Robinson+Cole

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Also admitted in Massachusetts

June 8, 2015

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

Re: **Notice of Exempt Modification – Facility Modification**
265 Benham Street, Hamden, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains fifteen (15) wireless telecommunications antennas at the 63.5-foot level on an existing 65-foot roof-mounted guyed lattice tower at 265 Benham Street in Hamden, Connecticut (the "Property"). The roof-top tower and the building are owned by the Apostles of the Sacred Heart of Jesus, Inc. The Council approved Cellco's shared use of this tower in 2000. Cellco now intends to modify its facility by replacing nine (9) of its existing antennas with two (2) model LNX-6514DS-VTM, 700 MHz antennas; one (1) model X7C-FRO640, 700 MHz antenna; two (2) model SBNHH-1D65B, 1900 MHz antennas; one (1) model SBNHH-1D45B, 1900 MHz antenna; and three (3) model HBXX-6517DS-VTM, 2100 MHz antennas, all at the same 63.5-foot level. Cellco also intends to replace three (3) existing remote radio heads ("RRHs") with three (3) newer model RRHs, one (1) each behind its 2100 MHz antennas, and add six (6) RRHs, one (1) each behind its 700 MHz and 1900 MHz antennas and one (1) HYBRIFLEX™ antenna cable. Included in Attachment 1 are specifications for Cellco's replacement antennas, RRHs and HYBRIFLEX™ cable.

Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to James Pascarella, Acting Mayor for the Town of Hamden. A copy of this letter is also being sent to the Apostles of the Sacred Heart of Jesus, Inc., the owner of the Property.

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

1. The proposed modifications will not result in an increase in the height of the existing tower. The replacement antennas and RRHs will be located at the 63.5-foot level on the 65-foot roof-top 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 replacement antennas will not increase radio frequency (RF) emissions at the facility to a level at or above the Federal Communications Commission (FCC) safety standard. Far Field Approximation tables for each of Cellco's operating frequencies are included behind Attachment 2. The Far Field calculations demonstrate that Cellco's modified facility will operate well within the RF emissions limits established by the FCC.

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

6. The tower 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:
James Pascarella, Hamden Acting Mayor
Apostles of the Sacred Heart of Jesus, Inc.
Tim Parks

ATTACHMENT 1

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

LNX-6514DS-VTM

Andrew® Antenna, 698–896 MHz, 65° horizontal beamwidth, RET compatible

- Great solution to maximize network coverage and capacity
- Excellent gain, VSWR, front-to-back ratio, and PIM specifications for robust network performance
- Ideal choice for site collocations and tough zoning restrictions
- Excellent solution for site sharing and maximizing capacity
- Fully compatible with Andrew remote electrical tilt system for greater OpEx savings
- The RF connectors are designed for IP67 rating and the radome for IP56 rating

Electrical Specifications

Frequency Band, MHz	**698–806**	**806–896**
Gain, dBi	15.8	15.9
Beamwidth, Horizontal, degrees	65	64
Beamwidth, Vertical, degrees	12.4	11.2
Beam Tilt, degrees	0–10	0–10
USLS, dB	17	18
Front-to-Back Ratio at 180°, dB	32	30
CPR at Boresight, dB	23	23
CPR at Sector, dB	12	10
Isolation, dB	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153
Input Power per Port, maximum, watts	400	400
Polarization	±45°	±45°
Impedance	50 ohm	50 ohm

Electrical Specifications, BASTA*

Frequency Band, MHz	**698–806**	**806–896**
Gain by all Beam Tilts, average, dBi	15.6	15.7
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.5
Gain by Beam Tilt, average, dBi	0 ° | 15.7 5 ° | 15.7 10 ° | 15.3	0 ° | 15.9 5 ° | 15.8 10 ° | 15.3
Beamwidth, Horizontal Tolerance, degrees	±0.9	±1.4
Beamwidth, Vertical Tolerance, degrees	±0.8	±0.6
USLS, dB	18	20
Front-to-Back Total Power at 180° ± 30°, dB	25	23
CPR at Boresight, dB	25	24
CPR at Sector, dB	15	12

* CommScope® supports NGMN recommendations on Base Station Antenna Standards (BASTA). To learn more about the benefits of BASTA, download the whitepaper Time to Raise the Bar on BSAs.

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol®
Band	Single band
Brand	DualPol® | Teletilt®

Product Specifications

LNX-6514DS-VTM

Operating Frequency Band	698 – 896 MHz
Performance Note	Outdoor usage

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Aluminum
Radome Material	Fiberglass, UV resistant
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	2
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph

Dimensions

Depth	180.5 mm | 7.1 in
Length	1851.0 mm | 72.9 in
Width	301.0 mm | 11.9 in
Net Weight	14.2 kg | 31.3 lb

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 2.0 Actuator	LNX-6514DS-A1M
RET System	Teletilt®

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

Included Products

DB380 — Pipe Mounting Kit for 2.4"-4.5" (60-115mm) OD round members on wide panel antennas. Includes 2 clamp sets and double nuts.

DB5083 — Downtilt Mounting Kit for 2.4"-4.5" (60 - 115 mm) OD round members. Includes a heavy-duty, galvanized steel downtilt mounting bracket assembly and associated hardware. This kit is compatible with the DB380 pipe mount kit for panel antennas that are equipped with two mounting brackets.

* Footnotes

Performance Note	Severe environmental conditions may degrade optimum performance

X7C-FRO-640-V

X-Pol Antenna, 698-896MHz, 72", Fast Roll Off 40° Azimuth
Variable E-Tilt, RET/MET

- Macro Cell, high gain antenna
- Fast Roll Off (FRO)
- Suitable for LTE/CDMA/UMTS/GSM
- AISG 2.0 RET or manual MET tilt control

ELECTRICAL SPECIFICATIONS

Frequency Band, MHz	**698-824**	**824-896**
Horizontal Beam width, 3dB points	46°	36°
Gain, dBi	17.3	18.5
Vertical Beam width, 3dB points	12.1°	10.2°
Front-to-Back at 180°, dB	24	
Upper Side Lobe Suppression, Typical, dB	18	
Polarization	Circular	
Electrical Down tilt	0-10° or 4-14°	
VSWR/Return Loss, dB, Maximum	1.5:1/-14.0	
Isolation Between Ports, dB, Minimum	28	
Intermodulation (2x20w), IM3, dBc	-150	
Impedance, ohms	50	
Maximum Power Per Connector, CW (w)	500	

MECHANICAL SPECIFICATIONS

Dimensions, Length/Width/Depth	72.0/18.8/9.1 in (1829/479/231 mm)
Connector (Quantity) Type	(2) 7-16 DIN Female
Connector Torque	220-265 lbf-in (23-30 N-m)
Connector Location	Back
Antenna Weight	42.4 Lbs (19.3 Kg)
Bracket Weight	13.4 lb (6.0 kg)
Standard Bracket Kit	P/N 919011 (Included)
Mechanical Downtilt Range	0-12°
Radome Material	High Strength Luran, UV Stabilized, ASTM D1925
Wind Survival	150 mph (241 km/h)
Front Wind Load	225.9 lbf (1005.1 N)
Equivalent Flat Plate	4.51 sq-ft (c=2)

RET INFORMATION

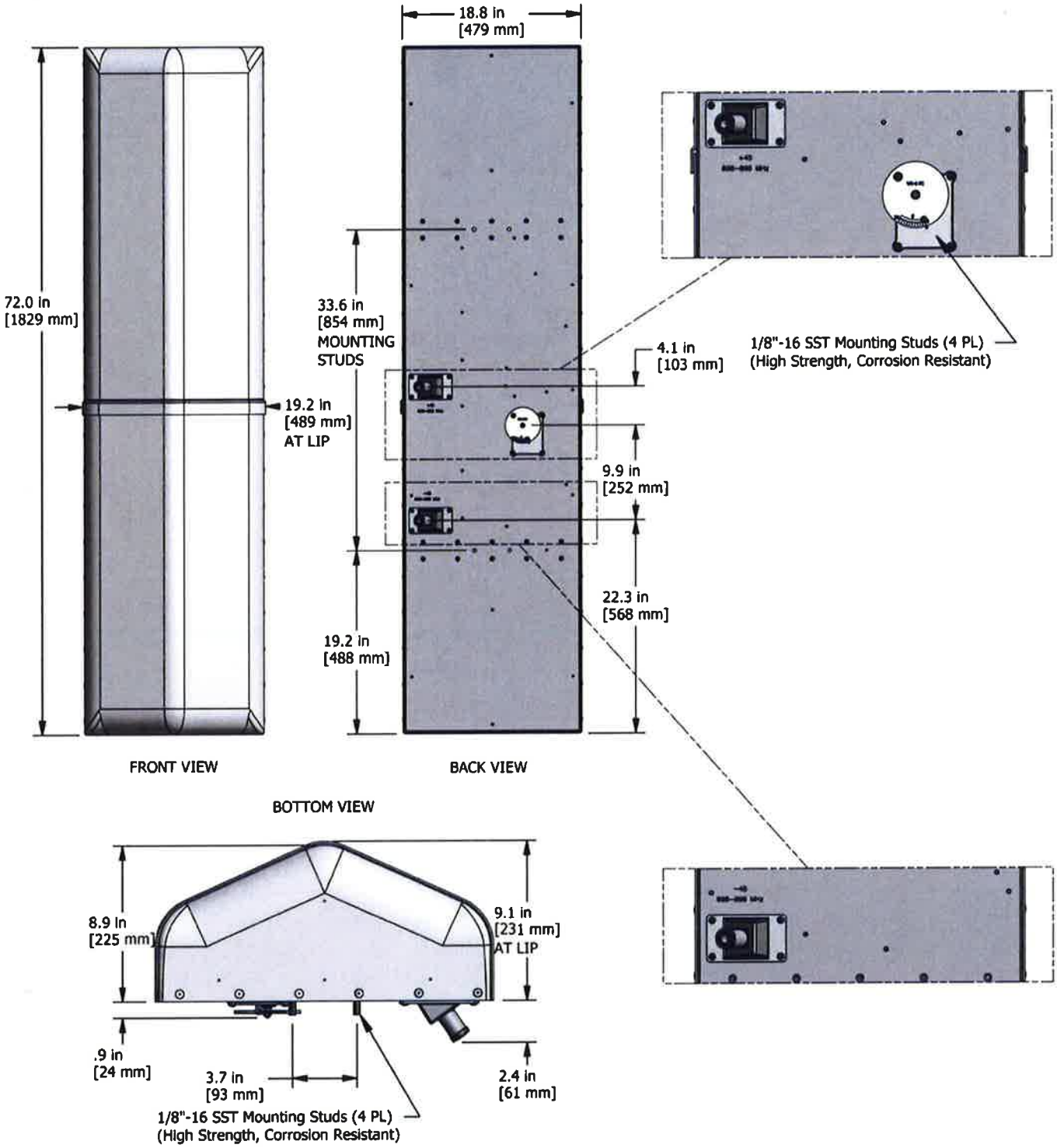
Model	CSS-RET-200
Mounting Location	Rear of Antenna
Weight	1.2 lb (0.54 kg)
Communication Standard	AISG 2.0
Control System	CSS-PCU-220

ORDER INFORMATION

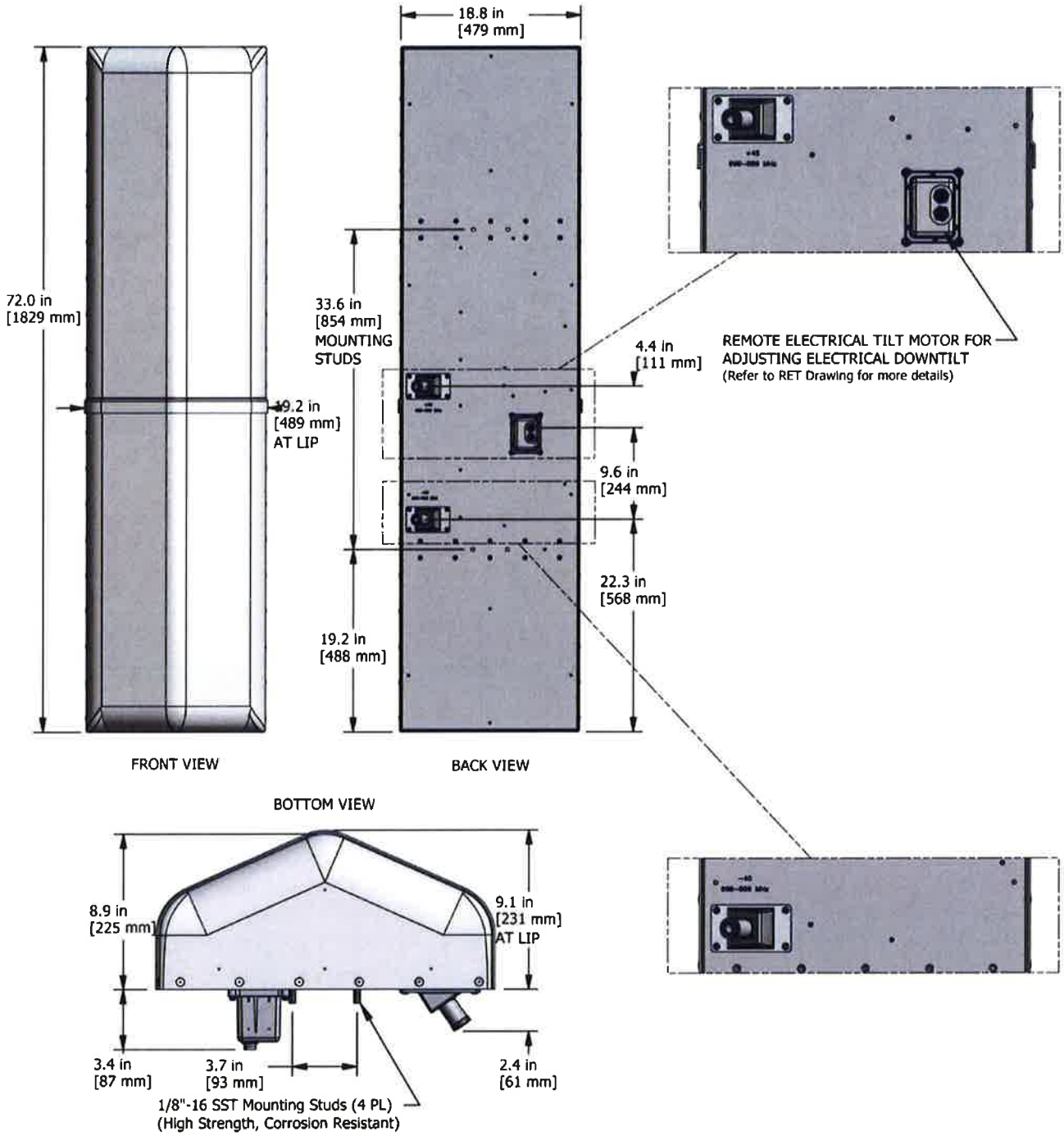
MODEL	DESCRIPTION
X7C-FRO-640-VM0	Antenna with manual MET adjust electrical downtilt 0-10°
X7C-FRO-640-VM4	Antenna with manual MET adjust electrical downtilt 4-14°
X7C-FRO-640-VR0	Antenna with remote RET adjust electrical downtilt 0-10°
X7C-FRO-640-VR4	Antenna with remote RET adjust electrical downtilt 4-14°
919036	Optional Bracket Kit, 2-Point, 12deg D-tilt, For 4.5" OD Pole

Mechanical Outline Drawing

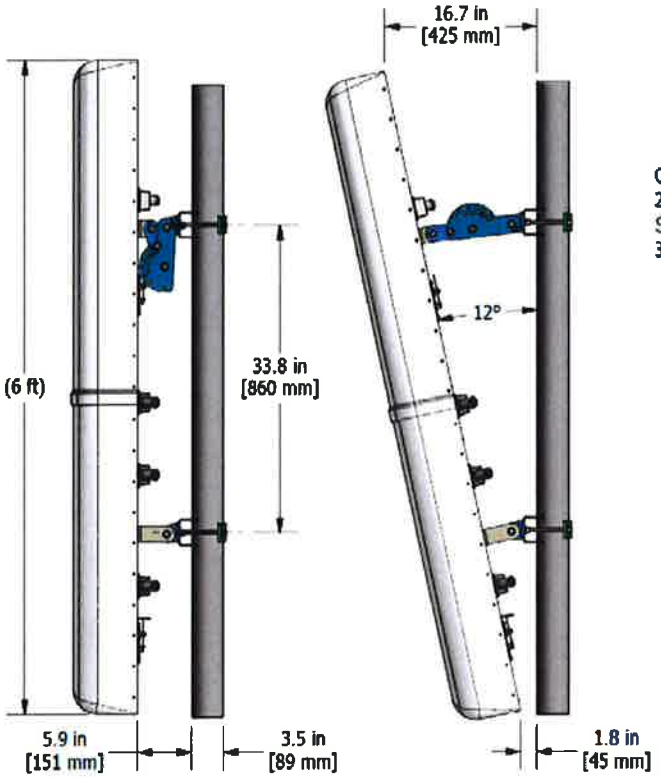
X7C-FRO-640-VM



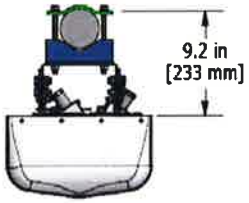
X7C-FRO-640-VR



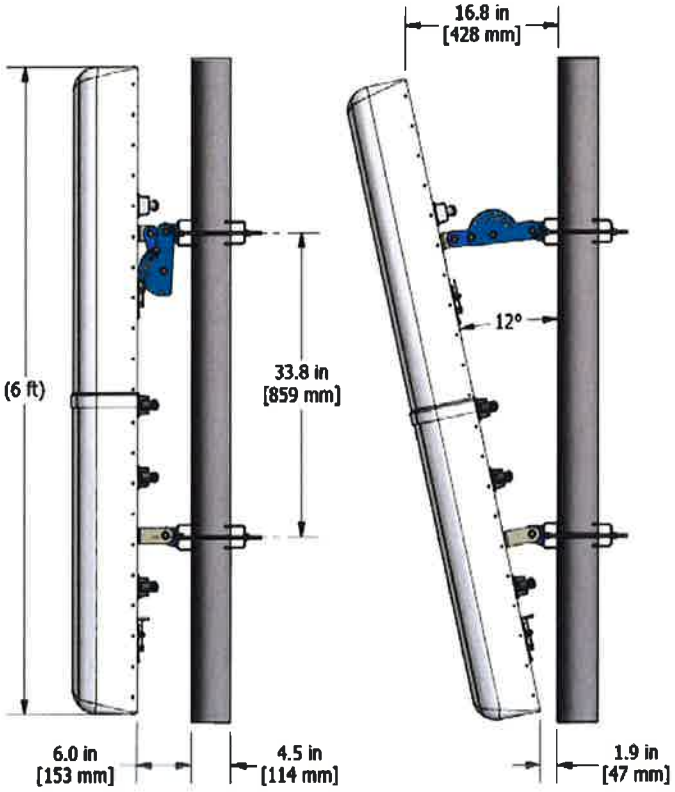
Standard Bracket Kit



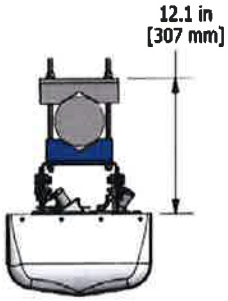
CSS P/N: 919011 BRACKET KIT
2 POINT, 12 DEGREE DOWN TILT
SHOWN MOUNTED ON 3.5" O.D. POLE
3.5" O.D. MAX POLE SIZE



Optional Bracket Kit



CSS P/N: 919036 BRACKET KIT
2 POINT, 12 DEGREE DOWN TILT
SHOWN MOUNTED ON 4.5" O.D. POLE
4.5" O.D. MAX POLE SIZE



Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

SBNHH-1D65B

Andrew® Tri-band Antenna, 698–896 and 2x 1695–2360 MHz, 65° horizontal beamwidth, internal RET. Both high bands share the same electrical tilt.

- Interleaved dipole technology providing for attractive, low wind load mechanical package

Electrical Specifications

Frequency Band, MHz	698–806	806–896	1695–1880	1850–1990	1920–2180	2300–2360
Gain, dBi	14.9	14.7	17.7	18.2	18.6	18.6
Beamwidth, Horizontal, degrees	68	66	69	66	63	58
Beamwidth, Vertical, degrees	12.1	10.7	5.6	5.2	5.0	4.5
Beam Tilt, degrees	0–14	0–14	0–7	0–7	0–7	0–7
USLS, dB	14	13	15	15	15	13
Front-to-Back Ratio at 180°, dB	27	29	28	28	28	27
CPR at Boresight, dB	20	23	20	20	17	21
CPR at Sector, dB	14	10	12	10	9	1
Isolation, dB	25	25	25	25	25	25
Isolation, Intersystem, dB	30	30	30	30	30	30
VSWR | Return Loss, dB	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350	350	350	300
Polarization	±45°	±45°	±45°	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm

Electrical Specifications, BASTA*

Frequency Band, MHz	698–806	806–896	1695–1880	1850–1990	1920–2180	2300–2360
Gain by all Beam Tilts, average, dBi	14.5	14.3	17.4	17.9	18.2	18.3
Gain by all Beam Tilts Tolerance, dB	±0.5	±0.8	±0.4	±0.3	±0.5	±0.3
Gain by Beam Tilt, average, dBi	0 ° | 14.6	0 ° | 14.5	0 ° | 17.4	0 ° | 17.8	0 ° | 18.1	0 ° | 18.2
	7 ° | 14.6	7 ° | 14.4	3 ° | 17.5	3 ° | 17.9	3 ° | 18.3	3 ° | 18.4
	14 ° | 14.2	14 ° | 13.6	7 ° | 17.4	7 ° | 17.9	7 ° | 18.2	7 ° | 18.4
Beamwidth, Horizontal Tolerance, degrees	±2.2	±3.4	±2	±4.6	±5.7	±4.3
Beamwidth, Vertical Tolerance, degrees	±0.8	±1	±0.3	±0.2	±0.3	±0.2
USLS, dB	16	14	16	16	16	15
Front-to-Back Total Power at 180° ± 30°, dB	25	26	27	26	26	26
CPR at Boresight, dB	22	23	21	20	20	22
CPR at Sector, dB	13	11	16	12	11	4

* CommScope® supports NGMN recommendations on Base Station Antenna Standards (BASTA). To learn more about the benefits of BASTA, download the whitepaper Time to Raise the Bar on BSAs.

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol® multiband with internal RET
Band	Multiband
Brand	DualPol® | Teletilt®
Operating Frequency Band	1695 – 2360 MHz | 698 – 896 MHz
Performance Note	Outdoor usage

Product Specifications

SBNHH-1D65B

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Aluminum | Low loss circuit board
Radome Material	Fiberglass, UV resistant
Reflector Material	Aluminum
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	6
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241.4 km/h | 150.0 mph

Dimensions

Depth	181.0 mm | 7.1 in
Length	1851.0 mm | 72.9 in
Width	301.0 mm | 11.9 in
Net Weight	18.4 kg | 40.6 lb

Remote Electrical Tilt (RET) Information

Input Voltage	10–30 Vdc
Power Consumption, idle state, maximum	2.0 W
Power Consumption, normal conditions, maximum	13.0 W
Protocol	3GPP/AISG 2.0 (Multi-RET)
RET Interface	8-pin DIN Female | 8-pin DIN Male
RET Interface, quantity	1 female | 1 male
RET System	Teletilt®

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

Included Products

BSAMNT-1 — Wide Profile Antenna Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Kit contains one scissor top bracket set and one bottom bracket set.

* Footnotes

Performance Note	Severe environmental conditions may degrade optimum performance

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

SBNHH-1D45B

Andrew® Tri-band Antenna, 698–896 and 2x 1695–2360 MHz, 45° horizontal beamwidth, internal RETs.

- Interleaved dipole technology providing for attractive, low wind load mechanical package
- Three internal RETs for independent tilt on all three bands

Electrical Specifications

Frequency Band, MHz	698–806	806–896	1695–1880	1850–1990	1920–2180	2300–2360
Gain, dBi	16.9	17.6	19.6	20.1	20.5	21.0
Beamwidth, Horizontal, degrees	47	43	45	42	42	39
Beamwidth, Vertical, degrees	12.4	11.4	5.8	5.3	5.1	4.5
Beam Tilt, degrees	0–14	0–14	0–8	0–8	0–8	0–8
USLS, dB	19	22	18	17	17	16
Front-to-Back Ratio at 180°, dB	30	31	31	33	33	35
CPR at Boresight, dB	27	27	21	23	16	17
CPR at 10 dB Horizontal Beamwidth, dB	11	14	10	11	11	13
Isolation, dB	25	25	25	25	25	25
Isolation, Intersystem, dB	30	30	30	30	30	30
VSWR | Return Loss, dB	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350	350	350	300
Polarization	±45°	±45°	±45°	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm

Electrical Specifications, BASTA*

Frequency Band, MHz	698–806	806–896	1695–1880	1850–1990	1920–2180	2300–2360
Gain by all Beam Tilts, average, dBi	16.6	17.3	19.2	19.8	20.1	20.8
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.3	±0.5	±0.4	±0.5	±0.4
Gain by Beam Tilt, average, dBi	0 ° | 16.6	0 ° | 17.3	0 ° | 19.3	0 ° | 19.9	0 ° | 20.1	0 ° | 20.7
	7 ° | 16.7	7 ° | 17.4	4 ° | 19.3	4 ° | 19.9	4 ° | 20.2	4 ° | 20.9
	14 ° | 16.4	14 ° | 17.1	8 ° | 19.0	8 ° | 19.6	8 ° | 20.0	8 ° | 20.4
Beamwidth, Horizontal Tolerance, degrees	±1.5	±2.8	±2.1	±1.7	±1	±1.7
Beamwidth, Vertical Tolerance, degrees	±0.8	±0.6	±0.3	±0.2	±0.4	±0.1
USLS, dB	19	23	16	15	16	16
Front-to-Back Total Power at 180° ± 30°, dB	24	24	28	30	31	30
CPR at Boresight, dB	28	29	23	24	20	19
CPR at 10 dB Horizontal Beamwidth, dB	13	17	13	13	13	13

* CommScope® supports NGMN recommendations on Base Station Antenna Standards (BASTA). To learn more about the benefits of BASTA, download the whitepaper Time to Raise the Bar on BSAs.

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol® multiband with internal RET
Band	Multiband
Brand	DualPol® | Teletilt®
Operating Frequency Band	1695 – 2360 MHz | 698 – 896 MHz
Performance Note	Outdoor usage

Product Specifications

SBNHH-1D45B

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Aluminum | Low loss circuit board
Radome Material	Fiberglass, UV resistant
Reflector Material	Aluminum
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	6
Wind Loading, maximum	1038.0 N @ 150 km/h 233.4 lbf @ 150 km/h
Wind Speed, maximum	241.4 km/h | 150.0 mph

Dimensions

Depth	178.0 mm | 7.0 in
Length	1829.0 mm | 72.0 in
Width	457.0 mm | 18.0 in
Net Weight	29.2 kg | 64.4 lb

Remote Electrical Tilt (RET) Information

Input Voltage	10–30 Vdc
Power Consumption, idle state, maximum	2.0 W
Power Consumption, normal conditions, maximum	13.0 W
Protocol	3GPP/AISG 2.0 (Multi-RET)
RET Interface	8-pin DIN Female | 8-pin DIN Male
RET Interface, quantity	1 female | 1 male
RET System	Teletilt®

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

Included Products

BSAMNT-1 — Wide Profile Antenna Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Kit contains one scissor top bracket set and one bottom bracket set.

* Footnotes

Performance Note	Severe environmental conditions may degrade optimum performance

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

HBXX-6517DS-VTM

Andrew® Quad Port Antenna, 1710–2180 MHz, 65° horizontal beamwidth, RET compatible

- Superior azimuth tracking and pattern symmetry with excellent passive intermodulation suppression

Electrical Specifications

Frequency Band, MHz	1710–1880	1850–1990	1920–2180
Gain, dBi	19.0	19.1	19.2
Beamwidth, Horizontal, degrees	67	66	65
Beamwidth, Vertical, degrees	5.0	4.7	4.4
Beam Tilt, degrees	0–6	0–6	0–6
USLS, dB	18	18	18
Front-to-Back Ratio at 180°, dB	30	30	30
CPR at Boresight, dB	21	22	21
CPR at Sector, dB	10	11	9
Isolation, dB	30	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350
Polarization	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm

Electrical Specifications, BASTA*

Frequency Band, MHz	1710–1880	1850–1990	1920–2180
Gain by all Beam Tilts, average, dBi	18.5	18.6	18.8
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.3	±0.4
Gain by Beam Tilt, average, dBi	0 ° | 18.4 3 ° | 18.7 6 ° | 18.4	0 ° | 18.4 3 ° | 18.7 6 ° | 18.5	0 ° | 18.7 3 ° | 18.9 6 ° | 18.6
Beamwidth, Horizontal Tolerance, degrees	±2.4	±1.7	±2.9
Beamwidth, Vertical Tolerance, degrees	±0.3	±0.3	±0.3
USLS, dB	18	19	19
Front-to-Back Total Power at 180° ± 30°, dB	25	26	26
CPR at Boresight, dB	22	23	22
CPR at Sector, dB	10	10	9

* CommScope® supports NGMN recommendations on Base Station Antenna Standards (BASTA). To learn more about the benefits of BASTA, download the whitepaper Time to Raise the Bar on BSAs.

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol® quad
Band	Single band
Brand	DualPol® | Teletilt®
Operating Frequency Band	1710 – 2180 MHz

Product Specifications

HBXX-6517DS-VTM

Performance Note	Outdoor usage

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Low loss circuit board
Radome Material	PVC, UV resistant
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	4
Wind Loading, maximum	668.0 N @ 150 km/h 150.2 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph

Dimensions

Depth	166.0 mm | 6.5 in
Length	1903.0 mm | 74.9 in
Width	305.0 mm | 12.0 in
Net Weight	19.5 kg | 43.0 lb

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 2.0 Actuator	HBXX-6517DS-A2M
RET System	Teletilt®

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

Included Products

600899A-2 — Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Kit contains one scissor top bracket set and one bottom bracket set.

* Footnotes

Performance Note	Severe environmental conditions may degrade optimum performance

ALCATEL-LUCENT B13 RRH4X30-4R

Alcatel-Lucent B13 Remote Radio Head 4x30-4R is the newest addition of Remote Radio Head to the extended product line of Alcatel-Lucent's distributed Base Station solutions, aimed at facilitating smooth RF site acquisition and related civil engineering.

