

What are “electromagnetic fields”?

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INTRODUCTION

We often see in the popular press, and in related technical articles, discussion of the possible adverse effects of the “electromagnetic fields” surrounding high-voltage transmission lines on plants, animals, or humans. We may know of *electric fields*, and *magnetic fields*, and *electromagnetic radiation* (which involves both of those kinds of fields). But just what are “electromagnetic fields”?

This article discusses what seems to be the meaning of “electromagnetic fields” in that area of interest and also in the area of formal physics. Considerable technical background is given, but only to such detail as is needed to support the topic of the article. No mathematics is involved. Appendixes cover related matters.

The article solely covers the terminology involved and its technical underpinnings. It does not discuss any matters of the adverse effects of various of the phenomena on plants, animals or humans.

1 THE QUICK ANSWER (FOR THE IMPATIENT READER)

For those readers who would be tempted to go “to the back of the book” and see the answer, here it is, in simplified form. The answer might not be fully meaningful to those not familiar with the technical background involved—that’s why the rest of the article is here!

- In formal physics, “electromagnetic field” refers to the combination of electric and magnetic fields that occur as electromagnetic radiation (such as a radio wave) is being generated, or in the radiation itself
- As encountered in the popular press, typically in writing about concern with possible physiological effects, and in related technical articles, “electromagnetic fields” most often means “electric fields and/or magnetic fields” but may in some cases also include electromagnetic radiation.

2 ELECTRIC AND MAGNETIC FIELDS

Two kinds of field play major roles in this story.

2.1 Electric field

Imagine that we have two metal plates, separated (let’s say in air) by a certain distance. We apply a certain electrical voltage between the two plates.

This creates between the two plates an *electric field*, the direction of which is perpendicular to the plates.

2.2 Magnetic field

Consider a straight electrical conductor carrying a certain current. At any point outside the wire, there is a *magnetic field*. Its direction is around a circle centered on the wire.

2.3 Time-varying fields

Of course the strength of an electric or magnetic field may vary over time, as a result of variation of the voltage (for the electric field) or current (for the magnetic field) that generates the field. If that voltage or current is what we consider an AC voltage or current, then we can think of the resulting field as being an “AC field”.

2.4 Those fields are stationary

It is important to note that either kind of field, of itself, is stationary. That is, it does not move in space (propagate). Accordingly, the phenomenon of an electric or magnetic field, of itself, even an AC one, does not qualify for the name “radiation”.

3 ELECTROMAGNETIC RADIATION

3.1 Introduction

Electromagnetic radiation is a physical phenomenon manifested, along a certain path in its travel, as an *electromagnetic wave* (of which a *radio wave* is a well-known example). In that wave we have an AC electric field and an AC magnetic field, with their directions at right angles, each varying at some frequency in synchronism with the other.¹

¹ For our purposes here we can consider *electromagnetic radiation* and *electromagnetic wave* to be interchangeable. For uniformity, I will mostly speak of *electromagnetic radiation*.

3.2 Propagation

This phenomenon propagates through space (“at the speed of light”²) and it is that property that earns this phenomenon the name “radiation”. As the radiation propagates, it transports energy. As the radiation propagates, the energy shifts back and forth between the electric and magnetic fields at the frequency of the radiation. The electric field generates the magnetic field, and the magnetic field generates the electric field. It is a wondrous “team collaboration.”

3.3 “Radio frequency”

Electromagnetic radiation is theoretically possible at any frequency. For a certain range of frequency, this phenomenon is spoken of as a “radio wave”, and the abbreviation “RF” (radio frequency) is often applied to such radiation or to the electrical signals that produce it.

3.4 Other forms of electromagnetic radiation

Light is the same phenomenon, albeit at a gigantically-high frequency. And x-rays are the same phenomenon, at an even higher frequency.

