 1 5/8" Hybriflex | 1.30 | 0.00 | 0.00 | 0.00 | N |
| 0.00 | 95.00 | 6 | 1 5/8" Coax | 4.92 | 0.00 | 0.00 | 0.00 | N |
| 0.00 | 90.00 | 2 | 0.40" Fiber Cable | 0.18 | 0.00 | 0.00 | 0.00 | N |
| 0.00 | 90.00 | 8 | 0.78" 8 AWG 6 | 4.72 | 0.00 | 0.00 | 0.00 | N |
| 0.00 | 90.00 | 5 | 3" Conduit | 37.90 | 0.00 | 0.00 | 0.00 | N |
| 0.00 | 90.00 | 3 | 3/8" Coax | 0.24 | 0.00 | 0.00 | 0.00 | N |
| 0.00 | 76.00 | 2 | 1 5/8" Hybriflex | 2.60 | 0.34 | 0.00 | 0.00 | Y |
| | | | Total Weight | 5,141.94 (lb) | | 0.00 (lb) | | |

## Segment Properties (Max Len : 5.ft)

| Seg Top Elev (ft) | Description | Thick (in) | Flat Dia (in) | Area ($in^2$) | Ix ($in^4$) | W/t Ratio | D/t Ratio | Fy (ksi) | Fb (ksi) | Fa (ksi) | Weight (lb) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | | 0.4375 | 48.670 | 66.974 | 19,685.3 | 18.21 | 111.25 | 65 | 52 | 0 | 0.0 |
| 5.00 | | 0.4375 | 47.545 | 65.413 | 18,340.0 | 17.75 | 108.67 | 65 | 52 | 0 | 1,126.2 |
| 10.00 | | 0.4375 | 46.421 | 63.851 | 17,057.5 | 17.30 | 106.10 | 65 | 52 | 0 | 1,099.6 |
| 15.00 | | 0.4375 | 45.296 | 62.289 | 15,836.2 | 16.85 | 103.53 | 65 | 52 | 0 | 1,073.1 |
| 20.00 | | 0.4375 | 44.171 | 60.727 | 14,674.6 | 16.39 | 100.96 | 65 | 52 | 0 | 1,046.5 |
| 25.00 | | 0.4375 | 43.046 | 59.165 | 13,571.2 | 15.94 | 98.39 | 65 | 52 | 0 | 1,019.9 |
| 30.00 | | 0.4375 | 41.922 | 57.604 | 12,524.6 | 15.49 | 95.82 | 65 | 52 | 0 | 993.3 |
| 35.00 | | 0.4375 | 40.797 | 56.042 | 11,533.3 | 15.03 | 93.25 | 65 | 52 | 0 | 966.8 |
| 40.00 | | 0.4375 | 39.672 | 54.480 | 10,595.7 | 14.58 | 90.68 | 65 | 52 | 0 | 940.2 |
| 45.00 | | 0.4375 | 38.547 | 52.918 | 9,710.3 | 14.13 | 88.11 | 65 | 52 | 0 | 913.6 |
| 48.50 | Bot - Section 2 | 0.4375 | 37.760 | 51.825 | 9,120.8 | 13.81 | 86.31 | 65 | 52 | 0 | 623.7 |
| 50.00 | | 0.4375 | 37.423 | 51.357 | 8,875.7 | 13.67 | 85.54 | 65 | 52 | 0 | 455.2 |
| 53.25 | Top - Section 1 | 0.3125 | 37.316 | 36.702 | 6,349.5 | 19.65 | 119.41 | 65 | 52 | 0 | 972.2 |
| 55.00 | | 0.3125 | 36.923 | 36.312 | 6,149.0 | 19.42 | 118.15 | 65 | 52 | 0 | 217.4 |
| 60.00 | | 0.3125 | 35.798 | 35.196 | 5,599.5 | 18.79 | 114.55 | 65 | 52 | 0 | 608.3 |
| 65.00 | | 0.3125 | 34.673 | 34.080 | 5,083.8 | 18.15 | 110.95 | 65 | 52 | 0 | 589.3 |
| 70.00 | | 0.3125 | 33.549 | 32.965 | 4,600.7 | 17.52 | 107.36 | 65 | 52 | 0 | 570.4 |
| 75.00 | | 0.3125 | 32.424 | 31.849 | 4,149.2 | 16.88 | 103.76 | 65 | 52 | 0 | 551.4 |
| 76.00 | | 0.3125 | 32.199 | 31.626 | 4,062.7 | 16.76 | 103.04 | 65 | 52 | 0 | 108.0 |
| 80.00 | | 0.3125 | 31.299 | 30.734 | 3,728.3 | 16.25 | 100.16 | 65 | 52 | 0 | 424.4 |
| 85.00 | | 0.3125 | 30.174 | 29.618 | 3,336.9 | 15.62 | 96.56 | 65 | 52 | 0 | 513.4 |
| 90.00 | | 0.3125 | 29.050 | 28.503 | 2,973.9 | 14.98 | 92.96 | 65 | 52 | 0 | 494.4 |
| 94.00 | | 0.3125 | 28.150 | 27.610 | 2,703.2 | 14.47 | 90.08 | 65 | 52 | 0 | 381.9 |
| 95.00 | | 0.3125 | 27.925 | 27.387 | 2,638.2 | 14.35 | 89.36 | 65 | 52 | 0 | 93.6 |
| 97.00 | | 0.3125 | 27.475 | 26.941 | 2,511.3 | 14.09 | 87.92 | 65 | 52 | 0 | 184.9 |
| 98.00 | | 0.3125 | 27.250 | 26.718 | 2,449.4 | 13.97 | 87.20 | 65 | 52 | 0 | 91.3 |
| | | | | | | | | | | | 16,059.1 |

Site Number: 283421 | Code: TIA/EIA-222-F | 

Site Name: Madison CT, CT | Engineering Number: 61586923 | 12/22/2015 10:48:56 AM

Customer: Verizon Wireless

**Load Case:** No Ice — 105.00 mph Wind with No Ice — 18 Iterations

Gust Response Factor : 1.69
Dead Load Factor : 1.00
Wind Load Factor : 1.00

## Applied Segment Forces Summary

| | | Shaft Forces | | Discrete Forces | | | | Linear Forces | | Sum of Forces | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Seg Elev (ft) | Description | Wind FX (lb) | Dead Load (lb) | Wind FX (lb) | Torsion MY (lb-ft) | Moment MZ (lb-ft) | Dead Load (lb) | Wind FX (lb) | Dead Load (lb) | Wind FX (lb) | Dead Load (lb) | Torsion MY (lb-ft) | Moment MZ (lb) |
| 0.00 | | 310.7 | 0.0 | | | | | 0.0 | 0.0 | 310.7 | 0.0 | 0.0 | 0.0 |
| 5.00 | | 614.2 | 1,126.2 | | | | | 81.1 | 283.9 | 695.3 | 1,410.1 | 0.0 | 0.0 |
| 10.00 | | 599.7 | 1,099.6 | | | | | 81.1 | 283.9 | 680.8 | 1,383.5 | 0.0 | 0.0 |
| 15.00 | | 585.1 | 1,073.1 | | | | | 81.1 | 283.9 | 666.2 | 1,357.0 | 0.0 | 0.0 |
| 20.00 | | 570.6 | 1,046.5 | | | | | 81.1 | 283.9 | 651.7 | 1,330.4 | 0.0 | 0.0 |
| 25.00 | | 556.1 | 1,019.9 | | | | | 81.1 | 283.9 | 637.2 | 1,303.8 | 0.0 | 0.0 |
| 30.00 | | 541.6 | 993.3 | | | | | 81.1 | 283.9 | 622.6 | 1,277.2 | 0.0 | 0.0 |
| 35.00 | | 536.7 | 966.8 | | | | | 81.1 | 283.9 | 617.8 | 1,250.7 | 0.0 | 0.0 |
| 40.00 | | 541.1 | 940.2 | | | | | 84.1 | 283.9 | 625.2 | 1,224.1 | 0.0 | 0.0 |
| 45.00 | | 462.1 | 913.6 | | | | | 87.2 | 283.9 | 549.3 | 1,197.5 | 0.0 | 0.0 |
| 48.50 | Bot - Section 2 | 273.6 | 623.7 | | | | | 62.7 | 198.7 | 336.3 | 822.5 | 0.0 | 0.0 |
| 50.00 | | 262.8 | 455.2 | | | | | 27.3 | 85.2 | 290.1 | 540.4 | 0.0 | 0.0 |
| 53.25 | Top - Section 1 | 276.4 | 972.2 | | | | | 59.9 | 184.5 | 336.3 | 1,156.8 | 0.0 | 0.0 |
| 55.00 | | 371.9 | 217.4 | | | | | 32.7 | 99.4 | 404.6 | 316.8 | 0.0 | 0.0 |
| 60.00 | | 548.4 | 608.3 | | | | | 95.0 | 283.9 | 643.4 | 892.2 | 0.0 | 0.0 |
| 65.00 | | 543.5 | 589.3 | | | | | 97.3 | 283.9 | 640.8 | 873.2 | 0.0 | 0.0 |
| 70.00 | | 537.1 | 570.4 | | | | | 99.5 | 283.9 | 636.6 | 854.3 | 0.0 | 0.0 |
| 75.00 | | 319.7 | 551.4 | | | | | 101.5 | 283.9 | 421.2 | 835.3 | 0.0 | 0.0 |
| 76.00 | Appertunance(s) | 262.6 | 108.0 | 7,805.1 | 0.0 | 0.0 | 2,913.9 | 20.5 | 56.8 | 8,088.3 | 3,078.7 | 0.0 | 0.0 |
| 80.00 | | 467.7 | 424.4 | | | | | 0.0 | 216.7 | 467.7 | 641.1 | 0.0 | 0.0 |
| 85.00 | | 510.7 | 513.4 | | | | | 0.0 | 270.9 | 510.7 | 784.3 | 0.0 | 0.0 |
| 90.00 | Appertunance(s) | 450.8 | 494.4 | 13,847.8 | 0.0 | -23,781.9 | 4,113.4 | 0.0 | 270.9 | 14,298.6 | 4,878.7 | 0.0 | 0.0 |
| 94.00 | Appertunance(s) | 247.0 | 381.9 | 1,687.9 | 0.0 | 1,687.9 | 150.0 | 0.0 | 44.6 | 1,934.9 | 576.4 | 0.0 | 0.0 |
| 95.00 | | 146.0 | 93.6 | | | | | 0.0 | 11.1 | 146.0 | 104.7 | 0.0 | 0.0 |
| 97.00 | Appertunance(s) | 145.3 | 184.9 | 3,901.0 | 0.0 | -2,635.5 | 1,485.6 | 0.0 | 12.4 | 4,046.3 | 1,682.9 | 0.0 | 0.0 |
| 98.00 | | 48.2 | 91.3 | | | | | 0.0 | 0.0 | 48.2 | 91.3 | 0.0 | 0.0 |
| | | | | | | | | Totals: | | 39,306.8 | 29,863.9 | 0.00 | 0.00 |

