STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

IN RE:	:	
	:	
APPLICATION OF HOMELAND TOWERS, LLC AND CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED FOR THE CONSTRUCTION, MAINTENANCE AND OPERATION OF A WIRELESS TELECOMMUNICATIONS FACILITY AT 515 MOREHOUSE ROAD, EASTON, CONNECTICUT	:	DOCKET NO. 473
	:	MAY 31, 2017

RESPONSES OF HOMELAND TOWERS, LLC AND CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS TO CONNECTICUT SITING COUNCIL PRE-HEARING INTERROGATORIES

On May 17, 2017, the Connecticut Siting Council ("Council") issued Pre-Hearing Interrogatories to Homeland Towers, LLC ("Homeland") and Cellco Partnership d/b/a Verizon Wireless ("Cellco"), relating to Docket No. 473. Below are Homeland's and Cellco's responses.

Question No. 1

Which frequencies would Cellco initially install at the proposed site? What is the determining factor for the deployment of additional frequencies within the proposed service area?

Response

Cellco will initially deploy its 700 MHz and 2100 MHz frequencies at the Easton Facility. Cellco typically deploys 700 MHz only at new sites in more rural settings, like the proposed facility in Easton. Cellco's 2100 MHz and other frequencies would be deployed as needed to address capacity needs. However, with the recent introduction of new "unlimited" service plans, Cellco is seeing some of its existing 700 MHz only sites reaching "exhaust" levels sooner than anticipated, requiring the introduction of additional capacity (2100 MHz) at these particular cell

sites. For this reason, Cellco is now deploying both 700 MHz and 2100 MHz frequencies at all new cell sites.

Question No. 2

How do the different frequencies interact? Are all frequencies used to transmit voice and data services? Are all frequencies LTE capable? Please explain.

Response

All of Cellco's licensed frequencies are LTE capable and are used to transmit voice and data services. Cellco's 700 MHz acts as the primary frequency for its LTE service. The 700 MHz frequencies transmit further (provide a larger coverage footprint) and can penetrate buildings and other indoor locations better than Cellco's other frequencies. Because the 700 MHz has a larger footprint and would typically exhaust before other carriers, Cellco attempts to push as much traffic as possible to its 2100 MHz (AWS) services. Customers nearer the cell site are more likely to use the 2100 MHz frequencies and the fringe users, physically further from the cell site would use 700 MHz frequencies.

Question No. 3

What is Cellco's service design threshold for each frequency?

Response

Cellco's minimum design threshold for CDMA signal strength is -85 dBm Receive Signal Strength Indicator (RSSI) for in-vehicle service and -75 dBm RSSI; for in-building service. For LTE signal strength, Cellco's minimum design threshold is 114 dB Reverse Link Operational Path Loss (RLOPL) for in-vehicle service and 95 dB RLOPL for in-building service.

Question No. 4

Application page 8 describes existing wireless service gaps in the proposed service area.

Please provide the area, in square miles, of existing inadequate service for each frequency that will be initially deployed within the target service area. Would any service gaps remain in the proposed service area after deployment of the Easton facility? If so, indicate their location and size.

Response

At 700 MHz, there are currently approximately 2.75 square miles service gaps (areas of unreliable or non-existent service) in the area that would be covered by the Easton Facility. Service in Cellco's 2100 MHz frequencies is effectively non-existent in the target service area.

After the Easton Facility is deployed, several small gaps in Cellco's 700 MHz wireless service, totaling approximately 0.6 square miles, will remain in some portions of the area around the Easton Facility, in large part, due to terrain. One such gap would remain along Route 58 between Norton Road and Center Street, including portion of Center Street. Another gap would remain along Route 136 near its intersection with Route 58. As indicated on the coverage plots provided in the Application, even after the deployment of the Easton Facility significant wireless service gaps will remain at 2100 MHz.

Question No. 5

Could the proposed coverage and capacity services be met by a series of small cell facilities or a distributed antenna system instead of the proposed macro-tower facility? If small cells are feasible, approximately how many would be required, assuming optimum placement.

Response

Using series of small cells or DAS systems may be technically feasible "on paper" but is not the most efficient or cost effective means of providing improved wireless service in the area. The actual number of small cell facilities that would be needed to provide coverage comparable

to that from the proposed Easton Facility is not known but would be significant given the overall size of the area that Cellco is attempting to serve and the topography in the southerly portion of Easton. This approach would also not be the optimal use of network resources like fiber optic connections, cell site equipment, and manpower for construction of each of the needed facilities.

Question No. 6

Does Cellco have any statistics on dropped calls and/or ineffective attempts in the vicinity of the proposed facility? If so, what do they indicate? Does Cellco have any other indicators of substandard service in this area?

Response

There are numerous parameters that Cellco considers in its effort to improve network performance. The most critical parameters are the Voice Over LTE (VoLTE) Ineffective Attempts (IA) and VoLTE Dropped Calls (DC). The table below includes the relevant DC and IA data for the month of April 2017 (excluding weekends and any maintenance windows).

Facility Name	Sector	Carrier	Ineffective Attempts % (IA)	Dropped Calls % (DC)
Easton North 2 CT	Gamma	700 MHz	0.49	2.09
Fairfield CT	Gamma	700 MHz	0.60	2.33
Plattsville CT	Gamma	700 MHz	0.56	1.75
Trumbull Center CT	Gamma	700 MHz	1.06	3.08
Weston North CT	Beta	700 MHz	1.86	4.91

* Data is for the entire month of April. It excludes Weekends and Maintenance Window

Cellco's system performance standard is 0.75% or better for dropped calls (DC) and ineffective attempts (IA). For LTE voice services, none of the surrounding cell sites satisfy Cellco's DC performance standard. Only three out of the five surrounding sites satisfies Cellco's IA performance standard.

Question No. 7

Application page 8 states the proposed site would provide capacity relief to the Fairfield Alpha and Plattsville Gamma sectors. Provide the following related information:

a) Identify the frequencies that have exhausted at these sectors.

b) What are the issues at adjacent sites/sectors that result in deficient service within the target service area?

c) What is the percentage of service from of each of these exhausting sectors that would be now served by the proposed site?

d) Would the deployment of Easton facility be sufficient to address these capacity concerns or would an additional facility be required in the near term to off-load traffic.

e) Once the proposed site is on-line and providing capacity relief to adjacent sites, what would be the effective service area for the 700 MHz frequency from the proposed site?

Response

Based from the data available through the end of April 2017, the Fairfield Alpha sector 700 MHz and 2100 MHz antennas are exhausting on the Forward Data Volume (FDV).[1] In addition, the Fairfield Alpha sector 700 MHz antennas are exhausting on Average Scheduled Eligible User (ASEU)[2], Average Active Connections (Average AC)[3], and Maximum Active

[1] FDV refers to how much data is being consumed by the end users at a given time.

[2] ASEU relates to the number of users that are scheduled to use the finite amount of radio spectrum available to Cellco's customers. This is a true blocking metric that could keep users from accessing the network.

[3] Average AC is an average of how many customers are using network resources at a given time.

Connections (Max AC)[4] matrices. The Plattsville Gamma sector 700 MHz antennas are exhausting on the FDV and ASEU matrices.

With the deployment of the Easton Facility, Cellco is looking to offload the existing Fairfield Alpha sector antennas by approximately 8-10% at both 700 MHz and 2100 MHz and the existing Plattsville Gamma sector antennas by approximately 12-15% at 700 MHz.

