Sublight Engineering PLLC

KC + MISSION HILLS RF ASSESSMENT

ExteNet Systems, Inc.

Abstract

Pole mounted antenna installations in and around Kansas City, KS.

Based on this assessment RF exposure levels in accessible areas near these installations will be below FCC limits for the General Public.

Matthew J Butcher
Registered Professional Engineer
Commonwealth of Virginia Lic. No.0402 40784

Matthew J Butcher
matt@sublight.net

September 18, 2024

Introduction

Sublight Engineering PLLC (Sublight) has been asked to assess compliance with the Federal Communications Commission (FCC) Radio Frequency (RF) exposure limits and interference requirements near the installations detailed below. ExteNet Systems, Inc. engaged Sublight and provided information for this assessment.

T-Mobile and Verizon will provide wireless communications services using the reviewed ExteNet pole mounted antenna system. The equipment operates in the PCS, AWS, and BRS/EBS bands.

This assessment reviewed RF exposure with respect to FCC limits in accessible areas near all the installations using worst-case (conservative) computer modeling.

Based on this assessment RF exposure levels in accessible areas near these installations will be below FCC limits for the General Public.

Installation Locations

This assessment covers 40 pole mounted antenna installations (nodes) in and around Kansas City, KS. Information on the locations can be found below and in the **Node Details** section starting on page 12.

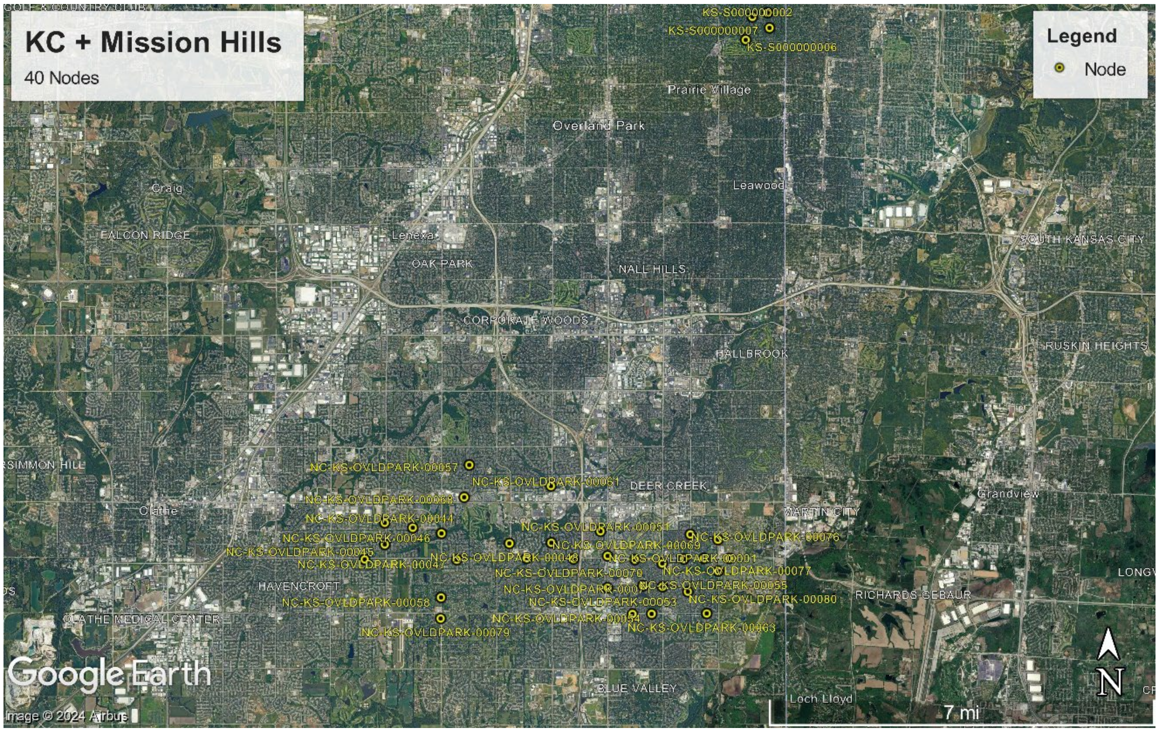


Figure 1 Google Earth Overview

FCC Regulations on RF Exposure

The US Congress instructed federal agencies to evaluate the effects of their actions on the quality of the human environment via the National Environmental Policy Act (NEPA) of 1969. As per that mandate the Federal Communications Commission (FCC) regulates exposure to RF energy. The FCC met this responsibility by issuing regulations to ensure that electromagnetic energy from FCC regulated facilities do not have an adverse effect on the human environment. These regulations were most recently updated in 2019[1].

Research in human interaction with electromagnetic energy dates to the 19th century. In 1890 d'Arsonval noted that 10 kHz electricity could warm the skin. In 1928 it was discovered that RF heating could affect internal organs and diathermy, a medical treatment, was introduced. Exposure to electromagnetic energy, specifically radio frequency (RF) energy, has been an area of concern and study since the 1950's. In 1953 the US Navy established limits to protect personnel from dangers introduced with high-power radars.

Since 1960 the International Committee on Electromagnetic Safety (ICES) has been responsible for the C95 series of standards, published now by the Institute of Electrical Engineers (IEEE). The latest in the series is IEEE C95.1-2019[2]. Another group, the International Commission on Non-Ionizing Radiation Protection (ICNIRP), also publishes a similar standard, RF EMF Guidelines 2020[3], which is adopted in much of the world. Health Canada developed Safety Code 6[4] which is adapted from C95.1. The congressionally chartered National Council on Radiation Protection and Measurements (NCRP) published a report[5] in 1986. That NCRP report, along with C95.1-1992, was used by the FCC to set the current exposure limits in effect for the United States.

The FCC, IEEE C95.1-2019, Health Canada Safety Code 6, and ICNIRP RF EMF Guidelines 2020 all have very similar exposure limits which are accepted by the World Health Organization (WHO) and most public health agencies around the world.