Site Number: 283421 | Code: TIA/EIA-222-F | 

Site Name: Madison CT, CT | Engineering Number: 61586923 | 12/22/2015 10:48:56 AM

Customer: Verizon Wireless

**Load Case:** No Ice — 105.00 mph Wind with No Ice — 18 Iterations

Gust Response Factor : 1.69
Dead Load Factor : 1.00
Wind Load Factor : 1.00

## Calculated Shaft Forces and Deflections

| Seg Elev (ft) | Lateral FX (-) (kips) | Axial FY (-) (kips) | Lateral FZ (kips) | Moment MX (ft-kips) | Torsion MY (ft-kips) | Moment MZ (ft-kips) | X Deflect (in) | Z Deflect (in) | Total Deflect (in) | Rotation (deg) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | -39.052 | -29.790 | 0.000 | 0.000 | 0.000 | -2,984.575 | 0.000 | 0.000 | 0.000 | 0.000 |
| 5.00 | -38.457 | -28.242 | 0.000 | 0.000 | 0.000 | -2,789.318 | -0.113 | 0.000 | 0.113 | -0.209 |
| 10.00 | -37.867 | -26.724 | 0.000 | 0.000 | 0.000 | -2,597.035 | -0.444 | 0.000 | 0.444 | -0.418 |
| 15.00 | -37.280 | -25.238 | 0.000 | 0.000 | 0.000 | -2,407.705 | -0.995 | 0.000 | 0.995 | -0.626 |
| 20.00 | -36.697 | -23.783 | 0.000 | 0.000 | 0.000 | -2,221.308 | -1.763 | 0.000 | 1.763 | -0.834 |
| 25.00 | -36.119 | -22.361 | 0.000 | 0.000 | 0.000 | -2,037.823 | -2.749 | 0.000 | 2.749 | -1.041 |
| 30.00 | -35.546 | -20.971 | 0.000 | 0.000 | 0.000 | -1,857.229 | -3.949 | 0.000 | 3.949 | -1.245 |
| 35.00 | -34.967 | -19.614 | 0.000 | 0.000 | 0.000 | -1,679.503 | -5.362 | 0.000 | 5.362 | -1.446 |
| 40.00 | -34.371 | -18.291 | 0.000 | 0.000 | 0.000 | -1,504.670 | -6.983 | 0.000 | 6.983 | -1.642 |
| 45.00 | -33.833 | -17.016 | 0.000 | 0.000 | 0.000 | -1,332.818 | -8.806 | 0.000 | 8.806 | -1.832 |
| 48.50 | -33.496 | -16.152 | 0.000 | 0.000 | 0.000 | -1,214.404 | -10.200 | 0.000 | 10.200 | -1.963 |
| 50.00 | -33.210 | -15.572 | 0.000 | 0.000 | 0.000 | -1,164.161 | -10.826 | 0.000 | 10.826 | -2.019 |
| 53.25 | -32.854 | -14.377 | 0.000 | 0.000 | 0.000 | -1,056.228 | -12.241 | 0.000 | 12.241 | -2.134 |
| 55.00 | -32.473 | -13.997 | 0.000 | 0.000 | 0.000 | -998.734 | -13.036 | 0.000 | 13.036 | -2.195 |
| 60.00 | -31.840 | -13.019 | 0.000 | 0.000 | 0.000 | -836.373 | -15.452 | 0.000 | 15.452 | -2.408 |
| 65.00 | -31.200 | -12.076 | 0.000 | 0.000 | 0.000 | -677.175 | -18.081 | 0.000 | 18.081 | -2.600 |
| 70.00 | -30.554 | -11.171 | 0.000 | 0.000 | 0.000 | -521.178 | -20.898 | 0.000 | 20.898 | -2.768 |
| 75.00 | -30.105 | -10.317 | 0.000 | 0.000 | 0.000 | -368.412 | -23.875 | 0.000 | 23.875 | -2.905 |
| 76.00 | -21.878 | -7.634 | 0.000 | 0.000 | 0.000 | -338.307 | -24.486 | 0.000 | 24.486 | -2.929 |
| 80.00 | -21.387 | -6.988 | 0.000 | 0.000 | 0.000 | -250.795 | -26.978 | 0.000 | 26.978 | -3.012 |
| 85.00 | -20.842 | -6.211 | 0.000 | 0.000 | 0.000 | -143.859 | -30.176 | 0.000 | 30.176 | -3.087 |
| 90.00 | -6.300 | -2.114 | 0.000 | 0.000 | 0.000 | -39.650 | -33.435 | 0.000 | 33.435 | -3.126 |
| 94.00 | -4.337 | -1.644 | 0.000 | 0.000 | 0.000 | -12.761 | -36.058 | 0.000 | 36.058 | -3.137 |
| 95.00 | -4.185 | -1.547 | 0.000 | 0.000 | 0.000 | -8.424 | -36.715 | 0.000 | 36.715 | -3.138 |
| 97.00 | -0.053 | -0.089 | 0.000 | 0.000 | 0.000 | -0.053 | -38.029 | 0.000 | 38.029 | -3.139 |
| 98.00 | -0.048 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -38.686 | 0.000 | 38.686 | -3.139 |

**Load Case:** No Ice — 105.00 mph Wind with No Ice — 18 Iterations

Gust Response Factor : 1.69
Dead Load Factor : 1.00
Wind Load Factor : 1.00

## Calculated Stresses

| Seg Elev (ft) | Applied Stresses | | | | | | | Allowable Stress (Fb) (ksi) | Allowable Stress (Fa) (ksi) | Stress Ratio |
|---|---|---|---|---|---|---|---|---|---|---|
| | Axial (Y) (ksi) | Shear (X) (ksi) | Shear (Z) (ksi) | Torsion (ksi) | Bending (X) (ksi) | Bending (Z) (ksi) | Combined (ksi) | | | |
| 0.00 | 0.44 | 1.18 | 0.00 | 0.00 | 0.00 | 44.96 | 45.45 | 52.0 | 0.0 | 0.874 |
| 5.00 | 0.43 | 1.18 | 0.00 | 0.00 | 0.00 | 44.06 | 44.54 | 52.0 | 0.0 | 0.857 |
| 10.00 | 0.42 | 1.20 | 0.00 | 0.00 | 0.00 | 43.06 | 43.53 | 52.0 | 0.0 | 0.837 |
| 15.00 | 0.41 | 1.21 | 0.00 | 0.00 | 0.00 | 41.96 | 42.41 | 52.0 | 0.0 | 0.816 |
| 20.00 | 0.39 | 1.22 | 0.00 | 0.00 | 0.00 | 40.74 | 41.18 | 52.0 | 0.0 | 0.792 |
| 25.00 | 0.38 | 1.23 | 0.00 | 0.00 | 0.00 | 39.38 | 39.82 | 52.0 | 0.0 | 0.766 |
| 30.00 | 0.36 | 1.24 | 0.00 | 0.00 | 0.00 | 37.87 | 38.30 | 52.0 | 0.0 | 0.737 |
| 35.00 | 0.35 | 1.26 | 0.00 | 0.00 | 0.00 | 36.20 | 36.61 | 52.0 | 0.0 | 0.704 |
| 40.00 | 0.34 | 1.27 | 0.00 | 0.00 | 0.00 | 34.32 | 34.73 | 52.0 | 0.0 | 0.668 |
| 45.00 | 0.32 | 1.29 | 0.00 | 0.00 | 0.00 | 32.24 | 32.63 | 52.0 | 0.0 | 0.628 |
| 48.50 | 0.31 | 1.30 | 0.00 | 0.00 | 0.00 | 30.63 | 31.02 | 52.0 | 0.0 | 0.597 |
| 50.00 | 0.30 | 1.30 | 0.00 | 0.00 | 0.00 | 29.91 | 30.29 | 52.0 | 0.0 | 0.583 |
| 53.25 | 0.39 | 1.80 | 0.00 | 0.00 | 0.00 | 37.82 | 38.34 | 52.0 | 0.0 | 0.738 |
| 55.00 | 0.39 | 1.80 | 0.00 | 0.00 | 0.00 | 36.54 | 37.05 | 52.0 | 0.0 | 0.713 |
| 60.00 | 0.37 | 1.82 | 0.00 | 0.00 | 0.00 | 32.58 | 33.10 | 52.0 | 0.0 | 0.637 |
| 65.00 | 0.35 | 1.85 | 0.00 | 0.00 | 0.00 | 28.14 | 28.67 | 52.0 | 0.0 | 0.552 |
| 70.00 | 0.34 | 1.87 | 0.00 | 0.00 | 0.00 | 23.15 | 23.72 | 52.0 | 0.0 | 0.456 |
| 75.00 | 0.32 | 1.91 | 0.00 | 0.00 | 0.00 | 17.54 | 18.17 | 52.0 | 0.0 | 0.349 |
| 76.00 | 0.24 | 1.39 | 0.00 | 0.00 | 0.00 | 16.34 | 16.75 | 52.0 | 0.0 | 0.322 |
| 80.00 | 0.23 | 1.40 | 0.00 | 0.00 | 0.00 | 12.83 | 13.28 | 52.0 | 0.0 | 0.255 |
| 85.00 | 0.21 | 1.42 | 0.00 | 0.00 | 0.00 | 7.93 | 8.50 | 52.0 | 0.0 | 0.163 |
| 90.00 | 0.07 | 0.45 | 0.00 | 0.00 | 0.00 | 2.36 | 2.55 | 52.0 | 0.0 | 0.049 |
| 94.00 | 0.06 | 0.32 | 0.00 | 0.00 | 0.00 | 0.81 | 1.03 | 52.0 | 0.0 | 0.020 |
| 95.00 | 0.06 | 0.31 | 0.00 | 0.00 | 0.00 | 0.54 | 0.80 | 52.0 | 0.0 | 0.015 |
| 97.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 52.0 | 0.0 | 0.000 |
| 98.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 52.0 | 0.0 | 0.000 |

