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Also admitted in Massachusetts

January 22, 2014

Melanie A. Bachman
Acting Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **Notice of Exempt Modification – Antenna Swap**
48 Newtown Road, Danbury, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) wireless telecommunications antennas at the 90-foot level on the existing 110-foot tower at 48 Newtown Road in Danbury (the "Property"). The tower is owned by Wireless Capital Partners. Cellco's shared use of this tower was approved in 1999. Cellco now intends to replace nine (9) of its existing antennas with two (2) model BXA-80080-6CF 850 MHz antennas; one (1) model BXA-70063-6CF 850 MHz antenna; three (3) model BXA-70063-6CF 700 MHz antennas; and three (3) model BXA-171063-8BF 2100 MHz antennas, at the same 90-foot level. Cellco also intends to install six (6) remote radio heads ("RRHs") behind its 700 MHz and 2100 MHz antennas and one (1) HYBRIFLEX™ antenna cable. Included in Attachment 1 are specifications for Cellco's replacement antennas, RRHs and HYBRIFLEX™ cable.

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 Mark D. Boughton, Mayor for the City of Danbury. A copy of this letter is also being sent to 48 Newtown Road Corporation, the owners of the Property.

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

1. The proposed modifications will not result in an increase in the height of the existing tower. Cellco's proposed antennas and RRHs will be located at the 90-foot level on the 110-foot tower.

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

3. The proposed modifications will not increase noise levels at the facility by six decibels or more, or to levels that exceed state and local criteria.

4. The operation of the modified facility will not increase radio frequency (RF) emissions at the facility to a level at or above the Federal Communications Commission (FCC) safety standard. Far Field Approximation tables for each of Cellco's operating frequencies are included behind Attachment 2. The Far Field calculations demonstrate that Cellco's modified facility will operate well within the RF emissions limits established by the FCC.

5. The proposed modifications will not cause a change or alteration in the physical or environmental characteristics of the site.

6. The tower and its foundation can support Cellco's proposed modifications. (*See* Structural Analysis included in Attachment 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:
Mark D. Boughton, Danbury Mayor
48 Newtown Road Corporation
Sandy M. Carter

ATTACHMENT 1

Amphenol ANTENNA SOLUTIONS

BXA-80080-6CF-EDIN-X

X-Pol | FET Panel | 80° | 13.5 dBd

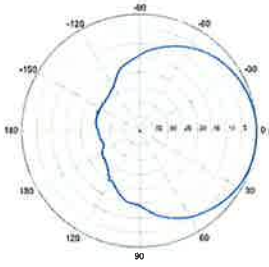
Replace "X" with desired electrical downtilt.

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

Electrical Characteristics				
Frequency bands	806-900 MHz*			
*Optional frequency band for iDEN	806-941 MHz (specify when ordering)			
Polarization	±45°			
Horizontal beamwidth	80°			
Vertical beamwidth	10°			
Gain	13.5 dBd (15.6 dBi)			
Electrical downtilt (X)	0, 2, 4, 6, 8, 10			
Impedance	**50Ω**			
VSWR	≤1.4:1			
Upper sidelobe suppression (0°)	-18.6 dB			
Front-to-back ratio (+/-30°)	-25.6 dB			
Null fill	5% (-26.02 dB)			
Isolation between ports	< -30 dB			
Input power with EDIN connectors	500 W			
Input power with NE connectors	300 W			
Lightning protection	Direct Ground			
Connector(s)	2 Ports / EDIN or NE / Female / Center (Back)			
Mechanical Characteristics				
Dimensions Length x Width x Depth	1804 x 204 x 151 mm		71.0 x 8.0 x 5.9 in	
Depth with z-brackets	191 mm		7.5 in	
Weight without mounting brackets	8.2 kg		18 lbs	
Survival wind speed	> 201 km/hr		> 125 mph	
Wind area	Front: 0.37 m^2	Side: 0.27 m^2	Front: 3.9 ft^2	Side: 2.9 ft^2
Wind load @ 161 km/hr (100 mph)	Front: 531 N	Side: 475 N	Front: 119 lbf	Side: 104 lbf

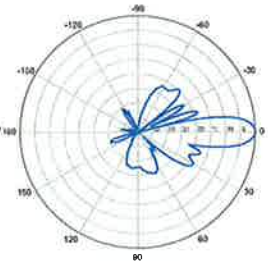
Mounting Options	Part Number	Fits Pipe Diameter	Weight
3-Point Mounting & Downtilt Bracket Kit	36210008	40-115 mm 1.57-4.5 in	6.9 kg 15.2 lbs
Concealment Configurations	For concealment configurations, order BXA-80080-6CF-EDIN-X-FP		

BXA-80080-6CF-EDIN-X



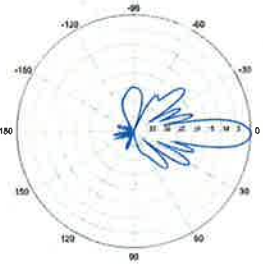
Horizontal

BXA-80080-6CF-EDIN-0



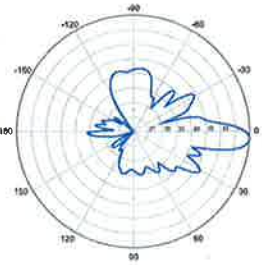
0° | Vertical

BXA-80080-6CF-EDIN-2



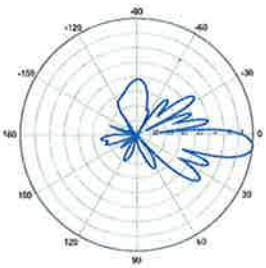
2° | Vertical

BXA-80080-6CF-EDIN-4



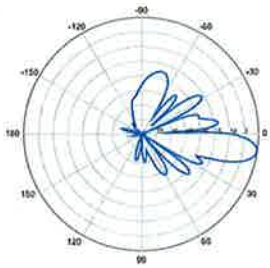
4° | Vertical

BXA-80080-6CF-EDIN-6



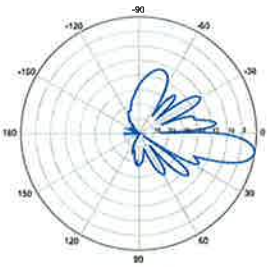
6° | Vertical

BXA-80080-6CF-EDIN-8



8° | Vertical

BXA-80080-6CF-EDIN-10



10° | Vertical

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

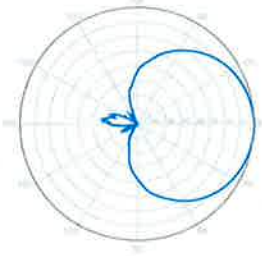
Replace "X" with desired electrical downtilt.

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	
IM3 (2x20W carriers)	< -153 dBc	
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

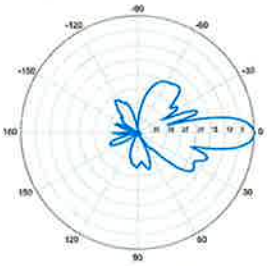
Mounting Options	Part Number	Fits Pipe Diameter	Weight
3-Point Mounting & Downtilt Bracket Kit	36210008	40-115 mm 1.57-4.5 in	6.9 kg 15.2 lbs
Concealment Configurations	For concealment configurations, order BXA-70063-6CF-EDIN-X-FP		

BXA-70063-6CF-EDIN-X



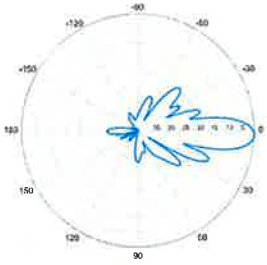
Horizontal | 750 MHz

BXA-70063-6CF-EDIN-0

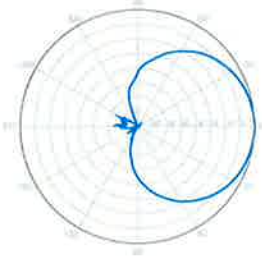


0° | Vertical | 750 MHz

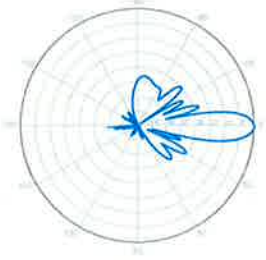
BXA-70063-6CF-EDIN-2



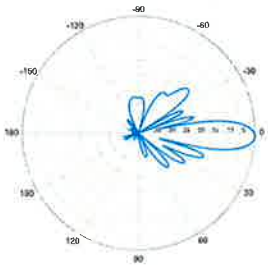
2° | Vertical | 750 MHz



Horizontal | 850 MHz



0° | Vertical | 850 MHz



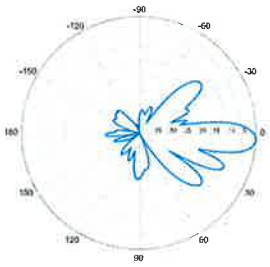
2° | Vertical | 850 MHz

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

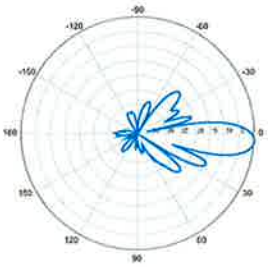
X-Pol | FET Panel | 63° | 14.5 dBd

BXA-70063-6CF-EDIN-3



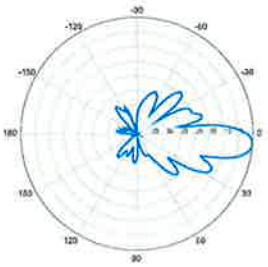
3° | Vertical | 750 MHz

BXA-70063-6CF-EDIN-4

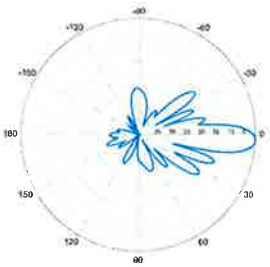


4° | Vertical | 750 MHz

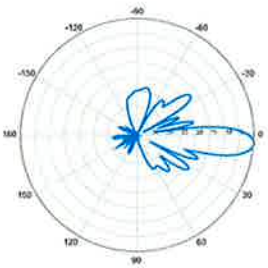
BXA-70063-6CF-EDIN-5



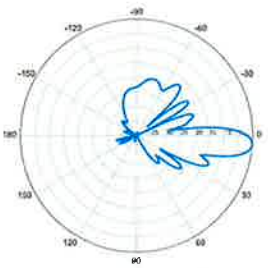
5° | Vertical | 750 MHz



3° | Vertical | 850 MHz

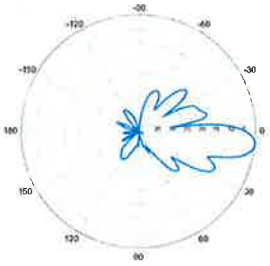


4° | Vertical | 850 MHz



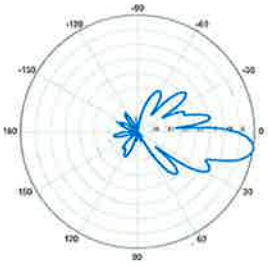
5° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-6



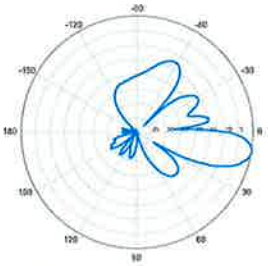
6° | Vertical | 750 MHz

BXA-70063-6CF-EDIN-8

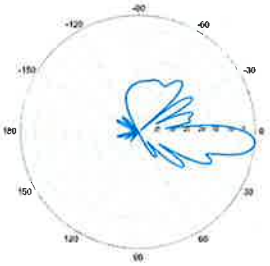


8° | Vertical | 750 MHz

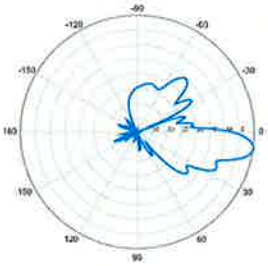
BXA-70063-6CF-EDIN-10



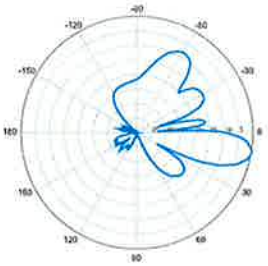
10° | Vertical | 750 MHz



6° | Vertical | 850 MHz



8° | Vertical | 850 MHz



10° | Vertical | 850 MHz

BXA-171063-8BF-EDIN-X

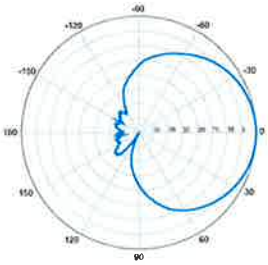
Replace "X" with desired electrical downtilt

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, 6, 8		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back ratio	> 30 dB		
In-band isolation	< -25 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	1225 x 154 x 105 mm	48.2 x 6.1 x 4.1 in	
Depth with t-brackets	133 mm	5.2 in	
Weight without mounting brackets	4.2 kg	9.2 lbs	
Survival wind speed	296 km/hr	184 mph	
Wind area	Front: 0.19 m² Side: 0.14 m²	Front: 2.0 ft² Side: 1.5 ft²	
Wind load @ 161 km/hr (100 mph)	Front: 281 N Side: 223 N	Front: 63 lbf Side: 50 lbf	

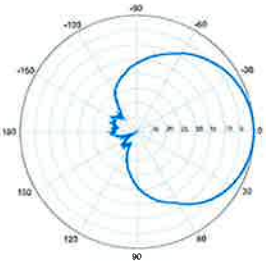
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	26799997	50-102 mm 2.0-4.0 in	2.3 kg 5 lbs
2-Point Mounting & Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	3.6 kg 8 lbs
Concealment Configurations	For concealment configurations, order BXA-171063-8BF-EDIN-X-FP		

BXA-171063-8BF-EDIN-X



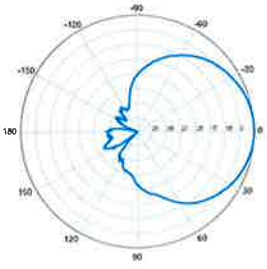
Horizontal | 1710-1880 MHz

BXA-171063-8BF-EDIN-X



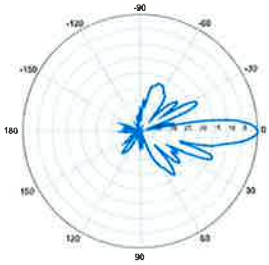
Horizontal | 1850-1990 MHz

BXA-171063-8BF-EDIN-X



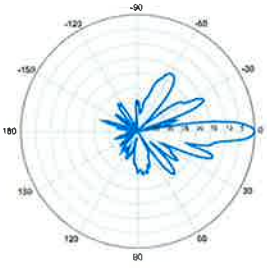
Horizontal | 1920-2170 MHz

BXA-171063-8BF-EDIN-0



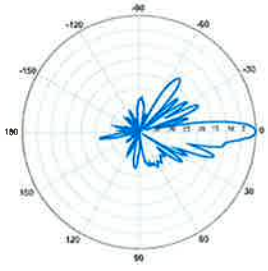
0° | Vertical | 1710-1880 MHz

BXA-171063-8BF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171063-8BF-EDIN-0

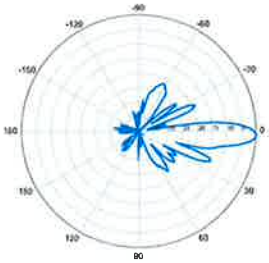


0° | Vertical | 1920-2170 MHz

BXA-171063-8BF-EDIN-X

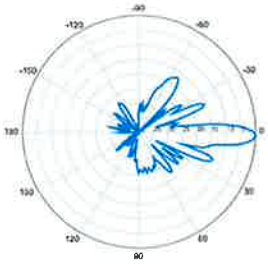
X-Pol | FET Panel | 63° | 17.4 dBi

BXA-171063-8BF-EDIN-2



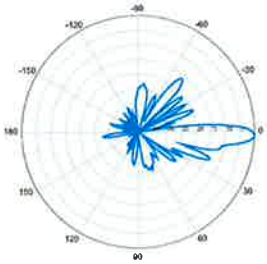
2° | Vertical | 1710-1880 MHz

BXA-171063-8BF-EDIN-2



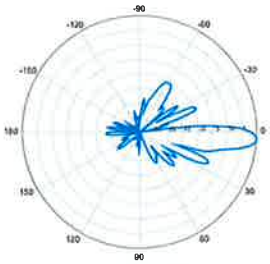
2° | Vertical | 1850-1990 MHz

BXA-171063-8BF-EDIN-2



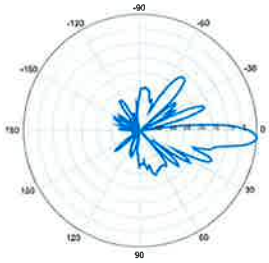
2° | Vertical | 1920-2170 MHz

BXA-171063-8BF-EDIN-4



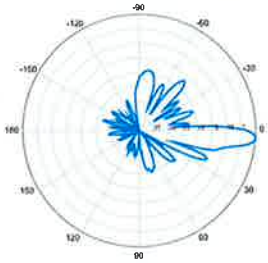
4° | Vertical | 1710-1880 MHz

BXA-171063-8BF-EDIN-4



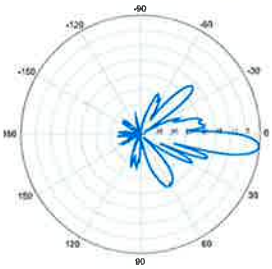
4° | Vertical | 1850-1990 MHz

BXA-171063-8BF-EDIN-4



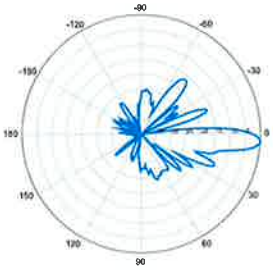
4° | Vertical | 1920-2170 MHz

BXA-171063-8BF-EDIN-6



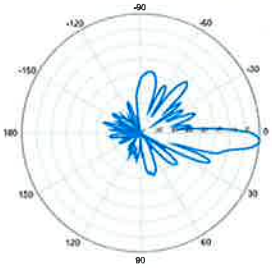
6° | Vertical | 1710-1880 MHz

BXA-171063-8BF-EDIN-6



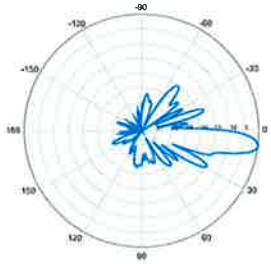
6° | Vertical | 1850-1990 MHz

BXA-171063-8BF-EDIN-6



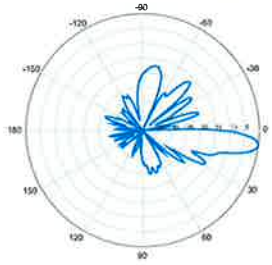
6° | Vertical | 1920-2170 MHz

BXA-171063-8BF-EDIN-8



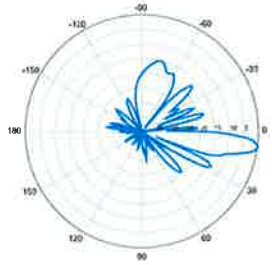
8° | Vertical | 1710-1880 MHz

BXA-171063-8BF-EDIN-8



8° | Vertical | 1850-1990 MHz

BXA-171063-8BF-EDIN-8



8° | Vertical | 1920-2170 MHz

Alcatel-Lucent RRH2x40-07-U

REMOTE RADIO HEAD

The Alcatel-Lucent RRH2x40-07-U is a high-power, small form-factor Remote Radio Head (RRH) operating in the North American Digital Dividend / 700MHz frequency band (3GPP Band 13). The Alcatel-Lucent RRH2x40-07-U is designed with an eco-efficient approach, providing operators with the means to achieve high quality and capacity coverage with minimum site requirements.

A distributed eNodeB expands deployment options by using two components, a Base Band Unit (BBU) containing the digital assets and a separate RRH containing the radio-frequency (RF) elements. This modular design optimizes available space and allows the main components of an eNodeB to be installed separately, within the same site or several kilometres apart.

The Alcatel-Lucent RRH2x40-07-U is linked to the BBU by an optical-fiber connection carrying downlink and uplink digital radio signals along with operations, administration and maintenance (OA&M) information. The Alcatel-Lucent RRH2x40-07-U has two transmit RF paths, 40 W RF output power per transmit path, and is designed to manage up to two-way receive diversity. The device is ideally suited to support macro coverage, with multiple-input multiple-output (MIMO) 2x2 operation in up to 10 MHz of bandwidth.

The Alcatel-Lucent RRH2x40-07-U is designed to make available all the benefits of a distributed eNodeB, with excellent RF characteristics, with low capital expenditures (CAPEX) and low operating expenditures (OPEX). The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment or require costly cranes to be employed, leaving coverage holes. However, many of these sites can host an Alcatel-Lucent RRH2x40-07-U installation, providing more flexible site selection and improved network quality along with greatly reduced installation time and costs.

Fast, low-cost installation and deployment

The Alcatel-Lucent RRH2x40-07-U is a zero-footprint solution and operates noise-free, simplifying negotiations with site property owners and minimizing environmental impacts. Installation can easily be done by a single person because the Alcatel-Lucent RRH2x40-07-U is compact and weights less than 23 kg (50 lb), eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day — a fraction of the time required for a traditional BTS.

Excellent RF performance

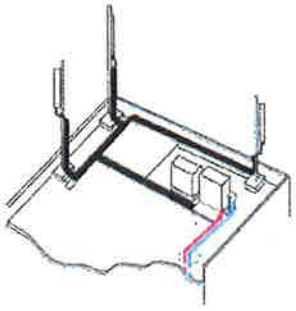
Because of its small size and weight, the Alcatel-Lucent RRH2x40-07-U can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-07-U where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation costs are reduced or eliminated, and there is no need for a Tower Mounted Amplifier (TMA) because losses introduced by the RF feeder are greatly reduced. The Alcatel-Lucent RRH2x40-07-U provides more RF power while at the same time consuming less electricity.

Features

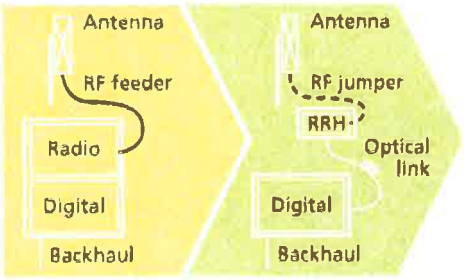
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless), noise-free, and heaterless unit
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

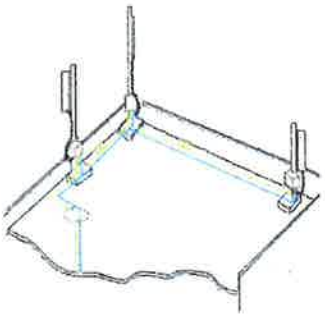
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility to network planning



Macro



RRH for space-constrained cell sites



Distributed

Technical specifications

Physical dimensions

- Height: 390 mm (15.4 in.)
- Width: 380 mm (15 in.)
- Depth: 210 mm (8.2 in.)
- Weight (without mounting kit): less than 23 kg (50 lb)

Power

- Power supply: -48V

Operating environment

- Outdoor temperature range:
  - ¬ With solar load: -40°C to +50°C (-40°F to +122°F)
  - ¬ Without solar load: -40°C to +55°C (-40°F to +131°F)
- Passive convection cooling (no fans)
- Enclosure protection
  - ¬ IP65 (International Protection rating)

RF characteristics

- Frequency band: 700 MHz; 3GPP Band 13
- Bandwidth: up to 10 MHz
- RF output power at antenna port:
  - ¬ 40 W nominal RF power for each Tx port
- Rx diversity: 2-way or 4-way
- Noise figure: below 2.5 dB typical
- ALD features
  - ¬ TMA
  - ¬ Remote electrical tilt (RET) support (AISG v2.0)

Optical characteristics

Type/number of fibers

- Up to 3.12 Gb/s line bit rate
- Single-mode variant
  - ¬ One SM fiber (9/125 µm) per RRH2x, carrying UL and DL using CWDM (at 1550/1310 nm)
- Multi-mode variant
  - ¬ Two MM fibers (50/125 µm) per RRH2x: one carrying UL, the other carrying DL (at 850 nm)

Optical fiber length

- Up to 500 m (0.31 mi), using MM fiber
- Up to 20 km (12.43 mi), using SM fiber

Alarms and ports

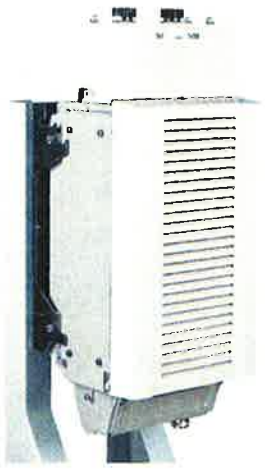
- Six external alarms
- Two optical ports to support daisy-chaining

Alcatel·Lucent

Alcatel-Lucent RRH2x40-AWS

REMOTE RADIO HEAD

The Alcatel-Lucent RRH2x40-AWS is a high-power, small form-factor Remote Radio Head (RRH) operating in the AWS frequency band (1700/2100MHz - 3GPP Band 4). The Alcatel-Lucent RRH2x40-AWS is designed with an eco-efficient approach, providing operators with the means to achieve high quality and capacity coverage with minimum site requirements.



A distributed eNodeB expands deployment options by using two components, a Base Band Unit (BBU) containing the digital assets and a separate RRH containing the radio-frequency (RF) elements. This modular design optimizes available space and allows the main components of an eNodeB to be installed separately, within the same site or several kilometres apart.

The Alcatel-Lucent RRH2x40-AWS is linked to the BBU by an optical-fiber connection carrying downlink and uplink digital radio signals along with operations, administration and maintenance (OA&M) information. The Alcatel-Lucent RRH2x40-AWS has two transmit RF paths, 40 W RF output power per transmit path, and is designed to manage up to four-way receive diversity. The device is ideally suited to support macro coverage, with multiple-input multiple-output (MIMO) 2x2 operation in up to 20 MHz of bandwidth.

The Alcatel-Lucent RRH2x40-AWS is designed to make available all the benefits of a distributed eNodeB, with excellent RF characteristics, with low capital expenditures (CAPEX) and low operating expenditures (OPEX). The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment or require costly cranes to be employed, leaving coverage holes. However, many of these sites can host an Alcatel-Lucent RRH2x40-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation time and costs.

Fast, low-cost installation and deployment

The Alcatel-Lucent RRH2x40-AWS is a zero-footprint solution and operates noise-free, simplifying negotiations with site property owners and minimizing environmental impacts. Installation can easily be done by a single person because the Alcatel-Lucent RRH2x40-AWS is compact and weighs less than 20 kg (44 lb), eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day — a fraction of the time required for a traditional BTS.

Excellent RF performance

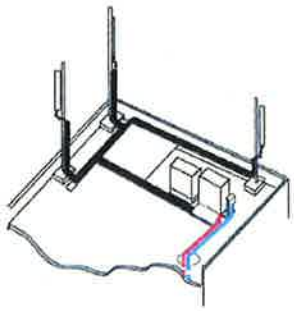
Because of its small size and weight, the Alcatel-Lucent RRH2x40-AWS can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-AWS where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation costs are reduced or eliminated, and there is no need for a Tower Mounted Amplifier (TMA) because losses introduced by the RF feeder are greatly reduced. The Alcatel-Lucent RRH2x40-AWS provides more RF power while at the same time consuming less electricity.

Features

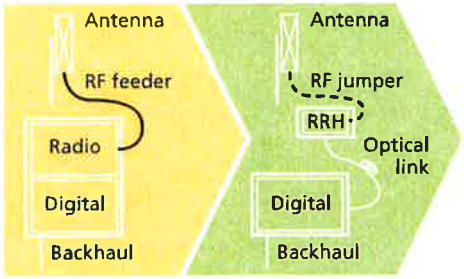
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless)
- Noise-free
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

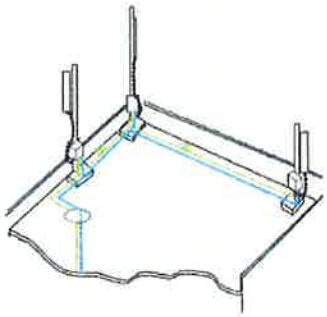
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility to network planning



Macro



RRH for space-constrained cell sites



Distributed

Technical specifications

Physical dimensions

- Height: 620 mm (24.4 in.)
- Width: 270 mm (10.63 in.)
- Depth: 170m (6.7 in.)
- Weight (without mounting kit): less than 20 kg (44 lb)

Power

- Power supply: -48VDC

Operating environment

- Outdoor temperature range:
  - ¬ With solar load: -40°C to +50°C (-40°F to +122°F)
  - ¬ Without solar load: -40°C to +55°C (-40°F to +131°F)
- Passive convection cooling (no fans)
- Enclosure protection
  - ¬ IP65 (International Protection rating)

RF characteristics

- Frequency band: 1700/2100 MHz (AWS); 3GPP Band 4
- Bandwidth: up to 20 MHz
- RF output power at antenna port: 40 W nominal RF power for each Tx port
- Rx diversity: 2-way or 4-way with optional Rx Diversity module
- Noise figure: below 2.0 dB typical
- Antenna Line Device features
  - ¬ TMA and Remote electrical tilt (RET) support via AISG v2.0

Optical characteristics

Type/number of fibers

- Single-mode variant
  - ¬ One Single Mode Single Fiber per RRH2x, carrying UL and DL using CWDM
  - ¬ Single mode dual fiber (SM/DF)
- Multi-mode variant
  - ¬ Two Multi-mode fibers per RRH2x: one carrying UL, the other carrying DL

Optical fiber length

- Up to 500 m (0.31 mi), using MM fiber
- Up to 20 km (12.43 mi), using SM fiber

Digital Ports and Alarms

- Two optical ports to support daisy-chaining
- Six external alarms

Alcatel·Lucent

Product Data Sheet HB158-1-08U8-S8J18

HYBRIFLEX™ RRH Hybrid Feeder Cabling Solution, 1-5/8", Single-Mode Fiber

Product Description

RFS' HYBRIFLEX Remote Radio Head (RRH) hybrid feeder cabling solution combines optical fiber and DC power for RRHs in a single lightweight aluminum corrugated cable, making it the world's most innovative solution for RRH deployments.

It was developed to reduce installation complexity and costs at Cellular sites. HYBRIFLEX allows mobile operators deploying an RRH architecture to standardize the RRH installation process and eliminate the need for and cost of cable grounding. HYBRIFLEX combines optical fiber (multi-mode or single-mode) and power in a single corrugated cable. It eliminates the need for junction boxes and can connect multiple RRHs with a single feeder. Standard RFS CELLFLEX® accessories can be used with HYBRIFLEX cable. Both pre-connectorized and on-site options are available.

