HF38B

HF-Analyser for Frequencies from 800 MHz to 2.5 GHz (to 3.3 GHz with additional tolerance)

Instruction Manual

Revision 4.5
This manual will be continuously updated, improved and expanded. You will find the current version at your local distributors homepage or at www.gigahertz-solutions.de

Please carefully review the manual before using the device. It contains important advice for use, safety and maintenance of the device. In addition it provides the background information necessary to make reliable measurements.

Professional Technology

With the HF analyzers, GIGAHERTZ SOLUTIONS© sets new standards in HF testing. Professional measurement engineering is offered with a unique price/performance ratio - the only one of its kind worldwide. This was made possible through the consistent use of innovative integrated components, as well as highly sophisticated production engineering. Some features have patents pending.

The HF analyzer you purchased allows a competent assessment of HF exposures between 800 MHz and 2.5 (3.3) GHz. From a building biology perspective, this particular frequency range is particularly relevant because cellular phones, cordless phones, microwave ovens as well as next-generation technologies such as UMTS/3G or Bluetooth and WLAN all make extensive use of it.

We appreciate the confidence you have shown in purchasing this HF Analyzer. With the confidence that your expectations will be met, we wish you great success in collecting valuable information with this HF analyzer.

If you should encounter any problems, please contact us immediately. We are here to help.

GIGAHERTZ SOLUTIONS GmbH, Germany
Am Galgenberg 12, D-90579 Langenzenn,
www.gigahertz-solutions.com

For your local distributor please contact
www.gigahertz-solutions.com

Contents

Safety Instructions:

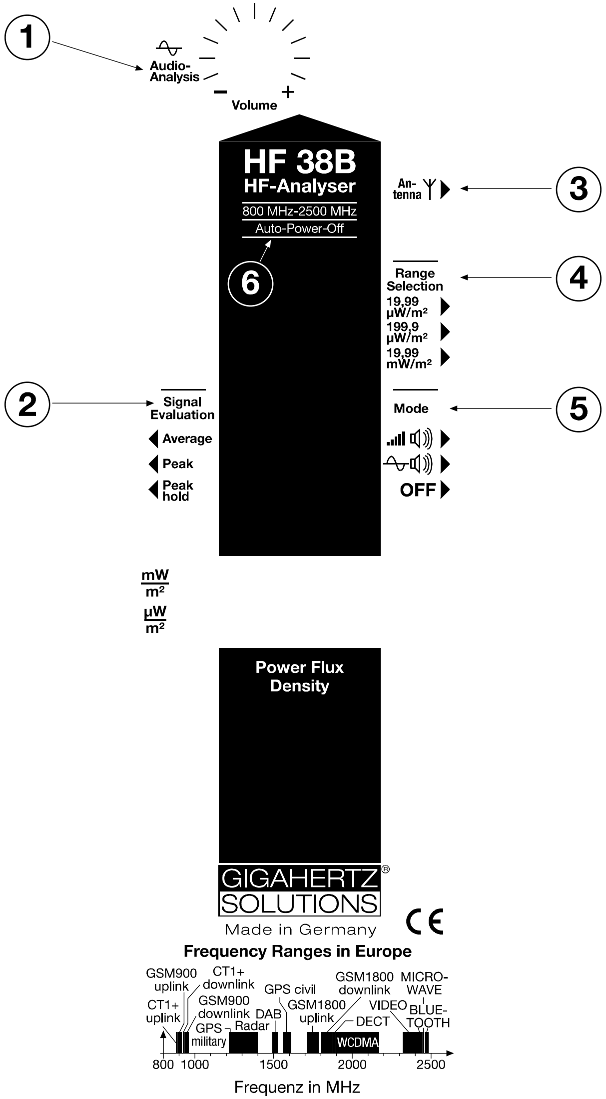
It is imperative to carefully study the instruction manual prior to using the HF analyzer. Important information regarding safety, use and maintenance is provided herein.

The HF analyzer should never come into contact with water or be used outdoors during rain. Clean the case only from the outside, using a slightly moist cloth. Do not use cleaners or sprays.

Prior to cleaning the HF analyzer or opening the case, shut it off and unplug all extension cords. There are no user-serviceable parts inside the instrument.

Due to the high sensitivity level, the electronics of the HF analyzer are very sensitive to heat, impact as well as touch. Therefore do not leave the instrument in the hot sun, on a heating element or in other damaging environments. Do not let it drop or try to manipulate its electronics inside when the case is open.

