Lawrence Behr Associates INC
www.lbagroup.com

Radio Frequency Emissions Report

SITE NAME:

302469 Bridgeport CT 2

LOCATION:

Bridgeport, Connecticut

COMPANY:

American Tower Corporation
Woburn, Massachusetts

September 10th, 2020

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GREENVILLE, NORTH CAROLINA

RADIO FREQUENCY EMISSIONS REPORT

302469 Bridgeport CT 2

Bridgeport, Connecticut

INTRODUCTION

Lawrence Behr Associates, Inc. (LBA) has been retained by American Tower Corporation (ATC) of Woburn, Massachusetts to evaluate the RF emissions of an existing tower at this location. AT&T is adding emitters to this site and the purpose of this study is to determine if, after the addition of the AT&T emitters, the site is in Compliance with FCC Regulations. This study determined that THIS SITE IS IN COMPLIANCE with Federal Regulations.

Details regarding the FCC Rules and the methodology used to determine compliance may be seen below.

SITE AND FACILITY CONSIDERATIONS

Site 302469 Bridgeport CT 2 is located at 1069 Connecticut Avenue in Bridgeport, Connecticut at coordinates 41.18361, -73.15838. The support structure is a 129' monopole.

All data used in this study was provided by one or more of the following sources:

1. ATC furnished data
2. Compiled from carrier and manufacturer standard configurations
3. Empirical data collected by LBA

AT&T proposes to add antennas to the tower at the 106' level. The structure already supports several antennas. This study only considers the new AT&T facility in detail.

The load list may be seen in Appendix 1. Appendix 2 contains the AT&T channel counts, frequency bands, and power levels. AT&T Antenna information may be seen in Appendix 3.

POWER DENSITY CALCULATIONS

Based upon the provided information and the FCC limits for exposure as outlined in 47 CFR 1.1307(b)(1) - (b)(3), the power levels and percentages of the FCC's allowable general population limit are shown in Appendix 4. Calculations were done at industry standard average head height of six feet above ground level.

A summary of the power density from all emitters may be seen in Appendix 5.

These limits are based upon the Information Relating to MPE Standards found in Appendix 6. Study methodology may be seen in Appendix 7, which describes the Non-Ionizing Radiation Prediction Models. Approximate radiation patterns may be found in Appendix 5. This site ***IS*** in compliance with FCC OET-65 MPE limits.

September 10th, 2020

Kathryn G. Tesh
Wireless Services Manager

APPENDIX 1 *Load List*

Proposed	Customer	RAD Height (ft)	Equipment Quantity	Equipment Type	Manufacturer	Model Number	Line Quantity	Line size	Mount Type	Azimuths	TX Frequency	RX Frequency
No	CLEARWIRE CORPORATION	131	1	DISH-HP	DragonWave	A-ANT-23G-1-C	1	1/2" Coax	T-Arm	125.6787	23	23
No	CLEARWIRE CORPORATION	131	1	DISH-HP	DragonWave	A-ANT-18G-2-C	2	1/2" Coax	T-Arm	255.2791	18	18
No	CLEARWIRE CORPORATION	131	3	PANEL	Commscope	NNVV-65B-R4			T-Arm	25/155/275	1850-1995, 806-869	1850-1995, 806-869
No	CLEARWIRE CORPORATION	127	3	PANEL	Argus	LLPX310R			T-Arm	30/150/270		
No	T-MOBILE	120	3	PANEL	Ericsson	Air 3246 B66	18	1 5/8" Coax	Low Profile Platform	20/120/240	2130-2135, 2135-2140, 2140-2145, 2145-2150	1730-1735, 1735-1740, 1740-1745, 1745-1750
No	T-MOBILE	120	3	PANEL	Ericsson	AIR-32 B2A/B66 Aa	1	1 1/4" (1.25" 31.8mm) Fiber	Low Profile Platform	20/120/240	1940-1950	1860-1870
No	T-MOBILE	120	3	PANEL	RFS	APXVAARR24_43-U-NA20	1	1 5/8" (1.63" 41.3mm) Fiber	Low Profile Platform	20/120/240	1940-1950, 2130-2150, 728-734	1730-1750, 1860-1870, 698-704
No	AT&T MOBILITY	106	3	PANEL	Powerwave Allgon	7750.00	12	1 5/8" Coax	Platform with Handrails	30/150/270	1930-1935, 1945-1950, 1965-1970, 891.6-893.8	1855, 1865-1870, 1885-1890, 846.6-848.8
No	AT&T MOBILITY	106	6	PANEL	CCI	OPA-65R-LCUU-H4			Platform with Handrails	30/150/270	1930-1935, 1945-1950, 2130-2135, 734-745, 880-890, 891-894	1730-1735, 1850-1855, 1865-1870, 1885-1890, 1902-1910, 703-715, 835-845, 846-849
Yes	SIGFOX S.A.	88	1	OMNI		CXL 900-3LW			Side Arm	0	905.2, 906	905.2, 906
No	SIGFOX S.A.	88	1	OMNI		CXL 900-3LW			Stand-Off	0	905.2, 906	905.2, 906
Yes	SIGFOX S.A.	10	1	DISH-STANDARD		Smart LNB				0	12.78	29.75

