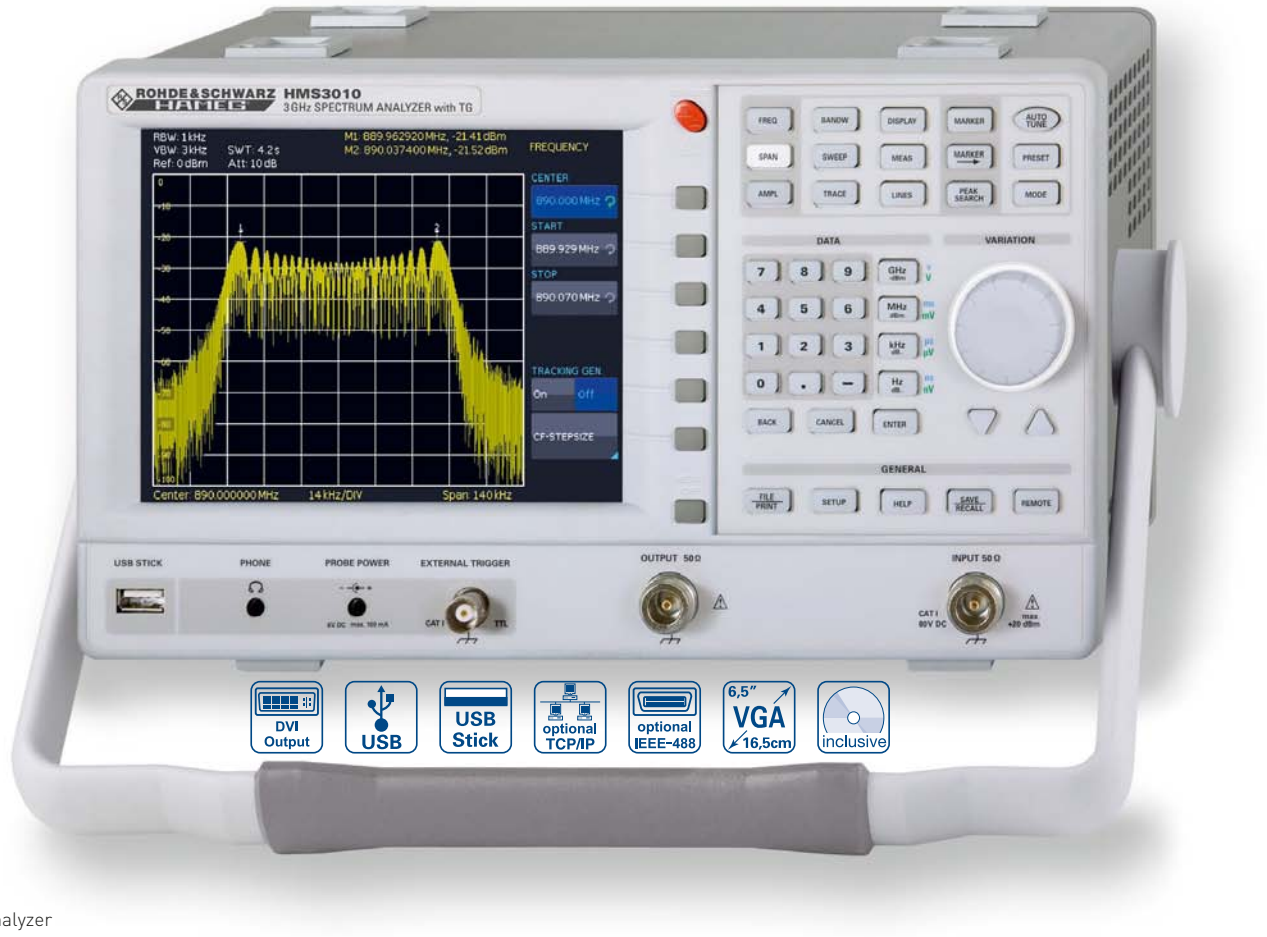
3GHz Spectrum Analyzer
HMS3000/HMS3010



3GHz Spectrum Analyzer
HMS3000 without TG

3GHz EMI Near Field Probe
Set HZ550L

VSWR Test Unit HZ547

- ☑ Frequency Range 100kHz...3GHz
- ☑ Tracking Generator HMS3010 -20...0dBm
- ☑ Amplitude Measurement Range -114...+20dBm
  DANL -135dBm with Preamp. Option HO3011
- ☑ Sweep Time 20ms...1000s
- ☑ Resolution Bandwidth 100Hz...1MHz in 1–3 Steps,
  200kHz (-3dB); additional 200Hz, 9kHz, 120kHz, 1MHz (-6dB)
- ☑ Spectral Purity <-100dBc/Hz (@100kHz)
- ☑ Video Bandwidth 10Hz...1MHz in 1–3 Steps
- ☑ Integrated AM and FM Demodulators (Phone and int. Speaker)
- ☑ Detectors: Auto-, Min-, Max-Peak, Sample, RMS, Quasi-Peak
- ☑ 8 Markers with Delta Marker, miscellaneous Peak Functions
- ☑ Crisp 16.5cm (6.5") TFT VGA Display, DVI Output
- ☑ 3 x USB for Mass-Storage, Printer and Remote Control,
  optional IEEE-488 (GPIB) or Ethernet/USB Dual-Interface

1.6 GHz Spectrum Analyzer HMS1000, HMS1010 (with TG) [3 GHz Spectrum Analyzer HMS3000, HMS3010 (with TG)]

Firmware: ≥ 2.022
All data valid at 23 °C after 30 minute warm-up.

Frequency	
Frequency range:	
HMS1000, HMS1010	100 kHz...1.6 GHz
HMS3000, HMS3010	100 kHz...3 GHz
Temperature stability:	±2 ppm (0...30 °C)
Aging:	±1 ppm/year
Frequency counter:	
Resolution	1 Hz
Accuracy	±(Frequency x tolerance of reference)
Span setting range:	
HMS1000, HMS1010	0 Hz (zero span) and 100 Hz...1.6 GHz
HMS3000, HMS3010	0 Hz (zero span) and 100 Hz...3 GHz
Spectral purity, SSB phase noise:	
30 kHz from carrier (500 MHz, +20...30 °C)	<-85 dBc/Hz
100 kHz from carrier (500M Hz, +20...30 °C)	<-100 dBc/Hz
1 MHz from carrier (500MHz, +20...30 °C)	<-120 dBc/Hz
Sweep time:	
Span = 0 Hz	2 ms...100 s
Span > 0 Hz	20 ms...1,000 s, min. 20 ms/600 MHz
Resolution bandwidths (-3 dB)**:**	100 Hz...1 MHz in 1–3 steps, 200 kHz
Tolerance	
≤300 kHz	±5 % typ.
1 MHz	±10 % typ.
Resolution bandwidths (-6 dB)**:**	200 Hz, 9 kHz, 120 kHz, 1 MHz
Video bandwidths:	10 Hz...1 MHz in 1–3 steps

Amplitude	
Display range:	Average noise level displayed up to +20 dBm
Amplitude measurement range:	Typ. -114...+20 dBm
Max. permissible DC at HF input:	80 V
Max. power at HF input:	20 dBm, 30 dBm for max. 3 Min.
Intermodulation free range:	
TOI products, 2 x -20 dBm (-10 dBm ref. level)	66 dB typ. (typ. +13 dBm third-order intercept)
(at distance between signals ≤2 MHz)	60 dB typ. (+10 dBm TOI)
(at distance between signals >2 MHz)	66 dB typ. (typ. +13 dBm TOI)
DANL (Displayed average noise level)**:**	
(RBW 100 Hz, VBW 10 Hz, ref. level ≤-30 dBm 10MHz...1.6GHz resp. 3GHz)	-115 dBm, typ. -124 dBm
With Preamp.	-135 dBm typ.
Inherent spurious:	
(ref. level ≤-20 dBm, f >30 MHz, RBW ≤100 kHz)	<-80 dBm
Input related spurious:	
(Mixer level ≤-40 dBm, carrier offset >1 MHz)	-70 dBc typ., [-55 dBc (2...3 GHz)]
2nd harmonic receive frequency:	
(mixer level -40 dBm)	-60 dBc typ.
Level display:	
Reference level	-80...+20 dBm in 1 dB steps
Display range	100 dB, 50 dB, 20 dB, 10 dB, linear
Logarithmic display scaling	dBm, dBµV, dBmV
Linear display scaling	Percentage of reference level
Measured curves:	1 curve and 1 memory curve
Trace mathematics:	A-B (curve-stored curve), B-A
Detectors:	Auto-, Min-, Max-Peak, Sample, RMS, Average, Quasi-Peak
Failure of level display: (ref. level -50 dBm, 20...30 °C)	<1.5 dB, typ. 0.5 dB

Marker/Deltamarker	
Number of marker:	8
Marker functions:	Peak, next peak, minimum, center = marker, frequency, reference level = marker level, all marker on peak
Marker displays:	Normal (level, lin. & log.), delta marker, noise marker, (frequency) counter

Inputs/Outputs	
HF Input:	N socket
Input Impedance	50 Ω
VSWR (10 MHz...1.6 GHz/3 GHz)	<1.5 typ.
Output tracking generator:	
(HMS1010/HMS3010)	N socket
Output Impedance	50 Ω
Frequency range	5 MHz...1.6 GHz (3 GHz)
Output level	-20...0 dBm, in 1 dB steps
Trigger input:	BNC female
Trigger voltage	TTL
Ext. reference input/output:	BNC females
Reference frequency	10 MHz
Essential level (50 Ω)	10 dBm
Supply output for field probes:	6 V_{dc}, max. 100 mA (2.5 mm DIN jack)
Audio output (Phone):	3.5 mm DIN jack
Demodulation	AM and FM (internal speaker)

Miscellaneous	
Display:	16.5 cm (6.5") TFT Color VGA Display
Save/Recall memory	10 complete device settings
Trigger	Free run, Video Trigger, Single Trigger, external Trigger
Interfaces:	Dual-Interface USB/RS-232 (HO720), USB-Stick (frontside), USB-Printer (rear side), DVI-D for ext. monitor
Power supply:	105...253 V, 50...60 Hz, CAT II
Power consumption:	Max. 40 W at 230 V, 50 Hz
Protection class:	Safety class I (EN61010-1)
Operating temperature:	+5...+40 °C
Storage temperature:	-20...+70 °C
Rel. humidity:	5...80 % (non condensing)
Dimensions (W x H x D)**:**	285 x 175 x 220 mm
Weight:	3.6 kg

Accessories supplied: Line cord, Operating manual, HZ21 Adapter plug, N-plug to BNC socket (2x HMS1010/3010), CD, Software

Recommended accessories:

HO730	Dual-Interface Ethernet/USB
HO740	Interface IEEE-488 (GPIB), galvanically isolated
HO3011	Preamplifier -135 dBm DANL (100 Hz RBW)
HZ13	Interface cable (USB) 1.8 m
HZ14	Interface cable (serial) 1:1
HZ20	Adapter, BNC to 4 mm banana
HZ33	Test cable 50 Ω, BNC/BNC, 0.5 m
HZ34	Test cable 50 Ω, BNC/BNC, 1.0 m
HZ46	4RU 19" Rackmount Kit
HZ72	GPIB-Cable 2 m
HZ99	Carrying Case for protection and transport
HZ520	Plug-in Antenna with BNC connection
HZ525	50 Ω-Termination, N plug
HZ530	Near-Field Probe Set 1 GHz for EMI diagnostics
HZ540/550	Near-Field Probe Set 3 GHz for EMI diagnostics
HZ540L/550L	Near-Field Probe Set 3 GHz for EMI diagnostics
HZ547	3 GHz VSWR Bridge for HMS1010, HMS3010
HZ560	Transient limiter
HZ575	75/50 Ω Converter
HZO30	Active probe 1 GHz (0.9 pF, 1 MΩ, including many accessories)

1 Installation and safety instructions

1.1 Setting up the instrument

As can be seen from the fi gures, the handle can be set into different positions:

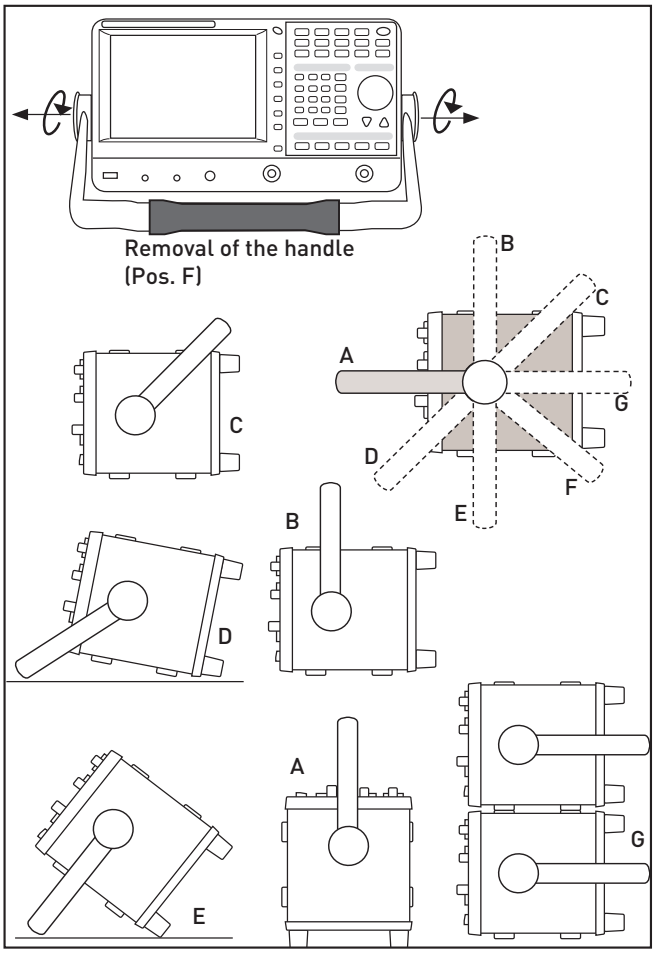
A and B = carrying
C = horizontal operating
D and E = operating at different angles
F = handle removal
G = operating using the feet's, batch use and for shipping in original packaging

Attention!
When changing the handle position, the instrument must be placed so that it cannot fall (e.g. placed on a table). Then the handle locking knobs must be simultaneously pulled outwards and rotated to the required position. Without pulling the locking knobs they will latch in into the next locking position.

Removal/fitting of the handle: The handle can be removed in position F, pulling the side parts outside the housing. Adding the handle works vice versa.

1.2 Safety

The instrument fulfi ls the VDE 0411 part 1 regulations for electrical measuring, control and laboratory instruments and was manufactured and tested accordingly. It left the factory in perfect safe condition. Hence it also corresponds to European Standard EN 61010-1 and International Standard IEC 1010-1. In order to maintain this condition and to ensure safe operation the user is required to observe the warnings and other directions for use in this manual. Housing, chassis as well as all measuring terminals are connected to safety ground of the mains. All accessible metal parts were tested against the mains with 2200 V_{DC}. The instrument conforms to safety class I. The oscilloscope may only be operated from mains outlets with a safety ground connector. The mains plug has to be installed prior to connecting any signals. It is prohibited to separate the safety ground connection. If suspected that safe operation may not be guaranteed do not use the instrument any more and lock it away in a secure place.



Safe operation may be endangered if any of the following was noticed:

- in case of visible damage.
- in case loose parts were noticed
- if it does not function any more.
- after prolonged storage under unfavourable conditions (e.g. like in the open or in moist atmosphere).
- after any improper transport (e.g. insuffi cient packing not conforming to the minimum standards of post, rail or transport firm)

1.3 Correct operation

Please note: This instrument is only destined for use by personnel well instructed and familiar with the dangers of electrical measurements. For safety reasons the oscilloscope may only be operated from mains outlets with safety ground connector. It is prohibited to separate the safety ground connection. The plug must be inserted prior to connecting any signals. The oscilloscope is destined for operation in industrial, business, manufacturing, and domestic sites.

1.4 Ambient conditions

Operating ambient temperature: +5 °C to +40 °C. During transport or storage the temperature may be –20 °C to +70°C. Please note that after exposure to such temperatures or in case of condensation, proper time must be allowed until the instrument has reached the permissible temperature, and until the condensation has evaporated before it may be turned on! Ordinarily this will be the case after 2 hours. The oscilloscope is destined for use in clean and dry environments. Do not operate in dusty or chemically aggressive atmosphere or if there is danger of explosion. The any operating position may be used, however, sufficient ventilation must be ensured. Prolonged operation requires the horizontal or inclined position.

Do not obstruct the ventilation holes!

Specifi cations are valid after a 30 minute warm-up period at 23 °C (tolerance ±2 °C). Specifications without tolerances are average values.

