ELECTROMAGNETIC ENERGY (EME) EXPOSURE REPORT

Site Name:	**Round Barn**
Site ID:	**CCL05865**
USID:	**325383**
FA Location:	**15974413**
Site Type:	**Rooftop**
Location:	**3562 Round Barn Circle Santa Rosa, CA 95403**
Latitude (NAD83):	**38.4799980**
Longitude (NAD83):	**-122.7308860**
Report Completed:	**February 09, 2024**
AT&T M-RFSC	**Casey Chan**

Prepared By:

OSC ENGINEERING

Prepared for: AT&T Mobility
c/o Centerline Communications
1150 Ballena Boulevard
Suite #259
Alameda, CA 94501

Site Compliance Conclusion

The AT&T site located at 3562 Round Barn Circle, Santa Rosa, CA 95403 will comply with FCC Guidelines.

Executive Summary

Occupational Safety & Compliance Engineering (OSC Engineering) has been contracted by Centerline Communications to conduct an RF (radio frequency) computer simulated analysis. The Federal Communications Commission (FCC) has set limits on RF energy exposed to humans on a wireless cell site. The FCC has also mandated that all RF wireless sites must be in compliance with the FCC limits and a compliance check should be performed routinely to ensure site compliance. Per AT&T Policy simulations are performed at 75% duty cycle other than UTMS (100%) or as noted. RoofMaster software was utilized in the creation of this report.

OSC Engineering uses the FCC OET-65 as well as AT&T Standards to make recommendations based on results and information gathered from drawings and Radio Frequency Data Sheets. Included in this analysis is an Ericsson AIR (TDD) power reduction factor (0.32) of the maximum to account for spatial distribution of served users, as recommended by AT&T, based on the United Nations International Telecommunication Union ITU-T Series K, Supplement 16 (20 May 2019).

A site-specific compliance plan is recommended for each transmitting site. This report serves as a single piece of the overall compliance plan.

Site Overview and Description

- The antennas are mounted on a Rooftop
- The AT&T site consists of four (4) sectors with a total of sixteen (16) antennas
- The site is not co-located

Compliance Results of the Proposed Site (theoretical simulation)

A result over 100% does not make a site out of compliance with FCC guidelines. For results over 100% of the FCC Limit, further remediation is required to consider the site compliant per FCC Guidelines. See the report page entitled ***RECOMMENDATIONS*** for compliance actions required for FCC and AT&T Compliance. Areas exceeding the FCC Limit are demarcated with barriers and appropriate signage. Areas outside of the demarcated areas are below the FCC Limits (under 100% GP). The remediation actions bring the site into compliance. Results are given in terms of the FCC General Population. Please see the page entitled ***FCC MPE Limits (from OET-65)*** for further information. On-site measurements may yield different results, as antennas do not always operate at full capacity.

Maximum simulated RF Exposure Level from (Ground Level):
3.48 % FCC General Population MPE Limit

Maximum simulated RF Exposure Level from (Main Roof):
1250.72 % FCC General Population MPE Limit

Maximum simulated RF Exposure Level from (Lower Roof -1):
13.46 % FCC General Population MPE Limit

Antenna Inventory

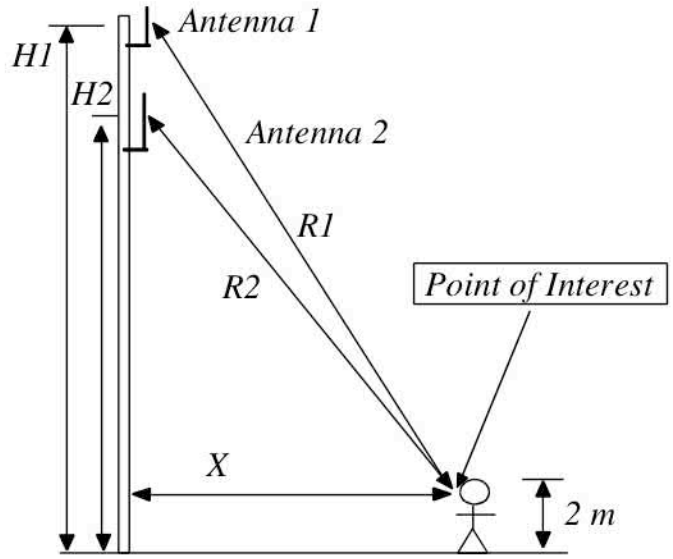
All technical data and specifications shown below are collected from drawings and/or documents provided by the client, as well as from online databases and/or a visit to this facility. Unknown wireless transmitting antennas are simulated using conservative values when information is not available.