This HF analyzer should only be used for the purposes described in this manual and only in combination with supplied or recommended accessories.



The HF component of the instrument is shielded against interference by an internal metal box at the antenna input (shielding factor ca. 35 – 40 dB)

Functions and Controls

1) Volume control for the audio analysis.

2) Selector switch for **signal evaluation. Standard setting: "Peak".**

3) Connecting socket for antenna cable. The antenna is inserted into the "cross like" opening at the front tip of the instrument.

4) **Measurement ranges**
   19.99 mW/m² (=19 990µW/m²; "coarse")
   199.9 µW/m² ("medium")
   19.99 µW/m² ("fine")
   A little bar on the very left of the LCD indicates the unit of the numerical reading:
   bar on top = **m**W/m² (Milliwatts/m²)
   bar on bottom = **u**W/m² (Microwatts/m²)
   Scaling with external amplifier or damper is different!

5) **ON/OFF switch**. In middle switch-position . ∿.🔊.., the audio analysis mode is activated. In upper position .ıl.🔊 setting, you can additionally hear a signal proportional to the field strength[1].

6) This instrument has an "Auto-Power-Off function" to avoid unintentional discharge of the battery[2].

Typical default settings of major functions are marked yellow in the text above.

[1] For this feature the volume control should be turned down completely because otherwise the sound mixes with the "audio analysis". Similar to Geiger counter.

[2] The instrument switches off after about 30 Minutes at regular charging level of the battery and after about 3 Minutes when "Low Batt." is displayed on the LCD.

Contents of the package

Instrument

Attachable antenna

Alkaline Mangan (AlMn) 9 V battery (inside the meter)

Comprehensive instruction manual

Check the HF analyzer and its antenna by following the instructions under "Getting Started."

Getting Started

Connecting the Antenna

Screw the angle connector of the antenna connection into the uppermost right socket of the HF analyzer. It is sufficient to tighten the connection with your fingers. (Do not use a wrench or other tools because over tightening may damage the threads.)

This SMA connector has gold-plated contacts is the highest quality commercial HF connector in that size.

Carefully check the tight fit of the connection at the antenna tip. This connection, at the tip of the antenna, must not be opened.

Slide the antenna into the vertical / cross shaped slot at the rounded top end of the HF analyzer. Make sure the antenna cable has no tension and lies below the instrument. It may help to loosen the SMA-connector temporarily to let the cable fall into a "relaxed" position.

Do not bend, break or stretch the antenna cable!

The antenna can be used by attaching it to the top end of the HF analyzer or holding it in your hand. When holding the antenna in your hand, please ensure that your fingers do not touch the first resonator or antenna conductors. Therefore it is recommended to hold it at the opposite end. For a precision measurement, the antenna should not be held with your fingers, but be attached to the designated slot at the top end of the HF analyzer.

There are small ferrite-rolls fitted on the connectors of the antenna cable. They serve the purpose of fine-tuning[3]. *Do not remove!*

Checking Battery Status

When the "Low Batt" indicator appears in the center of the display, measurement values are not reliable anymore. In this case the battery needs to be changed.

If there is nothing displayed at all upon switching the analyzer on, check the connections of the battery. If that does not help try a new battery.

Remember that rechargeable batteries only have about a quarter of the capacity of the recommended AlMn-batteries.

Note

Each time you make a new selection (e.g. switch to another measurement range) the display will systematically overreact for a moment and show higher values that droop down within a couple of seconds.

The instrument is *now ready for use.*

In the next chapter you will find the basics for true, accurate HF-measurement.

[3] Should they loosen they can be glued again with any household glue

Introduction to Properties and Measurement of HF Radiation

This instruction manual focuses on those properties that are particularly relevant for measurements in residential settings.

Across the specified frequency range (and beyond), HF radiation causes the following effects in materials exposed to it:

1. Partial Permeation
2. Partial Reflection
3. Partial Absorption.

The proportions of the various effects depend, in particular, on the exposed material, its thickness and the frequency of the HF radiation. Wood, drywall, roofs and windows, for example, are usually rather transparent spots in a house.

Minimum Distance

In order to measure the quantity of HF radiation in the common unit "power density" (W/m^2), a certain distance has to be kept from the HF source. It is important to keep a minimum distance of one to two meters between the HF38B and the source of radiation.