3.5 Universal ratio between the strength of the two fields

It turns out that for any electromagnetic radiation, no matter its frequency, or its source, or how far from then antenna we are, or how “potent” the radiation is at that point, for propagation through any given medium (*e.g.*, vacuum, air), the ratio of the strengths of the electric and magnetic fields is always the same (dictated by fundamental laws of physics).

3.6 Wavelength

We will soon encounter the concept of the *wavelength* of electromagnetic radiation at any given frequency.

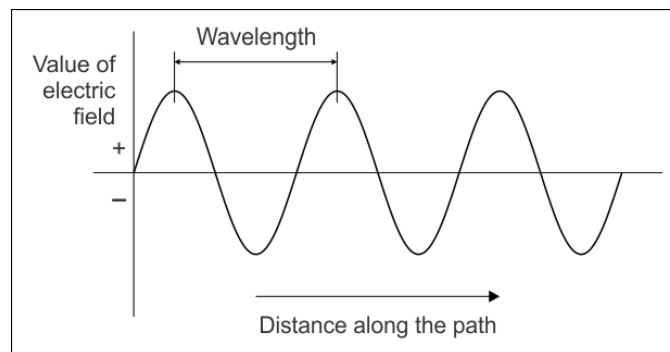


Figure 1. Electric field of an electromagnetic wave

² Not a surprise since light is in fact a form of electromagnetic radiation.

Figure 1 is a plot of the value of the electrical field of an *electromagnetic wave* (that is, electromagnetic radiation considered in its travel along a certain path) at some instant.

We note that along the path of the wave the electric field has both positive and negative values (just like the voltage of an AC electrical signal).

The distance along the direction of travel of the wave between two adjacent occurrences of, say, its positive maximum is defined as the *wavelength* of this wave.

The wavelength of an electromagnetic wave is proportional to the reciprocal of its frequency, thus:

$$\lambda = \frac{c_m}{f} \quad (1)$$

where λ (lower case Greek *lambda*) is the wavelength, c_m is the velocity of light (in the medium of propagation involved), and f is the frequency of the wave.

For perspective, note that the wavelength of electromagnetic radiation at a frequency of 2.4 Ghz (as used in, for example, Bluetooth wireless communication between electronic devices) is about 125 mm, or almost 5 inches.

But if we consider electromagnetic radiation at 60 Hz (the usual frequency of AC electrical power lines in the US), we would find that its wavelength is about 5000 km, or about 3100 miles!

3.7 The near and far fields, and in between

We often simplistically think in terms of electromagnetic radiation being created “right there” by an antenna energized by an AC voltage at the frequency of transmission.

But if we look a little more closely, we find that immediately at the antenna that antenna has generated an AC electrical field and an AC magnetic field, synchronized with each other, at some frequency.

The ratio of their strengths is not (necessarily) the universal ratio between the strength of the electric and magnetic fields in electromagnetic radiation. Each is not caused by the other; they are both caused by the antenna. So we can see that, even considered together, they do not seem to constitute “electromagnetic radiation.”

But most importantly, these fields do not propagate through space; they are “stationary” (although they vary in time at the frequency involved). It is for that reason that, even taken together, they are not considered “radiation”.

However, as we move outward from the antenna, we find that these stationary AC fields gradually give birth to the actual *electromagnetic radiation* phenomenon, where an AC electric field and an AC magnetic field travel together, each feeding the other, and which propagates through space at the speed of light, carrying energy as it goes.

And because this phenomenon does propagate through space, it earns the name “radiation”.

As we go along some direction of the propagation of this being-born electromagnetic radiation, the strengths of the stationary electric field and the stationary magnetic field decline. Their energy is sacrificed to the birth of the electromagnetic wave.

Now over what span of distance does this process of birth complete? If we look at the math involved, we find that theoretically it never completes. That is, at an arbitrary great distance from the transmitting antenna, there is still some remnant of the two stationary fields, albeit microscopic in strength.

The scale of this transformation process is proportional to the wavelength of the frequency involved.