Site Number: 283421 | Code: TIA/EIA-222-F | 

Site Name: Madison CT, CT | Engineering Number: 61586923 | 12/22/2015 10:48:56 AM

Customer: Verizon Wireless

**Load Case:** Ice — 90.93 mph Wind with Ice — 18 Iterations

Gust Response Factor : 1.69
Dead Load Factor : 1.00
Wind Load Factor : 1.00

## Applied Segment Forces Summary

| Seg Elev (ft) | Description | Shaft Forces Wind FX (lb) | Shaft Forces Dead Load (lb) | Discrete Forces Wind FX (lb) | Discrete Forces Torsion MY (lb-ft) | Discrete Forces Moment MZ (lb-ft) | Discrete Forces Dead Load (lb) | Linear Forces Wind FX (lb) | Linear Forces Dead Load (lb) | Sum of Forces Wind FX (lb) | Sum of Forces Dead Load (lb) | Sum of Forces Torsion MY (lb-ft) | Sum of Forces Moment MZ (lb) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | | 237.9 | 0.0 | | | | | 0.0 | 0.0 | 237.9 | 0.0 | 0.0 | 0.0 |
| 5.00 | | 470.3 | 1,274.5 | | | | | 0.0 | 270.9 | 470.3 | 1,545.4 | 0.0 | 0.0 |
| 10.00 | | 459.4 | 1,244.4 | | | | | 0.0 | 270.9 | 459.4 | 1,515.3 | 0.0 | 0.0 |
| 15.00 | | 448.5 | 1,214.4 | | | | | 0.0 | 270.9 | 448.5 | 1,485.3 | 0.0 | 0.0 |
| 20.00 | | 437.6 | 1,184.3 | | | | | 0.0 | 270.9 | 437.6 | 1,455.2 | 0.0 | 0.0 |
| 25.00 | | 426.7 | 1,154.3 | | | | | 0.0 | 270.9 | 426.7 | 1,425.2 | 0.0 | 0.0 |
| 30.00 | | 415.8 | 1,124.2 | | | | | 0.0 | 270.9 | 415.8 | 1,395.1 | 0.0 | 0.0 |
| 35.00 | | 412.4 | 1,094.2 | | | | | 0.0 | 270.9 | 412.4 | 1,365.1 | 0.0 | 0.0 |
| 40.00 | | 416.0 | 1,064.2 | | | | | 0.0 | 270.9 | 416.0 | 1,335.1 | 0.0 | 0.0 |
| 45.00 | | 355.5 | 1,034.1 | | | | | 0.0 | 270.9 | 355.5 | 1,305.0 | 0.0 | 0.0 |
| 48.50 | Bot - Section 2 | 210.6 | 706.4 | | | | | 0.0 | 189.6 | 210.6 | 896.0 | 0.0 | 0.0 |
| 50.00 | | 202.3 | 490.9 | | | | | 0.0 | 81.3 | 202.3 | 572.2 | 0.0 | 0.0 |
| 53.25 | Top - Section 1 | 212.9 | 1,048.1 | | | | | 0.0 | 176.1 | 212.9 | 1,224.2 | 0.0 | 0.0 |
| 55.00 | | 286.5 | 257.8 | | | | | 0.0 | 94.8 | 286.5 | 352.6 | 0.0 | 0.0 |
| 60.00 | | 422.8 | 720.3 | | | | | 0.0 | 270.9 | 422.8 | 991.2 | 0.0 | 0.0 |
| 65.00 | | 419.3 | 697.9 | | | | | 0.0 | 270.9 | 419.3 | 968.8 | 0.0 | 0.0 |
| 70.00 | | 414.8 | 675.4 | | | | | 0.0 | 270.9 | 414.8 | 946.3 | 0.0 | 0.0 |
| 75.00 | | 247.0 | 653.0 | | | | | 0.0 | 270.9 | 247.0 | 923.9 | 0.0 | 0.0 |
| 76.00 | Appertunance(s) | 203.2 | 128.2 | 6,746.0 | 0.0 | 0.0 | 4,084.8 | 0.0 | 54.2 | 6,949.1 | 4,267.2 | 0.0 | 0.0 |
| 80.00 | | 362.0 | 502.9 | | | | | 0.0 | 216.7 | 362.0 | 719.6 | 0.0 | 0.0 |
| 85.00 | | 395.7 | 608.1 | | | | | 0.0 | 270.9 | 395.7 | 879.0 | 0.0 | 0.0 |
| 90.00 | Appertunance(s) | 349.7 | 585.6 | 11,618.8 | 0.0 | -19,257.9 | 6,164.6 | 0.0 | 270.9 | 11,968.5 | 7,021.1 | 0.0 | 0.0 |
| 94.00 | Appertunance(s) | 191.7 | 452.6 | 1,438.9 | 0.0 | 1,438.9 | 321.0 | 0.0 | 44.6 | 1,630.6 | 818.2 | 0.0 | 0.0 |
| 95.00 | | 113.4 | 111.1 | | | | | 0.0 | 11.1 | 113.4 | 122.3 | 0.0 | 0.0 |
| 97.00 | Appertunance(s) | 112.9 | 219.4 | 3,401.3 | 0.0 | -2,217.4 | 2,011.1 | 0.0 | 12.4 | 3,514.2 | 2,242.9 | 0.0 | 0.0 |
| 98.00 | | 37.4 | 108.4 | | | | | 0.0 | 0.0 | 37.4 | 108.4 | 0.0 | 0.0 |
| | | | | | | | | Totals: | | 31,467.4 | 35,880.4 | 0.00 | 0.00 |

Site Number: 283421
Site Name: Madison CT, CT
Customer: Verizon Wireless

Code: TIA/EIA-222-F
Engineering Number: 61586923


12/22/2015 10:48:57 AM

**Load Case:** Ice — 90.93 mph Wind with Ice — 18 Iterations

Gust Response Factor : 1.69
Dead Load Factor : 1.00
Wind Load Factor : 1.00

## Calculated Shaft Forces and Deflections

| Seg Elev (ft) | Lateral FX (-) (kips) | Axial FY (-) (kips) | Lateral FZ (kips) | Moment MX (ft-kips) | Torsion MY (ft-kips) | Moment MZ (ft-kips) | X Deflect (in) | Z Deflect (in) | Total Deflect (in) | Rotation (deg) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | -31.285 | -35.832 | 0.000 | 0.000 | 0.000 | -2,463.112 | 0.000 | 0.000 | 0.000 | 0.000 |
| 5.00 | -30.916 | -34.194 | 0.000 | 0.000 | 0.000 | -2,306.690 | -0.093 | 0.000 | 0.093 | -0.172 |
| 10.00 | -30.548 | -32.589 | 0.000 | 0.000 | 0.000 | -2,152.115 | -0.367 | 0.000 | 0.367 | -0.345 |
| 15.00 | -30.182 | -31.016 | 0.000 | 0.000 | 0.000 | -1,999.378 | -0.822 | 0.000 | 0.822 | -0.518 |
| 20.00 | -29.818 | -29.476 | 0.000 | 0.000 | 0.000 | -1,848.472 | -1.459 | 0.000 | 1.459 | -0.691 |
| 25.00 | -29.455 | -27.969 | 0.000 | 0.000 | 0.000 | -1,699.386 | -2.276 | 0.000 | 2.276 | -0.863 |
| 30.00 | -29.095 | -26.495 | 0.000 | 0.000 | 0.000 | -1,552.111 | -3.272 | 0.000 | 3.272 | -1.034 |
| 35.00 | -28.729 | -25.055 | 0.000 | 0.000 | 0.000 | -1,406.639 | -4.446 | 0.000 | 4.446 | -1.202 |
| 40.00 | -28.350 | -23.649 | 0.000 | 0.000 | 0.000 | -1,262.998 | -5.794 | 0.000 | 5.794 | -1.366 |
| 45.00 | -28.014 | -22.288 | 0.000 | 0.000 | 0.000 | -1,121.250 | -7.312 | 0.000 | 7.312 | -1.526 |
| 48.50 | -27.808 | -21.360 | 0.000 | 0.000 | 0.000 | -1,023.202 | -8.473 | 0.000 | 8.473 | -1.636 |
| 50.00 | -27.615 | -20.759 | 0.000 | 0.000 | 0.000 | -981.491 | -8.996 | 0.000 | 8.996 | -1.683 |
| 53.25 | -27.391 | -19.506 | 0.000 | 0.000 | 0.000 | -891.743 | -10.176 | 0.000 | 10.176 | -1.781 |
| 55.00 | -27.133 | -19.107 | 0.000 | 0.000 | 0.000 | -843.810 | -10.839 | 0.000 | 10.839 | -1.832 |
| 60.00 | -26.731 | -18.050 | 0.000 | 0.000 | 0.000 | -708.148 | -12.857 | 0.000 | 12.857 | -2.012 |
| 65.00 | -26.322 | -17.028 | 0.000 | 0.000 | 0.000 | -574.494 | -15.055 | 0.000 | 15.055 | -2.175 |
| 70.00 | -25.907 | -16.040 | 0.000 | 0.000 | 0.000 | -442.885 | -17.413 | 0.000 | 17.413 | -2.317 |
| 75.00 | -25.639 | -15.097 | 0.000 | 0.000 | 0.000 | -313.353 | -19.907 | 0.000 | 19.907 | -2.434 |
| 76.00 | -18.523 | -11.116 | 0.000 | 0.000 | 0.000 | -287.714 | -20.419 | 0.000 | 20.419 | -2.455 |
| 80.00 | -18.142 | -10.391 | 0.000 | 0.000 | 0.000 | -213.623 | -22.508 | 0.000 | 22.508 | -2.525 |
| 85.00 | -17.716 | -9.516 | 0.000 | 0.000 | 0.000 | -122.911 | -25.190 | 0.000 | 25.190 | -2.589 |
| 90.00 | -5.441 | -3.045 | 0.000 | 0.000 | 0.000 | -34.332 | -27.923 | 0.000 | 27.923 | -2.623 |
| 94.00 | -3.775 | -2.303 | 0.000 | 0.000 | 0.000 | -11.129 | -30.125 | 0.000 | 30.125 | -2.632 |
| 95.00 | -3.656 | -2.186 | 0.000 | 0.000 | 0.000 | -7.354 | -30.676 | 0.000 | 30.676 | -2.633 |
| 97.00 | -0.042 | -0.107 | 0.000 | 0.000 | 0.000 | -0.042 | -31.779 | 0.000 | 31.779 | -2.633 |
| 98.00 | -0.037 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -32.330 | 0.000 | 32.330 | -2.633 |

