R C Petersen Associates LLC
Consulting – Wireless Safety

Site Conformity Assessment

with

FCC Rules and Regulations, 47 CFR § 1.1310 *et seq*.

(Radiofrequency Emissions)

FCC Licensee:	**Nextel Communications**
Site Name:	**WEC-CT-04**
Site Address:	**Margerie Reservoir** **Peck Road** **Danbury, Connecticut**

Prepared for

Wireless EDGE Fairfield Group LLC
270 North Avenue, Suite 809
New Rochelle, NY 10801

July 6, 2007

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Summary

This report is an analysis of the cumulative radiofrequency (RF) environment associated with the personal wireless telecommunication service facility proposed for installation in Danbury, CT. The analysis includes the contribution from cellular radio, enhanced specialized mobile radio, and personal communications services base-station antennas that could be co-located at this site. Engineering data and site information provided by Wireless EDGE and well-established analytical techniques were used for calculating the strength of the RF fields (RF power density) in order to assess compliance with federal safety guidelines. Worst-case assumptions were used to ensure safe-side estimates, i.e., the actual values will be significantly lower than the corresponding analytical values. The maximum level of RF energy associated with each transmitting antenna is compared with the appropriate frequency-dependent exposure limit, and these individual comparisons are combined to ensure that the *cumulative* RF environment complies with the Federal Communications Commission (FCC) safety guidelines.

The results of this analysis indicate that the maximum level of RF energy in all locations in the vicinity of the installation, that are normally accessible to the public, is below all applicable health and safety limits. Specifically, the maximum level of RF energy associated with *simultaneous and continuous operation of the Nextel transmitting antennas proposed for installation at this site plus the antennas of five additional wireless carriers that could locate on the structure* will be less than 2% of the safety criteria adopted by the FCC and mandated by the Telecommunications Act of 1996. The maximum level of RF energy in such locations will also be far below other contemporary science-based exposure limits, e.g., those of the American National Standards Institute, the Institute of Electrical and Electronics Engineers, the recommendations of the National Council on Radiation Protection and Measurements and international safety guidelines such as those of the International Commission on Non-Ionizing Radiation Protection. Because of the conservative way the analysis was performed, the levels of RF energy from these antennas at normally accessible locations in the immediate vicinity of the site will be considerably lower than the corresponding values cited above. The levels inside nearby homes and offices will be even lower because of the attenuation of commonly used building materials.

1. Introduction

This report was prepared in response to a request from Wireless EDGE for an analysis of the radiofrequency (RF) environment in the immediate vicinity of a personal wireless communications facility proposed for installation at the Margeire Reservoir (City of Danbury). The purpose of the report is to ensure that the RF environment associated with the operation of the facility will comply with Federal Communications Commission (FCC) safety guidelines (as required by the Telecommunications Act of 1996 [1]) and with other contemporary safety guidelines that address public health concerns associated with long-term exposure in RF environments. The analysis includes the contribution from the proposed Nextel enhanced specialized mobile radio (ESMR) antennas along with a potential for future additions of (2) cellular radio and (3) personal communications service (PCS) facilities.

2. Technical Data

The proposed base-station antennas (cellular, ESMR and PCS) would be mounted on a monopole-type tower located at the Margeire Reservoir (City of Danbury), off Peck Road in Danbury, CT. The PCS antennas transmit at frequencies between 1930 and 1990 million hertz (MHz). The cellular radio antennas transmit between 869 and 894 MHz and the ESMR antennas transmit at frequencies between 851 and 866 MHz (these frequencies were formerly allocated for UHF television channels 77 through 83).

The actual RF power propagated from PCS, ESMR and cellular radio antennas is typically less than 20 watts (W) per transmitter (channel) and the actual *total* RF power is typically less than 200 W per sector (assuming the maximum number of transmitters are installed and operate *at maximum power*). These are extremely low power systems when compared with other familiar radio systems, such as AM, FM, and television broadcast, which operate upwards of 50,000 watts. The attached figure, which depicts the electromagnetic spectrum, lists familiar uses of RF energy. Table 1 lists typical engineering specifications for the proposed systems.

