STATE OF CONNECTICUT

CONNECTICUT SITING COUNCIL

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

January 27, 2012

Kenneth C. Baldwin, Esq.
Robinson & Cole LLP
280 Trumbull Street
Hartford, CT 06103

RE: **EM-VER-023-120110B**- Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 14 Canton Springs Road, Canton, Connecticut.

Dear Attorney Baldwin:

The Connecticut Siting Council (Council) hereby acknowledges your notice to modify this existing telecommunications facility, pursuant to Section 16-50j-73 of the Regulations of Connecticut State Agencies with the following conditions:

- Any deviation from the proposed modification as specified in this notice and supporting materials with Council shall render this acknowledgement invalid;
- Any material changes to this modification as proposed shall require the filing of a new notice with the Council;
- Not less than 45 days after completion of construction, the Council shall be notified in writing that construction has been completed;
- The validity of this action shall expire one year from the date of this letter; and
- The applicant may file a request for an extension of time beyond the one year deadline provided that such request is submitted to the Council not less than 60 days prior to the expiration;

The proposed modifications including the placement of all necessary equipment and shelters within the tower compound are to be implemented as specified here and in your notice dated January 6, 2012. The modifications are in compliance with the exception criteria in Section 16-50j-72 (b) of the Regulations of Connecticut State Agencies as changes to an existing facility site that would not increase tower height, extend the boundaries of the tower site, increase noise levels at the tower site boundary by six decibels, and increase the total radio frequencies electromagnetic radiation power density measured at the tower site boundary to or above the standard adopted by the State Department of Environmental Protection pursuant to General Statutes § 22a-162. This facility has also been carefully modeled to ensure that radio frequency emissions are conservatively below State and federal standards applicable to the frequencies now used on this tower.

This decision is under the exclusive jurisdiction of the Council. Please be advised that the validity of this action shall expire one year from the date of this letter. Any additional change to this facility will require explicit notice to this agency pursuant to Regulations of Connecticut State Agencies Section 16-50j-73. Such notice shall include all relevant information regarding the proposed change with cumulative worst-case modeling of radio frequency exposure at the closest point of uncontrolled access to the tower base, consistent with Federal Communications Commission, Office of Engineering and Technology, Bulletin 65. Thank you for your attention and cooperation.

Very truly yours,

LRoberts

Linda Roberts
Executive Director

LR/CDM/laf

c: The Honorable Richard J. Barlow, First Selectman, Town of Canton
Robert H. Skinner, Chief Administrative Officer, Town of Canton
Susan Brodeur, Land Use Coordinator, Town of Canton
Canton Volunteer Fire Department

STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL
Ten Franklin Square, New Britain, CT 06051
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www.ct.gov/csc

January 11, 2012

The Honorable Richard J. Barlow
First Selectman
Town of Canton
4 Market Street
P. O. Box 168
Collinsville, CT 06022-0168

RE: **EM-VER-023-120110B**- Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 14 Canton Springs Road, Canton, Connecticut.

Dear First Selectman Barlow:

The Connecticut Siting Council (Council) received this request to modify an existing telecommunications facility, pursuant to Regulations of Connecticut State Agencies Section 16-50j-72.

If you have any questions or comments regarding this proposal, please call me or inform the Council by January 26, 2012.

Thank you for your cooperation and consideration.

Very truly yours,

Linda Roberts
Executive Director

LR/jbw

Enclosure: Notice of Intent

c: Robert H. Skinner, Chief Administrative Officer, Town of Canton
Susan Brodeur, Land Use Coordinator, Town of Canton

ROBINSON & COLE LLP

KENNETH C. BALDWIN

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

ORIGINAL

June 8, 2012

Linda Roberts
Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **EM-VER-023-120110B – 14 Canton Springs Road, Canton, Connecticut**
Completion of Construction Activity

Dear Ms. Roberts:

The purpose of this letter is to notify you and the Connecticut Siting Council that construction activity associated with the above-referenced exempt modification filing has now been completed.

If you have any questions or need any additional information regarding these facilities please do not hesitate to contact me.

Sincerely,

Kenneth C. Baldwin

Copy to:
Sandy M. Carter

11705911-v1

ROBINSON & COLE

EM-VER-023-120110B

KENNETH C. BALDWIN

280 Trumbull Street
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January 6, 2012

Linda Roberts
Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **Notice of Exempt Modification – Coax Cable Modifications**
14 Canton Springs Road, Canton, Connecticut

Dear Ms. Roberts:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains wireless telecommunications antennas at the 120-foot level on the existing 140-foot tower at the above-referenced address. The tower is owned by the Canton Volunteer Fire Department. The Council approved Cellco's use of the existing tower in 1999 and recently acknowledged Cellco's intent to replace its existing antennas and install six (6) additional coax cables inside the monopole (EM-VER-111114A). Due to space limitations inside the monopole, however, Cellco will need to modify this facility further and attach the six (6) additional coax cables to the outside of the monopole.

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 Richard Barlow, First Selectman of the Town of Canton. A copy of this letter is also being sent to Canton Volunteer Fire Company Inc., the owner of the property on which the tower is located.

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 an increase in the overall height of the existing tower.

2. The proposed modifications will not involve any change 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 relocation of the six (6) coax cables to the outside of the tower 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.

Also attached is a Structural Analysis Report confirming that the tower and foundation can support the above-described coax cable modifications.

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:
Richard Barlow, Canton First Selectman
Canton Volunteer Fire Company Inc.
Sandy M. Carter

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

140-ft Existing EEI Monopole

Proposed Verizon Wireless
Antenna Upgrade

Verizon Site Ref: Canton

14 Canton Springs Road
Canton, CT

Centek Project No. 11074.CO28

~~Date: September 29, 2011~~

Rev 1: December 7, 2011

Prepared for:

Verizon Wireless
99 East River Road, 9th Floor
East Hartford, CT 06108

63-2 North Branford Road, Branford, CT 06405 203.488.0580 Fax 203.488.8587 www.CentekEng.com

Table of Contents

Introduction

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

The host tower is a 140-ft tall, four-section, eighteen sided, tapered monopole, originally designed and manufactured by EEI job no; 4960, dated May 13, 1999. The tower geometry, structure member sizes and foundation system information were obtained from a previous structural report prepared by Centek Engineering dated November 12, 2008. Antenna and appurtenance information were obtained from the tower mapping and inventory report prepared by JWB Tower Services, LLC (JWB) dated September 11, 2011 and a Verizon RF data sheet.

The tower is made up of four (4) tapered vertical sections consisting of A572-65 pole sections. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 18.00-in at the top and 51.00-in at the base.

Verizon is proposing the removal of six (6) panel antennas and the installation of nine (9) panel antennas mounted to the existing platform w/ handrails. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

The existing, proposed and future loads considered in this analysis consist of the following:

- TOWN (Existing):
  Antennas: One (1) 20-ft x 2" dia. Omni-directional whip antenna mounted on a 4-ft side arm with an elevation of 138-ft above exiting grade.
  Coax Cables: Two (2) 7/8" ∅ coax cables running on the inside of the existing monopole.
- AT&T (Existing):
  Antennas: Six (6) CSS DUO1417-8686 panel antennas, three (3) Kathrein 800-10121 panel antennas, six (6) Cleargain 1900/800 TMA's, three (3) CSS combiners, three (3) Kathrein 782-10250 combiners and three (3) Kathrein Smart Bias-T mounted on a 13-ft platform w/ handrails with a RAD center elevation of 130-ft above exiting grade.
  Coax Cables: Twelve (12) 7/8" ∅ coax cables running on the inside of the existing monopole.
- NEXTEL (Existing):
  Antennas: Twelve (12) Andrew DB844H90E-XY panel antennas and two (2) LMU's mounted on a 13-ft platform w/ handrails with a RAD center elevation of 112-ft above exiting grade.
  Coax Cables: Twelve (12) 1-1/4" ∅ and two (2) 1/2" ∅ coax cables running on the inside of the existing monopole.

- T-MOBILE (Existing):
  Antennas: Four (4) EMS RR90-17-02DP panel antennas mounted on a 14-ft low profile platform with a RAD center elevation of 100-ft above exiting grade.
  Coax Cables: Eight (8) 1-5/8" ∅ coax cables running on the inside of the existing monopole.
- SPRINT (Existing):
  Antennas: Four (4) Andrew DB980F90T2E-M and two (2) Andrew DB978F30T2E-M panel antennas mounted on a 14-ft low profile platform with a RAD center elevation of 91-ft above exiting grade.
  Coax Cables: Six (6) 1-1/4" ∅ coax cables running on the inside of the existing monopole.
- METROPCS (Existing):
  Antennas: Three (3) RFS APXV18-206517S panel antennas flush mounted with a RAD center elevation of 83-ft above exiting grade.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the inside of the existing monopole.
- VERIZON (Existing to Remain):
  Antennas: Four (4) Antel LPA-80080/4CF panel antennas, two (2) Antel LPA-80063/4CF panel antennas and one (1) GPS antenna mounted to a 13-ft platform w/ handrails with a RAD center elevation of 120-ft above exiting grade.
  Coax Cables: Twelve (12) 1-5/8" ∅ and one (1) 1/2" ∅ coax cables running on the inside of the existing monopole.
- **VERIZON (Existing to Remove):**
  Antennas: Six (6) Andrew DB950F65E-M panel antennas mounted to a 13-ft platform w/ handrails with a RAD center elevation of 120-ft above exiting grade.
- **VERIZON (Proposed):**
  Antennas: Three (3) Antel BXA-70063-6CF and six (6) Antel LPA-171063-8CF panel antennas mounted to a 13-ft platform w/ handrails with a RAD center elevation of 120-ft above exiting grade.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables banded to the exterior of the existing tower.

Primary Assumptions Used in the Analysis

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

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 80 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:	Hartford; v = 80 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Canton; v = 95 mph (3 second gust) equivalent to v = 77.5 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA wind speed controls.	
Load Cases:	Load Case 1; 80 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation. This load case typically controls the design of monopole towers.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 69 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 69 mph wind speed velocity represents 75% of the wind pressure generated by the 80 mph wind speed. 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 1, per RISATower "Section Capacity Table", this tower was found to be at **53.8%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L3)	40.26'-79.83'	53.8%	**PASS**

Foundation and Anchors

The existing foundation consists of a 6.5-ft Ø x 4.5-ft long reinforced concrete pier on a 24.0-ft square x 3-ft thick reinforce concrete pad. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned structural analysis report prepared by Centek. Engineering The base of the tower is connected to the foundation by means of (20) 2.25"∅, ASTM A615-75 anchor bolts embedded approximately 5-ft into the concrete foundation structure.

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

- The tower base reactions developed from the governing Load Case 1 were used in the verification of the foundation and its anchors:

Location	Vector	Proposed Reactions
Base	Shear	23 kips
	Compression	39 kips
	Moment	2259 kip-ft

- The foundation was found to be within allowable limits.

Foundation	Design Limit	IBC 2003/2005 CT State Building Code Section 3108.4.2 (FS)[1]	Proposed Loading (FS)[1]	Result
Reinforced Concrete Pad and Pier	OTM[2]	2.0	2.71	**PASS**

Note 1: FS denotes Factor of Safety.
Note 2: OTM denotes Overturning Moment

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

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts	Compression	47.4%	**PASS**
Base Plate	Bending	56.0%	**PASS**

Conclusion

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

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

Please feel free to call with any questions or comments.

Respectfully Submitted by:

Carlo F. Centore, PE
Principal ~ Structural Engineer

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

Prepared by:

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

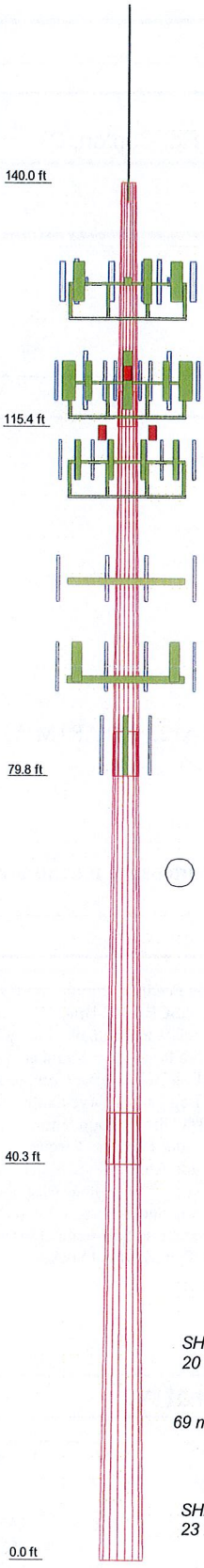
GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

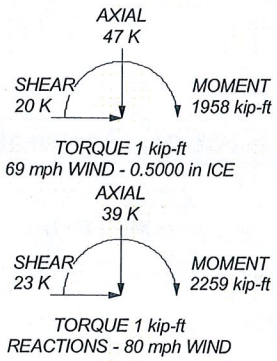
RISATower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, RISATower, formerly ERITower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

RISATower Features:

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

Section	1	2	3	4
Length (ft)	24.64	39.06	44.16	45.54
Number of Sides	18	18	18	18
Thickness (in)	0.1875	0.3125	0.4375	0.5000
Socket Length (ft)	3.53	4.59	5.28	
Top Dia (in)	18.0000	22.9814	30.9366	39.7436
Bot Dia (in)	24.2521	32.7041	41.9334	51.0000
Grade	A572-65			
Weight (K) 23.2	1.0	3.6	7.5	11.0





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
20' x 2" Dia Omni (Town - Existing)	148	BXA-70063/6CF (Verizon - Proposed)	120
4' Side Mount Standoff (Town - Existing)	138	LPA-171063-8CF (Verizon - Proposed)	120
(2) DUO1417-8686 (ATI - Existing)	130	LPA-80080-4CF (Verizon - Existing)	120
800 10121 (ATI - Existing)	130	LPA-80063/4CF (Verizon - Existing)	120
(2) CG 1900/800-DB-FB TMA (ATI - Existing)	130	LPA-171063-8CF (Verizon - Proposed)	120
Combiner (ATI - Existing)	130	BXA-70063/6CF (Verizon - Proposed)	120
Smart Bias T (ATI - Existing)	130	LPA-171063-8CF (Verizon - Proposed)	120
782 10250 (ATI - Existing)	130	LPA-80063/4CF (Verizon - Existing)	120
(2) DUO1417-8686 (ATI - Existing)	130	GPS (Verizon - Existing)	120
800 10121 (ATI - Existing)	130	13' Platform w/rails (Verizon - Existing)	118
(2) CG 1900/800-DB-FB TMA (ATI - Existing)	130	LMU (Nextel - Existing)	114
Combiner (ATI - Existing)	130	LMU (Nextel - Existing)	114
Smart Bias T (ATI - Existing)	130	(4) DB844H90E-XY (Nextel - Existing)	112
782 10250 (ATI - Existing)	130	(4) DB844H90E-XY (Nextel - Existing)	112
(2) DUO1417-8686 (ATI - Existing)	130	(4) DB844H90E-XY (Nextel - Existing)	112
800 10121 (ATI - Existing)	130	13' Platform w/rails (Nextel - Existing)	110
(2) CG 1900/800-DB-FB TMA (ATI - Existing)	130	14-ft Low Profile Platform (T-Mobile - Existing)	100
Combiner (ATI - Existing)	130	(2) RR90-17-02DP (T-Mobile - Existing)	100
Smart Bias T (ATI - Existing)	130	(2) RR90-17-02DP (T-Mobile - Existing)	100
782 10250 (ATI - Existing)	130	(2) DB978F30T2E-M (Sprint - Existing)	91.5
13' Platform w/rails (ATI - Existing)	128	(2) DB980F90T2E-M (Sprint - Existing)	91
LPA-80080-4CF (Verizon - Existing)	120	(2) DB980F90T2E-M (Sprint - Existing)	91
LPA-171063-8CF (Verizon - Proposed)	120	14-ft Low Profile Platform (Sprint - Existing)	90
BXA-70063/6CF (Verizon - Proposed)	120	Uni-Tri Bracket (MetroPCS - Existing)	83
LPA-171063-8CF (Verizon - Proposed)	120	APXV18-206517S (MetroPCS - Existing)	83
LPA-80080-4CF (Verizon - Existing)	120	APXV18-206517S (MetroPCS - Existing)	83
LPA-80080-4CF (Verizon - Existing)	120	APXV18-206517S (MetroPCS - Existing)	83
LPA-171063-8CF (Verizon - Proposed)	120		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 69 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
5. Welds are fabricated with ER-70S-6 electrodes.
6. TOWER RATING: 53.8%

Centek Engineering Inc.
63-2 North Branford Rd.
Branford, CT 06405
Phone: (203) 488-0580
FAX: (203) 488-8587

Job: *11074.CO28 - Canton*			
Project: *140' EEI Monopole - 14 Canton Springs Rd, Canton, CT*			
Client: Verizon Wireless	Drawn by: TJL	App'd:	
Code: TIA/EIA-222-F	Date: 12/07/11	Scale: NTS	
Path: J:\Jobs\11074\00\CO28 - Verizon Canton - Canton, CT\Rev (1)\Cad\cadER Files\140 EEI Monopole Canton.eri		Dwg No. E-1	

Tower Input Data

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

Basic wind speed of 80 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 69 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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

Tapered Pole Section Geometry

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

Tapered Pole Properties

Section	Tip Dia. in	Area in²	I in⁴	r in	C in	I/C in³	J in⁴	It/Q in²	w in	w/t
L1	18.2777	10.6007	424.9328	6.3234	9.1440	46.4712	850.4248	5.3013	2.8380	15.136
	24.6262	14.3214	1047.8077	8.5429	12.3201	85.0489	2096.9941	7.1621	3.9384	21.005
L2	24.2282	22.4847	1459.7753	8.0475	11.6746	125.0391	2921.4715	11.2445	3.4947	11.183
	33.2086	32.1284	4258.8427	11.4990	16.6137	256.3455	8523.2892	16.0673	5.2059	16.659
L3	32.5745	42.3518	4977.1676	10.8272	15.7158	316.6988	9960.8842	21.1799	4.6748	10.685
	42.5803	57.6222	12535.3942	14.7310	21.3022	588.4563	25087.2828	28.8166	6.6103	15.109
L4	41.6819	62.2795	12117.6844	13.9315	20.1897	600.1905	24251.3135	31.1457	6.1149	12.23
	51.7868	80.1435	25821.9188	17.9275	25.9080	996.6774	51677.8148	40.0794	8.0960	16.192

Tower Elevation ft	Gusset Area (per face) ft²	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 140.00-115.36				1	1	1		
L2 115.36-79.83				1	1	1		
L3 79.83-40.26				1	1	1		
L4 40.26-0.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft²/ft		Weight plf
7/8 (Town - Existing)	A	No	Inside Pole	140.00 - 3.00	2	No Ice	0.00		0.54
						1/2" Ice	0.00		0.54
7/8 (AT&T - Existing)	A	No	Inside Pole	130.00 - 3.00	12	No Ice	0.00		0.54
						1/2" Ice	0.00		0.54
1 5/8 (Verizon - Existing)	B	No	Inside Pole	120.00 - 3.00	12	No Ice	0.00		1.04
						1/2" Ice	0.00		1.04
1/2 (Verizon - Existing)	B	No	Inside Pole	120.00 - 3.00	1	No Ice	0.00		0.25
						1/2" Ice	0.00		0.25
1 1/4 (Nextel - Existing)	C	No	Inside Pole	110.00 - 3.00	12	No Ice	0.00		0.66
						1/2" Ice	0.00		0.66
1/2 (Nextel - Existing)	C	No	Inside Pole	110.00 - 3.00	2	No Ice	0.00		0.25
						1/2" Ice	0.00		0.25
1 5/8 (T-Mobile - Existing)	A	No	Inside Pole	100.00 - 3.00	8	No Ice	0.00		1.04
						1/2" Ice	0.00		1.04
1 1/4 (Sprint - Existing)	B	No	Inside Pole	90.00 - 3.00	6	No Ice	0.00		0.66
						1/2" Ice	0.00		0.66
1 5/8 (MetroPCS - Existing)	C	No	Inside Pole	83.00 - 3.00	6	No Ice	0.00		1.04
						1/2" Ice	rogra1.04	1.04	1.04
1 5/8 (Verizon - Proposed)	B	No	CaAa (Out Of Face)	120.00 - 3.00	1	No Ice	0.20		1.04
						1/2" Ice	0.30		2.55
1 5/8 (Verizon - Proposed)	B	No	CaAa (Out Of Face)	120.00 - 3.00	5	No Ice	0.00		1.04
						1/2" Ice	0.00		2.55

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	140.00-115.36	A	0.000	0.000	0.000	0.000	0.12
		B	0.000	0.000	0.000	0.919	0.09
		C	0.000	0.000	0.000	0.000	0.00
L2	115.36-79.83	A	0.000	0.000	0.000	0.000	0.44
		B	0.000	0.000	0.000	7.035	0.71
		C	0.000	0.000	0.000	0.000	0.27
L3	79.83-40.26	A	0.000	0.000	0.000	0.000	0.63
		B	0.000	0.000	0.000	7.835	0.91
		C	0.000	0.000	0.000	0.000	0.58
L4	40.26-0.00	A	0.000	0.000	0.000	0.000	0.59
		B	0.000	0.000	0.000	7.377	0.85
		C	0.000	0.000	0.000	0.000	0.55

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	140.00-115.36	A	0.500	0.000	0.000	0.000	0.000	0.12
		B		0.000	0.000	0.000	1.383	0.13
		C		0.000	0.000	0.000	0.000	0.00
L2	115.36-79.83	A	0.500	0.000	0.000	0.000	0.000	0.44
		B		0.000	0.000	0.000	10.588	1.04
		C		0.000	0.000	0.000	0.000	0.27
L3	79.83-40.26	A	0.500	0.000	0.000	0.000	0.000	0.63
		B		0.000	0.000	0.000	11.792	1.27
		C		0.000	0.000	0.000	0.000	0.58
L4	40.26-0.00	A	0.500	0.000	0.000	0.000	0.000	0.59
		B		0.000	0.000	0.000	11.103	1.19
		C		0.000	0.000	0.000	0.000	0.55

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	140.00-115.36	0.0531	0.0307	0.0757	0.0437
L2	115.36-79.83	0.2373	0.1370	0.3332	0.1924
L3	79.83-40.26	0.2417	0.1395	0.3445	0.1989
L4	40.26-0.00	0.2254	0.1301	0.3249	0.1876

