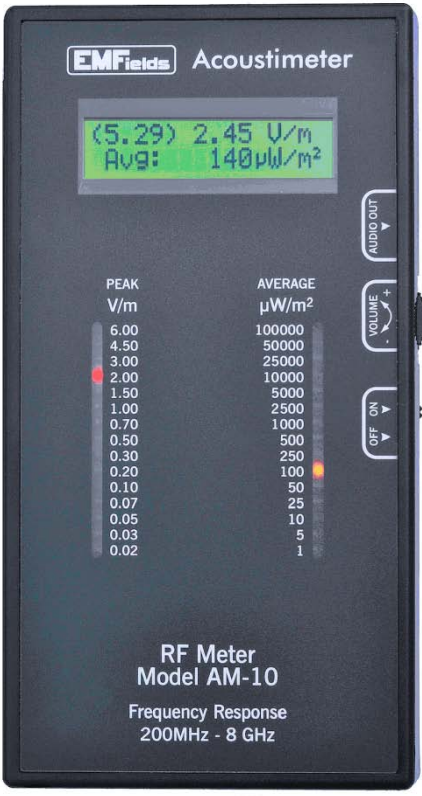
EMFields



Acoustimeter User Manual

Safety Instructions

Please read through these instructions carefully before operating the instrument. It contains important information regarding usage, safety and maintenance.

The instrument is not waterproof and should not come into direct contact with water, nor should it be used outdoors in the rain. If it is raining and you want to take measurements outside, please cover the instrument in a plastic bag that does not have holes in it. Clean the case using a damp cloth if necessary and do not use detergents.

This instrument is not intended to be serviced by the user neither does it need any special maintenance. Unscrewing the case will void the guarantee.

This instrument is sensitive to heat and impact. Exposing the instrument to high temperatures or dropping the meter on to a hard surface may cause it to stop functioning properly. It may not display properly while it is in temperatures below freezing (0°C).

Acoustimeter Manual

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Specifications

Typical overall frequency response using the internal antenna:
200 MHz – 8000 MHz ± 3dB
150-200 MHz and 8-10 GHz ± 6dB

MeasurementRange:
0.02 - 6.00 volts per metre (V/m)
1 - 100 000 microwatts per square metre ($\mu W/m^2$)

The detector can respond to levels below 0.02 V/m - audio from demodulation may be heard at levels below 0.02 V/m

Peak hold (since turned on), peak and average values displayed on LCD

LED Scale Points: (peak LEDs updated approximately every 0.1 seconds)

Peak: 0.02, 0.03, 0.05, 0.07, 0.1, 0.2, 0.3, 0.5, 0.7, 1, 1.5, 2, 3, 4.5, 6 V/m

Average: (calculated as the average of 1024 samples measured every c. 0.35 seconds) 1, 5, 10, 25, 50, 100, 250, 500, 1 000, 2 500, 5 000, 10 000, 25 000, 50 000, 100 000 $\mu W/m^2$

Power Draw: c.110 mA at 3 volts (2 x AA Alkaline or Rechargeable cells @ 1.2 - 1.5V)

Battery Life: Up to 20 hours. 'Low battery' detection is indicated.

Typically 15 hours on two new 1500 mAhr AA alkaline cells, and typically 25 hours on two charged 2700 mAhr NIMH rechargeable cells

Size: 190mm x 102mm x 33mm (LxWxD)

