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Response to WILA (Wissenschaftsladen Bonn) Report on RF meters

'Electrosmog meters put to the test' - *released in January 2016*

We were sent a copy of this report on Friday 22nd January 2016 by a Canadian journalist.

We are very disappointed by numerous aspects of this WILA report. Not only do they make multiple incorrect claims, but their descriptions are strongly contradicted by our own extensive testing of the Acoustimeter's performance. We have now re-tested 3 units of different ages and they continue to perform extremely well when measuring all common sources of microwave exposure, calling into question the content of the WILA report.

Specialist testing labs (even ones with anechoic rooms) are useful when checking specific technical functions of an instrument, especially in development. However, this approach is unsatisfactory when we look at what is necessary to evaluate exposure in real life environments.

Some of their results were mystifying and unlikely in view of the electronic components used in the manufacture of the Acoustimeter. All the five makes and models of meters were strongly criticised, the Acoustimeter came off best. We continue to believe that the Acoustimeter is a good value instrument to use for people to determine areas of high and low microwave exposure to make informed decisions about his or her environment.

WILA tested five meters costing under €500. We are disappointed that the current Gigahertz Solutions meters under the same price were not also tested at the same time as that would have helped to provide a measured benchmark to compare the other meters against. We are unclear why WILA chose a requirement that the meters measured up to 8 GHz as the public is exposed to few signals above the 5 - 6 GHz WiFi bands. We realise that Gigahertz Solutions do not sell a meter that covers the frequency range to 8 GHz at this price, but at least the range up to 3 GHz could have been compared as well as the higher frequency range using the extra HFW59D.

I, Alasdair Philips, and my colleague, Andrew Cohen, are the designers of the Acoustimeter AM10. It was first released in 2010 and is a popular meter that is used widely to assess broad-spectrum EMF exposure. I am an experienced and qualified electronics and RF engineer who first worked in the electronics and communications industry in 1969. In the 1980s and 1990s I specialised in EMC testing issues for various companies, carrying out compliance testing in many accredited test facilities in the UK. I have tested Acoustimeters on many occasions and I am confident that they give a very good overall indication of microwave electrosmog exposure.

The WILA report states:

> The display concept of different measurement units for peak and average values is problematic. For example, when a 100 times higher power density (in $\mu W/m^2$, the common display unit used in building biology) is shown in V/m, this value, in terms of numbers, is only by a factor of 10 higher-which makes it appear less harmful to laypersons. Therefore, the two rows of LEDs of both signals hardly provide any additional benefit. In the user guide, the explanations regarding this matter are rather confusing and, moreover, technically questionable.

We completely disagree with this. It was a very conscious choice to offer peak signal strength in volts per metre (V/m) as that is what we believe the science shows is the most bio-active metric to use.

Power Flux Density (PFD in μW/m^2) is really only relevant for heating (thermal) effects and most people concerned about EMF/RF/health are certain that almost all reported adverse effects on health and well-being occur at much lower, non-thermal levels.

We display the peak signals and use an advanced detector that has an extremely fast response so that it can accurately capture any potentially bio-active pulses. EMC Regulations specify immunity and susceptibility in terms of signal strength in V/m, not PFD, for the same reason, as it is the signal pulses that usually interfere with the normal operation of electronic equipment.

Current national and international human exposure guidance is almost all based only on thermal effects and stated as "average power". So, we added true Average Power values (calculated as the area under the graph) so that users could see how their readings compared with the current official exposure guidance. Some meters attempt to display "peak PFD" by just mathematically converting V/m into μW/m^2 , which as well as effectively being meaningless for modern pulsing communication signals, is not the value that is specified in the main published public exposure guidance tables. When they are stated they are thousands of times higher than the main exposure limits.

For continuous signals (CW) our LED scales approximately equate and the LEDs match at the same height across the front panel. For very pulsatile signals (like DECT or older WiFi), the average power values are much lower down the scale due to the gaps between pulses.

The clear and easy to read LED lines are the feature that we have had most praise from users about. The other popular feature is the very helpful sound demodulation of the microwave signal pulsing.

WILA state:

> In the frequency range below 2.7 GHz, the limitations of the internal antenna compromise the otherwise good design efforts. Therefore, the measurement values, which have been obtained by the experts from IMST under ideal testing conditions, can not necessarily be reproduced under real-life conditions and by technical lay persons. The measurement value can be dependent on where the user touches the meter and at which angle it is held in space. The user guide (which is available in English only) remains far too vague regarding the instructions on how to perform the measurements, and the recommendation to comfortably hold the meter at an angle may lead to measurement results that can be only a fraction of the actual exposure level, especially at the lower frequencies.

We agree that any internal antenna will always be a compromise. We designed the Acoustimeter with an antenna socket on the circuit board, but early tests showed that potential users at the time (7 years ago) really did not want an external antenna.