Polarization

When HF radiation is emitted, it is sent off with a "polarization". In short, the electromagnetic waves propagate either vertically or horizontally. Cellular phone technology, which is of greatest interest to us, is usually vertically polarized. In urban areas, however, it sometimes is already so highly deflected that it runs almost horizontally or at a 45-degree angle. Due to reflection effects and the many ways in which a cellular handset can be held, we also observe other polarization patterns. Therefore it is always strongly recommended to measure both polarization planes, which is defined by the orientation of the antenna.

Please note that the LogPer-antenna supplied with this instrument is optimized for one polarization only (**vertical** if mounted to the instrument - even if the horizontal “wing” suggests the opposite.)

Fluctuations with Regards to Space and Time

Amplification or cancellation effects can occur in certain spots, especially within houses. This is due to reflection and is dependent on the frequencies involved. Most transmitters or cellular handsets emit different amounts of energy during a given day or over longer periods of time, because reception conditions and network usage change constantly.

All the above-mentioned factors affect the measurement technology and especially the procedure for testing. This is why in most cases several testing sessions are necessary.

Measuring HF Radiation

When testing for HF exposure levels in an apartment, home or property, it is always recommended to record individual measurements on a data sheet. Later this will allow you to get a better idea of the complete situation.

It is important to repeat **measurements several times**: First, choose different daytimes and weekdays in order not to miss any of the fluctuations, which sometimes can be quite substantial. Second, once in a while, measurements should also be repeated over longer periods of time, since a situation can literally change “overnight.“ A transponder only needs to be tilted down by a few degrees in order to cause major changes in exposure levels (e.g. during installation or repair of cellular phone transmitters). Most of all it is the enormous speed with which the cellular phone network expands every day that causes changes in exposure levels. In the future we will also have to deal with third generation networks (e.g. UMTS/3G), which are expected to increase exposure levels considerably since their system design requires much more tightly woven “cells“ of base stations compared to current GSM networks.

Even if you only intend to test indoors, it is recommended first to take measurements **in each direction** outside of the building. This will give you an initial awareness of the “HF tightness“ of the building and also potential HF sources inside the building (e.g. 2.4 GHz telephones, also from neighbours).

Furthermore you should be aware that taking measurements indoors adds another dimension of testing uncertainties to the specified accuracy of the used HF analyzer due to the narrowness of indoor spaces. According to the “theory“ quantitatively accurate HF measurements are basically only reproducible under so-called “free field conditions”, yet we have to measure HF inside buildings because this is the place where we wish to know exposure levels. In order to keep system-immanent measurement uncertainties as low as possible, it is imperative to carefully follow the measurement instructions.

As mentioned earlier in the introduction, only slight changes in the positioning of the HF analyzer can lead to rather substantial fluctuations in measurement values. (This effect is even more prevalent in the ELF range.) **It is suggested that exposure assessments are based on the maximum value within a locally defined area** even though this particular value might not exactly coincide with a particular point of interest in, for example, the head area of the bed.

The above suggestion is based on the fact that slightest changes within the environment can cause rather major changes in the power density of a locally defined area. The person who performs the HF testing, for example, affects the exact point of the maximum value. It is quite possible to have two different readings within 24 hours at exactly the same spot. The maximum value across a locally defined area, usually changes only if the HF sources change, which is why the latter value is much more representative of the assessment of HF exposure.

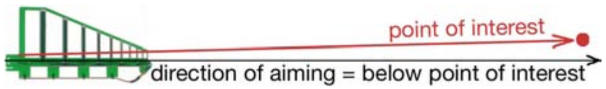
Step-by-Step-Instruction to HF-Measurement

Preliminary Notes Concerning the Antenna

The supplied logarithmic-periodic antenna (or aerial), has **exceptional directionality**. Thus it becomes possible to reliably locate or “target“ specific emission sources in order to determine their contribution to the total HF radiation level. To know exactly the direction from where a given HF radiation source originates is a fundamental prerequisite for effective shielding. Our logarithmic periodic antenna, the “LogPer antenna”, provides a distinct division of the horizontal and vertical polarization plane. Also the frequency response is exceptional. There is a patent pending for its design.

The missing directionality of standard telescope antennae is one of the reasons why they are not suited for reliable HF measurements in building biology EMR.

Important:
As the LogPer Antenna provided with this instrument is shielded against ground influences one should “aim” about 10 degrees below the emitting source one wants to measure. This is to avoid distortions of the reading.



The upper edge of the foremost resonator is a good “aiming aid” for the required angle. It does not matter if the angle gets a little too wide.