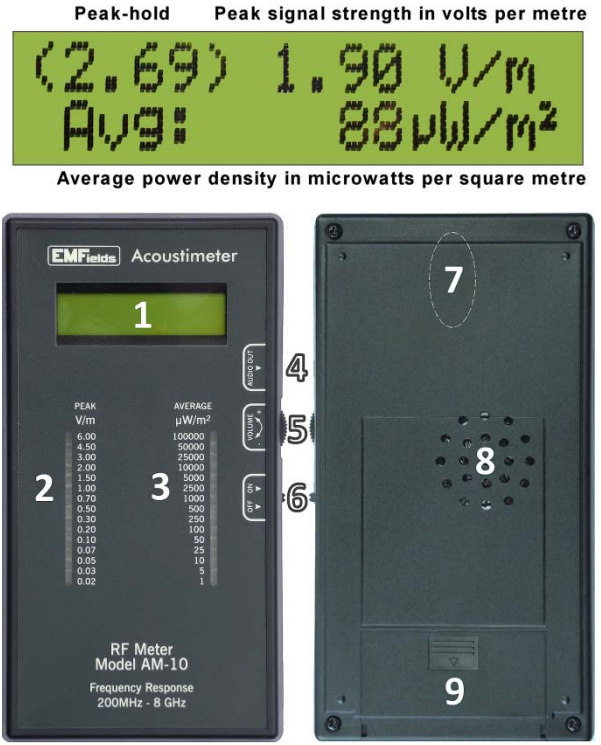
Weight: 280g, excluding batteries

Introduction

The Acoustimeter has been designed to enable you to make a quick and informed judgement regarding the level and nature of microwave signals in your environment. The Acoustimeter is a broadband instrument that accurately measures the totality of the radiation in the range 200 MHz to over 8000 MHz (8 GHz), which covers the frequencies used by most modern communication systems encountered in our everyday environment. The Acoustimeter was designed using the experience gained from many years of practical RF and microwave measurements using a wide variety of professional instruments.

Readings are shown on both an LCD display and two series of graduated LED lights. The LEDs update rapidly, and allow you to quickly gauge the levels in an area and find any hot-spots. The Acoustimeter also has a loudspeaker (and audio output socket for headphones or an audio recorder), allowing you to determine, with a small amount of practice, what type of device is creating the signals.

Layout of the meter



Key:

1. Display
2. Peak signal LEDs
3. Average power LEDs
4. Audio jack, mono, 2.5mm
5. Volume control
6. On - Off switch
7. Internal Antenna
8. Loudspeaker
9. Battery compartment

Operation and use

Ensure that you have correctly inserted correct batteries (2 x AA cells). Move the power switch into the "On" position. The LEDs should at once display a moving pattern across all LEDs and the LCD should briefly display

"Acoustimeter, © EMFields 2009"

changing to readings after a short time.

Hold the bottom of the instrument in one hand at least 30cm from your body as close proximity to your body will affect the readings. Keep your hands away from the top of the instrument as this contains the antenna which is located inside the case at the rear towards the top. The Acoustimeter can be placed upon a stable surface, but movements nearby can still affect the RF/microwave levels.

Adjust the volume to an appropriate level (usually somewhere about mid-volume is best; only use maximum when monitoring weak signals).

The instrument will display the peak signal strength and the average power on both the LEDs and the LCD. Slowly turn the instrument around in all directions. Stop moving the instrument and hold it still to take a reading.

Bear in mind that even moving the meter small distances can result in

detecting very different levels of microwave energy. Microwaves are reflected off the ground and other surfaces so it is important to check all angles. The highest readings will often be found when holding the instrument facing you at an angle between horizontal and vertical.

We recommend taking the highest reading found in any one spot, as this is when the antenna is most closely aligned with the directionality of the signal. The "Peak-hold" function will display the highest peak reading measured until the instrument is turned off and on again.

If there is hardly any noise with the volume turned up then the instrument is not detecting any amplitude modulated (i.e."pulsing") signals. Various sounds represent the amplitude modulation and digital pulsing of RF signals detected by the instrument.

It is sometimes possible to hear voices and music when very close to powerful medium and short-wave AM transmitters, which are outside of the normal RF frequency detection range of the meter.

When no LEDs are illuminated any regular very quiet ticking sounds should be ignored - they are due to the internal functioning of the meter.

Why are there two different readings?

The Acoustimeter is unique in the way it displays information about its measurements. There are two different displayed results, showing both Peak and Average measurements. At first, this may seem confusing. We believe that it is important to know both when assessing your exposure to modern telecommunication signals. We believe that it is the peaks in pulsing signals that are the most bio-active at typical modern relatively low exposure levels.

