So called Electrosmog is everywhere, one can't see, hear or smell it. Though it can have serious impact on human health.

Official “limits” protect only from short term heating effects and nothing else.

Now it seems difficult how to go on? Before questioning if someone is perhaps already affected, which is quite possible, in face of the microwave sea we all drown in, one should try to get an overview of his own exposure.

For private users payable, easy to use as well as sufficient correct working meters are so called broadband meters. They have the downside of not being able to show single sources, albeit usually the strongest source can be heard through speaker/headphone. One can hear the characteristic sound (hear examples – [http://microondes.wordpress.com/emf-sounds/](http://microondes.wordpress.com/emf-sounds/)).

Even if for instance GSM-900 and GSM-1800 (mobile phone technology with 900/1800 MHz) can't be differentiated through sound, both have the same. Frequencies are allocated, so if you know the frequency, you know which kind of source you have.

In the mean time there are meters, which for a sound price (few hundred Euro), promise features of spectrum analyzer, which cost thousands. We had been able to test one of those for a short duration and have to admit, we proved what can be read in various tests online. One or another frequency is found correctly, but there are others found that don't exist. Measured values can't be counted on. Our hint, don't spend your money. While searching the Internet you'll sooner or later stumble about this manufacturer and his blue meters, which name we exclude here, because of his extreme aggressive marketing.

This comparison contains meters from 90.- Euro to 1850.- Euro.

The following table contains an overview of the meters in this comparison, the detection range (MHz) is given by the manufacturer, in which the meter should operate with the outlined accuracy. The real detection range is usually a bit broader, in both directions.

_For explanation of abbreviations used please see question 5.(Abbreviation) of the FAQ in this document._
Meters Overview

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Type</th>
<th>Range (MHz)</th>
<th>Values µW/m²</th>
<th>Price Euro (about)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gigahertz Solutions</td>
<td>HF35C</td>
<td>800 - 2500</td>
<td>0,1 - 2000</td>
<td>300</td>
</tr>
<tr>
<td>Gigahertz Solutions</td>
<td>HFE35C</td>
<td>27 - 2500</td>
<td>0,1 - 2000</td>
<td>750</td>
</tr>
<tr>
<td>Gigahertz Solutions</td>
<td>HF38B</td>
<td>800 - 2500</td>
<td>0,01 - 20000</td>
<td>500</td>
</tr>
<tr>
<td>Gigahertz Solutions</td>
<td>HFE59B</td>
<td>27 - 3300</td>
<td>0,01 - 20000</td>
<td>1850</td>
</tr>
<tr>
<td>Rom-Elektronik</td>
<td>HFR-4</td>
<td>600 - 11000</td>
<td>0,01 - 10000</td>
<td>1000</td>
</tr>
<tr>
<td>Cornet</td>
<td>ED15-A</td>
<td>100 - 3000</td>
<td>1,8 - 580000</td>
<td>100</td>
</tr>
<tr>
<td>Sensory Perspective</td>
<td>Microwave Detector</td>
<td>30 - 3000</td>
<td>2,5 - +100000</td>
<td>90</td>
</tr>
</tbody>
</table>

The mostly covered frequency range from about 800 up to 2500 MHz contains GSM mobile radio, UMTS (3G) mobile technology, phones as well as base station receivers, DECT wireless phones, the commonly used WiFi range (2400 MHz) as well as bluetooth and microwave ovens.

The overview of the used meters shows the manufacturers values in which the meters should operate as announced. The real receiving range is usually somehow larger, in both directions.

With the frequency range 800-2500 MHz the majority of possible sources of high-frequency radiation can be measured. Below this range we find TV, in the mean time almost everywhere digital (DVB-T), TETRA, TETRAPOL as well as FM (UKW) radio. Above WiMAX, some RADAR and others.