Antenna	Operator	Frequency (MHz)	Antenna Type	Antenna Make	Antenna Model	Azimuth (°T)	Ground (Z) (ft)	Rooftop (Z) (ft)	Lower Rooftop (-1) (Z) (ft)
A1	AT&T LTE	700	Panel	Quintel	QD4612-3D	320	48.85	4.19	16.19
A1	AT&T 5G	850	Panel	Quintel	QD4612-3D	320	48.85	4.19	16.19
A1	AT&T LTE / 5G	1900	Panel	Quintel	QD4612-3D	320	48.85	4.19	16.19
A1	AT&T LTE / 5G AWS	2100	Panel	Quintel	QD4612-3D	320	48.85	4.19	16.19
A2	AT&T 5G DoD	3400	Panel	Ericsson	AIR6419	320	50.82	6.15	18.15
A3	AT&T LTE	700	Panel	Quintel	QD4616-7	320	48.86	4.19	16.19
A3	AT&T LTE AWS	2100	Panel	Quintel	QD4616-7	320	48.86	4.19	16.19
A4	AT&T 5G CBAND	3700	Panel	Ericsson	AIR6449	320	50.62	5.96	17.96
B1	AT&T LTE	700	Panel	Quintel	QD4612-3D	260	48.85	4.19	16.19
B1	AT&T 5G	850	Panel	Quintel	QD4612-3D	260	48.85	4.19	16.19
B1	AT&T LTE / 5G	1900	Panel	Quintel	QD4612-3D	260	48.85	4.19	16.19
B1	AT&T LTE / 5G AWS	2100	Panel	Quintel	QD4612-3D	260	48.85	4.19	16.19
B2	AT&T 5G DoD	3400	Panel	Ericsson	AIR6419	260	50.82	6.15	18.15
B3	AT&T LTE	700	Panel	Quintel	QD4616-7	260	48.86	4.19	16.19
B3	AT&T LTE AWS	2100	Panel	Quintel	QD4616-7	260	48.86	4.19	16.19
B4	AT&T 5G CBAND	3700	Panel	Ericsson	AIR6449	260	50.62	5.96	17.96
C1	AT&T LTE	700	Panel	Quintel	QD4612-3D	175	48.85	4.19	16.19
C1	AT&T 5G	850	Panel	Quintel	QD4612-3D	175	48.85	4.19	16.19
C1	AT&T LTE / 5G	1900	Panel	Quintel	QD4612-3D	175	48.85	4.19	16.19
C1	AT&T LTE / 5G AWS	2100	Panel	Quintel	QD4612-3D	175	48.85	4.19	16.19
C2	AT&T 5G DoD	3400	Panel	Ericsson	AIR6419	175	50.82	6.15	18.15
C3	AT&T LTE	700	Panel	Quintel	QD4616-7	175	48.86	4.19	16.19
C3	AT&T LTE AWS	2100	Panel	Quintel	QD4616-7	175	48.86	4.19	16.19
C4	AT&T 5G CBAND	3700	Panel	Ericsson	AIR6449	175	50.62	5.96	17.96
D1	AT&T LTE	700	Panel	Quintel	QD4612-3D	80	48.85	4.19	16.19
D1	AT&T 5G	850	Panel	Quintel	QD4612-3D	80	48.85	4.19	16.19
D1	AT&T LTE / 5G	1900	Panel	Quintel	QD4612-3D	80	48.85	4.19	16.19
D1	AT&T LTE / 5G AWS	2100	Panel	Quintel	QD4612-3D	80	48.85	4.19	16.19
D2	AT&T 5G DoD	3400	Panel	Ericsson	AIR6419	80	50.82	6.15	18.15
D3	AT&T LTE	700	Panel	Quintel	QD4616-7	80	48.86	4.19	16.19
D3	AT&T LTE AWS	2100	Panel	Quintel	QD4616-7	80	48.86	4.19	16.19
D4	AT&T 5G CBAND	3700	Panel	Ericsson	AIR6449	80	50.62	5.96	17.96

FCC Regulations and Guidelines from OET 65

When considering the contributions to field strength or power density from other RF sources, care should be taken to ensure that such variables as reflection and re-radiation are considered. In cases involving very complex sites predictions of RF fields may not be possible, and a measurement survey may be necessary The process for determining compliance for other situations can be similarly accomplished using the techniques described in this section and in Supplement A to this bulletin that deals with radio and television broadcast operations. However, as mentioned above, at very complex sites measurements may be necessary.

