FREQUENZ

RF Technical Services

Antenna Site Conformity

FCC RF Assessment and Report

prepared for FCC Licensee
New Cingular Wireless PCS, LLC

The new at&t
Your world. Delivered.

Site ID "OR-3792"

Site address:
56 Poplar Drive
Monroe, NY 10950

February 13, 2023

916 Route 9W • Selkirk, NY 12158 • 973-432-6445

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Overview and Summary

The purpose of this report is to ensure that the radiofrequency (RF) environment associated with the operation of a personal wireless telecommunication facility (base-station) for installation on an existing monopole located at 56 Poplar Drive, Monroe, NY 10950, will comply with the Federal Communications Commission (FCC) safety guidelines (as required by the Telecommunications act of 1996 [2]). Specifically, the report was prepared in response to a request from AT&T Wireless ("AT&T"), requesting Frequenz, LLC to perform an independent expert analysis of radiofrequency (RF) environment in publicly accessible areas in the vicinity of the proposed site and a conformity assessment with FCC and other contemporary health and safety criteria that address long-term exposure in RF environments. AT&T refers to the antenna site by the Site ID "OR-3792", the proposed AT&T installation services include service and transmission in the 700, 850, 1900, 2100, 2300 MHz frequency bands licensed to it by the FCC.

As part of FCC compliance, all wireless antenna operators must perform an assessment of potential human exposure to radiofrequency (RF) fields emanating from all the transmitting antennas at a site whenever antenna operations are added or modified and ensure compliance with the Maximum Permissible Exposure (MPE) limit as detailed in the FCC regulations.

For this site, the compliance assessment has considered the RF effects of another antenna operation (already collocated) at the site by Verizon Wireless. It must be noted that FCC regulations require any future antennas collocated at this site to be assessed to assure continued compliance based on the RF effects of all proposed and existing antennas at the site.

This report describes a methodology used to calculate the exposure levels with the proposed wireless telecommunications installation that the general public could be exposed to in the vicinity of the installation and at ground level. This report follows the guidelines as outlined in FCC OET Bulletin No. 65 [1] (see Environmental Levels of RF Energy Analysis). Further, the analytical technique used in this analysis uses a standard FCC formula which is very conservative and overestimates the actual RF power density. This is done to overstate the maximum RF levels associated with the proposed personal wireless telecommunications installation and thus will be far below the FCC limit for safe continuous exposure of the general public.

For this site, the mathematical analysis considers the potential exposure levels associated with simultaneous and continuous operation of all proposed AT&T, and existing Verizon Wireless, transmitting antennas at this site and can be readily calculated at any point in a plane at any height above ground level based on the information shown in Table 1, as well as the information provided for Verizon Wireless.

The results of the mathematical analysis can be explained simply by stating the calculated RF levels as percentages of the FCC MPE limit. If we assume that the reference of the FCC MPE limit is 100 percent, then any calculated RF levels higher than 100 percent indicate the MPE limit has been exceeded. Conversely, any mathematically calculated RF level which is consistently lower than 100 percent shows a sufficient demonstration of compliance with the MPE limit and is deemed safe for continuous exposure of the general public.

For this proposed site and in an area regularly accessible to the general public (at ground level), the combined maximum RF levels of the FCC RF compliance assessment is ***1.4676*** percent of the FCC general population MPE limit – which is far below the 100-percent reference for compliance.

This value has been calculated conservatively with the combination of proposed and existing antenna operations at the site.

With respect to FCC limits for public exposure, the combined analytical results show the maximum RF level in the vicinity of the site is 68.1 times below the established FCC limit as being considered safe for continuous human exposure to RF energy at the frequencies of interest.

The results of the calculations provide a clear demonstration that the RF levels associated from the combination of proposed and the existing antenna operations will be in compliance with the applicable FCC regulations and MPE limit. As a reminder, the analytical technique used for the analysis is extremely conservative and overestimates the actual RF power density. In fact, the actual (measured) power density levels have been found to be lower than the corresponding calculated levels even when extrapolated to maximum use conditions (all transmitters operating simultaneously at maximum power) [8], [9].

Subsequent sections of this report provide additional supporting documentation, including: technical data on the AT&T antenna operation that is proposed to be installed (as well as that of the existing Verizon Wireless, antenna operation); an explanation of the applicable FCC mathematical model used for assessing MPE limit compliance (showing application of the relevant data to the model); analysis of the results; and the compliance conclusion for the antenna operations at this site.