The readings from the instrument’s display reflect the integral power density in the “antenna lobe”. (ie., the antenna is most sensitive, with a rounded peak, to radiation from a direction parallel to its axis with the sensitivity tapering off rapidly with increasing angle of incidence.)

The frequency range of the LogPer aerial supplied covers cellular phone frequencies (e.g. GSM800, GSM1900, TDMA, CDMA, AMPS, iDEN), 2.4-GHz (DECT) cordless phones, frequencies of third generation technologies, such as UMTS, WLAN and Bluetooth, as well as other commercial frequency bands and microwave ovens. All the frequencies in between are also included. This is the frequency range which you would find most pulse-modulated signals, concerned scientists are worried about.

For monitoring of these critical sources of radiation as conveniently as possible the frequency band of the LogPer aerial supplied together with the instrument has been limited intentionally by its design to frequencies above 800 MHz, i.e. frequencies below 800 MHz are suppressed. The suppression is additionally enforced by an internal highpass filter at 800 MHz. This reduces the disturbing impact of most sources like radio broadcasting, television stations or amateur radio on the measurements to a minimum.

In order to measure frequencies below 800 MHz down to 27 MHz the instruments HFE35C and HFE59B are available from Gigahertz Solutions. They come with an active horizontally isotropic ultra broad band aerial down to 27 MHz, the UBB27

Measurements for a Quick Overview

This is helpful to gain insight into the overall situation. Since the actual number values are of secondary interest in this phase, it is usually best to simply follow the audio signals which are proportional to the field strength. (Set“ On/Off“ switch (“Mode” to: , and turn down the audio analysis knob to low).

Procedure for the Quick Overview Measurement:

The HF analyzer and antenna are to be checked following the instructions under “Getting Started.“

First set the measurement range (“Range Selection”) switch to “19.99mW/m^2” (coarse). Only if the displayed measurement values are persistently below ca. 0.10 mW/m^2, change to the measurement range “199.9µW/m^2” (medium) or even to “19.99 µW/m^2”(fine).

Note: When switching from the range 19.99mW/m^2 to 199.9µW/m^2, the volume of the audio signal increases sharply. When switching from the range 199.9µW/m^2 to 19.99µW/m^2 there is no difference in volume.

Set the “Signal Evaluation” switch to “Peak”

HF radiation exposure can differ at each point and from all directions. Even though the HF field strength of a given space changes far more rapidly than at lower frequencies, it is neither feasible nor necessary to measure all directions at any given point.

Since this is not an accurate quantitative measurement, but a quick overview assessment, the antenna can be removed from the top end of the HF analyzer, for convenience. Holding the antenna at its very end as described in “Getting Started”, the polarization plane (vertical or horizontal) can easily be changed with a turn of your wrist. However, you can just as well use the HF analyzer with the antenna attached to it.

Since there is no need to look at the display during an overview measurement, you only need to listen to the **audio signal**. It is very easy to walk slowly through in-door or outdoor spaces in question. In doing so constantly moving the antenna or the HF analyzer with attached antenna, in each direction. This will provide you with a quick overview of the situation. In in-door spaces, antenna movements towards the ceiling or the floor will reveal astonishing results.

As already mentioned above, overview measurements are not meant to provide accurate results, but to identify those zones within which local peak values are found.

Quantitative Measurement: Settings

After having identified the relevant measurement points following the instructions in the previous section. The actual testing can begin.

Setting:
Measurement Range Selection

Select the appropriate switch settings as described under “Quick Overview Measurements“. Basic rule for measurement range selection:

- As coarse as necessary, as fine as possible.

Note:

To allow for as wide a range of power densities to be read out without using an external attenuator, a factor of 100 lies between adjacent ranges. That means for example an actual value of 150 **µ**W/m² will be displayed as 150.0 **µ**W/m² in the range “199,9µW/m²” (“Medium”) and as 0.15 **m**W/m² in the range “19.99mW/m²” (“Coarse”). Due to technical reasons the tolerances of the instrument are relatively high in this overlapping 1% of the next higher range[4].

[4] Power densities of a few hundred µW/m², displayed as 0.01 up to about 0.30 mW/m² in the setting "19.99mW/m²", are those with the highest measurement uncertainties as % of the actual values. On the other hand setting the switch to "199,9µW/m²" activates an internal amplifier, which brings with it an additional waviness of up to +/- 1 dB, depending on the actual frequency analysed. Worst case combined to worst case could absorb almost +/- 3 dB, the maximum tolerance of the instrument. For very small readings in "19.99mW/m²" that could result in a factor of 4 difference of the corresponding reading with setting "Medium". Numerical example: In "199,9µW/m²" you read 150.0 µW/m². In "19.99mW/m²" you could read up to 0.6 mW/m² or down to 0.03 mW/m² in an extreme case. Normally the differences shown will be much smaller.

