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

Also admitted in Massachusetts

December 28, 2012

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

Re: **EM-VER-082-120829 – 393 Jackson Hill Road, Middlefield, Connecticut**
EM-VER-079-120807 – 175 South Main Street, Marlborough, Connecticut
EM-VER-005-120217B – 127 New Hartford Road, Barkhamsted, Connecticut
EM-VER-086-120216 – 41 Beckwith Road, Montville, Connecticut
EM-VER-036-120627 – 15 Pent Road, Deep River, Connecticut
EM-VER-041-120405 – 135 Honey Hill Road, East Haddam, Connecticut

Completion of Construction Activity

Dear Ms. Roberts:

The purpose of this letter is to notify the Siting Council that construction activity associated with the above-referenced Cellco Partnership d/b/a Verizon Wireless telecommunications facilities has been completed.

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

Sincerely,

Kenneth C. Baldwin

Copy to:
Sandy M. Carter

12012136-v1

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

March 6, 2012

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

RE: **EM-VER-005-120217B** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at New Hartford Road (aka Rust Road), Barkhamsted, 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 February 16, 2012. The modifications are in compliance with the exception criteria in Section 16-50j-72 (b) of the Regulations of Connecticut State Agencies as changes to an existing facility site that would not increase tower height, extend the boundaries of the tower site, increase noise levels at the tower site boundary by six decibels, and increase the total radio frequencies electromagnetic radiation power density measured at the tower site boundary to or above the standard adopted by the State Department of Environmental Protection pursuant to General Statutes § 22a-162. This facility has also been carefully modeled to ensure that radio frequency emissions are conservatively below State and federal standards applicable to the frequencies now used on this tower.

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

Very truly yours,

Linda Roberts

Linda Roberts
Executive Director

LR/CDM/laf

c: The Honorable Donald S. Stein, First Selectman, Town of Barkhamsted
Karl Nilsen, Zoning Enforcement Officer, Town of Barkhamsted

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

February 21, 2012

The Honorable Donald S. Stein
First Selectman
Town of Barkhamsted
Town Hall
67 Ripley Hill Road
P. O. Box 558
Pleasant Valley, CT 06063

RE: **EM-VER-005-120217B** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at New Hartford Road (aka Rust Road), Barkhamsted, Connecticut.

Dear First Selectman Stein:

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 March 6, 2012.

Thank you for your cooperation and consideration.

Very truly yours,

LRoberts

Linda Roberts
Executive Director

LR/jbw

Enclosure: Notice of Intent

c: Karl Nilsen, Zoning Enforcement Officer, Town of Barkhamsted

CSC
CONNECTICUT SITING COUNCIL

ROBINSON & COLE LLP

EM-VER-005-120217B

KENNETH C. BALDWIN

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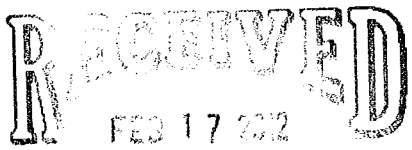
Direct (860) 275-8345

February 16, 2012



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

Re: **Notice of Exempt Modification – Antenna Swap**
New Hartford Road (aka Rust Road), Barkhamsted, Connecticut

Dear Ms. Roberts:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) wireless telecommunications antennas at the 133-foot level the existing 145-foot tower at the above-referenced address. The tower is owned by Cellco. The Council approved Cellco's use of the existing tower in 2004. Cellco now intends to modify its installation by replacing six (6) of its existing antennas with two (2) model BXA-171063-8BF PCS antennas; one (1) model BXA-171085-8BF PCS antenna; and three (3) model BXA-70063-6CF LTE antennas, all at the same 133-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 Donald S. Stein, First Selectman of the Town of Barkhamsted. A copy of this letter is also being sent to Regional Refuse/Dist. One, the owner of the property on which the tower is located.

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

1. The proposed modifications will not result in an increase in the overall height of the existing tower. Cellco's replacement antennas and diplexers will be located at the same 133-foot level on the 145-foot tower.

2. The proposed modifications will not involve a change to any 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 cumulative power density table 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 modifications. (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:
Donald S. Stein, Barkhamsted First Selectman
Regional Refuse/Dist. One
Sandy M. Carter

BXA-171063-8BF-EDIN-X

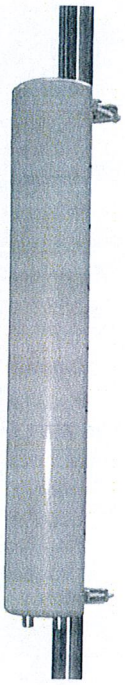
Replace "X" with desired electrical downtilt

X-Pol | FET Panel | 63° | 17.4 dBi

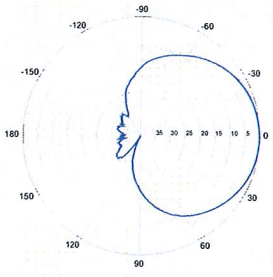
Electrical Characteristics	1710-2170 MHz		
Frequency bands	1710-1880 MHz	1850-1990 MHz	1920-2170 MHz
Polarization	±45°	±45°	±45°
Horizontal beamwidth	68°	65°	60°
Vertical beamwidth	7°	7°	7°
Gain	14.5 dBd / 16.6 dBi	14.9 dBd / 17.0 dBi	15.3 dBd / 17.4 dBi
Electrical downtilt (X)	0, 2, 4, 8		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back isolation	> 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	1232 x 154 x 105 mm	48.5 x 6.1 x 4.1 in
Depth with t-brackets	133 mm	5.2 in
Weight without mounting brackets	4.8 kg	10.5 lbs
Survival wind speed	296 km/hr	184 mph
Wind area	Front: 0.19 m² Side: 0.14 m²	Front: 2.0 ft² Side: 1.5 ft²
Wind load @ 161 km/hr (100 mph)	Front: 281 N Side: 223 N	Front: 63 lbf Side: 50 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-171063-8BF-EDIN-X-FP		

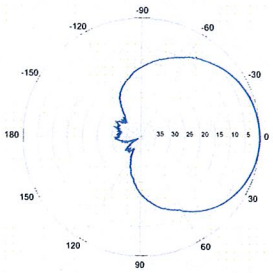


BXA-171063-8BF-EDIN-X



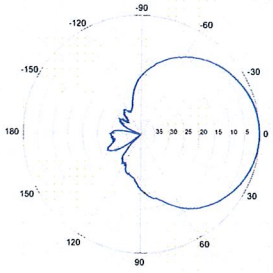
Horizontal | 1710-1880 MHz

BXA-171063-8BF-EDIN-X



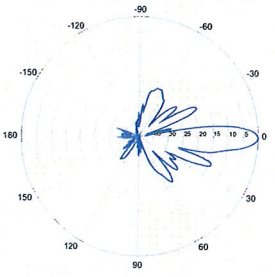
Horizontal | 1850-1990 MHz

BXA-171063-8BF-EDIN-X



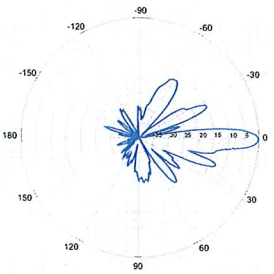
Horizontal | 1920-2170 MHz

BXA-171063-8BF-EDIN-0



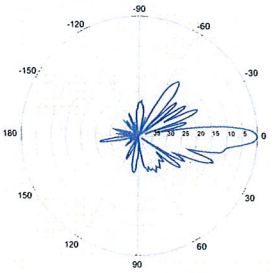
0° | Vertical | 1710-1880 MHz

BXA-171063-8BF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171063-8BF-EDIN-0

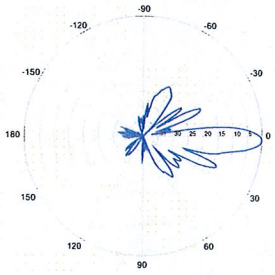


0° | Vertical | 1920-2170 MHz

BXA-171063-8BF-EDIN-X

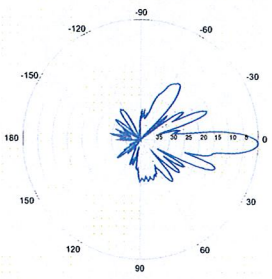
X-Pol | FET Panel | 63° | 17.4 dBi

BXA-171063-8BF-EDIN-2



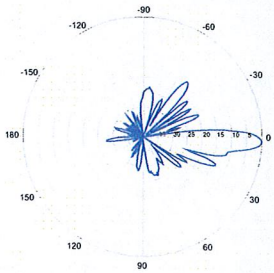
2° | Vertical | 1710-1880 MHz

BXA-171063-8BF-EDIN-2



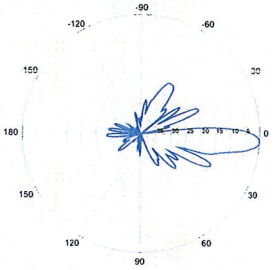
2° | Vertical | 1850-1990 MHz

BXA-171063-8BF-EDIN-2



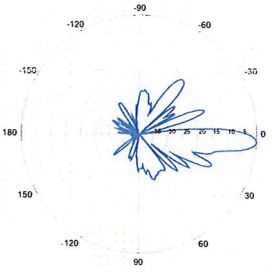
2° | Vertical | 1920-2170 MHz

BXA-171063-8BF-EDIN-4



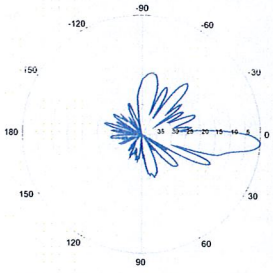
4° | Vertical | 1710-1880 MHz

BXA-171063-8BF-EDIN-4



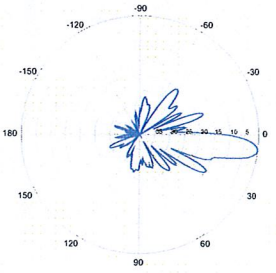
4° | Vertical | 1850-1990 MHz

BXA-171063-8BF-EDIN-4



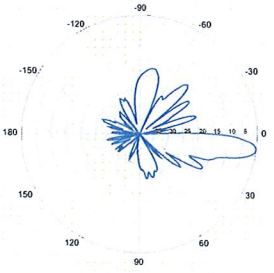
4° | Vertical | 1920-2170 MHz

BXA-171063-8BF-EDIN-8



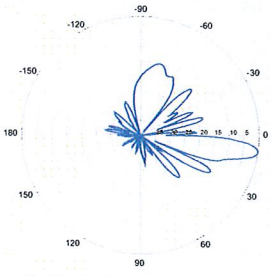
8° | Vertical | 1710-1880 MHz

BXA-171063-8BF-EDIN-8



8° | Vertical | 1850-1990 MHz

BXA-171063-8BF-EDIN-8



8° | Vertical | 1920-2170 MHz

Amphenol ANTENNA SOLUTIONS

BXA-171085-8BF-EDIN-X

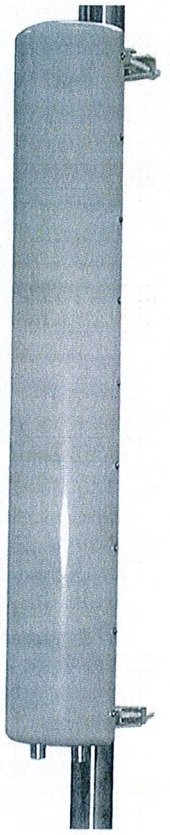
Replace 'X' with desired electrical downtilt.

X-Pol | FET Panel | 85° | 16.4 dBi

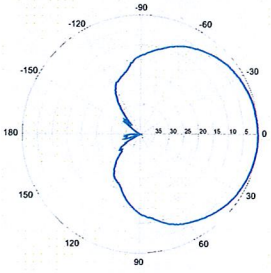
Electrical Characteristics	1710-2170 MHz		
Frequency bands	1710-1880 MHz	1850-1990 MHz	1920-2170 MHz
Polarization	±45°	±45°	±45°
Horizontal beamwidth	88°	85°	80°
Vertical beamwidth	7°	7°	7°
Gain	13.5 dBd / 15.6 dBi	13.9 dBd / 16.0 dBi	14.3 dBd / 16.4 dBi
Electrical downtilt (X)	0, 2, 4		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back isolation	> 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	1232 x 154 x 105 mm	48.5 x 6.1 x 4.1 in
Depth with t-brackets	133 mm	5.2 in
Weight without mounting brackets	4.8 kg	10.5 lbs
Survival wind speed	296 km/hr	184 mph
Wind area	Front: 0.19 m² Side: 0.14 m²	Front: 2.0 ft² Side: 1.5 ft²
Wind load @ 161 km/hr (100 mph)	Front: 281 N Side: 223 N	Front: 63 lbf Side: 50 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-171085-8BF-EDIN-X-FP		

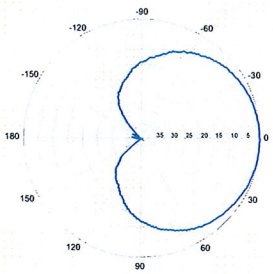


BXA-171085-8BF-EDIN-X



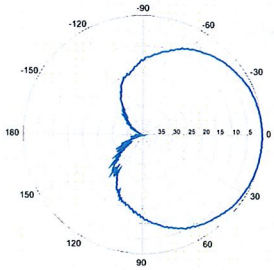
Horizontal | 1710-1880 MHz

BXA-171085-8BF-EDIN-X



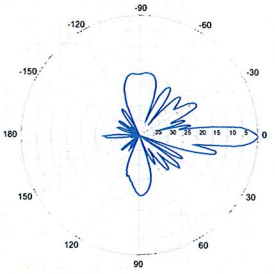
Horizontal | 1850-1990 MHz

BXA-171085-8BF-EDIN-X



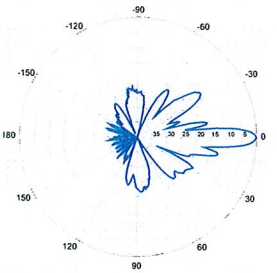
Horizontal | 1920-2170 MHz

BXA-171085-8BF-EDIN-0



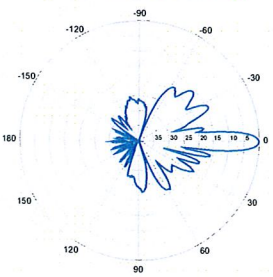
0° | Vertical | 1710-1880 MHz

BXA-171085-8BF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171085-8BF-EDIN-0

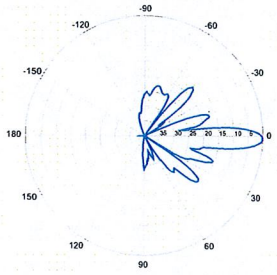


0° | Vertical | 1920-2170 MHz

BXA-171085-8BF-EDIN-X

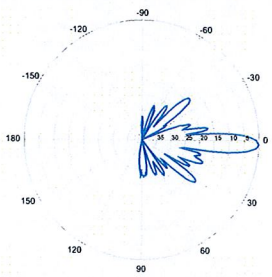
X-Pol | FET Panel | 85° | 16.4 dBi

BXA-171085-8BF-EDIN-2



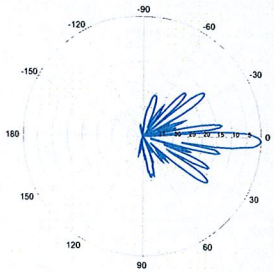
2° | Vertical | 1710-1880 MHz

BXA-171085-8BF-EDIN-2



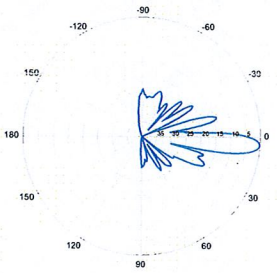
2° | Vertical | 1850-1990 MHz

BXA-171085-8BF-EDIN-2



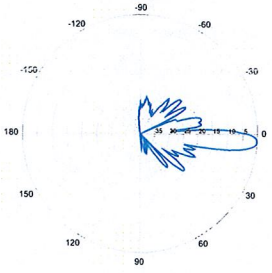
2° | Vertical | 1920-2170 MHz

BXA-171085-8BF-EDIN-4



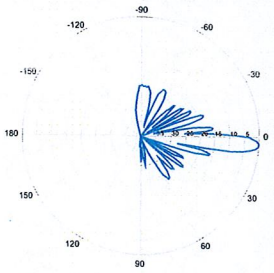
4° | Vertical | 1710-1880 MHz

BXA-171085-8BF-EDIN-4



4° | Vertical | 1850-1990 MHz

BXA-171085-8BF-EDIN-4



4° | Vertical | 1920-2170 MHz

Amphenol ANTENNA SOLUTIONS

BXA-70063-6CF-EDIN-X

X-Pol | FET Panel | 63° | 14.5 dBd

Replace "X" with desired electrical downtilt.

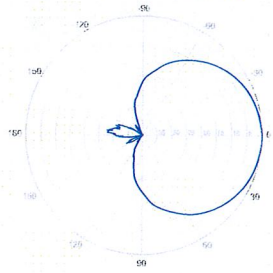
Antenna is also available with NE connector(s). Replace "EDIN" with "NE" in the model number when ordering.

