



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

April 20, 2012

The Honorable Scott Kaupin
Mayor
Town of Enfield
820 Enfield Street
Enfield, CT 06082

RE: **EM-VER-049-120419** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 37 Bacon Road, Enfield, Connecticut.

Dear Mayor Kaupin:

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 May 4, 2012.

Thank you for your cooperation and consideration.

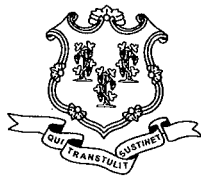
Very truly yours,

Linda Roberts
Executive Director

LR/jbw

Enclosure: Notice of Intent

c: Matthew W. Coppler, Town Manager, Town of Enfield
Jose Giner, Director of Planning and Community Development, Town of Enfield



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May 4, 2012

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

RE: **EM-VER-049-120419** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 37 Bacon Road, Enfield, 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 April 18, 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

Executive Director

LR/CDM/laf

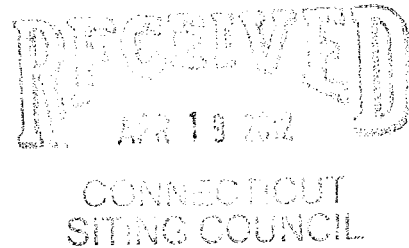
c: The Honorable Scott Kaupin, Mayor, Town of Enfield
Jose Giner, Director of Planning and Community Development, Town of Enfield
Shaker Pines Fire District #5

EM-VER-049-120419

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

April 18, 2012

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



**Re: Notice of Exempt Modification – Antenna Swap
37 Bacon Road, Enfield, Connecticut**

Dear Ms. Roberts:

Cellco Partnership d/b/a Verizon Wireless (“Cellco”) currently maintains twelve (12) wireless telecommunications antennas at the 150-foot level on an existing 180-foot tower at the above-referenced address. The tower and underlying property are owned by Shaker Pines Fire District #5. Cellco’s use of the tower was approved by the Council in 2005. Cellco now intends to replace all of its existing antennas with six (6) model LPA-80080-4CF cellular antennas; three (3) model BXA-171085-8BF PCS antennas; one (1) model BXA-70063-6CF LTE antenna; and two (2) model SLCP 2X6014 LTE antennas, all at the same 150-foot level. Cellco also intends to install six (6) coax cable diplexers to its existing antenna platform. Attached behind Tab 1 are the specifications for the replacement antennas and cable diplexers.

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

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 height of the existing tower. Cellco’s replacement antennas and diplexers will be located at the 150-foot level on the existing 180-foot tower.



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ROBINSON & COLE_{LLP}

Linda Roberts
April 18, 2012
Page 2

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

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

4. The operation of the replacement antennas will not increase radio frequency (RF) power density levels at the facility to a level at or above the Federal Communications Commission (FCC) adopted safety standard. A 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:

Matthew W. Coppler, Enfield Town Manager
Sandy M. Carter

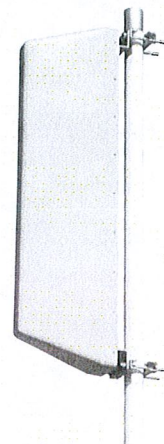


LPA-80080-4CF-EDIN-X

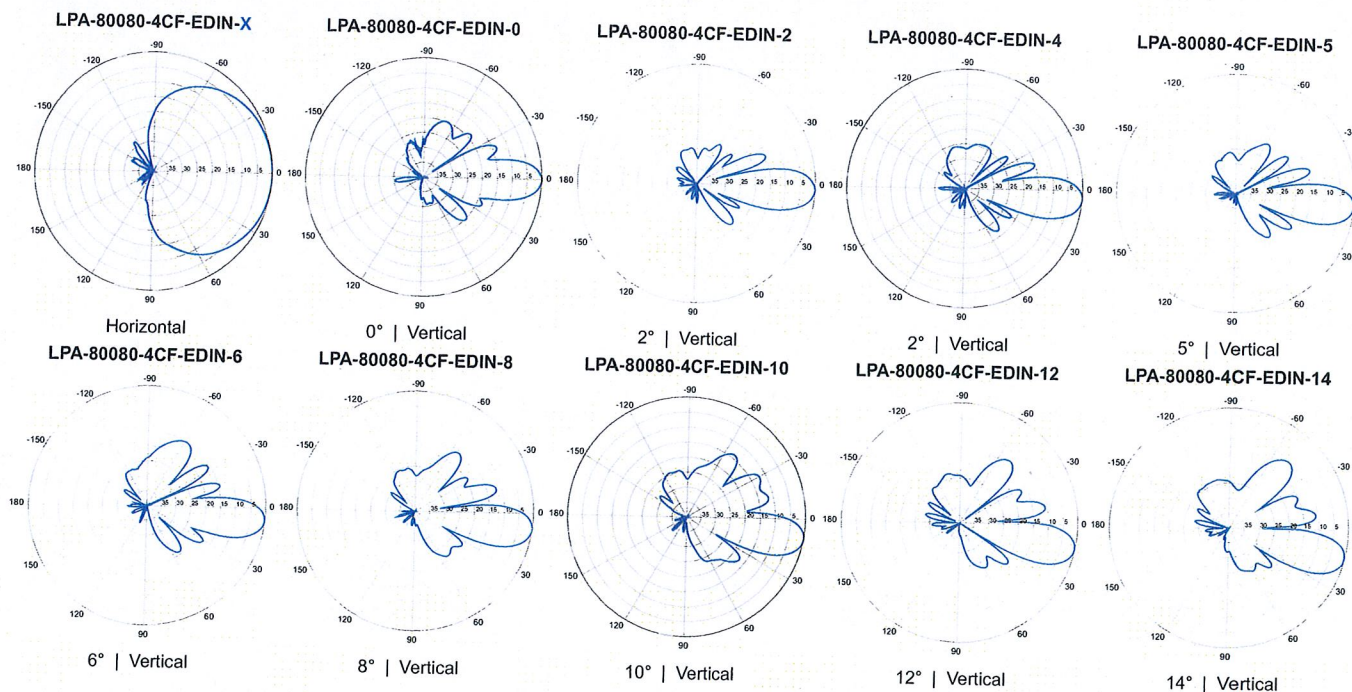
V-Pol | Log Periodic | 80° | 12.5 dBd

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 mm47.2 x 5.5 x 13.2 in
Depth of antenna with z-bracket	375 mm14.8 in
Weight without mounting brackets	5.4 kg12 lbs
Survival wind speed	> 201 km/hr> 125 mph
Wind area	Front: 0.17 m² Side: 0.40 m²Front: 1.8 ft² Side: 4.3 ft²
Wind load @ 161 km/hr (100 mph)	Front: 254 N Side: 574 NFront: 57 lbf Side: 129 lbf
Mounting Options	
2-Point Mounting & Downtilt Bracket Kit (0-20°)	Part Number21699999Fits Pipe Diameter50-102 mm 2.0-4.0 inWeight5.4 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.



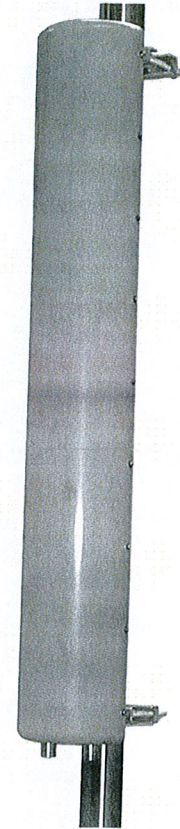
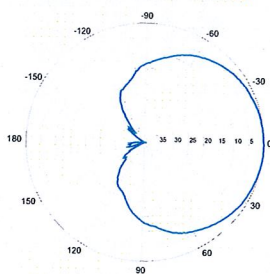
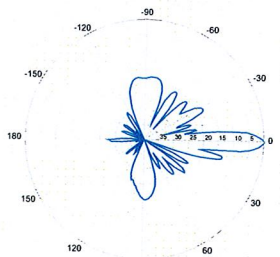
Quoted performance parameters are provided to offer typical or range values only and may vary as a result of normal manufacturing and operational conditions. Extreme operational conditions and/or stress on structural supports is beyond our control. Such conditions may result in damage to this product. Improvements to product may be made without notice.

BXA-171085-8BF-EDIN-X

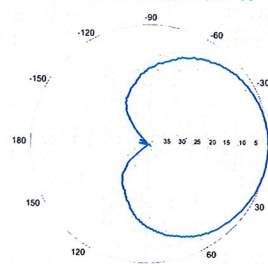
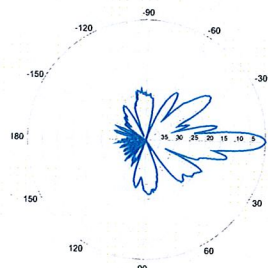
Replace "X" with desired electrical downtilt.

X-Pol | FET Panel | 85° | 16.4 dBi

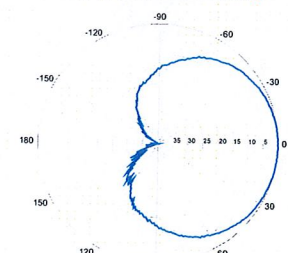
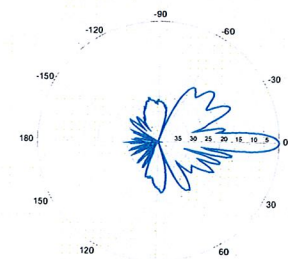
Electrical Characteristics		1710-2170 MHz		
Frequency bands		1710-1880 MHz	1850-1990 MHz	1920-2170 MHz
Polarization		±45°	±45°	±45°
Horizontal beamwidth		88°	85°	80°
Vertical beamwidth		7°	7°	7°
Gain		13.5 dBd / 15.6 dBi	13.9 dBd / 16.0 dBi	14.3 dBd / 16.4 dBi
Electrical downtilt (X)		0, 2, 4		
Impedance		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 m ² Side: 0.14 m ²	Front: 2.0 ft ² Side: 1.5 ft ²	
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-0

0° | Vertical | 1710-1880 MHz

BXA-171085-8BF-EDIN-XHorizontal | 1850-1990 MHz
BXA-171085-8BF-EDIN-0

0° | Vertical | 1850-1990 MHz

BXA-171085-8BF-EDIN-XHorizontal | 1920-2170 MHz
BXA-171085-8BF-EDIN-0

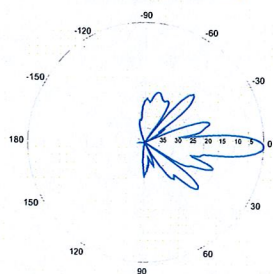
0° | Vertical | 1920-2170 MHz

Quoted performance parameters are provided to offer typical or range values only and may vary as a result of normal manufacturing and operational conditions. Extreme operational conditions and/or stress on structural supports is beyond our control. Such conditions may result in damage to this product. Improvements to product may be made without notice.

BXA-171085-8BF-EDIN-X

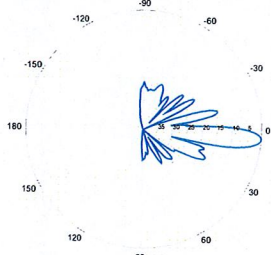
X-Pol | FET Panel | 85° | 16.4 dBi

BXA-171085-8BF-EDIN-2



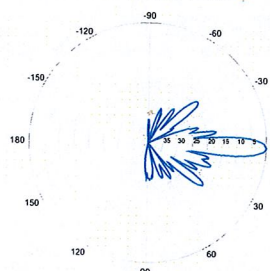
2° | Vertical | 1710-1880 MHz

BXA-171085-8BF-EDIN-4



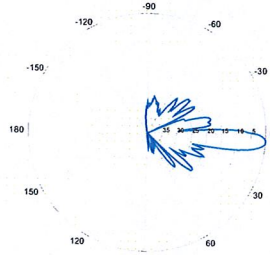
4° | Vertical | 1710-1880 MHz

BXA-171085-8BF-EDIN-2



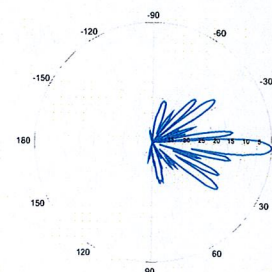
2° | Vertical | 1850-1990 MHz

BXA-171085-8BF-EDIN-4



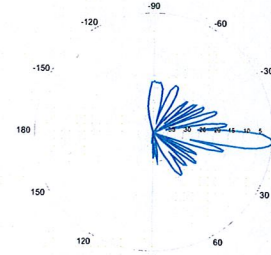
4° | Vertical | 1850-1990 MHz

BXA-171085-8BF-EDIN-2



2° | Vertical | 1920-2170 MHz

BXA-171085-8BF-EDIN-4



4° | Vertical | 1920-2170 MHz

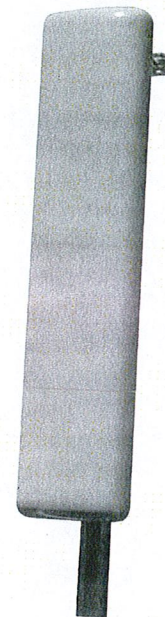
Quoted performance parameters are provided to offer typical or range values only and may vary as a result of normal manufacturing and operational conditions. Extreme operational conditions and/or stress on structural supports is beyond our control. Such conditions may result in damage to this product. Improvements to product may be made without notice.

BXA-70063-4CF-EDIN-X

X-Pol | FET Panel | 63° | 13.0 dBd

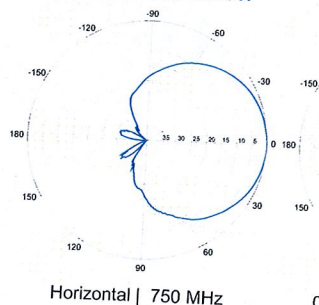
Replace "X" with desired electrical downtilt.

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

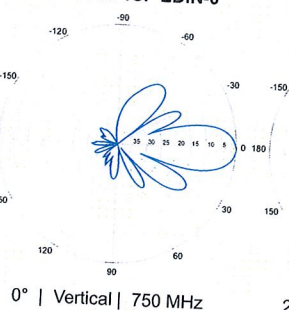


Electrical Characteristics		696-900 MHz	
Frequency bands		696-806 MHz	806-900 MHz
Polarization		65°	±45°
Horizontal beamwidth		17°	63°
Vertical beamwidth		12.5 dBd (14.6 dBi)	15°
Gain		0, 2, 3, 4, 5, 6, 8, 9, 10, 12, 14	13.0 dBd (15.1 dBi)
Electrical downtilt (X)		50Ω	
Impedance		≤1.35:1	
VSWR		-16.3 dB	-22.1 dB
Upper sidelobe suppression (0°)		-36.1 dB	-34.9 dB
Front-to-back ratio (+/-30°)		5% (-26.02 dB)	
Null fill		< -30 dB	
Isolation between ports		500 W	
Input power with EDIN connectors		300 W	
Input power with NE connectors		Direct Ground	
Lightning protection		2 Ports / EDIN or NE / Female / Center (Back)	
Connector(s)			
Mechanical Characteristics			
Dimensions Length x Width x Depth		1205 x 285 x 133 mm	47.4 x 11.2 x 5.2 in
Depth with z-brackets		173 mm	6.8 in
Weight without mounting brackets		4.5 kg	9.9 lbs
Survival wind speed		> 201 km/hr	> 125 mph
Wind area		Front: 0.34 m² Side: 0.16 m²	Front: 3.7 ft² Side: 1.7 ft²
Wind load @ 161 km/hr (100 mph)		Front: 498 N Side: 260 N	Front: 111 lbf Side: 55 lbf
Mounting Options			
2-Point Mounting Bracket Kit	Part Number	Fits Pipe Diameter	Weight
2-Point Downtilt Bracket Kit (0-20°)	36210002	50-160 mm 2.0-6.3 in	4.5 kg 10 lbs
Downtilt Mounting Applications	36114003	50-160 mm 2.0-6.3 in	4.9 kg 11 lbs
Concealment Configurations	A mounting bracket and downtilt bracket kit must be ordered for downtilt applications For concealment configurations, order BXA-70063-4CF-EDIN-X-FP		

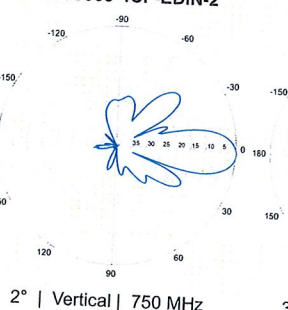
BXA-70063-4CF-EDIN-X



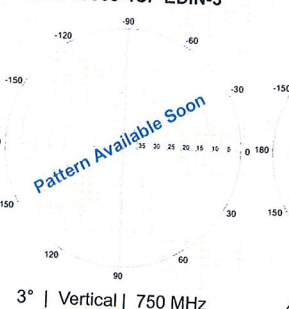
BXA-70063-4CF-EDIN-0



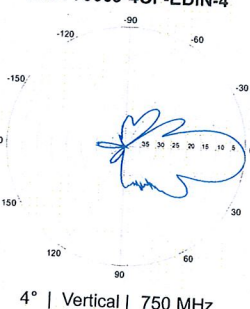
BXA-70063-4CF-EDIN-2



BXA-70063-4CF-EDIN-3



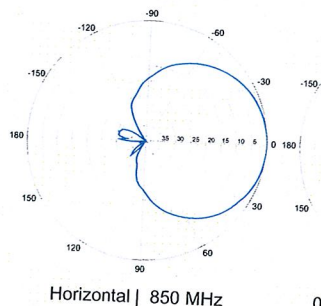
BXA-70063-4CF-EDIN-4



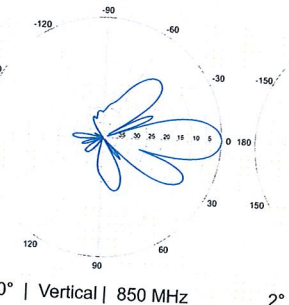
Pattern Available Soon

Pattern Available Soon

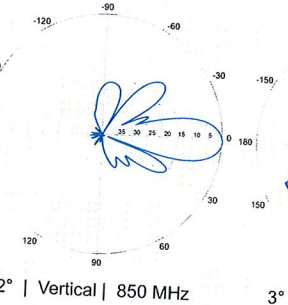
Horizontal | 850 MHz



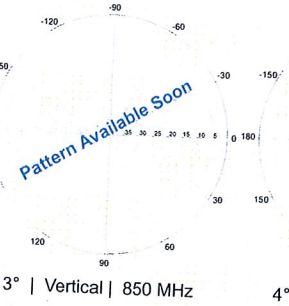
0° | Vertical | 850 MHz



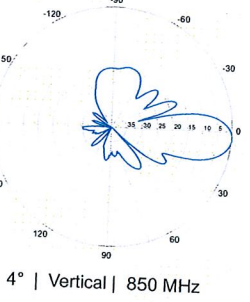
2° | Vertical | 850 MHz



3° | Vertical | 850 MHz



4° | Vertical | 850 MHz

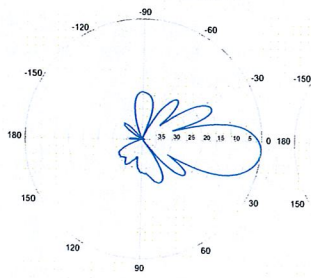


Quoted performance parameters are provided to offer typical or range values only and may vary as a result of normal manufacturing and operational conditions. Extreme operational conditions and/or stress on structural supports is beyond our control. Such conditions may result in damage to this product. Improvements to product may be made without notice.