**Load Case:** Ice — 90.93 mph Wind with Ice — 18 Iterations

Gust Response Factor : 1.69
Dead Load Factor : 1.00
Wind Load Factor : 1.00

## Calculated Stresses

| Seg Elev (ft) | Applied Stresses | | | | | | | Allowable Stress (Fb) (ksi) | Allowable Stress (Fa) (ksi) | Stress Ratio |
|---|---|---|---|---|---|---|---|---|---|---|
| | Axial (Y) (ksi) | Shear (X) (ksi) | Shear (Z) (ksi) | Torsion (ksi) | Bending (X) (ksi) | Bending (Z) (ksi) | Combined (ksi) | | | |
| 0.00 | 0.54 | 0.94 | 0.00 | 0.00 | 0.00 | 37.10 | 37.67 | 52.0 | 0.0 | 0.725 |
| 5.00 | 0.52 | 0.95 | 0.00 | 0.00 | 0.00 | 36.43 | 36.99 | 52.0 | 0.0 | 0.712 |
| 10.00 | 0.51 | 0.96 | 0.00 | 0.00 | 0.00 | 35.68 | 36.23 | 52.0 | 0.0 | 0.697 |
| 15.00 | 0.50 | 0.98 | 0.00 | 0.00 | 0.00 | 34.84 | 35.38 | 52.0 | 0.0 | 0.681 |
| 20.00 | 0.49 | 0.99 | 0.00 | 0.00 | 0.00 | 33.90 | 34.43 | 52.0 | 0.0 | 0.662 |
| 25.00 | 0.47 | 1.00 | 0.00 | 0.00 | 0.00 | 32.84 | 33.36 | 52.0 | 0.0 | 0.642 |
| 30.00 | 0.46 | 1.02 | 0.00 | 0.00 | 0.00 | 31.65 | 32.16 | 52.0 | 0.0 | 0.619 |
| 35.00 | 0.45 | 1.03 | 0.00 | 0.00 | 0.00 | 30.31 | 30.81 | 52.0 | 0.0 | 0.593 |
| 40.00 | 0.43 | 1.05 | 0.00 | 0.00 | 0.00 | 28.81 | 29.30 | 52.0 | 0.0 | 0.564 |
| 45.00 | 0.42 | 1.07 | 0.00 | 0.00 | 0.00 | 27.12 | 27.60 | 52.0 | 0.0 | 0.531 |
| 48.50 | 0.41 | 1.08 | 0.00 | 0.00 | 0.00 | 25.81 | 26.29 | 52.0 | 0.0 | 0.506 |
| 50.00 | 0.40 | 1.08 | 0.00 | 0.00 | 0.00 | 25.21 | 25.69 | 52.0 | 0.0 | 0.494 |
| 53.25 | 0.53 | 1.50 | 0.00 | 0.00 | 0.00 | 31.93 | 32.57 | 52.0 | 0.0 | 0.627 |
| 55.00 | 0.53 | 1.51 | 0.00 | 0.00 | 0.00 | 30.87 | 31.50 | 52.0 | 0.0 | 0.606 |
| 60.00 | 0.51 | 1.53 | 0.00 | 0.00 | 0.00 | 27.58 | 28.22 | 52.0 | 0.0 | 0.543 |
| 65.00 | 0.50 | 1.56 | 0.00 | 0.00 | 0.00 | 23.87 | 24.52 | 52.0 | 0.0 | 0.472 |
| 70.00 | 0.49 | 1.58 | 0.00 | 0.00 | 0.00 | 19.68 | 20.35 | 52.0 | 0.0 | 0.391 |
| 75.00 | 0.47 | 1.62 | 0.00 | 0.00 | 0.00 | 14.92 | 15.65 | 52.0 | 0.0 | 0.301 |
| 76.00 | 0.35 | 1.18 | 0.00 | 0.00 | 0.00 | 13.89 | 14.39 | 52.0 | 0.0 | 0.277 |
| 80.00 | 0.34 | 1.19 | 0.00 | 0.00 | 0.00 | 10.93 | 11.45 | 52.0 | 0.0 | 0.220 |
| 85.00 | 0.32 | 1.21 | 0.00 | 0.00 | 0.00 | 6.77 | 7.39 | 52.0 | 0.0 | 0.142 |
| 90.00 | 0.11 | 0.38 | 0.00 | 0.00 | 0.00 | 2.04 | 2.25 | 52.0 | 0.0 | 0.043 |
| 94.00 | 0.08 | 0.28 | 0.00 | 0.00 | 0.00 | 0.71 | 0.92 | 52.0 | 0.0 | 0.018 |
| 95.00 | 0.08 | 0.27 | 0.00 | 0.00 | 0.00 | 0.47 | 0.72 | 52.0 | 0.0 | 0.014 |
| 97.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 52.0 | 0.0 | 0.000 |
| 98.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 52.0 | 0.0 | 0.000 |

**Load Case:** Twist/Sway — 50.00 mph Wind with No Ice — 17 Iterations

Gust Response Factor : 1.69
Dead Load Factor : 1.00
Wind Load Factor : 1.00

## Applied Segment Forces Summary

| | | Shaft Forces | | Discrete Forces | | | | Linear Forces | | Sum of Forces | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Seg Elev (ft) | Description | Wind FX (lb) | Dead Load (lb) | Wind FX (lb) | Torsion MY (lb-ft) | Moment MZ (lb-ft) | Dead Load (lb) | Wind FX (lb) | Dead Load (lb) | Wind FX (lb) | Dead Load (lb) | Torsion MY (lb-ft) | Moment MZ (lb) |
| 0.00 | | 70.5 | 0.0 | | | | | 0.0 | 0.0 | 70.5 | 0.0 | 0.0 | 0.0 |
| 5.00 | | 139.3 | 1,126.2 | | | | | 18.4 | 283.9 | 157.7 | 1,410.1 | 0.0 | 0.0 |
| 10.00 | | 136.0 | 1,099.6 | | | | | 18.4 | 283.9 | 154.4 | 1,383.5 | 0.0 | 0.0 |
| 15.00 | | 132.7 | 1,073.1 | | | | | 18.4 | 283.9 | 151.1 | 1,357.0 | 0.0 | 0.0 |
| 20.00 | | 129.4 | 1,046.5 | | | | | 18.4 | 283.9 | 147.8 | 1,330.4 | 0.0 | 0.0 |
| 25.00 | | 126.1 | 1,019.9 | | | | | 18.4 | 283.9 | 144.5 | 1,303.8 | 0.0 | 0.0 |
| 30.00 | | 122.8 | 993.3 | | | | | 18.4 | 283.9 | 141.2 | 1,277.2 | 0.0 | 0.0 |
| 35.00 | | 121.7 | 966.8 | | | | | 18.4 | 283.9 | 140.1 | 1,250.7 | 0.0 | 0.0 |
| 40.00 | | 122.7 | 940.2 | | | | | 19.1 | 283.9 | 141.8 | 1,224.1 | 0.0 | 0.0 |
| 45.00 | | 104.8 | 913.6 | | | | | 19.8 | 283.9 | 124.6 | 1,197.5 | 0.0 | 0.0 |
| 48.50 | Bot - Section 2 | 62.0 | 623.7 | | | | | 14.2 | 198.7 | 76.3 | 822.5 | 0.0 | 0.0 |
| 50.00 | | 59.6 | 455.2 | | | | | 6.2 | 85.2 | 65.8 | 540.4 | 0.0 | 0.0 |
| 53.25 | Top - Section 1 | 62.7 | 972.2 | | | | | 13.6 | 184.5 | 76.3 | 1,156.8 | 0.0 | 0.0 |
| 55.00 | | 84.3 | 217.4 | | | | | 7.4 | 99.4 | 91.7 | 316.8 | 0.0 | 0.0 |
| 60.00 | | 124.4 | 608.3 | | | | | 21.5 | 283.9 | 145.9 | 892.2 | 0.0 | 0.0 |
| 65.00 | | 123.2 | 589.3 | | | | | 22.1 | 283.9 | 145.3 | 873.2 | 0.0 | 0.0 |
| 70.00 | | 121.8 | 570.4 | | | | | 22.6 | 283.9 | 144.4 | 854.3 | 0.0 | 0.0 |
| 75.00 | | 72.5 | 551.4 | | | | | 23.0 | 283.9 | 95.5 | 835.3 | 0.0 | 0.0 |
| 76.00 | Appertunance(s) | 59.6 | 108.0 | 1,769.9 | 0.0 | 0.0 | 2,913.9 | 4.7 | 56.8 | 1,834.1 | 3,078.7 | 0.0 | 0.0 |
| 80.00 | | 106.1 | 424.4 | | | | | 0.0 | 216.7 | 106.1 | 641.1 | 0.0 | 0.0 |
| 85.00 | | 115.8 | 513.4 | | | | | 0.0 | 270.9 | 115.8 | 784.3 | 0.0 | 0.0 |
| 90.00 | Appertunance(s) | 102.2 | 494.4 | 3,140.1 | 0.0 | -5,392.7 | 4,113.4 | 0.0 | 270.9 | 3,242.3 | 4,878.7 | 0.0 | 0.0 |
| 94.00 | Appertunance(s) | 56.0 | 381.9 | 382.7 | 0.0 | 382.7 | 150.0 | 0.0 | 44.6 | 438.8 | 576.4 | 0.0 | 0.0 |
| 95.00 | | 33.1 | 93.6 | | | | | 0.0 | 11.1 | 33.1 | 104.7 | 0.0 | 0.0 |
| 97.00 | Appertunance(s) | 32.9 | 184.9 | 884.6 | 0.0 | -597.6 | 1,485.6 | 0.0 | 12.4 | 917.5 | 1,682.9 | 0.0 | 0.0 |
| 98.00 | | 10.9 | 91.3 | | | | | 0.0 | 0.0 | 10.9 | 91.3 | 0.0 | 0.0 |
| | | | | | | | | Totals: | | 8,913.12 | 29,863.9 | 0.00 | 0.00 |