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

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(AT&T - Existing)			0.00 0.00			1/2" Ice	0.21	0.12	0.00
782 10250	C	From Face	4.00	0.0000	130.00	No Ice	0.52	0.27	0.01
(AT&T - Existing)			0.00 0.00			1/2" Ice	0.63	0.36	0.01
13' Platform w/rails	C	None		0.0000	118.00	No Ice	31.30	31.30	1.82
(Verizon - Existing)						1/2" Ice	40.20	40.20	2.45
LPA-80080-4CF	A	From Face	4.00	0.0000	120.00	No Ice	2.62	6.06	0.01
(Verizon - Existing)			-6.00 0.00			1/2" Ice	2.92	6.45	0.05
LPA-171063-8CF	A	From Face	4.00	0.0000	120.00	No Ice	3.69	3.69	0.01
(Verizon - Proposed)			-4.00 0.00			1/2" Ice	4.06	4.06	0.04
BXA-70063/6CF	A	From Face	4.00	0.0000	120.00	No Ice	7.73	4.16	0.02
(Verizon - Proposed)			0.00 0.00			1/2" Ice	8.27	4.60	0.06
LPA-171063-8CF	A	From Face	4.00	0.0000	120.00	No Ice	3.69	3.69	0.01
(Verizon - Proposed)			4.00 0.00			1/2" Ice	4.06	4.06	0.04
LPA-80080-4CF	A	From Face	4.00	0.0000	120.00	No Ice	2.62	6.06	0.01
(Verizon - Existing)			6.00 0.00			1/2" Ice	2.92	6.45	0.05
LPA-80080-4CF	B	From Face	4.00	0.0000	120.00	No Ice	2.62	6.06	0.01
(Verizon - Existing)			-6.00 0.00			1/2" Ice	2.92	6.45	0.05
LPA-171063-8CF	B	From Face	4.00	0.0000	120.00	No Ice	3.69	3.69	0.01
(Verizon - Proposed)			-4.00 0.00			1/2" Ice	4.06	4.06	0.04
BXA-70063/6CF	B	From Face	4.00	0.0000	120.00	No Ice	7.73	4.16	0.02
(Verizon - Proposed)			0.00 0.00			1/2" Ice	8.27	4.60	0.06
LPA-171063-8CF	B	From Face	4.00	0.0000	120.00	No Ice	3.69	3.69	0.01
(Verizon - Proposed)			4.00 0.00			1/2" Ice	4.06	4.06	0.04
LPA-80080-4CF	B	From Face	4.00	0.0000	120.00	No Ice	2.62	6.06	0.01
(Verizon - Existing)			6.00 0.00			1/2" Ice	2.92	6.45	0.05
LPA-80063/4CF	C	From Face	4.00	0.0000	120.00	No Ice	7.00	6.08	0.02
(Verizon - Existing)			-6.00 0.00			1/2" Ice	7.41	6.48	0.07
LPA-171063-8CF	C	From Face	4.00	0.0000	120.00	No Ice	3.69	3.69	0.01
(Verizon - Proposed)			-4.00 0.00			1/2" Ice	4.06	4.06	0.04
BXA-70063/6CF	C	From Face	4.00	0.0000	120.00	No Ice	7.73	4.16	0.02
(Verizon - Proposed)			0.00 0.00			1/2" Ice	8.27	4.60	0.06
LPA-171063-8CF	C	From Face	4.00	0.0000	120.00	No Ice	3.69	3.69	0.01
(Verizon - Proposed)			4.00 0.00			1/2" Ice	4.06	4.06	0.04
LPA-80063/4CF	C	From Face	4.00	0.0000	120.00	No Ice	7.00	6.08	0.02
(Verizon - Existing)			6.00 0.00			1/2" Ice	7.41	6.48	0.07
GPS	C	From Face	2.00	0.0000	120.00	No Ice	1.00	1.00	0.01
(Verizon - Existing)			0.00 0.00			1/2" Ice	1.50	1.50	0.01
13' Platform w/rails	C	None		0.0000	110.00	No Ice	31.30	31.30	1.82
(Nextel - Existing)						1/2" Ice	40.20	40.20	2.45

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
LMU	A	From Face	2.00	0.0000	114.00	No Ice	1.00	1.00	0.01
(Nextel - Existing)			0.00			1/2" Ice	1.50	1.50	0.01
			0.00						
LMU	B	From Face	2.00	0.0000	114.00	No Ice	1.00	1.00	0.01
(Nextel - Existing)			0.00			1/2" Ice	1.50	1.50	0.01
			0.00						
(4) DB844H90E-XY	A	From Face	4.00	0.0000	112.00	No Ice	2.87	3.73	0.01
(Nextel - Existing)			0.00			1/2" Ice	3.18	4.10	0.04
			0.00						
(4) DB844H90E-XY	B	From Face	4.00	0.0000	112.00	No Ice	2.87	3.73	0.01
(Nextel - Existing)			0.00			1/2" Ice	3.18	4.10	0.04
			0.00						
(4) DB844H90E-XY	C	From Face	4.00	0.0000	112.00	No Ice	2.87	3.73	0.01
(Nextel - Existing)			0.00			1/2" Ice	3.18	4.10	0.04
			0.00						
14-ft Low Profile Platform	C	None		0.0000	100.00	No Ice	16.50	16.50	1.55
(T-Mobile - Existing)						1/2" Ice	20.00	20.00	1.80
(2) RR90-17-02DP	A	From Face	4.00	0.0000	100.00	No Ice	4.36	1.97	0.02
(T-Mobile - Existing)			0.00			1/2" Ice	4.77	2.31	0.04
			0.00						
(2) RR90-17-02DP	B	From Face	4.00	0.0000	100.00	No Ice	4.36	1.97	0.02
(T-Mobile - Existing)			0.00			1/2" Ice	4.77	2.31	0.04
			0.00						
14-ft Low Profile Platform	C	None		0.0000	90.00	No Ice	16.50	16.50	1.55
(Sprint - Existing)						1/2" Ice	20.00	20.00	1.80
(2) DB980F90T2E-M	A	From Face	4.00	0.0000	91.00	No Ice	3.90	2.29	0.01
(Sprint - Existing)			0.00			1/2" Ice	4.28	2.65	0.03
			0.00						
(2) DB980F90T2E-M	B	From Face	4.00	0.0000	91.00	No Ice	3.90	2.29	0.01
(Sprint - Existing)			0.00			1/2" Ice	4.28	2.65	0.03
			0.00						
(2) DB978F30T2E-M	C	From Face	4.00	0.0000	91.50	No Ice	5.60	3.06	0.02
(Sprint - Existing)			0.00			1/2" Ice	5.99	3.39	0.05
			0.00						
Uni-Tri Bracket	C	None		0.0000	83.00	No Ice	1.75	1.75	0.00
(MetroPCS - Existing)						1/2" Ice	1.94	1.94	0.00
APXV18-206517S	A	From Face	1.50	0.0000	83.00	No Ice	5.17	3.04	0.03
(MetroPCS - Existing)			0.00			1/2" Ice	5.62	3.47	0.05
			0.00						
APXV18-206517S	B	From Face	1.50	0.0000	83.00	No Ice	5.17	3.04	0.03
(MetroPCS - Existing)			0.00			1/2" Ice	5.62	3.47	0.05
			0.00						
APXV18-206517S	C	From Face	1.50	0.0000	83.00	No Ice	5.17	3.04	0.03
(MetroPCS - Existing)			0.00			1/2" Ice	5.62	3.47	0.05
			0.00						

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 140.00-115.36	127.07	1.47	24	43.379	A	0.000	43.379	43.379	100.00	0.000	0.000
					B	0.000	43.379		100.00	0.000	0.919
					C	0.000	43.379		100.00	0.000	0.000
L2 115.36-79.83	96.90	1.36	22	83.739	A	0.000	83.739	83.739	100.00	0.000	0.000
					B	0.000	83.739		100.00	0.000	7.035
					C	0.000	83.739		100.00	0.000	0.000
L3 79.83-40.26	59.64	1.184	19	122.029	A	0.000	122.029	122.029	100.00	0.000	0.000
					B	0.000	122.029		100.00	0.000	7.835
					C	0.000	122.029		100.00	0.000	0.000
L4 40.26-0.00	19.40	1	16	154.412	A	0.000	154.412	154.412	100.00	0.000	0.000
					B	0.000	154.412		100.00	0.000	7.377
					C	0.000	154.412		100.00	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.690$

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
L1 140.00-115.36	127.07	1.47	18	0.5000	45.432	A	0.000	45.432	45.432	100.00	0.000	0.000
						B	0.000	45.432		100.00	0.000	1.383
						C	0.000	45.432		100.00	0.000	0.000
L2 115.36-79.83	96.90	1.36	17	0.5000	86.699	A	0.000	86.699	86.699	100.00	0.000	0.000
						B	0.000	86.699		100.00	0.000	10.588
						C	0.000	86.699		100.00	0.000	0.000
L3 79.83-40.26	59.64	1.184	14	0.5000	125.326	A	0.000	125.326	125.326	100.00	0.000	0.000
						B	0.000	125.326		100.00	0.000	11.792
						C	0.000	125.326		100.00	0.000	0.000
L4 40.26-0.00	19.40	1	12	0.5000	157.767	A	0.000	157.767	157.767	100.00	0.000	0.000
						B	0.000	157.767		100.00	0.000	11.103
						C	0.000	157.767		100.00	0.000	0.000

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 140.00-115.36	127.07	1.47	9	43.379	A	0.000	43.379	43.379	100.00	0.000	0.000
					B	0.000	43.379		100.00	0.000	0.919
					C	0.000	43.379		100.00	0.000	0.000
L2 115.36-79.83	96.90	1.36	9	83.739	A	0.000	83.739	83.739	100.00	0.000	0.000
					B	0.000	83.739		100.00	0.000	7.035
					C	0.000	83.739		100.00	0.000	0.000
L3 79.83-40.26	59.64	1.184	8	122.029	A	0.000	122.029	122.029	100.00	0.000	0.000
					B	0.000	122.029		100.00	0.000	7.835
					C	0.000	122.029		100.00	0.000	0.000
L4 40.26-0.00	19.40	1	6	154.412	A	0.000	154.412	154.412	100.00	0.000	0.000

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
					B	0.000	154.412		100.00	0.000	7.377
					C	0.000	154.412		100.00	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.21	1.04	A	1	0.65	1	1	1	43.379	1.19	48.09	C
140.00-115.36			B	1	0.65	1	1	1	43.379			
			C	1	0.65	1	1	1	43.379			
L2	1.42	3.63	A	1	0.65	1	1	1	83.739	2.31	65.06	C
115.36-79.83			B	1	0.65	1	1	1	83.739			
			C	1	0.65	1	1	1	83.739			
L3	2.12	7.51	A	1	0.65	1	1	1	122.029	2.84	71.85	C
79.83-40.26			B	1	0.65	1	1	1	122.029			
			C	1	0.65	1	1	1	122.029			
L4 40.26-0.00	1.99	11.04	A	1	0.65	1	1	1	154.412	2.98	74.10	C
			B	1	0.65	1	1	1	154.412			
			C	1	0.65	1	1	1	154.412			
Sum Weight:	5.74	23.22						OTM	602.03 kip-ft	9.32		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.21	1.04	A	1	0.65	1	1	1	43.379	1.19	48.09	C
140.00-115.36			B	1	0.65	1	1	1	43.379			
			C	1	0.65	1	1	1	43.379			
L2	1.42	3.63	A	1	0.65	1	1	1	83.739	2.31	65.06	C
115.36-79.83			B	1	0.65	1	1	1	83.739			
			C	1	0.65	1	1	1	83.739			
L3	2.12	7.51	A	1	0.65	1	1	1	122.029	2.84	71.85	C
79.83-40.26			B	1	0.65	1	1	1	122.029			
			C	1	0.65	1	1	1	122.029			
L4 40.26-0.00	1.99	11.04	A	1	0.65	1	1	1	154.412	2.98	74.10	C
			B	1	0.65	1	1	1	154.412			
			C	1	0.65	1	1	1	154.412			
Sum Weight:	5.74	23.22						OTM	602.03 kip-ft	9.32		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.21	1.04	A	1	0.65	1	1	1	43.379	1.19	48.09	C
140.00-115.36			B	1	0.65	1	1	1	43.379			
			C	1	0.65	1	1	1	43.379			
L2	1.42	3.63	A	1	0.65	1	1	1	83.739	2.31	65.06	C
115.36-79.83			B	1	0.65	1	1	1	83.739			
			C	1	0.65	1	1	1	83.739			
L3	2.12	7.51	A	1	0.65	1	1	1	122.029	2.84	71.85	C
79.83-40.26			B	1	0.65	1	1	1	122.029			
			C	1	0.65	1	1	1	122.029			
L4 40.26-0.00	1.99	11.04	A	1	0.65	1	1	1	154.412	2.98	74.10	C
			B	1	0.65	1	1	1	154.412			
			C	1	0.65	1	1	1	154.412			
Sum Weight:	5.74	23.22						OTM	602.03 kip-ft	9.32		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.21	1.04	A	1	0.65	1	1	1	43.379	1.19	48.09	C
140.00-115.36			B	1	0.65	1	1	1	43.379			
			C	1	0.65	1	1	1	43.379			
L2	1.42	3.63	A	1	0.65	1	1	1	83.739	2.31	65.06	C
115.36-79.83			B	1	0.65	1	1	1	83.739			
			C	1	0.65	1	1	1	83.739			
L3	2.12	7.51	A	1	0.65	1	1	1	122.029	2.84	71.85	C
79.83-40.26			B	1	0.65	1	1	1	122.029			
			C	1	0.65	1	1	1	122.029			
L4 40.26-0.00	1.99	11.04	A	1	0.65	1	1	1	154.412	2.98	74.10	C
			B	1	0.65	1	1	1	154.412			
			C	1	0.65	1	1	1	154.412			
Sum Weight:	5.74	23.22						OTM	602.03 kip-ft	9.32		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.25	1.37	A	1	0.65	1	1	1	45.432	0.94	38.30	C
140.00-115.36			B	1	0.65	1	1	1	45.432			
			C	1	0.65	1	1	1	45.432			
L2	1.75	4.26	A	1	0.65	1	1	1	86.699	1.89	53.15	C
115.36-79.83			B	1	0.65	1	1	1	86.699			
			C	1	0.65	1	1	1	86.699			
L3	2.47	8.43	A	1	0.65	1	1	1	125.326	2.28	57.66	C
79.83-40.26			B	1	0.65	1	1	1	125.326			
			C	1	0.65	1	1	1	125.326			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L4 40.26-0.00	2.33	12.19	A	1	0.65	1	1	1	157.767	2.36	58.62	C
			B	1	0.65	1	1	1	157.767			
			C	1	0.65	1	1	1	157.767			
Sum Weight:	6.80	26.25						OTM	484.75 kip-ft	7.47		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.25	1.37	A	1	0.65	1	1	1	45.432	0.94	38.30	C
140.00-115.36			B	1	0.65	1	1	1	45.432			
			C	1	0.65	1	1	1	45.432			
L2	1.75	4.26	A	1	0.65	1	1	1	86.699	1.89	53.15	C
115.36-79.83			B	1	0.65	1	1	1	86.699			
			C	1	0.65	1	1	1	86.699			
L3	2.47	8.43	A	1	0.65	1	1	1	125.326	2.28	57.66	C
79.83-40.26			B	1	0.65	1	1	1	125.326			
			C	1	0.65	1	1	1	125.326			
L4 40.26-0.00	2.33	12.19	A	1	0.65	1	1	1	157.767	2.36	58.62	C
			B	1	0.65	1	1	1	157.767			
			C	1	0.65	1	1	1	157.767			
Sum Weight:	6.80	26.25						OTM	484.75 kip-ft	7.47		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.25	1.37	A	1	0.65	1	1	1	45.432	0.94	38.30	C
140.00-115.36			B	1	0.65	1	1	1	45.432			
			C	1	0.65	1	1	1	45.432			
L2	1.75	4.26	A	1	0.65	1	1	1	86.699	1.89	53.15	C
115.36-79.83			B	1	0.65	1	1	1	86.699			
			C	1	0.65	1	1	1	86.699			
L3	2.47	8.43	A	1	0.65	1	1	1	125.326	2.28	57.66	C
79.83-40.26			B	1	0.65	1	1	1	125.326			
			C	1	0.65	1	1	1	125.326			
L4 40.26-0.00	2.33	12.19	A	1	0.65	1	1	1	157.767	2.36	58.62	C
			B	1	0.65	1	1	1	157.767			
			C	1	0.65	1	1	1	157.767			
Sum Weight:	6.80	26.25						OTM	484.75 kip-ft	7.47		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.25	1.37	A	1	0.65	1	1	1	45.432	0.94	38.30	C
140.00-115.36			B	1	0.65	1	1	1	45.432			
			C	1	0.65	1	1	1	45.432			
L2	1.75	4.26	A	1	0.65	1	1	1	86.699	1.89	53.15	C
115.36-79.83			B	1	0.65	1	1	1	86.699			
			C	1	0.65	1	1	1	86.699			
L3	2.47	8.43	A	1	0.65	1	1	1	125.326	2.28	57.66	C
79.83-40.26			B	1	0.65	1	1	1	125.326			
			C	1	0.65	1	1	1	125.326			
L4 40.26-0.00	2.33	12.19	A	1	0.65	1	1	1	157.767	2.36	58.62	C
			B	1	0.65	1	1	1	157.767			
			C	1	0.65	1	1	1	157.767			
Sum Weight:	6.80	26.25						OTM	484.75 kip-ft	7.47		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.21	1.04	A	1	0.65	1	1	1	43.379	0.46	18.79	C
140.00-115.36			B	1	0.65	1	1	1	43.379			
			C	1	0.65	1	1	1	43.379			
L2	1.42	3.63	A	1	0.65	1	1	1	83.739	0.90	25.42	C
115.36-79.83			B	1	0.65	1	1	1	83.739			
			C	1	0.65	1	1	1	83.739			
L3	2.12	7.51	A	1	0.65	1	1	1	122.029	1.11	28.07	C
79.83-40.26			B	1	0.65	1	1	1	122.029			
			C	1	0.65	1	1	1	122.029			
L4 40.26-0.00	1.99	11.04	A	1	0.65	1	1	1	154.412	1.17	28.95	C
			B	1	0.65	1	1	1	154.412			
			C	1	0.65	1	1	1	154.412			
Sum Weight:	5.74	23.22						OTM	235.17 kip-ft	3.64		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.21	1.04	A	1	0.65	1	1	1	43.379	0.46	18.79	C
140.00-115.36			B	1	0.65	1	1	1	43.379			
			C	1	0.65	1	1	1	43.379			
L2	1.42	3.63	A	1	0.65	1	1	1	83.739	0.90	25.42	C
115.36-79.83			B	1	0.65	1	1	1	83.739			
			C	1	0.65	1	1	1	83.739			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L3	2.12	7.51	A	1	0.65	1	1	1	122.029	1.11	28.07	C
79.83-40.26			B	1	0.65	1	1	1	122.029			
			C	1	0.65	1	1	1	122.029			
L4 40.26-0.00	1.99	11.04	A	1	0.65	1	1	1	154.412	1.17	28.95	C
			B	1	0.65	1	1	1	154.412			
			C	1	0.65	1	1	1	154.412			
Sum Weight:	5.74	23.22						OTM	235.17 kip-ft	3.64		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.21	1.04	A	1	0.65	1	1	1	43.379	0.46	18.79	C
140.00-115.36			B	1	0.65	1	1	1	43.379			
			C	1	0.65	1	1	1	43.379			
L2	1.42	3.63	A	1	0.65	1	1	1	83.739	0.90	25.42	C
115.36-79.83			B	1	0.65	1	1	1	83.739			
			C	1	0.65	1	1	1	83.739			
L3	2.12	7.51	A	1	0.65	1	1	1	122.029	1.11	28.07	C
79.83-40.26			B	1	0.65	1	1	1	122.029			
			C	1	0.65	1	1	1	122.029			
L4 40.26-0.00	1.99	11.04	A	1	0.65	1	1	1	154.412	1.17	28.95	C
			B	1	0.65	1	1	1	154.412			
			C	1	0.65	1	1	1	154.412			
Sum Weight:	5.74	23.22						OTM	235.17 kip-ft	3.64		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.21	1.04	A	1	0.65	1	1	1	43.379	0.46	18.79	C
140.00-115.36			B	1	0.65	1	1	1	43.379			
			C	1	0.65	1	1	1	43.379			
L2	1.42	3.63	A	1	0.65	1	1	1	83.739	0.90	25.42	C
115.36-79.83			B	1	0.65	1	1	1	83.739			
			C	1	0.65	1	1	1	83.739			
L3	2.12	7.51	A	1	0.65	1	1	1	122.029	1.11	28.07	C
79.83-40.26			B	1	0.65	1	1	1	122.029			
			C	1	0.65	1	1	1	122.029			
L4 40.26-0.00	1.99	11.04	A	1	0.65	1	1	1	154.412	1.17	28.95	C
			B	1	0.65	1	1	1	154.412			
			C	1	0.65	1	1	1	154.412			
Sum Weight:	5.74	23.22						OTM	235.17 kip-ft	3.64		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	23.22					
Bracing Weight	0.00					
Total Member Self-Weight	23.22			0.80	-0.96	
Total Weight	38.61			0.80	-0.96	
Wind 0 deg - No Ice		0.00	-23.23	-2201.47	-0.96	0.16
Wind 30 deg - No Ice		11.50	-20.12	-1906.42	-1087.00	0.52
Wind 45 deg - No Ice		16.26	-16.43	-1556.44	-1536.85	0.65
Wind 60 deg - No Ice		19.91	-11.62	-1100.34	-1882.03	0.73
Wind 90 deg - No Ice		22.99	0.00	0.80	-2173.03	0.75
Wind 120 deg - No Ice		19.91	11.62	1101.94	-1882.03	0.57
Wind 135 deg - No Ice		16.26	16.43	1558.05	-1536.85	0.42
Wind 150 deg - No Ice		11.50	20.12	1908.03	-1087.00	0.23
Wind 180 deg - No Ice		0.00	23.23	2203.08	-0.96	-0.16
Wind 210 deg - No Ice		-11.50	20.12	1908.03	1085.07	-0.52
Wind 225 deg - No Ice		-16.26	16.43	1558.05	1534.92	-0.65
Wind 240 deg - No Ice		-19.91	11.62	1101.94	1880.10	-0.73
Wind 270 deg - No Ice		-22.99	0.00	0.80	2171.11	-0.75
Wind 300 deg - No Ice		-19.91	-11.62	-1100.34	1880.10	-0.57
Wind 315 deg - No Ice		-16.26	-16.43	-1556.44	1534.92	-0.42
Wind 330 deg - No Ice		-11.50	-20.12	-1906.42	1085.07	-0.23
Member Ice	3.03					
Total Weight Ice	46.79			1.96	-2.36	
Wind 0 deg - Ice		0.00	-19.68	-1889.38	-2.36	0.19
Wind 30 deg - Ice		9.75	-17.04	-1635.99	-936.44	0.66
Wind 45 deg - Ice		13.79	-13.92	-1335.42	-1323.34	0.83
Wind 60 deg - Ice		16.88	-9.84	-943.71	-1620.23	0.95
Wind 90 deg - Ice		19.50	0.00	1.96	-1870.51	0.99
Wind 120 deg - Ice		16.88	9.84	947.63	-1620.23	0.76
Wind 135 deg - Ice		13.79	13.92	1339.34	-1323.34	0.57
Wind 150 deg - Ice		9.75	17.04	1639.90	-936.44	0.33
Wind 180 deg - Ice		0.00	19.68	1893.30	-2.36	-0.19
Wind 210 deg - Ice		-9.75	17.04	1639.90	931.71	-0.66
Wind 225 deg - Ice		-13.79	13.92	1339.34	1318.62	-0.83
Wind 240 deg - Ice		-16.88	9.84	947.63	1615.50	-0.95
Wind 270 deg - Ice		-19.50	0.00	1.96	1865.78	-0.99
Wind 300 deg - Ice		-16.88	-9.84	-943.71	1615.50	-0.76
Wind 315 deg - Ice		-13.79	-13.92	-1335.42	1318.62	-0.57
Wind 330 deg - Ice		-9.75	-17.04	-1635.99	931.71	-0.33
Total Weight	38.61			0.80	-0.96	
Wind 0 deg - Service		0.00	-9.07	-860.02	0.00	0.06
Wind 30 deg - Service		4.49	-7.86	-744.76	-424.23	0.20
Wind 45 deg - Service		6.35	-6.42	-608.05	-599.96	0.25
Wind 60 deg - Service		7.78	-4.54	-429.89	-734.79	0.29
Wind 90 deg - Service		8.98	0.00	0.25	-848.46	0.29
Wind 120 deg - Service		7.78	4.54	430.38	-734.79	0.22
Wind 135 deg - Service		6.35	6.42	608.55	-599.96	0.16
Wind 150 deg - Service		4.49	7.86	745.26	-424.23	0.09
Wind 180 deg - Service		0.00	9.07	860.51	0.00	-0.06
Wind 210 deg - Service		-4.49	7.86	745.26	424.23	-0.20
Wind 225 deg - Service		-6.35	6.42	608.55	599.96	-0.25
Wind 240 deg - Service		-7.78	4.54	430.38	734.79	-0.29
Wind 270 deg - Service		-8.98	0.00	0.25	848.46	-0.29
Wind 300 deg - Service		-7.78	-4.54	-429.89	734.79	-0.22
Wind 315 deg - Service		-6.35	-6.42	-608.05	599.96	-0.16

