SITESAFE
RF COMPLIANCE EXPERTS

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# Crown Castle
# Site BU – 830306
# Sprint App – 415157
# AT&T App – 471120
# T-Mobile App – 201930
# Verizon App – 452038
# Site Name – GRAFTON
# Site Compliance Report

**20 INDIAN PATH**
**GRAFTON, MA 01536**

Latitude: N42-13-42.90
Longitude: W71-41-24.40
Structure Type: Monopole

Report generated date: April 1, 2019
Report by: Scott Broyles
Customer Contact: PASCELLE SAINT-LAURENT

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**Crown Castle will be compliant upon completion of the remediation identified in Section 3.2.**

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GRAFTON, MA

COMMONWEALTH OF MASSACHUSETTS
MICHAEL A. McGUIRE
ELECTRICAL
NO. 38515
REGISTERED PROFESSIONAL ENGINEER

sealed 2apr2019 mike@h2dc.com
H2DC PLLC MaCoA#: 001239603

EXHIBIT 4

COPY

# Crown Castle
# GRAFTON - 830306
# Radio Frequency (RF) Site Compliance Report

**20 INDIAN PATH, GRAFTON, MA 01536**

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# 1 Executive Summary

Crown Castle has contracted with Sitesafe, LLC. (Sitesafe), an independent Radio Frequency (RF) regulatory and engineering consulting firm, to determine whether the proposed communications site, 830306 - GRAFTON, located at 20 INDIAN PATH, GRAFTON, MA, is in compliance with Federal Communication Commission (FCC) Rules and Regulations for RF emissions.

This report contains a detailed summary of the RF environment at the site including:

- Diagram of the site
- Inventory of the make / model of all antennas
- Theoretical MPE based on modeling

This report addresses exposure to radio frequency electromagnetic fields in accordance with the FCC Rules and Regulations for all individuals, classified in two groups, "Occupational or Controlled" and "General Public or Uncontrolled." **Crown Castle will be compliant** with the FCC rules and regulations, as described in OET Bulletin 65 **upon implementation of the proposed remediation.** The corrective actions needed to make this site compliant are located in Section 3.2.

The proposed antennas are noted as "proposed" in the antenna table under section 6.

This document and the conclusions herein are based on the information provided by Crown Castle.

If you have any questions regarding RF safety and regulatory compliance, please do not hesitate to contact Sitesafe's Customer Support Department at (703) 276-1100.

# 2 Regulatory Basis

## 2.1 FCC Rules and Regulations

In 1996, the Federal Communications Commission (FCC) adopted regulations for the evaluating of the effects of RF emissions in 47 CFR § 1.1307 and 1.1310. The guideline from the FCC Office of Engineering and Technology is Bulletin 65 ("OET Bulletin 65"), *Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields*, Edition 97-01, published August 1997. Since 1996 the FCC periodically reviews these rules and regulations as per their congressional mandate.

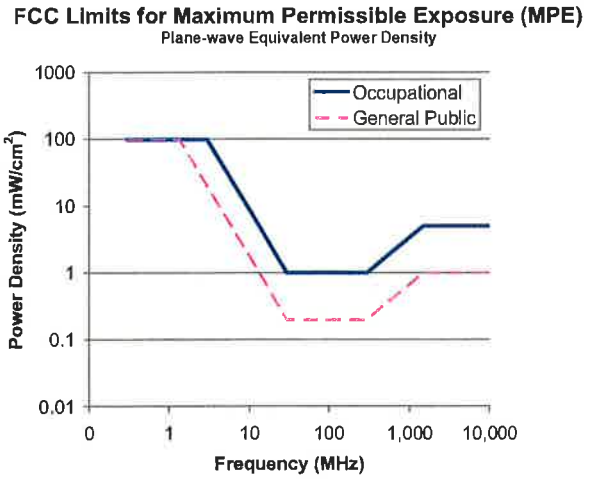
FCC regulations define two separate tiers of exposure limits: Occupational or "Controlled environment" and General Public or "Uncontrolled environment". The General Public limits are generally five times more conservative or restrictive than the Occupational limit. These limits apply to *accessible* areas where workers or the general public may be exposed to Radio Frequency (RF) electromagnetic fields.

Occupational or Controlled limits apply in situations in which persons are exposed as a consequence of their employment and where those persons exposed have been made fully aware of the potential for exposure and can exercise control over their exposure.

An area is considered a Controlled environment when access is limited to these aware personnel. Typical criteria are restricted access (i.e. locked or alarmed doors, barriers, etc.) to the areas where antennas are located coupled with proper RF warning signage. A site with Controlled environments is evaluated with Occupational limits.

All other areas are considered Uncontrolled environments. If a site has no access controls or no RF warning signage it is evaluated with General Public limits.

The theoretical modeling of the RF electromagnetic fields has been performed in accordance with OET Bulletin 65. The Maximum Permissible Exposure (MPE) limits utilized in this analysis are outlined in the following diagram:



**Limits for Occupational/Controlled Exposure (MPE)**

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) ($mW/cm^2$) | Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes) |
|---|---|---|---|---|
| 0.3-3.0 | 614 | 1.63 | (100)* | 6 |
| 3.0-30 | 1842/f | 4.89/f | ($900/f^2$)* | 6 |
| 30-300 | 61.4 | 0.163 | 1.0 | 6 |
| 300-1500 | -- | -- | f/300 | 6 |
| 1500-100,000 | -- | -- | 5 | 6 |

**Limits for General Population/Uncontrolled Exposure (MPE)**

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) ($mW/cm^2$) | Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes) |
|---|---|---|---|---|
| 0.3-1.34 | 614 | 1.63 | (100)* | 30 |
| 1.34-30 | 824/f | 2.19/f | ($180/f^2$)* | 30 |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1500 | -- | -- | f/1500 | 30 |
| 1500-100,000 | -- | -- | 1.0 | 30 |

f = frequency in MHz *Plane-wave equivalent power density

## 2.2 OSHA Statement

The General Duty clause of the OSHA Act (Section 5) outlines the occupational safety and health responsibilities of the employer and employee. The General Duty clause in Section 5 states:

(a) Each employer –

(1) shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees;

(2) shall comply with occupational safety and health standards promulgated under this Act.

(b) Each employee shall comply with occupational safety and health standards and all rules, regulations, and orders issued pursuant to this Act which are applicable to his own actions and conduct.

OSHA has defined Radiofrequency and Microwave Radiation safety standards for workers who may enter hazardous RF areas. Regulation Standards 29 CFR § 1910.147 identify a generic Lock Out Tag Out procedure aimed to control the unexpected energization or start up of machines when maintenance or service is being performed.

# 3 Site Compliance

## 3.1 Site Compliance Statement

Upon evaluation of the cumulative RF emission levels from all operators at this site, Sitesafe has determined that:

**Crown Castle will be compliant** with the FCC rules and regulations, as described in OET Bulletin 65 **upon implementation of the proposed remediation.** The corrective actions needed to make this site compliant are located in Section 3.2.

The compliance determination is based on theoretical modeling, RF signage placement recommendations, proposed antenna inventory and the level of restricted access to the antennas at the site. Any deviation from the Crown Castle's proposed deployment plan could result in the site being rendered non-compliant.

## 3.2 Actions for Site Compliance

Based on common industry practice and our understanding of FCC and OSHA requirements, this section provides a statement of recommendations for site compliance. RF alert signage recommendations have been proposed based on theoretical analysis of MPE levels. Barriers can consist of locked doors, fencing, railing, rope, chain, paint striping or tape, combined with RF alert signage.

