

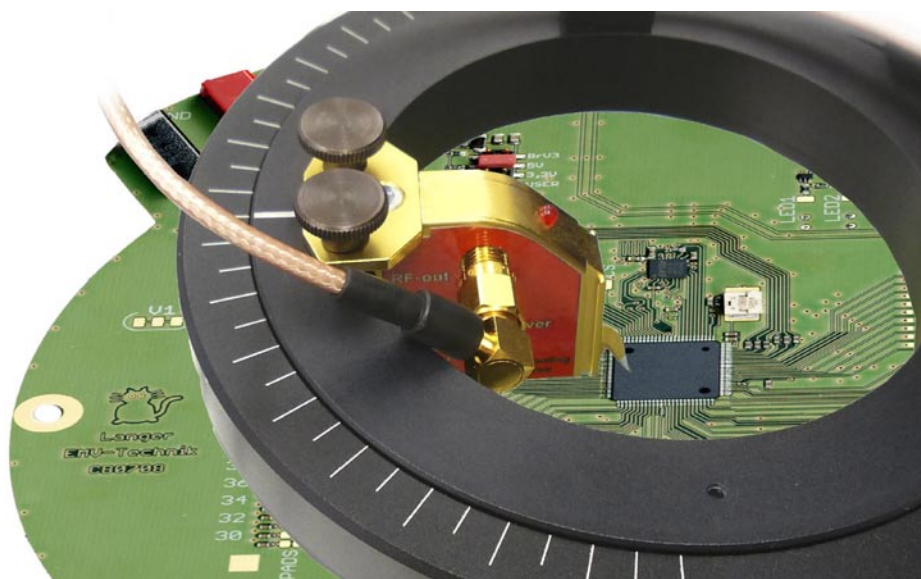


# IC TEST SYSTEM

Product group

Near-field microprobes

(ICR probes)





## 1. Near-field microprobes (ICR probes)

- 1.1 Field of application
- 1.2 Design and terminology
- 1.3 Probe types overview
- 1.4 Probe characteristics

## 2. IC scanner

The IC scanner is a modular device system with near-field microprobes for the automatic measurement of electric and magnetic near fields on die surface, bond wires and IC-pins .

Apart from the holder for the near-field microprobes, the system includes a 4-axis positioning system to guide the microprobes, a motor controller with cables to connect the device and the modular software. The system works directly with a PC and a spectrum analyzer via USB interfaces.

The system's components are:

1. Mover with 3 linear axes (x, y, z) or optionally 4 axes (x, y, z and  $\alpha$  rotation)
2. TB 1022 test board (GND plane, DUT holder and Connection board)
3. Motor controller to drive the mover
4. Spectrum analyzer
5. PC with ChipScan control and operating software

## 3. ChipScan software

The software comprises components to operate and control the entire measuring set-up. The devices are centrally managed and controlled. The mover can be controlled with a program. The measuring algorithms are carried out in an interactive mode and the results of the measurement are shown in a three-dimensional graphic. The measured data can be exported and used for other applications.

The measuring algorithms are freely programmable scans based on scripts which can be generated by the user.

Predefined measuring algorithms include:

- point scan (ptp scan)
- line scan (continuous scan)
- surface scan
- volume scan



The near-field microprobes developed by LANGER EMV-Technik can be used to measure magnetic or electric near fields with a high resolution and sensitivity. The probes are suitable for field measurements on ICs.

The dimensions of the near-field microprobes (ICR probes) are in the micrometer range. Thanks to their design and small size, they can be used to separately examine electrical (E-) and magnetical (H-) fields on ICs (die surface, bond wires, pins). They move approximately 20  $\mu\text{m}$  above the respective device under test. E- and H- near fields can be detected separately at a high resolution.

The near-field probes are microprobes which can no longer be guided by hand but have to be moved by a computer-controlled mover due to their high resolution and sensitivity.