1.5 Warranty and repair

Our instruments are subjected to a strict quality control. Prior to leaving the factory, each instrument is burnt in for 10 hours. By intermittent operation during this period almost all defects are detected. Following the burn in, each instrument is tested for function and quality, the specifications are checked in all operating modes; the test gear is calibrated to national standards. The warranty standards applicable are those of the country

in which the instrument was sold. Reclamations should be directed to the dealer.

Only valid in EU countries:
In order to speed claims, customers in EU countries may also contact HAMEG directly. Also, after the warranty expired, the HAMEG service will be at your disposal for any repairs.

Return Material Authorization (RMA):
Prior to returning an instrument to HAMEG, ask for a RMA number either by internet (http://www.hameg.com) or fax (+49 (0) 6182 800 501). If you do not have an original shipping carton, you may obtain one by calling the HAMEG service dept (+49 (0) 6182 800 500) or by sending an email to service@hameg.com.

1.6 Maintenance

Before cleaning please make sure the instrument is switched off and disconnected from all power supplies.

Clean the outer case using a dust brush or a soft, lint-free dust cloth at regular intervals.

No part of the instrument should be cleaned by the use of cleaning agents (as f.e. alcohol) as they may adversely affect the labeling, the plastic or lacquered surfaces.

The display can be cleaned using water or a glass cleaner (but not with alcohol or other cleaning agents). Thereafter wipe the surfaces with a dry cloth. No fluid may enter the instrument. Do not use other cleaning agents as they may adversely affect the labels, plastic or lacquered surfaces.

1.7 CAT I

This oscilloscope is destined for measurements in circuits not connected to the mains or only indirectly. Direct measurements, i.e. with a galvanic connection to circuits corresponding to the categories II, III, or IV are prohibited! The measuring circuits are considered not connected to the mains if a suitable isolation transformer fulfilling safety class II is used. Measurements on the mains are also possible if suitable probes like current probes are used which fulfill the safety class II. The measurement category of such probes must be checked and observed. The measurement categories were derived corresponding to the distance from the power station and the transients hence to be expected. Transients are short, very fast voltage or current excursions which may be periodic or not.

1.8 Mains voltage

The instrument has a wide range power supply from 105 to 253 V, 50 or 60 Hz ±10%. There is hence no line voltage selector. The line fuse is accessible on the rear panel and part of the line input connector. Prior to exchanging a fuse, the line cord must be pulled out. Exchange is only allowed if the fuse holder is undamaged. It can be taken out using a screwdriver put into the slot. The fuse can be pushed out of its holder and exchanged. The holder with the new fuse can then be pushed back in place against the spring. It is prohibited to "repair" blown fuses or to bridge the fuse. Any damages incurred by such measures will void the warranty.

Type of fuse:
Size 5 x 20 mm; 250V~, C; IEC 127, Bl. III;
DIN 41 662 (or DIN 41
571, Bl. 3). Cut off: slow blow (T) 2A.

2 Differences within the HMS series

Most of the technical data of the instruments of the HMS series are identical. Please find the most important differences at the following table. For each instrument find the complete technical data at www.hameg.com.

Type:	HMS1000E	HMS1000	HMS1010	HMS3000	HMS3010
Span setting range:	0 Hz (Zero Span) und 1 MHz...1.6 GHz	0 Hz (Zero Span) und 1 kHz...1.6 GHz	0 Hz (Zero Span) und 1 kHz...1.6 GHz	0 Hz (Zero Span) und 100 Hz...3 GHz	0 Hz (Zero Span) und 100 Hz...3 GHz
Resolution bandwidths (-3 dB):	10 kHz...1 MHz in 1–3 steps, 200 kHz	1 kHz...1 MHz in 1–3 steps, 200 kHz	1 kHz...1 MHz in 1–3 steps, 200 kHz	100 Hz...1 MHz in 1–3 steps, 200 kHz	100 Hz...1 MHz in 1–3 steps, 200 kHz
Resolution bandwidths (-6 dB):	–	9 kHz, 120 kHz, 1 MHz	9 kHz, 120 kHz, 1 MHz	200 Hz, 9 kHz, 120 kHz, 1 MHz	200 Hz, 9 kHz, 120 kHz, 1 MHz
Video bandwidth:	1 kHz...1 MHz in 1-3 steps	10 Hz...1 MHz in 1-3 steps	10 Hz...1 MHz in 1-3 steps	10 Hz...1 MHz in 1-3 steps	10 Hz...1 MHz in 1-3 steps
Amplitude measurement range:	Typ. -104...+20 dBm	Typ. -114...+20 dBm	Typ. -114...+20 dBm	Typ. -114...+20 dBm	Typ. -114...+20 dBm
DANL (Displayed average noise level):	-95 dBm, typ. -104 dBm	-105 dBm, typ. -114 dBm	-105 dBm, typ. -114 dBm	-105 dBm, typ. -114 dBm	-105 dBm, typ. -114 dBm
Detectors:	Auto-, Min-, Max-Peak, Sample, RMS, Average	Auto-, Min-, Max-Peak, Sample, RMS, Average, Quasi-Peak	Auto-, Min-, Max-Peak, Sample, RMS, Average, Quasi-Peak	Auto-, Min-, Max-Peak, Sample, RMS, Average, Quasi-Peak	Auto-, Min-, Max-Peak, Sample, RMS, Average, Quasi-Peak
Marker displays:	Normal (level & log.), delta marker, noise marker	Normal (level & log.), delta marker, noise marker, frequency counter	Normal (level & log.), delta marker, noise marker, frequency counter	Normal (level & log.), delta marker, noise marker, frequency counter	Normal (level & log.), delta marker, noise marker, frequency counter
Trigger:	Free run, Single Trigger, external Trigger	Free run, Single Trigger, external Trigger, Video Trigger	Free run, Single Trigger, external Trigger, Video Trigger	Free run, Single Trigger, external Trigger, Video Trigger	Free run, Single Trigger, external Trigger, Video Trigger
Tracking-Generator	–	–	yes	–	yes
HO3011 (Preamplifier)	–	Option	Option	Option	Option
EMV-Software	–	Option	Option	Option	Option

3 Controls and display

Front panel

(HMS1010 differs in frequency range;
HMS3000 / HMS1000 / HMS1000E without Tracking Generator)

1 **Display** (TFT)
6,5" VGA TFT Display

2 **Interaktive Softkeys**
Direct access of all relevant functions

3 **POWER**
Power switch turns the instrument on/off

Area A:
This area includes the parameter settings.

4 **AMPL** (illuminated button)
Setting of amplitude parameters

5 **SPAN** (illuminated button)
Setting of the Span

6 **FREQ** (illuminated button)
Setting of the frequency

7 **TRACE** (illuminated button)
Configuration of data aquisition and analysis

8 **SWEEP** (illuminated button)
Setting of the sweep time and the trigger source

9 **BANDW** (illuminated button)
Setting of the resolution and video bandwidth

10 **LINES** (illuminated button)
Configuration of displayed and limit lines

11 **MEAS** (illuminated button)
Implementation of extended measurements

12 **DISPLAY** (illuminated button)
Setting of the display

13 **PEAK SEARCH** (illuminated button)
Measuring value peak display

14 **MARKER →** (illuminated button)
Search function of marker

15 **MARKER** (illuminated button)
Selection and arrangement of the absolute and relative marker

16 **MODE** (illuminated button)
Switching between SWEEP- and RECEIVER-Mode

17 **PRESET**
Factory reset

18 **AUTO TUNE**
Automatically setting of instrument settings

Area B (Data):
This area includes the possibility of setting parameters via numerical keyboard and unit keys.

19 **Numerical keyboard** (buttons)
Set of all operating parameters

20 **BACK**
Set back of inputs

21 **CANCEL**
Terminate the editing mode

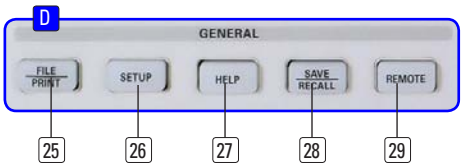
22 **ENTER**
Confirm the values via keyboard

Area C (Variation):
This area includes the settings via rotary knob and arrow buttons

23 **Rotary knob**
Knob to adjust and activate the values or menu items by pushing

24 **Arrow buttons ▲ ▼** (buttons)
Zoom-In / Zoom-Out functionality

Area D (General):
This area includes the general intrument settings

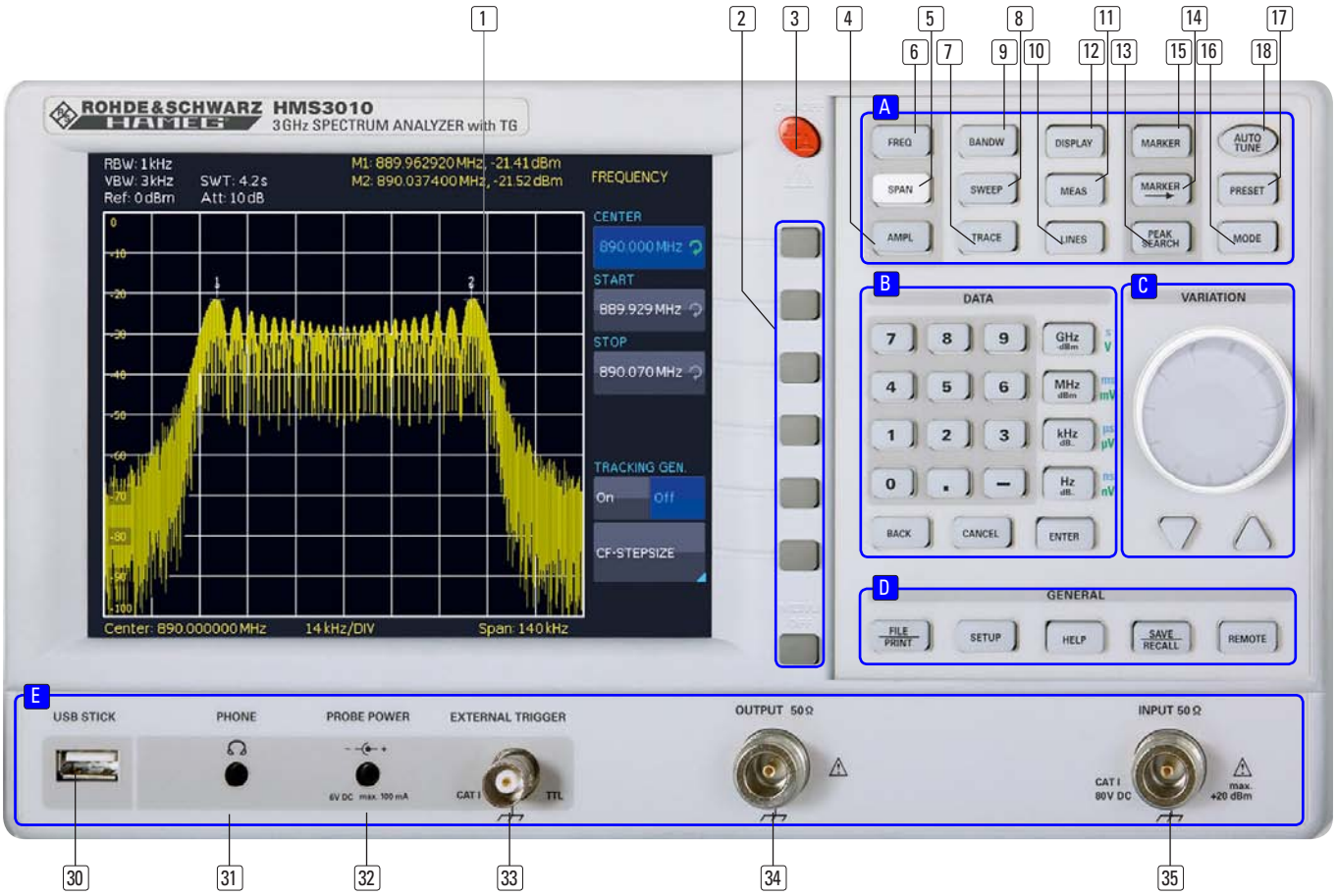


25 **FILE/PRINT**
The key FILE/PRINT on the front panel allows you to store instrument settings,
curves, screenshots or printing.

26 **SETUP** (illuminated button)
Display of general instrument settings

27 **HELP**
Including display help

28 **SAVE/RECALL** (illuminated button)
Store and restore of instrument settings, curves and screenshots



29 **REMOTE**
Toggling between front panel and external operation

Area E:
This area includes a series of connectors.

30 **USB port**
Front USB port for storing parameters

31 **PHONE** (connector)
Headphone connector 3,5 mm jack;
Impedance > 8 Ω

32 **PROBE POWER** (connector)
Power supply (6 V_{DC}) for field probes
(2,5 mm jack)

33 **External TRIGGER** (BNC socket)
BNC input for external trigger signal

34 **OUTPUT 50 Ω**
Tracking Generator (N connector)
(HMS3000, HMS1000/1000E haven't got this connector)

29 **INPUT 50 Ω**
Input N connector

Rear panel

36 **Mains input connector** with fuse

37 **Interface**
HO720 Dual-Interface (USB/RS-232) is provided as standard

38 **DVI** (connector)
Display of the instrument display 1:1 on an external DVI monitor or projector with DVI-D connector

39 **USB port**
Additional USB port

40 **REF IN** (BNC socket)
Reference input

41 **REF OUT** (BNC socket)
Reference output

4 Quick introduction

The following chapters are intended to introduce you to the most important functions and settings of your new HAMEG HMS spectrum analyzer (here: HMS3010) in order to enable you to immediately use it. You find more detailled explanations in the chapters following these ones.

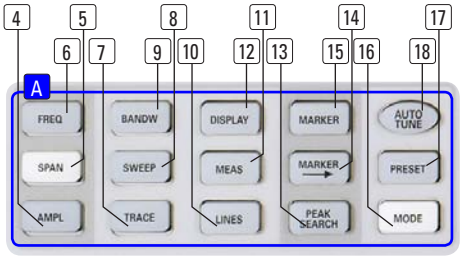


Fig. 4.1: Area A of the control panel

4.1 How to measure a sine wave signal

The fundamental measurement with a spectrum analyzer is the measurement of the level and the associated frequency of a sine wave signal. The following measurement example demonstrates the steps to be taken for the settings which allow to effectively perform this measurement with the HMS series. The signal source is a HF synthesizer, e.g. the HM8135. Connect the HF output of the synthesizer to the HF input of the spectrum analyzer.

Settings on the synthesizer:
- Frequency 100 MHz
- Level –10 dBm

Press the AUTO TUNE key [18] in order to cause the instrument to scan the whole measuring range in order to find the highest signal peak and to display it at the screen center together with the proper RBW and span settings. This procedure may take several seconds.

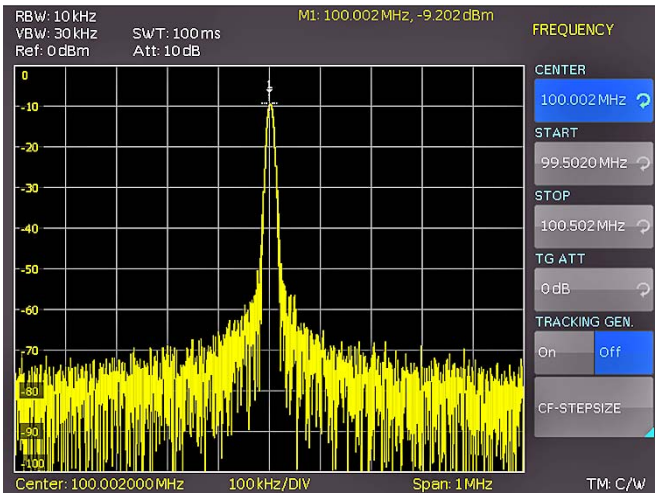


Fig. 4.2: Display with the AUTO TUNE function

4.2 Level measurement

In order to now perform the previouly automatically taken steps manually, press the key PRESET [17] which resets the instrument to its initial settings.

The analyzer displays the frequency spectrum of its full frequency range from 100 kHz to 1.6 GHz resp. 3 GHz. At 100 MHz the generator signal will be discernible as a line. Harmonics of the oscillator are also displayed at multiples of 100 MHz (not visible here). In order to analyze the generator signal further, use the frequency settings menu (key FREQ [6]) to set the start frequency to 50 MHz and the stop frequency to 250 MHz. The spectrum analyzer now displays the signal with a higher resolution.

In order to determine the level of the signal, the HMS series offers up to 8 markers. The marker is always attached to the measuring curve. The instrument indicates the level and the frequency at the relevant position on the screen.

Press the key MARKER [15] to enter the marker settings menu. Marker [1] will be activated by the soft key DISPLAY, it will be automatically positioned to the center frequency of the actual curve. The marker frequency is indicated by a cross resp. arrow symbol (next to the activated marker). The spectrum analyzer displays the level and the frequency of the marker position numerically at the top of the screen.