Supporting 2Tx/4Tx MIMO and 4-way Rx diversity, Alcatel-Lucent B13 RRH4x30-4R allows operators to have a compact radio solution to deploy LTE in the 700U band (700 MHz, 3GPP band 13), providing them with the means to achieve high capacity, high quality and high coverage with minimum site requirements.

The Alcatel-Lucent B13 RRH4x30-4R product has four transmit RF paths, offering the possibility to **select, via software only, 2Tx or 4Tx MIMO configurations** with either 2x60 W or 4x30 W RF output power. It supports also 4-way Rx diversity and up to 10MHz instantaneous bandwidth.

The Alcatel-Lucent B13 RRH4x30-4R is a near zero-footprint solution and operates noise free, simplifying negotiations with site property owners and minimizing environmental impacts.

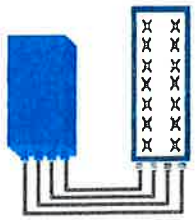
Its compactness and slim design makes the Alcatel-Lucent B13 RRH4x30-4R easy to install close to the antenna: operators can therefore locate this Remote Radio Head where RF design conditions are deemed ideal, minimizing trade-offs between available sites and RF optimum sites, together with reducing the RF feeder needs and installation costs.

FEATURES

- Supporting LTE in 700 MHz band (700U, 3GPP band 13)
- LTE 2Tx or 4Tx MIMO (SW switchable)
- Output power: Up to 2x60W or 4x30W
- 10MHz LTE carrier with 4Rx Diversity
- Convection-cooled (fan-less)
- Supports AISG 2.0 ALD devices (RET, TMA) through RS485 or RF ports

BENEFITS

- Compact to reduce additional footprint when adding LTE in 700U band
- MIMO scheme operation selection (2Tx or 4Tx) by software only
- Improves downlink spectral efficiency through MIMO4
- Increases LTE coverage thanks to 4Rx diversity capability and best in class Rx sensitivity
- Flexible mounting options: Pole or Wall



4x30W with 4T4R
or
2x60W with 2T4R

Can be switched between modes via SW w/o site visit

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Features & performance	
Number of TX/RX paths	4 duplexed (either 4T4R or 2T4R by SW)
Frequency band	U700 (C) (3GPP bands 13): DL: 746 - 756 MHz / UL: 777 - 787 MHz
Instantaneous bandwidth - #carriers	10MHz – 1 LTE carrier (in 10MHz occupied bandwidth)
LTE carrier bandwidth	10 MHz
RF output power	2x60W or 4x30W (by SW)
Noise figure – RX Diversity scheme	2 dB typ. (<2.5 dB max) – 2 or 4 way Rx diversity
Sizes (HxWxD) in mm (in.) Volume in L Weight in kg (lb) (w/o mounting HW)	550 x 305 x 230 (21.6" x 12.0" x 9") (with solar shield) 38 (with solar shield) 26 (57.2) (with solar shield)
DC voltage range DC power consumption	-40.5 to -57V at full performance, -38 to -57V with relaxation on power consumption 550W typical @100% RF load (in 2Tx or 4TX mode)
Environmental conditions Wind load (@150km/h or 93mph)	-40°C (-40°F) /+55°C (+131°F) IP65 Frontal: <200N / Lateral : <150N
Antenna ports	4 ports 7/16 DIN female (50 ohms) VSWR < 1.5
CPRI ports	2 CPRI ports (HW ready for Rate7, 9.8 Gbps) SFP single mode dual fiber
AISG interfaces	1 AISG2.0 output (RS485) Integrated Smart Bias Tees (x2)
Misc. Interfaces	4 external alarms (1 connector) – 4 RF Tx & 4 RF Rx monitor ports - 1 DC connector (2 pins)
Installation conditions	Pole and wall mounting
Regulatory compliance	3GPP 36.141 / 3GPP 36.113 / GR-1089-CORE / GR-3108-CORE / UL 60950-1 / FCC Part 27

PCS RF MODULES

RRH1900 2X60 - HW CHARACTERISTICS

LA6.0.1/13.3

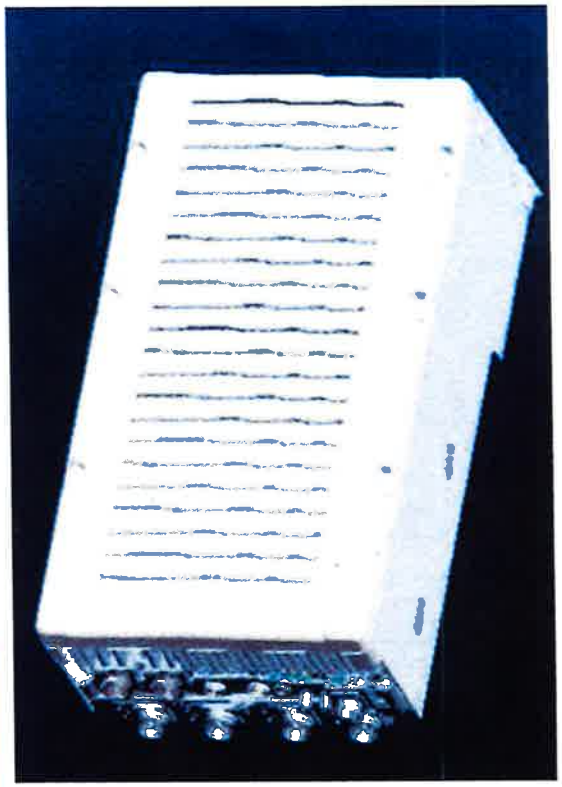
		RRH2x60
RF Output Power		2x60W
Instantaneous Bandwidth		20MHz
Transmitter		2 TX
Receiver	1900 HW version	2 Branch RX – LA6.0.1
	1900A HW version	4 Branch RX – LR13.3
Features		AISG 2.0 for RET/TMA
		Internal Smart Bias-T
Power		-48VDC
CPRI Ports		2 CPRI Rate 3 Ports
External Alarms		4 External User Alarms
Monitor Ports		TX
Environmental		GR487 Compliance
RF Connectors		7/16 DIN (top mounted)

** Not a Verizon Wireless deployed product

NEW PCS RF MODULES FOR VZW
RRH2X60 - HW CHARACTERISTICS

LR14.3

	RRH2x60
RF Output Power	2x60W (4x30W HW Ready)
Instantaneous Bandwidth	60MHz
Target Reliability (Annual Return Rate)	<2%
Receiver	4 Branch Rx
Features	AISG 2.0 for RET/TMA
Power	-48VDC
	Internal Smart Bias-T
CPRI Ports	2 CPRI Rate 5 Ports
External Alarms	4 External User Alarms
Monitor Ports	TX, RX
Environmental	GR487 Compliance
RF Connectors	7/16 DIN (downward facing)
Dimensions	22"(h) x 12"(w)x 9.4" (d)**
Weight	55lb**



**- Includes solar shield but not mounting brackets (8 lbs.)

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ALCATEL-LUCENT
WIRELESS PRODUCT DATASHEET
RRH2x60-AWS FOR BAND 4 APPLICATIONS

The Alcatel-Lucent RRH2x60-AWS is a high power, small form factor Remote Radio Head operating in the AWS frequency band (3GPP Band 4) for LTE technology. It is designed with an eco-efficient approach, providing operators with the means to achieve high quality and high capacity coverage with minimum site requirements and efficient operation.

A distributed Node B expands the 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 a Node B to be installed separately, within the same site or several kilometers apart.

The Alcatel-Lucent RRH2x60-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 RRH2x60-AWS integrates all the latest technologies. This allows to offer best-in-class characteristics.

It delivers an outstanding 120 watts of total RF power thanks to its two transmit RF paths of 60 W each.

It is ideally suited to support multiple-input multiple-output (MIMO) 2x2 operation.

It includes four RF receivers to natively support 4-way uplink reception diversity. This improves the radio uplink coverage and this can be used to extend the cell radius commensurate with 2x2MIMO 2x60 W for the downlink.

It supports multiple discontinuous LTE carriers within an instantaneous bandwidth of 45 MHz corresponding to the entire AWS B4 spectrum.

The latest generation power amplifiers (PA) used in this product achieve high efficiency (>40%), resulting in improved power consumption figures.

The Alcatel-Lucent RRH2x60-AWS is designed to make available all the benefits of a distributed Node B, with excellent RF characteristics, with low capital expenditures (CAPEX) and low operating expenditures (OPEX).

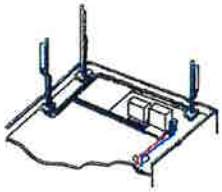
The Alcatel-Lucent RRH2x60-AWS is a very cost-effective solution to deploy LTE MIMO.

The RRH2x60-AWS includes a reversible mounting bracket which allows for ease of installation behind an antenna, or on a rooftop knee wall while providing easy access to the mid body RF connectors.

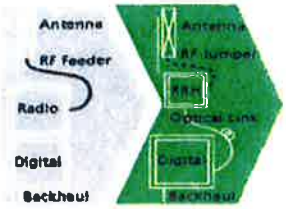
The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment. However, many of these sites can host an Alcatel-Lucent RRH2x60-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation time and costs.

The Alcatel-Lucent RRH2x60-AWS is a zero-footprint solution and is convection cooled without fans for silent operation, simplifying negotiations with site property owners and minimizing environmental impacts.

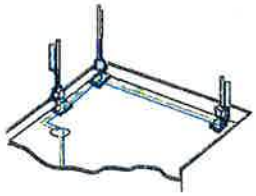
Installation can easily be done by a single person as the Alcatel-Lucent RRH2x60-AWS is compact and weighs about 20 kg, eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day.



Macro



RRH for space-constrained cell sites



Distributed

- RRH2x60-AWS integrates two power amplifiers of 60W rating (at each antenna connector)
- Support multiple carriers over the entire 3GPP band 4
- RRH2x60-AWS is optimized for LTE operation
- RRH2x60-AWS is a very compact and lightweight product
- Advanced power management techniques are embedded to provide power savings, such as PA bias control
- MIMO LTE operation with only one single unit per sector
- Improved uplink coverage with built-in 4-way receive diversity capability
- RRH can be mounted close to the antenna, eliminating nearly all losses in RF cables and thus reducing power consumption by 50% compared to conventional solutions
- Distributed configurations provide easily deployable and cost-effective solutions, near zero footprint and silent solutions, with minimum impact on the neighborhood, which ease the deployment
- RETA and TMA support without additional hardware thanks to the AISG v2.0 port and the integrated Bias-Tees. Bias-Tees support AISG DC supply and signaling.

Specifications listed are hardware capabilities. Some capabilities depend on support in a specific software release or future release.

Dimensions and weights
- HxWxD : 510x285x186mm (27 l with solar shield)
- Weight : 20 kg (44 lbs)

Electrical Data
- Power Supply : -48V DC (-40.5 to -57V)
- Power Consumption (ETSI average traffic load reference) : 250W @2x60W

RF Characteristics
- Frequency band: 1710-1755, UL / 2110-2155 MHz, DL (3GPP band 4)
- Output power: 2x60W at antenna connectors
- Technology supported: LTE
- Instantaneous bandwidth: 45 MHz
- Rx diversity: 2-way and 4-way uplink reception
- Typical sensitivity without Rx diversity: -105 dBm for LTE

Connectivity
- Two CPRI optical ports for daisychaining and up to six RRHs per fiber
- Type of optical fiber: Single-Mode (SM) and Multi-Mode (MM) SFPs
- Optical fiber length: up to 500m using MM fiber, up to 20km using SM fiber
- TMA/RETA : AISG 2.0 (RS485 connector and internal Bias-Tee)
- Six external alarms
- Surge protection for all external ports (DC and RF)

Environmental specifications
- Operating temperature: -40°C to 55°C including solar load
- Operating relative humidity: 8% to 100%
- Environmental Conditions : ETS 300 019-1-4 class 4.1E
- Ingress Protection : IEC 60529 IP65
- Acoustic Noise : Noiseless (natural convection cooling)

Safety and Regulatory Data
- EMC : 3GPP 25113, EN 301 489-1, EN 301 489-23, GR 1089, GR 3108, OET-65
- Safety : IEC60950-1, EN 60825-1, UL, ANSI/NFPA 70, CAN/CSA-C22.2
- Regulatory : FCC Part 15 Class B, CE Mark – European Directive : 2002/95/EC (ROHS); 2002/96/EC (WEEE); 1999/5/EC (R&TTE)
- Health : EN 50385

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AT THE SPEED OF IDEAS™

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)

* This data is provisional and subject to change

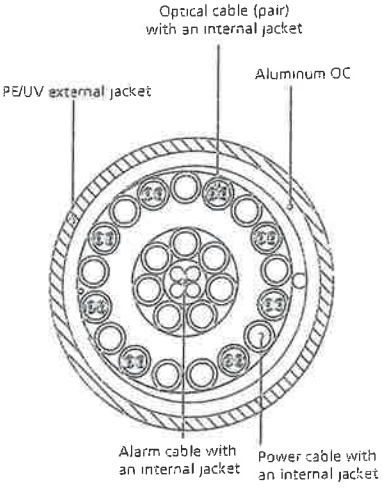


Figure 2: Construction Detail

ATTACHMENT 2

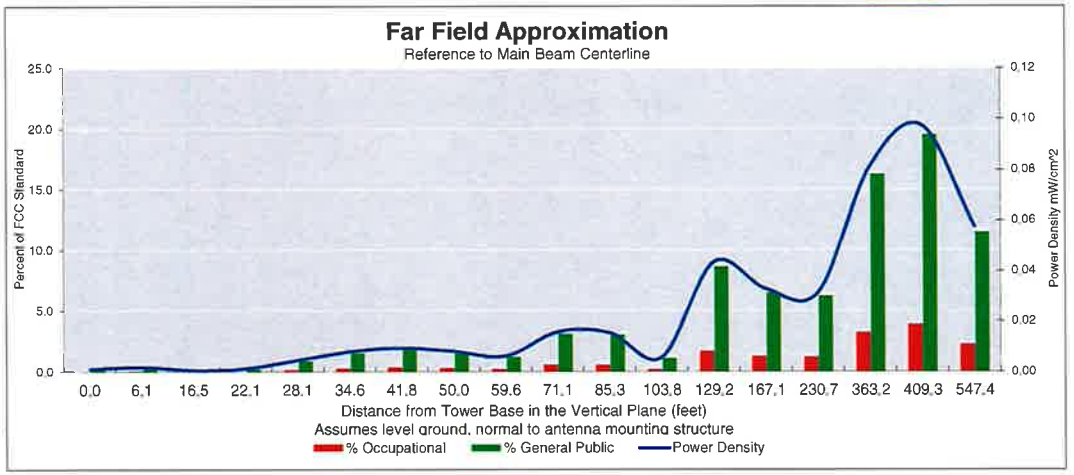
Far Field Approximation
with downtilt variation

Estimated Radiated Emission
Single Emitter Far Field Model
Dipole/Wire/Yagi Antenna Types

verizonwireless

Location:	**HAMDEN 2 CT**
Site #:	2-0058
Date:	04/24/15
Name:	Jaime Laredo
File Name:	HAMDEN 2 CT - FF POWER (LTE-700).xlsx

Operating Freq. (MHz):	**746.0**
Antenna Height (ft):	**60.5**
Antenna Gain (dBi):	**18.1**
Antenna Size (in.):	**72.1**
Downtilt (degrees):	**4.0**
Feedline Loss (dB):	**0.0**
ERP:	**1239.5**
Number of Channels:	**1**



This approximation is only valid in the far field, which begins at: ***64.5 ft***

Calc Angle	90.0	84.0	74.0	69.0	64.0	59.0	54.0	49.0	44.0	39.0	34.0	29.0	24.0	19.0	14.0	9.0	8.0	6.0
Solve for r, dx to antenna	57.5	57.8	59.8	61.6	64.0	67.1	71.1	76.2	82.8	91.4	102.9	118.7	141.4	176.7	237.8	367.8	413.4	550.4
Distance from Antenna Structure Base in Horizontal plane	0.0	6.1	16.5	22.1	28.1	34.6	41.8	50.0	59.6	71.1	85.3	103.8	129.2	167.1	230.7	363.2	409.3	547.4
Angle from Main Beam (reference to horizontal plane)	90	80	70	65	60	55	50	45	40	35	30	25	20	15	10	5	4	2
dB down from centerline (referenced to centerline)	36.76	34.35	38.52	35.34	29.54	26.8	25.59	25.63	25.99	21.21	20.29	23.24	13.03	12.3	9.92	2	0.2	0
Reflection Coefficient (1 to 4, 2.56 typical)	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Power Density (mW/cm^2)	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.04	0.03	0.03	0.08	0.10	0.06
Percent of Occupational Standard	0.0	0.1	0.0	0.1	0.2	0.3	0.4	0.3	0.3	0.6	0.6	0.2	1.7	1.3	1.3	3.3	3.9	2.3
Percent of General Population Standard	0.2	0.4	0.1	0.3	1.0	1.6	1.9	1.7	1.3	3.2	3.1	1.2	8.7	6.6	6.3	16.4	19.6	11.6

Antenna Type: **X7C-FRO-640-V-04**

Max%: **19.60%**

Instructions:

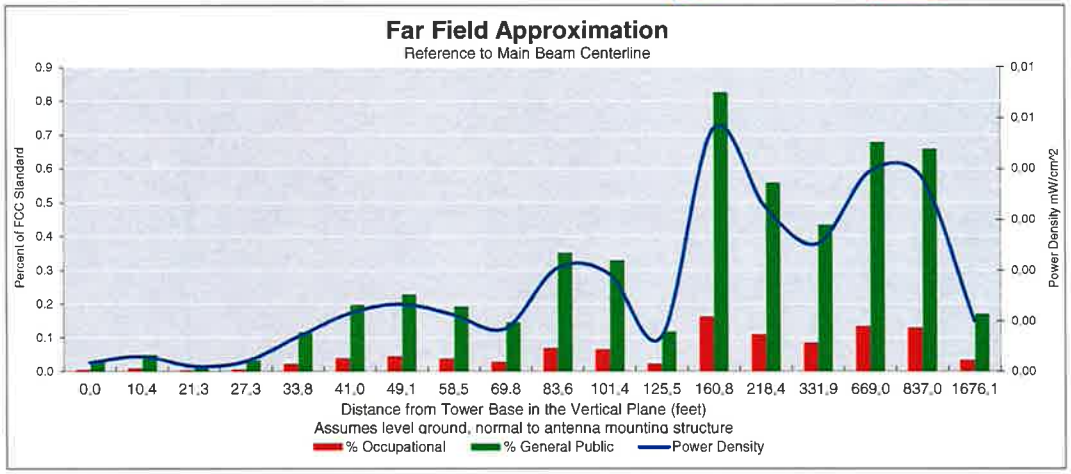
1) Fill in Site Location, Site number, Date, Name of Person Responsible for Date, and enter File Name to ba saved as.
2) References to J4 refer to a point where the transmission line exits the equipment shelter and proceeds to the antenna(s). There is typically a connector located here where power measurements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

Estimated Radiated Emission
Single Emitter Far Field Model
Dipole/Wire/Yagi Antenna Types

verizonwireless

Location:	HAMDEN 2 CT
Site #:	2-0058
Date:	04/24/15
Name:	Jaime Laredo
File Name:	HAMDEN 2 CT - FF POWER (Cellular).xlsx

Operating Freq. (MHz):	**869.0**
Antenna Height (ft):	**61.5**
Antenna Gain (dBi):	**15.7**
Antenna Size (in.):	**48.0**
Downtilt (degrees):	**0.0**
Feedline Loss (dB):	**0.0**
ERP (w):	**348.4**
Number of Channels:	**9**



Calc Angle	90.0	80.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0	10.0	5.0	4.0	2.0
Solve for r, dx to antenna	58.5	59.4	62.3	64.6	67.6	71.4	76.4	82.8	91.0	102.0	117.1	138.5	171.1	226.1	337.1	671.6	839.1	1677.1
Distance from Antenna Structure Base in Horizontal plane	0.0	10.4	21.3	27.3	33.8	41.0	49.1	58.5	69.8	83.6	101.4	125.5	160.8	218.4	331.9	669.0	837.0	1676.1
Angle from Main Beam (reference to horizontal plane)	90	80	70	65	60	55	50	45	40	35	30	25	20	15	10	5	4	2
dB down from centerline (referenced to centerline)	36.76	34.35	38.52	35.34	29.54	26.8	25.59	25.63	25.99	21.21	20.29	23.24	13.03	12.3	9.92	2	0.2	0
Reflection Coefficient (1 to 4, 2.56 typical)	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Power Density (mW/cm^2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Percent of Occupational Standard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.2	0.1	0.1	0.1	0.1	0.0
Percent of General Population Standard	0.0	0.1	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.4	0.3	0.1	0.8	0.6	0.4	0.7	0.7	0.2

Antenna Type: **DB844G65ZAXY_H**

Max%: **0.83%**

Instructions:

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

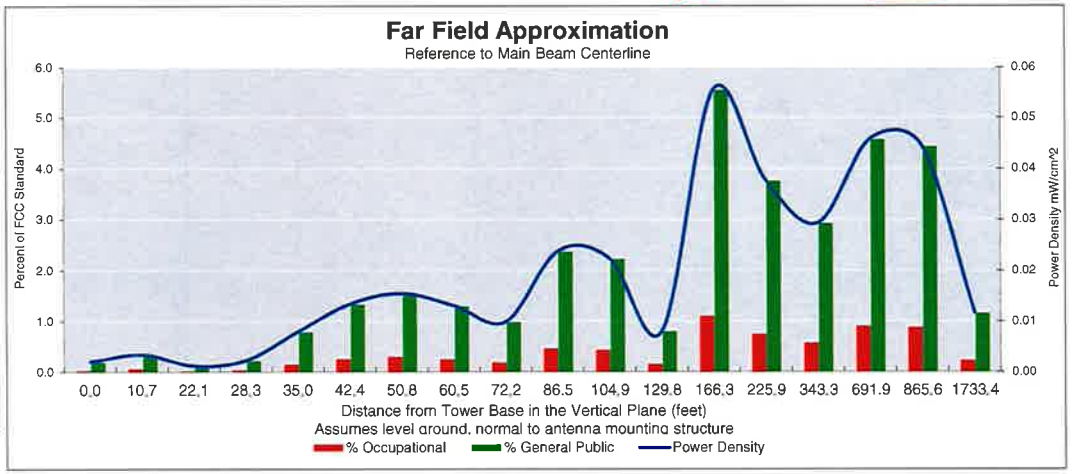
Far Field Approximation
with downtilt variation

Estimated Radiated Emission
Single Emitter Far Field Model
Dipole/Wire/Yagi Antenna Types

verizonwireless

Location:	**HAMDEN 2 CT**
Site #:	2-0058
Date:	04/24/15
Name:	Jaime Laredo
File Name:	HAMDEN 2 CT - FF POWER (PCS).xlsx

Operating Freq. (MHz):	**1970.0**
Antenna Height (ft):	**63.5**
Antenna Gain (dBi):	**18.4**
Antenna Size (in.):	**6.0**
Downtilt (degrees):	**0.0**
Feedline Loss (dB):	**0.0**
ERP (w):	**2334.3**
Number of Channels:	**1**



Calc Angle	90.0	80.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0	10.0	5.0	4.0	2.0
Solve for r, dx to antenna	60.5	61.4	64.4	66.8	69.9	73.9	79.0	85.6	94.2	105.5	121.1	143.2	177.0	233.9	348.6	694.5	867.7	1734.4
Distance from Antenna Structure Base in Horizontal plane	0.0	10.7	22.1	28.3	35.0	42.4	50.8	60.5	72.2	86.5	104.9	129.8	166.3	225.9	343.3	691.9	865.6	1733.4
Angle from Main Beam (reference to horizontal plane)	90	80	70	65	60	55	50	45	40	35	30	25	20	15	10	5	4	2
dB down from centerline (referenced to centerline)	36.76	34.35	38.52	35.34	29.54	26.8	25.59	25.63	25.99	21.21	20.29	23.24	13.03	12.3	9.92	2	0.2	0
Reflection Coefficient (1 to 4, 2.56 typical)	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Power Density (mW/cm^2)	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.06	0.04	0.03	0.05	0.04	0.01
Percent of Occupational Standard	0.0	0.1	0.0	0.0	0.2	0.3	0.3	0.3	0.2	0.5	0.4	0.2	1.1	0.8	0.6	0.9	0.9	0.2
Percent of General Population Standard	0.2	0.3	0.1	0.2	0.8	1.3	1.5	1.3	1.0	2.4	2.2	0.8	5.6	3.8	2.9	4.6	4.4	1.2

Antenna Type: **SBNHH-1D65B**

Max%: **5.57%**

Instructions:

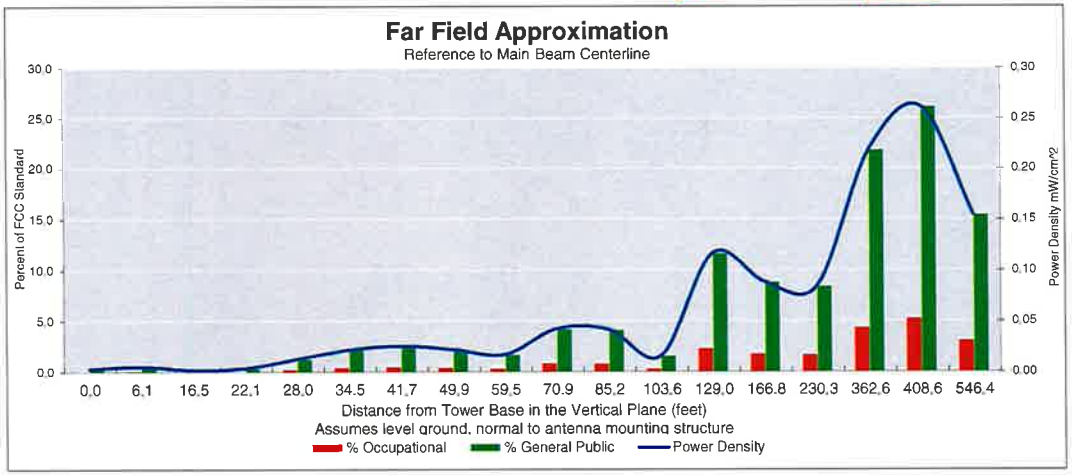
1) Fill in Site Location, Site number, Date, Name of Person Responsible for Date, and enter File Name to be saved as.
2) References to J4 refer to a point where the transmission line exits the equipment shelter and proceeds to the antenna(s). There is typically a connector located here where power measurements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

Estimated Radiated Emission
Single Emitter Far Field Model
Dipole/Wire/Yagi Antenna Types

verizonwireless

Location:	HAMDEN 2 CT
Site #:	2-0058
Date:	04/24/15
Name:	Jaime Laredo
File Name:	HAMDEN 2 CT - FF POWER (LTE-AWS).xlsx

Operating Freq. (MHz):	**2145.0**
Antenna Height (ft):	**60.4**
Antenna Gain (dBi):	**19.0**
Antenna Size (in.):	**74.9**
Downtilt (degrees):	**4.0**
Feedline Loss (dB):	**0.0**
ERP (w):	**2691.2**
Number of Channels:	**1**



Calc Angle	90.0	84.0	74.0	69.0	64.0	59.0	54.0	49.0	44.0	39.0	34.0	29.0	24.0	19.0	14.0	9.0	8.0	6.0
Solve for r, dx to antenna	57.4	57.7	59.7	61.5	63.9	67.0	71.0	76.1	82.7	91.2	102.7	118.5	141.2	176.4	237.4	367.1	412.6	549.4
Distance from Antenna Structure Base in Horizontal plane	0.0	6.1	16.5	22.1	28.0	34.5	41.7	49.9	59.5	70.9	85.2	103.6	129.0	166.8	230.3	362.6	408.6	546.4
Angle from Main Beam (reference to horizontal plane)	90	80	70	65	60	55	50	45	40	35	30	25	20	15	10	5	4	2
dB down from centerline (referenced to centerline)	36.76	34.35	38.52	35.34	29.54	26.8	25.59	25.63	25.99	21.21	20.29	23.24	13.03	12.3	9.92	2	0.2	0
Reflection Coefficient (1 to 4, 2.56 typical)	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Power Density (mW/cm^2)	0.00	0.01	0.00	0.00	0.01	0.02	0.03	0.02	0.02	0.04	0.04	0.02	0.12	0.09	0.08	0.22	0.26	0.15
Percent of Occupational Standard	0.1	0.1	0.0	0.1	0.3	0.4	0.5	0.4	0.3	0.8	0.8	0.3	2.3	1.8	1.7	4.4	5.2	3.1
Percent of General Population Standard	0.3	0.5	0.2	0.4	1.3	2.2	2.6	2.2	1.7	4.2	4.1	1.6	11.7	8.8	8.4	21.9	26.2	15.5

Antenna Type: **HBXX-6517DS-A2M**

Max%: **26.18%**

Instructions:

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

ATTACHMENT 3

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

65' Existing Roof Top Mounted
NUDD Guyed Lattice Tower

Proposed Verizon Wireless
Antenna Upgrade

Verizon Site Ref: Hamden 2

265 Benham Street
Hamden, CT

CENTEK Project No. 15001.035

~~Date: April 1, 2015~~
~~Rev 1: May 29, 2015~~
Rev 2: June 4, 2015

Prepared for:

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

Table of Contents

Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna upgrade proposed by Verizon Wireless on the existing lattice tower located in Hamden, Connecticut.

The host tower is a 65-ft, four-section, three legged guyed lattice tower originally designed and manufactured by Fred A Nudd Corporation. The tower type, geometry and structure member sizes were taken from a previous structural analysis report prepared by Centek Engineering project no. 13075.034 dated September 27, 2013.

Antenna and appurtenance inventory were taken from the aforementioned Centek structural analysis report and a Verizon RF data sheet.

The tower is made up of four (4) vertical sections consisting of A36 MOD-50 solid steel legs. Diagonal and horizontal bracing consists of A36 solid round and steel angle construction. The vertical tower legs are connected together with bolted flanges while bracing is connected by fully welded connections. The width of the tower face is 2'-6".

