

ATTACHMENT 6




Radio Frequency Emissions Analysis Report

T-Mobile Wireless Monopole Facility

August 31, 2016

Analysis Format: Theoretical Calculations

	Site Compliance Status: <u>Compliant</u>
	Sign Count Signage is not required as the antennas are mounted greater than 30' above ground level.

CTHA026
Glastonbury
63-80 Woodland Street, Glastonbury, CT 06073

OVERVIEW

Centerline Communications, LLC (“Centerline”) has been contracted to provide a Radio Frequency (RF) Analysis for the following T-Mobile wireless facility to determine whether the facility is in compliance with federal standards and regulations regarding RF emissions. This analysis includes theoretical emissions calculations for all proposed equipment for T-Mobile.

Analysis Site Data	
Site ID:	CTHA026
Site Name:	Glastonbury
Site Address:	63-80 Woodland Street, Glastonbury, CT 06073
Site Latitude:	41.660806 N
Site Longitude:	-72.574111 W
Facility Type:	Monopole
Compliance Summary	
Status:	Compliant
Site Composite MPE% (General Public Limit):	1.2
T-Mobile Max MPE% (General Public Limit):	1.2
Is Access Locked or Controlled? :	Controlled
Lock or Control Measures if Present:	Locked Access Gate

There are no additional system operators located on this facility or considered as part of this analysis.

FCC GUIDELINES

All power density values used in this report were analyzed as a percentage of current Maximum Permissible Exposure (% MPE) as listed in the FCC OET Bulletin 65 Edition 97-01 and ANSI/IEEE Std C95.1. The FCC regulates Maximum Permissible Exposure in units of microwatts per square centimeter ($\mu\text{W}/\text{cm}^2$). The number of $\mu\text{W}/\text{cm}^2$ 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.

General Population/Uncontrolled exposure 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 ($\mu\text{W}/\text{cm}^2$). The general population exposure limit for the 700 and 800 MHz Bands is approximately 467 $\mu\text{W}/\text{cm}^2$ and 567 $\mu\text{W}/\text{cm}^2$ respectively, and the general population exposure limit for the 1900 MHz PCS and 2100 MHz AWS bands is 1000 $\mu\text{W}/\text{cm}^2$. 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, have been properly trained in RF safety 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, have been trained in RF safety and can exercise control over his or her exposure by leaving the area or by some other appropriate means. The Occupational/Controlled exposure limits all utilized frequency bands is five (5) times the FCC's General Public / Uncontrolled exposure limit.

Additional details can be found in FCC OET 65.

CALCULATION METHODOLOGY & DATA

Centerline has performed theoretical calculations on all transmission equipment located on this facility. All calculations have been performed using the RoofView® software from Richard Tell Associates. This software performs calculations using a cylindrical model for very conservative power density predictions within the near-field of the antenna where the antenna pattern has not truly formed yet. Within this area power density values tend to decrease based upon an inverse distance function. At the point where it is appropriate for modeling to change from near-field calculations to far-field calculations the power decreases inversely with the square of the distance. This modeling technique is very accurate with very low antenna centerlines, such as rooftops, where persons can get very close to the antennas and pass through fields in close proximity.

The below calculation in Figure 1 shows the theoretical distribution of power over an imaginary cylinder with equal power distribution in all directions.

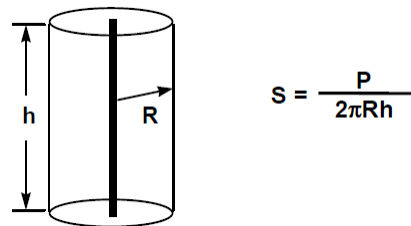


Figure 1: Distribution of power over an imaginary cylinder in all directions

This model can be modified for directional antennas to show directionality of power distribution. This formula will tend to be conservative as it assumes that all power is focused between the 3 dB power roll off points as shown in Figure 2.

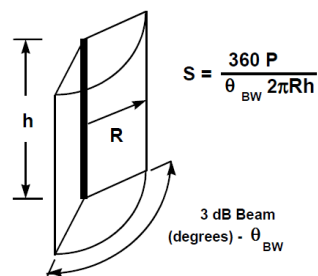


Figure 2: Distribution of power over an imaginary cylinder in all directions

For the required calculations, the following channel assignments and power values shown in **Table 1** were used for the T-Mobile radio configurations per sector.