In the near term (one (1) year projected data), Cellco expects that the Easton Facility will provide the Plattsville cell site with sufficient capacity relief. Longer term, additional facilities will be needed however, to resolve the exhaust problems at the Fairfield (Alpha sector) Facility. Cellco is currently evaluating the addition of at least two (2) small cells facilities in the area and a new macro-cell facility in the steeple of First Presbyterian Church at 2475 Easton Turnpike, in Fairfield CT.

As proposed, the effective service area of the Easton Facility would be 6.43 square miles at 700 MHz. The actual effective service area will be determined once the Easton Facility is on-air, the neighboring sectors are optimized and post-development drive test data, with the proposed site on-air, is evaluated.

Question No. 8

Provide an estimate of the residential population living within the 700 MHz target service area.

Response

The estimated residential population living within the 700 MHz wireless service footprint is 6,505.

[4] Max AC is total number of customers using network resources at a given time.

Question No. 9

Provide a traffic count for major roads that would be served by the proposed facility.

Response

According to Connecticut Department of Transportation information, there are 5,200 average daily trips (ADTs) along Route 58 near its intersection with Route 136; 6,500 ADTs along Route 136 near its intersection with Route 58; and 8,900 ADTs along Route 59 near its intersection with Center Street.

Question No. 10

Can the proposed facility support text-to-911 service? Is additional equipment required for this purpose? Is Cellco aware of any Public Safety Answering Points in the area of the proposed site that are able to accept text-to-911?

Response

Yes, the proposed Easton Facility will support text-to-911 as soon as the Public Safety Answering Point (PSAP) is capable of receiving text-to-911. No additional cell site equipment is necessary to support this service. Cellco is not aware of any Public Safety Answering Points in the area of the proposed Bridgeport NE cell site that are about to accept text-to-911 at this time.

Question No. 11

Would Cellco's installation comply with the intent of the *Warning, Alert and Response Network Act of 2006?*

Response

Yes.

Question No. 12

When did Cellco issue a search ring for this area? Provide a map depicting the search

ring. Did Cellco investigate other sites prior to selecting the proposed site? If so, provide a listing/map of the sites investigated and the reason(s) for rejection.

Response

Cellco issued its Easton search area in May of 2014. A copy of Cellco's search area map is included in Attachment 1. Homeland was primarily responsible for the site search effort in Easton. Alternative sites investigated are included in the Site Search Summary behind Tab 8 of the Application.

Question No. 13

The power density analysis in Application Tab 14 does not have a value for the Town antenna located at a tower height of 95 feet above ground level. Please revise if necessary.

Response

The power density analysis has been revised to include the value for the Town's microwave antenna located at a tower height of 95 and 150 feet. The conservatively calculated maximum RF emissions at street level from the assumed worst-case operations is 1.1176 percent of the FCC general population MPE limit. The revised analysis is included in an updated FCC compliance report by Pinnacle Telecom Group dated 5/31/17 and included in Attachment 2.

Question No. 14

Referencing Application Tab 14, provide the following information: number of channels per sector for each antenna system, effective radiated power per channel for each antenna system, height of each antenna system, and the frequency at which each antenna system would operate.

Response

Verizon's Equipment:

General Data	
Frequency Bands	746 MHz, 1900 MHz and 2100 MHz
Service Coverage Type	Sectorized
Antenna Type	Directional Panel
Antenna Centerline Height	145 ft.
Antenna Line Loss	Assumed 0 dB (conservatively ignored)
746 MHz Antenna Data	
Antenna Model (Max. Gain)	CSS X7C-FRO-660-VR0 (15.8 dBi)
RF Channels per Sector	Four 30-watt channels
1900 MHz Antenna Data	
Antenna Model (Max. Gain)	Amphenol WWX063X19G00 (18.6 dBi)
RF Channels per Sector	Two 60-watt channels
2100 MHz Antenna Data	
Antenna Model (Max. Gain)	Amphenol WWX063X19G00 (19.0 dBi)
RF Channels per Sector	Two 60-watt channels

Town's Public Safety Equipment:

Freq. Band and Use	*Max. Authorized Transmitter power*
Easton EMS 155.295 MHz	110 watts
Easton Police Department 154.040 MHz	70 watts
Easton Fire Department 33.56 MHz	100 watts
Town of Easton Public Safety MW 5GHz MHz	.5 watts

These tables have also been included in the updated Antenna Site FCC RF Compliance Assessment and Report, dated May 30, 2017 (Attachment 2).

Question No. 15

What measures are proposed to ensure site security?

Response

The tower and related equipment would be surrounded by an eight-foot security fence and locked gate. The fence surrounding the compound will maintain an anti-climb chain link mesh design. Cellco's radio equipment cabinets are locked and remotely monitored for intrusion 24 hours a day.

Question No. 16

Identify the safety standards and/or codes by which equipment, machinery, or technology would be used or operated at the proposed facility.

Response

- 2012 International Building Code with the 2016 CT Building Code Amendments
- National Electric Code (NFPA70)
- 2005 CT State Fire Safety Code with the 2009 Amendments
- TIA-222-G-1 "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures".
- Occupational Safety and Health Administration (OSHA).

Question No. 17

Page 8 of the Application states, "The back-up generator would be used to recharge the batteries." If the generator failed to start, about how long could the batteries alone supply power to Cellco's proposed telecommunication facility?

Response

The back-up batteries could supply power to the facility for 4 to 8 hours depending upon site loading. If site traffic increases significantly, battery life could be limited to as little as two (2) hours. This is why a permanent back-up power supply is so critical to the system.

Question No. 18

Describe any spill and/or leak prevention features of the diesel generator for fuel storage and tank re-filling.

Response

The diesel fuel tank, included as a part of the generator unit, maintains a double-walled tank with leak detection alarms. The generator also maintains secondary containment for engine oil and coolant within the generator's weather enclosure.

Question No. 19

Does the Town's equipment have an emergency backup power source?

Response

The Town currently uses a battery backup system at its other emergency service repeater locations around town. At this time, the Town has not decided on an emergency backup power source for their equipment at the proposed Easton Facility.

Question No. 20

Is it feasible to install a single generator within the compound capable of supplying emergency power to multiple carriers? Please explain.

Response

It is feasible that a properly sized generator at this site could provide back-up power to Cellco's and the Town's radio equipment.

Question No. 21

Can the proposed facility be relocated towards the southwest property line?

Response

Placement of the proposed facility closer to the southwest property line would require additional clearing of trees and would place the facility closer to wetland resources located primarily on the adjacent Aquarion Water Company land. Considering the facility is located within the public water supply watershed of Hemlocks Reservoir, an active source of public

drinking water for the Aquarion Water Company of Connecticut – Main System (PWSID #CT0150011), the additional ground disturbance and tree removal associated with possible relocation of the proposed facility closer to the southwest property line would increase the potential for erosion and sedimentation that could affect water quality, particularly in the nearby wetland areas. Homeland would not therefore, recommend moving the facility closer to the southwest property line.

Question No. 22

Was a site considered behind the animal control shelter? If not, why not?

Response

The area behind the animal control shelter is on a separate Town-owned parcel and was considered as an alternative tower site during the nearly three year municipal consultation process. In the end, the Town wanted to keep the rear portion of this parcel as open space. Additionally, a site behind the animal control shelter would be approximately 60 feet lower in ground elevation than the proposed tower location and would require a taller structure to meet the Town's and Cellco's service objectives.

Question No. 23

What is the distance/direction to the nearest National Audubon Society designated Important Bird Area?

