ROBINSON & COLE LLP

KENNETH C. BALDWIN

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

Also admitted in Massachusetts

October 2, 2013

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

Re: **Notice of Exempt Modification – Antenna Swap**
36 Ritch Avenue, Greenwich, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains fifteen (15) wireless telecommunications antennas at the 57-foot level of the existing 84-foot tree tower at the above-referenced address. The tower is owned by Cellco. The Council approved Cellco's shared use of this tower on July 14, 2011, in Docket No. 414. Cellco now intends to replace six (6) of its antennas with three (3) model BXA-171063-12BF PCS antennas and three (3) model BXA-171063-12BF AWS antennas, at the same level on the tower. Cellco also intends to install three (3) remote radio heads ("RRHs") behind its antennas and one (1) HYBRIFLEX™ antenna cable, inside the monopole tower. Included in Attachment 1 are specifications for the 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 Peter Tesei, First Selectman of the Town of Greenwich. A copy of this letter is also being sent to 36 Ritch Avenue LLC, the owner of the property on which the tower is located.

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

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12390119-v1

1. The proposed modifications will not result in an increase in the height of the existing tower. Cellco's replacement antennas and RRHs will be located at the 57-foot level of the 84-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 RF emissions at each of Cellco's operating frequencies, as modified, are included behind Tab 2.

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 Report 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:
Peter Tesei, Greenwich First Selectman
36 Ritch Avenue LLC
Sandy Carter

ATTACHMENT 1

Amphenol ANTENNA SOLUTIONS

BXA-171063-12BF-EDIN-X

Replace "X" with desired electrical downtilt.

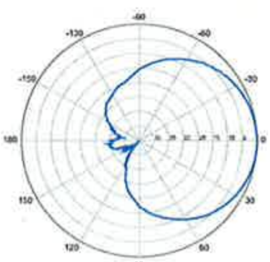
X-Pol | FET Panel | 63° | 19.0 dBi

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

Mechanical Characteristics		
Dimensions Length x Width x Depth	1842 x 154 x 105 mm	72.5 x 6.1 x 4.1 in
Depth with z-brackets	133 mm	5.2 in
Weight without mounting brackets	5.8 kg	12.8 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.28 m² Side: 0.19 m²	Front: 3.1 ft² Side: 2.1 ft²
Wind load @ 161 km/hr (100 mph)	Front: 460 N Side: 304 N	Front: 103 lbf Side: 68 lbf

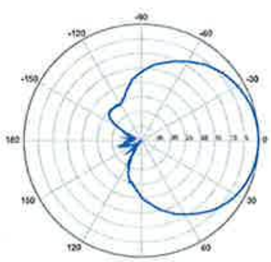
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	26799997	50-102 mm 2.0-4.0 in	2.3 kg 5 lbs
2-Point Mounting & Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	3.6 kg 8 lbs
Concealment Configurations	For concealment configurations, order BXA-171063-12BF-EDIN-X-FP		

BXA-171063-12BF-EDIN-X



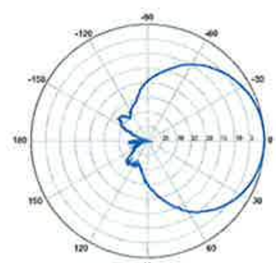
Horizontal | 1710-1880 MHz

BXA-171063-12BF-EDIN-X



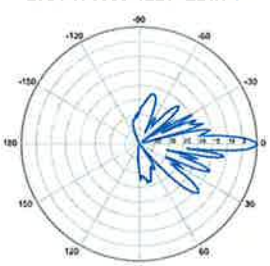
Horizontal | 1850-1990 MHz

BXA-171063-12BF-EDIN-X



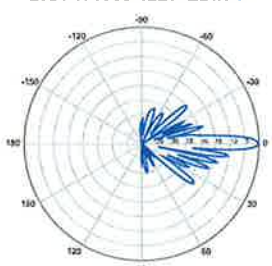
Horizontal | 1920-2170 MHz

BXA-171063-12BF-EDIN-0



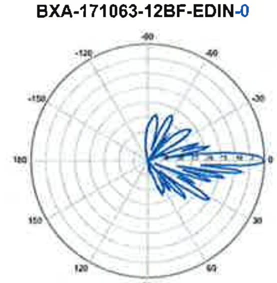
0° | Vertical | 1710-1880 MHz

BXA-171063-12BF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171063-12BF-EDIN-0

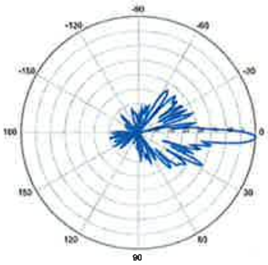


0° | Vertical | 1920-2170 MHz

BXA-171063-12BF-EDIN-X

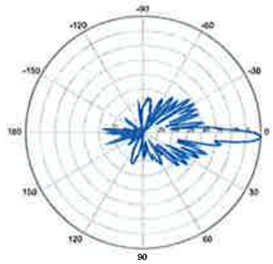
X-Pol | FET Panel | 63° | 19.0 dBi

BXA-171063-12BF-EDIN-2



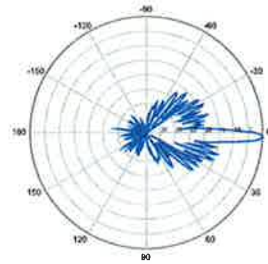
2° | Vertical | 1710-1880 MHz

BXA-171063-12BF-EDIN-2



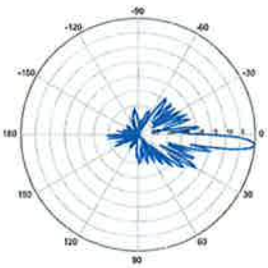
2° | Vertical | 1850-1990 MHz

BXA-171063-12BF-EDIN-2



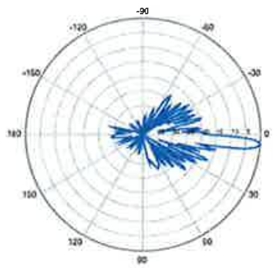
2° | Vertical | 1920-2170 MHz

BXA-171063-12BF-EDIN-5



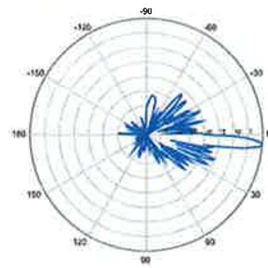
5° | Vertical | 1710-1880 MHz

BXA-171063-12BF-EDIN-5



5° | Vertical | 1850-1990 MHz

BXA-171063-12BF-EDIN-5



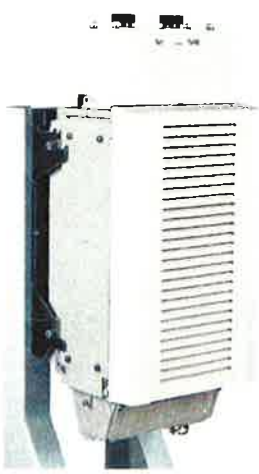
5° | Vertical | 1920-2170 MHz

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

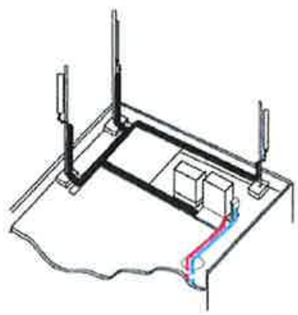
Because of its small size and weight, the Alcatel-Lucent RRH2x40-AWS can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-AWS where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation 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

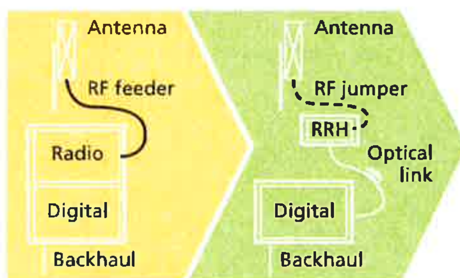
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless)
- Noise-free
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

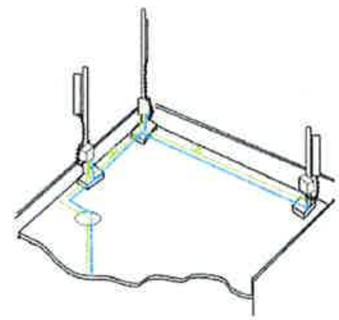
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility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

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

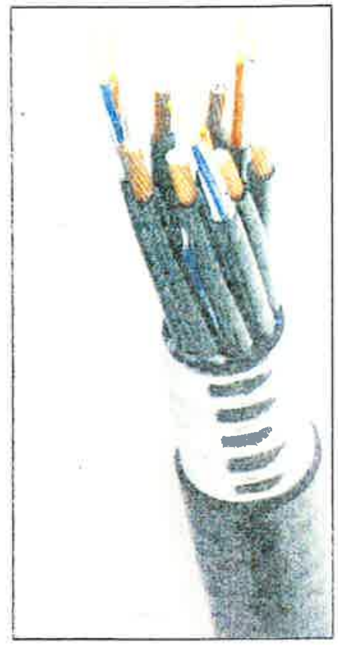


Figure 1: HYBRIFLEX Series

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)		[mm (AWG)]	8.4 (8)
Quantity, Wire Count (Power)			16 (8 pairs)
Size (Alarm)		[mm (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)

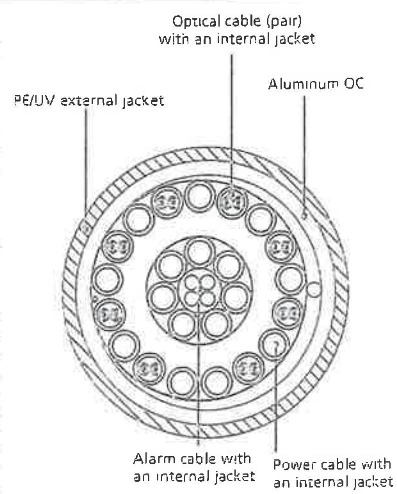


Figure 2: Construction Detail

* This data is provisional and subject to change

ATTACHMENT 2

Far Field Approximation
with downtilt variation

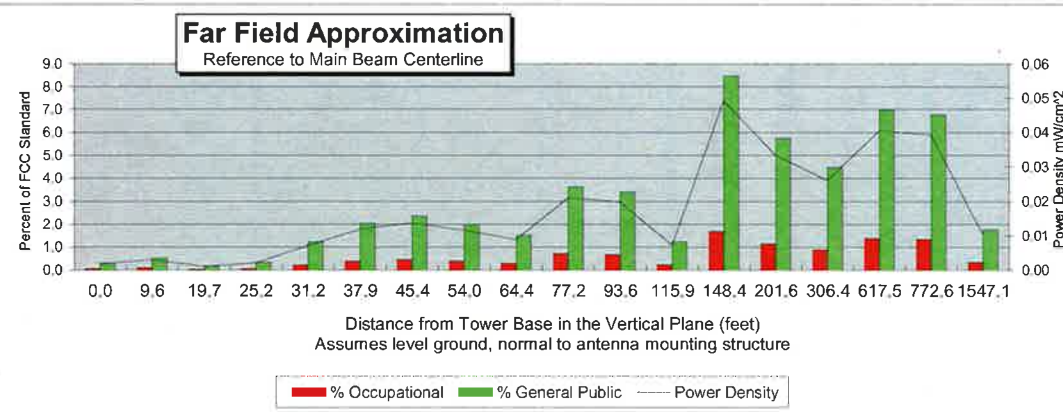
Estimated Radiated Emission

Single Emitter Far Field Model

Dipole / Wire/ Yagi Antenna Types

Location:	BYRAM PARK, CT
Site #:	5-0008
Date:	08/12/13
Name:	Mark Brauer
File Name:	BYRAM PARK, CT - FF Power

Operating Freq. (MHz)	869.0
Antenna Height (ft):	57.0
Antenna Gain (dBi):	14.5
Antenna Size (in.):	72.0
Downtilt (degrees):	0.0
Feedline Loss (dB):	0.0
Power @ J4 (w):	3985.0



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	54.0	54.8	57.5	59.6	62.4	65.9	70.5	76.4	84.0	94.2	108.0	127.8	158.0	208.7	311.1	619.9	774.5	1548.1	
Distance from Antenna Structure Base in Horizontal plane	0.0	9.6	19.7	25.2	31.2	37.9	45.4	54.0	64.4	77.2	93.6	115.9	148.4	201.6	306.4	617.5	772.6	1547.1	
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	
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	
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	
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	0.03	0.03	0.04	0.04	0.01	
Percent of Occupational 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	1.7	1.1	0.9	1.4	1.4	0.4	
Percent of General Population Standard	0.3	0.5	0.2	0.4	1.2	2.0	2.4	2.0	1.5	3.6	3.4	1.2	8.5	5.7	4.5	7.0	6.8	1.8	

Antenna Type LPA-80063-6CF
Max% 8.48%

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

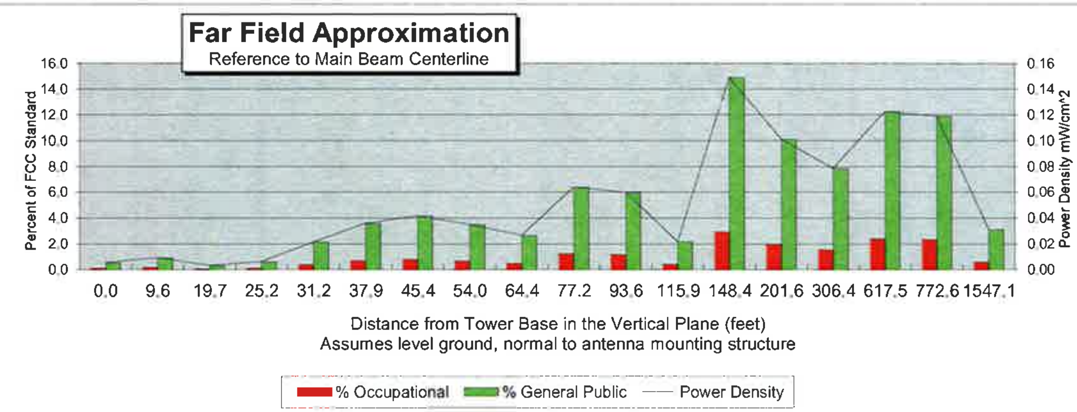
Estimated Radiated Emission

Single Emitter Far Field Model

Dipole / Wire/ Yagi Antenna Types

Location:	BYRAM PARK, CT
Site #:	5-0008
Date:	08/12/13
Name:	Mark Brauer
File Name:	BYRAM PARK, CT - FF Power