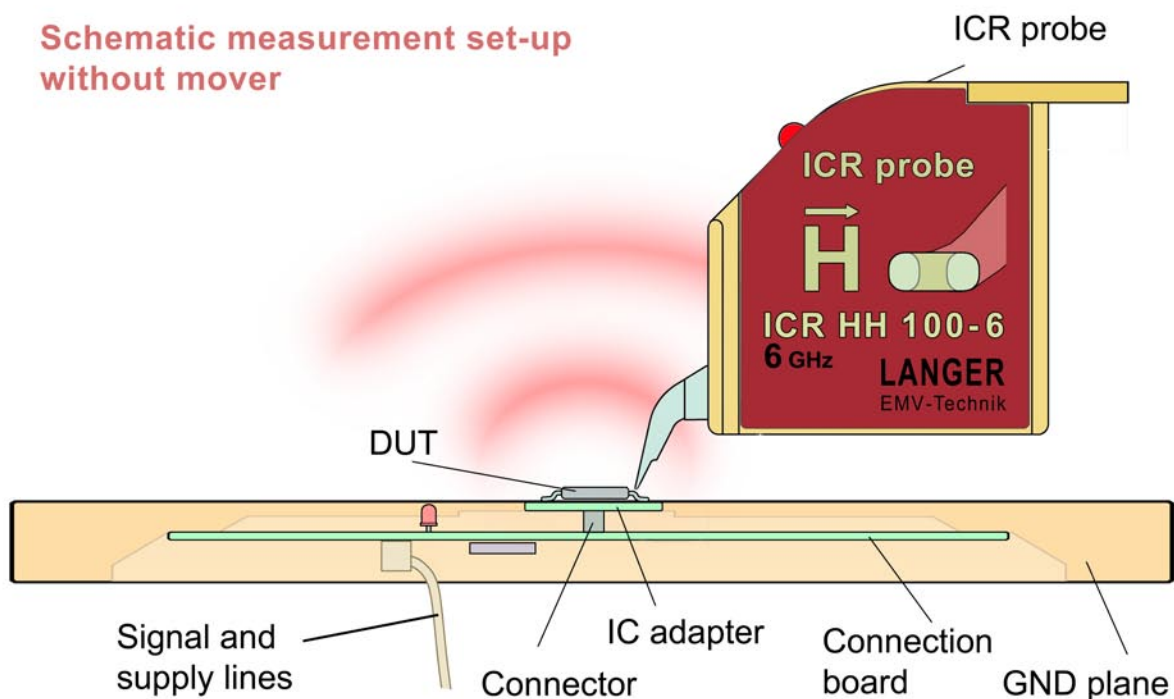
The E and H probes are mounted at the tip of the probe - the probe's head. An amplifier is integrated in the probe case.

The probe holder can alternatively be adapted to the customer's existing mover or robot systems on request.

The technical data sheets of the ICR probes show typical sets of characteristics.

Near-field microprobes can be delivered for a wide variety of measurement tasks that have to be carried out during development work. The portfolio of products thus allows the user to make an optimum choice for a wide range of practical measurement purposes.

**Schematic measurement set-up  
without mover**





**ICR near-field microprobe**

The ICR probe consists of:

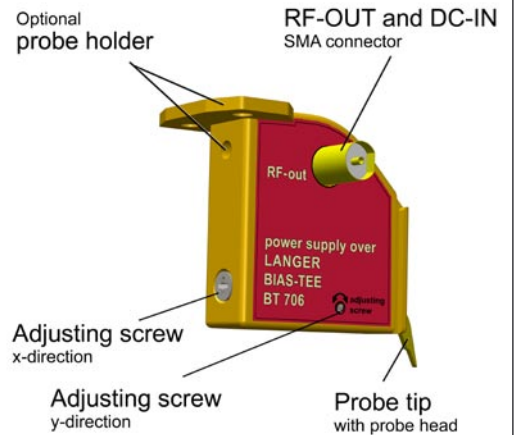
- probe case with integrated amplifier,
- clamping bolt and adjusting screws,
- probe tip with probe head.