Response

The closest Important Bird Area ("IBA") to the site is The Nature Conservancy's Devil's Den Preserve in Easton located approximately 2.25 miles to the northwest. This preserve is The Nature Conservancy's largest contiguous preserve in Connecticut, and is part of the largest tract of protected land located in the towns of Easton, Weston, Redding and Wilton in densely

developed Fairfield County. Devil's Den supports large populations of all of Connecticut's forest interior nesting bird species. Due to the significant distance separating the proposed facility from this IBA, no adverse impact to this resource or the bird species it supports are anticipated by the proposed development. Please see the Avian Resources Map provided as Attachment 3 for additional information.

Question No. 24

Would the proposed facility comply with the United States Fish and Wildlife Service recommended guidelines for reducing impacts to migratory birds?

Response

In August 2016, the USFWS prepared its *Recommended Best Practices for Communication Tower Design, Siting, Construction, Operation, Maintenance, and Decommissioning*. These suggested best practices were developed to assist tower companies in developing communication systems in a way which minimizes the risk to migratory birds and threatened and endangered species. The proposed facility would comply with the USFWS' recommended guidelines for reducing impacts to migratory birds as follows. The proposed facility would consist of a 157-foot "monopine" structure which requires neither guy wires nor lighting and is therefore consistent with USFWS' suggested tower design criteria: tower height is less than 200 feet above ground level (157 feet is proposed); no guy wires; no tower lighting and on-ground security lighting will be down-shielded and motion-sensored. In addition, placement of the facility avoids wetlands, known bird concentration areas (closest IBA is approximately five (5) miles away), rare species habitat (December 5, 2016 DEEP Natural Diversity Data Base letter did not reveal any rare species in proximity to the proposed facility) and ridgelines, thereby minimizing environmental impacts that could affect migratory birds. In order to comply with the

USFWS' construction recommendations, the following considerations will be made to reduce the take of birds: 1) If construction activities should occur during the peak nesting period of April 15 through July 15[5], efforts would be taken to complete tree clearing work prior to April 15th; 2) or, if tree clearing has not been completed by April 15th, an avian survey may be conducted to determine if breeding birds would be disturbed; and 3) If the avian survey concludes that breeding birds would be disturbed, tree clearing activities may be restricted from the April 15 through July 15 peak nesting period (or a modified time frame based on the specific findings of the survey).

Question No. 25

Is the site within an area defined as core forest? If so, how would development of the site affect core forest values?

Response

A forest fragmentation model has been developed by the University of Connecticut Center for Land Use Education and Research ("CLEAR") to classify forest cover into four main categories of increasing disturbance – core, perforated, edge and patch – based on a key metric called edge width.[6] Core forest areas are sub-classified into three categories – small core, medium core, and large core – based on the area of a given core patch: large core forest = >500 acres; medium core = 500 – 250 acres; small core = <250 acres. Based on this forest block classification tool, the subject property forest is classified as an Edge Forest Block (±199 acres) as a result of the on-site school and surrounding residential developments and roadways that have

[5] USFWS identifies the peak avian nesting season as April 15 through July 15 and recommends clearing activities be performed before this period in order to comply with the Migratory Bird Treaty Act, personal communication with Maria Tur, USFWS New England Field Office, February 27, 2014.

[6] Forest Fragmentation Assessment Model. UCONN Center for Land Use Education and Research. 2007. http://clear.uconn.edu/Projects/landscape/forestfrag/index.htm

significantly fragmented the small core forest block (±118 acres) located nearby to the west. Refer to the Forest Fragmentation Map provided in Attachment 4.

Development of the proposed facility will result in approximately 0.35 acre of forest removal within the Edge Forest Block which represents ±0.18% of the total Edge Forest Block. Therefore, since the proposed facility will not result in fragmentation of a core forest block and clearing would be limited to minor impact to the Edge Forest Block, no significant change to the overall nature and function of this forest habitat would occur due to the proposed development and no impact to core forest values would result.

Question No. 26

Were return receipts received for each abutting landowner identified in the application? If not, list the abutters that did not receive notice and describe any additional effort to serve notice.

Response

Cellco received 21 of the 22 certified mail receipts back from abutting landowners. A receipt was not received from Ricardo Lagos and Ariana Stolarz, the owners of property at 410 Morehouse Road. On May 30, 2017, a notice letter were resent to this property owner by regular mail.

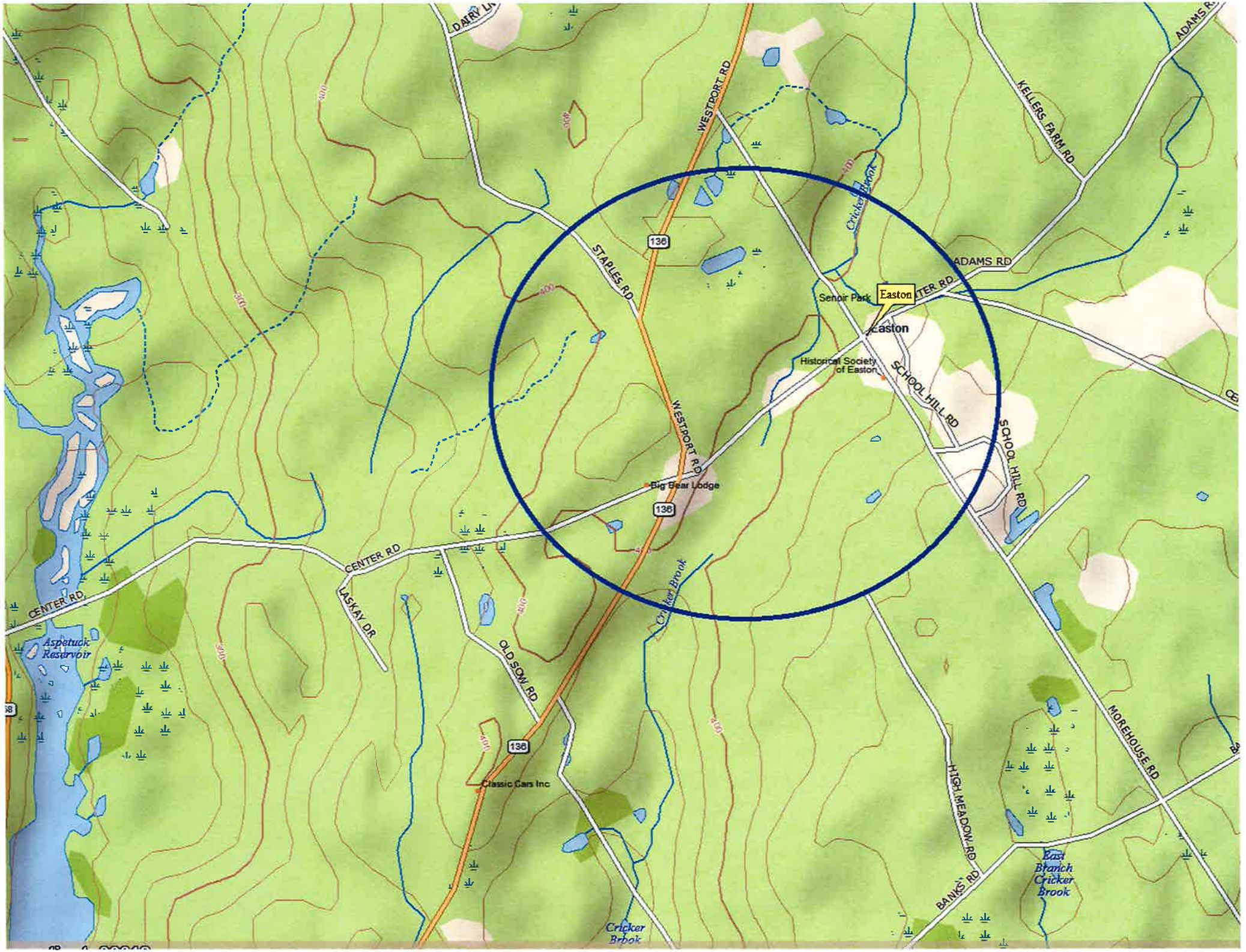
CERTIFICATION OF SERVICE

I hereby certify that on this 31st day of May 2017, a copy of the foregoing was sent via electronic mail to the following:

Pamela Westmoreland
400 Morehouse Road
Easton, CT 06612
pwestmor@hotmail.com

Kenneth C. Baldwin

ATTACHMENT 1


WESTPORT RD
KELLERS FARM RD
ADAMS RD
STAPLES RD
136
Cricker Brook
Senior Park
Easton
Historical Society of Easton
SCHOOL HILL RD
Big Bear Lodge
CENTER RD
LASKAY DR
OLD SOW RD
Aspetuck Reservoir
Classic Cars Inc
Cricker Brook
HIGH MEADOW RD
MOREHOUSE RD
BANKS RD
East Branch Cricker Brook
Cricker Brook

ATTACHMENT 2

PINNACLE TELECOM GROUP
Professional and Technical Services
Telecom Consulting

ANTENNA SITE FCC RF COMPLIANCE ASSESSMENT AND REPORT

HOMELAND TOWERS, LLC

SITE "CT254"
515 MOREHOUSE ROAD
EASTON, CT

MAY 31, 2017

14 RIDGEDALE AVENUE, SUITE 260 • CEDAR KNOLLS, NJ 07927 • 973-451-1630

Contents

Introduction and Summary

At the request of Homeland Towers, LLC, Pinnacle Telecom Group has performed an independent expert assessment of radiofrequency (RF) levels and related FCC compliance for wireless antenna operations on a proposed 150-foot monopole proposed at 515 Morehouse Road in Easton, CT.

Homeland Towers refers to the prospective site as "CT254", and the proposed pole will accommodate the directional panel antennas of Verizon Wireless, which plan to occupy the highest antenna mounting position on the pole, with an antenna center line of 145 feet. Easton Police Department and Easton EMS propose to mount antennas at the top of the pole at 150 feet. Easton Fire Department plans to mount antennas at 75 feet on the pole, we note that are point-to-point (dish) antennas at 150ft and 95ft on the monopole which are also included in the analysis.

The FCC requires wireless antenna operators to perform an assessment of the RF levels from all the transmitting antennas at a site whenever antenna operations are added or modified, and ensure compliance with the FCC Maximum Permissible Exposure (MPE) limit in areas of unrestricted public access, i.e., at street level around the site.

This assessment of antenna site compliance is based on the FCC limit for general population "maximum permissible exposure" (MPE), a limit established as safe for continuous exposure to RF fields by humans of either sex, all ages and sizes, and under all conditions.

The result of an FCC compliance assessment can be described in layman's terms by expressing the calculated RF levels as simple percentages of the FCC MPE limit. In that way, the figure 100 percent serves as the reference for compliance, and calculated RF levels below 100 percent indicate compliance with the MPE limit. An equivalent way to describe the calculated results is to relate them to a "times-below-the-limit" factor. Here, we will apply both descriptions.

The result of the FCC compliance assessment in this case is as follows:

- At street level around the site, the conservatively calculated maximum RF level caused by Verizon Wireless' panel antenna operations and all other proposed antenna operation is 1.1176 percent of the FCC general population MPE limit, well below the 100-percent reference for compliance. In other words, even with calculations designed to significantly overstate the RF levels versus those that could actually occur at the site, the worst-case calculated RF level in this case is still more than 89 times below the limit defined by the federal government as safe for continuous exposure of the general public.
- The results of the calculations provide a clear demonstration that the RF levels, even under worst-case circumstances, would satisfy the FCC requirement for controlling potential human exposure to RF fields. Moreover, because of the conservative methodology and assumptions applied in this analysis, RF levels actually caused by any antenna operations at this site will be even less significant than the calculation results here indicate.

The remainder of this report provides the following:

- relevant technical data on the parameters for the wireless carrier and the proposed Municipal operations;
- a description of the applicable FCC mathematical model for assessing compliance with the MPE limit, and application of the relevant technical data to that model; and
- analysis of the results of the calculations, and the compliance conclusion for the proposed site.

In addition, two Appendices are included. Appendix A provides background on the FCC MPE limit, along with a list of key references. Appendix B provides a summary of the qualifications of the author of this report.

Antenna and Transmission Data

As described, the proposed 150-foot pole will accommodate Verizon Wireless. Verizon wireless proposes to occupy the highest mounting position on the pole, and this analysis will include an assumption of "worst-case" for a Verizon Wireless site with an antenna centerline of 145 feet.

General Data	
Frequency Bands	746 MHz, 1900 MHz and 2100 MHz
Service Coverage Type	Sectorized
Antenna Type	Directional Panel
Antenna Centerline Height	145 ft.
Antenna Line Loss	Assumed 0 dB (conservatively ignored)
746 MHz Antenna Data	
Antenna Model (Max. Gain)	CSS X7C-FRO-660-VR0 (15.8 dBi)
RF Channels per Sector	Four 30-watt channels
1900 MHz Antenna Data	
Antenna Model (Max. Gain)	Amphenol WWX063X19G00 (18.6 dBi)
RF Channels per Sector	Two 60-watt channels
2100 MHz Antenna Data	
Antenna Model (Max. Gain)	Amphenol WWX063X19G00 (19.0 dBi)
RF Channels per Sector	Two 60-watt channels

The area below the antennas, at street level, is of interest in terms of potential "uncontrolled" exposure of the general public, so the antenna's vertical-plane emission characteristic is used in the calculations, as it is a key determinant in the relative level of RF emissions in the "downward" direction.

By way of illustration, Figure 1 that follows shows the vertical-plane radiation pattern of the antenna model to be used by Verizon Wireless in the 1900 MHz frequency band. Note that in this type of diagram, the antenna is effectively pointed at the three o'clock position (the horizon) and the relative strength of the pattern at different angles is described using decibel units.

The use of a decibel scale to describe the relative pattern at different angles incidentally tends to visually understate the actual focusing effects of the antenna.

Where the antenna pattern reads 20 dB, for example, the relative RF energy emitted at the corresponding downward angle is 1/100th of the maximum that occurs in the main beam (at 0 degrees); at a 30 dB point, the level is 1/1,000th of the maximum.

Note that the automatic pattern-scaling feature of our internal software may skew side-by-side visual comparisons of different antenna models, or even different parties' depictions of the same antenna model.