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 330 deg - Service		-4.49	-7.86	-744.76	424.23	-0.09

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice
3	Dead+Wind 30 deg - No Ice
4	Dead+Wind 45 deg - No Ice
5	Dead+Wind 60 deg - No Ice
6	Dead+Wind 90 deg - No Ice
7	Dead+Wind 120 deg - No Ice
8	Dead+Wind 135 deg - No Ice
9	Dead+Wind 150 deg - No Ice
10	Dead+Wind 180 deg - No Ice
11	Dead+Wind 210 deg - No Ice
12	Dead+Wind 225 deg - No Ice
13	Dead+Wind 240 deg - No Ice
14	Dead+Wind 270 deg - No Ice
15	Dead+Wind 300 deg - No Ice
16	Dead+Wind 315 deg - No Ice
17	Dead+Wind 330 deg - No Ice
18	Dead+Ice+Temp
19	Dead+Wind 0 deg+Ice+Temp
20	Dead+Wind 30 deg+Ice+Temp
21	Dead+Wind 45 deg+Ice+Temp
22	Dead+Wind 60 deg+Ice+Temp
23	Dead+Wind 90 deg+Ice+Temp
24	Dead+Wind 120 deg+Ice+Temp
25	Dead+Wind 135 deg+Ice+Temp
26	Dead+Wind 150 deg+Ice+Temp
27	Dead+Wind 180 deg+Ice+Temp
28	Dead+Wind 210 deg+Ice+Temp
29	Dead+Wind 225 deg+Ice+Temp
30	Dead+Wind 240 deg+Ice+Temp
31	Dead+Wind 270 deg+Ice+Temp
32	Dead+Wind 300 deg+Ice+Temp
33	Dead+Wind 315 deg+Ice+Temp
34	Dead+Wind 330 deg+Ice+Temp
35	Dead+Wind 0 deg - Service
36	Dead+Wind 30 deg - Service
37	Dead+Wind 45 deg - Service
38	Dead+Wind 60 deg - Service
39	Dead+Wind 90 deg - Service
40	Dead+Wind 120 deg - Service
41	Dead+Wind 135 deg - Service
42	Dead+Wind 150 deg - Service
43	Dead+Wind 180 deg - Service
44	Dead+Wind 210 deg - Service
45	Dead+Wind 225 deg - Service
46	Dead+Wind 240 deg - Service
47	Dead+Wind 270 deg - Service
48	Dead+Wind 300 deg - Service
49	Dead+Wind 315 deg - Service

Comb. No.	Description
50	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	140 - 115.36	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-5.59	-0.06	-0.84
			Max. Mx	6	-3.14	-58.78	-0.31
			Max. My	10	-3.11	-0.02	-59.55
			Max. Vy	6	7.69	-58.78	-0.31
			Max. Vx	10	8.05	-0.02	-59.55
			Max. Torque	23			-1.51
L2	115.36 - 79.83	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-20.39	-0.55	-0.92
			Max. Mx	6	-14.51	-515.17	-0.37
			Max. My	10	-14.48	-0.23	-525.76
			Max. Vy	6	16.94	-515.17	-0.37
			Max. Vx	10	17.19	-0.23	-525.76
			Max. Torque	23			-1.70
L3	79.83 - 40.26	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-30.78	-1.32	-1.37
			Max. Mx	6	-23.87	-1245.39	-0.57
			Max. My	10	-23.86	-0.56	-1265.43
			Max. Vy	6	20.11	-1245.39	-0.57
			Max. Vx	10	20.35	-0.56	-1265.43
			Max. Torque	23			-0.97
L4	40.26 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-46.79	-2.37	-1.97
			Max. Mx	6	-38.60	-2227.68	-0.83
			Max. My	10	-38.60	-0.99	-2258.56
			Max. Vy	6	23.01	-2227.68	-0.83
			Max. Vx	10	23.25	-0.99	-2258.56
			Max. Torque	23			-1.01

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	27	46.79	0.00	-19.68
	Max. H_x	14	38.61	22.99	-0.00
	Max. H_z	2	38.61	0.00	23.23
	Max. M_x	2	2256.90	0.00	23.23
	Max. M_z	6	2227.68	-22.99	-0.00
	Max. Torsion	31	1.01	19.50	0.00
	Min. Vert	1	38.61	0.00	0.00
	Min. H_x	6	38.61	-22.99	-0.00
	Min. H_z	10	38.61	0.00	-23.23
	Min. M_x	10	-2258.56	0.00	-23.23
	Min. M_z	14	-2225.70	22.99	-0.00
	Min. Torsion	23	-1.01	-19.50	0.00

Tower Mast Reaction Summary

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead Only	38.61	0.00	0.00	0.80	-0.96	0.00
Dead+Wind 0 deg - No Ice	38.61	0.00	-23.23	-2256.90	-0.99	0.16
Dead+Wind 30 deg - No Ice	38.61	11.50	-20.12	-1954.43	-1114.32	0.52
Dead+Wind 45 deg - No Ice	38.61	16.26	-16.43	-1595.64	-1575.48	0.65
Dead+Wind 60 deg - No Ice	38.61	19.91	-11.62	-1128.05	-1929.35	0.74
Dead+Wind 90 deg - No Ice	38.61	22.99	0.00	0.83	-2227.68	0.76
Dead+Wind 120 deg - No Ice	38.61	19.91	11.62	1129.71	-1929.35	0.58
Dead+Wind 135 deg - No Ice	38.61	16.26	16.43	1597.30	-1575.48	0.42
Dead+Wind 150 deg - No Ice	38.61	11.50	20.12	1956.09	-1114.32	0.24
Dead+Wind 180 deg - No Ice	38.61	0.00	23.23	2258.56	-0.99	-0.16
Dead+Wind 210 deg - No Ice	38.61	-11.50	20.12	1956.09	1112.34	-0.52
Dead+Wind 225 deg - No Ice	38.61	-16.26	16.43	1597.30	1573.51	-0.65
Dead+Wind 240 deg - No Ice	38.61	-19.91	11.62	1129.71	1927.38	-0.74
Dead+Wind 270 deg - No Ice	38.61	-22.99	0.00	0.83	2225.70	-0.76
Dead+Wind 300 deg - No Ice	38.61	-19.91	-11.62	-1128.05	1927.37	-0.58
Dead+Wind 315 deg - No Ice	38.61	-16.26	-16.43	-1595.64	1573.51	-0.42
Dead+Wind 330 deg - No Ice	38.61	-11.50	-20.12	-1954.43	1112.34	-0.24
Dead+Ice+Temp	46.79	0.00	0.00	1.97	-2.37	-0.00
Dead+Wind 0 deg+Ice+Temp	46.79	0.00	-19.68	-1953.86	-2.44	0.19
Dead+Wind 30 deg+Ice+Temp	46.79	9.75	-17.04	-1691.82	-968.35	0.67
Dead+Wind 45 deg+Ice+Temp	46.79	13.79	-13.92	-1381.00	-1368.44	0.85
Dead+Wind 60 deg+Ice+Temp	46.79	16.88	-9.84	-975.92	-1675.45	0.97
Dead+Wind 90 deg+Ice+Temp	46.79	19.50	0.00	2.04	-1934.27	1.01
Dead+Wind 120 deg+Ice+Temp	46.79	16.88	9.84	980.00	-1675.45	0.78
Dead+Wind 135 deg+Ice+Temp	46.79	13.79	13.92	1385.08	-1368.45	0.58
Dead+Wind 150 deg+Ice+Temp	46.79	9.75	17.04	1695.91	-968.35	0.34
Dead+Wind 180 deg+Ice+Temp	46.79	0.00	19.68	1957.95	-2.44	-0.19
Dead+Wind 210 deg+Ice+Temp	46.79	-9.75	17.04	1695.91	963.47	-0.67
Dead+Wind 225 deg+Ice+Temp	46.79	-13.79	13.92	1385.09	1363.56	-0.85
Dead+Wind 240 deg+Ice+Temp	46.79	-16.88	9.84	980.00	1670.57	-0.97
Dead+Wind 270 deg+Ice+Temp	46.79	-19.50	0.00	2.04	1929.39	-1.01
Dead+Wind 300 deg+Ice+Temp	46.79	-16.88	-9.84	-975.92	1670.57	-0.78
Dead+Wind 315 deg+Ice+Temp	46.79	-13.79	-13.92	-1381.00	1363.56	-0.58
Dead+Wind 330 deg+Ice+Temp	46.79	-9.75	-17.04	-1691.82	963.46	-0.34
Dead+Wind 0 deg - Service	38.61	0.00	-9.07	-881.48	-0.99	0.06
Dead+Wind 30 deg - Service	38.61	4.49	-7.86	-763.27	-436.07	0.20
Dead+Wind 45 deg - Service	38.61	6.35	-6.42	-623.05	-616.28	0.26
Dead+Wind 60 deg - Service	38.61	7.78	-4.54	-440.32	-754.57	0.29
Dead+Wind 90 deg - Service	38.61	8.98	0.00	0.83	-871.15	0.30
Dead+Wind 120 deg - Service	38.61	7.78	4.54	441.98	-754.57	0.23
Dead+Wind 135 deg - Service	38.61	6.35	6.42	624.71	-616.28	0.17
Dead+Wind 150 deg - Service	38.61	4.49	7.86	764.93	-436.07	0.09
Dead+Wind 180 deg - Service	38.61	0.00	9.07	883.13	-0.99	-0.06
Dead+Wind 210 deg - Service	38.61	-4.49	7.86	764.93	434.09	-0.20
Dead+Wind 225 deg - Service	38.61	-6.35	6.42	624.71	614.31	-0.26
Dead+Wind 240 deg - Service	38.61	-7.78	4.54	441.98	752.59	-0.29
Dead+Wind 270 deg - Service	38.61	-8.98	0.00	0.83	869.17	-0.30
Dead+Wind 300 deg - Service	38.61	-7.78	-4.54	-440.32	752.59	-0.23
Dead+Wind 315 deg - Service	38.61	-6.35	-6.42	-623.05	614.31	-0.17
Dead+Wind 330 deg - Service	38.61	-4.49	-7.86	-763.27	434.09	-0.09

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
1	0.00	-38.61	0.00	0.00	38.61	0.00	0.000%
2	0.00	-38.61	-23.23	0.00	38.61	23.23	0.000%
3	11.50	-38.61	-20.12	-11.50	38.61	20.12	0.000%
4	16.26	-38.61	-16.43	-16.26	38.61	16.43	0.000%
5	19.91	-38.61	-11.62	-19.91	38.61	11.62	0.000%
6	22.99	-38.61	0.00	-22.99	38.61	-0.00	0.000%
7	19.91	-38.61	11.62	-19.91	38.61	-11.62	0.000%
8	16.26	-38.61	16.43	-16.26	38.61	-16.43	0.000%
9	11.50	-38.61	20.12	-11.50	38.61	-20.12	0.000%
10	0.00	-38.61	23.23	0.00	38.61	-23.23	0.000%
11	-11.50	-38.61	20.12	11.50	38.61	-20.12	0.000%
12	-16.26	-38.61	16.43	16.26	38.61	-16.43	0.000%
13	-19.91	-38.61	11.62	19.91	38.61	-11.62	0.000%
14	-22.99	-38.61	0.00	22.99	38.61	-0.00	0.000%
15	-19.91	-38.61	-11.62	19.91	38.61	11.62	0.000%
16	-16.26	-38.61	-16.43	16.26	38.61	16.43	0.000%
17	-11.50	-38.61	-20.12	11.50	38.61	20.12	0.000%
18	0.00	-46.79	0.00	-0.00	46.79	-0.00	0.000%
19	0.00	-46.79	-19.68	0.00	46.79	19.68	0.000%
20	9.75	-46.79	-17.04	-9.75	46.79	17.04	0.000%
21	13.79	-46.79	-13.92	-13.79	46.79	13.92	0.000%
22	16.88	-46.79	-9.84	-16.88	46.79	9.84	0.000%
23	19.50	-46.79	0.00	-19.50	46.79	0.00	0.000%
24	16.88	-46.79	9.84	-16.88	46.79	-9.84	0.000%
25	13.79	-46.79	13.92	-13.79	46.79	-13.92	0.000%
26	9.75	-46.79	17.04	-9.75	46.79	-17.04	0.000%
27	0.00	-46.79	19.68	0.00	46.79	-19.68	0.000%
28	-9.75	-46.79	17.04	9.75	46.79	-17.04	0.000%
29	-13.79	-46.79	13.92	13.79	46.79	-13.92	0.000%
30	-16.88	-46.79	9.84	16.88	46.79	-9.84	0.000%
31	-19.50	-46.79	0.00	19.50	46.79	0.00	0.000%
32	-16.88	-46.79	-9.84	16.88	46.79	9.84	0.000%
33	-13.79	-46.79	-13.92	13.79	46.79	13.92	0.000%
34	-9.75	-46.79	-17.04	9.75	46.79	17.04	0.000%
35	0.00	-38.61	-9.07	0.00	38.61	9.07	0.000%
36	4.49	-38.61	-7.86	-4.49	38.61	7.86	0.000%
37	6.35	-38.61	-6.42	-6.35	38.61	6.42	0.000%
38	7.78	-38.61	-4.54	-7.78	38.61	4.54	0.000%
39	8.98	-38.61	0.00	-8.98	38.61	0.00	0.000%
40	7.78	-38.61	4.54	-7.78	38.61	-4.54	0.000%
41	6.35	-38.61	6.42	-6.35	38.61	-6.42	0.000%
42	4.49	-38.61	7.86	-4.49	38.61	-7.86	0.000%
43	0.00	-38.61	9.07	0.00	38.61	-9.07	0.000%
44	-4.49	-38.61	7.86	4.49	38.61	-7.86	0.000%
45	-6.35	-38.61	6.42	6.35	38.61	-6.42	0.000%
46	-7.78	-38.61	4.54	7.78	38.61	-4.54	0.000%
47	-8.98	-38.61	0.00	8.98	38.61	0.00	0.000%
48	-7.78	-38.61	-4.54	7.78	38.61	4.54	0.000%
49	-6.35	-38.61	-6.42	6.35	38.61	6.42	0.000%
50	-4.49	-38.61	-7.86	4.49	38.61	7.86	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001

2	Yes	4	0.00000001	0.00004208
3	Yes	5	0.00000001	0.00009341
4	Yes	5	0.00000001	0.00010257
5	Yes	5	0.00000001	0.00008659
6	Yes	4	0.00000001	0.00032562
7	Yes	5	0.00000001	0.00009445
8	Yes	5	0.00000001	0.00010255
9	Yes	5	0.00000001	0.00008894
10	Yes	4	0.00000001	0.00004212
11	Yes	5	0.00000001	0.00008835
12	Yes	5	0.00000001	0.00010240
13	Yes	5	0.00000001	0.00009456
14	Yes	4	0.00000001	0.00032536
15	Yes	5	0.00000001	0.00008666
16	Yes	5	0.00000001	0.00010236
17	Yes	5	0.00000001	0.00009278
18	Yes	4	0.00000001	0.00000001
19	Yes	5	0.00000001	0.00007812
20	Yes	5	0.00000001	0.00020802
21	Yes	5	0.00000001	0.00022938
22	Yes	5	0.00000001	0.00019664
23	Yes	5	0.00000001	0.00008157
24	Yes	5	0.00000001	0.00021122
25	Yes	5	0.00000001	0.00023021
26	Yes	5	0.00000001	0.00020084
27	Yes	5	0.00000001	0.00007833
28	Yes	5	0.00000001	0.00019929
29	Yes	5	0.00000001	0.00022936
30	Yes	5	0.00000001	0.00021090
31	Yes	5	0.00000001	0.00008139
32	Yes	5	0.00000001	0.00019625
33	Yes	5	0.00000001	0.00022841
34	Yes	5	0.00000001	0.00020633
35	Yes	4	0.00000001	0.00001890
36	Yes	4	0.00000001	0.00026666
37	Yes	4	0.00000001	0.00029094
38	Yes	4	0.00000001	0.00023005
39	Yes	4	0.00000001	0.00006606
40	Yes	4	0.00000001	0.00027573
41	Yes	4	0.00000001	0.00029117
42	Yes	4	0.00000001	0.00024064
43	Yes	4	0.00000001	0.00001895
44	Yes	4	0.00000001	0.00023709
45	Yes	4	0.00000001	0.00029019
46	Yes	4	0.00000001	0.00027623
47	Yes	4	0.00000001	0.00006591
48	Yes	4	0.00000001	0.00023001
49	Yes	4	0.00000001	0.00028913
50	Yes	4	0.00000001	0.00026247

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	140 - 115.36	22.074	43	1.3474	0.0079
L2	118.89 - 79.83	16.184	43	1.2935	0.0026
L3	84.42 - 40.26	7.949	43	0.9198	0.0007
L4	45.54 - 0	2.241	43	0.4582	0.0003

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
148.00	20' x 2" Dia Omni	43	22.074	1.3474	0.0079	38151
138.00	4' Side Mount Standoff	43	21.507	1.3455	0.0073	38151
130.00	(2) DUO1417-8686	43	19.248	1.3345	0.0051	19075
128.00	13' Platform w/rails	43	18.688	1.3300	0.0046	15896
120.00	LPA-80080-4CF	43	16.484	1.2997	0.0028	9607
118.00	13' Platform w/rails	43	15.945	1.2882	0.0025	8871
114.00	LMU	43	14.882	1.2598	0.0019	7883
112.00	(4) DB844H90E-XY	43	14.360	1.2432	0.0017	7492
110.00	13' Platform w/rails	43	13.844	1.2252	0.0015	7138
100.00	14-ft Low Profile Platform	43	11.372	1.1177	0.0009	5773
91.50	(2) DB978F30T2E-M	43	9.432	1.0115	0.0008	4966
91.00	(2) DB980F90T2E-M	43	9.323	1.0051	0.0008	4926
90.00	14-ft Low Profile Platform	43	9.107	0.9921	0.0008	4846
83.00	Uni-Tri Bracket	43	7.667	0.9015	0.0007	4457

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	140 - 115.36	56.392	10	3.4389	0.0245
L2	118.89 - 79.83	41.358	10	3.3046	0.0086
L3	84.42 - 40.26	20.321	10	2.3511	0.0025
L4	45.54 - 0	5.729	10	1.1716	0.0009

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
148.00	20' x 2" Dia Omni	10	56.392	3.4389	0.0245	15154
138.00	4' Side Mount Standoff	10	54.944	3.4345	0.0228	15154
130.00	(2) DUO1417-8686	10	49.179	3.4078	0.0161	7576
128.00	13' Platform w/rails	10	47.750	3.3966	0.0145	6313
120.00	LPA-80080-4CF	10	42.124	3.3202	0.0092	3814
118.00	13' Platform w/rails	10	40.747	3.2910	0.0081	3519
114.00	LMU	10	38.034	3.2190	0.0064	3122
112.00	(4) DB844H90E-XY	10	36.700	3.1768	0.0056	2964
110.00	13' Platform w/rails	10	35.382	3.1309	0.0050	2822
100.00	14-ft Low Profile Platform	10	29.067	2.8567	0.0032	2274
91.50	(2) DB978F30T2E-M	10	24.111	2.5856	0.0027	1952
91.00	(2) DB980F90T2E-M	10	23.833	2.5691	0.0027	1936
90.00	14-ft Low Profile Platform	10	23.281	2.5360	0.0026	1904

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
83.00	Uni-Tri Bracket	10	19.601	2.3045	0.0025	1749

Compression Checks

Pole Design Data

Section No.	Elevation	Size	L	L_u	Kl/r	F_a	A	Actual P	Allow. P_a	Ratio $\frac{P}{P_a}$
	ft		ft	ft		ksi	in^2	K	K	
L1	140 - 115.36 (1)	TP24.2521x18x0.1875	24.64	0.00	0.0	39.000	13.7884	-3.11	537.75	0.006
L2	115.36 - 79.83 (2)	TP32.7041x22.9814x0.3125	39.06	0.00	0.0	39.000	30.9952	-14.48	1208.81	0.012
L3	79.83 - 40.26 (3)	TP41.9334x30.9366x0.4375	44.16	0.00	0.0	39.000	55.7964	-23.86	2176.06	0.011
L4	40.26 - 0 (4)	TP51x39.7436x0.5	45.54	0.00	0.0	39.000	80.1435	-38.60	3125.60	0.012