Operating Freq. (MHz)	1970.0
Antenna Height (ft):	57.0
Antenna Gain (dBi):	16.5
Antenna Size (in.):	72.0
Downtilt (degrees):	0.0
Feedline Loss (dB):	0.0
Power @ J4 (w):	7622.0



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	54.0	54.8	57.5	59.6	62.4	65.9	70.5	76.4	84.0	94.2	108.0	127.8	158.0	208.7	311.1	619.9	774.5	1548.1	
Distance from Antenna Structure Base in Horizontal plane	0.0	9.6	19.7	25.2	31.2	37.9	45.4	54.0	64.4	77.2	93.6	115.9	148.4	201.6	306.4	617.5	772.6	1547.1	
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	
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	
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	
Power Density (mW/cm^2)	0.01	0.01	0.00	0.01	0.02	0.04	0.04	0.04	0.03	0.06	0.06	0.02	0.15	0.10	0.08	0.12	0.12	0.03	
Percent of Occupational Standard	0.1	0.2	0.1	0.1	0.4	0.7	0.8	0.7	0.5	1.3	1.2	0.4	3.0	2.0	1.6	2.5	2.4	0.6	
Percent of General Population Standard	0.5	0.9	0.3	0.6	2.1	3.6	4.1	3.5	2.7	6.4	6.0	2.2	14.9	10.1	7.9	12.3	11.9	3.1	

Antenna Type BXA-171063-12
Max% 14.90%

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

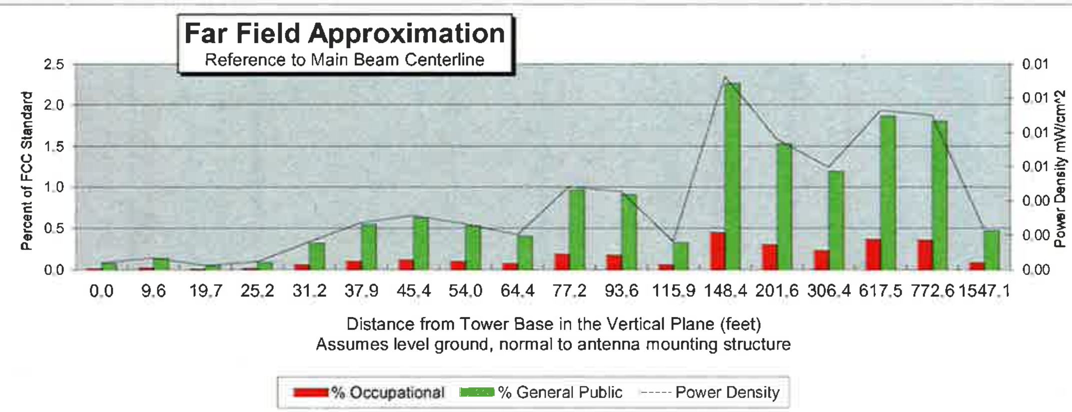
Estimated Radiated Emission

Single Emitter Far Field Model

Dipole / Wire/ Yagi Antenna Types

Location:	BYRAM PARK, CT
Site #:	5-0008
Date:	08/12/13
Name:	Mark Brauer
File Name:	BYRAM PARK, CT - FF Power

Operating Freq. (MHz)	746.0
Antenna Height (ft):	57.0
Antenna Gain (dBi):	13.9
Antenna Size (in.):	80.0
Downtilt (degrees):	0.0
Feedline Loss (dB):	0.0
Power @ J4 (w):	1050.0



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	54.0	54.8	57.5	59.6	62.4	65.9	70.5	76.4	84.0	94.2	108.0	127.8	158.0	208.7	311.1	619.9	774.5	1548.1	
Distance from Antenna Structure Base in Horizontal plane	0.0	9.6	19.7	25.2	31.2	37.9	45.4	54.0	64.4	77.2	93.6	115.9	148.4	201.6	306.4	617.5	772.6	1547.1	
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	
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	
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	
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	0.01	0.01	0.01	0.01	0.00	
Percent of Occupational Standard	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.5	0.3	0.2	0.4	0.4	0.1	
Percent of General Population Standard	0.1	0.1	0.0	0.1	0.3	0.5	0.6	0.5	0.4	1.0	0.9	0.3	2.3	1.5	1.2	1.9	1.8	0.5	

Antenna Type SLXW 5514
Max% 2.26%

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

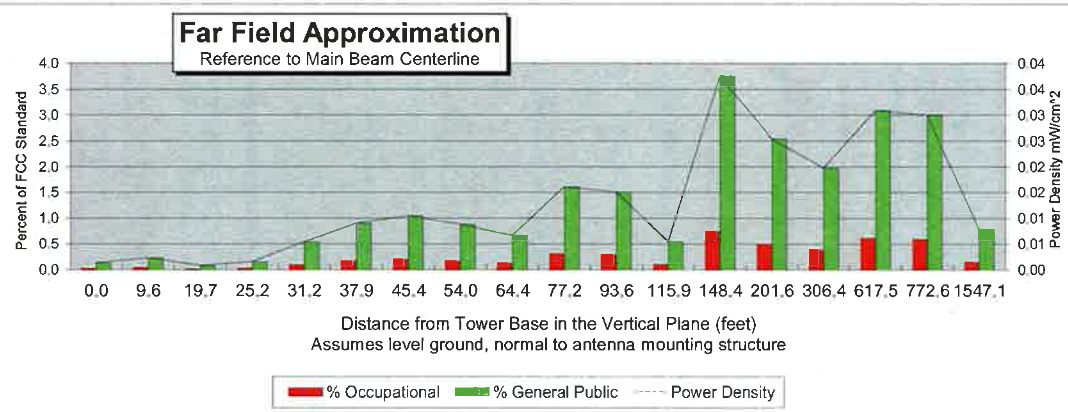
Estimated Radiated Emission

Single Emitter Far Field Model

Dipole / Wire/ Yagi Antenna Types

Location:	BYRAM PARK, CT
Site #:	5-0008
Date:	08/12/13
Name:	Mark Brauer
File Name:	BYRAM PARK, CT - FF Power

Operating Freq. (MHz)	2145.0
Antenna Height (ft):	57.0
Antenna Gain (dBi):	16.9
Antenna Size (in.):	72.0
Downtilt (degrees):	0.0
Feedline Loss (dB):	0.0
Power @ J4 (w):	1750.0



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	54.0	54.8	57.5	59.6	62.4	65.9	70.5	76.4	84.0	94.2	108.0	127.8	158.0	208.7	311.1	619.9	774.5	1548.1	
Distance from Antenna Structure Base in Horizontal plane	0.0	9.6	19.7	25.2	31.2	37.9	45.4	54.0	64.4	77.2	93.6	115.9	148.4	201.6	306.4	617.5	772.6	1547.1	
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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	
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	
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	0.04	0.03	0.02	0.03	0.03	0.01	
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	0.5	0.4	0.6	0.6	0.2	
Percent of General Population Standard	0.1	0.2	0.1	0.2	0.5	0.9	1.0	0.9	0.7	1.6	1.5	0.5	3.8	2.5	2.0	3.1	3.0	0.8	

Antenna Type BXA-171063-12
Max% 3.75%

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

77-ft Existing EEI Monopine

Proposed Verizon Wireless Antenna Upgrade

Verizon Site Ref: Byram Park

36 Ritch Ave
Greenwich, CT

Centek Project No. 13001.064

Date: October 1, 2013

STATE OF CONNECTICUT
No. 16694
LICENSED PROFESSIONAL ENGINEER

Prepared for:

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

Table of Contents

Introduction

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

The host tower is a 77-ft tall, three-section, eighteen sided, tapered monopine, originally designed and manufactured by Engineered Endeavors job no; 16733, dated December 9, 2011. The tower geometry and structure member sizes were obtained from the aforementioned design documents. The foundation system information was taken from the foundation design drawing prepared by Centek Engineering job no; 09129 dated February 14, 2012.

Antenna and appurtenance information were obtained from construction drawings prepared by Centek for Verizon job no; 09129 dated May 1, 2012, construction drawings prepared by Centek for AT&T job no: 11104 dated January 25, 2012 and a Verizon RF data sheet.

The tower is made up of three (3) tapered vertical sections consisting of A572-65 pole sections. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 27.75-in at the top and 52.0-in at the base.

Verizon proposes the removal of six (6) existing panel antennas and the installation of six (6) panel antennas, three (3) remote radio heads and one (1) main distribution box mounted on the existing T-arm array. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

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

- T-MOBILE (Reserved):
  Antennas: Three (3) Ericsson AIR21 panel antennas mounted on a 10-ft T-arm array with a RAD center elevation of 77-ft above the existing tower base plate.
  Coax Cables: One (1) 1-5/8" ∅ fiber cable running on the inside of the existing tower.
- AT&T (Existing):
  Antennas: Nine (9) Powerwave P65-16-XLH-RR panel antennas and six (6) CCI DTMABP7819VG12A TMA's mounted on a 10-ft T-arm array with a RAD center elevation of 67-ft above the existing tower base plate.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- 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 64-ft above grade level.
  Coax Cables: One (1) fiber cable and two (2) dc control cables running inside of the existing tower.

- VERIZON (Existing to Remain):
  Antennas: Three (3) Swedcom SLXW 5514 and six (6) Antel LPA-80063-6CF panel antennas mounted on a 10-ft T-arm array with a RAD center elevation of 57-ft above the existing tower base plate.
  Coax Cables: Eighteen (18) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- VERIZON (Existing to Remove):
  Antennas: Six (6) Antel LPA-171063-12CF panel antennas mounted on a 10-ft T-arm array with a RAD center elevation of 57-ft above the existing tower base plate.
- **VERIZON (Proposed):**
  Antennas: Six (6) BXA-171063-12BF panel antennas, three (3) Alcatel-Lucent RRH2x40-AWS Remote Radio Heads and one (1) RFS DB-T1-6Z-8AB-0Z main distribution box mounted on a 10-ft T-arm array with a RAD center elevation of 57-ft above the existing tower base plate.
  Coax Cables: One (1) 1-5/8" ∅ fiber cable running on the inside of the existing tower.

Primary Assumptions Used in the Analysis

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

Analysis

The existing tower was analyzed using a comprehensive computer program entitled 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]*
	Greenwich; v = 100 mph (3 second gust) equivalent to v = 80 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA-222-F wind speed controls.	
Load Cases:	<u>Load Case 1</u>; 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]*
	<u>Load Case 2</u>; 74 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 74 mph wind speed velocity represents 75% of the wind pressure generated by the 85 mph wind speed.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	<u>Load Case 3</u>; Seismic – not checked	*[Section 1614.5 of State Bldg. Code 2005] does not control in the design of this structure type*

[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 **59.5%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L3)	1.00'-23.92'	59.5%	**PASS**

Foundation and Anchors

The existing foundation consists of an 8.0-ft square x 2.0-ft long reinforced concrete pier on a 14.0-ft square x 4.0-ft thick reinforced concrete pad with sixteen (16) 1-3/8" ∅ x 34-ft long Williams 150 ksi rock anchors. The sub-grade conditions used in the analysis of the existing foundation were obtained from the geotechnical report prepared by Design Earth Technology (DET) job no; 2010.14 dated October 4, 2010 and addendum letter dated February 13, 2012. The base of the tower is connected to the foundation by means of (20) 2.25"∅, ASTM A615-75 anchor bolts embedded approximately 5-ft into the concrete foundation structure.

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

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

Location	Vector	Proposed Reactions
Base	Shear	49 kips
	Compression	35 kips
	Moment	2635 kip-ft

- The foundation was found to be within allowable limits.

Foundation	Design Limit	IBC 2003/2005 CT State Building Code Section 3108.4.2 (FS)(1)	Proposed Loading (FS)(1)	Result
Reinforced Concrete Pad and Pier w/ Rock Anchors	Uplift	2.0	4.51	**PASS**

Note 1: FS denotes Factor of Safety.

- 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	Combined Axial and Bending	55.0%	**PASS**
Base Plate	Bending	46.2%	**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

STATE OF CONNECTICUT CARLO F. CENTORE No.16884 LICENSED PROFESSIONAL ENGINEER

Prepared by:

Timothy J. Lynn, PE
Structural Engineer

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

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

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

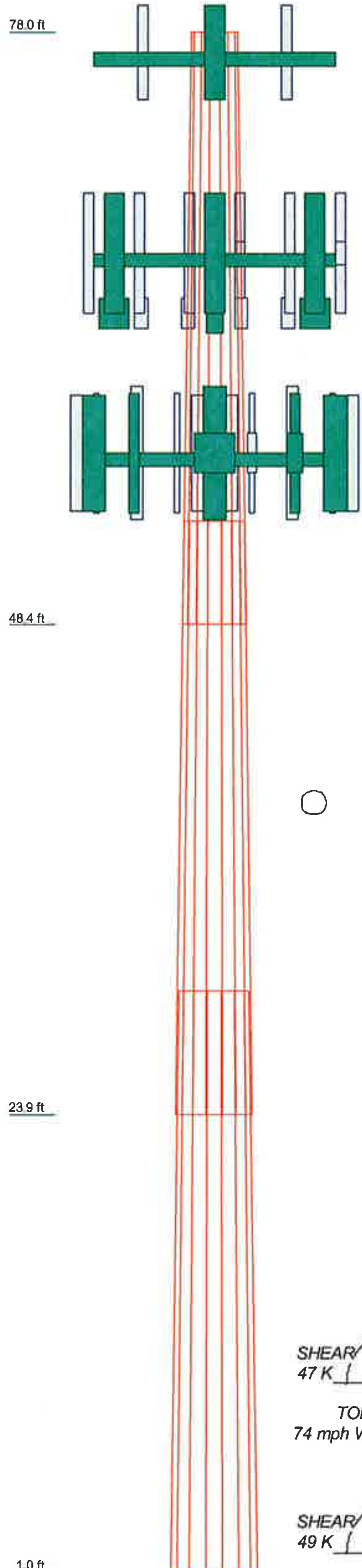
GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

TnxTower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, TnxTower, formerly ERITower, 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.

