ROBINSON & COLE LLP

EM-VER-062-100202

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ORIGINAL

February 2, 2010

Via Hand Delivery

RECEIVED
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CONNECTICUT
SITING COUNCIL

S. Derek Phelps
Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **Notice of Exempt Modification – Antenna Swap**
265 Benham Street, Hamden, Connecticut

Dear Mr. Phelps:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains wireless telecommunications antennas at the 63.5-foot level on an existing 65-foot roof-top tower at the above-referenced address. The tower and underlying property are owned by Apostles of the Sacred Heart of Jesus, Inc. The Council approved Cellco's shared use of the existing tower in 2000 through its approval of EM-VER-062-000922. Cellco now intends to modify its installation by replacing six (6) of its cellular antennas with four (4) model DB844G65ZAXY and two (2) model APL 866513 cellular antennas. Cellco also intends to install two (2) model LNX-6514DS-T4M and one (1) P65-16-XL-2 LTE antennas, for a total of fifteen (15) antennas, all at the same 63.5-foot level on the tower. Attached behind Tab 1 are the specifications for the proposed replacement antennas.

Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to Scott D. Jackson, Mayor for the Town of Hamden.

The planned modifications to the facility fall squarely within those activities explicitly provided for in R.C.S.A. § 16-50j-72(b)(2).

1. The proposed modifications will not result in the increase in the overall height of the existing tower. Cellco's antennas will be located at the same 63.5-foot level on the existing 65-foot roof-top tower.

2. The proposed modifications will not involve any modifications to ground-mounted equipment and, therefore, will not require the extension of the site boundaries.

3. The proposed modifications will not increase noise levels at the facility by six decibels or more.

4. The operation of the replacement antennas will not increase radio frequency (RF) power density levels at the facility to a level at or above the Federal Communications Commission (FCC) adopted safety standard. A Radio Frequency Exposure Report for Cellco's modified facility is included behind Tab 2.

Also attached is a Structural Analysis Report confirming that the tower and foundation can support Cellco's proposed antennas modification. (See Tab 3).

For the foregoing reasons, Cellco respectfully submits that the proposed modifications to the above-referenced telecommunications facility constitutes an exempt modification under R.C.S.A. § 16-50j-72(b)(2).

Sincerely,

Kenneth C. Baldwin

Enclosures
Copy to:
Scott D. Jackson, Hamden Mayor
Apostles of the Sacred Heart of Jesus, Inc.
Sandy M. Carter

Product Specifications

ANDREW®
A CommScope Company

DB844G65ZAXY

Directed Dipole™ Antenna, 806–960 MHz, 65° horizontal beamwidth, fixed electrical tilt

- Excellent azimuth roll-off, reducing sector-to-sector interference and soft hand-offs
- Air dielectric feed system with no screws, rivets, solder, or welding in dipole feed point
- Low profile for ease of zoning approval
- Excellent upper sidelobe suppression

CHARACTERISTICS

General Specifications

Antenna Type	Directed Dipole™
Brand	Directed Dipole™
Operating Frequency Band	806 – 960 MHz

Electrical Specifications

Frequency Band, MHz	**806–896**	**870–960**
Beamwidth, Horizontal, degrees	65	65
Gain, dBd	13.5	13.8
Gain, dBi	15.6	15.9
Beamwidth, Vertical, degrees	15.0	15.0
Beam Tilt, degrees	0	0
Upper Sidelobe Suppression (USLS), typical, dB	15	15
Null Fill, dB	20	20
Front-to-Back Ratio at 180°, dB	40	40
VSWR | Return Loss, db	1.33:1 | 17.0	1.33:1 | 17.0
Intermodulation Products, 3rd Order, 2 x 20 W, dBc	-150	-150
Input Power, maximum, watts	500	500
Polarization	Vertical	Vertical
Impedance, ohms	50	50
Lightning Protection	dc Ground	dc Ground

Product Specifications

DB844G65ZAXY

ANDREW®
A CommScope Company

Mechanical Specifications

Color	Light gray
Connector Interface	7-16 DIN Female
Connector Location	Back
Connector Quantity	1
Wind Loading, maximum	235.8 N @ 100 mph 53.0 lbf @ 100 mph
Wind Speed, maximum	241.4 km/h | 150.0 mph

Dimensions

Depth	203.2 mm | 8.0 in
Length	1219.2 mm | 48.0 in
Width	254.0 mm | 10.0 in
Net Weight	5.4 kg | 12.0 lb

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2002/95/EC	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)

INCLUDED PRODUCTS

DB5083
Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members

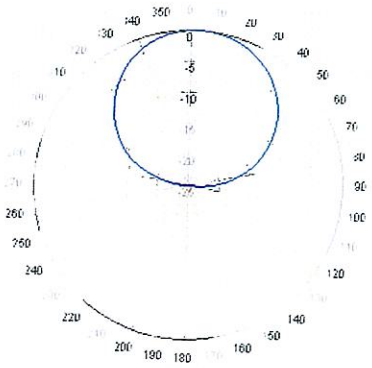
DB380
Pipe Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members

DB382NS
Side Offset Bracket for 4.5 in (114.3 mm) OD round members

Product Specifications

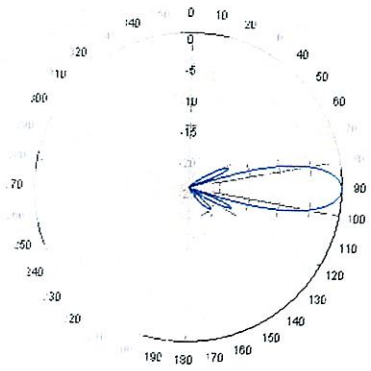
DB844G65ZAXY

Horizontal Pattern



Freq: 850 MHz, Tilt: 0°

Vertical Pattern



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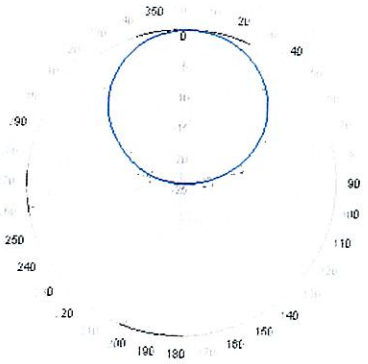

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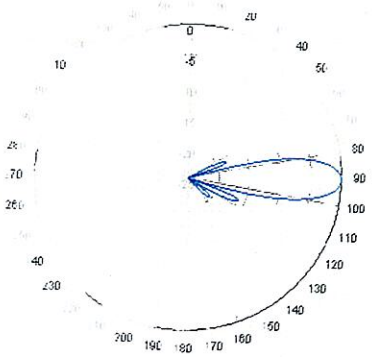


Freq: 935 MHz, Tilt: 0°

HOME

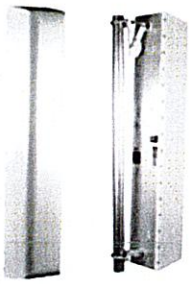
Download the Datasheet as PDF

Technical Data Sheet APL866513-42T0

Maximizer® Log Periodic Antenna, 806-894, 65deg, 15.1dBi, 1.2m, FET, 0deg

Product Description

The Celwave® Maximizer series is a log periodic dipole array which uses a patented design to achieve a front-to-back ratio of 45 dB, the highest front-to-back ratio in the industry. Maximizers are available to cover ESMR, AMPS, PCS and DCS frequency ranges. They use RFS's patented monolithic CELlite® technology, which eliminates cable and soldered joints to reduce the possibility of inter-modulation products. The CELlite technology assures high reliability and excellent repeatability of electrical characteristics. The cellular Maximizers are available in 65°, 80° and 90° horizontal beamwidths and the PCS/DCS Maximizers are available in 65° and 90° horizontal beamwidths. Patent number 6,133,889.



APL866513 Series

Features/Benefits

- **45 dB front-to-back ratio reduces co-channel interference.**
- **Monolithic construction reduces IM.**
- **No solder joints, high reliability.**
- **Surface treated components prevent galvanic corrosion.**
- **UV stabilized radome assures long life without radome deterioration due to UV exposure.**

Technical Specifications

Electrical Specifications

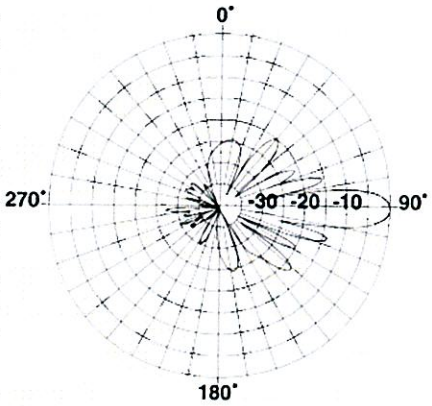
Frequency Range, MHz	806-894
Horizontal Beamwidth, deg	65
Vertical Beamwidth, deg	15
Electrical Downtilt, deg	0
Gain, dBi (dBd)	15.1 (13)
1st Upper Sidelobe Suppression, dB	>20
Upper Sidelobe Suppression, dB	>20
Front-To-Back Ratio, dB	45
Polarization	Vertical
VSWR	< 1.5:1
Impedance, Ohms	50
Maximum Power Input, W	500
Lightning Protection	Direct Ground
Connector Type	7-16 DIN Female

Mechanical Specifications

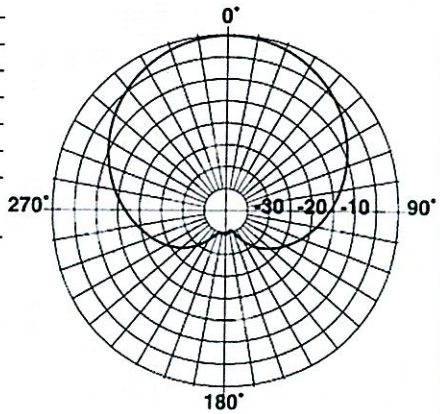
Dimensions - HxWxD, mm (in)	1219 x 234 x 203 (48 x 9.2 x 8)
Weight w/o Mtg Hardware, kg (lb)	7 (15.7)
Survival Wind Speed, km/h (mph)	200 (125)
Rated Wind Speed, km/h (mph)	180 (112)
Max Wind Loading Area, m² (ft²)	0.376 (4.05)
Maximum Thrust @ Rated Wind, N (lbf)	903 (203)
Wind Load - Side @ Rated Wind, N (lbf)	594 (133.5)
Radome Material	UV Stabilized High Impact ABS
Shipping Weight, kg (lb)	9.1 (20)
Packing Dimensions, HxWxD, mm (in)	1594 x 343 x 349 (62.75 x 13.5 x 13.75)

Ordering Information

Mounting Hardware	APM21-3



Vertical Pattern



Horizontal Pattern

P65-16-XL-2 | Very Low Broadband Antennas

POLARIZATION: Dual linear ±45°
FREQUENCY (MHz): 698-894
HORIZONTAL BEAM WIDTH (°): 65
GAIN (dBi/dBd): 16.0/13.9
TILT: 2
LENGTH: 72"

ELECTRICAL SPECIFICATIONS*

Frequency range (MHz)	698-894	
Frequency band (MHz)	698-806	806-894
Gain (dBi/dBd)	15.5/13.4	16.0/13.9
Polarization	Dual Linear +/- 45	
Nominal Impedance (Ω)	50	
VSWR	< 1.33: 1	
Horizontal beam width, -3 dB (°)	68	65
Vertical beam width, -3 dB (°)	10.5	9.5
Side lobe suppression, vertical 1st upper (dB)	> 15	> 15
Isolation between inputs (dB)	> 30	> 30
Tracking, horizontal plane ±60° (dB)	< 2	< 2
Electrical Downtilt Range	2	
Vertical beam squint (°)	< 0.5	< 0.5
Front to back ratio (dB)	> 30	> 30
Front to back ratio, total power (dB)	> 25	> 25
Cross polar discrimination (XPD) 0° (dB)	> 15	> 15
Cross polar discrimination (XPD) ±60° (dB)	> 10	> 10
IM3, 2xTx@43dBm (dBc)	-153	
Power handling, average per input (W)	400	
Power handling, average total (W)	800	

MECHANICAL SPECIFICATIONS*

Connector	2 X 7/16 DIN Female
Connector position	Bottom
Dimensions, HxWxD, in (mm)	72" x 12" x 5" (1829 x 305 x 125)
Mounting	Pre-mounted Tilt Brackets
Weight, with brackets, lbs (kg)	44 (20)
Weight, without brackets, lbs (kg)	33 (15)
Wind load, frontal/lateral/rear side 42 m/s Cd=1.0 (N)	1380
Maximum operational wind speed, mph (m/s)	100 (45)
Survival wind speed, mph (m/s)	125 (55)
Lightning protection	DC Ground
Radome material	PVC
Packet size, HxWxD, in (mm)	82" x 16" x 10" (2082 x 400 x 255)
Radome colour	Light Grey
Shipping weight, lbs (kg)	55 (25)
RET	N/A
Brackets	7256.00, 7454.00, 2210.00

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

ANTENNA PATTERNS*

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

Product Specifications

ANDREW®
A CommScope Company

LNX-6514DS-T4M

DualPol® Antenna, 698–896 MHz, 65° horizontal beamwidth, fixed electrical tilt

- Broadband, providing future-ready single antenna for application in 700 MHz and existing 850 MHz cellular operation
- Air dielectric design provides superior PIM performance with repeatable antenna-to-antenna gain and pattern consistency
- Single piece radome provides long term mechanical stability
- Proven core design technology, with over 1,000,000 similar antennas deployed
- Exceptional USLS pattern shaping for optimizing coverage and interference mitigation for LTE applications
- Specifically designed to have physical dimensions similar to most existing cellular antennas

CHARACTERISTICS

General Specifications

Antenna Type	DualPol®
Brand	DualPol®
Operating Frequency Band	698 – 896 MHz

Electrical Specifications

Frequency Band, MHz	**698–806**	**806–896**
Beamwidth, Horizontal, degrees	66	64
Gain, dBd	13.8	14.5
Gain, dBi	15.9	16.6
Beamwidth, Vertical, degrees	12.0	11.0
Beam Tilt, degrees	4	4
Upper Sidelobe Suppression (USLS), typical, dB	18	18
Front-to-Back Ratio at 180°, dB	33	33
Isolation, dB	30	30
VSWR | Return Loss, db	1.35:1 | 16.5	1.35:1 | 16.5
Intermodulation Products, 3rd Order, 2 x 20 W, dBc	-150	-150
Input Power, maximum, watts	500	500
Polarization	±45°	±45°
Impedance, ohms	50	50
Lightning Protection	dc Ground	dc Ground

Product Specifications

LNX-6514DS-T4M

ANDREW®
A CommScope Company

Mechanical Specifications

Color	Light gray
Connector Interface	7-16 DIN Female
Connector Location	Bottom
Connector Quantity	2
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241.4 km/h | 150.0 mph

Dimensions

Depth	181.0 mm | 7.1 in
Length	1847.0 mm | 72.7 in
Width	301.0 mm | 11.9 in
Net Weight	17.0 kg | 37.5 lb

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2002/95/EC	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)

INCLUDED PRODUCTS

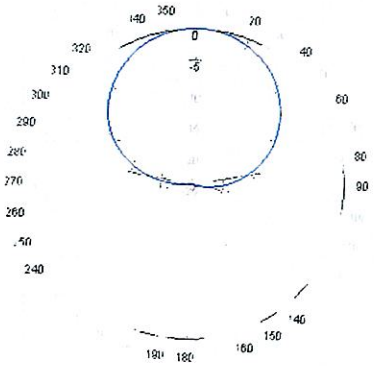
MTG-L-STD
Downtilt Mounting Kit for panel Antennas

Product Specifications

LNX-6514DS-T4M

ANDREW®
A CommScope Company

Horizontal Pattern



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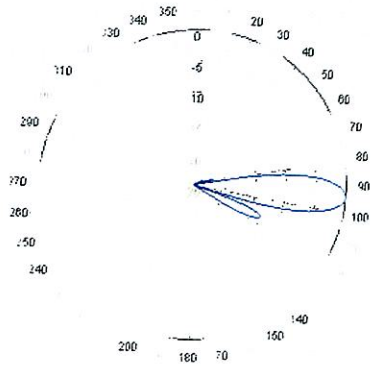
Vertical Pattern



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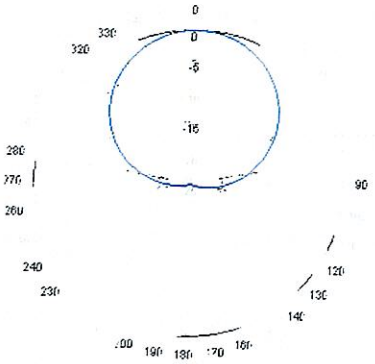

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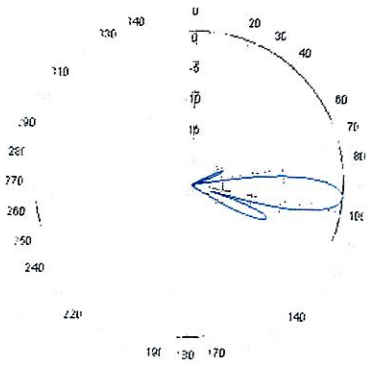

Freq: 850, Tilt 0

C Squared Systems, LLC
920 Candia Road
Manchester, NH 03109
Phone: (603) 657 9702
E-mail:
support@csquaredsystems.com

RADIO FREQUENCY EXPOSURE REPORT

HAMDEN 2

265 BENHAM STREET
HAMDEN, CT 06514

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1. Introduction

The purpose of this report is to investigate compliance with applicable FCC regulations for the proposed additions and modifications of the Verizon Wireless antennas at their Hamden 2 facility located in Hamden, CT. The site is a multi-story college preparatory academy with existing antennas operated by Verizon, AT&T, and T-Mobile. Additionally, there are 2 antennas operated by the town of Hamden, which are used for the police and fire departments. Figure 1 below is an aerial view of the facility.

Verizon Wireless has antennas collocated on the stub tower located on the North Rooftop and is proposing the following modifications to their antenna equipment:

1) Add one 700 MHz LTE antenna to each sectors (alpha, beta, gamma).
2) Replace all cellular antennas.
3) Modify downtilt of all cellular antennas.

Figure 1: Hamden 2

Site Address	265 Benham St, Hamden, CT 06514
Latitude	N 41° 22' 10.04"
Longitude	W 72° 55' 54.45"
Site Elevation AMSL	270 Feet
Main Roof Height AGL	30 Feet
Cellular License Information	KNKA313
PCS License Information	KNLH262
LTE License Information	WQJQ689 - Upper Band WQJQ696 - Lower Band
Name and title of individual(s) conducting survey	Evan Thibodeau - RF Engineer
Date and Time of Survey	12/18/2009 at 10 AM

Table 1: Site Specific Data

2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

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

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

Public exposure to radio frequencies is regulated and enforced in units of milliwatts per square centimeter (mW/cm^2). The general population exposure limits for the various frequency ranges are defined in the attached "FCC Limits for Maximum Permissible Exposure (MPE)" in Attachment B of this report. Because each carrier will be using different frequency bands, and each frequency band has different exposure limits, it is necessary to report percent of MPE rather than power density.

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

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

3. Survey Methodology

Prior to measuring exposure levels the following items are photo documented:

- Roof access points
- EME signage (Present and/or missing)
- Directional views
- All Antennas on the rooftop
- Neighboring facilities indentified to have RF sources (if applicable)

All antennas on the rooftop are documented and the following information is provided (where available[1]):

- Manufacturer
- Model number
- Height relative to roof
- Orientation
- Location on rooftop
- Physical characteristics including length and type.

Measurement points are established in a grid pattern not more than 20 feet apart over the entire area being surveyed. Additional measurement points are selected at potential "Hot Spots" (in close proximity to antennas).

[1] Where antenna model information is unattainable due accessibility or legibility of antenna label, model assumptions are made based on the carriers licensed frequency band and the physical dimensions and characteristics of the antenna.

4. Equipment, Roof Access, & Site Signage

Verizon's equipment shelter is located adjacent to the building. Figure 2 below shows their equipment shelter.

Figure 2: Verizon Equipment

Access to the south roof is through the hatch pictured below. Access to the north roof is through a door that has no signage. Both the access door and hatch remain locked at all times.

Figure 3: Roof Access Door

5. Directional Photos

Figure 4: Directional Photos – East, North, South, West

6. Antenna Inventory, Locations, & Photos

Table 2 below details all of the active antennas currently installed on the roof of Hamden 2. This inventory was taken on December 18, 2009.

Antenna ID	Operator	TX Freq. (MHz)	Power at Antenna (Watts)	Ant Gain (dBi)	Power EIRP (Watts)	Antenna Model	Beam Width	Antenna Downtilt	Length (feet)	Antenna Centerline Height
A	Verizon	1900	16	15.9	623	Andrew 948F85T2E-M_2	85	0	4	63.5
B	Verizon	850	80	15.6	2416	Andrew DB844H90-XY	90	0	4	63.5
C	Verizon	1900	32	15.9	1244.96	Andrew 948F85T2E-M_2	85	0	4	63.5
D	Verizon	850	100	15.6	3020	Andrew DB844H90-XY	90	0	4	63.5
E	Verizon	850	80	15.6	2416	Andrew DB844H90-XY	90	0	4	63.5
F	Verizon	1900	16	15.9	623	Andrew 948F85T2E-M_2	85	0	4	63.5
G	Verizon	850	100	15.6	3020	Andrew DB844H90-XY	90	0	4	63.5
H	Verizon	1900	32	15.9	1244.96	Andrew 948F85T2E-M_2	85	0	4	63.5
I	Verizon	1900	16	15.9	623	Andrew 948F85T2E-M_2	85	0	4	63.5
J	Verizon	1900	32	15.9	1244.96	Andrew 948F85T2E-M_2	85	0	4	63.5
K	Verizon	850	100	15.6	3020	Andrew DB844H90-XY	90	0	4	63.5
L	Verizon	850	80	15.6	2416	Andrew DB844H90-XY	90	0	4	63.5
M	AT&T	800	123	14.6	3555	844H65VTE*	65	0	4	54
N	AT&T	800	123	14.6	3555	844H65VTE*	65	0	4	54
O	AT&T	800	123	14.6	3555	844H65VTE*	65	0	4	54
M	AT&T	1900	22.4	17.9	1385	1900mhz_65deg_0dt*	65	0	5	54
N	AT&T	1900	22.4	17.9	1385	1900mhz_65deg_0dt*	65	0	5	54
O	AT&T	1900	22.4	17.9	1385	1900mhz_65deg_0dt*	65	0	5	54
P	T-Mobile	1900	29	18.4	2062	APX16DWV-16DWVS*	65	0	4.65	70
Q	T-Mobile	1900	29	18.4	2062	APX16DWV-16DWVS*	65	0	4.65	70
R	T-Mobile	1900	29	18.4	2062	APX16DWV-16DWVS*	65	0	4.65	70
P	T-Mobile	2100	35.22	18.4	2435	APX16DWV-16DWVS*	65	0	4.65	70
Q	T-Mobile	2100	35.22	18.4	2435	APX16DWV-16DWVS*	65	0	4.65	70
R	T-Mobile	2100	35.22	18.4	2435	APX16DWV-16DWVS*	65	0	4.65	70
S	Police	154.16	60	6	387.26	150-164_omni_0dg*	360	0	4	72
T	Fire	39.58	90	6	581.09	150-164_omni_0dg*	360	0	4	93.5

Table 2: Existing Antenna Inventory[2]

[2] Where the antennas' electrical and mechanical downtilt information was unavailable, 0° downtilt was assumed. Transmit power assumes 0 dB of cable loss. Asterisks indicate cases where the antenna model information was unavailable, in which case models shown are based on the carriers licensed frequency band and physical dimensions of the antenna.

Table 3 below outlines the proposed antenna configuration associated with Verizon's modifications. The Verizon antennas listed in Table 3 and the "other carrier's" antennas listed in Table 2 were utilized to perform the theoretical calculations as described in the Modeling Procedure section of this report.

Antenna ID	Operator	TX Freq. (MHz)	Power at Antenna (Watts)	Ant Gain (dBi)	Power EIRP (Watts)	Antenna Model	Beam Width	Antenna Downtilt	Length (feet)	Antenna Centerline Height
A	Verizon	1900	16	15.9	623	948F85T2E-M_2	85	0	4	63.5
B	Verizon	850	80	15.6	2416	DB844G65ZAXY	65	2	4	63.5
C	Verizon	1900	32	15.9	1244.96	948F85T2E-M_2	85	0	4	63.5
D	Verizon	850	100	15.6	3020	DB844G65ZAXY	65	2	4	63.5
E	Verizon	850	80	15.6	2416	APL866513	65	2	4	63.5
F	Verizon	1900	16	15.9	623	948F85T2E-M_2	85	0	4	63.5
G	Verizon	850	100	15.6	3020	APL866513	65	2	4	63.5
H	Verizon	1900	32	15.9	1244.96	948F85T2E-M_2	85	0	4	63.5
I	Verizon	1900	16	15.9	623	948F85T2E-M_2	85	0	4	63.5
J	Verizon	1900	32	15.9	1244.96	948F85T2E-M_2	85	0	4	63.5
K	Verizon	850	100	15.6	3020	DB844G65ZAXY	65	4	4	63.5
L	Verizon	850	80	15.6	2416	DB844G65ZAXY	65	4	4	63.5
U	Verizon	700	40	15.6	1556	LNX-6514DS-T4M	65	0	4	63.5
V	Verizon	700	40	15.6	1556	LNX-6514DS-T4M	65	0	4	63.5
W	Verizon	700	40	15.6	1556	LNX-6514DS-T4M	65	0	4	63.5

Table 3: Future Verizon Antenna Configuration

Figures 5 and 6 show each antenna on the tower located on the north rooftop of Hamden 2.

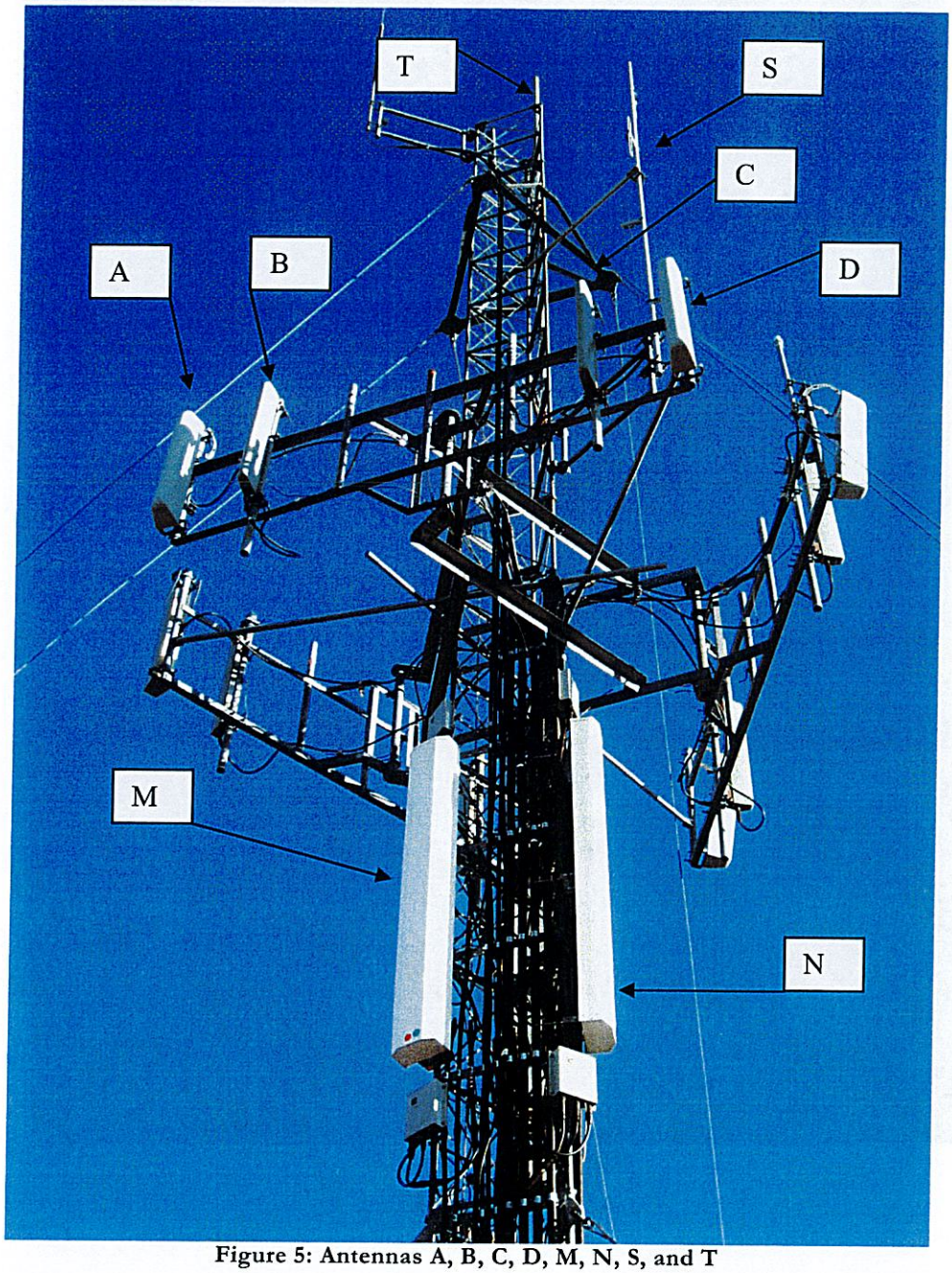


Figure 5: Antennas A, B, C, D, M, N, S, and T

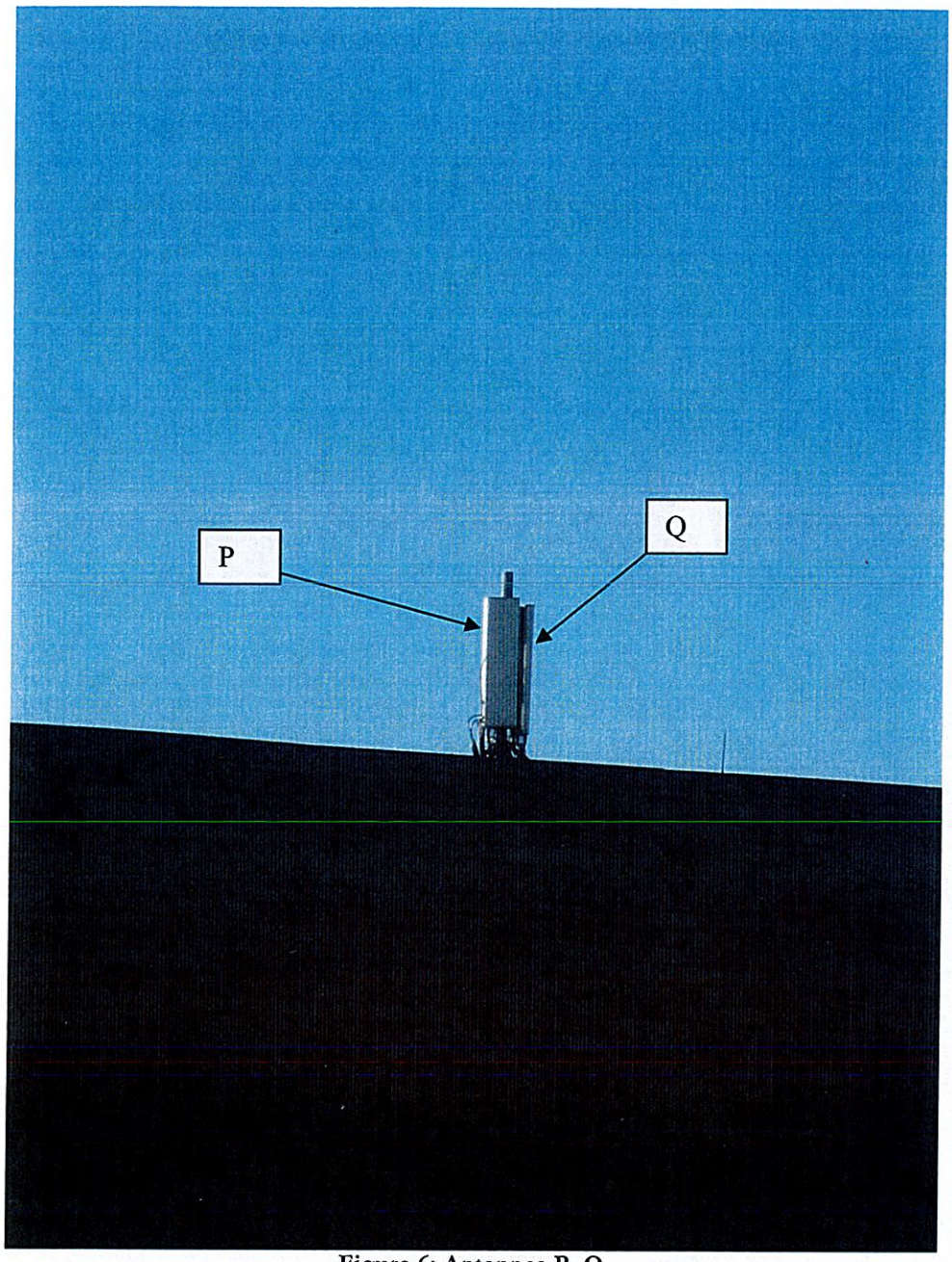


Figure 6: Antennas P, Q

7. Nearby RF Sources

At the time of this RFE survey no other neighboring RF sources were visible from the rooftop. Directional views from the rooftop are provided in Figure 4.