Rules of thumb for the interpretation of the results

Readings in the two adjacent sensitivity ranges “Medium” and “19.99mW/m²” use the one with the higher value.

Numbers below 0.05 mW/m² shown in the range “19.99mW/m²” are within the range of its potential zero bias. Use the reading shown in range “199,9µW/m²”.

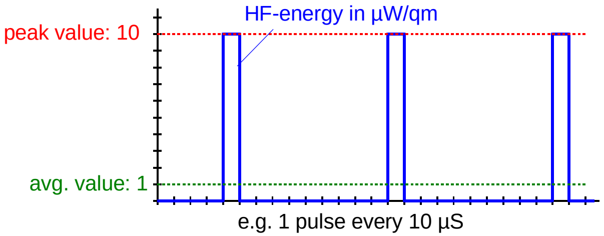
For comparative measurements (before / after shielding) use the same range selector position when possible.

Power densities beyond the designed range of the instrument (display shows “1” on its left side with the range set on “19.99mW/m²”) can still be measured by inserting the attenuator DG20, available as an optional accessory. When using this attenuator, multiply the displayed value by 100 to calculate the actual measurement.

Setting:
Signal Evaluation

Signal Evaluation – Average / Peak

A pulsed signal consists of sections of its time period with high output and another sections with zero output. Their maximum output is the wave peak. The following illustration shows the difference in the evaluation of a pulsed signal if displayed as an average value reading or a peak value reading.



Note: The **peak HF radiation value**, not the average value, is regarded as the measurement of critical “biological effects“. The peak value is displayed in the switch setting: “Peak”. The average value is displayed in the switch setting: “Average”.

An experienced measuring technician will be able to obtain additional information from the comparison of average and peak values. Basic Rule: The more the two measurement values differ from one another (in 2.4-GHz cordless phones the ratio can be as high as 1:100.), the higher is the potential of a contribution from e.g. a 2.4-GHz cordless phone or other pulsed signal source to the total maximum value.

Still today, some field meters only display average values. They are of little help when considering the potential health risks associated with pulse-modulated HF radiation since through the “averaging“ of steep HF pulses, HF radiation exposure can be underrated up to a factor of 100, such as in 2.4-GHz cordless phones.

Signal Evaluation – Peak Hold

Many measuring technicians work with the function “Signal Evaluation” “Peak Hold“. In “peak hold” mode the highest value of the signal from the moment the switch is set to “Peak Hold” can be obtained / “collected”. If the reading increases sharply or “jumps up” when switching scales, try again carefully to avoid these "virtual peaks".

In everyday measurement practice this function has great value. The peak value is related to the actual signal situation. This is important because the immission situation can change rapidly with time, direction of the radiation, polarization, and the points of measurements.. The “Peak Hold” mode guarantees that you do not miss single peaks.

The tone signal works independently of data collection in the peak hold mode. Its sound is proportional to the actual value measured. It helps to identify the location, direction, and polarization of the maximum field strength.

The inevitable “droop rate”, at which the held peak value decreases over time takes about 20 minutes to run out of the specified tolerance, but in order to get an accurate reading the display should be checked frequently. If very short signal peaks occur then the holding capacity of the function needs some recurrences to load fully.

Quantitative Measurement:
Determination of Total High Frequency Pollution

As described in Getting Started, attach the LogPer **antenna to the HF analyzer.** Hold the HF analyzer with a **slightly outstretched arm** because objects (mass) directly behind it “like yourself”, have effects on the testing result. Your hand should not get too close to the antenna, but should be near the bottom end of the instrument.

In the area of a **local maximum,** the positioning of the HF analyzer should be changed until the highest power density (the most important measurement value) can be located. This can be achieved as follows:

- When **scanning** “all directions“ with the LogPer to locate the direction from which the major HF emission(s) originate, move your wrist right and left. For emission sources behind your back, you have to turn around and place your body behind the HF analyzer.
- Through **rotating** the HF analyzer, with attached LogPer antenna, around its longitudinal axis, determine the polarization plane of the HF radiation.
- C**hange** the measurement position and avoid measuring exclusively in one spot.. because that spot may have local or antenna-specific cancellation effects.

Some manufacturers of field meters propagate the idea that the effective power density should be obtained by taking measurements of all three axes and calculating the result.

