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

October 11, 2011

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

RE: **EM-VER-077-110923** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 266R Center Street, Manchester, 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 September 22, 2011. The modifications are in compliance with the exception criteria in Section 16-50j-72 (b) of the Regulations of Connecticut State Agencies as changes to an existing facility site that would not increase tower height, extend the boundaries of the tower site, increase noise levels at the tower site boundary by six decibels, and increase the total radio frequencies electromagnetic radiation power density measured at the tower site boundary to or above the standard adopted by the State Department of Environmental Protection pursuant to General Statutes § 22a-162. This facility has also been carefully modeled to ensure that radio frequency emissions are conservatively below State and federal standards applicable to the frequencies now used on this tower.

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

Very truly yours,

Linda Roberts

Linda Roberts
Executive Director

LR/CDM/laf

c: The Honorable Louis A. Spadaccini, Mayor, Town of Manchester
Scott A. Shanley, general Manager, Town of Manchester
James Davis, Zoning Enforcement Officer, Town of Manchester
Crown Castle USA, Inc.

ROBINSON & COLE

EM-VER-077-110923

KENNETH C. BALDWIN

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September 22, 2011

Via Hand Delivery

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SEP 23 2011
CONNECTICUT
SITING COUNCIL

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

Re: **Notice of Exempt Modification**
266R Center Street, Manchester, Connecticut

Dear Ms. Roberts:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains wireless telecommunications antennas at the top of the existing 115-foot monopole tower at the above-referenced address. The tower and underlying property are owned by Crown Castle. The Council approved Cellco's use of this facility in Docket No. 129. Cellco now intends to modify its installation by replacing six (6) of its existing antennas with three (3) BXA-171063/12BF PCS antennas and three (3) BXA-70063/6CF LTE antennas at the same level on the tower. Cellco also intends to install six (6) coax cable diplexers on its antenna platform. Attached behind Tab 1 are the specifications for the proposed 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 Louis A. Spadaccini, Mayor of the Town of Manchester.

The planned modifications to the facility falls 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 any increase in the height of the existing structure. Cellco's replacement antennas will be located at the top of the 115-foot tower adjacent to its existing antennas.

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

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

4. The installation of replacement antennas will not increase radio frequency (RF) emissions at the facility to a level at or above the Federal Communications Commission (FCC) adopted safety standard. A cumulative power density table for the modified facility is included behind Tab 2.

Also attached is a Structural Analysis Report confirming that the tower and foundation can support the 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:
Louis A. Spadaccini, Manchester Mayor
Sandy M. Carter

Amphenol ANTENNA SOLUTIONS

BXA-171063-12BF-EDIN-X

Replace "X" with desired electrical downtilt.

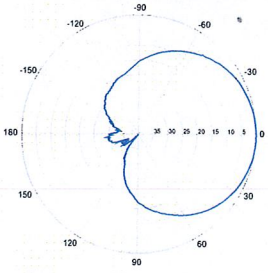
X-Pol | FET Panel | 63° | 19.0 dBi

Electrical Characteristics	1710-2170 MHz		
Frequency bands	1710-1880 MHz	1850-1990 MHz	1920-2170 MHz
Polarization	±45°	±45°	±45°
Horizontal beamwidth	68°	65°	60°
Vertical beamwidth	4.5°	4.5°	4.5°
Gain	16.1 dBd / 18.2 dBi	16.5 dBd / 18.6 dBi	16.9 dBd / 19.0 dBi
Electrical downtilt (X)	0, 2, 5		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back ratio	> 30 dB		
In-band isolation	> 28 dB		
IM3 (20W carrier)	< -150 dBc		
Input power	300 W		
Lightning protection	Direct Ground		
Connector(s)	2 Ports / EDIN / Female / Bottom		
Operating temperature	-40° to +60° C / -40° to +140° F		

Mechanical Characteristics		
Dimensions Length x Width x Depth	1820 x 154 x 105 mm	71.7 x 6.1 x 4.1 in
Depth with z-brackets	133 mm	5.2 in
Weight without mounting brackets	6.8 kg	15 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.28 m² Side: 0.19 m²	Front: 3.1 ft² Side: 2.1 ft²
Wind load @ 161 km/hr (100 mph)	Front: 460 N Side: 304 N	Front: 103 lbf Side: 68 lbf

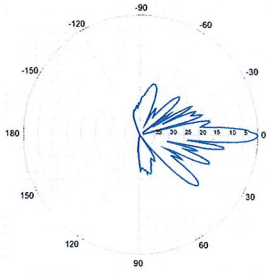
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	26799997	50-102 mm 2.0-4.0 in	2.3 kg 5 lbs
2-Point Mounting & Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	3.6 kg 8 lbs
Concealment Configurations	For concealment configurations, order BXA-171063-12BF-EDIN-X-FP		

BXA-171063-12BF-EDIN-X



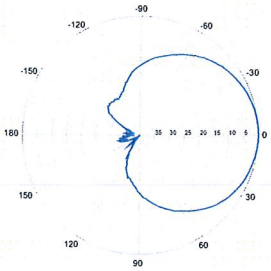
Horizontal | 1710-1880 MHz

BXA-171063-12BF-EDIN-0



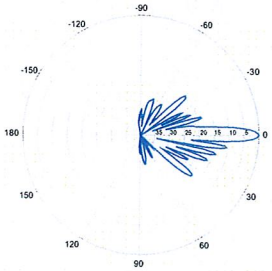
0° | Vertical | 1710-1880 MHz

BXA-171063-12BF-EDIN-X



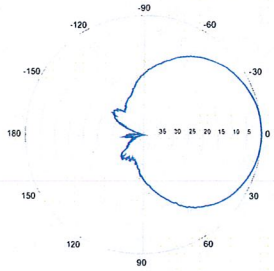
Horizontal | 1850-1990 MHz

BXA-171063-12BF-EDIN-0



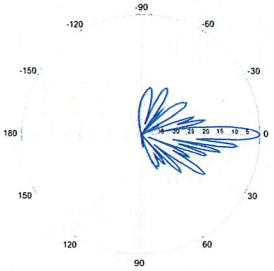
0° | Vertical | 1850-1990 MHz

BXA-171063-12BF-EDIN-X



Horizontal | 1920-2170 MHz

BXA-171063-12BF-EDIN-0

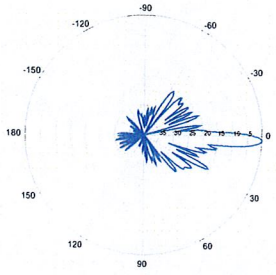


0° | Vertical | 1920-2170 MHz

BXA-171063-12BF-EDIN-X

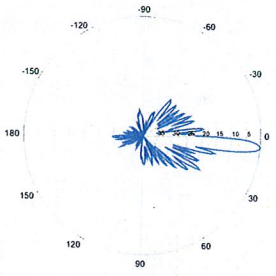
X-Pol | FET Panel | 63° | 19.0 dBi

BXA-171063-12BF-EDIN-2



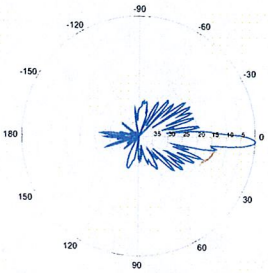
2° | Vertical | 1710-1880 MHz

BXA-171063-12BF-EDIN-5



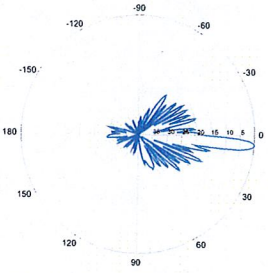
5° | Vertical | 1710-1880 MHz

BXA-171063-12BF-EDIN-2



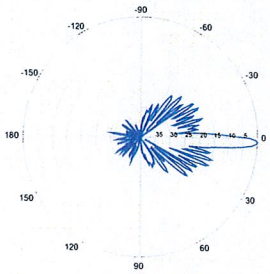
2° | Vertical | 1850-1990 MHz

BXA-171063-12BF-EDIN-5



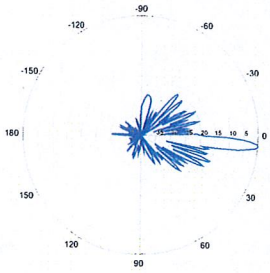
5° | Vertical | 1850-1990 MHz

BXA-171063-12BF-EDIN-2



2° | Vertical | 1920-2170 MHz

BXA-171063-12BF-EDIN-5



5° | Vertical | 1920-2170 MHz

Amphenol ANTENNA SOLUTIONS

BXA-70063-6CF-EDIN-X

X-Pol | FET Panel | 63° | 14.5 dBd

Replace "X" with desired electrical downtilt.

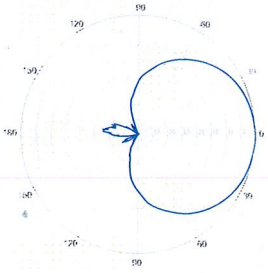
Antenna is also available with NE connector(s). Replace "EDIN" with "NE" in the model number when ordering.