8. Measured Values

8.1. Survey Equipment and Procedures

Frequencies from 300 KHz to 50 GHz were measured using the Narda Probe EA 5091, E-Field, shaped, FCC probe in conjunction with the NBM550 survey meter. The EA 5091 probe is "shaped" such that in a mixed signal environment (i.e.: more than one frequency band is used in a particular location), it accurately measures the percent of MPE.

From FCC OET Bulletin No. 65 - Edition 97-01 – "A useful characteristic of broadband probes used in multiple-frequency RF environments is a frequency-dependent response that corresponds to the variation in MPE limits with frequency. Broadband probes having such a "shaped" response permit direct assessment of compliance at sites where RF fields result from antennas transmitting over a wide range of frequencies. Such probes can express the composite RF field as a percentage of the applicable MPEs".

Probe Description - As suggested in FCC OET Bulletin No. 65 - Edition 97-01, the response of the measurement instrument should be essentially isotropic, (i.e., independent of orientation or rotation angle of the probe). For this reason, the Narda EA 5091 probe was used for these measurements.

Sampling Description - At each measurement location, a spatially averaged measurement is collected over the height of an average human body. The NBM550 survey meter performs a time average measurement while the user slowly moves the probe over a distance range of 20 cm to 200 cm (about 6 feet) above ground level. The results recorded at each measurement location include average values over the spatial distance.

Instrumentation Information - A summary of specifications for the equipment used is provided in the table below.

Manufacturer	Narda Microwave			
Probe	EA 5091, Serial# 01027			
Calibration Date	10/8/2008			
Calibration Interval	24 Months			
Meter	NBM550, Serial# B-0495			
Calibration Date	10/8/2008			
Calibration Interval	24 Months			
Probe Specifications	**Frequency Range**	**Field Measured**	**Standard**	**Measurement Range**
	300 KHz-50 GHz	E	FCC 1997	0.3 – 300 % of Controlled

Table 4: Instrumentation Information

Instrument Measurement Uncertainty - The total measurement uncertainty of the NARDA measurement probe and meter is no greater than ±2 dB. The factors which contribute to this include the probe's frequency response deviation, calibration uncertainty, ellipse ratio, and isotropic response. Every effort is taken to reduce the overall uncertainty during measurement collection including rotating the probe about the axis of the handle and pointing the probe directly at the likely highest source of emissions.

8.2. Survey Locations & Results

Figure 7 below shows the location of the measurements taken on the north rooftop on December 18, 2009.

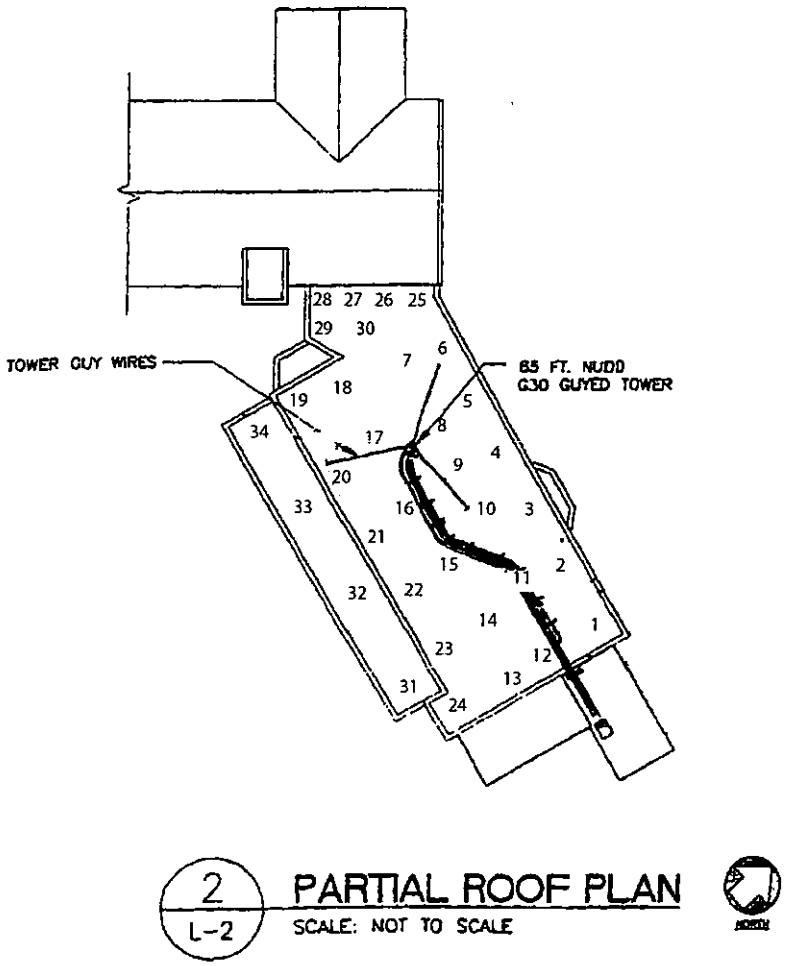


Figure 7: North Rooftop Measurement Locations

Figure 8 below shows the location of the measurements taken on the south rooftop on December 18, 2009.

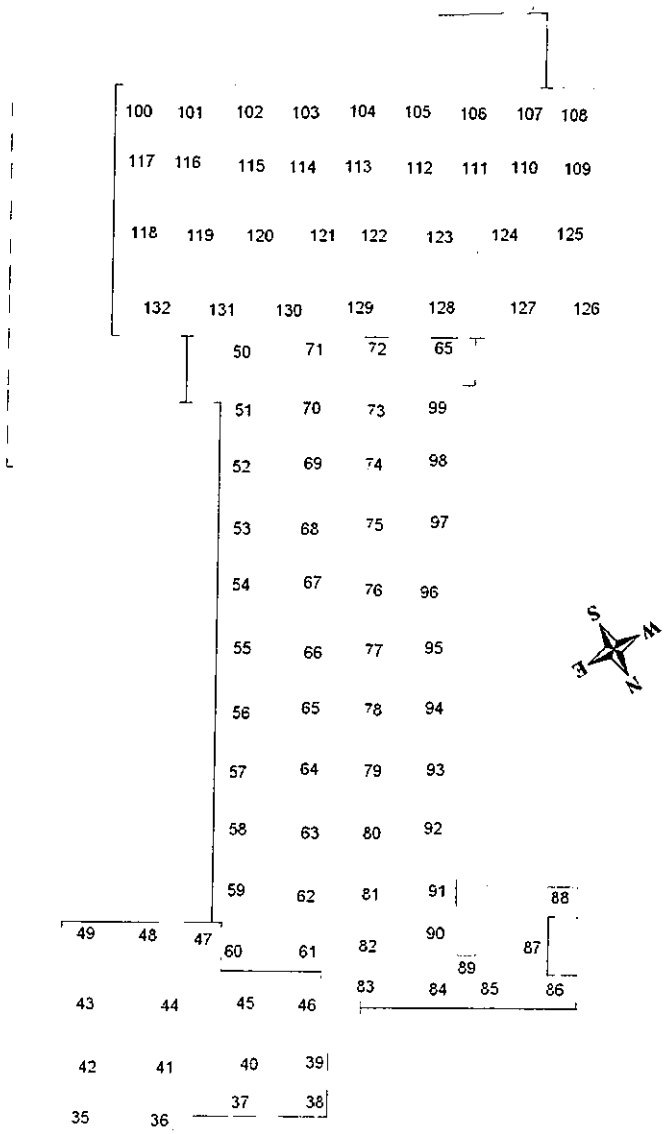


Figure 8: South Rooftop Measurement Locations

Figure 9 below shows an aerial view of the building and surrounding area with labeled ground measurement points which were taken on December 18, 2009.

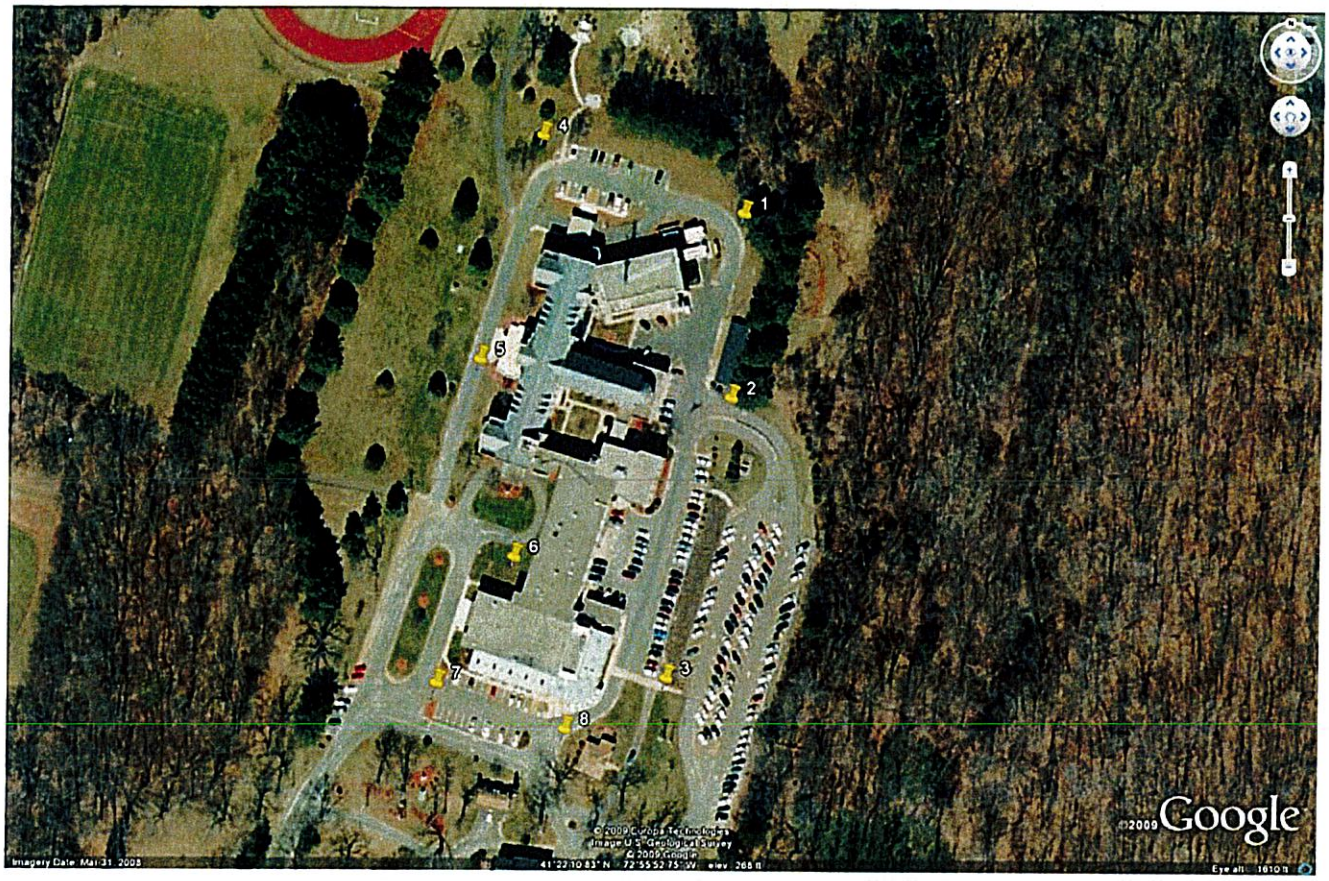


Figure 9: Ground Measurement Locations

Table 5 below shows 34 measurements taken on the north rooftop. Tables 6 and 7 show measurement values from point 35 to point 132 taken on the south roof while Table 8 shows eight measurement values taken on the ground. The highest measurement point, Point 17, was taken on the north rooftop, right under the antenna tower.

Measurement Point	Ave % Controlled/ Occupational	Ave % Uncontrolled/General
1	0.11	0.54
2	0.23	1.15
3	0.49	2.46
4	0.05	0.23
5	0.11	0.53
6	0.14	0.71
7	0.20	0.99
8	0.08	0.41
9	0.15	0.74
10	0.04	0.18
11	0.02	0.09
12	0.12	0.61
13	0.31	1.55
14	0.37	1.87
15	0.06	0.30
16	0.50	2.51
17	**4.85**	**24.23**
18	0.83	4.13
19	0.05	0.26
20	0.08	0.41
21	0.02	0.08
22	0.04	0.21
23	0.05	0.25
24	0.08	0.40
25	2.34	11.71
26	1.59	7.93
27	0.77	3.84
28	0.34	1.69
29	0.14	0.72
30	0.16	0.79
31	0.09	0.43
32	0.19	0.97
33	0.73	3.63
34	1.62	8.11

Table 5: North Rooftop Measurement Values

Measurement Point	Ave % Controlled/ Occupational	Ave % Uncontrolled/General
35	0.03	0.15
36	0.09	0.46
37	0.15	0.75
38	0.47	2.36
39	0.16	0.82
40	0.13	0.64
41	0.38	1.90
42	0.23	1.13
43	0.32	1.60
44	0.21	1.07
45	0.12	0.60
46	0.23	1.14
47	0.22	1.10
48	0.28	1.38
49	0.26	1.30
50	0.46	2.32
51	0.57	2.87
52	0.60	3.01
53	0.70	3.49
54	2.11	10.55
55	0.92	4.61
56	0.60	3.02
57	1.07	5.34
58	0.76	3.81
59	0.57	2.85
60	0.59	2.96
61	0.52	2.59
62	0.54	2.72
63	0.42	2.09
64	0.65	3.26
65	0.67	3.34
66	0.52	2.59
67	2.31	11.56
68	0.98	4.88
69	0.60	3.01
70	0.54	2.68
71	0.65	3.24
72	0.49	2.43
73	0.51	2.55
74	0.52	2.59
75	0.61	3.03
76	0.60	2.99
77	0.58	2.88
78	0.68	3.39
79	0.66	3.30
80	1.16	5.81
81	0.64	3.19
82	0.61	3.03
83	0.77	3.87

Table 6: South Rooftop Measurement Values

Measurement Point	Ave % Controlled/ Occupational	Ave % Uncontrolled/General
84	0.95	4.73
85	0.78	3.92
86	1.77	8.84
87	1.13	5.64
88	0.76	3.82
89	0.60	2.98
90	0.56	2.80
91	0.22	1.11
92	0.20	0.98
93	0.27	1.36
94	0.16	0.82
95	0.16	0.78
96	0.20	0.99
97	0.26	1.28
98	0.29	1.44
99	0.15	0.74
100	0.15	0.73
101	0.16	0.79
102	0.19	0.96
103	0.19	0.96
104	0.19	0.95
105	0.24	1.22
106	0.34	1.70
107	0.59	2.96
108	0.36	1.80
109	0.34	1.70
110	0.46	2.30
111	0.47	2.37
112	0.46	2.28
113	0.42	2.12
114	0.39	1.94
115	0.30	1.50
116	0.36	1.78
117	0.25	1.25
118	0.25	1.26
119	0.29	1.47
120	0.26	1.29
121	0.41	2.05
122	0.27	1.33
123	1.04	5.19
124	0.38	1.92
125	0.46	2.28
126	0.31	1.56
127	0.32	1.58
128	0.59	2.93
129	0.72	3.58
130	0.84	4.22
131	0.91	4.57
132	0.88	4.39

Table 7: South Rooftop Measurement Values Continued

Measurement Point	Ave % Controlled/ Occupational	Ave % Uncontrolled/General
1	0.64	3.22
2	4.32	21.61
3	1.64	8.20
4	0.63	3.13
5	2.41	12.04
6	1.61	8.05
7	0.51	2.53
8	0.19	0.95

Table 8: Ground Measurement Values

Ground measurement locations are shown in the figures below.