FCC regulations are developed via an open process which allows for participation from all interested parties. Additionally, the FCC consults with the Food and Drug Administration (FDA), Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA) and the National Institutes of Health (NIH) for guidance on electromagnetic exposure regulations.

---

[1] FCC 19-126 *RESOLUTION OF NOTICE OF INQUIRY, SECOND REPORT AND ORDER, NOTICE OF PROPOSED RULEMAKING, AND MEMORANDUM OPINION AND ORDER*; 2019.
[2] IEEE C95.1-2019 *IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz*; 2019.
[3] ICNIRP RF EMF Guidelines 2020. *Guidelines for limiting exposure to electromagnetic fields (100 kHz to 300 GHz).* Health Phys 118(00):000–000; 2020.
[4] Health Canada Safety Code 6 *Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz*; 2015.
[5] NCRP Report No. 86, *Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields*; 1986.

FCC regulations can be found in the Code of Federal Regulations[6]. Details on compliance are published in Bulletin OET-65[7] by the FCC's Office of Engineering and Technology (OET).

The 2019 update to the FCC regulations was in response to the FCC seeking comments through the Notice of Proposed Rulemaking and Notice of Inquiry process. Rule changes from this process include clarifications on exposure limits and how wireless communications sites are managed with respect to signs and controls for access to areas where RF exposure levels may or do exceed FCC limits.

The federal government, through law and regulations implemented by the FCC, has assumed authority over regulation of radiofrequency (RF) radiation exposure limits by wireless facilities. Under the United States Code, 47 USC § 332(c)(7)(B)(iv), no local government may regulate the placement, construction, or modification of wireless facilities on the basis of the environmental effects of RF emissions, except to the extent that such facilities comply with FCC regulations concerning such emissions.

[6] 47 CFR 1.1307 *Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared* and 47 CFR 1.1310 *Radiofrequency radiation exposure limits.*
[7] Bulletin OET-65 *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields*; 1997.

Antenna and Transmitter Information

The configuration used for each node has antennas directly connected to radios from T-Mobile and Verizon (no combiner network). The antennas are described below. Frequency and maximum transmitter power information is listed in the **Node Details** section.

The Amphenol 4U6VX065X06FxyS5 antenna is a directional antenna that is designed for the PCS, AWS, WCS, BRS/EBS, CBRS, and C-Band bands. This antenna provides RF coverage in a single direction.

Amphenol ANTENNA SOLUTIONS

20-Port Panel Antenna

(4x) 1695-2700 | (6x) 3300-4200 MHz

65° | 24.7 in | FIXED TILT

4U6VX065X06Fxys5

Features

- Unique high port count panel antenna for 4G/5G small cell applications
- 20 total connectors to service the 1695-2700 and 3300-4200 MHz bands
- Ideal for multi-carrier or 4x4 MIMO deployments
- Fixed tilt options

PRODUCT OVERVIEW		
Frequency Range (MHz)	(4x) 1695-2700	(6x) 3300-4200
Array	Y1, Y2, Y3, Y4	P1, P2, P3, P4, P5, P6
Connector	8 PORTS	12 PORTS
Polarization	XPOL	XPOL
Azimuth Beamwidth (avg)	65°	65°
Electrical Downtilt	2°, 4°, 6°	2°, 4°, 6°
Maximum Continuous Power Per Port @ 50° C (122° F)	300 WATTS	100 WATTS
Maximum Total Continuous Power at 50° C (122° F)	3600 WATTS	
Total Connector Count	20 PORTS	
Connector Type	4.3-10 FEMALE	
Dimensions	628 x 462 x 268 mm (24.7 x 18.2 x 10.6)	
Radome Color Options	GREY	

ELECTRICAL SPECIFICATIONS			Y1	Y2	Y3	Y4
Frequency Range		MHz	(4x) 1695-2700			
Frequency Sub-Range		MHz	1695-1880	1850-1990	1920-2200	2300-2700
Polarization		---	(4x) ±45°			
Gain	BASTA	dBi	12.5 ± 1.3	12.8 ± 1.0	12.9 ± 1.0	13.6 ± 0.7
	MAX	dBi	13.8	13.8	13.9	14.3
Azimuth Beamwidth (3 dB)		degrees	63.5° ± 16.6°	63.5° ± 13.6°	64.6° ± 11.4°	82.4° ± 15.4°
Elevation Beamwidth (3 dB)		degrees	20.7° ± 2.4°	19.8° ± 1.9°	18.4° ± 2.6°	15.8° ± 2.2°
Electrical Downtilt		degrees	(x) 2°, 4°, 6° (Refer to Ordering Options for available tilt combinations)			
Impedance		Ohms	50Ω			
VSWR		---	≤ 1.5:1			
Passive Intermodulation 3rd Order for 2x20 W Carriers		dBc	< -153			
Upper Sidelobe Suppression		dB	> 12			
Isolation	Intraband	dB	> 25	> 25	> 25	> 25
	Interband	dB	> 28	> 28	> 28	> 28

Figure 2 Amphenol 4U6VX065X06FxyS5 Antenna

The JMA CYL2Q16R-2XY antenna is an omni-directional antenna that is designed for the PCS, AWS, WCS, BRS/EBS, CBRS, and C-Band bands. This antenna provides RF coverage in all directions.