Pole Bending Design Data

Section No.	Elevation	Size	Actual M_x	Actual f_{bx}	Allow. F_{bx}	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y	Actual f_{by}	Allow. F_{by}	Ratio $\frac{f_{by}}{F_{by}}$
	ft		kip-ft	ksi	ksi		kip-ft	ksi	ksi	
L1	140 - 115.36 (1)	TP24.2521x18x0.1875	59.55	9.067	39.000	0.232	0.00	0.000	39.000	0.000
L2	115.36 - 79.83 (2)	TP32.7041x22.9814x0.3125	525.76	26.454	39.000	0.678	0.00	0.000	39.000	0.000
L3	79.83 - 40.26 (3)	TP41.9334x30.9366x0.4375	1265.43	27.531	39.000	0.706	0.00	0.000	39.000	0.000
L4	40.26 - 0 (4)	TP51x39.7436x0.5	2258.56	27.193	39.000	0.697	0.00	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation	Size	Actual V	Actual f_v	Allow. F_v	Ratio $\frac{f_v}{F_v}$	Actual T	Actual f_{vt}	Allow. F_{vt}	Ratio $\frac{f_{vt}}{F_{vt}}$
	ft		K	ksi	ksi		kip-ft	ksi	ksi	
L1	140 - 115.36 (1)	TP24.2521x18x0.1875	8.05	0.584	26.000	0.045	0.00	0.000	26.000	0.000
L2	115.36 - 79.83 (2)	TP32.7041x22.9814x0.3125	17.19	0.554	26.000	0.043	0.04	0.001	26.000	0.000
L3	79.83 - 40.26 (3)	TP41.9334x30.9366x0.4375	20.35	0.365	26.000	0.028	0.10	0.001	26.000	0.000
L4	40.26 - 0 (4)	TP51x39.7436x0.5	23.25	0.290	26.000	0.022	0.16	0.001	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio P / P_a	Ratio f_{bx} / F_{bx}	Ratio f_{by} / F_{by}	Ratio f_v / F_v	Ratio f_{vt} / F_{vt}	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	140 - 115.36 (1)	0.006	0.232	0.000	0.045	0.000	0.239 ✔	1.333	H1-3+VT ✔
L2	115.36 - 79.83 (2)	0.012	0.678	0.000	0.043	0.000	0.691 ✔	1.333	H1-3+VT ✔
L3	79.83 - 40.26 (3)	0.011	0.706	0.000	0.028	0.000	0.717 ✔	1.333	H1-3+VT ✔
L4	40.26 - 0 (4)	0.012	0.697	0.000	0.022	0.000	0.710 ✔	1.333	H1-3+VT ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P / K	$SF*P_{allow}$ / K	% Capacity	Pass Fail
L1	140 - 115.36	Pole	TP24.2521x18x0.1875	1	-3.11	716.82	17.9	Pass
L2	115.36 - 79.83	Pole	TP32.7041x22.9814x0.3125	2	-14.48	1611.34	51.8	Pass
L3	79.83 - 40.26	Pole	TP41.9334x30.9366x0.4375	3	-23.86	2900.69	53.8	Pass
L4	40.26 - 0	Pole	TP51x39.7436x0.5	4	-38.60	4166.42	53.2	Pass
							Summary	
						Pole (L3)	53.8	Pass
						RATING =	**53.8**	**Pass**

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Subject:		Anchor Bolt and Baseplate Analysis
Location:		140-ft Monopole Canton, CT
Rev. 1: 12/7/11		Prepared by: T.J.L. Checked by: C.F.C. Job No. 11074.CO28

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 2259·ft·kips	(Input From RisaTower)
Shear Force =	Shear := 23·kips	(Input From RisaTower)
Axial Force =	Axial := 39·kips	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 20	(User Input)
Diameter of Bolt Circle =	D_{bc} := 60.0·in	(User Input)
Bolt "Column" Distance =	l := 3.0·in	(User Input)
Bolt Ultimate Strenght =	F_u := 100·ksi	(User Input)
Bolt Yield Strenght =	F_y := 75·ksi	(User Input)
Bolt Modulus =	E := 29000·ksi	(User Input)
Diameter of Anchor Bolts =	D := 2.25·in	(User Input)
Threads per Inch =	n := 4.5	(User Input)

Base Plate Data:

Use ASTM A572 Grade 60

Plate Yield Strength =	Fy_{bp} := 60·ksi	(User Input)
Base Plate Thickness =	t_{bp} := 2.25·in	(User Input)
Base Plate Diameter =	D_{bp} := 66.0·in	(User Input)
Outer Pole Diameter =	D_{pole} := 51.0·in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 30 \cdot in$

Distance to Bolts = $i := 1 .. N$

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

$d_1 = 9.27 \cdot in$ $d_9 = 9.27 \cdot in$

$d_2 = 17.63 \cdot in$ $d_{10} = 0.00 \cdot in$

$d_3 = 24.27 \cdot in$ $d_{11} = -9.27 \cdot in$

$d_4 = 28.53 \cdot in$ $d_{12} = -17.63 \cdot in$

$d_5 = 30.00 \cdot in$ $d_{13} = -24.27 \cdot in$

$d_6 = 28.53 \cdot in$ $d_{14} = -28.53 \cdot in$

$d_7 = 24.27 \cdot in$ $d_{15} = -30.00 \cdot in$

$d_8 = 17.63 \cdot in$ $d_{16} = -28.53 \cdot in$

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 25.5 \cdot in$

Moment Arms of Bolts about Neutral Axis = $MA_i := if\left(d_i \geq R_{pole}, d_i - R_{pole}, 0in\right)$

$MA_1 = 0.00 \cdot in$ $MA_9 = 0.00 \cdot in$

$MA_2 = 0.00 \cdot in$ $MA_{10} = 0.00 \cdot in$

$MA_3 = 0.00 \cdot in$ $MA_{11} = 0.00 \cdot in$

$MA_4 = 3.03 \cdot in$ $MA_{12} = 0.00 \cdot in$

$MA_5 = 4.50 \cdot in$ $MA_{13} = 0.00 \cdot in$

$MA_6 = 3.03 \cdot in$ $MA_{14} = 0.00 \cdot in$

$MA_7 = 0.00 \cdot in$ $MA_{15} = 0.00 \cdot in$

$MA_8 = 0.00 \cdot in$ $MA_{16} = 0.00 \cdot in$

Effective Width of Baseplate for Bending = $B_{eff} := 0.8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 33.5 \cdot in$

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Location:	140-ft Monopole Canton, CT
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Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 9 \times 10^3 \cdot in^2$

Gross Area of Bolt = $A_g := \frac{\pi}{4} \cdot D^2 = 3.976 \cdot in^2$

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

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

Radius of Gyration of Bolt = $r := \frac{D_n}{4} = 0.508 \cdot in$

Section Modulus of Bolt = $S_x := \frac{\pi \cdot D_n^3}{32} = 0.826 \cdot in^3$

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 88.4 \cdot kips$

Allowable Tensile Force = $T_{ALL.Gross} := 1.333 \cdot \left(0.33 \cdot A_g \cdot F_u\right) = 174.9 \cdot kips$ (1.333 increase allowed per TIA/EIA)

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

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} = 45.4 \cdot \%$ Bolts are "upset bolts". Use net area per AISC

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

Condition1 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.287 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 4.2 \cdot ksi$

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

Check Combined Stress Requirement:

Per ASCE Manual 72: "If the clearance between the base plate and concrete does not exceed two times the bolt diameter a bending stress analysis of the bolts is NOT normally required.

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

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

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{l_p} + \frac{Axial}{N} = 92.3 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 28.4 \cdot ksi$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

$$F_a := 1.333 \cdot F_a = 60 \cdot ksi$$

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 47.4 \cdot \%$$

Condition 2 =

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

Condition2 = "OK"

Base Plate Analysis:

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

$C_1 = 29.9 \cdot kips$ $C_9 = 29.9 \cdot kips$

$C_2 = 55.1 \cdot kips$ $C_{10} = 2.0 \cdot kips$

$C_3 = 75.1 \cdot kips$ $C_{11} = -26.0 \cdot kips$

$C_4 = 87.9 \cdot kips$ $C_{12} = -51.2 \cdot kips$

$C_5 = 92.3 \cdot kips$ $C_{13} = -71.2 \cdot kips$

$C_6 = 87.9 \cdot kips$ $C_{14} = -84.0 \cdot kips$

$C_7 = 75.1 \cdot kips$ $C_{15} = -88.4 \cdot kips$

$C_8 = 55.1 \cdot kips$ $C_{16} = -84.0 \cdot kips$

Maximum Bending Stress in Plate = $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} \cdot t_{bp}^2\right)} = 33.5 \cdot ksi$

Allowable Bending Stress in Plate = $F_{bp} := 1.33 \cdot 0.75 \cdot Fy_{bp} = 59.9 \cdot ksi$

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} = 56.0 \cdot \%$

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

Condition3 = "Ok"

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Subject:		Foundation Analysis
Location:		140-ft Monopole Canton, CT
Rev. 1: 12/7/11		Prepared by: T.J.L. Checked by: C.F.C. Job No. 11074.CO28

Standard Monopole Foundation:

Input Data:

Tower Data

Overturning Moment =	$OM := 2259 \cdot ft \cdot kips$	(User Input from RISATower)	
Shear Force =	$Shear := 23 \cdot kip$	(User Input from RISATower)	
Axial Force =	$Axial := 39 \cdot kip$	(User Input from RISATower)	
Tower Height =	$H_t := 140 \cdot ft$	(User Input)	

Footing Data:

Overall Depth of Footing =	$D_f := 6.5 \cdot ft$	(User Input)	
Length of Pier =	$L_p := 4.5 \cdot ft$	(User Input)	
Extension of Pier Above Grade =	$L_{pag} := 1.0 \cdot ft$	(User Input)	
Diameter of Pier =	$d_p := 6.5 \cdot ft$	(User Input)	
Thickness of Footing =	$T_f := 3.0 \cdot ft$	(User Input)	
Width of Footing =	$W_f := 24.0 \cdot ft$	(User Input)	

Anchor Bolt Data:

Length of Anchor Bolts =	$L_{st} := 72 \cdot in$	(User Input)	
Projection of Anchor Bolts Above Pier =	$A_{BP} := 12.0 \cdot in$	(User Input)	
Anchor Bolt Diameter =	$d_{anchor} := 2.25 \cdot in$	(User Input)	
Base Plate Bolt Circle =	$MP := 60.0 \cdot in$	(User Input)	

Material Properties:

Concrete Compressive Strength =	$f_c := 4000 \cdot psi$	(User Input)	
Steel Reinforcment Yield Strength =	$f_y := 60000 \cdot psi$	(User Input)	
Anchor Bolt Yield Strength =	$f_{ya} := 75000 \cdot psi$	(User Input)	
Internal Friction Angle of Soil =	$\Phi_s := 30 \cdot deg$	(User Input)	
Allowable Soil Bearing Capacity =	$q_s := 4000 \cdot psf$	(User Input)	
Unit Weight of Soil =	$\gamma_{soil} := 100 \cdot pcf$	(User Input)	
Unit Weight of Concrete =	$\gamma_{conc} := 150 \cdot pcf$	(User Input)	
Foundation Bouyancy =	$Bouyancy := 0$	(User Input)	(Yes=1 / No=0)
Depth to Neglect =	$n := 1 \cdot ft$	(User Input)	
Cohesion of Clay Type Soil =	$c := 0 \cdot ksf$	(User Input)	(Use 0 for Sandy Soil)
Seismic Zone Factor =	$Z := 2$	(User Input)	(UBC-1997 Fig 23-2)
Coefficient of Friction Between Concrete =	$\mu := 0.45$	(User Input)	

Pier Reinforcement:

Bar Size =	$BS_{pier} := 8$	(User Input)	
Bar Diameter =	$d_{bpier} := 1.0 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 44$	(User Input)	
Clear Cover of Reinforcement =	$Cvr_{pier} := 3 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Diameter of Tie =	$d_{Tie} := 0.5 \cdot in$	(User Input)	

Pad Reinforcement:

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

Calculated Factors:

Pier Reinforcement Bar Area =

$$A_{bpier} := \frac{\pi \cdot d_{bpier}^2}{4} = 0.785 \cdot in^2$$

Pad Top Reinforcement Bar Area =

$$A_{btop} := \frac{\pi \cdot d_{btop}^2}{4} = 0.785 \cdot in^2$$

Pad Bottom Reinforcement Bar Area =

$$A_{bbot} := \frac{\pi \cdot d_{bbot}^2}{4} = 0.785 \cdot in^2$$

Coefficient of Lateral Soil Pressure =

$$K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 3$$

Load Factor =

$$LF := \begin{cases} 1.333 & \text{if } H_t \le 700 \cdot ft \\ 1.7 & \text{if } H_t \ge 1200 \cdot ft \\ 1.333 + \left(\frac{H_t - 700ft}{1200ft - 700ft}\right) \cdot 0.4 & \text{otherwise} \end{cases} = 1.333$$

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Subject: Foundation Analysis

Location: 140-ft Monopole
Canton, CT

Rev. 1: 12/7/11

Prepared by: T.J.L. Checked by: C.F.C.
Job No. 11074.CO28

Stability of Footing:

Adjusted Concrete Unit Weight =

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

Adjusted Soil Unit Weight =

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

Passive Pressure =

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

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

$$P_{top} := if\left[n < \left(D_f - T_f\right), P_{pt}, P_{pn}\right] = 1.05 \cdot ksf$$

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

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

$$T_p := if\left[n < \left(D_f - T_f\right), T_f, \left(D_f - n\right)\right] = 3$$

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

Ultimate Shear =

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

Weight of Concrete Pad =

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

Weight of Soil Above Footing =

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

Weight of Soil Wedge at Back Face =

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

Weight of Soil Wedge at back face Corners =

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

Total Weight =

$$WT_{tot} := WT_c + WT_{s1} + Axial = 456.303 \cdot kip$$

Resisting Moment =

$$M_r := \left(WT_{tot}\right) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + \left[\left(WT_{s2} + WT_{s3}\right) \cdot \left(W_f + \frac{D_f \cdot \tan\left(\Phi_s\right)}{3}\right)\right] = 6590 \cdot kip \cdot ft$$

Overturning Moment =

$$M_{ot} := OM + Shear \cdot \left(L_p + T_f\right) = 2432 \cdot kip \cdot ft$$

Factor of Safety Actual =

$$FS := \frac{M_r}{M_{ot}} = 2.71$$

Factor of Safety Required =

$$FS_{req} := 2$$

$$OverTurning\_Moment\_Check := if\left(FS \geq FS_{req}, "Okay", "No\ Good"\right)$$

OverTurning_Moment_Check = "Okay"

Shear Capacity in Pier:

Shear Resistance of Pier = $S_p := \frac{\mu \cdot WT_{tot}}{FS_{req}} = 102.668 \cdot kips$

$Shear\_Check := if(S_p > Shear, "Okay", "No Good")$

Shear_Check = "Okay"

Bearing Pressure Caused by Footing:

Area of the Mat = $A_{mat} := W_f^{\,2} = 576$

Section Modulus of Mat = $S := \frac{W_f^{\,3}}{6} = 2304 \cdot ft^3$

Maximum Pressure in Mat = $P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S} = 1.848 \cdot ksf$

$Max\_Pressure\_Check := if(P_{max} < q_s, "Okay", "No Good")$

Max_Pressure_Check = "Okay"

Minimum Pressure in Mat = $P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S} = -0.263 \cdot ksf$

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

Min_Pressure_Check = "No Good"

Distance to Resultant of Pressure Distribution = $X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 7.003$

Distance to Kern = $X_k := \frac{W_f}{6} = 4$

Since Resultant Force is Not in Kern, Area to which Pressure is Applied Must be Reduced.

Eccentricity = $e := \frac{M_{ot}}{WT_{tot}} = 5.329$

Adjusted Soil Pressure = $P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)} = 1.9 \cdot ksf$

$q_{adj} := if(P_{min} < 0, P_a, P_{max}) = 1.9 \cdot ksf$

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

Pressure_Check = "Okay"

Concrete Bearing Capacity:

Strength Reduction Factor = $\Phi_c := 0.65$ (ACI-2008 9.3.2.2)

Bearing Strength Between Pier and Pad = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 1.056 \times 10^4 \cdot kips$ (ACI-2008 10.14)

$Bearing\_Check := if(P_b > LF \cdot Axial, "Okay", "No Good")$

Bearing_Check = "Okay"

Shear Strength of Concrete:

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

$\phi_c := 0.85$ (ACI 9.3.2.5)

$d := T_f - Cvr_{pad} - d_{bbot} = 32 \cdot in$

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

$d_2 := d_1 - d$

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

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

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

$V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f_c \cdot psi} \cdot W_f \cdot d$ (ACI-2008 11.2.1.1)

$Beam\_Shear\_Check := if(V_{req} < V_{Avail}, "Okay", "No Good")$

Beam_Shear_Check = "Okay"

Punching Shear: (Critical Section Located at a distance of d/2 from the face of pier) (ACI 11.11.1.2)

Critical Perimeter of Punching Shear = $b_o := \left(d_p + d\right) \cdot \pi = 28.8$

Area Included Inside Perimeter = $A_{bo} := \frac{\pi \cdot \left(d_p + d\right)^2}{4} = 66$

Area Outside of Perimeter = $A_{out} := A_{mat} - A_{bo} = 510$

Guess Value = $v_u := 1ksf$

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

Given $d^2 + d_p \cdot d = \frac{WT_{tot}}{\pi \cdot v_u}$

$v_u := \text{Find}(v_u) = 5.9 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f = 380.3 \cdot kips$

Required Shear Strength = $V_{req} := LF \cdot V_u = 506.9 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 2377.9 \cdot kip$ (ACI-2008 11.11.2.1)

$Punching\_Shear\_Check := if(V_{req} < V_{Avail}, "Okay", "No Good")$

$Punching\_Shear\_Check = "Okay"$

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

Strength Reduction Factor = $\phi_m := .90$ (ACI-2008 9.3.2.1)

$q_b := q_{adj} - d_1 \cdot Slope = 1.069 \cdot ksf$

Maximum Bending at Face of Pier = $M_n := \frac{1}{LF \cdot \phi_m} \cdot \left[(q_{adj} - q_b) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 1243 \cdot kip \cdot ft$

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

(ACI-200810.2.7.3)

$R_u := \frac{M_n}{\phi_m \cdot W_f \cdot d^2} = 8.1 \cdot ksf$

$\rho := \frac{0.85 \cdot f_c}{f_y} \left(1 - \sqrt{1 - \frac{2 \cdot R_u}{0.85 \cdot f_c}} \right) = 0.0009$

$\rho_{min} := 1.333 \cdot \rho = 0.00126$

Required Reinforcement for Temperature and Shrinkage:

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

Check Bottom Bars:

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

$As_{prov} := A_{bbot} \cdot NB_{bot} = 31.4 \cdot in^2$

$Pad\_Reinforcement\_Bot := if(As_{prov} > As, "Okay", "No Good")$

Pad_Reinforcement_Bot = "Okay"

Check top Bars:

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

$As_{prov} := A_{btop} \cdot NB_{top} = 22 \cdot in^2$

$Pad\_Reinforcement\_Top := if(As_{prov} > As, "Okay", "No Good")$

Pad_Reinforcement_Top = "Okay"

Developement Length Pad Reinforcement:

Bar Spacing =

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

Spacing or Cover Dimension =

$$c := if\left(Cvr_{pad} < \frac{B_{sPad}}{2}, Cvr_{pad}, \frac{B_{sPad}}{2}\right) = 3 \cdot in$$

Transverse Reinforcement Index =

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

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

Minimum Development Length =

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

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

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad} = 102 \cdot in$$

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

Lpad_Check = "Okay"

Steel Reinforcement in Pier:

Area of Pier =

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

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

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

$$Steel\_Area\_Check := if(A_{sprov} > A_{smin}, "Okay", "No Good")$$

Steel_Area_Check = "Okay"

Bar Spacing In Pier =

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

Diameter of Reinforcement Cage =

$$Diam_{cage} := d_p - 2 \cdot Cvr_{pier} = 72 \cdot in$$

Maximum Moment in Pier =

$$M_p := \left[OM + Shear \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF = 37974.5 \cdot in \cdot kips$$

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

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

$$(D \; N \; n \; P_u \; M_{xu}) = (78 \;\; 44 \;\; 8 \;\; 51.987 \;\; 3.797 \times 10^4)$$

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

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

$$(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho) = (84.141 \;\; 6.146 \times 10^4 \;\; -60 \;\; 7.274 \times 10^{-3})$$

$$Axial\_Load\_Check := if(\phi P_n \geq P_u, "Okay", "No Good")$$

Axial_Load_Check = "Okay"

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

Bending_Check = "Okay"

Development Length Pier Reinforcement:

Available Length in Foundation:

$L_{pier} := L_p - Cvr_{pier} = 51 \cdot in$

$L_{pad} := T_f - Cvr_{pad} = 33 \cdot in$

Tension: (ACI-2008 12.2.3)

Spacing or Cover Dimension =

$c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right) = 2.285 \cdot in$

Transverse Reinforcement =

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

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

Minimum Development Length =

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

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

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

$L_{tension\_Check} := if\left(L_{pier} + L_{pad} > L_{dbt}, "Okay", "No Good"\right)$

$L_{tension\_Check} = "Okay"$

Compression: (ACI-2008 12.3.2)

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

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

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

$L_{compression\_Check} := if\left(L_{pier} + L_{pad} > L_{dbc}, "Okay", "No Good"\right)$

$L_{compression\_Check} = "Okay"$

Tie Size and Spacing in Column:

Minimum Tie Size = $Tie_{min} := if(BS_{pier} \le 10, 3, 4) = 3$

Used #4 Ties

Seismic Factor = $z := if(Z \le 2, 1, 0.5) = 1$ (ACI-2008 21.10.5)

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

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

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

$s_{lim4} := 18in$

Maximum Spacing = $s_{tie} := \min\left(\begin{pmatrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{pmatrix}\right) = 16 \cdot in$

Number of Ties Required = $n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 = 4$

Check Anchor Steel Embedment:

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

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

$Depth\_Check := if(D_{ab} \ge L_{anchor}, "Okay", "No Good")$

Depth_Check = "No Good"

Note: Anchor plate is provided

SITE NAME	CANTON CT	ECP - CELL #	8	13
LATITUDE	41-49-22.35 N	LONGITUDE	72-53-42.36 W	
Additional Comments: LTE antenna add and adding 6 additional main lines		SAVE BUTTON		
		STRUCTURE TYPE		

700 Mhz - LTE ANTENNA ADD	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	eNodeB	eNodeB	eNodeB
ANTENNA TYPE	BXA-70063-6CF_2	BXA-70063-6CF_4	BXA-70063-6CF_2
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	340	100	220
DOWN TILT (MECH/DEG)	0	2	0
RAD CTR (FT AGL)	120	120	120
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

850 Celluar - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	#N/A	#N/A	#N/A
ANTENNA TYPE	LPA-80080/4CF	LPA-80080/4CF	LPA-80063/4CF
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	340	100	220
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	120	120	120.1
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