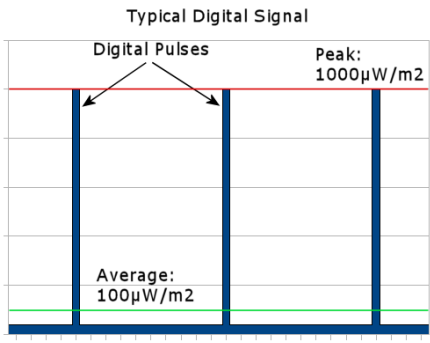
Digital and Analogue?

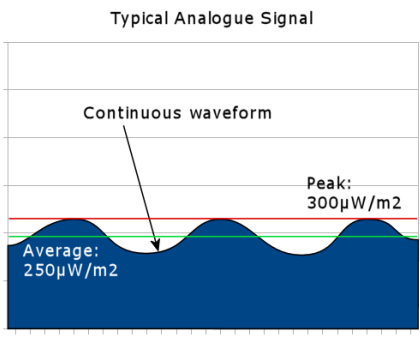
Most modern wireless devices use a **digital** system of communicating. This includes mobile phones, WiFi, Cordless phones (DECT), Digital TV & DAB Radio. Many modern digital systems turn the signal on and off at high speeds to represent data, often with extra gaps between data bursts. This produces a non-continuous signal, which we describe as "pulsing". The Acoustimeter allows you to hear this and it is one way of identifying the source of the signals.

An **analogue** signal is a system of communication that is not digital. They use a continuous carrier, and instead of turning "on and off" to represent data, will vary the frequency (FM) or strength (AM).

Differences between peak & average

With an analogue system, the peak and average levels should be similar, as the signal is continuously on while it is being used. However, because most digital systems spend a large proportion of their time not transmitting, the average level does not represent the actual waveform even though it is technically accurate as shown in the diagrams below.





Why does this matter?

Since wireless communications were first developed on a large scale, the scientific community held the opinion that "*if it does not heat you it will not hurt you*" as, 30 years ago, these were the only effects that were acknowledged. The average heating effect was what mattered. The measurement typically used now for measuring the time-averaged power of microwave frequency EMFs is microwatts of power arriving per square metre ($\mu W/m^2$), and we have used this for the Acoustimeter's average power measurement.

There have now been hundreds of studies finding non-thermal effects from modern wireless communication signals. This requires a change in what is measured to suit much lower signal levels with very different characteristics. We believe that peak signal strength is the most appropriate way to measure complex digitally modulated, often non-continuous, signals in a meaningful manner. Signal strength is measured in volts per metre (V/m). Many electrosensitive individuals report adverse health effects in areas that have quite high peak levels but have average field strengths below even the most precautionary guidelines regarding average power levels.

There is an approximate equivalence between the two columns of LEDs for continuous waveform (CW) signals. The Acoustimeter calculates the average power in the measured RF by a detailed analysis of the waveform. The result is on the average power LEDs and on the LCD display.

The LED points on each of the scales approximately match for continuous wave (CW) signals. The more pulsatile the signal is the higher the peak scale will read in comparison to the average power scale.

The EMFields website has a RF units

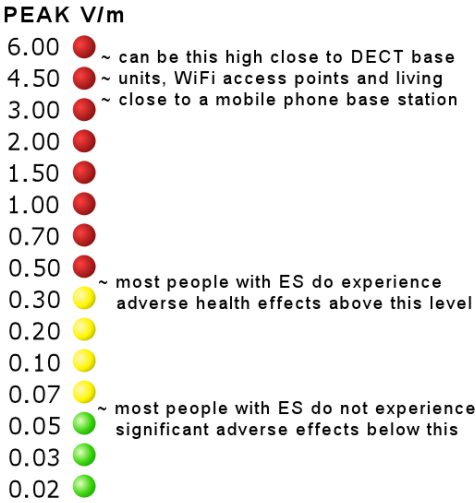
What do the LED colours mean?

