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

December 20, 2013

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

Re: **Notice of Exempt Modification – Facility Modification**
100 Universal Drive, North Haven, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) wireless telecommunications antennas at the top of the existing 80-foot tower at the above-referenced address. The tower and underlying property are owned by CSX Transportation, Inc. The Council approved Cellco's use of this tower in 1997. Cellco now intends to replace nine (9) of its antennas with three (3) model BXA-80063-4BF cellular antennas; three (3) model BXA-70063-6CF LTE antennas; and three (3) model MGD3-800TX AWS antennas, at the 80-foot level on the tower. Cellco also intends to install three (3) remote radio heads ("RRHs") behind its AWS antennas and one (1) HYBRIFLEX™ antenna cable. 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 Michael J. Freda, First Selectman for the Town of North Haven. A copy of this letter is also being sent to CSX Transportation, Inc., the owner of the property where 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).

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 80-foot level on the 80-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. A cumulative General Power Density table for Cellco's modified facility is included behind Attachment 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:
Michael J. Freda, North Haven First Selectman
CSX Transportation, Inc.
Sandy M. Carter

ATTACHMENT 1

BXA-80063-4BF-EDIN-X

X-Pol | FET Panel | 63° | 13.0 dBd

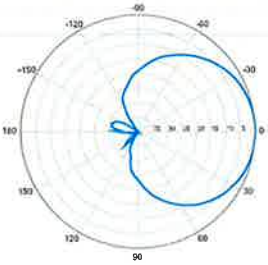
Replace "X" with desired electrical downtilt.

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

Electrical Characteristics		
Frequency bands	806-900 MHz*	
*Optional frequency band for iDEN	806-941 MHz (specify when ordering)	
Polarization	±45°	
Horizontal beamwidth	63°	
Vertical beamwidth	15°	
Gain	13.0 dBd (15.1 dBi)	
Electrical downtilt (X)	0, 2, 3, 4, 5, 6, 8, 9, 10, 12, 14	
Impedance	50Ω	
VSWR	≤1.4:1	
Upper sidelobe suppression (0°)	-22.1 dB	
Front-to-back ratio (+/-30°)	-34.9 dB	
Null fill	5% (-26.02 dB)	
Isolation between ports	< -25 dB	
Input power with EDIN connectors	500 W	
Input power with N connectors	300 W	
Lightning protection	Direct Ground	
Connector(s)	2 Ports / EDIN or N / Female / Bottom	
Mechanical Characteristics		
Dimensions Length x Width x Depth	1134 x 285 x 135 mm	44.6 x 11.2 x 5.3 in
Depth with z-brackets	175 mm	6.9 in
Weight without mounting brackets	5.7 kg	12.6 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.32 m² Side: 0.15 m²	Front: 3.5 ft² Side: 1.7 ft²
Wind load @ 161 km/hr (100 mph)	Front: 469 N Side: 249 N	Front: 104 lbf Side: 53 lbf

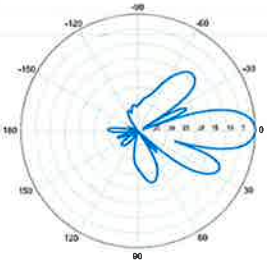
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting & Downtilt Bracket Kit	36210006	40-115 mm 1.57-4.5 in	4.1 kg 9 lbs
Concealment Configurations	For concealment configurations, order BXA-80063-4BF-EDIN-X-FP		

BXA-80063-4BF-EDIN-X



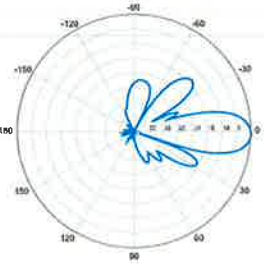
Horizontal

BXA-80063-4BF-EDIN-0



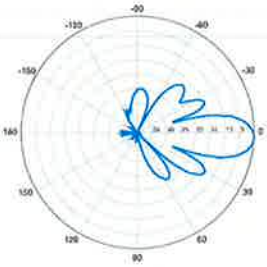
0° | Vertical

BXA-80063-4BF-EDIN-2



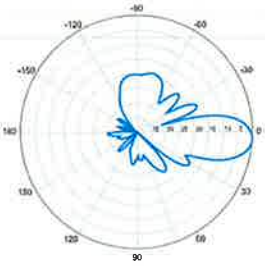
2° | Vertical

BXA-80063-4BF-EDIN-3



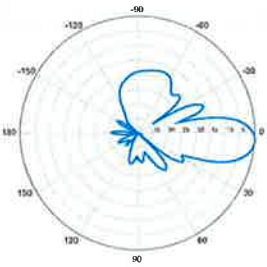
3° | Vertical

BXA-80063-4BF-EDIN-4



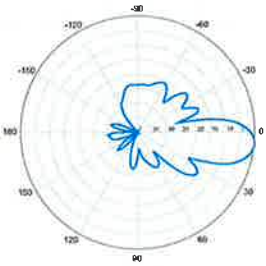
4° | Vertical

BXA-80063-4BF-EDIN-5



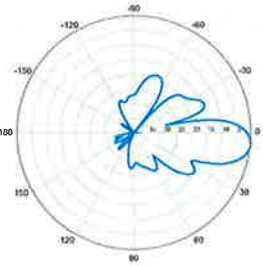
5° | Vertical

BXA-80063-4BF-EDIN-6



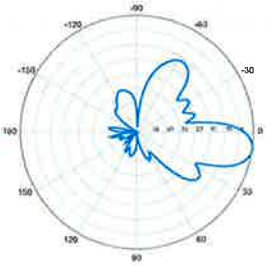
6° | Vertical

BXA-80063-4BF-EDIN-8



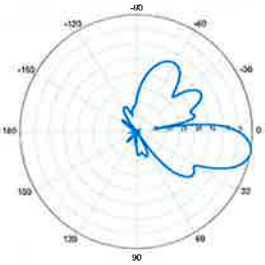
8° | Vertical

BXA-80063-4BF-EDIN-9



9° | Vertical

BXA-80063-4BF-EDIN-10

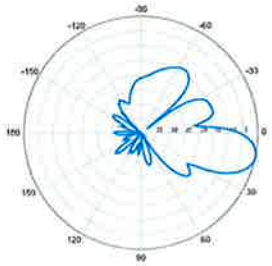


10° | Vertical

BXA-80063-4BF-EDIN-X

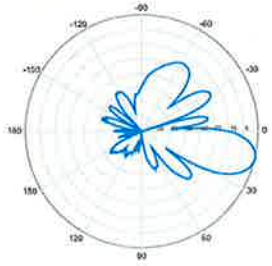
X-Pol | FET Panel | 63° | 13.0 dBd

BXA-80063-4BF-EDIN-12



12° | Vertical

BXA-80063-4BF-EDIN-14



14° | Vertical

BXA-70063-6CF-EDIN-X

X-Pol | FET Panel | 63° | 14.5 dBd

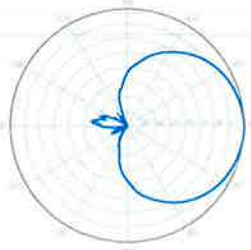
Replace "X" with desired electrical downtilt.

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

Electrical Characteristics	696-900 MHz	
Frequency bands	696-806 MHz	806-900 MHz
Polarization	±45°	
Horizontal beamwidth	65°	63°
Vertical beamwidth	13°	11°
Gain	14.0 dBd (16.1 dBi)	14.5 dBd (16.6 dBi)
Electrical downtilt (X)	0, 2, 3, 4, 5, 6, 8, 10	
Impedance	50Ω	
VSWR	≤1.35:1	
Upper sidelobe suppression (0°)	-18.3 dB	-18.2 dB
Front-to-back ratio (+/-30°)	-33.4 dB	-36.3 dB
Null fill	5% (-26.02 dB)	
Isolation between ports	< -25 dB	
Input power with EDIN connectors	500 W	
Input power with NE connectors	300 W	
IM3 (2x20W carriers)	< -153 dBc	
Lightning protection	Direct Ground	
Connector(s)	2 Ports / EDIN or NE / Female / Center (Back)	
Mechanical Characteristics		
Dimensions Length x Width x Depth	1804 x 285 x 132 mm	71.0 x 11.2 x 5.2 in
Depth with z-brackets	172 mm	6.8 in
Weight without mounting brackets	7.9 kg	17 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.51 m² Side: 0.24 m²	Front: 5.5 ft² Side: 2.6 ft²
Wind load @ 161 km/hr (100 mph)	Front: 759 N Side: 391 N	Front: 169 lbf Side: 89 lbf

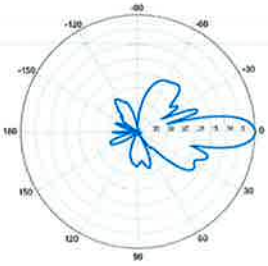
Mounting Options	Part Number	Fits Pipe Diameter	Weight
3-Point Mounting & Downtilt Bracket Kit	36210008	40-115 mm 1.57-4.5 in	6.9 kg 15.2 lbs
Concealment Configurations	For concealment configurations, order BXA-70063-6CF-EDIN-X-FP		

BXA-70063-6CF-EDIN-X



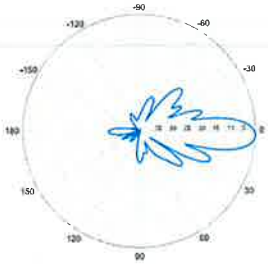
Horizontal | 750 MHz

BXA-70063-6CF-EDIN-0

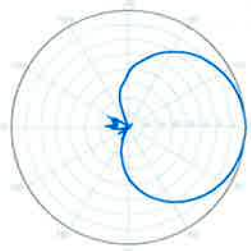


0° | Vertical | 750 MHz

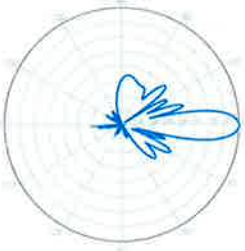
BXA-70063-6CF-EDIN-2



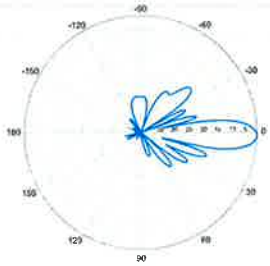
2° | Vertical | 750 MHz



Horizontal | 850 MHz



0° | Vertical | 850 MHz



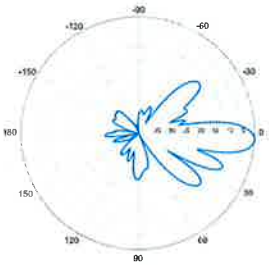
2° | Vertical | 850 MHz

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

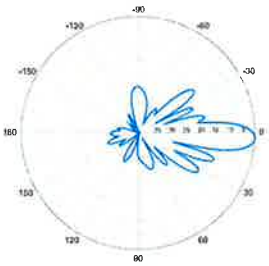
BXA-70063-6CF-EDIN-X

X-Pol | FET Panel | 63° | 14.5 dBd

BXA-70063-6CF-EDIN-3

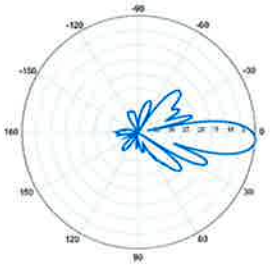


3° | Vertical | 750 MHz

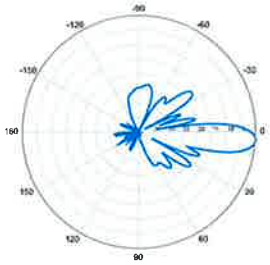


3° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-4

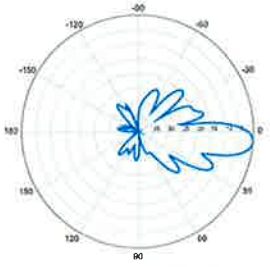


4° | Vertical | 750 MHz

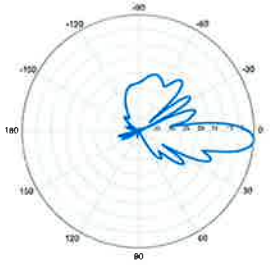


4° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-5

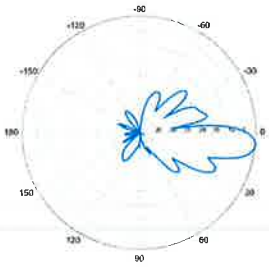


5° | Vertical | 750 MHz

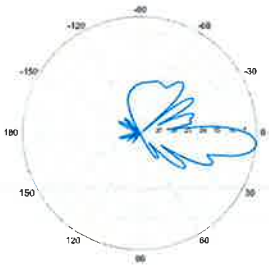


5° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-6

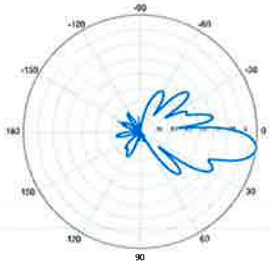


6° | Vertical | 750 MHz

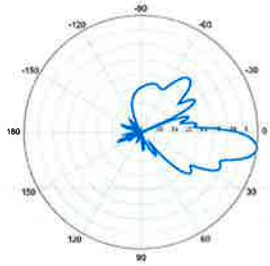


6° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-8

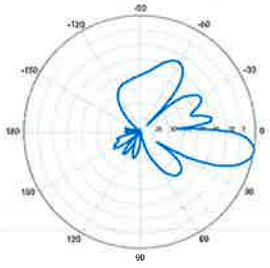


8° | Vertical | 750 MHz

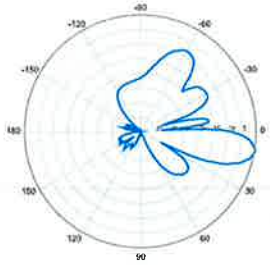


8° | Vertical | 850 MHz

BXA-70063-6CF-EDIN-10



10° | Vertical | 750 MHz



10° | Vertical | 850 MHz

SINGLE-BAND PANEL ANTENNA

BROADBAND 1710-2170 MHz

MGD3-800TX

1710 - 2170		
1710-1880	1850-1990	1920-2170
H66º V7.2º	H64º V6.6º	H63º V6.3º
Fixed Tilt	Fixed Tilt	Fixed Tilt
0º,2º,4º,6º	0º,2º,4º,6º	0º,2º,4º,6º

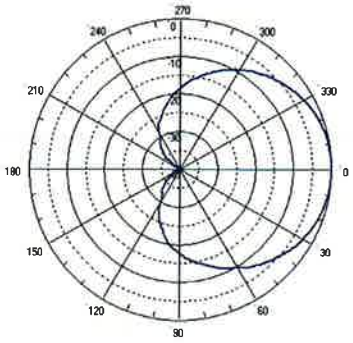
ELECTRICAL SPECIFICATIONS

BROADBAND 1710-2170 MHz

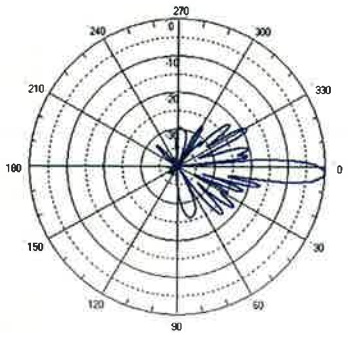
Antenna Model	MGD3-800TX		
Polarization	± 45º		
Frequency	***1710-2170***		
	1710 - 1880	1850 - 1990	1920 - 2170
Horizontal Beamwidth	66º	64º	63º
Vertical Beamwidth	7.2º	6.6º	6.3º
Gain (dBi)	18	18	18.5
Vertical Electrical Tilt	FIXED 0º,2º,4º,6º	FIXED 0º,2º,4º,6º	FIXED 0º,2º,4º,6º
Upper Sidelobe Suppression for the 1st lobe above main beam (dB)	20	20	20
Front-to-Back Ratio @ 180º ± 20º (dB)	> 30	> 30	> 30
VSWR	< 1.4 : 1	< 1.4 : 1	< 1.4 : 1
Cross Polar Ratio @ ± 60º (dB)	> 10	> 10	> 10
Isolation between Ports (dB)	> 30	> 30	> 30
Maximum Power Per Input (W)	250		
Intermodulation (dBc)	< - 150		
Impedance (Ω)	50		