Figure 1: HYBRIFLEX Series

Features/Benefits

- Aluminum corrugated armor with outstanding bending characteristics – minimizes installation time and enables mechanical protection and shielding
- Same accessories as 1 5/8" coaxial cable
- Outer conductor grounding – Eliminates typical grounding requirements and saves on installation costs
- Lightweight solution and compact design – Decreases tower loading
- Robust cabling – Eliminates need for expensive cable trays and ducts
- Installation of tight bundled fiber optic cable pairs directly to the RRH – Reduces CAPEX and wind load by eliminating need for interconnection
- Optical fiber and power cables housed in single corrugated cable – Saves CAPEX by standardizing RRH cable installation and reducing installation requirements
- Outdoor polyethylene jacket – Ensures long-lasting cable protection

Technical Specifications

Outer Conductor Armor	Corrugated Aluminum	[mm (in)]	46.5 (1.83)
Jacket	Polyethylene, PE	[mm (in)]	50.3 (1.98)
UV-Protection	Individual and External Jacket		Yes
Weight, Approximate		[kg/m (lb/ft)]	1.9 (1.30)
Minimum Bending Radius, Single Bending		[mm (in)]	200 (8)
Minimum Bending Radius, Repeated Bending		[mm (in)]	500 (20)
Recommended/Maximum Clamp Spacing		[m (ft)]	1.0 / 1.2 (3.25 / 4.0)
DC-Resistance Outer Conductor Armor		[Ω/km (Ω/1000ft)]	068 (0.205)
DC-Resistance Power Cable, 8.4mm²/8AWG)		[Ω/km (Ω/1000ft)]	2.1 (0.307)
Version			Single-mode OM3
Quantity, Fiber Count			16 (8 pairs)
Core/Clad		[µm]	50/125
Primary Coating (Acrylate)		[µm]	245
Buffer Diameter, Nominal		[µm]	900
Secondary Protection, Jacket, Nominal		[mm (in)]	2.0 (0.08)
Minimum Bending Radius		[mm (in)]	104 (4.1)
Insertion Loss @ wavelength 850nm		dB/km	3.0
Insertion Loss @ wavelength 1310nm		dB/km	1.0
Standards (Meets or exceeds)			UL94-V0, UL1666 RoHS Compliant
Size (Power)		[mm² (AWG)]	8.4 (8)
Quantity, Wire Count (Power)			16 (8 pairs)
Size (Alarm)		[mm² (AWG)]	0.8 (18)
Quantity, Wire Count (Alarm)			4 (2 pairs)
Type			UV protected
Strands			19
Primary Jacket Diameter, Nominal		[mm (in)]	6.8 (0.27)
Standards (Meets or exceeds)			NFPA 130, ICEA S-95-658 UL Type XHHW-2, UL 44 UL-LS Limited Smoke, UL VW-1 IEEE-383 (1974), IEEE1202/FT4 RoHS Compliant
Installation Temperature		[°C (°F)]	-40 to +65 (-40 to149)
Operation Temperature		[°C (°F)]	-40 to +65 (-40 to149)

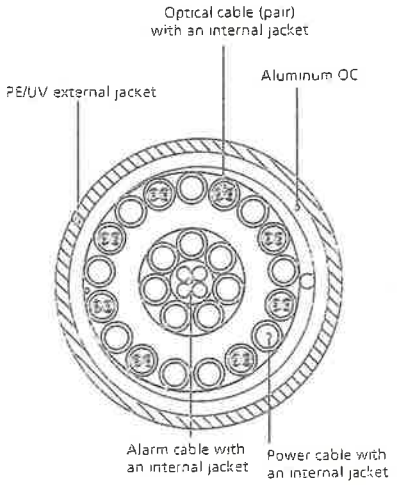


Figure 2: Construction Detail

* This data is provisional and subject to change

ATTACHMENT 2

Far Field Approximation
with downtilt variation

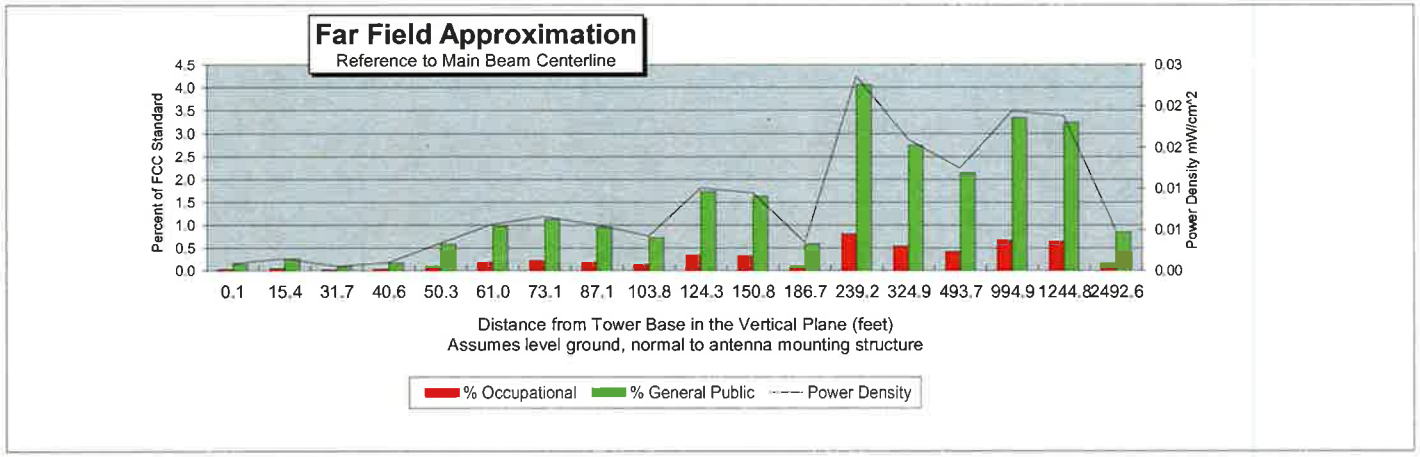
Estimated Radiated Emission

Single Emitter Far Field Model

Dipole / Wire/ Yagi Antenna Types

Location:	GERMANTOWN, CT
Site #:	5-0293
Date:	01/17/14
Name:	Ryan Ulanday
File Name:	Germantown CT - FF Power

Operating Freq. (MHz)	**869.0**
Antenna Height (ft):	**90.0**
Antenna Gain (dBi):	**15.7**
Antenna Size (in.):	**72.6**
Downtilt (degrees):	**0.0**
Feedline Loss (dB):	**0.0**
Power @ J4 (w):	**3798.0**



This approximation is only valid in the far field, which begins at: 65.5 Feet

Enter Main Beam Distance in feet below:

Calc Angle	90.0	80.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0	10.0	5.0	4.0	2.0	
Solve for r, dx to antenna	87.0	88.4	92.6	96.0	100.5	106.2	113.6	123.1	135.4	151.7	174.1	206.0	254.5	336.3	501.3	998.7	1247.8	2494.1	
Distance from Antenna Structure Base in Horizontal plane	0.1	15.4	31.7	40.6	50.3	61.0	73.1	87.1	103.8	124.3	150.8	186.7	239.2	324.9	493.7	994.9	1244.8	2492.6	#NUM!
Angle from Main Beam (reference to horizontal plane)	90	80	70	65	60	55	50	45	40	35	30	25	20	15	10	5	4	2	0
dB down from centerline (referenced to centerline)	36.76	34.35	38.52	35.34	29.54	26.8	25.59	25.63	25.99	21.21	20.29	23.24	13.03	12.3	9.92	2	0.2	0	0
Reflection Coefficient (1 to 4, 2.56 typical)	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Power Density (mW/cm^2)	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.02	0.02	0.01	0.02	0.02	0.00	#NUM!
Percent of Occupational Standard	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.3	0.3	0.1	0.8	0.6	0.4	0.7	0.6	0.2	#NUM!
Percent of General Population Standard	0.1	0.2	0.1	0.2	0.6	1.0	1.1	1.0	0.7	1.7	1.6	0.6	4.1	2.8	2.1	3.3	3.2	0.8	#NUM!

Antenna Type BXA-80080-6CF
Max% 4.06%

Instructions:

1) Fill in Site Location, Site number, Date, Name of Person Responsible for Date, and enter File Name to ba saved as.
2) References to J4 refer to a point where the transmission line exits the equipment shelter and proceeds to the antenna(s). There is typically a connector located here where power measurements are made.
3) Enter Antenna Height (in feet to bottom of antenna), Antenna Gain (expressed as dBi, add 2.17 to dBd to obtain dBi), Antenna Size (vertical size in inches), Downtilt (in Degrees, enter zero if none), Feedline loss from J4 to Antenna, and J4 P
4) From manufacturer's plots, or data sheet, input Angle from mainbeam and dB below mainbeam centerline.
5) Enter Reflection coefficient (2.56 would be typical, 1 for free space)
6) Spreadsheet calculates actual power density, then relates as Occupational or General Population percentage of FCC Standard.
7) An odd distance may be entered in the rightmost column of the lower table.

Far Field Approximation
with downtilt variation

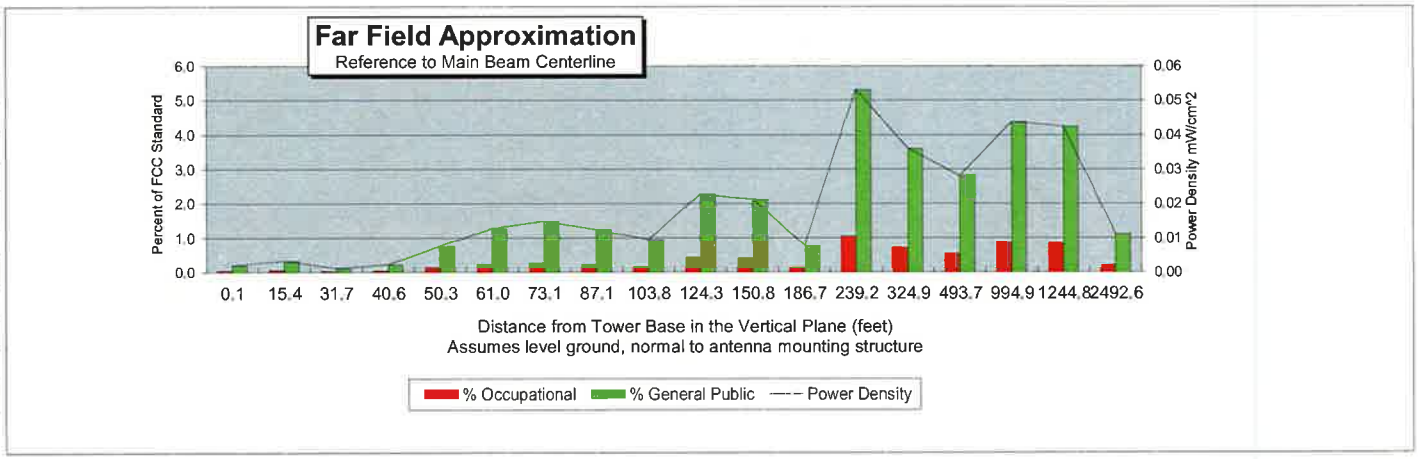
Estimated Radiated Emission

Single Emitter Far Field Model

Dipole / Wire/ Yagi Antenna Types

Location:	GERMANTOWN, CT
Site #:	5-0293
Date:	01/17/14
Name:	Ryan Ulanday
File Name:	Germantown CT - FF Power

Operating Freq. (MHz)	**1971.0**
Antenna Height (ft):	**90.0**
Antenna Gain (dBi):	**16.5**
Antenna Size (in.):	**54.3**
Downtilt (degrees):	**0.0**
Feedline Loss (dB):	**0.0**
Power @ J4 (w):	**7050.0**



This approximation is only valid in the far field, which begins at: 36.7 Feet

Enter Main Beam Distance in feet below:

Calc Angle	90.0	80.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0	10.0	5.0	4.0	2.0	
Solve for r, dx to antenna	87.0	88.4	92.6	96.0	100.5	106.2	113.6	123.1	135.4	151.7	174.1	206.0	254.5	336.3	501.3	998.7	1247.8	2494.1	
Distance from Antenna Structure Base in Horizontal plane	0.1	15.4	31.7	40.6	50.3	61.0	73.1	87.1	103.8	124.3	150.8	186.7	239.2	324.9	493.7	994.9	1244.8	2492.6	#NUM!
Angle from Main Beam (reference to horizontal plane)	90	80	70	65	60	55	50	45	40	35	30	25	20	15	10	5	4	2	0
dB down from centerline (referenced to centerline)	36.76	34.35	38.52	35.34	29.54	26.8	25.59	25.63	25.99	21.21	20.29	23.24	13.03	12.3	9.92	2	0.2	0	0
Reflection Coefficient (1 to 4, 2.56 typical)	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Power Density (mW/cm^2)	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.05	0.04	0.03	0.04	0.04	0.01	#NUM!
Percent of Occupational Standard	0.0	0.1	0.0	0.0	0.2	0.3	0.3	0.2	0.2	0.5	0.4	0.2	1.1	0.7	0.6	0.9	0.8	0.2	#NUM!
Percent of General Population Standard	0.2	0.3	0.1	0.2	0.8	1.3	1.5	1.2	0.9	2.3	2.1	0.8	5.3	3.6	2.8	4.4	4.2	1.1	#NUM!

Antenna Type MG D3-800T0
Max% 5.31%

Instructions:

1) Fill in Site Location, Site number, Date, Name of Person Responsible for Date, and enter File Name to ba saved as.
2) References to J4 refer to a point where the transmission line exits the equipment shelter and proceeds to the antenna(s). There is typically a connector located here where power measurements are made.
3) Enter Antenna Height (in feet to bottom of antenna), Antenna Gain (expressed as dBi, add 2.17 to dBd to obtain dBi), Antenna Size (vertical size in inches), Downtilt (in Degrees, enter zero if none), Feedline loss from J4 to Antenna, and J4 Pc
4) From manufacturer's plots, or data sheet, input Angle from mainbeam and dB below mainbeam centerline.
5) Enter Reflection coefficient (2.56 would be typical, 1 for free space)
6) Spreadsheet calculates actual power density, then relates as Occupational or General Population percentage of FCC Standard.
7) An odd distance may be entered in the rightmost column of the lower table.

Far Field Approximation
with downtilt variation

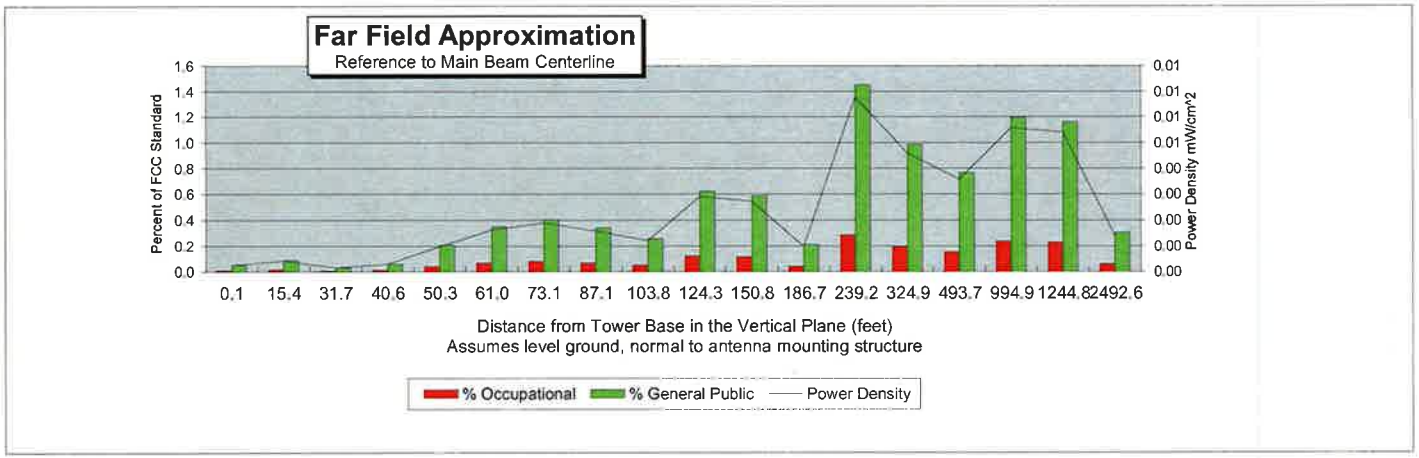
Estimated Radiated Emission

Single Emitter Far Field Model

Dipole / Wire/ Yagi Antenna Types

Location:	GERMANTOWN, CT
Site #:	5-0293
Date:	01/17/14
Name:	Ryan Ulanday
File Name:	Germantown CT - FF Power

Operating Freq. (MHz)	**698.0**
Antenna Height (ft):	**90.0**
Antenna Gain (dBi):	**16.7**
Antenna Size (in.):	**71.0**
Downtilt (degrees):	**0.0**
Feedline Loss (dB):	**0.0**
Power @ J4 (w):	**868.0**



This approximation is only valid in the far field, which begins at: 62.6 Feet

Enter Main Beam Distance in feet below:

Calc Angle	90.0	80.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0	10.0	5.0	4.0	2.0	
Solve for r, dx to antenna	87.0	88.4	92.6	96.0	100.5	106.2	113.6	123.1	135.4	151.7	174.1	206.0	254.5	336.3	501.3	998.7	1247.8	2494.1	
Distance from Antenna Structure Base in Horizontal plane	0.1	15.4	31.7	40.6	50.3	61.0	73.1	87.1	103.8	124.3	150.8	186.7	239.2	324.9	493.7	994.9	1244.8	2492.6	#NUM!
Angle from Main Beam (reference to horizontal plane)	90	80	70	65	60	55	50	45	40	35	30	25	20	15	10	5	4	2	0
dB down from centerline (referenced to centerline)	36.76	34.35	38.52	35.34	29.54	26.8	25.59	25.63	25.99	21.21	20.29	23.24	13.03	12.3	9.92	2	0.2	0	0
Reflection Coefficient (1 to 4, 2.56 typical)	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Power Density (mW/cm^2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00	#NUM!
Percent of Occupational Standard	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.3	0.2	0.2	0.2	0.2	0.1	#NUM!
Percent of General Population Standard	0.1	0.1	0.0	0.1	0.2	0.4	0.4	0.3	0.3	0.6	0.6	0.2	1.5	1.0	0.8	1.2	1.2	0.3	#NUM!

Antenna Type BXA-70063-6CF-2
Max% 1.45%

Instructions:

1) Fill in Site Location, Site number, Date, Name of Person Responsible for Date, and enter File Name to ba saved as.
2) References to J4 refer to a point where the transmission line exits the equipment shelter and proceeds to the antenna(s). There is typically a connector located here where power measurements are made.
3) Enter Antenna Height (in feet to bottom of antenna), Antenna Gain (expressed as dBi, add 2.17 to dBd to obtain dBi), Antenna Size (vertical size in inches), Downtilt (in Degrees, enter zero if none), Feedline loss from J4 to Antenna, and J4 Pc
4) From manufacturer's plots, or data sheet, input Angle from mainbeam and dB below mainbeam centerline.
5) Enter Reflection coefficient (2.56 would be typical, 1 for free space)
6) Spreadsheet calculates actual power density, then relates as Occupational or General Population percentage of FCC Standard.
7) An odd distance may be entered in the rightmost column of the lower table.

Far Field Approximation
with downtilt variation

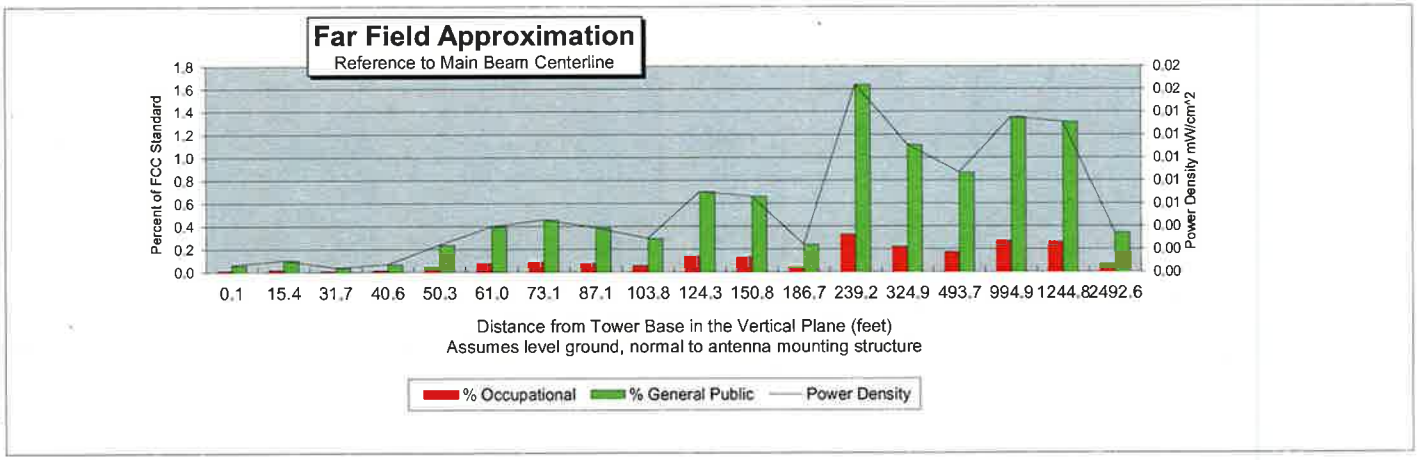
Estimated Radiated Emission

Single Emitter Far Field Model

Dipole / Wire/ Yagi Antenna Types

Location:	GERMANTOWN, CT
Site #:	5-0293
Date:	01/17/14
Name:	Ryan Ulanday
File Name:	Germantown CT - FF Power

Operating Freq. (MHz)	**2110.0**
Antenna Height (ft):	**90.0**
Antenna Gain (dBi):	**17.5**
Antenna Size (in.):	**48.5**
Downtilt (degrees):	**0.0**
Feedline Loss (dB):	**0.0**
Power @ J4 (w):	**1750.0**



This approximation is only valid in the far field, which begins at: 29.2 Feet

Enter Main Beam Distance in feet below:

Calc Angle	90.0	80.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0	10.0	5.0	4.0	2.0	
Solve for r, dx to antenna	87.0	88.4	92.6	96.0	100.5	106.2	113.6	123.1	135.4	151.7	174.1	206.0	254.5	336.3	501.3	998.7	1247.8	2494.1	
Distance from Antenna Structure Base in Horizontal plane	0.1	15.4	31.7	40.6	50.3	61.0	73.1	87.1	103.8	124.3	150.8	186.7	239.2	324.9	493.7	994.9	1244.8	2492.6	#NUM!
Angle from Main Beam (reference to horizontal plane)	90	80	70	65	60	55	50	45	40	35	30	25	20	15	10	5	4	2	0
dB down from centerline (referenced to centerline)	36.76	34.35	38.52	35.34	29.54	26.8	25.59	25.63	25.99	21.21	20.29	23.24	13.03	12.3	9.92	2	0.2	0	0
Reflection Coefficient (1 to 4, 2.56 typical)	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Power Density (mW/cm^2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.02	0.01	0.01	0.01	0.01	0.00	#NUM!
Percent of Occupational Standard	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.3	0.2	0.2	0.3	0.3	0.1	#NUM!
Percent of General Population Standard	0.1	0.1	0.0	0.1	0.2	0.4	0.5	0.4	0.3	0.7	0.7	0.2	1.6	1.1	0.9	1.4	1.3	0.3	#NUM!

Antenna Type BXA-171063-8BF
Max% 1.64%

Instructions:

1) Fill in Site Location, Site number, Date, Name of Person Responsible for Date, and enter File Name to ba saved as.
2) References to J4 refer to a point where the transmission line exits the equipment shelter and proceeds to the antenna(s). There is typically a connector located here where power measurements are made.
3) Enter Antenna Height (in feet to bottom of antenna), Antenna Gain (expressed as dBi, add 2.17 to dBd to obtain dBi), Antenna Size (vertical size in inches), Downtilt (in Degrees, enter zero if none), Feedline loss from J4 to Antenna, and J4 Pc
4) From manufacturer's plots, or data sheet, input Angle from mainbeam and dB below mainbeam centerline.
5) Enter Reflection coefficient (2.56 would be typical, 1 for free space)
6) Spreadsheet calculates actual power density, then relates as Occupational or General Population percentage of FCC Standard.
7) An odd distance may be entered in the rightmost column of the lower table.

ATTACHMENT 3

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

96-ft EEI Monopole with 14-ft Extension

Proposed Verizon Wireless
Antenna Upgrade

Verizon Wireless Site Ref: Germantown

48 Newtown Road
Danbury, CT

Centek Project No. 14001.001

Date: January 16, 2014

Prepared for:

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

63-2 North Branford Road, Branford, CT 06405 203.488.0580 Fax 203.488.8587 www.CentekEng.com

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Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna installation/modification proposed by Verizon Wireless on the existing monopole (tower) located in Danbury, Connecticut.

The host tower is a 96-ft tall (with 14-ft extension) two-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Incorporated (EEI); project no. 5246 dated July 6, 1999. The original tower geometry, structure member sizes and foundation system information were obtained from the aforementioned EEI design documents. The 14-ft extension and monopole reinforcement design information was obtained from a subsequent structural analysis and reinforcement design prepared by Structural Components job no. 090239 dated October 6, 2009 for MetroPCS. Reference was also made to previous structural analysis reports prepared by Centek Engineering, Job No. 12124.CO.23, marked Revision #1, dated February 20, 2013.

The tower consists of two (2) tapered steel vertical sections conforming to ASTM A572-65 (65ksi).The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 17.50-in at the top and 37.0-in at the base. The 14-ft extension consists of 16in. diameter pipe confirming to ASTM A36 and is connected to the tapered steel portion of the monopole via. a bolted steel flange plate.

Antenna and appurtenance information were obtained from a combination of the aforementioned structural analyses, an RF data sheet provided by Verizon Wireless and a field verification conducted from grade by Centek personnel during January 2014. Note that since the issuance of the February 20, 2013 structural report prepared by this office noted above, the Nextel radio equipment has been decommissioned and therefore is not included within this analysis.

Verizon proposes the removal of nine (9) panel antennas and the installation of nine (9) panel antennas, six (6) Remote Radio Heads (RRHs) and one (1) distribution box mounted on an existing EEI platform with handrails. 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 tower was designed to support several communication antennas. The existing, proposed and future loads considered in this analysis consist of the following:

- METRO PCS (EXISTING/RESERVED):
  Antennas: Three (3) Kathrein 800-10504 and three (3) Kathrein 742-351 panel antenna mounted on three (3) 10-ft T-Arms with a RAD center elevation of 108-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables (6 existing/6 reserved) running on the exterior of the existing tower in a 2x6 cable configuration.

- AT&T (EXISTING):
  Antennas: Six (6) Powerwave 7770.00 panel antennas, two (2) KMW AM-X-CD-14-65-00T panel antennas, one (1) KMW AM-X-CD-16-65-00T panel antennas, six (6) Powerwave LGP21401 TMA's, three (3) Powerwave TT19-08BP111-001 TMA's mounted on an EEI standard platform with a RAD center elevation of 100-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the exterior of the existing tower in a 2x6 cable configuration.

- AT&T (EXISTING):
  Antennas: Six (6) Ericsson RRUS-11 and one (1) Raycap DC6-48-60-18-8F surge arrestor mounted to one (1) universal ring mount with a RAD center elevation of 100-ft above existing grade level.
  Coax Cables: One (1) 5/8" ∅ fiber cable and two (2) #8 DC control cables running within one (1) 3" ∅ inner-duct running on the exterior of the existing tower.

- NEXTEL (DECOMISSIONED AND REMOVED):
  Antennas: Twelve (12) 4-ft panel antennas mounted on an EEI standard platform with a RAD center elevation of 78-ft above grade level.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the inside of the existing tower and six (6) 1-5/8" ∅ coax cables running on the exterior of the existing tower in a 1x6 cable configuration.

- VERIZON (EXISTING TO REMAIN):
  Antennas: Three (3) RYMSA MG D3-800T0 panel antennas and six (6) RFS FD9R6004/2C-3L Diplexers mounted on an existing EEI standard platform with a RAD center elevation of 90-ft above grade level.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.

- **VERIZON (EXISTING TO REMOVE):**
  Antennas: Two (2) Powerwave P65-16-XL-2 panel antennas, one (1) Antel BXA-70063-4CF panel antenna, four (4) Andrew DB846H80E-SX and two (2) Andrew DB846F65ZAXY panel antennas mounted on an existing EEI standard platform with a RAD center elevation of 90-ft above grade level.

- **VERIZON (Proposed):**
  Antennas: Three (3) Antel BXA-171063-8BF panel antennas, three (3) Antel BXA-70063-6CF panel antennas, two (2) Antel BXA-80080-6CF panel antennas and one (1) Antel BXA-80063-8BF panel antenna mounted on an existing EEI standard platform with a RAD center elevation of 90-ft above grade level.
  Misc. Equipment: Three (3) Alcatel-Lucent RRH2x40-AWS Remote Radio Heads, three (3) Alcatel-Lucent RRH2x40-07-U Remote Radio Heads and one (1) RFS DB-T1-6Z-8AB-0Z main distribution box mounted on an existing EEI standard platform with a RAD center elevation of 90-ft above grade level.
  Coax Cables: One (1) 1-5/8" ∅ Hybriflex fiber line running on the exterior of the monopole adjacent to the existing carrier coaxial cables.

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 coax cables are installed as indicated within Section 3 of this report.
- All aforementioned reinforcements designed by Structural Components are installed.

Analysis

The existing tower was analyzed using a comprehensive computer program entitled tnxTower. 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 the controlling basic wind speed (fastest mile) with no ice and a 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).

The controlling wind speed is determined by evaluating the local available wind speed data as provided in Appendix K of the CSBC[1] and the wind speed data available in the TIA/EIA-222-F-96 Standard. The higher of the two wind speeds is utilized in preparation on the tower analysis.

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 on the tower structure and its components.

Basic Wind Speed:	Fairfield; v = 85 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Danbury; v = 95 mph (3 second gust) equivalent to v = 77.5 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA wind speed controls.	
Load Cases:	Load Case 1; 85 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 74 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 74 mph wind speed velocity represents 75% of the wind pressure generated by the 85 mph wind speed.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 3; Seismic – not checked	*[Section 1614.5 of State Bldg. Code 2005] does not control in the design of this structure type*

[1] The 2005 Connecticut State Building Code as amended by the 2009 CT State Supplement. (CSBC)

Tower Capacity

Tower stresses were calculated utilizing the structural analysis software tnxTower. 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 tnxTower "Section Capacity Table", this tower was found to be at **93.4%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L3)	47.00'-97.00'	**93.4%**	**PASS**

Note: The wall thickness of the bottom 20-ft of the monopole was increased in the tnxTower analysis to reflect the reinforcements designed in the aforementioned structural analysis report prepared by Structural Components, job no. 090239, dated October 6, 2009.

