HFW59D

High Frequency Analyser
for frequencies from 2.4 GHz to 10 GHz

Thank you!

We appreciate the confidence you have shown in purchasing this HF Analyser. It will allow a professional analysis of the exposure with high frequency (HF) radiation corresponding to the baubiology recommendations.

Further to this manual you are welcome to have a look at the training videos on our homepage for an optimal use of our measurement technology.

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

For your local distributor pls check:

www.gigahertz-solutions.com

Contents

Instruction Manual

Revision 1.3

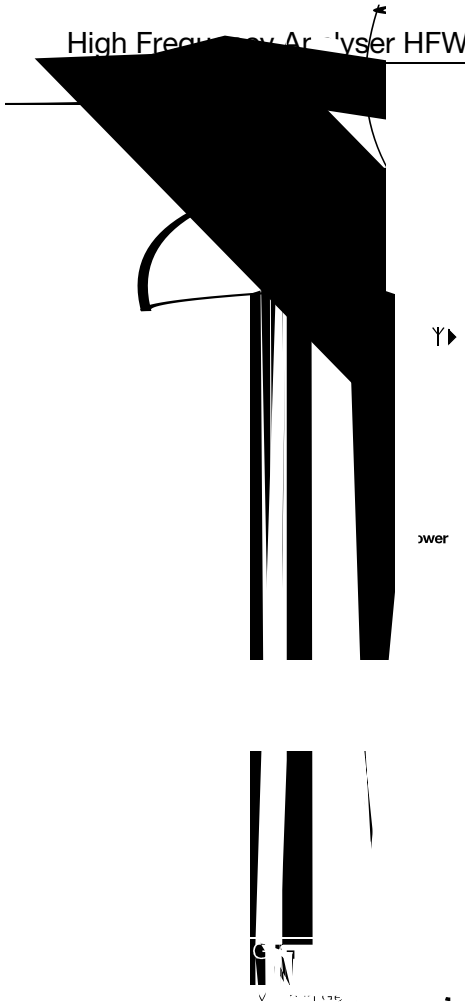
This manual is subject to continuous updates, amendments and adjustments. The most current version can always be found for download on your local distributor's homepage or under www.gigahertz-solutions.de

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.

Safety Instructions:

The HF analyser 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.

Due to the high sensitivity level, the electronics of the HF analyser 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 any other damaging environment. Do not let it drop or try to manipulate its electronics inside when the case is open.



Long and short switches

Long switches: Standard functions.

Short switches: In order to avoid unintentional switching for rarely used functions, some of the switches are recessed in the casing of the instrument.

Contents of the package

Instrument

LogPer antenna with SMA-connector

NiMH rechargeable batteries
(inside the meter)

Instructions manual

Getting Started

Connecting the Antenna

Screw the SMA angle connector of the antenna connection into the uppermost right socket of the HF analyser. 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).

Normally, the sources of radiation in the frequency range subject to measurement are vertically polarised. Therefore, the antenna should ideally be aligned as shown in the photo below:

Important: Please do not bend or twist either of the antenna cables.

For a horizontal antenna alignment please do not twist the cable itself, but turn the whole measurement device into the right direction. With the help of the LED at the antenna tip you can control the connection of the antenna cable to the device.

Please do not touch the antenna cable during measurement.

Further notes to the antenna

The SMA connection between the antenna and the meter is the highest quality industrial HF connection of this size. Furthermore, the semi-rigid antenna cable implied has excellent parameters for the frequency range in question. It is designed for several hundred bending cycles without causing losses to the quality of the measurements. The special implementation of a second “dummy” antenna cable is the subject matter of one of our pending patents, and compensates the internal weakness of the “simple-log-per-antenna” which is based on conductor plates. These are also sensitive to frequencies below the specified bandwidth, thus possibly falsifying measurements in the principal direction. The antenna supplied with the meter can suppress these disturbances by approx. 15 to 20 dB (in addition to the 40 dB of the internal high pass filter).

Checking Battery Status

If the “Low Batt” indicator appears in the center of the display, measurement values are no longer reliable. In this case, the battery needs to be charged.

If there is no display at all upon switching the analyser on, check the connections of the rechargeable battery. If that does not help try to insert a regular 9 Volt alkaline, (non-rechargeable) battery.

If a non-rechargeable battery is used, do not connect the analyser to a charger / AC-adaptor!

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 which will, however, 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.

Introduction to Properties and Measurements 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.

For measurements in the lower frequency limits of the HFW59D, the minimum distance between the antenna tip and the object of measurement should be half a meter.

Polarization

When HF radiation is emitted, it is sent off with a “polarization”. In short, the electromagnetic waves propagate either vertically or horizontally. Therefore, both planes of polarization ought to be checked in order to identify the one applying to the object in question. Please note that the antenna supplied with this instrument measures the vertically polarized plane if the upper surface of the meter is held horizontically.

Fluctuations with Regard 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. Furthermore, the transmitting power can be subject to variation or modification during a given day or over longer periods of time.

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

Step-by-Step-Instruction to HF-Measurement

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.

Procedure for the Quick Overview Measurement:

The HF analyser and antenna are to be checked following the instructions under "Getting Started."

First set the measurement range ("Range") switch to "max". Only if the displayed measurement values are persistently below approx. 0.10 mW/m², change to the measurement range "min" (199.9µW/m²).

Set the "Signal" 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 in the lower frequencies, it is neither feasible nor necessary to measure all directions at any given point.

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 move the antenna or the HF analyser 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, the aim of the quick overview measurement is to identify the zones of local peaks, not to supply exact data.

