GIGAHERTZ®
SOLUTIONS
Made in Germany

ME 3851A
(16 Hz – 100 kHz)

ME 3951A
(5 Hz – 400 kHz)

English

Page 7

Low-Frequency-Analyser

for electric and magnetic LF-fields

Manual

Rev. 3.0

Thank you!

We thank you for the confidence you have shown in buying this product. It allows for a qualified evaluation of the exposure caused by AC electric and AC magnetic fields according to the internationally recognized TCO guideline and the recommendations of the building biology.

In addition to this manual you can watch the **tutorial videos** on our website concerning the use of this meter.

Please read this manual carefully prior to using the meter. It contains important information concerning the safety, usage and maintenance of this meter.

English

General Hints for Measuring

As the field strength increases when coming closer to sources of EMF pollution, it is possible to locate these by following the higher readings until reaching the emitting source. The tone signal provided facilitates this process. As fields (especially magnetic fields) can penetrate even massive construction material, the sources might even be located outside the building, e.g. high-tension power lines, electrified railway trails, transformers as well as neighbouring houses and apartments.

Ideally, all measurements are to be repeated during various times of the day and on different days of the week in order to identify fluctuations. The SBM recommend a long-term recording of the magnetic flux density for 24 to 48 hours.

Structural videos for the proper use of our instruments can be found on our website.

Function Testing

Magnetic Flux Density

Turn on and select: Field Type = “M”, Measurement Range = ”200 nT/Vm”, Frequency Range = ”5 Hz - 400 kHz”.

Move the field meter in fast and short movements around its lon- gitudinal axis back and forth – readings will jump up (induced by the Earth’s magnetic field).

Electric Field Strength

Turn on and select: Field Type = “E”, Measurement Range = ”200 nT/Vm”, Frequency Range = ”5 Hz - 400 kHz”

Keep the field meter steady while tapping the front of the case with your fingers – readings will jump up (induced by changes of capacitive coupling between your finger and the field plate).

Defining the Offset:

Turn on the instrument and set the switch "field type" to the "test" position. On the left-hand side of the display a "1" (as icon for the test mode) will appear and on the right-hand side either "00.0" or "000", depending on the selected measurement range. If a higher measurement value is displayed, this value reflects the current additional tolerance of the instrument.

Choice of measurement range

General guideline: as coarse as necessary as fine as possible. Overflow will be shown by the vertical bar in the left segment of the display.

Measurement Instructions – Electric Fields

Electrical fields can be measured "vs ground potential" or "potential free"/"with floating potential". Both have their advantages and disadvantages. Over many years in the measurement "vs ground potential" was the only one recommended by SBM. For a grounded measurement of the electric field start by grounding the meter:

Insert the plug of the enclosed grounding cable into the dedicated socket of the meter ⏚ and run the cable along the side of the case to the back (see picture). Make sure that neither the grounding cable nor the user's hand is in the front of the meter (falsifies the reading!).

Unvarnished metal piping for water, gas or heating is especially adequate for grounding with the grounding cable, if need be the included grounding clamp will help making the contact. A large nail in the wet ground of the garden is fine, too. Professionals can also use the earth contact of a wall socket (Caution: Don't try this as a layman).

Turn on the field meter and set it to "E". Set the filter to "50 Hz", that is including the mains frequency of 60 Hz up to 400 kHz. Keep the meter close to your body. The further away from the body it is held, or if it is even put down, the more the testing results tend to become distorted into the higher range. During testing please make sure that the person performing the survey, as well as anybody else present, is located behind the meter. Proceed as follows:

- Move slowly through the room to be measured. Stop frequently and take measurements pointing to all directions including ceiling and floor.
- Move into the direction of the highest reading in order to identify the field source.
- In places where people spend substantial amounts of time, such as in bed or at a workplace, check all directions as mentioned above until you have reached the maximum reading at the spot, where the body of the person would be located.

An EMR survey of sleeping areas should be conducted under "sleep conditions," with all electrical equipment turned on or off as you have it at night. Under certain circumstances the electric field strength might even be higher if these items are switched off!

Some guidelines recommend the so-called "potential-free" measurement of electric fields, i.e. without needing to ground the meter. A potential-free measurement is, in principle, very adequate for the measurement of the total pollution. However, in order to obtain valid results, this method requires a great deal of know how, the use of a non-conductive holder (e.g. the PM5 by Gigahertz Solutions), three measurements in the three dimensional axes XYZ and the vectorial addition[2] of their results.

More adequate for the most important task, which is the identification of the sources of pollution, would be an earthed measurement, though, which is why this procedure is especially recommended for the private use. For more information about the NFA1000 which is specifically designed for this task please see our website.