Electrical Characteristics	696-900 MHz	
Frequency bands	696-806 MHz	806-900 MHz
Polarization	±45°	
Horizontal beamwidth	65°	63°
Vertical beamwidth	13°	11°
Gain	14.0 dBd (16.1 dBi)	14.5 dBd (16.6 dBi)
Electrical downtilt (X)	0, 2, 3, 4, 5, 6, 8, 10	
Impedance	50Ω	
VSWR	≤1.35:1	
Upper sidelobe suppression (0°)	-18.3 dB	-18.2 dB
Front-to-back ratio (+/-30°)	-33.4 dB	-36.3 dB
Null fill	5% (-26.02 dB)	
Isolation between ports	< -25 dB	
Input power with EDIN connectors	500 W	
Input power with NE connectors	300 W	
Lightning protection	Direct Ground	
Connector(s)	2 Ports / EDIN or NE / Female / Center (Back)	

Mechanical Characteristics		
Dimensions Length x Width x Depth	1804 x 285 x 132 mm	71.0 x 11.2 x 5.2 in
Depth with z-brackets	172 mm	6.8 in
Weight without mounting brackets	7.9 kg	17 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.51 m² Side: 0.24 m²	Front: 5.5 ft² Side: 2.6 ft²
Wind load @ 161 km/hr (100 mph)	Front: 759 N Side: 391 N	Front: 169 lbf Side: 89 lbf

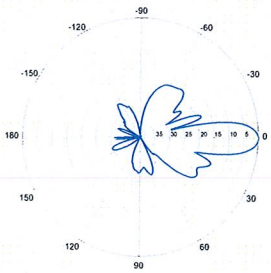
Mounting Options	Part Number	Fits Pipe Diameter	Weight
3-Point Mounting Bracket Kit	36210003	50-160 mm 2.0-6.3 in	6.3 kg 14 lbs
3-Point Downtilt Bracket Kit (0-14°)	36210004	50-160 mm 2.0-6.3 in	7.3 kg 16 lbs
Downtilt Mounting Applications	A mounting bracket and downtilt bracket kit must be ordered for downtilt applications		
Concealment Configurations	For concealment configurations, order BXA-70063-6CF-EDIN-X-FP		

BXA-70063-6CF-EDIN-X



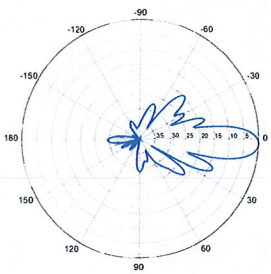
Horizontal | 750 MHz

BXA-70063-6CF-EDIN-0

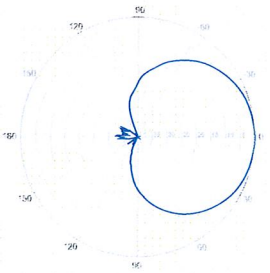


0° | Vertical | 750 MHz

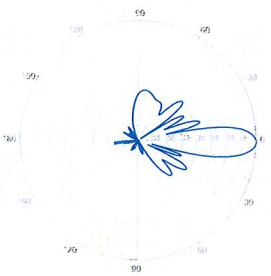
BXA-70063-6CF-EDIN-2



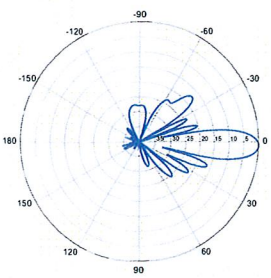
2° | Vertical | 750 MHz



Horizontal | 850 MHz



0° | Vertical | 850 MHz

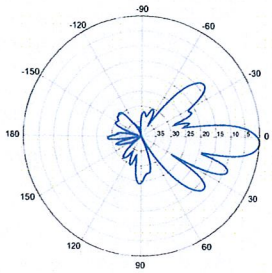


2° | Vertical | 850 MHz

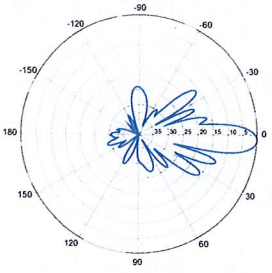
BXA-70063-6CF-EDIN-X

X-Pol | FET Panel | 63° | 14.5 dBd

BXA-70063-6CF-EDIN-3

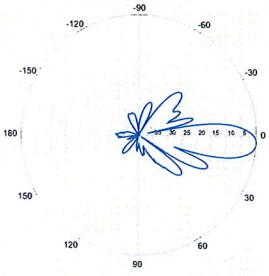


3° | Vertical | 750 MHz

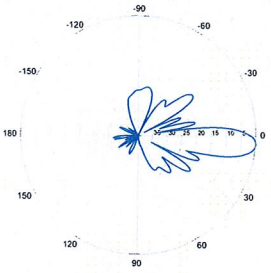


3° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-4

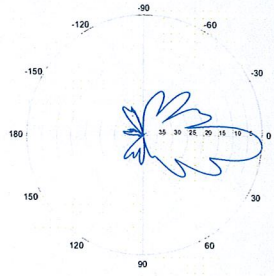


4° | Vertical | 750 MHz

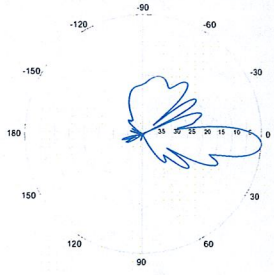


4° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-5

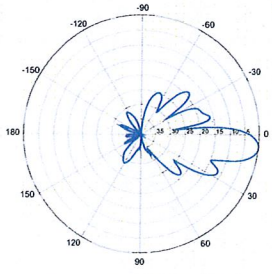


5° | Vertical | 750 MHz

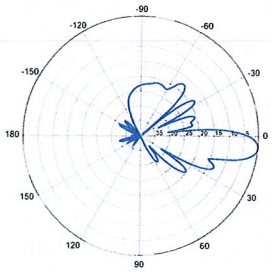


5° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-6

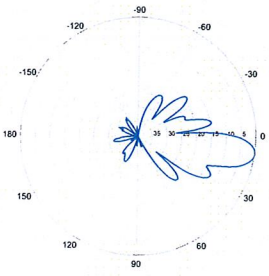


6° | Vertical | 750 MHz

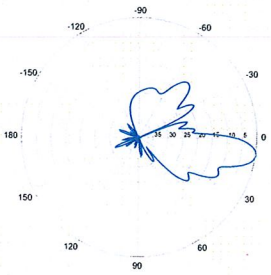


6° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-8

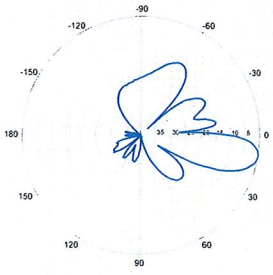


8° | Vertical | 750 MHz

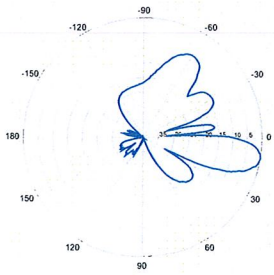


8° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-10



10° | Vertical | 750 MHz



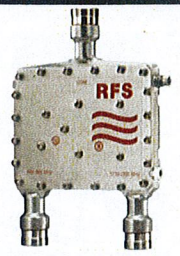
10° | Vertical | 850 MHz

Product Data Sheet | **FD9R6004/1C-3L**

ShareLite Wideband Diplexer – In-line 698-960 MHz/1710-2200 MHz, full DC pass

Product Description

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



Features/Benefits

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

Technical Specifications

Product Type	Diplexer/Cross Band Coupler
Frequency Range 1, MHz	698-960
Frequency Range 2, MHz	1710-2200
Application	LTE700, GSM900, UMTS, GSM1800, Cellular 800, PCS
Configuration	Sharelite Single diplexer, outdoor, full DC pass, with mounting hardware SEM2-1A
Mounting	Wall Mounting: With 4 screws (maximum 6mm diameter); Pole Mounting: With included clamp set 40-110mm (1.57-4.33)
Return Loss All Ports Min/Typ, dB	19/23
Power Handling Continuous, Max, W	1250 at common port; 750 in low frequency path & 500 in high frequency path
Power Handling Peak, Max, W	15000 in low frequency path & 8000 in high frequency path
Impedance, Ohms	50
Insertion Loss, Path 1, dB	0.07 typ.
Insertion Loss, Path 2, dB	0.13 typ.
Rejection Between Bands Min/Typ, dB	58/64@698-960MHz; 60/70@1710-2200MHz
IMP Level at the COM Port, Typ, dBm	-112 @ 2x43
DC Pass in Low Frequency Path	Yes
DC Pass in High Frequency Path	Yes
Temperature Range, °C (°F)	-40 to +60 (-40 to +140)
Environmental	ETSI 300-019-2-4 Class 4.1E
Ingress Protection	IP 67
Lightning Protection	EN/IEC61000-4-5 Level 4
Connectors	In-line long-neck 7-16-Female
Weight, kg (lb)	1.2 (2.6)
Shipping Weight, kg (lb)	3.2 (7) for 2 * single units in 1 * box, 9.8 (21.6) for 6 * units = 3 * Boxes in 1 * overwrap
Dimensions, H x W x D, mm (in)	147 x 164 x 37 (5.8 x 6.5 x 1.5)
Shipping Dimensions, H x W x D, mm (in)	254 x 406 x 82 (10 x 16 x 3.2) for 2 * Single Units in 1 * box, 280 x 406 x 241 (11 x 16 x 9.5) for 6 * units = 3 * Boxes in 1 * overwrap
Volume, L	0.43
Housing	Aluminum

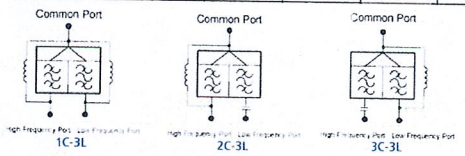
Notes

ShareLite Wideband Diplexer – In-line 698-960 MHz/1710-2200 MHz, full DC pass

Other Documentation

FD9R6004/1C-3L Installation Instructions: Wideband_Diplexer_Installation_Rev5.pdf

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



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

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

	General	Power	Density					
Site Name: Manchester								
Tower Height: Verizon @ 116ft								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*Clearwire	2	153	110	0.0091	2496	1.0000	0.91%	
*Clearwire	1	211	110	0.0063	18 GHz	1.0000	0.63%	
*XM Sat Radio	2	3141	125	0.1446	2337.49	1.0000	14.46%	
Verizon	**11**	**470**	**116**	**0.1382**	**1970**	**1.0000**	**13.82%**	
Verizon	**9**	**376**	**116**	**0.0904**	**869**	**0.5793**	**15.61%**	
Verizon	**1**	**643**	**116**	**0.0172**	**757**	**0.4973**	**3.45%**	
								48.87%
* Source: Siting Council								

Date: **August 20, 2011**

Veronica Harris
Crown Castle
1200 McArthur Blvd
Mahwah, NJ 07430

Crown Castle
2000 Corporate Drive
Canonsburg, PA 15317
(724) 416-2000

Subject: **Structural Analysis Report**

Carrier Designation:	***Verizon Wireless* Co-Locate**	
	Carrier Site Number:	
	Carrier Site Name:	Manchster, CT
Crown Castle Designation:	**Crown Castle BU Number:**	806372
	Crown Castle Site Name:	HRT 093 943228
	Crown Castle JDE Job Number:	164251
	Crown Castle Work Order Number:	430164
Engineering Firm Designation:	**Crown Castle Project Number:**	430164
Site Data:	**CENTER & PINE STREET, MANCHESTER, Hartford County, CT**	
	Latitude *41° 46' 19"*, Longitude *-72° 31' 48.8"*	
	115 Foot - Monopole Tower	

Dear Veronica Harris,

Crown Castle is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above mentioned tower. This analysis has been performed in accordance with the Crown Castle Structural 'Statement of Work' and the terms of Crown Castle Purchase Order Number 430164, in accordance with application 128651, revision 0.