Foundation and Anchors

The existing foundation consists of a 5.5-ft ∅ x 21.0-ft long reinforced concrete caisson. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned EEI design report; project no. 5246 dated July 6, 1999. The base of the tower is connected to the foundation by means of (8) 2.25"∅, ASTM A615-75 anchor bolts embedded approximately 5-ft into the concrete foundation structure. Three (3) additional 2-3/4" "∅ ASTM A193 Gr. B7 anchor rods were installed to accommodate the additional loading imposed by the previous MetroPCS installation noted within the aforementioned structural analysis report prepared by Structural Components and were also considered in this analysis.

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

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

Base Reactions	Vector	Proposed Load (kips/ft-kips)
Base	Shear	**17**
	Axial	**19**
	Moment	**1351**

- The foundation was found to be within allowable limits.

Foundation	Design Limit	Proposed Loading	Result
Reinforced Concrete Caisson	Moment Capacity	68.4%	**PASS**
	Lateral Deflection	0.68 in.[2]	**PASS**

Note 2: Lateral deflection typically limited to 1.0 in. for monopole tower structures.

- 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 (ASTM-A615)	Combined Compression/Bending	57.4%	**PASS**
Anchor Bolts (ASTM-A193)	Combined Compression/Bending	50.6%	**PASS**
Base Plate	Bending	38.4%	**PASS**

Conclusion

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

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

Please feel free to call with any questions or comments.

Respectfully Submitted by:

Carlo F. Centore, PE
Principal ~ Structural Engineer

Prepared by:

Jason R. Mead
Structural Engineer

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

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

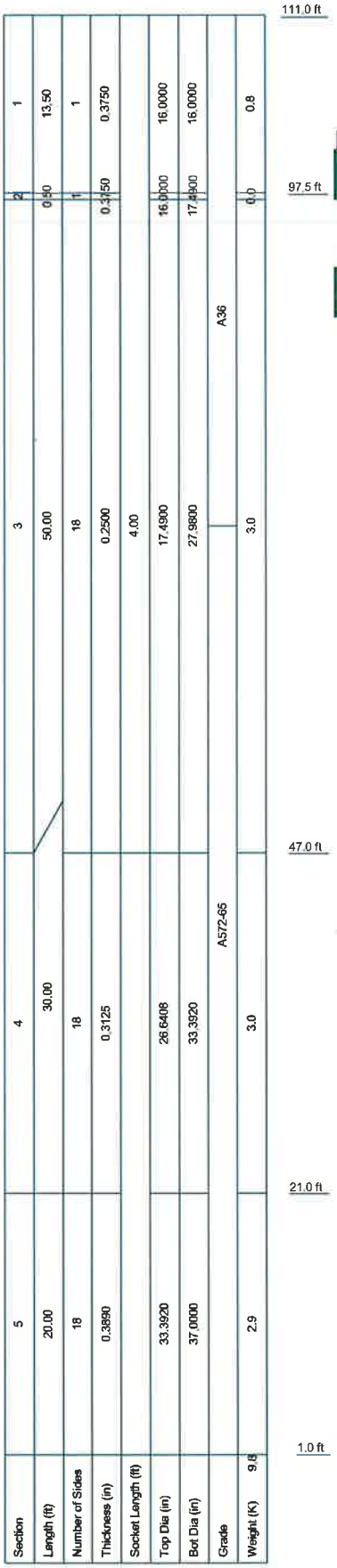
- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of CENTEK engineering, Inc. or generated by field inspections or measurements of the structure.
- It is the responsibility of the client to ensure that the information 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.

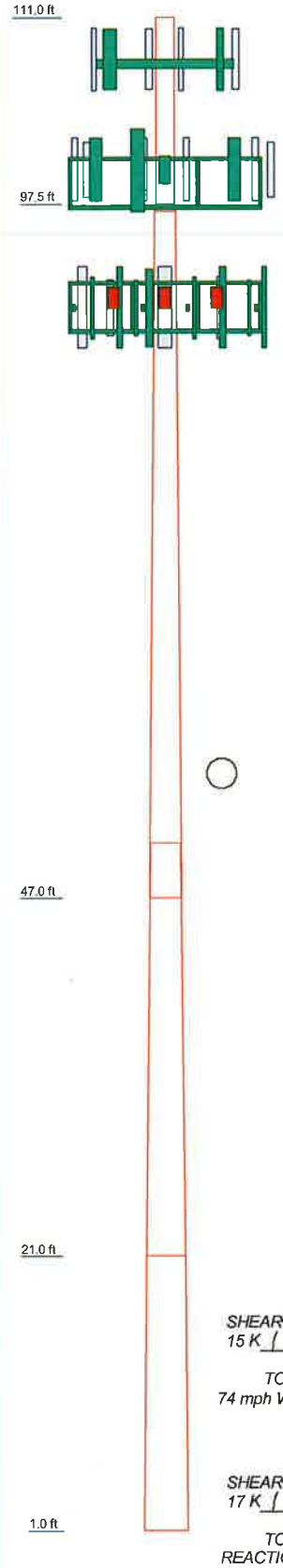
GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

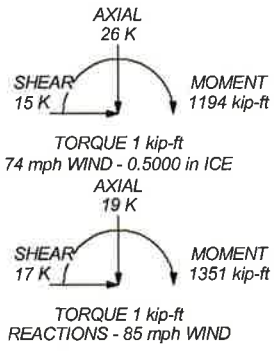
tnxTower is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, *tnxTower*, formerly RISATower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

tnxTower Features:

- *tnxTower* 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.
- *tnxTower* contains unique features such as True Cable behavior, hog rod take-up, foundation stiffness and much more.







DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
800-10504 (MetroPCS)	108	TT19-08BP111-001 TMA (ATI - Existing)	100
800-10504 (MetroPCS)	108	TT19-08BP111-001 TMA (ATI - Existing)	100
800-10504 (MetroPCS)	108	EEI Standard Platform (ATI - Existing)	99
742-351 (MetroPCS)	108	MG D3-800T0 (Verizon - Existing)	90
742-351 (MetroPCS)	108	BXA-80080-6CF (Verizon - Proposed)	90
742-351 (MetroPCS)	108	BXA-70063/6CF (Verizon - Existing)	90
2-ft Standoff T-Arm (10-ft Face Width) (MetroPCS)	108	BXA-171063/8BF (Verizon - Proposed)	90
2-ft Standoff T-Arm (10-ft Face Width) (MetroPCS)	108	MG D3-800T0 (Verizon - Existing)	90
2-ft Standoff T-Arm (10-ft Face Width) (MetroPCS)	108	BXA-80063-6BF (Verizon - Proposed)	90
(2) 7770.00 (ATI - Existing)	100	BXA-70063/6CF (Verizon - Existing)	90
(2) 7770.00 (ATI - Existing)	100	BXA-171063/8BF (Verizon - Proposed)	90
(2) 7770.00 (ATI - Existing)	100	MG D3-800T0 (Verizon - Existing)	90
AM-X-CD-14-65-00T-RET (ATI - Existing)	100	(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	90
AM-X-CD-14-65-00T-RET (ATI - Existing)	100	(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	90
AM-X-CD-16-65-00T-RET(72") (ATI - Existing)	100	(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	90
(2) RRUS-11 (ATI - Existing)	100	EEI Standard Platform (Verizon - Existing)	90
(2) RRUS-11 (ATI - Existing)	100	BXA-80080-6CF (Verizon - Proposed)	90
(2) RRUS-11 (ATI - Existing)	100	BXA-70063/6CF (Verizon - Existing)	90
DC6-48-60-18-8F Surge Arrestor (ATI - Existing)	100	BXA-171063/8BF (Verizon - Proposed)	90
LGP21401 TMA (ATI - Existing)	100	RRH2x40-07-U (Verizon - Proposed)	90
LGP21401 TMA (ATI - Existing)	100	RRH2x40-07-U (Verizon - Proposed)	90
LGP21401 TMA (ATI - Existing)	100	RRH2x40-07-U (Verizon - Proposed)	90
LGP21401 TMA (ATI - Existing)	100	RRH2x40-AWS (Verizon - Proposed)	90
LGP21401 TMA (ATI - Existing)	100	RRH2x40-AWS (Verizon - Proposed)	90
LGP21401 TMA (ATI - Existing)	100	RRH2x40-AWS (Verizon - Proposed)	90
TT19-08BP111-001 TMA (ATI - Existing)	100	DB-T1-6Z-8AB-0Z (Verizon - Proposed)	90

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A36	36 ksi	58 ksi	A572-65	65 ksi	80 ksi

TOWER DESIGN NOTES

1. Tower is located in Fairfield County, Connecticut.
2. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
4. Deflections are based upon a 50 mph wind.
5. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
6. Welds are fabricated with ER-70S-6 electrodes.
7. Analysis considers all reinforcements proposed and designed by Structural Components, LLC dated October 6, 2009.
8. TOWER RATING: 93.4%

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

Job: *110-ft EEI Monopole - Germantown*			
Project: *14001.001 - 48 Newton Rd., Danbury, CT*			
Client: Verizon Wireless	Drawn by: jrm	App'd:	
Code: TIA/EIA-222-F	Date: 01/16/14	Scale: NTS	
Path:		Dwg No. E-1	

tnxTower	Job	Page
	110-ft EEI Monopole - Germantown	1 of 28
Centek Engineering Inc. 63-2 N. Branford Road Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	**Project** 14001.001 - 48 Newton Rd., Danbury, CT	**Date** 15:00:13 01/16/14
	Client Verizon Wireless	**Designed by** jrm

Tower Input Data

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

Tower is located in Fairfield County, Connecticut.
Basic wind speed of 85 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 74 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
Analysis considers all reinforcements proposed and designed by Structural Components, LLC dated October 6, 2009..
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	111.00-97.50	13.50	0.00	Round	16.0000	16.0000	0.3750		A36 (36 ksi)
L2	97.50-97.00	0.50	0.00	Round	16.0000	17.4900	0.3750		A36 (36 ksi)
L3	97.00-47.00	50.00	4.00	18	17.4900	27.9800	0.2500	1.0000	A572-65 (65 ksi)

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
L4	47.00-21.00	30.00	0.00	18	26.6408	33.3920	0.3125	1.2500	A572-65 (65 ksi)
L5	21.00-1.00	20.00		18	33.3920	37.0000	0.3890	1.5560	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	16.0000	18.4078	562.1910	5.5313	8.0000	70.2739	1122.8505	9.1984	0.0000	0
	16.0000	18.4078	562.1910	5.5313	8.0000	70.2739	1122.8505	9.1984	0.0000	0
L2	16.0000	18.4078	562.1910	5.5313	8.0000	70.2739	1122.8505	9.1984	0.0000	0
	17.4900	20.1631	738.8470	6.0587	8.7450	84.4879	1475.6812	10.0755	0.0000	0
L3	17.7598	13.6799	513.6842	6.1202	8.8849	57.8153	1028.0442	6.8413	2.6382	10.553
	28.4116	22.0038	2137.6372	9.8442	14.2138	150.3912	4278.0871	11.0040	4.4845	17.938
L4	27.9658	26.1144	2286.9825	9.3465	13.5335	168.9864	4576.9743	13.0597	4.1388	13.244
	33.9071	32.8107	4535.9808	11.7432	16.9631	267.4023	9077.9301	16.4085	5.3270	17.046
L5	33.9071	40.7483	5607.3057	11.7161	16.9631	330.5583	11221.9896	20.3780	5.1924	13.348
	37.5708	45.2031	7654.7101	12.9969	18.7960	407.2521	15319.4925	22.6058	5.8274	14.98

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1				1	1	1		
111.00-97.50								
L2 97.50-97.00				1	1	1		
L3 97.00-47.00				1	1	1		
L4 47.00-21.00				1	1	1		
L5 21.00-1.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
1 5/8 (AT&T - Existing)	B	No	CaAa (Out Of Face)	99.00 - 16.00	2	No Ice	0.20	1.04
						1/2" Ice	0.30	2.55
1 5/8 (AT&T - Existing)	B	No	CaAa (Out Of Face)	99.00 - 16.00	10	No Ice	0.00	1.04
						1/2" Ice	0.00	2.55
1 5/8 (Verizon - Existing)	C	No	Inside Pole	89.00 - 16.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (MetroPCS - Existing)	C	No	CaAa (Out Of Face)	109.00 - 16.00	2	No Ice	0.20	1.04
						1/2" Ice	0.30	2.55
1 5/8 (MetroPCS - Existing)	C	No	CaAa (Out Of Face)	109.00 - 16.00	10	No Ice	0.00	1.04
						1/2" Ice	0.00	2.55
HYBRIFLEX 1-5/8" (Verizon - Proposed)	C	No	CaAa (Out Of Face)	95.00 - 16.00	1	No Ice	0.00	1.90
						1/2" Ice	0.00	3.41
3" dia Flex Conduit (AT&T - Existing)	B	No	Inside Pole	101.00 - 16.00	1	No Ice	0.00	5.00
						1/2" Ice	0.00	5.00

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	111.00-97.50	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.594	0.04
		C	0.000	0.000	0.000	4.554	0.14
L2	97.50-97.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.198	0.01
		C	0.000	0.000	0.000	0.198	0.01
L3	97.00-47.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	19.800	0.87
		C	0.000	0.000	0.000	19.800	1.24
L4	47.00-21.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	10.296	0.45
		C	0.000	0.000	0.000	10.296	0.70
L5	21.00-1.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	1.980	0.09
		C	0.000	0.000	0.000	1.980	0.13

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	111.00-97.50	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.894	0.06
		C		0.000	0.000	0.000	6.854	0.35
L2	97.50-97.00	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.298	0.02
		C		0.000	0.000	0.000	0.298	0.02
L3	97.00-47.00	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	29.800	1.78
		C		0.000	0.000	0.000	29.800	2.22
L4	47.00-21.00	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	15.496	0.93
		C		0.000	0.000	0.000	15.496	1.21
L5	21.00-1.00	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	2.980	0.18
		C		0.000	0.000	0.000	2.980	0.23

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	111.00-97.50	-0.2963	0.2224	-0.3841	0.2883
L2	97.50-97.00	0.0000	0.3789	0.0000	0.4671
L3	97.00-47.00	0.0000	0.4189	0.0000	0.5343
L4	47.00-21.00	0.0000	0.4528	0.0000	0.5951
L5	21.00-1.00	0.0000	0.1338	0.0000	0.1902

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
800-10504 (MetroPCS)	A	From Face	3.00 -4.00 0.00	0.0000	108.00	No Ice 1/2" Ice	3.66 4.01	2.26 2.59	0.02 0.04
800-10504 (MetroPCS)	B	From Face	3.00 -4.00 0.00	0.0000	108.00	No Ice 1/2" Ice	3.66 4.01	2.26 2.59	0.02 0.04
800-10504 (MetroPCS)	C	From Face	3.00 -4.00 0.00	0.0000	108.00	No Ice 1/2" Ice	3.66 4.01	2.26 2.59	0.02 0.04
742-351 (MetroPCS)	A	From Face	3.00 4.00 0.00	0.0000	108.00	No Ice 1/2" Ice	5.89 6.30	1.73 2.04	0.03 0.06
742-351 (MetroPCS)	B	From Face	3.00 4.00 0.00	0.0000	108.00	No Ice 1/2" Ice	5.89 6.30	1.73 2.04	0.03 0.06
742-351 (MetroPCS)	C	From Face	3.00 4.00 0.00	0.0000	108.00	No Ice 1/2" Ice	5.89 6.30	1.73 2.04	0.03 0.06
2-ft Standoff T-Arm (10-ft Face Width) (MetroPCS)	A	From Face	1.50 0.00 0.00	0.0000	108.00	No Ice 1/2" Ice	5.50 6.90	5.50 6.90	0.13 0.17
2-ft Standoff T-Arm (10-ft Face Width) (MetroPCS)	B	From Face	1.50 0.00 0.00	0.0000	108.00	No Ice 1/2" Ice	5.50 6.90	5.50 6.90	0.13 0.17
2-ft Standoff T-Arm (10-ft Face Width) (MetroPCS)	C	From Face	1.50 0.00 0.00	0.0000	108.00	No Ice 1/2" Ice	5.50 6.90	5.50 6.90	0.13 0.17
BXA-80080-6CF (Verizon - Proposed)	A	From Leg	4.00 -6.00 0.00	0.0000	90.00	No Ice 1/2" Ice	5.77 6.22	4.56 5.00	0.02 0.05
BXA-70063/6CF (Verizon - Existing)	A	From Leg	4.00 0.00 0.00	0.0000	90.00	No Ice 1/2" Ice	7.73 8.27	4.16 4.60	0.02 0.06
BXA-171063/8BF (Verizon - Proposed)	A	From Leg	4.00 -4.00 0.00	0.0000	90.00	No Ice 1/2" Ice	2.94 3.26	2.16 2.46	0.01 0.03
MG D3-800T0 (Verizon - Existing)	A	From Leg	4.00 4.00 0.00	0.0000	90.00	No Ice 1/2" Ice	3.46 3.80	2.24 2.57	0.03 0.05
BXA-80080-6CF (Verizon - Proposed)	B	From Leg	4.00 -6.00 0.00	0.0000	90.00	No Ice 1/2" Ice	5.77 6.22	4.56 5.00	0.02 0.05
BXA-70063/6CF (Verizon - Existing)	B	From Leg	4.00 0.00 0.00	0.0000	90.00	No Ice 1/2" Ice	7.73 8.27	4.16 4.60	0.02 0.06
BXA-171063/8BF (Verizon - Proposed)	B	From Leg	4.00 -4.00 0.00	0.0000	90.00	No Ice 1/2" Ice	2.94 3.26	2.16 2.46	0.01 0.03
MG D3-800T0 (Verizon - Existing)	B	From Leg	4.00 4.00 0.00	0.0000	90.00	No Ice 1/2" Ice	3.46 3.80	2.24 2.57	0.03 0.05

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
BXA-80063-6BF	C	From Leg	4.00	0.0000	90.00	No Ice	7.47	4.04	0.02
(Verizon - Proposed)			-6.00			1/2" Ice	7.99	4.46	0.06
			0.00						
BXA-70063/6CF	C	From Leg	3.00	0.0000	90.00	No Ice	7.73	4.16	0.02
(Verizon - Existing)			0.00			1/2" Ice	8.27	4.60	0.06
			0.00						
BXA-171063/8BF	C	From Leg	4.00	0.0000	90.00	No Ice	2.94	2.16	0.01
(Verizon - Proposed)			-4.00			1/2" Ice	3.26	2.46	0.03
			0.00						
MG D3-800T0	C	From Leg	3.00	0.0000	90.00	No Ice	3.46	2.24	0.03
(Verizon - Existing)			4.00			1/2" Ice	3.80	2.57	0.05
			0.00						
(2) FD9R6004/2C-3L	B	From Leg	4.00	0.0000	90.00	No Ice	0.37	0.08	0.00
Diplexer			0.00			1/2" Ice	0.45	0.14	0.01
(Verizon - Existing)			0.00						
(2) FD9R6004/2C-3L	B	From Leg	4.00	0.0000	90.00	No Ice	0.37	0.08	0.00
Diplexer			0.00			1/2" Ice	0.45	0.14	0.01
(Verizon - Existing)			0.00						
(2) FD9R6004/2C-3L	C	From Leg	4.00	0.0000	90.00	No Ice	0.37	0.08	0.00
Diplexer			0.00			1/2" Ice	0.45	0.14	0.01
(Verizon - Existing)			0.00						
EEI Standard Platform	C	None		0.0000	90.00	No Ice	30.00	30.00	1.60
(Verizon - Existing)						1/2" Ice	35.00	35.00	2.00
(2) 7770.00	A	From Face	4.00	0.0000	100.00	No Ice	5.88	2.93	0.04
(AT&T - Existing)			0.00			1/2" Ice	6.31	3.27	0.07
			0.00						
(2) 7770.00	B	From Face	4.00	0.0000	100.00	No Ice	5.88	2.93	0.04
(AT&T - Existing)			0.00			1/2" Ice	6.31	3.27	0.07
			0.00						
(2) 7770.00	C	From Face	4.00	0.0000	100.00	No Ice	5.88	2.93	0.04
(AT&T - Existing)			0.00			1/2" Ice	6.31	3.27	0.07
			0.00						
EEI Standard Platform	C	None		0.0000	99.00	No Ice	30.00	30.00	1.60
(AT&T - Existing)						1/2" Ice	35.00	35.00	2.00
AM-X-CD-14-65-00T-RET	A	From Face	7.00	0.0000	100.00	No Ice	5.51	2.83	0.04
(AT&T - Existing)			2.00			1/2" Ice	5.90	3.14	0.07
			0.00						
AM-X-CD-14-65-00T-RET	B	From Face	7.00	0.0000	100.00	No Ice	5.51	2.83	0.04
(AT&T - Existing)			2.00			1/2" Ice	5.90	3.14	0.07
			0.00						
AM-X-CD-16-65-00T-RET(7	C	From Face	7.00	0.0000	100.00	No Ice	8.26	4.64	0.05
2")			2.00			1/2" Ice	8.81	5.09	0.10
(AT&T - Existing)			0.00						
(2) RRUS-11	A	From Face	1.00	0.0000	100.00	No Ice	0.00	1.25	0.05
(AT&T - Existing)			2.00			1/2" Ice	0.00	1.41	0.07
			0.00						
(2) RRUS-11	B	From Face	1.00	0.0000	100.00	No Ice	0.00	1.25	0.05
(AT&T - Existing)			2.00			1/2" Ice	0.00	1.41	0.07
			0.00						
(2) RRUS-11	C	From Face	1.00	0.0000	100.00	No Ice	0.00	1.25	0.05
(AT&T - Existing)			2.00			1/2" Ice	0.00	1.41	0.07
			0.00						
DC6-48-60-18-8F Surge	C	From Face	0.50	0.0000	100.00	No Ice	2.23	2.23	0.02
Arrestor			0.00			1/2" Ice	2.45	2.45	0.04
(AT&T - Existing)			0.00						
LGP21401 TMA	A	From Face	3.50	0.0000	100.00	No Ice	0.95	0.37	0.02
(AT&T - Existing)			0.00			1/2" Ice	1.09	0.48	0.02

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0.00						
LGP21401 TMA	B	From Face	3.50	0.0000	100.00	No Ice	0.95	0.37	0.02
(AT&T - Existing)			0.00			1/2" Ice	1.09	0.48	0.02
			0.00						
LGP21401 TMA	C	From Face	3.50	0.0000	100.00	No Ice	0.95	0.37	0.02
(AT&T - Existing)			0.00			1/2" Ice	1.09	0.48	0.02
			0.00						
LGP21401 TMA	A	From Face	3.50	0.0000	100.00	No Ice	0.00	0.37	0.02
(AT&T - Existing)			0.00			1/2" Ice	0.00	0.48	0.02
			0.00						
LGP21401 TMA	B	From Face	3.50	0.0000	100.00	No Ice	0.00	0.37	0.02
(AT&T - Existing)			0.00			1/2" Ice	0.00	0.48	0.02
			0.00						
LGP21401 TMA	C	From Face	3.50	0.0000	100.00	No Ice	0.00	0.37	0.02
(AT&T - Existing)			0.00			1/2" Ice	0.00	0.48	0.02
			0.00						
TT19-08BP111-001 TMA	A	From Face	3.50	0.0000	100.00	No Ice	0.64	0.52	0.02
(AT&T - Existing)			0.00			1/2" Ice	0.76	0.62	0.02
			0.00						
TT19-08BP111-001 TMA	B	From Face	3.50	0.0000	100.00	No Ice	0.64	0.52	0.02
(AT&T - Existing)			0.00			1/2" Ice	0.76	0.62	0.02
			0.00						
TT19-08BP111-001 TMA	C	From Face	3.50	0.0000	100.00	No Ice	0.64	0.52	0.02
(AT&T - Existing)			0.00			1/2" Ice	0.76	0.62	0.02
			0.00						
RRH2x40-07-U	A	From Leg	3.50	0.0000	90.00	No Ice	2.25	1.23	0.05
(Verizon - Proposed)			0.00			1/2" Ice	2.45	1.39	0.07
			0.00						
RRH2x40-07-U	B	From Leg	3.50	0.0000	90.00	No Ice	2.25	1.23	0.05
(Verizon - Proposed)			0.00			1/2" Ice	2.45	1.39	0.07
			0.00						
RRH2x40-07-U	C	From Leg	3.50	0.0000	90.00	No Ice	2.25	1.23	0.05
(Verizon - Proposed)			0.00			1/2" Ice	2.45	1.39	0.07
			0.00						
RRH2x40-AWS	A	From Leg	3.50	0.0000	90.00	No Ice	2.52	1.59	0.04
(Verizon - Proposed)			0.00			1/2" Ice	2.75	1.80	0.06
			0.00						
RRH2x40-AWS	B	From Leg	3.50	0.0000	90.00	No Ice	2.52	1.59	0.04
(Verizon - Proposed)			0.00			1/2" Ice	2.75	1.80	0.06
			0.00						
RRH2x40-AWS	C	From Leg	3.50	0.0000	90.00	No Ice	2.52	1.59	0.04
(Verizon - Proposed)			0.00			1/2" Ice	2.75	1.80	0.06
			0.00						
DB-T1-6Z-8AB-0Z	A	From Leg	3.50	0.0000	90.00	No Ice	5.60	2.33	0.04
(Verizon - Proposed)			0.00			1/2" Ice	5.92	2.56	0.08
			0.00						

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1	104.25	1.389	26	18.000	A	0.000	18.000	18.000	100.00	0.000	0.000
111.00-97.50					B	0.000	18.000		100.00	0.000	0.594
					C	0.000	18.000		100.00	0.000	4.554
L2 97.50-97.00	97.25	1.362	25	0.698	A	0.000	0.698	0.698	100.00	0.000	0.000
					B	0.000	0.698		100.00	0.000	0.198
					C	0.000	0.698		100.00	0.000	0.198
L3 97.00-47.00	70.70	1.243	23	94.729	A	0.000	94.729	94.729	100.00	0.000	0.000
					B	0.000	94.729		100.00	0.000	19.800
					C	0.000	94.729		100.00	0.000	19.800
L4 47.00-21.00	33.58	1.005	19	66.011	A	0.000	66.011	66.011	100.00	0.000	0.000
					B	0.000	66.011		100.00	0.000	10.296
					C	0.000	66.011		100.00	0.000	10.296
L5 21.00-1.00	10.83	1	18	58.660	A	0.000	58.660	58.660	100.00	0.000	0.000
					B	0.000	58.660		100.00	0.000	1.980
					C	0.000	58.660		100.00	0.000	1.980

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 111.00-97.50	104.25	1.389	19	0.5000	19.125	A	0.000	19.125	19.125	100.00	0.000	0.000
						B	0.000	19.125		100.00	0.000	0.894
						C	0.000	19.125		100.00	0.000	6.854
L2 97.50-97.00	97.25	1.362	19	0.5000	0.739	A	0.000	0.739	0.739	100.00	0.000	0.000
						B	0.000	0.739		100.00	0.000	0.298
						C	0.000	0.739		100.00	0.000	0.298
L3 97.00-47.00	70.70	1.243	17	0.5000	98.896	A	0.000	98.896	98.896	100.00	0.000	0.000
						B	0.000	98.896		100.00	0.000	29.800
						C	0.000	98.896		100.00	0.000	29.800
L4 47.00-21.00	33.58	1.005	14	0.5000	68.177	A	0.000	68.177	68.177	100.00	0.000	0.000
						B	0.000	68.177		100.00	0.000	15.496
						C	0.000	68.177		100.00	0.000	15.496
L5 21.00-1.00	10.83	1	14	0.5000	60.327	A	0.000	60.327	60.327	100.00	0.000	0.000
						B	0.000	60.327		100.00	0.000	2.980
						C	0.000	60.327		100.00	0.000	2.980

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1	104.25	1.389	9	18.000	A	0.000	18.000	18.000	100.00	0.000	0.000
111.00-97.50					B	0.000	18.000		100.00	0.000	0.594
					C	0.000	18.000		100.00	0.000	4.554
L2 97.50-97.00	97.25	1.362	9	0.698	A	0.000	0.698	0.698	100.00	0.000	0.000

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
					B	0.000	0.698		100.00	0.000	0.198
					C	0.000	0.698		100.00	0.000	0.198
L3 97.00-47.00	70.70	1.243	8	94.729	A	0.000	94.729	94.729	100.00	0.000	0.000
					B	0.000	94.729		100.00	0.000	19.800
					C	0.000	94.729		100.00	0.000	19.800
L4 47.00-21.00	33.58	1.005	6	66.011	A	0.000	66.011	66.011	100.00	0.000	0.000
					B	0.000	66.011		100.00	0.000	10.296
					C	0.000	66.011		100.00	0.000	10.296
L5 21.00-1.00	10.83	1	6	58.660	A	0.000	58.660	58.660	100.00	0.000	0.000
					B	0.000	58.660		100.00	0.000	1.980
					C	0.000	58.660		100.00	0.000	1.980