MECHANICAL SPECIFICATIONS

Connectors		2 X 7/16 Female
Connector Position		Bottom
Survival Wind Speed	km/h (mph)	200 (125)
Front Windload N @ 160 km/h	(lbs @ 100 mph)	370 (85)
Lateral Windload N @ 160 km/h	(lbs @ 100 mph)	170 (40)
Radome Color		Grey, paintable
Humidity		100%
Antenna Weight	kg (lbs)	7 (15)
Antenna Dimension mm (in) H X W X D		1340 X 170 X 100 (53 X 7 X 4)



H&V Pattern



RYMSA Telecom Group (Headquarters)
Ctra. Campo Real Km. 2,700
28500 Arganda del Rey, Madrid - Spain
Phone: +34 91 876 06 80
Fax: +34 91 875 75 32
telecom.comercial@rymsa.com

RYMSA TELECOM GROUP
www.rymsa.com

RYMSA México telecom.comercial@rymsa.com
Phone: +52 55 1106 2623
RYMSA Wireless U.S.A. sales@rymsawireless.com
Phone: + 1 888 622 6995
www.rymsawireless.com

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

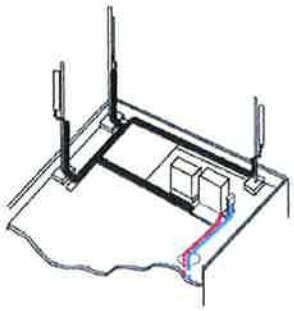
Because of its small size and weight, the Alcatel-Lucent RRH2x40-AWS can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-AWS where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation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

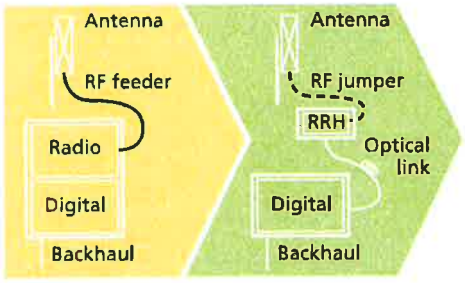
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless)
- Noise-free
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

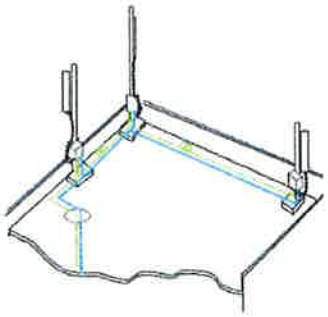
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility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

CPG2809100912 (09)

Alcatel·Lucent

Product Data Sheet HB158-1-08U8-S8J18

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

Product Description

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

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

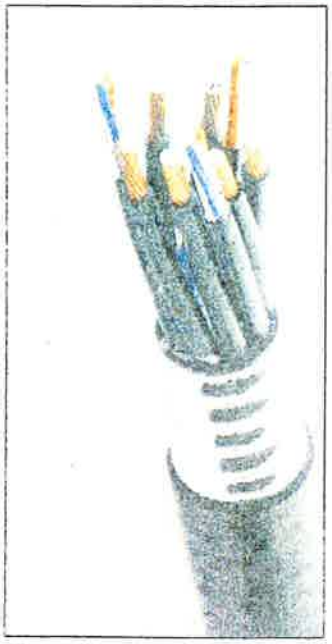


Figure 1: HYBRIFLEX Series

Features/Benefits

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

Technical Specifications

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

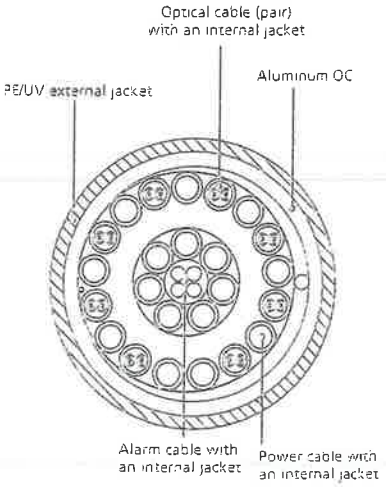


Figure 2: Construction Detail

* This data is provisional and subject to change

ATTACHMENT 2

Site Name: NORTH HAVEN SOUTH, CT
Cumulative Power Density

Operator	Operating Frequency	Number of Trans.	ERP Per Trans.	Total ERP	Distance to Target	Calculated Power Density	Maximum Permissable Exposure*	Fraction of MPE
	(MHz)		(watts)	(watts)	(feet)	(mW/cm^2)	(mW/cm^2)	(%)
VZW PCS	1970	9	481	4329	80	0.2432	1.0	24.32%
VZW Cellular	869	7	340	2380	80	0.1337	0.579333333	23.08%
VZW AWS	2145	1	1750	1750	80	0.0983	1.0	9.83%
VZW 700	698	1	879	879	80	0.0494	0.465333333	10.61%
Total Percentage of Maximum Permissible Exposure								67.86%

*Guidelines adopted by the FCC on August 1, 1996, 47 CFR Part 1 based on NCRP Report 86, 1986 and generally on ANSI/IEEE C95.1-1992

MHz = Megahertz
mW/cm^2 = milliwatts per square centimeter
ERP = Effective Radiated Power

Absolute worst case maximum values used.

ATTACHMENT 3

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

80' Existing Conrail Tower

Proposed Verizon Wireless
Antenna Upgrade

Verizon Wireless Site Ref:
North Haven South

100 Universal Drive
North Haven, CT

CENTEK Project No. 13075.046

Date: October 31, 2013

Prepared for:

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

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

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 installation/modification proposed by Verizon Wireless on the existing self supporting lattice tower located in North Haven, Connecticut.

The host tower is a 80-ft, four legged, tapered steel lattice tower. The manufacturer's drawings and calculations were unavailable for use in this report. The tower geometry, structure member sizes, tower reinforcements and foundation reinforcements were taken from a previous structural analysis report prepared by Centek Engineering, project no. 10001.CO59 dated July 8, 2010.

Antenna and appurtenance inventory was taken from the aforementioned structural analysis report and from a RF data sheet provided by Verizon Wireless.

The existing structure was significantly reinforced by Verizon Wireless (formerly Bell Atlantic Nynex Mobile) for the purpose of utilizing the structure as a communications tower. Calculations and drawings for this reinforcement were prepared by URS Greiner, Inc. AES; project no. F301208.55/F12, dated July 24, 1997.

The tower is made of four (4) tapered vertical sections consisting of built-up structural steel angle legs. Diagonal lateral support bracing consists of structural steel angle shapes connected to the leg sections via single 5/8" ∅ bolts. The built-up steel leg sections are connected by intermittent welds along their length. The width of the tower face is 6.00-ft at the base and 2.88-ft at the top. Since the age, condition and properties of the original steel members is unknown only the steel utilized in the prior reinforcement of the tower conforming to ASTM Grade A36 was considered in this analysis.

Verizon proposes the removal of nine (9) existing panel antennas and the installation of nine (9) panel antennas, three (3) remote radio heads and one (1) main distribution box mounted to an existing platform with handrails. Reference is made to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

The existing tower was designed to support several communication antennas. The existing, proposed and future loads considered in this analysis consist of the following:

- VERIZON (Existing to be Remain):
  Antennas: Three (3) RYMSA MG D3-800T0 panel antennas and six (6) RFS FD9R6004/2C-3L Diplexers mounted on an existing platform with handrails with a RAD center elevation of ±80-ft above the existing tower base.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the face of the existing tower configured in 2 rows of 6 cables as specified in Section 3 of this report.
- VERIZON (Existing to Remove):
  Antennas: Six (6) Andrew DB844G65ZXAY and three (3) Powerwave P65-16-XL-2 panel antennas mounted on an existing platform with handrails with a RAD center elevation of ±80-ft above the existing tower base.

- **VERIZON (Proposed):**
  Antennas: Three (3) RYMSA MG D3-800T0 panel antennas, three (3) Antel BXA-70063-6CF panel antennas, three (3) Antel BXA-80063-4BF 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 an existing platform with handrails with a RAD center elevation of ±80-ft above the existing tower base.
  Cables: One (1) 1-5/8" Ø fiber cable running on the face of the existing tower as specified in Section 3 of this report.

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.
- All members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
- All member protective coatings are in good condition.
- All tower members were properly designed, detailed, fabricated, installed and have been properly maintained since erection.
- Any deviation from the analyzed antenna loading will require a new analysis for verification of structural adequacy.
- **All coax cables routed as specified in Section 3 of 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:	New Haven; v = 85 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	North Haven; v = 110 mph (3 second gust) equivalent to v = 90 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	Appendix K wind speed controls.	
Load Cases:	Load Case 1; 90 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 78 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 78 mph wind speed velocity represents 75% of the wind pressure generated by the 90 mph wind speed.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 3; Seismic – not checked	*[Section 1614.5 of State Bldg. Code 2005] does not control in the design of this structure type*

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

Tower Capacity

Tower stresses were calculated utilizing the structural analysis software tnxTower. Allowable stresses were determined based on Table 5 of the TIA/EIA code with a 1/3 increase per Section 3.1.1.1 of the same code.

- Calculated stresses were found to be within allowable limits. In Load Case 1, per tnxTower "Section Capacity Table", this tower was found to be at **99.7%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Diagonal (T4)	0' - 19.6'	91.7%	**PASS**
Top Girt (T2)	38.8' – 58.7'	13.3%	**PASS**
Leg (T4)	0' - 19.6'	99.7%	**PASS**

Foundation and Anchors

The existing foundation consists of a 14.5-ft square x 5-ft thick concrete mat bearing directly on the existing sub grade. Allowable soil bearing pressure was assumed to be 3000 psf for the analysis. The tower legs are directly embedded into the concrete foundation structure.

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

Reactions	Vector	Proposed Base Reactions
Base	Shear	**12 kips**
	Compression	**9 kips**
	Moment	**581 kip-ft**
Leg	Shear	**6 kips**
	Compression	**80 kips**
	Uplift	**78 kips**

- The foundation was found to be within allowable limits.

Foundation	Design Limit	IBC 2003/2005 CT State Building Code Section 3108.4.2 (FS)[1]	Proposed Loading (FS)[1]	Result
Reinforced Concrete Mat	OTM[2]	2.0	2.12	**PASS**

Note 1: FS denotes Factor of Safety.
Note 2: OTM denotes Overturning Moment

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. 18894
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:

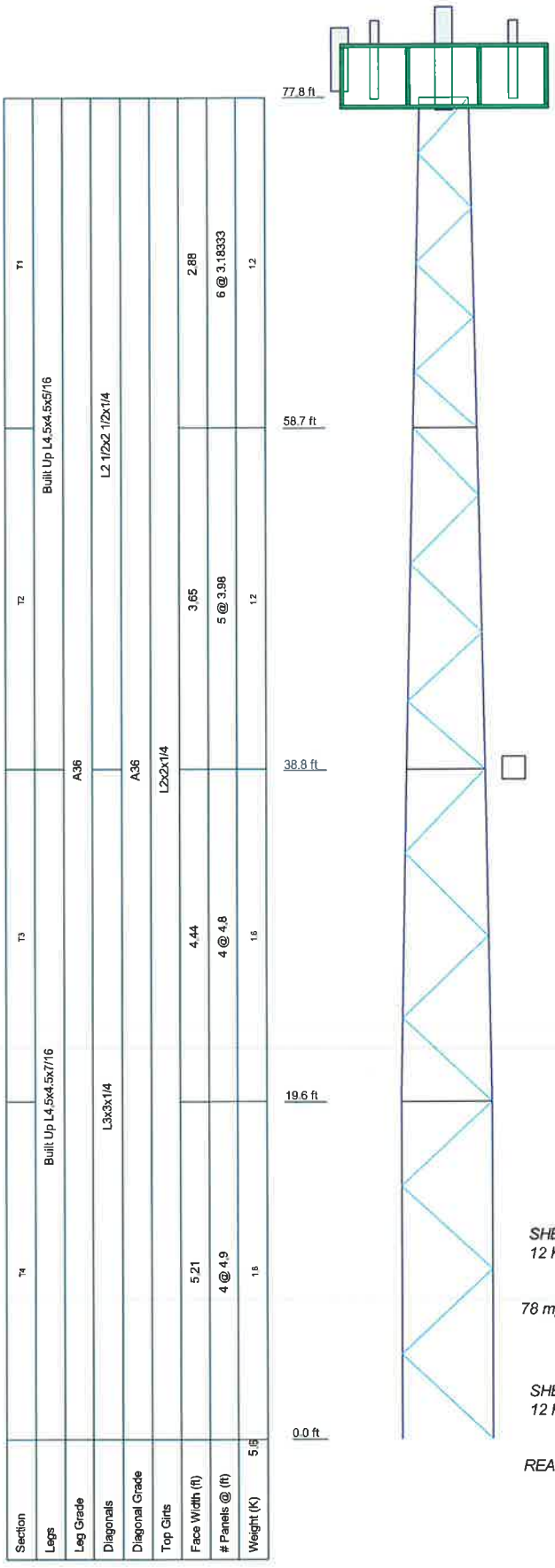
- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of CENTEK engineering, Inc. or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

General Description of Structural Analysis Program

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



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
BXA-80063-4BF (Verizon - Proposed)	80	RRH2x40-AWS (Verizon - Proposed)	80
MG D3-800T0 (Verizon - Existing)	80	RRH2x40-AWS (Verizon - Proposed)	80
BXA-70063/6CF (Verizon - Proposed)	80	RRH2x40-AWS (Verizon - Proposed)	80
MG D3-800T0 (Verizon - Proposed)	80	DB-T1-6Z-8AB-0Z (Verizon - Proposed)	80
BXA-80063-4BF (Verizon - Proposed)	80	Valmont 13' Platform w Rails (Verizon)	79
MG D3-800T0 (Verizon - Existing)	80	(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	78
BXA-70063/6CF (Verizon - Proposed)	80	(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	78
MG D3-800T0 (Verizon - Proposed)	80	(2) FD9R6004/2C-3L Diplexer (Verizon - Existing)	78
BXA-80063-4BF (Verizon - Proposed)	80		
MG D3-800T0 (Verizon - Existing)	80		
BXA-70063/6CF (Verizon - Proposed)	80		
MG D3-800T0 (Verizon - Proposed)	80		

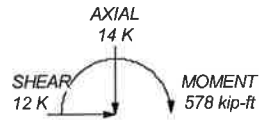
MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A36	36 ksi	58 ksi			

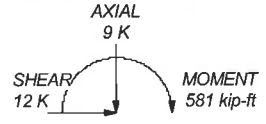
TOWER DESIGN NOTES

1. Tower designed for a 90 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 78 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: 99.7%