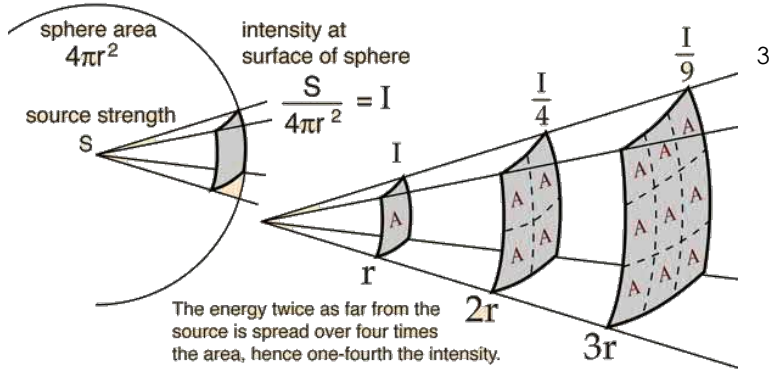
In the simple example shown in the below diagram, it is desired to determine the power density at a given location **X** meters from the base of a tower on which are mounted two antennas. One antenna is a CMRS antenna with several channels, and the other is an FM broadcast antenna. The system parameters that must be known are the total ERP for each antenna and the operating frequencies (to determine which MPE limits apply). The heights above ground level for each antenna, **H1** and **H2,** must be known in order to calculate the distances, **R1**and **R2**, from the antennas to the point of interest. [1]



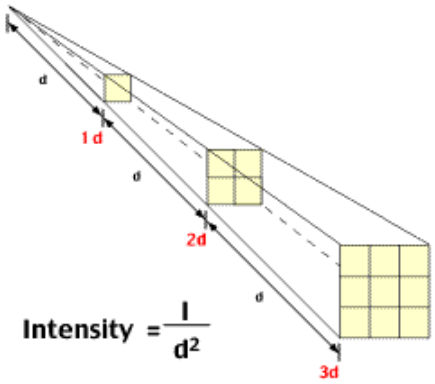
[1] OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, Page 37- 38

Inverse Square Law

The inverse-square law, in physics, is any physical law stating that a specified physical quantity or intensity is inversely proportional to the square of the distance from the source of that physical quantity. The fundamental cause for this can be understood as geometric dilution corresponding to point-source radiation into three-dimensional space
The inverse-square law generally applies when some force, energy, or other conserved quantity is evenly radiated outward from a point source in three-dimensional space. Since the surface area of a sphere (which is $4\pi r^2$) is proportional to the square of the radius, as the emitted radiation gets farther from the source, it is spread out over an area that is increasing in proportion to the square of the distance from the source.[2]



[3]



[4]

