

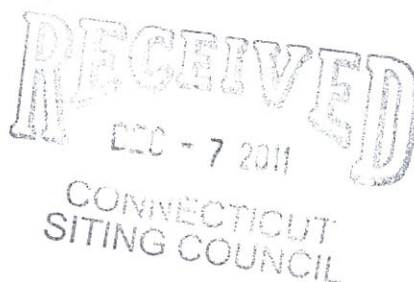
ROBINSON & COLE

EM-VER-024-111207

KENNETH C. BALDWIN

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December 6, 2011



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

Re: **Notice of Exempt Modification – Antenna Swap**
147 Palmer Road, Chaplin, Connecticut

Dear Ms. Roberts:

Cellco Partnership d/b/a Verizon Wireless (“Cellco”) currently maintains twelve (12) wireless telecommunications antennas at a centerline height of 149 feet above ground level on the existing 147-foot tower at the above-referenced address. The tower is owned by Cellco. The Council approved Cellco’s use of this tower in 2002 (Docket No. 211). Cellco now intends to modify its installation by replacing all of its existing antennas with two (2) model LPA-80063/4CF cellular antennas; four (4) model LPA-80080/4CF cellular antennas; one model BXA-171063/8BF PCS antenna; two (2) model BXA-171085/8BF PCS antennas; and three (3) model BXA-70063/6CF LTE antennas, all at the same 149-foot centerline height on the tower. Cellco also intends to install six (6) additional coax cables installed on the exterior of the monopole. Attached behind Tab 1 are the specifications for the proposed replacement antennas.



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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 William H. Rose IV, First Selectman of the Town of Chaplin. A copy of this letter is also being sent to Donald A. and Janet L. Bessette, the owners of the property on which the tower is located.

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

11419168-v1

ROBINSON & COLE_{LLP}

Linda Roberts
December 6, 2011
Page 2

1. The proposed modifications will not result in an increase in the overall height of the existing tower. Cellco's antennas will be located at the same 149-foot level on the existing tower.

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

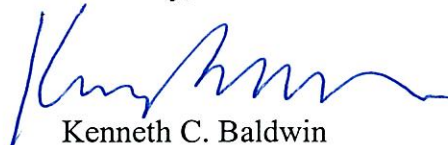
3. The proposed modifications will not increase noise levels at the facility by six decibels or more.

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 modification. (See Tab 3).

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

Sincerely,



Kenneth C. Baldwin

Enclosures

Copy to:

William H. Rose IV, Chaplin First Selectman
Donald A. and Janet L. Bessette
Sandy M. Carter



Mechanical specifications

Length	1205 mm	47.4 in
Width	386 mm	15.2 in
Depth	335 mm	13.2 in
Depth with z-bracket	375 mm	14.8 in
Weight ⁴⁾	9.1 kg	20 lbs
Wind Area Fore/Aft	0.47 m ²	5.0 ft ²
Wind Area Side	0.40 m ²	4.4 ft ²
Max Wind Survivability	>201 km/hr	>125 mph
Wind Load @ 100 mph (161 km/hr)		
Fore/Aft	665 N	150 lbf
Side	577 N	130 lbf

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

Mounting & Downtilting

Mounting hardware attaches to pipe diameter Ø50-102 mm; Ø2.0-4.0 in. If the lock-down brace is used, the maximum diameter is Ø88.9 mm (3.5 in).

Mounting & Downtilt Bracket Kit 21699999

Electrical specifications

Frequency Range	806-960 MHz
Impedance	50Ω
Connector ³⁾	NE or E-DIN Female 1 port / Center
VSWR ¹⁾	≤ 1.4:1
Polarization	Vertical
Gain ¹⁾	13.0 dBd 15.0 dBi
Power Rating ²⁾	500 W
Half Power Angle ¹⁾	
Horizontal Beamwidth	63°
Vertical Beamwidth	15°
Electrical downtilt ⁵⁾	0°
Null fill ¹⁾	10%
Lightning protection	Direct ground

1) Typical values.

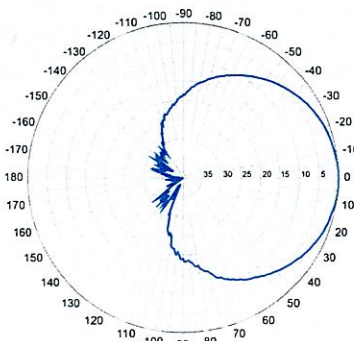
2) Power rating limited by connector only.

3) NE indicates an elongated N connector.
E-DIN indicates an elongated DIN connector.

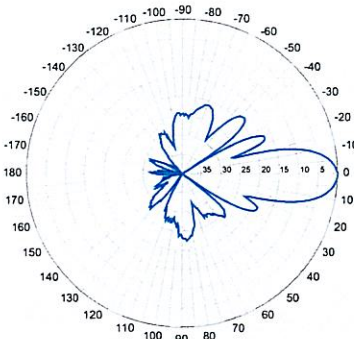
4) Antenna weight does not include brackets.

5) Add'l downtilts may be available. Check website for details.

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

Radiation-pattern¹⁾

Horizontal



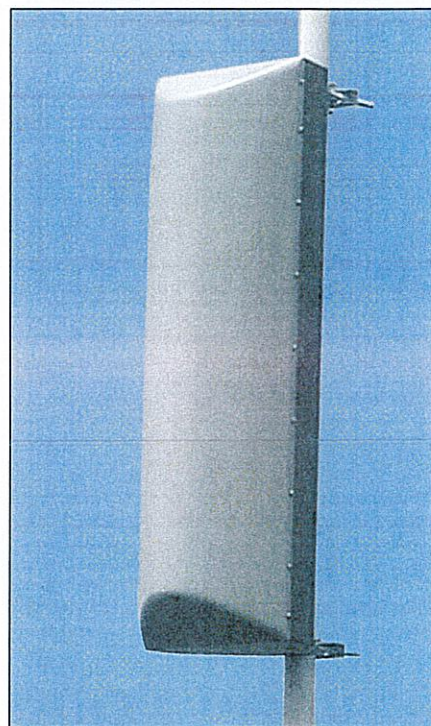
Vertical

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

Mounting on a metal pole will typically improve the front-to-back ratio.

LPA-80063/4CF ____

When ordering replace " ____ " with connector type.



Featuring our Exclusive
3T Technology™
Antenna Design:

- True log-periodic design allows for superior front-to-side characteristics to minimize sector overlap.
- Unique feedline design eliminates the need for conventional solder joints in the signal path.
- A non-collinear system with access to every radiating element for broad bandwidth and superior performance.
- Air as insulation for virtually no internal signal loss.

Warranty:

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

Revision Date: 12/26/08

806-960 MHz

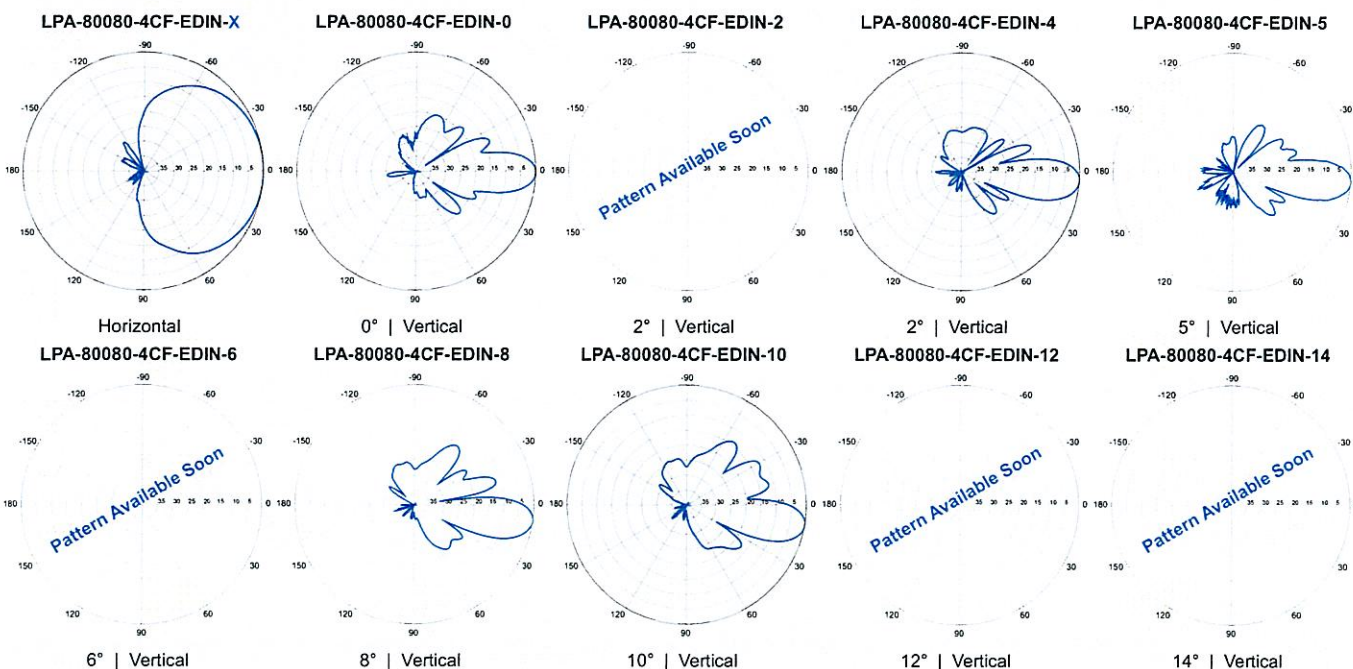
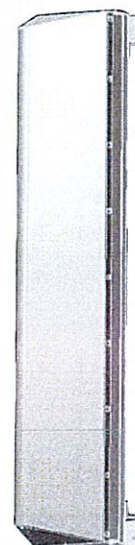
LPA-80080-4CF-EDIN-X

V-Pol | Log Periodic | 80° | 12.5 dBd

Replace "X" with desired electrical downtilt.

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

Electrical Characteristics	
Frequency bands	806-960 MHz
Polarization	Vertical
Horizontal beamwidth	80°
Vertical beamwidth	15°
Gain	12.5 dBd (14.6 dBi)
Electrical downtilt (X)	0, 2, 4, 5, 6, 8, 10, 12, 14
Impedance	50Ω
VSWR	≤1.4:1
Upper sidelobe suppression (0°)	-14.2 dB
Front-to-back ratio (+/-30°)	-34.7 dB
Null fill	15% (-16.48 dB)
Input power	500 W
Lightning protection	Direct Ground
Connector(s)	1 Port / EDIN or NE / Female / Center (Back)
Mechanical Characteristics	
Dimensions Length x Width x Depth	1200 x 140 x 335 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	
Part Number	Fits Pipe DiameterWeight
2-Point Mounting & Downtilt Bracket Kit (0-20°)	2169999950-102 mm 2.0-4.0 in5.4 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-171063-8BF-EDIN-X

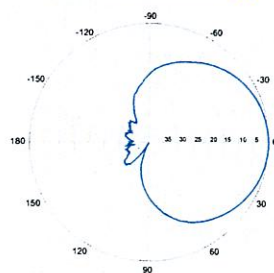
Replace "X" with desired electrical downtilt.

X-Pol | FET Panel | 63° | 17.4 dBi

Electrical Characteristics	1710-2170 MHz		
Frequency bands	1710-1880 MHz	1850-1990 MHz	1920-2170 MHz
Polarization	±45°	±45°	±45°
Horizontal beamwidth	68°	65°	60°
Vertical beamwidth	7°	7°	7°
Gain	14.5 dBd / 16.6 dBi	14.9 dBd / 17.0 dBi	15.3 dBd / 17.4 dBi
Electrical downtilt (X)	0, 2, 4, 8		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back isolation	> 30 dB		
In-band isolation	> 28 dB		
IM3 (20W carrier)	< -150 dBc		
Input power	300 W		
Lightning protection	Direct Ground		
Connector(s)	2 Ports / EDIN / Female / Bottom		
Operating temperature	-40° to +60° C / -40° to +140° F		
Mechanical Characteristics			
Dimensions Length x Width x Depth	1232 x 154 x 105 mm	48.5 x 6.1 x 4.1 in	
Depth with l-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-171063-8BF-EDIN-X-FP		

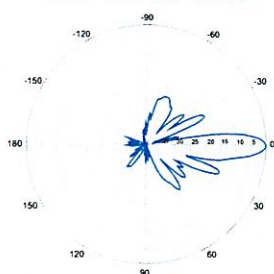


BXA-171063-8BF-EDIN-X



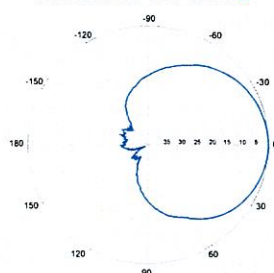
Horizontal | 1710-1880 MHz

BXA-171063-8BF-EDIN-0



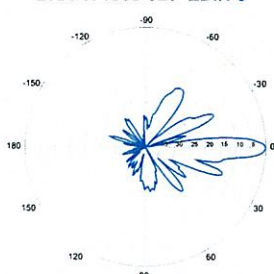
0° | Vertical | 1710-1880 MHz

BXA-171063-8BF-EDIN-X



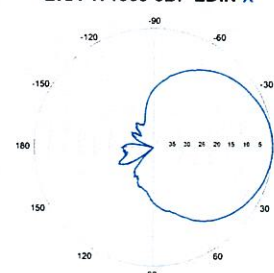
Horizontal | 1850-1990 MHz

BXA-171063-8BF-EDIN-0



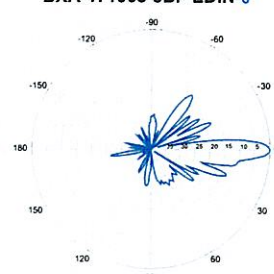
0° | Vertical | 1850-1990 MHz

BXA-171063-8BF-EDIN-X



Horizontal | 1920-2170 MHz

BXA-171063-8BF-EDIN-0



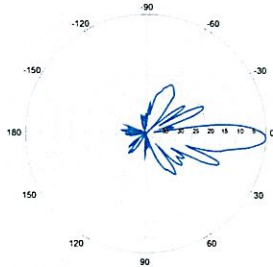
0° | Vertical | 1920-2170 MHz

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BXA-171063-8BF-EDIN-X

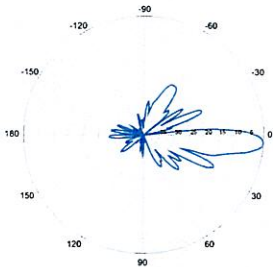
X-Pol | FET Panel | 63° | 17.4 dBi

BXA-171063-8BF-EDIN-2



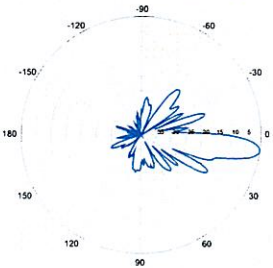
2° | Vertical | 1710-1880 MHz

BXA-171063-8BF-EDIN-4



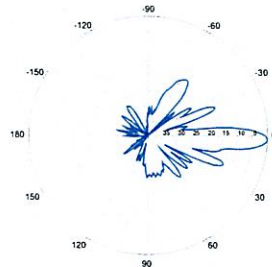
4° | Vertical | 1710-1880 MHz

BXA-171063-8BF-EDIN-8



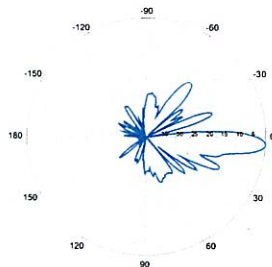
8° | Vertical | 1710-1880 MHz

BXA-171063-8BF-EDIN-2



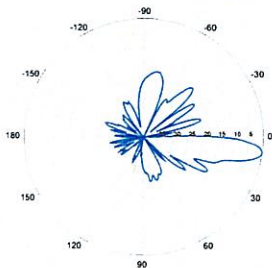
2° | Vertical | 1850-1990 MHz

BXA-171063-8BF-EDIN-4



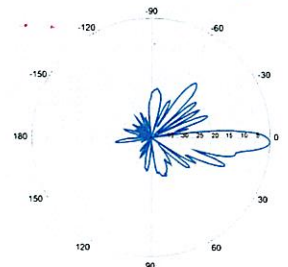
4° | Vertical | 1850-1990 MHz

BXA-171063-8BF-EDIN-8



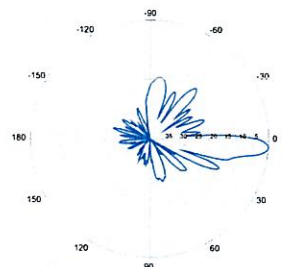
8° | Vertical | 1850-1990 MHz

BXA-171063-8BF-EDIN-2



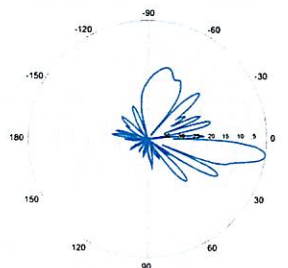
2° | Vertical | 1920-2170 MHz

BXA-171063-8BF-EDIN-4



4° | Vertical | 1920-2170 MHz

BXA-171063-8BF-EDIN-8



8° | Vertical | 1920-2170 MHz

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BXA-171085-8BF-EDIN-X

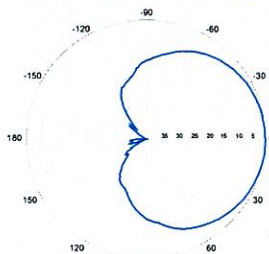
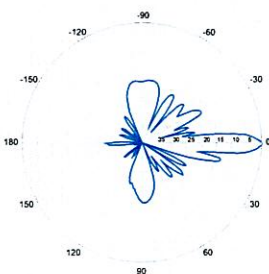
Replace "X" with desired electrical downtilt.

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		

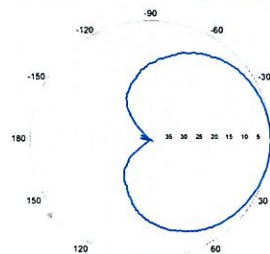
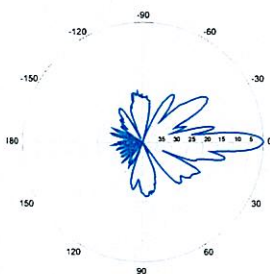


BXA-171085-8BF-EDIN-X

Horizontal | 1710-1880 MHz
BXA-171085-8BF-EDIN-0

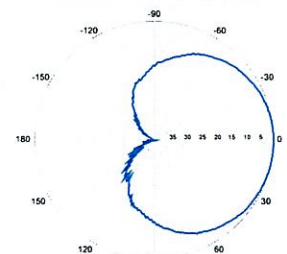
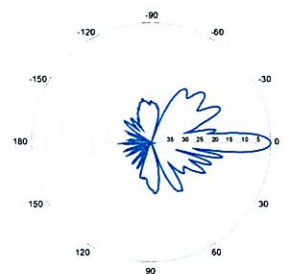
0° | Vertical | 1710-1880 MHz

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

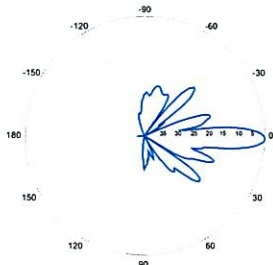
0° | Vertical | 1920-2170 MHz

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BXA-171085-8BF-EDIN-X

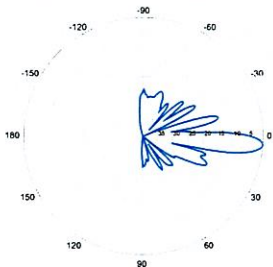
X-Pol | FET Panel | 85° | 16.4 dBi

BXA-171085-8BF-EDIN-2



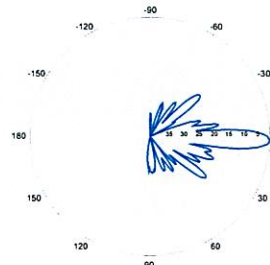
2° | Vertical | 1710-1880 MHz

BXA-171085-8BF-EDIN-4



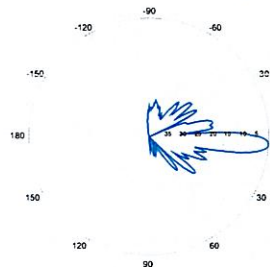
4° | Vertical | 1710-1880 MHz

BXA-171085-8BF-EDIN-2



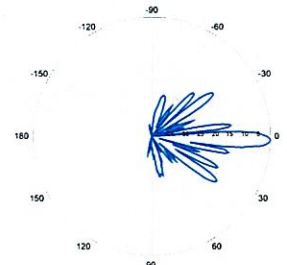
2° | Vertical | 1850-1990 MHz

BXA-171085-8BF-EDIN-4



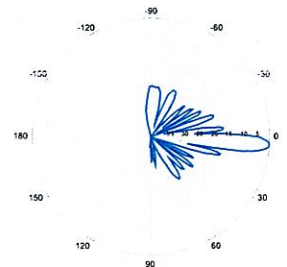
4° | Vertical | 1850-1990 MHz

BXA-171085-8BF-EDIN-2



2° | Vertical | 1920-2170 MHz

BXA-171085-8BF-EDIN-4



4° | Vertical | 1920-2170 MHz

BXA-70063-6CF-EDIN-X

X-Pol | FET Panel | 63° | 14.5 dBd

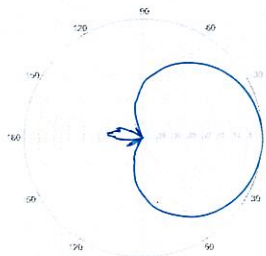
Replace "X" with desired electrical downtilt.

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



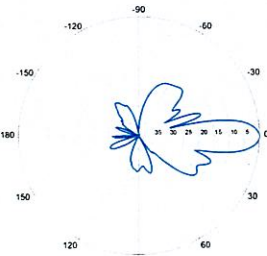
Electrical Characteristics	696-900 MHz			
Frequency bands	696-806 MHz		806-900 MHz	
Polarization	±45°			
Horizontal beamwidth	65°		63°	
Vertical beamwidth	13°		11°	
Gain	14.0 dBd (16.1 dBi)		14.5 dBd (16.6 dBi)	
Electrical downtilt (X)	0, 2, 3, 4, 5, 6, 8, 10			
Impedance	50Ω			
VSWR	≤1.35:1			
Upper 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 m ²	Side: 0.24 m ²	Front: 5.5 ft ²	Side: 2.6 ft ²
Wind load @ 161 km/hr (100 mph)	Front: 759 N	Side: 391 N	Front: 169 lbf	Side: 89 lbf
Mounting Options	Part Number	Fits Pipe Diameter		Weight
3-Point Mounting & Downtilt Bracket Kit	36210008	40-115 mm	1.57-4.5 in	6.9 kg 15.2 lbs
Concealment Configurations	For concealment configurations, order BXA-70063-6CF-EDIN-X-FP			

BXA-70063-6CF-EDIN-X



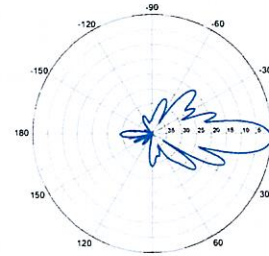
Horizontal | 750 MHz

BXA-70063-6CF-EDIN-0

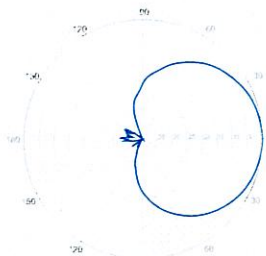


0° | Vertical | 750 MHz

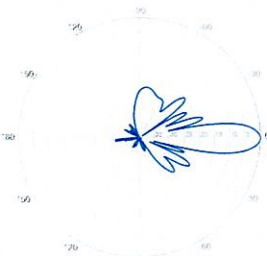
BXA-70063-6CF-EDIN-2



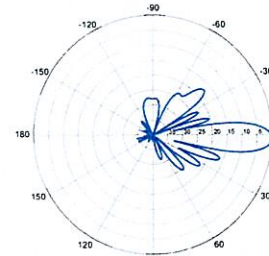
2° | Vertical | 750 MHz



Horizontal | 850 MHz



0° | Vertical | 850 MHz



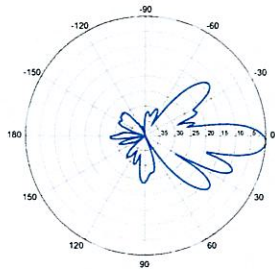
2° | Vertical | 850 MHz

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-70063-6CF-EDIN-X

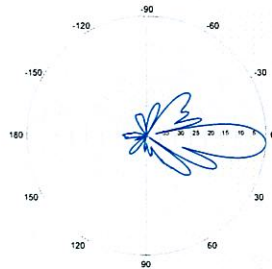
X-Pol | FET Panel | 63° | 14.5 dBd

BXA-70063-6CF-EDIN-3



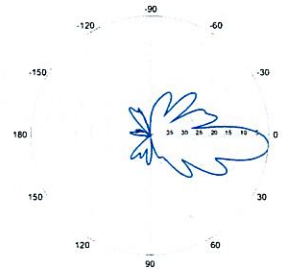
3° | Vertical | 750 MHz

BXA-70063-6CF-EDIN-4

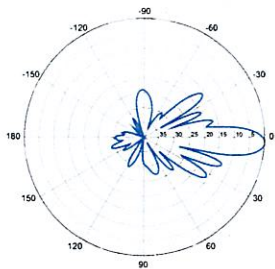


4° | Vertical | 750 MHz

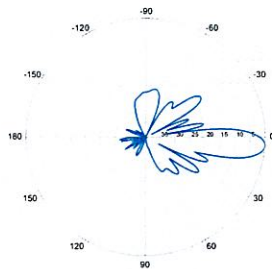
BXA-70063-6CF-EDIN-5



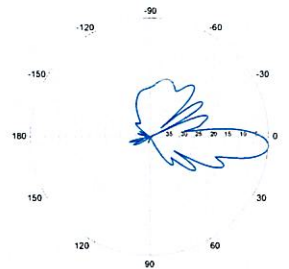
5° | Vertical | 750 MHz



3° | Vertical | 850 MHz

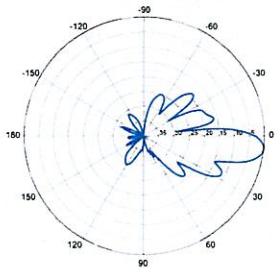


4° | Vertical | 850 MHz



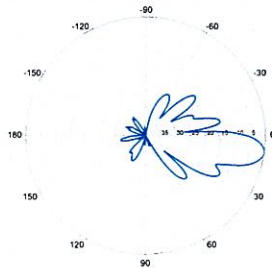
5° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-6



