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RF Exposure Measurements
Cell Tower and Broadcast

The popularity of cell phones and wireless communication devices has resulted in a proliferation of cell towers across the American landscape - in urban, suburban, and rural areas. Opposition to the placement of these towers has sometimes developed among segments of the population. This opposition has usually been based upon aesthetics, concern over the electromagnetic radiation, or a combination of the two.

Regulations adopted by the Federal Communications Commission (FCC) in 1996, and fully implemented in 2000, limit human exposure to electromagnetic emissions from cell phone, broadcast, and other radio communication systems. Both U.S. and international standards governing exposure to radio frequency (RF) fields have long existed, and the FCC regulations were adapted from a pre-existing standard. They establish maximum permissible exposures, or MPEs, for the full range of frequencies likely to be encountered near transmitting equipment, towers, and antennas. For cell phone base antennas (cell towers), the level of RF energy that one would realistically be exposed to is usually less than 1% of the MPE. One exception would be a location where cellular antennas are mounted on a building roof, and there is public access to the roof area. For broadcast towers, higher exposures are possible, although the MPEs are unlikely to be exceeded in any areas accessible to the public.

So why are people concerned about cell phone towers? Is some caution warranted? Three reasons for this concern are recognized:

1. Some people don't trust the cell phone companies or the government to act with the public's best interest in mind.

2. Many people equate the potential adverse health effects of **cell phone use** with the presence of **cell phone towers**. In reality, the energy that one is exposed to while holding a cell phone to the head is around 100 times greater than one is exposed to in the vicinity of a cell tower.

3. The existing exposure limitations are based primarily on the avoidance of energy deposition in the body sufficient to cause heating of tissue. A growing body of research data indicates that some types of radio frequency fields influence cellular function through mechanisms that do **not** involve heating. Thus, the exposure limitations may be based upon incomplete science, and therefore not fully protective.

To address the issue raised by #3 above, the so-called "athermal exposure," it is necessary to look beyond the current exposure limitations. Through a review of existing research on exposure to radio frequency fields that are below the levels which result in tissue heating, it is possible to identify a range of numbers below which no adverse effects have been noted (or which have been noted only in limited or questionable studies), and above which potentially adverse effects have been seen in a number of different studies. This range of numbers can form the basis for a "precautionary guideline." The science from which it is derived is not, at this time,

sufficient in strength or consistency to permit the revision of existing standards. However, reference to such a precautionary guideline will permit those individuals who seek a level of protection beyond that conferred by existing standards to do so in a rational manner while research proceeds on this important public health issue.

EMF Services can conduct testing and site assessments for individuals, institutions, or municipalities who wish to become aware of the RF levels at a location near cell phone or broadcast towers. The report that we provide will permit comparison of existing levels with Maximum Permissible Exposures (MPEs), precautionary guidelines, and routine background levels for comparable environments. If new transmitting facilities are planned for your location, our site survey can be used to establish a baseline RF level for later comparison. The purpose of this service is to empower you to make responsible, fact-based decisions regarding the RF environment surrounding your community, facility, or home. All services are delivered by personnel with several years of experience in planning and directing the installation of radio communication facilities, using equipment with current factory calibration certificates. *The greatest advantage of our surveys over that of other providers is the ability to address the issue of low-level, long-term, non-thermal exposures.*

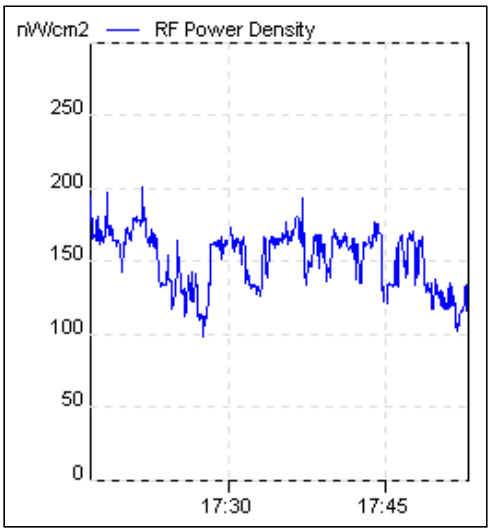
The purpose of our testing services is not to provide a basis for contesting the siting of cell phone towers or to seek their removal once sited. This position is not the result of an alliance between **EMF Services** and the cellular service providers. They are not our clients. Rather, it represents an effort to avoid leading you down the path toward a disappointing result. The RF levels near a cell tower will not approach Maximum Permissible Exposures at ground level where people are present. Therefore, from a legal perspective, grounds for such an action do not exist. Further, a court of law is not the best venue for a challenge to the science on which existing standards are based. The likely result is disappointment and a wasted financial expenditure. The best reason for testing and measurement services is to understand the field levels that exist, and what can be done to reduce them.

