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

March 26, 2012

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

Re: **Completion of Construction Activity**
EM-VER-009-111207 – Spring Hill Road, Bethel, Connecticut
EM-VER-014-111021 – 21 Acorn Road, Branford, Connecticut
EM-VER-023-120110 – 650 Albany Turnpike, Canton, Connecticut
EM-VER-032-111108 – 330 Middletown Road, Coventry , Connecticut
EM-VER-030-111005 – 400 Riley Mountain Road, Coventry, Connecticut
EM-VER-111-111213 – 297 North Adams Street, Plymouth, Connecticut
EM-VER-099-111101 – 83 Reeds Gap Road, North Branford, Connecticut

Dear Ms. Roberts:

The purpose of this letter is to notify you and the Connecticut Siting Council that construction activity associated with each of the above-referenced facility modification filings 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

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

December 23, 2011

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

RE: **EM-VER-009-111207** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 38 Spring Hill Lane, Bethel, 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 December 5, 2011. 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,

Linda Roberts
Executive Director

LR/CDM/laf

c: The Honorable Matthew S. Knickerbocker, First Selectman, Town of Bethel
Steve Palmer, Planning & Zoning Official, Town of Bethel
Valley Communications

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

December 8, 2011

The Honorable Matthew S. Knickerbocker
First Selectman
Town of Bethel
1 School Street
Bethel Municipal Center
Bethel, CT 06801-2105

RE: **EM-VER-009-111207** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 38 Spring Hill Lane, Bethel, Connecticut.

Dear First Selectman Knickerbocker:

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 December 22, 2011.

Thank you for your cooperation and consideration.

Very truly yours,

Linda Roberts
Executive Director

LR/jbw

Enclosure: Notice of Intent

c: Steve Palmer, Planning & Zoning Official, Town of Bethel

EM-VER-009-111207

ROBINSON & COLE

KENNETH C. BALDWIN

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

December 5, 2011

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

Re: **Notice of Exempt Modification – Antenna Swap**
38 Spring Hill Lane, Bethel, Connecticut

Dear Ms. Roberts:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains wireless telecommunications antennas at the 95-foot level on the existing 125-foot tower at the above-referenced address. The tower is owned by Valley Communications. The Council approved Cellco's use of the existing tower in 2006. Cellco now intends to modify its installation by replacing six (6) of its existing antennas with three (3) model BXA-171063-12BF PCS antennas; one (1) model SLCP 2X6014 LTE antenna; and two (2) model BXA-70063/4CF LTE antennas, all at the same 95-foot level on the tower. Cellco also intends to install six (6) coax cable diplexers on its antenna platform. Attached behind Tab 1 are the specifications for the proposed replacement antennas and cable diplexers.

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 Matthew Knickerbocker, First Selectman of the Town of Bethel. A copy of this letter is also being sent to Suzanne M. and Robert H. Hull IV, owners 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. Cellco's antennas and diplexers will be located at the same 95-foot level on the existing 125-foot 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 operation of the replacement antennas will not increase radio frequency (RF) power density levels at the facility to a level at or above the Federal Communications Commission (FCC) adopted safety standard. A Calculated Radio Frequency Emissions Report for Cellco's modified facility is included behind Tab 2.

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

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

Sincerely,

Kenneth C. Baldwin

Enclosures
Copy to:
Matthew Knickerbocker, Bethel First Selectman
Suzanne M. and Robert H. Hull IV
Sandy M. Carter

Amphenol ANTENNA SOLUTIONS

BXA-171063-12BF-EDIN-X

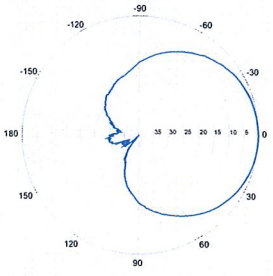
Replace 'X' with desired electrical downtilt

X-Pol | FET Panel | 63° | 19.0 dBi

Electrical Characteristics	1710-2170 MHz		
Frequency bands	1710-1880 MHz	1850-1990 MHz	1920-2170 MHz
Polarization	±45°	±45°	±45°
Horizontal beamwidth	68°	65°	60°
Vertical beamwidth	4.5°	4.5°	4.5°
Gain	16.1 dBd / 18.2 dBi	16.5 dBd / 18.6 dBi	16.9 dBd / 19.0 dBi
Electrical downtilt (X)	0, 2, 5		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back ratio	> 30 dB		
In-band isolation	> 28 dB		
IM3 (20W carrier)	< -150 dBc		
Input power	300 W		
Lightning protection	Direct Ground		
Connector(s)	2 Ports / EDIN / Female / Bottom		
Operating temperature	-40° to +60° C / -40° to +140° F		
Mechanical Characteristics			
Dimensions Length x Width x Depth	1820 x 154 x 105 mm		71.7 x 6.1 x 4.1 in
Depth with z-brackets	133 mm		5.2 in
Weight without mounting brackets	6.8 kg		15 lbs
Survival wind speed	> 201 km/hr		> 125 mph
Wind area	Front: 0.28 m² Side: 0.19 m²		Front: 3.1 ft² Side: 2.1 ft²
Wind load @ 161 km/hr (100 mph)	Front: 460 N Side: 304 N		Front: 103 lbf Side: 68 lbf

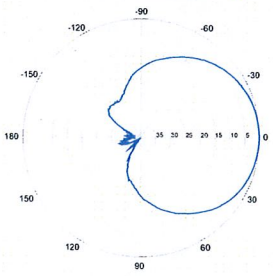
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	26799997	50-102 mm 2.0-4.0 in	2.3 kg 5 lbs
2-Point Mounting & Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	3.6 kg 8 lbs
Concealment Configurations	For concealment configurations, order BXA-171063-12BF-EDIN-X-FP		

BXA-171063-12BF-EDIN-X



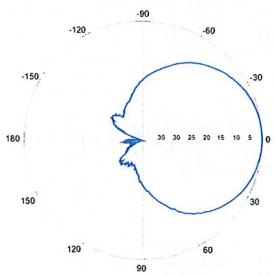
Horizontal | 1710-1880 MHz

BXA-171063-12BF-EDIN-X



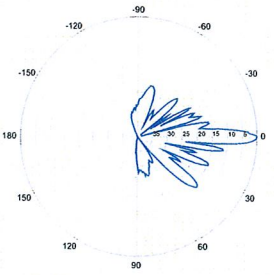
Horizontal | 1850-1990 MHz

BXA-171063-12BF-EDIN-X



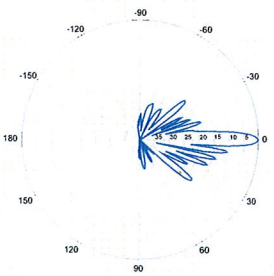
Horizontal | 1920-2170 MHz

BXA-171063-12BF-EDIN-0



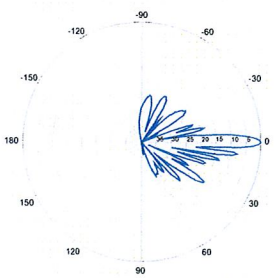
0° | Vertical | 1710-1880 MHz

BXA-171063-12BF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171063-12BF-EDIN-0

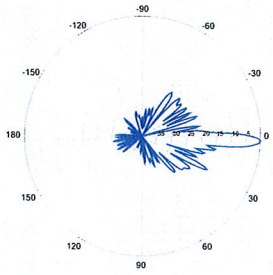


0° | Vertical | 1920-2170 MHz

BXA-171063-12BF-EDIN-X

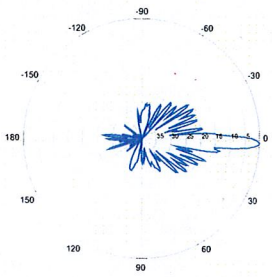
X-Pol | FET Panel | 63° | 19.0 dBi

BXA-171063-12BF-EDIN-2



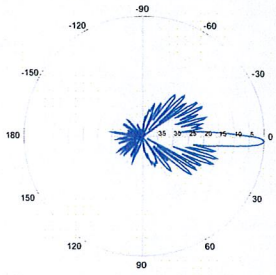
2° | Vertical | 1710-1880 MHz

BXA-171063-12BF-EDIN-2



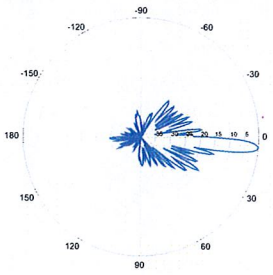
2° | Vertical | 1850-1990 MHz

BXA-171063-12BF-EDIN-2



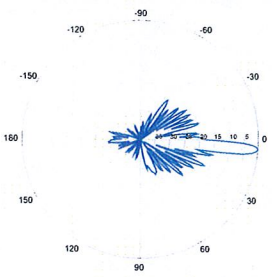
2° | Vertical | 1920-2170 MHz

BXA-171063-12BF-EDIN-5



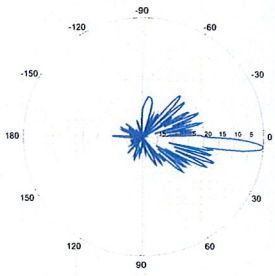
5° | Vertical | 1710-1880 MHz

BXA-171063-12BF-EDIN-5



5° | Vertical | 1850-1990 MHz

BXA-171063-12BF-EDIN-5

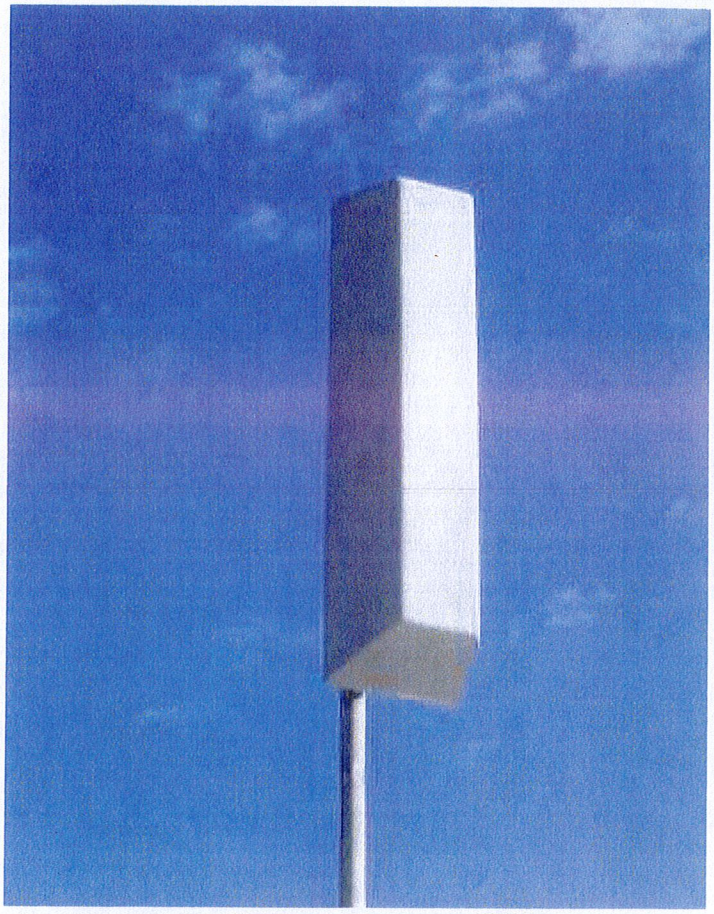


5° | Vertical | 1920-2170 MHz

Swedcom

SLCP 2x6014

Dual (2x) Circularly Polarized log-periodic antenna



Features

- Transmit Diversity Gain
- Can be configured to combine space & polarization diversity
- Outstanding performance over the entire band (700 - 800 MHz)
- Excellent Axial Ratio
- Optimized for 4G & 3G systems
- Low intermodulation
- Improved Side-to-side rejection
- Fading reduction
- Excellent isolation between ports

Electrical specifications

Frequency range:	**700-800 MHz**	
Impedance:	**50 ohm**	
Connector type:	**7/16 Din**	
Return loss:	**18 dB**	
Polarization:	**Circular**	
Gain ea. port [Circular]:	**2x14 dBdC**	
Gain ea. port [Linear]:	**2x11 dBdL**	
Axial Ratio:	**2 dB**	
Isolation between ports (TX band):	**30 dB**	
Front-to-back ratio:	**30 dB**	
Intermodulation (2x20W):	**IM3**	**150 dB**
	IM5	**160 dB**
	IM7/9	**170 dB**
Power rating:	**2x 500 W**	
H-plane (-3 dB point):	**2x 55°**	
V-plane (-3 dB point):	**2x 16°**	
Lightning protection:	**DC grounded**	

Mechanical specifications

Overall height:	**53 in**	**[1346 mm]**
Width:	**14 in**	**[356 mm]**
Depth:	**11 in**	**[279 mm]**
Weight (excluding brackets):	**20 lbs**	**[9 Kg]**
Wind load measured up to:	**150 mph**	**[240 Km/h]**
Wind area (side of antenna):	**5.15 sq. ft.**	**[0.48 sq.m]**
Lateral thrust at 113 mph/ 180 Km/h (worst case):	**263 lbs**	**[1171 N]**

Materials

Radiating Elements:	**Aluminum**
Transformer (Power distribution)	**Ceramic PCB**
Chassis:	**Aluminum**
Radome:	**Grey Fiberglass/PVC**
Mounting bolts:	**Stainless steel**

The SLCP 2x6014 is made in the U.S.A.

Slant ±45° Dual Polarized FET Panel 63° / 13 dBd
696-900 MHz

BXA-70063/4CF __

When ordering replace "__" with connector type.

Mechanical specifications

Length	1205	mm	47.4	in
Width	285	mm	11.2	in
Depth	126	mm	5.0	in
Depth with z-bracket	166	mm	6.5	in
Weight [4]	4.5	kg	9.9	lbs
Wind Area Fore/Aft	0.36	m^2	3.9	ft^2
Wind Area Side	0.15	m^2	1.7	ft^2
Max Wind Survivability	>201	km/hr	>125	mph
Wind Load @ 100 mph (161 km/hr)				
Fore/Aft	522	N	117	lbf
Side	244	N	55	lbf

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

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

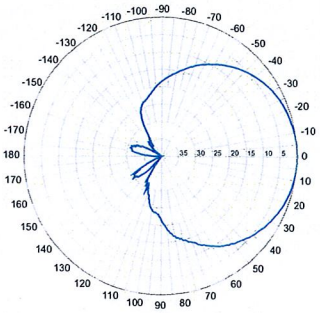
Frequency Range	696-900 MHz
Impedance	50Ω
Connector [3]	NE or E-DIN Female 2 ports / Center
VSWR [1]	≤ 1.4:1
Polarization	Slant ±45°
Isolation Between Ports [1]	< -30 dB
Gain [1]	13.0 dBd 15.0 dBi
Power Rating [2]	500 W
Half Power Angle [1]	
Horizontal Beamwidth	63°
Vertical Beamwidth	15°
Electrical downtilt [5]	0°
Null fill [1]	5%
Lightning protection	Direct ground

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

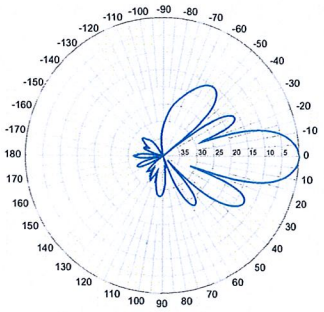
1) Typical values.
2) Power rating limited by connector only.
3) NE indicates an elongated N connector. E-DIN indicates an elongated DIN connector.
4) Antenna weight does not include brackets.
5) Add'l downtilts may be available. Check website for details.

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

Radiation-pattern[1]
750 MHz

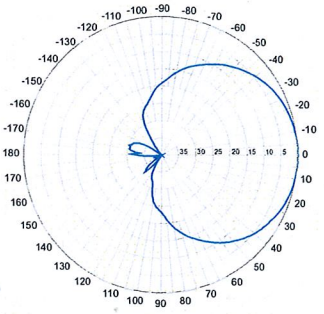


Horizontal

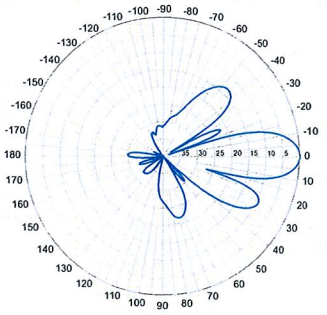


Vertical

850 MHz

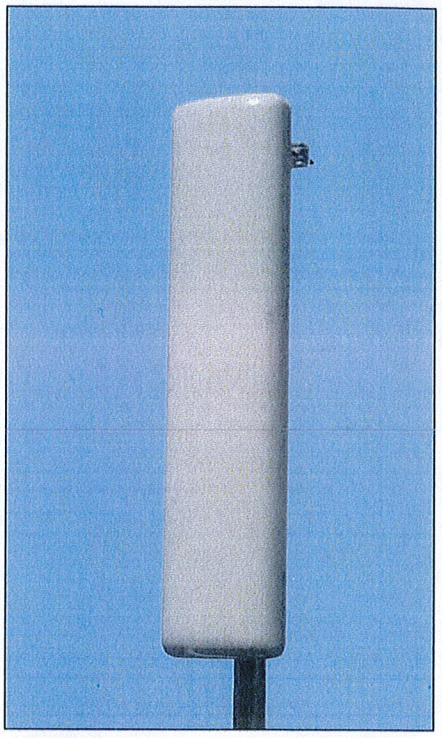


Horizontal



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: 10/27/08

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

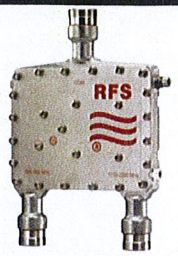
Amphenol Antel, Inc. The Antenna Technology Company

Product Data Sheet **FD9R6004/2C-3L**

ShareLite Wideband Diplexer – In-line 698-960 MHz/1710-2200 MHz, DC pass in high frequency path

Product Description

The ShareLite FD9R6004 Series of diplexers are designed to enable feeder sharing between systems in the 698-960 MHz range and in the 1710-2200 MHz range. The diplexer is equipped with in-line connector placement so it can be installed in the BTS cabinet or at the tower top. This is especially valuable in crowded sites or when the feeders are not easily accessible. Due to its wideband design, the FD9R6004 Series can accommodate many combining solutions between 698-960 MHz and 1710-2200 MHz systems such as LTE 700 MHz, Cellular 800 MHz with PCS, GSM900 with GSM1800, or GSM900 with UMTS. This diplexer features a highly selective filter. It provides a high level of isolation between ports, while keeping the insertion loss on both paths at an extremely low level. The FD9R6004 diplexers are available with various DC pass options, helpful in configurations with or without the Tower Mount Amplifiers installed.



Features/Benefits

- **LTE ready design**
- **Extremely Low Insertion Loss**
- **High level of Rejection between bands – Protection against interferences**
- **Extremely High Power Handling Capability**
- **Integrated DC block/bypass versions available**
- **Very compact & small size design – Easy installation and reduced tower load**
- **In-line long-neck connectors for easy connection & waterproofing**
- **Exceptional reliability & environmental protection (IP 67)**
- **Equipped with 1 * Breathable Vent – Prevent any humidity inside the product**
- **Mounting hardware for Wall and Pole mount provided (P/N SEM2-1A)**
- **Grounding already provided through the mounting bracket**
- **Kit available for easy dual mount**

Technical Specifications

Product Type	Diplexer/Cross Band Coupler
Frequency Range 1, MHz	698-960
Frequency Range 2, MHz	1710-2200
Application	LTE700, GSM900, UMTS, GSM1800, Cellular 800, PCS
Configuration	Sharelite Single diplexer, outdoor, DC pass in the 1710-2170MHz path, with mounting hardware SEM2-1A
Mounting	Wall Mounting: With 4 screws (maximum 6mm diameter); Pole Mounting: With included clamp set 40-110mm (1.57-4.33)
Return Loss All Ports Min/Typ, dB	19/23
Power Handling Continuous, Max, W	1250 at common port; 750 in low frequency path & 500 in high frequency path
Power Handling Peak, Max, W	15000 in low frequency path & 8000 in high frequency path
Impedance, Ohms	50
Insertion Loss, Path 1, dB	0.07 typ.
Insertion Loss, Path 2, dB	0.13 typ.
Rejection Between Bands Min/Typ, dB	58/64@698-960MHz; 60/70@1710-2200MHz
IMP Level at the COM Port, Typ, dBm	-112 @ 2x43
DC Pass in Low Frequency Path	No
DC Pass in High Frequency Path	Yes
Temperature Range, °C (°F)	-40 to +60 (-40 to +140)
Environmental	ETSI 300-019-2-4 Class 4.1E
Ingress Protection	IP 67
Lightning Protection	EN/IEC61000-4-5 Level 4
Connectors	In-line long-neck 7-16-Female
Weight, kg (lb)	1.2 (2.6)
Shipping Weight, kg (lb)	3.2 (7) for 2 * single units in 1 * box, 9.8 (21.6) for 6 * units = 3 * Boxes in 1 * overwrap
Dimensions, H x W x D, mm (in)	147 x 164 x 37 (5.8 x 6.5 x 1.5)
Shipping Dimensions, H x W x D, mm (in)	254 x 406 x 82 (10 x 16 x 3.2) for 2 * Single Units in 1 * box, 280 x 406 x 241 (11 x 16 x 9.5) for 6 * units = 3 * Boxes in 1 * overwrap
Volume, L	0.43
Housing	Aluminum

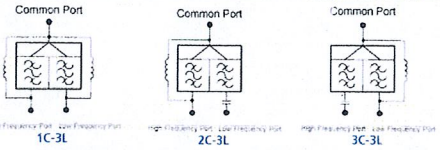
Notes

ShareLite Wideband Diplexer – In-line 698-960 MHz/1710-2200 MHz, DC pass in high frequency path

Other Documentation

FD9R6004/2C-3L Installation Instructions: Wideband_Diplexer_Installation_Rev5.pdf

Selection Guide Diplexer 698-960 / 1710-2200MHz					
	Model Number	Full DC Pass	DC Pass High Band	DC Pass Low Band	Mounting Hardware Included
Single	FD9R6004/1C-3L				X
	FD9R6004/2C-3L				X
	FD9R6004/3C-3L				X
Dual	KIT-FD9R6004/1C-DL				X
	KIT-FD9R6004/2C-DL				X
	KIT-FD9R6004/3C-DL				X



The FD9R6004 Series is upgradeable to a Dual Diplexer kit by means of 2 diplexers and mounting hardware kits SEM2-1A and SEM2-3

Mounting Hardware and Ground Cable Ordering Information		
Model Number	Description	
SEM2-1A	Mounting Hardware, Pole mount ø40-110mm (Included with the Single and Dual Diplexer) Wall Screws M6 (Not included with the product)	
SEM2-3	Assembly kit for 2 pcs of FD9R6004/xC-3L (Can be ordered separately but included with the Dual Diplexer Kit)	
CA020-2	Ground Cable, 2m, includes lugs (Optional)	
CA030-2	Ground Cable, 2m, includes lugs (Optional)	
SEM6	Mounting Hardware for 6 Diplexers, Tower Base (Optional)	

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

Calculated Radio Frequency Emissions

verizonwireless

Bethel CT

38 Spring Hill Lane, Bethel, CT 06801

November 29, 2011

Table of Contents

List of Tables

List of Figures

1. Introduction

The purpose of this report is to investigate compliance with applicable FCC regulations for the proposed modifications to the existing Verizon Wireless antenna arrays on the monopole tower located at 38 Spring Hill Lane in Bethel, CT. Verizon Wireless, AT&T, Sprint-Nextel, T-Mobile and other private/government operators all have antennas mounted on the tower. The coordinates of the tower are 41-21-43.44 N, 73-23-45.30 W.