Engineering Specifications

Relevant compliance-related data for the AT&T antenna operation, as proposed to be installed, is provided in Table 1 that follows.

Table 1- AT&T Engineering Specifications
Wireless Frequency Bands
700 MHz, 850 MHz, 1900 MHz, 2100 MHz, and 2300 MHz
Service Coverage Type
Sectorized (3 sectors)
Antenna Type
Directional Panel
Antenna Centerline Height
136ft. AGL
Antenna Line Loss
Conservativley ignored (assumed 0 dB)
700 MHz Data - Antenna Model (Max Gain)
Commscope NNHH-65A-R4 (13.4 dBi)
Total Input Power Per Sector 400 watts
850 MHz Data - Antenna Model (Max Gain)
Commscope NNHH-65A-R4 (13.9 dBi)
Total Input Power Per Sector 160 watts
1900 MHz Data - Antenna Model (Max Gain)
Commscope NNHH-65A-R4 (17.7 dBi)
Total Input Power Per Sector 320 watts
2100 MHz Data - Antenna Model (Max Gain)
Commscope NNHH-65A-R4 (17.8 dBi)
Total Input Power Per Sector 160 watts
2300 MHz Data - Antenna Model (Max Gain)
Commscope NNHH-65A-R4 (18.3 dBi)
Total Input Power Per Sector 100 watts

As stated in the introduction, in addition to the proposed AT&T site, there is also an existing wireless antenna operation by Verizon Wireless, to be included in the compliance assessment. We will conservatively assume operation with maximum channel and at maximum transmitter power in each of its respective FCC-licensed frequency bands.

Verizon Wireless is licensed to operate in the 746, 869, 1900, 2100 and 3700 MHz frequency bands. In the 746 MHz frequency band Verizon uses 160-watts total input power per antenna sector. In the 869 MHz frequency band, Verizon uses 300-watts total input power per antenna sector. In the 1900 MHz frequency band, Verizon uses 160-watts total input power per antenna sector. In the 2100 MHz frequency band, Verizon uses 160-watts total input power per antenna sector.

RF Energy Analysis Environmental Levels

The methodology used to calculate the RF levels follows that is outlined in the FCC Office of Engineering and Technology Bulletin 65 ("OET Bulletin 65") for mathematical models to calculate the RF levels of transmitting antennas at any point in a plane above grade. At ground level around an antenna site (commonly known as the "far field" of the antennas), the maximum radio frequency power density associated with a transmitting antenna can be calculated at any point in space using the Friis free-space transmission formula:

$$S = \left(\frac{P \cdot G_o(\theta)}{4\pi r^2} \right)$$

where:

S = plane-wave equivalent power density (watts per square centimeter- W/m^2)

P = total radiated power (watts – W)

r = radial distance from the antenna to the point of interest (meters – m)

$G_o(\theta)$ = directional gain of the antenna in the radial direction of interest (compared with the gain of an isotropic radiator, i.e., a hypothetical antenna that transmits equally in all directions)

For this site,

$$S = 4 \cdot \left(\frac{1.64 \cdot n \cdot P_n \cdot G_d(\theta)}{4\pi r^2} \right)$$

where:

n = number of radio channels per sector

P_n = antenna input power per radio channel (watts – W)

$G_d(\theta)$ = directional gain of the antenna with a resonant half-wave dipole. The directional gain is obtained from the antenna manufacturer – e.g., Commscope, CCI, Nokia.

1.64=correction factor to convert $G_d(\theta)$ to $G_o(\theta)$

The factor of 4 is included to account for the possibility of constructive interference of reflections

The above information was used to calculate the values shown on the next page in Table 2 of this report. Based on the information shown previously in Table 1 as well as the information provided above for Verizon Wireless, the maximum signal strength (power density) associated with the proposed and exiting systems, at any point in a horizontal plane 6ft. above ground level (approximately two meters the FCC recommended height), will be less than the values shown in Table 2. The results of this analysis (specifically, the maximum level of RF energy associated with simultaneous and continuous operation of the combination of proposed and existing services) indicate that the maximum level of RF energy in all publicly accessible locations in the

vicinity of the proposed and existing installation will be below all applicable health and safety limits.

The following conservative methodology and assumptions are incorporated into the MPE% calculations on a general basis: worst case exposure assessments which are based on the assumption that the transmitters operate continuously at the maximum output powers theoretically possible (Table 1). The calculations also assume that the power-attenuation effects of shadowing or other obstructions to the line-of-sight path from the transmitting antenna to the point of interest are ignored. The calculations include the effect of 100% field reinforcement from in-phase reflections from the intervening ground.