Now move the marker [1] to the displayed level at 100 MHz by pressing the soft key POSITION and, after selecting the marker (the marker indication will turn to orange), use the knob to move it to the left; you may also enter the desired frequency of 100 MHz directly via the keyboard.

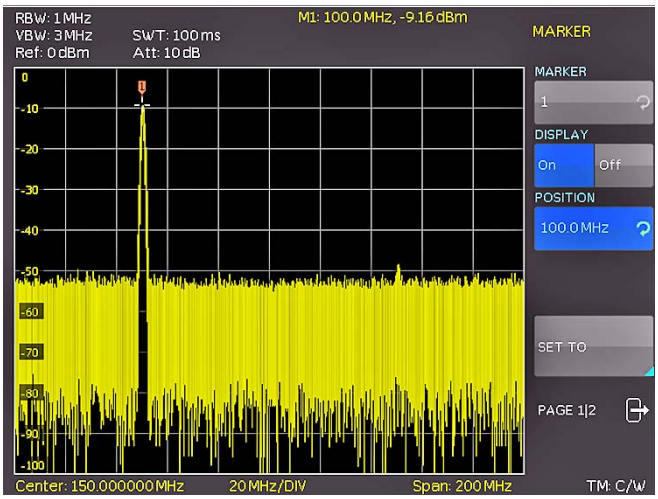


Fig. 4.3: Level measurement with marker

4.3 Measurement of the harmonics of a sine wave signal

Due to the property of a spectrum analyzer to resolve different signals in the frequency range, it is well suited to measure harmonics or the distance between harmonics and the fundamental. The HMS offers extended marker functions which allow to arrive at a result after just a few key pressures.

Due to the previous settings in chapter 4.2, the first marker is already located on the fundamental which should stand clearly out of the noise floor in the lefthand screen area. The marker should also display the selected level of –10 dBm in the upper screen area. The first harmonic of the sine wave should now appear at 200 MHz. Depending on the purity of the signal this harmonic may be well or hardly visible with the presently active settings.

In order to measure the distance of the first harmonic to the fundamental proceed as follows:
Press the soft key MARKER and move the knob by one detent position to the right in order to select a second marker (M2).

Activate the marker by pressing the soft key DISPLAY. The second marker will now appear in the center of the display. Select the marker by pressing the soft key POSITION (the marker indication will turn to orange) and move it with the knob (to the right) or via the keyboard by directly entering the value 200 MHz.

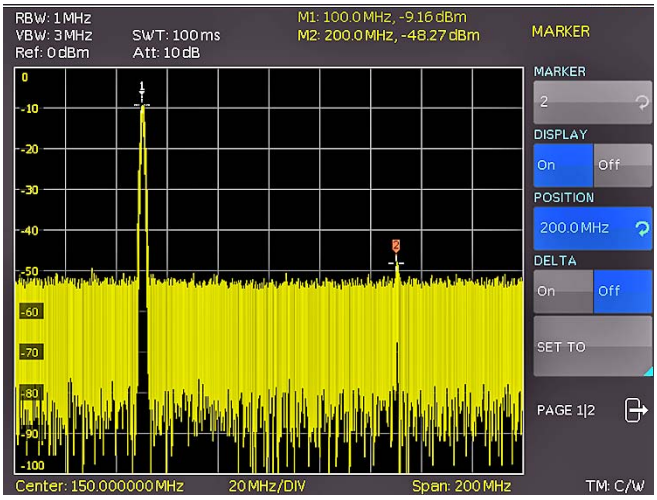


Fig. 4.4: Measurement of the harmonic of a sine wave signal

4.3.1 Selection of the proper filter settings

In order to better resolve the harmonic from the noise, the RBW and the VBW filters should be adapted to the measurement task by using the bandwidth menu (key BANDW 9). The HMS series standard procedure is to automatically set the RBW and VBW filters such that a first approximation of a measurement of the input signal will be possible. Manual selection of the filters will be always superior to an automatic presetting.

Activate the key BANDW 9 to enter the filter menu of the spectrum analyzer. Due to the presettings, the RBW and the VBW will be set to AUTO. Activate manual setting by pressing the top soft key, then use the knob to select the 100 kHz filter from the list in the menu which will appear.

The noise band displayed formerly should now be markedly reduced such that the first harmonic will be better visible. A further reduction of the RBW would display the harmonic still better at the expense of a massively extended sweep time. Here, a compromise must be found between display quality and measurement time, optimum for the actual measurement task.

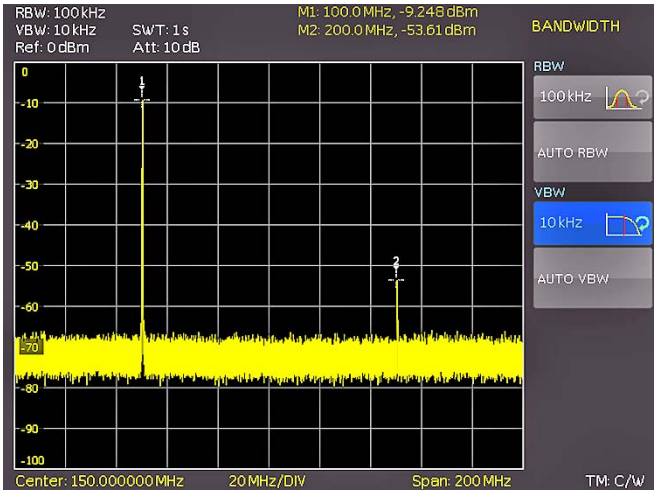


Fig. 4.5: Selection of the proper filter settings

Another means of spectrum analysis is the socalled video bandwidth (VBW). This is nothing else but a low pass filter which filters high frequency components from the signal. Using this filter can also cause a massive increase of the sweep time, and again a sound compromise has to be found between display quality and measurement time.

Activate the manual VBW selection by pressing the associated soft key and use the knob to select a 10 kHz filter from the list in the menu which will appear.

Both levels (fundamental and harmonic) should now be well visible on the HMS display.

4.3.2 How to measure the harmonic

In chapter 4.3.1 already two markers were positioned on the fundamental and the harmonic, the second one on the harmonic.

Open the marker menu by pressing the key MARKER 15.

The marker [2] is still selected (shown as an entry on the top soft key) Change the active marker [2] from an "absolute" marker to a "relative" DELTA marker by pressing the soft key DELTA. The marker display will change from an absolute frequency and level display to a relative frequency and level display; the values shown refer always to the main marker (marker [1]).

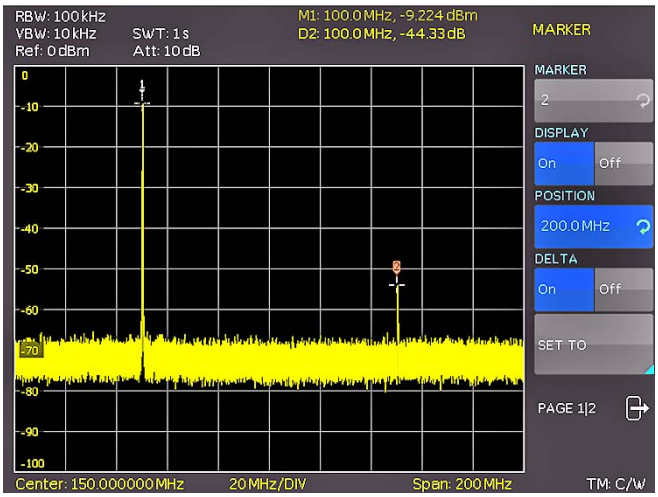


Fig. 4.6: Measuremen of the harmonic using the delta marker

4.3.3 Extended marker functions (PEAK SEARCH)

Press the key PEAK SEARCH in order to reach the extended marker functions. Select the marker to be used with the key (MARKER → 14). In the top screen area (where the level and frequency values of the markers can be read) the lettering of the marker selected will be shown pronounced bright.

Select the marker [2] and press the soft menu key PEAK. The second marker should now jump to the same spot where marker [1] already resides (that is the position of the fundamental), because the level of this is the highest. The values displayed for (DELTA-) frequency and level should be "0".

Press the soft menu key NEXT PEAK in order to cause the active marker to position again on the first harmonic. The values displayed for (DELTA-) frequency and level should be identical to the original ones.

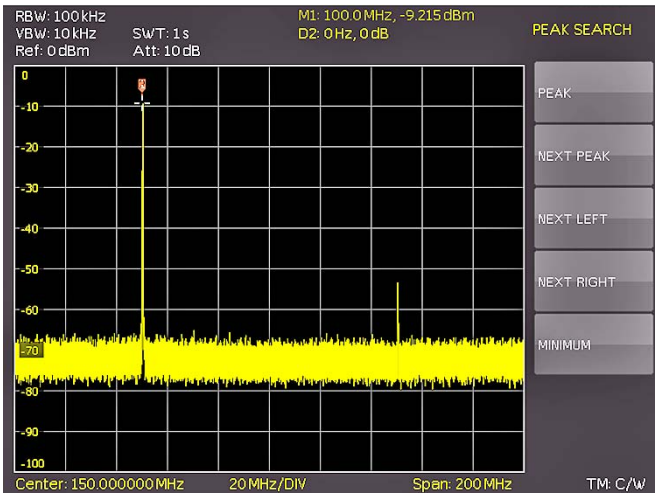


Fig. 4.7: PEAK SEARCH function

4.4 Setting of the reference level

The reference level in spectrum analyzers is always the level of the top graticule line. In order to realize the maximum dynamic range in spectrum measurement, the level display range of the spectrum analyzer should be fully used. This means that the highest level in the actual spectrum should be as close to the top graticule line (= reference level) as possible. The maximum value of the level display (Y axis) of the measurement display is determined by the reference level. However, take care that the top graticule line is not exceeded as this would cause overdrive of the spectrum analyzer input stage.

In order to prevent overdriving the input, the input attenuators of the spectrum analyzer are independently selectable and linked to the reference level. If the reference level in the amplitude selection menu (key AMPL 4) is increased by 20 dB (0 to 20 dBm), the input attenuator will be automatically switched to 30 dBm.This will cause the first harmonic of the signal (marker 2) to disappear in the noise floor.

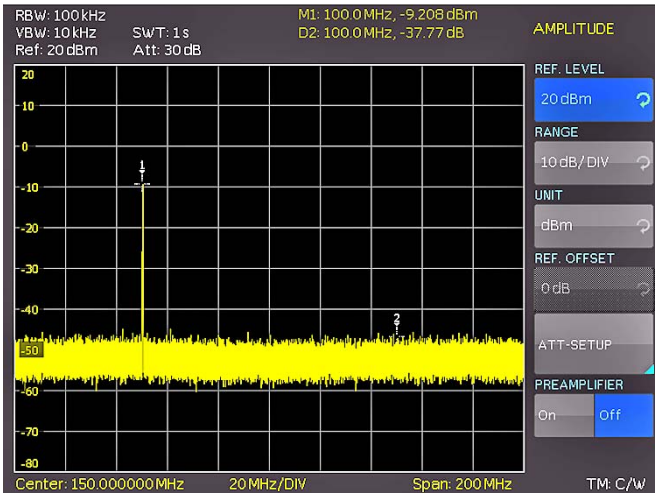


Fig. 4.8: Setting of the reference level

4.5 Operation in the receiver mode

For the measurement of levels of a signal frequency the HMS series offers the receiver mode. The spectrum analyzer operates like a receiver which is tuned to a frequency and measures the level. The menu of the measurement functions will open by pressing the key MEAS 11, If the soft key CF > RX is activated, the HMS will switch to the receiver mode and measures the level of the center frequency set. The most important settings of the measurement parameters are directly accessible in the main menu of the receiver mode and can be activated by pressing the appropriate keys.

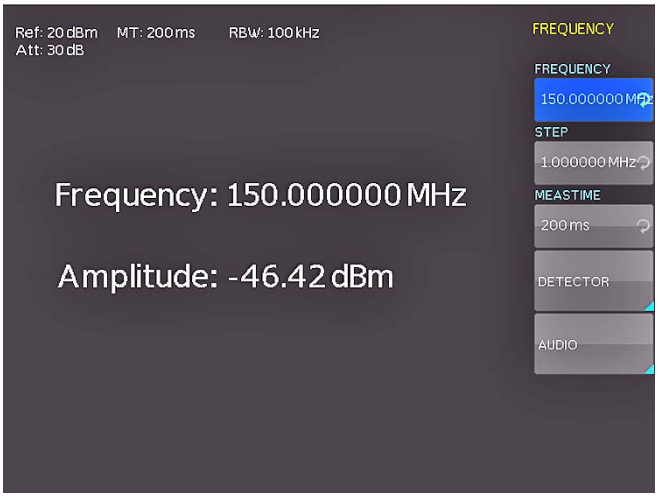


Fig. 4.9: Receiver mode with a center frequency set

In the receiver mode the same bandwidths are available as in the analyzer mode. Additionally, the bandwidths 200 Hz, 120 kHz, and 1 MHz (–6 dB) for emi measurements according to CISPR are provided (not available for HMS1000E). These can be chosen by pressing the key BANDW and using the knob.

The HMS series receiver mode offers peak, average, rms and quasi-peak detectors. The detector is selected in the main menu of the receiver mode with the soft key DETECTOR.

The quasi-peak detector is not available for the HMS1000E.

The measuring time is the time during which the spectrum analyzer collects measurement results and combines them for a result, depending on the detector selected. With the knob the measuring time may be varied, or it can be entered directly via the keyboard.

If the quasi-peak detector is selected, the measuring time should be >100 ms in order to measure varying or pulsed signals correctly.

5 Setting of parameters

5.1 Display segmentation in sweep mode

Three methods of setting signal parameters are offered:

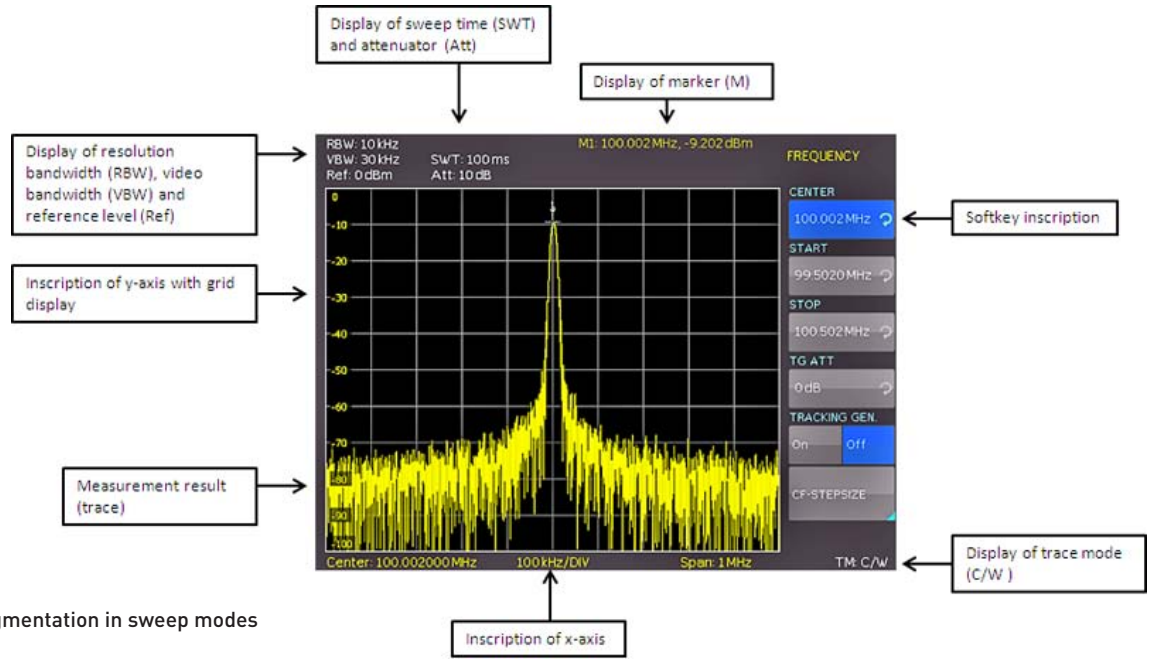


Fig. 5.1:
Display segmentation in sweep modes

- numerical keyboard
- knob
- arrow buttons

Please use the soft menu keys for selecting the respective menu item.

5.2 Numerical keyboard

The simplest method of entering parameters quickly and exactly is the entry via the numerical keyboard. When entering parameters via the keyboard the value will be accepted upon pushing the respective unit key GHz (-dBm), MHz (dBm), kHz (dB..) or Hz (dB..). Prior to pushing any such key an entry may be deleted by pushing the key BACK. During these operations the window will remain open. The CANCEL key will terminate the entry of parameters and close the window.