The site will be made compliant if the following changes are implemented:

**Site Gate Locations**

Ensure that this access point is locked/restricted.

**Monopole Access Location**

Ensure that a Caution sign is installed.
Ensure that a NOC sign is installed.

## 4 Safety Plan and Procedures

The following items are general safety recommendations that should be administered on a site by site basis as needed by the carrier.

**General Maintenance Work:** Any maintenance personnel required to work immediately in front of antennas and / or in areas indicated as above 100% of the Occupational MPE limits should coordinate with the wireless operators to disable transmitters during their work activities.

**Training and Qualification Verification:** All personnel accessing areas indicated as exceeding the General Population MPE limits should have a basic understanding of EME awareness and RF Safety procedures when working around transmitting antennas. Awareness training increases a workers understanding to potential RF exposure scenarios. Awareness can be achieved in a number of ways (e.g. videos, formal classroom lecture or internet based courses).

**Physical Access Control:** Access restrictions to transmitting antennas locations is the primary element in a site safety plan. Examples of access restrictions are as follows:

- Locked door or gate
- Alarmed door
- Locked ladder access
- Restrictive Barrier at antenna (e.g. Chain link with posted RF Sign)

**RF Signage:** Everyone should obey all posted signs at all times. RF signs play an important role in properly warning a worker prior to entering into a potential RF Exposure area.

**Assume all antennas are active:** Due to the nature of telecommunications transmissions, an antenna transmits intermittently. Always assume an antenna is transmitting. Never stop in front of an antenna. If you have to pass by an antenna, move through as quickly and safely as possible thereby reducing any exposure to a minimum.

**Maintain a 3 foot clearance from all antennas:** There is a direct correlation between the strength of an EME field and the distance from the transmitting antenna. The further away from an antenna, the lower the corresponding EME field is.

**Site RF Emissions Diagram:** Section 5 of this report contains an RF Diagram that outlines various theoretical Maximum Permissible Exposure (MPE) areas at the site. The modeling is a worst case scenario assuming a duty cycle of 100% for each transmitting antenna at full power. This analysis is based on one of two access control criteria: General Public criteria means the access to the site is uncontrolled and anyone can gain access. Occupational criteria means the access is restricted and only properly trained individuals can gain access to the antenna locations.

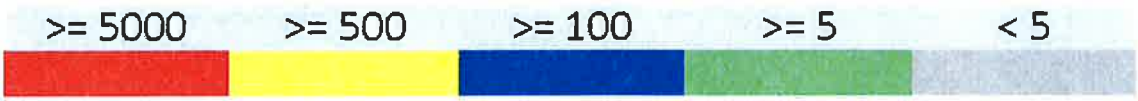
# 5 Analysis

## 5.1 RF Emissions Diagram

The RF diagram(s) below display theoretical spatially averaged percentage of the Maximum Permissible Exposure for all systems at the site unless otherwise noted. These diagrams use modeling as prescribed in OET Bulletin 65 and assumptions detailed in Appendix B.

The key at the bottom of each diagram indicates if percentages displayed are referenced to FCC General Population Maximum Permissible Exposure (MPE) limits. Color coding on the diagram is as follows:

**% of FCC Public Exposure Limit**




**This table displays the maximum theoretical percentage of the FCC's General Public MPE limits:**

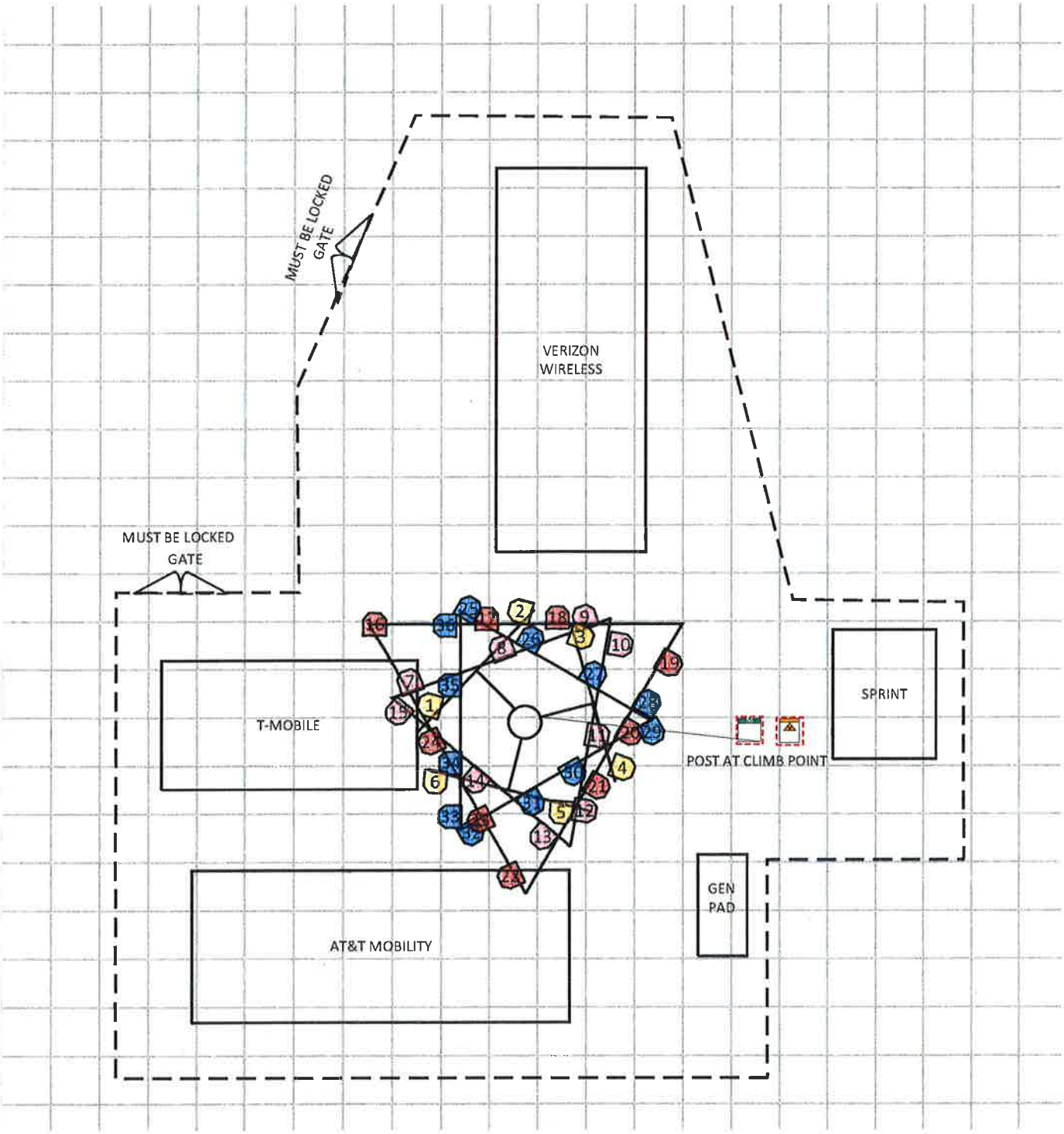
| | Maximum GP Levels: | |
|---|---|---|
| **Operator(s):** | **Ground Level** | |
| **Crown Castle** | <1% | |
| **Composite** | <1% | |

General Population diagrams are specified when an area is accessible to the public; i.e. personnel that do not meet Occupational or RF Safety trained criteria, could gain access.