Electrical Characteristics	696-900 MHz	
Frequency bands	696-806 MHz	806-900 MHz
Polarization	±45°	
Horizontal beamwidth	65°	63°
Vertical beamwidth	13°	11°
Gain	14.0 dBd (16.1 dBi)	14.5 dBd (16.6 dBi)
Electrical downtilt (X)	0, 2, 3, 4, 5, 6, 8, 10	
Impedance	50Ω	
VSWR	≤1.35:1	
Upper sidelobe suppression (0°)	-18.3 dB	-18.2 dB
Front-to-back ratio (+/-30°)	-33.4 dB	-36.3 dB
Null fill	5% (-26.02 dB)	
Isolation between ports	< -25 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	1804 x 285 x 132 mm	71.0 x 11.2 x 5.2 in
Depth with z-brackets	172 mm	6.8 in
Weight without mounting brackets	7.9 kg	17 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.51 m² Side: 0.24 m²	Front: 5.5 ft² Side: 2.6 ft²
Wind load @ 161 km/hr (100 mph)	Front: 759 N Side: 391 N	Front: 169 lbf Side: 89 lbf

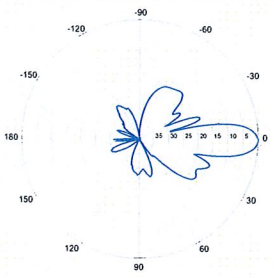
Mounting Options	Part Number	Fits Pipe Diameter	Weight
3-Point Mounting & Downtilt Bracket Kit	36210008	40-115 mm 1.57-4.5 in	6.9 kg 15.2 lbs
Concealment Configurations	For concealment configurations, order BXA-70063-6CF-EDIN-X-FP		

BXA-70063-6CF-EDIN-X



Horizontal | 750 MHz

BXA-70063-6CF-EDIN-0



0° | Vertical | 750 MHz

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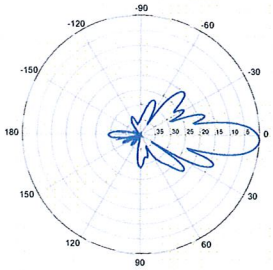
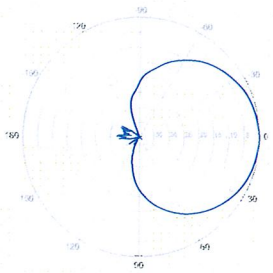
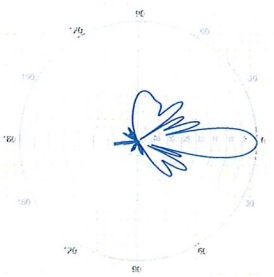


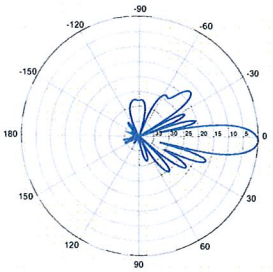
2° | Vertical | 750 MHz



Horizontal | 850 MHz



0° | Vertical | 850 MHz

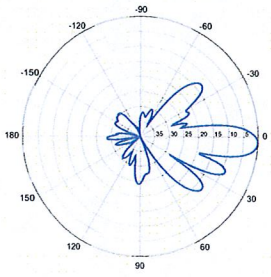


2° | Vertical | 850 MHz

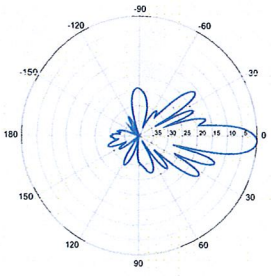
BXA-70063-6CF-EDIN-X

X-Pol | FET Panel | 63° | 14.5 dBd

BXA-70063-6CF-EDIN-3



3° | Vertical | 750 MHz



3° | Vertical | 850 MHz

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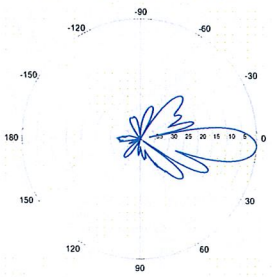
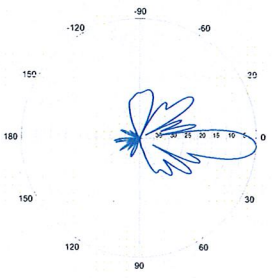
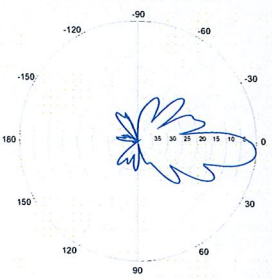


4° | Vertical | 750 MHz

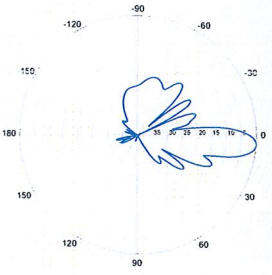


4° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-5

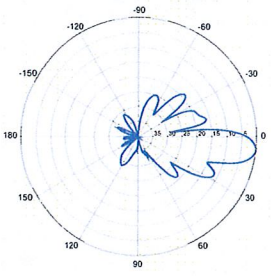


5° | Vertical | 750 MHz

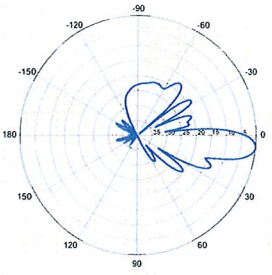


5° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-6



6° | Vertical | 750 MHz



6° | Vertical | 850 MHz

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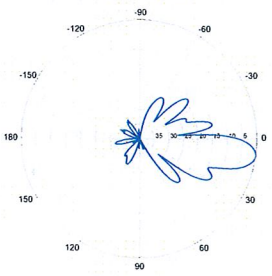
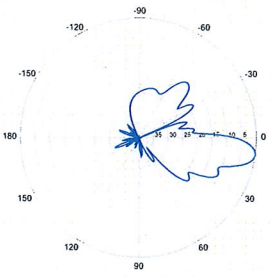
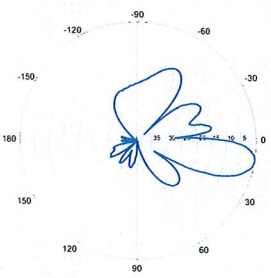


8° | Vertical | 750 MHz

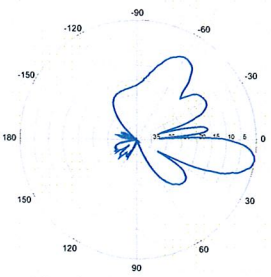


8° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-10



10° | Vertical | 750 MHz



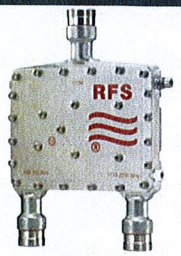
10° | Vertical | 850 MHz

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)**
- **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

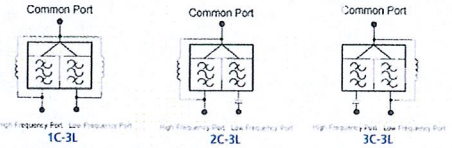
Notes

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)	

	General	Power	Density					
Site Name: Barkhamsted S								
Tower Height: Verizon @ 133ft								
CARRIER	# OF CHAN.	WATTS ERP	HEIGHT	CALC. POWER DENS	FREQ.	MAX. PERMISS. EXP.	FRACTION MPE	Total
*Cingular UMTS	1	500	114	0.0138	880	0.5867	2.36%	
*Cingular GSM	4	296	114	0.0328	880	0.5867	5.58%	
*Cingular GSM	2	427	114	0.0236	1900	1.0000	2.36%	
*Pocket	3	631	93	0.0787	2130	1.0000	7.87%	
*T-Mobile	8	168	101.5	0.0469	1945	1.0000	4.69%	
*Sprint	11	338.55	142	0.0664	1962.5	1.0000	6.64%	
*Nextel	9	100	127	0.0201	851	0.5673	3.54%	
Verizon PCS	**11**	**254**	**133**	**0.0568**	**1970**	**1.0000**	**5.68%**	
Verizon Cellular	**9**	**260**	**133**	**0.0476**	**869**	**0.5793**	**8.21%**	
Verizon AWS	**1**	**670**	**133**	**0.0136**	**2145**	**1.0000**	**1.36%**	
Verizon 700	**1**	**849**	**133**	**0.0173**	**698**	**0.4653**	**3.71%**	
								52.00%
* Source: Siting Council								

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

145-ft Existing Summit Monopine

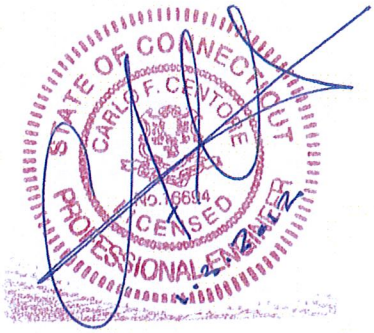
Proposed Verizon Wireless
Antenna Upgrade

Verizon Site Ref: Barkhamsted South

Rust Road
Barkhamsted, CT

Centek Project No. 12001.C03

Date: December 27, 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

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Introduction

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

The host tower is a 145-ft tall, four-section, eighteen sided, tapered monopole, originally manufactured by Summit Manufacturing and designed by Paul J. Ford and Company job no; 29200-1316, dated September 7, 2000. The tower geometry, structure member sizes and foundation system information were obtained from a previous structural report prepared by Centek (Formally Natcomm) job no. 09009.CO11 dated May 14, 2009. Antenna and appurtenance information were obtained from the aforementioned Centek structural report, visual verification from grade by Centek personnel on December 14, 2011 and a Verizon RF data sheet.

The tower is made up of four (4) tapered vertical sections consisting of A607-65 pole sections. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 25.41-in at the top and 66.05-in at the base.

Verizon proposes the removal of six (6) panel antennas and the installation of six (6) panel antennas and six (6) Diplexers mounted to the existing three (3) T-Arms. 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:

- SPRINT (EXISTING):
  Antennas: Six (6) Andrew DB980F90E-M panel antennas mounted on three (3) existing T-Arms with a RAD center elevation of 144-ft above grade.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- NEXTEL (EXISTING):
  Antennas: Twelve (12) Andrew DB844H90E-XY panel antennas mounted on three (3) existing T-Arms with a RAD center elevation of 124-ft above grade.
  Coax Cables: Twelve (12) 7/8" ∅ coax cables running on the inside of the existing tower.
- AT&T (EXISTING):
  Antennas: Six (6) Powerwave 7770 panel antennas, six (6) Powerwave LGP21401 TMA's and six (6) Powerwave LGP21901 Diplexers mounted on three (3) existing T-Arms with a RAD center elevation of 114-ft above grade.
  Coax Cables: Twelve (12) 1-1/4" ∅ coax cables running on the inside of the existing tower.
- T-MOBILE (EXISTING):
  Antennas: Three (3) RFS APX16DWV-16DWVS-E-A20 panel antennas and six (6) TMA's mounted on three (3) existing T-Arms with a RAD center elevation of 103-ft above grade.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.

- T-MOBILE (RESERVED):
  Antennas: Six (6) RFS APX16DWV-16DWVS-E-A20 panel antennas mounted on three (3) existing T-Arms with a RAD center elevation of 103-ft above grade.
- METROPCS (EXISTING):
  Antennas: Three (3) RFS APXV18-206517-C panel antennas flush mounted with a RAD center elevation of 93-ft above grade.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- VERIZON (EXISTING TO REMAIN):
  Antennas: Four (4) Antel LPA-80063-4CF and two (2) Antel LPA-80080-4CF panel antennas mounted on three (3) existing T-Arms with a RAD center elevation of 133-ft above grade.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- VERIZON (EXISTING TO REMOVE):
  Antennas: Four (4) Andrew DB948F65E-M and two (2) Andrew DB948G85E-M panel antennas mounted on three (3) existing T-Arms with a RAD center elevation of 133-ft above grade.
- **VERIZON (PROPOSED):**
  Antennas: Three (3) Antel BXA-70063-6CF panel antennas, two (2) Antel BXA-171063-8BF panel antennas, one (1) BXA-171085-8BF panel antenna and six (6) RFS FD9R6004/2C-3L Diplexers mounted on three (3) existing T-Arms with a RAD center elevation of 133-ft above 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 80 mph basic wind speed (fastest mile) with no ice and 75% reduction of wind force with ½ inch accumulative ice to determine stresses in members as per guidelines of TIA/EIA-222-F-96 entitled "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures", the American Institute of Steel Construction (AISC) and the Manual of Steel Construction; Allowable Stress Design (ASD).

Tower Loading

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

Basic Wind Speed:	Litchfield; v = 80 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Barkhamsted; v = 90 mph (3 second gust) equivalent to v = 75 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA-222-F wind speed controls.	
Load Cases:	Load Case 1; 80 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation. This load case typically controls the design of monopole towers.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 69 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 69 mph wind speed velocity represents 75% of the wind pressure generated by the 80 mph wind speed. This load case typically controls the design of lattice towers.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 3; Seismic – not checked	*[Section 1614.5 of State Bldg. Code 2005] does not control in the design of this structure type*

Tower Capacity

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

- Calculated stresses were found to be within allowable limits. In Load Case 1, per RISATower "Section Capacity Table", this tower was found to be at **74.9%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L4)	1.00'-43.00'	74.9%	**PASS**

Foundation and Anchors

The existing foundation consists of a 8-ft square x 5.5-ft long reinforced concrete pier on a 31.5-ft square x 4.0-ft thick reinforced concrete pad. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned structural report prepared by Centek job no. 09009.CO11 dated May 14, 2009. The base of the tower is connected to the foundation by means of (24) 2.25"∅, ASTM A615-75 anchor bolts embedded approximately 7-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	53 kips
	Compression	54 kips
	Moment	5385 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	2.08	**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
Flange Bolts	Tension	59.0%	**PASS**
Flange Plate	Bending	22.5%	**PASS**
Anchor Bolts	Compression	75.7%	**PASS**
Base Plate	Bending	60.8%	**PASS**

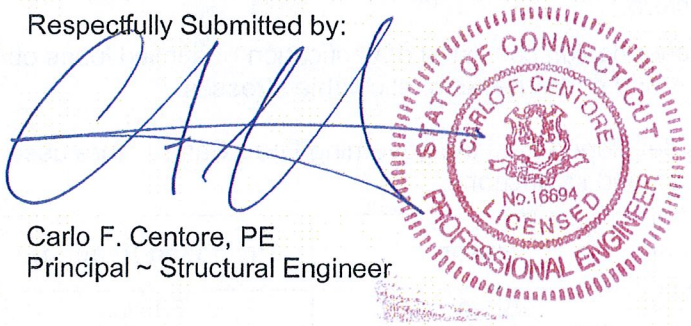
Conclusion

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

Prepared by:

Timothy J. Lynn, EIT
Structural Engineer

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

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

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

GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

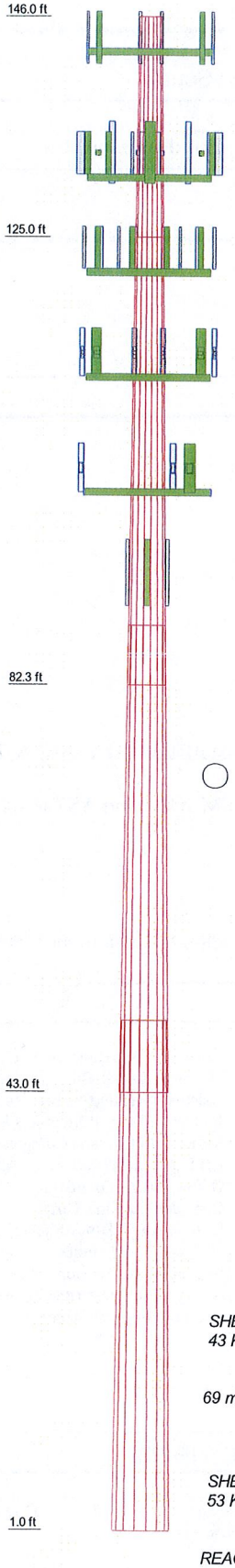
RISATower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, RISATower, formerly ERITower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

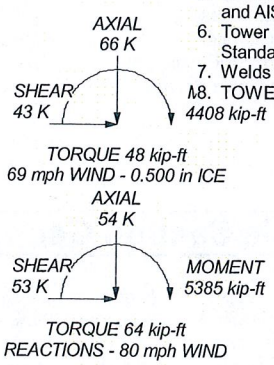
RISATower Features:

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

Section	1	2	3	4
Length (ft)	21.000	42.750	45.000	49.000
Number of Sides	18	18	18	18
Thickness (in)	0.250	0.375	0.438	0.500
Socket Length (ft)		5.750	7.000	
Top Dia (in)	25.410	32.508	42.251	52.154
Bot Dia (in)	32.508	44.632	55.014	66.050
Grade	A607-65			
Weight (K)	1.6	6.6	10.2	15.5

Total Weight (K) 34.0





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION
Barhamsted Branch 1	153.26
(2) DB980F90E-M (Sprint - Existing)	144
(2) DB980F90E-M (Sprint - Existing)	144
(2) DB980F90E-M (Sprint - Existing)	144
Valmont T-Arm (1) (Sprint - Existing)	143
Valmont T-Arm (1) (Sprint - Existing)	143
Valmont T-Arm (1) (Sprint - Existing)	143
Barhamsted Branch 2	138.16
BXA-70063/6CF (Verizon - Proposed)	133
LPA-80063/4CF (Verizon - Existing)	133
LPA-80063/4CF (Verizon - Existing)	133
BXA-171063/8BF (Verizon - Proposed)	133
BXA-70063/6CF (Verizon - Proposed)	133
LPA-80063/4CF (Verizon - Existing)	133
LPA-80080-4CF (Verizon - Existing)	133
BXA-171085-8BF (Verizon - Proposed)	133
BXA-70063/6CF (Verizon - Proposed)	133
LPA-80080-4CF (Verizon - Existing)	133
(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	133
(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	133
(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	133
LPA-80063/4CF (Verizon - Existing)	133
BXA-171063/8BF (Verizon - Proposed)	133
Valmont T-Arm (1) (Verizon - Existing)	131
Valmont T-Arm (1) (Verizon - Existing)	131
(4) DB844H90E-XY (Nextel - Existing)	124
(4) DB844H90E-XY (Nextel - Existing)	124
(4) DB844H90E-XY (Nextel - Existing)	124
EEI 10' Universal T-Arm (Nextel - Existing)	122
EEI 10' Universal T-Arm (Nextel - Existing)	122
EEI 10' Universal T-Arm (Nextel - Existing)	122
Barhamsted Branch 3	121.39
(2) LGP21401 TMA (ATI - Existing)	114
(2) LGP21401 TMA (ATI - Existing)	114
(2) LGP21401 TMA (ATI - Existing)	114
(2) LGP21901 Diplexer (ATI - Existing)	114
(2) LGP21901 Diplexer (ATI - Existing)	114
(2) LGP21901 Diplexer (ATI - Existing)	114
(2) 7770.00 (ATI - Existing)	114

