

Information About EMFs & Safety Levels¹

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What Are the Health Concerns?

Published studies from around the world have linked electromagnetic fields (EMFs) to increased risks for several types of cancer, as well as increased stress, suppression of the immune system, cellular and hormonal changes, and even depression and suicide. As of 2020, several thousand studies have reported important biological effects related to EMFs.^{Note 1}

Some of the specific illnesses include leukemia, lymphoma, brain tumors, melanoma, breast cancer, asthma, Alzheimer's disease, Lou Gehrig's disease, miscarriage and birth defects. Anecdotally, EMFs are often associated with sleep problems, headache, fatigue, anxiety, confusion, irritability, memory loss, dizziness, itchy or burning skin, tinnitus, and many other symptoms.¹

There are three main types of EMFs. All three types of EMFs have been linked to adverse biological effects. Each type of EMF is measured with a different kind of test instrument:

- A. **ELF Magnetic Fields** are the particular EMF component most often linked to serious health effects – such as childhood leukemia and other cancers – in the research studies. Common sources include electric power lines, electrical wiring, lighting fixtures, electric appliances and most electrical devices. Wiring problems and stray electrical current in metal pipes can also create surprisingly high levels. Magnetic fields are measured with an ELF gaussmeter, in units such as “milligauss” (mG).^{Notes 1, 2}
- B. **ELF Electric Fields** are also linked to important biological effects, but have been studied far less. Anecdotally, they are often involved when people feel “sensitive” to electromagnetic fields. Common sources include hidden electrical wiring, power cords for lamps and devices, and power lines. Electric fields create unnatural AC electric voltages on the skin, which can be measured directly with a Body Volt Meter, in units such as “Volts AC”.^{Notes 1, 2}
- C. **RF Fields** (*Radio Frequency Fields, including Microwaves*) have also been linked to a variety of cancers and other health effects. RF fields are commonly emitted from electronic and wireless equipment – including cell towers, cell phones, Wi-Fi routers, Smart Meters, computers, microwave ovens, radar, TV/radio station towers, automobiles, baby monitors, security systems, and much more. They are measured with an RF test meter, in units such as “microwatts per centimeter squared” ($\mu\text{W}/\text{cm}^2$), or “volts per meter” (V/m).^{Notes 1, 3}

Special Note: There is great controversy about the potential health effects from EMFs. Please refer to the proper medical authorities and scientific literature to make your own decisions regarding possible health effects and safety levels.^{Note 1} And the attached “*What EMF Level is Safe?*” chart shows some of the common EMF exposure guidelines that you may wish to consider.^{Notes 1, 4}

Note 1 I am engineer, and not a medical doctor. I cannot diagnose or treat any EMF-related health concerns. Please consult with your own doctor or other health professional regarding EMF exposure guidelines.

Note 2 Extremely-Low-Frequency or “ELF” is the EMF frequency range which includes the common 60 hertz (60 cycles-per-second) electric utility power used in the US/Canada and the 50 Hz power in Europe.

Note 3 “Dirty Electricity” occurs when unwanted RF frequencies are added to the ELF magnetic and electric fields – due to the use of electronic dimmers, fluorescent lights, solar inverters, smart meters, etc.

Note 4 Some of this information is anecdotal, based on my 28+ years of professional experience with clients.

What EMF Level is Safe?

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Possible Safety Levels to Consider (Notes 1 & 4)	ELF Magnetic Fields	ELF Electric Fields	Radio Frequency Fields or "RF" (Includes Microwaves)		
			Microwatts per meter ² ($\mu\text{W}/\text{m}^2$)	Microwatts per cm ² ($\mu\text{W}/\text{cm}^2$)	Volts per meter (V/m)
Unit of Measurement (Abbreviation)	Milligauss (mG)	AC Volts on skin (V or VAC)			
Lowest Level Linked to Cancer ^{5, 6}	1.0 (2.0) ⁵	unknown	2000 ⁶	0.2 ⁶	0.87 ⁶
Average Level in Homes ⁷	0.5 – 1.0	0.5 – 2.0	1 – 5000	0.0001 – 0.5	0.02 - 1.4
Building Biology, Severe Concern ⁸	1.0	0.1 (sleep)	10	0.001	0.061
BioInitiative Report ⁹	1.0	n/a	3	0.0003	0.034
General Public Precautionary ¹⁰	0.5	1.0 (sleep 0.5)	100	0.01	0.19
EMF Hypersensitivity Advice ¹¹	0.1	0.1	1	0.0001	0.02
Official FCC Safety Limit ^{12, 13}	n/a	n/a	10,000,000	1000 ¹³	61.4 ¹³
ICNIRP for General Public ¹²	2000	n/a	10,000,000	1000 ¹³	61.4 ¹³

⁵ The Lowest Level Linked to Cancer for Magnetic Fields: The strongest evidence comes from the Swedish epidemiological study which reported increased leukemia for children at levels of 2.0 mG or more (Feychting & Ahlbom, 1993). And a German study has linked exposures as low as 1.0 mG to reduced survival rates of children trying to recover from leukemia (Svendsen, Weikopf, Kaatsch & Schuz, 2007).

⁶ The Lowest Level Linked to Cancer for RF is from two Australian studies of radio/TV broadcast towers that found increased childhood leukemia at levels as low as 0.2 microwatts/cm². The first (Hocking, 1996) found that leukemia death rates were more than double for the exposed children. The second (Hocking, 2000) found that children trying to recover from leukemia were twice as likely to survive in a lower exposure home.

⁷ The Average Level in Homes for *magnetic fields* is derived from nationwide research studies and confirmed in my own testing experience. The average levels for *electric fields* and *RF fields* are estimates from my own 28 years of professional testing in the San Francisco Bay area.

⁸ The Building Biologists' Severe Concern levels are from the "Building Biology Evaluation Guidelines" published by the Institute for Baubiology. (Go to <https://buildingbiology.com/site/wp-content/uploads/richtwerte-2015-englisch.pdf> .)

⁹ The BioInitiative Report Recommendations are from the 2012 update of the "BioInitiative Report: A Rationale for a Biologically-Based Public Exposure Standard for Electromagnetic Fields". (Go to www.bioinitiative.org. For a list of the RF studies reporting adverse health effects and the associated RF levels, go to <https://bioinitiative.org/rf-color-charts/> .)

¹⁰ The General Public Precautionary levels are my own offering to healthy concerned clients based on my own understanding of the EMF research, and leaning towards caution. For example, for *magnetic fields*, to offer some margin of safety below the 1.0 mG linked to cancer, I might suggest a safety level of 0.5 mG.

¹¹ The EMF Hypersensitivity Advice levels are my own suggestions – based upon anecdotal evidence by EMF consultants (like myself) who often find it necessary to reduce EMFs to these levels in order for most highly sensitive people to report relief of their symptoms. However, there is no guarantee that these levels will be low enough for any particular individual.

¹² The FCC Safety Limit is the US "Maximum Permissible Exposure for the General Public" in FCC/OET Bulletin #56 (www.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet56/oet56e4.pdf). The ICNIRP Guidelines are from the commonly cited 2010 publication by the International Commission on Non-Ionizing Radiation Protection (<http://www.icnirp.org/cms/upload/publications/ICNIRPLFgdl.pdf>).

¹³ The official safety level depends on frequency. Value shown is for RF frequencies of 1500 MHz (1.5 GHz) and higher.