APPENDIX 2

AT&T Channels Used

AT&T A1	LTE	1900	1	40
AT&T A2	LTE	1900	1	40
AT&T A3	LTE	1900	1	40
AT&T A4	UMTS	850	1	40
AT&T A5	LTE	1900	1	40
AT&T A6	LTE	1900	1	40
AT&T A7	LTE	2100	1	40
AT&T A8	LTE	700	1	40
AT&T A9	UMTS	850	1	40
AT&T A10	UMTS	850	1	40
AT&T B1	LTE	1900	1	40
AT&T B2	LTE	1900	1	40
AT&T B3	LTE	1900	1	40
AT&T B4	UMTS	850	1	40
AT&T B5	LTE	1900	1	40
AT&T B6	LTE	1900	1	40
AT&T B7	LTE	2100	1	40
AT&T B8	LTE	700	1	40
AT&T B9	UMTS	850	1	40
AT&T B10	UMTS	850	1	40
AT&T C1	LTE	1900	1	40
AT&T C2	LTE	1900	1	40
AT&T C3	LTE	1900	1	40
AT&T C4	UMTS	850	1	40
AT&T C5	LTE	1900	1	40
AT&T C6	LTE	1900	1	40
AT&T C7	LTE	2100	1	40
AT&T C8	LTE	700	1	40
AT&T C9	UMTS	850	1	40
AT&T C10	UMTS	850	1	40

APPENDIX 3

AT&T Antenna Information

A	AT&T A1	Powerwave Allgon 7750.0	106
A	AT&T A2	Powerwave Allgon 7750.0	106
A	AT&T A3	Powerwave Allgon 7750.0	106
A	AT&T A4	Powerwave Allgon 7750.0	106
A	AT&T A5	CCI OPA-65R-LCUU-H4	106
A	AT&T A6	CCI OPA-65R-LCUU-H4	106
A	AT&T A7	CCI OPA-65R-LCUU-H4	106
A	AT&T A8	CCI OPA-65R-LCUU-H4	106
A	AT&T A9	CCI OPA-65R-LCUU-H4	106
A	AT&T A10	CCI OPA-65R-LCUU-H4	106
B	AT&T B1	Powerwave Allgon 7750.0	106
B	AT&T B2	Powerwave Allgon 7750.0	106
B	AT&T B3	Powerwave Allgon 7750.0	106
B	AT&T B4	Powerwave Allgon 7750.0	106
B	AT&T B5	CCI OPA-65R-LCUU-H4	106
B	AT&T B6	CCI OPA-65R-LCUU-H4	106
B	AT&T B7	CCI OPA-65R-LCUU-H4	106
B	AT&T B8	CCI OPA-65R-LCUU-H4	106
B	AT&T B9	CCI OPA-65R-LCUU-H4	106
B	AT&T B10	CCI OPA-65R-LCUU-H4	106
C	AT&T C1	Powerwave Allgon 7750.0	106
C	AT&T C2	Powerwave Allgon 7750.0	106
C	AT&T C3	Powerwave Allgon 7750.0	106
C	AT&T C4	Powerwave Allgon 7750.0	106
C	AT&T C5	CCI OPA-65R-LCUU-H4	106
C	AT&T C6	CCI OPA-65R-LCUU-H4	106
C	AT&T C7	CCI OPA-65R-LCUU-H4	106
C	AT&T C8	CCI OPA-65R-LCUU-H4	106
C	AT&T C9	CCI OPA-65R-LCUU-H4	106
C	AT&T C10	CCI OPA-65R-LCUU-H4	106