So which range do you need? Difficult to tell, due to the numerous sources, though with the 800-2500 MHz range you have usually covered quite some stuff. In addition sources such as FM radio are, unless you are close to such a radio station, usually next to impossible to measure with a broadband meter anyway. Unfortunately this doesn't cover the TETRA (digital authority radio - police/etc) frequencies, around 400 MHz. TETRA masts have components at 70 Hz (slots), 17.6 Hz (frames) and 0.98 Hz (the multiframe group) and can be a big annoyance for sensitive persons.

**Sensitivity**

![Sensitivity & Range Diagram]

*S*HF(E)59B with different Preamplifier, down to 1000 fold more sensitive. HV10 (down to 0.001 μW/m² – 10 fold) is included with HFE59B. Preamplifier HV10 works also with HFE35C.

Above graphic shows the meters sensitivity and maximum value which is possible to display, although all Gigahertz Solutions meter as well as Rom-Elektronik allow to attach adapter to measure higher values. *(See also question 4. of the FAQ in this document)*

Now of real importance is the sensitivity, we recommend at least 0,1 μW/m² for sensitive people. This value allows to check for SBM recommendation. You'll be surprised how hard it is to find a place where you reach this value, deep basements have the highest probability, outside it isn't that easy since we are microwaving this planet.

The natural high-frequency radiation is about 0,000.001 μW/m² ( = < 1 pW/m²). The official WHO approved “limit” concerning UMTS (3G) is 10.000.000.000.000 above the natural radiation, that is 10 billion fold! Hope you smell the rat?

Hundred years ago, all of the meters would have been totally quite at most places around the world. *(See also question 1. of the FAQ in this document)*

*“The clear consensus of the BioInitiative Working Group members is that the existing public safety limits are inadequate for both ELF and RF.”* - The BioInitiative Report

*It appears it is the INFORMATION conveyed by electromagnetic radiation (rather then the heat) that causes biological changes – some of these biological changes may lead to loss of well-being, disease and even death.* - The BioInitiative Report

*Both ELF and RF can be considered genotoxic (will damage DNA) ...... including exposure levels that are lower than existing safety limits.* - The BioInitiative Report

*Weak non-ionizing electromagnetic radiation in the environment can be linked to more “modern illness” then even the pessimists thought possible. Modern science can now begin to explain how.* Dr. Andrew Goldsworthy – August 2007
The Manufacturers

**Gigahertz Solutions:**

Manufacturer of high- and low-frequency meters (Germany). Can be named as market leader, those meters can be bought worldwide. Design and usage might seem old-fashioned. Exactness, solidity and easy handling tell the difference. Design is completely unimportant for a meter. The service of Gigahertz Solutions can be called extraordinary!

**Rom-Elektronik:**

Small manufacturer of high- and low-frequency (Germany). Interesting small meters, service works nicely.

**Cornet:**

USA manufacturer of small meters, produced in Taiwan, with great price/performance value.

**Sensory Perspective:**

Head Office: London
Sensory Perspective designs, patents and markets electromagnetic radiation detection devices, as well as products to protect people from the health effects of electromagnetic pollution (electrosmog).
Gigahertz Solutions

HF35C (about 300,- Euro)

Might be one of the most sold meters of the manufacturer, with acoustic demodulation and switch for peak/mean value. Two measure ranges (0,1-200 μW/m² and 1-2000 μW/m²). Exact, easy and cheap measure of high-frequency (our special hint).

HFE35C (about 700,- Euro)

Just like HF35C, but in addition with an active UBB-27 antenna, allowing measuring down to 27 MHz. The included suitcase works great for transport. Our hint for anyone who wants/needs to measure also Radio (FM), TETRA/TETRAPOOL and alike.

Picture showing HFE35C in about 150 meters from a GSM base station, being toasted! (1277 μW/m² are about 0,7 V/m)

HF38B (about 450,- Euro)

First meter of the professional series, more sensitive starting at 0,01 μW/m² (ours had a ground noise of about 0,08 μW/m²), three ranges up to 20000 μW/m². Additional Peak-Hold, to keep the peak value on the display. Important to find local maximal radiation. Our tip for people who want to go further.
HFE59B (about 1850,- Euro)

A kit out of HF59B and additional accessories. The top meter from Gigahertz Solutions regarding high-frequency.