Recommended Exposure Limit AC Electric Field:
Below 10 V/m, preferably below 1 V/m
(at 50/60 Hz for grounded measurement)
For potential-free measurement: below 1.5 pref. 0.3 V/m

For frequencies above 2 kHz significantly lower readings are to be desired.

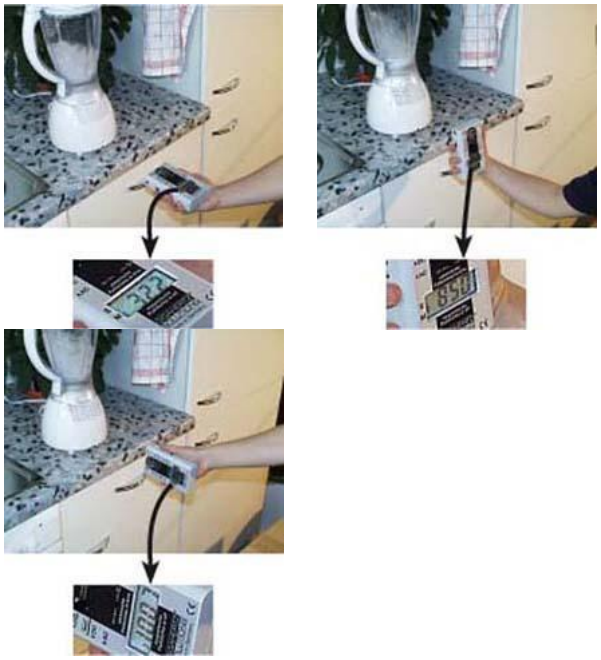
Measurement Instructions – Magnetic Fields:

Turn on the field meter and set the switch "Field Type" to "M" for AC magnetic field. Set the filter to "50 Hz". The field meter does not need to be grounded, persons present do not affect the

[2] Resulting total field strength = square root ($x^2 + y^2 + z^2$). Simplified calculation is possible by finding out the position / direction of highest reading as described in the next chapter for the magnetic field. The above formula is also valid for the calculation of the "3D" magnetic field.

testing results and there is no need to hold the meter close to your body. Proceed as follows:

- Move slowly through the room to be measured with special regard to the sleeping or working place.
- There is no need to turn the meter into different directions like for the E-field, instead check all three orientations from time to time as shown in the following pictures.
- In practice it is usually sufficient to "rotate" the meter out of your wrist until you have the position / **direction of the highest reading** (see pictures on next page). In this direction the meter shows the so-called **"resulting" field strength resp. magnetic flux density**.



Please note:

- Quick movements induce short peaks of pseudo readings that have nothing to do with actual fields (due to the earth's static magnetic field)
- Let the display settle for 2 seconds after every change of direction.

Recommended Exposure Limit AC Magnetic Field:
Below 200 nT, preferably below 20 nT
(Magnetic flux density at 50/60 Hz).

For frequencies above 2 kHz significantly lower readings are to be desired.

Conversion table nT to mG,

that is Nanotesla to Milligauss, on the last page of this manual.

Frequency Analysis

AC fields are not only defined by their field strength, but also by the frequency with which the polarity of the field changes. Your instrument can separate the following common frequencies and frequency bands:

5 Hz to 100 kHz ME3851A / 400 kHz ME3951A
Not recommended for hands-free measurements.

16.7 Hz
Overhead railway wires in Germany, France, Norway, Austria, Sweden and Switzerland.

50 Hz to 100 kHz ME3851A / 400 kHz ME3951A
Electric power grid and its harmonics.

2 kHz to 100 kHz ME3851A / 400 kHz ME3951A
"Artificial harmonics" above 2 kHz (e.g. from many AC-adaptors, energy-saving bulbs, TV-sets). Corresponds to band 2 of the Swedish TCO guideline. **A factor 10 lower safe limits are recommended for this range!**

Note: due to higher1/f- and white noise, tolerances of the filters and micro movements of the instrument as well as frequencies beyond the filter ranges, the reading in the position 5 Hz to 100/400 kHz can differ from the sum of the filtered readings.

AC Output

For a more detailed analysis of the different frequencies, a spectrum analyzer can be connected directly to the AC output of the field meter by means of the supplied adapter. At the AC output a DC offset of maximum 50 mV is applied. It is standard in oscilloscopes and spectrum analyzers that this DC offset is usually suppressed by a capacitive coupling. In case the peripheral analysis instruments are connected to the power grid including grounding conductor, the grounding of the field meter should not be connected in order to avoid ground loops!

The bandwidth of the AC output is limited to 30 kHz at full-scale. At hundred kilohertz it is still proportional up to 1/20 of the maximum reading. Since the field strengths in home and work- place settings under most circumstances are within this range, this output can actually be used up to 400 kHz.