Section	3	2	1
Length (ft)	29.081	29.693	29.609
Number of Sides	18	18	18
Thickness (in)	0.500	0.438	0.313
Socket Length (ft)		6.164	5.219
Top Dia (in)	42.370	35.371	27.750
Bot Dia (in)	52.000	45.307	37.761
Grade	A572-65	A572-65	A572-65
Weight (K) 16.2	7.3	5.6	3.2



DESIGNED APPURTENANCE LOADING

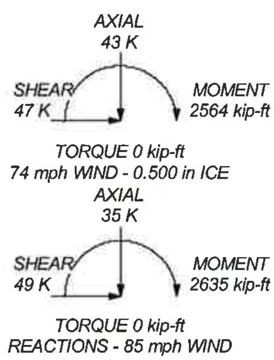
TYPE	ELEVATION
Byram Tower Branch	95
Byram Tower Branch	90
Byram Tower Branch	85
Byram Tower Branch	80
AIR21 (T-Mobile - Reserved)	77
AIR21 (T-Mobile - Reserved)	77
AIR21 (T-Mobile - Reserved)	77
EEI 10-ft T-Arm Array (T-Mobile - Reserved)	77
Byram Tower Branch	75
Byram Tower Branch	70
(3) P65-16-XLH-RR (ATI - Existing)	67
(3) P65-16-XLH-RR (ATI - Existing)	67
(3) P65-16-XLH-RR (ATI - Existing)	67
(2) DTMABP7819VG12A TMA (ATI - Existing)	67
(2) DTMABP7819VG12A TMA (ATI - Existing)	67
(2) DTMABP7819VG12A TMA (ATI - Existing)	67
EEI 10-ft T-Arm Array (ATI - Existing)	67
Byram Tower Branch	65
(2) RRUS-11 (ATI - Existing)	64
DC6-48-60-18-8F Surge Arrestor (ATI - Existing)	64
Valmont Uni-Tri Bracket (ATI - Existing)	64
(2) RRUS-11 (ATI - Existing)	64
(2) RRUS-11 (ATI - Existing)	64
Byram Tower Branch	60
LPA-80063-6CF (Verizon - Existing)	57
BXA-171063-12BF (Verizon - Proposed)	57
SLXW 5514 (Verizon - Existing)	57
BXA-171063-12BF (Verizon - Proposed)	57
LPA-80063-6CF (Verizon - Existing)	57
LPA-80063-6CF (Verizon - Existing)	57
BXA-171063-12BF (Verizon - Proposed)	57
SLXW 5514 (Verizon - Existing)	57
BXA-171063-12BF (Verizon - Proposed)	57
LPA-80063-6CF (Verizon - Existing)	57
LPA-80063-6CF (Verizon - Existing)	57
BXA-171063-12BF (Verizon - Proposed)	57
SLXW 5514 (Verizon - Existing)	57
BXA-171063-12BF (Verizon - Proposed)	57
LPA-80063-6CF (Verizon - Existing)	57
RRH2x40-AWS (Verizon - Proposed)	57
RRH2x40-AWS (Verizon - Proposed)	57
RRH2x40-AWS (Verizon - Proposed)	57
DB-T1-6Z-8AB-0Z (Verizon - Proposed)	57
EEI 10-ft T-Arm Array (Verizon - Existing)	57
Byram Tower Branch	55
Byram Tower Branch	50
Byram Tower Branch	45
Byram Tower Branch	40
Byram Tower Branch	35
Byram Tower Branch	30
Byram Tower Branch	25
Byram Tower Branch	20
Byram Tower Branch	15

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Weld together tower sections have flange connections.
5. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
6. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
7. Welds are fabricated with ER-70S-6 electrodes.
8. TOWER RATING: 59.5%



Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job: 13001.064 - Byram Park		
	Project: 77-ft EEI Monopine - 36 Ritch Ave., Greenwich, CT		
	Client: Verizon Wireless	Drawn by: TJL	App'd:
	Code: TIA/EIA-222-F	Date: 10/01/13	Scale: NTS
	Path:		Dwg No. E-1

Tower Input Data

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

- Basic wind speed of 85 mph.
- Nominal ice thickness of 0.500 in.
- Ice density of 56 pcf.
- A wind speed of 74 mph is used in combination with ice.
- Temperature drop of 50 °F.
- Deflections calculated using a wind speed of 50 mph.
- Weld together tower sections have flange connections..
- Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
- Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
- Welds are fabricated with ER-70S-6 electrodes..
- A non-linear (P-delta) analysis was used.
- Pressures are calculated at each section.
- Stress ratio used in pole design is 1.333.
- Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

Consider Moments - Legs
Consider Moments - Horizontals
Consider Moments - Diagonals
Use Moment Magnification
√ Use Code Stress Ratios
Use Code Safety Factors - Guys
Escalate Ice
Always Use Max Kz
Use Special Wind Profile
Include Bolts In Member Capacity
Leg Bolts Are At Top Of Section
Secondary Horizontal Braces Leg
Use Diamond Inner Bracing (4 Sided)
Add IBC .6D+W Combination

Distribute Leg Loads As Uniform
Assume Legs Pinned
√ Assume Rigid Index Plate
Use Clear Spans For Wind Area
Use Clear Spans For KL/r
Retension Guys To Initial Tension
√ Bypass Mast Stability Checks
Use Azimuth Dish Coefficients
√ Project Wind Area of Appurt.
Autocalc Torque Arm Areas
SR Members Have Cut Ends
√ Sort Capacity Reports By Component
Triangulate Diamond Inner Bracing

Treat Feedline Bundles As Cylinder
Use ASCE 10 X-Brace Ly Rules
Calculate Redundant Bracing Forces
Ignore Redundant Members in FEA
SR Leg Bolts Resist Compression
All Leg Panels Have Same Allowable
Offset Girt At Foundation
Consider Feedline Torque
Include Angle Block Shear Check
Poles
√ Include Shear-Torsion Interaction
√ Always Use Sub-Critical Flow
Use Top Mounted Sockets

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	78.000-48.391	29.609	5.219	18	27.750	37.761	0.313	1.250	A572-65 (65 ksi)
L2	48.391-23.917	29.693	6.164	18	35.371	45.307	0.438	1.750	A572-65 (65 ksi)
L3	23.917-1.000	29.081		18	42.370	52.000	0.500	2.000	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in²	I in⁴	r in	C in	I/C in³	J in⁴	It/Q in²	w in	w/t
L1	28.178	27.215	2588.380	9.740	14.097	183.612	5180.166	13.610	4.334	13.869
	38.343	37.144	6580.929	13.294	19.182	343.071	13170.518	18.575	6.096	19.507
L2	37.690	48.510	7479.270	12.401	17.969	416.241	14968.382	24.260	5.455	12.469
	46.006	62.308	15848.590	15.929	23.016	688.584	31718.035	31.160	7.204	16.467
L3	45.096	66.447	14716.934	14.864	21.524	683.750	29453.232	33.230	6.577	13.154
	52.802	81.731	27386.470	18.282	26.416	1036.738	54808.977	40.873	8.272	16.544

Tower Elevation ft	Gusset Area (per face) ft²	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 78.000-48.391				1	1	1		
L2 48.391-23.917				1	1	1		
L3 23.917-1.000				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft²/ft	Weight klf
1 5/8 (AT&T - Existing)	C	No	Inside Pole	68.000 - 4.000	12	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
RG6-Fiber (AT&T - Existing)	C	No	Inside Pole	68.000 - 4.000	1	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
#8 AWG Copper WIre (AT&T - Existing)	C	No	Inside Pole	68.000 - 4.000	2	No Ice	0.000	0.000
						1/2" Ice	0.000	0.000
1 5/8 (Verizon - Existing)	B	No	Inside Pole	58.000 - 4.000	18	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
HYBRIFLEX 1-5/8" (Verizon - Proposed)	B	No	Inside Pole	58.000 - 4.000	1	No Ice	0.000	0.002
						1/2" Ice	0.000	0.002
HYBRIFLEX 1-5/8" (T-Mobile - Reserved)	B	No	Inside Pole	78.000 - 4.000	1	No Ice	0.000	0.002
						1/2" Ice	0.000	0.002

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
L1	78.000-48.391	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.254
		C	0.000	0.000	0.000	0.000	0.266
L2	48.391-23.917	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.551

Tower Section	Tower Elevation ft	Face	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
		C	0.000	0.000	0.000	0.000	0.332
L3	23.917-1.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.449
		C	0.000	0.000	0.000	0.000	0.270

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
L1	78.000-48.391	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.254
		C		0.000	0.000	0.000	0.000	0.266
L2	48.391-23.917	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.551
		C		0.000	0.000	0.000	0.000	0.332
L3	23.917-1.000	A	0.500	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.449
		C		0.000	0.000	0.000	0.000	0.270

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft²	C_AA_A Side ft²	Weight K
(3) P65-16-XLH-RR (AT&T - Existing)	A	From Face	3.000 0.000 0.000	0.000	67.000	No Ice 1/2" Ice	8.400 8.949	4.700 5.147	0.060 0.107
(3) P65-16-XLH-RR (AT&T - Existing)	B	From Face	3.000 0.000 0.000	0.000	67.000	No Ice 1/2" Ice	8.400 8.949	4.700 5.147	0.060 0.107
(3) P65-16-XLH-RR (AT&T - Existing)	C	From Face	3.000 0.000 0.000	0.000	67.000	No Ice 1/2" Ice	8.400 8.949	4.700 5.147	0.060 0.107
(2) DTMABP7819VG12A TMA (AT&T - Existing)	A	From Face	3.000 0.000 0.000	0.000	67.000	No Ice 1/2" Ice	1.588 1.759	0.578 0.701	0.020 0.030
(2) DTMABP7819VG12A TMA (AT&T - Existing)	B	From Face	3.000 0.000 0.000	0.000	67.000	No Ice 1/2" Ice	1.588 1.759	0.578 0.701	0.020 0.030
(2) DTMABP7819VG12A TMA (AT&T - Existing)	C	From Face	3.000 0.000 0.000	0.000	67.000	No Ice 1/2" Ice	1.588 1.759	0.578 0.701	0.020 0.030
EEI 10-ft T-Arm Array (AT&T - Existing)	C	None		0.000	67.000	No Ice 1/2" Ice	23.000 26.500	23.000 26.500	1.600 1.850
(2) RRUS-11 (AT&T - Existing)	A	From Face	0.000 0.000 0.000	0.000	64.000	No Ice 1/2" Ice	2.994 3.226	1.246 1.412	0.050 0.070
(2) RRUS-11 (AT&T - Existing)	B	From Face	0.000 0.000	0.000	64.000	No Ice 1/2" Ice	2.994 3.226	1.246 1.412	0.050 0.070

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft* *ft* *ft*	*Azimuth Adjustment* °	*Placement* *ft*		*C_AA_A Front* *ft²*	*C_AA_A Side* *ft²*	*Weight* *K*
			0.000						
(2) RRUS-11 (AT&T - Existing)	C	From Face	0.000 0.000 0.000	0.000	64.000	No Ice 1/2" Ice	2.994 3.226	1.246 1.412	0.050 0.070
DC6-48-60-18-8F Surge Arrestor (AT&T - Existing)	C	From Face	0.000 0.000 0.000	0.000	64.000	No Ice 1/2" Ice	2.228 2.447	2.228 2.447	0.020 0.039
Valmont Uni-Tri Bracket (AT&T - Existing)	C	None		0.000	64.000	No Ice 1/2" Ice	1.750 1.940	1.750 1.940	0.290 0.306
Byram Tower Branch	C	None		0.000	95.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
Byram Tower Branch	C	None		0.000	90.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
Byram Tower Branch	C	None		0.000	85.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
Byram Tower Branch	C	None		0.000	80.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
Byram Tower Branch	C	None		0.000	75.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
Byram Tower Branch	C	None		0.000	70.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
Byram Tower Branch	C	None		0.000	65.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
Byram Tower Branch	C	None		0.000	60.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
Byram Tower Branch	C	None		0.000	55.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
Byram Tower Branch	C	None		0.000	50.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
Byram Tower Branch	C	None		0.000	45.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
Byram Tower Branch	C	None		0.000	40.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
Byram Tower Branch	C	None		0.000	35.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
Byram Tower Branch	C	None		0.000	30.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
Byram Tower Branch	C	None		0.000	25.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
Byram Tower Branch	C	None		0.000	20.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
Byram Tower Branch	C	None		0.000	15.000	No Ice 1/2" Ice	45.000 65.000	45.000 65.000	0.600 0.800
LPA-80063-6CF (Verizon - Existing)	A	From Face	3.000 -6.000 0.000	0.000	57.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
BXA-171063-12BF (Verizon - Proposed)	A	From Face	3.000 -4.000 0.000	0.000	57.000	No Ice 1/2" Ice	4.734 5.180	3.572 4.007	0.015 0.042
SLXW 5514 (Verizon - Existing)	A	From Face	3.000 0.000 0.000	0.000	57.000	No Ice 1/2" Ice	10.889 11.502	7.315 7.824	0.036 0.103
BXA-171063-12BF (Verizon - Proposed)	A	From Face	3.000 4.000 0.000	0.000	57.000	No Ice 1/2" Ice	4.734 5.180	3.572 4.007	0.015 0.042
LPA-80063-6CF (Verizon - Existing)	A	From Face	3.000 6.000	0.000	57.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101