This is the Gigahertz Solutions high-end meter, out of the professional series. It is more thought for building biologists or/and technicians in pre-compliance and alike areas.

Although it works for anyone really interested in HF radiation, it needs a little more knowledge than the more simple meters.

Even if the manual explains most things, it is really needed to read it a few times completely, for anyone not that close to high frequency meters, to get the most out of the set.

The sensitivity is outstanding for a broadband meter, with the included preamplifier HV10, down to $0.001 \, \mu W/m^2$, with additional HV30, down to $0.000,01 \, \mu W/m^2$ which is close to the value allowing to detect some “zone blanche” (Area without cell phone coverage – below $0.000,01 \, \mu W/m^2$ or -102 dBm, which is the GSM specification for minimum sensitivity of GSM phones!)

Preamplifier (HV10) connected in the right picture showing $0.014 \, \mu W/m^2$. The typical GSM-Sound was very well audible (hear examples at: [http://microondes.wordpress.com/emf-sounds/](http://microondes.wordpress.com/emf-sounds/)), from a GSM base station in about 2.8 km distance, without line of sight.

Find the maximal points of radiation with HFE59B quickly, then use a spectrum analyzer to dig deeper. That's how professional building biologist work.

In addition to the HF59B Meter, the log-per antenna and the charger for the internal rechargeable the kit includes:

- **Horizontal isotropic ultra broad bandwidth antenna UBB27_G3 from 27 MHz up to beyond 3.3 GHz**
- **800 MHz high pass filter (HP800), to suppress low frequencies**
- **High frequency preamplifier HV10, enhancing sensitivity down to $0.001 \, \mu W/m^2$**
- **Attenuator DG20, increases measurable value to 2000 mW/m²**
  ($2000000 \, \mu W/m^2 = 2 \, W/m^2$)
- **Plastic suite, with enough space for another meter**
- **Various adapter for headphones/etc, manuals**
Measurement with HF59B and UBB-27 antenna, close to a FM radio station (about 35 meter distance, approx. 12 meter below):

<table>
<thead>
<tr>
<th>HF59B</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>UBB-27</td>
<td>attached</td>
</tr>
<tr>
<td>Filter/Amplifier</td>
<td>none</td>
</tr>
<tr>
<td>Measure Range</td>
<td>coarse</td>
</tr>
<tr>
<td>Signal Evaluation</td>
<td>Peak hold</td>
</tr>
<tr>
<td>Drop rate</td>
<td>slow</td>
</tr>
<tr>
<td>Power level</td>
<td>0 dB</td>
</tr>
<tr>
<td>Signal fraction</td>
<td>Full</td>
</tr>
<tr>
<td>Video Bandwidth</td>
<td>TP30kHz</td>
</tr>
</tbody>
</table>

http://www.radio-samoens.com/ (100.9 MHz)

The radio station was clearly audible through the build-in speaker.

Result:
17.85 mW/m² == 17850 µW/m² (~2.6 V/m) - Other sources insignificant

To verify this we performed an additional measuring with our spectrum analyzer and its calibrated antenna:

Result:
All FM Radio stations in the Band 87-110 MHz calculated:

17726 µW/m² (~2.6 V/m)

Extreme close together, we used the about-turn method to gather the local maximum, with both the HF59B and the spectrum analyzer.

Anyone into HF measuring knows this is a stunning result, we hadn’t expect at all!

Still those 2.6 V/m aren’t even 10% of the ICNIRP limit of 28 V/m for this frequency, while international research says your health is already impacted in the long run with these values.

Conclusion: This antenna shouldn’t be directly in the small village nor should it be at that low height!
HFR-4 (about 950,- Euro + 300,- Euro PC-Interface)

Simple usage, display switchable (mV/m ↔ µW/m²). Additional Peak-Hold, to keep the peak value on the display. Important to find local maximal radiation. Display shows bars and values at the same time, bars show pulsed values as well as unpulsed.