DC Output

this output supplies a signal equalling minus 0.5 mV per digit. That would, for example, translate into minus 1 Volt at a maximum reading "2000 nT/Vm" or "200 nT/Vm". The negative signal was preferred over the positive signal because it clearly offered better linearity and correspondence with the display value.

The NFA line of instruments from Gigahertz Solutions offers a simplified three-dimensional frequency analysis and data logging of alternating magnetic field (NFA 400/1000: also electrical fields).

Battery, Auto-Power-Off, Low batt.

The meter is powered by a 9 V battery, situated within the meter. It will automatically be shut off after roundabout 40 minutes of continuous use in order to save battery capacity. When "Low. Batt." appears in the centre of the display, the field meter will be turned off after 3 min. in order to avoid measurement errors.

For charting please connect the A/C adapter and switch the instrument on and off once until the green LED lights. Charging will be interrupted automatically after about 11 hours.

Possibilities of Remediation

If possible, increase the distance to the source of pollution

Correct "Plugging":
Switch the meter to "E" and place it between e.g. the bedside light and the pillow. Switch off light. Reverse direction of plug by 180° and re-insert it. Logical: leave plug in the direction of lowest readings. This trick works best for an inline cable-switch of e.g. the lamp.

Use shielded socket-lines with two pole switch and shielded connection cables (for available versions check our website).

Install an automated "demand switch" in the house fuse box which cuts out electricity as soon as the last load is switched off and automatically reconnects as soon as electricity is needed again. As long as everything is switched off, there is no tension on the line and hence no pollution in the room. This is the most comfortable and effective measure you can take. Check www.gigahertz-solutions.com for most sophisticated and well reputed models.

It's easy to check for yourself whether a demand switch is a good investment for you (easiest in pairs):

- One person reads the meter on the bed to be inspected. Switch the meter to "E".
- The other person switches off the relevant fuses (one by one and different combinations)
- Install the demand switch into those circuits which show the highest reduction of field strength.

Further hints, literature and contact information regarding professional "building biologists" can be found on our website.

nanoTesla → milliGauss

nT	mG	nT	mG
0.1	0.001	16	0.16
---	---	18	0.18
---	---	20	0.20
---	---	25	0.25
---	---	30	0.30
0.2	0.002	35	0.35
---	---	40	0.40
0.3	0.003	50	0.50
---	---	60	0.60
0.4	0.004	70	0.70
0.5	0.005	80	0.80
0.6	0.006	90	0.90
0.7	0.007	100	1.00
0.8	0.008	120	1.20
0.9	0.009	140	1.40
1.0	0.010	160	1.60
1.2	0.012	180	1.80
1.4	0.014	200	2.00
1.6	0.016	250	2.50
1.8	0.018	300	3.00
2.0	0.020	350	3.50
2.5	0.025	400	4.00
3.0	0.030	500	5.00
3.5	0.035	600	6.00
4	0.040	700	7.00
5	0.050	800	8.00
6	0.060	900	9.00
7	0.070	1000	10.00
8	0.080	1200	12.00
9	0.090	1400	14.00
10	0.100	1600	16.00
12	0.120	1800	18.00
14	0.140	1999	19.99

Conversion Table

(µW/m² to V/m)

µW/m²	mV/m	µW/m²	mV/m	µW/m²	mV/m
0,01	1,94	1,0	19,4	100	194
-	-	1,2	21,3	120	213
-	-	1,4	23,0	140	230
-	-	1,6	24,6	160	246
-	-	1,8	26,0	180	261
0,02	2,75	2,0	27,5	200	275
-	-	2,5	30,7	250	307
0,03	3,36	3,0	33,6	300	336
-	-	3,5	36,3	350	363
0,04	3,88	4,0	38,8	400	388
0,05	4,34	5,0	43,4	500	434
0,06	4,76	6,0	47,6	600	476
0,07	5,14	7,0	51,4	700	514
0,08	5,49	8,0	54,9	800	549
0,09	5,82	9,0	58,2	900	582
0,10	6,14	10,0	61,4	1000	614
0,12	6,73	12,0	67,3	1200	673
0,14	7,26	14,0	72,6	1400	726
0,16	7,77	16,0	77,7	1600	777
0,18	8,24	18,0	82,4	1800	824
0,20	8,68	20,0	86,8	2000	868
0,25	9,71	25,0	97,1	2500	971
0,30	10,6	30,0	106	3000	1063
0,35	11,5	35,0	115	3500	1149
0,40	12,3	40,0	123	4000	1228
0,50	13,7	50,0	137	5000	1373
0,60	15,0	60,0	150	6000	1504
0,70	16,2	70,0	162	7000	1624
0,80	17,4	80,0	174	8000	1737
0,90	18,4	90,0	184	9000	1842

Hersteller / Manufacturer

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