Most manufacturers of professional testing equipment, however, do not share this view.

In general, it is well accepted that exposure limit comparisons should be based on the maximum value emitted from the direction of the strongest radiation source.

But the details of the situation need to be considered! For example, if a 2.4-GHz telephone inside the house emits a similar level of microwaves as a nearby cellular phone base station outside the house, it would be helpful to first turn off the 2.4-GHz telephone in the house. Now measure the exposure level originating from the outside. After having measured the emission of the 2.4-GHz telephone on its own, the sum of both measurement values could be used for the exposure assessment.

There is no “official regulation” nor clearly defined testing protocol, because according to German national standard-setting institutions, as described earlier, quantitatively reliable, targeted and reproducible measurements are only possible under “free field conditions“ but not in indoor environments.

Cellular phone channel emissions vary with the load. The minimum HF level occurs, when only the control channel operates. It is suggested that measurements should be taken at different times during the day / week in order to find out the times of highest traffic.

Quantitative Measurement:
Special case 1: UMTS / 3G

(Universal Mobile Telecommunication System, also known as the third generation of mobile phones.) This technology is designed to process huge amounts of data and has a narrowly meshed network.

With LogPer aerial and in “Peak “ mode identify the main direction of the signal and switch to “ Peak Hold – long”

Now “gather“ the highest value without moving the meter (use a wooden tripod) for at least 2 minutes in the same position. This is important as because of the signal characteristics of the UMTS/3G signal fluctuations by the factor +/- 6 are common.

To hear samples how a UMTS/3G signal sounds in the audio-analysis please check our website for links to MP3 files.

Please note:

- UMTS signals can be underrated by as much as 5 times. Gigahertz Solutions offers the HF58B-r and HF59B RF analysers, to measure the complex UMTS signals

Quantitative Measurement:
Special Case 2: Radar

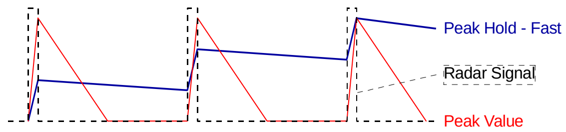
For air and sea navigation a radar antenna slowly rotates around its own axis, thereby emitting a tightly bundled “radar ray“. Even with sufficient signal strength, this ray can only be detected every couple of seconds, for a few milliseconds. This requires special measurement technology.

Please use the following procedure to ensure correct readings:

Setting: Signal Evaluation – “Peak”. With the help of the audio analysis (a very short “Beep” every couple of seconds), one can clearly identify a radar signal. With this setting and the LogPer antenna you can identify the direction of the source of the signal.

Switch to “Peak Hold” and direct the LogPer antenna towards the signal emitting source. Wait for several circles of the radar ray, move the instrument a little left and right in order to get the relevant maximum reading.

The long delays between pulses may consume a great deal of time trying to detect signal direction with a LogPer aerial. The following drawing shows the connection:



Depending on the type of radar, the average level can be up to 10 dB or 10 times lower than the actual peak power density, sometimes even more. To be on the safe side one should multiply the radar peaks (i.e. peak minus background radiation between pulses) by ten and compare this value with limits or recommendations.

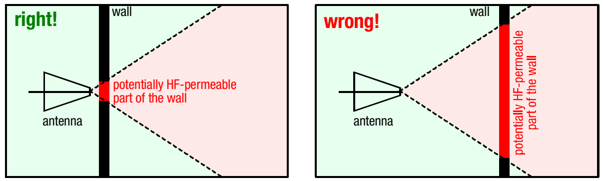
The HF58B-r and HF59B HF Analyzer’s contain patented circuitry specifically designed for radar signal analysis. When set to “Peak Hold”, they will display the full peak value of the radar beam after the first beam passing. This is true for most types of radar.

Please note that there are Radar systems that are operated at even higher frequencies that can be measured with this instrument, yet possibly not the full intensity.

Quantitative Measurement:

Identify where the radiation enters a structure

As a first step eliminate sources from within the same room (e.g. cordless phones, wireless routers, etc.) Once this is completed, the remaining radiation will originate from outside. For remedial shielding it is important to identify those areas of all walls (including doors, windows and window frames!), ceiling and floor, which are penetrated by the radiation. To do this one should not stand in the centre of the room, measuring in all directions from there, but monitor the permeable areas with the antenna (LogPer) directed and positioned close to the wall[5]. That is because the antenna lobe widens with increasing frequency. In addition reflections and cancellations inside rooms make it difficult and often impossible to locate the "leaks" accurately. See the illustrating sketch below!