MAX. CORNER REACTIONS AT BASE:
DOWN: 80 K
UPLIFT: -78 K
SHEAR: 6 K



TORQUE 5 kip-ft
78 mph WIND - 0.5000 in ICE



TORQUE 6 kip-ft
REACTIONS - 90 mph WIND

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

Job: 13075.046 - North Haven South			
Project: 80' Lattice Tower - 100 Universal Dr., North Haven, CT			
Client: Verizon Wireless	Drawn by: TJL	App'd:	
Code: TIA/EIA-222-F	Date: 10/31/13	Scale: NTS	
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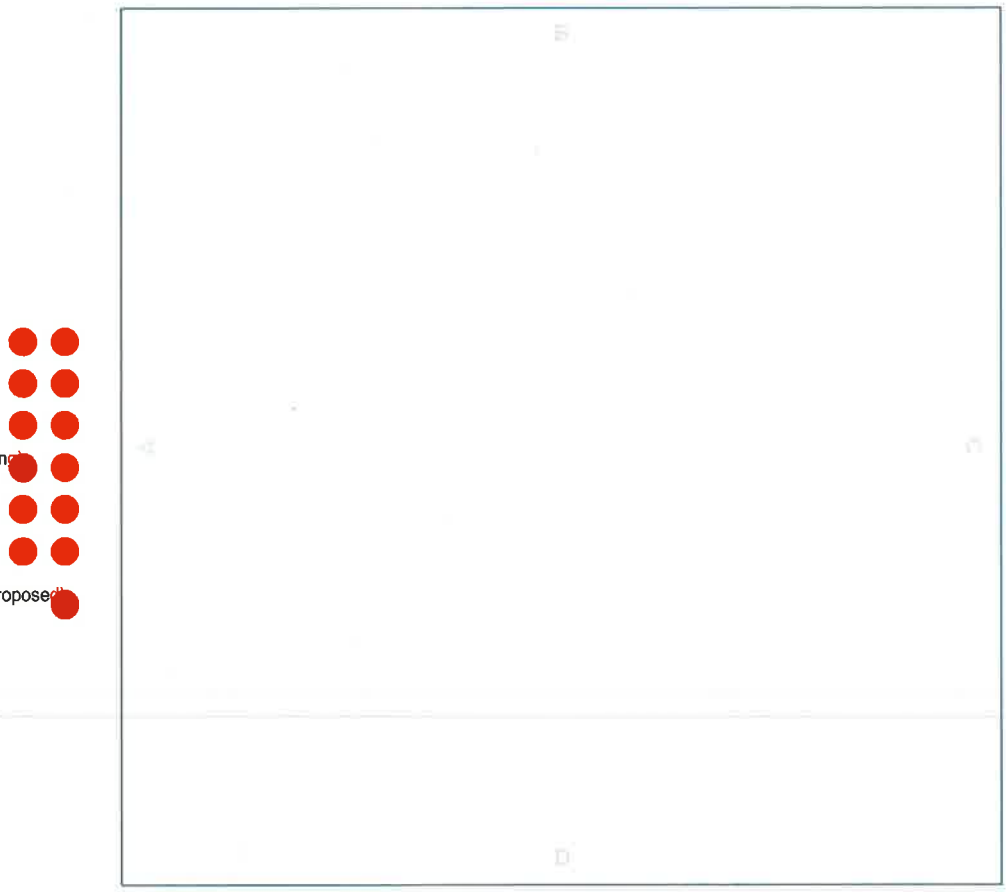
Feedline Plan

Round Flat App In Face App Out Face



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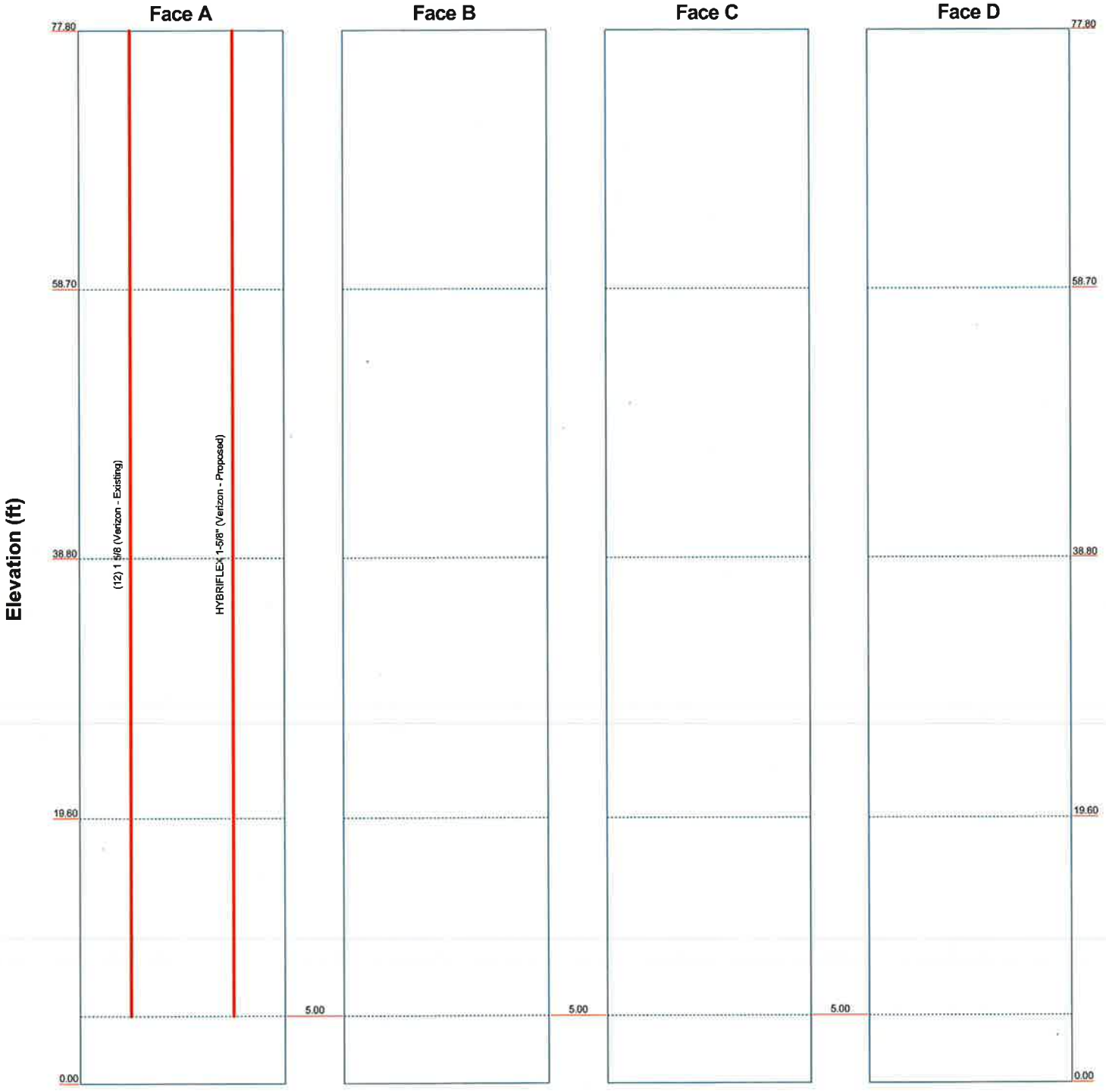
Feedline Distribution Chart
0' - 77'9-19/32"

Round | Flat | App In Face | App Out Face | Truss Leg



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Job: 13075.046 - North Haven South			
Project: 80' Lattice Tower - 100 Universal Dr., North Haven, CT			
Client: Verizon Wireless	Drawn by: TJL	App'd:	
Code: TIA/EIA-222-F	Date: 10/31/13	Scale: NTS	
Path: J:\Jobs\13075\00 W\046 - North Haven South\Structural\Calcs\ERAM7 Lattice Tower.er		Dwg No. E-7	

tnxTower	Job	Page
	13075.046 - North Haven South	1 of 22
Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	**Project** 80' Lattice Tower - 100 Universal Dr., North Haven, CT	**Date** 14:46:39 10/31/13
	Client Verizon Wireless	**Designed by** TJL

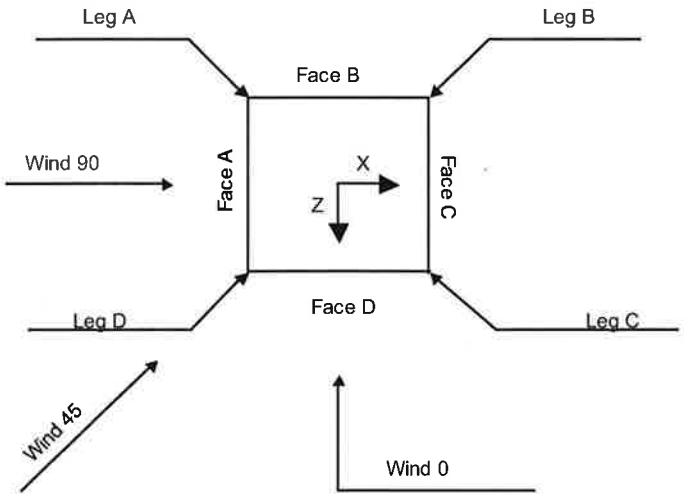
Tower Input Data

The main tower is a 4x free standing tower with an overall height of 77.80 ft above the ground line.
The base of the tower is set at an elevation of 0.00 ft above the ground line.
The face width of the tower is 2.88 ft at the top and 5.21 ft at the base.
This tower is designed using the TIA/EIA-222-F standard.
The following design criteria apply:

Basic wind speed of 90 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 78 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 tower member design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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



Square Tower

Tower Section Geometry

Tower Section	Tower Elevation	Assembly Database	Description	Section Width	Number of Sections	Section Length
	ft			ft		ft
T1	77.80-58.70			2.88	1	19.10
T2	58.70-38.80			3.65	1	19.90
T3	38.80-19.60			4.44	1	19.20
T4	19.60-0.00			5.21	1	19.60

Tower Section Geometry *(cont'd)*

Tower Section	Tower Elevation	Diagonal Spacing	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset	Bottom Girt Offset
	ft	ft				in	in
T1	77.80-58.70	3.18	K Brace Right	No	No	0.0000	0.0000
T2	58.70-38.80	3.98	K Brace Right	No	No	0.0000	0.0000
T3	38.80-19.60	4.80	K Brace Right	No	No	0.0000	0.0000
T4	19.60-0.00	4.90	K Brace Right	No	No	0.0000	0.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 77.80-58.70	Single Angle	Built Up L4.5x4.5x5/16	A36 (36 ksi)	Single Angle	L2 1/2x2 1/2x1/4	A36 (36 ksi)

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T2 58.70-38.80	Single Angle	Built Up L4.5x4.5x5/16	A36 (36 ksi)	Single Angle	L2 1/2x2 1/2x1/4	A36 (36 ksi)
T3 38.80-19.60	Single Angle	Built Up L4.5x4.5x7/16	A36 (36 ksi)	Single Angle	L3x3x1/4	A36 (36 ksi)
T4 19.60-0.00	Single Angle	Built Up L4.5x4.5x7/16	A36 (36 ksi)	Single Angle	L3x3x1/4	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 77.80-58.70	Single Angle	L2x2x1/4	A36 (36 ksi)	Equal Angle		A36 (36 ksi)
T2 58.70-38.80	Single Angle	L2x2x1/4	A36 (36 ksi)	Equal Angle		A36 (36 ksi)
T3 38.80-19.60	Single Angle	L2x2x1/4	A36 (36 ksi)	Equal Angle		A36 (36 ksi)
T4 19.60-0.00	Single Angle	L2x2x1/4	A36 (36 ksi)	Equal Angle		A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
T1 77.80-58.70	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000
T2 58.70-38.80	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000
T3 38.80-19.60	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000
T4 19.60-0.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K Factors[1] Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1 77.80-58.70	No	No	0.9	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T2	No	No	0.9	1	1	1	1	1	1	1

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	Legs	K Factors[1] X Brace Diags X	K Brace Diags X	Single Diags X	Girts X	Horiz. X	Sec. Horiz. X	Inner Brace X
				Y	Y	Y	Y	Y	Y	Y
58.70-38.80				1	1	1	1	1	1	1
T3	No	No	0.9	1	1	1	1	1	1	1
38.80-19.60				1	1	1	1	1	1	1
T4 19.60-0.00	No	No	0.9	1	1	1	1	1	1	1
				1	1	1	1	1	1	1

[1]*Note: K factors are applied to member segment lengths. K-braces without inner supporting members will have the K factor in the out-of-plane direction applied to the overall length.*

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Net Width Deduct in	Leg U	Diagonal Net Width Deduct in	Diagonal U	Top Girt Net Width Deduct in	Top Girt U	Bottom Girt Net Width Deduct in	Bottom Girt U	Mid Girt Net Width Deduct in	Mid Girt U	Long Horizontal Net Width Deduct in	Long Horizontal U	Short Horizontal Net Width Deduct in	Short Horizontal U
T1 77.80-58.70	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T2 58.70-38.80	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T3 38.80-19.60	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T4 19.60-0.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg Bolt Size in	Leg No.	Diagonal Bolt Size in	Diagonal No.	Top Girt Bolt Size in	Top Girt No.	Bottom Girt Bolt Size in	Bottom Girt No.	Mid Girt Bolt Size in	Mid Girt No.	Long Horizontal Bolt Size in	Long Horizontal No.	Short Horizontal Bolt Size in	Short Horizontal No.
T1 77.80-58.70	Flange	0.7500 A325N	0	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T2 58.70-38.80	Flange	0.7500 A325N	0	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.7500 A325X	0
T3 38.80-19.60	Flange	0.7500 A325N	0	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.7500 A325X	2
T4 19.60-0.00	Flange	0.7500 A325N	0	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	2

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
1 5/8 (Verizon - Existing)	A	Yes	Ar (CfAe)	77.80 - 5.00	3.0000	0	12	6	1.0000	1.9800		1.04

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
HYBRIFLEX 1-5/8" (Verizon - Proposed)	A	Yes	Ar (CfAe)	77.80 - 5.00	3.0000	-0.18	1	1	1.0000	1.9800		1.90

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	77.80-58.70	A	22.061	0.000	0.000	0.000	0.27
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
		D	0.000	0.000	0.000	0.000	0.00
T2	58.70-38.80	A	22.985	0.000	0.000	0.000	0.29
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
		D	0.000	0.000	0.000	0.000	0.00
T3	38.80-19.60	A	22.176	0.000	0.000	0.000	0.28
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
		D	0.000	0.000	0.000	0.000	0.00
T4	19.60-0.00	A	16.863	0.000	0.000	0.000	0.21
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
		D	0.000	0.000	0.000	0.000	0.00

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	77.80-58.70	A	0.500	9.486	23.716	0.000	0.000	0.79
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
		D		0.000	0.000	0.000	0.000	0.00
T2	58.70-38.80	A	0.500	9.884	24.709	0.000	0.000	0.83
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
		D		0.000	0.000	0.000	0.000	0.00
T3	38.80-19.60	A	0.500	9.536	23.840	0.000	0.000	0.80
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
		D		0.000	0.000	0.000	0.000	0.00
T4	19.60-0.00	A	0.500	7.251	18.128	0.000	0.000	0.61
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
		D		0.000	0.000	0.000	0.000	0.00

Feed Line Shielding

Section	Elevation ft	Face	A_R ft^2	A_R Ice ft^2	A_F ft^2	A_F Ice ft^2
T1	77.80-58.70	A	0.000	1.362	2.214	3.333
		B	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000
		D	0.000	0.000	0.000	0.000
T2	58.70-38.80	A	0.000	1.163	1.883	2.835
		B	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000
		D	0.000	0.000	0.000	0.000
T3	38.80-19.60	A	0.000	0.963	1.824	2.745
		B	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000
		D	0.000	0.000	0.000	0.000
T4	19.60-0.00	A	0.000	0.700	1.324	1.993
		B	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000
		D	0.000	0.000	0.000	0.000

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	77.80-58.70	-4.9816	0.2019	-4.5593	0.2221
T2	58.70-38.80	-5.9661	0.2521	-5.5269	0.2789
T3	38.80-19.60	-6.5822	0.2864	-6.1824	0.3209
T4	19.60-0.00	-5.4516	0.2399	-5.1596	0.2706

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Valmont 13' Platform w Rails	C	None		0.0000	79.00	No Ice	35.00	35.00	1.50
(Verizon)						1/2" Ice	42.00	42.00	2.50
(2) FD9R6004/2C-3L	A	From Face	3.00	0.0000	78.00	No Ice	0.00	0.08	0.00
Diplexer			0.00			1/2" Ice	0.00	0.14	0.01
(Verizon - Existing)			0.00						
(2) FD9R6004/2C-3L	B	From Face	3.00	0.0000	78.00	No Ice	0.00	0.08	0.00
Diplexer			0.00			1/2" Ice	0.00	0.14	0.01
(Verizon - Existing)			0.00						
(2) FD9R6004/2C-3L	C	From Face	3.00	0.0000	78.00	No Ice	0.00	0.08	0.00
Diplexer			0.00			1/2" Ice	0.00	0.14	0.01
(Verizon - Existing)			0.00						
BXA-80063-4BF	A	From Face	3.00	0.0000	80.00	No Ice	4.86	2.38	0.01
(Verizon - Proposed)			-6.00			1/2" Ice	5.22	2.66	0.04
			0.00						
MG D3-800T0	A	From Face	3.00	0.0000	80.00	No Ice	3.46	2.24	0.03