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.18	0.85	A	1	0.59	1	1	1	18.000	0.68	50.72	C
111.00-97.50			B	1	0.59	1	1	1	18.000			
			C	1	0.59	1	1	1	18.000			
L2	0.01	0.03	A	1	0.59	1	1	1	0.698	0.03	68.76	C
97.50-97.00			B	1	0.59	1	1	1	0.698			
			C	1	0.59	1	1	1	0.698			
L3	2.11	3.04	A	1	0.65	1	1	1	94.729	3.91	78.19	C
97.00-47.00			B	1	0.65	1	1	1	94.729			
			C	1	0.65	1	1	1	94.729			
L4	1.15	3.01	A	1	0.65	1	1	1	66.011	1.99	76.72	C
47.00-21.00			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L5 21.00-1.00	0.22	2.92	A	1	0.65	1	1	1	58.660	1.32	65.78	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	3.68	9.85						OTM	424.41 kip-ft	7.94		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.18	0.85	A	1	0.59	1	1	1	18.000	0.68	50.72	C
111.00-97.50			B	1	0.59	1	1	1	18.000			
			C	1	0.59	1	1	1	18.000			
L2	0.01	0.03	A	1	0.59	1	1	1	0.698	0.03	68.76	C
97.50-97.00			B	1	0.59	1	1	1	0.698			
			C	1	0.59	1	1	1	0.698			
L3	2.11	3.04	A	1	0.65	1	1	1	94.729	3.91	78.19	C
97.00-47.00			B	1	0.65	1	1	1	94.729			
			C	1	0.65	1	1	1	94.729			
L4	1.15	3.01	A	1	0.65	1	1	1	66.011	1.99	76.72	C
47.00-21.00			B	1	0.65	1	1	1	66.011			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
			C	1	0.65	1	1	1	66.011			
L5 21.00-1.00	0.22	2.92	A	1	0.65	1	1	1	58.660	1.32	65.78	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	3.68	9.85						OTM	424.41 kip-ft	7.94		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1	0.18	0.85	A	1	0.59	1	1	1	18.000	0.68	50.72	C
111.00-97.50			B	1	0.59	1	1	1	18.000			
			C	1	0.59	1	1	1	18.000			
L2	0.01	0.03	A	1	0.59	1	1	1	0.698	0.03	68.76	C
97.50-97.00			B	1	0.59	1	1	1	0.698			
			C	1	0.59	1	1	1	0.698			
L3	2.11	3.04	A	1	0.65	1	1	1	94.729	3.91	78.19	C
97.00-47.00			B	1	0.65	1	1	1	94.729			
			C	1	0.65	1	1	1	94.729			
L4	1.15	3.01	A	1	0.65	1	1	1	66.011	1.99	76.72	C
47.00-21.00			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L5 21.00-1.00	0.22	2.92	A	1	0.65	1	1	1	58.660	1.32	65.78	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	3.68	9.85						OTM	424.41 kip-ft	7.94		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1	0.18	0.85	A	1	0.59	1	1	1	18.000	0.68	50.72	C
111.00-97.50			B	1	0.59	1	1	1	18.000			
			C	1	0.59	1	1	1	18.000			
L2	0.01	0.03	A	1	0.59	1	1	1	0.698	0.03	68.76	C
97.50-97.00			B	1	0.59	1	1	1	0.698			
			C	1	0.59	1	1	1	0.698			
L3	2.11	3.04	A	1	0.65	1	1	1	94.729	3.91	78.19	C
97.00-47.00			B	1	0.65	1	1	1	94.729			
			C	1	0.65	1	1	1	94.729			
L4	1.15	3.01	A	1	0.65	1	1	1	66.011	1.99	76.72	C
47.00-21.00			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L5 21.00-1.00	0.22	2.92	A	1	0.65	1	1	1	58.660	1.32	65.78	C
			B	1	0.65	1	1	1	58.660			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
			C	1	0.65	1	1	1	58.660			
Sum Weight:	3.68	9.85						OTM	424.41 kip-ft	7.94		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1	0.42	0.98	A	1	0.59	1	1	1	19.125	0.62	45.91	C
111.00-97.50			B	1	0.59	1	1	1	19.125			
			C	1	0.59	1	1	1	19.125			
L2	0.03	0.04	A	1	0.59	1	1	1	0.739	0.03	65.91	C
97.50-97.00			B	1	0.59	1	1	1	0.739			
			C	1	0.59	1	1	1	0.739			
L3	4.00	3.75	A	1	0.65	1	1	1	98.896	3.59	71.80	C
97.00-47.00			B	1	0.65	1	1	1	98.896			
			C	1	0.65	1	1	1	98.896			
L4	2.13	3.50	A	1	0.65	1	1	1	68.177	1.77	68.24	C
47.00-21.00			B	1	0.65	1	1	1	68.177			
			C	1	0.65	1	1	1	68.177			
L5 21.00-1.00	0.41	3.37	A	1	0.65	1	1	1	60.327	1.06	52.95	C
			B	1	0.65	1	1	1	60.327			
			C	1	0.65	1	1	1	60.327			
Sum Weight:	6.99	11.64						OTM	385.61 kip-ft	7.08		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1	0.42	0.98	A	1	0.59	1	1	1	19.125	0.62	45.91	C
111.00-97.50			B	1	0.59	1	1	1	19.125			
			C	1	0.59	1	1	1	19.125			
L2	0.03	0.04	A	1	0.59	1	1	1	0.739	0.03	65.91	C
97.50-97.00			B	1	0.59	1	1	1	0.739			
			C	1	0.59	1	1	1	0.739			
L3	4.00	3.75	A	1	0.65	1	1	1	98.896	3.59	71.80	C
97.00-47.00			B	1	0.65	1	1	1	98.896			
			C	1	0.65	1	1	1	98.896			
L4	2.13	3.50	A	1	0.65	1	1	1	68.177	1.77	68.24	C
47.00-21.00			B	1	0.65	1	1	1	68.177			
			C	1	0.65	1	1	1	68.177			
L5 21.00-1.00	0.41	3.37	A	1	0.65	1	1	1	60.327	1.06	52.95	C
			B	1	0.65	1	1	1	60.327			
			C	1	0.65	1	1	1	60.327			
Sum Weight:	6.99	11.64						OTM	385.61 kip-ft	7.08		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.42	0.98	A	1	0.59	1	1	1	19.125	0.62	45.91	C
111.00-97.50			B	1	0.59	1	1	1	19.125			
			C	1	0.59	1	1	1	19.125			
L2	0.03	0.04	A	1	0.59	1	1	1	0.739	0.03	65.91	C
97.50-97.00			B	1	0.59	1	1	1	0.739			
			C	1	0.59	1	1	1	0.739			
L3	4.00	3.75	A	1	0.65	1	1	1	98.896	3.59	71.80	C
97.00-47.00			B	1	0.65	1	1	1	98.896			
			C	1	0.65	1	1	1	98.896			
L4	2.13	3.50	A	1	0.65	1	1	1	68.177	1.77	68.24	C
47.00-21.00			B	1	0.65	1	1	1	68.177			
			C	1	0.65	1	1	1	68.177			
L5 21.00-1.00	0.41	3.37	A	1	0.65	1	1	1	60.327	1.06	52.95	C
			B	1	0.65	1	1	1	60.327			
			C	1	0.65	1	1	1	60.327			
Sum Weight:	6.99	11.64						OTM	385.61 kip-ft	7.08		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.42	0.98	A	1	0.59	1	1	1	19.125	0.62	45.91	C
111.00-97.50			B	1	0.59	1	1	1	19.125			
			C	1	0.59	1	1	1	19.125			
L2	0.03	0.04	A	1	0.59	1	1	1	0.739	0.03	65.91	C
97.50-97.00			B	1	0.59	1	1	1	0.739			
			C	1	0.59	1	1	1	0.739			
L3	4.00	3.75	A	1	0.65	1	1	1	98.896	3.59	71.80	C
97.00-47.00			B	1	0.65	1	1	1	98.896			
			C	1	0.65	1	1	1	98.896			
L4	2.13	3.50	A	1	0.65	1	1	1	68.177	1.77	68.24	C
47.00-21.00			B	1	0.65	1	1	1	68.177			
			C	1	0.65	1	1	1	68.177			
L5 21.00-1.00	0.41	3.37	A	1	0.65	1	1	1	60.327	1.06	52.95	C
			B	1	0.65	1	1	1	60.327			
			C	1	0.65	1	1	1	60.327			
Sum Weight:	6.99	11.64						OTM	385.61 kip-ft	7.08		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1	0.18	0.85	A	1	0.59	1	1	1	18.000	0.24	17.55	C
111.00-97.50			B	1	0.59	1	1	1	18.000			
			C	1	0.59	1	1	1	18.000			
L2	0.01	0.03	A	1	0.59	1	1	1	0.698	0.01	23.79	C
97.50-97.00			B	1	0.59	1	1	1	0.698			
			C	1	0.59	1	1	1	0.698			
L3	2.11	3.04	A	1	0.65	1	1	1	94.729	1.35	27.05	C
97.00-47.00			B	1	0.65	1	1	1	94.729			
			C	1	0.65	1	1	1	94.729			
L4	1.15	3.01	A	1	0.65	1	1	1	66.011	0.69	26.55	C
47.00-21.00			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L5 21.00-1.00	0.22	2.92	A	1	0.65	1	1	1	58.660	0.46	22.76	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	3.68	9.85						OTM	146.85 kip-ft	2.75		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1	0.18	0.85	A	1	0.59	1	1	1	18.000	0.24	17.55	C
111.00-97.50			B	1	0.59	1	1	1	18.000			
			C	1	0.59	1	1	1	18.000			
L2	0.01	0.03	A	1	0.59	1	1	1	0.698	0.01	23.79	C
97.50-97.00			B	1	0.59	1	1	1	0.698			
			C	1	0.59	1	1	1	0.698			
L3	2.11	3.04	A	1	0.65	1	1	1	94.729	1.35	27.05	C
97.00-47.00			B	1	0.65	1	1	1	94.729			
			C	1	0.65	1	1	1	94.729			
L4	1.15	3.01	A	1	0.65	1	1	1	66.011	0.69	26.55	C
47.00-21.00			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L5 21.00-1.00	0.22	2.92	A	1	0.65	1	1	1	58.660	0.46	22.76	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	3.68	9.85						OTM	146.85 kip-ft	2.75		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1	0.18	0.85	A	1	0.59	1	1	1	18.000	0.24	17.55	C
111.00-97.50			B	1	0.59	1	1	1	18.000			
			C	1	0.59	1	1	1	18.000			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L2	0.01	0.03	A	1	0.59	1	1	1	0.698	0.01	23.79	C
97.50-97.00			B	1	0.59	1	1	1	0.698			
			C	1	0.59	1	1	1	0.698			
L3	2.11	3.04	A	1	0.65	1	1	1	94.729	1.35	27.05	C
97.00-47.00			B	1	0.65	1	1	1	94.729			
			C	1	0.65	1	1	1	94.729			
L4	1.15	3.01	A	1	0.65	1	1	1	66.011	0.69	26.55	C
47.00-21.00			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L5 21.00-1.00	0.22	2.92	A	1	0.65	1	1	1	58.660	0.46	22.76	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	3.68	9.85						OTM	146.85 kip-ft	2.75		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1	0.18	0.85	A	1	0.59	1	1	1	18.000	0.24	17.55	C
111.00-97.50			B	1	0.59	1	1	1	18.000			
			C	1	0.59	1	1	1	18.000			
L2	0.01	0.03	A	1	0.59	1	1	1	0.698	0.01	23.79	C
97.50-97.00			B	1	0.59	1	1	1	0.698			
			C	1	0.59	1	1	1	0.698			
L3	2.11	3.04	A	1	0.65	1	1	1	94.729	1.35	27.05	C
97.00-47.00			B	1	0.65	1	1	1	94.729			
			C	1	0.65	1	1	1	94.729			
L4	1.15	3.01	A	1	0.65	1	1	1	66.011	0.69	26.55	C
47.00-21.00			B	1	0.65	1	1	1	66.011			
			C	1	0.65	1	1	1	66.011			
L5 21.00-1.00	0.22	2.92	A	1	0.65	1	1	1	58.660	0.46	22.76	C
			B	1	0.65	1	1	1	58.660			
			C	1	0.65	1	1	1	58.660			
Sum Weight:	3.68	9.85						OTM	146.85 kip-ft	2.75		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	9.85					
Bracing Weight	0.00					
Total Member Self-Weight	9.85			1.18	0.17	
Total Weight	18.70			1.18	0.17	
Wind 0 deg - No Ice		0.03	-17.12	-1303.42	-2.50	0.31
Wind 30 deg - No Ice		8.54	-14.84	-1129.98	-650.03	0.65

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 - No Ice		12.06	-12.13	-923.20	-917.97	0.76
Wind 60 deg - No Ice		14.76	-8.59	-653.43	-1123.34	0.82
Wind 90 deg - No Ice		17.03	-0.03	-1.49	-1295.60	0.76
Wind 120 deg - No Ice		14.73	8.54	651.17	-1120.67	0.51
Wind 135 deg - No Ice		12.02	12.09	921.78	-914.19	0.32
Wind 150 deg - No Ice		8.49	14.81	1129.66	-645.41	0.11
Wind 180 deg - No Ice		-0.03	17.12	1305.78	2.83	-0.31
Wind 210 deg - No Ice		-8.54	14.84	1132.33	650.36	-0.65
Wind 225 deg - No Ice		-12.06	12.13	925.56	918.30	-0.76
Wind 240 deg - No Ice		-14.76	8.59	655.79	1123.67	-0.82
Wind 270 deg - No Ice		-17.03	0.03	3.85	1295.93	-0.76
Wind 300 deg - No Ice		-14.73	-8.54	-648.81	1121.00	-0.51
Wind 315 deg - No Ice		-12.02	-12.09	-919.43	914.52	-0.32
Wind 330 deg - No Ice		-8.49	-14.81	-1127.31	645.74	-0.11
Member Ice	1.80					
Total Weight Ice	25.81			2.96	0.36	
Wind 0 deg - Ice		0.02	-14.86	-1129.37	-1.67	0.26
Wind 30 deg - Ice		7.41	-12.88	-978.68	-564.28	0.58
Wind 45 deg - Ice		10.47	-10.52	-799.15	-797.12	0.68
Wind 60 deg - Ice		12.82	-7.45	-564.96	-975.60	0.74
Wind 90 deg - Ice		14.79	-0.02	0.93	-1125.41	0.71
Wind 120 deg - Ice		12.80	7.41	567.36	-973.58	0.48
Wind 135 deg - Ice		10.44	10.49	802.19	-794.25	0.32
Wind 150 deg - Ice		7.38	12.86	982.56	-560.77	0.13
Wind 180 deg - Ice		-0.02	14.86	1135.28	2.39	-0.26
Wind 210 deg - Ice		-7.41	12.88	984.59	565.00	-0.58
Wind 225 deg - Ice		-10.47	10.52	805.06	797.83	-0.68
Wind 240 deg - Ice		-12.82	7.45	570.87	976.32	-0.74
Wind 270 deg - Ice		-14.79	0.02	4.98	1126.13	-0.71
Wind 300 deg - Ice		-12.80	-7.41	-561.45	974.29	-0.48
Wind 315 deg - Ice		-10.44	-10.49	-796.28	794.97	-0.32
Wind 330 deg - Ice		-7.38	-12.86	-976.65	561.49	-0.13
Total Weight	18.70			1.18	0.17	
Wind 0 deg - Service		0.01	-5.92	-451.47	-0.97	0.11
Wind 30 deg - Service		2.95	-5.14	-391.46	-225.03	0.23
Wind 45 deg - Service		4.17	-4.20	-319.91	-317.74	0.26
Wind 60 deg - Service		5.11	-2.97	-226.56	-388.80	0.28
Wind 90 deg - Service		5.89	-0.01	-0.98	-448.41	0.26
Wind 120 deg - Service		5.10	2.95	224.86	-387.88	0.18
Wind 135 deg - Service		4.16	4.18	318.50	-316.44	0.11
Wind 150 deg - Service		2.94	5.13	390.43	-223.43	0.04
Wind 180 deg - Service		-0.01	5.92	451.37	0.88	-0.11
Wind 210 deg - Service		-2.95	5.14	391.35	224.93	-0.23
Wind 225 deg - Service		-4.17	4.20	319.80	317.64	-0.26
Wind 240 deg - Service		-5.11	2.97	226.46	388.71	-0.28
Wind 270 deg - Service		-5.89	0.01	0.87	448.31	-0.26
Wind 300 deg - Service		-5.10	-2.95	-224.96	387.78	-0.18
Wind 315 deg - Service		-4.16	-4.18	-318.60	316.34	-0.11
Wind 330 deg - Service		-2.94	-5.13	-390.53	223.33	-0.04

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice

Comb. No.	Description
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
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	111 - 97.5	Pole	Max Tension	10	0.00	0.00	0.00
			Max. Compression	18	-5.50	0.23	-0.40
			Max. Mx	14	-3.42	30.64	-0.09
			Max. My	10	-3.42	0.07	-30.81
			Max. Vy	14	-6.15	30.64	-0.09

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vx	10	6.19	0.07	-30.81
			Max. Torque	7			-0.74
L2	97.5 - 97	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-5.57	0.23	-0.41
			Max. Mx	14	-3.47	33.72	-0.10
			Max. My	10	-3.46	0.07	-33.92
			Max. Vy	14	-6.18	33.72	-0.10
			Max. Vx	10	6.23	0.07	-33.92
			Max. Torque	7			-0.74
L3	97 - 47	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-15.71	0.25	-1.67
			Max. Mx	14	-10.21	561.70	-1.84
			Max. My	10	-10.20	1.33	-566.50
			Max. Vy	14	-13.91	561.70	-1.84
			Max. Vx	10	14.01	1.33	-566.50
			Max. Torque	7			-0.75
L4	47 - 21	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-22.03	0.36	-2.89
			Max. Mx	14	-15.26	1010.90	-3.28
			Max. My	10	-15.25	2.32	-1019.08
			Max. Vy	14	-16.00	1010.90	-3.28
			Max. Vx	10	16.09	2.32	-1019.08
			Max. Torque	13			0.79
L5	21 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-25.81	0.38	-3.11
			Max. Mx	14	-18.69	1340.98	-3.98
			Max. My	10	-18.69	2.94	-1351.16
			Max. Vy	14	-17.04	1340.98	-3.98
			Max. Vx	10	17.13	2.94	-1351.16
			Max. Torque	13			0.80

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	27	25.81	0.02	-14.86
	Max. H_x	14	18.70	17.03	-0.03
	Max. H_z	2	18.70	-0.03	17.12
	Max. M_x	2	1348.72	-0.03	17.12
	Max. M_z	6	1340.64	-17.03	0.03
	Max. Torsion	13	0.80	14.76	-8.59
	Min. Vert	1	18.70	0.00	0.00
	Min. H_x	6	18.70	-17.03	0.03
	Min. H_z	10	18.70	0.03	-17.12
	Min. M_x	10	-1351.16	0.03	-17.12
	Min. M_z	14	-1340.98	17.03	-0.03
	Min. Torsion	5	-0.80	-14.76	8.59

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	18.70	0.00	0.00	1.19	0.17	-0.00
Dead+Wind 0 deg - No Ice	18.70	0.03	-17.12	-1348.72	-2.59	0.31
Dead+Wind 30 deg - No Ice	18.70	8.54	-14.84	-1169.25	-672.61	0.64
Dead+Wind 45 deg - No Ice	18.70	12.06	-12.13	-955.29	-949.86	0.75
Dead+Wind 60 deg - No Ice	18.70	14.76	-8.59	-676.15	-1162.37	0.80
Dead+Wind 90 deg - No Ice	18.70	17.03	-0.03	-1.54	-1340.64	0.74
Dead+Wind 120 deg - No Ice	18.70	14.73	8.54	673.81	-1159.62	0.49
Dead+Wind 135 deg - No Ice	18.70	12.02	12.09	953.84	-945.96	0.31
Dead+Wind 150 deg - No Ice	18.70	8.49	14.81	1168.94	-667.83	0.10
Dead+Wind 180 deg - No Ice	18.70	-0.03	17.12	1351.16	2.94	-0.31
Dead+Wind 210 deg - No Ice	18.70	-8.54	14.84	1171.68	672.96	-0.64
Dead+Wind 225 deg - No Ice	18.70	-12.06	12.13	957.73	950.21	-0.75
Dead+Wind 240 deg - No Ice	18.70	-14.76	8.59	678.59	1162.72	-0.80
Dead+Wind 270 deg - No Ice	18.70	-17.03	0.03	3.98	1340.98	-0.75
Dead+Wind 300 deg - No Ice	18.70	-14.73	-8.54	-671.37	1159.96	-0.49
Dead+Wind 315 deg - No Ice	18.70	-12.02	-12.09	-951.39	946.31	-0.31
Dead+Wind 330 deg - No Ice	18.70	-8.49	-14.81	-1166.49	668.18	-0.10
Dead+Ice+Temp	25.81	-0.00	0.00	3.11	0.38	-0.00
Dead+Wind 0 deg+Ice+Temp	25.81	0.02	-14.86	-1187.25	-1.75	0.26
Dead+Wind 30 deg+Ice+Temp	25.81	7.41	-12.88	-1028.84	-593.20	0.57
Dead+Wind 45 deg+Ice+Temp	25.81	10.47	-10.52	-840.11	-837.97	0.67
Dead+Wind 60 deg+Ice+Temp	25.81	12.82	-7.45	-593.91	-1025.61	0.72
Dead+Wind 90 deg+Ice+Temp	25.81	14.79	-0.02	1.00	-1183.11	0.68
Dead+Wind 120 deg+Ice+Temp	25.81	12.80	7.41	596.49	-1023.48	0.46
Dead+Wind 135 deg+Ice+Temp	25.81	10.44	10.49	843.36	-834.95	0.30
Dead+Wind 150 deg+Ice+Temp	25.81	7.38	12.86	1032.97	-589.50	0.11
Dead+Wind 180 deg+Ice+Temp	25.81	-0.02	14.86	1193.51	2.52	-0.26
Dead+Wind 210 deg+Ice+Temp	25.81	-7.41	12.88	1035.10	593.97	-0.57
Dead+Wind 225 deg+Ice+Temp	25.81	-10.47	10.52	846.37	838.74	-0.67
Dead+Wind 240 deg+Ice+Temp	25.81	-12.82	7.45	600.17	1026.37	-0.72
Dead+Wind 270 deg+Ice+Temp	25.81	-14.79	0.02	5.27	1183.87	-0.68
Dead+Wind 300 deg+Ice+Temp	25.81	-12.80	-7.41	-590.22	1024.25	-0.46
Dead+Wind 315 deg+Ice+Temp	25.81	-10.44	-10.49	-837.09	835.73	-0.30
Dead+Wind 330 deg+Ice+Temp	25.81	-7.38	-12.86	-1026.71	590.28	-0.11
Dead+Wind 0 deg - Service	18.70	0.01	-5.92	-466.55	-0.78	0.11
Dead+Wind 30 deg - Service	18.70	2.95	-5.14	-404.36	-232.96	0.22
Dead+Wind 45 deg - Service	18.70	4.17	-4.20	-330.22	-329.03	0.26
Dead+Wind 60 deg - Service	18.70	5.11	-2.97	-233.49	-402.67	0.28
Dead+Wind 90 deg - Service	18.70	5.89	-0.01	0.27	-464.43	0.26
Dead+Wind 120 deg - Service	18.70	5.10	2.95	234.29	-401.71	0.17
Dead+Wind 135 deg - Service	18.70	4.16	4.18	331.32	-327.68	0.11
Dead+Wind 150 deg - Service	18.70	2.94	5.13	405.86	-231.30	0.04
Dead+Wind 180 deg - Service	18.70	-0.01	5.92	469.01	1.13	-0.11
Dead+Wind 210 deg - Service	18.70	-2.95	5.14	406.82	233.31	-0.22
Dead+Wind 225 deg - Service	18.70	-4.17	4.20	332.68	329.38	-0.26
Dead+Wind 240 deg - Service	18.70	-5.11	2.97	235.95	403.01	-0.28
Dead+Wind 270 deg - Service	18.70	-5.89	0.01	2.19	464.78	-0.26
Dead+Wind 300 deg - Service	18.70	-5.10	-2.95	-231.83	402.06	-0.17
Dead+Wind 315 deg - Service	18.70	-4.16	-4.18	-328.87	328.02	-0.11
Dead+Wind 330 deg - Service	18.70	-2.94	-5.13	-403.40	231.65	-0.04

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
1	0.00	-18.70	0.00	0.00	18.70	0.00	0.000%
2	0.03	-18.70	-17.12	-0.03	18.70	17.12	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
3	8.54	-18.70	-14.84	-8.54	18.70	14.84	0.000%
4	12.06	-18.70	-12.13	-12.06	18.70	12.13	0.000%
5	14.76	-18.70	-8.59	-14.76	18.70	8.59	0.000%
6	17.03	-18.70	-0.03	-17.03	18.70	0.03	0.000%
7	14.73	-18.70	8.54	-14.73	18.70	-8.54	0.000%
8	12.02	-18.70	12.09	-12.02	18.70	-12.09	0.000%
9	8.49	-18.70	14.81	-8.49	18.70	-14.81	0.000%
10	-0.03	-18.70	17.12	0.03	18.70	-17.12	0.000%
11	-8.54	-18.70	14.84	8.54	18.70	-14.84	0.000%
12	-12.06	-18.70	12.13	12.06	18.70	-12.13	0.000%
13	-14.76	-18.70	8.59	14.76	18.70	-8.59	0.000%
14	-17.03	-18.70	0.03	17.03	18.70	-0.03	0.000%
15	-14.73	-18.70	-8.54	14.73	18.70	8.54	0.000%
16	-12.02	-18.70	-12.09	12.02	18.70	12.09	0.000%
17	-8.49	-18.70	-14.81	8.49	18.70	14.81	0.000%
18	0.00	-25.81	0.00	0.00	25.81	-0.00	0.000%
19	0.02	-25.81	-14.86	-0.02	25.81	14.86	0.000%
20	7.41	-25.81	-12.88	-7.41	25.81	12.88	0.000%
21	10.47	-25.81	-10.52	-10.47	25.81	10.52	0.000%
22	12.82	-25.81	-7.45	-12.82	25.81	7.45	0.000%
23	14.79	-25.81	-0.02	-14.79	25.81	0.02	0.000%
24	12.80	-25.81	7.41	-12.80	25.81	-7.41	0.000%
25	10.44	-25.81	10.49	-10.44	25.81	-10.49	0.000%
26	7.38	-25.81	12.86	-7.38	25.81	-12.86	0.000%
27	-0.02	-25.81	14.86	0.02	25.81	-14.86	0.000%
28	-7.41	-25.81	12.88	7.41	25.81	-12.88	0.000%
29	-10.47	-25.81	10.52	10.47	25.81	-10.52	0.000%
30	-12.82	-25.81	7.45	12.82	25.81	-7.45	0.000%
31	-14.79	-25.81	0.02	14.79	25.81	-0.02	0.000%
32	-12.80	-25.81	-7.41	12.80	25.81	7.41	0.000%
33	-10.44	-25.81	-10.49	10.44	25.81	10.49	0.000%
34	-7.38	-25.81	-12.86	7.38	25.81	12.86	0.000%
35	0.01	-18.70	-5.92	-0.01	18.70	5.92	0.000%
36	2.95	-18.70	-5.14	-2.95	18.70	5.14	0.000%
37	4.17	-18.70	-4.20	-4.17	18.70	4.20	0.000%
38	5.11	-18.70	-2.97	-5.11	18.70	2.97	0.000%
39	5.89	-18.70	-0.01	-5.89	18.70	0.01	0.000%
40	5.10	-18.70	2.95	-5.10	18.70	-2.95	0.000%
41	4.16	-18.70	4.18	-4.16	18.70	-4.18	0.000%
42	2.94	-18.70	5.13	-2.94	18.70	-5.13	0.000%
43	-0.01	-18.70	5.92	0.01	18.70	-5.92	0.000%
44	-2.95	-18.70	5.14	2.95	18.70	-5.14	0.000%
45	-4.17	-18.70	4.20	4.17	18.70	-4.20	0.000%
46	-5.11	-18.70	2.97	5.11	18.70	-2.97	0.000%
47	-5.89	-18.70	0.01	5.89	18.70	-0.01	0.000%
48	-5.10	-18.70	-2.95	5.10	18.70	2.95	0.000%
49	-4.16	-18.70	-4.18	4.16	18.70	4.18	0.000%
50	-2.94	-18.70	-5.13	2.94	18.70	5.13	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	5	0.00000001	0.00004807
3	Yes	6	0.00000001	0.00008677

4	Yes	6	0.00000001	0.00008907
5	Yes	6	0.00000001	0.00008058
6	Yes	5	0.00000001	0.00012280
7	Yes	6	0.00000001	0.00008623
8	Yes	6	0.00000001	0.00008867
9	Yes	6	0.00000001	0.00008289
10	Yes	4	0.00000001	0.00068989
11	Yes	6	0.00000001	0.00008170
12	Yes	6	0.00000001	0.00008921
13	Yes	6	0.00000001	0.00008786
14	Yes	5	0.00000001	0.00014530
15	Yes	6	0.00000001	0.00008105
16	Yes	6	0.00000001	0.00008856
17	Yes	6	0.00000001	0.00008441
18	Yes	4	0.00000001	0.00003410
19	Yes	5	0.00000001	0.00052234
20	Yes	6	0.00000001	0.00027373
21	Yes	6	0.00000001	0.00029823
22	Yes	6	0.00000001	0.00025886
23	Yes	5	0.00000001	0.00057765
24	Yes	6	0.00000001	0.00027402
25	Yes	6	0.00000001	0.00029889
26	Yes	6	0.00000001	0.00026592
27	Yes	5	0.00000001	0.00052002
28	Yes	6	0.00000001	0.00026450
29	Yes	6	0.00000001	0.00030164
30	Yes	6	0.00000001	0.00027918
31	Yes	5	0.00000001	0.00059511
32	Yes	6	0.00000001	0.00025947
33	Yes	6	0.00000001	0.00029647
34	Yes	6	0.00000001	0.00026781
35	Yes	4	0.00000001	0.00019924
36	Yes	5	0.00000001	0.00017496
37	Yes	5	0.00000001	0.00018959
38	Yes	5	0.00000001	0.00015168
39	Yes	4	0.00000001	0.00055842
40	Yes	5	0.00000001	0.00017415
41	Yes	5	0.00000001	0.00018868
42	Yes	5	0.00000001	0.00016088
43	Yes	4	0.00000001	0.00017295
44	Yes	5	0.00000001	0.00015739
45	Yes	5	0.00000001	0.00019233
46	Yes	5	0.00000001	0.00018116
47	Yes	4	0.00000001	0.00059129
48	Yes	5	0.00000001	0.00015302
49	Yes	5	0.00000001	0.00018680
50	Yes	5	0.00000001	0.00016588

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	111 - 97.5	26.546	43	2.0433	0.0052
L2	97.5 - 97	20.786	43	2.0211	0.0049
L3	97 - 47	20.574	43	2.0189	0.0049
L4	51 - 21	5.132	43	1.0163	0.0011
L5	21 - 1	0.739	43	0.3548	0.0003

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
108.00	800-10504	43	25.261	2.0419	0.0053	43103
100.00	(2) 7770.00	43	21.846	2.0299	0.0051	14624
99.00	EEI Standard Platform	43	21.421	2.0267	0.0050	10892
90.00	BXA-80080-6CF	43	17.690	1.9568	0.0042	3686

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	111 - 97.5	76.287	10	5.8740	0.0149
L2	97.5 - 97	59.751	10	5.8108	0.0140
L3	97 - 47	59.144	10	5.8046	0.0139
L4	51 - 21	14.772	10	2.9251	0.0033
L5	21 - 1	2.129	10	1.0217	0.0009

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
108.00	800-10504	10	72.598	5.8702	0.0152	15456
100.00	(2) 7770.00	10	62.795	5.8358	0.0146	5225
99.00	EEI Standard Platform	10	61.576	5.8269	0.0144	3884
90.00	BXA-80080-6CF	10	50.862	5.6267	0.0122	1306

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
L1	111 - 109.962	TP16x16x0.375	13.50	0.00	0.0	21.600	18.4078	-0.10	397.61	0.000
	109.962 - 108.923					21.600	18.4078	-0.21	397.61	0.001
	108.923 - 107.885					21.600	18.4078	-0.98	397.61	0.002
	107.885 - 106.846					21.600	18.4078	-0.66	397.61	0.002