**Load Case:** Twist/Sway — 50.00 mph Wind with No Ice — 17 Iterations

Gust Response Factor : 1.69
Dead Load Factor : 1.00
Wind Load Factor : 1.00

## Calculated Shaft Forces and Deflections

| Seg Elev (ft) | Lateral FX (-) (kips) | Axial FY (-) (kips) | Lateral FZ (kips) | Moment MX (ft-kips) | Torsion MY (ft-kips) | Moment MZ (ft-kips) | X Deflect (in) | Z Deflect (in) | Total Deflect (in) | Rotation (deg) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | -8.855 | -29.860 | 0.000 | 0.000 | 0.000 | -677.111 | 0.000 | 0.000 | 0.000 | 0.000 |
| 5.00 | -8.720 | -28.443 | 0.000 | 0.000 | 0.000 | -632.837 | -0.026 | 0.000 | 0.026 | -0.047 |
| 10.00 | -8.587 | -27.052 | 0.000 | 0.000 | 0.000 | -589.236 | -0.101 | 0.000 | 0.101 | -0.095 |
| 15.00 | -8.454 | -25.689 | 0.000 | 0.000 | 0.000 | -546.303 | -0.226 | 0.000 | 0.226 | -0.142 |
| 20.00 | -8.322 | -24.352 | 0.000 | 0.000 | 0.000 | -504.034 | -0.400 | 0.000 | 0.400 | -0.189 |
| 25.00 | -8.192 | -23.042 | 0.000 | 0.000 | 0.000 | -462.423 | -0.624 | 0.000 | 0.624 | -0.236 |
| 30.00 | -8.062 | -21.759 | 0.000 | 0.000 | 0.000 | -421.466 | -0.896 | 0.000 | 0.896 | -0.282 |
| 35.00 | -7.932 | -20.503 | 0.000 | 0.000 | 0.000 | -381.155 | -1.217 | 0.000 | 1.217 | -0.328 |
| 40.00 | -7.797 | -19.274 | 0.000 | 0.000 | 0.000 | -341.498 | -1.585 | 0.000 | 1.585 | -0.373 |
| 45.00 | -7.676 | -18.072 | 0.000 | 0.000 | 0.000 | -302.513 | -1.998 | 0.000 | 1.998 | -0.416 |
| 48.50 | -7.600 | -17.248 | 0.000 | 0.000 | 0.000 | -275.649 | -2.315 | 0.000 | 2.315 | -0.445 |
| 50.00 | -7.535 | -16.705 | 0.000 | 0.000 | 0.000 | -264.250 | -2.457 | 0.000 | 2.457 | -0.458 |
| 53.25 | -7.455 | -15.546 | 0.000 | 0.000 | 0.000 | -239.760 | -2.778 | 0.000 | 2.778 | -0.484 |
| 55.00 | -7.369 | -15.226 | 0.000 | 0.000 | 0.000 | -226.714 | -2.958 | 0.000 | 2.958 | -0.498 |
| 60.00 | -7.226 | -14.330 | 0.000 | 0.000 | 0.000 | -189.870 | -3.507 | 0.000 | 3.507 | -0.546 |
| 65.00 | -7.082 | -13.453 | 0.000 | 0.000 | 0.000 | -153.739 | -4.103 | 0.000 | 4.103 | -0.590 |
| 70.00 | -6.936 | -12.596 | 0.000 | 0.000 | 0.000 | -118.330 | -4.743 | 0.000 | 4.743 | -0.628 |
| 75.00 | -6.835 | -11.760 | 0.000 | 0.000 | 0.000 | -83.649 | -5.419 | 0.000 | 5.419 | -0.659 |
| 76.00 | -4.967 | -8.702 | 0.000 | 0.000 | 0.000 | -76.814 | -5.558 | 0.000 | 5.558 | -0.665 |
| 80.00 | -4.856 | -8.060 | 0.000 | 0.000 | 0.000 | -56.946 | -6.123 | 0.000 | 6.123 | -0.684 |
| 85.00 | -4.733 | -7.276 | 0.000 | 0.000 | 0.000 | -32.665 | -6.850 | 0.000 | 6.850 | -0.701 |
| 90.00 | -1.431 | -2.438 | 0.000 | 0.000 | 0.000 | -9.002 | -7.590 | 0.000 | 7.590 | -0.710 |
| 94.00 | -0.985 | -1.867 | 0.000 | 0.000 | 0.000 | -2.897 | -8.185 | 0.000 | 8.185 | -0.712 |
| 95.00 | -0.950 | -1.763 | 0.000 | 0.000 | 0.000 | -1.913 | -8.334 | 0.000 | 8.334 | -0.712 |
| 97.00 | -0.012 | -0.091 | 0.000 | 0.000 | 0.000 | -0.012 | -8.633 | 0.000 | 8.633 | -0.712 |
| 98.00 | -0.011 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -8.782 | 0.000 | 8.782 | -0.712 |

**Load Case:** Twist/Sway — 50.00 mph Wind with No Ice — 17 Iterations

Gust Response Factor : 1.69
Dead Load Factor : 1.00
Wind Load Factor : 1.00

## Calculated Stresses

| Seg Elev (ft) | Applied Stresses: Axial (Y) (ksi) | Shear (X) (ksi) | Shear (Z) (ksi) | Torsion (ksi) | Bending (X) (ksi) | Bending (Z) (ksi) | Combined (ksi) | Allowable Stress (Fb) (ksi) | Allowable Stress (Fa) (ksi) | Stress Ratio |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.45 | 0.27 | 0.00 | 0.00 | 0.00 | 10.20 | 10.66 | 52.0 | 0.0 | 0.205 |
| 5.00 | 0.43 | 0.27 | 0.00 | 0.00 | 0.00 | 10.00 | 10.44 | 52.0 | 0.0 | 0.201 |
| 10.00 | 0.42 | 0.27 | 0.00 | 0.00 | 0.00 | 9.77 | 10.20 | 52.0 | 0.0 | 0.196 |
| 15.00 | 0.41 | 0.27 | 0.00 | 0.00 | 0.00 | 9.52 | 9.94 | 52.0 | 0.0 | 0.191 |
| 20.00 | 0.40 | 0.28 | 0.00 | 0.00 | 0.00 | 9.24 | 9.66 | 52.0 | 0.0 | 0.186 |
| 25.00 | 0.39 | 0.28 | 0.00 | 0.00 | 0.00 | 8.94 | 9.34 | 52.0 | 0.0 | 0.180 |
| 30.00 | 0.38 | 0.28 | 0.00 | 0.00 | 0.00 | 8.59 | 8.99 | 52.0 | 0.0 | 0.173 |
| 35.00 | 0.37 | 0.29 | 0.00 | 0.00 | 0.00 | 8.21 | 8.59 | 52.0 | 0.0 | 0.165 |
| 40.00 | 0.35 | 0.29 | 0.00 | 0.00 | 0.00 | 7.79 | 8.16 | 52.0 | 0.0 | 0.157 |
| 45.00 | 0.34 | 0.29 | 0.00 | 0.00 | 0.00 | 7.32 | 7.67 | 52.0 | 0.0 | 0.148 |
| 48.50 | 0.33 | 0.30 | 0.00 | 0.00 | 0.00 | 6.95 | 7.30 | 52.0 | 0.0 | 0.141 |
| 50.00 | 0.33 | 0.30 | 0.00 | 0.00 | 0.00 | 6.79 | 7.13 | 52.0 | 0.0 | 0.137 |
| 53.25 | 0.42 | 0.41 | 0.00 | 0.00 | 0.00 | 8.58 | 9.04 | 52.0 | 0.0 | 0.174 |
| 55.00 | 0.42 | 0.41 | 0.00 | 0.00 | 0.00 | 8.29 | 8.74 | 52.0 | 0.0 | 0.168 |
| 60.00 | 0.41 | 0.41 | 0.00 | 0.00 | 0.00 | 7.40 | 7.84 | 52.0 | 0.0 | 0.151 |
| 65.00 | 0.39 | 0.42 | 0.00 | 0.00 | 0.00 | 6.39 | 6.82 | 52.0 | 0.0 | 0.131 |
| 70.00 | 0.38 | 0.42 | 0.00 | 0.00 | 0.00 | 5.26 | 5.69 | 52.0 | 0.0 | 0.109 |
| 75.00 | 0.37 | 0.43 | 0.00 | 0.00 | 0.00 | 3.98 | 4.42 | 52.0 | 0.0 | 0.085 |
| 76.00 | 0.28 | 0.32 | 0.00 | 0.00 | 0.00 | 3.71 | 4.02 | 52.0 | 0.0 | 0.077 |
| 80.00 | 0.26 | 0.32 | 0.00 | 0.00 | 0.00 | 2.91 | 3.22 | 52.0 | 0.0 | 0.062 |
| 85.00 | 0.25 | 0.32 | 0.00 | 0.00 | 0.00 | 1.80 | 2.12 | 52.0 | 0.0 | 0.041 |
| 90.00 | 0.09 | 0.10 | 0.00 | 0.00 | 0.00 | 0.54 | 0.65 | 52.0 | 0.0 | 0.012 |
| 94.00 | 0.07 | 0.07 | 0.00 | 0.00 | 0.00 | 0.18 | 0.28 | 52.0 | 0.0 | 0.005 |
| 95.00 | 0.06 | 0.07 | 0.00 | 0.00 | 0.00 | 0.12 | 0.22 | 52.0 | 0.0 | 0.004 |
| 97.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 52.0 | 0.0 | 0.000 |
| 98.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 52.0 | 0.0 | 0.000 |

