November 17, 2016

VIA EMAIL AND OVERNIGHT DELIVERY

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

RE: T-Mobile Northeast LLC – CTFF703A
Notice of Exempt Modification
303 Boxwood Lane, Danbury, CT
LAT: 41-24-2.15
LNG: 73-26-45.23

Dear Ms. Bachman:

T-Mobile Northeast LLC ("T-Mobile") currently maintains three (3) antennas at a centerline of 83' on the existing 100' lattice tower located at 303 Boxwood Lane, Danbury, CT. The structure is owned by Western Connecticut State University ("WCSU"); their use of the structure was approved by the Council on October 21, 1996 (Docket No. 176).

Please accept this letter as notification pursuant to Regulations of Connecticut State Agencies 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A.16-50j-72(b)(2). In accordance with R.C.S.A. l6-50j-73, a copy of this letter is being sent to Mayor Mark D. Boughton, City of Danbury and the property owner, the State of Connecticut.

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

1. The proposed modifications will not result in an increase in the height of the existing structure. T-Mobile proposes to add three (3) L700 antennas, at a centerline of 83' on the existing 100' structure, as well as add (3) RRUS and remove (6) coax cables.

2. The proposed modifications will not require the extension of the site boundary. There will be no effect on the site compound or T-Mobile's leased area.

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

negligible.

4. The operation of the replacement antennas will not increase radio frequency emissions at the facility to a level at or above the Federal Communications Commission safety standard. As indicated in the attached power density calculations, T-Mobile's operations at the site will result in a power density of 7.83%; the combined site operations will result in a total power density of 28.66%.

5. The proposed modifications will not cause a change or alteration in the physical or environmental characteristics of the site. T-Mobile will swap antennas on the existing mounts.

6. The existing structure and its foundation can support T-Mobile’s proposed loading, as indicated in the attached structural analysis.

For the foregoing reasons, T-Mobile respectfully submits that the proposed modifications to the above-referenced telecommunications facility constitute an exempt modification under R.C.S.A. J 6-50j-72(b)(2) .

Please feel free to call me with any questions or concerns regarding this matter. Thank you for your consideration.

Respectfully submitted,

By: ________________________
Jamie Ford, Agent for T-Mobile
jford@verticaldevelopmentllc.com
774-248-5373

Attachments

cc: Mayor Mark D. Boughton, City of Danbury
Western Connecticut State University

T-Mobile

WIRELESS COMMUNICATIONS FACILITY

CT703/WCSU
SITE ID: CTFF703A
303 BOXWOOD LANE
DANBURY, CT 06811

T-MOBILE RF CONFIGURATION: 702Cc

PROJECT SUMMARY

THE GENERAL SCOPE OF WORK CONSISTS OF THE FOLLOWING:

1. A TOTAL OF THREE (3) DIRECTIONAL PANEL ANTENNAS ARE TO BE INSTALLED ON A NEW MOUNT WITH THREE (3) EXISTING DIRECTIONAL PANEL ANTENNAS FOR A TOTAL OF SIX (6) AT A CENTERLINE ELEVATION OF ±83' A.G.L. ON A 100' TALL NUDD LATTICE TOWER.
2. INSTALL THREE (3) NEW RRUS11 B12'S BEHIND PROPOSED POSITION 2 ANTENNAS.
3. EXISTING T-MOBILE ERICSSON RBS 3106 EQUIPMENT CABINET TO BE UPGRADED TO BE A RBS 6131 EQUIPMENT CABINET WITHIN EXISTING COMPOUND.

GENERAL NOTES

1. ALL WORK SHALL BE IN ACCORDANCE WITH THE 2012 INTERNATIONAL BUILDING CODE AS MODIFIED BY THE 2016 CONNECTICUT SUPPLEMENT, INCLUDING THE TIA/EIA-222 REVISION "G" "STRUCTURAL STANDARDS FOR STEEL ANTENNA TOWERS AND SUPPORTING STRUCTURES." 2016 CONNECTICUT FIRE SAFETY CODE, NATIONAL ELECTRICAL CODE AND LOCAL CODES.
2. CONTRACTOR SHALL REVIEW ALL DRAWINGS AND SPECIFICATIONS IN THE CONTRACT DOCUMENT SET. CONTRACTOR SHALL COORDINATE ALL WORK SHOWN IN THE SET OF DRAWINGS. THE CONTRACTOR SHALL PROVIDE A COMPLETE SET OF DRAWINGS TO ALL SUBCONTRACTORS AND ALL RELATED PARTIES. THE SUBCONTRACTORS SHALL EXAMINE ALL THE DRAWINGS AND SPECIFICATIONS FOR THE INFORMATION THAT AFFECTS THEIR WORK.
3. CONTRACTOR SHALL PROVIDE A COMPLETE BUILD-OUT WITH ALL FINISHES, STRUCTURAL, MECHANICAL, AND ELECTRICAL COMPONENTS AND PROVIDE ALL ITEMS AS SHOWN OR INDICATED ON THE DRAWINGS OR IN THE WRITTEN SPECIFICATIONS.
4. CONTRACTOR SHALL FURNISH ALL MATERIAL, LABOR AND EQUIPMENT TO COMPLETE THE WORK AND FURNISH A COMPLETED JOB ALL IN ACCORDANCE WITH LOCAL AND STATE GOVERNING AUTHORITIES AND OTHER AUTHORITIES HAVING LAWFUL JURISDICTION OVER THE WORK.
5. CONTRACTOR SHALL SECURE AND PAY FOR ALL PERMITS AND ALL INSPECTIONS REQUIRED AND SHALL ALSO PAY FEES REQUIRED FOR THE GENERAL CONSTRUCTION, PLUMBING, ELECTRICAL AND HVAC. PERMITS SHALL BE PAID FOR BY THE RESPECTIVE SUBCONTRACTORS.
6. CONTRACTOR SHALL MAINTAIN A CURRENT SET OF DRAWINGS AND SPECIFICATIONS ON SITE AT ALL TIMES AND INSURE DISTRIBUTION OF NEW DRAWINGS TO SUBCONTRACTORS AND OTHER RELEVANT PARTIES AS SOON AS THEY ARE MADE AVAILABLE. ALL OLD DRAWINGS SHALL BE MARKED VOID AND REMOVED FROM THE CONTRACT AREA. THE CONTRACTOR SHALL FURNISH AN 'AS-BUILT' SET OF DRAWINGS TO OWNER UPON COMPLETION OF PROJECT.
7. LOCATION OF EQUIPMENT, AND WORK SUPPLIED BY OTHERS THAT IS DIAGRAMMATICALLY INDICATED ON THE DRAWINGS SHALL BE DETERMINED BY THE CONTRACTOR. THE CONTRACTOR SHALL DETERMINE LOCATIONS AND DIMENSIONS SUBJECT TO STRUCTURAL CONDITIONS AND WORK OF THE SUBCONTRACTORS.
8. THE CONTRACTOR IS SOLELY RESPONSIBLE TO DETERMINE CONSTRUCTION PROCEDURE AND SEQUENCE, AND TO ENSURE THE SAFETY OF THE EXISTING STRUCTURES AND ITS COMPONENT PARTS DURING CONSTRUCTION. THIS INCLUDES THE ADDITION OF WHATEVER SHORING, BRACING, UNDERPINNING, ETC. THAT MAY BE NECESSARY.
9. DRAWINGS INDICATE THE MINIMUM STANDARDS, BUT IF ANY WORK SHOULD BE INDICATED TO BE SUBSTANDARD TO ANY ORDINANCES, LAWS, CODES, RULES, OR REGULATIONS BEARING ON THE WORK, THE CONTRACTOR SHALL INCLUDE IN HIS WORK AND SHALL EXECUTE THE WORK CORRECTLY IN ACCORDANCE WITH SUCH ORDINANCES, LAWS, CODES, RULES OR REGULATIONS WITH NO INCREASE IN COSTS.
10. ALL UTILITY WORK SHALL BE IN ACCORDANCE WITH LOCAL UTILITY COMPANY REQUIREMENTS AND SPECIFICATIONS.
11. ALL EQUIPMENT AND PRODUCTS PURCHASED ARE TO BE REVIEWED BY CONTRACTOR AND ALL APPLICABLE SUBCONTRACTORS FOR ANY CONDITION PER MFR.'S RECOMMENDATIONS. CONTRACTOR TO SUPPLY THESE ITEMS AT NO COST TO OWNER OR CONSTRUCTION MANAGER.
12. ANY AND ALL ERRORS, DISCREPANCIES, AND 'MISSED" ITEMS ARE TO BE BROUGHT TO THE ATTENTION OF THE T-MOBILE CONSTRUCTION MANAGER DURING THE BIDDING PROCESS BY THE CONTRACTOR. ALL THESE ITEMS ARE TO BE INCLUDED IN THE BID. NO 'EXTRA' WILL BE ALLOWED FOR MISSED ITEMS.
13. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL ON-SITE SAFETY FROM THE TIME THE JOB IS AWARDED UNTIL ALL WORK IS COMPLETE AND ACCEPTED BY THE OWNER.
14. CONTRACTOR TO REVIEW ALL SHOP DRAWINGS AND SUBMIT COPY TO ENGINEER FOR APPROVAL. DRAWINGS MUST BEAR THE CHECKER'S INITIALS BEFORE SUBMITTING TO THE CONSTRUCTION MANAGER FOR REVIEW.
15. THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS, ELEVATIONS, ANGLES, AND EXISTING CONDITIONS AT THE SITE, PRIOR TO FABRICATION AND/OR INSTALLATION OF ANY WORK IN THE CONTRACT AREA.
16. COORDINATION, LAYOUT, FURNISHING AND INSTALLATION OF CONDUIT AND ALL APPURTENANCES REQUIRED FOR PROPER INSTALLATION OF ELECTRICAL AND TELECOMMUNICATION SERVICE SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
17. ALL DAMAGE CAUSED TO ANY EXISTING STRUCTURE SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR WILL BE HELD LIABLE FOR ALL REPAIRS REQUIRED FOR EXISTING STRUCTURES IF DAMAGED DURING CONSTRUCTION ACTIVITIES.
18. THE CONTRACTOR SHALL CONTACT "CALL BEFORE YOU DIG" AT LEAST 48 HOURS PRIOR TO ANY EXCAVATIONS AT 1-800-922-4455. ALL UTILITIES SHALL BE IDENTIFIED AND CLEARLY MARKED. CONTRACTOR SHALL MAINTAIN AND PROTECT MARKED UTILITIES THROUGHOUT PROJECT COMPLETION.
19. CONTRACTOR SHALL COMPLY WITH OWNERS ENVIRONMENTAL ENGINEER ON ALL METHODS AND PROVISIONS FOR ALL EXCAVATION ACTIVITIES INCLUDING SOIL DISPOSAL. ALL BACKFILL MATERIALS TO BE PROVIDED BY THE CONTRACTOR.

SITE DIRECTIONS

FROM: 35 GRIFFIN ROAD SOUTH, BLOOMFIELD, CT 06002

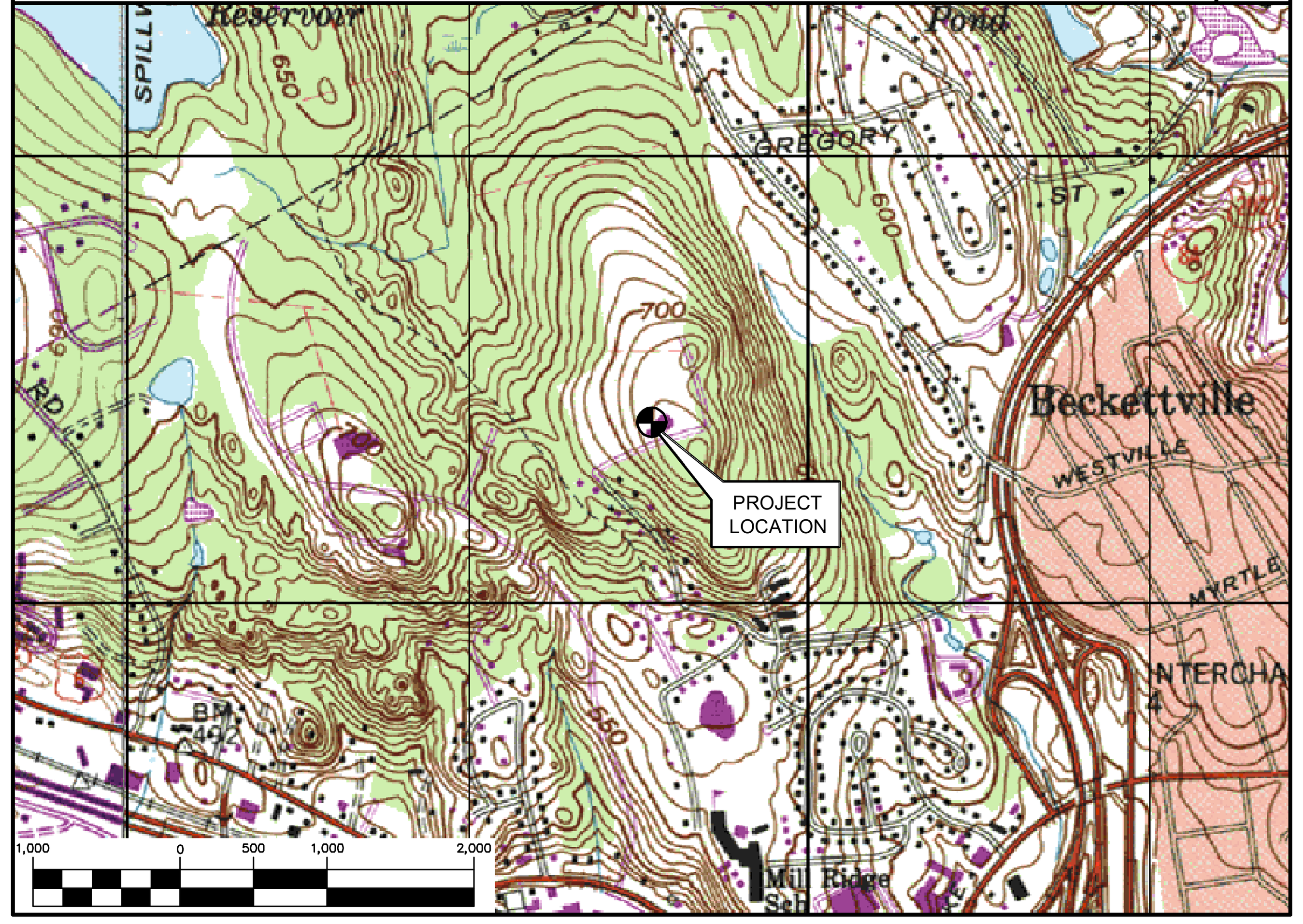
TO: 303 BOXWOOD LANE, DANBURY, CT 06811

1.	TURN LEFT ONTO CAPITOL BLVD	0.4 MI
2.	TURN LEFT ONTO WEST STREET	0.2 MI
3.	TAKE RAMP LEFT FOR I-91 S	0.3 MI
4.	AT EXIT 18, TAKE RAMP RIGHT FOR I-691 WEST TOWARD MERIDEN/WATERBURY	8.8 MI
5.	CONTINUE ONTO I-691 WEST.	7.7 MI
6.	AT EXIT 1, TAKE RAMP LEFT FOR I-84 WEST TOWARD WATERBURY/DANBURY, MERGE ONTO I-84 WEST.	35.9 MI
7.	TAKE EXIST 4 FOR US-6 WEST/US-202 WEST TOWARD LAKE AVE.	0.3 MI
8.	TURN RIGHT ONTO US-202 WEST/US-6 WEST/LAKE AVE. EXT.	404 FT
9.	TURN RIGHT ONTO MILL RIDGE ROAD	0.3 MI
10.	TURN RIGHT ONTO HIGH RIDGE ROAD	0.2 MI
11.	TURN LEFT AT THE 1ST CROSS STREET ONTO SCUPPO ROAD	89 FT
12.	SLIGHT RIGHT ONTO BOXWOOD LANE	0.1 MI
		0.1 MI

VICINITY MAP

SCALE: 1" = 1000'

NORTH



PROJECT INFORMATION

SITE NAME:	CT703/WCSU
SITE ID:	CTFF703A
SITE ADDRESS:	303 BOXWOOD LANE DANBURY, CT 06811
APPLICANT:	T-MOBILE NORTHEAST, LLC 35 GRIFFIN ROAD SOUTH BLOOMFIELD, CT 06002
CONTACT PERSON:	JAIME FORD (PROJECT MANAGER) VERTICAL DEVELOPMENT, LLC (774) 248-5373
ENGINEER:	CENTEK ENGINEERING, INC. 63-2 NORTH BRANFORD RD. BRANFORD, CT 06405
PROJECT COORDINATES:	LATITUDE: 41°-23'-41.90" N LONGITUDE: 73°-29'-12.27" W GROUND ELEVATION: 730'± AMSL SITE COORDINATES AND GROUND ELEVATION REFERENCED FROM CSC WEBLOG.