Verizon Wireless proposes the removal of nine (9) panel antennas and six (6) coax cables and the installation of nine (9) panel antennas and three (3) remote radio heads mounted on the existing T-Frames. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

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

- MUNICIPAL (Existing):
  Appurtenance: One (1) 17-ft Omni-directional whip antenna mounted on a 2-ft side arm with an elevation of 91-ft above grade (64-ft above tower base).
  Cable: One (1) 7/8" dia. coax cable running on the face of the existing tower as specified in Section 3 of this report.
- MUNICIPAL (Existing):
  Appurtenance: One (1) 20-ft Omni-directional whip antenna mounted on a 3-ft side arm with an elevation of 91-ft above grade (64-ft above tower base).
  Cable: One (1) 7/8" dia. coax cable running on the face of the existing tower as specified in Section 3 of this report.
- MUNICIPAL (Existing):
  Appurtenance: One (1) 8-ft Omni-directional whip antenna mounted on a 2-ft side arm with an elevation of 76.5-ft above grade (49.5-ft above tower base).
  Cable: One (1) 7/8" dia. coax cable.
- MUNICIPAL (Existing):
  Appurtenance: One (1) 21-ft 8-Bay Dipole antenna mounted on a 3-ft side arm with an elevation of 69-ft above grade (42-ft above tower base).
  Cable: One (1) 7/8" dia. coax cable running on the face of the existing tower as specified in Section 3 of this report.

- AT&T (Existing):
  Antennas: Six (6) KMW AMX-CD-16-65-00T-RET panel antennas, three (3) CCI DTMABP7819VG12A TMA's and six (6) Ericsson RRUS-11 mounted on (3) Primus tower stand-off sector frames (P/N SF-SU10-B) with a RAD center elevation of 54.5-ft above existing grade (27.5-ft above tower base).
  Misc. Equipment: One (1) Raycap DC6-48-60-18-8F surge arrestor leg mounted with an elevation of elevation of 56-ft above exiting grade (29-ft above tower base).
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables and six (6) RET cables, one (1) fiber cable and two (2) dc control cables running on a face of the existing tower as specified in Section 3 of this report.
- VERIZON (Existing to Remain):
  Antennas: Four (4) Andrew DB844G65ZAXY and two (2) RFS APL866513 panel antennas mounted to existing boom gates with a RAD center elevation of 63.5-ft above existing grade (36.5-ft above tower base).
  Misc Equipment: One (1) RFS DB-T1-6Z-8AB-0Z main distribution box leg mounted with a RAD center elevation of 63.5-ft above existing grade (36.5-ft above tower base).
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables and one (1) 1-5/8" ∅ fiber line running on the face of the existing tower as specified in Section 3 of this report.
- VERIZON (Existing to Remove):
  Antennas: Two (2) Antel BXA-70063-6CF panel antennas, one (1) Antel BXA-70040-6CF panel antenna, six (6) Antel BXA-171063-12CF panel antennas and three (3) Alcatel-Lucent RRH2x40-AWS Remote Radio Heads mounted to existing boom gates with a RAD center elevation of 63.5-ft above existing grade (36.5-ft above tower base).
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the southeast face of the existing tower as specified in Section 3 of this report.
- **VERIZON (Proposed):**
  Antennas: Two (2) Andrew LNX-6514DS panel antennas, one (1) JMA X7C-FR0-640 panel antenna, three (3) Andrew HBXX-6517DS panel antennas, two (2) SBNHH-1D65B panel antennas, one (1) SBNHH-1D45B panel antennas, three (3) Alcatel-Lucent RRH2x60-AWS remote radio heads, three (3) Alcatel-Lucent RRH2x60-PCS remote radio heads and three (3) Alcatel-Lucent RRH2x60-700 remote radio heads mounted to existing boom gates with a RAD center elevation of 63.5-ft above existing grade (36.5-ft above tower base).
  Misc Equipment: One (1) RFS DB-T1-6Z-8AB-0Z main distribution box leg mounted with a RAD center elevation of 63.5-ft above existing grade (36.5-ft above tower base).
  Coax Cables: One (1) 1-5/8" ∅ fiber line 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 should be 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 of 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]*
	Hamden; v = 105 mph (3 second gust) equivalent to v = 85 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA-222-F and Appendix-K wind speeds are equal.	
Load Cases:	Load Case 1; 85 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 74 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 74 mph wind speed velocity represents 75% of the wind pressure generated by the 85 mph wind speed.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 3; Seismic – not checked	*[Section 1614.5 of State Bldg. Code 2005] does not control in the design of this structure type*

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

Tower Capacity

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

- Calculated stresses were found to be within allowable limits. In Load Case 2, per tnxTower "Section Capacity Table", this tower was found to be at **93.8%** of its total capacity.

Tower Section	Elevation (AGL)	Stress Ratio (percentage of capacity)	Result
Leg (T4)	27'-0"-47'-0"	51.9%	**PASS**
Diagonal (T3)	47'-0"-67'-0"	93.8%	**PASS**
Guy B (T4)	27'-0"-47'-0"	54.5%	**PASS**

Existing Guy Anchors and Tower Base

Guy forces are transferred to the existing building structure via six (6) 9/16" and three (3) 3/4" ∅ galvanized steel guy wires with turnbuckles. All guy anchorage posts are positively attached to the existing building structure and consist of 6"x6"x1/4" tube steel with 1/2" thick guy connection plates with three 5/8" ∅ A325-N bolts in double shear. Connections to the existing building were originally designed by Natcomm for Verizon Wireless on October 02, 2000, reference project no. 985094.

The guyed tower base is pin connected to a 1-3/4" thick x 24" square base plate welded to an existing W8 steel dunnage frame. Frame loads are then transferred down onto the existing concrete roof structure via four (4) 6"x6"x1/4" tube steel posts with 1-1/4" thick x 12in square base plates.

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

- The worst case tower base and guy anchor reactions developed from the governing Load Case 2 were used in the verification of the anchorage:

Tower Guy Reactions			
Vector	**Guy A**	**Guy B**	**Guy C**
Horizontal (In Plane of GW)	16.5 kips	16.2 kips	16.3 kips
Horizontal (Out of Plane of GW)	0.3 kips	0.3 kips	0.3 kips
Vertical	19.1 kips	26.2 kips	24.8 kips
Resultant Force at end of Guy Wire	25.2 kips	30.8 kips	29.7 kips

Tower Base Reactions	
Vector	**Proposed Reaction**
Horizontal Shear	1.2 kips
Axial Compression	57.5 kips

- The guy anchor bolts were found to be within allowable limits.

Location	Design Limit	Load	Stress Ratio (percentage of capacity)	Result
Guy Anchor B	Shear	30.9 kips	80%	**PASS**

Conclusion and Recommendations

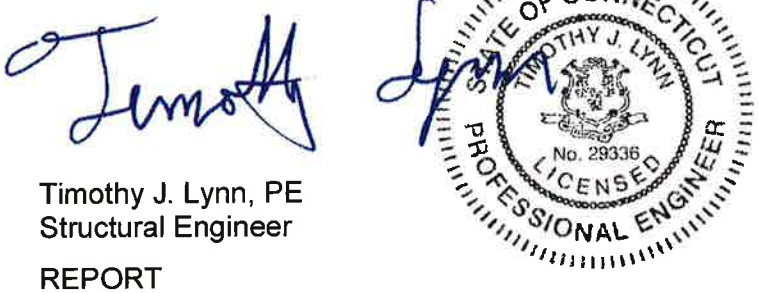
This analysis shows that the subject tower **is adequate** to support the proposed modified antenna configuration with the below recommendations.

- **Six (6) of the existing (14) coax cables mounted to the southeast face of the tower are to be removed. The remaining (8) cables to be double staked.**

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:



Timothy J. Lynn, PE
Structural Engineer

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

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

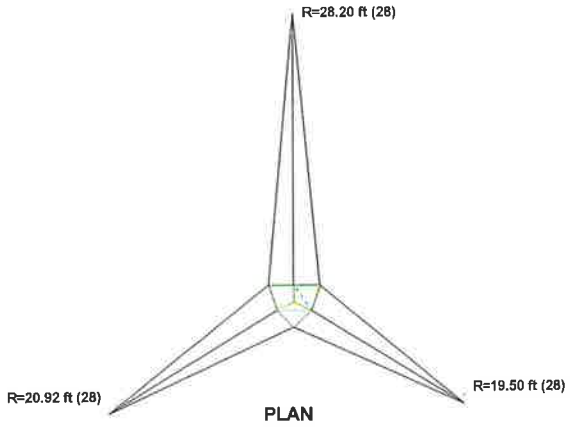
- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of Centek Engineering, Inc. or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

GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

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

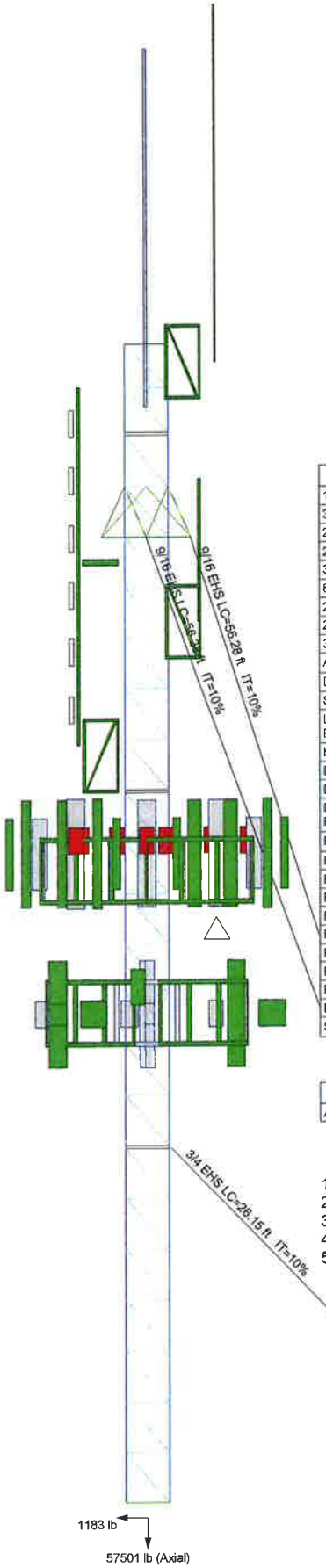
TnxTower Features:

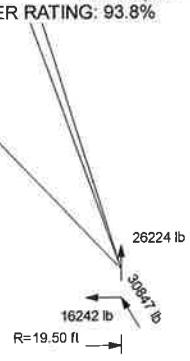
- TnxTower can analyze and design 3- and 4-sided guyed towers, 3- and 4-sided self-supporting towers and either round or tapered ground mounted poles with or without guys.
- The program analyzes towers using the TIA-222-G (2005) standard or any of the previous TIA/EIA standards back to RS-222 (1959).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



Legs	SR 1 3/4					2 @ 2.45833	184.1
Leg Grade	A36M-50						
Diagonals	SR 1/2					14 @ 2.83333	847.9
Diagonal Grade	A36						
Top Girts	L1 1/4x1 1/4x3/16						
Bottom Girts	L1 1/4x1 1/4x3/16						
Horizontals	L1 1/4x1 1/4x3/16						665.6
Face Width (ft)	2.5						
# Panels @ (ft)						7 @ 2.84524	665.9
Weight (lb)	2403.5						

92.0 ft
87.0 ft
81.3 ft
67.0 ft
47.0 ft
27.0 ft





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
17' x 3" Dia Omni (Municipal)	91	LNX-6514DS-VTM (Verizon - Proposed)	63.5
3' Side arm mount (Municipal)	91	HBXX-6517DS (Verizon - Proposed)	63.5
20' x 3" Dia Omni (Municipal)	91	X7C-FR0-640-V (Verizon - Proposed)	63.5
2' Side arm mount (Municipal)	91	HBXX-6517DS (Verizon - Proposed)	63.5
3' Pipe Brace (Municipal)	80	DB844G65ZAXY (Verizon - Existing)	63.5
8' x 3" Dia Omni (Municipal)	76.5	APL866513-42T0 (Verizon - Existing)	63.5
2' Side arm mount (Municipal)	76.5	SBNHH-1D45B (Verizon - Proposed)	63.5
21-ft 8-Bay Dipole (Municipal)	69	Rohn 6' x 12' Boom Gate (1) (Verizon - Existing)	62.5
3' Side arm mount (Municipal)	69	Rohn 6' x 12' Boom Gate (1) (Verizon - Existing)	62.5
APL866513-42T0 (Verizon - Existing)	63.5	Rohn 6' x 12' Boom Gate (1) (Verizon - Existing)	62.5
DB844G65ZAXY (Verizon - Existing)	63.5	DC6-48-60-18-8F Surge Arrestor (ATI)	56
SBNHH-1D65B (Verizon - Proposed)	63.5	Andrew SF-SU10-3-72 (ATI)	54.5
LNX-6514DS-VTM (Verizon - Proposed)	63.5	Andrew SF-SU10-3-72 (ATI)	54.5
HBXX-6517DS (Verizon - Proposed)	63.5	Andrew SF-SU10-3-72 (ATI)	54.5
DB844G65ZAXY (Verizon - Existing)	63.5	DTMABP7819VG12A TMA (ATI)	54.5
DB-T1-6Z-8AB-0Z (Verizon - Existing)	63.5	(2) RRUS-11 (ATI)	54.5
DB-T1-6Z-8AB-0Z (Verizon - Proposed)	63.5	(2) RRUS-11 (ATI)	54.5
RRH2x60-AWS (Verizon - Proposed)	63.5	(2) RRUS-11 (ATI)	54.5
RRH2x60-AWS (Verizon - Proposed)	63.5	(2) AM-X-CD-16-65-00T-RET(72") (ATI)	54.5
RRH2x60-AWS (Verizon - Proposed)	63.5	(2) AM-X-CD-16-65-00T-RET(72") (ATI)	54.5
RRH2x60-PCS (Verizon - Proposed)	63.5	(2) AM-X-CD-16-65-00T-RET(72") (ATI)	54.5
RRH2x60-PCS (Verizon - Proposed)	63.5	DTMABP7819VG12A TMA (ATI)	54.5
RRH2x60-PCS (Verizon - Proposed)	63.5	DTMABP7819VG12A TMA (ATI)	54.5
RRH4x30-B13 (Verizon - Proposed)	63.5		
RRH4x30-B13 (Verizon - Proposed)	63.5		
RRH4x30-B13 (Verizon - Proposed)	63.5		
DB844G65ZAXY (Verizon - Existing)	63.5		
SBNHH-1D65B (Verizon - Proposed)	63.5		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A36M-50	50 ksi	65 ksi	A36	36 ksi	58 ksi

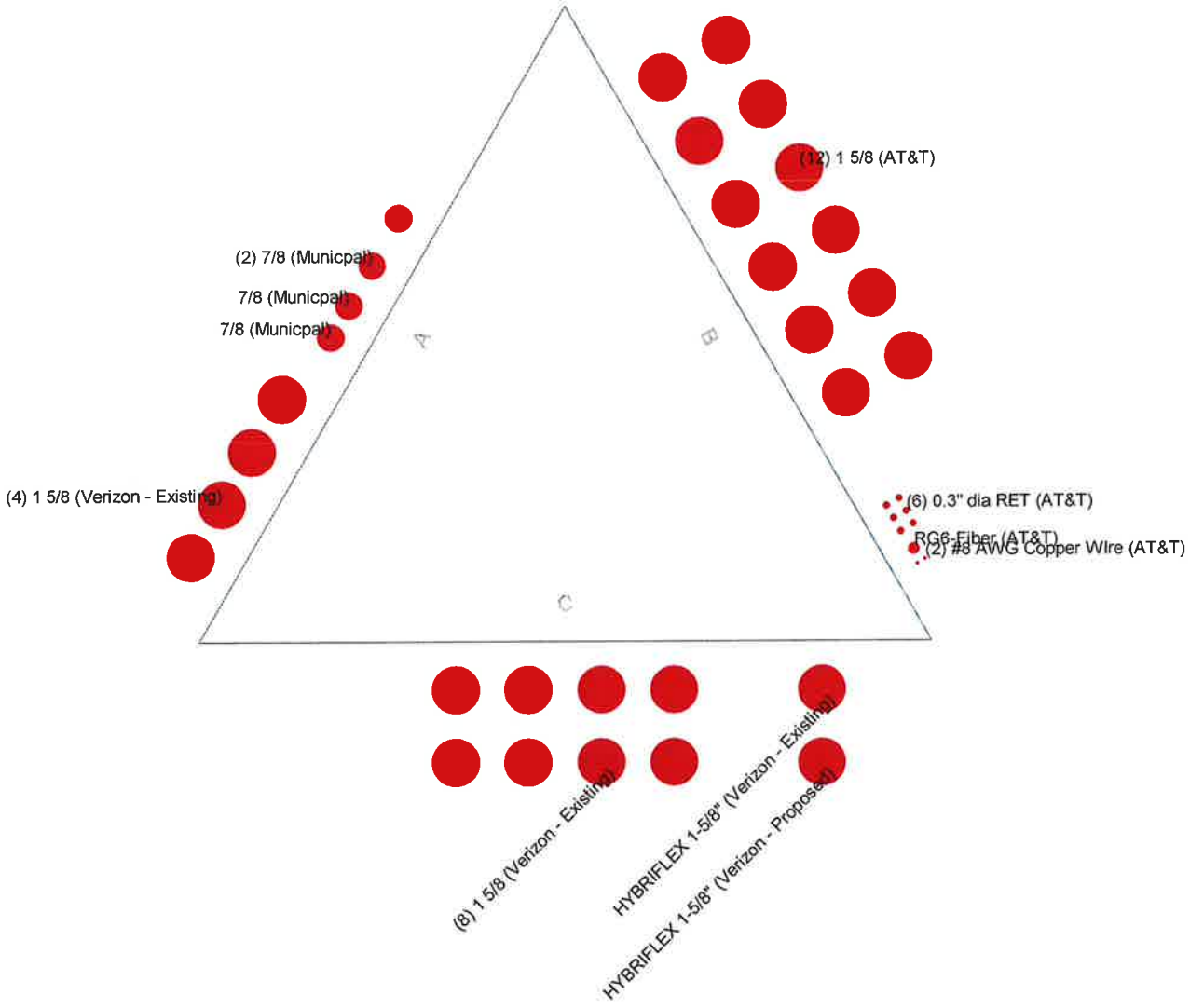
TOWER DESIGN NOTES

1. Tower is located in New Haven County, Connecticut.
2. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 93.8%

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

Job: 15001.035 - Hamden 2			
Project: 65-ft NUDD Guyed Tower - 265 Benham Street - Hamden,			
Client: Verizon Wireless	Drawn by: TJL	App'd:	
Code: TIA/EIA-222-F	Date: 05/29/15	Scale: NTS	
Path:		Dwg No. E-1	

Round Flat App In Face App Out Face



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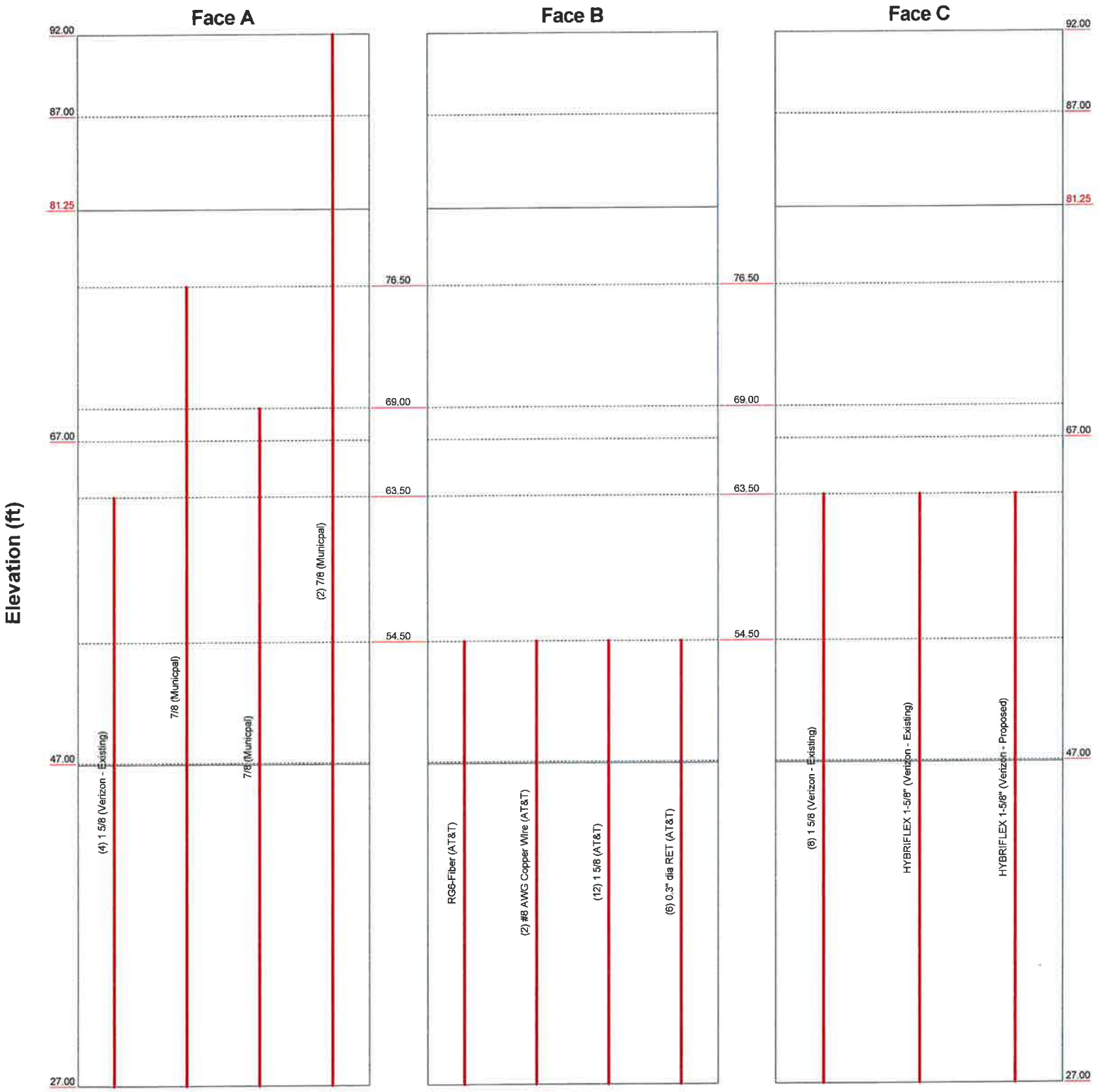
Project: 65-ft NUDD Guyed Tower - 265 Benham Street - Hamden,			
Client: Verizon Wireless	Drawn by: TJL	App'd:	
Code: TIA/EIA-222-F	Date: 05/29/15	Scale: NTS	
Path:		Dwg No. E-7	

27' - 92'

Round Flat App In Face App Out Face Truss Leg



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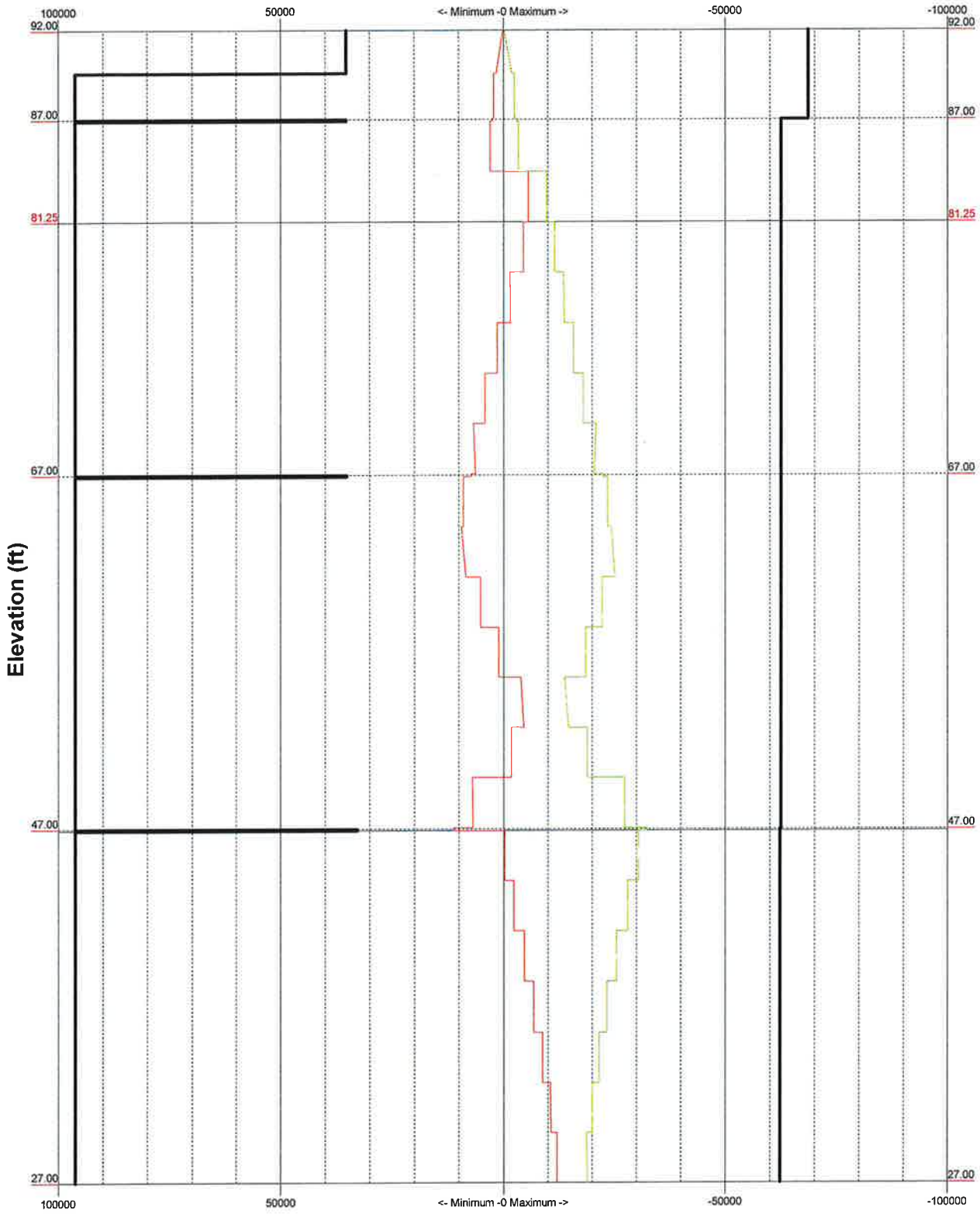
Job:	***15001.035 - Hamden 2***		
Project:	***65-ft NUDD Guyed Tower - 265 Benham Street - Hamden,***		
Client: Verizon Wireless		Drawn by: TJL	App'd:
Code: TIA/EIA-222-F		Date: 05/29/15	Scale: NTS
Path:			Dwg No. E-7

TIA/EIA-222-F - 85 mph/74 mph 0.500 in Ice

Leg Capacity ——— **Leg Compression (lb)**

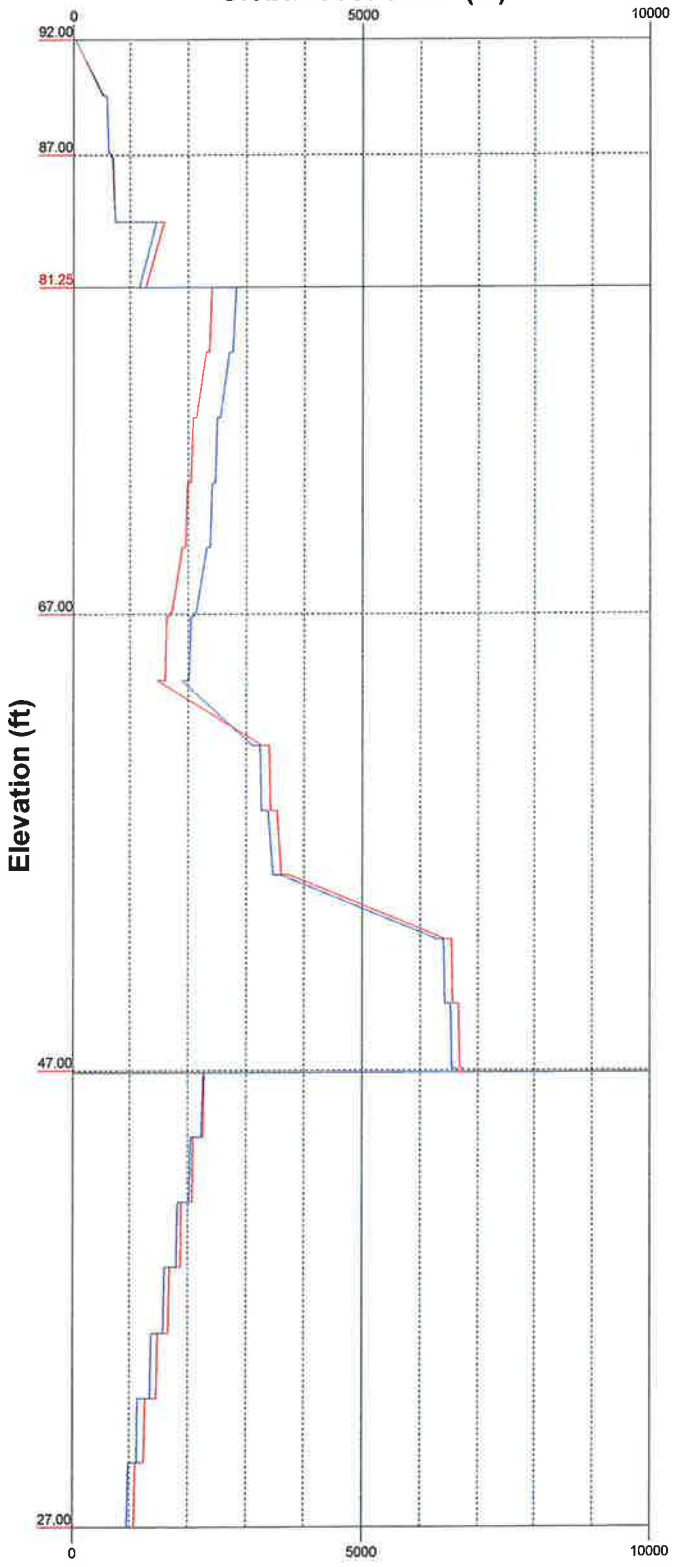


Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job: 15001.035 - Hamden 2		
	Project: 65-ft NUDD Guyed Tower - 265 Benham Street - Hamden,		
	Client: Verizon Wireless	Drawn by: TJL	App'd:
	Code: TIA/EIA-222-F	Date: 05/29/15	Scale: NTS
	Path:		Dwg No. E-3

