FIRST AMENDATORY LICENSE AGREEMENT

THIS FIRST AMENDATORY LICENSE AGREEMENT is made and entered into by and between the **CITY AND COUNTY OF DENVER**, a municipal corporation of the State of Colorado (the "City") and **T-MOBILE WEST LLC,** a Delaware limited liability company authorized to conduct business in Colorado (the "Licensee"), jointly "the parties."

RECITALS

A. The Parties entered into an Agreement executed on August 16, 2018 (the "Agreement") for certain rights and obligations in that Agreement and the exhibits thereto; and

B. Rather than enter into a new contract, the Parties wish to amend the Agreement to increase the License Fee and allow additional installation by the Licensee.

NOW, THEREFORE, in consideration of the premises and the Parties' mutual covenants and obligations, the parties hereby amend the Agreement effective upon full execution by the parties (Amendment Effective Date) as follows:

1. All references to "**Exhibit A**" in the existing License shall be amended to read "**Exhibit A-1**" and shall be titled "Licensed Area, License System, and Equipment and Specifications"; all references to "**Exhibit B**" in the existing License shall be amended to read "**Exhibit B-1**" and shall be titled "Minimum Technical Standards"; and all references to "**Exhibit C**" in the existing License shall be amended to read "**Exhibit C-1**", shall be titled "Authorized Frequencies". Exhibits A-1, B-1, and C-1 are attached hereto and incorporated herein by this reference.

2. "**Exhibit E**" entitled "Adcom911" shall be added to the Agreement. Exhibit E is attached hereto and incorporated herein by this reference.

3. Section 1.01 of the Agreement entitled "**Grant of License**" is amended to read as follows:

> "(b) As a condition of the grant of the License, Licensee shall construct, at its sole cost and expense, equipment as described and at the location specified in **Exhibit A-1**, for use Licensee; shall remove the "ADCOM" equipment described in **Exhibit E-1**; and install the equipment described in **Exhibit B-1**, including but not limited to the installation of three (3) additional antennae at a height of sixty-seven feet (67'). No removal of any equipment under this Section 1.01(b) shall proceed without a City Representative being present for the work. Licensee shall notify the City's Point of Contact or City Representative in sufficient, reasonable time to allow a City Representative to be present during the removal work."

4. Section 3.01 of the Agreement entitled "**License Fee.**" is amended to read as follows:

> "(a) Licensee agrees to pay City a monthly License Fee of **Three Thousand Six Hundred Dollars and Zero Cents** (**$3,600.00**), plus any increases in effect, payable in equal monthly installments beginning on the Amendment Effective Date and continuing on the first day of each month thereafter. The License Fee shall increase three percent (3%) each year, including each year of any renewals under Section 2.02, with the increased License Fee taking effect on the subsequent January 1 of each year under the Agreement."

5. Section 4 of the Agreement entitled "**General.**" is amended to read as follows:

> "(a) Licensee shall, at its sole cost and expense, design, construct and install within the Licensed Area, the Licensed System in accordance with **Exhibit A-1** and **Exhibit B-1** (unless changes are authorized under section 4.02), and in accordance with the terms and conditions of this Agreement. Licensee shall be permitted to install the Licensed System including any additional system components as set forth in **Exhibit A-1 and Exhibit B-1**."

6. Except as herein amended, the Agreement is affirmed and ratified in each and every particular.

7. This First Amendatory Agreement will not be effective or binding on the City until it has been fully executed by all required signatories of the City and County of Denver, and if required by Charter, approved by the City Council.

[SIGNATURE PAGES FOLLOW]

Contract Control Number: FINAN-202056550-01
Contractor Name: T-MOBILE WEST LLC

IN WITNESS WHEREOF, the parties have set their hands and affixed their seals at Denver, Colorado as of:

SEAL

CITY AND COUNTY OF DENVER:

ATTEST:

By: _____

_____

APPROVED AS TO FORM:

Attorney for the City and County of Denver

By: _____

REGISTERED AND COUNTERSIGNED:

By: _____

By: _____

Contract Control Number: FINAN-202056550-01
Contractor Name: T-MOBILE WEST LLC

By: ***PLEASE SEE NEXT PAGE FOR SIGNATURE***

Name: _____
(please print)

Title: _____
(please print)

ATTEST: [if required]

By: _____

Name: _____
(please print)

Title: _____
(please print)

Contract Control Number: FINAN-202056550-01
Contractor Name: T-MOBILE WEST LLC

By: DocuSigned by: 1F63845351CA46B...

Name: Scott W. DuBuke
(please print)

Title: Area Director, Network Engineering & Operations
(please print)

NATIONAL LEASE GOVERNANCE Approved T-MOBILE 2021

T-Mobile Legal Approval By:

ATTEST: [if required]

By: _____

Name: _____
(please print)

Title: _____
(please print)

EXHIBIT A-1

DN03634A

APPROVAL SIGNATURE BLOCK

The following parties have reviewed these documents.

All documents are subject to review by the local zoning/building departments and may impose changes or modifications.

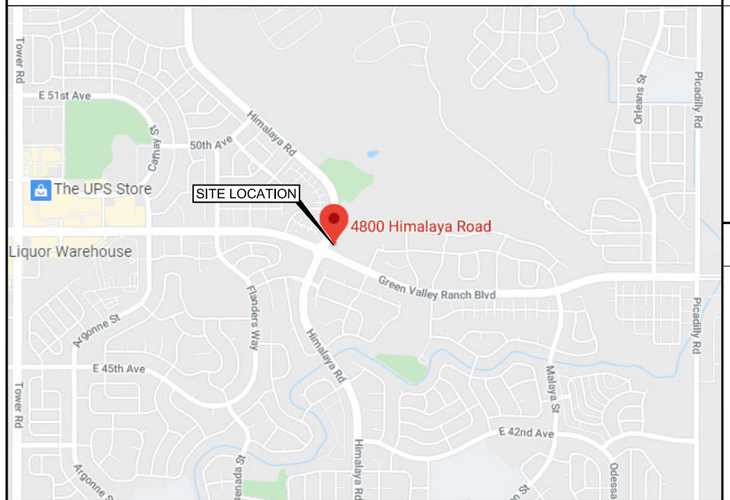
Project Manager (Print)	Project Manager ☐ Approved ☐ Rejected	Date
RF Engineer (Print)	RF Engineer ☐ Approved ☐ Rejected	Date
Site Acquisition (Print)	Site Acquisition ☐ Approved ☐ Rejected	Date
Construction Manager (Print)	Construction Manager ☐ Approved ☐ Rejected	Date
TMO Quality Assurance (Print)	TMO Quality Assurance ☐ Approved ☐ Rejected	Date

DENVER FIRE #29
DN03634A

4800 HIMALAYA RD
DENVER, CO 80249
LATITUDE: 39.78311389°
LONGITUDE: -104.75453890°

ANCHOR

VICINITY MAP



SITE PHOTO

DRIVING DIRECTIONS

FROM 18400 EAST 22ND AVENUE AURORA, CO 80011:
HEAD EAST ON E 22ND AVE TOWARD TOWER RD (0.1MI)
TURN LEFT AT THE 1ST CROSS STREET ONTO TOWARD RD (2.2MI)
TURN RIGHT ONTO GREEN VALLEY RANCH BLVD (1.2MI)
MAKE A U-TURN AT JABEL ST (0.3MI)
SLIGHT RIGHT (148FT)
DESTINATION WILL BE ON THE RIGHT.

SCOPE OF WORK

MODIFICATION OF AN EXISTING "NON-INHABITABLE" T-MOBILE TELECOMMUNICATIONS SITE

- INSTALL (6) (N) ANTENNAS, (3) (N) AHLOA, (3) (N) AHFIG & (1) (N) HCS 2.0 FIBER BREAKOUT FEATURE
- INSTALL (1) (N) 600A SSC CABINET W/ (2) (N) AMIAs, (1) (N) BATTERY CABINET & (1) (N) HCS 2.0 TOWER JUNCTION BOX
- INSTALL (1) (N) HCS 2.0 FIBER TRUNK CABLE
- INSTALL (3) (N) HCS 2.0 FIBER JUMPER CABLES
- REMOVE (3) (E) ANTENNAS W/ (3) (E) FRIJ, (3) (E) FHFB, (3) (E) FRBG, (2) FSMF, & (3) FBBC
- REMOVE (1) (E) DELTA SSC CABINET & (1) (E) STACKED MODULES, (1) (E) ALARM BOX AND (2) (E) JUNCTION BOXES
- RELOCATE (1) (E) COVP & (1) (E) 200A PPC CABINET

SITE INFORMATION

SITE TYPE:	TOWER - SELF SUPPORT
SITE NAME:	DENVER FIRE #29
SITE NUMBER:	DN03634A
SITE ADDRESS:	4800 HIMALAYA RD DENVER, CO 80249
JURISDICTION:	CITY AND COUNTY DENVER
PARCEL #:	0022100021000
A.D.A. COMPLIANCE:	NOT REQUIRED PER IBC 1103.2.9.
RFDS DATE:	06/04/20

CODE COMPLIANCE

ALL WORK SHALL BE PERFORMED AND MATERIALS INSTALLED IN ACCORDANCE WITH THE CURRENT EDITIONS OF THE FOLLOWING CODES AS ADOPTED BY THE LOCAL GOVERNING AUTHORITIES. NOTHING IN THESE PLANS IS TO BE CONSTRUED TO PERMIT WORK NOT CONFORMING TO THESE CODES.

GOVERNING CODES, AS APPLICABLE:
2018 IBC, 2018 IFC, 2018 IMC, 2018 IECC,
2020 NEC

GENERAL CONSTRUCTION NOTES

1. THE FACILITY IS AN UNOCCUPIED WIRELESS FACILITY.
2. PLANS ARE NOT TO BE SCALED AND ARE INTENDED TO BE A DIAGRAMMATIC OUTLINE ONLY, UNLESS NOTED OTHERWISE. THE WORK SHALL INCLUDE FURNISHING MATERIALS, EQUIPMENT, APPURTENANCES AND LABOR NECESSARY TO COMPLETE ALL INSTALLATIONS AS INDICATED ON THE DRAWINGS.
3. PRIOR TO THE SUBMISSION OF BIDS, THE CONTRACTORS SHALL VISIT THE JOB SITE AND BE RESPONSIBLE FOR ALL CONTRACT DOCUMENTS, FIELD CONDITIONS AND DIMENSIONS, AND CONFIRMING THAT THE WORK MAY BE ACCOMPLISHED AS SHOWN PRIOR TO PROCEEDING WITH CONSTRUCTION. ANY DISCREPANCIES ARE TO BE BROUGHT TO THE ATTENTION OF THE IMPLEMENTATION ENGINEER AND ARCHITECT/ENGINEER PRIOR TO PROCEEDING WITH THE WORK.
4. THE CONTRACTOR SHALL RECEIVE, IN WRITING, AUTHORIZATION TO PROCEED BEFORE STARTING WORK ON ANY ITEM NOT CLEARLY DEFINED OR IDENTIFIED BY THE CONTRACT DOCUMENTS.
5. CONTRACTOR SHALL CONTACT LOCAL DIGGERS HOTLINE 48 HOURS PRIOR TO PROCEEDING WITH ANY EXCAVATION, SITE WORK OR CONSTRUCTION.
6. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURERs RECOMMENDATIONS UNLESS SPECIFICALLY INDICATED OTHERWISE OR WHERE LOCAL CODES OR REGULATIONS TAKE PRECEDENCE.
7. ALL WORK PERFORMED AND MATERIALS INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS AND ORDINANCES. CONTRACTOR SHALL GIVE ALL NOTICES AND COMPLY WITH ALL LAWS, ORDINANCES, RULES, REGULATIONS AND LAWFUL ORDERS OF ANY PUBLIC AUTHORITY REGARDING THE PERFORMANCE OF THE WORK. MECHANICAL AND ELECTRICAL SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH ALL APPLICABLE MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS, AND LOCAL AND STATE JURISDICTIONAL CODES, ORDINANCES AND APPLICABLE REGULATIONS.

PROJECT CONTACTS

PROPERTY OWNER:
CITY & COUNTY OF DENVER
201 W. COLFAX AVE. 401
DENVER, CO 80202
STEVE GARROD: 720.913.3446

APPLICANT:
T-MOBILE WEST LLC
18400 EAST 22ND AVENUE
AURORA, CO 80011
303.313.6923

T-MOBILE PROJECT MANAGEMENT
18400 EAST 22ND AVENUE
AURORA, CO 80011
ALINA BESOIU
925.628.1880

T-MOBILE CONSTRUCTION MANAGER
18400 EAST 22ND AVENUE
AURORA, CO 80011
RICK SAWYER
303.521.8061

SITE ACQUISITION:
WYCO LAND SERVICES
6335 DOWNING STREET
DENVER, CO 80216
ANNIE MACKIEWICZ
303.601.7241

A&E PROJECT MANAGER
WYCO ENGINEERING SERVICES
6335 DOWNING STREET
DENVER, CO 80216
BRANDON SAENZ
815.375.3535

ENGINEER ON RECORD
WYCO ENGINEERING SERVICES
6335 DOWNING STREET
DENVER, CO 80216
PARTHA RAMAKRISHNAN, PE
303.253.4468

Partha Ramakrishnan

Digitally signed by Partha Ramakrishnan
Date: 2020.09.30 07:19:26-06'00'

DRAWING INDEX

T1	TITLE SHEET
A1	OVERALL SITE PLAN
A2	ENLARGED SITE PLAN
A3	EQUIPMENT LAYOUT
A4	TOWER ELEVATIONS
A5.1	ANTENNA & EQUIPMENT KEYS
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A7	CABLE COLOR CODING
A8	SAFETY PLAN
A9.1	ANTENNA SPECIFICATIONS
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A10	EQUIPMENT DETAILS
A11	EQUIPMENT DETAILS
A12	EQUIPMENT DETAILS
A13	EQUIPMENT DETAILS
A14	EQUIPMENT DETAILS
GN1	GENERAL NOTES

T-Mobile
18400 EAST 22ND AVE. AURORA, CO 80011

tellusconnect
5808 SOUTH RAPP ST., STE.150 LITTLETON, CO 80120

PROJECT INFORMATION:
SITE NAME:
DENVER FIRE #29
SITE ID:
DN03634A

4800 HIMALAYA RD
DENVER, CO 80249
CITY AND COUNTY DENVER

Rev:	Date:	Description:	By:
1	09/09/2020	PRELIM. CONST.	SS
2	09/21/2020	REV. 1	SF
3	09/29/2020	FINAL CONST	ML

PLANS PREPARED BY:
WYCO FIELD SERVICES
Where quality still counts.
6335 DOWNING STREET
DENVER, CO 80216
WYCOFS.COM

LICENSURE NO:
COLORADO LICENSED
PARTHA RAMAKRISHNAN
52228
PROFESSIONAL ENGINEER
09/30/2020

ALL SCALES ARE SET FOR 24"x36" SHEET

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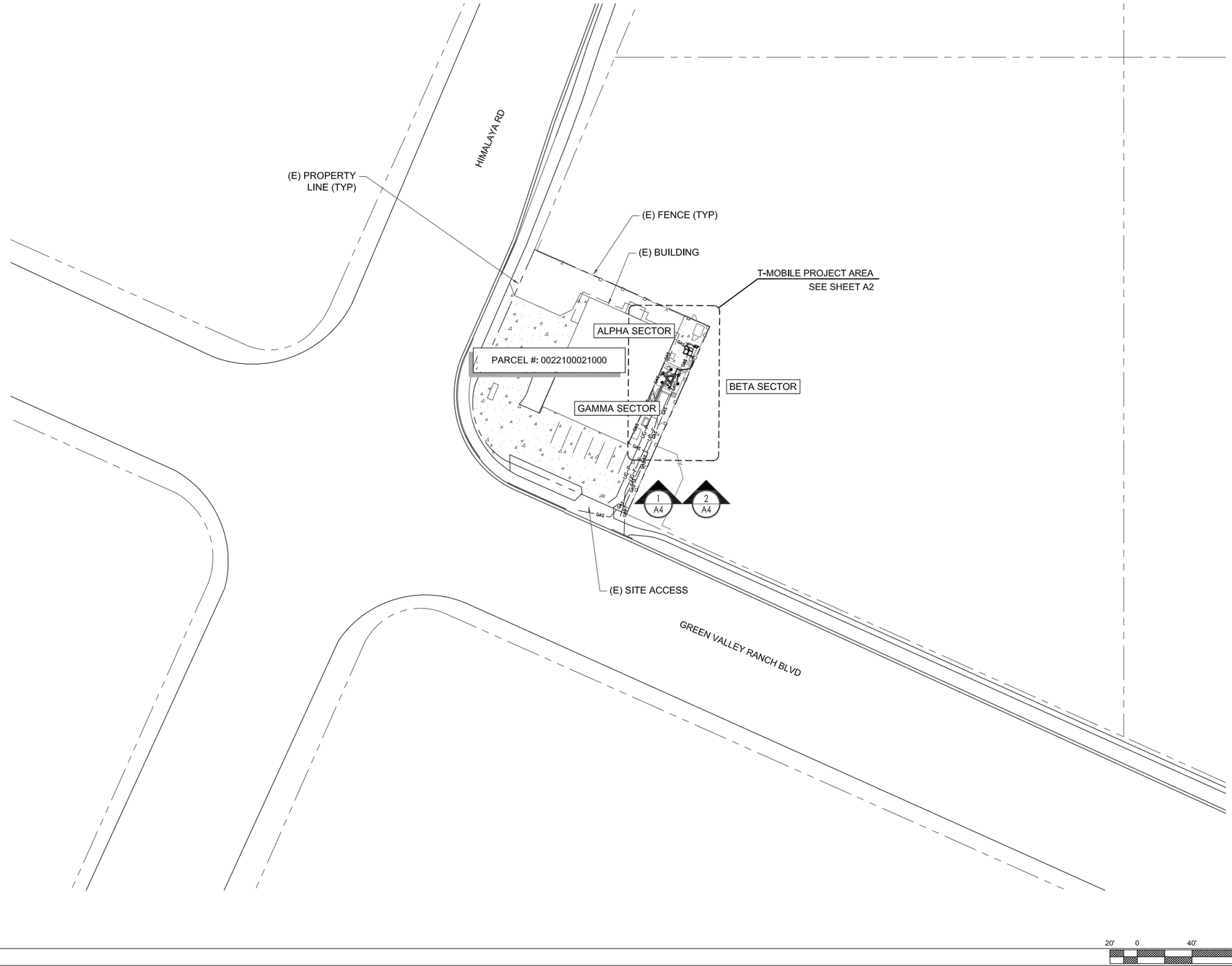
SS	ML	PR

Sheet Title:
TITLE SHEET

Sheet Number:
T1



1 OVERALL SITE PLAN

SCALE: AS NOTED

SCALE: 1"=40'-0"

T-Mobile

18400 EAST 22ND AVE. AURORA, CO 80011

tellusconnect

5808 SOUTH RAPP ST., STE.150 LITTLETON, CO 80120

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09/30/2020

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SS	ML	PR

Sheet Title:

OVERALL SITE PLAN

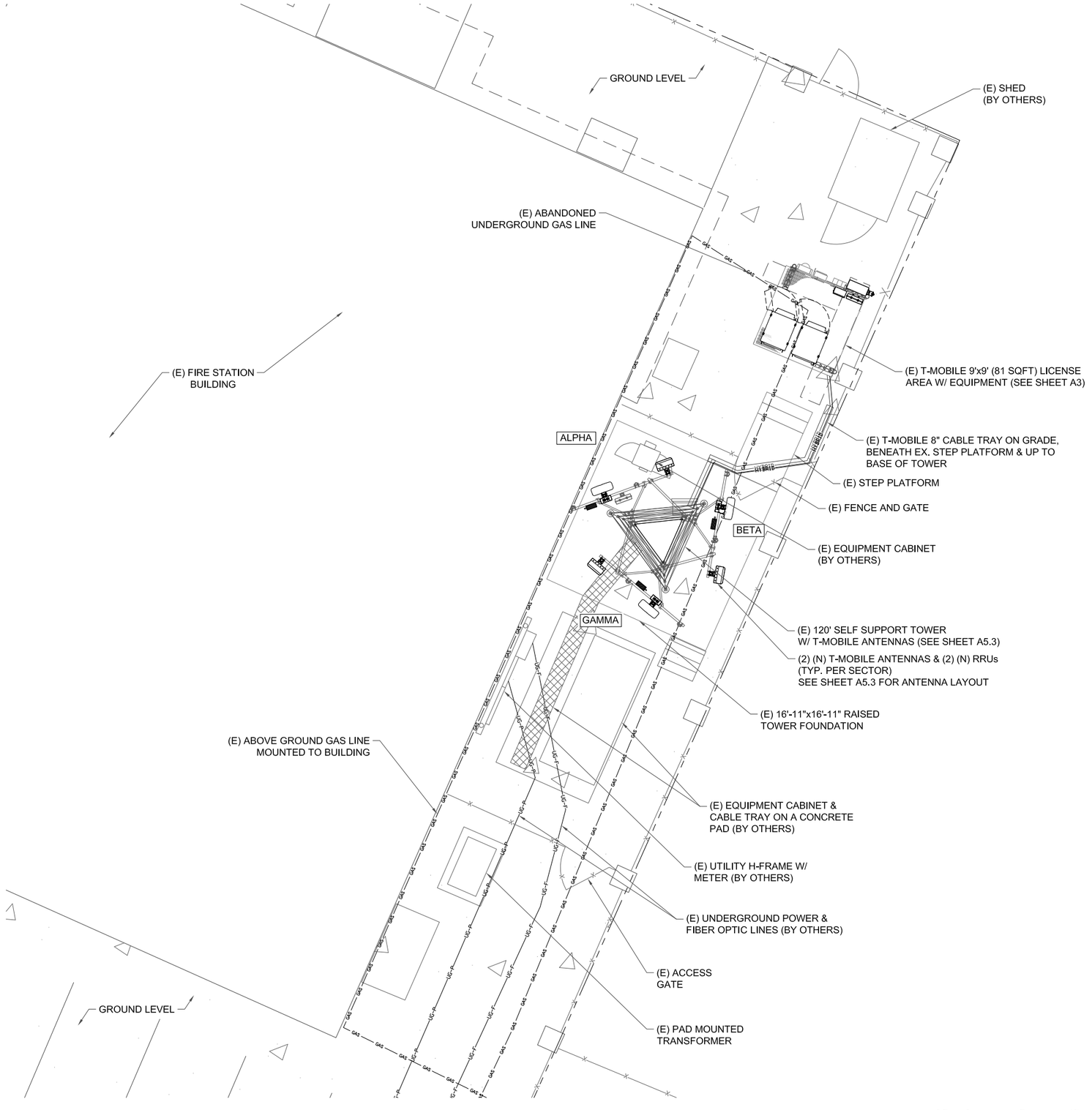
Sheet Number:

A1

1 T-MOBILE LEASE AREA PHOTO

SCALE: N.T.S.

NOTE:
ACTUAL GROUND SURVEY WAS NOT PERFORMED FOR THIS SITE. THE SITE PLAN WAS DERIVED FROM PROVIDED DRAWINGS AND PHOTOS, GIS DATA, AND AERIAL IMAGES.



2 ENLARGED SITE PLAN

SCALE: AS NOTED

SCALE: 3/16"=1'-0"

T-Mobile
18400 EAST 22ND AVE. AURORA, CO 80011

tellusconnect
5808 SOUTH RAPP ST., STE.150 LITTLETON, CO 80120

PROJECT INFORMATION:

SITE NAME:
DENVER FIRE #29

SITE ID:
DN03634A

4800 HIMALAYA RD
DENVER, CO 80249
CITY AND COUNTY DENVER

Rev:	Date:	Description:	By:
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PLANS PREPARED BY:

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Where quality still counts.
6335 DOWNING STREET
DENVER, CO 80216
WYCOFS.COM

LICENSURE NO:

COLORADO LICENSED
VARTHA RAMAKRISHNAN
52228
PROFESSIONAL ENGINEER
09/30/2020

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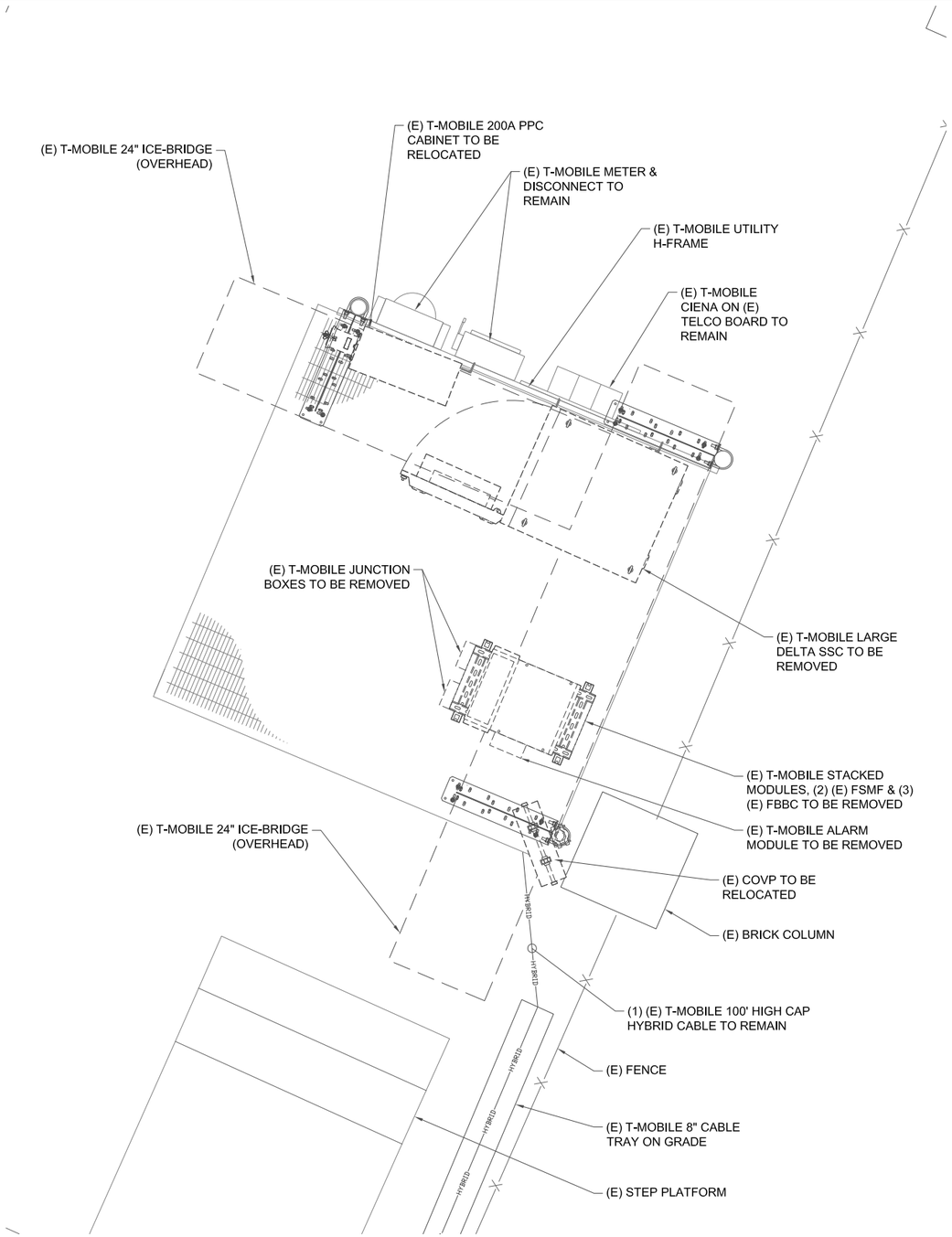
SS	ML	PR

Sheet Title:

ENLARGED SITE PLAN

Sheet Number:

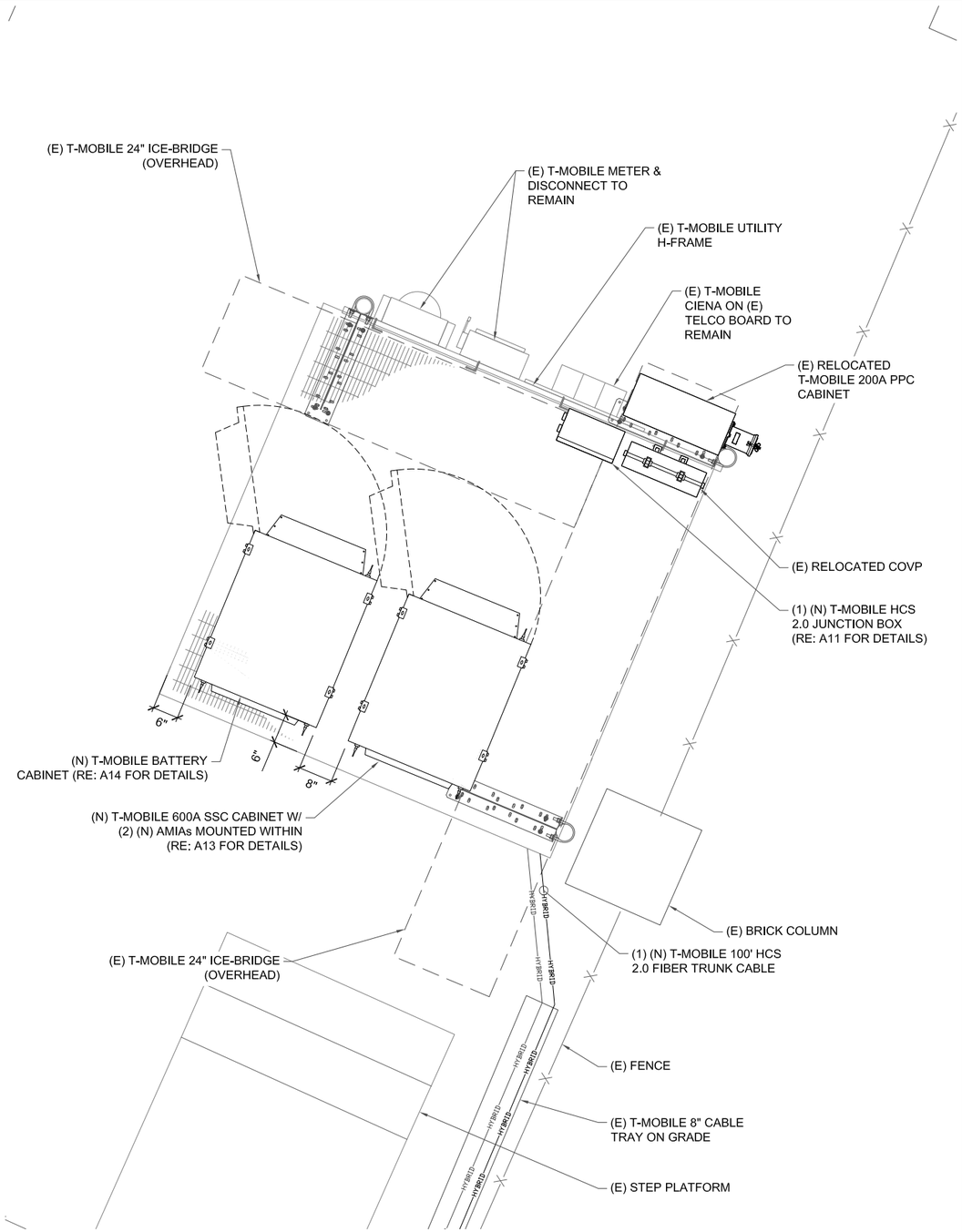
A2



1 EXISTING EQUIPMENT LAYOUT

SCALE: AS NOTED

SCALE: 3/4"=1'-0"



2 PROPOSED EQUIPMENT LAYOUT

SCALE: AS NOTED

SCALE: 3/4"=1'-0"

T-Mobile
18400 EAST 22ND AVE. AURORA, CO 80011
tellusconnect
5808 SOUTH RAPP ST., STE.150 LITTLETON, CO 80120

PROJECT INFORMATION:

SITE NAME:
DENVER FIRE #29

SITE ID:
DN03634A

4800 HIMALAYA RD
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CITY AND COUNTY DENVER

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PLANS PREPARED BY:

WYCO FIELD SERVICES
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6335 DOWNING STREET
DENVER, CO 80216
WYCOFS.COM

LICENSURE NO:

COLORADO LICENSED
LAKSHMA RAMAKRISHNAN
52228
PROFESSIONAL ENGINEER
09/30/2020

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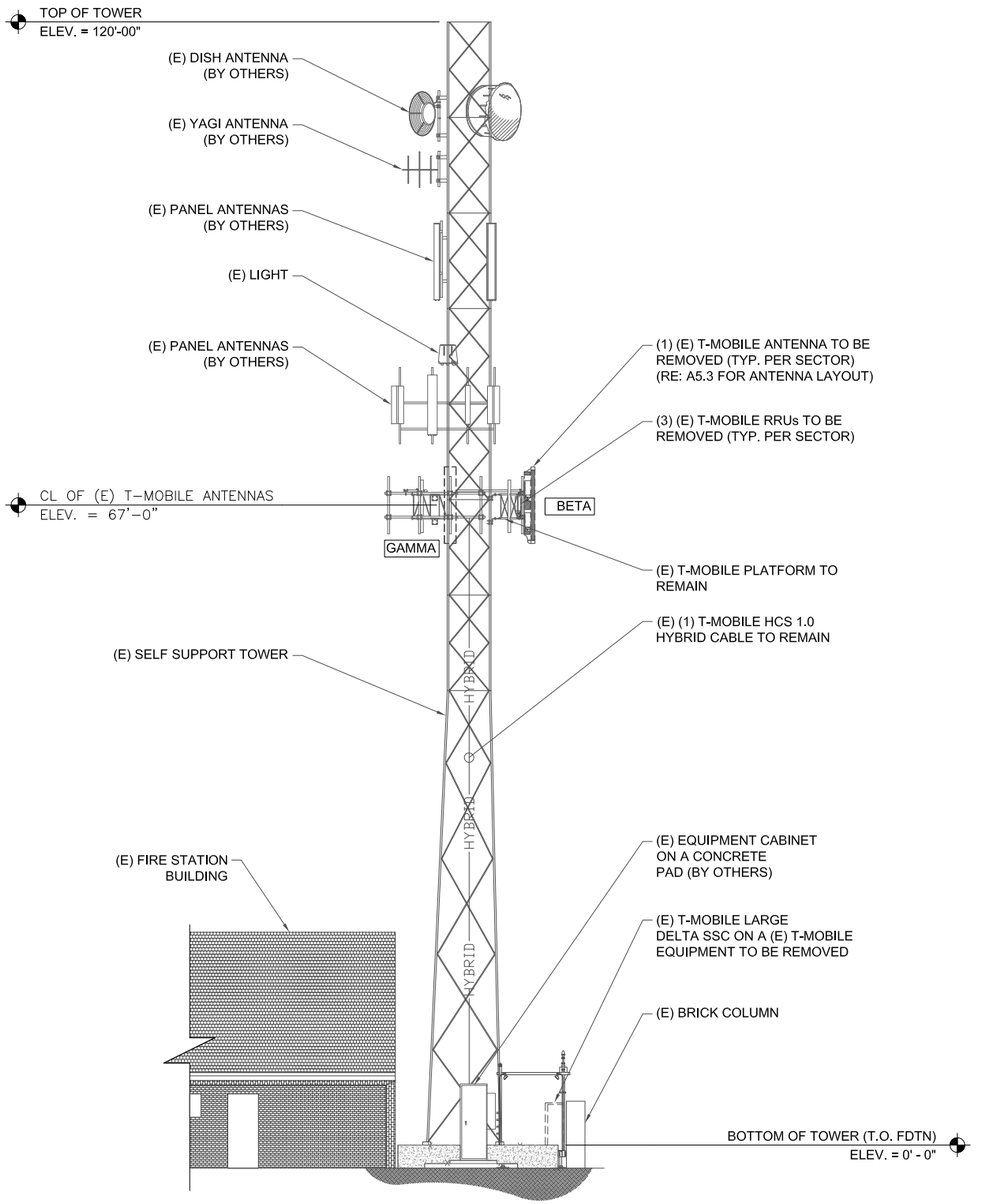
SS	ML	PR

Sheet Title:

EQUIPMENT LAYOUT

Sheet Number:

A3



1 EXISTING SOUTH ELEVATION

SCALE: AS NOTED

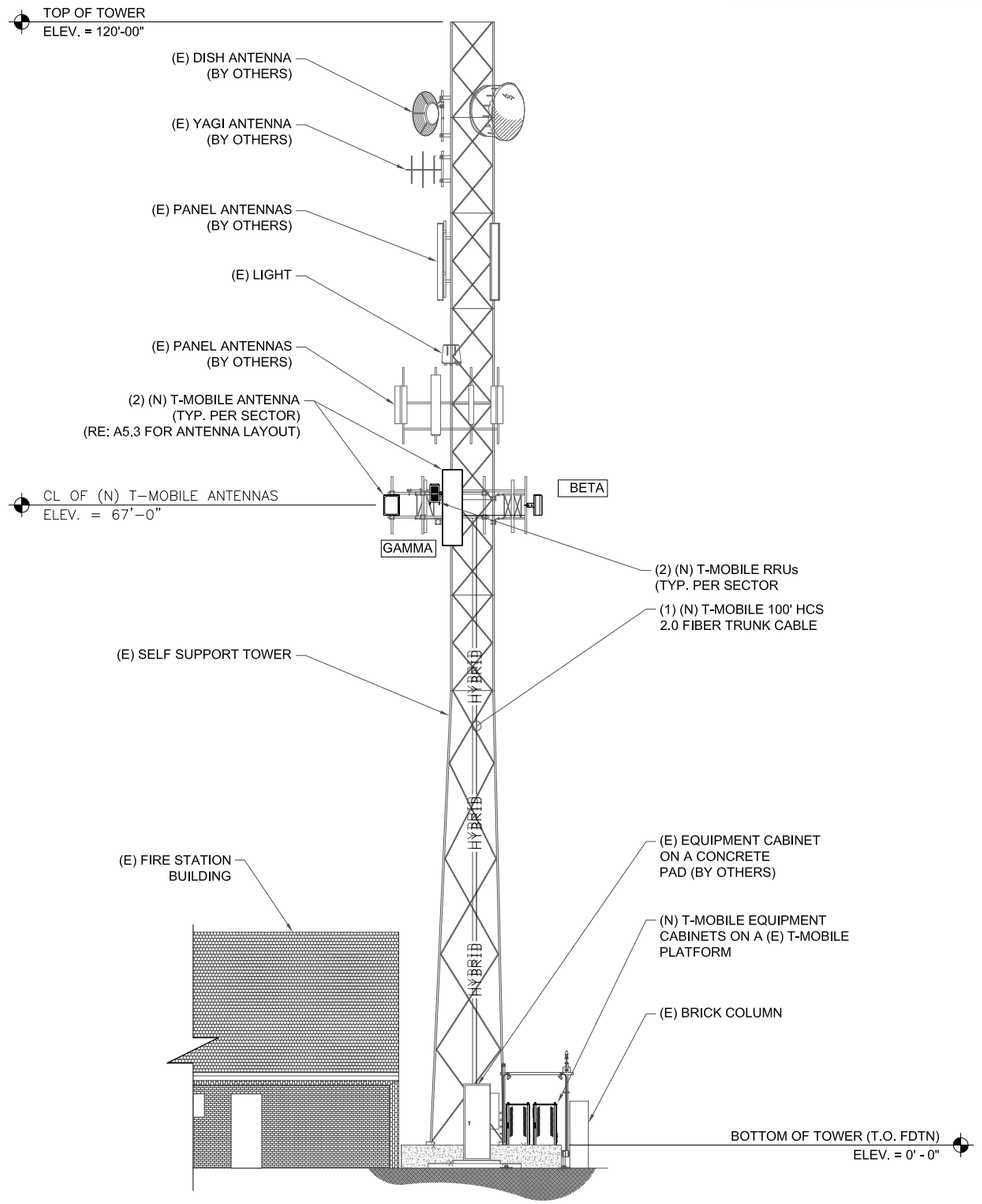
4' 0 8' 16' 24'

SCALE: 1/8"=1'-0"

STRUCTURAL NOTE/T-MOBILE STRUCTURAL SERVICES COMPLIANCE NOTE:

NO WORK SHALL COMMENCE WITHOUT THE APPROVED STRUCTURAL AND /OR ANTENNA MOUNT ANALYSIS REPORT (SIGNED AND SEALED) TO BE PROVIDED UNDER SEPARATE DOCUMENT. CONTRACTOR PRIOR TO CONSTRUCTION, SHALL REVIEW THE APPROVED ANTENNA MOUNT ANALYSIS REPORT SUPPLIED BY T-MOBILE AND MODIFY, IF REQUIRED, ALL APPLICABLE MEMBERS AS INDICATED IN CERTIFIED STRUCTURAL REPORT PRIOR TO INSTALLATION ON STRUCTURE.

NOTE:
PAINT ANTENNAS TO MATCH (E) BUILDING



2 PROPOSED SOUTH ELEVATION

SCALE: AS NOTED

4' 0 8' 16' 24'

SCALE: 1/8"=1'-0"

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LICENSURE NO:

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PARTHA RAMAKRISHNAN
52228
PROFESSIONAL ENGINEER
09/30/2020

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SS	ML	PR

Sheet Title:

TOWER
ELEVATION

Sheet Number:

A4

ANTENNA NOTES:

1. ANTENNA CONTRACTOR SHALL INSURE THAT ALL ANTENNA MOUNTING PIPES ARE PLUMB.
2. FEEDLINE LENGTHS INDICATED ARE APPROXIMATE.
3. ANTENNA COAXIAL FEEDERS & ANTENNA JUMPERS SHALL BE COLOR CODED PER T-MOBILE REQUIREMENTS.
4. IN ADDITION TO THE COLOR CODE, THE FOLLOWING ANTENNA SECTOR COLOR STRIPE SHALL BE ADDED TO EACH ANTENNA SECTOR FEEDLINE & JUMPER.
5. SEE SHEET A_ FOR DETAILS

   ALPHA - RED STRIPE
   BETA - BLUE STRIPE
   GAMMA - WHITE STRIPE
   DELTA - GREEN STRIPE
   EPSILON - GRAY STRIPE
   ZETA - BROWN STRIPE
   HYBRID - GRAY STRIPE

6. MULTI PORT ANTENNAS: TERMINATE UNUSED ANTENNA PORTS WITH CONNECTOR CAP & WEATHERPROOF THOROUGHLY. JUMPERS FROM TMAs MUST TERMINATE TO OPPOSITE POLARIZATIONS IN EACH SECTOR.
7. CONTRACTOR MUST FOLLOW ALL MANUFACTURERS' RECOMMENDATIONS REGARDING THE INSTALLATION OF FEEDLINES, CONNECTORS, AND ANTENNAS.
8. MINIMUM BEND RADIUS:

   LDF4-50A (1/2" HARD LINE) = 5"
   FSJ4-50B (1/2" SUPER FLEX) = 1 1/4"
   AVA5-50A (7/8" HARD LINE) = 10"
   AVA7-50A (1-5/8" HARD LINE) = 15"
   LDF7-50A (1-5/8" HARD LINE) = 20"

9. CONTRACTOR SHALL RECORD THE SERIAL #, SECTOR, AND POSITION OF EACH ACTUATOR INSTALLED AT THE ANTENNAS AND PROVIDE THE INFORMATION TO T-MOBILE.
10. WEATHERPROOF ALL ANTENNA CONNECTORS WITH SELF AMALGAMATING TAPE.
11. ANTENNA CONTRACTOR SHALL PERFORM A "TAPE DROP" MEASUREMENT TO CONFIRM/ VALIDATE ANTENNA CENTERLINE (ACL) HEIGHT. CONTRACTOR SHALL SUBMIT A COMPLETED HEIGHT VERIFICATION FORM TO THE CONSTRUCTION MANAGER.
12. ALL FIBER RUNS CONTAINED IN ONE COMMSCOPE HYBRID DC-FIBER CABLE (MODEL# HCS 2.0 TRUNK CABLE 12#6AWG24 SM FIBER PR) FROM LOWER JUNCTION BOX TO UPPER JUNCTION BOX, HYBRID CABLE SHALL BE COLOR CODED PER T-MOBILE REQUIREMENTS.

1 ANTENNA NOTES

SCALE: N.T.S.

2 NOT USED

SCALE: N.T.S.

ANTENNA KEY

STATUS	ANTENNA NUMBER	BEAM WIDTH	ANTENNA VENDOR	MODEL #	AZIMUTH	ELEC. DOWNTILT	MECH. DOWNTILT	ANTENNA CENTERLINE AGL	TECH.	HYBRID FEEDER (QTY) SIZE	HYBRID FEEDER COLOR CODE
NEW	A1	65°	COMMSCOPE	FFHH-65C-R3	340°	TBD	0°	67'	N 600 LTE 600 LTE 700 LTE 1900 LTE 2100 U 2100	(1) (E) HCS 1.0 HYBRID CABLE (100')	GRAY 1
NEW	A2	65°	NOKIA	AEHC	340°	TBD	0°	67'	LTE 2500 N 2500	(1) (N) HCS 2.0 TRUNK CABLE (100')	
NEW	B1	65°	COMMSCOPE	FFHH-65C-R3	100°	TBD	0°	67'	N 600 LTE 600 LTE 700 LTE 1900 LTE 2100 U 2100	SHARED W/ ALPHA	GRAY 2
NEW	B2	65°	NOKIA	AEHC	100°	TBD	0°	67'	LTE 2500 N 2500	(1) (N) HCS 2.0 FIBER JUMPER CABLE (30')	
NEW	C1	65°	COMMSCOPE	FFHH-65C-R3	220°	TBD	0°	67'	N 600 LTE 600 LTE 700 LTE 1900 LTE 2100 U 2100	SHARED W/ ALPHA	GRAY 3
NEW	C2	65°	NOKIA	AEHC	220°	TBD	0°	67'	LTE 2500 N 2500	(1) (N) HCS 2.0 FIBER JUMPER CABLE (30')	

EQUIPMENT PLATFORM / EQUIPMENT KEY

LOCATION	VENDOR	EQUIPMENT	MODEL NUMBER	TECH.	QTY.	STATUS
H-FRAME	NOKIA	FIBER J-BOX	HCS 2.0 TOWER J-BOX	-	1	(N)
H-FRAME	NOKIA	FIBER J-BOX	LARGE COVP	-	1	(E)
CABINET	NOKIA	SYSTEM MODULE	FSMF	U2100	1	(E)
CABINET	NOKIA	SYSTEM MODULE	ABIA	LTE 600 LTE 700 LTE 1900 LTE 2100	3	(N)
CABINET	NOKIA	SYSTEM MODULE	ASIB	LTE 600 LTE 700 LTE 1900 LTE 2100 LTE2500	2	(N)
CABINET	NOKIA	SYSTEM MODULE	ABIL	N2500 N600	4	(N)
CABINET	NOKIA	SYSTEM MODULE	ABIC	LTE 2500	3	(N)
CABINET	NOKIA	SYSTEM MODULE	ASIK	N2500 N600	2	(N)
CABINET	NOKIA	SYSTEM MODULE	AMIA	-	2	(N)
CABINET	NOKIA	TRANSPORT SYSTEM	CSR IXRe	-	1	(N)
-	NOKIA	VOLTAGE BOOSTER	VOLTAGE BOOSTER	-	1	(N)

NOTES:
- INFORMATION PER RFDS DATED: 06/04/2020
CONTRACTOR TO REFER TO MOST RECENT RFDS BY T-MOBILE PRIOR TO COMMENCING WORK.
- REFER TO SHEETS A9.1 & A9.2 FOR ANTENNA SPECIFICATIONS.