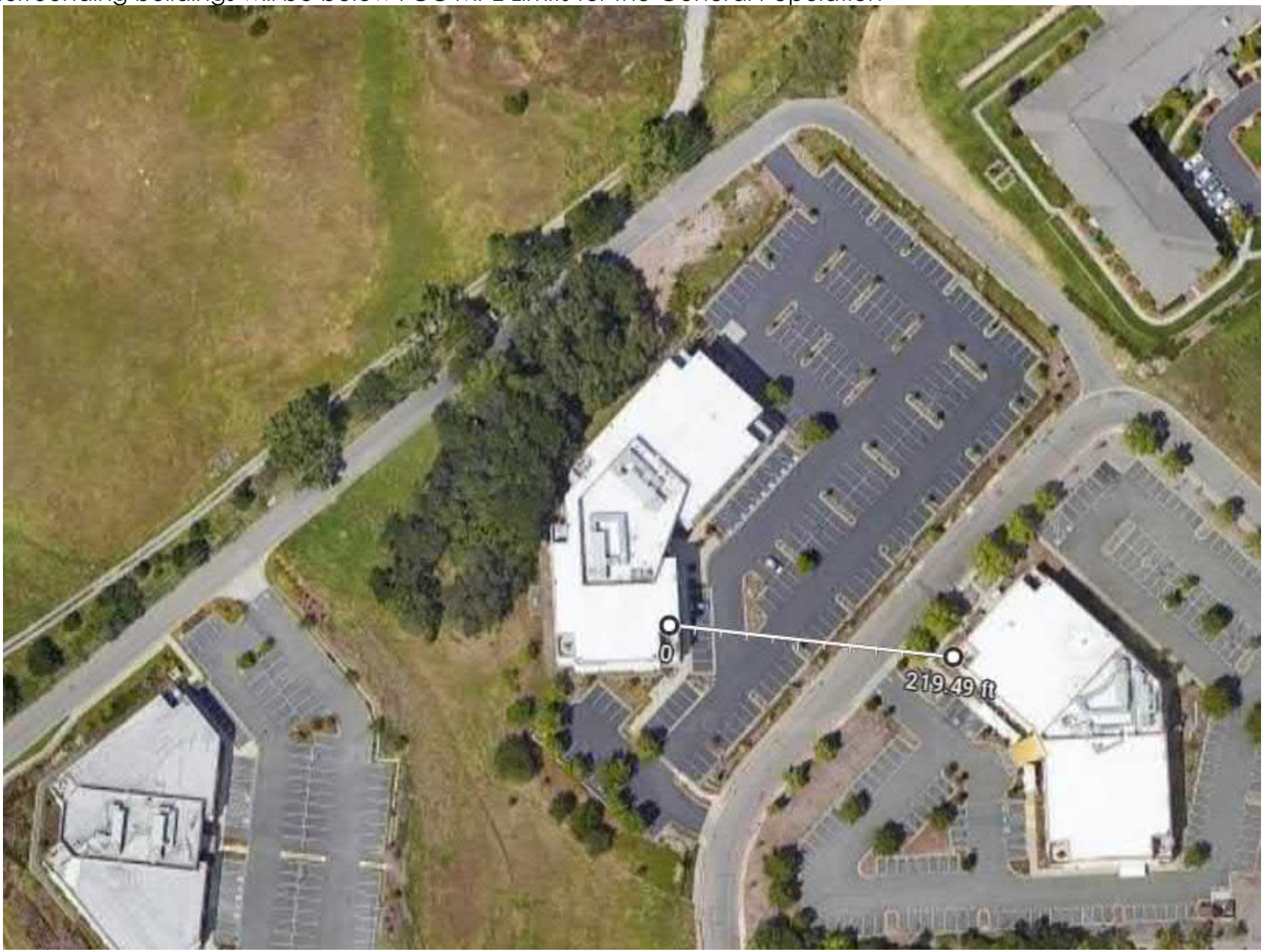
$$\frac{I_1}{I_2} = \frac{D_2^{\,2}}{D_1^{\,2}}$$

Where:
I_1 = Intensity 1 at D_1
I_2 = Intensity 2 at D_2
D_1 = Distance 1 from source
D_2 = Distance 2 from source

[2] https://en.wikipedia.org/wiki/Inverse-square_law
[3] http://hyperphysics.phy-astr.gsu.edu/hbase/Forces/isq.html
[4] https://www.nde-ed.org/GeneralResources/Formula/RTFormula/InverseSquare/InverseSquareLaw.htm

Result: Surrounding Building(s)

The surrounding buildings will be below FCC MPE Limits for the General Population



Certification

The undersigned is a Professional Engineer, holding a California Registration No. 19677

Reviewed and approved by:

John Bachoua, PE

Date: February 09, 2024

The engineering and design of all related structures as well as the impact of the antennas on the structural integrity of the design are specifically excluded from this report's scope of work. This report's scope of work is limited to an evaluation of the Electromagnetic Energy (EME) RF emissions field generated by the antennas listed in this report. When client and others have supplied data, it is assumed to be correct.

FCC MPE Limits (from OET-65)

Occupational/controlled[5] 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. As discussed later, the occupational/controlled exposure limits also apply to amateur radio operators and members of their immediate household.