The uncertainty of localization with HF-antennas

The shielding itself should be defined and surveyed by a specialist and in any case the area covered by it should be much larger than the leak

[5] Please note: In this position the readings on the LCD only indicate relative highs and lows that cannot be interpreted in absolute terms.

Limiting values, recommendations and precautions

Precautionary recommentation for sleeping areas for pulsed radiation

Below 0.1 µW/m²
(SBM 2003)

below 1 µW/m²
(Landessanitätsdirektion Salzburg, Austria)

The official regulations in many countries specify limits far beyond the recommendations of environmentally oriented doctors, "building biologists" and many scientific institutions and also those of other countries. They are vehemently criticised, but they are nonetheless "official". The limits depend on frequencies and in the HF range of interest here they are between 4 and 10 W/m², far beyond 10 million times the recommendations. Official limits are determined by the potential heat generation in the human body and consequently measurements of averages rather than peaks. This ignores the state of environmental medicine. The "official" limits are far beyond the range of this instrument, which is optimized for accurate measurement of power densities targeted by the building biologists.

The standard SBM 2003 cited above classifies power densities of below 1µW/m² as "no anomaly" for non pulsed radiation in sleeping areas, and for pulsed radiation one tenth of that.

The "Bund für Umwelt und Naturschutz Deutschland e. V." (BUND) proposes 100 µW/m² outside buildings. In view of the shielding properties of normal building materials, far lower values exist inside buildings.

In February 2002 the Medical Authority of the Federal State Salzburg, Austria, recommends to reduce its "Salzburger Precautionary Recommendation" from 1 000 µW/m² to 1 µW/m² inside buildings and 10 µW/m² outside. These limits are based on empirical evidence over the past few years.

The ECOLOG-Institute in Hannover, Germany made a recommendation only for outside areas, namely 10000 µW/m². This is well above the recommendation by building biologists and aims at getting consent also from the industry. This would possibly enable a compromise for a more realistic limit than the government regulations cited above. The authors qualify their recommendation in

- The limit should be applicable to the maximum possible emission of the transmitting stations. As the emission measured depends on the constantly varying actual load, this restricts the normal exposure much further.
- A single station should not contribute more than one third to this total.
- The extensive experience and findings of medical and building biology specialists could not be considered for the proposed limits, as their results are not sufficiently documented. The authors state, that "scientific scrutiny of their recommendations is needed urgently".
- Not all effects on and in cells found in their research could be considered for the proposed limits, as their damaging potential

could not be established with sufficient certainty.

In summary it confirms the justification of precautionary limits well below the present legal limits.

Note for owners of cellular phones:

Unimpaired reception of calls is possible with power densities far below even the very strict precautionary recommendation of 0.1 µW/m² for pulsed HF frequencies by the SBM 2003.

Audio Frequency Analysis

Many different frequencies within the frequency band between 800MHz and 2.5GHz, are being used by many different services. The audio analysis of the modulated portion of the HF signal, help to **identify the source of a given HF radiation signal**.

Marking of unpulsed signals

Un-pulsed signals by their very nature are not audible in the audio analysis and therefore easily missed. For that reason they are marked by a uniform "rattling" tone, with its volume proportional to its contents of the total signal. This "marking" has a frequency of 16 Hz, and an audio sample can also be downloaded as a MP3 file from our website.

How to proceed:

For audio analysis, simply turn the volume knob of the speaker at the top of the case all the way to the left ("-"). If you are switching to audio analysis while high field strength levels prevail, high volumes can be generated quite suddenly. This is especially true for measurements which are to be taken without audio analysis. The knob is not fastened with glue to prevent over winding. However, if by accident you should turn the knob too far, simply turn it back again. No damage will be caused.

Set the On/OFF switch at ⏦ 🔊.

Sounds and signals are very difficult to describe in writing. The best way to learn the signals is to approach known HF sources very closely and listen to their specific signal patterns. Without detailed knowledge, the **characteristic signal patterns** of the following HF sources can be easily identified: 2.4-GHz telephones (base station and handset) as well as cellular phones, the signal patterns of which can be divided into "a live connected phone call", "stand-by mode" and especially the "establishing of a connection". The typical signal patterns of a cellular phone base station can also be identified this way. For comparison reasons you are well advised to take measurements during high-traffic times, as well as some times during the night, in order to familiarize yourself with the different noises.