Verizon Wireless is proposing the following modifications:

1) Install three 750 MHz LTE antennas (one per sector);
2) Modify the azimuth of the alpha sector 850 MHz Cellular and 1900 MHz PCS antennas;
3) Remove six existing 1900 MHz PCS antennas (two per sector);
4) Install three replacement 1900 MHz PCS antennas (one per sector).

2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

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

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

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

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

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

3. RF Exposure Prediction Methods

The emission field calculation results displayed in the Section 4 were generated using the following formula as outlined in FCC bulletin OET 65:

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

Where:

EIRP = Effective Isotropic Radiated Power

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

H = Horizontal Distance from antenna in meters

V = Vertical Distance from radiation center of antenna in meters

Ground reflection factor of 1.6

Off Beam Loss is determined by the selected antenna patterns

These calculations assume that the antennas are operating at 100 percent capacity and power, and that all channels are transmitting simultaneously. Obstructions (trees, buildings, etc.) that would normally attenuate the signal are not taken into account. The calculations assume even terrain in the area of study and do not take into account actual terrain elevations which could attenuate the signal. As a result, the predicted signal levels reported below are much higher than the actual signal levels will be from the finished modifications.

4. Calculation Results

Table 1 below outlines the power density information for the site. All information for carriers other than Verizon Wireless comes directly from the current CSC database. Because the Verizon antennas are directional in nature, the majority of the RF power is focused out towards the horizon. As a result, there will be less RF power directed below the antennas relative to the horizon, and consequently lower power density levels around the base of the tower. Please refer to Attachment C for the vertical patterns of the Verizon antennas. The calculated results for Verizon in Table 1 include a nominal 10 dB off-beam pattern loss to account for the lower relative gain below the antennas.

Carrier	Antenna Height (Feet)	Operating Frequency (MHz)	Number of Trans.	ERP Per Transmitter (Watts)	Power Density (mw/cm^2)	Limit	%MPE
T-Mobile	105	1930	8	224	0.0584	1.0000	5.84%
Bethel PD	No RF information available per the current CSC database.						
Thomas Refuse							
Utility Comm.							
Valley Comm.							
Yankee Gas							
Sprint	112	1900	11	801	0.2526	1.0000	25.26%
AT&T UMTS	123	880	1	500	0.0119	0.5867	2.03%
AT&T UMTS	123	1900	1	500	0.0119	1.0000	1.19%
AT&T GSM	123	1945	4	427	0.0406	1.0000	4.06%
AT&T GSM	123	880	11	296	0.0774	0.5867	13.19%
AT&T LTE	123	740	1	500	0.0119	0.4933	2.41%
Nextel	85	851	24	100	0.1194	0.5673	21.05%
Verizon LTE	92	750	2	1005	0.0085	0.5000	1.71%
Verizon CDMA	92	850	9	797	0.0305	0.5667	5.38%
Verizon PCS	92	1900	15	715	0.0456	1.0000	4.56%
Verizon AWS	92	2100	1	1960	0.0083	1.0000	0.83%
						Total	**87.50%**

Table 1: Carrier Information[1]

[1] The nominal 10 dB off-beam loss factor for Verizon is derived from the specific Verizon antennas in use at this site and their associated antenna patterns, which are presented in Attachment C.

5. Conclusion

The above analysis verifies that emissions from the existing site will be below the maximum power density levels as outlined by the FCC in the OET Bulletin 65 Ed. 97-01. Even when using conservative methods, the power density from the proposed antenna configuration is below the limits for the general public. The highest expected percent of Maximum Permissible Exposure at the base of the tower is 87.50% of the FCC limit.

As noted in the introduction, obstructions (trees, buildings etc.) that would normally attenuate the signal are not taken into account. As a result, the predicted signal levels are more conservative (higher) than the actual signal levels will be from the finished modifications.

6. Statement of Certification

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

Daniel L. Goulet
C Squared Systems, LLC

November 29, 2011
Date

Attachment A: References

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

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

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

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

(A) Limits for Occupational/Controlled Exposure [2]

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

(B) Limits for General Population/Uncontrolled Exposure [3]

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

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

Table 2: FCC Limits for Maximum Permissible Exposure (MPE)

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

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

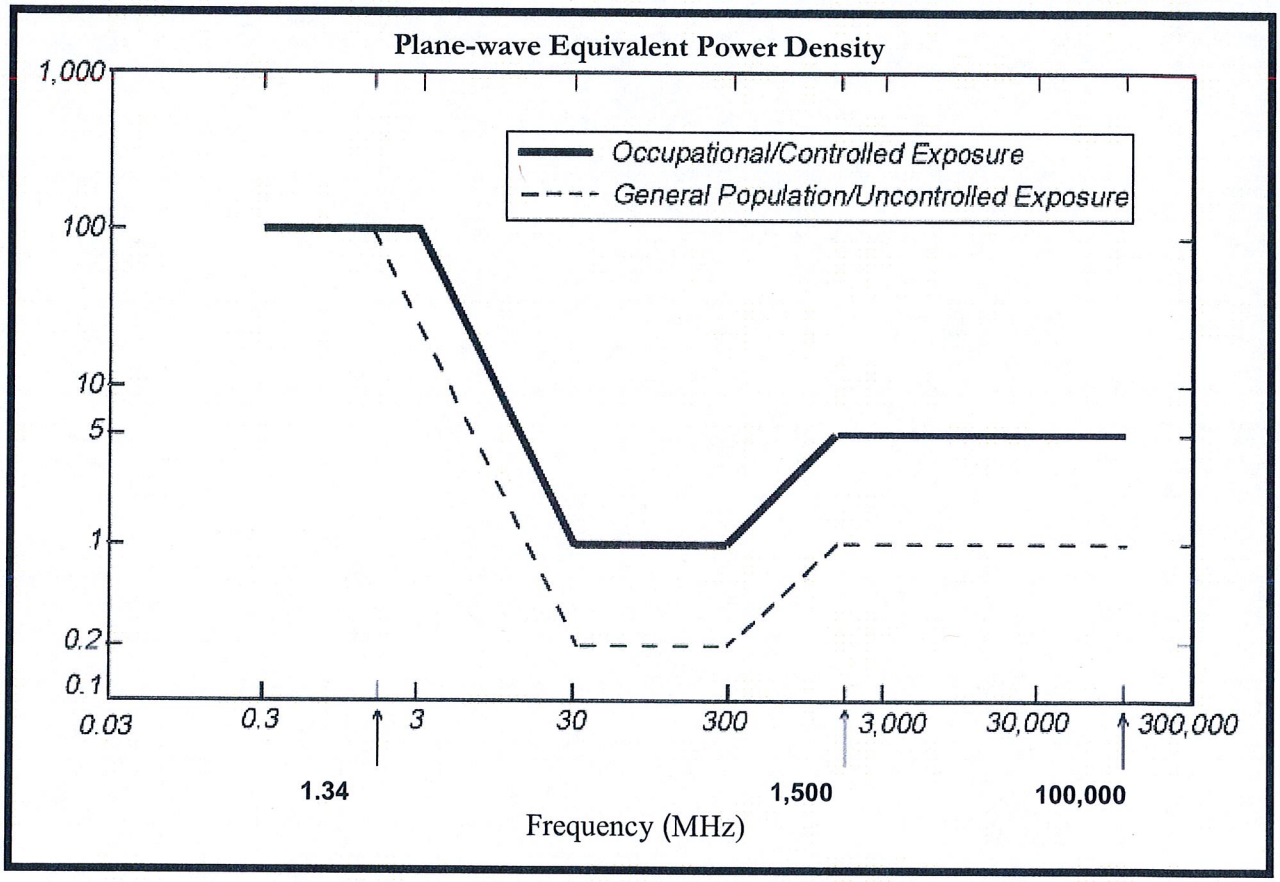
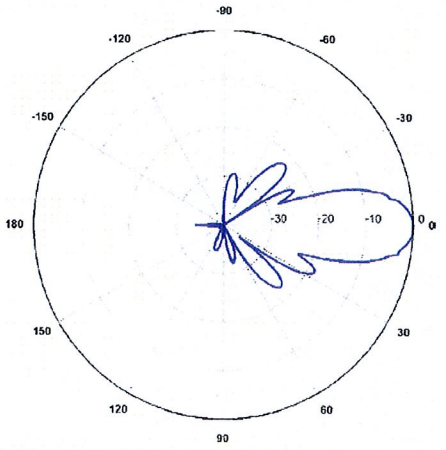


Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: Verizon Wireless' Antenna Model Data Sheets and Electrical Patterns

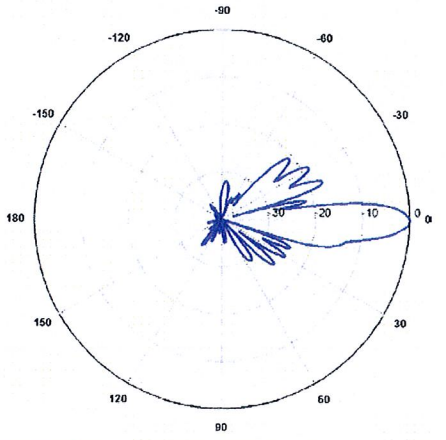
750 MHz

Manufacturer:	Swedcom
Model #:	SLCP 2x6014
Frequency Band:	700-800 MHz
Gain:	14.0 dBd
Vertical Beamwidth:	16°
Horizontal Beamwidth:	55°
Polarization:	±45°
Size L x W x D:	53.0" x 14.0" x 11.0"



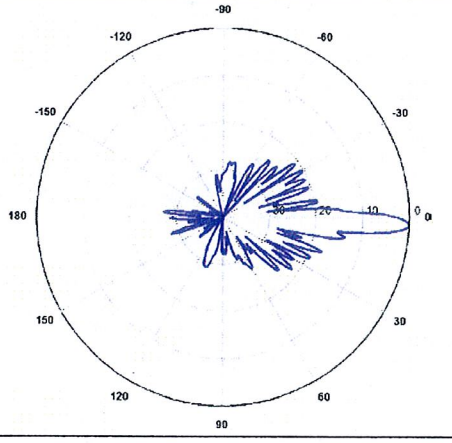
850 MHz

Manufacturer:	Amphenol
Model #:	LPA-80063/8CF
Frequency Band:	806-960 MHz
Gain:	16.0 dBd
Vertical Beamwidth:	7°
Horizontal Beamwidth:	63°
Polarization:	Vertical
Size L x W x D:	94.7" x 15.2" x 13.1"



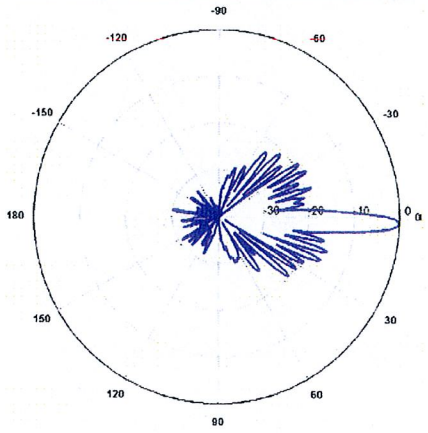
1900 MHz

Manufacturer:	Amphenol
Model #:	BXA-171063/12BF_2
Frequency Band:	1850-1990 MHz
Gain:	16.5 dBd
Vertical Beamwidth:	4.5°
Horizontal Beamwidth:	65°
Polarization:	±45°
Size L x W x D:	71.7" x 6.1" x 4.1"



2100 MHz

Manufacturer:	Amphenol
Model #:	BXA-171063/12BF_2
Frequency Band:	1920-2170 MHz
Gain:	16.9 dBd
Vertical Beamwidth:	4.5°
Horizontal Beamwidth:	60°
Polarization:	±45°
Size L x W x D:	71.7" x 6.1" x 4.1"



CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

125-ft Existing EEI Monopole

Proposed Verizon Wireless
Antenna Upgrade

Verizon Site Ref: Bethel

38 Spring Hill Lane
Bethel, CT

Centek Project No. 11001.CO61

~~Date: October 26, 2011~~

Rev 1: November 16, 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 Bethel, CT.

The host tower is a 125-ft tall, three-section, eighteen sided, tapered monopole originally designed and manufactured by EEI job no; 14009-E01, dated March 9, 2006. The tower geometry, structure member sizes and foundation system information were obtained from the aforementioned tower design documents. Antenna and appurtenance information were obtained from a previous structural report prepared by Clough Harbour and Associates (CHA) dated June 10, 2011, a Verizon RF data sheet and visual verification from grade by Centek personnel on October 26, 2011.

The tower is made up of three (3) 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 55.00-in at the base.

Verizon is proposing the removal of six (6) panel antennas and the installation of six (6) panel antennas and six (6) diplexers mounted to the existing low profile platform. 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) 18' x 3" Omni-directional whip antenna mounted on a 4-ft standoff with an elevation of 124-ft above existing grade.
  Coax Cables: Two (2) 1-5/8" ∅ coax cables running on the inside of the existing monopole.
- AT&T (Existing):
  Antennas: Six (6) Powerwave 7770 panel antennas, two (2) Powerwave P65-16-XLH-RR panel antennas, one (1) Powerwave P90-16-XLH-RR panel antennas, six (6) Powerwave LGP21401 TMA's and three (3) TT19-08BP111-001 TMA's mounted on a 13-ft low profile platform with a RAD center elevation of 123-ft above existing grade.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing monopole.
- AT&T (Reserved):
  Antennas: Two (2) Powerwave P65-16-XLH-RR panel antennas, one (1) Powerwave P90-16-XLH-RR panel antennas and three (3) TT19-08BP111-001 TMA's mounted on a 13-ft low profile platform with a RAD center elevation of 123-ft above existing grade.

- AT&T (Reserved):
  Antennas: Three (3) Ericsson RRUS-11 and one (1) Raycap DC6-48-60-18-8F surge arrestor mounted to one (1) universal ring mount with a RAD center elevation of 123-ft above existing grade level.
  Coax Cables: One (1) fiber cable and two (2) dc control cables running on the inside of the existing monopole.
- SPRINT (Existing):
  Antennas: Three (3) Andrew DB950F85T2E-M panel antennas, three (3) Andrew HBX-9014DS panel antennas and one (1) 10"x8"x3" TMA's mounted on a 13-ft low profile platform with a RAD center elevation of 114-ft above existing grade.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables (6 existing and 6 reserved) running on the inside of the existing monopole.
- T-MOBILE (Existing):
  Antennas: Three (3) RFS APX16DWV-16DWVS panel antennas, three (3) RFS APX16PVL panel antennas and six (6) Ericsson KRY-112 TMA's mounted on a 13-ft low profile platform with a RAD center elevation of 104-ft above existing grade.
  Coax Cables: Eighteen (18) 1-5/8" ∅ coax cables running on the inside of the existing monopole.
- TOWN (Existing):
  Antennas: One (1) 20' 4-bay dipole antenna mounted on the T-Mobile 13-ft low profile platform with an elevation of 102-ft above existing grade.
  Coax Cables: Two (2) 1-5/8" ∅ coax cables running on the inside of the existing monopole.
- TOWN (Existing):
  Antennas: Two (2) 18' x 3" Omni-directional whip antennas mounted on the Verizon 13-ft low profile platform with an elevation of 92-ft above existing grade.
  Coax Cables: Two (2) 1-5/8" ∅ coax cables running on the inside of the existing monopole.
- NEXTEL (Existing):
  Antennas: Twelve (12) Andrew DB844H90E-XY panel antennas mounted on a 13-ft low profile platform with a RAD center elevation of 84-ft above existing grade.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing monopole.
- TOWN (Existing):
  Antennas: One (1) 20' 4-bay dipole antenna mounted on a 13-ft low profile platform with an elevation of 72-ft above existing grade.
  Coax Cables: Two (2) 1-5/8" ∅ coax cables running on the inside of the existing monopole.
- VERIZON (Existing to Remain):
  Antennas: Two (2) Antel LPA-80063-8CF and four (4) LPA-80080-8CF panel antennas mounted to one (1) 13-ft low profile platform with a RAD center elevation of 95-ft above existing grade.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing monopole.

- **VERIZON (Existing to Remove):**
  Antennas: Six (6) Antel LPA-185080-12CF panel antennas mounted to one (1) 13-ft low profile platform with a RAD center elevation of 95-ft above existing grade.
- **VERIZON (Proposed):**
  Antennas: One (1) Swedcom SLCP 2x6014 panel antenna, two (2) Antel BXA-70063-4CF panel antennas, three (3) Antel BXA-171063-12BF panel antennas and six (6) RFS FD9R6004/2C-3L Diplexers mounted to one (1) low profile platform with a RAD center elevation of 95-ft above existing grade.