Fig. 5.2:
Section B with numerical keyboard, unit and command keys

5.3 Knob

It is possible to only use the knob for all settings. Turning the knob CW will increase the value, turning it CCW will decrease it. Such parameters can be modified only by using the knob (for example display settings).

5.4 Arrow buttons

The arrow buttons allow the Zoom-In resp. Zoom-Out functionality. The ▲ button will double the span, the ▼ button will halve the span.

5.5 Interactive softkeys

The grey soft menu keys at the righthand side of the screen are used for the menu field displayed. Use the knob or the numerical keyboard for setting the parameter selected. If a menu field was selected via the soft menu keys, this item will be marked in blue, it is now activated for entering a parameter. If an instrument function should not be available due to a specific setting, the associated soft menu key will be deactivated, the lettering will be shown in grey.

5.6 How to enter numerical values

- Use the grey soft menu keys for the selection of a menu item.
- Enter the value of the parameter using the numerical keyboard or modify it with the knob.
- After a keyboard entry push the respective unit key.

6 Instrument functions

6.1 Setting of the frequency (FREQ)

Pushing the FREQ key will call the menu for setting the frequency. The setting is performed as described in chapter 5.

Spectrum display needs to be parameterised before measurement is started. The two most important parameters are start and stop frequency of the sweep. The start frequency sets the frequency at the left border of the trace, the stop frequency sets the highest frequency at the right hand border. In some applications it is easier to modify the center frequency via the CENTER key. In this case start and stop frequencies are automatically adapted. The step size of the center frequency can be modified with CF-STEPSIZE. By pushing this soft menu key the settings menu will open.

- **0.1 x SPAN (Basic setting):** The step size is always 1/10 of the currently selected span (= 1 vertical division).
- **0.5 x SPAN:** The step size is always 1/2 of the currently selected span (= 5 vertical divisions).
- **SET TO CENTER:** The step size of the frequency is equal to the present center frequency. This mode is especially useful for the measurement of harmonics because each step will move the center frequency to the next harmonic.
- **MANUAL:** Any step size is available. This allows the easy measurement of spectra with regular frequency steps.

6.2 Aktivating/parameterizing the built in TG

The output of the tracking generators is nominal 0 dBm. It can be reduced via an adjustable TG attenuator in 1 dB steps up to –20 dBm (tracking generator attenuation). The tracking generator generates an output signal on the same frequency which is currently received by the analyzer.

It is strongly recommended to deactivate the tracking generator, whenever it is not required for the measurement. With activated tracking generator, the instrument is not able to compensate all imperfections any more. This will be indicated with a red „TG on“ message on the bottom right of the display, as well as a UNCAL message at the top of the display. The UNCAL message disappears, once the trace mathematics (Chapter 6.7.1) of the HMS is used to compensate the effects described above.

Performing measurements with the tracking generator
One of the most common application for TG measurements is the spectral investigation of hardware components. For this purpose, the DUT (device-under-test) is looped into the signal path between TG output and receiver input. In order to compensate any influences caused by cables, adaptors etc. used at the application, these will be directly connected to the spectrum analyzer without the DUT in the loop.

The resulting trace shows the interference of the cables, connectors, etc. and needs to be stored in the trace memory of the spectrum analyzer. Afterwards the trace mathematics (TRACE - MEM) shall be activated. Due to the mathematical compensation of all interferences, necessarily a straight line is displayed and the UNCAL message is removed. After connection of the DUT into the signal path, the frequency response of the DUT is shown at the display, based on the selected frequency range.

The UNCAL message disappears by using the trace math.

The signal output of the tracking generator of the HMS1010/3010 shows no "true" sine wave signal. The output signal of the TG is generally not sinusoidal in even spectrum analyzers from other manufacturers. A generator which can generate a uniform sinusoidal signal from 5 MHz to 1.6 GHz/3 GHz, is not absolutely necessary to provide the desired function. The shape of the signal output is frequency dependend. For the "interpretation" at the input of the HMS does not require a sinusoidal signal curve.

Through the reduction of the TG output signal to the input and the use of HMS (view in relation) narrow-band filter, neither the shape nor the signal harmonics of the signal are evaluated. The correct function of the TG by using the HMS is ensured at any time.

Since the existing tracking generator have to display frequencies in a very broad context, it is customary that the tracking generator can not display low frequency signals (frequency range 5 MHz to 1.6 GHz resp. 3 GHz).

6.3 Frequency range displayed (SPAN)

In principal there are two methods to define the displayed frequency range: Defining start and stop frequency or center frequency and span. The frequency range called span is the range on both sides of the center frequency which a spectrum analyzer displays on its screen. The span to be selected depends on the signal to be analyzed, in general, it should be at least twice as wide as the bandwidth of the signal.

The HMS series offers the following frequency ranges (Spans):

HMS1000E	**1 MHz bis 1.6 GHz**
HMS1000/1010	**1 kHz bis 1.6 GHz**
HMS3000/3010	**100 Hz bis 3 GHz**

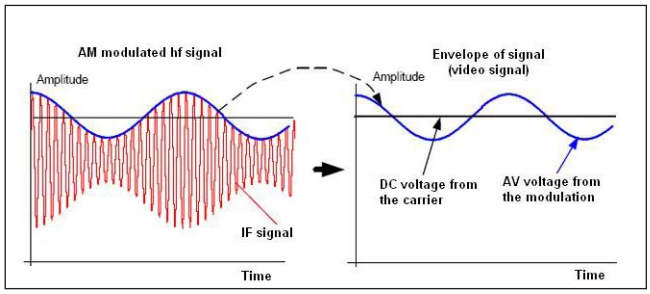


Fig. 6.1: Hf signal modulated by a sine wave signal and the resultant video signal vs. time

In zero span mode the spectrum analyzer acts similar to a receiver tuned to the center frequency. In this case the trace display does not represent a spectrum but the amplitude over time. In other words the spectrum analyzer behaves like a selective oscilloscope. In order to select the full (maximum) frequency range of 100 kHz to 1.6 GHz resp. 100 Hz to 3 GHz by pushing once, the soft menu item FULL is provided. The soft menu key LAST will restore the former setting (the last span setting). The setting is performed as described in chapter 4.

6.4 Setting of the amplitude parameters (AMPL)

The key AMPL is used for all settings of the amplitude displayed. The reference level (soft menu item REF.LEVEL) is identical to the top graticule line of the display. The setting is performed as described in chapter 5.

	Preamplifier OFF		Preamplifier ON		
Reference Level	ATT-Setup Low Noise	ATT-Setup Low Distortion	ATT-Setup Low Noise	ATT-Setup Low Distortion	Preamplifier
20 dBm	30 dB	30 dB	30 dB	30 dB	OFF
15 dBm	30 dB	30 dB	30 dB	30 dB	OFF
10 dBm	20 dB	30 dB	20 dB	30 dB	OFF
5 dBm	20 dB	30 dB	20 dB	30 dB	OFF
0 dBm	10 dB	20 dB	10 dB	20 dB	OFF
–5 dBm	10 dB	20 dB	10 dB	20 dB	OFF
–10 dBm	0 dB	10 dB	0 dB	10 dB	OFF
–15 dBm	0 dB	10 dB	10 dB	10 dB	ON
–20 dBm	0 dB	0 dB	10 dB	10 dB	ON
≤ –25 dBm	0 dB	0 dB	0 dB	0 dB	ON

Table 6.1: Relation between reference level and automatic setting of RF attenuation

The reference level represents the amplitude level which is displayed at the upper trace screen boundary. The actual setting is shown in the third line left in the readout. Adjusting the reference level automatically switches attenuator, gain and the optional preamplifier. Lowering the reference level increases sensitivity. Normally the reference level is chosen to display the whole dynamic range on screen. For strong input signals the reference level must be set high in order to prevent overdriving of the signal amplifier chain and in order to keep the signal within the visible display window. For spectra with many signals, the reference level should be so high that all signals remain within the display area.

The receiver input will be overloaded by a disadjusted reference level.

Directly coupled to the reference level is the setting of the RF input attenuation on the spectrum analyzer. If the reference level is too high, the spectrum analyzer switches the RF attenuation automatically according to table 6.1, so the input mixer can operate in the linear range at any time.
The basic unit (UNIT) of the reference level is dBm. Alternatively, the unit dBµV or (from firmware version 2.000) the linear unit V and W can be selected by pushing the softmenu key and using the knob. The scaling of the linear units V and W is set dynamically.

If the linear unit V or W is selected, the reference level is adjusted automatically.

The range (RANGE) defines the resolution of the amplitude axis of the display. The basic scaling is in dB. The standard scaling is 10 dB/DIV. In order to obtain a higher visual resolution, the spectrum analyzer also offers the scalings 5 dB/DIV, 2 dB/DIV, and 1 dB/DIV. A higher resolution does not increase the accuracy, it only improves the readability. An appropriate combination of reference level and vertical scale can be used to get a more detailed display of the trace.

If the unit is set to dBm or dBµV, the scaling of the reference level can be set to LIN % (linear percentage display). This means that a logarithmic unit is represented as a percentage value of the set reference level. This representation is useful if, for example, in the time domain (span = 0 Hz) a modulation of an AM-modulated carrier needs to be displayed.

The reference offset is used to vertically shift the trace if trace math is switched on. The reference offset adds a selectable value to the reference level. This is useful when prior to the RF input, an attenuator or an amplifier is used. The input of the reference offset is always given in dB, even if the reference level is set to a different unit.

The setting of the reference level will also directly affect the amount of RF attenuation at the input of the spectrum analyzer. The attenuation setup menu is used to influence the thresholds used for automatic attenuator selection when the reference level is adjusted.

The instrument offers two different modes of coupling which are selected via the softkey ATT-SETUP:

- **LOW NOISE:** When adjusting reference level switching thresholds for attenuator and gain are optimised to get the best signal/noise ratio.
- **LOW DISTORTION:** When adjusting reference level switching thresholds for attenuator and gain are optimised for lowest possible distortion.

If the unit contains the option „Preamplifier" this soft key is used to activate or deactivate the preamplifier (not available for HMS1000E). The preamplifier increases the signal/noise ratio by 10 dB (refer to chapter 13.1 for activate the optional preamplifier).

6.5 Setting of the bandwidth (BANDW)

Spectrum analyzers resolve the spectral content of a signal and display a frequency spectrum. The quality of the resolution is determined by the resolution bandwidth. Additionally, the spectrum analyzers offer a selectable video bandwidth. The instrument will automatically (or, if desired, manually) choose a slower sweep time if the span was set too wide for the RBW (resolution bandwidth) selected (provided the user did not set the span to manual operation).

The video bandwidth affects the smoothing (reduction of noise) of the displayed curve. It is determined by the bandwidth of the

low pass filter inserted between the video signal and the display. In contrast to the resolution bandwidth the video bandwidth has no influence on the resolution properties of the spectrum analyzer.

RBW	VBW
100 Hz *	10 Hz *
200 Hz *	30 Hz *
1 kHz	100 Hz *
3 kHz	300 Hz *
10 kHz	1 kHz
30 kHz	3 kHz
100 kHz	10 kHz
200 kHz	30 kHz
300 kHz	100 kHz
1MHz	200 kHz
	300 kHz
	1 MHz

Table 6.2: Available RBW and VBW settings
***) for the HMS1000E not available**

If the span was set manually too wide or the sweep time to too high, the amplitudes will be displayed with incorrect level; in such cases a red UNCAL message will warn. The span must then be reduced until the UNCAL message disappears.

By pushing the key BANDW you will enter the menu for setting the bandwidths. Both the resolution bandwidth (RBW) and the video bandwidth (VBW) may be set within the specified limits. The table 6.2 shows the step sizes which are available.
Additionally automatic selection for both bandwidths (AUTO RBW/AUTO VBW) may be chosen with the respective soft menu key. The knob is used for the setting of the parameters.

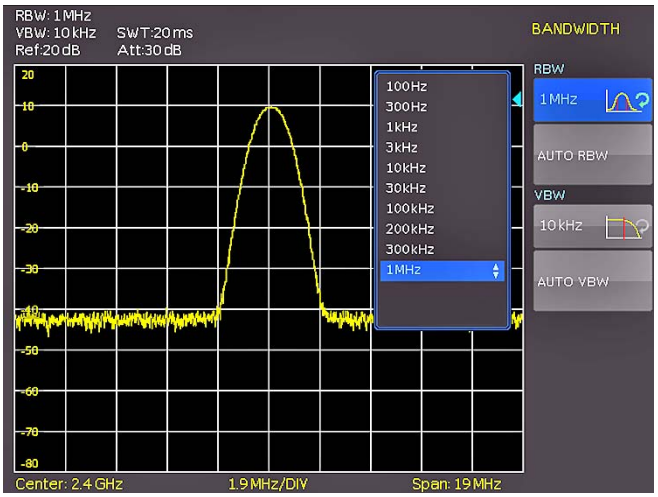


Fig. 6.2: The selections offered in the RBW menu

6.6 Setting of the SWEEP

At a frequency spectrum of f > 0 Hz the sweep time is the time the spectrum analyzer requires for sweeping the selected frequency range to measure the spectrum. Certain limits have to be observed (e.g. the resolution bandwidth set) in order to obtain a correct display.
Pushing the key SWEEP will call the selection menu. The SWEEP TIME can be varied within the specified limits. The setting of the parameters is performed as described in chapter 5. In order to assist the user when setting the sweep time, an automatic selection of the sweep time with respect to the RBW and the span settings may be chosen with the soft menu key AUTO. The automatic mode will always set the sweep time to the shortest possible value consistent with the correct display of the spectrum content.

The HMS series will sweep the selected frequency range continuously, i.e., after a sweep was completed, a new one will be started and the display refreshed. If continuous sweeping is not desired (e.g., if a single event shall be recorded upon a trigger), there is also the possibility of selecting SINGLE sweep. If single sweep is selected, the spectrum analyzer will sweep the frequency range once or it displays the video signal vs. time if the span is set to zero. The instrument will only repeat the measurement after the soft key SINGLE was pushed again. Additionally the soft menu TRIGGER offers diverse trigger functions in order to react to events.

6.6.1 SOURCE

With the submenu SOURCE an internal / external trigger source or the video trigger can be selected.

The video trigger can be only activated in zero span (span = 0 Hz).

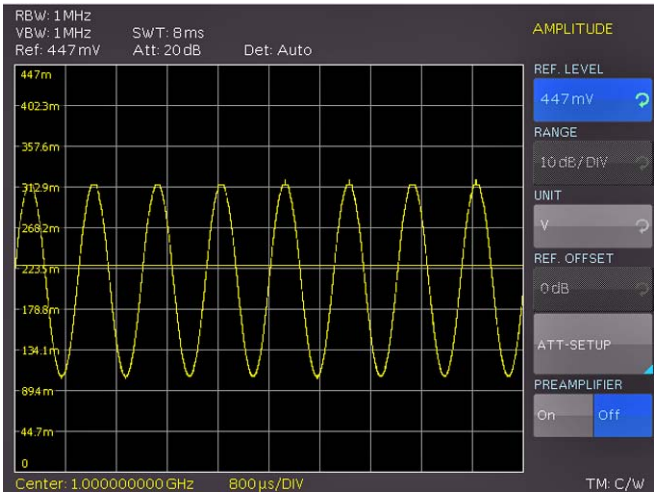


Fig. 6.3: Signal with AM modulation 50% in zero span with linear scaling

With a span setting of 0 Hz (zero span) the spectrum analyzer changes the display from spectrum versus time to discrete voltage versus time. The X-axis of the measurement diagram represents the time axis, starting with time 0s and ends with

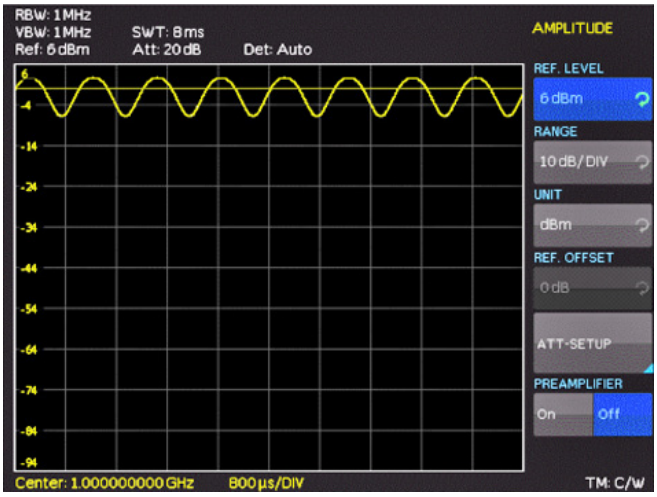


Fig. 6.4: Signal with AM modulation 50% in zero span with logarithmic scaling

the selected sweep time. The minimum sweep time in zero span mode is 2ms, the maximum is 1000s.