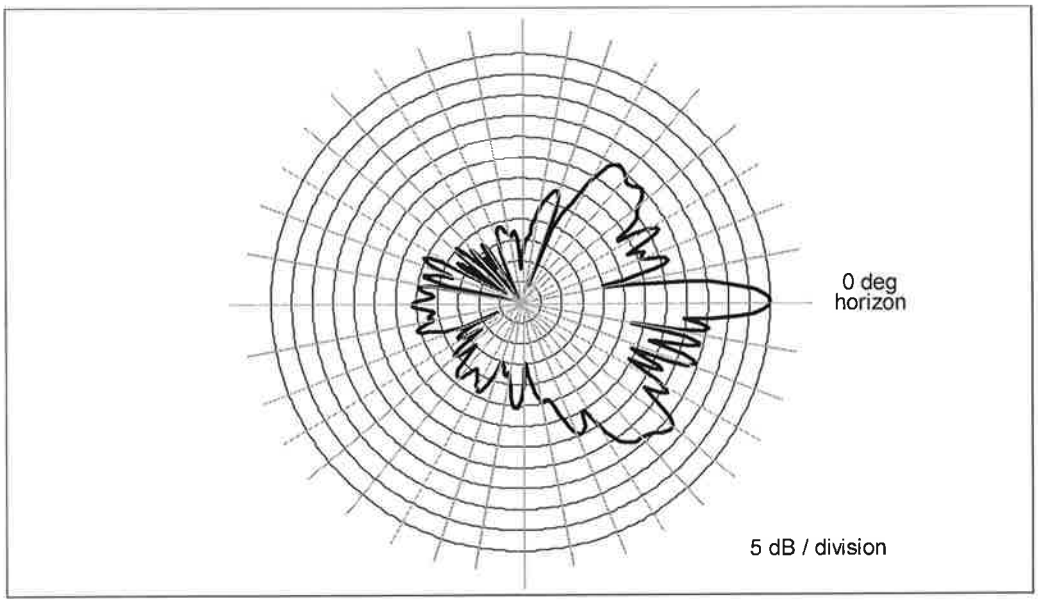


Figure 1. Commscope JAHH-65B-R3B Antenna – 1900 MHz Vertical-plane Pattern

In addition, and as mentioned at the outset, Easton Township Police, EMS, Public Safety and Fire have several omnidirectional (whip) antenna operations and microwave antennas proposed at the site. A search of FCC records indicates the Easton Township is authorized for the following;

Freq. Band and Use	*Max. Authorized Transmitter power*
Easton EMS 155.295 MHz	110 watts
Easton Police Department 154.040 MHz	70 watts
Easton Fire Department 33.56 MHz	100 watts
Town of Easton Public Safety MW 5GHz MHz	.5 watts

Compliance Analysis

FCC Office of Engineering and Technology Bulletin 65 ("OET Bulletin 65") provides guidelines for mathematical models to calculate potential RF exposure levels at various points around transmitting antennas.

Around an antenna site at ground level (in what is called the "far field" of the antennas), the RF levels are directly proportional to the total antenna input power and the relative antenna gain (focusing effect) in the downward direction of interest – and the levels are otherwise inversely proportional to the square of the straight-line distance to the antenna. Conservative calculations also assume the potential RF exposure is enhanced by reflection of the RF energy from the intervening ground. Our calculations will assume a 100% "perfect", mirror-like reflection, which is the absolute worst-case approach.

The formula for ground-level MPE compliance assessment of any given wireless antenna operation is as follows:

$$MPE\% = (100 * TxPower * 10^{(Gmax-Vdisc)/10} * 4) / (MPE * 4\pi * R^2)$$

where

MPE%	=	RF level, expressed as a percentage of the FCC MPE limit applicable to continuous exposure of the general public
100	=	factor to convert the raw result to a percentage
TxPower	=	maximum net power into antenna sector, in milliwatts, a function of the number of channels per sector, the transmitter power per channel, and line loss

$10^{(Gmax-Vdisc)/10}$	=	numeric equivalent of the relative antenna gain in the direction of interest downward toward ground level
4	=	factor to account for a 100-percent-efficient energy reflection from the ground, and the squared relationship between RF field strength and power density ($2^2 = 4$)
MPE	=	FCC general population MPE limit
R	=	straight-line distance from the RF source to the point of interest, centimeters

The MPE% calculations are normally performed out to a distance of 500 feet from the facility to points 6.5 feet (approximately two meters, the FCC-recommended standing height) off the ground, as illustrated in Figure 2 below.

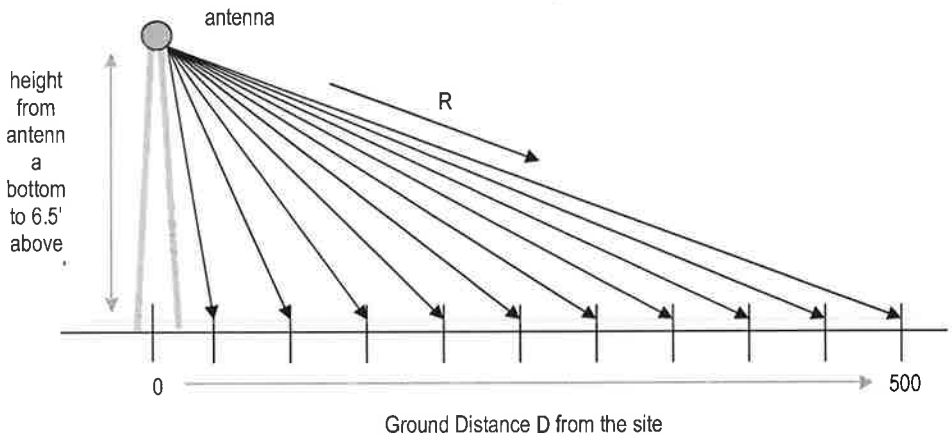


Figure 2. Street-level MPE% Calculation Geometry

It is popularly understood that the farther away one is from an antenna, the lower the RF level – which is generally but not universally correct. The results of MPE% calculations fairly close to the site will reflect the variations in the vertical-plane antenna pattern as well as the variation in straight-line distance to the antennas. Therefore, RF levels may actually increase slightly with increasing distance within the range of zero to 500 feet from the site. As the distance approaches 500 feet and beyond, though, the antenna pattern factor becomes less significant, the RF levels become primarily distance-controlled, and as a result the RF levels generally decrease with increasing distance, and are well understood to be in compliance.

FCC compliance for a multiple-band antenna operation is assessed in the following manner. At each distance point along the ground, an MPE% calculation is made for the RF effect in each frequency band, and the sum of the individual MPE% contributions at each point is compared to 100 percent, which serves as the normalized reference for the FCC MPE limit.

We refer to the sum of the individual MPE% contributions as "total MPE%", and any calculated MPE% total MPE% result exceeding 100 percent is, by definition, higher than the FCC limit and represents non-compliance and a need to mitigate the RF levels. If, on the other hand, all results are below 100 percent, that set of results serves as a demonstration of compliance with the MPE limit. Note that according to the FCC, when directional antennas are used, the compliance assessments are based on the RF effect of a single antenna sector (or, in cases of non-identical parameters, the worst-case effect of any individual sector).

The following conservative methodology and assumptions are incorporated into the MPE% calculations on a general basis:

1. The antennas are assumed to be operating continuously at maximum power, and at maximum channel capacity. In addition, the effects of antenna line loss are ignored wherever possible.

2. The power-attenuation effects of shadowing or other obstructions to the line-of-sight path from the antenna to the point of interest are ignored.

3. The calculations intentionally minimize the distance factor (R) by assuming a 6'6" human and performing the calculations from the bottom (rather than the centerline) of each operator's lowest-mounted antenna, as applicable.

