Field Analyzer

FA106 and FA306

Users Manual

Contents

Preface

The FA306 is a sensitive measurement device that measures three kinds of fields. The FA106 only measures high frequency electromagnetic fields.

The fields measured are:

1) High frequency electromagnetic fields that are emitted by:

- GSM mobile telephones and their base station/ broadcasting masts
- UMTS mobile telephones and their base station/ broadcasting masts
- DECT cordless phone base stations (they emit regardless in use or not)
- DECT cordless telephones
- WLAN (or WIFI) wireless computer networks
- wireless video systems
- microwave ovens
- bluetooth wireless systems
- television transmitters

2) Low frequency electric fields (FA 306 only) that are emitted by:

- Home supply power lines
- 230 volt wall sockets and connected appliances (also when switched off)
- Out door electric power lines

3) Low frequency magnetic fields (FA 306 only) that are emitted by:

- Power adapters
- Many 230 volt appliances
- Alarm clocks
- Transformers of halogen incandescent lamps
- outdoor electric power lines
- electric motors/ engines

The figures measured are displayed on a clear LCD display, where they show the strength of the field emitted by the measured source.
When measuring high frequency radiation, the pulsation can be heard via the build in speaker.

Four operation buttons provide all options for adjusting the device into different measuring modes.

The mains adapter as well as a computer or oscilloscope can be connected at the right side of the device.

Chapter 1 Basic Functions

1.1 Turning on/off

The device is turned ON by simultaneously pressing the top and the bottom buttons. The screen displays FA306/ FA106.
The same procedure applies for turning the device OFF. The screen displays 'OFF' until both buttons are released.

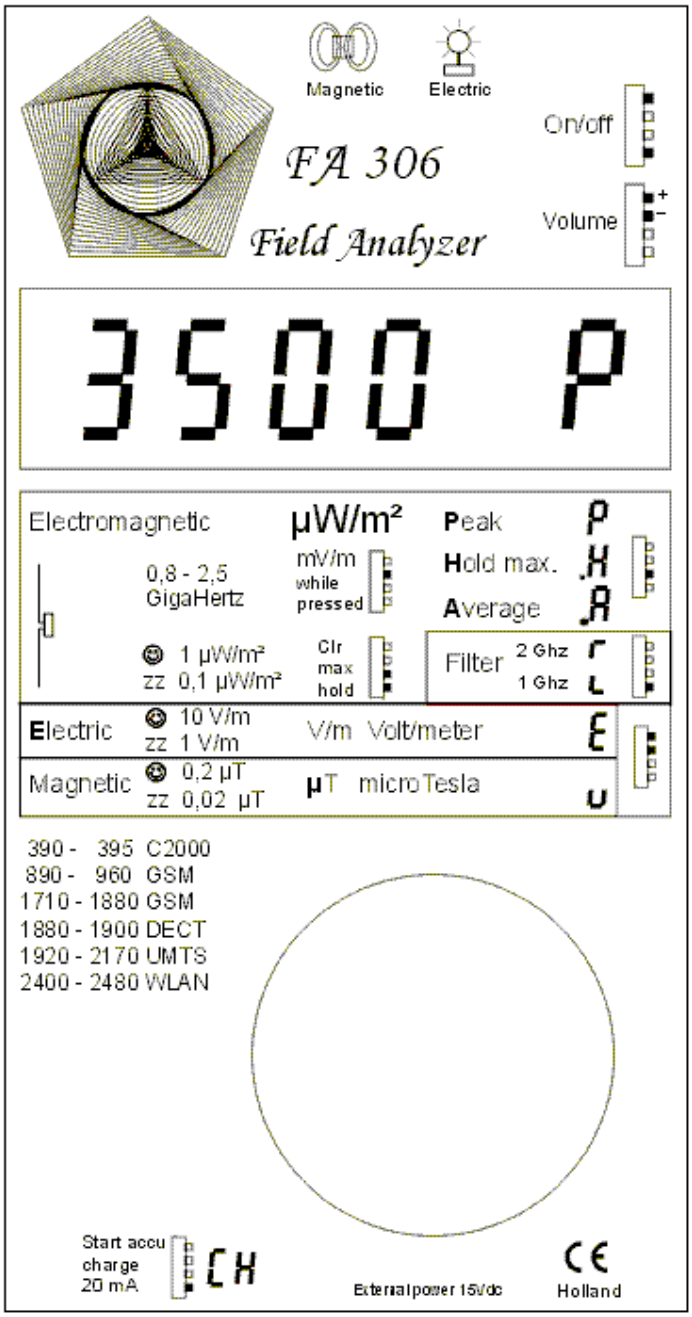
Pressing the bottom button only, the LCD screen displays the version number of the internal software. This manual describes version 1.5.