## Analysis Summary

| | Reactions | | | | | | Max Stresses | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Load Case | Shear FX (kips) | Shear FZ (kips) | Axial FY (kips) | Moment MX (ft-kips) | Moment MY (ft-kips) | Moment MZ (ft-kips) | Combined Stress (ksi) | Allowable Stress (ksi) | Elev (ft) | Stress Ratio |
| No Ice | 39.1 | 0.00 | 29.79 | 0.00 | 0.00 | 2984.57 | 45.45 | 52.0 | 0.00 | 0.874 |
| Ice | 31.3 | 0.00 | 35.83 | 0.00 | 0.00 | 2463.11 | 37.67 | 52.0 | 0.00 | 0.725 |
| Twist/Sway | 8.9 | 0.00 | 29.86 | 0.00 | 0.00 | 677.11 | 10.66 | 52.0 | 0.00 | 0.205 |

## Base Summary

### Reactions

| Original Design | | | Analysis | | | |
|---|---|---|---|---|---|---|
| Moment (kip-ft) | Axial (kip) | Shear (kip) | Moment (kip-ft) | Axial (kip) | Shear (kip) | Moment Design % |
| | | | 2,984.57 | 35.83 | 39.05 | |

### Base Plate

| Yield (ksi) | Thick (in) | Width (in) | Style | Poly Sides | Clip Len (in) | Effective Len (in) | Moment (kip-in) | Allow Stress (ksi) | Applied Stress (ksi) | Stress Ratio |
|---|---|---|---|---|---|---|---|---|---|---|
| 50.0 | 3.000 | 56.500 | Clipped | 0 | 12.00 | 38.232 | 1906.52 | 50.00 | 33.24 | 0.66 |

### Anchor Bolts

| Bolt Circle | Num Bolts | Bolt Type | Bolt Dia (in) | Yield (ksi) | Ultimate (ksi) | Arrange | Cluster Dist (in) | Start Angle (deg) | Compression Force (kip) | Compression Allow (kip) | Compression Ratio | Tension Force (kip) | Tension Allow (kip) | Tension Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 55.00 | 16 | 2.25" 18J | 2.25 | 75.00 | 100.00 | Clustered | 6.00 | 45.0 | 165.03 | 195.00 | 0.85 | 160.56 | 195.00 | 0.82 |

| | |
|---|---|
| Site Number: | **283421** |
| Site Name: | **Madison CT, CT** |
| Job Number: | **61586923** |
| Engineer: | **CRF** |
| Date: | **12/22/2015** |

## Base Plate and Bolt Analysis

| | | |
|---|---|---|
| Moment: | 2984.6 | k-ft |
| Shear/Leg: | 39.1 | k |
| Compression/Leg: | 35.8 | k |

| | | |
|---|---|---|
| TIA-222 Code Revision (F/G): | F | |
| Anchor Bolt Arrangement: | Corners | |
| Monopole Shaft Diameter (Across Flats): | 48.7 | in |
| Lower Monopole Thickness: | 0.438 | in |
| # of Sides of Pole: | 18 | |
| Monopole Shaft Yield Strength: | 65 | ksi |
| Baseplate Diameter / Length: | 56.50 | |
| Base Plate Thickness: | 3.00 | in |
| Base Plate Yield Strength: | 50 | ksi |
| Baseplate Detail Type: | D | |
| Include Plate Thickness Beyond Bolt Circle: | Y | |
| Stress Increase: | 1.00 | |
| Fillet Weld Size: | 0.375 | in |
| Weld Type (CJP or F/F): | CJP | |
| Weld Strength: | 70 | ksi |

### Anchor Bolts

| | | |
|---|---|---|
| Anchor Bolt Yield Strength: | 75 | ksi |
| Anchor Bolt Ultimate Strength: | 100 | ksi |
| Anchor Bolt Diameter: | 2.25 | in |
| Anchor Bolt Circle: | 55.00 | in |
| # of Anchor Bolts: | 16 | |
| Minimum Anchor Bolt Separation: | 6.00 | in |
| Additional Anchor Bolts Installed: | N | |

| | Baseplate Flexural Capacity | | | | | Baseplate Shear Capacity | | | |
|---|---|---|---|---|---|---|---|---|---|
| Failure Mode: | Effective Width (in) | Moment (k-in) | S/Z ($in^3$) | Capacity (k-in) | Usage | Shear (k) | Area ($in^2$) | Capacity (k) | Usage |
| AA | 30.14 | 1276.7 | 45.2 | 1695.2 | 0.75 | 640.4 | 90.4 | 1808.2 | 0.35 |
| AB | 37.86 | 1907.5 | 56.8 | 2129.5 | 0.90 | 640.4 | 113.6 | 2271.5 | 0.28 |
| BA | 31.62 | 1517.1 | 47.4 | 1778.5 | 0.85 | 640.4 | 94.9 | 1897.0 | 0.34 |
| BB | 39.64 | 1971.2 | 59.5 | 2229.9 | 0.88 | 640.4 | 118.9 | 2378.5 | 0.27 |

### Anchor Bolt Capacity

| | | |
|---|---|---|
| Area of Bolt: | 3.98 | $in^2$ |
| Inertia of Bolt: | 1.26 | $in^4$ |
| Total Bolt Inertia: | 24075.4 | $in^4$ |
| Maximum Bolt Tension: | 160.4 | k |
| Maximum Bolt Compression: | 164.9 | k |
| Bolt Shear: | 2.4 | k |
| Tensile Bolt Capacity: | 146.1 | k |
| Compressive Bolt Capacity: | 146.1 | k |
| Shear Bolt Capacity: | 67.6 | k |
| Interaction Equation: | 1.17 | Result: No Good |

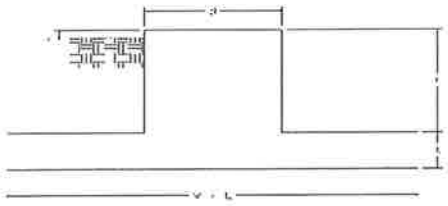
### Base Weld Capacity

| | | |
|---|---|---|
| Force / Weld: | 19.8 | k/in |
| Weld Capacity: | 19.3 | k/in |
| Interaction Equation: | 1.03 | Result: Acceptabl |

| | | |
|---|---|---|
| SES Base Plate Design Moment: | 521.9 | k-in |
| Design Stress: | 36.4 | ksi |
| SES Base Plate Allowable Stress / Moment Capacity: | 37.5 | ksi / k-in |
| Usage: | 0.97 | |
| Moment Factor: | 3.65 | |
| Length Factor: | 3.96 | |

| | |
|---|---|
| Site Name: | Madison CT, CT |
| Site Number: | 283421 |
| Engineering Number: | 61586923 |
| Engineer: | L. Paulson |
| Date: | 12/22/15 |
| Tower Type: | MP |