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(Verizon - Existing)			-4.00 0.00			1/2" Ice	3.80	2.57	0.05
BXA-70063/6CF (Verizon - Proposed)	A	From Face	3.00 0.00 0.00	0.0000	80.00	No Ice 1/2" Ice	7.73 8.27	4.16 4.60	0.02 0.06
MG D3-800T0 (Verizon - Proposed)	A	From Face	3.00 4.00 0.00	0.0000	80.00	No Ice 1/2" Ice	3.46 3.80	2.24 2.57	0.03 0.05
BXA-80063-4BF (Verizon - Proposed)	B	From Face	3.00 -6.00 0.00	0.0000	80.00	No Ice 1/2" Ice	4.86 5.22	2.38 2.66	0.01 0.04
MG D3-800T0 (Verizon - Existing)	B	From Face	3.00 -4.00 0.00	0.0000	80.00	No Ice 1/2" Ice	3.46 3.80	2.24 2.57	0.03 0.05
BXA-70063/6CF (Verizon - Proposed)	B	From Face	3.00 0.00 0.00	0.0000	80.00	No Ice 1/2" Ice	7.73 8.27	4.16 4.60	0.02 0.06
MG D3-800T0 (Verizon - Proposed)	B	From Face	3.00 4.00 0.00	0.0000	80.00	No Ice 1/2" Ice	3.46 3.80	2.24 2.57	0.03 0.05
BXA-80063-4BF (Verizon - Proposed)	C	From Face	3.00 -6.00 0.00	0.0000	80.00	No Ice 1/2" Ice	4.86 5.22	2.38 2.66	0.01 0.04
MG D3-800T0 (Verizon - Existing)	C	From Face	3.00 -4.00 0.00	0.0000	80.00	No Ice 1/2" Ice	3.46 3.80	2.24 2.57	0.03 0.05
BXA-70063/6CF (Verizon - Proposed)	C	From Face	3.00 0.00 0.00	0.0000	80.00	No Ice 1/2" Ice	7.73 8.27	4.16 4.60	0.02 0.06
MG D3-800T0 (Verizon - Proposed)	C	From Face	3.00 4.00 0.00	0.0000	80.00	No Ice 1/2" Ice	3.46 3.80	2.24 2.57	0.03 0.05
RRH2x40-AWS (Verizon - Proposed)	A	From Face	3.00 4.00 0.00	0.0000	80.00	No Ice 1/2" Ice	0.00 0.00	1.59 1.80	0.04 0.06
RRH2x40-AWS (Verizon - Proposed)	B	From Face	3.00 4.00 0.00	0.0000	80.00	No Ice 1/2" Ice	0.00 0.00	1.59 1.80	0.04 0.06
RRH2x40-AWS (Verizon - Proposed)	C	From Face	3.00 4.00 0.00	0.0000	80.00	No Ice 1/2" Ice	0.00 0.00	1.59 1.80	0.04 0.06
DB-T1-6Z-8AB-0Z (Verizon - Proposed)	A	From Face	3.00 -4.00 0.00	0.0000	80.00	No Ice 1/2" Ice	0.00 0.00	2.33 2.56	0.04 0.08

Tower Pressures - No Ice

$G_H = 1.181$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
T1 77.80-58.70	68.25	1.231	26	66.312	A	17.581	22.061	14.331	36.15	0.000	0.000
					B	19.796	0.000		72.39	0.000	0.000
					C	19.796	0.000		72.39	0.000	0.000
					D	19.796	0.000		72.39	0.000	0.000
T2 58.70-38.80	48.75	1.118	23	84.612	A	18.958	22.985	14.931	35.60	0.000	0.000
					B	20.842	0.000		71.64	0.000	0.000
					C	20.842	0.000		71.64	0.000	0.000
					D	20.842	0.000		71.64	0.000	0.000
T3 38.80-19.60	29.20	1	21	96.757	A	19.538	22.176	14.406	34.53	0.000	0.000
					B	21.362	0.000		67.44	0.000	0.000
					C	21.362	0.000		67.44	0.000	0.000
					D	21.362	0.000		67.44	0.000	0.000
T4 19.60-0.00	9.80	1	21	106.318	A	20.819	16.863	14.700	39.01	0.000	0.000
					B	22.143	0.000		66.39	0.000	0.000
					C	22.143	0.000		66.39	0.000	0.000
					D	22.143	0.000		66.39	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.181$

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
T1 77.80-58.70	68.25	1.231	19	0.5000	67.904	A	40.179	13.537	17.515	32.61	0.000	0.000
						B	19.796	5.412		69.48	0.000	0.000
						C	19.796	5.412		69.48	0.000	0.000
						D	19.796	5.412		69.48	0.000	0.000
T2 58.70-38.80	48.75	1.118	17	0.5000	86.270	A	42.716	14.458	18.249	31.92	0.000	0.000
						B	20.842	5.737		68.66	0.000	0.000
						C	20.842	5.737		68.66	0.000	0.000
						D	20.842	5.737		68.66	0.000	0.000
T3 38.80-19.60	29.20	1	16	0.5000	98.357	A	42.457	14.206	17.607	31.07	0.000	0.000
						B	21.362	5.633		65.22	0.000	0.000
						C	21.362	5.633		65.22	0.000	0.000
						D	21.362	5.633		65.22	0.000	0.000
T4 19.60-0.00	9.80	1	16	0.5000	107.951	A	38.278	12.433	17.967	35.43	0.000	0.000
						B	22.143	5.882		64.11	0.000	0.000
						C	22.143	5.882		64.11	0.000	0.000
						D	22.143	5.882		64.11	0.000	0.000

Tower Pressure - Service

$G_H = 1.181$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
T1 77.80-58.70	68.25	1.231	8	66.312	A	17.581	22.061	14.331	36.15	0.000	0.000
					B	19.796	0.000		72.39	0.000	0.000

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
					C	19.796	0.000		72.39	0.000	0.000
					D	19.796	0.000		72.39	0.000	0.000
T2 58.70-38.80	48.75	1.118	7	84.612	A	18.958	22.985	14.931	35.60	0.000	0.000
					B	20.842	0.000		71.64	0.000	0.000
					C	20.842	0.000		71.64	0.000	0.000
					D	20.842	0.000		71.64	0.000	0.000
T3 38.80-19.60	29.20	1	6	96.757	A	19.538	22.176	14.406	34.53	0.000	0.000
					B	21.362	0.000		67.44	0.000	0.000
					C	21.362	0.000		67.44	0.000	0.000
					D	21.362	0.000		67.44	0.000	0.000
T4 19.60-0.00	9.80	1	6	106.318	A	20.819	16.863	14.700	39.01	0.000	0.000
					B	22.143	0.000		66.39	0.000	0.000
					C	22.143	0.000		66.39	0.000	0.000
					D	22.143	0.000		66.39	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 ft²	F K	w plf	Ctrl. Face
T1	0.27	1.19	A	0.598	1.902	0.752	1	1	34.177	1.96	102.58	A
77.80-58.70			B	0.299	2.595	0.615	1	1	19.796			
			C	0.299	2.595	0.615	1	1	19.796			
			D	0.299	2.595	0.615	1	1	19.796			
T2	0.29	1.24	A	0.496	2.058	0.695	1	1	34.940	1.97	98.92	A
58.70-38.80			B	0.246	2.789	0.601	1	1	20.842			
			C	0.246	2.789	0.601	1	1	20.842			
			D	0.246	2.789	0.601	1	1	20.842			
T3	0.28	1.57	A	0.431	2.2	0.665	1	1	34.281	1.85	96.17	A
38.80-19.60			B	0.221	2.892	0.595	1	1	21.362			
			C	0.221	2.892	0.595	1	1	21.362			
			D	0.221	2.892	0.595	1	1	21.362			
T4 19.60-0.00	0.21	1.63	A	0.354	2.411	0.634	1	1	31.511	1.86	94.92	A
			B	0.208	2.945	0.592	1	1	22.143			
			C	0.208	2.945	0.592	1	1	22.143			
			D	0.208	2.945	0.592	1	1	22.143			
Sum Weight:	1.05	5.62						OTM	301.84 kip-ft	7.63		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
T1	0.27	1.19	A	0.598	1.902	0.752	1.2	1.2	41.012	2.35	123.10	A
77.80-58.70			B	0.299	2.595	0.615	1.2	1.2	23.755			
			C	0.299	2.595	0.615	1.2	1.2	23.755			
			D	0.299	2.595	0.615	1.2	1.2	23.755			
T2	0.29	1.24	A	0.496	2.058	0.695	1.2	1.2	41.928	2.36	118.70	A
58.70-38.80			B	0.246	2.789	0.601	1.185	1.185	24.692			
			C	0.246	2.789	0.601	1.185	1.185	24.692			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
			D	0.246	2.789	0.601	1.185	1.185	24.692			
T3	0.28	1.57	A	0.431	2.2	0.665	1.2	1.2	41.137	2.22	115.41	A
38.80-19.60			B	0.221	2.892	0.595	1.166	1.166	24.899			
			C	0.221	2.892	0.595	1.166	1.166	24.899			
			D	0.221	2.892	0.595	1.166	1.166	24.899			
T4 19.60-0.00	0.21	1.63	A	0.354	2.411	0.634	1.2	1.2	37.813	2.23	113.91	A
			B	0.208	2.945	0.592	1.156	1.156	25.602			
			C	0.208	2.945	0.592	1.156	1.156	25.602			
			D	0.208	2.945	0.592	1.156	1.156	25.602			
Sum Weight:	1.05	5.62						OTM	362.21 kip-ft	9.16		

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 plf	Ctrl. Face
T1	0.79	1.76	A	0.791	1.836	0.889	1	1	52.215	2.17	113.43	A
77.80-58.70			B	0.371	2.361	0.64	1	1	23.261			
			C	0.371	2.361	0.64	1	1	23.261			
			D	0.371	2.361	0.64	1	1	23.261			
T2	0.83	1.84	A	0.663	1.847	0.794	1	1	54.196	2.05	103.25	A
58.70-38.80			B	0.308	2.562	0.618	1	1	24.389			
			C	0.308	2.562	0.618	1	1	24.389			
			D	0.308	2.562	0.618	1	1	24.389			
T3	0.80	2.20	A	0.576	1.929	0.739	1	1	52.959	1.88	97.69	A
38.80-19.60			B	0.274	2.682	0.608	1	1	24.789			
			C	0.274	2.682	0.608	1	1	24.789			
			D	0.274	2.682	0.608	1	1	24.789			
T4 19.60-0.00	0.61	2.28	A	0.47	2.111	0.683	1	1	46.764	1.81	92.50	A
			B	0.26	2.738	0.604	1	1	25.698			
			C	0.26	2.738	0.604	1	1	25.698			
			D	0.26	2.738	0.604	1	1	25.698			
Sum Weight:	3.02	8.08						OTM	320.57 kip-ft	7.91		

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 ft²	F K	w plf	Ctrl. Face
T1	0.79	1.76	A	0.791	1.836	0.889	1.2	1.2	62.658	2.60	136.12	A
77.80-58.70			B	0.371	2.361	0.64	1.2	1.2	27.913			
			C	0.371	2.361	0.64	1.2	1.2	27.913			
			D	0.371	2.361	0.64	1.2	1.2	27.913			
T2	0.83	1.84	A	0.663	1.847	0.794	1.2	1.2	65.035	2.47	123.90	A
58.70-38.80			B	0.308	2.562	0.618	1.2	1.2	29.267			
			C	0.308	2.562	0.618	1.2	1.2	29.267			
			D	0.308	2.562	0.618	1.2	1.2	29.267			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
T3	0.80	2.20	A	0.576	1.929	0.739	1.2	1.2	63.551	2.25	117.23	A
38.80-19.60			B	0.274	2.682	0.608	1.2	1.2	29.747			
			C	0.274	2.682	0.608	1.2	1.2	29.747			
			D	0.274	2.682	0.608	1.2	1.2	29.747			
T4 19.60-0.00	0.61	2.28	A	0.47	2.111	0.683	1.2	1.2	56.117	2.18	111.00	A
			B	0.26	2.738	0.604	1.195	1.195	30.702			
			C	0.26	2.738	0.604	1.195	1.195	30.702			
			D	0.26	2.738	0.604	1.195	1.195	30.702			
Sum Weight:	3.02	8.08						OTM	384.68 kip-ft	9.49		

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 ft²	F K	w plf	Ctrl. Face
T1	0.27	1.19	A	0.598	1.902	0.752	1	1	34.177	0.60	31.66	A
77.80-58.70			B	0.299	2.595	0.615	1	1	19.796			
			C	0.299	2.595	0.615	1	1	19.796			
			D	0.299	2.595	0.615	1	1	19.796			
T2	0.29	1.24	A	0.496	2.058	0.695	1	1	34.940	0.61	30.53	A
58.70-38.80			B	0.246	2.789	0.601	1	1	20.842			
			C	0.246	2.789	0.601	1	1	20.842			
			D	0.246	2.789	0.601	1	1	20.842			
T3	0.28	1.57	A	0.431	2.2	0.665	1	1	34.281	0.57	29.68	A
38.80-19.60			B	0.221	2.892	0.595	1	1	21.362			
			C	0.221	2.892	0.595	1	1	21.362			
			D	0.221	2.892	0.595	1	1	21.362			
T4 19.60-0.00	0.21	1.63	A	0.354	2.411	0.634	1	1	31.511	0.57	29.30	A
			B	0.208	2.945	0.592	1	1	22.143			
			C	0.208	2.945	0.592	1	1	22.143			
			D	0.208	2.945	0.592	1	1	22.143			
Sum Weight:	1.05	5.62						OTM	93.16 kip-ft	2.36		

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 ft²	F K	w plf	Ctrl. Face
T1	0.27	1.19	A	0.598	1.902	0.752	1.2	1.2	41.012	0.73	37.99	A
77.80-58.70			B	0.299	2.595	0.615	1.2	1.2	23.755			
			C	0.299	2.595	0.615	1.2	1.2	23.755			
			D	0.299	2.595	0.615	1.2	1.2	23.755			
T2	0.29	1.24	A	0.496	2.058	0.695	1.2	1.2	41.928	0.73	36.64	A
58.70-38.80			B	0.246	2.789	0.601	1.185	1.185	24.692			
			C	0.246	2.789	0.601	1.185	1.185	24.692			
			D	0.246	2.789	0.601	1.185	1.185	24.692			
T3	0.28	1.57	A	0.431	2.2	0.665	1.2	1.2	41.137	0.68	35.62	A

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
38.80-19.60			B	0.221	2.892	0.595	1.166	1.166	24.899			
			C	0.221	2.892	0.595	1.166	1.166	24.899			
			D	0.221	2.892	0.595	1.166	1.166	24.899			
T4 19.60-0.00	0.21	1.63	A	0.354	2.411	0.634	1.2	1.2	37.813	0.69	35.16	A
			B	0.208	2.945	0.592	1.156	1.156	25.602			
			C	0.208	2.945	0.592	1.156	1.156	25.602			
			D	0.208	2.945	0.592	1.156	1.156	25.602			
Sum Weight:	1.05	5.62						OTM	111.79 kip-ft	2.83		

