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October 15, 2002

VIA HAND DELIVERY

Carol J. Mitten
District of Columbia Zoning Commission
441 4th Street N.W.
Suite 210 South
Washington, D.C. 20001

10-15-2002
11:40 AM

**Re: Zoning Commission Case Number 01-02
Hearing Date October 17, 2002
Proposed Text Amendment on Antennas, Antenna Towers and Monopoles**

Dear Chairman Mitten:

On October, 10, 2002, I submitted a letter requesting that the Zoning Commission set aside time for Mr. Jules Cohen, P.E., to have an opportunity to address the Commission on the issues of radio frequency transmission as it relates to cellular and PCS networks. Because of the complexity of the issues involved, and the fact that Mr. Cohen is considered an expert in the filed, we asked that Mr. Cohen be given twenty (20) minutes to testify and answer questions.

Additionally, I indicated that copies of Mr. Cohen's report would be made available to the Zoning Commission, staff and the Office of Planning. Attached please find twenty (20) copies as requested by staff.

Thank you. If there any questions, please do not hesitate to call the undersigned.

Sincerely,



Edward L. Donohue

ZONING COMMISSION
District of Columbia
Case 01-02
Exhibit 69

**ENGINEERING STATEMENT RELATIVE TO
WIRELESS COMMUNICATIONS SYSTEMS
FOR PRESENTATION TO
ZONING COMMISSION FOR THE DISTRICT OF COLUMBIA**

This engineering statement was prepared on behalf of the following wireless telecommunications service providers: AT&T Wireless, Cingular Communications, Nextel Communications, Sprint Wireless, Verizon Wireless and T-Mobile (formerly VoiceStream Wireless). The statement describes the basic elements of wireless telecommunications systems, their operating principles, and the magnitude of radio-frequency (RF) exposure from their operation.

Summarization:

RF exposure in the vicinity of antennas and base station equipment for wireless telecommunications systems is hundreds and more often thousands of times below the maximum exposure permitted under applicable Federal Communications Commission (FCC) rules. I have been intimately involved in the study of non-ionizing radiation for over twenty-five years, and considered an expert in the field. In my expert opinion, there is no risk of exposure to radio-frequency (RF) emissions from wireless telecommunications facilities that are properly installed and maintained in accordance with existing regulations.

With respect to the significant factors of RF emissions and tower heights employed, wireless communications systems must be distinguished from broadcast facilities whether those facilities may be television stations, FM, or AM broadcast stations. Whereas a television station may operate with peak radiated power of 5,000,000 watts, FM stations in the DC area may operate with peak radiated power of 50,000 watts, and an AM broadcast station with directional antenna may operate with peak radiated

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power in excess of 100,000 watts, wireless telecommunications systems rarely operate with peak radiated power in excess of 1,000 watts. Television stations in Zone I (the northeastern portion of the United States) usually employ tower heights of 1,000 to 1,200 feet in height, or as much as aeronautical hazard limits allow. FM broadcast stations often share towers with television stations but, if independent, generally seek to build towers in the order of 500 feet in height. AM broadcast tower heights vary with the operating frequency. At the low end of the broadcast spectrum, towers may be as tall as 450 feet. At the upper end of the AM broadcast spectrum, tower heights can be as low as 150 feet. Wireless telecommunications antennas in built-up areas are rarely placed higher than 100-125 feet above ground, and even in rural areas, 200 feet above ground is virtually never exceeded.

In other words, both the size of the support structure and the levels of RF emissions are dramatically different when one is discussing broadcast facilities and wireless telecommunications networks.

The regulatory scheme applied by the FCC is also substantially different for the wireless telecommunications systems as compared to broadcast systems. The FCC grants to the wireless carrier, the exclusive right to employ a particular band of frequencies to serve a designated area. Unlike broadcast stations that must obtain a construction permit for any facility to be constructed, and the application for construction permit must include a specific showing that the commission's RF exposure standards are not exceeded, wireless carriers are not required to file applications to construct particular base stations but must notify the FCC of such proposed construction. In recognition of the low power employed, showings of RF exposure need not be made except in rare instances of very low antenna heights and radiated power in excess of 1,000 watts.

Wireless telecommunications systems consist of fixed, interconnected base stations which both receive and transmit to mobile transmitting and receiving devices operated by subscribers. The systems not only communicate within themselves, but also interconnect with local wired telephone facilities. Each base station is designed to

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provide interference-free service within a portion of the entire designated area authorized by the FCC. Computing devices continuously monitor the strength of incoming communications from the mobile phones within the reach of the base station. When the signal strength from a mobile unit falls to a level that is less than the signal strength received at a nearby base station, that particular communication link is "handed off" to the nearby base station. The process is designed to be seamless with the subscriber unaware of having been transferred from one base station to another. When the system is completely developed with sufficient base stations to provide service within the total area assigned to the particular carrier, a subscriber should be able to originate and receive calls throughout the entire area without interruption.