T-Mobile Channel & Power Data Table

Sector	Frequency Band	Technology	TX Power Per Channel	Number of Channels
A	2100 MHz (AWS)	LTE	60	2
A	1900 MHz (PCS)	LTE	60	2
A	700 MHz	LTE	30	1
A	2100 MHz (AWS)	UMTS	30	2
A	2100 MHz (AWS)	UMTS	30	2
B	2100 MHz (AWS)	LTE	60	2
B	1900 MHz (PCS)	LTE	60	2
B	700 MHz	LTE	30	1
B	2100 MHz (AWS)	UMTS	30	2
B	2100 MHz (AWS)	UMTS	30	2
C	2100 MHz (AWS)	LTE	60	2
C	1900 MHz (PCS)	LTE	60	2
C	700 MHz	LTE	30	1
C	2100 MHz (AWS)	UMTS	30	2
C	2100 MHz (AWS)	UMTS	30	2

Table 1: T-Mobile channel & power data table

The antenna configuration for T-Mobile at this facility is shown below in **Table 2 – Total Site Antenna Data Table**.

All calculations for this facility were performed assuming that all radios were running at full power and were uncombined in their RF paths with the configuration shown in table 1. FCC OET Bulletin 65 – Edition 97-01 recommends that modeling of this nature should be done as described prior to yield a worst-case scenario. Due to the dynamic nature of many deployed systems the “real world” values will most likely be less than those shown in this report due to worst-case values being shown in all instances.

Total Site Antenna Data Table

Sector	Operator	Frequency Band	TX Power Per Channel	# of Channels	ERP	Antenna Make	Antenna Model	Gain (dBd)	Azimuth (°)	Z Value (ft)**
A	T-Mobile	2100 (AWS)	60	2	3928	Ericsson	Air 32 B66	15.65	0	143.64
A	T-Mobile	1900 (PCS)	60	2	3421	Ericsson	Air 32 B66	15.05	0	143.64
A	T-Mobile	700	30	1	419	CommScope	LNX-6512DS	11.95	0	143.98
A	T-Mobile	2100 (AWS)	30	2	2281	RFS	APX16DWV-16DWV	16.3	0	143.67

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B	T-Mobile	2100 (AWS)	60	2	3928	Ericsson	Air 32 B66	15.65	120	143.64
B	T-Mobile	1900 (PCS)	60	2	3421	Ericsson	Air 32 B66	15.05	120	143.64
B	T-Mobile	700	30	1	419	Commscope	LNx-6512DS	11.95	120	143.98
B	T-Mobile	2100 (AWS)	30	2	2281	RFS	APX16DWV-16DWV	16.3	120	143.67
B	T-Mobile	2100 (AWS)	30	2	2281	RFS	APX16DWV-16DWV	16.3	120	143.67
C	T-Mobile	2100 (AWS)	60	2	3928	Ericsson	Air 32 B66	15.65	240	143.64
C	T-Mobile	1900 (PCS)	60	2	3421	Ericsson	Air 32 B66	15.05	240	143.64
C	T-Mobile	700	30	1	419	Commscope	LNx-6512DS	11.95	240	143.98
C	T-Mobile	2100 (AWS)	30	2	2281	RFS	APX16DWV-16DWV	16.3	240	143.67
C	T-Mobile	2100 (AWS)	30	2	2281	RFS	APX16DWV-16DWV	16.3	240	143.67

Table 2: Total Site Antenna data table *** (Z Value is distance from bottom of antenna to walking surface)*

RESULTS

All calculations performed based upon the data listed for this facility have produced results that are within allowable limits for General Population and Occupational limits for exposure to RF emissions as specified by federal standards. T-Mobile can ensure compliance on this facility by following the signage recommendations presented in this report

The anticipated maximum power density value (% MPE) calculated in front of any of the T-Mobile sectors is **1.2 %** of the FCC's allowable limit for General Population exposure to radio frequency emissions (**0.24 %** of the FCC's allowable Occupational limit). This was determined based upon worst-case theoretical modeling as described in this report for all walking surfaces in close proximity to the antenna arrays. The following is a summary for each T-Mobile Sector.

Sector A: There are no areas that exceed the **FCC's General Public or Occupational limit** for exposure to radio frequency emissions. The maximum power density value (% MPE) calculated for T-Mobile's Sector A antennas is **1.2 %** of the FCC's allowable limit for General Population exposure to radio frequency emissions (**0.24 %** of the FCC's allowable Occupational limit).