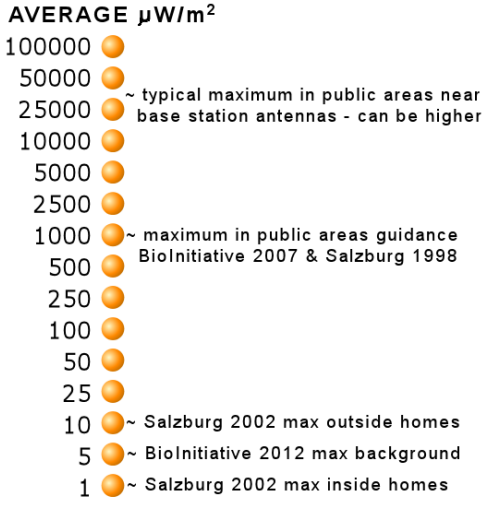
Our peak signal strength scale is coloured based on experience of what electrosensitive people have reported as adversely affecting their health.

Below 0.05 volts per metre (V/m), few people report ill-effects, so these are green. Between 0.05 and 0.5 V/m, some individuals report ill-effects, so these are yellow. Above 0.5 V/m, nearly all sensitive individuals report experiencing adverse health effects, so these are red.

The average power density scale LEDs are all orange in colour.

1 W/m² = 1,000,000 μW/m² =
= 100 μW/cm² = 0.1 mW/cm²


PEAK V/m
6.00
4.50
3.00
2.00
1.50
1.00
0.70
0.50
0.30
0.20
0.10
0.07
0.05
0.03
0.02
~ can be this high close to DECT base units, WiFi access points and living ~ close to a mobile phone base station
~ most people with ES do experience adverse health effects above this level
~ most people with ES do not experience significant adverse effects below this


AVERAGE µW/m²
100000
50000
25000
10000
5000
2500
1000
500
250
100
50
25
10
5
1
~ typical maximum in public areas near base station antennas - can be higher
~ maximum in public areas guidance BioInitiative 2007 & Salzburg 1998
~ Salzburg 2002 max outside homes
~ BioInitiative 2012 max background
~ Salzburg 2002 max inside homes

Troubleshooting

The meter is not working.

Check switch is in the "on" position.
Check that the batteries are correctly fitted.
The batteries may be flat. Try changing them.

Note: If the LCD is displaying a reading, then the meter is turned on and working.

LCD is blank or shows black squares.

Make sure that you leave 1 second between turning it off and turning it on again.

The meter makes three loud beeps.

Check for a "Low battery" screen message next time it beeps. Replace the batteries.

The instrument readings are varying.

Make sure your fingers are clear of the antenna. Modern signals pulse and peak signals are not consistent. The instrument is sensitive and picks up these variations. Regular high "blips" every few seconds may be due to a rotating radar transmitter or a WiFi signal.

The peak signal is high, but the average signal is low.

This is normal and to be expected from modern digital microwave frequency signals.

The levels are very low (no LEDs lit), but I can just hear a slow, regular, ticking (a bit like a very faint heartbeat)

This is the instrument picking up the noise of its own internal meter circuitry and not microwave signals. This will only happen if the external field levels are well below 0.02 V/m and no LEDs are lit.

The instrument is giving readings that surprise me. Are they correct?

Our extensive tests have shown that the Acoustimeter readings usually give a good indication of the microwave levels present.

The Specifications are given on page 4. Receiving and measuring pulsing RF signals over a wide frequency range is extremely difficult to do. Even professional instruments costing many thousands of pounds have quite large error margins. How you should add all the various frequencies and waveforms is a large debate on its own. Different meters may well give different readings depending on what is being measured. Many budget meters incorrectly display a peak power derived from peak signal strength as if it were a CW signal that will almost always be far too high.

It still makes a noise when inside a headnet or behind my screening

The audio produced by the Acoustimeter is logarithmic in volume, so even quiet signals can seem quite loud. Check the figures that the Acoustimeter is displaying. A 99.9% reduction of 100000 $\mu W/m^2$ to 10 $\mu W/m^2$ (2 V/m signal reduced to 0.05 V/m) will still be showing and sounding on the meter. Close to transmitting sources it is likely that you will still hear something.