The volume can be controlled with the "volume" (speaker) knob. Note: The power consumption of the speaker is directly proportional to the volume.

The optional variable frequency filters VF2 or VF4 available help to facilitate the audio analysis significantly and at the same time add to its accuracy. They filter out individual frequencies so contributions from other sources can be identified.

On our home page (www.gigahertz-solutions.de) is a link to some typical samples of audio analyses as MP3-files.

Further Analysis / Optional Accessories:

Gigahertz Solutions offers an attenuator to widen the range of power densities which can be processed with this instrument. See section "Quantitative Measurement".

Furthermore there are two variable frequency filters ("variable traps") for quantitative separation between different sources of radiation. One of them blocks the selected frequency by 20 dB to one hundredth of its real intensity; the other version blocks by 40 dB for a more accurate reading.

Instrument for lower frequencies

For measurement of signal frequencies above 27 MHz (including: CB radioing, analogue and digital TV and radio TETRA etc.) we offer the instruments HFE35C and HFE59B.

Instrument for yet higher frequencies

We are working on a new instrument for the analysis of yet higher frequencies (up to about 6 GHz, i.e. WLAN, WIMAX and some directional radio sources and flight radar).This will be available in 2006.

Available for low frequencies:

Electrosmog is not limited to the Radio Frequency range!

Also for the low frequency range such as power (distribution and domestic installations) including their higher harmonics we offer a broad range of affordably priced instruments with high professional standards.

Please refer to a list of contacts is at the end of this brochure.

Power Supply

Changing the Battery

The battery compartment is at the back of the analyzer. To remove the lid, press on the grooved arrow and pull the cap off.

Auto-Power-Off

This function conserves energy and extends the total operating time.

1. In case you have forgotten to turn OFF the HF analyzer or it has been turned ON accidentally during transport, it will shut off automatically after 40 minutes of continuous use.
2. If "low batt" appears vertically between the digits in the center of the display, the HF analyzer will turn OFF after 3 min in order to avoid unreliable measurements. In that case change the battery.

Remediation and Shielding

Please call us or send us an e-mail.

We will assist you in any shielding project you might have.

The shielding effect of the various materials is stated normally in "- dB", e.g. "– 20 dB".

Conversion of shielding effect into reduction of power density

„-10dB" is measured value divided by 10
"-15dB" is measured value divided by ~30
"-20dB" is measured value divided by 100
"-25dV" is measured value divided by ~300
"-30dB" is measured value divided by 1000
etc.

Please be aware of the manufacturer's notes about the normally achievable shielding effects, as 100 % shielding is almost always impossible. Partial shielding reduces the attenuation considerably. That is why shielding of seemingly radiation tight adjacent areas is highly recommended.

Warranty

We provide a two year warranty on factory defects of the HF analyzer, the antenna and accessories.

Antenna

Even though the antenna appears to be rather delicate, it is made from a highly durable FR4 base material that can easily withstand a fall from table height.

HF Analyzer

The analyzer itself is not impact proof, due to the comparatively heavy battery and the large number of wired components.

Any damage as a result of misuse is excluded from this warranty

DRU0160

Conversion Table W/m² and V/m

nW/m²	µW/m²	mW/m²	W/m²	mV/m	V/m
0,01	0,00001	0,00000001	0,00000000001	0,0614	0,0000614
0,1	0,0001	0,0000001	0,0000000001	0,194	0,000194
1	0,001	0,000001	0,000000001	0,614	0,000614
10	0,01	0,00001	0,00000001	1,94	0,00194
100	0,1	0,0001	0,0000001	6,14	0,00614
1.000	1	0,001	0,000001	19,4	0,0194
10.000	10	0,01	0,00001	61,4	0,0614
100.000	100	0,1	0,0001	194	0,194
1.000.000	1.000	1	0,001	614	0,614
10.000.000	10.000	10	0,01	1.940	1,94
100.000.000	100.000	100	0,1	6.140	6,14
1000.000.000	1.000.000	1.000	1	19.400	19,4
10.000.000.000	10.000.000	10.000	10	61.400	61,4

mV/m and V/m – figures are rounded!

Why no column „dBm"?

Most recommended limiting values for HF radiation are given in W/m² (sometimes also in V/m), which is why this instrument is displaying in power density, µW/m² resp. mW/m². A display in dBm as e.g. on a spectrum analyzer requires transformation by a complicated formula, which depends on frequency and specifics of the antenna used. A "reconversion" therefore does not make sense.

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