Sector B: There are no areas that exceed the **FCC's General Public or Occupational limit** for exposure to radio frequency emissions. The maximum power density value (% MPE) calculated for T-Mobile's Sector B antennas is **1.2 %** of the FCC's allowable limit for General Population exposure to radio frequency emissions (**0.24 %** of the FCC's allowable Occupational limit).

Sector C: There are no areas that exceed the **FCC's General Public or Occupational limit** for exposure to radio frequency emissions. The maximum power density value (% MPE) calculated for T-Mobile's Sector C antennas is **1.2 %** of the FCC's allowable limit for General Population exposure to radio frequency emissions (**0.24 %** of the FCC's allowable Occupational limit).

The FCC mandates that if a site is found to be out of compliance with regard to emissions that any system operator contributing 5% or more to areas exceeding the FCC's allowable limits, as outlined in this report, will be responsible for bringing the site into compliance. T-Mobile is the only carrier at this site.

Theoretical modeling has identified no areas on any accessible walking surfaces that exceed either the FCC's allowable limits for General Population or Occupational personnel. Areas directly in front of the antennas at the antenna height may exhibit higher power density values than areas vertically or horizontally separated from the antennas.

A Composite emissions threshold plot which graphically shows power density values is shown following in **Exhibit 1 – Emissions Thresholds for Walking Surfaces**

Recommended signage for this facility is shown in **Exhibit 2 – Signage Recommendation Plan**.

