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# ELECTROMAGNETIC ENERGY (EME) EXPOSURE REPORT

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Site Name: **CCL01420B - Bluebell**  
Site ID: **CCL01420**  
USID: **298809**  
FA Location: **11578682**

Site Type: **Monopole**

Location: **2400 Bluebell Drive  
Santa Rosa, CA 95403**

Latitude (NAD83): **38.4658560**  
Longitude (NAD83): **-122.7453820**

Report Completed: **May 19, 2021**  
AT&T M-RFSC **Casey Chan**

Prepared By:



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

## **Executive Summary**

Occupational Safety & Compliance Engineering (OSC Engineering) has been contracted by Qualtek 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.

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.

For this report, OSC Engineering utilized Roofview® software for the theoretical analysis of the AT&T Cellular Facility.

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

## **Site Compliance Conclusion**

**The AT&T site CCL01420 located at 2400 Bluebell Drive Santa Rosa, CA 95403 will comply with FCC Guidelines.**

## Site Overview and Description

- The antennas are mounted on a monopole
- The site consists of three (3) sectors with a total of twelve (12) antennas
- The site is within a fenced in area, access to the site is via a gate
- 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 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. For the purpose of theoretical simulation, OSC Engineering models antennas as if they are operating at full power (100% capacity). This assumption yields more conservative (higher) results. On-site measurements may yield different results, as antennas do not always operate at full capacity.

### **Maximum simulated RF Exposure Level from (AT&T antennas @ Adjacent roof):**

0.40 % FCC General Population MPE Limit

### **Maximum simulated RF Exposure Level from (AT&T antennas @ ground):**

15.5 % 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.

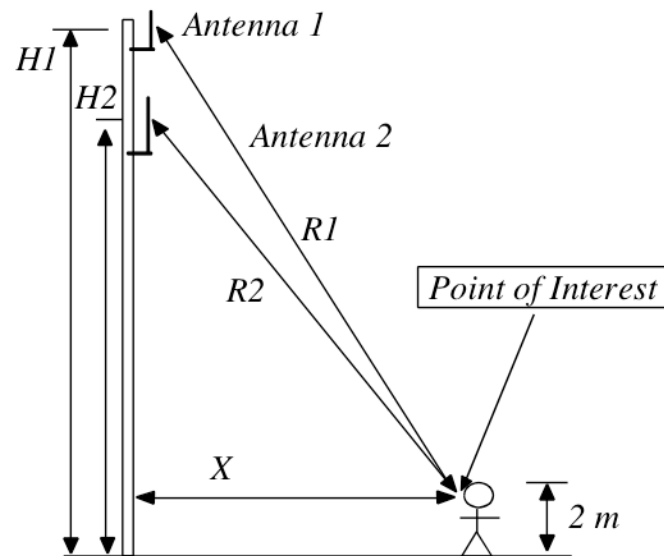
Antenna	Operator / Technology	Frequency (MHz)	Input Power (watts)	Antenna Type	Antenna Make	Antenna Model	Azimuth (°T)	Ground (Z) (ft)	Rooftop (Z) (ft)
A1	AT&T LTE B12	700	160.00	Panel	Commscope	NNHH-65B-R4	90	54	30
A1	AT&T 5G	850	160.00	Panel	Commscope	NNHH-65B-R4	90	54	30
A1	AT&T LTE	1900	160.00	Panel	Commscope	NNHH-65B-R4	90	54	30
A2	AT&T LTE	2100	160.00	Panel	Commscope	NNHH-65B-R4	90	54	30
A3	AT&T LTE B14	700	160.00	Panel	Commscope	NNHH-65B-R4	90	54	30
A3	AT&T LTE	2100	160.00	Panel	Commscope	NNHH-65B-R4	90	54	30
A4	AT&T LTE B29	700	80.00	Panel	Commscope	NNHH-65B-R4	90	54	30
A4	AT&T LTE	2300	100.00	Panel	Commscope	NNHH-65B-R4	90	54	30
B1	AT&T LTE B12	700	160.00	Panel	Commscope	NNHH-65B-R4	330	54	30
B1	AT&T 5G	850	160.00	Panel	Commscope	NNHH-65B-R4	330	54	30
B1	AT&T LTE	1900	160.00	Panel	Commscope	NNHH-65B-R4	330	54	30
B2	AT&T LTE	2100	160.00	Panel	Commscope	NNHH-65B-R4	330	54	30
B3	AT&T LTE B14	700	160.00	Panel	Commscope	NNHH-65B-R4	330	54	30
B3	AT&T LTE	2100	160.00	Panel	Commscope	NNHH-65B-R4	330	54	30