SHEET INDEX

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REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
1	11/03/16	KAWJR	HMR	CONSTRUCTION DRAWINGS
0	10/20/16	KAWJR	HMR	CONSTRUCTION DRAWINGS – ISSUED FOR CLIENT REVIEW

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www.CentekEng.com

T-MOBILE NORTHEAST LLC
WIRELESS COMMUNICATIONS FACILITY
CT703/WCSU
SITE ID: CTFF703A
303 BOXWOOD LANE
DANBURY, CT 06811

DATE:	10/17/16
SCALE:	AS NOTED
JOB NO.	16159.06

TITLE SHEET

T-1

DESIGN BASIS

1. GOVERNING CODE: 2012 INTERNATIONAL BUILDING CODE AS MODIFIED BY THE 2016 CT STATE SUPPLEMENT.
2. TIA/EIA–222 REVISION "G", ASCE MANUAL NO. 72 – "DESIGN OF STEEL TRANSMISSION POLE STRUCTURES SECOND EDITION".
3. DESIGN CRITERIA:

   WIND LOAD: (TOWER & FOUNDATION)
   NOMINAL DESIGN WIND SPEED (V) = 93 MPH (2016 CSBC: APPENDIX 'N')

GENERAL NOTES

1. IF ANY FIELD CONDITIONS EXIST WHICH PRECLUDE COMPLIANCE WITH THE DRAWINGS, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER AND SHALL PROCEED WITH AFFECTED WORK AFTER CONFLICT IS SATISFACTORILY RESOLVED.
2. DIMENSIONS AND DETAILS SHALL BE CHECKED AGAINST THE PRE MANUFACTURED EQUIPMENT BUILDING SHOP DRAWINGS.
3. THE CONTRACTOR SHALL VERIFY AND COORDINATE THE SIZE AND LOCATION OF ALL OPENINGS, SLEEVES AND ANCHOR BOLTS AS REQUIRED BY ALL TRADES.
4. REFER TO DRAWING T1 FOR ADDITIONAL NOTES AND REQUIREMENTS.

SITE NOTES

1. THE CONTRACTOR SHALL CALL UTILITIES PRIOR TO THE START OF CONSTRUCTION.
2. ACTIVE EXISTING UTILITIES, WHERE ENCOUNTERED IN THE WORK, SHALL BE PROTECTED AT ALL TIMES. THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY, PRIOR TO PROCEEDING, SHOULD ANY UNCOVERED EXISTING UTILITY PRECLUDE COMPLETION OF THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
3. ALL RUBBISH, STUMPS, DEBRIS, STICKS, STONES AND OTHER REFUSE SHALL BE REMOVED OFF SITE AND BE LEGALLY DISPOSED, AT NO ADDITIONAL COST.
4. THE SITE SHALL BE GRADED TO CAUSE SURFACE WATER TO FLOW AWAY FROM THE EQUIPMENT AND TOWER AREAS.
5. NO FILL OR EMBANKMENT MATERIAL SHALL BE PLACED ON FROZEN GROUND. FROZEN MATERIALS, SNOW OR ICE SHALL NOT BE PLACED IN ANY FILL OR EMBANKMENT.
6. THE SUBGRADE SHALL BE COMPACTED AND BROUGHT TO A SMOOTH UNIFORM GRADE PRIOR TO FINISHED SURFACE APPLICATION.
7. THE AREAS OF THE COMPOUND DISTURBED BY THE WORK SHALL BE RETURNED TO THEIR ORIGINAL CONDITION.
8. CONTRACTOR SHALL MINIMIZE DISTURBANCE TO EXISTING SITE DURING CONSTRUCTION. EROSION CONTROL MEASURES, SHALL BE IN CONFORMANCE WITH THE LOCAL GUIDELINES FOR EROSION AND SEDIMENT CONTROL.
9. IF ANY FIELD CONDITIONS EXIST WHICH PRECLUDE COMPLIANCE WITH THE DRAWINGS, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER AND SHALL PROCEED WITH AFFECTED WORK AFTER CONFLICT IS SATISFACTORILY RESOLVED.
10. DIMENSIONS AND DETAILS SHALL BE CHECKED AGAINST THE PRE MANUFACTURED EQUIPMENT BUILDING SHOP DRAWINGS.

ELECTRIC NOTES

1. ALL NEW ANTENNAS SHALL BE BONDED TO EXISTING GROUNDING SYSTEM PER MANUFACTURERS AND NEC SPECIFICATIONS. COORDINATE WITH CONSTRUCTION MANAGER FOR REQUIREMENTS.

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
0	10/20/16	KAW/JR	HMR	CONSTRUCTION DRAWINGS – ISSUED FOR CLIENT REVIEW
1	11/03/16	KAW/JR	HMR	CONSTRUCTION DRAWINGS

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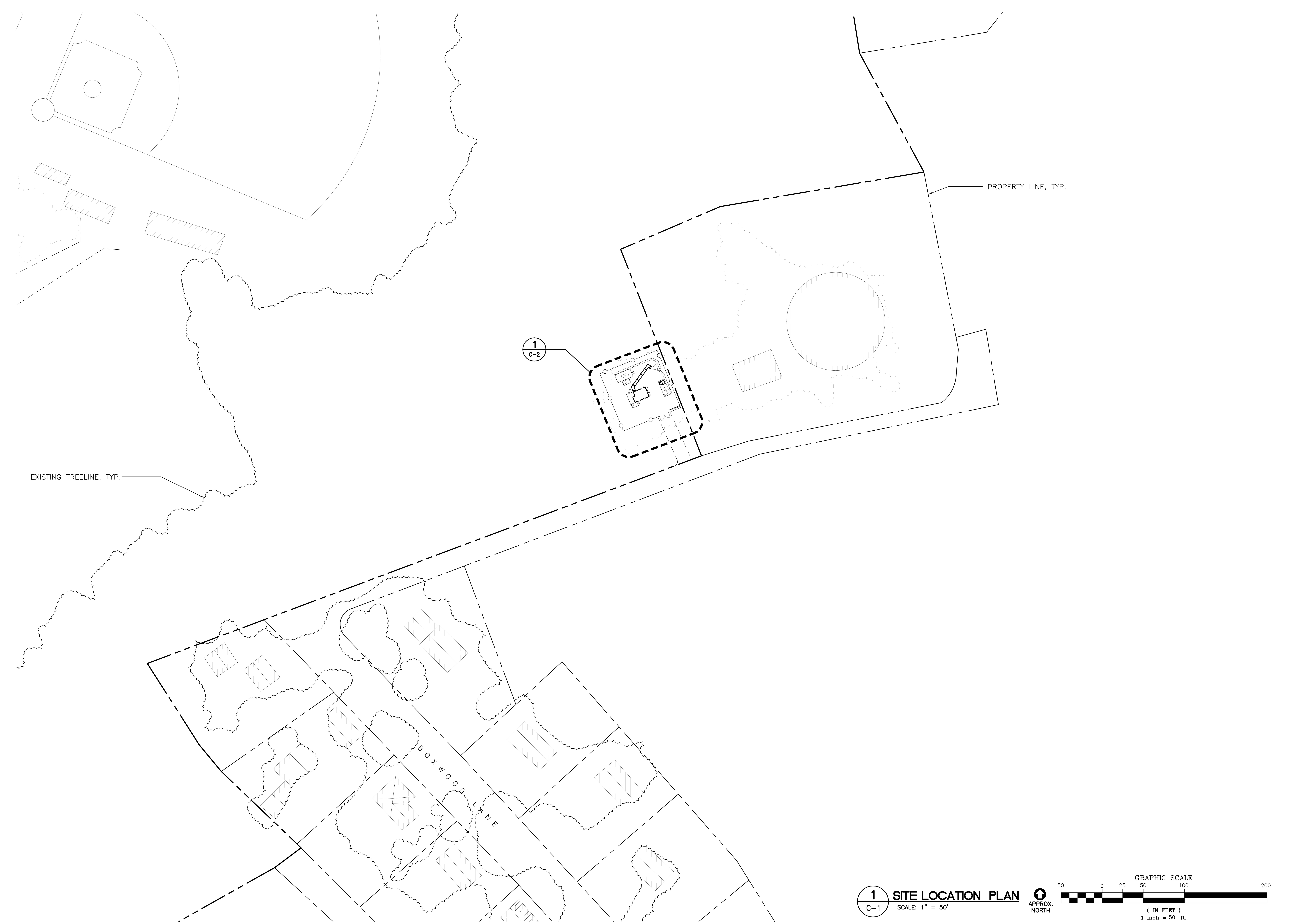
WIRELESS COMMUNICATIONS FACILITY
CT703/WCSU
SITE ID: CTFF703A
303 BOXWOOD LANE
DANBURY, CT 06811

DATE: 10/17/16
SCALE: AS NOTED
JOB NO. 16159.06

DESIGN BASIS AND SITE NOTES

N-1

Sheet No. 2 of 5



1 / C-1 SITE LOCATION PLAN
SCALE: 1" = 50'

APPROX. NORTH

GRAPHIC SCALE
50 0 25 50 100 200
(IN FEET)
1 inch = 50 ft.

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
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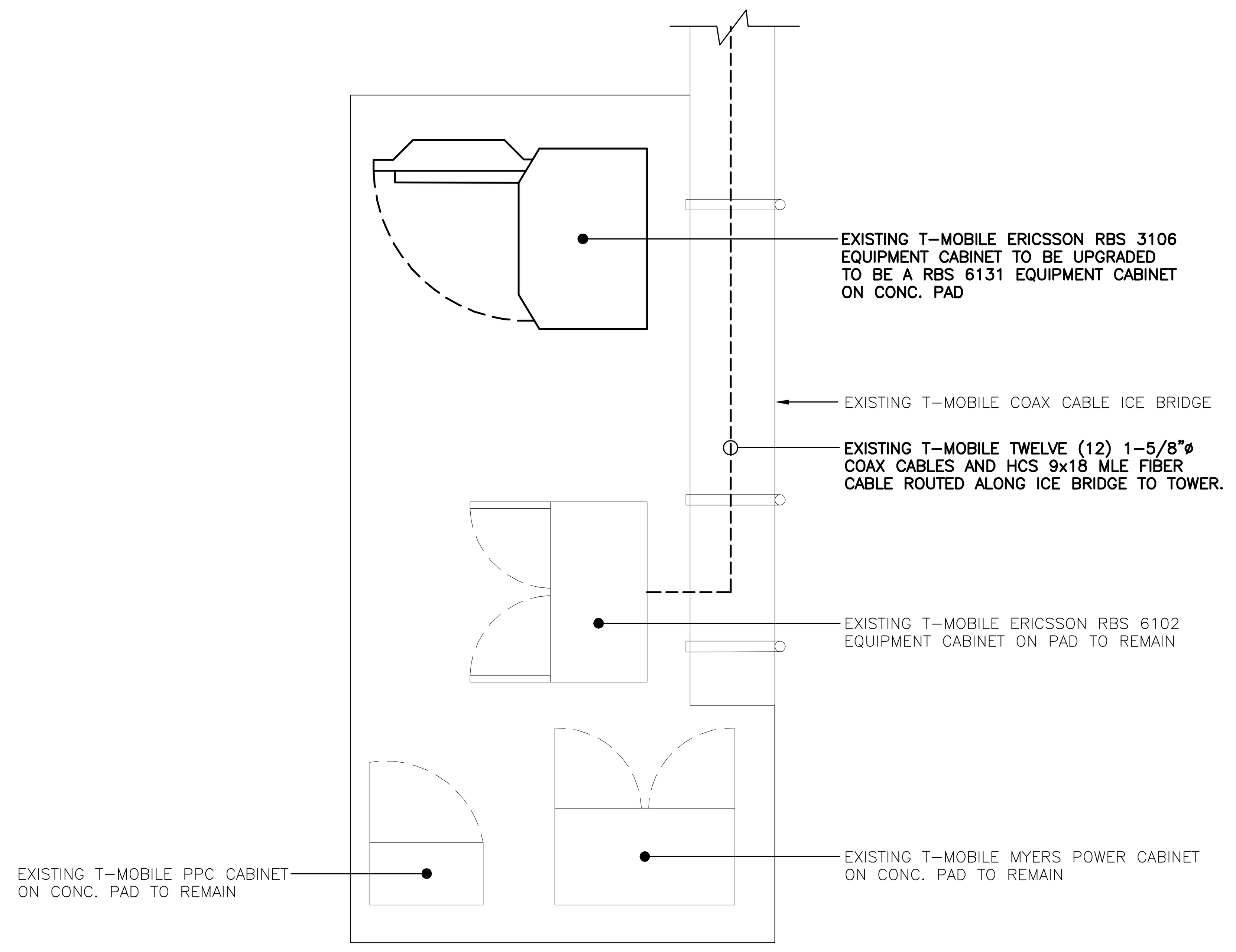
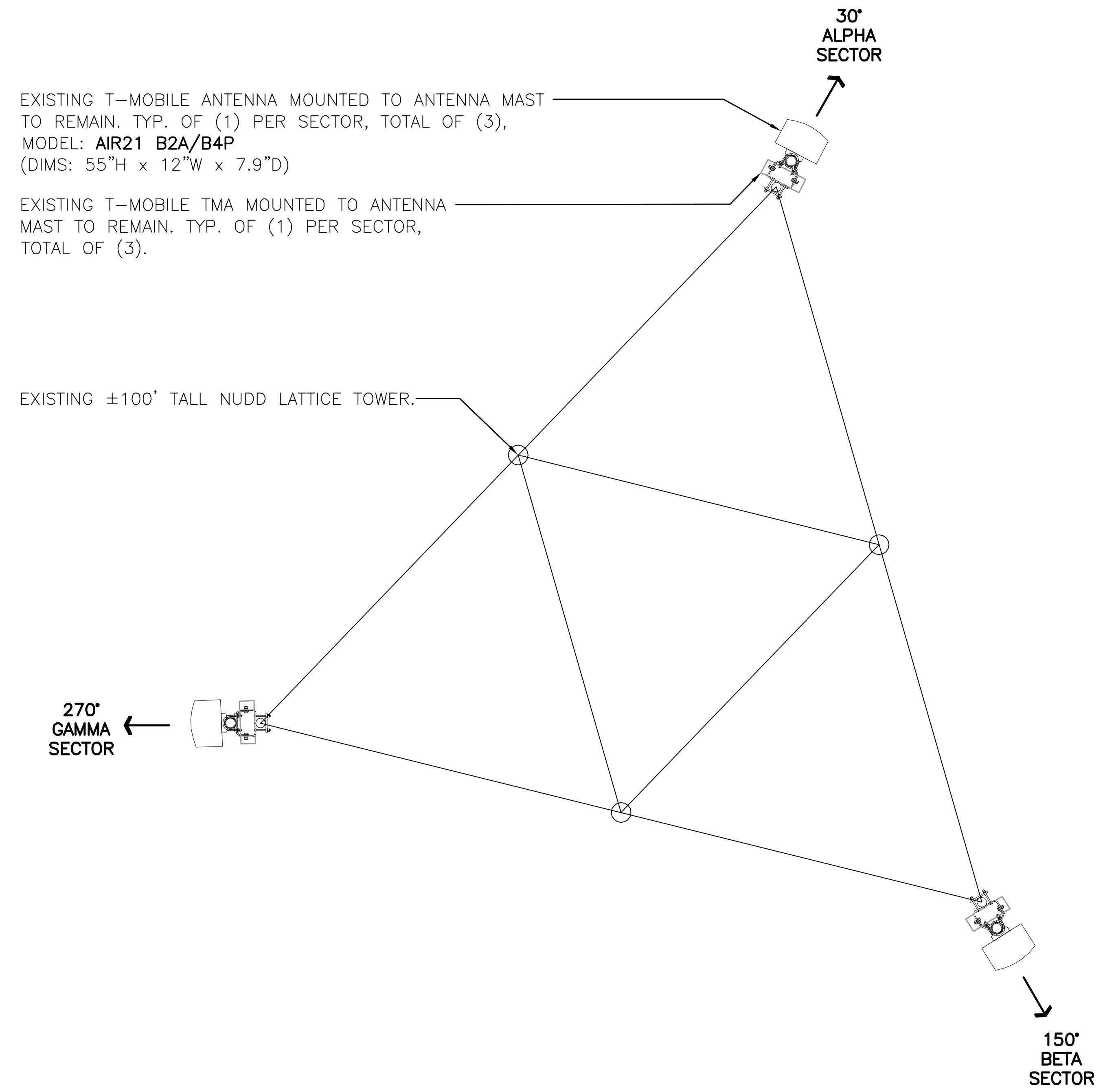
SCALE: AS NOTED
JOB NO. 16159.06