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

Tower Loading

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

Basic Wind Speed:	Fairfield; v = 85 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Bethel; 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; 85 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; 74 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 74 mph wind speed velocity represents 75% of the wind pressure generated by the 85 mph wind speed. This load case typically controls the design of lattice towers.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 3; Seismic – not checked	*[Section 1614.5 of State Bldg. Code 2005] does not control in the design of this structure type*

Tower Capacity

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

- Calculated stresses were found to be within allowable limits. In Load Case 1, per RISATower "Section Capacity Table", this tower was found to be at **83.8%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L2)	47.67' – 96'-04"	83.8%	**PASS**

Foundation and Anchors

The existing foundation consists of a 7-ft square x 1-ft long reinforced concrete pier on a 25.0-ft square x 4.5-ft thick reinforce concrete pad. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned EEI design documents. The base of the tower is connected to the foundation by means of (12) 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	26 kips
	Compression	34 kips
	Moment	2335 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	2.86	**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	77.6%	**PASS**
Base Plate	Bending	59.4%	**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:

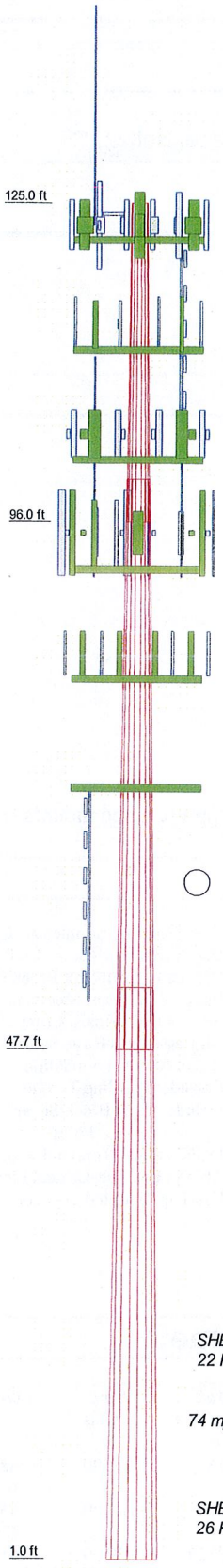
- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of Centek Engineering, Inc. or 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
Length (ft)	28.96	52.29	52.33
Number of Sides	18	18	18
Thickness (in)	0.1875	0.2500	0.3125
Socket Length (ft)	3.92	5.67	
Top Dia (in)	18.0000	25.3212	39.0504
Bot Dia (in)	26.9000	41.2800	55.0000
Grade	A572-65	A572-65	A572-65
Weight (K)	1.3	4.7	8.3

14.2

AXIAL 41 K
SHEAR 22 K
MOMENT 1979 kip-ft
TORQUE 4 kip-ft
74 mph WIND - 0.5000 in ICE

AXIAL 34 K
SHEAR 26 K
MOMENT 2335 kip-ft
TORQUE 4 kip-ft
REACTIONS - 85 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
18' x 4" Dia Omni (Town - Existing)	124	APX16PV-16PVL-X (T-Mobile - Existing)	104
4-ft Standoff (Town - Existing)	124	APX16PV-16PVL-X (T-Mobile - Existing)	104
(2) 7770.00 (ATI - Existing)	123	(2) KRY 112 TMA (T-Mobile - Existing)	104
(2) 7770.00 (ATI - Existing)	123	(2) KRY 112 TMA (T-Mobile - Existing)	104
(2) 7770.00 (ATI - Existing)	123	(2) KRY 112 TMA (T-Mobile - Existing)	104
P90-16-XLH-RR (ATI - Reserved)	123	ANT150D6-9 (Town - Existing)	102
P65-16-XLH-RR (ATI - Reserved)	123	EEI 12-ft Low Profile Platform (T-Mobile - Existing)	102
P65-16-XLH-RR (ATI - Reserved)	123	LPA-80063-8CF (Verizon - Existing)	95
TT19-08BP111-001 TMA (ATI - Reserved)	123	BXA-171063-12BF (Verizon - Proposed)	95
TT19-08BP111-001 TMA (ATI - Reserved)	123	SLCP 2x6014 (Verizon - Proposed)	95
TT19-08BP111-001 TMA (ATI - Reserved)	123	LPA-80063-8CF (Verizon - Existing)	95
(2) LGP21401 TMA (ATI - Existing)	123	LPA-80080/8CF (Verizon - Existing)	95
(2) LGP21401 TMA (ATI - Existing)	123	BXA-171063-12BF (Verizon - Proposed)	95
(2) LGP21401 TMA (ATI - Existing)	123	BXA-70063/4CF (Verizon - Proposed)	95
(2) RRUS-11 (ATI - Reserved)	123	LPA-80080/8CF (Verizon - Existing)	95
(2) RRUS-11 (ATI - Reserved)	123	LPA-80080/8CF (Verizon - Existing)	95
(2) RRUS-11 (ATI - Reserved)	123	BXA-171063-12BF (Verizon - Proposed)	95
DC6-48-60-18-8F Surge Arrestor (ATI - Reserved)	123	BXA-70063/4CF (Verizon - Proposed)	95
Valmont Uni-Tri Bracket (ATI - Reserved)	123	LPA-80080/8CF (Verizon - Existing)	95
EEI 12-ft Low Profile Platform (ATI - Existing)	122	(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	95
DB950F85T2E-M (Sprint - Existing)	114	(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	95
DB950F85T2E-M (Sprint - Existing)	114	(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	95
DB950F85T2E-M (Sprint - Existing)	114	EEI 12-ft Low Profile Platform (Verizon - Existing)	92
HBX-9014DS (Sprint - Existing)	114	18' x 4" Dia Omni (Town - Existing)	92
HBX-9014DS (Sprint - Existing)	114	18' x 4" Dia Omni (Town - Existing)	92
HBX-9014DS (Sprint - Existing)	114	(4) DB844H90E-XY (Nextel - Existing)	84
TMA 10"x8"x3" (Sprint - Existing)	114	(4) DB844H90E-XY (Nextel - Existing)	84
EEI Band-On 12' Low Profile Platform w/12 pipe (Sprint - Existing)	112	(4) DB844H90E-XY (Nextel - Existing)	84
APX16DWV-16DWV-S-E-ACU (T-Mobile - Existing)	104	EEI 12-ft Low Profile Platform (Nextel - Existing)	82
APX16DWV-16DWV-S-E-ACU (T-Mobile - Existing)	104	EEI 12-ft Low Profile Platform (Town - Existing)	72
APX16DWV-16DWV-S-E-ACU (T-Mobile - Existing)	104	ANT150D6-9 (Town - Existing)	72
APX16PV-16PVL-X (T-Mobile - Existing)	104		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. TOWER RATING: 83.8%

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

Job: 11001.CO61 - Bethel		
Project: 125' EEI Monopole - 38 Sprill Hill Lane, Bethel, CT		
Client: Verizon Wireless	Drawn by: TJL	App'd:
Code: TIA/EIA-222-F	Date: 11/16/11	Scale: NTS
Path: J:\Jobs\1100100.WI\CO61 - Bethel\Rev (1)\Calcs\ERI Files\125' EEI Monopole_Bethel_CT.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 85 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 74 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
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	125.00-96.04	28.96	3.92	18	18.0000	26.9000	0.1875	0.7500	A572-65 (65 ksi)
L2	96.04-47.67	52.29	5.67	18	25.3212	41.2800	0.2500	1.0000	A572-65 (65 ksi)
L3	47.67-1.00	52.33		18	39.0504	55.0000	0.3125	1.2500	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	18.2777	10.6007	424.9328	6.3234	9.1440	46.4712	850.4248	5.3013	2.8380	15.136
	27.3150	15.8973	1433.1421	9.4829	13.6652	104.8753	2868.1699	7.9501	4.4044	23.49
L2	26.9257	19.8940	1579.8327	8.9003	12.8632	122.8182	3161.7442	9.9489	4.0165	16.066
	41.9168	32.5573	6924.5082	14.5657	20.9702	330.2064	13858.1278	16.2817	6.8253	27.301
L3	41.4066	38.4232	7284.5741	13.7520	19.8376	367.2100	14578.7333	19.2153	6.3229	20.233
	55.8485	54.2432	20495.5041	19.4141	27.9400	733.5542	41017.9768	27.1267	9.1300	29.216

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 125.00-96.04				1	1	1		
L2 96.04-47.67				1	1	1		
L3 47.67-1.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
1 5/8 (AT&T - Existing)	C	No	Inside Pole	123.00 - 4.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Sprint - Existing)	C	No	Inside Pole	113.00 - 4.00	6	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (T-Mobile - Existing)	C	No	Inside Pole	103.00 - 4.00	18	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Verizon - Existing)	C	No	Inside Pole	93.00 - 4.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Nextel - Existing)	C	No	Inside Pole	83.00 - 4.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Town - Existing)	C	No	Inside Pole	123.00 - 4.00	4	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Town - Existing)	C	No	Inside Pole	93.00 - 4.00	2	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Town - Existing)	C	No	Inside Pole	73.00 - 4.00	2	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Sprint - Reserved)	C	No	Inside Pole	113.00 - 4.00	6	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	125.00-96.04	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.79
L2	96.04-47.67	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	3.47
L3	47.67-1.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00

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
		C	0.000	0.000	0.000	0.000	3.36

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	125.00-96.04	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.79
L2	96.04-47.67	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	3.47
L3	47.67-1.00	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	3.36

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
18' x 4" Dia Omni	A	From Face	4.00	0.0000	124.00	No Ice	7.20	7.20	0.05
(Town - Existing)			0.00			1/2" Ice	9.04	9.04	0.10
			9.00						
4-ft Standoff	A	From Face	2.00	0.0000	124.00	No Ice	1.40	0.09	0.03
(Town - Existing)			0.00			1/2" Ice	1.73	0.13	0.04
			0.00						
(2) 7770.00	A	From Face	3.50	0.0000	123.00	No Ice	5.88	2.93	0.04
(AT&T - Existing)			0.00			1/2" Ice	6.31	3.27	0.07
			0.00						
(2) 7770.00	B	From Face	3.50	0.0000	123.00	No Ice	5.88	2.93	0.04
(AT&T - Existing)			0.00			1/2" Ice	6.31	3.27	0.07
			0.00						
(2) 7770.00	C	From Face	3.50	0.0000	123.00	No Ice	5.88	2.93	0.04
(AT&T - Existing)			0.00			1/2" Ice	6.31	3.27	0.07
			0.00						
P90-16-XLH-RR	A	From Face	3.50	0.0000	123.00	No Ice	10.69	7.58	0.07
(AT&T - Reserved)			0.00			1/2" Ice	11.30	8.17	0.13
			0.00						
P65-16-XLH-RR	B	From Face	3.50	0.0000	123.00	No Ice	8.40	4.70	0.06
(AT&T - Reserved)			0.00			1/2" Ice	8.95	5.15	0.11
			0.00						
P65-16-XLH-RR	C	From Face	3.50	0.0000	123.00	No Ice	8.40	4.70	0.06
(AT&T - Reserved)			0.00			1/2" Ice	8.95	5.15	0.11
			0.00						
TT19-08BP111-001 TMA	A	From Face	3.50	0.0000	123.00	No Ice	0.64	0.52	0.02
(AT&T - Reserved)			0.00			1/2" Ice	0.76	0.62	0.02
			0.00						
TT19-08BP111-001 TMA	B	From Face	3.50	0.0000	123.00	No Ice	0.64	0.52	0.02

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(AT&T - Reserved)			0.00 0.00			1/2" Ice	0.76	0.62	0.02
TT19-08BP111-001 TMA	C	From Face	3.50	0.0000	123.00	No Ice	0.64	0.52	0.02
(AT&T - Reserved)			0.00 0.00			1/2" Ice	0.76	0.62	0.02
(2) LGP21401 TMA	A	From Face	3.50	0.0000	123.00	No Ice	0.95	0.37	0.02
(AT&T - Existing)			0.00 0.00			1/2" Ice	1.09	0.48	0.02
(2) LGP21401 TMA	B	From Face	3.50	0.0000	123.00	No Ice	0.95	0.37	0.02
(AT&T - Existing)			0.00 0.00			1/2" Ice	1.09	0.48	0.02
(2) LGP21401 TMA	C	From Face	3.50	0.0000	123.00	No Ice	0.95	0.37	0.02
(AT&T - Existing)			0.00 0.00			1/2" Ice	1.09	0.48	0.02
(2) RRUS-11	A	From Face	0.50	0.0000	123.00	No Ice	2.99	1.25	0.05
(AT&T - Reserved)			0.00 0.00			1/2" Ice	3.23	1.41	0.07
(2) RRUS-11	B	From Face	0.50	0.0000	123.00	No Ice	2.99	1.25	0.05
(AT&T - Reserved)			0.00 0.00			1/2" Ice	3.23	1.41	0.07
(2) RRUS-11	C	From Face	0.50	0.0000	123.00	No Ice	2.99	1.25	0.05
(AT&T - Reserved)			0.00 0.00			1/2" Ice	3.23	1.41	0.07
DC6-48-60-18-8F Surge	C	From Face	0.50	0.0000	123.00	No Ice	2.23	2.23	0.02
Arrestor			0.00			1/2" Ice	2.45	2.45	0.04
(AT&T - Reserved)			0.00						
Valmont Uni-Tri Bracket	C	None		0.0000	123.00	No Ice	1.75	1.75	0.29
(AT&T - Reserved)						1/2" Ice	1.94	1.94	0.31
EEI 12-ft Low Profile	C	None		0.0000	122.00	No Ice	15.00	15.00	1.50
Platform						1/2" Ice	18.40	18.40	1.75
(AT&T - Existing)									
ANT150D6-9	B	From Face	3.50	0.0000	102.00	No Ice	4.00	4.00	0.03
(Town - Existing)			0.00 10.00			1/2" Ice	4.60	4.60	0.03
DB950F85T2E-M	A	From Face	3.50	0.0000	114.00	No Ice	2.53	4.19	0.01
(Sprint - Existing)			-4.00 0.00			1/2" Ice	2.90	4.57	0.03
DB950F85T2E-M	B	From Face	3.50	0.0000	114.00	No Ice	2.53	4.19	0.01
(Sprint - Existing)			-4.00 0.00			1/2" Ice	2.90	4.57	0.03
DB950F85T2E-M	C	From Face	3.50	0.0000	114.00	No Ice	2.53	4.19	0.01
(Sprint - Existing)			-4.00 0.00			1/2" Ice	2.90	4.57	0.03
HBX-9014DS	A	From Face	3.50	0.0000	114.00	No Ice	3.42	2.18	0.01
(Sprint - Existing)			4.00 0.00			1/2" Ice	3.76	2.49	0.03
HBX-9014DS	B	From Face	3.50	0.0000	114.00	No Ice	3.42	2.18	0.01
(Sprint - Existing)			4.00 0.00			1/2" Ice	3.76	2.49	0.03
HBX-9014DS	C	From Face	3.50	0.0000	114.00	No Ice	3.42	2.18	0.01
(Sprint - Existing)			4.00 0.00			1/2" Ice	3.76	2.49	0.03
TMA 10"x8"x3"	A	From Face	3.50	0.0000	114.00	No Ice	0.78	0.29	0.02
(Sprint - Existing)			4.00 0.00			1/2" Ice	0.90	0.38	0.02
EEI Band-On 12' Low Profile	C	None		0.0000	112.00	No Ice	39.00	39.00	2.00
Platform w/12 pipe						1/2" Ice	50.00	50.00	3.00

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(Sprint - Existing)									
APX16DWV-16DWV-S-E-A	A	From Face	3.50	0.0000	104.00	No Ice	6.70	2.00	0.04
CU			-4.00			1/2" Ice	7.13	2.33	0.07
(T-Mobile - Existing)			0.00						
APX16DWV-16DWV-S-E-A	B	From Face	3.50	0.0000	104.00	No Ice	6.70	2.00	0.04
CU			-4.00			1/2" Ice	7.13	2.33	0.07
(T-Mobile - Existing)			0.00						
APX16DWV-16DWV-S-E-A	C	From Face	3.50	0.0000	104.00	No Ice	6.70	2.00	0.04
CU			-4.00			1/2" Ice	7.13	2.33	0.07
(T-Mobile - Existing)			0.00						
APX16PV-16PVL-X	A	From Face	3.50	0.0000	104.00	No Ice	6.70	2.00	0.04
(T-Mobile - Existing)			4.00			1/2" Ice	7.13	2.33	0.07
			0.00						
APX16PV-16PVL-X	B	From Face	3.50	0.0000	104.00	No Ice	6.70	2.00	0.04
(T-Mobile - Existing)			4.00			1/2" Ice	7.13	2.33	0.07
			0.00						
APX16PV-16PVL-X	C	From Face	3.50	0.0000	104.00	No Ice	6.70	2.00	0.04
(T-Mobile - Existing)			4.00			1/2" Ice	7.13	2.33	0.07
			0.00						
(2) KRY 112 TMA	A	From Face	3.50	0.0000	104.00	No Ice	0.78	0.49	0.03
(T-Mobile - Existing)			0.00			1/2" Ice	0.90	0.59	0.03
			0.00						
(2) KRY 112 TMA	B	From Face	3.50	0.0000	104.00	No Ice	0.78	0.49	0.03
(T-Mobile - Existing)			0.00			1/2" Ice	0.90	0.59	0.03
			0.00						
(2) KRY 112 TMA	C	From Face	3.50	0.0000	104.00	No Ice	0.78	0.49	0.03
(T-Mobile - Existing)			0.00			1/2" Ice	0.90	0.59	0.03
			0.00						
EEI 12-ft Low Profile	C	None		0.0000	102.00	No Ice	15.00	15.00	1.50
Platform						1/2" Ice	18.40	18.40	1.75
(T-Mobile - Existing)									
LPA-80063-8CF	A	From Face	3.50	0.0000	95.00	No Ice	13.99	12.13	0.04
(Verizon - Existing)			-6.00			1/2" Ice	14.71	12.76	0.14
			0.00						
BXA-171063-12BF	A	From Face	3.50	0.0000	95.00	No Ice	4.73	3.57	0.02
(Verizon - Proposed)			4.00			1/2" Ice	5.18	4.01	0.04
			0.00						
SLCP 2x6014	A	From Face	3.50	0.0000	95.00	No Ice	7.21	5.67	0.02
(Verizon - Proposed)			0.00			1/2" Ice	7.65	6.09	0.07
			0.00						
LPA-80063-8CF	A	From Face	3.50	0.0000	95.00	No Ice	13.99	12.13	0.04
(Verizon - Existing)			6.00			1/2" Ice	14.71	12.76	0.14
			0.00						
LPA-80080/8CF	B	From Face	3.50	0.0000	95.00	No Ice	6.28	12.17	0.02
(Verizon - Existing)			-6.00			1/2" Ice	6.85	12.83	0.09
			0.00						
BXA-171063-12BF	B	From Face	3.50	0.0000	95.00	No Ice	4.73	3.57	0.02
(Verizon - Proposed)			4.00			1/2" Ice	5.18	4.01	0.04
			0.00						
BXA-70063/4CF	B	From Face	3.50	0.0000	95.00	No Ice	5.16	2.44	0.01
(Verizon - Proposed)			0.00			1/2" Ice	5.55	2.74	0.04
			0.00						
LPA-80080/8CF	B	From Face	3.50	0.0000	95.00	No Ice	6.28	12.17	0.02
(Verizon - Existing)			6.00			1/2" Ice	6.85	12.83	0.09
			0.00						
LPA-80080/8CF	C	From Face	3.50	0.0000	95.00	No Ice	6.28	12.17	0.02
(Verizon - Existing)			-6.00			1/2" Ice	6.85	12.83	0.09

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0.00						
BXA-171063-12BF	C	From Face	3.50	0.0000	95.00	No Ice	4.73	3.57	0.02
(Verizon - Proposed)			4.00			1/2" Ice	5.18	4.01	0.04
			0.00						
BXA-70063/4CF	C	From Face	3.50	0.0000	95.00	No Ice	5.16	2.44	0.01
(Verizon - Proposed)			0.00			1/2" Ice	5.55	2.74	0.04
			0.00						
LPA-80080/8CF	C	From Face	3.50	0.0000	95.00	No Ice	6.28	12.17	0.02
(Verizon - Existing)			6.00			1/2" Ice	6.85	12.83	0.09
			0.00						
(2) FD9R6004/2C-3L	A	From Face	3.50	0.0000	95.00	No Ice	0.37	0.08	0.00
Diplexer			0.00			1/2" Ice	0.45	0.14	0.01
(Verizon - Proposed)			0.00						
(2) FD9R6004/2C-3L	B	From Face	3.50	0.0000	95.00	No Ice	0.37	0.08	0.00
Diplexer			0.00			1/2" Ice	0.45	0.14	0.01
(Verizon - Proposed)			0.00						
(2) FD9R6004/2C-3L	C	From Face	3.50	0.0000	95.00	No Ice	0.37	0.08	0.00
Diplexer			0.00			1/2" Ice	0.45	0.14	0.01
(Verizon - Proposed)			0.00						
EEI 12-ft Low Profile	C	None		0.0000	92.00	No Ice	15.00	15.00	1.50
Platform						1/2" Ice	18.40	18.40	1.75
(Verizon - Existing)									
18' x 4" Dia Omni	A	From Face	3.50	0.0000	92.00	No Ice	7.20	7.20	0.05
(Town - Existing)			0.00			1/2" Ice	9.04	9.04	0.10
			9.00						
18' x 4" Dia Omni	B	From Face	3.50	0.0000	92.00	No Ice	7.20	7.20	0.05
(Town - Existing)			0.00			1/2" Ice	9.04	9.04	0.10
			9.00						
(4) DB844H90E-XY	A	From Face	3.50	0.0000	84.00	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	3.50	0.0000	84.00	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	3.50	0.0000	84.00	No Ice	2.87	3.73	0.01
(Nextel - Existing)			0.00			1/2" Ice	3.18	4.10	0.04
			0.00						
EEI 12-ft Low Profile	C	None		0.0000	82.00	No Ice	15.00	15.00	1.50
Platform						1/2" Ice	18.40	18.40	1.75
(Nextel - Existing)									
EEI 12-ft Low Profile	C	None		0.0000	72.00	No Ice	15.00	15.00	1.50
Platform						1/2" Ice	18.40	18.40	1.75
(Town - Existing)									
ANT150D6-9	A	From Face	3.50	0.0000	72.00	No Ice	4.00	4.00	0.03
(Town - Existing)			0.00			1/2" Ice	4.60	4.60	0.03
			-10.00						