BXA-70063-4CF-EDIN-X

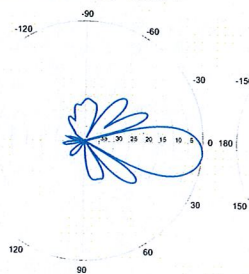
X-Pol | FET Panel | 63° | 13.0 dBd

BXA-70063-4CF-EDIN-5



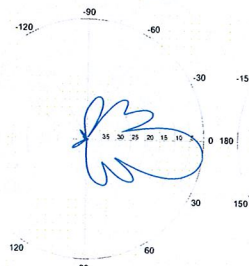
5° | Vertical | 750 MHz

BXA-70063-4CF-EDIN-6



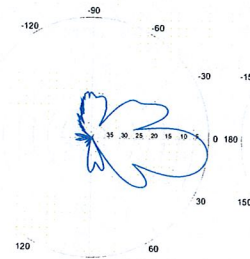
6° | Vertical | 750 MHz

BXA-70063-4CF-EDIN-8



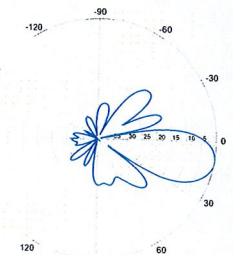
8° | Vertical | 750 MHz

BXA-70063-4CF-EDIN-9

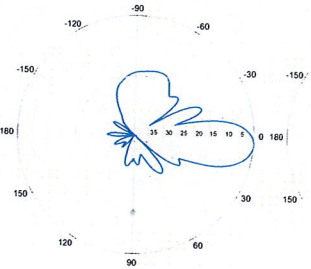


9° | Vertical | 750 MHz

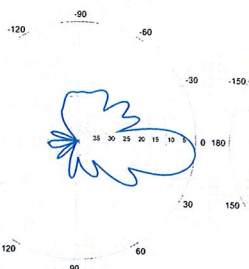
BXA-70063-4CF-EDIN-10



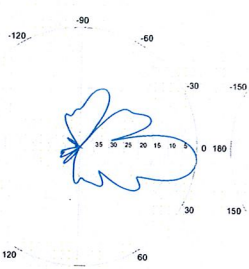
10° | Vertical | 750 MHz



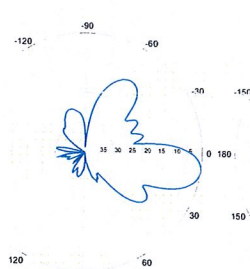
5° | Vertical | 850 MHz



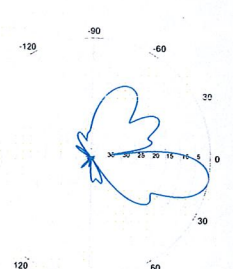
6° | Vertical | 850 MHz



8° | Vertical | 850 MHz

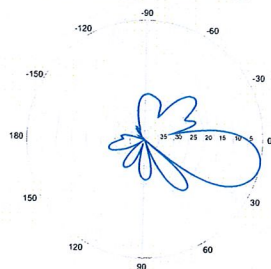


9° | Vertical | 850 MHz



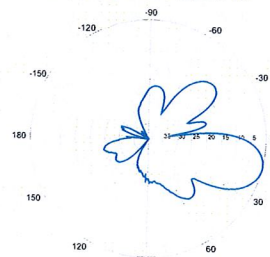
10° | Vertical | 850 MHz

BXA-70063-4CF-EDIN-12

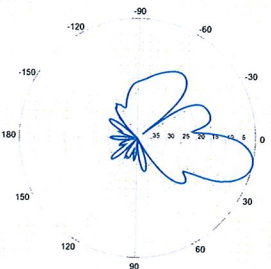


12° | Vertical | 750 MHz

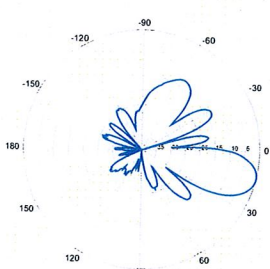
BXA-70063-4CF-EDIN-14



14° | Vertical | 750 MHz



12° | Vertical | 850 MHz



14° | Vertical | 850 MHz

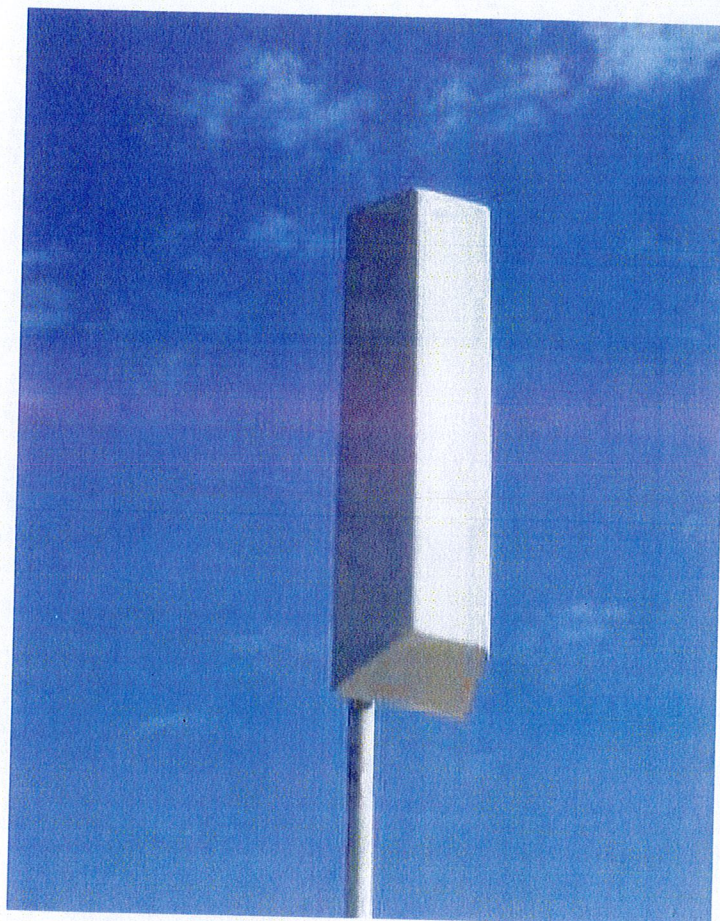
Quoted performance parameters are provided to offer typical or range values only and may vary as a result of normal manufacturing and operational conditions. Extreme operational conditions and/or stress on structural supports is beyond our control. Such conditions may result in damage to this product. Improvements to product may be made without notice.

SLCP 2x6014

Dual (2x) Circularly Polarized log-periodic antenna

Features

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



Electrical specifications

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

Mechanical specifications

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

Materials

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

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



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

RFS The Clear Choice®

FD9R6004/2C-3L

Rev: --

Print Date: 17.03.2010

Please visit us on the internet at <http://www.rfsworld.com/>

Radio Frequency Systems

	General	Power	Density			
Site Name: Somers W (Enfield)						
Tower Height: Verizon @ 150ft						
CARRIER	# OF CHAN.	WATTS ERP	HEIGHT	CALC. POWER DENS	FREQ.	MAX. PERMISS. EXP.
*Omnipoint	8	199	160	0.0224	1950	1.0000
*Town - UHF	2	250	180	0.0055	450	0.3000
*Town - VHF	1	60	180	0.0007	34	0.2000
*Circular GSM	3	296	179	0.0100	880	0.5867
*Circular GSM	2	427	168	0.0109	1900	1.0000
*Circular UMTS	1	500	168	0.0064	880	0.5867
Verizon PCS	11	224	150	0.0394	1970	1.0000
Verizon Cellular	9	243	150	0.0349	869	0.5793
Verizon AWS	1	670	150	0.0107	2145	1.0000
Verizon 700	2	729	150	0.0233	698	0.4653
						24.34%
* Source: Siting Council						

Structural Analysis Report

180-ft Existing Sabre Monopole

*Proposed Verizon Wireless
Antenna Upgrade*

Verizon Site Ref: Somers West

*37 Bacon Road
Enfield, CT*

Centek Project No. 12001.CO15

Date: February 1, 2012



Prepared for:

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

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- TOWER CAPACITY.
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- VERIZON RF DATA SHEET.
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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 monopole (tower) located in Enfield, CT.

The host tower is a 180-ft tall, four-section, eighteen sided, tapered monopole, originally designed and manufactured by Sabre Communications Corp. job no; 04-07104, dated July 23, 2003. The tower geometry, structure member sizes and foundation system information were obtained from the aforementioned Sabre design documents. Antenna and appurtenance information were obtained from visual verification from grade by Centek personnel on January 26, 2012 and a Verizon RF data sheet.

The tower is made up of four (4) tapered vertical sections consisting of A572-65 pole sections. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 14.40-in at the top and 53.23-in at the base.

Verizon proposes the removal of twelve (12) panel antennas and the installation of twelve (12) panel antennas and six (6) Diplexers mounted to the existing low profile platform. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

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

- **UNKNOWN (EXISTING):**

Antennas: One (1) 10-ft Omni-directional whip and one (1) 1'x1' panel antenna mounted on two (2) existing 4-ft Dual Standoff Mounts with an elevation of 177-ft above grade.

Coax Cables: One (1) 1-1/4" $\varnothing$ and one (1) 1/2" $\varnothing$ coax cables running on the inside of the existing tower.

- **AT&T (EXISTING):**

Antennas: Six (6) CSS DUO1417-8686 panel antennas, three (3) Kathrein 800-10121 panel antennas, six (6) Cleargain TMA's and three (3) 10"x8"x3" TMA's mounted on three (3) existing T-Arms with a RAD center elevation of 170-ft above grade.

Coax Cables: Twelve (12) 1-5/8" $\varnothing$ coax cables running on the inside of the existing tower.

- **T-MOBILE (EXISTING):**

Antennas: Three (3) EMS RR90-17-02DP panel antennas and six (6) 10"x8"x3" TMA's mounted on three (3) existing T-Arms w/ work support platforms with a RAD center elevation of 160-ft above grade.

Coax Cables: Six (6) 1-5/8" $\varnothing$ coax cables running on the inside of the existing tower.

- **VERIZON (EXISTING TO REMAIN):**

Coax Cables: Twelve (12) 1-5/8" $\varnothing$ coax cables running on the inside of the existing tower.

▪ **VERIZON (EXISTING TO REMOVE):**

Antennas: Six (6) Andrew DB844F90A-SX and six (6) Andrew DB948F85T2E-M panel antennas mounted on a low profile platform with a RAD center elevation of 150-ft above grade.

▪ **VERIZON (PROPOSED):**

Antennas: One (1) Antel BXA-70063-4CF panel antenna, two (2) Swedcom SLCP 2X6014 panel antennas, six (6) Antel LPA-80080-4CF panel antennas three (3) Antel BXA-171085-8BF panel antennas and six (6) RFS FD9R6004/2C-3L Diplexers mounted on a low profile platform with a RAD center elevation of 150-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.

A n a l y s i s

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).

T o w e r L o a d i n g

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

Basic Wind Speed:	Hartford; v = 80 mph (fastest mile)	[Section 16 of TIA/EIA-222-F-96]
	Enfield; v = 95 mph (3 second gust) equivalent to v = 77.5 mph (fastest mile)	[Appendix K of the 2005 CT Building Code Supplement]
	TIA/EIA-222-F wind speed controls.	
Load Cases:	<u>Load Case 1</u> ; 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]
	<u>Load Case 2</u> ; 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]
	<u>Load Case 3</u> ; 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 **92.4%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L4)	1.00'-48.75'	92.4%	PASS

Foundation and Anchors

The existing foundation consists of a 7-ft square x 4.5-ft long reinforced concrete pier on a 23.0-ft square x 2.0-ft thick reinforced concrete pad. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned design documents prepared by Sabre Communications Corp. job no; 04-07104, dated July 23, 2003. The base of the tower is connected to the foundation by means of (12) 2.25"Ø, ASTM A615-75 anchor bolts embedded approximately 6-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	21 kips
	Compression	30 kips
	Moment	2564 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	2.01	PASS

Note 1: FS denotes Factor of Safety.

Note 2: OTM denotes Overturning Moment

CEN TEK Engineering, Inc.
Structural Analysis - 180-ft Sabre Monopole
Verizon Wireless Antenna Upgrade – Somers West
Enfield, CT
February 1, 2012

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

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts	Compression	89.0%	PASS
Base Plate	Bending	47.0%	PASS

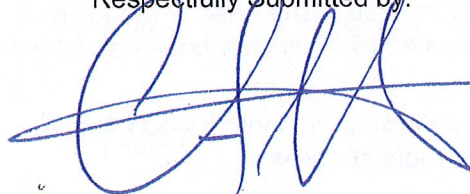
Conclusion

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

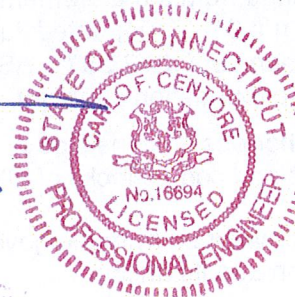
The analysis is based, in part, on the information provided to this office by Verizon Wireless. If the existing conditions are different than the information in this report, Centek Engineering, Inc. must be contacted for resolution of any potential issues.

Please feel free to call with any questions or comments.

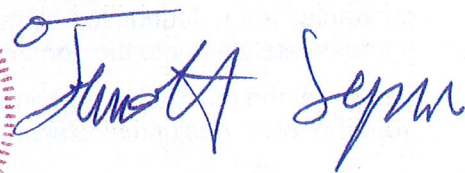
Respectfully Submitted by:



Carlo F. Centore, PE
Principal ~ Structural Engineer



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 uncorroded 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	Length (ft)	Number of Sides	Thickness (in)	Socket Length (ft)	Top Dia (in)	Bot Dia (in)	Grade	Weight (K)
1	31.00	18	0.1875	2.75	14.4000	21.3800	1.1	
2	53.50	18	0.2500	4.00	20.3858	32.4400	3.8	
3	53.50	18	0.3125	5.50	31.0388	43.1000	6.6	
4	53.25	18	0.3125	41.2351	53.2300		8.4	
								20.0

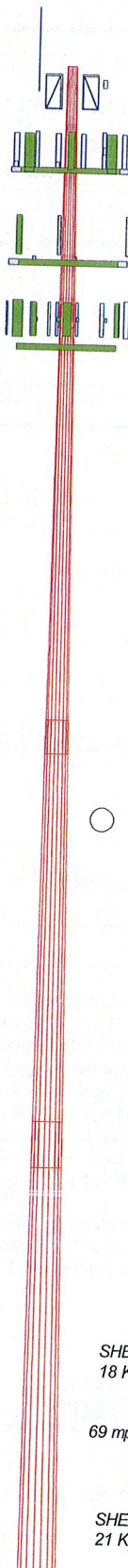
180.0 ft

149.0 ft

98.3 ft

48.8 ft

1.0 ft



DESIGNED APPURTENANCE LOADING

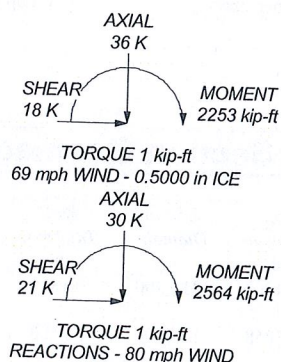
TYPE	ELEVATION	TYPE	ELEVATION
4-ft Dual Standoff Mount	177	(2) TMA 10"x8"x3" (T-Mobile - Existing)	157
4-ft Dual Standoff Mount	177	12-ft T-arm w/ Work Support Platform (T-Mobile - Existing)	157
10' x 1" Dia Omni	177	12-ft T-arm w/ Work Support Platform (T-Mobile - Existing)	157
1' x 1' Panel	177	12-ft T-arm w/ Work Support Platform (T-Mobile - Existing)	157
(2) DUO1417-8686 (ATI - Existing)	170	LPA-80080-4CF (Verizon - Proposed)	150
(2) DUO1417-8686 (ATI - Existing)	170	BXA-171085-8BF (Verizon - Proposed)	150
(2) DUO1417-8686 (ATI - Existing)	170	BXA-70063/4CF (Verizon - Proposed)	150
800 10121 (ATI - Existing)	170	LPA-80080-4CF (Verizon - Proposed)	150
800 10121 (ATI - Existing)	170	SLCP 2x6014 (Verizon - Proposed)	150
800 10121 (ATI - Existing)	170	BXA-171085-8BF (Verizon - Proposed)	150
TMA 10"x8"x3" (ATI - Existing)	170	BXA-70063/4CF (Verizon - Proposed)	150
TMA 10"x8"x3" (ATI - Existing)	170	LPA-80080-4CF (Verizon - Proposed)	150
TMA 10"x8"x3" (ATI - Existing)	170	SLCP 2x6014 (Verizon - Proposed)	150
(2) CG 1900/800-DB-FB TMA (ATI - Existing)	168	BXA-171085-8BF (Verizon - Proposed)	150
(2) CG 1900/800-DB-FB TMA (ATI - Existing)	168	BXA-70063/4CF (Verizon - Proposed)	150
(2) CG 1900/800-DB-FB TMA (ATI - Existing)	168	LPA-80080-4CF (Verizon - Proposed)	150
Valmont T-Arm (1) (ATI - Existing)	168	(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	150
Valmont T-Arm (1) (ATI - Existing)	168	(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	150
RR90-17-02DP (T-Mobile - Existing)	160	(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	150
RR90-17-02DP (T-Mobile - Existing)	160	Andrew 12'-6" Low Profile Platform (Verizon - Existing)	147
RR90-17-02DP (T-Mobile - Existing)	160		
(2) TMA 10"x8"x3" (T-Mobile - Existing)	157		
(2) TMA 10"x8"x3" (T-Mobile - Existing)	157		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 69 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
5. Welds are fabricated with ER-70S-6 electrodes.
6. TOWER RATING: 92.4%



Centek Engineering Inc.

63-2 North Branford Rd.
Branford, CT 06405

Phone: (203) 488-0580

FAX: (203) 488-8587

Job: 12001.CO15 - Somers West

Project: 180' Sabre Monopole - 37 Bacon Rd., Enfield, CT

Client: Verizon Wireless

Drawn by: T.J.L.

App'd:

Code: TIA/EIA-222-F

Date: 02/01/12

Scale: NTS

Path: J:\Jobs\12001.CO15 - Somers West\Calcs\ERI Files\180' Sabre Monopole Enfield.ctb

Dwg No. E-1

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12001.CO15 - Somers West	Page	1 of 20
	Project	180' Sabre Monopole - 37 Bacon Rd., Enfield, CT	Date	12:55:31 02/01/12
	Client	Verizon Wireless	Designed by	TJL

Tower Input Data

There is a pole section.

This tower is designed using the TIA/EIA-222-F standard.

The following design criteria apply:

Basic wind speed of 80 mph.

Nominal ice thickness of 0.5000 in.

Ice density of 56.0 pcf.

A wind speed of 69 mph is used in combination with ice.

Temperature drop of 50 °F.

Deflections calculated using a wind speed of 50 mph.

Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..

Welds are fabricated with ER-70S-6 electrodes..

A non-linear (P-delta) analysis was used.

Pressures are calculated at each section.

Stress ratio used in pole design is 1.333.

Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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

Tapered Pole Section Geometry

Section	Elevation	Section Length	Splice Length	Number of Sides	Top Diameter	Bottom Diameter	Wall Thickness	Bend Radius	Pole Grade
	ft	ft	ft		in	in	in	in	
L1	180.00-149.00	31.00	2.75	18	14.4000	21.3800	0.1875	0.7500	A572-65 (65 ksi)
L2	149.00-98.25	53.50	4.00	18	20.3858	32.4400	0.2500	1.0000	A572-65 (65 ksi)
L3	98.25-48.75	53.50	5.50	18	31.0388	43.1000	0.3125	1.2500	A572-65 (65 ksi)
L4	48.75-1.00	53.25		18	41.2351	53.2300	0.3125	1.2500	A572-65 (65 ksi)

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	Client	Verizon Wireless	Designed by	TJL

Tapered Pole Properties

Section	Tip Dia. in	Area in ²	I in ⁴	r in	C in	I/C in ³	J in ⁴	I/Q in ²	w in	w/t
L1	14.6221	8.4582	215.8525	5.0454	7.3152	29.5074	431.9890	4.2299	2.2044	11.757
L2	21.7098	12.6122	715.6361	7.5233	10.8610	65.8902	1432.2138	6.3073	3.4329	18.309
L3	32.9404	25.5428	3343.8540	11.4275	16.4795	202.9097	6692.1080	12.7738	5.2694	21.078
L4	43.1292	40.5901	8587.8163	14.5275	20.9474	409.9703	17186.9326	20.2989	6.7074	21.464
	54.0512	52.4875	18569.1639	18.7857	27.0408	686.7081	37162.7616	26.2488	8.8185	28.219

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 180.00-149.00				1	1	1		
L2 149.00-98.25				1	1	1		
L3 98.25-48.75				1	1	1		
L4 48.75-1.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number	C _A A _A	Weight
1 1/4	C	No	Inside Pole	180.00 - 1.00	1	ft ² /ft	plf
1/2	C	No	Inside Pole	180.00 - 1.00	1	No Ice 1/2" Ice	0.00 0.66
1 5/8	C	No	Inside Pole	171.00 - 1.00	12	No Ice 1/2" Ice	0.00 0.25
(AT&T - Existing)	C	No	Inside Pole	161.00 - 1.00	6	No Ice 1/2" Ice	0.00 1.04
1 5/8	C	No	Inside Pole	151.00 - 1.00	12	No Ice 1/2" Ice	0.00 1.04
(T-Mobile - Existing)	C	No	Inside Pole			No Ice 1/2" Ice	0.00 1.04
1 5/8	C	No	Inside Pole			No Ice 1/2" Ice	0.00 1.04
(Verizon - Existing)	C	No	Inside Pole			No Ice 1/2" Ice	0.00 1.04

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A _R	A _F	C _A A _A In Face ft ²	C _A A _A Out Face ft ²	Weight K
L1	180.00-149.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.40
L2	149.00-98.25	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1.63
L3	98.25-48.75	A	0.000	0.000	0.000	0.000	0.00

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Tower Section	Tower Elevation ft	Face	A_R ft ²	A_F ft ²	C_{AA} In Face ft ²	C_{AA} Out Face ft ²	Weight K
L4	48.75-1.00	B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1.59
		A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1.53

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} In Face ft ²	C_{AA} Out Face ft ²	Weight K
L1	180.00-149.00	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.40
L2	149.00-98.25	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1.63
L3	98.25-48.75	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1.59
L4	48.75-1.00	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1.53

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	180.00-149.00	0.0000	0.0000	0.0000	0.0000
L2	149.00-98.25	0.0000	0.0000	0.0000	0.0000
L3	98.25-48.75	0.0000	0.0000	0.0000	0.0000
L4	48.75-1.00	0.0000	0.0000	0.0000	0.0000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C_{AA} Front ft ²	C_{AA} Side ft ²	Weight K
4-ft Dual Standoff Mount	A	From Face	2.00	0.0000	177.00	No Ice	6.35	0.15
			0.00			1/2" Ice	8.43	0.20
			0.00					
4-ft Dual Standoff Mount	B	From Face	2.00	0.0000	177.00	No Ice	6.35	0.15
			0.00			1/2" Ice	8.43	0.20
			0.00					

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	Client	Verizon Wireless	Designed by TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
10' x 1" Dia Omni	A	From Face	4.00 0.00 5.00	0.0000	177.00	No Ice 1.00 1/2" Ice 2.02	1.00 2.02	0.03 0.04
1' x 1' Panel	B	From Face	4.00 0.00 1.00	0.0000	177.00	No Ice 1.40 1/2" Ice 1.56	0.35 0.45	0.02 0.03
Valmont T-Arm (1) (AT&T - Existing)	A	From Face	4.00 0.00 0.00	0.0000	168.00	No Ice 10.54 1/2" Ice 14.45	10.54 14.45	0.34 0.41
Valmont T-Arm (1) (AT&T - Existing)	B	From Face	4.00 0.00 0.00	0.0000	168.00	No Ice 10.54 1/2" Ice 14.45	10.54 14.45	0.34 0.41
Valmont T-Arm (1) (AT&T - Existing)	C	From Face	4.00 0.00 0.00	0.0000	168.00	No Ice 10.54 1/2" Ice 14.45	10.54 14.45	0.34 0.41
(2) DUO1417-8686 (AT&T - Existing)	A	From Face	4.00 0.00 0.00	0.0000	170.00	No Ice 6.53 1/2" Ice 6.94	4.20 4.57	0.02 0.06
(2) DUO1417-8686 (AT&T - Existing)	B	From Face	4.00 0.00 0.00	0.0000	170.00	No Ice 6.53 1/2" Ice 6.94	4.20 4.57	0.02 0.06
(2) DUO1417-8686 (AT&T - Existing)	C	From Face	4.00 0.00 0.00	0.0000	170.00	No Ice 6.53 1/2" Ice 6.94	4.20 4.57	0.02 0.06
800 10121 (AT&T - Existing)	A	From Face	4.00 0.00 0.00	0.0000	170.00	No Ice 5.46 1/2" Ice 5.88	3.29 3.64	0.05 0.08
800 10121 (AT&T - Existing)	B	From Face	4.00 0.00 0.00	0.0000	170.00	No Ice 5.46 1/2" Ice 5.88	3.29 3.64	0.05 0.08
800 10121 (AT&T - Existing)	C	From Face	4.00 0.00 0.00	0.0000	170.00	No Ice 5.46 1/2" Ice 5.88	3.29 3.64	0.05 0.08
(2) CG 1900/800-DB-FB TMA (AT&T - Existing)	A	From Face	4.00 0.00 0.00	0.0000	168.00	No Ice 1.55 1/2" Ice 1.72	0.81 0.94	0.02 0.03
(2) CG 1900/800-DB-FB TMA (AT&T - Existing)	B	From Face	4.00 0.00 0.00	0.0000	168.00	No Ice 1.55 1/2" Ice 1.72	0.81 0.94	0.02 0.03
(2) CG 1900/800-DB-FB TMA (AT&T - Existing)	C	From Face	4.00 0.00 0.00	0.0000	168.00	No Ice 1.55 1/2" Ice 1.72	0.81 0.94	0.02 0.03
TMA 10"x8"x3" (AT&T - Existing)	A	From Face	4.00 0.00 0.00	0.0000	170.00	No Ice 0.78 1/2" Ice 0.90	0.29 0.38	0.02 0.02
TMA 10"x8"x3" (AT&T - Existing)	B	From Face	4.00 0.00 0.00	0.0000	170.00	No Ice 0.78 1/2" Ice 0.90	0.29 0.38	0.02 0.02
TMA 10"x8"x3" (AT&T - Existing)	C	From Face	4.00 0.00 0.00	0.0000	170.00	No Ice 0.78 1/2" Ice 0.90	0.29 0.38	0.02 0.02
RR90-17-02DP (T-Mobile - Existing)	A	From Face	4.00 6.00 0.00	0.0000	160.00	No Ice 4.36 1/2" Ice 4.77	1.97 2.31	0.02 0.04
RR90-17-02DP (T-Mobile - Existing)	B	From Face	4.00 6.00 0.00	0.0000	160.00	No Ice 4.36 1/2" Ice 4.77	1.97 2.31	0.02 0.04

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	Client	Verizon Wireless	Designed by TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C _A A _A Front ft ²	C _A A _A Side ft ²	Weight K	
RR90-17-02DP (T-Mobile - Existing)	C	From Face	4.00 6.00 0.00	0.0000	160.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	0.02 0.04
(2) TMA 10"x8"x3" (T-Mobile - Existing)	A	From Face	4.00 5.00 0.00	0.0000	157.00	No Ice 1/2" Ice	0.78 0.90	0.29 0.38	0.02 0.02
(2) TMA 10"x8"x3" (T-Mobile - Existing)	A	From Face	4.00 5.00 0.00	0.0000	157.00	No Ice 1/2" Ice	0.78 0.90	0.29 0.38	0.02 0.02
(2) TMA 10"x8"x3" (T-Mobile - Existing)	A	From Face	4.00 5.00 0.00	0.0000	157.00	No Ice 1/2" Ice	0.78 0.90	0.29 0.38	0.02 0.02
12-ft T-arm w/ Work Support Platform (T-Mobile - Existing)	A	From Face	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice	14.20 19.70	14.20 19.70	0.49 0.57
12-ft T-arm w/ Work Support Platform (T-Mobile - Existing)	B	From Face	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice	14.20 19.70	14.20 19.70	0.49 0.57
12-ft T-arm w/ Work Support Platform (T-Mobile - Existing)	C	From Face	4.00 0.00 0.00	0.0000	157.00	No Ice 1/2" Ice	14.20 19.70	14.20 19.70	0.49 0.57
LPA-80080-4CF (Verizon - Proposed)	A	From Face	4.00 6.00 0.00	0.0000	150.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
BXA-171085-8BF (Verizon - Proposed)	A	From Face	4.00 4.00 0.00	0.0000	150.00	No Ice 1/2" Ice	2.94 3.26	2.16 2.46	0.01 0.03
BXA-70063/4CF (Verizon - Proposed)	A	From Face	4.00 0.00 0.00	0.0000	150.00	No Ice 1/2" Ice	5.16 5.55	2.44 2.74	0.01 0.04
LPA-80080-4CF (Verizon - Proposed)	A	From Face	4.00 -6.00 0.00	0.0000	150.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
SLCP 2x6014 (Verizon - Proposed)	B	From Face	4.00 6.00 0.00	0.0000	150.00	No Ice 1/2" Ice	7.21 7.65	5.67 6.09	0.02 0.07
BXA-171085-8BF (Verizon - Proposed)	B	From Face	4.00 4.00 0.00	0.0000	150.00	No Ice 1/2" Ice	2.94 3.26	2.16 2.46	0.01 0.03
BXA-70063/4CF (Verizon - Proposed)	B	From Face	4.00 0.00 0.00	0.0000	150.00	No Ice 1/2" Ice	5.16 5.55	2.44 2.74	0.01 0.04
LPA-80080-4CF (Verizon - Proposed)	B	From Face	4.00 -6.00 0.00	0.0000	150.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05
SLCP 2x6014 (Verizon - Proposed)	C	From Face	4.00 6.00 0.00	0.0000	150.00	No Ice 1/2" Ice	7.21 7.65	5.67 6.09	0.02 0.07
BXA-171085-8BF (Verizon - Proposed)	C	From Face	4.00 4.00 0.00	0.0000	150.00	No Ice 1/2" Ice	2.94 3.26	2.16 2.46	0.01 0.03
BXA-70063/4CF (Verizon - Proposed)	C	From Face	4.00 0.00 0.00	0.0000	150.00	No Ice 1/2" Ice	5.16 5.55	2.44 2.74	0.01 0.04
LPA-80080-4CF (Verizon - Proposed)	C	From Face	4.00 -6.00 0.00	0.0000	150.00	No Ice 1/2" Ice	2.62 2.92	6.06 6.45	0.01 0.05

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	Client	Verizon Wireless	Designed by	TJL

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	A	From Face	4.00 6.00 0.00	0.0000	150.00	No Ice 1/2" Ice	0.37 0.45	0.08 0.14	0.00 0.01
(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	B	From Face	4.00 6.00 0.00	0.0000	150.00	No Ice 1/2" Ice	0.37 0.45	0.08 0.14	0.00 0.01
(2) FD9R6004/2C-3L Diplexer (Verizon - Proposed)	C	From Face	4.00 6.00 0.00	0.0000	150.00	No Ice 1/2" Ice	0.37 0.45	0.08 0.14	0.00 0.01
Andrew 12'-6" Low Profile Platform (Verizon - Existing)	C	None		0.0000	147.00	No Ice 1/2" Ice	14.45 19.00	14.45 19.00	1.30 1.69

Tower Pressures - No Ice

$$G_H = 1.690$$

Section Elevation	z	K _z	q _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _{AA} In Face ft ²	C _{AA} Out Face ft ²
ft	ft		psf	ft ²		ft ²	ft ²	ft ²			
L1 180.00-149.00	163.60	1.58	25.88	46.216	A	0.000	46.216	46.216	100.00	0.000	0.000
					B	0.000	46.216		100.00	0.000	0.000
					C	0.000	46.216		100.00	0.000	0.000
L2 149.00-98.25	122.18	1.454	23.77	113.015	A	0.000	113.015	113.015	100.00	0.000	0.000
					B	0.000	113.015		100.00	0.000	0.000
					C	0.000	113.015		100.00	0.000	0.000
L3 98.25-48.75	72.87	1.254	20.44	154.771	A	0.000	154.771	154.771	100.00	0.000	0.000
					B	0.000	154.771		100.00	0.000	0.000
					C	0.000	154.771		100.00	0.000	0.000
L4 48.75-1.00	24.16	1	16.61	190.411	A	0.000	190.411	190.411	100.00	0.000	0.000
					B	0.000	190.411		100.00	0.000	0.000
					C	0.000	190.411		100.00	0.000	0.000

Tower Pressure - With Ice

$$G_H = 1.690$$

Section Elevation	z	K _z	q _z	t _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _{AA} In Face ft ²	C _{AA} Out Face ft ²
ft	ft		psf	in	ft ²		ft ²	ft ²	ft ²			
L1 180.00-149.00	163.60	1.58	19.41	0.5000	48.799	A	0.000	48.799	48.799	100.00	0.000	0.000
						B	0.000	48.799		100.00	0.000	0.000
						C	0.000	48.799		100.00	0.000	0.000
L2 149.00-98.25	122.18	1.454	17.83	0.5000	117.244	A	0.000	117.244	117.244	100.00	0.000	0.000
						B	0.000	117.244		100.00	0.000	0.000

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Section Elevation	z	K _Z	q _z	t _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
ft	ft		psf	in	ft ²		ft ²	ft ²	ft ²			
L3 98.25-48.75	72.87	1.254	15.33	0.5000	158.896	C	0.000	117.244		100.00	0.000	0.000
						A	0.000	158.896	158.896	100.00	0.000	0.000
						B	0.000	158.896		100.00	0.000	0.000
						C	0.000	158.896		100.00	0.000	0.000
L4 48.75-1.00	24.16	1	12.46	0.5000	194.390	A	0.000	194.390	194.390	100.00	0.000	0.000
						B	0.000	194.390		100.00	0.000	0.000
						C	0.000	194.390		100.00	0.000	0.000

Tower Pressure - Service

$$G_H = 1.690$$

Section Elevation	z	K _Z	q _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
ft	ft		psf	ft ²		ft ²	ft ²	ft ²			
L1 180.00-149.00	163.60	1.58	10.11	46.216	A	0.000	46.216	46.216	100.00	0.000	0.000
					B	0.000	46.216		100.00	0.000	0.000
					C	0.000	46.216		100.00	0.000	0.000
L2 149.00-98.25	122.18	1.454	9.28	113.015	A	0.000	113.015	113.015	100.00	0.000	0.000
					B	0.000	113.015		100.00	0.000	0.000
					C	0.000	113.015		100.00	0.000	0.000
L3 98.25-48.75	72.87	1.254	7.98	154.771	A	0.000	154.771	154.771	100.00	0.000	0.000
					B	0.000	154.771		100.00	0.000	0.000
					C	0.000	154.771		100.00	0.000	0.000
L4 48.75-1.00	24.16	1	6.49	190.411	A	0.000	190.411	190.411	100.00	0.000	0.000
					B	0.000	190.411		100.00	0.000	0.000
					C	0.000	190.411		100.00	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 180.00-149.00	0.40	1.11	A	1	0.65	1	1	1	46.216	1.31	42.38	C
			B	1	0.65	1	1	1	46.216			
			C	1	0.65	1	1	1	46.216			
L2 149.00-98.25	1.63	3.78	A	1	0.65	1	1	1	113.015	2.95	58.14	C
			B	1	0.65	1	1	1	113.015			
			C	1	0.65	1	1	1	113.015			
L3 98.25-48.75	1.59	6.64	A	1	0.65	1	1	1	154.771	3.47	70.19	C
			B	1	0.65	1	1	1	154.771			
			C	1	0.65	1	1	1	154.771			
L4 48.75-1.00	1.53	8.43	A	1	0.65	1	1	1	190.411	3.48	72.78	C
			B	1	0.65	1	1	1	190.411			
			C	1	0.65	1	1	1	190.411			
Sum Weight:	5.15	19.96						OTM	901.38 kip-ft	11.21		

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	Client	Verizon Wireless	Designed by	TJL

Tower Forces - No Ice - Wind 45 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 180.00-149.00	0.40	1.11	A	1	0.65	1	1	1	46.216	1.31	42.38	C
			B	1	0.65	1	1	1	46.216			
			C	1	0.65	1	1	1	46.216			
L2 149.00-98.25	1.63	3.78	A	1	0.65	1	1	1	113.015	2.95	58.14	C
			B	1	0.65	1	1	1	113.015			
			C	1	0.65	1	1	1	113.015			
L3 98.25-48.75	1.59	6.64	A	1	0.65	1	1	1	154.771	3.47	70.19	C
			B	1	0.65	1	1	1	154.771			
			C	1	0.65	1	1	1	154.771			
L4 48.75-1.00	1.53	8.43	A	1	0.65	1	1	1	190.411	3.48	72.78	C
			B	1	0.65	1	1	1	190.411			
			C	1	0.65	1	1	1	190.411			
Sum Weight:	5.15	19.96						OTM	901.38 kip-ft	11.21		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 180.00-149.00	0.40	1.11	A	1	0.65	1	1	1	46.216	1.31	42.38	C
			B	1	0.65	1	1	1	46.216			
			C	1	0.65	1	1	1	46.216			
L2 149.00-98.25	1.63	3.78	A	1	0.65	1	1	1	113.015	2.95	58.14	C
			B	1	0.65	1	1	1	113.015			
			C	1	0.65	1	1	1	113.015			
L3 98.25-48.75	1.59	6.64	A	1	0.65	1	1	1	154.771	3.47	70.19	C
			B	1	0.65	1	1	1	154.771			
			C	1	0.65	1	1	1	154.771			
L4 48.75-1.00	1.53	8.43	A	1	0.65	1	1	1	190.411	3.48	72.78	C
			B	1	0.65	1	1	1	190.411			
			C	1	0.65	1	1	1	190.411			
Sum Weight:	5.15	19.96						OTM	901.38 kip-ft	11.21		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 180.00-149.00	0.40	1.11	A	1	0.65	1	1	1	46.216	1.31	42.38	C
			B	1	0.65	1	1	1	46.216			
			C	1	0.65	1	1	1	46.216			
L2 149.00-98.25	1.63	3.78	A	1	0.65	1	1	1	113.015	2.95	58.14	C
			B	1	0.65	1	1	1	113.015			