*Program Last Updated:* *5/13/2014*



## Design Loads (Factored) - Analysis per TIA-222-G Standards

| | | | |
|---|---|---|---|
| Design / Analysis / Mapping: | Analysis | | |
| Compression/Leg: | 35.8 k | Concrete Strength ($f'_c$): | 4000 psi |
| Uplift/Leg: | 0.0 k | Pad Tension Steel Depth: | 20.00 in |
| Total Shear: | 39.1 k | $\phi_{Shear}$: | 0.75 |
| Moment: | 2984.6 k-ft | $\phi_{Flexure\ /\ Tension}$: | 0.90 |
| Tower + Appurtenance Weight: | 29.9 k | $\phi_{Compression:}$ | 0.65 |
| Depth to Base of Foundation (l + t - h): | 7.00 ft | $\beta$: | 0.85 |
| Diameter of Pier (d): | 7.00 ft | Bottom Pad Rebar Size #: | 9 |
| Height of Pier above Ground (h): | 1.00 | # of Bottom Pad Rebar: | 34 |
| Width of Pad (W): | 22.00 ft | Pad Bottom Steel Area: | 34.00 $in^2$ |
| Length of Pad (L): | 22.00 ft | Pad Steel $F_y$: | 60000 psi |
| Thickness of Pad (t): | 2.00 ft | Top Pad Rebar Size #: | 9 |
| Tower Leg Center to Center: | 0.00 ft | # of Top Pad Rebar: | 34 |
| Number of Tower Legs: | 1.0 (1 if MP or GT) | Pad Top Steel Area: | 34.00 $in^2$ |
| Tower Center from Mat Center: | 3.00 ft | Pier Rebar Size #: | 8 |
| Depth Below Ground Surface to Water Table: | 8.00 ft | Pier Steel Area (Single Bar): | 0.79 $in^2$ |
| Unit Weight of Concrete: | 150.0 pcf | # of Pier Rebar: | 36 |
| Unit Weight of Soil Above Water Table: | 100.0 pcf | Pier Steel $F_y$: | 60000 psi |
| Unit Weight of Water: | 62.4 pcf | Pier Cage Diameter: | 76.0 in |
| Unit Weight of Soil Below Water Table: | 50.0 pcf | Rebar Strain Limit: | 0.008 |
| Friction Angle of Uplift: | 0.0 Degrees | Steel Elastic Modulus: | 29000 ksi |
| Ultimate Coefficient of Shear Friction: | 0.35 | Tie Rebar Size #: | 4 |
| Ultimate Compressive Bearing Pressure: | 12000.0 psf | Tie Steel Area (Single Bar): | 0.20 $in^2$ |
| Ultimate Passive Pressure on Pad Face: | 0.0 psf | Tie Spacing: | 12 in |
| $\phi_{Soil\ and\ Concrete\ Weight}$: | 0.9 | Tie Steel $F_y$: | 60000 psi |
| $\phi_{Soil}$: | 0.75 | | |

## Overturning Moment Usage

| | | |
|---|---|---|
| Design OTM: | 3386.6 k-ft | |
| OTM Resistance: | 4164.8 k-ft | |
| Design OTM / OTM Resistance: | 0.81 | Result: OK |

## Soil Bearing Pressure Usage

| | | |
|---|---|---|
| Net Bearing Pressure: | 3211 psf | |
| Factored Nominal Bearing Pressure: | 9000 psf | |
| Net Bearing Pressure/Factored Nominal Bearing Pressure: | 0.36 | Result: OK |
| Load Direction Controling Design Bearing Pressure: | Diagonal to Pad Edge | |

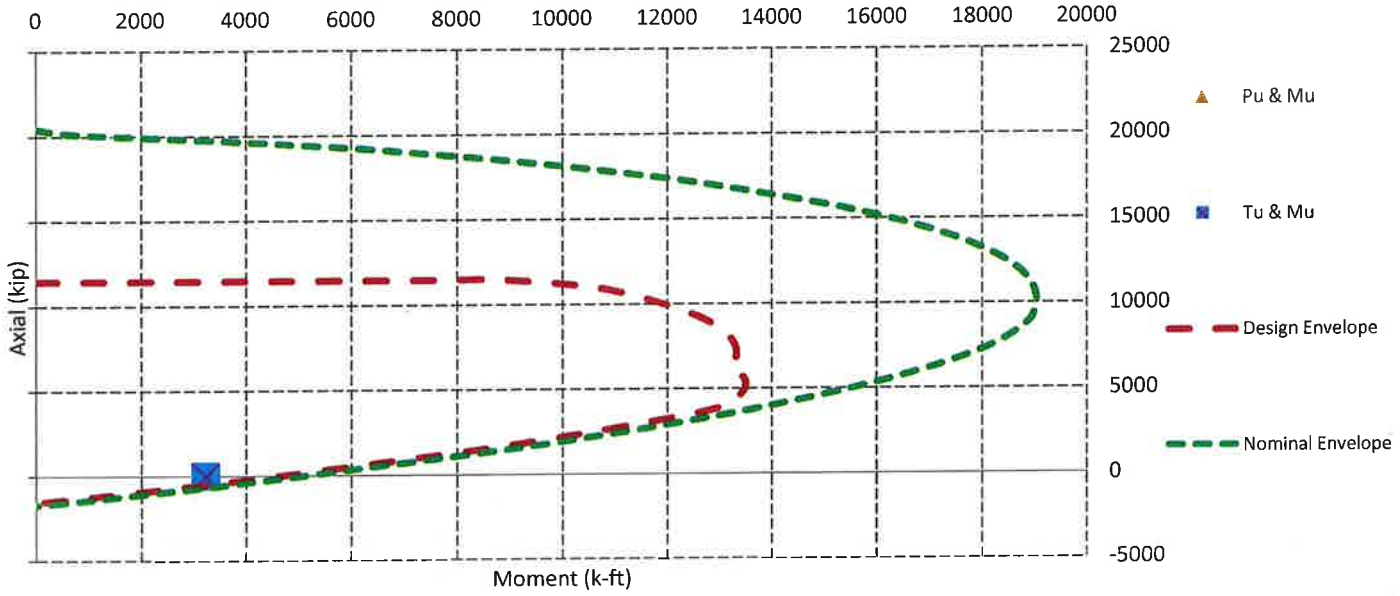
## Sliding Factor of Safety

| | | |
|---|---|---|
| Total Factored Sliding Resistance: | 112.2 k | |
| Sliding Design / Sliding Resistance: | 0.35 | Result: OK |

## One Way Shear, Flexual Capacity, and Punching Shear

| | | |
|---|---|---|
| Factored One Way Shear ($V_u$): | 225.2 k | |
| One Way Shear Capacity ($\phi V_c$): | 500.9 k | - ACI11.3.1.1 |
| $V_u / \phi V_c$: | 0.45 | Result: OK |
| Load Direction Controling Shear Capacity: | Parallel to Pad Edge | |
| Lower Steel Pad Factored Moment ($M_u$): | 1134.6 k-ft | |
| Lower Steel Pad Moment Capacity ($\phi M_n$): | 2912.2 k-ft | - ACI10.3 |
| $M_u / \phi M_n$: | 0.39 | Result: OK |
| Load Direction Controling Flexural Capacity: | Parallel to Pad Edge | |
| Upper Steel Pad Factored Moment ($M_u$): | 758.3 k-ft | |
| Upper Steel Pad Moment Capacity ($\phi M_n$): | 2912.2 k-ft | |
| $M_u / \phi M_n$: | 0.26 | Result: OK |
| Lower Pad Flexural Reinforcement Ratio: | 0.0064 | OK - Minimum Reinforcement Ratio Met - ACI10.5.1 |
| Upper Pad Flexural Reinforcement Ratio: | 0.0064 | OK - Minimum Reinforcement Ratio Met - ACI10.5.1 |
| Lower Pad Reinforcement Spacing: | 8 in | - Pad Reinforcing Spacing OK - ACI7.12.2.2 & 10.5.4 |
| Upper Pad Reinforcement Spacing: | 8 in | - Pad Reinforcing Spacing OK - ACI7.12.2.2 & 10.5.4 |
| Factored Punching Shear ($V_u$): | 0.0 k | |
| Nominal Punching Shear Capacity ($\phi_c V_n$): | 1239.8 k | - ACI11.12.2.1 |
| $V_u / \phi V_c$: | 0.00 | Result: OK |
| Factored Moment in Pier ($M_u$): | 3218.9 k-ft | |
| Pier Moment Capacity ($\phi M_n$): | 4756.5 k-ft | |
| $M_u / \phi M_n$: | 0.68 | Result: OK |
| Factored Shear in Pier ($V_u$): | 39.1 k | |
| Pier Shear Capacity ($\phi V_n$): | 527.4 k | |
| $V_u / \phi V_c$: | 0.07 | Result: OK |
| Pier Shear Reinforcement Ratio: | 0.0004 | No Ties Necessary for Shear - ACI11.5.6.1 |
| Factored Tension in Pier ($T_u$): | 0.0 k | |
| Pier Tension Capacity ($\phi T_n$): | 1535.8 k | |
| $T_u / \phi T_n$: | 0.00 | Result: OK |
| Factored Compression in Pier ($P_u$): | 35.8 k | |
| Pier Compression Capacity ($\phi P_n$): | 9747.6 k | - ACI10.3.6.2 |
| $P_u / \phi P_n$: | 0.00 | Result: OK |
| Pier Compression Reinforcement Ratio: | 0.005 | OK - Reinforcement Ratio Met - ACI10.9.1 & 10.8.4 |
| $M_u/\phi_B M_n + T_u/\phi_T T_n$: | 0.68 | Result: OK |

Nominal and Design Moment Capacity and Factored Design Loads



# ATTACHMENT 5

| | General | Power | Density | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Site Name: Madison 5** | | | | | | | | |
| **Tower Height:** 98ft | | | | | | | | |
| **CARRIER** | **# OF CHAN.** | **WATTS ERP** | **HEIGHT** | **CALC. POWER DENS** | **FREQ.** | **MAX. PERMISS. EXP.** | **FRACTION MPE** | **Total** |
| *T-Mobile | 1 | 445 | 95 | 700 | 0.0202 | 0.4667 | 0.43% | |
| *T-Mobile | 2 | 953 | 97 | 1900 | 0.0828 | 1.0000 | 0.83% | |
| *T-Mobile | 4 | 477 | 97 | 2100 | 0.0829 | 1.0000 | 0.83% | |
| *AT&T | 2 | 500 | 90 | 880 | 0.0510 | 0.5867 | 0.87% | |
| *AT&T | 1 | 500 | 90 | 1900 | 0.0255 | 1.0000 | 0.25% | |
| *AT&T | 1 | 500 | 90 | 700 | 0.0255 | 0.4667 | 0.55% | |
| *AT&T | 1 | 500 | 90 | 1900 | 0.0255 | 1.0000 | 0.25% | |
| *AT&T | 1 | 500 | 90 | 2300 | 0.0255 | 1.0000 | 0.25% | |
| **Verizon PCS** | **1** | **3754** | **76** | **0.2337** | **1970** | **1.0000** | **23.37%** | |
| **Verizon Cellular** | **0** | **457** | **76** | **0.0000** | **869** | **0.5793** | **0.00%** | |
| **Verizon AWS** | **1** | **1750** | **76** | **0.1089** | **2145** | **1.0000** | **10.89%** | |
| **Verizon 700** | **1** | **1050** | **76** | **0.0654** | **746** | **0.4973** | **13.14%** | |
| | | | | | | | | **51.68%** |
| * Source: Siting Council | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