General population/uncontrolled[6] 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.

[5] OET-65 "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields pg. 9.
[6] OET-65 "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields pg. 9.

Limits for Maximum Permissible Exposure (MPE)[7]

"The FCC Exposure limits are 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 30-300MHz 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."[8]

(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
32-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6

(B) Limits for General Population /Uncontrolled Exposure

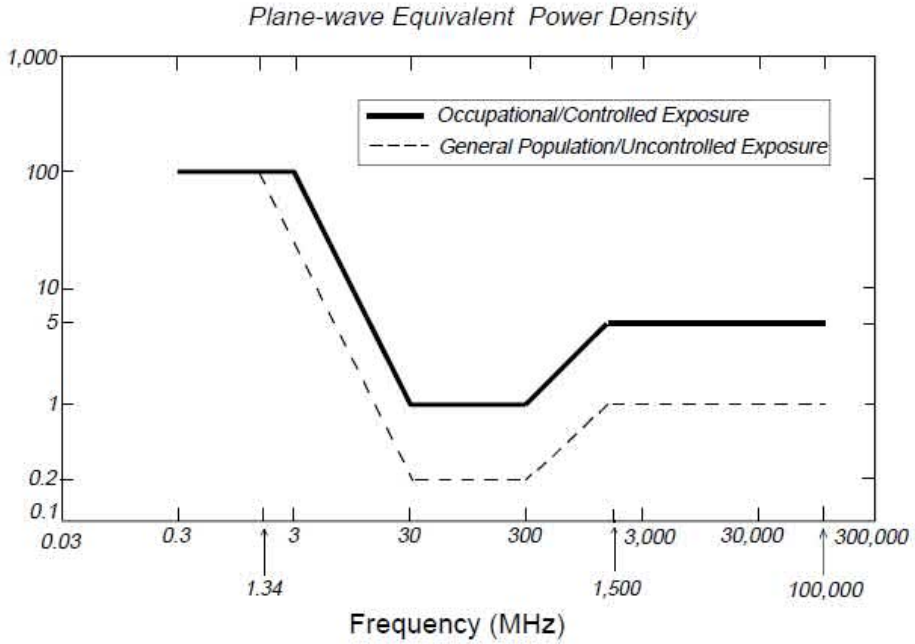
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	($180/f^2$)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--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

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

[7] OET-65 "FCC Guidelines Table 1 pg. 72.
[8] OET-65 "FCC Guidelines for Evaluating Exposure to RF Emissions", pg. 8

Limits for Maximum Permissible Exposure (MPE) continued[9]

Figure 1. *FCC Limits for Maximum Permissible Exposure (MPE)*



"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). In the far-field of a transmitting antenna, 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], these quantities are related by the following equation:

$$S = \frac{E^2}{3770} = 37.7H^2$$

where: S = power density (mW/cm^2)
E = electric field strength (V/m)
H = magnetic field strength (A/m)

[9] OET-65 "FCC Guidelines Table 1 pg. 72.

