

**Station KFLR-FM • 90.3 MHz, Channel 212C • Phoenix, Arizona**  
**Radio Frequency Exposure Measurements**

**Statement of Hammett & Edison, Inc., Consulting Engineers**

The firm of Hammett & Edison, Inc., Consulting Engineers, has been retained to evaluate the radio frequency radiation exposure conditions relative to the permitted operation for Station KFLR-FM at the South Mountain Communications Site in Phoenix, Arizona.

**Summary**

In accordance with special operating conditions 2, 3, and 4 of the KFLR-FM Construction Permit (BMPED-20061101ACH), proper radiofrequency electromagnetic (RF) field strength measurements have been made throughout the transmitter site area. The entire site is securely fenced to preclude unauthorized access. Contributions from the new KFLR-FM operation were calculated to be less than 5% of the applicable FCC limit beyond 60 meters from the KFLR-FM tower. Within the larger area extending 100 meters from the tower, exposure conditions were measured everywhere to be in compliance with the FCC limits with KFLR-FM operating at its permitted power of 100 kW. While some visual warning signs were posted in that area, none are required. Therefore, the new KFLR-FM permitted operation complies with applicable FCC Rules regarding human exposure to RF radiation.

**Electromagnetic Field Exposure Standard**

The U.S. Congress requires that the Federal Communications Commission (“FCC”) evaluate its actions for possible significant impact on the environment. In Docket 93-62, effective October 15, 1997, the FCC adopted the human exposure limits for field strength and power density recommended in Report No. 86, “Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,” published in 1986 by the Congressionally chartered National Council on Radiation Protection and Measurements (“NCRP”). Separate limits apply for occupational and public exposure conditions, with the latter limits generally five times more restrictive. The more recent standard, developed by the Institute of Electrical and Electronics Engineers and approved as American National Standard ANSI/IEEE C95.1-2006, “Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz,” includes similar exposure limits. A summary of the FCC’s exposure limits is shown in Figure 1. These limits apply for continuous exposures and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health.

The guidelines allow higher exposures for short time periods. Exposures can be averaged over a six-minute period, allowing, for example, a two-minute exposure to fields three times the limit if the remainder of the six-minute period does not include any significant exposure.



## **Station KFLR-FM • 90.3 MHz, Channel 212C • Phoenix, Arizona Radio Frequency Exposure Measurements**

Restrictions on access to strong fields may be achieved in different manners for casual public exposure than for occupational exposure. For example, persons who are authorized to be in a controlled site area can be educated to follow procedures that will limit time-averaged exposures to levels not exceeding the guidelines.

### **Facility Description**

The South Mountain Communications Site extends over 650 meters along a ridge in Phoenix, Arizona, and is entirely encompassed by a chain-link fence, with access into the interior controlled by two locked gates on which are posted appropriate RF warning signs.

Individuals requiring entry to the communications site must first be authorized by one of the tenant stations to obtain a gate combination or key, so a mechanism is in place to make occasional site visitors (for example, contractors, air conditioner service personnel, and equipment installers) aware of the possible presence of high RF fields within the site boundary.

Station KFLR-FM, 90.3 MHz, Phoenix, is located near the center of the site, on Tower 12, and has recently installed a directional four-bay “rototiller” antenna with 0.8 wavelength bay spacing at an effective height of 47 meters above ground.

### **Measurements at South Mountain**

Measurements were made by the undersigned engineer on September 10, 2007, throughout the communications site. The measurement equipment used was a Wandel & Goltermann Type EMR-300 Radiation Meter with a Type 25 Isotropic Field Probe (Serial No. E-0001). Both meter and probe were under current calibration by manufacturer. The probe is frequency-shaped to reflect the occupational exposure limits detailed in the FCC standard, allowing the meter to measure correctly the combined exposure levels from the various emitters at the site. The meter conveniently reads directly in percent of the occupational limits of the standard. With KFLR-FM operating at 100 kW, the maximum ambient RF levels at ground level in the area within 100 meters of the KFLR-FM transmitting antenna, measured 27% of the FCC occupational exposure limit. Measurements were also made in that area of exposure levels near re-radiating objects, including guy anchors and climbing safety lines; no levels were observed that exceeded the occupational limit beyond 20 cm from such objects.