The purpose of the analysis is to determine acceptability of the tower stress level. Based on our analysis we have determined the tower stress level for the structure and foundation, under the following load case, to be:

LC1: Existing + Reserved + Proposed Equipment **Sufficient Capacity**
Note: See Table I and Table II for the proposed and existing/reserved loading, respectively.

The analysis has been performed in accordance with the TIA/EIA-222-F standard and local code requirements based upon a wind speed of 80 mph fastest mile.

All equipment proposed in this report shall be installed in accordance with the attached drawings for the determined available structural capacity to be effective.

We at *Crown Castle* appreciate the opportunity of providing our continuing professional services to you and Crown Castle. If you have any questions or need further assistance on this or any other projects please give us a call.

Structural analysis prepared by: John Kazmierczak, Engineer I /FAA

Respectfully submitted by:

Aaron C. Poot, P.E.
Engineering Supervisor

RISA Tower Report - version 5.4.0

STATE OF CONNECTICUT
AARON C. POOT
No. 25050
LICENSED
PROFESSIONAL ENGINEER

8/20/11

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 115 ft Monopole tower designed by Valmont in May of 1990. The tower was originally designed for a wind speed of 90 mph per EIA-222-D.

2) ANALYSIS CRITERIA

The structural analysis was performed for this tower in accordance with the requirements of TIA/EIA-222-F Structural Standards for Steel Antenna Towers and Antenna Supporting Structures using a fastest mile wind speed of 80 mph with no ice, 28.1 mph with 1 inch ice thickness and 50 mph under service loads.

Table 1 - Proposed Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
115	116	3	antel	BXA-171063-12BF w/ Mount Pipe	-	-	-
		2	antel	BXA-70063/6CFx4 w/ Mount Pipe			
		1	antel	BXA-70063/6CFx6 w/ Mount Pipe			
		6	rfs celwave	FD9R6004/1C-3L			

Table 2 - Existing and Reserved Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
115	116	6	antel	BSA-185090/16CF w/ Mount Pipe	-	-	2
		2	antel	BXA-70063/6CFx4 w/ Mount Pipe	18	1-5/8	1
		1	antel	BXA-70063/6CFx6 w/ Mount Pipe			
		6	decibel	DB844G65ZAXY w/ Mount Pipe			
	115	1	tower mounts	Platform Mount [LP 713-1]			
		2	andrew	VHLP1-23			
	108	1	andrew	VHLP2-11-2GR			
		1	motorola	TIMING 2000			
	107	1	andrew	VHLP1-23			
105		3	argus technologies	LLPX310R w/ Mount Pipe	5 3 5	1/4 1/2 5/16	2
		4	dragonwave	HORIZON COMPACT	3	5/8	
	105	3	samsung telecommunications	WIMAX DAP HEAD			
		1	tower mounts	Side Arm Mount [SO 701-3]			

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
99	99	1	tower mounts	Platform Mount [LP 713-1]	-	-	1

Notes:
1) Existing Equipment
2) Existing Equipment to be Removed; not considered in this analysis
3) Reserved Equipment

Table 3 - Design Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
112	112	4	RFS/Celwave	PD10017	-	-
99	99	12	RFS/Celwave	PD1132	-	-

3) ANALYSIS PROCEDURE

Table 4 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	Testwell Craig Laboratories of CT, Inc.	262174	CCISITES
4-TOWER FOUNDATION MAPPING REPORT	FDH Engineering	2668863	CCISITES
4-TOWER MANUFACTURER DRAWINGS	Valmont	262172	CCISITES

3.1) Analysis Method

RISATower (version 5.4.2.0), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

3.2) Assumptions

1) Tower and structures were built in accordance with the manufacturer's specifications.
2) The tower and structures have been maintained in accordance with the manufacturer's specification.
3) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
4) When applicable, transmission cables are considered as structural components for calculating wind loads as allowed by TIA/EIA-222-F.
5) The existing base plate grout was not considered in this analysis.

This analysis may be affected if any assumptions are not valid or have been made in error. Crown Castle should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 5 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
L1	115 - 72.3333	Pole	TP30.45x21.91x0.2188	1	-6.84	1013.90	52.0	Pass
L2	72.3333 - 29.3333	Pole	TP38.61x29.0784x0.3125	2	-13.15	1944.14	58.2	Pass
L3	29.3333 - 0	Pole	TP43.85x36.8519x0.375	3	-20.80	2729.12	59.5	Pass
							Summary	
						Pole (L3)	59.5	Pass
						RATING =	59.5	Pass

Table 6 - Tower Component Stresses vs. Capacity - LC1

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	55.2	Pass
1	Base Plate	0	35.3	Pass
1	Base Foundation Soil Interaction	0	70.2	Pass

Structure Rating (max from all components) =	70.2%

Notes:
1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.

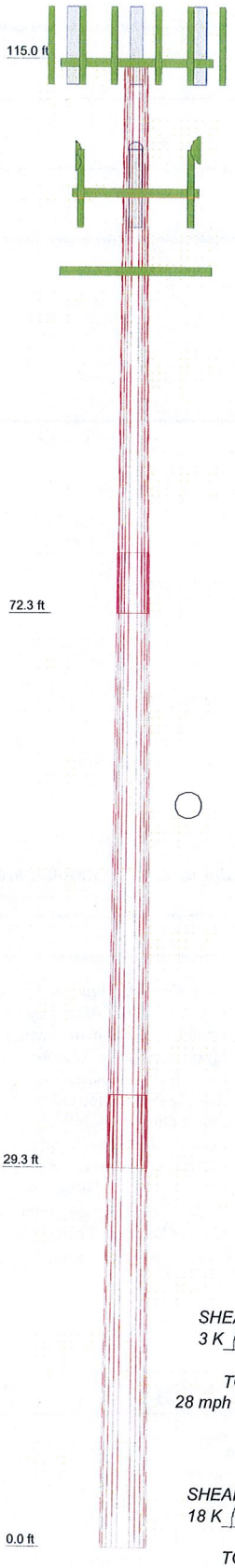
4.1) Recommendations

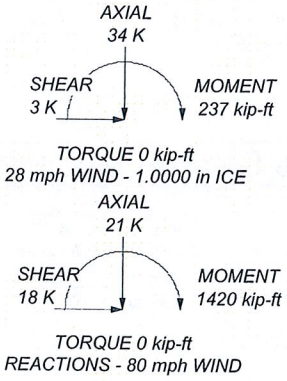
The tower and its foundation have sufficient capacity to support existing, reserved, and proposed loading. No modifications are required at this time.

APPENDIX A

RISA TOWER OUTPUT

Section	1	2	3
Length (ft)	42'8-1/32"	47'8-1/32"	35'
Number of Sides	12	12	12
Thickness (in)	0.2188	0.3125	0.3750
Socket Length (ft)	4'8-1/32"	5'8-1/32"	
Top Dia (in)	21.9100	29.0784	36.8519
Bot Dia (in)	30.4500	38.6100	43.8500
Grade		A572-65	
Weight (K)	2.7	5.5	5.7





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
BXA-70063/6CFx4 w/ Mount Pipe	115	HORIZON COMPACT	105
(2) DB844G65ZAXY w/ Mount Pipe	115	WIMAX DAP HEAD	105
BXA-70063/6CFx4 w/ Mount Pipe	115	LLPX310R w/ Mount Pipe	105
(2) DB844G65ZAXY w/ Mount Pipe	115	HORIZON COMPACT	105
BXA-70063/6CFx6 w/ Mount Pipe	115	TIMING 2000	105
(2) DB844G65ZAXY w/ Mount Pipe	115	WIMAX DAP HEAD	105
BXA-171063-12BF w/ Mount Pipe	115	LLPX310R w/ Mount Pipe	105
BXA-70063/6CFx4 w/ Mount Pipe	115	HORIZON COMPACT	105
(2) FD9R6004/1C-3L	115	HORIZON COMPACT	105
BXA-171063-12BF w/ Mount Pipe	115	WIMAX DAP HEAD	105
BXA-70063/6CFx4 w/ Mount Pipe	115	Side Arm Mount [SO 701-3]	105
(2) FD9R6004/1C-3L	115	VHLP1-23	105
BXA-171063-12BF w/ Mount Pipe	115	VHLP2-11-2GR	105
BXA-70063/6CFx6 w/ Mount Pipe	115	VHLP1-23	105
(2) FD9R6004/1C-3L	115	VHLP1-23	105
Platform Mount [LP 713-1]	115	Platform Mount [LP 713-1]	99
LLPX310R w/ Mount Pipe	105		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Hartford County, Connecticut.
2. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 28 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 59.5%

CROWN CASTLE
We Are Solutions
Crown Castle
2000 Corporate Drive
Canonsburg, PA
Phone: (724) 416-2000
FAX:

Job:	***BU #806372***		
Project:			
Client: Crown Castle	Drawn by: Firas Abdelahad	App'd:	
Code: TIA/EIA-222-F	Date: 08/20/11	Scale: NTS	
Path: R:\SA Models - Letters\Work Area\JKazmierczak\806372\temp\aa\806372.eri		Dwg No. E-1	

RISATower	Job	Page
	BU #806372	1 of 14
Crown Castle 2000 Corporate Drive Canonsburg, PA Phone: (724) 416-2000 FAX:	**Project**	**Date** 10:15:46 08/20/11
	Client Crown Castle	**Designed by** Firas Abdelahad