Section No.	Elevation	Size	L	L_u	Kl/r	F_a	A	Actual P	Allow. P_a	Ratio $\frac{P}{P_a}$
	ft		ft	ft		ksi	in^2	K	K	
	106.846 - 105.808					21.600	18.4078	-0.73	397.61	0.002
	105.808 - 104.769					21.600	18.4078	-0.81	397.61	0.002
	104.769 - 103.731					21.600	18.4078	-0.88	397.61	0.002
	103.731 - 102.692					21.600	18.4078	-0.95	397.61	0.002
	102.692 - 101.654					21.600	18.4078	-1.03	397.61	0.003
	101.654 - 100.615					21.600	18.4078	-1.10	397.61	0.003
	100.615 - 99.5769					21.600	18.4078	-1.81	397.61	0.005
	99.5769 - 98.5385					21.600	18.4078	-3.34	397.61	0.008
	98.5385 - 97.5					21.600	18.4078	-3.42	397.61	0.009
L2	97.5 - 97 (2)	TP17.49x16x0.375	0.50	0.00	0.0	21.600	18.4078	-3.44	397.61	0.009
L3	97 - 94.5789	TP27.98x17.49x0.25	50.00	0.00	0.0	39.000	14.0830	-3.66	549.24	0.007
	94.5789 - 92.1579					39.000	14.4860	-3.87	564.96	0.007
	92.1579 - 89.7368					39.000	14.8891	-5.84	580.67	0.010
	89.7368 - 87.3158					39.000	15.2921	-6.07	596.39	0.010
	87.3158 - 84.8947					39.000	15.6952	-6.30	612.11	0.010
	84.8947 - 82.4737					39.000	16.0982	-6.54	627.83	0.010
	82.4737 - 80.0526					39.000	16.5013	-6.79	643.55	0.011
	80.0526 - 77.6316					39.000	16.9043	-7.04	659.27	0.011
	77.6316 - 75.2105					39.000	17.3074	-7.30	674.99	0.011
	75.2105 - 72.7895					39.000	17.7104	-7.57	690.71	0.011
	72.7895 - 70.3684					39.000	18.1135	-7.84	706.42	0.011
	70.3684 - 67.9474					39.000	18.5165	-8.12	722.14	0.011
	67.9474 - 65.5263					39.000	18.9196	-8.40	737.86	0.011
	65.5263 - 63.1053					39.000	19.3226	-8.69	753.58	0.012
	63.1053 - 60.6842					39.000	19.7257	-8.98	769.30	0.012
	60.6842 - 58.2632					39.000	20.1287	-9.28	785.02	0.012
	58.2632 - 55.8421					39.000	20.5318	-9.58	800.74	0.012
	55.8421 - 53.4211					39.000	20.9348	-9.89	816.46	0.012
	53.4211 - 51					39.000	21.3379	-10.20	832.18	0.012
	51 - 47					39.000	22.0038	-5.01	858.15	0.006
L4	51 - 47	TP33.392x26.6408x0.3125	30.00	0.00	0.0	39.000	27.0072	-6.04	1053.28	0.006
	47 - 45.6316					39.000	27.3127	-11.26	1065.19	0.011
	45.6316 - 44.2632					39.000	27.6181	-11.47	1077.11	0.011
	44.2632 -					39.000	27.9236	-11.68	1089.02	0.011

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
	42.8947									
	42.8947 - 41.5263					39.000	28.2290	-11.89	1100.93	0.011
	41.5263 - 40.1579					39.000	28.5345	-12.11	1112.84	0.011
	40.1579 - 38.7895					39.000	28.8399	-12.32	1124.76	0.011
	38.7895 - 37.4211					39.000	29.1454	-12.54	1136.67	0.011
	37.4211 - 36.0526					39.000	29.4508	-12.75	1148.58	0.011
	36.0526 - 34.6842					39.000	29.7563	-12.97	1160.49	0.011
	34.6842 - 33.3158					39.000	30.0617	-13.19	1172.41	0.011
	33.3158 - 31.9474					39.000	30.3671	-13.42	1184.32	0.011
	31.9474 - 30.5789					39.000	30.6726	-13.64	1196.23	0.011
	30.5789 - 29.2105					39.000	30.9780	-13.87	1208.14	0.011
	29.2105 - 27.8421					39.000	31.2835	-14.09	1220.06	0.012
	27.8421 - 26.4737					39.000	31.5889	-14.32	1231.97	0.012
	26.4737 - 25.1053					39.000	31.8944	-14.55	1243.88	0.012
	25.1053 - 23.7368					39.000	32.1998	-14.78	1255.79	0.012
	23.7368 - 22.3684					39.000	32.5053	-15.02	1267.71	0.012
	22.3684 - 21					39.000	32.8107	-15.25	1279.62	0.012
L5	21 - 20	TP37x33.392x0.389	20.00	0.00	0.0	39.000	40.9711	-15.42	1597.87	0.010
	20 - 19					39.000	41.1938	-15.59	1606.56	0.010
	19 - 18					39.000	41.4166	-15.75	1615.25	0.010
	18 - 17					39.000	41.6393	-15.92	1623.93	0.010
	17 - 16					39.000	41.8620	-16.08	1632.62	0.010
	16 - 15					39.000	42.0848	-16.25	1641.31	0.010
	15 - 14					39.000	42.3075	-16.42	1649.99	0.010
	14 - 13					39.000	42.5302	-16.59	1658.68	0.010
	13 - 12					39.000	42.7530	-16.76	1667.37	0.010
	12 - 11					39.000	42.9757	-16.93	1676.05	0.010
	11 - 10					39.000	43.1985	-17.10	1684.74	0.010
	10 - 9					39.000	43.4212	-17.28	1693.43	0.010
	9 - 8					39.000	43.6439	-17.45	1702.11	0.010
	8 - 7					39.000	43.8667	-17.62	1710.80	0.010
	7 - 6					39.000	44.0894	-17.80	1719.49	0.010
	6 - 5					39.000	44.3121	-17.98	1728.17	0.010
	5 - 4					39.000	44.5349	-18.15	1736.86	0.010
	4 - 3					39.000	44.7576	-18.33	1745.55	0.011
	3 - 2					39.000	44.9804	-18.51	1754.23	0.011
	2 - 1					39.000	45.2031	-18.69	1762.92	0.011

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	111 - 109.962	TP16x16x0.375	0.05	-0.008	23.760	0.000	0.00	0.000	23.760	0.000
	109.962 - 108.923		0.15	-0.026	23.760	0.001	0.00	0.000	23.760	0.000
	108.923 - 107.885		0.49	-0.084	23.760	0.004	0.00	0.000	23.760	0.000
	107.885 - 106.846		2.45	-0.418	23.760	0.018	0.00	0.000	23.760	0.000
	106.846 - 105.808		4.46	-0.761	23.760	0.032	0.00	0.000	23.760	0.000
	105.808 - 104.769		6.54	-1.116	23.760	0.047	0.00	0.000	23.760	0.000
	104.769 - 103.731		8.67	-1.481	23.760	0.062	0.00	0.000	23.760	0.000
	103.731 - 102.692		10.88	-1.857	23.760	0.078	0.00	0.000	23.760	0.000
	102.692 - 101.654		13.14	-2.244	23.760	0.094	0.00	0.000	23.760	0.000
	101.654 - 100.615		15.47	-2.641	23.760	0.111	0.00	0.000	23.760	0.000
	100.615 - 99.5769		18.92	-3.231	23.760	0.136	0.00	0.000	23.760	0.000
	99.5769 - 98.5385		24.42	-4.170	23.760	0.175	0.00	0.000	23.760	0.000
	98.5385 - 97.5		30.81	-5.261	23.760	0.221	0.00	0.000	23.760	0.000
L2	97.5 - 97 (2)	TP17.49x16x0.375	30.81	-5.261	23.760	0.221	0.00	0.000	23.760	0.000
L3	97 - 94.5789	TP27.98x17.49x0.25	49.24	-9.639	39.000	0.247	0.00	0.000	39.000	0.000
	94.5789 - 92.1579		64.99	-12.021	39.000	0.308	0.00	0.000	39.000	0.000
	92.1579 - 89.7368		82.16	-14.379	39.000	0.369	0.00	0.000	39.000	0.000
	89.7368 - 87.3158		109.09	-18.092	39.000	0.464	0.00	0.000	39.000	0.000
	87.3158 - 84.8947		136.45	-21.476	39.000	0.551	0.00	0.000	39.000	0.000
	84.8947 - 82.4737		164.26	-24.566	39.000	0.630	0.00	0.000	39.000	0.000
	82.4737 - 80.0526		192.50	-27.394	39.000	0.702	0.00	0.000	39.000	0.000
	80.0526 - 77.6316		221.19	-29.984	39.000	0.769	0.00	0.000	39.000	0.000
	77.6316 - 75.2105		250.33	-32.363	39.000	0.830	0.00	0.000	39.000	0.000
	75.2105 - 72.7895		279.90	-34.550	39.000	0.886	0.00	0.000	39.000	0.000
	72.7895 - 70.3684		309.93	-36.564	39.000	0.938	0.00	0.000	39.000	0.000
	70.3684 - 67.9474		340.41	-38.421	39.000	0.985	0.00	0.000	39.000	0.000
	67.9474 - 65.5263		371.34	-40.136	39.000	1.029	0.00	0.000	39.000	0.000
	65.5263 - 63.1053		402.72	-41.722	39.000	1.070	0.00	0.000	39.000	0.000
	63.1053 - 60.6842		434.56	-43.190	39.000	1.107	0.00	0.000	39.000	0.000
	60.6842 - 58.2632		466.85	-44.551	39.000	1.142	0.00	0.000	39.000	0.000
	58.2632 - 55.8421		499.61	-45.815	39.000	1.175	0.00	0.000	39.000	0.000
	55.8421 - 53.4211		532.82	-46.989	39.000	1.205	0.00	0.000	39.000	0.000

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
	53.4211 - 51		566.50	-48.081	39.000	1.233	0.00	0.000	39.000	0.000
	51 - 47		286.16	-22.833	39.000	0.585	0.00	0.000	39.000	0.000
L4	51 - 47	TP33.392x26.6408x0.3125	337.11	-22.373	39.000	0.574	0.00	0.000	39.000	0.000
	47 - 45.6316		643.01	-41.721	39.000	1.070	0.00	0.000	39.000	0.000
	45.6316 - 44.2632		662.86	-42.058	39.000	1.078	0.00	0.000	39.000	0.000
	44.2632 - 42.8947		682.83	-42.377	39.000	1.087	0.00	0.000	39.000	0.000
	42.8947 - 41.5263		702.93	-42.680	39.000	1.094	0.00	0.000	39.000	0.000
	41.5263 - 40.1579		723.14	-42.967	39.000	1.102	0.00	0.000	39.000	0.000
	40.1579 - 38.7895		743.47	-43.240	39.000	1.109	0.00	0.000	39.000	0.000
	38.7895 - 37.4211		763.92	-43.498	39.000	1.115	0.00	0.000	39.000	0.000
	37.4211 - 36.0526		784.50	-43.743	39.000	1.122	0.00	0.000	39.000	0.000
	36.0526 - 34.6842		805.20	-43.975	39.000	1.128	0.00	0.000	39.000	0.000
	34.6842 - 33.3158		826.02	-44.196	39.000	1.133	0.00	0.000	39.000	0.000
	33.3158 - 31.9474		846.97	-44.405	39.000	1.139	0.00	0.000	39.000	0.000
	31.9474 - 30.5789		868.03	-44.603	39.000	1.144	0.00	0.000	39.000	0.000
	30.5789 - 29.2105		889.23	-44.791	39.000	1.148	0.00	0.000	39.000	0.000
	29.2105 - 27.8421		910.55	-44.970	39.000	1.153	0.00	0.000	39.000	0.000
	27.8421 - 26.4737		932.00	-45.139	39.000	1.157	0.00	0.000	39.000	0.000
	26.4737 - 25.1053		953.58	-45.299	39.000	1.162	0.00	0.000	39.000	0.000
	25.1053 - 23.7368		975.28	-45.451	39.000	1.165	0.00	0.000	39.000	0.000
	23.7368 - 22.3684		997.12	-45.596	39.000	1.169	0.00	0.000	39.000	0.000
	22.3684 - 21		1019.08	-45.732	39.000	1.173	0.00	0.000	39.000	0.000
L5	21 - 20	TP37x33.392x0.389	1035.19	-37.170	39.000	0.953	0.00	0.000	39.000	0.000
	20 - 19		1051.36	-37.341	39.000	0.957	0.00	0.000	39.000	0.000
	19 - 18		1067.57	-37.508	39.000	0.962	0.00	0.000	39.000	0.000
	18 - 17		1083.83	-37.670	39.000	0.966	0.00	0.000	39.000	0.000
	17 - 16		1100.15	-37.830	39.000	0.970	0.00	0.000	39.000	0.000
	16 - 15		1116.53	-37.985	39.000	0.974	0.00	0.000	39.000	0.000
	15 - 14		1132.95	-38.136	39.000	0.978	0.00	0.000	39.000	0.000
	14 - 13		1149.43	-38.285	39.000	0.982	0.00	0.000	39.000	0.000
	13 - 12		1165.95	-38.429	39.000	0.985	0.00	0.000	39.000	0.000
	12 - 11		1182.53	-38.571	39.000	0.989	0.00	0.000	39.000	0.000
	11 - 10		1199.16	-38.709	39.000	0.993	0.00	0.000	39.000	0.000
	10 - 9		1215.84	-38.843	39.000	0.996	0.00	0.000	39.000	0.000
	9 - 8		1232.58	-38.975	39.000	0.999	0.00	0.000	39.000	0.000
	8 - 7		1249.37	-39.103	39.000	1.003	0.00	0.000	39.000	0.000
	7 - 6		1266.20	-39.229	39.000	1.006	0.00	0.000	39.000	0.000
	6 - 5		1283.09	-39.351	39.000	1.009	0.00	0.000	39.000	0.000
	5 - 4		1300.04	-39.471	39.000	1.012	0.00	0.000	39.000	0.000
	4 - 3		1317.04	-39.588	39.000	1.015	0.00	0.000	39.000	0.000
	3 - 2		1334.08	-39.702	39.000	1.018	0.00	0.000	39.000	0.000
	2 - 1		1351.19	-39.814	39.000	1.021	0.00	0.000	39.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	111 - 109.962	TP16x16x0.375	0.000	0.000	0.000	0.001 ✓	1.333	H1-3 ✓
	109.962 - 108.923		0.001	0.001	0.000	0.002 ✓	1.333	H1-3 ✓
	108.923 - 107.885		0.002	0.004	0.000	0.006 ✓	1.333	H1-3 ✓
	107.885 - 106.846		0.002	0.018	0.000	0.019 ✓	1.333	H1-3 ✓
	106.846 - 105.808		0.002	0.032	0.000	0.034 ✓	1.333	H1-3 ✓
	105.808 - 104.769		0.002	0.047	0.000	0.049 ✓	1.333	H1-3 ✓
	104.769 - 103.731		0.002	0.062	0.000	0.065 ✓	1.333	H1-3 ✓
	103.731 - 102.692		0.002	0.078	0.000	0.081 ✓	1.333	H1-3 ✓
	102.692 - 101.654		0.003	0.094	0.000	0.097 ✓	1.333	H1-3 ✓
	101.654 - 100.615		0.003	0.111	0.000	0.114 ✓	1.333	H1-3 ✓
	100.615 - 99.5769		0.005	0.136	0.000	0.141 ✓	1.333	H1-3 ✓
	99.5769 - 98.5385		0.008	0.175	0.000	0.184 ✓	1.333	H1-3 ✓
	98.5385 - 97.5		0.009	0.221	0.000	0.230 ✓	1.333	H1-3 ✓
L2	97.5 - 97 (2)	TP17.49x16x0.375	0.009	0.221	0.000	0.230 ✓	1.333	H1-3 ✓
L3	97 - 94.5789	TP27.98x17.49x0.25	0.007	0.247	0.000	0.254 ✓	1.333	H1-3 ✓
	94.5789 - 92.1579		0.007	0.308	0.000	0.315 ✓	1.333	H1-3 ✓
	92.1579 - 89.7368		0.010	0.369	0.000	0.379 ✓	1.333	H1-3 ✓
	89.7368 - 87.3158		0.010	0.464	0.000	0.474 ✓	1.333	H1-3 ✓
	87.3158 - 84.8947		0.010	0.551	0.000	0.561 ✓	1.333	H1-3 ✓
	84.8947 - 82.4737		0.010	0.630	0.000	0.640 ✓	1.333	H1-3 ✓
	82.4737 - 80.0526		0.011	0.702	0.000	0.713 ✓	1.333	H1-3 ✓
	80.0526 - 77.6316		0.011	0.769	0.000	0.780 ✓	1.333	H1-3 ✓
	77.6316 - 75.2105		0.011	0.830	0.000	0.841 ✓	1.333	H1-3 ✓
	75.2105 - 72.7895		0.011	0.886	0.000	0.897 ✓	1.333	H1-3 ✓

tnxTower	Job	Page
	110-ft EEI Monopole - Germantown	26 of 28
Centek Engineering Inc. 63-2 N. Branford Road Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	**Project** 14001.001 - 48 Newton Rd., Danbury, CT	**Date** 15:00:13 01/16/14
	Client Verizon Wireless	**Designed by** jm

Section No.	Elevation ft	Size	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
	72.7895 - 70.3684		0.011	0.938	0.000	0.949 ✔	1.333	H1-3 ✔
	70.3684 - 67.9474		0.011	0.985	0.000	0.996 ✔	1.333	H1-3 ✔
	67.9474 - 65.5263		0.011	1.029	0.000	1.041 ✔	1.333	H1-3 ✔
	65.5263 - 63.1053		0.012	1.070	0.000	1.081 ✔	1.333	H1-3 ✔
	63.1053 - 60.6842		0.012	1.107	0.000	1.119 ✔	1.333	H1-3 ✔
	60.6842 - 58.2632		0.012	1.142	0.000	1.154 ✔	1.333	H1-3 ✔
	58.2632 - 55.8421		0.012	1.175	0.000	1.187 ✔	1.333	H1-3 ✔
	55.8421 - 53.4211		0.012	1.205	0.000	1.217 ✔	1.333	H1-3 ✔
	53.4211 - 51		0.012	1.233	0.000	1.245 ✔	1.333	H1-3 ✔
	51 - 47		0.006	0.585	0.000	0.591 ✔	1.333	H1-3 ✔
L4	51 - 47	TP33.392x26.6408x0.3125	0.006	0.574	0.000	0.579 ✔	1.333	H1-3 ✔
	47 - 45.6316		0.011	1.070	0.000	1.080 ✔	1.333	H1-3 ✔
	45.6316 - 44.2632		0.011	1.078	0.000	1.089 ✔	1.333	H1-3 ✔
	44.2632 - 42.8947		0.011	1.087	0.000	1.097 ✔	1.333	H1-3 ✔
	42.8947 - 41.5263		0.011	1.094	0.000	1.105 ✔	1.333	H1-3 ✔
	41.5263 - 40.1579		0.011	1.102	0.000	1.113 ✔	1.333	H1-3 ✔
	40.1579 - 38.7895		0.011	1.109	0.000	1.120 ✔	1.333	H1-3 ✔
	38.7895 - 37.4211		0.011	1.115	0.000	1.126 ✔	1.333	H1-3 ✔
	37.4211 - 36.0526		0.011	1.122	0.000	1.133 ✔	1.333	H1-3 ✔
	36.0526 - 34.6842		0.011	1.128	0.000	1.139 ✔	1.333	H1-3 ✔
	34.6842 - 33.3158		0.011	1.133	0.000	1.144 ✔	1.333	H1-3 ✔
	33.3158 - 31.9474		0.011	1.139	0.000	1.150 ✔	1.333	H1-3 ✔
	31.9474 - 30.5789		0.011	1.144	0.000	1.155 ✔	1.333	H1-3 ✔
	30.5789 - 29.2105		0.011	1.148	0.000	1.160 ✔	1.333	H1-3 ✔
	29.2105 - 27.8421		0.012	1.153	0.000	1.165 ✔	1.333	H1-3 ✔
	27.8421 - 26.4737		0.012	1.157	0.000	1.169 ✔	1.333	H1-3 ✔

Section No.	Elevation ft	Size	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
	26.4737 - 25.1053		0.012	1.162	0.000	1.173 ✔	1.333	H1-3 ✔
	25.1053 - 23.7368		0.012	1.165	0.000	1.177 ✔	1.333	H1-3 ✔
	23.7368 - 22.3684		0.012	1.169	0.000	1.181 ✔	1.333	H1-3 ✔
	22.3684 - 21		0.012	1.173	0.000	1.185 ✔	1.333	H1-3 ✔
L5	21 - 20	TP37x33.392x0.389	0.010	0.953	0.000	0.963 ✔	1.333	H1-3 ✔
	20 - 19		0.010	0.957	0.000	0.967 ✔	1.333	H1-3 ✔
	19 - 18		0.010	0.962	0.000	0.971 ✔	1.333	H1-3 ✔
	18 - 17		0.010	0.966	0.000	0.976 ✔	1.333	H1-3 ✔
	17 - 16		0.010	0.970	0.000	0.980 ✔	1.333	H1-3 ✔
	16 - 15		0.010	0.974	0.000	0.984 ✔	1.333	H1-3 ✔
	15 - 14		0.010	0.978	0.000	0.988 ✔	1.333	H1-3 ✔
	14 - 13		0.010	0.982	0.000	0.992 ✔	1.333	H1-3 ✔
	13 - 12		0.010	0.985	0.000	0.995 ✔	1.333	H1-3 ✔
	12 - 11		0.010	0.989	0.000	0.999 ✔	1.333	H1-3 ✔
	11 - 10		0.010	0.993	0.000	1.003 ✔	1.333	H1-3 ✔
	10 - 9		0.010	0.996	0.000	1.006 ✔	1.333	H1-3 ✔
	9 - 8		0.010	0.999	0.000	1.010 ✔	1.333	H1-3 ✔
	8 - 7		0.010	1.003	0.000	1.013 ✔	1.333	H1-3 ✔
	7 - 6		0.010	1.006	0.000	1.016 ✔	1.333	H1-3 ✔
	6 - 5		0.010	1.009	0.000	1.019 ✔	1.333	H1-3 ✔
	5 - 4		0.010	1.012	0.000	1.023 ✔	1.333	H1-3 ✔
	4 - 3		0.011	1.015	0.000	1.026 ✔	1.333	H1-3 ✔
	3 - 2		0.011	1.018	0.000	1.029 ✔	1.333	H1-3 ✔
	2 - 1		0.011	1.021	0.000	1.031 ✔	1.333	H1-3 ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	111 - 97.5	Pole	TP16x16x0.375	1	-3.42	530.01	17.3	Pass
L2	97.5 - 97	Pole	TP17.49x16x0.375	2	-3.44	530.01	17.3	Pass
L3	97 - 47	Pole	TP27.98x17.49x0.25	3	-10.20	1109.29	93.4	Pass
L4	47 - 21	Pole	TP33.392x26.6408x0.3125	4	-15.25	1705.73	88.9	Pass
L5	21 - 1	Pole	TP37x33.392x0.389	5	-18.69	2349.97	77.4	Pass
							Summary	
						Pole (L3)	93.4	Pass
						RATING =	**93.4**	**Pass**

CENTEK engineering
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P: (203) 488-0580
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Subject:	Anchor Bolt and Baseplate Analysis
Location:	96-ft EEI Monopole w/ 14-ft Extension Danbury, CT
Rev. 0: 01/16/14	Prepared by: J.R.M. Checked by: C.F.C. Job No. 14001.001

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	OM := 1351·ft·kips	(Input From RisaTower)
Shear Force =	Shear := 17·kips	(Input From RisaTower)
Axial Force =	Axial := 19·kips	(Input From RisaTower)

Existing Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	N := 8	(User Input)
Diameter of Bolt Circle =	D_{bc} := 45.00·in	(User Input)
Bolt "Column" Distance =	l := 3.0·in	(User Input)
Bolt Ultimate Strength =	F_u := 100·ksi	(User Input)
Bolt Yield Strength =	F_y := 75·ksi	(User Input)
Bolt Modulus =	E := 29000·ksi	(User Input)
Diameter of Anchor Bolts =	D := 2.25·in	(User Input)
Threads per Inch =	n := 4.5	(User Input)

Proposed Anchor Bolt Data:

Use ASTM A193 GR.B7

Number of Anchor Bolts =	N2 := 3	(User Input)
Diameter of Bolt Circle =	D_{bc2} := 59.00·in	(User Input)
Bolt "Column" Distance =	l2 := 8.0·in	(User Input)
Bolt Ultimate Strenght =	F_{u2} := 115·ksi	(User Input)
Bolt Yield Strenght =	F_{y2} := 95·ksi	(User Input)
Bolt Modulus =	E2 := 29000·ksi	(User Input)
Diameter of Anchor Bolts =	D2 := 2.75·in	(User Input)
Threads per Inch =	n2 := 4.0	(User Input)

Base Plate Data:

Use ASTM A572 GR 60

Plate Yield Strength =	Fy_{bp} := 60·ksi	(User Input)
Base Plate Thickness =	t_{bp} := 2.0·in	(User Input)
Base Plate Diameter =	D_{bp} := 51.00·in	(User Input)
Outer Pole Diameter =	D_{pole} := 37·in	(User Input)

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Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Distance to Bolts =

$d_1 := 14.75 \cdot in$ (User Input)

$d_2 := 15.9375 \cdot in$ (User Input)

$d_3 := 22.5 \cdot in$ (User Input)

$d_4 := 29.5 \cdot in$ (User Input)

Number of Bolts per Group =

$N_1 := 2$ (User Input)

$N_2 := 4$ (User Input)

$N_3 := 2$ (User Input)

$N_4 := 1$ (User Input)

Critical Distances For Bending in Plate:

Outer Pole Radius =

$$R_{pole} := \frac{D_{pole}}{2} = 18.5 \cdot in$$

Moment Arms of Bolts about Neutral Axis =

$MA_1 := 0 \cdot in$ (User Input)

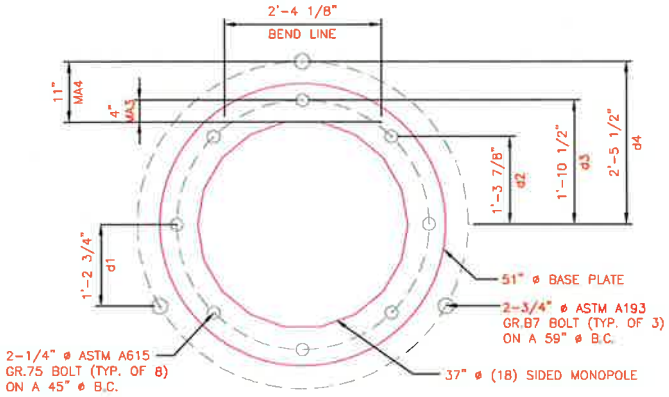
$MA_2 := 0 \cdot in$ (User Input)

$MA_3 := 4 \cdot in$ (User Input)

$MA_4 := 11 \cdot in$ (User Input)

Effective Width of Baseplate for Bending =

$$B_{eff} := .82 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 28.1 \cdot in$$



Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Existing Anchor Bolts:

Gross Area of Bolt = $A_g := \frac{\pi}{4} \cdot D^2 = 3.976 \cdot in^2$

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

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

Radius of Gyration of Bolt = $r := \frac{D_n}{4} = 0.508 \cdot in$

Section Modulus of Bolt = $S_x := \frac{\pi \cdot D_n^3}{32} = 0.826 \cdot in^3$

Proposed Anchor Bolts:

Gross Area of Bolt = $A_{g2} := \frac{\pi}{4} \cdot D2^2 = 5.94 \cdot in^2$

Net Area of Bolt = $A_{n2} := \frac{\pi}{4} \cdot \left(D2 - \frac{0.9743 \cdot in}{n2}\right)^2 = 4.934 \cdot in^2$

Net Diameter = $D_{n2} := \frac{2 \cdot \sqrt{A_{n2}}}{\sqrt{\pi}} = 2.506 \cdot in$

Radius of Gyration of Bolt = $r2 := \frac{D_{n2}}{4} = 0.627 \cdot in$

Section Modulus of Bolt = $S_{x2} := \frac{\pi \cdot D_{n2}^3}{32} = 1.546 \cdot in^3$

Total Polar Moment of Inertia = $I_p := d_1^2 \cdot N_1 + d_2^2 \cdot N_2 + d_3^2 \cdot N_3 + d_4^2 \cdot N_4 = 3333.9 \cdot in^2$

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Rev. 0: 01/16/14	Prepared by: J.R.M. Checked by: C.F.C. Job No. 14001.001

ASTM A615 GR. 65 Bolts:

Check Inner Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{d_3}{I_p} - \frac{Axial}{N + N2} = 107.7 \cdot kips$

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

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

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} = 55.3 \cdot \%$ Bolts are "upset bolts". Use net area per AISC

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

Condition1 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment = $M_x := \left(\frac{Shear}{N + N2}\right) \cdot l = 0.386 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 5.6 \cdot ksi$

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

Check Combined Stress Requirement:

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

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

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

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force = $C_{Max} := OM \cdot \frac{d_3}{I_p} + \frac{Axial}{N} = 111.8 \cdot kips$

Note: Calculation assumes that the total axial load is taken up in the original inner anchor bolts with no contribution from the external anchor bolts added as reinforcements.

Maximum Compressive Stress = $f_a := \frac{C_{Max}}{A_n} = 34.4 \cdot ksi$

$K := 0.65$

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

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

Allowable Compressive Stress = $F_a := 1.333 \cdot F_a = 60 \cdot ksi$ (1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity = $\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 57.4 \cdot \%$

Condition 2 = $Condition2 := if\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \le 1.00, "OK", "Overstressed"\right)$

Condition2 = "OK"

ASTM A193 Gr.B7 Bolts:

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max2} := OM \cdot \frac{d_4}{I_p} - \frac{Axial}{N + N2} = 141.7 \cdot kips$

Allowable Tensile Force = $T_{ALL.Gross2} := 1.333 \cdot \left(0.33 \cdot A_{g2} \cdot F_{u2}\right) = 300.5 \cdot kips$ (1.333 increase allowed per TIA/EIA)

$T_{ALL.Net2} := 1.333 \cdot \left(0.60 \cdot A_{n2} \cdot F_{y2}\right) = 374.89 \cdot kips$ (1.333 increase allowed per TIA/EIA)

Bolt Tension % of Capacity = $\frac{T_{Max2}}{T_{ALL.Net2}} = 37.8 \cdot \%$ Bolts are "upset bolts". Use net area per AISC

Condition 3 = $Condition3 := if\left(\frac{T_{Max}}{T_{ALL.Net}} \le 1.00, "OK", "Overstressed"\right)$

Condition3 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment = $M_{x2} := \left(\frac{Shear}{N + N2}\right) \cdot l2 = 1.03 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx2} := \frac{M_{x2}}{S_{x2}} = 8 \cdot ksi$

Allowable Bending Stress = $F_{bx2} := 1.333 \cdot 0.6 \cdot F_{y2} = 76 \cdot ksi$ (1.333 increase allowed per TIA/EIA)

Check Combined Stress Requirement:

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

$l2 := \begin{cases} l2 & \text{if } l2 > 2 \cdot D_{n2} \\ 0 & \text{otherwise} \end{cases} = 8 \cdot in$

$f_{bx2} := \begin{cases} f_{bx2} & \text{if } l2 > 2 \cdot D_{n2} \\ 0 & \text{otherwise} \end{cases} = 8 \cdot ksi$

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force = $C_{Max2} := OM \cdot \frac{d_4}{I_p} + \frac{Axial}{N} = 145.8 \cdot kips$

Note: Calculation assumes that the total axial load is taken up in the original inner anchor bolts with no contribution from the external anchor bolts added as reinforcements.