JMA

CYL2Q16R-2xy

NWAV™ Cylinder Antenna

16-port cylinder antenna 1695-4200 MHz:

8 ports 1695-2690 MHz and 8 ports 3400-4200 MHz

- Future-proof design to support up to 4200 MHz
- Increased 3.5 GHz gain
- Supports multi-carrier deployments with 4x4 MIMO capability with all bands
- Symmetrical omni-directional pattern performance across all 8 ports 1695-2690
- Excellent cross-polar discrimination for enhanced MIMO performance
- Center-mounted lift ring for easy installations

	Mid band				3.5 GHz			
Frequency bands, MHz	1695-2700				3400-4200			
Array	Y1	Y2	Y3	Y4	P1	P2	P3	P4
Connector	8 PORTS				4 PORTS			
Polarization	XPOL				XPOL			
Horizontal beamwidth (HBW), degrees[1]	360				360			
Electrical downtilt (EDT), degrees[1]	2, 4, 6				0			
Configuration	Omni antenna pattern							
Connector type	(16x) 4.3-10 female							
Dimensions, in. (mm)	24.0/ 14.6 (609.6/ 370.8)							
Maximum composite power, watts (all ports)	1000							

Electrical specifications Mid Band Y1 Y2 Y3 Y4				
Frequency range, MHz	1695-2700			
Frequency sub-range, MHz	1695-1880	1850-1990	1920-2200	2300-2700
Polarization	± 45°			
Gain, MAX, dBi	8.8	9.2	9.6	10.7
Gain, BASTA, dBi	8.5 ± 0.3	8.9 ± 0.3	9.1 ± 0.5	10.2 ± 0.5
Average gain across full 360°, dBi	7.5 ± 0.3	7.6 ± 0.3	8.3 ± 0.4	8.9 ± 0.3
Horizontal beamwidth (HBW), 3 dB, degrees[1]	360	360	360	360
Vertical beamwidth (VBW), 3dB, degrees[1]	21.5 ± 2.5	20 ± 0.5	18.5 ± 1.5	15.7 ± 1.1
Cross-polar discrimination over 360°[1]	>15	>16	>17	>18
Upper side lobe suppression	>14	>14	>15	>15
Electrical downtilt (EDT), degrees	2 or 4 or 6			
Impedance, ohms	50			
VSWR	≤ 1.5:1			
PIM, 2x20W carrier, dBc	< -153			
Isolation, intra-band, dB	>25			
Isolation, inter-band, dB	>28			
Input power per port, watts	125			

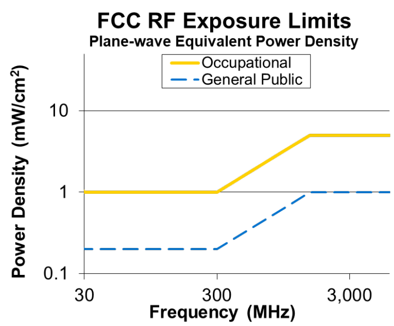
Figure 2 JMA CYL2Q16R-2XY Antenna

Computer Modeling

This RF Exposure assessment is based on power density modeling and a comparison with whole body exposure limits set by the Federal Communications Commission (FCC) and codified in their rules [8]. The FCC has two limits: one for the General Public and a less conservative or higher limit for Occupational workers. An Occupational worker is defined as someone who through training and notification can understand and control their exposure to RF that they may encounter in the workplace. Everyone else is considered the General Public. In this assessment, both limits are considered but the stricter, General Public, limits are used to determine compliance.

This assessment uses maximum power to the antennas and conservative modeling techniques to determine the greatest possible extent of compliance boundaries. Outside the boundaries, exposure levels will always be below the limits. Most of the time, the actual power will be much less, likely by a large margin, so levels will be below exposure limits even within the boundaries.

FCC plane-wave equivalent power density limits for maximum permissible exposure are derived from the whole-body SAR limits and expressed in milliwatts per square centimeter (mW/cm^2). FCC exposure limits are for continuous exposure spatial-averaged over the whole body and time-averaged, over 6 minutes for Occupational and 30 minutes for General Public limits. To account for changes in absorption relative to frequency, the limits are dependent on the frequency of the RF energy. This graph indicates that frequency relationship.



To calculate exposure and compliance boundaries, power density from each source (exposure value by frequency EV_f) is divided by the appropriate exposure limit (EL_f), creating an exposure ratio (ER_f).

$$ER_f = \frac{EV_f}{EL_f}$$

Ratios from each source are combined to determine a total exposure ratio TER. This ratio is used to determine exposure and compliance boundaries.

$$TER = \sum_{i=1}^{n} ER_i$$

RF power density levels are calculated using the IXUS Modeler [9]. IXUS employs a synthetic ray tracing method for panel and omnidirectional antennas and a conservative cylindrical envelope method for microwave dish (parabolic reflector / aperture) antennas.

---

[8] 47 CFR § 1.1310 *Radiofrequency radiation exposure limits*; US Code of Federal Regulations.

[9] IXUS *EMF Compliance Management Software version 4.10 (0)2023 5.0 (Calculator 2023.5) from 2023 11-24*; Alphawave Mobile Network Products.

The ray tracing method is an advanced computation method described in IEC 62232 [10]. The power is summed from elemental sources representing the individual components of the antenna. These elemental sources are selected by an analysis of the proposed antennas and their manufacturers datasheets. Ray tracing algorithms typically overestimate RF field strength due to absorption of RF energy in the ground, building walls and other man-made structures.

IXUS combines results from all sources to create graphic 3D compliance boundaries around antennas.

The following depictions graphically show compliance boundaries with respect to the antenna and its mount pole for each configuration. Blue indicates areas that may exceed the FCC's General Public exposure limits. Yellow indicates areas that may exceed the Occupational exposure limits. Orange/red indicates areas that may exceed 10 times the Occupational limits.

Ground level predictions are based on the lowest antenna height and maximum electrical downtilt for each configuration. Higher antennas will have lower ground level exposure.

[10] IEC 62232: *Determination of RF field strength, power density and SAR in the vicinity of base stations for the purpose of evaluating human exposure*; International Electrotechnical Commission, Geneva; 2022.