TYPE	ELEVATION
(2) 7770.00 (ATI - Existing)	114
(2) 7770.00 (ATI - Existing)	114
EEI 10' Universal T-Arm (ATI - Existing)	112
EEI 10' Universal T-Arm (ATI - Existing)	112
EEI 10' Universal T-Arm (ATI - Existing)	112
Barhamsted Branch 4	109.85
ATMAA1412D-1A20 TMA (T-Mobile - Existing)	103
ATMAA1412D-1A20 TMA (T-Mobile - Existing)	103
ETW190VS12UB TMA (T-Mobile - Existing)	103
ETW190VS12UB TMA (T-Mobile - Existing)	103
ETW190VS12UB TMA (T-Mobile - Existing)	103
(2) APX16DWV-16DWVS-E-A20 (T-Mobile - Reserved)	103
(2) APX16DWV-16DWVS-E-A20 (T-Mobile - Reserved)	103
(2) APX16DWV-16DWVS-E-A20 (T-Mobile - Reserved)	103
APX16DWV-16DWVS-E-A20 (T-Mobile - Existing)	103
APX16DWV-16DWVS-E-A20 (T-Mobile - Existing)	103
APX16DWV-16DWVS-E-A20 (T-Mobile - Existing)	103
ATMAA1412D-1A20 TMA (T-Mobile - Existing)	103
Valmont T-Arm (1) (T-Mobile - Existing)	101
Valmont T-Arm (1) (T-Mobile - Existing)	101
Valmont T-Arm (1) (T-Mobile - Existing)	101
APXV18-206517-C (MetroPCS - Existing)	93
APXV18-206517-C (MetroPCS - Existing)	93
Valmont Uni-Tri Bracket (MetroPCS - Existing)	93
APXV18-206517-C (MetroPCS - Existing)	93
Barhamsted Branch 5	91.6
Barhamsted Branch 6	82.8

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A607-65	65 ksi	80 ksi			

TOWER DESIGN NOTES

1. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 69 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Weld together tower sections have flange connections.
5. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
6. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
7. Welds are fabricated with ER-70S-6 electrodes.
8. TOWER RATING: 74.9%

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

Job: 12001.CO3 - Barkhamsted South			
Project: 145-ft Summit Monopine - Rust Rd., Barkhamsted, CT			
Client: Verizon Wireless	Drawn by: TJL	App'd:	
Code: TIA/EIA-222-F	Date: 12/27/11	Scale: NTS	
Path: J:\Jobs\12001\00 WIP\CO3 - Barkhamsted South\Calcs\ER Files\145' Summit Monopine - Barkhamsted CT.er		Dwg No. E-1	

Tower Input Data

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

Basic wind speed of 80 mph.
Nominal ice thickness of 0.500 in.
Ice density of 56 pcf.
A wind speed of 69 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
Weld together tower sections have flange connections..
Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	146.000-125.000	21.000	0.000	18	25.410	32.508	0.250	1.000	A607-65 (65 ksi)
L2	125.000-82.250	42.750	5.750	18	32.508	44.632	0.375	1.500	A607-65 (65 ksi)
L3	82.250-43.000	45.000	7.000	18	42.251	55.014	0.438	1.750	A607-65 (65 ksi)

RISATower	Job	Page
	12001.CO3 - Barkhamsted South	2 of 22
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	**Project** 145-ft Summit Monopine - Rust Rd., Barkhamsted, CT	**Date** 09:44:54 12/27/11
	Client Verizon Wireless	**Designed by** TJL

Section	Elevation	Section Length	Splice Length	Number of Sides	Top Diameter	Bottom Diameter	Wall Thickness	Bend Radius	Pole Grade
	ft	ft	ft		in	in	in	in	
L4	43.000-1.000	49.000		18	52.154	66.050	0.500	2.000	A607-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia.	Area	I	r	C	I/C	J	It/Q	w	w/t
	in	in^2	in^4	in	in	in^3	in^4	in^2	in	
L1	25.802	19.964	1596.674	8.932	12.908	123.694	3195.449	9.984	4.032	16.129
	33.009	25.597	3365.090	11.452	16.514	203.771	6734.608	12.801	5.281	21.126
L2	33.009	38.246	4989.183	11.407	16.514	302.117	9984.932	19.127	5.061	13.497
	45.321	52.677	13035.316	15.711	22.673	574.925	26087.784	26.343	7.195	19.187
L3	44.559	58.064	12825.695	14.844	21.464	597.554	25668.266	29.037	6.666	15.237
	55.863	75.786	28519.340	19.375	27.947	1020.475	57076.207	37.900	8.912	20.371
L4	54.974	81.974	27632.387	18.337	26.494	1042.965	55301.134	40.995	8.299	16.598
	67.069	104.028	56471.908	23.270	33.553	1683.046	113018.124	52.024	10.745	21.49

Tower Elevation	Gusset Area (per face)	Gusset Thickness	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals	Double Angle Stitch Bolt Spacing Horizontals
ft	ft^2	in					in	in
L1 146.000-125.000				1	1	1		
L2 125.000-82.250				1	1	1		
L3 82.250-43.000				1	1	1		
L4 43.000-1.000				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement	Total Number		C_AA_A	Weight
				ft			ft^2/ft	klf
1 5/8 (Sprint - Existing)	B	No	Inside Pole	145.000 - 4.000	6	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1 5/8 (Verizon - Existing)	B	No	Inside Pole	134.000 - 4.000	12	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
7/8 (Nextel - Existing)	B	No	Inside Pole	125.000 - 4.000	12	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1 1/4 (AT&T - Existing)	B	No	Inside Pole	115.000 - 4.000	12	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1 5/8 (T-Mobile - Existing)	B	No	Inside Pole	104.000 - 4.000	12	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1 5/8 (MetroPCS - Existing)	B	No	Inside Pole	94.000 - 4.000	6	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001

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	146.000-125.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.237
		C	0.000	0.000	0.000	0.000	0.000
L2	125.000-82.250	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	1.681
		C	0.000	0.000	0.000	0.000	0.000
L3	82.250-43.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	2.035
		C	0.000	0.000	0.000	0.000	0.000
L4	43.000-1.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	2.022
		C	0.000	0.000	0.000	0.000	0.000

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	146.000-125.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.237
		C		0.000	0.000	0.000	0.000	0.000
L2	125.000-82.250	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	1.681
		C		0.000	0.000	0.000	0.000	0.000
L3	82.250-43.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	2.035
		C		0.000	0.000	0.000	0.000	0.000
L4	43.000-1.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	2.022
		C		0.000	0.000	0.000	0.000	0.000

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
(2) DB980F90E-M (Sprint - Existing)	A	From Face	3.000 0.000 0.000	0.000	144.000	No Ice 1/2" Ice	3.896 4.276	2.292 2.654	0.009 0.029
(2) DB980F90E-M (Sprint - Existing)	B	From Face	3.000 0.000 0.000	0.000	144.000	No Ice 1/2" Ice	3.896 4.276	2.292 2.654	0.009 0.029
(2) DB980F90E-M (Sprint - Existing)	C	From Face	3.000 0.000 0.000	0.000	144.000	No Ice 1/2" Ice	3.896 4.276	2.292 2.654	0.009 0.029
Valmont T-Arm (1) (Sprint - Existing)	A	From Face	2.000 0.000	0.000	143.000	No Ice 1/2" Ice	10.540 14.450	10.540 14.450	0.336 0.412

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0.000						
Valmont T-Arm (1)	B	From Face	2.000	0.000	143.000	No Ice	10.540	10.540	0.336
(Sprint - Existing)			0.000			1/2" Ice	14.450	14.450	0.412
			0.000						
Valmont T-Arm (1)	C	From Face	2.000	0.000	143.000	No Ice	10.540	10.540	0.336
(Sprint - Existing)			0.000			1/2" Ice	14.450	14.450	0.412
			0.000						
LPA-80063/4CF	A	From Face	3.000	0.000	133.000	No Ice	7.005	6.083	0.020
(Verizon - Existing)			6.000			1/2" Ice	7.415	6.480	0.073
			0.000						
BXA-171063/8BF	A	From Face	3.000	0.000	133.000	No Ice	2.941	2.156	0.011
(Verizon - Proposed)			4.000			1/2" Ice	3.255	2.458	0.029
			0.000						
BXA-70063/6CF	A	From Face	3.000	0.000	133.000	No Ice	7.731	4.158	0.017
(Verizon - Proposed)			0.000			1/2" Ice	8.268	4.595	0.059
			0.000						
LPA-80063/4CF	A	From Face	3.000	0.000	133.000	No Ice	7.005	6.083	0.020
(Verizon - Existing)			-6.000			1/2" Ice	7.415	6.480	0.073
			0.000						
LPA-80063/4CF	B	From Face	3.000	0.000	133.000	No Ice	7.005	6.083	0.020
(Verizon - Existing)			6.000			1/2" Ice	7.415	6.480	0.073
			0.000						
BXA-171063/8BF	B	From Face	3.000	0.000	133.000	No Ice	2.941	2.156	0.011
(Verizon - Proposed)			4.000			1/2" Ice	3.255	2.458	0.029
			0.000						
BXA-70063/6CF	B	From Face	3.000	0.000	133.000	No Ice	7.731	4.158	0.017
(Verizon - Proposed)			0.000			1/2" Ice	8.268	4.595	0.059
			0.000						
LPA-80063/4CF	B	From Face	3.000	0.000	133.000	No Ice	7.005	6.083	0.020
(Verizon - Existing)			-6.000			1/2" Ice	7.415	6.480	0.073
			0.000						
LPA-80080-4CF	C	From Face	3.000	0.000	133.000	No Ice	2.619	6.057	0.012
(Verizon - Existing)			6.000			1/2" Ice	2.922	6.453	0.045
			0.000						
BXA-171085-8BF	C	From Face	3.000	0.000	133.000	No Ice	2.941	2.156	0.011
(Verizon - Proposed)			4.000			1/2" Ice	3.255	2.458	0.029
			0.000						
BXA-70063/6CF	C	From Face	3.000	0.000	133.000	No Ice	7.731	4.158	0.017
(Verizon - Proposed)			0.000			1/2" Ice	8.268	4.595	0.059
			0.000						
LPA-80080-4CF	C	From Face	3.000	0.000	133.000	No Ice	2.619	6.057	0.012
(Verizon - Existing)			-6.000			1/2" Ice	2.922	6.453	0.045
			0.000						
(2) FD9R6004/2C-3L	A	From Face	3.000	0.000	133.000	No Ice	0.367	0.085	0.003
Diplexer			0.000			1/2" Ice	0.451	0.136	0.005
(Verizon - Proposed)			0.000						
(2) FD9R6004/2C-3L	B	From Face	3.000	0.000	133.000	No Ice	0.367	0.085	0.003
Diplexer			0.000			1/2" Ice	0.451	0.136	0.005
(Verizon - Proposed)			0.000						
(2) FD9R6004/2C-3L	C	From Face	3.000	0.000	133.000	No Ice	0.367	0.085	0.003
Diplexer			0.000			1/2" Ice	0.451	0.136	0.005
(Verizon - Proposed)			0.000						
Valmont T-Arm (1)	A	From Face	2.000	0.000	131.000	No Ice	10.540	10.540	0.336
(Verizon - Existing)			0.000			1/2" Ice	14.450	14.450	0.412
			0.000						
Valmont T-Arm (1)	B	From Face	2.000	0.000	131.000	No Ice	10.540	10.540	0.336
(Verizon - Existing)			0.000			1/2" Ice	14.450	14.450	0.412

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
			0.000						
Valmont T-Arm (1)	C	From Face	2.000	0.000	131.000	No Ice	10.540	10.540	0.336
(Verizon - Existing)			0.000			1/2" Ice	14.450	14.450	0.412
			0.000						
(4) DB844H90E-XY	A	From Face	3.000	0.000	124.000	No Ice	2.867	3.733	0.010
(Nextel - Existing)			0.000			1/2" Ice	3.177	4.101	0.035
			0.000						
(4) DB844H90E-XY	B	From Face	3.000	0.000	124.000	No Ice	2.867	3.733	0.010
(Nextel - Existing)			0.000			1/2" Ice	3.177	4.101	0.035
			0.000						
(4) DB844H90E-XY	C	From Face	3.000	0.000	124.000	No Ice	2.867	3.733	0.010
(Nextel - Existing)			0.000			1/2" Ice	3.177	4.101	0.035
			0.000						
EEI 10' Universal T-Arm	A	None		0.000	122.000	No Ice	13.340	13.340	0.450
(Nextel - Existing)						1/2" Ice	16.800	16.800	0.600
EEI 10' Universal T-Arm	B	None		0.000	122.000	No Ice	13.340	13.340	0.450
(Nextel - Existing)						1/2" Ice	16.800	16.800	0.600
EEI 10' Universal T-Arm	C	None		0.000	122.000	No Ice	13.340	13.340	0.450
(Nextel - Existing)						1/2" Ice	16.800	16.800	0.600
(2) 7770.00	A	From Face	3.000	0.000	114.000	No Ice	5.882	2.928	0.035
(AT&T - Existing)			0.000			1/2" Ice	6.314	3.273	0.068
			0.000						
(2) 7770.00	B	From Face	3.000	0.000	114.000	No Ice	5.882	2.928	0.035
(AT&T - Existing)			0.000			1/2" Ice	6.314	3.273	0.068
			0.000						
(2) 7770.00	C	From Face	3.000	0.000	114.000	No Ice	5.882	2.928	0.035
(AT&T - Existing)			0.000			1/2" Ice	6.314	3.273	0.068
			0.000						
(2) LGP21401 TMA	A	From Face	3.000	0.000	114.000	No Ice	0.953	0.367	0.018
(AT&T - Existing)			0.000			1/2" Ice	1.093	0.480	0.023
			0.000						
(2) LGP21401 TMA	B	From Face	3.000	0.000	114.000	No Ice	0.953	0.367	0.018
(AT&T - Existing)			0.000			1/2" Ice	1.093	0.480	0.023
			0.000						
(2) LGP21401 TMA	C	From Face	3.000	0.000	114.000	No Ice	0.953	0.367	0.018
(AT&T - Existing)			0.000			1/2" Ice	1.093	0.480	0.023
			0.000						
(2) LGP21901 Diplexer	A	From Face	3.000	0.000	114.000	No Ice	0.233	0.117	0.006
(AT&T - Existing)			0.000			1/2" Ice	0.302	0.166	0.008
			0.000						
(2) LGP21901 Diplexer	B	From Face	3.000	0.000	114.000	No Ice	0.233	0.117	0.006
(AT&T - Existing)			0.000			1/2" Ice	0.302	0.166	0.008
			0.000						
(2) LGP21901 Diplexer	C	From Face	3.000	0.000	114.000	No Ice	0.233	0.117	0.006
(AT&T - Existing)			0.000			1/2" Ice	0.302	0.166	0.008
			0.000						
EEI 10' Universal T-Arm	A	None		0.000	112.000	No Ice	13.340	13.340	0.450
(AT&T - Existing)						1/2" Ice	16.800	16.800	0.600
EEI 10' Universal T-Arm	B	None		0.000	112.000	No Ice	13.340	13.340	0.450
(AT&T - Existing)						1/2" Ice	16.800	16.800	0.600
EEI 10' Universal T-Arm	C	None		0.000	112.000	No Ice	13.340	13.340	0.450
(AT&T - Existing)						1/2" Ice	16.800	16.800	0.600
APX16DWV-16DWVS-E-A	A	From Face	3.500	0.000	103.000	No Ice	7.065	2.150	0.041
20			-4.000			1/2" Ice	7.516	2.490	0.074
(T-Mobile - Existing)			0.000						
APX16DWV-16DWVS-E-A	B	From Face	3.500	0.000	103.000	No Ice	7.065	2.150	0.041
20			-4.000			1/2" Ice	7.516	2.490	0.074

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
(T-Mobile - Existing)			0.000						
APX16DWV-16DWVS-E-A 20	C	From Face	3.500 -4.000	0.000	103.000	No Ice 1/2" Ice	7.065 7.516	2.150 2.490	0.041 0.074
(T-Mobile - Existing)			0.000						
ATMAA1412D-1A20 TMA	A	From Face	3.500	0.000	103.000	No Ice	1.167	0.467	0.013
(T-Mobile - Existing)			-4.000 0.000			1/2" Ice	1.314	0.575	0.021
ATMAA1412D-1A20 TMA	B	From Face	3.500	0.000	103.000	No Ice	1.167	0.467	0.013
(T-Mobile - Existing)			-4.000 0.000			1/2" Ice	1.314	0.575	0.021
ATMAA1412D-1A20 TMA	C	From Face	3.500	0.000	103.000	No Ice	1.167	0.467	0.013
(T-Mobile - Existing)			-4.000 0.000			1/2" Ice	1.314	0.575	0.021
ETW190VS12UB TMA	A	From Face	3.500	0.000	103.000	No Ice	0.664	0.367	0.015
(T-Mobile - Existing)			-4.000 0.000			1/2" Ice	0.778	0.461	0.020
ETW190VS12UB TMA	B	From Face	3.500	0.000	103.000	No Ice	0.664	0.367	0.015
(T-Mobile - Existing)			-4.000 0.000			1/2" Ice	0.778	0.461	0.020
ETW190VS12UB TMA	C	From Face	3.500	0.000	103.000	No Ice	0.664	0.367	0.015
(T-Mobile - Existing)			-4.000 0.000			1/2" Ice	0.778	0.461	0.020
(2)	A	None		0.000	103.000	No Ice	7.065	2.150	0.041
APX16DWV-16DWVS-E-A 20						1/2" Ice	7.516	2.490	0.074
(T-Mobile - Reserved)									
(2)	B	None		0.000	103.000	No Ice	7.065	2.150	0.041
APX16DWV-16DWVS-E-A 20						1/2" Ice	7.516	2.490	0.074
(T-Mobile - Reserved)									
(2)	C	None		0.000	103.000	No Ice	7.065	2.150	0.041
APX16DWV-16DWVS-E-A 20						1/2" Ice	7.516	2.490	0.074
(T-Mobile - Reserved)									
Valmont T-Arm (1)	A	From Face	2.000	0.000	101.000	No Ice	10.540	10.540	0.336
(T-Mobile - Existing)			0.000 0.000			1/2" Ice	14.450	14.450	0.412
Valmont T-Arm (1)	B	From Face	2.000	0.000	101.000	No Ice	10.540	10.540	0.336
(T-Mobile - Existing)			0.000 0.000			1/2" Ice	14.450	14.450	0.412
Valmont T-Arm (1)	C	From Face	2.000	0.000	101.000	No Ice	10.540	10.540	0.336
(T-Mobile - Existing)			0.000 0.000			1/2" Ice	14.450	14.450	0.412
APXV18-206517-C	A	From Face	0.500	0.000	93.000	No Ice	5.513	3.929	0.022
(MetroPCS - Existing)			0.000 0.000			1/2" Ice	5.983	4.385	0.053
APXV18-206517-C	B	From Face	0.500	0.000	93.000	No Ice	5.513	3.929	0.022
(MetroPCS - Existing)			0.000 0.000			1/2" Ice	5.983	4.385	0.053
APXV18-206517-C	C	From Face	0.500	0.000	93.000	No Ice	5.513	3.929	0.022
(MetroPCS - Existing)			0.000 0.000			1/2" Ice	5.983	4.385	0.053
Valmont Uni-Tri Bracket	A	From Face	0.500	0.000	93.000	No Ice	1.750	1.750	0.290
(MetroPCS - Existing)			0.000 0.000			1/2" Ice	1.940	1.940	0.306
Barhamsted Branch 1	A	From Face	3.000	0.000	153.260	No Ice	48.510	48.510	0.320
			0.000			1/2" Ice	48.150	48.510	0.730