Although this process never actually “completes”, for convenience of calculation we often arbitrarily consider that at a distance of 2 times the wavelength from the antenna or more, the process is so nearly complete that we consider the electromagnetic radiation to be completely formed, and the stationary fields completely gone (sacrificed to the birth of the electromagnetic wave).

We describe that as the “far field” situation.

In that same vein, over a distance from the antenna out to 1 times the wavelength we arbitrarily consider that the stationary fields are of constant strength and no electromagnetic radiation has yet been born.

We describe that as the “near field” situation.

In the intervening region of distance from the transmitter from 1 times the wavelength to 2 times the wavelength, we arbitrarily consider that there exist both the stationary fields and electromagnetic radiation, as though the transformation from one to another wholly takes place in the “no man’s land” between the near field and far field regions.

We may speak of that region as the “transition region”

4 QUANTIFYING THESE PHENOMENA

The “strength” of electric fields, magnetic fields, and electromagnetic waves can be quantitatively specified with various units. This is discussed in Appendix A.

5 THE “ELECTROMAGNETIC FIELD”

5.1 Introduction

Here we get to the actual question that is the title tune of this article: “what does ‘electromagnetic field’ mean?”

5.2 In physics

In formal writing in the area of physics, the term “electromagnetic field” refers to, throughout the saga of the birth of electromagnetic radiation, the collective phenomena of both an AC electric field and a companion synchronized AC magnetic field, whether stationary precursors to the electromagnetic radiation, as components of the actual propagating electromagnetic radiation, or a mixture of the two.

Note that here, “electromagnetic field” does not refer to some phenomenon different from the electric field or the magnetic field. It just collects related instances of those two (like the term “steak and potatoes”).

There are several ways to mathematically describe such an electromagnetic field. One way describes its electric field aspect as a vector quantity, and also its magnetic field aspect as another vector quantity (both functions of space and time—the “where and when”).

Another way is with a mathematical tensor that in effect combines both those descriptions (also a function of space and time).

5.3 In the popular press

5.3.1 *Introduction*

In the popular press, we may find discussions of concerns that plants, animals, or humans may be physiologically damaged by extended exposure to what are almost always described as “electromagnetic fields” (often abbreviated as “EMF”) generated, for example, by high-voltage electrical transmission lines, or perhaps by cellular telephone towers. What are those “electromagnetic fields”?

5.3.2 *Electromagnetic radiation?*

We might from the term at first think that the phenomenon mentioned is *electromagnetic radiation*. But a prominent subset of this area of concern relates to phenomena generated by power transmission lines, operating in the US at a frequency of 60 Hz.

if we delve into the math involved, we find that even in the case of a 60 Hz transmission line operating at an extremely high voltage, and whose conductors carry immense currents, the resulting electromagnetic radiation even on the ground directly under the transmission line is of inconsequential strength.

This is a consequence of the large wavelength of that frequency, so at such a point we are just at the very beginning of the “near field” region (as discussed in Section 3.7), in which we consider the actual electromagnetic radiation to have not yet been born to any degree. So it generally warrants no attention in this specific area of discussion. It can’t there be considered as what is meant by “electromagnetic fields”.

5.3.3 *The same as used in physics?*

Or perhaps the reference is to the electromagnetic field as the term is used in physics (as discussed in Section 5.2). But no.

5.3.4 *What it does mean*

It turns out that in this area of interest, the term “electromagnetic field” usually means “electric fields, or magnetic fields, or (maybe) electromagnetic radiation”.

5.3.5 *What it is not*

Note that here, “electromagnetic field” does not refer to some phenomenon different from the electric field, the magnetic field, or electromagnetic radiation. It is just a term that refers to any of those, whichever is of importance in a particular discussion.

5.4 In related technical articles

In technical (but not “learned journal” level) articles about this particular area of concern, “electromagnetic fields” is often used in this same way: not to describe a unique physical phenomenon, but rather to mean electric fields, or magnetic fields, or maybe electromagnetic radiation.