APPENDIX 4

FCC OET-65 MPE Limit Study

Antenna ID	Antenna Make / Model	Frequency Band	Antenna Gain (dBd)	Antenna Height (ft)	Channel Count	TX Power (W)	ERP (W) (All Channels)	Total Power Density (µW/cm^2)	Allowable Public MPE (µW/cm^2)	Public MPE%
AT&T A1	Powerwave Allgon 7750.0	1900	15.15	106	1	40	2148.13	0.5267617	1000.00	0.052676%
AT&T A2	Powerwave Allgon 7750.0	1900	15.15	106	1	40	2148.13	0.5267617	1000.00	0.052676%
AT&T A3	Powerwave Allgon 7750.0	1900	15.15	106	1	40	2148.13	0.5267617	1000.00	0.052676%
AT&T A4	Powerwave Allgon 7750.0	850	12.85	106	1	40	1264.91	0.2852893	566.67	0.050345%
AT&T A5	CCI OPA-65R-LCUU-H4	1900	13.55	106	1	40	1486.14	4.311297	1000.00	0.431130%
AT&T A6	CCI OPA-65R-LCUU-H4	1900	13.55	106	1	40	1486.14	4.311297	1000.00	0.431130%
AT&T A7	CCI OPA-65R-LCUU-H4	2100	14.25	106	1	40	1746.06	0.9423075	1000.00	0.094231%
AT&T A8	CCI OPA-65R-LCUU-H4	700	10.55	106	1	40	744.83	0.508011	466.67	0.108860%
AT&T A9	CCI OPA-65R-LCUU-H4	850	11.15	106	1	40	855.18	1.2352893	566.67	0.217992%
AT&T A10	CCI OPA-65R-LCUU-H4	850	11.15	106	1	40	855.18	1.2352893	566.67	0.217992%
AT&T B1	Powerwave Allgon 7750.0	1900	15.15	106	1	40	2148.13	0.5267617	1000.00	0.052676%
AT&T B2	Powerwave Allgon 7750.0	1900	15.15	106	1	40	2148.13	0.5267617	1000.00	0.052676%
AT&T B3	Powerwave Allgon 7750.0	1900	15.15	106	1	40	2148.13	0.5267617	1000.00	0.052676%
AT&T B4	Powerwave Allgon 7750.0	850	12.85	106	1	40	1264.91	0.2852893	566.67	0.050345%
AT&T B5	CCI OPA-65R-LCUU-H4	1900	13.55	106	1	40	1486.14	4.311297	1000.00	0.431130%
AT&T B6	CCI OPA-65R-LCUU-H4	1900	13.55	106	1	40	1486.14	4.311297	1000.00	0.431130%
AT&T B7	CCI OPA-65R-LCUU-H4	2100	14.25	106	1	40	1746.06	0.9423075	1000.00	0.094231%
AT&T B8	CCI OPA-65R-LCUU-H4	700	10.55	106	1	40	744.83	0.508011	466.67	0.108860%
AT&T B9	CCI OPA-65R-LCUU-H4	850	11.15	106	1	40	855.18	1.2352893	566.67	0.217992%
AT&T B10	CCI OPA-65R-LCUU-H4	850	11.15	106	1	40	855.18	1.2352893	566.67	0.217992%
AT&T C1	Powerwave Allgon 7750.0	1900	15.15	106	1	40	2148.13	0.5267617	1000.00	0.052676%
AT&T C2	Powerwave Allgon 7750.0	1900	15.15	106	1	40	2148.13	0.5267617	1000.00	0.052676%
AT&T C3	Powerwave Allgon 7750.0	1900	15.15	106	1	40	2148.13	0.5267617	1000.00	0.052676%
AT&T C4	Powerwave Allgon 7750.0	850	12.85	106	1	40	1264.91	0.2852893	566.67	0.050345%
AT&T C5	CCI OPA-65R-LCUU-H4	1900	13.55	106	1	40	1486.14	4.311297	1000.00	0.431130%
AT&T C6	CCI OPA-65R-LCUU-H4	1900	13.55	106	1	40	1486.14	4.311297	1000.00	0.431130%
AT&T C7	CCI OPA-65R-LCUU-H4	2100	14.25	106	1	40	1746.06	0.9423075	1000.00	0.094231%
AT&T C8	CCI OPA-65R-LCUU-H4	700	10.55	106	1	40	744.83	0.508011	466.67	0.108860%
AT&T C9	CCI OPA-65R-LCUU-H4	850	11.15	106	1	40	855.18	1.2352893	566.67	0.217992%
AT&T C10	CCI OPA-65R-LCUU-H4	850	11.15	106	1	40	855.18	1.2352893	566.67	0.217992%
AT&T All Sectors									**Total:**	**5.1291%**