850 Celluar - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	#N/A	#N/A	#N/A
ANTENNA TYPE	LPA-80080/4CF	LPA-80080/4CF	LPA-80063/4CF
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	340	100	220
DOWN TILT (MECH/DEG)	0	2	0
RAD CTR (FT AGL)	120	120	120.1
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEX WITH LTE CABLE			

1900 PCS - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0	PCS Modcell 4.0	PCS Modcell 4.0
ANTENNA TYPE	DB950F65E-M_0	DB950F65E-M_0	DB950F65E-M_0
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	340	100	220
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	120	120	120.1
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

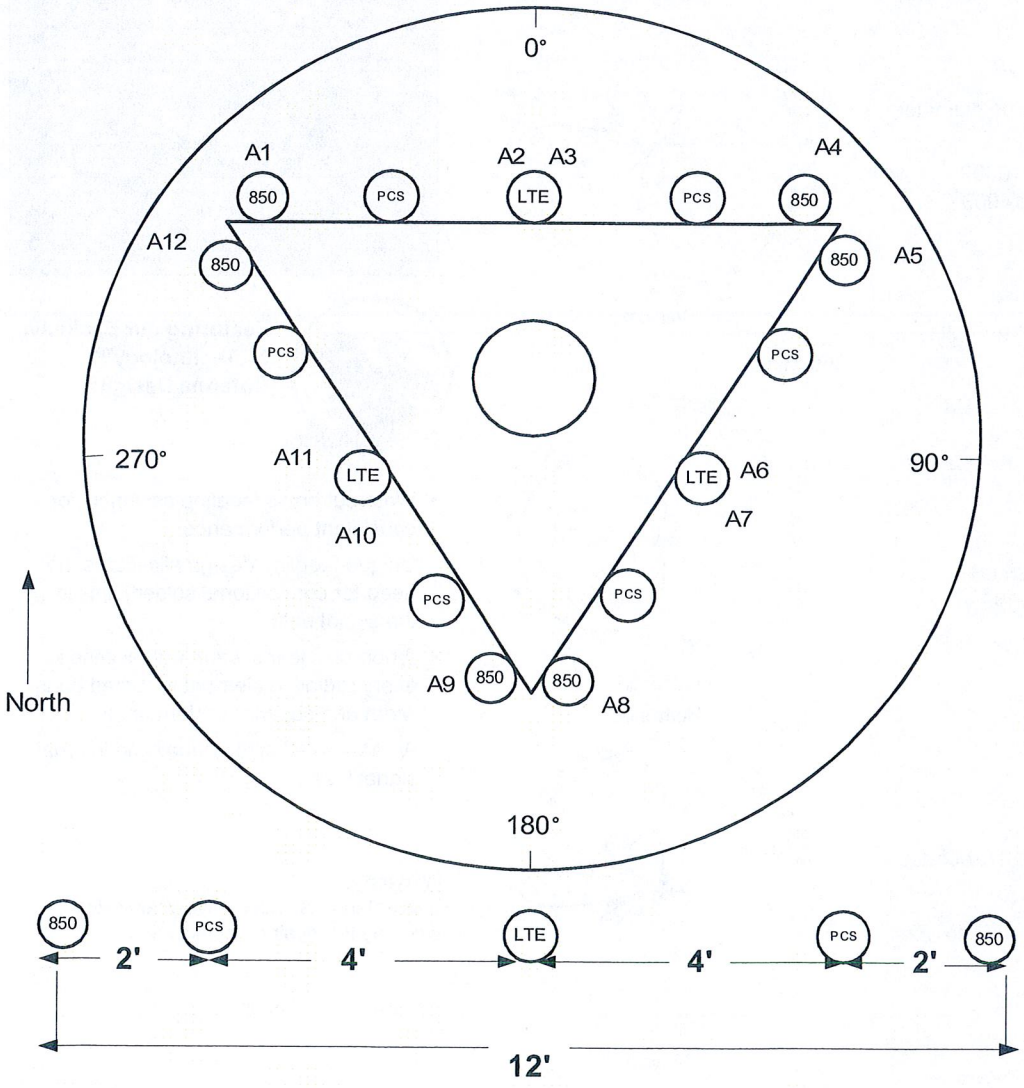
1900 PCS - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0	PCS Modcell 4.0	PCS Modcell 4.0
ANTENNA TYPE	LPA-171063-8CF_2	LPA-171063-8CF_2	LPA-171063-8CF_2
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	340	100	220
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	120	120	120.1
TMA - QTY / MODEL			
DIPLEX WITH CELLULAR CABLE			

NUMBER OF CABLE'S NEEDED					ESTIMATED CABLE LENGTH			
MAINLINE SIZE	1 5/8"	TOTAL # OF MAINLINES		18	MAINLINE (FT)			
JUMPER SIZE	1/2 "	TOTAL # OF TOP JUMPERS		18	TOP JUMPER (FT)			12
Equipment Cable Ordering		MAIN CABLE #	12	+ 6	TOP JUMPER #	12	+	6

TX / RX FREQUENCIES			TX POWER OUTPUT	
Cellular A-Band	PCS F / AWS-Band	700 Mhz C - B	Cellular (Watts)	20

TX - 869-880,890-891.5 MHz				TX - 1970-1975 / 2145-21				TX - 746-757			PCS (Watts)	16
RX - 824-835,845-846.5 MHz				RX - 1890-1895 / 1745-17				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: Mark Brauer				Steve Weatherbee				MB			8/31/2011	

Site Configuration



Slant ±45° Dual Polarized FET Panel 63° / 14.5 dBd
696-900 MHz

BXA-70063/6CF __
When ordering replace "__" with connector type.

Mechanical specifications

Length	1804	mm	71.0	in
Width	285	mm	11.2	in
Depth	114	mm	4.5	in
Depth with z-bracket	154	mm	6.1	in
Weight [4]	7.9	kg	17.0	lbs
Wind Area Fore/Aft	0.51	m^2	5.5	ft^2
Wind Area Side	0.21	m^2	2.2	ft^2
Max Wind Survivability	>201	km/hr	>125	mph
Wind Load @ 100 mph (161 km/hr)				
Fore/Aft	753	N	169	lbf
Side	351	N	79	lbf

Antenna consisting of aluminum alloy with brass feedlines covered by a UV safe fiber-glass radome.

Mounting & Downtilting

Mounting hardware attaches to pipe diameter Ø50-160 mm; Ø2.0-6.3 in

Mounting Bracket Kit	36210002
Downtilt Bracket Kit	36114003

Electrical specifications

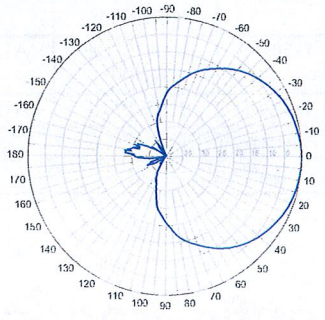
Frequency Range	696-900 MHz
Impedance	50Ω
Connector [3]	NE or E-DIN Female 2 ports / Center
VSWR [1]	≤ 1.4:1
Polarization	Slant ±45°
Isolation Between Ports [1]	< -25 dB
Gain [1]	14.5 dBd
Power Rating [2]	500 W
Half Power Angle [1]	
Horizontal Beamwidth	63°
Vertical Beamwidth	11°
Electrical downtilt [5]	0°
Null fill [1]	5%
Lightning protection	Direct ground

Patented Dipole Design: U.S. Patent No. 6,608,600 B2

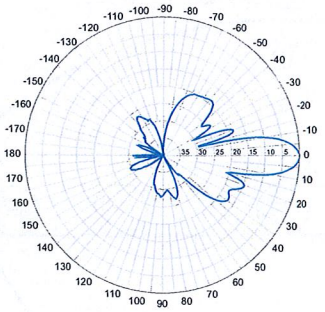
1) Typical values.
2) Power rating limited by connector only.
3) NE indicates an elongated N connector. E-DIN indicates an elongated DIN connector.
4) Antenna weight does not include brackets.
5) Add'l downtilts may be available. Check website for details.

Improvements to mechanical and/or electrical performance of the antenna may be made without notice.

Radiation-pattern[1]
750 MHz

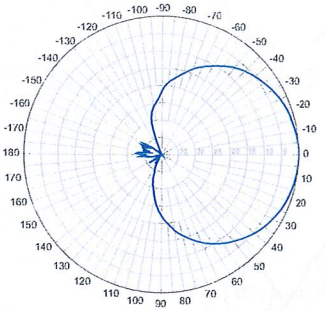


Horizontal



Vertical

850 MHz



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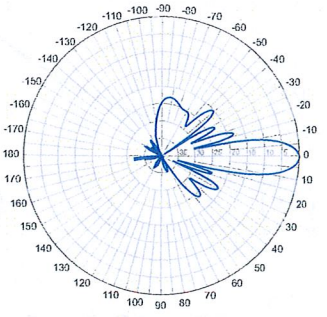
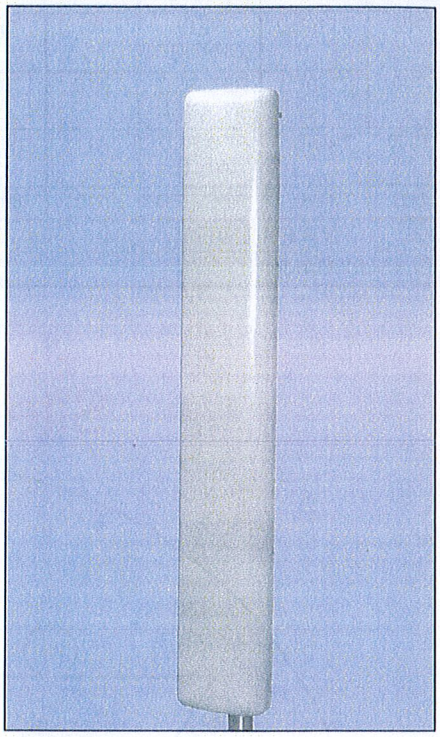


Vertical

696-900 MHz



Featuring our Exclusive 3T Technology™ Antenna Design:

- Watercut brass feedline assembly for consistent performance.
- Unique feedline design eliminates the need for conventional solder joints in the signal path.
- A non-collinear system with access to every radiating element for broad band-width and superior performance.
- Air as insulation for virtually no internal signal loss.

Warranty:
This antenna is under a five-year limited warranty for repair or replacement.

Revision Date: 08/07/08

815.399.0001 • antel@antelinc.com • www.antelinc.com

Amphenol Antel, Inc. The Antenna Technology Company

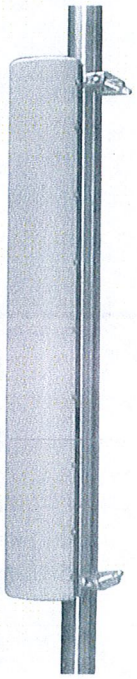
Amphenol ANTENNA SOLUTIONS

LPA-171063-8CF-EDIN-X

V-Pol | Log Periodic | 63° | 17.0-17.5 dBi

Replace "X" with desired electrical downtilt.

Antenna is available with NE connector(s). Replace "EDIN" with "NE" in the model number when ordering.

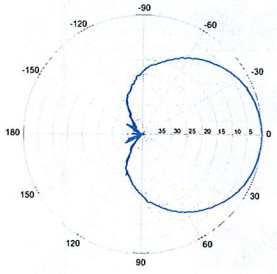


Electrical Characteristics	1710-2170 MHz		
Frequency bands	1710-1755 MHz	1850-1990 MHz	1920-2170 MHz
Polarization	Vertical		
Horizontal beamwidth	61°	63°	60°
Vertical beamwidth	6°	7°	6°
Gain	14.9 dBd (17.0 dBi)	15.4 dBd (17.5 dBi)	14.9 dBd (17.0 dBi)
Electrical downtilt (X)	0, 2		
Impedance	50Ω		
VSWR	≤ 1.5:1		
Null fill	5% (-26.02 dB)		
Input power	250 W		
Lightning protection	Direct Ground		
Connector(s)	1 Port / EDIN or NE / Female / Center (Back)		

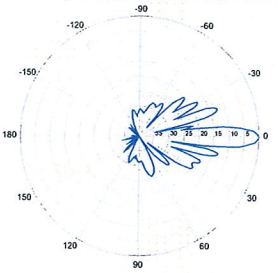
Mechanical Characteristics		
Dimensions Length x Width x Depth	1207 x 203 x 203 mm	47.5 x 8.0 x 8.0 in
Weight without mounting brackets	5.2 kg	11.5 lbs
Survival wind speed	>201 km/hr	>125 mph
Wind area	Front: 0.20 m² Side: 0.27 m²	Front: 2.2 ft² Side: 2.9 ft²
Wind load @ 161 km/hr (100 mph)	Front: 246 N Side: 323 N	Front: 55.3 lbf Side: 72.7 lbf

Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	26799997	50-102 mm 2.0-4.0 in	2.3 kg 5.0 lbs
2-Point Mounting and Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	2.3 kg 5.0 lbs

1710-1880 MHz

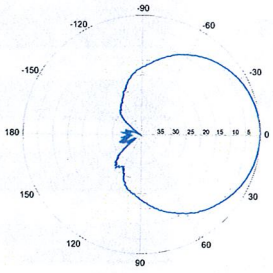


Horizontal



0° | Vertical

1850-1990 MHz



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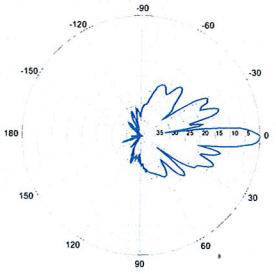
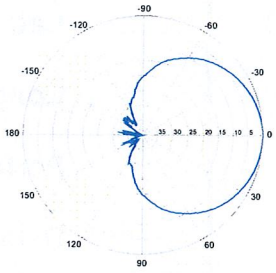


0° | Vertical

1920-2170 MHz



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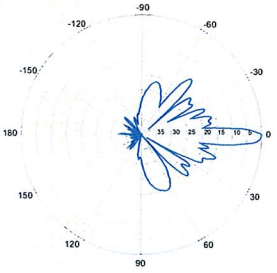


0° | Vertical

JWB Tower Services, LLC
148 Governor Street
New Britain, CT 06053
(800) 819-3084
(860) 256-8175 fax

Monopole Inventory
General Information

Site Name:		Canton Fire Department
Site Number:		
FCC Number:		
Manufacturer ID #		EEI
Street Address:		14 Canton Springs Road
City/State/Zip Code:		Canton, CT
County:		
Lat:	N/S	41° 49' 22"
Long:	E/W	72° 53' 43"
Performed By:		JWB
Date:		9/11/2011

Antenna Information:

CARRIER	Town					PIC #	3

MOUNT

Type:	Standoff	Manf.:	Unknown				
Elev. C/L:	138'	Bottom:		Top:		Leg:	
Face Width:	4"	Height:	4"	Projection:	4'	Azimuth/s:	

ANTENNA

Type:	Omni	Manf.:	Unknown	Model:			
Elev. C/L:		Bottom:	138'	Top:	158'	Leg:	
Quantity:	1	Dim: (HxWxD)	20'x2"			Azimuth/s:	

TMA'S

Quantity:	N/A	Manf.:		Model:	

COAX One coax doesn't appear to be in use

Quantity:	2	Size:	7/8"	Jumper:	1/2"	Color:	N/A

CARRIER	AT&T					PIC #	4

MOUNT

Type:	Plat w/ rail	Manf.:	EEI				
Elev. C/L:	128'	Bottom:		Top:		Leg:	
Face Width:	13'	Height:	3'	Projection:	N/A	Azimuth/s:	

ANTENNA 1 - Outer

Type:	Panel	Manf.:	CSS	Model:	DUO1417-8686-4		
Elev. C/L:	130'	Bottom:		Top:		Leg:	
Quantity:	6	Dim: (HxWxD)				Azimuth/s:	

ANTENNA 2 - Inner

Type:	Panel	Manf.:	Kathrein	Model:	80010121		
Elev. C/L:	130'	Bottom:		Top:		Leg:	
Quantity:	3	Dim: (HxWxD)				Azimuth/s:	

TMA'S - Outer

Quantity:	6	Manf.:	ADC - Cleargain	Model:	DD1900 w/800 bypass 12"x10"x3"

TMA'S Inner

Quantity:	3	Manf.:	Kathrein	Model:	TMA: 78210250
Quantity:	3	Manf.:	Kathrein	Model:	Bias T: 4"x4"x2"
Quantity:	3	Manf.:	CSS	Model:	Comminer: 10"x7"x2"

COAX

Quantity:	12	Size:	7/8"	Jumper:	1/2"	Color:	N/A

CARRIER: Verizon — PIC #: 5

MOUNT

Type:	Plat w/ rail	Manf.:	EEI				
Elev. C/L:	118'	Bottom:		Top:		Leg:	
Face Width:	13'	Height:	4"	Projection:	N/A	Azimuth/s:	

ANTENNA 1 - Outer

Type:	Panel	Manf.:	Antel/Amphenol	Model:	LPA-80063/4CF		
Elev. C/L:	120'	Bottom:		Top:		Leg:	
Quantity:	2	Dim: (HxWxD)				Azimuth/s:	

ANTENNA 2 - Outer

Type:	Panel	Manf.:	Antel/Amphenol	Model:	LPA-80080/4CF		
Elev. C/L:	120'	Bottom:		Top:		Leg:	
Quantity:	4	Dim: (HxWxD)				Azimuth/s:	

ANTENNA 3 - Inner

Type:	Panel	Manf.:	Andrew/Decibel	Model:	DB950F65E-M		
Elev. C/L:	120'	Bottom:		Top:		Leg:	
Quantity:	6	Dim: (HxWxD)				Azimuth/s:	

GPS

Quantity:	1	Manf.:	Unknown	Model:	6"x4"

COAX

Quantity:	12	Size:	1 5/8"	Jumper:	1/2"	Color:	N/A
Quantity:	1	Size:	1/2"	Jumper:	N/A	Color:	N/A

CARRIER: Sprint Nextel — PIC #: 6

MOUNT

Type:	Plat w/ rail	Manf.:	EEI				
Elev. C/L:	110'	Bottom:		Top:		Leg:	
Face Width:	13'	Height:	4"	Projection:	N/A	Azimuth/s:	

ANTENNA

Type:	Panel	Manf.:	Decibel	Model:	DB844... Label Faded		
Elev. C/L:	112'	Bottom:		Top:		Leg:	
Quantity:	12	Dim: (HxWxD)	48"x6.5"x8"			Azimuth/s:	

LMU

Quantity:	2	Manf.:	Unkown	Model:	4"x2"

COAX

Quantity:	12	Size:	1 1/4"	Jumper:	1/2"	Color:	N/A
Quantity:	2	Size:	1/2"	Jumper:	N/A	Color:	N/A

CARRIER: T-Mobile — PIC #: 7

MOUNT

Type:	Platform	Manf.:	Unknown				
Elev. C/L:	100'	Bottom:		Top:		Leg:	
Face Width:	13'-6"	Height:	6"	Projection:		Azimuth/s:	

ANTENNA

Type:	Panel	Manf.:	EMS	Model:	RR901702DP		
Elev. C/L:	100'	Bottom:		Top:		Leg:	
Quantity:	4	Dim: (HxWxD)				Azimuth/s:	

TMA'S

Quantity:	N/A	Manf.:		Model:	

COAX

Quantity:	8	Size:	1 5/8"	Jumper:	1/2"	Color:	N/A

CARRIER: Sprint — PIC #: 8

MOUNT

Type:	Lo-Pro Plat	Manf.:	Summit				
Elev. C/L:	90'	Bottom:		Top:		Leg:	
Face Width:	14'	Height:	3"	Projection:		Azimuth/s:	

ANTENNA 1

Type:	Panel	Manf.:	Decibel	Model:	980F90T2E-M		
Elev. C/L:	91'	Bottom:		Top:		Leg:	
Quantity:	4	Dim: (HxWxD)				Azimuth/s:	

ANTENNA 2

Type:	Panel	Manf.:	Decibel	Model:	978F30T2E-M		
Elev. C/L:	91'-6"	Bottom:		Top:		Leg:	
Quantity:	2	Dim: (HxWxD)				Azimuth/s:	

TMA'S

Quantity:	N/A	Manf.:		Model:	

COAX

Quantity:	6	Size:	1 1/4"	Jumper:	1/2"	Color:	N/A

CARRIER: MetroPCS — PIC #: 9

MOUNT

Type:	Flush	Manf.:	Unknown/Chain Mount				
Elev. C/L:	83'	Bottom:		Top:		Leg:	
Face Width:	2.5"	Height:	N/A	Projection:	N/A	Azimuth/s:	

ANTENNA

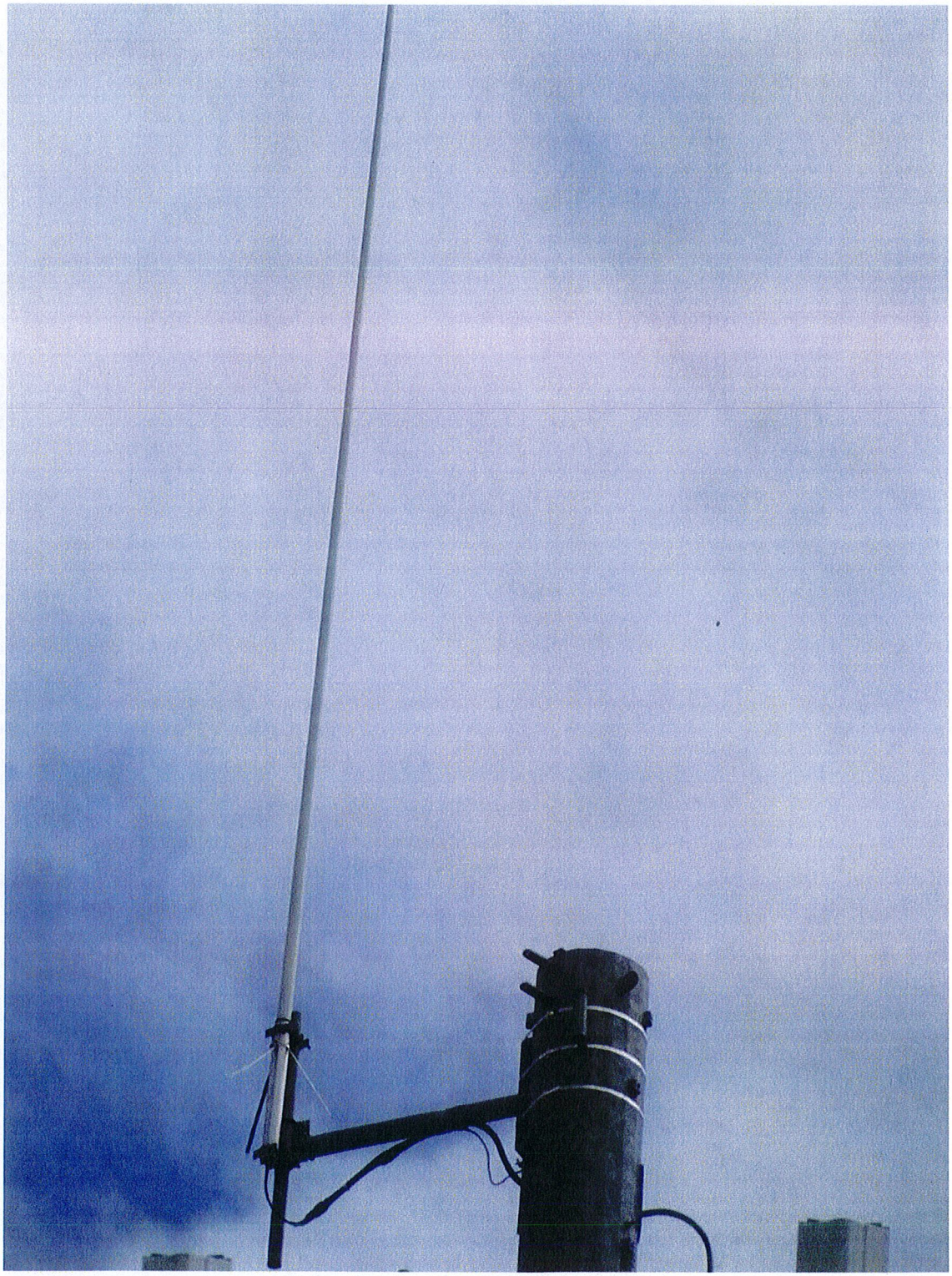
Type:	Panel	Manf.:	RFS	Model:	APXV18-206517S		
Elev. C/L:	83'	Bottom:		Top:		Leg:	
Quantity:	3	Dim: (HxWxD)				Azimuth/s:	