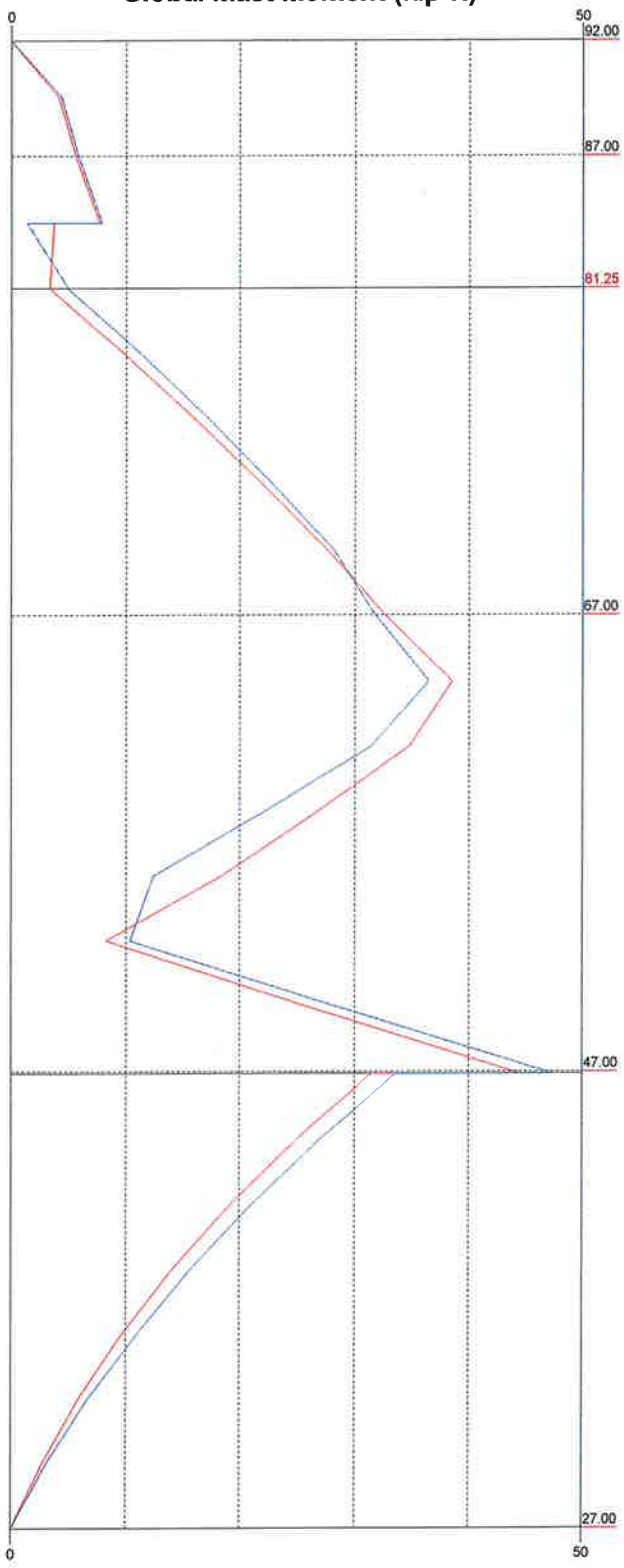
Vx Vz

Mx Mz

Global Mast Shear (lb)



Global Mast Moment (kip-ft)



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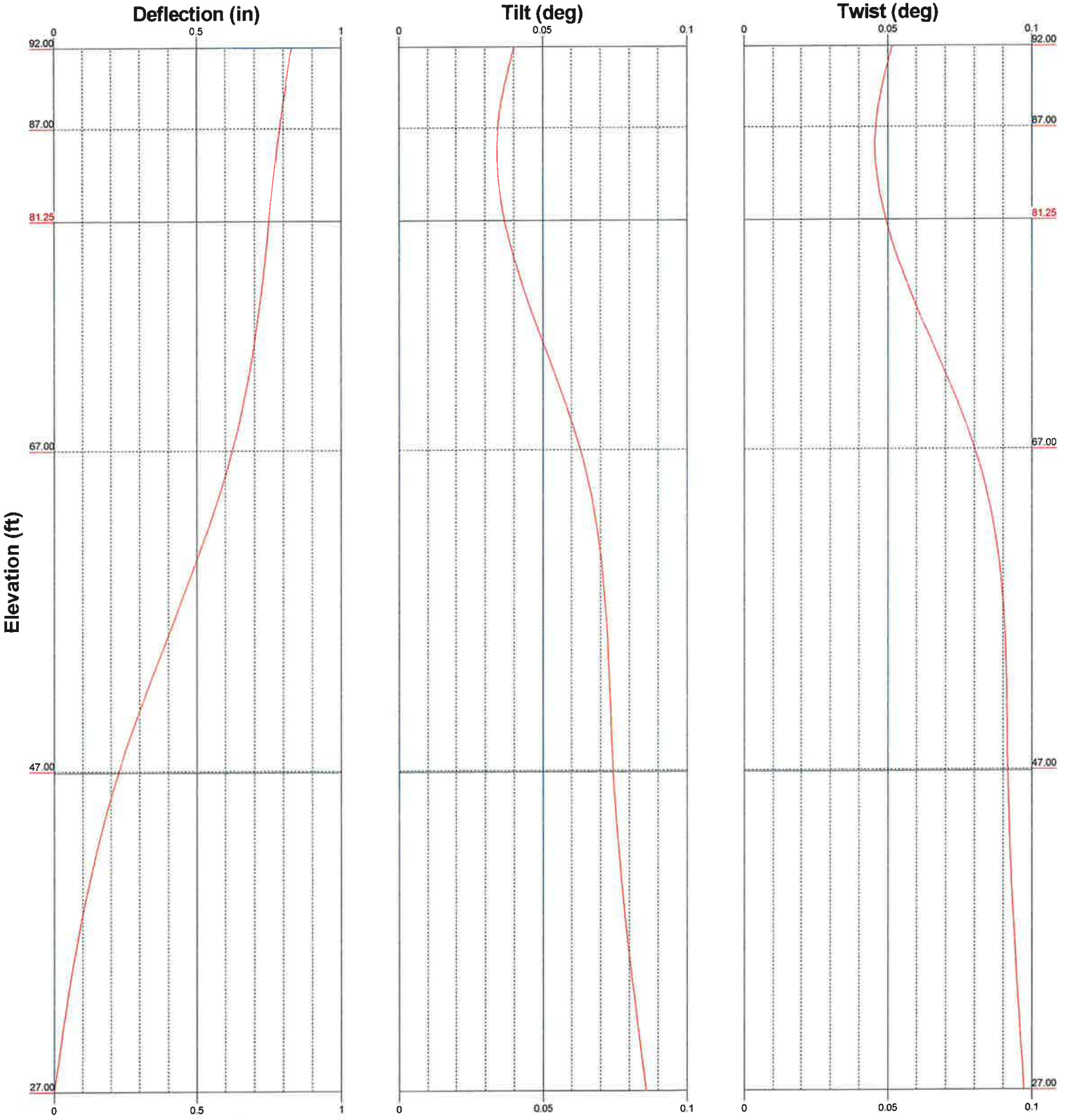
Job: 15001.035 - Hamden 2		
Project: 65-ft NUDD Guyed Tower - 265 Benham Street - Hamden,		
Client: Verizon Wireless	Drawn by: TJL	App'd:
Code: TIA/EIA-222-F	Date: 05/29/15	Scale: NTS
Path:		Dwg No. E-4

TIA/EIA-222-F - Service - 50 mph

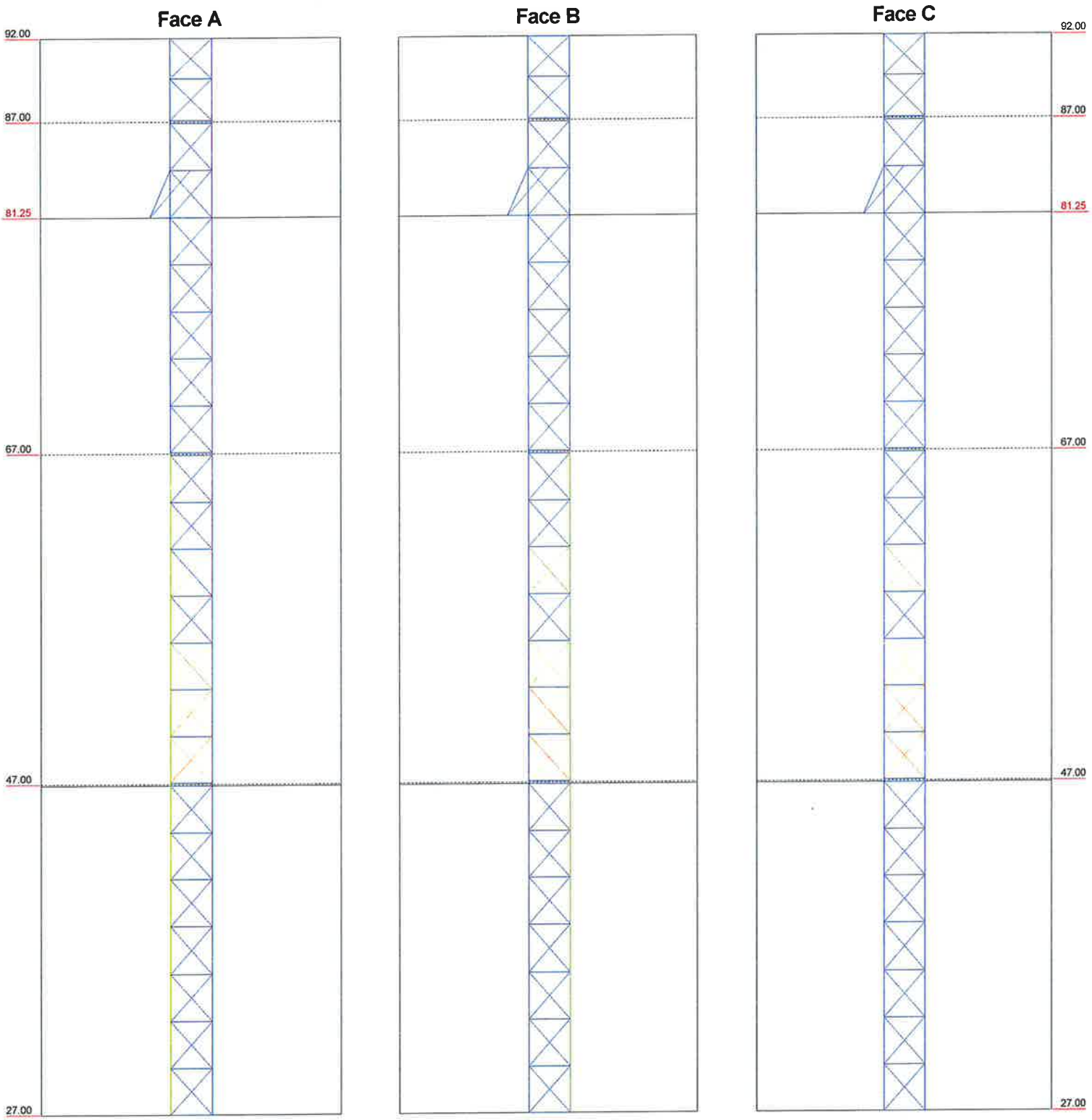
Maximum Values



Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job: ***15001.035 - Hamden 2***		
	Project: ***65-ft NUDD Guyed Tower - 265 Benham Street - Hamden,***		
	Client: Verizon Wireless	Drawn by: TJL	App'd:
	Code: TIA/EIA-222-F	Date: 05/29/15	Scale: NTS
	Path:		Dwg No. E-5

27' - 92'

> 100% | 90%-100% | 75%-90% | 50%-75% | < 50% Overstress



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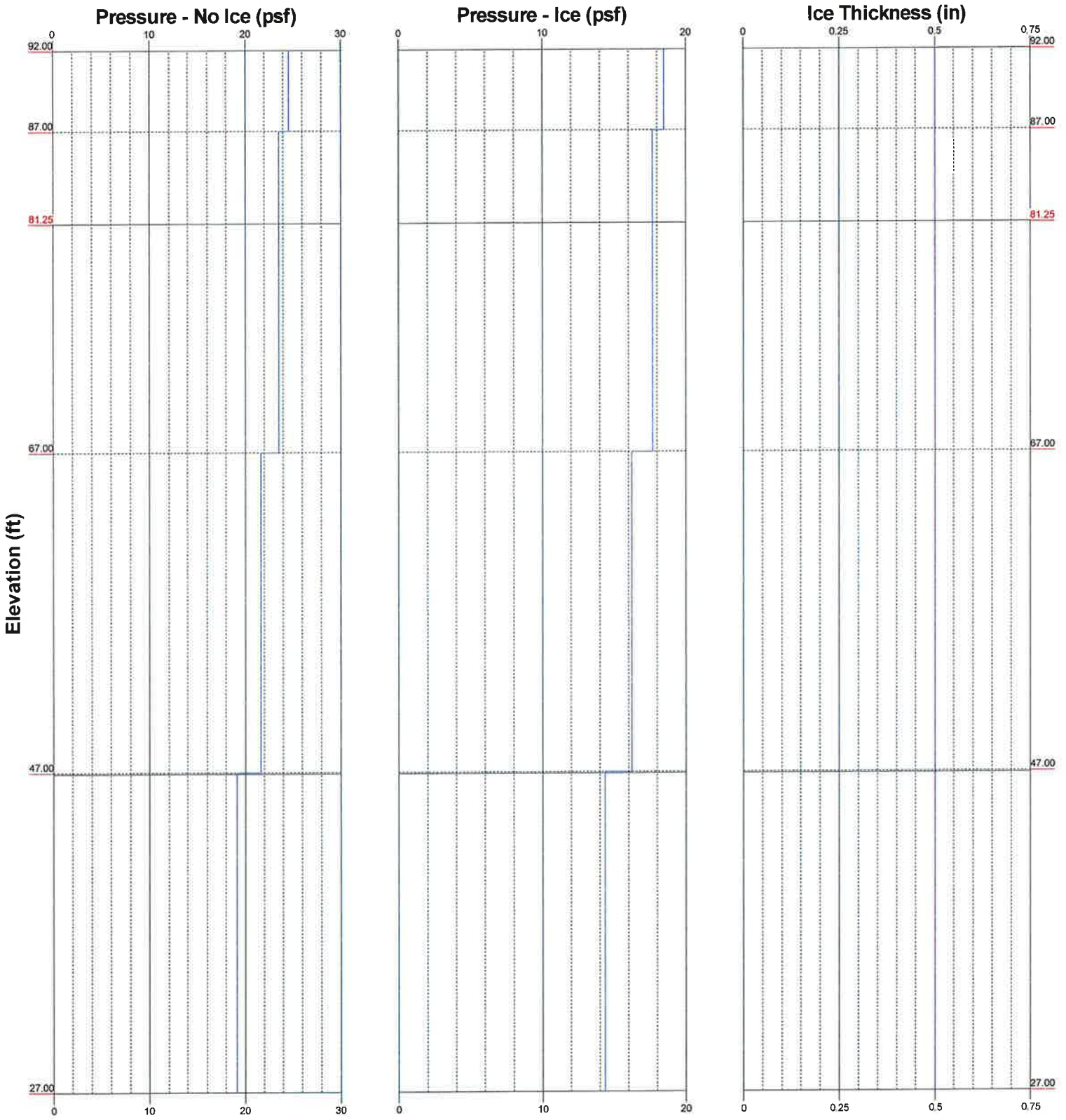
Job: ***15001.035 - Hamden 2***		
Project: ***65-ft NUDD Guyed Tower - 265 Benham Street - Hamden,***		
Client: Verizon Wireless	Drawn by: TJL	App'd:
Code: TIA/EIA-222-F	Date: 05/29/15	Scale: NTS
Path:		Dwg No. E-8

Wind Pressures and Ice Thickness

TIA/EIA-222-F - 85 mph/74 mph 0.500 in Ice



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Phone: (203) 488-0580
FAX: (203) 488-8587

Job:	***15001.035 - Hamden 2***		
Project:	***65-ft NUDD Guyed Tower - 265 Benham Street - Hamden,***		
Client: Verizon Wireless		Drawn by: TJL	App'd:
Code: TIA/EIA-222-F		Date: 05/29/15	Scale: NTS
Path:			Dwg No. E-9

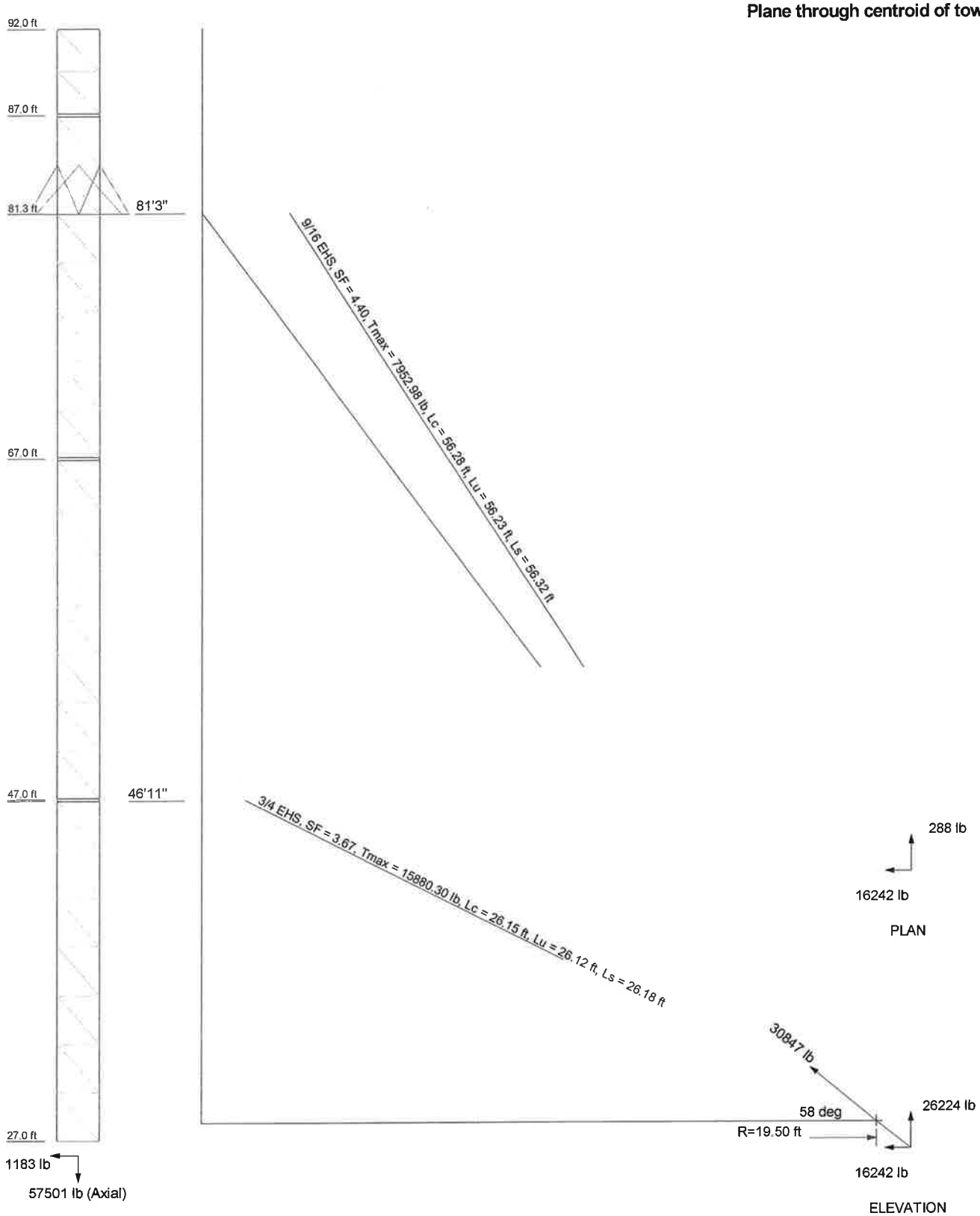
Guy Tensions and Tower Reactions

TIA/EIA-222-F - 85 mph/74 mph 0.500 in Ice

Maximum Values

Anchor 'B'@19.5 ft Azimuth 120 deg Elev 28 ft

Plane through centroid of tower



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Job: 15001.035 - Hamden 2			
Project: 65-ft NUDD Guyed Tower - 265 Benham Street - Hamden,			
Client: Verizon Wireless	Drawn by: TJL	App'd:	
Code: TIA/EIA-222-F	Date: 05/29/15	Scale: NTS	
Path:		Dwg No. E-6	

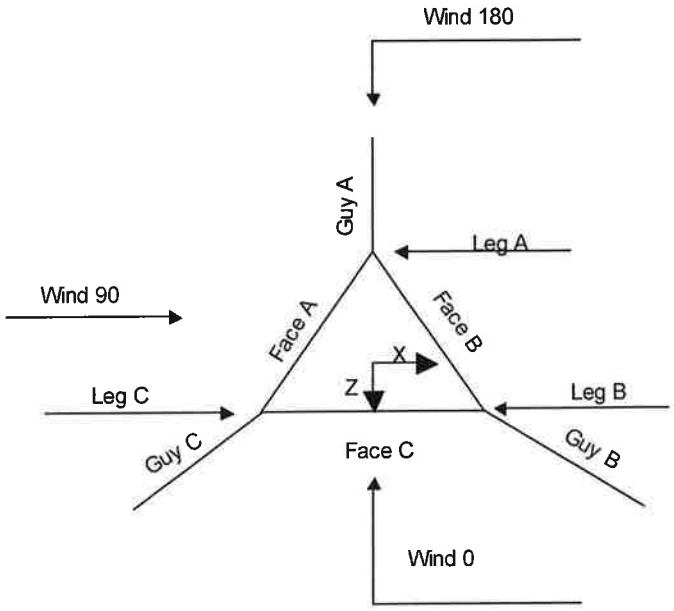
Tower Input Data

The main tower is a 3x guyed tower with an overall height of 92.00 ft above the ground line.
The base of the tower is set at an elevation of 27.00 ft above the ground line.
The face width of the tower is 2.50 ft at the top and 2.50 ft at the base.
This tower is designed using the TIA/EIA-222-F standard.
The following design criteria apply:

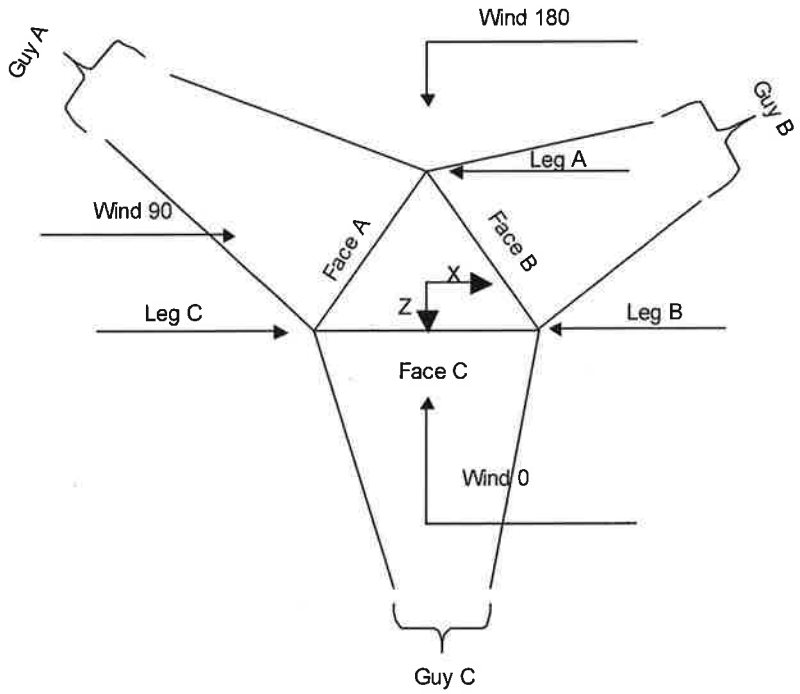
Tower is located in New Haven County, Connecticut.
Basic wind speed of 85 mph.
Nominal ice thickness of 0.500 in.
Ice density of 56 pcf.
A wind speed of 74 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
Pressures are calculated at each section.
Safety factor used in guy design is 2.
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		



Corner & Starmount Guyed Tower



Face Guyed

Tower Section Geometry

Tower Section	Tower Elevation	Assembly Database	Description	Section Width	Number of Sections	Section Length
	ft			ft		ft
T1	92.00-87.00			2.50	1	5.00
T2	87.00-67.00			2.50	1	20.00
T3	67.00-47.00			2.50	1	20.00
T4	47.00-27.00			2.50	1	20.00

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	92.00-87.00	2.46	X Brace	No	Yes	0.000	1.000

Tower Section	Tower Elevation ft	Diagonal Spacing ft	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset in	Bottom Girt Offset in
T2	87.00-67.00	2.83	X Brace	No	Yes	1.000	1.000
T3	67.00-47.00	2.83	X Brace	No	Yes	1.000	1.000
T4	47.00-27.00	2.85	X Brace	No	Yes	1.000	0.000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 92.00-87.00	Solid Round	1 3/4	A36M-50 (50 ksi)	Solid Round	1/2	A36 (36 ksi)
T2 87.00-67.00	Solid Round	1 3/4	A36M-50 (50 ksi)	Solid Round	1/2	A36 (36 ksi)
T3 67.00-47.00	Solid Round	1 3/4	A36M-50 (50 ksi)	Solid Round	1/2	A36 (36 ksi)
T4 47.00-27.00	Solid Round	1 3/4	A36M-50 (50 ksi)	Solid Round	1/2	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 92.00-87.00	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)
T2 87.00-67.00	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)
T3 67.00-47.00	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)
T4 47.00-27.00	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	No. of Mid Girts	Mid Girt Type	Mid Girt Size	Mid Girt Grade	Horizontal Type	Horizontal Size	Horizontal Grade
T1 92.00-87.00	None	Flat Bar		A36 (36 ksi)	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)
T2 87.00-67.00	None	Flat Bar		A36 (36 ksi)	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)
T3 67.00-47.00	None	Flat Bar		A36 (36 ksi)	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)
T4 47.00-27.00	None	Flat Bar		A36 (36 ksi)	Single Angle	L1 1/4x1 1/4x3/16	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft²	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
T1 92.00-87.00	0.00	0.000	A36 (36 ksi)	1	1	1	36.000	36.000
T2 87.00-67.00	0.00	0.000	A36 (36 ksi)	1	1	1	36.000	36.000
T3 67.00-47.00	0.00	0.000	A36 (36 ksi)	1	1	1	36.000	36.000
T4 47.00-27.00	0.00	0.000	A36 (36 ksi)	1	1	1	36.000	36.000

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	Yes	Yes	1	0.5	1	1	1	1	1	1
92.00-87.00				0.5	1	1	1	1	1	1
T2	Yes	Yes	1	0.5	1	1	1	1	1	1
87.00-67.00				0.5	1	1	1	1	1	1
T3	Yes	Yes	1	0.5	1	1	1	1	1	1
67.00-47.00				0.5	1	1	1	1	1	1
T4	Yes	Yes	1	0.5	1	1	1	1	1	1
47.00-27.00				0.5	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	U	Diagonal Net Width Deduct in	U	Top Girt Net Width Deduct in	U	Bottom Girt Net Width Deduct in	U	Mid Girt Net Width Deduct in	U	Long Horizontal Net Width Deduct in	U	Short Horizontal Net Width Deduct in	U
T1 92.00-87.00	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
T2 87.00-67.00	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
T3 67.00-47.00	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
T4 47.00-27.00	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75

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 92.00-87.00	Flange	0.875 A325N	1	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0
T2 87.00-67.00	Flange	0.875 A325N	1	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0
T3 67.00-47.00	Flange	0.875 A325N	1	0.000 A325N	0	0.500 A325N	0	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0
T4 47.00-27.00	Flange	0.875 A325N	1	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0

Guy Data

Guy Elevation ft	Guy Grade		Guy Size	Initial Tension lb	%	Guy Modulus ksi	Guy Weight plf	L_u ft	Anchor Radius ft	Anchor Azimuth Adj. °	Anchor Elevation ft	End Fitting Efficiency %
81.25	EHS	A	9/16	3500.00	10%	21000	0.671	59.60	28.20	0.0000	28.00	100%
		B	9/16	3500.00	10%	21000	0.671	56.24	19.50	0.0000	28.00	100%
		C	9/16	3500.00	10%	21000	0.671	56.71	20.92	0.0000	28.00	100%
46.9167	EHS	A	3/4	5830.00	10%	19000	1.155	32.74	28.20	0.0000	28.00	100%
		B	3/4	5830.00	10%	19000	1.155	26.13	19.50	0.0000	28.00	100%
		C	3/4	5830.00	10%	19000	1.155	27.13	20.92	0.0000	28.00	100%

Guy Data*(cont'd)*

Guy Elevation ft	Mount Type	Torque-Arm Spread ft	Torque-Arm Leg Angle °	Torque-Arm Style	Torque-Arm Grade	Torque-Arm Type	Torque-Arm Size
81.25	Torque Arm	5.00	45.0000	Dog Ear	A36 (36 ksi)	Single Angle	L2x2x5/16 L3x3x1/4
46.9167	Corner						

Guy Data *(cont'd)*

Guy Elevation ft	Diagonal Grade	Diagonal Type	Upper Diagonal Size	Lower Diagonal Size	Is Strap.	Pull-Off Grade	Pull-Off Type	Pull-Off Size
81.25	A36 (36 ksi)	Solid Round				A36 (36 ksi)	Single Angle	
46.92	A36 (36 ksi)	Solid Round				A36 (36 ksi)	Single Angle	

Guy Data *(cont'd)*

Guy Elevation ft	Cable Weight A lb	Cable Weight B lb	Cable Weight C lb	Cable Weight D lb	Tower Intercept A ft	Tower Intercept B ft	Tower Intercept C ft	Tower Intercept D ft
81.25	39.99	37.73	38.05		0.34 1.0 sec/pulse	0.30 0.9 sec/pulse	0.31 1.0 sec/pulse	
46.9167	37.81	30.18	31.33		0.11 0.6 sec/pulse	0.07 0.4 sec/pulse	0.07 0.5 sec/pulse	

Guy Data *(cont'd)*

Guy Elevation ft	Calc K Single Angles	Calc K Solid Rounds	Torque Arm K_x	Torque Arm K_y	Pull Off K_x	Pull Off K_y	Diagonal K_x	Diagonal K_y
81.25	Yes	Yes	1	1	1	1	1	1
46.9167	No	No			1	1	1	1

