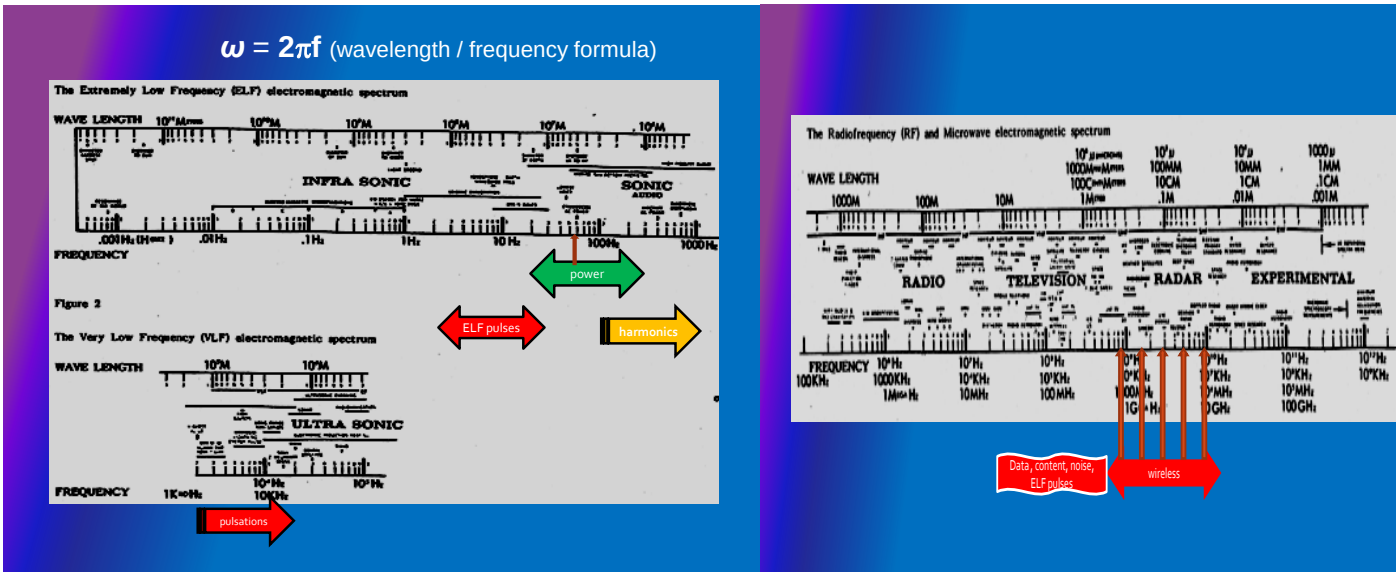
# Essentia™ Electromagnetic Monitor *Model: EM2*

The **Essentia™** *EM2* was designed to bridge the gap between inexpensive monitors with limited response and expensive full spectrum units. It has a small, sensitive circuit capable of detecting the electric field component spectrum from below 50Hz to beyond 10GHz microwaves and converts it into a visually-displayed signal.

The *EM2* may be used to measure the level of radiation from all household appliances and wiring as well as most cell, radio, television and microwave transmitters. Below is shown the portion of interest of the electromagnetic spectrums:




**Radiation monitored**

Extremely Low Frequency (**ELF**) AC fields, such as from power generation, including **Sonics**, and Very Low Frequency (**VLF**), including **Ultrasound**, drop off rapidly away from the source following the inverse square of the distance. This is not the case with **Radio waves** that decrease quasi-linearly with distance. Cell, tablet, pod transmissions and **Microwave**s also fall off somewhat linearly but may be directed to keep their intensity over large distances. In practice the fields around electromagnetic sources are much more complex due to the landscape, atmospheric conditions and antenna geometries. Proximity to the ground, being inside structures with significant amounts of metal are factors which can also change field strength.