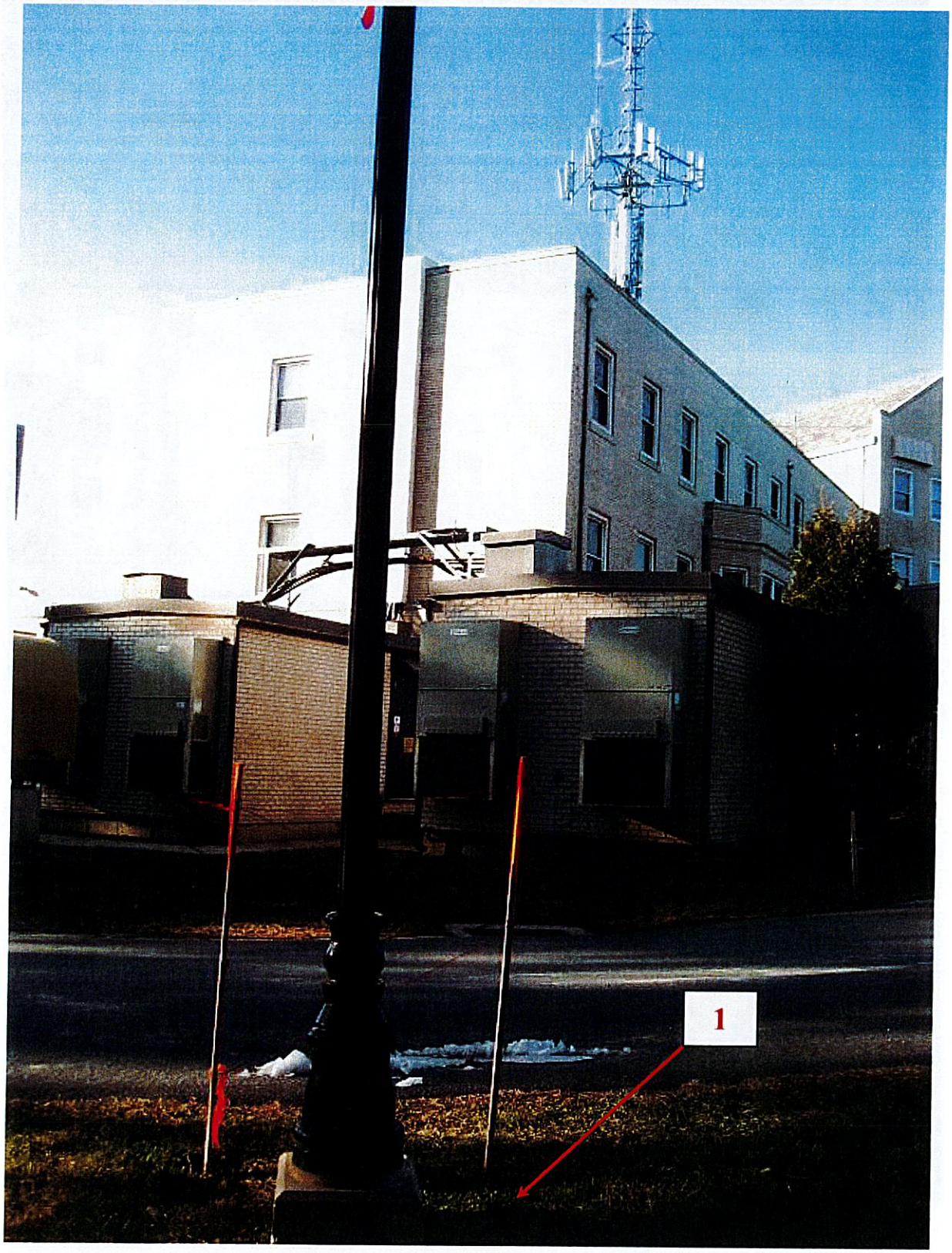


Figure 10: Ground Measurement Location 1

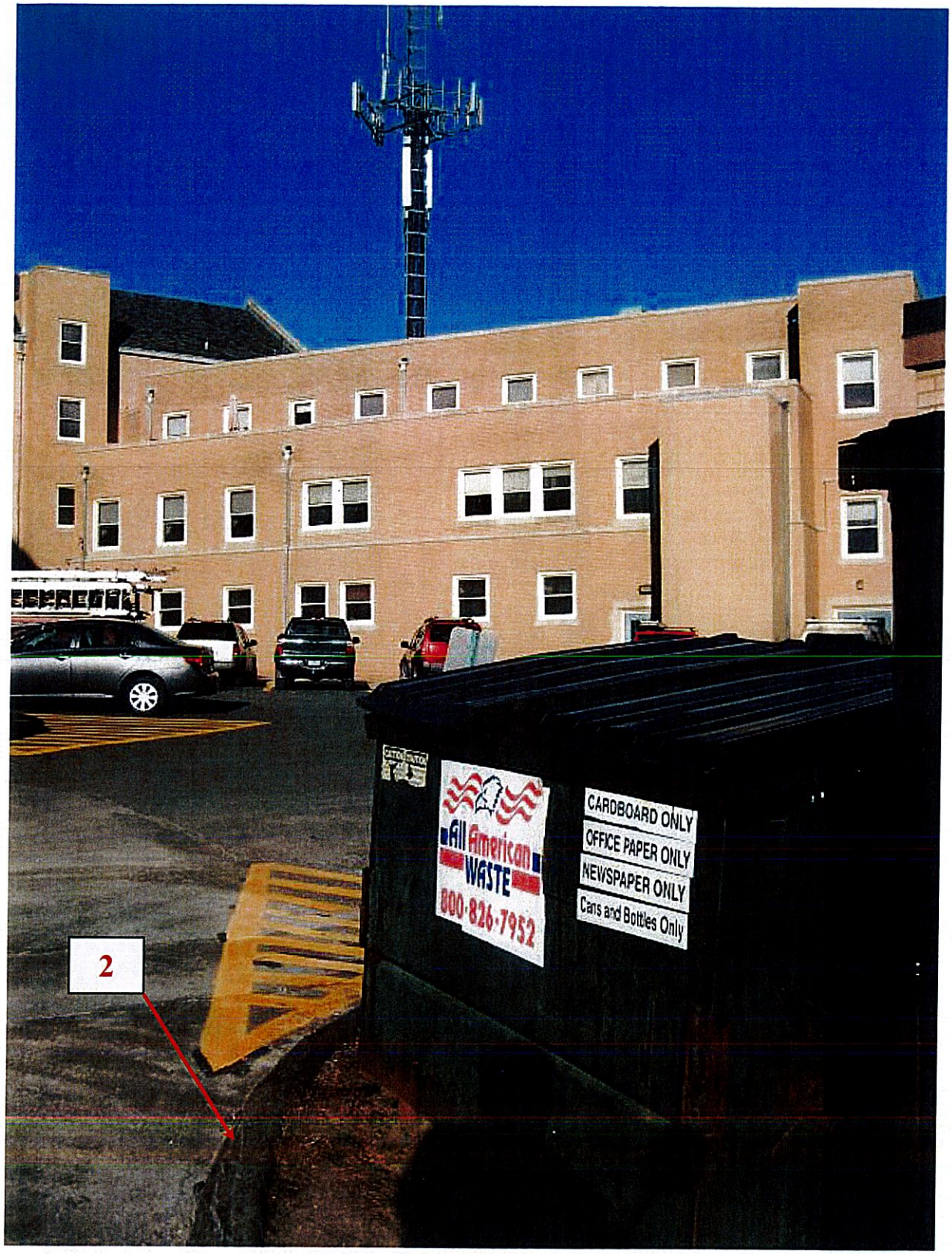


Figure 11: Ground Measurement Location 2

Figure 12: Ground Measurement Location 3

Figure 13: Ground Measurement Location 4

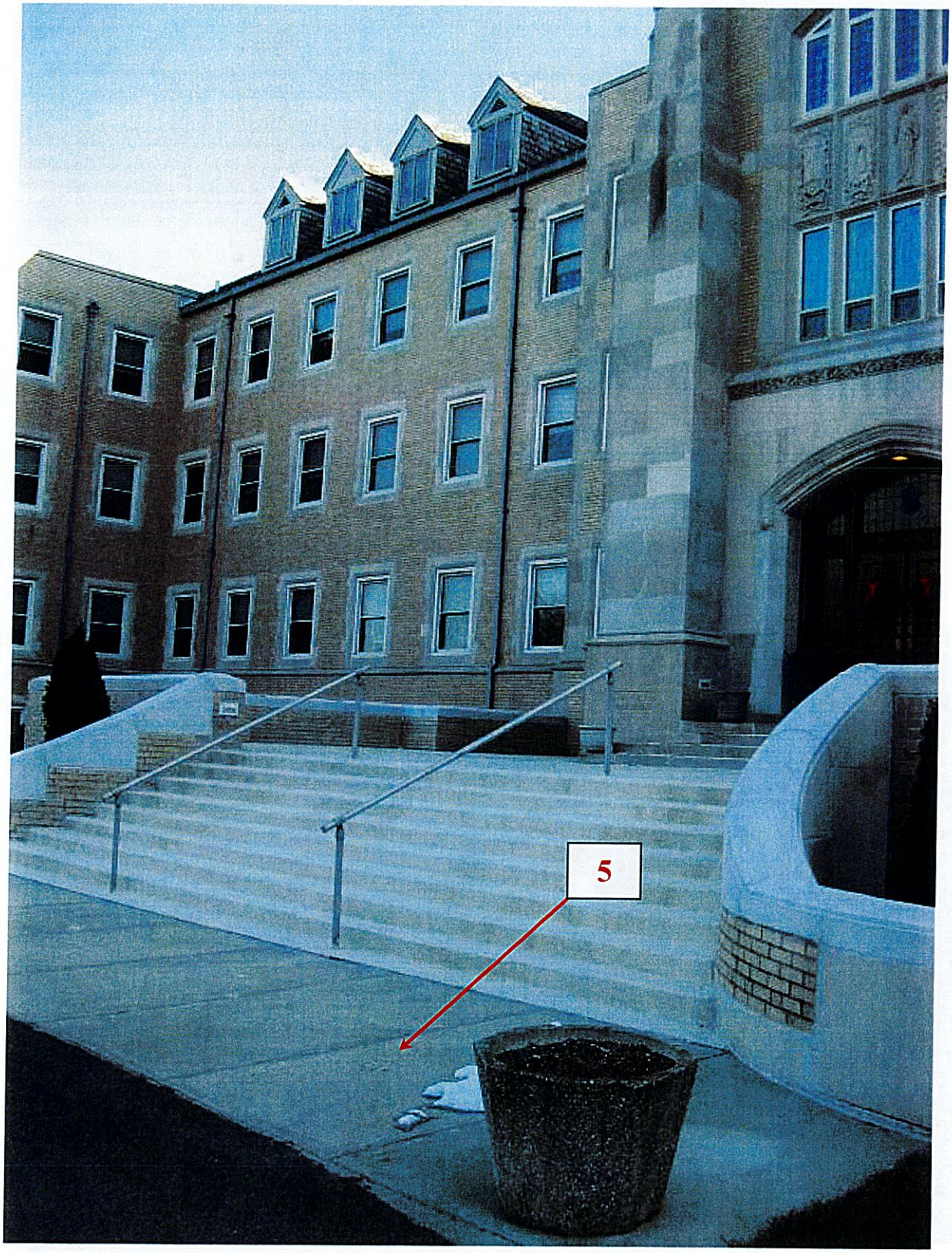


Figure 14: Ground Measurement Location 5

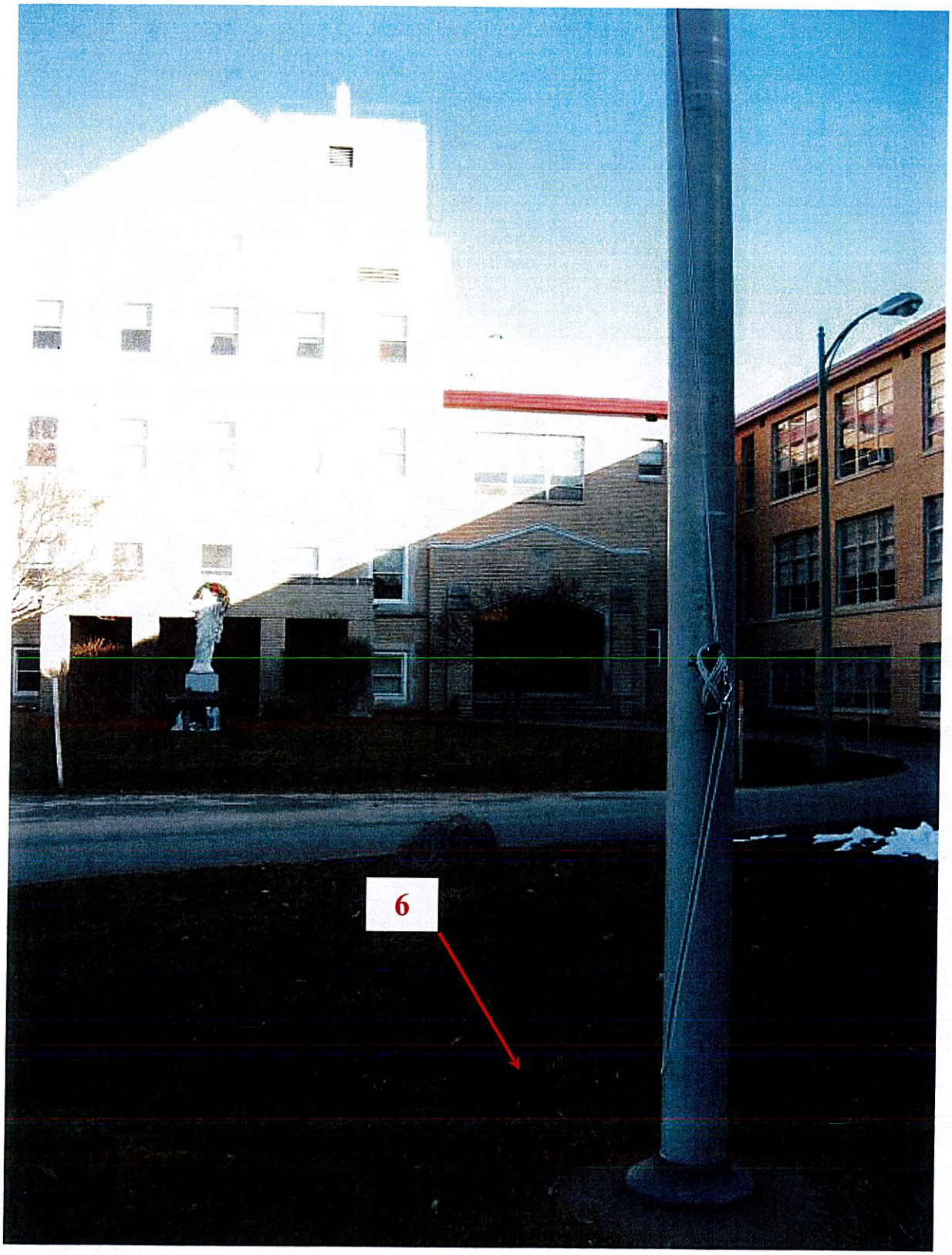


Figure 15: Ground Measurement Location 6

Figure 16: Ground Measurement Location 7

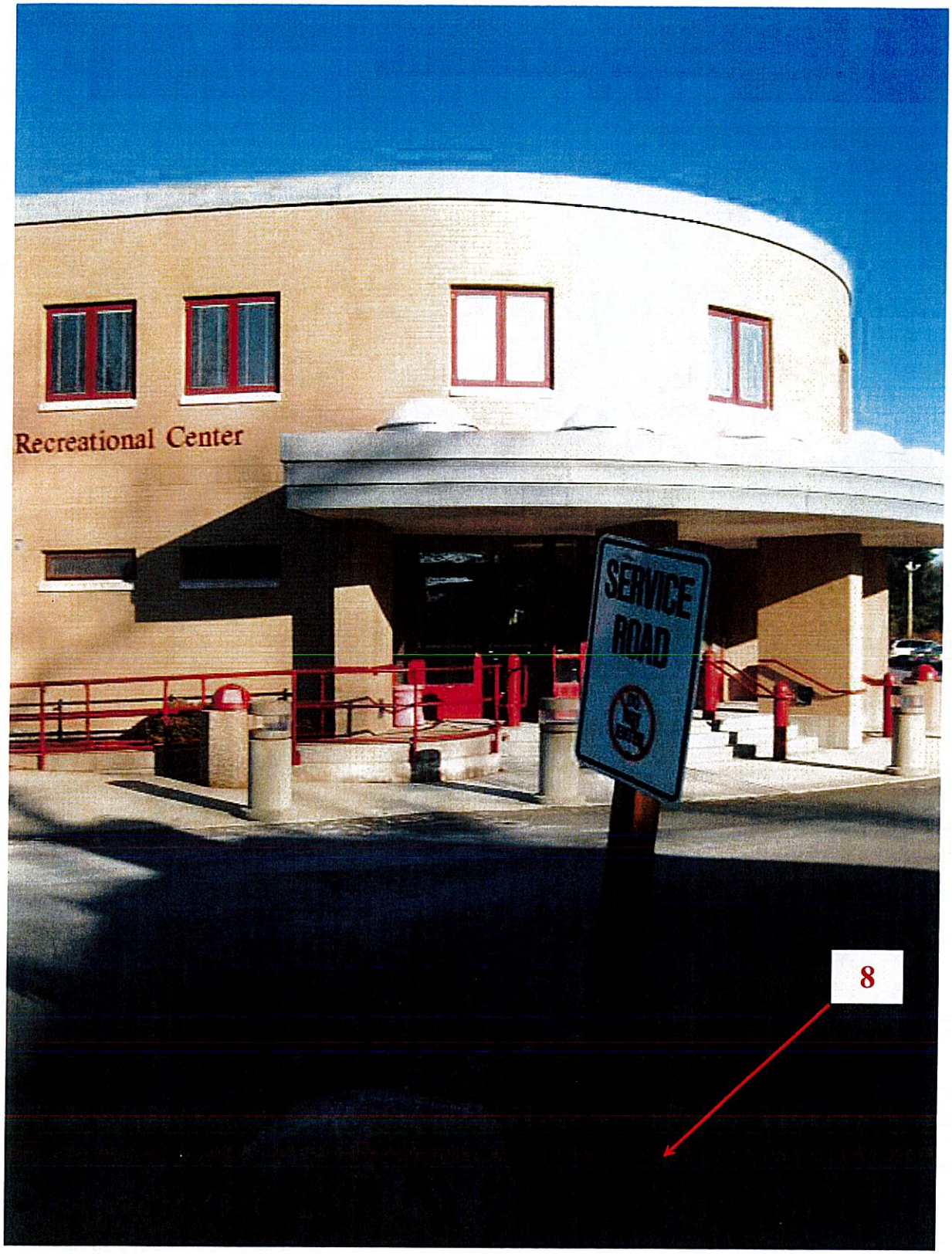


Figure 17: Ground Measurement Location 8

9. Calculated Values

9.1. Modeling Procedure for the Calculations on Rooftop

The emission field calculation results displayed in the following figures were generated using proprietary computer software modeling prediction tool, PDCalc, as developed and provided by C Squared Systems, LLC. PDCalc uses the following power density calculation formulas:

Dish Antennas:

Near Field

$$\text{End of Near Field} = \frac{D^2}{(4 \times \lambda)}$$

$$\text{Power Density Near} = \text{PDN} = \frac{16 \times A \times P}{\pi \times D^2}$$

Where:

D = Antenna Diameter

λ = Wavelength

A = Aperture Efficiency

P = Power Input to the Antenna

- 20 dB of attenuation is added for any points greater than one antenna diameter from the main beam.

Transition Region:

$$\text{End of Transition Region} = \frac{(2 \times \text{D}^2)}{\lambda} \times FarFieldFa\ ctor$$

$$\text{Power Density Transition} = \frac{PDN \times \text{Near Region}}{R}$$

Where:

D = Antenna Diameter

FarFieldFactor = multiplier which expands or contracts transition region to determine start of Far Field

λ = Wavelength

PDN = Power Density Near

R = Radial Distance

$$\textit{Near Region} = \frac{D^2}{(4 \times \lambda)}$$

- 20 dB of attenuation is added for any points greater than one antenna diameter from the main beam.

Far Field:

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

Where:

Off Beam Loss is determined by the selected antenna patterns

R = Radial Distance

Directional and Omni Antennas:

Near Field:

$$S = \frac{P_t \times K(H_a, L_a)}{20 \times \pi \times L_a \times R_h \times \left(\frac{BW}{360}\right)}$$

Where:
S = Power Density in mw/ cm²
P_t = Actual (or worst case assumed) power delivered to the antenna (watts)
$K(H_a, La)$ = Correction factor for antenna mounting height
Ha = Antenna mounting height in feet
L_a = Antenna length in meters
R_h = the horizontal distance along roof from antenna to point of interest
BW = Antenna beamwidth

$K(H_a, L_a) = 0.99013 - 0.14656 \times H_a$ for $0 \leq H_a \leq 6$
$= 1/H_a$ for $H_a > 6$

- If the horizontal distance from the bottom of the antenna is < 1 foot, then 1 foot is used for the distance.

In order to deal with directional antennas, a modified cylindrical model is used. This is done by approximating the horizontal pattern with a model that is conservative, and applying the results to the cylindrical model above. The equation to be used is:

$$A = \cos^n\left(\phi/2\right)$$

Where:
A = Attenuation
ϕ = Angle between antenna azimuth and point in question
n = Factor to shape the function for a particular beamwidth
BW = Antenna beamwidth

By setting the attenuation equal to 0.5 at the half power point $(\phi = BW/2)$, n can be solved. However, in order to ensure that the attenuation model is conservative, n is solved when $\phi = (BW/2) \times (4/3)$. This essentially assumes a larger beamwidth for margin. Therefore, solving for n, we have

$$n = \frac{\ln(0.5)}{\ln(\cos(BW/3))}$$

As a result, antennas with a beamwidth wider than 270° will be treated as an omni-directional antenna. Finally, the maximum attenuation is capped at 15 dB to assure a conservative result in the rear of the antenna.

Far Field:

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

Where:

EIRP = Effective Isotropic Radiated Power Watts

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

H = Horizontal Distance from antenna in meters

V = Vertical Distance from radiation center of antenna in meters

Off Beam Loss is determined by the selected antenna patterns

9.2. Calculated Results for Rooftop Emissions

Figure 18 below shows the current RF environment on the rooftop of Hamden 2.

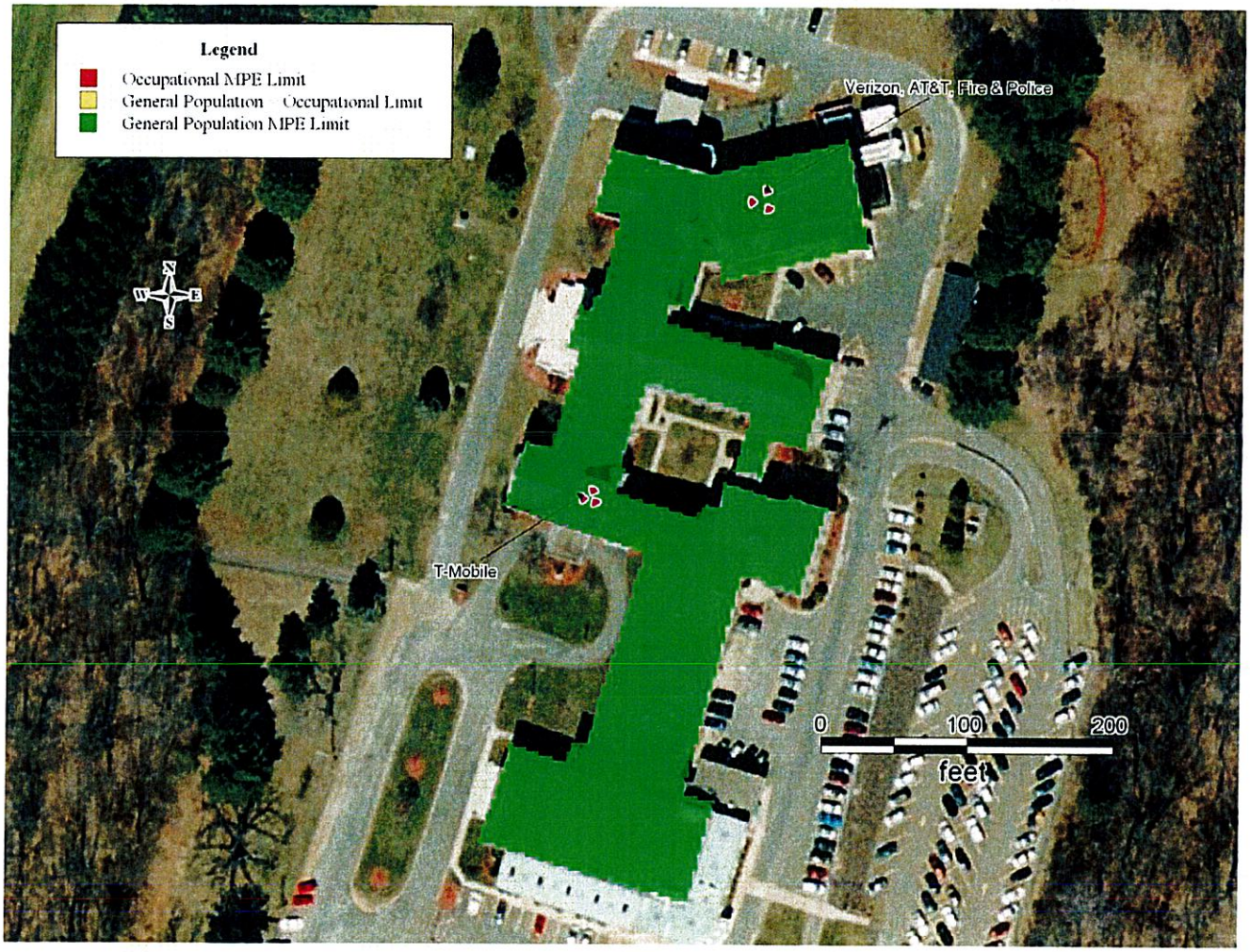


Figure 18: Existing Power Density Levels on Rooftop – All Carriers

Figure 19 shows the predicted RF environment once the proposed Verizon Wireless changes and modifications are complete[3].

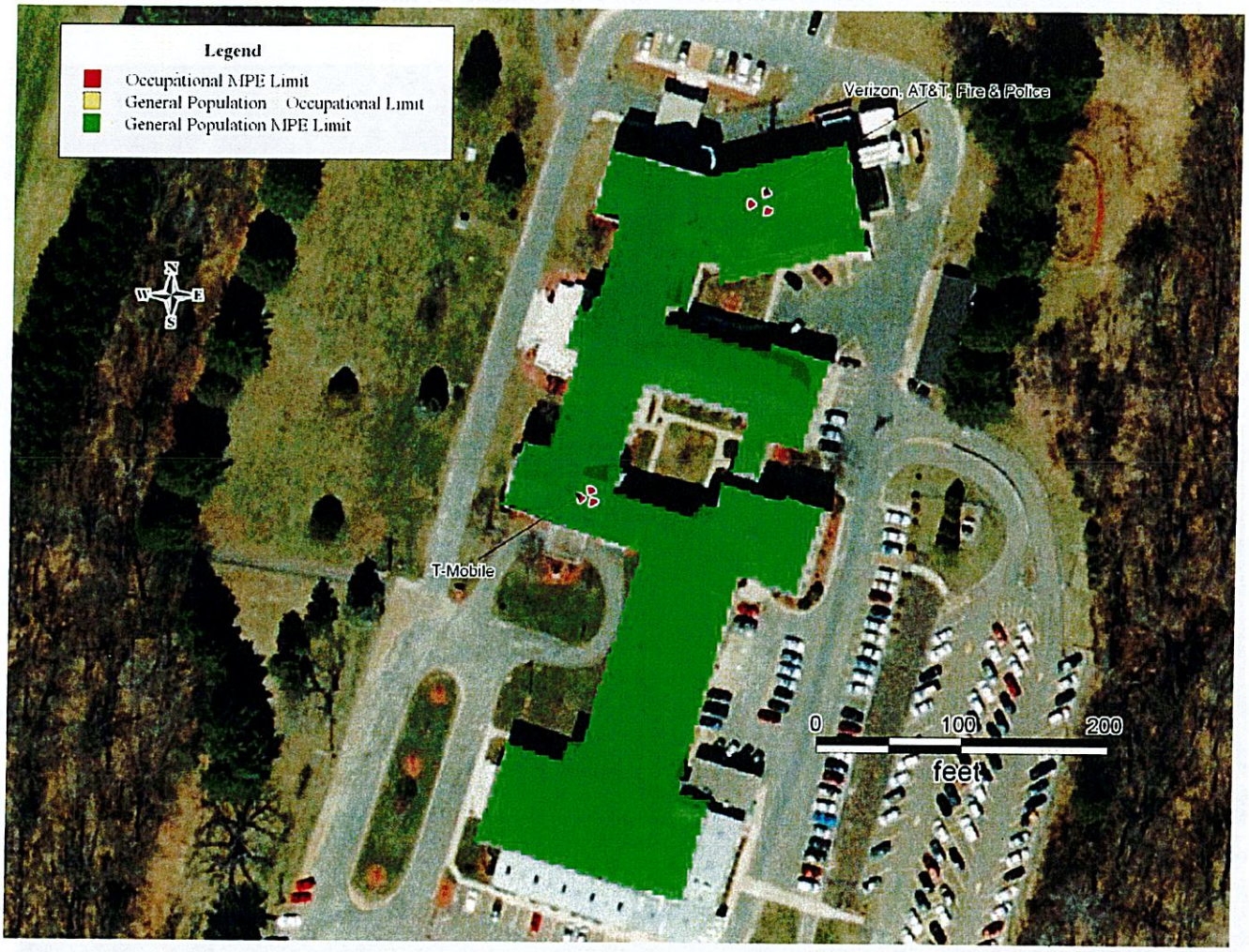


Figure 19: Predicted Power Density Levels on Rooftop – All Carriers (Post-Modification)

[3] Calculations were done using the proposed Verizon Wireless antenna configuration in addition to the other non-Verizon antennas as listed in Table 2.

The rules adopted by the FCC specify that, in general, at multiple transmitter sites, actions necessary to bring the area into compliance with the guidelines are the shared responsibility of all licensees whose transmitters produce field strengths or power density levels at the area in question in excess of 5% of the exposure limit applicable to their particular transmitter. Figure 20 below shows the 5% boundary from the existing Verizon Wireless antennas.

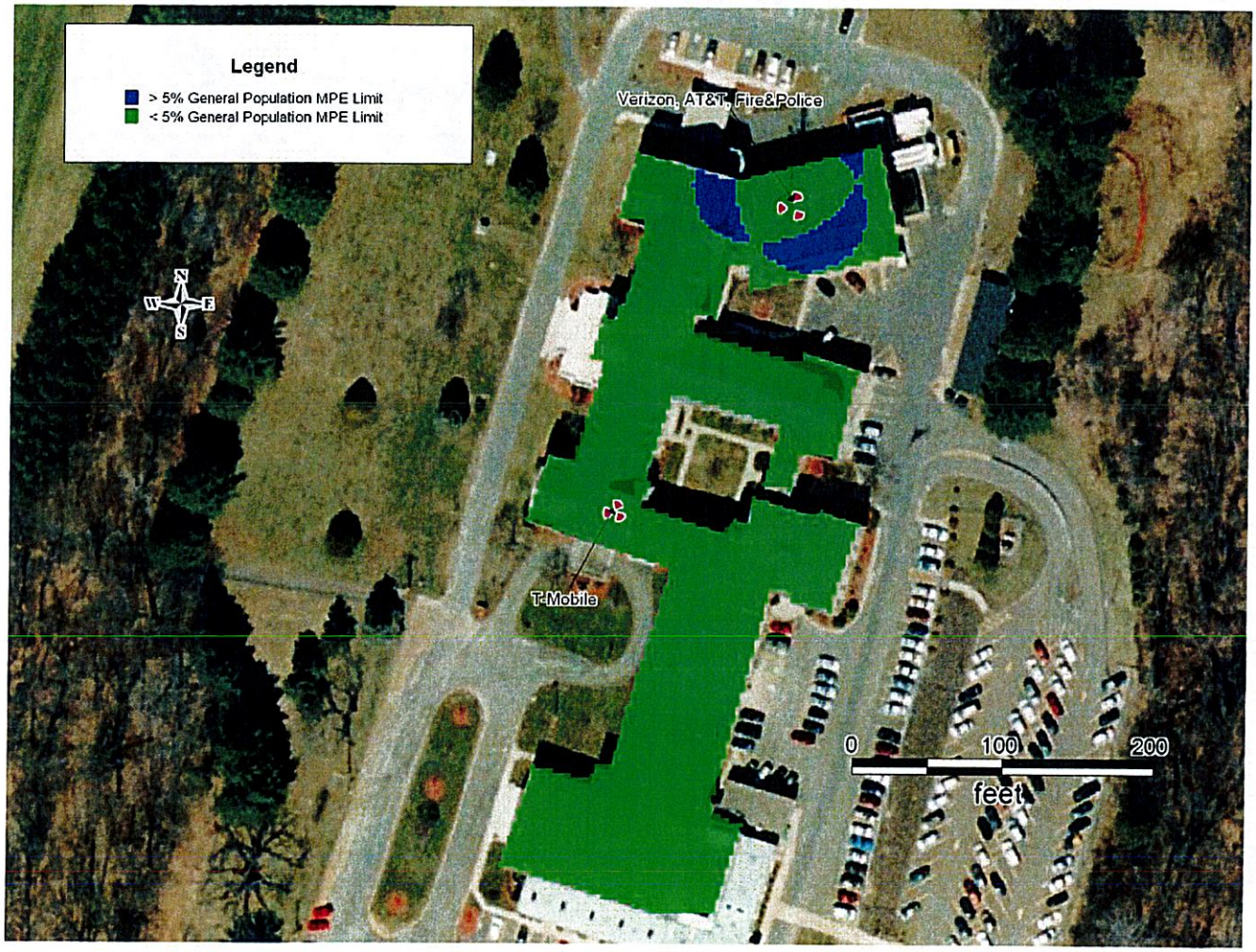


Figure 20: Existing 5% Levels on Rooftop – Verizon Antennas Only

Figure 21 provides a visual representation of this 5% boundary from the existing and proposed Hamden 2 antennas[4].

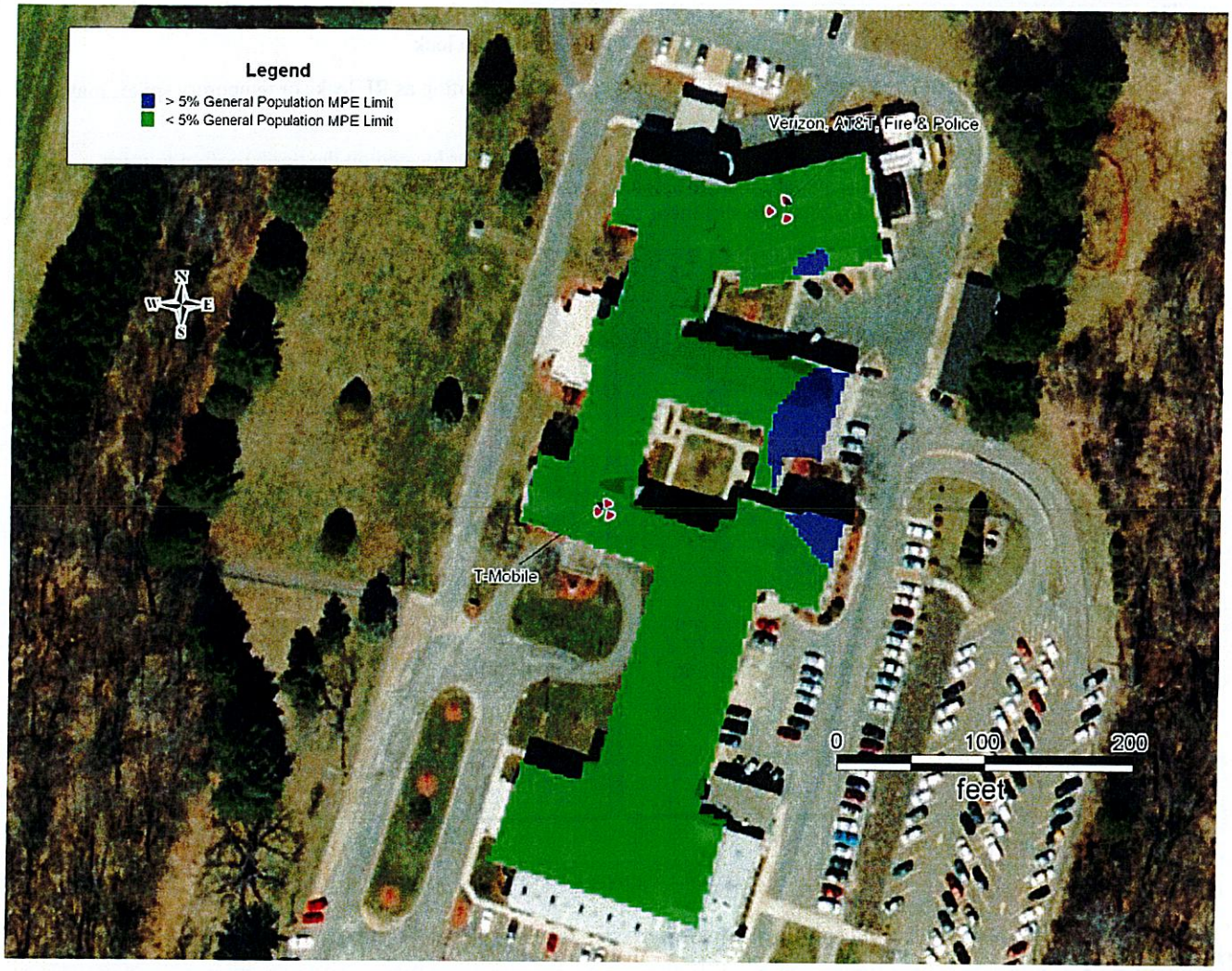


Figure 21: Predicted 5% Levels on Rooftop – Verizon Antennas Only (Post-Modification)

[4] Calculations were done using the proposed Verizon Wireless antenna configuration.

10. Recommendations

- The site owner/manager should ensure that access to the rooftop is restricted to authorized personnel only at all times. Current access to the north rooftop is through a door with a dead bolt but no lock.
- A blue "Notice" sign should be posted at the point of access to the north rooftop as RF leaks or temporary spikes may occur but not exceed general population limits.
- A yellow RF "CAUTION" signage should be posted at the base of the tower located on the north rooftop to warn authorized personnel working on the tower of areas that may have RF emission levels that exceed the FCC General Population/ Uncontrolled standard. (Example signage is shown in 22 below.)

Figure 22: Signage Examples

The following guidelines should be followed by all persons accessing the rooftop at 265 Benham St in Hamden, CT:

- All personnel accessing the rooftop must be authorized and have the necessary intellectual and physical tools to allow them to control or mitigate their exposure.
- Obey all posted signs
- Assume all antennas are active
- Do not stop in front of antennas

11. Summary of Findings

The rooftop survey and predicted analysis for this site finds that the existing levels are currently well below the FCC limits for the general population and will remain below the FCC limit for the general population after the planned Verizon Wireless antenna modifications proposed herein.

Statement of Certification

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

Tony Wells
C Squared Systems

January 22, 2010
Date

Attachment A: References

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

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

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

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

(A) Limits for Occupational/Controlled Exposure

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

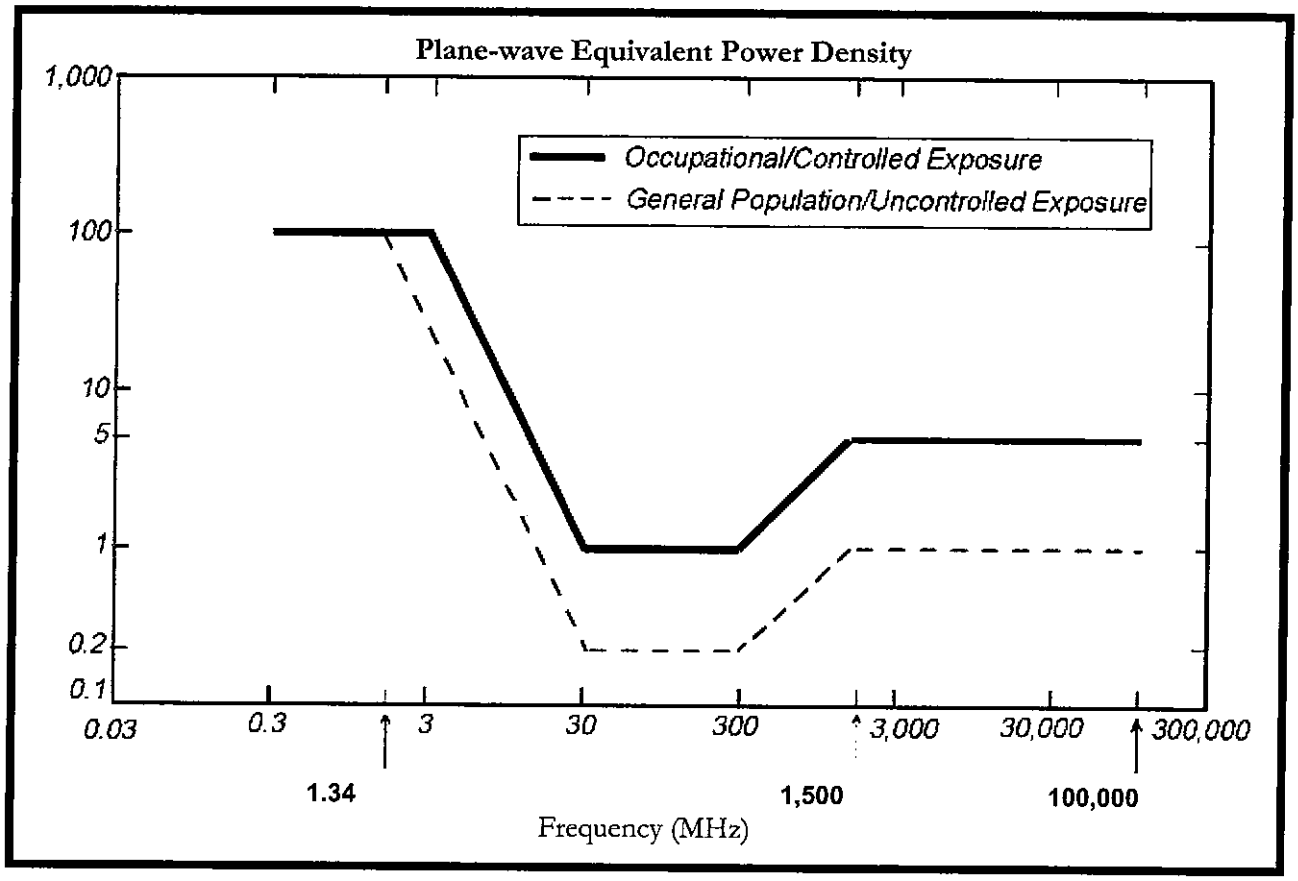
(B) Limits for General Population/Uncontrolled Exposure

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

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

NOTE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.