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Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L3	1.59	6.64	C	1	0.65	1	1	1	113.015			
98.25-48.75			A	1	0.65	1	1	1	154.771	3.47	70.19	C
			B	1	0.65	1	1	1	154.771			
			C	1	0.65	1	1	1	154.771			
L4 48.75-1.00	1.53	8.43	A	1	0.65	1	1	1	190.411	3.48	72.78	C
			B	1	0.65	1	1	1	190.411			
			C	1	0.65	1	1	1	190.411			
Sum Weight:	5.15	19.96						OTM	901.38 kip-ft	11.21		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1	0.40	1.46	A	1	0.65	1	1	1	48.799	1.04	33.56	C
180.00-149.00			B	1	0.65	1	1	1	48.799			
			C	1	0.65	1	1	1	48.799			
L2	1.63	4.63	A	1	0.65	1	1	1	117.244	2.30	45.24	C
149.00-98.25			B	1	0.65	1	1	1	117.244			
			C	1	0.65	1	1	1	117.244			
L3	1.59	7.80	A	1	0.65	1	1	1	158.896	2.68	54.05	C
98.25-48.75			B	1	0.65	1	1	1	158.896			
			C	1	0.65	1	1	1	158.896			
L4 48.75-1.00	1.53	9.86	A	1	0.65	1	1	1	194.390	2.66	55.73	C
			B	1	0.65	1	1	1	194.390			
			C	1	0.65	1	1	1	194.390			
Sum Weight:	5.15	23.75						OTM	701.28 kip-ft	8.67		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1	0.40	1.46	A	1	0.65	1	1	1	48.799	1.04	33.56	C
180.00-149.00			B	1	0.65	1	1	1	48.799			
			C	1	0.65	1	1	1	48.799			
L2	1.63	4.63	A	1	0.65	1	1	1	117.244	2.30	45.24	C
149.00-98.25			B	1	0.65	1	1	1	117.244			
			C	1	0.65	1	1	1	117.244			
L3	1.59	7.80	A	1	0.65	1	1	1	158.896	2.68	54.05	C
98.25-48.75			B	1	0.65	1	1	1	158.896			
			C	1	0.65	1	1	1	158.896			
L4 48.75-1.00	1.53	9.86	A	1	0.65	1	1	1	194.390	2.66	55.73	C
			B	1	0.65	1	1	1	194.390			
			C	1	0.65	1	1	1	194.390			
Sum Weight:	5.15	23.75						OTM	701.28 kip-ft	8.67		

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Tower Forces - With Ice - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 180.00-149.00	0.40	1.46	A	1	0.65	1	1	1	48.799	1.04	33.56	C
			B	1	0.65	1	1	1	48.799			
			C	1	0.65	1	1	1	48.799			
L2 149.00-98.25	1.63	4.63	A	1	0.65	1	1	1	117.244	2.30	45.24	C
			B	1	0.65	1	1	1	117.244			
			C	1	0.65	1	1	1	117.244			
L3 98.25-48.75	1.59	7.80	A	1	0.65	1	1	1	158.896	2.68	54.05	C
			B	1	0.65	1	1	1	158.896			
			C	1	0.65	1	1	1	158.896			
L4 48.75-1.00	1.53	9.86	A	1	0.65	1	1	1	194.390	2.66	55.73	C
			B	1	0.65	1	1	1	194.390			
			C	1	0.65	1	1	1	194.390			
Sum Weight:	5.15	23.75						OTM	701.28 kip-ft	8.67		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 180.00-149.00	0.40	1.46	A	1	0.65	1	1	1	48.799	1.04	33.56	C
			B	1	0.65	1	1	1	48.799			
			C	1	0.65	1	1	1	48.799			
L2 149.00-98.25	1.63	4.63	A	1	0.65	1	1	1	117.244	2.30	45.24	C
			B	1	0.65	1	1	1	117.244			
			C	1	0.65	1	1	1	117.244			
L3 98.25-48.75	1.59	7.80	A	1	0.65	1	1	1	158.896	2.68	54.05	C
			B	1	0.65	1	1	1	158.896			
			C	1	0.65	1	1	1	158.896			
L4 48.75-1.00	1.53	9.86	A	1	0.65	1	1	1	194.390	2.66	55.73	C
			B	1	0.65	1	1	1	194.390			
			C	1	0.65	1	1	1	194.390			
Sum Weight:	5.15	23.75						OTM	701.28 kip-ft	8.67		

Tower Forces - Service - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 180.00-149.00	0.40	1.11	A	1	0.65	1	1	1	46.216	0.51	16.55	C
			B	1	0.65	1	1	1	46.216			
			C	1	0.65	1	1	1	46.216			

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	Client	Verizon Wireless	Designed by	TJL

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L2 149.00-98.25	1.63	3.78	A	1	0.65	1	1	1	113.015	1.15	22.71	C
			B	1	0.65	1	1	1	113.015			
			C	1	0.65	1	1	1	113.015			
L3 98.25-48.75	1.59	6.64	A	1	0.65	1	1	1	154.771	1.36	27.42	C
			B	1	0.65	1	1	1	154.771			
			C	1	0.65	1	1	1	154.771			
L4 48.75-1.00	1.53	8.43	A	1	0.65	1	1	1	190.411	1.36	28.43	C
			B	1	0.65	1	1	1	190.411			
			C	1	0.65	1	1	1	190.411			
Sum Weight:	5.15	19.96						OTM	352.10 kip-ft	4.38		

Tower Forces - Service - Wind 45 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 180.00-149.00	0.40	1.11	A	1	0.65	1	1	1	46.216	0.51	16.55	C
			B	1	0.65	1	1	1	46.216			
			C	1	0.65	1	1	1	46.216			
L2 149.00-98.25	1.63	3.78	A	1	0.65	1	1	1	113.015	1.15	22.71	C
			B	1	0.65	1	1	1	113.015			
			C	1	0.65	1	1	1	113.015			
L3 98.25-48.75	1.59	6.64	A	1	0.65	1	1	1	154.771	1.36	27.42	C
			B	1	0.65	1	1	1	154.771			
			C	1	0.65	1	1	1	154.771			
L4 48.75-1.00	1.53	8.43	A	1	0.65	1	1	1	190.411	1.36	28.43	C
			B	1	0.65	1	1	1	190.411			
			C	1	0.65	1	1	1	190.411			
Sum Weight:	5.15	19.96						OTM	352.10 kip-ft	4.38		

Tower Forces - Service - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 180.00-149.00	0.40	1.11	A	1	0.65	1	1	1	46.216	0.51	16.55	C
			B	1	0.65	1	1	1	46.216			
			C	1	0.65	1	1	1	46.216			
L2 149.00-98.25	1.63	3.78	A	1	0.65	1	1	1	113.015	1.15	22.71	C
			B	1	0.65	1	1	1	113.015			
			C	1	0.65	1	1	1	113.015			
L3 98.25-48.75	1.59	6.64	A	1	0.65	1	1	1	154.771	1.36	27.42	C
			B	1	0.65	1	1	1	154.771			
			C	1	0.65	1	1	1	154.771			
L4 48.75-1.00	1.53	8.43	A	1	0.65	1	1	1	190.411	1.36	28.43	C
			B	1	0.65	1	1	1	190.411			
			C	1	0.65	1	1	1	190.411			

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Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
Sum Weight:	5.15	19.96						OTM	352.10 kip-ft	4.38		

Tower Forces - Service - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	R _R	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K							ft ²	K	plf	
L1 180.00-149.00	0.40	1.11	A	1	0.65	1	1	1	46.216	0.51	16.55	C
			B	1	0.65	1	1	1	46.216			
L2 149.00-98.25	1.63	3.78	C	1	0.65	1	1	1	46.216			
			A	1	0.65	1	1	1	113.015	1.15	22.71	C
			B	1	0.65	1	1	1	113.015			
L3 98.25-48.75	1.59	6.64	C	1	0.65	1	1	1	113.015			
			A	1	0.65	1	1	1	154.771	1.36	27.42	C
			B	1	0.65	1	1	1	154.771			
L4 48.75-1.00	1.53	8.43	C	1	0.65	1	1	1	154.771			
			A	1	0.65	1	1	1	190.411	1.36	28.43	C
			B	1	0.65	1	1	1	190.411			
Sum Weight:	5.15	19.96	C	1	0.65	1	1	1	190.411			
								OTM	352.10 kip-ft	4.38		

Force Totals

Load Case	Vertical Forces	Sum of Forces X	Sum of Forces Z	Sum of Overturning Moments, M _x	Sum of Overturning Moments, M _z	Sum of Torques
	K	K	K	kip-ft	kip-ft	kip-ft
Leg Weight	19.96					
Bracing Weight	0.00					
Total Member Self-Weight	19.96					
Total Weight	30.02			-1.24	0.23	
Wind 0 deg - No Ice		0.06	-20.83	-1.24	0.23	
Wind 30 deg - No Ice		10.45	-18.06	-2440.38	-8.58	-0.59
Wind 45 deg - No Ice		14.75	-14.77	-2118.00	-1226.05	-0.99
Wind 60 deg - No Ice		18.05	-10.46	-1732.20	-1729.42	-1.10
Wind 90 deg - No Ice		20.81	-0.06	-1228.44	-2114.93	-1.13
Wind 120 deg - No Ice		17.99	10.36	-10.05	-2437.06	-0.96
Wind 135 deg - No Ice		14.67	14.68	1210.69	-2106.12	-0.54
Wind 150 deg - No Ice		10.35	18.01	1717.25	-1716.96	-0.27
Wind 180 deg - No Ice		-0.06	20.83	2106.70	-1210.78	0.03
Wind 210 deg - No Ice		-10.45	18.06	2437.89	9.04	0.59
Wind 225 deg - No Ice		-14.75	14.77	2115.52	1226.50	0.99
Wind 240 deg - No Ice		-18.05	10.46	1729.72	1729.88	1.10
Wind 270 deg - No Ice		-20.81	0.06	1225.96	2115.39	1.13
Wind 300 deg - No Ice		-17.99	-10.36	7.57	2437.52	0.96
Wind 315 deg - No Ice		-14.67	-14.68	-1213.18	2106.58	0.54
Wind 330 deg - No Ice		-10.35	-18.01	-1719.74	1717.42	0.27
Member Ice	3.79			-2109.19	1211.24	-0.03

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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
Total Weight Ice	35.70			-1.29	0.22	
Wind 0 deg - Ice		0.04	-17.49	-2114.09	-6.34	-0.59
Wind 30 deg - Ice		8.77	-15.17	-1834.31	-1061.37	-1.07
Wind 45 deg - Ice		12.39	-12.40	-1499.91	-1497.69	-1.20
Wind 60 deg - Ice		15.16	-8.78	-1063.38	-1831.94	-1.26
Wind 90 deg - Ice		17.47	-0.04	-7.86	-2111.58	-1.11
Wind 120 deg - Ice		15.11	8.71	1049.42	-1825.37	-0.67
Wind 135 deg - Ice		12.33	12.33	1488.04	-1488.41	-0.37
Wind 150 deg - Ice		8.70	15.12	1825.16	-1049.99	-0.05
Wind 180 deg - Ice		-0.04	17.49	2111.50	6.79	0.59
Wind 210 deg - Ice		-8.77	15.17	1831.72	1061.81	1.07
Wind 225 deg - Ice		-12.39	12.40	1497.32	1498.14	1.20
Wind 240 deg - Ice		-15.16	8.78	1060.79	1832.38	1.26
Wind 270 deg - Ice		-17.47	0.04	5.27	2112.03	1.11
Wind 300 deg - Ice		-15.11	-8.71	-1052.00	1825.82	0.67
Wind 315 deg - Ice		-12.33	-12.33	-1490.62	1488.85	0.37
Wind 330 deg - Ice		-8.70	-15.12	-1827.74	1050.44	0.05
Total Weight	30.02			-1.24	0.23	
Wind 0 deg - Service		0.02	-8.13	-954.03	-3.21	-0.23
Wind 30 deg - Service		4.08	-7.06	-828.10	-478.79	-0.39
Wind 45 deg - Service		5.76	-5.77	-677.40	-675.42	-0.43
Wind 60 deg - Service		7.05	-4.09	-480.62	-826.01	-0.44
Wind 90 deg - Service		8.13	-0.02	-4.68	-951.84	-0.38
Wind 120 deg - Service		7.03	4.05	472.17	-822.56	-0.21
Wind 135 deg - Service		5.73	5.74	670.05	-670.55	-0.10
Wind 150 deg - Service		4.04	7.03	822.17	-472.82	0.01
Wind 180 deg - Service		-0.02	8.13	951.54	3.67	0.23
Wind 210 deg - Service		-4.08	7.06	825.62	479.24	0.39
Wind 225 deg - Service		-5.76	5.77	674.91	675.87	0.43
Wind 240 deg - Service		-7.05	4.09	478.13	826.46	0.44
Wind 270 deg - Service		-8.13	0.02	2.20	952.29	0.38
Wind 300 deg - Service		-7.03	-4.05	-474.65	823.02	0.21
Wind 315 deg - Service		-5.73	-5.74	-672.53	671.01	0.10
Wind 330 deg - Service		-4.04	-7.03	-824.66	473.28	-0.01

Load Combinations

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

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	Client	Verizon Wireless	Designed by TJL

Comb. No.	Description
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	180 - 149	Pole	Max Tension	35	0.00	-0.00	-0.00
			Max. Compression	18	-6.22	0.26	1.52
			Max. Mx	14	-3.66	120.04	0.82
			Max. My	2	-3.67	-0.01	120.18
			Max. Vy	14	-8.63	120.04	0.82
			Max. Vx	2	-8.55	-0.01	120.18
			Max. Torque	6			1.94
			Max Tension	1	0.00	0.00	0.00
L2	149 - 98.25	Pole	Max. Compression	18	-14.37	0.24	1.40
			Max. Mx	14	-10.18	754.86	-1.87
			Max. My	2	-10.18	-2.93	755.77
			Max. Vy	14	-14.49	754.86	-1.87
			Max. Vx	2	-14.51	-2.93	755.77
			Max. Torque	22			1.28
			Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-23.20	0.24	1.40
L3	98.25 - 48.75	Pole	Max. Mx	14	-18.40	1526.89	-4.76
			Max. My	2	-18.40	-5.85	1528.79
			Max. Vy	14	-17.67	1526.89	-4.76
			Max. Vx	2	-17.69	-5.85	1528.79

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Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L4	48.75 - 1	Pole	Max. Torque	22			1.27
			Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-35.70	0.24	1.40
			Max. Mx	14	-30.00	2552.87	-7.91
			Max. My	2	-30.00	-9.02	2555.85
			Max. Vy	14	-20.83	2552.87	-7.91
			Max. Vx	2	-20.85	-9.02	2555.85
			Max. Torque	22			1.26

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	19	35.70	-0.04	17.49
	Max. H _x	14	30.02	20.81	-0.06
	Max. H _z	2	30.02	-0.06	20.83
	Max. M _x	2	2555.85	-0.06	20.83
	Max. M _z	6	2552.38	-20.81	0.06
	Max. Torsion	22	1.26	-15.16	8.78
	Min. Vert	1	30.02	0.00	0.00
	Min. H _x	6	30.02	-20.81	0.06
	Min. H _z	10	30.02	0.06	-20.83
	Min. M _x	10	-2553.17	0.06	-20.83
	Min. M _z	14	-2552.87	20.81	-0.06
	Min. Torsion	30	-1.26	15.16	-8.78

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	30.02	0.00	-0.00	-1.32	0.24	0.00
Dead+Wind 0 deg - No Ice	30.02	0.06	-20.83	-2555.85	-9.02	-0.56
Dead+Wind 30 deg - No Ice	30.02	10.45	-18.06	-2218.20	-1284.07	-0.96
Dead+Wind 45 deg - No Ice	30.02	14.75	-14.77	-1814.16	-1811.24	-1.07
Dead+Wind 60 deg - No Ice	30.02	18.05	-10.46	-1286.60	-2214.98	-1.11
Dead+Wind 90 deg - No Ice	30.02	20.81	-0.06	-10.61	-2552.38	-0.96
Dead+Wind 120 deg - No Ice	30.02	17.99	10.36	1267.91	-2205.81	-0.55
Dead+Wind 135 deg - No Ice	30.02	14.67	14.68	1798.45	-1798.23	-0.27
Dead+Wind 150 deg - No Ice	30.02	10.35	18.01	2206.34	-1268.08	0.02
Dead+Wind 180 deg - No Ice	30.02	-0.06	20.83	2553.17	9.50	0.57
Dead+Wind 210 deg - No Ice	30.02	-10.45	18.06	2215.52	1284.55	0.97
Dead+Wind 225 deg - No Ice	30.02	-14.75	14.77	1811.48	1811.73	1.07
Dead+Wind 240 deg - No Ice	30.02	-18.05	10.46	1283.91	2215.47	1.11
Dead+Wind 270 deg - No Ice	30.02	-20.81	0.06	7.91	2552.87	0.95
Dead+Wind 300 deg - No Ice	30.02	-17.99	-10.36	-1270.61	2206.29	0.54
Dead+Wind 315 deg - No Ice	30.02	-14.67	-14.68	-1801.15	1798.71	0.27
Dead+Wind 330 deg - No Ice	30.02	-10.35	-18.01	-2209.03	1268.56	-0.01
Dead+Ice+Temp	35.70	-0.00	-0.00	-1.40	0.24	0.00
Dead+Wind 0 deg+Ice+Temp	35.70	0.04	-17.49	-2247.09	-6.76	-0.57
Dead+Wind 30 deg+Ice+Temp	35.70	8.77	-15.17	-1949.71	-1128.14	-1.06
Dead+Wind 45 deg+Ice+Temp	35.70	12.39	-12.40	-1594.28	-1591.89	-1.20

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Load Combination	Vertical K	Shear _x K	Shear _y K	Overturning Moment, M _x kip-ft	Overturning Moment, M _y kip-ft	Torque kip-ft
Dead+Wind 60 deg+Ice+Temp	35.70	15.16	-8.78	-1130.31	-1947.15	-1.26
Dead+Wind 90 deg+Ice+Temp	35.70	17.47	-0.04	-8.45	-2244.40	-1.13
Dead+Wind 120 deg+Ice+Temp	35.70	15.11	8.71	1115.32	-1940.20	-0.69
Dead+Wind 135 deg+Ice+Temp	35.70	12.33	12.33	1581.53	-1582.03	-0.39
Dead+Wind 150 deg+Ice+Temp	35.70	8.70	15.12	1939.86	-1116.03	-0.07
Dead+Wind 180 deg+Ice+Temp	35.70	-0.04	17.49	2244.19	7.25	0.57
Dead+Wind 210 deg+Ice+Temp	35.70	-8.77	15.17	1946.82	1128.62	1.06
Dead+Wind 225 deg+Ice+Temp	35.70	-12.39	12.40	1591.39	1592.38	1.20
Dead+Wind 240 deg+Ice+Temp	35.70	-15.16	8.78	1127.43	1947.64	1.26
Dead+Wind 270 deg+Ice+Temp	35.70	-17.47	0.04	5.56	2244.89	1.12
Dead+Wind 300 deg+Ice+Temp	35.70	-15.11	-8.71	-1118.22	1940.70	0.69
Dead+Wind 315 deg+Ice+Temp	35.70	-12.33	-12.33	-1584.43	1582.53	0.39
Dead+Wind 330 deg+Ice+Temp	35.70	-8.70	-15.12	-1942.76	1116.52	0.07
Dead+Wind 0 deg - Service	30.02	0.02	-8.13	-1001.59	-3.38	-0.22
Dead+Wind 30 deg - Service	30.02	4.08	-7.06	-869.40	-502.63	-0.39
Dead+Wind 45 deg - Service	30.02	5.76	-5.77	-711.20	-709.06	-0.43
Dead+Wind 60 deg - Service	30.02	7.05	-4.09	-504.62	-867.14	-0.44
Dead+Wind 90 deg - Service	30.02	8.13	-0.02	-5.00	-999.23	-0.38
Dead+Wind 120 deg - Service	30.02	7.03	4.05	495.60	-863.52	-0.22
Dead+Wind 135 deg - Service	30.02	5.73	5.74	703.33	-703.93	-0.11
Dead+Wind 150 deg - Service	30.02	4.04	7.03	863.04	-496.35	0.01
Dead+Wind 180 deg - Service	30.02	-0.02	8.13	998.84	3.88	0.23
Dead+Wind 210 deg - Service	30.02	-4.08	7.06	866.66	503.14	0.39
Dead+Wind 225 deg - Service	30.02	-5.76	5.77	708.46	709.56	0.43
Dead+Wind 240 deg - Service	30.02	-7.05	4.09	501.88	867.65	0.44
Dead+Wind 270 deg - Service	30.02	-8.13	0.02	2.25	999.73	0.38
Dead+Wind 300 deg - Service	30.02	-7.03	-4.05	-498.35	864.02	0.22
Dead+Wind 315 deg - Service	30.02	-5.73	-5.74	-706.08	704.43	0.11
Dead+Wind 330 deg - Service	30.02	-4.04	-7.03	-865.78	496.86	-0.00