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
			0.000						
Barhamsted Branch 2	A	From Face	3.000	0.000	138.160	No Ice	120.490	120.490	2.290
			0.000			1/2" Ice	120.490	120.490	3.830
			0.000						
Barhamsted Branch 3	A	From Face	3.000	0.000	121.390	No Ice	13.860	13.860	0.090
			0.000			1/2" Ice	13.860	13.860	0.210
			0.000						
Barhamsted Branch 4	A	From Face	3.000	0.000	109.850	No Ice	134.660	134.660	2.560
			0.000			1/2" Ice	134.660	134.660	4.280
			0.000						
Barhamsted Branch 5	A	From Face	3.000	0.000	91.600	No Ice	28.620	28.620	0.900
			0.000			1/2" Ice	28.620	28.620	1.440
			0.000						
Barhamsted Branch 6	A	From Face	3.000	0.000	82.800	No Ice	22.070	22.070	0.770
			0.000			1/2" Ice	22.070	22.070	1.300
			0.000						

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1	135.071	1.496	0.025	50.678	A	0.000	50.678	50.678	100.00	0.000	0.000
146.000-125.0					B	0.000	50.678		100.00	0.000	0.000
00					C	0.000	50.678		100.00	0.000	0.000
L2	102.819	1.384	0.023	137.406	A	0.000	137.406	137.406	100.00	0.000	0.000
125.000-82.25					B	0.000	137.406		100.00	0.000	0.000
0					C	0.000	137.406		100.00	0.000	0.000
L3	62.331	1.199	0.020	161.736	A	0.000	161.736	161.736	100.00	0.000	0.000
82.250-43.000					B	0.000	161.736		100.00	0.000	0.000
					C	0.000	161.736		100.00	0.000	0.000
L4	21.306	1	0.016	210.331	A	0.000	210.331	210.331	100.00	0.000	0.000
43.000-1.000					B	0.000	210.331		100.00	0.000	0.000
					C	0.000	210.331		100.00	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	t_Z in	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1	135.071	1.496	0.018	0.500	52.428	A	0.000	52.428	52.428	100.00	0.000	0.000

Section Elevation ft	z ft	K_Z	q_z ksf	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
146.000-125.000						B	0.000	52.428		100.00	0.000	0.000
						C	0.000	52.428		100.00	0.000	0.000
L2	102.819	1.384	0.017	0.500	140.968	A	0.000	140.968	140.968	100.00	0.000	0.000
125.000-82.250						B	0.000	140.968		100.00	0.000	0.000
						C	0.000	140.968		100.00	0.000	0.000
L3	62.331	1.199	0.015	0.500	165.007	A	0.000	165.007	165.007	100.00	0.000	0.000
82.250-43.000						B	0.000	165.007		100.00	0.000	0.000
						C	0.000	165.007		100.00	0.000	0.000
L4 43.000-1.000	21.306	1	0.012	0.500	213.831	A	0.000	213.831	213.831	100.00	0.000	0.000
						B	0.000	213.831		100.00	0.000	0.000
						C	0.000	213.831		100.00	0.000	0.000

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	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	135.071	1.496	0.010	50.678	A	0.000	50.678	50.678	100.00	0.000	0.000
146.000-125.0					B	0.000	50.678		100.00	0.000	0.000
00					C	0.000	50.678		100.00	0.000	0.000
L2	102.819	1.384	0.009	137.406	A	0.000	137.406	137.406	100.00	0.000	0.000
125.000-82.25					B	0.000	137.406		100.00	0.000	0.000
0					C	0.000	137.406		100.00	0.000	0.000
L3	62.331	1.199	0.008	161.736	A	0.000	161.736	161.736	100.00	0.000	0.000
82.250-43.000					B	0.000	161.736		100.00	0.000	0.000
					C	0.000	161.736		100.00	0.000	0.000
L4	21.306	1	0.006	210.331	A	0.000	210.331	210.331	100.00	0.000	0.000
43.000-1.000					B	0.000	210.331		100.00	0.000	0.000
					C	0.000	210.331		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 klf	Ctrl. Face
L1	0.237	1.628	A	1	1.2	1	1	1	50.678	2.519	0.120	C
146.000-125.0			B	1	1.2	1	1	1	50.678			
00			C	1	1.2	1	1	1	50.678			
L2	1.681	6.613	A	1	1.2	1	1	1	137.406	6.305	0.147	C
125.000-82.25			B	1	1.2	1	1	1	137.406			
0			C	1	1.2	1	1	1	137.406			
L3	2.035	10.248	A	1	1.2	1	1	1	161.736	6.415	0.163	C
82.250-43.000			B	1	1.2	1	1	1	161.736			
			C	1	1.2	1	1	1	161.736			
L4	2.022	15.507	A	1	1.2	1	1	1	210.331	6.989	0.166	C
43.000-1.000			B	1	1.2	1	1	1	210.331			
			C	1	1.2	1	1	1	210.331			
Sum Weight:	5.975	33.996						OTM	1514.985	22.227		

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 klf	Ctrl. Face
									kip-ft			

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 klf	Ctrl. Face
L1	0.237	1.628	A	1	1.2	1	1	1	50.678	2.519	0.120	C
146.000-125.0			B	1	1.2	1	1	1	50.678			
00			C	1	1.2	1	1	1	50.678			
L2	1.681	6.613	A	1	1.2	1	1	1	137.406	6.305	0.147	C
125.000-82.25			B	1	1.2	1	1	1	137.406			
0			C	1	1.2	1	1	1	137.406			
L3	2.035	10.248	A	1	1.2	1	1	1	161.736	6.415	0.163	C
82.250-43.000			B	1	1.2	1	1	1	161.736			
			C	1	1.2	1	1	1	161.736			
L4	2.022	15.507	A	1	1.2	1	1	1	210.331	6.989	0.166	C
43.000-1.000			B	1	1.2	1	1	1	210.331			
			C	1	1.2	1	1	1	210.331			
Sum Weight:	5.975	33.996						OTM	1514.985 kip-ft	22.227		

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 klf	Ctrl. Face
L1	0.237	1.628	A	1	1.2	1	1	1	50.678	2.519	0.120	C
146.000-125.0			B	1	1.2	1	1	1	50.678			
00			C	1	1.2	1	1	1	50.678			
L2	1.681	6.613	A	1	1.2	1	1	1	137.406	6.305	0.147	C
125.000-82.25			B	1	1.2	1	1	1	137.406			
0			C	1	1.2	1	1	1	137.406			
L3	2.035	10.248	A	1	1.2	1	1	1	161.736	6.415	0.163	C
82.250-43.000			B	1	1.2	1	1	1	161.736			
			C	1	1.2	1	1	1	161.736			
L4	2.022	15.507	A	1	1.2	1	1	1	210.331	6.989	0.166	C
43.000-1.000			B	1	1.2	1	1	1	210.331			
			C	1	1.2	1	1	1	210.331			
Sum Weight:	5.975	33.996						OTM	1514.985 kip-ft	22.227		

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 klf	Ctrl. Face
L1	0.237	1.628	A	1	1.2	1	1	1	50.678	2.519	0.120	C
146.000-125.0			B	1	1.2	1	1	1	50.678			
00			C	1	1.2	1	1	1	50.678			
L2	1.681	6.613	A	1	1.2	1	1	1	137.406	6.305	0.147	C
125.000-82.25			B	1	1.2	1	1	1	137.406			
0			C	1	1.2	1	1	1	137.406			
L3	2.035	10.248	A	1	1.2	1	1	1	161.736	6.415	0.163	C
82.250-43.000			B	1	1.2	1	1	1	161.736			
			C	1	1.2	1	1	1	161.736			
L4	2.022	15.507	A	1	1.2	1	1	1	210.331	6.989	0.166	C
43.000-1.000			B	1	1.2	1	1	1	210.331			
			C	1	1.2	1	1	1	210.331			
Sum Weight:	5.975	33.996						OTM	1514.985 kip-ft	22.227		

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 klf	Ctrl. Face
L1	0.237	2.010	A	1	1.2	1	1	1	52.428	1.954	0.093	C
146.000-125.0			B	1	1.2	1	1	1	52.428			
00			C	1	1.2	1	1	1	52.428			
L2	1.681	7.644	A	1	1.2	1	1	1	140.968	4.851	0.113	C
125.000-82.25			B	1	1.2	1	1	1	140.968			
0			C	1	1.2	1	1	1	140.968			
L3	2.035	11.458	A	1	1.2	1	1	1	165.007	4.909	0.125	C
82.250-43.000			B	1	1.2	1	1	1	165.007			
			C	1	1.2	1	1	1	165.007			
L4	2.022	17.077	A	1	1.2	1	1	1	213.831	5.329	0.127	C
43.000-1.000			B	1	1.2	1	1	1	213.831			
			C	1	1.2	1	1	1	213.831			
Sum Weight:	5.975	38.189						OTM	1165.205 kip-ft	17.043		

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 klf	Ctrl. Face
L1	0.237	2.010	A	1	1.2	1	1	1	52.428	1.954	0.093	C
146.000-125.0			B	1	1.2	1	1	1	52.428			
00			C	1	1.2	1	1	1	52.428			
L2	1.681	7.644	A	1	1.2	1	1	1	140.968	4.851	0.113	C
125.000-82.25			B	1	1.2	1	1	1	140.968			
0			C	1	1.2	1	1	1	140.968			
L3	2.035	11.458	A	1	1.2	1	1	1	165.007	4.909	0.125	C
82.250-43.000			B	1	1.2	1	1	1	165.007			
			C	1	1.2	1	1	1	165.007			

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 klf	Ctrl. Face
L4	2.022	17.077	A	1	1.2	1	1	1	213.831	5.329	0.127	C
43.000-1.000			B	1	1.2	1	1	1	213.831			
			C	1	1.2	1	1	1	213.831			
Sum Weight:	5.975	38.189						OTM	1165.205 kip-ft	17.043		

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 klf	Ctrl. Face
L1	0.237	2.010	A	1	1.2	1	1	1	52.428	1.954	0.093	C
146.000-125.0			B	1	1.2	1	1	1	52.428			
00			C	1	1.2	1	1	1	52.428			
L2	1.681	7.644	A	1	1.2	1	1	1	140.968	4.851	0.113	C
125.000-82.25			B	1	1.2	1	1	1	140.968			
0			C	1	1.2	1	1	1	140.968			
L3	2.035	11.458	A	1	1.2	1	1	1	165.007	4.909	0.125	C
82.250-43.000			B	1	1.2	1	1	1	165.007			
			C	1	1.2	1	1	1	165.007			
L4	2.022	17.077	A	1	1.2	1	1	1	213.831	5.329	0.127	C
43.000-1.000			B	1	1.2	1	1	1	213.831			
			C	1	1.2	1	1	1	213.831			
Sum Weight:	5.975	38.189						OTM	1165.205 kip-ft	17.043		

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 klf	Ctrl. Face
L1	0.237	2.010	A	1	1.2	1	1	1	52.428	1.954	0.093	C
146.000-125.0			B	1	1.2	1	1	1	52.428			
00			C	1	1.2	1	1	1	52.428			
L2	1.681	7.644	A	1	1.2	1	1	1	140.968	4.851	0.113	C
125.000-82.25			B	1	1.2	1	1	1	140.968			
0			C	1	1.2	1	1	1	140.968			
L3	2.035	11.458	A	1	1.2	1	1	1	165.007	4.909	0.125	C
82.250-43.000			B	1	1.2	1	1	1	165.007			
			C	1	1.2	1	1	1	165.007			
L4	2.022	17.077	A	1	1.2	1	1	1	213.831	5.329	0.127	C
43.000-1.000			B	1	1.2	1	1	1	213.831			
			C	1	1.2	1	1	1	213.831			
Sum Weight:	5.975	38.189						OTM	1165.205 kip-ft	17.043		

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 klf	Ctrl. Face
L1	0.237	1.628	A	1	1.2	1	1	1	50.678	0.984	0.047	C
146.000-125.0			B	1	1.2	1	1	1	50.678			
00			C	1	1.2	1	1	1	50.678			
L2	1.681	6.613	A	1	1.2	1	1	1	137.406	2.463	0.058	C
125.000-82.25			B	1	1.2	1	1	1	137.406			
0			C	1	1.2	1	1	1	137.406			
L3	2.035	10.248	A	1	1.2	1	1	1	161.736	2.506	0.064	C
82.250-43.000			B	1	1.2	1	1	1	161.736			
			C	1	1.2	1	1	1	161.736			
L4	2.022	15.507	A	1	1.2	1	1	1	210.331	2.730	0.065	C
43.000-1.000			B	1	1.2	1	1	1	210.331			
			C	1	1.2	1	1	1	210.331			
Sum Weight:	5.975	33.996						OTM	591.791 kip-ft	8.682		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.237	1.628	A	1	1.2	1	1	1	50.678	0.984	0.047	C
146.000-125.0			B	1	1.2	1	1	1	50.678			
00			C	1	1.2	1	1	1	50.678			
L2	1.681	6.613	A	1	1.2	1	1	1	137.406	2.463	0.058	C
125.000-82.25			B	1	1.2	1	1	1	137.406			
0			C	1	1.2	1	1	1	137.406			
L3	2.035	10.248	A	1	1.2	1	1	1	161.736	2.506	0.064	C
82.250-43.000			B	1	1.2	1	1	1	161.736			
			C	1	1.2	1	1	1	161.736			
L4	2.022	15.507	A	1	1.2	1	1	1	210.331	2.730	0.065	C
43.000-1.000			B	1	1.2	1	1	1	210.331			
			C	1	1.2	1	1	1	210.331			
Sum Weight:	5.975	33.996						OTM	591.791 kip-ft	8.682		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.237	1.628	A	1	1.2	1	1	1	50.678	0.984	0.047	C
146.000-125.0			B	1	1.2	1	1	1	50.678			
00			C	1	1.2	1	1	1	50.678			
L2	1.681	6.613	A	1	1.2	1	1	1	137.406	2.463	0.058	C
125.000-82.25			B	1	1.2	1	1	1	137.406			
0			C	1	1.2	1	1	1	137.406			

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 klf	Ctrl. Face
L3	2.035	10.248	A	1	1.2	1	1	1	161.736	2.506	0.064	C
82.250-43.000			B	1	1.2	1	1	1	161.736			
			C	1	1.2	1	1	1	161.736			
L4	2.022	15.507	A	1	1.2	1	1	1	210.331	2.730	0.065	C
43.000-1.000			B	1	1.2	1	1	1	210.331			
			C	1	1.2	1	1	1	210.331			
Sum Weight:	5.975	33.996						OTM	591.791 kip-ft	8.682		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	0.237	1.628	A	1	1.2	1	1	1	50.678	0.984	0.047	C
146.000-125.0			B	1	1.2	1	1	1	50.678			
00			C	1	1.2	1	1	1	50.678			
L2	1.681	6.613	A	1	1.2	1	1	1	137.406	2.463	0.058	C
125.000-82.25			B	1	1.2	1	1	1	137.406			
0			C	1	1.2	1	1	1	137.406			
L3	2.035	10.248	A	1	1.2	1	1	1	161.736	2.506	0.064	C
82.250-43.000			B	1	1.2	1	1	1	161.736			
			C	1	1.2	1	1	1	161.736			
L4	2.022	15.507	A	1	1.2	1	1	1	210.331	2.730	0.065	C
43.000-1.000			B	1	1.2	1	1	1	210.331			
			C	1	1.2	1	1	1	210.331			
Sum Weight:	5.975	33.996						OTM	591.791 kip-ft	8.682		

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	33.996					
Bracing Weight	0.000					
Total Member Self-Weight	33.996			-15.821	27.285	
Total Weight	54.168			-15.821	27.285	
Wind 0 deg - No Ice		0.000	-52.906	-5235.748	27.285	-56.048
Wind 30 deg - No Ice		26.633	-45.818	-4536.410	-2606.409	-64.723
Wind 45 deg - No Ice		37.665	-37.411	-3706.867	-3697.322	-62.519
Wind 60 deg - No Ice		46.130	-26.453	-2625.784	-4534.408	-56.055
Wind 90 deg - No Ice		53.266	0.000	-15.821	-5240.104	-32.368
Wind 120 deg - No Ice		46.130	26.453	2594.142	-4534.408	-0.008
Wind 135 deg - No Ice		37.665	37.411	3675.224	-3697.322	16.744
Wind 150 deg - No Ice		26.633	45.818	4504.768	-2606.409	32.355
Wind 180 deg - No Ice		0.000	52.906	5204.105	27.285	56.048
Wind 210 deg - No Ice		-26.633	45.818	4504.768	2660.980	64.723
Wind 225 deg - No Ice		-37.665	37.411	3675.224	3751.892	62.519