Exhibit 1 - Emissions Thresholds for Walking Surfaces

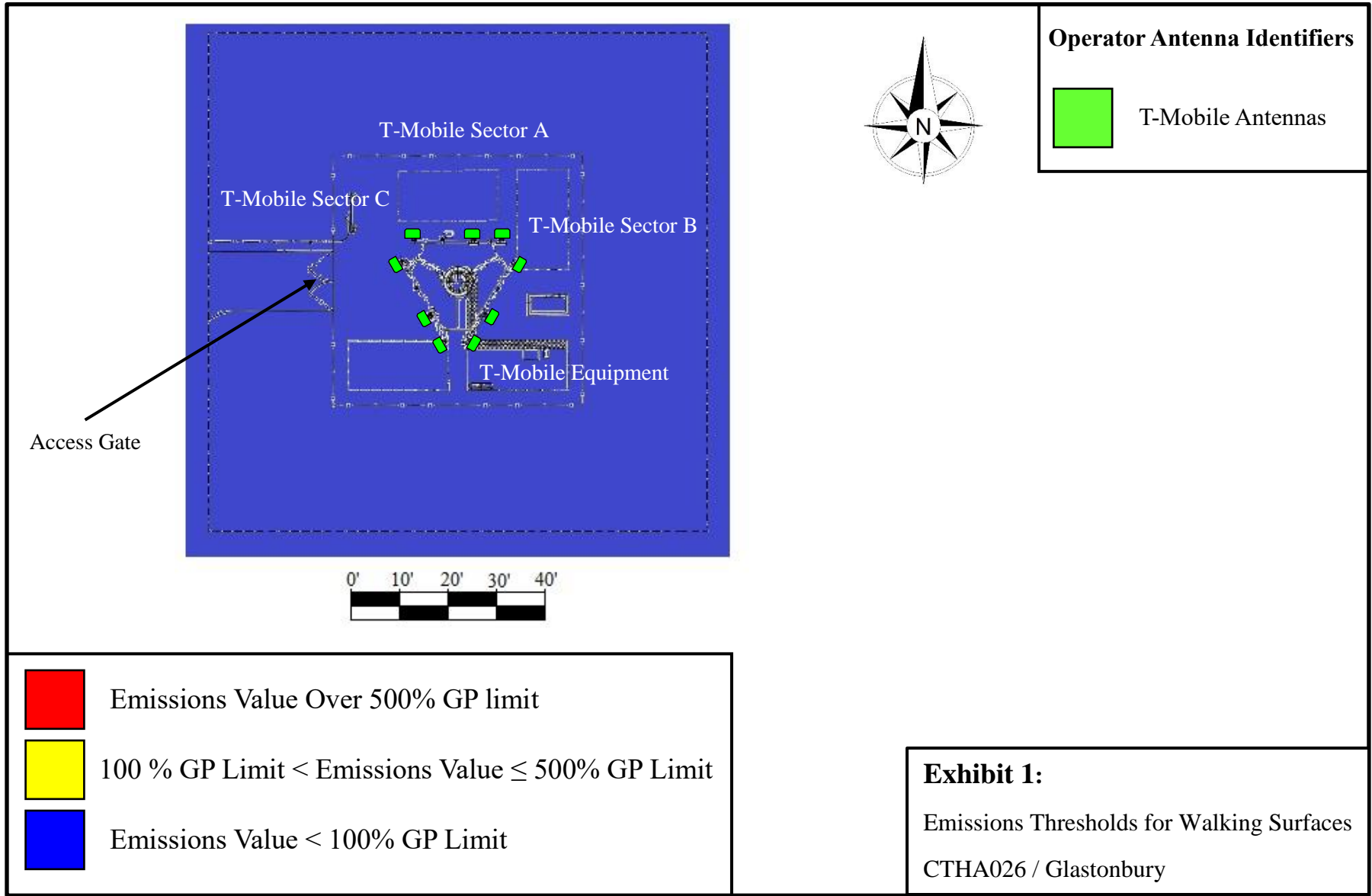
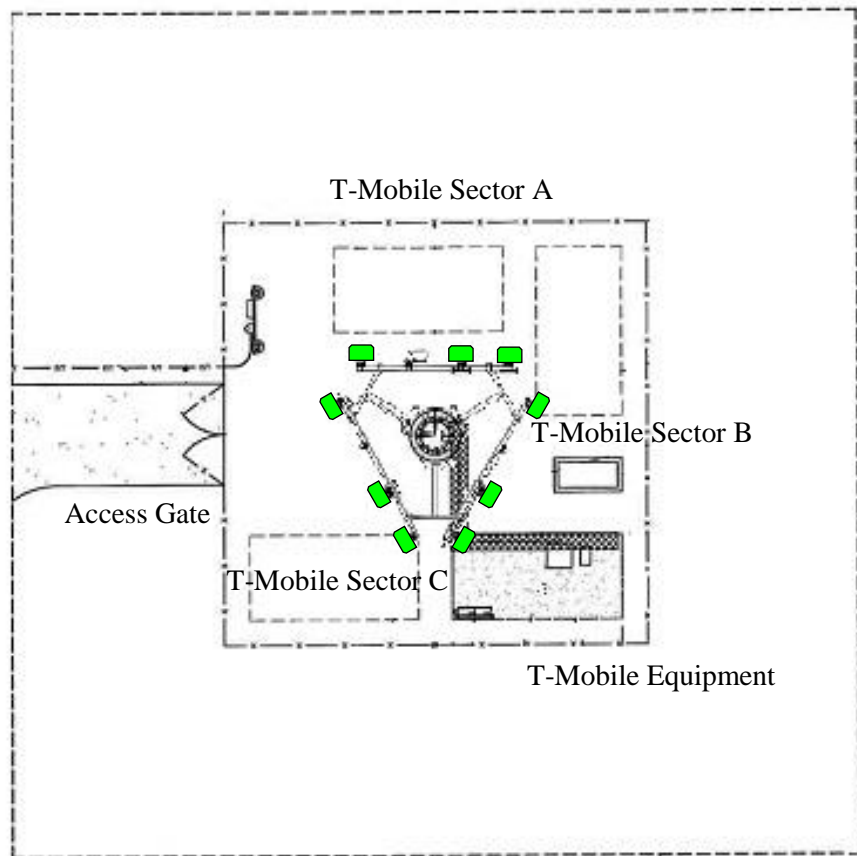


Exhibit 2 – Signage Recommendation Plan

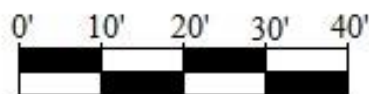


Operator Antenna Identifiers



T-Mobile Antennas

*No signage is required because the antennas are mounted higher than 30' above ground level



Signage Count



0



0



0



0

Exhibit 2:

Signage Recommendation Plan

CTHA026 / Glastonbury

RF Signage Description Table



Sign	Description	Posting Guidelines
	<p style="text-align: center;">RF Guideline Sign</p> <p>Gives guidelines on how to proceed in areas that may exceed either the FCC’s General Population or Occupational emissions limits.</p>	<p>No signage is required because the antennas are mounted higher than 30’ above ground level</p>
	<p style="text-align: center;">Blue Notice Sign</p> <p>Used to inform individuals that they are entering an area that may exceed either the FCC’s General Population or Occupational emissions limits. Must be placed anywhere the public can get within 30 feet vertically or horizontally of an antenna.</p>	<p>No signage is required because the antennas are mounted higher than 30’ above ground level</p>