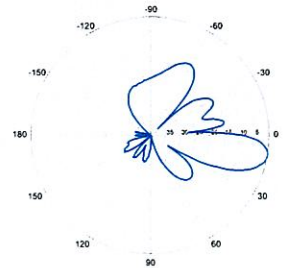
6° | Vertical | 750 MHz

BXA-70063-6CF-EDIN-8

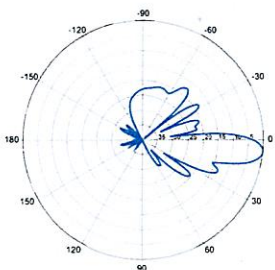


8° | Vertical | 750 MHz

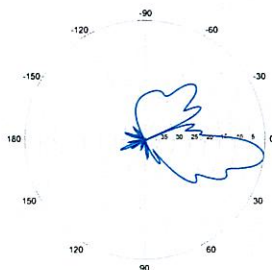
BXA-70063-6CF-EDIN-10



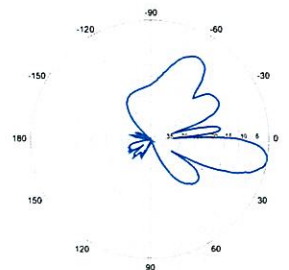
10° | Vertical | 750 MHz



6° | Vertical | 850 MHz



8° | Vertical | 850 MHz



10° | Vertical | 850 MHz

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	General	Power	Density				
Site Name: Chaplin							
Tower Height: Verizon @ 149ft							
CARRIER	# OF CHAN.	WATTS ERP	HEIGHT	CALC. POWER DENS	FREQ.	MAX. PERMISS. EXP.	FRACTION MPE
*Cingular GSM	4	296	127	0.0264	880	0.5867	4.50%
*Cingular GSM	2	427	127	0.0190	1900	1.0000	1.90%
*Cingular UMTS	1	500	127	0.0111	880	0.5867	1.90%
*Sprint	11	342.5	137	0.0722	1962.5	1.0000	7.22%
*T-Mobile	8	137	117	0.0288	1935	1.0000	2.88%
Verizon PCS	11	268	149	0.0477	1970	1.0000	4.77%
Verizon Cellular	9	264	149	0.0385	869	0.5793	6.64%
Verizon AWS	1	654	149	0.0106	2145	1.0000	1.06%
Verizon 700	2	695	149	0.0225	698	0.4653	4.84%
							30.88%
* Source: Siting Council							

Structural Analysis Report

147-ft Existing EEL Monopole

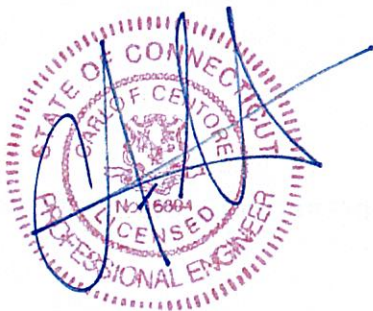
*Proposed Verizon Wireless
Antenna Upgrade*

Verizon Wireless Site Ref: Chaplin South

*123 Palmer Road
Chaplin, CT*

Centek Project No. 11074.CO18

Date: October 18, 2011



Prepared for:

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

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- ANTENNA CUT SHEETS.
- TOWER INVENTORY MAPPING REPORT prepared by JWB TOWER SERVICES, LLC dated October 10, 2011.

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 Chaplin, CT.

The host tower is a 147-ft, three-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Inc (EEI)—job no: 11855, dated September 8, 2003. The tower geometry, structure member sizes and foundation system information were obtained from the aforementioned EEI design report. Antenna and appurtenance information were obtained from the tower mapping and inventory report prepared by JWB Tower Services, LLC (JWB) dated October 10, 2011 and a Verizon RF data sheet..

The tower is made up of three (3) tapered vertical sections consisting of A572-65 pole sections. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 21.00-in at the top and 50.50-in at the base.

Verizon is proposing the removal of twelve (12) panel antennas and the installation of twelve (12) panel antennas 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:

- Sprint (Existing):
Antennas: Four (4) Decibel DB950F85E-M and two (2) Decibel DB950G40E-M panel antennas mounted to one (1) low profile platform with a RAD center elevation of 138-ft above grade level.
Coax Cables: Six (6) 1 5/8" $\varnothing$ coax cables running on the interior of monopole.
- AT&T (Existing):
Antennas: Six (6) Powerwave 7770 panel antennas, six (6) Powerwave LGP21401 TMA's, six (6) Powerwave LGP21901 Diplexers and three (3) PolyPahser DAS-DFDM-06 Bias-T mounted on one (1) low profile platform at a RAD center elevation of 128-ft above grade level.
Coax Cables: Twelve (12) 1 5/8" $\varnothing$ coax cables running on the interior of monopole.
- T-Mobile (Existing):
Antennas: Three (3) EMS RR90-17-02DP panel antennas and three (3) 10"x8"x5" TMA's mounted to one (1) low profile platform with a RAD center elevation of 118-ft above grade level.
Coax Cables: Six (6) 1 5/8" $\varnothing$ coax cables running on the interior of the monopole.
- AT&T (Existing):
GPS: One (1) GPS antenna mounted on a 4-ft standoff arm with a RAD center elevation of 74-ft above grade level.
Coax Cables: One (1) 1/2" $\varnothing$ coax cable running on the exterior of monopole.

- Sprint (Existing):
GPS: One (1) GPS antenna mounted on a 4-ft standoff arm with a RAD center elevation of 62-ft above grade level.
Coax Cables: One (1) 1/2" Ø coax cable running on the exterior of monopole.
- VERIZON (Existing to Remain):
Coax Cables: Twelve (12) 1 5/8" Ø coax cables running on the interior of monopole.
- VERIZON (Existing to Remove):
Antennas: Six (6) Decibel DB844F90A-SX and six (6) Decibel DB948F85T2E-M panel antennas mounted to one (1) low profile platform with a RAD center elevation of 149-ft above grade level.
- VERIZON (Proposed):
Antennas: Four (4) Antel LPA-80080-4CF, two (2) Antel LPA-80063-4CF, two (2) Antel BXA-171085-8BF, one (1) Antel BXA-171063-8BF and three (3) Antel BXA-70063-6CF panel antennas mounted to one (1) low profile platform with a RAD center elevation of 149-ft above grade level.
Coax Cables: Six (6) 1 5/8" Ø coax cables running on the exterior of monopole.

Primary Assumptions Used in the Analysis

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

Analysis

The existing tower was analyzed using a comprehensive computer program entitled RISATower. The program analyzes the tower, considering the worst case loading condition. The tower is considered as loaded by concentric forces along the tower shaft, and the model assumes that the shaft members are subjected to bending, axial, and shear forces.

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

Tower Loading

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

Basic Wind Speed:	Windham; $v = 85$ mph (fastest mile)	[Section 16 of TIA/EIA-222-F-96]
	Chaplin; $v = 105$ mph (3 second gust) equivalent to $v = 85$ mph (fastest mile)	[Appendix K of the 2005 CT Building Code Supplement]
	TIA/EIA wind speed and appendix K wind speed are equal.	
Load Cases:	<u>Load Case 1</u> ; 85 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation. This load case typically controls the design of monopole towers.	[Section 2.3.16 of TIA/EIA-222-F-96]
	<u>Load Case 2</u> ; 74 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 74 mph wind speed velocity represents 75% of the wind pressure generated by the 85 mph wind speed. This load case typically controls the design of lattice towers.	[Section 2.3.16 of TIA/EIA-222-F-96]
	<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 **87.9%** of its total capacity.

Tower Section	Component	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L2)	48.17'-94.75'	87.9%	PASS

Foundation and Anchors

The existing foundation consists of an 7-ft Ø x 1.0-ft long reinforced concrete pier on a 24.0-ft square x 4.5-ft thick reinforce concrete pad. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned EEI design report; job no: 11855, dated September 8, 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 5-ft into the concrete foundation structure.

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

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

Reactions	Vector	Proposed Load
Base	Shear	21 kips
	Axial	28 kips
	Moment	2149 ft-kips

- 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
Reinf. Conc. Pad and Pier	OTM	2.0 ⁽²⁾	2.59	PASS

1. FS denote Factor of Safety

2. OTM denotes Overturning Moment

CEN TEK Engineering, Inc.

Structural Analysis – 147' EEI Monopole

Verizon Wireless Antenna Upgrade – Chaplin South

Chaplin, CT

October 18, 2011

- 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	76.0%	PASS
Base Plate	Bending	84.0%	PASS

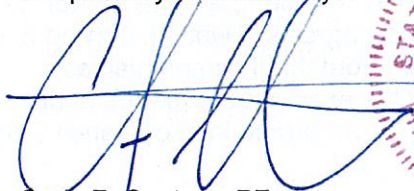
Conclusion

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

CEN TEK Engineering, Inc.

Structural Analysis – 147' EEI Monopole

Verizon Wireless Antenna Upgrade – Chaplin South

Chaplin, CT

October 18, 2011

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

CEN TEK Engineering, Inc.

Structural Analysis – 147' EEI Monopole

Verizon Wireless Antenna Upgrade – Chaplin South

Chaplin, CT

October 18, 2011

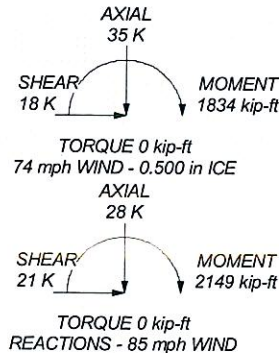
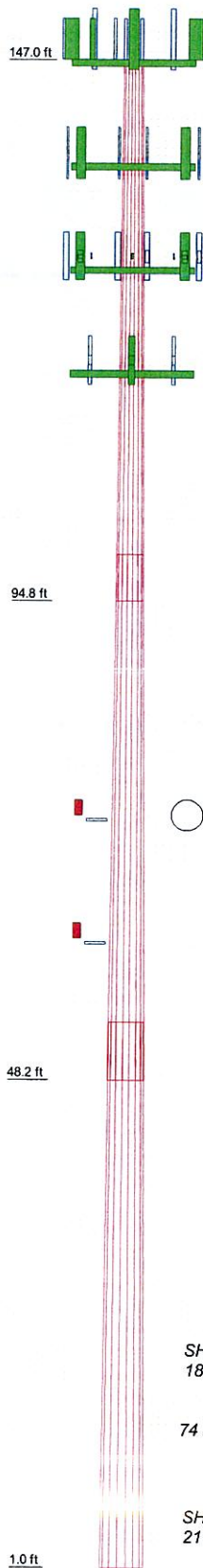
General Description of Structural Analysis Program

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

RISATower Features:

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

Section	1	2	3	
Length (ft)	52.250	51.080	52.840	
Number of Sides	18	18	18	
Thickness (in)	0.188	0.250	0.313	
Socket Length (ft)	4.500	5.670	39.555	
Top Dia (in)	21.000	30.641	50.500	
Bot Dia (in)	31.960	41.230		
Grade	A572-65	A572-65		
Weight (K)	2.8	4.9	8.0	15.7



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
LPA-80080-4CF (Verizon Proposed)	149	(2) LGP21401 TMA (ATI Existing)	128
BXA-171085-8BF (Verizon Proposed)	149	(2) LGP21901 Diplexer (ATI Existing)	128
BXA-70063/6CF (Verizon Proposed)	149	(2) LGP21901 Diplexer (ATI Existing)	128
LPA-80080-4CF (Verizon Proposed)	149	(2) LGP21901 Diplexer (ATI Existing)	128
LPA-80080-4CF (Verizon Proposed)	149	DAS-HY-DFDM-06 BIAS-T (ATI Existing)	128
BXA-171085-8BF (Verizon Proposed)	149	DAS-HY-DFDM-06 BIAS-T (ATI Existing)	128
BXA-70063/6CF (Verizon Proposed)	149	DAS-HY-DFDM-06 BIAS-T (ATI Existing)	128
LPA-80080-4CF (Verizon Proposed)	149	DAS-HY-DFDM-06 BIAS-T (ATI Existing)	128
LPA-80063/4CF (Verizon Proposed)	149	EEI 12-ft Low Profile Platform (ATI Existing)	127
BXA-171063/8BF (Verizon Proposed)	149	RR90-17-02DP (T-Mobile Existing)	118
BXA-70063/6CF (Verizon Proposed)	149	RR90-17-02DP (T-Mobile Existing)	118
LPA-80063/4CF (Verizon Proposed)	149	RR90-17-02DP (T-Mobile Existing)	118
EEI 14-ft Low Profile Platform (Verizon Existing)	147	TMA 10"x8"x5" (T-Mobile Existing)	118
(2) DB950F85E-M (Sprint Existing)	138	TMA 10"x8"x5" (T-Mobile Existing)	118
(2) DB950F85E-M (Sprint Existing)	138	TMA 10"x8"x5" (T-Mobile Existing)	118
(2) DB950G40E-M (Sprint Existing)	138	TMA 10"x8"x5" (T-Mobile Existing)	118
EEI 12-ft Low Profile Platform (Sprint Existing)	137	Andrew 12'-6" Low Profile Platform (T-Mobile Existing)	117
(2) 7770.00 (ATI Existing)	128	GPS (ATI Existing)	74
(2) 7770.00 (ATI Existing)	128	4-ft Standoff (ATI Existing)	73.5
(2) 7770.00 (ATI Existing)	128	GPS (Sprint Existing)	62
(2) LGP21401 TMA (ATI Existing)	128	4-ft Standoff (Sprint Existing)	61.5
(2) LGP21401 TMA (ATI Existing)	128		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Weld together tower sections have flange connections.
5. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
6. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
7. Welds are fabricated with ER-70S-6 electrodes.
8. TOWER RATING: 87.9%

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

Job: **11074.CO18 - Chaplin South**
Project: **147' EEI Monopole - 123 Palmer Road Chaplin, CT**
Client: Verizon Wireless
Code: TIA/EIA-222-F
Path: J:\2011\1074\1074\1074-147' EEI Monopole - 123 Palmer Road Chaplin, CT.dwg
Drawn by: TJL
Date: 10/18/11
Scale: NTS
App'd:
Dwg No. E-1

<i>RISATower</i> Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job 11074.CO18 - Chaplin South	Page 1 of 19
	Project 147' EEI Monopole - 123 Palmer Road Chaplin, CT	Date 10:52:06 10/18/11
	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 85 mph.

Nominal ice thickness of 0.500 in.

Ice density of 56 pcf.

A wind speed of 74 mph is used in combination with ice.

Temperature drop of 50 °F.

Deflections calculated using a wind speed of 50 mph.

Weld together tower sections have flange connections..

Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..

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

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

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

Pressures are calculated at each section.

Stress ratio used in pole design is 1.333.

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

Options

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

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	147.000-94.750	52.250	4.500	18	21.000	31.960	0.188	0.750	A572-65 (65 ksi)
L2	94.750-48.170	51.080	5.670	18	30.641	41.230	0.250	1.000	A572-65 (65 ksi)
L3	48.170-1.000	52.840		18	39.555	50.500	0.313	1.250	A572-65 (65 ksi)

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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	21.324	12.386	677.826	7.388	10.668	63.538	1356.544	6.194	3.366	17.952
	32.453	18.909	2411.570	11.279	16.236	148.535	4826.313	9.456	5.295	28.24
L2	32.061	24.115	2813.991	10.789	15.566	180.782	5631.684	12.060	4.953	19.811
	41.866	32.518	6899.224	14.548	20.945	329.400	13807.526	16.262	6.816	27.266
L3	41.357	38.923	7572.709	13.931	20.094	376.869	15155.382	19.465	6.412	20.517
	51.279	49.780	15840.945	17.817	25.654	617.484	31702.734	24.895	8.338	26.682

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 147.000- 94.750				1	1	1		
L2 94.750- 48.170				1	1	1		
L3 48.170- 1.000				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 ft ² /ft	Weight klf
1 5/8 (Verizon Existing)	C	No	Inside Pole	147.000 - 2.000	12	No Ice	0.000	0.001
1 5/8 (Sprint Existing)	C	No	Inside Pole	138.000 - 2.000	6	1/2" Ice	0.000	0.001
1 5/8 (AT&T Existing)	C	No	Inside Pole	128.000 - 2.000	12	No Ice	0.000	0.001
1 5/8 (T-Mobile Existing)	C	No	Inside Pole	118.000 - 2.000	6	1/2" Ice	0.000	0.001
1/2 (AT&T Existing)	C	No	CaAa (Out Of Face)	74.000 - 2.000	1	No Ice	0.058	0.000
1/2 (Sprint Existing)	C	No	CaAa (Out Of Face)	62.000 - 2.000	1	1/2" Ice	0.158	0.001
1 5/8 (Verizon Proposed)	C	No	CaAa (Out Of Face)	147.000 - 2.000	1	No Ice	0.198	0.001
1 5/8 (Verizon Proposed)	C	No	CaAa (Out Of Face)	147.000 - 2.000	5	1/2" Ice	0.298	0.003
						No Ice	0.000	0.001
						1/2" Ice	0.000	0.003

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A _R ft ²	A _F ft ²	C _A A _A In Face ft ²	C _A A _A Out Face ft ²	Weight K
L1	147.000-94.750	A	0.000	0.000	0.000	0.000	0.000

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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
L2	94.750-48.170	B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	10.345	1.808
		A	0.000	0.000	0.000	0.000	0.000
L3	48.170-1.000	B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	11.523	2.045
		A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	14.497	2.040

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	147.000-94.750	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	15.570	2.281
L2	94.750-48.170	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	20.147	2.493
L3	48.170-1.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	28.348	2.519

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
LPA-80080-4CF (Verizon Proposed)	A	From Face	3.500 6.000 0.000	0.000	149.000	No Ice 1/2" Ice 2.619 2.922	6.057 6.453	0.012 0.045
BXA-171085-8BF (Verizon Proposed)	A	From Face	3.500 4.000 0.000	0.000	149.000	No Ice 1/2" Ice 2.941 3.255	2.156 2.458	0.011 0.029
BXA-70063/6CF (Verizon Proposed)	A	From Face	3.500 0.000 0.000	0.000	149.000	No Ice 1/2" Ice 7.731 8.268	4.158 4.595	0.017 0.059
LPA-80080-4CF (Verizon Proposed)	A	From Face	3.500 -6.000 0.000	0.000	149.000	No Ice 1/2" Ice 2.619 2.922	6.057 6.453	0.012 0.045
LPA-80080-4CF (Verizon Proposed)	B	From Face	3.500 6.000 0.000	0.000	149.000	No Ice 1/2" Ice 2.619 2.922	6.057 6.453	0.012 0.045
BXA-171085-8BF (Verizon Proposed)	B	From Face	3.500 4.000 0.000	0.000	149.000	No Ice 1/2" Ice 2.941 3.255	2.156 2.458	0.011 0.029
BXA-70063/6CF (Verizon Proposed)	B	From Face	3.500 0.000 0.000	0.000	149.000	No Ice 1/2" Ice 7.731 8.268	4.158 4.595	0.017 0.059

RISATower

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Project

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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
LPA-80080-4CF (Verizon Proposed)	B	From Face	3.500 -6.000 0.000	0.000	149.000	No Ice 1/2" Ice	2.619 2.922	6.057 6.453	0.012 0.045
LPA-80063/4CF (Verizon Proposed)	C	From Face	3.500 6.000 0.000	0.000	149.000	No Ice 1/2" Ice	7.005 7.415	6.083 6.480	0.020 0.073
BXA-171063/8BF (Verizon Proposed)	C	From Face	3.500 4.000 0.000	0.000	149.000	No Ice 1/2" Ice	2.941 3.255	2.156 2.458	0.011 0.029
BXA-70063/6CF (Verizon Proposed)	C	From Face	3.500 0.000 0.000	0.000	149.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.017 0.059
LPA-80063/4CF (Verizon Proposed)	C	From Face	3.500 -6.000 0.000	0.000	149.000	No Ice 1/2" Ice	7.005 7.415	6.083 6.480	0.020 0.073
EEI 14-ft Low Profile Platform (Verizon Existing)	C	None		0.000	147.000	No Ice 1/2" Ice	16.500 20.000	16.500 20.000	1.550 1.800
(2) DB950F85E-M (Sprint Existing)	A	From Face	3.500 0.000 0.000	0.000	138.000	No Ice 1/2" Ice	2.778 3.146	4.236 4.620	0.012 0.036
(2) DB950F85E-M (Sprint Existing)	B	From Face	3.500 0.000 0.000	0.000	138.000	No Ice 1/2" Ice	2.778 3.146	4.236 4.620	0.012 0.036
(2) DB950G40E-M (Sprint Existing)	C	From Face	3.500 0.000 0.000	0.000	138.000	No Ice 1/2" Ice	6.417 6.881	4.722 5.112	0.019 0.061
EEI 12-ft Low Profile Platform (Sprint Existing)	C	None		0.000	137.000	No Ice 1/2" Ice	15.000 18.400	15.000 18.400	1.500 1.750
(2) 7770.00 (AT&T Existing)	A	From Face	3.500 0.000 0.000	0.000	128.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
(2) 7770.00 (AT&T Existing)	B	From Face	3.500 0.000 0.000	0.000	128.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
(2) 7770.00 (AT&T Existing)	C	From Face	3.500 0.000 0.000	0.000	128.000	No Ice 1/2" Ice	5.882 6.314	2.928 3.273	0.035 0.068
(2) LGP21401 TMA (AT&T Existing)	A	From Face	3.500 0.000 0.000	0.000	128.000	No Ice 1/2" Ice	0.953 1.093	0.367 0.480	0.018 0.023
(2) LGP21401 TMA (AT&T Existing)	B	From Face	3.500 0.000 0.000	0.000	128.000	No Ice 1/2" Ice	0.953 1.093	0.367 0.480	0.018 0.023
(2) LGP21401 TMA (AT&T Existing)	C	From Face	3.500 0.000 0.000	0.000	128.000	No Ice 1/2" Ice	0.953 1.093	0.367 0.480	0.018 0.023
(2) LGP21901 Diplexer (AT&T Existing)	A	From Face	3.500 0.000 0.000	0.000	128.000	No Ice 1/2" Ice	0.233 0.302	0.117 0.166	0.006 0.008
(2) LGP21901 Diplexer (AT&T Existing)	B	From Face	3.500 0.000 0.000	0.000	128.000	No Ice 1/2" Ice	0.233 0.302	0.117 0.166	0.006 0.008
(2) LGP21901 Diplexer (AT&T Existing)	C	From Face	3.500 0.000 0.000	0.000	128.000	No Ice 1/2" Ice	0.233 0.302	0.117 0.166	0.006 0.008

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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
DAS-HY-DFDM-06 BIAS-T (AT&T Existing)	A	From Face	3.500 0.000 0.000	0.000	128.000	No Ice 1/2" Ice	0.102 0.161	0.136 0.199	0.080 0.081
DAS-HY-DFDM-06 BIAS-T (AT&T Existing)	B	From Face	3.500 0.000 0.000	0.000	128.000	No Ice 1/2" Ice	0.102 0.161	0.136 0.199	0.080 0.081
DAS-HY-DFDM-06 BIAS-T (AT&T Existing)	C	From Face	3.500 0.000 0.000	0.000	128.000	No Ice 1/2" Ice	0.102 0.161	0.136 0.199	0.080 0.081
EEI 12-ft Low Profile Platform (AT&T Existing)	C	None		0.000	127.000	No Ice 1/2" Ice	15.000 18.400	15.000 18.400	1.500 1.750
RR90-17-02DP (T-Mobile Existing)	A	From Face	3.500 0.000 0.000	0.000	118.000	No Ice 1/2" Ice	4.356 4.775	1.974 2.312	0.018 0.040
RR90-17-02DP (T-Mobile Existing)	B	From Face	3.500 0.000 0.000	0.000	118.000	No Ice 1/2" Ice	4.356 4.775	1.974 2.312	0.018 0.040
RR90-17-02DP (T-Mobile Existing)	C	From Face	3.500 0.000 0.000	0.000	118.000	No Ice 1/2" Ice	4.356 4.775	1.974 2.312	0.018 0.040
TMA 10"x8"x5" (T-Mobile Existing)	A	From Face	3.500 0.000 0.000	0.000	118.000	No Ice 1/2" Ice	0.778 0.899	0.486 0.588	0.020 0.026
TMA 10"x8"x5" (T-Mobile Existing)	B	From Face	3.500 0.000 0.000	0.000	118.000	No Ice 1/2" Ice	0.778 0.899	0.486 0.588	0.020 0.026
TMA 10"x8"x5" (T-Mobile Existing)	C	From Face	3.500 0.000 0.000	0.000	118.000	No Ice 1/2" Ice	0.778 0.899	0.486 0.588	0.020 0.026
Andrew 12'-6" Low Profile Platform (T-Mobile Existing)	C	None		0.000	117.000	No Ice 1/2" Ice	14.450 19.000	14.450 19.000	1.300 1.690
GPS (AT&T Existing)	A	From Face	4.000 0.000 0.000	0.000	74.000	No Ice 1/2" Ice	1.000 1.500	1.000 1.500	0.010 0.015
4-ft Standoff (AT&T Existing)	A	From Face	2.000 0.000 0.000	0.000	73.500	No Ice 1/2" Ice	1.400 1.735	0.087 0.131	0.030 0.041
GPS (Sprint Existing)	A	From Face	4.000 0.000 0.000	0.000	62.000	No Ice 1/2" Ice	1.000 1.500	1.000 1.500	0.010 0.015
4-ft Standoff (Sprint Existing)	A	From Face	2.000 0.000 0.000	0.000	61.500	No Ice 1/2" Ice	1.400 1.735	0.087 0.131	0.030 0.041