Power supply:

- via LANGER BT 706 Bias-Tee

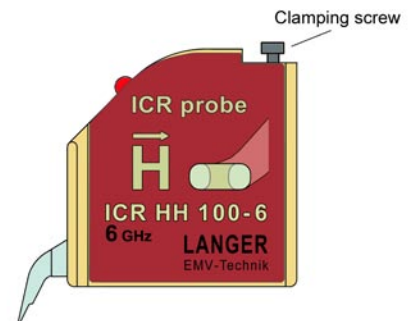
**Note:**

Due to its design the ICR probe is sensitive to shocks and thus delivered with a transport and handling protective cap.



**Clamping screw:**

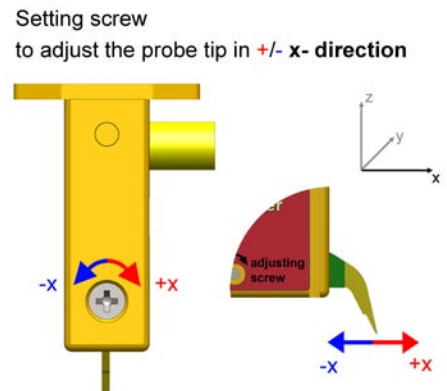
To fit the enclosed probe holder or alternative adjusting system.



**Adjusting screw 1:**

To adjust the probe head in the centre of the rotary unit and position the probe tip in the x-direction

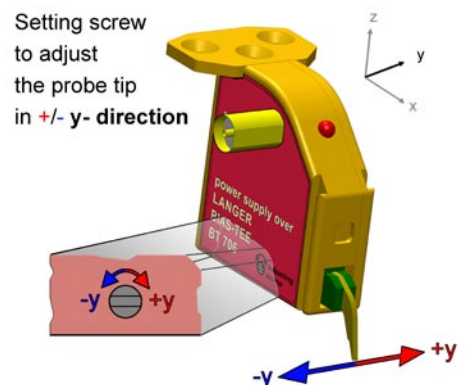
- The adjustment path in the x-direction is +/- 1 mm.



**Adjusting screw 2:**

To adjust the probe head in the centre of the rotary unit and position the probe tip in the y-direction

- The adjustment path in the y-direction is +/- 1 mm.



**1.2  
ICR probes**

**Design and terminology**

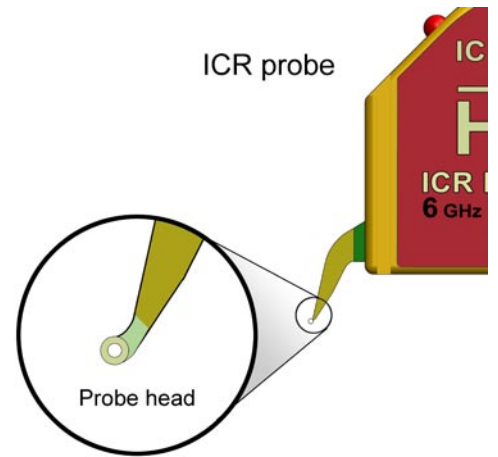


**Probe tip**

The probe tip protrudes from the amplifier case and allows optical positioning of the ICR probe above the DUT.

**Probe head**

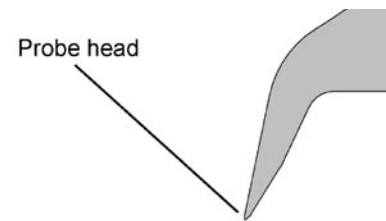
The probe head is the sensing element of the near-field microprobe.  
Horizontal and vertical probe heads with different inside diameters are available for measuring the magnetic field.



**Probe protection**

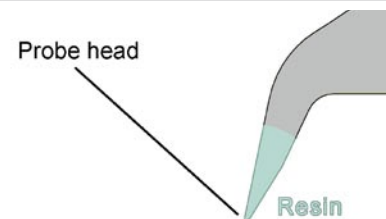
**- without protection  
(ideal for positioning with IC scanner)**

The probe head gets closer to the object to be measured and can measure higher signal intensities.  
The probe head is more easily visible and can be positioned more precisely relative to the object to be measured.