3. Environmental Levels of RF Energy

The antennas used for PCS, ESMR and cellular radio propagate most of the RF energy in a relatively narrow beam (in the vertical plane) directed toward the horizon. Because of the small amount of energy directed along radials below the horizon (downward direction towards the ground), the RF environment at normally accessible locations on the site property and surrounding properties will be far lower than the maximal values shown in Table 2

The methodology used to calculate the exposure levels follows that outlined in FCC OET Bulletin No. 65 [2]. For the case at hand, the maximal potential exposure levels associated with *simultaneous and continuous operation of all* transmitting antennas (Nextel plus five additional carriers) can be readily calculated at any point in a plane at any height above grade. Based on the information shown in Table 1, the maximum intensity (power density) associated with the proposed systems, at any point in a horizontal plane 6 ft and 16 ft above grade, will be less than the values shown in Table 2. The values at 16 ft above grade are representative of the maximum power density immediately outside the upper floor of nearby residential or commercial 2-story structures (assuming level terrain). The results are also shown in Table 2 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* [3]).

The values shown in Table 2 are the theoretical maxima that could occur and are not typical values. There are a number of reasons why this is true including the following:

- The calculations include the effect of 100% field reinforcement from in-phase reflections, which quadruples the power density. Although this is possible theoretically for a single frequency and perfect reflecting surfaces, the probability of it occurring here is negligible.
- It is assumed that each transmitter operates continuously at maximum power.
- Calculations do not include cable loss (attenuation) which could substantially reduce power into the antenna.
- The combined maximum power density is obtained by adding the maximum values for each of the services. This assumes that the maximum power density for each service occurs at the same horizontal distance from the installation – which is not the case.

Experience has confirmed that the analytical technique used in this analysis is extremely conservative and overestimates the actual RF power density. The actual (measured) power density levels have always been found to be smaller than the corresponding calculated levels even when extrapolated to maximum use conditions (all transmitters operating simultaneously) [4].

The maximum values shown in Table 2 correspond to those associated with outdoor (open-air) environments. The levels inside nearby homes and buildings will be considerably lower than those immediately outside because of the attenuation of common building materials, particularly at the higher frequencies.

4. Comparison of Environmental Levels with RF Safety Criteria

Table 3 shows federal, state and consensus exposure limits for human exposure to RF energy at the frequencies of interest. Because the MPEs vary with frequency, the calculated RF levels must first be weighted with frequency (the percentages are shown in Table 2) and then combined before comparing with the safety guidelines. With respect to FCC limits for public exposure, comparisons of the weighted *combined* analytical results indicate that the maximal power density (the summation of the maximum values for each service) in normally accessible locations in the vicinity of this installation will be at least 50 times below the MPE; i.e., 2% of the MPE.

5. Discussion of Safety Criteria

Those who are not familiar with the subject tend to think that the study of the safe use of RF energy is in its infancy. This is not the case. Studies of the biological effects associated with exposure to RF energy and the development of safety standards for human exposure based on these studies is a continuous process that has been on-going throughout the world for more than six decades. The first safety guidelines were proposed in the early 1950's when concern first arose in the US about exposure to electromagnetic energy, particularly at microwave frequencies. Although the guidelines first recommended in the 1950's varied considerably from organization to organization, eventually most organizations in the Western World adopted limits similar to those adopted by the FCC. The bases of contemporary safety limits, called "basic restrictions," were first proposed in 1981 by a committee sponsored by National Council on Radiation Protection and Measurements[1] (NCRP) [5] and affirmed by an accredited American National Standards Institute (ANSI) committee as the basis of their 1982 RF safety standard [6]. In 1986, an NCRP committee adopted the same basic restrictions as the basis of their 1986