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	3.42					
Bracing Weight	2.20					
Total Member Self-Weight	5.62			-0.34	2.78	
Total Weight	8.62			-0.34	2.78	
Wind 0 deg - No Ice		0.00	-10.23	-508.57	2.78	-4.90
Wind 30 deg - No Ice		5.95	-10.18	-492.76	-287.07	-5.67
Wind 45 deg - No Ice		8.41	-8.31	-402.40	-407.13	-5.11
Wind 60 deg - No Ice		10.30	-5.88	-284.64	-499.25	-4.20
Wind 90 deg - No Ice		10.37	0.00	-0.34	-516.55	-1.63
Wind 120 deg - No Ice		10.30	5.88	283.96	-499.25	1.43
Wind 135 deg - No Ice		8.41	8.31	401.72	-407.13	2.85
Wind 150 deg - No Ice		5.95	10.18	492.09	-287.07	4.07
Wind 180 deg - No Ice		0.00	10.23	507.90	2.78	4.90
Wind 210 deg - No Ice		-5.95	10.18	492.09	292.63	5.67
Wind 225 deg - No Ice		-8.41	8.31	401.72	412.68	5.11
Wind 240 deg - No Ice		-10.30	5.88	283.96	504.81	4.20
Wind 270 deg - No Ice		-10.37	0.00	-0.34	522.10	1.63
Wind 300 deg - No Ice		-10.30	-5.88	-284.64	504.81	-1.43
Wind 315 deg - No Ice		-8.41	-8.31	-402.40	412.68	-2.85
Wind 330 deg - No Ice		-5.95	-10.18	-492.76	292.63	-4.07
Member Ice	2.46					
Total Weight Ice	14.48			-0.66	8.17	
Wind 0 deg - Ice		0.00	-10.14	-498.93	8.17	-4.53
Wind 30 deg - Ice		5.91	-10.15	-487.70	-276.88	-5.18
Wind 45 deg - Ice		8.36	-8.29	-398.32	-394.95	-4.62
Wind 60 deg - Ice		10.24	-5.86	-281.85	-485.55	-3.74
Wind 90 deg - Ice		10.24	0.00	-0.66	-497.81	-1.34
Wind 120 deg - Ice		10.24	5.86	280.53	-485.55	1.48
Wind 135 deg - Ice		8.36	8.29	397.00	-394.95	2.77
Wind 150 deg - Ice		5.91	10.15	486.37	-276.88	3.88
Wind 180 deg - Ice		0.00	10.14	497.60	8.17	4.53
Wind 210 deg - Ice		-5.91	10.15	486.37	293.21	5.18
Wind 225 deg - Ice		-8.36	8.29	397.00	411.28	4.62
Wind 240 deg - Ice		-10.24	5.86	280.53	501.88	3.74
Wind 270 deg - Ice		-10.24	0.00	-0.66	514.14	1.34
Wind 300 deg - Ice		-10.24	-5.86	-281.85	501.88	-1.48
Wind 315 deg - Ice		-8.36	-8.29	-398.32	411.28	-2.77
Wind 330 deg - Ice		-5.91	-10.15	-487.70	293.21	-3.88
Total Weight	8.62			-0.34	2.78	
Wind 0 deg - Service		0.00	-3.16	-157.31	0.08	-1.51

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 30 deg - Service		1.84	-3.14	-152.43	-89.38	-1.75
Wind 45 deg - Service		2.60	-2.57	-124.54	-126.44	-1.58
Wind 60 deg - Service		3.18	-1.81	-88.19	-154.87	-1.30
Wind 90 deg - Service		3.20	0.00	-0.44	-160.21	-0.50
Wind 120 deg - Service		3.18	1.81	87.30	-154.87	0.44
Wind 135 deg - Service		2.60	2.57	123.65	-126.44	0.88
Wind 150 deg - Service		1.84	3.14	151.54	-89.38	1.26
Wind 180 deg - Service		0.00	3.16	156.42	0.08	1.51
Wind 210 deg - Service		-1.84	3.14	151.54	89.54	1.75
Wind 225 deg - Service		-2.60	2.57	123.65	126.59	1.58
Wind 240 deg - Service		-3.18	1.81	87.30	155.02	1.30
Wind 270 deg - Service		-3.20	0.00	-0.44	160.36	0.50
Wind 300 deg - Service		-3.18	-1.81	-88.19	155.02	-0.44
Wind 315 deg - Service		-2.60	-2.57	-124.54	126.59	-0.88
Wind 330 deg - Service		-1.84	-3.14	-152.43	89.54	-1.26

Load Combinations

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

Comb. No.	Description
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
T1	77.8 - 58.7	Leg	Max Tension	12	13.42	-0.03	0.03
			Max. Compression	4	-15.11	-0.04	-0.11
			Max. Mx	34	-0.50	0.17	0.01
			Max. My	3	-5.77	0.08	-0.19
			Max. Vy	6	0.87	0.00	-0.00
			Max. Vx	14	0.82	0.00	-0.00
		Diagonal	Max Tension	14	2.81	0.00	0.00
			Max. Compression	6	-2.83	0.00	0.00
			Max. Mx	31	2.07	-0.01	0.00
			Max. My	20	-0.87	0.00	-0.00
			Max. Vy	31	0.01	0.00	0.00
			Max. Vx	20	0.00	0.00	0.00
		Top Girt	Max Tension	6	0.84	0.00	0.00
			Max. Compression	14	-0.85	0.00	0.00
			Max. Mx	31	-0.12	-0.01	0.00
			Max. My	28	0.36	0.00	0.00
			Max. Vy	31	0.01	0.00	0.00
			Max. Vx	28	-0.00	0.00	0.00
T2	58.7 - 38.8	Leg	Max Tension	12	29.71	-0.04	0.07
			Max. Compression	33	-32.05	-0.05	-0.16
			Max. Mx	34	2.91	0.30	-0.04
			Max. My	28	1.85	-0.07	0.28
			Max. Vy	20	-0.10	0.23	-0.08
			Max. Vx	26	0.10	-0.05	0.22
		Diagonal	Max Tension	3	3.77	0.00	0.00
			Max. Compression	11	-3.74	0.00	0.00
			Max. Mx	31	3.00	-0.02	0.00
			Max. My	20	-1.32	0.00	-0.00
			Max. Vy	31	-0.01	0.00	0.00
			Max. Vx	30	0.00	0.00	0.00
		Top Girt	Max Tension	13	2.15	0.00	0.00
			Max. Compression	5	-2.15	0.00	0.00
			Max. Mx	31	0.22	-0.01	0.00
			Max. My	28	-1.41	0.00	0.00
			Max. Vy	31	-0.01	0.00	0.00
			Max. Vx	28	0.00	0.00	0.00
T3	38.8 - 19.6	Leg	Max Tension	12	46.72	-0.07	0.14
			Max. Compression	33	-49.78	-0.07	-0.15
			Max. Mx	17	5.44	0.41	-0.09

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. My	28	4.41	-0.06	0.38
			Max. Vy	20	0.12	0.36	-0.13
			Max. Vx	28	0.12	-0.06	0.38
		Diagonal	Max Tension	3	4.68	0.00	0.00
			Max. Compression	28	-4.57	0.00	0.00
			Max. Mx	31	3.79	-0.03	0.00
			Max. My	20	-1.77	0.00	-0.00
			Max. Vy	31	0.02	0.00	0.00
			Max. Vx	30	-0.00	0.00	0.00
		Top Girt	Max Tension	20	0.11	0.00	0.00
			Max. Compression	8	-0.13	0.00	0.00
			Max. Mx	31	-0.08	-0.01	0.00
			Max. My	28	0.01	0.00	0.00
			Max. Vy	31	0.01	0.00	0.00
			Max. Vx	28	0.00	0.00	0.00
T4	19.6 - 0	Leg	Max Tension	12	74.36	-0.09	0.20
			Max. Compression	33	-76.65	0.00	-0.00
			Max. Mx	34	6.68	0.62	-0.21
			Max. My	32	-28.68	0.03	-0.49
			Max. Vy	9	-0.16	-0.62	0.17
			Max. Vx	28	-0.13	-0.13	0.47
		Diagonal	Max Tension	3	7.87	0.00	0.00
			Max. Compression	13	-7.79	0.00	0.00
			Max. Mx	32	5.55	-0.04	0.00
			Max. My	30	-2.94	0.00	0.00
			Max. Vy	32	0.02	0.00	0.00
			Max. Vx	30	-0.00	0.00	0.00
		Top Girt	Max Tension	33	1.14	0.00	0.00
			Max. Compression	12	-1.10	0.00	0.00
			Max. Mx	19	0.78	-0.02	0.00
			Max. My	28	0.25	0.00	0.00
			Max. Vy	19	0.01	0.00	0.00
			Max. Vx	28	-0.00	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Leg D	Max. Vert	29	80.00	-0.04	-4.36
	Max. H_x	9	23.36	0.03	-5.63
	Max. H_z	3	-74.34	-0.07	5.89
	Min. Vert	4	-77.43	-0.08	4.93
	Min. H_x	21	-74.48	-0.12	4.88
	Min. H_z	9	23.36	0.03	-5.63
Leg C	Max. Vert	25	78.36	-4.21	0.04
	Max. H_x	15	-75.24	5.55	0.08
	Max. H_z	33	-75.98	4.74	0.12
	Min. Vert	16	-77.94	4.77	0.08
	Min. H_x	7	76.09	-5.08	0.04
	Min. H_z	4	4.28	-3.90	-0.04
Leg B	Max. Vert	21	78.51	0.04	3.47
	Max. H_x	29	-75.88	0.13	-4.00
	Max. H_z	17	22.85	-0.04	4.85
	Min. Vert	12	-77.90	0.09	-3.96
	Min. H_x	17	22.85	-0.04	4.85
	Min. H_z	28	-72.88	0.12	-4.84

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Leg A	Max. Vert	33	80.16	3.68	-0.04
	Max. H_x	13	24.87	5.70	0.03
	Max. H_z	13	24.87	5.70	0.03
	Min. Vert	8	-77.38	-4.22	-0.09
	Min. H_x	5	-17.05	-5.39	-0.03
	Min. H_z	25	-74.38	-4.21	-0.13

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	8.62	0.00	0.00	-0.34	2.79	0.00
Dead+Wind 0 deg - No Ice	8.62	-0.00	-10.23	-510.11	2.80	-4.91
Dead+Wind 30 deg - No Ice	8.62	5.95	-10.18	-494.24	-287.90	-5.68
Dead+Wind 45 deg - No Ice	8.62	8.41	-8.31	-403.60	-408.32	-5.12
Dead+Wind 60 deg - No Ice	8.62	10.30	-5.88	-285.49	-500.73	-4.21
Dead+Wind 90 deg - No Ice	8.62	10.37	-0.00	-0.35	-518.11	-1.64
Dead+Wind 120 deg - No Ice	8.62	10.30	5.88	284.79	-500.74	1.43
Dead+Wind 135 deg - No Ice	8.62	8.41	8.31	402.91	-408.33	2.85
Dead+Wind 150 deg - No Ice	8.62	5.95	10.18	493.55	-287.91	4.08
Dead+Wind 180 deg - No Ice	8.62	0.00	10.23	509.43	2.79	4.91
Dead+Wind 210 deg - No Ice	8.62	-5.95	10.18	493.54	293.49	5.69
Dead+Wind 225 deg - No Ice	8.62	-8.41	8.31	402.90	413.91	5.12
Dead+Wind 240 deg - No Ice	8.62	-10.30	5.88	284.79	506.32	4.21
Dead+Wind 270 deg - No Ice	8.62	-10.37	0.00	-0.33	523.69	1.64
Dead+Wind 300 deg - No Ice	8.62	-10.30	-5.88	-285.46	506.32	-1.43
Dead+Wind 315 deg - No Ice	8.62	-8.41	-8.31	-403.57	413.91	-2.85
Dead+Wind 330 deg - No Ice	8.62	-5.95	-10.18	-494.21	293.50	-4.08
Dead+Ice+Temp	14.48	0.00	0.00	-0.67	8.21	-0.00
Dead+Wind 0 deg+Ice+Temp	14.48	-0.00	-10.14	-501.36	8.23	-4.56
Dead+Wind 30 deg+Ice+Temp	14.48	5.91	-10.15	-490.06	-278.18	-5.21
Dead+Wind 45 deg+Ice+Temp	14.48	8.36	-8.29	-400.26	-396.82	-4.65
Dead+Wind 60 deg+Ice+Temp	14.48	10.24	-5.86	-283.22	-487.86	-3.77
Dead+Wind 90 deg+Ice+Temp	14.48	10.24	-0.00	-0.68	-500.24	-1.35
Dead+Wind 120 deg+Ice+Temp	14.48	10.24	5.86	281.87	-487.88	1.50
Dead+Wind 135 deg+Ice+Temp	14.48	8.36	8.29	398.91	-396.84	2.80
Dead+Wind 150 deg+Ice+Temp	14.48	5.91	10.15	488.71	-278.20	3.90
Dead+Wind 180 deg+Ice+Temp	14.48	0.00	10.14	500.03	8.21	4.56
Dead+Wind 210 deg+Ice+Temp	14.48	-5.91	10.15	488.69	294.63	5.22
Dead+Wind 225 deg+Ice+Temp	14.48	-8.36	8.29	398.89	413.26	4.65
Dead+Wind 240 deg+Ice+Temp	14.48	-10.24	5.86	281.85	504.30	3.77
Dead+Wind 270 deg+Ice+Temp	14.48	-10.24	0.00	-0.66	516.66	1.35
Dead+Wind 300 deg+Ice+Temp	14.48	-10.24	-5.86	-283.18	504.30	-1.50
Dead+Wind 315 deg+Ice+Temp	14.48	-8.36	-8.29	-400.21	413.26	-2.80
Dead+Wind 330 deg+Ice+Temp	14.48	-5.91	-10.15	-490.02	294.63	-3.90
Dead+Wind 0 deg - Service	8.62	-0.00	-3.16	-157.68	2.79	-1.51
Dead+Wind 30 deg - Service	8.62	1.84	-3.14	-152.78	-86.94	-1.75
Dead+Wind 45 deg - Service	8.62	2.60	-2.57	-124.81	-124.11	-1.58
Dead+Wind 60 deg - Service	8.62	3.18	-1.81	-88.35	-152.62	-1.30
Dead+Wind 90 deg - Service	8.62	3.20	-0.00	-0.34	-157.99	-0.50
Dead+Wind 120 deg - Service	8.62	3.18	1.81	87.67	-152.63	0.44
Dead+Wind 135 deg - Service	8.62	2.60	2.57	124.13	-124.11	0.88
Dead+Wind 150 deg - Service	8.62	1.84	3.14	152.10	-86.94	1.26
Dead+Wind 180 deg - Service	8.62	0.00	3.16	157.00	2.79	1.51
Dead+Wind 210 deg - Service	8.62	-1.84	3.14	152.10	92.52	1.75
Dead+Wind 225 deg - Service	8.62	-2.60	2.57	124.12	129.68	1.58

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead+Wind 240 deg - Service	8.62	-3.18	1.81	87.67	158.20	1.30
Dead+Wind 270 deg - Service	8.62	-3.20	0.00	-0.34	163.56	0.50
Dead+Wind 300 deg - Service	8.62	-3.18	-1.81	-88.35	158.20	-0.44
Dead+Wind 315 deg - Service	8.62	-2.60	-2.57	-124.80	129.68	-0.88
Dead+Wind 330 deg - Service	8.62	-1.84	-3.14	-152.78	92.52	-1.26