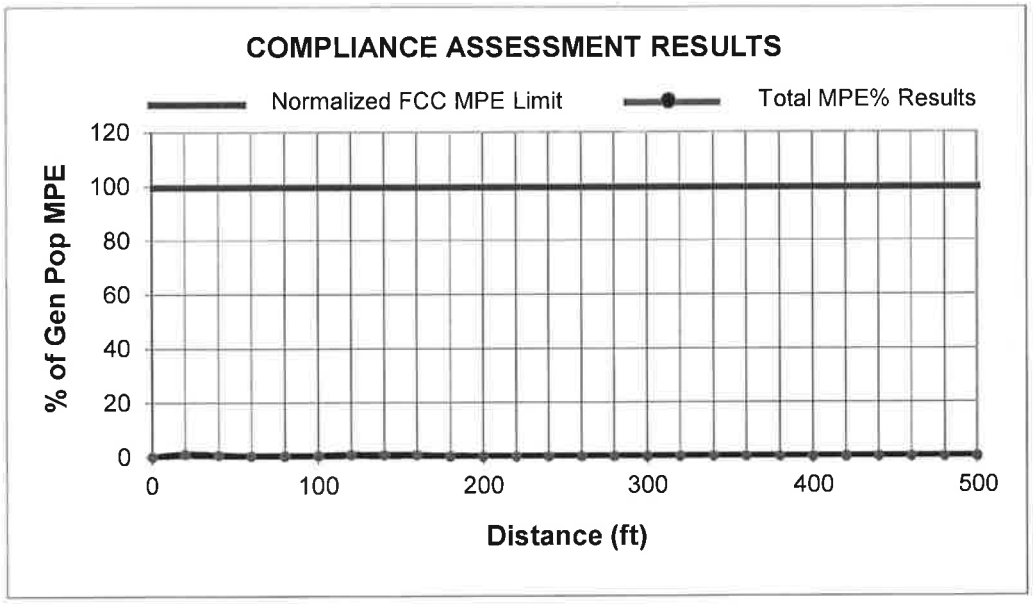
4. The potential RF exposure at ground level is assumed to be 100-percent enhanced (increased) via a "perfect" field reflection from the intervening ground.

The net result of these assumptions is to significantly overstate the calculated RF exposure levels relative to the levels that will actually occur – and the purpose of this conservatism is to allow very "safe-side" conclusions about compliance. The table that follows provide the results of the MPE% calculations for each operator, with the worst-case result highlighted in bold in the last column of the table.

Ground Distance (ft)	Verizon MPE% 700 MHz	Verizon MPE% 1900 MHz	Verizon MPE% 2100 MHz	Easton MW MPE% 5 GHz	Easton EMS MPE% 155 MHz	Easton PD MPE% 154 MHz	Easton FD MPE% 33 MHz	Total MPE%
0	0.0040	0.0000	0.0001	0.0001	0.0222	0.0151	0.0886	0.1301
20	0.0017	0.0021	0.0004	0.0001	0.1986	0.1354	0.7793	**1.1176**
40	0.0019	0.0104	0.0002	0.0001	0.2365	0.1612	0.3235	0.7338
60	0.0094	0.0419	0.0001	0.0001	0.0947	0.0646	0.1585	0.3693
80	0.0764	0.0033	0.0149	0.0001	0.1199	0.0817	0.0985	0.3948
100	0.1463	0.1805	0.0174	0.0000	0.0506	0.0345	0.0937	0.5230
120	0.1060	0.2856	0.0566	0.0000	0.1112	0.0758	0.1541	0.7893
140	0.0361	0.4062	0.1834	0.0000	0.0021	0.0014	0.0450	0.6742
160	0.0132	0.4437	0.1949	0.0001	0.0197	0.0135	0.0042	0.6893
180	0.0043	0.0268	0.1813	0.0001	0.0544	0.0371	0.0195	0.3235
200	0.0087	0.0276	0.0727	0.0001	0.0434	0.0296	0.0114	0.1935
220	0.0153	0.0792	0.0098	0.0001	0.0100	0.0068	0.0032	0.1244
240	0.0190	0.0072	0.0550	0.0001	0.0321	0.0219	0.0113	0.1466
260	0.0270	0.0262	0.0388	0.0001	0.0350	0.0239	0.0338	0.1848
280	0.0437	0.0404	0.0188	0.0001	0.0231	0.0158	0.0588	0.2007
300	0.0503	0.0179	0.0195	0.0001	0.0030	0.0020	0.0763	0.1691
320	0.0608	0.0137	0.0084	0.0002	0.0002	0.0001	0.0674	0.1508
340	0.0556	0.0393	0.0025	0.0001	0.0034	0.0023	0.0689	0.1721
360	0.0457	0.0550	0.0099	0.0001	0.0048	0.0033	0.0538	0.1726
380	0.0323	0.0441	0.0263	0.0001	0.0048	0.0033	0.0484	0.1593
400	0.0178	0.0167	0.0361	0.0001	0.0045	0.0031	0.0283	0.1066
420	0.0056	0.0001	0.0289	0.0001	0.0029	0.0019	0.0257	0.0652
440	0.0051	0.0001	0.0265	0.0001	0.0026	0.0018	0.0085	0.0447
460	0.0020	0.0121	0.0103	0.0002	0.0008	0.0005	0.0078	0.0337
480	0.0064	0.0427	0.0005	0.0002	0.0001	0.0001	0.0072	0.0572
500	0.0059	0.0396	0.0004	0.0002	0.0001	0.0001	0.0038	0.0501

As indicated, the overall worst-case calculated result is 1.1176 percent of the FCC general population MPE limit – well below the 100-percent reference for compliance, particularly given the significant conservatism incorporated in the analysis.

A graph of the overall calculation results, shown below, provides perhaps a clearer *visual* illustration of the relative compliance of the calculated RF levels. The line representing the overall MPE% results barely rises above the graph's baseline, and shows a consistent, comfortable margin to the FCC MPE limit.



Compliance Conclusion

The FCC MPE limit has been constructed in such a manner that continuous human exposure to RF fields up to and including 100 percent of the MPE limit is acceptable and completely safe.

The conservatively calculated maximum RF effect at street level from the assumed worst-case operations is 1.1176 percent of the FCC general population MPE limit.

In other words, even with an extremely conservative analysis intended to dramatically overstate the RF effects of any scenario at the site, the calculated worst-case RF level is still more than 89 times below the FCC MPE limit.

The results of the calculations indicate clear compliance with the FCC regulations and the related MPE limit, even for a worst-case scenario. Because of the conservative calculation methodology and operational assumptions applied in this analysis, the RF levels actually caused by the antennas will be even less significant than the calculation results here indicate, and compliance would be achieved by an even larger margin.

Certification

The undersigned certifies as follows:

1. I have read and fully understand the FCC regulations concerning RF safety and the control of human exposure to RF fields (47 CFR 1.1301 *et seq*).
2. To the best of my knowledge, the statements and information disclosed in this report are true, complete and accurate.
3. The analysis of site RF compliance provided herein is consistent with the applicable FCC regulations, additional guidelines issued by the FCC, and industry practice.
4. The results of the analysis demonstrate compliance with the FCC regulations and limit concerning the control of potential human exposure to the RF emissions from antennas.

Daniel Penesso

Daniel Penesso
Director- RF Engineering
Pinnacle Telecom Group, LLC

5/31/17
Date

Appendix A. Background on the FCC MPE Limit

As directed by the Telecommunications Act of 1996, the FCC has established limits for maximum continuous human exposure to RF fields.