Maximum Compressive Stress = $f_{a2} := \frac{C_{Max2}}{A_{n2}} = 29.6 \cdot ksi$

$K := 0.65$

$C_c := \sqrt{\frac{2 \cdot \pi^2 \cdot E2}{F_{y2}}} = 77.625$

$$F_{a2} := \begin{cases} \frac{\left[1 - \frac{\left(\frac{K \cdot l2}{r2}\right)^2}{2 \cdot C_c^2}\right] \cdot F_{y2}}{\frac{5}{3} + \frac{3 \cdot \left(\frac{K \cdot l2}{r2}\right)}{8 \cdot C_c} - \frac{\left(\frac{K \cdot l2}{r2}\right)^3}{8 \cdot C_c^3}} & \text{if } \frac{K \cdot l2}{r2} \le C_c \\ \frac{12 \cdot \pi^2 \cdot E2}{23 \cdot \left(\frac{K \cdot l2}{r2}\right)^2} & \text{if } \frac{K \cdot l2}{r2} > C_c \end{cases} = 55.348 \cdot ksi$$

Allowable Compressive Stress = $F_{a2} := 1.333 \cdot F_{a2} = 73.8 \cdot ksi$ (1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity = $\left(\frac{f_{a2}}{F_{a2}} + \frac{f_{bx2}}{F_{bx2}}\right) = 50.6 \cdot \%$

Condition 4 = $Condition4 := if\left(\frac{f_{a2}}{F_{a2}} + \frac{f_{bx2}}{F_{bx2}} \le 1.00, "OK", "Overstressed"\right)$

Condition4 = "OK"

Base Plate Analysis:

Note: Only the force from the original anchor bolts attribuites to the baseplate bending. The anchor bolts located outside the edge of the baseplate provide addtional anchor bolt capacity only..

Force from Bolts = $C_1 := T_{Max} = 107.69 \cdot kips$

Maximum Bending Stress in Plate = $f_{bp} := \frac{6 \cdot (C_1 \cdot MA_3)}{(B_{eff} \cdot t_{bp}^2)} = 23 \cdot ksi$

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

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} = 38.4 \cdot \%$

Condition5 = $Condition5 := if\left(\frac{f_{bp}}{F_{bp}} < 1.00, "Ok", "Overstressed"\right)$

Condition5 = "Ok"

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Subject:	CAISSON FOUNDATION
Location:	96-ft EEI Monopole w/ 14-ft Extension Danbury, CT
Rev. 0: 01/16/14	Prepared by: J.R.M. Checked by: C.F.C. Job No. 14001.001

Caisson Foundation:

Input Data:

Shear Force =	$S := 20k$	*USER INPUT-FROM RISATower*
Overturning Moment =	$M := 1351ft \cdot k$	*USER INPUT-FROM RISATower*
Applied Axial Load =	$A1 := 19k$	*USER INPUT-FROM RISATower*
Bending Moment =	$Mu := 1432ft \cdot k$	*USER INPUT--FROM LPILE*
Moment Capacity =	$Mn := 2662ft \cdot k$	*USER INPUT--FROM LPILE*
Foundation Diameter =	$d := 5.5ft$	*USER INPUT*
Overall Length of Caisson =	$L_c := 21.0ft$	*USER INPUT*
Depth From Top of Caisson to Grade =	$L_{pag} := 1.0ft$	*USER INPUT*
Number of Rebar =	$n := 24$	*USER INPUT*
Area of Rebar =	$Ar := 0.79in^2$	*USER INPUT*
Rebar Yield Strength =	$fy := 60ksi$	*USER INPUT*
Concrete Comp Strength =	$f'c := 3ksi$	*USER INPUT*

Check Foundation Depth:

Depth of Caisson Below Ground Level = $LD := L_c - L_{pag} = 20ft$ (TIA/EIA-222-F 7.2.5)

Depth Required = $LD1 := 2.0ft + \left(\frac{S \cdot ft^2}{3k \cdot d}\right) + 2ft \cdot .5\left(\frac{M \cdot ft}{3 \cdot kd} + \frac{S \cdot ft}{2k} + \frac{S^2 ft^3}{18k^2 d^2}\right)^{.5} = 22.46ft$

$DepthCheck := if(LD1 \le LD, "OK", "NO GOOD")$

DepthCheck = "NO GOOD"

Note: Result not applicable. Actual soil is better than normal soil as defined in TIA/EIA 222 F. Refer to L-Pile analysis.

Check Moment Capacity:

Factor of Safety = $FS := \frac{Mn}{Mu} = 1.9$

Factor of Safety Required = $FS_{reqd} := 1.3$

$FOSCheck := if(FS \ge FS_{reqd}, "OK", "NO GOOD")$

FOSCheck = "OK"

Check Axial Capacity:

Concrete Weight = $A2 := .150\frac{k}{ft^3} \cdot LD \cdot \pi \frac{d^2}{4} = 71.3 \cdot kips$

Total Axial Load = $AT := A1 + A2 = 90.3 \cdot kips$

Area of Concrete = $Ag := \pi \cdot \frac{d^2}{4} = 23.76ft^2$

Axial Capacity = $Po := n \cdot Ar \cdot fy + (Ag - n \cdot Ar) \cdot 0.85 \cdot f'c = 9813.3 \cdot kips$

$AxialCheck := if(AT \le Po, "OK", "NO GOOD")$

AxialCheck = "OK"

LPILE Plus for Windows, Version 5.0 (5.0.47)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

This program is licensed to:

User
Centek Engineering, Inc.

Files Used for Analysis

Path to file locations: J:\Jobs\1400100.WI\001 - Germantown\Backup Documentation\Calcs\Foundation\
Name of input data file: Germantown Caisson Analysis.lpd
Name of output file: Germantown Caisson Analysis.lpo
Name of plot output file: Germantown Caisson Analysis.lpp
Name of runtime file: Germantown Caisson Analysis.lpr

Time and Date of Analysis

Date: January 16, 2014 Time: 15:05:59

Problem Title

Germantown

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 3:
- Computation of Nonlinear Bending Stiffness and Ultimate Bending Moment Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- Analysis includes computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile

- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-04 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 8

Pile Structural Properties and Geometry

Pile Length = 252.00 in

Depth of ground surface below top of pile = 12.00 in

Slope angle of ground surface = 0.00 deg.

Structural properties of pile defined using 2 points

Point No.	Point Depth in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	66.00000000	931420.0000	3421.2000	3600000.
2	252.0000	66.00000000	931420.0000	3421.2000	3600000.

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of moment of inertia and modulus of are not used for any computations other than total stress due to combined axial loading and bending.

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 12.000 in
Distance from top of pile to bottom of layer = 48.000 in
p-y subgrade modulus k for top of soil layer = 1.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 1.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 48.000 in
Distance from top of pile to bottom of layer = 168.000 in
p-y subgrade modulus k for top of soil layer = 122.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 122.000 lbs/in**3

Layer 3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 168.000 in
Distance from top of pile to bottom of layer = 360.000 in
p-y subgrade modulus k for top of soil layer = 100.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 100.000 lbs/in**3

(Depth of lowest layer extends 108.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 6 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	12.00	0.05800
2	48.00	0.05800
3	48.00	0.07800
4	168.00	0.07800
5	168.00	0.04300
6	360.00	0.04300

Shear Strength of Soils

Shear strength parameters with depth defined using 6 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	12.000	0.00000	28.00	------	------
2	48.000	0.00000	28.00	------	------
3	48.000	0.00000	38.00	------	------
4	168.000	0.00000	38.00	------	------
5	168.000	0.00000	38.00	------	------
6	360.000	0.00000	38.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head = 17000.000 lbs
Bending moment at pile head = 16212000.000 in-lbs
Axial load at pile head = 19000.000 lbs

Non-zero moment at pile head for this load case indicates the pile-head may rotate under the applied pile-head loading, but is not a free-head (zero moment) condition.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Number of sections = 1

Pile Section No. 1

The sectional shape is a circular drilled shaft (bored pile).

Outside Diameter = 66.0000 in

Material Properties:

Compressive Strength of Concrete	=	3.000 kip/in**2
Yield Stress of Reinforcement	=	60. kip/in**2
Modulus of Elasticity of Reinforcement	=	29000. kip/in**2
Number of Reinforcing Bars	=	24
Area of Single Bar	=	0.79000 in**2
Number of Rows of Reinforcing Bars	=	13
Area of Steel	=	18.960 in**2
Area of Shaft	=	3421.194 in**2
Percentage of Steel Reinforcement	=	0.554 percent
Cover Thickness (edge to bar center)	=	4.000 in

Unfactored Axial Squash Load Capacity = 9813.30 kip

Distribution and Area of Steel Reinforcement

Row Number	Area of Reinforcement in**2	Distance to Centroidal Axis in
1	0.790	29.000
2	1.580	28.012
3	1.580	25.115
4	1.580	20.506
5	1.580	14.500
6	1.580	7.506
7	1.580	0.000
8	1.580	-7.506
9	1.580	-14.500
10	1.580	-20.506
11	1.580	-25.115
12	1.580	-28.012
13	0.790	-29.000

Axial Thrust Force = 19000.00 lbs

Bending Moment in-lbs	Bending Stiffness lb-in2	Bending Curvature rad/in	Maximum Strain in/in	Neutral Axis Position inches	Max. Concrete Stress psi	Max. Steel Stress psi
2629441.	3.155329E+12	8.333333E-07	0.00002930	35.16311556	90.03320698	753.10863
5230073.	3.138044E+12	0.00000167	0.00005689	34.13221174	173.22699	1456.39023
7803291.	3.121316E+12	0.00000250	0.00008453	33.81156296	255.16139	2161.33831
10347765.	3.104330E+12	0.00000333	0.00011213	33.63963944	335.54518	2865.16515
12863941.	3.087346E+12	0.00000417	0.00013974	33.53642553	414.49520	3568.98475
12863941.	2.572788E+12	0.00000500	0.00008149	16.29820043	241.95810	6626.76094
12863941.	2.205247E+12	0.00000583	0.00009382	16.08280724	277.37795	7767.65844
12863941.	1.929591E+12	0.00000667	0.00010616	15.92358631	312.56962	8908.10665
12863941.	1.715192E+12	0.00000750	0.00011851	15.80182403	347.53227	10048.10327
12863941.	1.543673E+12	0.00000833	0.00013089	15.70630091	382.26525	11187.64395
12863941.	1.403339E+12	0.00000917	0.00014327	15.62986904	416.76769	12326.72648
12863941.	1.286394E+12	0.00001000	0.00015568	15.56776839	451.03884	13465.34717
12863941.	1.187441E+12	0.00001083	0.00016810	15.51669842	485.07782	14603.50391
12863941.	1.102624E+12	0.00001167	0.00018053	15.47431058	518.88399	15741.19159
12863941.	1.029115E+12	0.00001250	0.00019299	15.43887395	552.45642	16878.40819
12863941.	9.647956E+11	0.00001333	0.00020545	15.40909034	585.79416	18015.15174
12863941.	9.080429E+11	0.00001417	0.00021817	15.39999908	619.51868	19144.83371
12863941.	8.575961E+11	0.00001500	0.00023100	15.39999908	653.28043	20271.00040
12863941.	8.124594E+11	0.00001583	0.00024366	15.38928312	686.28755	21402.08750
12863941.	7.718365E+11	0.00001667	0.00025622	15.37291414	718.70583	22536.42483
12863941.	7.350824E+11	0.00001750	0.00026879	15.35916120	750.88861	23670.22569
12863941.	7.016695E+11	0.00001833	0.00028137	15.34768206	782.83530	24803.48237
12863941.	6.711621E+11	0.00001917	0.00029398	15.33818561	814.54483	25936.19183
12863941.	6.431971E+11	0.00002000	0.00030661	15.33043188	846.01627	27068.34951
12863941.	6.174692E+11	0.00002083	0.00031925	15.32422024	877.24872	28199.95027
12863941.	5.937204E+11	0.00002167	0.00033192	15.31937760	908.24108	29330.99107
12863941.	5.717307E+11	0.00002250	0.00034460	15.31576234	938.99256	

30461.46507					
12863941.	5.513118E+11	0.00002333	0.00035731	15.31324464	969.50188
31591.37113					
12863941.	5.323010E+11	0.00002417	0.00037003	15.31172222	999.76829
32720.70134					
13094962.	5.237985E+11	0.00002500	0.00038278	15.31110066	1029.79069
33849.45202					
13511928.	5.230424E+11	0.00002583	0.00039554	15.31130129	1059.56818
34977.61678					
13928373.	5.223140E+11	0.00002667	0.00040833	15.31224936	1089.09944
36105.19383					
14344300.	5.216109E+11	0.00002750	0.00042113	15.31388980	1118.38387
37232.17288					
14759696.	5.209304E+11	0.00002833	0.00043396	15.31615967	1147.41985
38358.55547					
15174562.	5.202707E+11	0.00002917	0.00044680	15.31901568	1176.20662
39484.33257					
15588895.	5.196298E+11	0.00003000	0.00045967	15.32241458	1204.74305
40609.49932					
16002689.	5.190061E+11	0.00003083	0.00047256	15.32631701	1233.02794
41734.05154					
16415943.	5.183982E+11	0.00003167	0.00048547	15.33069152	1261.06034
42857.98162					
16828653.	5.178047E+11	0.00003250	0.00049840	15.33550662	1288.83905
43981.28501					
17652417.	5.166561E+11	0.00003417	0.00052433	15.34634846	1343.63048
46225.99306					
18473956.	5.155523E+11	0.00003583	0.00055035	15.35866159	1397.39328
48468.12416					
19293236.	5.144863E+11	0.00003750	0.00057646	15.37229258	1450.11775
50707.63182					
20110218.	5.134524E+11	0.00003917	0.00060266	15.38711160	1501.79362
52944.47240					
20920643.	5.123423E+11	0.00004083	0.00062883	15.39999908	1552.16810
55182.16775					
21708410.	5.107861E+11	0.00004250	0.00065450	15.39999908	1600.33227
57434.50113					
22490990.	5.092300E+11	0.00004417	0.00068017	15.39999908	1647.30509
59686.83451					
23196262.	5.061003E+11	0.00004583	0.00070583	15.39999908	1693.08657
60000.00000					
23801384.	5.010818E+11	0.00004750	0.00073099	15.38920051	1736.76469
60000.00000					
24289199.	4.940176E+11	0.00004917	0.00075403	15.33628553	1775.64841
60000.00000					
24693777.	4.857792E+11	0.00005083	0.00077612	15.26796144	1811.95451
60000.00000					
25097173.	4.780414E+11	0.00005250	0.00079826	15.20504647	1847.48188
60000.00000					
25482558.	4.704472E+11	0.00005417	0.00082023	15.14268619	1881.84333
60000.00000					
25755968.	4.613009E+11	0.00005583	0.00084068	15.05695456	1912.96416
60000.00000					
26028509.	4.526697E+11	0.00005750	0.00086118	14.97697431	1943.41187
60000.00000					
26300161.	4.445098E+11	0.00005917	0.00088172	14.90226156	1973.18151
60000.00000					
26570922.	4.367823E+11	0.00006083	0.00090230	14.83239537	2002.26899
60000.00000					
26840789.	4.294526E+11	0.00006250	0.00092294	14.76699811	2030.66995
60000.00000					
27050745.	4.215701E+11	0.00006417	0.00094262	14.69015712	2056.99701
60000.00000					

27221360.	4.134890E+11	0.00006583	0.00096168	14.60786766	2081.80994
60000.00000					
27391289.	4.057969E+11	0.00006750	0.00098079	14.53018874	2106.03074
60000.00000					
27560548.	3.984658E+11	0.00006917	0.00099993	14.45680171	2129.65678
60000.00000					
27729131.	3.914701E+11	0.00007083	0.00101911	14.38740760	2152.68438
60000.00000					
27897019.	3.847865E+11	0.00007250	0.00103833	14.32173103	2175.10947
60000.00000					
28168009.	3.797934E+11	0.00007417	0.00106058	14.30000013	2200.43745
60000.00000					
28248173.	3.725034E+11	0.00007583	0.00108135	14.25960284	2223.20420
60000.00000					
28411956.	3.666059E+11	0.00007750	0.00110024	14.19662887	2243.14918
60000.00000					
28549147.	3.606208E+11	0.00007917	0.00111853	14.12882406	2261.83941
60000.00000					
28643939.	3.543580E+11	0.00008083	0.00113584	14.05160147	2278.92959
60000.00000					
28738264.	3.483426E+11	0.00008250	0.00115318	13.97788793	2295.52929
60000.00000					
28832109.	3.425597E+11	0.00008417	0.00117055	13.90747494	2311.63543
60000.00000					
28925473.	3.369958E+11	0.00008583	0.00118795	13.84017366	2327.24522
60000.00000					
29018356.	3.316383E+11	0.00008750	0.00120538	13.77581102	2342.35591
60000.00000					
29110743.	3.264756E+11	0.00008917	0.00122285	13.71422178	2356.96430
60000.00000					
29202652.	3.214971E+11	0.00009083	0.00124035	13.65526432	2371.06807
60000.00000					
29294051.	3.166924E+11	0.00009250	0.00125789	13.59878916	2384.66341
60000.00000					
29384966.	3.120527E+11	0.00009417	0.00127546	13.54467827	2397.74812
60000.00000					
29475365.	3.075690E+11	0.00009583	0.00129306	13.49280185	2410.31840
60000.00000					
29565259.	3.032334E+11	0.00009750	0.00131070	13.44305366	2422.37154
60000.00000					
29654648.	2.990385E+11	0.00009917	0.00132837	13.39533144	2433.90449
60000.00000					
29831866.	2.910426E+11	0.00010250	0.00136382	13.30557150	2455.39624
60000.00000					
29981222.	2.832871E+11	0.00010583	0.00139852	13.21437961	2474.28362
60000.00000					
30105396.	2.757746E+11	0.00010917	0.00143999	13.19070929	2494.26355
60000.00000					
30191918.	2.683726E+11	0.00011250	0.00147161	13.08100051	2507.27270
60000.00000					
30277032.	2.613844E+11	0.00011583	0.00150336	12.97862452	2518.59675
60000.00000					
30360717.	2.547752E+11	0.00011917	0.00153522	12.88298339	2528.21572
60000.00000					
30442956.	2.485139E+11	0.00012250	0.00156721	12.79354602	2536.10909
60000.00000					
30523725.	2.425726E+11	0.00012583	0.00159932	12.70983642	2542.25572
60000.00000					
30602990.	2.369264E+11	0.00012917	0.00163156	12.63142580	2546.63383
60000.00000					
30680742.	2.315528E+11	0.00013250	0.00166393	12.55793649	2549.22115
60000.00000					
30756773.	2.264302E+11	0.00013583	0.00169643	12.48902231	2549.58557

60000.00000					
30829548.	2.215297E+11	0.00013917	0.00172906	12.42437249	2544.18311
60000.00000					
30901501.	2.168526E+11	0.00014250	0.00176183	12.36370379	2541.65258
60000.00000					
30972634.	2.123838E+11	0.00014583	0.00179474	12.30676836	2545.86097
60000.00000					
31042926.	2.081090E+11	0.00014917	0.00182779	12.25333411	2548.61873
60000.00000					
31112346.	2.040154E+11	0.00015250	0.00186099	12.20318860	2549.90298
60000.00000					
31173314.	2.000427E+11	0.00015583	0.00189392	12.15350729	2546.94055
60000.00000					
31173314.	1.958533E+11	0.00015917	0.00192592	12.09999830	2542.29318
60000.00000					
31173314.	1.918358E+11	0.00016250	0.00196625	12.09999830	2540.27990
60000.00000					
31290664.	1.886874E+11	0.00016583	0.00200389	12.08375126	2545.02787
60000.00000					
31315126.	1.851140E+11	0.00016917	0.00203360	12.02125329	2547.47409
60000.00000					
31339258.	1.816769E+11	0.00017250	0.00206340	11.96173328	2549.10555
60000.00000					
31363047.	1.783680E+11	0.00017583	0.00209330	11.90502995	2549.91056
60000.00000					
31386166.	1.751786E+11	0.00017917	0.00212338	11.85143048	2548.01467
60000.00000					
31408749.	1.721027E+11	0.00018250	0.00215360	11.80056506	2544.32145
60000.00000					
31431145.	1.691362E+11	0.00018583	0.00218390	11.75190657	2540.61578
60000.00000					
31453342.	1.662732E+11	0.00018917	0.00221426	11.70534092	2536.89756
60000.00000					
31475317.	1.635081E+11	0.00019250	0.00224470	11.66075796	2536.96406
60000.00000					
31497095.	1.608362E+11	0.00019583	0.00227521	11.61807114	2540.64059
60000.00000					
31518670.	1.582527E+11	0.00019917	0.00230579	11.57718998	2543.72118
60000.00000					
31540016.	1.557532E+11	0.00020250	0.00233645	11.53802401	2546.19803
60000.00000					
31561152.	1.533335E+11	0.00020583	0.00236719	11.50050241	2548.06357
60000.00000					
31582067.	1.509900E+11	0.00020917	0.00239800	11.46455044	2549.30977
60000.00000					
31602747.	1.487188E+11	0.00021250	0.00242890	11.43009728	2549.92843
60000.00000					
31622904.	1.465154E+11	0.00021583	0.00245995	11.39746553	2548.30906
60000.00000					
31642639.	1.443771E+11	0.00021917	0.00249114	11.36642700	2545.08936
60000.00000					
31662245.	1.423022E+11	0.00022250	0.00252238	11.33654505	2541.86082
60000.00000					
31681738.	1.402881E+11	0.00022583	0.00255367	11.30777639	2538.62313
60000.00000					
31701111.	1.383321E+11	0.00022917	0.00258502	11.28007382	2535.37622
60000.00000					
31720362.	1.364317E+11	0.00023250	0.00261641	11.25339407	2532.11999
60000.00000					
31758485.	1.327881E+11	0.00023917	0.00267937	11.20294172	2535.08216
60000.00000					
31796099.	1.293401E+11	0.00024583	0.00274255	11.15612429	2541.46584
60000.00000					

31833177.	1.260720E+11	0.00025250	0.00280595	11.11267430	2546.10632
60000.00000					
31869717.	1.229700E+11	0.00025917	0.00286959	11.07235962	2548.96394
60000.00000					
31905696.	1.200214E+11	0.00026583	0.00293346	11.03496784	2549.99704
60000.00000					
31940290.	1.172121E+11	0.00027250	0.00299786	11.00130934	2544.80318
60000.00000					
31940290.	1.144130E+11	0.00027917	0.00307083	10.99999934	2537.79106
60000.00000					
31940290.	1.117445E+11	0.00028583	0.00314417	10.99999934	2530.71632
60000.00000					
31940290.	1.091976E+11	0.00029250	0.00321750	10.99999934	2523.64158
60000.00000					
32016813.	1.070200E+11	0.00029917	0.00328796	10.99040061	2530.57102
60000.00000					
32018976.	1.046942E+11	0.00030583	0.00334645	10.94206864	2535.24130
60000.00000					
32021042.	1.024673E+11	0.00031250	0.00340505	10.89616388	2539.29387
60000.00000					
32023009.	1.003332E+11	0.00031917	0.00346377	10.85254079	2542.71694
60000.00000					
32024869.	9.828604E+10	0.00032583	0.00352261	10.81106561	2545.49830
60000.00000					
32026620.	9.632066E+10	0.00033250	0.00358156	10.77161640	2547.62544
60000.00000					
32028272.	9.443225E+10	0.00033917	0.00364064	10.73408693	2549.08551
60000.00000					
32029802.	9.261630E+10	0.00034583	0.00369985	10.69836706	2549.86482
60000.00000					
32031069.	9.086828E+10	0.00035250	0.00375935	10.66481084	2548.70790
60000.00000					
32032011.	8.918425E+10	0.00035917	0.00381917	10.63341433	2545.28943
60000.00000					

Unfactored (Nominal) Moment Capacity at Concrete Strain of 0.003 = 31940.28960 in-kip

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Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Shear and Moment (Pile-head Condition Type 1)
Specified shear force at pile head = 17000.000 lbs
Specified moment at pile head = 16212000.000 in-lbs
Specified axial load at pile head = 19000.000 lbs

Depth	Deflect.	Moment	Shear	Slope	Total	Flx. Rig.	Soil Res. Es*h
X	y	M	V	S	Stress	EI	p F/L
in	in	lbs-in	lbs	Rad.	lbs/in**2	lbs-in**2	lbs/in
0.000	0.678342	1.62E+07	17000.	-0.006553	579.941	5.19E+11	0.000
0.000							
20.160	0.552629	1.66E+07	16981.	-0.005916	592.166	5.18E+11	-4.509
20.563							
40.320	0.439902	1.69E+07	16803.	-0.005265	604.317	5.18E+11	-12.458

71.366							
60.480	0.340442	1.72E+07	4340.334	-0.004600	614.045	5.17E+11	-1311.261
9706.149							
80.640	0.254439	1.69E+07	-29127.	-0.003933	605.974	5.18E+11	-1852.301
18345.							
100.800	0.181691	1.60E+07	-66044.	-0.003290	571.930	5.19E+11	-1769.576
24543.							
120.960	0.121414	1.43E+07	-99086.	-0.002701	512.639	5.22E+11	-1481.125
30741.							
141.120	0.071536	1.20E+07	-1.25E+05	-0.002360	432.172	3.09E+12	-1048.605
36939.							
161.280	0.024694	9.35E+06	-1.40E+05	-0.002290	336.845	3.11E+12	-422.711
43137.							
181.440	-0.020927	6.50E+06	-1.41E+05	-0.002239	235.671	3.13E+12	329.391
39664.							
201.600	-0.065703	3.78E+06	-1.26E+05	-0.002206	139.404	3.14E+12	1166.606
44744.							
221.760	-0.109985	1.54E+06	-92576.	-0.002189	60.136	3.16E+12	2174.600
49825.							
241.920	-0.154060	1.93E+05	-37112.	-0.002184	12.388	3.16E+12	3356.611
54905.							

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	0.67834194 in
Computed slope at pile head	=	-0.00655310
Maximum bending moment	=	17181574. lbs-in
Maximum shear force	=	-142266.61944 lbs
Depth of maximum bending moment	=	63.00000000 in
Depth of maximum shear force	=	171.36000 in
Number of iterations	=	60
Number of zero deflection points	=	1

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment,	y = pile-head displacment in
Type 2 = Shear and Slope,	M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,	V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,	S = Pile-head Slope, radians
Type 5 = Deflection and Slope,	R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs

1	V=	17000.	M=	1.62E+07	19000.0000	0.6783419	1.7182E+07	-142267.

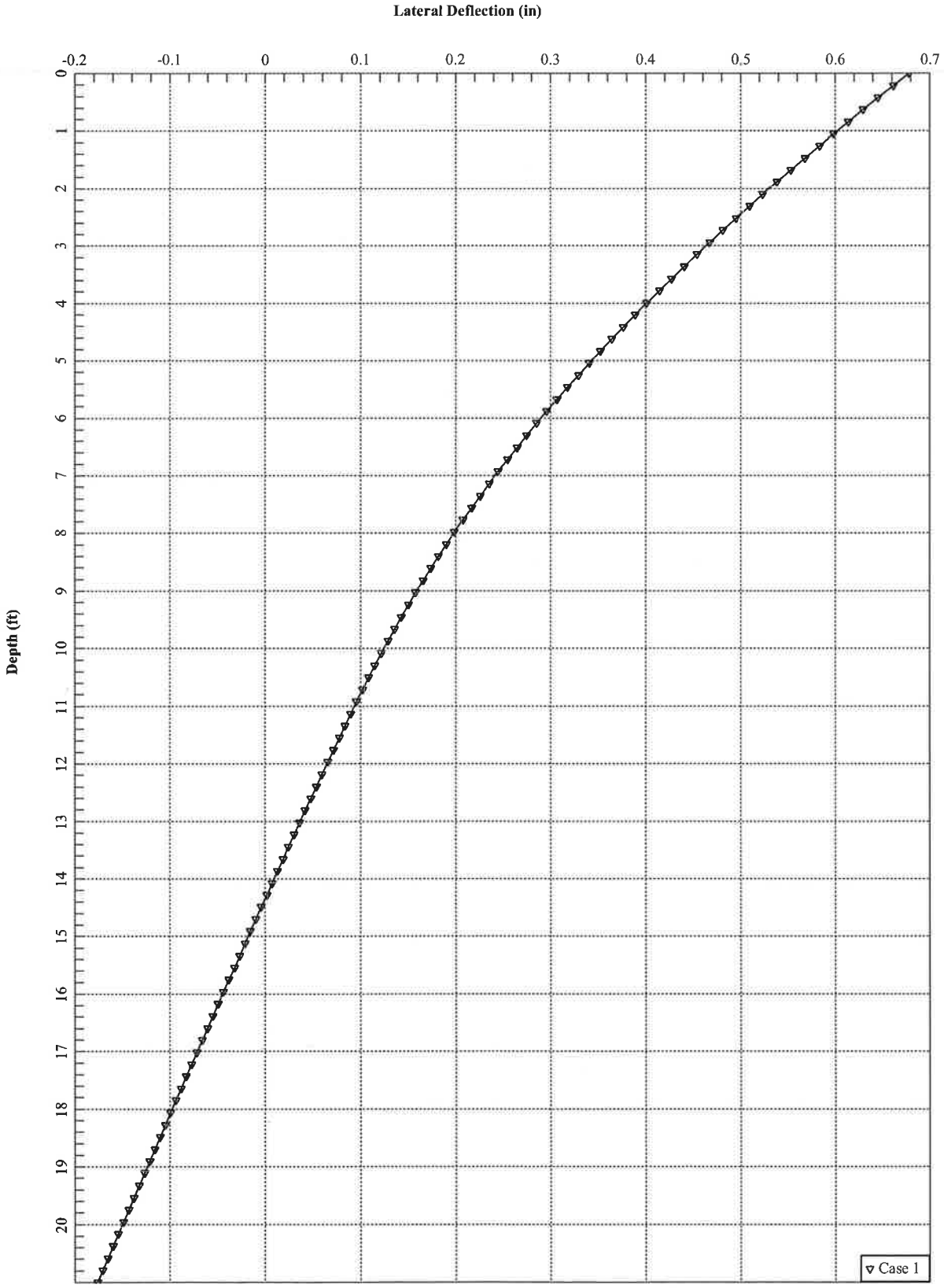
Computed Pile-head Stiffness Matrix Members
K22, K23, K32, K33 for Superstructure