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
1	0.00	-8.62	0.00	0.00	8.62	0.00	0.000%
2	0.00	-8.62	-10.23	0.00	8.62	10.23	0.001%
3	5.95	-8.62	-10.18	-5.95	8.62	10.18	0.003%
4	8.41	-8.62	-8.31	-8.41	8.62	8.31	0.001%
5	10.30	-8.62	-5.88	-10.30	8.62	5.88	0.001%
6	10.37	-8.62	0.00	-10.37	8.62	0.00	0.001%
7	10.30	-8.62	5.88	-10.30	8.62	-5.88	0.003%
8	8.41	-8.62	8.31	-8.41	8.62	-8.31	0.001%
9	5.95	-8.62	10.18	-5.95	8.62	-10.18	0.001%
10	0.00	-8.62	10.23	-0.00	8.62	-10.23	0.001%
11	-5.95	-8.62	10.18	5.95	8.62	-10.18	0.003%
12	-8.41	-8.62	8.31	8.41	8.62	-8.31	0.001%
13	-10.30	-8.62	5.88	10.30	8.62	-5.88	0.001%
14	-10.37	-8.62	0.00	10.37	8.62	-0.00	0.001%
15	-10.30	-8.62	-5.88	10.30	8.62	5.88	0.002%
16	-8.41	-8.62	-8.31	8.41	8.62	8.31	0.001%
17	-5.95	-8.62	-10.18	5.95	8.62	10.18	0.001%
18	0.00	-14.48	0.00	0.00	14.48	0.00	0.000%
19	0.00	-14.48	-10.14	0.00	14.48	10.14	0.001%
20	5.91	-14.48	-10.15	-5.91	14.48	10.15	0.001%
21	8.36	-14.48	-8.29	-8.36	14.48	8.29	0.000%
22	10.24	-14.48	-5.86	-10.24	14.48	5.86	0.001%
23	10.24	-14.48	0.00	-10.24	14.48	0.00	0.001%
24	10.24	-14.48	5.86	-10.24	14.48	-5.86	0.002%
25	8.36	-14.48	8.29	-8.36	14.48	-8.29	0.001%
26	5.91	-14.48	10.15	-5.91	14.48	-10.15	0.001%
27	0.00	-14.48	10.14	-0.00	14.48	-10.14	0.001%
28	-5.91	-14.48	10.15	5.91	14.48	-10.15	0.002%
29	-8.36	-14.48	8.29	8.36	14.48	-8.29	0.001%
30	-10.24	-14.48	5.86	10.24	14.48	-5.86	0.001%
31	-10.24	-14.48	0.00	10.24	14.48	-0.00	0.001%
32	-10.24	-14.48	-5.86	10.24	14.48	5.86	0.002%
33	-8.36	-14.48	-8.29	8.36	14.48	8.29	0.000%
34	-5.91	-14.48	-10.15	5.91	14.48	10.15	0.001%
35	0.00	-8.62	-3.16	0.00	8.62	3.16	0.000%
36	1.84	-8.62	-3.14	-1.84	8.62	3.14	0.000%
37	2.60	-8.62	-2.57	-2.60	8.62	2.57	0.000%
38	3.18	-8.62	-1.81	-3.18	8.62	1.81	0.000%
39	3.20	-8.62	0.00	-3.20	8.62	0.00	0.000%
40	3.18	-8.62	1.81	-3.18	8.62	-1.81	0.000%
41	2.60	-8.62	2.57	-2.60	8.62	-2.57	0.000%
42	1.84	-8.62	3.14	-1.84	8.62	-3.14	0.000%
43	0.00	-8.62	3.16	-0.00	8.62	-3.16	0.000%
44	-1.84	-8.62	3.14	1.84	8.62	-3.14	0.000%
45	-2.60	-8.62	2.57	2.60	8.62	-2.57	0.000%
46	-3.18	-8.62	1.81	3.18	8.62	-1.81	0.000%
47	-3.20	-8.62	0.00	3.20	8.62	-0.00	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
48	-3.18	-8.62	-1.81	3.18	8.62	1.81	0.000%
49	-2.60	-8.62	-2.57	2.60	8.62	2.57	0.000%
50	-1.84	-8.62	-3.14	1.84	8.62	3.14	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	0.00000541
3	Yes	4	0.00000001	0.00003810
4	Yes	4	0.00000001	0.00004296
5	Yes	4	0.00000001	0.00003664
6	Yes	4	0.00000001	0.00000495
7	Yes	4	0.00000001	0.00003946
8	Yes	4	0.00000001	0.00004383
9	Yes	4	0.00000001	0.00003697
10	Yes	4	0.00000001	0.00000523
11	Yes	4	0.00000001	0.00003783
12	Yes	4	0.00000001	0.00004198
13	Yes	4	0.00000001	0.00003553
14	Yes	4	0.00000001	0.00000490
15	Yes	4	0.00000001	0.00003604
16	Yes	4	0.00000001	0.00004048
17	Yes	4	0.00000001	0.00003472
18	Yes	4	0.00000001	0.00000001
19	Yes	4	0.00000001	0.00000659
20	Yes	4	0.00000001	0.00004698
21	Yes	4	0.00000001	0.00005349
22	Yes	4	0.00000001	0.00004588
23	Yes	4	0.00000001	0.00000516
24	Yes	4	0.00000001	0.00004976
25	Yes	4	0.00000001	0.00005609
26	Yes	4	0.00000001	0.00004789
27	Yes	4	0.00000001	0.00000518
28	Yes	4	0.00000001	0.00004249
29	Yes	4	0.00000001	0.00004806
30	Yes	4	0.00000001	0.00004113
31	Yes	4	0.00000001	0.00000526
32	Yes	4	0.00000001	0.00003955
33	Yes	4	0.00000001	0.00004534
34	Yes	4	0.00000001	0.00003922
35	Yes	4	0.00000001	0.00000001
36	Yes	4	0.00000001	0.00000001
37	Yes	4	0.00000001	0.00000001
38	Yes	4	0.00000001	0.00000001
39	Yes	4	0.00000001	0.00000001
40	Yes	4	0.00000001	0.00000001
41	Yes	4	0.00000001	0.00000001
42	Yes	4	0.00000001	0.00000001
43	Yes	4	0.00000001	0.00000001
44	Yes	4	0.00000001	0.00000001
45	Yes	4	0.00000001	0.00000001
46	Yes	4	0.00000001	0.00000001
47	Yes	4	0.00000001	0.00000001
48	Yes	4	0.00000001	0.00000001

49	Yes	4	0.00000001	0.00000001
50	Yes	4	0.00000001	0.00000001

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	77.8 - 58.7	1.530	48	0.1450	0.0258
T2	58.7 - 38.8	0.960	48	0.1306	0.0184
T3	38.8 - 19.6	0.470	48	0.0936	0.0101
T4	19.6 - 0	0.151	48	0.0560	0.0053

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
80.00	BXA-80063-4BF	48	1.530	0.1450	0.0258	152055
79.00	Valmont 13' Platform w Rails	48	1.530	0.1450	0.0258	152055
78.00	(2) FD9R6004/2C-3L Diplexer	48	1.530	0.1450	0.0258	152055

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	77.8 - 58.7	4.898	15	0.4631	0.0855
T2	58.7 - 38.8	3.077	15	0.4177	0.0649
T3	38.8 - 19.6	1.508	15	0.2999	0.0474
T4	19.6 - 0	0.484	15	0.1795	0.0329

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
80.00	BXA-80063-4BF	15	4.898	0.4631	0.0855	48013
79.00	Valmont 13' Platform w Rails	15	4.898	0.4631	0.0855	48013
78.00	(2) FD9R6004/2C-3L Diplexer	15	4.898	0.4631	0.0855	48013

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load K	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	77.8	Diagonal	A325N	0.6250	1	2.83	6.44	0.439 ✓	1.333	Bolt Shear
T2	58.7	Diagonal	A325N	0.6250	1	3.77	6.44	0.584 ✓	1.333	Bolt Shear
T3	38.8	Diagonal	A325N	0.6250	1	4.68	6.44	0.726 ✓	1.333	Bolt Shear
T4	19.6	Diagonal	A325N	0.6250	1	7.87	6.44	1.222 ✓	1.333	Bolt Shear

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio P / P_a
T1	77.8 - 58.7	Built Up L4.5x4.5x5/16	19.11	3.18	51.4 K=1.20	18.227	2.7148	-15.11	49.48	0.305 ✓
T2	58.7 - 38.8	Built Up L4.5x4.5x5/16	19.91	3.98	64.2 K=1.20	17.015	2.7148	-32.05	46.19	0.694 ✓
T3	38.8 - 19.6	Built Up L4.5x4.5x7/16	19.21	4.80	78.1 K=1.20	15.564	3.7461	-49.78	58.30	0.854 ✓
T4	19.6 - 0	Built Up L4.5x4.5x7/16	19.60	4.90	79.7 K=1.20	15.388	3.7461	-76.65	57.64	1.330 ✓

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio P / P_a
T1	77.8 - 58.7	L2 1/2x2 1/2x1/4	4.80	4.29	104.9 K=1.00	12.342	1.1900	-2.78	14.69	0.189 ✓
T2	58.7 - 38.8	L2 1/2x2 1/2x1/4	5.90	5.40	131.9 K=1.00	8.583	1.1900	-3.74	10.21	0.366 ✓
T3	38.8 - 19.6	L3x3x1/4	7.01	6.50	131.8 K=1.00	8.602	1.4400	-4.57	12.39	0.369 ✓
T4	19.6 - 0	L3x3x1/4	7.15	6.64	134.5 K=1.00	8.250	1.4400	-7.79	11.88	0.656 ✓

Top Girt Design Data (Compression)

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 $\frac{P}{P_a}$
T1	77.8 - 58.7	L2x2x1/4	2.88	2.50	76.9 K=1.00	15.699	0.9380	-0.85	14.73	0.058 ✔
T2	58.7 - 38.8	L2x2x1/4	3.65	3.27	100.5 K=1.00	12.913	0.9380	-2.15	12.11	0.178 ✔
T3	38.8 - 19.6	L2x2x1/4	4.44	4.06	124.8 K=1.00	9.590	0.9380	-0.13	9.00	0.015 ✔
T4	19.6 - 0	L2x2x1/4	5.21	4.84	148.4 K=1.00	6.782	0.9380	-1.10	6.36	0.173 ✔

Tension Checks

Leg Design Data (Tension)

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 $\frac{P}{P_a}$
T1	77.8 - 58.7	Built Up L4.5x4.5x5/16	19.11	3.18	27.2	21.600	2.7148	13.42	58.64	0.229 ✔
T2	58.7 - 38.8	Built Up L4.5x4.5x5/16	19.91	3.98	34.0	21.600	2.7148	29.71	58.64	0.507 ✔
T3	38.8 - 19.6	Built Up L4.5x4.5x7/16	19.21	4.80	41.6	21.600	3.7461	46.72	80.92	0.577 ✔
T4	19.6 - 0	Built Up L4.5x4.5x7/16	19.60	4.90	42.4	21.600	3.7461	74.36	80.92	0.919 ✔

Diagonal Design Data (Tension)

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 $\frac{P}{P_a}$
T1	77.8 - 58.7	L2 1/2x2 1/2x1/4	4.70	4.20	65.5	21.600	1.1900	2.81	25.70	0.109 ✔
T2	58.7 - 38.8	L2 1/2x2 1/2x1/4	5.90	5.40	84.2	21.600	1.1900	3.77	25.70	0.146 ✔
T3	38.8 - 19.6	L3x3x1/4	7.01	6.50	83.9	21.600	1.4400	4.68	31.10	0.150 ✔
T4	19.6 - 0	L3x3x1/4	7.15	6.64	85.6	21.600	1.4400	7.87	31.10	0.253 ✔

Top Girt Design Data (Tension)

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 $\frac{P}{P_a}$
T1	77.8 - 58.7	L2x2x1/4	2.88	2.50	49.4	21.600	0.9380	0.84	20.26	0.041 ✔
T2	58.7 - 38.8	L2x2x1/4	3.65	3.27	64.5	21.600	0.9380	2.15	20.26	0.106 ✔
T3	38.8 - 19.6	L2x2x1/4	4.44	4.06	80.1	21.600	0.9380	0.11	20.26	0.006 ✔
T4	19.6 - 0	L2x2x1/4	5.21	4.84	95.3	21.600	0.9380	1.14	20.26	0.056 ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
T1	77.8 - 58.7	Leg	Built Up L4.5x4.5x5/16	3	-15.11	65.96	22.9	Pass
T2	58.7 - 38.8	Leg	Built Up L4.5x4.5x5/16	36	-32.05	61.57	52.1	Pass
T3	38.8 - 19.6	Leg	Built Up L4.5x4.5x7/16	64	-49.78	77.72	64.0	Pass
T4	19.6 - 0	Leg	Built Up L4.5x4.5x7/16	88	-76.65	76.84	99.7	Pass
T1	77.8 - 58.7	Diagonal	L2 1/2x2 1/2x1/4	11	-2.78	19.58	14.2 33.0 (b)	Pass
T2	58.7 - 38.8	Diagonal	L2 1/2x2 1/2x1/4	44	-3.74	13.62	27.5 43.8 (b)	Pass
T3	38.8 - 19.6	Diagonal	L3x3x1/4	72	-4.57	16.51	27.7 54.5 (b)	Pass
T4	19.6 - 0	Diagonal	L3x3x1/4	95	-7.79	15.84	49.2 91.7 (b)	Pass
T1	77.8 - 58.7	Top Girt	L2x2x1/4	7	-0.85	19.63	4.3	Pass
T2	58.7 - 38.8	Top Girt	L2x2x1/4	39	-2.15	16.15	13.3	Pass
T3	38.8 - 19.6	Top Girt	L2x2x1/4	68	-0.13	11.99	1.1	Pass
T4	19.6 - 0	Top Girt	L2x2x1/4	91	-1.10	8.48	13.0	Pass
							Summary	
						Leg (T4)	99.7	Pass
						Diagonal (T4)	91.7	Pass
						Top Girt (T2)	13.3	Pass
						Bolt Checks	91.7	Pass
						RATING =	**99.7**	**Pass**

CENTEK engineering
Centered on Solutions
63-2 North Branford Road
Branford, CT 06405
www.centekeng.com
P:(203)488-0580
F:(203)488-8587

Subject:	TENSION ON DIAGONAL STEEL ANGLES DUE TO SECTION LOSS
Location:	North Haven, CT
Rev. 0: 10/31/13	Prepared by: T.J.L. Checked by: C.F.C. Job No. 13075.046

Tension on Existing Diagonal Angles

Note: Reinforced angle bracing terminate before connection to tower legs. Original steel angles connect to leg.
Material grade and age of structure unknown. Assumed allowable working stress of 18ksi per "AISC Iron and Steel Beams 1873 to 1952" as utilized for steel construction between 1914 and 1933.

Allowable Steel Stress = $F_y := 18ksi$ (User Input)

Top Diagonal Bracing Size - L2x2x1/4

Gross Area = $Ag_{diagtop} := 0.9398in^2$ (User Input)

Member Tension = $T_{act.top} := 3.77kips$ (User Input from RISA Tower - Section T2)

Assume 25% reduction in gross cross-sectional area due to corrosion and bolt hole

Net Area = $An_{diagtop} := 0.75 \cdot 0.9398in^2$ $An_{diagtop} = 0.705 \cdot in^2$

Allowable Tension on Reduced Area = $T_{all.top} := F_y \cdot An_{diagtop} = 12.687 \cdot kips$

Tension Ratio = $Ratio_{top} := \left(\frac{T_{act.top}}{T_{all.top}}\right) = 0.3$

$Tension_{topcheck} := if(Ratio_{top} \le 1.00, "Okay", "No Good")$

$Tension_{topcheck} = "Okay"$

Top Diagonal Bracing Size - L21/2x21/2x1/4

Gross Area = $Ag_{diagbot} := 1.19in^2$ (User Input)

Member Tension = $T_{act.bot} := 7.87kips$ (User Input from RISA Tower - Section T4)

Assume 25% reduction in gross cross-sectional area due to corrosion and bolt hole

Net Area = $An_{diagbot} := 0.75 \cdot Ag_{diagbot}$ $An_{diagbot} = 0.892 \cdot in^2$

Allowable Tension on Reduced Area = $T_{all.bot} := F_y \cdot An_{diagbot} = 16.065 \cdot kips$

Tension Ratio = $Ratio_{bot} := \left(\frac{T_{act.bot}}{T_{all.bot}}\right) = 0.49$

$Tension_{botcheck} := if(Ratio_{top} \le 1.00, "Okay", "No Good")$

$Tension_{topcheck} = "Okay"$

CENTEK engineering
Centered on Solutions
63-2 North Branford Road
Branford, CT 06405
www.centekeng.com
P: (203) 488-0580
F: (203) 488-8587

Subject:	FOUNDATION ANALYSIS
Location:	North Haven, CT
Rev. 0: 10/31/13	Prepared by: T.J.L. Checked by: C.F.C. Job No. 13075.046

Pier and Mat Foundation Analysis:

Input Data:

Tower Data

Overturning Moment =	$OM := 581 \cdot ft \cdot kips$	(User Input from RISATower)	
Shear Force =	$S_t := 12 \cdot kip$	(User Input from RISATower)	
Axial Force =	$WT_t := 9 \cdot kip$	(User Input from RISATower)	
Max Compression Force =	$C_t := 80 \cdot kip$	(User Input from RISATower)	
Max Uplift Force =	$U_t := 78 \cdot kip$	(User Input from RISATower)	
Tower Height =	$H_t := 80 \cdot ft$	(User Input)	
Tower Width =	$W_t := 5.21 \cdot ft$	(User Input)	
Tower Position on Foundation (1=offset, 2=centered) =	$Pos_t := 2$	(User Input)	

Footing Data:

Overall Depth of Footing =	$D_f := 4.0 \cdot ft$	(User Input)	
Thickness of Footing =	$T_f := 5.0 \cdot ft$	(User Input)	
Width of Footing =	$W_f := 14.5 \cdot ft$	(User Input)	

Material Properties:

Concrete Compressive Strength =	$f'c := 3000 \cdot psi$	(User Input)	
Steel Reinforcment Yield Strength =	$f_y := 60000 \cdot psi$	(User Input)	
Internal Friction Angle of Soil =	$\Phi_s := 30 \cdot deg$	(User Input)	
Allowable Soil Bearing Capacity =	$q_s := 3000 \cdot psf$	(User Input)	
Unit Weight of Soil =	$\gamma_{soil} := 100 \cdot pcf$	(User Input)	
Unit Weight of Concrete =	$\gamma_{conc} := 150 \cdot pcf$	(User Input)	
Foundation Bouyancy =	$Bouyancy := 0$	(User Input)	(Yes=1 / No=0)
Depth to Neglect =	$n := 0 \cdot ft$	(User Input)	
Cohesion of Clay Type Soil =	$c := 0 \cdot ksf$	(User Input)	(Use 0 for Sandy Soil)
Seismic Zone Factor =	$Z := 2$	(User Input)	(UBC-1997 Fig 23-2)
Coefficient of Friction Between Concrete =	$\mu := 0.45$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{top} := 6$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 0.750 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 28$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 6$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 0.750 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 28$	(User Input)	(Bottom of Pad)
Clear Cover of Reinforcement =	$Cvr_{pad} := 3.0 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)

Calculated Factors:

Pad Top Reinforcement Bar Area =

$$A_{btop} := \frac{\pi \cdot d_{btop}^2}{4} = 0.442 \cdot in^2$$

Pad Bottom Reinforcement Bar Area =

$$A_{bbot} := \frac{\pi \cdot d_{bbot}^2}{4} = 0.442 \cdot in^2$$

Coefficient of Lateral Soil Pressure =

$$K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 3$$

Load Factor =

$$LF := \begin{cases} 1.333 & \text{if } H_t \le 700 \cdot ft \\ 1.7 & \text{if } H_t \ge 1200 \cdot ft \\ 1.333 + \left(\frac{H_t - 700ft}{1200ft - 700ft} \right) \cdot 0.4 & \text{otherwise} \end{cases} = 1.333$$

Stability of Footing:

Adjusted Concrete Unit Weight = $\gamma_c := if(Bouyancy = 1, \gamma_{conc} - 62.4pcf, \gamma_{conc}) = 150 \cdot pcf$

Adjusted Soil Unit Weight = $\gamma_s := if(Bouyancy = 1, \gamma_{soil} - 62.4pcf, \gamma_{soil}) = 100 \cdot pcf$

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

$P_{pt} := K_p \cdot \gamma_s \cdot (D_f - T_f) + c \cdot 2 \cdot \sqrt{K_p} = -0.3 \cdot ksf$

$P_{top} := if[n < (D_f - T_f), P_{pt}, P_{pn}] = 0 \cdot ksf$

$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p} = 1.2 \cdot ksf$

$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 0.6 \cdot ksf$

$T_p := if[n < (D_f - T_f), T_f, (D_f - n)] = 4$

$A_p := W_f \cdot T_p = 58$

Ultimate Shear = $S_u := P_{ave} \cdot A_p = 34.8 \cdot kip$

Weight of Concrete = $WT_c := (W_f^2 \cdot T_f) \cdot \gamma_c = 157.688 \cdot kip$

Weight of Soil Above Footing = $WT_{s1} := 0kip$ Mat Foundation is above grade, i.e no soil above.

Weight of Soil Wedge at Back Face = $WT_{s2} := \left[\frac{(D_f - n)^2 \cdot \tan(\Phi_s)}{2} \cdot W_f\right] \cdot \gamma_s = 6.697 \cdot kip$

Tower Offset = $X_{t1} := \left[\frac{W_f}{2} - \frac{(W_t)}{2}\right]$ $X_{t2} := \frac{W_f}{2} - \frac{(W_t)}{3}$

$X_t := if(Pos_t, X_{t1}, X_{t2}) = 4.645$

Total Weight = $WT_{tot} := WT_c + WT_t + WT_{s1} = 166.7 \cdot kip$

Resisting Moment = $M_r := (WT_{tot}) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_p}{3} + WT_{s2} \cdot \left(W_f + \frac{T_p \cdot \tan(\Phi_s)}{3}\right) = 1357 \cdot kip \cdot ft$

Overturning Moment = $M_{ot} := OM + S_t \cdot T_f = 641 \cdot kip \cdot ft$

Factor of Safety Actual = $FS := \frac{M_r}{M_{ot}} = 2.12$

Factor of Safety Required = $FS_{req} := 2$

$OverTurning\_Moment\_Check := if(FS \geq FS_{req}, "Okay", "No Good")$

$OverTurning\_Moment\_Check = "Okay"$

BEARING PRESSURES

Eccentricity = $e := \frac{M_{ot}}{WT_{tot}} = 3.846$

Distance to Kern = $X_k := \frac{W_f}{6} = 2.417$

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

Bearing Pressure Caused by Footing:

Total Load = $Load_{tot} := WT_c + WT_t + WT_{s1} = 167 \cdot kip$

Area of the Mat = $A_{mat} := W_f^2 = 210.25$

Maximum Contact Pressure =

$$P_{max} := \begin{cases} \frac{Load_{tot}}{W_f^2} \cdot \left(1 + \frac{6 \cdot e}{W_f}\right) & \text{if } e \le X_k \\ \frac{2 \cdot Load_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)} & \text{otherwise} \end{cases}$$

$P_{max} = 2.251 \cdot ksf$

Minimum Contact Pressure =

$$P_{min} := \begin{cases} \frac{Load_{tot}}{W_f^2} \cdot \left(1 - \frac{6 \cdot e}{W_f}\right) & \text{if } e \le X_k \\ 0ksf & \text{otherwise} \end{cases}$$

$P_{min} = 0 \cdot ksf$

Distance to Resultant of Pressure Distribution =

$$P_{min} := \begin{cases} \frac{Load_{tot}}{W_f^2} \cdot \left(1 - \frac{6 \cdot e}{W_f}\right) & \text{if } e \le X_k \\ 0ksf & \text{otherwise} \end{cases}$$

$P_{min} = 0 \cdot ksf$

Length of Applied Pressure =

$$X_p := \begin{cases} W_f & \text{if } e \le X_k \\ 3 \cdot \left(\frac{W_f}{2} - e\right) & \text{otherwise} \end{cases}$$

$X_p = 10.213 \cdot ft$

Pressure Slope = $m_p := \frac{P_{max} - P_{min}}{X_p}$

$m_p = 0.22 \cdot ksf$

Beam (One-Way) Shear Action (ACI 11.3.1.1):

Shear Strength of Concrete:

Capacity Reduction Factor: (ACI 9.3.2.3)

$\phi_c := 0.85$

$d := T_f - Cvr_{pad} - d_{bbot}$ $d = 56.25 \cdot in$

Factored Pressure at "d" Distance =

$P_d := LF \cdot \left[P_{max} - \left(X_t - d\right) \cdot m_p\right]$ $P_d = 3.013 \cdot ksf$

Factored Pressure at Edge =

$P_{edge} := LF \cdot P_{max}$ $P_{edge} = 3.001 \cdot ksf$

Average Pressure =

$P_{ave} := \frac{P_d + P_{edge}}{2}$ $P_{ave} = 3.007 \cdot ksf$

Applied Shear Force =

$V_{req} := P_{ave} \cdot \left(X_t - d\right) \cdot W_f$ $V_{req} = -1.853 \cdot kips$

Available Shear = (ACI 11.3.1.1)

$V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f'c \cdot psi} \cdot W_f \cdot d = 911 \cdot kip$ (ACI-2008 11.2.1.1)

Check Capacity =

$Beam\_Shear\_Check := if\left(V_{req} < V_{Avail}, "Okay", "No Good"\right)$

Beam_Shear_Check = "Okay"

Punching (Two-Way) Shear Action (ACI 11.12.2.1):

Critical Perimeter of Punching Shear =

$b_o := 4(d)$ $b_o = 18.75 \cdot ft$

Factored Maximum Punching Shear Force =

$FL := LF \cdot C_t$ $FL = 106.64 \cdot kip$

Available Shear Strength = (ACI-2008 11.11.2.1)

$V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f'c \cdot psi} \cdot b_o \cdot d$ $V_{Avail} = 2356.92 \cdot kips$

$Punching\_Shear\_Check := if\left(V_{req} < V_{Avail}, "Okay", "No Good"\right)$

Punching_Shear_Check = "Okay"

Maximim Bending Moment:

Distance From Edge of FTG To Face of Pier: $X_b := \frac{W_f}{2} - e$ $X_b = 3.404 \cdot ft$

Moment Due To Overturning:

Factored Pressure at "d" Distance: $P_{face} := LF \cdot (P_{max} - X_b \cdot m_p)$ $P_{face} = 2 \cdot ksf$

Factored Pressure at Edge: $P_{edge} := LF \cdot P_{max}$ $P_{edge} = 3.001 \cdot ksf$

Moment Due To Rectangular Loading: $M_1 := (P_{face} \cdot X_b \cdot W_f) \cdot \left(\frac{1}{2} \cdot X_b\right)$ $M_1 = 168.101 \cdot kip \cdot ft$

Moment Due to Triangular Loading: $M_2 := \left[\frac{1}{2} \cdot X_b \cdot (P_{edge} - P_{face})\right] \cdot \left(\frac{2}{3} \cdot X_b\right)$ $M_2 = 3.864 \cdot kip \cdot ft$

Sum Moments: $M_{ot} := M_1 + M_2$ $M_{ot} = 171.966 \cdot kip \cdot ft$

Moment Due To Uplift:

Pier Forces: $M_{nT} := LF \cdot \left[U_t \cdot \left(W_f - 2 \cdot X_b - \frac{d}{2} - d\right) + S_t \cdot (D_f)\right]$ $M_{nT} = 132.585 \cdot kip \cdot ft$

Concrete Resistance: $M_{nS} := \frac{1}{2} \cdot (W_f - X_b)^2 \cdot (T_f \cdot W_f) \cdot \gamma_s$ $M_{nS} = 446.276 \cdot kip \cdot ft$

Soil Resistance: $M_{nC} := \frac{1}{2} \cdot (W_f - X_b)^2 \cdot (T_f \cdot W_f) \cdot \gamma_c$ $M_{nC} = 669.414 \cdot kip \cdot ft$

Sum Moments $M_{uplift} := M_{nT} - M_{nS} - M_{nC}$ $M_{uplift} = -983.104 \cdot kips \cdot ft$

Select Controlling Moment: $M_u := \begin{cases} M_{ot} & \text{if } M_{ot} \geq M_{uplift} \\ M_{uplift} & \text{otherwise} \end{cases}$ $M_u = 171.966 \cdot kips \cdot ft$

Size Reinforcing Steel:

Strength Reduction Factor:
(ACI 9.3.2.2)

$\phi_m := .90$

Effective Width:

$b_{eff} := W_f$ $\quad b_{eff} := W_f = 174 \cdot in$

(ACI-200810.2.7.3)

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

$$R_n := \frac{M_u}{\phi_m \cdot W_f \cdot d^2} = 4.2 \cdot psi$$

$$\rho := \frac{0.85 \cdot f'c}{f_y}\left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f'c}}\right) \quad \rho = 0.00007$$

$\rho_{min} := 1.333 \cdot \rho = 0.00009$

Required Reinforcement for Temperature and Shrinkage:

$$\rho_{sh} := \begin{cases} .0018 & \text{if } f_y \ge 60000 \cdot psi \\ .0020 & \text{otherwise} \end{cases} \quad = 0.0018 \quad \text{(ACI -2008 7.12.2.1)}$$

Area Required:

$$As := \max\left(\rho, \rho_{min}, \rho_{sh}\right) \cdot \frac{b_{eff}}{2} \cdot d = 8.8 \cdot in^2$$

$As_{prov} := A_{bbot} \cdot NB_{bot} = 12.4 \cdot in^2$

$Pad\_Reinforcement\_Bot := if\left(As_{prov} > As, "Okay", "No\ Good"\right)$

Pad_Reinforcement_Bot = "Okay"

Development Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 5.44 \cdot in$$

Spacing or Cover Dimension =

$$c := if\left(Cvr_{pad} < \frac{B_{sPad}}{2}, Cvr_{pad}, \frac{B_{sPad}}{2}\right) = 2.722 \cdot in$$

Transverse Reinforcement Index =

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

$$L_{dbt} := \frac{3 \cdot f_y \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f'c \cdot psi} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 17 \cdot in$$

Minimum Development Length =

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

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

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{W_t}{2} - Cvr_{pad} = 52.74 \cdot in$$

$$Lpad\_Check := if\left(L_{Pad} > L_{dbt}, \text{"Okay"}, \text{"No Good"}\right)$$

Lpad_Check = "Okay"

SITE NAME	NORTH HAVEN S CT	ECP - CELL #	0	2	215
LATITUDE	41-20-41.35 N	LONGITUDE	72-52-17.36 W		
		SAVE BUTTON			
Additional Comments:		STRUCTURE TYPE	MONOPOLE		

AWS - LTE ANTENNA ADD	ALPHA		BETA		GAMMA	
EQUIPMENT TYPE	9412 eNodeB		9412 eNodeB		9412 eNodeB	
ANTENNA TYPE	MG D3-800T0		MG D3-800T0		MG D3-800T0	
QTY OF ANTENNAS PER FACE	1		1		1	
ORIENTATION (DEG)	30		150		270	
DOWN TILT (MECH/DEG)	0		0		0	
RAD CTR (FT AGL)	82		82		82	
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
RRH - QTY/MODEL	1	ALU RH_2X40-AWS	1	ALU RH_2X40-AWS	1	ALU RH_2X40-AWS
SECTOR DISTRIBUTION BOX	1	DB-E1-3B-8AB-0Z	1	DB-E1-3B-8AB-0Z	1	DB-E1-3B-8AB-0Z
MAIN DISTRIBUTION BOX	1				DB-T1-6Z-8AB-0Z	
700 Mhz - LTE Current Config	**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE	9412 eNodeB		9412 eNodeB		9412 eNodeB	
ANTENNA TYPE	P65-16-XL-2_2_750		P65-16-XL-2_2_750		P65-16-XL-2_2_750	
QTY OF ANTENNAS PER FACE	1		1		1	
ORIENTATION (DEG)	30		150		270	
DOWN TILT (MECH/DEG)	0		0		0	
RAD CTR (FT AGL)	82		82		82	
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
700 Mhz - LTE Future Config	**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE	9412 eNodeB		9412 eNodeB		9412 eNodeB	
ANTENNA TYPE	BXA-70063-6CF-2-750MHz		BXA-70063-6CF-2-750MHz		BXA-70063-6CF-2-750MHz	
QTY OF ANTENNAS PER FACE	1		1		1	
ORIENTATION (DEG)	30		150		270	
DOWN TILT (MECH/DEG)	0		0		0	
RAD CTR (FT AGL)	82		82		82	
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
850 Celluar - Current Config	**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE	Cellular Mod 4.0B		Cellular Mod 4.0B		Cellular Mod 4.0B	
ANTENNA TYPE	DB844G65ZAXY_H		DB844G65ZAXY_H		DB844G65ZAXY_H	
QTY OF ANTENNAS PER FACE	2		2		2	
ORIENTATION (DEG)	30		150		270	
DOWN TILT (MECH/DEG)	2		0		0	
RAD CTR (FT AGL)	82		82		82	
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
850 Celluar - Future Config	**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE	Cellular Mod 4.0B		Cellular Mod 4.0B		Cellular Mod 4.0B	
ANTENNA TYPE	BXA-80063-4BF-EDIN-0		BXA-80063-4BF-EDIN-0		BXA-80063-4BF-EDIN-0	
QTY OF ANTENNAS PER FACE	1		1		1	
ORIENTATION (DEG)	30		150		270	
DOWN TILT (MECH/DEG)	2		0		0	
RAD CTR (FT AGL)	82		82		82	
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
DIPLEX WITH LTE CABLE						
1900 PCS - Current Config	**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE	PCS Mod 4.0B		PCS Mod 4.0B		PCS Mod 4.0B	
ANTENNA TYPE	MG D3-800T0		MG D3-800T0		MG D3-800T0	
QTY OF ANTENNAS PER FACE	1		1		1	
ORIENTATION (DEG)	30		150		270	
DOWN TILT (MECH/DEG)	2		2		2	
RAD CTR (FT AGL)	82		82		82	
TMA - QTY / MODEL						
DIPLEXER - QTY / MODEL						
1900 PCS - Future Config	**ALPHA**		**BETA**		**GAMMA**	
EQUIPMENT TYPE	PCS Mod 4.0B		PCS Mod 4.0B		PCS Mod 4.0B	
ANTENNA TYPE	MG D3-800T0		MG D3-800T0		MG D3-800T0	
QTY OF ANTENNAS PER FACE	1		1		1	
ORIENTATION (DEG)	30		150		270	
DOWN TILT (MECH/DEG)	2		2		2	
RAD CTR (FT AGL)	82		82		82	
TMA - QTY / MODEL						
DIPLEX WITH CELLULAR CABLE						