1.2 Choosing the required measuring mode

After turning on as explained above, the FA306 is automatically set to high frequency measurement. A '**P**' shows up on the display. *(For high frequency measurement see chapt.2)*

To measure low frequency electric and magnetic fields both upper buttons have to be pressed simultaneously.
Press once for measuring low frequency electric fields. The display then shows an '**E**' *(see chapt.3)*
Press twice for measuring low frequency magnetic fields. A '**u**' is displayed.
(See chapt.4)

1.3 Picture of front panel



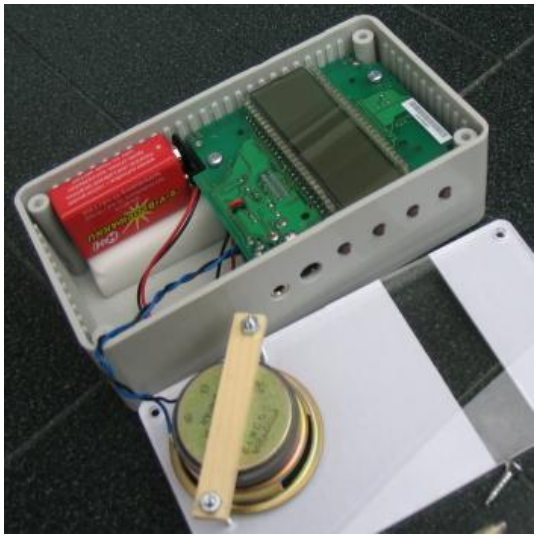
The four control buttons are at the right side. At this side you also find the connector for mains adapter and for connecting to a computer (sound card input) or oscilloscope.

1.4 The Battery

The FA106/FA306 device is powered by a 9-volt battery or by a mains power adapter. A NiMH rechargeable battery can be recharged via the mains power adapter with the battery remaining in the device.

The message **BAT** indicates necessity of replacing or recharging the battery.

Please be aware that most newly bought NiMH rechargeable batteries have to be charged before the first use.



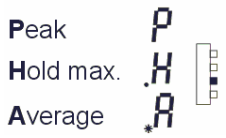
To change the battery, the device has to be opened up by unscrewing the four screws at the corners of the front panel. The front panel is then removed from the case but stays connected via the speaker wiring.
The battery is placed on the foam next to the speaker as shown on the picture above. When the front panel is mounted again, the battery is fixed between the front panel and the foam.

1.5 Using the mains adapter

A mains adapter can be used instead of the battery. The battery will be switched off when the mains adapter is connected to the device and to the mains.

Picture showing the right side of the device with connections and operation buttons

When the device is switched ON while the mains adapter is connected, the screen will show '**CH_'**. By pressing the **P, H, A** button, the normal functions can be used without starting the battery to recharge. The 'dash' behind the '**CH**' is not moving, indicating that charging has not yet begun.



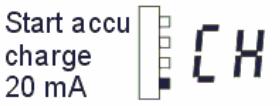
The adapter should have a voltage between 13 and 15 volts DC. The inner conductor is poled plus, the outer one minus. The device is protected against wrong polarity. Use an adapter that can deliver 100mA or more.

When using the adapter, the low frequency electric field measurement will produce a good result only when a good earth connection is used. Low frequency magnetic measurement will also not work well.

1.6 Charging a rechargeable battery

When the device is switched ON while the mains adapter is connected, the screen will show **CH_**. As mentioned above, the 'dash' is not moving, indicating that charging has not yet begun.

Pressing the bottom button starts the charging of the battery. This must never be done when a normal, not-rechargeable battery is nested in the device!