To achieve the objective of seamless service within the designated area, an integrated system design is necessary. The antenna height, power, and antenna type for individual base stations cannot be selected without consideration of the system as a whole. Because of the limited bandwidth assigned by the FCC for the exclusive use of each carrier for transmission and reception, the same channels within the authorized band must be reused at multiple locations. The number of subscribers that can be accommodated by the wireless system is affected primarily by the number of base stations, or "cells." As the subscriber load grows, more cells are needed, each serving smaller areas than may have been used in the initial stages of operation. System design therefore balances the desirable extent of each service area against the avoidance of interference to other service cells using the same group of channels.

Propagation characteristics play an important role in the design. Consideration of both the natural terrain throughout the service area and man-made construction are essential. To the extent possible, line of sight must be achieved from transmitter to receiver if dropped calls are to be avoided. Sophisticated computer programs have been developed to aid in determining the area within which the base station must be located. The ultimate determination of whether a particular site is likely to be suitable usually requires the use of a test transmission and observation of signal strength throughout the cell area.

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Strictly applied restrictions on permissible base station locations and limiting of antenna heights creating signal blockage by nearby buildings, prevent the achievement of optimum, or near optimum, system configuration. The result is loss of universal service from the wireless systems upon which increasingly large numbers of people depend for communications and safety.

Base stations operate with low power. Input to the antenna is typically in the range from five to twenty-five watts per channel. Antennas employed concentrate energy toward the outer edge of the service area and minimize energy directed downward and toward nearby places. The result is very little exposure of the public to the emitted energy. In recognition of this fact, the FCC exempts wireless communications applicants from a requirement to make special showings of RF exposure except in a few cases of exceptionally low antenna heights.

Furthermore, the United States Congress acknowledged in the 1996 revision of the Communications Act the low potential of public exposure from wireless communications systems. The following provision is found in Section 704 of the Act:

"No State or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's regulations concerning such emissions."

Congress also required the FCC to complete the long-pending proceeding on adopting standards for RF exposure within 180 days after enactment of the Act.

Rules were adopted by the FCC after comments and reply comments were received from interested parties. Recommendations were solicited from agencies of the Federal Government charged with the protection of ~~the~~the public from health hazards. These agencies included the Environmental Protection Agency (EPA), the National Institute of Occupational Safety and Health (NIOSH), the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA).

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Complying with recommendations from those agencies, the adopted rules were based, primarily, on the criteria embodied in the National Council on Radiation Protection and Measurements (NCRP) Report No. 86 titled *Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields*. Some provisions of the rules were adopted from the 1991 RF exposure criteria incorporated in the Institute of Electrical and Electronics Engineers (IEEE) Standard C95.1. (In 1992, IEEE C95.1 was adopted by the American National Standards Institute (ANSI) without change.) In the portion of ~~the~~of the spectrum of importance to wireless communications, the FCC criteria for maximum permitted exposure are virtually identical to the recently adopted standards of the European Union as developed by the International Committee on Non-ionizing Radiation Protection (ICNIRP).

NCRP is a private, non-profit organization chartered by Congress. Its services have been called upon often for the development of standards for both the ionizing and non-ionizing parts of the electromagnetic spectrum. (Ionizing relates to those frequencies above the ultra-violet, such as x-rays and gamma rays, where each photon carries enough energy to cause cell changes. Non-ionizing relates to all the remaining frequencies where photon energy is insufficient to produce cell changes. A photon is a very small parcel into which electromagnetic energy is subdivided.) The IEEE standard was developed by Standards Coordinating Committee 28 (SCC28), now the International Committee on Exposure Standards (ICES). SCC28 included a membership of approximately 175, mostly from academia, whose areas of expertise included medicine, biology, physiology, epidemiology, engineering and medical statistics.

Although the RF exposure in the vicinity of a base station is hundreds, and more often, thousands of times below the maximum exposure permitted by FCC rules, calculations are made of RF exposure to be expected from each base station. The calculations, specific for the characteristics of the particular base station, provide to local authorities the assurance that the facilities constructed will comply with FCC rules. The calculations are conservative. They assume maximum power that can be employed by the base station consistent with system design. Further, they assume that a nearby surface

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is reflecting the signal and that the reflection arrives at the point of study in phase with, thus adding to, the directly received signal. In fact, the reflected signal, if there at all, could arrive out of phase and subtract from the direct signal. As an additional conservative measure, the assumption is made that an absolutely clear path exists from the antenna to the point of interest, with no trees, walls, or terrain obstructions. In sum, the calculations assure that no location will experience any exposure in excess of that determined.

As indicated previously, antennas used in the wireless communications services are designed to limit energy directed downward and toward nearby areas where, because of their proximity, little energy is needed for satisfactory communications with mobile units. The result of this beam shaping may be slightly increased RF exposure while moving away from the antenna over a few hundred feet. As distance is increased further, the direct ray from antenna to point of interest originates from the antenna's main beam. Once this distance has been reached, the exposure level declines as the square of the distance, *i.e.* if the distance doubles, the RF exposure drops to one quarter of the exposure at the closer distance.

Wireless telecommunications facilities operate in their own exclusive bands and are not a source of interference to broadcast receivers or other electronic devices. They do not add to traffic in the vicinity and are neither a source of noise or pollution. RF exposure levels are far below domestic and worldwide exposure standards.

Jules Cohen, P.E.
DC Reg. No. 1131

October 14, 2002