Technical Challenges

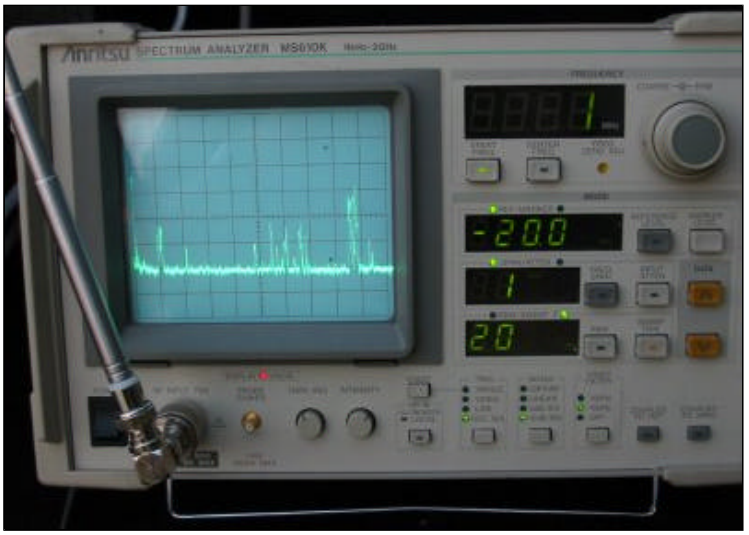
Measurement of the emissions from cell phone towers presents particular technical challenges beyond those encountered for broadcast antenna sites. To understand these challenges, a few brief comments about radio frequency measurement are required. Protocols for the measurement of RF energy for the purpose of human exposure assessment recommend the use of an "isotropic broadband probe" whenever possible. This type of sensor responds equally to energy arriving from any direction, and over a broad frequency range, as does the human body. Unfortunately, some of the instruments typically used by companies which perform "RF compliance surveys" are unable to accurately measure the low field strengths or power densities present at some cell sites. An alternate approach is required.

A related problem involves the concurrent presence

of other signals besides those from the cell phone system. The "broadband" characteristic of the isotropic broadband probe means that it is sensitive to, and will measure, any signals across a wide range of frequencies. The reading produced by the instrument will be the combination of all signals present. In a large number of cases, the other signals present near a cell tower will be as strong as the cell phone signals that one is trying to measure. In fact, an FM radio broadcast station a half mile away, and out of sight, can be the strongest signal present near a cell tower. Realistically, this composite measurement of all signals may be the most relevant exposure metric, but an interpretation of the significance of a reading sometimes requires that one know the frequency of the signal that produced it. For instance, is it FM, TV, cell site, or something else? Again, an alternate approach is required.



A third challenge results from the fact that field strength or power density levels at a cell tower site are not constant, as they usually are at a broadcast antenna site. People use their cell phones much more at some times of the day, and on some days of the week, than at others. The cellular carriers, or service providers, maintain additional capacity in the form of multiple channels which will become active as needed to meet demand. Each active channel adds to the measured power density at the cell site. The variable and cyclic nature of power density levels at the site must be taken into account when performing an assessment. We employ computer data logging to produce a graphic presentation of field strength variation over time. This technique will capture the very substantial field strength transitions that occur with varying levels of cellular usage on the system, and produce a much more meaningful assessment than spot readings with a simple handheld meter.



RF measurement surveys conducted by **EMF Services** employ procedures and equipment to address each of the challenges noted above. We use a high sensitivity (10 nanowatt/cm^2) **isotropic broadband probe**, which is adequate to measure all but the smallest signals. A **spectrum analyzer** is used to view the range of signals present at the site. This permits a determination of the frequency and magnitude of each signal, even those far below any level that is significant from an exposure perspective. The use of this instrument with a calibrated antenna will allow "narrow band measurement" of the strength of an individual signal among the others present, when this is required. More importantly, one can easily determine which signals are actually being measured by the broadband probe. Our survey report includes spectrum analyzer plots or actual screen shots of the RF activity at each site location.

Spectrum Analyzer screen shot:

Left side - FM Broadcast Band

Center - UHF TV Stations

Right side - 800/900 MHz Cell Tower Signals

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