The video trigger allows to trigger on a defined signal level. This so-called edge trigger works reliably up to a delta of at least 3 dB between the selected level (trigger line) and the applied signal amplitude. The level of the video trigger can be set with the soft menu key LEVEL.

6.6.2 SLOPE

With the softkey SLOPE the sweep of an external trigger signal will be started by a positive or negative edge; the external trigger signal is applied via the BNC connector EXTERNAL TRIGGER (TTL logic levels).
Use the respective soft key for the selection of the desired trigger mode.

6.7 Curve display settings (TRACE)

The trace menu can be opened by pressing the TRACE button. The HMS series can simultaneously display up to 3 waveforms on the screen. The trace mode of trace 2 and 3 is fixed and can not be changed by the user.

Trace 1 = normal Sweep (yellow / free configurable)
Trace 2 = Max hold mode (purple)
Trace 3 = Min hold mode (green)

Trace 2 and 3 are each based on the freely configurable trace 1. Trace 2 and 3 can only be turned on or off.
If all traces are enabled, it's possible to analyze the signal „progression" by the resulting min-max graph.

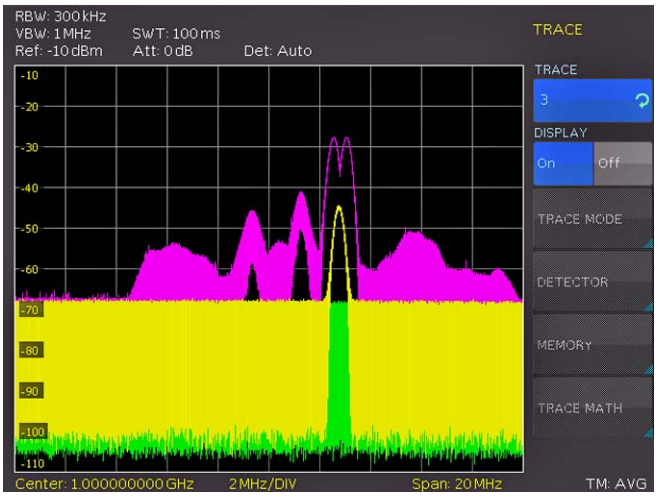


Fig. 6.5: Simultaneous display of 3 traces

There are several modes of curve display (TRACE MODE):

- **CLEAR / WRITE (basic setting):** The previous curve will be erased during a new sweep.

- **MAX HOLD:** The maxima of the curve being measured and all previous ones will be displayed. MAX HOLD allows to easily find intermittent signals in the spectrum or the maximum values of varying signals.

- **MIN HOLD:** The minima of the curve being measured and all previous ones will be displayed. MIN HOLD allows to recover periodic signals out of the noise floor or to suppress intermittent signals.

- **AVERAGE:** The average level of consecutive measurements will be displayed. In the standard setting, averaging will be performed pixel by pixel and over the last measured curves. The average mode is hence suitable for an improved display of periodic signals close to the noise level

- **HOLD:** Freezes the curve being displayed, the measurement will be terminated, this allows to subsequently use the markers for the measurement of spectra.

6.7.1 Trace Mathematics

The sub function TRACE ⇨ MEMORY allows to transfer a curve to the background curve memory; by pushing the soft menu key SHOW MEMORY it will be displayed and can be compared to the presently displayed curve. The stored curve will always be shown in white and thus can be easily differentiated from the presently displayed curve. In order to let the stored curve disappear, push the SHOW MEMORY key again.

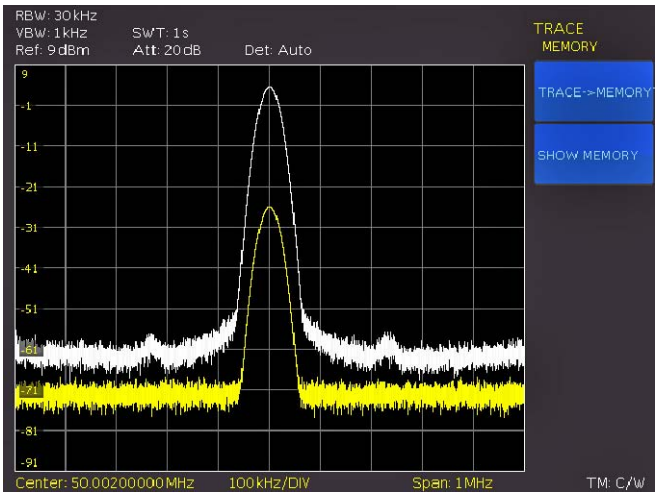


Fig. 6.6: Display of a measured and a stored reference curve

The spectrum analyzer can subtract a stored curve from an active curve and display the difference. If there is a curve stored under TRACE ⇨ MEMORY the difference between the stored an the active curves will be displayed by pushing the soft menu key TRACE MATH. In order to let the stored curve disappear push the key TRACE MATH and select OFF.

The TRACE MATH function can not be used in HOLD mode.

Pushing the softkey TRACE MATH will call the menu of the curve mathematics. After saving a trace in memory (via the softkey TRACE ⇨ MEMORY) the difference between this memory and the actual trace can be displayed using the TRACE-MEM button. If there is a curve stored under TRACE ⇨ MEMORY the difference between the stored an the active curves will be displayed by pushing the softkey MEM-TRACE. With the softkey OFF the saved waveform can be faded out.

The curve in the memory (Memory Trace) will be stored in the video memory as a bitmap. The spectrum analyzer hence will not adapt the stored curve if the reference level or the displayed frequency range are changed.

6.7.2 Detector

A detector converts the video signal of a spectrum analyzer before it will be displayed. It functions pixel by pixel, determining how the value of a pixel will be measured. Pushing the soft menu key DETECTOR will call the settings menu for the selection of various types of detectors.

- **AUTO PEAK:** The spectrum analyzer will display the maximum and minimum value of each pixel from the frequency range represented by that pixel, no signal will be lost; if the signal level fluctuates (noise), the width of the curve will indicate the width of the signal fluctuations (Basic setting).

- **SAMPLE:** Only displays an arbitrary point within a display pixel. The sample detector should be always used at span = 0 Hz, because this is the only method for a correct display of the video signal vs. time. Can be used for the measurement of noise power. For spans wider than than the resolution bandwidth x 501, signals may be lost.

- **MAX PEAK:** In contrast to the auto peak detector this detector will deliver only the maximum value of the spectrum within a pixel of the curve (e.g. the measurement of pulsed signals or frequency modulated signals).

- **MIN PEAK:** Delivers the minimum of a spectrum within a pixel of the curve. Sine wave signals will be displayed with their correct levels while noise-like signals will be suppressed (e.g. for filtering sine wave signals from noise).

6.8 The use of markers

The HMS series offers several markers and delta markers for the evaluation of curves. The markers are always tied to the curve and indicate the frequency and the level at that. The frequency position of the marker is marked by an arrow icon. The nurmerical values of the frequency and the level are shown as a "M" at the top of the screen. The unit of the level is the same as the unit selected for the reference level.
The knob allows to choose up to 8 different markers. The individual markers can be switched on and off with the respective soft menu key. The soft menu key POSITION is used to set the frequency position of the marker along the trace. If marker 1 is activated, a frequency counter function can be enabled for this marker by pushing the the soft menu key „COUNTER". The corresponding frequency value of the marker is now shown at the top of the display marked with an „F".

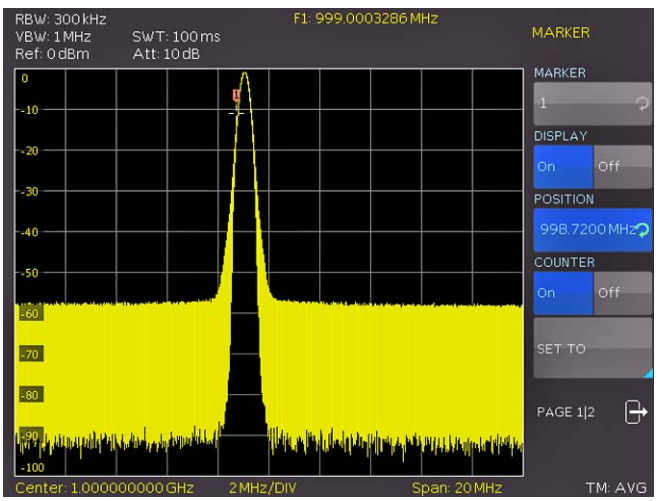


Fig. 6.7: Frequency counter

The delta marker level is always relative to the level of the main marker (Marker 1), the unit of level is always dB. If a marker is set to delta mode it is marked by a "D" in the read out to distinguish it from a standard marker designated by a leading "M".

This button activates a submenu in which the active marker can be set to the center frequency or the center frequency can be set to the frequency of the active marker. Marker to center (MKR TO CENT) allows to set the activated marker to the center frequency. In contrast to marker to center allows center to marker (CENT TO MKR) to set the center frequency to an activated marker. A noise marker displays the noise at the marker position. The REF TO MKR button allows to set the reference level to the value of the current marker.

The spectrum analyzer calculates the noise power density in dBm/Hz from the trace pixel values, the selected resolution bandwidth and the detector. Noise power density can provide useful information when measurements are made on noise or digitally modulated signals. However, valid results are obtained only if the spectrum in the vicinity of the marker has a flat frequency response. The function gives incorrect results if measurements are made on discrete signals. Noise marker mode is designated by a leading "N" in the marker readout. Please note that the unit for the level measurement switches from dBm to dBm/Hz. The noise marker can switch on/off with a push on the softkey. The submenu All Marker Off can be used to turn off all previous activated markers simultaneously. In addition it's possible to switch off all markers by pushing the softmenu button ALL OFF.

6.9 Peak-Search

The so called Peak-Search key will show the user the display of the next maximum value. The button PEAK SEARCH activates a menu which is used to detect peaks in the trace and assign markers to them:

- **PEAK:** this function places the marker or the delta marker on the highest peak of the trace; the function acts on the active marker, which is activated in the marker menu before.

- **NEXT PEAK:** this function places the marker or the delta marker relative to their current positions on the next lower peak of the trace; the function acts on the active marker, which is activated in the marker menu before.

- **NEXT LEFT:** this function places the marker or the delta marker relative to their current positions on the next left peak of the trace; the function acts on the active marker, which is activated in the marker menu before.
- **NEXT RIGHT:** this function places the marker or the delta marker relative to their current positions on the next right peak of the trace; the function acts on the active marker, which is activated in the marker menu before.

- **MINIMUM:** this function places the marker or the delta marker on the lowest value of the trace; the function acts on the active marker, which is activated in the marker menu before.

- **ALL TO PEAK:** This function will set all markers to the highest peak; from this point a new arrangement can be realized easily.

6.10 Limit Lines

Limit lines are used to set limits for level characteristics versus time or versus frequency on the display. They must not be exceeded. For instance, the upper limits of permissible spurious or harmonics of a DUT are marked by limit lines. In the HMS series, the upper and lower limit value can be preset by way of limit lines.

Pushing the button LINES will call the setting menu to set limit lines. The softkey UPPER LIMIT activates / deactivates the upper limit line which is displayed as a red line. After activating the softkey UPPER POSITION the amplitude value for the upper limit line can be set via the knob. The softkey LOWER LIMIT activates / deactivates the lower limit line which is displayed as a red line. After activating the softkey LOWER POSITION the amplitude value for the lower limit line can be set via the knob.

Additionally, the softkey BEEP activates an acoustic signal which warns as soon as the trace leaves the amplitude range defined by the upper und lower limit line. The softkey MESSAGE activates a message in the upper left corner of the trace display which shows if the whole trace is inside (pass/green) or outside (fail/red) the amplitude range defined by the upper and lower limit line.

6.11 Measure Menu

The button MEAS opens the measure menu with different options. The softkey CF ⇨ RX opens the receiver mode tuned to the actual center frequency. The softkey M1 ⇨ RX opens the receiver mode tuned to the actual frequency of marker 1.

The softkey button REFLECTION CAL starts the calibration wizard of the reflection measurement.

The reflection measurement menu is only available with HMS1010 and HMS3010.

To use the wizard, the HAMEG VSWR bridge HZ547 is recommended. The VSWR bridge HZ547 allows the measurement of the voltage standing wave ratio (VSWR) and the reflection coefficient of 50 Ω devices. The frequency range is 100 kHz to 3 GHz.

The HMS1010 resp. the HMS3010 guides the user through all steps of the reflection measurement sequentially. Concerning the reflection measurement you have to connect the VSWR measuring bridge to the spectrum analyzer. The tracking generator (TG) will be switched on automatically, if you don't have activated it already.

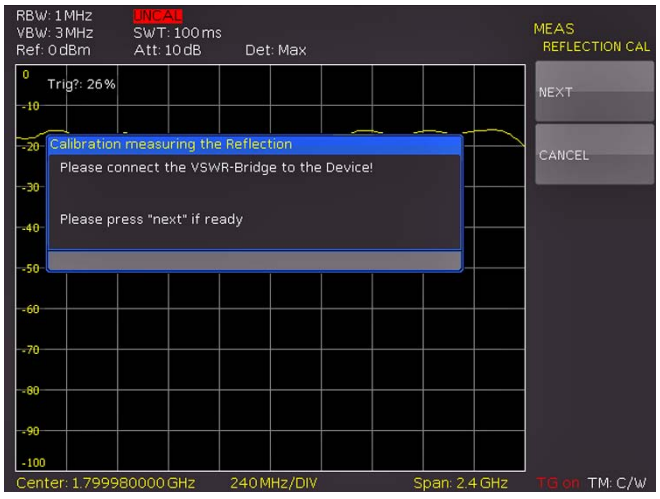


Fig. 6.8: Calibration menu of the VSWR wizard

Before starting the wizard, the user is able to select a trace detector. The selected detector will be used during the measurement.

The signal source (tracking generator / OUTPUT) needs to be connected to the IN connector of the VSWR bridge. The OUT terminal of the bridge needs to be connected to the input (INPUT) of the spectrum analyzer. At first, you have to let the DUT terminal open which equals total mismatch. Afterwards, a short calibration measurement will perform. A review of these two signals with the trace math will illustrate that both measurements are phase shifted by 180°. The white waveform describes the open calibration measurement, the yellow waveform describes the short calibration measurement. Based on the trace math (TRACE - MEM) a total compensation of the measurement deviation is archieved and the deviation of the device under test to a ZERO measurement will be shown now.

The measured reflected energy by the spectrum analyzer which will now indicate the algebraic difference between both measurements in dB which is the desired return loss. Once the return loss has been determined use the table on the VSWR measuring bridge to read the REFLECTION COEFFICIENT and the VSWR. More detailed information about the VSWR measuring bridge HZ547 you can find in the appropriate manual which can be downloaded from our homepage www.hameg.com.

6.12 Auto Tune

The AUTO TUNE button forces the HMS to perform a scan at full span, locate the maximum peak value and center it in combination with applicable RBW and span settings on the display.

The AUTO TUNE function is a comfort function to aid the user. The closer the signal level is located to the general noise floor, the harder the peak is detectable for the AUTO TUNE algorithm. Therefore, it is possible that the settings must be slightly adjusted by the user. This process can hold up few seconds.

6.13 Receiver-Mode

6.13.1 Display layout in receiver mode

By pushing the MODE key the selection menu will be called which allows to switch between sweep mode (analyzer mode) and receiver mode. The spectrum analyzer acts as a receiver which measures the level at a preselected frequency. The most important parameters such as e.g. frequency, amplitude, resolution bandwidth may be set using the appropriate keys and can be vary via knob or numerical keyboard.

6.13.2 Operation in the Receiver-Mode

In the receiver mode the same bandwidths are available as in the spectrum analyzer mode. Additionally the bandwidths: 200 Hz, 9 kHz, 120 kHz and 1 MHz are available for emi emission measurements according to CISPR (not available for HMS1000E).

Following detectors are available in the receiver mode and can be set with the softkey menu DETECTOR:

– **PEAK:** the peak detector displays the highest level during the set measurement time.

- **AVG:** the Average detector displays the linear average of the measurement signal within the selected measurement time.
- **QPEAK:** the quasi-peak detector evaluates the measurement signal according to the evaluation curves defined in the CISPR standard (not available for HMS1000E).
- **RMS:** the RMS detector takes the rms value of the measurement signal during the set measurement time.

The key FREQ and the softkey DETECTOR selects the detector (Peak, RMS, Average and Quasi-Peak). The measurement time is the time during which the spectrum analyzer collects measurements and combines them according to the detector selected for a display.

With the soft menu item AUDIO the HMS series offers an AM and a FM demodulator allowing listening to modulated signals. The demodulated signal may be listened to with a headphone and an intern speaker. The headphone is connected to the headphone connector (3.5 mm female connector). If the headphone is activated, the intern speaker will be deactivated. The respective soft menu keys allow to switch the demodulator on or off and to set the volume.