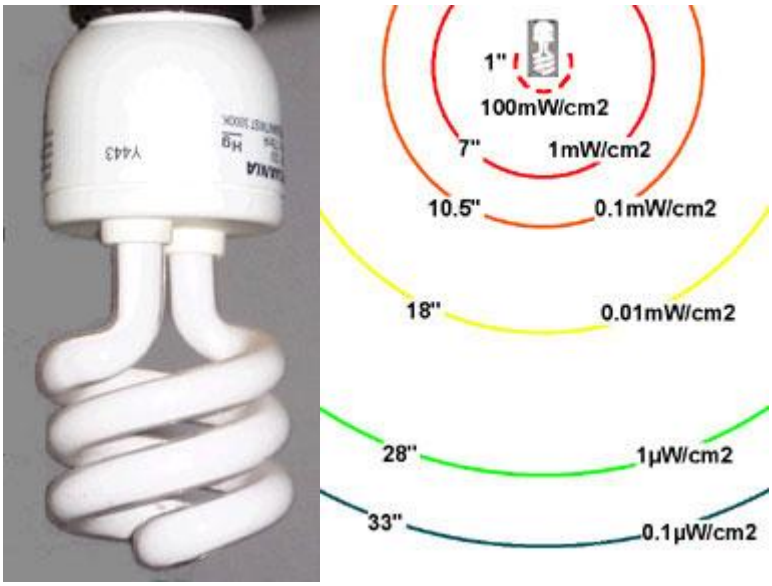
**Indoor measurements**

Indoor **AC electrical wires** surround the occupants with a quite uniform ELF electromagnetic field. **AC voltage** in relation to ground may be at a very high level inside a house (180V peak) but variations in the field will be much smaller. These variations are perhaps a few volts and will result in readings of about 0.1µW/cm$^2$. Actual electromagnetic power density between head and foot for a human might actually be over 1mW/cm$^2$.

Some **appliances and electrical fixtures** tend to produce large amounts of electromagnetic radiation. The worst offenders are usually microwave ovens, compact fluorescent light bulbs, televisions, shavers, and fans. **Wireless** phones have low output but their frequency of operation is typically in the most dangerous region of the electromagnetic spectrum. Cell phones and **SMART** meters are especially hazardous since the **microwave**

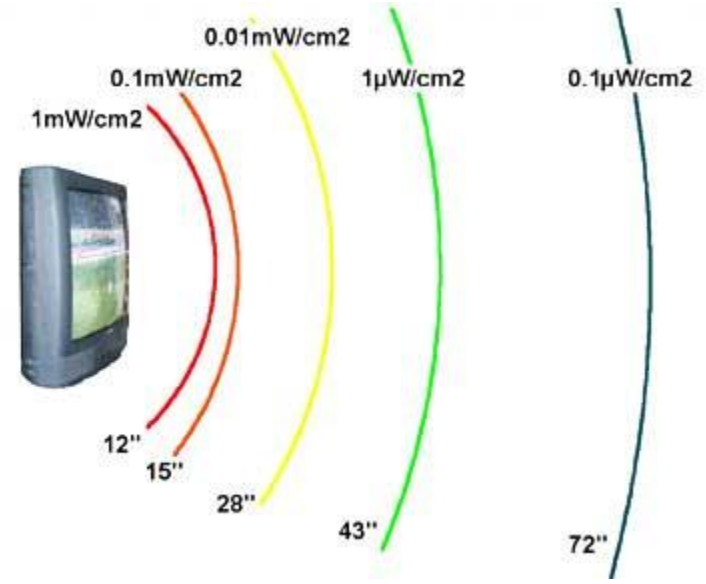
**radiation** they emit is close to body /user's head. **Digital** phones have less average power than the **Analog** types. Exposure **is cumulative**. In **"**waiting" mode radiation levels are lower on average.

**Compact fluorescent bulbs** have a noisy high voltage, high frequency circuit inside to trigger and maintain their glow. As the operating frequency of these bulbs is below the AM radio band, there are no restrictions on the electromagnetic radiation that they generate; manufacturers strive to make the lowest cost bulbs using unshielded circuits that generate very high field levels. An example of a compact fluorescent bulb is shown below. The field strength within one inch of the bulb is an incredible 100mW/cm$^2$.