The device will indicate that charging has started by moving the 'dash' about once a second.

By pressing the **P, H, A** button now, you can use the normal functions of the device while the battery is charging.

Pressing the **P, H, A** button several times can check the charging progression. This recovers the '**CH**' state. The battery is charging as long as the 'dash' flashes.

A NiMH battery with a capacity of 150mAh takes 12 hours to fully charge.
A NiMH battery with a capacity of 200mAh takes 16 hours to fully charge.

When the charging time has elapsed, the device has to be turned OFF. The device will NOT do this automatically!

The charging current is 20 mA (milli-Ampere).
When the mains power is interrupted during charging the device switches off.

Chapter 2 High frequency electromagnetic field

2.1 General

The screen displays the strength of the radiation in microwatt per square meter (µW/m²). There are three ranges. Switching between the ranges is automatic.

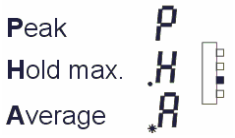
```
-  0,02 .. 39,0  µW/m²
-    20 .. 3900  µW/m²
-  2000 .. 39000 µW/m²
```

Values of 40000 µW/m² and higher cannot be displayed, in this case the display will flash.

There are three possibilities for displaying the radiation strength.

1. The Peak mode

Peak is the most important one. It gives the peak value of the radiation. This is used to determine if the radiation is hazardous.



2. The Hold mode

By pressing the **P, H, and A** button once, the display is switched from Peak to **Hold**.
Hold displays the highest Peak-value measured so far, and the display will be updated when an even higher Peak value is measured.

The Hold-value can be reset to the current peak-value by pressing both lower buttons at the same time.

The Hold-value will also be updated while the Peak or Average value is displayed.

3. The Average mode

By pressing the P, H, A, button twice, the display is switched from Hold to **Average**. This is the average value of the radiation. This can be used to determine if the radiation is pulsed. The radiation is pulsed if the average value is lower than the peak value. The radiation is not pulsed when the peak value is about the same as the average value.

By pressing a third time, the display is switched back to Peak.

*While displaying **H**old you see a dot before the 'H', and while displaying **A**verage you see a flashing dot. This allows for differentiation between P, H, and A modes when using a filter.*

2.2 Orientation of the device for optimum results

For optimum results hold the device at the right hand side in a vertical position. Due to the position of the internal antenna the measured value will be lower and imprecise when holding the device at the left side, because the radiation becomes partially absorbed by the hand.

Position of measurement

The measured value strongly depends on the position of the device i.e. its distance and angle to the source of radiation, especially for indoor measurements. Radiation is generally not emitted with the same strength in all directions.

In most indoor situation, the radiation is coming directly from the source but can also be reflected by big objects (indoor or outdoor objects). The combination of direct and reflected signals causes interference patterns. Due to interference the measured value can vary a lot, even when the device is moved only about 10 or 20 cm. The interference pattern can also be heard via the speaker.
The highest value measured is used to determine if the amount of radiation is acceptable. The **hold** mode makes it easy to determine the highest value measured when moving the device through the room.

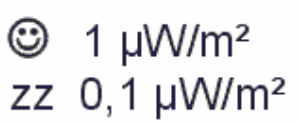
Spacial orientation

Most signals have a “vertical polarization”. Due to this, a vertical position of the device is optimal. Signals with “horizontal polarization” can be measured by holding the device in a horizontal position.
The polarization of radiation might change when it is reflected from a metal object. Also, the polarization of a signal can be somewhere between horizontal and vertical.

The radiation of a mast can be lower when measured very close to the mast. This is due to a horizontal concentration of the antenna’s radiation. Near the mast most of the radiation flies over the head of the person measuring there.

2.3 Safe values

For indoor living or working areas a Peak value of 1,0 µW/m² or lower is safe.
For sleeping areas a Peak value of 0,1 µW/m² or lower is safe.



Example:
A value of 0,7 µW/m² is acceptable for the living room.
A value of 0,06 µW/m² is acceptable for bedroom and living room.

Keep in mind that the device may have a statistical error of 30%.

The value for sleeping areas is derived from SBM2003, see appendix.
The value for indoor living or working areas is the "Salzburger Vorsorgewert" (1 uW/m² for indoor, and 10 uW m² for outdoor). See appendix.