If an AM or FM demodulation is activated, the device demodulates the signal and can not simultaneously perform a level measurement. The unit shows n/a dBm on the display.

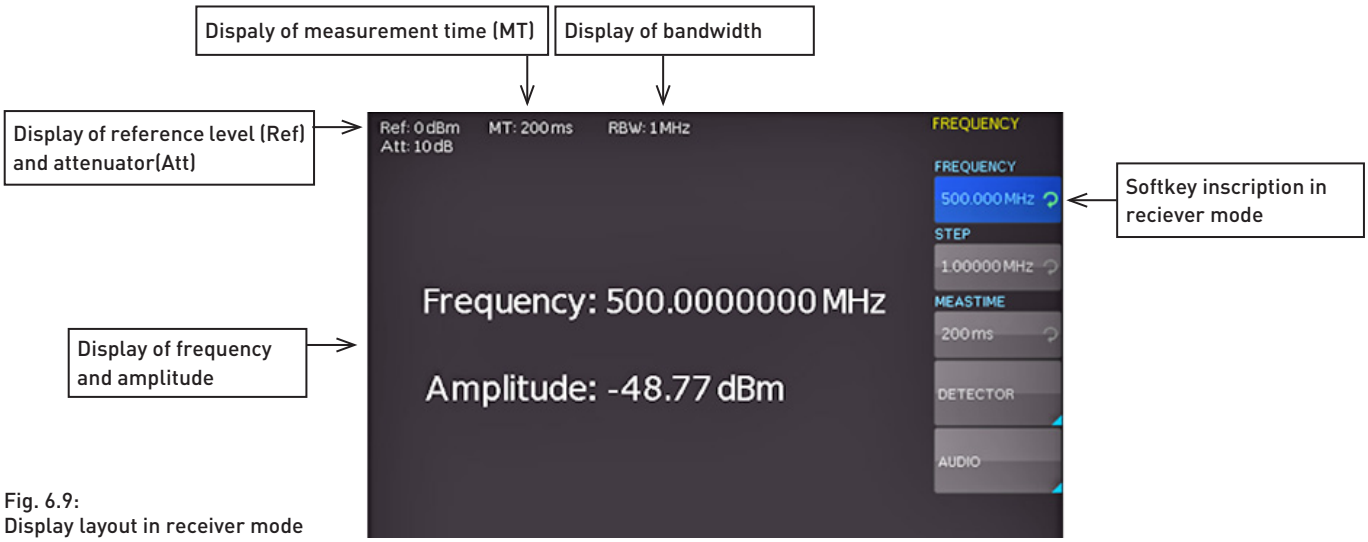


Fig. 6.9:
Display layout in receiver mode

7 Store and recall instrument settings

Your spectrum analyzer can store three different kinds of data:
- Instrument settings
- Waveforms
- Screen displays

Waveforms and screen displays can only be stored on USB sticks. Instrument settings can be stored either on a USB stick or in the instrument's non-volatile memories.

7.1 Instrument settings

Push the key SAVE/RECALL for calling the main menu for storage and load functions. First a listing is shown of the kinds of data which can be stored and loaded. By pushing the key next to the top menu item DEVICE SETTINGS this menu will open.

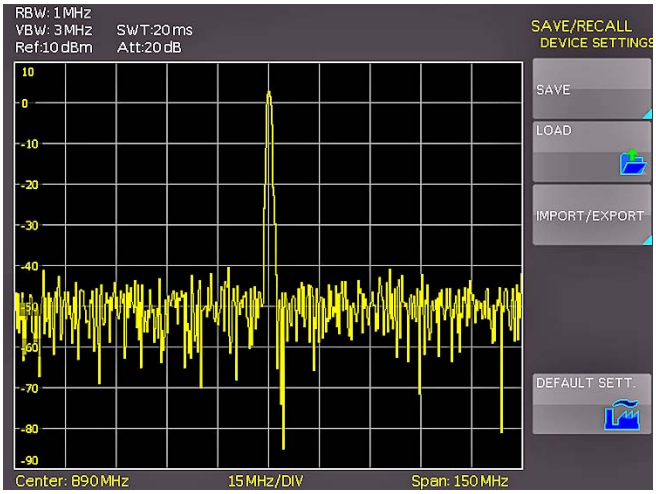


Fig. 7.1: Basic menu for instrument settings

In this menu, by pushing the respective key, it is possible to call the menu for storing, the data manager for loading, and the menu for exporting and importing instrument settings. Additionally, the menu item DEFAULT SETT. will reset the instrument to the factory settings. The storing menu is opened by pushing the SAVE key.

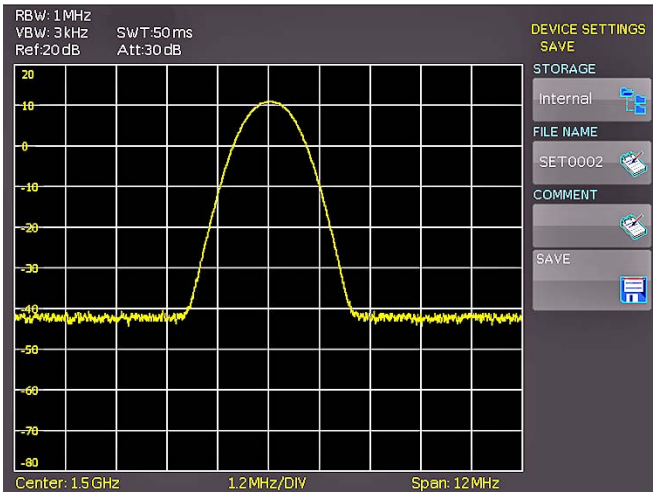


Fig. 7.2: Saving instrument settings

Here the storage location (internal memory, front panel USB, rear panel USB) is selected, also a name and a commentary can be added; these will be stored by pushing the soft menu key next to SAVE. In order to recall stored instrument settings, call the main instrument settings menu and select LOAD by pushing the respective soft menu key. The data manager will open, use the menu keys and the universal knob for navigating.

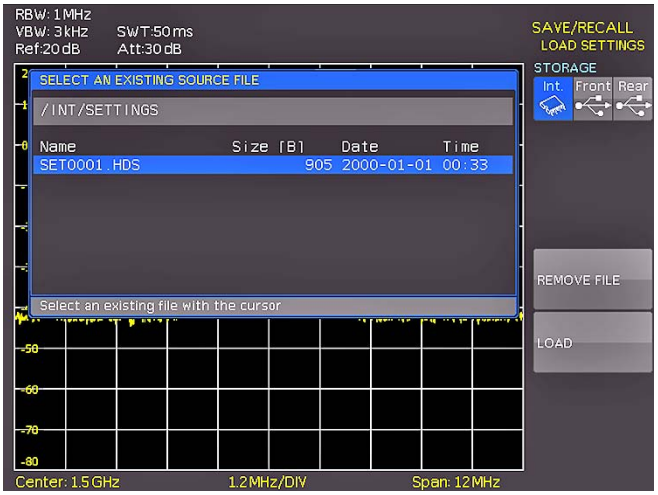


Fig. 7.3: Loading instrument settings

Here the location is selected from which the settings data are to be loaded. After the selection in the data manager, load the settings by pushing the soft menu key LOAD. The data manager also allows you to erase individual settings in the internal memory. If a USB stick is plugged in and has been selected as the location, it is also possible to change or erase directories. In order to export or import instrument settings, a USB stick must be plugged in, otherwise this menu can not be accessed. Provided this is fulfilled, pushing the key next to IMPORT/EXPORT will open a menu allowing to copy instrument settings between the internal memory and a USB stick.

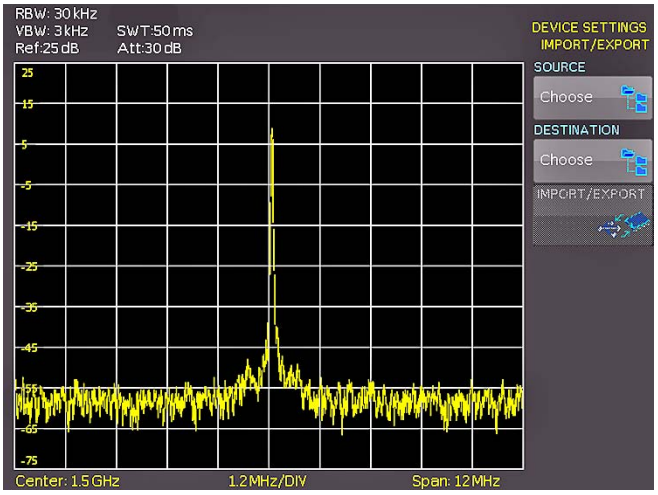


Fig. 7.4: IMPORT / EXPORT menu for instrument settings

The source is selected by pushing the respective key (e.g. INTERNAL), the selection will be indicated by its blue background. Then the destination is selected (e.g. FRONT). By pushing the key next to IMPORT/EXPORT, the selected settings data will be copied as previously chosen (in this example from the internal memory to a USB stick). It is possible to copy from the internal memory to the external memory and also between two USB sticks.

7.2 Waveforms

In addition to references, the waveform data can be stored only on external USB sticks, not internally.

- **HAMEG Binary format:**
  A binary data set may contain bytes of any length. The curves will be stored without any time information.

- **CSV (Comma Separated Values):**
  CSV data sets store the curves in tables, the lines are separated by commas.

- **TXT data sets** store the trace data in a comma separated list. These data sets differ from CSV files, due to the absense of tabstops and carriage returns.

In order to store waveforms, push the key SAVE/RECALL and select in the main menu the item TRACES by pushing the respective softmenu key.

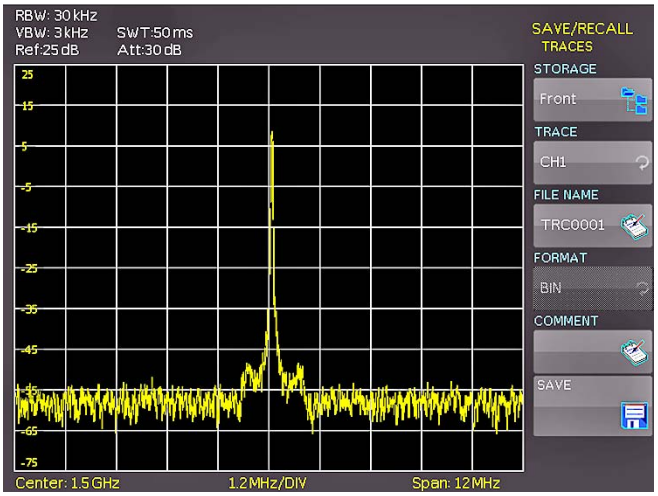


Fig. 7.5: Menu to save a waveform

In this menu which will open, the top item allows the selection of the front or rear panel USB port. This choice is only possible if the instrument recognized a USB stick at the designated port. If a stick is present and the port selection done by pushing the respective soft key, the first time this happens, the data manager will appear with the associated menu. Here, a listing of destinations can be selected or generated. Confirm the selection of the destination listing by pushing OK, this will recall the menu for storing curves. Pushing the soft key next to the second menu item (TRACE) will activate this function as indicated by the blue background.

Pushing the menu key next to FILE NAME will open the menu for entering names: in order to do this first push the CURSOR/SELECT key, then use this menu and the universal knob to enter the desired name which will be stored by pushing ACCEPT. This will recall again the menu for storing waveforms. Now push the soft key FORMAT, this will open a window for selecting the format. The selection is performed again with the universal knob. Additionally, a commentary can be stored along with a curve. This is done by pushing the menu key next to COMMENTARY, this will open a window for the entry. After entering the commentary and storing it by pushing ACCEPT, again the menu for storing curves will appear. After completion of all these entries, pushing the menu key next to STORE will store the curve according to the selected settings.

7.3 Screenshots

The most important method of storing for documentation purposes is the screen photo. At least one USB stick must be connected, only then will any settings regarding the destination and the format be possible. Push the keys SAVE/RECALL and SCREENSHOTS for opening the appropriate menu.

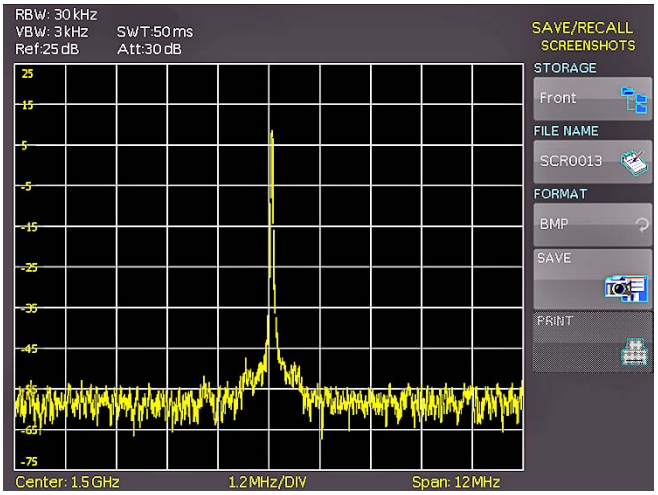


Fig. 7.6: Menu for screenshots

Also in this menu the destination (according to the USB sticks connected) can be selected with the top menu key. When this is done the first time, the data manager will appear in order to either select or generate a destination listing. After the entry of this information, the SCREENSHOTS storing menu will reappear. The second menu item FILE NAME allows you to enter a name with the respective name entry menu which will open automatically upon selecting this menu item. If FORMAT is selected with the respective menu key, these formats will be offered and can be selected with the universal knob: BMP = Windows Bitmap (uncompressed format) and GIF. Pushing the key next to SAVE will store the actual screen display along with the name and format at the destination selected.

Screenshot example

In order to store data you have to define the kind of data and the destination. First attach a USB stick (refer to 10.1 USB connector) to the front panel connector. Press SAVE/RECALL in order to call the respective menu.

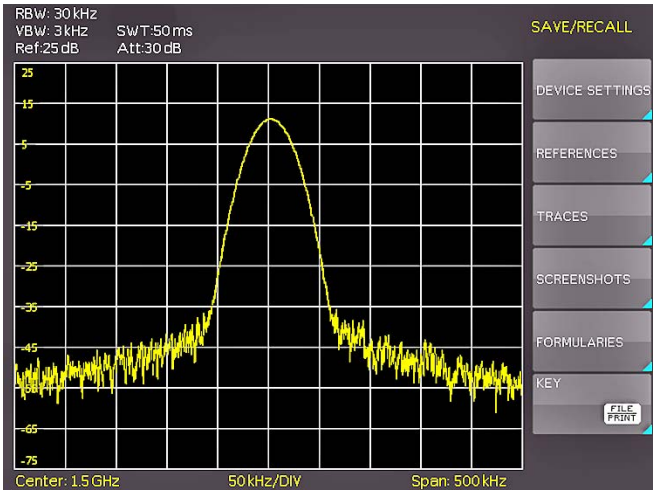


Fig. 7.7: Save/Load menu

Select the kind of data by pressing the respective soft key (in this example SCREENSHOTS) in order to access the settings menu.

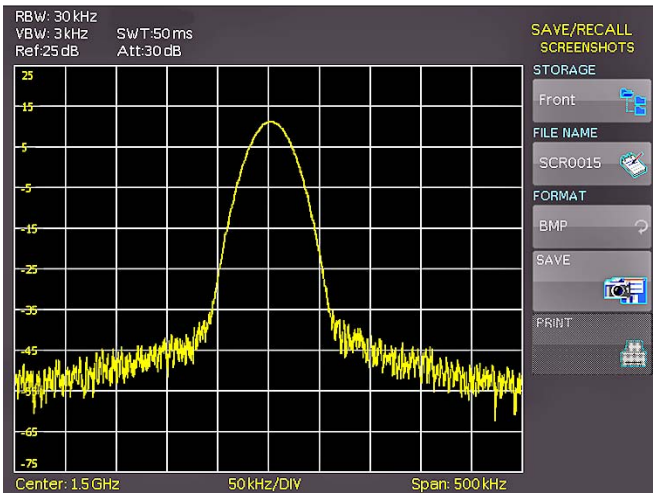


Fig. 7.8: Menu with the settings for screenshots

Please verify that the USB connector into which you plugged the USB stick (front or rear) is written in the top softmenu (you can change the destination by opening the respective menu if you press the softkey next to STORAGE). You can now save a Screenshot if you press the softkey next to SAVE using the predefined name written in the menu below FILE NAME. You may name the destination memory with up to 7 characters; in order to do this select the menu item FILE NAME and define the name by using the knob and the CURSOR SELECT key (in this example PRINT).