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 240 deg - No Ice		-46.130	26.453	2594.142	4588.979	56.055
Wind 270 deg - No Ice		-53.266	0.000	-15.821	5294.675	32.368
Wind 300 deg - No Ice		-46.130	-26.453	-2625.784	4588.979	0.008
Wind 315 deg - No Ice		-37.665	-37.411	-3706.867	3751.892	-16.744
Wind 330 deg - No Ice		-26.633	-45.818	-4536.410	2660.980	-32.355
Member Ice	4.193					
Total Weight Ice	66.390			-26.778	45.977	
Wind 0 deg - Ice		0.005	-42.361	-4249.823	45.212	-42.046
Wind 30 deg - Ice		21.320	-36.688	-3684.424	-2083.997	-48.554
Wind 45 deg - Ice		30.149	-29.957	-3013.462	-2965.865	-46.901
Wind 60 deg - Ice		36.923	-21.185	-2138.962	-3642.482	-42.052
Wind 90 deg - Ice		42.632	-0.005	-27.542	-4212.647	-24.282
Wind 120 deg - Ice		36.918	21.176	2084.083	-3641.717	-0.006
Wind 135 deg - Ice		30.142	29.950	2958.825	-2964.784	12.561
Wind 150 deg - Ice		21.311	36.683	3630.104	-2082.673	24.272
Wind 180 deg - Ice		-0.005	42.361	4196.267	46.741	42.046
Wind 210 deg - Ice		-21.320	36.688	3630.868	2175.951	48.554
Wind 225 deg - Ice		-30.149	29.957	2959.906	3057.819	46.901
Wind 240 deg - Ice		-36.923	21.185	2085.406	3734.435	42.052
Wind 270 deg - Ice		-42.632	0.005	-26.014	4304.601	24.282
Wind 300 deg - Ice		-36.918	-21.176	-2137.638	3733.671	0.006
Wind 315 deg - Ice		-30.142	-29.950	-3012.381	3056.738	-12.561
Wind 330 deg - Ice		-21.311	-36.683	-3683.660	2174.627	-24.272
Total Weight	54.168			-15.821	27.285	
Wind 0 deg - Service		0.000	-20.667	-2054.855	27.285	-21.894
Wind 30 deg - Service		10.404	-17.898	-1781.676	-1001.502	-25.282
Wind 45 deg - Service		14.713	-14.613	-1457.636	-1427.639	-24.422
Wind 60 deg - Service		18.019	-10.333	-1035.338	-1754.626	-21.897
Wind 90 deg - Service		20.807	0.000	-15.821	-2030.289	-12.644
Wind 120 deg - Service		18.019	10.333	1003.696	-1754.626	-0.003
Wind 135 deg - Service		14.713	14.613	1425.994	-1427.639	6.541
Wind 150 deg - Service		10.404	17.898	1750.034	-1001.502	12.639
Wind 180 deg - Service		0.000	20.667	2023.213	27.285	21.894
Wind 210 deg - Service		-10.404	17.898	1750.034	1056.072	25.282
Wind 225 deg - Service		-14.713	14.613	1425.994	1482.210	24.422
Wind 240 deg - Service		-18.019	10.333	1003.696	1809.197	21.897
Wind 270 deg - Service		-20.807	0.000	-15.821	2084.859	12.644
Wind 300 deg - Service		-18.019	-10.333	-1035.338	1809.197	0.003
Wind 315 deg - Service		-14.713	-14.613	-1457.636	1482.210	-6.541
Wind 330 deg - Service		-10.404	-17.898	-1781.676	1056.072	-12.639

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

Comb. No.	Description
12	Dead+Wind 225 deg - No Ice
13	Dead+Wind 240 deg - No Ice
14	Dead+Wind 270 deg - No Ice
15	Dead+Wind 300 deg - No Ice
16	Dead+Wind 315 deg - No Ice
17	Dead+Wind 330 deg - No Ice
18	Dead+Ice+Temp
19	Dead+Wind 0 deg+Ice+Temp
20	Dead+Wind 30 deg+Ice+Temp
21	Dead+Wind 45 deg+Ice+Temp
22	Dead+Wind 60 deg+Ice+Temp
23	Dead+Wind 90 deg+Ice+Temp
24	Dead+Wind 120 deg+Ice+Temp
25	Dead+Wind 135 deg+Ice+Temp
26	Dead+Wind 150 deg+Ice+Temp
27	Dead+Wind 180 deg+Ice+Temp
28	Dead+Wind 210 deg+Ice+Temp
29	Dead+Wind 225 deg+Ice+Temp
30	Dead+Wind 240 deg+Ice+Temp
31	Dead+Wind 270 deg+Ice+Temp
32	Dead+Wind 300 deg+Ice+Temp
33	Dead+Wind 315 deg+Ice+Temp
34	Dead+Wind 330 deg+Ice+Temp
35	Dead+Wind 0 deg - Service
36	Dead+Wind 30 deg - Service
37	Dead+Wind 45 deg - Service
38	Dead+Wind 60 deg - Service
39	Dead+Wind 90 deg - Service
40	Dead+Wind 120 deg - Service
41	Dead+Wind 135 deg - Service
42	Dead+Wind 150 deg - Service
43	Dead+Wind 180 deg - Service
44	Dead+Wind 210 deg - Service
45	Dead+Wind 225 deg - Service
46	Dead+Wind 240 deg - Service
47	Dead+Wind 270 deg - Service
48	Dead+Wind 300 deg - Service
49	Dead+Wind 315 deg - Service
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	146 - 125	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-10.134	16.591	9.814
			Max. Mx	14	-5.821	232.697	4.973
			Max. My	2	-5.858	8.505	225.858
			Max. Vy	14	-16.127	232.697	4.973
			Max. Vx	2	-15.762	8.505	225.858
			Max. Torque	3			29.133
L2	125 - 82.25	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-31.103	41.489	24.193
			Max. Mx	14	-20.672	1325.709	13.653
			Max. My	2	-20.712	23.534	1299.008
			Max. Vy	14	-39.071	1325.709	13.653
			Max. Vx	2	-38.698	23.534	1299.008
			Max. Torque	3			60.525

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L3	82.25 - 43	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-44.920	47.648	27.752
			Max. Mx	14	-33.434	2955.593	16.089
			Max. My	2	-33.455	27.749	2913.408
			Max. Vy	14	-45.891	2955.593	16.089
			Max. Vx	2	-45.521	27.749	2913.408
			Max. Torque	3			64.436
L4	43 - 1	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-66.390	47.936	27.920
			Max. Mx	14	-54.140	5385.305	16.220
			Max. My	2	-54.140	27.976	5325.216
			Max. Vy	14	-53.295	5385.305	16.220
			Max. Vx	2	-52.935	27.976	5325.216
			Max. Torque	3			64.364

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	31	66.390	42.632	-0.005
	Max. H_x	14	54.168	53.266	0.000
	Max. H_z	2	54.168	0.000	52.906
	Max. M_x	2	5325.216	0.000	52.906
	Max. M_z	6	5329.247	-53.266	0.000
	Max. Torsion	3	64.333	-26.633	45.818
	Min. Vert	1	54.168	0.000	0.000
	Min. H_x	6	54.168	-53.266	0.000
	Min. H_z	10	54.168	0.000	-52.906
	Min. M_x	10	-5292.708	0.000	-52.906
	Min. M_z	14	-5385.305	53.266	0.000
	Min. Torsion	11	-64.323	26.633	-45.818

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	54.168	-0.000	-0.000	-16.283	28.081	-0.000
Dead+Wind 0 deg - No Ice	54.168	0.000	-52.906	-5325.216	27.968	-55.704
Dead+Wind 30 deg - No Ice	54.168	26.633	-45.818	-4613.901	-2650.693	-64.333
Dead+Wind 45 deg - No Ice	54.168	37.665	-37.411	-3770.187	-3760.207	-62.145
Dead+Wind 60 deg - No Ice	54.168	46.130	-26.453	-2670.659	-4611.552	-55.719
Dead+Wind 90 deg - No Ice	54.168	53.266	0.000	-16.218	-5329.247	-32.171
Dead+Wind 120 deg - No Ice	54.168	46.130	26.453	2638.204	-4611.520	-0.001
Dead+Wind 135 deg - No Ice	54.168	37.665	37.411	3737.714	-3760.170	16.652
Dead+Wind 150 deg - No Ice	54.168	26.633	45.818	4581.411	-2650.660	32.169
Dead+Wind 180 deg - No Ice	54.168	0.000	52.906	5292.708	27.971	55.713
Dead+Wind 210 deg - No Ice	54.168	-26.633	45.818	4581.466	2706.631	64.323
Dead+Wind 225 deg - No Ice	54.168	-37.665	37.411	3737.779	3816.170	62.128
Dead+Wind 240 deg - No Ice	54.168	-46.130	26.453	2638.261	4667.550	55.701
Dead+Wind 270 deg - No Ice	54.168	-53.266	0.000	-16.215	5385.305	32.162
Dead+Wind 300 deg - No Ice	54.168	-46.130	-26.453	-2670.710	4667.579	0.011

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 - No Ice	54.168	-37.665	-37.411	-3770.248	3816.204	-16.635
Dead+Wind 330 deg - No Ice	54.168	-26.633	-45.818	-4613.954	2706.659	-32.150
Dead+Ice+Temp	66.390	-0.000	-0.000	-27.920	47.936	-0.000
Dead+Wind 0 deg+Ice+Temp	66.390	0.005	-42.361	-4351.459	47.033	-41.809
Dead+Wind 30 deg+Ice+Temp	66.390	21.320	-36.688	-3772.574	-2132.914	-48.287
Dead+Wind 45 deg+Ice+Temp	66.390	30.149	-29.957	-3085.628	-3035.783	-46.646
Dead+Wind 60 deg+Ice+Temp	66.390	36.923	-21.185	-2190.307	-3728.504	-41.824
Dead+Wind 90 deg+Ice+Temp	66.390	42.632	-0.005	-28.644	-4312.225	-24.149
Dead+Wind 120 deg+Ice+Temp	66.390	36.918	21.176	2133.221	-3727.697	0.002
Dead+Wind 135 deg+Ice+Temp	66.390	30.142	29.950	3028.783	-3034.646	12.502
Dead+Wind 150 deg+Ice+Temp	66.390	21.311	36.683	3716.045	-2131.528	24.150
Dead+Wind 180 deg+Ice+Temp	66.390	-0.005	42.361	4295.708	48.613	41.821
Dead+Wind 210 deg+Ice+Temp	66.390	-21.320	36.688	3716.867	2228.560	48.281
Dead+Wind 225 deg+Ice+Temp	66.390	-30.149	29.957	3029.937	3131.443	46.632
Dead+Wind 240 deg+Ice+Temp	66.390	-36.923	21.185	2134.621	3824.183	41.806
Dead+Wind 270 deg+Ice+Temp	66.390	-42.632	0.005	-27.063	4407.940	24.136
Dead+Wind 300 deg+Ice+Temp	66.390	-36.918	-21.176	-2188.971	3823.412	0.004
Dead+Wind 315 deg+Ice+Temp	66.390	-30.142	-29.950	-3084.549	3130.347	-12.489
Dead+Wind 330 deg+Ice+Temp	66.390	-21.311	-36.683	-3771.818	2227.209	-24.132
Dead+Wind 0 deg - Service	54.168	0.000	-20.667	-2091.046	28.110	-21.834
Dead+Wind 30 deg - Service	54.168	10.404	-17.898	-1813.078	-1018.714	-25.215
Dead+Wind 45 deg - Service	54.168	14.713	-14.613	-1483.360	-1452.320	-24.357
Dead+Wind 60 deg - Service	54.168	18.019	-10.333	-1053.666	-1785.036	-21.838
Dead+Wind 90 deg - Service	54.168	20.807	-0.000	-16.300	-2065.525	-12.609
Dead+Wind 120 deg - Service	54.168	18.019	10.333	1021.064	-1785.030	-0.001
Dead+Wind 135 deg - Service	54.168	14.713	14.613	1450.755	-1452.314	6.525
Dead+Wind 150 deg - Service	54.168	10.404	17.898	1780.470	-1018.708	12.606
Dead+Wind 180 deg - Service	54.168	0.000	20.667	2058.436	28.111	21.836
Dead+Wind 210 deg - Service	54.168	-10.404	17.898	1780.479	1074.934	25.213
Dead+Wind 225 deg - Service	54.168	-14.713	14.613	1450.765	1508.544	24.354
Dead+Wind 240 deg - Service	54.168	-18.019	10.333	1021.073	1841.265	21.835
Dead+Wind 270 deg - Service	54.168	-20.807	-0.000	-16.299	2121.764	12.608
Dead+Wind 300 deg - Service	54.168	-18.019	-10.333	-1053.674	1841.269	0.003
Dead+Wind 315 deg - Service	54.168	-14.713	-14.613	-1483.369	1508.549	-6.522
Dead+Wind 330 deg - Service	54.168	-10.404	-17.898	-1813.085	1074.938	-12.604

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
1	0.000	-54.168	0.000	0.000	54.168	0.000	0.000%
2	0.000	-54.168	-52.906	0.000	54.168	52.906	0.000%
3	26.633	-54.168	-45.818	-26.633	54.168	45.818	0.000%
4	37.665	-54.168	-37.411	-37.665	54.168	37.411	0.000%
5	46.130	-54.168	-26.453	-46.130	54.168	26.453	0.000%
6	53.266	-54.168	0.000	-53.266	54.168	0.000	0.000%
7	46.130	-54.168	26.453	-46.130	54.168	-26.453	0.000%
8	37.665	-54.168	37.411	-37.665	54.168	-37.411	0.000%
9	26.633	-54.168	45.818	-26.633	54.168	-45.818	0.000%
10	0.000	-54.168	52.906	0.000	54.168	-52.906	0.000%
11	-26.633	-54.168	45.818	26.633	54.168	-45.818	0.000%
12	-37.665	-54.168	37.411	37.665	54.168	-37.411	0.000%
13	-46.130	-54.168	26.453	46.130	54.168	-26.453	0.000%
14	-53.266	-54.168	0.000	53.266	54.168	0.000	0.000%
15	-46.130	-54.168	-26.453	46.130	54.168	26.453	0.000%
16	-37.665	-54.168	-37.411	37.665	54.168	37.411	0.000%
17	-26.633	-54.168	-45.818	26.633	54.168	45.818	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
18	0.000	-66.390	0.000	0.000	66.390	0.000	0.000%
19	0.005	-66.390	-42.361	-0.005	66.390	42.361	0.000%
20	21.320	-66.390	-36.688	-21.320	66.390	36.688	0.000%
21	30.149	-66.390	-29.957	-30.149	66.390	29.957	0.000%
22	36.923	-66.390	-21.185	-36.923	66.390	21.185	0.000%
23	42.632	-66.390	-0.005	-42.632	66.390	0.005	0.000%
24	36.918	-66.390	21.176	-36.918	66.390	-21.176	0.000%
25	30.142	-66.390	29.950	-30.142	66.390	-29.950	0.000%
26	21.311	-66.390	36.683	-21.311	66.390	-36.683	0.000%
27	-0.005	-66.390	42.361	0.005	66.390	-42.361	0.000%
28	-21.320	-66.390	36.688	21.320	66.390	-36.688	0.000%
29	-30.149	-66.390	29.957	30.149	66.390	-29.957	0.000%
30	-36.923	-66.390	21.185	36.923	66.390	-21.185	0.000%
31	-42.632	-66.390	0.005	42.632	66.390	-0.005	0.000%
32	-36.918	-66.390	-21.176	36.918	66.390	21.176	0.000%
33	-30.142	-66.390	-29.950	30.142	66.390	29.950	0.000%
34	-21.311	-66.390	-36.683	21.311	66.390	36.683	0.000%
35	0.000	-54.168	-20.667	0.000	54.168	20.667	0.000%
36	10.404	-54.168	-17.898	-10.404	54.168	17.898	0.000%
37	14.713	-54.168	-14.613	-14.713	54.168	14.613	0.000%
38	18.019	-54.168	-10.333	-18.019	54.168	10.333	0.000%
39	20.807	-54.168	0.000	-20.807	54.168	0.000	0.000%
40	18.019	-54.168	10.333	-18.019	54.168	-10.333	0.000%
41	14.713	-54.168	14.613	-14.713	54.168	-14.613	0.000%
42	10.404	-54.168	17.898	-10.404	54.168	-17.898	0.000%
43	0.000	-54.168	20.667	0.000	54.168	-20.667	0.000%
44	-10.404	-54.168	17.898	10.404	54.168	-17.898	0.000%
45	-14.713	-54.168	14.613	14.713	54.168	-14.613	0.000%
46	-18.019	-54.168	10.333	18.019	54.168	-10.333	0.000%
47	-20.807	-54.168	0.000	20.807	54.168	0.000	0.000%
48	-18.019	-54.168	-10.333	18.019	54.168	10.333	0.000%
49	-14.713	-54.168	-14.613	14.713	54.168	14.613	0.000%
50	-10.404	-54.168	-17.898	10.404	54.168	17.898	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	0.00009936
3	Yes	5	0.00000001	0.00010661
4	Yes	5	0.00000001	0.00013353
5	Yes	5	0.00000001	0.00013870
6	Yes	5	0.00000001	0.00005719
7	Yes	5	0.00000001	0.00005065
8	Yes	5	0.00000001	0.00006521
9	Yes	5	0.00000001	0.00005649
10	Yes	5	0.00000001	0.00009897
11	Yes	5	0.00000001	0.00015412
12	Yes	5	0.00000001	0.00013305
13	Yes	5	0.00000001	0.00009110
14	Yes	5	0.00000001	0.00005757
15	Yes	5	0.00000001	0.00005407
16	Yes	5	0.00000001	0.00006777
17	Yes	5	0.00000001	0.00009978
18	Yes	4	0.00000001	0.00005511

19	Yes	5	0.00000001	0.00018315
20	Yes	5	0.00000001	0.00019734
21	Yes	5	0.00000001	0.00023871
22	Yes	5	0.00000001	0.00024363
23	Yes	5	0.00000001	0.00011009
24	Yes	5	0.00000001	0.00011441
25	Yes	5	0.00000001	0.00013915
26	Yes	5	0.00000001	0.00012399
27	Yes	5	0.00000001	0.00017983
28	Yes	5	0.00000001	0.00027118
29	Yes	5	0.00000001	0.00024112
30	Yes	5	0.00000001	0.00017663
31	Yes	5	0.00000001	0.00011356
32	Yes	5	0.00000001	0.00012902
33	Yes	5	0.00000001	0.00015408
34	Yes	5	0.00000001	0.00019122
35	Yes	5	0.00000001	0.00002595
36	Yes	5	0.00000001	0.00002701
37	Yes	5	0.00000001	0.00002894
38	Yes	5	0.00000001	0.00002836
39	Yes	4	0.00000001	0.00066529
40	Yes	4	0.00000001	0.00024589
41	Yes	4	0.00000001	0.00044221
42	Yes	4	0.00000001	0.00057781
43	Yes	5	0.00000001	0.00002521
44	Yes	5	0.00000001	0.00003259
45	Yes	5	0.00000001	0.00002930
46	Yes	5	0.00000001	0.00002341
47	Yes	4	0.00000001	0.00070083
48	Yes	4	0.00000001	0.00030481
49	Yes	4	0.00000001	0.00049587
50	Yes	4	0.00000001	0.00087217