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*
LPA-80063-6CF (Verizon - Existing)	B	From Face	0.000 3.000 -6.000	0.000	57.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
BXA-171063-12BF (Verizon - Proposed)	B	From Face	0.000 3.000 -4.000	0.000	57.000	No Ice 1/2" Ice	4.734 5.180	3.572 4.007	0.015 0.042
SLXW 5514 (Verizon - Existing)	B	From Face	0.000 3.000 0.000	0.000	57.000	No Ice 1/2" Ice	10.889 11.502	7.315 7.824	0.036 0.103
BXA-171063-12BF (Verizon - Proposed)	B	From Face	0.000 3.000 4.000	0.000	57.000	No Ice 1/2" Ice	4.734 5.180	3.572 4.007	0.015 0.042
LPA-80063-6CF (Verizon - Existing)	B	From Face	0.000 3.000 6.000	0.000	57.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
LPA-80063-6CF (Verizon - Existing)	C	From Face	0.000 3.000 -6.000	0.000	57.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
BXA-171063-12BF (Verizon - Proposed)	C	From Face	0.000 3.000 -4.000	0.000	57.000	No Ice 1/2" Ice	4.734 5.180	3.572 4.007	0.015 0.042
SLXW 5514 (Verizon - Existing)	C	From Face	0.000 3.000 0.000	0.000	57.000	No Ice 1/2" Ice	10.889 11.502	7.315 7.824	0.036 0.103
BXA-171063-12BF (Verizon - Proposed)	C	From Face	0.000 3.000 4.000	0.000	57.000	No Ice 1/2" Ice	4.734 5.180	3.572 4.007	0.015 0.042
LPA-80063-6CF (Verizon - Existing)	C	From Face	0.000 3.000 6.000	0.000	57.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
RRH2x40-AWS (Verizon - Proposed)	A	From Face	0.000 3.000 -4.000	0.000	57.000	No Ice 1/2" Ice	2.522 2.753	1.589 1.795	0.044 0.061
RRH2x40-AWS (Verizon - Proposed)	B	From Face	0.000 3.000 -4.000	0.000	57.000	No Ice 1/2" Ice	2.522 2.753	1.589 1.795	0.044 0.061
RRH2x40-AWS (Verizon - Proposed)	C	From Face	0.000 3.000 -4.000	0.000	57.000	No Ice 1/2" Ice	2.522 2.753	1.589 1.795	0.044 0.061
DB-T1-6Z-8AB-0Z (Verizon - Proposed)	C	From Face	0.000 3.000 0.000	0.000	57.000	No Ice 1/2" Ice	5.600 5.915	2.333 2.558	0.044 0.080
EEI 10-ft T-Arm Array (Verizon - Existing)	C	None	0.000	0.000	57.000	No Ice 1/2" Ice	23.000 26.500	23.000 26.500	1.600 1.850
AIR21 (T-Mobile - Reserved)	A	From Face	3.000 0.000 0.000	0.000	77.000	No Ice 1/2" Ice	6.533 6.978	4.356 4.775	0.083 0.125
AIR21 (T-Mobile - Reserved)	B	From Face	3.000 0.000 0.000	0.000	77.000	No Ice 1/2" Ice	6.533 6.978	4.356 4.775	0.083 0.125
AIR21 (T-Mobile - Reserved)	C	From Face	3.000 0.000 0.000	0.000	77.000	No Ice 1/2" Ice	6.533 6.978	4.356 4.775	0.083 0.125
EEI 10-ft T-Arm Array (T-Mobile - Reserved)	C	None		0.000	77.000	No Ice 1/2" Ice	23.000 26.500	23.000 26.500	1.600 1.850

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 78.000-48.391	62.441	1.2	0.022	80.822	A	0.000	80.822	80.822	100.00	0.000	0.000
					B	0.000	80.822		100.00	0.000	0.000
					C	0.000	80.822		100.00	0.000	0.000
L2 48.391-23.917	35.748	1.023	0.019	84.053	A	0.000	84.053	84.053	100.00	0.000	0.000
					B	0.000	84.053		100.00	0.000	0.000
					C	0.000	84.053		100.00	0.000	0.000
L3 23.917-1.000	12.158	1	0.018	92.059	A	0.000	92.059	92.059	100.00	0.000	0.000
					B	0.000	92.059		100.00	0.000	0.000
					C	0.000	92.059		100.00	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	t_Z in	A_G 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 78.000-48.391	62.441	1.2	0.017	0.500	83.290	A	0.000	83.290	83.290	100.00	0.000	0.000
						B	0.000	83.290		100.00	0.000	0.000
						C	0.000	83.290		100.00	0.000	0.000
L2 48.391-23.917	35.748	1.023	0.014	0.500	86.092	A	0.000	86.092	86.092	100.00	0.000	0.000
						B	0.000	86.092		100.00	0.000	0.000
						C	0.000	86.092		100.00	0.000	0.000
L3 23.917-1.000	12.158	1	0.014	0.500	93.969	A	0.000	93.969	93.969	100.00	0.000	0.000
						B	0.000	93.969		100.00	0.000	0.000
						C	0.000	93.969		100.00	0.000	0.000

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 78.000-48.391	62.441	1.2	0.008	80.822	A	0.000	80.822	80.822	100.00	0.000	0.000
					B	0.000	80.822		100.00	0.000	0.000
					C	0.000	80.822		100.00	0.000	0.000
L2 48.391-23.917	35.748	1.023	0.007	84.053	A	0.000	84.053	84.053	100.00	0.000	0.000
					B	0.000	84.053		100.00	0.000	0.000

Section Elevation ft	z ft	K_Z	q_z ksf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
					C	0.000	84.053		100.00	0.000	0.000
L3 23.917-1.000	12.158	1	0.006	92.059	A	0.000	92.059	92.059	100.00	0.000	0.000
					B	0.000	92.059		100.00	0.000	0.000
					C	0.000	92.059		100.00	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1 78.000-48.391	0.521	3.242	A	1	1.2	1	1	1	80.822	3.638	0.123	C
			B	1	1.2	1	1	1	80.822			
			C	1	1.2	1	1	1	80.822			
L2 48.391-23.917	0.884	5.598	A	1	1.2	1	1	1	84.053	3.226	0.132	C
			B	1	1.2	1	1	1	84.053			
			C	1	1.2	1	1	1	84.053			
L3 23.917-1.000	0.719	7.332	A	1	1.2	1	1	1	92.059	3.453	0.151	C
			B	1	1.2	1	1	1	92.059			
			C	1	1.2	1	1	1	92.059			
Sum Weight:	2.123	16.172						OTM	374.111 kip-ft	10.316		

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 ft^2	F K	w klf	Ctrl. Face
L1 78.000-48.391	0.521	3.242	A	1	1.2	1	1	1	80.822	3.638	0.123	C
			B	1	1.2	1	1	1	80.822			
			C	1	1.2	1	1	1	80.822			
L2 48.391-23.917	0.884	5.598	A	1	1.2	1	1	1	84.053	3.226	0.132	C
			B	1	1.2	1	1	1	84.053			
			C	1	1.2	1	1	1	84.053			
L3 23.917-1.000	0.719	7.332	A	1	1.2	1	1	1	92.059	3.453	0.151	C
			B	1	1.2	1	1	1	92.059			
			C	1	1.2	1	1	1	92.059			
Sum Weight:	2.123	16.172						OTM	374.111 kip-ft	10.316		

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 klf	Ctrl. Face
L1 78.000-48.391	0.521	3.242	A	1	1.2	1	1	1	80.822	3.638	0.123	C
			B	1	1.2	1	1	1	80.822			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
			C	1	1.2	1	1	1	80.822			
L2 48.391-23.917	0.884	5.598	A	1	1.2	1	1	1	84.053	3.226	0.132	C
			B	1	1.2	1	1	1	84.053			
			C	1	1.2	1	1	1	84.053			
L3 23.917-1.000	0.719	7.332	A	1	1.2	1	1	1	92.059	3.453	0.151	C
			B	1	1.2	1	1	1	92.059			
			C	1	1.2	1	1	1	92.059			
Sum Weight:	2.123	16.172						OTM	374.111 kip-ft	10.316		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1 78.000-48.391	0.521	3.242	A	1	1.2	1	1	1	80.822	3.638	0.123	C
			B	1	1.2	1	1	1	80.822			
			C	1	1.2	1	1	1	80.822			
L2 48.391-23.917	0.884	5.598	A	1	1.2	1	1	1	84.053	3.226	0.132	C
			B	1	1.2	1	1	1	84.053			
			C	1	1.2	1	1	1	84.053			
L3 23.917-1.000	0.719	7.332	A	1	1.2	1	1	1	92.059	3.453	0.151	C
			B	1	1.2	1	1	1	92.059			
			C	1	1.2	1	1	1	92.059			
Sum Weight:	2.123	16.172						OTM	374.111 kip-ft	10.316		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1 78.000-48.391	0.521	3.850	A	1	1.2	1	1	1	83.290	2.811	0.095	C
			B	1	1.2	1	1	1	83.290			
			C	1	1.2	1	1	1	83.290			
L2 48.391-23.917	0.884	6.228	A	1	1.2	1	1	1	86.092	2.478	0.101	C
			B	1	1.2	1	1	1	86.092			
			C	1	1.2	1	1	1	86.092			
L3 23.917-1.000	0.719	8.020	A	1	1.2	1	1	1	93.969	2.644	0.115	C
			B	1	1.2	1	1	1	93.969			
			C	1	1.2	1	1	1	93.969			
Sum Weight:	2.123	18.099						OTM	288.340 kip-ft	7.933		

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 klf	Ctrl. Face
L1 78.000-48.391	0.521	3.850	A	1	1.2	1	1	1	83.290	2.811	0.095	C
			B	1	1.2	1	1	1	83.290			
			C	1	1.2	1	1	1	83.290			
L2 48.391-23.917	0.884	6.228	A	1	1.2	1	1	1	86.092	2.478	0.101	C
			B	1	1.2	1	1	1	86.092			
			C	1	1.2	1	1	1	86.092			
L3 23.917-1.000	0.719	8.020	A	1	1.2	1	1	1	93.969	2.644	0.115	C
			B	1	1.2	1	1	1	93.969			
			C	1	1.2	1	1	1	93.969			
Sum Weight:	2.123	18.099						OTM	288.340 kip-ft	7.933		

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 ft^2	F K	w klf	Ctrl. Face
L1 78.000-48.391	0.521	3.850	A	1	1.2	1	1	1	83.290	2.811	0.095	C
			B	1	1.2	1	1	1	83.290			
			C	1	1.2	1	1	1	83.290			
L2 48.391-23.917	0.884	6.228	A	1	1.2	1	1	1	86.092	2.478	0.101	C
			B	1	1.2	1	1	1	86.092			
			C	1	1.2	1	1	1	86.092			
L3 23.917-1.000	0.719	8.020	A	1	1.2	1	1	1	93.969	2.644	0.115	C
			B	1	1.2	1	1	1	93.969			
			C	1	1.2	1	1	1	93.969			
Sum Weight:	2.123	18.099						OTM	288.340 kip-ft	7.933		

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 ft^2	F K	w klf	Ctrl. Face
L1 78.000-48.391	0.521	3.850	A	1	1.2	1	1	1	83.290	2.811	0.095	C
			B	1	1.2	1	1	1	83.290			
			C	1	1.2	1	1	1	83.290			
L2 48.391-23.917	0.884	6.228	A	1	1.2	1	1	1	86.092	2.478	0.101	C
			B	1	1.2	1	1	1	86.092			
			C	1	1.2	1	1	1	86.092			
L3 23.917-1.000	0.719	8.020	A	1	1.2	1	1	1	93.969	2.644	0.115	C
			B	1	1.2	1	1	1	93.969			
			C	1	1.2	1	1	1	93.969			
Sum Weight:	2.123	18.099						OTM	288.340 kip-ft	7.933		

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 klf	Ctrl. Face
L1 78.000-48.391	0.521	3.242	A	1	1.2	1	1	1	80.822	1.259	0.043	C
			B	1	1.2	1	1	1	80.822			
			C	1	1.2	1	1	1	80.822			
L2 48.391-23.917	0.884	5.598	A	1	1.2	1	1	1	84.053	1.116	0.046	C
			B	1	1.2	1	1	1	84.053			
			C	1	1.2	1	1	1	84.053			
L3 23.917-1.000	0.719	7.332	A	1	1.2	1	1	1	92.059	1.195	0.052	C
			B	1	1.2	1	1	1	92.059			
			C	1	1.2	1	1	1	92.059			
Sum Weight:	2.123	16.172						OTM	129.450 kip-ft	3.570		

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 klf	Ctrl. Face
L1 78.000-48.391	0.521	3.242	A	1	1.2	1	1	1	80.822	1.259	0.043	C
			B	1	1.2	1	1	1	80.822			
			C	1	1.2	1	1	1	80.822			
L2 48.391-23.917	0.884	5.598	A	1	1.2	1	1	1	84.053	1.116	0.046	C
			B	1	1.2	1	1	1	84.053			
			C	1	1.2	1	1	1	84.053			
L3 23.917-1.000	0.719	7.332	A	1	1.2	1	1	1	92.059	1.195	0.052	C
			B	1	1.2	1	1	1	92.059			
			C	1	1.2	1	1	1	92.059			
Sum Weight:	2.123	16.172						OTM	129.450 kip-ft	3.570		

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 klf	Ctrl. Face
L1 78.000-48.391	0.521	3.242	A	1	1.2	1	1	1	80.822	1.259	0.043	C
			B	1	1.2	1	1	1	80.822			
			C	1	1.2	1	1	1	80.822			
L2 48.391-23.917	0.884	5.598	A	1	1.2	1	1	1	84.053	1.116	0.046	C
			B	1	1.2	1	1	1	84.053			
			C	1	1.2	1	1	1	84.053			
L3 23.917-1.000	0.719	7.332	A	1	1.2	1	1	1	92.059	1.195	0.052	C
			B	1	1.2	1	1	1	92.059			
			C	1	1.2	1	1	1	92.059			
Sum Weight:	2.123	16.172						OTM	129.450 kip-ft	3.570		

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 ft^2	F K	w klf	Ctrl. Face
L1 78.000-48.391	0.521	3.242	A	1	1.2	1	1	1	80.822	1.259	0.043	C
			B	1	1.2	1	1	1	80.822			
			C	1	1.2	1	1	1	80.822			
L2 48.391-23.917	0.884	5.598	A	1	1.2	1	1	1	84.053	1.116	0.046	C
			B	1	1.2	1	1	1	84.053			
			C	1	1.2	1	1	1	84.053			
L3 23.917-1.000	0.719	7.332	A	1	1.2	1	1	1	92.059	1.195	0.052	C
			B	1	1.2	1	1	1	92.059			
			C	1	1.2	1	1	1	92.059			
Sum Weight:	2.123	16.172						OTM	129.450 kip-ft	3.570		