The best way to test hand–held microwave meters is at an open area test site (OATS), not inside a test chamber – even one that is meant to be anechoic. The IMST facility has many RF absorbing cones, but I have tested inside many accredited test chambers and there are always reflections. This does not matter too much with a relatively large external receiving antenna, but with a small internal or external monopole antenna you can detect large numbers of "hot-spots" (where reflections add) and "cold-spots" (where reflections cancel). This is the same in houses and offices. Many people want to know where these are, and the only way to do this is with a meter with a small antenna and by moving it about, and at different angles, to get the highest readings. This is what we recommend in our user guide.

Andrew Cohen and I have done a large number of RF surveys over the past 6 years. We use an Acoustimeter and also the excellent (€1844) Gigahertz Solutions HFE59B with the UBB27 small active monopole antenna. We generally find good agreement between the meters except near 5 GHz band WiFi which the Gigahertz Solutions meter does not pick up. We also have an Anritsu MS2721A spectrum analyser with a range of calibrated antennas. Again, we generally find good agreement when summing the main signal levels.

WILA state:

> Like the other meters, the specification for 8 GHz is also clearly exaggerated: not a single test signal of 10 μW/m^2 (threshold level between the slight and severe anomaly range of the SBM) above 2.7 GHz was detected by the meter. It only displayed its own noise.

We are very surprised by this claim. Even with its internal antenna that will pick up some internal noise, 'its own noise' is negligible – less than 0.02 V/m and less than 1 μW/m^2 i.e. no LEDs light in low external RF fields, so it is not clear in what way it was displaying 'its own noise'.

To anybody who has used the Acoustimeter, even briefly, it is clearly apparent that it is sensitive to below 10 µW/m^2.

We have just taken 3 'off the shelf' Acoustimeters (manufactured 2013, 2014 and 2015) and the meters read correctly within their specification limits at a broad variety of frequencies and signal strengths. The WILA tests did not report the serial number of the Acoustimeter used in the tests and so we cannot directly compare it to another instrument from that production batch. It is surprising and most unhelpful that WILA do not give the serial numbers of the various meters they tested, so we have no idea how old they are or their history.

WILA state:

> In this higher frequency range, the Acoustimeter responded to stronger test signals, but the displayed measurement values were 25 to more than 30 times lower. The test signal of 783 µW/m^2 at 8 GHz, for example, was displayed as only 21.5 µW/m^2.

We are naturally disappointed and surprised that its performance seems too poor at 8 GHz. There currently are very few RF sources that expose the public between 6 and 8 GHz. It would have been much more reasonable to measure the performance at 5.1 and 5.7 GHz to cover the upper WiFi bands.

Our re-testing of three Acoustimeters shows it to perform well up to at least 6 GHz. The V/m scale works better than the average power scale at the bottom three scale points and we will investigate this. Although we cannot immediately re-test up to 8 GHz, we are confident that it continues to outperform the report's claimed results. The detector used within the Acoustimeter is rated up to 10 GHz.

WILA state:

> And there is another major limitation that tarnishes the image: The meter is based on a logarithmic RF detection module that is designed to measure a single RF source. In a typical living environment, we usually encounter a broad mix of different RF sources (e.g. mobile networks, DECT, Wi-Fi, etc.), which is why this meter only displays the strongest RF source and the others fall by the wayside. This also greatly reduces the practical benefit of the audio analysis to recognize active RF sources by their typical sounds because any other RF source but the strongest are cut out.

The AD8317 device used is not intended to measure a single RF source – it detects and demodulates the sum of signals at any instance over its full frequency range. Indeed this would be immediately apparent to anyone using an Acoustimeter in an urban environment where, in the complex audio, you can separately hear GSM, 3G, 4G base-stations, various WiFi and Wi-Max signals and DECT cordless telephones. Almost all meters with a large scale use a logarithmic detector in order to fit the vast range and still allow good resolution at the lower levels.

Walking down a street that is full of mobile phone signals you can also tell which houses have DECT cordless phones and operating WiFi. The report's nonsensical text must have been written by someone who has misunderstood the detector's datasheet and not actually used an Acoustimeter in real-world exposure.

WILA state:

> **Conclusion:** For the Acoustimeter, a frequency range specification of up to 2.7 GHz instead of 8 GHz would have been appropriate. Good design efforts at the lower frequency range, at least at the lower field strengths of the test signals, are compromised by the exaggerated specification, systemic weaknesses of the internal RF probe and the processing of the measurement value. Thus the recommendation of the user guide to hold the meter at an angle may cause the measurement values to drop to only a fraction of the correct values in typical testing situations, and also in the frequency range be low 2.7 GHz. Furthermore, only the strongest signal is considered for the displayed measurement value and the-useful-acoustic interpretation of the modulation. Since all other signals of RF sources fall by the wayside, they either do not register at all on the display or are greatly underrepresented so that the mix of frequencies, which is nearly ubiquitous in modern living environments, will be easily overlooked and certainly underestimated.

For reasons given elsewhere in this response, we disagree with almost all the statements in the above 'Conclusion'.

What members of the general public need is an instrument that is affordable, easy to use, and sufficiently accurate to enable them to make informed choices about what they want to expose themselves to in their living and working environments.
The Acoustimeter meets all of these criteria.

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