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 125.00-96.04	109.56	1.409	26	54.179	A	0.000	54.179	54.179	100.00	0.000	0.000
					B	0.000	54.179		100.00	0.000	0.000
					C	0.000	54.179		100.00	0.000	0.000
L2 96.04-47.67	70.68	1.243	23	136.647	A	0.000	136.647	136.647	100.00	0.000	0.000
					B	0.000	136.647		100.00	0.000	0.000
					C	0.000	136.647		100.00	0.000	0.000
L3 47.67-1.00	23.31	1	19	186.235	A	0.000	186.235	186.235	100.00	0.000	0.000
					B	0.000	186.235		100.00	0.000	0.000
					C	0.000	186.235		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 125.00-96.04	109.56	1.409	20	0.5000	56.593	A	0.000	56.593	56.593	100.00	0.000	0.000
						B	0.000	56.593		100.00	0.000	0.000
						C	0.000	56.593		100.00	0.000	0.000
L2 96.04-47.67	70.68	1.243	17	0.5000	140.678	A	0.000	140.678	140.678	100.00	0.000	0.000
						B	0.000	140.678		100.00	0.000	0.000
						C	0.000	140.678		100.00	0.000	0.000
L3 47.67-1.00	23.31	1	14	0.5000	190.124	A	0.000	190.124	190.124	100.00	0.000	0.000
						B	0.000	190.124		100.00	0.000	0.000
						C	0.000	190.124		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 125.00-96.04	109.56	1.409	9	54.179	A	0.000	54.179	54.179	100.00	0.000	0.000
					B	0.000	54.179		100.00	0.000	0.000
					C	0.000	54.179		100.00	0.000	0.000
L2 96.04-47.67	70.68	1.243	8	136.647	A	0.000	136.647	136.647	100.00	0.000	0.000
					B	0.000	136.647		100.00	0.000	0.000
					C	0.000	136.647		100.00	0.000	0.000
L3 47.67-1.00	23.31	1	6	186.235	A	0.000	186.235	186.235	100.00	0.000	0.000
					B	0.000	186.235		100.00	0.000	0.000
					C	0.000	186.235		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	0.79	1.31	A	1	0.65	1	1	1	54.179	1.55	53.56	C
125.00-96.04			B	1	0.65	1	1	1	54.179			
			C	1	0.65	1	1	1	54.179			
L2	3.47	4.67	A	1	0.65	1	1	1	136.647	3.43	70.97	C
96.04-47.67			B	1	0.65	1	1	1	136.647			
			C	1	0.65	1	1	1	136.647			
L3 47.67-1.00	3.36	8.25	A	1	0.65	1	1	1	186.235	3.82	81.93	C
			B	1	0.65	1	1	1	186.235			
			C	1	0.65	1	1	1	186.235			
Sum Weight:	7.62	14.22						OTM	492.89 kip-ft	8.81		

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	0.79	1.31	A	1	0.65	1	1	1	54.179	1.55	53.56	C
125.00-96.04			B	1	0.65	1	1	1	54.179			
			C	1	0.65	1	1	1	54.179			
L2	3.47	4.67	A	1	0.65	1	1	1	136.647	3.43	70.97	C
96.04-47.67			B	1	0.65	1	1	1	136.647			
			C	1	0.65	1	1	1	136.647			
L3 47.67-1.00	3.36	8.25	A	1	0.65	1	1	1	186.235	3.82	81.93	C
			B	1	0.65	1	1	1	186.235			
			C	1	0.65	1	1	1	186.235			
Sum Weight:	7.62	14.22						OTM	492.89 kip-ft	8.81		

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	0.79	1.31	A	1	0.65	1	1	1	54.179	1.55	53.56	C
125.00-96.04			B	1	0.65	1	1	1	54.179			
			C	1	0.65	1	1	1	54.179			
L2	3.47	4.67	A	1	0.65	1	1	1	136.647	3.43	70.97	C
96.04-47.67			B	1	0.65	1	1	1	136.647			
			C	1	0.65	1	1	1	136.647			
L3 47.67-1.00	3.36	8.25	A	1	0.65	1	1	1	186.235	3.82	81.93	C
			B	1	0.65	1	1	1	186.235			
			C	1	0.65	1	1	1	186.235			
Sum Weight:	7.62	14.22						OTM	492.89 kip-ft	8.81		

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	0.79	1.31	A	1	0.65	1	1	1	54.179	1.55	53.56	C
125.00-96.04			B	1	0.65	1	1	1	54.179			
			C	1	0.65	1	1	1	54.179			
L2	3.47	4.67	A	1	0.65	1	1	1	136.647	3.43	70.97	C
96.04-47.67			B	1	0.65	1	1	1	136.647			
			C	1	0.65	1	1	1	136.647			
L3 47.67-1.00	3.36	8.25	A	1	0.65	1	1	1	186.235	3.82	81.93	C
			B	1	0.65	1	1	1	186.235			
			C	1	0.65	1	1	1	186.235			
Sum Weight:	7.62	14.22						OTM	492.89 kip-ft	8.81		

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	0.79	1.72	A	1	0.65	1	1	1	56.593	1.22	41.96	C
125.00-96.04			B	1	0.65	1	1	1	56.593			
			C	1	0.65	1	1	1	56.593			
L2	3.47	5.69	A	1	0.65	1	1	1	140.678	2.65	54.80	C
96.04-47.67			B	1	0.65	1	1	1	140.678			
			C	1	0.65	1	1	1	140.678			
L3 47.67-1.00	3.36	9.64	A	1	0.65	1	1	1	190.124	2.93	62.73	C
			B	1	0.65	1	1	1	190.124			
			C	1	0.65	1	1	1	190.124			
Sum Weight:	7.62	17.05						OTM	381.92 kip-ft	6.79		

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	0.79	1.72	A	1	0.65	1	1	1	56.593	1.22	41.96	C
125.00-96.04			B	1	0.65	1	1	1	56.593			
			C	1	0.65	1	1	1	56.593			
L2	3.47	5.69	A	1	0.65	1	1	1	140.678	2.65	54.80	C
96.04-47.67			B	1	0.65	1	1	1	140.678			
			C	1	0.65	1	1	1	140.678			
L3 47.67-1.00	3.36	9.64	A	1	0.65	1	1	1	190.124	2.93	62.73	C
			B	1	0.65	1	1	1	190.124			
			C	1	0.65	1	1	1	190.124			
Sum Weight:	7.62	17.05						OTM	381.92 kip-ft	6.79		

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	0.79	1.72	A	1	0.65	1	1	1	56.593	1.22	41.96	C
125.00-96.04			B	1	0.65	1	1	1	56.593			
			C	1	0.65	1	1	1	56.593			
L2	3.47	5.69	A	1	0.65	1	1	1	140.678	2.65	54.80	C
96.04-47.67			B	1	0.65	1	1	1	140.678			
			C	1	0.65	1	1	1	140.678			
L3 47.67-1.00	3.36	9.64	A	1	0.65	1	1	1	190.124	2.93	62.73	C
			B	1	0.65	1	1	1	190.124			
			C	1	0.65	1	1	1	190.124			
Sum Weight:	7.62	17.05						OTM	381.92 kip-ft	6.79		

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	0.79	1.72	A	1	0.65	1	1	1	56.593	1.22	41.96	C
125.00-96.04			B	1	0.65	1	1	1	56.593			
			C	1	0.65	1	1	1	56.593			
L2	3.47	5.69	A	1	0.65	1	1	1	140.678	2.65	54.80	C
96.04-47.67			B	1	0.65	1	1	1	140.678			
			C	1	0.65	1	1	1	140.678			
L3 47.67-1.00	3.36	9.64	A	1	0.65	1	1	1	190.124	2.93	62.73	C
			B	1	0.65	1	1	1	190.124			
			C	1	0.65	1	1	1	190.124			
Sum Weight:	7.62	17.05						OTM	381.92 kip-ft	6.79		

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	0.79	1.31	A	1	0.65	1	1	1	54.179	0.54	18.53	C
125.00-96.04			B	1	0.65	1	1	1	54.179			
			C	1	0.65	1	1	1	54.179			
L2	3.47	4.67	A	1	0.65	1	1	1	136.647	1.19	24.56	C
96.04-47.67			B	1	0.65	1	1	1	136.647			
			C	1	0.65	1	1	1	136.647			
L3 47.67-1.00	3.36	8.25	A	1	0.65	1	1	1	186.235	1.32	28.35	C
			B	1	0.65	1	1	1	186.235			
			C	1	0.65	1	1	1	186.235			
Sum Weight:	7.62	14.22						OTM	170.55	3.05		

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	K	K							ft^2	K	plf	
									kip-ft			

Tower Forces - Service - Wind 45 To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	K	K							ft^2	K	plf	
L1	0.79	1.31	A	1	0.65	1	1	1	54.179	0.54	18.53	C
125.00-96.04			B	1	0.65	1	1	1	54.179			
			C	1	0.65	1	1	1	54.179			
L2	3.47	4.67	A	1	0.65	1	1	1	136.647	1.19	24.56	C
96.04-47.67			B	1	0.65	1	1	1	136.647			
			C	1	0.65	1	1	1	136.647			
L3 47.67-1.00	3.36	8.25	A	1	0.65	1	1	1	186.235	1.32	28.35	C
			B	1	0.65	1	1	1	186.235			
			C	1	0.65	1	1	1	186.235			
Sum Weight:	7.62	14.22						OTM	170.55 kip-ft	3.05		

Tower Forces - Service - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	K	K							ft^2	K	plf	
L1	0.79	1.31	A	1	0.65	1	1	1	54.179	0.54	18.53	C
125.00-96.04			B	1	0.65	1	1	1	54.179			
			C	1	0.65	1	1	1	54.179			
L2	3.47	4.67	A	1	0.65	1	1	1	136.647	1.19	24.56	C
96.04-47.67			B	1	0.65	1	1	1	136.647			
			C	1	0.65	1	1	1	136.647			
L3 47.67-1.00	3.36	8.25	A	1	0.65	1	1	1	186.235	1.32	28.35	C
			B	1	0.65	1	1	1	186.235			
			C	1	0.65	1	1	1	186.235			
Sum Weight:	7.62	14.22						OTM	170.55 kip-ft	3.05		

Tower Forces - Service - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	Face	e	C_F	R_R	D_F	D_R	A_E	F	w	Ctrl. Face
ft	K	K							ft^2	K	plf	
L1	0.79	1.31	A	1	0.65	1	1	1	54.179	0.54	18.53	C
125.00-96.04			B	1	0.65	1	1	1	54.179			
			C	1	0.65	1	1	1	54.179			

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
L2	3.47	4.67	A	1	0.65	1	1	1	136.647	1.19	24.56	C
96.04-47.67			B	1	0.65	1	1	1	136.647			
			C	1	0.65	1	1	1	136.647			
L3 47.67-1.00	3.36	8.25	A	1	0.65	1	1	1	186.235	1.32	28.35	C
			B	1	0.65	1	1	1	186.235			
			C	1	0.65	1	1	1	186.235			
Sum Weight:	7.62	14.22						OTM	170.55 kip-ft	3.05		

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	14.22					
Bracing Weight	0.00					
Total Member Self-Weight	14.22			-0.75	0.56	
Total Weight	33.70			-0.75	0.56	
Wind 0 deg - No Ice		-0.29	-25.68	-2224.04	28.09	-2.33
Wind 30 deg - No Ice		12.76	-22.09	-1912.41	-1103.14	-3.83
Wind 45 deg - No Ice		18.19	-17.95	-1553.39	-1574.56	-4.21
Wind 60 deg - No Ice		22.38	-12.59	-1088.55	-1938.63	-4.30
Wind 90 deg - No Ice		26.01	0.29	26.78	-2254.52	-3.62
Wind 120 deg - No Ice		22.67	13.09	1134.74	-1966.16	-1.97
Wind 135 deg - No Ice		18.59	18.36	1590.82	-1613.49	-0.92
Wind 150 deg - No Ice		13.25	22.38	1938.44	-1150.82	0.20
Wind 180 deg - No Ice		0.29	25.68	2222.54	-26.97	2.33
Wind 210 deg - No Ice		-12.76	22.09	1910.91	1104.26	3.83
Wind 225 deg - No Ice		-18.19	17.95	1551.89	1575.68	4.21
Wind 240 deg - No Ice		-22.38	12.59	1087.05	1939.75	4.30
Wind 270 deg - No Ice		-26.01	-0.29	-28.28	2255.64	3.62
Wind 300 deg - No Ice		-22.67	-13.09	-1136.24	1967.28	1.97
Wind 315 deg - No Ice		-18.59	-18.36	-1592.32	1614.61	0.92
Wind 330 deg - No Ice		-13.25	-22.38	-1939.94	1151.94	-0.20
Member Ice	2.83					
Total Weight Ice	40.74			-1.32	1.16	
Wind 0 deg - Ice		-0.22	-21.30	-1871.78	22.59	-2.04
Wind 30 deg - Ice		10.59	-18.33	-1610.47	-927.88	-3.40
Wind 45 deg - Ice		15.08	-14.90	-1308.79	-1323.80	-3.75
Wind 60 deg - Ice		18.56	-10.46	-918.00	-1629.42	-3.84
Wind 90 deg - Ice		21.56	0.22	20.10	-1894.04	-3.26
Wind 120 deg - Ice		18.78	10.84	952.46	-1650.84	-1.81
Wind 135 deg - Ice		15.40	15.22	1336.44	-1354.10	-0.87
Wind 150 deg - Ice		10.97	18.56	1629.25	-965.00	0.13
Wind 180 deg - Ice		0.22	21.30	1869.13	-20.27	2.04
Wind 210 deg - Ice		-10.59	18.33	1607.83	930.20	3.40
Wind 225 deg - Ice		-15.08	14.90	1306.14	1326.12	3.75
Wind 240 deg - Ice		-18.56	10.46	915.35	1631.74	3.84
Wind 270 deg - Ice		-21.56	-0.22	-22.75	1896.36	3.26
Wind 300 deg - Ice		-18.78	-10.84	-955.11	1653.17	1.81
Wind 315 deg - Ice		-15.40	-15.22	-1339.09	1356.42	0.87
Wind 330 deg - Ice		-10.97	-18.56	-1631.90	967.32	-0.13
Total Weight	33.70			-0.75	0.56	
Wind 0 deg - Service		-0.10	-8.88	-770.05	10.09	-0.80
Wind 30 deg - Service		4.41	-7.64	-662.22	-381.34	-1.32

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 45 deg - Service		6.29	-6.21	-537.99	-544.46	-1.46
Wind 60 deg - Service		7.74	-4.36	-377.15	-670.44	-1.49
Wind 90 deg - Service		9.00	0.10	8.78	-779.74	-1.25
Wind 120 deg - Service		7.84	4.53	392.15	-679.97	-0.68
Wind 135 deg - Service		6.43	6.35	549.97	-557.94	-0.32
Wind 150 deg - Service		4.59	7.74	670.25	-397.84	0.07
Wind 180 deg - Service		0.10	8.88	768.55	-8.97	0.80
Wind 210 deg - Service		-4.41	7.64	660.72	382.46	1.32
Wind 225 deg - Service		-6.29	6.21	536.49	545.58	1.46
Wind 240 deg - Service		-7.74	4.36	375.65	671.56	1.49
Wind 270 deg - Service		-9.00	-0.10	-10.28	780.86	1.25
Wind 300 deg - Service		-7.84	-4.53	-393.65	681.09	0.68
Wind 315 deg - Service		-6.43	-6.35	-551.47	559.05	0.32
Wind 330 deg - Service		-4.59	-7.74	-671.75	398.96	-0.07

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

Comb. No.	Description
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
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	125 - 96.04	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-11.36	0.53	0.50
			Max. Mx	14	-7.90	166.56	0.87
			Max. My	2	-7.91	0.78	166.00
			Max. Vy	14	-10.86	166.56	0.87
			Max. Vx	2	-10.82	0.78	166.00
			Max. Torque	11			-2.15
L2	96.04 - 47.667	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-26.57	1.20	1.37
			Max. Mx	14	-20.34	1052.16	13.78
			Max. My	2	-20.36	13.60	1037.35
			Max. Vy	14	-22.41	1052.16	13.78
			Max. Vx	2	-22.07	13.60	1037.35
			Max. Torque	13			-4.27
L3	47.667 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-40.74	1.20	1.37
			Max. Mx	14	-33.68	2318.17	29.06
			Max. My	2	-33.68	28.86	2285.75
			Max. Vy	14	-26.03	2318.17	29.06
			Max. Vx	2	-25.70	28.86	2285.75
			Max. Torque	13			-4.27

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	31	40.74	21.56	0.22
	Max. H_x	14	33.70	26.01	0.29
	Max. H_z	2	33.70	0.29	25.68
	Max. M_x	2	2285.75	0.29	25.68
	Max. M_z	6	2316.99	-26.01	-0.29
	Max. Torsion	5	4.26	-22.38	12.59
	Min. Vert	1	33.70	0.00	0.00
	Min. H_x	6	33.70	-26.01	-0.29
	Min. H_z	10	33.70	-0.29	-25.68

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
	Min. M_x	10	-2284.18	-0.29	-25.68
	Min. M_z	14	-2318.17	26.01	0.29
	Min. Torsion	13	-4.26	22.38	-12.59

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	33.70	0.00	0.00	-0.75	0.56	0.00
Dead+Wind 0 deg - No Ice	33.70	-0.29	-25.68	-2285.75	28.86	-2.31
Dead+Wind 30 deg - No Ice	33.70	12.76	-22.09	-1965.50	-1133.76	-3.79
Dead+Wind 45 deg - No Ice	33.70	18.19	-17.95	-1596.50	-1618.25	-4.17
Dead+Wind 60 deg - No Ice	33.70	22.38	-12.59	-1118.76	-1992.40	-4.26
Dead+Wind 90 deg - No Ice	33.70	26.01	0.29	27.51	-2316.99	-3.59
Dead+Wind 120 deg - No Ice	33.70	22.67	13.09	1166.16	-2020.61	-1.95
Dead+Wind 135 deg - No Ice	33.70	18.59	18.36	1634.89	-1658.17	-0.91
Dead+Wind 150 deg - No Ice	33.70	13.25	22.38	1992.15	-1182.70	0.20
Dead+Wind 180 deg - No Ice	33.70	0.29	25.68	2284.18	-27.71	2.31
Dead+Wind 210 deg - No Ice	33.70	-12.76	22.09	1963.94	1134.90	3.79
Dead+Wind 225 deg - No Ice	33.70	-18.19	17.95	1594.95	1619.40	4.17
Dead+Wind 240 deg - No Ice	33.70	-22.38	12.59	1117.22	1993.56	4.26
Dead+Wind 270 deg - No Ice	33.70	-26.01	-0.29	-29.06	2318.17	3.59
Dead+Wind 300 deg - No Ice	33.70	-22.67	-13.09	-1167.72	2021.80	1.95
Dead+Wind 315 deg - No Ice	33.70	-18.59	-18.36	-1636.45	1659.35	0.91
Dead+Wind 330 deg - No Ice	33.70	-13.25	-22.38	-1993.73	1183.87	-0.20
Dead+Ice+Temp	40.74	-0.00	-0.00	-1.37	1.20	-0.00
Dead+Wind 0 deg+Ice+Temp	40.74	-0.22	-21.30	-1940.33	23.43	-2.01
Dead+Wind 30 deg+Ice+Temp	40.74	10.59	-18.33	-1669.47	-961.82	-3.36
Dead+Wind 45 deg+Ice+Temp	40.74	15.08	-14.90	-1356.73	-1372.22	-3.71
Dead+Wind 60 deg+Ice+Temp	40.74	18.56	-10.46	-951.63	-1689.01	-3.80
Dead+Wind 90 deg+Ice+Temp	40.74	21.56	0.22	20.80	-1963.28	-3.23
Dead+Wind 120 deg+Ice+Temp	40.74	18.78	10.84	987.25	-1711.16	-1.79
Dead+Wind 135 deg+Ice+Temp	40.74	15.40	15.22	1385.28	-1403.57	-0.86
Dead+Wind 150 deg+Ice+Temp	40.74	10.97	18.56	1688.81	-1000.24	0.13
Dead+Wind 180 deg+Ice+Temp	40.74	0.22	21.30	1937.50	-20.97	2.01
Dead+Wind 210 deg+Ice+Temp	40.74	-10.59	18.33	1666.65	964.29	3.36
Dead+Wind 225 deg+Ice+Temp	40.74	-15.08	14.90	1353.92	1374.69	3.71
Dead+Wind 240 deg+Ice+Temp	40.74	-18.56	10.46	948.83	1691.48	3.80
Dead+Wind 270 deg+Ice+Temp	40.74	-21.56	-0.22	-23.60	1965.76	3.23
Dead+Wind 300 deg+Ice+Temp	40.74	-18.78	-10.84	-990.07	1713.66	1.79
Dead+Wind 315 deg+Ice+Temp	40.74	-15.40	-15.22	-1388.10	1406.06	0.86
Dead+Wind 330 deg+Ice+Temp	40.74	-10.97	-18.56	-1691.64	1002.73	-0.13
Dead+Wind 0 deg - Service	33.70	-0.10	-8.88	-791.97	10.38	-0.80
Dead+Wind 30 deg - Service	33.70	4.41	-7.64	-681.07	-392.17	-1.32
Dead+Wind 45 deg - Service	33.70	6.29	-6.21	-553.31	-559.93	-1.45
Dead+Wind 60 deg - Service	33.70	7.74	-4.36	-387.90	-689.49	-1.48
Dead+Wind 90 deg - Service	33.70	9.00	0.10	9.00	-801.89	-1.25
Dead+Wind 120 deg - Service	33.70	7.84	4.53	403.28	-699.27	-0.68
Dead+Wind 135 deg - Service	33.70	6.43	6.35	565.58	-573.77	-0.32
Dead+Wind 150 deg - Service	33.70	4.59	7.74	689.28	-409.13	0.07
Dead+Wind 180 deg - Service	33.70	0.10	8.88	790.38	-9.20	0.80
Dead+Wind 210 deg - Service	33.70	-4.41	7.64	679.49	393.35	1.32
Dead+Wind 225 deg - Service	33.70	-6.29	6.21	551.73	561.11	1.45
Dead+Wind 240 deg - Service	33.70	-7.74	4.36	386.32	690.66	1.48
Dead+Wind 270 deg - Service	33.70	-9.00	-0.10	-10.58	803.07	1.25
Dead+Wind 300 deg - Service	33.70	-7.84	-4.53	-404.86	700.46	0.68