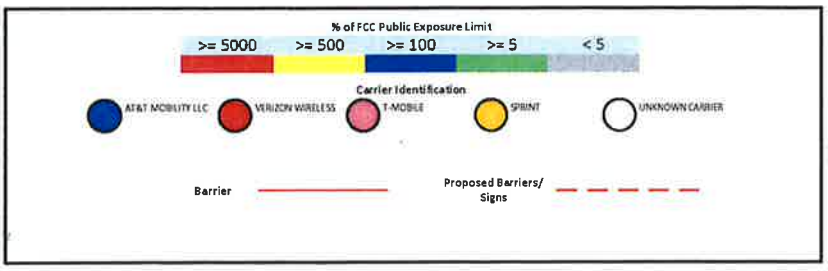
If trained occupational personnel require access to areas that may be above 100% of the limit, SiteSafe recommends that they utilize the proper personal protection equipment (RF monitors), coordinate with the carriers to reduce or shutdown power, or make real-time power density measurements with the appropriate power density meter to determine real-time MPE levels. This will allow the personnel to ensure that their work area is within exposure limits.

On the diagrams shown below, each level is marked with a height. The modeling program will spatially average the emissions within the area six feet above each set level. This provides an accurate spatial average of the percentage of the FCC's MPE limits within an accessible area.

# Site Scale Map For: GRAFTON




% of FCC Public Exposure Limit
Spatial average 0' - 6'



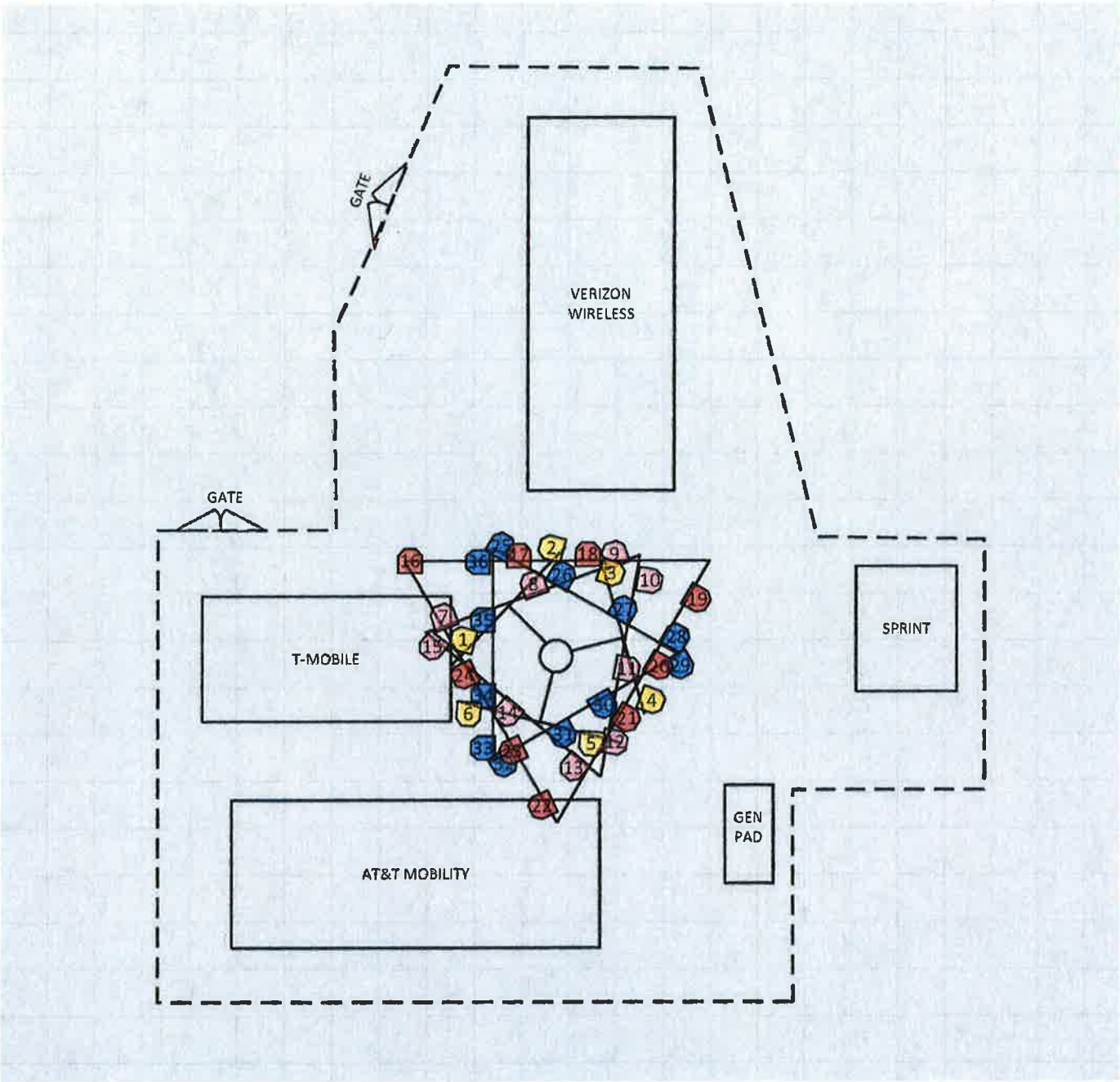

(Feet)

0 5.8 11.6

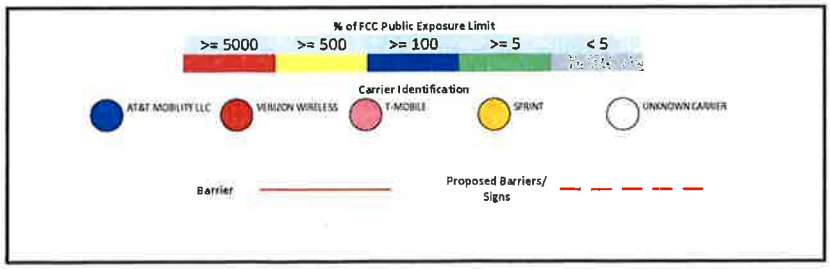
www.sitesafe.com
Site Name:GRAFTON
4/1/2019 4:54:22 PM

Sitesafe OET-65 Model
Near Field Boundary:
1.5 * Aperture
Reflection Factor: 1
Spatially Averaged

RF Exposure Simulation For: GRAFTON
Composite View




% of FCC Public Exposure Limit
Spatial average 0' - 6'