The approach (and assumptions) used for the mathematical calculations and analysis of this site is very conservative and overestimates the calculated RF exposure levels relative to the levels that will actually occur. This is done in abundance of caution to ensure safety with FCC MPE limit compliance for continuous exposure for the general public in the vicinity of the site.

Table 2 below provides the results of the MPE% calculations for each wireless carrier, with the maximum calculated "total MPE%" result 'in bold' in the last column. The results in Table 2 are shown as a percentage of the FCC's maximum permissible exposure (MPE) values found in the Telecommunications Act of 1996 (specifically, in the FCC Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation [7]).

Table 2 - MPE% Calculation Results

AT&T MPE%	Verizon Wireless MPE%	Total MPE%
1.2778	0.1898	***1.4676***

As shown in Table 2, the combined total maximum calculated result is ***1.4676*** percent of the FCC MPE limit – far below the 100-percent compliance reference.

Compliance Assessment Conclusion

In conclusion, in areas normally accessible to the public, the maximum levels of RF energy associated with the proposed personal wireless telecommunications installation will be far below any science-based safety standards and guidelines.

There are more than 60 years of studies around the potential biological effects associated with exposure to RF energy that have led to a large body of scientific literature with refered reports and studies. There have been numerous independent reviews of the collective credible evidence, including the results of epidemiological studies of individuals exposed to radio waves and studies of animals with both short and long-term exposure. The result of the independent reviews have not demonstrated that exposure to RF energy at levels that comply with contemporary science-based safety guidelines, such as those adopted by the FCC, can affect biological systems in a manner that might lead to, or augment, any health effect or interfere with the operation of medical devices such as hearing aids or implanted cardiac pacemakers.

In support of this conclusion, the World Health Organization (WHO) published a position statement that specifically addresses base-stations used for personal wireless telecommunications. The WHO fact sheet concludes with the following:

"*Considering the very low exposure levels and research results collected to date, there is no convincing scientific evidence that the weak RF signals from base stations and wireless networks cause adverse health effects".*

For this site, the analysis determined that the maximum calculated RF level from the combination of the proposed and existing antenna operations at the site is 1.4676 percent of the FCC general population MPE limit. Simply put, the worst-case RF level around the site is 68.1 times below the FCC MPE limit. These values are also far below other contemporary science-based exposure limits, e.g., those of the American National Standards Institute/Institute of Electrical and Electronics Engineers [4], the recommendations of the National Council on Radiation Protection and Measurements [5], and international safety guidelines such as those of the International Commission on Non-Ionizing Radiation Protection [6]. Because of the conservative method used to perform the analysis, the actual corresponding levels of RF energy at publicly accessible locations in the immediate vicinity of the site will be considerably lower than the values cited above.

In summary, the findings of the mathematical calculations and analyses of this site show complete compliance with the FCC MPE limit guidelines. Further, due to the conservative approach taken with the calculations and analyses, the RF levels created by the antennas at the site will be far less significant than the results show.

Certification

The undersigned certifies as follows:

1. I am thoroughly familiar and fully understand the FCC regulations concerning RF safety and the control of human exposure to RF energy (47 CFR 1.1301 et seq).
2. In my opinion, the statements and information disclosed in this report are true, complete and accurate.
3. The results of the technical analysis of 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 technical analysis show that the maximum levels of RF energy of the proposed antenna operations at the subject site will be completely compliant as defined in the FCC regulations concerning the control of potential human RF exposure.

Daniel Penesso
Chief Technical Officer
Frequenz, LLC
February 13, 2023

References

[1] OET Bulletin 65, Edition 97-01, August 1997. Federal Communications Commission, Office of Engineering and Technology, Washington, DC.

[2] Telecommunications Act of 1996, Pub. L. No. 104-104, 1 10 Stat. 56 (1996)

[3] N.J.A.C. 7:28-42, (Radio Frequency Radiation).