1. NCRP is a non-profit corporation chartered by Congress "To collect, analyze, develop and disseminate in the public interest information and recommendations about (a) protection against radiation (referred to herein as radiation protection) and (b) radiation measurements, quantities and units, particularly those concerned with radiation protection." Although more focused on "ionizing radiation;" e.g., X-rays, gamma-rays, nuclear radiation, NCRP has developed several reports that address radiofrequency issues and their recommendations are the basis of the FCC guidelines at the frequencies of interest.

recommendations on RF safety [7]. The ANSI committee, now the Institute of Electrical and Electronics Engineers (IEEE)[2] International Committee on Electromagnetic Safety (ICES), reaffirmed these same basic restrictions in 1991 [8] and again in 2005 [9] following extensive critical reviews of the scientific literature. In fact, every recent major independent review of the science continually supports the validity of these basic restrictions.

The scientific literature related to biological effects of RF energy is highly diverse, both in terms of scientific quality and in terms of relevance to possible health and safety risks to humans. Occasionally media reports on the results of some new study conclude that exposure to low-level radiowaves could be harmful. In many cases these reports are based on press releases by a researcher or the researcher's institution. Many such reports include gratuitous speculation suggesting that, based on the results of the study, devices such as mobile phones, microwave ovens or even computer display terminals might be unsafe. Even though many such reports describe only preliminary or unconfirmed results of studies that have not been subjected to peer-review or accepted for publication, and may not even be relevant to human health, they are sometimes given an inordinate amount of attention. In many cases it is not the scientist who creates significance by postulating adversity, but rather the media because of the implied "newsworthiness" of the story. In bioelectromagnetics, as in most areas of science, it takes a considerable amount of time and effort for scientists to sift and winnow facts from conjecture, and while most of these controversial reports and reported preliminary results of unpublished studies do not stand up to scientific scrutiny, or cannot be related to adverse human health, they nevertheless are the focus of concern to the lay person because of the alarming way they are interpreted and presented.

Contrary to what some of these stories may imply, a lot is known about the safety of electromagnetic energy at radiofrequencies. What is important is that in spite of the tremendous amount of research that has been reported in this field over the past five or six decades, there is a complete lack of any reliable evidence showing that exposure to RF energy at levels below contemporary safety guidelines is harmful to humans, including children. Moreover, the reliable scientific evidence clearly demonstrates that biological effects associated with exposure to RF energy are "threshold effects." This means that effects are only associated with exposures above a specific intensity – regardless of the exposure duration.[3] The threshold exposure levels at which potentially harmful effects might occur has been independently established and confirmed many times over. These thresholds, with large built-in margins of safety, are the bases of contemporary safety guidelines and recommendations, such as those supported or developed independently by expert panels and committees sponsored by the IEEE [9], the NCRP [7], the International Commission on Non-Ionizing Radiation Protection (ICNIRP) [10], Health Canada [11], the Health Council of the Netherlands, [12], [13], the National Radiological Protection Board (NRPB) in the UK [14], the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) [15], and the safety guidelines adopted by the FCC [16]. The FCC safety guidelines, which are a composite of the most restrictive portions of the standards and recommendations developed by committees of the IEEE and NCRP, and with which all wireless facilities in the US must comply, are supported by the federal public health agencies. Table 3 is a summary of the corresponding safety criteria recommended by various organizations throughout the world.

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2. IEEE is a non-profit technical professional society with more than 350,000 members in 150 countries. Within IEEE are a number of societies, including the Consumer Electronics Society, Education Society, Electromagnetic Compatibility Society, Engineering in Medicine and Biology Society, Information Theory Society, Neural Networks Society, Society on Social Implications of Technology, plus about twenty more. IEEE membership is not a requirement of participating on the IEEE ICES committee or any of its subcommittees.