6 ABOUT “ELF” PHENOMENA

Often, especially in discussions of the possibility that electric and/or magnetic fields could have physiological effects, we see the abbreviation “ELF”³ (extremely low frequency) mentioned, sometimes even as the seeming descriptor of some particular physical phenomenon. The usage there is a bit tricky, and is discussed further in Appendix B.

7 CONSUMER “EMF METERS”

There are available at the consumer level instruments that are typically described as “EMF meters”. These are suggested for use to assess the level of exposure to “electromagnetic fields” that may be found near electrical transmission lines, or (for some meters) perhaps emanated from a nearby cellular telephone base station (“cell tower) or from such appliances as microwave ovens, or the Wi-Fi hub in a home’s computer system,. They are often commonly described as also being of use in “ghost hunting”. These are discussed further in Appendix C.

8 EFFECT ON ANIMALS AND HUMANS

Although it is almost only in discussions of the possible adverse effect of the phenomena discussed in this paper on animals and humans that we encounter the use of the term “electromagnetic fields”, those matters themselves are far outside the scope of this article (and the ken of this author).

But it is of note that in writings that discuss some specific harm to animals or humans, possibly even suggesting the physiological mechanisms of that harm, almost always the phenomenon involved is specifically the electric field. or the magnetic field, or electromagnetic radiation.

So, while ascribing that harm to “electromagnetic fields” is not false (under the meaning of that term used in this area of interest), it inappropriately suggests the existence of some phenomenon that is not the electric field, or the magnetic field, or electromagnetic radiation.

9 ELECTROMAGNETIC HYPERSENSITIVITY

This is also related to the topic of this article only by way of the use of the terminology discussed here.

³ Usually said “E-L-F”, not “elf”.

Electromagnetic hypersensitivity is an ailment in which an individual is said to seemingly be overly-sensitive to “electromagnetic radiation”, usually in an adverse way.⁴ But what phenomena are considered “electromagnetic radiation” in this regard?

It seems that the scope of the ailment includes over-sensitivity to electric fields, and/or magnetic fields, and/or electromagnetic waves (electromagnetic radiation). That is, the meaning of “electromagnetic radiation” here is essentially the same as elsewhere in the area of concern over adverse effects of “electromagnetic fields” on animals and humans.

10 OTHER USES OF THE TERM

In some contexts, “electromagnetic fields” is used when it is in particular *electromagnetic radiation* that is of interest. While, based on the usage in formal physics, “electromagnetic fields” does include the **fields** that are the sole components of electromagnetic radiation, in my opinion the use of the term “electromagnetic fields” (rather than “electromagnetic radiation”) to refer to this phenomenon unduly obscures what is really meant.

We most often see this usage in publications relating to the adverse physiological effects of electromagnetic radiation.

11 THE OTHER “EMF”

One reason that electrical engineers, first encountering “EMF” in the context of concern with the effects of such on animals and people, are baffled⁵ is that “EMF” has a long history of use in the field of electrical engineering, as the abbreviation for *electromotive force*.

That is actually the formal name for the electrical property usually today described as “voltage”. The name comes from the fact that this property describes with what force the electrical phenomenon of interest motivates electrons to move through a circuit (thus creating an electrical current).

As this area of study progressed, this property was defined to be denominated in the unit *volt*.

⁴ Perhaps the most well-known case today is that of a fictional character, Chuck McGill in the TV series “Better Call Saul”.

⁵ Myself included

As a result, perhaps because the term “electromotive force” was rather clumsy, in practical work that property was usually spoken of as the “voltage” of a certain circuit. And that eventually became the official term for that property in, for example, the International System of Units.⁶

But there were a few situations where, for some reason, the historical term “electromotive force” continued in use (albeit often only abbreviated as “EMF”). For example, in a certain type of electric motor, the “stator” (the stationary part) carries coils that generate a magnetic field. There are coils in the “rotor” (the rotating part) that are fed with a voltage, which causes a current to flow through them. The result is that those coils experience a physical force that leads to a torque that turns the rotor.