• **FCC Limits for Maximum Permissible Exposure (MPE)**

NATCOMM INC.
CONSULTING ENGINEERS

Structural Analysis Report

65-ft Existing Roof top Mounted NUDD
Guyed Lattice Tower

Proposed Verizon Wireless
LTE Antenna Installation

Verizon Wireless Site Ref:
Hamden 2

Apostles of the Sacred Heart of Jesus
265 Benham Street
Hamden, CT 06514

Natcomm Project No. 10001.CO1

~~Date: December 14, 2009~~
~~Rev 1: January 27, 2010~~
Rev 2: February 1, 2010

STATE OF CONNECTICUT
CARLOS CANDORE
No.16691
LICENSED
PROFESSIONAL ENGINEER

Prepared for:

Verizon Wireless
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Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna installation proposed by Verizon Wireless on the existing guyed lattice (tower) located in Hamden, CT.

The host tower is a 65-ft, four-section, three legged guyed lattice tower originally designed and manufactured by Fred A Nudd Corporation. The tower type, geometry and structure member sizes were taken from the manufacturer's design information in conjunction with field verification of the existing structure and antenna inventory conducted from the roof top level by Natcomm personnel on December 10, 2009 and the comparison to the Connecticut Siting Council database.

Proposed antenna and appurtenance information was obtained from a RF data sheet supplied by Verizon Wireless. The aforementioned materials are available within Section 3 of this report.

The tower is made up of four (4) vertical sections consisting of A36 MOD-50 solid steel legs. Diagonal and horizontal bracing consists of A36 solid round and steel angle construction. The vertical tower legs are connected together with bolted flanges while bracing is connected by fully welded connections. The width of the tower face is 30in.

Verizon Wireless proposes the replacement of six (6) existing panel antennas with six (6) proposed panel antennas and the addition of three LTE (3) panel antennas. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

The existing tower was designed to support several communication antennas. The existing, proposed and future loads considered in this analysis consist of the following:

- MUNICIPAL (Existing):
  Appurtenance: One (1) 17-ft Omni-directional whip antenna mounted on a 2-ft side arm with an elevation of 91-ft above grade (64-ft above tower base).
  Cable: One (1) 7/8" dia. coax cable running on the face of the existing tower as specified in Section 3 of this report.
- MUNICIPAL (Existing):
  Appurtenance: One (1) 20-ft Omni-directional whip antenna mounted on a 3-ft side arm with an elevation of 91-ft above grade (64-ft above tower base).
  Cable: One (1) 7/8" dia. coax cable running on the face of the existing tower as specified in Section 3 of this report.
- MUNICIPAL (Existing):
  Appurtenance: One (1) 8-ft Omni-directional whip antenna mounted on a 2-ft side arm with an elevation of 76.5-ft above grade (49.5-ft above tower base).
  Cable: One (1) 7/8" dia. coax cable.

- MUNICIPAL (Existing):
  Appurtenance: One (1) 21-ft 8-Bay Dipole antenna mounted on a 3-ft side arm with an elevation of 69-ft above grade (42-ft above tower base).
  Cable: One (1) 7/8" dia. coax cable running on the face of the existing tower as specified in Section 3 of this report.
- AT&T (Existing):

  Antennas: Three EMS MB96RR900200DPBL panel antennas flush mounted with a RAD center elevation of 27.5-ft above exiting grade (54.5-ft above tower base).
  TMA's: Six (6) TMA's flush mounted with RAD center elevations of 59-ft and 50-ft above exiting grade (32-ft and 23-ft above tower base).
  Coax Cables: Nine (9) 7/8" ∅ coax cables running on the face of the existing tower as specified in Section 3 of this report.
- VERIZON (Existing to remain):
  Antennas: Six (6) Andrew DB948F85T2E-M panel antennas mounted to existing boom gates with a RAD center elevation of 63.5-ft above existing grade (36.5-ft above tower base).
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the face of the existing tower as specified in Section 3 of this report.
- **VERIZON (Proposed):**
  Antennas: Four (4) Andrew DB844G65ZAXY, two (2) RFS APL866513, one (1) Powerwave P65-16-XL-2 and two (2) Andrew LNX-6514DS-T4M panel antennas mounted to existing boom gates with a RAD center elevation of 63.5-ft above existing grade (36.5-ft above tower base).
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the face of the existing tower as specified in Section 3 of this report.

Primary Assumptions Used in the Analysis

- The tower structure's theoretical capacity not including any assessment of the condition of the tower.
- The tower carries the horizontal and vertical loads due to the weight of antennas, ice load and wind.
- Tower is properly installed and maintained.
- Tower is in plumb condition.
- Tower loading for antennas and mounts as listed in this report.
- All bolts are appropriately tightened providing the necessary connection continuity.
- All welds are fabricated with ER-70S-6 electrodes.
- All members are assumed to be as specified in the original tower design documents or reinforcement drawings.
- All members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
- All member protective coatings are in good condition.
- All tower members were properly designed, detailed, fabricated, installed and have been properly maintained since erection.
- Any deviation from the analyzed antenna loading will require a new analysis for verification of structural adequacy.
- All existing coax cables to be installed within tower through engineered port holes.
- Due to monopole size constraints it is assumed that there is insufficient space within the interior of the existing monopole in which to locate the proposed Verizon Wireless coax cables.

Analysis

The existing tower was analyzed using a comprehensive computer program entitled RISATower. The program analyzes the tower, considering the worst case loading condition. The tower is considered as loaded by concentric forces along the tower shaft, and the model assumes that the shaft members are subjected to bending, axial, and shear forces.

The existing tower was analyzed for 85 mph basic wind speed (fastest mile) with no ice and 75% reduction of wind force with ½ inch accumulative ice to determine stresses in members as per guidelines of TIA/EIA-222-F-96 entitled "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures", the American Institute of Steel Construction (AISC) and the Manual of Steel Construction; Allowable Stress Design (ASD).

Tower Loading

Tower loading was determined by the basic wind speed as applied to projected surface areas with modification factors per TIA/EIA-222-F, gravity loads of the tower structure and its components, and the application of ½" radial ice tower structure and its components.

Basic Wind Speed:	New Haven; v = 85 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Hamden; v = 105 mph (3 second gust) equivalent to v = 85 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA and Appendix K wind speed criteria equal.	
Load Cases:	Load Case 1; 85mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation. This load case typically controls the design. This load case typically controls the design of monopole towers.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 74 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 74 mph wind speed velocity represents 75% of the wind pressure generated by the 85 mph wind speed. This load case typically controls the design of lattice towers.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 3; Seismic – not checked	*[Section 1614.5 of State Bldg. Code 2005] does not control in the design of this structure type*

Tower Capacity

Tower stresses were calculated utilizing the structural analysis software RISATower. Allowable stresses were determined based on Table 5 of the TIA/EIA code with a 1/3 increase per Section 3.1.1.1 of the same code.

Calculated stresses were found to be within allowable limits. In Load Case 2, per RISATower "Section Capacity Table", this tower was found to be at **95.7%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Diagonal (T3)	47'-67' (20'-40')	95.7%	**PASS**
Leg (T4)	27'-47' (0'-20')	55.5%	**PASS**
Guy A	55' (28')	44.6%	**PASS**
Guy B	55' (28')	55.6%	**PASS**
Guy C	55' (28')	53.1%	**PASS**

Existing Guy Anchors and Tower Base

Guy forces are transferred to the existing building structure via six (6) 9/16" and three (3) 3/4" ∅ galvanized steel guy wires with turnbuckles. All guy anchorage posts are positively attached to the existing building structure and consist of 6"x6"x1/4" tube steel with 1/2" thick guy connection plates with three 5/8" ∅ A325-N bolts in double shear. Connections to the existing building were originally designed by Natcomm for Verizon Wireless on October 02, 2000, reference project no. 985094.

The guyed tower base is pin connected to a 1-3/4" thick x 24" square base plate welded to an existing W8 steel dunnage frame. Frame loads are then transferred down onto the existing concrete roof structure via four (4) 6"x6"x1/4" tube steel posts with 1-1/4" thick x 12in square base plates.

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

- The tower base and guy anchor reactions developed from the governing Load Case 2 were used in the verification of the anchors:

Tower Component	Load (kips)	Load Effect	Stress Ratio (percentage of capacity)	Result
Base Plate	58.5 (Vert)	Bending	66%	**PASS**
	1.1 (Horz)			
Guy Anchor B @ 19.5'	26.9 (Vert)	Shear	82%	**PASS**
	16.6 (Horz)	Shear		

- The guy anchor bolts and tower base plate **were found** to be within allowable limits.

Conclusions

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

The analysis is based, in part, on the information provided to this office by Verizon Wireless. If the existing conditions are different than the information in this report, Natcomm, Inc. must be contacted for resolution of any potential issues.

Please feel free to call with any questions or comments.

Respectfully Submitted by:

Carlo F. Centore, PE
Principal ~ Structural Engineer

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

Prepared by:

Jason R. Mead,
Structural Engineer

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

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

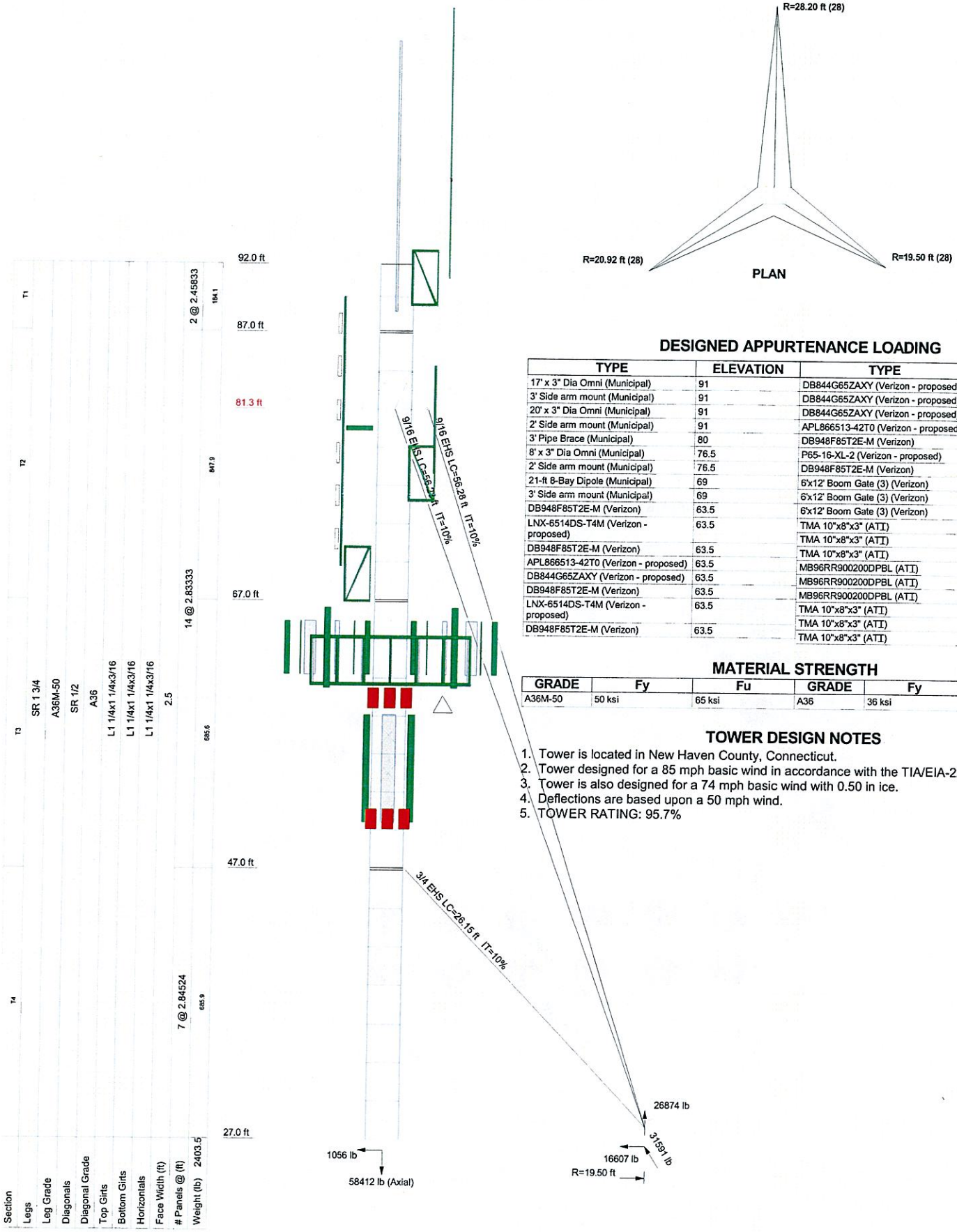
- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of Natcomm, Inc. or generated by field inspections or measurements of the structure.
- It is the responsibility of the client to ensure that the information provide to Natcomm, Inc. and used in the performance of our engineering services is correct and complete. In the absence of information to the contrary, we assume that all structures were constructed in accordance with the drawings and specifications and are in an un-corroded condition and have not deteriorated. It is therefore assumed that its capacity has not significantly changed from the "as new" condition.
- All services will be performed to the codes specified by the client, and we do not imply to meet any other codes or requirements unless explicitly agreed in writing. If wind and ice loads or other relevant parameters are to be different from the minimum values recommended by the codes, the client shall specify the exact requirement. In the absence of information to the contrary, all work will be performed in accordance with the latest revision of ANSI/ASCE10 & ANSI/EIA-222
- All services performed, results obtained, and recommendations made are in accordance with generally accepted engineering principles and practices. Natcomm, Inc. is not responsible for the conclusions, opinions and recommendations made by others based on the information we supply.

General Description of Structural Analysis Program

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

RISATower Features:

- RISATower can analyze and design 3- and 4-sided guyed towers, 3- and 4-sided self-supporting towers and either round or tapered ground mounted poles with or without guys.
- The program analyzes towers using the TIA-222-G (2005) standard or any of the previous TIA/EIA standards back to RS-222 (1959). Steel design is checked using the AISC ASD 9th Edition or the AISC LRFD specifications.
- Linear and non-linear (P-delta) analyses can be used in determining displacements and forces in the structure. Wind pressures and forces are automatically calculated.
- Extensive graphics plots include material take-off, shear-moment, leg compression, displacement, twist, feed line, guy anchor and stress plots.
- RISATower contains unique features such as True Cable behavior, hog rod take-up, foundation stiffness and much more.



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
17' x 3" Dia Omni (Municipal)	91	DB844G65ZAXY (Verizon - proposed)	63.5
3' Side arm mount (Municipal)	91	DB844G65ZAXY (Verizon - proposed)	63.5
20' x 3" Dia Omni (Municipal)	91	DB844G65ZAXY (Verizon - proposed)	63.5
2' Side arm mount (Municipal)	91	APL866513-42T0 (Verizon - proposed)	63.5
3' Pipe Brace (Municipal)	80	DB948F85T2E-M (Verizon)	63.5
8' x 3" Dia Omni (Municipal)	76.5	P65-16-XL-2 (Verizon - proposed)	63.5
2' Side arm mount (Municipal)	76.5	DB948F85T2E-M (Verizon)	63.5
21-ft 8-Bay Dipole (Municipal)	69	6'x12' Boom Gate (3) (Verizon)	62.5
3' Side arm mount (Municipal)	69	6'x12' Boom Gate (3) (Verizon)	62.5
DB948F85T2E-M (Verizon)	63.5	6'x12' Boom Gate (3) (Verizon)	62.5
LNX-6514DS-T4M (Verizon - proposed)	63.5	TMA 10"x8"x3" (ATI)	59
		TMA 10"x8"x3" (ATI)	59
DB948F85T2E-M (Verizon)	63.5	TMA 10"x8"x3" (ATI)	59
APL866513-42T0 (Verizon - proposed)	63.5	MB96RR900200DPBL (ATI)	54.5
DB844G65ZAXY (Verizon - proposed)	63.5	MB96RR900200DPBL (ATI)	54.5
DB948F85T2E-M (Verizon)	63.5	MB96RR900200DPBL (ATI)	54.5
LNX-6514DS-T4M (Verizon - proposed)	63.5	TMA 10"x8"x3" (ATI)	50
		TMA 10"x8"x3" (ATI)	50
DB948F85T2E-M (Verizon)	63.5	TMA 10"x8"x3" (ATI)	50

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A36M-50	50 ksi	65 ksi	A36	36 ksi	58 ksi

TOWER DESIGN NOTES

1. Tower is located in New Haven County, Connecticut.
2. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 95.7%

NATCOMM
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Phone: (203) 488-0580
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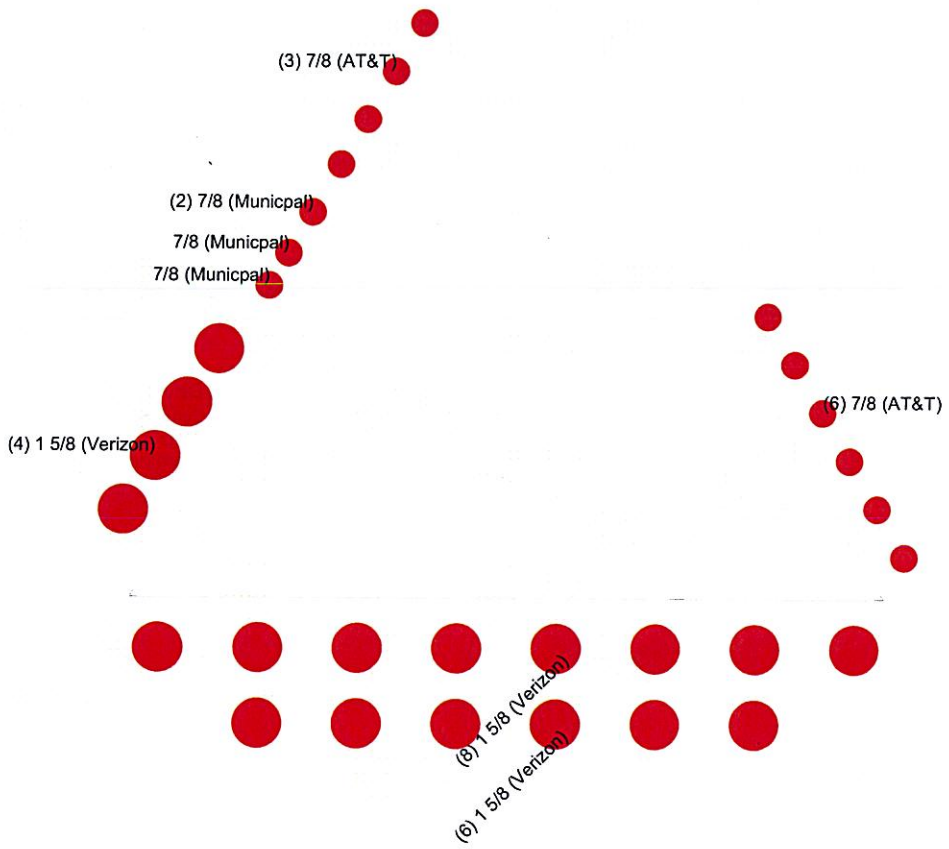
Job: ***65-ft NUDD G30WRAR Guyed Tower - Rev 2***			
Project: ***265 Benham Street - Hamden, CT***			
Client: Verizon Wireless - Hamden 2	Drawn by: TJL	App'd:	
Code: TIA/EIA-222-F	Date: 02/01/10	Scale: NTS	
Path:		Dwg No. E-1	

Feedline Plan

Round _____ Flat _____ App In Face App Out Face



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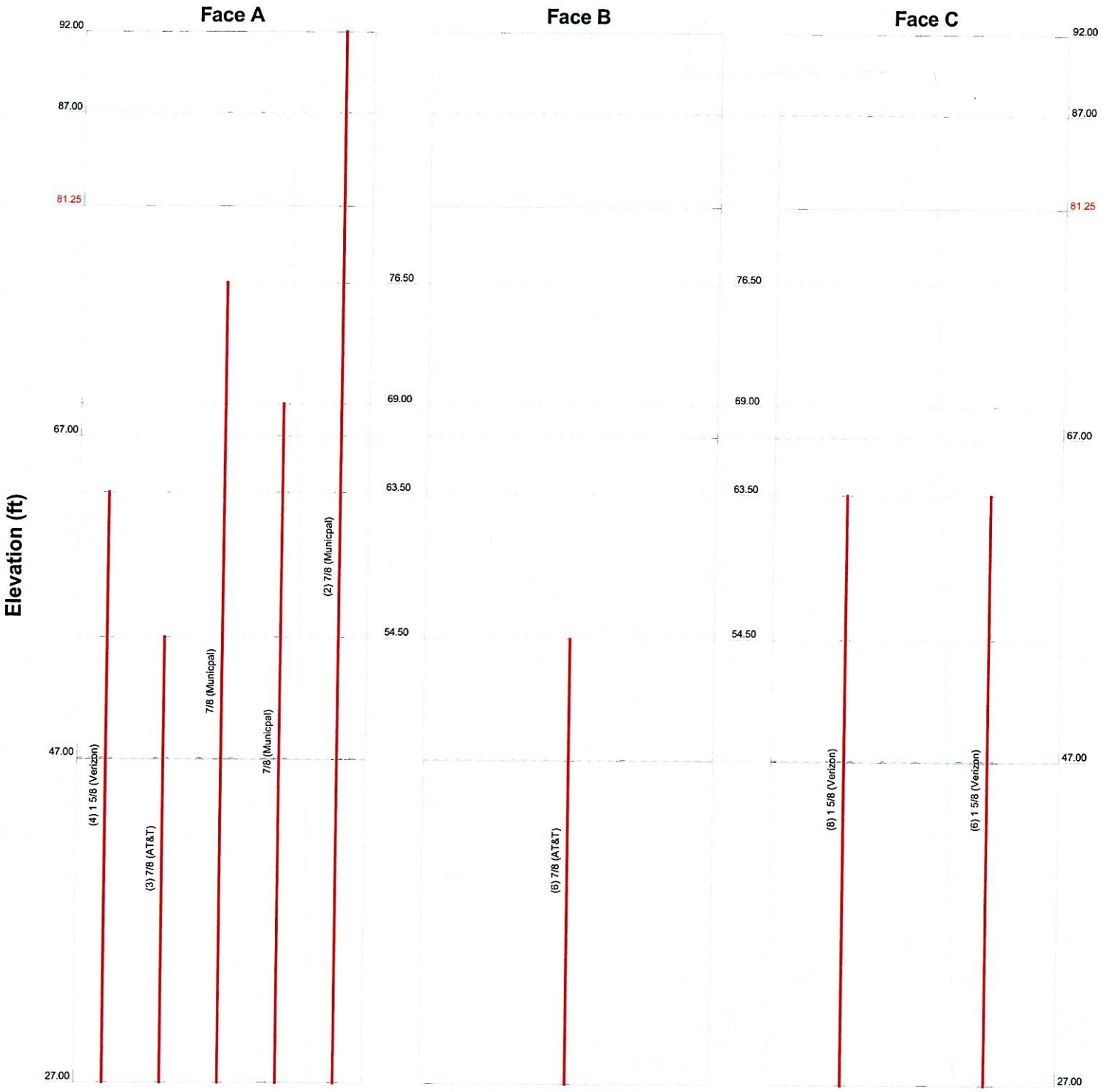
	Project: ***265 Benham Street - Hamden, CT***		
	Client: Verizon Wireless - Hamden 2	Drawn by: TJL	App'd:
	Code: TIA/EIA-222-F	Date: 02/01/10	Scale: NTS
	Path:		Dwg No. E-7

Feedline Distribution Chart
27' - 92'

Round | Flat | App In Face | App Out Face | Truss Leg



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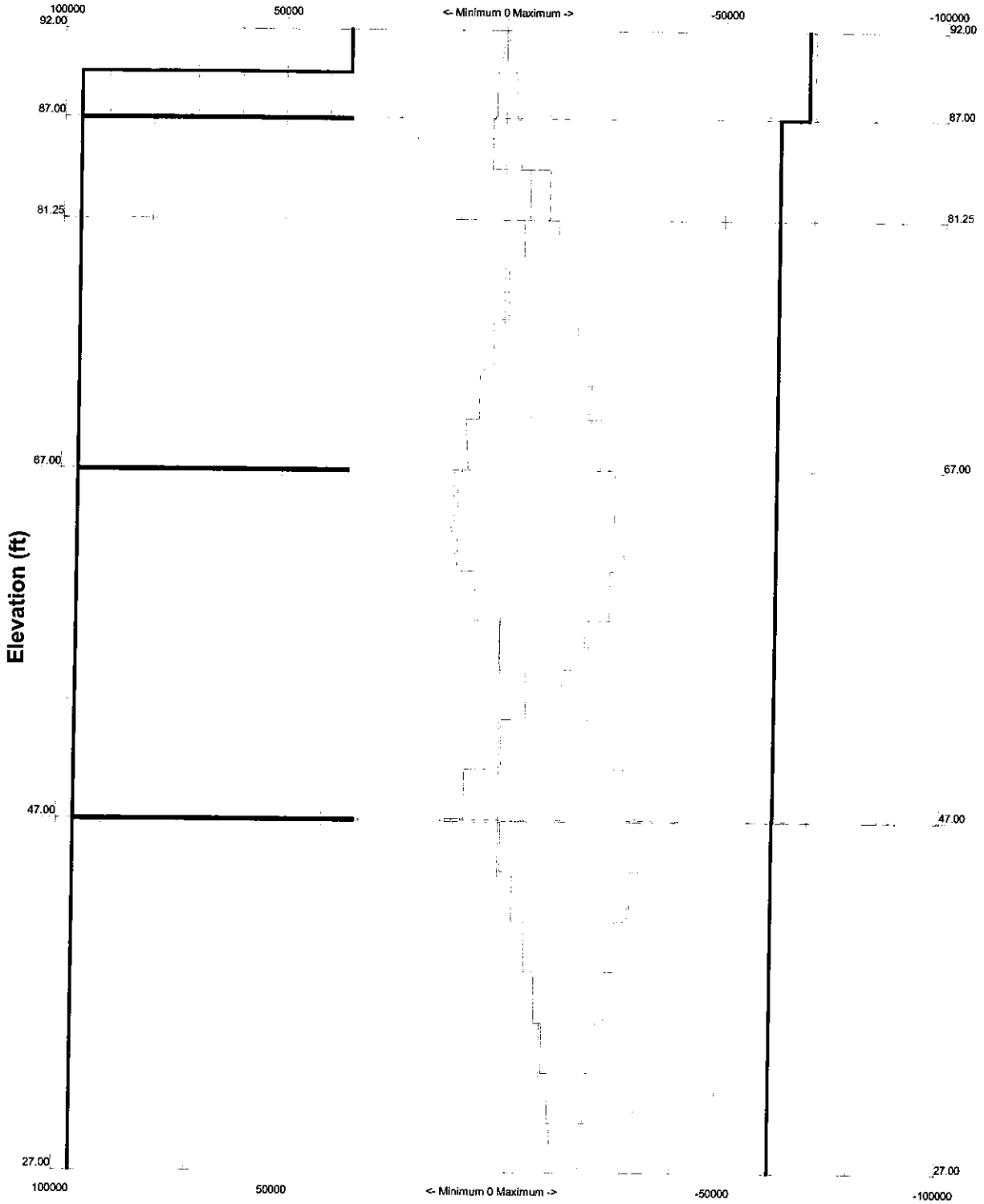
	Project: ***265 Benham Street - Hamden, CT***		
	Client: Verizon Wireless - Hamden 2	Drawn by: TJL	App'd:
	Code: TIA/EIA-222-F	Date: 02/01/10	Scale: NTS
	Path:		Dwg No. E-7

TIA/EIA-222-F - 85 mph/74 mph 0.500 in Ice

Leg Capacity ——— Leg Compression (lb)



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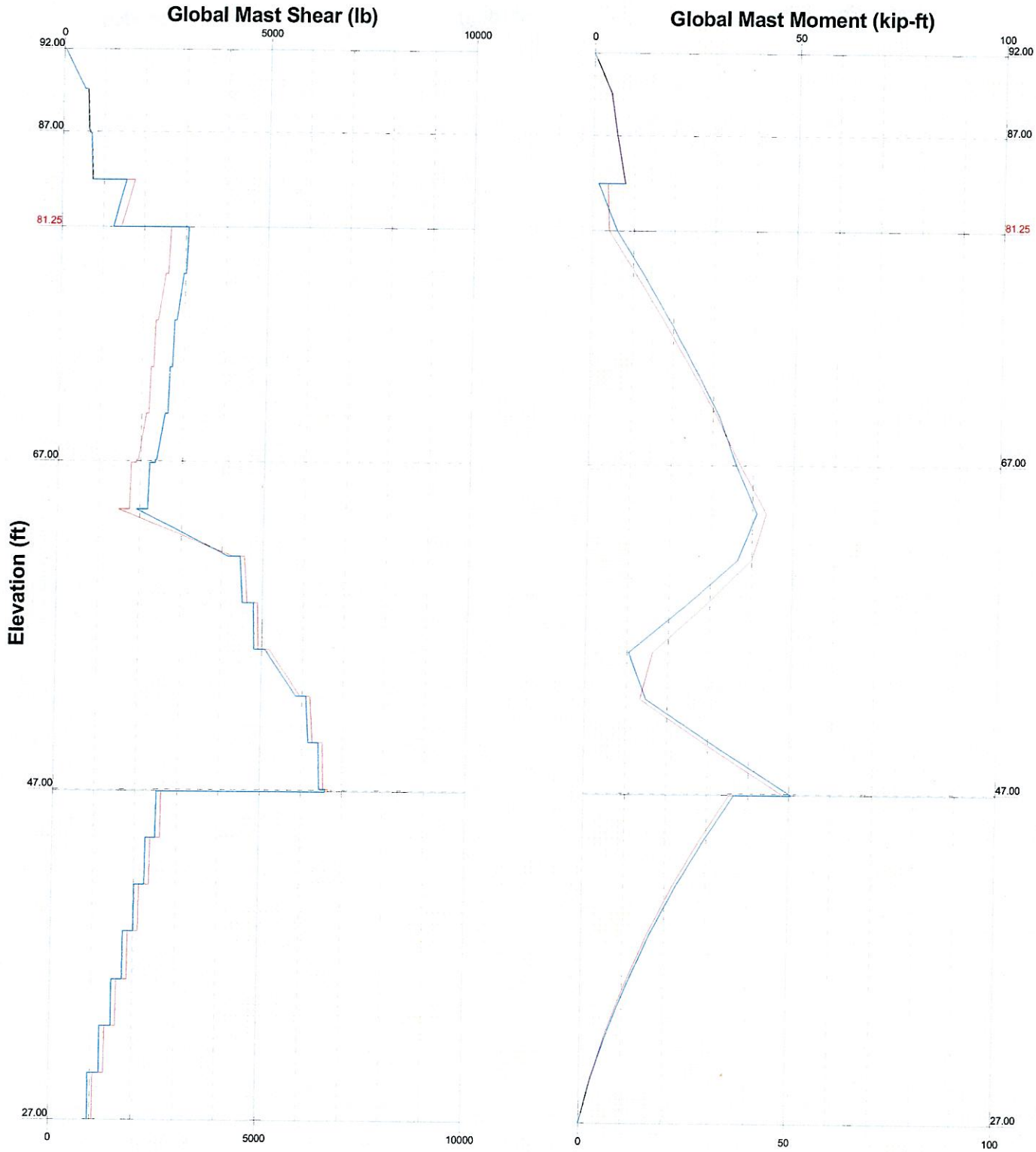
63-2 N. Branford Rd.	Project: ***265 Benham Street - Hamden, CT***		
Branford, CT 06405	Client: Verizon Wireless - Hamden 2	Drawn by: TJL	App'd:
Phone: (203) 488-0580	Code: TIA/EIA-222-F	Date: 02/01/10	Scale: NTS
FAX: (203) 488-8587	Path:		Dwg No. E-3