[4] ANSI/IEEE Std C95.l-2005, "IEEE Standard for safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," Institute of Electrical and Electronics Engineers, New York, NY, 2005

[5] Biological Effects and Exposure Criteria for Radio Frequency Electromagnetic Fields, NCRP Report No. 86, National Council on Radiation Protection and Measurements, Bethesda, MD. (1986)

[6] ICNIRP (International Commission on Non-Ionizing Radiation Protection), "Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)," Health Physics, vol. 74, no. 4, pp. 494-522, 1998

[7] Federal Communication Commission 47 CFR Parts l , 2, 15, 24 and 97. "Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation" (August 6, 1996)

[8] Petersen, R.C., and Testagrossa, P.A., "Radiofrequency Fields Associated with Cellular Radio Cell-Site Antennas," Bio-electromagnetics, Vol. 13, No. 6. (1992)

[9] Petersen, R. C., Fahy-Elwood, A. K. and Testagrossa, P. A., "Personal Wireless Communications: Potential Exposure Levels in the Vicinity of Typical Base-Station Installations," Proceedings of the International Seminar on EMF Health Effects and Standards, Beijing, China, May 4-5, 1999

[10] 47 CFR, FCC Rules and Regulations, Part 1 (Practice and Procedure), Section 1.1310 (Radiofrequency radiation exposure limits).

[11] 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.

[12] 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

[13] 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.

[14] 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.

[B1] Croft, R., Mckenzie, R., and Leung, S., “EME in Homes Survey: Final Report,” Australian Centre for Radio-Frequency Bioeffects Research, July 2009.

Annex A. The FCC MPE Limits

FCC Regulations MPE Limits

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.

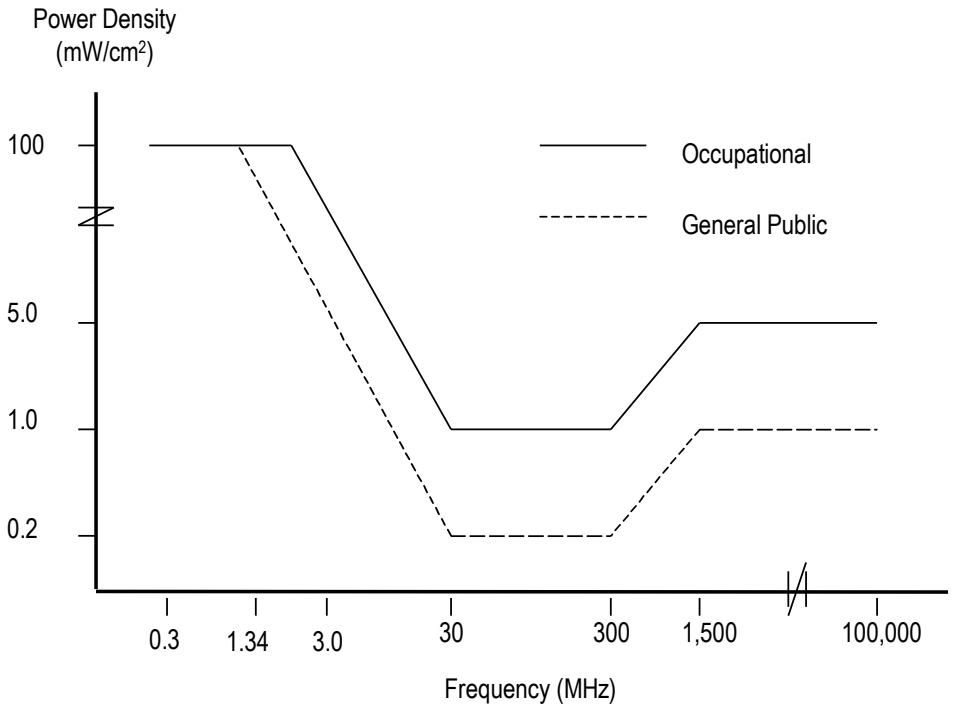
The reason for two tiers of MPE limits is based on an understanding and assumption that members of the general public are unlikely to have had appropriate RF safety training and may not be aware of the exposures they receive; occupational exposure in controlled environments, on the other hand, is assumed 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 below 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.