Solution Summary

Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
1	0.00	-30.02	0.00	0.00	30.02	0.00	0.000%
2	0.06	-30.02	-20.83	-0.06	30.02	20.83	0.000%
3	10.45	-30.02	-18.06	-10.45	30.02	18.06	0.000%
4	14.75	-30.02	-14.77	-14.75	30.02	14.77	0.000%
5	18.05	-30.02	-10.46	-18.05	30.02	10.46	0.000%
6	20.81	-30.02	-0.06	-20.81	30.02	0.06	0.000%
7	17.99	-30.02	10.36	-17.99	30.02	-10.36	0.000%
8	14.67	-30.02	14.68	-14.67	30.02	-14.68	0.000%
9	10.35	-30.02	18.01	-10.35	30.02	-18.01	0.000%
10	-0.06	-30.02	20.83	0.06	30.02	-20.83	0.000%
11	-10.45	-30.02	18.06	10.45	30.02	-18.06	0.000%
12	-14.75	-30.02	14.77	14.75	30.02	-14.77	0.000%
13	-18.05	-30.02	10.46	18.05	30.02	-10.46	0.000%
14	-20.81	-30.02	0.06	20.81	30.02	-0.06	0.000%
15	-17.99	-30.02	-10.36	17.99	30.02	10.36	0.000%
16	-14.67	-30.02	-14.68	14.67	30.02	14.68	0.000%
17	-10.35	-30.02	-18.01	10.35	30.02	18.01	0.000%
18	0.00	-35.70	0.00	0.00	35.70	0.00	0.000%
19	0.04	-35.70	-17.49	-0.04	35.70	17.49	0.000%
20	8.77	-35.70	-15.17	-8.77	35.70	15.17	0.000%
21	12.39	-35.70	-12.40	-12.39	35.70	12.40	0.000%
22	15.16	-35.70	-8.78	-15.16	35.70	8.78	0.000%
23	17.47	-35.70	-0.04	-17.47	35.70	0.04	0.000%

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Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
24	15.11	-35.70	8.71	-15.11	35.70	-8.71	0.000%
25	12.33	-35.70	12.33	-12.33	35.70	-12.33	0.000%
26	8.70	-35.70	15.12	-8.70	35.70	-15.12	0.000%
27	-0.04	-35.70	17.49	0.04	35.70	-17.49	0.000%
28	-8.77	-35.70	15.17	8.77	35.70	-15.17	0.000%
29	-12.39	-35.70	12.40	12.39	35.70	-12.40	0.000%
30	-15.16	-35.70	8.78	15.16	35.70	-8.78	0.000%
31	-17.47	-35.70	0.04	17.47	35.70	-0.04	0.000%
32	-15.11	-35.70	-8.71	15.11	35.70	8.71	0.000%
33	-12.33	-35.70	-12.33	12.33	35.70	12.33	0.000%
34	-8.70	-35.70	-15.12	8.70	35.70	15.12	0.000%
35	0.02	-30.02	-8.13	-0.02	30.02	8.13	0.000%
36	4.08	-30.02	-7.06	-4.08	30.02	7.06	0.000%
37	5.76	-30.02	-5.77	-5.76	30.02	5.77	0.000%
38	7.05	-30.02	-4.09	-7.05	30.02	4.09	0.000%
39	8.13	-30.02	-0.02	-8.13	30.02	0.02	0.000%
40	7.03	-30.02	4.05	-7.03	30.02	-4.05	0.000%
41	5.73	-30.02	5.74	-5.73	30.02	-5.74	0.000%
42	4.04	-30.02	7.03	-4.04	30.02	-7.03	0.000%
43	-0.02	-30.02	8.13	0.02	30.02	-8.13	0.000%
44	-4.08	-30.02	7.06	4.08	30.02	-7.06	0.000%
45	-5.76	-30.02	5.77	5.76	30.02	-5.77	0.000%
46	-7.05	-30.02	4.09	7.05	30.02	-4.09	0.000%
47	-8.13	-30.02	0.02	8.13	30.02	-0.02	0.000%
48	-7.03	-30.02	-4.05	7.03	30.02	4.05	0.000%
49	-5.73	-30.02	-5.74	5.73	30.02	5.74	0.000%
50	-4.04	-30.02	-7.03	4.04	30.02	7.03	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	0.00002585
3	Yes	6	0.00000001	0.00012197
4	Yes	6	0.00000001	0.00012776
5	Yes	6	0.00000001	0.00013066
6	Yes	5	0.00000001	0.00016414
7	Yes	6	0.00000001	0.00012154
8	Yes	6	0.00000001	0.00012675
9	Yes	6	0.00000001	0.00012486
10	Yes	5	0.00000001	0.00007926
11	Yes	6	0.00000001	0.00012924
12	Yes	6	0.00000001	0.00012755
13	Yes	6	0.00000001	0.00012090
14	Yes	5	0.00000001	0.00011247
15	Yes	6	0.00000001	0.00012774
16	Yes	6	0.00000001	0.00012700
17	Yes	6	0.00000001	0.00012408
18	Yes	4	0.00000001	0.00001004
19	Yes	5	0.00000001	0.00046113
20	Yes	6	0.00000001	0.00031448
21	Yes	6	0.00000001	0.00035204
22	Yes	6	0.00000001	0.00033639
23	Yes	5	0.00000001	0.00056856
24	Yes	6	0.00000001	0.00031083

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25	Yes	6	0.00000001	0.00034638
26	Yes	6	0.00000001	0.00031974
27	Yes	5	0.00000001	0.00047791
28	Yes	6	0.00000001	0.00033185
29	Yes	6	0.00000001	0.00035053
30	Yes	6	0.00000001	0.00031089
31	Yes	5	0.00000001	0.00052881
32	Yes	6	0.00000001	0.00032808
33	Yes	6	0.00000001	0.00034834
34	Yes	6	0.00000001	0.00031823
35	Yes	4	0.00000001	0.00039618
36	Yes	5	0.00000001	0.00029345
37	Yes	5	0.00000001	0.00035238
38	Yes	5	0.00000001	0.00032691
39	Yes	4	0.00000001	0.00072976
40	Yes	5	0.00000001	0.00028375
41	Yes	5	0.00000001	0.00033735
42	Yes	5	0.00000001	0.00029676
43	Yes	4	0.00000001	0.00043987
44	Yes	5	0.00000001	0.00031750
45	Yes	5	0.00000001	0.00034700
46	Yes	5	0.00000001	0.00028576
47	Yes	4	0.00000001	0.00065655
48	Yes	5	0.00000001	0.00031328
49	Yes	5	0.00000001	0.00034487
50	Yes	5	0.00000001	0.00029858

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	180 - 149	64.371	36	3.3457	0.0152
L2	151.75 - 98.25	44.971	36	3.1099	0.0066
L3	102.25 - 48.75	18.724	36	1.8576	0.0019
L4	54.25 - 1	4.952	37	0.8786	0.0006

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
177.00	4-ft Dual Standoff Mount	36	62.250	3.3313	0.0143	15622
170.00	(2) DUO1417-8686	36	57.324	3.2936	0.0120	7810
168.00	Valmont T-Arm (1)	36	55.929	3.2808	0.0113	6508
160.00	RR90-17-02DP	36	50.432	3.2145	0.0089	3904
157.00	(2) TMA 10"x8"x3"	36	48.418	3.1815	0.0080	3394
150.00	LPA-80080-4CF	36	43.848	3.0816	0.0064	2762
147.00	Andrew 12'-6" Low Profile Platform	36	41.954	3.0281	0.0057	2708

Maximum Tower Deflections - Design Wind

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Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	180 - 149	163.210	3	8.4865	0.0425
L2	151.75 - 98.25	114.230	3	7.9026	0.0189
L3	102.25 - 48.75	47.692	4	4.7321	0.0055
L4	54.25 - 1	12.632	4	2.2410	0.0018

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
177.00	4-ft Dual Standoff Mount	3	157.858	8.4516	0.0405	6467
170.00	(2) DUO1417-8686	3	145.428	8.3598	0.0340	3232
168.00	Valmont T-Arm (1)	3	141.905	8.3284	0.0322	2693
160.00	RR90-17-02DP	3	128.027	8.1644	0.0255	1613
157.00	(2) TMA 10"x8"x3"	3	122.939	8.0820	0.0232	1401
150.00	LPA-80080-4CF	3	111.391	7.8315	0.0184	1137
147.00	Andrew 12'-6" Low Profile Platform	3	106.600	7.6966	0.0167	1112

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 P P _a
L1	180 - 149 (1)	TP21.38x14.4x0.1875	31.00	0.00	0.0	39.000	12.2437	-3.66	477.50	0.008
L2	149 - 98.25 (2)	TP32.44x20.3858x0.25	53.50	0.00	0.0	39.000	24.8276	-10.17	968.28	0.011
L3	98.25 - 48.75 (3)	TP43.1x31.0388x0.3125	53.50	0.00	0.0	39.000	41.2100	-18.40	1607.19	0.011
L4	48.75 - 1 (4)	TP53.23x41.2351x0.3125	53.25	0.00	0.0	36.843	52.4875	-30.00	1933.82	0.016

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M _x kip-ft	Actual f _{bx} ksi	Allow. F _{bx} ksi	Ratio f _{bx} F _{bx}	Actual M _y kip-ft	Actual f _{by} ksi	Allow. F _{by} ksi	Ratio f _{by} F _{by}
L1	180 - 149 (1)	TP21.38x14.4x0.1875	120.37	23.267	39.000	0.597	0.00	0.000	39.000	0.000
L2	149 - 98.25 (2)	TP32.44x20.3858x0.25	758.40	47.483	39.000	1.218	0.00	0.000	39.000	0.000
L3	98.25 - 48.75 (3)	TP43.1x31.0388x0.3125	1533.86	43.551	39.000	1.117	0.00	0.000	39.000	0.000
L4	48.75 - 1 (4)	TP53.23x41.2351x0.3125	2563.55	44.797	36.843	1.216	0.00	0.000	36.843	0.000

Pole Shear Design Data

RISATower Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job	12001.CO15 - Somers West	Page	20 of 20
	Project	180' Sabre Monopole - 37 Bacon Rd., Enfield, CT	Date	12:55:31 02/01/12
	Client	Verizon Wireless	Designed by	TJL

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_w ksi	Allow. F_w ksi	Ratio $\frac{f_w}{F_w}$
L1	180 - 149 (1)	TP21.38x14.4x0.1875	8.56	0.699	26.000	0.054	1.31	0.123	26.000	0.005
L2	149 - 98.25 (2)	TP32.44x20.3858x0.25	14.56	0.586	26.000	0.045	1.08	0.033	26.000	0.001
L3	98.25 - 48.75 (3)	TP43.1x31.0388x0.3125	17.74	0.430	26.000	0.033	1.07	0.015	26.000	0.001
L4	48.75 - 1 (4)	TP53.23x41.2351x0.3125	20.90	0.398	26.000	0.031	1.07	0.009	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio P $\frac{P_a}{P_v}$	Ratio f_{bx} $\frac{F_{bx}}{F_v}$	Ratio f_{by} $\frac{F_{by}}{F_v}$	Ratio f_v $\frac{f_v}{F_v}$	Ratio f_w $\frac{f_w}{F_w}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	180 - 149 (1)	0.008	0.597	0.000	0.054	0.005	0.605	1.333	H1-3+VT ✓
L2	149 - 98.25 (2)	0.011	1.218	0.000	0.045	0.001	✓ 1.229	1.333	H1-3+VT ✓
L3	98.25 - 48.75 (3)	0.011	1.117	0.000	0.033	0.001	✓ 1.128	1.333	H1-3+VT ✓
L4	48.75 - 1 (4)	0.016	1.216	0.000	0.031	0.000	✓ 1.232	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	180 - 149	Pole	TP21.38x14.4x0.1875	1	-3.66	636.51	45.4	Pass
L2	149 - 98.25	Pole	TP32.44x20.3858x0.25	2	-10.17	1290.71	92.2	Pass
L3	98.25 - 48.75	Pole	TP43.1x31.0388x0.3125	3	-18.40	2142.38	84.7	Pass
L4	48.75 - 1	Pole	TP53.23x41.2351x0.3125	4	-30.00	2577.78	92.4	Pass
Summary								
Pole (L4)							92.4	Pass
RATING =							92.4	Pass

Subject:

Anchor Bolt and Baseplate Analysis

Location:

180-ft Sabre Monopole
Enfield, CT

Rev. 0: 2/1/12

Prepared by: T.J.L. Checked by: C.F.C.
Job No. 12001.CO15

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturing Moment =	OM := 2564-ft-kips	(Input From RisaTower)
Shear Force =	Shear := 21-kips	(Input From RisaTower)
Axial Force =	Axial := 30-kips	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 12	(User Input)
Diameter of Bolt Circle =	D _{bc} := 60.0-in	(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 Mod 60

Plate Yield Strength =	F _{ybp} := 60-ksi	(User Input)
Base Plate Thickness =	t _{bp} := 2.00-in	(User Input)
Base Plate Diameter =	D _{bp} := 66.0-in	(User Input)
Outer Pole Diameter =	D _{pole} := 53.25-in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =:

$$R_{bc} := \frac{D_{bc}}{2} = 30\text{-in}$$

Distance to Bolts =

$$i := 1..N$$

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

$$d_1 = 15.00\text{-in}$$

$$d_7 = -15.00\text{-in}$$

$$d_2 = 25.98\text{-in}$$

$$d_8 = -25.98\text{-in}$$

$$d_3 = 30.00\text{-in}$$

$$d_9 = -30.00\text{-in}$$

$$d_4 = 25.98\text{-in}$$

$$d_{10} = -25.98\text{-in}$$

$$d_5 = 15.00\text{-in}$$

$$d_{11} = -15.00\text{-in}$$

$$d_6 = 0.00\text{-in}$$

etc.

Critical Distances For Bending in Plate:

Outer Pole Radius =

$$R_{pole} := \frac{D_{pole}}{2} = 26.6\text{-in}$$

Moment Arms of Bolts about Neutral Axis =

$$MA_i := \text{if}(d_i \geq R_{pole}, d_i - R_{pole}, 0\text{in})$$

$$MA_1 = 0.00\text{-in}$$

$$MA_7 = 0.00\text{-in}$$

$$MA_2 = 0.00\text{-in}$$

$$MA_8 = 0.00\text{-in}$$

$$MA_3 = 3.38\text{-in}$$

$$MA_9 = 0.00\text{-in}$$

$$MA_4 = 0.00\text{-in}$$

$$MA_{10} = 0.00\text{-in}$$

$$MA_5 = 0.00\text{-in}$$

$$MA_{11} = 0.00\text{-in}$$

$$MA_6 = 0.00\text{-in}$$

etc

Effective Width of Baseplate for Bending =

$$B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2} \right)^2 - \left(\frac{D_{pole}}{2} \right)^2} = 31.2\text{-in}$$

Subject:

Anchor Bolt and Baseplate Analysis

Location:

180-ft Sabre Monopole
Enfield, CT

Rev. 0: 2/1/12

Prepared by: T.J.L. Checked by: C.F.C.
Job No. 12001.CO15**Anchor Bolt Analysis:**Calculated Anchor Bolt Properties:

Polar Moment of Inertia =

$$I_p := \sum_i (d_i)^2 = 5.4 \times 10^3 \cdot \text{in}^2$$

Gross Area of Bolt =

$$A_g := \frac{\pi}{4} \cdot D^2 = 3.976 \cdot \text{in}^2$$

Net Area of Bolt =

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

Net Diameter =

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

Radius of Gyration of Bolt =

$$r := \frac{D_n}{4} = 0.508 \cdot \text{in}$$

Section Modulus of Bolt =

$$S_x := \frac{\pi \cdot D_n^3}{32} = 0.826 \cdot \text{in}^3$$

Check Anchor Bolt Tension Force:

Maximum Tensile Force =

$$T_{\text{Max}} := \text{OM} \cdot \frac{R_{bc}}{I_p} - \frac{\text{Axial}}{N} = 168.4 \cdot \text{kips}$$

Allowable Tensile Force =

$$T_{\text{ALL.Gross}} := 1.333 \cdot (0.33 \cdot A_g \cdot F_u) = 174.9 \cdot \text{kips}$$

(1.333 increase
allowed per TIA/EIA)

$$T_{\text{ALL.Net}} := 1.333 \cdot (0.60 \cdot A_n \cdot F_y) = 194.812 \cdot \text{kips}$$

(1.333 increase
allowed per TIA/EIA)

Bolt Tension % of Capacity =

$$\frac{T_{\text{Max}}}{T_{\text{ALL.Net}}} = 86.5\% \quad \text{Bolts are "upset bolts". Use net area per AISC}$$

Condition1 =

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

Condition1 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment =

$$M_x := \left(\frac{\text{Shear}}{N} \right) \cdot l = 0.437 \cdot \text{ft-kips}$$

Maximum Bending Stress =

$$f_{bx} := \frac{M_x}{S_x} = 6.4 \cdot \text{ksi}$$

Allowable Bending Stress =

$$F_{bx} := 1.333 \cdot 0.6 \cdot F_y = 60 \cdot \text{ksi}$$

(1.333 increase
allowed per TIA/EIA)

Check Combined Stress Requirement:

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

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

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

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{l_p} + \frac{Axial}{N} = 173.4 \text{ kips}$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 53.4 \text{ ksi}$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

$$F_a := 1.333 \cdot F_a = 60 \text{ ksi} \quad \text{(1.333 increase allowed per TIA/EIA)}$$

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \right) = 89. \%$$

Condition 2 =

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

Condition2 = "OK"

Base Plate Analysis:

Force from Bolts =

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

$$C_1 = 88.0\text{-kips}$$

$$C_7 = -83.0\text{-kips}$$

$$C_2 = 150.5\text{-kips}$$

$$C_8 = -145.5\text{-kips}$$

$$C_3 = 173.4\text{-kips}$$

$$C_9 = -168.4\text{-kips}$$

$$C_4 = 150.5\text{-kips}$$

$$C_{10} = -145.5\text{-kips}$$

$$C_5 = 88.0\text{-kips}$$

$$C_{11} = -83.0\text{-kips}$$

$$C_6 = 2.5\text{-kips}$$

etc.