2.4 Frequency filter

The device has two internal antennas. The first one is tuned around a frequency of 1 GHz, and the second one around 2 GHz. During normal (unfiltered) operation, the device switches between the two antennas several thousand times a second.
The highest of the two measured values is displayed on the screen.
The frequency range reaches from 0,8 GHz up to 2.5Ghz as shown on the front panel.
Within this range, the displayed value is correct within certain limits.
Signals outside this range can be measured but won't be displayed correctly.

The device has a frequency filter. Activating the filter means to only use one antenna and thereby dividing the frequency range in two sections (with a certain part in common).

- A range around 1 GigaHertz
- A range around 2 GigaHertz

Pressing the lower button once activates the 2 GHz filter. Pressing it a second time activates the 1 GHz filter. When using the filter only the value measured by the chosen antenna is displayed. Pressing it a third time activates the 2 GHz filter again.

The difference between the two individually measured values of each antenna can be used to estimate the frequency of the signal. Keep in mind that there may be several signals with different frequencies present at the same time

The filter is switched off by pressing the **P, H, and A** button.

Using the filter in Hold/ Average modes

The filter can also be used together with the Hold or Average mode. The dot shows what mode is used.

- No dot: Peak
- Continuous dot: Hold
- Flashing dot: Average

The Hold-function will give the maximum value that was measured in the selected frequency range.

The hold-value is continuously updated for both antennas independently, also during unfiltered Peak, Hold or Average. When the filter is switched on, only a single antenna is used. In this case, the hold value is updated only for the selected frequency range.

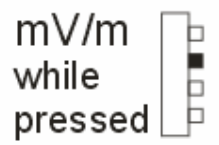
The filter can also be used to prevent interference in the sound. (See the section about Sound)

2.5 Conversion from microwatt /m² to milliVolt /meter*.*

The screen displays the strength of the radiation in microwatt per square meter (µW/m²).. The unit 'Volt per meter' (V/m) is also frequently used, and can be calculated with the following table.

	display		
mV/m	µW/m²		
4000	40.000		
3500	32.000		
3200	25.000		
2800	20.000		
2500	16.000		
2200	12.500		
2000	**10.000**		
1800	8.000		
1600	6.300		
1400	5.000		
1250	4.000		
1100	3.200		
1000	2.500		
900	2.000		
800	1.600		
700	1.250		
620	**1.000**		
560	800		
500	630		
450	500		
400	400		
350	320		
320	250		
280	200		
250	160		
220	125		
200	**100**		
180	80		
160	63		
140	50		
125	40		
110	32		
100	25		
90	20		
80	16		
70	12,5		
62	**10,0**		
56	8,0		
50	6,3		
45	5,0		
40	4,0		
35	3,2		
32	2,5		
28	2,0		
25	1,6		
22	1,25		
20	**1,00**	☺	Safe for waking hours
18	0,80		
16	0,63		
14	0,50		
12,5	0,40		
11	0,32		
10	0,25		
9	0,20		
8	0,16		
7	0,125		
6,2	**0,100**	**zz**	Safe for sleeping
5,6	0,080		
5,0	0,063		
4,5	0,050		
4,0	0,040		
3,5	0,032		
3,2	0,025		
2,8	0,020		
2,5	0,016		
2,2	0,0125		
2,0	**0,0100**		

The value in the mV/m column should be divided by 1000 to convert it to Volt per meter.



The conversion from microwatt per square meter into milliVolt per meter can be done pressing the indicated button.

The conversion between these units is quadratic. When the mV/m value doubles, the µW/m² value quadruples.

The values in the table are slightly rounded.

2.6 Sound

The speaker volume can be set with the upper two buttons. This gives an audible impression of the pulse modulation of the radiation. After some practice it is possible to identify the kind of radiation by the sound it produces.

The strength of the radiation has no influence on the sound volume. Weak signals can produce as much sound as strong signals.

During setting the volume, the volume setting is displayed. It can be set to a value on the scale from 0 to 8.

The speaker system uses a lot of current from the battery. Therefore to save the battery the sound should be switched off (volume=0).