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	146 - 125	24.154	48	1.428	0.084
L2	125 - 82.25	18.023	48	1.333	0.058
L3	88 - 43	8.891	48	0.976	0.028
L4	50 - 1	2.793	48	0.521	0.011

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
153.260	Barhamsted Branch 1	48	24.154	1.428	0.084	31366
144.000	(2) DB980F90E-M	48	23.559	1.420	0.081	31366
143.000	Valmont T-Arm (1)	48	23.262	1.417	0.080	31366
138.160	Barhamsted Branch 2	48	21.827	1.398	0.074	20004
133.000	LPA-80063/4CF	48	20.313	1.376	0.067	12063
131.000	Valmont T-Arm (1)	48	19.733	1.366	0.065	10455
124.000	(4) DB844H90E-XY	48	17.743	1.326	0.057	7499
122.000	EEI 10' Universal T-Arm	48	17.188	1.313	0.055	7237

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
121.390	Barhamsted Branch 3	48	17.020	1.309	0.054	7180
114.000	(2) 7770.00	48	15.037	1.250	0.047	6643
112.000	EEI 10' Universal T-Arm	48	14.516	1.232	0.046	6512
109.850	Barhamsted Branch 4	48	13.965	1.212	0.044	6378
103.000	APX16DWV-16DWVS-E-A20	48	12.269	1.144	0.038	5983
101.000	Valmont T-Arm (1)	48	11.791	1.123	0.037	5876
93.000	APXV18-206517-C	48	9.963	1.034	0.031	5487
91.600	Barhamsted Branch 5	48	9.657	1.018	0.030	5424
82.800	Barhamsted Branch 6	48	7.836	0.914	0.025	5029

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	146 - 125	60.590	14	3.545	0.214
L2	125 - 82.25	45.338	14	3.330	0.149
L3	88 - 43	22.456	14	2.456	0.072
L4	50 - 1	7.074	14	1.319	0.027

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
153.260	Barhamsted Branch 1	14	60.590	3.545	0.214	13382
144.000	(2) DB980F90E-M	14	59.111	3.529	0.207	13382
143.000	Valmont T-Arm (1)	14	58.372	3.521	0.204	13382
138.160	Barhamsted Branch 2	14	54.807	3.480	0.188	8534
133.000	LPA-80063/4CF	14	51.042	3.430	0.172	5146
131.000	Valmont T-Arm (1)	14	49.598	3.408	0.166	4460
124.000	(4) DB844H90E-XY	14	44.640	3.315	0.146	3189
122.000	EEI 10' Universal T-Arm	14	43.255	3.283	0.141	3068
121.390	Barhamsted Branch 3	14	42.836	3.273	0.139	3040
114.000	(2) 7770.00	14	37.879	3.131	0.121	2778
112.000	EEI 10' Universal T-Arm	14	36.577	3.088	0.116	2715
109.850	Barhamsted Branch 4	14	35.198	3.039	0.112	2650
103.000	APX16DWV-16DWVS-E-A20	14	30.945	2.872	0.098	2462
101.000	Valmont T-Arm (1)	14	29.746	2.820	0.094	2412
93.000	APXV18-206517-C	14	25.153	2.600	0.080	2230
91.600	Barhamsted Branch 5	14	24.384	2.561	0.077	2201
82.800	Barhamsted Branch 6	14	19.801	2.303	0.064	2026

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	146 - 125 (1)	TP32.508x25.41x0.25	21.000	0.000	0.0	39.000	25.597	-5.827	998.272	0.006
L2	125 - 82.25 (2)	TP44.632x32.508x0.375	42.750	0.000	0.0	39.000	50.736	-20.672	1978.700	0.010
L3	82.25 - 43 (3)	TP55.014x42.251x0.438	45.000	0.000	0.0	39.000	73.029	-33.434	2848.150	0.012
L4	43 - 1 (4)	TP66.05x52.154x0.5	49.000	0.000	0.0	39.000	104.028	-54.140	4057.090	0.013

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	146 - 125 (1)	TP32.508x25.41x0.25	233.465	13.749	39.000	0.353	0.000	0.000	39.000	0.000
L2	125 - 82.25 (2)	TP44.632x32.508x0.375	1325.775	29.839	39.000	0.765	0.000	0.000	39.000	0.000
L3	82.25 - 43 (3)	TP55.014x42.251x0.438	2955.633	37.441	39.000	0.960	0.000	0.000	39.000	0.000
L4	43 - 1 (4)	TP66.05x52.154x0.5	5385.333	38.397	39.000	0.985	0.000	0.000	39.000	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	146 - 125 (1)	TP32.508x25.41x0.25	16.038	0.627	26.000	0.048	0.010	0.000	26.000	0.000
L2	125 - 82.25 (2)	TP44.632x32.508x0.375	39.071	0.770	26.000	0.059	30.258	0.332	26.000	0.013
L3	82.25 - 43 (3)	TP55.014x42.251x0.438	45.891	0.628	26.000	0.048	32.182	0.199	26.000	0.008
L4	43 - 1 (4)	TP66.05x52.154x0.5	53.295	0.512	26.000	0.039	32.162	0.112	26.000	0.004

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	146 - 125 (1)	0.006	0.353	0.000	0.048	0.000	0.359 ✔	1.333	H1-3+VT ✔
L2	125 - 82.25 (2)	0.010	0.765	0.000	0.059	0.013	0.777 ✔	1.333	H1-3+VT ✔
L3	82.25 - 43 (3)	0.012	0.960	0.000	0.048	0.008	0.973 ✔	1.333	H1-3+VT ✔
L4	43 - 1 (4)	0.013	0.985	0.000	0.039	0.004	0.998 ✔	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	146 - 125	Pole	TP32.508x25.41x0.25	1	-5.827	1330.697	26.9	Pass
L2	125 - 82.25	Pole	TP44.632x32.508x0.375	2	-20.672	2637.607	58.3	Pass
L3	82.25 - 43	Pole	TP55.014x42.251x0.438	3	-33.434	3796.584	73.0	Pass
L4	43 - 1	Pole	TP66.05x52.154x0.5	4	-54.140	5408.101	74.9	Pass
							Summary	
						Pole (L4)	74.9	Pass
						RATING =	**74.9**	**Pass**

Flange Bolt and Flange Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 233·ft·kips	(Input From RisaTower)
Shear Force =	Shear := 16.2·kips	(Input From RisaTower)
Axial Force =	Axial := 10.2·kips	(Input From RisaTower)

Flange Bolt Data:

Use ASTM A325

Number of Flange Bolts =	N := 12	(User Input)
Diameter of Bolt Circle =	D_{bc} := 37.0·in	(User Input)
Bolt Ultimate Strength =	F_u := 120·ksi	(User Input)
Bolt Yield Strength =	F_y := 92·ksi	(User Input)
Bolt Modulus =	E := 29000·ksi	(User Input)
Diameter of Flange Bolts =	D := 1.0·in	(User Input)
Threads per Inch =	n := 8	(User Input)

Flange Plate Data:

Use ASTM A572 Mod 50

Plate Yield Strength =	Fy_{bp} := 50·ksi	(User Input)
Flange Plate Thickness =	t_{bp} := 1.25·in	(User Input)
Flange Plate Diameter =	D_{bp} := 41.0·in	(User Input)
Outer Pole Diameter =	D_{pole} := 32.51·in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 18.5 \cdot in$

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

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

$d_1 = 9.25 \cdot in$ $d_7 = -9.25 \cdot in$

$d_2 = 16.02 \cdot in$ $d_8 = -16.02 \cdot in$

$d_3 = 18.50 \cdot in$ $d_9 = -18.50 \cdot in$

$d_4 = 16.02 \cdot in$ $d_{10} = -16.02 \cdot in$

$d_5 = 9.25 \cdot in$ $d_{11} = -9.25 \cdot in$

$d_6 = 0.00 \cdot in$ $d_{12} = -0.00 \cdot in$

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 16.3 \cdot in$

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

$MA_1 = 0.00 \cdot in$ $MA_7 = 0.00 \cdot in$

$MA_2 = 0.00 \cdot in$ $MA_8 = 0.00 \cdot in$

$MA_3 = 2.25 \cdot in$ $MA_9 = 0.00 \cdot in$

$MA_4 = 0.00 \cdot in$ $MA_{10} = 0.00 \cdot in$

$MA_5 = 0.00 \cdot in$ $MA_{11} = 0.00 \cdot in$

$MA_6 = 0.00 \cdot in$ $MA_{12} = 0.00 \cdot in$

Effective Width of Flangeplate for Bending = $B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 20 \cdot in$

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Subject:		Flange Bolts and Flangeplate Analysis
Location:		145-ft Summit Monopine Barkhamsted, CT
Rev. 0: 12/27/11		Prepared by: T.J.L. Checked by: C.F.C. Job No. 12001.CO3

Flange Bolt Analysis:

Calculated Flange Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 2.053 \times 10^3 \cdot in^2$

Gross Area of Bolt = $A_g := \frac{\pi}{4} \cdot D^2 = 0.785 \cdot in^2$

Net Area of Bolt = $A_n := \frac{\pi}{4} \cdot \left(D - \frac{0.9743 \cdot in}{n}\right)^2 = 0.606 \cdot in^2$

Net Diameter = $D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} = 0.878 \cdot in$

Radius of Gyration of Bolt = $r := \frac{D_n}{4} = 0.22 \cdot in$

Section Modulus of Bolt = $S_x := \frac{\pi \cdot D_n^3}{32} = 0.066 \cdot in^3$

Check Flange Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 24.3 \cdot kips$

Allowable Tensile Force = $T_{ALL.Gross} := 1.333 \cdot \left(0.33 \cdot A_g \cdot F_u\right) = 41.5 \cdot kips$ (1.333 increase allowed per TIA/EIA)

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Gross}} = 59 \cdot \%$

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

Condition1 = "OK"

Flange Plate Analysis:

Force from Bolts =

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

$C_1 = 13.4 \cdot kips$
$C_2 = 22.7 \cdot kips$
$C_3 = 26.0 \cdot kips$
$C_4 = 22.7 \cdot kips$
$C_5 = 13.4 \cdot kips$
$C_6 = 0.9 \cdot kips$
$C_7 = -11.7 \cdot kips$
$C_8 = -21.0 \cdot kips$
$C_9 = -24.3 \cdot kips$
$C_{10} = -21.0 \cdot kips$
$C_{11} = -11.7 \cdot kips$
$C_{12} = 0.8 \cdot kips$

Maximum Bending Stress in Plate =

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} \, t_{bp}^{\,2}\right)} = 11.2 \cdot ksi$$

Allowable Bending Stress in Plate =

$$F_{bp} := 1.33 \cdot 0.75 \cdot Fy_{bp} = 49.9 \cdot ksi$$

Plate Bending Stress % of Capacity =

$$\frac{f_{bp}}{F_{bp}} = 22.5 \cdot \%$$

Condition3 =

$$Condition2 := if\left(\frac{f_{bp}}{F_{bp}} < 1.00, "Ok", "Overstressed"\right)$$

Condition2 = "Ok"

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Subject:		Anchor Bolt and Baseplate Analysis
Location:		145-ft Summit Monopine Barkhamsted, CT
	Rev. 0: 12/27/11	Prepared by: T.J.L. Checked by: C.F.C. Job No. 12001.CO3

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 5385·ft·kips	(Input From RisaTower)
Shear Force =	Shear := 53·kips	(Input From RisaTower)
Axial Force =	Axial := 54·kips	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 24	(User Input)
Bolt "Column" Distance =	l := 3.0·in	(User Input)
Bolt Ultimate Strength =	F_u := 100·ksi	(User Input)
Bolt Yield Strength =	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 Gr. 55

Plate Yield Strength =	Fy_{bp} := 55·ksi	(User Input)
Base Plate Thickness =	t_{bp} := 3.25·in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

$d_1 := 36.875in$ (User Input)

$d_2 := 35.75in$ (User Input)

$d_3 := 33.75in$ (User Input)

$d_4 := 15.125in$ (User Input)

$d_5 := 9.375in$ (User Input)

$d_6 := 3.0in$ (User Input)

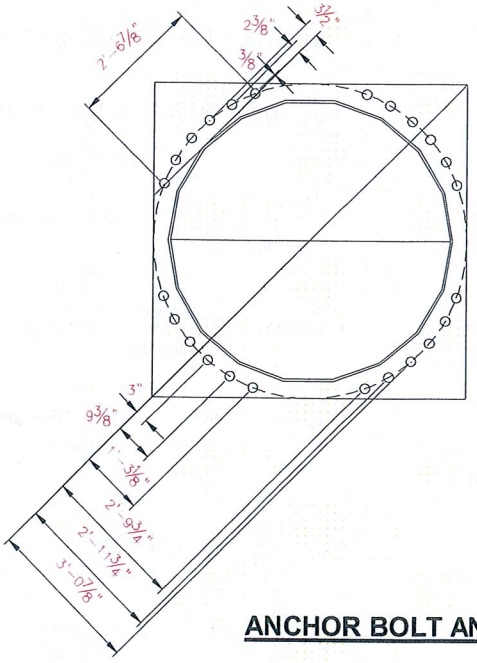
Critical Distances For Bending in Plate:

$ma_1 := 3.5in$ (User Input)

$ma_2 := 2.375in$ (User Input)

$ma_3 := 0.375in$ (User Input)

Effective Width of Baseplate for Bending = $B_{eff} := 30.875in$ (User Input)



ANCHOR BOLT AND PLATE GEOMETRY

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \left[(d_1)^2 \cdot 4 + (d_2)^2 \cdot 4 + (d_3)^2 \cdot 4 + (d_4)^2 \cdot 4 + (d_5)^2 \cdot 4 + (d_6)^2 \cdot 4 \right] = 16410 \cdot in^2$

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 = $T_{Max} := OM \cdot \frac{d_1}{I_p} - \frac{Axial}{N} = 143 \cdot kips$

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

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

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} = 73.4 \cdot \%$ Bolts are "upset bolts". Use net area per AISC

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

Condition1 = "OK" Note Shear stress is negligible

Check Anchor Bolt Bending Stress:

Maximum Bending Moment = $M_x := \left(\frac{Shear}{N} \right) \cdot l = 0.552 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 8 \cdot ksi$

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.

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

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

Check Anchor Bolt Compression/Combined Stress:

Applied Compressive Force =

$$C_{Max} := OM \cdot \frac{d_1}{I_p} + \frac{Axial}{N} = 147.5 \cdot kips$$

Applied Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 45.4 \cdot ksi$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

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

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 75.7 \cdot \%$$

Condition 2 =

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

Condition2 = "OK"

Base Plate Analysis:

Force from Bolts =

$$C_1 := \frac{OM \cdot d_1}{I_p} + \frac{Axial}{N} = 147.456 \cdot kips$$

$$C_2 := \frac{OM \cdot d_2}{I_p} + \frac{Axial}{N} = 143.026 \cdot kips$$

$$C_3 := \frac{OM \cdot d_3}{I_p} + \frac{Axial}{N} = 135.151 \cdot kips$$

Applied Bending Stress in Plate =

$$f_{bp} := \frac{6 \cdot \left(2C_1 \cdot ma_1 + 2C_2 \cdot ma_2 + 2C_3 \cdot ma_3\right)}{B_{eff} \cdot t_{bp}^{\,2}} = 33.35 \cdot ksi$$

Allowable Bending Stress in Plate =

$$F_{bp} := 1.33 \cdot 0.75 \cdot Fy_{bp} = 54.9 \cdot ksi$$

Plate Bending Stress % of Capacity =

$$\frac{f_{bp}}{F_{bp}} = 60.8 \cdot \%$$

Condition3 =

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

Condition3 = "Ok"

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Subject: FOUNDATION ANALYSIS

Location: 145-ft Summit Monopine
Barkhamsted, CT

Rev. 0: 12/27/11

Prepared by: T.J.L. Checked by: C.F.C.
Job No. 12001.CO3

Standard Monopole Foundation:

Input Data:

Tower Data

Overturning Moment =	OM := 5385·ft·kips	(User Input from RISATower)	
Shear Force =	Shear := 53·kip	(User Input from RISATower)	
Axial Force =	Axial := 54·kip	(User Input from RISATower)	
Tower Height =	H_t := 145·ft	(User Input)	

Footing Data:

Overall Depth of Footing =	D_f := 9.0·ft	(User Input)	
Length of Pier =	L_p := 5.5·ft	(User Input)	
Extension of Pier Above Grade =	L_{pag} := 0.5·ft	(User Input)	
Diameter of Pier =	d_p := 8.0·ft	(User Input)	
Thickness of Footing =	T_f := 4·ft	(User Input)	
Width of Footing =	W_f := 31.5·ft	(User Input)	

Anchor Bolt Data:

Length of Anchor Bolts =	L_{st} := 96·in	(User Input)	
Projection of Anchor Bolts Above Pier =	A_{BP} := 12·in	(User Input)	
Anchor Bolt Diameter =	d_{anchor} := 2.25·in	(User Input)	
Base Plate Bolt Circle =	MP := 74.0·in	(User Input)	

Material Properties:

Concrete Compressive Strength =	f_c := 3000·psi	(User Input)	
Steel Reinforcment Yield Strength =	f_y := 60000·psi	(User Input)	
Anchor Bolt Yield Strength =	f_{ya} := 75000·psi	(User Input)	
Internal Friction Angle of Soil =	Φ_s := 30·deg	(User Input)	
Allowable Soil Bearing Capacity =	q_s := 4000·psf	(User Input)	
Unit Weight of Soil =	γ_{soil} := 120·pcf	(User Input)	
Unit Weight of Concrete =	γ_{conc} := 150·pcf	(User Input)	
Foundation Bouyancy =	Bouyancy := 1	(User Input)	(Yes=1 / No=0)
Depth to Neglect =	n := 1·ft	(User Input)	
Cohesion of Clay Type Soil =	c := 0·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 =	μ := 0.45	(User Input)	

Pier Reinforcement:

Bar Size =	$BS_{pier} := 11$	(User Input)	
Bar Diameter =	$d_{bpier} := 1.41 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 60$	(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 =	$d_{Tie} := 3 \cdot in$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{top} := 11$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 1.41 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 48$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 11$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 1.41 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 48$	(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 =

$$A_{bpier} := \frac{\pi \cdot d_{bpier}^2}{4} = 1.561 \cdot in^2$$

Pad Top Reinforcement Bar Area =

$$A_{btop} := \frac{\pi \cdot d_{btop}^2}{4} = 1.561 \cdot in^2$$

Pad Bottom Reinforcement Bar Area =

$$A_{bbot} := \frac{\pi \cdot d_{bbot}^2}{4} = 1.561 \cdot in^2$$

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 = $\gamma_c := if(Bouyancy = 1, \gamma_{conc} - 62.4pcf, \gamma_{conc}) = 87.6 \cdot pcf$