**Luminescent tubes working with new ballasts** operate in kHz (VLF – radio) range, with their tube plasma emitting (radio) MHz range strong scalar, high-penetration capability elevated broad band EM radiation when striking matter (gas, liquid, solid object, human tissue, especially the brain) – 1 milli W/cm$^2$ at one meter distance (1,000 micro Watt/cm$^2$) – above the ***Canada Safety Code 6***. Such new lights are often provided by utilities for free in order to save energy. The mechanism for the effect is described as HRM effect (a ***Heterodyne Resonance Mechanism***) and involves longitudinal waves, and are picked up by the **Essentia**™ ***EM2*** meter. Such waves are powerful enough to break and re-arrange weak hydrogen bonds, liable to cause mutation, somewhat like radioactivity (**ionizing radiation**)[1].

**Televisions and computer monitors** are being superseded by LCD technology but consumers still use cathode ray tube (CRT) devices that contain a high voltage power supply and electron gun that beam electromagnetic radiation and X-rays. A 27" TV has a high emission at 12 to 15" from the screen. Safe watching distance is beyond the lime green line at 43".

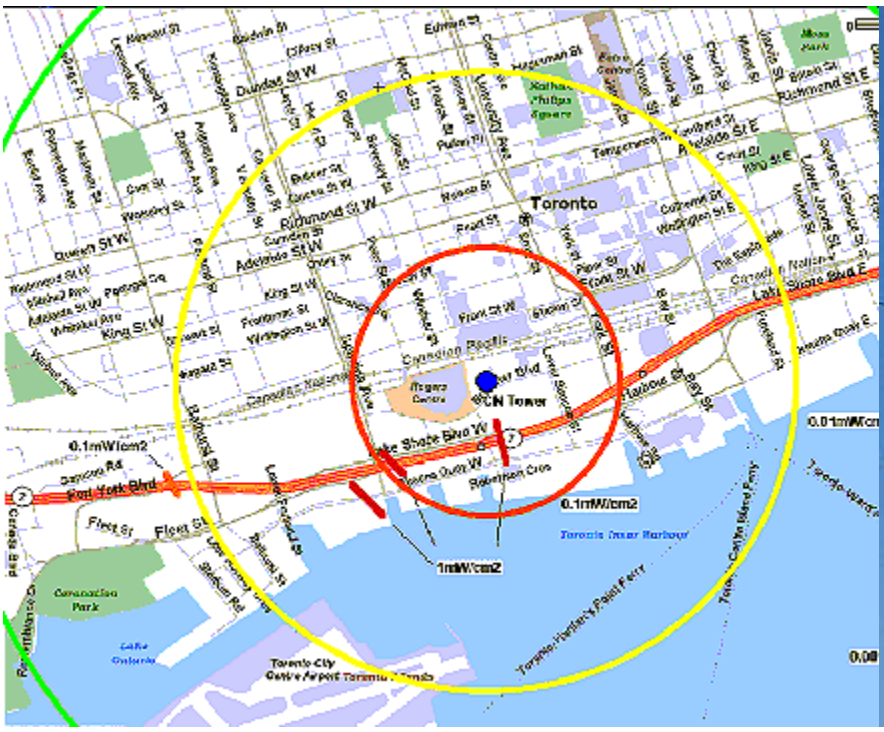



[1] Communication from Dr. Stoyan Sarg, York University

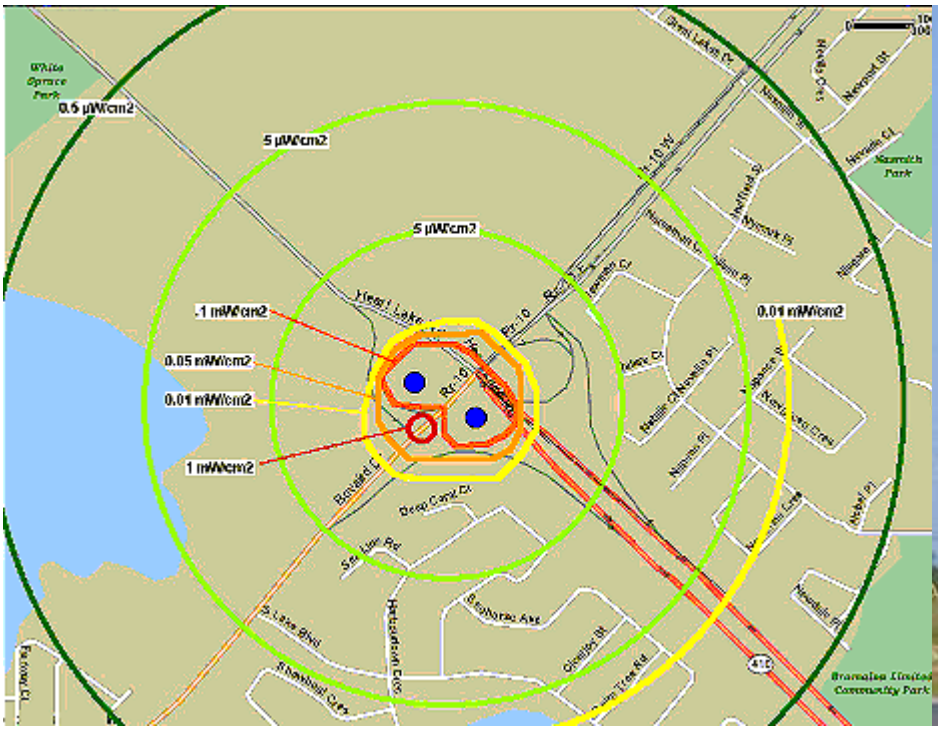
**Outdoor measurements**

**Cities** have become a **network of microwave generators** on towers - on apartment buildings, transmission lines towers and on hand. Add to this the myriad of **emergency and safety transmitters**, **TV** and **radio broadcast towers**, **airport navigational and communication** systems, **amateur radio** operators and **military communications**. To make matters worse, each cell network provider has their own network, multiplying the exposure by the number of providers. Especially around major highways and urban cores, **radiation