



Electric and magnetic fields (EMF) 101

What are electric and magnetic fields (EMF)?

Electric and magnetic fields (EMF) occur everywhere that electricity flows. For instance, EMF are present in all energized electrical wires and, as a result, all lighting and electrical appliances.

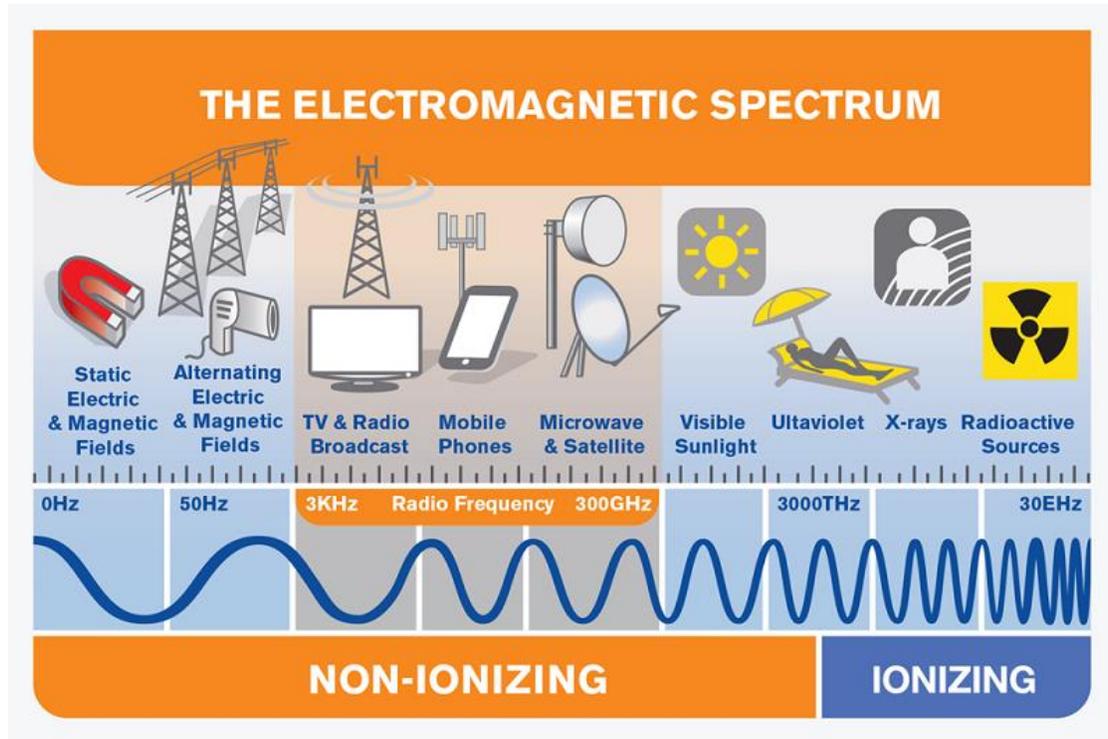
Interestingly, these are not the only places that EMF are present. In fact, EMF have always been a very important part of daily life and EMF produced by electrical power are only part of a broad range of waves referred to as the electromagnetic spectrum, depicted in *Figure 1*.

The various EMF allow for life as we know it. For instance, we are warmed by electromagnetic radiation emitted from the sun and our ability to attribute colour to various objects is a result of our eyes' ability to detect the visible light of the electromagnetic spectrum.

Various forms of electromagnetic energy are differentiated, amongst other things, by frequency. Frequency is measured in hertz (Hz). Electrical power EMF in North America operates at a frequency of 60 Hz and is classified as extremely low frequency (ELF), since it alternates at 60 times per second. On the other end of the spectrum are X-rays and Gamma waves, which operate at very high frequencies and have very small wavelengths. Frequencies on the lower end of the EMF spectrum, such as electrical power EMF or ELF, possess much less energy than frequencies on the upper end.



Figure 1



These concepts are helpful in understanding why electrical power ELF and radio frequency (RF) signals effects upon human health are likely to be of less potential concern. As *Figure 1* demonstrates, the electromagnetic spectrum can be broken down into two broad categories, based upon the manner in which electromagnetic waves interact with biological tissue.

¹ UN-ITU, “The electromagnetic spectrum” United Nations – International Telecommunication Union (UN-ITU) <http://emfguide.itu.int/emfguide_m.html#page1_1> (Accessed: December 2015).





1. The first is known as “non-ionizing” and generally includes frequencies up to 300 GHz. Non-ionizing electromagnetic waves do not affect biological tissue, aside from tissue heating that can be associated with RF exposure. Non-ionizing electromagnetic waves include those in the ELF band as well as radio waves and microwaves in the RF communication band.²
2. The second broad electromagnetic category is referred to as “ionizing” and includes: gamma rays, x-rays and ultraviolet radiation. The ionizing region of the electromagnetic (EM) spectrum generally have very short wavelengths, very high frequencies and extreme intensities. Affects to biological tissue have been observed with this category.³

This fundamental distinction is useful in the assessment of any possible health effects related to EMF.

² RFcom, “FAQ” [McLaughlin Centre for Population Health Risk Assessment - University of Ottawa](http://www.rfcom.ca/faq/answers.shtml#q1) <<http://www.rfcom.ca/faq/answers.shtml#q1>> (Accessed: November, 2015).

³ RFcom.