SITE LOCATION PLAN

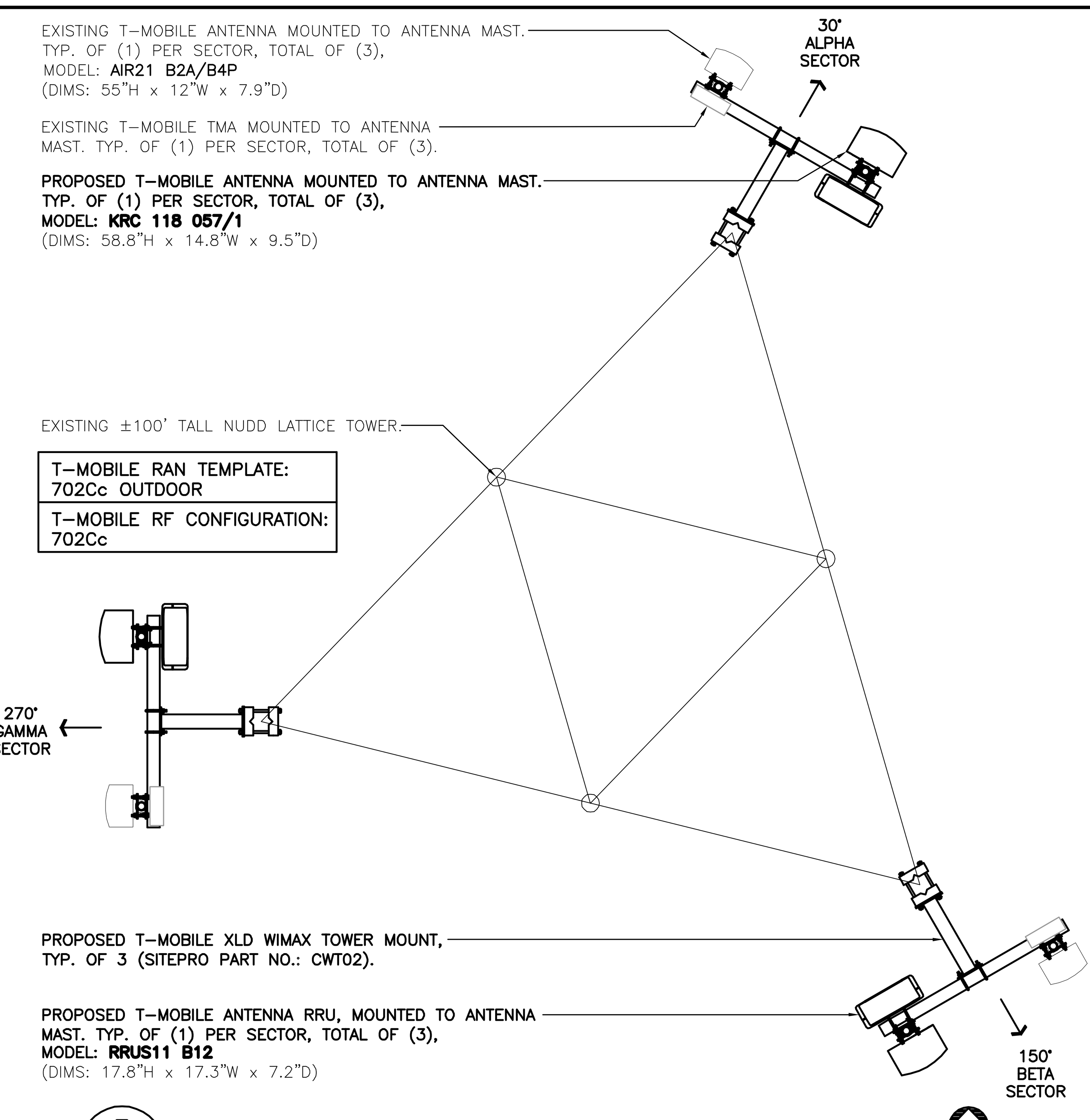
C-1
Sheet No. 3 of 5



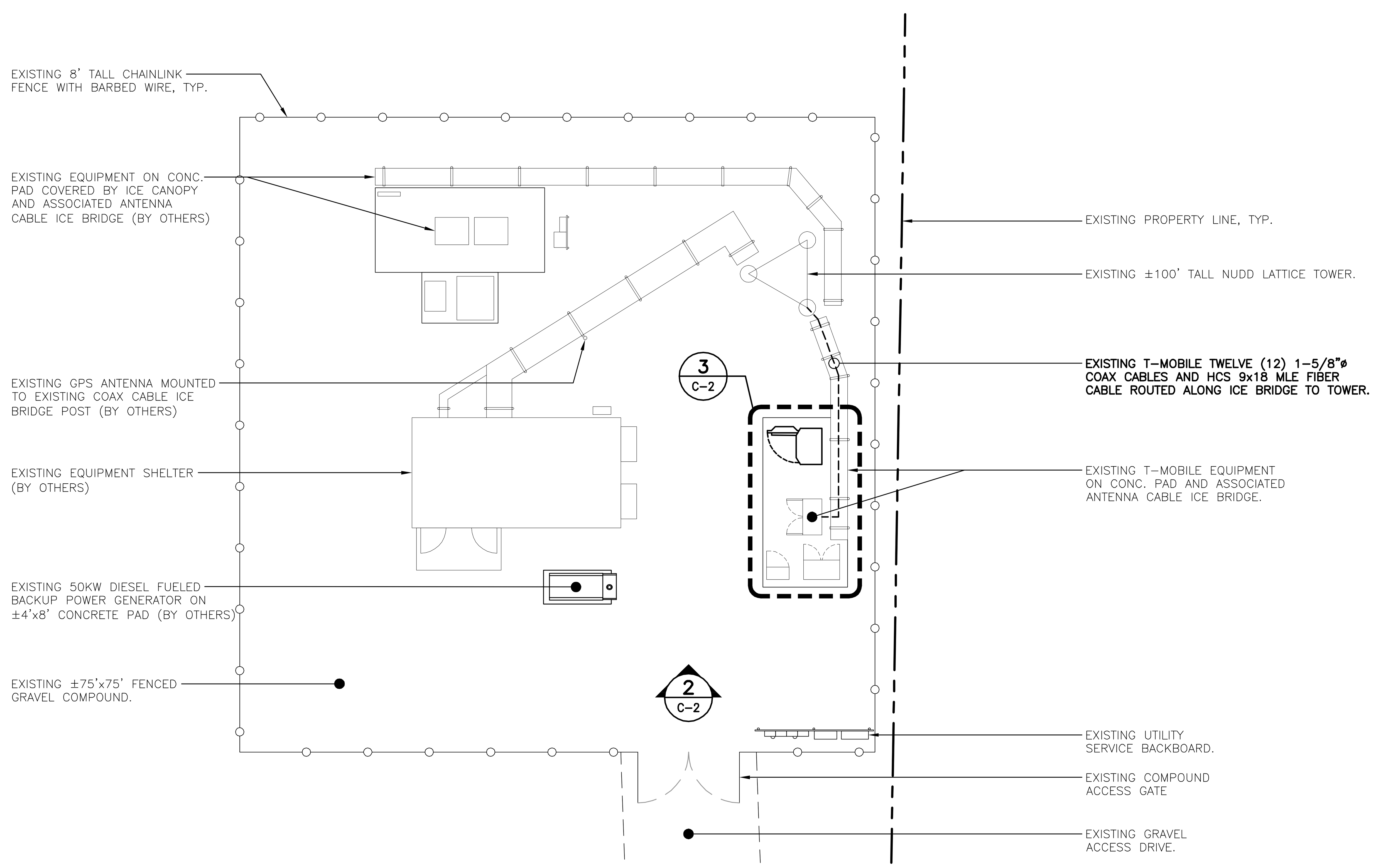
3 C-2 **EQUIPMENT PLAN** SCALE: 3/8" = 1' TRUE NORTH



4 C-2 **EXISTING ANTENNA MOUNTING CONFIGURATION** SCALE: 3/8" = 1' 83' ELEVATION TRUE NORTH



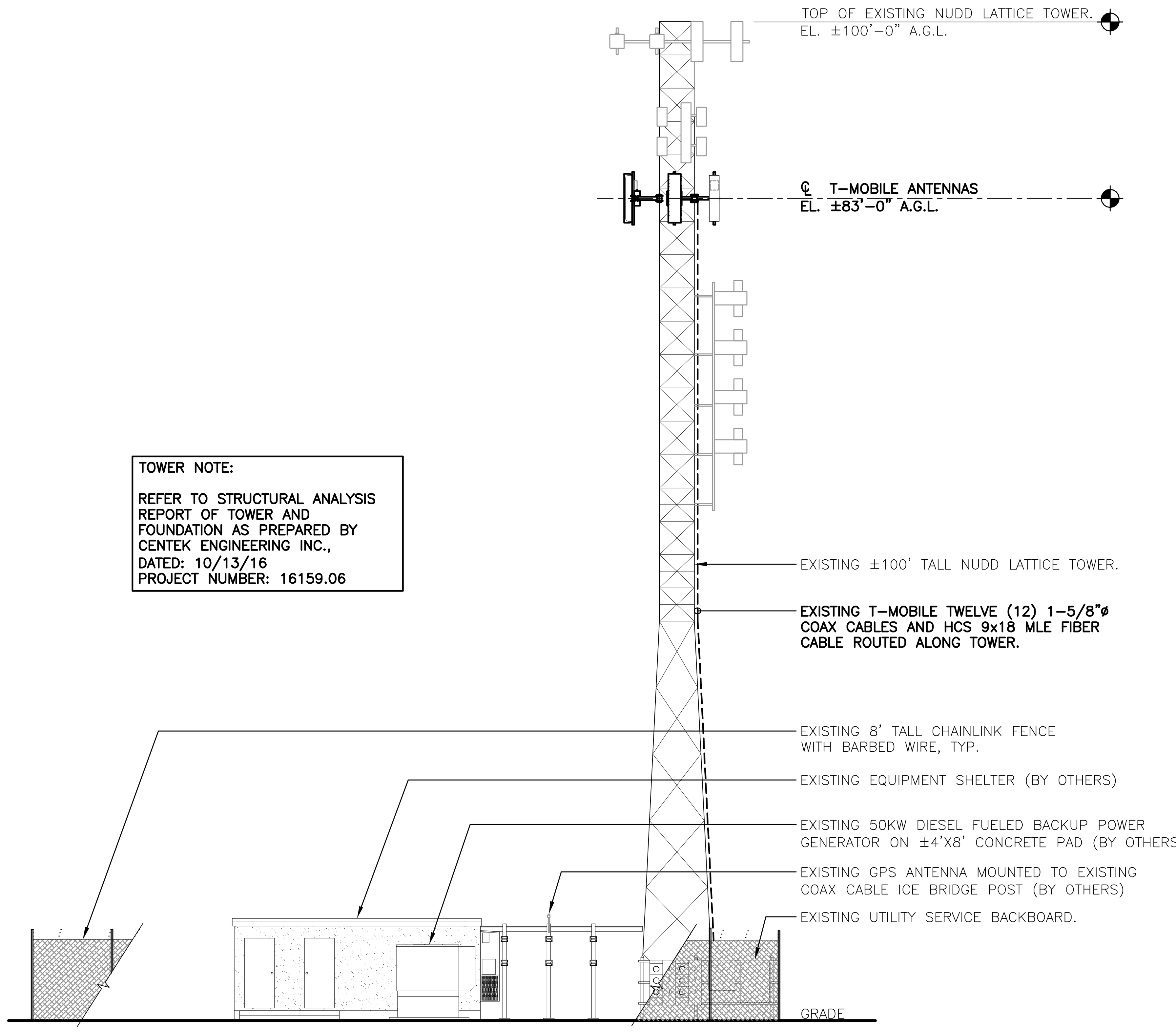
5 C-2 **PROPOSED ANTENNA MOUNTING CONFIGURATION** SCALE: 3/8" = 1' 83' ELEVATION TRUE NORTH



1 C-2 **COMPOUND PLAN** SCALE: 1" = 10' TRUE NORTH

TOWER NOTE:

REFER TO STRUCTURAL ANALYSIS REPORT OF TOWER AND FOUNDATION AS PREPARED BY CENTEK ENGINEERING INC., DATED: 10/13/16 PROJECT NUMBER: 16159.06



