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wireless beyond boundaries

60GHz Safety

**Notes on safety aspects of wireless devices operating in the
60GHz band of radio spectrum**

Dr. Gary L. Baldwin

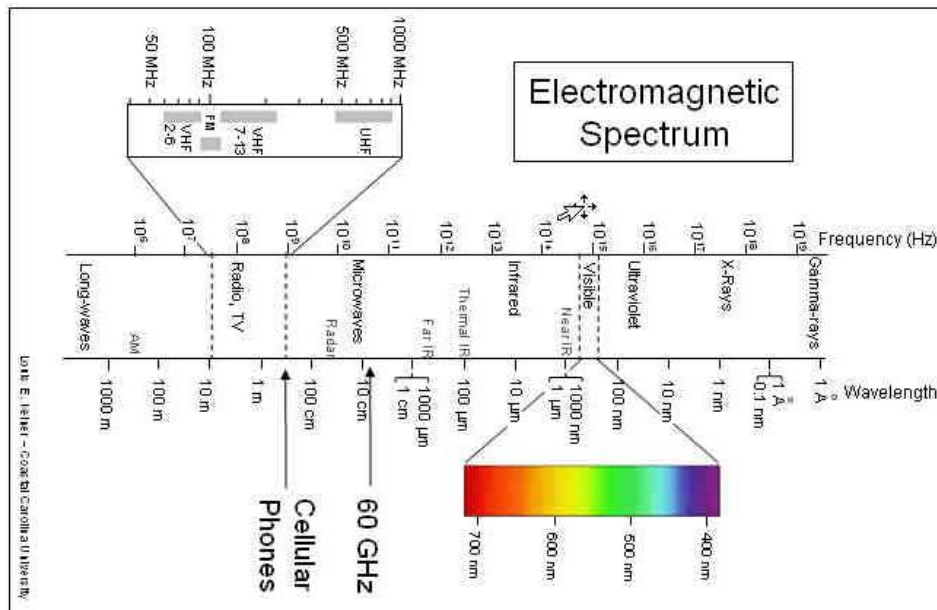
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Over the past several decades, use of electromagnetic energy in the form of radio waves in consumer electronics has increased dramatically. In addition to radios and TVs, the omni-present cell phone and other wireless devices operate in some portion of the electromagnetic (EM) spectrum, ranging from a few megahertz up through infrared (see diagram below). Even TV / DVD / VCR remote controllers operate in some portion of the EM spectrum, whether their source is radio waves or an infrared light beam.

Any EM energy (sunlight is a familiar example) can be harmful if use is excessive or is outside the bounds that have been established to insure safe exposure for humans or other animals. Since it is always in the best interest of personal and public safety for consumer devices like those mentioned above to operate well within limits of safety, numerous medical, professional, and government oversight organizations have been most active in setting industry standards and licensing policies to protect the users of these devices.

Like those devices that operate in the lower microwave regime (cellular telephones (0.8 to 1.9 GHz) and wireless Internet access systems (2.4 to 5.8 GHz and higher)), wireless systems operating between 57 and 64 GHz are strictly regulated regarding the amount of output power that they may safely emit, in compliance with a rigid set of safety standards established by the



FCC. These standards are based on solid medical experimentation and evidence that show where the limits lie and what guidelines must be established to protect individual users. These standards and recommendations reflect the consensus of the scientific community and result from deliberations of panels and committees of scientists and citizens who continually review and interpret the extensive research literature.

The limits established by the FCC differ for different kinds of radio emissions in different parts of the spectrum. The usual concern is the potential for damage to biological tissue by too much exposure, and that damage has been found to be a function of the depth of penetration of the radio

waves into the biological tissue. Owing to the extremely short wavelengths used by wireless devices operating in the oxygen absorption band, the depth of penetration is limited to the superficial layers of tissue that are biologically sensitive. Ocular tissue is of principal concern because of its unique structure, location, biochemistry, physiology, and sensitivity to various physical agents¹.

The FCC established its limitations on radio emissions in the 57 – 64 GHz based on the results obtained from the study by Dr. Kues cited in (1) above. From that study, it appears that neither single nor repeated exposure to 10 mW/cm² from a 60 GHz continuous wave source results in any observable ocular changes to the eyes of subject animals.

The FCC limitation for radiated power in the oxygen absorption band is fully ten times lower than that which was found in the Kues study². Specifically, no commercial wireless systems operating in that band may radiate more than 1 mW/cm², nor may it transmit more than 500 mW of peak power at any given time. That is **fully ten times lower** than the lowest level studied in the medical experiments, and – again – even that level produced no observable effects.

An additional safety factor results from the separation of 60 GHz devices from their users. The devices envisioned for the 60 GHz band operate much farther away (greater than a meter) from any human or other biological tissue than cell phones or other familiar consumer radio devices. In addition, owing to the limitations imposed by the electronics contained in these devices, they are simply not capable of putting out enough power to exceed the limitations imposed by the regulations.

Therefore, any wireless device operating in compliance with the international regulatory limitations established for the 57 – 64 GHz band will be completely safe for use by consumers.

¹ *Absence of Ocular Effects After Either Single or Repeated Exposure to 10 mW/cm² from a 60 GHz CW Source*, Henry A. Kues, et. al., *Bioelectromagnetics*, Vol. 20, 1999, pp. 463-473.

² *Federal Register*, Vol. 63, No. 152, August 7, 1998, p. 42280.