3. This is a completely different phenomenon than that associated with exposure to much more energetic forms of radiation such as X-radiation, nuclear radiation, etc., (called "ionizing radiation") where exposures even at low levels might damage genetic material.

In spite of speculations about the possibility of effects occurring at levels below the safety guidelines, the fact is that the only effects reliably demonstrated in humans or laboratory animals are related to RF exposure at levels far in excess of the guidelines (thousands of times greater than what would be expected in normally accessible areas around antenna installations such as this site). This is not to say that exposure to radiowaves at any intensity cannot cause untoward effects. Exposures at levels far higher than the safety guidelines can lead to whole or partial-body heating and, possibly, burns from touching an object on which high RF currents are flowing.[4] The safety guidelines protect humans from these effects. The overwhelming consensus of the international scientific community is that as long as the system complies with the safety guidelines there is no adverse health risk, i.e., exposure to RF energy at levels at or below the safety guidelines is safe.

During the past several years a number of independent critical reviews of the relevant scientific literature were undertaken by expert panels throughout the world. Many of these reviews focused on mobile telephones and base stations, but they also addressed the adequacy of contemporary safety standards. The following excerpts from some of these panels summarize the consensus of the scientific community:

- In a May 2000 report, the Independent Expert Group on Mobile Phones (IEGMP), often referred to as the Stewart Expert Group, found that "[The] balance of evidence is that exposures to RF energy below present safety limits in the UK [which are similar to FCC limits], do not cause health effects to the general population." [17]
- In a January 2001 report to the French Health General Directorate (the "Zmirou Report"), a panel that reviewed the scientific literature concludes "…no risk has yet been demonstrated, in spite of the considerable amount of work done over the past several years." [18]
- In a January 2000 report, the Health Council of the Netherlands committee concludes "The Committee comes to the conclusion that there is at present no reason for concern." [12]
- In a more recent report (2002) the Health Council of Netherlands issued a major "update" to its January 2000 report, which also found no evidence of hazard from RF energy below recommended limits [13]. (The referenced limits are those of ICNIRP, the basic restrictions of which are the same as those of the FCC.)
- In 2004, the NRPB (United Kingdom) issued a new report on the health effects from RF electromagnetic fields. Their conclusion is "…the weight of evidence now available does not suggest that there are adverse health effects from exposure to RF fields below guideline levels, but published work on RF exposures and health has limitations." [14]
- In 2005, the NRPB issued another report on the health effects of RF electromagnetic fields, particularly addressing mobile radio (cellphones and cellular base stations) and the adequacy of current exposure guidelines. Their conclusion is "In aggregate the research published since the IEGMP report does not give cause for concern." [19]
- In April 2006, the latest revision of IEEE standard C95.1 was published [9]. This revision represents the culmination of an intensive review of approximately 1300 relevant papers from the world's peer-reviewed scientific literature by a committee of more than 120 scientists and engineers from around the world, representing more than 20 countries. The conclusion of the committee, which operated through an open consensus process, transparent at every level, is that there is no convincing evidence that would suggest lowering the values of the basic restrictions found in the 1991 C95.1 standard is warranted.

4. There are no components associated with the base-station installation where this is possible – not even the antennas themselves.

- In 2006, the World Organization in Fact sheet No. 304, concluded "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" [20].
- In 2007, in a Clarification Statement regarding children and mobile phones, the Word Health Organization concluded "To date, all expert reviews on the health effects of exposure to RF fields have reached the same conclusion: There have been no adverse health consequences established from exposure to RF fields at levels below the international guidelines on exposure limits published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP, 1998)" [21].

These reports largely addressed concerns about possible health effects of exposure to RF energy. Each of the expert panels examined a large body of evidence for hazards, including reports of "non thermal" effects, but the only convincing evidence that could be related to adverse effects in humans involved high exposure levels and obviously thermal phenomena. Expert committees such as NCRP, IEEE ICES and ICNIRP have each independently reached the same conclusion and are very explicit about the lack of reliable evidence for possible hazards from low-level exposures or "non-thermal" effects.