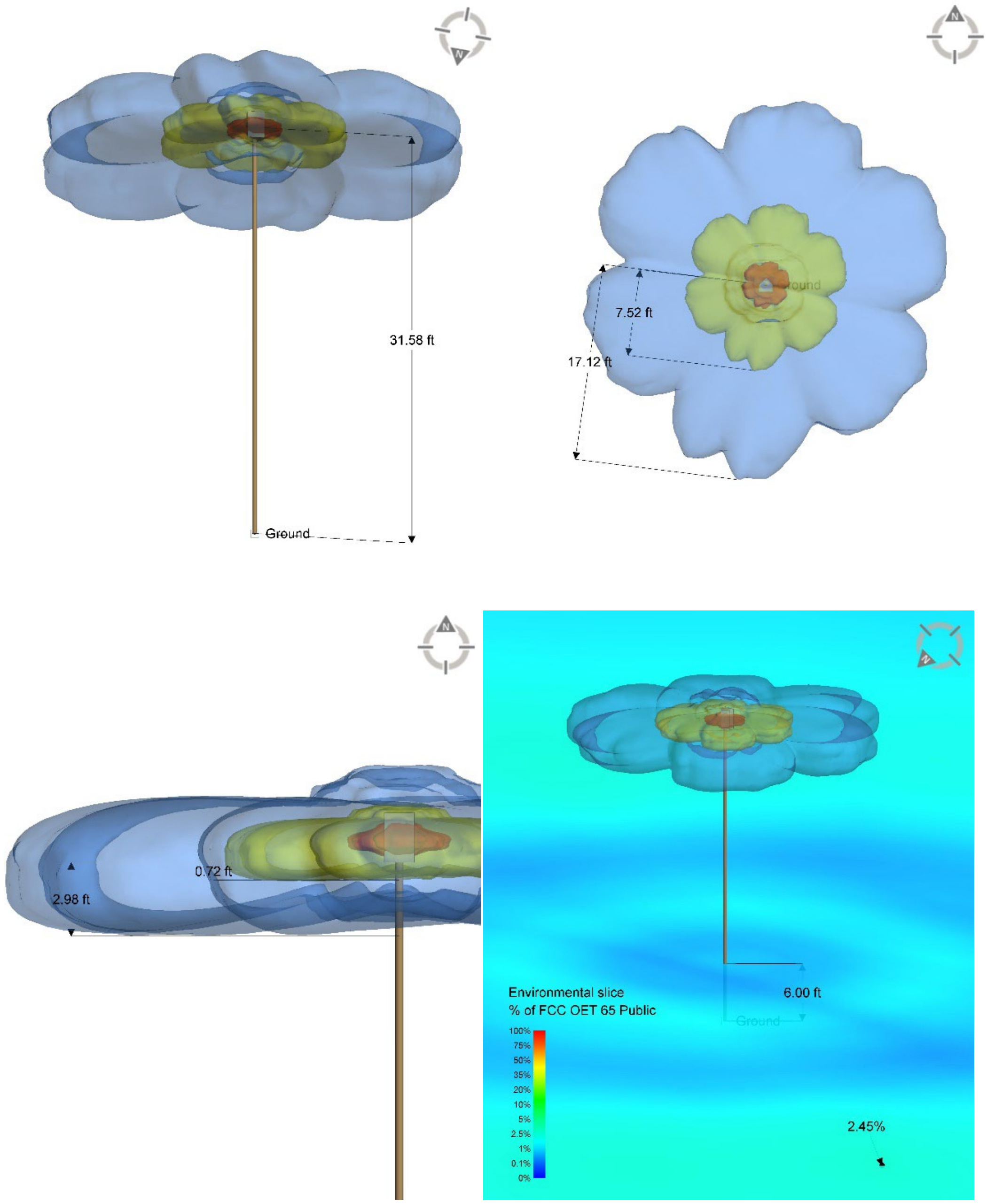


Figure 3 Configuration 1 Compliance Boundary / Pattern Oblique, Overhead, Side and Ground Views