TIA/EIA-222-F - 85 mph/74 mph 0.500 in Ice

Vx — Vz

Maximum Values

Mx — Mz



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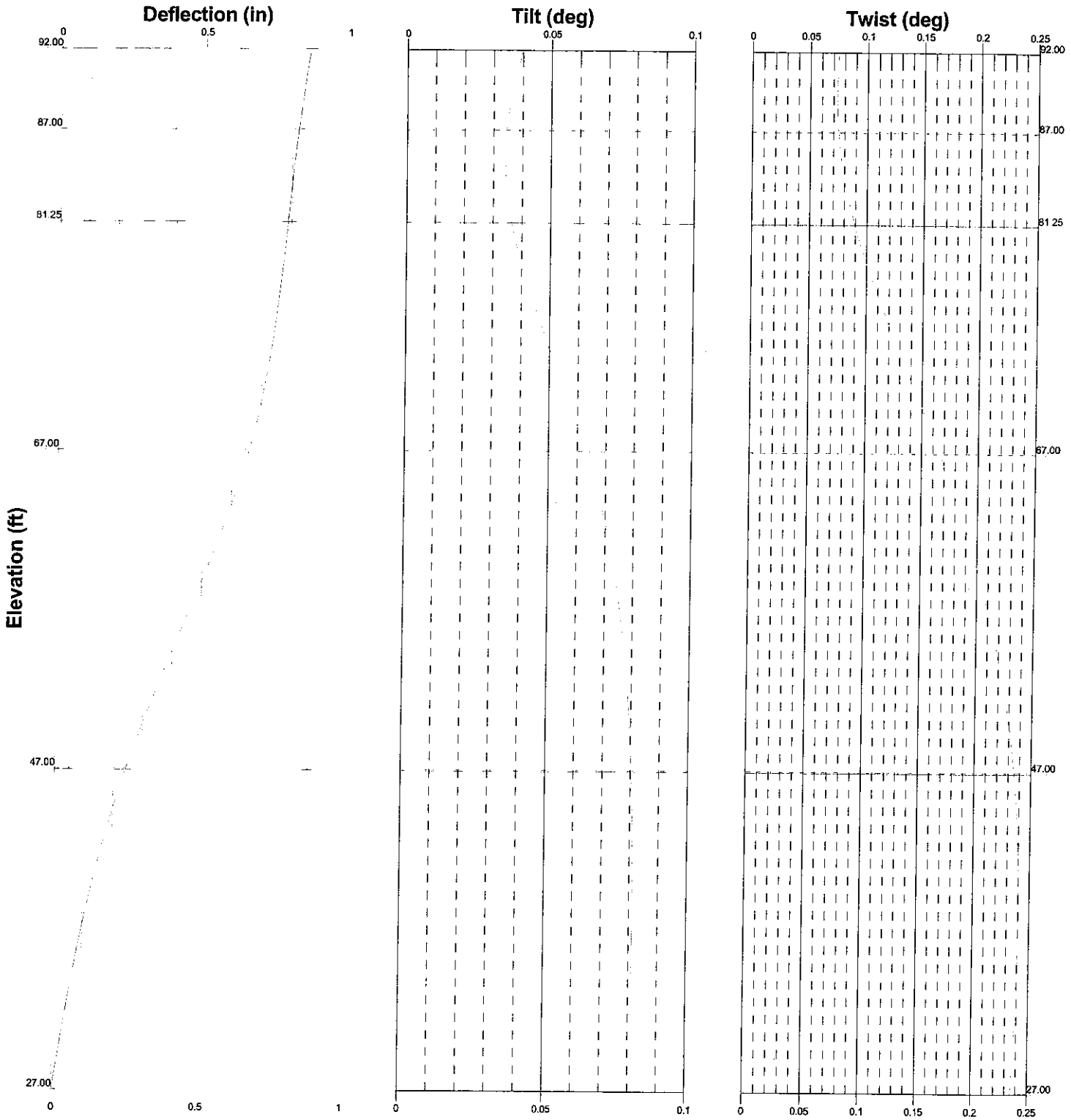
63-2 N. Branford Rd.	Project: ***265 Benham Street - Hamden, CT***		
Branford, CT 06405	Client: Verizon Wireless - Hamden 2	Drawn by: TJL	App'd:
Phone: (203) 488-0580	Code: TIA/EIA-222-F	Date: 02/01/10	Scale: NTS
FAX: (203) 488-8587	Path:		Dwg No. E-4

TIA/EIA-222-F - Service - 50 mph

Maximum Values



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	Project: ***265 Benham Street - Hamden, CT***		
	Client: Verizon Wireless - Hamden 2	Drawn by: TJL	App'd:
	Code: TIA/EIA-222-F	Date: 02/01/10	Scale: NTS
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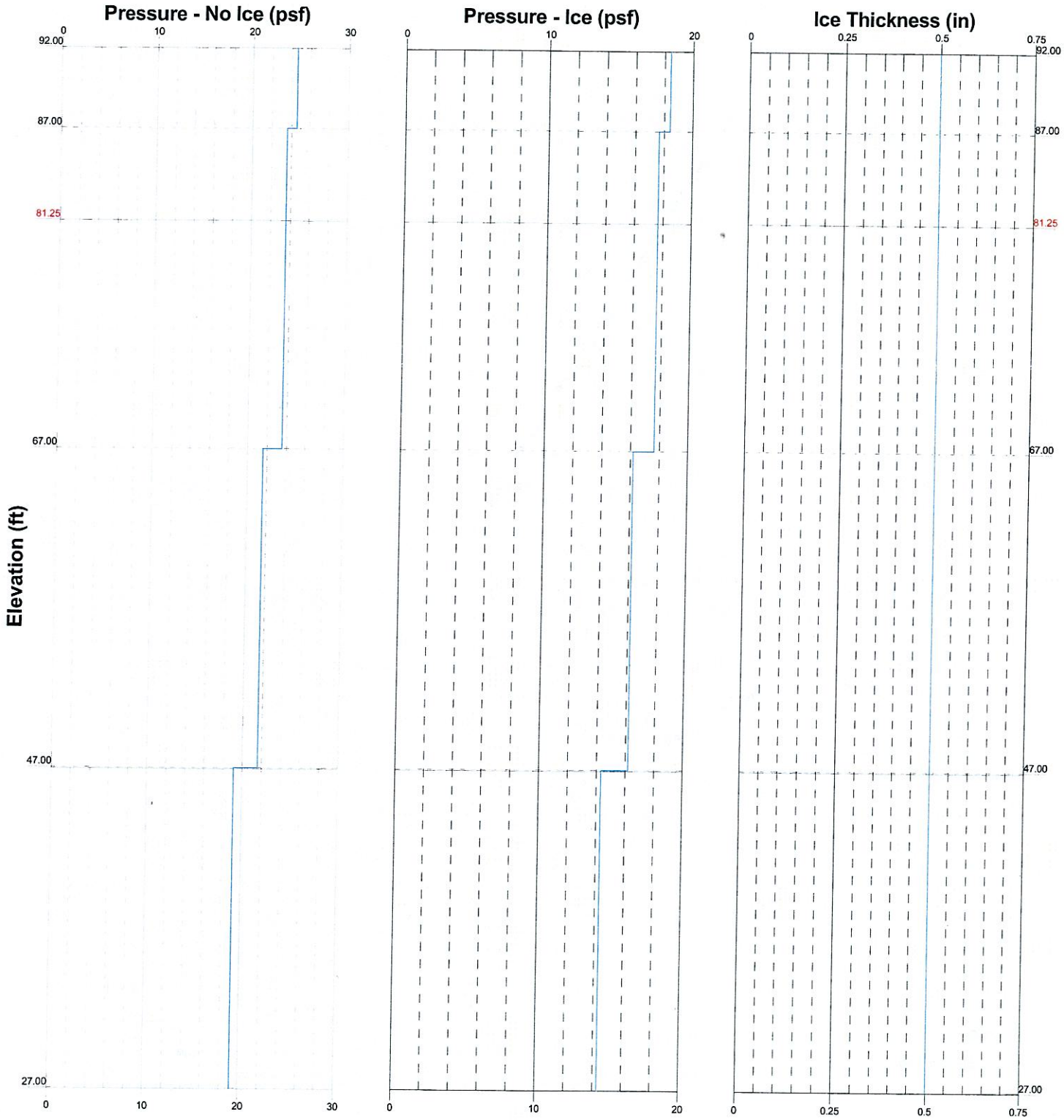
Wind Pressures and Ice Thickness

TIA/EIA-222-F - 85 mph/74 mph 0.500 in Ice



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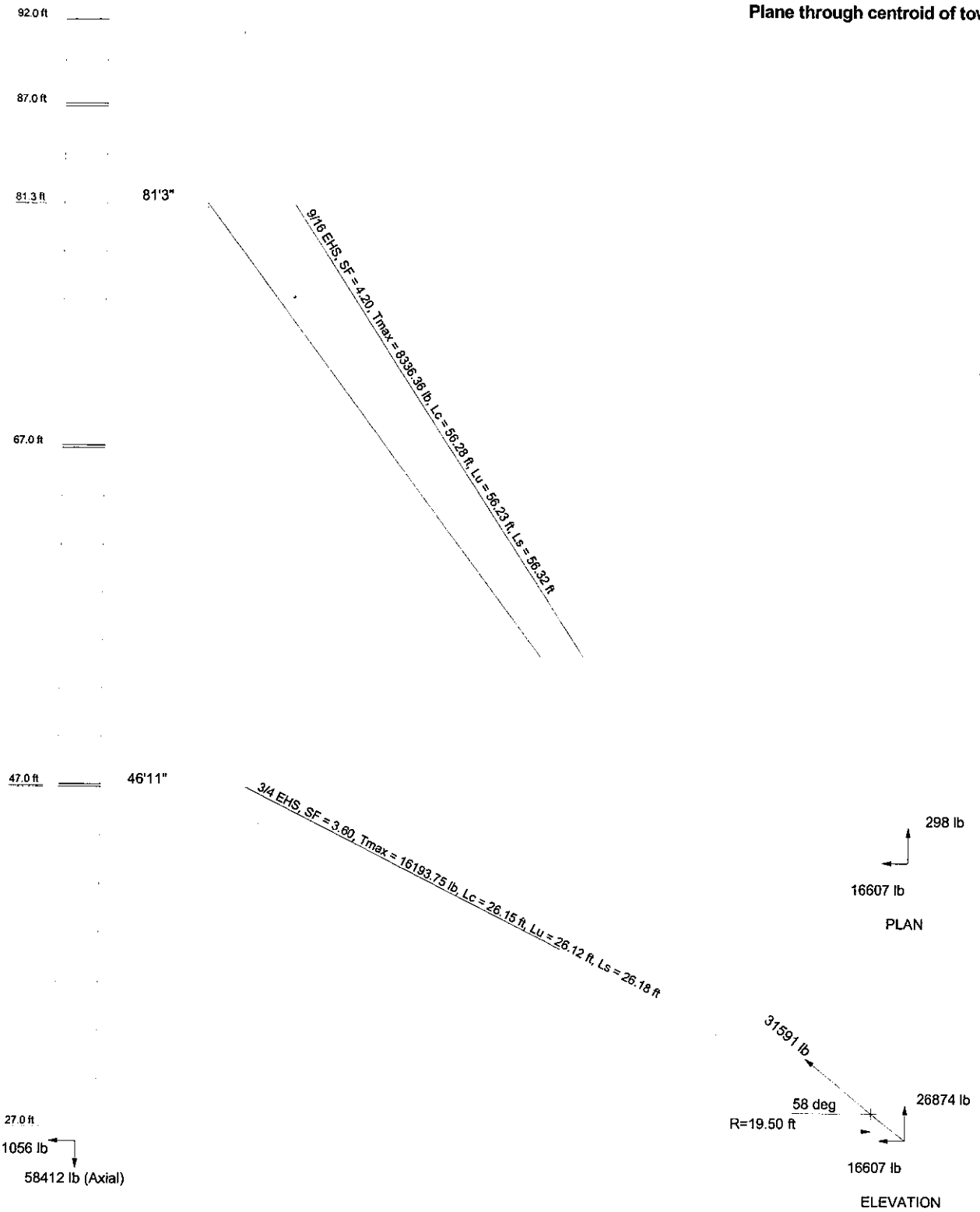
	Code: TIA/EIA-222-F	Date: 02/01/10	Scale: NTS
	Path:		Dwg No. E-9

Guy Tensions and Tower Reactions

TIA/EIA-222-F - 85 mph/74 mph 0.500 in Ice

Maximum Values
Anchor 'B'@19.5 ft Azimuth 120 deg Elev 28 ft
Plane through centroid of tower



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	Code: TIA/EIA-222-F	Date: 02/01/10	Scale: NTS
	Path:		Dwg No. E-6

Tower Input Data

The main tower is a 3x guyed tower with an overall height of 92.00 ft above the ground line.
The base of the tower is set at an elevation of 27.00 ft above the ground line.
The face width of the tower is 2.50 ft at the top and 2.50 ft at the base.
This tower is designed using the TIA/EIA-222-F standard.
The following design criteria apply:

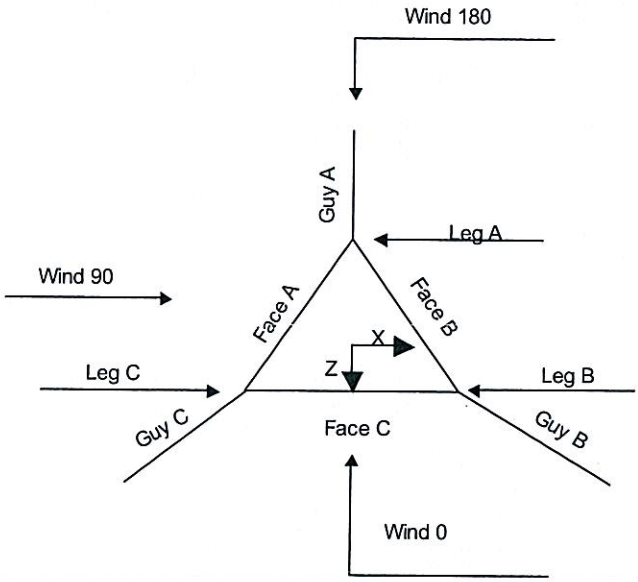
Tower is located in New Haven County, Connecticut.
Basic wind speed of 85 mph.
Nominal ice thickness of 0.500 in.
Ice density of 56 pcf.
A wind speed of 74 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
Pressures are calculated at each section.
Safety factor used in guy design is 2.
Stress ratio used in tower member design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

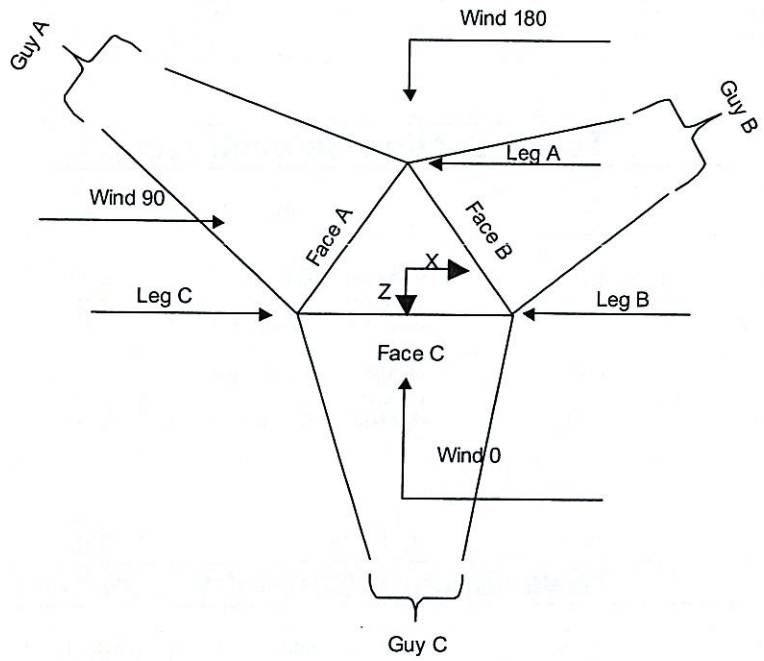
Consider Moments - Legs
Consider Moments - Horizontals
Consider Moments - Diagonals
Use Moment Magnification
√ Use Code Stress Ratios
√ Use Code Safety Factors - Guys
Escalate Ice
Always Use Max Kz
Use Special Wind Profile
√ Include Bolts In Member Capacity
√ Leg Bolts Are At Top Of Section
Secondary Horizontal Braces Leg
Use Diamond Inner Bracing (4 Sided)
Add IBC .6D+W Combination

Distribute Leg Loads As Uniform
Assume Legs Pinned
Assume Rigid Index Plate
√ Use Clear Spans For Wind Area
√ Use Clear Spans For KL/r
√ Retension Guys To Initial Tension
Bypass Mast Stability Checks
Use Azimuth Dish Coefficients
√ Project Wind Area of Appurt.
√ Autocalc Torque Arm Areas
√ SR Members Have Cut Ends
√ Sort Capacity Reports By Component
Triangulate Diamond Inner Bracing

Treat Feedline Bundles As Cylinder
Use ASCE 10 X-Brace Ly Rules
Calculate Redundant Bracing Forces
Ignore Redundant Members in FEA
SR Leg Bolts Resist Compression
√ All Leg Panels Have Same Allowable
Offset Girt At Foundation
√ Consider Feedline Torque
Include Angle Block Shear Check
Poles
Include Shear-Torsion Interaction
Always Use Sub-Critical Flow
Use Top Mounted Sockets



Corner & Starmount Guyed Tower



Face Guyed

Tower Section Geometry

Tower Section	Tower Elevation ft	Assembly Database	Description	Section Width ft	Number of Sections	Section Length ft
T1	92.00-87.00			2.50	1	5.00
T2	87.00-67.00			2.50	1	20.00
T3	67.00-47.00			2.50	1	20.00
T4	47.00-27.00			2.50	1	20.00

Tower Section Geometry *(cont'd)*

Tower Section	Tower Elevation ft	Diagonal Spacing ft	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset in	Bottom Girt Offset in
T1	92.00-87.00	2.46	X Brace	No	Yes	0.000	1.000

Tower Section	Tower Elevation ft	Diagonal Spacing ft	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset in	Bottom Girt Offset in
T2	87.00-67.00	2.83	X Brace	No	Yes	1.000	1.000
T3	67.00-47.00	2.83	X Brace	No	Yes	1.000	1.000
T4	47.00-27.00	2.85	X Brace	No	Yes	1.000	0.000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 92.00-87.00	Solid Round	1 3/4	A36M-50 (50 ksi)	Solid Round	1/2	A36 (36 ksi)
T2 87.00-67.00	Solid Round	1 3/4	A36M-50 (50 ksi)	Solid Round	1/2	A36 (36 ksi)
T3 67.00-47.00	Solid Round	1 3/4	A36M-50 (50 ksi)	Solid Round	1/2	A36 (36 ksi)
T4 47.00-27.00	Solid Round	1 3/4	A36M-50 (50 ksi)	Solid Round	1/2	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 92.00-87.00	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)
T2 87.00-67.00	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)
T3 67.00-47.00	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)
T4 47.00-27.00	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	No. of Mid Girts	Mid Girt Type	Mid Girt Size	Mid Girt Grade	Horizontal Type	Horizontal Size	Horizontal Grade
T1 92.00-87.00	None	Flat Bar		A36 (36 ksi)	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)
T2 87.00-67.00	None	Flat Bar		A36 (36 ksi)	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)
T3 67.00-47.00	None	Flat Bar		A36 (36 ksi)	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)
T4 47.00-27.00	None	Flat Bar		A36 (36 ksi)	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
T1 92.00-87.00	0.00	0.000	A36 (36 ksi)	1	1	1	36.000	36.000
T2 87.00-67.00	0.00	0.000	A36 (36 ksi)	1	1	1	36.000	36.000
T3 67.00-47.00	0.00	0.000	A36 (36 ksi)	1	1	1	36.000	36.000
T4 47.00-27.00	0.00	0.000	A36 (36 ksi)	1	1	1	36.000	36.000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	Legs	K Factors[1] X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1 92.00-87.00	Yes	Yes	1	0.5 0.5	1 1	1 1	1 1	1 1	1 1	1 1
T2 87.00-67.00	Yes	Yes	1	0.5 0.5	1 1	1 1	1 1	1 1	1 1	1 1
T3 67.00-47.00	Yes	Yes	1	0.5 0.5	1 1	1 1	1 1	1 1	1 1	1 1
T4 47.00-27.00	Yes	Yes	1	0.5 0.5	1 1	1 1	1 1	1 1	1 1	1 1

[1]*Note: K factors are applied to member segment lengths. K-braces without inner supporting members will have the K factor in the out-of-plane direction applied to the overall length.*

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Net Width Deduct in	Leg U	Diagonal Net Width Deduct in	Diagonal U	Top Girt Net Width Deduct in	Top Girt U	Bottom Girt Net Width Deduct in	Bottom Girt U	Mid Girt Net Width Deduct in	Mid Girt U	Long Horizontal Net Width Deduct in	Long Horizontal U	Short Horizontal Net Width Deduct in	Short Horizontal U
T1 92.00-87.00	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
T2 87.00-67.00	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
T3 67.00-47.00	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
T4 47.00-27.00	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg Bolt Size in	Leg No.	Diagonal Bolt Size in	Diagonal No.	Top Girt Bolt Size in	Top Girt No.	Bottom Girt Bolt Size in	Bottom Girt No.	Mid Girt Bolt Size in	Mid Girt No.	Long Horizontal Bolt Size in	Long Horizontal No.	Short Horizontal Bolt Size in	Short Horizontal No.
T1 92.00-87.00	Flange	0.875 A325N	1	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0
T2 87.00-67.00	Flange	0.875 A325N	1	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0
T3 67.00-47.00	Flange	0.875 A325N	1	0.000 A325N	0	0.500 A325N	0	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0
T4 47.00-27.00	Flange	0.875 A325N	1	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0

Guy Data

Guy Elevation ft	Guy Grade		Guy Size	Initial Tension lb	%	Guy Modulus ksi	Guy Weight plf	L_u ft	Anchor Radius ft	Anchor Azimuth Adj. °	Anchor Elevation ft	End Fitting Efficiency %
81.25	EHS	A	9/16	3500.00	10%	21000	0.671	59.60	28.20	0.0000	28.00	100%
		B	9/16	3500.00	10%	21000	0.671	56.24	19.50	0.0000	28.00	100%
		C	9/16	3500.00	10%	21000	0.671	56.71	20.92	0.0000	28.00	100%
46.9167	EHS	A	3/4	5830.00	10%	19000	1.155	32.74	28.20	0.0000	28.00	100%
		B	3/4	5830.00	10%	19000	1.155	26.13	19.50	0.0000	28.00	100%
		C	3/4	5830.00	10%	19000	1.155	27.13	20.92	0.0000	28.00	100%

Guy Data *(cont'd)*

Guy Elevation ft	Mount Type	Torque-Arm Spread ft	Torque-Arm Leg Angle °	Torque-Arm Style	Torque-Arm Grade	Torque-Arm Type	Torque-Arm Size
81.25	Torque Arm	5.00	45.0000	Dog Ear	A36 (36 ksi)	Single Angle	L2x2x5/16 L3x3x1/4
46.9167	Corner						

Guy Data *(cont'd)*

Guy Elevation ft	Diagonal Grade	Diagonal Type	Upper Diagonal Size	Lower Diagonal Size	Is Strap.	Pull-Off Grade	Pull-Off Type	Pull-Off Size
81.25	A36 (36 ksi)	Solid Round				A36 (36 ksi)	Single Angle	
46.92	A36 (36 ksi)	Solid Round				A36 (36 ksi)	Single Angle	

Guy Data *(cont'd)*

Guy Elevation ft	Cable Weight A lb	Cable Weight B lb	Cable Weight C lb	Cable Weight D lb	Tower Intercept A ft	Tower Intercept B ft	Tower Intercept C ft	Tower Intercept D ft
81.25	39.99	37.73	38.05		0.34 1.0 sec/pulse	0.30 0.9 sec/pulse	0.31 1.0 sec/pulse	
46.9167	37.81	30.18	31.33		0.11 0.6 sec/pulse	0.07 0.4 sec/pulse	0.07 0.5 sec/pulse	

Guy Data *(cont'd)*

Guy Elevation ft	Calc K Single Angles	Calc K Solid Rounds	Torque Arm K_x	Torque Arm K_y	Pull Off K_x	Pull Off K_y	Diagonal K_x	Diagonal K_y
81.25	Yes	Yes	1	1	1	1	1	1
46.9167	No	No			1	1	1	1

Guy Data *(cont'd)*

Guy Elevation ft	Torque-Arm Bolt Size in	Torque-Arm Number	Torque-Arm Net Width Deduct in	Torque-Arm U	Pull Off Bolt Size in	Pull Off Number	Pull Off Net Width Deduct in	Pull Off U	Diagonal Bolt Size in	Diagonal Number	Diagonal Net Width Deduct in	Diagonal U
81.25	0.000 A325N	0	0.000	1	0.625 A325N	0	0.000	0.75	0.625 A325N	0	0.000	0.75
46.9167	0.000 A325N	0	0.000	1	0.625 A325N	0	0.000	0.75	0.625 A325N	0	0.000	0.75

Guy Pressures

Guy Elevation ft	Guy Location	z ft	q_z psf	q_z Ice psf	Ice Thickness in
81.25	A	54.63	21	16	0.500
	B	54.63	21	16	0.500
	C	54.63	21	16	0.500
46.9167	A	37.46	19	14	0.500
	B	37.46	19	14	0.500
	C	37.46	19	14	0.500

Guy-Mast Forces (Excluding Wind) - No Ice

Guy Elevation	Guy Location	Chord Angle	Guy Tension Top Bottom	F_x	F_y	F_z	M_x	M_y	M_z
ft		°	lb	lb	lb	lb	kip-ft	kip-ft	kip-ft
81.25	A	63.2217	3535.70 3500.00	-147.44	3160.57	-1578.04	-4.56	4.16	-7.90
	A	63.2217	3535.70 3500.00	147.44	3160.57	-1578.04	-4.56	-4.16	7.90
	B	71.1026	3535.70 3500.00	1055.49	3347.10	428.96	9.66	3.05	0.00
	B	71.1026	3535.70 3500.00	899.24	3347.10	699.60	-4.83	-3.05	-8.37
	C	69.7581	3535.70 3500.00	-967.99	3319.61	737.80	-4.79	3.24	8.30
	C	69.7581	3535.70 3500.00	-1122.95	3319.61	469.41	9.58	-3.24	0.00
			Sum:	-136.21	19654.57	-820.32	0.50	0.00	-0.07
46.9167	A	35.2599	5851.83 5830.00	0.00	3390.76	-4769.35	-4.89	0.00	0.00
	B	46.3325	5851.83 5830.00	3492.66	4240.16	2016.49	3.06	0.00	-5.30
	C	44.1644	5851.83 5830.00	-3628.59	4085.14	2094.97	2.95	-0.00	5.11
			Sum:	-135.93	11716.06	-657.89	1.11	0.00	-0.19

Guy-Mast Forces (Excluding Wind) - Ice

Guy Elevation	Guy Location	Chord Angle	Guy Tension Top Bottom	F_x	F_y	F_z	M_x	M_y	M_z
ft		°	lb	lb	lb	lb	kip-ft	kip-ft	kip-ft
81.25	A	63.2217	4885.70 4815.47	-203.30	4369.71	-2175.85	-6.31	5.73	-10.92
	A	63.2217	4885.70 4815.47	203.30	4369.71	-2175.85	-6.31	-5.73	10.92
	B	71.1026	4882.79 4812.56	1454.48	4623.50	591.12	13.35	4.20	0.00
	B	71.1026	4882.79 4812.56	1239.16	4623.50	964.06	-6.67	-4.20	-11.56
	C	69.7581	4883.17 4812.94	-1334.00	4586.06	1016.77	-6.62	4.47	11.47
	C	69.7581	4883.17 4812.94	-1547.55	4586.06	646.90	13.24	-4.47	0.00
			Sum:	-187.91	27158.55	-1132.86	0.68	0.00	-0.09
46.9167	A	35.2599	7939.17 7902.91	0.00	4604.11	-6467.82	-6.65	0.00	0.00
	B	46.3325	7937.17 7900.91	4735.30	5753.37	2733.93	4.15	0.00	-7.19
	C	44.1644	7937.49 7901.23	-4919.78	5543.59	2840.44	4.00	-0.00	6.93
			Sum:	-184.48	15901.07	-893.45	1.51	0.00	-0.26

Guy-Mast Forces (Excluding Wind) - Service

Guy Elevation	Guy Location	Chord Angle	Guy Tension Top Bottom	F_x	F_y	F_z	M_x	M_y	M_z
ft		°	lb	lb	lb	lb	kip-ft	kip-ft	kip-ft
81.25	A	63.2217	3535.70 3500.00	-147.44	3160.57	-1578.04	-4.56	4.16	-7.90
	A	63.2217	3535.70 3500.00	147.44	3160.57	-1578.04	-4.56	-4.16	7.90
	B	71.1026	3535.70 3500.00	1055.49	3347.10	428.96	9.66	3.05	0.00
	B	71.1026	3535.70 3500.00	899.24	3347.10	699.60	-4.83	-3.05	-8.37
	C	69.7581	3535.70 3500.00	-967.99	3319.61	737.80	-4.79	3.24	8.30
	C	69.7581	3535.70 3500.00	-1122.95	3319.61	469.41	9.58	-3.24	0.00
			Sum:	-136.21	19654.57	-820.32	0.50	0.00	-0.07
46.9167	A	35.2599	5851.83 5830.00	0.00	3390.76	-4769.35	-4.89	0.00	0.00
	B	46.3325	5851.83 5830.00	3492.66	4240.16	2016.49	3.06	0.00	-5.30
	C	44.1644	5851.83 5830.00	-3628.59	4085.14	2094.97	2.95	-0.00	5.11
			Sum:	-135.93	11716.06	-657.89	1.11	0.00	-0.19