Guy Data *(cont'd)*

Guy Elevation ft	Torque-Arm Bolt Size in	Torque-Arm Number	Torque-Arm Net Width Deduct in	Torque-Arm U	Pull Off Bolt Size in	Pull Off Number	Pull Off Net Width Deduct in	Pull Off U	Diagonal Bolt Size in	Diagonal Number	Diagonal Net Width Deduct in	Diagonal U
81.25	0.000 A325N	0	0.000	1	0.625 A325N	0	0.000	0.75	0.625 A325N	0	0.000	0.75
46.9167	0.000 A325N	0	0.000	1	0.625 A325N	0	0.000	0.75	0.625 A325N	0	0.000	0.75

Guy Pressures

Guy Elevation ft	Guy Location	z ft	q_z psf	q_z Ice psf	Ice Thickness in
81.25	A	54.63	21	16	0.500
	B	54.63	21	16	0.500
	C	54.63	21	16	0.500
46.9167	A	37.46	19	14	0.500
	B	37.46	19	14	0.500
	C	37.46	19	14	0.500

Guy-Mast Forces (Excluding Wind) - No Ice

Guy Elevation	Guy Location	Chord Angle	Guy Tension Top Bottom lb	F_x	F_y	F_z	M_x	M_y	M_z
ft		°		lb	lb	lb	kip-ft	kip-ft	kip-ft
81.25	A	63.2217	3535.70 3500.00	-147.44	3160.57	-1578.04	-4.56	4.16	-7.90
	A	63.2217	3535.70 3500.00	147.44	3160.57	-1578.04	-4.56	-4.16	7.90
	B	71.1026	3535.70 3500.00	1055.49	3347.10	428.96	9.66	3.05	0.00
	B	71.1026	3535.70 3500.00	899.24	3347.10	699.60	-4.83	-3.05	-8.37
	C	69.7581	3535.70 3500.00	-967.99	3319.61	737.80	-4.79	3.24	8.30
	C	69.7581	3535.70 3500.00	-1122.95	3319.61	469.41	9.58	-3.24	0.00
			Sum:	**-136.21**	19654.57	**-820.32**	**0.50**	0.00	**-0.07**
46.9167	A	35.2599	5851.83 5830.00	0.00	3390.76	-4769.35	-4.89	0.00	0.00
	B	46.3325	5851.83 5830.00	3492.66	4240.16	2016.49	3.06	0.00	-5.30
	C	44.1644	5851.83 5830.00	-3628.59	4085.14	2094.97	2.95	-0.00	5.11
			Sum:	**-135.93**	11716.06	**-657.89**	**1.11**	0.00	**-0.19**

Guy-Mast Forces (Excluding Wind) - Ice

Guy Elevation	Guy Location	Chord Angle	Guy Tension Top Bottom lb	F_x	F_y	F_z	M_x	M_y	M_z
ft		°		lb	lb	lb	kip-ft	kip-ft	kip-ft
81.25	A	63.2217	4885.70 4815.47	-203.30	4369.71	-2175.85	-6.31	5.73	-10.92
	A	63.2217	4885.70 4815.47	203.30	4369.71	-2175.85	-6.31	-5.73	10.92
	B	71.1026	4882.79 4812.56	1454.48	4623.50	591.12	13.35	4.20	0.00
	B	71.1026	4882.79 4812.56	1239.16	4623.50	964.06	-6.67	-4.20	-11.56
	C	69.7581	4883.17 4812.94	-1334.00	4586.06	1016.77	-6.62	4.47	11.47
	C	69.7581	4883.17 4812.94	-1547.55	4586.06	646.90	13.24	-4.47	0.00
			Sum:	**-187.91**	27158.55	**-1132.86**	**0.68**	0.00	**-0.09**
46.9167	A	35.2599	7939.17 7902.91	0.00	4604.11	-6467.82	-6.65	0.00	0.00
	B	46.3325	7937.17 7900.91	4735.30	5753.37	2733.93	4.15	0.00	-7.19
	C	44.1644	7937.49 7901.23	-4919.78	5543.59	2840.44	4.00	-0.00	6.93
			Sum:	**-184.48**	15901.07	**-893.45**	**1.51**	0.00	**-0.26**

Guy-Mast Forces (Excluding Wind) - Service

Guy Elevation ft	Guy Location	Chord Angle °	Guy Tension Top / Bottom lb	F_x lb	F_y lb	F_z lb	M_x kip-ft	M_y kip-ft	M_z kip-ft
81.25	A	63.2217	3535.70 3500.00	-147.44	3160.57	-1578.04	-4.56	4.16	-7.90
	A	63.2217	3535.70 3500.00	147.44	3160.57	-1578.04	-4.56	-4.16	7.90
	B	71.1026	3535.70 3500.00	1055.49	3347.10	428.96	9.66	3.05	0.00
	B	71.1026	3535.70 3500.00	899.24	3347.10	699.60	-4.83	-3.05	-8.37
	C	69.7581	3535.70 3500.00	-967.99	3319.61	737.80	-4.79	3.24	8.30
	C	69.7581	3535.70 3500.00	-1122.95	3319.61	469.41	9.58	-3.24	0.00
			Sum:	**-136.21**	19654.57	**-820.32**	**0.50**	0.00	**-0.07**
46.9167	A	35.2599	5851.83 5830.00	0.00	3390.76	-4769.35	-4.89	0.00	0.00
	B	46.3325	5851.83 5830.00	3492.66	4240.16	2016.49	3.06	0.00	-5.30
	C	44.1644	5851.83 5830.00	-3628.59	4085.14	2094.97	2.95	-0.00	5.11
			Sum:	**-135.93**	11716.06	**-657.89**	**1.11**	0.00	**-0.19**

Guy-Tensioning Information

Guy Elevation ft		H ft	V ft	Temperature At Time Of Tensioning: 0 F Initial Tension lb	0 F Intercept ft	20 F Initial Tension lb	20 F Intercept ft	40 F Initial Tension lb	40 F Intercept ft	60 F Initial Tension lb	60 F Intercept ft	80 F Initial Tension lb	80 F Intercept ft	100 F Initial Tension lb	100 F Intercept ft	120 F Initial Tension lb	120 F Intercept ft
81.25	A	26.87	53.25	3823	0.31	3715	0.32	3608	0.33	3500	0.34	3393	0.35	3285	0.36	3178	0.37
	B	18.23	53.25	3667	0.29	3611	0.29	3556	0.30	3500	0.30	3444	0.31	3389	0.31	3333	0.32
	C	19.64	53.25	3691	0.29	3627	0.30	3563	0.30	3500	0.31	3437	0.31	3373	0.32	3310	0.32
46.9167	A	26.76	18.92	7488	0.08	6935	0.09	6382	0.10	5830	0.11	5278	0.12	4728	0.13	4178	0.15
	B	18.06	18.92	7017	0.06	6621	0.06	6225	0.06	5830	0.07	5435	0.07	5040	0.08	4645	0.08
	C	19.48	18.92	7111	0.06	6684	0.06	6257	0.07	5830	0.07	5403	0.08	4977	0.09	4551	0.09

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)	63.50 - 27.00	1.000	-0.28	4	4	0.500	1.980		1.04
1 5/8 (Verizon - Existing)	C	Yes	Ar (CfAe)	63.50 - 27.00	1.000	0	8	4	1.000	1.980		1.04
7/8 (Municpal)	A	Yes	Ar (CfAe)	76.50 - 27.00	1.000	-0.05	1	1	1.110	1.110		0.54
7/8 (Municpal)	A	Yes	Ar (CfAe)	69.00 - 27.00	1.000	0	1	1	1.110	1.110		0.54
7/8	A	Yes	Ar (CfAe)	92.00 - 27.00	1.000	0.1	2	2	1.110	1.110		0.54

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
(Municpal) RG6-Fiber (AT&T)	B	Yes	Ar (CfAe)	54.50 - 27.00	1.000	0.38	1	1	0.500	0.500		1.00
#8 AWG Copper WIre (AT&T)	B	Yes	Ar (CfAe)	54.50 - 27.00	1.000	0.4	2	1	0.250	0.129		0.05
1 5/8 (AT&T)	B	Yes	Ar (CfAe)	54.50 - 27.00	1.000	-0.1	12	6	1.000	1.980		1.04
0.3" dia RET (AT&T)	B	Yes	Ar (CfAe)	54.50 - 27.00	1.000	0.33	6	3	0.300	0.300		0.00
HYBRIFLEX 1-5/8" (Verizon - Existing)	C	Yes	Ar (CfAe)	63.50 - 27.00	1.000	-0.35	1	1	0.000	1.980		1.90
HYBRIFLEX 1-5/8" (Verizon - Proposed)	C	Yes	Ar (CfAe)	63.50 - 27.00	4.000	-0.35	1	1	0.000	1.980		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 lb
T1	92.00-87.00	A	0.925	0.000	0.000	0.000	5.40
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T2	87.00-67.00	A	4.764	0.000	0.000	0.000	27.81
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T3	67.00-47.00	A	18.290	0.000	0.000	0.000	111.84
		B	8.380	0.000	0.000	0.000	101.94
		C	16.335	0.000	0.000	0.000	199.98
T4	47.00-27.00	A	20.600	0.000	0.000	0.000	126.40
		B	22.348	0.000	0.000	0.000	271.84
		C	19.800	0.000	0.000	0.000	242.40

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 lb
T1	92.00-87.00	A	0.500	1.758	0.000	0.000	0.000	15.23
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
T2	87.00-67.00	A	0.500	9.055	0.000	0.000	0.000	78.46
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
T3	67.00-47.00	A	0.500	18.164	10.230	0.000	0.000	298.51
		B		4.318	10.063	0.000	0.000	315.77
		C		12.293	12.293	0.000	0.000	523.32
T4	47.00-27.00	A	0.500	19.033	12.400	0.000	0.000	335.98
		B		11.514	26.833	0.000	0.000	842.05
		C		14.900	14.900	0.000	0.000	634.32

Feed Line Shielding

Section	Elevation	Face	A_R	A_R Ice	A_F	A_F Ice
	ft		ft^2	ft^2	ft^2	ft^2
T1	92.00-87.00	A	0.043	0.335	0.058	0.110
		B	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000
T2	87.00-67.00	A	0.210	1.499	0.198	0.377
		B	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000
T3	67.00-47.00	A	0.806	4.702	0.762	1.183
		B	0.369	2.381	0.349	0.599
		C	0.720	4.071	0.681	1.024
T4	47.00-27.00	A	0.910	5.215	0.858	1.310
		B	0.987	6.362	0.931	1.598
		C	0.875	4.944	0.825	1.242

Feed Line Center of Pressure

Section	Elevation	CP_X	CP_Z	CP_X Ice	CP_Z Ice
	ft	in	in	in	in
T1	92.00-87.00	-0.668	-0.701	-0.564	-0.592
T2	87.00-67.00	-1.003	-0.883	-0.878	-0.773
T3	67.00-47.00	-0.929	1.514	-0.308	0.733
T4	47.00-27.00	0.471	0.631	0.780	0.265

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral / Vert	Azimuth Adjustment	Placement		C_AA_A Front	C_AA_A Side	Weight
			ft / ft / ft	°	ft		ft^2	ft^2	lb
DB844G65ZAXY	A	From Leg	4.00	0.0000	63.50	No Ice	4.67	3.73	16.00
(Verizon - Existing)			6.00			1/2" Ice	5.05	4.10	48.76
			0.00						
SBNHH-1D65B	A	From Leg	4.00	0.0000	63.50	No Ice	8.33	5.34	42.00
(Verizon - Proposed)			4.00			1/2" Ice	8.88	5.79	92.05
			0.00						
LNX-6514DS-VTM	A	From Leg	4.00	0.0000	63.50	No Ice	8.41	5.41	39.00
(Verizon - Proposed)			0.00			1/2" Ice	8.96	5.86	89.51
			0.00						
HBXX-6517DS	A	From Leg	4.00	0.0000	63.50	No Ice	8.74	5.24	50.00
(Verizon - Proposed)			-4.00			1/2" Ice	9.31	5.71	100.49
			0.00						
DB844G65ZAXY	A	From Leg	4.00	0.0000	63.50	No Ice	4.67	3.73	16.00

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 lb
(Verizon - Existing)			-6.00 0.00			1/2" Ice	5.05	4.10	48.76
APL866513-42T0	B	From Leg	4.00	0.0000	63.50	No Ice	4.29	3.73	16.00
(Verizon - Existing)			6.00 0.00			1/2" Ice	4.67	4.10	47.29
SBNHH-1D45B	B	From Leg	4.00	0.0000	63.50	No Ice	12.60	5.28	65.00
(Verizon - Proposed)			4.00 0.00			1/2" Ice	13.19	5.74	130.59
X7C-FR0-640-V	B	From Leg	4.00	0.0000	63.50	No Ice	13.16	6.51	45.00
(Verizon - Proposed)			0.00 0.00			1/2" Ice	13.75	6.97	118.91
HBXX-6517DS	B	From Leg	4.00	0.0000	63.50	No Ice	8.74	5.24	50.00
(Verizon - Proposed)			-4.00 0.00			1/2" Ice	9.31	5.71	100.49
APL866513-42T0	B	From Leg	4.00	0.0000	63.50	No Ice	4.29	3.73	16.00
(Verizon - Existing)			-6.00 0.00			1/2" Ice	4.67	4.10	47.29
DB844G65ZAXY	C	From Leg	4.00	0.0000	63.50	No Ice	4.67	3.73	16.00
(Verizon - Existing)			6.00 0.00			1/2" Ice	5.05	4.10	48.76
SBNHH-1D65B	C	From Leg	4.00	0.0000	63.50	No Ice	8.33	5.34	42.00
(Verizon - Proposed)			4.00 0.00			1/2" Ice	8.88	5.79	92.05
LNX-6514DS-VTM	C	From Leg	4.00	0.0000	63.50	No Ice	8.41	5.41	39.00
(Verizon - Proposed)			0.00 0.00			1/2" Ice	8.96	5.86	89.51
HBXX-6517DS	C	From Leg	4.00	0.0000	63.50	No Ice	8.74	5.24	50.00
(Verizon - Proposed)			-4.00 0.00			1/2" Ice	9.31	5.71	100.49
DB844G65ZAXY	C	From Leg	4.00	0.0000	63.50	No Ice	4.67	3.73	16.00
(Verizon - Existing)			-6.00 0.00			1/2" Ice	5.05	4.10	48.76
DB-T1-6Z-8AB-0Z	C	From Face	0.50	0.0000	63.50	No Ice	5.60	2.33	44.00
(Verizon - Existing)			0.00 0.00			1/2" Ice	5.92	2.56	80.13
DB-T1-6Z-8AB-0Z	B	From Face	0.50	0.0000	63.50	No Ice	5.60	2.33	44.00
(Verizon - Proposed)			0.00 0.00			1/2" Ice	5.92	2.56	80.13
RRH2x60-AWS	A	From Face	3.50	0.0000	63.50	No Ice	3.78	2.07	55.00
(Verizon - Proposed)			0.00 0.00			1/2" Ice	4.09	2.35	78.25
RRH2x60-AWS	B	From Face	3.50	0.0000	63.50	No Ice	3.78	2.07	55.00
(Verizon - Proposed)			0.00 0.00			1/2" Ice	4.09	2.35	78.25
RRH2x60-AWS	C	From Face	3.50	0.0000	63.50	No Ice	3.78	2.07	55.00
(Verizon - Proposed)			0.00 0.00			1/2" Ice	4.09	2.35	78.25
RRH2x60-PCS	A	From Face	3.50	0.0000	63.50	No Ice	2.51	1.55	55.00
(Verizon - Proposed)			4.00 0.00			1/2" Ice	2.73	1.74	72.75
RRH2x60-PCS	B	From Face	3.50	0.0000	63.50	No Ice	2.51	1.55	55.00
(Verizon - Proposed)			4.00 0.00			1/2" Ice	2.73	1.74	72.75
RRH2x60-PCS	C	From Face	3.50	0.0000	63.50	No Ice	2.51	1.55	55.00
(Verizon - Proposed)			4.00 0.00			1/2" Ice	2.73	1.74	72.75
RRH4x30-B13	A	From Face	3.50	0.0000	63.50	No Ice	2.52	1.89	58.00

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 lb
(Verizon - Proposed)			0.00 0.00			1/2" Ice	2.74	2.09	77.61
RRH4x30-B13	B	From Face	3.50 0.00 0.00	0.0000	63.50	No Ice 1/2" Ice	2.52 2.74	1.89 2.09	58.00 77.61
(Verizon - Proposed)									
RRH4x30-B13	C	From Face	3.50 0.00 0.00	0.0000	63.50	No Ice 1/2" Ice	2.52 2.74	1.89 2.09	58.00 77.61
(Verizon - Proposed)									
Rohn 6' x 12' Boom Gate (1)	A	From Leg	2.00 0.00 0.00	0.0000	62.50	No Ice 1/2" Ice	16.60 19.80	16.60 19.80	560.00 700.00
(Verizon - Existing)									
Rohn 6' x 12' Boom Gate (1)	B	From Leg	2.00 0.00 0.00	0.0000	62.50	No Ice 1/2" Ice	16.60 19.80	16.60 19.80	560.00 700.00
(Verizon - Existing)									
Rohn 6' x 12' Boom Gate (1)	C	From Leg	2.00 0.00 0.00	0.0000	62.50	No Ice 1/2" Ice	16.60 19.80	16.60 19.80	560.00 700.00
(Verizon - Existing)									
DC6-48-60-18-8F Surge Arrestor	C	From Face	0.50 0.50 0.00	0.0000	56.00	No Ice 1/2" Ice	2.23 2.45	2.23 2.45	20.00 39.36
(AT&T)									
(2) AM-X-CD-16-65-00T-RET(72")	A	From Face	2.00 0.00 0.00	0.0000	54.50	No Ice 1/2" Ice	8.26 8.81	4.64 5.09	50.00 96.50
(AT&T)									
(2) AM-X-CD-16-65-00T-RET(72")	B	From Face	2.00 0.00 0.00	0.0000	54.50	No Ice 1/2" Ice	8.26 8.81	4.64 5.09	50.00 96.50
(AT&T)									
(2) AM-X-CD-16-65-00T-RET(72")	C	From Face	2.00 0.00 0.00	0.0000	54.50	No Ice 1/2" Ice	8.26 8.81	4.64 5.09	50.00 96.50
(AT&T)									
DTMABP7819VG12A TMA	A	From Face	2.00 5.00 0.00	0.0000	54.50	No Ice 1/2" Ice	1.59 1.76	0.58 0.70	20.00 29.77
(AT&T)									
DTMABP7819VG12A TMA	B	From Face	2.00 5.00 0.00	0.0000	54.50	No Ice 1/2" Ice	1.59 1.76	0.58 0.70	20.00 29.77
(AT&T)									
DTMABP7819VG12A TMA	C	From Face	2.00 5.00 0.00	0.0000	54.50	No Ice 1/2" Ice	1.59 1.76	0.58 0.70	20.00 29.77
(AT&T)									
(2) RRUS-11	A	From Face	2.00 -2.00 0.00	0.0000	54.50	No Ice 1/2" Ice	2.99 3.23	1.25 1.41	50.00 69.57
(AT&T)									
(2) RRUS-11	B	From Face	2.00 -2.00 0.00	0.0000	54.50	No Ice 1/2" Ice	2.99 3.23	1.25 1.41	50.00 69.57
(AT&T)									
(2) RRUS-11	C	From Face	2.00 -2.00 0.00	0.0000	54.50	No Ice 1/2" Ice	2.99 3.23	1.25 1.41	50.00 69.57
(AT&T)									
Andrew SF-SU10-3-72	A	From Leg	2.25 0.00 0.00	0.0000	54.50	No Ice 1/2" Ice	16.80 21.90	16.80 21.90	423.00 592.00
(AT&T)									
Andrew SF-SU10-3-72	B	From Leg	2.25 0.00 0.00	0.0000	54.50	No Ice 1/2" Ice	16.80 21.90	16.80 21.90	423.00 592.00
(AT&T)									
Andrew SF-SU10-3-72	C	From Leg	2.25	0.0000	54.50	No Ice	16.80	16.80	423.00

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 lb
(AT&T)			0.00 0.00			1/2" Ice	21.90	21.90	592.00
17' x 3" Dia Omni (Municipal)	A	From Leg	3.00 0.00 7.50	0.0000	91.00	No Ice 1/2" Ice	5.10 6.83	5.10 6.83	47.60 84.35
3' Side arm mount (Municipal)	A	From Leg	1.50 0.00 0.00	0.0000	91.00	No Ice 1/2" Ice	2.00 2.60	2.00 2.60	70.00 82.00
20' x 3" Dia Omni (Municipal)	B	From Leg	3.00 0.00 10.00	0.0000	91.00	No Ice 1/2" Ice	6.00 8.03	6.00 8.03	50.00 93.17
2' Side arm mount (Municipal)	B	From Leg	1.00 0.00 0.00	0.0000	91.00	No Ice 1/2" Ice	2.00 2.60	2.00 2.60	70.00 82.00
21-ft 8-Bay Dipole (Municipal)	C	From Leg	3.00 0.00 10.60	0.0000	69.00	No Ice 1/2" Ice	3.15 5.67	3.15 5.67	32.00 41.60
3' Side arm mount (Municipal)	C	From Leg	1.50 0.00 0.00	0.0000	69.00	No Ice 1/2" Ice	2.00 2.60	2.00 2.60	70.00 82.00
3' Pipe Brace (Municipal)	C	From Leg	1.50 0.00 0.00	0.0000	80.00	No Ice 1/2" Ice	0.58 0.77	0.58 0.77	10.95 16.37
8' x 3" Dia Omni (Municipal)	B	From Leg	2.00 0.00 4.00	0.0000	76.50	No Ice 1/2" Ice	2.40 3.19	2.40 3.19	25.00 42.51
2' Side arm mount (Municipal)	B	From Leg	1.00 0.00 0.00	0.0000	76.50	No Ice 1/2" Ice	2.00 2.60	2.00 2.60	70.00 82.00

Tower Pressures - No Ice

$G_H = 1.195$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
T1 92.00-87.00	89.50	1.33	25	13.229	A	0.678	2.890	1.458	40.87	0.000	0.000
					B	0.736	2.009		53.14	0.000	0.000
					C	0.736	2.009		53.14	0.000	0.000
T2 87.00-67.00	77.00	1.274	24	52.917	A	1.763	12.463	5.833	41.00	0.000	0.000
					B	1.962	7.909		59.10	0.000	0.000
					C	1.962	7.909		59.10	0.000	0.000
T3 67.00-47.00	57.00	1.169	22	52.917	A	1.200	25.393	5.833	21.94	0.000	0.000
					B	1.613	15.920		33.27	0.000	0.000
					C	1.281	23.524		23.52	0.000	0.000
T4 47.00-27.00	37.00	1.033	19	52.917	A	1.103	27.604	5.833	20.32	0.000	0.000
					B	1.031	29.274		19.25	0.000	0.000
					C	1.137	26.839		20.85	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.195$

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 92.00-87.00	89.50	1.33	18	0.500	13.646	A	0.626	5.955	2.292	34.82	0.000	0.000
						B	0.736	4.531		43.51	0.000	0.000
						C	0.736	4.531		43.51	0.000	0.000
T2 87.00-67.00	77.00	1.274	18	0.500	54.583	A	1.584	24.519	9.167	35.12	0.000	0.000
						B	1.962	16.963		48.44	0.000	0.000
						C	1.962	16.963		48.44	0.000	0.000
T3 67.00-47.00	57.00	1.169	16	0.500	54.583	A	11.009	30.425	9.167	22.12	0.000	0.000
						B	11.425	18.900		30.23	0.000	0.000
						C	13.230	25.185		23.86	0.000	0.000
T4 47.00-27.00	37.00	1.033	14	0.500	54.583	A	13.052	30.796	9.167	20.91	0.000	0.000
						B	27.197	22.130		18.58	0.000	0.000
						C	15.620	26.934		21.54	0.000	0.000

Tower Pressure - Service

$G_H = 1.195$

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 92.00-87.00	89.50	1.33	9	13.229	A	0.678	2.890	1.458	40.87	0.000	0.000
					B	0.736	2.009		53.14	0.000	0.000
					C	0.736	2.009		53.14	0.000	0.000
T2 87.00-67.00	77.00	1.274	8	52.917	A	1.763	12.463	5.833	41.00	0.000	0.000
					B	1.962	7.909		59.10	0.000	0.000
					C	1.962	7.909		59.10	0.000	0.000
T3 67.00-47.00	57.00	1.169	7	52.917	A	1.200	25.393	5.833	21.94	0.000	0.000
					B	1.613	15.920		33.27	0.000	0.000
					C	1.281	23.524		23.52	0.000	0.000
T4 47.00-27.00	37.00	1.033	7	52.917	A	1.103	27.604	5.833	20.32	0.000	0.000
					B	1.031	29.274		19.25	0.000	0.000
					C	1.137	26.839		20.85	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1	5.40	184.08	A	0.27	2.38	0.607	1	1	2.433	170.10	34.02	A
92.00-87.00			B	0.207	2.571	0.592	1	1	1.925			
			C	0.207	2.571	0.592	1	1	1.925			
T2	27.81	685.64	A	0.269	2.382	0.607	1	1	9.326	625.37	31.27	A

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
87.00-67.00		TA 162.22	B	0.187	2.642	0.588	1	1	6.610			
			C	0.187	2.642	0.588	1	1	6.610			
T3	413.76	685.64	A	0.503	1.897	0.699	1	1	18.944	928.11	46.41	A
67.00-47.00			B	0.331	2.216	0.626	1	1	11.578			
			C	0.469	1.944	0.682	1	1	17.326			
T4	640.64	685.89	A	0.542	1.851	0.72	1	1	20.981	941.38	47.07	B
47.00-27.00			B	0.573	1.823	0.737	1	1	22.613			
			C	0.529	1.866	0.713	1	1	20.261			
Sum Weight:	1087.61	2403.47								2664.96		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1	5.40	184.08	A	0.27	2.38	0.607	0.825	1	2.314	161.80	32.36	A
92.00-87.00			B	0.207	2.571	0.592	0.825	1	1.796			
			C	0.207	2.571	0.592	0.825	1	1.796			
T2	27.81	685.64	A	0.269	2.382	0.607	0.825	1	9.018	604.68	30.23	A
87.00-67.00		TA 162.22	B	0.187	2.642	0.588	0.825	1	6.267			
			C	0.187	2.642	0.588	0.825	1	6.267			
T3	413.76	685.64	A	0.503	1.897	0.699	0.825	1	18.734	917.83	45.89	A
67.00-47.00			B	0.331	2.216	0.626	0.825	1	11.296			
			C	0.469	1.944	0.682	0.825	1	17.102			
T4	640.64	685.89	A	0.542	1.851	0.72	0.825	1	20.788	933.87	46.69	B
47.00-27.00			B	0.573	1.823	0.737	0.825	1	22.433			
			C	0.529	1.866	0.713	0.825	1	20.062			
Sum Weight:	1087.61	2403.47								2618.18		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1	5.40	184.08	A	0.27	2.38	0.607	0.8	1	2.297	160.62	32.12	A
92.00-87.00			B	0.207	2.571	0.592	0.8	1	1.778			
			C	0.207	2.571	0.592	0.8	1	1.778			
T2	27.81	685.64	A	0.269	2.382	0.607	0.8	1	8.974	601.72	30.09	A
87.00-67.00		TA 162.22	B	0.187	2.642	0.588	0.8	1	6.218			
			C	0.187	2.642	0.588	0.8	1	6.218			
T3	413.76	685.64	A	0.503	1.897	0.699	0.8	1	18.704	916.36	45.82	A
67.00-47.00			B	0.331	2.216	0.626	0.8	1	11.256			
			C	0.469	1.944	0.682	0.8	1	17.070			
T4	640.64	685.89	A	0.542	1.851	0.72	0.8	1	20.760	932.80	46.64	B
47.00-27.00			B	0.573	1.823	0.737	0.8	1	22.407			
			C	0.529	1.866	0.713	0.8	1	20.033			
Sum Weight:	1087.61	2403.47								2611.50		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1	5.40	184.08	A	0.27	2.38	0.607	0.85	1	2.331	162.99	32.60	A
92.00-87.00			B	0.207	2.571	0.592	0.85	1	1.814			
			C	0.207	2.571	0.592	0.85	1	1.814			
T2	27.81	685.64	A	0.269	2.382	0.607	0.85	1	9.062	607.63	30.38	A
87.00-67.00		TA 162.22	B	0.187	2.642	0.588	0.85	1	6.316			
			C	0.187	2.642	0.588	0.85	1	6.316			
T3	413.76	685.64	A	0.503	1.897	0.699	0.85	1	18.764	919.30	45.96	A
67.00-47.00			B	0.331	2.216	0.626	0.85	1	11.336			
			C	0.469	1.944	0.682	0.85	1	17.134			
T4	640.64	685.89	A	0.542	1.851	0.72	0.85	1	20.815	934.95	46.75	B
47.00-27.00			B	0.573	1.823	0.737	0.85	1	22.459			
			C	0.529	1.866	0.713	0.85	1	20.090			
Sum Weight:	1087.61	2403.47								2624.86		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1	15.23	260.86	A	0.482	1.924	0.689	1	1	4.726	200.42	40.08	A
92.00-87.00			B	0.386	2.092	0.646	1	1	3.663			
			C	0.386	2.092	0.646	1	1	3.663			
T2	78.46	946.29	A	0.478	1.93	0.687	1	1	18.420	750.47	37.52	A
87.00-67.00		TA 246.87	B	0.347	2.179	0.631	1	1	12.671			
			C	0.347	2.179	0.631	1	1	12.671			
T3	1137.60	946.29	A	0.759	1.791	0.864	1	1	37.293	1294.22	64.71	A
67.00-47.00			B	0.556	1.838	0.727	1	1	25.173			
			C	0.704	1.776	0.823	1	1	33.947			
T4	1812.35	946.77	A	0.803	1.819	0.899	1	1	40.742	1619.65	80.98	B
47.00-27.00			B	0.904	1.929	0.987	1	1	49.029			
			C	0.78	1.802	0.88	1	1	39.321			
Sum Weight:	3043.64	3347.09								3864.76		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1	15.23	260.86	A	0.482	1.924	0.689	0.825	1	4.617	195.77	39.15	A
92.00-87.00			B	0.386	2.092	0.646	0.825	1	3.534			
			C	0.386	2.092	0.646	0.825	1	3.534			
T2	78.46	946.29	A	0.478	1.93	0.687	0.825	1	18.143	739.18	36.96	A
87.00-67.00		TA 246.87	B	0.347	2.179	0.631	0.825	1	12.327			
			C	0.347	2.179	0.631	0.825	1	12.327			
T3	1137.60	946.29	A	0.759	1.791	0.864	0.825	1	35.366	1227.36	61.37	A