Tower Input Data

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

Tower is located in Hartford County, Connecticut.
Basic wind speed of 80 mph.
Nominal ice thickness of 1.0000 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 28 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	115'-72'3-31/32"	42'8-1/32"	4'8-1/32"	12	21.9100	30.4500	0.2188	0.8750	A572-65 (65 ksi)
L2	72'3-31/32"-29'3 -31/32"	47'8-1/32"	5'8-1/32"	12	29.0784	38.6100	0.3125	1.2500	A572-65 (65 ksi)
L3	29'3-31/32"-0'	35'		12	36.8519	43.8500	0.3750	1.5000	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	22.6829	15.2788	917.5793	7.7655	11.3494	80.8484	1859.2645	7.5197	5.2856	24.163
	31.5242	21.2941	2484.0378	10.8228	15.7731	157.4857	5033.3340	10.4803	7.5743	34.626
L2	31.0703	28.9457	3057.2253	10.2982	15.0626	202.9676	6194.7673	14.2462	6.9555	22.258
	39.9720	38.5369	7214.4482	13.7105	20.0000	360.7228	14618.4279	18.9667	9.5100	30.432
L3	39.3249	44.0458	7480.4210	13.0587	19.0893	391.8652	15157.3610	21.6780	8.8713	23.657
	45.3969	52.4961	12664.6112	15.5641	22.7143	557.5611	25661.9358	25.8370	10.7468	28.658

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 115'-72'3-31/32"				1	1	1		
L2 72'3-31/32"-29'3-31/32"				1	1	1		
L3 29'3-31/32"-0'				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
LDF7-50A(1-5/8")	C	No	Inside Pole	115' - 0'	12	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
						2" Ice	0.00	0.82
						4" Ice	0.00	0.82
LDF7-50A(1-5/8")	C	No	CaAa (Out Of Face)	115' - 0'	5	No Ice	0.00	0.82
						1/2" Ice	0.00	2.33
						1" Ice	0.00	4.46
						2" Ice	0.00	10.54
						4" Ice	0.00	30.04
LDF7-50A(1-5/8")	C	No	CaAa (Out Of Face)	115' - 0'	1	No Ice	0.20	0.82
						1/2" Ice	0.30	2.33
						1" Ice	0.40	4.46
						2" Ice	0.60	10.54
						4" Ice	1.00	30.04
*								
FSJ1-50A(1/4")	C	No	Inside Pole	105' - 0'	5	No Ice	0.00	0.04
						1/2" Ice	0.00	0.04
						1" Ice	0.00	0.04
						2" Ice	0.00	0.04
						4" Ice	0.00	0.04
FSJ4-50B(1/2")	C	No	Inside Pole	105' - 0'	3	No Ice	0.00	0.14
						1/2" Ice	0.00	0.14
						1" Ice	0.00	0.14
						2" Ice	0.00	0.14
						4" Ice	0.00	0.14
HJ4.5-50(5/8")	C	No	Inside Pole	105' - 0'	3	No Ice	0.00	0.40
						1/2" Ice	0.00	0.40

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
						1" Ice	0.00	0.40
						2" Ice	0.00	0.40
						4" Ice	0.00	0.40
9207(5/16")	C	No	Inside Pole	105' - 0'	5	No Ice	0.00	0.60
						1/2" Ice	0.00	0.60
						1" Ice	0.00	0.60
						2" Ice	0.00	0.60
						4" Ice	0.00	0.60
2-1/2" Rigid Conduit	C	No	Inside Pole	105' - 0'	2	No Ice	0.00	3.00
						1/2" Ice	0.00	3.00
						1" Ice	0.00	3.00
						2" Ice	0.00	3.00
						4" Ice	0.00	3.00

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	115'-72'3-31/32"	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	8.448	0.98
L2	72'3-31/32"-29'3-3 1/32"	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	8.514	1.10
L3	29'3-31/32"-0'	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	5.808	0.75

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	115'-72'3-31/32"	A	1.132	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	18.109	2.12
L2	72'3-31/32"-29'3-3 1/32"	A	1.053	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	18.251	2.25
L3	29'3-31/32"-0'	A	1.000	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	11.983	1.45

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	115'-72'3-31/32"	-0.2358	0.1361	-0.4304	0.2485
L2	72'3-31/32"-29'3-31/	-0.2406	0.1389	-0.4540	0.2621

Section	Elevation	CP_X	CP_Z	CP_X Ice	CP_Z Ice
	ft	in	in	in	in
L3	32" 29'3-31/32"-0'	-0.2431	0.1404	-0.4531	0.2616

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
BXA-70063/6CFx4 w/ Mount Pipe	A	From Leg	4.00 0' 1'	0.0000	115'	No Ice	7.97	5.40	0.04
						1/2" Ice	8.61	6.55	0.10
						1" Ice	9.22	7.41	0.17
						2" Ice	10.46	9.18	0.33
						4" Ice	13.07	12.93	0.79
(2) DB844G65ZAXY w/ Mount Pipe	A	From Leg	4.00 0' 1'	0.0000	115'	No Ice	4.90	4.92	0.03
						1/2" Ice	5.35	5.60	0.08
						1" Ice	5.80	6.28	0.13
						2" Ice	6.73	7.71	0.26
						4" Ice	8.73	10.83	0.62
BXA-70063/6CFx4 w/ Mount Pipe	B	From Leg	4.00 0' 1'	0.0000	115'	No Ice	7.97	5.40	0.04
						1/2" Ice	8.61	6.55	0.10
						1" Ice	9.22	7.41	0.17
						2" Ice	10.46	9.18	0.33
						4" Ice	13.07	12.93	0.79
(2) DB844G65ZAXY w/ Mount Pipe	B	From Leg	4.00 0' 1'	0.0000	115'	No Ice	4.90	4.92	0.03
						1/2" Ice	5.35	5.60	0.08
						1" Ice	5.80	6.28	0.13
						2" Ice	6.73	7.71	0.26
						4" Ice	8.73	10.83	0.62
BXA-70063/6CFx6 w/ Mount Pipe	C	From Leg	4.00 0' 1'	0.0000	115'	No Ice	7.97	5.40	0.03
						1/2" Ice	8.61	6.55	0.08
						1" Ice	9.22	7.41	0.15
						2" Ice	10.46	9.18	0.31
						4" Ice	13.07	12.93	0.77
(2) DB844G65ZAXY w/ Mount Pipe	C	From Leg	4.00 0' 1'	0.0000	115'	No Ice	4.90	4.92	0.03
						1/2" Ice	5.35	5.60	0.08
						1" Ice	5.80	6.28	0.13
						2" Ice	6.73	7.71	0.26
						4" Ice	8.73	10.83	0.62
*									
BXA-171063-12BF w/ Mount Pipe	A	From Leg	4.00 0' 1'	0.0000	115'	No Ice	4.97	5.23	0.04
						1/2" Ice	5.52	6.39	0.08
						1" Ice	6.04	7.26	0.14
						2" Ice	7.09	9.05	0.27
						4" Ice	9.36	12.82	0.67
BXA-70063/6CFx4 w/ Mount Pipe	A	From Leg	4.00 0' 1'	0.0000	115'	No Ice	7.97	5.40	0.04
						1/2" Ice	8.61	6.55	0.10
						1" Ice	9.22	7.41	0.17
						2" Ice	10.46	9.18	0.33
						4" Ice	13.07	12.93	0.79
(2) FD9R6004/1C-3L	A	From Leg	4.00 0' 1'	0.0000	115'	No Ice	0.37	0.08	0.00
						1/2" Ice	0.45	0.14	0.01
						1" Ice	0.54	0.20	0.01

Description	Face or Leg	Offset Type	Offsets: Horz Lateral / Vert (ft / ft / ft)	Azimuth Adjustment (°)	Placement (ft)		C_AA_A Front (ft^2)	C_AA_A Side (ft^2)	Weight (K)
						2" Ice	0.75	0.34	0.02
						4" Ice	1.28	0.74	0.06
BXA-171063-12BF w/ Mount Pipe	B	From Leg	4.00 0' 1'	0.0000	115'	No Ice	4.97	5.23	0.04
						1/2" Ice	5.52	6.39	0.08
						1" Ice	6.04	7.26	0.14
						2" Ice	7.09	9.05	0.27
						4" Ice	9.36	12.82	0.67
BXA-70063/6CFx4 w/ Mount Pipe	B	From Leg	4.00 0' 1'	0.0000	115'	No Ice	7.97	5.40	0.04
						1/2" Ice	8.61	6.55	0.10
						1" Ice	9.22	7.41	0.17
						2" Ice	10.46	9.18	0.33
						4" Ice	13.07	12.93	0.79
(2) FD9R6004/1C-3L	B	From Leg	4.00 0' 1'	0.0000	115'	No Ice	0.37	0.08	0.00
						1/2" Ice	0.45	0.14	0.01
						1" Ice	0.54	0.20	0.01
						2" Ice	0.75	0.34	0.02
						4" Ice	1.28	0.74	0.06
BXA-171063-12BF w/ Mount Pipe	C	From Leg	4.00 0' 1'	0.0000	115'	No Ice	4.97	5.23	0.04
						1/2" Ice	5.52	6.39	0.08
						1" Ice	6.04	7.26	0.14
						2" Ice	7.09	9.05	0.27
						4" Ice	9.36	12.82	0.67
BXA-70063/6CFx6 w/ Mount Pipe	C	From Leg	4.00 0' 1'	0.0000	115'	No Ice	7.97	5.40	0.03
						1/2" Ice	8.61	6.55	0.08
						1" Ice	9.22	7.41	0.15
						2" Ice	10.46	9.18	0.31
						4" Ice	13.07	12.93	0.77
(2) FD9R6004/1C-3L	C	From Leg	4.00 0' 1'	0.0000	115'	No Ice	0.37	0.08	0.00
						1/2" Ice	0.45	0.14	0.01
						1" Ice	0.54	0.20	0.01
						2" Ice	0.75	0.34	0.02
						4" Ice	1.28	0.74	0.06
*									
Platform Mount [LP 713-1]	C	None		0.0000	115'	No Ice	31.27	31.27	1.51
						1/2" Ice	39.68	39.68	1.93
						1" Ice	48.09	48.09	2.35
						2" Ice	64.91	64.91	3.19
						4" Ice	98.55	98.55	4.86
***									
LLPX310R w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.0000	105'	No Ice	5.07	2.98	0.05
						1/2" Ice	5.48	3.53	0.08
						1" Ice	5.91	4.09	0.13
						2" Ice	6.79	5.31	0.23
						4" Ice	8.70	8.13	0.54
HORIZON COMPACT	A	From Leg	4.00 0' 0'	0.0000	105'	No Ice	0.84	0.43	0.01
						1/2" Ice	0.97	0.52	0.02
						1" Ice	1.10	0.63	0.03
						2" Ice	1.39	0.86	0.05
						4" Ice	2.08	1.43	0.12
WIMAX DAP HEAD	A	From Leg	4.00 0' 0'	0.0000	105'	No Ice	1.80	0.78	0.03
						1/2" Ice	1.99	0.92	0.04
						1" Ice	2.18	1.07	0.06
						2" Ice	2.59	1.39	0.09
						4" Ice	3.51	2.14	0.20
*									
LLPX310R w/ Mount Pipe	B	From Leg	4.00 0'	0.0000	105'	No Ice	5.07	2.98	0.05
						1/2" Ice	5.48	3.53	0.08