But as the rotor coils travel through the magnetic field from the stator, that generates a voltage in the rotor coils (just as would be the case of a generator). That voltage is inherently opposite in direction from the voltage applied to the rotor coils, and thus counters that voltage, leading to a lower net voltage to energize the rotor.

In fact, at a certain speed of rotation, and assuming a certain load on the motor at that speed, this situation reaches equilibrium, the net voltage on the rotor windings causing a current that creates a torque on the rotor just matching the load on the motor, and the motor continues to turn at that equilibrium speed.

But, for whatever historical reason, that *voltage* that is generated in the rotor coils is almost always called by the historical name as the “counter electro-motive force”, or more commonly, the “counter EMF” (or sometimes the “back EMF”).

And of course this meaning of “EMF” has nothing to do with the other two meanings of “EMF” discussed in this article.

12 SUMMARY

- As encountered in the context of formal physics, “electromagnetic field” refers to the combination of the stationary synchronized AC electric and magnetic fields that are the precursors of electromagnetic radiation; or the combination of the fields that are the components of propagating electromagnetic radiation (as an

⁶ You might think that for a similar reason, electrical *current*, dominated in the unit *ampere*, would have come to be called in practical work “amperage”, and while there is some history of that, it did not become the usual, or “official”, term.

electromagnetic wave); or the overall combination of the fields of both types (both stationary and propagating) that we consider to exist in the “transition region”. Note that here, “electromagnetic field” does not refer to some phenomenon distinct from the electric field or the magnetic field.

- As encountered in the popular press, typically in writing about concern with possible physiological effects, and in related technical articles, “electromagnetic fields” most often means “electric fields and/or magnetic fields” but may in many cases also includes electromagnetic radiation. Note that here, “electromagnetic field” does not refer to some phenomenon distinct from an electric field, a magnetic field, or electromagnetic radiation.

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Appendix A

Quantifying these phenomena

A.1 INTRODUCTION

The “strength” of electric fields, magnetic fields, and electromagnetic waves can be quantified in different ways, various units being involved. This appendix summarizes that situation.

In this discussion, “SI” is used to refer to the International System of Units, the “modern metric system”, whose units are preferred for use especially in scientific and engineering work

A.2 ELECTRIC FIELDS

The strength of an electric field, symbolized mathematically as E , is stated in *volts per meter* (V/m), a composite SI unit. As with all SI and composite SI units, multipliers may be used.

The usual SI multiplier prefixes (*mili*, *kilo*, etc.) may of course be applied. That is, an electric field strength of 0.04 V/m may be stated as 40 mV/m.

In the case of an AC electric field, which varies over time, it is usually the root-mean-square (RMS) measure of the field strength that is stated,

A.3 MAGNETIC FIELDS

A.3.1 Two meanings

Here we can be confounded by the fact that, throughout the technical literature, “magnetic field” can be used to denote two related properties of a magnetic field phenomena. It is as if, in an electric circuit where two related but distinct properties are the *voltage* and the *current*, we would speak of both as, to make up an example, “the electric strength”.

A.3.2 Magnetic flux density

Without getting further into this tricky problem, I will note that in the area of interest considered in this article, the “strength of a magnetic field” usually means the property that is called in the SI the “magnetic flux density” of the field. Its mathematical symbol is B .

As to the units, wide use is made of two units. The SI unit of magnetic flux density is the *tesla*⁷ (T). This unit is used today in essentially all contexts in Europe, and hopefully in serious technical writing in the United States.

But still in much technical writing in the United States, and almost universally in the area of interest discussed here, the older (and non-SI) unit the gauss⁸ (G) is used⁹. It is related to the tesla (T) thus:

$$10,000 \text{ gauss} = 1 \text{ tesla} \quad (\text{exactly})$$

Again, in either case, the usual SI multiplier prefixes (*mili*, *kilo*, etc.) may of course be applied.