3 ANTENNA & EQUIPMENT KEYS

SCALE: N.T.S.

T-Mobile
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tellusconnect
5808 SOUTH RAPP ST., STE.150 LITTLETON, CO 80120

PROJECT INFORMATION:

SITE NAME:
DENVER FIRE #29
SITE ID:
DN03634A

4800 HIMALAYA RD
DENVER, CO 80249
CITY AND COUNTY DENVER

Rev:	Date:	Description:	By:
1	09/09/2020	PRELIM. CONST.	SS
2	09/21/2020	REV. 1	SF
3	09/29/2020	FINAL CONST	ML

PLANS PREPARED BY:

WYCO FIELD SERVICES
Where quality still counts.
6335 DOWNING STREET
DENVER, CO 80216
WYCOFS.COM

LICENSURE NO:

COLORADO LICENSED
GOPALAKRISHNA RAMAKRISHNAN
52228
PROFESSIONAL ENGINEER
09/30/2020

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SS	ML	PR

Sheet Title:

ANTENNA & EQUIPMENT KEYS

Sheet Number:

A5.1

ANTENNA NOTES:

1. ANTENNA CONTRACTOR SHALL INSURE THAT ALL ANTENNA MOUNTING PIPES ARE PLUMB.
2. FEEDLINE LENGTHS INDICATED ARE APPROXIMATE.
3. ANTENNA COAXIAL FEEDERS & ANTENNA JUMPERS SHALL BE COLOR CODED PER T-MOBILE REQUIREMENTS.
4. IN ADDITION TO THE COLOR CODE, THE FOLLOWING ANTENNA SECTOR COLOR STRIPE SHALL BE ADDED TO EACH ANTENNA SECTOR FEEDLINE & JUMPER.
5. SEE SHEET A_ FOR DETAILS

   ALPHA - RED STRIPE
   BETA - BLUE STRIPE
   GAMMA - WHITE STRIPE
   DELTA - GREEN STRIPE
   EPSILON - GRAY STRIPE
   ZETA - BROWN STRIPE
   HYBRID - GRAY STRIPE

6. MULTI PORT ANTENNAS: TERMINATE UNUSED ANTENNA PORTS WITH CONNECTOR CAP & WEATHERPROOF THOROUGHLY. JUMPERS FROM TMAs MUST TERMINATE TO OPPOSITE POLARIZATIONS IN EACH SECTOR.
7. CONTRACTOR MUST FOLLOW ALL MANUFACTURERS' RECOMMENDATIONS REGARDING THE INSTALLATION OF FEEDLINES, CONNECTORS, AND ANTENNAS.
8. MINIMUM BEND RADIUS:

   LDF4-50A (1/2" HARD LINE) = 5"
   FSJ4-50B (1/2" SUPER FLEX) = 1 1/4"
   AVA5-50A (7/8" HARD LINE) = 10"
   AVA7-50A (1-5/8" HARD LINE) = 15"
   LDF7-50A (1-5/8" HARD LINE) = 20"

9. CONTRACTOR SHALL RECORD THE SERIAL #, SECTOR, AND POSITION OF EACH ACTUATOR INSTALLED AT THE ANTENNAS AND PROVIDE THE INFORMATION TO T-MOBILE.
10. WEATHERPROOF ALL ANTENNA CONNECTORS WITH SELF AMALGAMATING TAPE.
11. ANTENNA CONTRACTOR SHALL PERFORM A "TAPE DROP" MEASUREMENT TO CONFIRM/ VALIDATE ANTENNA CENTERLINE (ACL) HEIGHT. CONTRACTOR SHALL SUBMIT A COMPLETED HEIGHT VERIFICATION FORM TO THE CONSTRUCTION MANAGER.
12. ALL FIBER RUNS CONTAINED IN ONE COMMSCOPE HYBRID DC-FIBER CABLE (MODEL# HCS 2.0 TRUNK CABLE 12#6AWG24 SM FIBER PR) FROM LOWER JUNCTION BOX TO UPPER JUNCTION BOX, HYBRID CABLE SHALL BE COLOR CODED PER T-MOBILE REQUIREMENTS.

1 ANTENNA NOTES

SCALE: N.T.S.

2 NOT USED

SCALE: N.T.S.

TOWER TOP EQUIPMENT KEY

LOCATION	VENDOR	EQUIPMENT	MODEL NUMBER	TECH.	QTY.	STATUS
-	NOKIA	COVP	-	-	1	(E)
1 PER SECTOR	NOKIA	RRU	AHLOA	N600 LTE600 LTE700	3	(N)
1 PER SECTOR	NOKIA	RRU	AHFIG	LTE 1900 LTE 2100 U 2100	3	(N)
-	NOKIA	FIBER J-BOX	PENDANT/BREAKOUT FEATURE	-	1	(N)

EQUIPMENT FEEDLINE KEY

LOCATION	VENDOR	EQUIPMENT	MODEL NUMBER	TECH.	QTY.	STATUS
-	COMMSCOPE	FIBER JUMPER	±30' HCS 2.0 JUMPER CABLE 10AWG-2-PR-AIRSCALE	-	3	(N)
-	COMMSCOPE	HYBRID TRUNK	±100' HCS 2.0 TRUNK CABLE 12#6AWG 24 SM FIBER PR	-	1	(N)
-	COMMSCOPE	HYBRID TRUNK	±100' HCS 1.0 TRUNK CABLE	-	1	(E)

NOTES:
- INFORMATION PER RFDS DATED: 06/04/2020
CONTRACTOR TO REFER TO MOST RECENT RFDS BY T-MOBILE PRIOR TO COMMENCING WORK.
- REFER TO SHEETS A9.1 & A9.2 FOR ANTENNA SPECIFICATIONS.

3 ANTENNA & EQUIPMENT KEYS

SCALE: N.T.S.

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WYCOFS.COM

LICENSURE NO:

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LAKSHMI RAMAKRISHNAN
52228
PROFESSIONAL ENGINEER
09/30/2020

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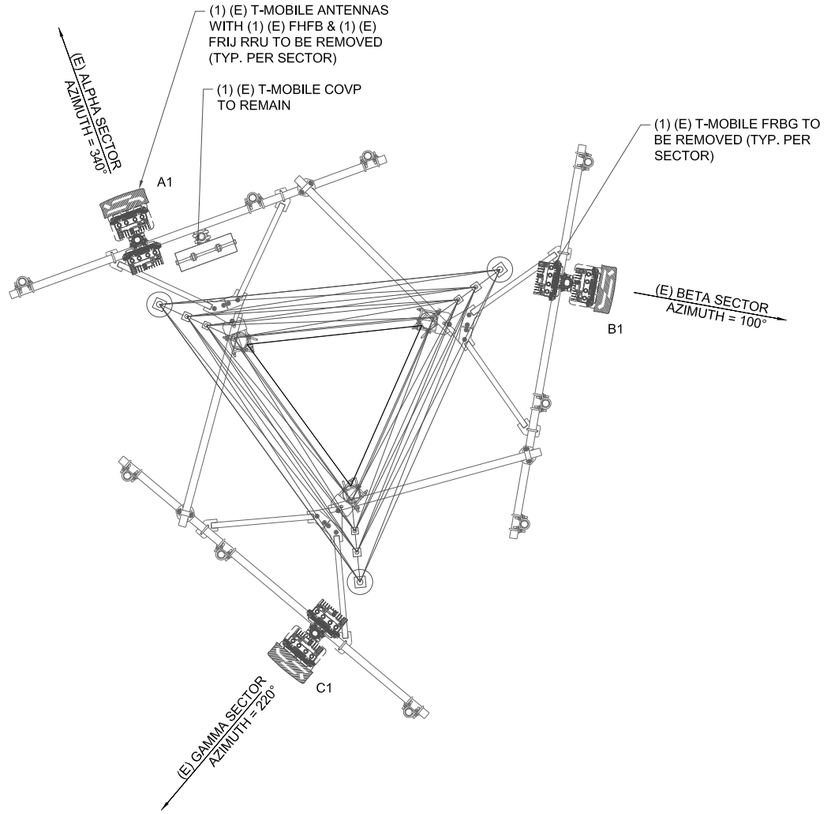
Sheet Title:

ANTENNA & EQUIPMENT KEYS

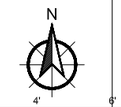
Sheet Number:

A5.2



1 EXISTING ANTENNA LAYOUTS

SCALE: AS NOTED

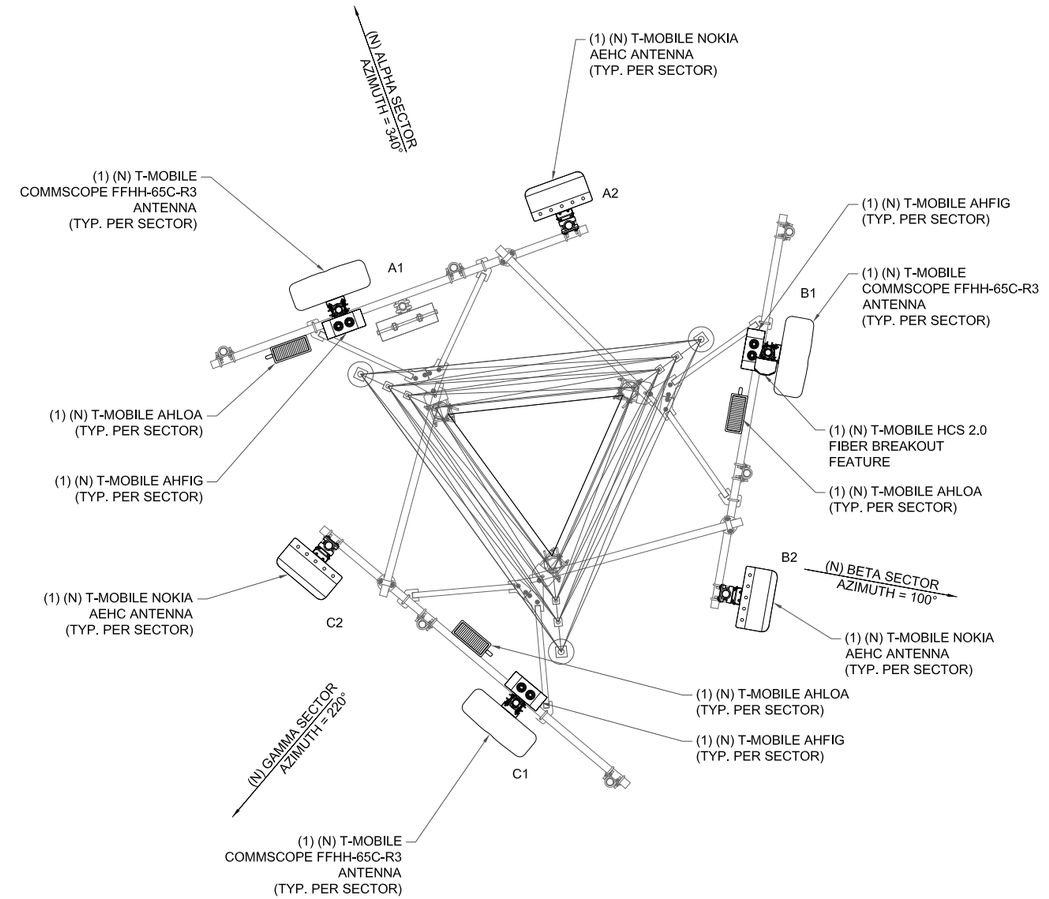


1' 0 2' 4' 6'

SCALE: 1/2"=1'-0"

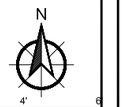
NOTES:
- INFORMATION PER RFDS DATED: 06/04/2020
CONTRACTOR TO REFER TO MOST RECENT RFDS BY T-MOBILE PRIOR TO COMMENCING WORK.
- REFER TO SHEETS A9.1 & A9.2 FOR ANTENNA SPECIFICATIONS.

STRUCTURAL NOTE:
PER MOUNT ANALYSIS FROM WYCO FIELD SERVICES DATED 09.28.20 FOR ALPHA, BETA, AND GAMMA SECTORS - (1) (E) T-MOBILE ANTENNA WILL BE REMOVED AND REPLACED WITH (1) (N) COMMSCOPE FFHH-65C-R3 AND (1) (N) AAHF ANTENNA IN EACH SECTOR.THE (N) COMMSCOPE FFHH-65C-R3 SHALL BE PLACED IN POSITION #1 AND THE AAHF ANTENNA IN POSITION #2.



2 PROPOSED ANTENNA LAYOUTS

SCALE: AS NOTED



1' 0 2' 4' 6'

SCALE: 1/2"=1'-0"

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52228
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09/30/2020

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Sheet Title:

ANTENNA LAYOUT

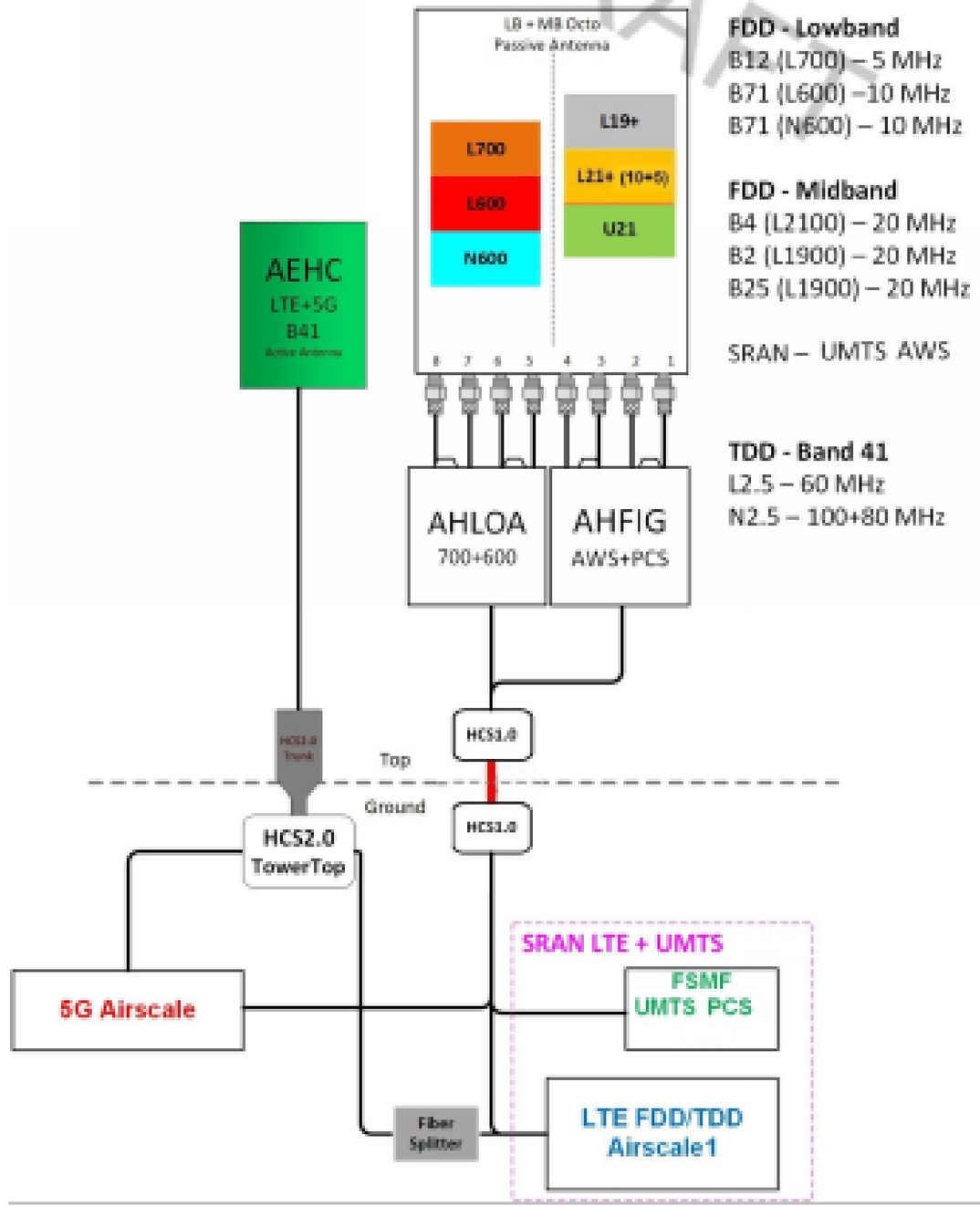
Sheet Number:

A5.3

Configuration 56791EZ_SR_U21

For 5G and LTE Airscale BB dimensioning refer to Fiber Port matrices.

(Alpha, Beta & Gamma)



FDD - Lowband
B12 (L700) – 5 MHz
B71 (L600) –10 MHz
B71 (N600) – 10 MHz

FDD - Midband
B4 (L2100) – 20 MHz
B2 (L1900) – 20 MHz
B25 (L1900) – 20 MHz

SRAN – UMTS AWS

TDD - Band 41
L2.5 – 60 MHz
N2.5 – 100+80 MHz

1	RFDS

SCALE: N.T.S.

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09/30/2020

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SS	ML	PR

Sheet Title:

RFDS

Sheet Number:

A6

N600 / L600 COAX & JUMPERS = DOUBLE PINK

ALPHA 1
ALPHA 2
ALPHA 3
ALPHA 4

BETA 1
BETA 2
BETA 3
BETA 4

GAMMA 1
GAMMA 2
GAMMA 3
GAMMA 4

DELTA 1
DELTA 2
DELTA 3
DELTA 4

EPSILON 1
EPSILON 2
EPSILON 3
EPSILON 4

ZETA 1
ZETA 2
ZETA 3
ZETA 4

L700 COAX & JUMPERS = PINK

ALPHA 1
ALPHA 2
ALPHA 3
ALPHA 4

BETA 1
BETA 2
BETA 3
BETA 4

GAMMA 1
GAMMA 2
GAMMA 3
GAMMA 4

DELTA 1
DELTA 2
DELTA 3
DELTA 4

EPSILON 1
EPSILON 2
EPSILON 3
EPSILON 4

ZETA 1
ZETA 2
ZETA 3
ZETA 4

L2100 COAX & JUMPERS

ALPHA 1
ALPHA 2
ALPHA 3
ALPHA 4

BETA 1
BETA 2
BETA 3
BETA 4

GAMMA 1
GAMMA 2
GAMMA 3
GAMMA 4

DELTA 1
DELTA 2
DELTA 3
DELTA 4

EPSILON 1
EPSILON 2
EPSILON 3
EPSILON 4

ZETA 1
ZETA 2
ZETA 3
ZETA 4

EXISTING AWS COAX & JUMPERS = YELLOW

ALPHA 1
ALPHA 2
ALPHA 3
ALPHA 4

BETA 1
BETA 2
BETA 3
BETA 4

GAMMA 1
GAMMA 2
GAMMA 3
GAMMA 4

DELTA 1
DELTA 2
DELTA 3
DELTA 4

EPSILON 1
EPSILON 2
EPSILON 3
EPSILON 4

ZETA 1
ZETA 2
ZETA 3
ZETA 4

GSM (PCS BAND) COAX & JUMPERS = ORANGE

ALPHA 1
ALPHA 2
ALPHA 3
ALPHA 4

BETA 1
BETA 2
BETA 3
BETA 4

GAMMA 1
GAMMA 2
GAMMA 3
GAMMA 4

DELTA 1
DELTA 2
DELTA 3
DELTA 4

EPSILON 1
EPSILON 2
EPSILON 3
EPSILON 4

ZETA 1
ZETA 2
ZETA 3
ZETA 4

UMTS (PCS BAND) COAX & JUMPERS = PURPLE

ALPHA 1
ALPHA 2
ALPHA 3
ALPHA 4

BETA 1
BETA 2
BETA 3
BETA 4

GAMMA 1
GAMMA 2
GAMMA 3
GAMMA 4

DELTA 1
DELTA 2
DELTA 3
DELTA 4

EPSILON 1
EPSILON 2
EPSILON 3
EPSILON 4

ZETA 1
ZETA 2
ZETA 3
ZETA 4

NEW LMU COAX & JUMPERS = BROWN

ALPHA 1
ALPHA 2
ALPHA 3
ALPHA 4

BETA 1
BETA 2
BETA 3
BETA 4

GAMMA 1
GAMMA 2
GAMMA 3
GAMMA 4

DELTA 1
DELTA 2
DELTA 3
DELTA 4

EPSILON 1
EPSILON 2
EPSILON 3
EPSILON 4

ZETA 1
ZETA 2
ZETA 3
ZETA 4

L1900 (PCS BAND) COAX & JUMPERS = DOUBLE PURPLE

ALPHA 1
ALPHA 2
ALPHA 3
ALPHA 4

BETA 1
BETA 2
BETA 3
BETA 4

GAMMA 1
GAMMA 2
GAMMA 3
GAMMA 4

DELTA 1
DELTA 2
DELTA 3
DELTA 4

EPSILON 1
EPSILON 2
EPSILON 3
EPSILON 4

ZETA 1
ZETA 2
ZETA 3
ZETA 4

1	CABLE COLOR CODING

SCALE: N.T.S.

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WYCOFS.COM

LICENSURE NO:

COLORADO LICENSED
PRAVEEN RAMAKRISHNAN
52228
PROFESSIONAL ENGINEER
09/30/2020

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SS	ML	PR

Sheet Title:
CABLE
COLOR CODING

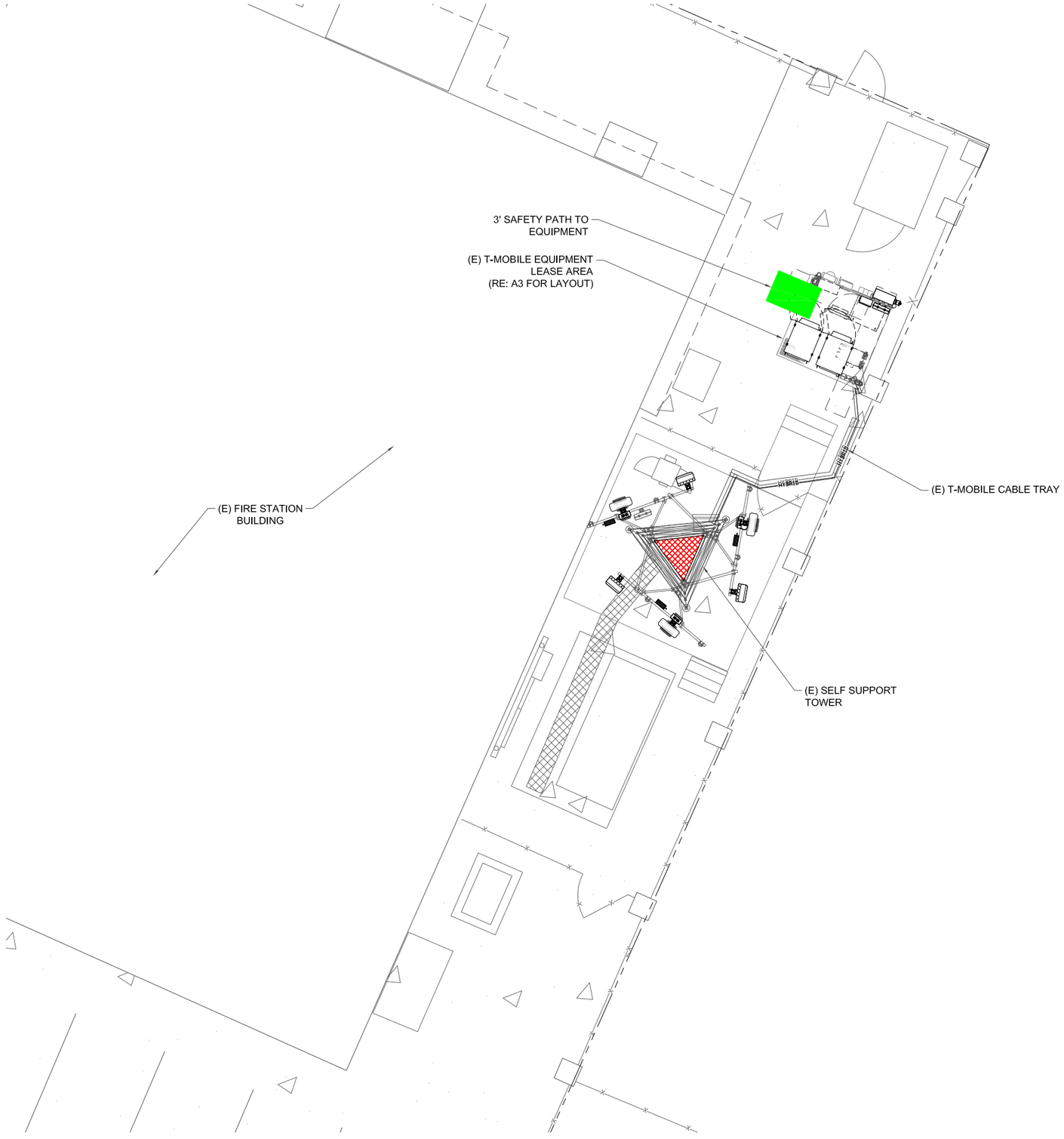
Sheet Number:
A7

NOTE:
THIS SITE MEETS OSHA COMPLIANCE FOR FIELD OPERATIONS TO ACCESS BTS EQUIPMENT ON CONCRETE EQUIPMENT PAD. ALPHA, BETA, & GAMMA SECTOR RADIO'S & ANTENNA'S ON SELF SUPPORT TOWER ARE ACCESSIBLE BY TOWER CREW ONLY.

LEGEND

15' FALL ZONE & INACCESSIBLE AREAS

3' SAFETY PATH TO EQUIPMENT



1 SAFETY PLAN

SCALE: N.T.S.

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PROFESSIONAL ENGINEER
09/30/2020

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Sheet Title:

SAFETY PLAN

Sheet Number:

A8

Product Specifications

COMMSCOPE®

FFHH-65C-R3

8-port sector antenna, 4x 617-806 and 4x 1695–2360 MHz, 65° HPBW, 3x RET, 600 MHz-Ready Antenna Technology

Electrical Specifications

Frequency Band, MHz	617–698	698–806	1695–1880	1850–1990	1920–2200	2300–2360
Gain, dBi	15.3	15.5	17.8	18.2	18.9	19.6
Beamwidth, Horizontal, degrees	67	63	65	66	64	55
Beamwidth, Vertical, degrees	10.2	9.1	5.7	5.3	4.9	4.4
Beam Tilt, degrees	2–13	2–13	2–12	2–12	2–12	2–12
USLS (First Lobe), dB	19	17	20	19	19	21
Front-to-Back Ratio at 180°, dB	32	29	35	40	40	41
Isolation, dB	28	28	28	28	28	28
Isolation, Intersystem, dB	28	28	28	28	28	28
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
Input Power per Port, maximum, watts	300	300	300	300	300	250
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	617–698	698–806	1695–1880	1850–1990	1920–2200	2300–2360
Gain by all Beam Tilts, average, dBi	15.0	15.2	17.4	17.9	18.5	19.3
Gain by all Beam Tilts Tolerance, dB	±0.6	±0.5	±0.4	±0.5	±0.6	±0.5
	2 ° | 14.8	2 ° | 15.0	2 ° | 17.2	2 ° | 17.6	2 ° | 18.1	2 ° | 18.8
Gain by Beam Tilt, average, dBi	8 ° | 15.1	8 ° | 15.3	7 ° | 17.5	7 ° | 18.0	7 ° | 18.6	7 ° | 19.4
	13 ° | 15.0	13 ° | 15.1	12 ° | 17.4	12 ° | 17.8	12 ° | 18.4	12 ° | 19.2
Beamwidth, Horizontal Tolerance, degrees	±2.7	±4.8	±5.5	±5.2	±4.9	±6.4
Beamwidth, Vertical Tolerance, degrees	±0.6	±0.7	±0.4	±0.3	±0.4	±0.1
USLS, beampeak to 20° above beampeak, dB	17	12	15	16	16	18
Front-to-Back Total Power at 180° ± 30°, dB	23	21	29	31	31	31
CPR at Boresight, dB	24	23	21	20	21	22
CPR at Sector, dB	6	10	9	9	9	8

* 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.

Array Layout

Product Specifications

COMMSCOPE®

FFHH-65C-R3

RF Connector Quantity, high band	4
RF Connector Interface	4.3-10 Female
Color	Light gray
Grounding Type	RF connector inner conductor and body grounded to reflector and mounting bracket
Radiator Material	Aluminum | Low loss circuit board
Radome Material	Fiberglass, UV resistant
Reflector Material	Aluminum
RF Connector Location	Bottom
Wind Loading, frontal	1925.0 N @ 150 km/h 432.8 lbf @ 150 km/h
Wind Loading, lateral	351.0 N @ 150 km/h 78.9 lbf @ 150 km/h
Wind Loading, rear	1945.0 N @ 150 km/h 437.3 lbf @ 150 km/h
Wind Speed, maximum	241 km/h | 150 mph

Dimensions

Length	2437.0 mm | 95.9 in
Width	640.0 mm | 25.2 in
Depth	235.0 mm | 9.3 in
Net Weight, without mounting kit	57.9 kg | 127.6 lb

Remote Electrical Tilt (RET) Information

Input Voltage	10–30 Vdc
Internal RET	High band (2) | Low band (1)
Power Consumption, idle state, maximum	1 W
Power Consumption, normal conditions, maximum	10 W
Protocol	3GPP/AISG 2.0 (Single RET)
RET Interface	8-pin DIN Female | 8-pin DIN Male
RET Interface, quantity	1 female | 1 male

Packed Dimensions

Length	2590.0 mm | 102.0 in
Width	752.0 mm | 29.6 in
Depth	380.0 mm | 15.0 in
Shipping Weight	84.4 kg | 186.1 lb

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

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SS	ML	PR

Sheet Title:

ANTENNA SPECIFICATIONS

Sheet Number:

A9.1

1	ANTENNA SPECIFICATIONS

SCALE: N.T.S.

AEHC AirScale MAA 64T64R 192AE B41 320W

Preliminary technical data

Specification	Details
Standard	3GPP NR and LTE compliant, TDD, FCC compliant
Band / Frequency range	2496 - 2690 MHz 3GPP B41
Max. supported modulation	256 QAM
Number of TX/RX paths	64T / 64R
MIMO streams	16
Instantaneous bandwidth IBW	194 MHz
Occupied bandwidth OBW	190 MHz
Total average EIRP	79 dBm
Max. output power per TRX	5 W / TRX (320 W total)
Dimensions	970 mm (H) x 540 mm (W) x 205 mm (D)
Volume	94 l
Weight	47 kg (without mounting brackets)
Supply voltage / Connector type	DC -36 V ... -60 V / 2 pole connector
Power consumption	≤1280 W typical (75% DL duty cycle, 30% RF load) ≤1690 W max (75% DL duty cycle, 100% RF load)
Optical ports	4 x SFP28, 10/25GE eCPRI (Octis)
Other interfaces / Connector type	RF monitor port / SMA, Control AISG, External Alarms / MDR26, status LED
Operational temperature range	-40 °C ... +55 °C
Cooling	Natural convection cooling
Installation options	Pole / Wall, ± 15° vertical
Ingress / Surge protection	IP65, Class II 20 kA
Supported RAT	5G, TD-LTE

AirScale High Power Wide Band MAA benefits

- 5G Adaptive Antenna System for optimized capacity and coverage
- Beamforming capable 64T64R with total 320W output power
- Full band operation for B41

AEHC 475124A

NOKIA

1 ANTENNA SPECIFICATIONS

SCALE: N.T.S.

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tellusconnect
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PROJECT INFORMATION:

SITE NAME:
DENVER FIRE #29

SITE ID:
DN03634A

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ANTENNA SPECIFICATIONS

Sheet Number:

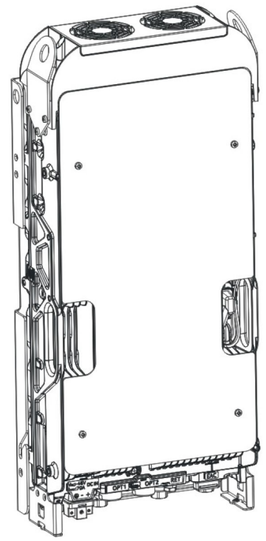
A9.2

AirScale Dual RRH 4T4R B12/71 240W AHLOA

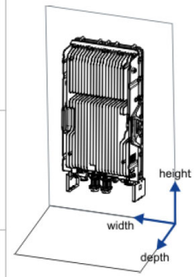
Product Code: 474331A	
Supported Frequency bands	3GPP Band 12/71
Frequencies	Band 12 adjusted: UL 698 – 716 MHz, DL 728 – 746 MHz Band 71: UL 663 MHz – 698 MHz, DL 617 MHz – 652 MHz
Number of TX/RX paths/pipes	4 pipes; 2T2R, 2T4R, 4T4R for both bands
Instantaneous Bandwidth IBW	17 MHz for B12 and 35MHz for B71 1 MHz below B12 NB IoT future use
Occupied Bandwidth OBW	UL 53MHz contiguous DL B12 17MHz + 1 MHz NB IoT future use. B71 35MHz
Output Power	60W per TX shared between bands
Supply Voltage / Range	DC-48 V / -36 V to -60 V
Typical Power Consumption	640W [ETSI Busy Hour Load at 4TX@60W
	450W [ETSI Busy Hour Load at 4TX@20W
Antenna Ports	4 ports, 4.3-10+
Optical Ports	2 x CPRI 9.8 Gbps
ALD Control Interfaces	AISG3.0 and RET (DC on ANT1 & ANT3)
Other Interfaces	External Alarm MDR-26 (4 inputs, 1 Output) DC Circular Power Connector
Physical	560 mm x 308 mm x 189 mm Approximately 38kg with no covers or brackets
Operating Temperature Range	-40°C to 55°C (with no solar load)
Surge Protection	Class II 5A
Installation Options	Pole, Wall, Book Mount

NOKIA

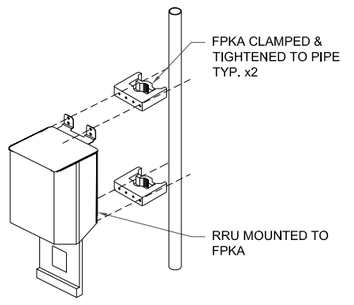
1 RRU SPECIFICATIONS (AHLOA)
SCALE: N.T.S.

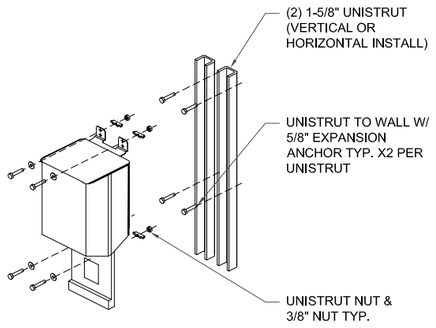


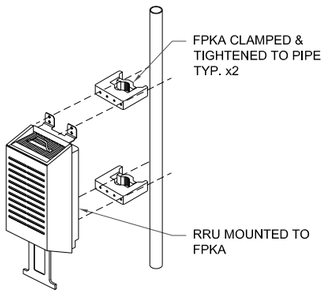
Property	Value	Dimensions orientation
Height	Core RRH: 695 mm (27.36 in.) With upper and lower mounting brackets: 730 mm (28.74 in.)	
Width	Core RRH: 308 mm (12.13 in.) With mounting cover: 327 mm (12.87 in.)	
Depth	Core RRH: 131 mm (5.15 in.) With mounting cover: 142 mm (5.59 in.)	
Weight	Core RRH: 32 kg (70.55 lb)	
Volume	Core RRH: 31 l	



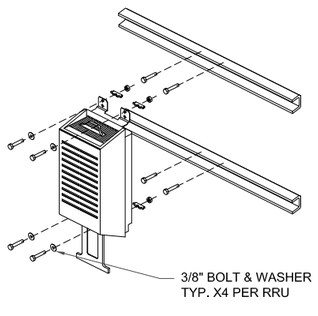
2 RRU SPECIFICATIONS (AHFIG)
SCALE: N.T.S.







PIPE MOUNTED



UNISTRUT MOUNTED

3 RRU MOUNTING DETAIL
SCALE: N.T.S.

4 NOT USED
SCALE: N.T.S.

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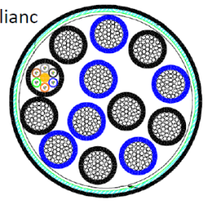
A10

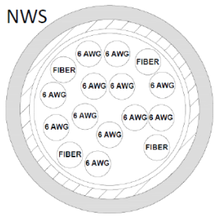
Trunk Cable General Specifications

Characteristics	Alliance	CommScope	NWS
Outer Diam.	1.46”	1.55”	1.48”
Weight	1.61 lb/ft	1.71 lb/ft	1.61 lb/ft
Min. Bend Rad	14.6”	18.6”	21.5”
DC Conductors	12 x 6AWG	12 x 6AWG	12 x 6AWG
Armor	Corrugated Cu	Corrugated Al	Cu tape, PVC
Conductor Termination	None	None	None
Single-Mode Fibers	48	48	48
Fiber Termination	LC pair	LC pair	LC pair

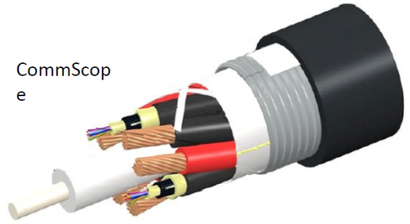
Alliance



NWS



CommScope

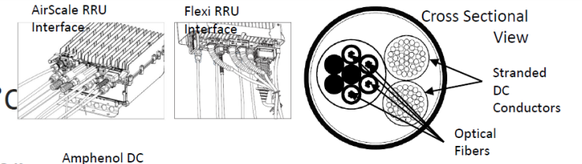


1 HCS 2.0 TRUNK CABLE SPECIFICATIONS

SCALE: N.T.S.

Hybrid Jumper Cable General Specifications

- Outer diameter: 0.72”
- Weight: 0.34 lb/ft
- Operating Temp: -40 °C to +75 °C
- Connectorized for mating with tower top trunk cable breakout or roof top box
- DC and fiber interfaces versions for Nokia Airscale and Flexi RRUs
- Short (tower top 15’) & long (roof top 20’ - 250’) AirScale versions available
- Also available with legacy booted LC connectors and blunt cut DC conductors for Flexi RRU applications



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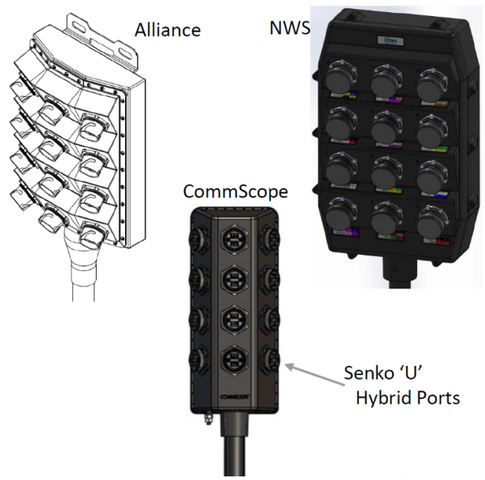
2 HCS 2.0 HYBRID JUMPER CABLE SPECIFICATIONS

SCALE: N.T.S.

Breakout Feature General Specifications

Characteristics	Alliance	CommScope	NWS
Dimensions, in.	9.3x14.9x5.8	6.7x16.9x4.7	10.2x16.0x3.2
Weight	1.61 lb/ft	0.970 lb/ft	1.61 lb/ft
Port Interface	Senko U	Senko U	Senko U
Hybrid Ports	12	12	12
Conductor Termination	None	None	None
Single Mode Fibers	48	48	48
Fiber Termination	LC pair	LC pair	LC pair
Max RRU	12	12	12

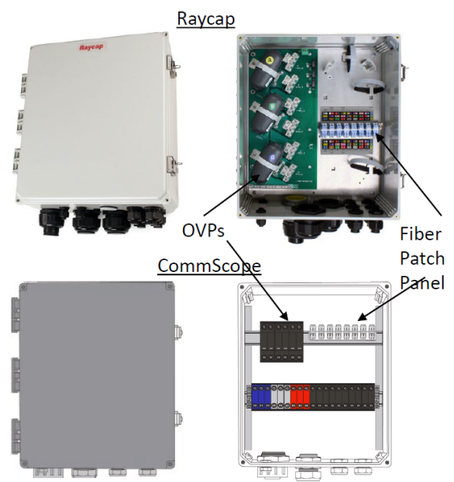


3 HCS 2.0 PENDANT/BREAKOUT FEATURE SPECIFICATIONS

SCALE: N.T.S.

Bottom Junction Box General Specifications

Characteristics	CommScope	Raycap
Dimensions	14”x16”x8”	14”x16”x8”
Weight	23.5 lb	21.9 lb
OVP, IEC 61643-1	24”	Class I SPD (3)
UL Rating		1449, 4th Ed.
OVP Monitoring	Dry contact	Dry contact
Fiber Patch Panel	24 LC pairs	24 LC pairs
Environmental Rating	IP67	IP66
Operating Temperature	-40 °C to +75 °C	-40 °C to +80 °C



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4 HCS 2.0 BOTTOM JUNCTION BOX SPECIFICATIONS

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A11

Figure: *AMIA AirScale Subrack (factory default)*

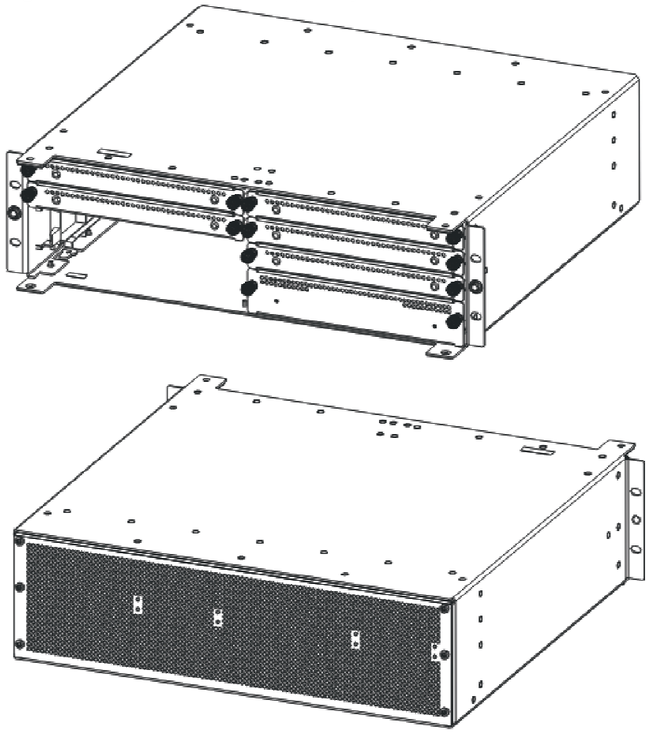
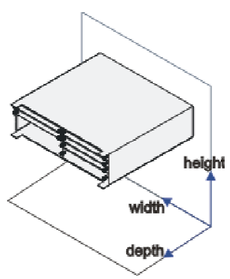


Table: *AMIA dimensions and weight*

Property	Value	Dimensions orientation
Height	128.5 mm (5.1 in.)	
Depth	400 mm (15.7 in.)	
Width	447 mm (17.6 in.)	

Property	Value	Dimensions orientation
Weight	Empty: 5.1 kg (11.2 lb) With dummy panels: 6.8 kg (15 lb) With all units: 23.9 kg (52.7 lb)	

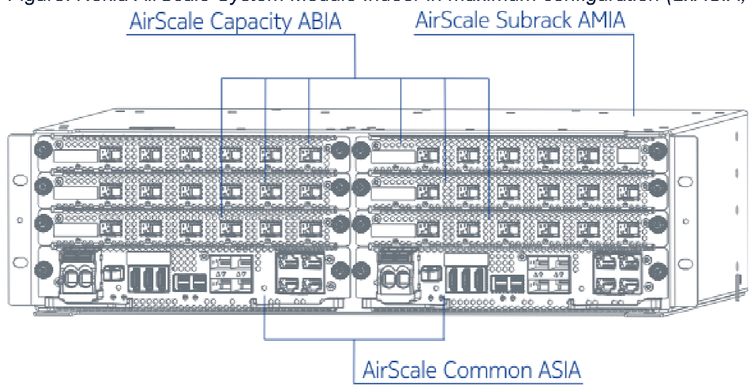
For more information, see the *Nokia AirScale Base Station Product Description* document.

