From: Ray Vergati <rv@homelandtowers.us>
Sent: Thursday, June 29, 2023 6:23 AM
To: Bachman, Melanie <Melanie.Bachman@ct.gov>
Cc: CSC-DL Siting Council <Siting.Council@ct.gov>; Chiocchio, Lucia <LChiocchio@CUDDYFEDER.COM>; Christine Vergati <cv@homelandtowers.us>; Roni Jackson <Roni.Jackson@infraholdingsllc.com>
Subject: Docket No. 499 - 16 Coote Hill Rd, Sherman CT (CT009) Power Density Report

Dear Ms. Bachman.

Per Council's Decision & Order on Docket No. 499 dated August 26, 2021, please find attached a power density report prepared by C Squared Systems dated June 21, 2023. This report contains worst-case modeling for both AT&T's and the Town of Sherman's antennas located on the facility.

Best,

Ray

Raymond Vergati
Regional Manager

HOMELAND TOWERS

Homeland Towers, LLC
9 Harmony Street, 2nd Floor
Danbury, CT 06810

Cell: (203) 605-9646
Office: (203) 297-6345
Email: rv@homelandtowers.us

C Squared Systems, LLC
65 Dartmouth Drive
Auburn, NH 03032
603-644-2800
support@csquaredsystems.com

Calculated Radio Frequency Exposure

CT1341

16 Coote Hill Road, Sherman, CT 06784

June 21, 2023

Table of Contents

List of Tables

List of Figures

1. Introduction

The purpose of this report is to investigate compliance with applicable FCC regulations for the proposed installation of the AT&T antenna arrays on a new monopole tower located at 16 Coote Hill Road in Sherman, CT. The coordinates of the tower are 41° 32' 02.50" N, 73° 29' 34.45" W. The Town of Sherman will also install antenna mounted on the proposed tower.

AT&T is proposing the following:

1) Install nine (9) multi-band antennas (three per sector) to support its commercial LTE network and the FirstNet National Public Safety Broadband Network ("NPSBN").

This report considers the planned antenna configuration for AT&T[1] to derive the resulting % Maximum Permissible Exposure of its proposed installation.

2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

In 1985, the FCC established rules to regulate radio frequency (RF) exposure from FCC licensed antenna facilities. In 1996, the FCC updated these rules, which were further amended in August 1997 by OET Bulletin 65 Edition 97-01. These new rules include Maximum Permissible Exposure (MPE) limits for transmitters operating between 300 kHz and 100 GHz. The FCC MPE limits are based upon those recommended by the National Council on Radiation Protection and Measurements (NCRP), developed by the Institute of Electrical and Electronics Engineers, Inc., (IEEE) and adopted by the American National Standards Institute (ANSI).

The FCC general population/uncontrolled limits set the maximum exposure to which most people may be subjected. General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

Public exposure to radio frequencies is regulated and enforced in units of milliwatts per square centimeter (mW/cm^2). The general population exposure limits for the various frequency ranges are defined in the attached "FCC Limits for Maximum Permissible Exposure (MPE)" in Attachment B of this report.

Higher exposure limits are permitted under the occupational/controlled exposure category, but only for persons who are exposed as a consequence of their employment and who have been made fully aware of the potential for exposure, and they must be able to exercise control over their exposure. General population/uncontrolled limits are five times more stringent than the levels that are acceptable for occupational, or radio frequency trained individuals. Attachment B contains excerpts from OET Bulletin 65 and defines the Maximum Exposure Limit.

Finally, it should be noted that the MPE limits adopted by the FCC for both general population/uncontrolled exposure and for occupational/controlled exposure incorporate a substantial margin of safety and have been established to be well below levels generally accepted as having the potential to cause adverse health effects.

[1] As referenced to AT&T's Radio Frequency Design Sheet updated 01/27/2021.

3. RF Exposure Calculation Methods

The power density calculation results were generated using the following formula as outlined in FCC bulletin OET 65, and Connecticut Siting Council recommendations:

$$\text{Power Density} = \left(\frac{\text{GRF}^2 \times 1.64 \times \text{ERP}}{4\pi \times R^2}\right) \text{X Off Beam Loss}$$

Where:

ERP = Effective Radiated Power

R = Radial Distance = $\sqrt{\left(H^2 + V^2\right)}$

H = Horizontal Distance from antenna

V = Vertical Distance from radiation center of antenna

Ground reflection factor (GRF) of 1.6

Off Beam Loss is determined by the selected antenna pattern

These calculations assume that the antennas are operating at 100 percent capacity and power, and that all antenna channels are transmitting simultaneously. Obstructions (trees, buildings, etc.) that would normally attenuate the signal are not taken into account. The calculations assume even terrain in the area of study and do not consider actual terrain elevations which could attenuate the signal. As a result, the predicted signal levels reported below are much higher than the actual signal levels will be from the final installations.