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead+Wind 315 deg - Service	33.70	-6.43	-6.35	-567.16	574.96	0.31
Dead+Wind 330 deg - Service	33.70	-4.59	-7.74	-690.86	410.31	-0.07

Solution Summary

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
1	0.00	-33.70	0.00	0.00	33.70	0.00	0.000%
2	-0.29	-33.70	-25.68	0.29	33.70	25.68	0.000%
3	12.76	-33.70	-22.09	-12.76	33.70	22.09	0.000%
4	18.19	-33.70	-17.95	-18.19	33.70	17.95	0.000%
5	22.38	-33.70	-12.59	-22.38	33.70	12.59	0.000%
6	26.01	-33.70	0.29	-26.01	33.70	-0.29	0.000%
7	22.67	-33.70	13.09	-22.67	33.70	-13.09	0.000%
8	18.59	-33.70	18.36	-18.59	33.70	-18.36	0.000%
9	13.25	-33.70	22.38	-13.25	33.70	-22.38	0.000%
10	0.29	-33.70	25.68	-0.29	33.70	-25.68	0.000%
11	-12.76	-33.70	22.09	12.76	33.70	-22.09	0.000%
12	-18.19	-33.70	17.95	18.19	33.70	-17.95	0.000%
13	-22.38	-33.70	12.59	22.38	33.70	-12.59	0.000%
14	-26.01	-33.70	-0.29	26.01	33.70	0.29	0.000%
15	-22.67	-33.70	-13.09	22.67	33.70	13.09	0.000%
16	-18.59	-33.70	-18.36	18.59	33.70	18.36	0.000%
17	-13.25	-33.70	-22.38	13.25	33.70	22.38	0.000%
18	0.00	-40.74	0.00	0.00	40.74	0.00	0.000%
19	-0.22	-40.74	-21.30	0.22	40.74	21.30	0.000%
20	10.59	-40.74	-18.33	-10.59	40.74	18.33	0.000%
21	15.08	-40.74	-14.90	-15.08	40.74	14.90	0.000%
22	18.56	-40.74	-10.46	-18.56	40.74	10.46	0.000%
23	21.56	-40.74	0.22	-21.56	40.74	-0.22	0.000%
24	18.78	-40.74	10.84	-18.78	40.74	-10.84	0.000%
25	15.40	-40.74	15.22	-15.40	40.74	-15.22	0.000%
26	10.97	-40.74	18.56	-10.97	40.74	-18.56	0.000%
27	0.22	-40.74	21.30	-0.22	40.74	-21.30	0.000%
28	-10.59	-40.74	18.33	10.59	40.74	-18.33	0.000%
29	-15.08	-40.74	14.90	15.08	40.74	-14.90	0.000%
30	-18.56	-40.74	10.46	18.56	40.74	-10.46	0.000%
31	-21.56	-40.74	-0.22	21.56	40.74	0.22	0.000%
32	-18.78	-40.74	-10.84	18.78	40.74	10.84	0.000%
33	-15.40	-40.74	-15.22	15.40	40.74	15.22	0.000%
34	-10.97	-40.74	-18.56	10.97	40.74	18.56	0.000%
35	-0.10	-33.70	-8.88	0.10	33.70	8.88	0.000%
36	4.41	-33.70	-7.64	-4.41	33.70	7.64	0.000%
37	6.29	-33.70	-6.21	-6.29	33.70	6.21	0.000%
38	7.74	-33.70	-4.36	-7.74	33.70	4.36	0.000%
39	9.00	-33.70	0.10	-9.00	33.70	-0.10	0.000%
40	7.84	-33.70	4.53	-7.84	33.70	-4.53	0.000%
41	6.43	-33.70	6.35	-6.43	33.70	-6.35	0.000%
42	4.59	-33.70	7.74	-4.59	33.70	-7.74	0.000%
43	0.10	-33.70	8.88	-0.10	33.70	-8.88	0.000%
44	-4.41	-33.70	7.64	4.41	33.70	-7.64	0.000%
45	-6.29	-33.70	6.21	6.29	33.70	-6.21	0.000%
46	-7.74	-33.70	4.36	7.74	33.70	-4.36	0.000%
47	-9.00	-33.70	-0.10	9.00	33.70	0.10	0.000%
48	-7.84	-33.70	-4.53	7.84	33.70	4.53	0.000%
49	-6.43	-33.70	-6.35	6.43	33.70	6.35	0.000%
50	-4.59	-33.70	-7.74	4.59	33.70	7.74	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	5	0.00000001	0.00003597
3	Yes	5	0.00000001	0.00015869
4	Yes	5	0.00000001	0.00020699
5	Yes	5	0.00000001	0.00021034
6	Yes	4	0.00000001	0.00097475
7	Yes	5	0.00000001	0.00017663
8	Yes	5	0.00000001	0.00020726
9	Yes	5	0.00000001	0.00018314
10	Yes	4	0.00000001	0.00071529
11	Yes	5	0.00000001	0.00020658
12	Yes	5	0.00000001	0.00020557
13	Yes	5	0.00000001	0.00015668
14	Yes	5	0.00000001	0.00004550
15	Yes	5	0.00000001	0.00019895
16	Yes	5	0.00000001	0.00020850
17	Yes	5	0.00000001	0.00019037
18	Yes	4	0.00000001	0.00000001
19	Yes	5	0.00000001	0.00009395
20	Yes	5	0.00000001	0.00028185
21	Yes	5	0.00000001	0.00035616
22	Yes	5	0.00000001	0.00034728
23	Yes	5	0.00000001	0.00009591
24	Yes	5	0.00000001	0.00030500
25	Yes	5	0.00000001	0.00035829
26	Yes	5	0.00000001	0.00031324
27	Yes	5	0.00000001	0.00008642
28	Yes	5	0.00000001	0.00034195
29	Yes	5	0.00000001	0.00035454
30	Yes	5	0.00000001	0.00027970
31	Yes	5	0.00000001	0.00010519
32	Yes	5	0.00000001	0.00033625
33	Yes	5	0.00000001	0.00036261
34	Yes	5	0.00000001	0.00032449
35	Yes	4	0.00000001	0.00015628
36	Yes	4	0.00000001	0.00029266
37	Yes	4	0.00000001	0.00044632
38	Yes	4	0.00000001	0.00048907
39	Yes	4	0.00000001	0.00018367
40	Yes	4	0.00000001	0.00031230
41	Yes	4	0.00000001	0.00039900
42	Yes	4	0.00000001	0.00033371
43	Yes	4	0.00000001	0.00013806
44	Yes	4	0.00000001	0.00046971
45	Yes	4	0.00000001	0.00044074
46	Yes	4	0.00000001	0.00029188
47	Yes	4	0.00000001	0.00020283
48	Yes	4	0.00000001	0.00040821
49	Yes	4	0.00000001	0.00040762
50	Yes	4	0.00000001	0.00036716

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	125 - 96.04	21.168	48	1.5196	0.0165
L2	99.957 - 47.667	13.522	48	1.3406	0.0085
L3	53.334 - 1	3.522	48	0.6378	0.0022

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
124.00	18' x 4" Dia Omni	48	20.852	1.5141	0.0162	23645
123.00	(2) 7770.00	48	20.537	1.5086	0.0158	23645
122.00	EEI 12-ft Low Profile Platform	48	20.221	1.5030	0.0155	23645
114.00	DB950F85T2E-M	48	17.716	1.4554	0.0126	10747
112.00	EEI Band-On 12' Low Profile Platform w/12 pipe	48	17.098	1.4422	0.0119	9094
104.00	APX16DWV-16DWV-S-E-ACU	48	14.691	1.3796	0.0096	5630
102.00	ANT150D6-9	48	14.108	1.3611	0.0090	5167
95.00	LPA-80063-8CF	48	12.146	1.2845	0.0074	4473
92.00	EEI 12-ft Low Profile Platform	48	11.345	1.2465	0.0068	4336
84.00	(4) DB844H90E-XY	48	9.333	1.1332	0.0054	4008
82.00	EEI 12-ft Low Profile Platform	48	8.859	1.1027	0.0051	3933
72.00	EEI 12-ft Low Profile Platform	48	6.678	0.9418	0.0038	3599

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	125 - 96.04	60.935	15	4.3707	0.0478
L2	99.957 - 47.667	38.958	15	3.8614	0.0247
L3	53.334 - 1	10.157	15	1.8396	0.0063

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
124.00	18' x 4" Dia Omni	15	60.027	4.3551	0.0468	8353
123.00	(2) 7770.00	15	59.120	4.3394	0.0457	8353
122.00	EEI 12-ft Low Profile Platform	15	58.213	4.3237	0.0447	8353
114.00	DB950F85T2E-M	15	51.013	4.1889	0.0365	3796
112.00	EEI Band-On 12' Low Profile Platform w/12 pipe	15	49.239	4.1512	0.0345	3212
104.00	APX16DWV-16DWV-S-E-ACU	15	42.317	3.9730	0.0277	1987
102.00	ANT150D6-9	15	40.642	3.9199	0.0262	1823
95.00	LPA-80063-8CF	15	34.999	3.7005	0.0214	1575

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
92.00	EEI 12-ft Low Profile Platform	15	32.694	3.5915	0.0196	1525
84.00	(4) DB844H90E-XY	15	26.901	3.2660	0.0155	1405
82.00	EEI 12-ft Low Profile Platform	15	25.537	3.1782	0.0146	1378
72.00	EEI 12-ft Low Profile Platform	15	19.255	2.7151	0.0109	1257

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
L1	125 - 123.682	TP26.9x18x0.1875	28.96	0.00	0.0	39.000	10.8417	-0.21	422.83	0.001
	123.682 - 122.364					39.000	11.0828	-1.18	432.23	0.003
	122.364 - 121.046					39.000	11.3239	-2.71	441.63	0.006
	121.046 - 119.728					39.000	11.5649	-2.79	451.03	0.006
	119.728 - 118.41					39.000	11.8060	-2.87	460.43	0.006
	118.41 - 117.092					39.000	12.0470	-2.96	469.83	0.006
	117.092 - 115.774					39.000	12.2881	-3.05	479.24	0.006
	115.774 - 114.456					39.000	12.5292	-3.13	488.64	0.006
	114.456 - 113.138					39.000	12.7702	-3.24	498.04	0.007
	113.138 - 111.819					39.000	13.0113	-5.20	507.44	0.010
	111.819 - 110.501					39.000	13.2524	-5.29	516.84	0.010
	110.501 - 109.183					39.000	13.4934	-5.39	526.24	0.010
	109.183 - 107.865					39.000	13.7345	-5.48	535.64	0.010
	107.865 - 106.547					39.000	13.9756	-5.58	545.05	0.010
	106.547 - 105.229					39.000	14.2166	-5.68	554.45	0.010
	105.229 - 103.911					39.000	14.4577	-6.11	563.85	0.011
	103.911 - 102.593					39.000	14.6988	-6.21	573.25	0.011
	102.593 - 101.275					39.000	14.9398	-7.78	582.65	0.013
	101.275 - 99.957					39.000	15.1809	-7.89	592.05	0.013
	99.957 - 96.04					39.000	15.8973	-3.69	619.99	0.006
L2	99.957 - 96.04	TP41.28x25.3212x0.25	52.29	0.00	0.0	39.000	20.8426	-4.78	812.86	0.006
	96.04 - 93.6674					39.000	21.4172	-8.82	835.27	0.011
	93.6674 - 91.2949					39.000	21.9918	-10.70	857.68	0.012

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
	91.2949 - 88.9223					39.000	22.5663	-11.06	880.09	0.013
	88.9223 - 86.5498					39.000	23.1409	-11.44	902.50	0.013
	86.5498 - 84.1772					39.000	23.7155	-11.81	924.90	0.013
	84.1772 - 81.8047					39.000	24.2900	-13.69	947.31	0.014
	81.8047 - 79.4321					39.000	24.8646	-14.09	969.72	0.015
	79.4321 - 77.0596					39.000	25.4392	-14.49	992.13	0.015
	77.0596 - 74.687					39.000	26.0138	-14.90	1014.54	0.015
	74.687 - 72.3144					39.000	26.5883	-15.31	1036.94	0.015
	72.3144 - 69.9419					39.000	27.1629	-17.22	1059.35	0.016
	69.9419 - 67.5693					39.000	27.7375	-17.65	1081.76	0.016
	67.5693 - 65.1968					39.000	28.3120	-18.08	1104.17	0.016
	65.1968 - 62.8242					39.000	28.8866	-18.52	1126.58	0.016
	62.8242 - 60.4517					39.000	29.4612	-18.96	1148.99	0.017
	60.4517 - 58.0791					38.850	30.0358	-19.41	1166.91	0.017
	58.0791 - 55.7066					38.526	30.6103	-19.87	1179.30	0.017
	55.7066 - 53.334					38.202	31.1849	-20.33	1191.32	0.017
	53.334 - 47.667					37.427	32.5573	-10.02	1218.53	0.008
L3	53.334 - 47.667	TP55x39.0504x0.3125	52.33	0.00	0.0	39.000	40.1363	-12.11	1565.31	0.008
	47.667 - 45.2108					39.000	40.8787	-22.69	1594.27	0.014
	45.2108 - 42.7547					39.000	41.6212	-23.25	1623.23	0.014
	42.7547 - 40.2985					39.000	42.3637	-23.81	1652.18	0.014
	40.2985 - 37.8424					39.000	43.1061	-24.38	1681.14	0.015
	37.8424 - 35.3862					39.000	43.8486	-24.96	1710.10	0.015
	35.3862 - 32.9301					39.000	44.5911	-25.54	1739.05	0.015
	32.9301 - 30.4739					39.000	45.3335	-26.13	1768.01	0.015
	30.4739 - 28.0177					39.000	46.0760	-26.72	1796.96	0.015
	28.0177 - 25.5616					38.891	46.8185	-27.32	1820.82	0.015
	25.5616 - 23.1054					38.623	47.5610	-27.93	1836.94	0.015
	23.1054 - 20.6493					38.355	48.3034	-28.54	1852.67	0.015
	20.6493 - 18.1931					38.087	49.0459	-29.16	1867.99	0.016
	18.1931 - 15.7369					37.818	49.7884	-29.79	1882.91	0.016

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
	15.7369 - 13.2808					37.550	50.5308	-30.42	1897.44	0.016
	13.2808 - 10.8246					37.282	51.2733	-31.06	1911.57	0.016
	10.8246 - 8.36847					37.014	52.0158	-31.71	1925.30	0.016
	8.36847 - 5.91232					36.746	52.7582	-32.36	1938.63	0.017
	5.91232 - 3.45616					36.477	53.5007	-33.01	1951.57	0.017
	3.45616 - 1					36.209	54.2432	-33.68	1964.10	0.017

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	125 - 123.682	TP26.9x18x0.1875	3.58	0.884	39.000	0.023	0.00	0.000	39.000	0.000
	123.682 - 122.364		6.29	1.485	39.000	0.038	0.00	0.000	39.000	0.000
	122.364 - 121.046		12.15	2.747	39.000	0.070	0.00	0.000	39.000	0.000
	121.046 - 119.728		18.38	3.985	39.000	0.102	0.00	0.000	39.000	0.000
	119.728 - 118.41		24.71	5.138	39.000	0.132	0.00	0.000	39.000	0.000
	118.41 - 117.092		31.12	6.214	39.000	0.159	0.00	0.000	39.000	0.000
	117.092 - 115.774		37.63	7.220	39.000	0.185	0.00	0.000	39.000	0.000
	115.774 - 114.456		44.23	8.162	39.000	0.209	0.00	0.000	39.000	0.000
	114.456 - 113.138		51.75	9.192	39.000	0.236	0.00	0.000	39.000	0.000
	113.138 - 111.819		60.02	10.267	39.000	0.263	0.00	0.000	39.000	0.000
	111.819 - 110.501		70.51	11.625	39.000	0.298	0.00	0.000	39.000	0.000
	110.501 - 109.183		81.10	12.896	39.000	0.331	0.00	0.000	39.000	0.000
	109.183 - 107.865		91.79	14.086	39.000	0.361	0.00	0.000	39.000	0.000
	107.865 - 106.547		102.57	15.201	39.000	0.390	0.00	0.000	39.000	0.000
	106.547 - 105.229		113.47	16.247	39.000	0.417	0.00	0.000	39.000	0.000
	105.229 - 103.911		124.58	17.246	39.000	0.442	0.00	0.000	39.000	0.000
	103.911 - 102.593		137.42	18.403	39.000	0.472	0.00	0.000	39.000	0.000
	102.593 - 101.275		152.75	19.798	39.000	0.508	0.00	0.000	39.000	0.000
	101.275 - 99.957		167.02	20.964	39.000	0.538	0.00	0.000	39.000	0.000
	99.957 - 96.04		92.75	10.612	39.000	0.272	0.00	0.000	39.000	0.000
L2	99.957 - 96.04	TP41.28x25.3212x0.25	117.39	10.445	39.000	0.268	0.00	0.000	39.000	0.000

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
	96.04 - 93.6674		242.54	20.432	39.000	0.524	0.00	0.000	39.000	0.000
	93.6674 - 91.2949		286.02	22.847	39.000	0.586	0.00	0.000	39.000	0.000
	91.2949 - 88.9223		326.44	24.759	39.000	0.635	0.00	0.000	39.000	0.000
	88.9223 - 86.5498		367.22	26.481	39.000	0.679	0.00	0.000	39.000	0.000
	86.5498 - 84.1772		408.38	28.033	39.000	0.719	0.00	0.000	39.000	0.000
	84.1772 - 81.8047		453.59	29.675	39.000	0.761	0.00	0.000	39.000	0.000
	81.8047 - 79.4321		500.96	31.271	39.000	0.802	0.00	0.000	39.000	0.000
	79.4321 - 77.0596		548.70	32.716	39.000	0.839	0.00	0.000	39.000	0.000
	77.0596 - 74.687		596.80	34.023	39.000	0.872	0.00	0.000	39.000	0.000
	74.687 - 72.3144		645.27	35.208	39.000	0.903	0.00	0.000	39.000	0.000
	72.3144 - 69.9419		694.41	36.298	39.000	0.931	0.00	0.000	39.000	0.000
	69.9419 - 67.5693		745.53	37.366	39.000	0.958	0.00	0.000	39.000	0.000
	67.5693 - 65.1968		797.01	38.336	39.000	0.983	0.00	0.000	39.000	0.000
	65.1968 - 62.8242		848.87	39.217	39.000	1.006	0.00	0.000	39.000	0.000
	62.8242 - 60.4517		901.08	40.016	39.000	1.026	0.00	0.000	39.000	0.000
	60.4517 - 58.0791		953.67	40.741	38.850	1.049	0.00	0.000	38.850	0.000
	58.0791 - 55.7066		1006.63	41.400	38.526	1.075	0.00	0.000	38.526	0.000
	55.7066 - 53.334		1059.97	41.997	38.202	1.099	0.00	0.000	38.202	0.000
	53.334 - 47.667		541.09	19.663	37.427	0.525	0.00	0.000	37.427	0.000
L3	53.334 - 47.667	TP55x39.0504x0.3125	648.04	19.401	39.000	0.497	0.00	0.000	39.000	0.000
	47.667 - 45.2108		1245.86	35.952	39.000	0.922	0.00	0.000	39.000	0.000
	45.2108 - 42.7547		1302.97	36.265	39.000	0.930	0.00	0.000	39.000	0.000
	42.7547 - 40.2985		1360.45	36.545	39.000	0.937	0.00	0.000	39.000	0.000
	40.2985 - 37.8424		1418.32	36.793	39.000	0.943	0.00	0.000	39.000	0.000
	37.8424 - 35.3862		1476.57	37.014	39.000	0.949	0.00	0.000	39.000	0.000
	35.3862 - 32.9301		1535.21	37.209	39.000	0.954	0.00	0.000	39.000	0.000
	32.9301 - 30.4739		1594.25	37.380	39.000	0.958	0.00	0.000	39.000	0.000
	30.4739 - 28.0177		1653.68	37.530	39.000	0.962	0.00	0.000	39.000	0.000
	28.0177 - 25.5616		1713.52	37.660	38.891	0.968	0.00	0.000	38.891	0.000
	25.5616 - 23.1054		1773.76	37.773	38.623	0.978	0.00	0.000	38.623	0.000