Nokia AirScale System Module Indoor

Nokia AirScale System Module Indoor consists of the following items:

- One Nokia AirScale Subrack (AMIA), including backplane for high bandwidth connectivity between processing plug-in units
- One or two Nokia AirScale Common (ASIA) plug-in units for transport interfacing and for centralized processing
- Up to six Nokia AirScale Capacity (ABIA) plug-in units for baseband processing and for optical interfaces with radio units

Figure: *Nokia AirScale System Module Indoor in maximum configuration (2xASIA, 6xABIA)*



1	AMIA SYSTEM MODULE DETAIL

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EQUIPMENT DETAILS

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A12

HP-Large 3 Power Cabinet

Product Features

Compact design for equipment, power and battery:

- 30RU supports 3 radios and transport equipment
- 600A @ -48V power system
- Slimline high efficiency rectifier
- ORION Touch screen Controller
- Rear Access Hatch

Direct air cooling solution, 6000W capacity, 5°C delta T

Easy slide-in filter replacement for Merv-13 or Gore filter Mates with:

- New 2 string Slim Battery cabinet
- Large-2 battery cabinet
- V2 Equipment and battery cabinet

Designed to GR-487 specification

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Specifications

Model	HP-Large 3 Power Cabinet
1. General	
Construction	Aluminum enclosure
Dimensions (W x H x D)	30 x 72 x 35 in.(766x 1829x 889mm), Depth with Door: 41 in. (1067 mm)
Weight	~551 lbs (~270kg) (withoutcustomer equipment or batteries)
Internal rack dimension	Total Equipment space, 30RU: Horizontal rack: 19" x 27RU Vertical rack: 19" x 3RU Power System space: 23" x 12RU
Mounting options	Pad-mount, plinth option
Finish	Polyester Powder Paint (Tan)
Safety	UL Listed , IEC / EN 60950
2. Environment	
Operating temperature	-40°C to +50°C (-40°F to +122°F) with solar load. IP55
Protection class	designed to GR-487
Acoustics	5°C delta T: 70 dBA @ 6000W, 65dBA @5000W heat load
Humidity (relative)	95%,non-condensing (Max.)
3. Thermal management	
Cooling Equipment:	Direct Air Cooling 6000W, 5°C delta T (6) centrifugal redundant fans. (3) Merv-13 or optional GORE filters front door (3) Merv-13 filters rear hatch
Heating Equipment:	Forced air heating (2) 1000W AC heaters
4. Equipment	
Cable Entry	Knock-out plate on each upper side wall Additional knockouts each side (1) 3" conduit hole with hole plug
Door latch	3 point latching, 5/16 nut driver tool, pad-locking capability
Primary ground	10 double-hole ¼"-20 threaded holes on 5/8" center ground bar
Lifting Ears	4 Lifting Tabs
Standard equipment	AC Load Center: 240V dual feed / (1) 200A + (1)100A 208V single feed / (1) 200A AC Surge Protection for each breaker feed GFCI Receptacle 120V (6 form-C) Alarm Termination block (1) Thermal Probe 605A/ 54V (336kW) redundant Power System with DIN rail distribution: 12 rectifier positions (qty 3x55A DPR3000 rectifiers included) 52 poles for load (qty 1x150A, 3x10A load circuit breakers included) 16 poles for battery (qty 2x200A battery circuit breakers included) (2) SB350 generator connector LVD over-ride switch (2) SB175 Battery connections (2) SB350 Battery connections Front Door: (6) DC powered centrifugal fans with (3) MERV-13 filters, (GORE option) Clogged Filter alarm pressure switch Door intrusion alarm (2) 1000W AC powered heaters LED interior cabinet light Rear Hatch: Exhaust vent with (3) MERV-13 filters

5. Ordering information		
Cabinet	ESOA600-HCU01	HP-Large 3 600A Power / Equipment Cabinet
Rectifier	ESR-48/60A D-A	48V / 56A 3000W, 96.4%, CAN communication
Controller (Spare)	TPS1020028AU17	Orion TOUCH Controller
Plinth, 6"	37993318816900-S	Plinth for V1/V2, HPL2, HPL3, LB2 cabinets only

Delta Group Website:
www.deltaww.com

Product Website:
www.deltapowersolutions.com

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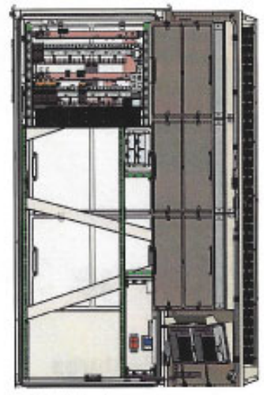

Front Door Open

Rear Hatch View

*All specifications are subject to change without prior notice.

1 SITE SUPPORT CABINET (SSC) DETAIL

SCALE: N.T.S.

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A13

Large Battery 3 Cabinet

Product Features

Compact design for battery strings:

- Direct air cooling solution
- Supports four strings of -48V VRLA batteries up to 210Ah
- 600A rated bus bar with 200A breaker per string
- Bulk Input / Output with ability to daisy chain cabinets
- Front to Front Air Flow
- Corrosion resistant aluminum construction
- Powder coated high gloss finish
- Designed to meet GR-487

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Specifications

Model	LB3 (Large Battery 3 Cabinet)	
1. General		
Construction	Aluminium enclosure	
Dimensions (W x H x D)	30 x 72 x 35 in. (381 x 1829x 889mm), Depth with Door: 41.2 in. (1047mm)	
Weight	~540 lbs (~245kg) (without batteries)	
Internal rack dimension	4 battery trays to support up to 4 strings 210Ah batteries	
Mounting options	Pad-mount, plinth option	
Finish	Polyester Power Paint (Tan)	
Safety	UL Listed , IEC / EN 60950	
2. Environment		
Operating temperature	-40°C to +50°C (-40°F to +122°F) with solar load	
Protection class	IP55 designed to GR-487	
Acoustics	65dBA	
Humidity (relative)	95%, non-condensing (Max.)	
3. Thermal Management		
Cooling Equipment:	Direct Air Cooling	
Heating Equipment:	Forced air heating (1) 1000W AC heaters	
4. Equipment		
Cable entry	Knock-out plate on each upper side wall Additional knockouts each side	
Door latch	3 point latching, 5/16 nut driver tool, pad-locking capability	
Primary ground	10 double-hole ¼"-20 threaded holes on 5/8" center ground bar	
Lifting Ears	4 Lifting Tabs	
Plinth	Optional 6" plinth available	
Standard equipment	AC Load Center: 30A heater breaker Left or Right side AC entry options AC Surge Protection (option) DC Load Center: 600A bulk feed bus bar (4) 200A bolt in battery breakers (4) 2-hole lug landings,(2 output/2 input from second battery cabinet) Temp Probes Battery Trays: (4) battery trays (4) -48V battery strings (210Ah max each) Connection kit: (1) DC 10A Breaker supplied (install onto HPL3 Power Cabinet) LED interior cabinet light	
Front Door:	(2) DC powered Axial fans with (1) F5 Filters Door intrusion alarm (1) 1000W AC powered heaters	
5. Ordering information		
Cabinet	ESOF015-ECV04	Large Battery 3 (LB3) Cabinet
Plinth, 6"	37993318816900-S	Plinth for V1/V2, HPL2, HPL3, LB2 and LB3

*All specifications are subject to change without prior notice.

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Product Website:
www.deltapowersolutions.com

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1	BATTERY CABINET DETAIL

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09/30/2020

ALL SCALES ARE SET FOR 24"x36" SHEET

DRAWN BY:	CHK BY:	APV BY:
SS	ML	PR

Sheet Title:
EQUIPMENT DETAILS

Sheet Number:
A14

GENERAL CONSTRUCTION NOTES:

1. THE FACILITY IS AN UNOCCUPIED WIRELESS FACILITY.
2. PLANS ARE NOT TO BE SCALED AND ARE INTENDED TO BE A DIAGRAMMATIC OUTLINE ONLY, UNLESS NOTED OTHERWISE. THE WORK SHALL INCLUDE FURNISHING MATERIALS, EQUIPMENT, APPURTENANCES AND LABOR NECESSARY TO COMPLETE ALL INSTALLATIONS AS INDICATED ON THE DRAWINGS.
3. PRIOR TO THE SUBMISSION OF BIDS, THE CONTRACTORS SHALL VISIT THE JOB SITE AND BE RESPONSIBLE FOR ALL CONTRACT DOCUMENTS, FIELD CONDITIONS AND DIMENSIONS, AND CONFIRMING THAT THE WORK MAY BE ACCOMPLISHED AS SHOWN PRIOR TO PROCEEDING WITH CONSTRUCTION. ANY DISCREPANCIES ARE TO BE BROUGHT TO THE ATTENTION OF THE IMPLEMENTATION ENGINEER AND ARCHITECT/ENGINEER PRIOR TO PROCEEDING WITH THE WORK.
4. THE CONTRACTOR SHALL RECEIVE, IN WRITING, AUTHORIZATION TO PROCEED BEFORE STARTING WORK ON ANY ITEM NOT CLEARLY DEFINED OR IDENTIFIED BY THE CONTRACT DOCUMENTS.
5. CONTRACTOR SHALL CONTACT LOCAL DIGGERS HOTLINE 48 HOURS PRIOR TO PROCEEDING WITH ANY EXCAVATION, SITE WORK OR CONSTRUCTION.
6. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURERs RECOMMENDATIONS UNLESS SPECIFICALLY INDICATED OTHERWISE OR WHERE LOCAL CODES OR REGULATIONS TAKE PRECEDENCE.
7. ALL WORK PERFORMED AND MATERIALS INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS AND ORDINANCES. CONTRACTOR SHALL GIVE ALL NOTICES AND COMPLY WITH ALL LAWS, ORDINANCES, RULES, REGULATIONS AND LAWFUL ORDERS OF ANY PUBLIC AUTHORITY REGARDING THE PERFORMANCE OF THE WORK. MECHANICAL AND ELECTRICAL SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH ALL APPLICABLE MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS, AND LOCAL AND STATE JURISDICTIONAL CODES, ORDINANCES AND APPLICABLE REGULATIONS.
8. THE GENERAL CONTRACTOR SHALL SUPERVISE AND DIRECT THE WORK, USING THE BEST SKILLS AND ATTENTION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES AND PROCEDURES AND FOR COORDINATING ALL PORTIONS OF THE WORK UNDER THE CONTRACT INCLUDING CONTACT AND COORDINATION WITH THE CONSTRUCTION FIELD ENGINEER AND WITH THE LANDLORDs AUTHORIZED REPRESENTATIVE.
9. DETAILS ARE INTENDED TO SHOW END RESULT OF DESIGN. MINOR MODIFICATIONS MAY BE REQUIRED TO SUIT JOB DIMENSIONS OR CONDITIONS, AND SUCH MODIFICATIONS SHALL BE INCLUDED AS PART OF THE WORK.
10. REPRESENTATIONS OF TRUE NORTH, OTHER THAN THOSE FOUND ON THE PLOT OF SURVEY DRAWING, SHALL NOT BE USED TO IDENTIFY OR ESTABLISH THE BEARING OF TRUE NORTH AT THE SITE. THE CONTRACTOR SHALL RELY SOLELY ON THE PLOT OF SURVEY DRAWING AND ANY SURVEYORs MARKINGS AT THE SITE FOR THE ESTABLISHMENT OF TRUE NORTH, AND SHALL NOTIFY THE ARCHITECT/ENGINEER PRIOR TO PROCEEDING WITH THE WORK IF ANY DISCREPANCY IS FOUND BETWEEN THE VARIOUS ELEMENTS OF THE WORKING DRAWINGS AND THE TRUE NORTH ORIENTATION AS DEPICTED ON THE PLAT OF SURVEY. THE CONTRACTOR SHALL ASSUME SOLE LIABILITY FOR ANY FAILURE TO NOTIFY THE ARCHITECT/ENGINEER.

STRUCTURAL NOTES:

1.0 GENERAL CONDITIONS
1.1 DESIGN AND CONSTRUCTION OF ALL WORK SHALL CONFORM TO THE APPROVED EDITION OF THE IBC EDITION AND ALL OTHER APPLICABLE STATE CODES, ORDINANCES, AND REGULATIONS. IN CASE OF CONFLICT BETWEEN THE CODES, STANDARDS, AND REGULATIONS, SPECIFICATIONS, GENERAL NOTES AND/OR MANUFACTURERs REQUIREMENTS. USE THE MOST STRINGENT PROVISION.
1.2 IT IS THE EXPRESS INTENT OF THE PARTIES INVOLVED IN THIS PROJECT THAT THE CONTRACTOR OR SUBCONTRACTOR OR INDEPENDENT CONTRACTOR OR THEIR RESPECTIVE EMPLOYEES SHALL EXCULPATE THE ARCHITECT, THE ENGINEER, THE CONSTRUCTION MANAGER, THE OWNER, AND THEIR AGENTS, FROM ANY LIABILITY WHATSOEVER AND HOLD THEM HARMLESS AGAINST LOSS, DAMAGES, LIABILITY OR ANY EXPENSE ARISING IN ANY MATTER FROM THE WRONGFUL OR NEGLIGENT ACT, OR FAILURE TO CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, OR THE CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES OR PROCEDURES OR FAILURE TO CONFORM TO THE STATE SCAFFOLDING ACT IN CONNECTION WITH THE WORK.
1.3 DO NOT SCALE DRAWINGS.
1.4 VERIFY ALL EQUIPMENT MOUNTING DIMENSIONS PER MANUFACTURER DRAWINGS.
1.5 SUBMIT ONE SEPIA AND TWO PRINTS OF ALL STRUCTURAL SHOP DRAWINGS. MARKED UP SEPIA SHALL BE RETURNED.

STRUCTURAL STEEL NOTES:

1. CHANNELS, ANGLES AND PLATES SHALL BE ASTM A36 MATERIAL, UNLESS NOTED OTHERWISE.
2. SQUARE AND RECTANGULAR TUBE STEEL HSS SECTIONS SHALL BE ASTM A500, GRADE B (Fy = 46 ksi) MATERIAL.
3. ROUND PIPE SECTIONS SHALL BE ASTM A53, GRADE B (Fy =35 ksi) MATERIAL.
4. DESIGN, FABRICATION, AND ERECTION SHALL BE IN ACCORDANCE WITH THE "AISC SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS", WITH COMMENTARY AND THE "CODE OF STANDARD PRACTICE".
5. ALL STEEL SHALL HAVE ONE COAT OF SHOP PRIMER. DO NOT PAINT AREAS WITHIN 3" OF BOLTS, WELDS OR HEADED STUDS.
6. BOLTS SHALL BE HIGH STRENGTH BOLTS, A325, CONFORMING TO ASTM SPECIFICATIONS. ALL CONNECTIONS SHALL HAVE A MINIMUM OF 2 BOLTS.
7. WELDING SHALL BE CONDUCTED BY CERTIFIED WELDERS AND SHALL CONFORM TO THE AWS CODES FOR ARC AND GAS WELDING IN BUILDING CONSTRUCTION.
8. WELDS SHALL BE MADE USING E70XX ELECTRODES AND SHALL BE 3/16" MINIMUM UNLESS OTHERWISE NOTED.
9. WELDING SHALL BE PERFORMED IN ACCORDANCE WITH A WELDED PROCEDURE SPECIFICATION (WPS) AS PER AWS D1.1 , D1.3 AND D1.4.
10. ONLY PRE-QUALIFIED WELDING PROCEDURES SHALL BE USED.
11. UNLESS SPECIFICALLY ADDRESSED IN THE SPECIFICATIONS OR THE DETAILS, ALL STEEL ITEMS PERMANENTLY EXPOSED TO EARTH OR WEATHER SHALL BE CORROSION-RESISTANT BY GALVANIZING OR BY THE USE OF STAINLESS STEEL.
12. ALL FIELD WELDS ON GALVANIZED MATERIAL SHALL BE BRUSH-COATED WITH A ZINC-RICH PAINT.

FRP NOTES:

1. ALL FRP MATERIAL SHALL BE EXTREN SERIES 500 OR EQUIVALENT, PRODUCED BY THE PULTRUSION METHOD.
2. ALL ADHESIVE RESIN SHALL BE PLEXUS METHACRYLATE OR AN EQUIVALENT ADHESIVE RESIN THAT IS COMPATIBLE WITH THE RESIN MATRIX USED IN THE STRUCTURAL SHAPES.
3. ALL FRP CONNECTIONS SHALL BE FULLY-BONDED AT EACH SIDE WITH A 1/4" PLATE AND A MINIMUM OF (2) 3/8" DIAMETER FLATHEAD FRP SCREWS PER MEMBER.
4. ISOPLAST NUTS AND BOLTS SHALL BE TIGHTENED TO A SNUG-TIGHT FIT PLUS AN ADDITIONAL 1/2 TURN, PRIOR TO BEING LOCKED WITH EPOXY.
5. ALL PANELS / SHEATHING SHALL BE FULLY BONDED WITH 3/8" FLATHEAD FRP SCREWS AT 12" O.C.
6. ALL FIELD CUT AND DRILLED EDGES, HOLES AND ABRASIONS SHALL BE SEALED WITH A CATALYZED EPOXY RESIN COMPATIBLE WITH THE MANUFACTURERs ORIGINAL RESIN.

CONCRETE NOTES:

3.0 STANDARDS FOR ALL CONCRETE WORK:
3.1 ALL CONCRETE WORK SHALL CONFORM WITH ACI. 318 OR LATEST. DETAIL REINFORCING IN CONFORMANCE WITH ACI. SP66 LATEST.
3.2 NO SPLICES OF REINFORCEMENT SHALL BE MADE EXCEPT AS DETAILED OR AUTHORIZED BY THE STRUCTURAL ENGINEER. LAP SPLICES WHERE PERMITTED SHALL BE A MINIMUM OF 30 BAR DIAMETERS.
3.3 PROVIDE ALL ACCESSORIES NECESSARY TO SUPPORT REINFORCING AT POSITIONS SHOW ON DRAWINGS.
3.4 WIRE FABRIC REINFORCEMENT MUST LAP ONE FULL MESH AT SIDE AND END LAPS SHALL BE TIED TOGETHER.
3.5 CURE AFTER FINISHING CONCRETE. KEEP MOIST FOR 7 DAYS AFTER POURING.
3.6 COMPACT STRUCTURAL FILL 95% PROCTOR DENSITY PRIOR TO PLACING CONCRETE UNDER SLABS.
3.7 1/4" CHAMFER ON ALL CORNERS AND EDGES.
3.8 ALL CONCRETE SHALL BE PORTLAND, TYPE 1 CEMENT WITH A MINIMUM OF 28 DAY STRENGTH OF 3000 PSI., 4" SLUMP AND A MINIMUM AIR ENTRAPMENT OF 4%.
3.9 ALL REINFORCING STEEL SHALL BE GRADE 60. ALL REINFORCING MESH SHALL CONFORM TO ASTM A 185.

ELECTRICAL NOTES:

1. SUBMITTAL OF BID INDICATES CONTRACTOR IS COGNIZANT OF ALL JOB SITE CONDITIONS AND WORK TO BE PREFORMED UNDER THIS CONTRACT. CONTRACTOR IS RESPONSIBLE FOR ALL FIELD VERIFICATION.
2. THESE PLANS ARE DIAGRAMMATIC ONLY, AND NOT TO BE SCALED.
3. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, INSURANCE, EQUIPMENT, INSTALLATION, CONSTRUCTION TOOLS, TRANSPORTATION, ETC. FOR A COMPLETE AND PROPERLY OPERATIVE SYSTEM ENERGIZED THROUGHOUT AND AS INDICATED ON DRAWINGS, AS SPECIFIED HEREIN AND/OR AS OTHERWISE REQUIRED.
4. ALL MATERIALS AND EQUIPMENT SHALL BE NEW AND IN PERFECT CONDITION WHEN INSTALLED AND SHALL BE OF THE BEST GRADE OR GROUP OF EQUIPMENT. MATERIALS SHALL BE LISTED AND APPROVED BY UNDER-WRITERs LABORATORY AND SHALL BEAR THE INSPECTION LABEL "J" WHERE SUBJECT TO SUCH APPROVAL MATERIALS SHALL MEET WITH APPROVAL OF THE DIVISION OF INDUSTRIAL SAFETY AND ALL GOVERNING BODIES HAVING JURISDICTION. MATERIALS SHALL BE MANUFACTURED IN ACCORDANCE WITH APPLICABLE STANDARDS ESTABLISHED BY ANSI, NEMA AND NBFU.
5. ALL CONDUIT INSTALLED SHALL BE SURFACE MOUNTED UNLESS OTHERWISE NOTED.
6. ELECTRICAL CONTRACTOR SHALL CARRY OUT HIS WORK WITH ACCORDANCE WITH ALL GOVERNING STATE, COUNTY, LOCAL CODES AND O.S.H.A.
7. ELECTRICAL CONTRACTOR SHALL SECURE ALL NECESSARY ELECTRICAL PERMITS, AND PAY ALL REQUIRED FEES.
8. COMPLETE JOB SHALL BE GUARANTEED FOR A PERIOD OF NO LESS THAN ONE YEAR AFTER THE DATE OF JOB COMPLETION. ANY WORK, MATERIAL, OR EQUIPMENT FOUND TO BE FAULTY DURING THAT PERIOD SHALL BE CORRECTED AT ONCE, UPON WRITTEN NOTIFICATION, AT THE EXPENSE OF THE ELECTRICAL CONTRACTOR.
9. ALL CONDUIT ONLY (C.O.) SHALL HAVE A PULL WIRE OR ROPE, AND TRUE TAPE.
10. PROVIDE THE OWNER WITH ONE SET OF COMPLETE DIMENSIONS AND CIRCUITS, WITHIN 10 WORKING DAYS OF PROJECT COMPLETION. ELECTRICAL "AS BUILT" DRAWINGS, SHOWING ACTUAL LOCATION OF CONDUITS.
11. ALL BROCHURES, OPERATING MANUALS, CATALOGS, SHOP DRAWINGS, ETC. SHALL BE TURNED OVER TO PROJECT MANAGER AT JOB COMPLETION.
12. USE T-TAP CONNECTIONS ON ALL MULTI-CIRCUITS WITH COMMON NEUTRAL CONDUCTOR FOR LIGHTING FIXTURE. ALL CONDUCTORS SHALL BE COPPER.
13. THE EXTERIOR GROUND RING SHALL BE TESTED PER CCI SPECIFICATIONS AND SHALL HAVE A RESISTANCE TO EARTH OF 5 OHMS OR LESS. IF NOT NOTIFY ENGINEER.
14. ALL CIRCUIT BREAKERS, FUSES AND ELECTRICAL EQUIPMENT SHALL HAVE AN INTERRUPTING RATING NOT LESS THAN THE MAXIMUM SHORT CIRCUIT CURRENT TO WHICH THEY MAY BE SUBJECTED, AND A MINIMUM OF 10,000 A.I.C.
15. THE ENTIRE ELECTRICAL INSTALLATION SHALL BE GROUNDED AS REQUIRED BY ALL APPLICABLE CODES.
16. PATCH, REPAIR, AND PAINT ANY AREA THAT HAS BEEN DAMAGED IN THE COURSE OF THE ELECTRICAL WORK.
17. IN DRILLING HOLES INTO CONCRETE (WHETHER FOR FASTENING OR ANCHORING PURPOSES OR PENETRATIONS THROUGH THE FLOOR FOR CONDUIT RUNS, PIPE RUNS, ETC.) IT MUST BE CLEARLY UNDERSTOOD THAT TENDONS AND RE-BARS WILL NOT BE DRILLED INTO, CUT, OR DAMAGED UNDER ANY CIRCUMSTANCES.
18. LOCATION OF TENDONS AN RE-BARS ARE NOT DEFINITELY KNOWN AND THEREFORE MUST BE SEARCHED FOR BY APPROPRIATE METHODS AND EQUIPMENT VIA X-RAY, OR OTHER DEVICES THAT CAN ACCURATELY LOCATE THE REINFORCING STEEL TENDONS.
19. PENETRATIONS IN FIRE RATED WALLS SHALL BE FIRE STOPPED IN ACCORDANCE WITH APPLICABLE LOCAL BUILDING CODES. USING U.L. RATED MATERIALS.
20. ELECTRICAL CONTRACTOR IS TO COORDINATE WITH UTILITY COMPANY FOR CONNECTION OF TEMPORARY AND PERMANENT POWER TO THE SITE. THE TEMPORARY POWER AND ALL HOOK-UP COSTS SHALL BE PAID BY THE CONTRACTOR.
21. ELECTRICAL CONTRACTOR SHALL SUBMIT SHOP DRAWINGS AND/OR CATALOG CUT-SHEETS ON ALL NON-SPECIFIED ORIGINAL MATERIALS AND EQUIPMENT, TO PROJECT MANAGER PRIOR TO COMMENCEMENT OF THE WORK.
22. UPON COMPLETION OF WORK, CONDUCT CONTINUITY AND SHORT CIRCUIT, AS WELL AS, GROUNDING TEST, GROUNDING TEST SHALL BE PREFORMED BY INDEPENDENT TESTING AGENCY, WITH WRITTEN REPORT SUBMITTED TO THE PROJECT MANAGER FOR REVIEW AND APPROVAL.
23. CLEAN PREMISES DAILY OF ALL DEBRIS RESULTING FROM WORK AND LEAVE WORK PREMISES IN A COMPLETE AND UNDAMAGED CONDITION.
24. ALL EXTERIOR WALL PENETRATIONS SHALL BE SEALED WITH POLYSEAM SEALANT.
25. ALL #2 TINNED BARE COPPER DOWNLEADS TO BE PROTECTED BY 1/2" P.V.C. PIPE AND SECURED.
26. COMPRESSION FITTINGS TO BE USED ON ALL CONDUITS (NO SET SCREWS).
27. ALL #6 STRANDED COPPER WITH GREEN INSULATION TO BE ATTACHED WITH CRIMPED DOUBLE LUG, ATTACHED WITH NUTS, BOLTS AND STAR WASHERS TYPICAL AND NO-OX GREASE BETWEEN LUG AND BUS BAR.
28. ALL ABOVE GROUND CONDUIT SHALL BE RIGID GALVANIZED CONDUIT WITH WEATHERPROOF FITTINGS.

GROUNDING:

1. ALL METALLIC PARTS OF ELECTRICAL EQUIPMENT WHICH DO NOT CARRY CURRENT SHALL BE GROUNDED IN ACCORDANCE WITH THE REQUIREMENTS OF THE BUILDING MANUFACTURER, T-MOBILE GROUNDING AND BONDING STANDARDS, AND THE NATIONAL ELECTRICAL CODE.
2. PROVIDE ELECTRICAL GROUNDING AND BONDING SYSTEM INDICATED WITH ASSEMBLY OF MATERIALS, INCLUDING GROUNDING ELECTRODES, BONDING JUMPERS AND ADDITIONAL ACCESSORIES AS REQUIRED FOR A COMPLETE INSTALLATION.
3. ALL GROUNDING CONDUCTORS SHALL PROVIDE A STRAIGHT DOWNWARD PATH TO GROUND WITH GRADUAL BEND AS REQUIRED. GROUNDING CONDUCTORS SHALL NOT BE LOOPED OR SHARPLY BENT. ROUTE GROUNDING CONNECTIONS AND CONDUCTORS TO GROUND IN THE SHORTEST AND STRAIGHTEST PATHS POSSIBLE TO MINIMIZE TRANSIENT VOLTAGE RISES.
4. GROUNDING CONDUCTORS ARE REQUIRED TO BE ROUTED TO GRADE, THE CONTRACTOR SHALL ROUTE TWO GROUNDING CONDUCTORS FROM THE ROOFTOP, TOWERS, AND WATER TOWERS GROUND RING, TO THE EXISTING GROUNDING SYSTEM, THE GROUNDING CONDUCTORS SHALL NOT BE SMALLER THAN #2 AWG COPPER. ROOFTOP GROUND RING SHALL BE BONDED TO THE EXISTING GROUNDING SYSTEM, THE BUILDING STEEL COLUMNS, LIGHTNING PROTECTION SYSTEM, AND BUILDING MAIN WATER LINE (FERROUS OR NONFERROUS METAL PIPING ONLY).
5. TIGHTEN GROUNDING AND BONDING CONNECTORS, INCLUDING SCREWS AND BOLTS, IN ACCORDANCE WITH MANUFACTURERs PUBLISHED TORQUE TIGHTENING VALUES FOR CONNECTORS AND BOLTS. WHERE MANUFACTURERs TORQUING REQUIREMENTS ARE NOT AVAILABLE, TIGHTEN CONNECTIONS TO COMPLY WITH TIGHTENING TORQUE VALUES SPECIFIED IN UL TO ASSURE PERMANENT AND EFFECTIVE GROUNDING. CONTRACTOR SHALL VERIFY THE LOCATIONS OF GROUNDING TIE-IN-POINTS TO THE EXISTING GROUNDING SYSTEM.
6. ALL UNDERGROUND GROUNDING CONNECTIONS SHALL BE MADE BY THE GROUNDING SYSTEM. EXOTHERMIC WELD PROCESS AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURERs INSTRUCTIONS.
7. ALL GROUNDING CONNECTIONS SHALL BE INSPECTED FOR TIGHTNESS. EXOTHERMIC WELDED CONNECTIONS SHALL BE APPROVED BY THE INSPECTOR HAVING JURISDICTION BEFORE BEING PERMANENTLY CONCEALED.
8. APPLY CORROSION-RESISTANCE FINISH TO FIELD CONNECTIONS AND PLACES WHERE FACTORY APPLIED PROTECTIVE COATINGS HAVE BEEN DESTROYED.
9. A SEPARATE, CONTINUOUS, INSULATED EQUIPMENT GROUNDING CONDUCTOR SHALL BE INSTALLED IN ALL FEEDER AND BRANCH CIRCUITS.
10. BOND ALL INSULATED GROUNDING BUSHINGS WITH A BARE 6 AWG GROUNDING CONDUCTOR TO A GROUND BUS.
11. DIRECT BURIED GROUNDING CONDUCTORS SHALL BE INSTALLED AT A NOMINAL DEPTH OF 36" MINIMUM BELOW GRADE, OR 6" BELOW THE FROST LINE, USE THE GREATER OF THE TWO DISTANCES.
12. ALL GROUNDING CONDUCTORS EMBEDDED IN OR PENETRATING CONCRETE SHALL BE INSTALLED IN SCHEDULE 40 PVC CONDUIT.
13. THE INSTALLATION OF CHEMICAL ELECTROLYTIC GROUNDING SYSTEM IN STRICT ACCORDANCE WITH MANUFACTURERs INSTRUCTIONS. REMOVE SEALING TAPE FROM LEACHING AND BREATHER HOLES. INSTALL PROTECTIVE BOX FLUSH WITH GRADE.
14. DRIVE GROUND RODS UNTIL TOPS ARE A MINIMUM DISTANCE OF 36" DEPTH OR 6" BELOW FROST LINE, USING THE GREATER OF THE TWO DISTANCES.
15. IF COAX ON THE ICE BRIDGE IS MORE THAN 6 FT. FROM THE GROUND BAR AT THE BASE OF THE TOWER, A SECOND GROUND BAR WILL BE NEEDED AT THE END OF THE ICE BRIDGE, TO GROUND THE COAX CABLE GROUNDING KITS AND IN-LINE ARRESTORS.
16. CONTRACTOR SHALL REPAIR, AND/OR REPLACE, EXISTING GROUNDING SYSTEM COMPONENTS DAMAGED DURING CONSTRUCTION AT THE CONTRACTORS EXPENSE.

T-Mobile
18400 EAST 22ND AVE. AURORA, CO 80011

tellusconnect
5808 SOUTH RAPP ST., STE.150 LITTLETON, CO 80120

PROJECT INFORMATION:

SITE NAME:
DENVER FIRE #29

SITE ID:
DN03634A

4800 HIMALAYA RD
DENVER, CO 80249
CITY AND COUNTY DENVER

Rev:	Date:	Description:	By:
1	09/09/2020	PRELIM. CONST.	SS
2	09/21/2020	REV. 1	SF
3	09/29/2020	FINAL CONST	ML

PLANS PREPARED BY:

WYCO FIELD SERVICES
Where quality still counts.

STAMPED FOR STRUCTURAL NOTES ONLY

LICENSURE NO:

COLORADO LICENSED
RAVITHA RAMAKRISHNAN
52228
PROFESSIONAL ENGINEER
09/30/2020

ALL SCALES ARE SET FOR 24"x36" SHEET

DRAWN BY:	CHK BY:	APV BY:
SS	ML	PR

Sheet Title:
GENERAL NOTES

Sheet Number:
GN1

STRUCTURAL ANALYSIS

DN03634A_DENVER FIRE #29
ANCHOR

4800 HIMALAYA ROAD
DENVER, CO 80249

OCTOBER 12, 2020

STRUCTURAL STATUS: PASSING

GOVERNING MECHANISM: COMPRESSION OF TOWER LEG AT SECTION T3 (79.2%)

Partha Ramakrishnan

Digitally signed by Partha Ramakrishnan
Date: 2020.10.12 15:19:37-06'00'

COLORADO LICENSED
PARTHA RAMAKRISHNAN
52228
PROFESSIONAL ENGINEER

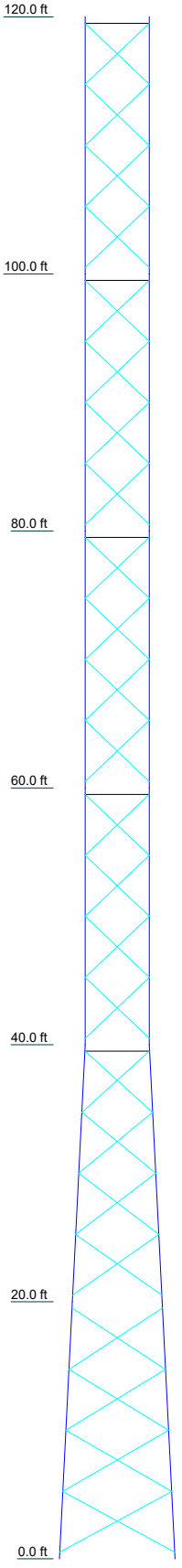
TABLE OF CONTENTS

Summary and Recommendations

The (E) tower will see the addition of (1) (N) Commscope FFHH-65C-R3, (1) (N) AAHF, (1) (N) AHFIG and (1) (N) AHLOA for Alpha, Beta & Gamma sectors. Per the structural analysis on page 3, the (E) tower is structurally adequate to support the additional load.

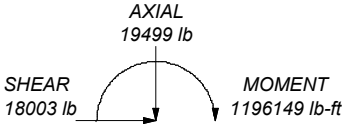
Calculations were completed in accordance with IBC 2018, TIA-222-H and requirements by the City and County of Denver.

Section	T1	T2	T3	T4	T5	T6	
Legs	P2x.154		P2.5x.276	P4x.337	P5x.375		
Leg Grade	A572-50						
Diagonals	L2x2x1/8		L2x2x3/16	L2x2x1/4	L2x2x1/8		
Diagonal Grade	A36						
Top Girts	L2x2x1/8		L2x2x3/16	L2x2x1/4	L2x2x1/8	N.A.	
Face Width (ft)	5					7	9
# Panels @ (ft)	24 @ 4.75						
Weight (lb) 6647.6	524.0	524.0	906.3	1483.1	1585.0	1625.2	



ALL REACTIONS ARE FACTORED

MAX. CORNER R
DOWN: 159965 lb
SHEAR: 11860 lb
UPLIFT: -1428
SHEAR: 10845 lb



TORQUE 6614 lb-ft
REACTIONS - 120 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Pipe Mt	110	Commscope FFHH-65C-R3 (T-Mobile)	67
SPD6-5.2 (DFD)	110	Commscope FFHH-65C-R3 (T-Mobile)	67
Radwin RW-9061-5001 (DFD)	106	Commscope FFHH-65C-R3 (T-Mobile)	67
Pipe Mt	105	AEHC (T-Mobile)	67
4' Grid	105	AEHC (T-Mobile)	67
3' Yagi	105	AEHC (T-Mobile)	67
P90-16-XLH-RR (First Net)	92.5	AHFIG (T-Mobile)	67
P90-16-XLH-RR (First Net)	92.5	AHFIG (T-Mobile)	67
EnodeB (First Net)	92.5	AHFIG (T-Mobile)	67
EnodeB (First Net)	92.5	AHLOA (T-Mobile)	67
EnodeB (First Net)	92.5	AHLOA (T-Mobile)	67
2" x 10' Pipe	92.5	AHLOA (T-Mobile)	67
2" x 10' Pipe	92.5	2.375" OD Sch 40 Mounting Pipe (T-Mobile)	67
2" x 10' Pipe	92.5		
GPS (First Net)	92.5	2.375" OD Sch 40 Mounting Pipe (T-Mobile)	67
P90-16-XLH-RR (First Net)	92.5		
COVP (large) (VZW)	83	2.375" OD Sch 40 Mounting Pipe (T-Mobile)	67
(2) LPA-80063/4CF w/Mt. Pipe (VZW)	77.5		
(2) LPA-80063/4CF w/Mt. Pipe (VZW)	77.5	2.375" OD Sch 40 Mounting Pipe (T-Mobile)	67
(2) HEX656CW0000x w/ Mt Pipe (VZW)	77.5	2.375" OD Sch 40 Mounting Pipe (T-Mobile)	67
(2) HEX656CW0000x w/ Mt Pipe (VZW)	77.5	2.375" OD Sch 40 Mounting Pipe (T-Mobile)	67
(2) HEX656CW0000x w/ Mt Pipe (VZW)	77.5	2.375" OD Sch 40 Mounting Pipe (T-Mobile)	67
RRU - typ (VZW)	77.5	2.375" OD Sch 40 Mounting Pipe (T-Mobile)	67
RRU - typ (VZW)	77.5		
RRU - typ (VZW)	77.5	2.375" OD Sch 40 Mounting Pipe (T-Mobile)	67
RRH2X40-AWS (VZW)	77.5		
RRH2X40-AWS (VZW)	77.5	2.375" OD Sch 40 Mounting Pipe (T-Mobile)	67
RRH2X40-AWS (VZW)	77.5		
RRH2X60-AWS (VZW)	77.5	2.375" OD Sch 40 Mounting Pipe (T-Mobile)	67
RRH2X60-AWS (VZW)	77.5		
RRH2X60-AWS (VZW)	77.5	2.375" OD Sch 40 Mounting Pipe (T-Mobile)	67
Sabre Ultra Boom - 14' (VZW)	77.5		
Sabre Ultra Boom - 14' (VZW)	77.5	FASB 2.4m RAS w/ Mt Pipe (T-mobile)	67
Sabre Ultra Boom - 14' (VZW)	77.5	3" x 10.5" Antenna	60
(2) LPA-80063/4CF w/Mt. Pipe (VZW)	77.5	3" x 10.5" Antenna	60
FASB 2.4m RAS w/ Mt Pipe (T-mobile)	67	VHLP800-11	57
FASB 2.4m RAS w/ Mt Pipe (T-mobile)	67	Siren (DFD)	53
COVP (Large) (T-mobile)	67	MD-S4 Ice Shield	50
VFA12-HD (T-mobile)	67	Jxn Box	47.67
VFA12-HD (T-mobile)	67	GPS w/Mount	42
VFA12-HD (T-mobile)	67		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi	A36	36 ksi	58 ksi

TOWER DESIGN NOTES

1. Tower designed for Exposure C to the TIA-222-H Standard.
2. Tower designed for a 120 mph basic wind in accordance with the TIA-222-H Standard.
3. Deflections are based upon a 60 mph wind.
4. Tower Risk Category III.
5. Topographic Category 1 with Crest Height of 0.00 ft
6. Weld together tower sections have flange connections.
7. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
8. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
9. Welds are fabricated with ER-70S-6 electrodes.
10. TOWER RATING: 79.2%

WYCO Field Services
6335 Downing St
Denver, CO 80216
Phone:
FAX:

Job: ***DN03634A***			
Project: ***DENVER FIRE #29***			
Client: T-MOBILE	Drawn by: EE	App'd:	
Code: TIA-222-H	Date: 10/12/20	Scale: NTS	
Path: Z:\Shared\Structural Drive\DN03634A_Fire Station #29\Anchor\SA\Tnx Tower\tnx Tower.dri		Dwg No. E-1	

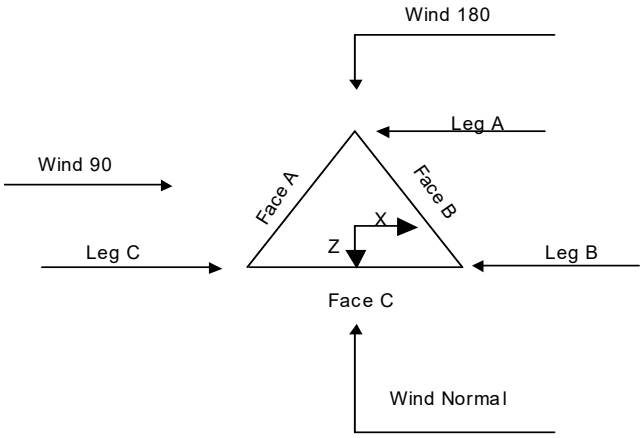
Tower Input Data

The main tower is a 3x free standing tower with an overall height of 120.00 ft above the ground line.
The base of the tower is set at an elevation of 0.00 ft above the ground line.
The face width of the tower is 5.00 ft at the top and 9.00 ft at the base.
This tower is designed using the TIA-222-H standard.
The following design criteria apply:

Tower base elevation above sea level: 0.00 ft.
Basic wind speed of 120 mph.
Risk Category III.
Exposure Category C.
Simplified Topographic Factor Procedure for wind speed-up calculations is used.
Topographic Category: 1.
Crest Height: 0.00 ft.
Deflections calculated using a wind speed of 60 mph.
Weld together tower sections have flange connections..
Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in tower member design is 1.
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

	Consider Moments - Legs		Distribute Leg Loads As Uniform		Use ASCE 10 X-Brace Ly Rules
	Consider Moments - Horizontals		Assume Legs Pinned	√	Calculate Redundant Bracing Forces
	Consider Moments - Diagonals	√	Assume Rigid Index Plate		Ignore Redundant Members in FEA
	Use Moment Magnification	√	Use Clear Spans For Wind Area		SR Leg Bolts Resist Compression
√	Use Code Stress Ratios	√	Use Clear Spans For KL/r		All Leg Panels Have Same Allowable
√	Use Code Safety Factors - Guys		Retension Guys To Initial Tension		Offset Girt At Foundation
	Escalate Ice		Bypass Mast Stability Checks	√	Consider Feed Line Torque
	Always Use Max Kz	√	Use Azimuth Dish Coefficients		Include Angle Block Shear Check
	Use Special Wind Profile	√	Project Wind Area of Appurt.		Use TIA-222-H Bracing Resist. Exemption
	Include Bolts In Member Capacity	√	Autocalc Torque Arm Areas		Use TIA-222-H Tension Splice Exemption
√	Leg Bolts Are At Top Of Section		Add IBC .6D+W Combination		Poles
√	Secondary Horizontal Braces Leg	√	Sort Capacity Reports By Component		Include Shear-Torsion Interaction
	Use Diamond Inner Bracing (4 Sided)	√	Triangulate Diamond Inner Bracing		Always Use Sub-Critical Flow
	SR Members Have Cut Ends		Treat Feed Line Bundles As Cylinder		Use Top Mounted Sockets
	SR Members Are Concentric		Ignore KL/ry For 60 Deg. Angle Legs		Pole Without Linear Attachments
					Pole With Shroud Or No Appurtenances
					Outside and Inside Corner Radii Are Known



Triangular Tower

Tower Section Geometry

Tower Section	Tower Elevation ft	Assembly Database	Description	Section Width ft	Number of Sections	Section Length ft
T1	120.00-100.00			5.00	1	20.00
T2	100.00-80.00			5.00	1	20.00
T3	80.00-60.00			5.00	1	20.00
T4	60.00-40.00			5.00	1	20.00
T5	40.00-20.00			5.00	1	20.00
T6	20.00-0.00			7.00	1	20.00

Tower Section Geometry *(cont'd)*

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
T1	120.00-100.00	4.75	X Brace	No	No	6.0000	6.0000
T2	100.00-80.00	4.75	X Brace	No	No	6.0000	6.0000
T3	80.00-60.00	4.75	X Brace	No	No	6.0000	6.0000
T4	60.00-40.00	4.75	X Brace	No	No	6.0000	6.0000
T5	40.00-20.00	4.75	X Brace	No	No	6.0000	6.0000
T6	20.00-0.00	4.75	X Brace	No	No	6.0000	6.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Leg Type*	*Leg Size*	*Leg Grade*	*Diagonal Type*	*Diagonal Size*	*Diagonal Grade*
T1 120.00-100.00	Pipe	P2x.154	A572-50 (50 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T2 100.00-80.00	Pipe	P2x.154	A572-50 (50 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T3 80.00-60.00	Pipe	P2.5x.276	A572-50 (50 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T4 60.00-40.00	Pipe	P4x.337	A572-50 (50 ksi)	Equal Angle	L2x2x1/4	A36 (36 ksi)
T5 40.00-20.00	Pipe	P5x.375	A572-50 (50 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T6 20.00-0.00	Pipe	P5x.375	A572-50 (50 ksi)	Equal Angle	L2x2x1/8	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 120.00-100.00	Equal Angle	L2x2x1/8	A36 (36 ksi)	Flat Bar		A36 (36 ksi)
T2 100.00-80.00	Equal Angle	L2x2x1/8	A36 (36 ksi)	Flat Bar		A36 (36 ksi)
T3 80.00-60.00	Equal Angle	L2x2x3/16	A36 (36 ksi)	Flat Bar		A36 (36 ksi)
T4 60.00-40.00	Equal Angle	L2x2x1/4	A36 (36 ksi)	Flat Bar		A36 (36 ksi)
T5 40.00-20.00	Equal Angle	L2x2x1/8	A36 (36 ksi)	Flat Bar		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*	*Double Angle Stitch Bolt Spacing Redundants in*
T1 120.00-100.00	0.23	0.2500	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T2 100.00-80.00	0.23	0.2500	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T3 80.00-60.00	0.23	0.2500	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T4 60.00-40.00	0.23	0.2500	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T5 40.00-20.00	0.23	0.2500	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T6 20.00-0.00	0.23	0.2500	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K Factors[1] Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1	Yes	Yes	1	1	1	1	1	1	1	1
120.00-100.00				1	1	1	1	1	1	1
T2	Yes	Yes	1	1	1	1	1	1	1	1
100.00-80.00				1	1	1	1	1	1	1
T3	Yes	Yes	1	1	1	1	1	1	1	1
80.00-60.00				1	1	1	1	1	1	1
T4	Yes	Yes	1	1	1	1	1	1	1	1
60.00-40.00				1	1	1	1	1	1	1
T5	Yes	Yes	1	1	1	1	1	1	1	1
40.00-20.00				1	1	1	1	1	1	1
T6 20.00-0.00	Yes	Yes	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1

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

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Net Width Deduct in	Leg U	Diagonal Net Width Deduct in	Diagonal U	Top Girt Net Width Deduct in	Top Girt U	Bottom Girt Net Width Deduct in	Bottom Girt U	Mid Girt Net Width Deduct in	Mid Girt U	Long Horizontal Net Width Deduct in	Long Horizontal U	Short Horizontal Net Width Deduct in	Short Horizontal U
T1 120.00-100.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T2 100.00-80.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T3 80.00-60.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T4 60.00-40.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T5 40.00-20.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T6 20.00-0.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	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 120.00-100.00	Flange	0.7500 A325N	6	0.6250 A325X	1	0.6250 A325X	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T2 100.00-80.00	Flange	0.7500 A325N	6	0.6250 A325X	1	0.6250 A325X	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T3 80.00-60.00	Flange	0.7500 A325N	6	0.6250 A325X	1	0.6250 A325X	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T4 60.00-40.00	Flange	1.0000 A325N	6	0.6250 A325X	1	0.6250 A325X	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T5 40.00-20.00	Flange	1.0000 A325N	6	0.6250 A325X	1	0.6250 A325X	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T6 20.00-0.00	Flange	1.0000 F1554-105	6	0.6250 A325X	1	0.0000 A325X	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
LDF5-50A(7/8 FOAM) (DFD)	A	No	No	Ar (CaAa)	0.00 - 105.00	0.0000	-0.05	1	1	1.0900 0.0000	1.0900		0.33
1/2" OD	A	No	No	Ar (CaAa)	0.00 - 105.00	0.0000	-0.1	1	1	0.5000 0.0000	0.5000		0.15
Hybriflex (FirstNet)	A	No	No	Ar (CaAa)	0.00 - 92.50	0.0000	-0.15	1	1	1.0900 0.0000	1.0900		0.37
LDF5-50A (7/8 FOAM) (VZW)	A	No	No	Ar (CaAa)	0.00 - 77.50	0.0000	0.25	18	6	1.0900 0.0000	1.0900		0.33
Hybriflex (FirstNet)	A	No	No	Ar (CaAa)	0.00 - 67.00	0.0000	-0.15	1	1	1.0900 0.0000	1.0900		0.37
1/4" OD	A	No	No	Ar (CaAa)	0.00 - 60.00	0.0000	-0.2	2	2	0.2500 0.0000	0.2500		0.05
1" Rigid Conduit (DFD)	B	No	No	Ar (CaAa)	0.00 - 47.67	0.0000	-0.25	1	1	1.0000 0.0000	1.0000		0.70
5/8" Feed Line	A	No	No	Ar (CaAa)	0.00 - 42.00	9.0000	0.25	1	1	0.6250 0.0000	0.6250		0.40
Feedline Ladder (Af)	A	No	No	Ar (CaAa)	0.00 - 120.00	0.0000	0	1	1	3.0000 0.0000	3.0000		8.40
LDF7-50A (1-5/8 FOAM) (T-mobile)	A	No	No	Ar (CaAa)	0.00 - 110.00	0.0000	-0.28	1	1	1.9800 0.0000	1.9800		0.82
LDF5-50A (7/8 FOAM) (T-mobile)	A	No	No	Ar (CaAa)	0.00 - 57.00	0.0000	-0.26	1	1	1.0900 0.0000	1.0900		0.33
LDF5-50A (7/8 FOAM) (DFD-RADWIN)	A	No	No	Ar (CaAa)	0.00 - 106.00	0.0000	0.1	1	1	1.0900 0.0000	1.0900		0.33