4. Calculation Results

The calculated power density results are shown in Figure 1 below. For completeness, the calculations for this analysis range from 0 feet horizontal distance (directly below the antennas) to a value of 3,000 feet horizontal distance from the site. In addition to the other worst-case scenario considerations that were previously mentioned, the power density calculations to each horizontal distance point away from the antennas was completed using a local maximum off beam antenna gain (within ± 5 degrees of the true mathematical angle) to incorporate a realistic worst-case scenario.

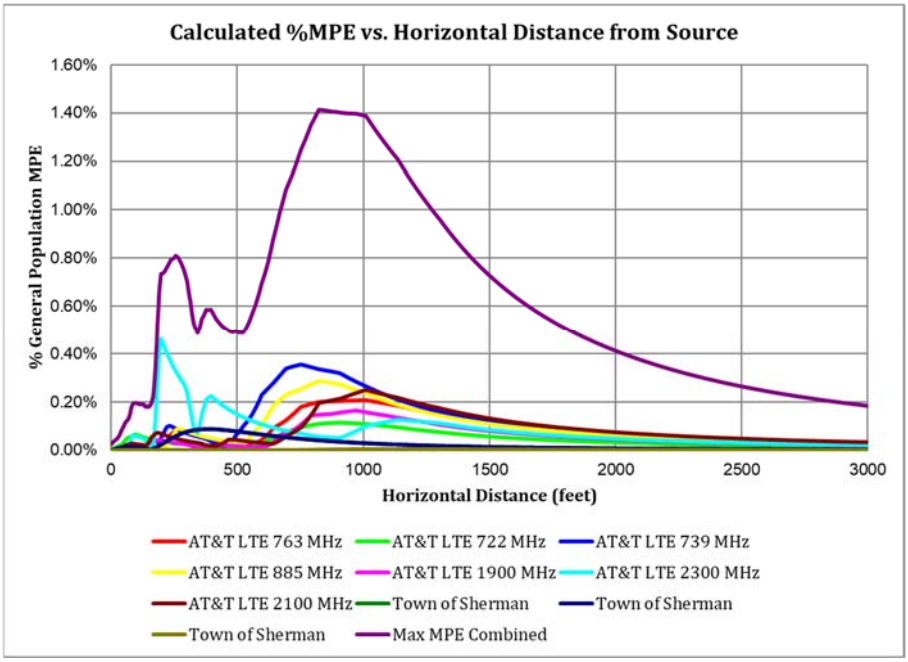


Figure 1: Graph of General Population % MPE vs. Distance

The highest percent of MPE (1.41% of the General Population limit) is calculated to occur at a horizontal distance of 824 feet from antennas. Please note that the percent of MPE calculations close to the site take into account off beam loss, which is determined from the vertical pattern of the antennas used. Therefore, RF power density levels may increase as the distance from the site increases. At distances of approximately 1500 feet and beyond, one would now be in the main beam of the antenna pattern and off beam loss is no longer considered. Beyond this point, RF levels become calculated solely on distance from the site and the percent of MPE decreases significantly as distance from the site increases.

Table 2 below lists percent of MPE values as well as the associated parameters that were included in the calculations. The highest percent of MPE value was calculated to occur at a horizontal distance of 824 feet from the site (reference Figure 1).

As stated in Section 3, all calculations assume that the antennas are operating at 100 percent capacity, that all antenna channels are transmitting simultaneously, and that the radio transmitters are operating at full power. Obstructions (trees, buildings etc.) that would normally attenuate the signal are not taken into account. In addition, a six foot height offset was considered in this analysis to account for average human height. As a result, the predicted signal levels are significantly higher than the actual signal levels will be from the final configuration. The results presented in Figure 1 and Table 2 assume level ground elevation from the base of the tower out to the horizontal distances calculated.