Antenna	Operator / Technology	Frequency (MHz)	Input Power (watts)	Antenna Type	Antenna Make	Antenna Model	Azimuth (°T)	Ground (Z) (ft)	Rooftop (Z) (ft)
B4	AT&T LTE B29	700	80.00	Panel	Commscope	NNHH-65B-R4	330	54	30
B4	AT&T LTE	2300	100.00	Panel	Commscope	NNHH-65B-R4	330	54	30
C1	AT&T LTE B12	700	160.00	Panel	Commscope	NNHH-65B-R4	230	54	30
C1	AT&T 5G	850	160.00	Panel	Commscope	NNHH-65B-R4	230	54	30
C1	AT&T LTE	1900	160.00	Panel	Commscope	NNHH-65B-R4	230	54	30
C2	AT&T LTE	2100	160.00	Panel	Commscope	NNHH-65B-R4	230	54	30
C3	AT&T LTE B14	700	160.00	Panel	Commscope	NNHH-65B-R4	230	54	30
C3	AT&T LTE	2100	160.00	Panel	Commscope	NNHH-65B-R4	230	54	30
C4	AT&T LTE B29	700	80.00	Panel	Commscope	NNHH-65B-R4	230	54	30
C4	AT&T LTE	2300	100.00	Panel	Commscope	NNHH-65B-R4	230	54	30

## 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.<sup>1</sup>



<sup>1</sup> OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, Page 37- 38

## Computer Simulation Analysis

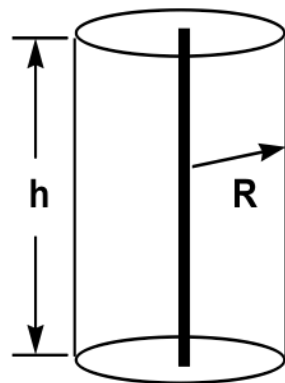
The Federal Communications Commission (FCC) governs the telecommunications services, facilities, and devices used by the public, industrial and state organizations in the United States.

“RoofView® is a software analysis tool for evaluating radiofrequency (RF) field levels at roof-top telecommunications sites produced by vertical collinear antennas of the type commonly used in the cellular, paging, PCS, ESMR and conventional two-way radio communications services.”<sup>2</sup>

“RF near-field levels are computed from selected antennas by applying a cylindrical model that takes into account the antenna’s aperture height, mounting height above the roof, azimuthal beam width for directional antennas and the location of the antennas on the roof. Resulting, spatially averaged power densities are expressed as a percentage of a user selectable exposure limit depending on frequency. The entire roof is composed of one-square-foot pixels and RF fields are computed for each of these pixels for each selected antenna.”<sup>3</sup>

Computer simulations produced for clients are simulated with “Uptime = 100%”. This means that all transmitters associated with an antenna are considered to be “on”.<sup>4</sup>

RoofView® uses a near-field method of computing the field based on assuming that the total input power delivered to the antenna, at its input terminal, is distributed over an imaginary cylindrical surface surrounding the antenna. The height of the cylinder is equal to the aperture height of the antenna while the radius is simply the distance from the antenna at which the field power density is to be computed. Within the aperture of the antenna, this approximation is quite accurate but as the antenna is elevated above the region of interest, the model output must be corrected for mounting height.<sup>5</sup>



$$S = \frac{P}{2\pi Rh}$$

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<sup>2</sup> Roofview User Guide 4.15, Page 7, Richard A Tell Associates

<sup>3</sup> Roofview User Guide 4.15, Page 7, Richard A Tell Associates

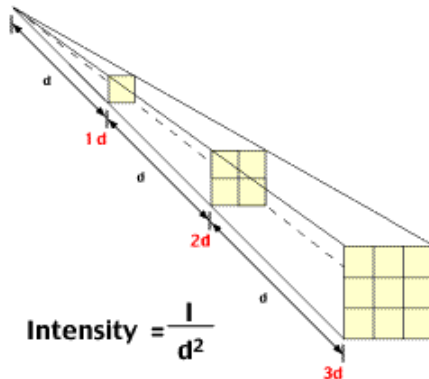
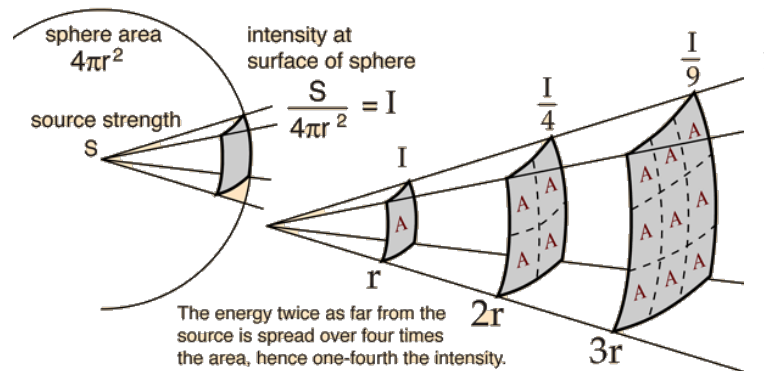
<sup>4</sup> Roofview User Guide 4.15, Page 10, Richard A Tell Associates

