Field Analyzer  FA505

Users Manual  Version 1.0

www.envionic.com
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Preface

The FA505 is a sensitive measurement device that measures three kinds of 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
   - TETRA communication network
   - WLAN (or WIFI) wireless computer networks
   - wireless video systems
   - microwave ovens
   - bluetooth wireless systems
   - television transmitters

2) **Low frequency electric fields** 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** that are emitted by:
   - Power adapters
   - Many 230 volt appliances
   - Alarm clocks
   - Transformers of halogen incandescent lamps
   - Out door electric power lines
   - Electric motors/ engines

The figures measured are displayed on a graphic LCD screen, where they show the strength of the field emitted by the measured source.

The graphical screen displays the pulse structure of the high frequency signal (as a function of time). Its logarithmic presentation can display weak signals in the presence of strong pulses. The pulsation can also 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 same procedure applies for turning the device OFF. The screen displays ‘OFF’ until both buttons are released.

While pressing both buttons, the LCD screen also displays the version number of the internal software. This manual describes version 2.2.

Directly after turning the device ON, the brightness of the display can be set with the lower two buttons.

1.2  Choosing the required measuring mode

The function of the four operation buttons is displayed at the right side of the screen, and can change according to the situation.

After turning on as explained above, the FA505 is automatically set to high frequency measurement.  *(For high frequency measurement see chapt.2)*

For measuring low frequency **electric** fields see chapter 3.

For measuring low frequency **magnetic** fields see chapter 4.

After measuring electric or magnetic fields, the FA505 returns to high frequency measurements when the upper button is pressed.
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 FA505 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.

When the battery is weak, a battery symbol will be visible at the upper left corner of the screen. When it is almost empty, this symbol will flash.

When the battery voltage has become too low for correct operation, the message **BAT** will be shown for a short time, and the device will switch itself off.

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.

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

When the screen backlight is used a lot, the battery may be exhausted soon. For that reason the use of rechargeable batteries is recommended.
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.

As long as the device is operated from the mains, a mains-plug symbol will be visible at the upper right corner of the screen.

It will, however, not automatically start charging the battery (see next page).

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 might be affected by the magnetic field of the mains adapter.

The FA505 will be delivered with one of the following mains adapters:

- 110 Volts (USA)
- 240 Volts (United Kingdom)
- 240 Volts (Europe, except United Kingdom)
1.6 Charging a rechargeable battery

The following sequence starts the charging of the battery. This must never be done when a normal, not-rechargeable battery is nested in the device!

1) Press this button until “FUNC” is displayed
2) Press this button until “CHG” is displayed
3) Press the “OK” button.

A charging battery will be displayed at the upper left corner of the display.

While the battery is being charged, all functions of the device can be used.

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 to stop charging. The device will NOT stop charging 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. (This controls only the displayed number, not the graphic display)
You can switch between the three modes by pressing the upper button.

- **Peak.** Peak is the most important one. It gives the peak value of the radiation. This is used to determine if the radiation is hazardous.
- **Hold.** The FA505 will remember the highest measured Peak value. This remembered value is displayed in the HOLD mode. During Hold mode, the displayed value will also be updated when an even higher Peak value is measured. The hold value is also visible as a dashed line on the screen, except when a filter is used.

The Hold-value can be reset to the current peak-value by the following sequence:

1) Press this button until “FUNC” is displayed
2) Press this button until “CLR” is displayed
3) Press the “OK” button.

- **Average (AVG).** 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. Of course, the pulses are also visible on the graphic screen.
2.2 Graphic screen

The strength of the radiation is displayed as a graph, as a function of time. The pulses of the radiation (many sources use pulsed radiation) are easily recognized. The strength of the radiation is displayed on a logarithmic scale. The difference between two vertical points is a factor 100 (in µW/m²) in intensity. The logarithmic presentation can display weak signals in the presence of strong pulses.

The HOLD value is displayed as a dashed line, also in the Peak or Average mode. It is not visible when a filter is switched on.

The brightness of the screen can be set as follows:

1) Press this button until “LITE” is displayed
2) Press “UP” or “DN” to control the brightness (from 0 to 4).

A high brightness will use a lot of current from the battery. Therefore to save the battery the brightness should not be too high.

2.3 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.*

**2.4 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.

😊 1 µW/m²
zz 0,1 µW/m²

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 µW/m² for indoor, and 10 µW m² for outdoor). See appendix.*
2.5 Frequency filter

The device has three internal antennas. The first one is tuned around a frequency of 400MHz, the second around 1 GHz, and the third one around 2 GHz. During normal (unfiltered) operation, the device switches between the three antennas several thousand times a second.

The highest of the three measured values is displayed on the screen.

The frequency range reaches from 0,3 GHz up to 3GHz 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 three sections (with a certain part in common).

- A range from 0,3 - 0,7 GigaHertz
- A range from 0,7 - 1,5 GigaHertz
- A range from 1,5 - 3,0 GigaHertz

1) Press this button until “FILT” is displayed
2) Press “UP” or “DN” to select the frequency range

The selected frequency range is displayed at the bottom side of the screen.