In the case of an AC magnetic field, which varies over time, it is usually the root-mean-square (RMS) measure of the magnetic flux density that is stated.

A.3.3 Magnetic field strength

But as to the second property that is often called the strength of the magnetic field, its SI name is *magnetic field strength*. Its mathematical symbol is *H*.

Its SI unit is a composite one, the ampere-meter.

Again, in the case of an AC magnetic field, which varies over time, it is usually the root-mean-square (RMS) measure of the magnetic field strength that is stated.

A.4 ELECTROMAGNETIC RADIATION

A.4.1 Introduction

The “strength” of electromagnetic radiation at some point in its travels is commonly stated in one of two forms.

⁷ Named in honor of the brilliant but decidedly eccentric pioneer in the field of electricity and its applications, Nikola Tesla.

⁸ Named in honor of the German mathematician and physicist Carl Friedrich Gauss, a major contributor to the scientific understanding of magnetism

⁹ For SI units named in honor of a person, the unit name is not capitalized (“volt”) but the abbreviation is (“V”). But the gauss is not an SI unit, so that rule does not apply, and the traditional abbreviation for that unit is “G”.

A.4.2 Areal power density

We can state the *areal*¹⁰ *power density* (usually said as just “power density”) of the radiation at the point of interest. This is the amount of power transported by the radiation per unit area of an infinitesimal region of a hypothetical plane through that point, perpendicular to the direction of propagation of the radiation.

The areal power density of electromagnetic radiation is the product of the electric field strength (E) and the magnetic field strength (H).

The SI unit for this property (an SI composite unit) is the *watt per square meter* (W/m²). As always, SI multiplier prefixes are used when appropriate.

This is the notation used in most scientific work, and is also used in some regulatory contexts.

In the case of an AC electromagnetic wave, where the areal power density varies over time, it is usually the time average of the areal power density that is stated.

A.4.3 Electric field strength

In an electric circuit the power is the product of the voltage and the current.

In a somewhat similar way, in electromagnetic radiation the areal power density is proportional to the product of the strength of the electric field and the strength of the magnetic field.

But, as I mentioned in Section 3, in a given medium through which electromagnetic radiation propagates (and we are most often concerned with that being air), the ratio of the strength of the electric field to the strength of the magnetic field is always the same.

Thus, the areal power density is proportional to the square of the strength of the electric field (on an RMS basis).

Accordingly, we can quantify the strength of electromagnetic radiation at a certain point in terms of the strength its electric field¹¹.

¹⁰ “Areal” means “pertaining to area”. It is often confused with “aerial” (which essentially means “pertaining to air”).

¹¹ Yes, alternatively we could also state the strength of the magnetic field, But the nature of the unit of an electric field has been much more easily grasped than the nature of the unit of magnetic flux density, and so the electric field got the honor of this form of notation.

As we saw above, the basic SI composite unit for electric field strength is the volt per meter (V/m). As always, SI multiplier prefixes are used when appropriate.

This is the notation used in much radio engineering work, and is also used in some regulatory contexts.

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Appendix B About “ELF” phenomena

B.1 ITU RADIO FREQUENCY BANDS

With respect to radio waves, the International Telecommunication Union (ITU) classifies the frequencies of such waves over the total range of 3 Hz-3 THz in terms of a set of decade-wide “frequency bands”.

The lowest of those bands, spanning the frequency range 3-30 Hz, is called the “extra low frequency” (ELF) band. The next of those bands, spanning the frequency range 30-300 Hz, is called the “super low frequency” (SLF band).

A few steps higher we have the range from 30 Mhz-300 Mhz, called the “very high frequency” (VHF) band. At the top of this scheme we have the range from 300 Ghz-3 THz, called the “tremendously high frequency” (THF) band.

While these frequency band designations are intended to be used to describe the frequencies of radio waves, is not unusual to use those band definitions for things that are not radio waves but are related to such (such as radio frequency electrical signals or AC electric and magnetic fields).