**- with protection  
(ideal for manual positioning)**

The probe head is reinforced with a resin.  
This enhances the probe tip's stability and prevents the probe head from being damaged.



**BT 706 Bias-Tee**

Power is supplied to the integrated amplifier via the bias-tee.

This BT 706 has an impedance of 50 ohm and stabilises the current (9 V, 100 mA) for the ICR probe.

Frequency range: 500 kHz to 6 GHz  
Connection: SMA connector  
Plug-in power supply unit 12 V / 70 mA

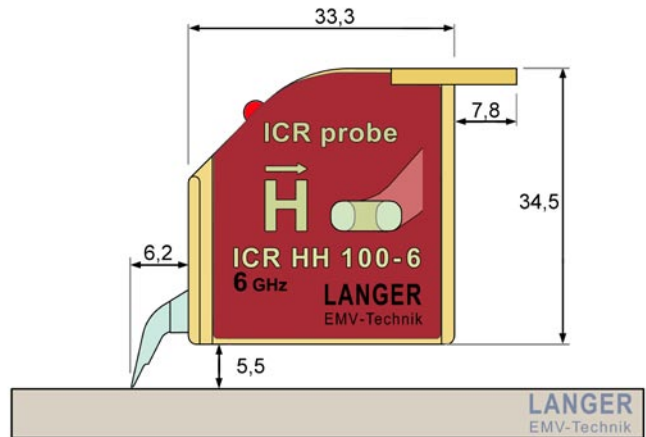
**Note:**

The bias tee from LANGER EMV-Technik GmbH features integrated voltage stabilisation at 9 V. The ICR probes can thus only be used with this bias tee.

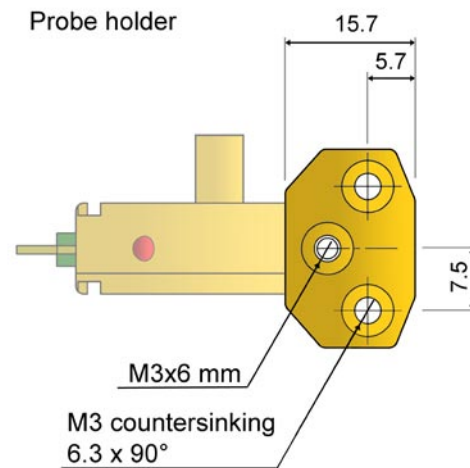




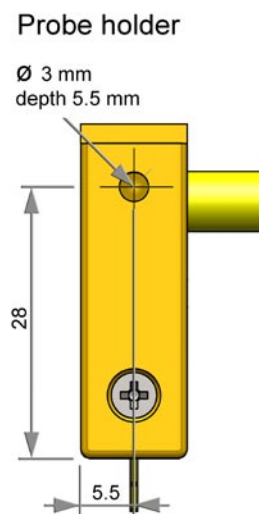
**Front view**  
Details of:  
- probe type  
- resolution  
- frequency range



**Top view**  
The probe is delivered with a holder that can be used to fit it to the scanner from LANGER EMV-Technik.












**Rear view**  
Alternatively the probe can be connected to an adjusting system through an opening beneath the scanner holder.