Tower Pressures - No Ice

$$G_H = 1.690$$

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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		ksf	ft ²		ft ²	ft ²	ft ²			
L1 147.000-94.750	119.473	1.444	0.027	115.298	A	0.000	115.298	115.298	100.00	0.000	0.000
					B	0.000	115.298		100.00	0.000	0.000
					C	0.000	115.298		100.00	0.000	10.345
L2 94.750-48.170	70.977	1.245	0.023	141.300	A	0.000	141.300	141.300	100.00	0.000	0.000
					B	0.000	141.300		100.00	0.000	0.000
					C	0.000	141.300		100.00	0.000	11.523
L3 48.170-1.000	23.896	1	0.019	179.303	A	0.000	179.303	179.303	100.00	0.000	0.000
					B	0.000	179.303		100.00	0.000	0.000
					C	0.000	179.303		100.00	0.000	14.497

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 _A A _A In Face ft ²	C _A A _A Out Face ft ²
ft	ft		ksf	in	ft ²		ft ²	ft ²	ft ²			
L1 147.000-94.750	119.473	1.444	0.020	0.500	119.653	A	0.000	119.653	119.653	100.00	0.000	0.000
						B	0.000	119.653		100.00	0.000	0.000
						C	0.000	119.653		100.00	0.000	15.570
L2 94.750-48.170	70.977	1.245	0.017	0.500	145.182	A	0.000	145.182	145.182	100.00	0.000	0.000
						B	0.000	145.182		100.00	0.000	0.000
						C	0.000	145.182		100.00	0.000	20.147
L3 48.170-1.000	23.896	1	0.014	0.500	183.234	A	0.000	183.234	183.234	100.00	0.000	0.000
						B	0.000	183.234		100.00	0.000	0.000
						C	0.000	183.234		100.00	0.000	28.348

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		ksf	ft ²		ft ²	ft ²	ft ²			
L1 147.000-94.750	119.473	1.444	0.009	115.298	A	0.000	115.298	115.298	100.00	0.000	0.000
					B	0.000	115.298		100.00	0.000	0.000
					C	0.000	115.298		100.00	0.000	10.345
L2 94.750-48.170	70.977	1.245	0.008	141.300	A	0.000	141.300	141.300	100.00	0.000	0.000
					B	0.000	141.300		100.00	0.000	0.000
					C	0.000	141.300		100.00	0.000	11.523
L3 48.170-1.000	23.896	1	0.006	179.303	A	0.000	179.303	179.303	100.00	0.000	0.000
					B	0.000	179.303		100.00	0.000	0.000
					C	0.000	179.303		100.00	0.000	14.497

Tower Forces - No Ice - Wind Normal To Face

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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	klf	
L1 147.000-94.750	1.808	2.782	A	1	0.65	1	1	1	115.298	3.842	0.074	C
			B	1	0.65	1	1	1	115.298			
			C	1	0.65	1	1	1	115.298			
L2 94.750-48.170	2.045	4.922	A	1	0.65	1	1	1	141.300	4.001	0.086	C
			B	1	0.65	1	1	1	141.300			
			C	1	0.65	1	1	1	141.300			
L3 48.170-1.000	2.040	7.975	A	1	0.65	1	1	1	179.303	4.147	0.088	C
			B	1	0.65	1	1	1	179.303			
			C	1	0.65	1	1	1	179.303			
Sum Weight:	5.892	15.678						OTM	830.157 kip-ft	11.991		

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	klf	
L1 147.000-94.750	1.808	2.782	A	1	0.65	1	1	1	115.298	3.842	0.074	C
			B	1	0.65	1	1	1	115.298			
			C	1	0.65	1	1	1	115.298			
L2 94.750-48.170	2.045	4.922	A	1	0.65	1	1	1	141.300	4.001	0.086	C
			B	1	0.65	1	1	1	141.300			
			C	1	0.65	1	1	1	141.300			
L3 48.170-1.000	2.040	7.975	A	1	0.65	1	1	1	179.303	4.147	0.088	C
			B	1	0.65	1	1	1	179.303			
			C	1	0.65	1	1	1	179.303			
Sum Weight:	5.892	15.678						OTM	830.157 kip-ft	11.991		

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	klf	
L1 147.000-94.750	1.808	2.782	A	1	0.65	1	1	1	115.298	3.842	0.074	C
			B	1	0.65	1	1	1	115.298			
			C	1	0.65	1	1	1	115.298			
L2 94.750-48.170	2.045	4.922	A	1	0.65	1	1	1	141.300	4.001	0.086	C
			B	1	0.65	1	1	1	141.300			
			C	1	0.65	1	1	1	141.300			
L3 48.170-1.000	2.040	7.975	A	1	0.65	1	1	1	179.303	4.147	0.088	C
			B	1	0.65	1	1	1	179.303			
			C	1	0.65	1	1	1	179.303			
Sum Weight:	5.892	15.678						OTM	830.157 kip-ft	11.991		

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Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	F a c e	e	C _F	R _R	D _F	D _R	A _E ft ²	F K	w klf	Ctrl. Face
L1 147.000-94.750	1.808	2.782	A	1	0.65	1	1	1	115.298	3.842	0.074	C
			B	1	0.65	1	1	1	115.298			
			C	1	0.65	1	1	1	115.298			
L2 94.750-48.170	2.045	4.922	A	1	0.65	1	1	1	141.300	4.001	0.086	C
			B	1	0.65	1	1	1	141.300			
			C	1	0.65	1	1	1	141.300			
L3 48.170-1.000	2.040	7.975	A	1	0.65	1	1	1	179.303	4.147	0.088	C
			B	1	0.65	1	1	1	179.303			
			C	1	0.65	1	1	1	179.303			
Sum Weight:	5.892	15.678						OTM	830.157 kip-ft	11.991		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	F a c e	e	C _F	R _R	D _F	D _R	A _E ft ²	F K	w klf	Ctrl. Face
L1 147.000-94.750	2.281	3.652	A	1	0.65	1	1	1	119.653	3.154	0.060	C
			B	1	0.65	1	1	1	119.653			
			C	1	0.65	1	1	1	119.653			
L2 94.750-48.170	2.493	5.983	A	1	0.65	1	1	1	145.182	3.325	0.071	C
			B	1	0.65	1	1	1	145.182			
			C	1	0.65	1	1	1	145.182			
L3 48.170-1.000	2.519	9.317	A	1	0.65	1	1	1	183.234	3.500	0.074	C
			B	1	0.65	1	1	1	183.234			
			C	1	0.65	1	1	1	183.234			
Sum Weight:	7.293	18.952						OTM	686.424 kip-ft	9.978		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	F a c e	e	C _F	R _R	D _F	D _R	A _E ft ²	F K	w klf	Ctrl. Face
L1 147.000-94.750	2.281	3.652	A	1	0.65	1	1	1	119.653	3.154	0.060	C
			B	1	0.65	1	1	1	119.653			
			C	1	0.65	1	1	1	119.653			
L2 94.750-48.170	2.493	5.983	A	1	0.65	1	1	1	145.182	3.325	0.071	C
			B	1	0.65	1	1	1	145.182			
			C	1	0.65	1	1	1	145.182			
L3 48.170-1.000	2.519	9.317	A	1	0.65	1	1	1	183.234	3.500	0.074	C
			B	1	0.65	1	1	1	183.234			
			C	1	0.65	1	1	1	183.234			
Sum Weight:	7.293	18.952						OTM	686.424 kip-ft	9.978		

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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	klf	
L1 147.000-94.750	2.281	3.652	A	1	0.65	1	1	1	119.653	3.154	0.060	C
			B	1	0.65	1	1	1	119.653			
			C	1	0.65	1	1	1	119.653			
L2 94.750-48.170	2.493	5.983	A	1	0.65	1	1	1	145.182	3.325	0.071	C
			B	1	0.65	1	1	1	145.182			
			C	1	0.65	1	1	1	145.182			
L3 48.170-1.000	2.519	9.317	A	1	0.65	1	1	1	183.234	3.500	0.074	C
			B	1	0.65	1	1	1	183.234			
			C	1	0.65	1	1	1	183.234			
Sum Weight:	7.293	18.952						OTM	686.424 kip-ft	9.978		

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	klf	
L1 147.000-94.750	2.281	3.652	A	1	0.65	1	1	1	119.653	3.154	0.060	C
			B	1	0.65	1	1	1	119.653			
			C	1	0.65	1	1	1	119.653			
L2 94.750-48.170	2.493	5.983	A	1	0.65	1	1	1	145.182	3.325	0.071	C
			B	1	0.65	1	1	1	145.182			
			C	1	0.65	1	1	1	145.182			
L3 48.170-1.000	2.519	9.317	A	1	0.65	1	1	1	183.234	3.500	0.074	C
			B	1	0.65	1	1	1	183.234			
			C	1	0.65	1	1	1	183.234			
Sum Weight:	7.293	18.952						OTM	686.424 kip-ft	9.978		

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	klf	
L1 147.000-94.750	1.808	2.782	A	1	0.65	1	1	1	115.298	1.329	0.025	C
			B	1	0.65	1	1	1	115.298			
			C	1	0.65	1	1	1	115.298			
L2 94.750-48.170	2.045	4.922	A	1	0.65	1	1	1	141.300	1.385	0.030	C
			B	1	0.65	1	1	1	141.300			
			C	1	0.65	1	1	1	141.300			
L3 48.170-1.000	2.040	7.975	A	1	0.65	1	1	1	179.303	1.435	0.030	C
			B	1	0.65	1	1	1	179.303			
			C	1	0.65	1	1	1	179.303			
Sum Weight:	5.892	15.678						OTM	287.251	4.149		

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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	klf	
									kip-ft			

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	klf	
L1 147.000- 94.750	1.808	2.782	A	1	0.65	1	1	1	115.298	1.329	0.025	C
			B	1	0.65	1	1	1	115.298			
			C	1	0.65	1	1	1	115.298			
L2 94.750- 48.170	2.045	4.922	A	1	0.65	1	1	1	141.300	1.385	0.030	C
			B	1	0.65	1	1	1	141.300			
			C	1	0.65	1	1	1	141.300			
L3 48.170- 1.000	2.040	7.975	A	1	0.65	1	1	1	179.303	1.435	0.030	C
			B	1	0.65	1	1	1	179.303			
			C	1	0.65	1	1	1	179.303			
Sum Weight:	5.892	15.678						OTM	287.251 kip-ft	4.149		

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	klf	
L1 147.000- 94.750	1.808	2.782	A	1	0.65	1	1	1	115.298	1.329	0.025	C
			B	1	0.65	1	1	1	115.298			
			C	1	0.65	1	1	1	115.298			
L2 94.750- 48.170	2.045	4.922	A	1	0.65	1	1	1	141.300	1.385	0.030	C
			B	1	0.65	1	1	1	141.300			
			C	1	0.65	1	1	1	141.300			
L3 48.170- 1.000	2.040	7.975	A	1	0.65	1	1	1	179.303	1.435	0.030	C
			B	1	0.65	1	1	1	179.303			
			C	1	0.65	1	1	1	179.303			
Sum Weight:	5.892	15.678						OTM	287.251 kip-ft	4.149		

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	klf	
L1 147.000- 94.750	1.808	2.782	A	1	0.65	1	1	1	115.298	1.329	0.025	C
			B	1	0.65	1	1	1	115.298			
			C	1	0.65	1	1	1	115.298			

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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	klf	
L2 94.750- 48.170	2.045	4.922	A	1	0.65	1	1	1	141.300	1.385	0.030	C
			B	1	0.65	1	1	1	141.300			
			C	1	0.65	1	1	1	141.300			
L3 48.170- 1.000	2.040	7.975	A	1	0.65	1	1	1	179.303	1.435	0.030	C
			B	1	0.65	1	1	1	179.303			
			C	1	0.65	1	1	1	179.303			
Sum Weight:	5.892	15.678						OTM	287.251 kip-ft	4.149		

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	15.678					
Bracing Weight	0.000					
Total Member Self-Weight	15.678			-0.030	0.281	
Total Weight	28.467			-0.030	0.281	
Wind 0 deg - No Ice		-0.044	-21.139	-2068.068	3.184	-0.389
Wind 30 deg - No Ice		10.199	-18.285	-1789.552	-981.552	-0.342
Wind 45 deg - No Ice		14.446	-14.917	-1460.301	-1389.743	-0.283
Wind 60 deg - No Ice		17.709	-10.532	-1031.535	-1703.206	-0.204
Wind 90 deg - No Ice		20.473	0.044	2.873	-1968.413	-0.010
Wind 120 deg - No Ice		17.752	10.607	1036.504	-1706.110	0.186
Wind 135 deg - No Ice		14.508	14.978	1464.347	-1393.849	0.268
Wind 150 deg - No Ice		10.274	18.329	1792.395	-986.580	0.332
Wind 180 deg - No Ice		0.044	21.139	2068.009	-2.622	0.389
Wind 210 deg - No Ice		-10.199	18.285	1789.492	982.113	0.342
Wind 225 deg - No Ice		-14.446	14.917	1460.241	1390.304	0.283
Wind 240 deg - No Ice		-17.709	10.532	1031.475	1703.768	0.204
Wind 270 deg - No Ice		-20.473	-0.044	-2.933	1968.974	0.010
Wind 300 deg - No Ice		-17.752	-10.607	-1036.563	1706.671	-0.186
Wind 315 deg - No Ice		-14.508	-14.978	-1464.406	1394.410	-0.268
Wind 330 deg - No Ice		-10.274	-18.329	-1792.455	987.141	-0.332
Member Ice	3.273					
Total Weight Ice	35.246			0.235	0.399	
Wind 0 deg - Ice		-0.040	-17.821	-1742.768	3.060	-0.438
Wind 30 deg - Ice		8.624	-15.414	-1507.919	-830.817	-0.424
Wind 45 deg - Ice		12.216	-12.573	-1230.372	-1176.496	-0.373
Wind 60 deg - Ice		14.977	-8.876	-868.962	-1441.971	-0.297
Wind 90 deg - Ice		17.317	0.040	2.896	-1666.643	-0.090
Wind 120 deg - Ice		15.016	8.945	874.041	-1444.632	0.141
Wind 135 deg - Ice		12.273	12.630	1234.606	-1180.259	0.246
Wind 150 deg - Ice		8.693	15.454	1511.051	-835.427	0.334
Wind 180 deg - Ice		0.040	17.821	1743.238	-2.262	0.438
Wind 210 deg - Ice		-8.624	15.414	1508.390	831.615	0.424
Wind 225 deg - Ice		-12.216	12.573	1230.843	1177.293	0.373
Wind 240 deg - Ice		-14.977	8.876	869.432	1442.768	0.297
Wind 270 deg - Ice		-17.317	-0.040	-2.426	1667.440	0.090
Wind 300 deg - Ice		-15.016	-8.945	-873.571	1445.430	-0.141
Wind 315 deg - Ice		-12.273	-12.630	-1234.136	1181.057	-0.246
Wind 330 deg - Ice		-8.693	-15.454	-1510.580	836.224	-0.334
Total Weight	28.467			-0.030	0.281	
Wind 0 deg - Service		-0.015	-7.315	-715.614	1.285	-0.135
Wind 30 deg - Service		3.529	-6.327	-619.241	-339.454	-0.118

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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
Wind 45 deg - Service		4.999	-5.162	-505.314	-480.696	-0.098
Wind 60 deg - Service		6.128	-3.644	-356.952	-589.161	-0.070
Wind 90 deg - Service		7.084	0.015	0.975	-680.928	-0.004
Wind 120 deg - Service		6.143	3.670	358.632	-590.166	0.064
Wind 135 deg - Service		5.020	5.183	506.675	-482.117	0.093
Wind 150 deg - Service		3.555	6.342	620.187	-341.194	0.115
Wind 180 deg - Service		0.015	7.315	715.554	-0.724	0.135
Wind 210 deg - Service		-3.529	6.327	619.182	340.015	0.118
Wind 225 deg - Service		-4.999	5.162	505.254	481.258	0.098
Wind 240 deg - Service		-6.128	3.644	356.892	589.722	0.070
Wind 270 deg - Service		-7.084	-0.015	-1.034	681.489	0.004
Wind 300 deg - Service		-6.143	-3.670	-358.692	590.727	-0.064
Wind 315 deg - Service		-5.020	-5.183	-506.734	482.678	-0.093
Wind 330 deg - Service		-3.555	-6.342	-620.246	341.755	-0.115

Load Combinations

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

RISATower

Centek Engineering Inc.
63-2 North Branford Rd.
Branford, CT 06405
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Client

Verizon Wireless

Designed by

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Comb. No.	Description
38	Dead+Wind 60 deg - Service
39	Dead+Wind 90 deg - Service
40	Dead+Wind 120 deg - Service
41	Dead+Wind 135 deg - Service
42	Dead+Wind 150 deg - Service
43	Dead+Wind 180 deg - Service
44	Dead+Wind 210 deg - Service
45	Dead+Wind 225 deg - Service
46	Dead+Wind 240 deg - Service
47	Dead+Wind 270 deg - Service
48	Dead+Wind 300 deg - Service
49	Dead+Wind 315 deg - Service
50	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	147 - 94.75	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-14.251	0.000	-0.466
			Max. Mx	14	-10.108	413.762	-0.110
			Max. My	10	-9.998	-0.004	-447.722
			Max. Vy	14	-12.528	413.762	-0.110
			Max. Vx	10	13.287	-0.004	-447.722
			Max. Torque	14			0.218
L2	94.75 - 48.17	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-22.344	0.399	-0.236
			Max. Mx	14	-17.023	1070.189	0.670
			Max. My	2	-16.966	0.930	1137.402
			Max. Vy	14	-16.415	1070.189	0.670
			Max. Vx	2	-17.113	0.930	1137.402
			Max. Torque	27			-0.433
L3	48.17 - 1	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-35.246	0.399	-0.235
			Max. Mx	14	-28.450	2045.873	2.997
			Max. My	2	-28.449	3.261	2149.294
			Max. Vy	14	-20.495	2045.873	2.997
			Max. Vx	2	-21.161	3.261	2149.294
			Max. Torque	27			-0.433

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	18	35.246	-0.000	0.000
	Max. H _x	14	28.467	20.472	0.044
	Max. H _z	2	28.467	0.044	21.137
	Max. M _x	2	2149.294	0.044	21.137
	Max. M _z	6	2045.289	-20.472	-0.044
	Max. Torsion	19	0.432	0.040	17.821
	Min. Vert	10	28.467	-0.044	-21.137
	Min. H _x	6	28.467	-20.472	-0.044
	Min. H _z	10	28.467	-0.044	-21.137

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Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
	Min. M _x	10	-2149.241	-0.044	-21.137
	Min. M _z	14	-2045.873	20.472	0.044
	Min. Torsion	27	-0.433	-0.040	-17.821

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	28.467	-0.000	0.000	-0.030	0.281	0.000
Dead+Wind 0 deg - No Ice	28.467	-0.044	-21.137	-2149.294	3.261	-0.383
Dead+Wind 30 deg - No Ice	28.467	10.199	-18.285	-1860.106	-1019.885	-0.356
Dead+Wind 45 deg - No Ice	28.467	14.446	-14.917	-1517.954	-1444.054	-0.300
Dead+Wind 60 deg - No Ice	28.467	17.709	-10.532	-1072.323	-1769.826	-0.218
Dead+Wind 90 deg - No Ice	28.467	20.472	0.044	2.943	-2045.289	-0.006
Dead+Wind 120 deg - No Ice	28.467	17.752	10.607	1077.410	-1772.791	0.207
Dead+Wind 135 deg - No Ice	28.467	14.508	14.978	1522.095	-1448.250	0.291
Dead+Wind 150 deg - No Ice	28.467	10.274	18.329	1863.016	-1025.026	0.350
Dead+Wind 180 deg - No Ice	28.467	0.044	21.137	2149.241	-2.678	0.384
Dead+Wind 210 deg - No Ice	28.467	-10.199	18.285	1860.053	1020.468	0.315
Dead+Wind 225 deg - No Ice	28.467	-14.446	14.917	1517.901	1444.639	0.252
Dead+Wind 240 deg - No Ice	28.467	-17.709	10.532	1072.270	1770.411	0.177
Dead+Wind 270 deg - No Ice	28.467	-20.472	-0.044	-2.997	2045.873	0.006
Dead+Wind 300 deg - No Ice	28.467	-17.752	-10.607	-1077.464	1773.374	-0.166
Dead+Wind 315 deg - No Ice	28.467	-14.508	-14.978	-1522.149	1448.833	-0.244
Dead+Wind 330 deg - No Ice	28.467	-10.274	-18.329	-1863.070	1025.608	-0.309
Dead+Ice+Temp	35.246	0.000	-0.000	0.235	0.399	0.000
Dead+Wind 0 deg+Ice+Temp	35.246	-0.040	-17.821	-1833.539	3.160	-0.432
Dead+Wind 30 deg+Ice+Temp	35.246	8.624	-15.414	-1586.608	-873.800	-0.427
Dead+Wind 45 deg+Ice+Temp	35.246	12.216	-12.573	-1294.629	-1237.368	-0.376
Dead+Wind 60 deg+Ice+Temp	35.246	14.976	-8.876	-914.385	-1516.601	-0.297
Dead+Wind 90 deg+Ice+Temp	35.246	17.316	0.040	3.013	-1752.835	-0.078
Dead+Wind 120 deg+Ice+Temp	35.246	15.016	8.945	919.674	-1519.337	0.163
Dead+Wind 135 deg+Ice+Temp	35.246	12.273	12.630	1299.045	-1241.239	0.267
Dead+Wind 150 deg+Ice+Temp	35.246	8.693	15.454	1589.887	-878.543	0.350
Dead+Wind 180 deg+Ice+Temp	35.246	0.040	17.821	1834.081	-2.321	0.433
Dead+Wind 210 deg+Ice+Temp	35.246	-8.624	15.414	1587.151	874.639	0.399
Dead+Wind 225 deg+Ice+Temp	35.246	-12.216	12.573	1295.174	1238.208	0.344
Dead+Wind 240 deg+Ice+Temp	35.246	-14.976	8.876	914.930	1517.442	0.269
Dead+Wind 270 deg+Ice+Temp	35.246	-17.316	-0.040	-2.468	1753.677	0.077
Dead+Wind 300 deg+Ice+Temp	35.246	-15.016	-8.945	-919.131	1520.180	-0.136
Dead+Wind 315 deg+Ice+Temp	35.246	-12.273	-12.630	-1298.503	1242.082	-0.235
Dead+Wind 330 deg+Ice+Temp	35.246	-8.693	-15.454	-1589.345	879.385	-0.322
Dead+Wind 0 deg - Service	28.467	-0.015	-7.313	-744.570	1.321	-0.133
Dead+Wind 30 deg - Service	28.467	3.528	-6.326	-644.309	-353.063	-0.119
Dead+Wind 45 deg - Service	28.467	4.998	-5.160	-525.777	-499.963	-0.098
Dead+Wind 60 deg - Service	28.467	6.126	-3.644	-371.414	-612.772	-0.071
Dead+Wind 90 deg - Service	28.467	7.083	0.015	1.002	-708.210	-0.002
Dead+Wind 120 deg - Service	28.467	6.141	3.670	373.142	-613.800	0.068
Dead+Wind 135 deg - Service	28.467	5.019	5.182	527.178	-501.416	0.096
Dead+Wind 150 deg - Service	28.467	3.554	6.341	645.285	-354.844	0.117
Dead+Wind 180 deg - Service	28.467	0.015	7.313	744.518	-0.735	0.133
Dead+Wind 210 deg - Service	28.467	-3.528	6.326	644.258	353.650	0.114
Dead+Wind 225 deg - Service	28.467	-4.998	5.160	525.725	500.549	0.093
Dead+Wind 240 deg - Service	28.467	-6.126	3.644	371.362	613.359	0.066
Dead+Wind 270 deg - Service	28.467	-7.083	-0.015	-1.054	708.797	0.002
Dead+Wind 300 deg - Service	28.467	-6.141	-3.670	-373.194	614.386	-0.063