In addition PC-Connection as well as software (MS-Windows) is available. With an USB ↔ RS232 adapter (not included) usable on modern PC without serial connector. With Linux easily usable with a small Perl script, if you like you can have ours, please email us: http://microondes.wordpress.com/about/

The meter comes with two antennas (600 - 2600 MHz and 2600 – 11000 MHz).

Hint for anyone who wants to measure WiMAX, RADAR around 9,x GHz and alike. Hard to find broadband meters which work up to this frequency. In addition to the build in speaker it has a headphone plug which can be also used to record (MP3 player, laptop/etc).

Picture showing HFR-4 with a few GSM/UMTS base stations around (929 µW/m² are close to 0.6 V/m)

Example of a 13 hours recorded measurement with HFR-4 (graphic self made from raw HFR-4 data).
Cornet

ED15-AC (about 100,- Euro)

Very easy and small meter, sadly without acoustic demodulation, so it is impossible to tell the source. Albeit it shows various units (dBm, µW/m²), LEDs and a small history of the last 30 seconds measuring.

From our experience the meter can be halfway trusted, though strong radiation might be shown even higher then it is. Our ED15-A broke after a few years even if it was very seldom used. Dimension just 6.9 x 11 cm, internal antenna. For the price a quite interesting meter, our special hint for anyone needing values who doesn't want or can't spend much money. Other version with WiFi analysis available.

Picture shows ED15-SA with additional WiFi analyse.

Sensory Perspective

Microwave Detector MW1 (about 90,- Euro)

Nothing works easier then this meter, doing something wrong is hardly possible, there is just a switch to turn off/on and a volume control! The sensitivity of about 2,5 µW/m² is usually good enough to get a rough over view.

Due to its small size it fits in most jackets and can be used almost anywhere in a few seconds. Unfortunately no display showing the radiation strength, though the sound volume is somehow proportional to the received radiation strength. With strong radiation it will scream even on the lowest volume setting. In addition to the build in speaker it has a headphone plug which can be also used to record (MP3 player, laptop/etc).

Our hint for anyone who doesn't want to know about all those technical stuff, but wants a quick overview of the situation regarding microwaves. Right now it seems the two MW-1 we had are unfortunately lost! ;-(

Frequently Asked Questions (FAQ)

1. Is it possible to detect a “zone blanche” (no cell phone coverage) with my broadband meter?

Unfortunately not*, most broadband meters are not sensitive enough. Mobile phones need not even 0.00001 µW/m² or -102 dBm, which is the GSM specification for minimum sensitivity of GSM phones, this is in order of magnitudes behind any broadband meter capabilities, the more sensitive require a minimum of 0.01 µW/m². If your broadband meter shows 0.0 or 0.00 µW/m² you have already found a quite silent spot.

If you get such values outside, it might be possible that inside a building at this place you have zero or limited mobile phone reception.

*The only exception from this rule seems so far Gigahertz Solutions HF59B with preamplifier HV30, working down to 0.00001 µW/m² which is very close to the value allowing to detect a “zone blanche”. Though it isn't that easy in our environment to find some place with such low radiation.

2. My broadband meter seems to “eat” 9V batteries, please help!

A quite common problem, please get your hands on at least 2-3 9V rechargeable with the greatest capacity possible (300 mAh), if impossible a little less will do as well, in addition to a charger that stops automatically if rechargeable are full. Unfortunately this isn't the case with all 9V recharger and might destroy rechargeable soon. With a good recharger you save in no time, rechargeable can be used a few hundred times, some even work a few thousand times.

3. I read, official limits for instance concerning UMTS (3G) are 61 V/m (10 000 000 µW/m²), most broadband meter just show 2000, some 20000 µW/m² max, how come?