2 C-2 **SOUTH TOWER ELEVATION** SCALE: 1" = 10'

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
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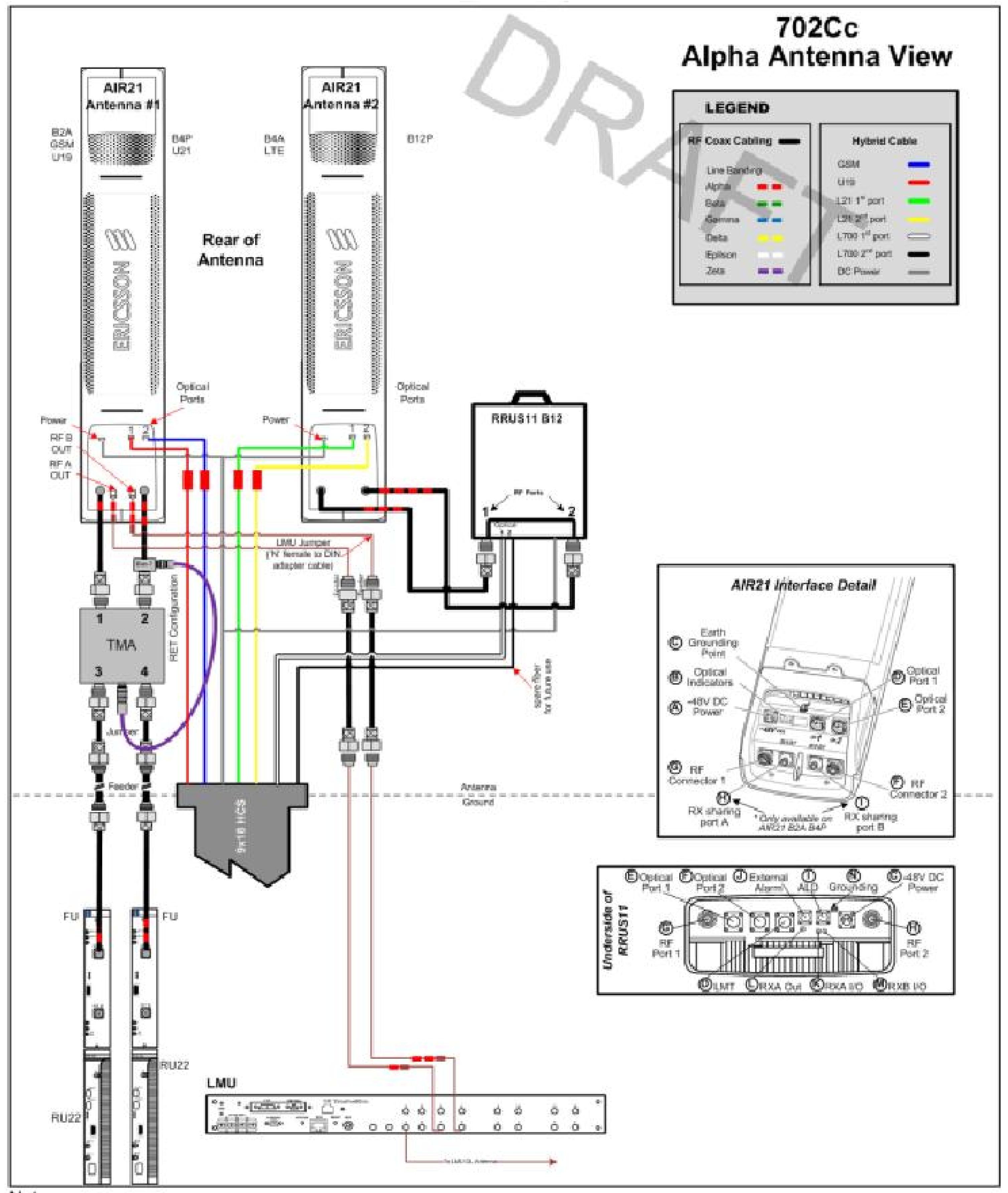
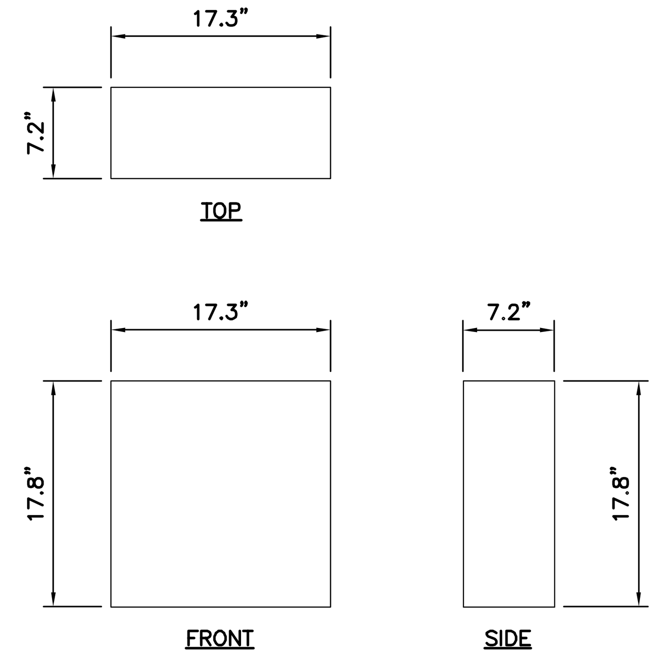
JOB NO. 16159.06

COMPOUND PLAN, ELEVATION AND ANTENNA MOUNTING CONFIG.

C-2



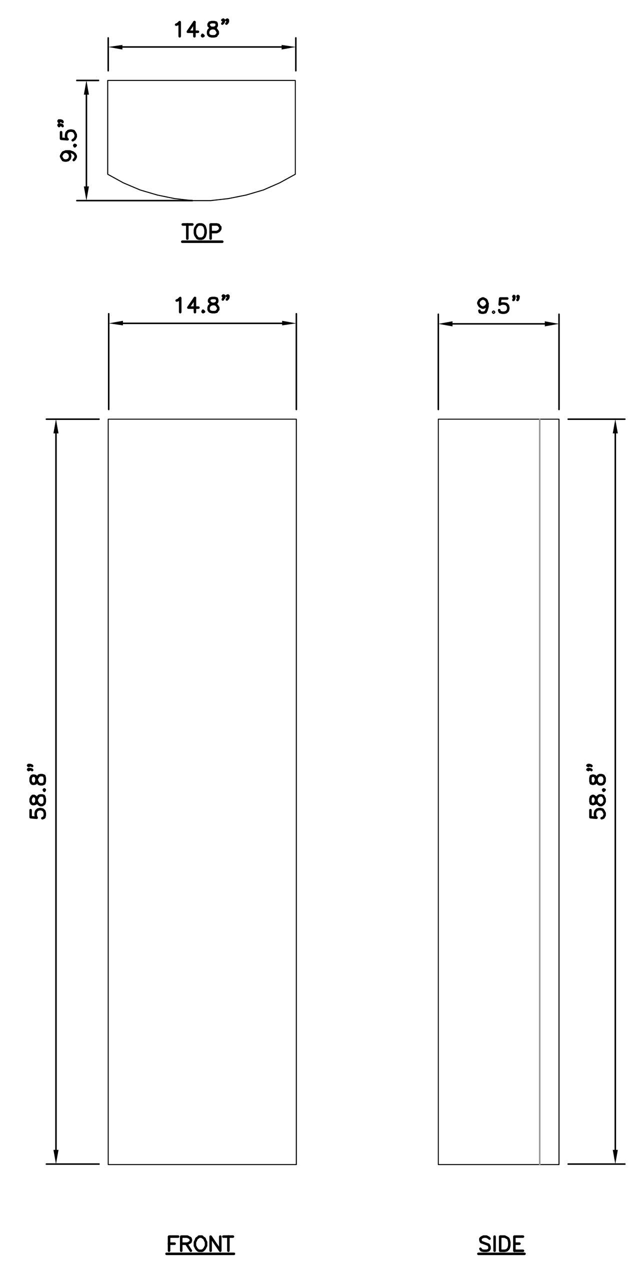
4 PROPOSED PLUMBING DIAGRAM
C-3
SCALE: NOT TO SCALE



WEIGHT: 50 LB

ERICSSON: RRUS11 B12

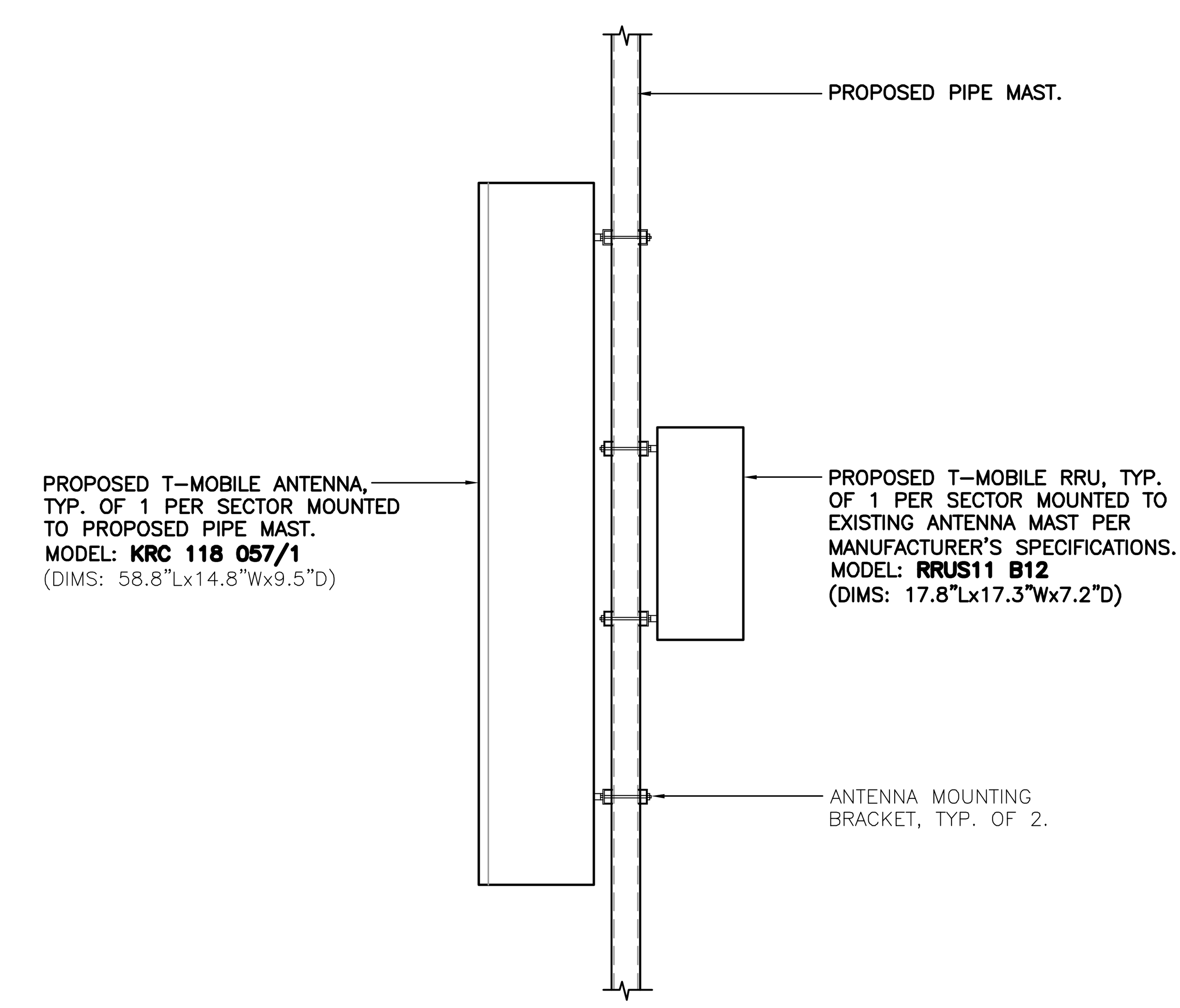
3 PROPOSED RRU DETAIL
C-3
SCALE: 1" = 1'-0"



WEIGHT: 65.0 LB

ERICSSON KRC 118 057/1

2 PROPOSED ANTENNA DETAIL
C-3
SCALE: 1" = 1'-0"



1 PROPOSED ANTENNA/RRH MOUNTING DETAIL
C-3
SCALE: 1" = 1'-0"

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JOB NO. 16159.06

ANTENNA DETAILS

C-3

Sheet No. 5 of 5

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

100' Existing NUDD Lattice Tower

Proposed T-Mobile Antenna Upgrade

T-Mobile Site Ref: CTFF703A

303 Boxwood Lane,
Danbury, CT

CENTEK Project No. 16159.06

Date: October 13, 2016

Prepared for:

T-Mobile USA
35 Griffin Road
Bloomfield, CT 06002

Table of Contents

Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna upgrade proposed by T-Mobile on the existing self supporting lattice tower located in Danbury, Connecticut.

The host tower is a 100-ft, three-legged self-support lattice tower originally designed and manufactured by Fred A. Nudd Corporation; file no: 96-4992 dated January 21, 1997. Subsequent reinforcements were made to the tower per Centek job no. 361A dated November 28, 2001 and Centek job no. 10106 dated August 16, 2010. The tower geometry, structure member sizes and the foundation system information were taken from the aforementioned design documents.

Antenna and appurtenance information were obtained from a previous structural report prepared by Centek job no. 14301.00 dated November 21, 2014 and visual verification from grade conducted by Centek personnel on September 29, 2016.

The tower is made up of five (5) steel sections consisting of A500-42, A500-50, and A500-61ksi pipe legs. Diagonal lateral support bracing consists of A36 single angle and steel rod construction. The vertical tower sections are connected by bolted flange plates while the pipe legs and bracing are connected by welded connections (40'-100'), bolted and welded gusset connections (0'-40'). The tower face width is 7.5-ft at the bottom tapering to 3.5-ft at the top.

T-Mobile proposes the installation of three (3) panel antennas and three (3) remote radio heads mounted on three (3) proposed mounts. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna configuration

Antenna and Appurtenance Summary

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

- AT&T Mobility (Existing):
  Antennas: Six (6) CCI OPA-65R-LUCC-H4 panel antennas, six (6) Ericsson RRUS-11 remote radio heads, three (3) Ericsson RRUS-12 remote radio heads, three (3) Ericsson RRUS-32 remote radio heads, three (3) Ericsson A2 units and four (4) Raycap DC6-48-60-18-8F surge arrestors mounted on three (3) existing sector frames with a RAD center elevation of 98-ft above the existing tower base.
  <u>Coax Cables:</u> Two (2) fiber cable, eight (8) dc control cables and three (3) RET cables running on a face of the existing tower
- Unknown (Existing):
  <u>Antennas:</u> One (1) 3' parabolic grid antenna with a RAD center elevation of 96-ft above the existing tower base.
  <u>Coax Cables:</u> One (1) 1/2" ∅ coax cable.
- Sprint (Existing/Reserved):
  <u>Antennas:</u> Three (3) RFS APXVSPP18-C-A20 panel antennas, three (3) RFS APXVTM14 panel antennas, six (6) Alcatel-Lucent 1900 MHz RRH's, three (3) Alcatel-Lucent 800 MHz RRH's and three (3) Alcatel-Lucent TD-RRH8x20 remote radio heads mounted on three (3) sector frames with a RAD center elevation of 89-ft above the existing tower base.
  <u>Coax Cables:</u> Four (4) 1-1/4" ∅ fiber cables and one (1) RET cable.

- WCSU FM (Existing):
  Antennas: One (1) 4-Bay Shively Labs 6810 FM Antenna w/ Radomes with a RAD center elevation of 65-ft above the existing tower base.
  Coax Cables: One (1) 1 5/8” ∅ coax cable.
- Sprint (Existing):
  Antennas: (1) GPS antenna mounted to a 2’ standoff mount with a RAD center elevation of 30-ft above the existing tower base.
  Coax Cables: One (1) 1/2” ∅ coax cable.
- T-Mobile: (Existing to Remain):
  Antennas: Three (3) Ericsson AIR21 panel antennas and three (3) TMA’s relocated to new antenna mounts with a RAD center elevation of 83-ft above the existing tower base.
  Coax Cables: Twelve (12) 1 5/8” ∅ and one (1) 7/8” ∅ coax cables.
- **T-Mobile: (Proposed):**
  Antennas: Three (3) Ericsson KRC-118 057/01 panel antennas and three (3) Ericsson RRUS-11 remote radio heads mounted on three (3) SitePro WiMAX Tower mounts (p/n CWT02) with a RAD center elevation of 83-ft above the existing tower base.
  Coax Cables: One (1) 1 5/8” ∅ fiber cable.

Primary Assumptions Used in the Analysis

- The tower structure’s theoretical capacity not including any assessment of the condition of the tower.
- The tower carries the horizontal and vertical loads due to the weight of antennas, ice load and wind.
- Tower is properly installed and maintained.
- Tower is in plumb condition.
- Tower loading for antennas and mounts as listed in this report.
- All bolts are appropriately tightened providing the necessary connection continuity.
- All welds are fabricated with ER-70S-6 electrodes.
- All members are assumed to be as specified in the original tower design documents.
- All members are “hot dipped” galvanized in accordance with ASTM A123 and ASTM A153 Standards.
- All member protective coatings are in good condition.
- All tower members were properly designed, detailed, fabricated, installed and have been properly maintained since erection.
- Any deviation from the analyzed antenna loading will require a new analysis for verification of structural adequacy.
- All coax cables shall be routed as specified on in Section 3 of this report.

Analysis

The existing tower was analyzed using a comprehensive computer program entitled tnxTower. The program analyzes the tower, considering the worst case loading condition. The tower is considered as loaded by concentric forces along the tower, and the model assumes that the tower members are subjected to bending, axial, and shear forces.