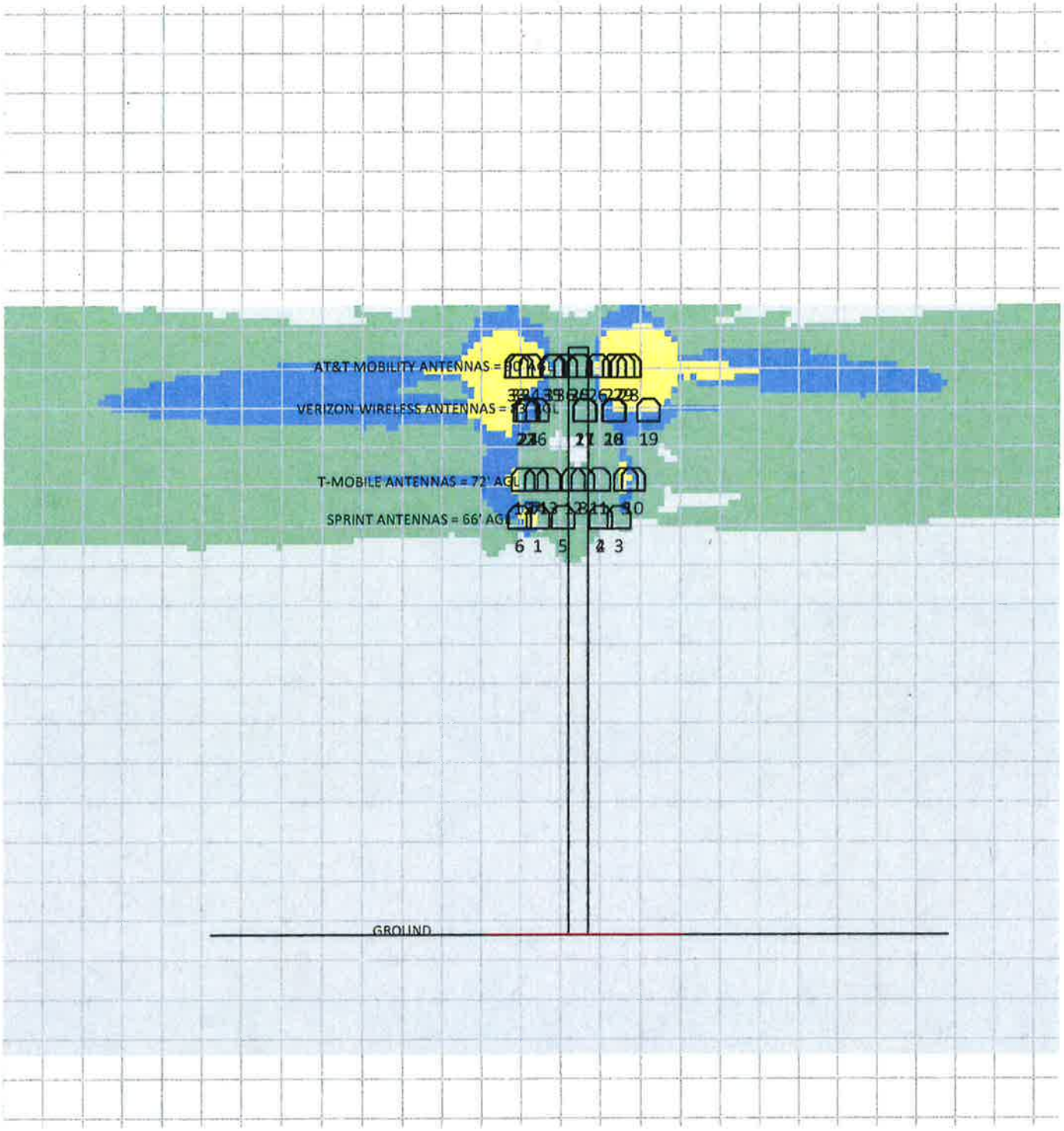

(Feet)

0 6 11.9

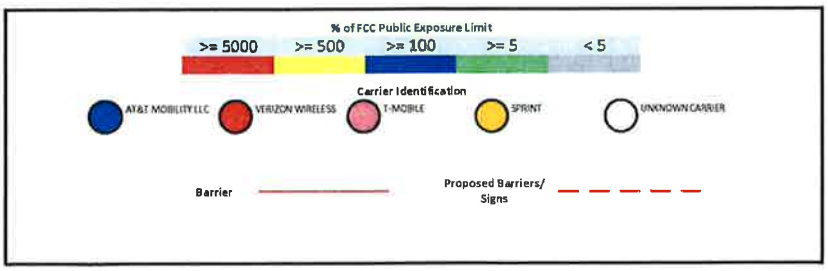
www.sitesafe.com
Site Name:GRAFTON
4/1/2019 4:18:52 PM

Sitesafe OET-65 Model
Near Field Boundary:
1.5 * Aperture
Reflection Factor: 1
Spatially Averaged

# RF Exposure Simulation For: GRAFTON
## Elevation View




% of FCC Public Exposure Limit




(Feet)

0 11.1 22.2

www.sitesafe.com
Site Name:GRAFTON
4/1/2019 4:50:23 PM

Sitesafe OET-65 Model
Near Field Boundary:
1.5 * Aperture
Reflection Factor: 1
Single Level (0)

# 6 Antenna Inventory

The Antenna Inventory shows all transmitting antennas at the site. This inventory was provided by the customer, and was utilized by Sitesafe to perform theoretical modeling of RF emissions. The inventory coincides with the site diagrams in this report, identifying each antenna's location at 830306 - GRAFTON. The antenna information collected includes the following information:

- Licensee or wireless operator name
- Frequency or frequency band
- Transmitter power – Effective Radiated Power ("ERP"), or Equivalent Isotropic Radiated Power ("EIRP") in Watts
- Antenna manufacturer make, model, and gain

For other carriers at this site, the use of "Generic" as an antenna model, or "Unknown" for an operator means the information with regard to carrier, their FCC license and/or antenna information was not available nor could it be secured while on site. Equipment, antenna models and nominal transmit power were used for modeling, based on past experience with radio service providers.

The following antenna inventory was provided by the customer and was utilized to create the site model diagrams:

| Table 3: Antenna Inventory | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ant # | Operated By | Antenna Model | Ant Type | Len (ft) | TX Freq (MHz) | TECH | Az (Deg) | Antenna Gain (dBd) | Horizontal Half Power Beamwidth (Deg) | POWER | POWER TYPE | POWER UNITS | # of Trans | ERP (Watts) | Z (ft) | MDT | EDT |
| 1 | SPRINT (Proposed) | Nokia 2.5G MAA AAHC(64T64R) | Panel | 2.1 | 2500 | LTE | 285 | 13.26 | 67 | 160 | TPO | Watt | 1 | 3389.4 | 66 | 0 | 0 |
| 2 | SPRINT (Proposed) | Commscope NNVV-65B-R4 | Panel | 6 | 1900 | LTE | 285 | 15.06 | 60 | 90 | TPO | Watt | 1 | 2885.6 | 66 | 0 | 0 |
| 2 | SPRINT (Proposed) | Commscope NNVV-65B-R4 | Panel | 6 | 862 | LTE | 285 | 12.76 | 64 | 100 | TPO | Watt | 1 | 1888 | 66 | 0 | 0 |
| 3 | SPRINT (Proposed) | Nokia 2.5G MAA AAHC(64T64R) | Panel | 2.1 | 2500 | LTE | 110 | 13.26 | 67 | 160 | TPO | Watt | 1 | 3389.4 | 66 | 0 | 0 |
| 4 | SPRINT (Proposed) | Commscope NNVV-65B-R4 | Panel | 6 | 1900 | LTE | 110 | 15.06 | 60 | 90 | TPO | Watt | 1 | 2885.6 | 66 | 0 | 0 |
| 4 | SPRINT (Proposed) | Commscope NNVV-65B-R4 | Panel | 6 | 862 | LTE | 110 | 12.76 | 64 | 100 | TPO | Watt | 1 | 1888 | 66 | 0 | 0 |
| 5 | SPRINT (Proposed) | Nokia 2.5G MAA AAHC(64T64R) | Panel | 2.1 | 2500 | LTE | 185 | 13.26 | 67 | 160 | TPO | Watt | 1 | 3389.4 | 66 | 0 | 0 |
| 6 | SPRINT (Proposed) | Commscope NNVV-65B-R4 | Panel | 6 | 1900 | LTE | 185 | 15.06 | 60 | 90 | TPO | Watt | 1 | 2885.6 | 66 | 0 | 0 |
| 6 | SPRINT (Proposed) | Commscope NNVV-65B-R4 | Panel | 6 | 862 | LTE | 185 | 12.76 | 64 | 100 | TPO | Watt | 1 | 1888 | 66 | 0 | 0 |
| 7 | T-MOBILE (Proposed) | Ericsson AIR 21 B2A B4P | Panel | 4.7 | 1900 | GSM | 340 | 15.37 | 65 | 60 | TPO | Watt | 1 | 2066.1 | 72 | 0 | 0 |
| 7 | T-MOBILE (Proposed) | Ericsson AIR 21 B2A B4P | Panel | 4.7 | 1900 | LTE | 340 | 15.37 | 65 | 60 | TPO | Watt | 1 | 2066.1 | 72 | 0 | 0 |
| 7 | T-MOBILE (Proposed) | Ericsson AIR 21 B2A B4P | Panel | 4.7 | 2100 | UMTS | 340 | 15.37 | 65 | 60 | TPO | Watt | 1 | 2066.1 | 72 | 0 | 0 |