COAX

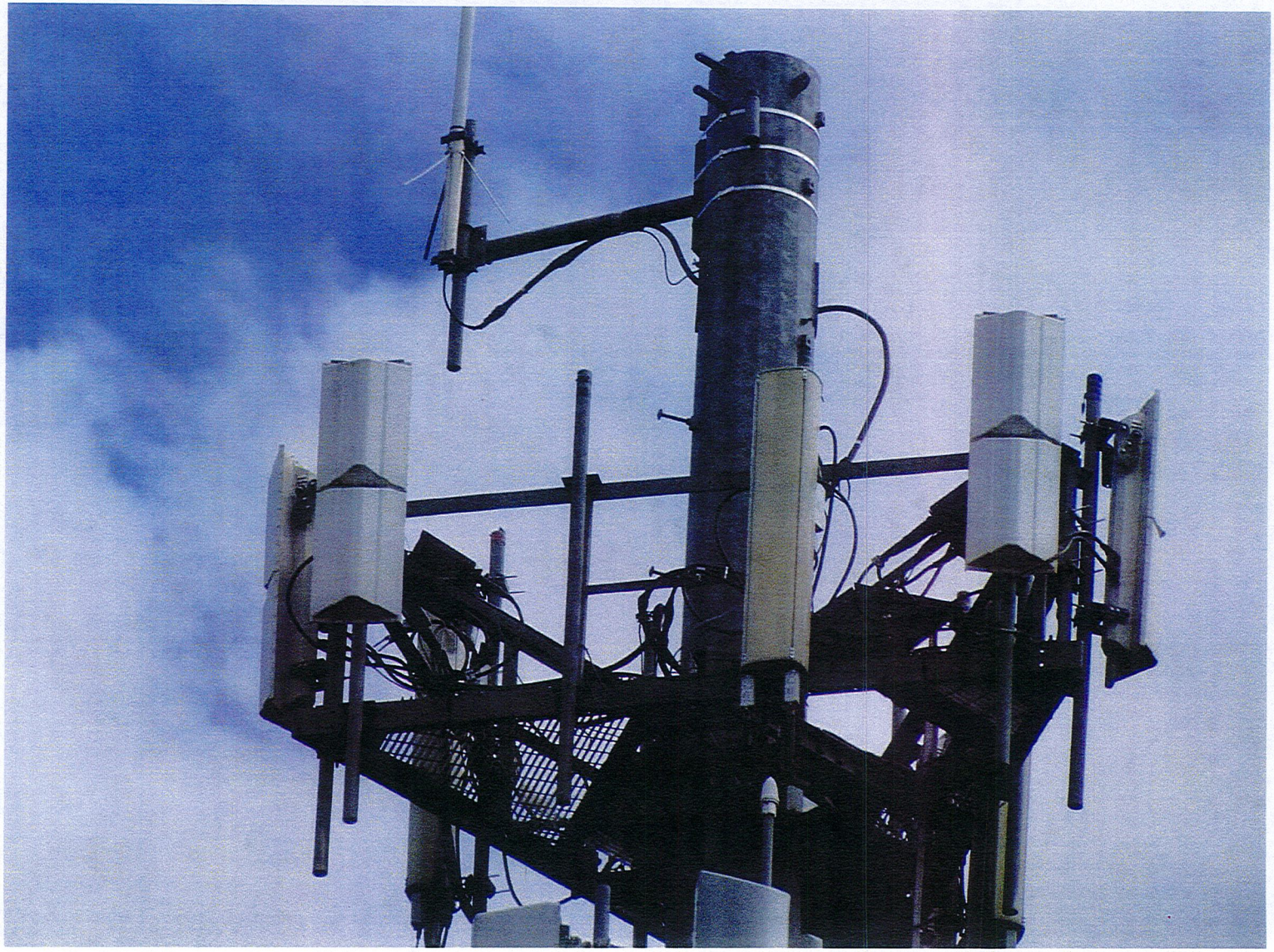
Quantity:	6	Size:	1 5/8"	Jumper:	1/2"	Color:	N/A

1.0 Elevation

2.0 Base

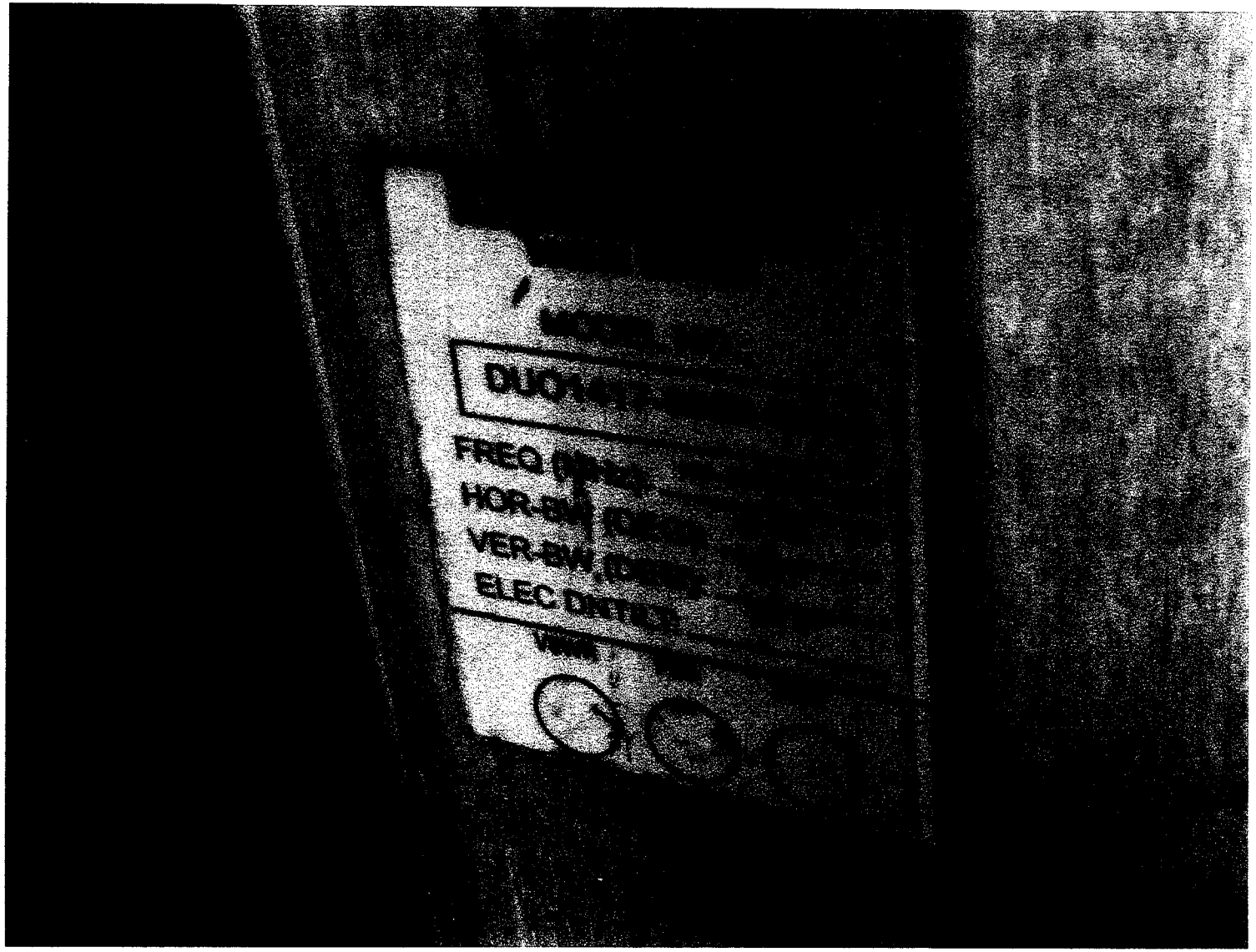


3.0 Town

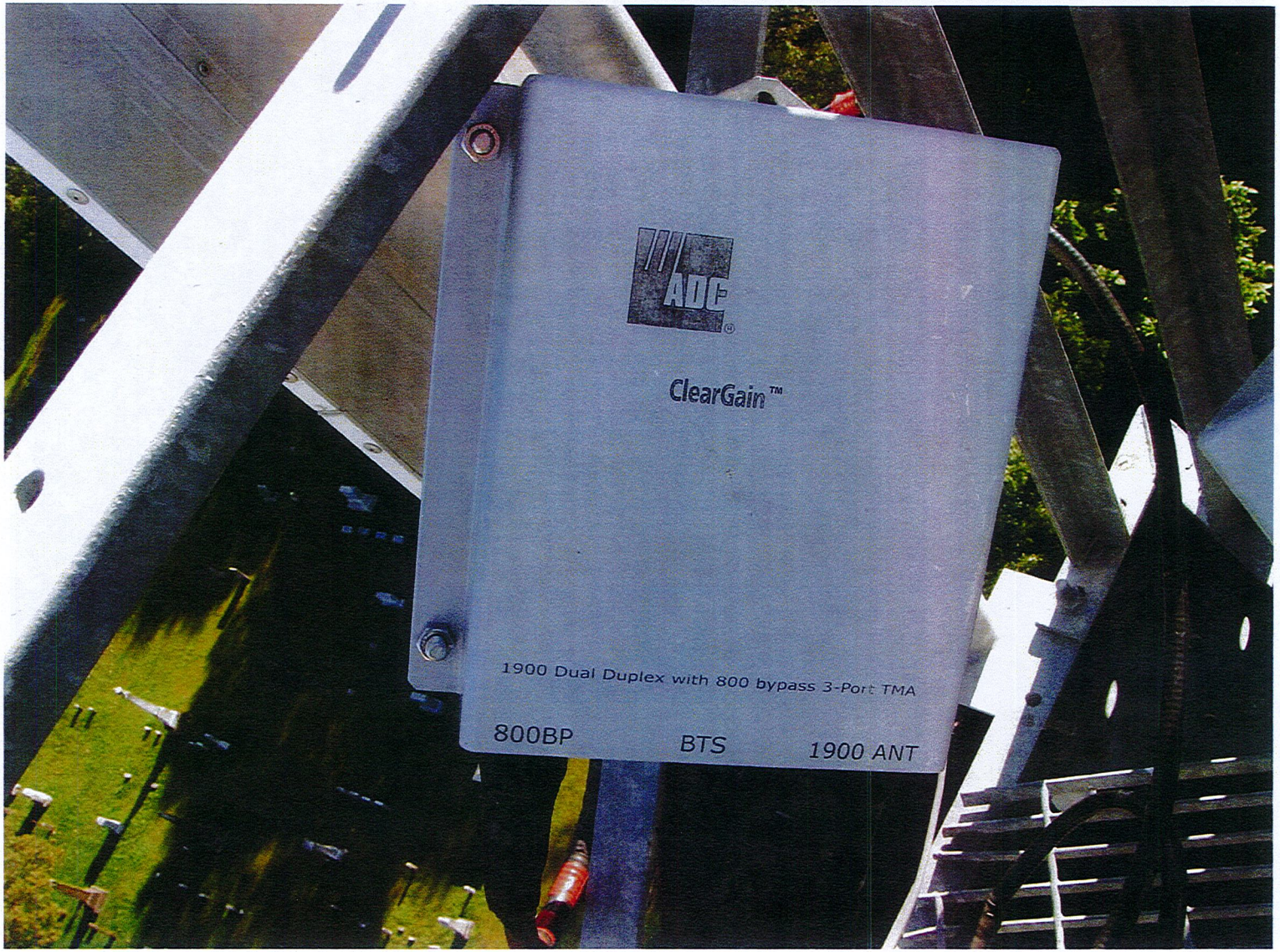


4.1 ATT

4.2 ATT



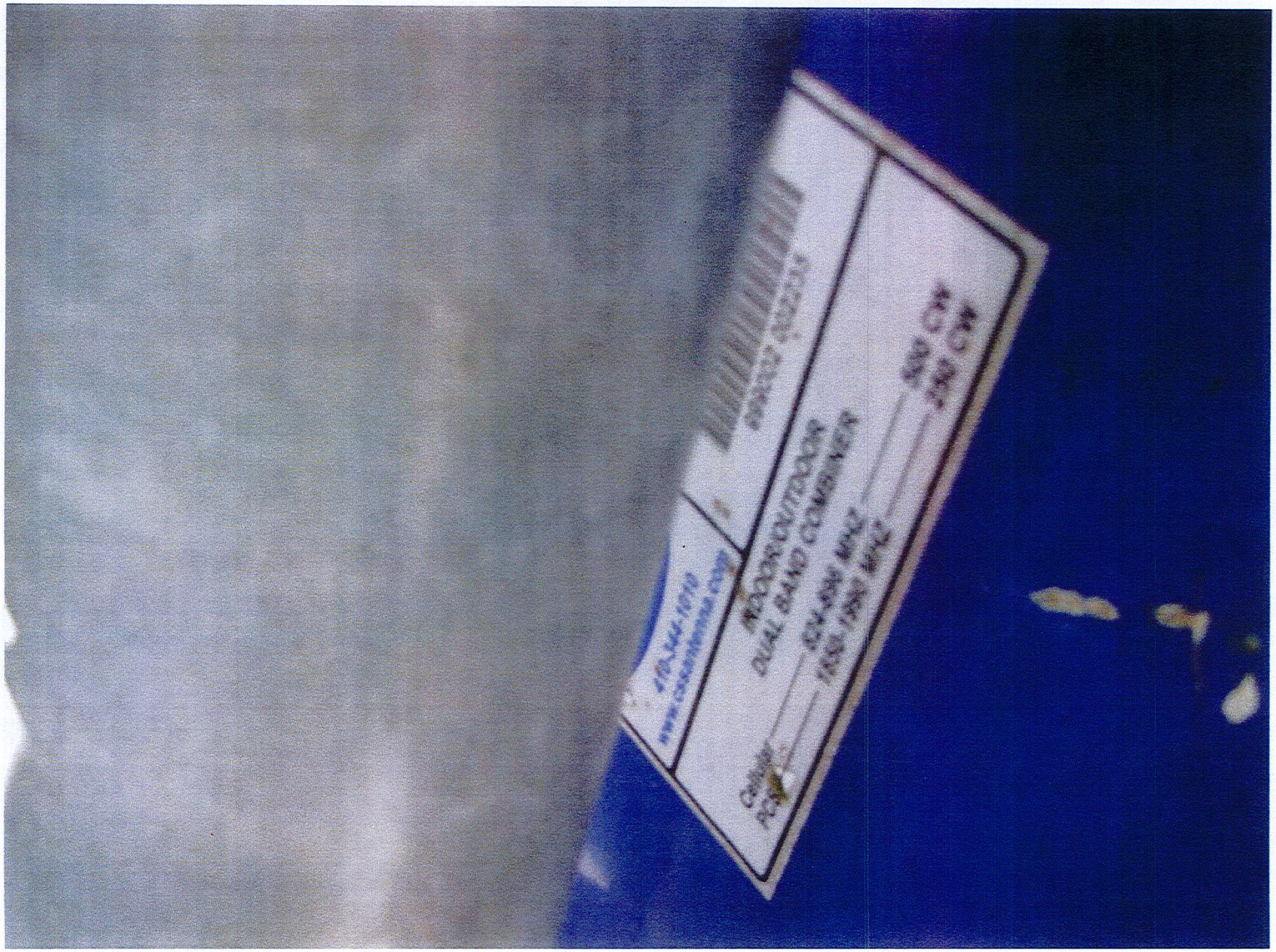
4.3 ATT


ADC
ClearGain™
1900 Dual Duplex with 800 bypass 3-Port TMA
800BP
BTS
1900 ANT

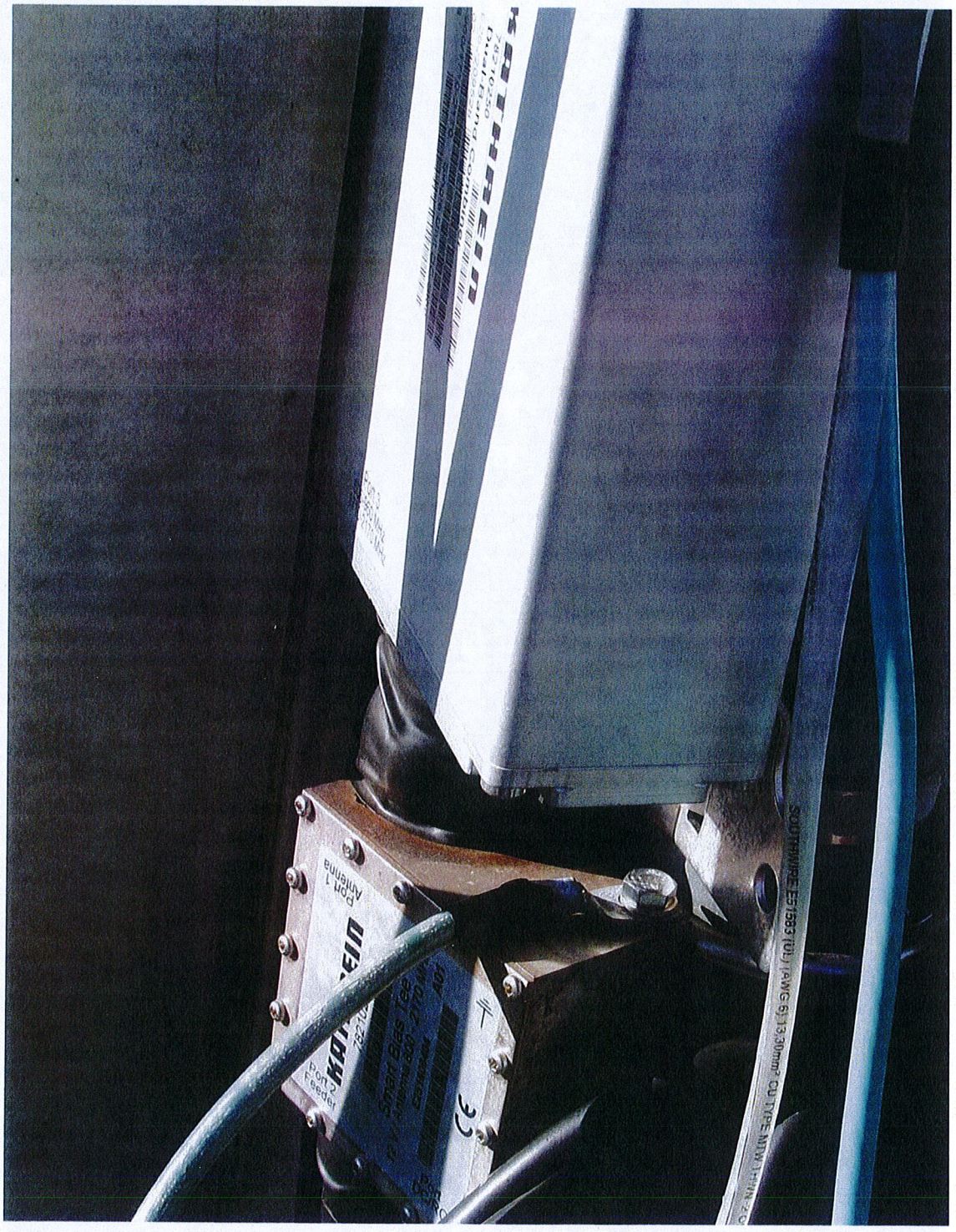
4.4 ATT


KATHREIN
Type no. 80010121
Type XXPol A-Panel 806-960/1710-2180
88° /88° 13.5/16.5dBi 0°-12°/0° -10°T
Serial no. W055119020
X mm
2° 83
4° 121
6° 166
8° 214
10° 263
13° 337
16°