# ATTACHMENT 6

Robinson+Cole

KENNETH C. BALDWIN

280 Trumbull Street
Hartford, CT 06103-3597
Main (860) 275-8200
Fax (860) 275-8299
kbaldwin@rc.com
Direct (860) 275-8345

Also admitted in Massachusetts

June 15, 2016

*Via Certificate of Mailing*

Thomas Banish, First Selectman
Town of Madison
8 Campus Drive
Madison, CT 06443

Re: **Proposed Modifications to a Telecommunications Facility at 15 Orchard Park Road in Madison, Connecticut**

Dear Mr. Banish:

This firm represents Cellco Partnership d/b/a Verizon Wireless ("Cellco"). Today, Cellco filed a Sub-Petition for Declaratory Ruling ("Sub-Petition") with the Connecticut Siting Council ("Council") seeking approval to install antennas and related equipment on the existing 98-foot tower at 15 Orchard Park Road in Madison, Connecticut (the "Property"). Cellco intends to install twelve (12) antennas and nine (9) remote radio heads at the 76-foot level on the tower. Equipment associated with Cellco's antennas and an emergency back-up generator will be installed on a new equipment platform with canopy roof.

As presented in the Sub-Petition, the proposed facility modifications constitute an eligible facility request pursuant to Section 6409(a) of the Federal Middle Class Tax Relief and Job Creation act of 2012 (47 U.S.C. § 1455(a)) and the October 21, 2014 Order of the Federal Communications Commission (FCC-14-153). A copy of the full Sub-Petition is attached for your review. Landowners whose property abuts the Property were also sent notice of this filing along with a copy of the Sub-Petition.

14873579-v1

Robinson+Cole



**Pursuant to its decision in Petition No. 1133, comments or concerns regarding this proposal should be submitted to the Council within thirty (30) days of the date of the attached Sub-Petition.**

Please contact me if you have any questions regarding this proposal.

Sincerely,

Kenneth C. Baldwin

Attachment

Robinson+Cole

KENNETH C. BALDWIN

280 Trumbull Street
Hartford, CT 06103-3597
Main (860) 275-8200
Fax (860) 275-8299
kbaldwin@rc.com
Direct (860) 275-8345

Also admitted in Massachusetts

June 15, 2016

*Via Certificate of Mailing*

15 Orchard Park Road LLC
40 Mungertown Road
Madison, CT 06443

Re: **Proposed Modifications to a Telecommunications Facility at 15 Orchard Park Road in Madison, Connecticut**

Dear Sir or Madam:

This firm represents Cellco Partnership d/b/a Verizon Wireless ("Cellco"). Today, Cellco filed a Sub-Petition for Declaratory Ruling ("Sub-Petition") with the Connecticut Siting Council ("Council") seeking approval to install antennas and related equipment on the existing 98-foot tower at 15 Orchard Park Road in Madison, Connecticut (the "Property"). Cellco intends to install twelve (12) antennas and nine (9) remote radio heads at the 76-foot level on the tower. Equipment associated with Cellco's antennas and an emergency back-up generator will be installed on a new equipment platform with canopy roof.

As presented in the Sub-Petition, the proposed facility modifications constitute an eligible facility request pursuant to Section 6409(a) of the Federal Middle Class Tax Relief and Job Creation act of 2012 (47 U.S.C. § 1455(a)) and the October 21, 2014 Order of the Federal Communications Commission (FCC-14-153). A copy of the full Sub-Petition is attached for your review. Landowners whose property abuts the Property were also sent notice of this filing along with a copy of the Sub-Petition.

14874091-v1

Robinson+Cole



**Pursuant to its decision in Petition No. 1133, comments or concerns regarding this proposal should be submitted to the Council within thirty (30) days of the date of the attached Sub-Petition.**

Please contact me if you have any questions regarding this proposal.

Sincerely,

Kenneth C. Baldwin

Attachment

Robinson+Cole

KENNETH C. BALDWIN

280 Trumbull Street
Hartford, CT 06103-3597
Main (860) 275-8200
Fax (860) 275-8299
kbaldwin@rc.com
Direct (860) 275-8345

Also admitted in Massachusetts

June 15, 2016

*Via Certificate of Mailing*

Heather Douglas Wilkins
Territory Manager-Business Development
Northeast (New England/NY)
American Tower Corporation
10 Presidential Way
Woburn, MA 01801

Re: **Proposed Modifications to a Telecommunications Facility at 15 Orchard Park Road in Madison, Connecticut**

Dear Ms. Wilkins:

This firm represents Cellco Partnership d/b/a Verizon Wireless ("Cellco"). Today, Cellco filed a Sub-Petition for Declaratory Ruling ("Sub-Petition") with the Connecticut Siting Council ("Council") seeking approval to install antennas and related equipment on the existing 98-foot tower at 15 Orchard Park Road in Madison, Connecticut (the "Property"). Cellco intends to install twelve (12) antennas and nine (9) remote radio heads at the 76-foot level on the tower. Equipment associated with Cellco's antennas and an emergency back-up generator will be installed on a new equipment platform with canopy roof.

As presented in the Sub-Petition, the proposed facility modifications constitute an eligible facility request pursuant to Section 6409(a) of the Federal Middle Class Tax Relief and Job Creation act of 2012 (47 U.S.C. § 1455(a)) and the October 21, 2014 Order of the Federal Communications Commission (FCC-14-153). A copy of the full Sub-Petition is attached for your review. Landowners whose property abuts the Property were also sent notice of this filing along with a copy of the Sub-Petition.

14874104-v1

Robinson+Cole



**Pursuant to its decision in Petition No. 1133, comments or concerns regarding this proposal should be submitted to the Council within thirty (30) days of the date of the attached Sub-Petition.**

Please contact me if you have any questions regarding this proposal.

Sincerely,

Kenneth C. Baldwin

Attachment

# ATTACHMENT 7

KENNETH C. BALDWIN

280 Trumbull Street
Hartford, CT 06103-3597
Main (860) 275-8200
Fax (860) 275-8299
kbaldwin@rc.com
Direct (860) 275-8345

Also admitted in Massachusetts

**[SAMPLE ABUTTERS LETTER]**

June 15, 2016

***Via Certificate of Mailing***

«Name_and_Address»

Re: **Proposed Telecommunications Facility at 15 Orchard Park Road in Madison, Connecticut**

Dear «Salutation»:

This firm represents Cellco Partnership d/b/a Verizon Wireless ("Cellco"). Today, Cellco filed a Sub-Petition for Declaratory Ruling ("Sub-Petition") with the Connecticut Siting Council ("Council") seeking approval to install antennas and related equipment on the existing 98-foot tower at 15 Orchard Park Road in Madison, Connecticut (the "Property"). Cellco intends to install twelve (12) antennas and nine (9) remote radio heads at the 76-foot level on the tower. Equipment associated with Cellco's antennas and an emergency back-up generator will be installed on a new equipment platform with canopy roof.

As presented in the Sub-Petition, the proposed facility improvements at the Property constitute an eligible facility request pursuant to Section 6409(a) of the Federal Middle Class Tax Relief and Job Creation act of 2012 (47 U.S.C. § 1455(a)) and the October 21, 2014 Order of the Federal Communications Commission (FCC-14-153). A copy of the full Sub-Petition is attached for your review.

**Pursuant to its decision in Petition No. 1133, comments or concerns regarding this proposal should be submitted to the Council within thirty (30) days of the date of the Sub-Petition.**

This notice is being sent to you because you are listed as an owner of land that abuts the Property. If you have any questions regarding the Sub-Petition, the Council's process for reviewing the Sub-Petition or the details of the filing itself, please feel free to contact me at the number listed above. You may also contact the Council directly at 860-827-2935.

Sincerely,

Kenneth C. Baldwin

Attachment

**CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS**

**ABUTTING PROPERTY OWNERS**

**15 ORCHARD PARK ROAD**
**MADISON, CONNECTICUT**

| | Property Address | Owner's and Mailing Address |
|---|---|---|
| 1. | 39 Orchard Park Road | Marjorie J. and Henry H. Rowell, Sr.<br>39 Orchard Park Road<br>Madison, CT 06443 |
| 2. | 17 Orchard Park Road | Jennifer and Jeffrey Rowell<br>17 Orchard Park Road<br>Madison, CT 06443 |
| 3. | 301 Boston Post Road | Ryan and Katherine McGetrick<br>145 Middle Beach Road<br>Madison, CT 06443 |
| 4. | Fort Path Road | Milano Properties LLC<br>40 Mungertown Road<br>Madison, CT 06443 |
| 5. | 7 Orchard Park Road | 7 Orchard Park Rd LLC<br>40 Mungertown Road<br>Madison, CT 06443 |
| 6. | 32 Johnson Lane | Doreen P. Elia, Trustee of The Elia Family Trust<br>32 Johnson Lane<br>Madison, CT 06443 |
| 7. | 36 Johnson Lane | Sandra Brown<br>36 Johnson Lane<br>Madison, CT 06443 |
| 8. | 40 Johnson Lane | Cheryl Roby<br>40 Johnson Lane<br>Madison, CT 06443 |
| 9. | 44 Johnson Lane | Nilva Sein<br>44 Johnson Lane<br>Madison, CT 06443 |

| | Property Address | Owner's and Mailing Address |
|---|---|---|
| 10. | 48 Johnson Lane | Matthew Meeker, Susan Thomas and Judith Robinson<br>48 Johnson Lane<br>Madison, CT 06443 |
| 11. | Railroad | New Haven Shoreline Railway Co.<br>195 Church Street<br>New Haven, CT 06510 |