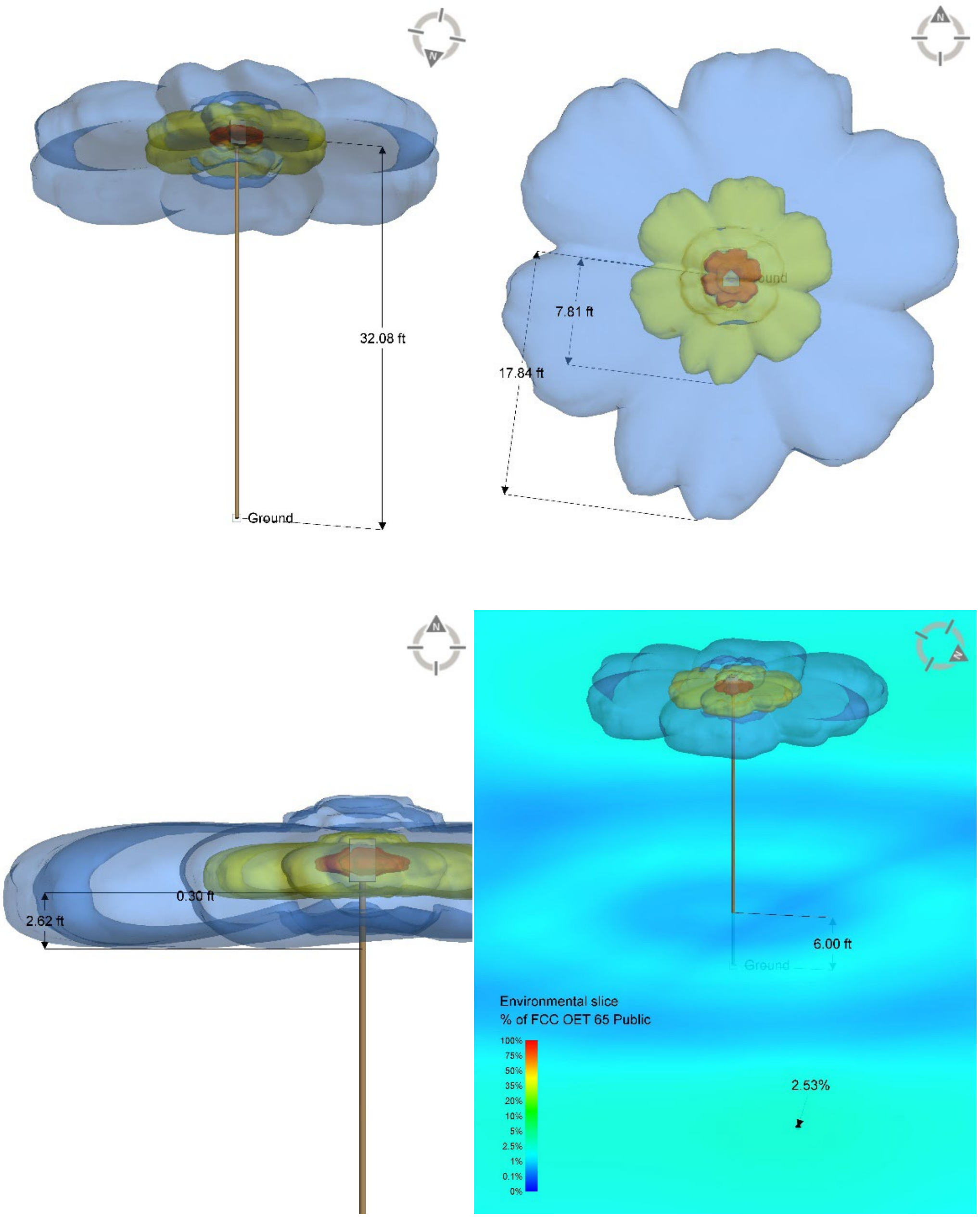


Figure 4 Configuration 2 Compliance Boundary / Pattern Oblique, Overhead, Side and Ground Views

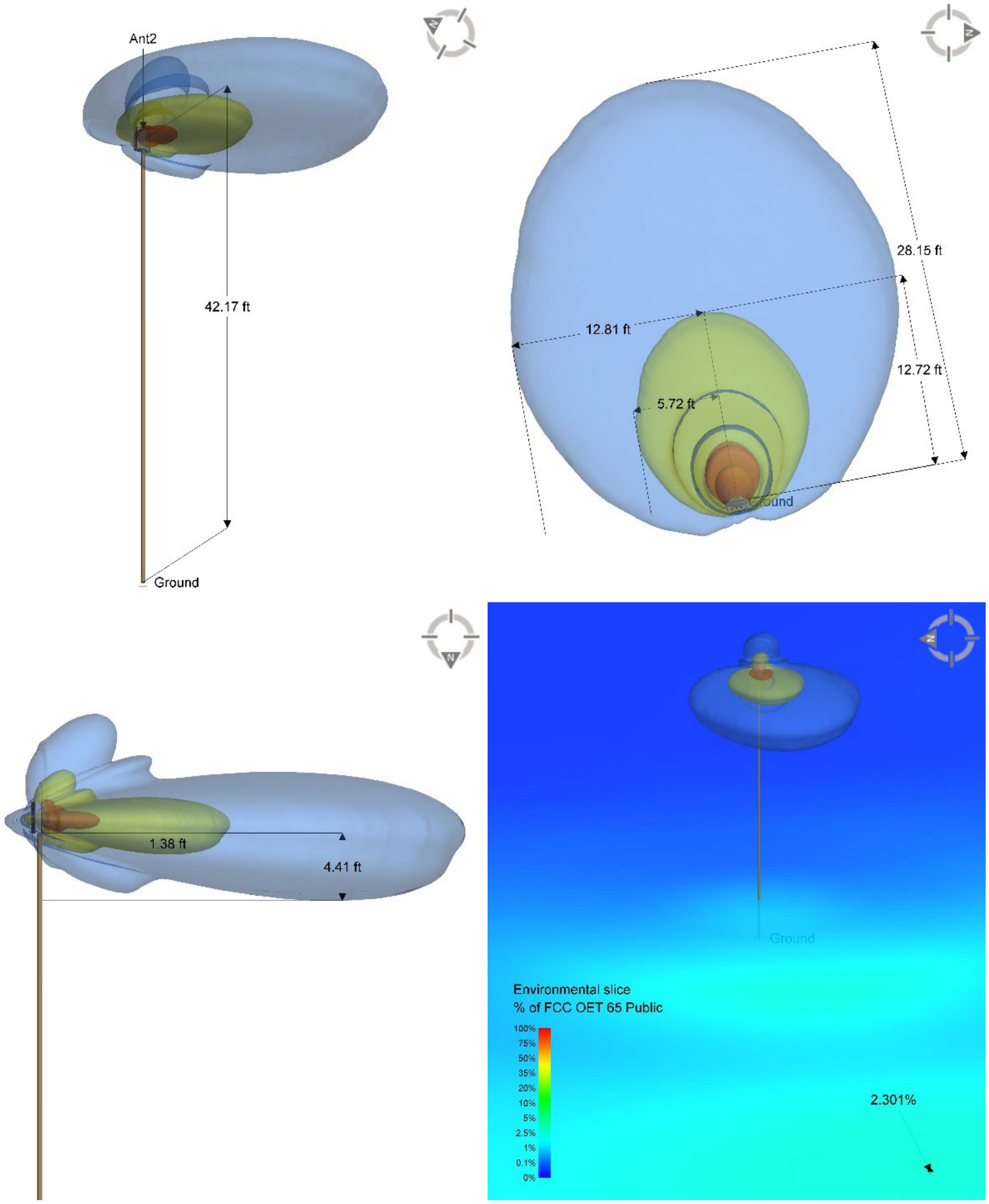


Figure 5 Configuration 3 Compliance Boundary / Pattern Oblique, Overhead, Side and Ground Views

Assessment

Review of the 40 nodes was completed using available imagery from Google Earth™ and EagleView™.

Based on modeling and proximity no sites showed publicly accessible locations exposed to levels that may exceed the General Public limits.

Small areas near the antennas are predicted to exceed the Occupational compliance limits and guidance to workers is recommended in the form of signage to be installed at each node. For details, see the **RF Safety Program** section.

An RF exposure assessment is based on cumulative exposure from all sources. Adjacent nodes as well as other RF transmitting installations in proximity could affect the compliance boundaries significantly if they were located close by, i.e., within about the computed boundary distance of either node. Directions away from adjacent nodes or other RF transmitting installations will have minimal changes to their compliance distances. None of the nodes in this study have been identified as located close to any adjacent nodes or other RF transmitting installations.