The filter is switched off by pressing ‘DN’ until the full frequency range (0,3 GHz - 3,0 GHz) is displayed at the bottom side of the screen.

*The difference between the three 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*

Using the filter in Hold/ Average modes

The filter can also be used together with the Hold or Average mode.

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

*The hold-value is continuously updated for the three 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)*
2.6 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.

<table>
<thead>
<tr>
<th>display</th>
<th>mV/m</th>
<th>µW/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>4000</td>
<td>4.000</td>
<td></td>
</tr>
<tr>
<td>3500</td>
<td>3.200</td>
<td></td>
</tr>
<tr>
<td>3200</td>
<td>2.500</td>
<td></td>
</tr>
<tr>
<td>2800</td>
<td>2.000</td>
<td></td>
</tr>
<tr>
<td>2500</td>
<td>1.600</td>
<td></td>
</tr>
<tr>
<td>2200</td>
<td>1.250</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>1800</td>
<td>0.800</td>
<td></td>
</tr>
<tr>
<td>1600</td>
<td>0.630</td>
<td></td>
</tr>
<tr>
<td>1400</td>
<td>0.500</td>
<td></td>
</tr>
<tr>
<td>1250</td>
<td>0.400</td>
<td></td>
</tr>
<tr>
<td>1100</td>
<td>0.320</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>0.250</td>
<td></td>
</tr>
<tr>
<td>900</td>
<td>0.200</td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>0.160</td>
<td></td>
</tr>
<tr>
<td>700</td>
<td>0.125</td>
<td></td>
</tr>
<tr>
<td>620</td>
<td>0.100</td>
<td></td>
</tr>
<tr>
<td>600</td>
<td>0.080</td>
<td></td>
</tr>
<tr>
<td>560</td>
<td>0.063</td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>0.050</td>
<td></td>
</tr>
<tr>
<td>450</td>
<td>0.040</td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>0.032</td>
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<td>350</td>
<td>0.025</td>
<td></td>
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<tr>
<td>320</td>
<td>0.020</td>
<td></td>
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<tr>
<td>280</td>
<td>0.016</td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>0.0125</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>0.0100</td>
<td></td>
</tr>
</tbody>
</table>

The device can also display in mV/m units. In the following way:

1) Press this button until “FUNC” is displayed
2) Press this button until “UNIT” is displayed
3) Press the “OK” button

Pressing OK again will switch back to µW/m² units.

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

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.
2.7 Sound

The speaker can give 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 speaker volume can be set as follows:

1) Press this button until “VOL” is displayed
2) Set the volume with the “UP” or “DN” button

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.

When the speaker is switched on, the filter will be set to the 1,5 – 3,0 GigaHertz range. The reason is, that the switching between antennas can cause interference in the sound. By using the filter, the interference disappears.

After setting the volume, you can of course select another filter range or switch the filter off again (but you will here the interference in the sound in this case).

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

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

<table>
<thead>
<tr>
<th>MHz</th>
<th>pulse</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>17,64 Hz</td>
</tr>
<tr>
<td>900</td>
<td>217 Hz</td>
</tr>
<tr>
<td>1700</td>
<td>217 Hz</td>
</tr>
<tr>
<td>1900</td>
<td>100 Hz</td>
</tr>
<tr>
<td>2100</td>
<td></td>
</tr>
<tr>
<td>2400</td>
<td>10 Hz</td>
</tr>
<tr>
<td>2400</td>
<td>1600Hz</td>
</tr>
<tr>
<td>2455</td>
<td></td>
</tr>
</tbody>
</table>


## 2.8 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 controlled by the volume setting. When a plug is inserted at this connection, the internal speaker will be switched off.

*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 as follows:

1) Press this button until “FUNC” is displayed
2) Press this button until “ELEC” is displayed
3) Press the “OK” button.

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.

😊 10 V/m
zz 1 V/m

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 as follows:

1) Press this button until “FUNC” is displayed
2) Press this button until “MAGN” is displayed
3) Press the “OK” button.

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 produced by a magnet, can’t be measured. However, changes in the magnetic field are visible. The device will show a value when it is turned in the magnetic field of the earth.

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

The waveform of the magnetic field is visible on the graphic screen. The magnitude on the screen will automatically be adapted for the best visibility.
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.

😊 0,2 µT
zz 0,02 µT

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 FA505

HIGH FREQUENCY FIELDS

- Measures high frequency electromagnetic field from
  300 Megahertz up to 3,0 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
- Graphical screen displays pulse structure of HF signal.
- Logarithmic presentation displays weak signals in the presence of strong pulses.
- Display Peak or Average value.
- Hold function for remembering the highest peak value
- Value can also be displayed in mV/m units
- Speaker with volume control
- Three internal antennas
- Filter function for central frequency 400MHz, 1 GHz or 2 GHz
- Audio connection for oscilloscope or PC-soundcard

LOW FREQUENCY FIELDS

- 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

- 9V battery or 9V NiMH rechargeable battery.
- Indication for low battery voltage
- Connection for mains adapter.
- Built-in charger for NiMH rechargeable battery

OTHER

- Graphical screen 128x64 pixels, with adjustable backlight
- 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:

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

Appendix 3  Abbreviations

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

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 FA505, 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 ---