| Table 3: Antenna Inventory | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ant # | Operated By | Antenna Model | Ant Type | Len (ft) | TX Freq (MHz) | TECH | Az (Deg) | Antenna Gain (dBd) | Horizontal Half Power Beamwidth (Deg) | POWER | POWER TYPE | POWER UNITS | # of Trans | ERP (Watts) | Z (ft) | MDT | EDT |
| 8 | T-MOBILE (Proposed) | Andrew LNX-6515DS-VTM | Panel | 8 | 700 | LTE | 340 | 14.42 | 65 | 60 | TPO | Watt | 1 | 1660.2 | 72 | 0 | 0 |
| 9 | T-MOBILE (Proposed) | Ericsson AIR 21 B4A B2P | Panel | 4.7 | 2100 | LTE | 340 | 15.37 | 65 | 60 | TPO | Watt | 1 | 2066.1 | 72 | 0 | 0 |
| 10 | T-MOBILE (Proposed) | Ericsson AIR 21 B2A B4P | Panel | 4.7 | 1900 | GSM | 100 | 15.37 | 65 | 60 | TPO | Watt | 1 | 2066.1 | 72 | 0 | 0 |
| 10 | T-MOBILE (Proposed) | Ericsson AIR 21 B2A B4P | Panel | 4.7 | 1900 | LTE | 100 | 15.37 | 65 | 60 | TPO | Watt | 1 | 2066.1 | 72 | 0 | 0 |
| 10 | T-MOBILE (Proposed) | Ericsson AIR 21 B2A B4P | Panel | 4.7 | 2100 | UMTS | 100 | 15.37 | 65 | 60 | TPO | Watt | 1 | 2066.1 | 72 | 0 | 0 |
| 11 | T-MOBILE (Proposed) | Andrew LNX-6515DS-VTM | Panel | 8 | 700 | LTE | 100 | 14.42 | 65 | 60 | TPO | Watt | 1 | 1660.2 | 72 | 0 | 0 |
| 12 | T-MOBILE (Proposed) | Ericsson AIR 21 B4A B2P | Panel | 4.7 | 2100 | LTE | 100 | 15.37 | 65 | 60 | TPO | Watt | 1 | 2066.1 | 72 | 0 | 0 |
| 13 | T-MOBILE (Proposed) | Ericsson AIR 21 B2A B4P | Panel | 4.7 | 1900 | GSM | 220 | 15.37 | 65 | 60 | TPO | Watt | 1 | 2066.1 | 72 | 0 | 0 |
| 13 | T-MOBILE (Proposed) | Ericsson AIR 21 B2A B4P | Panel | 4.7 | 1900 | LTE | 220 | 15.37 | 65 | 60 | TPO | Watt | 1 | 2066.1 | 72 | 0 | 0 |
| 13 | T-MOBILE (Proposed) | Ericsson AIR 21 B2A B4P | Panel | 4.7 | 2100 | UMTS | 220 | 15.37 | 65 | 60 | TPO | Watt | 1 | 2066.1 | 72 | 0 | 0 |
| 14 | T-MOBILE (Proposed) | Andrew LNX-6515DS-VTM | Panel | 8 | 700 | LTE | 220 | 14.42 | 65 | 60 | TPO | Watt | 1 | 1660.2 | 72 | 0 | 0 |
| 15 | T-MOBILE (Proposed) | Ericsson AIR 21 B4A B2P | Panel | 4.7 | 2100 | LTE | 220 | 15.37 | 65 | 60 | TPO | Watt | 1 | 2066.1 | 72 | 0 | 0 |
| 16 | VERIZON WIRELESS (Proposed) | Commscope JAHH-65B-R3B | Panel | 6 | 1900 | CDMA | 0 | 15.66 | 63 | 160 | TPO | Watt | 1 | 5890.1 | 83 | 0 | 0 |
| 16 | VERIZON WIRELESS (Proposed) | Commscope JAHH-65B-R3B | Panel | 6 | 751 | LTE | 0 | 12.21 | 67 | 160 | TPO | Watt | 1 | 2661.5 | 83 | 0 | 0 |

| Table 3: Antenna Inventory | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ant # | Operated By | Antenna Model | Ant Type | Len (ft) | TX Freq (MHz) | TECH | Az (Deg) | Antenna Gain (dBd) | Horizontal Half Power Beamwidth (Deg) | POWER | POWER TYPE | POWER UNITS | # of Trans | ERP (Watts) | Z (ft) | MDT | EDT |
| 17 | VERIZON WIRELESS (Proposed) | Commscope JAHH-65B-R3B | Panel | 6 | 2100 | LTE | 0 | 15.79 | 65 | 180 | TPO | Watt | 1 | 6827.7 | 83 | 0 | 0 |
| 18 | VERIZON WIRELESS | CSS X7C-680 | Panel | 6 | 850 | CDMA | 0 | 12.81 | 80 | 160 | TPO | Watt | 1 | 3055.8 | 83 | 0 | 0 |
| 19 | VERIZON WIRELESS (Proposed) | Commscope JAHH-65B-R3B | Panel | 6 | 1900 | CDMA | 120 | 15.66 | 63 | 160 | TPO | Watt | 1 | 5890.1 | 83 | 0 | 0 |
| 19 | VERIZON WIRELESS (Proposed) | Commscope JAHH-65B-R3B | Panel | 6 | 751 | LTE | 120 | 12.21 | 67 | 160 | TPO | Watt | 1 | 2661.5 | 83 | 0 | 0 |
| 20 | VERIZON WIRELESS (Proposed) | Commscope JAHH-65B-R3B | Panel | 6 | 2100 | LTE | 120 | 15.79 | 65 | 180 | TPO | Watt | 1 | 6827.7 | 83 | 0 | 0 |
| 21 | VERIZON WIRELESS | CSS X7C-680 | Panel | 6 | 850 | CDMA | 120 | 12.81 | 80 | 160 | TPO | Watt | 1 | 3055.8 | 83 | 0 | 0 |
| 22 | VERIZON WIRELESS (Proposed) | Commscope JAHH-65B-R3B | Panel | 6 | 751 | LTE | 245 | 12.21 | 67 | 160 | TPO | Watt | 1 | 2661.5 | 83 | 0 | 0 |
| 22 | VERIZON WIRELESS (Proposed) | Commscope JAHH-65B-R3B | Panel | 6 | 1900 | CDMA | 245 | 15.66 | 63 | 160 | TPO | Watt | 1 | 5890.1 | 83 | 0 | 0 |
| 23 | VERIZON WIRELESS (Proposed) | Commscope JAHH-65B-R3B | Panel | 6 | 2100 | LTE | 245 | 15.79 | 65 | 180 | TPO | Watt | 1 | 6827.7 | 83 | 0 | 0 |
| 24 | VERIZON WIRELESS | CSS X7C-680 | Panel | 6 | 850 | CDMA | 245 | 12.81 | 80 | 160 | TPO | Watt | 1 | 3055.8 | 83 | 0 | 0 |
| 25 | AT&T MOBILITY LLC | Kathrein-Scala 800-10121 | Panel | 4.5 | 850 | UMTS | 30 | 11.35 | 87.6 | 40 | TPO | Watt | 1 | 545.8 | 90 | 0 | 0 |