With respect to the proposed antennas at this site, be assured that the actual exposure levels in the vicinity of the installation will be below any science-based safety and health standard used anywhere in the world and literally thousands of times below any level associated with verifiable evidence of any functional change in humans or laboratory animals. This holds true even when all transmitters operate *simultaneously and continuously at their highest power*. Power density levels of this magnitude are not even a subject of speculation by the scientific community with regard to an association with adverse health effects.

The collective credible evidence, including the results of epidemiological studies of individuals exposed to radiowaves and laboratory studies of animals exposed both short-term and throughout their entire lifetimes, has not demonstrated that exposure to radio frequency 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.

6. For Further Information

Anyone interested can obtain additional information about the environmental impact of ESMR, cellular radio and PCS communications from:

Mr. Edwin Mantiply
Federal Communications Commission
Office of Engineering and Technology
445 – 12th Street SW
Washington, DC 20554
(202) 418-2423

7. Conclusion

The results of this analysis indicate that the maximal levels of RF energy in all normally accessible locations in the vicinity of the proposed wireless facility will be below all applicable health and safety limits. Specifically, the maximum level of RF energy associated with *simultaneous and continuous operation of the proposed Nextel transmitting antennas, plus the antennas of five additional carriers that could locate on the structure*, will be less than 2% of the safety criteria adopted by the FCC and mandated by the Telecommunications Act of 1996. The

maximum level of RF energy in such locations will also be far below other contemporary science-based exposure limits, e.g., those of the ANSI, the IEEE, the recommendations of the NCRP and international safety guidelines such as those of the ICNIRP. Because of the conservative way the analysis was performed, the levels of RF energy from these antennas at normally accessible locations in the immediate vicinity of the site will be considerably lower than the corresponding values cited above. The levels inside nearby homes and offices will be even lower because of the attenuation of commonly used building materials.

Enclosure:
Figure. Electromagnetic Spectrum

References

[1] Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (1996).

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

[3] Federal Communication Commission 47 CFR Parts 1, 2, 15, 24 and 97. "*Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation*" (August 6, 1996)

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

[5] *Radiofrequency Electromagnetic Fields – Properties, Quantities and Units, Biophysical Interaction, and Measurements*, NCRP Report no. 67, National Council on Radiation Protection and Measurements, Bethesda, MD, 1981

[6] ANSI Std C95.1-1982, "American National Standard Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300 kHz to 100 GHz," American National Standards Institute, New York, NY, 1982

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

[8] IEEE Std C95.1-1991, "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," (1999 edition), Institute of Electrical and Electronics Engineers, Piscataway, NJ, 1999

[9] IEEE Std C95.1-2005, "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," (1999 edition), Institute of Electrical and Electronics Engineers, Piscataway, NJ, 2005

[10] 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

[11] Health Canada Safety Code 6, "Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz," Environmental Health Directorate, Health Protection Branch. Published by authority of the Minister of Health, 1999

[12] HCN, "Exposure to Electromagnetic Fields (0 Hz – 10 MHz)," Publication 200/6, Health Council of the Netherlands, Report No. 2000/06E, The Hague, 7 March 2000

[13] HCN Report, "Mobile Telephones: An Evaluation of Health Effects," Health Council of the Netherlands, Report No. 2002/01E, The Hague, 28 January 2002

[14] NRPB, "Review of the Scientific Evidence for Limiting Exposure to Electromagnetic Fields (0 – 300 GHz)," *Documents of the NRPB*, vol. 12, no. 3, National Radiological Protection Board, Chilton, Didcot, Oxfordshire, UK, 2004

[15] ARPANSA Radiation Protection Standard, "Maximum Exposure Levels to Radiofrequency Fields - 3 kHz to 300 GHz," Radiation Protection Series Publication No. 3, Australian Radiation Protection and Nuclear Safety Agency, 2003

[16] FCC Rules and Regulations, 47 CFR § 1.1310 *et seq*.