All facilities at the South Mountain site were reported to be operating at full power during the measurements, with the exception of FM Stations KUPD, 97.9 MHz, and KMLE, 107.9 MHz, which were temporarily operating at reduced power due to equipment problems. Both stations are licensed to operate at 100 kW, with KUPD and KMLE reportedly operating at 83 kW and 50 kW, respectively, at



**Station KFLR-FM • 90.3 MHz, Channel 212C • Phoenix, Arizona**  
**Radio Frequency Exposure Measurements**

the time of the measurements. KUPD transmits from the far west side of the site about 280 meters from KFLR and its small KUPD reduction has negligible impact on RF exposure levels in the area surrounding the KFLR-FM tower. KMLE is located on Tower 13, adjacent to KFLR-FM. Therefore, a Narda Type SRM-3000 Selective Radiation Meter (Serial No. F-0031) was used to determine the relative contribution of KMLE in the areas surrounding the KFLR-FM tower. The maximum contribution at ground level from KMLE measured less than 2% of the FCC occupational exposure limit. Thus, under full power operation, KMLE would contribute less than 4% of the FCC limit anywhere at ground level. In addition, MediaFlo is in the process of installing a Model TLP-8 antenna on Tower 12 operating on Channel 55 at 50 kW ERP, from an effective height of 30.5 meters above ground. The maximum ambient RF levels due to this proposed installation are calculated to be 1.2% of the FCC occupational limit. Therefore, assuming full-power operation for KMLE and MediaFlo in addition to the measured levels, the “worst-case” maximum ambient RF level in the area surrounding the KFLR-FM antenna would be 32.2% of the FCC occupational exposure limit.

**Authorship**

The undersigned author of this statement is a qualified Professional Engineer, holding California Registration No. E-16747, which expires on September 30, 2008. This work has been carried out by him or under his direction, and all statements are true and correct of his own knowledge except, where noted, when data has been supplied by others, which data he believes to be correct.

September 12, 2007



*Mark D. Neumann*  
Mark D. Neumann, P.E.

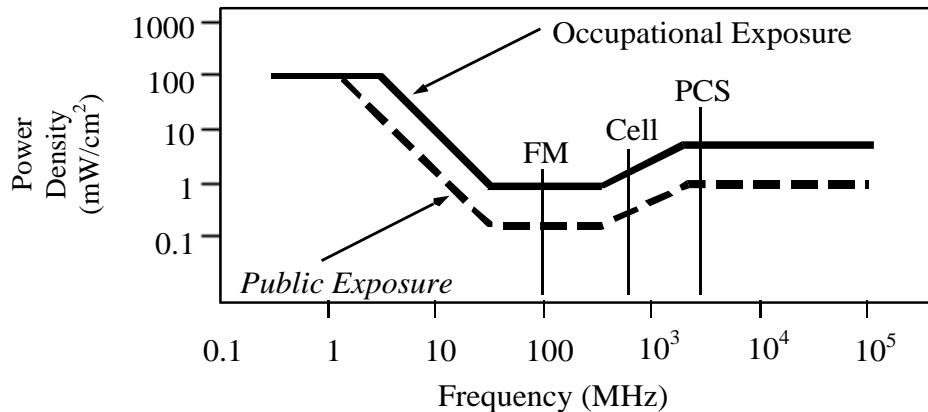


## FCC Radio Frequency Protection Guide

The U.S. Congress required (1996 Telecom Act) the Federal Communications Commission (“FCC”) to adopt a nationwide human exposure standard to ensure that its licensees do not, cumulatively, have a significant impact on the environment. The FCC adopted the limits from Report No. 86, “Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,” published in 1986 by the Congressionally chartered National Council on Radiation Protection and Measurements (“NCRP”). Separate limits apply for occupational and public exposure conditions, with the latter limits generally five times more restrictive. The more recent standard, developed by the Institute of Electrical and Electronics Engineers and approved as American National Standard ANSI/IEEE C95.1-2006, “Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz,” includes similar limits. These limits apply for continuous exposures from all sources and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health.