Maximum Bending Stress in Plate =

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{(B_{eff} t_{bp})^2} = 28.1\text{-ksi}$$

Allowable Bending Stress in Plate =

$$F_{bp} := 1.33 \cdot 0.75 \cdot F_y = 59.9\text{-ksi}$$

Plate Bending Stress % of Capacity =

$$\frac{f_{bp}}{F_{bp}} = 47.0\%$$

Condition3 =

$$\text{Condition3} := \begin{cases} \frac{f_{bp}}{F_{bp}} < 1.00, \text{"Ok"} \\ \text{"Overstressed"} \end{cases}$$

Condition3 = "Ok"

Standard Monopole Foundation:**Input Data:**Tower Data

Overturing Moment =	OM := 2564-ft-kips	(User Input from RISATower)
Shear Force =	Shear := 21-kip	(User Input from RISATower)
Axial Force =	Axial := 30-kip	(User Input from RISATower)
Tower Height =	H _t := 180-ft	(User Input)

Footing Data:

Overall Depth of Footing =	D _f := 5.5-ft	(User Input)
Length of Pier =	L _p := 4.5-ft	(User Input)
Extension of Pier Above Grade =	L _{pag} := 1-ft	(User Input)
Diameter of Pier =	d _p := 7-ft	(User Input)
Thickness of Footing =	T _f := 2.0-ft	(User Input)
Width of Footing =	W _f := 23.0-ft	(User Input)

Anchor Bolt Data:

Length of Anchor Bolts =	L _{st} := 84-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 := 60.0-in	(User Input)

Material Properties:

Concrete Compressive Strength =	f _c := 4000-psi	(User Input)
Steel Reinforcement 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 := 2000-1.33-psf	(User Input) 1/3 Increase in bearing pressure allowed for transient loading.
Unit Weight of Soil =	γ _{soil} := 110-pcf	(User Input) Soil unit weight assuming backfill material compacted to ASTM D1557.
Unit Weight of Concrete =	γ _{conc} := 150-pcf	(User Input)
Foundation Bouyancy =	Bouyancy := 0	(User Input) (Yes=1 / No=0)
Depth to Neglect =	n := 0-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 =	$BS_{\text{pier}} := 8$	(User Input)	
Bar Diameter =	$db_{\text{pier}} := 1.00\text{-in}$	(User Input)	
Number of Bars =	$NB_{\text{pier}} := 36$	(User Input)	
Clear Cover of Reinforcement =	$Cvr_{\text{pier}} := 3\text{-in}$	(User Input)	
Reinforcement Location Factor =	$\alpha_{\text{pier}} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{\text{pier}} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{\text{pier}} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{\text{pier}} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Diameter of Tie =	$d_{\text{Tie}} := 3\text{-in}$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{\text{top}} := 8$	(User Input)	(Top of Pad)
Bar Diameter =	$db_{\text{top}} := 1.00\text{-in}$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{\text{top}} := 36$	(User Input)	(Top of Pad)
Bar Size =	$BS_{\text{bot}} := 8$	(User Input)	(Bottom of Pad)
Bar Diameter =	$db_{\text{bot}} := 1.00\text{-in}$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{\text{bot}} := 36$	(User Input)	(Bottom of Pad)
Clear Cover of Reinforcement =	$Cvr_{\text{pad}} := 3.0\text{-in}$	(User Input)	
Reinforcement Location Factor =	$\alpha_{\text{pad}} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{\text{pad}} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{\text{pad}} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{\text{pad}} := 1.0$	(User Input)	(ACI-2008 12.2.4)

Calculated Factors:

Pier Reinforcement Bar Area =	$A_{\text{bpier}} := \frac{\pi \cdot db_{\text{pier}}^2}{4} = 0.785\text{-in}^2$	
Pad Top Reinforcement Bar Area =	$A_{\text{btop}} := \frac{\pi \cdot db_{\text{top}}^2}{4} = 0.785\text{-in}^2$	
Pad Bottom Reinforcement Bar Area =	$A_{\text{bbot}} := \frac{\pi \cdot db_{\text{bot}}^2}{4} = 0.785\text{-in}^2$	
Coefficient of Lateral Soil Pressure =	$K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 3$	
Load Factor =	$LF := \begin{cases} 1.333 & \text{if } H_t \leq 700\text{-ft} \\ 1.7 & \text{if } H_t \geq 1200\text{-ft} \\ 1.333 + \left(\frac{H_t - 700\text{ft}}{1200\text{ft} - 700\text{ft}} \right) \cdot 0.4 & \text{otherwise} \end{cases}$	= 1.333

Stability of Footing:

Adjusted Concrete Unit Weight =

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

Adjusted Soil Unit Weight =

$$\gamma_s := \text{if}(\text{Bouyancy} = 1, \gamma_{\text{soil}} - 62.4 \text{pcf}, \gamma_{\text{soil}}) = 110 \text{pcf}$$

Passive Pressure =

$$P_{pn} := K_p \cdot \gamma_s \cdot n + c \cdot 2 \cdot \sqrt{K_p} = 0 \text{ksf}$$

$$P_{pt} := K_p \cdot \gamma_s \cdot (D_f - T_f) + c \cdot 2 \cdot \sqrt{K_p} = 1.155 \text{ksf}$$

$$P_{top} := \text{if}(n < (D_f - T_f), P_{pt}, P_{pn}) = 1.155 \text{ksf}$$

$$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p} = 1.815 \text{ksf}$$

$$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 1.485 \text{ksf}$$

$$T_p := \text{if}(n < (D_f - T_f), T_f, (D_f - n)) = 2$$

$$A_p := W_f \cdot T_p = 46$$

Ultimate Shear =

$$S_u := P_{ave} \cdot A_p = 68.31 \text{kip}$$

Weight of Concrete Pad =

$$WT_c := (W_f^2 \cdot T_f + d_p^2 \cdot L_p) \cdot \gamma_c = 191.775 \text{kip}$$

Weight of Soil Above Footing =

$$WT_{s1} := \left[(W_f^2 - d_p^2) \cdot (L_p - L_{pag} - n) \right] \cdot \gamma_s = 184.8 \text{kip}$$

Weight of Soil Wedge at Back Face =

$$WT_{s2} := \left(\frac{D_f^2 \cdot \tan(\Phi_s)}{2} \cdot W_f \right) \cdot \gamma_s = 22.093 \text{kip}$$

Weight of Soil Wedge at back face Corners =

$$WT_{s3} := 2 \cdot \left(D_f^3 \cdot \frac{\tan(\Phi_s)}{3} \right) \cdot \gamma_s = 7.044 \text{kips}$$

Total Weight =

$$WT_{tot} := WT_c + WT_{s1} + \text{Axial} = 406.575 \text{kip}$$

Resisting Moment =

$$M_r := (WT_{tot}) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + \left[(WT_{s2} + WT_{s3}) \cdot \left(W_f + \frac{D_f \tan(\Phi_s)}{3} \right) \right] = 5422 \text{kip-ft}$$

Overtuning Moment =

$$M_{ot} := OM + \text{Shear} \cdot (L_p + T_f) = 2701 \text{kip-ft}$$

Factor of Safety Actual =

$$FS := \frac{M_r}{M_{ot}} = 2.01$$

Factor of Safety Required =

$$FS_{req} := 2$$

$$\text{OverTurning_Moment_Check} := \text{if}(FS \geq FS_{req}, \text{"Okay"}, \text{"No Good"})$$

$$\text{OverTurning_Moment_Check} = \text{"Okay"}$$

Shear Capacity in Pier:

Shear Resistance of Pier =

$$S_p := \frac{P_{ave} \cdot A_p + \mu \cdot W_{T_{tot}}}{FS_{req}} = 125.634 \text{ kips}$$

$$\text{Shear_Check} := \text{if}(S_p > \text{Shear}, \text{"Okay"}, \text{"No Good"})$$

$$\text{Shear_Check} = \text{"Okay"}$$

Bearing Pressure Caused by Footing:

Area of the Mat =

$$A_{mat} := W_f^2 = 529$$

Section Modulus of Mat =

$$S := \frac{W_f^3}{6} = 2027.83 \text{ ft}^3$$

Maximum Pressure in Mat =

$$P_{max} := \frac{W_{T_{tot}}}{A_{mat}} + \frac{M_{ot}}{S} = 2.1 \text{ ksf}$$

$$\text{Max_Pressure_Check} := \text{if}(P_{max} < q_s, \text{"Okay"}, \text{"No Good"})$$

$$\text{Max_Pressure_Check} = \text{"Okay"}$$

Minimum Pressure in Mat =

$$P_{min} := \frac{W_{T_{tot}}}{A_{mat}} - \frac{M_{ot}}{S} = -0.563 \text{ ksf}$$

$$\text{Min_Pressure_Check} := \text{if}((P_{min} \geq 0) \cdot (P_{min} < q_s), \text{"Okay"}, \text{"No Good"})$$

$$\text{Min_Pressure_Check} = \text{"No Good"}$$

Distance to Resultant of Pressure Distribution =

$$X_p := \frac{P_{max}}{P_{max} - P_{min}} \cdot \frac{1}{3} = 6.046$$

Distance to Kern =

$$X_k := \frac{W_f}{6} = 3.833$$

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

Eccentricity =

$$e := \frac{M_{ot}}{W_{T_{tot}}} = 6.642$$

Adjusted Soil Pressure =

$$P_a := \frac{2 \cdot W_{T_{tot}}}{3 \cdot W_f \left(\frac{W_f}{2} - e \right)} = 2.426 \text{ ksf}$$

$$q_{adj} := \text{if}(P_{min} < 0, P_a, P_{max}) = 2.426 \text{ ksf}$$

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

$$\text{Pressure_Check} = \text{"Okay"}$$

Concrete Bearing Capacity:

Strength Reduction Factor =

$$\Phi_c := 0.65 \quad (\text{ACI-2008 9.3.2.2})$$

Bearing Strength Between Pier and Pad =

$$P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 1.225 \times 10^4 \cdot \text{kips} \quad (\text{ACI-2008 10.14})$$

$$\text{Bearing_Check} := \text{if}(P_b > \text{LF} \cdot \text{Axial}, \text{"Okay"}, \text{"No Good"})$$

$$\text{Bearing_Check} = \text{"Okay"}$$

Shear Strength of Concrete:

Beam Shear:

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

$$\Phi_c := 0.85 \quad (\text{ACI 9.3.2.5})$$

$$d := T_f - C_{vr_pad} - d_{bbot}$$

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

$$d_2 := d_1 - d$$

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

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

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

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

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

$$\text{Beam_Shear_Check} = \text{"Okay"}$$

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 =

$$b_o := (d_p + d) \cdot \pi = 27.2$$

Area Included Inside Perimeter =

$$A_{bo} := \frac{\pi \cdot (d_p + d)^2}{4} = 59$$

Area Outside of Perimeter =

$$A_{out} := A_{mat} - A_{bo} = 470$$

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Rev. 0: 2/1/12

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 Job No. 12001.CO15

Guess Value =

$$v_u := 1 \text{ ksf}$$

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

Given

$$d^2 + d_p \cdot d = \frac{W_{T_{tot}}}{\pi \cdot v_u}$$

$$v_u := \text{Find}(v_u) = 9 \text{ ksf}$$

$$V_u := v_u \cdot d \cdot W_f = 343.5 \text{ kips}$$

Required Shear Strength =

$$V_{req} := LF \cdot V_u = 457.8 \text{ kips}$$

Available Shear Strength =

$$V_{avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot \text{psi}} \cdot b_o \cdot d = 1405.1 \text{ kip} \quad (\text{ACI-2008 11.11.2.1})$$

$$\text{Punching_Shear_Check} := \text{if}(V_{req} < V_{avail}, \text{"Okay"}, \text{"No Good"})$$

$$\text{Punching_Shear_Check} = \text{"Okay"}$$

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

Strength Reduction Factor =

$$\phi_m := .90$$

(ACI-2008 9.3.2.1)

$$q_b := q_{adj} - d_1 \cdot \text{Slope} = 1.094 \text{ ksf}$$

Maximum Bending at Face of Pier =

$$M_n := \frac{1}{LF \cdot \phi_m} \cdot \left[(q_{adj} - q_b) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 1215.9 \text{ kip-ft}$$

$$\beta := \begin{cases} 0.85 & \text{if } 2500 \text{ psi} \leq f_c \leq 4000 \text{ psi} \\ 0.65 & \text{if } f_c > 8000 \text{ psi} \\ \left[0.85 - \left[\frac{\left(\frac{f_c}{\text{psi}} - 4000 \right)}{1000} \right] \cdot 0.5 \right] & \text{otherwise} \end{cases} = 0.85 \quad (\text{ACI-2008 10.2.7.3})$$

$$R_u := \frac{M_n}{\phi_m \cdot W_f \cdot d^2} = 146.9 \text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \left(1 - \sqrt{1 - \frac{2 \cdot R_u}{0.85 \cdot f_c}} \right) = 0.0025$$

$$\rho_{min} := 1.333 \cdot \rho = 0.00334$$

Required Reinforcement for Temperature and Shrinkage:

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

Check Bottom Bars:

$$A_s := \max(\rho, \rho_{min}, \rho_{sh}) \cdot W_f \cdot d = 18.4 \text{ in}^2$$

$$A_{s_{prov}} := A_{bbot} \cdot NB_{bot} = 28.3 \text{ in}^2$$

$$Pad_Reinforcement_Bot := \text{if}(A_{s_{prov}} > A_s, \text{"Okay"}, \text{"No Good"})$$

$$Pad_Reinforcement_Bot = \text{"Okay"}$$

Check top Bars:

$$A_s := \rho_{sh} \cdot (W_f \cdot d) = 9.9 \text{ in}^2$$

$$A_{s_{prov}} := A_{btop} \cdot NB_{top} = 28.3 \text{ in}^2$$

$$Pad_Reinforcement_Top := \text{if}(A_{s_{prov}} > A_s, \text{"Okay"}, \text{"No Good"})$$

$$Pad_Reinforcement_Top = \text{"Okay"}$$

Development Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2 \cdot C_{vr_{pad}} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 6.69 \text{ in}$$

Spacing or Cover Dimension =

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

Transverse Reinforcement Index =

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

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

Minimum Development Length =

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

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

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - C_{vr_{pad}} = 93 \text{ in}$$

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

$$L_{pad_Check} = \text{"Okay"}$$

Steel Reinforcement in Pier:

Area of Pier =

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

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

$$A_{sprov} := N_{B_{pier}} \cdot A_{bpier} = 28.27 \cdot \text{in}^2$$

$$\text{Steel_Area_Check} := \text{if}(A_{sprov} > A_{smin}, \text{"Okay"}, \text{"No Good"})$$

Steel_Area_Check = "Okay"

Bar Spacing In Pier =

$$B_{sPier} := \frac{d_p \cdot \pi}{N_{B_{pier}}} - d_{bpier} = 6.33 \cdot \text{in}$$

Diameter of Reinforcement Cage =

$$\text{Diam}_{cage} := d_p - 2 \cdot C_{vr_{pier}} = 78 \cdot \text{in}$$

Maximum Moment in Pier =

$$M_p := \left[OM + \text{Shear} \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF = 42693.3 \cdot \text{in-kips}$$

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

$$(D \ N \ n \ P_u \ M_{xu}) := \left(d_p \cdot 12 \ N_{B_{pier}} \ B_{s_{pier}} \ \frac{\text{Axial} \cdot 1.333}{\text{kips}} \ \frac{M_p}{\text{in-kips}} \right)$$

$$(D \ N \ n \ P_u \ M_{xu}) = (84 \ 36 \ 8 \ 40 \ 42693.3)$$

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

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

$$(\phi P_n \ \phi M_{xn} \ f_{sp} \ \rho) = (52.3 \ 55829.9 \ -60 \ 0)$$

$$\text{Axial_Load_Check} := \text{if}(\phi P_n \geq P_u, \text{"Okay"}, \text{"No Good"})$$

Axial_Load_Check = "Okay"

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

Bending_Check = "Okay"

Development Length Pier Reinforcement:

Available Length in Foundation:

$$L_{\text{pier}} := L_p - C_{\text{vr}}_{\text{pier}} = 51 \cdot \text{in}$$

$$L_{\text{pad}} := T_f - C_{\text{vr}}_{\text{pad}} = 21 \cdot \text{in}$$

Tension:

(ACI-2008 12.2.3)

Spacing or Cover Dimension =

$$c := \text{if} \left(C_{\text{vr}}_{\text{pier}} < \frac{B_{\text{SPier}}}{2}, C_{\text{vr}}_{\text{pier}}, \frac{B_{\text{SPier}}}{2} \right) = 3 \cdot \text{in}$$

Transverse Reinforcement =

$$k_{\text{tr}} := 0$$

(ACI-2008 12.2.3)

$$L_{\text{dbt}} := \frac{3 \cdot f_y \cdot \alpha_{\text{pier}} \cdot \beta_{\text{pier}} \cdot \gamma_{\text{pier}} \cdot \lambda_{\text{pier}}}{40 \cdot \sqrt{f_c \cdot \text{psi}} \cdot \left(\frac{c + k_{\text{tr}}}{d_{\text{bpier}}} \right)} \cdot d_{\text{bpier}} = 23.72 \cdot \text{in}$$

Minimum Development Length =

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

$$L_{\text{dh}} := \frac{1200 \cdot d_{\text{bpier}}}{\sqrt{\frac{f_c}{\text{psi}}}} \cdot 0.7 = 13.282 \cdot \text{in} \quad (\text{ACI } 12.2.1)$$

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

$$L_{\text{tension_Check}} := \text{if}(L_{\text{pier}} + L_{\text{pad}} > L_{\text{dbt}}, \text{"Okay"}, \text{"No Good"})$$

$$L_{\text{tension_Check}} = \text{"Okay"}$$

Compression:

(ACI-2008 12.3.2)

$$L_{\text{dbc1}} := \frac{0.02 \cdot d_{\text{bpier}} \cdot f_y}{\sqrt{f_c \cdot \text{psi}}} = 18.974 \cdot \text{in}$$

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

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

$$L_{\text{compression_Check}} := \text{if}(L_{\text{pier}} + L_{\text{pad}} > L_{\text{dbc}}, \text{"Okay"}, \text{"No Good"})$$

$$L_{\text{compression_Check}} = \text{"Okay"}$$

Tie Size and Spacing in Column:

Minimum Tie Size =

$$Tie_{min} := \text{if}(BS_{pier} \leq 10, 3, 4) = 3$$

Used #3 Ties

Seismic Factor =

$$z := \text{if}(Z \leq 2, 1, 0.5) = 1$$

(ACI-2008 21.10.5)

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

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

$$s_{lim3} := D_f \cdot z = 66 \cdot \text{in}$$

$$s_{lim4} := 18 \cdot \text{in}$$

Maximum Spacing =

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

Number of Ties Required =

$$n_{tie} := \frac{L_{pier} - 3 \cdot \text{in}}{s_{tie}} + 1 = 4$$

Check Anchor Steel Embedment:

Depth Available =

$$D_{ab} := L_{st} - A_{BP} = 6 \cdot \text{ft}$$

Length of Anchor Bolt =

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

$$\text{Depth_Check} := \text{if}(D_{ab} \geq L_{anchor}, \text{"Okay"}, \text{"No Good"})$$

Depth_Check = "No Good"

Note: Anchor plate is provided

Units:

Angular

$$\text{rad} = 1$$

$$\text{deg} = \pi \cdot \frac{\text{rad}}{180}$$

Weight

$$\text{lb} = \text{lbf}$$

$$\text{kips} = 1000\text{-lb}$$

$$\text{k} = \text{kips}$$

$$\text{tons} = 2000\text{-lb}$$

Unit Weight

$$\text{plf} = \frac{\text{lb}}{\text{ft}}$$

$$\text{klf} = \frac{\text{kips}}{\text{ft}}$$

Pressure

$$\text{psf} = \frac{\text{lb}}{\text{ft}^2}$$

$$\text{psi} = \frac{\text{lb}}{\text{in}^2}$$

$$\text{ksf} = \frac{\text{kips}}{\text{ft}^2}$$

$$\text{ksi} = \frac{\text{kips}}{\text{in}^2}$$

Density

$$\text{pcf} = \frac{\text{lb}}{\text{ft}^3}$$

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FOUNDATION ANALYSIS

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180-ft Sabre Monopole
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Rev. 0: 2/1/12

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NOTE: Anchor Bolts are not accounted for in reinforcement calculation and will provide additional reinforcement to satisfy minimum requirement of steel.

(defined variables)

The required input is column diameter in inches, number of reinforcing bars, bar size number, factored axial load in kips and moment in kip inches:

Clears any previous output:

The Output is given as useable axial load in kips, moment capacity in kip inches, splicing stress in ksi, and reinforcement ratio:

Column size and reinforcement may be changed to match capacity to the applied load.