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
	23.1054 - 20.6493		1834.41	37.869	38.355	0.987	0.00	0.000	38.355	0.000
	20.6493 - 18.1931		1895.47	37.950	38.087	0.996	0.00	0.000	38.087	0.000
	18.1931 - 15.7369		1956.94	38.017	37.818	1.005	0.00	0.000	37.818	0.000
	15.7369 - 13.2808		2018.84	38.072	37.550	1.014	0.00	0.000	37.550	0.000
	13.2808 - 10.8246		2081.17	38.116	37.282	1.022	0.00	0.000	37.282	0.000
	10.8246 - 8.36847		2143.92	38.149	37.014	1.031	0.00	0.000	37.014	0.000
	8.36847 - 5.91232		2207.11	38.172	36.746	1.039	0.00	0.000	36.746	0.000
	5.91232 - 3.45616		2270.72	38.187	36.477	1.047	0.00	0.000	36.477	0.000
	3.45616 - 1		2334.79	38.194	36.209	1.055	0.00	0.000	36.209	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	125 - 123.682	TP26.9x18x0.1875	0.44	0.040	26.000	0.003	0.00	0.000	26.000	0.000
	123.682 - 122.364		3.84	0.346	26.000	0.027	0.11	0.013	26.000	0.000
	122.364 - 121.046		4.70	0.415	26.000	0.032	0.11	0.012	26.000	0.000
	121.046 - 119.728		4.76	0.412	26.000	0.032	0.11	0.012	26.000	0.000
	119.728 - 118.41		4.83	0.409	26.000	0.031	0.11	0.011	26.000	0.000
	118.41 - 117.092		4.90	0.407	26.000	0.031	0.11	0.011	26.000	0.000
	117.092 - 115.774		4.97	0.405	26.000	0.031	0.11	0.010	26.000	0.000
	115.774 - 114.456		5.04	0.403	26.000	0.031	0.11	0.010	26.000	0.000
	114.456 - 113.138		5.98	0.468	26.000	0.036	0.11	0.010	26.000	0.000
	113.138 - 111.819		7.92	0.609	26.000	0.047	0.03	0.002	26.000	0.000
	111.819 - 110.501		8.00	0.604	26.000	0.046	0.03	0.002	26.000	0.000
	110.501 - 109.183		8.07	0.598	26.000	0.046	0.03	0.002	26.000	0.000
	109.183 - 107.865		8.15	0.593	26.000	0.046	0.03	0.002	26.000	0.000
	107.865 - 106.547		8.23	0.589	26.000	0.045	0.03	0.002	26.000	0.000
	106.547 - 105.229		8.30	0.584	26.000	0.045	0.03	0.002	26.000	0.000
	105.229 - 103.911		9.71	0.671	26.000	0.052	0.03	0.002	26.000	0.000
	103.911 - 102.593		9.79	0.666	26.000	0.051	0.03	0.002	26.000	0.000

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
	102.593 - 101.275		10.80	0.723	26.000	0.056	0.72	0.045	26.000	0.002
	101.275 - 99.957		10.88	0.716	26.000	0.055	0.72	0.044	26.000	0.002
	99.957 - 96.04		4.99	0.314	26.000	0.024	0.32	0.018	26.000	0.001
L2	99.957 - 96.04	TP41.28x25.3212x0.25	6.16	0.296	26.000	0.023	0.40	0.017	26.000	0.001
	96.04 - 93.6674		15.46	0.722	26.000	0.056	0.72	0.029	26.000	0.001
	93.6674 - 91.2949		16.97	0.772	26.000	0.059	1.96	0.076	26.000	0.003
	91.2949 - 88.9223		17.12	0.759	26.000	0.058	1.96	0.072	26.000	0.003
	88.9223 - 86.5498		17.28	0.747	26.000	0.057	1.96	0.069	26.000	0.003
	86.5498 - 84.1772		17.43	0.735	26.000	0.057	1.96	0.066	26.000	0.003
	84.1772 - 81.8047		19.90	0.819	26.000	0.063	1.96	0.063	26.000	0.002
	81.8047 - 79.4321		20.06	0.807	26.000	0.062	1.96	0.060	26.000	0.002
	79.4321 - 77.0596		20.21	0.795	26.000	0.061	1.96	0.057	26.000	0.002
	77.0596 - 74.687		20.37	0.783	26.000	0.060	1.96	0.054	26.000	0.002
	74.687 - 72.3144		20.52	0.772	26.000	0.059	1.96	0.052	26.000	0.002
	72.3144 - 69.9419		21.49	0.791	26.000	0.061	1.96	0.050	26.000	0.002
	69.9419 - 67.5693		21.64	0.780	26.000	0.060	1.96	0.048	26.000	0.002
	67.5693 - 65.1968		21.80	0.770	26.000	0.059	1.96	0.046	26.000	0.002
	65.1968 - 62.8242		21.95	0.760	26.000	0.058	1.96	0.044	26.000	0.002
	62.8242 - 60.4517		22.11	0.750	26.000	0.058	1.96	0.042	26.000	0.002
	60.4517 - 58.0791		22.26	0.741	26.000	0.057	1.96	0.041	26.000	0.002
	58.0791 - 55.7066		22.42	0.732	26.000	0.056	1.96	0.039	26.000	0.002
	55.7066 - 53.334		22.58	0.724	26.000	0.056	1.96	0.038	26.000	0.001
	53.334 - 47.667		10.61	0.326	26.000	0.025	0.89	0.016	26.000	0.001
L3	53.334 - 47.667	TP55x39.0504x0.3125	12.43	0.310	26.000	0.024	1.07	0.016	26.000	0.001
	47.667 - 45.2108		23.19	0.567	26.000	0.044	1.96	0.028	26.000	0.001
	45.2108 - 42.7547		23.35	0.561	26.000	0.043	1.96	0.027	26.000	0.001
	42.7547 - 40.2985		23.50	0.555	26.000	0.043	1.95	0.026	26.000	0.001
	40.2985 - 37.8424		23.66	0.549	26.000	0.042	1.95	0.025	26.000	0.001
	37.8424 - 35.3862		23.82	0.543	26.000	0.042	1.95	0.024	26.000	0.001
	35.3862 - 32.9301		23.98	0.538	26.000	0.041	1.95	0.023	26.000	0.001
	32.9301 - 30.4739		24.14	0.532	26.000	0.041	1.95	0.022	26.000	0.001

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
	30.4739 - 28.0177		24.30	0.527	26.000	0.041	1.95	0.022	26.000	0.001
	28.0177 - 25.5616		24.47	0.523	26.000	0.040	1.95	0.021	26.000	0.001
	25.5616 - 23.1054		24.63	0.518	26.000	0.040	1.95	0.020	26.000	0.001
	23.1054 - 20.6493		24.80	0.513	26.000	0.039	1.95	0.020	26.000	0.001
	20.6493 - 18.1931		24.97	0.509	26.000	0.039	1.95	0.019	26.000	0.001
	18.1931 - 15.7369		25.14	0.505	26.000	0.039	1.95	0.019	26.000	0.001
	15.7369 - 13.2808		25.31	0.501	26.000	0.039	1.95	0.018	26.000	0.001
	13.2808 - 10.8246		25.48	0.497	26.000	0.038	1.95	0.017	26.000	0.001
	10.8246 - 8.36847		25.66	0.493	26.000	0.038	1.95	0.017	26.000	0.001
	8.36847 - 5.91232		25.84	0.490	26.000	0.038	1.95	0.017	26.000	0.001
	5.91232 - 3.45616		26.02	0.486	26.000	0.037	1.95	0.016	26.000	0.001
	3.45616 - 1		26.20	0.483	26.000	0.037	1.95	0.016	26.000	0.001

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	125 - 123.682	0.001	0.023	0.000	0.003	0.000	0.023 ✔	1.333	H1-3+VT ✔
	123.682 - 122.364	0.003	0.038	0.000	0.027	0.000	0.041 ✔	1.333	H1-3+VT ✔
	122.364 - 121.046	0.006	0.070	0.000	0.032	0.000	0.077 ✔	1.333	H1-3+VT ✔
	121.046 - 119.728	0.006	0.102	0.000	0.032	0.000	0.109 ✔	1.333	H1-3+VT ✔
	119.728 - 118.41	0.006	0.132	0.000	0.031	0.000	0.138 ✔	1.333	H1-3+VT ✔
	118.41 - 117.092	0.006	0.159	0.000	0.031	0.000	0.166 ✔	1.333	H1-3+VT ✔
	117.092 - 115.774	0.006	0.185	0.000	0.031	0.000	0.192 ✔	1.333	H1-3+VT ✔
	115.774 - 114.456	0.006	0.209	0.000	0.031	0.000	0.216 ✔	1.333	H1-3+VT ✔
	114.456 - 113.138	0.007	0.236	0.000	0.036	0.000	0.243 ✔	1.333	H1-3+VT ✔
	113.138 - 111.819	0.010	0.263	0.000	0.047	0.000	0.274 ✔	1.333	H1-3+VT ✔
	111.819 - 110.501	0.010	0.298	0.000	0.046	0.000	0.309 ✔	1.333	H1-3+VT ✔

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
	110.501 - 109.183	0.010	0.331	0.000	0.046	0.000	0.341 ✔	1.333	H1-3+VT ✔
	109.183 - 107.865	0.010	0.361	0.000	0.046	0.000	0.372 ✔	1.333	H1-3+VT ✔
	107.865 - 106.547	0.010	0.390	0.000	0.045	0.000	0.401 ✔	1.333	H1-3+VT ✔
	106.547 - 105.229	0.010	0.417	0.000	0.045	0.000	0.427 ✔	1.333	H1-3+VT ✔
	105.229 - 103.911	0.011	0.442	0.000	0.052	0.000	0.454 ✔	1.333	H1-3+VT ✔
	103.911 - 102.593	0.011	0.472	0.000	0.051	0.000	0.483 ✔	1.333	H1-3+VT ✔
	102.593 - 101.275	0.013	0.508	0.000	0.056	0.002	0.522 ✔	1.333	H1-3+VT ✔
	101.275 - 99.957	0.013	0.538	0.000	0.055	0.002	0.552 ✔	1.333	H1-3+VT ✔
	99.957 - 96.04	0.006	0.272	0.000	0.024	0.001	0.278 ✔	1.333	H1-3+VT ✔
L2	99.957 - 96.04	0.006	0.268	0.000	0.023	0.001	0.274 ✔	1.333	H1-3+VT ✔
	96.04 - 93.6674	0.011	0.524	0.000	0.056	0.001	0.535 ✔	1.333	H1-3+VT ✔
	93.6674 - 91.2949	0.012	0.586	0.000	0.059	0.003	0.599 ✔	1.333	H1-3+VT ✔
	91.2949 - 88.9223	0.013	0.635	0.000	0.058	0.003	0.648 ✔	1.333	H1-3+VT ✔
	88.9223 - 86.5498	0.013	0.679	0.000	0.057	0.003	0.693 ✔	1.333	H1-3+VT ✔
	86.5498 - 84.1772	0.013	0.719	0.000	0.057	0.003	0.733 ✔	1.333	H1-3+VT ✔
	84.1772 - 81.8047	0.014	0.761	0.000	0.063	0.002	0.777 ✔	1.333	H1-3+VT ✔
	81.8047 - 79.4321	0.015	0.802	0.000	0.062	0.002	0.817 ✔	1.333	H1-3+VT ✔
	79.4321 - 77.0596	0.015	0.839	0.000	0.061	0.002	0.855 ✔	1.333	H1-3+VT ✔
	77.0596 - 74.687	0.015	0.872	0.000	0.060	0.002	0.888 ✔	1.333	H1-3+VT ✔
	74.687 - 72.3144	0.015	0.903	0.000	0.059	0.002	0.919 ✔	1.333	H1-3+VT ✔
	72.3144 - 69.9419	0.016	0.931	0.000	0.061	0.002	0.948 ✔	1.333	H1-3+VT ✔
	69.9419 - 67.5693	0.016	0.958	0.000	0.060	0.002	0.975 ✔	1.333	H1-3+VT ✔
	67.5693 - 65.1968	0.016	0.983	0.000	0.059	0.002	1.000 ✔	1.333	H1-3+VT ✔
	65.1968 - 62.8242	0.016	1.006	0.000	0.058	0.002	1.023 ✔	1.333	H1-3+VT ✔
	62.8242 - 60.4517	0.017	1.026	0.000	0.058	0.002	1.043 ✔	1.333	H1-3+VT ✔
	60.4517 - 58.0791	0.017	1.049	0.000	0.057	0.002	1.066 ✔	1.333	H1-3+VT ✔

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
	58.0791 - 55.7066	0.017	1.075	0.000	0.056	0.002	1.092 ✓	1.333	H1-3+VT ✓
	55.7066 - 53.334	0.017	1.099	0.000	0.056	0.001	1.117 ✓	1.333	H1-3+VT ✓
	53.334 - 47.667	0.008	0.525	0.000	0.025	0.001	0.534 ✓	1.333	H1-3+VT ✓
L3	53.334 - 47.667	0.008	0.497	0.000	0.024	0.001	0.505 ✓	1.333	H1-3+VT ✓
	47.667 - 45.2108	0.014	0.922	0.000	0.044	0.001	0.937 ✓	1.333	H1-3+VT ✓
	45.2108 - 42.7547	0.014	0.930	0.000	0.043	0.001	0.945 ✓	1.333	H1-3+VT ✓
	42.7547 - 40.2985	0.014	0.937	0.000	0.043	0.001	0.952 ✓	1.333	H1-3+VT ✓
	40.2985 - 37.8424	0.015	0.943	0.000	0.042	0.001	0.958 ✓	1.333	H1-3+VT ✓
	37.8424 - 35.3862	0.015	0.949	0.000	0.042	0.001	0.964 ✓	1.333	H1-3+VT ✓
	35.3862 - 32.9301	0.015	0.954	0.000	0.041	0.001	0.969 ✓	1.333	H1-3+VT ✓
	32.9301 - 30.4739	0.015	0.958	0.000	0.041	0.001	0.974 ✓	1.333	H1-3+VT ✓
	30.4739 - 28.0177	0.015	0.962	0.000	0.041	0.001	0.978 ✓	1.333	H1-3+VT ✓
	28.0177 - 25.5616	0.015	0.968	0.000	0.040	0.001	0.984 ✓	1.333	H1-3+VT ✓
	25.5616 - 23.1054	0.015	0.978	0.000	0.040	0.001	0.994 ✓	1.333	H1-3+VT ✓
	23.1054 - 20.6493	0.015	0.987	0.000	0.039	0.001	1.003 ✓	1.333	H1-3+VT ✓
	20.6493 - 18.1931	0.016	0.996	0.000	0.039	0.001	1.012 ✓	1.333	H1-3+VT ✓
	18.1931 - 15.7369	0.016	1.005	0.000	0.039	0.001	1.021 ✓	1.333	H1-3+VT ✓
	15.7369 - 13.2808	0.016	1.014	0.000	0.039	0.001	1.030 ✓	1.333	H1-3+VT ✓
	13.2808 - 10.8246	0.016	1.022	0.000	0.038	0.001	1.039 ✓	1.333	H1-3+VT ✓
	10.8246 - 8.36847	0.016	1.031	0.000	0.038	0.001	1.048 ✓	1.333	H1-3+VT ✓
	8.36847 - 5.91232	0.017	1.039	0.000	0.038	0.001	1.056 ✓	1.333	H1-3+VT ✓
	5.91232 - 3.45616	0.017	1.047	0.000	0.037	0.001	1.064 ✓	1.333	H1-3+VT ✓
	3.45616 - 1	0.017	1.055	0.000	0.037	0.001	1.072 ✓	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	125 - 96.04	Pole	TP26.9x18x0.1875	1	-7.89	789.21	41.4	Pass
L2	96.04 - 47.667	Pole	TP41.28x25.3212x0.25	2	-20.33	1588.03	83.8	Pass
L3	47.667 - 1	Pole	TP55x39.0504x0.3125	3	-33.68	2618.15	80.4	Pass
							Summary	
						Pole (L2)	83.8	Pass
						RATING =	**83.8**	**Pass**

CENTEK engineering
Centered on Solutions
63-2 North Branford Road
Branford, CT 06405
www.centekeng.com
P: (203) 488-0580
F: (203) 488-8587

Subject:		Anchor Bolt and Baseplate Analysis
Location:		125-ft EEI Monopole Bethel, CT
Rev. 1: 11/16/11		Prepared by: T.J.L. Checked by: C.F.C. Job No. 11001.CO61

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 2335·ft·kips	(Input From RisaTower)
Shear Force =	Shear := 26·kips	(Input From RisaTower)
Axial Force =	Axial := 34·kips	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 12	(User Input)
Diameter of Bolt Circle =	D_{bc} := 63.0·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} := 1.75·in	(User Input)
Base Plate Diameter =	D_{bp} := 69.0·in	(User Input)
Outer Pole Diameter =	D_{pole} := 55.0·in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 31.5 \cdot in$

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

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

$d_1 = 15.75 \cdot in$ $d_9 = -31.50 \cdot in$

$d_2 = 27.28 \cdot in$ $d_{10} = -27.28 \cdot in$

$d_3 = 31.50 \cdot in$ $d_{11} = -15.75 \cdot in$

$d_4 = 27.28 \cdot in$ $d_{12} = -0.00 \cdot in$

$d_5 = 15.75 \cdot in$

$d_6 = 0.00 \cdot in$

$d_7 = -15.75 \cdot in$

$d_8 = -27.28 \cdot in$

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 27.5 \cdot in$

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

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

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

$MA_3 = 4.00 \cdot in$ $MA_{11} = 0.00 \cdot in$

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

$MA_5 = 0.00 \cdot in$

$MA_6 = 0.00 \cdot in$

$MA_7 = 0.00 \cdot in$

$MA_8 = 0.00 \cdot in$

Effective Width of Baseplate for Bending = $B_{eff} := 0.8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 33.3 \cdot in$

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 5.953 \times 10^3 \cdot in^2$

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 = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 145.4 \cdot kips$

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 = $\frac{T_{Max}}{T_{ALL.Net}} = 74.6 \cdot \%$ 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 = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.542 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 7.9 \cdot ksi$

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 =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 151.1 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 46.5 \cdot ksi$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

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

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 77.6 \cdot \%$$

Condition 2 =

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

Condition2 = "OK"

Base Plate Analysis:

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

$C_1 = 77.0 \cdot kips$ $C_9 = -145.4 \cdot kips$

$C_2 = 131.2 \cdot kips$ $C_{10} = -125.6 \cdot kips$

$C_3 = 151.1 \cdot kips$ $C_{11} = -71.3 \cdot kips$

$C_4 = 131.2 \cdot kips$ $C_{12} = 2.8 \cdot kips$

$C_5 = 77.0 \cdot kips$

$C_6 = 2.8 \cdot kips$

$C_7 = -71.3 \cdot kips$

$C_8 = -125.6 \cdot kips$

Maximum Bending Stress in Plate = $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} t_{bp}^2\right)} = 35.5 \cdot ksi$

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

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} = 59.4 \cdot \%$

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

Condition3 = "Ok"

CENTEK engineering
Centered on Solutions
63-2 North Branford Road
Branford, CT 06405
www.centekeng.com
P: (203) 488-0580
F: (203) 488-8587

Subject:	Foundation Analysis
Location:	125-ft Monopole Bethel, CT
Rev. 1: 11/16/11	Prepared by: T.J.L. Checked by: C.F.C. Job No. 11001.CO61

Standard Monopole Foundation:

Input Data:

Tower Data

Overturning Moment =	$OM := 2335 \cdot ft \cdot kips$	(User Input from RISATower)	
Shear Force =	$Shear := 26 \cdot kip$	(User Input from RISATower)	
Axial Force =	$Axial := 34 \cdot kip$	(User Input from RISATower)	
Tower Height =	$H_t := 125 \cdot ft$	(User Input)	

Footing Data:

Overall Depth of Footing =	$D_f := 4.5 \cdot ft$	(User Input)	
Length of Pier =	$L_p := 1.0 \cdot ft$	(User Input)	
Extension of Pier Above Grade =	$L_{pag} := 1.0 \cdot ft$	(User Input)	
Diameter of Pier =	$d_p := 7.0 \cdot ft$	(User Input)	
Thickness of Footing =	$T_f := 4.5 \cdot ft$	(User Input)	
Width of Footing =	$W_f := 25.0 \cdot ft$	(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 =	$MP := 63.0 \cdot in$	(User Input)	

Material Properties:

Concrete Compressive Strength =	$f_c := 3000 \cdot psi$	(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 =	$q_s := 3000 \cdot psf$	(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)	

CENTEK engineering
Centered on Solutions
63-2 North Branford Road
Branford, CT 06405
www.centekeng.com
P: (203) 488-0580
F: (203) 488-8587

Subject:	Foundation Analysis	
Location:	125-ft Monopole Bethel, CT	
Rev. 1: 11/16/11	Prepared by: T.J.L. Checked by: C.F.C. Job No. 11001.CO61	

Pier Reinforcement:

Bar Size =	$BS_{pier} := 9$	(User Input)	
Bar Diameter =	$d_{bpier} := 1.128 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 24$	(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 =	$BS_{top} := 9$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 1.128 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 28$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 9$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 1.128 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 28$	(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 =
$$A_{bpier} := \frac{\pi \cdot d_{bpier}^2}{4} = 0.999 \cdot in^2$$

Pad Top Reinforcement Bar Area =
$$A_{btop} := \frac{\pi \cdot d_{btop}^2}{4} = 0.999 \cdot in^2$$

Pad Bottom Reinforcement Bar Area =
$$A_{bbot} := \frac{\pi \cdot d_{bbot}^2}{4} = 0.999 \cdot in^2$$

Coefficient of Lateral Soil Pressure =
$$K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 3$$

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

Stability of Footing:

Adjusted Concrete Unit Weight = $\gamma_c := if(Bouyancy = 1, \gamma_{conc} - 62.4pcf, \gamma_{conc}) = 150 \cdot pcf$