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0'			1" Ice	5.91	4.09	0.13
						2" Ice	6.79	5.31	0.23
						4" Ice	8.70	8.13	0.54
HORIZON COMPACT	B	From Leg	4.00 0' 0'	0.0000	105'	No Ice	0.84	0.43	0.01
						1/2" Ice	0.97	0.52	0.02
						1" Ice	1.10	0.63	0.03
						2" Ice	1.39	0.86	0.05
						4" Ice	2.08	1.43	0.12
TIMING 2000	B	From Leg	4.00 0' 3'	0.0000	105'	No Ice	0.13	0.13	0.00
						1/2" Ice	0.18	0.18	0.00
						1" Ice	0.24	0.24	0.01
						2" Ice	0.38	0.38	0.01
						4" Ice	0.78	0.78	0.05
WIMAX DAP HEAD	B	From Leg	4.00 0' 0'	0.0000	105'	No Ice	1.80	0.78	0.03
						1/2" Ice	1.99	0.92	0.04
						1" Ice	2.18	1.07	0.06
						2" Ice	2.59	1.39	0.09
						4" Ice	3.51	2.14	0.20
*									
LLPX310R w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.0000	105'	No Ice	5.07	2.98	0.05
						1/2" Ice	5.48	3.53	0.08
						1" Ice	5.91	4.09	0.13
						2" Ice	6.79	5.31	0.23
						4" Ice	8.70	8.13	0.54
HORIZON COMPACT	C	From Leg	4.00 0' 0'	0.0000	105'	No Ice	0.84	0.43	0.01
						1/2" Ice	0.97	0.52	0.02
						1" Ice	1.10	0.63	0.03
						2" Ice	1.39	0.86	0.05
						4" Ice	2.08	1.43	0.12
HORIZON COMPACT	C	From Leg	4.00 0' 0'	0.0000	105'	No Ice	0.84	0.43	0.01
						1/2" Ice	0.97	0.52	0.02
						1" Ice	1.10	0.63	0.03
						2" Ice	1.39	0.86	0.05
						4" Ice	2.08	1.43	0.12
WIMAX DAP HEAD	C	From Leg	4.00 0' 0'	0.0000	105'	No Ice	1.80	0.78	0.03
						1/2" Ice	1.99	0.92	0.04
						1" Ice	2.18	1.07	0.06
						2" Ice	2.59	1.39	0.09
						4" Ice	3.51	2.14	0.20
*									
Side Arm Mount [SO 701-3]	C	None		0.0000	105'	No Ice	2.83	2.83	0.20
						1/2" Ice	3.92	3.92	0.24
						1" Ice	5.01	5.01	0.28
						2" Ice	7.19	7.19	0.36
						4" Ice	11.55	11.55	0.53
*									
Platform Mount [LP 713-1]	C	None		0.0000	99'	No Ice	31.27	31.27	1.51
						1/2" Ice	39.68	39.68	1.93
						1" Ice	48.09	48.09	2.35
						2" Ice	64.91	64.91	3.19
						4" Ice	98.55	98.55	4.86

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft²	Weight K
VHLP1-23	A	Paraboloid w/o Radome	From Leg	4.00 0' 3'	0.0000		105'	1.27	No Ice	1.28	0.01
									1/2" Ice	1.45	0.02
									1" Ice	1.62	0.02
									2" Ice	1.97	0.04
									4" Ice	2.66	0.07
VHLP2-11-2GR	B	Paraboloid w/o Radome	From Leg	4.00 0' 3'	0.0000		105'	2.17	No Ice	3.72	0.03
									1/2" Ice	4.01	0.03
									1" Ice	4.30	0.04
									2" Ice	4.88	0.07
									4" Ice	6.04	0.19
VHLP1-23	C	Paraboloid w/o Radome	From Leg	4.00 0' 3'	0.0000		105'	1.27	No Ice	1.28	0.01
									1/2" Ice	1.45	0.02
									1" Ice	1.62	0.02
									2" Ice	1.97	0.04
									4" Ice	2.66	0.07
VHLP1-23	C	Paraboloid w/o Radome	From Leg	4.00 0' 2'	0.0000		105'	1.27	No Ice	1.28	0.01
									1/2" Ice	1.45	0.02
									1" Ice	1.62	0.02
									2" Ice	1.97	0.04
									4" Ice	2.66	0.07

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg % %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1	92'10-3/16'	1.344	22	93.084	A	0.000	93.084	93.084	100.00	0.000	0.000
115'-72'3-31/32"	'				B	0.000	93.084		100.00	0.000	0.000
					C	0.000	93.084		100.00	0.000	8.448
L2	50'7-3/16"	1.13	18	122.947	A	0.000	122.947	122.947	100.00	0.000	0.000
72'3-31/32"-29' 3-31/32"					B	0.000	122.947		100.00	0.000	0.000
					C	0.000	122.947		100.00	0.000	8.514
L3	14'3-27/32'	1	16	100.020	A	0.000	100.020	100.020	100.00	0.000	0.000
29'3-31/32"-0'	'				B	0.000	100.020		100.00	0.000	0.000
					C	0.000	100.020		100.00	0.000	5.808

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg % %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1	92'10-3/16"	1.344	3	1.1322	101.135	A	0.000	101.135	101.135	100.00	0.000	0.000
115'-72'3-31/32"						B	0.000	101.135		100.00	0.000	0.000

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L2 72'3-31/32"-29'3-31/32"	50'7-3/16"	1.13	2	1.0526	131.061	C	0.000	101.135		100.00	0.000	18.109
						A	0.000	131.061	131.061	100.00	0.000	0.000
						B	0.000	131.061		100.00	0.000	0.000
L3 29'3-31/32"-0'	14'3-27/32"	1	2	1.0000	105.167	C	0.000	131.061		100.00	0.000	18.251
						A	0.000	105.167	105.167	100.00	0.000	0.000
						B	0.000	105.167		100.00	0.000	0.000
						C	0.000	105.167		100.00	0.000	11.983

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 115'-72'3-31/32"	92'10-3/16'	1.344	9	93.084	A	0.000	93.084	93.084	100.00	0.000	0.000
					B	0.000	93.084		100.00	0.000	0.000
					C	0.000	93.084		100.00	0.000	8.448
L2 72'3-31/32"-29'3-31/32"	50'7-3/16"	1.13	7	122.947	A	0.000	122.947	122.947	100.00	0.000	0.000
					B	0.000	122.947		100.00	0.000	0.000
					C	0.000	122.947		100.00	0.000	8.514
L3 29'3-31/32"-0'	14'3-27/32'	1	6	100.020	A	0.000	100.020	100.020	100.00	0.000	0.000
					B	0.000	100.020		100.00	0.000	0.000
					C	0.000	100.020		100.00	0.000	5.808

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 60 deg - No Ice
5	Dead+Wind 90 deg - No Ice
6	Dead+Wind 120 deg - No Ice
7	Dead+Wind 150 deg - No Ice
8	Dead+Wind 180 deg - No Ice
9	Dead+Wind 210 deg - No Ice
10	Dead+Wind 240 deg - No Ice
11	Dead+Wind 270 deg - No Ice
12	Dead+Wind 300 deg - No Ice
13	Dead+Wind 330 deg - No Ice
14	Dead+Ice+Temp
15	Dead+Wind 0 deg+Ice+Temp
16	Dead+Wind 30 deg+Ice+Temp
17	Dead+Wind 60 deg+Ice+Temp
18	Dead+Wind 90 deg+Ice+Temp
19	Dead+Wind 120 deg+Ice+Temp
20	Dead+Wind 150 deg+Ice+Temp
21	Dead+Wind 180 deg+Ice+Temp
22	Dead+Wind 210 deg+Ice+Temp

Comb. No.	Description
23	Dead+Wind 240 deg+Ice+Temp
24	Dead+Wind 270 deg+Ice+Temp
25	Dead+Wind 300 deg+Ice+Temp
26	Dead+Wind 330 deg+Ice+Temp
27	Dead+Wind 0 deg - Service
28	Dead+Wind 30 deg - Service
29	Dead+Wind 60 deg - Service
30	Dead+Wind 90 deg - Service
31	Dead+Wind 120 deg - Service
32	Dead+Wind 150 deg - Service
33	Dead+Wind 180 deg - Service
34	Dead+Wind 210 deg - Service
35	Dead+Wind 240 deg - Service
36	Dead+Wind 270 deg - Service
37	Dead+Wind 300 deg - Service
38	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	115 - 72.3333	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-14.35	1.18	-0.82
			Max. Mx	11	-6.84	310.25	3.21
			Max. My	2	-6.84	1.84	310.05
			Max. Vy	11	-10.67	310.25	3.21
			Max. Vx	2	-10.68	1.84	310.05
			Max. Torque	5			-0.29
L2	72.3333 - 29.3333	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-23.74	2.84	-1.79
			Max. Mx	11	-13.16	844.43	7.60
			Max. My	2	-13.16	4.34	843.90
			Max. Vy	11	-14.71	844.43	7.60
			Max. Vx	2	-14.72	4.34	843.90
			Max. Torque	13			0.36
L3	29.3333 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-34.07	4.30	-2.63
			Max. Mx	11	-20.80	1417.81	11.18
			Max. My	2	-20.80	6.44	1416.92
			Max. Vy	11	-18.05	1417.81	11.18
			Max. Vx	2	-18.06	6.44	1416.92
			Max. Torque	13			0.44