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
1 5/8 (Verizon)	A	Yes	Ar (CfAe)	63.50 - 27.00	1.000	-0.28	4	4	0.500	1.980		1.04
1 5/8 (Verizon)	C	Yes	Ar (CfAe)	63.50 - 27.00	1.000	0	8	8	1.980	1.980		1.04
7/8 (AT&T)	A	Yes	Ar (CfAe)	54.50 - 27.00	1.000	0.28	3	3	1.110	1.110		0.54
7/8 (Municpal)	A	Yes	Ar (CfAe)	76.50 - 27.00	1.000	-0.05	1	1	1.110	1.110		0.54
7/8 (Municpal)	A	Yes	Ar (CfAe)	69.00 - 27.00	1.000	0	1	1	1.110	1.110		0.54
7/8 (AT&T)	B	Yes	Ar (CfAe)	54.50 - 27.00	1.000	0.28	6	6	1.110	1.110		0.54
7/8 (Municpal)	A	Yes	Ar (CfAe)	92.00 - 27.00	1.000	0.1	2	2	1.110	1.110		0.54
1 5/8 (Verizon)	C	Yes	Ar (CfAe)	63.50 - 27.00	4.000	0	6	6	1.980	1.980		1.04

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
T1	92.00-87.00	A	0.925	0.000	0.000	0.000	5.40

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T2	87.00-67.00	A	4.764	0.000	0.000	0.000	27.81
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T3	67.00-47.00	A	20.371	0.000	0.000	0.000	123.99
		B	4.162	0.000	0.000	0.000	24.30
		C	38.115	0.000	0.000	0.000	240.24
T4	47.00-27.00	A	26.150	0.000	0.000	0.000	158.80
		B	11.100	0.000	0.000	0.000	64.80
		C	46.200	0.000	0.000	0.000	291.20

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
T1	92.00-87.00	A	0.500	1.758	0.000	0.000	0.000	15.23
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
T2	87.00-67.00	A	0.500	9.055	0.000	0.000	0.000	78.46
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
T3	67.00-47.00	A	0.500	22.120	10.230	0.000	0.000	332.79
		B		7.913	0.000	0.000	0.000	68.56
		C		57.365	0.000	0.000	0.000	590.19
T4	47.00-27.00	A	0.500	29.583	12.400	0.000	0.000	427.39
		B		21.100	0.000	0.000	0.000	182.82
		C		69.533	0.000	0.000	0.000	715.38

Feed Line Shielding

Section	Elevation ft	Face	A_R ft^2	A_R Ice ft^2	A_F ft^2	A_F Ice ft^2
T1	92.00-87.00	A	0.043	0.335	0.058	0.110
		B	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000
T2	87.00-67.00	A	0.210	1.499	0.198	0.377
		B	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000
T3	67.00-47.00	A	0.898	5.357	0.849	1.348
		B	0.183	1.310	0.173	0.330
		C	1.680	9.499	1.588	2.390
T4	47.00-27.00	A	1.156	6.965	1.090	1.749
		B	0.490	3.500	0.462	0.879
		C	2.041	11.535	1.925	2.897

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	92.00-87.00	-0.668	-0.701	-0.564	-0.592
T2	87.00-67.00	-1.003	-0.883	-0.878	-0.773
T3	67.00-47.00	-1.713	4.360	-0.911	3.447
T4	47.00-27.00	-1.031	4.208	-0.191	3.315

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
6'x12' Boom Gate (3) (Verizon)	A	From Leg	2.00 0.00 0.00	0.0000	62.50	No Ice 1/2" Ice	49.80 59.30	49.80 59.30	1680.00 2100.00
6'x12' Boom Gate (3) (Verizon)	B	From Leg	2.00 0.00 0.00	0.0000	62.50	No Ice 1/2" Ice	49.80 59.30	49.80 59.30	1680.00 2100.00
6'x12' Boom Gate (3) (Verizon)	C	From Leg	2.00 0.00 0.00	0.0000	62.50	No Ice 1/2" Ice	49.80 59.30	49.80 59.30	1680.00 2100.00
DB844G65ZAXY (Verizon - proposed)	A	From Leg	4.00 6.00 0.00	0.0000	63.50	No Ice 1/2" Ice	4.67 5.05	3.73 4.10	16.00 48.76
DB948F85T2E-M (Verizon)	A	From Leg	4.00 4.00 0.00	0.0000	63.50	No Ice 1/2" Ice	1.92 2.22	3.26 3.62	8.50 27.57
P65-16-XL-2 (Verizon - proposed)	A	From Leg	4.00 0.00 0.00	0.0000	63.50	No Ice 1/2" Ice	8.40 8.95	4.12 4.56	20.00 64.53
DB948F85T2E-M (Verizon)	A	From Leg	4.00 -4.00 0.00	0.0000	63.50	No Ice 1/2" Ice	1.92 2.22	3.26 3.62	8.50 27.57
DB844G65ZAXY (Verizon - proposed)	A	From Leg	4.00 -6.00 0.00	0.0000	63.50	No Ice 1/2" Ice	4.67 5.05	3.73 4.10	16.00 48.76
APL866513-42T0 (Verizon - proposed)	B	From Leg	4.00 6.00 0.00	0.0000	63.50	No Ice 1/2" Ice	4.29 4.67	3.73 4.10	15.70 46.99
DB948F85T2E-M (Verizon)	B	From Leg	4.00 4.00 0.00	0.0000	63.50	No Ice 1/2" Ice	1.92 2.22	3.26 3.62	8.50 27.57
LNX-6514DS-T4M (Verizon - proposed)	B	From Leg	4.00 0.00 0.00	0.0000	63.50	No Ice 1/2" Ice	8.41 8.96	5.41 5.86	38.00 88.51
DB948F85T2E-M (Verizon)	B	From Leg	4.00 -4.00 0.00	0.0000	63.50	No Ice 1/2" Ice	1.92 2.22	3.26 3.62	8.50 27.57
APL866513-42T0 (Verizon - proposed)	B	From Leg	4.00 -6.00 0.00	0.0000	63.50	No Ice 1/2" Ice	4.29 4.67	3.73 4.10	15.70 46.99
DB844G65ZAXY (Verizon - proposed)	C	From Leg	4.00 6.00 0.00	0.0000	63.50	No Ice 1/2" Ice	4.67 5.05	3.73 4.10	16.00 48.76

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
DB948F85T2E-M	C	From Leg	4.00	0.0000	63.50	No Ice	1.92	3.26	8.50
(Verizon)			4.00			1/2" Ice	2.22	3.62	27.57
			0.00						
LNX-6514DS-T4M	C	From Leg	4.00	0.0000	63.50	No Ice	8.41	5.41	38.00
(Verizon - proposed)			0.00			1/2" Ice	8.96	5.86	88.51
			0.00						
DB948F85T2E-M	C	From Leg	4.00	0.0000	63.50	No Ice	1.92	3.26	8.50
(Verizon)			-4.00			1/2" Ice	2.22	3.62	27.57
			0.00						
DB844G65ZAXY	C	From Leg	4.00	0.0000	63.50	No Ice	4.67	3.73	16.00
(Verizon - proposed)			-6.00			1/2" Ice	5.05	4.10	48.76
			0.00						
MB96RR900200DPBL	A	From Leg	0.50	0.0000	54.50	No Ice	11.47	7.58	35.00
(AT&T)			0.00			1/2" Ice	12.08	8.17	100.59
			0.00						
MB96RR900200DPBL	B	From Leg	0.50	0.0000	54.50	No Ice	11.47	7.58	35.00
(AT&T)			0.00			1/2" Ice	12.08	8.17	100.59
			0.00						
MB96RR900200DPBL	C	From Leg	0.50	0.0000	54.50	No Ice	11.47	7.58	35.00
(AT&T)			0.00			1/2" Ice	12.08	8.17	100.59
			0.00						
TMA 10"x8"x3"	A	From Leg	0.00	0.0000	50.00	No Ice	0.78	0.29	15.00
(AT&T)			0.00			1/2" Ice	0.90	0.38	20.06
			0.00						
TMA 10"x8"x3"	B	From Leg	0.00	0.0000	50.00	No Ice	0.78	0.29	15.00
(AT&T)			0.00			1/2" Ice	0.90	0.38	20.06
			0.00						
TMA 10"x8"x3"	C	From Leg	0.00	0.0000	50.00	No Ice	0.78	0.29	15.00
(AT&T)			0.00			1/2" Ice	0.90	0.38	20.06
			0.00						
TMA 10"x8"x3"	A	From Leg	0.00	0.0000	59.00	No Ice	0.78	0.29	15.00
(AT&T)			0.00			1/2" Ice	0.90	0.38	20.06
			0.00						
TMA 10"x8"x3"	B	From Leg	0.00	0.0000	59.00	No Ice	0.78	0.29	15.00
(AT&T)			0.00			1/2" Ice	0.90	0.38	20.06
			0.00						
TMA 10"x8"x3"	C	From Leg	0.00	0.0000	59.00	No Ice	0.78	0.29	15.00
(AT&T)			0.00			1/2" Ice	0.90	0.38	20.06
			0.00						
17' x 3" Dia Omni	A	From Leg	3.00	0.0000	91.00	No Ice	5.10	5.10	47.60
(Municipal)			0.00			1/2" Ice	6.83	6.83	84.35
			7.50						
3' Side arm mount	A	From Leg	1.50	0.0000	91.00	No Ice	2.00	2.00	70.00
(Municipal)			0.00			1/2" Ice	2.60	2.60	82.00
			0.00						
20' x 3" Dia Omni	B	From Leg	3.00	0.0000	91.00	No Ice	6.00	6.00	50.00
(Municipal)			0.00			1/2" Ice	8.03	8.03	93.17
			10.00						
2' Side arm mount	B	From Leg	1.00	0.0000	91.00	No Ice	2.00	2.00	70.00
(Municipal)			0.00			1/2" Ice	2.60	2.60	82.00
			0.00						
21-ft 8-Bay Dipole	C	From Leg	3.00	0.0000	69.00	No Ice	3.15	3.15	32.00
(Municipal)			0.00			1/2" Ice	5.67	5.67	41.60
			10.60						
3' Side arm mount	C	From Leg	1.50	0.0000	69.00	No Ice	2.00	2.00	70.00
(Municipal)			0.00			1/2" Ice	2.60	2.60	82.00
			0.00						

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
3' Pipe Brace (Municipal)	C	From Leg	1.50 0.00 0.00	0.0000	80.00	No Ice 1/2" Ice	0.58 0.77	0.58 0.77	10.95 16.37
8' x 3" Dia Omni (Municipal)	B	From Leg	2.00 0.00 4.00	0.0000	76.50	No Ice 1/2" Ice	2.40 3.19	2.40 3.19	25.00 42.51
2' Side arm mount (Municipal)	B	From Leg	1.00 0.00 0.00	0.0000	76.50	No Ice 1/2" Ice	2.00 2.60	2.00 2.60	70.00 82.00

Tower Pressures - No Ice

$G_H = 1.195$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg % 	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
T1 92.00-87.00	89.50	1.33	25	13.229	A	0.678	2.890	1.458	40.87	0.000	0.000
					B	0.736	2.009		53.14	0.000	0.000
					C	0.736	2.009		53.14	0.000	0.000
T2 87.00-67.00	77.00	1.274	24	52.917	A	1.763	12.463	5.833	41.00	0.000	0.000
					B	1.962	7.909		59.10	0.000	0.000
					C	1.962	7.909		59.10	0.000	0.000
T3 67.00-47.00	57.00	1.169	22	52.917	A	1.113	27.382	5.833	20.47	0.000	0.000
					B	1.788	11.888		42.65	0.000	0.000
					C	0.374	44.344		13.04	0.000	0.000
T4 47.00-27.00	37.00	1.033	19	52.917	A	0.872	32.908	5.833	17.27	0.000	0.000
					B	1.499	18.523		29.13	0.000	0.000
					C	0.037	52.072		11.19	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.195$

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg % 	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
T1 92.00-87.00	89.50	1.33	18	0.500	13.646	A	0.626	5.955	2.292	34.82	0.000	0.000
						B	0.736	4.531		43.51	0.000	0.000
						C	0.736	4.531		43.51	0.000	0.000
T2 87.00-67.00	77.00	1.274	18	0.500	54.583	A	1.584	24.519	9.167	35.12	0.000	0.000
						B	1.962	16.963		48.44	0.000	0.000
						C	1.962	16.963		48.44	0.000	0.000
T3 67.00-47.00	57.00	1.169	16	0.500	54.583	A	10.844	33.727	9.167	20.57	0.000	0.000
						B	1.632	23.565		36.38	0.000	0.000

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
T4 47.00-27.00	37.00	1.033	14	0.500	54.583	C	0.000	64.829		14.14	0.000	0.000
						A	12.613	39.596	9.167	17.56	0.000	0.000
						B	1.083	34.577		25.71	0.000	0.000
						C	0.000	74.976		12.23	0.000	0.000

Tower Pressure - Service

$G_H = 1.195$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
T1 92.00-87.00	89.50	1.33	9	13.229	A	0.678	2.890	1.458	40.87	0.000	0.000
					B	0.736	2.009		53.14	0.000	0.000
					C	0.736	2.009		53.14	0.000	0.000
T2 87.00-67.00	77.00	1.274	8	52.917	A	1.763	12.463	5.833	41.00	0.000	0.000
					B	1.962	7.909		59.10	0.000	0.000
					C	1.962	7.909		59.10	0.000	0.000
T3 67.00-47.00	57.00	1.169	7	52.917	A	1.113	27.382	5.833	20.47	0.000	0.000
					B	1.788	11.888		42.65	0.000	0.000
					C	0.374	44.344		13.04	0.000	0.000
T4 47.00-27.00	37.00	1.033	7	52.917	A	0.872	32.908	5.833	17.27	0.000	0.000
					B	1.499	18.523		29.13	0.000	0.000
					C	0.037	52.072		11.19	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1 92.00-87.00	5.40	184.08	A	0.27	2.38	0.607	1	1	2.433	170.10	34.02	A
			B	0.207	2.571	0.592	1	1	1.925			
			C	0.207	2.571	0.592	1	1	1.925			
T2 87.00-67.00	27.81	685.64	A	0.269	2.382	0.607	1	1	9.326	625.37	31.27	A
		TA 162.22	B	0.187	2.642	0.588	1	1	6.610			
			C	0.187	2.642	0.588	1	1	6.610			
T3 67.00-47.00	388.53	685.64	A	0.538	1.855	0.718	1	1	20.770	2004.15	100.21	C
			B	0.258	2.412	0.604	1	1	8.969			
			C	0.845	1.856	0.934	1	1	41.799			
T4 47.00-27.00	514.80	685.89	A	0.638	1.785	0.778	1	1	26.469	2416.17*	120.81	C
			B	0.378	2.108	0.643	1	1	13.410			
			C	0.985	2.069	1	1	1	52.109			
Sum Weight:	936.54	2403.47			*2A_g limit					5215.78		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1 92.00-87.00	5.40	184.08	A	0.27	2.38	0.607	0.825	1	2.314	161.80	32.36	A
			B	0.207	2.571	0.592	0.825	1	1.796			
			C	0.207	2.571	0.592	0.825	1	1.796			
T2 87.00-67.00	27.81	685.64	A	0.269	2.382	0.607	0.825	1	9.018	604.68	30.23	A
		TA 162.22	B	0.187	2.642	0.588	0.825	1	6.267			
			C	0.187	2.642	0.588	0.825	1	6.267			
T3 67.00-47.00	388.53	685.64	A	0.538	1.855	0.718	0.825	1	20.575	2001.01	100.05	C
			B	0.258	2.412	0.604	0.825	1	8.657			
			C	0.845	1.856	0.934	0.825	1	41.734			
T4 47.00-27.00	514.80	685.89	A	0.638	1.785	0.778	0.825	1	26.317	2416.17*	120.81	C
			B	0.378	2.108	0.643	0.825	1	13.148			
			C	0.985	2.069	1	0.825	1	52.103			
Sum Weight:	936.54	2403.47			*$2A_g$ limit					5183.66		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1 92.00-87.00	5.40	184.08	A	0.27	2.38	0.607	0.8	1	2.297	160.62	32.12	A
			B	0.207	2.571	0.592	0.8	1	1.778			
			C	0.207	2.571	0.592	0.8	1	1.778			
T2 87.00-67.00	27.81	685.64	A	0.269	2.382	0.607	0.8	1	8.974	601.72	30.09	A
		TA 162.22	B	0.187	2.642	0.588	0.8	1	6.218			
			C	0.187	2.642	0.588	0.8	1	6.218			
T3 67.00-47.00	388.53	685.64	A	0.538	1.855	0.718	0.8	1	20.548	2000.57	100.03	C
			B	0.258	2.412	0.604	0.8	1	8.612			
			C	0.845	1.856	0.934	0.8	1	41.725			
T4 47.00-27.00	514.80	685.89	A	0.638	1.785	0.778	0.8	1	26.295	2416.17*	120.81	C
			B	0.378	2.108	0.643	0.8	1	13.110			
			C	0.985	2.069	1	0.8	1	52.102			
Sum Weight:	936.54	2403.47			*$2A_g$ limit					5179.07		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1 92.00-87.00	5.40	184.08	A	0.27	2.38	0.607	0.85	1	2.331	162.99	32.60	A
			B	0.207	2.571	0.592	0.85	1	1.814			
			C	0.207	2.571	0.592	0.85	1	1.814			
T2 87.00-67.00	27.81	685.64	A	0.269	2.382	0.607	0.85	1	9.062	607.63	30.38	A
		TA 162.22	B	0.187	2.642	0.588	0.85	1	6.316			
			C	0.187	2.642	0.588	0.85	1	6.316			
T3 67.00-47.00	388.53	685.64	A	0.538	1.855	0.718	0.85	1	20.603	2001.46	100.07	C
			B	0.258	2.412	0.604	0.85	1	8.701			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
			C	0.845	1.856	0.934	0.85	1	41.743			
T4 47.00-27.00	514.80	685.89	A	0.638	1.785	0.778	0.85	1	26.339	2416.17*	120.81	C
			B	0.378	2.108	0.643	0.85	1	13.185			
			C	0.985	2.069	1	0.85	1	52.104			
Sum Weight:	936.54	2403.47			*$2A_g$ limit					5188.25		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1 92.00-87.00	15.23	260.86	A	0.482	1.924	0.689	1	1	4.726	200.42	40.08	A
			B	0.386	2.092	0.646	1	1	3.663			
			C	0.386	2.092	0.646	1	1	3.663			
T2 87.00-67.00	78.46	946.29	A	0.478	1.93	0.687	1	1	18.420	750.47	37.52	A
		TA 246.87	B	0.347	2.179	0.631	1	1	12.671			
			C	0.347	2.179	0.631	1	1	12.671			
T3 67.00-47.00	991.54	946.29	A	0.817	1.829	0.91	1	1	41.537	2114.84*	105.74	C
			B	0.462	1.955	0.679	1	1	17.625			
			C	1	2.1	1	1	1	64.829			
T4 47.00-27.00	1325.59	946.77	A	0.956	2.015	1	1	1	52.209	1869.20*	93.46	C
			B	0.653	1.781	0.788	1	1	28.318			
			C	1	2.1	1	1	1	74.976			
Sum Weight:	2410.82	3347.09			*$2A_g$ limit					4934.93		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1 92.00-87.00	15.23	260.86	A	0.482	1.924	0.689	0.825	1	4.617	195.77	39.15	A
			B	0.386	2.092	0.646	0.825	1	3.534			
			C	0.386	2.092	0.646	0.825	1	3.534			
T2 87.00-67.00	78.46	946.29	A	0.478	1.93	0.687	0.825	1	18.143	739.18	36.96	A
		TA 246.87	B	0.347	2.179	0.631	0.825	1	12.327			
			C	0.347	2.179	0.631	0.825	1	12.327			
T3 67.00-47.00	991.54	946.29	A	0.817	1.829	0.91	0.825	1	39.639	2114.84*	105.74	C
			B	0.462	1.955	0.679	0.825	1	17.340			
			C	1	2.1	1	0.825	1	64.829			
T4 47.00-27.00	1325.59	946.77	A	0.956	2.015	1	0.825	1	50.001	1869.20*	93.46	C
			B	0.653	1.781	0.788	0.825	1	28.129			
			C	1	2.1	1	0.825	1	74.976			
Sum Weight:	2410.82	3347.09			*$2A_g$ limit					4918.99		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1 92.00-87.00	15.23	260.86	A	0.482	1.924	0.689	0.8	1	4.601	195.11	39.02	A
			B	0.386	2.092	0.646	0.8	1	3.515			
			C	0.386	2.092	0.646	0.8	1	3.515			
T2 87.00-67.00	78.46	946.29	A	0.478	1.93	0.687	0.8	1	18.103	737.56	36.88	A
		TA 246.87	B	0.347	2.179	0.631	0.8	1	12.278			
			C	0.347	2.179	0.631	0.8	1	12.278			
T3 67.00-47.00	991.54	946.29	A	0.817	1.829	0.91	0.8	1	39.368	2114.84*	105.74	C
			B	0.462	1.955	0.679	0.8	1	17.299			
			C	1	2.1	1	0.8	1	64.829			
T4 47.00-27.00	1325.59	946.77	A	0.956	2.015	1	0.8	1	49.686	1869.20*	93.46	C
			B	0.653	1.781	0.788	0.8	1	28.102			
			C	1	2.1	1	0.8	1	74.976			
Sum Weight:	2410.82	3347.09			*$2A_g$ limit					4916.71		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1 92.00-87.00	15.23	260.86	A	0.482	1.924	0.689	0.85	1	4.632	196.44	39.29	A
			B	0.386	2.092	0.646	0.85	1	3.552			
			C	0.386	2.092	0.646	0.85	1	3.552			
T2 87.00-67.00	78.46	946.29	A	0.478	1.93	0.687	0.85	1	18.182	740.79	37.04	A
		TA 246.87	B	0.347	2.179	0.631	0.85	1	12.376			
			C	0.347	2.179	0.631	0.85	1	12.376			
T3 67.00-47.00	991.54	946.29	A	0.817	1.829	0.91	0.85	1	39.910	2114.84*	105.74	C
			B	0.462	1.955	0.679	0.85	1	17.381			
			C	1	2.1	1	0.85	1	64.829			
T4 47.00-27.00	1325.59	946.77	A	0.956	2.015	1	0.85	1	50.317	1869.20*	93.46	C
			B	0.653	1.781	0.788	0.85	1	28.156			
			C	1	2.1	1	0.85	1	74.976			
Sum Weight:	2410.82	3347.09			*$2A_g$ limit					4921.27		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1 92.00-87.00	5.40	184.08	A	0.27	2.38	0.607	1	1	2.433	58.86	11.77	A
			B	0.207	2.571	0.592	1	1	1.925			
			C	0.207	2.571	0.592	1	1	1.925			
T2 87.00-67.00	27.81	685.64	A	0.269	2.382	0.607	1	1	9.326	216.39	10.82	A
		TA 162.22	B	0.187	2.642	0.588	1	1	6.610			
			C	0.187	2.642	0.588	1	1	6.610			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T3 67.00-47.00	388.53	685.64	A	0.538	1.855	0.718	1	1	20.770	693.48	34.67	C
			B	0.258	2.412	0.604	1	1	8.969			
			C	0.845	1.856	0.934	1	1	41.799			
T4 47.00-27.00	514.80	685.89	A	0.638	1.785	0.778	1	1	26.469	836.04*	41.80	C
			B	0.378	2.108	0.643	1	1	13.410			
			C	0.985	2.069	1	1	1	52.109			
Sum Weight:	936.54	2403.47			*2A_g limit					1804.77		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1 92.00-87.00	5.40	184.08	A	0.27	2.38	0.607	0.825	1	2.314	55.99	11.20	A
			B	0.207	2.571	0.592	0.825	1	1.796			
			C	0.207	2.571	0.592	0.825	1	1.796			
T2 87.00-67.00	27.81	685.64	A	0.269	2.382	0.607	0.825	1	9.018	209.23	10.46	A
		TA 162.22	B	0.187	2.642	0.588	0.825	1	6.267			
			C	0.187	2.642	0.588	0.825	1	6.267			
T3 67.00-47.00	388.53	685.64	A	0.538	1.855	0.718	0.825	1	20.575	692.39	34.62	C
			B	0.258	2.412	0.604	0.825	1	8.657			
			C	0.845	1.856	0.934	0.825	1	41.734			
T4 47.00-27.00	514.80	685.89	A	0.638	1.785	0.778	0.825	1	26.317	836.04*	41.80	C
			B	0.378	2.108	0.643	0.825	1	13.148			
			C	0.985	2.069	1	0.825	1	52.103			
Sum Weight:	936.54	2403.47			*2A_g limit					1793.65		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1 92.00-87.00	5.40	184.08	A	0.27	2.38	0.607	0.8	1	2.297	55.58	11.12	A
			B	0.207	2.571	0.592	0.8	1	1.778			
			C	0.207	2.571	0.592	0.8	1	1.778			
T2 87.00-67.00	27.81	685.64	A	0.269	2.382	0.607	0.8	1	8.974	208.21	10.41	A
		TA 162.22	B	0.187	2.642	0.588	0.8	1	6.218			
			C	0.187	2.642	0.588	0.8	1	6.218			
T3 67.00-47.00	388.53	685.64	A	0.538	1.855	0.718	0.8	1	20.548	692.24	34.61	C
			B	0.258	2.412	0.604	0.8	1	8.612			
			C	0.845	1.856	0.934	0.8	1	41.725			
T4 47.00-27.00	514.80	685.89	A	0.638	1.785	0.778	0.8	1	26.295	836.04*	41.80	C
			B	0.378	2.108	0.643	0.8	1	13.110			
			C	0.985	2.069	1	0.8	1	52.102			
Sum Weight:	936.54	2403.47			*2A_g limit					1792.07		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1 92.00-87.00	5.40	184.08	A	0.27	2.38	0.607	0.85	1	2.331	56.40	11.28	A
			B	0.207	2.571	0.592	0.85	1	1.814			
			C	0.207	2.571	0.592	0.85	1	1.814			
T2 87.00-67.00	27.81	685.64 TA 162.22	A	0.269	2.382	0.607	0.85	1	9.062	210.25	10.51	A
			B	0.187	2.642	0.588	0.85	1	6.316			
			C	0.187	2.642	0.588	0.85	1	6.316			
T3 67.00-47.00	388.53	685.64	A	0.538	1.855	0.718	0.85	1	20.603	692.55	34.63	C
			B	0.258	2.412	0.604	0.85	1	8.701			
			C	0.845	1.856	0.934	0.85	1	41.743			
T4 47.00-27.00	514.80	685.89	A	0.638	1.785	0.778	0.85	1	26.339	836.04*	41.80	C
			B	0.378	2.108	0.643	0.85	1	13.185			
			C	0.985	2.069	1	0.85	1	52.104			
Sum Weight:	936.54	2403.47			*$2A_g$ limit					1795.24		

Force Totals (Does not include forces on guys)

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Torques kip-ft
Leg Weight	1596.01			
Bracing Weight	807.45			
Total Member Self-Weight	2403.47			
Guy Weight	330.87			
Total Weight	9593.82			
Wind 0 deg - No Ice		8.61	-12640.31	0.07
Wind 30 deg - No Ice		6291.86	-10927.29	0.97
Wind 45 deg - No Ice		8890.33	-8921.43	1.34
Wind 60 deg - No Ice		10881.26	-6309.26	1.61
Wind 90 deg - No Ice		12568.80	-8.61	1.82
Wind 120 deg - No Ice		10904.44	6312.70	1.54
Wind 135 deg - No Ice		8878.15	8909.25	1.23
Wind 150 deg - No Ice		6276.94	10918.68	0.85
Wind 180 deg - No Ice		-8.61	12603.60	-0.07
Wind 210 deg - No Ice		-6291.86	10927.29	-0.97
Wind 225 deg - No Ice		-8890.33	8921.43	-1.34
Wind 240 deg - No Ice		-10913.05	6327.62	-1.61
Wind 270 deg - No Ice		-12568.80	8.61	-1.82
Wind 300 deg - No Ice		-10872.64	-6294.34	-1.54
Wind 315 deg - No Ice		-8878.15	-8909.25	-1.23
Wind 330 deg - No Ice		-6276.94	-10918.68	-0.85
Member Ice	943.62			
Guy Ice	289.63			
Total Weight Ice	14402.51			
Wind 0 deg - Ice		6.55	-11486.21	0.25
Wind 30 deg - Ice		5725.28	-9938.79	0.91
Wind 45 deg - Ice		8091.77	-8115.33	1.16
Wind 60 deg - Ice		9905.99	-5739.67	1.32
Wind 90 deg - Ice		11439.22	-6.55	1.38

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Torques kip-ft
Wind 120 deg - Ice		9915.22	5737.43	1.07
Wind 135 deg - Ice		8082.51	8106.07	0.80
Wind 150 deg - Ice		5713.94	9932.24	0.48
Wind 180 deg - Ice		-6.55	11467.99	-0.25
Wind 210 deg - Ice		-5725.28	9938.79	-0.91
Wind 225 deg - Ice		-8091.77	8115.33	-1.16
Wind 240 deg - Ice		-9921.77	5748.78	-1.32
Wind 270 deg - Ice		-11439.22	6.55	-1.38
Wind 300 deg - Ice		-9899.44	-5728.32	-1.07
Wind 315 deg - Ice		-8082.51	-8106.07	-0.80
Wind 330 deg - Ice		-5713.94	-9932.24	-0.48
Total Weight	9593.82			
Wind 0 deg - Service		2.98	-4373.81	0.02
Wind 30 deg - Service		2177.11	-3781.07	0.34
Wind 45 deg - Service		3076.24	-3087.00	0.46
Wind 60 deg - Service		3765.14	-2183.14	0.56
Wind 90 deg - Service		4349.06	-2.98	0.63
Wind 120 deg - Service		3773.16	2184.32	0.53
Wind 135 deg - Service		3072.02	3082.78	0.43
Wind 150 deg - Service		2171.95	3778.09	0.29
Wind 180 deg - Service		-2.98	4361.11	-0.02
Wind 210 deg - Service		-2177.11	3781.07	-0.34
Wind 225 deg - Service		-3076.24	3087.00	-0.46
Wind 240 deg - Service		-3776.14	2189.49	-0.56
Wind 270 deg - Service		-4349.06	2.98	-0.63
Wind 300 deg - Service		-3762.16	-2177.97	-0.53
Wind 315 deg - Service		-3072.02	-3082.78	-0.43
Wind 330 deg - Service		-2171.95	-3778.09	-0.29