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Load Combination	Vertical K	Shear ₁ K	Shear ₂ K	Overturning Moment, M ₁ kip-ft	Overturning Moment, M ₂ kip-ft	Torque kip-ft
Dead+Wind 315 deg - Service	28.467	-5.019	-5.182	-527.230	502.003	-0.090
Dead+Wind 330 deg - Service	28.467	-3.554	-6.341	-645.337	355.430	-0.112

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	0.000	-28.467	0.000	0.000	28.467	0.000	0.000%
2	-0.044	-28.467	-21.139	0.044	28.467	21.137	0.004%
3	10.199	-28.467	-18.285	-10.199	28.467	18.285	0.000%
4	14.446	-28.467	-14.917	-14.446	28.467	14.917	0.000%
5	17.709	-28.467	-10.532	-17.709	28.467	10.532	0.000%
6	20.473	-28.467	0.044	-20.472	28.467	-0.044	0.004%
7	17.752	-28.467	10.607	-17.752	28.467	-10.607	0.000%
8	14.508	-28.467	14.978	-14.508	28.467	-14.978	0.000%
9	10.274	-28.467	18.329	-10.274	28.467	-18.329	0.000%
10	0.044	-28.467	21.139	-0.044	28.467	-21.137	0.004%
11	-10.199	-28.467	18.285	10.199	28.467	-18.285	0.000%
12	-14.446	-28.467	14.917	14.446	28.467	-14.917	0.000%
13	-17.709	-28.467	10.532	17.709	28.467	-10.532	0.000%
14	-20.473	-28.467	-0.044	20.472	28.467	0.044	0.004%
15	-17.752	-28.467	-10.607	17.752	28.467	10.607	0.000%
16	-14.508	-28.467	-14.978	14.508	28.467	14.978	0.000%
17	-10.274	-28.467	-18.329	10.274	28.467	18.329	0.000%
18	0.000	-35.246	0.000	-0.000	35.246	0.000	0.000%
19	-0.040	-35.246	-17.821	0.040	35.246	17.821	0.002%
20	8.624	-35.246	-15.414	-8.624	35.246	15.414	0.000%
21	12.216	-35.246	-12.573	-12.216	35.246	12.573	0.000%
22	14.977	-35.246	-8.876	-14.976	35.246	8.876	0.000%
23	17.317	-35.246	0.040	-17.316	35.246	-0.040	0.002%
24	15.016	-35.246	8.945	-15.016	35.246	-8.945	0.000%
25	12.273	-35.246	12.630	-12.273	35.246	-12.630	0.000%
26	8.693	-35.246	15.454	-8.693	35.246	-15.454	0.000%
27	0.040	-35.246	17.821	-0.040	35.246	-17.821	0.002%
28	-8.624	-35.246	15.414	8.624	35.246	-15.414	0.000%
29	-12.216	-35.246	12.573	12.216	35.246	-12.573	0.000%
30	-14.977	-35.246	8.876	14.976	35.246	-8.876	0.000%
31	-17.317	-35.246	-0.040	17.316	35.246	0.040	0.002%
32	-15.016	-35.246	-8.945	15.016	35.246	8.945	0.000%
33	-12.273	-35.246	-12.630	12.273	35.246	12.630	0.000%
34	-8.693	-35.246	-15.454	8.693	35.246	15.454	0.000%
35	-0.015	-28.467	-7.315	0.015	28.467	7.313	0.005%
36	3.529	-28.467	-6.327	-3.528	28.467	6.326	0.005%
37	4.999	-28.467	-5.162	-4.998	28.467	5.160	0.005%
38	6.128	-28.467	-3.644	-6.126	28.467	3.644	0.005%
39	7.084	-28.467	0.015	-7.083	28.467	-0.015	0.005%
40	6.143	-28.467	3.670	-6.141	28.467	-3.670	0.005%
41	5.020	-28.467	5.183	-5.019	28.467	-5.182	0.005%
42	3.555	-28.467	6.342	-3.554	28.467	-6.341	0.005%
43	0.015	-28.467	7.315	-0.015	28.467	-7.313	0.005%
44	-3.529	-28.467	6.327	3.528	28.467	-6.326	0.005%
45	-4.999	-28.467	5.162	4.998	28.467	-5.160	0.005%
46	-6.128	-28.467	3.644	6.126	28.467	-3.644	0.005%
47	-7.084	-28.467	-0.015	7.083	28.467	0.015	0.005%
48	-6.143	-28.467	-3.670	6.141	28.467	3.670	0.005%
49	-5.020	-28.467	-5.183	5.019	28.467	5.182	0.005%
50	-3.555	-28.467	-6.342	3.554	28.467	6.341	0.005%

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Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.00000001	0.00000001
2	Yes	14	0.00005547	0.00008393
3	Yes	17	0.00000001	0.00006665
4	Yes	17	0.00000001	0.00007548
5	Yes	17	0.00000001	0.00006514
6	Yes	14	0.00005585	0.00008044
7	Yes	17	0.00000001	0.00006568
8	Yes	17	0.00000001	0.00007566
9	Yes	17	0.00000001	0.00006667
10	Yes	14	0.00005547	0.00008346
11	Yes	17	0.00000001	0.00006714
12	Yes	17	0.00000001	0.00007558
13	Yes	17	0.00000001	0.00006521
14	Yes	14	0.00005585	0.00008024
15	Yes	17	0.00000001	0.00006509
16	Yes	17	0.00000001	0.00007578
17	Yes	17	0.00000001	0.00006756
18	Yes	6	0.00000001	0.00000001
19	Yes	15	0.00000001	0.00007324
20	Yes	17	0.00000001	0.00006994
21	Yes	17	0.00000001	0.00007971
22	Yes	17	0.00000001	0.00006910
23	Yes	15	0.00000001	0.00007002
24	Yes	17	0.00000001	0.00006964
25	Yes	17	0.00000001	0.00008009
26	Yes	17	0.00000001	0.00007022
27	Yes	15	0.00000001	0.00007319
28	Yes	17	0.00000001	0.00007073
29	Yes	17	0.00000001	0.00007999
30	Yes	17	0.00000001	0.00006913
31	Yes	15	0.00000001	0.00007003
32	Yes	17	0.00000001	0.00006908
33	Yes	17	0.00000001	0.00008009
34	Yes	17	0.00000001	0.00007096
35	Yes	13	0.00014240	0.00009068
36	Yes	13	0.00014206	0.00009655
37	Yes	13	0.00014192	0.00009587
38	Yes	13	0.00014199	0.00009043
39	Yes	13	0.00014230	0.00008553
40	Yes	13	0.00014197	0.00009243
41	Yes	13	0.00014190	0.00009611
42	Yes	13	0.00014205	0.00009580
43	Yes	13	0.00014242	0.00009070
44	Yes	13	0.00014207	0.00009890
45	Yes	13	0.00014192	0.00009628
46	Yes	13	0.00014199	0.00009073
47	Yes	13	0.00014229	0.00008560
48	Yes	13	0.00014196	0.00008929
49	Yes	13	0.00014188	0.00009675
50	Yes	13	0.00014204	0.00010023

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Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	147 - 94.75	32.840	43	2.021	0.001
L2	99.25 - 48.17	14.608	43	1.465	0.000
L3	53.84 - 1	4.055	35	0.712	0.000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
149.000	LPA-80080-4CF	43	32.840	2.021	0.001	29654
147.000	EEI 14-ft Low Profile Platform	43	32.840	2.021	0.001	29654
138.000	(2) DB950F85E-M	43	29.136	1.930	0.001	16474
137.000	EEI 12-ft Low Profile Platform	43	28.727	1.919	0.001	14827
128.000	(2) 7770.00	43	25.093	1.825	0.001	7803
127.000	EEI 12-ft Low Profile Platform	43	24.695	1.814	0.001	7413
118.000	RR90-17-02DP	43	21.203	1.712	0.001	5111
117.000	Andrew 12'-6" Low Profile Platform	43	20.826	1.700	0.001	4941
74.000	GPS	35	7.757	1.051	0.000	3107
73.500	4-ft Standoff	35	7.646	1.043	0.000	3107
62.000	GPS	35	5.364	0.846	0.000	3109
61.500	4-ft Standoff	35	5.277	0.837	0.000	3109

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	147 - 94.75	94.598	10	5.822	0.004
L2	99.25 - 48.17	42.121	10	4.225	0.001
L3	53.84 - 1	11.699	2	2.053	0.001

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
149.000	LPA-80080-4CF	10	94.598	5.822	0.005	10472
147.000	EEI 14-ft Low Profile Platform	10	94.598	5.822	0.005	10472
138.000	(2) DB950F85E-M	10	83.940	5.560	0.004	5817
137.000	EEI 12-ft Low Profile Platform	10	82.763	5.530	0.004	5235
128.000	(2) 7770.00	10	72.304	5.258	0.003	2753
127.000	EEI 12-ft Low Profile Platform	10	71.161	5.227	0.003	2615
118.000	RR90-17-02DP	10	61.110	4.934	0.003	1802
117.000	Andrew 12'-6" Low Profile Platform	10	60.024	4.900	0.003	1741
74.000	GPS	2	22.377	3.033	0.001	1084
73.500	4-ft Standoff	2	22.057	3.008	0.001	1084

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Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
62.000	GPS	2	15.476	2.440	0.001	1082
61.500	4-ft Standoff	2	15.224	2.416	0.001	1081

Compression Checks

Pole Design Data

Section No.	Elevation	Size	L	L _u	Kl/r	F _a	A	Actual P	Allow. P _a	Ratio P
	ft		ft	ft		ksi	in ²	K	K	P _a
L1	147 - 94.75 (1)	TP31.96x21x0.188	52.250	0.000	0.0	37.394	18.347	-9.998	686.060	0.015
L2	94.75 - 48.17 (2)	TP41.23x30.641x0.25	51.080	0.000	0.0	37.976	31.585	-16.966	1199.480	0.014
L3	48.17 - 1 (3)	TP50.5x39.555x0.313	52.840	0.000	0.0	37.822	49.780	-28.449	1882.740	0.015

Pole Bending Design Data

Section No.	Elevation	Size	Actual M _x	Actual f _{bx}	Allow. F _{bx}	Ratio	Actual M _y	Actual f _{by}	Allow. F _{by}	Ratio
	ft		kip-ft	ksi	ksi	$\frac{f_{bx}}{F_{bx}}$	kip-ft	ksi	ksi	$\frac{f_{by}}{F_{by}}$
L1	147 - 94.75 (1)	TP31.96x21x0.188	447.723	38.427	37.394	1.028	0.000	0.000	37.394	0.000
L2	94.75 - 48.17 (2)	TP41.23x30.641x0.25	1137.40	43.927	37.976	1.157	0.000	0.000	37.976	0.000
L3	48.17 - 1 (3)	TP50.5x39.555x0.313	2149.30	41.769	37.822	1.104	0.000	0.000	37.822	0.000

Pole Shear Design Data

Section No.	Elevation	Size	Actual V	Actual f _v	Allow. F _v	Ratio	Actual T	Actual f _{vt}	Allow. F _{vt}	Ratio
	ft		K	ksi	ksi	$\frac{f_v}{F_v}$	kip-ft	ksi	ksi	$\frac{f_{vt}}{F_{vt}}$
L1	147 - 94.75 (1)	TP31.96x21x0.188	13.287	0.724	26.000	0.056	0.000	0.000	26.000	0.000
L2	94.75 - 48.17 (2)	TP41.23x30.641x0.25	17.113	0.542	26.000	0.042	0.384	0.007	26.000	0.000
L3	48.17 - 1 (3)	TP50.5x39.555x0.313	21.162	0.425	26.000	0.033	0.383	0.004	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation	Ratio P	Ratio f _{bx}	Ratio f _{by}	Ratio f _v	Ratio f _{vt}	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
	ft	$\frac{P}{P_a}$	$\frac{f_{bx}}{F_{bx}}$	$\frac{f_{by}}{F_{by}}$	$\frac{f_v}{F_v}$	$\frac{f_{vt}}{F_{vt}}$			

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Section No.	Elevation ft	Ratio P P_a	Ratio f_{bx} F_{bx}	Ratio f_{bv} F_{bv}	Ratio f_v F_v	Ratio f_{vt} F_{vt}	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	147 - 94.75 (1)	0.015	1.028	0.000	0.056	0.000	1.043 ✓	1.333	H1-3+VT ✓
L2	94.75 - 48.17 (2)	0.014	1.157	0.000	0.042	0.000	1.171 ✓	1.333	H1-3+VT ✓
L3	48.17 - 1 (3)	0.015	1.104	0.000	0.033	0.000	1.120 ✓	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	147 - 94.75	Pole	TP31.96x21x0.188	1	-9.998	914.518	78.2	Pass
L2	94.75 - 48.17	Pole	TP41.23x30.641x0.25	2	-16.966	1598.907	87.9	Pass
L3	48.17 - 1	Pole	TP50.5x39.555x0.313	3	-28.449	2509.692	84.0	Pass
							Summary	
							Pole (L2)	87.9 Pass
							RATING =	87.9 Pass

Anchor Bolt and Base Plate Analysis:**Input Data:**Tower Reactions:

Overturing Moment =	OM := 2149-ft-kips	(Input From RisaTower)
Shear Force =	Shear := 21-kips	(Input From RisaTower)
Axial Force =	Axial := 28-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} := 59-in	(User Input)
Bolt "Column" Distance =	l := 3-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} := 1.5-in	(User Input)
Base Plate Diameter =	D _{bp} := 65-in	(User Input)
Outer Pole Diameter =	D _{pole} := 50.5-in	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =:

$$R_{bc} := \frac{D_{bc}}{2} = 29.5\text{-in}$$

Distance to Bolts =

$$i := 1..N$$

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

$$d_1 = 14.75\text{-in}$$

$$d_7 = -14.75\text{-in}$$

$$d_2 = 25.55\text{-in}$$

$$d_8 = -25.55\text{-in}$$

$$d_3 = 29.50\text{-in}$$

$$d_9 = -29.50\text{-in}$$

$$d_4 = 25.55\text{-in}$$

$$d_{10} = -25.55\text{-in}$$

$$d_5 = 14.75\text{-in}$$

$$d_{11} = -14.75\text{-in}$$

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

$$\text{etc.}$$

Critical Distances For Bending in Plate:

Outer Pole Radius =

$$R_{pole} := \frac{D_{pole}}{2} = 25.3\text{-in}$$

Moment Arms of Bolts about Neutral Axis =

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

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

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

$$MA_2 = 0.30\text{-in}$$

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

$$MA_3 = 4.25\text{-in}$$

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

$$MA_4 = 0.30\text{-in}$$

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

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

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

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

$$\text{etc}$$

Effective Width of Baseplate for Bending =

$$W_{eff} := .9 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2} \right)^2 - \left(\frac{D_{pole}}{2} \right)^2} = 36.8\text{-in}$$

Anchor Bolt Analysis:Calculated Anchor Bolt Properties:

Polar Moment of Inertia =

$$I_p := \sum_i (d_i)^2 = 5221.5 \cdot \text{in}^2$$

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 =

$$T_{\text{Max}} := OM \cdot \frac{R_{bc}}{I_p} - \frac{\text{Axial}}{N} = 143.4 \cdot \text{kips}$$

Allowable Tensile Force =

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

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

Bolt Tension % of Capacity =

$$\frac{T_{\text{Max}}}{T_{\text{ALL.Net}}} = 0.736 \quad \text{Bolts are "upset bolts". Use net area per AISC}$$

Condition1 =

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

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 =

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

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 =

$$C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 148 \text{ kips}$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 45.6 \text{ ksi}$$

$$K := 0.65$$

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

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

Allowable Compressive Stress =

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

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \right) = 0.76$$

Condition 2 =

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

Condition2 = "OK"

Base Plate Analysis:

Force from Bolts =

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

$$C_1 = 72.8 \text{ kips}$$

$$C_7 = -72.8 \text{ kips}$$

$$C_2 = 126.2 \text{ kips}$$

$$C_8 = -126.2 \text{ kips}$$

$$C_3 = 145.7 \text{ kips}$$

$$C_9 = -145.7 \text{ kips}$$

$$C_4 = 126.2 \text{ kips}$$

$$C_{10} = -126.2 \text{ kips}$$

$$C_5 = 72.8 \text{ kips}$$

$$C_{11} = -72.8 \text{ kips}$$

$$C_6 = 0.0 \text{ kips}$$

etc.

Maximum Bending Stress in Plate =

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot M A_i}{(W_{eff} t_{bp})^2} = 50.3 \text{ ksi}$$

Allowable Bending Stress in Plate =

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

Plate Bending Stresse % of Capacity =

$$\frac{f_{bp}}{F_{bp}} = 0.84$$

Condition3 =

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

Condition3 = "Ok"

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

Overturning Moment =	OM := 2149-ft-kips	(User Input from RISATower)
Shear Force =	Shear := 21-kip	(User Input from RISATower)
Axial Force =	Axial := 28-kip	(User Input from RISATower)
Tower Height =	H _t := 147-ft	(User Input)

Footing Data:

Overall Depth of Footing =	D _f := 4.5-ft	(User Input)
Length of Pier =	L _p := 1.0-ft	(User Input)
Extension of Pier Above Grade =	L _{pag} := 1.0-ft	(User Input)
Diameter of Pier =	d _p := 7.0-ft	(User Input)
Thickness of Footing =	T _f := 4.5-ft	(User Input)
Width of Footing =	W _f := 24.0-ft	(User Input)

Anchor Bolt Data:

Length of Anchor Bolts =	L _{st} := 72.0-in	(User Input)
Projection of Anchor Bolts Above Pier =	A _{BP} := 12.0-in	(User Input)
Anchor Bolt Diameter =	d _{anchor} := 2.25-in	(User Input)
Base Plate Bolt Circle =	MP := 59.0-in	(User Input)

Material Properties:

Concrete Compressive Strength =	f _c := 3000-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 := 10-deg	(User Input)
Allowable Soil Bearing Capacity =	q _s := 6000-psf	(User Input)
Unit Weight of Soil =	γ _{soil} := 100-pcf	(User Input)
Unit Weight of Concrete =	γ _{conc} := 150-pcf	(User Input)
Foundation Bouyancy =	Bouyancy := 0	(User Input) (Yes=1 / No=0)
Depth to Neglect =	n := 1.0-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 =	$d_{\text{bpier}} := 1.0\text{-in}$	(User Input)	
Number of Bars =	$NB_{\text{pier}} := 44$	(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 12.2.4)
Coating Factor =	$\beta_{\text{pier}} := 1.0$	(User Input)	(ACI 12.2.4)
Concrete Strength Factor =	$\lambda_{\text{pier}} := 1.0$	(User Input)	(ACI 12.2.4)
Reinforcement Size Factor =	$\gamma_{\text{pier}} := 1.0$	(User Input)	(ACI 12.2.4)
Diameter of Tie =	$d_{\text{Tie}} := 4\text{-in}$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{\text{top}} := 8$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{\text{btop}} := 1.00\text{-in}$	(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 =	$d_{\text{bbot}} := 1.00\text{-in}$	(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 12.2.4)
Coating Factor =	$\beta_{\text{pad}} := 1.0$	(User Input)	(ACI 12.2.4)
Concrete Strength Factor =	$\lambda_{\text{pad}} := 1.0$	(User Input)	(ACI 12.2.4)
Reinforcement Size Factor =	$\gamma_{\text{pad}} := 1.0$	(User Input)	(ACI 12.2.4)

Calculated Factors:

Pier Reinforcement Bar Area =	$A_{\text{bpier}} := \frac{\pi \cdot d_{\text{bpier}}^2}{4} = 0.785\text{-in}^2$	
Pad Top Reinforcement Bar Area =	$A_{\text{btop}} := \frac{\pi \cdot d_{\text{btop}}^2}{4} = 0.785\text{-in}^2$	
Pad Bottom Reinforcement Bar Area =	$A_{\text{bbot}} := \frac{\pi \cdot d_{\text{bbot}}^2}{4} = 0.785\text{-in}^2$	
Coefficient of Lateral Soil Pressure =	$K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 1.42$	
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 =

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

Passive Pressure =

$$P_{pn} := K_p \cdot \gamma_s \cdot n + c \cdot 2 \cdot \sqrt{K_p} = 0.142 \text{ksf}$$

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

$$P_{top} := \text{if}(n < (D_f - T_f), P_{pt}, P_{pn}) = 0.142 \text{ksf}$$

$$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p} = 0.639 \text{ksf}$$

$$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 0.391 \text{ksf}$$

$$T_p := \text{if}(n < (D_f - T_f), T_f, (D_f - n)) = 3.5$$

$$A_p := W_f \cdot T_p = 84$$

Ultimate Shear =

$$S_u := P_{ave} \cdot A_p = 32.808 \text{kip}$$

Weight of Concrete Pad =

$$WT_c := \left[(W_f^2 \cdot T_f) + \frac{d_p^2 \cdot \pi}{4} L_p \right] \cdot \gamma_c = 394.573 \text{kip}$$

Weight of Soil Above Footing =

$$WT_{s1} := \left[W_f^2 \cdot (|L_p - L_{pag} - n|) - \frac{d_p^2 \cdot \pi}{4} \cdot (|L_p - L_{pag} - n|) \right] \cdot \gamma_s = 53.75 \text{kip}$$

Weight of Soil Wedge at Back Face =

$$WT_{s2} := \left(\frac{D_f^2 \cdot \tan(\Phi_s)}{2} \cdot W_f \right) \cdot \gamma_s = 4.285 \text{kip}$$

Total Weight =

$$WT_{tot} := WT_c + WT_{s1} + \text{Axial} = 476.324 \text{kip}$$

Resisting Moment =

$$M_r := (WT_{tot}) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + WT_{s2} \left(W_f + \frac{D_f \cdot \tan(\Phi_s)}{3} \right) = 5.869 \times 10^3 \text{kip}\cdot\text{ft}$$

Overturning Moment =

$$M_{ot} := OM + \text{Shear} \cdot (L_p + T_f) = 2.265 \times 10^3 \text{kip}\cdot\text{ft}$$

Factor of Safety Actual =

$$FS := \frac{M_r}{M_{ot}} = 2.59$$

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 =

$$S_p := \frac{P_{ave} A_p + \mu \cdot W_{T_{tot}}}{FS_{req}} = 123.577 \text{ kips}$$

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

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

Bearing Pressure Caused by Footing:

Area of the Mat =

$$A_{mat} := W_f^2 = 576$$

Section Modulus of Mat =

$$S := \frac{W_f^3}{6} = 2304 \text{ ft}^3$$

Maximum Pressure in Mat =

$$P_{max} := \frac{W_{T_{tot}}}{A_{mat}} + \frac{M_{ot}}{S} = 1.81 \text{ ksf}$$

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

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

Minimum Pressure in Mat =

$$P_{min} := \frac{W_{T_{tot}}}{A_{mat}} - \frac{M_{ot}}{S} = -0.156 \text{ ksf}$$

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

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

Distance to Resultant of Pressure Distribution =

$$X_p := \frac{\frac{P_{max}}{P_{max} - P_{min}} \cdot \frac{1}{3}}{\frac{W_f}{W_f}} = 7.366$$

Distance to Kern =

$$X_k := \frac{W_f}{6} = 4$$

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

Eccentricity =

$$e := \frac{M_{ot}}{W_{T_{tot}}} = 4.754$$

Adjusted Soil Pressure =

$$P_a := \frac{2 \cdot W_{T_{tot}}}{3 \cdot W_f \left(\frac{W_f}{2} - e \right)} = 1.826 \text{ ksf}$$

$$q_{adj} := \text{if}(P_{min} < 0, P_a, P_{max}) = 1.826 \text{ ksf}$$

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

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

Concrete Bearing Capacity:

Strength Reduction Factor =

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

Bearing Strength Between Pier and Pad =

$$P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 9.185 \times 10^3 \text{ kips} \quad (\text{ACI 10.14})$$

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

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

Shear Strength of Concrete:

Beam Shear:

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

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

$$d := T_f - \text{Cvr}_{\text{pad}} - d_{\text{bot}}$$

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

$$d_2 := d_1 - d$$

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

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

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

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

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

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

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 =

$$b_o := (d_p + d) \cdot \pi = 35.1$$

Area Included Inside Perimeter =

$$A_{bo} := \frac{\pi \cdot (d_p + d)^2}{4} = 97.9$$

Area Outside of Perimeter =

$$A_{\text{out}} := A_{\text{mat}} - A_{bo} = 478.1$$

Guess Value =

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

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

Given

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

$$v_u := \text{Find}(v_u) = 3.3 \text{ ksf}$$

$$V_u := v_u \cdot d \cdot W_f = 325.9 \text{ kips}$$

Required Shear Strength =

$$V_{req} := LF \cdot V_u = 434.4 \text{ kips}$$

Available Shear Strength =

$$V_{avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot \text{psi}} \cdot b_o \cdot d = 3919.8 \text{ kip} \quad (\text{ACI 11.11.2.1})$$

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

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

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

Strength Reduction Factor =

$$\phi_m := .90 \quad (\text{ACI 9.3.2.1})$$

$$q_b := q_{adj} - d_1 \cdot \text{Slope} = 1.112 \text{ ksf}$$

Maximum Bending at Face of Pier =

$$M_n := \frac{1}{LF \cdot \phi_m} \cdot \left[(q_{adj} - q_b) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 1147.6 \text{ kip-ft}$$

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

$$R_u := \frac{M_n}{\phi_m \cdot W_f \cdot d^2} = 3.1 \text{ ksf}$$

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

$$\rho_{min} := 1.333 \cdot \rho = 0.00047$$

Required Reinforcement for Temperature and Shrinkage:

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

Check Bottom Bars:

$$A_s := \max(\rho, \rho_{min}, \rho_{sh}) \cdot W_f \cdot d = 25.9 \text{ in}^2$$

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

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

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

Check top Bars:

$$A_s := \rho_{sh} \cdot (W_f \cdot d) = 25.9 \text{ in}^2$$

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

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

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

Development Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 7.03 \text{ in}$$

Spacing or Cover Dimension =

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

Transverse Reinforcement Index =

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

$$L_{dbt} := \frac{3 \cdot f_y \cdot \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f_c} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 27.4 \text{ in}$$

Minimum Development Length =

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

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

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad} = 99 \text{ in}$$

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

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

Steel Reinforcement in Pier:

Area of Pier =

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

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

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

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

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

Bar Spacing In Pier =

$$B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 4.998 \cdot \text{in}$$

Diameter of Reinforcement Cage =

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

Maximum Moment in Pier =

$$M_p := \left[OM + \text{Shear} \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF = 34879.3 \cdot \text{in-kips}$$

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

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

$$(D \ N \ n \ P_u \ M_{xu}) = (84 \ 44 \ 8 \ 37.324 \ 3.488 \times 10^4)$$

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

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

$$(\phi P_n \ \phi M_{xn} \ f_{sp} \ \rho) = (71.85 \ 6.714 \times 10^4 \ -60 \ 6.272 \times 10^{-3})$$

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

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

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

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

Development Length Pier Reinforcement:

Available Length in Foundation:

$$L_{\text{pier}} := L_p - C_{\text{vr}}_{\text{pier}} = 9 \cdot \text{in}$$

$$L_{\text{pad}} := T_f - C_{\text{vr}}_{\text{pad}} = 51 \cdot \text{in}$$

Tension:

(ACI 12.2.3)

Spacing or Cover Dimension =

$$c := \text{if} \left(C_{\text{vr}}_{\text{pier}} < \frac{B_{\text{sPier}}}{2}, C_{\text{vr}}_{\text{pier}}, \frac{B_{\text{sPier}}}{2} \right) = 2.499 \cdot \text{in}$$

Transverse Reinforcement =

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

$$L_{\text{dbt}} := \frac{3 \cdot f_y \cdot \alpha_{\text{pier}} \cdot \beta_{\text{pier}} \cdot \gamma_{\text{pier}} \cdot \lambda_{\text{pier}}}{40 \cdot \sqrt{f_c} \cdot \text{psi} \cdot \left(\frac{c + k_{\text{tr}}}{d_{\text{bpier}}} \right)} \cdot d_{\text{bpier}} = 32.88 \cdot \text{in}$$

Minimum Development Length =

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

$$L_{\text{dh}} := \frac{1200 \cdot d_{\text{bpier}}}{\sqrt{\frac{f_c}{\text{psi}}}} \cdot .7 = 15.336 \cdot \text{in} \quad (\text{ACI 12.2.1})$$

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

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

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

Compression:

(ACI 12.3.2)

$$L_{\text{dbc1}} := \frac{.02 \cdot d_{\text{bpier}} \cdot f_y}{\sqrt{f_c} \cdot \text{psi}} = 21.909 \cdot \text{in}$$

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

$$L_{\text{dbc}} := \text{if}(L_{\text{dbc1}} \geq L_{\text{dbmin}}, L_{\text{dbc1}}, L_{\text{dbmin}}) = 21.909 \cdot \text{in}$$

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

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

Tie Size and Spacing in Column:

Minimum Tie Size =

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

Used #4 Ties

Seismic Factor =

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

(ACI 21.10.5)

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

$$s_{lim2} := \frac{48 \cdot d_{Tie}}{8} \cdot z = 24 \cdot \text{in}$$

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

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

Maximum Spacing =

$$s_{tie} := \min \begin{pmatrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{pmatrix} = 16 \cdot \text{in}$$

Number of Ties Required =

$$n_{tie} := \frac{L_{pier} - 3 \cdot \text{in}}{s_{tie}} + 1 = 1.375$$

Check Anchor Steel Embedment:

Depth Available =

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

Length of Anchor Bolt =

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

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

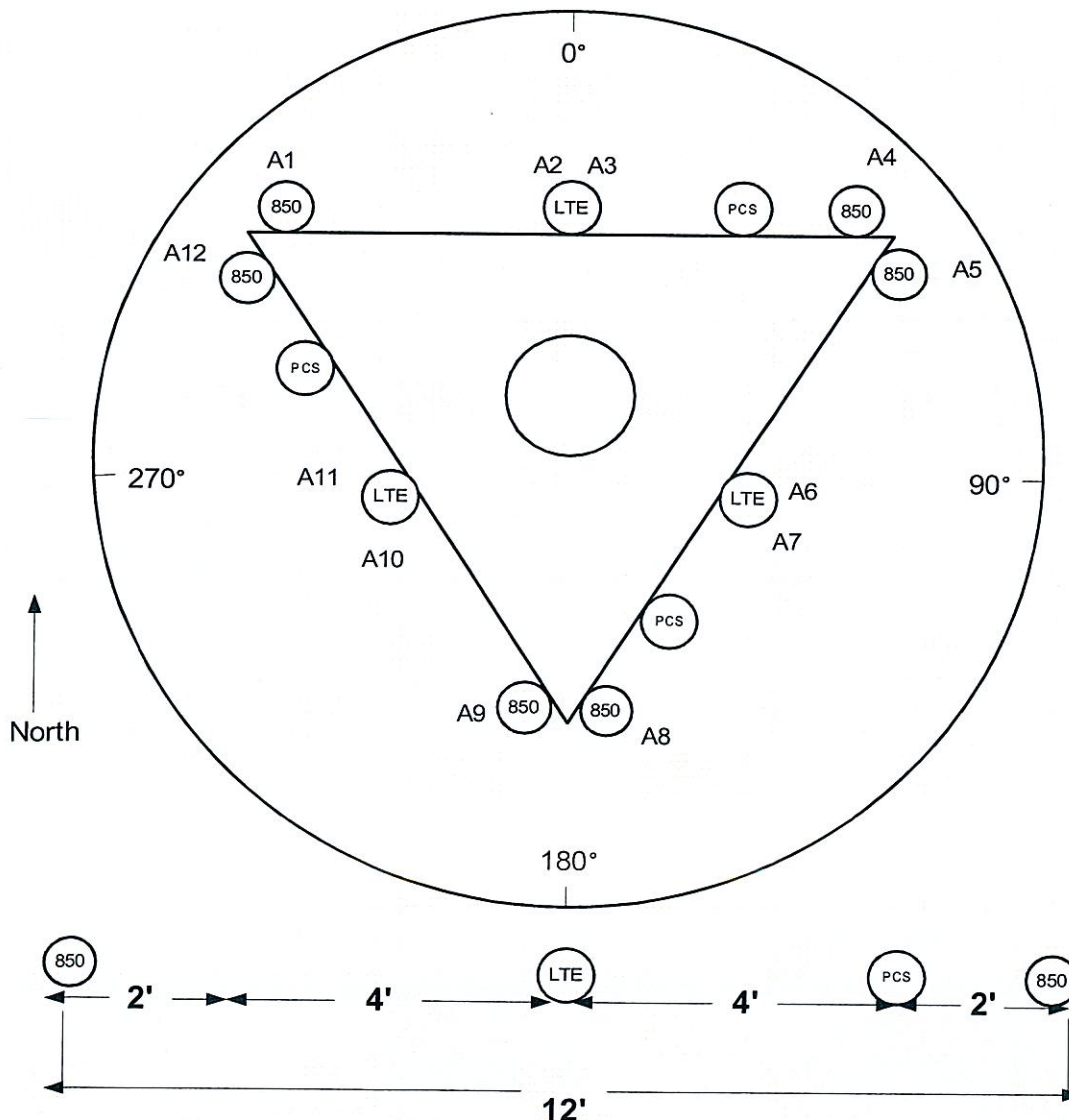
Depth_Check = "No Good"

Note: Anchor plate is provided

SITE NAME		CHAPLIN SOUTH CT		ECP - CELL #		2		317		
LATITUDE		41-47-04.30 N		LONGITUDE		72-08-08.50 W				
Additional Comments: LTE antenna add keeping with 12 antennas and adding 6 additional main lines				SAVE BUTTON						
				STRUCTURE TYPE						
700 Mhz - LTE ANTENNA ADD		ALPHA		BETA		GAMMA				
EQUIPMENT TYPE		eNodeB		eNodeB		eNodeB				
ANTENNA TYPE		BXA-70063-6CF_2		BXA-70063-6CF_4		BXA-70063-6CF_2				
QTY OF ANTENNAS PER FACE		1		1		1				
ORIENTATION (DEG)		30		150		255				
DOWN TILT (MECH/DEG)		0		0		4				
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		LPA-80080-4CF		LPA-80063-4CF				
QTY OF ANTENNAS PER FACE		2		2		2				
ORIENTATION (DEG)		30		150		255				
DOWN TILT (MECH/DEG)		0		0		4				
RAD CTR (FT AGL)		150		150		150				
TMA - QTY / MODEL										
DIPLEXER - QTY / MODEL										
DIPLEX WITH LTE CABLE										
1900 PCS - Current Config		ALPHA		BETA		GAMMA				
EQUIPMENT TYPE		PCS Modcell 4.0		PCS Modcell 4.0		PCS Modcell 4.0				
ANTENNA TYPE		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_2		BXA-171085-8BF_2		BXA-171063-8BF_2				
QTY OF ANTENNAS PER FACE		1		1		1				
ORIENTATION (DEG)		30		150		255				
DOWN TILT (MECH/DEG)		0		0		0				
RAD CTR (FT AGL)		150		150		150				
TMA - QTY / MODEL										
DIPLEX WITH CELLULAR CABLE										
NUMBER OF CABLE'S NEEDED				ESTIMATED CABLE LENGTH						
MAINLINE SIZE		1 5/8"		TOTAL # OF MAINLINES		18		MAINLINE (FT)		
JUMPER SIZE		1/2 "		TOTAL # OF TOP JUMPERS		18		TOP JUMPER (FT)		12
Equipment Cable Ordering		MAIN CABLE		12		+		6		6
TX / RX FREQUENCIES				TX POWER OUTPUT						
Cellular A-Band		PCS F / AWS-Band		700 Mhz C - E		Cellular (Watts)		20		

TX - 869-880,890-891.5 MHz				TX - 1970-1975 / 2145-21				TX - 746-757				PCS (Watts)		16
RX - 824-835,845-846.5 MHz				RX - 1890-1895 / 1745-17				RX - 776-787				LTE (Watts)		40
ALPHA				BETA				GAMMA						
Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code			
A1	800	Tx1/Rx0	RED	A7	800	Tx2/Rx0	BLUE	A13	800	Tx3/Rx0	GREEN			
A2	1900	Tx1/Rx0	RED/WHITE	A8	1900	Tx2/Rx0	BLUE/WHITE	A14	1900	Tx3/Rx0	GREEN/WHITE			
A3	700	Tx1/Rx0	RED/ORANGE	A9	700	Tx2/Rx0	BLUE/ORANGE	A15	700	Tx3/Rx0	GREEN/ORANGE			
A4	700	Tx4/Rx1	RED/RED/ORANGE	A10	700	Tx5/Rx1	BLUE/BLUE/ORANGE	A16	700	Tx6/Rx1	GREEN/GREEN/ORANGE			
A5	1900	Tx4/Rx1	RED/RED/WHITE	A11	1900	Tx5/Rx1	BLUE/BLUE/WHITE	A17	1900	Tx6/Rx1	GREEN/GREEN/WHITE			
A6	800	Tx4/Rx1	RED/RED	A12	800	Tx5/Rx1	BLUE/BLUE	A18	800	Tx6/Rx1	GREEN/GREEN			
RF ENGINEER				RF MANAGER				INITIALS				DATE		
Prepared By: Mark Brauer				Steve Weatherbee				MB				8/31/2011		

Site Configuration



Slant $\pm 45^\circ$ Dual Polarized FET Panel 63° / 14.5 dBd 696-900 MHz

Mechanical specifications

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

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

Mounting & Downtilting

Mounting hardware attaches to pipe diameter $\varnothing 50$ -160 mm; $\varnothing 2.0$ -6.3 in

Mounting Bracket Kit	36210002
Downtilt Bracket Kit	36114003

Electrical specifications

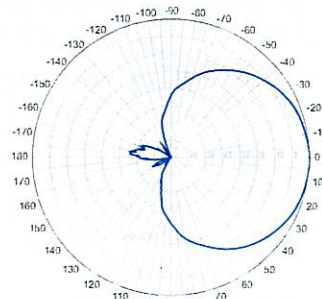
Frequency Range	696-900 MHz
Impedance	50 Ω
Connector ³⁾	NE or E-DIN Female 2 ports / Center
VSWR ¹⁾	$\leq 1.4:1$
Polarization	Slant $\pm 45^\circ$
Isolation Between Ports ¹⁾	< -25 dB
Gain ¹⁾	14.5 dBd
Power Rating ²⁾	500 W
Half Power Angle ¹⁾	
Horizontal Beamwidth	63°
Vertical Beamwidth	11°
Electrical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

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

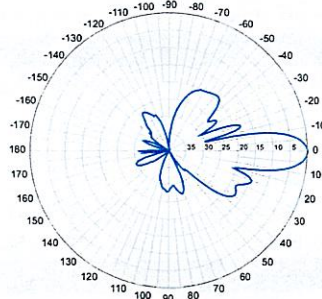
- 1) Typical values.
- 2) Power rating limited by connector only.
- 3) NE indicates an elongated N connector.
E-DIN indicates an elongated DIN connector.
- 4) Antenna weight does not include brackets.
- 5) Add'l downtilts may be available. Check website for details.

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

Radiation-pattern¹⁾
750 MHz

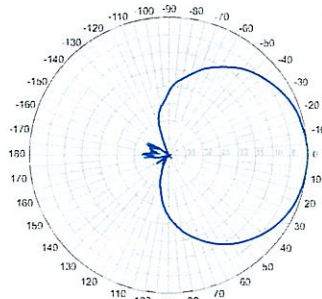


Horizontal

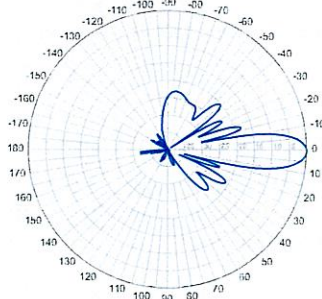


Vertical

850 MHz



Horizontal

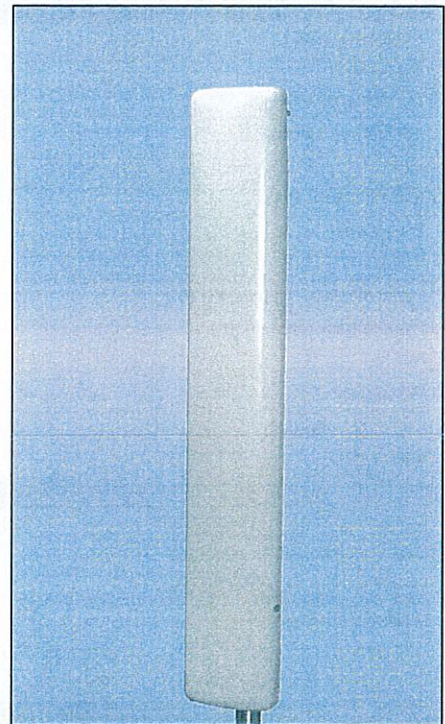


Vertical

696-900 MHz

BXA-70063/6CF

When ordering replace "___" with connector type.



Featuring our Exclusive
3T Technology™
Antenna Design:

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

Warranty:

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

Revision Date: 08/07/08

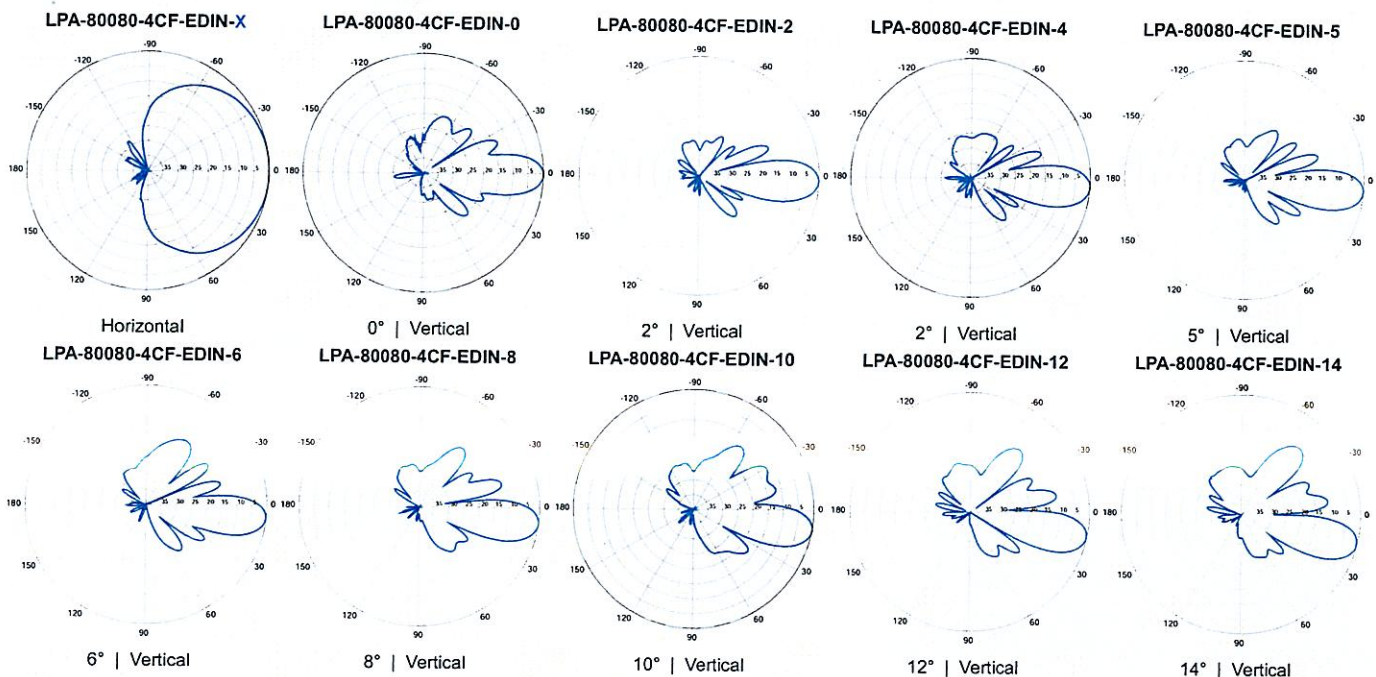
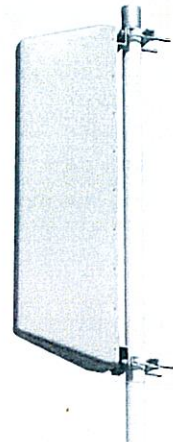
LPA-80080-4CF-EDIN-X

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	
Part Number	Fits Pipe DiameterWeight
2-Point Mounting & Downtilt Bracket Kit (0-20°)	2169999950-102 mm 2.0-4.0 in5.4 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



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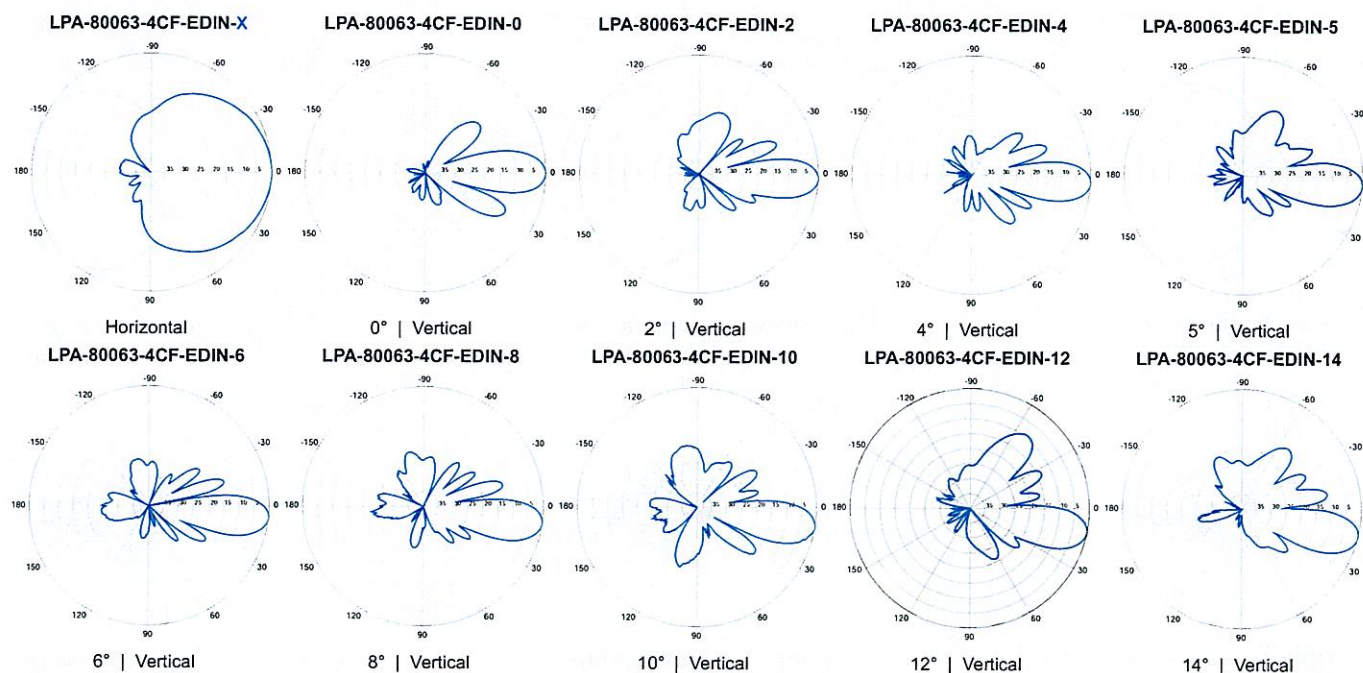
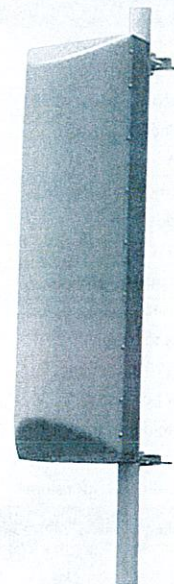
LPA-80063-4CF-EDIN-X

V-Pol | Log Periodic | 63° | 13.0 dBi

Replace "X" with desired electrical downtilt.

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

Electrical Characteristics	
Frequency bands	806-960 MHz
Polarization	Vertical
Horizontal beamwidth	63°
Vertical beamwidth	15°
Gain	13.0 dBi (15.1 dBi)
Electrical downtilt (X)	0, 2, 4, 5, 6, 8, 10, 12, 14
Impedance	50Ω
VSWR	≤1.4:1
Upper sidelobe suppression (0°)	-15.7 dB
Front-to-back ratio (+/-30°)	-31.7 dB
Null fill	5% (-26.02 dB)
Input power	500 W
Lightning protection	Direct Ground
Connector(s)	1 Port / EDIN or NE / Female / Center (Back)
Mechanical Characteristics	
Dimensions Length x Width x Depth	1205 x 385 x 332 mm 47.4 x 15.2 x 13.1 in
Depth of antenna with z-bracket	372 mm 14.6 in
Weight without mounting brackets	9.1 kg 20 lbs
Survival wind speed	> 201 km/hr > 125 mph
Wind area	Front: 0.46 m ² Side: 0.39 m ² Front: 5.0 ft ² Side: 4.2 ft ²
Wind load @ 161 km/hr (100 mph)	Front: 660 N Side: 550 N Front: 149 lbf Side: 124 lbf
Mounting Options	
Part Number	Fits Pipe Diameter
2-Point Mounting & Downtilt Bracket Kit (0-20°)	21699999 50-102 mm 2.0-4.0 in
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.



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BXA-171085-8BF-EDIN-X

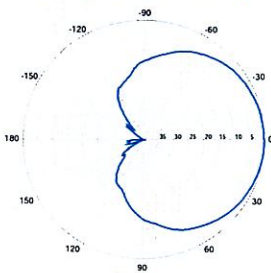
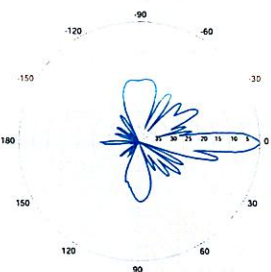
Replace "X" with desired electrical downtilt.