The FCC maximum permissible exposure (MPE) limits represent the consensus of federal agencies and independent experts responsible for RF safety matters. Those agencies include the National Council on Radiation Protection and Measurements (NCRP), the Occupational Safety and Health Administration (OSHA), the National Institute for Occupational Safety and Health (NIOSH), the American National Standards Institute (ANSI), the Environmental Protection Agency (EPA), and the Food and Drug Administration (FDA). In formulating its guidelines, the FCC also considered input from the public and technical community – notably the Institute of Electrical and Electronics Engineers (IEEE).

The FCC's RF exposure guidelines are incorporated in Section 1.301 *et seq* of its Rules and Regulations (47 CFR 1.1301-1.1310). Those guidelines specify MPE limits for both occupational and general population exposure.

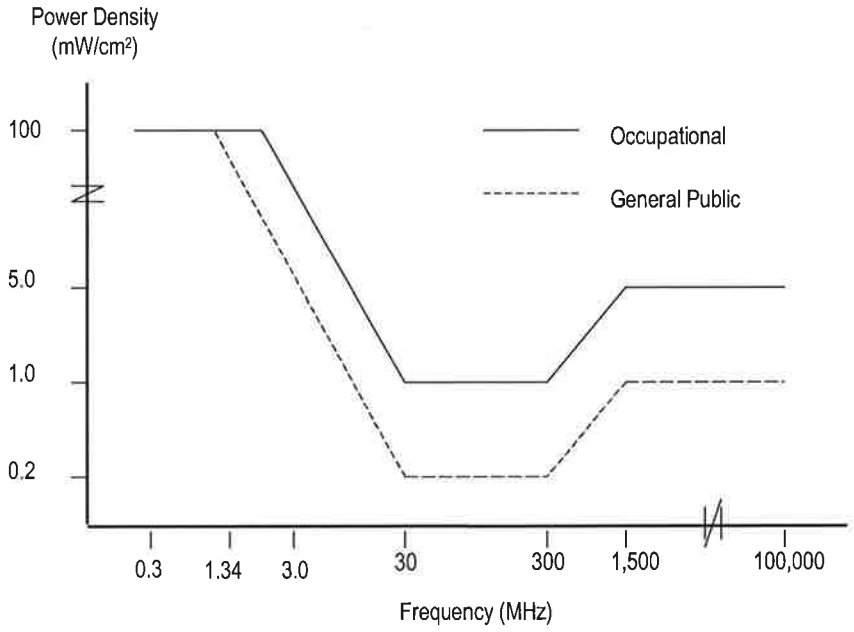
The specified continuous exposure MPE limits are based on known variation of human body susceptibility in different frequency ranges, and a Specific Absorption Rate (SAR) of 4 watts per kilogram, which is universally considered to accurately represent human capacity to dissipate incident RF energy (in the form of heat). The occupational MPE guidelines incorporate a safety factor of 10 or greater with respect to RF levels known to represent a health hazard, and an additional safety factor of five is applied to the MPE limits for general population exposure. Thus, the general population MPE limit has a built-in safety factor of more than 50. The limits were constructed to appropriately protect humans of both sexes and all ages and sizes and under all conditions – and continuous exposure at levels equal to or below the applicable MPE limits is considered to result in no adverse health effects or even health risk.

The reason for *two* tiers of MPE limits is based on an understanding and assumption that members of the general public are unlikely to have had appropriate RF safety training and may not be aware of the exposures they receive; occupational exposure in controlled environments, on the other hand, is assumed to involve individuals who have had such training, are aware of the exposures, and know how to maintain a safe personal work environment.

The FCC's RF exposure limits are expressed in two equivalent forms, using alternative units of field strength (expressed in volts per meter, or V/m), and power density (expressed in milliwatts per square centimeter, or mW/cm^2). The table on the next page lists the FCC limits for both occupational and general population exposures, using the mW/cm^2 reference, for the different radio frequency ranges.

Frequency Range (F) (MHz)	Occupational Exposure (mW/cm^2)	General Public Exposure (mW/cm^2)
0.3 - 1.34	100	100
1.34 - 3.0	100	$180 / F^2$
3.0 - 30	$900 / F^2$	$180 / F^2$
30 - 300	1.0	0.2
300 - 1,500	F / 300	F / 1500
1,500 - 100,000	5.0	1.0

The diagram below provides a graphical illustration of both the FCC's occupational and general population MPE limits.



Because the FCC's RF exposure limits are frequency-shaped, the exact MPE limits applicable to the instant situation depend on the frequency range used by the systems of interest.

The most appropriate method of determining RF compliance is to calculate the RF power density attributable to a particular system and compare that to the MPE limit applicable to the operating frequency in question. The result is usually expressed as a percentage of the MPE limit.

For potential exposure from multiple systems, the respective percentages of the MPE limits are added, and the total percentage compared to 100 (percent of the limit). If the result is less than 100, the total exposure is in compliance; if it is more than 100, exposure mitigation measures are necessary to achieve compliance.

Note that the FCC "categorically excludes" all "non-building-mounted" wireless antenna operations whose mounting heights are more than 10 meters (32.8 feet) from the routine requirement to demonstrate compliance with the MPE limit, because such operations "are deemed, individually and cumulatively, to have no significant effect on the human environment". The categorical exclusion also applies to *all* point-to-point antenna operations, regardless of the type of structure they're mounted on. Note that the FCC considers any facility qualifying for the categorical exclusion to be automatically in compliance.

FCC References on RF Compliance

47 CFR, FCC Rules and Regulations, Part 1 (Practice and Procedure), Section 1.1310 (Radiofrequency radiation exposure limits).

FCC Second Memorandum Opinion and Order and Notice of Proposed Rulemaking (FCC 97-303), *In the Matter of Procedures for Reviewing Requests for Relief From State and Local Regulations Pursuant to Section 332(c)(7)(B)(v) of the Communications Act of 1934 (WT Docket 97-192), Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation (ET Docket 93-62), and Petition for Rulemaking of the Cellular Telecommunications Industry Association Concerning Amendment of the Commission's Rules to Preempt State and Local Regulation of Commercial Mobile Radio Service Transmitting Facilities*, released August 25, 1997.

FCC First Memorandum Opinion and Order, ET Docket 93-62, *In the Matter of Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation*, released December 24, 1996.

FCC Report and Order, ET Docket 93-62, *In the Matter of Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation*, released August 1, 1996.

FCC Office of Engineering and Technology (OET) Bulletin 65, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition 97-01, August 1997.

FCC Office of Engineering and Technology (OET) Bulletin 56, "Questions and Answers About Biological Effects and Potential Hazards of RF Radiation", edition 4, August 1999.