**1.3  
ICR probes**

**Probe types' overview**



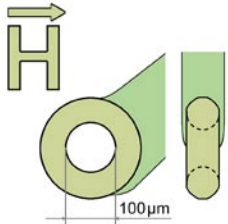
Probe types	Inside diameter	Orientation	Measuring range
ICR HV 100-27	100 µm	 vertical	1.5 MHz to 6 GHz
ICR HV 100-6			2.5 MHz to 6 GHz
ICR HH 100-27	100 µm	 horizontal	1.5 MHz to 6 GHz
ICR HH 100-6			2.5 MHz to 6 GHz
ICR HV 150-27	150 µm	 vertical	1.5 MHz to 6 GHz
ICR HV 150-6			2.5 MHz to 6 GHz
ICR HH 150-27	150 µm	 horizontal	1.5 MHz to 6 GHz
ICR HH 150-6			2.5 MHz to 6 GHz
ICR HV 250-75	250 µm	 vertical	500 kHz to 2 GHz
ICR HV 250-6			2.5 MHz to 6 GHz
ICR HH 250-75	250 µm	 horizontal	500 kHz to 2 GHz
ICR HH 250-6			2.5 MHz to 6 GHz
ICR HV 500-75	500 µm	 vertical	200 kHz to 1 GHz
ICR HV 500-6			2 MHz to 6 GHz
ICR HH 500-75	500 µm	 horizontal	200 kHz to 1 GHz
ICR HH 500-6			2 MHz to 6 GHz
ICR E 150	150 µm x 35 µm	 horizontal	7 MHz to 3 GHz

# 1.4 ICR probes

# Probe characteristics ICR HV 100



## Probes



### H field probes

ICR HH 150-27

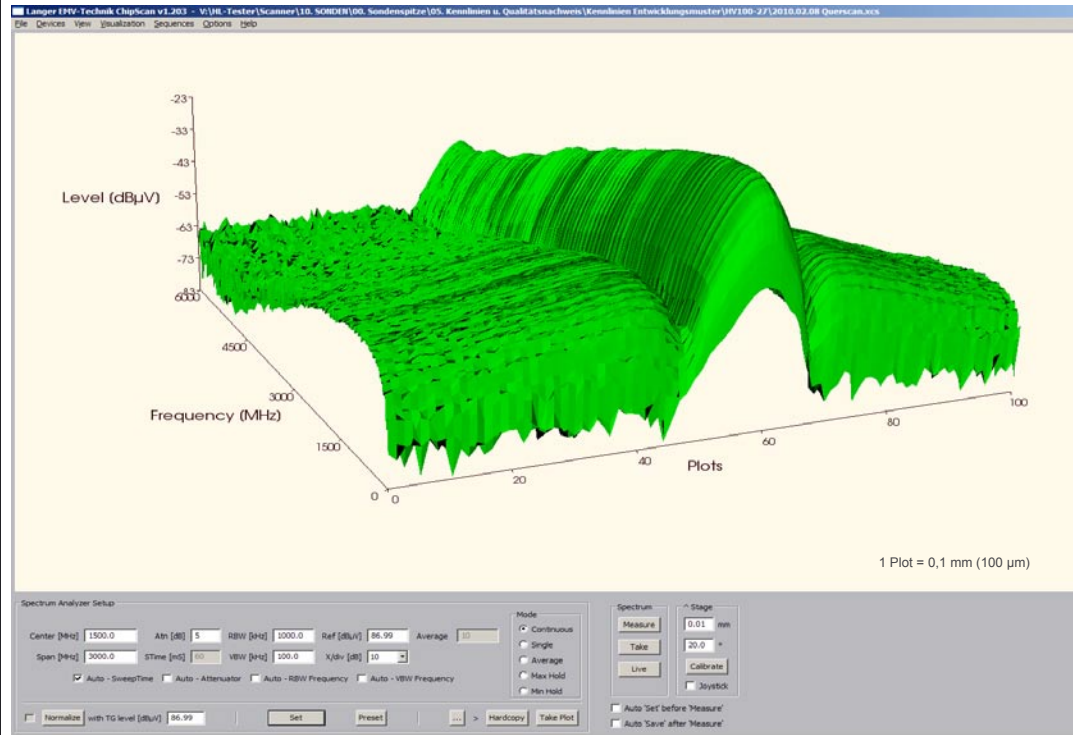
1.5 MHz - 6 GHz

ICR HV 100-6

2.5 MHz - 6 GHz

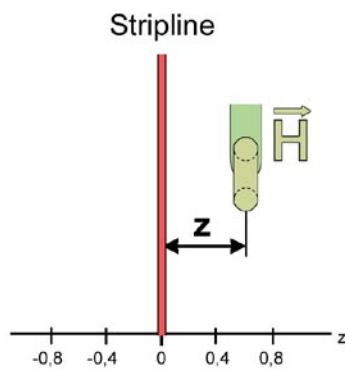
- Resolution 60 µm
- Vertical measuring coil
- Inside diameter 100 µm
- Screened measuring coil