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	14	34.07	0.00	-0.00
	Max. H_x	11	20.81	18.05	0.11
	Max. H_z	2	20.81	0.05	18.05
	Max. M_x	2	1416.92	0.05	18.05
	Max. M_z	5	1414.27	-18.02	0.08

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
	Max. Torsion	13	0.44	9.10	15.54
	Min. Vert	1	20.81	0.00	0.00
	Min. H_x	5	20.81	-18.02	0.08
	Min. H_z	8	20.81	-0.00	-17.97
	Min. M_x	8	-1409.55	-0.00	-17.97
	Min. M_z	11	-1417.81	18.05	0.11
	Min. Torsion	5	-0.38	-18.02	0.08

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	20.81	0.00	0.00	0.44	0.59	0.00
Dead+Wind 0 deg - No Ice	20.81	-0.05	-18.05	-1416.92	6.44	-0.23
Dead+Wind 30 deg - No Ice	20.81	9.06	-15.52	-1215.43	-712.28	0.06
Dead+Wind 60 deg - No Ice	20.81	15.62	-9.00	-705.73	-1226.04	0.27
Dead+Wind 90 deg - No Ice	20.81	18.02	-0.08	-8.35	-1414.27	0.38
Dead+Wind 120 deg - No Ice	20.81	15.67	8.96	702.47	-1230.98	0.35
Dead+Wind 150 deg - No Ice	20.81	8.95	15.57	1221.91	-700.26	0.21
Dead+Wind 180 deg - No Ice	20.81	0.00	17.97	1409.55	0.49	0.14
Dead+Wind 210 deg - No Ice	20.81	-8.95	15.56	1220.53	701.15	0.06
Dead+Wind 240 deg - No Ice	20.81	-15.70	8.92	697.99	1236.11	-0.11
Dead+Wind 270 deg - No Ice	20.81	-18.05	-0.11	-11.18	1417.81	-0.26
Dead+Wind 300 deg - No Ice	20.81	-15.65	-9.02	-707.52	1230.12	-0.41
Dead+Wind 330 deg - No Ice	20.81	-9.10	-15.54	-1217.00	718.15	-0.44
Dead+Ice+Temp	34.07	-0.00	0.00	2.63	4.30	0.00
Dead+Wind 0 deg+Ice+Temp	34.07	-0.01	-2.78	-228.84	4.99	-0.06
Dead+Wind 30 deg+Ice+Temp	34.07	1.39	-2.39	-196.06	-112.16	-0.01
Dead+Wind 60 deg+Ice+Temp	34.07	2.40	-1.38	-112.75	-196.05	0.04
Dead+Wind 90 deg+Ice+Temp	34.07	2.77	-0.01	1.21	-226.77	0.07
Dead+Wind 120 deg+Ice+Temp	34.07	2.41	1.38	117.32	-196.80	0.08
Dead+Wind 150 deg+Ice+Temp	34.07	1.38	2.40	202.21	-110.12	0.07
Dead+Wind 180 deg+Ice+Temp	34.07	-0.00	2.76	232.91	4.36	0.05
Dead+Wind 210 deg+Ice+Temp	34.07	-1.38	2.39	202.07	118.83	0.03
Dead+Wind 240 deg+Ice+Temp	34.07	-2.41	1.37	116.86	205.97	-0.02
Dead+Wind 270 deg+Ice+Temp	34.07	-2.77	-0.02	0.94	235.74	-0.06
Dead+Wind 300 deg+Ice+Temp	34.07	-2.41	-1.39	-112.92	205.05	-0.09
Dead+Wind 330 deg+Ice+Temp	34.07	-1.40	-2.39	-196.21	121.35	-0.10
Dead+Wind 0 deg - Service	20.81	-0.02	-7.05	-553.44	2.88	-0.09
Dead+Wind 30 deg - Service	20.81	3.54	-6.06	-474.70	-277.99	0.02
Dead+Wind 60 deg - Service	20.81	6.10	-3.52	-275.51	-478.76	0.11
Dead+Wind 90 deg - Service	20.81	7.04	-0.03	-2.99	-552.32	0.15
Dead+Wind 120 deg - Service	20.81	6.12	3.50	274.79	-480.69	0.14
Dead+Wind 150 deg - Service	20.81	3.50	6.08	477.78	-273.29	0.08
Dead+Wind 180 deg - Service	20.81	0.00	7.02	551.11	0.55	0.06
Dead+Wind 210 deg - Service	20.81	-3.50	6.08	477.24	274.36	0.02
Dead+Wind 240 deg - Service	20.81	-6.13	3.49	273.04	483.42	-0.04
Dead+Wind 270 deg - Service	20.81	-7.05	-0.04	-4.09	554.43	-0.10
Dead+Wind 300 deg - Service	20.81	-6.11	-3.52	-276.21	481.08	-0.16
Dead+Wind 330 deg - Service	20.81	-3.56	-6.07	-475.31	281.01	-0.17

Solution Summary

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
1	0.00	-20.81	0.00	0.00	20.81	0.00	0.000%
2	-0.05	-20.81	-18.05	0.05	20.81	18.05	0.000%
3	9.06	-20.81	-15.52	-9.06	20.81	15.52	0.000%
4	15.62	-20.81	-9.00	-15.62	20.81	9.00	0.000%
5	18.02	-20.81	-0.08	-18.02	20.81	0.08	0.000%
6	15.67	-20.81	8.96	-15.67	20.81	-8.96	0.000%
7	8.95	-20.81	15.57	-8.95	20.81	-15.57	0.000%
8	0.00	-20.81	17.97	-0.00	20.81	-17.97	0.000%
9	-8.95	-20.81	15.56	8.95	20.81	-15.56	0.000%
10	-15.70	-20.81	8.92	15.70	20.81	-8.92	0.000%
11	-18.05	-20.81	-0.11	18.05	20.81	0.11	0.000%
12	-15.65	-20.81	-9.02	15.65	20.81	9.02	0.000%
13	-9.10	-20.81	-15.54	9.10	20.81	15.54	0.000%
14	0.00	-34.07	0.00	0.00	34.07	-0.00	0.000%
15	-0.01	-34.07	-2.78	0.01	34.07	2.78	0.000%
16	1.39	-34.07	-2.39	-1.39	34.07	2.39	0.000%
17	2.40	-34.07	-1.38	-2.40	34.07	1.38	0.000%
18	2.77	-34.07	-0.01	-2.77	34.07	0.01	0.000%
19	2.41	-34.07	1.38	-2.41	34.07	-1.38	0.000%
20	1.38	-34.07	2.40	-1.38	34.07	-2.40	0.000%
21	-0.00	-34.07	2.76	0.00	34.07	-2.76	0.000%
22	-1.38	-34.07	2.39	1.38	34.07	-2.39	0.000%
23	-2.41	-34.07	1.37	2.41	34.07	-1.37	0.000%
24	-2.77	-34.07	-0.02	2.77	34.07	0.02	0.000%
25	-2.41	-34.07	-1.39	2.41	34.07	1.39	0.000%
26	-1.40	-34.07	-2.39	1.40	34.07	2.39	0.000%
27	-0.02	-20.81	-7.05	0.02	20.81	7.05	0.000%
28	3.54	-20.81	-6.06	-3.54	20.81	6.06	0.000%
29	6.10	-20.81	-3.52	-6.10	20.81	3.52	0.000%
30	7.04	-20.81	-0.03	-7.04	20.81	0.03	0.000%
31	6.12	-20.81	3.50	-6.12	20.81	-3.50	0.000%
32	3.50	-20.81	6.08	-3.50	20.81	-6.08	0.000%
33	0.00	-20.81	7.02	-0.00	20.81	-7.02	0.000%
34	-3.50	-20.81	6.08	3.50	20.81	-6.08	0.000%
35	-6.13	-20.81	3.49	6.13	20.81	-3.49	0.000%
36	-7.05	-20.81	-0.04	7.05	20.81	0.04	0.000%
37	-6.11	-20.81	-3.52	6.11	20.81	3.52	0.000%
38	-3.56	-20.81	-6.07	3.56	20.81	6.07	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00003553
3	Yes	5	0.00000001	0.00002734
4	Yes	5	0.00000001	0.00002668
5	Yes	4	0.00000001	0.00003225
6	Yes	5	0.00000001	0.00002763
7	Yes	5	0.00000001	0.00002670
8	Yes	4	0.00000001	0.00001886
9	Yes	5	0.00000001	0.00002679
10	Yes	5	0.00000001	0.00002737
11	Yes	4	0.00000001	0.00001852
12	Yes	5	0.00000001	0.00002684
13	Yes	5	0.00000001	0.00002796

14	Yes	4	0.00000001	0.00001090
15	Yes	4	0.00000001	0.00038685
16	Yes	4	0.00000001	0.00039197
17	Yes	4	0.00000001	0.00039265
18	Yes	4	0.00000001	0.00038318
19	Yes	4	0.00000001	0.00039954
20	Yes	4	0.00000001	0.00040058
21	Yes	4	0.00000001	0.00039481
22	Yes	4	0.00000001	0.00040996
23	Yes	4	0.00000001	0.00041430
24	Yes	4	0.00000001	0.00039967
25	Yes	4	0.00000001	0.00040798
26	Yes	4	0.00000001	0.00040278
27	Yes	4	0.00000001	0.00001099
28	Yes	4	0.00000001	0.00010637
29	Yes	4	0.00000001	0.00010114
30	Yes	4	0.00000001	0.00001282
31	Yes	4	0.00000001	0.00010901
32	Yes	4	0.00000001	0.00010240
33	Yes	4	0.00000001	0.00000985
34	Yes	4	0.00000001	0.00010345
35	Yes	4	0.00000001	0.00010723
36	Yes	4	0.00000001	0.00001059
37	Yes	4	0.00000001	0.00010201
38	Yes	4	0.00000001	0.00011091