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
67.00-47.00			B	0.556	1.838	0.727	0.825	1	23.174			
			C	0.704	1.776	0.823	0.825	1	31.632			
T4	1812.35	946.77	A	0.803	1.819	0.899	0.825	1	38.458	1462.42	73.12	B
47.00-27.00			B	0.904	1.929	0.987	0.825	1	44.269			
			C	0.78	1.802	0.88	0.825	1	36.588			
Sum Weight:	3043.64	3347.09								3624.73		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1	15.23	260.86	A	0.482	1.924	0.689	0.8	1	4.601	195.11	39.02	A
92.00-87.00			B	0.386	2.092	0.646	0.8	1	3.515			
			C	0.386	2.092	0.646	0.8	1	3.515			
T2	78.46	946.29	A	0.478	1.93	0.687	0.8	1	18.103	737.56	36.88	A
87.00-67.00		TA 246.87	B	0.347	2.179	0.631	0.8	1	12.278			
			C	0.347	2.179	0.631	0.8	1	12.278			
T3	1137.60	946.29	A	0.759	1.791	0.864	0.8	1	35.091	1217.81	60.89	A
67.00-47.00			B	0.556	1.838	0.727	0.8	1	22.888			
			C	0.704	1.776	0.823	0.8	1	31.301			
T4	1812.35	946.77	A	0.803	1.819	0.899	0.8	1	38.131	1439.96	72.00	B
47.00-27.00			B	0.904	1.929	0.987	0.8	1	43.589			
			C	0.78	1.802	0.88	0.8	1	36.197			
Sum Weight:	3043.64	3347.09								3590.44		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1	15.23	260.86	A	0.482	1.924	0.689	0.85	1	4.632	196.44	39.29	A
92.00-87.00			B	0.386	2.092	0.646	0.85	1	3.552			
			C	0.386	2.092	0.646	0.85	1	3.552			
T2	78.46	946.29	A	0.478	1.93	0.687	0.85	1	18.182	740.79	37.04	A
87.00-67.00		TA 246.87	B	0.347	2.179	0.631	0.85	1	12.376			
			C	0.347	2.179	0.631	0.85	1	12.376			
T3	1137.60	946.29	A	0.759	1.791	0.864	0.85	1	35.641	1236.91	61.85	A
67.00-47.00			B	0.556	1.838	0.727	0.85	1	23.459			
			C	0.704	1.776	0.823	0.85	1	31.962			
T4	1812.35	946.77	A	0.803	1.819	0.899	0.85	1	38.784	1484.88	74.24	B
47.00-27.00			B	0.904	1.929	0.987	0.85	1	44.949			
			C	0.78	1.802	0.88	0.85	1	36.978			
Sum Weight:	3043.64	3347.09								3659.02		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	5.40	184.08	A	0.27	2.38	0.607	1	1	2.433	58.86	11.77	A
92.00-87.00			B	0.207	2.571	0.592	1	1	1.925			
			C	0.207	2.571	0.592	1	1	1.925			
T2	27.81	685.64	A	0.269	2.382	0.607	1	1	9.326	216.39	10.82	A
87.00-67.00		TA 162.22	B	0.187	2.642	0.588	1	1	6.610			
			C	0.187	2.642	0.588	1	1	6.610			
T3	413.76	685.64	A	0.503	1.897	0.699	1	1	18.944	321.15	16.06	A
67.00-47.00			B	0.331	2.216	0.626	1	1	11.578			
			C	0.469	1.944	0.682	1	1	17.326			
T4	640.64	685.89	A	0.542	1.851	0.72	1	1	20.981	325.74	16.29	B
47.00-27.00			B	0.573	1.823	0.737	1	1	22.613			
			C	0.529	1.866	0.713	1	1	20.261			
Sum Weight:	1087.61	2403.47								922.13		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	5.40	184.08	A	0.27	2.38	0.607	0.825	1	2.314	55.99	11.20	A
92.00-87.00			B	0.207	2.571	0.592	0.825	1	1.796			
			C	0.207	2.571	0.592	0.825	1	1.796			
T2	27.81	685.64	A	0.269	2.382	0.607	0.825	1	9.018	209.23	10.46	A
87.00-67.00		TA 162.22	B	0.187	2.642	0.588	0.825	1	6.267			
			C	0.187	2.642	0.588	0.825	1	6.267			
T3	413.76	685.64	A	0.503	1.897	0.699	0.825	1	18.734	317.59	15.88	A
67.00-47.00			B	0.331	2.216	0.626	0.825	1	11.296			
			C	0.469	1.944	0.682	0.825	1	17.102			
T4	640.64	685.89	A	0.542	1.851	0.72	0.825	1	20.788	323.14	16.16	B
47.00-27.00			B	0.573	1.823	0.737	0.825	1	22.433			
			C	0.529	1.866	0.713	0.825	1	20.062			
Sum Weight:	1087.61	2403.47								905.94		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	5.40	184.08	A	0.27	2.38	0.607	0.8	1	2.297	55.58	11.12	A
92.00-87.00			B	0.207	2.571	0.592	0.8	1	1.778			
			C	0.207	2.571	0.592	0.8	1	1.778			
T2	27.81	685.64	A	0.269	2.382	0.607	0.8	1	8.974	208.21	10.41	A
87.00-67.00		TA 162.22	B	0.187	2.642	0.588	0.8	1	6.218			
			C	0.187	2.642	0.588	0.8	1	6.218			
T3	413.76	685.64	A	0.503	1.897	0.699	0.8	1	18.704	317.08	15.85	A
67.00-47.00			B	0.331	2.216	0.626	0.8	1	11.256			
			C	0.469	1.944	0.682	0.8	1	17.070			
T4	640.64	685.89	A	0.542	1.851	0.72	0.8	1	20.760	322.77	16.14	B

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
47.00-27.00			B	0.573	1.823	0.737	0.8	1	22.407			
			C	0.529	1.866	0.713	0.8	1	20.033			
Sum Weight:	1087.61	2403.47								903.63		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1	5.40	184.08	A	0.27	2.38	0.607	0.85	1	2.331	56.40	11.28	A
92.00-87.00			B	0.207	2.571	0.592	0.85	1	1.814			
			C	0.207	2.571	0.592	0.85	1	1.814			
T2	27.81	685.64	A	0.269	2.382	0.607	0.85	1	9.062	210.25	10.51	A
87.00-67.00		TA 162.22	B	0.187	2.642	0.588	0.85	1	6.316			
			C	0.187	2.642	0.588	0.85	1	6.316			
T3	413.76	685.64	A	0.503	1.897	0.699	0.85	1	18.764	318.10	15.90	A
67.00-47.00			B	0.331	2.216	0.626	0.85	1	11.336			
			C	0.469	1.944	0.682	0.85	1	17.134			
T4	640.64	685.89	A	0.542	1.851	0.72	0.85	1	20.815	323.51	16.18	B
47.00-27.00			B	0.573	1.823	0.737	0.85	1	22.459			
			C	0.529	1.866	0.713	0.85	1	20.090			
Sum Weight:	1087.61	2403.47								908.26		

Force Totals (Does not include forces on guys)

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Torques kip-ft
Leg Weight	1596.01			
Bracing Weight	807.45			
Total Member Self-Weight	2403.47			
Guy Weight	330.87			
Total Weight	9006.49			
Wind 0 deg - No Ice		-45.69	-10952.47	0.47
Wind 30 deg - No Ice		5443.00	-9427.55	0.81
Wind 45 deg - No Ice		7716.49	-7679.18	0.90
Wind 60 deg - No Ice		9461.66	-5409.93	0.93
Wind 90 deg - No Ice		10965.13	45.69	0.80
Wind 120 deg - No Ice		9553.65	5515.81	0.46
Wind 135 deg - No Ice		7781.10	7743.80	0.23
Wind 150 deg - No Ice		5522.14	9473.24	-0.01
Wind 180 deg - No Ice		45.69	10899.01	-0.47
Wind 210 deg - No Ice		-5443.00	9427.55	-0.81
Wind 225 deg - No Ice		-7716.49	7679.18	-0.90
Wind 240 deg - No Ice		-9507.96	5436.66	-0.93
Wind 270 deg - No Ice		-10965.13	-45.69	-0.80
Wind 300 deg - No Ice		-9507.35	-5489.07	-0.46
Wind 315 deg - No Ice		-7781.10	-7743.80	-0.23
Wind 330 deg - No Ice		-5522.14	-9473.24	0.01

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Torques kip-ft
Member Ice	943.62			
Guy Ice	289.63			
Total Weight Ice	14668.15			
Wind 0 deg - Ice		-34.03	-11101.97	0.47
Wind 30 deg - Ice		5438.29	-9419.40	0.74
Wind 45 deg - Ice		7684.27	-7656.49	0.80
Wind 60 deg - Ice		9394.03	-5384.35	0.81
Wind 90 deg - Ice		10935.52	34.03	0.67
Wind 120 deg - Ice		9665.63	5580.45	0.35
Wind 135 deg - Ice		7732.40	7704.61	0.15
Wind 150 deg - Ice		5497.23	9453.43	-0.07
Wind 180 deg - Ice		34.03	10827.65	-0.46
Wind 210 deg - Ice		-5438.29	9419.40	-0.74
Wind 225 deg - Ice		-7684.27	7656.49	-0.80
Wind 240 deg - Ice		-9631.60	5521.51	-0.82
Wind 270 deg - Ice		-10935.52	-34.03	-0.67
Wind 300 deg - Ice		-9428.06	-5443.30	-0.35
Wind 315 deg - Ice		-7732.40	-7704.61	-0.15
Wind 330 deg - Ice		-5497.23	-9453.43	0.07
Total Weight	9006.49			
Wind 0 deg - Service		-15.81	-3789.78	0.16
Wind 30 deg - Service		1883.39	-3262.13	0.28
Wind 45 deg - Service		2670.06	-2657.16	0.31
Wind 60 deg - Service		3273.93	-1871.95	0.32
Wind 90 deg - Service		3794.16	15.81	0.28
Wind 120 deg - Service		3305.76	1908.58	0.16
Wind 135 deg - Service		2692.42	2679.51	0.08
Wind 150 deg - Service		1910.77	3277.94	-0.00
Wind 180 deg - Service		15.81	3771.28	-0.16
Wind 210 deg - Service		-1883.39	3262.13	-0.28
Wind 225 deg - Service		-2670.06	2657.16	-0.31
Wind 240 deg - Service		-3289.95	1881.20	-0.32
Wind 270 deg - Service		-3794.16	-15.81	-0.28
Wind 300 deg - Service		-3289.74	-1899.33	-0.16
Wind 315 deg - Service		-2692.42	-2679.51	-0.08
Wind 330 deg - Service		-1910.77	-3277.94	0.00

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice+Guy
3	Dead+Wind 30 deg - No Ice+Guy
4	Dead+Wind 45 deg - No Ice+Guy
5	Dead+Wind 60 deg - No Ice+Guy
6	Dead+Wind 90 deg - No Ice+Guy
7	Dead+Wind 120 deg - No Ice+Guy
8	Dead+Wind 135 deg - No Ice+Guy
9	Dead+Wind 150 deg - No Ice+Guy
10	Dead+Wind 180 deg - No Ice+Guy
11	Dead+Wind 210 deg - No Ice+Guy
12	Dead+Wind 225 deg - No Ice+Guy
13	Dead+Wind 240 deg - No Ice+Guy

Comb. No.	Description
14	Dead+Wind 270 deg - No Ice+Guy
15	Dead+Wind 300 deg - No Ice+Guy
16	Dead+Wind 315 deg - No Ice+Guy
17	Dead+Wind 330 deg - No Ice+Guy
18	Dead+Ice+Temp+Guy
19	Dead+Wind 0 deg+Ice+Temp+Guy
20	Dead+Wind 30 deg+Ice+Temp+Guy
21	Dead+Wind 45 deg+Ice+Temp+Guy
22	Dead+Wind 60 deg+Ice+Temp+Guy
23	Dead+Wind 90 deg+Ice+Temp+Guy
24	Dead+Wind 120 deg+Ice+Temp+Guy
25	Dead+Wind 135 deg+Ice+Temp+Guy
26	Dead+Wind 150 deg+Ice+Temp+Guy
27	Dead+Wind 180 deg+Ice+Temp+Guy
28	Dead+Wind 210 deg+Ice+Temp+Guy
29	Dead+Wind 225 deg+Ice+Temp+Guy
30	Dead+Wind 240 deg+Ice+Temp+Guy
31	Dead+Wind 270 deg+Ice+Temp+Guy
32	Dead+Wind 300 deg+Ice+Temp+Guy
33	Dead+Wind 315 deg+Ice+Temp+Guy
34	Dead+Wind 330 deg+Ice+Temp+Guy
35	Dead+Wind 0 deg - Service+Guy
36	Dead+Wind 30 deg - Service+Guy
37	Dead+Wind 45 deg - Service+Guy
38	Dead+Wind 60 deg - Service+Guy
39	Dead+Wind 90 deg - Service+Guy
40	Dead+Wind 120 deg - Service+Guy
41	Dead+Wind 135 deg - Service+Guy
42	Dead+Wind 150 deg - Service+Guy
43	Dead+Wind 180 deg - Service+Guy
44	Dead+Wind 210 deg - Service+Guy
45	Dead+Wind 225 deg - Service+Guy
46	Dead+Wind 240 deg - Service+Guy
47	Dead+Wind 270 deg - Service+Guy
48	Dead+Wind 300 deg - Service+Guy
49	Dead+Wind 315 deg - Service+Guy
50	Dead+Wind 330 deg - Service+Guy

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
T1	92 - 87	Leg	Max Tension	22	2545.14	0.03	-0.02
			Max. Compression	19	-2826.49	-0.01	-0.01
			Max. Mx	33	-1362.04	-0.16	0.03
			Max. My	27	-1042.20	0.02	0.16
			Max. Vy	29	-289.56	-0.01	0.00
			Max. Vx	26	375.98	-0.00	0.02
		Diagonal	Max Tension	34	649.67	0.00	0.00
			Max. Compression	34	-670.32	0.00	0.00
			Max. Mx	20	126.51	-0.00	0.00
			Max. My	9	-649.97	-0.00	-0.00
			Max. Vy	20	1.02	-0.00	0.00
			Max. Vx	9	0.19	-0.00	-0.00
		Horizontal	Max Tension	30	40.18	0.00	0.00
			Max. Compression	32	-25.40	0.00	0.00
			Max. Mx	18	3.83	-0.00	0.00
			Max. Vy	18	3.54	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vx	19	0.00	0.00	0.00
		Top Girt	Max Tension	30	35.92	0.00	0.00
			Max. Compression	32	-34.39	0.00	0.00
			Max. Mx	18	-0.57	-0.00	0.00
			Max. Vy	18	3.54	0.00	0.00
			Max. Vx	19	0.00	0.00	0.00
		Bottom Girt	Max Tension	27	44.31	0.00	0.00
			Max. Compression	7	-40.51	0.00	0.00
			Max. Mx	18	4.10	-0.00	0.00
			Max. Vy	18	3.54	0.00	0.00
			Max. Vx	20	-0.00	0.00	0.00
T2	87 - 67	Leg	Max Tension	7	7379.99	-0.01	0.01
			Max. Compression	10	-22505.20	0.02	0.07
			Max. Mx	6	-7882.44	0.07	0.00
			Max. My	34	-7600.84	0.02	-0.10
			Max. Vy	7	-799.91	-0.01	0.01
			Max. Vx	10	-961.78	0.02	-0.01
		Diagonal	Max Tension	6	1309.33	0.00	0.00
			Max. Compression	6	-1797.69	0.00	0.00
			Max. Mx	27	445.50	-0.00	-0.00
			Max. My	2	-453.08	-0.00	0.00
			Max. Vy	27	1.13	-0.00	-0.00
			Max. Vx	2	-2.32	-0.00	0.00
		Horizontal	Max Tension	10	1386.18	0.00	0.00
			Max. Compression	19	-912.35	0.00	0.00
			Max. Mx	26	653.60	-0.00	0.00
			Max. My	31	407.20	0.00	-0.00
			Max. Vy	26	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
		Top Girt	Max Tension	30	27.01	0.00	0.00
			Max. Compression	32	-29.33	0.00	0.00
			Max. Mx	18	-2.12	-0.00	0.00
			Max. Vy	18	3.54	0.00	0.00
			Max. Vx	20	-0.00	0.00	0.00
		Bottom Girt	Max Tension	7	436.56	0.00	0.00
			Max. Compression	10	-94.44	0.00	0.00
			Max. Mx	28	387.52	-0.00	0.00
			Max. My	31	194.03	0.00	-0.00
			Max. Vy	27	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
		Guy A	Bottom Tension	27	6752.10		
			Top Tension	27	6822.03		
			Top Cable Vert	27	6124.89		
			Top Cable Norm	27	3004.29		
			Top Cable Tan	27	6.20		
			Bot Cable Vert	27	-5982.45		
			Bot Cable Norm	27	3130.67		
			Bot Cable Tan	27	8.62		
		Guy B	Bottom Tension	31	7883.36		
			Top Tension	31	7952.98		
			Top Cable Vert	31	7542.35		
			Top Cable Norm	31	2522.37		
			Top Cable Tan	31	22.76		
			Bot Cable Vert	31	-7422.59		
			Bot Cable Norm	31	2655.38		
			Bot Cable Tan	31	37.63		
		Guy C	Bottom Tension	22	7758.01		
			Top Tension	22	7827.72		
			Top Cable Vert	22	7366.48		
			Top Cable Norm	22	2647.29		
			Top Cable Tan	22	5.78		

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Bot Cable Vert	22	-7240.35		
			Bot Cable Norm	22	2786.35		
			Bot Cable Tan	22	14.49		
		Torque Arm Top	Max Tension	34	8212.05	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	34	6210.77	-0.01	0.00
			Max. My	19	3225.67	0.00	-0.00
			Max. Vy	34	7.33	0.00	0.00
			Max. Vx	19	0.03	0.00	0.00
		Torque Arm Bottom	Max Tension	12	492.05	0.00	0.00
			Max. Compression	31	-6074.46	0.00	0.00
			Max. Mx	23	-5103.06	-0.01	0.00
			Max. My	30	-3914.36	0.00	0.00
			Max. Vy	28	9.52	0.00	0.00
			Max. Vx	30	-0.00	0.00	0.00
T3	67 - 47	Leg	Max Tension	15	11262.82	-0.24	-0.14
			Max. Compression	19	-32312.49	0.00	0.10
			Max. Mx	6	-9815.22	0.42	0.00
			Max. My	10	-13746.72	0.00	0.42
			Max. Vy	32	-4068.85	0.10	0.05
			Max. Vx	27	4333.91	-0.00	-0.10
		Diagonal	Max Tension	14	3210.17	0.00	0.00
			Max. Compression	14	-3701.77	0.00	0.00
			Max. Mx	31	2978.59	-0.00	0.00
			Max. My	32	-579.84	-0.00	-0.01
			Max. Vy	31	1.17	-0.00	0.00
			Max. Vx	32	4.27	-0.00	-0.01
		Horizontal	Max Tension	7	1395.29	0.00	0.00
			Max. Compression	10	-663.42	0.00	0.00
			Max. Mx	29	900.94	-0.00	0.00
			Max. My	31	463.59	0.00	-0.00
			Max. Vy	29	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
		Top Girt	Max Tension	34	251.14	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	28	239.38	-0.00	0.00
			Max. My	31	221.42	0.00	-0.00
			Max. Vy	27	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
		Bottom Girt	Max Tension	19	1179.25	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	18	981.05	-0.00	0.00
			Max. My	31	1066.37	0.00	-0.00
			Max. Vy	18	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
T4	47 - 27	Leg	Max Tension	15	11261.51	0.10	0.05
			Max. Compression	19	-32313.26	0.00	0.25
			Max. Mx	31	-4195.11	0.45	0.16
			Max. My	27	2516.90	0.00	-0.46
			Max. Vy	32	-4070.04	0.44	0.25
			Max. Vx	27	4334.49	0.00	-0.46
		Diagonal	Max Tension	22	596.40	0.00	0.00
			Max. Compression	31	-1640.56	0.00	0.00
			Max. Mx	31	-1393.73	-0.00	-0.00
			Max. My	32	-541.58	-0.00	-0.01
			Max. Vy	31	1.23	-0.00	-0.00
			Max. Vx	32	5.83	-0.00	-0.01
		Horizontal	Max Tension	15	934.25	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	29	757.89	-0.00	0.00
			Max. My	31	667.72	0.00	-0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vy	18	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
		Top Girt	Max Tension	19	4145.78	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	18	2422.96	-0.00	0.00
			Max. My	31	2571.71	0.00	-0.00
			Max. Vy	18	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
		Bottom Girt	Max Tension	2	51.08	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	29	37.40	-0.00	0.00
			Max. My	31	17.02	0.00	-0.00
			Max. Vy	18	3.54	0.00	0.00
			Max. Vx	31	0.00	0.00	0.00
		Guy A	Bottom Tension	27	12675.52		
			Top Tension	27	12711.72		
			Top Cable Vert	27	7364.80		
			Top Cable Norm	27	10360.86		
			Top Cable Tan	27	0.11		
			Bot Cable Vert	27	-7275.21		
			Bot Cable Norm	27	10379.80		
			Bot Cable Tan	27	0.11		
		Guy B	Bottom Tension	32	15844.16		
			Top Tension	32	15880.30		
			Top Cable Vert	32	11496.55		
			Top Cable Norm	32	10955.07		
			Top Cable Tan	32	0.20		
			Bot Cable Vert	32	-11418.04		
			Bot Cable Norm	32	10984.80		
			Bot Cable Tan	32	0.20		
		Guy C	Bottom Tension	22	15117.49		
			Top Tension	22	15153.65		
			Top Cable Vert	22	10570.99		
			Top Cable Norm	22	10857.58		
			Top Cable Tan	22	0.28		
			Bot Cable Vert	22	-10490.55		
			Bot Cable Norm	22	10885.17		
			Bot Cable Tan	22	0.28		
		Base Beam	Max Tension	32	1160.68	-24.87	-0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	19	-19185.52	-27.67	0.00
			Max. My	14	-14648.32	-21.13	0.25
			Max. Vy	19	-19185.52	-27.67	0.00
			Max. Vx	14	175.80	-21.13	0.25

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Guy C @ 20.92 ft Elev 28 ft Azimuth 240 deg	Max. Vert	13	-1198.73	-320.28	190.87
	Max. H_x	13	-1198.73	-320.28	190.87
	Max. H_z	22	-24781.11	-14157.90	8166.43
	Min. Vert	22	-24781.11	-14157.90	8166.43
	Min. H_x	22	-24781.11	-14157.90	8166.43

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
	Min. H_z	13	-1198.73	-320.28	190.87
Guy B @ 19.5 ft Elev 28 ft Azimuth 120 deg	Max. Vert	7	-1430.94	363.60	214.18
	Max. H_x	32	-26224.50	14065.61	8122.20
	Max. H_z	32	-26224.50	14065.61	8122.20
	Min. Vert	32	-26224.50	14065.61	8122.20
	Min. H_x	7	-1430.94	363.60	214.18
	Min. H_z	7	-1430.94	363.60	214.18
Guy A @ 28.2 ft Elev 28 ft Azimuth 0 deg	Max. Vert	2	-660.97	0.93	-316.19
	Max. H_x	31	-9790.80	259.87	-8309.28
	Max. H_z	2	-660.97	0.93	-316.19
	Min. Vert	27	-19090.79	-6.78	-16539.54
	Min. H_x	23	-10077.48	-257.14	-8514.81
	Min. H_z	27	-19090.79	-6.78	-16539.54
Mast	Max. Vert	19	57501.32	-32.99	-955.31
	Max. H_x	6	43200.68	1086.25	-89.84
	Max. H_z	10	40173.49	11.92	776.94
	Max. M_x	1	0.00	-9.39	-55.03
	Max. M_z	1	0.00	-9.39	-55.03
	Max. Torsion	1	0.00	-9.39	-55.03
	Min. Vert	43	39854.92	-1.70	225.77
	Min. H_x	14	43923.10	-1126.55	-136.02
	Min. H_z	2	49192.22	-47.29	-1055.96
	Min. M_x	1	0.00	-9.39	-55.03
	Min. M_z	1	0.00	-9.39	-55.03
	Min. Torsion	1	0.00	-9.39	-55.03

Tower Mast Reaction Summary

Load Combination	Vertical lb	$Shear_x$ lb	$Shear_z$ lb	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	39926.88	9.39	55.03	0.00	0.00	0.00
Dead+Wind 0 deg - No Ice+Guy	49192.22	47.29	1055.96	0.00	0.00	0.00
Dead+Wind 30 deg - No Ice+Guy	45126.29	-540.91	864.43	0.00	0.00	0.00
Dead+Wind 45 deg - No Ice+Guy	42267.05	-790.33	717.08	0.00	0.00	0.00
Dead+Wind 60 deg - No Ice+Guy	41260.52	-990.95	497.61	0.00	0.00	0.00
Dead+Wind 90 deg - No Ice+Guy	43200.68	-1086.25	89.84	0.00	0.00	0.00
Dead+Wind 120 deg - No Ice+Guy	44770.25	-886.19	-293.29	0.00	0.00	0.00
Dead+Wind 135 deg - No Ice+Guy	43605.55	-708.35	-471.13	0.00	0.00	0.00
Dead+Wind 150 deg - No Ice+Guy	41777.35	-530.63	-638.14	0.00	0.00	0.00
Dead+Wind 180 deg - No Ice+Guy	40173.49	-11.92	-776.94	0.00	0.00	0.00
Dead+Wind 210 deg - No Ice+Guy	41901.93	516.11	-615.57	0.00	0.00	0.00
Dead+Wind 225 deg - No	43989.14	713.87	-442.20	0.00	0.00	0.00

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	lb	lb	lb	kip-ft	kip-ft	kip-ft
Ice+Guy Dead+Wind 240 deg - No Ice+Guy	45416.06	915.56	-260.62	0.00	0.00	0.00
Dead+Wind 270 deg - No Ice+Guy	43923.10	1126.55	136.02	0.00	0.00	0.00
Dead+Wind 300 deg - No Ice+Guy	41454.71	1049.00	546.72	0.00	0.00	0.00
Dead+Wind 315 deg - No Ice+Guy	42770.62	857.76	763.36	0.00	0.00	0.00
Dead+Wind 330 deg - No Ice+Guy	45790.24	620.43	908.50	0.00	0.00	0.00
Dead+Ice+Temp+Guy	48184.26	-10.70	23.82	0.00	0.00	0.00
Dead+Wind 0 deg+Ice+Temp+Guy	57501.32	32.99	955.31	0.00	0.00	0.00
Dead+Wind 30 deg+Ice+Temp+Guy	54155.32	-430.45	876.40	0.00	0.00	0.00
Dead+Wind 45 deg+Ice+Temp+Guy	52243.45	-648.33	696.92	0.00	0.00	0.00
Dead+Wind 60 deg+Ice+Temp+Guy	51398.87	-846.71	443.30	0.00	0.00	0.00
Dead+Wind 90 deg+Ice+Temp+Guy	52043.35	-1032.44	-0.96	0.00	0.00	0.00
Dead+Wind 120 deg+Ice+Temp+Guy	53217.16	-834.89	-246.83	0.00	0.00	0.00
Dead+Wind 135 deg+Ice+Temp+Guy	52028.49	-767.78	-414.06	0.00	0.00	0.00
Dead+Wind 150 deg+Ice+Temp+Guy	50663.50	-574.68	-501.17	0.00	0.00	0.00
Dead+Wind 180 deg+Ice+Temp+Guy	49752.81	-24.52	-572.47	0.00	0.00	0.00
Dead+Wind 210 deg+Ice+Temp+Guy	50840.45	544.33	-482.86	0.00	0.00	0.00
Dead+Wind 225 deg+Ice+Temp+Guy	52434.54	753.32	-387.92	0.00	0.00	0.00
Dead+Wind 240 deg+Ice+Temp+Guy	53818.74	841.63	-216.39	0.00	0.00	0.00
Dead+Wind 270 deg+Ice+Temp+Guy	52747.20	1059.07	42.02	0.00	0.00	0.00
Dead+Wind 300 deg+Ice+Temp+Guy	51730.65	889.63	501.05	0.00	0.00	0.00
Dead+Wind 315 deg+Ice+Temp+Guy	52678.71	694.81	758.66	0.00	0.00	0.00
Dead+Wind 330 deg+Ice+Temp+Guy	54708.44	485.51	920.19	0.00	0.00	0.00
Dead+Wind 0 deg - Service+Guy	40065.49	18.17	336.46	0.00	0.00	0.00
Dead+Wind 30 deg - Service+Guy	40064.09	-177.14	295.39	0.00	0.00	0.00
Dead+Wind 45 deg - Service+Guy	40054.93	-258.75	249.76	0.00	0.00	0.00
Dead+Wind 60 deg - Service+Guy	40038.52	-322.89	191.20	0.00	0.00	0.00
Dead+Wind 90 deg - Service+Guy	39986.69	-379.37	49.42	0.00	0.00	0.00
Dead+Wind 120 deg - Service+Guy	39926.37	-331.93	-91.61	0.00	0.00	0.00
Dead+Wind 135 deg - Service+Guy	39899.44	-270.34	-148.37	0.00	0.00	0.00
Dead+Wind 150 deg - Service+Guy	39878.03	-191.42	-191.97	0.00	0.00	0.00
Dead+Wind 180 deg -	39854.92	1.70	-225.77	0.00	0.00	0.00

Load Combination	Vertical lb	$Shear_x$ lb	$Shear_z$ lb	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Service+Guy Dead+Wind 210 deg - Service+Guy	39862.39	196.91	-184.24	0.00	0.00	0.00
Dead+Wind 225 deg - Service+Guy	39877.56	278.34	-137.44	0.00	0.00	0.00
Dead+Wind 240 deg - Service+Guy	39899.52	343.12	-78.18	0.00	0.00	0.00
Dead+Wind 270 deg - Service+Guy	39957.44	398.93	64.73	0.00	0.00	0.00
Dead+Wind 300 deg - Service+Guy	40014.63	350.83	204.28	0.00	0.00	0.00
Dead+Wind 315 deg - Service+Guy	40035.44	291.01	260.89	0.00	0.00	0.00
Dead+Wind 330 deg - Service+Guy	40050.12	211.82	303.27	0.00	0.00	0.00