Adjusted Soil Unit Weight = $\gamma_s := if(Bouyancy = 1, \gamma_{soil} - 62.4pcf, \gamma_{soil}) = 100 \cdot pcf$

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

$P_{pt} := K_p \cdot \gamma_s \cdot (D_f - T_f) + c \cdot 2 \cdot \sqrt{K_p} = 0 \cdot ksf$

$P_{top} := if[n < (D_f - T_f), P_{pt}, P_{pn}] = 0.3 \cdot ksf$

$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p} = 1.35 \cdot ksf$

$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 0.825 \cdot ksf$

$T_p := if[n < (D_f - T_f), T_f, (D_f - n)] = 3.5$

$A_p := W_f \cdot T_p = 87.5$

Ultimate Shear = $S_u := P_{ave} \cdot A_p = 72.188 \cdot kip$

Weight of Concrete Pad = $WT_c := \left[\left(W_f^2 \cdot T_f\right) + \frac{d_p^2 \cdot \pi}{4} L_p\right] \cdot \gamma_c = 427.648 \cdot kip$

Weight of Soil Above Footing = $WT_{s1} := \left[\left(W_f^2 - \frac{d_p^2 \cdot \pi}{4}\right) \cdot \left(\left|L_p - L_{pag} - n\right|\right)\right] \cdot \gamma_s = 58.65 \cdot kip$

Weight of Soil Wedge at Back Face = $WT_{s2} := \left(\frac{D_f^2 \cdot \tan(\Phi_s)}{2} \cdot W_f\right) \cdot \gamma_s = 14.614 \cdot kip$

Weight of Soil Wedge at back face Corners = $WT_{s3} := 2 \cdot \left[(D_f)^3 \cdot \frac{\tan(\Phi_s)}{3}\right] \cdot \gamma_s = 3.507 \cdot kips$

Total Weight = $WT_{tot} := WT_c + WT_{s1} + Axial = 520.299 \cdot kip$

Resisting Moment = $M_r := (WT_{tot}) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + \left[(WT_{s2} + WT_{s3}) \cdot \left(W_f + \frac{D_f \cdot \tan(\Phi_s)}{3}\right)\right] = 7081 \cdot kip \cdot ft$

Overturning Moment = $M_{ot} := OM + Shear \cdot (L_p + T_f) = 2478 \cdot kip \cdot ft$

Factor of Safety Actual = $FS := \frac{M_r}{M_{ot}} = 2.86$

Factor of Safety Required = $FS_{req} := 2$

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

$OverTurning\_Moment\_Check = "Okay"$

Shear Capacity in Pier:

Shear Resistance of Pier =

$$S_p := \frac{\mu \cdot WT_{tot}}{FS_{req}} = 117.067 \cdot kips$$

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

Shear_Check = "Okay"

Bearing Pressure Caused by Footing:

Area of the Mat =

$$A_{mat} := W_f^{\,2} = 625$$

Section Modulus of Mat =

$$S := \frac{W_f^{\,3}}{6} = 2604.17 \cdot ft^3$$

Maximum Pressure in Mat =

$$P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S} = 1.784 \cdot ksf$$

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

Max_Pressure_Check = "Okay"

Minimum Pressure in Mat =

$$P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S} = -0.119 \cdot ksf$$

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

Min_Pressure_Check = "No Good"

Distance to Resultant of Pressure Distribution =

$$X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 7.812$$

Distance to Kern =

$$X_k := \frac{W_f}{6} = 4.167$$

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

Eccentricity =

$$e := \frac{M_{ot}}{WT_{tot}} = 4.763$$

Adjusted Soil Pressure =

$$P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)} = 1.793 \cdot ksf$$

$$q_{adj} := if(P_{min} < 0, P_a, P_{max}) = 1.793 \cdot ksf$$

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

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 = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 9.185 \times 10^3 \cdot kips$ (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)

$d := T_f - Cvr_{pad} - d_{bbot} = 49.872 \cdot in$

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

$d_2 := d_1 - d$

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

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

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

$V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f_c \cdot psi} \cdot W_f \cdot d$ (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 = $b_o := \left(d_p + d\right) \cdot \pi = 35$

Area Included Inside Perimeter = $A_{bo} := \frac{\pi \cdot \left(d_p + d\right)^2}{4} = 97.7$

Area Outside of Perimeter = $A_{out} := A_{mat} - A_{bo} = 527.3$

Guess Value = $v_u := 1ksf$ (From "Foundation Analysis and design", By Joseph Bowles, Eq. 8-9)

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

$v_u := \text{Find}(v_u) = 3.6 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f = 371.1 \cdot kips$

Required Shear Strength = $V_{req} := LF \cdot V_u = 494.7 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 3906 \cdot kip$ (ACI-2008 11.11.2.1)

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

Punching_Shear_Check = "Okay"

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

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

$q_b := q_{adj} - d_1 \cdot Slope = 1.098 \cdot ksf$

Maximum Bending at Face of Pier = $M_n := \frac{1}{LF \cdot \phi_m} \cdot \left[\left(q_{adj} - q_b \right) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 1317.8 \cdot kip \cdot ft$

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

(ACI-200810.2.7.3)

$R_u := \frac{M_n}{\phi_m \cdot W_f \cdot d^2} = 3.4 \cdot ksf$

$\rho := \frac{0.85 \cdot f_c}{f_y} \left(1 - \sqrt{1 - \frac{2 \cdot R_u}{0.85 \cdot f_c}} \right) = 0.0004$

$\rho_{min} := 1.333 \cdot \rho = 0.00053$

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:

$$As := \max\left(\rho, \rho_{min}, \rho_{sh}\right) \cdot W_f \cdot d = 26.9 \cdot in^2$$

$$As_{prov} := A_{bbot} \cdot NB_{bot} = 28 \cdot in^2$$

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

Pad_Reinforcement_Bot = "Okay"

Check top Bars:

$$As := \rho_{sh} \cdot \left(W_f \cdot d\right) = 26.9 \cdot in^2$$

$$As_{prov} := A_{btop} \cdot NB_{top} = 28 \cdot in^2$$

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

Pad_Reinforcement_Top = "Okay"

Developement Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 9.72 \cdot in$$

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)

$$L_{dbt} := \frac{3 \cdot f_y \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 34.8 \cdot in$$

Minimum Development Length =

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

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

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad} = 105 \cdot in$$

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

Lpad_Check = "Okay"

Steel Reinforcement in Pier:

Area of Pier = $A_p := \frac{\pi \cdot d_p^2}{4} = 5541.77 \cdot in^2$

$A_{smin} := 0.01 \cdot 0.05 \cdot A_p = 2.77 \cdot in^2$ (ACI-2008 10.8.4 & 10.9.1)

$A_{sprov} := NB_{pier} \cdot A_{bpier} = 23.98 \cdot in^2$

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

Steel_Area_Check = "Okay"

Bar Spacing In Pier = $B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 9.868 \cdot in$

Diameter of Reinforcement Cage = $Diam_{cage} := d_p - 2 \cdot Cvr_{pier} = 78 \cdot in$

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;

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

$(D\ N\ n\ P_u\ M_{xu}) = (84\ \ 24\ \ 9\ \ 45.322\ \ 3.797 \times 10^4)$

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

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

$(\phi P_n\ \ \phi M_{xn}\ \ f_{sp}\ \ \rho) = (57.452\ \ 4.814 \times 10^4\ \ -60\ \ 4.331 \times 10^{-3})$

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

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:

$L_{pier} := L_p - Cvr_{pier} = 9 \cdot in$

$L_{pad} := T_f - Cvr_{pad} = 51 \cdot in$

Tension: (ACI-2008 12.2.3)

Spacing or Cover Dimension =

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

Transverse Reinforcement =

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

$L_{dbt} := \frac{3 \cdot f_y \alpha_{pier} \cdot \beta_{pier} \cdot \gamma_{pier} \cdot \lambda_{pier}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \left(\frac{c + k_{tr}}{d_{bpier}}\right)} \cdot d_{bpier} = 34.85 \cdot in$

Minimum Development Length =

$L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f_c}{psi}}} \cdot .7 = 17.299 \cdot in$ (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)

$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot f_y}{\sqrt{f_c \cdot psi}} = 24.713 \cdot in$

$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot \left(d_{bpier} \cdot f_y\right) = 20.304 \cdot in$

$L_{dbc} := if\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right) = 24.713 \cdot in$

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

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

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)

$s_{lim1} := 16 \cdot d_{bpier} \cdot z = 18.048 \cdot in$

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

$s_{lim3} := D_f \cdot z = 54 \cdot in$

$s_{lim4} := 18in$

Maximum Spacing =

$$s_{tie} := \min\left(\begin{pmatrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{pmatrix}\right) = 18 \cdot in$$

Number of Ties Required =

$$n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 = 1.333$$

Check Anchor Steel Embedment:

Depth Available =

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

Length of Anchor Bolt =

$$L_{anchor} := \frac{(0.11 \cdot f_{ya}) \cdot in}{\sqrt{f_c \cdot psi}} = 12.552 \cdot ft$$

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

Depth_Check = "No Good"

Note: Anchor plate is provided

SITE NAME	BETHEL CT	ECP - CELL #	5	184
LATITUDE	41-21-43.44 N	LONGITUDE	73-23-45.30 W	
		SAVE BUTTON		
Additional Comments:		STRUCTURE TYPE	MONOPOLE	

700 Mhz - LTE ANTENNA ADD	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	eNodeB	eNodeB	eNodeB
ANTENNA TYPE	SLCP 2X6014	BXA-70063-4CF	BXA-70063-4CF
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	0	90	210
DOWN TILT (MECH/DEG)	5	0	3
RAD CTR (FT AGL)	105	105	105
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

850 Celluar - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Modcell 4.0B	Cellular Modcell 4.0B	Cellular Modcell 4.0B
ANTENNA TYPE	LPA-80063/8CF	LPA-80080/8CF	LPA-80080/8CF
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	350	90	210
DOWN TILT (MECH/DEG)	5	0	3
RAD CTR (FT AGL)	105	105	105
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

850 Celluar - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Modcell 4.0B	Cellular Modcell 4.0B	Cellular Modcell 4.0B
ANTENNA TYPE	LPA-80063/8CF	LPA-80080/8CF	LPA-80080/8CF
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	0	90	210
DOWN TILT (MECH/DEG)	5	0	3
RAD CTR (FT AGL)	105	105	105
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL	2 FD9R6004/2C-3L	2 FD9R6004/2C-3L	2 FD9R6004/2C-3L
DIPLEX WITH LTE CABLE			

1900 PCS - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0B	PCS Modcell 4.0B	PCS Modcell 4.0B
ANTENNA TYPE	LPA-185080-12CF 2	LPA-185080-12CF 2	LPA-185080-12CF 2
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	350	90	210
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	105	105	105
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

1900 PCS - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Modcell 4.0B	PCS Modcell 4.0B	PCS Modcell 4.0B
ANTENNA TYPE	BXA-171063/12BF-2°	BXA-171063/12BF-2°	BXA-171063/12BF-2°
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	0	90	210
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	105	105	105
TMA - QTY / MODEL			
DIPLEX WITH CELLULAR CABLE	DIPLEX with Cellular Cable	DIPLEX with Cellular Cable	DIPLEX with Cellular Cable

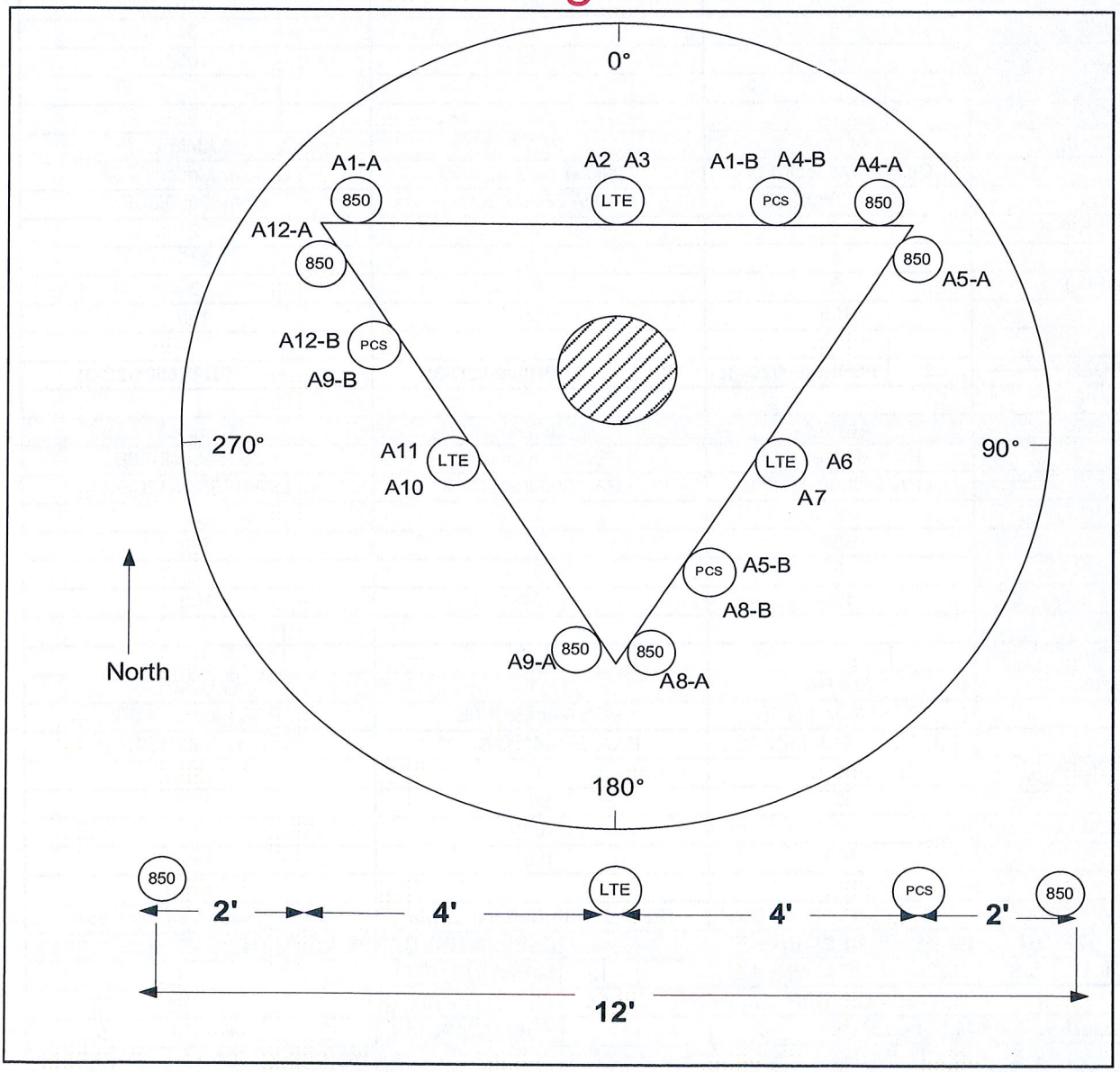
NUMBER OF CABLE'S NEEDED				ESTIMATED CABLE LENGTH			
MAINLINE SIZE	1 5/8"	TOTAL # OF MAINLINES	12	MAINLINE (FT)			
JUMPER SIZE	1/2 "	TOTAL # OF TOP JUMPERS	18	TOP JUMPER (FT)			12
Equipment Cable Ordering		MAIN CABLE	12 +	TOP JUMPER #	12	+	6

TX / RX FREQUENCIES			TX POWER OUTPUT	
Cellular A-Band	PCS F / AWS-Band	700 Mhz C - E	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-A	800	Tx1/Rx0	RED	A5-A	800	Tx2/Rx0	BLUE	A9-A	800	Tx3/Rx0	GREEN
A1-B	1900	Tx1/Rx0	RED/ WHITE	A5-B	1900	Tx2/Rx0	BLUE/ WHITE	A9-B	1900	Tx3/Rx0	GREEN/WHITE
A2	700	Tx1/Rx0	RED/ ORANGE	A6	700	Tx2/Rx0	BLUE/ ORANGE	A10	700	Tx3/Rx0	GREEN/ORANGE
A3	700	Tx4/Rx1	RED/RED/ ORANGE	A7	700	Tx5/Rx1	BLUE/BLUE/ ORANGE	A11	700	Tx6/Rx1	GREEN/GREEN/ ORANGE
A4-B	1900	Tx4/Rx1	RED/RED/ WHITE	A8-B	1900	Tx5/Rx1	BLUE/BLUE/ WHITE	A12-B	1900	Tx6/Rx1	GREEN/GREEN/ WHITE
A4-A	800	Tx4/Rx1	RED/RED	A8-A	800	Tx5/Rx1	BLUE/BLUE	A12-A	800	Tx6/Rx1	GREEN/GREEN

RF ENGINEER	RF MANAGER	INITIALS	DATE
Prepared By: Dany Bustamante	Steve Weatherbee	DB	8/19/2011

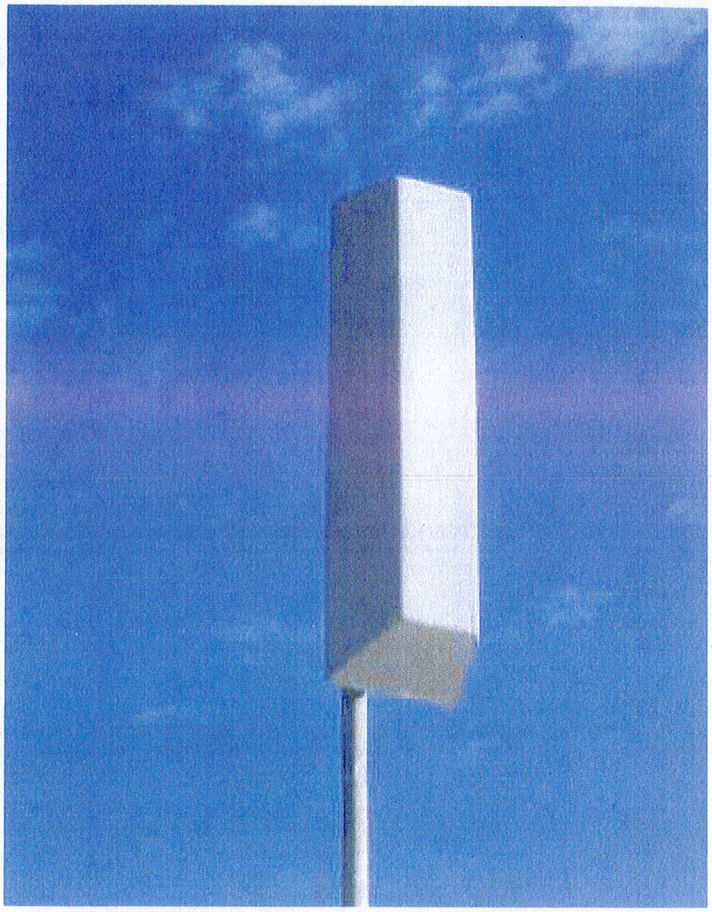
Site Configuration



Swedcom

SLCP 2x6014

Dual (2x) Circularly Polarized log-periodic antenna



Features

- Transmit Diversity Gain
- Can be configured to combine space & polarization diversity
- Outstanding performance over the entire band (700 - 800 MHz)
- Excellent Axial Ratio
- Optimized for 4G & 3G systems
- Low intermodulation
- Improved Side-to-side rejection
- Fading reduction
- Excellent isolation between ports

Electrical specifications

Frequency range:	**700-800 MHz**
Impedance:	**50 ohm**
Connector type:	**7/16 Din**
Return loss:	**18 dB**
Polarization:	**Circular**
Gain ea. port [Circular]:	**2x14 dBdC**
Gain ea. port [Linear]:	**2x11 dBdL**
Axial Ratio:	**2 dB**
Isolation between ports (TX band):	**30 dB**
Front-to-back ratio:	**30 dB**
Intermodulation (2x20W):	**IM3 150 dB**
	IM5 160 dB
	IM7/9 170 dB
Power rating:	**2x 500 W**
H-plane (-3 dB point):	**2x 55°**
V-plane (-3 dB point):	**2x 16°**
Lightning protection:	**DC grounded**

Mechanical specifications

Overall height:	**53 in**	**[1346 mm]**
Width:	**14 in**	**[356 mm]**
Depth:	**11 in**	**[279 mm]**
Weight (excluding brackets):	**20 lbs**	**[9 Kg]**
Wind load measured up to:	**150 mph**	**[240 Km/h]**
Wind area (side of antenna):	**5.15 sq. ft.**	**[0.48 sq.m]**
Lateral thrust at 113 mph/ 180 Km/h (worst case):	**263 lbs**	**[1171 N]**

Materials

Radiating Elements:	**Aluminum**
Transformer (Power distribution)	**Ceramic PCB**
Chassis:	**Aluminum**
Radome:	**Grey Fiberglass/PVC**
Mounting bolts:	**Stainless steel**

The SLCP 2x6014 is made in the U.S.A.