Table 4: T-Mobile RF Signage Description Table

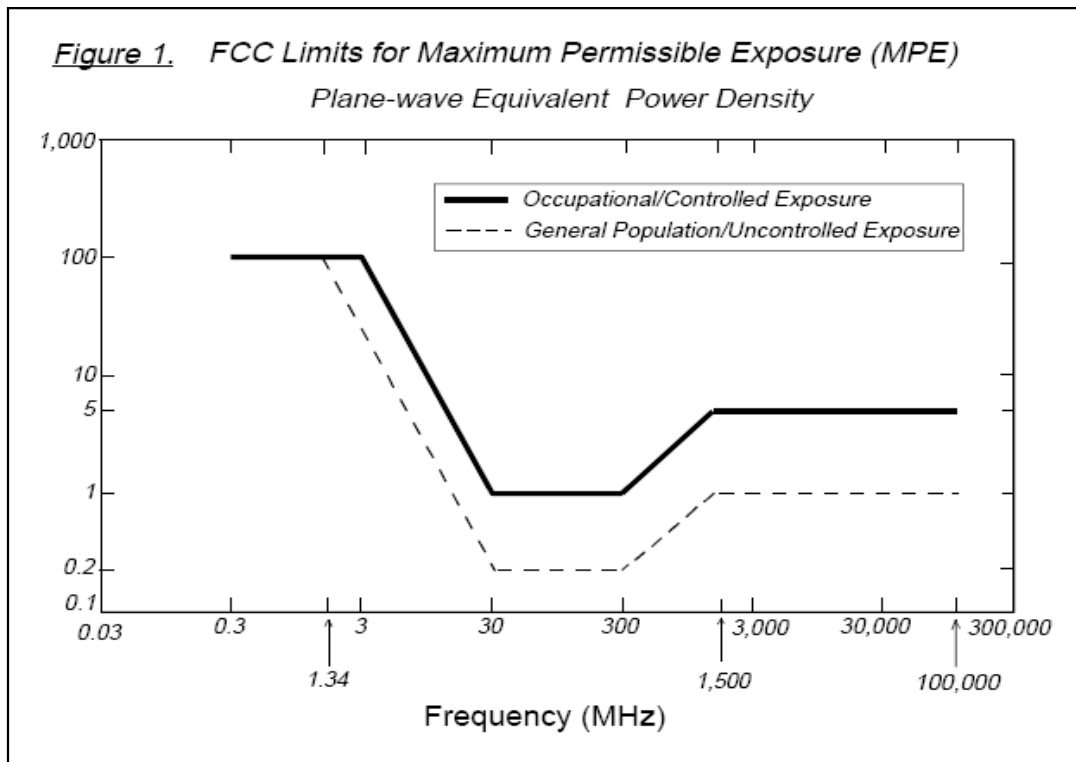
APPENDIX A: FCC Emissions Threshold Limits

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Table 1: Limits for Maximum Permissible Exposure (MPE)				
(A) Limits for Occupational/Controlled Exposure				
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
300-1,500	--	--	f/300	6
1,500-100,000	--	--	5	6
(B) Limits for General Public/Uncontrolled Exposure				
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
300-1,500	--	--	f/1,500	30
1,500-100,000	--	--	1.0	30

f = Frequency in (MHz)

* Plane-wave equivalent power density



APPENDIX B: Certifications

I, Ryan McManus, preparer of this report certify that I am fully trained and aware of the Rules and Regulations of both the Federal Communications Commissions (FCC) and the Occupational Safety and Health Administration (OSHA) with regard to Human Exposure to Radio Frequency Radiation. I have been trained in the procedures and requirements outlined in T-Mobile's FCC Regulatory Compliance Manual.



8/31/2016

I, Scott Heffernan, reviewer and approver of this report certify that I am fully trained and aware of the Rules and Regulations of both the Federal Communications Commissions (FCC) and the Occupational Safety and Health Administration (OSHA) with regard to Human Exposure to Radio Frequency Radiation. I have been trained in the procedures and requirements outlined in T-Mobile's FCC Regulatory Compliance Manual.



8/31/2016