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	16.172					
Bracing Weight	0.000					
Total Member Self-Weight	16.172			0.223	0.000	
Total Weight	35.350			0.223	0.000	
Wind 0 deg - No Ice		0.000	-48.815	-2616.494	0.000	0.000
Wind 30 deg - No Ice		24.348	-42.275	-2265.920	-1305.016	0.247
Wind 45 deg - No Ice		34.433	-34.517	-1850.075	-1845.571	0.349
Wind 60 deg - No Ice		42.171	-24.407	-1308.135	-2260.354	0.427
Wind 90 deg - No Ice		48.695	0.000	0.223	-2610.032	0.493
Wind 120 deg - No Ice		42.171	24.407	1308.581	-2260.354	0.427
Wind 135 deg - No Ice		34.433	34.517	1850.521	-1845.571	0.349
Wind 150 deg - No Ice		24.348	42.275	2266.366	-1305.016	0.247
Wind 180 deg - No Ice		0.000	48.815	2616.939	0.000	0.000
Wind 210 deg - No Ice		-24.348	42.275	2266.366	1305.016	-0.247
Wind 225 deg - No Ice		-34.433	34.517	1850.521	1845.571	-0.349
Wind 240 deg - No Ice		-42.171	24.407	1308.581	2260.354	-0.427
Wind 270 deg - No Ice		-48.695	0.000	0.223	2610.032	-0.493
Wind 300 deg - No Ice		-42.171	-24.407	-1308.135	2260.354	-0.427
Wind 315 deg - No Ice		-34.433	-34.517	-1850.075	1845.571	-0.349
Wind 330 deg - No Ice		-24.348	-42.275	-2265.920	1305.016	-0.247
Member Ice	1.927					
Total Weight Ice	43.086			0.410	0.000	
Wind 0 deg - Ice		0.000	-46.789	-2540.336	0.000	0.000
Wind 30 deg - Ice		23.349	-40.521	-2199.941	-1267.797	0.203
Wind 45 deg - Ice		33.020	-33.085	-1796.169	-1792.935	0.287
Wind 60 deg - Ice		40.441	-23.395	-1269.963	-2195.888	0.352
Wind 90 deg - Ice		46.697	0.000	0.410	-2535.594	0.406
Wind 120 deg - Ice		40.441	23.395	1270.783	-2195.888	0.352
Wind 135 deg - Ice		33.020	33.085	1796.989	-1792.935	0.287
Wind 150 deg - Ice		23.349	40.521	2200.761	-1267.797	0.203
Wind 180 deg - Ice		0.000	46.789	2541.156	0.000	0.000
Wind 210 deg - Ice		-23.349	40.521	2200.761	1267.797	-0.203

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 225 deg - Ice		-33.020	33.085	1796.989	1792.935	-0.287
Wind 240 deg - Ice		-40.441	23.395	1270.783	2195.888	-0.352
Wind 270 deg - Ice		-46.697	0.000	0.410	2535.594	-0.406
Wind 300 deg - Ice		-40.441	-23.395	-1269.963	2195.888	-0.352
Wind 315 deg - Ice		-33.020	-33.085	-1796.169	1792.935	-0.287
Wind 330 deg - Ice		-23.349	-40.521	-2199.941	1267.797	-0.203
Total Weight	35.350			0.223	0.000	
Wind 0 deg - Service		0.000	-16.891	-905.215	0.000	0.000
Wind 30 deg - Service		8.425	-14.628	-783.910	-451.563	0.085
Wind 45 deg - Service		11.914	-11.944	-640.019	-638.606	0.121
Wind 60 deg - Service		14.592	-8.445	-452.496	-782.129	0.148
Wind 90 deg - Service		16.850	0.000	0.223	-903.125	0.171
Wind 120 deg - Service		14.592	8.445	452.942	-782.129	0.148
Wind 135 deg - Service		11.914	11.944	640.464	-638.606	0.121
Wind 150 deg - Service		8.425	14.628	784.355	-451.563	0.085
Wind 180 deg - Service		0.000	16.891	905.661	0.000	0.000
Wind 210 deg - Service		-8.425	14.628	784.355	451.563	-0.085
Wind 225 deg - Service		-11.914	11.944	640.464	638.606	-0.121
Wind 240 deg - Service		-14.592	8.445	452.942	782.129	-0.148
Wind 270 deg - Service		-16.850	0.000	0.223	903.125	-0.171
Wind 300 deg - Service		-14.592	-8.445	-452.496	782.129	-0.148
Wind 315 deg - Service		-11.914	-11.944	-640.019	638.606	-0.121
Wind 330 deg - Service		-8.425	-14.628	-783.910	451.563	-0.085

Load Combinations

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

Comb. No.	Description
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	78 - 48.3906	Pole	Max Tension	18	0.000	0.000	0.000
			Max. Compression	18	-19.979	0.000	-0.410
			Max. Mx	23	-19.375	-501.635	-0.408
			Max. My	27	-19.371	0.000	-502.369
			Max. Vy	14	-29.952	496.827	-0.219
			Max. Vx	10	30.073	0.000	-497.465
			Max. Torque	6			-0.492
L2	48.3906 - 23.9167	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-29.477	0.000	-0.410
			Max. Mx	6	-22.914	-1314.035	-0.224
			Max. My	10	-22.912	0.000	-1317.501
			Max. Vy	6	39.032	-1314.035	-0.224
			Max. Vx	10	39.152	0.000	-1317.501
			Max. Torque	6			-0.492
L3	23.9167 - 1	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-43.086	0.000	-0.410
			Max. Mx	14	-35.336	2628.435	-0.225
			Max. My	10	-35.336	0.000	-2635.387
			Max. Vy	14	-48.705	2628.435	-0.225
			Max. Vx	10	48.825	0.000	-2635.387
			Max. Torque	6			-0.492

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	27	43.086	0.000	-46.789
	Max. H_x	14	35.350	48.695	0.000
	Max. H_z	2	35.350	0.000	48.815
	Max. M_x	2	2634.937	0.000	48.815
	Max. M_z	6	2628.435	-48.695	0.000
	Max. Torsion	14	0.491	48.695	0.000
	Min. Vert	39	35.350	-16.850	0.000
	Min. H_x	6	35.350	-48.695	0.000
	Min. H_z	10	35.350	0.000	-48.815
	Min. M_x	10	-2635.387	0.000	-48.815
	Min. M_z	14	-2628.435	48.695	0.000
	Min. Torsion	6	-0.491	-48.695	0.000

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	35.350	0.000	0.000	0.223	0.000	0.000
Dead+Wind 0 deg - No Ice	35.350	0.000	-48.815	-2634.937	0.000	0.000
Dead+Wind 30 deg - No Ice	35.350	24.348	-42.275	-2281.892	-1314.217	0.247
Dead+Wind 45 deg - No Ice	35.350	34.433	-34.517	-1863.116	-1858.584	0.349
Dead+Wind 60 deg - No Ice	35.350	42.171	-24.407	-1317.356	-2276.291	0.427
Dead+Wind 90 deg - No Ice	35.350	48.695	0.000	0.225	-2628.435	0.491
Dead+Wind 120 deg - No Ice	35.350	42.171	24.407	1317.807	-2276.291	0.424
Dead+Wind 135 deg - No Ice	35.350	34.433	34.517	1863.567	-1858.584	0.346
Dead+Wind 150 deg - No Ice	35.350	24.348	42.275	2282.343	-1314.217	0.244
Dead+Wind 180 deg - No Ice	35.350	0.000	48.815	2635.387	0.000	0.000
Dead+Wind 210 deg - No Ice	35.350	-24.348	42.275	2282.343	1314.217	-0.244
Dead+Wind 225 deg - No Ice	35.350	-34.433	34.517	1863.567	1858.584	-0.346
Dead+Wind 240 deg - No Ice	35.350	-42.171	24.407	1317.807	2276.291	-0.424
Dead+Wind 270 deg - No Ice	35.350	-48.695	0.000	0.225	2628.435	-0.491
Dead+Wind 300 deg - No Ice	35.350	-42.171	-24.407	-1317.356	2276.291	-0.427
Dead+Wind 315 deg - No Ice	35.350	-34.433	-34.517	-1863.116	1858.584	-0.349
Dead+Wind 330 deg - No Ice	35.350	-24.348	-42.275	-2281.892	1314.217	-0.247
Dead+Ice+Temp	43.086	0.000	0.000	0.410	0.000	0.000
Dead+Wind 0 deg+Ice+Temp	43.086	0.000	-46.789	-2563.327	0.000	0.000
Dead+Wind 30 deg+Ice+Temp	43.086	23.349	-40.521	-2219.851	-1279.274	0.203
Dead+Wind 45 deg+Ice+Temp	43.086	33.020	-33.085	-1812.424	-1809.166	0.286
Dead+Wind 60 deg+Ice+Temp	43.086	40.441	-23.395	-1281.456	-2215.767	0.350
Dead+Wind 90 deg+Ice+Temp	43.086	46.697	0.000	0.416	-2558.548	0.403
Dead+Wind 120 deg+Ice+Temp	43.086	40.441	23.395	1282.288	-2215.767	0.347
Dead+Wind 135 deg+Ice+Temp	43.086	33.020	33.085	1813.256	-1809.166	0.283
Dead+Wind 150 deg+Ice+Temp	43.086	23.349	40.521	2220.683	-1279.274	0.200
Dead+Wind 180 deg+Ice+Temp	43.086	0.000	46.789	2564.159	0.000	0.000
Dead+Wind 210 deg+Ice+Temp	43.086	-23.349	40.521	2220.683	1279.274	-0.200
Dead+Wind 225 deg+Ice+Temp	43.086	-33.020	33.085	1813.256	1809.166	-0.283
Dead+Wind 240 deg+Ice+Temp	43.086	-40.441	23.395	1282.288	2215.767	-0.347
Dead+Wind 270 deg+Ice+Temp	43.086	-46.697	0.000	0.416	2558.548	-0.403
Dead+Wind 300 deg+Ice+Temp	43.086	-40.441	-23.395	-1281.456	2215.767	-0.350
Dead+Wind 315 deg+Ice+Temp	43.086	-33.020	-33.085	-1812.424	1809.166	-0.286
Dead+Wind 330 deg+Ice+Temp	43.086	-23.349	-40.521	-2219.851	1279.274	-0.203
Dead+Wind 0 deg - Service	35.350	0.000	-16.891	-911.684	0.000	0.000
Dead+Wind 30 deg - Service	35.350	8.425	-14.628	-789.511	-454.791	0.085
Dead+Wind 45 deg - Service	35.350	11.914	-11.944	-644.589	-643.168	0.121
Dead+Wind 60 deg - Service	35.350	14.592	-8.445	-455.727	-787.717	0.148
Dead+Wind 90 deg - Service	35.350	16.850	0.000	0.226	-909.577	0.170

Load Combination	Vertical K	Shear$_x$ K	Shear$_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead+Wind 120 deg - Service	35.350	14.592	8.445	456.178	-787.717	0.147
Dead+Wind 135 deg - Service	35.350	11.914	11.944	645.043	-643.171	0.120
Dead+Wind 150 deg - Service	35.350	8.425	14.628	789.962	-454.791	0.085
Dead+Wind 180 deg - Service	35.350	0.000	16.891	912.135	0.000	0.000
Dead+Wind 210 deg - Service	35.350	-8.425	14.628	789.962	454.791	-0.085
Dead+Wind 225 deg - Service	35.350	-11.914	11.944	645.043	643.171	-0.120
Dead+Wind 240 deg - Service	35.350	-14.592	8.445	456.178	787.717	-0.147
Dead+Wind 270 deg - Service	35.350	-16.850	0.000	0.226	909.577	-0.170
Dead+Wind 300 deg - Service	35.350	-14.592	-8.445	-455.727	787.717	-0.148
Dead+Wind 315 deg - Service	35.350	-11.914	-11.944	-644.589	643.168	-0.121
Dead+Wind 330 deg - Service	35.350	-8.425	-14.628	-789.511	454.791	-0.085

Solution Summary

Load Comb.	Sum of Applied Forces PX K	 PY K	 PZ K	Sum of Reactions PX K	 PY K	 PZ K	% Error
1	0.000	-35.350	0.000	0.000	35.350	0.000	0.000%
2	0.000	-35.350	-48.815	0.000	35.350	48.815	0.000%
3	24.348	-35.350	-42.275	-24.348	35.350	42.275	0.000%
4	34.433	-35.350	-34.517	-34.433	35.350	34.517	0.000%
5	42.171	-35.350	-24.407	-42.171	35.350	24.407	0.000%
6	48.695	-35.350	0.000	-48.695	35.350	0.000	0.000%
7	42.171	-35.350	24.407	-42.171	35.350	-24.407	0.000%
8	34.433	-35.350	34.517	-34.433	35.350	-34.517	0.000%
9	24.348	-35.350	42.275	-24.348	35.350	-42.275	0.000%
10	0.000	-35.350	48.815	0.000	35.350	-48.815	0.000%
11	-24.348	-35.350	42.275	24.348	35.350	-42.275	0.000%
12	-34.433	-35.350	34.517	34.433	35.350	-34.517	0.000%
13	-42.171	-35.350	24.407	42.171	35.350	-24.407	0.000%
14	-48.695	-35.350	0.000	48.695	35.350	0.000	0.000%
15	-42.171	-35.350	-24.407	42.171	35.350	24.407	0.000%
16	-34.433	-35.350	-34.517	34.433	35.350	34.517	0.000%
17	-24.348	-35.350	-42.275	24.348	35.350	42.275	0.000%
18	0.000	-43.086	0.000	0.000	43.086	0.000	0.000%
19	0.000	-43.086	-46.789	0.000	43.086	46.789	0.000%
20	23.349	-43.086	-40.521	-23.349	43.086	40.521	0.000%
21	33.020	-43.086	-33.085	-33.020	43.086	33.085	0.000%
22	40.441	-43.086	-23.395	-40.441	43.086	23.395	0.000%
23	46.697	-43.086	0.000	-46.697	43.086	0.000	0.000%
24	40.441	-43.086	23.395	-40.441	43.086	-23.395	0.000%
25	33.020	-43.086	33.085	-33.020	43.086	-33.085	0.000%
26	23.349	-43.086	40.521	-23.349	43.086	-40.521	0.000%
27	0.000	-43.086	46.789	0.000	43.086	-46.789	0.000%
28	-23.349	-43.086	40.521	23.349	43.086	-40.521	0.000%
29	-33.020	-43.086	33.085	33.020	43.086	-33.085	0.000%
30	-40.441	-43.086	23.395	40.441	43.086	-23.395	0.000%
31	-46.697	-43.086	0.000	46.697	43.086	0.000	0.000%
32	-40.441	-43.086	-23.395	40.441	43.086	23.395	0.000%
33	-33.020	-43.086	-33.085	33.020	43.086	33.085	0.000%
34	-23.349	-43.086	-40.521	23.349	43.086	40.521	0.000%
35	0.000	-35.350	-16.891	0.000	35.350	16.891	0.000%
36	8.425	-35.350	-14.628	-8.425	35.350	14.628	0.000%
37	11.914	-35.350	-11.944	-11.914	35.350	11.944	0.000%
38	14.592	-35.350	-8.445	-14.592	35.350	8.445	0.000%
39	16.850	-35.350	0.000	-16.850	35.350	0.000	0.000%
40	14.592	-35.350	8.445	-14.592	35.350	-8.445	0.000%
41	11.914	-35.350	11.944	-11.914	35.350	-11.944	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	*PX K*	*PY K*	*PZ K*	*PX K*	*PY K*	*PZ K*	*% Error*
42	8.425	-35.350	14.628	-8.425	35.350	-14.628	0.000%
43	0.000	-35.350	16.891	0.000	35.350	-16.891	0.000%
44	-8.425	-35.350	14.628	8.425	35.350	-14.628	0.000%
45	-11.914	-35.350	11.944	11.914	35.350	-11.944	0.000%
46	-14.592	-35.350	8.445	14.592	35.350	-8.445	0.000%
47	-16.850	-35.350	0.000	16.850	35.350	0.000	0.000%
48	-14.592	-35.350	-8.445	14.592	35.350	8.445	0.000%
49	-11.914	-35.350	-11.944	11.914	35.350	11.944	0.000%
50	-8.425	-35.350	-14.628	8.425	35.350	14.628	0.000%