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		

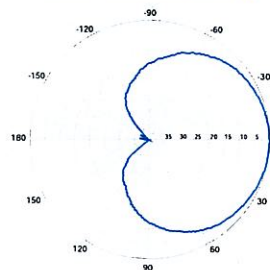
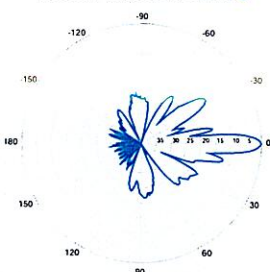


BXA-171085-8BF-EDIN-X

Horizontal | 1710-1880 MHz
BXA-171085-8BF-EDIN-0

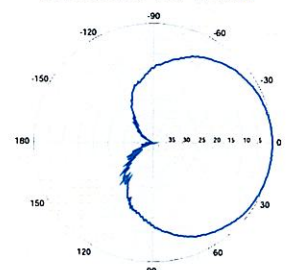
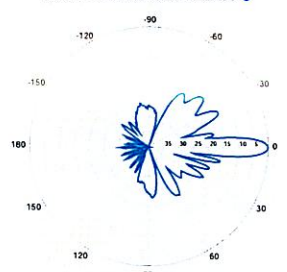
0° | Vertical | 1710-1880 MHz

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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BXA-171063-8BF-EDIN-X

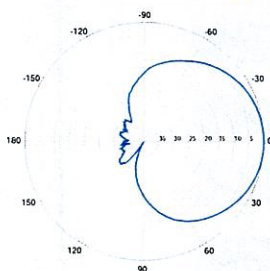
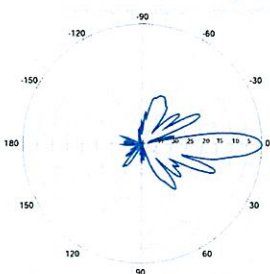
Replace "X" with desired electrical downtilt.

X-Pol | FET Panel | 63° | 17.4 dBi

Electrical Characteristics	1710-2170 MHz		
Frequency bands	1710-1880 MHz	1850-1990 MHz	1920-2170 MHz
Polarization	±45°	±45°	±45°
Horizontal beamwidth	68°	65°	60°
Vertical beamwidth	7°	7°	7°
Gain	14.5 dBd / 16.6 dBi	14.9 dBd / 17.0 dBi	15.3 dBd / 17.4 dBi
Electrical downtilt (X)	0, 2, 4, 8		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back isolation	> 30 dB		
In-band isolation	> 28 dB		
IM3 (20W carrier)	< -150 dBc		
Input power	300 W		
Lightning protection	Direct Ground		
Connector(s)	2 Ports / EDIN / Female / Bottom		
Operating temperature	-40° to +60° C / -40° to +140° F		
Mechanical Characteristics			
Dimensions Length x Width x Depth	1232 x 154 x 105 mm	48.5 x 6.1 x 4.1 in	
Depth with t-brackets	133 mm	5.2 in	
Weight without mounting brackets	4.8 kg	10.5 lbs	
Survival wind speed	296 km/hr	184 mph	
Wind area	Front: 0.19 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-171063-8BF-EDIN-X-FP		

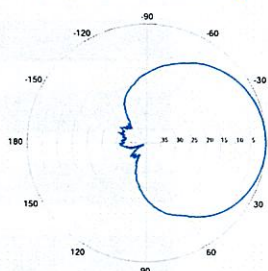
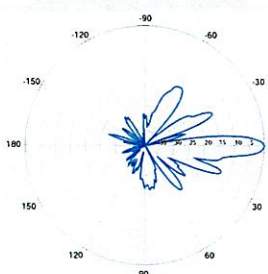


BXA-171063-8BF-EDIN-X

Horizontal | 1710-1880 MHz
BXA-171063-8BF-EDIN-0

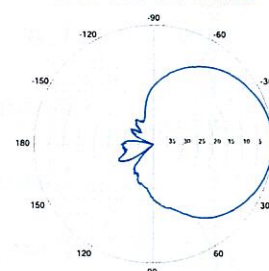
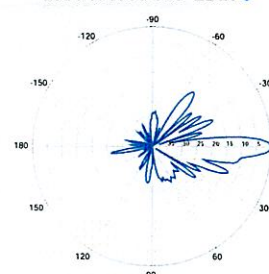
0° | Vertical | 1710-1880 MHz

BXA-171063-8BF-EDIN-X

Horizontal | 1850-1990 MHz
BXA-171063-8BF-EDIN-0

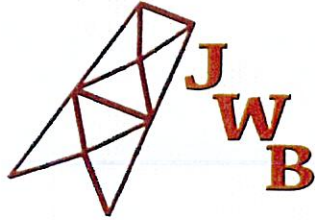
0° | Vertical | 1850-1990 MHz

BXA-171063-8BF-EDIN-X

Horizontal | 1920-2170 MHz
BXA-171063-8BF-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.



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

Monopole Inventory General Information

Site Name:	Chaplin South	
Site Number:		
FCC Number:		
Manufacturer ID #	EEl: GSC31428, EEI12120	
Street Address:	123 Palmer Road	
City/State/Zip Code:	Chaplin, CT	
County:		
Lat:	N/S	41° 47' 04.3"
Long:	E/W	72° 08' 08.5"
Performed By:	JWB	
Date:	Rev 1 10.10.2011	

Manufacture: (Circle One)

Rohn

Summit

EEI

Pirol

Sabre

Fort Worth

Valmont

Nudd

Other

Foundation:

Reveal: 6"
Grout: 2" (No Grout)
Size/Circumference: 7'

Anchor Bolts:

Base Plate Grouted:

Yes

No

Number of Anchor Bolts: 12
Anchor Bolt Spacing: Equal

Diameter of Anchor Bolts: 2.25"

Safety Climb:

Start Elevation (AGL) 10'

End Elevation (AGL) 146'

Location East

Climbing Components:

Step Bolts

Climbing Ladder

Internal

External

East Leg
Start Elevation: (AGL) 10'

End Elevation: (AGL) 147'

Leg
Start Elevation: (AGL) _____

End Elevation: (AGL) _____

Leg
Start Elevation: (AGL) _____

End Elevation: (AGL) _____

Leg
Start Elevation: (AGL) _____

End Elevation: (AGL) _____

Lighting System Information:

1st OB: N/A
2nd OB: _____
3rd OB: _____
4th OB: _____

1st Beacon: N/A
2nd Beacon: _____
3rd Beacon: _____
4th Beacon: _____

Top of Tower Steel (Top of Concrete) 147'

Antenna Information:

CARRIER		Verizon		PIC #		2	
MOUNT							
Type:	Lo-pro Plat	Manf.:	EEI				
Elev. C/L:	147'	Bottom:	Top:	Leg:			
Face Width:	14'	Height:	4"	Projection:	N/A	Azimuth/s:	
ANTENNA 1							
Type:	Panel	Manf.:	Andrew/Decibel	Model:	DB844F90A-SX		
Elev. C/L:	149'	Bottom:	Top:	Leg:			
Quantity:	6	Dim: (HxWxD)					
ANTENNA 2							
Type:	Panel	Manf.:	Andrew/Decibel	Model:	DB948F85T2E-M		
Elev. C/L:	149'	Bottom:	Top:	Leg:			
Quantity:	6	Dim: (HxWxD)					
TMA'S							
Quantity:	N/A	Manf.:	Model:				
COAX							
	Inside						
Quantity:	12	Size:	1 5/8"	Jumper:	1/2"	Color:	N/A

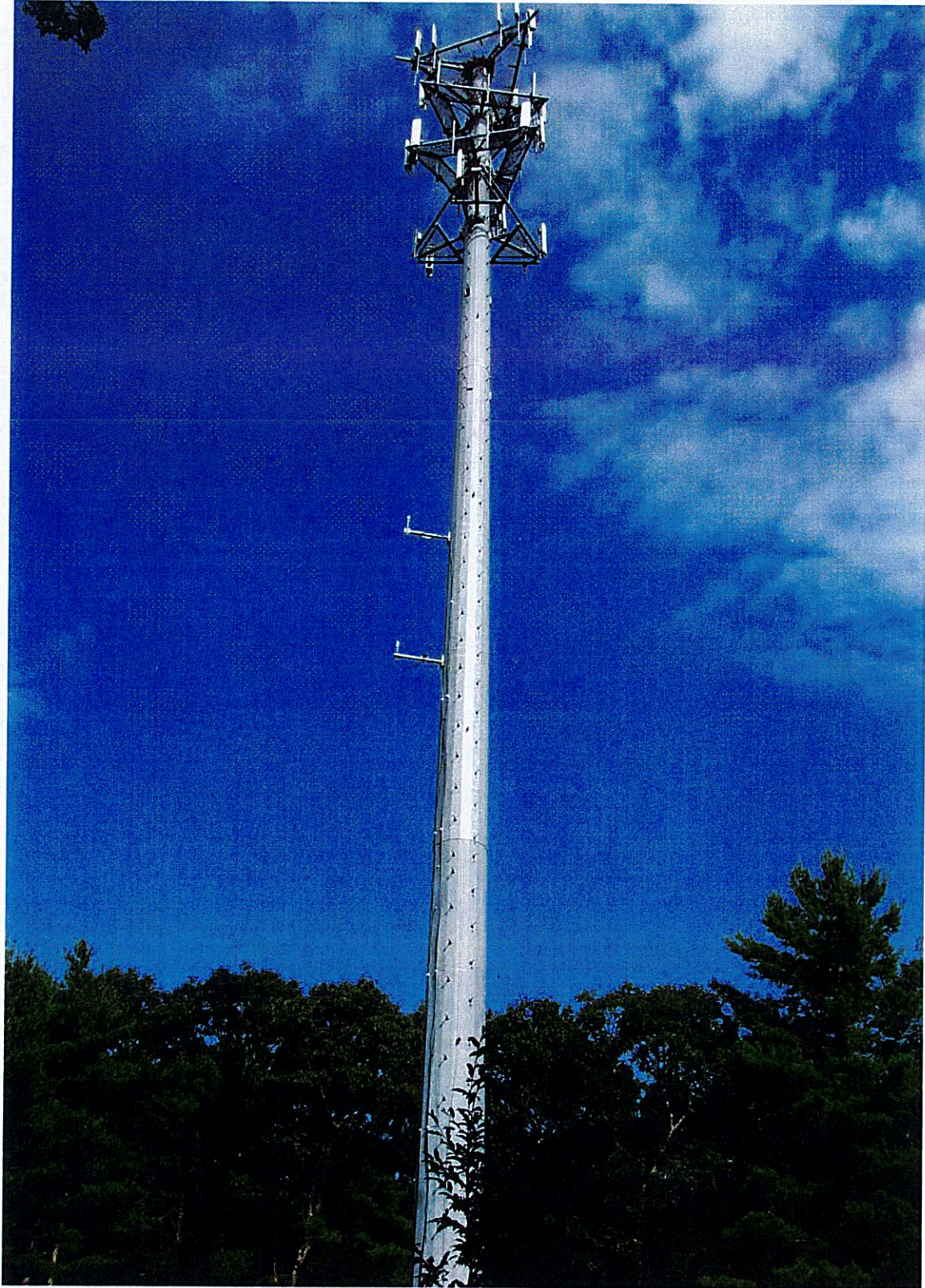
CARRIER		Sprint		PIC #		3	
MOUNT							
Type:	Lo-pro Plat	Manf.:	EEI				
Elev. C/L:	137'	Bottom:	Top:	Leg:			
Face Width:	12'	Height:	4"	Projection:	N/A	Azimuth/s:	
ANTENNA 1							
Type:	Panel	Manf.:	Andrew/Decibel	Model:	DB950F85E-M		
Elev. C/L:	138'	Bottom:	Top:	Leg:			
Quantity:	4	Dim: (HxWxD)	60"x4"x7"				
ANTENNA 2							
Type:	Panel	Manf.:	Andrew/Decibel	Model:	DB950G40E-M		
Elev. C/L:	138'	Bottom:	Top:	Leg:			
Quantity:	2	Dim: (HxWxD)	60"x11"x8"				
TMA'S							
Quantity:	N/A	Manf.:	Model:				
COAX							
	Inside						
Quantity:	6	Size:	1 5/8"	Jumper:	1/2"	Color:	N/A

CARRIER		AT&T		PIC #		4	
MOUNT							
Type:	Lo-pro Plat	Manf.:	EEI				
Elev. C/L:	127'	Bottom:	Top:	Leg:			
Face Width:	12'	Height:	4"	Projection:	N/A	Azimuth/s:	
ANTENNA							
Type:	Panel	Manf.:	Powerwave	Model:	7770		
Elev. C/L:	128'	Bottom:	Top:	Leg:			
Quantity:	6	Dim: (HxWxD)		Azimuth/s:			
TMA'S							
Quantity:	6	Manf.:	Powerwave	Model:	LGP21401		
Diplexer							
Quantity:	6	Manf.:	Powerwave	Model:	LGP21901		
Bias T							
Quantity:	3	Manf.:	PolyPhaser	Model:	DAS-HY-DFDM-06		
COAX							
	Inside						
Quantity:	12	Size:	1 5/8"	Jumper:	1/2"	Color:	N/A

CARRIER		T-Mobile		PIC #		5	
MOUNT							
Type:	Lo-pro Plat	Manf.:	Valmont				
Elev. C/L:	117'	Bottom:	Top:	Leg:			
Face Width:	12'	Height:	4"	Projection:	N/A	Azimuth/s:	
ANTENNA							
Type:	Panel	Manf.:	EMS	Model:	RR90-17-02DP		
Elev. C/L:	118	Bottom:	Top:	Leg:			
Quantity:	3	Dim: (HxWxD)		Azimuth/s:			
TMA'S							
Quantity:	3	Manf.:	No Markings (Possibly Ericsson)	Model:	10"x8"x5"		
COAX							
	Inside						
Quantity:	6	Size:	1 5/8"	Jumper:	1/2"	Color:	N/A

CARRIER		Sprint		PIC #		6	
MOUNT							
Type:	Standoff	Manf.:	Custom				
Elev. C/L:	61'-6"	Bottom:		Top:		Leg:	
Face Width:	3"	Height:	3"	Projection:	4'	Azimuth/s:	
ANTENNA							
Type:	GPS	Manf.:	Unknown		Model:		
Elev. C/L:	62'	Bottom:		Top:		Leg:	
Quantity:	1	Dim: (HxWxD)	6"x5"		Azimuth/s:		
COAX							
Quantity:	1	Size:	1/2"	Jumper:	N/A	Color:	N/A

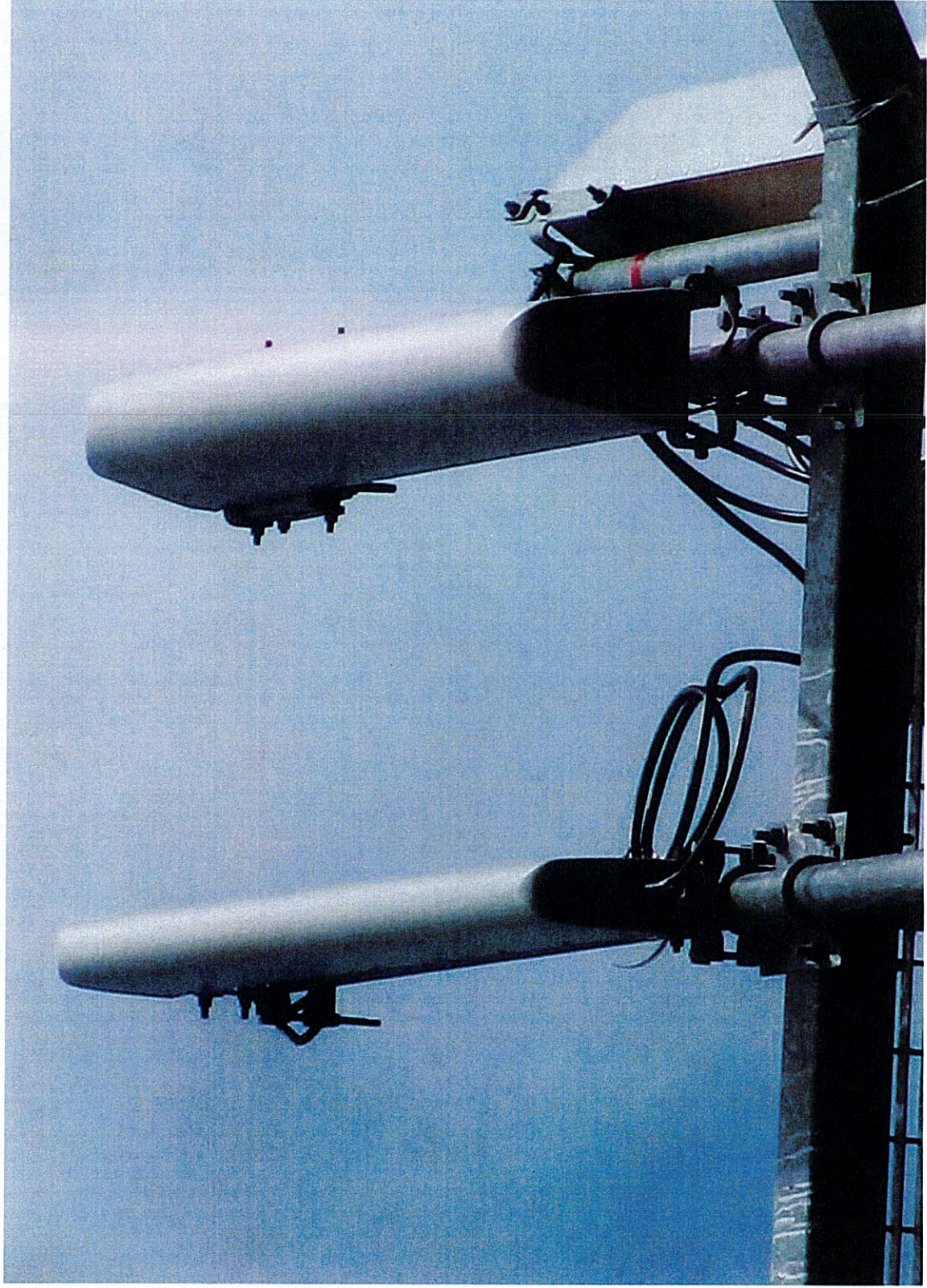
CARRIER		AT&T		PIC #		6	
MOUNT							
Type:	Standoff	Manf.:	Custom				
Elev. C/L:	73'-6"	Bottom:		Top:		Leg:	
Face Width:	3"	Height:	3"	Projection:	4'	Azimuth/s:	
ANTENNA 1							
Type:	GPS	Manf.:	Unknown		Model:		
Elev. C/L:	74'	Bottom:		Top:		Leg:	
Quantity:	1	Dim: (HxWxD)	6"x5"		Azimuth/s:		
COAX							
Quantity:	1	Size:	1/2"	Jumper:	N/A	Color:	N/A



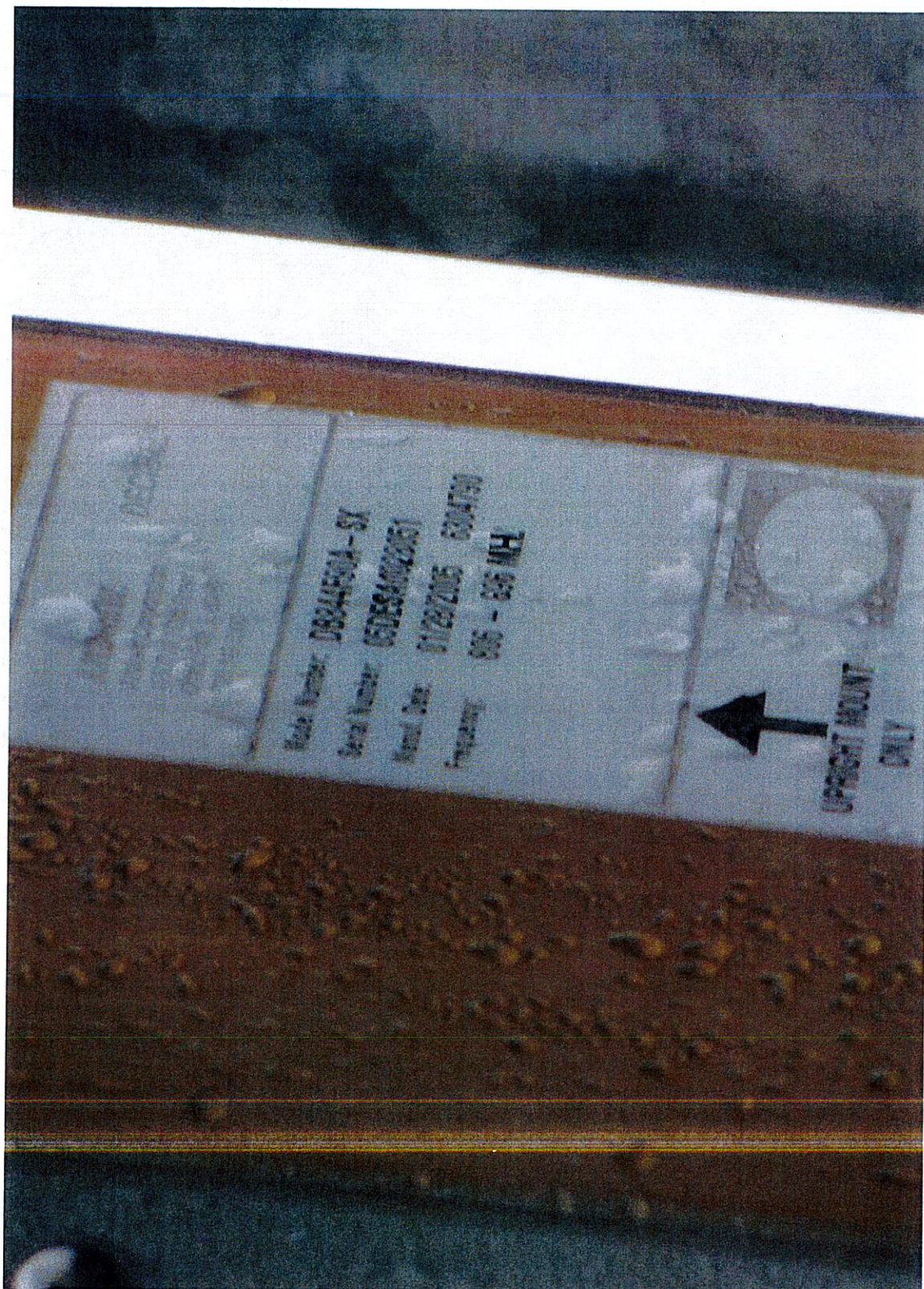
1.0 Elevation



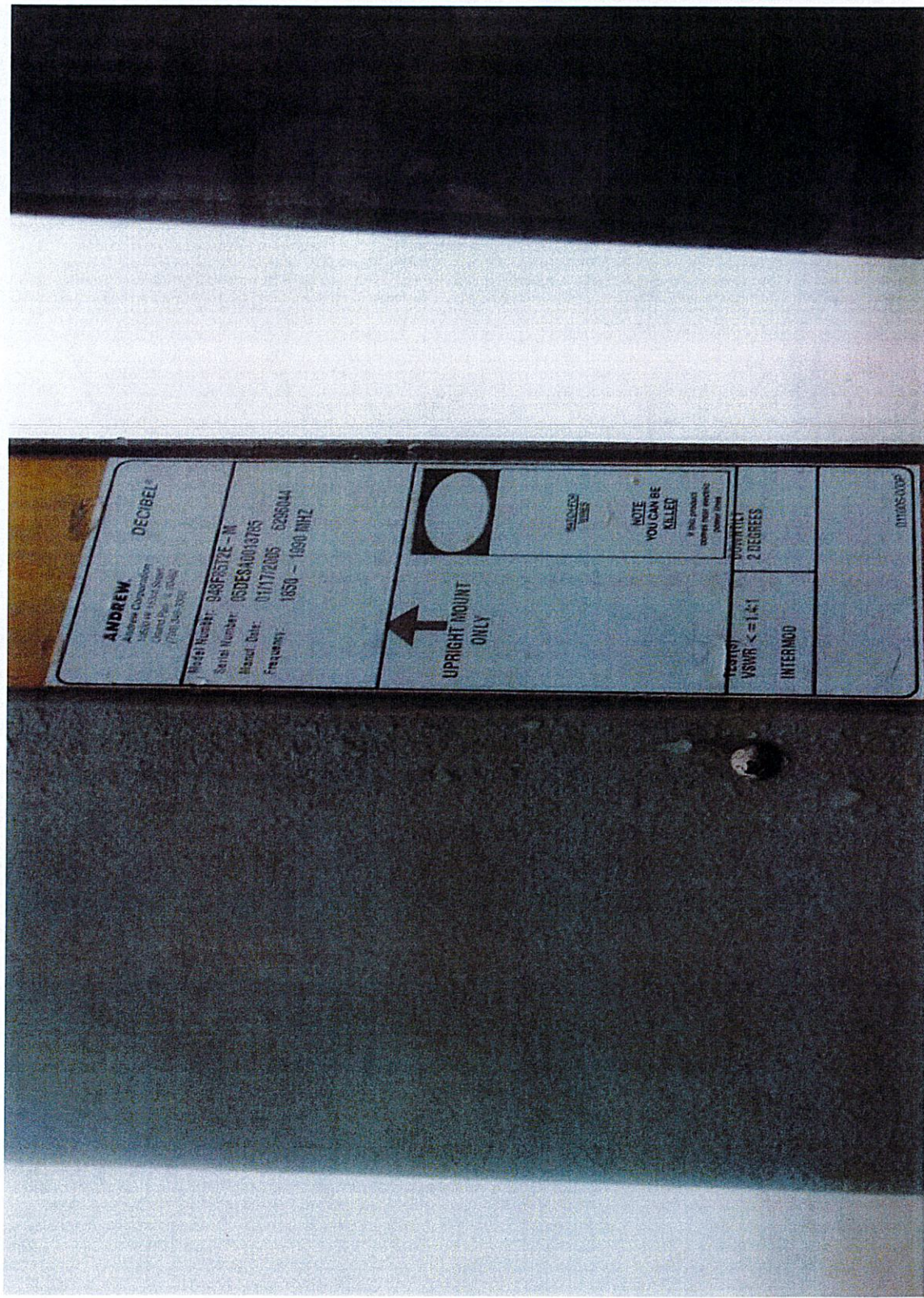
2.1 Verizon



2.2 Verizon



2.3 Verizon



ANDREW

Andrew Corporation
12501 15th Street
Chandler, AZ 85226
(704) 344-3300

DECIBEL

Model Number: 948F512E-M
Serial Number: 05DESAD013705
Brand Date: 01/17/2005 8208044
Frequency: 1850 - 1950 MHz