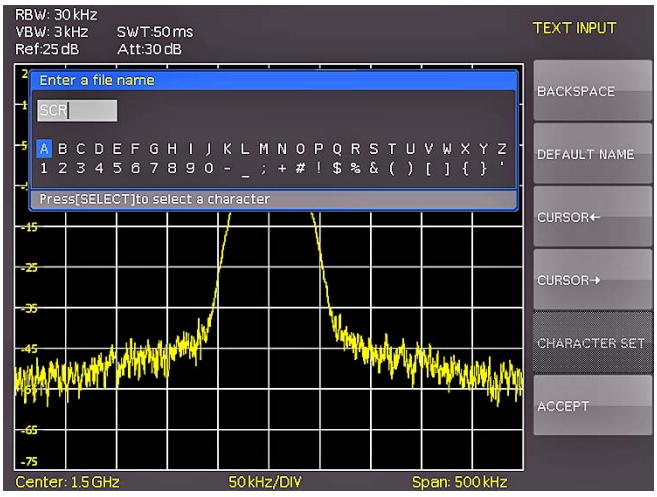


Fig. 7.9: Defining file names

After the softkey next to ACCEPT was pressed the oscilloscope will have stored the name and return to the settings menu. Here you can now store the actual screen display by pressing the SAVE softkey. Alternatively, you can return to a lower menu level (by pressing the lowest Menu OFF key) and select the menu item key FILE/PRINT. In the following menu press the soft menu key next to SCREENSHOTS: this will assign the function screenshot to the key FILE/PRINT with the settings chosen. This enables you to store a bitmap file on your USB stick by just pressing FILE/PRINT at any time and in any menu.

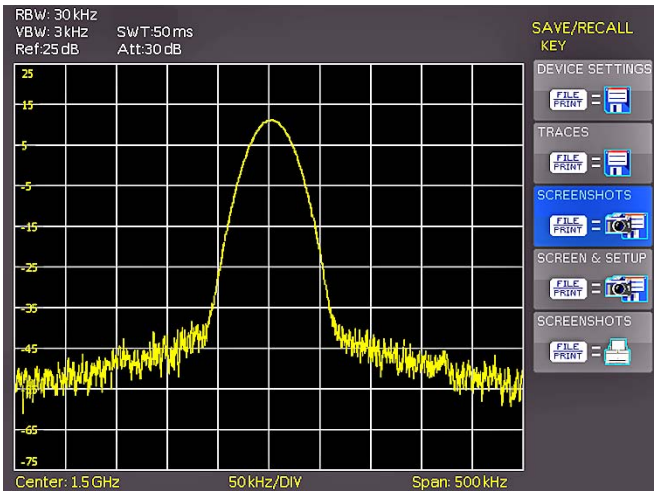


Fig. 7.10: Settings of the button FILE/PRINT

8 Extended operating modes

8.1 Using the help function

The integrated help function can be activated by pressing the key HELP in the GENERAL area of the control panel. A window will open and the text inside is dynamically updated depending on the key (including softmenu key's) you are pushing or the knob you are turning. Additionally, the appropriate SCPI interface command is displayed. If you do not need the help anymore, you can switch off the help window by pushing the HELP key.

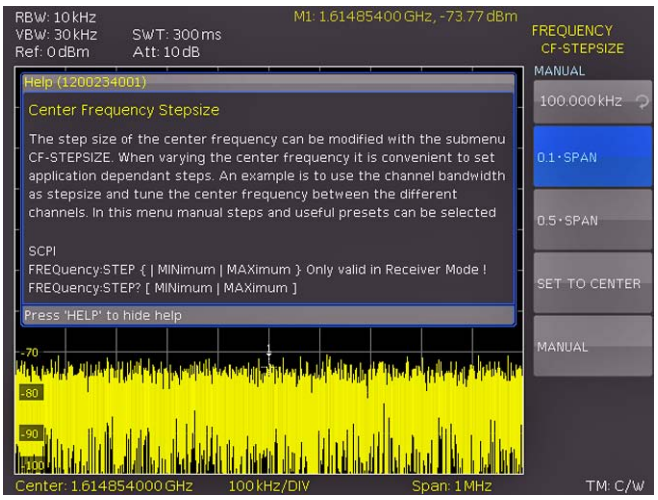


Fig. 8.1: Internal help function

8.2 Display settings

By pushing the key DISPLAY the display settings menu will be called; here several choices are offered:

- **TRACE:** EAdjustment of the trace intensity (0 ... 100 %) of the displayed spectrum.
- **BACKLIGHT:** Adjustment of the backlight intensity (0...100 %).
- **GRID:** Adjustment of the raster intensity (0 ... 100 %). The soft menu item GRID SETUP allows to select a cross, raster lines or no raster with the respective soft menu keys. Also the raster designations (SCALE) can be switched on or off.

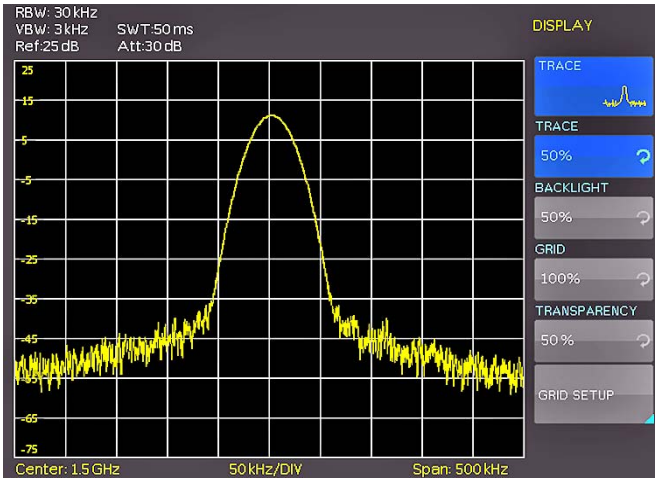


Fig. 8.2: Display settings menu (DISPLAY)

The soft menu key LED INTENS changes the LED intensity from dark to light, this is effective for all backlighted keys and all other display LED's on the front panel.

- **TRANSPARENCY:** Adjustment of the transparency (0 ... 100 %) of the raster inscriptions.

If a soft menu item is activated, its background will be blue. The setting of the parameters is performed according to chapter 5.

8.3 Selection of the standard instrument settings (PRESET)

By pushing the key PRESET the spectrum analyzer will resume its preset standard settings. This allows to generate a new configuration, starting out from defined parameters, no parameter from a former setting will be active any more.

Center frequency:	1.5 GHz (HMS3000/3010)
	500 MHz (HMS1000E/1000/1010)
Span:	3 GHz (HMS3000/3010)
	1.6 GHz (HMS1000E/1000/1010)

8.4 EMC Precompliance software

To perform EMC measurements, a free of charge software is necessary. It is available from www.hameg.com. For further information to the HAMEG EMC software, please refer to the software built-in help-sytem.

An EMC software is not available for the HMS1000E.

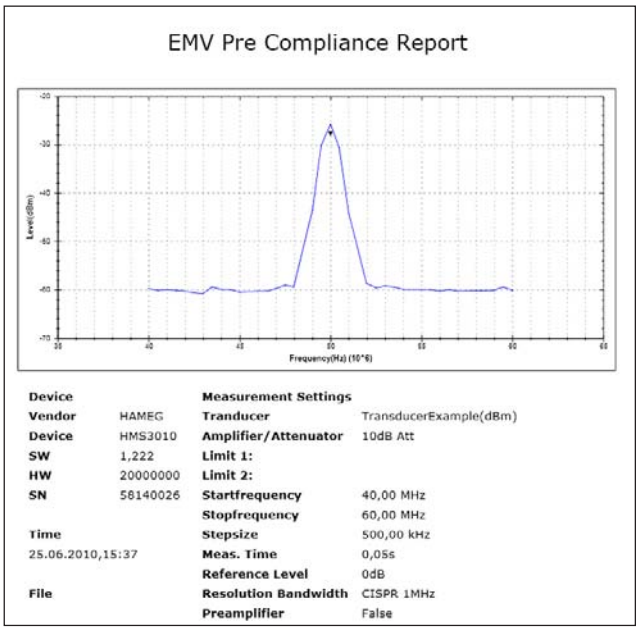


Fig. 8.3: EMV report

During EMC measurement the REMOTE key lights up and the front panel controls are locked.
To unlock the front panel controls use the softkey UNLOCK KEYS .

9 General instrument settings

Basic settings like language for user interface and help, miscellaneous settings and interface settings can be set using the menu which opens after pressing the SETUP key in the GENERAL area of the control panel. Pushing the soft menu key MENU OFF will call the next lower level.

9.1 Language settings

The HMS series provides four different languages for the menu and help text:

German, English, French and Spanish

By pushing the soft menu key LANGUAGE the language selection is called, the language selected is active if the menu item's background is blue.

9.2 Basic settings

9.2.1 Clock & Time

Pushing the soft menu key SET CLOCK will call the clock and date settings menu. These settings will be used for adding a time and date stamp on print-outs and stored files. The user can modify the time and date with the knob. The respective soft menu item is active if it its background is blue. The time and date settings will be accepted by pushing ENTER.

9.2.2 SOUND

The HMS series offers the possibility to sound a warning which can be switched on or off using SOUND. The control resp. warning tone will be active if the respective menu item's background is blue.

9.2.3 Device Name

In this menu item you can set a name for the HMS series. By pressing the softkey a key panel will show. You can choose the character via the knob. The character will confirm with the enter button (refer to chapter 7.3).

9.2.4 Device Infos

Choosing this soft menu item will call instrument information such as serial number, software version etc.

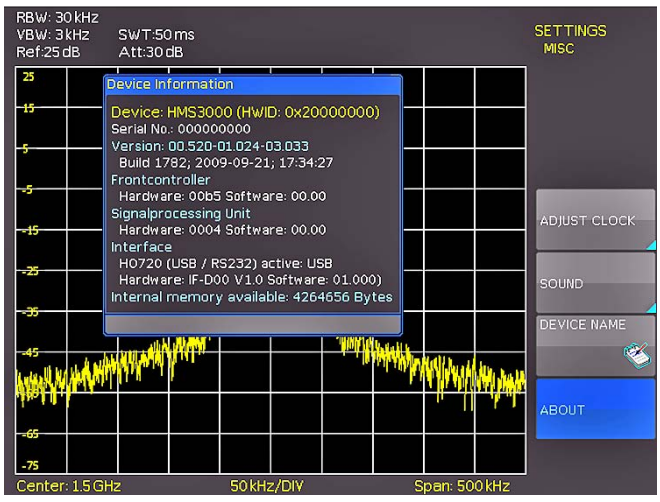


Fig. 9.1: Instrument Informations

9.3 Interface settings

Selecting this soft menu item will allow to modify the settings for:

- the Dual Interface HO720 USB/RS-232 (Baud rate, number of stop bits, parity, handshake on/off)
- LAN Interface HO730 (IP address, sub net mask etc., see the manual of the HO730) and
- the IEEE-488 GPIB interface HO740 (GPIB-address)

The interface desired for the communication can be selected with the respective soft menu key. Use the soft menu item PARAMETER to set the necessary interface parameters. More information about the selected interface you can find on www.hameg.com.

9.4 Printer settings

The HMS series supports printing of the screen contents on a connected printer (USB printers with postscript).

The HMS series supports the output of the screen content on a connected printer. The menu item PRINTER contains settings for POSTSCRIPT and PCL printers. Pushing this softkey will open a submenu in which you can select the paper format and the color mode. If you choose the top menu item PAPER FORMAT with the associated soft menu key, a window will open which offers the selection of A4, A5, B5, B6, and Executive. Use the universal knob to select the desired format which will then be indicated on the softkey.

The next lower menu item COLOR MODE allows the selection of the modes Greyscale, Color, and Inverted following the same procedure. The Greyscale mode converts a color display to a greyscale display which can be printed on a Black-and-White printer. The Color Mode will print the display in color as it is shown on the screen (black background). In the Inverted Mode the color display will be printed in color with a white background on a color printer in order to save toner and ink.

9.5 Reference frequency

This submenu is used to switch between the internal (TCXO) and external reference source. The softkey INTERNAL switches to the built in TCXO. The softkey EXTERNAL is used to select the reference source. To improve frequency accuracy an external 10 MHz reference clock can be used.

9.6 Update (Firmware / Help)

You are invited to download the most recent firmware under www. hameg.com. Firmware and help are packed into one ZIP data packet. After downloading the ZIP data unpack it into an USB stick's basic directory (refer to 10.1 USB connector). Thereupon insert the stick into the USB port of the spectrum analyzer and push the key SETUP in the GENERAL area of the front panel. Here you shall find the menu item UPDATE. After selecting this menu item a window will open which displays the actual firmware version indicating the version number, the date and build information.

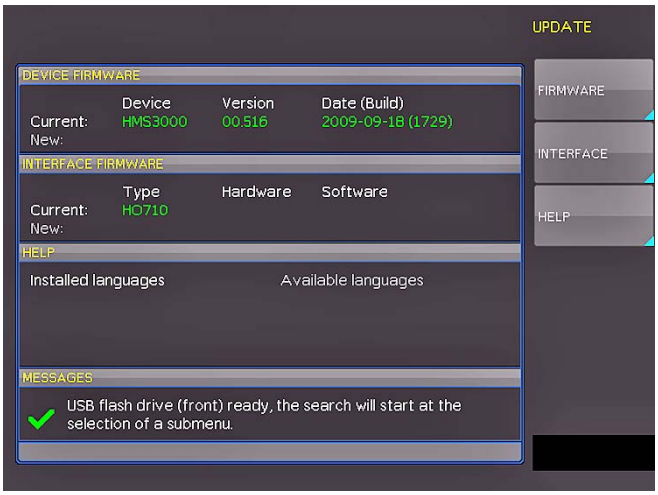


Fig. 9.2: Updating menu

Now choose which to update: the firmware or the help function. If both are to be updated it is recommended to first update the firmware. After you selected firmware updating by pushing the appropriate key the respective date will be searched on the stick, the information of the firmware to be updated from the stick will be displayed below the line NEW. In case the new firmware should be identical to the existing one, the number of the version will be shown in red, otherwise it will be shown in green; only then should you activate the updating by pushing the soft key EXECUTE. If you intend to update the help function or add a help language choose HELP in the updating menu. The information window will now display the languages installed, the date, and the information about the languages available on the stick. With the soft menu, languages may be added, removed or updated. Please note the format of the date:YYYY-MM-DD according to the multi language norm of ISO 8601.

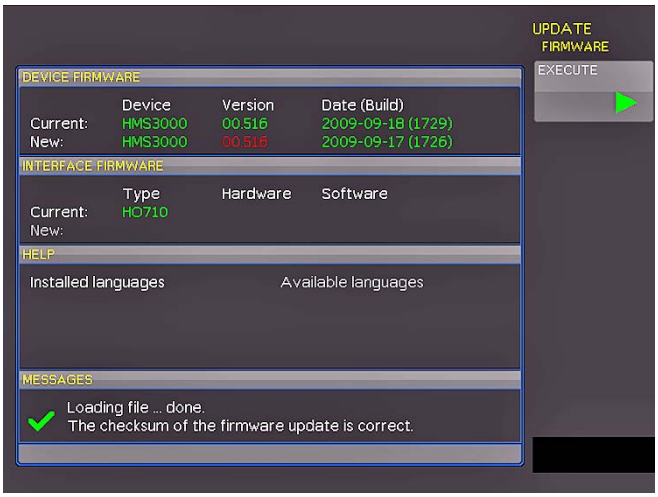


Fig. 9.3: Info display of help update

9.7 Upgrade of software options

The HMS series may be upgraded with options which will become accessible after inputting a licence key. At this time, the option HO3011 is available (preamplifier, not for HMS1000E).

The licence key will be sent to you by email as an appended data file (name: SERIAL NUMBER.hlk). This file is an ASCII file and may be opened with an editor, then the true key can be read. There are two methods for employing the key to use the desired option: the automatic or the manual input. The fastest and simplest method is the automatic input: first store the file on an USB memory stick, then install the stick into the front panel FRONT USB port of your HMS and press the key SETUP in the GENERAL area of the HMS front panel. The SETUP menu will open. Select page 2 by pressing the respective softkey, the following menu will open:

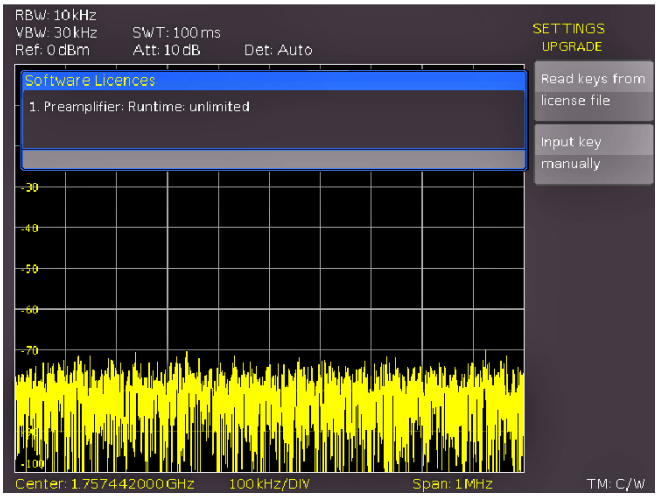


Fig. 9.4: UPGRADE menu

Now open the UPGRADE menu by pressing the respective softkey. Then press the soft menu key next to „Read Licence file" which will open the data manager. Use the universal knob to select the correct file and then press the softkey next to LOAD. This will load the licence key; the option will be ready to use immediately after a fresh start of the instrument.