APPENDIX 5

Summary of Power Density

Carriers	Power Density Value (% of General Population)
AT&T All Sectors:	5.1291%
Other Carriers:	34.4909%
Site Total:	39.6200%
Site Compliance Status:	Compliant

APPENDIX 6 *Information Pertaining to MPE Studies*

In 1985, the FCC first adopted guidelines to be used for evaluating human exposure to RF emissions. The FCC revised and updated these guidelines on August 1, 1996, as a result of a rule-making proceeding initiated in 1993. The new guidelines incorporate limits for Maximum Permissible Exposure (MPE) in terms of electric and magnetic field strength and power density for transmitters operating at frequencies between 300 kHz and 100 GHz.

The FCC's MPE limits are based on exposure limits recommended by the National Council on Radiation Protection and Measurements (NCRP) and, over a wide range of frequencies, the exposure limits were developed by the Institute of Electrical and Electronics Engineers, Inc., (IEEE) and adopted by the American National Standards Institute (ANSI) to replace the 1982 ANSI guidelines. Limits for localized absorption are based on recommendations of both ANSI/IEEE and NCRP.

The FCC's limits, and the NCRP and ANSI/IEEE limits on which they are based, are derived from exposure criteria quantified in terms of specific absorption rate (SAR). The basis for these limits is a whole-body averaged SAR threshold level of 4 watts per kilogram (4 W/kg), as averaged over the entire mass of the body, above which expert organizations have determined that potentially hazardous exposures may occur. The MPE limits are derived by incorporating safety factors that lead, in some cases, to limits that are more conservative than the limits originally adopted by the FCC in 1985. Where more conservative limits exist, they do not arise from a fundamental change in the RF safety criteria for whole-body averaged SAR, but from a precautionary desire to protect subgroups of the general population who, potentially, may be more at risk.

The FCC exposure limits are also based on data showing that the human body absorbs RF energy at some frequencies more efficiently than at others. The most restrictive limits occur in the frequency range of 30-300 MHz where whole-body absorption of RF energy by human beings is most efficient. At other frequencies, whole-body absorption is less efficient, and consequently, the MPE limits are less restrictive.

MPE limits are defined in terms of power density (units of milliwatts per centimeter squared: mW/cm^2), electric field strength (units of volts per meter: V/m) and magnetic field strength (units of amperes per meter: A/m). The far-field of a transmitting antenna is where the electric field vector (E), the

magnetic field vector (H), and the direction of propagation can be considered to be all mutually orthogonal ("plane-wave" conditions).

The FCC guidelines define two separate tiers of exposure limits. As defined by the FCC, these limits are:

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.

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. Additional details can be found in FCC OET 65.

For the purposes of this study, only General population/uncontrolled exposure limits were studied.

APPENDIX 7 *MPE Standards Methodology*

This study predicts RF field strength and power density levels that emanate from communications system antennae. It considers all transmitter power levels (less filter and line losses) delivered to each active transmitting antenna at the communications site. Calculations are performed to determine power density and MPE levels for each antenna as well as composite levels from all antennas. The calculated levels are based on where a human (Observer) would be standing at various locations at the site. The point of interest where the MPE level is predicted is based on the height of the Observer.

Compliance with the FCC limits on RF emissions are determined by spatially averaging a person's exposure over the projected area of an adult human body, that is approximately six-feet or two-meters, as defined in the ANSI/IEEE C95.1 standard. The MPE limits are specified as time-averaged exposure limits. This means that exposure is averaged over an identifiable time interval. It is 30 minutes for the general population/uncontrolled RF environment and 6 minutes for the occupational/controlled RF environment. However, in the case of the general public, time averaging should not be applied because the general public is typically not aware of RF exposure and they do not have control of their exposure time. Therefore, it should be assumed that any RF exposure to the general public will be continuous.