Carrier	Number of Transmitters	Power out of Base Station Per Transmitter (Watts)	Antenna Height (Feet)	Distance to the Base of Antennas (Feet)	Power Density (mW/cm^2)	Limit (mW/cm^2)	% MPE
AT&T LTE 1900 MHz	1	160.0	160.0	824	0.001468	1.000	0.15%
AT&T LTE 2100 MHz	1	240.0	166.0	824	0.001953	1.000	0.20%
AT&T LTE 2300 MHz	1	160.0	166.0	824	0.000559	1.000	0.06%
AT&T LTE 722 MHz	1	80.0	166.0	824	0.000526	0.481	0.11%
AT&T LTE 739 MHz	1	160.0	166.0	824	0.001651	0.493	0.34%
AT&T LTE 763 MHz	1	160.0	166.0	824	0.001014	0.509	0.20%
AT&T LTE 885 MHz	1	160.0	166.0	824	0.001690	0.590	0.29%
Town of Sherman	1	100.0	182.0	824	0.000082	0.200	0.04%
Town of Sherman	1	100.0	182.0	824	0.000082	0.200	0.04%
Town of Sherman	1	1.0	172.0	824	0.000025	1.000	0.00%
						Total	**1.41%**

Table 1: Maximum Percent of General Population Exposure Values

5. Conclusion

The above analysis verifies that RF exposure levels from the site with Verizon's proposed antenna configuration will be well below the maximum permissible levels as outlined by the FCC in the OET Bulletin 65 Ed. 97-01. Using the conservative calculation methods and parameters detailed above, the maximum cumulative percent of MPE in consideration of all transmitters is calculated to be **1.41% of the FCC limit (General Population/Uncontrolled)**. This maximum cumulative percent of MPE value is calculated to occur 824 feet away from the site.

In response to Condition 3 of the Docket 499 Decision and Order dated August 26, 2021:

> The closest point of uncontrolled access to the tower base is at the compound fence which is 20 feet from the tower at its closest point. At this distance, the cumulative percent of MPE in consideration of all transmitters is calculated to be **0.04%**.

6. Statement of Certification

I certify to the best of my knowledge that the statements in this report are true and accurate. The calculations follow guidelines set forth in FCC OET Bulletin 65 Edition 97-01, ANSI/IEEE Std. C95.1 and ANSI/IEEE Std. C95.3.

Report Prepared By: Ram Acharya
RF Engineer 1
C Squared Systems, LLC

June 22, 2023
Date

Reviewed/Approved By: Martin J. Lavin
Senior RF Engineer
C Squared Systems, LLC

June 23, 2023
Date

Attachment A: References

OET Bulletin 65 - Edition 97-01 - August 1997 Federal Communications Commission Office of Engineering & Technology

IEEE C95.1-2005, IEEE Standard Safety Levels With Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz IEEE-SA Standards Board

IEEE C95.3-2002 (R2008), IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields, 100 kHz-300 GHz IEEE-SA Standards Board

Attachment B: FCC Limits for Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/Controlled Exposure[2]

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (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

(B) Limits for General Population/Uncontrolled Exposure[3]

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (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

Table 2: FCC Limits for Maximum Permissible Exposure (MPE)