Adjusted Soil Unit Weight = $\gamma_s := if(Bouyancy = 1, \gamma_{soil} - 62.4pcf, \gamma_{soil}) = 57.6 \cdot pcf$

Passive Pressure = $P_{pn} := K_p \cdot \gamma_s \cdot n + c \cdot 2 \cdot \sqrt{K_p} = 0.173 \cdot ksf$

$P_{pt} := K_p \cdot \gamma_s \cdot (D_f - T_f) + c \cdot 2 \cdot \sqrt{K_p} = 0.864 \cdot ksf$

$P_{top} := if[n < (D_f - T_f), P_{pt}, P_{pn}] = 0.864 \cdot ksf$

$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p} = 1.555 \cdot ksf$

$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 1.21 \cdot ksf$

$T_p := if[n < (D_f - T_f), T_f, (D_f - n)] = 4$

$A_p := W_f \cdot T_p = 126$

Ultimate Shear = $S_u := P_{ave} \cdot A_p = 152.41 \cdot kip$

Weight of Concrete Pad = $WT_c := \left[\left(W_f^2 \cdot T_f\right) + \frac{d_p^2 \cdot \pi}{4} L_p\right] \cdot \gamma_c = 371.902 \cdot kip$

Weight of Soil Above Footing = $WT_{s1} := \left[\left(W_f^2 - \frac{d_p^2 \cdot \pi}{4}\right) \cdot \left(\left|L_p - L_{pag} - n\right|\right)\right] \cdot \gamma_s = 217.03 \cdot kip$

Weight of Soil Wedge at Back Face = $WT_{s2} := \left(\frac{D_f^2 \cdot \tan(\Phi_s)}{2} \cdot W_f\right) \cdot \gamma_s = 42.426 \cdot kip$

Weight of Soil Wedge at back face Corners = $WT_{s3} := 2 \cdot \left[(D_f)^3 \cdot \frac{\tan(\Phi_s)}{3}\right] \cdot \gamma_s = 16.162 \cdot kips$

Total Weight = $WT_{tot} := WT_c + WT_{s1} + Axial = 642.936 \cdot kip$

Resisting Moment = $M_r := (WT_{tot}) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + \left[(WT_{s2} + WT_{s3}) \cdot \left(W_f + \frac{D_f \cdot \tan(\Phi_s)}{3}\right)\right] = 12276 \cdot kip \cdot ft$

Overturning Moment = $M_{ot} := OM + Shear \cdot (L_p + T_f) = 5889 \cdot kip \cdot ft$

Factor of Safety Actual = $FS := \frac{M_r}{M_{ot}} = 2.08$

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 =

$$S_p := \frac{P_{ave} \cdot A_p + \mu \cdot WT_{tot}}{FS_{req}} = 220.865 \cdot kips$$

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

Shear_Check = "Okay"

Bearing Pressure Caused by Footing:

Area of the Mat =

$$A_{mat} := W_f^{\,2} = 992.25$$

Section Modulus of Mat =

$$S := \frac{W_f^{\,3}}{6} = 5209.31 \cdot ft^3$$

Maximum Pressure in Mat =

$$P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S} = 1.778 \cdot ksf$$

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

Max_Pressure_Check = "Okay"

Minimum Pressure in Mat =

$$P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S} = -0.482 \cdot ksf$$

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

Min_Pressure_Check = "No Good"

Distance to Resultant of Pressure Distribution =

$$X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 8.259$$

Distance to Kern =

$$X_k := \frac{W_f}{6} = 5.25$$

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

Eccentricity =

$$e := \frac{M_{ot}}{WT_{tot}} = 9.159$$

Adjusted Soil Pressure =

$$P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)} = 2.064 \cdot ksf$$

$$q_{adj} := if\left(P_{min} < 0, P_a, P_{max}\right) = 2.064 \cdot ksf$$

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

Pressure_Check = "Okay"

Concrete Bearing Capacity:

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

Bearing Strength Between Pier and Pad = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 1.2 \times 10^4 \cdot kips$ (ACI-2008 10.14)

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

Bearing_Check = "Okay"

Shear Strength of Concrete:

Beam Shear:

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

$\phi_c := 0.85$ (ACI 9.3.2.5)

$d := T_f - Cvr_{pad} - d_{bbot}$

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

$d_2 := d_1 - d$

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

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

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

$V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f_c \cdot psi} \cdot W_f \cdot d$ (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 = $b_o := (d_p + d) \cdot \pi = 36.5$

Area Included Inside Perimeter = $A_{bo} := \frac{\pi \cdot (d_p + d)^2}{4} = 106.3$

Area Outside of Perimeter = $A_{out} := A_{mat} - A_{bo} = 886$

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

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

$v_u := \text{Find}(v_u) = 4.8 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f = 554.2 \cdot kips$

Required Shear Strength = $V_{req} := LF \cdot V_u = 738.7 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 3559.8 \cdot kip$ (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)

$q_b := q_{adj} - d_1 \cdot Slope = 0.838 \cdot ksf$

Maximum Bending at Face of Pier = $M_n := \frac{1}{LF \cdot \phi_m} \cdot \left[\left(q_{adj} - q_b \right) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 3000.7 \cdot kip \cdot ft$

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

(ACI-200810.2.7.3)

$R_u := \frac{M_n}{\phi_m \cdot W_f \cdot d^2} = 55.7 \cdot psi$

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

$\rho_{min} := 1.333 \cdot \rho = 0.00125$

Required Reinforcement for Temperature and Shrinkage:

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

Check Bottom Bars:

$As := \max(\rho, \rho_{min}, \rho_{sh}) \cdot W_f \cdot d = 29.7 \cdot in^2$

$As_{prov} := A_{bbot} \cdot NB_{bot} = 74.9 \cdot in^2$

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

Pad_Reinforcement_Bot = "Okay"

Check top Bars:

$As := \rho_{sh} \cdot (W_f \cdot d) = 29.7 \cdot in^2$

$As_{prov} := A_{btop} \cdot NB_{top} = 74.9 \cdot in^2$

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

Pad_Reinforcement_Top = "Okay"

Developement Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 6.47 \cdot in$$

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)

$$L_{dbt} := \frac{3 \cdot f_y \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 54.4 \cdot in$$

Minimum Development Length =

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

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

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad} = 138 \cdot in$$

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

Lpad_Check = "Okay"

Steel Reinforcement in Pier:

Area of Pier = $A_p := \frac{\pi \cdot d_p^2}{4} = 7238.23 \cdot in^2$

$A_{smin} := 0.01 \cdot 0.05 \cdot A_p = 3.62 \cdot in^2$ (ACI-2008 10.8.4 & 10.9.1)

$A_{sprov} := NB_{pier} \cdot A_{bpier} = 93.69 \cdot in^2$

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

Steel_Area_Check = "Okay"

Bar Spacing In Pier = $B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 3.617 \cdot in$

Diameter of Reinforcement Cage = $Diam_{cage} := d_p - 2 \cdot Cvr_{pier} = 90 \cdot in$

Maximum Moment in Pier = $M_p := \left[OM + Shear \cdot \left(L_p + \frac{A_{BP}}{2}\right)\right] \cdot LF = 91225.2 \cdot in \cdot kips$

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

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

$(D \; N \; n \; P_u \; M_{xu}) = (96 \;\; 60 \;\; 11 \;\; 72 \;\; 91225.2)$

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

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

$(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho) = (150.3 \;\; 1.9 \times 10^5 \;\; -60 \;\; 0)$

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

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:

$L_{pier} := L_p - Cvr_{pier} = 63 \cdot in$

$L_{pad} := T_f - Cvr_{pad} = 45 \cdot in$

Tension: (ACI-2008 12.2.3)

Spacing or Cover Dimension =

$c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right) = 1.808 \cdot in$

Transverse Reinforcement =

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

$L_{dbt} := \frac{3 \cdot f_y \alpha_{pier} \cdot \beta_{pier} \cdot \gamma_{pier} \cdot \lambda_{pier}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \left(\frac{c + k_{tr}}{d_{bpier}}\right)} \cdot d_{bpier} = 90.33 \cdot in$

Minimum Development Length =

$L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f_c}{psi}}} \cdot .7 = 21.624 \cdot in$ (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)

$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot f_y}{\sqrt{f_c \cdot psi}} = 30.892 \cdot in$

$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot \left(d_{bpier} \cdot f_y\right) = 25.38 \cdot in$

$L_{dbc} := if\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right) = 30.892 \cdot in$

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

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

Tie Size and Spacing in Column:

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

Used #3 Ties

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

$s_{lim1} := 16 \cdot d_{bpier} \cdot z = 22.56 \cdot in$

$s_{lim2} := \frac{48 \cdot d_{Tie}}{8} \cdot z = 18 \cdot in$

$s_{lim3} := D_f \cdot z = 108 \cdot in$

$s_{lim4} := 18in$

Maximum Spacing = $s_{tie} := \min\begin{pmatrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{pmatrix} = 18 \cdot in$

Number of Ties Required = $n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 = 4.333$

Check Anchor Steel Embedment:

Depth Available = $D_{ab} := L_{st} - A_{BP} = 7 \cdot ft$

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	BARKHAMSTED S CT	ECP - CELL #	2	482
LATITUDE	41-53-37.72 N	LONGITUDE	72-59-47.34 W	
Additional Comments: LTE antenna add keeping with 12 antennas and adding diplexers to the main lines		SAVE BUTTON		
		STRUCTURE TYPE	MONOPINE	

700 Mhz - LTE ANTENNA ADD	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	eNodeB	eNodeB	eNodeB
ANTENNA TYPE	BXA-70063-6CF_2	BXA-70063-6CF_2	BXA-70063-6CF_2
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	10	110	230
DOWN TILT (MECH/DEG)	5	3	4
RAD CTR (FT AGL)	127.5	127.5	127.5
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

850 Celluar - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	#N/A	#N/A	#N/A
ANTENNA TYPE	LPA-80063/4CF	LPA-80063/4CF 5	LPA-80080/4CF
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	10	110	230
DOWN TILT (MECH/DEG)	5	3	4
RAD CTR (FT AGL)	127.5	127.5	127.5
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

850 Celluar - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	#N/A	#N/A	#N/A
ANTENNA TYPE	LPA-80063/4CF	LPA-80063/4CF 5	LPA-80080/4CF
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	10	110	230
DOWN TILT (MECH/DEG)	5	3	4
RAD CTR (FT AGL)	127.5	127.5	127.5
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	#N/A	#N/A	#N/A
ANTENNA TYPE	DB948F65E-M_0	DB948F65E-M_0	DB948G85E-M_0
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	10	110	230
DOWN TILT (MECH/DEG)	5	5	2
RAD CTR (FT AGL)	127.5	127.5	127.5
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

1900 PCS - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	#N/A	#N/A	#N/A
ANTENNA TYPE	BXA-171063-8BF_2	BXA-171063-8BF_2	BXA-171085-8BF_2
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	10	110	230
DOWN TILT (MECH/DEG)	3	3	0
RAD CTR (FT AGL)	127.5	127.5	127.5
TMA - QTY / MODEL			
DIPLEX WITH CELLULAR CABLE	Diplex with cellular cable	Diplex with cellular cable	Diplex with cellular cable

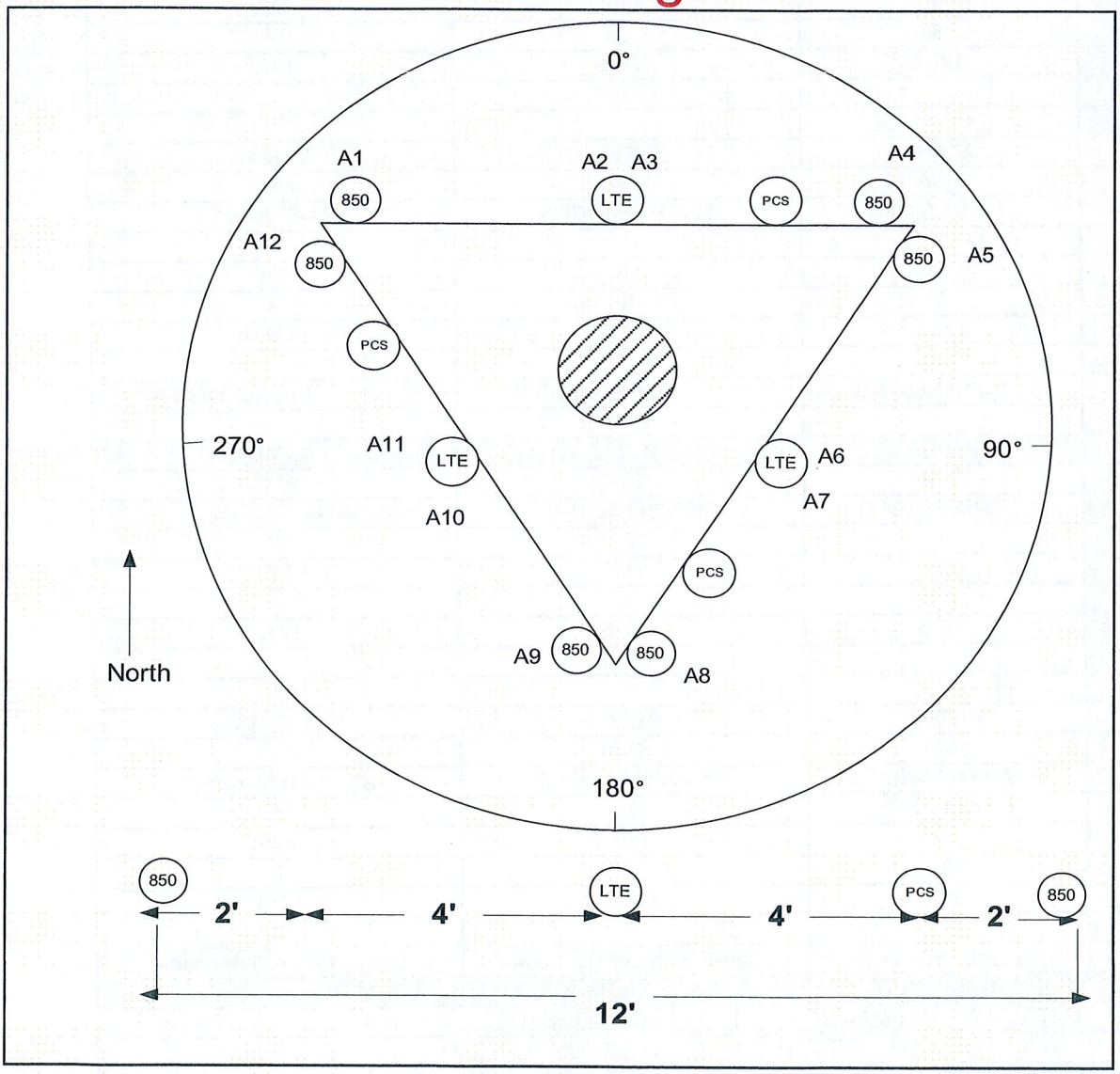
NUMBER OF CABLE'S NEEDED					ESTIMATED CABLE LENGTH			
MAINLINE SIZE	1 5/8"	TOTAL # OF MAINLINES		12	MAINLINE (FT)			
JUMPER SIZE	1/2 "	TOTAL # OF TOP JUMPERS		12	TOP JUMPER (FT)			12
Equipment Cable Ordering		MAIN CABLE	12 +	0	TOP JUMPER #	12	+	6

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	800	Tx1/Rx0	RED	A7	800	Tx2/Rx0	BLUE	A13	800	Tx3/Rx0	GREEN
A2	1900	Tx1/Rx0	RED/ WHITE	A8	1900	Tx2/Rx0	BLUE/ WHITE	A14	1900	Tx3/Rx0	GREEN/WHITE
A3	700	Tx1/Rx0	RED/ ORANGE	A9	700	Tx2/Rx0	BLUE/ ORANGE	A15	700	Tx3/Rx0	GREEN/ORANGE
A4	700	Tx4/Rx1	RED/RED/ ORANGE	A10	700	Tx5/Rx1	BLUE/BLUE/ ORANGE	A16	700	Tx6/Rx1	GREEN/GREEN/ ORANGE
A5	1900	Tx4/Rx1	RED/RED/ WHITE	A11	1900	Tx5/Rx1	BLUE/BLUE/ WHITE	A17	1900	Tx6/Rx1	GREEN/GREEN/ WHITE
A6	800	Tx4/Rx1	RED/RED	A12	800	Tx5/Rx1	BLUE/BLUE	A18	800	Tx6/Rx1	GREEN/GREEN

RF ENGINEER	RF MANAGER	INITIALS	DATE
Prepared By: Mark Brauer	Steve Weatherbee	MB	8/31/2011

Site Configuration



Amphenol ANTENNA SOLUTIONS

BXA-70063-6CF-EDIN-X

X-Pol | FET Panel | 63° | 14.5 dBd

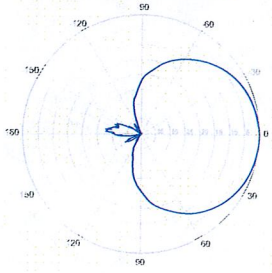
Replace "X" with desired electrical downtilt.