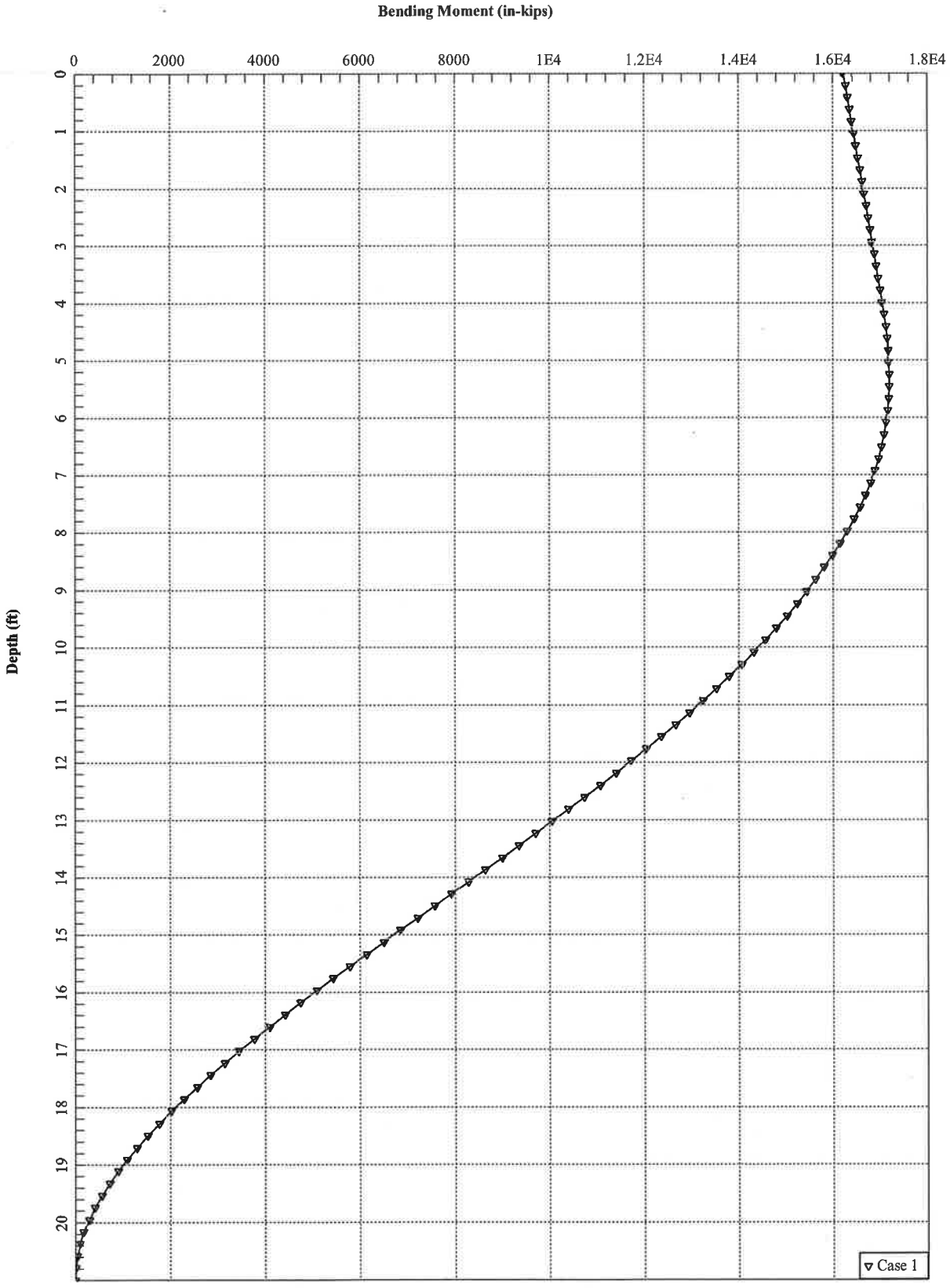
Top y in	Shear React. lbs	Mom. React. in-lbs	K22 lbs/in	K32 in-lbs/in
0.00132930	1700.00003	245542.12227	1278865.	1.847149E+08
0.00400160	5117.50993	739155.42900	1278865.	1.847149E+08
0.00634239	8111.06133	1171534.	1278865.	1.847149E+08
0.00800320	10235.01985	1478311.	1278865.	1.847149E+08
0.00929143	11882.49007	1716266.	1278865.	1.847149E+08
0.01034399	13228.57126	1910689.	1278865.	1.847149E+08
0.01123392	14366.66668	2075072.	1278865.	1.847149E+08
0.01200481	15352.52978	2217466.	1278865.	1.847149E+08
0.01268478	16222.12266	2343067.	1278865.	1.847149E+08
0.01329304	17000.00000	2455421.	1278865.	1.847149E+08

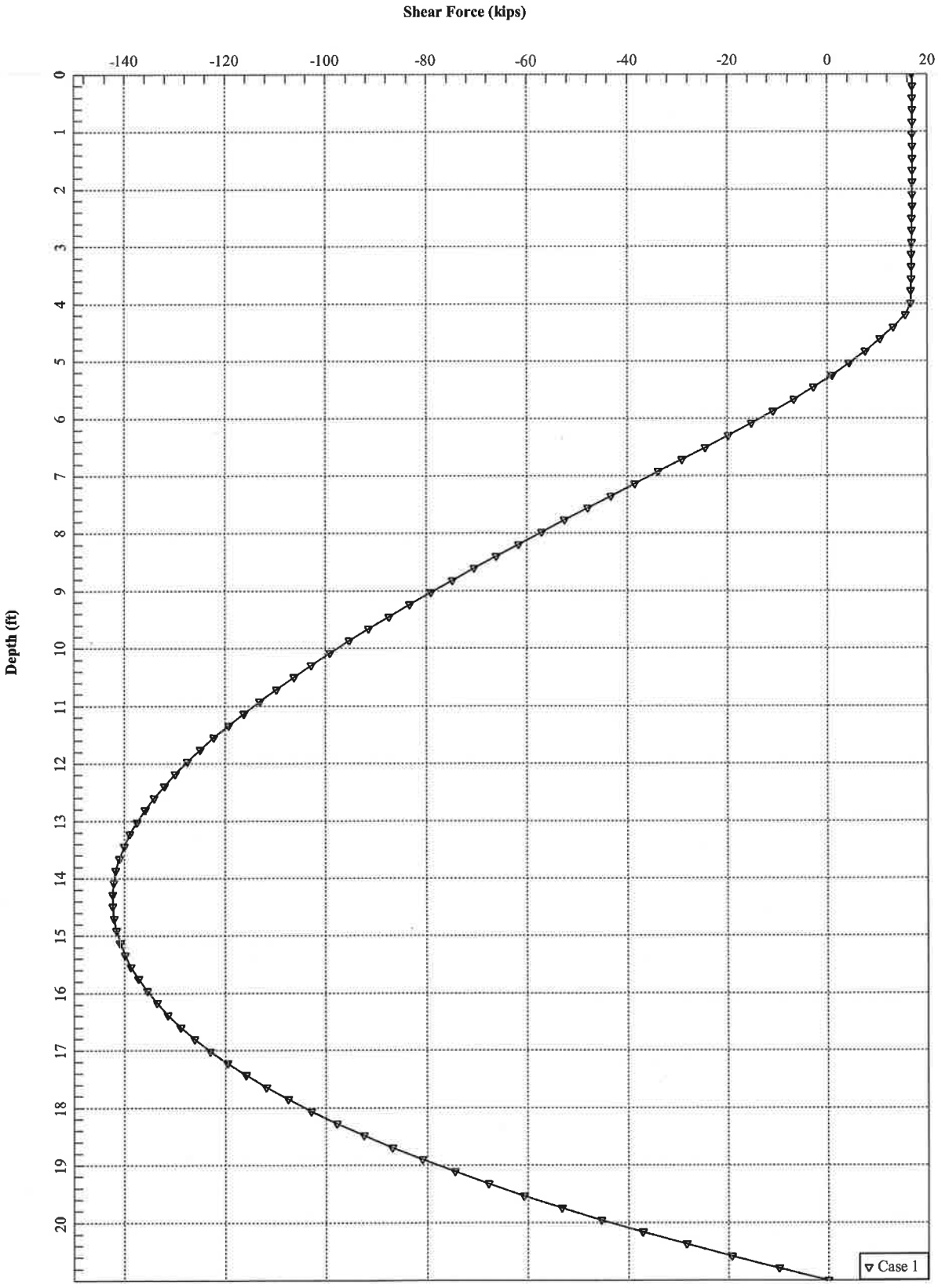
Top Rota. rad	Shear React. lbs	Mom. React. in-lbs	K23 lbs/rad	K33 in-lbs/rad
0.00004970	9181.17678	1621200.	1.847149E+08	3.261671E+10
0.00014990	27640.12574	4880298.	1.843921E+08	3.255732E+10
0.00023819	43815.67574	7735090.	1.839519E+08	3.247433E+10
0.00030114	55296.18323	9760597.	1.836212E+08	3.241187E+10
0.00035014	64203.36662	11331702.	1.833628E+08	3.236299E+10
0.00039030	71482.52340	12615388.	1.831453E+08	3.232188E+10
0.00042992	77642.84061	13700729.	1.805973E+08	3.186790E+10
0.00048012	83011.08290	14640895.	1.728965E+08	3.049424E+10
0.00096327	89003.59186	15470180.	92397785.	1.606014E+10
0.00114307	94205.67815	16212000.	82414689.	1.418287E+10

K22 = abs(Shear Reaction/Top y)
K23 = abs(Shear Reaction/Top Rotation)
K32 = abs(Moment Reaction/Top y)
K33 = abs(Moment Reaction/Top Rotation)

The analysis ended normally.


Lateral Deflection (in)
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Case 1


Bending Moment (in-kips)
0
2000
4000
6000
8000
1E4
1.2E4
1.4E4
1.6E4
1.8E4
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Case 1


Shear Force (kips)
-140
-120
-100
-80
-60
-40
-20
0
20
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Case 1

SITE NAME	GERMANTOWN CT	ECP - CELL #	AWS1	5	293	
LATITUDE	41-24-12.34 N	LONGITUDE	73-25-26.44 W			
Additional Comments:		SAVE BUTTON				
		STRUCTURE TYPE	MONOPOLE			

AWS - LTE ANTENNA ADD	ALPHA	BETA	GAMMA	
EQUIPMENT TYPE	2100 MHz BBU + RRH	2100 MHz BBU + RRH	2100 MHz BBU + RRH	
ANTENNA TYPE	BXA-171063-8BF-EDIN-0	BXA-171063-8BF-EDIN-0	BXA-171063-8BF-EDIN-0	
QTY OF ANTENNAS PER FACE	1	1	1	
ORIENTATION (DEG)	30	150	270	
DOWN TILT (MECH/DEG)	0	0	0	
RAD CTR (FT AGL)	90	90	90	
TMA - QTY / MODEL				
DIPLEXER - QTY / MODEL				
RRH - QTY/MODEL	1 ALU RH_2X40-AWS	1 ALU RH_2X40-AWS	1 ALU RH_2X40-AWS	
SECTOR DISTRIBUTION BOX				ROOFTOP ONLY
MAIN DISTRIBUTION BOX	1		DB-T1-6Z-8AB-0Z	

700 Mhz - LTE Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	700 eNodeB + TRDU	700 eNodeB + TRDU	700 eNodeB + TRDU
ANTENNA TYPE	P65-16-XL-2_2_790_-2	P65-16-XL-2_2_790_-2	BXA-70063-4CF-750MHZ
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	90	90	90
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

700 Mhz - LTE Future Config	ALPHA	BETA	GAMMA	
EQUIPMENT TYPE	700 BBU + RRH	700 BBU + RRH	700 BBU + RRH	
ANTENNA TYPE	BXA-70063-6CF-2-750MHZ	BXA-70063-6CF-2-750MHZ	BXA-70063-6CF-750MHZ	
QTY OF ANTENNAS PER FACE	1	1	1	
ORIENTATION (DEG)	30	150	270	
DOWN TILT (MECH/DEG)	0	0	0	
RAD CTR (FT AGL)	90	90	90	
TMA - QTY / MODEL				
DIPLEXER - QTY / MODEL				
RRH - QTY/MODEL	1 ALU RH_2X40-700	1 ALU RH_2X40-700	1 ALU RH_2X40-700	
SECTOR DISTRIBUTION BOX				ROOFTOP ONLY
MAIN DISTRIBUTION BOX				

850 Celluar - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Mod 4.0B	Cellular Mod 4.0B	Cellular Mod 4.0B
ANTENNA TYPE	DB846H80E-SX_0	DB846H80E-SX_0	DB846F65ZAXY_869_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)	90	90	90
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

850 Celluar - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Mod 4.0B	Cellular Mod 4.0B	Cellular Mod 4.0B
ANTENNA TYPE	BXA-80080-6CF	BXA-80080-6CF	BXA-80063-6BF
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	90	90	90
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL	2 FD9R6004/2C-3L	2 FD9R6004/2C-3L	2 FD9R6004/2C-3L
DIPLEX WITH LTE CABLE			

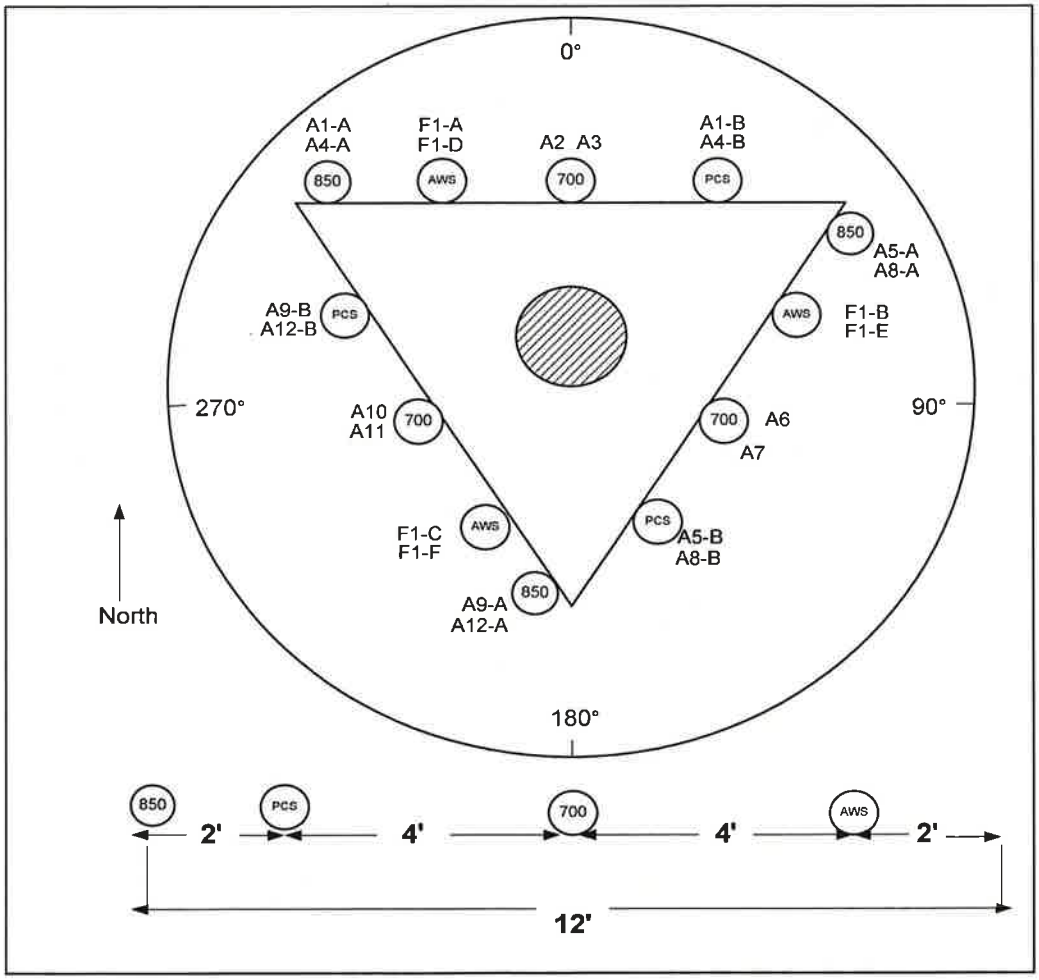
1900 PCS - Current Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Mod 4.0B	PCS Mod 4.0B	PCS Mod 4.0B
ANTENNA TYPE	MG D3-800T0	MG D3-800T0	MG D3-800T0
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	90	90	90
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

1900 PCS - Future Config	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Mod 4.0B	PCS Mod 4.0B	PCS Mod 4.0B
ANTENNA TYPE	MG D3-800T0	MG D3-800T0	MG D3-800T0
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270

DOWN TILT (MECH/DEG)		0		0		0					
RAD CTR (FT AGL)		90		90		90					
TMA - QTY / MODEL											
DIPLEX WITH CELLULAR CABLE		DIPLEX with Cellular Cable		DIPLEX with Cellular Cable		DIPLEX with Cellular Cable					
NUMBER OF CABLE'S NEEDED						**Fiber Lines Model number**					
TOTAL # FIBER LINES	1	TOTAL # OF MAINLINES		12		FIBER LINE MODEL #				HB158-1-08U8-S8J18	
TOTAL # TOP JUMPERS	12	TOTAL # OF TOP JUMPERS		12		FIBER TOP JUMPER MODEL #				HB114-1-08U4-S4J18	
Equipment Cable Ordering		**MAIN CABLE**	12	+		**TOP JUMPER #**	18	+			
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/ AWS (Watts)				40	

ALPHA				**BETA**				**GAMMA**			
Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code
A1-A	800	Tx1/Rx0	RED	A5-A	800	Tx2/Rx0	BLUE	A9-A	800	Tx3/Rx0	GREEN
A1-B	1900	Tx1/Rx0	RED/ WHITE	A5-B	1900	Tx2/Rx0	BLUE/ WHITE	A9-B	1900	Tx3/Rx0	GREEN/WHITE
A2	700	Tx1/Rx0	RED/ ORANGE	A6	700	Tx2/Rx0	BLUE/ ORANGE	A10	700	Tx3/Rx0	GREEN/ORANGE
A3	700	Tx4/Rx1	RED/RED/ ORANGE	A7	700	Tx5/Rx1	BLUE/BLUE/ORANGE	A11	700	Tx6/Rx1	GREEN/GREEN/ORANGE
A4-B	1900	Tx4/Rx1	RED/RED/ WHITE	A8-B	1900	Tx5/Rx1	BLUE/BLUE/WHITE	A12-B	1900	Tx6/Rx1	GREEN/GREEN/WHITE
A4-A	800	Tx4/Rx1	RED/RED	A8-A	800	Tx5/Rx1	BLUE/BLUE	A12-A	800	Tx6/Rx1	GREEN/GREEN
F1-A	1700	Tx/Rx	RED/ BROWN	F1-B	1700	Tx/Rx	BLUE/BROWN	F1-C	1700	Tx/Rx	GREEN/BROWN
F1-D	1700	Tx/Rx	RED/RED/ BROWN	F1-E	1700	Tx/Rx	BLUE/BLUE/BROWN	F1-F	1700	Tx/Rx	GREEN/GREEN/BROWN

RF ENGINEER	**RF MANAGER**	**INITIALS**	**DATE**
Prepared By: Dany Bustamante / Jay Latorre	Robert Hesselbach	DB / JFL	4/29/2013



BXA-171063-8BF-EDIN-X

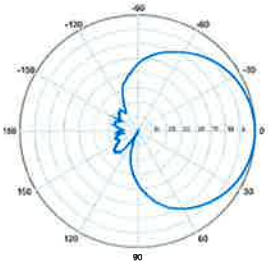
Replace "X" with desired electrical downtilt.

X-Pol | FET Panel | 63° | 17.4 dBi

Electrical Characteristics	1710-2170 MHz		
Frequency bands	1710-1880 MHz	1850-1990 MHz	1920-2170 MHz
Polarization	±45°	±45°	±45°
Horizontal beamwidth	68°	65°	60°
Vertical beamwidth	7°	7°	7°
Gain	14.5 dBd / 16.6 dBi	14.9 dBd / 17.0 dBi	15.3 dBd / 17.4 dBi
Electrical downtilt (X)	0, 2, 4, 8		
Impedance	50Ω		
VSWR	≤1.5:1		
First upper sidelobe	< -17 dB		
Front-to-back isolation	> 30 dB		
In-band isolation	> 28 dB		
IM3 (20W carrier)	< -150 dBc		
Input power	300 W		
Lightning protection	Direct Ground		
Connector(s)	2 Ports / EDIN / Female / Bottom		
Operating temperature	-40° to +60° C / -40° to +140° F		
Mechanical Characteristics			
Dimensions Length x Width x Depth	1232 x 154 x 105 mm	48.5 x 6.1 x 4.1 in	
Depth with t-brackets	133 mm	5.2 in	
Weight without mounting brackets	4.8 kg	10.5 lbs	
Survival wind speed	296 km/hr	184 mph	
Wind area	Front: 0.19 m² Side: 0.14 m²	Front: 2.0 ft² Side: 1.5 ft²	
Wind load @ 161 km/hr (100 mph)	Front: 281 N Side: 223 N	Front: 63 lbf Side: 50 lbf	

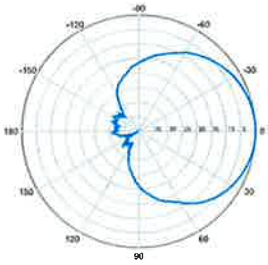
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	26799997	50-102 mm 2.0-4.0 in	2.3 kg 5 lbs
2-Point Mounting & Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	3.6 kg 8 lbs
Concealment Configurations	For concealment configurations, order BXA-171063-8BF-EDIN-X-FP		

BXA-171063-8BF-EDIN-X



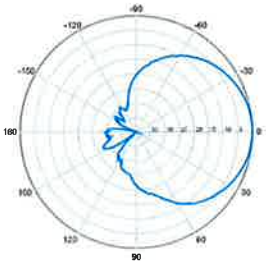
Horizontal | 1710-1880 MHz

BXA-171063-8BF-EDIN-X



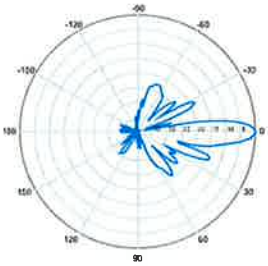
Horizontal | 1850-1990 MHz

BXA-171063-8BF-EDIN-X



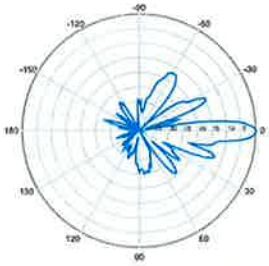
Horizontal | 1920-2170 MHz

BXA-171063-8BF-EDIN-0



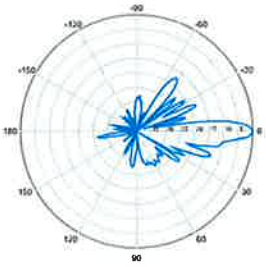
0° | Vertical | 1710-1880 MHz

BXA-171063-8BF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171063-8BF-EDIN-0



0° | Vertical | 1920-2170 MHz

BXA-80080-6CF-EDIN-X

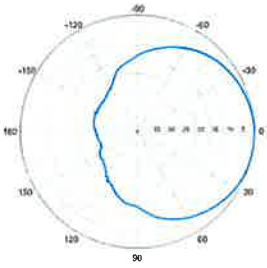
X-Pol | FET Panel | 80° | 13.5 dBd

Replace "X" with desired electrical downtilt.

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

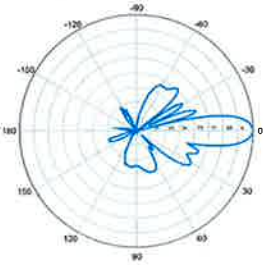
Electrical Characteristics				
Frequency bands	806-900 MHz*			
*Optional frequency band for iDEN	806-941 MHz (specify when ordering)			
Polarization	±45°			
Horizontal beamwidth	80°			
Vertical beamwidth	10°			
Gain	13.5 dBd (15.6 dBi)			
Electrical downtilt (X)	0, 2, 4, 6, 8, 10			
Impedance	50Ω			
VSWR	≤1.4:1			
Upper sidelobe suppression (0°)	-18.6 dB			
Front-to-back ratio (+/-30°)	-25.6 dB			
Null fill	5% (-26.02 dB)			
Isolation between ports	< -30 dB			
Input power with EDIN connectors	500 W			
Input power with NE connectors	300 W			
Lightning protection	Direct Ground			
Connector(s)	2 Ports / EDIN or NE / Female / Center (Back)			
Mechanical Characteristics				
Dimensions Length x Width x Depth	1804 x 204 x 151 mm		71.0 x 8.0 x 5.9 in	
Depth with z-brackets	191 mm		7.5 in	
Weight without mounting brackets	8.2 kg		18 lbs	
Survival wind speed	> 201 km/hr		> 125 mph	
Wind area	Front: 0.37 m²	Side: 0.27 m²	Front: 3.9 ft²	Side: 2.9 ft²
Wind load @ 161 km/hr (100 mph)	Front: 531 N	Side: 475 N	Front: 119 lbf	Side: 104 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-80080-6CF-EDIN-X-FP			

BXA-80080-6CF-EDIN-X



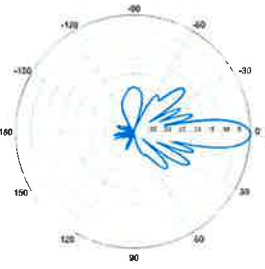
Horizontal

BXA-80080-6CF-EDIN-0



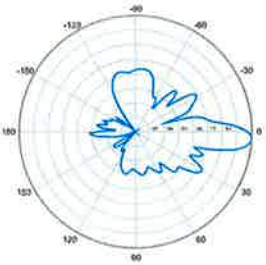
0° | Vertical

BXA-80080-6CF-EDIN-2



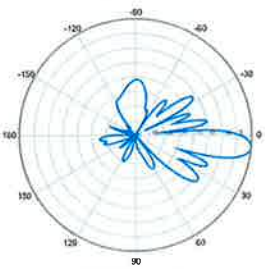
2° | Vertical

BXA-80080-6CF-EDIN-4



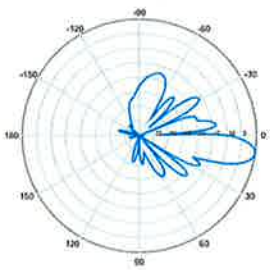
4° | Vertical

BXA-80080-6CF-EDIN-6



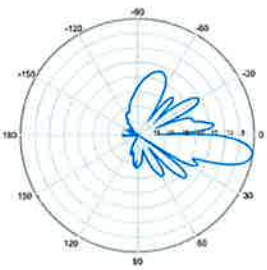
6° | Vertical

BXA-80080-6CF-EDIN-8



8° | Vertical

BXA-80080-6CF-EDIN-10



10° | Vertical

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-80063-6BF-EDIN-X

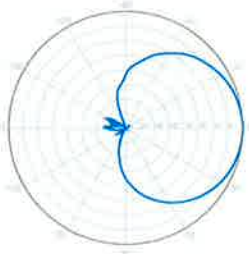
X-Pol | FET Panel | 63° | 14.5 dBd

Replace "X" with desired electrical downtilt.

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

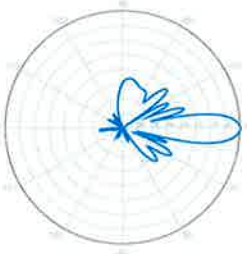
Electrical Characteristics				
Frequency bands	806-900 MHz*			
*Optional frequency band for iDEN	806-941 MHz (specify when ordering)			
Polarization	±45°			
Horizontal beamwidth	63°			
Vertical beamwidth	11°			
Gain	14.5 dBd (16.6 dBi)			
Electrical downtilt (X)	0, 2, 3, 4, 5, 6, 8, 10, 15			
Impedance	50Ω			
VSWR	≤1.4:1			
Upper sidelobe suppression (0°)	-18.2 dB			
Front-to-back ratio (+/-30°)	-36.3 dB			
Null fill	5% (-26.02 dB)			
Isolation between ports	< -25 dB			
Input power with EDIN connectors	500 W			
Input power with N connectors	300 W			
Lightning protection	Direct Ground			
Connector(s)	2 Ports / EDIN or N / Female / Bottom			
Mechanical Characteristics				
Dimensions Length x Width x Depth	1742 x 285 x 135 mm		68.6 x 11.2 x 5.3 in	
Depth with z-brackets	175 mm		6.9 in	
Weight without mounting brackets	8.7 kg		19.2 lbs	
Survival wind speed	> 201 km/hr		> 125 mph	
Wind area	Front: 0.50 m^2	Side: 0.24 m^2	Front: 5.3 ft^2	Side: 2.5 ft^2
Wind load @ 161 km/hr (100 mph)	Front: 733 N	Side: 386 N	Front: 164 lbf	Side: 88 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-80063-6BF-EDIN-X-FP			

BXA-80063-6BF-EDIN-X



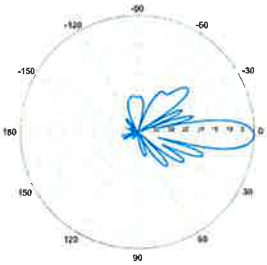
Horizontal

BXA-80063-6BF-EDIN-0



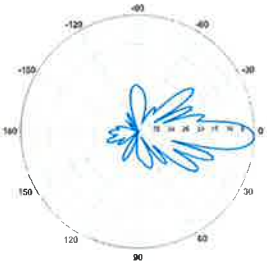
0° | Vertical

BXA-80063-6BF-EDIN-2



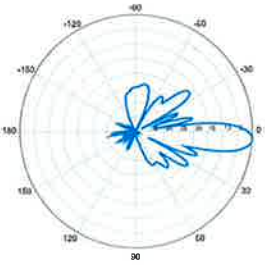
2° | Vertical

BXA-80063-6BF-EDIN-3



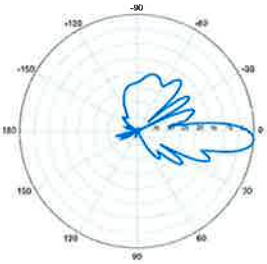
3° | Vertical

BXA-80063-6BF-EDIN-4



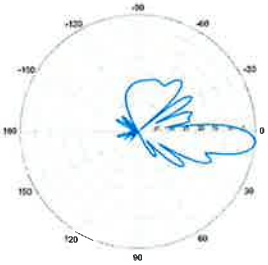
4° | Vertical

BXA-80063-6BF-EDIN-5



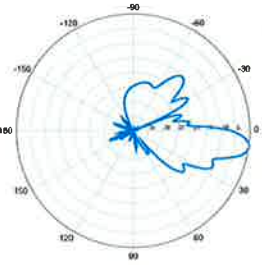
5° | Vertical

BXA-80063-6BF-EDIN-6



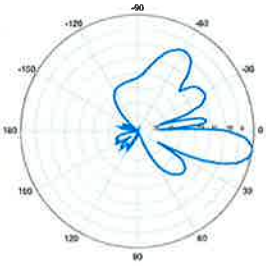
6° | Vertical

BXA-80063-6BF-EDIN-8



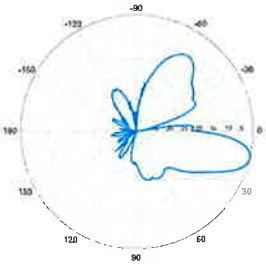
8° | Vertical

BXA-80063-6BF-EDIN-10



10° | Vertical

BXA-80063-6BF-EDIN-15



15° | Vertical

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Alcatel-Lucent RRH2x40-AWS

REMOTE RADIO HEAD

The Alcatel-Lucent RRH2x40-AWS is a high-power, small form-factor Remote Radio Head (RRH) operating in the AWS frequency band (1700/2100MHz - 3GPP Band 4). The Alcatel-Lucent RRH2x40-AWS is designed with an eco-efficient approach, providing operators with the means to achieve high quality and capacity coverage with minimum site requirements.