[2] Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure

[3] General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure

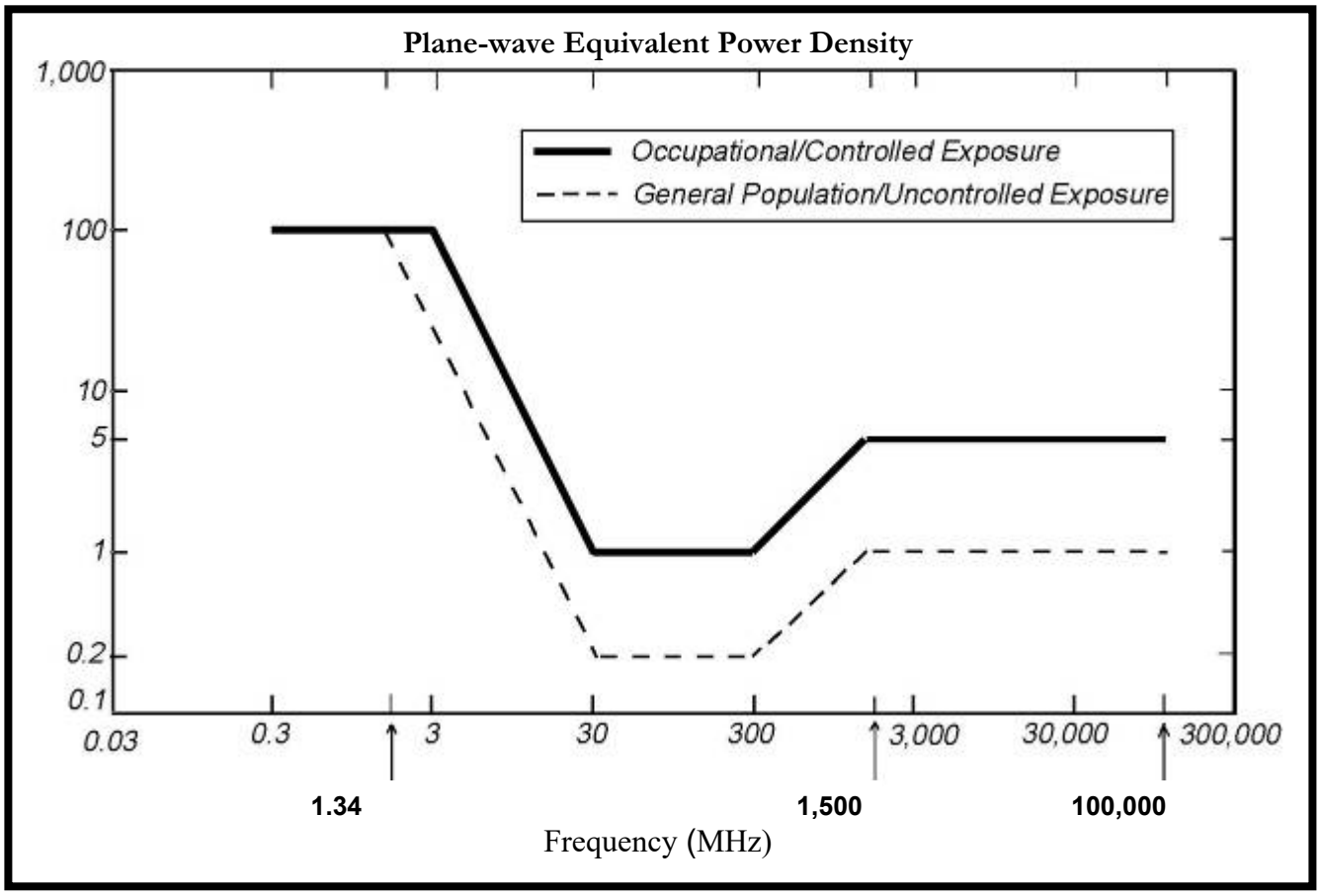
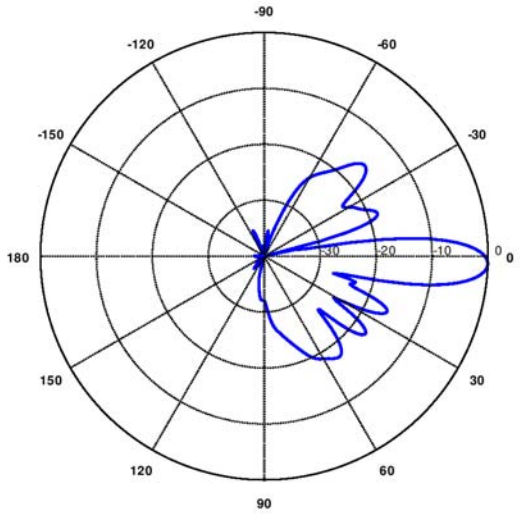


Figure 2: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: AT&T Antenna Data Sheets and Electrical Patterns

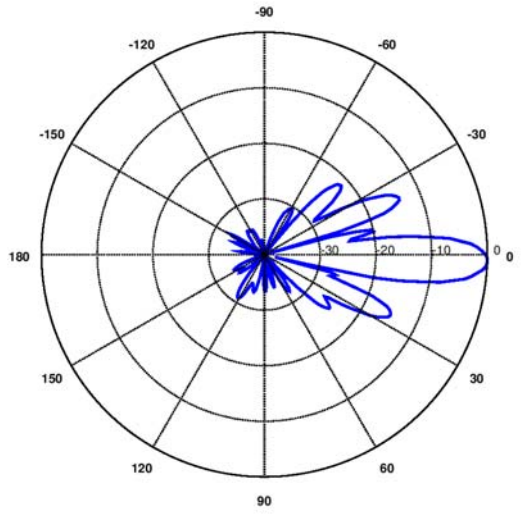
722 MHz

Manufacturer:	CCI Products
Model #:	HPA65R-BU8A
Frequency Band:	698-806 MHz
Gain:	12.85 dBd
Vertical Beamwidth:	9.7°
Horizontal Beamwidth:	67°
Polarization:	Dual Linear 45°
Size L x W x D:	96.0” x 11.7” x 7.7”