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	120.00-100.00	A	0.000	0.000	9.429	0.000	180.58
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T2	100.00-80.00	A	0.000	0.000	16.683	0.000	205.22
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T3	80.00-60.00	A	0.000	0.000	52.598	0.000	314.54
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T4	60.00-40.00	A	0.000	0.000	61.898	0.000	342.61
		B	0.000	0.000	0.767	0.000	5.37
		C	0.000	0.000	0.000	0.000	0.00
T5	40.00-20.00	A	0.000	0.000	63.350	0.000	350.80
		B	0.000	0.000	2.000	0.000	14.00
		C	0.000	0.000	0.000	0.000	0.00
T6	20.00-0.00	A	0.000	0.000	63.350	0.000	350.80
		B	0.000	0.000	2.000	0.000	14.00
		C	0.000	0.000	0.000	0.000	0.00

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	120.00-100.00	-2.2671	-0.8814	-2.2671	-0.8814
T2	100.00-80.00	-3.7344	-1.1372	-3.7344	-1.1372
T3	80.00-60.00	-4.5254	-5.6548	-4.5254	-5.6548
T4	60.00-40.00	-4.8761	-5.5734	-4.8104	-5.5014
T5	40.00-20.00	-5.3079	-6.4928	-5.1492	-6.3051
T6	20.00-0.00	-6.3691	-7.9419	-6.2072	-7.7443

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	1	LDF5-50A(7/8 FOAM) (DFD)	100.00 - 105.00	0.6000	0.6000
T1	2	1/2" OD	100.00 - 105.00	0.6000	0.6000
T1	9	Feedline Ladder (Af)	100.00 - 120.00	0.6000	0.6000
T1	10	LDF7-50A (1-5/8 FOAM) (T-mobile)	100.00 - 110.00	0.6000	0.6000
T1	12	LDF5-50A (7/8 FOAM) (DFD-RADW IN)	100.00 - 106.00	0.6000	0.6000
T2	1	LDF5-50A(7/8 FOAM) (DFD)	80.00 - 100.00	0.6000	0.6000
T2	2	1/2" OD	80.00 - 100.00	0.6000	0.6000
T2	3	Hybriflex (FirstNet)	80.00 - 92.50	0.6000	0.6000
T2	9	Feedline Ladder (Af)	80.00 - 100.00	0.6000	0.6000
T2	10	LDF7-50A (1-5/8 FOAM) (T-mobile)	80.00 - 100.00	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T2	12	LDF5-50A (7/8 FOAM) (DFD-RADW IN)	80.00 - 100.00	0.6000	0.6000
T3	1	LDF5-50A(7/8 FOAM) (DFD)	60.00 - 80.00	0.6000	0.6000
T3	2	1/2" OD	60.00 - 80.00	0.6000	0.6000
T3	3	Hybriflex (FirstNet)	60.00 - 80.00	0.6000	0.6000
T3	4	LDF5-50A (7/8 FOAM) (VZW)	60.00 - 77.50	0.6000	0.6000
T3	5	Hybriflex (FirstNet)	60.00 - 67.00	0.6000	0.6000
T3	9	Feedline Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T3	10	LDF7-50A (1-5/8 FOAM) (T-mobile)	60.00 - 80.00	0.6000	0.6000
T3	12	LDF5-50A (7/8 FOAM) (DFD-RADW IN)	60.00 - 80.00	0.6000	0.6000
T4	1	LDF5-50A(7/8 FOAM) (DFD)	40.00 - 60.00	0.6000	0.6000
T4	2	1/2" OD	40.00 - 60.00	0.6000	0.6000
T4	3	Hybriflex (FirstNet)	40.00 - 60.00	0.6000	0.6000
T4	4	LDF5-50A (7/8 FOAM) (VZW)	40.00 - 60.00	0.6000	0.6000
T4	5	Hybriflex (FirstNet)	40.00 - 60.00	0.6000	0.6000
T4	6	1/4" OD	40.00 - 60.00	0.6000	0.6000
T4	7	1" Rigid Conduit (DFD)	40.00 - 47.67	0.6000	0.6000
T4	8	5/8" Feed Line	40.00 - 42.00	0.6000	0.6000
T4	9	Feedline Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T4	10	LDF7-50A (1-5/8 FOAM) (T-mobile)	40.00 - 60.00	0.6000	0.6000
T4	11	LDF5-50A (7/8 FOAM) (T-mobile)	40.00 - 57.00	0.6000	0.6000
T4	12	LDF5-50A (7/8 FOAM) (DFD-RADW IN)	40.00 - 60.00	0.6000	0.6000
T5	1	LDF5-50A(7/8 FOAM) (DFD)	20.00 - 40.00	0.6000	0.6000
T5	2	1/2" OD	20.00 - 40.00	0.6000	0.6000
T5	3	Hybriflex (FirstNet)	20.00 - 40.00	0.6000	0.6000
T5	4	LDF5-50A (7/8 FOAM) (VZW)	20.00 - 40.00	0.6000	0.6000
T5	5	Hybriflex (FirstNet)	20.00 - 40.00	0.6000	0.6000
T5	6	1/4" OD	20.00 - 40.00	0.6000	0.6000
T5	7	1" Rigid Conduit (DFD)	20.00 - 40.00	0.6000	0.6000
T5	8	5/8" Feed Line	20.00 - 40.00	0.6000	0.6000
T5	9	Feedline Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T5	10	LDF7-50A (1-5/8 FOAM) (T-mobile)	20.00 - 40.00	0.6000	0.6000
T5	11	LDF5-50A (7/8 FOAM) (T-mobile)	20.00 - 40.00	0.6000	0.6000
T5	12	LDF5-50A (7/8 FOAM) (DFD-RADW IN)	20.00 - 40.00	0.6000	0.6000
T6	1	LDF5-50A(7/8 FOAM) (DFD)	0.00 - 20.00	0.6000	0.6000
T6	2	1/2" OD	0.00 - 20.00	0.6000	0.6000
T6	3	Hybriflex (FirstNet)	0.00 - 20.00	0.6000	0.6000
T6	4	LDF5-50A (7/8 FOAM) (VZW)	0.00 - 20.00	0.6000	0.6000
T6	5	Hybriflex (FirstNet)	0.00 - 20.00	0.6000	0.6000
T6	6	1/4" OD	0.00 - 20.00	0.6000	0.6000
T6	7	1" Rigid Conduit (DFD)	0.00 - 20.00	0.6000	0.6000
T6	8	5/8" Feed Line	0.00 - 20.00	0.6000	0.6000
T6	9	Feedline Ladder (Af)	0.00 - 20.00	0.6000	0.6000
T6	10	LDF7-50A (1-5/8 FOAM) (T-mobile)	0.00 - 20.00	0.6000	0.6000
T6	11	LDF5-50A (7/8 FOAM)	0.00 - 20.00	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T6	12	(T-mobile) LDF5-50A (7/8 FOAM) (DFD-RADW IN)	0.00 - 20.00	0.6000	0.6000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
Radwin RW-9061-5001 (DFD)	A	From Leg	1.00 0.00 0.00	0.0000	106.00	No Ice	1.05	0.59	5.00
Pipe Mt	C	From Leg	0.50 0.00 0.00	0.0000	110.00	No Ice	0.05	0.05	15.00
3' Yagi	B	From Leg	2.00 0.00 0.00	0.0000	105.00	No Ice	2.08	2.08	30.95
Pipe Mt	B	From Leg	0.50 0.00 0.00	0.0000	105.00	No Ice	0.05	0.05	15.00
GPS (First Net)	A	From Leg	1.00 0.00 0.00	0.0000	92.50	No Ice	0.17	0.17	5.00
P90-16-XLH-RR (First Net)	A	From Leg	1.00 0.00 0.00	0.0000	92.50	No Ice	10.69	7.58	62.00
P90-16-XLH-RR (First Net)	B	From Leg	1.00 0.00 0.00	0.0000	92.50	No Ice	10.69	7.58	62.00
P90-16-XLH-RR (First Net)	C	From Leg	1.00 0.00 0.00	0.0000	92.50	No Ice	10.69	7.58	62.00
EnodeB (First Net)	A	From Leg	0.00 0.00 0.00	0.0000	92.50	No Ice	1.48	2.75	40.00
EnodeB (First Net)	B	From Leg	0.00 0.00 0.00	0.0000	92.50	No Ice	1.48	2.75	40.00
EnodeB (First Net)	C	From Leg	0.00 0.00 0.00	0.0000	92.50	No Ice	1.48	2.75	40.00
2" x 10' Pipe	A	From Leg	0.50 0.00 0.00	0.0000	92.50	No Ice	0.03	0.03	40.00
2" x 10' Pipe	B	From Leg	0.50 0.00 0.00	0.0000	92.50	No Ice	0.03	0.03	40.00
2" x 10' Pipe	C	From Leg	0.50 0.00 0.00	0.0000	92.50	No Ice	0.03	0.03	40.00

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
Siren (DFD)	C	From Leg	2.00 0.00 0.00	0.0000	53.00	No Ice	3.10	2.85	480.00
COVP (large) (VZW)	C	From Leg	4.00 0.00 0.00	0.0000	83.00	No Ice	3.20	1.03	14.85
(2) LPA-80063/4CF w/Mt. Pipe (VZW)	A	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	6.15	6.29	34.60
(2) LPA-80063/4CF w/Mt. Pipe (VZW)	B	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	6.15	6.29	34.60
(2) LPA-80063/4CF w/Mt. Pipe (VZW)	C	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	6.15	6.29	34.60
(2) HEX656CW0000x w/ Mt Pipe (VZW)	A	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	8.72	7.28	62.15
(2) HEX656CW0000x w/ Mt Pipe (VZW)	B	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	8.72	7.28	62.15
(2) HEX656CW0000x w/ Mt Pipe (VZW)	C	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	8.72	7.28	62.15
RRU - typ (VZW)	A	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.33	1.33	50.00
RRU - typ (VZW)	B	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.33	1.33	50.00
RRU - typ (VZW)	C	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.33	1.33	50.00
RRH2X40-AWS (VZW)	A	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.14	1.77	47.63
RRH2X40-AWS (VZW)	B	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.14	1.77	47.63
RRH2X40-AWS (VZW)	C	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.14	1.77	47.63
RRH2X60-AWS (VZW)	A	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.36	2.01	55.00
RRH2X60-AWS (VZW)	B	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.36	2.01	55.00
RRH2X60-AWS (VZW)	C	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.36	2.01	55.00
Sabre Ultra Boom - 14' (VZW)	A	From Leg	2.00 0.00 0.00	0.0000	77.50	No Ice	8.80	6.14	346.00
Sabre Ultra Boom - 14' (VZW)	B	From Leg	2.00 0.00 0.00	0.0000	77.50	No Ice	8.80	6.14	346.00

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
Sabre Ultra Boom - 14' (VZW)	C	From Leg	2.00 0.00 0.00	0.0000	77.50	No Ice	8.80	6.14	346.00
FASB 2.4m RAS w/ Mt Pipe (T-mobile)	A	From Leg	3.00 0.00 0.00	0.0000	67.00	No Ice	12.71	16.12	256.42
FASB 2.4m RAS w/ Mt Pipe (T-mobile)	B	From Leg	3.00 0.00 0.00	0.0000	67.00	No Ice	12.71	16.12	256.42
FASB 2.4m RAS w/ Mt Pipe (T-mobile)	C	From Leg	3.00 0.00 0.00	0.0000	67.00	No Ice	12.71	16.12	256.42
COVP (Large) (T-mobile)	C	From Leg	2.00 0.00 0.00	0.0000	67.00	No Ice	3.20	1.03	14.85
VFA12-HD (T-mobile)	A	From Leg	2.00 0.00 0.00	0.0000	67.00	No Ice	13.07	9.57	620.00
VFA12-HD (T-mobile)	B	From Leg	2.00 0.00 0.00	0.0000	67.00	No Ice	13.07	9.57	620.00
VFA12-HD (T-mobile)	C	From Leg	2.00 0.00 0.00	0.0000	67.00	No Ice	13.07	9.57	620.00
3" x 10.5" Antenna	A	From Leg	0.50 0.00 0.00	0.0000	60.00	No Ice	0.31	0.12	2.00
3" x 10.5" Antenna	C	From Leg	0.50 0.00 0.00	0.0000	60.00	No Ice	0.31	0.12	2.00
MD-S4 Ice Shield	B	From Face	0.00 0.00 0.00	0.0000	50.00	No Ice	5.00	3.20	290.10
Jxn Box	A	From Face	0.00 0.00 0.00	0.0000	47.67	No Ice	0.64	0.60	10.00
GPS w/Mount	C	From Leg	4.00 0.00 0.00	0.0000	42.00	No Ice	0.51	0.51	12.30
Commscope FFHH-65C-R3 (T-Mobile)	A	From Leg	3.71 3.13 0.00	0.0000	67.00	No Ice	21.11	9.35	127.60
Commscope FFHH-65C-R3 (T-Mobile)	B	From Leg	3.71 3.13 0.00	0.0000	67.00	No Ice	21.11	9.35	127.60
Commscope FFHH-65C-R3 (T-Mobile)	C	From Leg	3.71 3.13 0.00	0.0000	67.00	No Ice	21.11	9.35	127.60
AEHC (T-Mobile)	A	From Leg	3.71 6.25 0.00	0.0000	67.00	No Ice	6.77	1.44	103.60
AEHC (T-Mobile)	B	From Leg	3.71 6.25 0.00	0.0000	67.00	No Ice	6.77	1.44	103.60
AEHC (T-Mobile)	C	From Leg	3.71 6.25 0.00	0.0000	67.00	No Ice	6.77	1.44	103.60

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
AHFIG (T-Mobile)	A	From Leg	3.71 3.13 0.00	0.0000	67.00	No Ice	3.08	1.47	70.60
AHFIG (T-Mobile)	B	From Leg	3.71 3.13 0.00	0.0000	67.00	No Ice	3.08	1.47	70.60
AHFIG (T-Mobile)	C	From Leg	3.71 3.13 0.00	0.0000	67.00	No Ice	3.08	1.47	70.60
AHLOA (T-Mobile)	A	From Leg	3.71 -6.25 0.00	0.0000	67.00	No Ice	2.23	1.39	83.80
AHLOA (T-Mobile)	B	From Leg	3.71 -6.25 0.00	0.0000	67.00	No Ice	2.23	1.39	83.80
AHLOA (T-Mobile)	C	From Leg	3.71 -6.25 0.00	0.0000	67.00	No Ice	2.23	1.39	83.80
2.375" OD Sch 40 Mounting Pipe (T-Mobile)	A	From Leg	3.71 -6.25 0.00	0.0000	67.00	No Ice	0.24	0.24	29.60
2.375" OD Sch 40 Mounting Pipe (T-Mobile)	A	From Leg	3.71 6.25 0.00	0.0000	67.00	No Ice	0.24	0.24	29.60
2.375" OD Sch 40 Mounting Pipe (T-Mobile)	A	From Leg	3.71 3.13 0.00	0.0000	67.00	No Ice	0.24	0.24	29.60
2.375" OD Sch 40 Mounting Pipe (T-Mobile)	A	From Leg	3.71 -3.13 0.00	0.0000	67.00	No Ice	0.24	0.24	29.60
2.375" OD Sch 40 Mounting Pipe (T-Mobile)	B	From Leg	3.71 -6.25 0.00	0.0000	67.00	No Ice	0.24	0.24	29.60
2.375" OD Sch 40 Mounting Pipe (T-Mobile)	B	From Leg	3.71 6.25 0.00	0.0000	67.00	No Ice	0.24	0.24	29.60
2.375" OD Sch 40 Mounting Pipe (T-Mobile)	B	From Leg	3.71 3.13 0.00	0.0000	67.00	No Ice	0.24	0.24	29.60
2.375" OD Sch 40 Mounting Pipe (T-Mobile)	B	From Leg	3.71 -3.13 0.00	0.0000	67.00	No Ice	0.24	0.24	29.60
2.375" OD Sch 40 Mounting Pipe (T-Mobile)	C	From Leg	3.71 -6.25 0.00	0.0000	67.00	No Ice	0.24	0.24	29.60
2.375" OD Sch 40 Mounting Pipe (T-Mobile)	C	From Leg	3.71 6.25 0.00	0.0000	67.00	No Ice	0.24	0.24	29.60
2.375" OD Sch 40 Mounting Pipe (T-Mobile)	C	From Leg	3.71 3.13 0.00	0.0000	67.00	No Ice	0.24	0.24	29.60
2.375" OD Sch 40 Mounting Pipe (T-Mobile)	C	From Leg	3.71 3.13 0.00	0.0000	67.00	No Ice	0.24	0.24	29.60

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft²	Weight lb
4' Grid	C	Grid	From Leg	1.00 0.00 0.00	0.0000		105.00	4.00	No Ice	12.57	12.00
SPD6-5.2 (DFD)	A	Paraboloid w/Radome	From Leg	1.00 0.00 0.00	0.0000		110.00	6.42	No Ice	32.34	222.00
VHLP800-11	B	Paraboloid w/Shroud (HP)	From Leg	0.00 0.00 0.00	0.0000		57.00	2.60	No Ice	5.31	49.00

Discrete Appurtenance Pressures - No Ice $G_H = 0.850$

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft²	C_AA_C Side ft²
Radwin RW-9061-5001	0.0000	5.00	0.00	-3.89	106.00	1.281	40	1.05	0.59
Pipe Mt	240.0000	15.00	-2.93	1.69	110.00	1.291	40	0.05	0.05
3' Yagi	120.0000	30.95	4.23	2.44	105.00	1.279	40	2.08	2.08
Pipe Mt	120.0000	15.00	2.93	1.69	105.00	1.279	40	0.05	0.05
GPS	0.0000	5.00	0.00	-3.89	92.50	1.245	39	0.17	0.17
P90-16-XLH-RR	0.0000	62.00	0.00	-3.89	92.50	1.245	39	10.69	7.58
P90-16-XLH-RR	120.0000	62.00	3.37	1.94	92.50	1.245	39	10.69	7.58
P90-16-XLH-RR	240.0000	62.00	-3.37	1.94	92.50	1.245	39	10.69	7.58
EnodeB	0.0000	40.00	0.00	-2.89	92.50	1.245	39	1.48	2.75
EnodeB	120.0000	40.00	2.50	1.44	92.50	1.245	39	1.48	2.75
EnodeB	240.0000	40.00	-2.50	1.44	92.50	1.245	39	1.48	2.75
2" x 10' Pipe	0.0000	40.00	0.00	-3.39	92.50	1.245	39	0.03	0.03
2" x 10' Pipe	120.0000	40.00	2.93	1.69	92.50	1.245	39	0.03	0.03
2" x 10' Pipe	240.0000	40.00	-2.93	1.69	92.50	1.245	39	0.03	0.03
Siren	240.0000	480.00	-4.23	2.44	53.00	1.107	35	3.10	2.85
COVP (large)	240.0000	14.85	-5.96	3.44	83.00	1.217	38	3.20	1.03
LPA-80063/4CF w/Mt. Pipe	0.0000	69.20	0.00	-6.89	77.50	1.199	38	12.30	12.58
LPA-80063/4CF w/Mt. Pipe	120.0000	69.20	5.96	3.44	77.50	1.199	38	12.30	12.58
LPA-80063/4CF w/Mt. Pipe	240.0000	69.20	-5.96	3.44	77.50	1.199	38	12.30	12.58
HEX656CW0000x w/ Mt Pipe	0.0000	124.30	0.00	-6.89	77.50	1.199	38	17.44	14.56
HEX656CW0000x w/ Mt Pipe	120.0000	124.30	5.96	3.44	77.50	1.199	38	17.44	14.56
HEX656CW0000x w/ Mt Pipe	240.0000	124.30	-5.96	3.44	77.50	1.199	38	17.44	14.56
RRU - typ	0.0000	50.00	0.00	-6.89	77.50	1.199	38	3.33	1.33
RRU - typ	120.0000	50.00	5.96	3.44	77.50	1.199	38	3.33	1.33
RRU - typ	240.0000	50.00	-5.96	3.44	77.50	1.199	38	3.33	1.33
RRH2X40-AWS	0.0000	47.63	0.00	-6.89	77.50	1.199	38	3.14	1.77
RRH2X40-AWS	120.0000	47.63	5.96	3.44	77.50	1.199	38	3.14	1.77
RRH2X40-AWS	240.0000	47.63	-5.96	3.44	77.50	1.199	38	3.14	1.77
RRH2X60-AWS	0.0000	55.00	0.00	-6.89	77.50	1.199	38	3.36	2.01

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft^2	C_AA_C Side ft^2
RRH2X60-AWS	120.0000	55.00	5.96	3.44	77.50	1.199	38	3.36	2.01
RRH2X60-AWS	240.0000	55.00	-5.96	3.44	77.50	1.199	38	3.36	2.01
Sabre Ultra Boom - 14'	0.0000	346.00	0.00	-4.89	77.50	1.199	38	8.80	6.14
Sabre Ultra Boom - 14'	120.0000	346.00	4.23	2.44	77.50	1.199	38	8.80	6.14
Sabre Ultra Boom - 14'	240.0000	346.00	-4.23	2.44	77.50	1.199	38	8.80	6.14
FASB 2.4m RAS w/ Mt Pipe	0.0000	256.42	0.00	-5.89	67.00	1.163	36	12.71	16.12
FASB 2.4m RAS w/ Mt Pipe	120.0000	256.42	5.10	2.94	67.00	1.163	36	12.71	16.12
FASB 2.4m RAS w/ Mt Pipe	240.0000	256.42	-5.10	2.94	67.00	1.163	36	12.71	16.12
COVP (Large)	240.0000	14.85	-4.23	2.44	67.00	1.163	36	3.20	1.03
VFA12-HD	0.0000	620.00	0.00	-4.89	67.00	1.163	36	13.07	9.57
VFA12-HD	120.0000	620.00	4.23	2.44	67.00	1.163	36	13.07	9.57
VFA12-HD	240.0000	620.00	-4.23	2.44	67.00	1.163	36	13.07	9.57
3" x 10.5" Antenna	0.0000	2.00	0.00	-3.39	60.00	1.137	36	0.31	0.12
3" x 10.5" Antenna	240.0000	2.00	-2.93	1.69	60.00	1.137	36	0.31	0.12
MD-S4 Ice Shield	60.0000	290.10	1.25	-0.72	50.00	1.094	34	5.00	3.20
Jxn Box	300.0000	10.00	-1.25	-0.72	47.67	1.083	34	0.64	0.60
GPS w/Mount	240.0000	12.30	-5.96	3.44	42.00	1.054	33	0.51	0.51
Commscope FFHH-65C-R3	0.0000	127.60	3.13	-6.59	67.00	1.163	36	21.11	9.35
Commscope FFHH-65C-R3	120.0000	127.60	4.15	6.00	67.00	1.163	36	21.11	9.35
Commscope FFHH-65C-R3	240.0000	127.60	-7.27	0.59	67.00	1.163	36	21.11	9.35
AEHC	0.0000	103.60	6.25	-6.59	67.00	1.163	36	6.77	1.44
AEHC	120.0000	103.60	2.59	8.71	67.00	1.163	36	6.77	1.44
AEHC	240.0000	103.60	-8.84	-2.12	67.00	1.163	36	6.77	1.44
AHFIG	0.0000	70.60	3.13	-6.59	67.00	1.163	36	3.08	1.47
AHFIG	120.0000	70.60	4.15	6.00	67.00	1.163	36	3.08	1.47
AHFIG	240.0000	70.60	-7.27	0.59	67.00	1.163	36	3.08	1.47
AHLOA	0.0000	83.80	-6.25	-6.59	67.00	1.163	36	2.23	1.39
AHLOA	120.0000	83.80	8.84	-2.12	67.00	1.163	36	2.23	1.39
AHLOA	240.0000	83.80	-2.59	8.71	67.00	1.163	36	2.23	1.39
2.375" OD Sch 40 Mounting Pipe	0.0000	29.60	-6.25	-6.59	67.00	1.163	36	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	0.0000	29.60	6.25	-6.59	67.00	1.163	36	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	0.0000	29.60	3.13	-6.59	67.00	1.163	36	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	0.0000	29.60	-3.13	-6.59	67.00	1.163	36	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	120.0000	29.60	8.84	-2.12	67.00	1.163	36	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	120.0000	29.60	2.59	8.71	67.00	1.163	36	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	120.0000	29.60	4.15	6.00	67.00	1.163	36	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	120.0000	29.60	7.27	0.59	67.00	1.163	36	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	240.0000	29.60	-2.59	8.71	67.00	1.163	36	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	240.0000	29.60	-8.84	-2.12	67.00	1.163	36	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	240.0000	29.60	-7.27	0.59	67.00	1.163	36	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	240.0000	29.60	-7.27	0.59	67.00	1.163	36	0.24	0.24
	Sum Weight:	7540.70							

Discrete Appurtenance Pressures - Service $G_H = 0.850$

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft^2	C_AA_C Side ft^2
Radwin RW-9061-5001	0.0000	5.00	0.00	-3.89	106.00	1.281	10	1.05	0.59
Pipe Mt	240.0000	15.00	-2.93	1.69	110.00	1.291	10	0.05	0.05
3' Yagi	120.0000	30.95	4.23	2.44	105.00	1.279	10	2.08	2.08
Pipe Mt	120.0000	15.00	2.93	1.69	105.00	1.279	10	0.05	0.05
GPS	0.0000	5.00	0.00	-3.89	92.50	1.245	10	0.17	0.17
P90-16-XLH-RR	0.0000	62.00	0.00	-3.89	92.50	1.245	10	10.69	7.58
P90-16-XLH-RR	120.0000	62.00	3.37	1.94	92.50	1.245	10	10.69	7.58
P90-16-XLH-RR	240.0000	62.00	-3.37	1.94	92.50	1.245	10	10.69	7.58
EnodeB	0.0000	40.00	0.00	-2.89	92.50	1.245	10	1.48	2.75
EnodeB	120.0000	40.00	2.50	1.44	92.50	1.245	10	1.48	2.75
EnodeB	240.0000	40.00	-2.50	1.44	92.50	1.245	10	1.48	2.75
2" x 10' Pipe	0.0000	40.00	0.00	-3.39	92.50	1.245	10	0.03	0.03
2" x 10' Pipe	120.0000	40.00	2.93	1.69	92.50	1.245	10	0.03	0.03
2" x 10' Pipe	240.0000	40.00	-2.93	1.69	92.50	1.245	10	0.03	0.03
Siren	240.0000	480.00	-4.23	2.44	53.00	1.107	9	3.10	2.85
COVP (large)	240.0000	14.85	-5.96	3.44	83.00	1.217	10	3.20	1.03
LPA-80063/4CF w/Mt. Pipe	0.0000	69.20	0.00	-6.89	77.50	1.199	9	12.30	12.58
LPA-80063/4CF w/Mt. Pipe	120.0000	69.20	5.96	3.44	77.50	1.199	9	12.30	12.58
LPA-80063/4CF w/Mt. Pipe	240.0000	69.20	-5.96	3.44	77.50	1.199	9	12.30	12.58
HEX656CW0000x w/ Mt Pipe	0.0000	124.30	0.00	-6.89	77.50	1.199	9	17.44	14.56
HEX656CW0000x w/ Mt Pipe	120.0000	124.30	5.96	3.44	77.50	1.199	9	17.44	14.56
HEX656CW0000x w/ Mt Pipe	240.0000	124.30	-5.96	3.44	77.50	1.199	9	17.44	14.56
RRU - typ	0.0000	50.00	0.00	-6.89	77.50	1.199	9	3.33	1.33
RRU - typ	120.0000	50.00	5.96	3.44	77.50	1.199	9	3.33	1.33
RRU - typ	240.0000	50.00	-5.96	3.44	77.50	1.199	9	3.33	1.33
RRH2X40-AWS	0.0000	47.63	0.00	-6.89	77.50	1.199	9	3.14	1.77
RRH2X40-AWS	120.0000	47.63	5.96	3.44	77.50	1.199	9	3.14	1.77
RRH2X40-AWS	240.0000	47.63	-5.96	3.44	77.50	1.199	9	3.14	1.77
RRH2X60-AWS	0.0000	55.00	0.00	-6.89	77.50	1.199	9	3.36	2.01
RRH2X60-AWS	120.0000	55.00	5.96	3.44	77.50	1.199	9	3.36	2.01
RRH2X60-AWS	240.0000	55.00	-5.96	3.44	77.50	1.199	9	3.36	2.01
Sabre Ultra Boom - 14'	0.0000	346.00	0.00	-4.89	77.50	1.199	9	8.80	6.14
Sabre Ultra Boom - 14'	120.0000	346.00	4.23	2.44	77.50	1.199	9	8.80	6.14
Sabre Ultra Boom - 14'	240.0000	346.00	-4.23	2.44	77.50	1.199	9	8.80	6.14
FASB 2.4m RAS w/ Mt Pipe	0.0000	256.42	0.00	-5.89	67.00	1.163	9	12.71	16.12
FASB 2.4m RAS w/ Mt Pipe	120.0000	256.42	5.10	2.94	67.00	1.163	9	12.71	16.12
FASB 2.4m RAS w/ Mt Pipe	240.0000	256.42	-5.10	2.94	67.00	1.163	9	12.71	16.12
COVP (Large)	240.0000	14.85	-4.23	2.44	67.00	1.163	9	3.20	1.03
VFA12-HD	0.0000	620.00	0.00	-4.89	67.00	1.163	9	13.07	9.57
VFA12-HD	120.0000	620.00	4.23	2.44	67.00	1.163	9	13.07	9.57
VFA12-HD	240.0000	620.00	-4.23	2.44	67.00	1.163	9	13.07	9.57
3" x 10.5" Antenna	0.0000	2.00	0.00	-3.39	60.00	1.137	9	0.31	0.12
3" x 10.5" Antenna	240.0000	2.00	-2.93	1.69	60.00	1.137	9	0.31	0.12
MD-S4 Ice Shield	60.0000	290.10	1.25	-0.72	50.00	1.094	9	5.00	3.20
Jxn Box	300.0000	10.00	-1.25	-0.72	47.67	1.083	8	0.64	0.60
GPS w/Mount	240.0000	12.30	-5.96	3.44	42.00	1.054	8	0.51	0.51

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft^2	C_AA_C Side ft^2
Commscope FFHH-65C-R3	0.0000	127.60	3.13	-6.59	67.00	1.163	9	21.11	9.35
Commscope FFHH-65C-R3	120.0000	127.60	4.15	6.00	67.00	1.163	9	21.11	9.35
Commscope FFHH-65C-R3	240.0000	127.60	-7.27	0.59	67.00	1.163	9	21.11	9.35
AEHC	0.0000	103.60	6.25	-6.59	67.00	1.163	9	6.77	1.44
AEHC	120.0000	103.60	2.59	8.71	67.00	1.163	9	6.77	1.44
AEHC	240.0000	103.60	-8.84	-2.12	67.00	1.163	9	6.77	1.44
AHFIG	0.0000	70.60	3.13	-6.59	67.00	1.163	9	3.08	1.47
AHFIG	120.0000	70.60	4.15	6.00	67.00	1.163	9	3.08	1.47
AHFIG	240.0000	70.60	-7.27	0.59	67.00	1.163	9	3.08	1.47
AHLOA	0.0000	83.80	-6.25	-6.59	67.00	1.163	9	2.23	1.39
AHLOA	120.0000	83.80	8.84	-2.12	67.00	1.163	9	2.23	1.39
AHLOA	240.0000	83.80	-2.59	8.71	67.00	1.163	9	2.23	1.39
2.375" OD Sch 40 Mounting Pipe	0.0000	29.60	-6.25	-6.59	67.00	1.163	9	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	0.0000	29.60	6.25	-6.59	67.00	1.163	9	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	0.0000	29.60	3.13	-6.59	67.00	1.163	9	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	0.0000	29.60	-3.13	-6.59	67.00	1.163	9	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	120.0000	29.60	8.84	-2.12	67.00	1.163	9	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	120.0000	29.60	2.59	8.71	67.00	1.163	9	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	120.0000	29.60	4.15	6.00	67.00	1.163	9	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	120.0000	29.60	7.27	0.59	67.00	1.163	9	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	240.0000	29.60	-2.59	8.71	67.00	1.163	9	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	240.0000	29.60	-8.84	-2.12	67.00	1.163	9	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	240.0000	29.60	-7.27	0.59	67.00	1.163	9	0.24	0.24
2.375" OD Sch 40 Mounting Pipe	240.0000	29.60	-7.27	0.59	67.00	1.163	9	0.24	0.24
	Sum Weight:	7540.70							

Dish Pressures - No Ice

Elevation ft	Dish Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	K_z	A_A ft^2	q_z psf
105.00	4' Grid	240.0000	12.00	-3.37	1.94	1.279	12.57	40
110.00	SPD6-5.2	0.0000	222.00	0.00	-3.89	1.291	32.34	40
57.00	VHLP800-11	120.0000	49.00	2.50	1.44	1.124	5.31	35
		Sum Weight:	283.00					

Dish Pressures - Service

Elevation ft	Dish Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	K_z	A_A ft^2	q_z psf
105.00	4' Grid	240.0000	12.00	-3.37	1.94	1.279	12.57	10
110.00	SPD6-5.2	0.0000	222.00	0.00	-3.89	1.291	32.34	10
57.00	VHLP800-11	120.0000	49.00	2.50	1.44	1.124	5.31	9
		Sum Weight:	283.00					

Force Totals

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Overturning Moments, M_x lb-ft	Sum of Overturning Moments, M_z lb-ft	Sum of Torques lb-ft
Leg Weight	4298.61					
Bracing Weight	2306.69					
Total Member Self-Weight	6605.30			-1831.93	4237.25	
Gusset Weight	42.26					
Total Weight	16249.19			-1831.93	4237.25	
Wind 0 deg - No Ice		-21.82	-18003.18	-1187098.55	3645.78	-4759.62
Wind 90 deg - No Ice		17806.95	133.91	12441.56	-1141083.34	-6472.84
Wind 180 deg - No Ice		-28.47	17250.83	1144786.63	8291.41	4671.66
Total Weight	16249.19			-1831.93	4237.25	
Wind 0 deg - Service		-5.46	-4500.79	-296075.50	1643.44	-1189.91
Wind 90 deg - Service		4451.74	33.48	3809.53	-284538.84	-1618.21
Wind 180 deg - Service		-7.12	4312.71	286895.80	2804.85	1167.91

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.0 Wind 0 deg - No Ice
3	1.2D+1.0W (pattern 1) 0 deg - No Ice
4	1.2D+1.0W (pattern 2) 0 deg - No Ice
5	0.9 Dead+1.0 Wind 0 deg - No Ice
6	1.2 Dead+1.0 Wind 90 deg - No Ice
7	1.2D+1.0W (pattern 1) 90 deg - No Ice
8	1.2D+1.0W (pattern 2) 90 deg - No Ice
9	0.9 Dead+1.0 Wind 90 deg - No Ice
10	1.2 Dead+1.0 Wind 180 deg - No Ice
11	1.2D+1.0W (pattern 1) 180 deg - No Ice
12	1.2D+1.0W (pattern 2) 180 deg - No Ice
13	0.9 Dead+1.0 Wind 180 deg - No Ice
14	Dead+Wind 0 deg - Service
15	Dead+Wind 90 deg - Service
16	Dead+Wind 180 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
T1	120 - 100	Leg	Max Tension	13	5168.49	-35.03	536.57
			Max. Compression	2	-6227.73	-4.57	-4.16
			Max. Mx	6	-311.29	373.77	25.80
			Max. My	2	-6224.76	38.29	-556.83
			Max. Vy	6	791.66	-20.86	0.46
			Max. Vx	2	-1107.86	-4.57	-4.16
		Diagonal	Max Tension	2	1332.59	0.00	0.00
			Max. Compression	10	-1333.25	0.00	0.00
			Max. Mx	2	-164.73	17.59	0.01
			Max. My	5	-1033.39	-7.71	7.14
			Max. Vy	2	7.57	17.59	0.01
			Max. Vx	5	2.09	-7.71	7.14
		Top Girt	Max Tension	9	92.21	0.00	0.00
			Max. Compression	4	-96.87	0.00	0.00
			Max. Mx	4	-96.87	-6.18	0.00
			Max. My	6	-7.41	0.00	0.00
			Max. Vy	4	4.94	0.00	0.00
			Max. Vx	6	-0.00	0.00	0.00
T2	100 - 80	Leg	Max Tension	13	21548.46	-29.30	409.01
			Max. Compression	4	-23821.79	-44.74	631.05
			Max. Mx	6	-18006.26	-534.26	-160.76
			Max. My	2	-23818.96	-49.75	682.56
			Max. Vy	8	1627.76	-477.74	-167.49
			Max. Vx	4	-2324.30	-44.74	631.05
		Diagonal	Max Tension	4	2320.35	0.00	0.00
			Max. Compression	10	-2228.34	0.00	0.00
			Max. Mx	10	1550.04	25.17	1.77
			Max. My	4	-2004.67	-23.41	6.67
			Max. Vy	10	9.81	25.17	1.77
			Max. Vx	4	1.95	-23.41	6.67
		Top Girt	Max Tension	5	93.41	0.00	0.00
			Max. Compression	10	-96.53	0.00	0.00
			Max. Mx	4	89.70	-6.18	0.00
			Max. My	6	-15.76	0.00	0.00
			Max. Vy	4	4.94	0.00	0.00
			Max. Vx	6	-0.00	0.00	0.00
T3	80 - 60	Leg	Max Tension	13	59254.59	-48.56	1153.31
			Max. Compression	2	-68095.34	-78.91	1981.26
			Max. Mx	6	-54757.46	-1487.14	-700.01
			Max. My	2	-68095.34	-78.91	1981.26
			Max. Vy	6	4933.77	-1487.14	-700.01
			Max. Vx	2	-6499.26	-78.91	1981.26
		Diagonal	Max Tension	10	5425.79	0.00	0.00
			Max. Compression	2	-5617.21	0.00	0.00
			Max. Mx	2	4631.86	42.53	-0.90
			Max. My	3	-4748.38	-28.89	7.49
			Max. Vy	2	-16.03	42.53	-0.90
			Max. Vx	3	2.19	-28.89	7.49
		Top Girt	Max Tension	5	225.18	0.00	0.00
			Max. Compression	10	-217.59	0.00	0.00
			Max. Mx	4	188.36	-9.12	0.00
			Max. My	6	-14.29	0.00	0.00
			Max. Vy	4	7.30	0.00	0.00
			Max. Vx	6	-0.00	0.00	0.00
T4	60 - 40	Leg	Max Tension	13	117391.45	-99.34	547.08
			Max. Compression	2	-129869.78	-52.68	3601.06
			Max. Mx	6	-54766.70	-3936.39	-1830.28
			Max. My	2	-68115.58	-216.58	5200.90
			Max. Vy	6	6223.29	-2645.49	-1381.36
			Max. Vx	2	-8309.35	-52.68	3601.06
		Diagonal	Max Tension	13	6677.98	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Max. Compression	2	-7220.68	0.00	0.00
			Max. Mx	2	5716.92	64.98	-2.86
			Max. My	6	-6179.68	-34.53	16.05
			Max. Vy	2	-23.67	64.98	-2.86
			Max. Vx	6	-4.66	-34.53	16.05
		Top Girt	Max Tension	10	872.99	0.00	0.00
			Max. Compression	5	-739.21	0.00	0.00
			Max. Mx	4	-624.49	-11.97	0.00
			Max. My	6	57.74	0.00	0.00
			Max. Vy	4	9.58	0.00	0.00
			Max. Vx	6	-0.00	0.00	0.00
T5	40 - 20	Leg	Max Tension	13	131521.35	171.52	138.05
			Max. Compression	2	-146338.47	804.02	-7.82
			Max. Mx	2	-130148.78	3975.03	236.36
			Max. My	6	-3241.93	-3.67	1504.61
			Max. Vy	3	-2202.59	652.16	-8.52
			Max. Vx	6	-1997.31	-3.65	1504.61
		Diagonal	Max Tension	9	2652.32	0.00	0.00
			Max. Compression	2	-2972.19	0.00	0.00
			Max. Mx	2	982.13	23.05	2.46
			Max. My	2	-2967.25	-20.14	8.36
			Max. Vy	2	-9.18	23.05	2.46
			Max. Vx	2	-2.55	0.00	0.00
		Top Girt	Max Tension	3	3.13	0.00	0.00
			Max. Compression	6	-87.36	0.00	0.00
			Max. Mx	4	-52.92	-6.30	0.00
			Max. My	6	-87.36	0.00	0.18
			Max. Vy	4	4.99	0.00	0.00
			Max. Vx	6	-0.14	0.00	0.00
T6	20 - 0	Leg	Max Tension	13	143222.84	1213.68	139.04
			Max. Compression	2	-160379.00	0.00	-0.16
			Max. Mx	5	-144522.61	1833.67	159.22
			Max. My	6	-4146.84	-9.27	1395.21
			Max. Vy	3	-2868.34	0.00	-0.15
			Max. Vx	6	-1207.24	-9.27	1395.21
		Diagonal	Max Tension	11	2338.95	0.00	0.00
			Max. Compression	3	-2572.97	0.00	0.00
			Max. Mx	2	1080.96	17.94	1.69
			Max. My	6	-1500.23	3.61	3.47
			Max. Vy	2	-7.80	17.43	2.10
			Max. Vx	6	-0.94	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Leg C	Max. Vert	10	81481.28	4822.78	-3526.61
	Max. H_x	10	81481.28	4822.78	-3526.61
	Max. H_z	9	-121820.14	-8173.00	4874.69
	Min. Vert	9	-121820.14	-8173.00	4874.69
	Min. H_x	9	-121820.14	-8173.00	4874.69
	Min. H_z	10	81481.28	4822.78	-3526.61
Leg B	Max. Vert	6	134880.54	-8769.17	-5247.16
	Max. H_x	5	-72039.27	4691.68	2853.90
	Max. H_z	5	-72039.27	4691.68	2853.90
	Min. Vert	5	-72039.27	4691.68	2853.90

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Leg A	Min. H_x	6	134880.54	-8769.17	-5247.16
	Min. H_z	6	134880.54	-8769.17	-5247.16
	Max. Vert	2	159964.61	-298.10	11864.50
	Max. H_x	13	-142821.48	303.59	-10840.54
	Max. H_z	2	159964.61	-298.10	11864.50
	Min. Vert	13	-142821.48	303.59	-10840.54
	Min. H_x	7	5709.67	-982.84	340.66
	Min. H_z	13	-142821.48	303.59	-10840.54

Tower Mast Reaction Summary

Load Combination	Vertical lb	$Shear_x$ lb	$Shear_z$ lb	Overturning Moment, M_x lb-ft	Overturning Moment, M_z lb-ft	Torque lb-ft
Dead Only	16249.19	0.08	0.06	-1831.15	4236.56	-0.01
1.2 Dead+1.0 Wind 0 deg - No Ice	19499.02	-21.82	-18002.55	-1196140.82	4541.01	-4813.58
1.2D+1.0W (pattern 1) 0 deg - No Ice	19499.02	-32.49	-16082.33	-1001196.84	5666.20	-4650.40
1.2D+1.0W (pattern 2) 0 deg - No Ice	19499.02	-2.41	-12721.74	-913553.72	3648.87	-4698.40
0.9 Dead+1.0 Wind 0 deg - No Ice	14624.25	-21.81	-18002.13	-1193332.33	3255.41	-4799.85
1.2 Dead+1.0 Wind 90 deg - No Ice	19499.02	17806.33	133.93	12140.42	-1148418.51	-6499.89
1.2D+1.0W (pattern 1) 90 deg - No Ice	19499.02	16097.87	80.13	6157.45	-976034.14	-5553.55
1.2D+1.0W (pattern 2) 90 deg - No Ice	19499.02	12392.26	134.16	12385.32	-859413.24	-6613.74
0.9 Dead+1.0 Wind 90 deg - No Ice	14624.25	17805.90	133.96	12671.12	-1147569.73	-6493.85
1.2 Dead+1.0 Wind 180 deg - No Ice	19499.02	-28.46	17250.15	1152815.22	9256.28	4724.59
1.2D+1.0W (pattern 1) 180 deg - No Ice	19499.02	-12.81	15394.65	963640.52	7591.10	4565.39
1.2D+1.0W (pattern 2) 180 deg - No Ice	19499.02	-32.72	12205.61	880012.07	9271.07	4641.19
0.9 Dead+1.0 Wind 180 deg - No Ice	14624.25	-28.45	17249.67	1151178.18	7952.13	4711.19
Dead+Wind 0 deg - Service	16249.19	-5.45	-4500.48	-299959.10	4117.56	-1201.26
Dead+Wind 90 deg - Service	16249.19	4451.45	33.48	1746.39	-283767.31	-1622.87
Dead+Wind 180 deg - Service	16249.19	-7.11	4312.40	286554.28	5293.63	1179.03

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	-16249.19	-0.00	-0.08	16249.19	-0.06	0.001%
2	-21.82	-19499.02	-18003.18	21.82	19499.02	18002.55	0.002%
3	-32.50	-19499.02	-16082.82	32.49	19499.02	16082.33	0.002%
4	-2.42	-19499.02	-12722.26	2.41	19499.02	12721.74	0.002%
5	-21.82	-14624.27	-18003.18	21.81	14624.25	18002.13	0.005%
6	17806.95	-19499.02	133.91	-17806.33	19499.02	-133.93	0.002%