Non-Linear Convergence Results

Load Combination	*Converged?*	*Number of Cycles*	*Displacement Tolerance*	*Force Tolerance*
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00000582
3	Yes	4	0.00000001	0.00007329
4	Yes	4	0.00000001	0.00008296
5	Yes	4	0.00000001	0.00007095
6	Yes	4	0.00000001	0.00000687
7	Yes	4	0.00000001	0.00007400
8	Yes	4	0.00000001	0.00008300
9	Yes	4	0.00000001	0.00007159
10	Yes	4	0.00000001	0.00000582
11	Yes	4	0.00000001	0.00007159
12	Yes	4	0.00000001	0.00008300
13	Yes	4	0.00000001	0.00007400
14	Yes	4	0.00000001	0.00000687
15	Yes	4	0.00000001	0.00007095
16	Yes	4	0.00000001	0.00008296
17	Yes	4	0.00000001	0.00007329
18	Yes	4	0.00000001	0.00000001
19	Yes	4	0.00000001	0.00024366
20	Yes	4	0.00000001	0.00031870
21	Yes	4	0.00000001	0.00033950
22	Yes	4	0.00000001	0.00031794
23	Yes	4	0.00000001	0.00024366
24	Yes	4	0.00000001	0.00031914
25	Yes	4	0.00000001	0.00033970
26	Yes	4	0.00000001	0.00031829
27	Yes	4	0.00000001	0.00024379
28	Yes	4	0.00000001	0.00031829
29	Yes	4	0.00000001	0.00033970
30	Yes	4	0.00000001	0.00031914
31	Yes	4	0.00000001	0.00024366
32	Yes	4	0.00000001	0.00031794
33	Yes	4	0.00000001	0.00033950
34	Yes	4	0.00000001	0.00031870
35	Yes	4	0.00000001	0.00000001
36	Yes	4	0.00000001	0.00000787
37	Yes	4	0.00000001	0.00000872
38	Yes	4	0.00000001	0.00000756
39	Yes	4	0.00000001	0.00000001
40	Yes	4	0.00000001	0.00000797
41	Yes	4	0.00000001	0.00000874
42	Yes	4	0.00000001	0.00000764

43	Yes	4	0.00000001	0.00000001
44	Yes	4	0.00000001	0.00000764
45	Yes	4	0.00000001	0.00000874
46	Yes	4	0.00000001	0.00000797
47	Yes	4	0.00000001	0.00000001
48	Yes	4	0.00000001	0.00000756
49	Yes	4	0.00000001	0.00000872
50	Yes	4	0.00000001	0.00000787

Maximum Tower Deflections - Service Wind

Section No.	*Elevation ft*	*Horz. Deflection in*	*Gov. Load Comb.*	*Tilt °*	*Twist °*
L1	78 - 48.3906	5.077	43	0.557	0.000
L2	53.6094 - 23.9167	2.515	43	0.422	0.000
L3	30.0807 - 1	0.816	43	0.244	0.000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	*Appurtenance*	*Gov. Load Comb.*	*Deflection in*	*Tilt °*	*Twist °*	*Radius of Curvature ft*
95.000	Byram Tower Branch	43	5.077	0.557	0.000	38449
90.000	Byram Tower Branch	43	5.077	0.557	0.000	38449
85.000	Byram Tower Branch	43	5.077	0.557	0.000	38449
80.000	Byram Tower Branch	43	5.077	0.557	0.000	38449
77.000	AIR21	43	4.966	0.552	0.000	38449
75.000	Byram Tower Branch	43	4.744	0.542	0.000	38449
70.000	Byram Tower Branch	43	4.193	0.516	0.000	24030
67.000	(3) P65-16-XLH-RR	43	3.868	0.501	0.000	17477
65.000	Byram Tower Branch	43	3.654	0.490	0.000	14788
64.000	(2) RRUS-11	43	3.549	0.484	0.000	13732
60.000	Byram Tower Branch	43	3.136	0.462	0.000	10680
57.000	LPA-80063-6CF	43	2.838	0.444	0.000	9161
55.000	Byram Tower Branch	43	2.645	0.431	0.000	8422
50.000	Byram Tower Branch	43	2.191	0.398	0.000	7398
45.000	Byram Tower Branch	43	1.777	0.362	0.000	6812
40.000	Byram Tower Branch	43	1.407	0.324	0.000	6315
35.000	Byram Tower Branch	43	1.084	0.284	0.000	5885
30.000	Byram Tower Branch	43	0.812	0.243	0.000	5746
25.000	Byram Tower Branch	43	0.593	0.202	0.000	6683
20.000	Byram Tower Branch	43	0.419	0.160	0.000	8442
15.000	Byram Tower Branch	43	0.280	0.118	0.000	11456

Maximum Tower Deflections - Design Wind

Section No.	*Elevation ft*	*Horz. Deflection in*	*Gov. Load Comb.*	*Tilt °*	*Twist °*
L1	78 - 48.3906	14.666	10	1.609	0.001

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* *°*	*Twist* *°*
L2	53.6094 - 23.9167	7.266	10	1.220	0.001
L3	30.0807 - 1	2.359	10	0.704	0.000

Critical Deflections and Radius of Curvature - Design Wind

Elevation *ft*	*Appurtenance*	*Gov. Load Comb.*	*Deflection* *in*	*Tilt* *°*	*Twist* *°*	*Radius of Curvature* *ft*
95.000	Byram Tower Branch	10	14.666	1.609	0.001	13000
90.000	Byram Tower Branch	10	14.666	1.609	0.001	13000
85.000	Byram Tower Branch	10	14.666	1.609	0.001	13000
80.000	Byram Tower Branch	10	14.666	1.609	0.001	13000
77.000	AIR21	10	14.345	1.594	0.001	13000
75.000	Byram Tower Branch	10	13.703	1.565	0.001	13000
70.000	Byram Tower Branch	10	12.111	1.492	0.001	8125
67.000	(3) P65-16-XLH-RR	10	11.172	1.446	0.001	5909
65.000	Byram Tower Branch	10	10.555	1.415	0.001	5000
64.000	(2) RRUS-11	10	10.251	1.399	0.001	4642
60.000	Byram Tower Branch	10	9.058	1.334	0.001	3610
57.000	LPA-80063-6CF	10	8.197	1.282	0.001	3097
55.000	Byram Tower Branch	10	7.642	1.246	0.001	2850
50.000	Byram Tower Branch	10	6.329	1.149	0.001	2526
45.000	Byram Tower Branch	10	5.133	1.045	0.000	2355
40.000	Byram Tower Branch	10	4.063	0.935	0.000	2187
35.000	Byram Tower Branch	10	3.132	0.820	0.000	2038
30.000	Byram Tower Branch	10	2.347	0.702	0.000	1990
25.000	Byram Tower Branch	10	1.713	0.583	0.000	2314
20.000	Byram Tower Branch	10	1.209	0.463	0.000	2923
15.000	Byram Tower Branch	10	0.808	0.342	0.000	3966

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	78 - 48.3906 (1)	TP37.761x27.75x0.313	29.609	0.000	0.0	39.000	35.394	-19.371	1380.360	0.014
L2	48.3906 - 23.9167 (2)	TP45.308x35.371x0.438	29.693	0.000	0.0	39.000	59.443	-22.912	2318.290	0.010
L3	23.9167 - 1 (3)	TP52x42.37x0.5	29.081	0.000	0.0	39.000	81.730	-35.336	3187.490	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	78 - 48.3906 (1)	TP37.761x27.75x0.313	502.369	19.361	39.000	0.496	0.000	0.000	39.000	0.000
L2	48.3906 - 23.9167 (2)	TP45.308x35.371x0.438	1317.500	25.238	39.000	0.647	0.000	0.000	39.000	0.000
L3	23.9167 - 1 (3)	TP52x42.37x0.5	2635.392	30.504	39.000	0.782	0.000	0.000	39.000	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	78 - 48.3906 (1)	TP37.761x27.75x0.313	28.890	0.816	26.000	0.063	0.000	0.000	26.000	0.000
L2	48.3906 - 23.9167 (2)	TP45.308x35.371x0.438	39.152	0.659	26.000	0.051	0.000	0.000	26.000	0.000
L3	23.9167 - 1 (3)	TP52x42.37x0.5	48.825	0.597	26.000	0.046	0.000	0.000	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	78 - 48.3906 (1)	0.014	0.496	0.000	0.063	0.000	0.511 ✔	1.333	H1-3+VT ✔
L2	48.3906 - 23.9167 (2)	0.010	0.647	0.000	0.051	0.000	0.658 ✔	1.333	H1-3+VT ✔
L3	23.9167 - 1 (3)	0.011	0.782	0.000	0.046	0.000	0.794 ✔	1.333	H1-3+VT ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	78 - 48.3906	Pole	TP37.761x27.75x0.313	1	-19.371	1840.020	38.4	Pass
L2	48.3906 - 23.9167	Pole	TP45.308x35.371x0.438	2	-22.912	3090.280	49.3	Pass
L3	23.9167 - 1	Pole	TP52x42.37x0.5	3	-35.336	4248.924	59.5	Pass
							Summary	
						Pole (L3)	59.5	Pass
						RATING =	**59.5**	**Pass**

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	$OM := 2635 \cdot ft \cdot kips$	(Input From RisaTower)
Shear Force =	$Shear := 49 \cdot kips$	(Input From RisaTower)
Axial Force =	$Axial := 35 \cdot kips$	(Input From RisaTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	$N := 20$	(User Input)
Diameter of Bolt Circle =	$D_{bc} := 60 \cdot in$	(User Input)
Bolt "Column" Distance =	$l := 3.0 \cdot in$	(User Input)
Bolt Ultimate Strenght =	$F_u := 100 \cdot ksi$	(User Input)
Bolt Yeild Strenght =	$F_y := 75 \cdot ksi$	(User Input)
Bolt Modulus =	$E := 29000 \cdot ksi$	(User Input)
Diameter of Anchor Bolts =	$D := 2.25 \cdot in$	(User Input)
Threads per Inch =	$n := 4.5$	(User Input)

Base Plate Data:

Use ASTM A572 Grade 50

Plate Yield Strength =	$Fy_{bp} := 50 \cdot ksi$	(User Input)
Base Plate Thickness =	$t_{bp} := 2.75 \cdot in$	(User Input)
Base Plate Diameter =	$D_{bp} := 66 \cdot in$	(User Input)
Outer Pole Diameter =	$D_{pole} := 52.0 \cdot in$	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 30 \cdot in$

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

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

$d_1 = 9.27 \cdot in$	$d_7 = 24.27 \cdot in$
$d_2 = 17.63 \cdot in$	$d_8 = 17.63 \cdot in$
$d_3 = 24.27 \cdot in$	$d_9 = 9.27 \cdot in$
$d_4 = 28.53 \cdot in$	$d_{10} = 0.00 \cdot in$
$d_5 = 30.00 \cdot in$	$d_{11} = -9.27 \cdot in$
$d_6 = 28.53 \cdot in$	etc.

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 26 \cdot in$

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

$MA_1 = 0.00 \cdot in$	$MA_7 = 0.00 \cdot in$
$MA_2 = 0.00 \cdot in$	$MA_8 = 0.00 \cdot in$
$MA_3 = 0.00 \cdot in$	$MA_9 = 0.00 \cdot in$
$MA_4 = 2.53 \cdot in$	$MA_{10} = 0.00 \cdot in$
$MA_5 = 4.00 \cdot in$	$MA_{11} = 0.00 \cdot in$
$MA_6 = 2.53 \cdot in$	etc

Effective Width of Baseplate for Bending = $B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 32.5 \cdot in$

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i (d_i)^2 = 9 \times 10^3 \cdot in^2$

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

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

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

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

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

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 103.6 \cdot kips$

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

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

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} = 53.2 \cdot \%$ Bolts are "upset bolts". Use net area per AISC

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

Condition1 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.612 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 8.9 \cdot ksi$

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 = $C_{Max} := OM \cdot \frac{R_{bc}}{I_p} + \frac{Axial}{N} = 107.1 \cdot kips$

Maximum Compressive Stress = $f_a := \frac{C_{Max}}{A_n} = 33 \cdot ksi$

$K := 0.65$

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

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

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

Combined Stress % of Capacity = $\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) = 55 \cdot \%$

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

Condition2 = "OK"

Base Plate Analysis:

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

$C_1 = 34.3 \cdot kips$	$C_7 = 87.0 \cdot kips$
$C_2 = 63.7 \cdot kips$	$C_8 = 63.7 \cdot kips$
$C_3 = 87.0 \cdot kips$	$C_9 = 34.3 \cdot kips$
$C_4 = 102.0 \cdot kips$	$C_{10} = 1.8 \cdot kips$
$C_5 = 107.1 \cdot kips$	$C_{11} = -30.8 \cdot kips$
$C_6 = 102.0 \cdot kips$	etc.