As the computer modeling is worst-case (conservative) based upon line-of-sight (with no obstructions) as well as the nodes operating at maximum power (which is rare), the actual exposure ***will be less*** than predicted. Obstructions including trees further attenuate RF signals between these nodes and any nearby residences or buildings. For these reasons there will be insignificant RF exposure impact on nearby residences or buildings located further away from the stated compliance boundaries quite possibly orders of magnitude less (fractions of a percent). For perspective, occupants of nearby residences or buildings typically experience ***greater*** RF exposure from any wireless devices that may be located within (i.e., mobile phones, Wi-Fi routers, computers, etc.) than they would from these node locations.

Node Details

The following tables detail each configuration and lists the Worst-Case Compliance Boundary distances in front of (Horizontal) and below (Vertical) as well as the maximum ground level exposure for the lowest antenna height of each configuration in this study.

Table 1 Configuration Link Budget(s) and Compliance Boundaries

CONFIG	Carrier	Tech	Freq Band (MHz)	Max Power per Tx (dBm)	System Loss (dB)	TDD Duty Cycle Factor (dB)	Tx Count	Antenna	Antenna Max Gain (dBi)	Total EIRP (dBm)	Antenna Beamwidth		Antenna Aperture (ft)	General Public		Occupational	
											Horizontal (°)	Vertical (°)		Worst-Case Horizontal Compliance Boundary (ft)	Worst-Case Vertical Compliance Boundary (ft)	Worst-Case Horizontal Compliance Boundary (ft)	Worst-Case Vertical Compliance Boundary (ft)
1	TMo	4G-LTE	1900	46.0	1.0	0.0	4	JMA CYL2Q16R-2XY	9.2	60.2	360.0	20.0	2.00	17.1	3.0	7.5	0.7
	TMo	4G-LTE	2100	46.0	1.0	0.0	4		9.1	60.1	360.0	18.5					
	TMo	5G-LTE	2500	46.0	1.0	1.5	4		10.2	59.7	360.0	15.7					
2	TMo	4G-LTE	1900	46.0	1.0	0.0	4	JMA CYL2Q16R-2XY	9.2	60.2	360.0	20.0	2.00	17.8	2.6	7.8	0.3
	TMo	4G-LTE	2100	46.0	1.0	0.0	4		9.1	60.1	360.0	18.5					
	TMo	5G-LTE	2500	46.0	1.0	1.5	4		10.2	59.7	360.0	15.7					
	VZW	4G-LTE	2100	46.0	1.0	0.0	1		9.1	54.1	360.0	18.5					
3	TMo	4G-LTE	1900	46.0	1.0	0.0	4	Amphenol 4U6VX065X06FxyS5	13.8	64.8	63.5	19.8	2.06	28.2	4.4	12.7	1.4
	TMo	4G-LTE	2100	46.0	1.0	0.0	4		13.9	64.9	64.6	18.4					
	TMo	5G-LTE	2500	46.0	1.0	1.5	4		14.3	63.8	82.4	15.8					

Note: Tx Ports: number of radio transmitter ports connected to the antenna; dB: decibel; dBm: relative to a milliwatt; dBi: relative to isotropic antenna; EIRP: effective radiated power relative to an isotropic antenna; W: watt.

The node and all adjacent structures have been reviewed and there are no accessible areas within the General Population (GP) compliance boundary at any of these nodes. The Compliance Boundary Toward Closest Structure listed below are toward the nearest adjacent structure. The specified azimuths were used and the compliance distance to the side and behind the antenna are determined from the modeling represented in the graphics in the Assessment section.

Table 2 Node Details and Assessment

ExteNet Node ID	CARRIER Node ID	LATITUDE	LONGITUDE	MUNI	CONFIG	RAD Center (ft)	Azimuth (°)	Max %MPE GP @ Ground Level	Compliance Boundary Toward Closest Structure	
									GP (ft)	Notes (distance to closest structure)
KS-S000000002	KC015	39.010870	-94.618809	Mission Hills	1	32.00	OMNI	2.5%	17.1	98 feet from nearest structure.
KS-S000000003	KC016	39.018326	-94.615076	Mission Hills	1	31.58	OMNI	2.5%	17.1	127 feet from nearest structure.
KS-S000000006	KC019	39.004837	-94.621038	Mission Hills	1	31.58	OMNI	2.5%	17.1	98 feet from nearest structure.
KS-S000000007	KC020	39.007963	-94.613036	Mission Hills	1	36.30	OMNI	2.5%	17.1	47 feet from nearest structure.
KS-S000000008	KC022	39.011939	-94.613651	Mission Hills	1	31.58	OMNI	2.5%	17.1	50 feet from nearest structure.
KS-S000000009	KC023	39.026047	-94.607512	Kansas City	1	31.58	OMNI	2.5%	17.1	121 feet from nearest structure.
KS-S000000010	KC024	39.021151	-94.609843	Mission Hills	1	31.58	OMNI	2.5%	17.1	96 feet from nearest structure.
KS-S000000014	KC028	39.026945	-94.621763	Mission Hills	1	45.28	OMNI	2.5%	17.1	88 feet from nearest structure.
NC-KS-OVLDPARK-00001	KC1027BA_51LAB	38.869947	-94.667639	Overland Park	1	58.17	OMNI	2.5%	17.1	73 feet from nearest structure.
NC-KS-OVLDPARK-00043	KC1025BA_61LAB	38.868989	-94.749328	Olathe	1	42.67	OMNI	2.5%	17.1	87 feet from nearest structure.
NC-KS-OVLDPARK-00044	KC1025BA_31LAB	38.878567	-94.742577	Olathe	1	48.17	OMNI	2.5%	17.1	75 feet from nearest structure.
NC-KS-OVLDPARK-00045	KC1025BA_51LAB	38.872911	-94.742569	Olathe	1	52.33	OMNI	2.5%	17.1	52 feet from nearest structure.
NC-KS-OVLDPARK-00046	KC1026BA_11LAB	38.875823	-94.723499	Overland Park	1	53.67	OMNI	2.5%	17.1	328 feet from nearest structure.
NC-KS-OVLDPARK-00047	KC1026BA_21LAB	38.868942	-94.718354	Overland Park	2	47.67	OMNI	2.5%	17.8	46 feet from nearest structure.