| Table 3: Antenna Inventory | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ant # | Operated By | Antenna Model | Ant Type | Len (ft) | TX Freq (MHz) | TECH | Az (Deg) | Antenna Gain (dBd) | Horizontal Half Power Beamwidth (Deg) | POWER | POWER TYPE | POWER UNITS | # of Trans | ERP (Watts) | Z (ft) | MDT | EDT |
| 26 | AT&T MOBILITY LLC (Proposed) | Kathrein-Scala 800-10966 | Panel | 8 | 1900 | LTE | 30 | 15.85 | 66 | 160 | TPO | Watt | 1 | 6153.5 | 90 | 0 | 0 |
| 26 | AT&T MOBILITY LLC (Proposed) | Kathrein-Scala 800-10966 | Panel | 8 | 2100 | LTE | 30 | 16.15 | 64.4 | 160 | TPO | Watt | 1 | 6593.6 | 90 | 0 | 0 |
| 26 | AT&T MOBILITY LLC (Proposed) | Kathrein-Scala 800-10966 | Panel | 8 | 2300 | LTE | 30 | 15.95 | 59.7 | 100 | TPO | Watt | 1 | 3935.5 | 90 | 0 | 0 |
| 27 | AT&T MOBILITY LLC | CCI Antennas OPA-65R-LCUU-H8 | Panel | 7.7 | 850 | UMTS | 30 | 13.86 | 59.2 | 40 | TPO | Watt | 1 | 972.9 | 90 | 0 | 0 |
| 27 | AT&T MOBILITY LLC | CCI Antennas OPA-65R-LCUU-H8 | Panel | 7.7 | 737 | LTE | 30 | 12.26 | 63.9 | 160 | TPO | Watt | 1 | 2692.3 | 90 | 0 | 0 |
| 28 | AT&T MOBILITY LLC (Proposed) | Kathrein-Scala 800-10966 | Panel | 8 | 763 | LTE | 30 | 13.55 | 67.9 | 160 | TPO | Watt | 1 | 3623.4 | 90 | 0 | 0 |
| 29 | AT&T MOBILITY LLC | Kathrein-Scala 800-10121 | Panel | 4.5 | 850 | LTE | 150 | 11.35 | 87.6 | 40 | TPO | Watt | 1 | 545.8 | 90 | 0 | 0 |
| 30 | AT&T MOBILITY LLC (Proposed) | Kathrein-Scala 800-10966 | Panel | 8 | 1900 | LTE | 150 | 15.85 | 66 | 160 | TPO | Watt | 1 | 6153.5 | 90 | 0 | 0 |
| 30 | AT&T MOBILITY LLC | Kathrein-Scala 800-10966 | Panel | 8 | 2100 | LTE | 150 | 16.15 | 64.4 | 160 | TPO | Watt | 1 | 6593.6 | 90 | 0 | 0 |

| Table 3: Antenna Inventory | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ant # | Operated By | Antenna Model | Ant Type | Len (ft) | TX Freq (MHz) | TECH | Az (Deg) | Antenna Gain (dBd) | Horizontal Half Power Beamwidth (Deg) | POWER | POWER TYPE | POWER UNITS | # of Trans | ERP (Watts) | Z (ft) | MDT | EDT |
| | (Proposed) | | | | | | | | | | | | | | | | |
| 30 | AT&T MOBILITY LLC (Proposed) | Kathrein-Scala 800-10966 | Panel | 8 | 2300 | LTE | 150 | 15.95 | 59.7 | 100 | TPO | Watt | 1 | 3935.5 | 90 | 0 | 0 |
| 31 | AT&T MOBILITY LLC | CCI Antennas OPA-65R-LCUU-H8 | Panel | 7.7 | 850 | UMTS | 150 | 13.86 | 59.2 | 40 | TPO | Watt | 1 | 972.9 | 90 | 0 | 0 |
| 31 | AT&T MOBILITY LLC | CCI Antennas OPA-65R-LCUU-H8 | Panel | 7.7 | 737 | LTE | 150 | 12.26 | 63.9 | 160 | TPO | Watt | 1 | 2692.3 | 90 | 0 | 0 |
| 32 | AT&T MOBILITY LLC (Proposed) | Kathrein-Scala 800-10966 | Panel | 8 | 763 | LTE | 150 | 13.55 | 67.9 | 160 | TPO | Watt | 1 | 3623.4 | 90 | 0 | 0 |
| 33 | AT&T MOBILITY LLC | Kathrein-Scala 800-10121 | Panel | 4.5 | 850 | UMTS | 270 | 11.35 | 87.6 | 40 | TPO | Watt | 1 | 545.8 | 90 | 0 | 0 |
| 34 | AT&T MOBILITY LLC (Proposed) | Kathrein-Scala 800-10966 | Panel | 8 | 1900 | LTE | 270 | 15.85 | 66 | 160 | TPO | Watt | 1 | 6153.5 | 90 | 0 | 0 |
| 34 | AT&T MOBILITY LLC (Proposed) | Kathrein-Scala 800-10966 | Panel | 8 | 2100 | LTE | 270 | 16.15 | 64.4 | 160 | TPO | Watt | 1 | 6593.6 | 90 | 0 | 0 |
| 34 | AT&T MOBILITY LLC (Proposed) | Kathrein-Scala 800-10966 | Panel | 8 | 2300 | LTE | 270 | 15.95 | 59.7 | 100 | TPO | Watt | 1 | 3935.5 | 90 | 0 | 0 |

| Table 3: Antenna Inventory | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ant # | Operated By | Antenna Model | Ant Type | Len (ft) | TX Freq (MHz) | TECH | Az (Deg) | Antenna Gain (dBd) | Horizontal Half Power Beamwidth (Deg) | POWER | POWER TYPE | POWER UNITS | # of Trans | ERP (Watts) | Z (ft) | MDT | EDT |
| 35 | AT&T MOBILITY LLC | CCI Antennas OPA-65R-LCUU-H8 | Panel | 7.7 | 850 | UMTS | 270 | 13.86 | 59.2 | 40 | TPO | Watt | 1 | 972.9 | 90 | 0 | 0 |
| 35 | AT&T MOBILITY LLC | CCI Antennas OPA-65R-LCUU-H8 | Panel | 7.7 | 737 | LTE | 270 | 12.26 | 63.9 | 160 | TPO | Watt | 1 | 2692.3 | 90 | 0 | 0 |
| 36 | AT&T MOBILITY LLC (Proposed) | Kathrein-Scala 800-10966 | Panel | 8 | 763 | LTE | 270 | 13.55 | 67.9 | 160 | TPO | Watt | 1 | 3623.4 | 90 | 0 | 0 |

NOTE: Z indicates relative position of the antenna to the origin location on the site, displayed in the model results diagram. The Z reference indicates antenna height above the main site level unless otherwise indicated. ERP values provided by the client and used in the modeling may be greater than are currently deployed. For other carriers at this site the use of "Generic" as an antenna model or "Unknown" for a wireless operator means the information with regard to carrier, their FCC license and/or antenna information was not available nor could it be secured while on site. Equipment, antenna models and nominal transmit power were used for modeling, based on past experience with radio service providers.