Amphenol ANTENNA SOLUTIONS

BXA-70063-4CF-EDIN-X

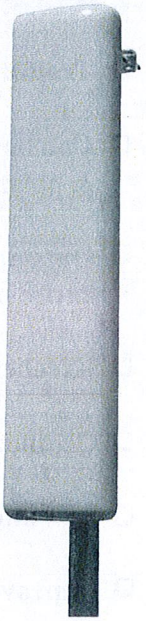
X-Pol | FET Panel | 63° | 13.0 dBd

Replace "X" with desired electrical downtilt.

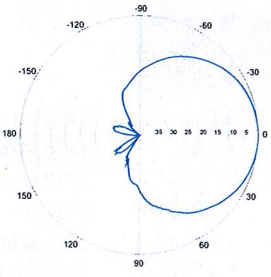
Antenna is also available with NE connector(s). Replace "EDIN" with "NE" in the model number when ordering.

Electrical Characteristics	696-900 MHz	
Frequency bands	696-806 MHz	806-900 MHz
Polarization	±45°	
Horizontal beamwidth	65°	63°
Vertical beamwidth	17°	15°
Gain	12.5 dBd (14.6 dBi)	13.0 dBd (15.1 dBi)
Electrical downtilt (X)	0, 2, 3, 4, 5, 6, 8, 9, 10, 12, 14	
Impedance	50Ω	
VSWR	≤1.35:1	
Upper sidelobe suppression (0°)	-16.3 dB	-22.1 dB
Front-to-back ratio (+/-30°)	-36.1 dB	-34.9 dB
Null fill	5% (-26.02 dB)	
Isolation between ports	< -30 dB	
Input power with EDIN connectors	500 W	
Input power with NE connectors	300 W	
Lightning protection	Direct Ground	
Connector(s)	2 Ports / EDIN or NE / Female / Center (Back)	
Mechanical Characteristics		
Dimensions Length x Width x Depth	1205 x 285 x 133 mm	47.4 x 11.2 x 5.2 in
Depth with z-brackets	173 mm	6.8 in
Weight without mounting brackets	4.5 kg	9.9 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.34 m² Side: 0.16 m²	Front: 3.7 ft² Side: 1.7 ft²
Wind load @ 161 km/hr (100 mph)	Front: 498 N Side: 260 N	Front: 111 lbf Side: 55 lbf

Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	36210002	50-160 mm 2.0-6.3 in	4.5 kg 10 lbs
2-Point Downtilt Bracket Kit (0-20°)	36114003	50-160 mm 2.0-6.3 in	4.9 kg 11 lbs
Downtilt Mounting Applications	A mounting bracket and downtilt bracket kit must be ordered for downtilt applications		
Concealment Configurations	For concealment configurations, order BXA-70063-4CF-EDIN-X-FP		

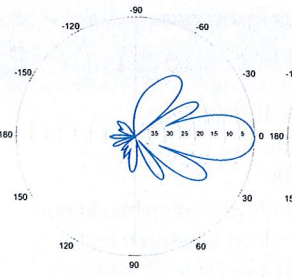


BXA-70063-4CF-EDIN-X



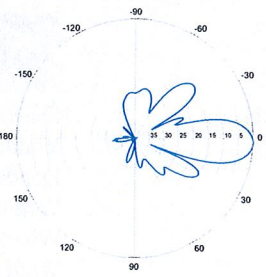
Horizontal | 750 MHz

BXA-70063-4CF-EDIN-0



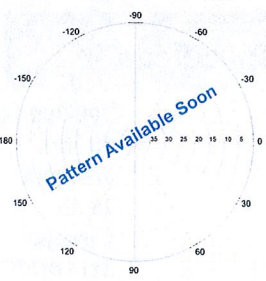
0° | Vertical | 750 MHz

BXA-70063-4CF-EDIN-2



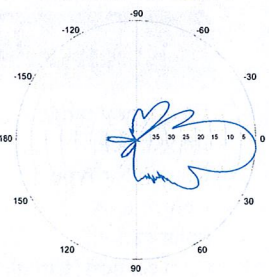
2° | Vertical | 750 MHz

BXA-70063-4CF-EDIN-3

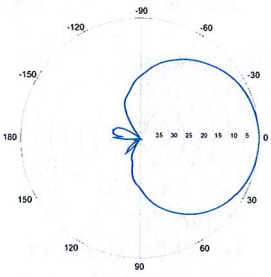


3° | Vertical | 750 MHz

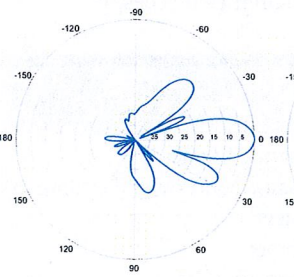
BXA-70063-4CF-EDIN-4



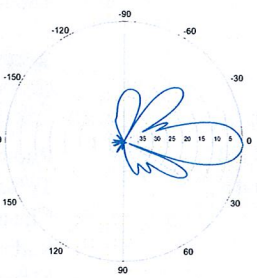
4° | Vertical | 750 MHz



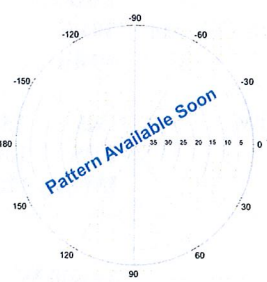
Horizontal | 850 MHz



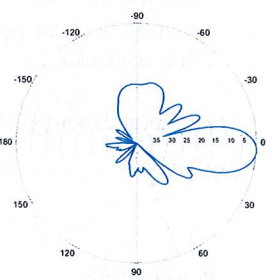
0° | Vertical | 850 MHz



2° | Vertical | 850 MHz



3° | Vertical | 850 MHz



4° | Vertical | 850 MHz

BXA-171063-12BF-EDIN-X

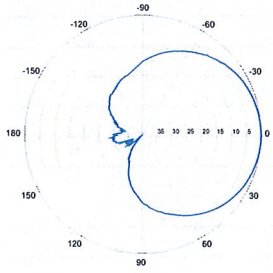
Replace 'X' with desired electrical downtilt.

X-Pol | FET Panel | 63° | 19.0 dBi

Electrical Characteristics	1710-2170 MHz		
Frequency bands	1710-1880 MHz	1850-1990 MHz	1920-2170 MHz
Polarization	±45°	±45°	±45°
Horizontal beamwidth	68°	65°	60°
Vertical beamwidth	4.5°	4.5°	4.5°
Gain	16.1 dBd / 18.2 dBi	16.5 dBd / 18.6 dBi	16.9 dBd / 19.0 dBi
Electrical downtilt (X)	0, 2, 5		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back ratio	> 30 dB		
In-band isolation	> 28 dB		
IM3 (20W carrier)	< -150 dBc		
Input power	300 W		
Lightning protection	Direct Ground		
Connector(s)	2 Ports / EDIN / Female / Bottom		
Operating temperature	-40° to +60° C / -40° to +140° F		
Mechanical Characteristics			
Dimensions Length x Width x Depth	1820 x 154 x 105 mm		71.7 x 6.1 x 4.1 in
Depth with z-brackets	133 mm		5.2 in
Weight without mounting brackets	6.8 kg		15 lbs
Survival wind speed	> 201 km/hr		> 125 mph
Wind area	Front: 0.28 m² Side: 0.19 m²		Front: 3.1 ft² Side: 2.1 ft²
Wind load @ 161 km/hr (100 mph)	Front: 460 N Side: 304 N		Front: 103 lbf Side: 68 lbf

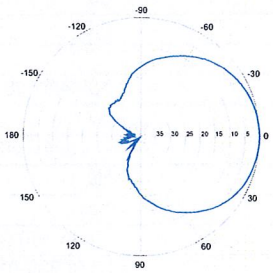
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	26799997	50-102 mm 2.0-4.0 in	2.3 kg 5 lbs
2-Point Mounting & Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	3.6 kg 8 lbs
Concealment Configurations	For concealment configurations, order BXA-171063-12BF-EDIN-X-FP		

BXA-171063-12BF-EDIN-X



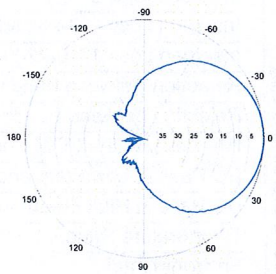
Horizontal | 1710-1880 MHz

BXA-171063-12BF-EDIN-X



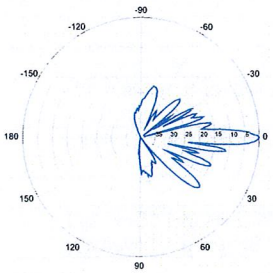
Horizontal | 1850-1990 MHz

BXA-171063-12BF-EDIN-X



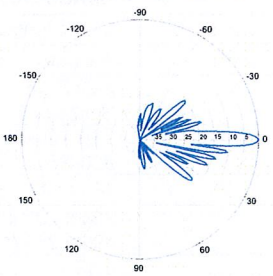
Horizontal | 1920-2170 MHz

BXA-171063-12BF-EDIN-0



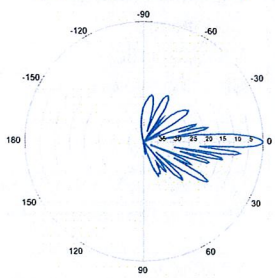
0° | Vertical | 1710-1880 MHz

BXA-171063-12BF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171063-12BF-EDIN-0



0° | Vertical | 1920-2170 MHz

Product Data Sheet **FD9R6004/2C-3L**

ShareLite Wideband Diplexer – In-line 698-960 MHz/1710-2200 MHz, DC pass in high frequency path

Product Description

The ShareLite FD9R6004 Series of diplexers are designed to enable feeder sharing between systems in the 698-960 MHz range and in the 1710-2200 MHz range. The diplexer is equipped with in-line connector placement so it can be installed in the BTS cabinet or at the tower top. This is especially valuable in crowded sites or when the feeders are not easily accessible. Due to its wideband design, the FD9R6004 Series can accommodate many combining solutions between 698-960 MHz and 1710-2200 MHz systems such as LTE 700 MHz, Cellular 800 MHz with PCS, GSM900 with GSM1800, or GSM900 with UMTS. This diplexer features a highly selective filter. It provides a high level of isolation between ports, while keeping the insertion loss on both paths at an extremely low level. The FD9R6004 diplexers are available with various DC pass options, helpful in configurations with or without the Tower Mount Amplifiers installed.

Features/Benefits

- **LTE ready design**
- **Extremely Low Insertion Loss**
- **High level of Rejection between bands – Protection against interferences**
- **Extremely High Power Handling Capability**
- **Integrated DC block/bypass versions available**
- **Very compact & small size design – Easy installation and reduced tower load**
- **In-line long-neck connectors for easy connection & waterproofing**
- **Exceptional reliability & environmental protection (IP 67)**
- **Mounting hardware for Wall and Pole mount provided (P/N SEM2-1A)**
- **Grounding already provided through the mounting bracket**
- **Kit available for easy dual mount**

Technical Specifications

Product Type	Diplexer/Cross Band Coupler
Frequency Band, MHz	698-2200
Configuration	Sharelite Single diplexer, outdoor, DC pass in the 1710 - 2170 MHz path, with mounting hardware SEM2-1A
Mounting	Wall, pole
Frequency Range Low Frequency Path, MHz	698-960
Frequency Range High Frequency Path, MHz	1710-2200
Return Loss All Ports, Min, dB	19
Power Handling Continuous, Max, W	1250 at common port; 750 in low frequency path & 500 in high frequency path
Power Handling Peak, Max, W	15000 in low frequency path & 8000 in high frequency path
Impedance, Ohms	50
Insertion Loss 698-960 MHz Path, Typ, dB	0.07
Insertion Loss 1710-2200MHz path, Typ, dB	0.13
Rejection Between Bands Min/Typ, dB	58/64@698-960MHz; 60/70@1710-2200MHz
Rejection between Bands, Min, dB	60
IMP Level at the COM Port, Typ, dBm	-112 @ 2x43
DC Pass in Low Frequency Path	No
DC Pass in High Frequency Path	Yes
Temperature Range, °C (°F)	-40 to +60 (-40 to +140)
Environmental	ETSI 300-019-2-4 Class 4.1E
Ingress Protection	IP 67
Lightning Protection	EN/IEC61000-4-5 Level 4
Connectors	In-line long-neck 7-16-Female
Weight, kg (lb)	1.2 (2.6)
Shipping Weight, kg (lb)	3.2 (7) for 2 * single units in 1 * box, 9.8 (21.6) for 6 * units = 3 * Boxes in 1 * overwrap
Application	LTE 700MHz, GSM900/3G/UMTS, GSM900/GSM1800, Cellular 800/PCS
Dimensions, H x W x D, mm (in)	147 x 164 x 37 (5.8 x 6.5 x 1.5)
Shipping Dimensions, H x W x D, mm (in)	254 x 406 x 82 (10 x 16 x 3.2) for 2 * Single Units in 1 * box, 280 x 406 x 241 (11 x 16 x 9.5) for 6 * units = 3 * Boxes in 1 * overwrap
Volume, L	0.43
Housing	Aluminum

Notes

Vertically Polarized, Log Periodic 80° / 15 dBd

LPA-80080/8CF ___

When ordering, replace "___" with connector type.

Mechanical specifications

	Length	2400 mm	94.5	in
	Width	140 mm	5.5	in
	Depth	335 mm	13.2	in
4)	Weight	10.89 kg	24	lbs
	Wind Area			
	Front	0.336 m^2	3.6	ft^2
	Side	0.806 m^2	8.7	ft^2
	Rated Wind Velocity (Safety factor 2.0)			
		>340 km/hr	>211	mph
	Wind load @ 100 mph (161 km/hr)			
	Front	580 N	130	lbs
	Side	1198 N	269	lbs

Antenna consisting of aluminum alloy with brass feedlines covered by a UV safe fiberglass radome.

Mounting & Downtilting:

Mounting brackets attach to a pipe diameter of Ø50-102 mm (2.0-4.0 in).

Mounting bracket kit #21699999

Downtilt bracket kit #21699999
The downtilt bracket kit includes the mounting bracket kit.

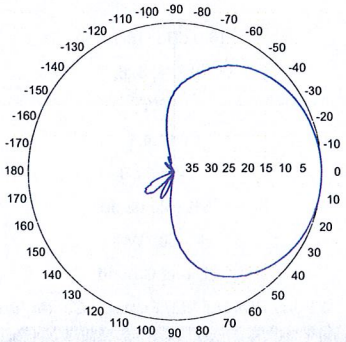
Electrical specifications

	Frequency Range	806-960 MHz
	Impedance	50Ω
3)	Connector	NE, E-DIN
1)	VSWR	≤1.4:1
	Polarization	Vertical
1)	Gain	15 dBd
2)	Power Rating	500 W
1)	Half Power Angle	
	H-Plane	80°
	E-Plane	7°
1)	Electrical Downtilt	0°
1)	Null Fill	10%
	Lightning Protection	Direct Ground

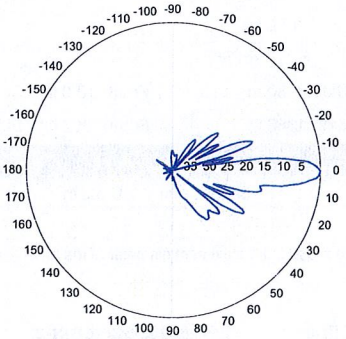
1) Typical Values
2) Power Rating limited by connector only.
3) NE indicates an elongated N Connector.
E-DIN indicates an elongated DIN Connector.
4) The antenna weight listed above does not include the bracket weight.

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

Radiation-pattern[1)]



Horizontal



Vertical

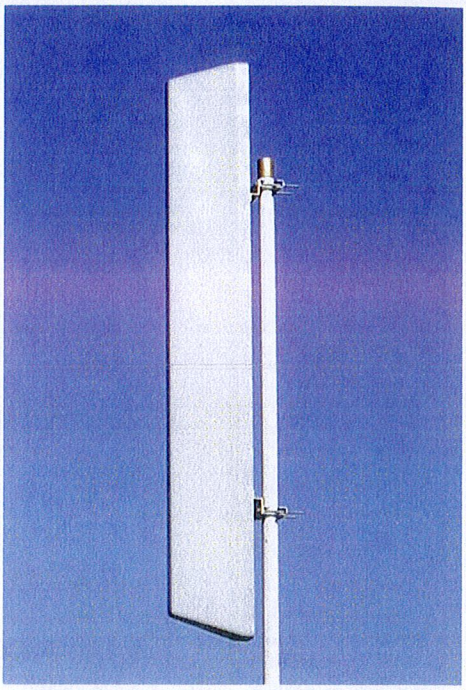
Featuring upper side lobe suppression.

Radiation patterns for all antennas are measured with the antenna mounted on a fiberglass pole.

Mounting on a metal pole will typically improve the Front-to-Back Ratio.

CF Denotes a Center-Fed Connector.

806-960 MHz



Amphenol Antel's Exclusive 3T (True Transmission Line Technology) Antenna Design:

- True log-periodic design allows for superior front-to-side characteristics to minimize sector overlap.
- 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 bandwidth and superior performance.
- Air as insulation for virtually no internal signal loss.

Every Amphenol Antel antenna is under a five-year limited warranty for repair or replacement.

Antenna available with center-fed connector only.

Amphenol Antel, Inc.
The Antenna Technology Company

1300 Capital Drive Rockford, IL 61109 Toll-Free (888) 417-9562 Tel. (815) 399-0001
Fax. (815) 399-0156 Email: antel@antelinc.com www.antelinc.com

Revision Date: 12/1/05

Amphenol ANTENNA SOLUTIONS

LPA-80063-8CF-EDIN-X

V-Pol | Log Periodic | 63° | 16.0 dBd

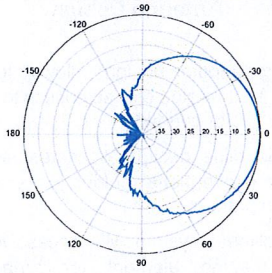
Replace "X" with desired electrical downtilt.

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

Electrical Characteristics		
Frequency bands	806-960 MHz	
Polarization	Vertical	
Horizontal beamwidth	63°	
Vertical beamwidth	7°	
Gain	16.0 dBd (18.1 dBi)	
Electrical downtilt (X)	0, 2, 4, 5, 6, 7	
Impedance	50Ω	
VSWR	≤1.4:1	
Upper sidelobe suppression (0°)	-19.5 dB	
Null fill	5% (-26.02 dB)	
Input power	500 W	
Lightning protection	Direct Ground	
Connector(s)	1 Port / EDIN or NE / Female / Center (Back)	
Mechanical Characteristics		
Dimensions Length x Width x Depth	2405 x 385 x 332 mm	94.7 x 15.2 x 13.1 in
Depth of antenna with z-bracket	372 mm	14.6 in
Weight without mounting brackets	17.2 kg	38 lbs
Survival wind speed	> 217 km/hr	> 135 mph
Wind area	Front: 0.93 m² Side: 0.80 m²	Front: 10.0 ft² Side: 8.6 ft²
Wind load @ 161 km/hr (100 mph)	Front:1341 N Side:1386 N	Front: 302 lbf Side: 312 lbf

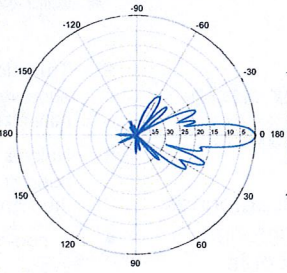
Mounting Options	Part Number	Fits Pipe Diameter	Weight
3-Point Mounting & Downtilt Bracket Kit (0-17°)	21700000	50-102 mm 2.0-4.0 in	11 kg 25 lbs
Lock-Down Brace	If the lock-down brace is used, the maximum diameter of the mounting pipe is 88.9 mm or 3.5 in.		

LPA-80063-8CF-EDIN-X



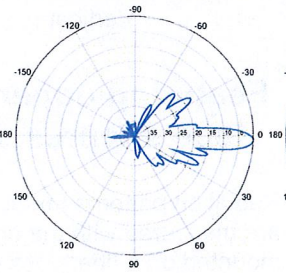
Horizontal

LPA-80063-8CF-EDIN-0



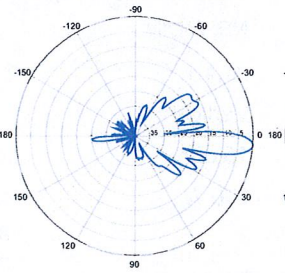
0° | Vertical

LPA-80063-8CF-EDIN-2



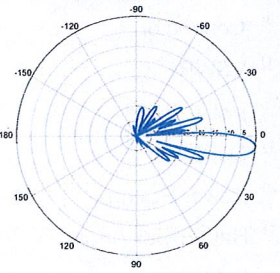
2° | Vertical

LPA-80063-8CF-EDIN-4



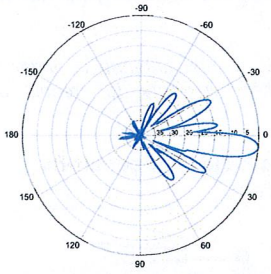
4° | Vertical

LPA-80063-8CF-EDIN-5



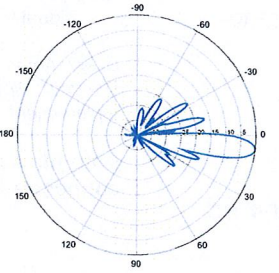
5° | Vertical

LPA-80063-8CF-EDIN-6



6° | Vertical

LPA-80063-8CF-EDIN-7



7° | Vertical