levels can be dangerously high**. **Rural routes** are near **cell** & **SMART** meter network towers. Electromagnetic radiation from **FM radio stations**, **aircraft** and **police communications** and **TV** stations are the most dangerous due to their resonance with the human body (30 and 300 MHz). Radio and TV towers are often located on top of tall buildings, on fixed towers or phased array tower farms and because of their power (often **tens of thousands of watts**) and long range care must be taken in their presence.

The Toronto CN Tower is an example of a multi-use tower with broadcast and communications of many types. Microwave transmitters exist hidden by an air inflated Radom below the deck as seen below. The radiation pattern around CN Tower affects the highway that is about 20 feet (7m) above ground, along which ***EM2*** readings are *10 times higher than at ground level*.



**Wireless devices** transmit 0.1 to 1 watt depending on service. **Cell towers** are typically limited to 500 Watts of effective radiated power (ERP) per channel for large towers and less than 100 watts for smaller towers in urban areas. *Micro* and *pico* installations on building sides or between floors may have ERPs of less than 10 watts per channel. A typical tower can have 63 channels with an effective power of 6.3kW. Figures reported from government[2] claim emissions at the base of cell towers are very low, perhaps 1µW/cm$^2$. Though true, it may be somewhat misleading, since the transmitters are directional and aimed so that their maximum power density will hit ground at some distance from the tower, usually several hundred meters away from base. To understand radiation around a tower, readings are taken at several distances and at different heights. The figures below show an example of a twin tower installation. Stealth towers are shown further down.