The existing tower was analyzed for the controlling basic wind speed (3-second gust) with no ice and the applicable wind and ice combination to determine stresses in members as per guidelines of TIA-222-G-2005 entitled “Structural Standard for Antenna Support Structures and Antennas”, the American Institute of Steel Construction (AISC) and the Manual of Steel Construction; Load and Resistance Factor Design (LRFD).

The controlling wind speed is determined by evaluating the local available wind speed data as provided in Appendix N of the CSBC[1] and the wind speed data available in the TIA-222-G-2005 Standard.

Tower Loading

Tower loading was determined by the basic wind speed as applied to projected surface areas with modification factors per TIA-222-G-2005, gravity loads of the tower structure and its components, and the application of 0.75” radial ice on the tower structure and its components.

Basic Wind Speed:	Fairfield; v = 90-110 mph (3-second gust)	*[Annex B of TIA-222-G-2005]*
	Danbury; v = 93 mph (3 second gust)	*[Appendix N of the 2016 CT Building Code]*
Load Cases:	Load Case 1; 93 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.	*[Appendix N of the 2016 CT Building Code]*
	Load Case 2; 50 mph wind speed w/ 0.75” radial ice plus gravity load – used in calculation of tower stresses.	*[Annex B of TIA-222-G-2005]*

[1] The 2012 International Building Code as amended by the 2016 Connecticut State Building Code (CSBC).

Tower Capacity

Tower stresses were calculated utilizing the structural analysis software tnxTower. Allowable stresses were determined based on Table 4-8 of the TIA code.

- Calculated stresses were found to be within allowable limits. In Load Case 2, per tnxtower "Section Capacity Table", this tower was found to be at **86.1%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Diagonal (T2)	60'-0"-80'-0"	86.1%	**PASS**
Leg (T4)	40'-0"-53'-4"	82.2%	**PASS**

Foundation and Anchors

The existing foundation consists of three (3) 2.0-ft ∅ x 4.25-ft long reinforced concrete piers on a 14.5-ft square x 3-ft thick reinforced concrete pad bearing directly on existing sub grade. The existing foundation dimensions and sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned manufacturers original design documents; Fred A. Nudd Corporation; file no: 96-4992. Tower legs are connected to the foundation by means of (4) 1.5" ∅, ASTM A36 anchor bolts per leg, embedded into the concrete foundation structure.

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

Reactions	Vector	Proposed Base Reactions
Base	Shear	**13 kips**
	Compression	**22 kips**
	Moment	**843 kip-ft**
Leg	Shear	**10 kips**
	Compression	**137 kips**
	Uplift	**122 kips**

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

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts	Tension	52.3%	**PASS**

- The foundation was found to be within allowable limits.

Foundation	Design Limit	TIA-222-G Section 9.4 FS(1)	Proposed Loading (FS)(1)	Result
Reinforced Concrete Mat	OTM(2)	1.0	1.79	**PASS**

Conclusion

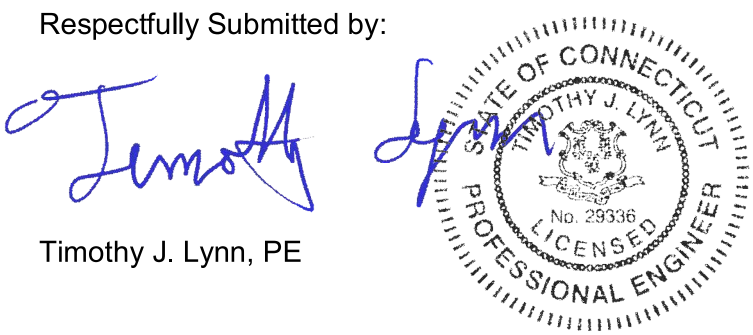
This analysis shows that the subject tower **is adequate** to support the proposed modified antenna configuration with the below recommendations.

- **All coax cables routed as specified in Section 3 of this report.**

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

Please feel free to call with any questions or comments.

Respectfully Submitted by:



Timothy J. Lynn, PE

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

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

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

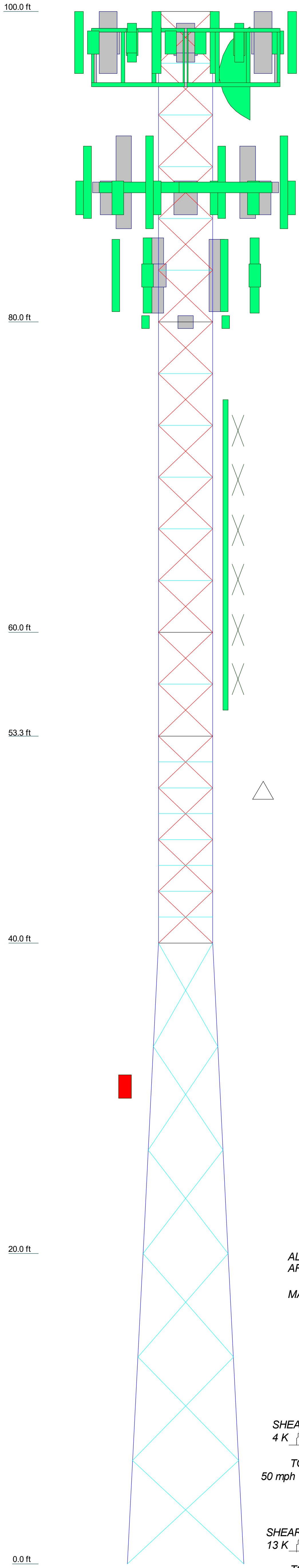
General Description of Structural Analysis Program

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

tnxTower Features:

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

Section	Legs	Leg Grade	Diagonals	Diagonal Grade	Top Girts	Bottom Girts	Horizontals	Sec. Horizontals	Face Width (ft)	# Panels @ (ft)	Weight (K)
T1	P2.5x.276	A500-50	SR 5/8	A36	L1 1/2x1 1/2x3/16	N.A.	L1 1/2x1 1/2x3/16	N.A.	3.5	12 @ 3.33333	0.8
T2	P2.5x.276 (GR)	A500-50	SR 5/8	A36	2L1 1/2x1 1/2x3/16	N.A.	2L1 1/2x1 1/2x3/16	N.A.		12 @ 3.33333	1.1
T3	P3x.3 (GR)	A500M-61	SR 3/4	A36	2L1 1/2x1 1/2x3/16	N.A.	2L1 1/2x1 1/2x3/16	N.A.		2 @ 3.335	0.5
T4	P3x.3 (GR)	A500M-61	SR 3/4	A36	N.A.	2L1 1/2x1 1/2x3/16	N.A.	L2 1/2x2 1/2x5/16		4 @ 3.3325	1.3
T5	P5x.375 (GR)	A500-42	L2x2x3/16	A36	N.A.	N.A.	N.A.	N.A.	5.5	6 @ 6.66667	2.7
T6	P5x.375 (GR)	A500-42	L2 1/2x2 1/2x3/16	A36	N.A.	N.A.	N.A.	N.A.	7.5	6 @ 6.66667	2.9
											9.3



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
(2) OPA-65R-LCUU-H4 (ATT - Existing)	98	FD-RRH 2x50 800 (Sprint - Existing)	88
(2) OPA-65R-LCUU-H4 (ATT - Existing)	98	FD-RRH 2x50 800 (Sprint - Existing)	88
(2) OPA-65R-LCUU-H4 (ATT - Existing)	98	TD-RRH8x20-25 (Sprint - Existing)	88
(2) RRUS-11 (ATT - Existing)	98	TD-RRH8x20-25 (Sprint - Existing)	88
RRUS-12 (ATT - Existing)	98	TD-RRH8x20-25 (Sprint - Existing)	88
RRUS-32 (ATT - Existing)	98	(2) FD-RRH 4x45 1900 (Sprint - Existing)	88
A2 (ATT - Existing)	98	(2) FD-RRH 4x45 1900 (Sprint - Existing)	88
(2) RRUS-11 (ATT - Existing)	98	(2) FD-RRH 4x45 1900 (Sprint - Existing)	88
RRUS-12 (ATT - Existing)	98	AIR21 B2A/B4P (T-Mobile - Existing)	83
RRUS-32 (ATT - Existing)	98	AIR21 B2A/B4P (T-Mobile - Existing)	83
A2 (ATT - Existing)	98	AIR21 B2A/B4P (T-Mobile - Existing)	83
(2) RRUS-11 (ATT - Existing)	98	KRC 118 057/1 (T-Mobile - Proposed)	83
RRUS-12 (ATT - Existing)	98	KRC 118 057/1 (T-Mobile - Proposed)	83
RRUS-32 (ATT - Existing)	98	KRC 118 057/1 (T-Mobile - Proposed)	83
A2 (ATT - Existing)	98	RRUS-11 (T-Mobile - Proposed)	83
DC6-48-60-18-8F Surge Arrestor (ATT - Existing)	98	RRUS-11 (T-Mobile - Proposed)	83
DC6-48-60-18-8F Surge Arrestor (ATT - Existing)	98	RRUS-11 (T-Mobile - Proposed)	83
DC6-48-60-18-8F Surge Arrestor (ATT - Existing)	98	Site Pro WiMAX Tower Mount CWT02 (T-Mobile - Proposed)	83
DC6-48-60-18-8F Surge Arrestor (ATT - Existing)	98	Site Pro WiMAX Tower Mount CWT02 (T-Mobile - Proposed)	83
12' Boom Starmount (ATT - Existing)	97	Site Pro WiMAX Tower Mount CWT02 (T-Mobile - Proposed)	83
12' Boom Starmount (ATT - Existing)	97	ATMAA1412D-1A20 Twin TMA (T-Mobile - Existing)	80
12' Boom Starmount (ATT - Existing)	97	ATMAA1412D-1A20 Twin TMA (T-Mobile - Existing)	80
Parabolic Grid	96	ATMAA1412D-1A20 Twin TMA (T-Mobile - Existing)	80
APXVSPP18-C-A20 (Sprint - Existing)	89	6810 4 Bay	65
APXVSPP18-C-A20 (Sprint - Existing)	89	2.5" Tube x 2' Standoff (Sprint)	30
APXVSPP18-C-A20 (Sprint - Existing)	89	GPS (Sprint)	30
APXVTM14 (Sprint - Existing)	89		
APXVTM14 (Sprint - Existing)	89		
APXVTM14 (Sprint - Existing)	89		
13-ft T-Frame (Sprint - Existing)	89		
13-ft T-Frame (Sprint - Existing)	89		
13-ft T-Frame (Sprint - Existing)	89		
FD-RRH 2x50 800 (Sprint - Existing)	88		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A500-50	50 ksi	62 ksi	A500M-61	61 ksi	75 ksi
A36	36 ksi	58 ksi	A500-42	42 ksi	58 ksi

TOWER DESIGN NOTES

1. Tower designed for Exposure B to the TIA-222-G Standard.
2. Tower designed for a 93 mph basic wind in accordance with the TIA-222-G Standard.
3. Tower is also designed for a 50 mph basic wind with 0.75 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 60 mph wind.
5. Tower Structure Class II.
6. Topographic Category 1 with Crest Height of 0.00 ft
7. Grouted pipe f'c is 5 ksi
8. 3/4" dia SR used for sections T3 _T4 to account for 5/8" SR with 1/4" bar
9. TOWER RATING: 86.1%

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 137 K
SHEAR: 10 K

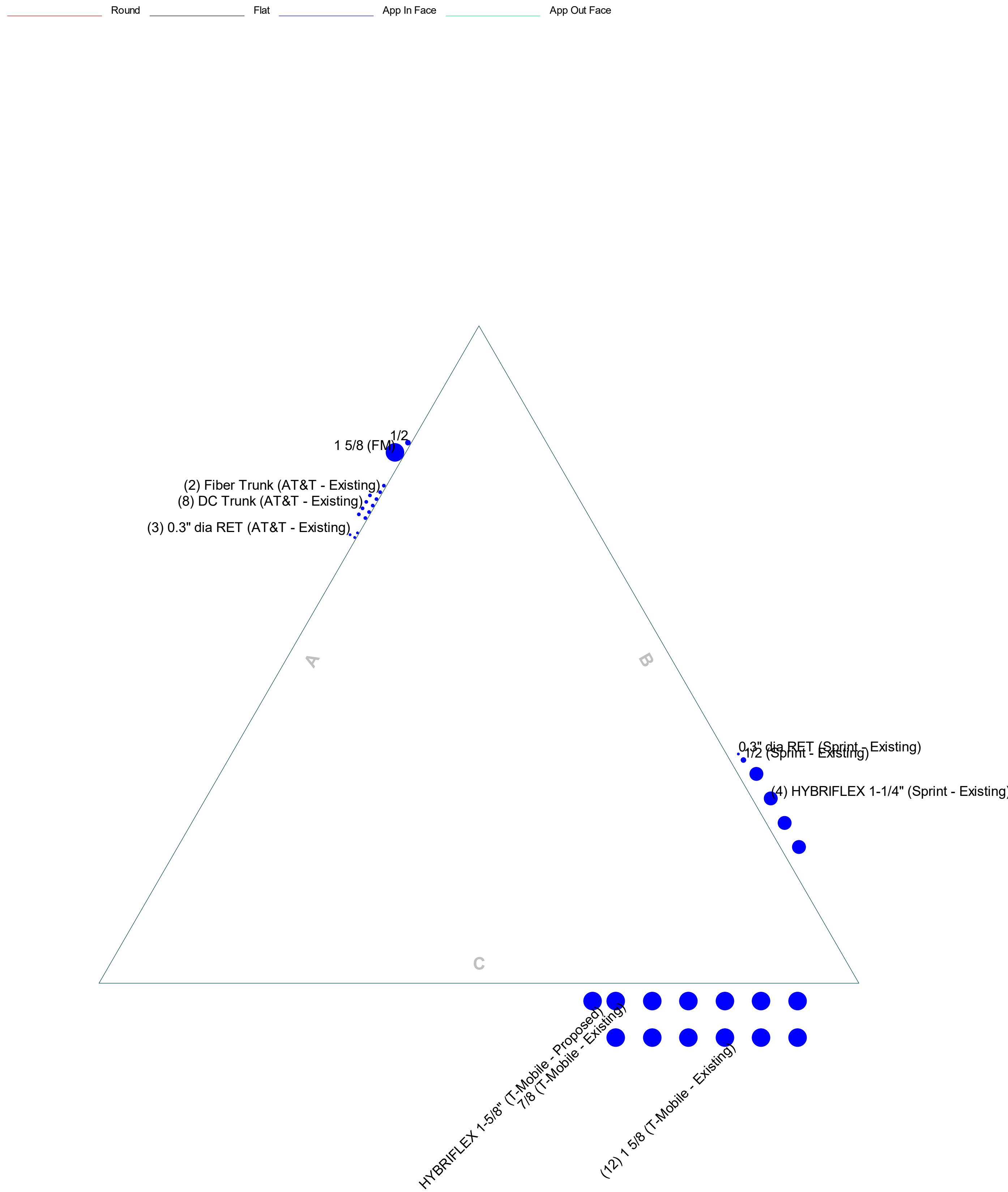
UPLIFT: -122 K
SHEAR: 8 K

AXIAL 55 K
SHEAR 4 K
MOMENT 297 kip-ft
TORQUE 1 kip-ft
50 mph WIND - 0.7500 in ICE