Load Comb.	Sum of Applied Forces PX lb	PY lb	PZ lb	Sum of Reactions PX lb	PY lb	PZ lb	% Error
7	16098.36	-19499.02	80.11	-16097.87	19499.02	-80.13	0.002%
8	12392.76	-19499.02	134.15	-12392.26	19499.02	-134.16	0.002%
9	17806.95	-14624.27	133.91	-17805.90	14624.25	-133.96	0.005%
10	-28.47	-19499.02	17250.83	28.46	19499.02	-17250.15	0.003%
11	-12.82	-19499.02	15395.17	12.81	19499.02	-15394.65	0.002%
12	-32.73	-19499.02	12206.15	32.72	19499.02	-12205.61	0.002%
13	-28.47	-14624.27	17250.83	28.45	14624.25	-17249.67	0.005%
14	-5.46	-16249.19	-4500.79	5.45	16249.19	4500.48	0.002%
15	4451.74	-16249.19	33.48	-4451.45	16249.19	-33.48	0.002%
16	-7.12	-16249.19	4312.71	7.11	16249.19	-4312.40	0.002%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.00000001	0.00005622
2	Yes	13	0.00000001	0.00007702
3	Yes	13	0.00000001	0.00007538
4	Yes	13	0.00000001	0.00008005
5	Yes	12	0.00000001	0.00011971
6	Yes	13	0.00000001	0.00007992
7	Yes	13	0.00000001	0.00007752
8	Yes	13	0.00000001	0.00008211
9	Yes	12	0.00000001	0.00012614
10	Yes	13	0.00000001	0.00008459
11	Yes	13	0.00000001	0.00008145
12	Yes	13	0.00000001	0.00008589
13	Yes	12	0.00000001	0.00013523
14	Yes	12	0.00000001	0.00013796
15	Yes	12	0.00000001	0.00013756
16	Yes	12	0.00000001	0.00014110

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	120 - 100	4.574	14	0.3009	0.0773
T2	100 - 80	3.306	14	0.2943	0.0669
T3	80 - 60	2.117	14	0.2493	0.0489
T4	60 - 40	1.149	14	0.1857	0.0366
T5	40 - 20	0.476	14	0.1123	0.0264
T6	20 - 0	0.121	14	0.0508	0.0108

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
110.00	SPD6-5.2	14	3.936	0.3011	0.0730	163352
106.00	Radwin RW-9061-5001	14	3.683	0.2996	0.0709	116680
105.00	4' Grid	14	3.620	0.2990	0.0703	108901
92.50	GPS	14	2.843	0.2814	0.0605	37656
83.00	COVP (large)	14	2.284	0.2578	0.0515	22414
77.50	(2) LPA-80063/4CF w/Mt. Pipe	14	1.982	0.2420	0.0469	19334
67.00	FASB 2.4m RAS w/ Mt Pipe	14	1.457	0.2095	0.0401	17256
60.00	3" x 10.5" Antenna	14	1.149	0.1857	0.0366	16164
57.00	VHLP800-11	14	1.028	0.1749	0.0352	15815
53.00	Siren	14	0.877	0.1601	0.0334	15412
50.00	MD-S4 Ice Shield	14	0.773	0.1489	0.0320	15125
47.67	Jxn Box	14	0.696	0.1402	0.0308	14909
42.00	GPS w/Mount	14	0.529	0.1194	0.0277	14453

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	120 - 100	18.144	2	1.1852	0.3137
T2	100 - 80	13.144	2	1.1625	0.2721
T3	80 - 60	8.434	2	0.9898	0.1997
T4	60 - 40	4.583	2	0.7399	0.1499
T5	40 - 20	1.899	2	0.4478	0.1080
T6	20 - 0	0.484	2	0.2023	0.0440

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
110.00	SPD6-5.2	2	15.632	1.1872	0.2965	47899
106.00	Radwin RW-9061-5001	2	14.632	1.1820	0.2880	34214
105.00	4' Grid	2	14.383	1.1798	0.2857	31933
92.50	GPS	2	11.314	1.1137	0.2462	9918
83.00	COVP (large)	2	9.099	1.0227	0.2102	5563
77.50	(2) LPA-80063/4CF w/Mt. Pipe	2	7.896	0.9616	0.1917	4851
67.00	FASB 2.4m RAS w/ Mt Pipe	2	5.809	0.8341	0.1643	4383
60.00	3" x 10.5" Antenna	2	4.583	0.7399	0.1499	4086
57.00	VHLP800-11	2	4.101	0.6971	0.1443	3992
53.00	Siren	2	3.501	0.6383	0.1369	3882
50.00	MD-S4 Ice Shield	2	3.083	0.5936	0.1311	3804
47.67	Jxn Box	2	2.778	0.5589	0.1264	3746
42.00	GPS w/Mount	2	2.109	0.4760	0.1133	3622

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt lb	Allowable Load per Bolt lb	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	120	Leg	A325N	0.7500	6	0.18	30101.40	0.000 ✔	1	Bolt Tension
		Diagonal	A325X	0.6250	1	1332.59	5220.00	0.255 ✔	1	Member Bearing
		Top Girt	A325X	0.6250	1	92.21	5220.00	0.018 ✔	1	Member Bearing
T2	100	Leg	A325N	0.7500	6	861.05	30101.40	0.029 ✔	1	Bolt Tension
		Diagonal	A325X	0.6250	1	2320.35	5220.00	0.445 ✔	1	Member Bearing
		Top Girt	A325X	0.6250	1	93.41	5220.00	0.018 ✔	1	Member Bearing
T3	80	Leg	A325N	0.7500	6	3590.64	30101.40	0.119 ✔	1	Bolt Tension
		Diagonal	A325X	0.6250	1	5425.79	7830.00	0.693 ✔	1	Member Bearing
		Top Girt	A325X	0.6250	1	225.18	7830.00	0.029 ✔	1	Member Bearing
T4	60	Leg	A325N	1.0000	6	9874.09	54517.00	0.181 ✔	1	Bolt Tension
		Diagonal	A325X	0.6250	1	6677.98	10440.00	0.640 ✔	1	Member Bearing
		Top Girt	A325X	0.6250	1	872.99	10440.00	0.084 ✔	1	Gusset Bearing
T5	40	Leg	A325N	1.0000	6	19604.10	54517.00	0.360 ✔	1	Bolt Tension
		Diagonal	A325X	0.6250	1	2652.32	5220.00	0.508 ✔	1	Member Bearing
		Top Girt	A325X	0.6250	1	87.36	8700.00	0.010 ✔	1	Member Bearing
T6	20	Leg	F1554-105	1.0000	6	21918.40	56788.50	0.386 ✔	1	Bolt Tension
		Diagonal	A325X	0.6250	1	2338.95	5220.00	0.448 ✔	1	Member Bearing

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	120 - 100	P2x.154	20.00	4.75	72.4 K=1.00	1.0745	-4941.28	32954.30	0.150 [1] ✔
T2	100 - 80	P2x.154	20.00	4.75	72.4 K=1.00	1.0745	-21329.40	32954.30	0.647 [1] ✔
T3	80 - 60	P2.5x.276	20.00	4.75	61.7 K=1.00	2.2535	-60825.40	76780.60	0.792 [1] ✔
T4	60 - 40	P4x.337	20.00	4.75	38.6 K=1.00	4.4074	-120556.00	177862.00	0.678 [1] ✔
T5	40 - 20	P5x.375	20.03	4.76	31.0 K=1.00	6.1120	-144225.00	256322.00	0.563 [1] ✔
T6	20 - 0	P5x.375	20.03	4.76	31.0 K=1.00	6.1120	-158076.00	256322.00	0.617 [1] ✔

[1] P_u / ϕP_n controls

Diagonal Design Data (Compression)

Section No.	Elevation	Size	L	L_u	Kl/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	lb	lb	
T1	120 - 100	L2x2x1/8	6.90	3.19	102.3 K=1.06	0.4844	-1333.25	11494.70	0.116 [1] ✔
T2	100 - 80	L2x2x1/8	6.90	3.19	102.3 K=1.06	0.4844	-2228.34	11494.70	0.194 [1] ✔
T3	80 - 60	L2x2x3/16	6.90	3.16	102.3 K=1.06	0.7150	-5617.21	17276.70	0.325 [1] ✔
T4	60 - 40	L2x2x1/4	6.90	3.07	100.7 K=1.07	0.9380	-7220.68	23008.80	0.314 [1] ✔
T5	40 - 20	L2x2x1/8	7.11	3.31	104.9 K=1.05	0.4844	-2972.19	11210.20	0.265 [1] ✔
T6	20 - 0	L2x2x1/8	9.92	4.71	142.3 K=1.00	0.4844	-2572.97	6848.35	0.376 [1] ✔

[1] P_u / ϕP_n controls

Top Girt Design Data (Compression)

Section No.	Elevation	Size	L	L_u	Kl/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	lb	lb	
T1	120 - 100	L2x2x1/8	5.00	4.56	137.7 K=1.00	0.4844	-96.87	7309.33	0.013 [1] ✔
T2	100 - 80	L2x2x1/8	5.00	4.56	137.7 K=1.00	0.4844	-96.53	7309.33	0.013 [1] ✔
T3	80 - 60	L2x2x3/16	5.00	4.52	137.7 K=1.00	0.7150	-217.59	10794.40	0.020 [1] ✔
T4	60 - 40	L2x2x1/4	5.00	4.39	134.6 K=1.00	0.9380	-739.21	14820.70	0.050 [1] ✔
T5	40 - 20	L2x2x1/8	5.05	4.35	131.2 K=1.00	0.4844	-87.36	8052.63	0.011 [1] ✔

[1] P_u / ϕP_n controls

Tension Checks

Leg Design Data (Tension)

Section No.	Elevation	Size	L	L_u	Kl/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	lb	lb	

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	120 - 100	P2x.154	20.00	0.50	7.6	1.0745	5168.49	48353.90	0.107 [1] ✔
T2	100 - 80	P2x.154	20.00	0.50	7.6	1.0745	21548.50	48353.90	0.446 [1] ✔
T3	80 - 60	P2.5x.276	20.00	0.50	6.5	2.2535	59254.60	101409.00	0.584 [1] ✔
T4	60 - 40	P4x.337	20.00	0.50	4.1	4.4074	117391.00	198335.00	0.592 [1] ✔
T5	40 - 20	P5x.375	20.03	0.50	3.3	6.1120	131521.00	275039.00	0.478 [1] ✔
T6	20 - 0	P5x.375	20.03	0.50	3.3	6.1120	143223.00	275039.00	0.521 [1] ✔

[1] P_u / ϕP_n controls

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	120 - 100	L2x2x1/8	6.90	3.19	63.5	0.2930	1332.59	12744.10	0.105 [1] ✔
T2	100 - 80	L2x2x1/8	6.90	3.19	63.5	0.2930	2320.35	12744.10	0.182 [1] ✔
T3	80 - 60	L2x2x3/16	6.90	3.16	63.9	0.4308	5425.79	18739.00	0.290 [1] ✔
T4	60 - 40	L2x2x1/4	6.90	3.07	62.9	0.5629	6677.98	24485.10	0.273 [1] ✔
T5	40 - 20	L2x2x1/8	7.11	3.31	65.7	0.2930	2652.32	12744.10	0.208 [1] ✔
T6	20 - 0	L2x2x1/8	9.92	4.71	92.6	0.2930	2338.95	12744.10	0.184 [1] ✔

[1] P_u / ϕP_n controls

Top Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	120 - 100	L2x2x1/8	5.00	4.56	92.0	0.2930	92.21	12744.10	0.007 [1] ✔
T2	100 - 80	L2x2x1/8	5.00	4.56	92.0	0.2930	93.41	12744.10	0.007 [1] ✔
T3	80 - 60	L2x2x3/16	5.00	4.52	92.6	0.4308	225.18	18739.00	0.012 [1] ✔
T4	60 - 40	L2x2x1/4	5.00	4.39	91.1	0.5629	872.99	24485.10	0.036 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T5	40 - 20	L2x2x1/8	5.05	4.35	87.9	0.2930	3.13	12744.10	0.000 [1]

[1] $P_u / \phi P_n$ controls

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
T1	120 - 100	Leg	P2x.154	3	-4941.28	32954.30	15.0	Pass
T2	100 - 80	Leg	P2x.154	33	-21329.40	32954.30	64.7	Pass
T3	80 - 60	Leg	P2.5x.276	63	-60825.40	76780.60	79.2	Pass
T4	60 - 40	Leg	P4x.337	93	-120556.00	177862.00	67.8	Pass
T5	40 - 20	Leg	P5x.375	123	-144225.00	256322.00	56.3	Pass
T6	20 - 0	Leg	P5x.375	153	-158076.00	256322.00	61.7	Pass
T1	120 - 100	Diagonal	L2x2x1/8	12	-1333.25	11494.70	11.6	Pass
T2	100 - 80	Diagonal	L2x2x1/8	42	-2228.34	11494.70	19.4	Pass
T3	80 - 60	Diagonal	L2x2x3/16	71	-5617.21	17276.70	32.5	Pass
T4	60 - 40	Diagonal	L2x2x1/4	101	-7220.68	23008.80	31.4	Pass
T5	40 - 20	Diagonal	L2x2x1/8	149	-2972.19	11210.20	26.5	Pass
T6	20 - 0	Diagonal	L2x2x1/8	158	-2572.97	6848.35	37.6	Pass
T1	120 - 100	Top Girt	L2x2x1/8	4	-96.87	7309.33	1.3	Pass
T2	100 - 80	Top Girt	L2x2x1/8	34	-96.53	7309.33	1.3	Pass
T3	80 - 60	Top Girt	L2x2x3/16	64	-217.59	10794.40	2.0	Pass
T4	60 - 40	Top Girt	L2x2x1/4	94	-739.21	14820.70	5.0	Pass
T5	40 - 20	Top Girt	L2x2x1/8	124	-87.36	8052.63	1.1	Pass
							Summary	
							Leg (T3) 79.2	Pass
							Diagonal (T6) 37.6	Pass
							Top Girt (T4) 5.0	Pass
							Bolt Checks 69.3	Pass
							RATING = 79.2	**Pass**

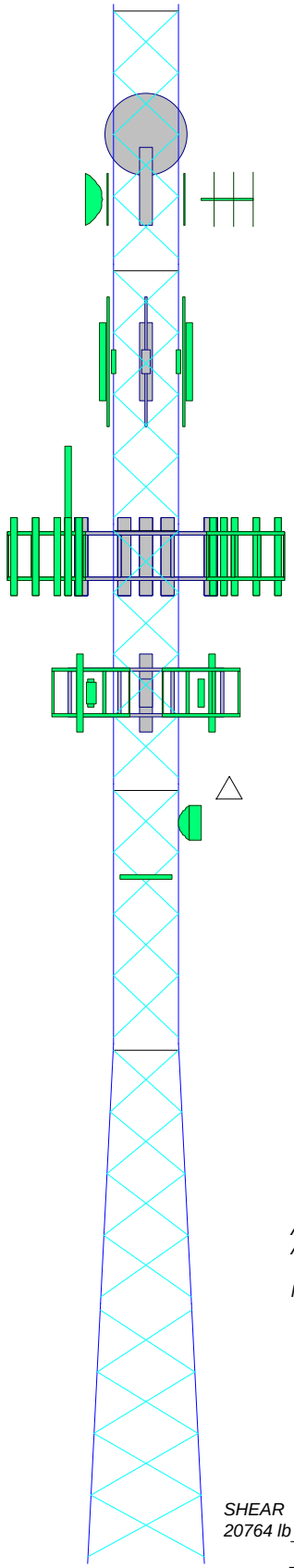
Element Map

Section No.	Section Elevation ft	Component Type	Element List
T1	120.00-100.00	Leg	1-3
		Diagonal	7-30
		Top Girt	4-6
T2	100.00-80.00	Leg	31-33
		Diagonal	37-60
		Top Girt	34-36
T3	80.00-60.00	Leg	61-63
		Diagonal	67-90
		Top Girt	64-66
T4	60.00-40.00	Leg	91-93

Section No.	Section Elevation ft	Component Type	Element List
		Diagonal	97-120
		Top Girt	94-96
T5	40.00-20.00	Leg	121-123
		Diagonal	127-150
		Top Girt	124-126
T6	20.00-0.00	Leg	151-153
		Diagonal	154-177
		Total number of elements: 177	

APPENDIX - REFERENCES

Section	T1	T2	T3	T4	T5	T6	
Legs		P2x.154	P2.5x.276	P4x.337	P5x.375		
Leg Grade	A572-50						
Diagonals	L2x2x1/8		L2x2x3/16	L2x2x1/4	L2x2x1/8	N.A.	
Diagonal Grade	A36						
Top Girts	L2x2x1/8		L2x2x3/16	L2x2x1/4	L2x2x1/8		
Face Width (ft)	5				7	9	
# Panels @ (ft)	24 @ 4.75						
Weight (lb)	524.0	524.0	906.3	1483.1	1585.0	1625.2	6647.6



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
SPD6-5.2 (DFD)	110	RRH2X40-AWS (VZW)	77.5
Radwin RW-9061-5001 (DFD)	106	RRH2X40-AWS (VZW)	77.5
Pipe Mt	105	RRH2X40-AWS (VZW)	77.5
3' Yagi	105	RRH2X60-AWS (VZW)	77.5
4' Grid	105	RRH2X60-AWS (VZW)	77.5
Pipe Mt	105	RRH2X60-AWS (VZW)	77.5
P90-16-XLH-RR (FirstNet)	92.5	Sabre Ultra Boom - 14' (VZW)	77.5
P90-16-XLH-RR (FirstNet)	92.5	Sabre Ultra Boom - 14' (VZW)	77.5
EnodeB (FirstNet)	92.5	Sabre Ultra Boom - 14' (VZW)	77.5
EnodeB (FirstNet)	92.5	(2) LPA-80063/4CF w/ Mt. Pipe (VZW)	77.5
EnodeB (FirstNet)	92.5	FASB 2.4m RAS w/ Mt Pipe (T-Mobile)	67
2" x 10' pipe	92.5	FASB 2.4m RAS w/ Mt Pipe (T-Mobile)	67
2" x 10' pipe	92.5	FRBG (T-Mobile)	67
2" x 10' pipe	92.5	FRBG (T-Mobile)	67
GPS (FirstNet)	92.5	FRBG (T-Mobile)	67
P90-16-XLH-RR (FirstNet)	92.5	COVP (large) (T-Mobile)	67
COVP (large) (VZW)	83	VFA12-HD (T-Mobile)	67
(2) LPA-80063/4CF w/ Mt. Pipe (VZW)	77.5	VFA12-HD (T-Mobile)	67
(2) LPA-80063/4CF w/ Mt. Pipe (VZW)	77.5	VFA12-HD (T-Mobile)	67
(2) HEX656CW0000x w/ Mt Pipe (VZW)	77.5	FASB 2.4m RAS w/ Mt Pipe (T-Mobile)	67
(2) HEX656CW0000x w/ Mt Pipe (VZW)	77.5	3" x 10.5" Antenna	60
(2) HEX656CW0000x w/ Mt Pipe (VZW)	77.5	3" x 10.5" Antenna	60
RRU - typ (vzw)	77.5	VHLP800-11	57
RRU - typ (vzw)	77.5	Siren Mount (DFD)	53
RRU - typ (vzw)	77.5	MD-S4 Ice Shield	50
		Jxn Box	47.67
		GPS w/ Mount	42

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi	A36	36 ksi	58 ksi

TOWER DESIGN NOTES

1. Tower is located in Denver County, Colorado.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 90 mph basic wind in accordance with the TIA-222-G Standard.
4. Deflections are based upon a 60 mph wind.
5. Tower Structure Class III.
6. Topographic Category 1 with Crest Height of 0.00 ft
7. Assumptions:
8. Weld together tower sections have flange connections.
9. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
10. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
11. Welds are fabricated with ER-70S-6 electrodes.
12. TOWER RATING: 90%

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 182104 lb
SHEAR: 13555 lb

UPLIFT: -164399 lb
SHEAR: 12534 lb

AXIAL 17899 lb

SHEAR 20764 lb

MOMENT 1372871 lb-ft

TORQUE 4972 lb-ft
REACTIONS - 90 mph WIND

Centerline Solutions
16360 Table Mountain Parkway
Golden, CO 80403
Phone: (303) 993-3293
FAX: (303) 993-3019

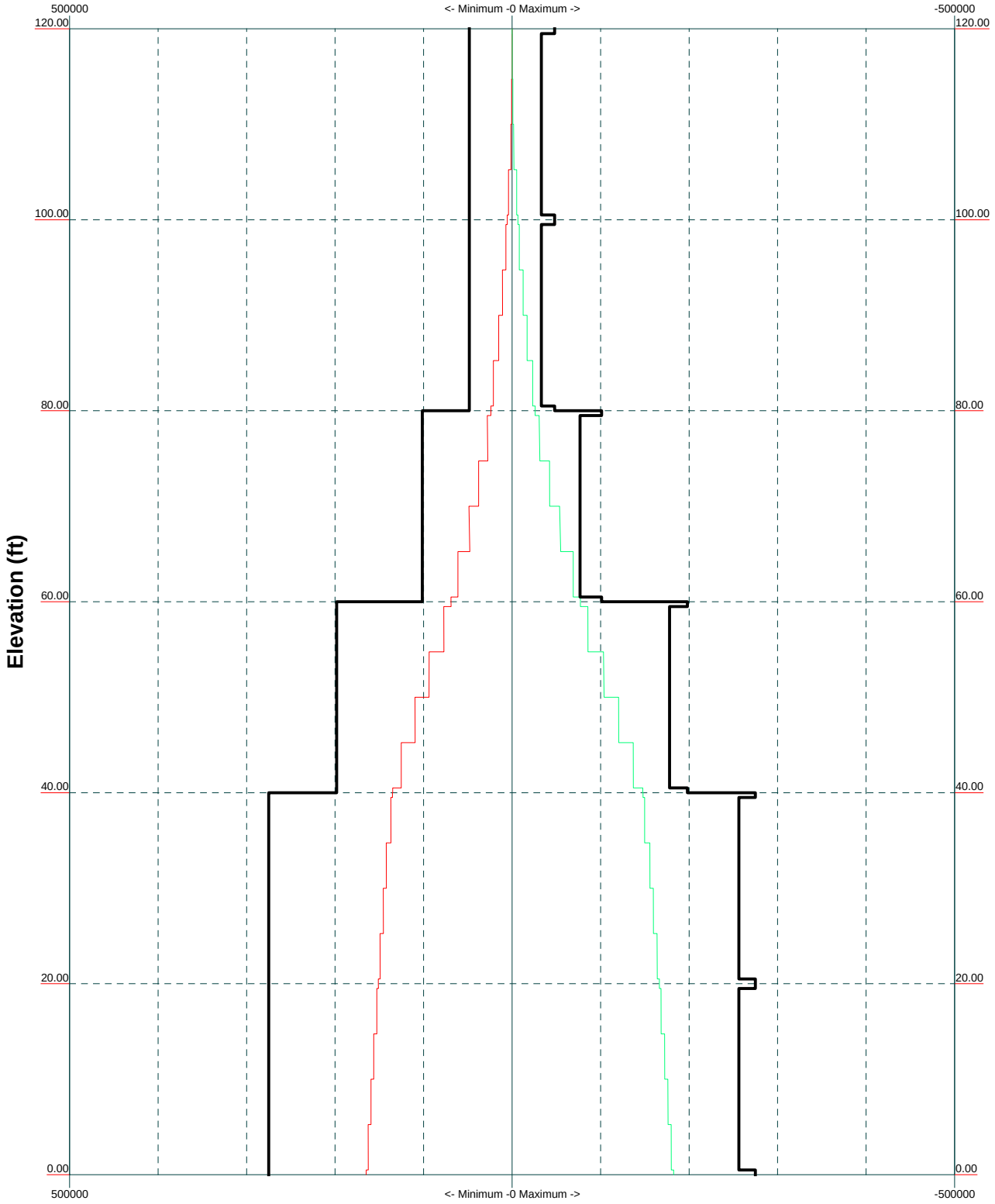
Job: ***TMO-15-0141-7 REV 4***			
Project: ***DN03634 - NSD***			
Client: T-Mobile	Drawn by: Jacob Leavengood	App'd:	
Code: TIA-222-G	Date: 10/31/17	Scale: NTS	
Path:		Dwg No. E-1	

CENTERLINE SOLUTIONS
16035 Table Mountain Parkway, Golden, CO 80403
303.993.3293

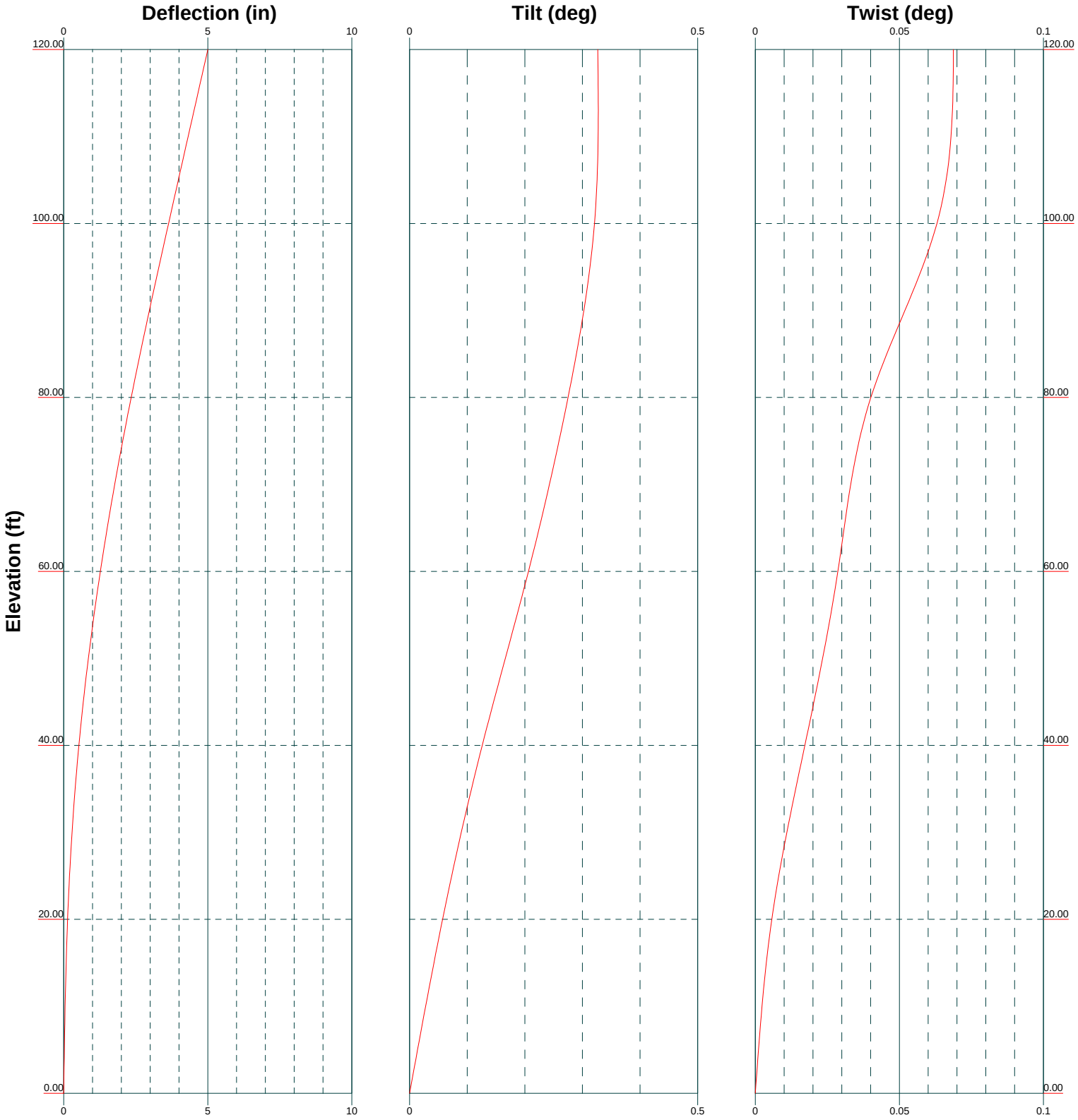
MISCELLANEOUS PLOTS

TIA-222-G - 90 mph Exposure C

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



Centerline Solutions	Job: ***TMO-15-0141-7 REV 4***		
16360 Table Mountain Parkway	Project: ***DN03634 - NSD***		
Golden, CO 80403	Client: T-Mobile	Drawn by: Jacob Leavengood	App'd:
Phone: (303) 993-3293	Code: TIA-222-G	Date: 10/31/17	Scale: NTS
FAX: (303) 993-3019	Path:		Dwg No. E-3

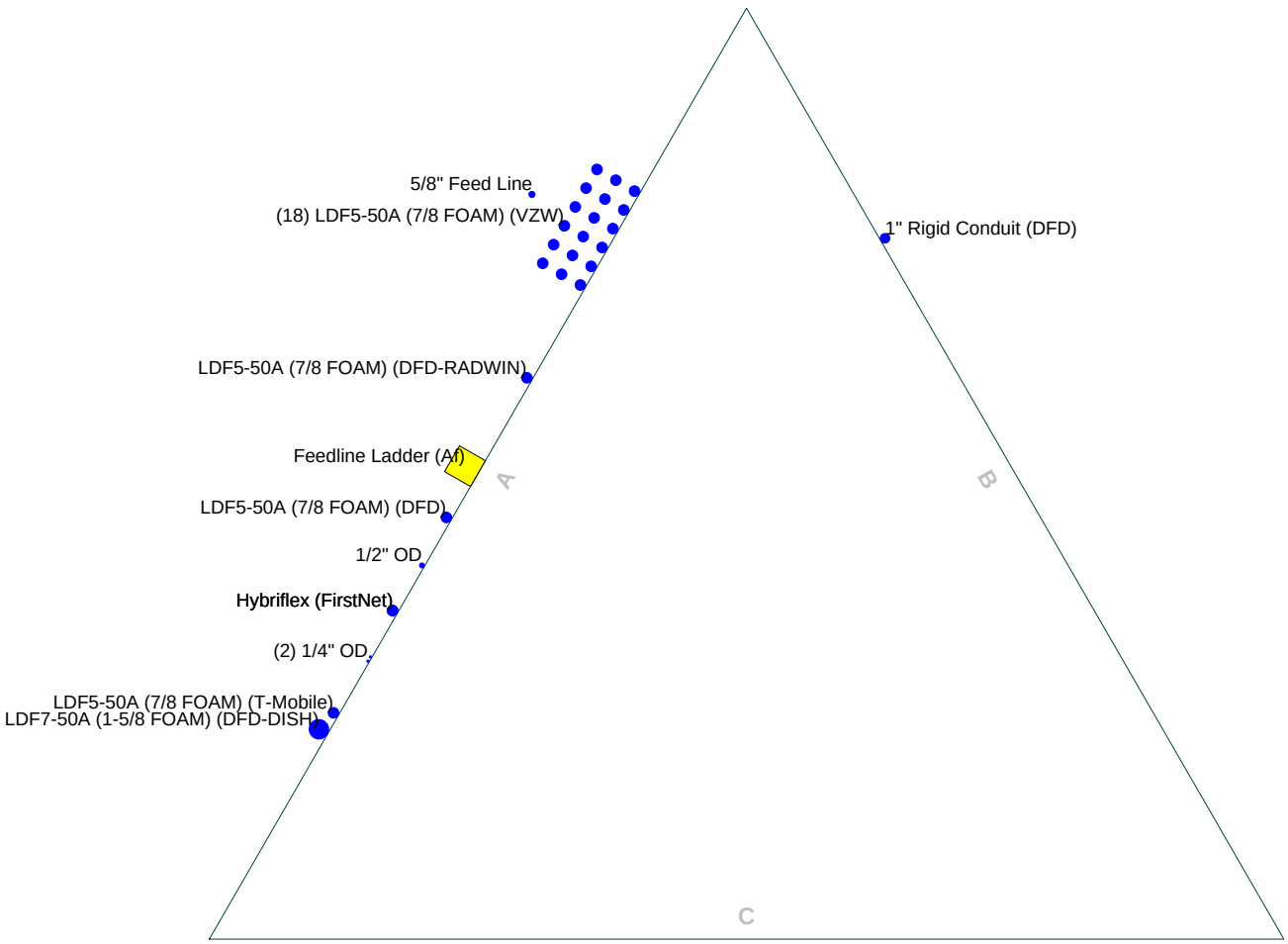


Centerline Solutions
16360 Table Mountain Parkway
Golden, CO 80403
Phone: (303) 993-3293
FAX: (303) 993-3019

Job: ***TMO-15-0141-7 REV 4***		
Project: ***DN03634 - NSD***		
Client: T-Mobile	Drawn by: Jacob Leavengood	App'd:
Code: TIA-222-G	Date: 10/31/17	Scale: NTS
Path:		Dwg No. E-5

Feed Line Plan

Round Flat App In Face App Out Face

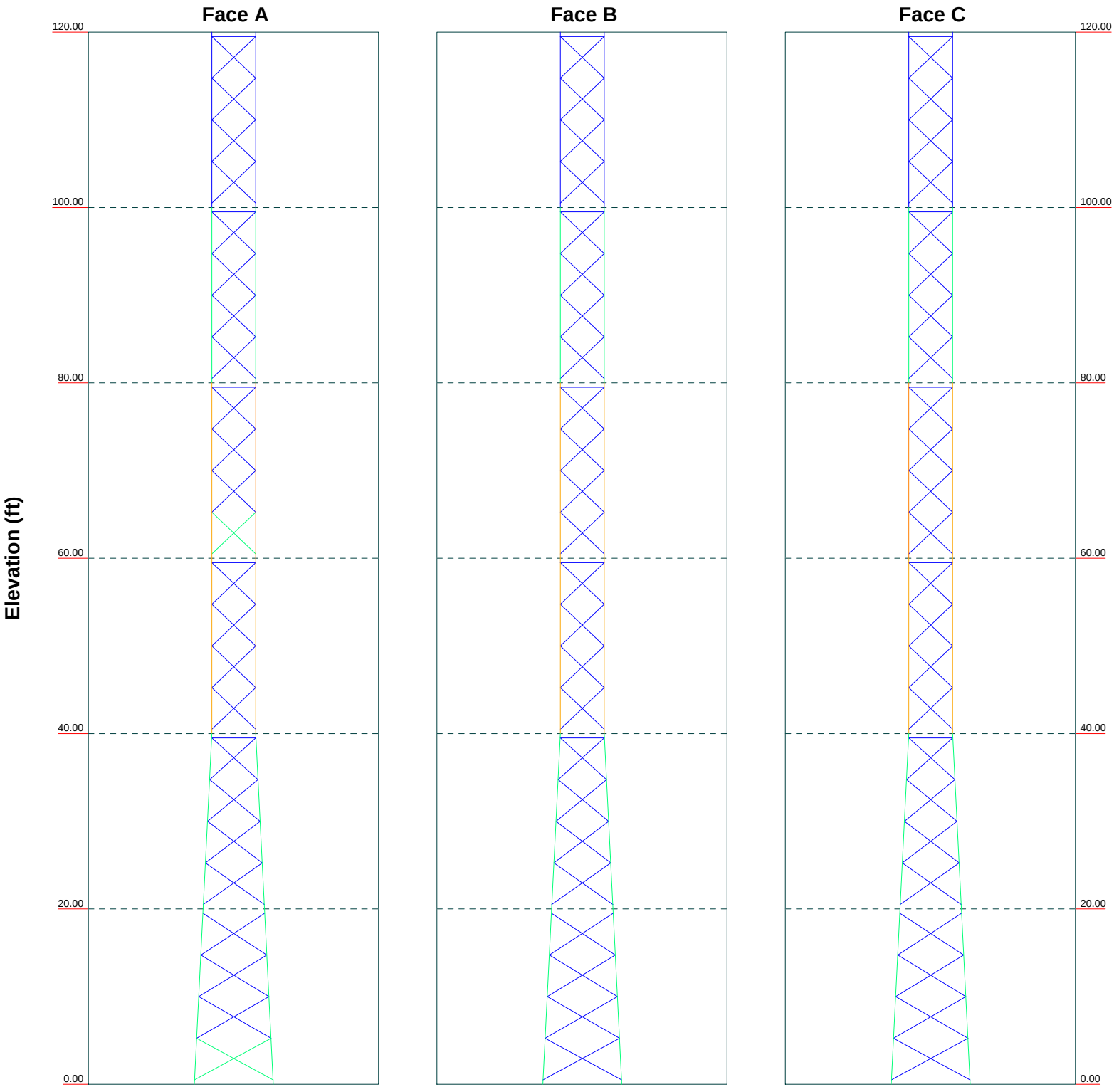


Centerline Solutions
16360 Table Mountain Parkway
Golden, CO 80403
Phone: (303) 993-3293
FAX: (303) 993-3019

Job: ***TMO-15-0141-7 REV 4***		
Project: ***DN03634 - NSD***		
Client: T-Mobile	Drawn by: Jacob Leavengood	App'd:
Code: TIA-222-G	Date: 10/31/17	Scale: NTS
Path:		Dwg No. E-7

Stress Distribution Chart
0' - 120'

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



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Code: TIA-222-G	Date: 10/31/17	Scale: NTS
Path:		Dwg No. E-8

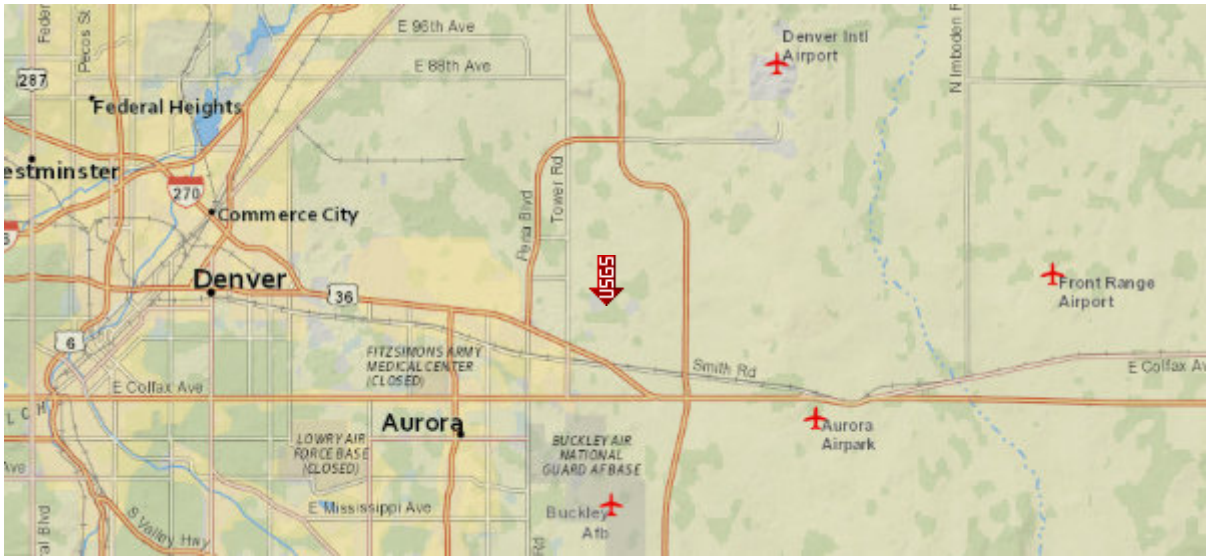
CENTERLINE SOLUTIONS
16035 Table Mountain Parkway, Golden, CO 80403
303.993.3293

SEISMIC LOADING CHECK

USGS Design Maps Summary Report

User–Specified Input

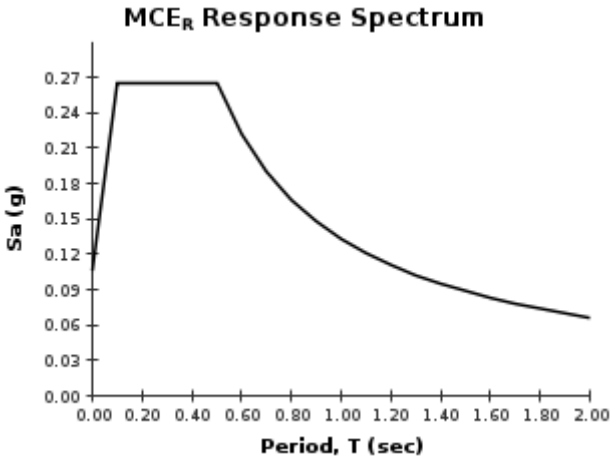
Report Title	Fire Station #29 (DN03634A) Thu September 15, 2016 18:12:11 UTC
Building Code Reference Document	2012/2015 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	39.78311°N, 104.75454°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	IV (e.g. essential facilities)

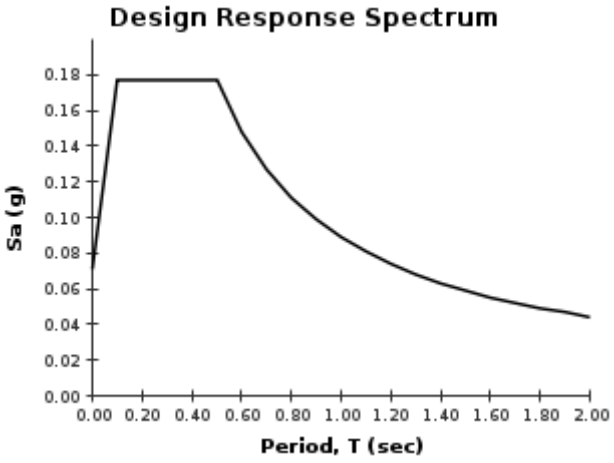


USGS–Provided Output

S_S =	0.166 g	S_{MS} =	0.265 g	S_{DS} =	0.177 g
S_1 =	0.055 g	S_{M1} =	0.133 g	S_{D1} =	0.089 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





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CALCULATION PRINTOUT

tnxTower	Job	Page
Centerline Solutions 16360 Table Mountain Parkway Golden, CO 80403 Phone: (303) 993-3293 FAX: (303) 993-3019	TMO-15-0141-7 REV 4	1 of 17
	Project DN03634 - NSD	**Date** 14:48:43 10/31/17
	Client T-Mobile	**Designed by** Jacob Leavengood

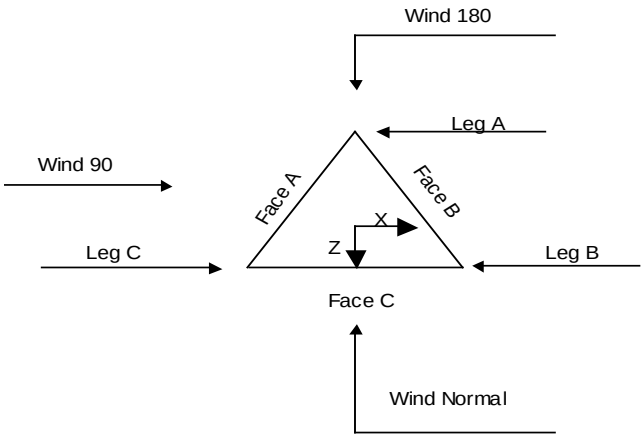
Tower Input Data

The main tower is a 3x free standing tower with an overall height of 120.00 ft above the ground line.
The base of the tower is set at an elevation of 0.00 ft above the ground line.
The face width of the tower is 5.00 ft at the top and 9.00 ft at the base.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

- Tower is located in Denver County, Colorado.
- Basic wind speed of 90 mph.
- Structure Class III.
- Exposure Category C.
- Topographic Category 1.
- Crest Height 0.00 ft.
- Deflections calculated using a wind speed of 60 mph.
- Assumptions:.
- Weld together tower sections have flange connections..
- Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
- Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
- Welds are fabricated with ER-70S-6 electrodes..
- A non-linear (P-delta) analysis was used.
- Pressures are calculated at each section.
- Stress ratio used in tower member design is 1.
- Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

	Consider Moments - Legs		Distribute Leg Loads As Uniform		Use ASCE 10 X-Brace Ly Rules
	Consider Moments - Horizontals		Assume Legs Pinned	√	Calculate Redundant Bracing Forces
	Consider Moments - Diagonals	√	Assume Rigid Index Plate		Ignore Redundant Members in FEA
	Use Moment Magnification	√	Use Clear Spans For Wind Area		SR Leg Bolts Resist Compression
√	Use Code Stress Ratios	√	Use Clear Spans For KL/r		All Leg Panels Have Same Allowable
√	Use Code Safety Factors - Guys		Retension Guys To Initial Tension		Offset Girt At Foundation
	Escalate Ice		Bypass Mast Stability Checks	√	Consider Feed Line Torque
	Always Use Max Kz	√	Use Azimuth Dish Coefficients		Include Angle Block Shear Check
	Use Special Wind Profile	√	Project Wind Area of Appurt.		Use TIA-222-G Bracing Resist. Exemption
	Include Bolts In Member Capacity	√	Autocalc Torque Arm Areas		Use TIA-222-G Tension Splice Exemption
√	Leg Bolts Are At Top Of Section		Add IBC .6D+W Combination		Poles
√	Secondary Horizontal Braces Leg	√	Sort Capacity Reports By Component		Include Shear-Torsion Interaction
	Use Diamond Inner Bracing (4 Sided)	√	Triangulate Diamond Inner Bracing		Always Use Sub-Critical Flow
	SR Members Have Cut Ends		Treat Feed Line Bundles As Cylinder		Use Top Mounted Sockets
	SR Members Are Concentric				



Triangular Tower

Tower Section Geometry

Tower Section	Tower Elevation ft	Assembly Database	Description	Section Width ft	Number of Sections	Section Length ft
T1	120.00-100.00			5.00	1	20.00
T2	100.00-80.00			5.00	1	20.00
T3	80.00-60.00			5.00	1	20.00
T4	60.00-40.00			5.00	1	20.00
T5	40.00-20.00			5.00	1	20.00
T6	20.00-0.00			7.00	1	20.00