Quantitative Measurement: Settings

Once the relevant measurement points have been identified following the instructions in the previous section, the quantitative and precise measurements can be started.

Setting: **"Range"**

Select the appropriate switch settings as described under "Quick Overview Measurements": First switch the Range switch to "max". Only switch to "min" if you're constantly shown very low values. Basic rule for measurement range selection:

As coarse as necessary, as fine as possible.

Power densities beyond the designed range of the instrument (display shows "1" on its left side with the range set to "max") can still be measured by inserting the attenuator DG20_G10, available as an optional accessory. By setting the "ext. adapt." switch to 20 dB on your instrument, you will ensure a correct display of the measurement value (i.e. indication of unit and correct decimal point).

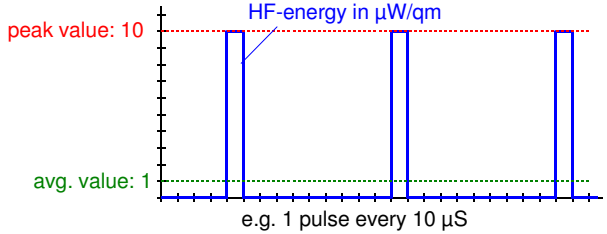
The optional HF preamplifier HV20_2400G10, to be used as plug-in into the antenna input socket, increases the sensitivity by a factor of 100. With the help of this, the meter reaches a theoretical minimum resolution of 0.01 µW/m². The realistic minimum resolution is slightly lower due to the noise margin.

A list of all possible ranges can be found at the end of this brochure.

Setting: **"Signal"**

Peak / RMS

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 ("RMS" and "Peak"):



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: "RMS".

Peak Hold

Many measuring technicians work with the function “Signal” “Peak hold“. In “Peak hold” mode the highest value of the signal within a defined time span can be obtained / “collected”.

In order to obtain accurate readings you must use the small black button on the meter face labeled "clear”. Failure to clear the LCD display screen by pressing this button, for two seconds, will result in inaccurate readings. While this button is pushed and held, the readings are regular "Peak" readings. If any switch settings are changed while measuring, and also in order to start any new "Peak hold" measurement, you must always first hold this "clear" button for some seconds, then release it. This will ensure accurate readings.

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.

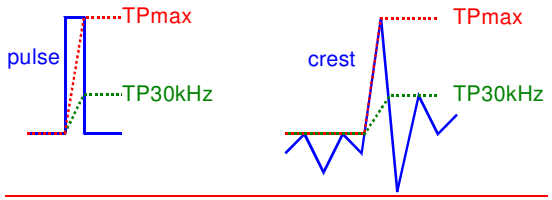
The tone signal works independently of data collection in the peak hold mode. Its sound is proportional to the actual value measured. It helps to identify the location, direction, and polarization of the maximum field strength.

You can chose the (inevitable) droop rate, at which the held peak value decreases over time. Set the switch below the signal evaluation switch (recessed in the casing) to “+” or “-”. In the slow mode it takes about 20 minutes to run out of 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.

Setting:
VBW Maximum / VBW Standard

VBW stands for “video bandwidth” and is an important classification of the technical capabilities and limits of a high frequency measurement device. It defines the minimum duration of short pulses that still can be measured by the meter without being distorted.

For most signals, select the setting “VBW Standard” (30 kHz). In order to be able to display signals such as radar (“pulse” in the following drawing), or broadband modulated signals such as LTE (4G), or WLAN during data transmission without falsifications, you will need the maximum video bandwidth (2 MHz). The following drawing will explain why:



However, the advantages of the high video bandwith also involve a higher noise level.

Quantitative Measurement: Determination of Total High Frequency Pollution

Hold the HF analyser from its rear side with a **slightly outstretched arm**.

In the area of a **local maximum,** the positioning of the HF analyser 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 analyser.
- Through **rotating** the HF analyser around its longitudinal axis, thus taking into account the polarization plane of the HF radiation.
- **Change** 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.

Limiting values, reference values, and precautionary values

Precautionary recommendation
for pulsed radiation in sleeping areas

Below 0.1 µW/m²
(SBM 2008: “no concern”)

below 1 µW/m² (“for indoors”)
(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 (1 W/m² = 1,000,000 µW/m²). 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 2008 cited above classifies power densities of below 1 µW/m² as “no anomaly” for non pulsed radiation in sleeping areas, and for pulsed radiation one tenth of that.

Building biology guideline acc.to SBM-2008
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	no	**slight**	**strong**	**extreme**
Readings in µW/m²	concern < 0.1	concern 0.1 - 10	concern 10-1000	concern > 1000

The "Bund fuer 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 of 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 Hanover, Germany made a recommendation only for outside areas, namely 10,000 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.

Audio Frequency Analysis

The audio analysis of the modulated portion of the HF signal helps to **identify the source of a given HF radiation signal**.

First get the HF analyser ready for testing by following the instructions in the relevant section.

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

Measurement ranges of the HFW59D

Range	Bar on LCD	**Instrument as delivered,** i.e. without preamplifier or attenuator ("ext. adapt." to "0 dB") **Displayed** value & unit
max	▮	0.01 - 19.99 **m**W/m²
min	▮	1 - 1999 **µ**W/m²
Simply read out, no correction factor		

Range	Bar on LCD	**With ext. Attenuator DG20,** ("ext. adapt." to "-20 dB") **Displayed** value & unit
max	▮	1 - 1999 **m**W/m²
min	▮	0.1 - 19.99 **m**W/m²
Simply read out, no correction factor		

Range	Bar on LCD	**With ext. Preamplifier HV20,** ("ext. adapt." to "+20 dB")