AXIAL 22 K
SHEAR 13 K
MOMENT 843 kip-ft
TORQUE 3 kip-ft
REACTIONS - 93 mph WIND

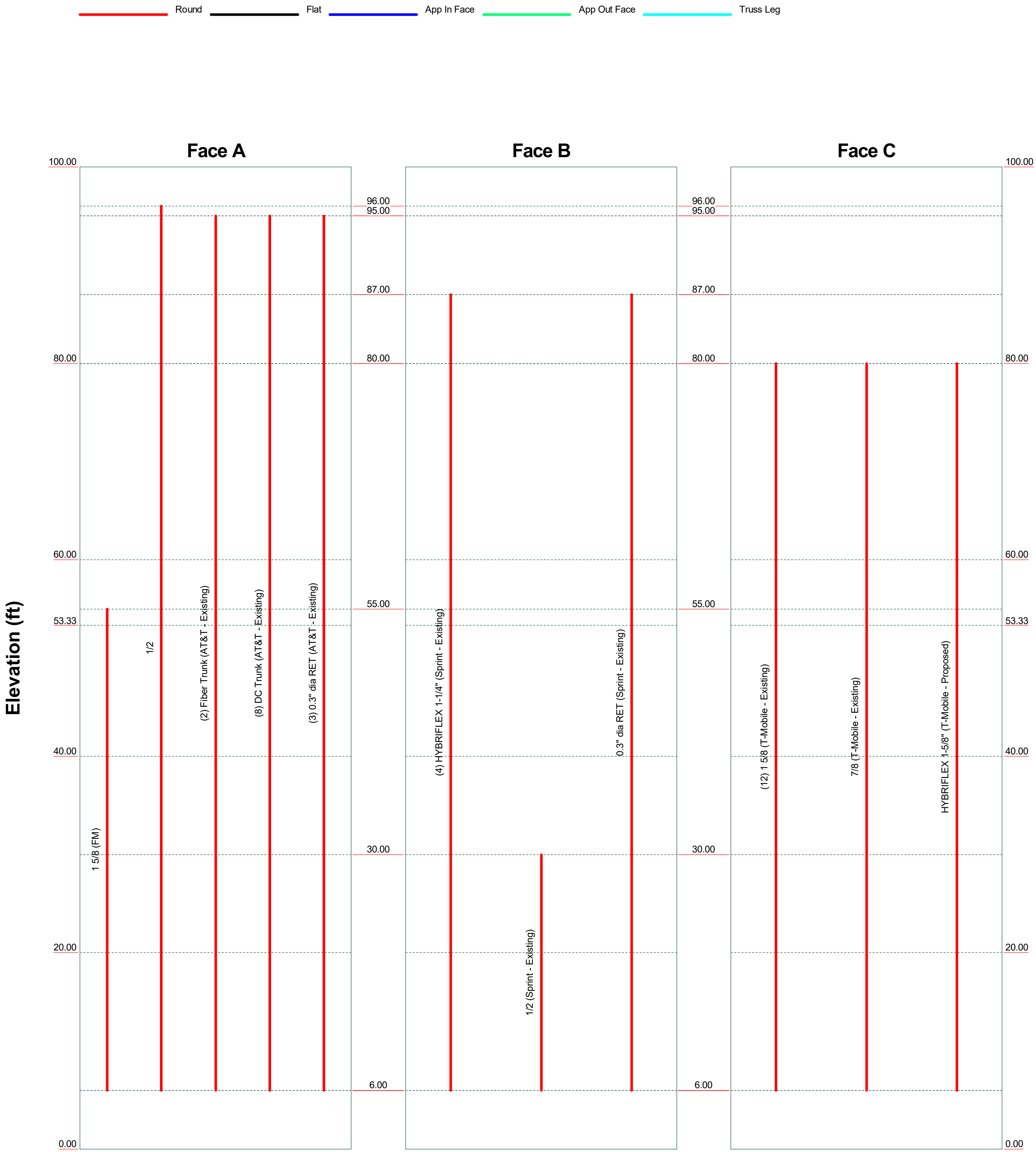
Centek Engineering Inc.	Job: 16159.06 - CTFF703A		
63-2 North Branford Rd.	Project: 100' Nudd Lattice - 303 Boxwood Lane, Danbury, CT		
Branford, CT 06405	Client: T-Mobile	Drawn by: TJL	App'd:
Phone: (203) 488-0580	Code: TIA-222-G	Date: 10/13/16	Scale: NTS
FAX: (203) 488-8587	Path:		Dwg No. E-1

Feed Line Plan



Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job: ***16159.06 - CTFF703A***		
	Project: ***100' Nudd Lattice - 303 Boxwood Lane, Danbury, CT***		
	Client: T-Mobile	Drawn by: TJL	App'd:
	Code: TIA-222-G	Date: 10/13/16	Scale: NTS
	Path:		Dwg No. E-7

Feed Line Distribution Chart
0' - 100'



Centek Engineering Inc.	Job: ***16159.06 - CTFF703A***		
63-2 North Branford Rd.	Project: ***100' Nudd Lattice - 303 Boxwood Lane, Danbury, CT***		
Branford, CT 06405	Client: T-Mobile	Drawn by: TJL	App'd:
Phone: (203) 488-0580	Code: TIA-222-G	Date: 10/13/16	Scale: NTS
FAX: (203) 488-8587	Path:		Dwg No. E-7

Pier and Mat Foundation Analysis:

Input Data:

Tower Data

Overturning Moment =	$OM := 843 \cdot ft \cdot kips$	(User Input from tnxTower)
Shear Force =	$S_t := 13 \cdot kip$	(User Input from tnxTower)
Axial Force =	$WT_t := 22 \cdot kip$	(User Input from tnxTower)
Max Compression Force =	$C_t := 137 \cdot kip$	(User Input from tnxTower)
Max Uplift Force =	$U_t := 122 \cdot kip$	(User Input from tnxTower)
Tower Height =	$H_t := 100 \cdot ft$	(User Input)
Tower Width =	$W_t := 7.5 \cdot ft$	(User Input)
Tower Position on Foundation (1=offset, 2=centered) =	$Pos_t := 2$	(User Input)

Footing Data:

Overall Depth of Footing =	$D_f := 7.0 \cdot ft$	(User Input)
Length of Pier =	$L_p := 4.25 \cdot ft$	(User Input)
Extension of Pier Above Grade =	$L_{pag} := 0.25 \cdot ft$	(User Input)
Diameter of Pier =	$d_p := 2.0 \cdot ft$	(User Input)
Thickness of Footing =	$T_f := 3.0 \cdot ft$	(User Input)
Width of Footing =	$W_f := 14.5 \cdot ft$	(User Input)

Material Properties:

Concrete Compressive Strength =	$f_c := 4000 \cdot psi$	(User Input)	
Steel Reinforcment Yield Strength =	$f_y := 60000 \cdot psi$	(User Input)	
Internal Friction Angle of Soil =	$\Phi_s := 30 \cdot deg$	(User Input)	
Allowable Soil Bearing Capacity =	$q_s := 10000 \cdot psf$	(User Input)	
Unit Weight of Soil =	$\gamma_{soil} := 120 \cdot pcf$	(User Input)	
Unit Weight of Concrete =	$\gamma_{conc} := 150 \cdot pcf$	(User Input)	
Foundation Bouyancy =	$Bouyancy := 0$	(User Input)	(Yes=1 / No=0)
Depth to Neglect =	$n := 0 \cdot ft$	(User Input)	
Cohesion of Clay Type Soil =	$c := 0 \cdot ksf$	(User Input)	(Use 0 for Sandy Soil)
Seismic Zone Factor =	$Z := 2$	(User Input)	(UBC-1997 Fig 23-2)
Coefficient of Friction Between Concrete =	$\mu := 0.45$	(User Input)	

Pier Reinforcement:

Bar Size =	$BS_{pier} := 8$	(User Input)	
Bar Diameter =	$d_{bpier} := 1.0 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 8$	(User Input)	
Clear Cover of Reinforcement =	$Cvr_{pier} := 3 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Diameter of Tie =	$d_{Tie} := 4 \cdot in$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{top} := 6$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 0.750 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 15$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 8$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 1.000 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 15$	(User Input)	(Bottom of Pad)
Clear Cover of Reinforcement =	$Cvr_{pad} := 3.0 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)

Calculated Factors:

Pier Reinforcement Bar Area = $A_{bpier} := \frac{\pi \cdot d_{bpier}^2}{4} = 0.785 \cdot in^2$

Pad Top Reinforcement Bar Area = $A_{btop} := \frac{\pi \cdot d_{btop}^2}{4} = 0.442 \cdot in^2$

Pad Bottom Reinforcement Bar Area = $A_{bbot} := \frac{\pi \cdot d_{bbot}^2}{4} = 0.785 \cdot in^2$

Coefficient of Lateral Soil Pressure = $K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 3$

Load Factor = $LF := 1$

Stability of Footing:

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

Adjusted Soil Unit Weight = $\gamma_s := \text{if}\left(\text{Bouyancy} = 1, \gamma_{soil} - 62.4\text{pcf}, \gamma_{soil}\right) = 120\cdot\text{pcf}$

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

$P_{pt} := K_p\cdot\gamma_s\cdot\left(D_f - T_f\right) + c\cdot 2\cdot\sqrt{K_p} = 1.44\cdot\text{ksf}$

$P_{top} := \text{if}\left[n < \left(D_f - T_f\right), P_{pt}, P_{pn}\right] = 1.44\cdot\text{ksf}$

$P_{bot} := K_p\cdot\gamma_s\cdot D_f + c\cdot 2\cdot\sqrt{K_p} = 2.52\cdot\text{ksf}$

$$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 1.98\cdot\text{ksf}$$

$T_p := \text{if}\left[n < \left(D_f - T_f\right), T_f, \left(D_f - n\right)\right] = 3\cdot\text{ft}$

$A_p := W_f\cdot T_p = 43.5\cdot\text{ft}^2$

Ultimate Shear = $S_u := P_{ave}\cdot A_p = 86.13\cdot\text{kip}$

Weight of Concrete = $$WT_c := \left[\left(W_f^{\,2}\cdot T_f\right) + (3)\cdot\left(\frac{d_p^{\,2}\cdot\pi}{4}\cdot L_p\right)\right]\cdot\gamma_c = 100.621\cdot\text{kip}$$

Weight of Soil Above Footing = $$WT_{s1} := \left[\left[W_f^{\,2} - (3)\cdot\left(\frac{d_p^{\,2}\cdot\pi}{4}\right)\right]\cdot\left(\left|L_p - L_{pag} - n\right|\right)\right]\cdot\gamma_s = 96.4\cdot\text{kip}$$

Weight of Soil Wedge at Back Face = $$WT_{s2} := \left[\frac{\left(D_f - n\right)^2\cdot\tan\left(\Phi_s\right)}{2}\cdot W_f\right]\cdot\gamma_s = 24.612\cdot\text{kip}$$

Foundation has undercut toe per Fred A. Nudd dwg 96-4992-1

Tower Offset = $$X_{t1} := \left[\frac{W_f}{2} - \frac{\left(W_t\cdot\cos(30\cdot\text{deg})\right)}{2}\right] \qquad X_{t2} := \frac{W_f}{2} - \frac{\left(W_t\cdot\cos(30\cdot\text{deg})\right)}{3}$$

$X_t := \text{if}\left(\text{Pos}_t = 1, X_{t1}, X_{t2}\right) = 5.085$

$$X_{off1} := \frac{W_f}{2} - \left[\frac{\left(W_t\cdot\cos(30\cdot\text{deg})\right)}{3} + X_t\right] = 0 \qquad X_{off2} := 0$$

$X_{off} := \text{if}\left(\text{Pos}_t = 1, X_{off1}, X_{off2}\right) \qquad X_{off} = 0\cdot\text{ft}$

Total Weight = $WT_{tot} := 0.9WT_c + 0.75WT_{s1} = 162.9\cdot\text{kip}$

Resisting Moment = $$M_r := \left(WT_{tot}\right)\cdot\frac{W_f}{2} + 0.9WT_t\cdot\left(\frac{W_f}{2} - X_{off}\right) + 0.75\left(S_u\cdot\frac{T_p}{3}\right) + 0.75WT_{s2}\cdot\left[W_f + \frac{\left(D_f - n\right)\cdot\tan\left(\Phi_s\right)}{3}\right] = 1681\cdot\text{kip}\cdot\text{ft}$$

Overturning Moment = $M_{ot} := OM + S_t\cdot\left(L_p + T_f\right) = 937.3\cdot\text{kip}\cdot\text{ft}$

Foundation has undercut toe per Fred A. Nudd dwg 96-4992-1

Factor of Safety Actual = $$FS := \frac{M_r}{M_{ot}} = 1.79$$

Factor of Safety Required = $FS_{req} := 1$ $\quad$ OverTurning_Moment_Check := if$\left(FS \ge FS_{req}, \text{"Okay"}, \text{"No Good"}\right)$

OverTurning_Moment_Check = "Okay"

Shear Capacity in Pier:

Shear Resistance of Pier = $S_p := \dfrac{P_{ave} \cdot A_p + \mu \cdot WT_{tot}}{FS_{req}} = 159.415 \cdot kips$

Shear_Check := if($S_p > S_t$, "Okay" , "No Good")

Shear_Check = "Okay"

Bearing Pressure Caused by Footing:

Total Load = $Load_{tot} := WT_c + WT_{s1} + WT_t = 219 \cdot kip$

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

Section Modulus of Mat = $S := \dfrac{W_f^{\,3}}{6} = 508.1 \cdot ft^3$

Maximum Pressure in Mat = $P_{max} := \dfrac{Load_{tot}}{A_{mat}} + \dfrac{M_{ot}}{S} = 2.886 \cdot ksf$

Max_Pressure_Check := if($P_{max} < 0.75 q_s$, "Okay" , "No Good")

Max_Pressure_Check = "Okay"

Minimum Pressure in Mat = $P_{min} := \dfrac{Load_{tot}}{A_{mat}} - \dfrac{M_{ot}}{S} = -0.803 \cdot ksf$

Min_Pressure_Check := if[($P_{min} \geq 0$)·($P_{min} < 0.75 q_s$), "Okay" , "No Good"]

Min_Pressure_Check = "No Good"

Distance to Resultant of Pressure Distribution = $X_p := \dfrac{P_{max}}{\dfrac{P_{max} - P_{min}}{W_f}} \cdot \dfrac{1}{3} = 3.781$

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

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

Eccentricity = $e := \dfrac{M_{ot}}{Load_{tot}} = 4.279$

Adjusted Soil Pressure = $P_a := \dfrac{2 \cdot Load_{tot}}{3 \cdot W_f \cdot \left(\dfrac{W_f}{2} - e\right)} = 3.39 \cdot ksf$

$q_{adj} := \text{if}(P_{min} < 0, P_a, P_{max}) = 3.39 \cdot ksf$

Pressure_Check := if($q_{adj} < 0.75 q_s$, "Okay" , "No Good")

Pressure_Check = "Okay"

Concrete Bearing Capacity:

Strength Reduction Factor = $\Phi_c := 0.65$ (ACI-2008 9.3.2.2)

Bearing Strength Between Pier and Pad = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 999.78 \cdot kips$ (ACI-2008 10.14)

Bearing_Check := if($P_b > LF \cdot C_t$, "Okay", "No Good")

Bearing_Check = "Okay"

Shear Strength of Concrete:

Beam Shear: (Critical section located at a distance d from the face of Pier) (ACI 11.3.1.1)

$\phi_c := 0.85$ (ACI 9.3.2.5)

$d := T_f - Cvr_{pad} - d_{bbot} = 32 \cdot in$

$FL := LF \cdot \frac{C_t}{W_f^2} = 0.652 \cdot ksf$

$V_{req} := FL \cdot (X_t - .5 \cdot d_p - d) \cdot W_f = 13.4 \cdot kips$

$V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f_c \cdot psi} \cdot W_f \cdot d = 599 \cdot kip$ (ACI-2008 11.2.1.1)

Beam_Shear_Check := if($V_{req} < V_{Avail}$, "Okay", "No Good")

Beam_Shear_Check = "Okay"

Punching Shear: (Critical Section Located at a distance of d/2 from the face of pier) (ACI 11.11.1.2)

Critical Perimeter of Punching Shear = $b_o := (d_p + d) \cdot \pi = 14.7$

Area Included Inside Perimeter = $A_{bo} := \frac{\pi \cdot (d_p + d)^2}{4} = 17.1$

Required Shear Strength = $V_{req} := FL \cdot (W_f^2 - A_{bo}) = 126 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 1210.6 \cdot kip$ (ACI-2008 11.11.2.1)