## 7 Engineer Certification

The professional engineer whose seal appears on the cover of this document hereby certifies and affirms:

That I am registered as a Professional Engineer in the jurisdiction indicated in the professional engineering stamp on the cover of this document; and

That I am an employee of Sitesafe, LLC., in Vienna, Virginia, at which place the staff and I provide RF compliance services to clients in the wireless communications industry; and

That I am thoroughly familiar with the Rules and Regulations of the Federal Communications Commission (FCC) as well as the regulations of the Occupational Safety and Health Administration (OSHA), both in general and specifically as they apply to the FCC Guidelines for Human Exposure to Radio-frequency Radiation; and

That I have thoroughly reviewed this Site Compliance Report and believe it to be true and accurate to the best of my knowledge as assembled by and attested to by Scott Broyles.

April 1, 2019

## Appendix A – Statement of Limiting Conditions

Sitesafe will not be responsible for matters of a legal nature that affect the site or property.

Due to the complexity of some wireless sites, Sitesafe performed this analysis and created this report utilizing best industry practices and due diligence. Sitesafe cannot be held accountable or responsible for anomalies or discrepancies due to actual site conditions (i.e., mislabeling of antennas or equipment, inaccessible cable runs, inaccessible antennas or equipment, etc.) or information or data supplied by Crown Castle, the site manager, or their affiliates, subcontractors or assigns.

Sitesafe has provided computer generated model(s) in this Site Compliance Report to show approximate dimensions of the site, and the model is included to assist the reader of the compliance report to visualize the site area, and to provide supporting documentation for Sitesafe's recommendations.

Sitesafe may note in the Site Compliance Report any adverse physical conditions, such as needed repairs, observed during the survey of the subject property or that Sitesafe became aware of during the normal research involved in performing this survey. Sitesafe will not be responsible for any such conditions that do exist or for any engineering or testing that might be required to discover whether such conditions exist. Because Sitesafe is not an expert in the field of mechanical engineering or building maintenance, the Site Compliance Report must not be considered a structural or physical engineering report.

Sitesafe obtained information used in this Site Compliance Report from sources that Sitesafe considers reliable and believes them to be true and correct. Sitesafe does not assume any responsibility for the accuracy of such items that were furnished by other parties. When conflicts in information occur between data provided by a second party and physical data collected by Sitesafe, the physical data will be used.

## Appendix B – Assumptions and Definitions

### General Model Assumptions

In this site compliance report, it is assumed that all antennas are operating at **full power at all times.** Software modeling was performed for all transmitting antennas located on the site. Sitesafe has further assumed a 100% duty cycle and maximum radiated power.

The site has been modeled with these assumptions to show the maximum RF energy density. Sitesafe believes this to be a *worst-case* analysis, based on best available data. Areas modeled to predict emissions greater than 100% of the applicable MPE level may not actually occur, but are shown as a *worst-case* prediction that could be realized real time. Sitesafe believes these areas to be safe for entry by occupationally trained personnel utilizing appropriate personal protective equipment (in most cases, a personal monitor).

Thus, at any time, if power density measurements were made, we believe the real-time measurements would indicate levels below those depicted in the RF emission diagram(s) in this report. By modeling in this way, Sitesafe has conservatively shown exclusion areas – areas that should not be entered without the use of a personal monitor, carriers reducing power, or performing real-time measurements to indicate real-time exposure levels.

### Use of Generic Antennas

For the purposes of this report, the use of "Generic" as an antenna model, or "Unknown" for an operator means the information about a carrier, their FCC license and/or antenna information was not provided and could not be obtained while on site. In the event of unknown information, Sitesafe will use our industry specific knowledge of equipment, antenna models, and transmit power to model the site. If more specific information can be obtained for the unknown measurement criteria, Sitesafe recommends remodeling of the site utilizing the more complete and accurate data. Information about similar facilities is used when the service is identified and associated with a particular antenna. If no information is available regarding the transmitting service associated with an unidentified antenna, using the antenna manufacturer's published data regarding the antenna's physical characteristics makes more conservative assumptions.

Where the frequency is unknown, Sitesafe uses the closest frequency in the antenna's range that corresponds to the highest Maximum Permissible Exposure (MPE), resulting in a conservative analysis.

## Definitions

***5% Rule*** – The rules adopted by the FCC specify that, in general, at multiple transmitter sites actions necessary to bring the area into compliance with the guidelines are the shared responsibility of all licensees whose transmitters produce field strengths or power density levels at the area in question in excess of 5% of the exposure limits. In other words, any wireless operator that contributes 5% or greater of the MPE limit in an area that is identified to be greater than 100% of the MPE limit is responsible taking corrective actions to bring the site into compliance.

***Compliance*** – The determination of whether a site is safe or not with regards to Human Exposure to Radio Frequency Radiation from transmitting antennas.

***Decibel (dB)*** – A unit for measuring power or strength of a signal.

***Duty Cycle*** – The percent of pulse duration to the pulse period of a periodic pulse train. Also, may be a measure of the temporal transmission characteristic of an intermittently transmitting RF source such as a paging antenna by dividing average transmission duration by the average period for transmission. A duty cycle of 100% corresponds to continuous operation.

***Effective (or Equivalent) Isotropic Radiated Power (EIRP)*** – The product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna.

***Effective Radiated Power (ERP)*** – In a given direction, the relative gain of a transmitting antenna with respect to the maximum directivity of a half wave dipole multiplied by the net power accepted by the antenna from the connecting transmitter.

***Gain (of an antenna)*** – The ratio of the maximum intensity in a given direction to the maximum radiation in the same direction from an isotropic radiator. Gain is a measure of the relative efficiency of a directional antennas as compared to an omni directional antenna.

***General Population/Uncontrolled Environment*** – Defined by the FCC, as an area where RFR exposure may occur to persons who are **unaware** of the potential for exposure and who have no control of their exposure. General Population is also referenced as General Public.

***Generic Antenna*** – For the purposes of this report, the use of "Generic" as an antenna model means the antenna information was not provided and could not be obtained while on site. In the event of unknown information, Sitesafe will use our industry specific knowledge of antenna models to select a worst case scenario antenna to model the site.

***Isotropic Antenna*** – An antenna that is completely non-directional. In other words, an antenna that radiates energy equally in all directions.

***Maximum Measurement*** – This measurement represents the single largest measurement recorded when performing a spatial average measurement.

***Maximum Permissible Exposure (MPE)*** – The rms and peak electric and magnetic field strength, their squares, or the plane-wave equivalent power densities associated with these fields to which a person may be exposed without harmful effect and with acceptable safety factor.