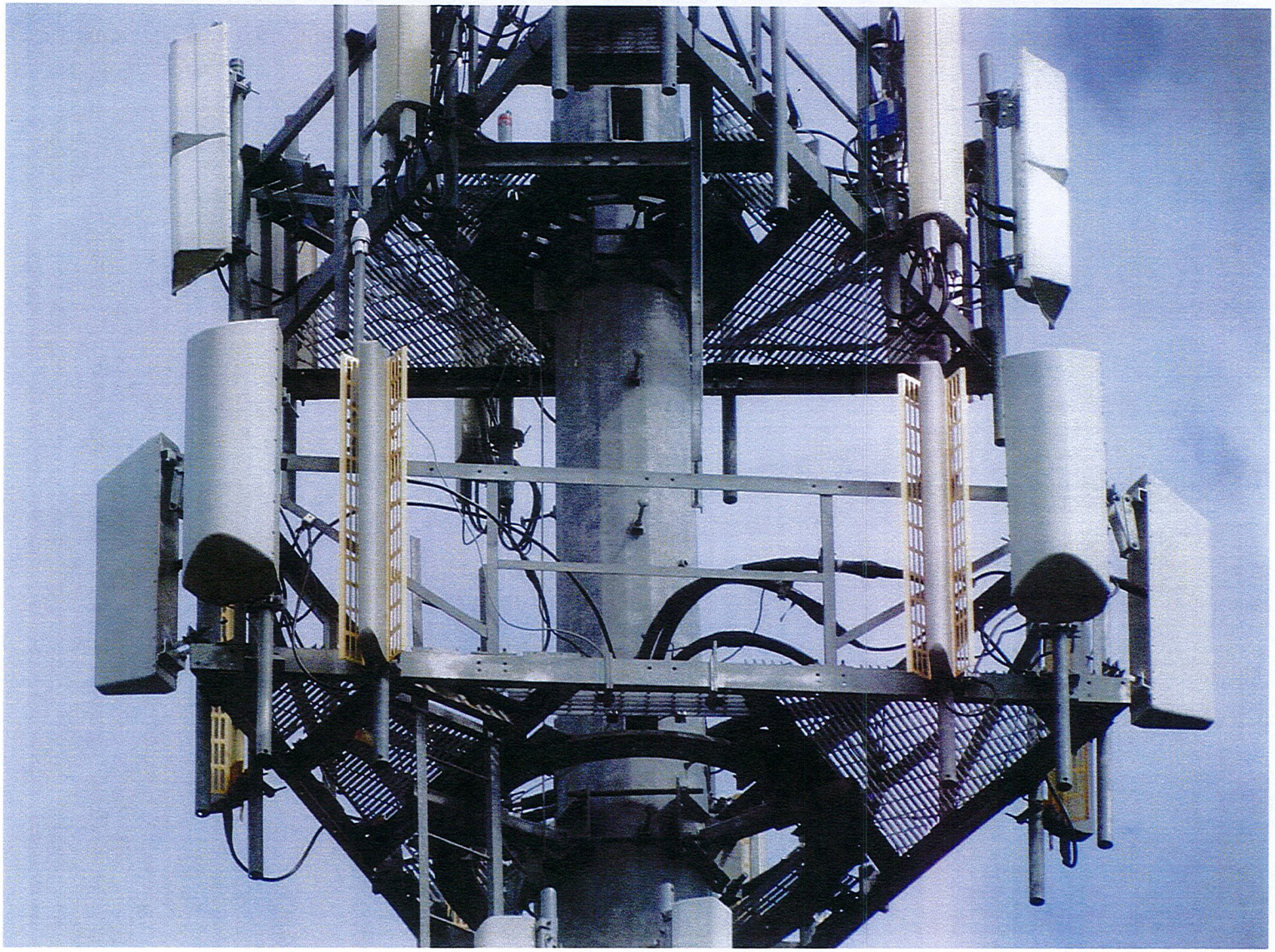
4.5 ATT



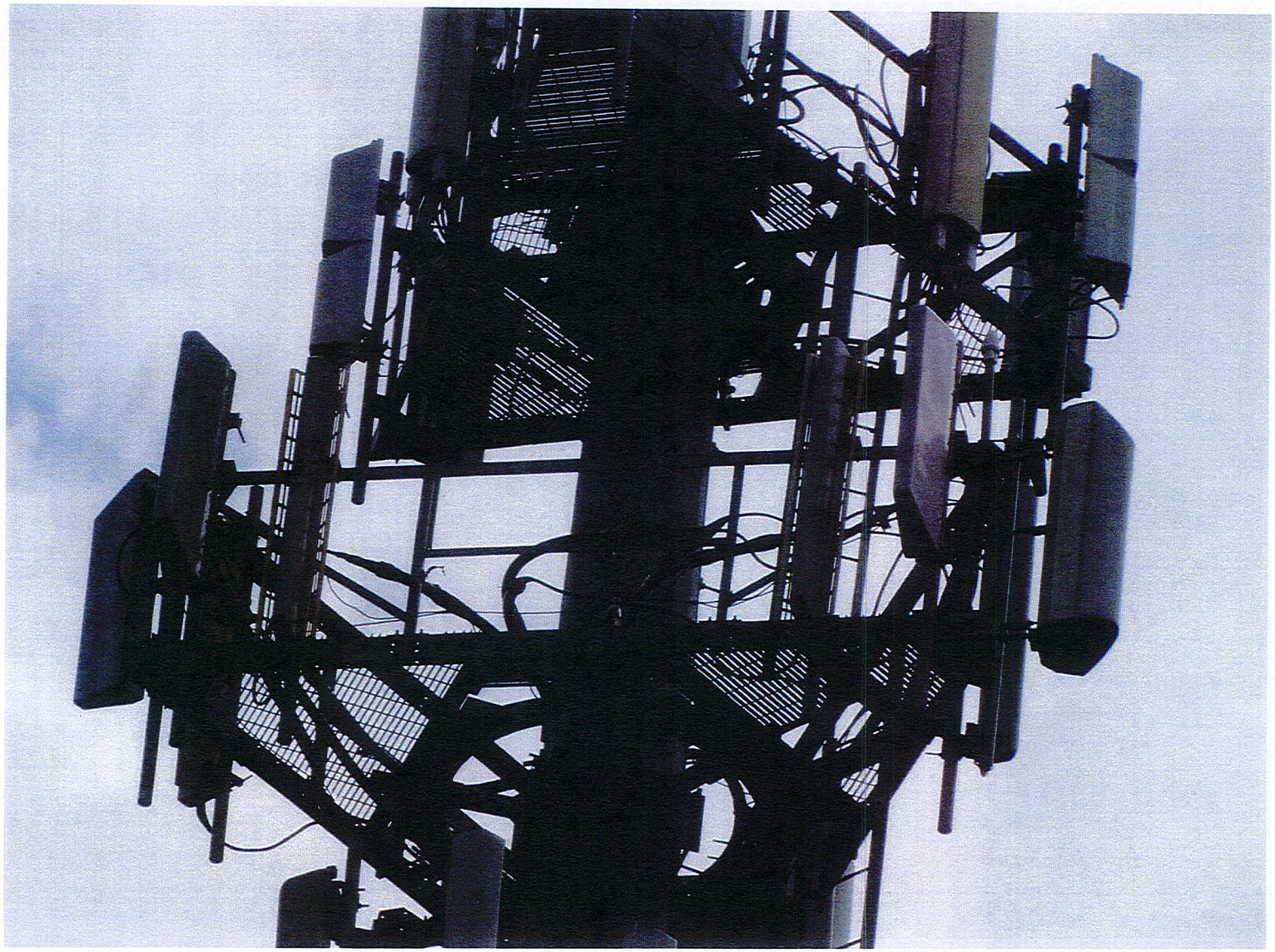
4.6 ATT



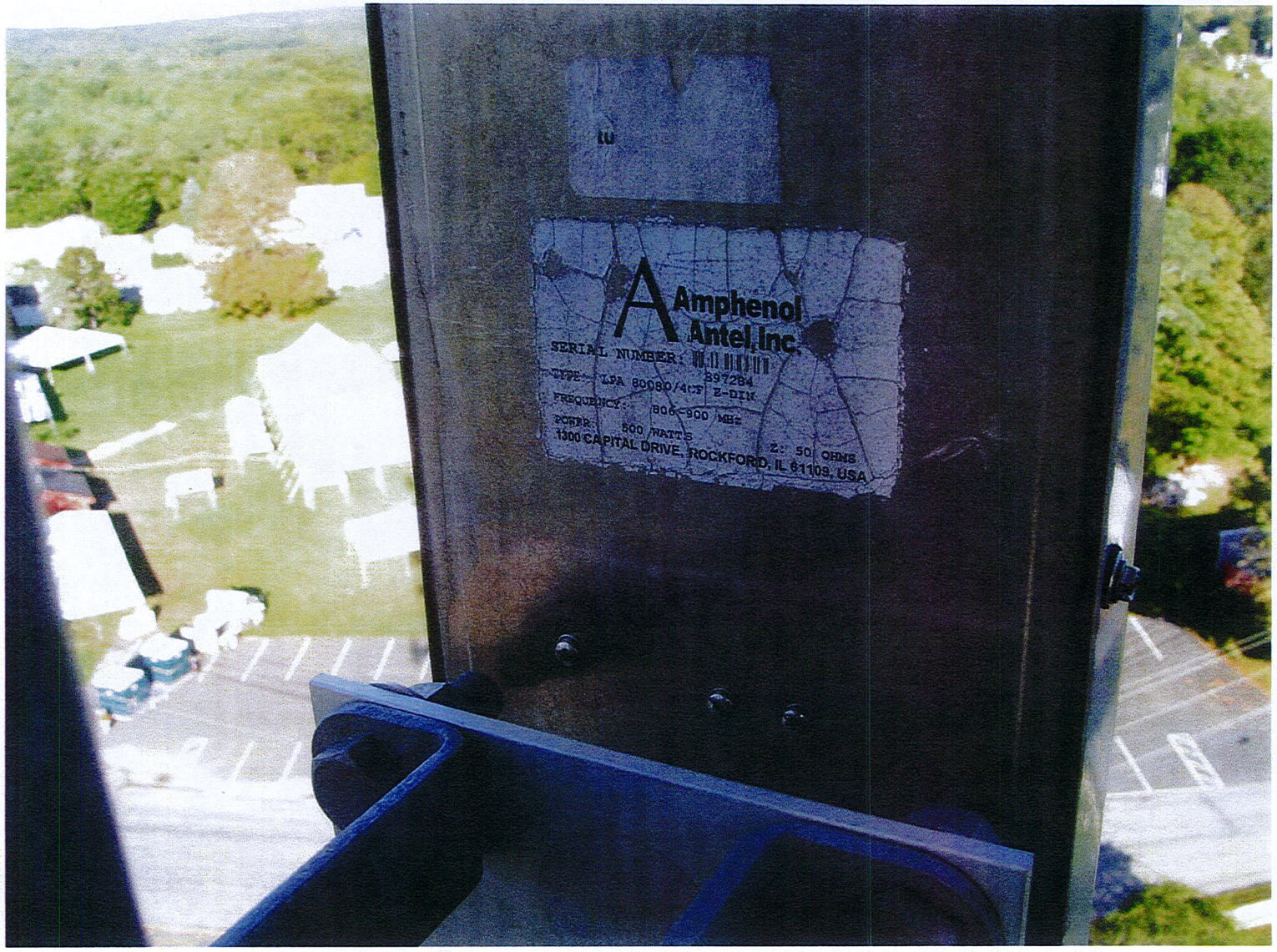
4.7 ATT



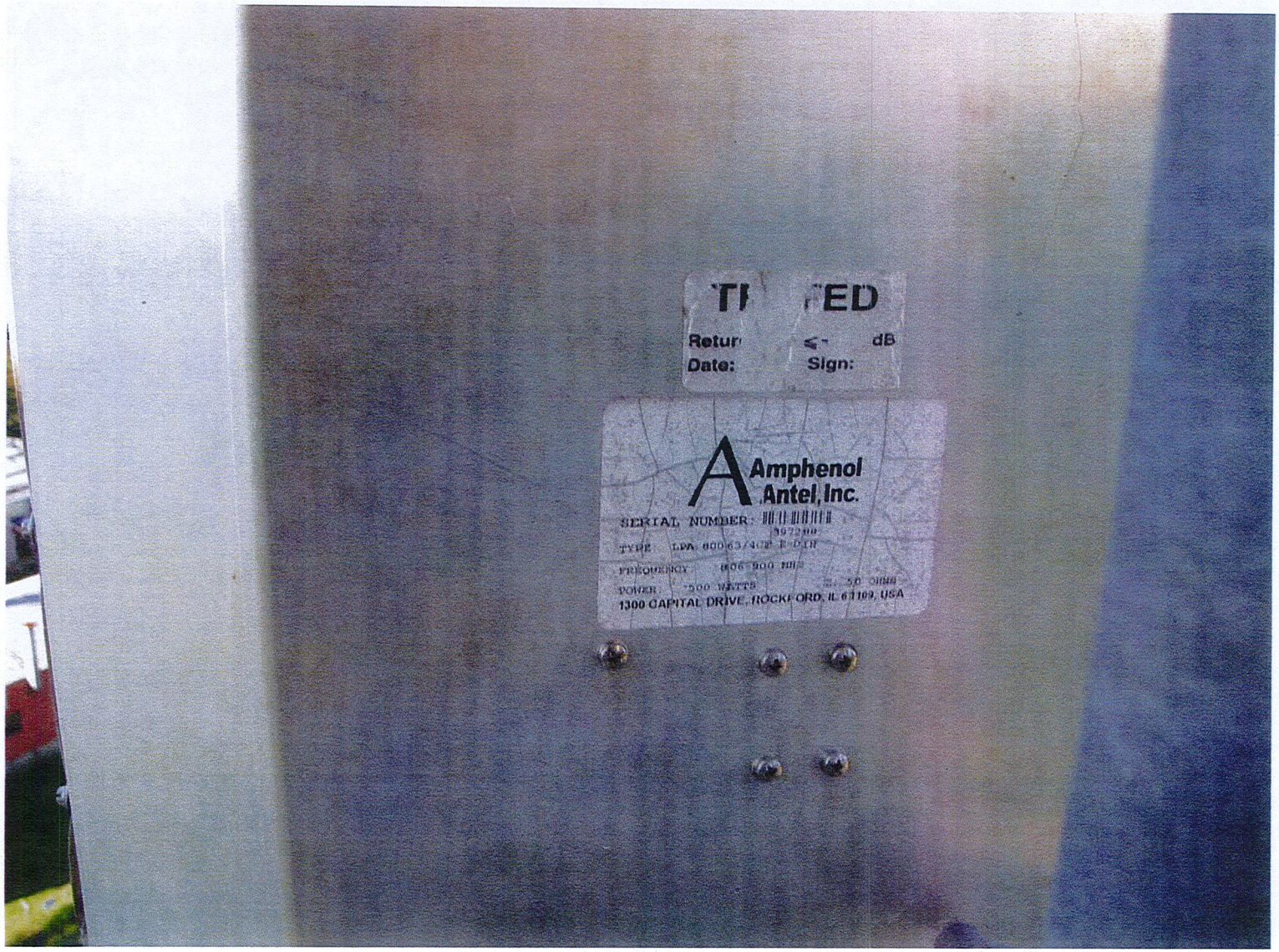
5.1 Verizon



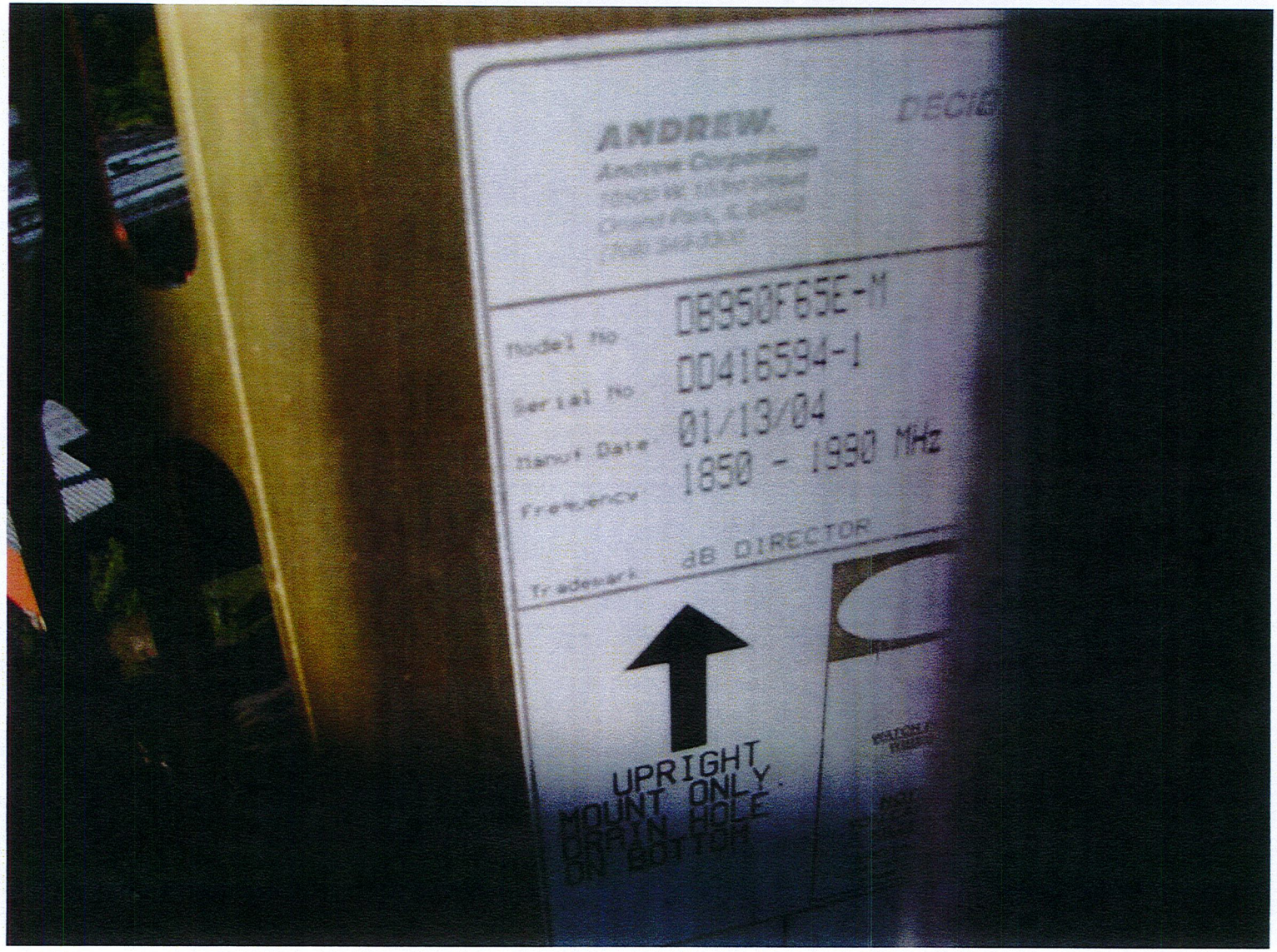
5.2 Verizon


Amphenol
Antel, Inc.
SERIAL NUMBER:
897284
TYPE: LPA 80080/4CF E-DIM
FREQUENCY: 806-900 MHz
POWER: 500 WATTS
Z: 50 OHMS
1300 CAPITAL DRIVE, ROCKFORD, IL 61109, USA

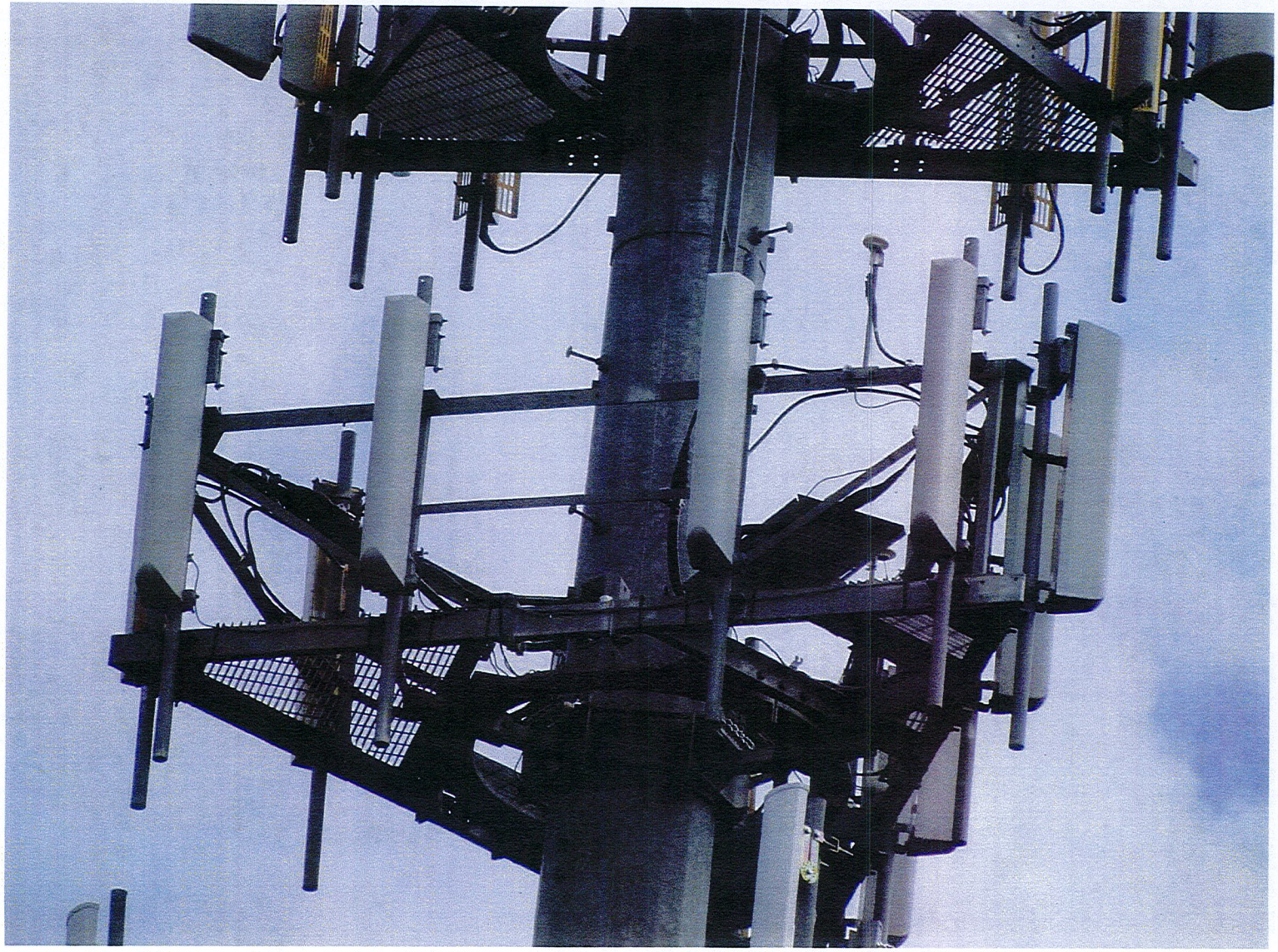
5.3 Verizon


TI ED
Retur ≤- dB
Date: Sign:
Amphenol
Antel, Inc.
SERIAL NUMBER:
TYPE LPA
FREQUENCY 806-900 MHz
POWER 500 WATTS
1300 CAPITAL DRIVE, ROCKFORD, IL 61109, USA