[17] IEGMP, "Mobile Phones and Health". Report from the Independent Expert Group on Mobile Phones, UK, May 2000

[18] "Zmirou Report" To the French Health General Directorate, January2001

[19] NRPB "Mobile Phones and Health 2004: A report by the Board of the National Radiological Protection Board (NRPB)," *Documents of the NRPB*, vol. 15, no. 5, National Radiological Protection Board, Chilton, Didcot, Oxfordshire, UK, 2004, Released Jan 11, 2005

References (continued)

[20] World Health Organization Fact sheet N°304, "Electromagnetic fields and public health; Base stations and wireless technologies," May 2006. (Available at Internet site http://www.who.int/mediacentre/factsheets/fs304/en/)

[21] World Health Organization, Children and Mobile Phones: Clarification Statement (2007), (Available at Internet site http://www.who.int/peh-emf/meetings/ottawa_june05/en/index4.html)

Table 1
Engineering Specifications for the Proposed PCS, ESMR and Cellular Radio Systems
Peck Road, Danbury, CT

	Cellular Radio Systems* (869 – 894 MHz)		PCS* (1930 – 1990 MHz)			Nextel ESMR (851– 866 MHz)
Site Specifications	**1**	**2**	**1**	**2**	**3**	**1**
maximum ERP per channel †	400 watts	100 watts	250 watts	622 watts	427 watts	100 watts
actual radiated power per channel	20 watts	6.8 watts	9.7 watts	16 watts	14.6 watts	6.6 watts
actual *total* radiated power per sector	180 watts	47.6 watts	117 watts	48 watts	43.8 watts	79.2 watts
number of transmit (Tx) antennas	N/A	1 per sector	N/A	N/A	N/A	N/A
number of receive (Rx) antennas	N/A	2 per sector	N/A	N/A	N/A	N/A
number of Tx/Rx antennas (duplexed)	2 per sector	N/A	4 per sector	2 per sector	2 per sector	4 per sector
number of transmitters (RF channels)	9 per sector	7 per sector	12 per sector	3 per sector	3	12 per sector
number of sectors configured	3	3	3	3	3	3
antenna centerline height above grade	93 ft ±	113 ft ±	103 ft ±	123 ft ±	133 ft ±	143 ft ±
antenna manufacturer	Antel	Decibel Products	EMS Wireless	Decibel Products	Powerwave	Andrew (EMS)
model number	LPD 6513	DB774G90V1ESXM	DR85-17-02DPL2Q	DB932DG65T2E-M	7770.00	FV9012-00DBL2
Gain	15.15 dBi	13.85 dBi	16.35 dBi	18 dBi	16.8 dBi	13.95 dBi
Type	directional	directional	directional	directional	directional	directional
Downtilt	0^o	2^o (electrical)	2^o (electrical)	2^o (electrical)	0^o	0^o

* Typical configuration and specifications for the proposed wireless services

† *Effective Radiated Power* (ERP) is a measure of how well an antenna concentrates RF energy; it is not the actual power transmitted by the antenna. To illustrate the difference, compare the brightness of an ordinary 100 watt light bulb with that from a 100 watt spot-light. Even though both are 100 watts, the spot-light appears brighter because it concentrates the light in one direction. In this direction, the spot-light effectively appears to be emitting more than 100 watts. In other directions, there is almost no light emitted by the spot-light and it effectively appears to be much less than 100 watts.