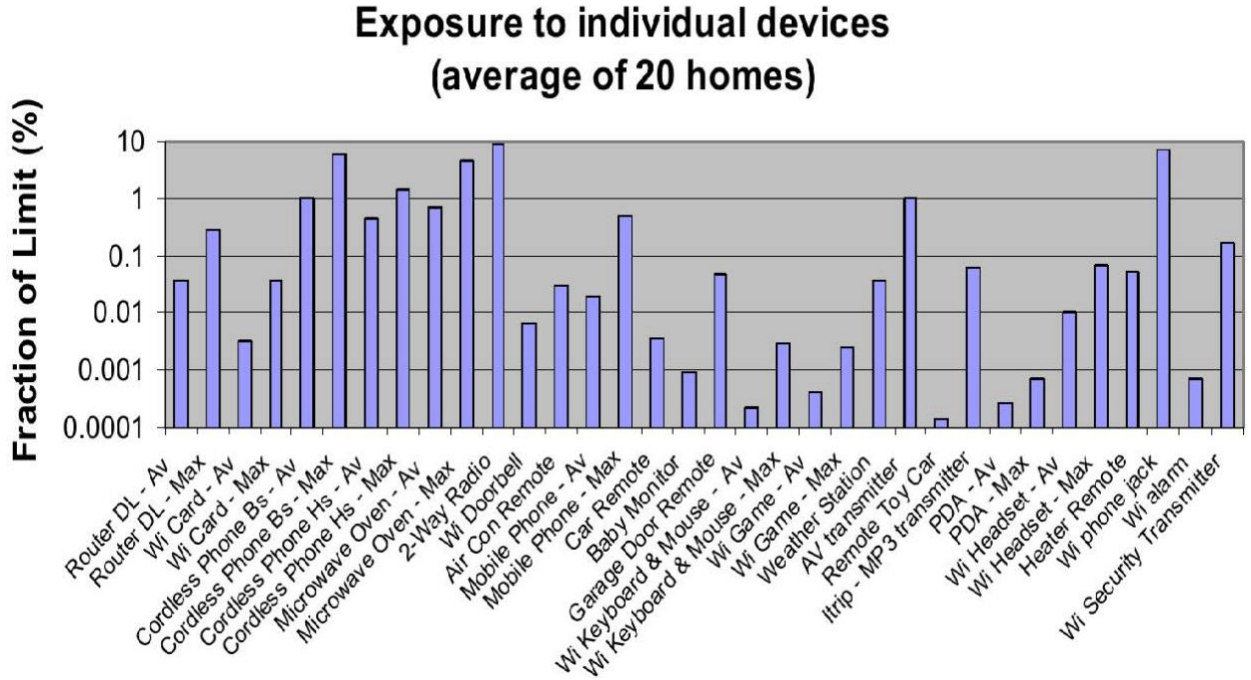
For potential exposure from multiple systems, the respective percentages of the MPE limits are added, and the total percentage compared to 100 (percent of the limit). If the result is less than 100, the total exposure is in compliance; if it is more than 100, exposure mitigation measures are necessary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

Annex B. Radiofrequency (RF) in the Home

A Comparison of Exposures from Consumer Products with Those from a Nearby Mobile Telephone Base Station

Numerous measurements of typical radiofrequency (RF) exposure levels in the home have been carried out by various researchers and agencies throughout the world. For example, Croft, et al., carried out detailed measurements of typical exposures associated with consumer electronics in 20 homes in Australia [B1]. Included were microwave ovens, WiFi routers, cordless telephones, wireless computer keyboards, etc. Their results are summarized in the figures below. As seen in figure 3 on the next page, most exposures are below 10% of the safety limits, with the microwave oven being the major contributor. The predicted maximal exposure values for all sectors of the existing installation and proposed AT&T installation are less than 1.5% of the FCC safety guidelines at 6.5 ft. above grade, respectively. These values would occur *outside* of nearby homes and buildings, - *not inside.* Because of the attenuation of building materials and the directionality of the antenna patterns, the corresponding levels form the AT&T installation would be far lower inside any structure.

Figure 3. Exposure to individual devices – average of 20 homes (from Croft, et al., [B1]



Annex C. Professional Qualifications

Daniel Penesso, Chief Technical Officer, Frequenz, LLC

Professional Experience*:*

25 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. Performed RF engineering and FCC compliance work for all the major wireless carriers and infrastructure providers – AT&T, Verizon Wireless, T-Mobile, and Crown Castle. Provided expert witness testimony for RF Engineering and FCC RF Compliance for 100's of sites before municipal boards throughout New Jersey and New York.

Current Responsibilities:

Management of Frequenz, LLC operations and work for FCC RF compliance for wireless antenna sites. Provision of math-based FCC compliance assessments and reports for AT&T, Verizon Wireless, T-Mobile, and Crown Castle. Expert testimony at municipal hearings and town meetings, and compliance-related support in client meetings with prospective site landlords.

Education:

B.S. Electrical Engineering
DeVry Institute of Technology, Chicago, IL