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	13°	11°
Gain	14.0 dBd (16.1 dBi)	14.5 dBd (16.6 dBi)
Electrical downtilt (X)	0, 2, 3, 4, 5, 6, 8, 10	
Impedance	50Ω	
VSWR	≤1.35:1	
Upper sidelobe suppression (0°)	-18.3 dB	-18.2 dB
Front-to-back ratio (+/-30°)	-33.4 dB	-36.3 dB
Null fill	5% (-26.02 dB)	
Isolation between ports	< -25 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	1804 x 285 x 132 mm	71.0 x 11.2 x 5.2 in
Depth with z-brackets	172 mm	6.8 in
Weight without mounting brackets	7.9 kg	17 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.51 m² Side: 0.24 m²	Front: 5.5 ft² Side: 2.6 ft²
Wind load @ 161 km/hr (100 mph)	Front: 759 N Side: 391 N	Front: 169 lbf Side: 89 lbf

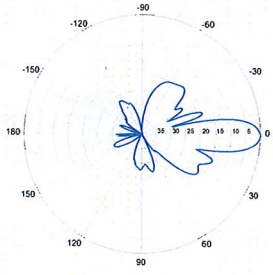
Mounting Options	Part Number	Fits Pipe Diameter	Weight
3-Point Mounting & Downtilt Bracket Kit	36210008	40-115 mm 1.57-4.5 in	6.9 kg 15.2 lbs
Concealment Configurations	For concealment configurations, order BXA-70063-6CF-EDIN-X-FP		

BXA-70063-6CF-EDIN-X



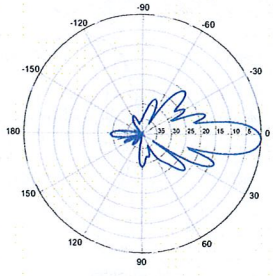
Horizontal | 750 MHz

BXA-70063-6CF-EDIN-0

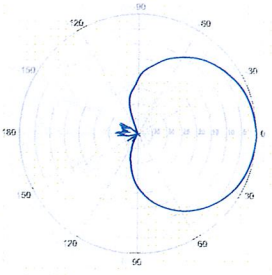


0° | Vertical | 750 MHz

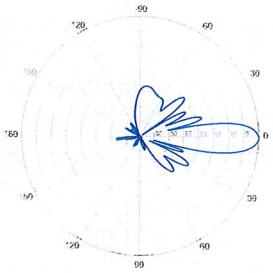
BXA-70063-6CF-EDIN-2



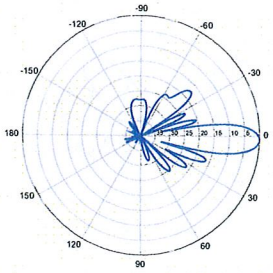
2° | Vertical | 750 MHz



Horizontal | 850 MHz



0° | Vertical | 850 MHz



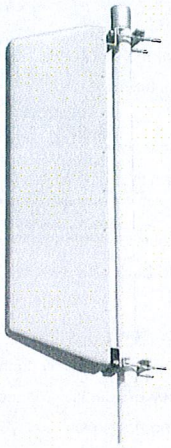
2° | Vertical | 850 MHz

LPA-80080-4CF-EDIN-X

V-Pol | Log Periodic | 80° | 12.5 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.

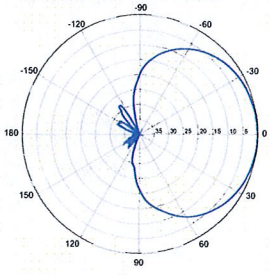


Electrical Characteristics	
Frequency bands	806-960 MHz
Polarization	Vertical
Horizontal beamwidth	80°
Vertical beamwidth	15°
Gain	12.5 dBd (14.6 dBi)
Electrical downtilt (X)	0, 2, 4, 5, 6, 8, 10, 12, 14
Impedance	50Ω
VSWR	≤1.4:1
Upper sidelobe suppression (0°)	-14.2 dB
Front-to-back ratio (+/-30°)	-34.7 dB
Null fill	15% (-16.48 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	1200 x 140 x 335 mm	47.2 x 5.5 x 13.2 in
Depth of antenna with z-bracket	375 mm	14.8 in
Weight without mounting brackets	5.4 kg	12 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.17 m² Side: 0.40 m²	Front: 1.8 ft² Side: 4.3 ft²
Wind load @ 161 km/hr (100 mph)	Front: 254 N Side: 574 N	Front: 57 lbf Side: 129 lbf

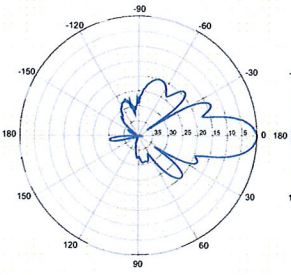
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting & Downtilt Bracket Kit (0-20°)	21699999	50-102 mm 2.0-4.0 in	5.4 kg 12 lbs
Lock-Down Brace	If the lock-down brace is used, the maximum diameter of the mounting pipe is 88.9 mm or 3.5 in.		

LPA-80080-4CF-EDIN-X



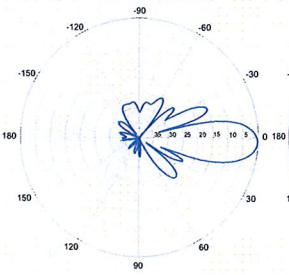
Horizontal

LPA-80080-4CF-EDIN-0



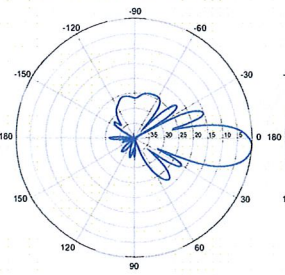
0° | Vertical

LPA-80080-4CF-EDIN-2



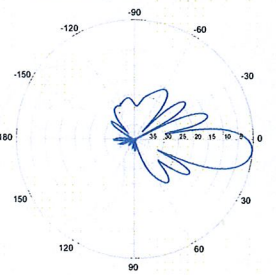
2° | Vertical

LPA-80080-4CF-EDIN-4



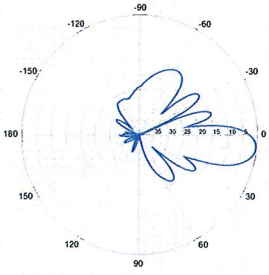
2° | Vertical

LPA-80080-4CF-EDIN-5



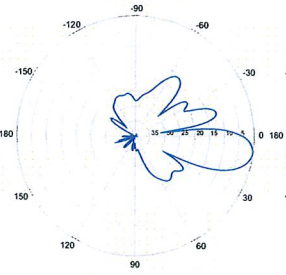
5° | Vertical

LPA-80080-4CF-EDIN-6



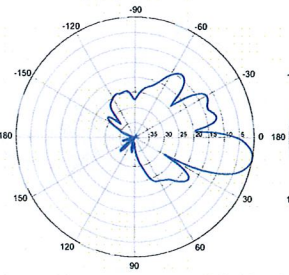
6° | Vertical

LPA-80080-4CF-EDIN-8



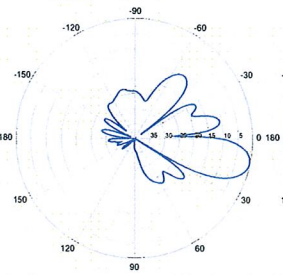
8° | Vertical

LPA-80080-4CF-EDIN-10



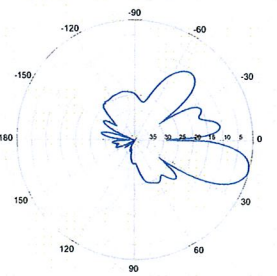
10° | Vertical

LPA-80080-4CF-EDIN-12



12° | Vertical

LPA-80080-4CF-EDIN-14



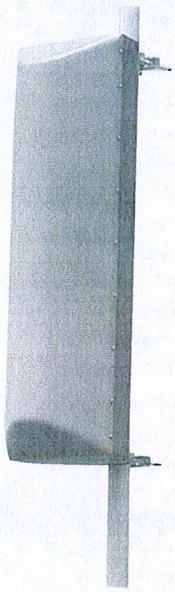
14° | Vertical

LPA-80063-4CF-EDIN-X

V-Pol | Log Periodic | 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.

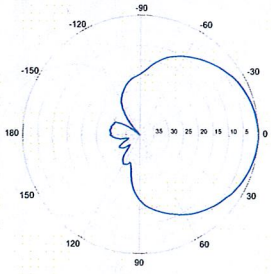


Electrical Characteristics	
Frequency bands	806-960 MHz
Polarization	Vertical
Horizontal beamwidth	63°
Vertical beamwidth	15°
Gain	13.0 dBd (15.1 dBi)
Electrical downtilt (X)	0, 2, 4, 5, 6, 8, 10, 12, 14
Impedance	50Ω
VSWR	≤1.4:1
Upper sidelobe suppression (0°)	-15.7 dB
Front-to-back ratio (+/-30°)	-31.7 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	1205 x 385 x 332 mm	47.4 x 15.2 x 13.1 in
Depth of antenna with z-bracket	372 mm	14.6 in
Weight without mounting brackets	9.1 kg	20 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.46 m² Side: 0.39 m²	Front: 5.0 ft² Side: 4.2 ft²
Wind load @ 161 km/hr (100 mph)	Front: 660 N Side: 550 N	Front: 149 lbf Side: 124 lbf

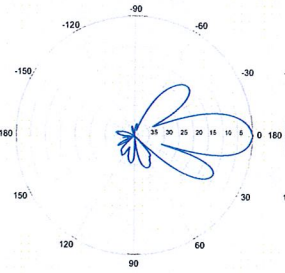
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting & Downtilt Bracket Kit (0-20°)	21699999	50-102 mm 2.0-4.0 in	5.4 kg 12 lbs
Lock-Down Brace	If the lock-down brace is used, the maximum diameter of the mounting pipe is 88.9 mm or 3.5 in.		

LPA-80063-4CF-EDIN-X



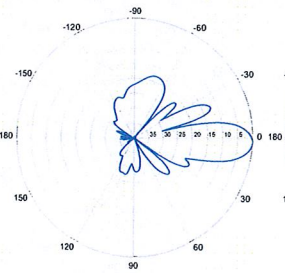
Horizontal

LPA-80063-4CF-EDIN-0



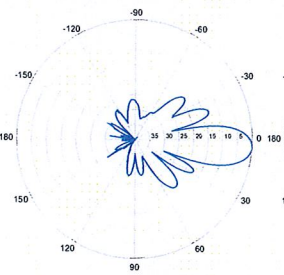
0° | Vertical

LPA-80063-4CF-EDIN-2



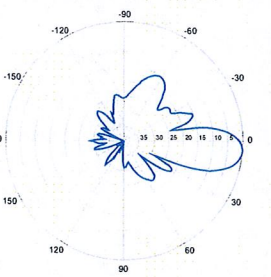
2° | Vertical

LPA-80063-4CF-EDIN-4



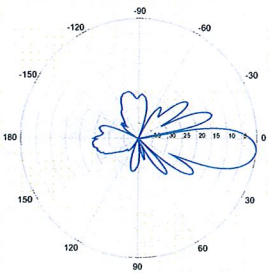
4° | Vertical

LPA-80063-4CF-EDIN-5



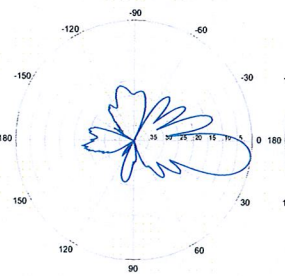
5° | Vertical

LPA-80063-4CF-EDIN-6



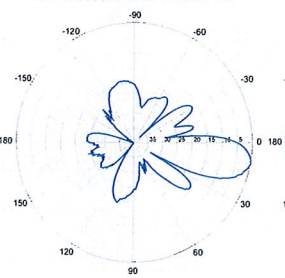
6° | Vertical

LPA-80063-4CF-EDIN-8



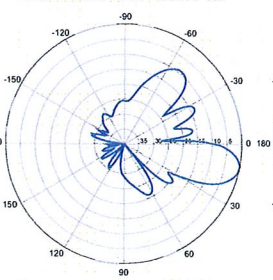
8° | Vertical

LPA-80063-4CF-EDIN-10



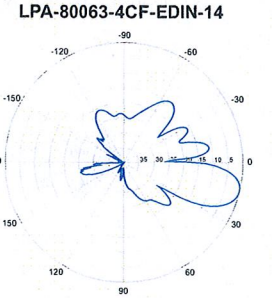
10° | Vertical

LPA-80063-4CF-EDIN-12



12° | Vertical

LPA-80063-4CF-EDIN-14



14° | Vertical

Amphenol ANTENNA SOLUTIONS

BXA-171063-8BF-EDIN-X

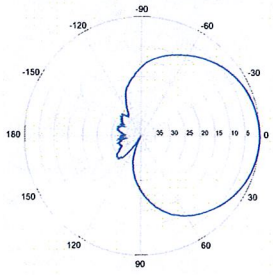
Replace 'X' with desired electrical downtilt.

X-Pol | FET Panel | 63° | 17.4 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	7°	7°	7°
Gain	14.5 dBd / 16.6 dBi	14.9 dBd / 17.0 dBi	15.3 dBd / 17.4 dBi
Electrical downtilt (X)	0, 2, 4, 8		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back isolation	> 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	1232 x 154 x 105 mm		48.5 x 6.1 x 4.1 in
Depth with t-brackets	133 mm		5.2 in
Weight without mounting brackets	4.8 kg		10.5 lbs
Survival wind speed	296 km/hr		184 mph
Wind area	Front: 0.19 m² Side: 0.14 m²		Front: 2.0 ft² Side: 1.5 ft²
Wind load @ 161 km/hr (100 mph)	Front: 281 N Side: 223 N		Front: 63 lbf Side: 50 lbf

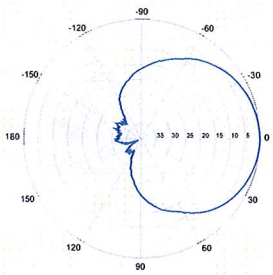
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	26799997	50-102 mm 2.0-4.0 in	2.3 kg 5 lbs
2-Point Mounting & Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	3.6 kg 8 lbs
Concealment Configurations	For concealment configurations, order BXA-171063-8BF-EDIN-X-FP		

BXA-171063-8BF-EDIN-X



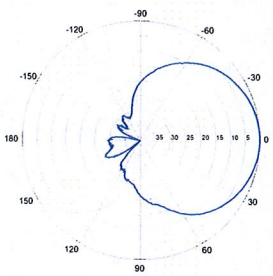
Horizontal | 1710-1880 MHz

BXA-171063-8BF-EDIN-X



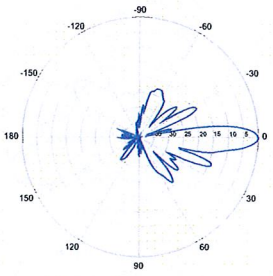
Horizontal | 1850-1990 MHz

BXA-171063-8BF-EDIN-X



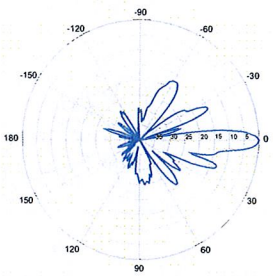
Horizontal | 1920-2170 MHz

BXA-171063-8BF-EDIN-0



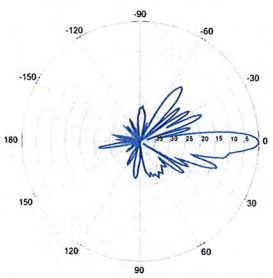
0° | Vertical | 1710-1880 MHz

BXA-171063-8BF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171063-8BF-EDIN-0



0° | Vertical | 1920-2170 MHz

BXA-171085-8BF-EDIN-X

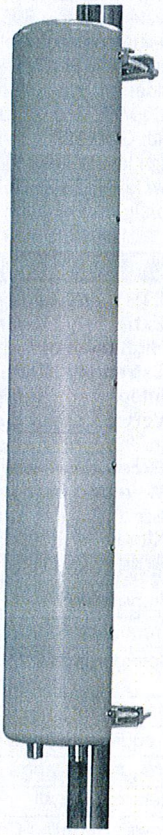
Replace "X" with desired electrical downtilt.

X-Pol | FET Panel | 85° | 16.4 dBi

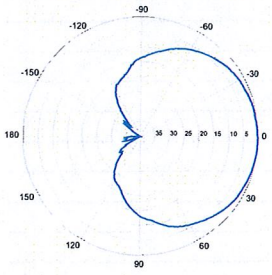
Electrical Characteristics	1710-2170 MHz		
Frequency bands	1710-1880 MHz	1850-1990 MHz	1920-2170 MHz
Polarization	±45°	±45°	±45°
Horizontal beamwidth	88°	85°	80°
Vertical beamwidth	7°	7°	7°
Gain	13.5 dBd / 15.6 dBi	13.9 dBd / 16.0 dBi	14.3 dBd / 16.4 dBi
Electrical downtilt (X)	0, 2, 4		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back isolation	> 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	1232 x 154 x 105 mm	48.5 x 6.1 x 4.1 in
Depth with t-brackets	133 mm	5.2 in
Weight without mounting brackets	4.8 kg	10.5 lbs
Survival wind speed	296 km/hr	184 mph
Wind area	Front: 0.19 m² Side: 0.14 m²	Front: 2.0 ft² Side: 1.5 ft²
Wind load @ 161 km/hr (100 mph)	Front: 281 N Side: 223 N	Front: 63 lbf Side: 50 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-171085-8BF-EDIN-X-FP		

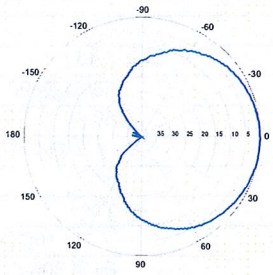


BXA-171085-8BF-EDIN-X



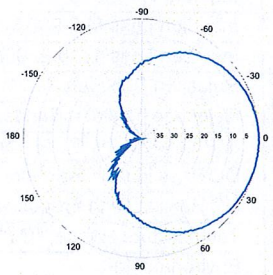
Horizontal | 1710-1880 MHz

BXA-171085-8BF-EDIN-X



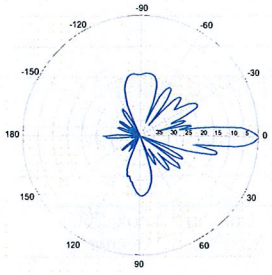
Horizontal | 1850-1990 MHz

BXA-171085-8BF-EDIN-X



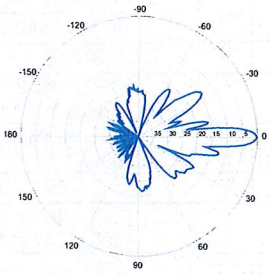
Horizontal | 1920-2170 MHz

BXA-171085-8BF-EDIN-0



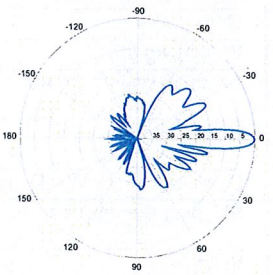
0° | Vertical | 1710-1880 MHz

BXA-171085-8BF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171085-8BF-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