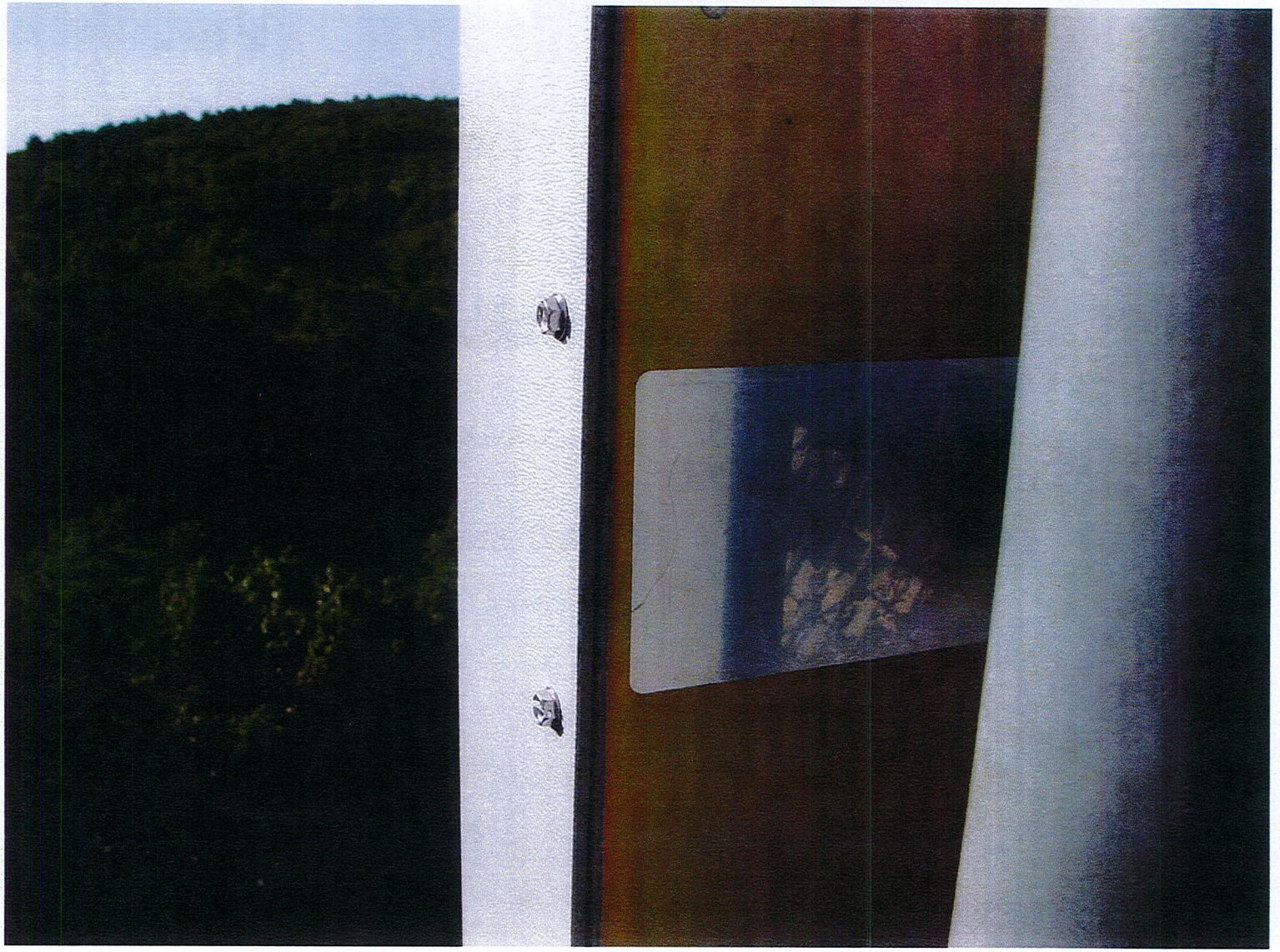
5.4 Verizon


ANDREW.
Andrew Corporation
Model No
DB950F65E-M
Serial No
00416594-1
Manuf Date
01/13/04
Frequency
1850 - 1990 MHz
Tradewark
dB DIRECTOR
UPRIGHT
MOUNT ONLY.
DRAIN HOLE
ON BOTTOM

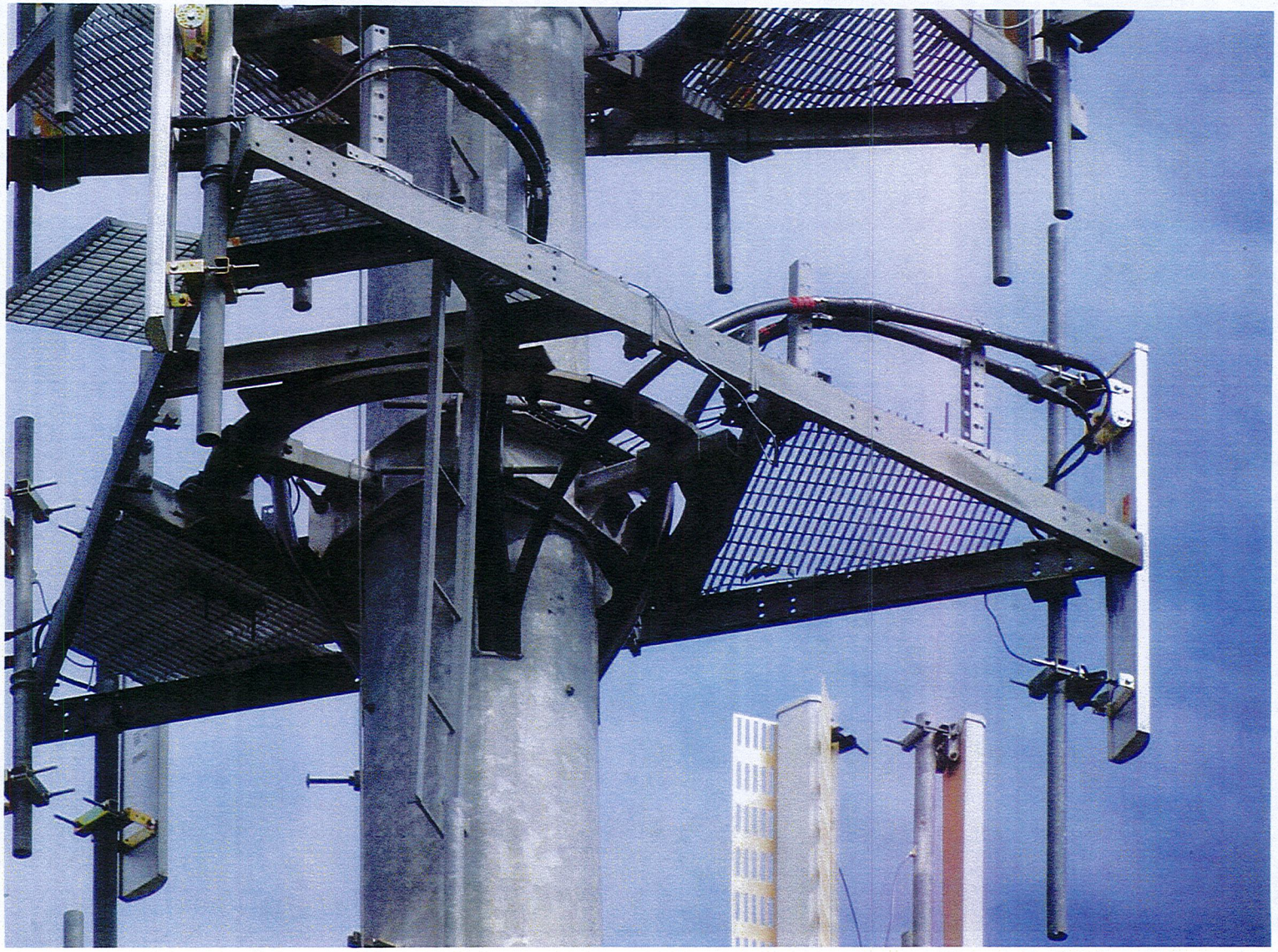
5.5 Verizon



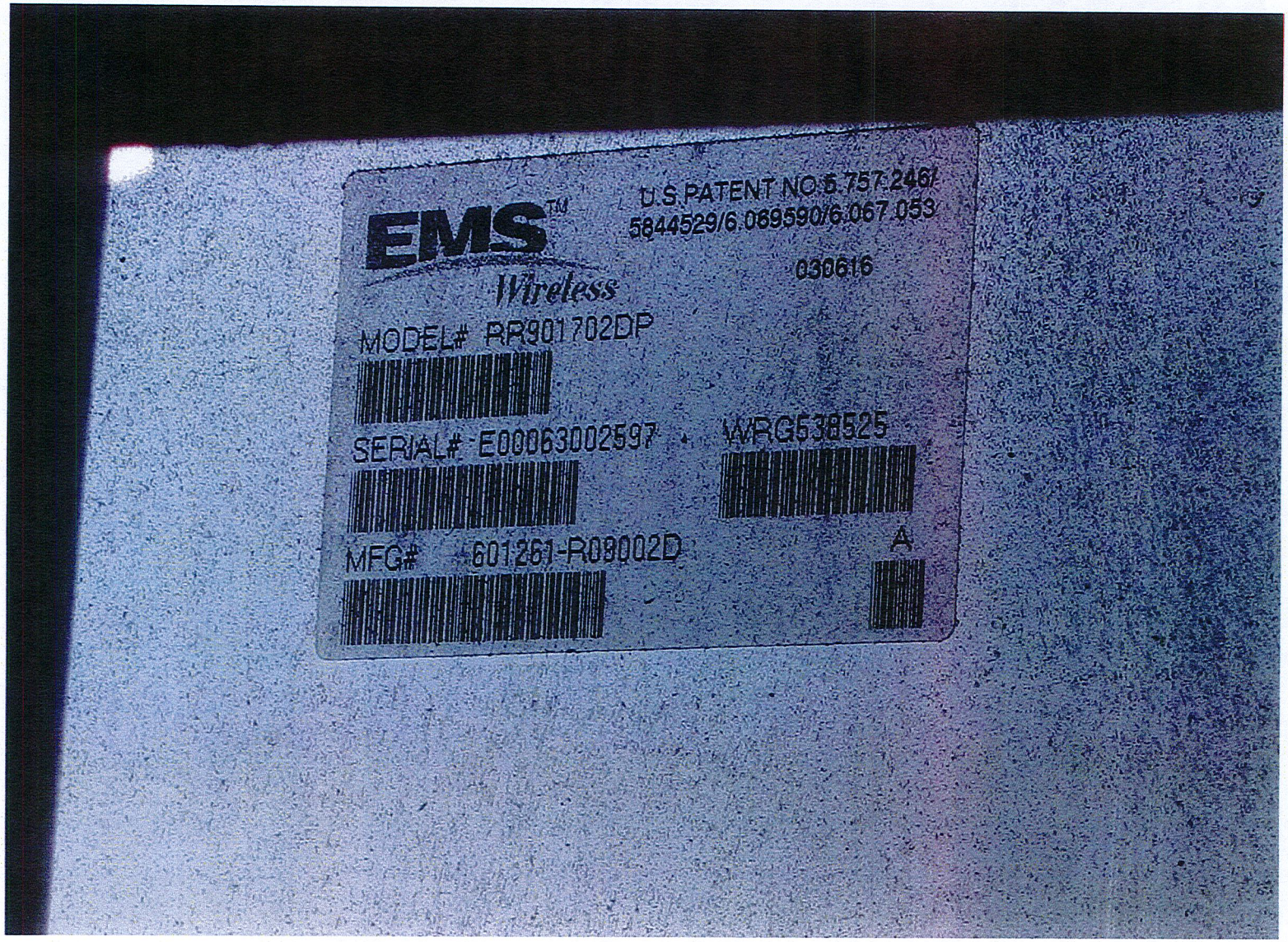
6.1 Sprint Nextel



6.2 Sprint Nextel

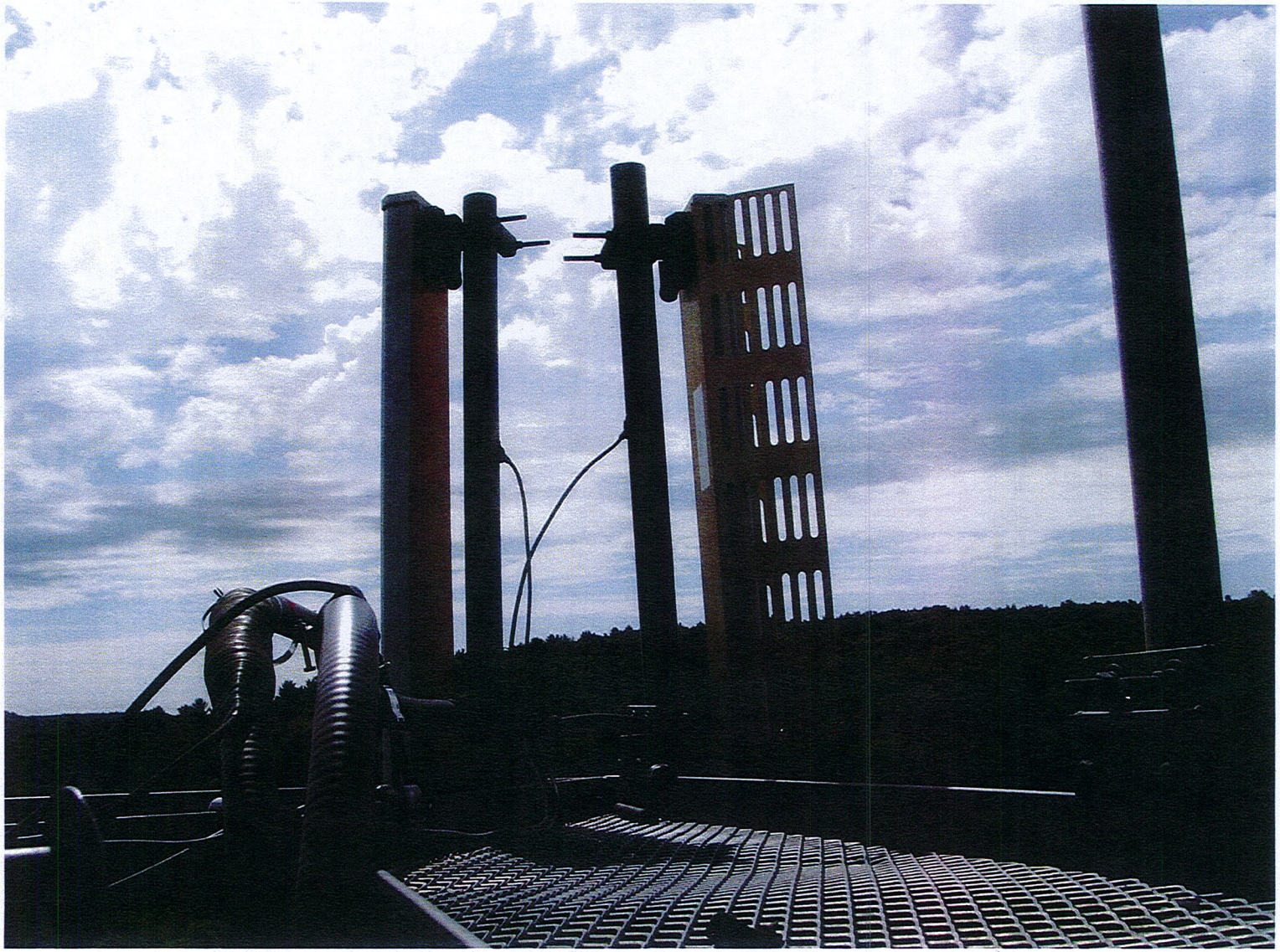


7.1 T-Mobile

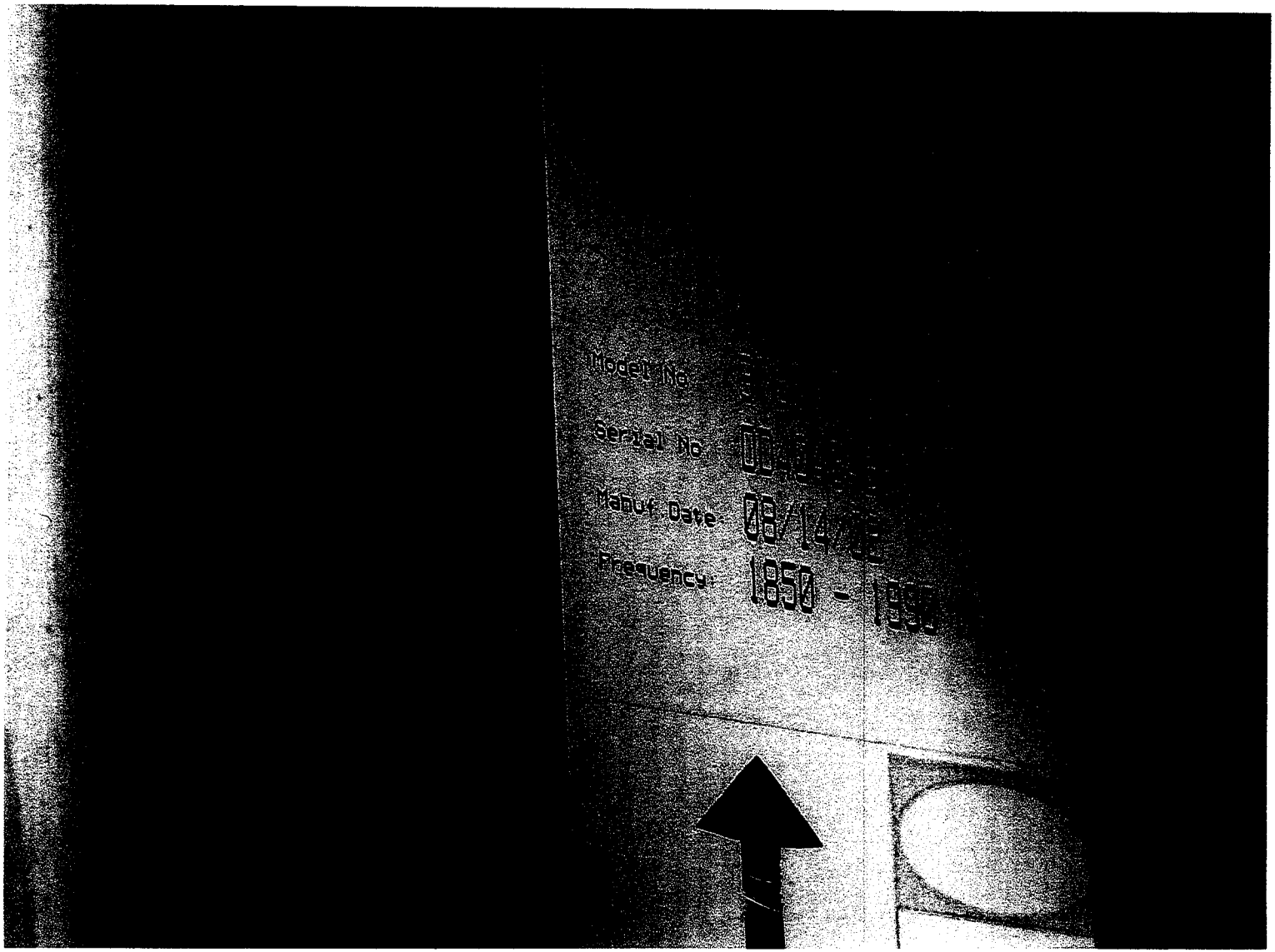

EMS™
Wireless
U.S.PATENT NO.5,757,246/
5844529/6.069590/6.067 053
030616
MODEL# RR901702DP
SERIAL# E00063002597
WRG538525
MFG# 601261-R09002D
A

7.2 T-Mobile

8.1 Sprint



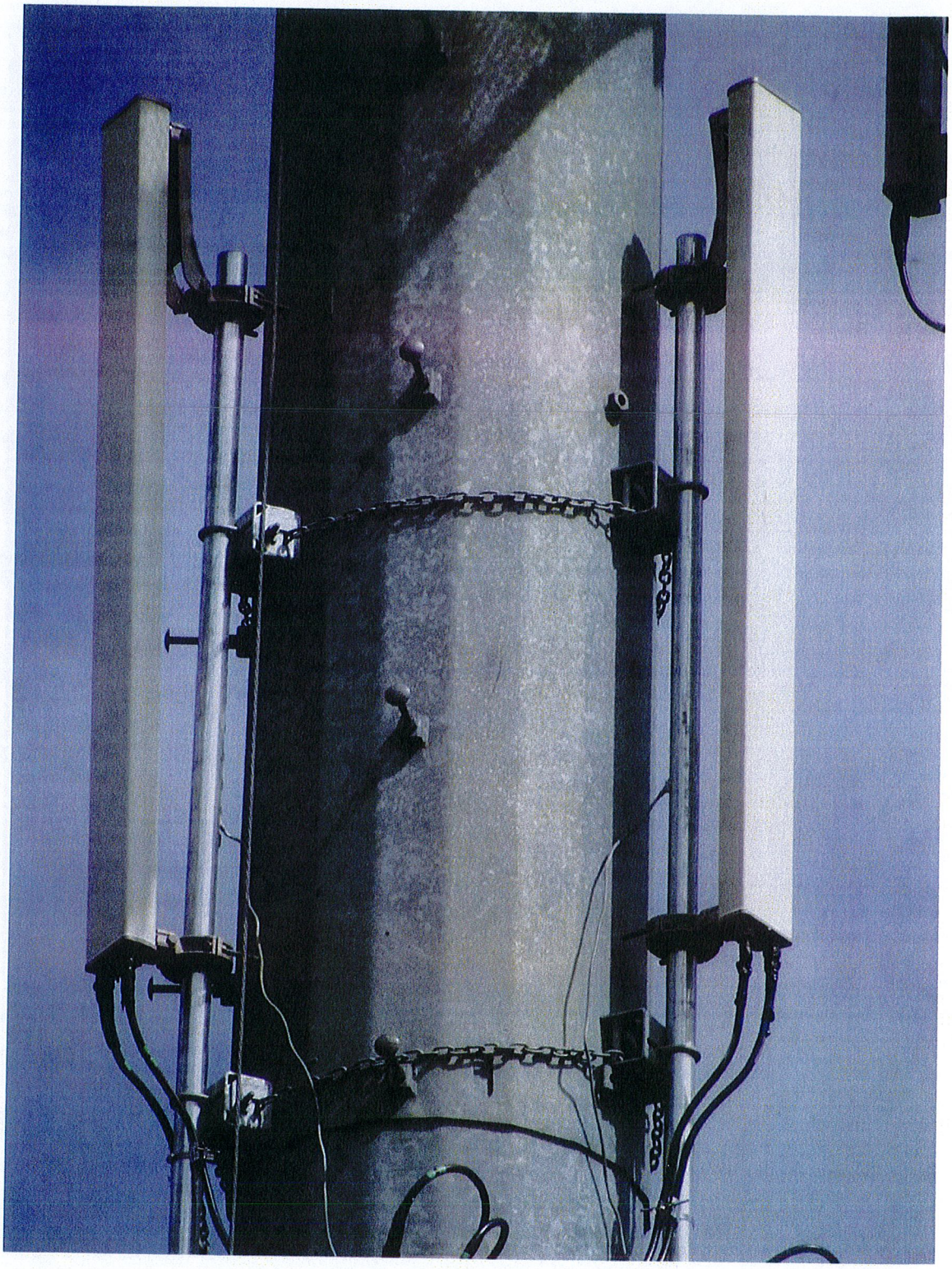
8.2 Sprint



8.3 Sprint


UPRIGHT
MOUNT ONLY
DRAIN HOLE
ON BOTTOM
NOTE
YOU CAN BE
KILLED

8.4 Sprint



9.1 MetroPCS

9.2 MetroPCS