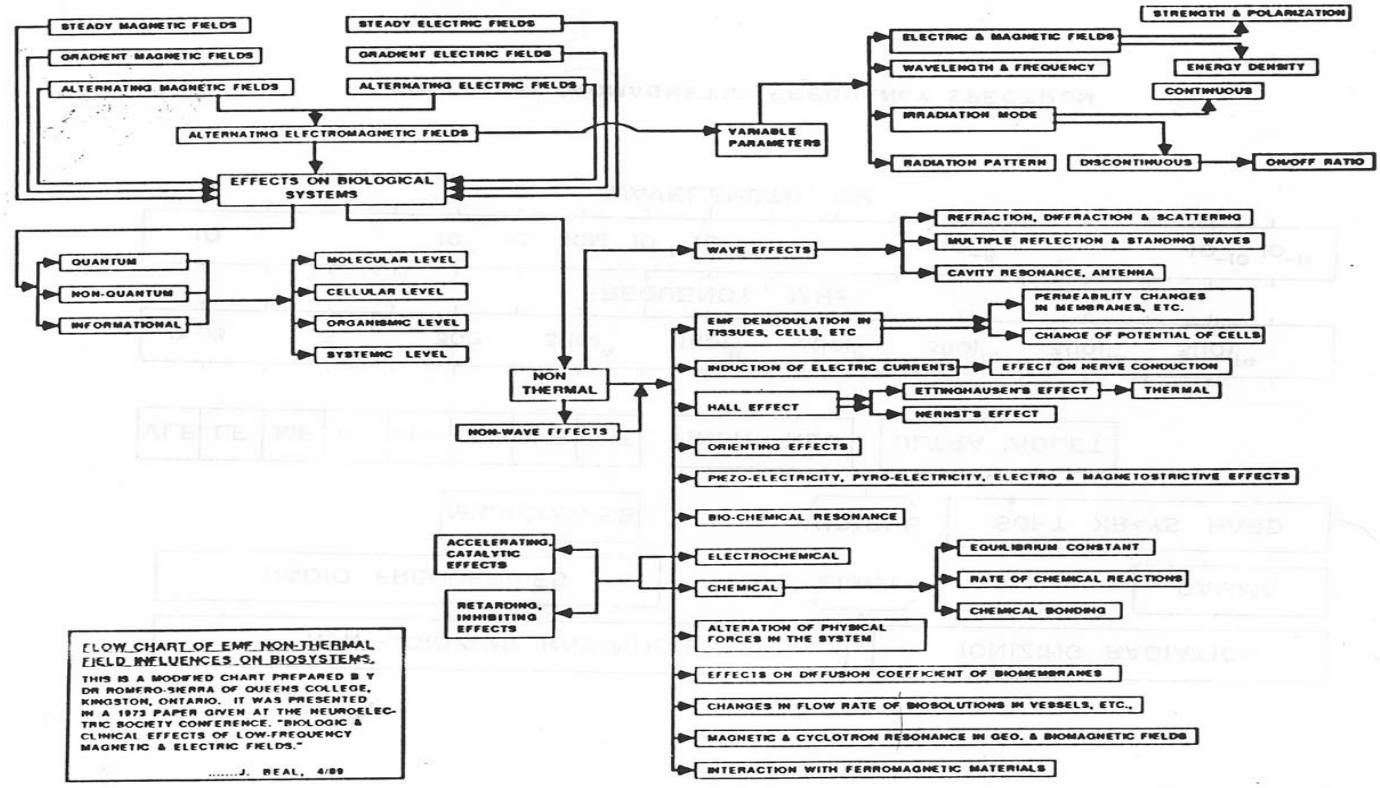


**High voltage AC transmission** lines are usually strung on towers at various levels above the ground. Due the high voltage, the ELF (extremely low frequencies) electromagnetic field around these structures is intense. The figure below shows a segment of a transmission line containing two parallel sets of lines.

[2] Information On Human Exposure To Radiofrequency Fields From Cellular and PCS Radio Transmitters. FCC website www.fcc.gov/oet/rfsafety/cellpcs.html

The red lines are directly below the high tension wires. The radiation from AC power drops off very rapidly as you move away from the lines but levels off at 0.01mW/cm$^2$ over highway 407 and the adjacent residential neighborhood. The green line, indicating a level of 1µW/cm$^2$ begins at 1.5km from the power lines.

**The best advice is to be aware of the sources of radiation** and the **Essentia**™ ***EM2*** meter can help monitor the overall impact of man-made electromagnetic fields, whose non-thermal effects, whether non-wave, or wave, accelerating or inhibiting are shown from the 1972 National Research of Canada flow chart below



# Essentia™ Electromagnetic Monitor *Model: EM2*

**Specifications:**
Frequency response: 50Hz to 10GHz with decreased response up to 18GHz
Sensitivity range: 0.005µW/cm$^2$ to 40*m*W/cm$^2$
Accuracy: +/- 10% 50Hz to 10GHz
Battery life: 9V Duracell, approx 50 hours
Temperature range: 0 – 40$^o$C, 32 – 100$^o$F
Mode of detection: Electric Field

**Made in Canada**

# ESSENTIA

100 Bronson Avenue, Suite 1001,

Ottawa, Ontario K1R 6G8, Canada

(613) 238-4437 / **(888) 639-7730**

essentia@essentia.ca

www.essentia.ca