Firstly those 20000 µW/m² are about 2.75 V/m, official limits are only reached very close to antennas, a couple of meters with mobile phone base-stations, with mobile phones a few centimeters.

For this reason measuring if the official limits are kept is a joke, they are always kept, outside the security distance to an antenna. Those limits are also only valid for fixed antennas with more then 10 W power, meaning unfortunately they are not valid for mobile phones.

Meters should allow the user to measure biological interesting values. Although there are adapter to reduce radiation about 100 fold and more, which can be mounted with the better meters between the meter and their external antenna, allowing to measure much higher radiation. For instance with a meter working up to 20000 µW/m², then up to 2 000 000 µW/m² (about 27.5 V/m).

Attention, do not place a broadband meter even with such an adapter
to close to a mobile phone the meter can be easily damaged, radiation close to a mobile phone can be more than 100 V/m (27,000,000 µW/m²)!

4. Thx for the hints, though they don't tell me much if anything, what can I do to protect me and my family?

Allow a professional building biological to perform a measurement and get anything explained. Then you know your situation, problems and get hints how to improve the situation, if needed.

Perhaps you get your hands on the Electrosomg Detector afterward ot the HF35C from Gigahertz-Solutions?

5. While all those abbreviations sound quite important, I dunno (m)any of them?

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSM</td>
<td>Global System for Mobile Communications</td>
</tr>
<tr>
<td>ATIS</td>
<td>Automatic Transmitter Identification System (Airport)</td>
</tr>
<tr>
<td>TETRA</td>
<td>Trans European Trunked Radio System (authority radio, Police/etc, UK and others)</td>
</tr>
<tr>
<td>TETRAPOL</td>
<td>Digital PMR technology (authority radio, Police/etc, France and others)</td>
</tr>
<tr>
<td>GSM-900 UL</td>
<td>Mobile phone with GSM technology in the 900 MHz band (UL = Uplink)</td>
</tr>
<tr>
<td>GSM-900</td>
<td>Mobile phone basestation with GSM technology in the 900 MHz band</td>
</tr>
<tr>
<td>DME</td>
<td>Distance Measuring Equipment (Airport)</td>
</tr>
<tr>
<td>GSM-1800 UL</td>
<td>Mobile phone with GSM technology in the 1800 MHz band (UL = Uplink)</td>
</tr>
<tr>
<td>GSM-1800</td>
<td>Mobile phone basestation with GSM technology in the 1800 MHz band</td>
</tr>
<tr>
<td>DECT</td>
<td>Digital Enhanced Cordless Telecommunication System (Common technology wireless phones at home use, max. 400 meter distance)</td>
</tr>
<tr>
<td>UMTS (3G)</td>
<td>Universal Mobile Telecommunication System, (3. Generation)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WLAN/WiFi</th>
<th>Wireless Local Area Network/Wireless Fidelity (Wireless computer network for short distance (max. 100 meters), such as Internet Connection at home)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WiMAX</td>
<td>Worldwide Interoperability for Microwave Access (wireless computer network for medium distance up to a few/couple kilometer/miles)</td>
</tr>
<tr>
<td>dB</td>
<td>Decibel</td>
</tr>
<tr>
<td>dBm</td>
<td>dB relative to the power of 1 mW at 50 Ohm load</td>
</tr>
<tr>
<td>µW/m²</td>
<td>1/million Watt per square meter (unit used to measure power density)</td>
</tr>
<tr>
<td>V/m</td>
<td>Volt per meter (unit for power flux) µW/m² ↔ V/m can be converted from each other</td>
</tr>
<tr>
<td>MHz</td>
<td>Million Cycles per second (1 Hz = 1 Hertz = 1 cycle per second (sec⁻¹); MHz → Mega Hertz)</td>
</tr>
<tr>
<td>ELF</td>
<td>Extreme Low Frequency; Mostly below 30 kHz, down to 50 Hz (European electricity) and 16 1/3 Hz (train)</td>
</tr>
<tr>
<td>RF</td>
<td>Radio Frequencies</td>
</tr>
</tbody>
</table>

6. **Why are the various meters in this overview not directly compared?**

Good question, the reason is rather simple. Measuring high-frequency is a delicate task. Radiation changes quite often in order of 10, 100 fold or even more in a matter of a few centimeters and also over time. So you'd need at first peak hold to allow for better comparison, but not every meter has this function.