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice+Guy
3	Dead+Wind 30 deg - No Ice+Guy
4	Dead+Wind 45 deg - No Ice+Guy
5	Dead+Wind 60 deg - No Ice+Guy
6	Dead+Wind 90 deg - No Ice+Guy
7	Dead+Wind 120 deg - No Ice+Guy
8	Dead+Wind 135 deg - No Ice+Guy
9	Dead+Wind 150 deg - No Ice+Guy
10	Dead+Wind 180 deg - No Ice+Guy
11	Dead+Wind 210 deg - No Ice+Guy
12	Dead+Wind 225 deg - No Ice+Guy
13	Dead+Wind 240 deg - No Ice+Guy
14	Dead+Wind 270 deg - No Ice+Guy
15	Dead+Wind 300 deg - No Ice+Guy
16	Dead+Wind 315 deg - No Ice+Guy
17	Dead+Wind 330 deg - No Ice+Guy
18	Dead+Ice+Temp+Guy
19	Dead+Wind 0 deg+Ice+Temp+Guy
20	Dead+Wind 30 deg+Ice+Temp+Guy
21	Dead+Wind 45 deg+Ice+Temp+Guy

Comb. No.	Description
22	Dead+Wind 60 deg+Ice+Temp+Guy
23	Dead+Wind 90 deg+Ice+Temp+Guy
24	Dead+Wind 120 deg+Ice+Temp+Guy
25	Dead+Wind 135 deg+Ice+Temp+Guy
26	Dead+Wind 150 deg+Ice+Temp+Guy
27	Dead+Wind 180 deg+Ice+Temp+Guy
28	Dead+Wind 210 deg+Ice+Temp+Guy
29	Dead+Wind 225 deg+Ice+Temp+Guy
30	Dead+Wind 240 deg+Ice+Temp+Guy
31	Dead+Wind 270 deg+Ice+Temp+Guy
32	Dead+Wind 300 deg+Ice+Temp+Guy
33	Dead+Wind 315 deg+Ice+Temp+Guy
34	Dead+Wind 330 deg+Ice+Temp+Guy
35	Dead+Wind 0 deg - Service+Guy
36	Dead+Wind 30 deg - Service+Guy
37	Dead+Wind 45 deg - Service+Guy
38	Dead+Wind 60 deg - Service+Guy
39	Dead+Wind 90 deg - Service+Guy
40	Dead+Wind 120 deg - Service+Guy
41	Dead+Wind 135 deg - Service+Guy
42	Dead+Wind 150 deg - Service+Guy
43	Dead+Wind 180 deg - Service+Guy
44	Dead+Wind 210 deg - Service+Guy
45	Dead+Wind 225 deg - Service+Guy
46	Dead+Wind 240 deg - Service+Guy
47	Dead+Wind 270 deg - Service+Guy
48	Dead+Wind 300 deg - Service+Guy
49	Dead+Wind 315 deg - Service+Guy
50	Dead+Wind 330 deg - Service+Guy

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
T1	92 - 87	Leg	Max Tension	22	2545.48	0.03	-0.02
			Max. Compression	19	-2826.87	-0.01	-0.01
			Max. Mx	16	-1269.63	-0.16	0.03
			Max. My	27	-1042.13	0.02	0.16
			Max. Vy	29	-290.29	-0.01	0.00
			Max. Vx	26	376.72	-0.00	0.02
		Diagonal	Max Tension	34	650.01	0.00	0.00
			Max. Compression	34	-670.73	0.00	0.00
			Max. Mx	23	176.32	-0.00	-0.00
			Max. My	17	-653.27	-0.00	0.00
			Max. Vy	20	1.02	-0.00	0.00
			Max. Vx	17	0.19	0.00	0.00
		Horizontal	Max Tension	30	40.16	0.00	0.00
			Max. Compression	32	-25.52	0.00	0.00
			Max. Mx	18	3.83	-0.00	0.00
			Max. My	31	4.51	0.00	-0.00
			Max. Vy	18	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
		Top Girt	Max Tension	30	35.89	0.00	0.00
			Max. Compression	32	-34.50	0.00	0.00
			Max. Mx	18	-0.57	-0.00	0.00
			Max. My	31	0.53	0.00	-0.00
			Max. Vy	18	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
		Bottom Girt	Max Tension	27	43.17	0.00	0.00
			Max. Compression	7	-39.08	0.00	0.00
			Max. Mx	18	4.11	-0.00	0.00
			Max. My	31	7.74	0.00	-0.00
			Max. Vy	18	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
T2	87 - 67	Leg	Max Tension	13	9024.68	-0.00	0.01
			Max. Compression	10	-24476.58	0.02	0.09
			Max. Mx	14	-8081.97	-0.09	0.00
			Max. My	2	-16943.36	0.00	-0.10
			Max. Vy	7	-983.92	-0.01	0.04
			Max. Vx	10	-1075.10	0.02	0.00
		Diagonal	Max Tension	6	1710.35	0.00	0.00
			Max. Compression	6	-2191.33	0.00	0.00
			Max. Mx	27	600.15	-0.00	0.00
			Max. My	2	-351.44	-0.00	0.01
			Max. Vy	27	1.14	-0.00	0.00
			Max. Vx	2	-3.04	-0.00	0.01
		Horizontal	Max Tension	10	1463.08	0.00	0.00
			Max. Compression	19	-953.66	0.00	0.00
			Max. Mx	26	659.52	-0.00	0.00
			Max. My	31	410.62	0.00	-0.00
			Max. Vy	18	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
		Top Girt	Max Tension	30	28.07	0.00	0.00
			Max. Compression	32	-30.64	0.00	0.00
			Max. Mx	18	-2.13	-0.00	0.00
			Max. My	31	-3.18	0.00	-0.00
			Max. Vy	18	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
		Bottom Girt	Max Tension	8	476.69	0.00	0.00
			Max. Compression	10	-128.28	0.00	0.00
			Max. Mx	28	417.05	-0.00	0.00
			Max. My	31	193.68	0.00	-0.00
			Max. Vy	27	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
		Guy A	Bottom Tension	27	6925.97		
			Top Tension	27	6995.88		
			Top Cable Vert	27	6279.70		
			Top Cable Norm	27	3083.44		
			Top Cable Tan	27	5.88		
			Bot Cable Vert	27	-6137.27		
			Bot Cable Norm	27	3209.82		
			Bot Cable Tan	27	8.94		
		Guy B	Bottom Tension	31	8266.80		
			Top Tension	31	8336.36		
			Top Cable Vert	31	7903.88		
			Top Cable Norm	31	2650.12		
			Top Cable Tan	31	20.83		
			Bot Cable Vert	31	-7784.13		
			Bot Cable Norm	31	2783.13		
			Bot Cable Tan	31	39.56		
		Guy C	Bottom Tension	22	8068.13		
			Top Tension	22	8137.80		
			Top Cable Vert	22	7656.54		
			Top Cable Norm	22	2757.04		
			Top Cable Tan	22	5.59		
			Bot Cable Vert	22	-7530.41		
			Bot Cable Norm	22	2896.09		
			Bot Cable Tan	22	14.69		
		Torque Arm Top	Max Tension	34	8404.99	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	19	7653.92	-0.01	0.00
			Max. My	31	8354.37	0.00	0.00
			Max. Vy	19	7.33	0.00	0.00
			Max. Vx	31	0.04	0.00	0.00
		Torque Arm Bottom	Max Tension	12	616.90	0.00	0.00
			Max. Compression	31	-6406.68	0.00	0.00
			Max. Mx	26	-680.56	-0.01	0.00
			Max. My	31	-2440.28	0.00	0.00
			Max. Vy	26	9.52	0.00	0.00
			Max. Vx	31	-0.00	0.00	0.00
T3	67 - 47	Leg	Max Tension	15	11974.88	-0.23	-0.15
			Max. Compression	19	-34541.75	-0.00	-0.06
			Max. Mx	14	8760.80	-0.74	0.00
			Max. My	2	-17689.05	-0.01	-0.74
			Max. Vy	14	-4047.74	0.11	0.00
			Max. Vx	27	4345.08	0.00	-0.09
		Diagonal	Max Tension	16	3259.20	0.00	0.00
			Max. Compression	17	-3773.54	0.00	0.00
			Max. Mx	31	2777.52	-0.00	-0.00
			Max. My	32	-628.24	-0.00	0.01
			Max. Vy	31	1.19	-0.00	-0.00
			Max. Vx	32	4.92	0.00	0.00
		Horizontal	Max Tension	7	1438.82	0.00	0.00
			Max. Compression	10	-721.76	0.00	0.00
			Max. Mx	25	1244.07	-0.00	0.00
			Max. My	31	508.74	0.00	-0.00
			Max. Vy	25	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
		Top Girt	Max Tension	34	254.00	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	27	168.86	-0.00	0.00
			Max. My	31	226.11	0.00	-0.00
			Max. Vy	27	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
		Bottom Girt	Max Tension	19	1203.50	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	18	982.01	-0.00	0.00
			Max. My	31	1105.16	0.00	-0.00
			Max. Vy	18	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
T4	47 - 27	Leg	Max Tension	15	11973.68	0.10	0.04
			Max. Compression	19	-34541.68	0.00	0.09
			Max. Mx	14	-3760.94	0.45	0.16
			Max. My	10	-3314.02	0.00	-0.46
			Max. Vy	14	-4049.37	0.45	0.16
			Max. Vx	27	4345.70	0.00	-0.46
		Diagonal	Max Tension	15	1135.10	0.00	0.00
			Max. Compression	31	-1889.14	0.00	0.00
			Max. Mx	31	-1745.18	-0.00	0.00
			Max. My	32	-630.43	-0.00	0.01
			Max. Vy	31	1.25	-0.00	0.00
			Max. Vx	32	6.18	0.00	0.00
		Horizontal	Max Tension	27	944.71	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	18	764.55	-0.00	0.00
			Max. My	31	655.88	0.00	-0.00
			Max. Vy	18	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
		Top Girt	Max Tension	2	4251.02	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Mx	18	2424.53	-0.00	0.00
			Max. My	31	2646.35	0.00	-0.00
			Max. Vy	18	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
		Bottom Girt	Max Tension	2	52.82	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	18	28.24	-0.00	0.00
			Max. My	31	14.68	0.00	-0.00
			Max. Vy	18	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
		Guy A	Bottom Tension	27	12966.28		
			Top Tension	27	13002.47		
			Top Cable Vert	27	7532.22		
			Top Cable Norm	27	10598.58		
			Top Cable Tan	27	1.03		
			Bot Cable Vert	27	-7442.63		
			Bot Cable Norm	27	10617.52		
			Bot Cable Tan	27	1.03		
		Guy B	Bottom Tension	32	16157.61		
			Top Tension	32	16193.75		
			Top Cable Vert	32	11722.52		
			Top Cable Norm	32	11172.29		
			Top Cable Tan	32	5.36		
			Bot Cable Vert	32	-11644.02		
			Bot Cable Norm	32	11202.02		
			Bot Cable Tan	32	5.36		
		Guy C	Bottom Tension	22	15430.09		
			Top Tension	22	15466.24		
			Top Cable Vert	22	10788.09		
			Top Cable Norm	22	11082.49		
			Top Cable Tan	22	3.46		
			Bot Cable Vert	22	-10707.65		
			Bot Cable Norm	22	11110.08		
			Bot Cable Tan	22	3.46		
		Base Beam	Max Tension	33	1140.16	-25.44	0.06
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	19	-19491.64	-28.11	0.01
			Max. My	31	-17780.65	-25.65	0.23
			Max. Vy	19	-19491.64	-28.11	0.01
			Max. Vx	31	160.64	-25.65	0.23

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Guy C @ 20.92 ft Elev 28 ft Azimuth 240 deg	Max. Vert	13	-1032.21	-267.68	160.50
	Max. H_x	13	-1032.21	-267.68	160.50
	Max. H_z	22	-25404.38	-14490.50	8344.96
	Min. Vert	22	-25404.38	-14490.50	8344.96
	Min. H_x	22	-25404.38	-14490.50	8344.96
	Min. H_z	13	-1032.21	-267.68	160.50
Guy B @ 19.5 ft Elev 28 ft Azimuth 120 deg	Max. Vert	7	-1255.27	310.15	185.90

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
	Max. H_x	32	-26873.54	14390.86	8288.86
	Max. H_z	32	-26873.54	14390.86	8288.86
	Min. Vert	32	-26873.54	14390.86	8288.86
	Min. H_x	7	-1255.27	310.15	185.90
	Min. H_z	7	-1255.27	310.15	185.90
Guy A @ 28.2 ft Elev 28 ft Azimuth 0 deg	Max. Vert	2	-584.12	0.33	-272.12
	Max. H_x	31	-10049.70	251.49	-8545.57
	Max. H_z	2	-584.12	0.33	-272.12
	Min. Vert	27	-19636.85	-2.16	-16969.99
	Min. H_x	23	-10207.62	-248.24	-8629.28
	Min. H_z	27	-19636.85	-2.16	-16969.99
Mast	Max. Vert	19	58411.59	-64.55	-1009.05
	Max. H_x	23	52342.53	953.34	22.36
	Max. H_z	27	49602.75	-20.29	507.62
	Max. M_x	1	0.00	-22.32	-47.52
	Max. M_z	1	0.00	-22.32	-47.52
	Max. Torsion	1	0.00	-22.32	-47.52
	Min. Vert	43	40423.68	-18.02	-1.28
	Min. H_x	31	53315.12	-1055.48	-8.38
	Min. H_z	19	58411.59	-64.55	-1009.05
	Min. M_x	1	0.00	-22.32	-47.52
	Min. M_z	1	0.00	-22.32	-47.52
	Min. Torsion	1	0.00	-22.32	-47.52

Tower Mast Reaction Summary

Load Combination	Vertical lb	$Shear_x$ lb	$Shear_z$ lb	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	40512.60	22.32	47.52	0.00	0.00	0.00
Dead+Wind 0 deg - No Ice+Guy	52391.22	54.53	393.01	0.00	0.00	0.00
Dead+Wind 30 deg - No Ice+Guy	47701.04	-197.48	269.05	0.00	0.00	0.00
Dead+Wind 45 deg - No Ice+Guy	43840.03	-307.52	214.87	0.00	0.00	0.00
Dead+Wind 60 deg - No Ice+Guy	42101.24	-403.01	159.92	0.00	0.00	0.00
Dead+Wind 90 deg - No Ice+Guy	45074.67	-362.55	114.07	0.00	0.00	0.00
Dead+Wind 120 deg - No Ice+Guy	46962.84	-249.47	68.06	0.00	0.00	0.00
Dead+Wind 135 deg - No Ice+Guy	45570.51	-162.63	34.74	0.00	0.00	0.00
Dead+Wind 150 deg - No Ice+Guy	43288.39	-115.00	-25.29	0.00	0.00	0.00
Dead+Wind 180 deg - No Ice+Guy	40764.51	12.31	-109.03	0.00	0.00	0.00
Dead+Wind 210 deg - No Ice+Guy	43682.66	140.06	-6.16	0.00	0.00	0.00
Dead+Wind 225 deg - No Ice+Guy	46347.50	213.21	53.37	0.00	0.00	0.00
Dead+Wind 240 deg - No Ice+Guy	48027.15	322.75	86.61	0.00	0.00	0.00
Dead+Wind 270 deg - No	46112.08	436.69	142.46	0.00	0.00	0.00

Load Combination	Vertical lb	$Shear_x$ lb	$Shear_z$ lb	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Ice+Guy						
Dead+Wind 300 deg - No Ice+Guy	42366.35	485.54	190.53	0.00	0.00	0.00
Dead+Wind 315 deg - No Ice+Guy	44394.96	391.23	249.36	0.00	0.00	0.00
Dead+Wind 330 deg - No Ice+Guy	48323.36	292.05	307.62	0.00	0.00	0.00
Dead+Ice+Temp+Guy	47955.02	24.27	2.79	0.00	0.00	0.00
Dead+Wind 0 deg+Ice+Temp+Guy	58411.59	64.55	1009.05	0.00	0.00	0.00
Dead+Wind 30 deg+Ice+Temp+Guy	54888.82	-370.25	844.54	0.00	0.00	0.00
Dead+Wind 45 deg+Ice+Temp+Guy	52463.17	-569.48	659.58	0.00	0.00	0.00
Dead+Wind 60 deg+Ice+Temp+Guy	51393.44	-752.62	394.37	0.00	0.00	0.00
Dead+Wind 90 deg+Ice+Temp+Guy	52342.53	-953.34	-22.36	0.00	0.00	0.00
Dead+Wind 120 deg+Ice+Temp+Guy	53566.97	-826.23	-274.51	0.00	0.00	0.00
Dead+Wind 135 deg+Ice+Temp+Guy	52459.15	-682.54	-376.61	0.00	0.00	0.00
Dead+Wind 150 deg+Ice+Temp+Guy	50760.02	-512.12	-464.99	0.00	0.00	0.00
Dead+Wind 180 deg+Ice+Temp+Guy	49602.75	20.29	-507.62	0.00	0.00	0.00
Dead+Wind 210 deg+Ice+Temp+Guy	51157.21	566.26	-451.01	0.00	0.00	0.00
Dead+Wind 225 deg+Ice+Temp+Guy	53201.80	751.65	-356.24	0.00	0.00	0.00
Dead+Wind 240 deg+Ice+Temp+Guy	54517.36	915.73	-252.42	0.00	0.00	0.00
Dead+Wind 270 deg+Ice+Temp+Guy	53315.12	1055.48	8.38	0.00	0.00	0.00
Dead+Wind 300 deg+Ice+Temp+Guy	51746.23	866.42	437.73	0.00	0.00	0.00
Dead+Wind 315 deg+Ice+Temp+Guy	52903.81	681.61	710.59	0.00	0.00	0.00
Dead+Wind 330 deg+Ice+Temp+Guy	55412.66	489.11	883.64	0.00	0.00	0.00
Dead+Wind 0 deg - Service+Guy	40668.29	28.03	95.77	0.00	0.00	0.00
Dead+Wind 30 deg - Service+Guy	40665.41	-49.68	86.47	0.00	0.00	0.00
Dead+Wind 45 deg - Service+Guy	40654.51	-83.10	79.00	0.00	0.00	0.00
Dead+Wind 60 deg - Service+Guy	40635.60	-108.31	68.65	0.00	0.00	0.00
Dead+Wind 90 deg - Service+Guy	40576.13	-132.04	44.21	0.00	0.00	0.00
Dead+Wind 120 deg - Service+Guy	40507.10	-115.82	19.29	0.00	0.00	0.00
Dead+Wind 135 deg - Service+Guy	40475.81	-89.02	11.45	0.00	0.00	0.00
Dead+Wind 150 deg - Service+Guy	40450.85	-58.25	4.52	0.00	0.00	0.00
Dead+Wind 180 deg - Service+Guy	40423.68	18.02	1.28	0.00	0.00	0.00
Dead+Wind 210 deg - Service+Guy	40433.16	95.40	9.53	0.00	0.00	0.00
Dead+Wind 225 deg -	40451.48	127.55	18.49	0.00	0.00	0.00

Load Combination	Vertical lb	$Shear_x$ lb	$Shear_z$ lb	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Service+Guy						
Dead+Wind 240 deg - Service+Guy	40477.79	156.23	27.91	0.00	0.00	0.00
Dead+Wind 270 deg - Service+Guy	40546.09	177.46	53.71	0.00	0.00	0.00
Dead+Wind 300 deg - Service+Guy	40612.78	159.03	76.54	0.00	0.00	0.00
Dead+Wind 315 deg - Service+Guy	40636.59	136.04	85.31	0.00	0.00	0.00
Dead+Wind 330 deg - Service+Guy	40652.87	105.03	91.31	0.00	0.00	0.00

Solution Summary

Load Comb.	Sum of Applied Forces PX lb	PY lb	PZ lb	Sum of Reactions PX lb	PY lb	PZ lb	% Error
1	-0.00	-9593.78	-0.00	-1.68	9594.06	-3.82	0.044%
2	6.54	-9588.52	-13158.45	-6.65	9588.36	13156.61	0.011%
3	6561.54	-9582.03	-11376.05	-6562.97	9581.92	11368.73	0.046%
4	9276.35	-9578.26	-9288.52	-9277.16	9578.23	9287.21	0.009%
5	11358.65	-9579.18	-6569.24	-11358.41	9579.16	6566.52	0.017%
6	13125.77	-9596.60	-6.89	-13124.48	9596.56	8.17	0.011%
7	11384.87	-9613.20	6576.83	-11381.87	9613.15	-6575.03	0.021%
8	9267.96	-9613.24	9280.61	-9265.41	9613.20	-9279.59	0.017%
9	6550.69	-9608.35	11371.05	-6549.68	9608.34	-11370.88	0.006%
10	-6.54	-9599.04	13121.74	5.94	9599.03	-13118.24	0.022%
11	-6561.54	-9605.53	11376.05	6556.88	9605.49	-11374.88	0.029%
12	-9276.35	-9609.30	9288.52	9271.33	9609.23	-9286.28	0.034%
13	-11390.32	-9608.52	6587.55	11385.84	9608.43	-6584.81	0.032%
14	-13125.77	-9590.96	6.89	13123.39	9590.91	-4.90	0.019%
15	-11353.08	-9574.36	-6558.47	11353.64	9574.33	6558.63	0.004%
16	-9267.96	-9574.33	-9280.61	9268.95	9574.28	9278.41	0.015%
17	-6550.69	-9579.21	-11371.05	6551.85	9579.12	11364.75	0.039%
18	-0.00	-14402.43	-0.00	-1.09	14402.44	-4.61	0.033%
19	2.56	-14389.44	-12537.04	-2.48	14389.21	12535.89	0.006%
20	6271.61	-14378.09	-10849.09	-6271.31	14377.96	10850.04	0.005%
21	8873.24	-14371.70	-8860.04	-8873.51	14371.67	8859.83	0.002%
22	10871.93	-14374.14	-6267.11	-10872.04	14374.09	6266.87	0.001%
23	12565.66	-14408.22	-3.19	-12565.37	14408.12	2.46	0.004%
24	10887.08	-14440.63	6272.90	-10887.58	14440.52	-6273.23	0.003%
25	8871.32	-14441.26	8859.02	-8871.83	14441.18	-8859.22	0.003%
26	6268.16	-14432.56	10849.48	-6268.22	14432.51	-10849.81	0.002%
27	-2.56	-14415.42	12518.82	1.78	14415.41	-12516.22	0.014%
28	-6271.61	-14426.77	10849.09	6272.41	14426.72	-10848.95	0.004%
29	-8873.24	-14433.16	8860.04	8873.69	14433.07	-8860.34	0.003%
30	-10887.71	-14430.72	6276.22	10888.25	14430.58	-6276.62	0.004%
31	-12565.66	-14396.64	3.19	12566.00	14396.50	-3.69	0.003%
32	-10871.30	-14364.23	-6263.79	10871.46	14364.18	6263.51	0.002%
33	-8871.32	-14363.60	-8859.02	8871.63	14363.56	8858.55	0.003%
34	-6268.16	-14372.30	-10849.48	6267.80	14372.15	10850.42	0.005%
35	2.26	-9591.96	-4553.10	-2.74	9591.95	4543.02	0.095%
36	2270.43	-9589.71	-3936.35	-2266.42	9589.70	3927.81	0.089%
37	3209.81	-9588.41	-3214.02	-3206.76	9588.41	3210.30	0.045%
38	3930.33	-9588.73	-2273.09	-3926.41	9588.72	2270.16	0.046%
39	4541.79	-9594.76	-2.38	-4536.72	9594.75	1.75	0.048%
40	3939.40	-9600.50	2275.72	-3935.10	9600.50	-2274.46	0.042%
41	3206.91	-9600.51	3211.29	-3201.05	9600.51	-3208.15	0.063%

Load Comb.	Sum of Applied Forces PX lb	PY lb	PZ lb	Sum of Reactions PX lb	PY lb	PZ lb	% Error
42	2266.68	-9598.82	3934.62	-2262.71	9598.82	-3931.31	0.049%
43	-2.26	-9595.60	4540.39	2.01	9595.59	-4537.02	0.032%
44	-2270.43	-9597.85	3936.35	2265.92	9597.84	-3932.97	0.053%
45	-3209.81	-9599.15	3214.02	3203.28	9599.14	-3210.75	0.069%
46	-3941.33	-9598.83	2279.44	3936.47	9598.83	-2278.18	0.047%
47	-4541.79	-9592.81	2.38	4535.72	9592.80	-3.30	0.058%
48	-3928.40	-9587.06	-2269.37	3923.39	9587.06	2266.04	0.057%
49	-3206.91	-9587.05	-3211.29	3202.82	9587.05	3207.18	0.055%
50	-2266.68	-9588.74	-3934.62	2263.60	9588.74	3930.13	0.051%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	8	0.00000001	0.00035901
2	Yes	22	0.00093607	0.00065265
3	Yes	17	0.00098234	0.00044234
4	Yes	17	0.00097206	0.00046138
5	Yes	10	0.00088490	0.00028299
6	Yes	17	0.00099056	0.00037038
7	Yes	17	0.00096352	0.00024606
8	Yes	17	0.00090541	0.00020550
9	Yes	19	0.00098967	0.00019926
10	Yes	7	0.00082328	0.00059700
11	Yes	14	0.00095670	0.00019149
12	Yes	16	0.00088940	0.00025329
13	Yes	17	0.00092641	0.00033409
14	Yes	17	0.00095481	0.00036965
15	Yes	19	0.00095671	0.00047791
16	Yes	17	0.00094124	0.00044586
17	Yes	18	0.00098939	0.00036619
18	Yes	5	0.00000001	0.00023065
19	Yes	22	0.00083757	0.00094607
20	Yes	28	0.00092470	0.00069887
21	Yes	23	0.00097074	0.00044338
22	Yes	25	0.00099147	0.00044357
23	Yes	36	0.00099683	0.00042591
24	Yes	29	0.00085310	0.00057807
25	Yes	33	0.00091512	0.00046166
26	Yes	47	0.00096462	0.00031897
27	Yes	9	0.00000001	0.00024645
28	Yes	40	0.00098538	0.00038364
29	Yes	30	0.00086060	0.00051025
30	Yes	26	0.00091520	0.00071644
31	Yes	31	0.00089153	0.00057893
32	Yes	23	0.00096461	0.00049886
33	Yes	22	0.00094277	0.00045677
34	Yes	27	0.00097445	0.00073900
35	Yes	5	0.00000001	0.00058276
36	Yes	5	0.00000001	0.00064836
37	Yes	6	0.00000001	0.00057498
38	Yes	6	0.00000001	0.00071752
39	Yes	6	0.00000001	0.00085290
40	Yes	6	0.00000001	0.00072773
41	Yes	5	0.00000001	0.00097888
42	Yes	5	0.00000001	0.00073046

43	Yes	5	0.00000001	0.00030735
44	Yes	5	0.00000001	0.00043993
45	Yes	5	0.00000001	0.00074477
46	Yes	6	0.00000001	0.00067327
47	Yes	6	0.00000001	0.00096666
48	Yes	6	0.00000001	0.00098371
49	Yes	6	0.00000001	0.00088435
50	Yes	6	0.00000001	0.00073185

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	92 - 87	0.862	48	0.0374	0.0727
T2	87 - 67	0.822	48	0.0363	0.0729
T3	67 - 47	0.659	48	0.0650	0.1655
T4	47 - 27	0.243	49	0.0781	0.2351

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
91.00	17' x 3" Dia Omni	48	0.853	0.0370	0.0722	22849
81.25	Guy	48	0.786	0.0406	0.0907	76650
80.00	3' Pipe Brace	48	0.779	0.0423	0.0961	94137
76.50	8' x 3" Dia Omni	48	0.758	0.0481	0.1133	26107
69.00	21-ft 8-Bay Dipole	48	0.688	0.0618	0.1548	10463
63.50	DB844G65ZAXY	49	0.599	0.0696	0.1829	12052
62.50	6'x12' Boom Gate (3)	49	0.579	0.0707	0.1875	13289
59.00	TMA 10"x8"x3"	49	0.505	0.0737	0.2023	21291
54.50	MB96RR900200DPBL	49	0.403	0.0762	0.2180	90708
50.00	TMA 10"x8"x3"	49	0.303	0.0776	0.2296	18500
46.92	Guy	49	0.241	0.0781	0.2352	13726

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	92 - 87	3.292	19	0.1971	0.3041
T2	87 - 67	3.083	19	0.1925	0.3188
T3	67 - 47	2.387	2	0.2544	0.5744
T4	47 - 27	0.993	2	0.2884	0.7599

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
91.00	17' x 3" Dia Omni	19	3.249	0.1958	0.3061	8631
81.25	Guy	19	2.875	0.1998	0.3636	44206
80.00	3' Pipe Brace	19	2.832	0.2031	0.3773	39550
76.50	8' x 3" Dia Omni	2	2.740	0.2146	0.4220	9314
69.00	21-ft 8-Bay Dipole	2	2.483	0.2458	0.5399	3649
63.50	DB844G65ZAXY	2	2.185	0.2682	0.6351	4183
62.50	6'x12' Boom Gate (3)	2	2.120	0.2718	0.6518	4647
59.00	TMA 10"x8"x3"	2	1.875	0.2820	0.7057	7811
54.50	MB96RR900200DPBL	2	1.538	0.2889	0.7560	18140
50.00	TMA 10"x8"x3"	2	1.202	0.2944	0.7732	5637
46.92	Guy	2	0.987	0.2881	0.7592	4364

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt lb	Allowable Load lb	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	92	Leg	A325N	0.875	1	1651.59	26457.50	0.062 ✔	1.333	Bolt Tension
T2	87	Leg	A325N	0.875	1	2544.67	26449.80	0.096 ✔	1.333	Bolt Tension
T3	67	Leg	A325N	0.875	1	9023.91	26378.80	0.342 ✔	1.333	Bolt Tension
T4	47	Leg	A325N	0.875	1	11973.70	24615.90	0.486 ✔	1.333	Bolt Tension

Guy Design Data

Section No.	Elevation ft	Size	Initial Tension lb	Breaking Load lb	Actual T lb	Allowable T_a lb	Required S.F.	Actual S.F.
T2	81.25 (A) (244)	9/16 EHS	3500.00	35000.04	6995.88	17500.00	2.000	5.003 ✔
	81.25 (A) (245)	9/16 EHS	3500.00	35000.04	6905.67	17500.00	2.000	5.068 ✔
	81.25 (B) (238)	9/16 EHS	3500.00	35000.04	8336.36	17500.00	2.000	4.198 ✔
	81.25 (B) (239)	9/16 EHS	3500.00	35000.04	8035.42	17500.00	2.000	4.356 ✔
	81.25 (C) (232)	9/16 EHS	3500.00	35000.04	7748.48	17500.00	2.000	4.517 ✔
	81.25 (C) (233)	9/16 EHS	3500.00	35000.04	8137.80	17500.00	2.000	4.301 ✔
T4	46.92 (A) (252)	3/4 EHS	5830.00	58299.92	13002.50	29150.00	2.000	4.484 ✔
	46.92 (B) (251)	3/4 EHS	5830.00	58299.92	16193.80	29150.00	2.000	3.600 ✔
	46.92 (C) (250)	3/4 EHS	5830.00	58299.92	15466.20	29150.00	2.000	3.770 ✔