Tower Section Geometry *(cont'd)*

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
T1	120.00-100.00	4.75	X Brace	No	No	6.0000	6.0000
T2	100.00-80.00	4.75	X Brace	No	No	6.0000	6.0000
T3	80.00-60.00	4.75	X Brace	No	No	6.0000	6.0000
T4	60.00-40.00	4.75	X Brace	No	No	6.0000	6.0000
T5	40.00-20.00	4.75	X Brace	No	No	6.0000	6.0000
T6	20.00-0.00	4.75	X Brace	No	No	6.0000	6.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Leg Type*	*Leg Size*	*Leg Grade*	*Diagonal Type*	*Diagonal Size*	*Diagonal Grade*
T1 120.00-100.00	Pipe	P2x.154	A572-50 (50 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T2 100.00-80.00	Pipe	P2x.154	A572-50 (50 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T3 80.00-60.00	Pipe	P2.5x.276	A572-50 (50 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T4 60.00-40.00	Pipe	P4x.337	A572-50 (50 ksi)	Equal Angle	L2x2x1/4	A36 (36 ksi)
T5 40.00-20.00	Pipe	P5x.375	A572-50 (50 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T6 20.00-0.00	Pipe	P5x.375	A572-50 (50 ksi)	Equal Angle	L2x2x1/8	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 120.00-100.00	Equal Angle	L2x2x1/8	A36 (36 ksi)	Flat Bar		A36 (36 ksi)
T2 100.00-80.00	Equal Angle	L2x2x1/8	A36 (36 ksi)	Flat Bar		A36 (36 ksi)
T3 80.00-60.00	Equal Angle	L2x2x3/16	A36 (36 ksi)	Flat Bar		A36 (36 ksi)
T4 60.00-40.00	Equal Angle	L2x2x1/4	A36 (36 ksi)	Flat Bar		A36 (36 ksi)
T5 40.00-20.00	Equal Angle	L2x2x1/8	A36 (36 ksi)	Flat Bar		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*	*Double Angle Stitch Bolt Spacing Redundants in*
T1 120.00-100.00	0.23	0.2500	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T2 100.00-80.00	0.23	0.2500	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T3 80.00-60.00	0.23	0.2500	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T4 60.00-40.00	0.23	0.2500	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T5 40.00-20.00	0.23	0.2500	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T6 20.00-0.00	0.23	0.2500	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K Factors[1] Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1	Yes	Yes	1	1	1	1	1	1	1	1
120.00-100.00				1	1	1	1	1	1	1
T2	Yes	Yes	1	1	1	1	1	1	1	1
100.00-80.00				1	1	1	1	1	1	1
T3	Yes	Yes	1	1	1	1	1	1	1	1
80.00-60.00				1	1	1	1	1	1	1
T4	Yes	Yes	1	1	1	1	1	1	1	1
60.00-40.00				1	1	1	1	1	1	1
T5	Yes	Yes	1	1	1	1	1	1	1	1
40.00-20.00				1	1	1	1	1	1	1
T6 20.00-0.00	Yes	Yes	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1

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

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Net Width Deduct in	Leg U	Diagonal Net Width Deduct in	Diagonal U	Top Girt Net Width Deduct in	Top Girt U	Bottom Girt Net Width Deduct in	Bottom Girt U	Mid Girt Net Width Deduct in	Mid Girt U	Long Horizontal Net Width Deduct in	Long Horizontal U	Short Horizontal Net Width Deduct in	Short Horizontal U
T1 120.00-100.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T2 100.00-80.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T3 80.00-60.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T4 60.00-40.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T5 40.00-20.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T6 20.00-0.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	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 120.00-100.00	Flange	0.7500 A325N	6	0.6250 A325X	1	0.6250 A325X	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T2 100.00-80.00	Flange	0.7500 A325N	6	0.6250 A325X	1	0.6250 A325X	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T3 80.00-60.00	Flange	0.7500 A325N	6	0.6250 A325X	1	0.6250 A325X	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T4 60.00-40.00	Flange	1.0000 A325N	6	0.6250 A325X	1	0.6250 A325X	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T5 40.00-20.00	Flange	1.0000 A325N	6	0.6250 A325X	1	0.6250 A325X	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T6 20.00-0.00	Flange	1.0000 F1554-105	6	0.6250 A325X	1	0.6250 A325X	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

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
LDF5-50A (7/8 FOAM) (DFD)	A	No	Ar (CaAa)	105.00 - 0.00	0.0000	-0.05	1	1	1.0900	1.0900		0.33
1/2" OD	A	No	Ar (CaAa)	105.00 - 0.00	0.0000	-0.1	1	1	0.5000	0.5000		0.15
Hybriflex (FirstNet)	A	No	Ar (CaAa)	92.50 - 0.00	0.0000	-0.15	1	1	1.0900	1.0900		0.37
LDF5-50A (7/8 FOAM) (VZW)	A	No	Ar (CaAa)	77.50 - 0.00	0.0000	0.25	18	6	1.0900	1.0900		0.33
Hybriflex (FirstNet)	A	No	Ar (CaAa)	67.00 - 0.00	0.0000	-0.15	1	1	1.0900	1.0900		0.37
1/4" OD	A	No	Ar (CaAa)	60.00 - 0.00	0.0000	-0.2	2	2	0.2500	0.2500		0.05
1" Rigid Conduit (DFD)	B	No	Ar (CaAa)	47.67 - 0.00	0.0000	-0.25	1	1	1.0000	1.0000		0.70
5/8" Feed Line	A	No	Ar (CaAa)	42.00 - 0.00	9.0000	0.25	1	1	0.6250	0.6250		0.40
Feedline Ladder (Af)	A	No	Af (CaAa)	120.00 - 0.00	0.0000	0	1	1	3.0000	3.0000		8.40
LDF7-50A (1-5/8 FOAM) (DFD-DISH)	A	No	Ar (CaAa)	110.00 - 0.00	0.0000	-0.28	1	1	1.9800	1.9800		0.82
LDF5-50A (7/8 FOAM) (T-Mobile)	A	No	Ar (CaAa)	57.00 - 0.00	0.0000	-0.26	1	1	1.0900	1.0900		0.33
LDF5-50A (7/8 FOAM) (DFD-RADWIN)	A	No	Ar (CaAa)	106.00 - 0.00	0.0000	0.1	1	1	1.0900	1.0900		0.33

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

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	120.00-100.00	A	0.000	0.000	13.429	0.000	180.58
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T2	100.00-80.00	A	0.000	0.000	20.683	0.000	205.22
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T3	80.00-60.00	A	0.000	0.000	56.598	0.000	314.54
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T4	60.00-40.00	A	0.000	0.000	65.898	0.000	342.61
		B	0.000	0.000	0.767	0.000	5.37
		C	0.000	0.000	0.000	0.000	0.00
T5	40.00-20.00	A	0.000	0.000	67.350	0.000	350.80
		B	0.000	0.000	2.000	0.000	14.00
		C	0.000	0.000	0.000	0.000	0.00
T6	20.00-0.00	A	0.000	0.000	67.350	0.000	350.80
		B	0.000	0.000	2.000	0.000	14.00
		C	0.000	0.000	0.000	0.000	0.00

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	120.00-100.00	-1.6293	-0.6784	-2.3892	-1.1172
T2	100.00-80.00	-2.1433	-0.7121	-2.7751	-1.0769
T3	80.00-60.00	-2.2678	-2.5801	-2.6318	-2.7902
T4	60.00-40.00	-2.2301	-2.4215	-2.5312	-2.5954
T5	40.00-20.00	-2.4434	-2.7973	-2.7699	-2.9858
T6	20.00-0.00	-3.1083	-3.6079	-3.5282	-3.8504

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	1	LDF5-50A (7/8 FOAM)	100.00 - 105.00	0.6000	0.6000
T1	2	1/2" OD	100.00 - 105.00	0.6000	0.6000
T1	11	Feedline Ladder (Af)	100.00 - 120.00	0.6000	0.6000
T1	12	LDF7-50A (1-5/8 FOAM)	100.00 - 110.00	0.6000	0.6000
T1	14	LDF5-50A (7/8 FOAM)	100.00 - 106.00	0.6000	0.6000
T2	1	LDF5-50A (7/8 FOAM)	80.00 - 100.00	0.6000	0.6000
T2	2	1/2" OD	80.00 - 100.00	0.6000	0.6000
T2	3	Hybriflex	80.00 - 92.50	0.6000	0.6000
T2	11	Feedline Ladder (Af)	80.00 - 100.00	0.6000	0.6000
T2	12	LDF7-50A (1-5/8 FOAM)	80.00 - 100.00	0.6000	0.6000
T2	14	LDF5-50A (7/8 FOAM)	80.00 - 100.00	0.6000	0.6000
T3	1	LDF5-50A (7/8 FOAM)	60.00 - 80.00	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T3	2	1/2" OD	60.00 - 80.00	0.6000	0.6000
T3	3	Hybriflex	60.00 - 80.00	0.6000	0.6000
T3	5	LDF5-50A (7/8 FOAM)	60.00 - 77.50	0.6000	0.6000
T3	7	Hybriflex	60.00 - 67.00	0.6000	0.6000
T3	11	Feedline Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T3	12	LDF7-50A (1-5/8 FOAM)	60.00 - 80.00	0.6000	0.6000
T3	14	LDF5-50A (7/8 FOAM)	60.00 - 80.00	0.6000	0.6000
T4	1	LDF5-50A (7/8 FOAM)	40.00 - 60.00	0.6000	0.6000
T4	2	1/2" OD	40.00 - 60.00	0.6000	0.6000
T4	3	Hybriflex	40.00 - 60.00	0.6000	0.6000
T4	5	LDF5-50A (7/8 FOAM)	40.00 - 60.00	0.6000	0.6000
T4	7	Hybriflex	40.00 - 60.00	0.6000	0.6000
T4	8	1/4" OD	40.00 - 60.00	0.6000	0.6000
T4	9	1" Rigid Conduit	40.00 - 47.67	0.6000	0.6000
T4	10	5/8" Feed Line	40.00 - 42.00	0.6000	0.6000
T4	11	Feedline Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T4	12	LDF7-50A (1-5/8 FOAM)	40.00 - 60.00	0.6000	0.6000
T4	13	LDF5-50A (7/8 FOAM)	40.00 - 57.00	0.6000	0.6000
T4	14	LDF5-50A (7/8 FOAM)	40.00 - 60.00	0.6000	0.6000
T5	1	LDF5-50A (7/8 FOAM)	20.00 - 40.00	0.6000	0.6000
T5	2	1/2" OD	20.00 - 40.00	0.6000	0.6000
T5	3	Hybriflex	20.00 - 40.00	0.6000	0.6000
T5	5	LDF5-50A (7/8 FOAM)	20.00 - 40.00	0.6000	0.6000
T5	7	Hybriflex	20.00 - 40.00	0.6000	0.6000
T5	8	1/4" OD	20.00 - 40.00	0.6000	0.6000
T5	9	1" Rigid Conduit	20.00 - 40.00	0.6000	0.6000
T5	10	5/8" Feed Line	20.00 - 40.00	0.6000	0.6000
T5	11	Feedline Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T5	12	LDF7-50A (1-5/8 FOAM)	20.00 - 40.00	0.6000	0.6000
T5	13	LDF5-50A (7/8 FOAM)	20.00 - 40.00	0.6000	0.6000
T5	14	LDF5-50A (7/8 FOAM)	20.00 - 40.00	0.6000	0.6000
T6	1	LDF5-50A (7/8 FOAM)	0.00 - 20.00	0.6000	0.6000
T6	2	1/2" OD	0.00 - 20.00	0.6000	0.6000
T6	3	Hybriflex	0.00 - 20.00	0.6000	0.6000
T6	5	LDF5-50A (7/8 FOAM)	0.00 - 20.00	0.6000	0.6000
T6	7	Hybriflex	0.00 - 20.00	0.6000	0.6000
T6	8	1/4" OD	0.00 - 20.00	0.6000	0.6000
T6	9	1" Rigid Conduit	0.00 - 20.00	0.6000	0.6000
T6	10	5/8" Feed Line	0.00 - 20.00	0.6000	0.6000
T6	11	Feedline Ladder (Af)	0.00 - 20.00	0.6000	0.6000
T6	12	LDF7-50A (1-5/8 FOAM)	0.00 - 20.00	0.6000	0.6000
T6	13	LDF5-50A (7/8 FOAM)	0.00 - 20.00	0.6000	0.6000
T6	14	LDF5-50A (7/8 FOAM)	0.00 - 20.00	0.6000	0.6000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
***									
Pipe Mt	C	From Leg	0.50	0.0000	105.00	No Ice	0.05	0.05	15.00

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
			0.00 0.00						
***									
3' Yagi	B	From Leg	2.00 0.00 0.00	0.0000	105.00	No Ice	2.08	2.08	30.95
Pipe Mt	B	From Leg	0.50 0.00 0.00	0.0000	105.00	No Ice	0.05	0.05	15.00
***									
Radwin RW-9061-5001 (DFD)	A	From Leg	1.00 0.00 0.00	0.0000	106.00	No Ice	1.05	0.59	5.00
***									
GPS (FirstNet)	A	From Leg	1.00 0.00 0.00	0.0000	92.50	No Ice	0.17	0.17	5.00
P90-16-XLH-RR (FirstNet)	A	From Leg	1.00 0.00 0.00	0.0000	92.50	No Ice	10.69	7.58	62.00
P90-16-XLH-RR (FirstNet)	B	From Leg	1.00 0.00 0.00	0.0000	92.50	No Ice	10.69	7.58	62.00
P90-16-XLH-RR (FirstNet)	C	From Leg	1.00 0.00 0.00	0.0000	92.50	No Ice	10.69	7.58	62.00
EnodeB (FirstNet)	A	From Leg	0.00 0.00 0.00	0.0000	92.50	No Ice	1.48	2.75	40.00
EnodeB (FirstNet)	B	From Leg	0.00 0.00 0.00	0.0000	92.50	No Ice	1.48	2.75	40.00
EnodeB (FirstNet)	C	From Leg	0.00 0.00 0.00	0.0000	92.50	No Ice	1.48	2.75	40.00
2" x 10' pipe	A	From Leg	0.50 0.00 0.00	0.0000	92.50	No Ice	0.03	0.03	40.00
2" x 10' pipe	B	From Leg	0.50 0.00 0.00	0.0000	92.50	No Ice	0.03	0.03	40.00
2" x 10' pipe	C	From Leg	0.50 0.00 0.00	0.0000	92.50	No Ice	0.03	0.03	40.00
***									
Siren Mount (DFD)	C	From Face	2.00 0.00 0.00	0.0000	53.00	No Ice	3.10	2.85	480.00
***									
COVP (large) (VZW)	C	From Leg	4.00 0.00 0.00	0.0000	83.00	No Ice	3.20	1.03	14.85
(2) LPA-80063/4CF w/ Mt. Pipe (VZW)	A	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	6.15	6.29	34.60
(2) LPA-80063/4CF w/ Mt. Pipe	B	From Leg	4.00 0.00	0.0000	77.50	No Ice	6.15	6.29	34.60

tnxTower	Job: TMO-15-0141-7 REV 4	Page: 9 of 17
Centerline Solutions 16360 Table Mountain Parkway Golden, CO 80403 Phone: (303) 993-3293 FAX: (303) 993-3019	Project: DN03634 - NSD	Date: 14:48:43 10/31/17
	Client: T-Mobile	Designed by: Jacob Leavengood

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
(VZW)			0.00						
(2) LPA-80063/4CF w/ Mt. Pipe	C	From Leg	4.00 0.00	0.0000	77.50	No Ice	6.15	6.29	34.60
(VZW)			0.00						
(2) HEX656CW0000x w/ Mt Pipe	A	From Leg	4.00 0.00	0.0000	77.50	No Ice	8.72	7.28	62.15
(VZW)			0.00						
(2) HEX656CW0000x w/ Mt Pipe	B	From Leg	4.00 0.00	0.0000	77.50	No Ice	8.72	7.28	62.15
(VZW)			0.00						
(2) HEX656CW0000x w/ Mt Pipe	C	From Leg	4.00 0.00	0.0000	77.50	No Ice	8.72	7.28	62.15
(VZW)			0.00						
RRU - typ (vzw)	A	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.33	1.33	50.00
RRU - typ (vzw)	B	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.33	1.33	50.00
RRU - typ (vzw)	C	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.33	1.33	50.00
RRH2X40-AWS (VZW)	A	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.14	1.77	47.63
RRH2X40-AWS (VZW)	B	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.14	1.77	47.63
RRH2X40-AWS (VZW)	C	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.14	1.77	47.63
RRH2X60-AWS (VZW)	A	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.36	2.01	55.00
RRH2X60-AWS (VZW)	B	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.36	2.01	55.00
RRH2X60-AWS (VZW)	C	From Leg	4.00 0.00 0.00	0.0000	77.50	No Ice	3.36	2.01	55.00
Sabre Ultra Boom - 14' (VZW)	A	From Leg	2.00 0.00 0.00	0.0000	77.50	No Ice	8.80	6.14	346.00
Sabre Ultra Boom - 14' (VZW)	B	From Leg	2.00 0.00 0.00	0.0000	77.50	No Ice	8.80	6.14	346.00
Sabre Ultra Boom - 14' (VZW)	C	From Leg	2.00 0.00 0.00	0.0000	77.50	No Ice	8.80	6.14	346.00
***									
FASB 2.4m RAS w/ Mt Pipe (T-Mobile)	A	From Leg	3.00 0.00 0.00	0.0000	67.00	No Ice	12.71	16.12	256.42
FASB 2.4m RAS w/ Mt Pipe (T-Mobile)	B	From Leg	3.00 0.00 0.00	0.0000	67.00	No Ice	12.71	16.12	256.42
FASB 2.4m RAS w/ Mt Pipe	C	From Leg	3.00	0.0000	67.00	No Ice	12.71	16.12	256.42

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
(T-Mobile)			0.00 0.00						
FRBG (T-Mobile)	A	From Leg	2.00 0.00 0.00	0.0000	67.00	No Ice	2.64	1.67	59.50
FRBG (T-Mobile)	B	From Leg	2.00 0.00 0.00	0.0000	67.00	No Ice	2.64	1.67	59.50
FRBG (T-Mobile)	C	From Leg	2.00 0.00 0.00	0.0000	67.00	No Ice	2.64	1.67	59.50
COVP (large) (T-Mobile)	C	From Leg	2.00 0.00 0.00	0.0000	67.00	No Ice	3.20	1.03	14.85
VFA12-HD (T-Mobile)	A	From Leg	2.00 0.00 0.00	0.0000	67.00	No Ice	13.07	9.57	620.00
VFA12-HD (T-Mobile)	B	From Leg	2.00 0.00 0.00	0.0000	67.00	No Ice	13.07	9.57	620.00
VFA12-HD (T-Mobile)	C	From Leg	2.00 0.00 0.00	0.0000	67.00	No Ice	13.07	9.57	620.00
***									
3" x 10.5" Antenna	A	From Leg	0.50 0.00 0.00	0.0000	60.00	No Ice	0.31	0.12	2.00
3" x 10.5" Antenna	C	From Leg	0.50 0.00 0.00	0.0000	60.00	No Ice	0.31	0.12	2.00
***									
MD-S4 Ice Shield	B	From Face	0.00 0.00 0.00	0.0000	50.00	No Ice	5.00	3.20	290.10
Jxn Box	A	From Face	0.00 0.00 0.00	0.0000	47.67	No Ice	0.64	0.60	10.00
GPS w/ Mount	C	From Leg	4.00 0.00 0.00	0.0000	42.00	No Ice	0.51	0.51	12.30

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral ft Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight lb
4' Grid	C	Grid	From Leg	1.00 0.00 0.00	0.0000		105.00	4.00	No Ice	12.57	12.00

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight lb
SPD6-5.2 (DFD)	A	Paraboloid w/Radome	From Leg	1.00 0.00 0.00	0.0000		110.00	6.42	No Ice	32.34	222.00
VHLP800-11	B	Paraboloid w/Shroud (HP)	From Leg	0.00 0.00 0.00	0.0000		57.00	2.60	No Ice	5.31	49.00

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice
3	1.2D+1.6W (pattern 1) 0 deg - No Ice
4	1.2D+1.6W (pattern 2) 0 deg - No Ice
5	0.9 Dead+1.6 Wind 0 deg - No Ice
6	1.2 Dead+1.6 Wind 30 deg - No Ice
7	1.2D+1.6W (pattern 1) 30 deg - No Ice
8	1.2D+1.6W (pattern 2) 30 deg - No Ice
9	0.9 Dead+1.6 Wind 30 deg - No Ice
10	1.2 Dead+1.6 Wind 60 deg - No Ice
11	1.2D+1.6W (pattern 1) 60 deg - No Ice
12	1.2D+1.6W (pattern 2) 60 deg - No Ice
13	0.9 Dead+1.6 Wind 60 deg - No Ice
14	1.2 Dead+1.6 Wind 90 deg - No Ice
15	1.2D+1.6W (pattern 1) 90 deg - No Ice
16	1.2D+1.6W (pattern 2) 90 deg - No Ice
17	0.9 Dead+1.6 Wind 90 deg - No Ice
18	1.2 Dead+1.6 Wind 120 deg - No Ice
19	1.2D+1.6W (pattern 1) 120 deg - No Ice
20	1.2D+1.6W (pattern 2) 120 deg - No Ice
21	0.9 Dead+1.6 Wind 120 deg - No Ice
22	1.2 Dead+1.6 Wind 150 deg - No Ice
23	1.2D+1.6W (pattern 1) 150 deg - No Ice
24	1.2D+1.6W (pattern 2) 150 deg - No Ice
25	0.9 Dead+1.6 Wind 150 deg - No Ice
26	1.2 Dead+1.6 Wind 180 deg - No Ice
27	1.2D+1.6W (pattern 1) 180 deg - No Ice
28	1.2D+1.6W (pattern 2) 180 deg - No Ice
29	0.9 Dead+1.6 Wind 180 deg - No Ice
30	1.2 Dead+1.6 Wind 210 deg - No Ice
31	1.2D+1.6W (pattern 1) 210 deg - No Ice
32	1.2D+1.6W (pattern 2) 210 deg - No Ice
33	0.9 Dead+1.6 Wind 210 deg - No Ice
34	1.2 Dead+1.6 Wind 240 deg - No Ice
35	1.2D+1.6W (pattern 1) 240 deg - No Ice
36	1.2D+1.6W (pattern 2) 240 deg - No Ice
37	0.9 Dead+1.6 Wind 240 deg - No Ice
38	1.2 Dead+1.6 Wind 270 deg - No Ice
39	1.2D+1.6W (pattern 1) 270 deg - No Ice
40	1.2D+1.6W (pattern 2) 270 deg - No Ice
41	0.9 Dead+1.6 Wind 270 deg - No Ice
42	1.2 Dead+1.6 Wind 300 deg - No Ice
43	1.2D+1.6W (pattern 1) 300 deg - No Ice
44	1.2D+1.6W (pattern 2) 300 deg - No Ice
45	0.9 Dead+1.6 Wind 300 deg - No Ice

Comb. No.	Description
46	1.2 Dead+1.6 Wind 330 deg - No Ice
47	1.2D+1.6W (pattern 1) 330 deg - No Ice
48	1.2D+1.6W (pattern 2) 330 deg - No Ice
49	0.9 Dead+1.6 Wind 330 deg - No Ice
50	Dead+Wind 0 deg - Service
51	Dead+Wind 30 deg - Service
52	Dead+Wind 60 deg - Service
53	Dead+Wind 90 deg - Service
54	Dead+Wind 120 deg - Service
55	Dead+Wind 150 deg - Service
56	Dead+Wind 180 deg - Service
57	Dead+Wind 210 deg - Service
58	Dead+Wind 240 deg - Service
59	Dead+Wind 270 deg - Service
60	Dead+Wind 300 deg - Service
61	Dead+Wind 330 deg - Service

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	120 - 100	5.003	58	0.3272	0.0716
T2	100 - 80	3.639	58	0.3204	0.0610
T3	80 - 60	2.342	58	0.2746	0.0417
T4	60 - 40	1.272	58	0.2055	0.0289
T5	40 - 20	0.527	58	0.1243	0.0200
T6	20 - 0	0.135	58	0.0562	0.0079

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
110.00	SPD6-5.2	58	4.319	0.3273	0.0673	165205
106.00	Radwin RW-9061-5001	58	4.046	0.3258	0.0652	118003
105.00	4' Grid	58	3.978	0.3252	0.0646	110137
92.50	GPS	58	3.137	0.3072	0.0541	36365
83.00	COVP (large)	58	2.526	0.2833	0.0445	21308
77.50	(2) LPA-80063/4CF w/ Mt. Pipe	58	2.193	0.2670	0.0396	18165
67.00	FASB 2.4m RAS w/ Mt Pipe	58	1.613	0.2319	0.0324	15700
60.00	3" x 10.5" Antenna	58	1.272	0.2055	0.0289	14496
57.00	VHLP800-11	58	1.138	0.1935	0.0276	14189
53.00	Siren Mount	58	0.972	0.1772	0.0259	13859
50.00	MD-S4 Ice Shield	58	0.856	0.1648	0.0247	13625
47.67	Jxn Box	58	0.771	0.1551	0.0237	13449
42.00	GPS w/ Mount	58	0.586	0.1322	0.0211	13076

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	120 - 100	20.694	34	1.3398	0.3020
T2	100 - 80	15.040	34	1.3183	0.2582
T3	80 - 60	9.676	34	1.1347	0.1781
T4	60 - 40	5.256	34	0.8486	0.1250
T5	40 - 20	2.179	34	0.5134	0.0869
T6	20 - 0	0.557	34	0.2320	0.0340

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
110.00	SPD6-5.2	34	17.855	1.3430	0.2843	47045
106.00	Radwin RW-9061-5001	34	16.725	1.3380	0.2753	33603
105.00	4' Grid	34	16.443	1.3359	0.2728	31363
92.50	GPS	34	12.962	1.2679	0.2296	9349
83.00	COVP (large)	34	10.436	1.1708	0.1897	5269
77.50	(2) LPA-80063/4CF w/ Mt. Pipe	34	9.061	1.1032	0.1693	4458
67.00	FASB 2.4m RAS w/ Mt Pipe	34	6.665	0.9575	0.1398	3834
60.00	3" x 10.5" Antenna	34	5.256	0.8486	0.1250	3513
57.00	VHLP800-11	34	4.703	0.7992	0.1195	3433
53.00	Siren Mount	34	4.014	0.7316	0.1124	3355
50.00	MD-S4 Ice Shield	34	3.536	0.6804	0.1071	3299
47.67	Jxn Box	34	3.186	0.6406	0.1029	3257
42.00	GPS w/ Mount	34	2.420	0.5457	0.0915	3169

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	120	Leg	A325N	0.7500	6	0.18	29820.60	0.000 ✔	1	Bolt Tension
		Diagonal	A325X	0.6250	1	1720.21	5655.00	0.304 ✔	1	Member Bearing
		Top Girt	A325X	0.6250	1	113.20	5655.00	0.020 ✔	1	Member Bearing
T2	100	Leg	A325N	0.7500	6	917.50	29820.60	0.031 ✔	1	Bolt Tension
		Diagonal	A325X	0.6250	1	2865.83	5655.00	0.507 ✔	1	Member Bearing
		Top Girt	A325X	0.6250	1	86.57	5655.00	0.015 ✔	1	Member Bearing
T3	80	Leg	A325N	0.7500	6	3977.37	29820.60	0.133 ✔	1	Bolt Tension
		Diagonal	A325X	0.6250	1	6849.90	8482.50	0.808 ✔	1	Member Bearing
		Top Girt	A325X	0.6250	1	300.54	8482.50	0.035 ✔	1	Member Bearing
T4	60	Leg	A325N	1.0000	6	11509.40	53014.40	0.217 ✔	1	Bolt Tension
		Diagonal	A325X	0.6250	1	7850.72	11310.00	0.694 ✔	1	Member Bearing
		Top Girt	A325X	0.6250	1	932.16	11310.00	0.082 ✔	1	Member Bearing
T5	40	Leg	A325N	1.0000	6	22529.40	53014.40	0.425 ✔	1	Bolt Tension
		Diagonal	A325X	0.6250	1	3081.19	5655.00	0.545 ✔	1	Member Bearing

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
T6	20	Top Girt	A325X	0.6250	1	104.31	8700.00	0.012 ✔	1	Member Bearing
		Leg	F1554-105	1.0000	6	25191.90	55223.30	0.456 ✔	1	Bolt Tension
		Diagonal	A325X	0.6250	1	2741.32	5655.00	0.485 ✔	1	Member Bearing

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	120 - 100	P2x.154	20.00	4.75	72.4 K=1.00	1.0745	-5182.66	32954.30	0.157 [1] ✔
T2	100 - 80	P2x.154	20.00	4.75	72.4 K=1.00	1.0745	-23343.50	32954.30	0.708 [1] ✔
T3	80 - 60	P2.5x.276	20.00	4.75	61.7 K=1.00	2.2535	-69118.20	76780.60	0.900 [1] ✔
T4	60 - 40	P4x.337	20.00	4.75	38.6 K=1.00	4.4074	-137019.00	177862.00	0.770 [1] ✔
T5	40 - 20	P5x.375	20.03	4.76	31.0 K=1.00	6.1120	-163972.00	256322.00	0.640 [1] ✔
T6	20 - 0	P5x.375	20.03	4.76	31.0 K=1.00	6.1120	-179908.00	256322.00	0.702 [1] ✔

[1] P_u / ϕP_n controls

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	120 - 100	L2x2x1/8	6.90	3.19	102.1 K=1.06	0.4844	-1608.93	8918.60	0.180 [1] ✔
T2	100 - 80	L2x2x1/8	6.90	3.19	102.1 K=1.06	0.4844	-2807.73	8918.60	0.315 [1] ✔
T3	80 - 60	L2x2x3/16	6.90	3.16	102.1 K=1.06	0.7150	-6903.06	13376.30	0.516 [1] ✔
T4	60 - 40	L2x2x1/4	6.90	3.06	100.5 K=1.07	0.9380	-8240.05	17849.70	0.462 [1] ✔
T5	40 - 20	L2x2x1/8	7.11	3.31	104.8 K=1.05	0.4844	-3306.25	8670.29	0.381 [1] ✔
T6	20 - 0	L2x2x1/8	9.92	4.71	142.1	0.4844	-2891.56	5417.37	0.534 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
					K=1.00				✔

[1] P_u / ϕP_n controls

Top Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	120 - 100	L2x2x1/8	5.00	4.55	137.4 K=1.00	0.4844	-120.71	5795.69	0.021 [1] ✔
T2	100 - 80	L2x2x1/8	5.00	4.55	137.4 K=1.00	0.4844	-87.16	5795.69	0.015 [1] ✔
T3	80 - 60	L2x2x3/16	5.00	4.51	137.4 K=1.00	0.7150	-276.34	8559.38	0.032 [1] ✔
T4	60 - 40	L2x2x1/4	5.00	4.38	134.3 K=1.00	0.9380	-827.17	11753.80	0.070 [1] ✔
T5	40 - 20	L2x2x1/8	5.05	4.34	130.9 K=1.00	0.4844	-104.31	6343.00	0.016 [1] ✔

[1] P_u / ϕP_n controls

Tension Checks

Leg Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	120 - 100	P2x.154	20.00	0.50	7.6	1.0745	5507.16	48353.90	0.114 [1] ✔
T2	100 - 80	P2x.154	20.00	0.50	7.6	1.0745	23869.70	48353.90	0.494 [1] ✔
T3	80 - 60	P2.5x.276	20.00	0.50	6.5	2.2535	69067.90	101409.00	0.681 [1] ✔
T4	60 - 40	P4x.337	20.00	0.50	4.1	4.4074	134912.00	198335.00	0.680 [1] ✔
T5	40 - 20	P5x.375	20.03	0.50	3.3	6.1120	151163.00	275039.00	0.550 [1] ✔
T6	20 - 0	P5x.375	20.03	0.50	3.3	6.1120	164863.00	275039.00	0.599 [1] ✔

[1] P_u / ϕP_n controls

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	120 - 100	L2x2x1/8	6.90	3.19	63.5	0.2930	1720.21	12744.10	0.135 [1] ✔
T2	100 - 80	L2x2x1/8	6.90	3.19	63.5	0.2930	2865.83	12744.10	0.225 [1] ✔
T3	80 - 60	L2x2x3/16	6.90	3.16	63.9	0.4308	6849.90	18739.00	0.366 [1] ✔
T4	60 - 40	L2x2x1/4	6.90	3.06	62.9	0.5629	7850.72	24485.10	0.321 [1] ✔
T5	40 - 20	L2x2x1/8	7.11	3.31	65.7	0.2930	3081.19	12744.10	0.242 [1] ✔
T6	20 - 0	L2x2x1/8	9.92	4.71	92.6	0.2930	2741.32	12744.10	0.215 [1] ✔

[1] P_u / ϕP_n controls

Top Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	120 - 100	L2x2x1/8	5.00	4.55	92.0	0.2930	113.20	12744.10	0.009 [1] ✔
T2	100 - 80	L2x2x1/8	5.00	4.55	92.0	0.2930	86.57	12744.10	0.007 [1] ✔
T3	80 - 60	L2x2x3/16	5.00	4.51	92.6	0.4308	300.54	18739.00	0.016 [1] ✔
T4	60 - 40	L2x2x1/4	5.00	4.38	91.1	0.5629	932.16	24485.10	0.038 [1] ✔
T5	40 - 20	L2x2x1/8	5.05	4.34	87.9	0.2930	4.85	12744.10	0.000 [1] ✔

[1] P_u / ϕP_n controls

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
T1	120 - 100	Leg	P2x.154	3	-5182.66	32954.30	15.7	Pass
T2	100 - 80	Leg	P2x.154	33	-23343.50	32954.30	70.8	Pass
T3	80 - 60	Leg	P2.5x.276	61	-69118.20	76780.60	90.0	Pass
T4	60 - 40	Leg	P4x.337	91	-137019.00	177862.00	77.0	Pass
T5	40 - 20	Leg	P5x.375	121	-163972.00	256322.00	64.0	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
T6	20 - 0	Leg	P5x.375	151	-179908.00	256322.00	70.2	Pass
T1	120 - 100	Diagonal	L2x2x1/8	12	-1608.93	8918.60	18.0	Pass
T2	100 - 80	Diagonal	L2x2x1/8	42	-2807.73	8918.60	31.5	Pass
T3	80 - 60	Diagonal	L2x2x3/16	72	-6903.06	13376.30	51.6	Pass
T4	60 - 40	Diagonal	L2x2x1/4	102	-8240.05	17849.70	46.2	Pass
T5	40 - 20	Diagonal	L2x2x1/8	150	-3306.25	8670.29	38.1	Pass
T6	20 - 0	Diagonal	L2x2x1/8	159	-2891.56	5417.37	53.4	Pass
T1	120 - 100	Top Girt	L2x2x1/8	5	-120.71	5795.69	2.1	Pass
T2	100 - 80	Top Girt	L2x2x1/8	34	-87.16	5795.69	1.5	Pass
T3	80 - 60	Top Girt	L2x2x3/16	65	-276.34	8559.38	3.2	Pass
T4	60 - 40	Top Girt	L2x2x1/4	95	-827.17	11753.80	7.0	Pass
T5	40 - 20	Top Girt	L2x2x1/8	125	-104.31	6343.00	1.6	Pass
							Summary	
						Leg (T3)	90.0	Pass
						Diagonal (T6)	53.4	Pass
						Top Girt (T4)	7.0	Pass
						Bolt Checks	80.8	Pass
						RATING =	**90.0**	**Pass**

Exhibit B-1
Minimum Technical Standards

Note: Some standards may not apply to your facility due to frequency of operation or type of service.

1.0 General

1.1 Posting of Information. The following information shall be posted on or near your cabinet:

Copy of FCC license (if applicable)
Equipment Identification Card with the following information:

- Transmit and receive frequencies (or frequency bands in case of wireless operators)
- Type of service
- Authorized output power & ERP
- Antenna model number
- Transmission line model number and type
- Name of licensee
- Contact information for responsible person (name, phone, email)

Unidentified equipment shall be considered unauthorized and may be red tagged and removed after 30 days.

1.2 Installations at City Fire Stations. The City may require that the Tenant (Licensee) upgrade City radio equipment to ensure interference-free coexistence. Specifically, there is a problem with installing an isolator on the existing 900 MHz Alligator Model 1888 MAS transceiver used at most City fire stations. The isolator must be installed only on the transmit line, but the transceiver uses a duplexed (switched) output whereby both the transmitter and the receiver share the same antenna line. Similarly, separate cavity filters are required for the receiver and transmitter, but it is not possible to install both on a single duplexed line. For this reason, the City usually directs that the Alligator Model 1888 be replaced with a Model 1800 Master unit with separate transmit and receive antenna ports. A duplexer cavity filter should be used to combine transmit and receive into the existing antenna. Contact the City's Technical Representative for recommended vendors for these components.

1.3 Changes. Notify the City's Technical Representative immediately of any changes to frequencies, antennas or other equipment configuration. Obtain City's approval prior to making those changes as required by the Lease (License). Approved changes shall be shown on an updated Equipment ID Card.

2.0 Mobile Wireless Services

2.1 Land Mobile Radio Filter and Isolator Requirements. For land mobile radio (LMR), as a

minimum, each transmitter shall employ a dual stage isolator followed by a single cavity bandpass filter. All transmitters shall have built-in or external harmonic (low pass) filters. The low pass filter must be a true low pass filter, not a notch filter tuned to just one or two harmonic frequencies. Harmonic rejection shall be at least 60 dB at the second harmonic and at least 50 dB at the third harmonic. The following minimum isolator and bandpass cavity filter specifications apply:

30-50 MHz
Isolators - None required.
TX cavity - minimum of 20 dB rejection at + 0.5 MHz

72-76 MHz
Isolators - Minimum of 25 dB
TX cavity - minimum of 20 dB rejection at + 0.5 MHz

138-174, 216-222 MHz
Dual Stage Isolators - minimum of 60 dB
TX cavity - minimum of 20 dB rejection at + 1.5 MHz

406-512 MHz
Dual Stage Isolators - minimum of 60 dB
TX cavity - minimum of 20 dB rejection at + 3.5 MHz

698-941 MHz (excluding airphone)
Dual Stage Isolators - minimum of 60 dB
Tx cavity - minimum of 20 dB rejection at + 6 MHz

Explanation. The bandpass filter and lowpass filter must follow the isolator because ferrite isolators are nonlinear and can create harmonics. Please note that most bandpass cavity filters will pass odd harmonics of the tuned frequency, so an external lowpass filter following the isolator is also required. Transmitter combiners will be considered on a case-by-case basis. Please provide all combiner technical information to the City's Technical Representative.

2.2 Airphone (849-851 MHz transmit, 894-896 MHz receive)
Transmitter out-of-band emissions shall not cause harmful interference to cellular base station receivers (824-849 MHz). Tenant (Licensee) shall submit plans, including bandpass filter response curves, to the City's Technical Representative for approval prior to installation. Tenant (Licensee) shall install adequate receiver bandpass filtering to preclude receiver desensitization or receiver intermodulation caused indirectly by cellular base stations on the site.

2.3 LMR Duplexers. Notch duplexers are not adequate. The duplexer must also have a bandpass characteristic to ensure other transmit signals do not enter the transmitter or over drive the receiver This is especially important for VHF repeaters which are vulnerable to FM broadcast signals and other closely-spaced VHF transmitters.

2.4 Personal Wireless Services. These services include, but are not limited to the 698-806, 806-869, 1710-1755, 1850-2000, 2110-2155, 2500-2600 MHz bands (excluding 700 and 800 MHz public safety bands). Because the wireless provider is assumed to have exclusive use of a band of frequencies, out-of-band emissions are expected to be attenuated significantly by the manufacturer's standard combiners, duplexers and cross-band couplers. Ferrite isolators may not be required. Submit your plans to the City's Technical Representative for approval.

2.5 Unlicensed Band (License-Free) Radios. Unlicensed band radios and shared-band services, including, but not limited to those operating in the 902-928 MHz, 2.4-2.4835 GHz, 3.5 GHz, 4.9 GHz (public safety only) and 5 GHz bands are not allowed unless specifically authorized in the Tenant's (Licensee's) Lease (License). When authorized, Tenant (Licensee) shall not change operating frequencies without first getting approval from City. License-free radios are notorious for their poor quality in a harsh RF environment and specific make, model and technical specifications must be provided to the City's Technical Representative for approval. Additional protective devices, shielded CAT 6 cable and shielded NEMA cases may be required before such devices can be installed on the tower.

2.6 Receivers. The site may have relatively high radio frequency (RF) levels in all mobile radio bands. Your receiver amplifier must be robust to work in this environment. Ensure the receiver has good intermodulation (IM) rejection and high 1 dB compression point. If interference is encountered and we find the receiver is not performing up to the standards exhibited by state-of-the-art equipment, the City may require receiver improvements or upgrades before requiring changes to other tenant (licensee) equipment or configurations. This requirement applies to both new and existing tenants (licensees).

Filters are required for mobile radio receivers. Single receivers must employ a minimum of a single 7" diameter (or equivalent) cavity bandpass filter with a rejection curve corresponding to 1 dB insertion loss or better. Additional filter isolation may be required in special cases. Receiver multicouplers must use a bandpass filter (preselector) prior to the multicoupler amplifier.

2.7 Antennas. Select antennas designed to minimize passive intermodulation generation. Note that antennas that pass intermodulation tests at the factory may not provide good intermodulation rejection after years of exposure to heat, cold, vibration from wind, and humidity. Only new antennas are allowed for new installations. Select antennas specifically designed to reject intermodulation over the life of the antenna. Unless the antenna is a duplex configuration, transmit and receive antennas should be separated vertically on the tower. If the tower is owned by the City, the City will designate antenna locations. Antennas must be DC grounded to the tower for lightning protection.

2.8 Transmission Lines. Coaxial cable should be grounded at the top and the bottom of the run with an Andrew ground kit or equivalent. Ensure that ground conductors run straight down with no sharp bends because bends will increase the impedance of the grounding conductor. We also require that the line be marked so we can identify it later. We suggest bands of colored electrical tape at the bottom, middle and top of the run (similar to a resistor color code). Install a Huber-Suhner (or equivalent) coaxial surge arrestor at the bulkhead. All exterior transmission lines

must be solid outer conductors. If possible, receive and transmit lines should be separated by at least one foot from cabinet to antenna.

2.9 Connectors. Connectors are often sources of RF leakage and passive intermodulation. UHF connectors (PL259) are not allowed on connections external to the radio cabinet. Type "N" connectors are allowed below 512 MHz. 7/16 DIN connectors should be used at 698 MHz and above and are required above 1.7 GHz. Connectors using dissimilar metal contacts or ferrous materials (e.g., nickel plating) are not allowed. The preferred connector uses a silver plated body with gold plated inner conductor. Brass bodies and silver or brass inner conductors are also allowed.

2.10 Additional Protective Devices May Be Required. The specifications above are minimum requirements. Additional protective devices may be required based upon evaluation of the following information:

Theoretical TX mixes, particularly second and third order
Antenna location and type
Combiner/multicoupler configurations
Transmitter specifications
Receiver specifications
Historical problems
Transmitter to transmitter isolation
Transmitter to antenna isolation
Transmitter to receiver isolation
Calculated and measured level of IM products
Transmitter output power
Transmitter ERP
Spectrum analyzer measurements
VSWR measurements
Existing cavity selectivity
Antenna to antenna proximity

3.0 FM & IBOC Broadcast (Part 73, ERP > 1 kW)

3.1 FM Broadcast Transmitters. FM and IBOC Broadcast transmitters will be either combined with other stations into a common antenna or stand-alone. If combined, the combiner design shall be approved by the City's Technical Representative. If stand-alone, the transmitter shall employ a bandpass cavity filter with the following minimum performance specifications:

3.1.1. Rejection. The bandpass filter shall provide the following minimum rejection for Class C, C0 and C1 stations:

From Center +/-	Minimum Rejection
800 kHz	22 dB
1 MHz	28 dB

1.2 MHz 32 dB
1.4 MHz 38 dB
1.6 MHz 43 dB

Note that four cavities are required to meet this specification. Class C2 and C3 stations may use three-cavity filters. These filter requirements also apply to stations with FM & IBOC combined outputs. A stand alone IBOC transmitter and antenna shall comply with the following requirements: IBOC ERP greater than 5,000 Watts: 4 cavity filter (see rejection above), IBOC ERP less than or equal to 5,000 Watts: 3 cavity filter.

3.1.2 Gain Flatness. +/-0.5 dB from +/-200 kHz from center frequency.

3.1.3. Group Delay Flatness. No greater than +/- 150 nanoseconds (symmetrical) in +/- 200 kHz (I.e., minimum to maximum delay difference shall be no greater than 300 nanoseconds in the band f_c - 200 kHz to f_c + 200 kHz.

3.1.4. VSWR. No greater than 1.1:1 in +/- 200 kHz (assuming filter is terminated in perfect 50 ohm load).

3.1.5. Insertion Loss. No greater than 0.3 dB in +/- 200 kHz.

The transmitter should comply with current FCC rules regarding out-of-band emissions at transmitter output (before the bandpass cavity filter). The external filter is required to provide further rejection of out-of-band emissions to ensure electromagnetic compatibility with other users on the site.

3.2 FM Broadcast Antennas. FM Broadcast antennas mounted below 250' AGL (center of radiation) shall employ short element spacing to reduce downward radiation and ensure compliance with CFR 47, Parts 1.1307-1.1310. This requirement does not apply to stations that employ a single element antenna. Examples of short element spacing are a 6 bay antenna with half-wavelength spacing or an 8 bay antenna with 3/4 wavelength spacing. Submit a plot of predicted power density versus distance at ground level for City's Technical Representative approval.

4.0 Full-Power Television

4.1 Full-power television transmitters shall include band pass and low pass filters.

4.2 For television transmitters, measured out-of-band emissions (including harmonics) greater than 3 MHz from the respective channel edge shall be more than 80 dB below the measured power over the entire channel. Both measurements shall use a 6 MHz measurement bandwidth.

5.0 Low Power Television (analog and digital)

5.1 Low Power Television (LPTV) transmitters and television translators must have low pass

filters that attenuate all harmonics and spurious products at least 80 dB below the power measured at the carrier frequency. To facilitate measurements of spurious products, each LPTV and translator transmitter shall have installed a line section and appropriate directional coupler element. For routine use, the line section may employ a standard DC element and be connected to a wattmeter capable of measuring forward and reflected power. In addition, the Tenant (Licensee) shall own or have access to an RF load capable of dissipating the full power of the transmitter for troubleshooting purposes.

6.0 Grounding, Bonding and Shielding

6.1 Shielding. RF interference can get directly into the electronics of a receiver or transmitter. Cabinet shielding must be in place and maintained to the manufacturer's specifications. Do not leave cabinet doors open because open cabinet doors defeat the shielding.

6.2 Grounding. Equipment grounding and bonding should be accomplished in accordance with Mil Std 188-124, Military Handbook 419 and Motorola R56. Contact the City's Technical Representative for guidance on grounding and bonding at your particular facility.

7.0 Site Work

7.1 Tower Work Insurance and Experience Requirements. All tower riggers or installers of antennas, transmission lines, cabinets, wiring or similar hardware or apparatus must meet the minimum basic requirements of the City. These will include, but not be limited to, the following:

- The rigging company must have a current Certificate of Insurance on file with the City. The certificate will include, but not be limited to the following:

    1. General Comprehensive & Liability: $5,000,000
    2. Vehicle Liability: $1,000,000
    3. Workman's Compensation Insurance (By Statute)

- Demonstrated experience on similar tower types and similar work activity on similar towers within the past two years with a list of at least two recent clients or professional references with actual knowledge of experience and necessary qualifications, or in lieu thereof; previous working relationship with the City and known by the City's personnel.

City reserves the right, at its sole discretion, to reject the use of any person or tower rigging company on City-owned towers or properties.