<sup>5</sup> Roofview User Guide 4.15, Page 45, Richard A Tell Associates



## 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.<sup>6</sup>



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

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

8

<sup>6</sup> [https://en.wikipedia.org/wiki/Inverse-square\\_law](https://en.wikipedia.org/wiki/Inverse-square_law)

<sup>7</sup> <http://hyperphysics.phy-astr.gsu.edu/hbase/Forces/isq.html>

<sup>8</sup> <https://www.nde-ed.org/GeneralResources/Formula/RTFormula/InverseSquare/InverseSquareLaw.htm>

## Certification

The undersigned is a Professional Engineer, holding a California Registration No. E22553

Reviewed and approved by:



Takeshi Tsuji, PE

Date: May 19, 2021

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**<sup>9</sup> 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**<sup>10</sup> 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.

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<sup>9</sup> OET-65 "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields pg. 9.

<sup>10</sup> OET-65 "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields pg. 9.

## Limits for Maximum Permissible Exposure (MPE)<sup>11</sup>

“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.”<sup>12</sup>

### (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 <sup>2</sup> )	Averaging Time  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f <sup>2</sup> )*	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 <sup>2</sup> )	Averaging Time  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f <sup>2</sup> )*	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

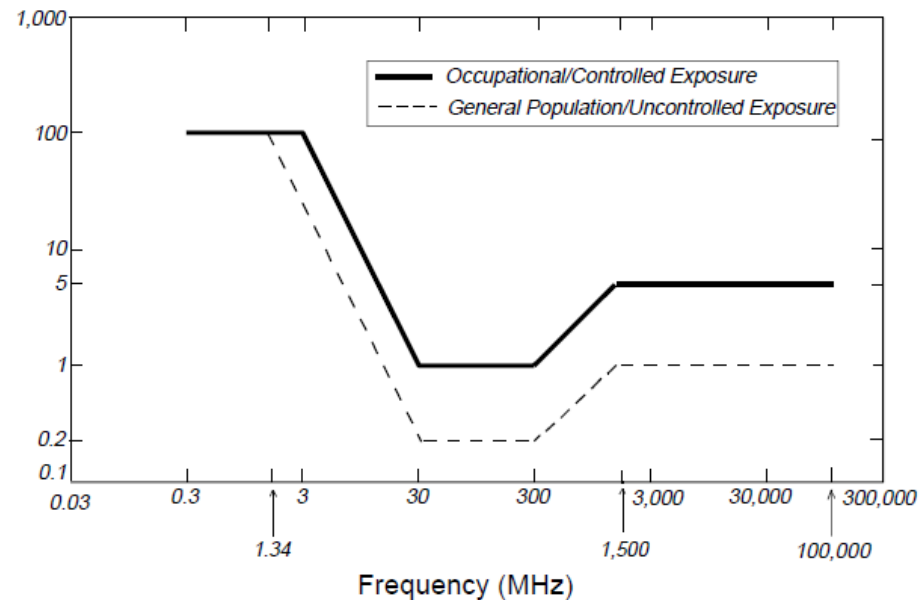
\*Plane-wave equivalent power density

<sup>11</sup> OET-65 “FCC Guidelines Table 1 pg. 72.

<sup>12</sup> OET-65 “FCC Guidelines for Evaluating Exposure to RF Emissions”, pg. 8

## Limits for Maximum Permissible Exposure (MPE) continued<sup>13</sup>

*Figure 1. FCC Limits for Maximum Permissible Exposure (MPE)  
Plane-wave Equivalent Power Density*



“MPE Limits are defined in terms of power density (units of milliwatts per centimeter squared: mW/cm<sup>2</sup>), 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<sup>2</sup>)  
E = electric field strength (V/m)  
H = magnetic field strength (A/m)

<sup>13</sup> OET-65 “FCC Guidelines Table 1 pg. 72.

## **Limitations**

OSC Engineering completed this report based on information and data provided by the client and 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)<sup>14</sup>. As the site is being upgraded and changed this report will become obsolete. 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. 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.