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NOTE: Anchor bolts and plate provided

$$\text{kip} = 1000\text{-lb}$$

$$\text{psf} = \frac{\text{lb}}{\text{ft}^2}$$

$$\text{ksf} = \frac{\text{kip}}{\text{ft}^2}$$

$$\text{pcf} = \frac{\text{lb}}{\text{ft}^3}$$

$$\text{ksi} = \frac{\text{kip}}{\text{in}^2}$$

Angular

$$\text{rad} = 1$$

$$\text{deg} = \pi \cdot \frac{\text{rad}}{180}$$

Linear

$$\text{ft} = 1$$

$$\text{in} = \frac{\text{ft}}{12}$$

$$\text{ft}^2 = 1$$

$$\text{ft}^2 = 144\text{in}^2$$

Weight

$$\text{lb} = \text{lbf}$$

$$\text{tons} = 2000\text{-lb}$$

$$\text{kips} = 1000\text{-lb}$$

$$\text{kip} = 1000\text{-lb}$$

$$\text{pcf} = \frac{\text{lb}}{\text{ft}^3}$$

$$\text{kcf} = \frac{\text{kips}}{\text{ft}^3}$$

Pressure

$$\text{psi} = \frac{\text{lb}}{\text{in}^2}$$

$$\text{psf} = \frac{\text{lb}}{\text{ft}^2}$$

$$\text{ksi} = \frac{1000\text{-lb}}{\text{in}^2}$$

$$\text{ksf} = \frac{\text{kips}}{\text{ft}^2}$$

$$\text{lbft} = \text{lb}\cdot\text{ft}$$

Work

$$\text{kft} = \text{kips}\cdot\text{ft}$$

$$\text{lb}\cdot\text{in} = \text{lb}\cdot\text{in}$$

$$\text{kin} = \text{kips}\cdot\text{in}$$

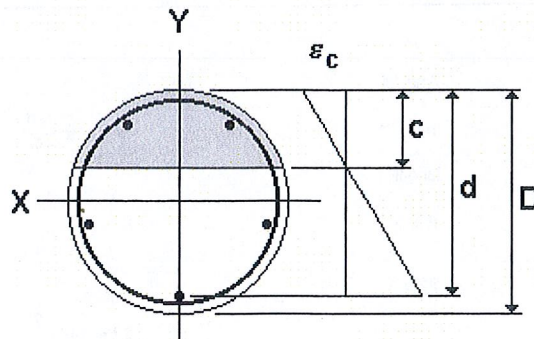
Miscellaneous

$$\text{kpLF} = 1000 \cdot \frac{\text{lb}}{\text{ft}}$$

$$\text{kpi} = 1000 \cdot \frac{\text{lb}}{\text{in}}$$

Circular Reinforced Concrete Columns with Axial Load and Bending

Notation



P_u	factored axial load in kips
M_{xu}	factored moment about X axis in kip inches
D	column diameter in inches
N	number of bars, minimum of 4 bars
n	standard reinforcing bar number designation, 3 through 11, 14 & 18
c	distance from the extreme compression fiber to the neutral axis in inches
ϕP_n	useable axial load in kips
f_{sp}	reinforcing bar stress (maximum tension or minimum compression in ksi) for determining required type of column splice
ρ	ratio of the area of longitudinal reinforcement to the gross area of the concrete section

Axial loads and bending moments must be greater than zero, reinforcement ratios must be between 0.005 and 0.08, and yield strength of reinforcement must be 80 ksi or less.

Stresses in reinforcing bars are positive for compression and negative for tension.

1) Compressive strength of concrete and yield strength of reinforcement, in ksi, and clear cover of main reinforcement in inches:

$$(f_c \ f_y \ c) = (3 \ 60 \ 3)$$

2) Lateral reinforcement variable Spiral, define as 1 if spiral reinforcement used and as 0 if circular ties are used:

$$\text{Spiral} = 0$$

3) Modulus of elasticity of reinforcement in ksi and strain in the concrete at compression failure:

$$(E_s \quad \epsilon_c) = (29000 \quad 0.003)$$

4) Strain in reinforcement at yield stress f_y :

$$\epsilon_y = \frac{f_y}{E_s} \quad \epsilon_y = 0.002069$$

5) Factor used to calculate depth of equivalent rectangular stress block:

$$\beta_1 = \text{if} \left[(f_c \geq 4) \cdot (f_c \leq 8), 0.85 - 0.05 \cdot (f_c - 4), \text{if} \left[(f_c \leq 4), 0.85, 0.65 \right] \right]$$

$$\beta_1 = 0.85$$

6) Reinforcing bar diameters in inches and cross section areas in square inches:

$$d_b = (0 \quad 0 \quad 0 \quad 0.375 \quad 0.5 \quad 0.625 \quad 0.75 \quad 0.875 \quad 1.00 \quad 1.128 \quad 1.27 \quad 1.41 \quad 0 \quad 0 \quad 1.693 \quad 0 \quad 0 \quad 0 \quad 2.257)^T$$

$$A_b = (0 \quad 0 \quad 0 \quad 0.11 \quad 0.20 \quad 0.31 \quad 0.44 \quad 0.60 \quad 0.79 \quad 1.00 \quad 1.27 \quad 1.56 \quad 0 \quad 0 \quad 2.25 \quad 0 \quad 0 \quad 0 \quad 4.00)^T$$

Distance of the reinforcing bars from the center of column measured parallel to the axis of bending:

$$\text{coord}(D, N, n) = \begin{cases} r_s \leftarrow \frac{D}{2} - c_l - \frac{d_{b_n}}{2} \\ \text{for } i \in 0..N-1 \\ \quad \alpha_i \leftarrow (2 \cdot i + 1) \cdot \frac{\pi}{N} \\ \quad y_i \leftarrow r_s \cdot \cos(\alpha_i) \end{cases}$$

The first reinforcing bar is assumed at an angle of π/N , measured counterclockwise from the Y axis. In most cases it is impractical to control the location of reinforcing bars in a circular

column, so the assumed locations should be in the least favorable position.

Stresses in the reinforcing bars with and without reduction of $0.85 \cdot f_c$ for the portion of the bar areas within the rectangular stress block zone:

$$\begin{aligned}
 f1(D, N, n, c) = & \quad y \leftarrow \text{coord}(D, N, n) \\
 & \quad y \leftarrow -y + \frac{D}{2} \\
 & \quad \epsilon_s \leftarrow \text{if } [c = 0, (y - y) - \epsilon_y, \left(1 - \frac{y}{c}\right) \cdot \epsilon_c] \\
 & \quad \text{for } i \in 0.. \text{last}(y) \\
 & \quad \quad f_{s_i} \leftarrow \text{if } \left(\left| \epsilon_{s_i} \right| \leq \epsilon_y, \epsilon_{s_i} \cdot E_s, \text{if } \left(\epsilon_{s_i} < 0, -\epsilon_y \cdot E_s, \epsilon_y \cdot E_s \right) \right) \\
 & \quad \quad f_{se_i} \leftarrow \begin{cases} f_{s_i} - 0.85 \cdot f_c & \text{if } \left(y_i \leq \beta_1 \cdot c - \frac{d_{b_n}}{2} \right) \cdot (f_{s_i} > 0.85 \cdot f_c) \\ f_{s_i} & \text{if } y_i \geq \beta_1 \cdot c + \frac{d_{b_n}}{2} \end{cases} \\
 & \quad \quad \text{otherwise} \\
 & \quad \quad \quad \theta_i \leftarrow \arccos \left(2 \cdot \frac{-y_i + \beta_1 \cdot c}{d_{b_n}} \right) \\
 & \quad \quad \quad R_i \leftarrow \frac{1}{2} \cdot \frac{2\pi - 2\theta_i + \sin(2\theta_i)}{\pi} \\
 & \quad \quad \quad f_{s_i} - R_i \cdot 0.85 \cdot f_c \quad \text{if } f_{s_i} > R_i \cdot 0.85 \cdot f_c \\
 & \quad \quad \quad f_{s_i} \quad \text{otherwise} \\
 & \quad \text{augment}(f_s, f_{se})
 \end{aligned}$$

Stresses in the reinforcing bars:

$$f_s(D, N, n, c) \equiv f1(D, N, n, c) \langle 0 \rangle$$

Stresses in the reinforcing bars, reduced by $0.85 \cdot f_c$ for the portion of the bar area within the rectangular stress block zone:

$$f_{se}(D, N, n, c) \equiv f1(D, N, n, c) \langle 1 \rangle$$

Effective concrete area, and distance of the centroid from the center of the column:

$$f2(D, c) \equiv \left| \begin{array}{l} r \leftarrow \frac{D}{2} \\ c \leftarrow D \text{ if } c > D \\ \text{if } c \leq r \\ \quad \theta \leftarrow 2 \cdot \arccos\left(\frac{r-c}{r}\right) \\ \quad A_c \leftarrow \frac{1}{2} \cdot r^2 \cdot (\theta - \sin(\theta)) \\ \quad y_c \leftarrow \frac{4}{3} \cdot r \cdot \sin\left(\frac{\theta}{2}\right) \cdot \frac{1 - \cos\left(\frac{\theta}{2}\right)}{\theta - \sin(\theta)} \\ \text{if } c > r \\ \quad \theta \leftarrow 2 \cdot \arccos\left(\frac{c-r}{r}\right) \\ \quad A_c \leftarrow \pi \cdot r^2 - \frac{r^2 \cdot (\theta - \sin(\theta))}{2} \\ \quad y_c \leftarrow \frac{4}{3} \cdot r \cdot \sin\left(\frac{\theta}{2}\right) \cdot \frac{1 - \cos\left(\frac{\theta}{2}\right)}{2\pi - \theta + \sin(\theta)} \\ (A_c \ y_c)^T \end{array} \right|$$

Nominal axial load and moment capacity P_n and M_{xn} :

$$f3(D, N, n, c) \equiv \left| \begin{array}{l} X \leftarrow f2(D, c) \\ A_c \leftarrow X_0 \\ y_c \leftarrow X_1 \\ f_{se} \leftarrow f_{se}(D, N, n, c) \\ y \leftarrow coord(D, N, n) \\ P_n \leftarrow 0.85 \cdot f_c \cdot A_c + \sum (f_{se} \cdot A_{b_n}) \\ M_{xn} \leftarrow 0.85 \cdot f_c \cdot A_c \cdot y_c + A_{b_n} \cdot (f_{se} \cdot y) \\ ((P_n \ M_{xn}))^T \end{array} \right|$$

$$P'_n(D, N, n, c) \equiv f3(D, N, n, c)_0$$

$$M'_{xn}(D, N, n, c) \equiv f3(D, N, n, c)_1$$

Useable axial load ϕP_n and moment capacity ϕM_{xn} before reductions for

$\rho < 0.01$, and $P_n > 0.8 \cdot P_o$ for circular ties or $P_n > 0.85 \cdot P_o$ for spiral reinforcement:

$$\begin{aligned} f4(D, N, n, c) \equiv & \begin{cases} X \leftarrow f3(D, N, n, c) \\ P_n \leftarrow X_0 \\ A_g \leftarrow \frac{\pi \cdot D^2}{4} \\ y \leftarrow \text{coord}(D, N, n) \\ y \leftarrow -y + \frac{D}{2} \\ d \leftarrow \max(y) \\ d' \leftarrow cl + \frac{d_{bn}}{2} \\ \gamma \leftarrow \frac{d - d'}{D} \\ c_b \leftarrow \frac{\epsilon_c \cdot d}{\epsilon_y + \epsilon_c} \\ P_b \leftarrow P'_n(D, N, n, c_b) \\ \phi_c \leftarrow \text{if}(\text{Spiral}, 0.75, 0.7) \\ \phi \leftarrow \begin{cases} \phi_c & \text{if } \phi_c \cdot P_n \geq 0.10 \cdot f'_c \cdot A_g \\ \text{otherwise} \\ \text{cond} \leftarrow (\gamma \geq 0.7) \cdot (f_y \leq 60) + (\phi_c \cdot P_b > 0.10 \cdot f'_c \cdot A_g) \\ 0.9 - (0.9 - \phi_c) \cdot \frac{\phi_c \cdot P_n}{0.10 \cdot f'_c \cdot A_g} & \text{if cond} \\ 0.9 - (0.9 - \phi_c) \cdot \frac{P_n}{P_b} & \text{otherwise} \end{cases} \\ X \leftarrow X \cdot \phi \\ X_2 \leftarrow \phi \\ X \end{cases} \end{aligned}$$

Useable axial load ϕP_n moment capacity ϕM_{xn} and splicing stress f_{sp} for known values of c .

$$\begin{aligned}
 f5(D, N, n, c) &\equiv X \leftarrow f4(D, N, n, c) \\
 \phi P_n &\leftarrow X_0 \\
 \phi &\leftarrow X_2 \\
 A_s &\leftarrow A_{b_n} \cdot N \\
 A_g &\leftarrow \frac{\pi \cdot D^2}{4} \\
 \rho &\leftarrow \frac{A_s}{A_g} \\
 f_{sp} &\leftarrow \min(f_s(D, N, n, c)) \\
 R_p &\leftarrow \text{if} \left(\rho \geq 0.01, 1, \frac{\rho}{0.01} \right) \\
 P_o &\leftarrow 0.85 \cdot f_c \cdot A_g + A_s \cdot (f_y - 0.85 \cdot f_c) \\
 k &\leftarrow \text{if}(\text{Spiral}, 0.85, 0.8) \\
 R_o &\leftarrow \text{if} \left(R_p \cdot \phi P_n \leq \phi \cdot k \cdot P_o, 1, \frac{k \cdot \phi \cdot P_o}{R_p \cdot \phi P_n} \right) \\
 X &\leftarrow R_o \cdot X \\
 X_2 &\leftarrow f_{sp} \\
 X_3 &\leftarrow \rho \\
 X &
 \end{aligned}$$

Neutral axis location for moment about the X axis:

$$c'(D, N, n, P_u, M_{xu}) \equiv \left| \begin{array}{l} c \leftarrow \frac{3}{4} \cdot D \\ c_{\min} \leftarrow \text{root}(P'_n(D, N, n, c), c) \\ e_y \leftarrow \frac{M_{xu}}{P_u} \\ c \leftarrow \max\left(\left(\frac{3}{4} \cdot D, c_{\min}\right)\right) \\ c \leftarrow \text{root}(P'_n(D, N, n, c) \cdot e_y - M'_{xn}(D, N, n, c), c) \end{array} \right.$$

Useable axial load ϕP_n , moment capacity ϕM_{xn} , and splicing stress f_{sp} for known values of P_u and M_{xu} :

$$\phi P'_n(D, N, n, P_u, M_{xu}) \equiv \left| \begin{array}{l} A_g \leftarrow \frac{\pi \cdot D^2}{4} \\ \rho \leftarrow \frac{N \cdot A_{bn}}{A_g} \\ c1 \leftarrow (\rho < 0.003) + (\rho > 0.05) + (f_y > 80) \\ c2 \leftarrow (P_u \leq 0) + (M_{xu} = 0) \\ X \leftarrow (0 \ 0 \ 0 \ \rho)^T \text{ if } c1 + c2 \\ \text{otherwise} \\ \left| \begin{array}{l} c \leftarrow c'(D, N, n, P_u, M_{xu}) \\ X \leftarrow f5(D, N, n, c) \end{array} \right. \end{array} \right.$$

Subject:

FOUNDATION ANALYSIS

Location:

180-ft Sabre Monopole
Enfield, CT

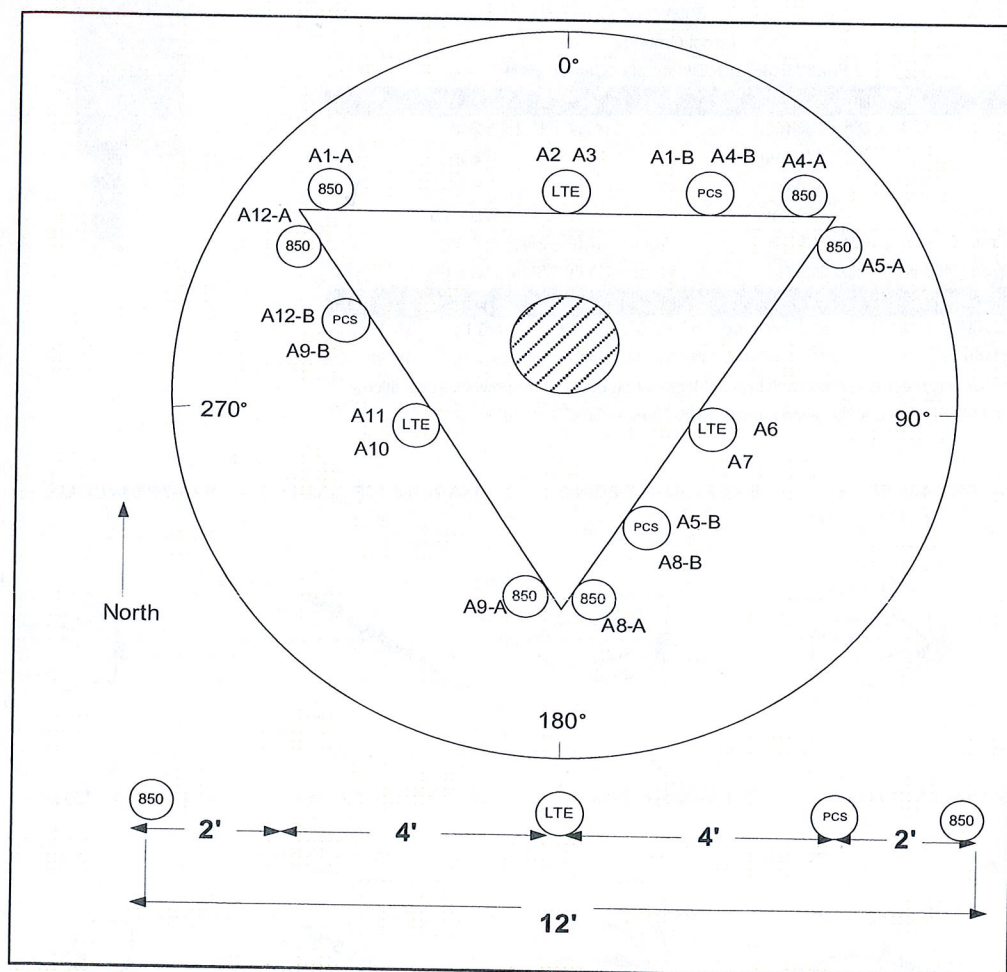
Rev. 0: 2/1/12

Prepared by: T.J.L. Checked by: C.F.C.
Job No. 12001.CO15

SITE NAME		SOMERS WEST CT			ECP - CELL #		8		16								
LATITUDE		42-00-57.37 N			LONGITUDE		72-31-43.46 W										
Additional Comments: LTE Phase 4 Add and associated ANTMO.					SAVE BUTTON												
					STRUCTURE TYPE		MONOPOLE										
700 Mhz - LTE ANTENNA ADD		ALPHA		BETA		GAMMA											
EQUIPMENT TYPE		eNodeB		eNodeB		eNodeB											
ANTENNA TYPE		BXA-70063-4CF-EDIN-5		SLCP 2X6014		SLCP 2X6014											
QTY OF ANTENNAS PER FACE		1		1		1											
ORIENTATION (DEG)		30		150		270											
DOWN TILT (MECH/DEG)		2		0		2											
RAD CTR (FT AGL)		150		150		150											
TMA - QTY / MODEL																	
DIPLEXER - QTY / MODEL																	
850 Cellular - Current Config		ALPHA		BETA		GAMMA											
EQUIPMENT TYPE		Cellular Modcell 4.0		Cellular Modcell 4.0		Cellular Modcell 4.0											
ANTENNA TYPE		DB844F90A-SX_0		DB844F90A-SX_0		DB844F90A-SX_0											
QTY OF ANTENNAS PER FACE		2		2		2											
ORIENTATION (DEG)		30		150		270											
DOWN TILT (MECH/DEG)		0		0		0											
RAD CTR (FT AGL)		150		150		150											
TMA - QTY / MODEL																	
DIPLEXER - QTY / MODEL																	
850 Cellular - Future Config		ALPHA		BETA		GAMMA											
EQUIPMENT TYPE		Cellular Modcell 4.0		Cellular Modcell 4.0		Cellular Modcell 4.0											
ANTENNA TYPE		LPA-80080-4CF-EDIN-0		LPA-80080-4CF-EDIN-5		LPA-80080-4CF-EDIN-5											
QTY OF ANTENNAS PER FACE		2		2		2											
ORIENTATION (DEG)		30		150		270											
DOWN TILT (MECH/DEG)		0		0		0											
RAD CTR (FT AGL)		150		150		150											
TMA - QTY / MODEL																	
DIPLEXER - QTY / MODEL		2 FD9R6004/2C-3L		2 FD9R6004/2C-3L		2		FD9R6004/2C-3L									
DIPLEX WITH LTE CABLE																	
1900 PCS - Current Config		ALPHA		BETA		GAMMA											
EQUIPMENT TYPE		PCS Modcell 4.0		PCS Modcell 4.0		PCS Modcell 4.0											
ANTENNA TYPE		948F85T2E-M_2		948F85T2E-M_2		948F85T2E-M_2											
QTY OF ANTENNAS PER FACE		2		2		2											
ORIENTATION (DEG)		30		150		270											
DOWN TILT (MECH/DEG)		0		0		0											
RAD CTR (FT AGL)		150		150		150											
TMA - QTY / MODEL																	
DIPLEXER - QTY / MODEL																	
1900 PCS - Future Config		ALPHA		BETA		GAMMA											
EQUIPMENT TYPE		PCS Modcell 4.0		PCS Modcell 4.0		PCS Modcell 4.0											
ANTENNA TYPE		BXA-171085-8BF-EDIN-2		BXA-171085-8BF-EDIN-2		BXA-171085-8BF-EDIN-2											
QTY OF ANTENNAS PER FACE		1		1		1											
ORIENTATION (DEG)		30		150		270											
DOWN TILT (MECH/DEG)		0		0		0											
RAD CTR (FT AGL)		150		150		150											
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)		190							
JUMPER SIZE		1/2 "		TOTAL # OF TOP JUMPERS		18		TOP JUMPER (FT)		12							
Equipment Cable Ordering		MAIN CABLE		12		+		6		TOP JUMPER #		12		+		6	
TX / RX FREQUENCIES					TX POWER OUTPUT												
Cellular A-Band		PCS F / AWS-Band		700 Mhz C - B		Cellular (Watts)		20									
TX - 869-880,890-891.5 MHz		TX - 1970-1975 / 2145-21		TX - 746-757		PCS (Watts)		16									
RX - 824-835,845-846.5 MHz		RX - 1890-1895 / 1745-17		RX - 776-787		LTE (Watts)		40									