Table 2

Calculated Maximal RF Power Densities Expressed in Microwatts per Square Centimeter and as a Percentage of 1996 FCC MPEs* for the Proposed PCS, ESMR and Cellular Radio Antennas Peck Road, Danbury, CT

Service	Power Density ($\mu W/cm^2$)		% of MPEs*	
	6 ft AMGL†	16 ft AMGL†	6 ft AMGL†	16 ft AMGL†
Cellular – 1	< 3.95	< 5.04	0.72%	0.92%
Cellular – 2	< 1.54	< 1.97	0.28%	0.36%
PCS – 1	< 0.89	< 1.11	0.09%	0.11%
PCS – 2	< 0.53	< 0.63	0.05%	0.06%
PCS – 3	< 0.28	< 0.33	0.03%	0.04%
Nextel ESMR	< 0.23	< 0.27	0.04%	0.05%
		Total	**1.21%**	**1.54%**

* MPE: The FCC maximum permissible exposure values (same as the 1986 NCRP limits at the frequencies of interest)

† AMGL: above mean grade level

Table 3

Summary of International, Federal, State and Consensus Safety Criteria for Exposure to Radiofrequency Energy at Frequencies Used for Radio Communication Systems (400- 2000 MHz)

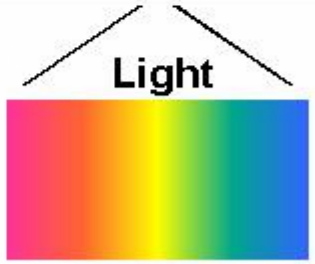
Organization/Government Agency	Exposure Population	Power Density ($\mu W/cm^2$) 400 - 2000 MHz
International Safety Criteria/Recommendations		
International Commission on Non-Ionizing Radiation Protection (1997) *Health Physics*, Vol. 74, No. 4, pp 494-522. (1998) [1]	Occupational	f / 0.4
	Public	f / 2
Federal Requirements		
Federal Communications Commission (47 CFR §1.1310) [2]	Occupational	f / 0.3
	Public	f / 1.5
Consensus Standards and Recommendations		
Institute of Electrical and Electronics Engineers (IEEE Standard C95.1-2005) [3]	Occupational	f / 0.3
	Action Level [4]	f / 2
National Council on Radiation Protection & Measurements (NCRP Report 86, 1986)	Occupational	f / 0.3
	Public	f / 1.5
State Codes		
New Jersey (NJAC 7:28-42)	Public	f / 0.3
Massachusetts (Department of Health 105 CMR 122)	Public	f / 1.5
New York State [5]	Public	f / 1.5

f = frequency in MHz

NOTES:

1. Update of the 1989 International Radiation Protection Association (IRPA) guidelines. Reaffirmed in 1997 and published, with modification, in 1998.
2. All licensees are required to comply with the limits outlined in 47 CFR §1.1307.
3. Incorporates IEEE Standard C95.1-1991, IEEE Standard C95.1a-1998 and C95.1b-2004.
4. The "action level" is defined as the level at which mitigative measures (e.g., an RF safety program) are implemented to protect against exposures that could exceed the upper tier (occupational limits).
5. State of New York Department of Health follows the recommendations in NCRP Report 86.

ELECTROMAGNETIC SPECTRUM



Service/Device: Frequency Range

AM Radio: *535 – 1605 kHz*
CB Radio: *27 MHz*
Cordless Phones: *49 - 2450 MHz*
TV CH 2 – 6: *54 – 88 MHz*
FM Radio: *88 – 108 MHz*
Marine/Weather Radio: *160 MHz*
TV CH 7 – 13: *174 – 216 MHz*
TV UHF CH 14 – 69 *470 – 800 MHz*
Cellular Radio, ESMR, Paging/Data: *806 – 946 MHz*
Antitheft devices: *10 – 20 kHz and/or 915 MHz*
Wireless LAN (WiFi): *915 – 5800 MHz*
Microwave oven: *915 and 2450 MHz*
Personal Communication Services: *1800 – 2200 MHz*
Intrusion alarms/door openers: *10.5 GHz*
Microwave radio: *1 – 40 GHz*
Satellite communications: *100 MHz – 275 GHz*

Power
Frequency