7.2 Work Standards. The installation of any and all materials on the tower and in the accompanying shelter must be pre-authorized and approved by the City's Technical Representative. The following guidelines will be strictly enforced:

7.2.1 Equipment or cabinets mounted on platforms will be constructed of galvanized or

stainless steel and will be securely attached to the tower members or platforms with J-bolts, U-bolts or similar clamping devices which do not penetrate tower members or any part of the galvanized coating. All mounting hardware must be hot-dipped galvanized or stainless steel (NOT PLATED). All mounting nuts, bolts, washers or similar must be Grade 5 or better.

7.2.2 Antennas and the mounting thereof must be approved in advance of installation. Data in reference to antenna type, weight, wind loading, gain, bandwidth and mounting details must be provided to the City's Technical Representative and may not be modified or replaced without expressed written permission of City. Installation of antennas on City-owned towers may require a new structural study at the Tenant (Licensee)‘s expense.

7.2.3 Transmission lines and hardware must be approved in advance of installation by the City's Technical Representative and must be specified as to manufacturer, size and type and shown on the City’s New Tenant Questionnaire. All the mounting hardware must be of appropriate type and design to support the transmission lines with strain-reliefs installed at the manufacturer’s recommended intervals. Under no circumstances will stainless steel automotive-type hose clamps be used to secure transmission lines or cables to tower members. Where not previously designated, all lines will be positioned on the tower to minimize wind loading and provide a minimum of obstruction to climbing or removal/replacement of other lines. Each line will be mounted independently of other lines on the tower. Cable trays, waveguide entrances, tower ladders, elevator rails and other similar members are to be kept clear of all cables on the tower. Stainless steel lashing ties are acceptable for use on the tower but are not to be used as strain reliefs.

7.2.4 Antenna jumper cables or cables to/from crossband couplers or similar devices on the tower will be kept to minimum required lengths and will be made of solid shield outer conductor cables with outer jackets capable of withstanding severe weather and ultraviolet rays. All such cable types must be pre-approved by the City.

7.2.5 UNDER NO CIRCUMSTANCES –

- will welding or drilling of tower members be allowed;
- will modifications to the tower, bridge, building entrance fittings or similar be permitted;
- will transmission line splices (a pair of connectors at other than the top or bottom of the run on the tower) be permitted except by prior approval or necessitated by damage only repairable by splicing;
- will any tampering, retuning, rerouting or other modifications be permitted to equipment owned by City or other tenants.

7.2.6 All installations will be performed in accordance with good engineering practice and within the guidelines of this document. Any deviation from these minimum requirements and technical standards must be approved in writing prior to installation or modification.

7.3 Removal of Unused Antennas and Lines. Tenant (Licensee) shall remove all unused antennas, transmission lines and associated mounting hardware from City's tower within 90 days of the date an antenna is no longer in service.

7.4 NO PRESENT INSTALLATION WILL BE "GRANDFATHERED" and must conform to these work standards within a reasonable time period to be determined by the City's Technical Representative. Periodic inspections may be performed to ensure that all installations meet technical standards.

8.0 Shelters

8.1 Cable Dressing Inside Building or Shelter. All wiring and cables within a given rack will be properly dressed and/or bundled with cable ties with excess cut close to the barbs. Twisted wire, tape, rope, twine, phone wire and similar bits of debris usually available on site ARE NOT ACCEPTABLE substitutes for proper securing hardware. All inter-rack cables and wiring must be properly routed and utilize the cable trays provided even if between adjacent racks. Overhead cables and RF lines must be easily removed or reworked within the cable trays. Proper care must be taken to ensure that new cables added to the trays are not stressed or intertwined with existing cables. OVERHEAD CABLES MAY NOT CROSS PERPENDICULARS OR BE SUSPENDED IN MID AIR WITHOUT SUPPORTS. NO SUPPORTS MAY BE INSTALLED WITHOUT PRIOR APPROVAL. All long cable runs must be properly identified at each end indicating the opposite cable end address. All cabling within the building must be cut to proper length except phasing harnesses, where required.

9.0 Towers

9.1 Tenant (Licensee) may not erect new towers without the City's prior written consent, which may be granted or denied in City's sole discretion, and towers that are approved may only be constructed after plans for the tower have been approved by the City and by the zoning authority.

9.2 New towers shall comply with TIA-222-G or the most recent edition adopted by the local zoning authority. Changes to an existing tower, including addition or replacement of antennas requires that TIA-222-G or the most recent edition be used. Tenant (Licensee)-owned towers that present an immediate safety hazard shall be corrected by Tenant (Licensee) regardless of the status of the current lease or the particular edition of TIA-222 in use at the time of tower construction. Installation of antennas on City-owned towers may require a new structural study at the Tenant (Licensee)'s expense.

10.0 Permits

10.1 Tenant (Licensee) shall comply with all local and Federal regulations. Tenant (Licensee) is responsible for acquiring all applicable permits, including, but not limited to FCC construction permits and building permits. Tenant (Licensee) is also responsible for performing any required studies, including RF exposure and RF interference studies required by the FCC, local

government, and City. Tenant (Licensee) shall furnish all applicable permits, studies, and approvals to the City for approval before starting any construction, including antenna installation.

11.0 Radio Frequency Safety

11.1 The engineering, design, configuration, installation, and maintenance of high power (> 1 kW ERP) radio facilities on the site shall be accomplished in a manner that minimizes downward radiation. Changes to proposed systems may be directed by City to comply with this objective.

11.2 Everyone on the site shall follow these guidelines:

- All personnel entering the site must be authorized
- Obey all posted signs
- Assume all antennas are active unless proven otherwise
- Before working on an antenna, notify the owner and disable the transmitter
- Use a radio frequency (RF) personal monitor when working near antennas
- Never operate transmitters without shields

11.3 Power densities on towers can be much higher than at ground level. For this reason, tower climbers should request power reductions from high-power tenants and carry RF personal monitors when climbing towers. The City's Technical Representative can tell you which transmitters should be turned down before climbing the tower.

11.4 Federal Government guidelines regarding human exposure to radio frequency energy are found in the Code of Federal Regulations (CFR) Title 47, Parts 1.1307-1.1310.

Figure 1 - Warning Sign to be Posted at Base of Tower
(Available from Tessco, Holaday, Narda and other Sources)

EXHIBIT C-1

RADIO FREQUENCY INTERFERENCE ANALYSIS REPORT

T-Mobile

Site ID: DN03634A
Site Name: Denver Fire #29

December 14, 2020

Prepared By:
Site Safe, LLC
8618 Westwood Center Drive, Suite 315
Vienna, VA 22182
(703) 276-1100
Report Created By: Anthony Handley
Report Reviewed By: Michael Fischer

No Harmful Interference affecting the existing carrier(s) / operations is predicted as a result of T-Mobile's proposed modifications on this structure.

Table of Contents

1.0 Executive Summary

This report presents a radio frequency interference (RFI) analysis which was performed on the DN03634A - Denver Fire #29 site. The RFI analysis consists of transmitter noise, receiver desensitization, intermodulation, harmonic and transmitter spurious output interference. The report consists of Sections that provide details of the communications site, antenna systems, operational frequencies and each interference analysis mode.

A summary of the interference analysis results is depicted in the following Table.

Interference Analysis Mode	Type Mix	Status	Summary	Worst-Case Margin (dB)
Transmitter Noise	N/A	Passed	No Interference was predicted	31.6
Receiver Desensitization	N/A	Passed	No Interference was predicted	107.2
Transmitter Intermodulation	1 Tx	Passed	No Interference was predicted	N/A
Transmitter Intermodulation	2 Tx	Passed	No Interference was predicted	N/A
Transmitter Intermodulation	3 Tx	Passed	No Interference was predicted	N/A
Transmitter Intermodulation	4 Tx	Passed	No Interference was predicted	N/A
Transmitter Intermodulation	5 Tx	Passed	No Interference was predicted	N/A
Receiver Intermodulation	1 Tx	Passed	No Interference was predicted	N/A
Receiver Intermodulation	2 Tx	Passed	No Interference was predicted	N/A
Receiver Intermodulation	3 Tx	Passed	No Interference was predicted	N/A
Receiver Intermodulation	4 Tx	Passed	No Interference was predicted	N/A
Receiver Intermodulation	5 Tx	Passed	No Interference was predicted	N/A
Transmitter Harmonics	N/A	Passed	No Interference was predicted	N/A
Transmitter Spurious Output	N/A	Passed	No Interference was predicted	N/A
Interference Level Summing - C/(I+N)	N/A	Passed	No Interference was predicted	N/A

The analysis was performed with the setup options depicted in the Table below.

Analysis	Description
Receiver Performance	Receiver Sensitivity Threshold
Receiver Bandwidth	Receiver Dependent
Antenna Patterns Considered	No (Worst-Case)
Measured Antenna Isolation Data	No
Filters/Multicouplers Considered	Yes
Number of Simultaneous Transmitters Mixed	5
Highest Intermodulation Order Tested	7
Condense Intermodulation Hit Quantity	Yes - 1000/Order
TX IM Bandwidth Multiplication	Yes
Tx/Rx Systems Excluded	None
Site File Name	DN03634A - Denver Fire #29.dta
Report File Name	DN03634A - Denver Fire #29.docx
WirelessSiteRFI Software Version	10.0.10

2.0 Site Description

The communication systems located at this site are described in this section as well as the configuration of the antenna systems.

The site parameters are:

Site Name: DN03634A - Denver Fire #29
Owner: City and County of Denver
Site Description: Self-Support Tower = 120' (AGL)
Address: 4800 Himalaya Road, Denver, CO 80249 (Denver County)
Latitude: 39:46:59.21 N
Longitude: 104:45:16.34 W
Elevation: 5412’ (AMSL)
Notes: T-Mobile plans to replace antennas and equipment to accommodate UMTS, LTE and/or 5G service in the 600 MHz, 700 MHz, 1900 MHz, 2100 MHz and 2500 MHz frequency bands. The final count will be (6) total antennas.

2.1 Communications Systems

System	Provider	Technology	Frequency Band
1	T-Mobile (Proposed)	LTE-600	617 - 652; 663 - 698 MHz - 600 MHz Band
2	T-Mobile (Proposed)	5G	617 - 652; 663 - 698 MHz - 600 MHz Band
3	T-Mobile (Proposed)	LTE-700	698 - 806 MHz - 700 MHz Band
4	T-Mobile (Proposed)	LTE-1900	1850 - 1995 MHz - PCS
5	T-Mobile (Proposed)	LTE-2100	1710 - 2155 MHz - AWS1
6	T-Mobile (Proposed)	UMTS-2100	1710 - 2155 MHz - AWS1
7	T-Mobile (Proposed)	LTE-2500	2496 - 2690 MHz - BRS/EBS
8	T-Mobile (Proposed)	5G	2496 - 2690 MHz - BRS/EBS
9	WRCA702 - Denver, City & County	Microwave	4940 - 4990 MHz - 4.9 GHz Microwave
10	WRCA702 - Denver, City & County	Microwave	4940 - 4990 MHz - 4.9 GHz Microwave
11	WJZ71 - Denver, City & County	FM Land Mobile	72 - 88 MHz - Land Mobile
12	AT&T/FirstNet	LTE-700	698 - 806 MHz - 700 MHz Band
13	AT&T	LTE-700	698 - 806 MHz - 700 MHz Band
14	AT&T	LTE-700	698 - 806 MHz - 700 MHz Band
15	AT&T	LTE-1900	1850 - 1995 MHz - PCS
16	AT&T	LTE-2100	1710 - 2180 MHz - AWS1 & AWS3
17	AT&T	LTE-2300	2305 - 2360 MHz - WCS
18	Verizon Wireless	LTE-700	698 - 806 MHz - 700 MHz Band
19	Verizon Wireless	LTE-850	835 - 894 MHz - Cellular B Band
20	Verizon Wireless	LTE-1900	1850 - 1995 MHz - PCS
21	Verizon Wireless	LTE-2100	1710 - 2180 MHz - AWS1 & AWS3

2.2 Antenna Systems

Ant #	Mfg	Antenna Model	Gain (dBd)	Hgt (ft)	Orient (deg)	Sec-tor	Ant Use	Transmission Line Type	Line Loss (/100')	Line Length (ft)
1	Commscope	FFHH-65C-R3	12.08	67	340	A	Dplx	Fiber	0.001	10
2	Commscope	FFHH-65C-R3	12.08	67	100	B	Dplx	Fiber	0.001	10
3	Commscope	FFHH-65C-R3	12.08	67	220	C	Dplx	Fiber	0.001	10
4	Commscope	FFHH-65C-R3	12.08	67	340	A	Dplx	Fiber	0.001	10
5	Commscope	FFHH-65C-R3	12.08	67	100	B	Dplx	Fiber	0.001	10
6	Commscope	FFHH-65C-R3	12.08	67	220	C	Dplx	Fiber	0.001	10
7	Commscope	FFHH-65C-R3	12.72	67	340	A	Dplx	Fiber	0.001	10
8	Commscope	FFHH-65C-R3	12.72	67	100	B	Dplx	Fiber	0.001	10
9	Commscope	FFHH-65C-R3	12.72	67	220	C	Dplx	Fiber	0.001	10
10	Commscope	FFHH-65C-R3	15.63	67	340	A	Dplx	Fiber	0.001	10
11	Commscope	FFHH-65C-R3	15.63	67	100	B	Dplx	Fiber	0.001	10
12	Commscope	FFHH-65C-R3	15.63	67	220	C	Dplx	Fiber	0.001	10
13	Commscope	FFHH-65C-R3	16.37	67	340	A	Dplx	Fiber	0.001	10
14	Commscope	FFHH-65C-R3	16.37	67	100	B	Dplx	Fiber	0.001	10
15	Commscope	FFHH-65C-R3	16.37	67	220	C	Dplx	Fiber	0.001	10
16	Commscope	FFHH-65C-R3	16.37	67	340	A	Dplx	Fiber	0.001	10
17	Commscope	FFHH-65C-R3	16.37	67	100	B	Dplx	Fiber	0.001	10
18	Commscope	FFHH-65C-R3	16.37	67	220	C	Dplx	Fiber	0.001	10
19	Nokia	AEHC	22.76	67	340	A	Dplx	Fiber	0.001	10
20	Nokia	AEHC	22.76	67	100	B	Dplx	Fiber	0.001	10
21	Nokia	AEHC	22.76	67	220	C	Dplx	Fiber	0.001	10
22	Nokia	AEHC	22.76	67	340	A	Dplx	Fiber	0.001	10
23	Nokia	AEHC	22.76	67	100	B	Dplx	Fiber	0.001	10
24	Nokia	AEHC	22.76	67	220	C	Dplx	Fiber	0.001	10
25	Generic	Microwave Dish	30.4	108	252.4		Tx/Rx	EW	0.001	138
26	Generic	Microwave Dish	30.4	108	252.4		Tx/Rx	EW	0.001	138
27	Generic	Yagi	6	102	360		Tx/Rx	7/8 in. Foam	0.45	132
28	Generic	Panel	13.71	93	0	A	Dplx	Fiber	0.001	10
29	Generic	Panel	13.71	93	120	B	Dplx	Fiber	0.001	10
30	Generic	Panel	13.71	93	240	C	Dplx	Fiber	0.001	10
31	Generic	Panel	13.71	93	0	A	Tx	Fiber	0.001	10
32	Generic	Panel	13.71	93	120	B	Tx	Fiber	0.001	10
33	Generic	Panel	13.71	93	240	C	Tx	Fiber	0.001	10
34	Generic	Panel	13.71	93	0	A	Dplx	Fiber	0.001	10
35	Generic	Panel	13.71	93	120	B	Dplx	Fiber	0.001	10
36	Generic	Panel	13.71	93	240	C	Dplx	Fiber	0.001	10
37	Generic	Panel	15.89	93	0	A	Dplx	Fiber	0.001	10
38	Generic	Panel	15.89	93	120	B	Dplx	Fiber	0.001	10
39	Generic	Panel	15.89	93	240	C	Dplx	Fiber	0.001	10
40	Generic	Panel	16.09	93	0	A	Dplx	Fiber	0.001	10
41	Generic	Panel	16.09	93	120	B	Dplx	Fiber	0.001	10
42	Generic	Panel	16.09	93	240	C	Dplx	Fiber	0.001	10
43	Generic	Panel	16.26	93	0	A	Dplx	Fiber	0.001	10
44	Generic	Panel	16.26	93	120	B	Dplx	Fiber	0.001	10
45	Generic	Panel	16.26	93	240	C	Dplx	Fiber	0.001	10
46	Generic	Panel	12.91	77	0	A	Dplx	Fiber	0.001	10
47	Generic	Panel	12.91	77	120	B	Dplx	Fiber	0.001	10
48	Generic	Panel	12.91	77	240	C	Dplx	Fiber	0.001	10
49	Generic	Panel	13.47	77	0	A	Dplx	Fiber	0.001	10
50	Generic	Panel	13.47	77	120	B	Dplx	Fiber	0.001	10
51	Generic	Panel	13.47	77	240	C	Dplx	Fiber	0.001	10
52	Generic	Panel	16.14	77	0	A	Dplx	Fiber	0.001	10
53	Generic	Panel	16.14	77	120	B	Dplx	Fiber	0.001	10
54	Generic	Panel	16.14	77	240	C	Dplx	Fiber	0.001	10
55	Generic	Panel	16.17	77	0	A	Dplx	Fiber	0.001	10
56	Generic	Panel	16.17	77	120	B	Dplx	Fiber	0.001	10
57	Generic	Panel	16.17	77	240	C	Dplx	Fiber	0.001	10

3.0 Transmitter Frequencies

Freq #	Ant #	Provider	Model	Technology	Channel Label	ID	Frequency	Power (Watts)	BW (KHz)
1	1	T-Mobile (Proposed)	Nokia	LTE-600		A	670.500000	60	5000
2	2	T-Mobile (Proposed)	Nokia	LTE-600		B	670.500000	60	5000
3	3	T-Mobile (Proposed)	Nokia	LTE-600		C	670.500000	60	5000
4	4	T-Mobile (Proposed)	Nokia	5G		D	680.500000	60	10000
5	5	T-Mobile (Proposed)	Nokia	5G		E	680.500000	60	10000
6	6	T-Mobile (Proposed)	Nokia	5G		F	680.500000	60	10000
7	7	T-Mobile (Proposed)	Nokia	LTE-700		G	731.500000	60	5000
8	8	T-Mobile (Proposed)	Nokia	LTE-700		H	731.000000	60	5000
9	9	T-Mobile (Proposed)	Nokia	LTE-700		I	731.000000	60	5000
10	10	T-Mobile (Proposed)	Nokia	LTE-1900		J	1957.500000	40	15000
11	11	T-Mobile (Proposed)	Nokia	LTE-1900		K	1957.500000	40	15000
12	12	T-Mobile (Proposed)	Nokia	LTE-1900		L	1957.500000	40	15000
13	13	T-Mobile (Proposed)	Nokia	LTE-2100		M	2115.100000	40	10000
14	14	T-Mobile (Proposed)	Nokia	LTE-2100		N	2115.100000	40	10000
15	15	T-Mobile (Proposed)	Nokia	LTE-2100		O	2115.100000	40	10000
16	13	T-Mobile (Proposed)	Nokia	LTE-2100		P	2147.500000	40	5000
17	14	T-Mobile (Proposed)	Nokia	LTE-2100		Q	2147.500000	40	5000
18	15	T-Mobile (Proposed)	Nokia	LTE-2100		R	2147.500000	40	5000
19	16	T-Mobile (Proposed)	Nokia	UMTS-2100		S	2152.500000	10	5000
20	17	T-Mobile (Proposed)	Nokia	UMTS-2100		T	2152.500000	10	5000
21	18	T-Mobile (Proposed)	Nokia	UMTS-2100		U	2152.500000	10	5000
22	19	T-Mobile (Proposed)	Nokia	LTE-2500		V	2538.000000	5	20000
23	20	T-Mobile (Proposed)	Nokia	LTE-2500		W	2538.000000	5	20000
24	21	T-Mobile (Proposed)	Nokia	LTE-2500		X	2538.000000	5	20000
25	19	T-Mobile (Proposed)	Nokia	LTE-2500		Y	2558.000000	5	20000
26	20	T-Mobile (Proposed)	Nokia	LTE-2500		Z	2558.000000	5	20000
27	21	T-Mobile (Proposed)	Nokia	LTE-2500		AA	2558.000000	5	20000
28	22	T-Mobile (Proposed)	Nokia	5G		AB	2598.000000	5	60000
29	23	T-Mobile (Proposed)	Nokia	5G		AC	2598.000000	5	60000
30	24	T-Mobile (Proposed)	Nokia	5G		AD	2598.000000	5	60000
31	25	WRCA702 - Denver, City & County	Generic	Microwave		AE	4950.000000	.3	20000
32	26	WRCA702 - Denver, City & County	Generic	Microwave		AF	4980.000000	.3	5000
33	27	WJZ71 - Denver, City & County	Generic	FM Land Mobile		AG	72.760000	100	12.5
34	28	AT&T/FirstNet	Nokia	LTE-700		AH	763.000000	40	10000
35	29	AT&T/FirstNet	Nokia	LTE-700		AI	763.000000	40	10000
36	30	AT&T/FirstNet	Nokia	LTE-700		AJ	763.000000	40	10000
37	31	AT&T	Nokia	LTE-700		AK	719.000000	25	5000
38	32	AT&T	Nokia	LTE-700		AL	719.000000	25	5000
39	33	AT&T	Nokia	LTE-700		AM	719.000000	25	5000
40	34	AT&T	Nokia	LTE-700		AN	740.000000	40	10000
41	35	AT&T	Nokia	LTE-700		AO	740.000000	40	10000
42	36	AT&T	Nokia	LTE-700		AP	740.000000	40	10000
43	37	AT&T	Nokia	LTE-1900		AQ	1940.000000	40	20000
44	38	AT&T	Nokia	LTE-1900		AR	1940.000000	40	20000
45	39	AT&T	Nokia	LTE-1900		AS	1940.000000	40	20000
46	37	AT&T	Nokia	LTE-1900		AT	1977.500000	40	5000
47	38	AT&T	Nokia	LTE-1900		AU	1977.500000	40	5000
48	39	AT&T	Nokia	LTE-1900		AV	1977.500000	40	5000
49	40	AT&T	Nokia	LTE-2100		AW	2137.500000	40	15000
50	40	AT&T	Nokia	LTE-2100		AX	2165.000000	40	10000
51	41	AT&T	Nokia	LTE-2100		AY	2137.500000	40	15000
52	41	AT&T	Nokia	LTE-2100		AZ	2165.000000	40	10000
53	42	AT&T	Nokia	LTE-2100		BA	2137.500000	40	15000
54	42	AT&T	Nokia	LTE-2100		BB	2165.000000	40	10000
55	43	AT&T	Nokia	LTE-2300		BC	2317.500000	25	5000
56	45	AT&T	Nokia	LTE-2300		BD	2317.500000	25	5000
57	44	AT&T	Nokia	LTE-2300		BE	2317.500000	25	5000
58	43	AT&T	Nokia	LTE-2300		BF	2347.500000	25	5000
59	45	AT&T	Nokia	LTE-2300		BG	2347.500000	25	5000

60	44	AT&T	Nokia	LTE-2300		BH	2347.500000	25	5000
61	43	AT&T	Nokia	LTE-2300		BI	2352.500000	25	5000
62	45	AT&T	Nokia	LTE-2300		BJ	2352.500000	25	5000
63	44	AT&T	Nokia	LTE-2300		BK	2352.500000	25	5000
64	43	AT&T	Nokia	LTE-2300		BL	2357.500000	25	5000
65	45	AT&T	Nokia	LTE-2300		BM	2357.500000	25	5000
66	44	AT&T	Nokia	LTE-2300		BN	2357.500000	25	5000
67	46	Verizon Wireless	Nokia	LTE-700		BO	751.500000	40	10000
68	47	Verizon Wireless	Nokia	LTE-700		BP	751.500000	40	10000
69	48	Verizon Wireless	Nokia	LTE-700		BQ	751.500000	40	10000
70	49	Verizon Wireless	Nokia	LTE-850		BR	885.000000	40	10000
71	50	Verizon Wireless	Nokia	LTE-850		BS	885.000000	40	10000
72	51	Verizon Wireless	Nokia	LTE-850		BT	885.000000	40	10000
73	52	Verizon Wireless	Nokia	LTE-1900		BU	1970.000000	40	10000
74	53	Verizon Wireless	Nokia	LTE-1900		BV	1970.000000	40	10000
75	54	Verizon Wireless	Nokia	LTE-1900		BW	1970.000000	40	10000
76	55	Verizon Wireless	Nokia	LTE-2100		BX	2125.000000	40	10000
77	56	Verizon Wireless	Nokia	LTE-2100		BY	2125.000000	40	10000
78	57	Verizon Wireless	Nokia	LTE-2100		BZ	2125.000000	40	10000
79	55	Verizon Wireless	Nokia	LTE-2100		CA	2175.000000	40	10000
80	56	Verizon Wireless	Nokia	LTE-2100		CB	2175.000000	40	10000
81	57	Verizon Wireless	Nokia	LTE-2100		CC	2175.000000	40	10000

4.0 Receiver Frequencies

Freq #	Ant #	Provider	Model	Technology	Channel Label	ID	Frequency	Sen (dBm)	BW (KHz)
1	1	T-Mobile (Proposed)	Nokia	LTE-600		A	624.500000	-106	5000
2	2	T-Mobile (Proposed)	Nokia	LTE-600		B	624.500000	-106	5000
3	3	T-Mobile (Proposed)	Nokia	LTE-600		C	624.500000	-106	5000
4	4	T-Mobile (Proposed)	Nokia	5G		D	634.500000	-106	10000
5	5	T-Mobile (Proposed)	Nokia	5G		E	634.500000	-106	10000
6	6	T-Mobile (Proposed)	Nokia	5G		F	634.500000	-106	10000
7	7	T-Mobile (Proposed)	Nokia	LTE-700		G	701.500000	-106	5000
8	8	T-Mobile (Proposed)	Nokia	LTE-700		H	701.000000	-106	5000
9	9	T-Mobile (Proposed)	Nokia	LTE-700		I	701.000000	-106	5000
10	10	T-Mobile (Proposed)	Nokia	LTE-1900		J	1877.500000	-106	15000
11	11	T-Mobile (Proposed)	Nokia	LTE-1900		K	1877.500000	-106	15000
12	12	T-Mobile (Proposed)	Nokia	LTE-1900		L	1877.500000	-106	15000
13	13	T-Mobile (Proposed)	Nokia	LTE-2100		M	1715.100000	-106	10000
14	14	T-Mobile (Proposed)	Nokia	LTE-2100		N	1715.100000	-106	10000
15	15	T-Mobile (Proposed)	Nokia	LTE-2100		O	1715.100000	-106	5000
16	13	T-Mobile (Proposed)	Nokia	LTE-2100		P	1747.500000	-106	5000
17	14	T-Mobile (Proposed)	Nokia	LTE-2100		Q	1747.500000	-106	5000
18	15	T-Mobile (Proposed)	Nokia	LTE-2100		R	1747.500000	-106	5000
19	16	T-Mobile (Proposed)	Nokia	UMTS-2100		S	1752.500000	-106	5000
20	17	T-Mobile (Proposed)	Nokia	UMTS-2100		T	1752.500000	-106	5000
21	18	T-Mobile (Proposed)	Nokia	UMTS-2100		U	1752.500000	-106	5000
22	19	T-Mobile (Proposed)	Nokia	LTE-2500		V	2538.000000	-104	20000
23	20	T-Mobile (Proposed)	Nokia	LTE-2500		W	2538.000000	-104	20000
24	21	T-Mobile (Proposed)	Nokia	LTE-2500		X	2538.000000	-104	20000
25	19	T-Mobile (Proposed)	Nokia	LTE-2500		Y	2558.000000	-104	20000
26	20	T-Mobile (Proposed)	Nokia	LTE-2500		Z	2558.000000	-104	20000
27	21	T-Mobile (Proposed)	Nokia	LTE-2500		AA	2558.000000	-104	20000
28	22	T-Mobile (Proposed)	Nokia	5G		AB	2598.000000	-97	60000
29	23	T-Mobile (Proposed)	Nokia	5G		AC	2598.000000	-97	60000
30	24	T-Mobile (Proposed)	Nokia	5G		AD	2598.000000	-97	60000
31	25	WRCA702 - Denver, City & County	Generic	Microwave		AE	4950.000000	-83	20000
32	26	WRCA702 - Denver, City & County	Generic	Microwave		AF	4980.000000	-83	5000
33	27	WJZ71 - Denver, City & County	Generic	FM Land Mobile		AG	72.760000	-119	12.5
34	28	AT&T/FirstNet	Nokia	LTE-700		AH	793.000000	-102	10000
35	29	AT&T/FirstNet	Nokia	LTE-700		AI	793.000000	-102	10000
36	30	AT&T/FirstNet	Nokia	LTE-700		AJ	793.000000	-102	10000
37	34	AT&T	Nokia	LTE-700		AN	710.000000	-102	10000
38	35	AT&T	Nokia	LTE-700		AO	710.000000	-102	10000
39	36	AT&T	Nokia	LTE-700		AP	710.000000	-102	10000
40	37	AT&T	Nokia	LTE-1900		AQ	1860.000000	-102	20000
41	38	AT&T	Nokia	LTE-1900		AR	1860.000000	-102	20000
42	39	AT&T	Nokia	LTE-1900		AS	1860.000000	-102	20000
43	37	AT&T	Nokia	LTE-1900		AT	1897.500000	-102	5000
44	38	AT&T	Nokia	LTE-1900		AU	1897.500000	-102	5000
45	39	AT&T	Nokia	LTE-1900		AV	1897.500000	-102	5000
46	40	AT&T	Nokia	LTE-2100		AW	1737.500000	-102	15000
47	40	AT&T	Nokia	LTE-2100		AX	1765.000000	-102	10000
48	41	AT&T	Nokia	LTE-2100		AY	1737.500000	-102	15000
49	41	AT&T	Nokia	LTE-2100		AZ	1765.000000	-102	10000
50	42	AT&T	Nokia	LTE-2100		BA	1737.500000	-102	15000
51	42	AT&T	Nokia	LTE-2100		BB	1765.000000	-102	10000
52	43	AT&T	Nokia	LTE-2300		BC	2317.500000	-102	5000
53	45	AT&T	Nokia	LTE-2300		BD	2317.500000	-102	5000
54	44	AT&T	Nokia	LTE-2300		BE	2317.500000	-102	5000
55	43	AT&T	Nokia	LTE-2300		BF	2347.500000	-102	5000
56	45	AT&T	Nokia	LTE-2300		BG	2347.500000	-102	5000
57	44	AT&T	Nokia	LTE-2300		BH	2347.500000	-102	5000
58	43	AT&T	Nokia	LTE-2300		BI	2307.500000	-102	5000
59	45	AT&T	Nokia	LTE-2300		BJ	2307.500000	-102	5000

60	44	AT&T	Nokia	LTE-2300		BK	2307.500000	-102	5000
61	43	AT&T	Nokia	LTE-2300		BL	2312.500000	-102	5000
62	45	AT&T	Nokia	LTE-2300		BM	2312.500000	-102	5000
63	44	AT&T	Nokia	LTE-2300		BN	2312.500000	-102	5000
64	46	Verizon Wireless	Nokia	LTE-700		BO	781.500000	-102	10000
65	47	Verizon Wireless	Nokia	LTE-700		BP	781.500000	-102	10000
66	48	Verizon Wireless	Nokia	LTE-700		BQ	781.500000	-102	10000
67	49	Verizon Wireless	Nokia	LTE-850		BR	840.000000	-102	10000
68	50	Verizon Wireless	Nokia	LTE-850		BS	840.000000	-102	10000
69	51	Verizon Wireless	Nokia	LTE-850		BT	840.000000	-102	10000
70	52	Verizon Wireless	Nokia	LTE-1900		BU	1890.000000	-102	10000
71	53	Verizon Wireless	Nokia	LTE-1900		BV	1890.000000	-102	10000
72	54	Verizon Wireless	Nokia	LTE-1900		BW	1890.000000	-102	10000
73	55	Verizon Wireless	Nokia	LTE-2100		BX	1725.000000	-102	10000
74	56	Verizon Wireless	Nokia	LTE-2100		BY	1725.000000	-102	10000
75	57	Verizon Wireless	Nokia	LTE-2100		BZ	1725.000000	-102	10000
76	55	Verizon Wireless	Nokia	LTE-2100		CA	1775.000000	-102	10000
77	56	Verizon Wireless	Nokia	LTE-2100		CB	1775.000000	-102	10000
78	57	Verizon Wireless	Nokia	LTE-2100		CC	1775.000000	-102	10000

5.0 Transmitter Noise Analysis

Transmitter noise interference occurs because a transmitter radiates energy on its operating frequency as well as frequencies above and below the assigned frequency. The energy that is radiated above and below the assigned frequency is known as sideband noise energy and extends for several megahertz on either side of the operating frequency. This undesired noise energy can fall within the passband of a nearby receiver even if the receiver's operating frequency is several megahertz away. The transmitter noise appears as "on-channel" noise interference and cannot be filtered out at the receiver. It is on the receiver's operating frequency and competes with the desired signal, which in effect, degrades the operational performance.

The analysis predicts each transmitter's noise signal level present at the input of each receiver. It takes into account the transmitter's noise characteristics, frequency separation, power output, transmission line losses, filters, duplexers, combiners, isolators, multi-couplers and other RF devices that are present in both systems. Additionally, the analysis considers the antenna separation space loss, horizontal and vertical gain components of the antennas as well as how they are mounted on the structure. The gain components are derived from antenna pattern data published by each manufacturer.

The analysis determines how much isolation is required, if any, to prevent receiver performance degradation caused by transmitter noise interference. The Table below depicts the results of this analysis. For each receiver, the transmitter that has the worst-case impact is displayed. The Signal Margin represents the margin in dB, before the receiver's performance is degraded. A negative number indicates that the performance is degraded and the value indicates how much additional isolation is required to prevent receiver performance degradation.

Receiver Provider	Receive Channel	Receive Frequency (MHz)	Transmitter Provider	Transmit Channel	Transmit Frequency (MHz)	Attn Required (dB)	Attn Provided (dB)	Signal Margin (dB)
T-Mobile (Proposed)		624.500000	T-Mobile (Proposed)		670.500000	39.8	152.8	113
T-Mobile (Proposed)		624.500000	T-Mobile (Proposed)		670.500000	39.8	152.8	113
T-Mobile (Proposed)		624.500000	T-Mobile (Proposed)		670.500000	39.8	152.8	113
T-Mobile (Proposed)		634.500000	T-Mobile (Proposed)		680.500000	39.8	149	109.2
T-Mobile (Proposed)		634.500000	T-Mobile (Proposed)		680.500000	39.8	149	109.2
T-Mobile (Proposed)		634.500000	T-Mobile (Proposed)		680.500000	39.8	149	109.2
T-Mobile (Proposed)		701.500000	T-Mobile (Proposed)		731.000000	39.8	121.5	81.7
T-Mobile (Proposed)		701.000000	T-Mobile (Proposed)		731.000000	39.8	122.3	82.5
T-Mobile (Proposed)		701.000000	T-Mobile (Proposed)		731.000000	39.8	122.3	82.5
T-Mobile (Proposed)		1877.500000	T-Mobile (Proposed)		1957.500000	44.6	92.1	47.4
T-Mobile (Proposed)		1877.500000	T-Mobile (Proposed)		1957.500000	44.6	92.1	47.4
T-Mobile (Proposed)		1877.500000	T-Mobile (Proposed)		1957.500000	44.6	92.1	47.4

T-Mobile (Proposed)		1715.100000	T-Mobile (Proposed)		1957.500000	44.6	132.1	87.5
T-Mobile (Proposed)		1715.100000	T-Mobile (Proposed)		1957.500000	44.6	107.7	63.1
T-Mobile (Proposed)		1715.100000	T-Mobile (Proposed)		1957.500000	44.6	107.8	63.1
T-Mobile (Proposed)		1747.500000	T-Mobile (Proposed)		1957.500000	44.6	132.1	87.5
T-Mobile (Proposed)		1747.500000	T-Mobile (Proposed)		1957.500000	44.6	107.7	63.1
T-Mobile (Proposed)		1747.500000	T-Mobile (Proposed)		1957.500000	44.6	107.8	63.1
T-Mobile (Proposed)		1752.500000	T-Mobile (Proposed)		1957.500000	44.6	132.1	87.5
T-Mobile (Proposed)		1752.500000	T-Mobile (Proposed)		1957.500000	44.6	132.1	87.5
T-Mobile (Proposed)		1752.500000	T-Mobile (Proposed)		1957.500000	44.6	132.1	87.5
AT&T/FirstNet		793.000000	AT&T/FirstNet		763.000000	44.3	126.9	82.7
AT&T/FirstNet		793.000000	AT&T/FirstNet		763.000000	44.3	126.9	82.7
AT&T/FirstNet		793.000000	AT&T/FirstNet		763.000000	44.3	126.9	82.7
AT&T		710.000000	AT&T		719.000000	33.1	64.7	31.6
AT&T		710.000000	AT&T		719.000000	33.1	64.7	31.6
AT&T		710.000000	AT&T		719.000000	33.1	64.7	31.6
AT&T		1860.000000	AT&T		1940.000000	40.6	92.1	51.4
AT&T		1860.000000	AT&T		1940.000000	40.6	92.1	51.4
AT&T		1860.000000	AT&T		1940.000000	40.6	92.1	51.4
AT&T		1897.500000	AT&T		1940.000000	41.2	87.2	46
AT&T		1897.500000	AT&T		1940.000000	41.2	87.2	46
AT&T		1897.500000	AT&T		1940.000000	41.2	87.2	46
AT&T		1737.500000	AT&T		1940.000000	40.6	105.8	65.2
AT&T		1765.000000	AT&T		1940.000000	40.6	105.6	65
AT&T		1737.500000	AT&T		1940.000000	40.6	105.8	65.2
AT&T		1765.000000	AT&T		1940.000000	40.6	105.6	65
AT&T		1737.500000	AT&T		1940.000000	40.6	105.8	65.2
AT&T		1765.000000	AT&T		1940.000000	40.6	105.6	65
Verizon Wireless		781.500000	Verizon Wireless		751.500000	44.3	126.9	82.7
Verizon Wireless		781.500000	Verizon Wireless		751.500000	44.3	126.9	82.7
Verizon Wireless		781.500000	Verizon Wireless		751.500000	44.3	126.9	82.7
Verizon Wireless		840.000000	Verizon Wireless		885.000000	37.6	149.8	112.2
Verizon Wireless		840.000000	Verizon Wireless		885.000000	37.6	149.8	112.2
Verizon Wireless		840.000000	Verizon Wireless		885.000000	37.6	149.8	112.2
Verizon Wireless		1890.000000	Verizon Wireless		1970.000000	40.6	92.1	51.4
Verizon Wireless		1890.000000	Verizon Wireless		1970.000000	40.6	92.1	51.4
Verizon Wireless		1890.000000	Verizon Wireless		1970.000000	40.6	92.1	51.4
Verizon Wireless		1725.000000	Verizon Wireless		1970.000000	40.6	99.9	59.3
Verizon Wireless		1725.000000	Verizon Wireless		1970.000000	40.6	108.3	67.7
Verizon Wireless		1725.000000	Verizon Wireless		1970.000000	40.6	104.4	63.8
Verizon Wireless		1775.000000	Verizon Wireless		1970.000000	40.6	99.9	59.3
Verizon Wireless		1775.000000	Verizon Wireless		1970.000000	40.6	108.3	67.7
Verizon Wireless		1775.000000	Verizon Wireless		1970.000000	40.6	104.4	63.8

No transmitter noise interference problems were predicted.

6.0 Receiver Desensitization Analysis

Receiver desensitization interference occurs when an undesired signal from a nearby "off-frequency" transmitter is sufficiently close to a receiver's operating frequency. The signal may get through the RF selectivity of the receiver. If this undesired signal is of sufficient amplitude, the receiver's critical voltage and current levels are altered and the performance of the receiver is degraded at its operating frequency. The gain of the receiver is reduced, thereby reducing the performance of the receiver.

A transmitter can be operating several megahertz away from the receiver frequency and/or its antenna can be located several thousand feet from the receiver's antenna and still cause interference.

The analysis predicts each transmitter's signal level present at the input of each receiver. It takes into account the transmitter's power output, frequency separation, transmission line losses, filters, duplexers, combiners, isolators, multi-couplers and other RF devices that are present in both systems. Additionally, the analysis considers the antenna separation space loss, horizontal and vertical gain components of the antennas as well as how they are mounted on the structure. The gain components are derived from antenna pattern data published by each manufacturer.

The analysis determines how much isolation is required, if any, to prevent receiver performance degradation caused by receiver desensitization interference. The Table below depicts the results of this analysis. For each receiver, the transmitter that has the worst-case impact is displayed. The Signal Margin represents the margin in dB, before the receiver's performance is degraded. A negative number indicates that the performance is degraded and the value indicates how much additional isolation is required to prevent receiver performance degradation.

Receiver Provider	Receive Channel	Receive Frequency (MHz)	Transmitter Provider	Transmit Channel	Transmit Frequency (MHz)	Attn Required (dB)	Attn Provided (dB)	Signal Margin (dB)
T-Mobile (Proposed)		624.500000	T-Mobile (Proposed)		670.500000	7.8	156.3	148.5
T-Mobile (Proposed)		624.500000	T-Mobile (Proposed)		670.500000	7.8	156.3	148.5
T-Mobile (Proposed)		624.500000	T-Mobile (Proposed)		670.500000	7.8	156.3	148.5
T-Mobile (Proposed)		634.500000	T-Mobile (Proposed)		680.500000	7.8	159	151.2
T-Mobile (Proposed)		634.500000	T-Mobile (Proposed)		680.500000	7.8	159	151.2
T-Mobile (Proposed)		634.500000	T-Mobile (Proposed)		680.500000	7.8	159	151.2
T-Mobile (Proposed)		701.500000	T-Mobile (Proposed)		731.000000	7.8	122.8	115
T-Mobile (Proposed)		701.000000	T-Mobile (Proposed)		731.000000	7.8	123.4	115.7
T-Mobile (Proposed)		701.000000	T-Mobile (Proposed)		731.000000	7.8	123.4	115.7
T-Mobile (Proposed)		1877.500000	T-Mobile (Proposed)		1957.500000	9	162.2	153.2
T-Mobile (Proposed)		1877.500000	T-Mobile (Proposed)		1957.500000	9	162.2	153.2
T-Mobile (Proposed)		1877.500000	T-Mobile (Proposed)		1957.500000	9	162.2	153.2

T-Mobile (Proposed)		1715.100000	T-Mobile (Proposed)		1957.500000	9	204.3	195.2
T-Mobile (Proposed)		1715.100000	T-Mobile (Proposed)		1957.500000	9	179.8	170.8
T-Mobile (Proposed)		1715.100000	T-Mobile (Proposed)		1957.500000	9	179.9	170.9
T-Mobile (Proposed)		1747.500000	T-Mobile (Proposed)		1957.500000	9	200.7	191.7
T-Mobile (Proposed)		1747.500000	T-Mobile (Proposed)		1957.500000	9	176.2	167.2
T-Mobile (Proposed)		1747.500000	T-Mobile (Proposed)		1957.500000	9	176.3	167.3
T-Mobile (Proposed)		1752.500000	T-Mobile (Proposed)		1957.500000	9	199.7	190.7
T-Mobile (Proposed)		1752.500000	T-Mobile (Proposed)		1957.500000	9	199.7	190.7
T-Mobile (Proposed)		1752.500000	T-Mobile (Proposed)		1957.500000	9	199.7	190.7
AT&T/FirstNet		793.000000	AT&T/FirstNet		763.000000	8.3	120.5	112.2
AT&T/FirstNet		793.000000	AT&T/FirstNet		763.000000	8.3	120.5	112.2
AT&T/FirstNet		793.000000	AT&T/FirstNet		763.000000	8.3	120.5	112.2
AT&T		710.000000	AT&T		719.000000	0	107.3	107.2
AT&T		710.000000	AT&T		719.000000	0	107.3	107.2
AT&T		710.000000	AT&T		719.000000	0	107.3	107.2
AT&T		1860.000000	AT&T		1940.000000	5	162.2	157.2
AT&T		1860.000000	AT&T		1940.000000	5	162.2	157.2
AT&T		1860.000000	AT&T		1940.000000	5	162.2	157.2
AT&T		1897.500000	AT&T		1940.000000	5.2	158.5	153.3
AT&T		1897.500000	AT&T		1940.000000	5.2	158.5	153.3
AT&T		1897.500000	AT&T		1940.000000	5.2	158.5	153.3
AT&T		1737.500000	AT&T		1940.000000	5	169.2	164.2
AT&T		1765.000000	AT&T		1940.000000	5	169.2	164.2
AT&T		1737.500000	AT&T		1940.000000	5	169.2	164.2
AT&T		1765.000000	AT&T		1940.000000	5	169.2	164.2
AT&T		1737.500000	AT&T		1940.000000	5	169.2	164.2
AT&T		1765.000000	AT&T		1940.000000	5	169.2	164.2
Verizon Wireless		781.500000	Verizon Wireless		751.500000	8.3	120.5	112.2
Verizon Wireless		781.500000	Verizon Wireless		751.500000	8.3	120.5	112.2
Verizon Wireless		781.500000	Verizon Wireless		751.500000	8.3	120.5	112.2
Verizon Wireless		840.000000	Verizon Wireless		885.000000	9.6	154.3	144.7
Verizon Wireless		840.000000	Verizon Wireless		885.000000	9.6	154.3	144.7
Verizon Wireless		840.000000	Verizon Wireless		885.000000	9.6	154.3	144.7
Verizon Wireless		1890.000000	Verizon Wireless		1970.000000	5	162.2	157.2
Verizon Wireless		1890.000000	Verizon Wireless		1970.000000	5	162.2	157.2
Verizon Wireless		1890.000000	Verizon Wireless		1970.000000	5	162.2	157.2
Verizon Wireless		1725.000000	Verizon Wireless		1970.000000	5	172	167
Verizon Wireless		1725.000000	Verizon Wireless		1970.000000	5	180.5	175.4
Verizon Wireless		1725.000000	Verizon Wireless		1970.000000	5	176.6	171.5
Verizon Wireless		1775.000000	Verizon Wireless		1970.000000	5	165.2	160.2
Verizon Wireless		1775.000000	Verizon Wireless		1970.000000	5	173.6	168.6
Verizon Wireless		1775.000000	Verizon Wireless		1970.000000	5	169.7	164.7

No receiver desensitization interference problems were predicted.