Limitations

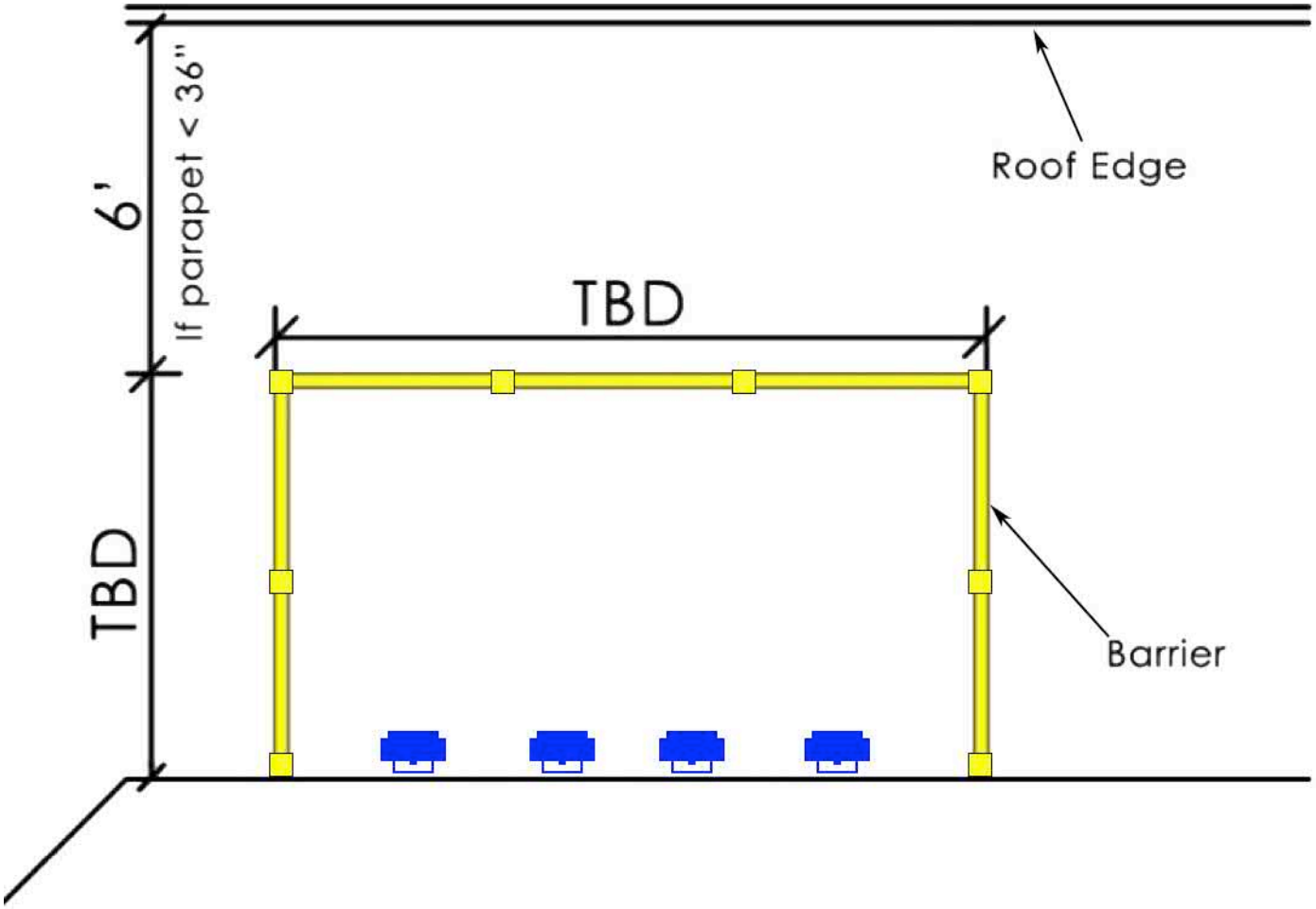
OSC Engineering completed this report based on information and data provided by the client and/or on-site data collection. The data provided by the client is assumed to be accurate. This report is completed by OSC Engineering to determine whether the wireless communications facility complies with the Federal Communications Commission (FCC) Radio Frequency (RF) Safety Guidelines. The Office of Engineering and Technology (OET-65) *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Radiation* has been prepared to provide assistance in determining whether proposed or existing transmitting facilities, operations or devices comply with limits for human exposure to radiofrequency (RF) fields adopted by the Federal Communications Commission (FCC)[10]. As the site is being upgraded and changed this report will become obsolete. A statistical factor reducing the actual power of the antenna system to 0.32 of maximum theoretical power is used to account for spatial distribution of users, network utilization, time division duplexing, and scheduling time. AT&T recommends the use of this factor based on a combination of guidance from its antenna system manufacturers, supporting international industry standards, industry publications, and its extensive experience. Use of this document will not hold OSC Engineering Inc. nor it's employees liable legally or otherwise. This report shall not be used as a determination as to what is safe or unsafe on a given site: only for what is compliant per the FCC standards outlined in the OET-65. All workers or other people accessing any transmitting site should have proper EME awareness training. This includes, but is not limited to, obeying posted signage, keeping a minimum distance from antennas, watching EME awareness videos and formal classroom training.