ExteNet Node ID	CARRIER Node ID	LATITUDE	LONGITUDE	MUNI	CONFIG	RAD Center (ft)	Azimuth (°)	Max %MPE GP @ Ground Level	Compliance Boundary Toward Closest Structure	
									GP (ft)	Notes (distance to closest structure)
NC-KS-OVLDPARK-00048	KC1026BA_51LAB	38.873197	-94.700663	Overland Park	1	45.75	OMNI	2.5%	17.1	122 feet from nearest structure.
NC-KS-OVLDPARK-00049	KC1026BA_41LAB	38.869317	-94.694843	Overland Park	2	42.58	OMNI	2.5%	17.8	219 feet from nearest structure.
NC-KS-OVLDPARK-00051	KC1027BA_41LAB	38.876381	-94.670036	Overland Park	2	46.67	OMNI	2.5%	17.8	44 feet from nearest structure.
NC-KS-OVLDPARK-00052	KC1028BA_21LAB	38.862117	-94.655735	Overland Park	1	32.17	OMNI	2.5%	17.1	74 feet from nearest structure.
NC-KS-OVLDPARK-00053	KC1027BA_61LAB	38.861623	-94.667626	Overland Park	2	55.67	OMNI	2.5%	17.8	135 feet from nearest structure.
NC-KS-OVLDPARK-00054	KC1028BA_41LAB	38.854790	-94.652821	Overland Park	2	47.00	OMNI	2.5%	17.8	151 feet from nearest structure.
NC-KS-OVLDPARK-00055	KC1029BA_51LAB	38.865968	-94.630405	Overland Park	2	48.17	OMNI	2.5%	17.8	81 feet from nearest structure.
NC-KS-OVLDPARK-00057	KC1025BA_11LAB	38.893695	-94.714147	Overland Park	1	44.58	OMNI	2.5%	17.1	69 feet from nearest structure.
NC-KS-OVLDPARK-00058	KC1026BA_31LAB	38.859064	-94.723654	Olathe	1	45.17	OMNI	2.5%	17.1	95 feet from nearest structure.
NC-KS-OVLDPARK-00061	KC1027BA_11LAB	38.888208	-94.686689	Overland Park	1	49.17	OMNI	2.5%	17.1	156 feet from nearest structure.
NC-KS-OVLDPARK-00062	KC1028BA_31LAB	38.854739	-94.659269	Overland Park	2	45.17	OMNI	2.5%	17.8	279 feet from nearest structure.
NC-KS-OVLDPARK-00063	KC1029BA_41LAB	38.854880	-94.634303	Leawood	2	53.67	OMNI	2.5%	17.8	195 feet from nearest structure.
NC-KS-OVLDPARK-00064	KC1030BA_21LAB	38.874175	-94.630511	Leawood	2	32.08	OMNI	2.5%	17.8	78 feet from nearest structure.
NC-KS-OVLDPARK-00067	KC1025BA_41LAB	38.877279	-94.733165	Overland Park	1	32.17	OMNI	2.5%	17.1	96 feet from nearest structure.
NC-KS-OVLDPARK-00068	KC1025BA_21LAB	38.885246	-94.715872	Overland Park	1	32.17	OMNI	2.5%	17.1	107 feet from nearest structure.
NC-KS-OVLDPARK-00069	KC1027BA_21LAB	38.873361	-94.686549	Overland Park	1	42.17	OMNI	2.5%	17.1	98 feet from nearest structure.
NC-KS-OVLDPARK-00070	KC1027BA_31LAB	38.869146	-94.679072	Overland Park	1	42.17	OMNI	2.5%	17.1	65 feet from nearest structure.
NC-KS-OVLDPARK-00071	KC1028BA_51LAB	38.861884	-94.649178	Overland Park	1	42.17	OMNI	2.5%	17.1	135 feet from nearest structure.

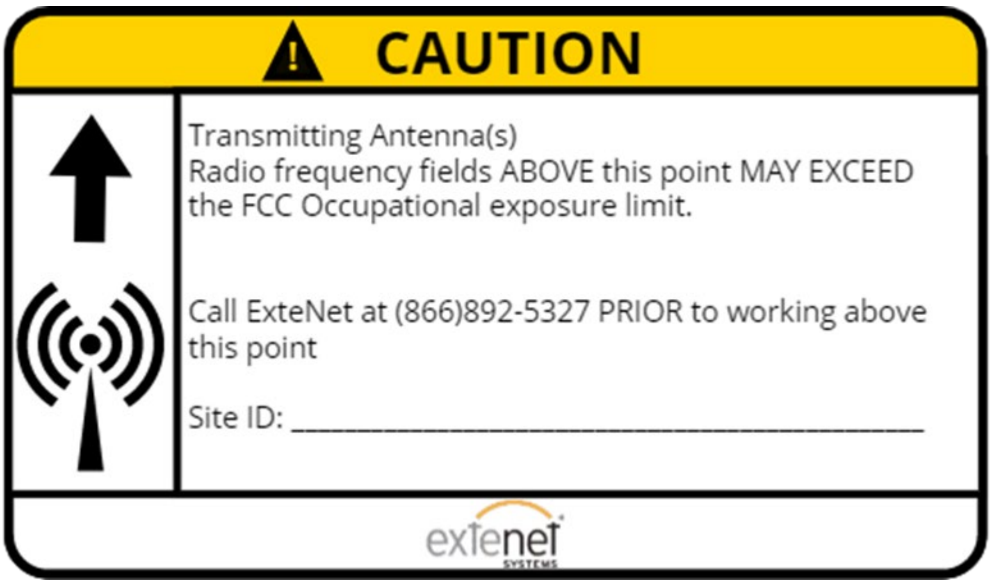
ExteNet Node ID	CARRIER Node ID	LATITUDE	LONGITUDE	MUNI	CONFIG	RAD Center (ft)	Azimuth (°)	Max %MPE GP @ Ground Level	Compliance Boundary Toward Closest Structure	
									GP (ft)	Notes (distance to closest structure)
NC-KS-OVLDPARK-00072	KC1029BA_21LAB	38.869108	-94.641961	Overland Park	1	32.92	OMNI	2.5%	17.1	216 feet from nearest structure.
NC-KS-OVLDPARK-00073	KC1030BA_11LAB	38.869273	-94.635239	Overland Park	1	32.92	OMNI	2.5%	17.1	142 feet from nearest structure.
NC-KS-OVLDPARK-00074	KC1029BA_61LAB	38.869283	-94.626717	Overland Park	1	32.92	OMNI	2.5%	17.1	145 feet from nearest structure.
NC-KS-OVLDPARK-00075	KC1028BA_11LAB	38.868964	-94.658459	Overland Park	1	32.17	OMNI	2.5%	17.1	56 feet from nearest structure.
NC-KS-OVLDPARK-00076	KC1029BA_11LAB	38.875546	-94.639809	Overland Park	1	32.17	OMNI	2.5%	17.1	137 feet from nearest structure.
NC-KS-OVLDPARK-00077	KC1028BA_61LAB	38.867954	-94.649236	Overland Park	1	42.17	OMNI	2.5%	17.1	140 feet from nearest structure.
NC-KS-OVLDPARK-00079	KC1026BA_61LAB	38.853553	-94.723777	Overland Park	3	42.17	260	2.3%	28.2	283 feet from nearest structure.
NC-KS-OVLDPARK-00080	KC1029BA_31LAB	38.860563	-94.640638	Leawood	1	32.17	OMNI	2.5%	17.1	43 feet from nearest structure.