As shown in the table and chart below, separate limits apply for occupational and public exposure conditions, with the latter limits (in *italics* and/or dashed) up to five times more restrictive:

Frequency Applicable Range (MHz)	Electromagnetic Fields (f is frequency of emission in MHz)					
	Electric Field Strength (V/m)		Magnetic Field Strength (A/m)		Equivalent Far-Field Power Density (mW/cm <sup>2</sup> )	
0.3 – 1.34	614	<i>614</i>	1.63	<i>1.63</i>	100	<i>100</i>
1.34 – 3.0	614	<i>823.8/f</i>	1.63	<i>2.19/f</i>	100	<i>180/f<sup>2</sup></i>
3.0 – 30	1842/f	<i>823.8/f</i>	4.89/f	<i>2.19/f</i>	900/f <sup>2</sup>	<i>180/f<sup>2</sup></i>
30 – 300	61.4	<i>27.5</i>	0.163	<i>0.0729</i>	1.0	<i>0.2</i>
300 – 1,500	3.54√f	<i>1.59√f</i>	√f/106	<i>√f/238</i>	f/300	<i>f/1500</i>
1,500 – 100,000	137	<i>61.4</i>	0.364	<i>0.163</i>	5.0	<i>1.0</i>



Higher levels are allowed for short periods of time, such that total exposure levels averaged over six or thirty minutes, for occupational or public settings, respectively, do not exceed the limits, and higher levels also are allowed for exposures to small areas, such that the spatially averaged levels do not exceed the limits. However, neither of these allowances is incorporated in the conservative calculation formulas in the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) for projecting field levels. Hammett & Edison has built those formulas into a proprietary program that calculates, at each location on an arbitrary rectangular grid, the total expected power density from any number of individual radio sources. The program allows for the description of buildings and uneven terrain, if required to obtain more accurate projections.



## RFR.CALC™ Calculation Methodology

### Assessment by Calculation of Compliance with FCC Exposure Guidelines

The U.S. Congress required (1996 Telecom Act) the Federal Communications Commission (“FCC”) to adopt a nationwide human exposure standard to ensure that its licensees do not, cumulatively, have a significant impact on the environment. The maximum permissible exposure limits adopted by the FCC (see Figure 1) apply for continuous exposures from all sources and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health. Higher levels are allowed for short periods of time, such that total exposure levels averaged over six or thirty minutes, for occupational or public settings, respectively, do not exceed the limits.

#### Near Field.

Prediction methods have been developed for the near field zone of panel (directional) and whip (omnidirectional) antennas, typical at wireless telecommunications base stations, as well as dish (aperture) antennas, typically used for microwave links. The antenna patterns are not fully formed in the near field at these antennas, and the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) gives suitable formulas for calculating power density within such zones.

For a panel or whip antenna, power density  $S = \frac{180}{\theta_{BW}} \times \frac{0.1 \times P_{net}}{\pi \times D^2 \times h}$ , in mW/cm<sup>2</sup>,

and for an aperture antenna, maximum power density  $S_{max} = \frac{0.1 \times 16 \times \eta \times P_{net}}{\pi \times h^2}$ , in mW/cm<sup>2</sup>,

where  $\theta_{BW}$  = half-power beamwidth of the antenna, in degrees, and

$P_{net}$  = net power input to the antenna, in watts,

$D$  = distance from antenna, in meters,

$h$  = aperture height of the antenna, in meters, and

$\eta$  = aperture efficiency (unitless, typically 0.5-0.8).

The factor of 0.1 in the numerators converts to the desired units of power density.

#### Far Field.

OET-65 gives this formula for calculating power density in the far field of an individual RF source:

power density  $S = \frac{2.56 \times 1.64 \times 100 \times RFF^2 \times ERP}{4 \times \pi \times D^2}$ , in mW/cm<sup>2</sup>,

where ERP = total ERP (all polarizations), in kilowatts,

RFF = relative field factor at the direction to the actual point of calculation, and

$D$  = distance from the center of radiation to the point of calculation, in meters.

The factor of 2.56 accounts for the increase in power density due to ground reflection, assuming a reflection coefficient of 1.6 (1.6 x 1.6 = 2.56). The factor of 1.64 is the gain of a half-wave dipole relative to an isotropic radiator. The factor of 100 in the numerator converts to the desired units of power density. This formula has been built into a proprietary program that calculates, at each location on an arbitrary rectangular grid, the total expected power density from any number of individual radiation sources. The program also allows for the description of uneven terrain in the vicinity, to obtain more accurate projections.