Punching_Shear_Check := if($V_{req} < V_{Avail}$, "Okay", "No Good")

Punching_Shear_Check = "Okay"

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

Strength Reduction Factor = $\phi_m := .90$ (ACI-2008 9.3.2.1)

Maximum Moment in Pad = $M_{max} := 352 \cdot kip \cdot ft$ (User Input)

Design Moment = $M_n := \dfrac{LF \cdot M_{max}}{\phi_m} = 391.111 \cdot kips \cdot ft$

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

(ACI-200810.2.7.3)

$$b_{eff} := W_t \cdot \cos(30 \cdot deg) + d_p = 101.942 \cdot in$$

$$A_s := \frac{M_n}{\left(f_y \cdot d\right)} = 2.444 \cdot in^2$$

$$a := \frac{A_s \cdot f_y}{\beta \cdot f_c \cdot b_{eff}} = 0.423 \cdot in$$

$$A_s := \frac{M_n}{f_y \cdot \left(d - \dfrac{a}{2}\right)} = 2.461 \cdot in^2$$

$$\rho := \frac{A_s}{b_{eff} \cdot d} = 0.00905 \cdot in$$

Required Reinforcement for Temperature and Shrinkage:

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

Check Bottom Bars:

$As := \text{if}\left(\rho \geq \rho_{sh}, A_s, \rho_{sh} \cdot \frac{b_{eff}}{2} \cdot d\right) = 2.9 \cdot in^2$

$As_{prov} := A_{bbot} \cdot NB_{bot} = 11.8 \cdot in^2$

Pad_Reinforcement_Bot := if($As_{prov} > As$, "Okay", "No Good")

Pad_Reinforcement_Bot = "Okay"

Check top Bars:

$As := \text{if}\left(\rho \geq \rho_{sh}, A_s, \rho_{sh} \cdot \frac{b_{eff}}{2} \cdot d\right) = 2.9 \cdot in^2$

$As_{prov} := A_{btop} \cdot NB_{top} = 6.6 \cdot in^2$

Pad_Reinforcement_Top := if($As_{prov} > As$, "Okay", "No Good")

Pad_Reinforcement_Top = "Okay"

Developement Length Pad Reinforcement:

Bar Spacing = $B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 10.93 \cdot in$

Spacing or Cover Dimension = $c := \text{if}\left(Cvr_{pad} < \frac{B_{sPad}}{2}, Cvr_{pad}, \frac{B_{sPad}}{2}\right) = 3 \cdot in$

Transverse Reinforcement Index = $k_{tr} := 0$ (ACI-2008 12.2.3)

$L_{dbt} := \frac{3 \cdot f_y \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 23.7 \cdot in$

Minimum Development Length = $L_{dbmin} := 12 \cdot in$ (ACI-2008 12.2.1)

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

Available Length in Pad = $L_{Pad} := \frac{W_f}{2} - \frac{W_t}{2} - Cvr_{pad} = 39 \cdot in$

Lpad_Check := if($L_{Pad} > L_{dbt}$, "Okay", "No Good")

Lpad_Check = "Okay"

Steel Reinforcement in Pier:

Area of Pier = $A_p := \frac{\pi \cdot d_p^2}{4} = 452.39 \cdot in^2$

$A_{smin} := 0.01 \cdot 0.5 \cdot A_p = 2.26 \cdot in^2$ (ACI-2008 10.8.4 & 10.9.1)

$A_{sprov} := NB_{pier} \cdot A_{bpier} = 6.28 \cdot in^2$

$Steel\_Area\_Check := if(A_{sprov} > A_{smin}, "Okay", "No Good")$

$Steel\_Area\_Check = "Okay"$

Bar Spacing In Pier = $B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 8.425 \cdot in$

Diameter of Reinforcement Cage = $Diam_{cage} := d_p - 2 \cdot Cvr_{pier} = 18 \cdot in$

Maximum Moment in Pier = $M_p := S_t \cdot (L_p) \cdot LF = 663 \cdot in \cdot kips$

Pier Check evaluated from outside program and results are listed below;

$$\begin{pmatrix} D & N & n & P_u & M_{xu} \end{pmatrix} := \begin{pmatrix} d_p \cdot 12 & NB_{pier} & BS_{pier} & \frac{C_t \cdot 1.333}{kips} & \frac{M_p}{in \cdot kips} \end{pmatrix}$$

$$\begin{pmatrix} D & N & n & P_u & M_{xu} \end{pmatrix} = (24 \quad 8 \quad 8 \quad 182.621 \quad 663)$$

$$\begin{pmatrix} \phi P_n & \phi M_{xn} & f_{sp} & \rho \end{pmatrix} := (0 \quad 0 \quad 0 \quad 0)$$

$$\begin{pmatrix} \phi P_n & \phi M_{xn} & f_{sp} & \rho \end{pmatrix} := \phi P'_n(D, N, n, P_u, M_{xu})^T$$

$$\begin{pmatrix} \phi P_n & \phi M_{xn} & f_{sp} & \rho \end{pmatrix} = \begin{pmatrix} 674.98 & 2.45 \times 10^3 & -18.903 & 0.014 \end{pmatrix}$$

$Axial\_Load\_Check := if(\phi P_n \geq P_u, "Okay", "No Good")$

$Axial\_Load\_Check = "Okay"$

$Bending\_Check := if(\phi M_{xn} \geq M_{xu}, "Okay", "No Good")$

$Bending\_Check = "Okay"$

Development Length Pier Reinforcement:

Available Length in Foundation:

$L_{pier} := L_p - Cvr_{pier} = 48 \cdot in$

$L_{pad} := T_f - Cvr_{pad} = 33 \cdot in$

Tension: (ACI-2008 12.2.3)

Spacing or Cover Dimension = $c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right) = 3 \cdot in$

Transverse Reinforcement = $k_{tr} := 0$ (ACI-2008 12.2.3)

$$L_{dbt} := \frac{3 \cdot f_y \cdot \alpha_{pier} \cdot \beta_{pier} \cdot \gamma_{pier} \cdot \lambda_{pier}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \left(\frac{c + k_{tr}}{d_{bpier}}\right)} \cdot d_{bpier} = 23.72 \cdot in$$

Minimum Development Length = $L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f_c}{psi}}} \cdot .7 = 13.282 \cdot in$ (ACI 12.2.1)

Pier reinforcement bars are standard 90 degree hooks and therefore developement in the pad is computed as follows:

$L_{db} := max(L_{dbt}, L_{dbmin}) = 23.717 \cdot in$

$L_{tension\_Check} := if(L_{pier} + L_{pad} > L_{dbt}, \text{"Okay"}, \text{"No Good"})$

$L_{tension\_Check} = \text{"Okay"}$

Compression: (ACI-2008 12.3.2)

$$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot f_y}{\sqrt{f_c \cdot psi}} = 18.974 \cdot in$$

$$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot (d_{bpier} \cdot f_y) = 18 \cdot in$$

$L_{dbc} := if(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}) = 18.974 \cdot in$

$L_{compression\_Check} := if(L_{pier} + L_{pad} > L_{dbc}, \text{"Okay"}, \text{"No Good"})$

$L_{compression\_Check} = \text{"Okay"}$

Tie Size and Spacing in Column:

Minimum Tie Size = $Tie_{min} := if(BS_{pier} \le 10, 3, 4) = 3$

Used #4 Ties

Seismic Factor = $z := if(Z \le 2, 1, 0.5) = 1$ (ACI-2008 21.10.5)

$s_{lim1} := 16 \cdot d_{bpier} \cdot z = 16 \cdot in$

$$s_{lim2} := \frac{48 \cdot d_{Tie}}{8} \cdot z = 24 \cdot in$$

$s_{lim3} := D_f \cdot z = 84 \cdot in$

$s_{lim4} := 18in$

Maximum Spacing = $$s_{tie} := min\left(\left(\begin{matrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{matrix}\right)\right) = 16 \cdot in$$

Number of Ties Required = $$n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 = 3.813$$

RAN Template:	A&L Template:
702Cc Outdoor	702Cc

CTFF703A_1.1_L700

Section 1 - Site Information

Site ID: CTFF703A
Status: Draft
Version: 1.1
Project Type: L700
Approved: Not Approved
Approved By: Not Approved
Last Modified: 9/22/2016 12:03:41 PM
Last Modified By: GSM1900\VJaini

Site Name: CT703/WCSU ET
Site Class: Self Support Tower
Site Type: Structure Non Building
Solution Type:
Plan Year:
Market: CONNECTICUT
Vendor: Ericsson
Landlord: State of Connecticut

Latitude: 41.39472156
Longitude: -73.48666590
Address: 303 Boxwood Lane
City, State: Danbury, CT
Region: NORTHEAST

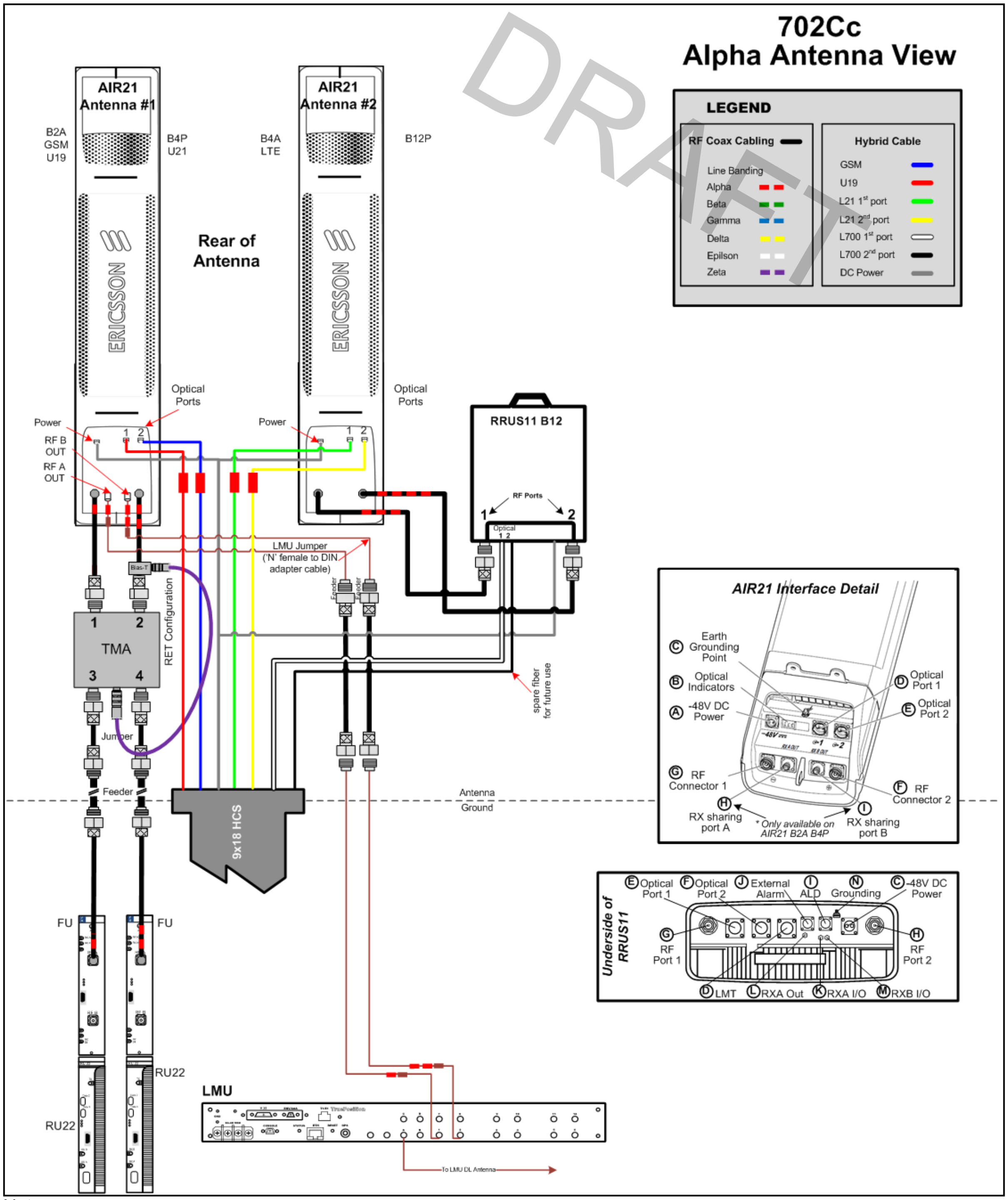
RAN Template: 702Cc Outdoor		**AL Template:** 702Cc		
Sector Count: 3	**Antenna Count:** 6	**Coax Line Count:** 6	**TMA Count:** 3	**RRU Count:** 3

Section 2 - Existing Template Images

----- This section is intentionally blank. -----

Section 3 - Proposed Template Images

AL_702Cc.png



Notes:

Section 4 - Siteplan Images

----- This section is intentionally blank. -----

RAN Template:	A&L Template:
702Cc Outdoor	702Cc

CTFF703A_1.1_L700

Section 5 - RAN Equipment

Existing RAN Equipment

Template: 1B

Enclosure	1	2
Enclosure Type	RBS 3106	RBS 6102
Baseband		DUL20, DUW30 **(x2)**, DUG20
Radio		RUS01 B4 **(x6)**

Proposed RAN Equipment

Template: 702Cc Outdoor

Enclosure	1	2
Enclosure Type	RBS 6131	Tower Top Mount
Baseband	DUS41 (L2100, L700), DUW30 (U2100), DUW30 (U1900), DUG20 (G1900)	
Hybrid Cable System		Ericsson 9x18 HCS *Select Length*
Multiplexer	XMU	
Radio	RU22 **(x6)** (U2100)	

RAN Scope of Work:

RAN Template:	A&L Template:
702Cc Outdoor	702Cc

CTFF703A_1.1_L700

Section 6 - A&L Equipment

Existing Template: 1B
Proposed Template: 702Cc

Sector 1 (Existing) view from behind		
Coverage Type	A - Outdoor Macro	
Antenna	1	
Antenna Model	AIR21 B2A/B4P (Quad)	
Azimuth	30	
M. Tilt	0	
Height	83	
Ports	P1	P2
Active Tech.	U1900 G1900	U2100 L2100
Dark Tech.		
Restricted Tech.		
Decomm. Tech.		
E. Tilt	2	2
Cables	1-5/8" LMU Coax - 125 ft. 1-5/8" LMU Coax - 125 ft. Fiber Jumper - 15 ft. Fiber Jumper - 15 ft.	1-5/8" Coax - 125 ft. 1-5/8" Coax - 125 ft.
TMAs		Generic Style 1B - Twin AWS
Diplexers / Combiners		
Radio		
Sector Equipment		

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
702Cc Outdoor	702Cc

CTFF703A_1.1_L700

Sector 1 (Proposed) view from behind				
Coverage Type	A - Outdoor Macro			
Antenna	1		2	
Antenna Model	AIR21 B2A/B4P (Quad)		KRC 118 057/1 (Quad)	
Azimuth	30		30	
M. Tilt	0		0	
Height	83		83	
Ports	P1	P2	P3	P4
Active Tech.	U1900 G1900	U2100	L2100	L700
Dark Tech.				
Restricted Tech.				
Decomm. Tech.				
E. Tilt	2	2	2	2
Cables	1-5/8" LMU Coax - 125 ft. 1-5/8" LMU Coax - 125 ft. Fiber Jumper Fiber Jumper	1-5/8" Coax - 125 ft. 1-5/8" Coax - 125 ft.	Fiber Jumper Fiber Jumper	Fiber Jumper Fiber Jumper
TMAs		Generic Style 1B - Twin AWS		
Diplexers / Combiners				
Radio				RRUS11 B12
Sector Equipment				