UPRIGHT MOUNT
ONLY



NOTES

NOTE
YOU CAN BE
KILLED

IF THIS POWER
EXCEEDS YOUR POWER
RATING

POWER RATING

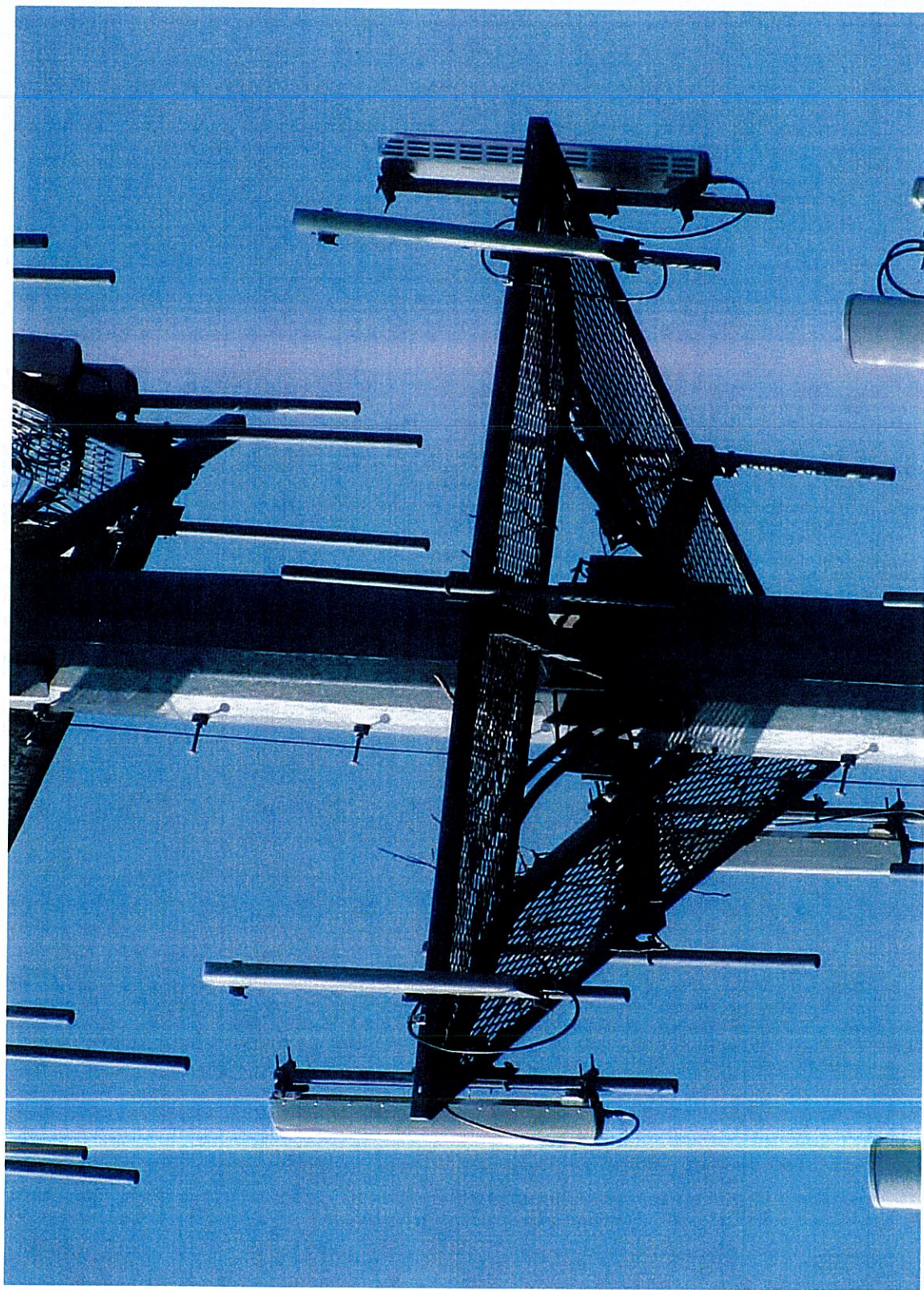
VSWR < 1.4:1

INTERMOD

POWER

2 DEGREES

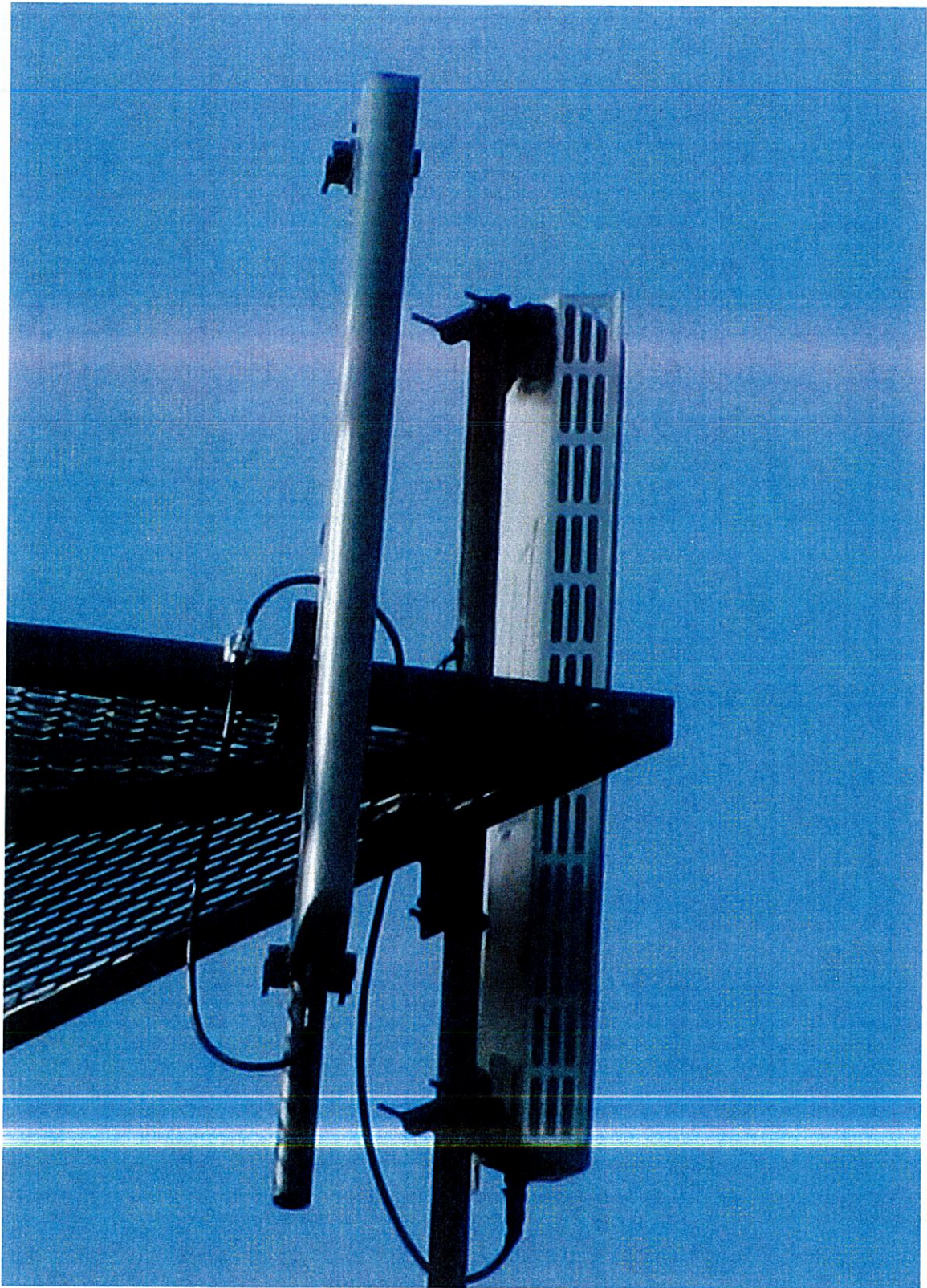
011005-001P



3.1 Sprint



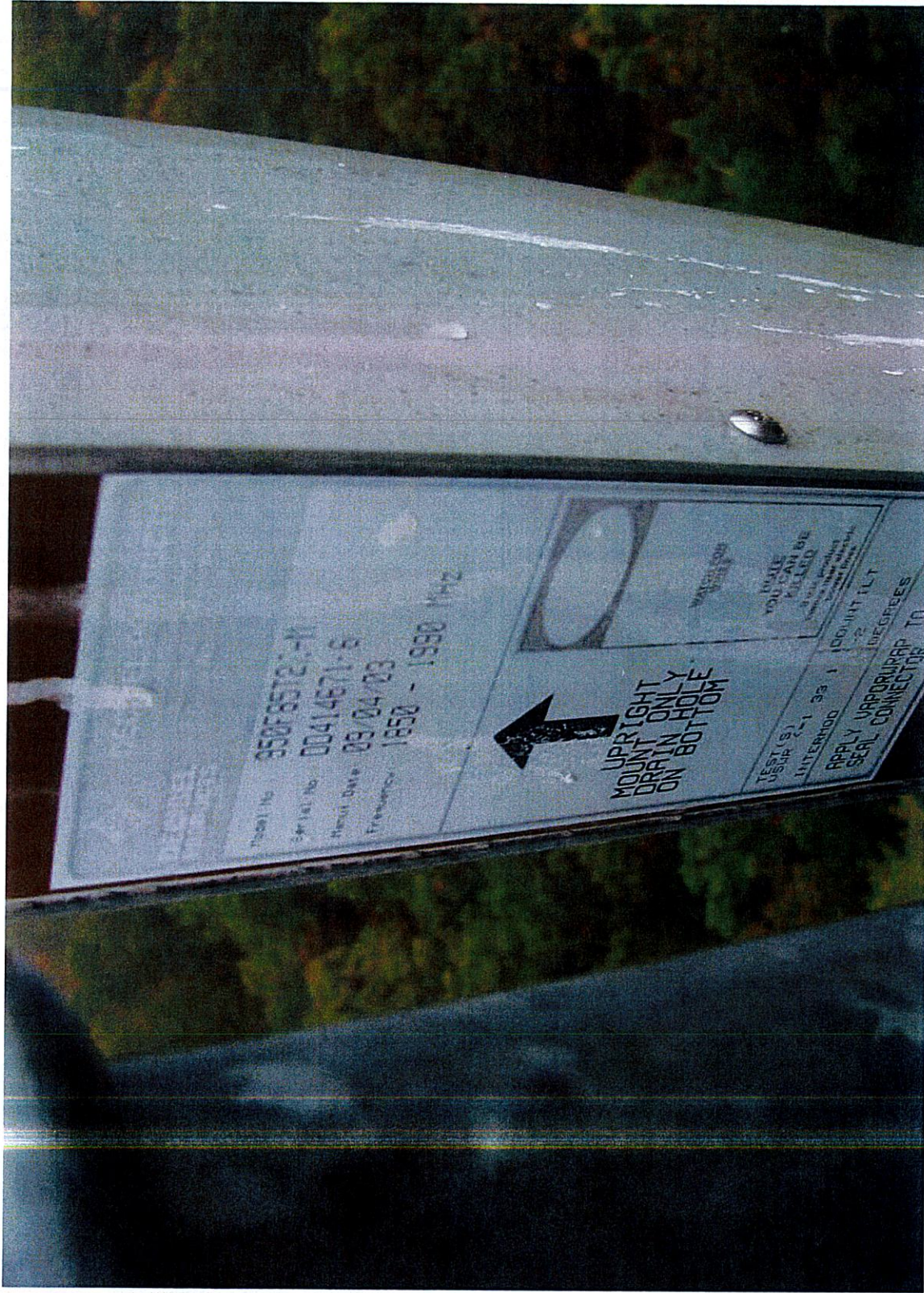
3.2 Sprint



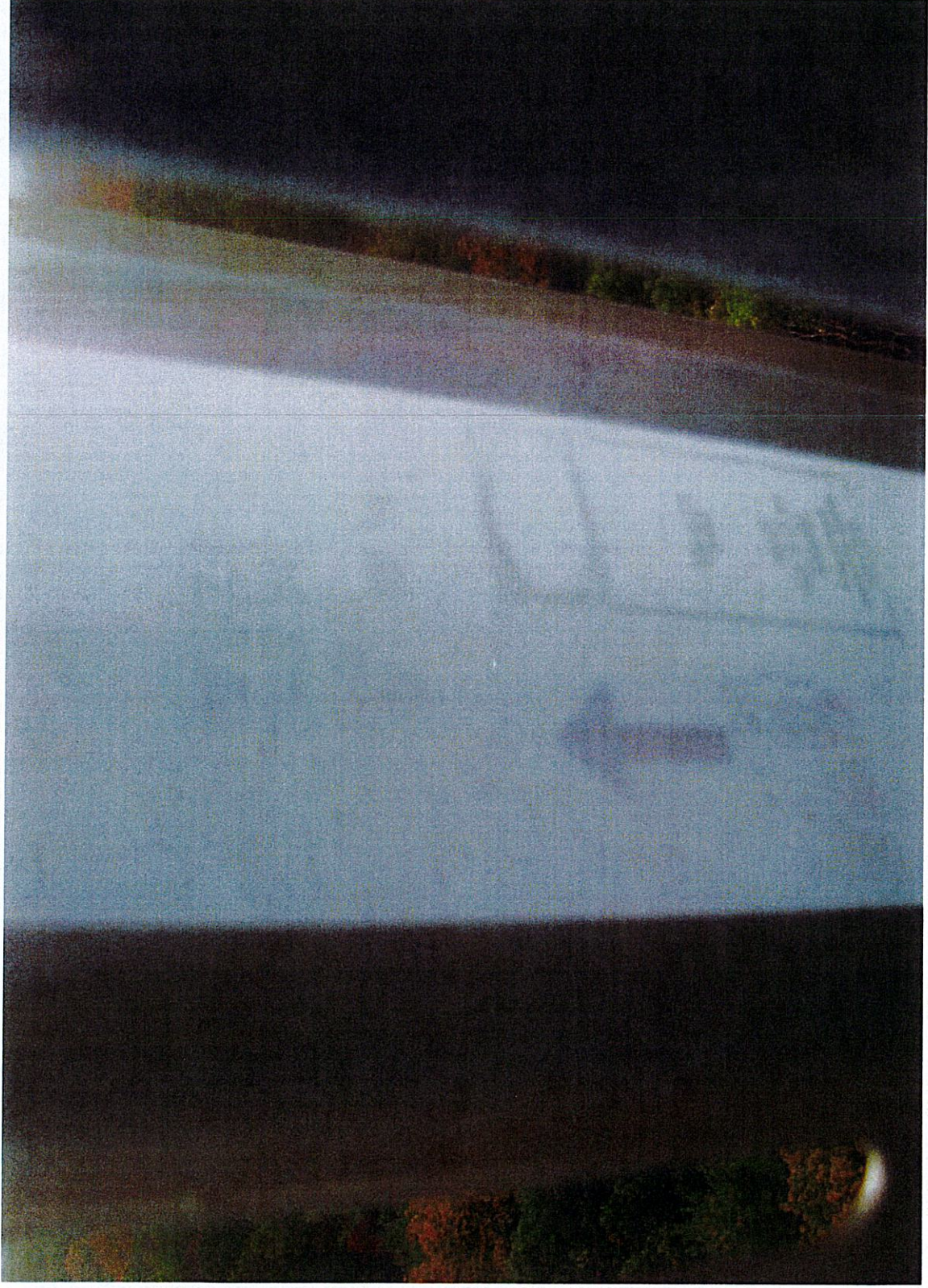
3.3 Sprint



3.4 Sprint



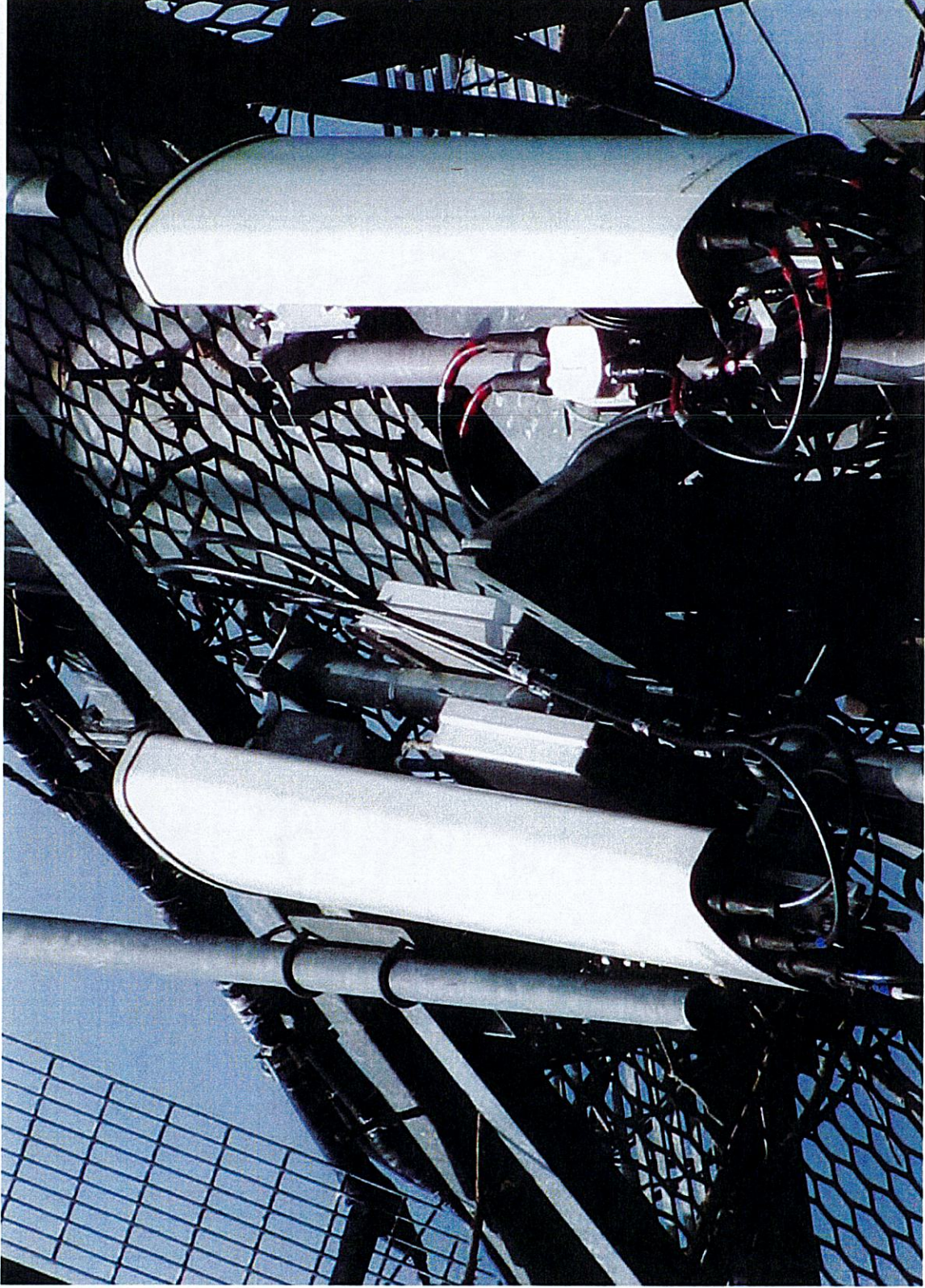
3.5 Sprint



3.6 Sprint



4.1 ATT



4.2 ATT



4.3 ATT

consultation
 Antenna installations must be grounded according to local and national codes. Do not install or work on antennas near powerlines. Install or work on antennas or similar structures out of falling distance of all such lines.
 Every electrical and telephone wire is potentially dangerous