A distributed eNodeB expands deployment options by using two components, a Base Band Unit (BBU) containing the digital assets and a separate RRH containing the radio-frequency (RF) elements. This modular design optimizes available space and allows the main components of an eNodeB to be installed separately, within the same site or several kilometres apart.

The Alcatel-Lucent RRH2x40-AWS is linked to the BBU by an optical-fiber connection carrying downlink and uplink digital radio signals along with operations, administration and maintenance (OA&M) information. The Alcatel-Lucent RRH2x40-AWS has two transmit RF paths, 40 W RF output power per transmit path, and is designed to manage up to four-way receive diversity. The device is ideally suited to support macro coverage, with multiple-input multiple-output (MIMO) 2x2 operation in up to 20 MHz of bandwidth.

The Alcatel-Lucent RRH2x40-AWS is designed to make available all the benefits of a distributed eNodeB, with excellent RF characteristics, with low capital expenditures (CAPEX) and low operating expenditures (OPEX). The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment or require costly cranes to be employed, leaving coverage holes. However, many of these sites can host an Alcatel-Lucent RRH2x40-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation time and costs.

Fast, low-cost installation and deployment

The Alcatel-Lucent RRH2x40-AWS is a zero-footprint solution and operates noise-free, simplifying negotiations with site property owners and minimizing environmental impacts. Installation can easily be done by a single person because the Alcatel-Lucent RRH2x40-AWS is compact and weighs less than 20 kg (44 lb), eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day — a fraction of the time required for a traditional BTS.

Excellent RF performance

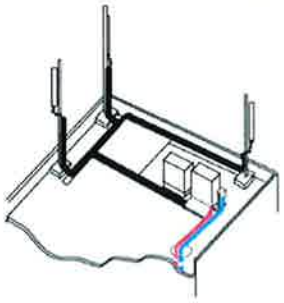
Because of its small size and weight, the Alcatel-Lucent RRH2x40-AWS can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-AWS where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation costs are reduced or eliminated, and there is no need for a Tower Mounted Amplifier (TMA) because losses introduced by the RF feeder are greatly reduced. The Alcatel-Lucent RRH2x40-AWS provides more RF power while at the same time consuming less electricity.

Features

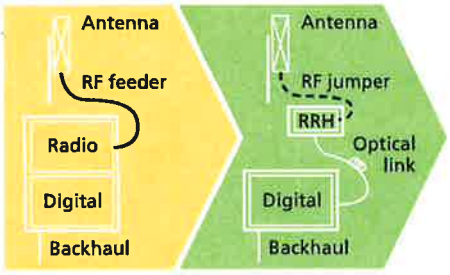
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless)
- Noise-free
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

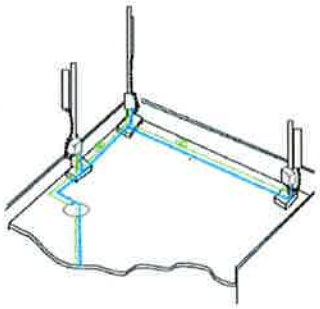
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility to network planning



Macro



RRH for space-constrained cell sites



Distributed

Technical specifications

Physical dimensions

- Height: 620 mm (24.4 in.)
- Width: 270 mm (10.63 in.)
- Depth: 170m (6.7 in.)
- Weight (without mounting kit): less than 20 kg (44 lb)

Power

- Power supply: -48VDC

Operating environment

- Outdoor temperature range:
  - ¬ With solar load: -40°C to +50°C (-40°F to +122°F)
  - ¬ Without solar load: -40°C to +55°C (-40°F to +131°F)
- Passive convection cooling (no fans)
- Enclosure protection
  - ¬ IP65 (International Protection rating)

RF characteristics

- Frequency band: 1700/2100 MHz (AWS); 3GPP Band 4
- Bandwidth: up to 20 MHz
- RF output power at antenna port: 40 W nominal RF power for each Tx port
- Rx diversity: 2-way or 4-way with optional Rx Diversity module
- Noise figure: below 2.0 dB typical
- Antenna Line Device features
  - ¬ TMA and Remote electrical tilt (RET) support via AISG v2.0

Optical characteristics

Type/number of fibers

- Single-mode variant
  - ¬ One Single Mode Single Fiber per RRH2x, carrying UL and DL using CWDM
  - ¬ Single mode dual fiber (SM/DF)
- Multi-mode variant
  - ¬ Two Multi-mode fibers per RRH2x: one carrying UL, the other carrying DL

Optical fiber length

- Up to 500 m (0.31 mi), using MM fiber
- Up to 20 km (12.43 mi), using SM fiber

Digital Ports and Alarms

- Two optical ports to support daisy-chaining
- Six external alarms

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CPG2809100912 (09)

Alcatel·Lucent

Alcatel-Lucent RRH2x40-07-U

REMOTE RADIO HEAD

The Alcatel-Lucent RRH2x40-07-U is a high-power, small form-factor Remote Radio Head (RRH) operating in the North American Digital Dividend / 700MHz frequency band (3GPP Band 13). The Alcatel-Lucent RRH2x40-07-U is designed with an eco-efficient approach, providing operators with the means to achieve high quality and capacity coverage with minimum site requirements.

A distributed eNodeB expands deployment options by using two components, a Base Band Unit (BBU) containing the digital assets and a separate RRH containing the radio-frequency (RF) elements. This modular design optimizes available space and allows the main components of an eNodeB to be installed separately, within the same site or several kilometres apart.

The Alcatel-Lucent RRH2x40-07-U is linked to the BBU by an optical-fiber connection carrying downlink and uplink digital radio signals along with operations, administration and maintenance (OA&M) information. The Alcatel-Lucent RRH2x40-07-U has two transmit RF paths, 40 W RF output power per transmit path, and is designed to manage up to two-way receive diversity. The device is ideally suited to support macro coverage, with multiple-input multiple-output (MIMO) 2x2 operation in up to 10 MHz of bandwidth.

The Alcatel-Lucent RRH2x40-07-U is designed to make available all the benefits of a distributed eNodeB, with excellent RF characteristics, with low capital expenditures (CAPEX) and low operating expenditures (OPEX). The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment or require costly cranes to be employed, leaving coverage holes. However, many of these sites can host an Alcatel-Lucent RRH2x40-07-U installation, providing more flexible site selection and improved network quality along with greatly reduced installation time and costs.

Fast, low-cost installation and deployment

The Alcatel-Lucent RRH2x40-07-U is a zero-footprint solution and operates noise-free, simplifying negotiations with site property owners and minimizing environmental impacts. Installation can easily be done by a single person because the Alcatel-Lucent RRH2x40-07-U is compact and weights less than 23 kg (50 lb), eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day — a fraction of the time required for a traditional BTS.

Excellent RF performance

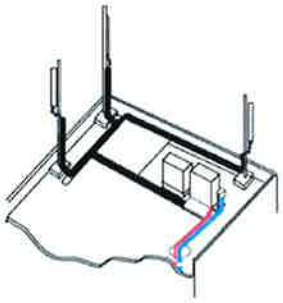
Because of its small size and weight, the Alcatel-Lucent RRH2x40-07-U can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-07-U where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation costs are reduced or eliminated, and there is no need for a Tower Mounted Amplifier (TMA) because losses introduced by the RF feeder are greatly reduced. The Alcatel-Lucent RRH2x40-07-U provides more RF power while at the same time consuming less electricity.

Features

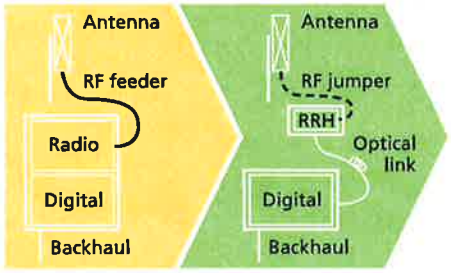
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless), noise-free, and heaterless unit
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

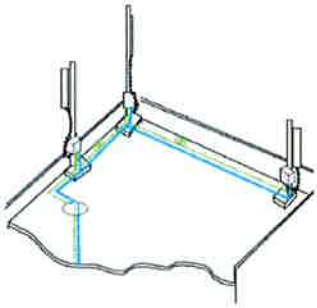
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility to network planning



Macro



RRH for space-constrained cell sites



Distributed

Technical specifications

Physical dimensions

- Height: 390 mm (15.4 in.)
- Width: 380 mm (15 in.)
- Depth: 210 mm (8.2 in.)
- Weight (without mounting kit): less than 23 kg (50 lb)

Power

- Power supply: -48V

Operating environment

- Outdoor temperature range:
  - ¬ With solar load: -40°C to +50°C (-40°F to +122°F)
  - ¬ Without solar load: -40°C to +55°C (-40°F to +131°F)
- Passive convection cooling (no fans)
- Enclosure protection
  - ¬ IP65 (International Protection rating)

RF characteristics

- Frequency band: 700 MHz; 3GPP Band 13
- Bandwidth: up to 10 MHz
- RF output power at antenna port:
  - ¬ 40 W nominal RF power for each Tx port
- Rx diversity: 2-way or 4-way
- Noise figure: below 2.5 dB typical
- ALD features
  - ¬ TMA
  - ¬ Remote electrical tilt (RET) support (AISG v2.0)

Optical characteristics

Type/number of fibers

- Up to 3.12 Gb/s line bit rate
- Single-mode variant
  - ¬ One SM fiber (9/125 µm) per RRH2x, carrying UL and DL using CWDM (at 1550/1310 nm)
- Multi-mode variant
  - ¬ Two MM fibers (50/125 µm) per RRH2x: one carrying UL, the other carrying DL (at 850 nm)

Optical fiber length

- Up to 500 m (0.31 mi), using MM fiber
- Up to 20 km (12.43 mi), using SM fiber

Alarms and ports

- Six external alarms
- Two optical ports to support daisy-chaining

Alcatel·Lucent

Product Data Sheet DB-B1 and DB-T1 Series

DC and Fiber Management Distribution Boxes for HYBRIFLEX™ Cable

Product Description

The RFS Distribution Box design comes with the option for pluggable over voltage protection (OVP) for up to 6 remote radios and the connection for 6 pairs of optical fiber with LC optical fiber cable management. There is a hybrid cable input with a jumper configuration for power and optical fiber to the remote radio heads (RRHs). A custom wall, a 2-inch pole, and an H-Frame mounting bracket are included. Both the compact and standard design are available with lightening protection.

Features/Benefits

- Designed to accommodate varying diameters of HYBRIFLEX™ (combined power and fiber optic) cables – up to 2 inches
- Supports Single- and Multi-Mode Optical fiber
- NEMA 4x rated enclosure – allows **flexibility for indoor or outdoor installation** on a roof or tower top
- Weatherproof enclosure and ports – **improves system reliability**
- Modular design – makes replacement or addition of OVP easy without removal of other components within the box
- Strikesorb OVP technology – protects equipment from damaging surges up to 60 kA on an 8/20 waveform and up to 5 kA on a 10/350 waveform (certain models only)
- Low residual voltage and high impedance – **ideally suited for RRH technology** – won't shut down the RRH the way spark gap technology does (certain models only)

Technical Specifications

Mechanical Specifications

Model Number	DB-B1-6C-8AB-0Z	DB-T1-6Z-8AB-0Z
Enclosure Design	Standard, 6 OVP's	Standard without OVP
Dimensions - H x W x D, mm (in)	610 x 610 x 254 (24 x 24 x 10)	610 x 610 x 254 (24 x 24 x 10)
Weight, kg (lb)	20 (44)	20 (44)
Suppression Connection Method	Compression lug, #2-#14 AWG Copper, #2-#12 Aluminum	
Fiber Connection Method	LC-LC Single- or Multi-mode duplex	
Environmental Rating	NEMA 4x	
Operating Temperature, °C (°F)	-40 to +80 (-40 to +176)	
UV Protection	ISO 4892-2 Method A Xenon-Arc 2160 hrs	

Electrical Specifications

Nominal Operating Voltage	48 VDC	
Nominal Discharge Current (I_n) per UL 1449 3rd Ed	20 kA 8/20 µs	N/A
Maximum Discharge Current (I_{max}) per NEMA LS-1	60 kA 8/20 µs	N/A
Maximum Impulse (Lightning) Current (I_{imp}) per IEC 61643-1	5 kA 10/350 µs	N/A
Maximum Continuous Operating Voltage (U_c)	75 VDC	N/A
Voltage Protection Rating per UL1449 3rd Ed	400 V	N/A
Protection Class as per IEC 61643-1	Class 1	N/A
Strikesorb OVP Compliance	ANSI/UL 1449-3rd Ed	N/A
	IEEE C62.41	N/A
	NEMA LS-1	N/A
	IEC 61643-1	N/A
	IEC 61643-12	N/A
	EN 61643-11	N/A

* This data is provisional and subject to change.

Product Data Sheet HB158-1-08U8-S8J18

HYBRIFLEX™ RRH Hybrid Feeder Cabling Solution, 1-5/8", Single-Mode Fiber

Product Description

RFS' HYBRIFLEX Remote Radio Head (RRH) hybrid feeder cabling solution combines optical fiber and DC power for RRHs in a single lightweight aluminum corrugated cable, making it the world's most innovative solution for RRH deployments.

It was developed to reduce installation complexity and costs at Cellular sites. HYBRIFLEX allows mobile operators deploying an RRH architecture to standardize the RRH installation process and eliminate the need for and cost of cable grounding. HYBRIFLEX combines optical fiber (multi-mode or single-mode) and power in a single corrugated cable. It eliminates the need for junction boxes and can connect multiple RRHs with a single feeder. Standard RFS CELLFLEX® accessories can be used with HYBRIFLEX cable. Both pre-connectorized and on-site options are available.

Figure 1: HYBRIFLEX Series

Features/Benefits

- Aluminum corrugated armor with outstanding bending characteristics – **minimizes installation time and enables mechanical protection and shielding**
- Same accessories as 1 5/8" coaxial cable
- Outer conductor grounding – **Eliminates typical grounding requirements and saves on installation costs**
- Lightweight solution and compact design – **Decreases tower loading**
- Robust cabling – **Eliminates need for expensive cable trays and ducts**
- Installation of tight bundled fiber optic cable pairs directly to the RRH – **Reduces CAPEX and wind load by eliminating need for interconnection**
- Optical fiber and power cables housed in single corrugated cable – **Saves CAPEX by standardizing RRH cable installation and reducing installation requirements**
- Outdoor polyethylene jacket – **Ensures long-lasting cable protection**

Technical Specifications

Structure			
Outer Conductor Armor:	Corrugated Aluminum	[mm (in)]	46.5 (1.83)
Jacket:	Polyethylene, PE	[mm (in)]	50.3 (1.98)
UV-Protection:	Individual and External Jacket		Yes
Mechanical Properties			
Weight, Approximate		[kg/m (lb/ft)]	1.9 (1.30)
Minimum Bending Radius, Single Bending		[mm (in)]	200 (8)
Minimum Bending Radius, Repeated Bending		[mm (in)]	500 (20)
Recommended/Maximum Clamp Spacing		[m (ft)]	1.0 / 1.2 (3.25 / 4.0)
Electrical Properties			
DC-Resistance Outer Conductor Armor		[Ω/km (Ω/1000ft)]	068 (0.205)
DC-Resistance Power Cable, 8.4mm² (8AWG)		[Ω/km (Ω/1000ft)]	2.1 (0.307)
Fiber Optic Properties			
Version			Single-mode OM3
Quantity, Fiber Count			16 (8 pairs)
Core/Clad		[µm]	50/125
Primary Coating (Acrylate)		[µm]	245
Buffer Diameter, Nominal		[µm]	900
Secondary Protection, Jacket, Nominal		[mm (in)]	2.0 (0.08)
Minimum Bending Radius		[mm (in)]	104 (4.1)
Insertion Loss @ wavelength 850nm		dB/km	3.0
Insertion Loss @ wavelength 1310nm		dB/km	1.0
Standards (Meets or exceeds)			UL94-V0, UL1666 RoHS Compliant
DC Power Cable Properties			
Size (Power)		[mm² (AWG)]	8.4 (8)
Quantity, Wire Count (Power)			16 (8 pairs)
Size (Alarm)		[mm² (AWG)]	0.8 (18)
Quantity, Wire Count (Alarm)			4 (2 pairs)
Type			UV protected
Strands			19
Primary Jacket Diameter, Nominal		[mm (in)]	6.8 (0.27)
Standards (Meets or exceeds)			NFPA 130, ICEA S-95-658 UL Type XHHW-2, UL 44 UL-LS Limited Smoke, UL VW-1 IEEE-383 (1974), IEEE1202/FT4 RoHS Compliant
Environment			
Installation Temperature		[°C (°F)]	-40 to +65 (-40 to149)
Operation Temperature		[°C (°F)]	-40 to +65 (-40 to149)

* This data is provisional and subject to change.

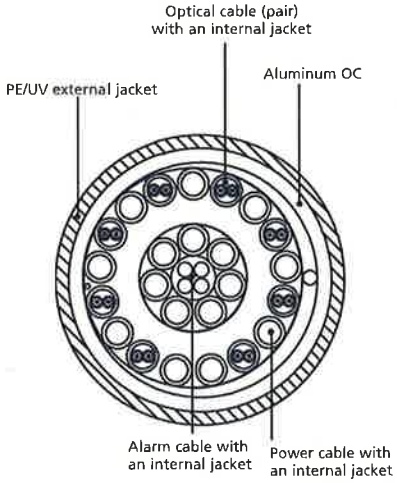


Figure 2: Construction Detail

P65-16-XL -2 Very Low Broadband Antennas

POLARIZATION: Dual linear ±45°
FREQUENCY (MHz): 698-894
HORIZONTAL BEAM WIDTH (°): 65
GAIN (dBi/dBd): 16.0/13.9
TILT: 2
LENGTH: 72"

ELECTRICAL SPECIFICATIONS*

Frequency range (MHz)	698-894		
Frequency band (MHz)	698-806		806-894
Gain (dBi/dBd)	15.5/13.4		16.0/13.9
Polarization			
Nominal Impedance (Ω)			
VSWR			
Horizontal beam width, -3 dB (°)	68		65
Vertical beam width, -3 dB (°)	10.5		9.5
Electrical down tilt (°)			
Side lobe suppression, vertical 1st upper (dB)	> 15		> 15
Isolation between inputs (dB)	> 30		> 30
Tracking, horizontal plane ±60° (dB)	< 2		< 2
First null fill (dB)	-		-
Vertical beam squint (°)	< 0.5		< 0.5
Front to back ratio (dB)	> 30		> 30
Front to back ratio, total power (dB)	> 25		> 25
Cross polar discrimination (XPD) 0° (dB)	> 15	> 15	
Cross polar discrimination (XPD) ±60° (dB)	> 10		> 10
Far field coupling			
IM3, 2xTx@43dBm (dBc)	-153		
IM7, 2xTx@43dBm (dBc)			
Power handling, average per input (W)			
Power handling, average total (W)			

MECHANICAL SPECIFICATIONS*

Connector	2 X 7/16 DIN Female
Connector position	Bottom
Dimensions, HxWxD, mm (ft)	72" x 12" x 5" (1829 x 305 x 125)
Mounting	Pre-mounted Tilt Brackets
Weight, with brackets, kg (lbs)	44 (20)
Weight, without brackets, kg (lbs)	33 (15)
Wind load, frontal/lateral/rear side 42 m/s Cd=1.6 (N)	1380
Maximum operational wind speed, m/s (mph)	100 (45)
Survival wind speed, m/s (mph)	125 (55)
Lightning protection	DC Ground
Radome material	PVC
Radome colour	Light Grey
Package size, HxWxD, mm (ft)	82" x 16" x 10" (2082 x 400 x 255)
Shipping weight, kg (lbs)	55 (25)
RET	N/A
Brackets	7256.00, 7454.00, 2210.00

*All specifications subject to change without notice. Please contact your Powerwave representative for complete performance data.

ANTENNA PATTERNS*

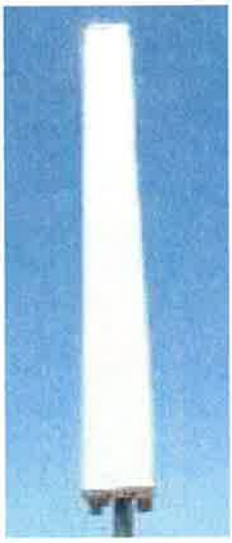
For detailed patterns visit http://www.powerwave.com/rpa/.

MG D3-800Tx

Xpol GSM1800+PCS & UMTS Panel Antenna
15.9 dBd/18 dBi
WIDE BAND 1710-2170 MHz
H 65° V 6.5°

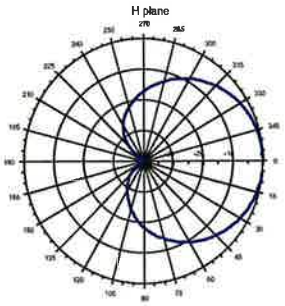
Electrical Specifications

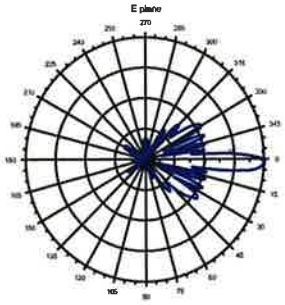
Antenna Model	MG D3-800Tx		
Frequency Range (MHz)	1710-1880	1850-1990	1920-2170
Impedance	50 Ohms		
VSWR	1.40:1		
Polarization	±45°		
Isolation between Ports (dB)	30		
Average Gain (dBd/dBi)	15.7/17.8	15.9/18	16.15/18.25
Horizontal Beamwidth (deg)	65°±5°		
Vertical Beamwidth (deg)	6.5°±0.5°	6.3°±0.5°	6.3°±0.5°
Electrical Tilt (deg)	Fixed 0°-14°		
Sidelobe Suppression (dB)	18	18	18
Front to Back Ratio (dB) @180°±20°	30		
Polarization Isolation (dB) @3 dB Beamwidth	20		
Maximum Power per Input (w)	250		
Intermodulation Products (dBc)	-150		
Connectors	2 x 7/16 Female		
Connector Position	Antenna Bottom		



Mechanical & Environmental Specifications

Dimensions (mm)	1380 x 160 x 90
Survival Wind Speed	200 km/h
Front Windload (N) @ 160 km/h	335
Lateral Windload (N) @ 160 km/h	188
Antenna Weight (kg)	7
Clamps Weight (kg)	2
Mast Mounting	50 to 135 mm
Radome Color	Grey
Grounding	All metallic parts are DC grounded
Temperature Range	-55 to +60°C
Humidity	100 %





Shipping Specifications

Dimensions (mm)	1580 x 340 x 210
Weight (kg)	12
Material	Cardboard and Foam

Ctra. Campo Real, Km 2,100
28500 Arganda del Rey
Madrid-Spain

RYMSA

Phone: 34 91 876 06 81
Fax: 34 91 876 07 09
E-mail: telecom.commercial@rymsa.com
Web: www.rymsa.com

DB844G65ZAXY

Directed Dipole™ Antenna

Base Station Antenna
Directed Dipole™

- Exceptional azimuth roll-off, reducing sector-to-sector interference and softer hand-offs
- Air dielectric feed system, no screws, rivets, welds or solder in RF element feed path
- Strong upper side lobe suppression
- Low profile appearance and low wind loading for easier zoning approvals

ELECTRICAL

Frequency (MHz) :	806 - 896	870 - 960
Polarization :	Vertical	Vertical
Gain (dBd/dBi) :	13.5/15.6	13.8/15.9
Azimuth BW (Deg.):	65	65
Elevation BW (Deg.):	15	15
Beam Tilt (Deg.):	0	0
USLS* (dB) :	15	15
Null Fill (dB) :	<20-25	<20-25
Front-To-Back Ratio* (dB) :	40	40
VSWR :	<1.33:1	<1.33:1
PIM3 @ 2 x 20w (dBc) :	-150	-150
Max. Input Power (Watts) :	500	500
Impedance (Ohms) :	50	50
Lightning Protection :	dc Ground	dc Ground

MECHANICAL

Weight :	5.4 kg (12 lb)
Dimensions (LxWxD) :	1,219 x 254 x 203 mm (48 x 10 x 8 in)
Max. Wind Area :	0.09 m² (1 ft²)
Max. Wind Load (@ 100 mph) :	235.7 N (53 lbf)
Max. Wind Speed :	241 km/h (150 mph)
Hardware Material :	Galvanized steel
Connector Type :	7-16 DIN Female (1, Back)
Color :	Light gray
Standard Mounting Hardware :	DB380
Standard Downtilt Mounting Hardware :	DB5083

Andrew Corporation
2601 Telecom Parkway
Richardson, Texas U.S.A 75082-3521
Tel: 214.631.0310

Fax: 214.631.4706
Toll Free Tel: 1.800.676.5342
Fax: 1.800.229.4706
www.andrew.com

* - Indicates Typical

10/11/2007

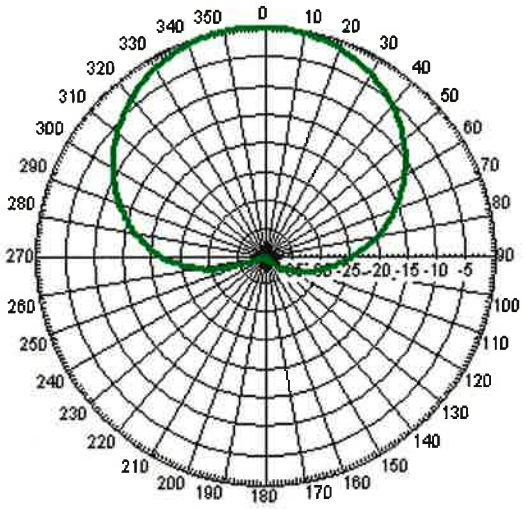
dbtech@andrew.com

DB844G65ZAXY

Directed Dipole™ Antenna

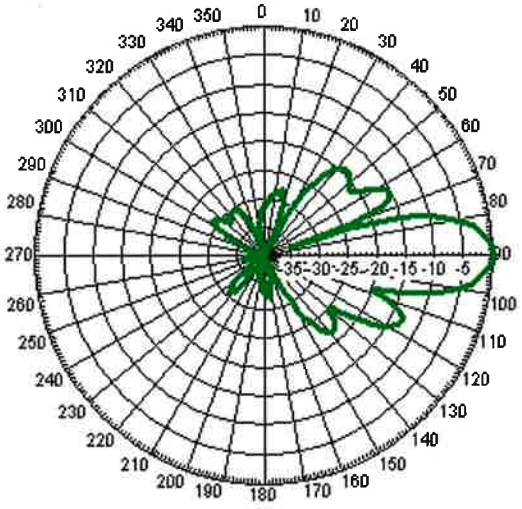
Base Station Antenna
Directed Dipole™

AZIMUTH PATTERN



Freq: 880 MHz, Tilt: 0

ELEVATION PATTERN



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* - Indicates Typical

10/11/2007

dbtech@andrew.com

DB846H80E-SX

Directed Dipole Antenna

Decibel®
Base Station Antennas

- Excellent azimuth roll-off, 15-20% reduction in cell to cell overlap
- Superior front to back ratio
- Low profile, low wind load for easy zoning
- Outstanding field record, with thousands of units deployed, world wide

ELECTRICAL

Frequency (MHz) :	806 - 896
Polarization :	Vertical
Gain (dBd/dBi) :	14/16.1
Azimuth BW (Deg.):	80
Elevation BW (Deg.):	10
Beam Tilt (Deg.):	0
USLS* (dB) :	15
Front-To-Back Ratio* (dB) :	40
VSWR :	<1.5:1
Max. Input Power (Watts) :	500
Impedance (Ohms) :	50
Lightning Protection :	DC Ground

MECHANICAL

Weight :	7.2 kg (16 lb)
Dimensions (LxWxD) :	1,829 x 165 x 203 mm (72 x 6.5 x 8 in)
Max. Wind Area :	0.16 m² (1.7 ft²)
Max. Wind Load (@ 100 mph) :	425.2 N (95.6 lbf)
Max. Wind Speed :	241 km/h (150 mph)
Hardware Material :	Galvanized Steel
Connector Type :	7-16 DIN - Female (1, Back)
Color :	Light Gray
Standard Mounting Hardware :	DB380
Standard Downtilt Mounting Hardware :	DB5083

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* - Indicates Typical

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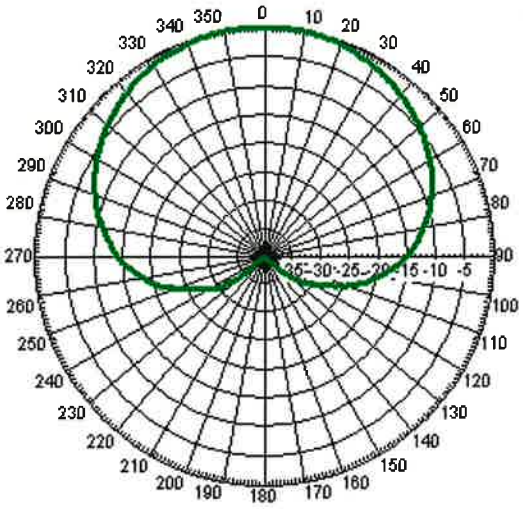
Directed Dipole Antenna

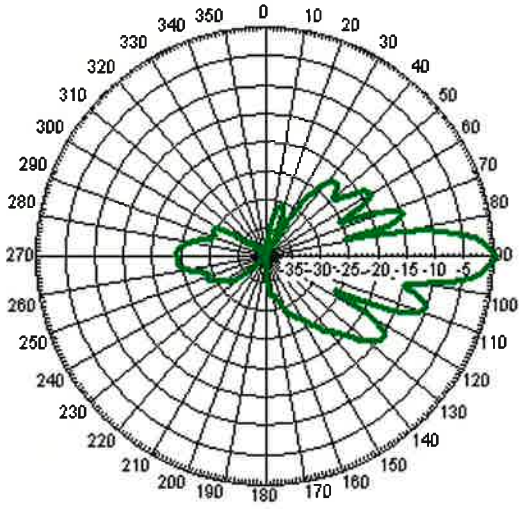
Decibel®
Base Station Antennas

AZIMUTH PATTERN



Freq: 850 MHz, Tilt: 0

ELEVATION PATTERN



Freq: 850 MHz, Tilt: 0

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www.andrew.com

* - Indicates Typical

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