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<sup>14</sup> OET-65 "FCC Guidelines for Evaluating Exposure to RF Emissions", pg. 1

## **AT&T Antenna Shut-Down Protocol**

**AT&T provides Lockout/Tagout (LOTO) procedures in Section 9.4<sup>15</sup> (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.

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<sup>15</sup> ND-00059\_Rev\_5.1 "Lockout/Tagout (LOTO) Procedures" Page 45.

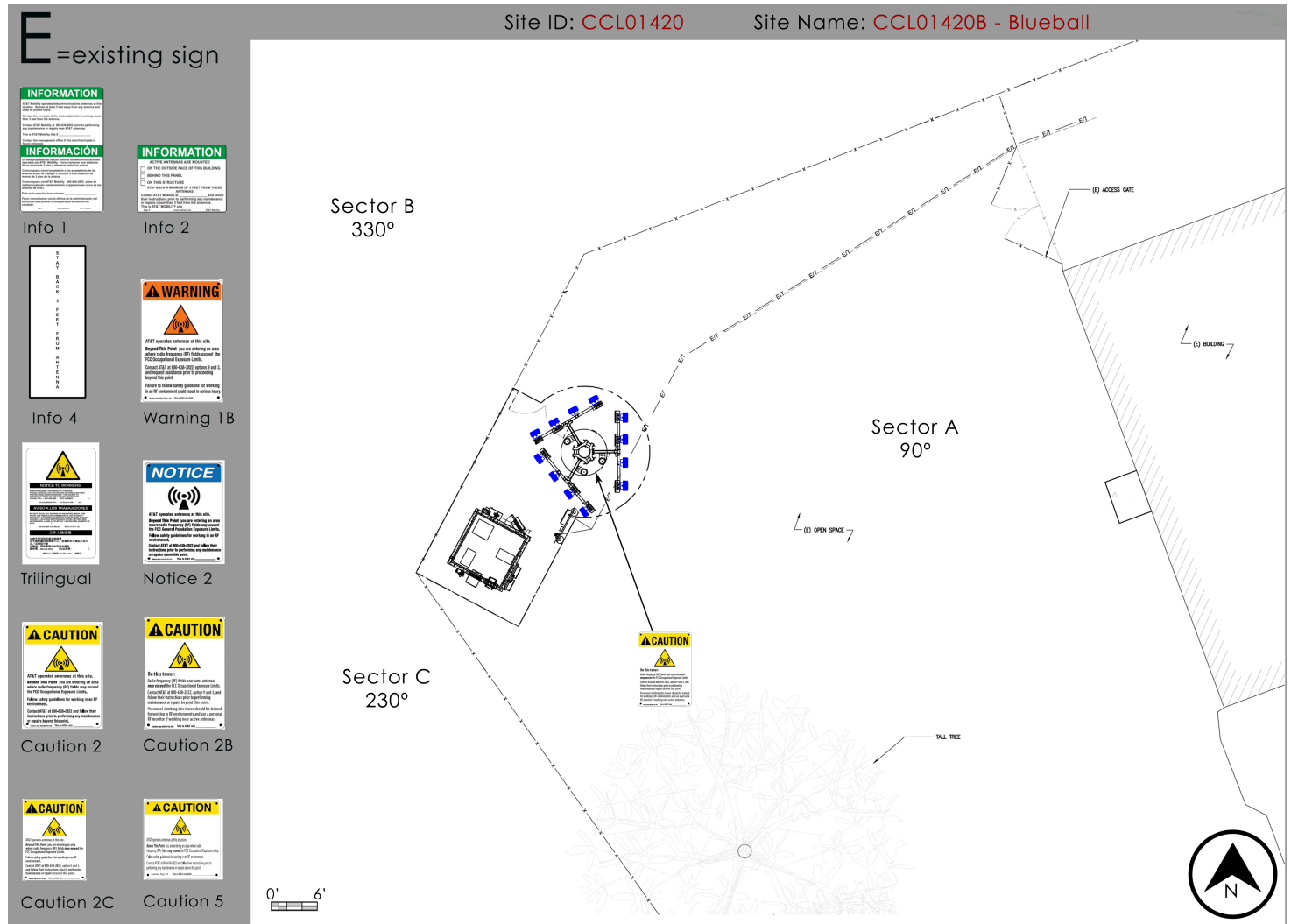
# RECOMMENDATIONS

• **AT&T Access Point(s):**  
Caution Sign 2B  
(Tower) @ base of  
monopole (to be  
posted)

• **AT&T Sector A**  
No signage or barrier  
action required

• **AT&T Sector B**  
No signage or barrier  
action required

• **AT&T Sector C**  
No signage or barrier  
action required



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.