6.5-A-D

↑ UP

Powerwave

824-836	1850-1990
EDT 1-10	EDT 0-8

Powerwave

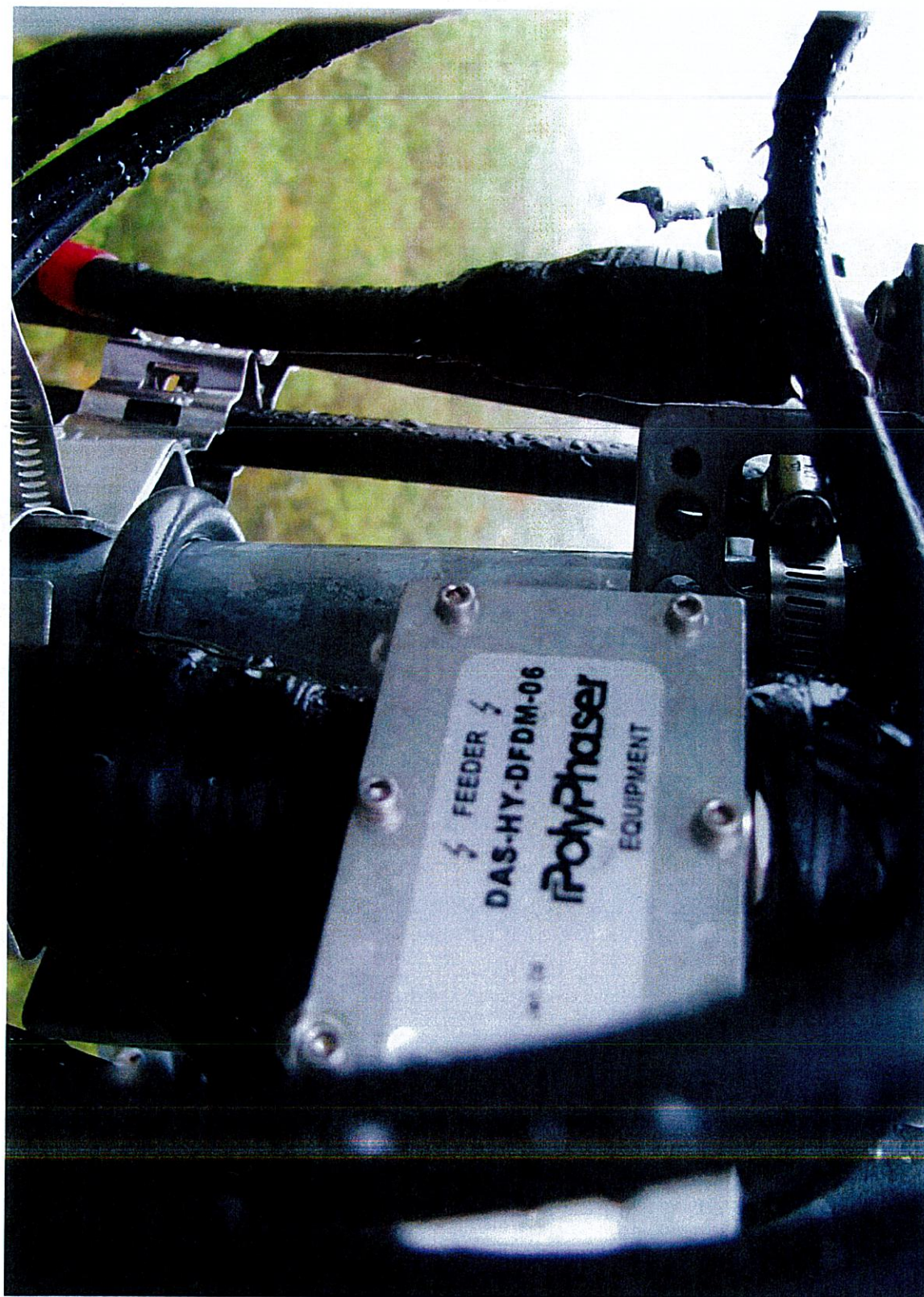
RA21.7770.00
 RET+Antenna assy

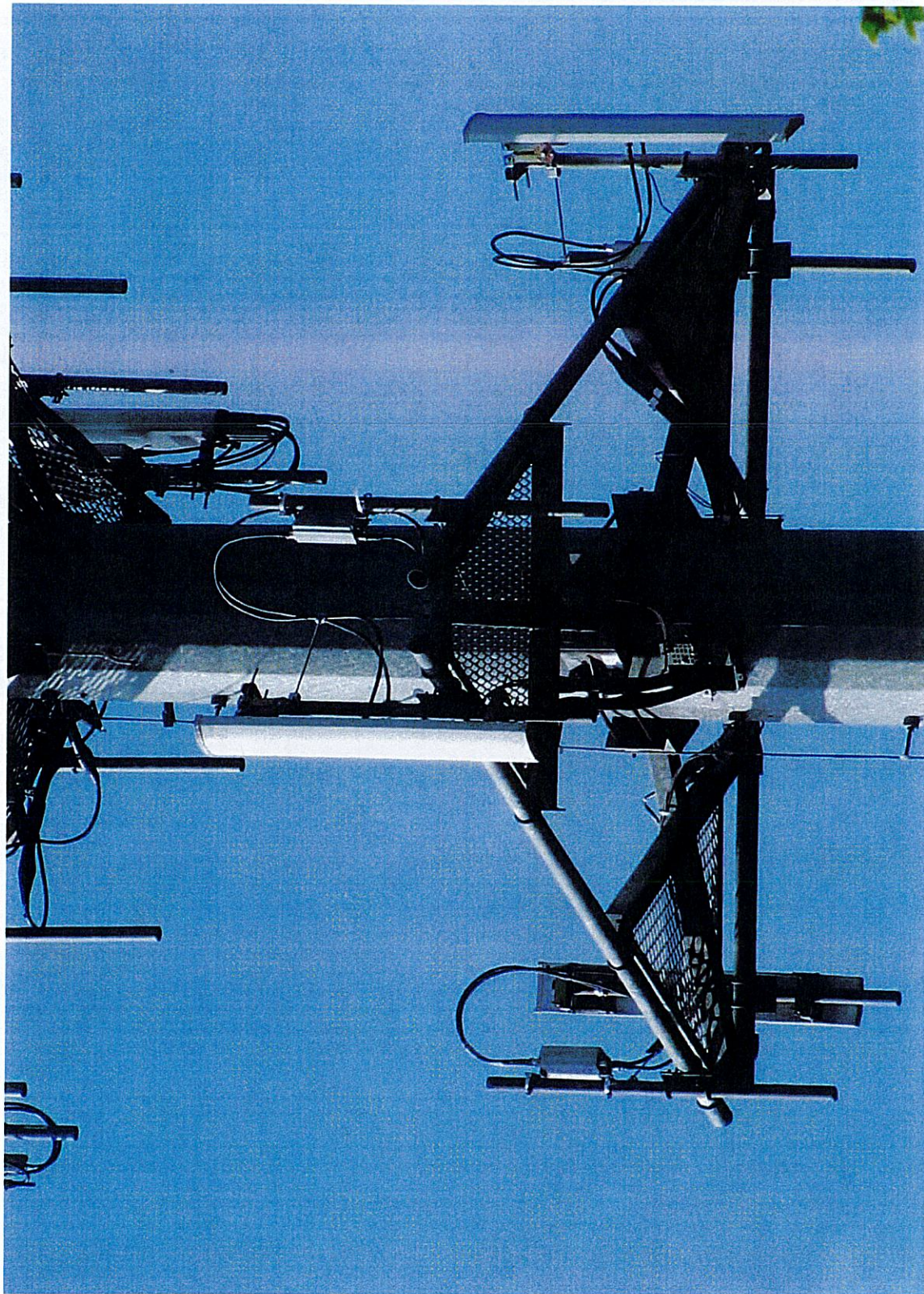
RA21.7770.00K8A091002587



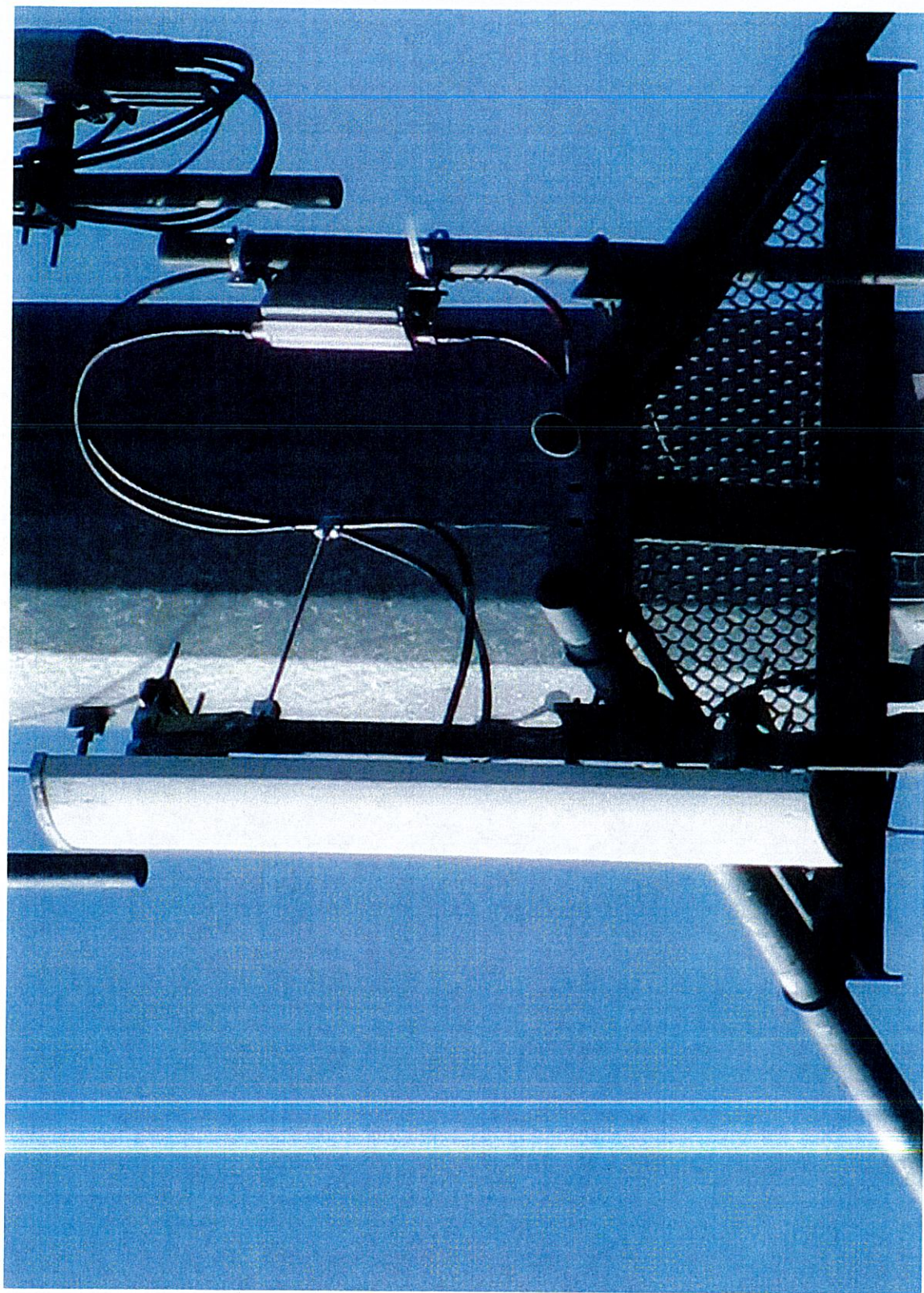
4.5 ATT







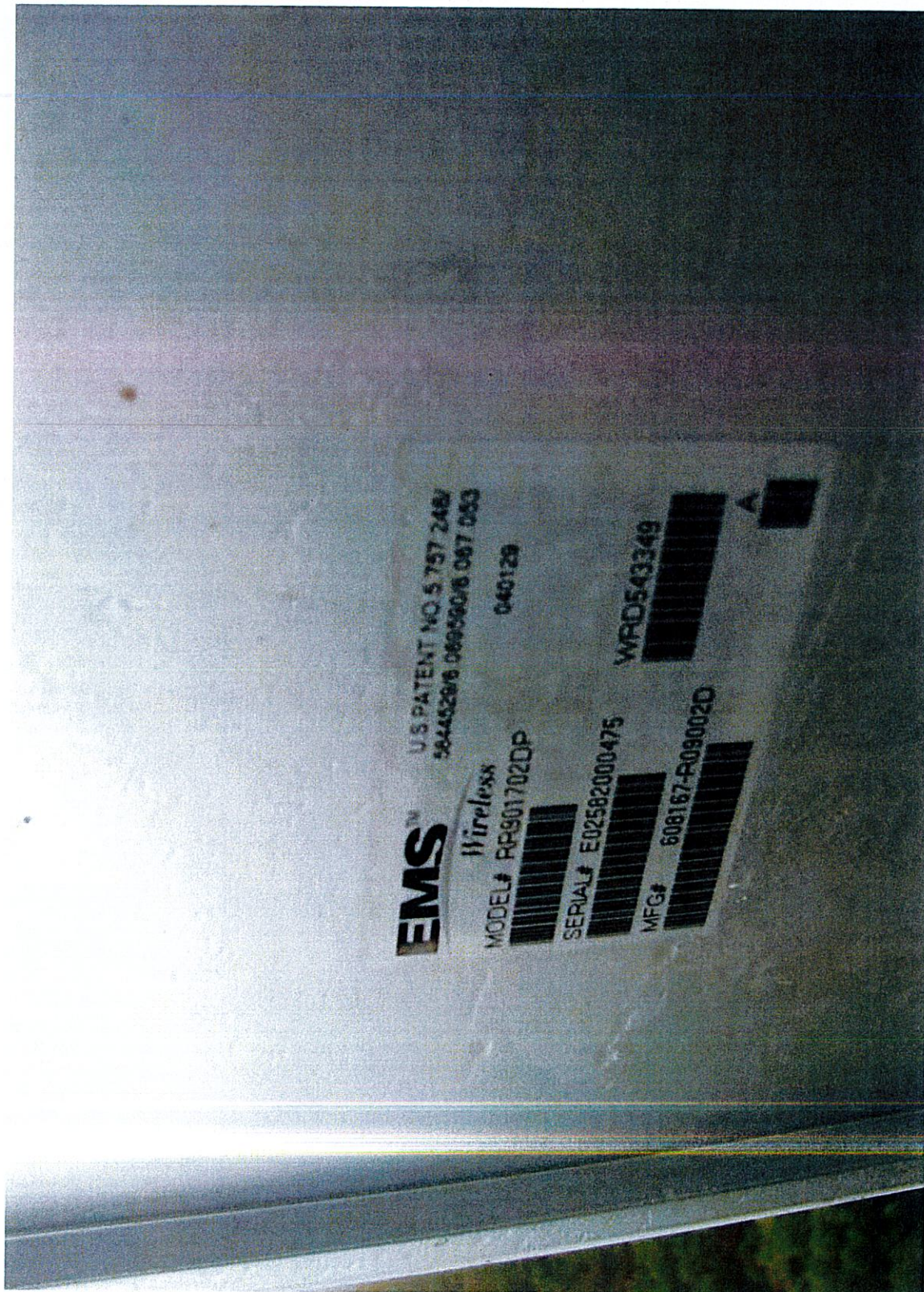
5.1 T-Mobile



5.2 T-Mobile



5.3 T-Mobile



EMS™

U.S. PATENT NO. 5,757,248/
5944,529/6 069590/6 067 053

Wireless

MODEL# RP901702DP

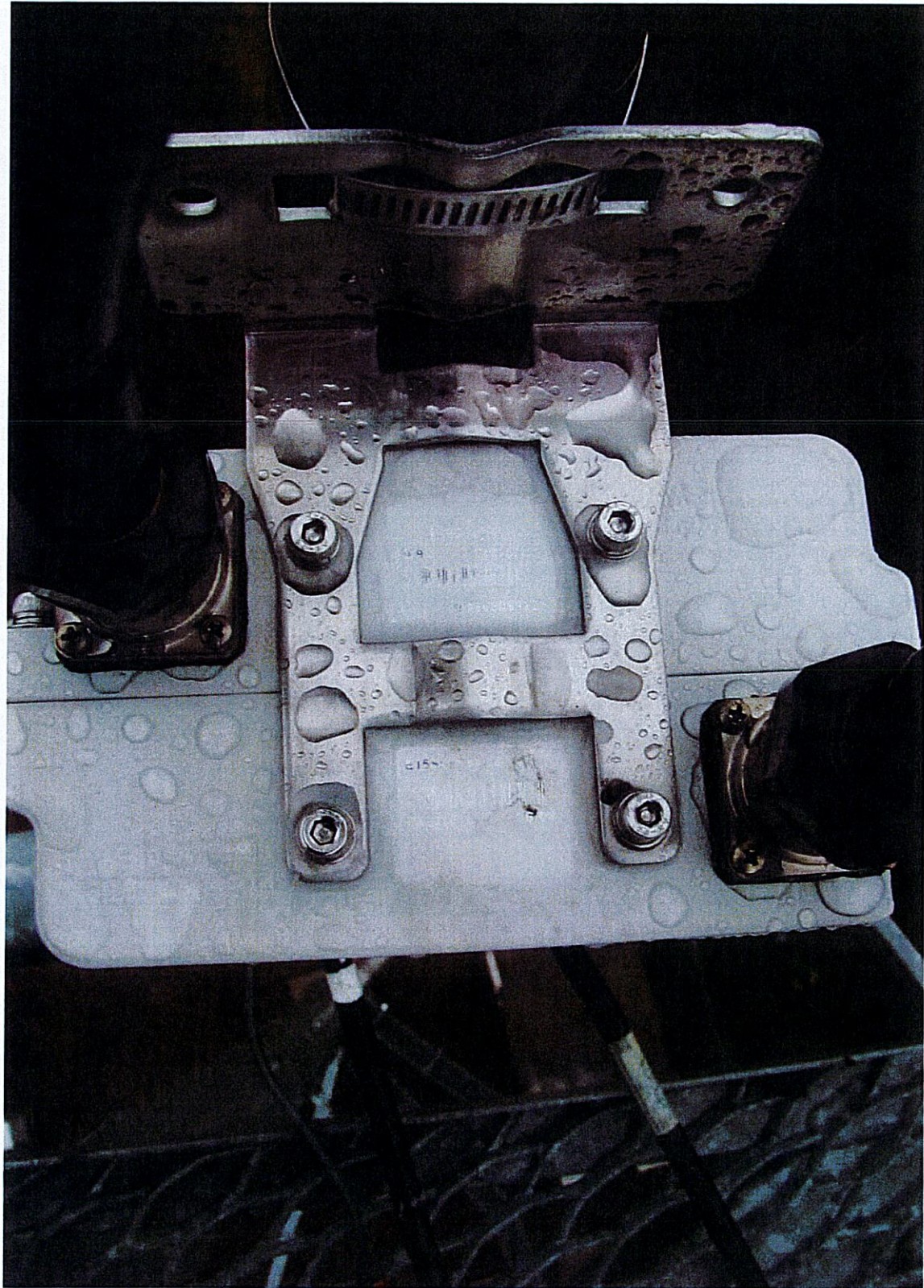
040129

SERIAL# E02582000475

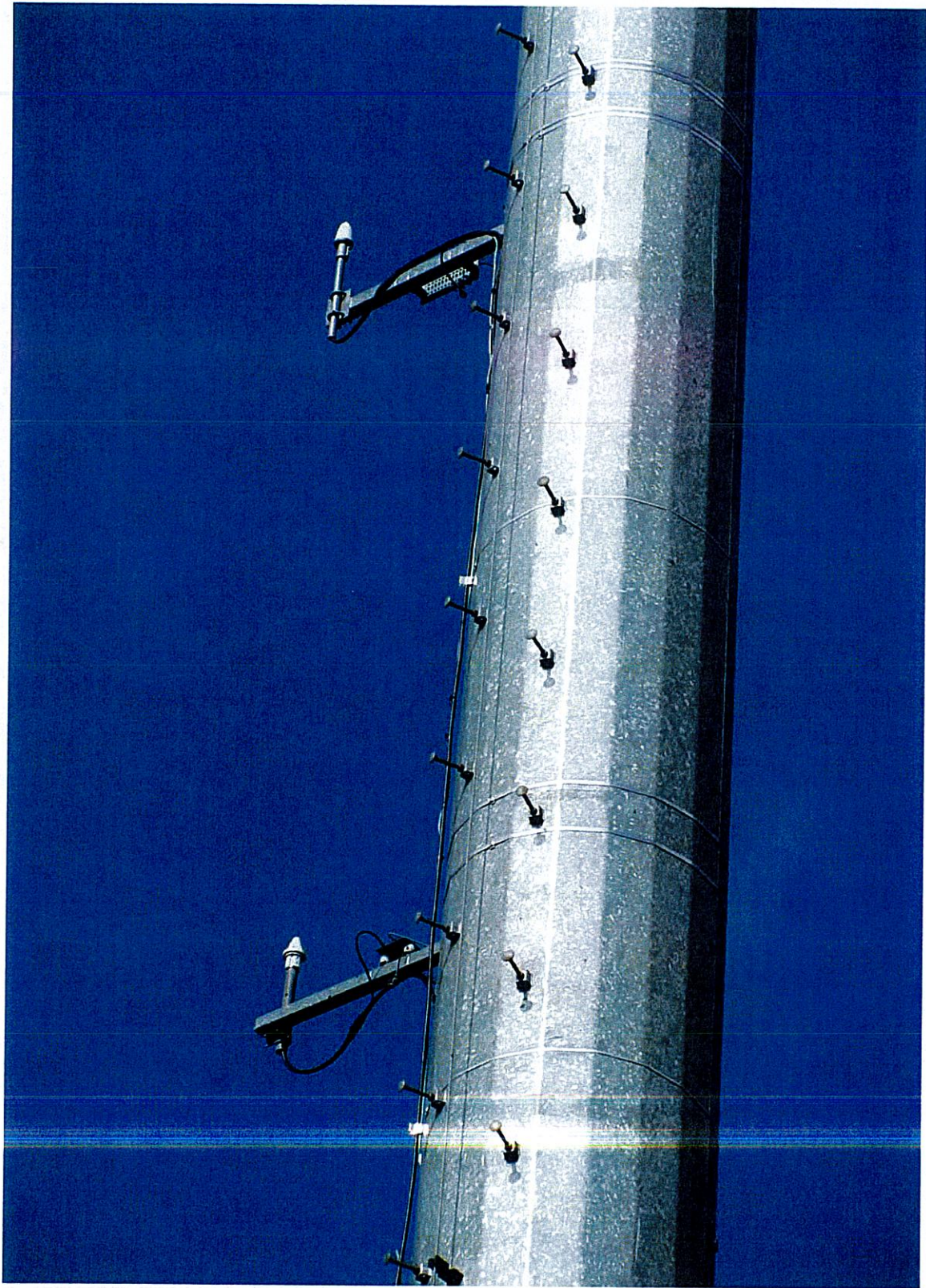
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WRD543349

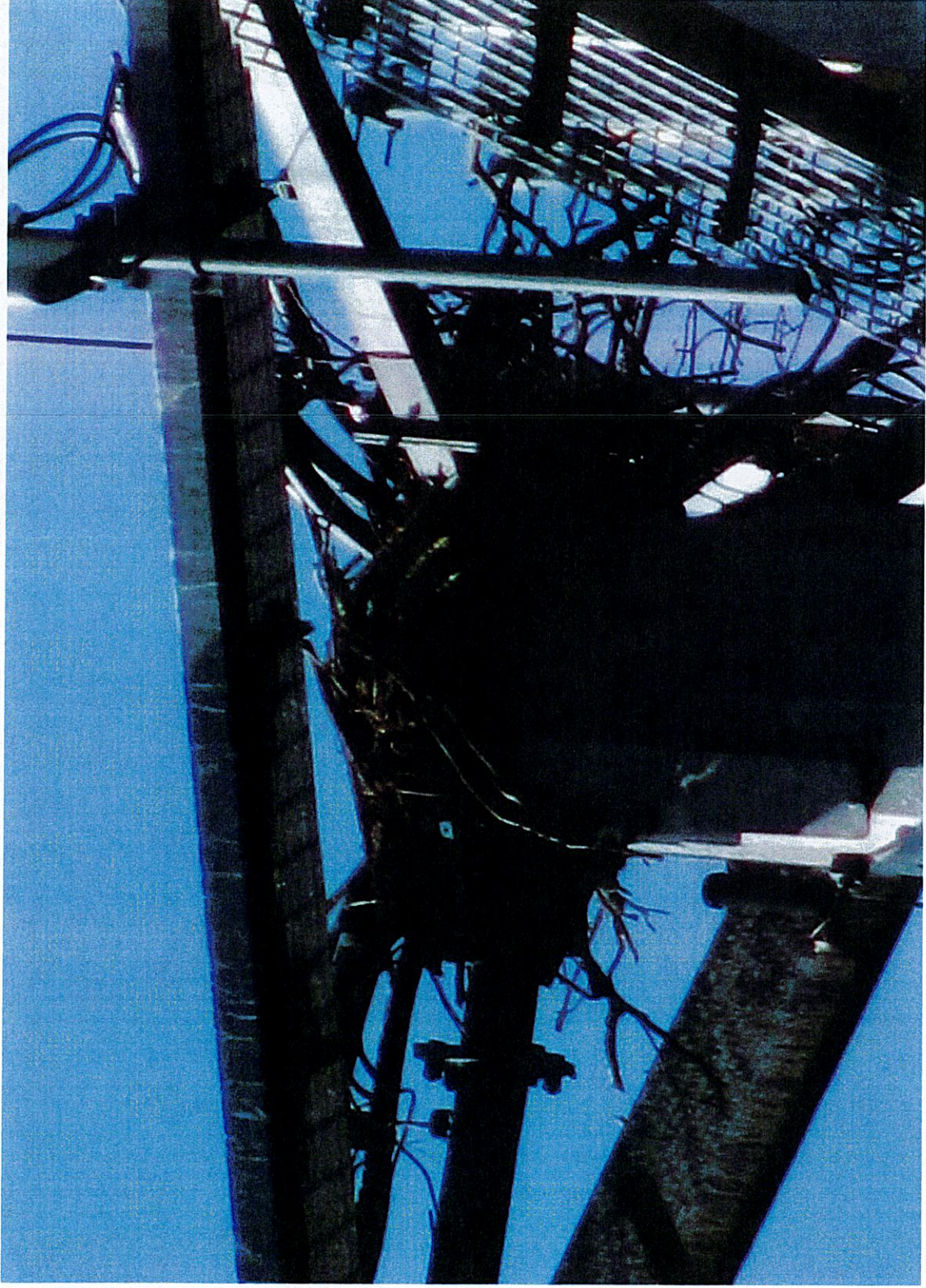
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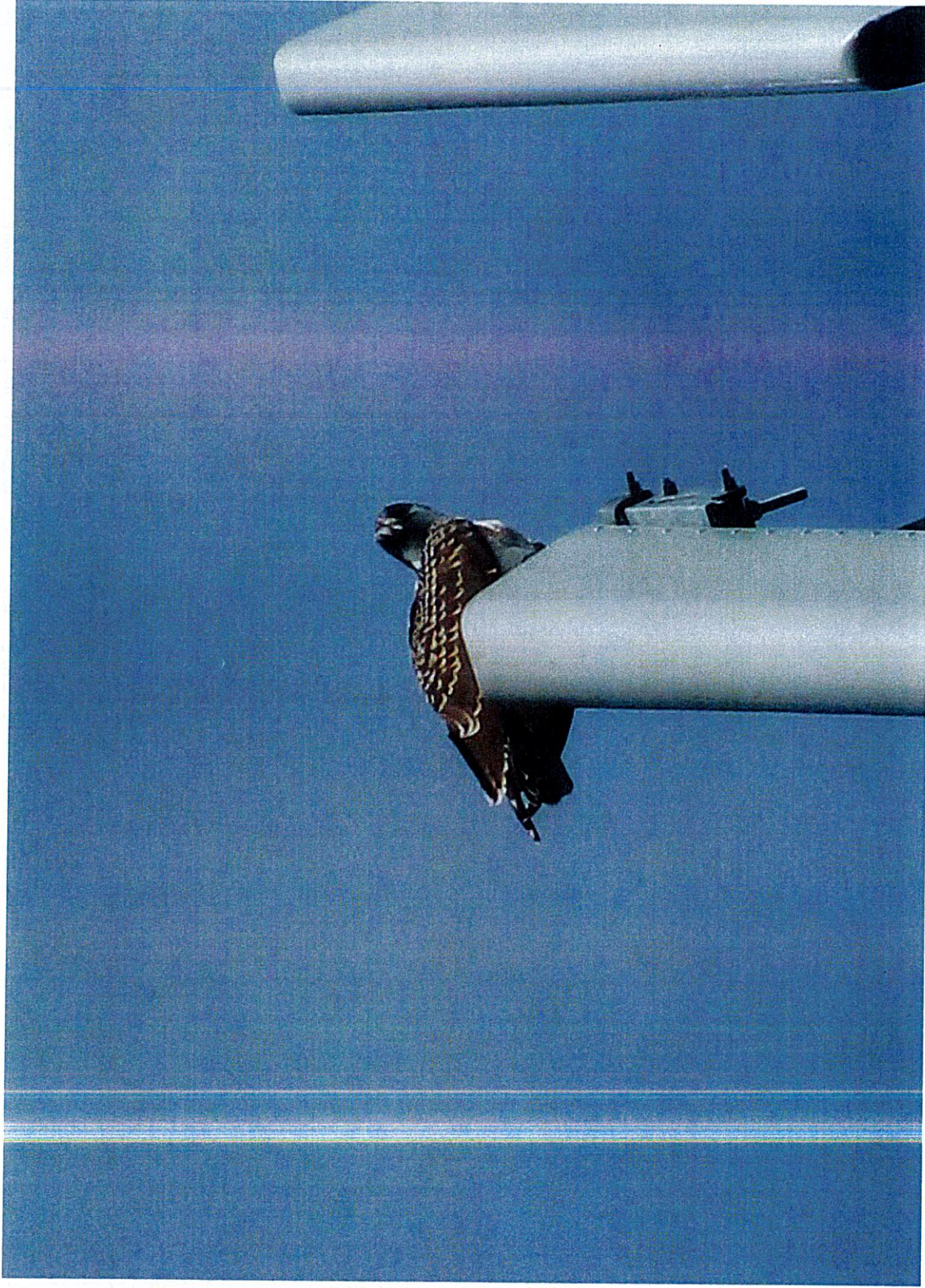
5.5 T-Mobile



6.0 TMA



7.1 Additional Tenant



7.2 Additional Tenant



8.1 Compound



8.2 Compound