The alternative method is the manual input of the licence key. Select the menu UPGRADE and press the soft menu key next to „Manual key input". This will open an input window, use the universal knob and the ENTER-key to input the licence key.

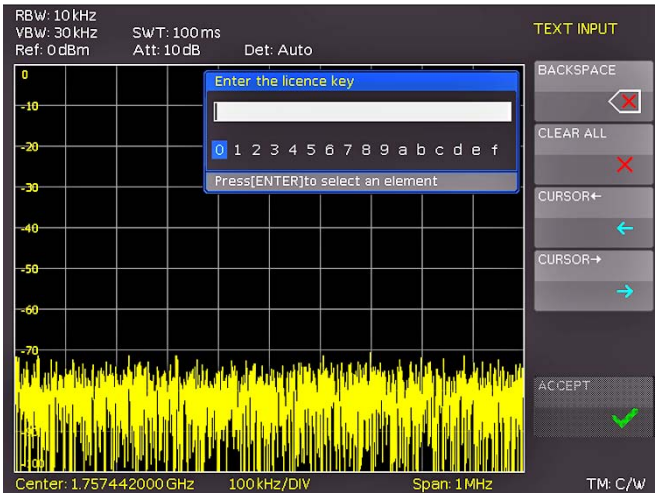


Fig. 9.5: Manual licence key input

After inputting of the complete key please press the softkey next to ACCEPT in order to input the key into the system. The option will be activated after a fresh start of the instrument.

You can check the successful installation of the HO3011 in the SETUP menu (device info) of the HMS instrument.

10 Front panel Connections

10.1 USB connector

Using the front panel USB connector a software update of the HMS firmware can be performed or screenshots can be strored. Please use only FAT or FAT32 formatted mass memory (chapter 9.6).

10.2 PHONE

The signal available at this connector comes from an AM detector and it helps to identify the sources of interference e.g. when making precompliance measurements. If an antenna is connected to the analyzer input, selecting CENTER and using the knob the analyzer can be tuned to a transmitter (Receiver mode chapter 6.13). The demodulation has to activated. Please note that this operational mode may be subject to national restrictions!

10.3 PROBE POWER

This connector can be used as a supply (6 V_{DC}) e.g. for HAMEG probes. The inner contact is +6 V, the outer contact is connected to the instrument housing and thus with the measurement inputs' ground potential and also protective earth (PE).

10.4 EXTERNAL TRIGGER

The external trigger input connector is used for the control of measurements by an external signal. (TTL levels.)

10.5 OUTPUT 50Ω (Tracking Generator)

The tracking generator output (only HMS1010 and 3010) has to be connected to the measuring object with a N connector cable. A test signal with a spectrum from 5 MHz to 1.6 GHz resp. 3 GHz is available.

10.6 INPUT 50Ω

Without attenuation (ATT 0 dB) 80 V_{DC} must not be exceeded. With an attenuation of 10 to 50 dB, the maximum level is +20 dBm. Levels or DC voltages above the values mentioned may destruct the input stage. The outer contact is connected to the instrument chassis and thus to safety ground (PE). The maximum input levels resp. voltages must not be exceeded. Danger of destruction!

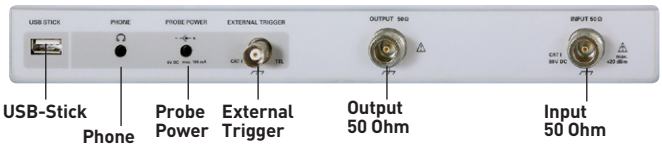


Fig. 10.1: Connections Front Panel

11 Rear panel Connections

11.1 USB connector

The USB interface on the rear panel can be used to connect a printer (see chapter 9.4).

11.2 DVI connector

In addition the rear panel of the spectrum analyzer also holds the standard DVI-D connector for the connection of external monitors or projectors. The DVI-D connector only provides digital signals, therefore an analog input of a monitor or projector cannot be used to connect the analyzer. The HMS series delivers a DVI signal in VGA resolution (640 x 480), so any standard TFT monitor can be connected. Modern flat screens will interpolate the signal providing a full screen image. When connecting a projector to the HMS please make sure to select a type of projector that has been designed for the use with computers/ notebooks, as these projector will be able to handle the VGA resolution of the HMS.

DVI-VGA adapters as well as DVI-composite adapters are not supported. You might encounter difficulties when connecting the HMS to an HDTV set through an HDMI adapter, as most HDTV sets expect an HDMI signal of 720p and higher.

11.3 REF IN / REF OUT

In order to further increase the frequency stability, the internal oscillator may be replaced by an external one which can be connected to the 10 MHz REF IN/REF OUT connectors on the rear panel. The external reference frequency signal must comply with the specifications given with respect to frequency accuracy and amplitude.

The switching between internal and external reference frequency can be effected via the button SETUP and the softkey REF. FREQUENCY.

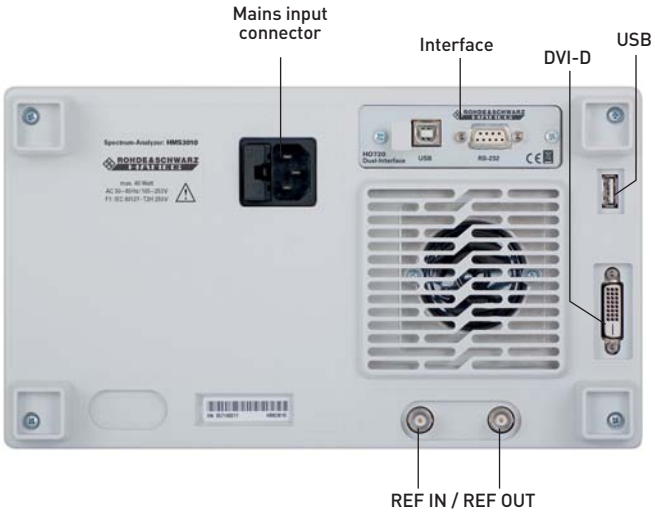


Fig. 11.1: Connections Rear Panel

12 Remote Control

The HMS series is basically supplied with an USB/RS-232 interface. The respective drivers are available on the enclosed Product CD or can be downloaded at http://www.hameg.com.

To establish a basic communication a serial cable (1:1) as well as a terminal program like Windows HyperTerminal is required. The Windows HyperTerminal program is part of any Windows operating systems. A detailed instruction how to setup a basic communication using HyperTerminal is available at the HAMEG Knowledge Base at http://www.hameg.com/hyperterminal.

The HMS series uses SCPI (= Standard Commands for Programmable Instruments) for remote control. Remote control is possible via the built-in dual interface USB/RS-232 (options: Ethernet/USB, IEEE-488). This allow access to nearly all functions which are available on the front panel. A detailed document about the provided SCPI commands is available at http://www.hameg.com.

12.1 RS-232

The RS-232 interface is made as a 9 pole D-SUB connecter. Over this bidirectional interface you can transfer settings, data and screen dumps from an external device (PC) to the power supply or vice versa. The direct physical link between the instrument and serial port of the PC can be done via an 9 pole cable with shielding (1:1 wired). The maximal length must below 3 meter. The exact pinning oft he plug is as follow:

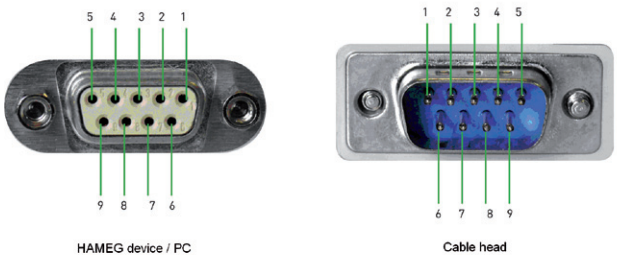


Fig. 12.1: Pin Assignment RS-232

The pin assignment:
2 Tx Data (Data from the HAMEG device to the PC)
3 Rx Data (Data from the PC to the HAMEG device)
7 CTS Ready to send
8 RTS Ready to receive
5 Ground (Reference potential connected via the HAMEG instrument of safety class I with the line cord and thus to the safety earth of the wall outlet)
9 +5 V Supply voltage for external devices (max. 400 mA)

The maxiaml amplitude at Tx, Rx, RTS und CTS is ±12 Volt. The standard RS-232 settings are:

8-N-1 (8 data bits,no parityt, 1 stop bit), RTS/CTS-Hardware-protocol: none.

In order to set these parameter at the instrument, please press the button MENU and choose the menu item INTERFACE. Make sure the RS-232 interface is chosen (menu text marked with a hook) and then choose the menu item INTERFACE SETTINGS. This opens a menu where you can set all parameters for the RS-232 communication.

12.2 USB

All descriptions regarding the USB interface are true for the HO720 interface card as well as for the optional HO730 USB part. All currently available USB driver are fully tested, functional and released for 32 Bit and 64 Bit Windows™ systems.

The USB interface must be chosen in the instrument and does not need any setting. At the first connection Windows™ ask for a driver. The driver you can find on the delivered CD or on our homepage www.hameg.com at the download area for the HO720/HO730. The connection can be done via the normal USB or via the virtual COM port (VCP). The description how to install the driver you can find in the HO720/HO730 manual.

If the virtual COM port will be used, you must set USB as interface at the power supply.

12.3 Ethernet (Option HO730)

The optional interface card HO730 does have a USB and Ethernet connection. The settings of the parameters at the instrument are done after selecting ETHERNET as the interface. You can set anything including a fix IP adress. Alternative you can chose a dynamic IP setting via the DHCP function. Please ask your IT department for the correct setting at your network.

If DHCP is used and the HMS does not get any IP adress (f.e. if no ethernet cable is connected to the scope or the network does not support DHCP) it may take up to three minutes until a time out make the interface available again for configuration.

If the instrument does have an IP Adress you can open your web browser and put this IP adress into the adress line (http//xxx.xxx.xxx.xx). Since the HO730 does have a webserver integrated it will open a site with informations about the HMP, the interface and it's setting. On the left side there are links to „Screen Data" which make it possible to transfer a screen dump to the PC (using the right mouse click this can be transferred to the clip board for further use). The link „SCPI Device Control" open a site with a console to send remote SCPI commands to the power supply.

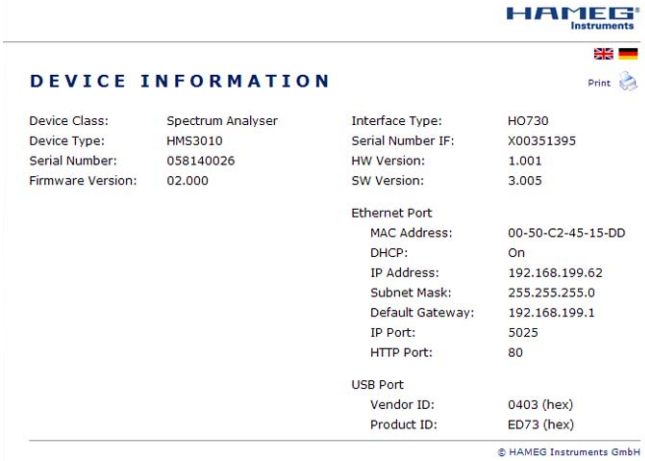


Fig. 12.2: Webserver

In general, the HO730 works with a RAW-Socket communication to control the instrument and to request the measurement values. Therefore, a TMC or similar protocol is not supported.

12.4 IEEE 488.2 / GPIB (Option HO740)

The optional interface card HO740 does have a IEEE488.2 connection. The settings of the interface can be done in the power supply after chose the IEEE 488 as interface and hitting. Further information you can find at the manual of the HO740 at the download area on our homepage www.hameg.com.

13 Optional Accessories

13.1 Activation of the Preamplifier HO3011

The software option HO3011 provides a Preamplifier which increases the sensitivity of the instrument. This Preamplifier is frequency dependent and increases the sensitivity, depending on the environmental settings up to 10...20dB.The license file, used to unlock this option, is linked to the serial number of the device.

The Preamplifier (DANL –135 dBm typ. / 100 RBW) will activate in the Setup menu with the softkey **UPGRADE**. Please look at chapter 9.7 for the procedure of the upgrade. This preamplifier isn't included in the supplied accessories and can be acquired by purchase (not available for HMS1000E).

The Preamplifier option HO3011 can be unlocked anytime, even after purchase.

13.2 19'' Rack mount kit 4HE HZ46

For the application in rack systems we provides a kit for the HMS series. Technical details and a description about the mounting you can find in the manual HZ46 on our homepage http://www.hameg.com/downloads.

13.3 Carrying case HZ99

The Carrying Case HZ99 is used to transport your spectrum analyzer and is available "on stock".

Fig. 13.1: Carrying case HZ99

13.4 Near field probe HZ530/HZ540

The set includes 3 hand-held probes with a built-in preamplifier covering the frequency range from 100 kHz to 1 GHz resp. <1 MHz to 3 GHz. When used in conjuction with a spectrum analyzer or a measuring receiver, the probes can be used to locate and qualify EMI sources, as well as evaluate EMC problems at the breadboard and prototype level. The power can be supplied either from batteries (HZ530) or through a power cord directly connected to an spectrum analyzer (HZ540). Signal feed is via a BNC-cable or SMA/N-cable. They enable the user to evaluate radiated fi elds and perform shield effectiveness comparisons.

The probes – one magnetic field probe, one electric field probe and one high impedance probe – are all matched to the 50Ω inputs of spectrum analyzers. The technical specifications are described in the HZ530/HZ540 manual on our homepage http://www.hameg.com/downloads.

13.5 Measurements of spectra with a VSWR bridge HZ547 (HMS1010/3010)

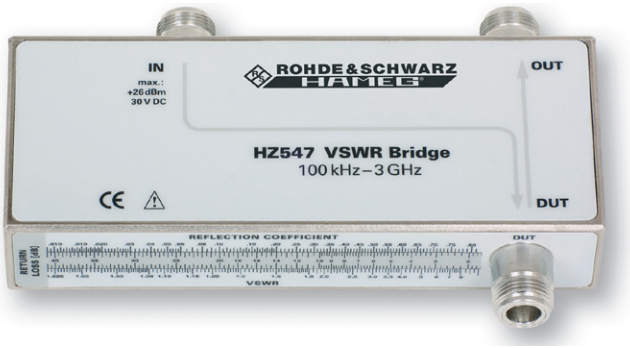


Fig. 13.2: VSWR bridge HZ547 for HMS1010/3010

The VSWR bridge HZ57 allows the measurement of the voltage standing wave ratio (VSWR) and the reflection coefficient of 50Ω devices. Typical objects are e.g. 50Ω attenuators, load resistors, amplifiers, cables, mixers, frequency selective devices. The frequency range is 100 kHz...3 GHz. The technical specifications and the measurement set-up are decribed in the HZ547 manual on our homepage http://www.hameg.com/downloads.

13.6 Transient Limiter HZ560

Fig. 13.3: Transient Limiter HZ560

The Transient Limiter HZ560 protects the input circuit of spectrum analyzers and measurement receivers, in particular in combination with the use of a Line Impedance Stabilization Network (i.e. LISN HM6050). The technical specifications are decribed in the HZ560 manual on our homepage http://www.hameg.com/downloads.

13.7 75/50-Ω-Converter HZ575

Fig. 13.4: 75/50-Ω-Converter HZ575

The converter HZ575 has a 75Ω AC coupled input and a 50Ω DC coupled output. Using HZ575, spectrum analyzers with 50Ω input can be used for measurement in 75Ω environment. HZ575 can be used reversed too. A 50Ω signal applied at the 50Ω "output" is present at the 75Ω BNC "input" socket with an impedance of 75Ω. The technical specifications are decribed in the HZ575 manual on our homepage http://www.hameg.com/downloads.

14 Appendix

14.1 List of figures

14.2 Glossary

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A Rohde&Schwarz Company

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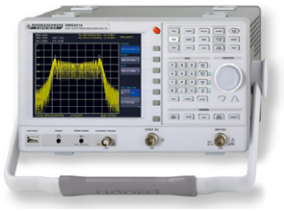
Spectrum Analyzer



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HAMEG Instruments GmbH
Industriestraße 6
D-63533 Mainhausen
Tel +49 (0) 61 82 800-0
Fax +49 (0) 61 82 800-100
sales@hameg.de