Appendix B. Summary of Expert Qualifications

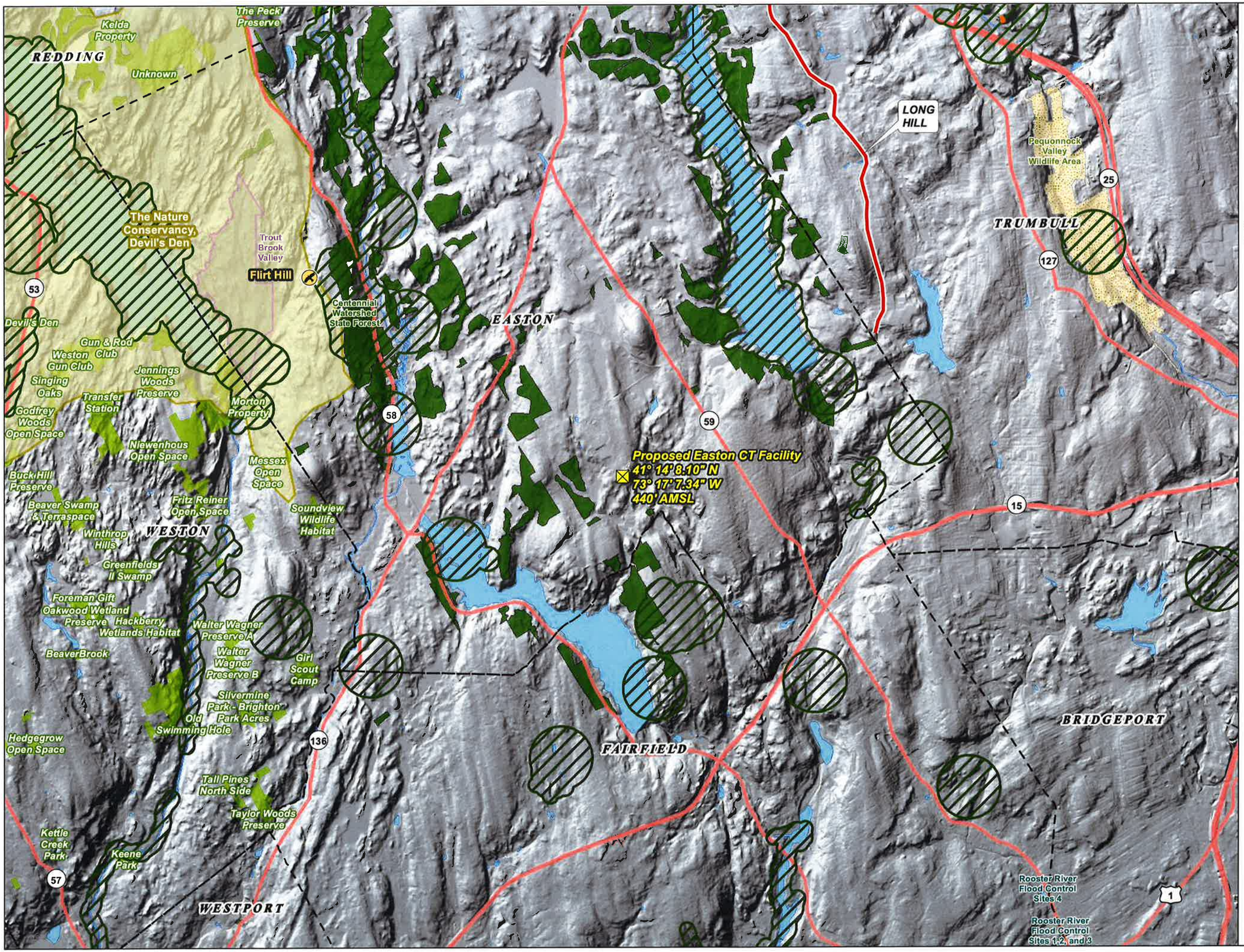
Daniel Penesso, Director – RF Engineering, Pinnacle Telecom Group, LLC

Synopsis:	• 19 years of experience in all aspects of wireless RF engineering, including network design and implementation, interference analysis, FCC and FAA regulatory matters, and antenna site compliance with FCC RF exposure regulations • Have performed RF engineering and FCC compliance work for all the major wireless carriers – AT&T, Verizon Wireless, Sprint, T-Mobile, and MetroPCS, as well as Crown Castle • Have served as an expert witness on RF engineering and/or FCC RF compliance more than 100 times before municipal boards in New Jersey and New York
Education:	• Bachelor of Science in Electrical Engineering, DeVry Institute of Technology, Chicago, IL, 1987
Current Responsibilities	• Manages PTG staff work involving FCC RF compliance for wireless antenna sites, including the provision of math- and measurements-based site compliance reports, related expert testimony in municipal hearings, and compliance-related support in client meetings with prospective site landlords and in town meetings • Provides math-based FCC compliance assessments and reports for PTG's wireless clients, including AT&T, Verizon Wireless, T-Mobile, Sprint, MetroPCS, and Crown Castle • Responsible for providing client consulting and in-house training on FCC and OSHA RF safety compliance
Prior Experience:	• Have served as senior RF engineer for four of the five national wireless carriers – AT&T, T-Mobile, Sprint, and MetroPCS – in the New York and New Jersey markets • Served as an RF engineer for Metricom, Triton PCS, Alltel Communications, and Western Wireless • Have worked as an RF engineer for several engineering services companies, including Sublime Wireless, Amirit Technologies, Celcite, and Wireless Facilities Incorporated

ATTACHMENT 3

Avian Resources Map

Proposed Wireless
Telecommunications Facility
Easton CT
515 Morehouse Road
Easton, Connecticut



Legend

- Proposed Facility
- Hawk Watch Site
- Important Bird Site*
- Important Bird Area
- Bald Eagle Survey Route*
- Breeding Bird Survey Route
- Natural Diversity Database (CTDEEP, 12/2016)
- Critical Habitat (CTDEEP, 07/2009)
- Migratory Waterfowl (CTDEEP, 1999)*
- Protected Open Space (CTDEEP, 2011)
- Federal Open Space (CTDEEP, 2004)*

CT DEP Property (CT DEEP, 12/2010)

- State Forest
- State Park*
- DEP Owned Waterbody*
- State Park Scenic Reserve*
- Historic Preserve*
- Natural Area Preserve*
- Fish Hatchery*
- Flood Control
- State Park Trail
- Water Access*
- Wildlife Area
- Wildlife Sanctuary*
- Other
- Open Water
- Town Boundary
- State Boundary

**None within mapped extents*

Avian Source Information:
Bald Eagle Sites: U.S. Geological Survey, National Biological Information Infrastr, 2008, Midwinter Bald Eagle Counts, 1986-2005 (update 2008).
Hawk Watch Sites: Hawk Migration Association of North America (HMANA), Hawk Count website: http://hawkcount.org/sitesel.php?country=USA&stateprov=Connecticut
Migratory Waterfowl: CTDEEP GIS, 1999
Important Bird Sites/Areas: National Audubon Society, Audubon Connecticut
http://ct.audubon.org/BirdSci_IBAs.html
Breeding Bird Survey Routes: Patuxent Wildlife Research Center of the U.S. Geological Survey and the Canadian Wildlife Service's National Wildlife Research Centre
http://www.nationalatlas.gov/mld/bbsrtsl.html

Base Map Source: 2012 aerial photograph (CTECO map service)

Map Date: May 2017

N
W E
S

0.5 0.25 0 0.5 Miles

ALL-POINTS TECHNOLOGY CORPORATION

C:\GIS\Projects\Verizon\Easton CT\mxd\Avian_Resources Shaded Relief.mxd

ATTACHMENT 4

Legend

- Proposed Monopine Tower
- Approximate Facility Layout
- Proposed Access Along Existing Access Drive
- Proposed Underground Utility Route
- Approximate Host Property
- Forest Block (+/-317 Acres)
- Edge Forest Block (+/-199 Acres)
- Small Core Forest Block (+/-118 Acres)

N
W E
S

825 412.5 0 825
Feet

Forest Fragmentation Map

Proposed Homeland Towers
Easton Facility
515 Morehouse Road
Easton, Connecticut

Map Notes:
Base Map Source: 2012 Aerial Photograph (CT ECO)
Map Scale:1 inch = 825 feet
Map Date: May 2017

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