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	Mast Stability Index	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	1 3/4	5.00	2.46	67.4 K=1.00	1.00	21.409	2.405	-2826.88	51495.40	0.055 ✓
T2	87 - 67	1 3/4	20.00	2.83	77.7 K=1.00	1.00	19.465	2.405	-24476.60	46819.90	0.523 ✓
T3	67 - 47	1 3/4	20.00	2.83	77.7 K=1.00	1.00	19.465	2.405	-34541.80	46819.90	0.738 ✓
T4	47 - 27	1 3/4	20.00	2.85	78.0 K=1.00	1.00	19.401	2.405	-34541.70	46665.30	0.740 ✓

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	1/2	3.51	1.65	79.2 K=0.50	15.440	0.196	-670.73	3031.57	0.221 ✓
T2	87 - 67	1/2	3.78	1.78	82.5 K=0.48	15.073	0.196	-2191.33	2959.56	0.740 ✓
T3	67 - 47	1/2	3.78	1.78	82.5 K=0.48	15.073	0.196	-3773.54	2959.56	1.275 ✓
T4	47 - 27	1/2	3.79	1.78	82.6 K=0.48	15.063	0.196	-1889.14	2957.62	0.639 ✓

Horizontal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	L1 1/4x1 1/4x3/16	2.50	2.35	118.0 K=1.02	10.571	0.434	-25.52	4583.43	0.006 ✓
T2	87 - 67	L1 1/4x1 1/4x3/16	2.50	2.35	118.0 K=1.02	10.571	0.434	-953.66	4583.43	0.208 ✓
T3	67 - 47	L1 1/4x1 1/4x3/16	2.50	2.35	118.0 K=1.02	10.571	0.434	-721.76	4583.43	0.157 ✓

Top Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	L1 1/4x1 1/4x3/16	2.50	2.35	118.0 K=1.02	10.571	0.434	-34.50	4583.43	0.008 ✓
T2	87 - 67	L1 1/4x1 1/4x3/16	2.50	2.35	118.0 K=1.02	10.571	0.434	-30.64	4583.43	0.007 ✓

Bottom Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	L1 1/4x1 1/4x3/16	2.50	2.35	118.0 K=1.02	10.571	0.434	-39.08	4583.43	0.009 ✓
T2	87 - 67	L1 1/4x1 1/4x3/16	2.50	2.35	118.0 K=1.02	10.571	0.434	-128.28	4583.43	0.028 ✓

Torque-Arm Bottom Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T2	87 - 67 (236)	L3x3x1/4	2.50	2.43	84.6 K=1.72	14.836	1.440	-5753.58	21363.20	0.269 ✓
T2	87 - 67 (237)	L3x3x1/4	2.50	2.43	84.6 K=1.72	14.836	1.440	-5220.07	21363.20	0.244 ✓
T2	87 - 67 (242)	L3x3x1/4	2.50	2.43	84.6 K=1.72	14.836	1.440	-6406.68	21363.20	0.300 ✓
T2	87 - 67 (243)	L3x3x1/4	2.50	2.43	84.6 K=1.72	14.836	1.440	-6240.45	21363.20	0.292 ✓
T2	87 - 67 (248)	L3x3x1/4	2.50	2.43	84.6 K=1.72	14.836	1.440	-5885.65	21363.20	0.276 ✓
T2	87 - 67 (249)	L3x3x1/4	2.50	2.43	84.6 K=1.72	14.836	1.440	-5145.81	21363.20	0.241 ✓

Tension Checks

Leg Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	1 3/4	5.00	2.46	67.4	30.000	2.405	2545.48	72158.50	0.035 ✓
T2	87 - 67	1 3/4	20.00	2.83	77.7	30.000	2.405	9024.68	72158.50	0.125

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T3	67 - 47	1 3/4	20.00	2.83	77.7	30.000	2.405	11974.90	72158.50	0.166 ✓
T4	47 - 27	1 3/4	20.00	2.85	78.0	30.000	2.405	11973.70	72158.50	0.166 ✓

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	1/2	3.51	1.65	158.5	21.600	0.196	650.01	4241.15	0.153 ✓
T2	87 - 67	1/2	3.78	1.78	170.8	21.600	0.196	1710.35	4241.15	0.403 ✓
T3	67 - 47	1/2	3.78	1.78	170.8	21.600	0.196	3259.20	4241.15	0.768 ✓
T4	47 - 27	1/2	3.79	1.78	171.2	21.600	0.196	1135.10	4241.15	0.268 ✓

Horizontal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	40.16	9365.63	0.004 ✓
T2	87 - 67	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	1463.08	9365.63	0.156 ✓
T3	67 - 47	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	1438.82	9365.63	0.154 ✓
T4	47 - 27	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	765.74	9365.63	0.082* ✓

* DL controls

Top Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	35.89	9365.63	0.004 ✓
T2	87 - 67	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	28.07	9365.63	0.003

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T3	67 - 47	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	254.00	9365.63	0.027 ✓
T4	47 - 27	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	4251.02	9365.63	0.454 ✓

Bottom Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	43.17	9365.63	0.005 ✓
T2	87 - 67	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	476.69	9365.63	0.051 ✓
T3	67 - 47	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	1000.47	9365.63	0.107* ✓
T4	47 - 27	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	52.82	9365.63	0.006 ✓

* DL controls

Torque-Arm Top Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T2	87 - 67 (234)	L2x2x5/16	3.78	3.67	73.2	21.600	1.150	8091.62	24840.00	0.326 ✓
T2	87 - 67 (235)	L2x2x5/16	3.78	3.67	73.2	21.600	1.150	7015.13	24840.00	0.282 ✓
T2	87 - 67 (240)	L2x2x5/16	3.78	3.67	73.2	21.600	1.150	8404.99	24840.00	0.338 ✓
T2	87 - 67 (241)	L2x2x5/16	3.78	3.67	73.2	21.600	1.150	7827.42	24840.00	0.315 ✓
T2	87 - 67 (246)	L2x2x5/16	3.78	3.67	73.2	21.600	1.150	8370.94	24840.00	0.337 ✓
T2	87 - 67 (247)	L2x2x5/16	3.78	3.67	73.2	21.600	1.150	6758.86	24840.00	0.272 ✓

Torque-Arm Bottom Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T2	87 - 67 (236)	L3x3x1/4	2.50	2.43	31.3	21.600	1.440	616.90	31104.00	0.020 ✓
T2	87 - 67 (237)	L3x3x1/4	2.50	2.43	31.3	21.600	1.440	378.07	31104.00	0.012 ✓
T2	87 - 67 (242)	L3x3x1/4	2.50	2.43	31.3	21.600	1.440	298.30	31104.00	0.010 ✓
T2	87 - 67 (243)	L3x3x1/4	2.50	2.43	31.3	21.600	1.440	241.22	31104.00	0.008 ✓
T2	87 - 67 (248)	L3x3x1/4	2.50	2.43	31.3	21.600	1.440	435.40	31104.00	0.014 ✓
T2	87 - 67 (249)	L3x3x1/4	2.50	2.43	31.3	21.600	1.440	88.56	31104.00	0.003 ✓

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	$SF*P_{allow}$ lb	% Capacity	Pass Fail
T1	92 - 87	Leg	1 3/4	3	-2826.88	68643.36	4.1 4.7 (b)	Pass
T2	87 - 67	Leg	1 3/4	27	-24476.60	62410.92	39.2	Pass
T3	67 - 47	Leg	1 3/4	96	-34541.80	62410.92	55.3	Pass
T4	47 - 27	Leg	1 3/4	165	-34541.70	62204.84	55.5	Pass
T1	92 - 87	Diagonal	1/2	13	-670.73	4041.08	16.6	Pass
T2	87 - 67	Diagonal	1/2	70	-2191.33	3945.09	55.5	Pass
T3	67 - 47	Diagonal	1/2	106	-3773.54	3945.09	95.7	Pass
T4	47 - 27	Diagonal	1/2	218	-1889.14	3942.51	47.9	Pass
T1	92 - 87	Horizontal	L1 1/4x1 1/4x3/16	18	-25.52	6109.71	0.4	Pass
T2	87 - 67	Horizontal	L1 1/4x1 1/4x3/16	85	-953.66	6109.71	15.6	Pass
T3	67 - 47	Horizontal	L1 1/4x1 1/4x3/16	154	-721.76	6109.71	11.8	Pass
T4	47 - 27	Horizontal	L1 1/4x1 1/4x3/16	180	765.74	9365.63	8.2	Pass
T1	92 - 87	Top Girt	L1 1/4x1 1/4x3/16	6	-34.50	6109.71	0.6	Pass
T2	87 - 67	Top Girt	L1 1/4x1 1/4x3/16	30	-30.64	6109.71	0.5	Pass
T3	67 - 47	Top Girt	L1 1/4x1 1/4x3/16	97	254.00	12484.38	2.0	Pass
T4	47 - 27	Top Girt	L1 1/4x1 1/4x3/16	166	4251.02	12484.38	34.1	Pass
T1	92 - 87	Bottom Girt	L1 1/4x1 1/4x3/16	9	-39.08	6109.71	0.6	Pass
T2	87 - 67	Bottom Girt	L1 1/4x1 1/4x3/16	33	476.69	12484.38	3.8	Pass
T3	67 - 47	Bottom Girt	L1 1/4x1 1/4x3/16	102	1000.47	9365.63	10.7	Pass
T4	47 - 27	Bottom Girt	L1 1/4x1 1/4x3/16	169	52.82	12484.38	0.4	Pass
T2	87 - 67	Guy A@81.25	9/16	244	6995.88	17500.00	40.0	Pass
T4	47 - 27	Guy A@46.9167	3/4	252	13002.50	29150.00	44.6	Pass
T2	87 - 67	Guy B@81.25	9/16	238	8336.36	17500.00	47.6	Pass
T4	47 - 27	Guy B@46.9167	3/4	251	16193.80	29150.00	55.6	Pass
T2	87 - 67	Guy C@81.25	9/16	233	8137.80	17500.00	46.5	Pass
T4	47 - 27	Guy C@46.9167	3/4	250	15466.20	29150.00	53.1	Pass
T2	87 - 67	Torque Arm Top@81.25	L2x2x5/16	240	8404.99	33111.72	25.4	Pass
T2	87 - 67	Torque Arm Bottom@81.25	L3x3x1/4	242	-6406.68	28477.14	22.5	Pass
							Summary	
						Leg (T4)	55.5	Pass
						Diagonal (T3)	95.7	Pass
						Horizontal (T2)	15.6	Pass
						Top Girt	34.1	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	$SF*P_{allow}$ lb	% Capacity	Pass Fail
						(T4)		
						Bottom Girt (T3)	10.7	Pass
						Guy A (T4)	44.6	Pass
						Guy B (T4)	55.6	Pass
						Guy C (T4)	53.1	Pass
						Torque Arm Top (T2)	25.4	Pass
						Torque Arm Bottom (T2)	22.5	Pass
						Bolt Checks	36.5	Pass
						RATING =	**95.7**	**Pass**

Guy Anchor Connection Bolts Capacity Check:

Input Data:

Guy Anchor Reactions:

Guy Anchor B @ 19.5ft:

NOTE: Analysis considers a single 5/8" dia thru bolt at anchor rod connection to anchor plate as critical failure point. (Existing anchor steel connection to existing structure considered adequate by inspection).

Horz Force (H) = $Fh := 16.6 \cdot kips$ (Input From RisaTower)

Vertical Force (V)= $Fv := 26.9 \cdot kips$ (Input From RisaTower)

Resultant Force (R) = $Fr := 31.6kips$ (Input From RisaTower)

Guy Anchor A Connection Bolt Data:

Use ASTM A325 Steel

Bolt Ultimate Strength = $F_u := 120 \cdot ksi$ (ASD 9th Ed)

Bolt Yield Strength= $F_y := 92 \cdot ksi$ (User Input)

Diameter of Bolt = $D := 0.625 \cdot in$ (User Input)

Calculated Bolt Properties:

Gross Area of Bolt = $A_g := \frac{\pi}{4} \cdot D^2 = 0.307 \cdot in^2$

Number of Shear Planes = $N_{sp} := 6$ (3 Bolts in Double Shear Considered)

Check Anchor Connection Bolt Shear Force:

Maximum Shear Stress in 1 Bolt = $f_v := \frac{Fr}{(A_g \cdot N_{sp})}$ $f_v = 17.17 \cdot ksi$

Bolt Allowable Shear Stress:

$F_v := 21.0ksi$ Ref Table I-D, pg 4-5 ASD 9th Ed)

Note: (Allowable shear stress may be increased by 1.333 under transient loading per Section A5.2, ASD 9th Ed)

Condition1 = $Condition1 := if\left(\frac{f_v}{F_v} \le 1.00, "OK", "Overstressed"\right)$

$\frac{f_v}{F_v} = 0.82$

Condition1 = "OK"

SITE NAME	HAMDEN 2 CT	ECP - CELL #	2 / 176
LATITUDE	41-22-11.35 N	LONGITUDE	72-55-54.37 W
Additional Comments:		SAVE BUTTON	
		STRUCTURE TYPE	LATTICE ON ROOF

700 Mhz - LTE ANTENNA ADD	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Lucent	Lucent	Lucent
ANTENNA TYPE	P65-16-XL-2	LNX-6514DS-T4M	LNX-6514DS-T4M
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	63.5	63.5	63.5
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			

850 Celluar - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Modcell	Cellular Modcell	Cellular Modcell
ANTENNA TYPE	DB844H90-XY	DB844H90-XY	DB844H90-XY
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	63.5	63.5	63.5
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			

850 Celluar - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Modcell	Cellular Modcell	Cellular Modcell
ANTENNA TYPE	DB844G65ZAXY	APL866513	DB844G65ZAXY
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	2	2	4
RAD CTR (FT AGL)	63.5	63.5	63.5
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			

1900 Cellular - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0	PCS Modcell 4.0	PCS Modcell 4.0
ANTENNA TYPE	948F85T2E-M_2	948F85T2E-M_2	948F85T2E-M_2
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	63.5	63.5	63.5
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			

1900 Cellular - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0	PCS Modcell 4.0	PCS Modcell 4.0
ANTENNA TYPE	948F85T2E-M_2	948F85T2E-M_2	948F85T2E-M_2
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	63.5	63.5	63.5
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			

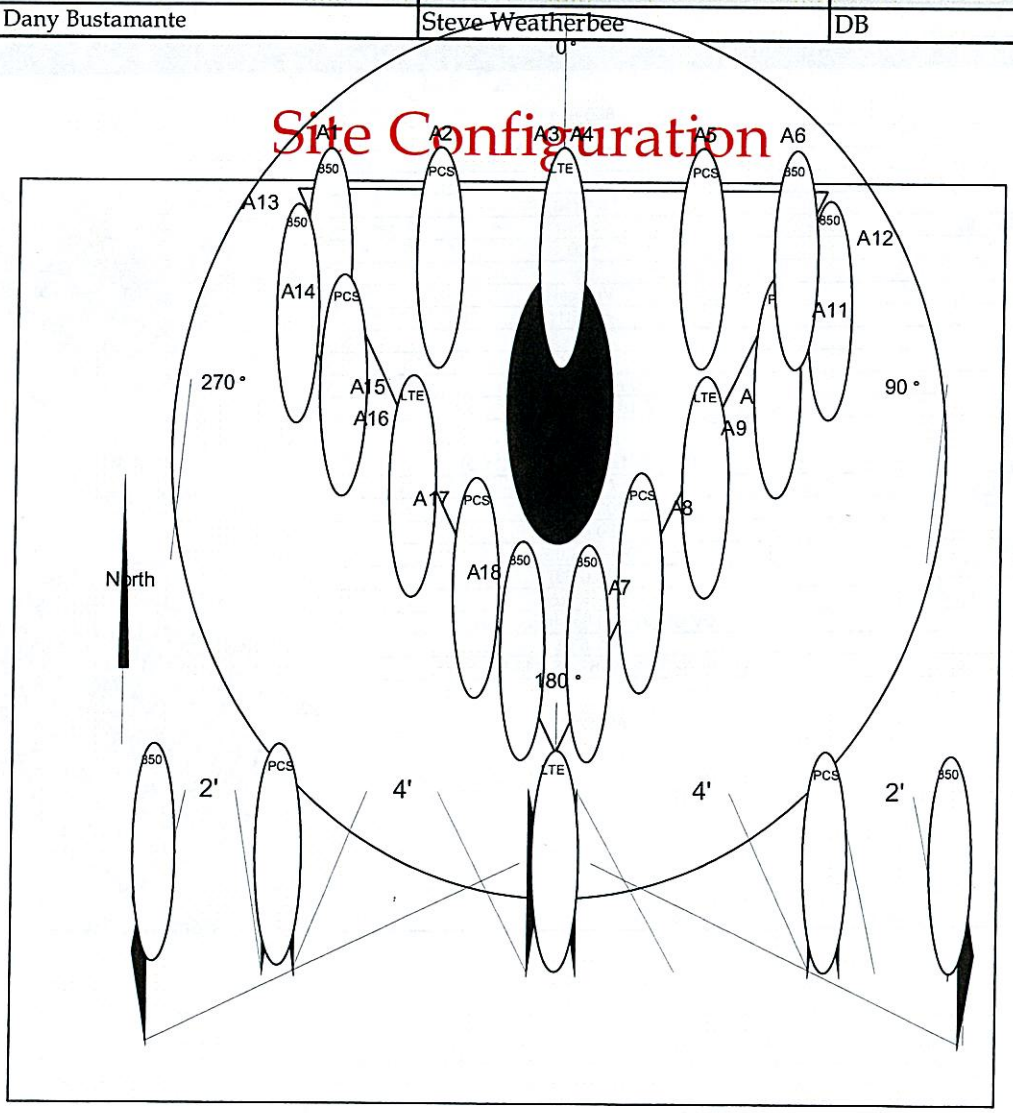
NUMBER OF CABLE'S NEEDED				ESTIMATED CABLE LENGTH	
MAINLINE SIZE	1 5/8"	TOTAL # OF MAINLINES	18	MAINLINE (FT)	150
JUMPER SIZE	1/2 "	TOTAL # OF TOP JUMPERS	18	TOP JUMPER (FT)	10

TX / RX FREQUENCIES			TX POWER OUTPUT	
Cellular A-Band	**PCS F-Band**	**700 Mhz C - Blo**	Cellular (Watts)	20
TX - 869-880,890-891.5 MHz	TX - 1970-1975	TX - 746-757	PCS (Watts)	16
RX - 824-835,845-846.5 MHz	RX - 1890-1895	RX - 776-787	LTE (Watts)	40

ALPHA				BETA				GAMMA			
Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code
A1	800	Tx1/Rx0	RED	A7	800	Tx2/Rx0	BLUE	A13	800	Tx3/Rx0	GREEN
A2	1900	Tx1/Rx0	RED/ WHITE	A8	1900	Tx2/Rx0	BLUE/ WHITE	A14	1900	Tx3/Rx0	GREEN/WHITE
A3	700	Tx1/Rx0	RED/ ORANGE	A9	700	Tx2/Rx0	BLUE/ ORANGE	A15	700	Tx3/Rx0	GREEN/ORANGE
A4	700	Tx4/Rx1	RED/RED/ ORANGE	A10	700	Tx5/Rx1	BLUE/BLUE/ ORANGE	A16	700	Tx6/Rx1	GREEN/GREEN/ ORANGE
A5	1900	Tx4/Rx1	RED/RED/ WHITE	A11	1900	Tx5/Rx1	BLUE/BLUE/ WHITE	A17	1900	Tx6/Rx1	GREEN/GREEN/ WHITE
A6	800	Tx4/Rx1	RED/RED	A12	800	Tx5/Rx1	BLUE/BLUE	A18	800	Tx6/Rx1	GREEN/GREEN

RF ENGINEER	RF MANAGER	INITIALS	DATE
Prepared By : Dany Bustamante	Steve Weatherbee	DB	11/6/2009

Site Configuration

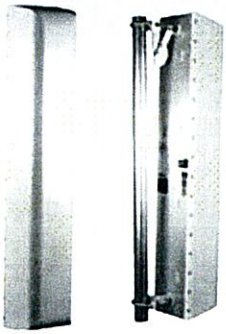


Product Data Sheet **APL866513-42T0**

Maximizer® Log Periodic Antenna, 806-894, 65deg, 15.1dBi, 1.2m, FET, 0deg

Product Description

The Celwave® Maximizer series is a log periodic dipole array which uses a patented design to achieve a front-to-back ratio of 45 dB, the highest front-to-back ratio in the industry. Maximizers are available to cover ESMR, AMPS, PCS and DCS frequency ranges. They use RFS's patented monolithic CELlite® technology, which eliminates cable and soldered joints to reduce the possibility of inter-modulation products. The CELlite technology assures high reliability and excellent repeatability of electrical characteristics. The cellular Maximizers are available in 65°, 80° and 90° horizontal beamwidths and the PCS/DCS Maximizers are available in 65° and 90° horizontal beamwidths. Patent number 6,133,889.



FRONT BACK

Features/Benefits

- **45 dB front-to-back ratio reduces co-channel interference.• Monolithic construction reduces IM.• No solder joints, high reliability.• Surface treated components prevent galvanic corrosion.• UV stabilized radome assures long life without radome deterioration due to UV exposure.**

Technical Specifications

Electrical Specifications

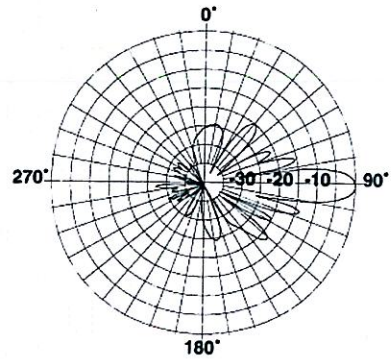
Frequency Range, MHz	806-894
Horizontal Beamwidth, deg	65
Vertical Beamwidth, deg	15
Electrical Downtilt, deg	0
Gain, dBi (dBd)	15.1 (13)
1st Upper Sidelobe Suppression, dB	>20
Upper Sidelobe Suppression, dB	>20
Front-To-Back Ratio, dB	45
Polarization	Vertical
VSWR	< 1.5:1
Impedance, Ohms	50
Maximum Power Input, W	500
Lightning Protection	Direct Ground
Connector Type	7-16 DIN Female

Mechanical Specifications

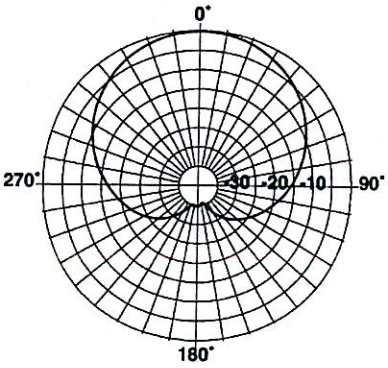
Dimensions - HxWxD, mm (in)	1219 x 234 x 203 (48 x 9.2 x 8)
Weight w/o Mtg Hardware, kg (lb)	7 (15.7)
Survival Wind Speed, km/h (mph)	200 (125)
Rated Wind Speed, km/h (mph)	180 (112)
Max Wind Loading Area, m² (ft²)	0.376 (4.05)
Maximum Thrust @ Rated Wind, N (lbf)	903 (203)
Wind Load - Side @ Rated Wind, N (lbf)	594 (133.5)
Radome Material	UV Stabilized High Impact ABS
Shipping Weight, kg (lb)	9.1 (20)
Packing Dimensions, HxWxD, mm (in)	1594 x 343 x 349 (62.75 x 13.5 x 13.75)

Ordering Information

Mounting Hardware	APM21-3



Vertical Pattern



Horizontal Pattern

DB844G65ZAXY

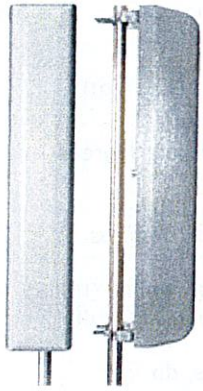
Directed Dipole™ Antenna

Base Station Antenna
Directed Dipole™

- Exceptional azimuth roll-off, reducing sector-to-sector interference and softer hand-offs
- Air dielectric feed system, no screws, rivets, welds or solder in RF element feed path
- Strong upper side lobe suppression
- Low profile appearance and low wind loading for easier zoning approvals

ELECTRICAL

Frequency (MHz) :	806 - 896	870 - 960
Polarization :	Vertical	Vertical
Gain (dBd/dBi) :	13.5/15.6	13.8/15.9
Azimuth BW (Deg.):	65	65
Elevation BW (Deg.):	15	15
Beam Tilt (Deg.):	0	0
USLS* (dB) :	15	15
Null Fill (dB) :	<20-25	<20-25
Front-To-Back Ratio* (dB) :	40	40
VSWR :	<1.33:1	<1.33:1
PIM3 @ 2 x 20w (dBc) :	-150	-150
Max. Input Power (Watts) :	500	500
Impedance (Ohms) :	50	50
Lightning Protection :	dc Ground	dc Ground



MECHANICAL

Weight :	5.4 kg (12 lb)
Dimensions (LxWxD) :	1,219 x 254 x 203 mm (48 x 10 x 8 in)
Max. Wind Area :	0.09 m² (1 ft²)
Max. Wind Load (@ 100 mph) :	235.7 N (53 lbf)
Max. Wind Speed :	241 km/h (150 mph)
Hardware Material :	Galvanized steel
Connector Type :	7-16 DIN Female (1, Back)
Color :	Light gray
Standard Mounting Hardware :	DB380
Standard Downtilt Mounting Hardware :	DB5083

Andrew Corporation
2601 Telecom Parkway
Richardson, Texas U.S.A 75082-3521
Tel: 214.631.0310

Fax: 214.631.4706
Toll Free Tel: 1.800.676.5342
Fax: 1.800.229.4706
www.andrew.com

* - Indicates Typical

10/11/2007

dbtech@andrew.com

Product Specifications

ANDREW®
A CommScope Company

LNX-6514DS-T4M

DualPol® Antenna, 698–896 MHz, 65° horizontal beamwidth, fixed electrical tilt

- **Broadband, providing future-ready single antenna for application in 700 MHz and existing 850 MHz cellular operation**
- **Air dielectric design provides superior PIM performance with repeatable antenna-to-antenna gain and pattern consistency**
- **Single piece radome provides long term mechanical stability**
- **Proven core design technology, with over 1,000,000 similar antennas deployed**
- **Exceptional USLS pattern shaping for optimizing coverage and interference mitigation for LTE applications**
- **Specifically designed to have physical dimensions similar to most existing cellular antennas**

CHARACTERISTICS

General Specifications

Antenna Type	DualPol®
Brand	DualPol®
Operating Frequency Band	698 – 896 MHz

Electrical Specifications

Frequency Band, MHz	**698–806**	**806–896**
Beamwidth, Horizontal, degrees	66	64
Gain, dBd	13.8	14.5
Gain, dBi	15.9	16.6
Beamwidth, Vertical, degrees	12.0	11.0
Beam Tilt, degrees	4	4
Upper Sidelobe Suppression (USLS), typical, dB	18	18
Front-to-Back Ratio at 180°, dB	33	33
Isolation, dB	30	30
VSWR | Return Loss, db	1.35:1 | 16.5	1.35:1 | 16.5
Intermodulation Products, 3rd Order, 2 x 20 W, dBc	-150	-150
Input Power, maximum, watts	500	500
Polarization	±45°	±45°
Impedance, ohms	50	50
Lightning Protection	dc Ground	dc Ground

Product Specifications

LNX-6514DS-T4M

ANDREW®
A CommScope Company

Mechanical Specifications

Color	Light gray
Connector Interface	7-16 DIN Female
Connector Location	Bottom
Connector Quantity	2
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241.4 km/h | 150.0 mph

Dimensions

Depth	181.0 mm | 7.1 in
Length	1847.0 mm | 72.7 in
Width	301.0 mm | 11.9 in
Net Weight	17.0 kg | 37.5 lb

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2002/95/EC	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)

INCLUDED PRODUCTS

MTG-L-STD
Downtilt Mounting Kit for panel Antennas

P65-16-XL -2 Very Low Broadband Antennas

POLARIZATION: Dual linear ±45°
FREQUENCY (MHz): 698-894
HORIZONTAL BEAM WIDTH (°): 65
GAIN (dBi/dBd): 16.0/13.9
TILT: 2
LENGTH: 72"

ELECTRICAL SPECIFICATIONS*

Frequency range (MHz)		698-894	
Frequency band (MHz)	698-806		806-894
Gain (dBi/dBd)	15.5/13.4		16.0/13.9
Polarization			
Nominal Impedance (Ω)			
VSWR			
Horizontal beam width, -3 dB (°)	68		65
Vertical beam width, -3 dB (°)	10.5		9.5
Electrical down tilt (°)			
Side lobe suppression, vertical 1st upper (dB)	> 15		> 15
Isolation between inputs (dB)	> 30		> 30
Tracking, horizontal plane ±60° (dB)	< 2		< 2
First null fill (dB)	-		-
Vertical beam squint (°)	< 0.5		< 0.5
Front to back ratio (dB)	> 30		> 30
Front to back ratio, total power (dB)	> 25		> 25
Cross polar discrimination (XPD) 0° (dB)	> 15	> 15	
Cross polar discrimination (XPD) ±60° (dB)	> 10		> 10
Far field coupling			
IM3, 2xTx@43dBm (dBc)	-153		
IM7, 2xTx@43dBm (dBc)			
Power handling, average per input (W)			
Power handling, average total (W)			

MECHANICAL SPECIFICATIONS*

Connector	2 X 7/16 DIN Female
Connector position	Bottom
Dimensions, HxWxD, mm (ft)	72" x 12" x 5" (1829 x 305 x 125)
Mounting	Pre-mounted Tilt Brackets
Weight, with brackets, kg (lbs)	44 (20)
Weight, without brackets, kg (lbs)	33 (15)
Wind load, frontal/lateral/rear side 42 m/s Cd=1.6 (N)	1380
Maximum operational wind speed, m/s (mph)	100 (45)
Survival wind speed, m/s (mph)	125 (55)
Lightning protection	DC Ground
Radome material	PVC
Radome colour	Light Grey
Package size, HxWxD, mm (ft)	82" x 16" x 10" (2082 x 400 x 255)
Shipping weight, kg (lbs)	55 (25)
RET	N/A
Brackets	7256.00, 7454.00, 2210.00

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

ANTENNA PATTERNS*

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