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX lb	PY lb	PZ lb	PX lb	PY lb	PZ lb	% Error
1	-0.00	-9006.45	-0.00	-1.62	9006.72	-3.76	0.046%
2	-47.76	-9001.19	-11470.61	47.78	9001.08	11465.61	0.034%
3	5712.67	-8994.70	-9876.30	-5713.44	8994.65	9873.75	0.018%
4	8102.51	-8990.93	-8046.27	-8103.03	8990.91	8046.26	0.004%
5	9939.06	-8991.85	-5669.91	-9937.89	8991.83	5665.57	0.031%
6	11522.11	-9009.27	47.42	-11521.36	9009.24	-46.15	0.010%
7	10034.09	-9025.87	5779.93	-10029.55	9025.81	-5777.26	0.036%
8	8170.91	-9025.91	8115.16	-8165.87	9025.85	-8113.05	0.037%
9	5795.89	-9021.02	9925.60	-5790.48	9020.98	-9924.04	0.039%
10	47.76	-9011.71	11417.14	-48.19	9011.69	-11410.46	0.046%
11	-5712.67	-9018.20	9876.30	5706.17	9018.15	-9874.43	0.047%
12	-8102.51	-9021.97	8046.27	8098.09	9021.92	-8044.38	0.033%
13	-9985.25	-9021.18	5696.59	9980.90	9021.12	-5693.96	0.035%
14	-11522.11	-9003.63	-47.42	11520.47	9003.59	49.35	0.017%
15	-9987.79	-8987.03	-5753.20	9985.73	8987.00	5747.01	0.045%
16	-8170.91	-8987.00	-8115.16	8171.50	8986.97	8114.89	0.004%
17	-5795.89	-8991.88	-9925.60	5796.71	8991.82	9922.16	0.024%
18	-0.00	-14668.07	-0.00	-0.97	14668.08	-4.55	0.032%
19	-38.02	-14655.08	-12152.81	38.12	14654.88	12152.51	0.002%
20	5984.62	-14643.73	-10329.70	-5984.24	14643.61	10330.68	0.006%
21	8465.74	-14637.34	-8401.20	-8465.77	14637.31	8401.40	0.001%
22	10359.98	-14639.78	-5911.80	-10360.02	14639.74	5911.85	0.000%
23	12061.96	-14673.86	37.39	-12062.45	14673.77	-38.18	0.005%
24	10637.49	-14706.27	6115.92	-10638.10	14706.18	-6116.52	0.004%
25	8521.21	-14706.90	8457.56	-8521.78	14706.83	-8457.95	0.004%
26	6051.45	-14698.20	10370.67	-6051.87	14698.15	-10370.34	0.003%
27	38.02	-14681.06	11878.49	-38.42	14681.05	-11876.00	0.013%
28	-5984.62	-14692.41	10329.70	5985.31	14692.36	-10329.72	0.004%
29	-8465.74	-14698.80	8401.20	8466.26	14698.73	-8401.52	0.003%
30	-10597.54	-14696.36	6048.96	10598.19	14696.26	-6049.46	0.004%
31	-12061.96	-14662.28	-37.39	12062.56	14662.18	36.45	0.006%
32	-10399.92	-14629.87	-5978.76	10400.04	14629.83	5978.88	0.001%
33	-8521.21	-14629.24	-8457.56	8521.16	14629.20	8457.74	0.001%
34	-6051.45	-14637.94	-10370.67	6051.10	14637.80	10371.60	0.005%
35	-16.53	-9004.63	-3969.07	16.14	9004.63	3959.99	0.092%
36	1976.70	-9002.39	-3417.41	-1973.01	9002.38	3409.72	0.087%
37	2803.64	-9001.08	-2784.18	-2798.45	9001.07	2777.22	0.088%

Load Comb.	Sum of Applied Forces PX lb	PY lb	PZ lb	Sum of Reactions PX lb	PY lb	PZ lb	% Error
38	3439.12	-9001.40	-1961.91	-3435.56	9001.39	1959.16	0.046%
39	3986.89	-9007.43	16.41	-3982.34	9007.42	-17.14	0.047%
40	3472.00	-9013.17	1999.98	-3465.10	9013.16	-1997.95	0.073%
41	2827.31	-9013.18	2808.02	-2822.15	9013.17	-2805.37	0.059%
42	2005.50	-9011.49	3434.46	-2002.05	9011.48	-3431.63	0.045%
43	16.53	-9008.27	3950.57	-16.74	9008.27	-3947.62	0.030%
44	-1976.70	-9010.52	3417.41	1972.82	9010.51	-3414.53	0.049%
45	-2803.64	-9011.82	2784.18	2797.93	9011.81	-2781.43	0.064%
46	-3455.14	-9011.51	1971.16	3447.30	9011.50	-1969.08	0.082%
47	-3986.89	-9005.48	-16.41	3981.44	9005.47	15.36	0.056%
48	-3455.98	-8999.73	-1990.73	3451.43	8999.73	1987.57	0.056%
49	-2827.31	-8999.72	-2808.02	2823.57	8999.72	2804.23	0.054%
50	-2005.50	-9001.41	-3434.46	2002.68	9001.41	3430.38	0.050%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	8	0.00000001	0.00035653
2	Yes	19	0.00099933	0.00041613
3	Yes	18	0.00089156	0.00039892
4	Yes	20	0.00094964	0.00042282
5	Yes	9	0.00065246	0.00041157
6	Yes	16	0.00099062	0.00038687
7	Yes	15	0.00090966	0.00022501
8	Yes	14	0.00091239	0.00017392
9	Yes	12	0.00094387	0.00017136
10	Yes	6	0.00093289	0.00047262
11	Yes	12	0.00097364	0.00021633
12	Yes	15	0.00081862	0.00017623
13	Yes	16	0.00088024	0.00026963
14	Yes	16	0.00095347	0.00046857
15	Yes	9	0.00091349	0.00066192
16	Yes	19	0.00092019	0.00045640
17	Yes	18	0.00087085	0.00040597
18	Yes	5	0.00000001	0.00022635
19	Yes	23	0.00088210	0.00091590
20	Yes	30	0.00094805	0.00067415
21	Yes	25	0.00097449	0.00041124
22	Yes	26	0.00097436	0.00043850
23	Yes	37	0.00090088	0.00051736
24	Yes	29	0.00097480	0.00061661
25	Yes	34	0.00095507	0.00049716
26	Yes	50	0.00091927	0.00033919
27	Yes	9	0.00000001	0.00022801
28	Yes	46	0.00091578	0.00036255
29	Yes	33	0.00084491	0.00048064
30	Yes	28	0.00087755	0.00062744
31	Yes	32	0.00097423	0.00063199
32	Yes	23	0.00098816	0.00052148
33	Yes	23	0.00099798	0.00046219
34	Yes	28	0.00094213	0.00074687
35	Yes	5	0.00000001	0.00044684
36	Yes	5	0.00000001	0.00050988
37	Yes	5	0.00000001	0.00057999
38	Yes	6	0.00000001	0.00042740

39	Yes	6	0.00000001	0.00044247
40	Yes	5	0.00000001	0.00050613
41	Yes	5	0.00000001	0.00038862
42	Yes	5	0.00000001	0.00028903
43	Yes	5	0.00000001	0.00020416
44	Yes	5	0.00000001	0.00032346
45	Yes	5	0.00000001	0.00044033
46	Yes	5	0.00000001	0.00057904
47	Yes	6	0.00000001	0.00052625
48	Yes	6	0.00000001	0.00051516
49	Yes	6	0.00000001	0.00046504
50	Yes	6	0.00000001	0.00039810

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	92 - 87	0.829	48	0.0381	0.0513
T2	87 - 67	0.788	48	0.0368	0.0462
T3	67 - 47	0.624	48	0.0628	0.0814
T4	47 - 27	0.227	49	0.0757	0.0906

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
91.00	17' x 3" Dia Omni	48	0.820	0.0376	0.0498	24245
81.25	Guy	48	0.751	0.0408	0.0491	76712
80.00	3' Pipe Brace	48	0.744	0.0423	0.0509	105126
76.50	8' x 3" Dia Omni	48	0.722	0.0476	0.0572	28375
69.00	21-ft 8-Bay Dipole	48	0.652	0.0599	0.0773	11360
63.50	DB844G65ZAXY	49	0.566	0.0667	0.0864	13274
62.50	Rohn 6' x 12' Boom Gate (1)	49	0.547	0.0676	0.0874	14652
56.00	DC6-48-60-18-8F Surge Arrestor	49	0.412	0.0719	0.0905	49881
54.50	(2) AM-X-CD-16-65-00T-RET(72")	49	0.379	0.0726	0.0907	83962
46.92	Guy	49	0.226	0.0757	0.0906	14277

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	92 - 87	3.036	19	0.1806	0.1805
T2	87 - 67	2.844	19	0.1760	0.1721
T3	67 - 47	2.110	19	0.2307	0.2935
T4	47 - 27	0.848	2	0.2580	0.3133

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
91.00	17' x 3" Dia Omni	19	2.996	0.1793	0.1762	9181
81.25	Guy	19	2.654	0.1836	0.1892	42780
80.00	3' Pipe Brace	19	2.615	0.1869	0.1986	48360
76.50	8' x 3" Dia Omni	19	2.502	0.1980	0.2265	10361
69.00	21-ft 8-Bay Dipole	19	2.209	0.2246	0.2824	3993
63.50	DB844G65ZAXY	2	1.909	0.2389	0.3069	4606
62.50	Rohn 6' x 12' Boom Gate (1)	2	1.851	0.2408	0.3095	5125
56.00	DC6-48-60-18-8F Surge Arrestor	2	1.432	0.2492	0.3162	21860
54.50	(2) AM-X-CD-16-65-00T-RET(72")	2	1.331	0.2504	0.3161	20392
46.92	Guy	2	0.843	0.2583	0.3132	4851

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt lb	Allowable Load lb	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	92	Leg	A325N	0.875	1	1651.62	26457.50	0.062 ✔	1.333	Bolt Tension
T2	87	Leg	A325N	0.875	1	2544.32	26449.80	0.096 ✔	1.333	Bolt Tension
T3	67	Leg	A325N	0.875	1	7379.31	26392.60	0.280 ✔	1.333	Bolt Tension
T4	47	Leg	A325N	0.875	1	11261.50	24632.10	0.457 ✔	1.333	Bolt Tension

Guy Design Data

Section No.	Elevation ft	Size	Initial Tension lb	Breaking Load lb	Actual T lb	Allowable T_a lb	Required S.F.	Actual S.F.
T2	81.25 (A) (244)	9/16 EHS	3500.00	35000.04	6822.03	17500.00	2.000	5.130 ✔
	81.25 (A) (245)	9/16 EHS	3500.00	35000.04	6654.35	17500.00	2.000	5.260 ✔
	81.25 (B) (238)	9/16 EHS	3500.00	35000.04	7952.98	17500.00	2.000	4.401 ✔
	81.25 (B) (239)	9/16 EHS	3500.00	35000.04	7918.07	17500.00	2.000	4.420 ✔
	81.25 (C) (232)	9/16 EHS	3500.00	35000.04	7624.39	17500.00	2.000	4.591 ✔
	81.25 (C) (233)	9/16 EHS	3500.00	35000.04	7827.72	17500.00	2.000	4.471 ✔
T4	46.92 (A) (252)	3/4 EHS	5830.00	58299.91	12711.70	29150.00	2.000	4.586 ✔
	46.92 (B) (251)	3/4 EHS	5830.00	58299.91	15880.30	29150.00	2.000	3.671 ✔
	46.92 (C) (250)	3/4 EHS	5830.00	58299.91	15153.60	29150.00	2.000	3.847 ✔

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	Mast Stability Index	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	1 3/4	5.00	2.46	67.4 K=1.00	1.00	21.409	2.405	-2826.49	51495.40	0.055 ✓
T2	87 - 67	1 3/4	20.00	2.83	77.7 K=1.00	1.00	19.465	2.405	-22505.20	46819.90	0.481 ✓
T3	67 - 47	1 3/4	20.00	2.83	77.7 K=1.00	1.00	19.465	2.405	-32312.50	46819.90	0.690 ✓
T4	47 - 27	1 3/4	20.00	2.85	78.0 K=1.00	1.00	19.401	2.405	-32313.30	46665.30	0.692 ✓

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	1/2	3.51	1.65	79.2 K=0.50	15.440	0.196	-670.32	3031.57	0.221 ✓
T2	87 - 67	1/2	3.78	1.78	82.5 K=0.48	15.073	0.196	-1797.69	2959.56	0.607 ✓
T3	67 - 47	1/2	3.78	1.78	82.5 K=0.48	15.073	0.196	-3701.77	2959.56	1.251 ✓
T4	47 - 27	1/2	3.79	1.78	82.6 K=0.48	15.063	0.196	-1640.56	2957.62	0.555 ✓

Horizontal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	L1 1/4x1 1/4x3/16	2.50	2.35	118.0 K=1.02	10.571	0.434	-25.40	4583.43	0.006 ✓
T2	87 - 67	L1 1/4x1 1/4x3/16	2.50	2.35	118.0 K=1.02	10.571	0.434	-912.35	4583.43	0.199 ✓
T3	67 - 47	L1 1/4x1 1/4x3/16	2.50	2.35	118.0 K=1.02	10.571	0.434	-663.42	4583.43	0.145 ✓

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 lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	L1 1/4x1 1/4x3/16	2.50	2.35	118.0 K=1.02	10.571	0.434	-34.39	4583.43	0.008 ✔
T2	87 - 67	L1 1/4x1 1/4x3/16	2.50	2.35	118.0 K=1.02	10.571	0.434	-29.33	4583.43	0.006 ✔

Bottom Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	L1 1/4x1 1/4x3/16	2.50	2.35	118.0 K=1.02	10.571	0.434	-40.51	4583.43	0.009 ✔
T2	87 - 67	L1 1/4x1 1/4x3/16	2.50	2.35	118.0 K=1.02	10.571	0.434	-94.44	4583.43	0.021 ✔

Torque-Arm Bottom Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T2	87 - 67 (236)	L3x3x1/4	2.50	2.43	84.6 K=1.72	14.836	1.440	-5597.99	21363.20	0.262 ✔
T2	87 - 67 (237)	L3x3x1/4	2.50	2.43	84.6 K=1.72	14.836	1.440	-5014.23	21363.20	0.235 ✔
T2	87 - 67 (242)	L3x3x1/4	2.50	2.43	84.6 K=1.72	14.836	1.440	-6074.46	21363.20	0.284 ✔
T2	87 - 67 (243)	L3x3x1/4	2.50	2.43	84.6 K=1.72	14.836	1.440	-5951.91	21363.20	0.279 ✔
T2	87 - 67 (248)	L3x3x1/4	2.50	2.43	84.6 K=1.72	14.836	1.440	-5774.82	21363.20	0.270 ✔
T2	87 - 67 (249)	L3x3x1/4	2.50	2.43	84.6 K=1.72	14.836	1.440	-4996.26	21363.20	0.234 ✔

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 lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	1 3/4	5.00	2.46	67.4	30.000	2.405	2545.14	72158.50	0.035 ✔

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T2	87 - 67	1 3/4	20.00	2.83	77.7	30.000	2.405	7379.99	72158.50	0.102 ✔
T3	67 - 47	1 3/4	20.00	2.83	77.7	30.000	2.405	11262.80	72158.50	0.156 ✔
T4	47 - 27	1 3/4	20.00	2.85	78.0	30.000	2.405	11261.50	72158.50	0.156 ✔

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	1/2	3.51	1.65	158.5	21.600	0.196	649.67	4241.15	0.153 ✔
T2	87 - 67	1/2	3.78	1.78	170.8	21.600	0.196	1309.33	4241.15	0.309 ✔
T3	67 - 47	1/2	3.78	1.78	170.8	21.600	0.196	3210.17	4241.15	0.757 ✔
T4	47 - 27	1/2	3.79	1.78	171.2	21.600	0.196	596.41	4241.15	0.141 ✔

Horizontal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	40.18	9365.63	0.004 ✔
T2	87 - 67	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	1386.18	9365.63	0.148 ✔
T3	67 - 47	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	1395.29	9365.63	0.149 ✔
T4	47 - 27	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	768.28	9365.63	0.082* ✔

* DL controls

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 lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	35.92	9365.63	0.004 ✔

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T2	87 - 67	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	27.01	9365.63	0.003 ✔
T3	67 - 47	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	251.14	9365.63	0.027 ✔
T4	47 - 27	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	4145.78	9365.63	0.443 ✔

Bottom Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T1	92 - 87	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	44.31	9365.63	0.005 ✔
T2	87 - 67	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	436.56	9365.63	0.047 ✔
T3	67 - 47	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	998.01	9365.63	0.107* ✔
T4	47 - 27	L1 1/4x1 1/4x3/16	2.50	2.35	75.0	21.600	0.434	51.08	9365.63	0.005 ✔

* DL controls

Torque-Arm Top Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T2	87 - 67 (234)	L2x2x5/16	3.78	3.67	73.2	21.600	1.150	7840.74	24840.00	0.316 ✔
T2	87 - 67 (235)	L2x2x5/16	3.78	3.67	73.2	21.600	1.150	6889.94	24840.00	0.277 ✔
T2	87 - 67 (240)	L2x2x5/16	3.78	3.67	73.2	21.600	1.150	8212.05	24840.00	0.331 ✔
T2	87 - 67 (241)	L2x2x5/16	3.78	3.67	73.2	21.600	1.150	7602.78	24840.00	0.306 ✔
T2	87 - 67 (246)	L2x2x5/16	3.78	3.67	73.2	21.600	1.150	8057.12	24840.00	0.324 ✔
T2	87 - 67 (247)	L2x2x5/16	3.78	3.67	73.2	21.600	1.150	6574.71	24840.00	0.265 ✔

Torque-Arm Bottom Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P lb	Allow. P_a lb	Ratio $\frac{P}{P_a}$
T2	87 - 67 (236)	L3x3x1/4	2.50	2.43	31.3	21.600	1.440	492.05	31104.00	0.016 ✔
T2	87 - 67 (237)	L3x3x1/4	2.50	2.43	31.3	21.600	1.440	300.08	31104.00	0.010 ✔
T2	87 - 67 (242)	L3x3x1/4	2.50	2.43	31.3	21.600	1.440	147.26	31104.00	0.005 ✔
T2	87 - 67 (243)	L3x3x1/4	2.50	2.43	31.3	21.600	1.440	85.21	31104.00	0.003 ✔
T2	87 - 67 (248)	L3x3x1/4	2.50	2.43	31.3	21.600	1.440	369.23	31104.00	0.012 ✔
T2	87 - 67 (249)	L3x3x1/4	2.50	2.43	31.3	21.600	1.440	61.80	31104.00	0.002 ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	$SF*P_{allow}$ lb	% Capacity	Pass Fail
T1	92 - 87	Leg	1 3/4	3	-2826.49	68643.36	4.1 4.7 (b)	Pass
T2	87 - 67	Leg	1 3/4	27	-22505.20	62410.92	36.1	Pass
T3	67 - 47	Leg	1 3/4	96	-32312.50	62410.92	51.8	Pass
T4	47 - 27	Leg	1 3/4	165	-32313.30	62204.84	51.9	Pass
T1	92 - 87	Diagonal	1/2	13	-670.32	4041.08	16.6	Pass
T2	87 - 67	Diagonal	1/2	70	-1797.69	3945.09	45.6	Pass
T3	67 - 47	Diagonal	1/2	112	-3701.77	3945.09	93.8	Pass
T4	47 - 27	Diagonal	1/2	218	-1640.56	3942.51	41.6	Pass
T1	92 - 87	Horizontal	L1 1/4x1 1/4x3/16	18	-25.40	6109.71	0.4	Pass
T2	87 - 67	Horizontal	L1 1/4x1 1/4x3/16	85	-912.35	6109.71	14.9	Pass
T3	67 - 47	Horizontal	L1 1/4x1 1/4x3/16	156	1395.29	12484.38	11.2	Pass
T4	47 - 27	Horizontal	L1 1/4x1 1/4x3/16	180	768.28	9365.63	8.2	Pass
T1	92 - 87	Top Girt	L1 1/4x1 1/4x3/16	6	-34.39	6109.71	0.6	Pass
T2	87 - 67	Top Girt	L1 1/4x1 1/4x3/16	30	-29.33	6109.71	0.5	Pass
T3	67 - 47	Top Girt	L1 1/4x1 1/4x3/16	97	251.14	12484.38	2.0	Pass
T4	47 - 27	Top Girt	L1 1/4x1 1/4x3/16	166	4145.78	12484.38	33.2	Pass
T1	92 - 87	Bottom Girt	L1 1/4x1 1/4x3/16	9	-40.51	6109.71	0.7	Pass
T2	87 - 67	Bottom Girt	L1 1/4x1 1/4x3/16	33	436.56	12484.38	3.5	Pass
T3	67 - 47	Bottom Girt	L1 1/4x1 1/4x3/16	102	998.01	9365.63	10.7	Pass
T4	47 - 27	Bottom Girt	L1 1/4x1 1/4x3/16	169	51.08	12484.38	0.4	Pass
T2	87 - 67	Guy A@81.25	9/16	244	6822.03	17500.00	39.0	Pass
T4	47 - 27	Guy A@46.9167	3/4	252	12711.70	29150.00	43.6	Pass
T2	87 - 67	Guy B@81.25	9/16	238	7952.98	17500.00	45.4	Pass
T4	47 - 27	Guy B@46.9167	3/4	251	15880.30	29150.00	54.5	Pass
T2	87 - 67	Guy C@81.25	9/16	233	7827.72	17500.00	44.7	Pass
T4	47 - 27	Guy C@46.9167	3/4	250	15153.60	29150.00	52.0	Pass
T2	87 - 67	Torque Arm Top@81.25	L2x2x5/16	240	8212.05	33111.72	24.8	Pass
T2	87 - 67	Torque Arm Bottom@81.25	L3x3x1/4	242	-6074.46	28477.14	21.3	Pass
						Summary		
						Leg (T4)	51.9	Pass
						Diagonal (T3)	93.8	Pass
						Horizontal (T2)	14.9	Pass
						Top Girt	33.2	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	$SF*P_{allow}$ lb	% Capacity	Pass Fail
						(T4) Bottom Girt (T3)	10.7	Pass
						Guy A (T4)	43.6	Pass
						Guy B (T4)	54.5	Pass
						Guy C (T4)	52.0	Pass
						Torque Arm Top (T2)	24.8	Pass
						Torque Arm Bottom (T2)	21.3	Pass
						Bolt Checks	34.3	Pass
						RATING =	**93.8**	**Pass**

CENTEK engineering
Centered on Solutions
(203) 488-0580
(203) 488-8587

Subject: GUY ANCHOR ANALYSIS

Location: 65-ft Guyed Lattice Tower, Hamden, CT

Rev. 1: 5/29/15

Prepared by: Staff. Checked by: C.F.C.
Job No. 15001.035

Guy Anchor Connection Bolts Capacity Check:

Input Data:

Guy Anchor Reactions:

NOTE: Analysis considers a single 5/8" dia thru bolt at anchor rod connection to anchor plate as critical failure point. (Existing anchor steel connection to existing structure considered adequate by inspection).

Guy Anchor B @ 19.5ft:

Horz Force (H) = $Fh := 16.3 \cdot kips$ (Input From tnxTower)

Vertical Force (V)= $Fv := 26.2 \cdot kips$ (Input From tnxTower)

Resultant Force (R) = $Fr := 30.9 kips$ (Input From tnxTower)

Guy Anchor B Connection Bolt Data:

Use ASTM A325 Steel

Bolt Ultimate Strength = $F_u := 120 \cdot ksi$ (ASD 9th Ed)

Bolt Yield Strength= $F_y := 92 \cdot ksi$ (User Input)

Diameter of Bolt = $D := 0.625 \cdot in$ (User Input)

Calculated Bolt Properties:

Gross Area of Bolt = $A_g := \frac{\pi}{4} \cdot D^2 = 0.307 \cdot in^2$

Number of Shear Planes = $N_{sp} := 6$ (3 Bolts in Double Shear Considered)

Check Anchor Connection Bolt Shear Force:

Maximum Shear Stress in 1 Bolt = $f_v := \frac{Fr}{(A_g \cdot N_{sp})}$ $f_v = 16.79 \cdot ksi$

Bolt Allowable Shear Stress:

$F_v := 21.0 ksi$ Ref Table I-D, pg 4-5 ASD 9th Ed)

Note: (Allowable shear stress may be increased by 1.333 under transient loading per Section A5.2, ASD 9th Ed)

Condition1 = $Condition1 := if\left(\frac{f_v}{F_v} \le 1.00, "OK", "Overstressed"\right)$

$\frac{f_v}{F_v} = 0.8$

Condition1 = "OK"

SITE NAME	HAMDEN 2 CT	ECP & CELL #	2	0058
Note: PCS carrier add, 700 RRH and additional 1 fiber+distribution box for leasing only.		LATITUDE	41-22-12.70 N	
		LONGITUDE	72-55-53.40 W	
		STRUCTURE TYPE	Lattice on Roof	

700 MHz LTE - CURRENT CONFIG	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	LTE-700U eNodeB	LTE-700U eNodeB	LTE-700U eNodeB
ANTENNA TYPE	BXA-70063-6CF-750MHZ	BXA-70040-6CF-EDIN-4	BXA-70063-6CF-750MHZ
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	0	160	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	63,5	63,5	63,5
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
RRH - QTY/MODEL			
SECTOR DISTRIBUTION BOX			
MAIN DISTRIBUTION BOX			

700 MHz LTE - FUTURE CONFIG	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	LTE-700U eNodeB	LTE-700U eNodeB	LTE-700U eNodeB
ANTENNA TYPE	LNX-6514DS-A1M_0DT_750MHZ	X7C-FRO0640-V-04	LNX-6514DS-A1M_4DT_750MHZ
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	0	120	220
DOWN TILT (MECH/DEG)	0	4 EDT / 0 MDT	0
RAD CTR (FT AGL)	63,5	63,5	63,5
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			
RRH - QTY/MODEL	1 ALU RH_2X60-700	1 ALU RH_2X60-700	1 ALU RH_2X60-700
SECTOR DISTRIBUTION BOX			
MAIN DISTRIBUTION BOX	1		DB-T1-6Z-8AB-0Z

850 MHz CELLULAR - CURRENT CONFIG	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Mod 4.0B	Cellular Mod 4.0B	Cellular Mod 4.0B
ANTENNA TYPE	DB844G65ZAXY_H	APL866513	DB844G65ZAXY_H
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	2	2	4
RAD CTR (FT AGL)	63,5	63,5	63,5
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

850 MHz CELLULAR - FUTURE CONFIG	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	Cellular Mod 4.0B	Cellular Mod 4.0B	Cellular Mod 4.0B
ANTENNA TYPE	DB844G65ZAXY_H	APL866513	DB844G65ZAXY_H
QTY OF ANTENNAS PER FACE	2	2	2
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	2	2	4
RAD CTR (FT AGL)	63,5	63,5	63,5
TMA - QTY / MODEL			
DIPLEXER - QTY / MODEL			

1900 MHz PCS - CURRENT CONFIG	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	PCS Mod 4.0B	PCS Mod 4.0B	PCS Mod 4.0B
ANTENNA TYPE	BXA-171063-12CF-EDIN-2	BXA-171063-12CF-EDIN-2	BXA-171063-12CF-EDIN-2
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	30	150	270
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	63,5	63,5	63,5
TMA - QTY / MODEL			
DIPLEX WITH CELLULAR CABLE			
RRH - QTY / MODEL			
SECTOR DISTRIBUTION BOX			
MAIN DISTRIBUTION BOX			

1900 MHz PCS - FUTURE CONFIG	ALPHA	BETA	GAMMA
EQUIPMENT TYPE	LTE-PCS BBU+RRH	LTE-PCS BBU+RRH	LTE-PCS BBU+RRH
ANTENNA TYPE	SBNHH-1D65B_01DT	SBNHH-1D45B_04DT	SBNHH-1D65B_03DT
QTY OF ANTENNAS PER FACE	1	1	1
ORIENTATION (DEG)	0	120	220
DOWN TILT (MECH/DEG)	0	0	0
RAD CTR (FT AGL)	63,5	63,5	63,5
TMA - QTY / MODEL			
DIPLEX WITH CELLULAR CABLE			
RRH - QTY / MODEL	1 ALU RH_2X60-PCS	1 ALU RH_2X60-PCS	1 ALU RH_2X60-PCS
SECTOR DISTRIBUTION BOX			
MAIN DISTRIBUTION BOX			

2100 MHz AWS - CURRENT CONFIG	ALPHA		BETA		GAMMA	
EQUIPMENT TYPE	LTE-AWS BBU+RRH		LTE-AWS BBU+RRH		LTE-AWS BBU+RRH	
ANTENNA TYPE	BXA-171063-12CF-EDIN-2		BXA-171063-12CF-EDIN-2		BXA-171063-12CF-EDIN-2	
QTY OF ANTENNAS PER FACE	1		1		1	
ORIENTATION (DEG)	30		150		270	
DOWN TILT (MECH/DEG)	1		0		2	
RAD CTR (FT AGL)	63.5		63.5		63.5	
TMA - QTY / MODEL						
DIPLEX WITH LTE-700 CABLE						
RRH - QTY / MODEL	1	ALU RH_2X40-AWS	1	ALU RH_2X40-AWS	1	ALU RH_2X40-AWS
SECTOR DISTRIBUTION BOX						
MAIN DISTRIBUTION BOX	1		DB-T1-6Z-8AB-0Z			

2100 MHz AWS - FUTURE CONFIG	ALPHA		BETA		GAMMA	
EQUIPMENT TYPE	LTE-AWS BBU+RRH		LTE-AWS BBU+RRH		LTE-AWS BBU+RRH	
ANTENNA TYPE	HBXX-6517DS-A2M_PORT 3 - +45_02DT_2110		HBXX-6517DS-A2M_PORT 3 - +45_02DT_2110		HBXX-6517DS-A2M_PORT 3 - +45_04DT_2110	
QTY OF ANTENNAS PER FACE	1		1		1	
ORIENTATION (DEG)	0		120		220	
DOWN TILT (MECH/DEG)	0		0		0	
RAD CTR (FT AGL)	63.5		63.5		63.5	
TMA - QTY / MODEL						
DIPLEX WITH LTE-700 CABLE						
RRH - QTY / MODEL	1	ALU RH_2X60-AWS	1	ALU RH_2X60-AWS	1	ALU RH_2X60-AWS
SECTOR DISTRIBUTION BOX						
MAIN DISTRIBUTION BOX	1		DB-T1-6Z-8AB-0Z			

NUMBER OF CABLES NEEDED				FIBER LINES MODEL NUMBER					
TOTAL # FIBER LINES	2	TOTAL # OF MAINLINES	12	FIBER LINE MODEL #			HB158-1-08U8-S8J18		
TOTAL # TOP JUMPERS	6	TOTAL # OF TOP JUMPERS	24	FIBER TOP JUMPER MODEL #			HB114-1-08U4-S4J18		
EQUIPMENT CABLE ORDERING		MAIN CABLE #	18	+	-6	TOP JUMPER #	24	+	0

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 MHz	TX: 746-757 MHz	PCS (Watts)	16
RX: 824-835/845-846.5 MHz	RX: 1890-1895/1745-1755 MHz	RX: 776-787 MHz	LTE/AWS/PCS (Watts)	40/60/60

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

RF ENGINEER	RF MANAGER	INITIALS	DATE
Prepared by: Jaime Laredo	Robert Hesselbach	JL	4/22/2015

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

HBXX-6517DS-VTM

Andrew® Quad Port Teletilt® Antenna, 1710–2180 MHz, 65° horizontal beamwidth, RET compatible

- Superior azimuth tracking and pattern symmetry with excellent passive intermodulation suppression
- The values presented on this datasheet have been calculated based on N-P-BASTA White Paper version 9.6 by the NGMN Alliance

Electrical Specifications

Frequency Band, MHz	**1710–1880**	**1850–1990**	**1920–2180**
Gain by all Beam Tilts, average, dBi	18.5	18.6	18.8
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.3	±0.4
Gain by Beam Tilt, average, dBi	0 ° | 18.4 3 ° | 18.7 6 ° | 18.4	0 ° | 18.4 3 ° | 18.7 6 ° | 18.5	0 ° | 18.7 3 ° | 18.9 6 ° | 18.6
Beamwidth, Horizontal, degrees	67	66	65
Beamwidth, Horizontal Tolerance, degrees	±2.4	±1.7	±2.9
Beamwidth, Vertical, degrees	5.0	4.7	4.4
Beamwidth, Vertical Tolerance, degrees	±0.3	±0.3	±0.3
Beam Tilt, degrees	0–6	0–6	0–6
USLS, dB	18	19	19
Front-to-Back Total Power at 180° ± 30°, dB	25	26	26
CPR at Boresight, dB	22	23	22
CPR at Sector, dB	10	10	9
Isolation, dB	30	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350
Polarization	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol® single band, quad
Band	Single band
Brand	DualPol® | Teletilt®
Operating Frequency Band	1710 – 2180 MHz
Number of Ports, all types	4

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Low loss circuit board
Radome Material	PVC, UV resistant
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom

Product Specifications

HBXX-6517DS-VTM

RF Connector Quantity, total	4
Wind Loading, maximum	668.0 N @ 150 km/h 150.2 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph

Dimensions

Depth	166.0 mm | 6.5 in
Length	1903.0 mm | 74.9 in
Width	305.0 mm | 12.0 in
Net Weight	19.5 kg | 43.0 lb

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 1.1 Actuator	HBXX-6517DS-R2M
Model with Factory Installed AISG 2.0 Actuator	HBXX-6517DS-A2M
RET System	Teletilt®

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

Included Products

600899A-2 — Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Kit contains one scissor top bracket set and one bottom bracket set.