## Characteristic

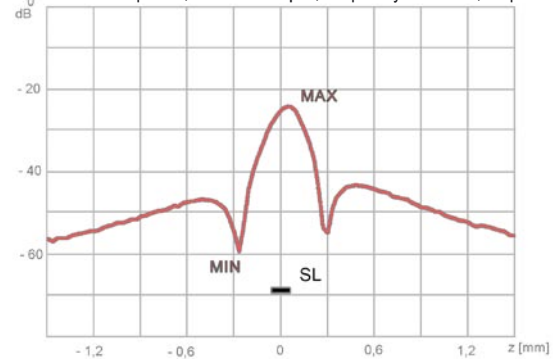


### Transverse profile

Position z of the HV probe variable relative to the strip line SL

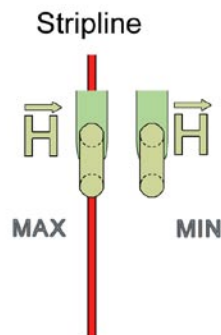


ICR HV 100 on 20 µm strip line  
Transverse profile, distance 10 µm, frequency 500 MHz, step width 20 µm

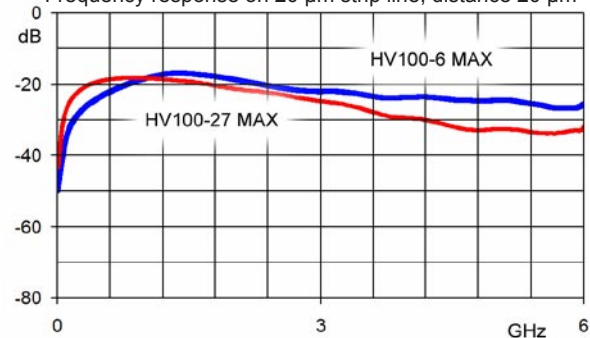


### Frequency response

of the HV probe measured at minimum and maximum



ICR HV 100-27 and HV 100-6  
Frequency response on 20 µm strip line, distance 20 µm