ALPHA				BETA				GAMMA			
Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code
A1-A	800	Tx1/Rx0	RED	A5-A	800	Tx2/Rx0	BLUE	A9-A	800	Tx3/Rx0	GREEN
A1-B	1900	Tx1/Rx0	RED/WHITE	A5-B	1900	Tx2/Rx0	BLUE/WHITE	A9-B	1900	Tx3/Rx0	GREEN/WHITE
A2	700	Tx1/Rx0	RED/ORANGE	A6	700	Tx2/Rx0	BLUE/ORANGE	A10	700	Tx3/Rx0	GREEN/ORANGE
A3	700	Tx4/Rx1	RED/RED/ORANGE	A7	700	Tx5/Rx1	BLUE/BLUE/ORANGE	A11	700	Tx6/Rx1	GREEN/GREEN/ORANGE
A4-B	1900	Tx4/Rx1	RED/RED/WHITE	A8-B	1900	Tx5/Rx1	BLUE/BLUE/WHITE	A12-B	1900	Tx6/Rx1	GREEN/GREEN/WHITE
A4-A	800	Tx4/Rx1	RED/RED	A8-A	800	Tx5/Rx1	BLUE/BLUE	A12-A	800	Tx6/Rx1	GREEN/GREEN
RF ENGINEER				RF MANAGER				INITIALS		DATE	
Prepared By: Jay Latorre				Steve Weatherbee				JFL		1/13/2012	

Site Configuration



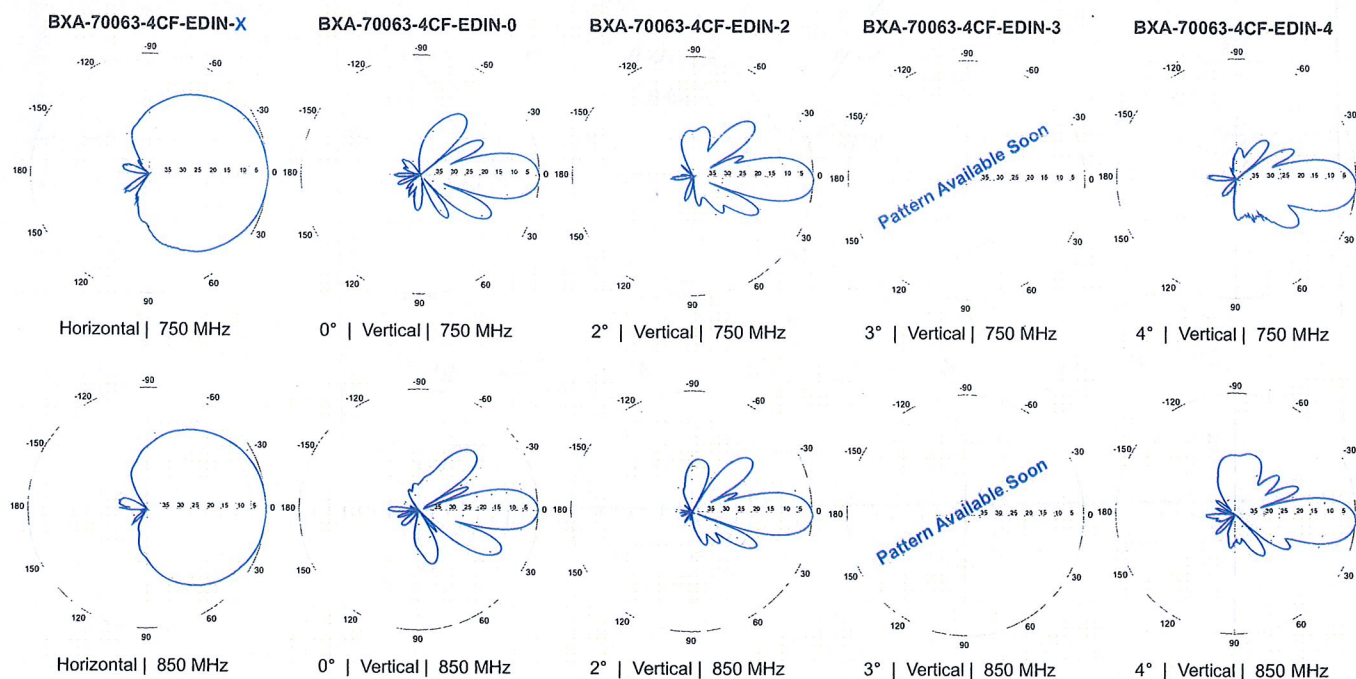
BXA-70063-4CF-EDIN-X

X-Pol | FET Panel | 63° | 13.0 dBd

Replace "X" with desired electrical downtilt.

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

Electrical Characteristics		696-900 MHz	
Frequency bands		696-806 MHz	806-900 MHz
Polarization		$\pm 45^\circ$	
Horizontal beamwidth		65°	63°
Vertical beamwidth		17°	15°
Gain		12.5 dBd (14.6 dBi)	13.0 dBd (15.1 dBi)
Electrical downtilt (X)		0, 2, 3, 4, 5, 6, 8, 9, 10, 12, 14	
Impedance		50Ω	
VSWR		$\leq 1.35:1$	
Upper sidelobe suppression (0°)		-16.3 dB	-22.1 dB
Front-to-back ratio (+/-30°)		-36.1 dB	-34.9 dB
Null fill		5% (-26.02 dB)	
Isolation between ports		< -30 dB	
Input power with EDIN connectors		500 W	
Input power with NE connectors		300 W	
Lightning protection		Direct Ground	
Connector(s)		2 Ports / EDIN or NE / Female / Center (Back)	
Mechanical Characteristics			
Dimensions Length x Width x Depth		1205 x 285 x 133 mm	47.4 x 11.2 x 5.2 in
Depth with z-brackets		173 mm	6.8 in
Weight without mounting brackets		4.5 kg	9.9 lbs
Survival wind speed		> 201 km/hr	> 125 mph
Wind area		Front: 0.34 m ² Side: 0.16 m ²	Front: 3.7 ft ² Side: 1.7 ft ²
Wind load @ 161 km/hr (100 mph)		Front: 498 N Side: 260 N	Front: 111 lbf Side: 55 lbf
Mounting Options			
	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	36210002	50-160 mm 2.0-6.3 in	4.5 kg 10 lbs
2-Point Downtilt Bracket Kit (0-20°)	36114003	50-160 mm 2.0-6.3 in	4.9 kg 11 lbs
Downtilt Mounting Applications	A mounting bracket and downtilt bracket kit must be ordered for downtilt applications		
Concealment Configurations	For concealment configurations, order BXA-70063-4CF-EDIN-X-FP		



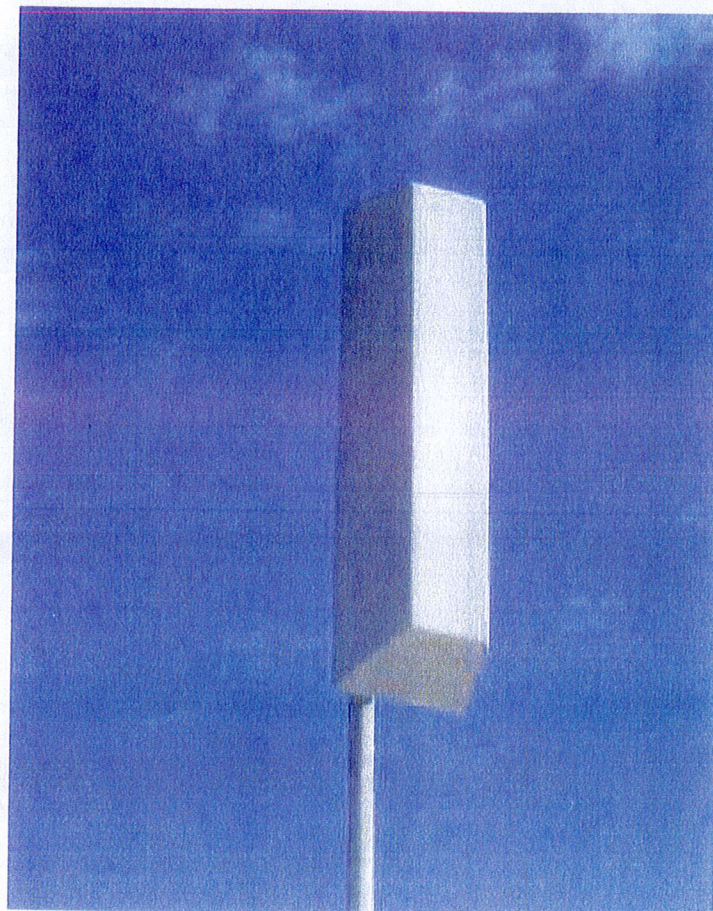
Quoted performance parameters are provided to offer typical or range values only and may vary as a result of normal manufacturing and operational conditions. Extreme operational conditions and/or stress on structural supports is beyond our control. Such conditions may result in damage to this product. Improvements to product may be made without notice.

SLCP 2x6014

Dual (2x) Circularly Polarized log-periodic antenna

Features

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



Electrical specifications

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

Mechanical specifications

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

Materials

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

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

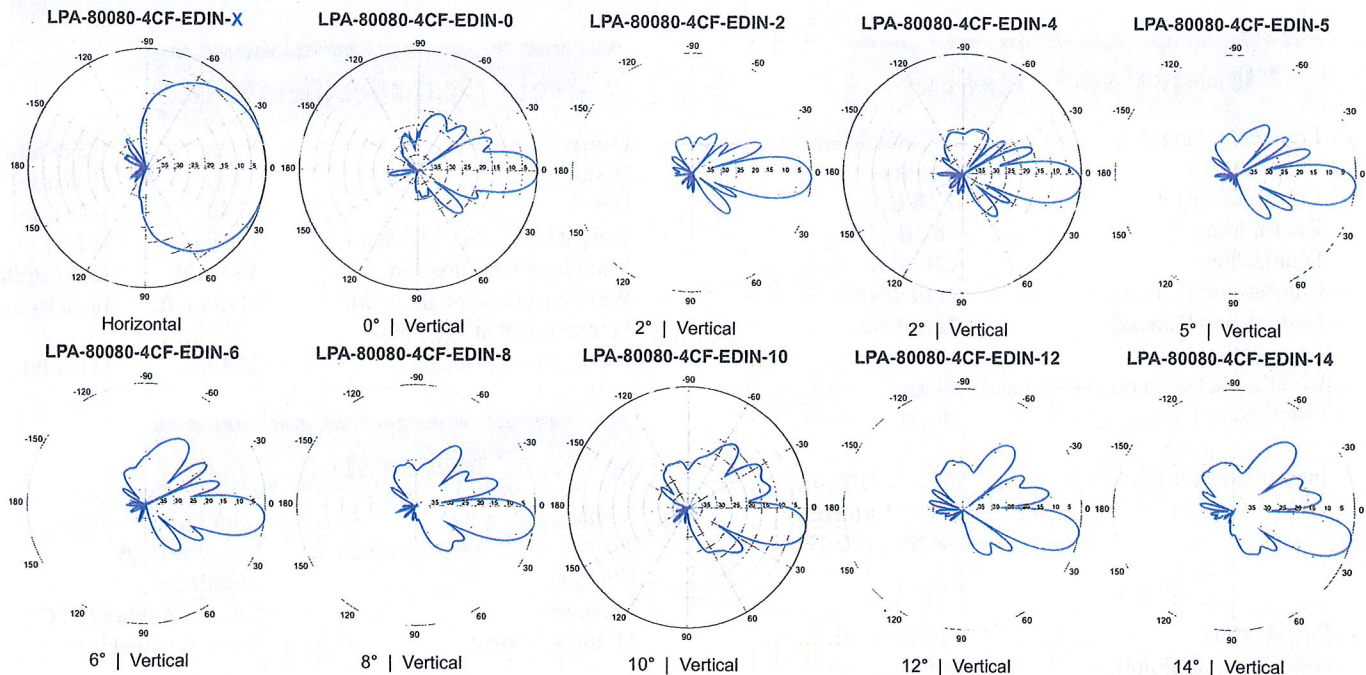
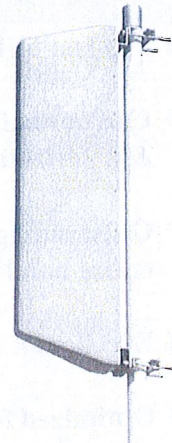
LPA-80080-4CF-EDIN-X

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 m ² Side: 0.40 m ² Front: 1.8 ft ² Side: 4.3 ft ²
Wind load @ 161 km/hr (100 mph)	Front: 254 N Side: 574 N Front: 57 lbf Side: 129 lbf
Mounting Options	
2-Point Mounting & Downtilt Bracket Kit (0-20°)	Part Number: 21699999 Fits Pipe Diameter: 50-102 mm 2.0-4.0 in Weight: 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.



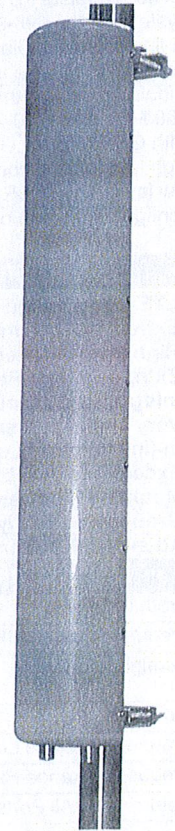
Quoted performance parameters are provided to offer typical or range values only and may vary as a result of normal manufacturing and operational conditions. Extreme operational conditions and/or stress on structural supports is beyond our control. Such conditions may result in damage to this product. Improvements to product may be made without notice.

BXA-171085-8BF-EDIN-X

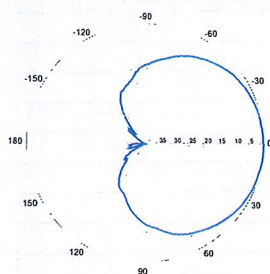
Replace "X" with desired electrical downtilt.

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 m ² Side: 0.14 m ²	Front: 2.0 ft ² Side: 1.5 ft ²	
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		

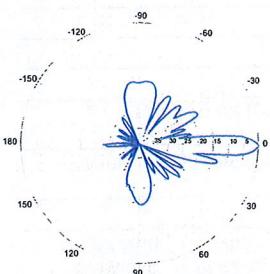


BXA-171085-8BF-EDIN-X



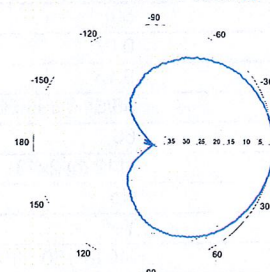
Horizontal | 1710-1880 MHz

BXA-171085-8BF-EDIN-0



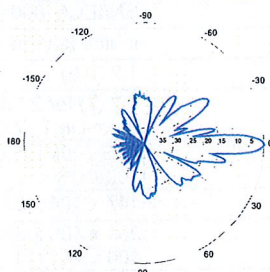
0° | Vertical | 1710-1880 MHz

BXA-171085-8BF-EDIN-X



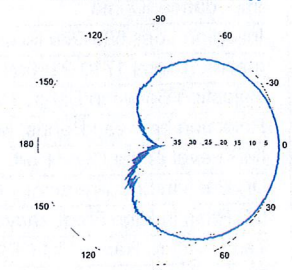
Horizontal | 1850-1990 MHz

BXA-171085-8BF-EDIN-0



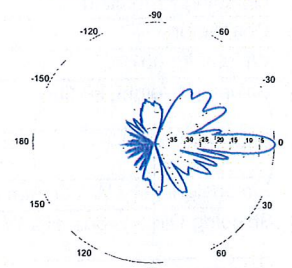
0° | Vertical | 1850-1990 MHz

BXA-171085-8BF-EDIN-X



Horizontal | 1920-2170 MHz

BXA-171085-8BF-EDIN-0



0° | Vertical | 1920-2170 MHz

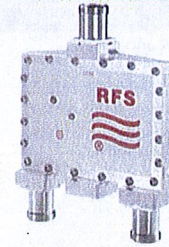
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ShareLite Wideband Diplexer – In-line 698-960 MHz/1710-2200 MHz, DC pass in high frequency path

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

RFS The Clear Choice ®

FD9R6004/2C-3L

Rev: --

Print Date: 17.03.2010

Please visit us on the internet at <http://www.rfsworld.com/>

Radio Frequency Systems

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Also admitted in Massachusetts

ORIGINAL

October 24, 2012

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CONNECTICUT
SITING COUNCIL

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

Re: **EM-VER-049-120419** – 37 Bacon Road, Enfield, Connecticut
EM-VER-134-120229 – 200 Brendan Street, Stafford, Connecticut
EM-VER-150-111219 – 6 Mountain Road, Washington, Connecticut
EM-VER-168-120316 – 478 Good Hill Road, Woodbury, Connecticut
EM-VER-018-120727 – 37 Carmen Hill Road, Brookfield, Connecticut

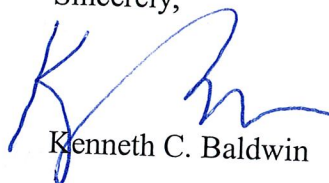
Completion of Construction Activity

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 facility modifications 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



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