Feeding a signal directly into the antenna connector of a meter might help to circumvent these problems, but then you do not test the antenna, which is an important component of a meter and some meters do not have an antenna connector, but an internal antenna, where this is not easily possible. Also you'd need a quite advanced signal generator to simulate more complex signals such as GSM or/and UMTS (3G) mobile phones/base stations.

For this and other reasons we've called this a comparison, though you can be assured that any meter here works to measure high-frequency radiation. Sure as the price range is from 90,- Euro to 1850,- Euro you can't expect the same accuracy/features and alike. This is the reason behind this comparison, to give a short overview what you can expect.
Conclusion

If you aren't into the matter of high and low frequency measuring, please let someone establish a professional measurement, this gives you an complete frequency selective overview about your exposure. While measuring ask to get an explanation of how to measure with a broadband meter, later you can buy such a meter, perhaps from the same manufacturer? (To get an overview and to find local maximal radiation points, professional measurements will at first use broadband meters. Afterward a spectrum analyzer will be used to confirm each and every source separately.) Also you know after a measurement which frequencies are used, which might help to decide if you want to get your hands on some meter.

If possible do not ask an accredited measurement company to do the work. You might ask why now?

– Accredited companies usually work with mobile phone operators, this makes measuring easier, though it might well be the operator changes antenna downtilt and/or sending power while the measuring is going on. All that can be done in seconds remotely without anyone at the operators NMC (Network Management Center) leaving his chair. Unsure? We have close to a decade experience working for and directly inside the mobile telecommunication industry, operators as well as producer of mobile phone technology.

– They'll just measure the biological completely uninteresting mean value of the in most cases pulsed radiation. Though this is in most country the official way to measure. The following picture shows this with a DECT (wireless home telephone), the small base station send 100 times per second a short pulse (red). If we now simply “measure” the per meter calculated mean value, we get a value (green/blue) that is about up to 100 times below the real (red) value:

– Mobile phone technology (GSM) works with similar pulses, which also makes measuring mean values “somehow” unrealistic.
– A building biological measurement isn't just about measuring the situation and leaving people with some colorful measurement values. But gives hints and further guidance to improve the situation keeping the financial situation in mind. Even changing the apartment might be a good solution, if the radiation is as high that it would be extreme expensive to get down to reasonable values.

– The SBM standards of building biology contains human factors, has an eye on the technology possible, but also at sick, older and handicapped people in order to allow them a life without pain. They have been developed through tens of thousands of measurements in the real world.

– Many Building biologists do not sell anything, don't refurbish apartments and alike, which has the sense to stay independent.

For those who want or have to refuse a professional measurement but want to know their exposure on a small budget, we have the following suggestion:

Cornet ED15-A & Microwave Detector (about 190,- Euro together)

or

HF35C Gigahertz Solutions (about 300,- Euro)

The later might convince neighbors with DECT/WiFi permanent radiation sources sooner, it simply looks much more professional!
Next - Contact

We'll add another overview about low frequency radiation meters soon. Quite often low-frequency electromagnetic radiation is home made, sources can be found more easy and exposure lowered dramatically with little afford. In addition we'll add an enhanced version of this comparison, if possible with more meters, is seems we are receiving quite some feedback.

Please visit us online:  http://microondes.wordpress.com/  mailto:m.heiming@gmx.com

Manufacturer Links:

Gigahertz Solutions:  http://www.gigahertz-solutions.de/
Rom-Elektronik:  http://rom-elektronik.de/
Cornet:  http://cornetmicro.diytrade.com/
Sensory Perspective:  http://www.detect-protect.com/