Maximum Bending Stress in Plate = $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} \cdot t_{bp}^{\,2}\right)} = 23.1 \cdot ksi$

Allowable Bending Stress in Plate = $F_{bp} := 1.33 \cdot 0.75 \cdot Fy_{bp} = 49.9 \cdot ksi$

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} = 46.2 \cdot \%$

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

Condition3 = "Ok"

Rock Anchor Design:

Input Data:

Max Pier Reactions:

Moment =	$Moment := 2635 \cdot ft \cdot kips$	user input	
Shear =	$Shear := 49 \cdot kips$	user input	
Compression =	$Axial := 35 \cdot kips$	user input	

Structure:

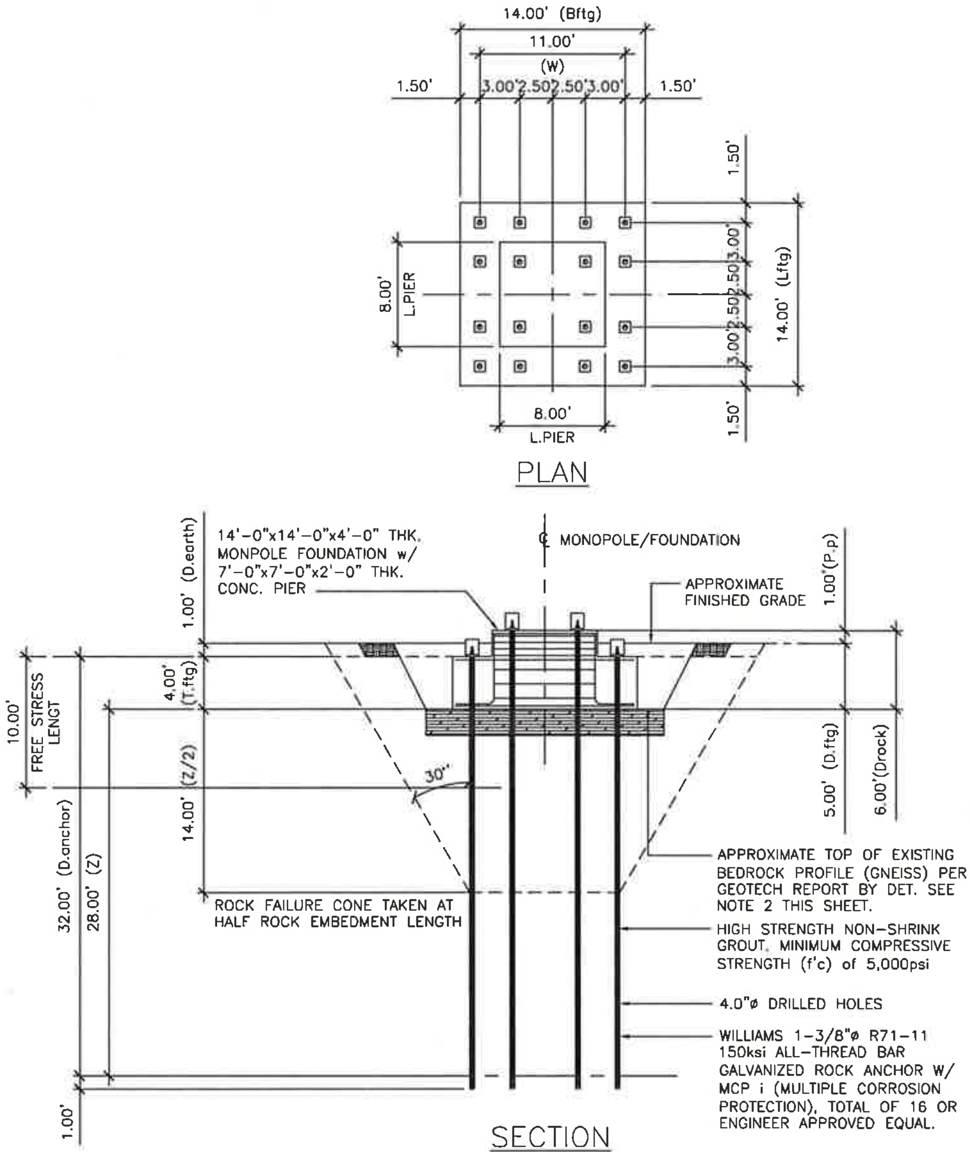
Footing Width =	$W_{ftg} := 14ft$	user input	
Footing Length =	$L_{ftg} := 14ft$	user input	
Footing Thickness =	$T_{ftg} := 4.0ft$	user input	
Pier Length=	$L_{pier} := 8.0ft$	user input	
Pier Depth =	$T_{pier} := 2.0ft$	user input	
Pier Projection Above Grade =	$P_p := 1.0 \cdot ft$	user input	

Depths:

Depth to Bottom of Footing =	$D_{ftg} := 5.0ft$	user input	(from grade line)
Depth to Sound (Competent) Rock Per Geo-tech Report =	$D_{rock} := 5.0ft$	user input	(from grade line)
Depth to Suitable Earth =	$D_{earth} := 1.0ft$	user input	(from grade line)
Anchor Depth =	$D_{anchor} := 32ft$	user input	(from grade line)

Subgrade Properties:

Internal Friction Angle =	$\phi := 30deg$	user input	
Unit Weight of Earth =	$\gamma_{earth} := 125 \frac{lb}{ft^3}$	user input	
Unit Weight of Rock =	$\gamma_{rock} := 165 \frac{lb}{ft^3}$	user input	
Unit Weight of Conc =	$\gamma_{conc} := 150 \frac{lb}{ft^3}$	user input	*(Based on Addendum Letter to Geotechnical Report prepared by Design Earth Technology (DET), dated October 4, 2010. Gneiss Bedrock with average RQD of 70% and average Uniaxial Compressive Strength of 6,870psi at boring B-1.*
Allowable Bearing =	$q_s := 20000 \cdot psf$	user input	



Rock Anchor Foundation Geometry:

Rock Anchor Properties:

Number of Anchors (along width) =	$N_{anchor} := 4$	user input	
Hole Diameter =	$hole_d := 4in$	user input	
Ultimate Bond Stress Between Rock and Grout =	$\sigma_{bond} := 75 \cdot psi$	user input	
Allowable Bond Stress Between Rock and Grout =	$\sigma_{allbond} := \sigma_{bond} \cdot 0.5 = 37.5psi$	user input	
Grout Allowable Compressive Stress =	$fc_g := 5000 \cdot psi$	user input	
Anchor Spacing* (along length) =	$S_{anchor} := 11ft$	user input	
Required Factor of Safety =	$F_S := 2.0$	user input	
Rock Anchor Ultimate Strength =	$Fu_{anchor} := 150.0ksi$	user input	Williams R71-14 1.75" dia. 150ksi
Rock Anchor Yield Strength =	$Fy_{anchor} := 127.7ksi$	user input	Per Recommendation of PTI For Prestressed Rock Soil and Soil Anchors Section 6.6 Design Load Should Be Designed so that the design load is not more than 60% of Specified Minimum Tensile Strength per Recommendation per PTI Section 6.6
Rock Anchor Diameter =	$d_{ra} := 1.375in$	user input	
Rock Anchor Area per Group =	$A_g := 1.580in^2$	user input	
Rock Anchor Ultimate Tensile Strength =	$P_u := 237kips$	user input	
Rock Anchor Allowable Tension =	$P_{all} := 0.60 \cdot P_u = 142.2 \cdot kips$		
Rock Anchor Maximum Working Load to Yield =	$T_y := 0.80 \cdot P_u = 189.6 \cdot kips$		
Rock Anchor Shear Capacity =	$Sh := 0.4 \cdot T_y = 75.84 \cdot kips$		
Number of Rock Anchors =	$n_{anchor} := 16$	user input	

Rock Anchor Tension/Shear Check:

Overturning Moment =	$OM := Moment + Shear \cdot (T_{ftg} + T_{pier}) = 2929 \cdot ft \cdot kips$
Weight of Pad =	$W_{pad} := (W_{ftg} \cdot L_{ftg} \cdot T_{ftg}) \cdot \gamma_{conc} = 117.6 \cdot kips$
Weight of Pier =	$W_{pier} := (L_{pier}{}^2 \cdot T_{pier}) \cdot \gamma_{conc} = 19.2 \cdot kips$
Weight of Soil =	$W_{soil} := \left[\left[(W_{ftg} \cdot L_{ftg}) - L_{pier}{}^2\right] \cdot D_{earth}\right] \cdot \gamma_{earth} = 16.5 \cdot kips$
Total Weight =	$W_{conc} := W_{pad} + W_{pier} = 136.8 \cdot kips$
Total Weight of Foundation =	$W_{tot} := W_{conc} + W_{soil} + Axial = 188.3 \cdot kips$
Resisting Moment =	$M_r := W_{tot} \cdot \left(\frac{W_{ftg}}{2}\right) = 1318.1 ft \cdot kips$
Moment Required w/ F.O.S of 2.0 =	$M_{reqd} := OM \cdot (F_S) = 5858 ft \cdot kips$
Net Moment Required =	$M_{net} := M_{reqd} - M_r = 4539.9 ft \cdot kips$

Check Perpendicular About Foundation Toe

Rock Anchor Distance 1 = $d_1 := 2.5 \cdot ft$ *user input*

Rock Anchor Distance 2 = $d_2 := 5.5 \cdot ft$ *user input*

Number of Rock Anchors in Group 1 = $n_1 := 8$ *user input*

Number of Rock Anchors in Group 2 = $n_2 := 8$ *user input*

Polar Moment of Inertia = $I_{p1} := d_1^2 \cdot n_1 + d_2^2 \cdot n_2 = 292 ft^2$

Tension Force per Anchor = $P_{design.perp} := \frac{d_2}{I_{p1}} \cdot (M_{net}) = 85.5 \cdot kips$

Check @ 45 Degree Angle About Foundation Toe

Rock Anchor Distance 1 = $d_3 := 2.13 \cdot ft$ *user input*

Rock Anchor Distance 2 = $d_4 := 3.5 \cdot ft$ *user input*

Rock Anchor Distance 2 = $d_5 := 5.63 \cdot ft$ *user input*

$d_6 := 7.75 \cdot ft$ *user input*

Number of Rock Anchors in Group = $n_3 := 4$ *user input*

$n_4 := 2$ *user input*

$n_5 := 4$ *user input*

$n_6 := 2$ *user input*

Polar Moment of Inertia = $I_{p2} := d_3^2 \cdot n_3 + d_4^2 \cdot n_4 + d_5^2 \cdot n_5 + d_6^2 \cdot n_6 = 289.56 ft^2$

Tension Force per Anchor = $P_{design.diag} := \frac{d_6}{I_{p2}} \cdot (M_{net}) = 121.5 \cdot kips$

Design Tension Force per Anchor = $P_{design} := (P_{design.perp}) = 85.5 \cdot kips$

Proof Load Rock Anchors To 1.33x Design Load for Working Loads or Maximum of 0.8x Ultimate Design Load =

$P_{Lreqd} = P_{design} \cdot 1.33 = 113.7 \cdot kips$ $L_{Lreqd} = P_{design} \cdot 1.10 = 94.1 \cdot kips$

$P_{Lmax} := P_u \cdot 0.80 = 189.6 \cdot kips$ $L_{Lmax} := P_u \cdot 0.60 = 142.2 \cdot kips$

Check Anchor Design Load Against Max Allowable Tensile Load =

$TensionCheck1 := max(P_{Lmax}, P_{Lreqd}) = 189.6 \cdot kips$

$TensionCheck2 := max(L_{Lmax}, L_{Lreqd}) = 142.2 \cdot kips$

TensionCondition1 := if($P_{Lreqd} \le P_{Lmax}$, "OK", "IncreaseAnchorDia") = "OK"

TensionCondition2 := if($L_{Lreqd} \le L_{Lmax}$, "OK", "IncreaseAnchorDia") = "OK"

Provided Safety Factor = $\frac{P_{design}}{P_{all}} = 0.60$

SafetyFactor := if($\frac{P_{design}}{P_{all}} \le 1.0$, "OK", "Overstressed")

SafetyFactor = "OK"

Rock Anchor Req'd Development Length in Rock:

Minimum Free Stress Length Required = $F_{stressreqd} := 10.0ft$ *user input*

Minimum Free Stress Length Provided = $F_{stressprov} := 10ft$ *user input*

Controlling Free Stress Length: $L_f := if(F_{stressprov} > F_{stressreqd}, F_{stressprov}, F_{stressreqd})$ $L_f = 10ft$

Rock Anchor/Grout Bond Length: $L_d := \dfrac{\left(\dfrac{0.04}{in} P_u\right)}{\sqrt{fc_g \cdot psi}}$ $L_d = 11.17 \cdot ft$

Rock/Grout Bond Length: $L_b := \dfrac{P_u}{\pi \cdot hole_d \cdot \sigma_{bond}} = 20.96ft$

Controlling Length: $L_a := if(L_b < L_d, L_d, L_b)$ $L_a = 20.96ft$

$L_{bprov} := D_{anchor} - T_{ftg} = 28ft$

$Bond\_Length\_Check := if\left(\dfrac{L_a}{L_{bprov}} \le 1.00, \text{"OK"}, \text{"Increase Length"}\right)$

$\dfrac{L_a}{L_{bprov}} = 0.75$ $Bond\_Length\_Check = \text{"OK"}$

Resistance Calculations:

Intermediate Dimension:

Total Anchor Width = $W := S_{anchor} = 11ft$

Volumes:

Base Area 1 of Resisting Pyramid = $B_1 := W^2 = 121ft^2$

Base Area 2 of Resisting Pyramid = $B_2 := \left[\tan(\phi) \cdot \left[(D_{anchor} - L_f) \cdot 0.5 + L_f - T_{ftg}\right] \cdot 2 + W\right]^2 = 938.2ft^2$

Base Area 3 of Resisting Pyramid = $B_3 := \left[\tan(\phi) \cdot \left[(D_{anchor} - L_f) \cdot 0.5 + L_f\right] \cdot 2 + W\right]^2 = 1242.5ft^2$