By pressing the two middle buttons at the same time a different kind of sound can be heard which is a pitch that is proportional to the strength of the radiation. That allows finding the optimum position for measuring without constantly having to look at the display.
This option is not shown on the front panel.

Interference

During normal use (P, H or A), the device switches between the two antennas several thousand times a second. This can cause interference in the sound. By using the filter the interference disappears.

The next table shows the frequency area and pulse frequency of several sources of radiation.

MHz	pulse	
400	17,64 Hz	TETRA
900	217 Hz	GSM 900
1700	217 Hz	GSM 1800
1900	100 Hz	DECT
2100		UMTS
2400	10 Hz	WLAN
2400	1600Hz	Bluetooth
2455		Microwave oven

2.7 Sound connection

Next to the connection for a mains adapter at the right side of the device is a 3.5 mm stereo connection. One of the two channels of this connection provides the sound signal to an external device. The channel can be connected to the sound input of a computer sound card, or to an oscilloscope.

The amplitude of the signal on this connection is independent from the volume setting of the speaker sound. However, there will be no signal when the speaker is off (volume=0).

The same connection is used as a ground connection for the low frequency electric field measurement.

Chapter 3 Low frequency electric field

3.1 General

The measurement of low frequency electric fields is started by simultaneously pressing the upper two buttons. The display will show an **E**.
This option is not provided on the FA106 device.

The screen will show the strength of the electric field in V/m (Volt per meter) units. There are two ranges:

- 0,0 .. 20,0 V/m
- 15 .. 199 V/m

Switching between these ranges is automatic. When the value is too high, the display will flash.

The device measures fields in the frequency range from 15…300 Hz. Signals outside this range can be measured but won't be displayed correctly. Static electric fields can't be measured.

After switching to the E-field measurement, the device needs approx. 10 seconds to settle.

3.2 Orientation of the device for optimum results

The electric field sensor is inside at the top of the device. (The position is indicated by a small symbol). The device has to be held at the speaker side and the top be pointed to the source of the field. (However, the orientation of the device has not much influence on the measured value).

Holding the device at the top will produce a wrong value, because the electric field is shielded through the hand.

For a good result the device has to have a ground connection. This can be provided in two ways:

1) During the measurement one finger can be placed on the round metal ring of the "Sound connection" at the side of the device. This method normally gives a good impression of the electric field.

2) Connect a wire between the ground of the device (round metal ring of the “Sound connection”) and a suitable ground point. A suitable ground point can be the safety conductor of a mains outlet, or a tube of the central heating.
This will give a more precise result.

Moving the device a little won’t change the measured value a lot when, but the distance to the source of the field has a big influence on precision.

The device responds to changes in the surrounding electric field. This means that it will respond to the 50 Hz changing field of the electric wiring and devices in the house, but it will also respond to a change in the static electric field.
A static electric field can be as strong as 1000V/m and it will not be the same at every place in the room. A small movement in this field can produce a high result on the screen. Thus the device should not be moved during the measuring procedure.
The static electric field can change as well when someone else walks through the room and this also can have an influence on the measurement result.

3.3 Safe values

For indoor living or working areas a value of 10 V/m or lower is safe.
For sleeping areas a value of 1V/m or lower is safe.

Example:
A value of 8 V/m is acceptable for the living room.
A value of 0.7 V/m is acceptable for bedroom and living room.

Keep in mind that the device may have a statistical error.
It is also possible that there are fields with a frequency that can’t be detected by this device. The grounding method also has its influence on the result.

The value for sleeping areas is derived from SBM2003, see appendix.

Chapter 4 Low frequency magnetic field

4.1 General

The measurement of low frequency magnetic fields is started by simultaneously pressing the upper two buttons. The display will show an **E**. Pressing those buttons simultaneously twice will display a **u** (for the magnetic unit **µ**T, microTesla).
This option is not provided on the FA106 device.

The display shows the strength of the magnetic field in microTesla (1/1000000 Tesla). The range reaches from 0,01 µT up to 3,99 µT. When the value is too high, the display will flash.

The unit nanoTesla (nT) is also frequently used. The displayed value has to be taken times 1000 to convert it to nanoTesla.