[10] OET-65 "FCC Guidelines for Evaluating Exposure to RF Emissions", pg. 1

AT&T Barrier Guidelines

Environmental, Health and Safety (EH&S) guidelines prohibit construction of RF safety barriers that extend to, or are within the 6-ft setback from, unprotected roof edges but do not meet the OSHA fall protection requirements of 29 CFR 1910.23 and 29 CFR 1926.500 through 1926.503. The following details are intended to assist AT&T RF safety engineers and RSVs in meeting the AT&T Mobility RF safety compliance guidelines as defined in ND-00059. Whereas, AT&T employees and contractors working within 6 ft. from an unprotected roof edge must follow OSHA guidelines with respect to fall protection and roof line safety.[11]

For Clarity: Unprotected roof edge refers to a parapet less than thirty-six (36) inches in height.



[11] RF Safety Barrier 6-ft Rule v3_ehscmts_EHS cmts_ws, "Installing Radio Frequency (RF) safety barriers on roofs with unprotected edges job aid" Page 1 Overview

AT&T Antenna Shut-Down Protocol

AT&T provides Lockout/Tagout (LOTO) procedures in Section 9.4[12] (9.4.1- 9.4.9) in the ND-00059. These procedures are to be followed in the event of anyone who needs access at or in the vicinity of transmitting AT&T antennas. Contact AT&T when accessing the rooftop near the transmitting antennas. Below is information regarding when to contact an AT&T representative.

9.4.7 Maintenance work being performed near transmitting antennas

Whenever anyone is working within close proximity to the transmitting antenna(s), the antenna sector, multiple sectors, or entire cell site may need to be shut down to ensure compliance with the applicable FCC MPE limit. This work may include but is not limited to structural repairs, painting or non-RF equipment services by AT&T personnel/contractors or the owner of a tower, water tank, rooftop, or other low-centerline sites. The particular method of energy control will depend on the scope of work (e.g., duration, impact to the antenna or transmission cabling, etc.) and potential for RF levels to exceed the FCC MPE limits for General Population/Uncontrolled environments

9.4.8 AT&T Employees and Contractors

AT&T employees and contractors performing work on AT&T cell sites must be trained in RF awareness and must exercise control over their exposure to ensure compliance with the FCC MPE limit for Occupational/Controlled Environments ("Occupational MPE Limit").

The rule of staying at least 3 feet from antennas is no longer always adequate to prevent exposure above the Occupational MPE Limit. That general rule was applied early in the development of cellular when omni-directional antennas were primarily used and later when wide-beamwidth antennas were used. That application was then appropriate for the Occupational exposure category. However, the current prevalence of antennas with 60- and 70- degree horizontal half-power beamwidths at urban and suburban GSM and UMTS/HSDPA sites raises some question about the continued reliability of the 3-foot rule. Antennas with low bottom-tip heights and total input powers around 70-80 W can produce exposure levels exceeding the Occupational MPE Limits at 4 feet, and these levels can be augmented by emissions of co-located operators. Therefore, AT&T employees and contractors should apply the above general work procedures and use an RF personal monitor to assess exposure levels within the work vicinity.

9.4.9 Other Incidental Workers

All other incidental workers who are not trained in RF safety are considered general public and subject to the FCC MPE limits for General Population/Uncontrolled Environments. In such instance, the M-RFSC (primary contact) or R-RFSC (secondary contact) must refer to the Mobility RF site survey plan to assess the potential RF exposure levels associated with the antenna system. If capable of exceeding the FCC General Population/Uncontrolled MPE limit, then local sector/site shutdown is necessary. The FE/FT must also follow the local shutdown procedure and use their RF personal monitor as a screening tool for verification, as necessary.

[12] ND-00059_Rev_5.1 "Lockout/Tagout (LOTO) Procedures" Page 45.