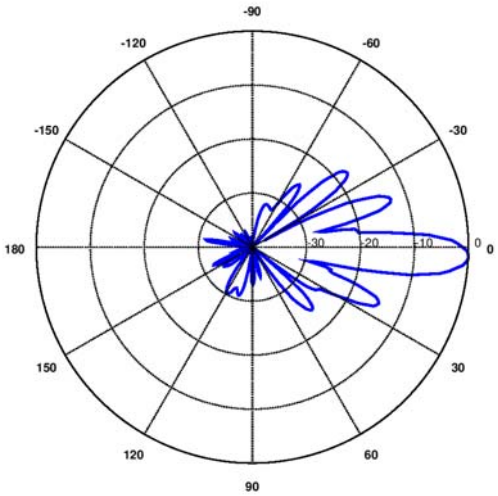
739/763 MHz

Manufacturer:	KMW
Model #:	EPBQ-654L8H8-L2
Frequency Band:	698 - 806MHz
Gain:	13.75 dBd
Vertical Beamwidth:	9.3°
Horizontal Beamwidth:	67°
Polarization:	Dual Linear 45°
Size L x W x D:	96.0” x 21” x 6.3”



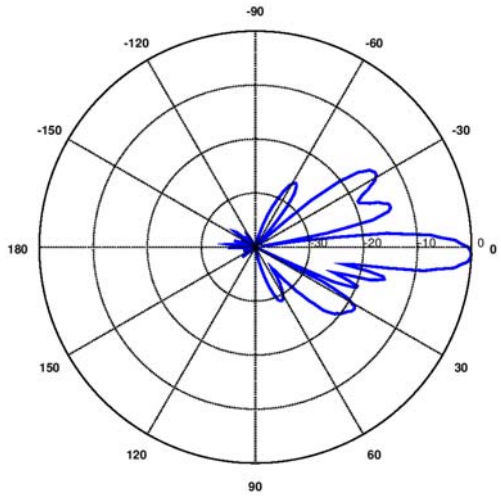
885 MHz

Manufacturer:	KMW
Model #:	EPBQ-654L8H8-L2
Frequency Band:	806 - 894 MHz
Gain:	14.05 dBd
Vertical Beamwidth:	8.7°
Horizontal Beamwidth:	66°
Polarization:	Dual Linear 45°
Size L x W x D:	96.0” x 21” x 6.3”



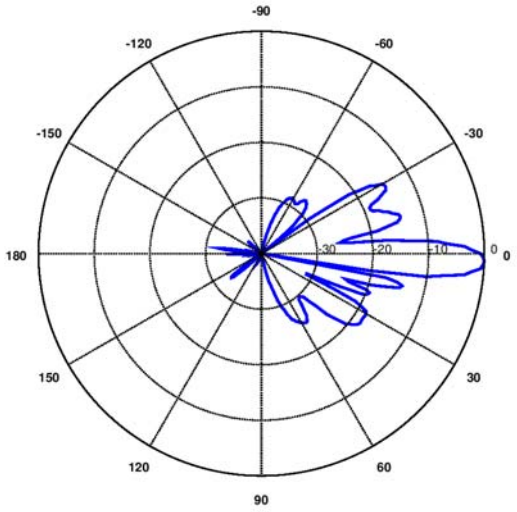
1900 MHz

Manufacturer:	KMW
Model #:	EPBQ-654L8H8-L2
Frequency Band:	1850-1910 MHz
Gain:	15.15 dBd
Vertical Beamwidth:	7.8°
Horizontal Beamwidth:	60°
Polarization:	Dual Linear 45°
Size L x W x D:	96.0” x 21” x 6.3”



2100 MHz

Manufacturer:	KMW
Model #:	EPBQ-654L8H8-L2
Frequency Band:	1910-2180 MHz
Gain:	15.55 dBd
Vertical Beamwidth:	7.4°
Horizontal Beamwidth:	60°
Polarization:	Dual Linear 45°
Size L x W x D:	96.0” x 21” x 6.3”



2300 MHz

Manufacturer:	CCI Products
Model #:	HPA-65R-BU8A
Frequency Band:	2300 - 2400 MHz
Gain:	15.05 dBd
Vertical Beamwidth:	4.0°
Horizontal Beamwidth:	60°
Polarization:	Dual Linear 45°
Size L x W x D:	96.0” × 11.7” × 7.7”