The device measures fields in the frequency range from 40 up to 7000 Hz. Signals outside this range can be measured but won't be displayed correctly.
Static magnetic fields, like the field produces by a magnet, can't be measured.

After switching to the magnetic field measurement, the device needs approx. 10 seconds to settle.

4.2 Orientation of the device for optimum results

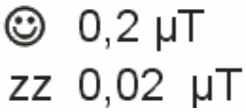
The "magnetic centre line" of the device goes right through the vertical centre of the front panel. The position of the magnetic field sensor is indicated by a small symbol at the top of the front panel.

The "magnetic centre line" of the device should be directed in the same direction as the field lines of the magnetic field to be measured. The main direction of the field lines can be determined by moving the device about several times.

The distance to the source of the magnetic field has a big influence on the measured strength of the magnetic field.

4.3 Safe values

For indoor living or working areas a value of 0,2 µT or lower is safe.
For sleeping areas a value of 0,02 µT or lower is safe.



Example:
A value of 0,15 µT is acceptable for the living room.
A value of 0,01 µT is acceptable for bedroom and living room.

Keep in mind that the device may have a statistical error.
It is also possible that there are fields with a frequency that cannot be detected by this device

The value for sleeping areas is derived from SBM2003, see appendix.

Appendices

Appendix 1 Specifications FA106/FA306

HIGH FREQUENCY FIELDS

- Measures high frequency electromagnetic field from
  800 Megahertz up to 2,5 Gigahertz,
  Displays in microwatt per square meter (µW/m²).
- Three ranges:
  0,02 - 39,00 µW/m²
  20 -3900 µW/m²
  2000- 39000 µW/m²
  Automatic switching between ranges
- Display Peak or Average value.
- Hold function for remembering the highest peak value
- LCD screen with 12mm character height
- Value can also be displayed in mV/m units
- Speaker with volume control
- Two internal antennas
- Filter function for central frequency 1 GHz or 2 GHz
- Audio connection for oscilloscope or PC-soundcard

LOW FREQUENCY FIELDS (FA306 only)

- Low frequency electric field from 0,1 V/m up to 199 V/m (Volt per meter)
- Low frequency magnetic field from 0,01 µT up to 3,99 µT (microTesla)

POWER SOURCE

- Needs 9V battery or 9V NiMH rechargeable battery. (Not included)
- Indication for low battery voltage
- Connection for mains adapter. (Mains adapter optional)
- Built-in charger for NiMH rechargeable battery (mains adapter needed)

OTHER

- Dimensions 15 x 8 x 5 cm.
- Weight 310 gram
- Safe values indicated on front panel
- Manual in PDF format

Appendix 2 More information

www.powerwatch.org.uk
www.scram.uk.com
www.mast-victims.org
www.buergerwelle.de/english_start.html
www.tetrawatch.net

The SBM2003 can be found at:
http://www.baubiologie.de/site/downloads/english/SBM2003_engl_neu.pdf

The "Salzburger Vorsorgewert" can be found at:
www.ohne-elektrosmog-wohnen.de/html/oberfeld.pdf page 13 and 18 (German).

Appendix 3 Abbreviations

Hz	Hertz	Unit for the number of cycles per second
KHz	KiloHertz	1.000 Hertz
MHz	MegaHertz	1.000.000 Hertz
GHz	GigaHertz	1.000.000.000 Hertz
T	Tesla	Unit for strength of magnetic field
µT	microTesla	0,000.001 Tesla
nT	nanoTesla	0,000.000.001 Tesla
V	Volt	Unit for electric potential difference
mV	milliVolt	0,001 Volt
W	Watt	Unit for power (energy per second)
µW	microWatt	0,000.001 Watt

DECT	Digital Enhanced Cordless Telephone
GSM	Global System for Mobile Communications
TETRA	Terrestrial Trunked Radio
UMTS	Universal Mobile telecommunications system
WLAN	Wireless local area network

Due to continuous improvements in the FA106 and FA306, information contained in this manual is subject to change without notice.

The device and the manual were assembled with great care. However, the seller or manufacturer can not be held responsible if any direct or indirect damage occurs during or after the use of this device or the information in this manual.

--- End of manual ---