NUMBER OF CABLE'S NEEDED						ESTIMATED CABLE LENGTH			
MAINLINE SIZE		TOTAL # OF MAINLINES			18	MAINLINE (FT)			
JUMPER SIZE	1/2 "	TOTAL # OF TOP JUMPERS			24	TOP JUMPER (FT)			
		MAIN CABLE #	18	+	0	TOP JUMPER #	18	+	6
FIBER LINE SIZE	1 5/8"	TOTAL # OF FIBER LINES			1	FIBER LINE MODEL #			HB158-1-08U8-S8J18
JUMPER SIZE	1 1/4"	TOTAL # OF TOP JUMPERS			3	TOP JUMPER MODEL #			HB114-1-08U4-S4J18
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	+	4

TX / RX FREQUENCIES				TX POWER OUTPUT	
Cellular A-Band	PCS F / AWS-Band	700 Mhz C - Block		Cellular (Watts)	20
TX - 869-880,890-891.5 MHz	TX - 1970-1975 / 2145-2155	TX - 746-757		PCS (Watts)	16
RX - 824-835,845-846.5 MHz	RX - 1890-1895 / 1745-1755	RX - 776-787		700 Mhz / AWS (Watts)	40

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

RF ENGINEER	RF MANAGER	INITIALS	DATE
Prepared By: Jay Latorre Don McMenemy	Robert Hesselbach	JL DAM	8/2/2013

Site Configuration

Amphenol ANTENNA SOLUTIONS

BXA-70063-6CF-EDIN-X

X-Pol | FET Panel | 63° | 14.5 dBd

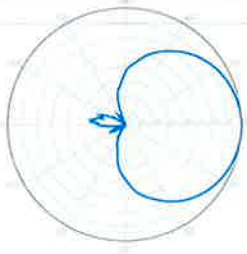
Replace "X" with desired electrical downtilt.

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

Electrical Characteristics	696-900 MHz	
Frequency bands	696-806 MHz	806-900 MHz
Polarization	±45°	
Horizontal beamwidth	65°	63°
Vertical beamwidth	13°	11°
Gain	14.0 dBd (16.1 dBi)	14.5 dBd (16.6 dBi)
Electrical downtilt (X)	0, 2, 3, 4, 5, 6, 8, 10	
Impedance	50Ω	
VSWR	≤1.35:1	
Upper sidelobe suppression (0°)	-18.3 dB	-18.2 dB
Front-to-back ratio (+/-30°)	-33.4 dB	-36.3 dB
Null fill	5% (-26.02 dB)	
Isolation between ports	< -25 dB	
Input power with EDIN connectors	500 W	
Input power with NE connectors	300 W	
Lightning protection	Direct Ground	
Connector(s)	2 Ports / EDIN or NE / Female / Center (Back)	
Mechanical Characteristics		
Dimensions Length x Width x Depth	1804 x 285 x 132 mm	71.0 x 11.2 x 5.2 in
Depth with z-brackets	172 mm	6.8 in
Weight without mounting brackets	7.9 kg	17 lbs
Survival wind speed	> 201 km/hr	> 125 mph
Wind area	Front: 0.51 m^2 Side: 0.24 m^2	Front: 5.5 ft^2 Side: 2.6 ft^2
Wind load @ 161 km/hr (100 mph)	Front: 759 N Side: 391 N	Front: 169 lbf Side: 89 lbf

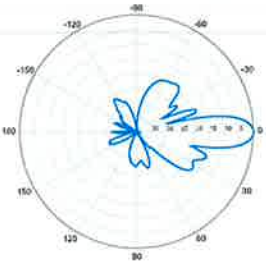
Mounting Options	Part Number	Fits Pipe Diameter	Weight
3-Point Mounting & Downtilt Bracket Kit	36210008	40-115 mm 1.57-4.5 in	6.9 kg 15.2 lbs
Concealment Configurations	For concealment configurations, order BXA-70063-6CF-EDIN-X-FP		

BXA-70063-6CF-EDIN-X



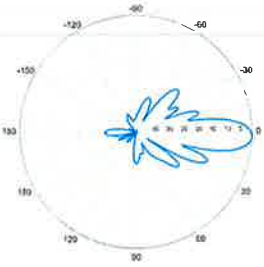
Horizontal | 750 MHz

BXA-70063-6CF-EDIN-0

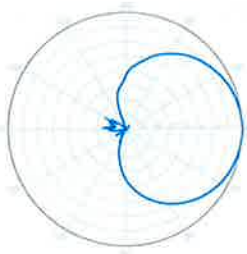


0° | Vertical | 750 MHz

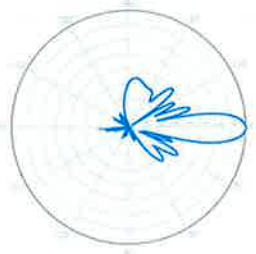
BXA-70063-6CF-EDIN-2



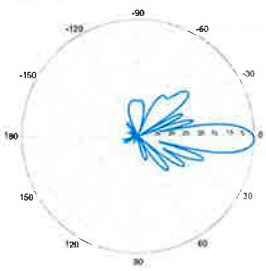
2° | Vertical | 750 MHz



Horizontal | 850 MHz



0° | Vertical | 850 MHz



2° | Vertical | 850 MHz

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

BXA-80063-4BF-EDIN-X

X-Pol | FET Panel | 63° | 13.0 dBd

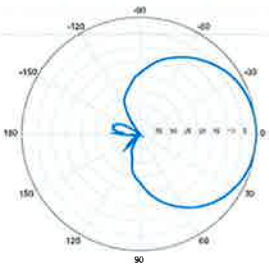
Replace "X" with desired electrical downtilt.

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

Electrical Characteristics				
Frequency bands	806-900 MHz*			
*Optional frequency band for iDEN	806-941 MHz (specify when ordering)			
Polarization	±45°			
Horizontal beamwidth	63°			
Vertical beamwidth	15°			
Gain	13.0 dBd (15.1 dBi)			
Electrical downtilt (X)	0, 2, 3, 4, 5, 6, 8, 9, 10, 12, 14			
Impedance	50Ω			
VSWR	≤1.4:1			
Upper sidelobe suppression (0°)	-22.1 dB			
Front-to-back ratio (+/-30°)	-34.9 dB			
Null fill	5% (-26.02 dB)			
Isolation between ports	< -25 dB			
Input power with EDIN connectors	500 W			
Input power with N connectors	300 W			
Lightning protection	Direct Ground			
Connector(s)	2 Ports / EDIN or N / Female / Bottom			
Mechanical Characteristics				
Dimensions Length x Width x Depth	1134 x 285 x 135 mm		44.6 x 11.2 x 5.3 in	
Depth with z-brackets	175 mm		6.9 in	
Weight without mounting brackets	5.7 kg		12.6 lbs	
Survival wind speed	> 201 km/hr		> 125 mph	
Wind area	Front: 0.32 m²	Side: 0.15 m²	Front: 3.5 ft²	Side: 1.7 ft²
Wind load @ 161 km/hr (100 mph)	Front: 469 N	Side: 249 N	Front: 104 lbf	Side: 53 lbf

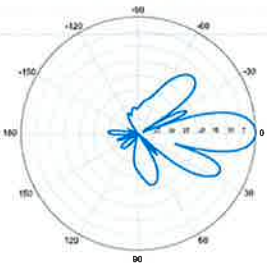
Mounting Options	Part Number	Fits Pipe Diameter	Weight
2-Point Mounting & Downtilt Bracket Kit	36210006	40-115 mm 1.57-4.5 in	4.1 kg 9 lbs
Concealment Configurations	For concealment configurations, order BXA-80063-4BF-EDIN-X-FP		

BXA-80063-4BF-EDIN-X



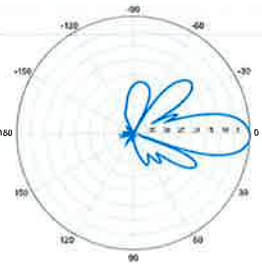
Horizontal

BXA-80063-4BF-EDIN-0



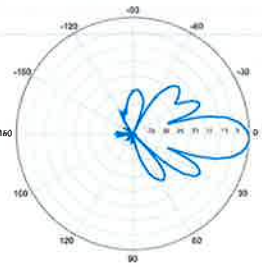
0° | Vertical

BXA-80063-4BF-EDIN-2



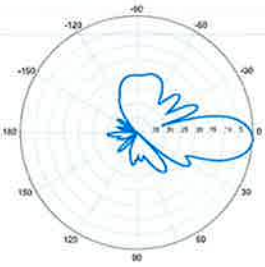
2° | Vertical

BXA-80063-4BF-EDIN-3



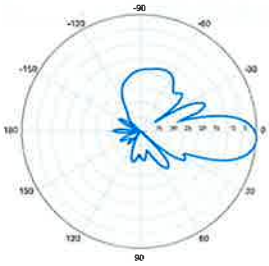
3° | Vertical

BXA-80063-4BF-EDIN-4



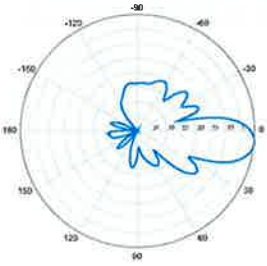
4° | Vertical

BXA-80063-4BF-EDIN-5



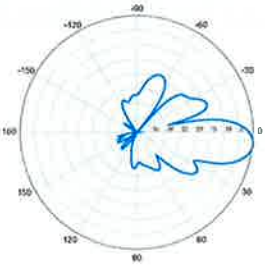
5° | Vertical

BXA-80063-4BF-EDIN-6



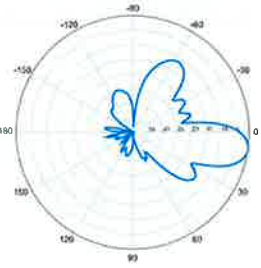
6° | Vertical

BXA-80063-4BF-EDIN-8



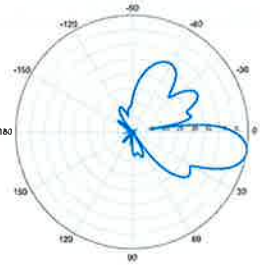
8° | Vertical

BXA-80063-4BF-EDIN-9



9° | Vertical

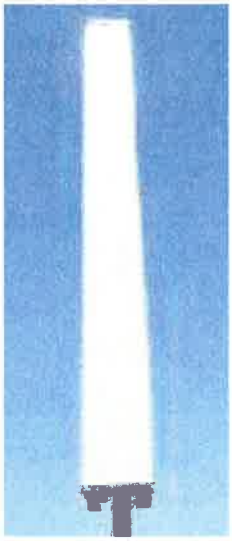
BXA-80063-4BF-EDIN-10



10° | Vertical

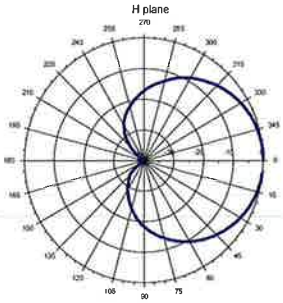
MG D3-800Tx

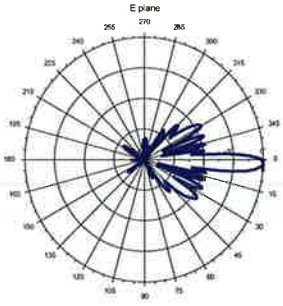
Xpol GSM1800+PCS & UMTS Panel Antenna
15.9 dBd/18 dBi
WIDE BAND 1710-2170 MHz
H 65º V 6.5º



Electrical Specifications

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





Mechanical & Environmental Specifications

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

Shipping Specifications

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

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

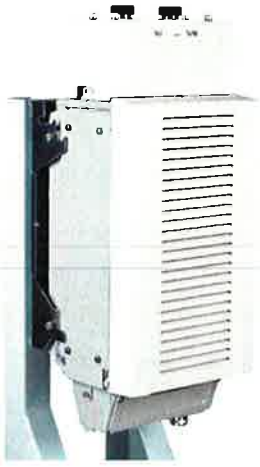
RYMSA

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

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

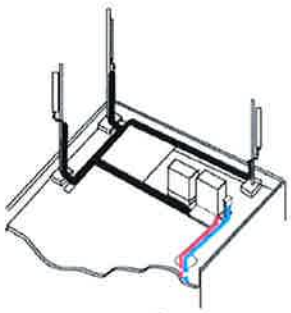
Because of its small size and weight, the Alcatel-Lucent RRH2x40-AWS can be installed close to the antenna. Operators can therefore locate the Alcatel-Lucent RRH2x40-AWS where RF engineering is deemed ideal, minimizing trade-offs between available sites and RF optimum sites. The RF feeder cost and installation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

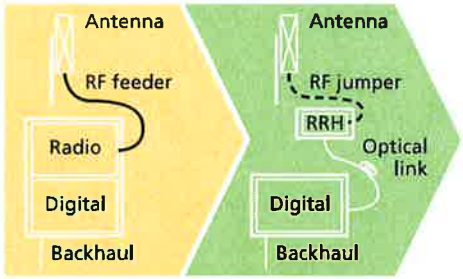
- Zero-footprint deployment
- Easy installation, with a lightweight unit can be carried and set up by one person
- Optimized RF power, with flexible site selection and elimination of a TMA
- Convection-cooled (fanless)
- Noise-free
- Best-in-class power efficiency, with significantly reduced energy consumption

Benefits

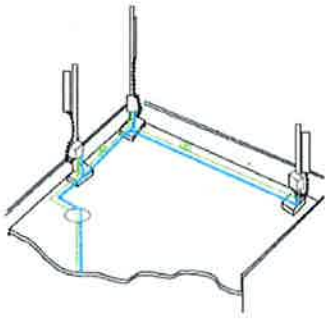
- Leverages existing real estate with lower site costs
- Reduces installation costs, with fewer installation materials and simplified logistics
- Decreases power costs and minimizes environmental impacts, with the potential for eco-sustainable power options
- Improves RF performance and adds flexibility 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 DB-B1 and DB-T1 Series

DC and Fiber Management Distribution Boxes for HYBRIFLEX™ Cable

Product Description

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

Features/Benefits

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

Technical Specifications

Mechanical Specifications

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

Electrical Specifications

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

* This data is provisional and subject to change.