***Occupational/Controlled Environment*** – Defined by the FCC, as an area where Radio Frequency Radiation (RFR) exposure may occur to persons who are **aware** of the potential for exposure as a condition of employment or specific activity and can exercise control over their exposure.

***OET Bulletin 65*** – Technical guideline developed by the FCC's Office of Engineering and Technology to determine the impact of Radio Frequency radiation on Humans. The guideline was published in August 1997.

***OSHA* (Occupational Safety and Health Administration)** – Under the Occupational Safety and Health Act of 1970, employers are responsible for providing a safe and healthy workplace for their employees. OSHA's role is to promote the safety and health of America's working men and women by setting and enforcing standards; providing training, outreach and education; establishing partnerships; and encouraging continual process improvement in workplace safety and health. For more information, visit www.osha.gov.

***Radio Frequency Radiation*** – Electromagnetic waves that are propagated from antennas through space.

***Spatial Average Measurement*** – A technique used to average a minimum of ten (10) measurements taken in a ten (10) second interval from zero (0) to six (6) feet. This measurement is intended to model the average energy an average sized human body will absorb while present in an electromagnetic field of energy.

***Transmitter Power Output (TPO)*** – The radio frequency output power of a transmitter's final radio frequency stage as measured at the output terminal while connected to a load.

## Appendix C – Rules & Regulations

### Explanation of Applicable Rules and Regulations

The FCC has set forth guidelines in OET Bulletin 65 for human exposure to radio frequency electromagnetic fields. Specific regulations regarding this topic are listed in Part 1, Subpart I, of Title 47 in the Code of Federal Regulations. Currently, there are two different levels of MPE - General Public MPE and Occupational MPE. An individual classified as Occupational can be defined as an individual who has received appropriate RF training and meets the conditions outlined below. General Public is defined as anyone who does not meet the conditions of being Occupational. FCC and OSHA Rules and Regulations define compliance in terms of total exposure to total RF energy, regardless of location of or proximity to the sources of energy.

It is the responsibility of all licensees to ensure these guidelines are maintained at all times. It is the ongoing responsibility of all licensees composing the site to maintain ongoing compliance with FCC rules and regulations. Individual licensees that contribute less than 5% MPE to any total area out of compliance are not responsible for corrective actions.

OSHA has adopted and enforces the FCC's exposure guidelines. A building owner or site manager can use this report as part of an overall RF Health and Safety Policy. It is important for building owners/site managers to identify areas in excess of the General Population MPE and ensure that only persons qualified as Occupational are granted access to those areas.

### Occupational Environment Explained

The FCC definition of Occupational exposure limits apply to persons who:

- are exposed to RF energy as a consequence of their employment;
- have been made aware of the possibility of exposure; and
- can exercise control over their exposure.

OSHA guidelines go further to state that persons must complete RF Safety Awareness training and must be trained in the use of appropriate personal protective equipment.

In order to consider this site an Occupational Environment, the site must be controlled to prevent access by any individuals classified as the General Public. Compliance is also maintained when any non-occupational individuals (the General Public) are prevented from accessing areas indicated as Red or Yellow in the attached RF Emissions diagram. In addition, a person must be aware of the RF environment into which they are entering. This can be accomplished by an RF Safety Awareness class, and by appropriate written documentation such as this Site Compliance Report.

All Crown Castle employees who require access to this site must complete RF Safety Awareness training and must be trained in the use of appropriate personal protective equipment.

## Appendix D – General Safety Recommendations

The following are *general recommendations* appropriate for any site with accessible areas in excess of 100% General Public MPE. These recommendations are not specific to this site. These are safety recommendations appropriate for typical site management, building management, and other tenant operations.

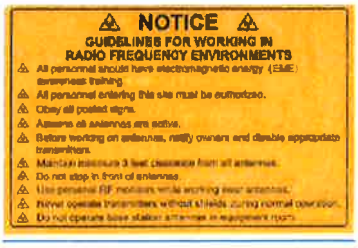
1. All individuals needing access to the main site (or the area indicated to be in excess of General Public MPE) should wear a personal RF Exposure monitor, successfully complete proper RF Safety Awareness training, and have and be trained in the use of appropriate personal protective equipment.

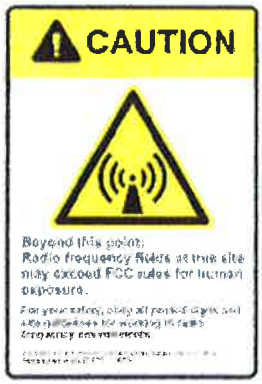
2. All individuals needing access to the main site should be instructed to read and obey all posted placards and signs.

3. The site should be routinely inspected and this or similar report updated with the addition of any antennas or upon any changes to the RF environment including:

- adding new antennas that may have been located on the site
- removing of any existing antennas
- changes in the radiating power or number of RF emitters

4. Post the appropriate **NOTICE**, **CAUTION**, or **WARNING** sign at the main site access point(s) and other locations as required. Note: Please refer to RF Exposure Diagrams in Appendix B, to inform <u>everyone</u> who has access to this site that beyond posted signs there may be levels in excess of the limits prescribed by the FCC. In addition to RF Advisory Signage, a RF Guideline Signage is recommended to be posted at the main site access point(s). The signs below are examples of signs meeting FCC guidelines.





5. Ensure that the site door remains locked (or appropriately controlled) to deny access to the general public if deemed as policy by the building/site owner.

6. For a General Public environment the four color levels identified in this analysis can be interpreted in the following manner:

- Gray represents area at below 5% of the General Public MPE limits or below. This level is safe for a worker to be in at any time.

- Green represents areas predicted to be between 5% and 100% of the General Public MPE limits. This level is safe for a worker to be in at any time.
- Blue represents areas predicted to be between 100% and 500% of the General Public MPE limits. This level is safe for a worker to be in at any time.
- Yellow represents areas predicted to be between 500% and 5000% of the General Public MPE limits. This level is safe for a worker to be in.
- Red areas indicated predicted levels greater than 5000% of the General Public MPE limits. This level is not safe for the General Public to be in.

7. For an Occupational environment the five color levels identified in this analysis can be interpreted in the following manner:

- Areas indicated as Gray are at 5% of the Occupational MPE limits or below. This level is safe for a worker to be in at any time.
- Green represents areas predicted to be between 5% and 20% of the Occupational MPE limits. This level is safe for a worker to be in at any time.
- Blue represents areas predicted to be between 20% and 100% of the Occupational MPE limits. This level is safe for a worker to be in at any time.
- Yellow represents areas predicted to be between 100% and 500% of the Occupational MPE limits. Only individuals that have been properly trained in RF Health and Safety should be allowed to work in this area. This is not an area that is suitable for the General Public to be in.s
- Red areas indicated predicted levels greater than 500% of the Occupational MPE limits. This level is not safe for the Occupational worker to be in for prolonged periods of time. Special procedures must be adhered to such as lock out tag out procedures to minimize the workers exposure to EME.

8. Use of a Personal Protective Monitor: When working around antennas, Sitesafe strongly recommends the use of a Personal Protective Monitor (PPM). Wearing a PPM will properly forewarn the individual prior to entering an RF exposure area.

Keep a copy of this report available for all persons who must access the site. They should read this report and be aware of the potential hazards with regards to RF and MPE limits.

## Additional Information

Additional RF information is available by visiting both www.Sitesafe.com and www.fcc.gov/oet/rfsafety. OSHA has additional information available at: http://www.osha-slc.gov/SLTC/radiofrequencyradiation.