Note: % MPE GP: exposure as a percentage of FCC General Public maximum permissible exposure.

RF Safety Program

ExteNet has an RF Exposure Safety Program for their transmitting sites. Part of this program requires the installation of signs near antennas where workers could access areas that exceed FCC RF exposure limits.

Based on this assessment, the following or similar signs should be installed on the pole approximately 3 feet below the antenna so they can be seen, read, and understood by a worker before they enter areas that may exceed exposure limits.



Conclusions

This assessment concludes that RF exposure in accessible areas near these installations will be below FCC limits for the General Public when installed as specified.

This engineer hereby certifies that these wireless facilities operated by ExteNet Systems Inc. Will comply with the RF exposure limits set forth by the FCC and as required by federal law.

If you have any questions on this assessment, please contact Sublight Engineering PLLC.

Engineering Statement

My professional engineer seal on this document certifies and affirms that:

I am registered as a Professional Engineer.

I am the principal of Sublight Engineering PLLC, in Arlington, Virginia.

I provide RF engineering services.

I am thoroughly familiar with the rules and regulations of the Federal Communications Commission (FCC) as well as the regulations of the Occupational Safety and Health Administration (OSHA), both in general and specifically as they apply to the FCC radiofrequency radiation exposure limits and electro-magnetic interference.

That I have prepared this engineering report and believe it to be true and accurate to the best of my knowledge.

September 18, 2024

Matthew J Butcher, principal of Sublight Engineering, has over 30 years of experience as an electrical engineer with practice areas of radio frequency (RF), electrical, and computer engineering. His RF work includes human exposure assessment; wireless network design; and interference assessment and mitigation.

Measuring, modeling, providing guidance on, and developing standards related to human exposure to RF is a primary focus of Sublight Engineering. Since 2000 Mr. Butcher has been working with industry, government, workers, and the public on this topic.

As a Senior Member of the IEEE and the International Committee on Electromagnetic Safety (ICES) Mr. Butcher helps develop the C95 standards for the safe use of electromagnetic energy. He is the co-chair of (SC1) Techniques, Procedures, & Instrumentation, responsible for C95.3 - IEEE Recommended Practice for Measurements and Computations of Electric, Magnetic, and Electromagnetic Fields with Respect to Human Exposure to Such Fields, 0 Hz to 300 GHz.

He also is on the United States National Committee of the International Electrotechnical Commission (USNC/IEC) for TC106: Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure.

Mr. Butcher earned a Bachelor of Science in Electrical Engineering from the University of Maryland and holds Professional Engineer licenses in multiple states. He is the Secretary of the Association of Federal Communications Consulting Engineers (AFCCE) and is Assistant To Senior Vice-President for the Advisory Panel on Nonionizing Radiation of the National Council on Radiation Protection and Measurements.

Appendix

This report discusses bands. The following table relates FCC bands to the frequencies that base-stations transmit (downlink). Operators' licenses give them exclusive use in a geographic area to specific frequency ranges or blocks in specific bands.

Band		Frequency	
Low	600 MHz	663	MHz
		698	MHz
	700 MHz	716	MHz
		776	MHz
	SMR (860 MHz)	862	MHz
		869	MHz
	Cellular (880 MHz)	869	MHz
		894	MHz
	ISM[11] (915 MHz)	902	MHz
		928	MHz
Mid	PCS (1950 MHz)	1,930	MHz
		2,000	MHz
	AWS (2.1 GHz)	2,100	MHz
		2,190	MHz
	WCS (2.3 GHz)	2,305	MHz
		2,360	MHz
	ISM (2.4 GHz)	2,400	MHz
		2,485	MHz
	BRS/EBS (2.5 GHz)	2,496	MHz
		2,690	MHz
	3.45 GHz	3,450	MHz
		3,550	MHz
	CBRS (3.5 GHz)	3,550	MHz
		3,700	MHz
	C-Band (4 GHz)	3,700	MHz
		3,980	MHz
	U-NII/LAA-LTE/ISM (6 GHz)	5,150	MHz
		5,825	MHz
High	UMFUS/mmWave	24	GHz
		48	GHz

[11] ISM or industrial, scientific and medical bands are unlicensed and generally have power limits of 1 watt or less.