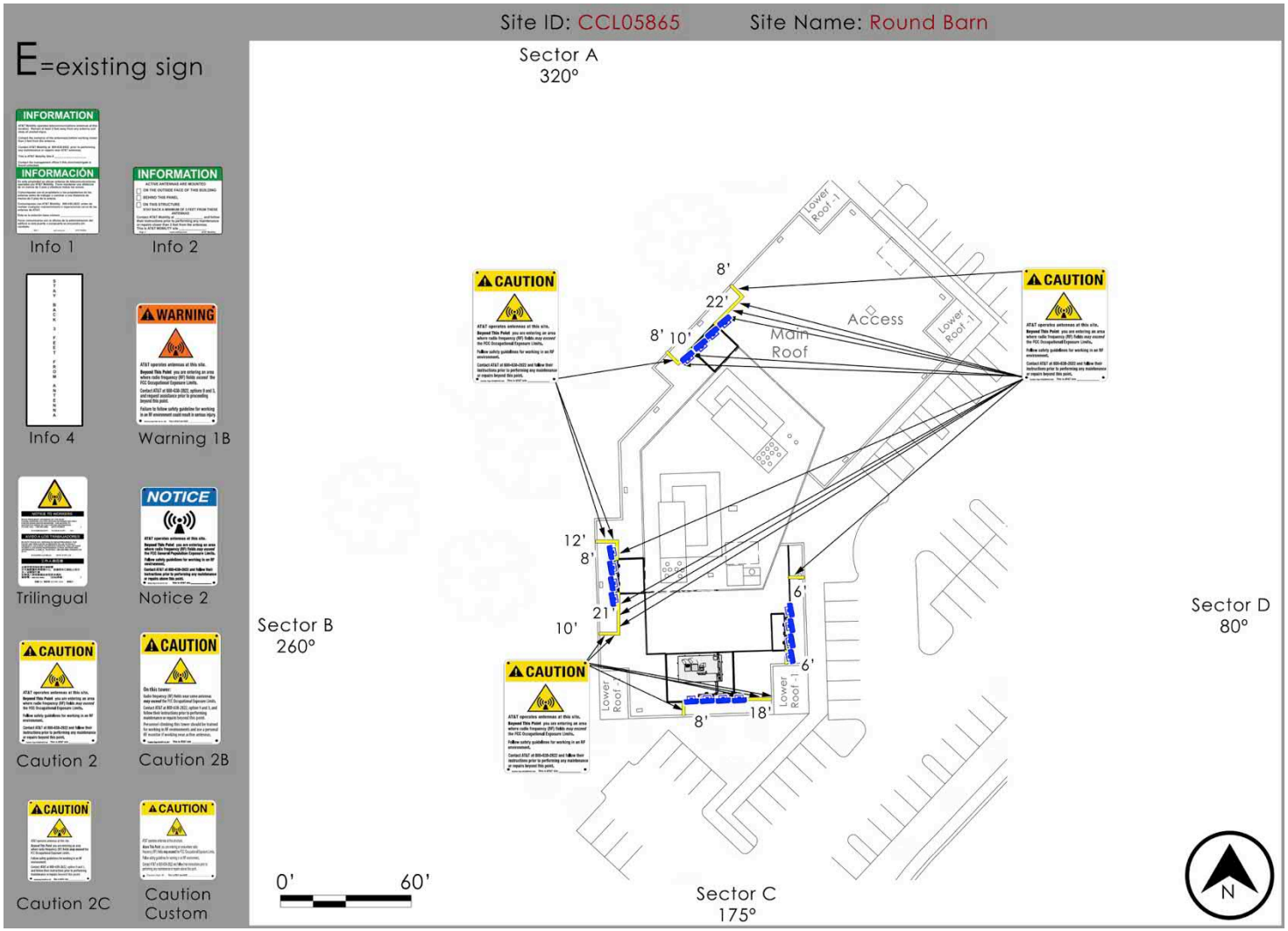
RECOMMENDATIONS

- **AT&T Sector A**
  To be installed: a 8' X 22' X 10' X 8' wide physical barrier with Caution 2 sign on all approaches to the physical barrier

- **AT&T Sector B**
  To be installed: a 12' X 8' X 21' X 10' wide physical barrier with Caution 2 sign on all approaches to the physical barrier

- **AT&T Sector C**
  To be installed: a 8' X 18' wide physical barrier with Caution 2 sign on all approaches to the physical barrier

- **AT&T Sector D**
  To be installed: a 6' X 6' wide physical barrier with Caution 2 sign on all approaches to the physical barrier



If work is being performed in the vicinity of the transmitting antennas, site shut-down procedures must be followed. See page entitled AT&T Antenna Shut-down protocol for further information.

If the parapet is less than 36" in height: Barriers must be built a minimum of 6 feet away from the roof edge to comply with AT&T safety standards