Under the ISO scheme, AC electric and magnetic fields with a frequency of 50 Hz or 60 Hz (the frequencies of most AC power lines worldwide) would be considered SLF phenomena.

However, various scientific, regulatory, and advisory bodies, and some authors, use “ELF” to designate a different frequency range, especially with respect to the matters discussed in this article. In fact, in that area of discussion, those 50 Hz-60 Hz phenomena are typically spoken of as “ELF” phenomena, that frequency range usually in that case being considered to run from just above zero through 100 kHz. In other contexts, that range is considered as being from just above zero through 300 kHz

And often, especially in the popular press and related technical articles, the various phenomena of the type being considered here whose frequencies fall in that range are characterized as “ELF” phenomena, without mentioning the nature of the phenomenon being mentioned.

Now, from the broader context, it would seem that what is implied by, for example, “ELF fields” would include *electric fields*, *magnetic fields*, and *magnetic radiation* of frequency in that range. But as I discussed in section 5.3.2, at a frequency of 50 Hz or 60 Hz, the

electromagnetic radiation from an AC power line would be miniscule, As a result, it is “understood” that when mention is made of “ELF fields”, that refers only to *electric fields* or *magnetic fields*. Sometimes we see mention of “ELF-EMF” phenomena, but with that same implication.

In such contexts, when actual electromagnetic radiation is to be mentioned (typically at a frequency of well above 100 kHz) it is characterized as an “RF” (radio frequency) phenomenon, since the frequencies at which is generally practical to generate a usable electromagnetic wave are typically considered the “radio frequencies”.

So, to summarize, in this area of discussion:

- When we see ELF “things” mentioned, almost always the reference is to electric or magnetic fields (and at relatively low frequencies).
- When we see “RF” things mentioned, almost always the reference is to electromagnetic radiation (and at not “relatively low” frequencies).

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Appendix C EMF meters

C.1 INTRODUCTION

There are available at the consumer level instruments that are typically described as “EMF meters”. These are suggested for use to assess the level of exposure to “electromagnetic fields” that may be emanated by electrical power lines, or in the case of some of those meters, from a nearby cellular telephone base station (“cell tower”), or from such appliances as microwave ovens, or the Wi-Fi hub in a home’s computer system, or the computers themselves. They are often commonly described by sellers as also being of use in “ghost hunting”.

C.2 PROPERTIES DETECTED AND MEASURED

Many of those meters are described as being able to detect and report the magnitude of *electric fields* and *magnetic fields* but not of *electromagnetic radiation*. They typically report the strength of detected electric or magnetic fields in the accepted scientific/engineering metrics and units (see Appendix A).

Some units, however, also detect *electromagnetic radiation*. This latter aspect (when present) is most commonly described for use in detecting “RF” (radio frequency) phenomena, since the range of frequencies over which they can detect electromagnetic radiation is that generally considered to be “radio frequencies”.

These devices report the strength of detected electromagnetic radiation in one of the accepted scientific/engineering metrics and units

Devices of this latter kind are often described as detecting “EF/MF/RF” (electric fields, magnetic fields, and radio-frequency electromagnetic radiation).

C.3 FREQUENCY RANGES

One model with that full range of capabilities, made by a well-respected maker of electrical measuring instruments¹², as to the detection of electric fields and magnetic fields has a stated frequency range of 30 Hz-1000 Hz, and thus would be well suited for the detection of such fields generated by, for example, high voltage transmission lines.

¹² Apparently embarrassed by the mention, by sellers of this unit, of its use for “ghost hunting”, as this unit does not appear in their general catalog of measuring instruments.

As to the detection of electromagnetic radiation ("RF"), the unit has a stated range of 50 MHz-3.5 GHz. It would thus not be suited for the detection of electromagnetic radiation from power lines. But as we heard before, the electromagnetic radiation produced by transmission lines operating at the usual US frequency of 60 Hz would be miniscule, and thus does not generally warrant measurement.

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