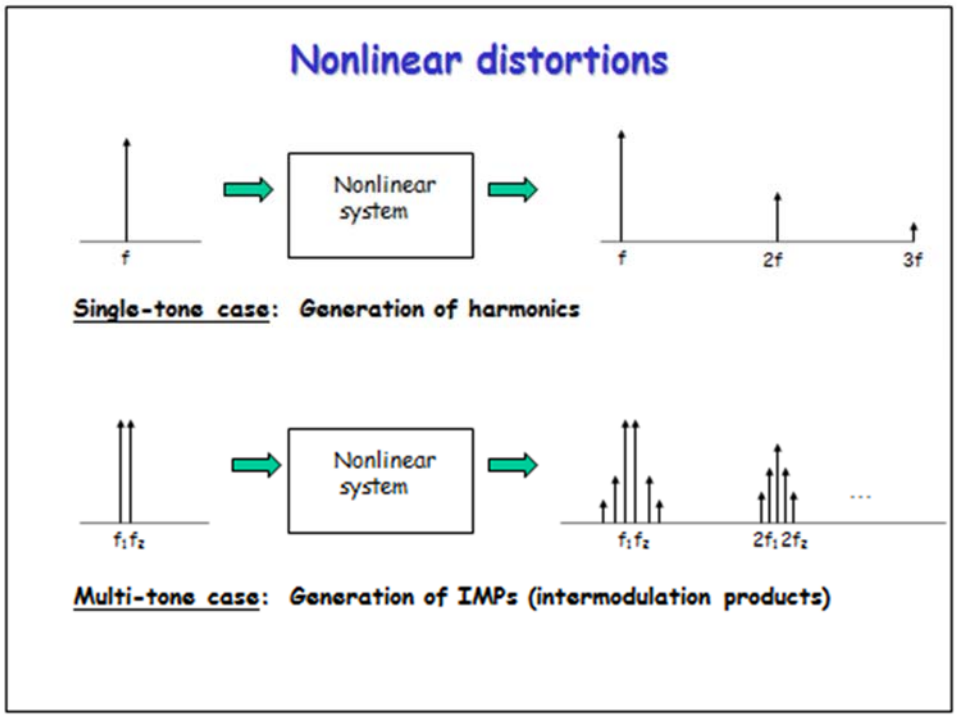
7.0 Intermodulation Interference Analysis

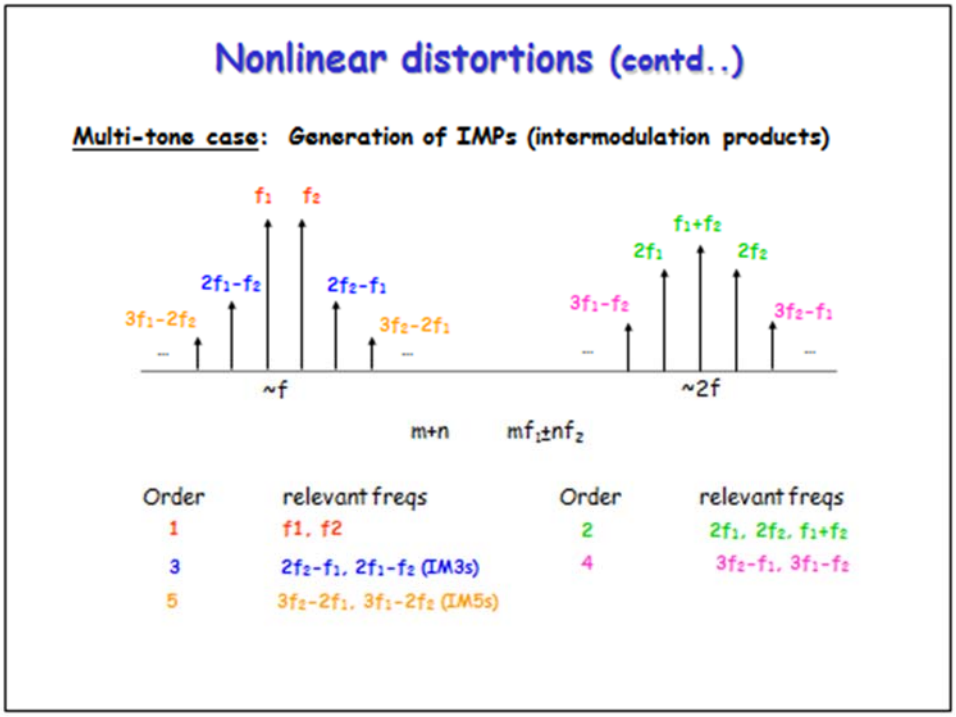
There are three basic categories of Intermodulation (IM) interference. They are receiver produced, transmitter produced, and "other" radiated IM. Transmitter produced IM is the result of one or more transmitters impressing a signal in the non-linear final output stage circuitry of another transmitter, usually via antenna coupling. The IM product frequency is then re-radiated from the transmitter's antenna. Receiver produced IM is the result of two or more transmitter signals mixing in a receiver RF amplifier or mixer stage when operating in a non-linear range.

"Other" radiated IM is the result of transmitter signals mixing in other non-linear junctions. These junctions are usually metallic, such as rusty bolts on a tower, dissimilar metallic junctions, or other non-linear metallic junctions in the area. IM products can also be caused by non-linearity in the transmission system such as antenna, transmission line, or connectors.

Communication sites with co-located transmitters, usually have RF coupling between each transmitter and antenna system. This results in the signals of each transmitter entering the nonlinear final output (PA) circuitry of the other transmitters. When intermodulation (IM) products are created in the output circuitry and they fall within the passband of the final amplifier, the IM products are re-radiated and may interfere with receivers at the same site or at other nearby sites. Additionally, these strong transmitter signals may directly enter a receiver and drive the RF amplifier into a nonlinear operation, or if not filtered effectively by the receiver input circuitry, these signals could mix in the nonlinear circuitry of the receiver front-end or mixer, creating IM products directly in the receiver.

The frequencies of IM mixing are known as nonlinear distortions. The images below depict how these IM products are derived when passing through a nonlinear junction/system.





Not all of the mixing possibilities are significant in creating interference signals. Some fall “out-of-band” of the receiver and the higher order IM products are usually weaker in signal strength.

7.1 Transmitter Generated Intermodulation Analysis

Intermodulation in transmitters occurs when a signal from another transmitter is impressed on the nonlinear final output stage circuitry, usually via antenna coupling. The power level of the IM product is determined by the power level of the incoming extraneous signal from another transmitter and by a conversion loss factor. The conversion loss factor takes into account the mixing efficiency of the transmitter's final output stage. Conversion loss differs with transmitter design, adjustment, frequency separation of the source signals, and with the order of the IM product.

The analysis calculates all possible IM product frequencies that could potentially interfere with receivers at the communications site based on each receiver's individual bandwidth. It then predicts each IM signal level present at the input of each affected receiver. For each IM frequency, the analysis considers all possible sources of IM generation in the transmitters. For example, if there are four transmitters involve, the analysis will calculate the IM signal level that would be generated in each transmitter. For this example, that would be four possible mixing conditions.

The analysis takes into account the transmitter's power output, modulation bandwidth, conversion losses, transmission line losses, filters, duplexers, combiners, isolators, multi-couplers and other RF devices that are present in each system. Additionally, the analysis considers the antenna separation space loss, horizontal and vertical gain components of the antennas as well as how they are mounted on the structure. The gain components are derived from antenna pattern data published by each manufacturer.

The analysis determines how much isolation is required to prevent receiver performance degradation for each IM interference signal that occurs. Receivers experiencing transmitter generated intermodulation interference are depicted in the following Table.

Tx 1 Source Mix Tx		Tx 2 Source		TX 3 Source		Tx 4 Source		Tx 5 Source		Intermod Hit			Affected Receiver		Attn Need
ID	Freq (MHz)	ID	Freq (MHz)	ID	Freq (MHz)	ID	Freq (MHz)	ID	Freq (MHz)	Freq (MHz)	Ord	ID	Freq (MHz)		
None															

No transmitter generated intermodulation interference problems were predicted.

7.2 Receiver Generated Intermodulation Analysis

Within a receiver, when two or more strong off-channel signals enter and mix in the receiver and one of the IM product frequencies created coincides with the receiver operating frequency, potential interference results. This internal IM mixing process takes place in the receiver's RF amplifier when it operates in a nonlinear range and/or in the first mixer, which, of course, has been designed to operate as a nonlinear device.

Receivers have a similar conversion loss type factor and receiver performance is commonly described in terms of conversion loss with respect to the 2A - B type products. Here, conversion loss is the ratio of a specified level of A and B to the level of the resulting IM product, when the product is viewed as an equivalent on-channel signal. Receiver conversion loss varies with input levels, AGC action, and product order.

The analysis calculates all possible IM product frequencies that could potentially interfere with receivers at the communications site based on each receiver's individual bandwidth. It then predicts each IM signal level present at the input of each affected receiver. For each IM frequency, the analysis considers that the IM signal is generated directly in the receiver.

The analysis takes into account the transmitter's power output, modulation bandwidth, conversion losses, transmission line losses, filters, duplexers, combiners, isolators, multi-couplers and other RF devices that are present in each system. Additionally, the analysis considers the antenna separation space loss, horizontal and vertical gain components of the antennas as well as how they are mounted on the structure. The gain components are derived from antenna pattern data published by each manufacturer.

The analysis determines how much isolation is required to prevent receiver performance degradation for each IM interference signal that occurs. Receivers experiencing receiver generated intermodulation interference are depicted in the following Table.

Tx 1 Source		Tx 2 Source		TX 3 Source		Tx 4 Source		Tx 5 Source		Intermod Hit		Affected Receiver		Attn Need
ID	Freq (MHz)	ID	Freq (MHz)	ID	Freq (MHz)	ID	Freq (MHz)	ID	Freq (MHz)	Freq (MHz)	Ord	ID	Freq (MHz)	
None														

No receiver generated intermodulation interference problems were predicted.

8.0 Transmitter Harmonic Output Interference Analysis

Transmitter harmonic interference is due to non-linear characteristics in a transmitter. The harmonics are typically created due to frequency multipliers and the non-linear design of the final output stage of the transmitter. If the harmonic signal falls within the passband of a nearby receiver and the signal level is of sufficient amplitude, it can degrade the performance of the receiver.

The analysis takes into account the transmitter's harmonic characteristics, output level, transmission line losses, filters, duplexers, combiners, isolators, multi-couplers and other RF devices that are present in each system. Additionally, the analysis considers the antenna separation space loss, horizontal and vertical gain components of the antennas as well as how they are mounted on the structure. The gain components are derived from antenna pattern data published by each manufacturer.

The analysis determines how much isolation is required to prevent receiver performance degradation for any harmonics that fall within a receiver's passband. Receivers experiencing transmitter harmonic interference are depicted in the following Table.

Transmitter		Harmonic		Affected Receiver		Attn Needed
ID	Frequency (MHz)	Frequency (MHz)	Order	ID	Frequency (MHz)	
None						

No transmitter generated harmonic interference problems were predicted.

9.0 Transmitter Spurious Output Interference Analysis

Transmitter spurious output interference can be attributed to many different factors in a transmitter. The generation of spurious frequencies could be due to non-linear characteristics in a transmitter or possibly the physical placement of components and unwanted coupling. If a spurious signal falls within the passband of a nearby receiver and the signal level is of sufficient amplitude, it can degrade the performance of the receiver.

The analysis takes into account a transmitter's spurious output specification, output levels, transmission line losses, filters, duplexers, combiners, isolators, multi-couplers and other RF devices that are present in each system. Additionally, the analysis considers the antenna separation space loss, horizontal and vertical gain components of the antennas as well as how they are mounted on the structure. The gain components are derived from antenna pattern data published by each manufacturer.

The analysis determines how much isolation is required to prevent receiver performance degradation for any transmitter spurious signals that fall within a receiver's passband. Receivers experiencing transmitter spurious output interference are depicted in the following Table.

Transmitter		Affected Receiver		Attn Needed
ID	**Frequency (MHz)**	**ID**	**Frequency (MHz)**	
None				

No transmitter generated spurious interference problems were predicted.

10.0 Interference Power Level Summing Analysis

This section of the report provides a simulation of Intermodulation (IM) interference, transmitter wideband noise and receiver desensitization interference occurring on each individual receiver when all transmitters at the site are active at the same instance in time. Even though individual interference modes may not be reported in other report sections, this summing analysis represents a worst-case interference scenario.

However, the probability of this interference occurrence for an individual receiver could be low since it depends on the utilization of the transmitters involved in the interference generation.

The carrier-to-noise C/(I + N) ratio for each receiver is based on the aggregate of interference power levels. A negative C/(I + N) ratio indicates that the performance of the receiver could possibly be degraded by the value shown.

The following Table presents this data:

Receiver		Interference Power Level (dBw)				
Channel Label	Freq (MHz)	Tx Noise	Rx Desense	IM Power	Aggregate	C / (I+N)
	624.500000	-243.8294	-279.6687	-218.6043	-218.6	82.6
	624.500000	-243.8294	-279.6687	-218.6301	-218.6	82.6
	624.500000	-243.8294	-279.6687	-218.6301	-218.6	82.6
	634.500000	-240.2385	-281.7727	-216.9661	-216.9	80.9
	634.500000	-240.2385	-281.7727	-217.1609	-217.1	81.1
	634.500000	-240.2385	-281.7727	-217.1609	-217.1	81.1
	701.500000	-212.1176	-245.8992	-198.4722	-198.3	62.3
	701.000000	-212.6251	-246.4383	-198.4521	-198.3	62.3
	701.000000	-211.5547	-247.09	-231.5992	-211.5	75.5
	1877.500000	-178.6592	-284.4272	-281.0443	-178.7	42.7
	1877.500000	-178.6592	-284.4272	-281.0443	-178.7	42.7
	1877.500000	-178.6592	-284.4272	-281.0443	-178.7	42.7
	1715.100000	-218.7267	-326.4507	-290.7814	-218.7	82.7
	1715.100000	-194.2821	-302.0071	-288.5004	-194.3	58.3
	1715.100000	-194.373	-302.098	-290.2972	-194.4	58.4
	1747.500000	-218.7267	-322.8796	-371.6861	-218.7	82.7
	1747.500000	-194.2821	-298.4341	-369.1787	-194.3	58.3
	1747.500000	-194.373	-298.525	-371.2718	-194.4	58.4
	1752.500000	-218.7267	-321.8646	-371.6775	-218.7	82.7
	1752.500000	-218.7267	-321.8646	-371.6775	-218.7	82.7
	1752.500000	-218.7267	-321.8646	-371.6775	-218.7	82.7
	2538.000000	0	0	-405.5229	-405.5	271.5
	2538.000000	0	0	-409.6466	-409.6	275.6
	2538.000000	0	0	-397.9642	-398	264
	2558.000000	0	0	-408.5445	-408.5	274.5
	2558.000000	0	0	-411.0436	-411	277
	2558.000000	0	0	-398.8369	-398.8	264.8
	2598.000000	0	0	-333.652	-333.7	206.7
	2598.000000	0	0	-333.652	-333.7	206.7

	2598.000000	0	0	-333.652	-333.7	206.7
	4950.000000	0	0	-263.3712	-263.4	150.4
	4980.000000	0	0	-274.4684	-274.5	161.5
	72.760000	0	0	-249.7271	-249.7	100.7
	793.000000	-209.8912	-239.4266	-195.1066	-195	63
	793.000000	-209.8912	-239.4266	-195.1066	-195	63
	793.000000	-209.8912	-239.4266	-195.1066	-195	63
	710.000000	-158.81	-234.2962	-241.8278	-158.8	26.8
	710.000000	-158.81	-234.2962	-241.8278	-158.8	26.8
	710.000000	-158.81	-234.2962	-241.8278	-158.8	26.8
	1860.000000	-180.0258	-285.7938	-397.3252	-180	48
	1860.000000	-180.0258	-285.7938	-397.4094	-180	48
	1860.000000	-180.0258	-285.7938	-396.3386	-180	48
	1897.500000	-176.4919	-283.3951	-309.0176	-176.5	44.5
	1897.500000	-176.4919	-283.3951	-306.0122	-176.5	44.5
	1897.500000	-176.4919	-283.3951	-304.5499	-176.5	44.5
	1737.500000	-191.2202	-292.5034	-418.8996	-191.2	59.2
	1765.000000	-191.0837	-292.5034	-294.175	-191.1	59.1
	1737.500000	-191.2202	-292.5034	-416.9643	-191.2	59.2
	1765.000000	-191.0837	-292.5034	-297.8537	-191.1	59.1
	1737.500000	-191.2202	-292.5034	-416.6544	-191.2	59.2
	1765.000000	-191.0837	-292.5034	-294.6523	-191.1	59.1
	2317.500000	0	0	-315.6151	-315.6	183.6
	2317.500000	0	0	-315.6154	-315.6	183.6
	2317.500000	0	0	-315.6151	-315.6	183.6
	2347.500000	0	0	-284.5798	-284.6	152.6
	2347.500000	0	0	-284.5798	-284.6	152.6
	2347.500000	0	0	-292.2909	-292.3	160.3
	2307.500000	0	0	-273.3471	-273.3	141.3
	2307.500000	0	0	-273.3471	-273.3	141.3
	2307.500000	0	0	-281.1151	-281.1	149.1
	2312.500000	0	0	-301.6282	-301.6	169.6
	2312.500000	0	0	-301.6282	-301.6	169.6
	2312.500000	0	0	-309.3942	-309.4	177.4
	781.500000	-209.89	-239.4264	-224.1997	-209.7	77.7
	781.500000	-209.89	-239.4264	-224.1997	-209.7	77.7
	781.500000	-209.89	-239.4264	-224.1997	-209.7	77.7
	840.000000	-239.382	-271.8958	-348.2762	-239.4	107.4
	840.000000	-239.382	-271.8958	-348.2762	-239.4	107.4
	840.000000	-239.382	-271.8958	-348.2762	-239.4	107.4
	1890.000000	-178.6592	-284.4272	-363.5376	-178.7	46.7
	1890.000000	-178.6592	-284.4272	-363.5376	-178.7	46.7
	1890.000000	-178.6592	-284.4272	-363.5376	-178.7	46.7
	1725.000000	-186.5142	-294.2392	-291.889	-186.5	54.5
	1725.000000	-194.944	-302.6689	-288.5096	-194.9	62.9
	1725.000000	-191.0348	-298.7598	-290.8562	-191	59
	1775.000000	-186.5142	-287.4129	-270.7165	-186.5	54.5
	1775.000000	-194.944	-295.8424	-278.3312	-194.9	62.9
	1775.000000	-191.0348	-291.9335	-267.4311	-191	59

11.0 Discussion and Recommendations

Sitesafe has provided FCC research on this site and used this information whenever possible in this study.

Generic antennas/systems for the existing licensees currently collocated on the structure were used when specific antenna details were not provided or found in our FCC research.

Conclusion: There is no indication that the proposed modifications by T-Mobile will cause interference to the existing carrier(s) / operations on this structure.

12.0 Reviewer Certification

Engineering Statement Re:

Potential for Interference to Existing Services

At

DN03634A – Denver Fire #29 for T-Mobile

My signature on this study hereby certifies and affirms:

That I am employed by Site Safe, LLC which provides engineering services to clients in the radio communications field; and

That I have examined the technical information supplied by T-Mobile and their representatives relating to their intention to install antennas, transmitters and associated technical equipment on an existing communication site, on an existing tower/structure, currently identified as DN03634A – Denver Fire #29; and

That the technical equipment to be installed by T-Mobile represents the state of the art and that it has been carefully designed to preclude the possibility of interference to other services, including the transmission and reception of broadcast AM, FM, and Television and other communications services, such as police, fire, utility and other public safety and public service facilities as well as private communications installations, such as cordless telephones, and Citizen's Band and Radio Amateur stations; and

That the equipment to be installed by T-Mobile meets or exceeds all Federal Communications Commission emission requirements to avoid interfering with other services and home/business equipment; and

That frequency information provided by T-Mobile concerning existing installations on this structure has been examined to estimate the potential for interference to existing and proposed operations, resulting from the introduction of the T-Mobile's operations; and

That this examination involved the computation of intermodulation products, transmitter harmonics, receiver desensitization, and transmitter spurious emissions produced by the combination of frequencies associated with existing services known to currently operate at the DN03634A – Denver Fire #29 site, and these frequencies, which could be used by others at the DN03634A – Denver Fire #29 site; and

That intermodulation products were computed (as a minimum) for the fundamental (f_0), second ($2\ f_0$) thru seventh ($7\ f_0$) harmonic components of frequencies at this site; and

That predicted products were not found to potentially cause intermodulation to T-Mobile's proposed operations or to the other licensees currently operating at the DN03634A – Denver Fire #29 site; and

That no additional isolation needs to be provided between antennas in the horizontal and vertical planes, and the attenuation along the nadir and zenith associated with vertical plane radiation patterns; and

That after examination of the levels of RF energy present at the DN03634A – Denver Fire #29 site, receiver sensitivity should not be degraded by either the existing or T-Mobile's proposed operations; and

That, if interference were to occur as a result of T-Mobile's operations, T-Mobile would be expected to recognize its responsibility to act promptly to take steps necessary to correct the interference, including, but not limited to, filtering and frequency coordination; and

In summary, it is stated here that there is not an indication that the installation being proposed by T-Mobile will create interference to their own operations, or the operations of any of the services currently operating at the DN03634A – Denver Fire #29 site. Even in the event that, upon installation of T-Mobile's equipment, interference was determined to exist, and T-Mobile's equipment was determined to be the actual interference source, frequency coordination and filtering would be T-Mobile's primary corrective course of action and should successfully eliminate the problem.

Michael Fischer

Certain generic technical assumptions regarding power settings, filtering, and equipment characteristics were made in preparing this analysis,
as this technical information was not made available by the client.

Thank You for Using Sitesafe for Your RF Engineering Needs.

EXHIBIT D

CERTIFICATE OF LIABILITY INSURANCE

5/1/2021

DATE (MM/DD/YYYY)
4/27/2020

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Lockton Companies Three City Place Drive, Suite 900 St. Louis MO 63141-7081 (314) 432-0500	**CONTACT NAME:**		
	PHONE (A/C, No, Ext):	**FAX (A/C, No):**	
	E-MAIL ADDRESS:		
	INSURER(S) AFFORDING COVERAGE		**NAIC #**
	INSURER A : XL Insurance America, Inc.		24554
INSURED 1358772 T-Mobile US, Inc. Its Subsidiaries and Affiliates 12920 SE 38th Street Bellevue WA 98006	**INSURER B :** Greenwich Insurance Company		22322
	INSURER C : National Union Fire Ins Co Pitts. PA		19445
	INSURER D :		
	INSURER E :		
	INSURER F :		

COVERAGES TMOBI **CERTIFICATE NUMBER:** 15614325 **REVISION NUMBER:** XXXXXXX

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
B	X **COMMERCIAL GENERAL LIABILITY** CLAIMS-MADE [X] OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: POLICY [ ] PRO-JECT [X] LOC OTHER:	Y	Y	RGD5000259-09	5/1/2020	5/1/2021	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG 	$ 1,000,000 $ 1,000,000 $ 25,000 $ 1,000,000 $ 2,000,000 $ 2,000,000 $
B	**AUTOMOBILE LIABILITY** X ANY AUTO OWNED AUTOS ONLY [ ] SCHEDULED AUTOS HIRED AUTOS ONLY [ ] NON-OWNED AUTOS ONLY	Y	Y	RAD5000257-09	5/1/2020	5/1/2021	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident) 	$ 2,000,000 $ XXXXXXX $ XXXXXXX $ XXXXXXX $ XXXXXXX
C C C	X **UMBRELLA LIAB** [X] OCCUR **EXCESS LIAB** [ ] CLAIMS-MADE DED [X] RETENTION $ 25,000	Y	N	51569656 SIR applies per policy terms & conditions	5/1/2020	5/1/2021	EACH OCCURRENCE AGGREGATE 	$ 5,000,000 $ 5,000,000 $ XXXXXXX
A A	**WORKERS COMPENSATION AND EMPLOYERS' LIABILITY** ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? **(Mandatory in NH)** Y/N [N] If yes, describe under DESCRIPTION OF OPERATIONS below	N / A	N	RWD5000301-08 AOS RWR5000302-08 WI	5/1/2020 5/1/2020	5/1/2021 5/1/2021	X PER STATUTE [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $ 1,000,000 $ 1,000,000 $ 1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

The Certificate Holder and other entities defined by written contract, statute, permit application or written agreement are additional insureds on a primary and non-contributory basis under general liability and are additional insured under automobile liability as required by written contract. Waiver of Subrogation applies under general liability and automobile liability as required by written contract. **See Attached Endorsements** DN03108E - 501 Knox Court, Denver, CO 80204 DN03433C - 4306 S. Wolff Street, Denver, CO 80236 DN03753A - 700 14th Street, Denver, CO 80202 DN03634A - 4800 Himalaya Way, Denver, CO 80249

CERTIFICATE HOLDER

15614325
City and County of Denver, its Elected and Appointed Officials, Employees and Volunteers
700 14th Street
Denver CO 80202

CANCELLATION See Attachments

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

City and County of Denver, its Elected and Appointed Officials,
Employees and Volunteers
700 14th Street
Denver CO 80202

To whom it may concern:

In our continuing effort to provide timely certificate delivery, Lockton Companies is transitioning to paperless delivery of Certificates of Insurance.

To ensure electronic delivery for future renewals of this certificate, we need your email address. Please contact us via one of the methods below, referencing Certificate ID 15614325.

- Email: STL-edelivery@lockton.com
- Phone: (866) 728-5657 (toll-free)

If you received this certificate through an internet link where the current certificate is viewable, we have your email and no further action is needed.

In the event your mailing address has changed, will change in the future, or you no longer require this certificate, please let us know using one of the methods above.

The above inbox is for providing e-Delivery email addresses for next year's renewal *certificates ONLY. Your information will be input within 90 days.*

Thank you for your cooperation and willingness in reducing our environmental footprint.

Lockton Companies

ENDORSEMENT # 021

This endorsement, effective 12:01 a.m., 5/1/2020, forms a part of

Policy No.RGD5000259-09 issued to T-Mobile US, Inc.

by Greenwich Insurance Company

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

WASHINGTON - CANCELLATION NOTIFICATION

TO OTHERS ENDORSEMENT

In the event coverage is cancelled for any statutorily permitted reason, other than nonpayment of premium, advanced written notice will be mailed or delivered to person(s) or entity(ies) according to the notification schedule shown below:

Name of Person(s) or Entity(ies)	Mailing Address:	Number of Days Advanced Notice of Cancellation
Per the most current schedule of Certificate Holders maintained by Lockton Companies and furnished to AXA XL Insurance on a monthly basis		30

In the event of cancellation for nonpayment of premium, ten (10) days notice will be given.

All other terms and conditions of the Policy remain unchanged.

IXI 405-WA 1210

ENDORSEMENT # 004

This endorsement, effective 12:01 a.m., 5/1/2020 forms a part of

Policy No. RAD5000257-09 issued to T-MOBILE US, INC.

by Greenwich Insurance Company

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

WASHINGTON - CANCELLATION NOTIFICATION

TO OTHERS ENDORSEMENT

In the event coverage is cancelled for any statutorily permitted reason, other than nonpayment of premium, advanced written notice will be mailed or delivered to person(s) or entity(ies) according to the notification schedule shown below:

Name of Person(s) or Entity(ies)	Mailing Address:	Number of Days Advanced Notice of Cancellation
Per the most current schedule of Certificate Holders maintained by Lockton Companies and furnished to AXA XL Insurance on a monthly basis		30

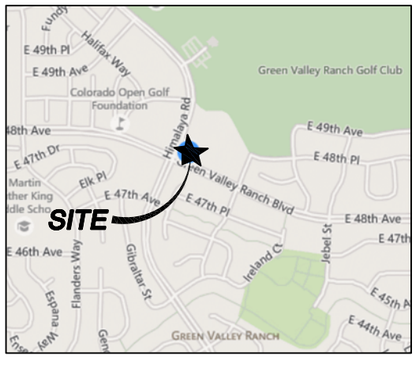
In the event of cancellation for nonpayment of premium, ten (10) days notice will be given.

All other terms and conditions of the Policy remain unchanged.

Adcom911

EXHIBIT E

SITE NAME
FIRE STATION #29



NORTH

DRIVING DIRECTIONS FROM I25 & I70:

DEPART ON I70 WEST TO PENA BLVD NORTH. EXIST ONTO 48TH AVE. AND HEAD EAST TO THE SITE ON THE LEFT A HIMALAYA RD.

CONSULTING TEAM

A&E FIRM:
CENTERLINE SOLUTIONS
16360 TABLE MOUNTAIN PARKWAY
GOLDEN, CO 80403
P: (303) 993-3293 EXT. 417
CONTACT: KHRISTOPHER SCOTT, PE

PROJECT SUMMARY

SITE ADDRESS:
4800 HIMALAYA ROAD
DENVER CO 80249

OWNER/LANDLORD:
CITY AND COUNTY OF DENVER FIRE DEPARTMENT

APPLICANT:
ADCOM911
CONTACT: WALT LESLIE
PHONE: (303) 887-7111

SITE DEVELOPMENT:
CENTERLINE SOLUTIONS
CONTACT: CHARLES AUGELLO
16360 TABLE MOUNTAIN PARKWAY
GOLDEN, CO 80403
PHONE: (720) 236-9199

PROJECT DESCRIPTION:
INSTALLATION OF A "NON-INHABITABLE" TELECOMMUNICATIONS SITE CONSISTING OF PLACING NEW ANTENNAS AND eNODEb'S ON AN EXISTING TOWER WITH A NEW EQUIPMENT CABINET ON AN EXISTING CONCRETE SLAB

PROJECT DATA:

NATIONAL ELECTRICAL CODE	*2011 EDITION*
INTERNATIONAL BUILDING CODE	*2012 EDITION*
INTERNATIONAL MECHANICAL CODE	*2012 EDITION*

SHEET INDEX

Adcom911

REV.	DATE	REVISION DESCRIPTION	BY
0	7/28/14	PRELIM CONST	KS

ISSUED FOR:
CONSTRUCTION

CENTERLINE SOLUTIONS
Advancing Wireless Networks
16360 TABLE MOUNTAIN PARKWAY
Golden, CO 80403
303-993-3293
WWW.CENTERLINESOLUTIONS.COM

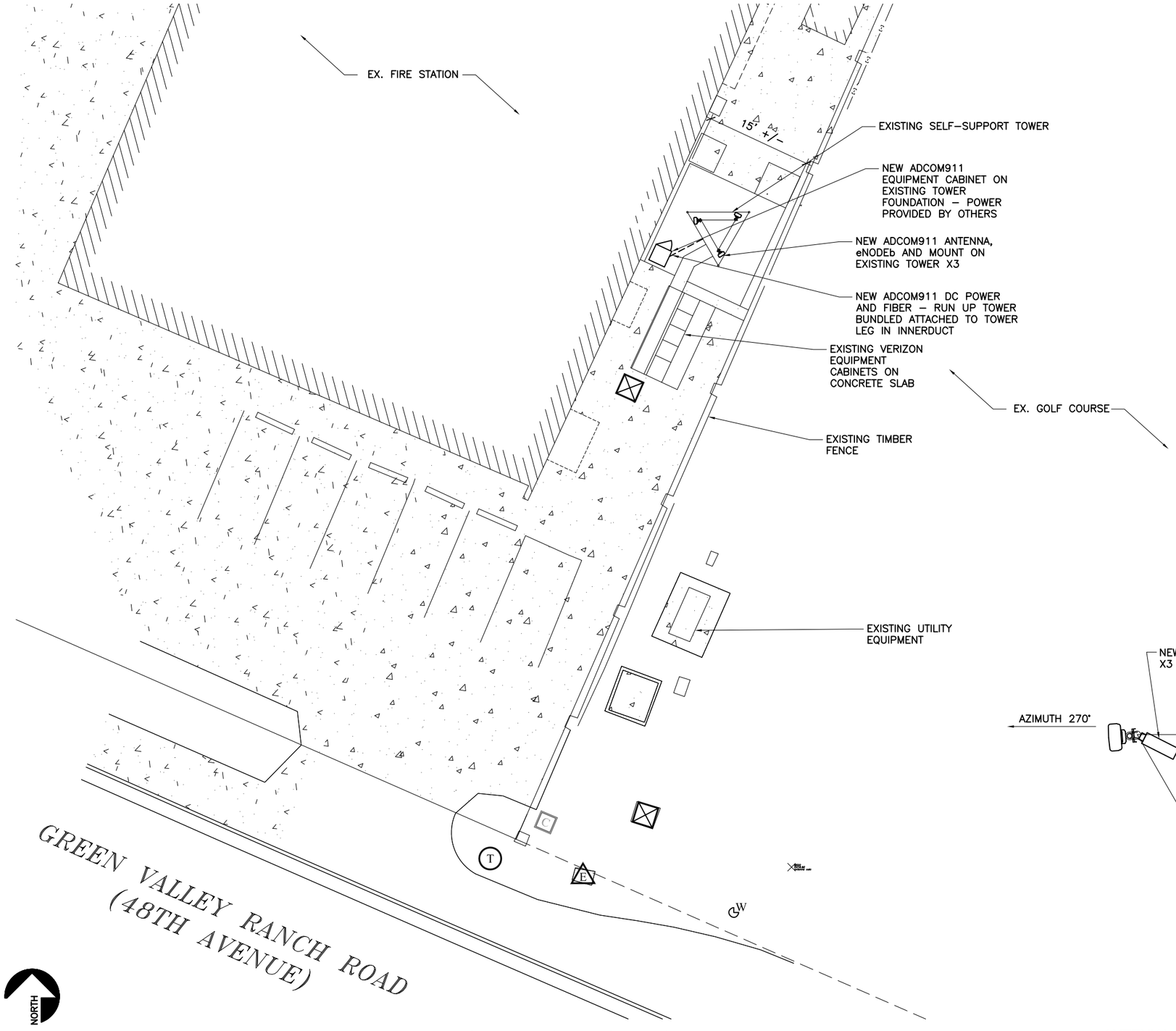
ALL SCALES ARE SET FOR A SIZE "D" 24"X36" SHEET

PROJECT INFORMATION:
FIRE STATION #29
4800 HIMALAYA
DENVER, CO 80249

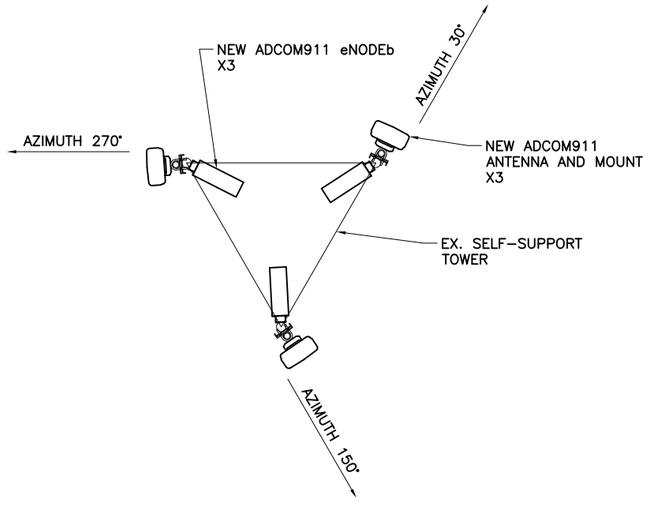
DRAWN BY:	CHECKED BY:	APPROVED BY:
MC	KS	KS

SHEET TITLE:
TITLE PAGE, VICINITY MAP & GENERAL INFO

SHEET NUMBER:
T1



1 **OVERALL SITE PLAN**
1/8" = 1'-0"



2 **ANTENNA DETAIL**
1/2" = 1'-0"

Adcom911

REV.	DATE	REVISION DESCRIPTION	BY
0	7/28/14	PRELIM CONST	KS

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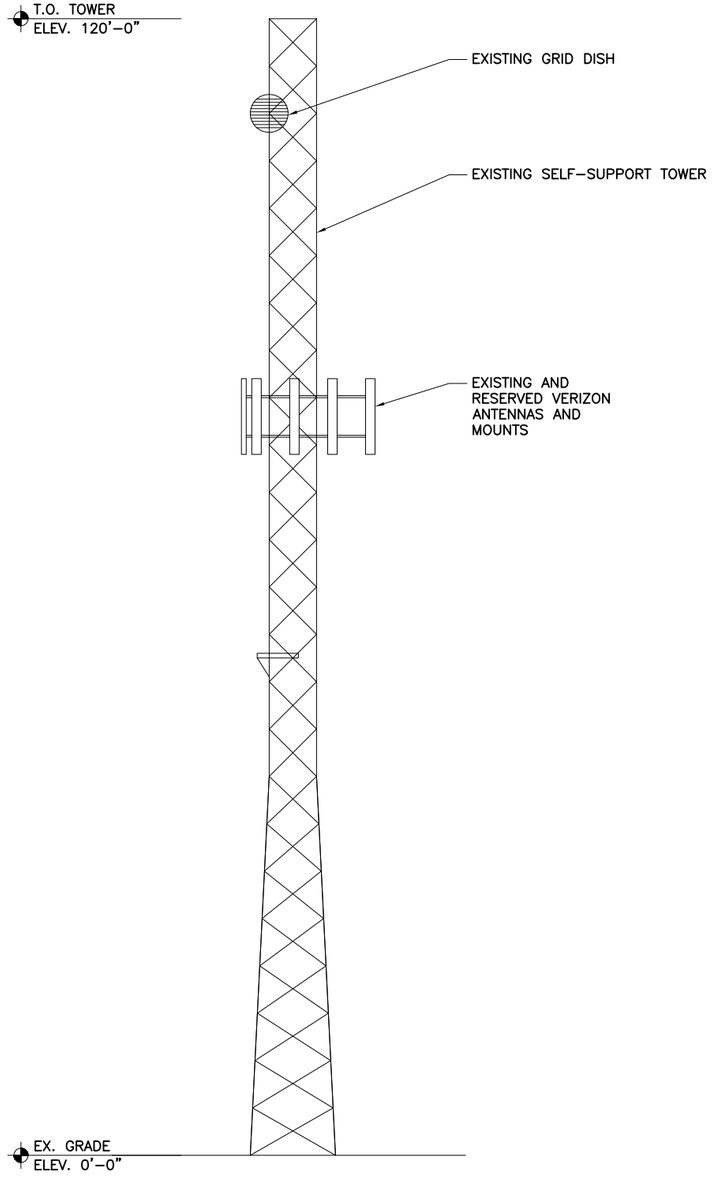
ALL SCALES ARE SET FOR A SIZE "D" 24"X36" SHEET

PROJECT INFORMATION:
FIRE STATION #29
4800 HIMALAYA
DENVER, CO 80249

DRAWN BY:	CHECKED BY:	APPROVED BY:
MC	KS	KS

SHEET TITLE:
OVERALL SITE PLAN & ANTENNA DETAIL

SHEET NUMBER:
A1

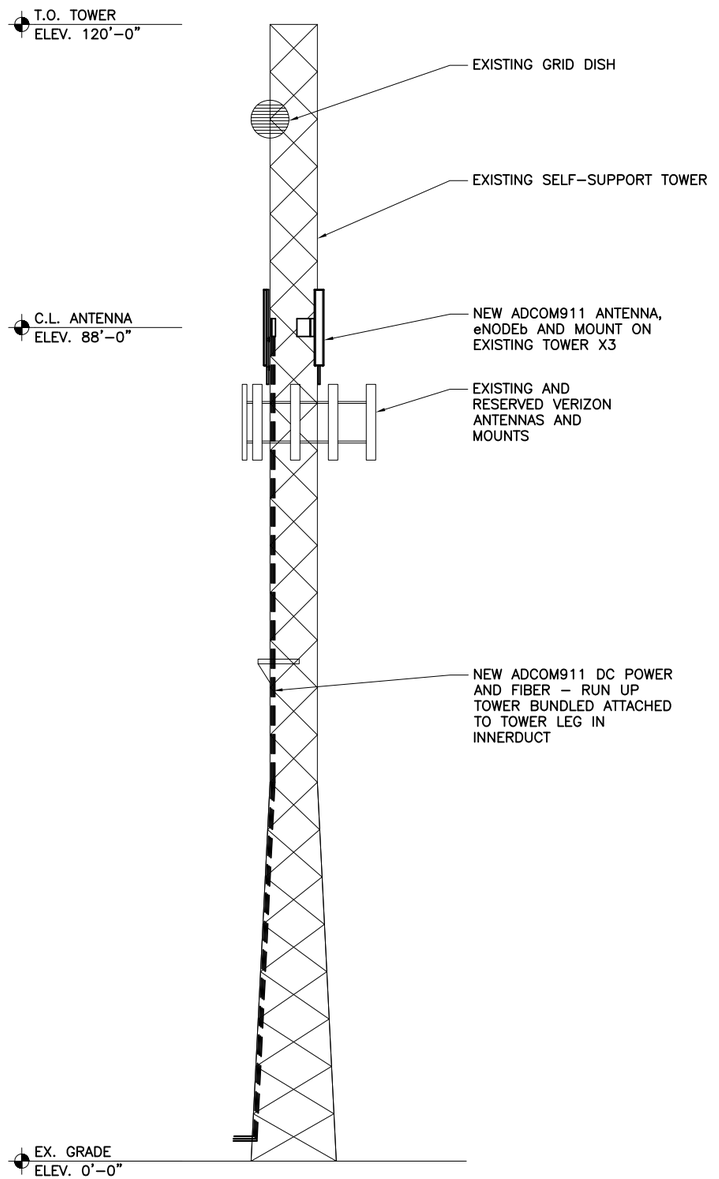


1 **EXISTING SOUTH ELEVATION**

1/8" = 1'-0"

4' 0 8' 16' 24'

SCALE: 1/8"=1'-0"



2 **NEW SOUTH ELEVATION**

1/8" = 1'-0"

4' 0 8' 16' 24'

SCALE: 1/8"=1'-0"

Adcom911

REV.	DATE	REVISION DESCRIPTION	BY
0	7/28/14	PRELIM CONST	KS

ISSUED FOR:

CONSTRUCTION

CENTERLINE SOLUTIONS
Advancing Wireless Networks

16360 TABLE MOUNTAIN PARKWAY
Golden, CO 80403
303-993-3293
WWW.CENTERLINESOLUTIONS.COM

ALL SCALES ARE SET FOR A SIZE "D" 24"X36" SHEET

PROJECT INFORMATION:

FIRE STATION #29

4800 HIMALAYA
DENVER, CO 80249

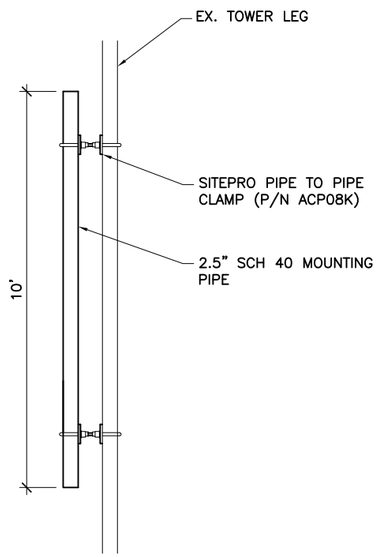
DRAWN BY:	CHECKED BY:	APPROVED BY:
MC	KS	KS

SHEET TITLE:

EXISTING & NEW ELEVATIONS

SHEET NUMBER:

A2



1 ANTENNA AND RRU MOUNT
1"=1'-0"

STRUCTURAL NOTES

1.0 GENERAL CONDITIONS

1.1 DESIGN AND CONSTRUCTION OF ALL WORK SHALL CONFORM TO THE IBC 2012 EDITION AND ALL OTHER APPLICABLE STATE CODES, ORDINANCES, AND REGULATIONS. IN CASE OF CONFLICT BETWEEN THE CODES, STANDARDS, AND REGULATIONS. SPECIFICATIONS, GENERAL NOTES AND/OR MANUFACTURER'S REQUIREMENTS. USE THE MOST STRINGENT PROVISION.

1.2 IT IS THE EXPRESS INTENT OF THE PARTIES INVOLVED IN THIS PROJECT THAT THE CONTRACTOR OR SUBCONTRACTOR OR INDEPENDENT CONTRACTOR OR THEIR RESPECTIVE EMPLOYEES SHALL EXCULPATE THE ARCHITECT, THE ENGINEER, THE CONSTRUCTION MANAGER, THE OWNER, AND THEIR AGENTS, FROM ANY LIABILITY WHATSOEVER AND HOLD THEM HARMLESS AGAINST LOSS, DAMAGES, LIABILITY OR ANY EXPENSE ARISING IN ANY MATTER FROM THE WRONGFUL OR NEGLIGENT ACT, OR FAILURE TO CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, OR THE CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES OR PROCEDURES OR FAILURE TO CONFORM TO THE STATE SCAFFOLDING ACT IN CONNECTION WITH THE WORK.

1.3 DO NOT SCALE DRAWINGS.

1.4 VERIFY ALL EQUIPMENT MOUNTING DIMENSIONS PER MANUFACTURER DRAWINGS.

1.5 SUBMIT ONE SEPIA AND TWO PRINTS OF ALL STRUCTURAL SHOP DRAWINGS. MARKED UP SEPIA SHALL BE RETURNED.

1.6 DESIGN LOADS ARE:
WIND SPEED 90 MPH 3 SEC EXP C

2.0 STEEL

2.1 MEET OR EXCEED THE FOLLOWING CODES & STANDARDS (LATEST EDITION) EXCEPT AS NOTED:

A. STRUCTURAL STEEL...AISC SPECIFICATION & CODE OF STANDARD PRACTICE
–SHAPES AND PLATES...ASTM A572
–PLATES BENT OR COLD FORMED...ASTM A 283, GRADE C
–PIPES...ASTM A 53, GRADE B
–STRUCTURAL SHEETS, HOT ROLLED...ASTM A 510
–COLD FORMED STEEL TUBING...ASTM A 500 GRADE B
–BOLTS, NUTS & WASHERS FOR ANCHOR BOLTS AND SECONDARY CONNECTIONS...ASTM A307
–ALL STEEL SHALL BE HOT–DIPPED GALVANIZED.

B. WELDS...AWS E 70XX
EXCEPTION IS TAKEN TO AISC CODE OF STANDARD PRACTICE PARAGRAPH 4.2.1 REGARDING OWNERS AND FABRICATOR'S RESPONSIBILITY FOR CONNECTION DESIGN AND DETAILING IS THE CONTRACTORS RESPONSIBILITY. ENGINEER'S REVIEW OF SHOP DRAWINGS IS FOR GENERAL CONSIDERATIONS ONLY AND DOES NOT CONSTITUTE AN ACCEPTANCE OF THESE RESPONSIBILITIES BY THE OWNER AND/OR ENGINEER.

Adcom911

REV.	DATE	REVISION DESCRIPTION	BY
0	7/28/14	PRELIM CONST	KS

ISSUED FOR:
CONSTRUCTION

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Advancing Wireless Networks
16360 TABLE MOUNTAIN PARKWAY
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PROJECT INFORMATION:
FIRE STATION #29
4800 HIMALAYA
DENVER, CO 80249

DRAWN BY:	CHECKED BY:	APPROVED BY:
MC	KS	KS

SHEET TITLE:
STRUCTURAL DETAILS & NOTES

SHEET NUMBER:
S1