The screening material may have degraded over time, or you may have a gap in your screening. Even small gaps (including above and below you) will let in microwave signals.

General Public Levels	Frequency **MHz**
ICNIRP, 1998 (recognised by WHO, EU & UK)	400 900 1800 2100
Russia 2003 (general public), PRChina	300 - 300000
Italy, Decree 381 (1999)	30 - 30000
Swiss Ordinance ORNI, rms values , (*for base stations*) 1st. Feb. 2000	900 1800
EU & UK EMC suscept. regulations	30 - 2000
Belgium - Wallonia	900, 1800, 2100
Typical max in public areas near base station masts (can be higher)	900, 1800, 2100
USA City Dweller max (FCC 1999)	30 - 300000
Wien (Vienna)	Sum of GSM
Italy (2003) each base station (aim); Lichtenstein law from 2013	900, 1800, 2100
Salzburg - 1998 & 2000	Sum of GSM
BioInitiative, 2007	30 - 300000
EU-Parliament bill, GD Wissenschaft, STOA GSM (2001)	900, 1800, 2100
Typical US (EPA 1980, mainly FM & TV)	30 - 300000
Salzburg - 2002, outside houses aim	900, 1800, 2100
BioInitiative, 2012 (guidance)	30 - 300000
Salzburg - 2002, inside houses	900, 1800, 2100
Mobile phones will work at levels	900 - 2100
Broadband 'natural' background	300 - 3000

Frequency **MHz**	E field **V/m**	Power **W/m²**	Power **μW/m²**
400 900 1800 2100	28 41 58 61	2 4.5 9 10	2 000 000 4 500 000 9 000 000 10 000 000
300 - 300000	6	0.1	100 000
30 - 30000	6	0.1	100 000
900 1800	4 6	not spec	not specified
30 - 2000	3	not spec	not spec
900, 1800, 2100	3	0.024	24 000
900, 1800, 2100	2	0.01	10 000
30 - 300000	< 2	< 0.01	< 10 000
Sum of GSM	1.9	0.01	10 000
900, 1800, 2100	0.6	0.001	1000
Sum of GSM	0.6	0.001	1000
30 - 300000	0.6	0.001	1000
900, 1800, 2100	0.2	0.0001	100
30 - 300000	< 0.13	<0.00005	< 50
900, 1800, 2100	0.06	0.000 01	10
30 - 300000	0.03	0.000 005	5
900, 1800, 2100	0.02	0.000 001	1
900 - 2100	0.00001	< 3 e-11	< 0.000 03
300 - 3000	<0.00003	< 1 e-13	<0.0000001

Disclaimer

While EMFields considers that the information and opinions given here are sound, you must rely upon your own skill and judgement when interpreting or making use of the information contained in this manual.

Guarantee

The Acoustimeter comes with a 2 year return-to-base Guarantee. Please contact us (see page 19) for details and to arrange a return if required. The meter is guaranteed to be free of manufacturing defects, but not against wear from normal use, nor damage caused by water or by physical impacts such as from dropping it.

Note: It has a degree of overload protection built-in, but it should not be used next to high-powered RF transmitters that are likely to grossly overload it. Approach these with caution and watch the displays to avoid gross overload.

European Approvals:

CE, ROHS and WEEE

The Acoustimeter meets EN61000-6-3:2001+A11:2004 & EN61000-6-1:2001 Electromagnetic compatibility (EMC) standards and also meets

ROHS 2 2011 (2002/95/EC) and
WEEE (2012/19/EU) (2002/96/EC)

The Waste Electrical and Electronic Equipment (WEEE) Directive requires that unwanted electronic equipment must be disposed of using specialist recycling. Your Acoustimeter can be returned to us for recycling.
UK local waste recycling centres also provide free collection points for WEEE.

Contact

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v5.0 2013-10-24