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

LNX-6514DS-VTM

Andrew® Antenna, 698–896 MHz, 65° horizontal beamwidth, RET compatible

- Great solution to maximize network coverage and capacity
- Excellent gain, VSWR, front-to-back ratio, and PIM specifications for robust network performance
- Ideal choice for site collocations and tough zoning restrictions
- Excellent solution for site sharing and maximizing capacity
- Fully compatible with Andrew remote electrical tilt system for greater OpEx savings
- The RF connectors are designed for IP67 rating and the radome for IP56 rating

Electrical Specifications

Frequency Band, MHz	**698–806**	**806–896**
Gain, dBi	15.7	16.3
Beamwidth, Horizontal, degrees	65	65
Beamwidth, Horizontal Tolerance, degrees	±3	±3
Beamwidth, Vertical, degrees	12.5	11.2
Beam Tilt, degrees	0–10	0–10
USLS, typical, dB	17	18
Front-to-Back Ratio at 180°, dB	32	30
CPR at Boresight, dB	20	20
CPR at Sector, dB	10	10
Isolation, dB	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153
Input Power per Port, maximum, watts	400	400
Polarization	±45°	±45°
Impedance	50 ohm	50 ohm

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol®
Band	Single band
Brand	DualPol® | Teletilt®
Operating Frequency Band	698 – 896 MHz

Mechanical Specifications

Color	Light gray
Connector Interface	7-16 DIN Female
Connector Location	Bottom
Connector Quantity, total	2
Lightning Protection	dc Ground
Radiator Material	Aluminum
Radome Material	Fiberglass, UV resistant
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241.0 km/h | 149.8 mph

Product Specifications

LNX-6514DS-VTM

Dimensions

Depth	181.0 mm | 7.1 in
Length	1847.0 mm | 72.7 in
Width	301.0 mm | 11.9 in
Net Weight	17.6 kg | 38.8 lb

Remote Electrical Tilt (RET) Information

Model with Factory Installed AISG 1.1 Actuator	LNX-6514DS-R2M
Model with Factory Installed AISG 2.0 Actuator	LNX-6514DS-A1M
RET System	Teletilt®

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

Included Products

DB380 — Pipe Mounting Kit for 2.4"-4.5" (60-115mm) OD round members on wide panel antennas. Includes 2 clamp sets and double nuts.

DB5083 — Downtilt Mounting Kit for 2.4"-4.5" (60 - 115 mm) OD round members. Includes a heavy-duty, galvanized steel downtilt mounting bracket assembly and associated hardware. This kit is compatible with the DB380 pipe mount kit for panel antennas that are equipped with two mounting brackets.

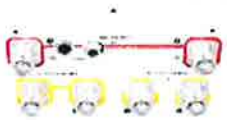
Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

SBNHH-1D65B

Andrew® Tri-band Antenna, 698–896 and 2 x 1710–2360 MHz, 65° horizontal beamwidth, internal RET. Both high bands share the same electrical tilt.



- Interleaved dipole technology providing for attractive, low wind load mechanical package

Electrical Specifications

Frequency Band, MHz	698–806	806–896	1710–1880	1850–1990	1920–2180	2300–2360
Gain, dBi	14.9	14.7	17.7	18.2	18.6	18.6
Beamwidth, Horizontal, degrees	68	66	69	66	63	58
Beamwidth, Vertical, degrees	12.1	10.7	5.6	5.2	5.0	4.5
Beam Tilt, degrees	0–14	0–14	0–7	0–7	0–7	0–7
USLS, dB	14	13	15	15	15	13
Front-to-Back Ratio at 180°, dB	27	29	28	28	28	27
CPR at Boresight, dB	20	23	20	20	17	21
CPR at Sector, dB	14	10	12	10	9	1
Isolation, dB	25	25	25	25	25	25
Isolation, Intersystem, dB	30	30	30	30	30	30
VSWR | Return Loss, dB	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350	350	350	300
Polarization	±45°	±45°	±45°	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm

Electrical Specifications, BASTA*

Frequency Band, MHz	698–806	806–896	1710–1880	1850–1990	1920–2180	2300–2360
Gain by all Beam Tilts, average, dBi	14.5	14.3	17.4	17.9	18.2	18.3
Gain by all Beam Tilts Tolerance, dB	±0.5	±0.8	±0.4	±0.3	±0.5	±0.3
Gain by Beam Tilt, average, dBi	0 ° | 14.6	0 ° | 14.5	0 ° | 17.4	0 ° | 17.8	0 ° | 18.1	0 ° | 18.2
	7 ° | 14.6	7 ° | 14.4	3 ° | 17.5	3 ° | 17.9	3 ° | 18.3	3 ° | 18.4
	14 ° | 14.2	14 ° | 13.6	7 ° | 17.4	7 ° | 17.9	7 ° | 18.2	7 ° | 18.4
Beamwidth, Horizontal Tolerance, degrees	±2.2	±3.4	±2	±4.6	±5.7	±4.3
Beamwidth, Vertical Tolerance, degrees	±0.8	±1	±0.3	±0.2	±0.3	±0.2
USLS, dB	16	14	16	16	16	15
Front-to-Back Total Power at 180° ± 30°, dB	25	26	27	26	26	26
CPR at Boresight, dB	22	23	21	20	20	22
CPR at Sector, dB	13	11	16	12	11	4

* CommScope® supports NGMN recommendations on Base Station Antenna Standards (BASTA). To learn more about the benefits of BASTA, download the whitepaper Time to Raise the Bar on BSAs.

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol® multiband with internal RET
Band	Multiband
Brand	DualPol® | Teletilt®
Operating Frequency Band	1710 – 2360 MHz | 698 – 896 MHz

Mechanical Specifications

Product Specifications

SBNHH-1D65B

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Aluminum | Low loss circuit board
Radome Material	Fiberglass, UV resistant
Reflector Material	Aluminum
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	6
Wind Loading, maximum	617.7 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Speed, maximum	241.4 km/h | 150.0 mph

Dimensions

Depth	181.0 mm | 7.1 in
Length	1828.0 mm | 72.0 in
Width	301.0 mm | 11.9 in
Net Weight	18.4 kg | 40.6 lb

Remote Electrical Tilt (RET) Information

Input Voltage	10–30 Vdc
Power Consumption, idle state, maximum	2.0 W
Power Consumption, normal conditions, maximum	13.0 W
Protocol	3GPP/AISG 2.0 (Multi-RET)
RET Interface	8-pin DIN Female | 8-pin DIN Male
RET Interface, quantity	1 female | 1 male
RET System	Teletilt®

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

Included Products

BSAMNT-1 — Wide Profile Antenna Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Kit contains one scissor top bracket set and one bottom bracket set.

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

SBNHH-1D45B

Andrew® Tri-band Antenna, 698–896 and 2x 1695–2360 MHz, 45° horizontal beamwidth, internal RETs.

- Interleaved dipole technology providing for attractive, low wind load mechanical package
- Three internal RETs for independent tilt on all three bands

Electrical Specifications

Frequency Band, MHz	698–806	806–896	1695–1880	1850–1990	1920–2180	2300–2360
Gain, dBi	16.9	17.6	19.6	20.1	20.5	21.0
Beamwidth, Horizontal, degrees	47	43	45	42	42	39
Beamwidth, Vertical, degrees	12.4	11.4	5.8	5.3	5.1	4.5
Beam Tilt, degrees	0–14	0–14	0–8	0–8	0–8	0–8
USLS, dB	19	22	18	17	17	16
Front-to-Back Ratio at 180°, dB	30	31	31	33	33	35
CPR at Boresight, dB	27	27	21	23	16	17
CPR at 10 dB Horizontal Beamwidth, dB	11	14	10	11	11	13
Isolation, dB	25	25	25	25	25	25
Isolation, Intersystem, dB	30	30	30	30	30	30
VSWR | Return Loss, dB	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350	350	350	300
Polarization	±45°	±45°	±45°	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm

Electrical Specifications, BASTA*

Frequency Band, MHz	698–806	806–896	1695–1880	1850–1990	1920–2180	2300–2360
Gain by all Beam Tilts, average, dBi	16.6	17.3	19.2	19.8	20.1	20.8
Gain by all Beam Tilts Tolerance, dB	±0.4	±0.3	±0.5	±0.4	±0.5	±0.4
Gain by Beam Tilt, average, dBi	0 ° | 16.6	0 ° | 17.3	0 ° | 19.3	0 ° | 19.9	0 ° | 20.1	0 ° | 20.7
	7 ° | 16.7	7 ° | 17.4	4 ° | 19.3	4 ° | 19.9	4 ° | 20.2	4 ° | 20.9
	14 ° | 16.4	14 ° | 17.1	8 ° | 19.0	8 ° | 19.6	8 ° | 20.0	8 ° | 20.4
Beamwidth, Horizontal Tolerance, degrees	±1.5	±2.8	±2.1	±1.7	±1	±1.7
Beamwidth, Vertical Tolerance, degrees	±0.8	±0.6	±0.3	±0.2	±0.4	±0.1
USLS, dB	19	23	16	15	16	16
Front-to-Back Total Power at 180° ± 30°, dB	24	24	28	30	31	30
CPR at Boresight, dB	28	29	23	24	20	19
CPR at 10 dB Horizontal Beamwidth, dB	13	17	13	13	13	13

* CommScope® supports NGMN recommendations on Base Station Antenna Standards (BASTA). To learn more about the benefits of BASTA, download the whitepaper Time to Raise the Bar on BSAs.

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol® multiband with internal RET
Band	Multiband
Brand	DualPol® | Teletilt®
Operating Frequency Band	1695 – 2360 MHz | 698 – 896 MHz
Performance Note	Outdoor usage

Product Specifications

SBNHH-1D45B

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Aluminum | Low loss circuit board
Radome Material	Fiberglass, UV resistant
Reflector Material	Aluminum
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	6
Wind Loading, maximum	1038.0 N @ 150 km/h 233.4 lbf @ 150 km/h
Wind Speed, maximum	241.4 km/h | 150.0 mph

Dimensions

Depth	178.0 mm | 7.0 in
Length	1829.0 mm | 72.0 in
Width	457.0 mm | 18.0 in
Net Weight	29.2 kg | 64.4 lb

Remote Electrical Tilt (RET) Information

Input Voltage	10–30 Vdc
Power Consumption, idle state, maximum	2.0 W
Power Consumption, normal conditions, maximum	13.0 W
Protocol	3GPP/AISG 2.0 (Multi-RET)
RET Interface	8-pin DIN Female | 8-pin DIN Male
RET Interface, quantity	1 female | 1 male
RET System	Teletilt®

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

Included Products

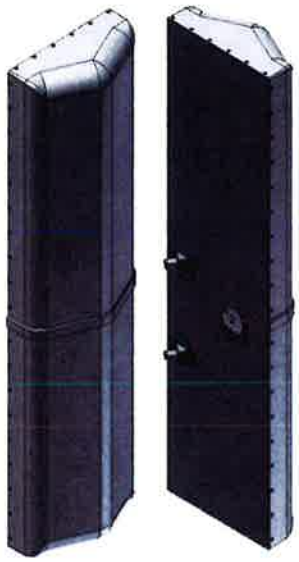
BSAMNT-1 — Wide Profile Antenna Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Kit contains one scissor top bracket set and one bottom bracket set.

* Footnotes

Performance Note	Severe environmental conditions may degrade optimum performance

X7C-FRO-640-V

X-Pol Antenna, 698-896MHz, 72", Fast Roll Off 40° Azimuth
Variable E-Tilt, RET/MET



- Macro Cell, high gain antenna
- Fast Roll Off (FRO)
- Suitable for LTE/CDMA/UMTS/GSM
- AISG 2.0 RET or manual MET tilt control

ELECTRICAL SPECIFICATIONS

Frequency Band, MHz	**698-824**	**824-896**
Horizontal Beam width, 3dB points	46°	36°
Gain, dBi	17.3	18.5
Vertical Beam width, 3dB points	12.1°	10.2°
Front-to-Back at 180°, dB	24	
Upper Side Lobe Suppression, Typical, dB	18	
Polarization	Circular	
Electrical Down tilt	0-10° or 4-14°	
VSWR/Return Loss, dB, Maximum	1.5:1/-14.0	
Isolation Between Ports, dB, Minimum	28	
Intermodulation (2x20w), IM3, dBc	-150	
Impedance, ohms	50	
Maximum Power Per Connector, CW (w)	500	

X7C-FRO-640-V

JMA WIRELESS

MECHANICAL SPECIFICATIONS

Dimensions, Length/Width/Depth	72.0/18.8/9.1 in (1829/479/231 mm)
Connector (Quantity) Type	(2) 7-16 DIN Female
Connector Torque	220-265 lbf-in (23-30 N-m)
Connector Location	Back
Antenna Weight	42.4 Lbs (19.3 Kg)
Bracket Weight	13.4 lb (6.0 kg)
Standard Bracket Kit	P/N 919011 (Included)
Mechanical Downtilt Range	0-12°
Radome Material	High Strength Luran, UV Stabilized, ASTM D1925
Wind Survival	150 mph (241 km/h)
Front Wind Load	225.9 lbf (1005.1 N)
Equivalent Flat Plate	4.51 sq-ft (c=2)

RET INFORMATION

Model	CSS-RET-200
Mounting Location	Rear of Antenna
Weight	1.2 lb (0.54 kg)
Communication Standard	AISG 2.0
Control System	CSS-PCU-220

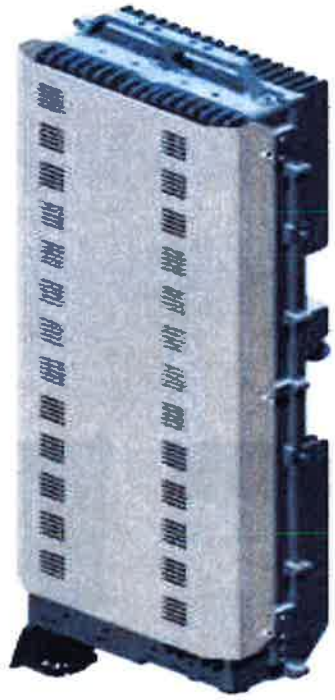
ORDER INFORMATION

MODEL	DESCRIPTION
X7C-FRO-640-VM0	Antenna with manual MET adjust electrical downtilt 0-10°
X7C-FRO-640-VM4	Antenna with manual MET adjust electrical downtilt 4-14°
X7C-FRO-640-VR0	Antenna with remote RET adjust electrical downtilt 0-10°
X7C-FRO-640-VR4	Antenna with remote RET adjust electrical downtilt 4-14°
919036	Optional Bracket Kit, 2-Point, 12deg D-tilt, For 4.5" OD Pole

ALCATEL-LUCENT WIRELESS PRODUCT DATASHEET

RRH2X60-AWS FOR BAND 4 APPLICATIONS

The Alcatel-Lucent RRH2x60-AWS is a high power, small form factor Remote Radio Head operating in the AWS frequency band (3GPP Band 4) for LTE technology. It is designed with an eco-efficient approach, providing operators with the means to achieve high quality and high capacity coverage with minimum site requirements and efficient operation.



A distributed Node B expands the 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 a Node B to be installed separately, within the same site or several kilometers apart.

The Alcatel-Lucent RRH2x60-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.

SUPERIOR RF PERFORMANCE

The Alcatel-Lucent RRH2x60-AWS integrates all the latest technologies. This allows to offer best-in-class characteristics.

It delivers an outstanding 120 watts of total RF power thanks to its two transmit RF paths of 60 W each.

It is ideally suited to support multiple-input multiple-output (MIMO) 2x2 operation.

It includes four RF receivers to natively support 4-way uplink reception diversity. This improves the radio uplink coverage and this can be used to extend the cell radius commensurate with 2x2MIMO 2x60 W for the downlink.

It supports multiple discontinuous LTE carriers within an instantaneous bandwidth of 45 MHz corresponding to the entire AWS B4 spectrum.

The latest generation power amplifiers (PA) used in this product achieve high efficiency (>40%), resulting in improved power consumption figures.

OPTIMIZED TCO

The Alcatel-Lucent RRH2x60-AWS is designed to make available all the benefits of a distributed Node B, with excellent RF characteristics, with low capital expenditures (CAPEX) and low operating expenditures (OPEX).

The Alcatel-Lucent RRH2x60-AWS is a very cost-effective solution to deploy LTE MIMO.

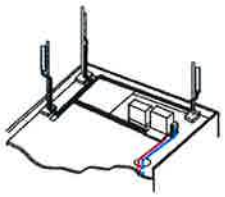
EASY INSTALLATION

The RRH2x60-AWS includes a reversible mounting bracket which allows for ease of installation behind an antenna, or on a rooftop knee wall while providing easy access to the mid body RF connectors.

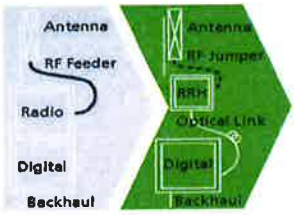
The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment. However, many of these sites can host an Alcatel-Lucent RRH2x60-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation time and costs.

The Alcatel-Lucent RRH2x60-AWS is a zero-footprint solution and is convection cooled without fans for silent operation, simplifying negotiations with site property owners and minimizing environmental impacts.

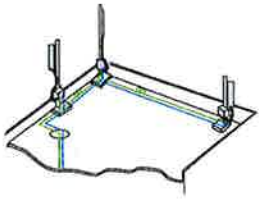
Installation can easily be done by a single person as the Alcatel–Lucent RRH2x60-AWS is compact and weighs about 20 kg, eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day.



Macro



RRH for space-constrained cell sites



Distributed

FEATURES

- RRH2x60-AWS integrates two power amplifiers of 60W rating (at each antenna connector)
- Support multiple carriers over the entire 3GPP band 4
- RRH2x60-AWS is optimized for LTE operation
- RRH2x60-AWS is a very compact and lightweight product
- Advanced power management techniques are embedded to provide power savings, such as PA bias control

BENEFITS

- MIMO LTE operation with only one single unit per sector
- Improved uplink coverage with built-in 4-way receive diversity capability
- RRH can be mounted close to the antenna, eliminating nearly all losses in RF cables and thus reducing power consumption by 50% compared to conventional solutions
- Distributed configurations provide easily deployable and cost-effective solutions, near zero footprint and silent solutions, with minimum impact on the neighborhood, which ease the deployment
- RETA and TMA support without additional hardware thanks to the AISG v2.0 port and the integrated Bias-Tees. Bias-Tees support AISG DC supply and signaling.

TECHNICAL SPECIFICATIONS

Specifications listed are hardware capabilities. Some capabilities depend on support in a specific software release or future release.

Dimensions and weights

36.7"x10.6"x5.8"

- HxWxD ~~510x205x186mm~~ (27 l with solar shield)
- Weight : 20 kg (44 lbs)

Electrical Data

- Power Supply : -48V DC (-40.5 to -57V)
- Power Consumption (ETSI average traffic load reference) : 250W @2x60W

RF Characteristics

- Frequency band: 1710-1755, UL / 2110-2155 MHz, DL (3GPP band 4)
- Output power: 2x60W at antenna connectors
- Technology supported: LTE
- Instantaneous bandwidth: 45 MHz
- Rx diversity: 2-way and 4-way uplink reception
- Typical sensitivity without Rx diversity: -105 dBm for LTE

Connectivity

- Two CPRI optical ports for daisychaining and up to six RRHs per fiber
- Type of optical fiber: Single-Mode (SM) and Multi-Mode (MM) SFPs
- Optical fiber length: up to 500m using MM fiber, up to 20km using SM fiber
- TMA/RETA : AISG 2.0 (RS485 connector and internal Bias-Tee)
- Six external alarms
- Surge protection for all external ports (DC and RF)

Environmental specifications

- Operating temperature: -40°C to 55°C including solar load
- Operating relative humidity: 8% to 100%
- Environmental Conditions : ETS 300 019-1-4 class 4.1E
- Ingress Protection : IEC 60529 IP65
- Acoustic Noise : Noiseless (natural convection cooling)

Safety and Regulatory Data

- EMC : 3GPP 25113, EN 301 489-1, EN 301 489-23, GR 1089, GR 3108, OET-65
- Safety : IEC60950-1, EN 60825-1, UL, ANSI/NFPA 70, CAN/CSA-C22.2
- Regulatory : FCC Part 15 Class B, CE Mark – European Directive : 2002/95/EC (ROHS); 2002/96/EC (WEEE); 1999/5/EC (R&TTE)
- Health : EN 50385

Alcatel·Lucent

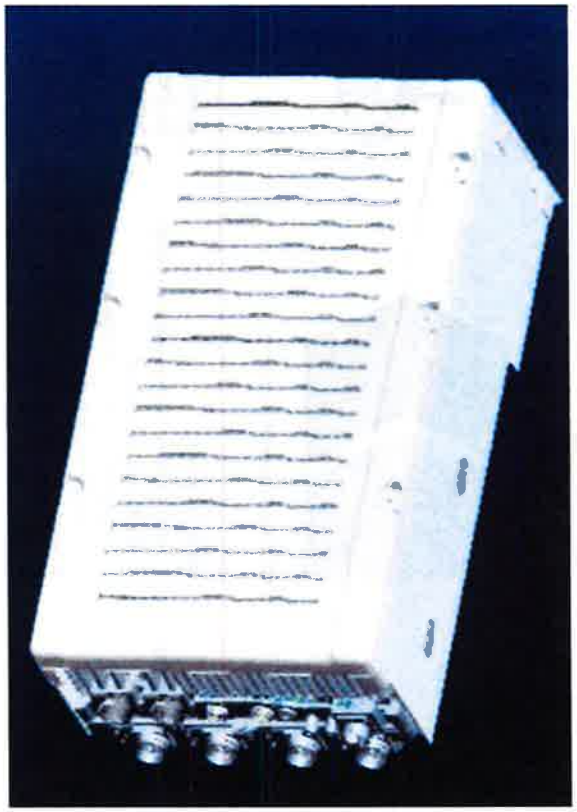
AT THE SPEED OF IDEAS™

NEW PCS RF MODULES FOR VZW

RRH2X60 - HW CHARACTERISTICS

LR14.3

	RRH2x60
RF Output Power	2x60W (4x30W HW Ready)
Instantaneous Bandwidth	60MHz
Target Reliability (Annual Return Rate)	<2%
Receiver	4 Branch Rx
Features	AISG 2.0 for RET/TMA
Power	-48VDC
	Internal Smart Bias-T
CPRI Ports	2 CPRI Rate 5 Ports
External Alarms	4 External User Alarms
Monitor Ports	TX, RX
Environmental	GR487 Compliance
RF Connectors	7/16 DIN (downward facing)
Dimensions	22"(h) x 12"(w)x 9.4" (d)**
Weight	55lb**



**- Includes solar shield but not mounting brackets (8 lbs.)

ALCATEL-LUCENT B13 RRH4X30-4R

Alcatel-Lucent B13 Remote Radio Head 4x30-4R is the newest addition of Remote Radio Head to the extended product line of Alcatel-Lucent's distributed Base Station solutions, aimed at facilitating smooth RF site acquisition and related civil engineering.

Supporting 2Tx/4Tx MIMO and 4-way Rx diversity, Alcatel-Lucent B13 RRH4x30-4R allows operators to have a compact radio solution to deploy LTE in the 700U band (700 MHz, 3GPP band 13), providing them with the means to achieve high capacity, high quality and high coverage with minimum site requirements.

The Alcatel-Lucent B13 RRH4x30-4R product has four transmit RF paths, offering the possibility to **select, via software only, 2Tx or 4Tx MIMO configurations** with either 2x60 W or 4x30 W RF output power. It supports also 4-way Rx diversity and up to 10MHz instantaneous bandwidth.

The Alcatel-Lucent B13 RRH4x30-4R is a near zero-footprint solution and operates noise free, simplifying negotiations with site property owners and minimizing environmental impacts.

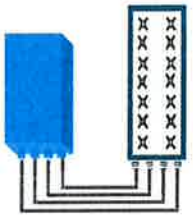
Its compactness and slim design makes the Alcatel-Lucent B13 RRH4x30-4R easy to install close to the antenna: operators can therefore locate this Remote Radio Head where RF design conditions are deemed ideal, minimizing trade-offs between available sites and RF optimum sites, together with reducing the RF feeder needs and installation costs.

FEATURES

- Supporting LTE in 700 MHz band (700U, 3GPP band 13)
- LTE 2Tx or 4Tx MIMO (SW switchable)
- Output power: Up to 2x60W or 4x30W
- 10MHz LTE carrier with 4Rx Diversity
- Convection-cooled (fan-less)
- Supports AISG 2.0 ALD devices (RET, TMA) through RS485 or RF ports

BENEFITS

- Compact to reduce additional footprint when adding LTE in 700U band
- MIMO scheme operation selection (2Tx or 4Tx) by software only
- Improves downlink spectral efficiency through MIMO4
- Increases LTE coverage thanks to 4Rx diversity capability and best in class Rx sensitivity
- Flexible mounting options: Pole or Wall



4x30W with 4T4R
or
2x60W with 2T4R

Can be switched between modes via SW w/o site visit

Alcatel·Lucent

TECHNICAL SPECIFICATIONS

Features & performance	
Number of TX/RX paths	4 duplexed (either 4T4R or 2T4R by SW)
Frequency band	U700 (C) (3GPP bands 13): DL: 746 - 756 MHz / UL: 777 - 787 MHz
Instantaneous bandwidth - #carriers	10MHz – 1 LTE carrier (In 10MHz occupied bandwidth)
LTE carrier bandwidth	10 MHz
RF output power	2x60W or 4x30W (by SW)
Noise figure – RX Diversity scheme	2 dB typ. (<2.5 dB max) – 2 or 4 way Rx diversity
Sizes (HxWxD) in mm (in.) Volume in L Weight in kg (lb) (w/o mounting HW)	550 x 305 x 230 (21.6" x 12.0" x 9") (with solar shield) 38 (with solar shield) 26 (57.2) (with solar shield)
DC voltage range DC power consumption	-40.5 to -57V at full performance, -38 to -57V with relaxation on power consumption 550W typical @100% RF load (In 2Tx or 4TX mode)
Environmental conditions Wind load (@150km/h or 93mph)	-40°C (-40°F) /+55°C (+131°F) IP65 Frontal: <200N / Lateral : <150N
Antenna ports	4 ports 7/16 DIN female (50 ohms) VSWR < 1.5
CPRI ports	2 CPRI ports (HW ready for Rate7, 9.8 Gbps) SFP single mode dual fiber
AISG interfaces	1 AISG2.0 output (RS485) Integrated Smart Bias Tees (x2)
Misc. Interfaces	4 external alarms (1 connector) – 4 RF Tx & 4 RF Rx monitor ports - 1 DC connector (2 pins)
Installation conditions	Pole and wall mounting
Regulatory compliance	3GPP 36.141 / 3GPP 36.113 / GR-1089-CORE / GR-3108-CORE / UL 60950-1 / FCC Part 27

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.