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	115 - 72.3333	16.915	35	1.2772	0.0013
L2	77 - 29.3333	7.705	35	0.9412	0.0006
L3	35 - 0	1.594	35	0.4076	0.0002

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
115'	BXA-70063/6CFx4 w/ Mount Pipe	35	16.915	1.2772	0.0013	32439
108'	VHLP1-23	35	15.098	1.2225	0.0012	23171
107'	VHLP1-23	35	14.840	1.2146	0.0011	20274
105'	LLPX310R w/ Mount Pipe	35	14.325	1.1987	0.0011	16219
99'	Platform Mount [LP 713-1]	35	12.802	1.1497	0.0010	10137

Maximum Tower Deflections - Design Wind

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

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	115 - 72.3333	43.217	10	3.2648	0.0034
L2	77 - 29.3333	19.691	10	2.4058	0.0015
L3	35 - 0	4.076	10	1.0419	0.0004

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
115'	BXA-70063/6CFx4 w/ Mount Pipe	10	43.217	3.2648	0.0034	12765
108'	VHLP1-23	10	38.576	3.1249	0.0030	9117
107'	VHLP1-23	10	37.917	3.1047	0.0029	7978
105'	LLPX310R w/ Mount Pipe	10	36.603	3.0640	0.0028	6382
99'	Platform Mount [LP 713-1]	10	32.713	2.9388	0.0025	3988

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
L1	115 - 72.3333 (1)	TP30.45x21.91x0.2188	42'8-1/32'	0'	0.0	36.858	20.6362	-6.84	760.62	0.009
L2	72.3333 - 29.3333 (2)	TP38.61x29.0784x0.3125	47'8-1/32'	0'	0.0	39.000	37.3967	-13.15	1458.47	0.009
L3	29.3333 - 0 (3)	TP43.85x36.8519x0.375	35'	0'	0.0	39.000	52.4961	-20.80	2047.35	0.010

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	115 - 72.3333 (1)	TP30.45x21.91x0.2188	310.77	25.219	36.858	0.684	0.00	0.000	36.858	0.000
L2	72.3333 - 29.3333 (2)	TP38.61x29.0784x0.3125	845.63	29.880	39.000	0.766	0.00	0.000	39.000	0.000
L3	29.3333 - 0 (3)	TP43.85x36.8519x0.375	1419.57	30.552	39.000	0.783	0.00	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	115 - 72.3333 (1)	TP30.45x21.91x0.2188	10.69	0.518	26.000	0.040	0.11	0.004	26.000	0.000
L2	72.3333 - 29.3333 (2)	TP38.61x29.0784x0.3125	14.73	0.394	26.000	0.031	0.11	0.002	26.000	0.000
L3	29.3333 - 0 (3)	TP43.85x36.8519x0.375	18.07	0.344	26.000	0.027	0.11	0.001	26.000	0.000

Pole Interaction Design Data

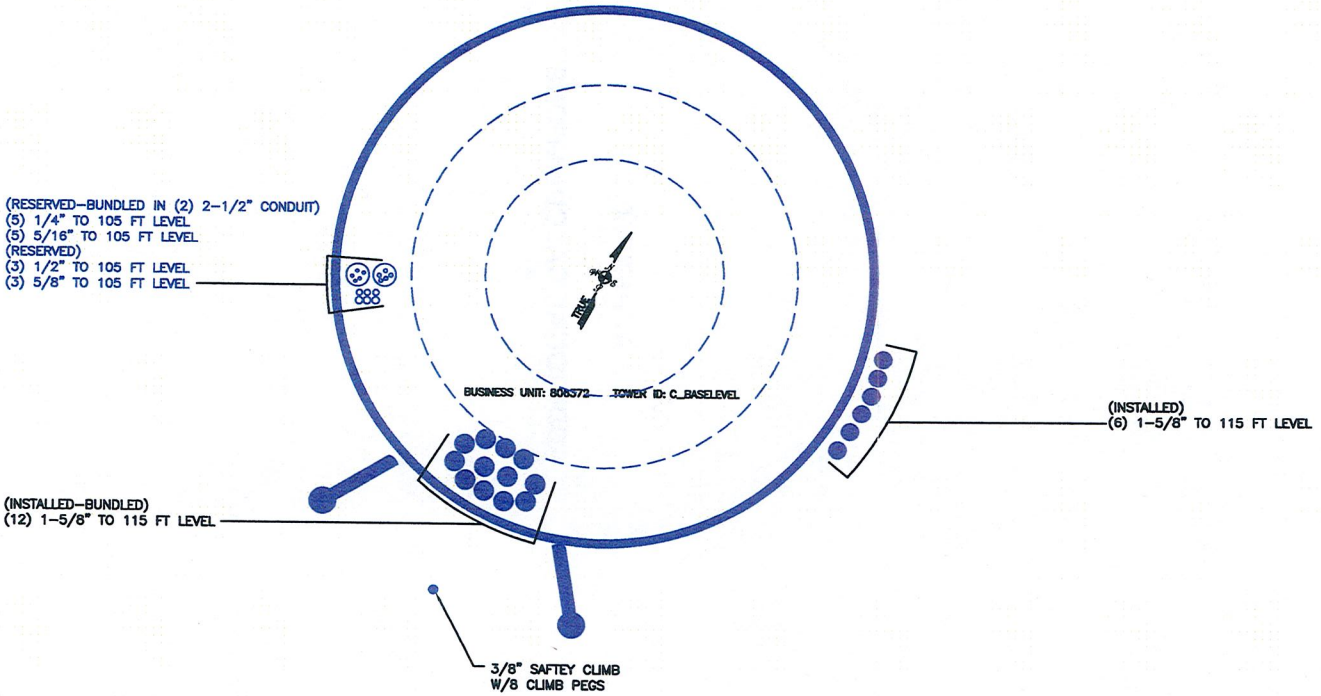
Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	115 - 72.3333 (1)	0.009	0.684	0.000	0.040	0.000	0.694 ✓	1.333	H1-3+VT ✓
L2	72.3333 - 29.3333 (2)	0.009	0.766	0.000	0.031	0.000	0.775 ✓	1.333	H1-3+VT ✓
L3	29.3333 - 0 (3)	0.010	0.783	0.000	0.027	0.000	0.794 ✓	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	115 - 72.3333	Pole	TP30.45x21.91x0.2188	1	-6.84	1013.90	52.0	Pass
L2	72.3333 - 29.3333	Pole	TP38.61x29.0784x0.3125	2	-13.15	1944.14	58.2	Pass
L3	29.3333 - 0	Pole	TP43.85x36.8519x0.375	3	-20.80	2729.12	59.5	Pass
							Summary	
						Pole (L3)	59.5	Pass
						RATING =	**59.5**	**Pass**

APPENDIX B

BASE LEVEL DRAWING


(RESERVED–BUNDLED IN (2) 2–1/2" CONDUIT)
(5) 1/4" TO 105 FT LEVEL
(5) 5/16" TO 105 FT LEVEL
(RESERVED)
(3) 1/2" TO 105 FT LEVEL
(3) 5/8" TO 105 FT LEVEL
BUSINESS UNIT: 808372 TOWER ID: C_BASELEVEL
(INSTALLED)
(6) 1–5/8" TO 115 FT LEVEL
(INSTALLED–BUNDLED)
(12) 1–5/8" TO 115 FT LEVEL
3/8" SAFTEY CLIMB
W/8 CLIMB PEGS


0
1
2
3FT

: SCALE :

APPENDIX C

ADDITIONAL CALCULATIONS

Moment Capacity of Drilled Concrete Shaft (Caisson) for TIA Rev F or G

Note: Shaft assumed to have ties, not spiral, transverse reinforcing

Site Data

BU#: *806372*
Site Name: *HRT 093 943228*
App #: *128651, Rev. 0*

Maximum Shaft Superimposed Forces		
TIA Revision:	F	
Max. Service Shaft M:	1622.951	ft-kips (* Note)
Max. Service Shaft P:	21	kips
Max Axial Force Type:	Comp.	

(*) Note: Max Shaft Superimposed Moment does not necessarily equal to the shaft top reaction moment

Enter Load Factors Below:		
For M (WL)	1.3	<---- Enter Factor
For P (DL)	1.3	<---- Enter Factor

Load Factor	Shaft Factored Loads		
1.30	Mu:	2109.837	ft-kips
1.30	Pu:	27.3	kips

Pier Properties		
Concrete:		
Pier Diameter =	6.0	ft
Concrete Area =	4071.5	in^2
Reinforcement:		
Clear Cover to **Tie**=	4.00	in
Horiz. **Tie** Bar Size=	4	
Vert. Cage Diameter =	5.14	ft
Vert. Cage Diameter =	61.73	in
Vertical Bar Size =	10	
Bar Diameter =	1.27	in
Bar Area =	1.27	in^2
Number of Bars =	20	
As Total=	25.4	in^2
A s/ Aconc, Rho:	0.0062	0.62%

Material Properties		
Concrete Comp. strength, f'c =	3000	psi
Reinforcement yield strength, Fy =	60	ksi
Reinforcing Modulus of Elasticity, E =	29000	ksi
Reinforcement yield strain =	0.00207	
Limiting compressive strain =	0.003	
ACI 318 Code		
Select Analysis ACI Code=	2002	
Seismic Properties		
Seismic Design Category =	B	
Seismic Risk =	**Low**	

Solve (Run) <-- Press Upon Completing All Input

ACI 10.5 , ACI 21.10.4, and IBC 1810.
Min As for Flexural, Tension Controlled, Shafts:

(3)*(Sqrt(f'c)/Fy:	0.0027	
200 / Fy:	0.0033	
IBC 1810.1.2:	None	SDC A or B
Governing:	0.0033	**0.33%**

ACI 10.8 and 10.9
Min As for Columns, Comp. Controlled, Shafts:

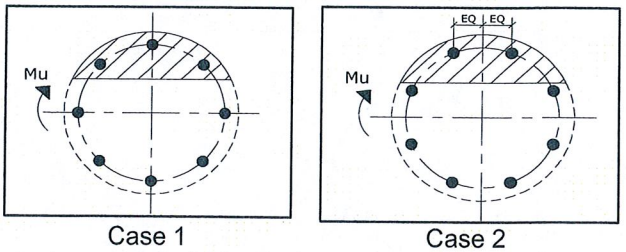
Min As:	0.0050	**0.50%**

Minimum Rho Check:

Actual Req'd Min. Rho:	0.33%	Flexural
Provided Rho:	0.62%	OK

Results:

Governing Orientation Case: **1**



Case 1 Case 2

Dist. From Edge to Neutral Axis:	**12.36**	in
Extreme Steel Strain, εt:	**0.0132**	
εt > 0.0050, Tension Controlled		
Reduction Factor,φ:	**0.900**	

<-- Comment Box

Ref. Shaft Max Axial Capacities, ϕ Max(Pn or Tn):		
Max Pu = (φ=0.65) Pn.		
Pn per ACI 318 (10-2)	6157.61	kips
at Mu=(ϕ=0.65)Mn=	3177.55	ft-kips
Max Tu, (φ=0.9) Tn =	1371.6	kips
at Mu=ϕ=(0.90)Mn=	0.00	ft-kips

Output Note: Negative Pu=Tension

For Axial Compression, φ Pn = Pu:	27.30	kips
Drilled Shaft Moment Capacity, φMn:	**3362.19**	ft-kips
Drilled Shaft Superimposed Mu:	**2109.84**	ft-kips

(Mu/φMn, Drilled Shaft Flexure CSR:	**62.75%**

Terzaghi's Equation for Bearing Capacity

BU #: 806372
Site Name: HRT 093 943228
App. Name: 128651, Rev. 0

Footing Parameters		
Depth, **D**:	21.0	ft
Width, **W**:	6.0	ft
*Foundation Type, **T**:	D	
Type, **J (0, 1, 2):	1	

***Note: S= Shallow, D= Deep**

****Note: 0 = Strip, 1 = Round, 2 = Square**

Soil Parameters		
Unit Weight, **γ**:	0.1200	kcf
Cohesion, **Co**:	0.00	ksf
Phi Angle, **Φ**:	30.0	deg
Blows per foot @ Subgrade, **N**:	18	

Factors	
Nc:	30.1
Nq:	12.0
Nγ:	15.7

Modifiers	
Sc:	1.3
Sγ:	0.6

Allowable Gross Bearing Capacity = 10.08 ksf

Monopole Drilled Pier

Checks capacity of a single drilled shaft foundation for a monopole

BU#: 806372
Site Name: *HRT 093 943228*
App Number: *128651, Rev. 0*

CROWN CASTLE

ACI 318 Version: 2002

Design Reactions		
Shear, **S**:	18.00	kips
Moment, **Mt**:	1420.00	ft-kips
Tower Weight, **Wt**:	21.00	kips
Tower Height, **H**:	115	ft
Base Diameter, **BD**:	43.85	in

Foundation Dimensions		
Caisson Diameter, **CD**:	6.0	ft
Ext. Above Grade, **E**:	0.5	ft
Depth Below Grade, **L**:	21.0	ft
Neglected Depth, **N**:	5.0	ft
Rebar Size, **Sp**:	10	
Rebar Quantity, **mp**:	20	
Tie Size, **tp**:	4	

Material Properties		
Rebar Tensile, **Fy**:	60	ksi
Concrete Strength, **F'c**:	3000	psi
Concrete Density, **δx**:	150	pcf
Clear Cover, **cc**:	4	in

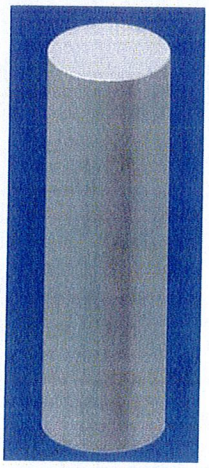
Soil Properties		
Soil Unit Weight, γ:	120	pcf
Allowable Bearing, **Bc**:	10.080	ksf
Seismic Design Cat, **z**:	B	

Caisson Analysis		
Depth to Zero Shear:	6.9	ft
Max Factored Moment:	2109.84	ft-kips
Overturning FOS:	2.85	

Depth		Shear		Moment	
4.3	ft	18.2	kips	1583.1	ft-kips
6.45	ft	6.4	kips	1616.7	ft-kips
8.6	ft	-28	kips	1595.4	ft-kips

Design Checks	*Capacity/ Availability*	*Demand/ Limits*	*Check*
Minimum Req'd Dia. 1 (ft):	6.00	1.63	OK
Minimum Req'd Dia. 2 (ft):	6.00	5.15	OK
Bearing (ksf):	10.08	0.74	OK
Rebar Area (in^2):	25.40	13.57	OK
Pier moment capacity (k-ft):	3362.19	2109.84	OK
Rebar spacing (in):	8.78	2 < Bs <18	OK
Development Length (in):	165.80	12.00	OK
Soil moment capacity (FOS):	2.85	2.00	OK

☐ **Assume 0.5% Minimum Steel?**



Bearing: 7.4%

Steel: 62.8%

Soil: 70.2%

Stiffened or Unstiffened, Ungrouted, Circular Base Plate - Any Rod Material

TIA Rev F

Site Data

BU#: *806372*
Site Name: *HRT 093 943228*
App #: *128651, Rev. 0*

Pole Manufacturer:	*Other*

Reactions		
Moment:	1420	ft-kips
Axial:	21	kips
Shear:	18	kips

If No stiffeners, Criteria:	AISC ASD	<-Only Applcable to Unstiffened Cases

Anchor Rod Data		
Qty:	12	
Diam:	2.25	in
Rod Material:	A615-J	
Strength (Fu):	100	ksi
Yield (Fy):	75	ksi
Bolt Circle:	51.9	in

Anchor Rod Results

		Rigid
Maximum Rod Tension:	107.7 Kips	Service, ASD
Allowable Tension:	195.0 Kips	Fty*ASIF
Anchor Rod Stress Ratio:	55.2% **Pass**	

Plate Data		
Diam:	57.9	in
Thick:	2.625	in
Grade:	60	ksi
Single-Rod B-eff:	11.75	in

Base Plate Results

	Flexural Check	Rigid
Base Plate Stress:	21.2 ksi	Service ASD
Allowable Plate Stress:	60.0 ksi	0.75*Fy*ASIF
Base Plate Stress Ratio:	35.3% **Pass**	Y.L. Length: 27.76

Stiffener Data (Welding at both sides)		
Config:	0	*
Weld Type:		
Groove Depth:		in **
Groove Angle:		degrees
Fillet H. Weld:		<-- Disregard
Fillet V. Weld:		in
Width:		in
Height:		in
Thick:		in
Notch:		in
Grade:		ksi
Weld str.:		ksi

n/a

Stiffener Results

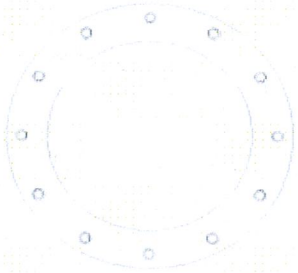
Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

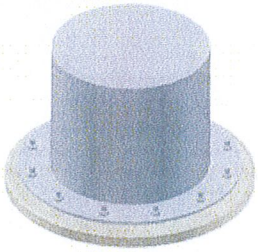
Pole Results

Pole Punching Shear Check: n/a

Pole Data		
Diam:	43.85	in
Thick:	0.375	in
Grade:	65	ksi
# of Sides:	12	"0" IF Round
Fu	80	ksi
Reinf. Fillet Weld	0	"0" if None

Stress Increase Factor		
ASIF:	1.333	





* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

CAISSON Version 10.40 10:26:56 AM Saturday, August 20, 2011
Crown Castle USA

Project Title: BU #806372
Project Notes: App. #128651, Rev. 0

Calculation Method: Full 8CD

******* I N P U T D A T A

Pier Properties

Diameter (ft)	Distance of Top of Pier above Ground (ft)	Concrete Strength (ksi)	Steel Yield Strength (ksi)
6.00	0.50	3.00	60.00

Soil Properties

Layer	Type	Thickness (ft)	Depth at Top of Layer (ft)	Density (lbs/ft^3)	CU (psf)	KP	PHI (deg)
1	Clay	5.00	0.00	120.0			
2	Sand	9.00	5.00	120.0		3.000	30.00
3	Sand	4.00	14.00	120.0		4.396	39.00
4	Sand	20.00	18.00	120.0		3.000	30.00
5	Sand	10.00	38.00	120.0		3.537	34.00
6	Sand	19.00	48.00	120.0		2.882	29.00

Design (Factored) Loads at Top of Pier

Moment (ft-k)	Axial Load (kips)	Shear Load (kips)	Additional Safety Factor Against Soil Failure
1420.0	21.0	18.00	2.85

******* R E S U L T S

Calculated Pier Properties

Length (ft)	Weight (kips)	End Bearing Pressure (psf)
21.500	91.185	742.7

Ultimate Resisting Forces Along Pier

Type	Distance of Top of Layer to Top of Pier (ft)	Thickness (ft)	Density (lbs/ft^3)	CU (psf)	KP	Force (kips)	Arm (ft)
Clay	0.50	5.00	120.0			0.00	3.00
Sand	5.50	9.00	120.0		3.000	554.04	10.71
Sand	14.50	1.72	120.0		4.396	242.28	15.38
Sand	16.22	2.28	120.0		4.396	-365.36	17.38
Sand	18.50	3.00	120.0		3.000	-379.08	20.04

Shear and Moments Along Pier

Distance below Top of Pier (ft)	Shear (with Safety Factor) (kips)	Moment (with Safety Factor) (ft-k)	Shear (without Safety Factor) (kips)	Moment (without Safety Factor) (ft-k)
0.00	51.9	4288.6	18.2	1504.8
2.15	51.9	4400.2	18.2	1543.9
4.30	51.9	4511.7	18.2	1583.1
6.45	18.2	4607.7	6.4	1616.7
8.60	-79.7	4546.9	-28.0	1595.4
10.75	-207.5	4243.5	-72.8	1489.0
12.90	-365.3	3633.1	-128.2	1274.8
15.05	-576.7	2644.8	-202.4	928.0
17.20	-593.2	1216.9	-208.1	427.0
19.35	-277.6	303.8	-97.4	106.6
21.50	-0.0	-0.0	-0.0	-0.0