The FCC's limits for exposure at different frequencies are shown in the following Tables.

Limits for Occupational/Controlled Exposure				
Frequency Range (MHz)	**Electric Field Strength (E) (V/m)**	**Magnetic Field Strength (H) (A/m)**	**Power Density (S) (mW/cm²)**	**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/F²	6
30 - 300	61.4	0.163	1.0	6
300 - 1500	--	--	f/300	6
1500 - 100,000	--	--	5	6

Where:
f = frequency
* = Plane-wave equivalent power density

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.

Limits for General Population/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 -1500	--	--	f/1500	30
1500 -100,000	--	--	1.0	30

Where:
f = frequency
* = Plane-wave equivalent power density

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.

It is important to understand that these limits apply cumulatively to all sources of RF emissions affecting a given area. For example, if several different communications system antennas occupy a shared facility such as a tower or rooftop, then the total exposure from all systems at the facility must be within compliance of the FCC guidelines.

The field strength emanating from an antenna can be estimated based on the characteristics of an antenna radiating in free space. There are basically two field areas associated with a radiating antenna. When close to the antenna, the region is known as the Near Field. Within this region, the characteristics of the RF fields are very complex and the wave front is extremely curved. As you move further from the antenna, the wave front has less curvature and becomes planar. The wave front still

has a curvature but it appears to occupy a flat plane in space (plane-wave radiation). This region is known as the Far Field.

Two models are utilized to predict Near and Far field power densities. They are based on the formulae in FCC OET 65. As this study is concerned only with Near Field calculations, we will only describe the model used for this study. For additional details, refer to FCC OET Bulletin 65.

Cylindrical Model (Near Field Predictions)

Spatially averaged plane-wave equivalent power densities parallel to the antenna may be estimated by dividing the antenna input power by the surface area of an imaginary cylinder surrounding the length of the radiating antenna. While the actual power density will vary along the height of the antenna, the average value along its length will closely follow the relation given by the following equation:

$$S = P \div 2\pi RL$$

Where:
S = Power Density
P = Total Power into antenna
R = Distance from the antenna
L = Antenna aperture length

For directional-type antennas, power densities can be estimated by dividing the input power by that portion of a cylindrical surface area corresponding to the angular beam width of the antenna. For example, for the case of a 120-degree azimuthal beam width, the surface area should correspond to 1/3 that of a full cylinder. This would increase the power density near the antenna by a factor of three over that for a purely omni-directional antenna. Mathematically, this can be represented by the following formula:

$$S = (180 / \theta_{BW}) P \div \pi RL$$

Where:
S = Power Density
θ_{BW} = Beam width of antenna in degrees (3 dB half-power point)
P = Total Power into antenna
R = Distance from the antenna
L = Antenna aperture length

If the antenna is a 360-degree omni-directional antenna, this formula would be equivalent to the previous formula.

Spherical Model (Far Field Predictions)

Spatially averaged plane-wave power densities in the Far Field of an antenna may be estimated by considering the additional factors of antenna gain and reflective waves that would contribute to exposure.

The radiation pattern of an antenna has developed in the Far Field region and the power gain needs to be considered in exposure predictions. Also, if the vertical radiation pattern of the antenna is considered, the exposure predictions would most likely be reduced significantly at ground level, resulting in a more realistic estimate of the actual exposure levels.

Additionally, to model a truly "worst case" prediction of exposure levels at or near a surface, such as at ground-level or on a rooftop, reflection off the surface of antenna radiation power can be assumed, resulting in a potential four-fold increase in power density.

These additional factors are considered and the Far Field prediction model is determined by the following equation:

$$S = EIRP \times Rc \div 4\pi R^2$$

Where:
S = Power Density
EIRP = Effective Radiated Power from antenna
Rc = Reflection Coefficient (2.56)
R = Distance from the antenna

The EIRP includes the antenna gain. If the antenna pattern is considered, the antenna gain is relative based on the horizontal and vertical pattern gain values at that particular location in space, on a rooftop or on the ground. However, it is recommended that the antenna radiation pattern characteristics not be considered to provide a conservative "worst case" prediction. This is the equation is utilized for the Far Field exposure predictions herein.