Total Volume of Resisting Material = $V_{tot} := \dfrac{\left[\left[(D_{anchor} - L_f) \cdot 0.5 + L_f\right] \cdot \left(B_1 + B_3 + \sqrt{B_1 \cdot B_3}\right)\right]}{3} = 12258.5 \cdot ft^3$

Volume of Rock = $V_{rock} := \dfrac{\left[\left[(D_{anchor} - L_f) \cdot 0.5 + L_f - T_{ftg}\right] \cdot \left(B_1 + B_2 + \sqrt{B_1 \cdot B_2}\right)\right]}{3} = 7911.3 \cdot ft^3$

Volume of Concrete = $V_{conc} := (W_{ftg} \cdot L_{ftg} \cdot T_{ftg}) + (L_{pier}^2 \cdot T_{pier}) = 912 \cdot ft^3$

Volume of Earth = $V_{earth} := V_{tot} - V_{rock} - W_{ftg} \cdot L_{ftg} \cdot T_{ftg} = 3563.1 \cdot ft^3$

Resisting Forces:

Resisting Rock Force = $W_{rock} := V_{rock} \cdot \gamma_{rock} = 1305.4 \cdot kips$

Resisting Earth Force = $W_{earth} := V_{earth} \cdot \gamma_{earth} = 445.4 \cdot kips$

Resisting Concrete Force = $W_{conc} = 136.8 \cdot kips$

Total Resisting Force = $W_{total} := W_{rock} + W_{earth} + W_{conc} = 1887.6 \cdot kips$

Foundation Uplift Check:

Check Perpendicular to Foundation =

Uplift Force = $Uplift_{perp} := \dfrac{OM}{\left(\dfrac{W_{ftg}}{2}\right)} = 418.4 \cdot kips$

Factor of Safety = $\dfrac{W_{total}}{Uplift_{perp}} = 4.51$

$Uplift\_Perp\_Check := if\left(\dfrac{W_{total}}{Uplift_{perp}} \geq F_S, \text{"OK"}, \text{"Overstressed"}\right)$

Uplift_Perp_Check = "OK"

Check @ 45 Degree Angle to Foundation =

Uplift Force = $Uplift_{Diag} := \dfrac{OM}{\dfrac{\left(\sqrt{2} \cdot L_{ftg}\right)}{2}} = 295.9 \cdot kips$

Factor of Safety = $\dfrac{W_{total}}{Uplift_{Diag}} = 6.38$

$Uplift\_Diag\_Check := if\left(\dfrac{W_{total}}{Uplift_{Diag}} \geq F_S, \text{"OK"}, \text{"Overstressed"}\right)$

Uplift_Diag_Check = "OK"

Rock Bearing Capacity Check:

Bearing Force = $MaxBearing := \left[\dfrac{\left(Axial + W_{conc}\right) + \left(n_{anchor} L_{reqd}\right)}{W_{ftg} \cdot L_{ftg}}\right] + \dfrac{OM}{\left(\dfrac{W_{ftg}^{\,3}}{6}\right)}$

$MaxBearing = 14.96 \cdot ksf$

$\dfrac{MaxBearing}{q_s} = 0.75$

$Rock\_Bearing\_Check := if\left(\dfrac{MaxBearing}{q_s} \leq 1.00, \text{"OK"}, \text{"Overstressed"}\right)$

Rock_Bearing_Check = "OK"

SITE NAME	BYRAM PARK CT	ECP - CELL #	5	8
LATITUDE	41-00-18.23 N	LONGITUDE	73-38-53.92 W	
		SAVE BUTTON		
AWS: swap out PCS antenna for xpol, add AWS antenna, fiber & RRH.		STRUCTURE TYPE	MONOPOLE	

2100 Mhz - LTE ADD	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	2100 BBU & RRH	2100 BBU & RRH	2100 BBU & RRH
ANTENNA TYPE	BXA-171063-12BF-EDIN-0	BXA-171063-12BF-EDIN-0	BXA-171063-12BF-EDIN-0
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	340	80	230
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	57	57	57
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			
RRH - QTY/MODEL	1 ALU RH_2X40-AWS	1 ALU RH_2X40-AWS	1 ALU RH_2X40-AWS
SECTOR DISTRIBUTION BOX			
MAIN DISTRIBUTION BOX	1	DB-T1-6Z-8AB-0Z	
700 Mhz - LTE Current Config	**ALPHA**	**BETA**	**GAMMA**
EQUIPMENT TYPE	700 MHz eNodeB + TRDU	700 MHz eNodeB + TRDU	700 MHz eNodeB + TRDU
ANTENNA TYPE	SLXW5514	SLXW5514	SLXW5514
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	330	70	230
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	57	57	57
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			
RRH - QTY/MODEL			
SECTOR DISTRIBUTION BOX			
MAIN DISTRIBUTION BOX			
700 Mhz - LTE Future Config	**ALPHA**	**BETA**	**GAMMA**
EQUIPMENT TYPE	700 MHz eNodeB + TRDU	700 MHz eNodeB + TRDU	700 MHz eNodeB + TRDU
ANTENNA TYPE	SLXW5514	SLXW5514	SLXW5514
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	330	70	230
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	57	57	57
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
MCPA BRICKS (QTY)			
RRH - QTY/MODEL			
SECTOR DISTRIBUTION BOX			
MAIN DISTRIBUTION BOX			
850 Celluar - Current Config	**ALPHA**	**BETA**	**GAMMA**
EQUIPMENT TYPE	Cellular Modcell 4.0HD	Cellular Modcell 4.0HD	Cellular Modcell 4.0HD
ANTENNA TYPE	LPA-80063/6CF	LPA-80063/6CF	LPA-80063/6CF
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	340	80	230
DOWN TILT (MECH/DEG)	2	2	2
RAD CTR (FT AGL)	57	57	57
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEXER KIT - QTY / MODEL			
MCPA BRICKS (QTY)			
850 Celluar - Future Config	**ALPHA**	**BETA**	**GAMMA**
EQUIPMENT TYPE	Cellular Modcell 4.0HD	Cellular Modcell 4.0HD	Cellular Modcell 4.0HD
ANTENNA TYPE	LPA-80063/6CF	LPA-80063/6CF	LPA-80063/6CF
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	340	80	230
DOWN TILT (MECH/DEG)	2	2	2
RAD CTR (FT AGL)	57	57	57
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEXER KIT - QTY / MODEL			
MCPA BRICKS (QTY)			
1900 PCS - Current Config	**ALPHA**	**BETA**	**GAMMA**
EQUIPMENT TYPE	PCS Modcell 4.0	PCS Modcell 4.0	PCS Modcell 4.0
ANTENNA TYPE	LPA-171063-12CF	LPA-171063-12CF	LPA-171063-12CF
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	340	80	230
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	57	57	57
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
DIPLEXER KIT - QTY / MODEL			
MCPA BRICKS (QTY)			
1900 PCS - Future Config	**ALPHA**	**BETA**	**GAMMA**
EQUIPMENT TYPE	PCS Modcell 4.0	PCS Modcell 4.0	PCS Modcell 4.0
ANTENNA TYPE	BXA-171063-12BF-EDIN-0	BXA-171063-12BF-EDIN-0	BXA-171063-12BF-EDIN-0
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	340	80	230
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	57	57	57
TMA - QTY / MODEL			
DIPLEX WITH CELLULAR CABLE			
MCPA BRICKS (QTY)			

NUMBER OF CABLE'S NEEDED						ESTIMATED CABLE LENGTH			
MAINLINE SIZE	1 5/8"	TOTAL # OF MAINLINES			18	MAINLINE (FT)			
JUMPER SIZE	1/2 "	TOTAL # OF TOP JUMPERS			18	TOP JUMPER (FT)			12
Equipment Cable Ordering		**MAIN CABLE**	18	+	0	**TOP JUMPER #**	18	+	0
FIBER LINE SIZE	1 5/8"	TOTAL # OF FIBER LINES			1	FIBER LINE MODEL #			**HB158-1-08U8-S8J18**
JUMPER SIZE	5/8"	TOTAL # OF TOP JUMPERS			3	TOP JUMPER MODEL #			**HB058-1-08U1-S1J18**
Fiber Cable Ordering		**FIBER CABLE**	0	+	1	**TOP JUMPER #**	0	+	3

TX / RX FREQUENCIES			TX POWER OUTPUT	
Cellular A-Band	**PCS F-Band**	**700 Mhz C - E**	Cellular (Watts)	20
TX - 869-880,890-891.5 MHz	TX - 1970-1975	TX - 746-757	PCS (Watts)	16
RX - 824-835,845-846.5 MHz	RX - 1890-1895	RX - 776-787	LTE (Watts)	40

ALPHA				BETA				GAMMA			
Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code	Ant.	Freq.	Func.	Color Code
A1	800	Tx1/Rx0	RED	A7	800	Tx2/Rx0	BLUE	A13	800	Tx3/Rx0	GREEN
A2	1900	Tx1/Rx0	RED/	A8	1900	Tx2/Rx0	BLUE/ WHITE	A14	1900	Tx3/Rx0	GREEN/WHITE
A3	700	Tx1/Rx0	RED/	A9	700	Tx2/Rx0	BLUE/ ORANGE	A15	700	Tx3/Rx0	GREEN/ORANGE
A4	700	Tx4/Rx1	RED/RED/ ORANGE	A10	700	Tx5/Rx1	BLUE/BLUE/ ORANGE	A16	700	Tx6/Rx1	GREEN/GREEN/ ORANGE
A5	1900	Tx4/Rx1	RED/RED/ WHITE	A11	1900	Tx5/Rx1	BLUE/BLUE/ WHITE	A17	1900	Tx6/Rx1	GREEN/GREEN/ WHITE
A6	800	Tx4/Rx1	RED/RED	A12	800	Tx5/Rx1	BLUE/BLUE	A18	800	Tx6/Rx1	GREEN/GREEN
F1-A	1700	Tx/Rx	RED/	F1-B	1700	Tx/Rx	BLUE/BROWN	F1-C	1700	Tx/Rx	GREEN/BROWN
F1-D	1700	Tx/Rx	RED/RED/	F1-E	1700	Tx/Rx	BLUE/BLUE/BR	F1-F	1700	Tx/Rx	GREEN/GREEN/BROWN

RF ENGINEER	RF MANAGER	INITIALS	DATE
Prepared By :Maria Montrose	Robert Hesselbach	MMM	8/8/2013

Site Configuration

Amphenol ANTENNA SOLUTIONS

BXA-171063-12BF-EDIN-X

Replace "X" with desired electrical downtilt

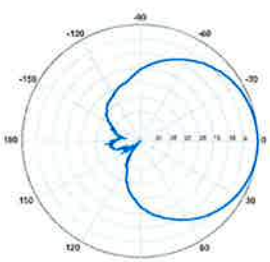
X-Pol | FET Panel | 63° | 19.0 dBi

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

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

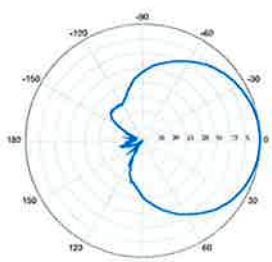
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting Bracket Kit	26799997	50-102 mm 2.0-4.0 in	2.3 kg 5 lbs
2-Point Mounting & Downtilt Bracket Kit	26799999	50-102 mm 2.0-4.0 in	3.6 kg 8 lbs
Concealment Configurations	For concealment configurations, order BXA-171063-12BF-EDIN-X-FP		

BXA-171063-12BF-EDIN-X



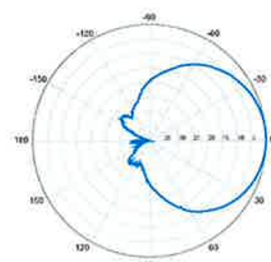
Horizontal | 1710-1880 MHz

BXA-171063-12BF-EDIN-X



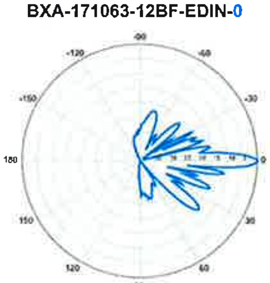
Horizontal | 1850-1990 MHz

BXA-171063-12BF-EDIN-X



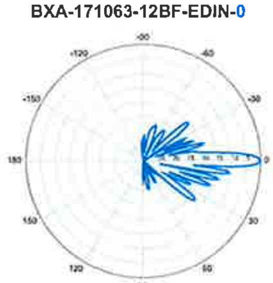
Horizontal | 1920-2170 MHz

BXA-171063-12BF-EDIN-0



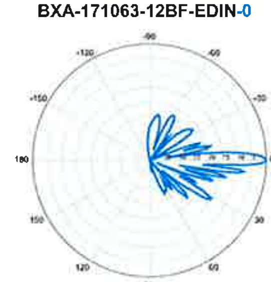
0° | Vertical | 1710-1880 MHz

BXA-171063-12BF-EDIN-0



0° | Vertical | 1850-1990 MHz

BXA-171063-12BF-EDIN-0



0° | Vertical | 1920-2170 MHz

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

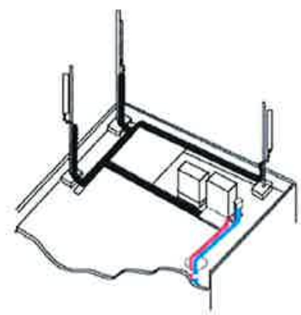
Because of its small size and weight, the Alcatel-Lucent RRH2x40-AWS can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-AWS where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation 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

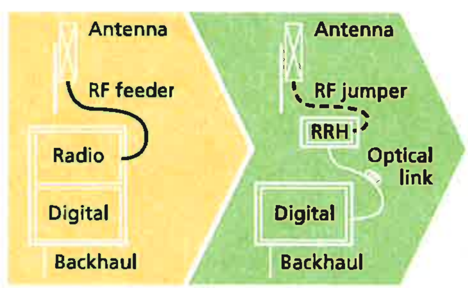
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless)
- Noise-free
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

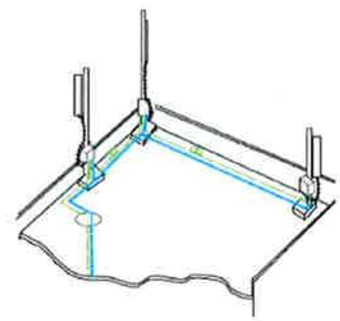
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility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

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.