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
702Cc Outdoor	702Cc

CTFF703A_1.1_L700

Sector 2 (Existing) view from behind		
Coverage Type	A - Outdoor Macro	
Antenna	1	
Antenna Model	AIR21 B2A/B4P (Quad)	
Azimuth	150	
M. Tilt	0	
Height	83	
Ports	P1	P2
Active Tech.	U1900 G1900	U2100 L2100
Dark Tech.		
Restricted Tech.		
Decomm. Tech.		
E. Tilt	4	4
Cables	Fiber Jumper - 15 ft. 1-5/8" LMU Coax - 125 ft. 1-5/8" LMU Coax - 125 ft. Fiber Jumper - 15 ft.	1-5/8" Coax - 125 ft. 1-5/8" Coax - 125 ft.
TMAs		Generic Style 1B - Twin AWS
Diplexers / Combiners		
Radio		
Sector Equipment		

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
702Cc Outdoor	702Cc

CTFF703A_1.1_L700

Sector 2 (Proposed) view from behind

Coverage Type	A - Outdoor Macro			
Antenna	1		2	
Antenna Model	AIR21 B2A/B4P (Quad)		KRC 118 057/1 (Quad)	
Azimuth	150		150	
M. Tilt	0		0	
Height	83		83	
Ports	P1	P2	P3	P4
Active Tech.	U1900 G1900	U2100	L2100	L700
Dark Tech.				
Restricted Tech.				
Decomm. Tech.				
E. Tilt	2	2	2	2
Cables	1-5/8" LMU Coax - 125 ft. 1-5/8" LMU Coax - 125 ft. Fiber Jumper Fiber Jumper	1-5/8" Coax - 125 ft. 1-5/8" Coax - 125 ft.	Fiber Jumper Fiber Jumper	Fiber Jumper Fiber Jumper
TMAs		Generic Style 1B - Twin AWS		
Diplexers / Combiners				
Radio				RRUS11 B12
Sector Equipment				

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
702Cc Outdoor	702Cc

CTFF703A_1.1_L700

Sector 3 (Existing) view from behind		
Coverage Type	A - Outdoor Macro	
Antenna	1	
Antenna Model	AIR21 B2A/B4P (Quad)	
Azimuth	270	
M. Tilt	0	
Height	83	
Ports	P1	P2
Active Tech.	U1900 G1900	U2100 L2100
Dark Tech.		
Restricted Tech.		
Decomm. Tech.		
E. Tilt	2	2
Cables	1-5/8" LMU Coax - 125 ft. 1-5/8" LMU Coax - 125 ft. Fiber Jumper - 15 ft. Fiber Jumper - 15 ft.	1-5/8" Coax - 125 ft. 1-5/8" Coax - 125 ft.
TMAs		Generic Style 1B - Twin AWS
Diplexers / Combiners		
Radio		
Sector Equipment		

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
702Cc Outdoor	702Cc

CTFF703A_1.1_L700

Sector 3 (Proposed) view from behind				
Coverage Type	A - Outdoor Macro			
Antenna	1		2	
Antenna Model	AIR21 B2A/B4P (Quad)		KRC 118 057/1 (Quad)	
Azimuth	270		270	
M. Tilt	0		0	
Height	83		83	
Ports	P1	P2	P3	P4
Active Tech.	U1900 G1900	U2100	L2100	L700
Dark Tech.				
Restricted Tech.				
Decomm. Tech.				
E. Tilt	2	2	2	2
Cables	1-5/8" LMU Coax - 125 ft. 1-5/8" LMU Coax - 125 ft. Fiber Jumper Fiber Jumper	1-5/8" Coax - 125 ft. 1-5/8" Coax - 125 ft.	Fiber Jumper Fiber Jumper	Fiber Jumper Fiber Jumper
TMAs		Generic Style 1B - Twin AWS		
Diplexers / Combiners				
Radio				RRUS11 B12
Sector Equipment				

Unconnected Equipment:

Scope of Work:

RRUS 11

Frequency (AT&T)
- ✓ Band 12 (Lower 700 MHz)
- ✓ Band 4 (AWS, 17/2100 MHz) — 2Q2011

RF Characteristics
- ✓ Output power: 2x30 Watts
- ✓ 2x2 MIMO Capable
- ✓ IBW of 20 MHz
- ✓ Rx Sens.: Better than -105 dBm (5 MHz)

RET/TMA Support
- ✓ AISG 2.0 Compatible
- ✓ Via RET Port and Centre Conductor
- ✓ Cascading
- ✓ 30 VDC Bias

Environmental
- ✓ Self Convection
- ✓ Temperature -40 to 131 F

Power
- ✓ Input voltage: -48 VDC or AC (exemption)
- ✓ Fuse size: 13 – 32 A
  - Recommended: 25 A
- ✓ Power Consumption:
  - Typical 200 Watts
  - Max 310 Watts
  - Excl. RET and TMA load

RRUS 11 Mechanics

Wall and pole mounting brackets
- Reused from RRUW and RRU22
- Vertical Mount Only

Clearing distances:
- Above >= 16 in.
- Below >= 12 in.
- Side >= 0 mm

DC connector
- Bayonet
- Screw terminals in connector plug
- Supported outer cable diameter: 6-18 mm

CPRI connector
- LCD with proprietary cover
- Separate cover available from 1Q2011

Size & Weight
- Band 4: 44 lbs
- Band 12: 50 lbs
- 17.8” x 17.3” x 7.2” incl. sun shield

EBI Consulting
environmental | engineering | due diligence

RADIO FREQUENCY EMISSIONS ANALYSIS REPORT EVALUATION OF HUMAN EXPOSURE POTENTIAL TO NON-IONIZING EMISSIONS

T-Mobile Existing Facility

Site ID: CTFF703A

CT703/WCSU
303 Boxwood Lane
Danbury, CT 06811

November 16, 2016

EBI Project Number: 6216005334

Site Compliance Summary	
Compliance Status:	**COMPLIANT**
Site total MPE% of FCC general public allowable limit:	**28.66 %**

21 B Street · Burlington, MA 01803 · Tel: (781) 273.2500 · Fax: (781) 273.3311

EBI Consulting
environmental | engineering | due diligence

November 16, 2016

T-Mobile USA
Attn: Jason Overbey, RF Manager
35 Griffin Road South
Bloomfield, CT 06002

Emissions Analysis for Site: **CTFF703A – CT703/WCSU**

EBI Consulting was directed to analyze the proposed T-Mobile facility located at **303 Boxwood Lane, Danbury, CT**, for the purpose of determining whether the emissions from the Proposed T-Mobile Antenna Installation located on this property are within specified federal limits.

All information used in this report was analyzed as a percentage of current Maximum Permissible Exposure (% MPE) as listed in the FCC OET Bulletin 65 Edition 97-01and ANSI/IEEE Std C95.1. The FCC regulates Maximum Permissible Exposure in units of microwatts per square centimeter (μW/cm2). The number of $\mu W/cm^2$ calculated at each sample point is called the power density. The exposure limit for power density varies depending upon the frequencies being utilized. Wireless Carriers and Paging Services use different frequency bands each with different exposure limits, therefore it is necessary to report results and limits in terms of percent MPE rather than power density.

All results were compared to the FCC (Federal Communications Commission) radio frequency exposure rules, 47 CFR 1.1307(b)(1) – (b)(3), to determine compliance with the Maximum Permissible Exposure (MPE) limits for General Population/Uncontrolled environments as defined below.

<u>General population/uncontrolled exposure</u> limits apply to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Therefore, members of the general public would always be considered under this category when exposure is not employment related, for example, in the case of a telecommunications tower that exposes persons in a nearby residential area.

Public exposure to radio frequencies is regulated and enforced in units of microwatts per square centimeter ($\mu W/cm^2$). The general population exposure limit for the 700 MHz Band is approximately 467 $\mu W/cm^2$, and the general population exposure limit for the 1900 MHz (PCS) and 2100 MHz (AWS) bands is 1000 $\mu W/cm^2$. Because each carrier will be using different frequency bands, and each frequency band has different exposure limits, it is necessary to report percent of MPE rather than power density.

Occupational/controlled exposure limits apply to situations in which persons are exposed as a consequence of their employment and in which those persons who are exposed have been made fully aware of the potential for exposure and can exercise control over their exposure. Occupational/controlled exposure limits also apply where exposure is of a transient nature as a result of incidental passage through a location where exposure levels may be above general population/uncontrolled limits (see below), as long as the exposed person has been made fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Additional details can be found in FCC OET 65.

CALCULATIONS

Calculations were done for the proposed T-Mobile Wireless antenna facility located at **303 Boxwood Lane, Danbury, CT**, using the equipment information listed below. All calculations were performed per the specifications under FCC OET 65. Since T-Mobile is proposing highly focused directional panel antennas, which project most of the emitted energy out toward the horizon, all calculations were performed assuming a lobe representing the maximum gain of the antenna per the antenna manufactures supplied specifications, minus 10 dB, was focused at the base of the tower. For this report the sample point is the top of a 6-foot person standing at the base of the tower.

For all calculations, all equipment was calculated using the following assumptions:

1) 2 GSM channels (PCS Band - 1900 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 30 Watts per Channel.

2) 2 UMTS channels (PCS Band - 1900 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 30 Watts per Channel.

3) 2 UMTS channels (AWS Band – 2100 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 30 Watts per Channel.

4) 2 LTE channels (AWS Band – 2100 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 60 Watts per Channel

5) 1 LTE channel (700 MHz Band) was considered for each sector of the proposed installation. This channel has a transmit power of 30 Watts.

6) Since the 2100 MHz UMTS radios are ground mounted there are additional cabling losses accounted for. For each ground mounted 2100 MHz UMTS RF path an additional 1.33 dB of cable loss was factored into the calculations for these paths. This is based on manufacturers Specifications for 125 feet of 1-5/8" coax cable on each path.

7) All radios at the proposed installation were considered to be running at full power and were uncombined in their RF transmissions paths per carrier prescribed configuration. Per FCC OET Bulletin No. 65 - Edition 97-01 recommendations to achieve the maximum anticipated value at each sample point, all power levels emitting from the proposed antenna installation are increased by a factor of 2.56 to account for possible in-phase reflections from the surrounding environment. This is rarely the case, and if so, is never continuous.

8) For the following calculations the sample point was the top of a 6-foot person standing at the base of the tower. The maximum gain of the antenna per the antenna manufactures supplied specifications minus 10 dB was used in this direction. This value is a very conservative estimate as gain reductions for these particular antennas are typically much higher in this direction.

9) The antennas used in this modeling are the **Ericsson KRC 118 057/1 (AIR21 B4A/B12P)** for 700 MHz and 2100 MHz (AWS) channels & the **Ericsson AIR21 B2A/B4P** for 1900 MHz (PCS) and 2100 MHz (AWS) channels. This is based on feedback from the carrier with regards to anticipated antenna selection. The **Ericsson KRC 118 057/1 (AIR21 B4A/B12P)** has a maximum gain of **15.9 dBd** at its main lobe at 2100 MHz and a maximum gain of **14.6 dBd** at its main lobe at 700 MHz. The **Ericsson AIR21 B2A/B4P** has a maximum gain of **15.9 dBd** at its main lobe at 1900 MHz and 2100 MHz. The maximum gain of the antenna per the antenna manufactures supplied specifications, minus 10 dB, was used for all calculations. This value is a very conservative estimate as gain reductions for these particular antennas are typically much higher in this direction.

10) The antenna mounting height centerline of the proposed antennas is **83 feet** above ground level (AGL).

11) Emissions values for additional carriers were taken from the Connecticut Siting Council active database. Values in this database are provided by the individual carriers themselves.

12) All calculations were done with respect to uncontrolled / general public threshold limits.

T-Mobile Site Inventory and Power Data

Sector:	A	Sector:	B	Sector:	C
Antenna #:	**1**	Antenna #:	**1**	Antenna #:	**1**
Make / Model:	Ericsson KRC 118 057/1 (AIR21 B4A/B12P)	Make / Model:	Ericsson KRC 118 057/1 (AIR21 B4A/B12P)	Make / Model:	Ericsson KRC 118 057/1 (AIR21 B4A/B12P)
Gain:	14.6 dBd / 15.9 dBd	Gain:	14.6 dBd / 15.9 dBd	Gain:	14.6 dBd / 15.9 dBd
Height (AGL):	83	Height (AGL):	83	Height (AGL):	83
Frequency Bands	700 MHz / 2100 MHz (AWS)	Frequency Bands	700 MHz / 2100 MHz (AWS)	Frequency Bands	700 MHz / 2100 MHz (AWS)
Channel Count	3	Channel Count	3	Channel Count	3
Total TX Power(W):	150	Total TX Power(W):	150	Total TX Power(W):	150
ERP (W):	5,533.75	ERP (W):	5,533.75	ERP (W):	5,533.75
Antenna A1 MPE%	3.95	Antenna B1 MPE%	3.95	Antenna C1 MPE%	3.95
Antenna #:	**2**	Antenna #:	**2**	Antenna #:	**2**
Make / Model:	Ericsson AIR21 B2A/B4P	Make / Model:	Ericsson AIR21 B2A/B4P	Make / Model:	Ericsson AIR21 B2A/B4P
Gain:	15.9 dBd	Gain:	15.9 dBd	Gain:	15.9 dBd
Height (AGL):	83	Height (AGL):	83	Height (AGL):	83
Frequency Bands	1900 MHz(PCS) / 2100 MHz (AWS)	Frequency Bands	1900 MHz(PCS) / 2100 MHz (AWS)	Frequency Bands	1900 MHz(PCS) / 2100 MHz (AWS)
Channel Count	6	Channel Count	6	Channel Count	6
Total TX Power(W):	180	Total TX Power(W):	180	Total TX Power(W):	180
ERP (W):	6,387.05	ERP (W):	6,387.05	ERP (W):	6,387.05
Antenna A2 MPE%	3.87	Antenna B2 MPE%	3.87	Antenna C2 MPE%	3.87

Site Composite MPE%	
Carrier	**MPE%**
T-Mobile (Per Sector Max)	**7.83 %**
AT&T	2.51 %
Sprint	2.82 %
WCXI (WCSU)	15.50 %
Site Total MPE %:	**28.66 %**

T-Mobile Sector A Total:	7.83 %
T-Mobile Sector B Total:	7.83 %
T-Mobile Sector C Total:	7.83 %
Site Total:	28.66 %

T-Mobile _per sector	# Channels	Watts ERP (Per Channel)	Height (feet)	Total Power Density (µW/cm²)	Frequency (MHz)	Allowable MPE (µW/cm²)	Calculated % MPE
T-Mobile AWS - 2100 MHz LTE	2	2,334.27	83	28.31	AWS - 2100 MHz	1000	2.83%
T-Mobile 700 MHz LTE	1	865.21	83	5.25	700 MHz	1000	1.12%
T-Mobile AWS - 2100 MHz UMTS	2	859.25	83	10.42	AWS - 2100 MHz	1000	1.04%
T-Mobile PCS - 1950 MHz UMTS	2	1,167.14	83	14.15	PCS - 1950 MHz	1000	1.42%
T-Mobile PCS - 1950 MHz GSM	2	1,167.14	83	14.15	PCS - 1950 MHz	1000	1.42%
						Total:	**7.83%**

Summary

All calculations performed for this analysis yielded results that were **within** the allowable limits for general public exposure to RF Emissions.

The anticipated maximum composite contributions from the T-Mobile facility as well as the site composite emissions value with regards to compliance with FCC's allowable limits for general public exposure to RF Emissions are shown here:

T-Mobile Sector	Power Density Value (%)
Sector A:	7.83 %
Sector B:	7.83 %
Sector C:	7.83 %
T-Mobile Per Sector Maximum:	7.83 %
Site Total:	28.66 %
Site Compliance Status:	**COMPLIANT**

The anticipated composite MPE value for this site assuming all carriers present is **28.66%** of the allowable FCC established general public limit sampled at the ground level. This is based upon values listed in the Connecticut Siting Council database for existing carrier emissions.

FCC guidelines state that if a site is found to be out of compliance (over allowable thresholds), that carriers over a 5% contribution to the composite value will require measures to bring the site into compliance. For this facility, the composite values calculated were well within the allowable 100% threshold standard per the federal government.