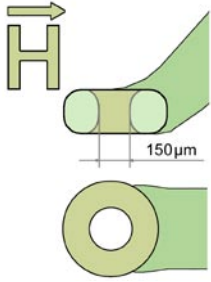


# 1.4 ICR probes

# Probe characteristics ICR HH 100



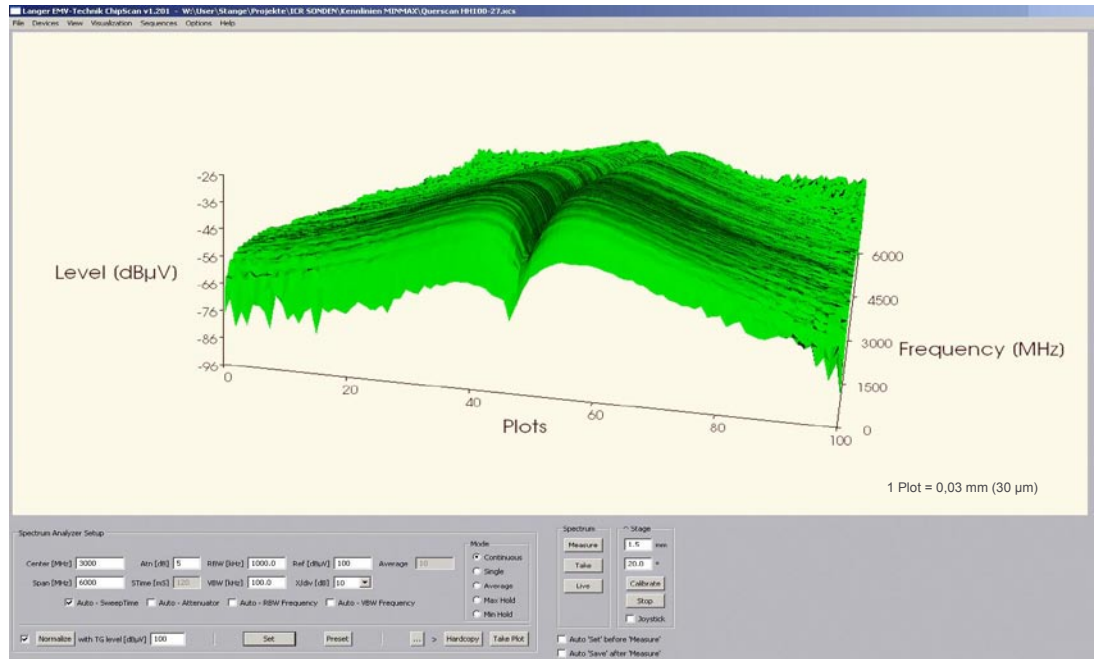
## Probes



**H field probes**  
ICR HH 100-27  
1.5 MHz - 6 GHz  
ICR HH 100-6  
2.5 MHz - 6 GHz

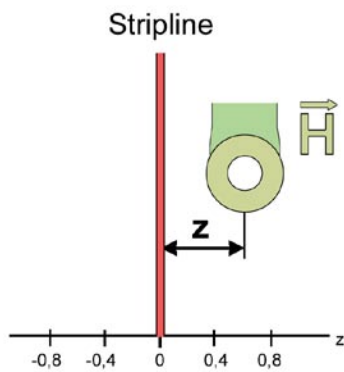
- Resolution 70 µm
- Horizontal measuring coil
- Inside diameter 100 µm
- Screened measuring coil

## Characteristic

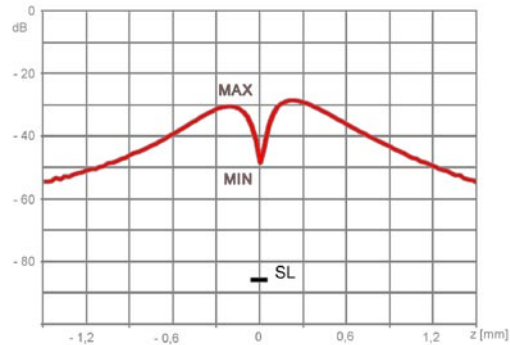


## Transverse profile

Position z of the HH probe variable relative to the strip line SL

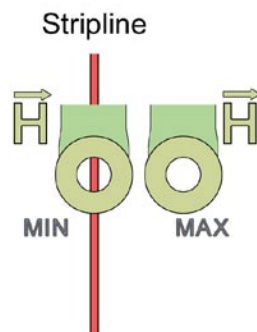


ICR HH 100 on 20 µm strip line  
Transverse profile, distance 10 µm, frequency 500 MHz, step width 20 µm

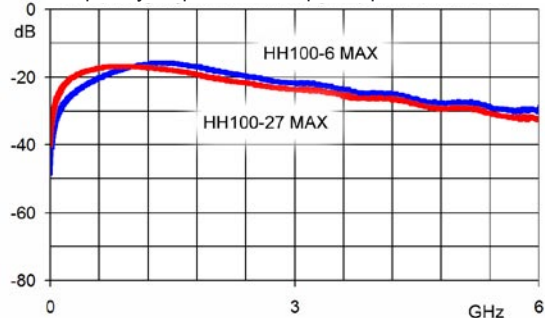


## Frequency response

of the HH probe measured at minimum and maximum



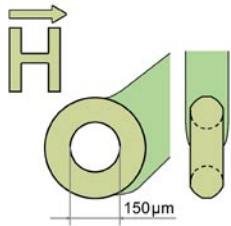
ICR HH 100-27 and HH 100-6  
Frequency response on 20 µm strip line, distance 20 µm





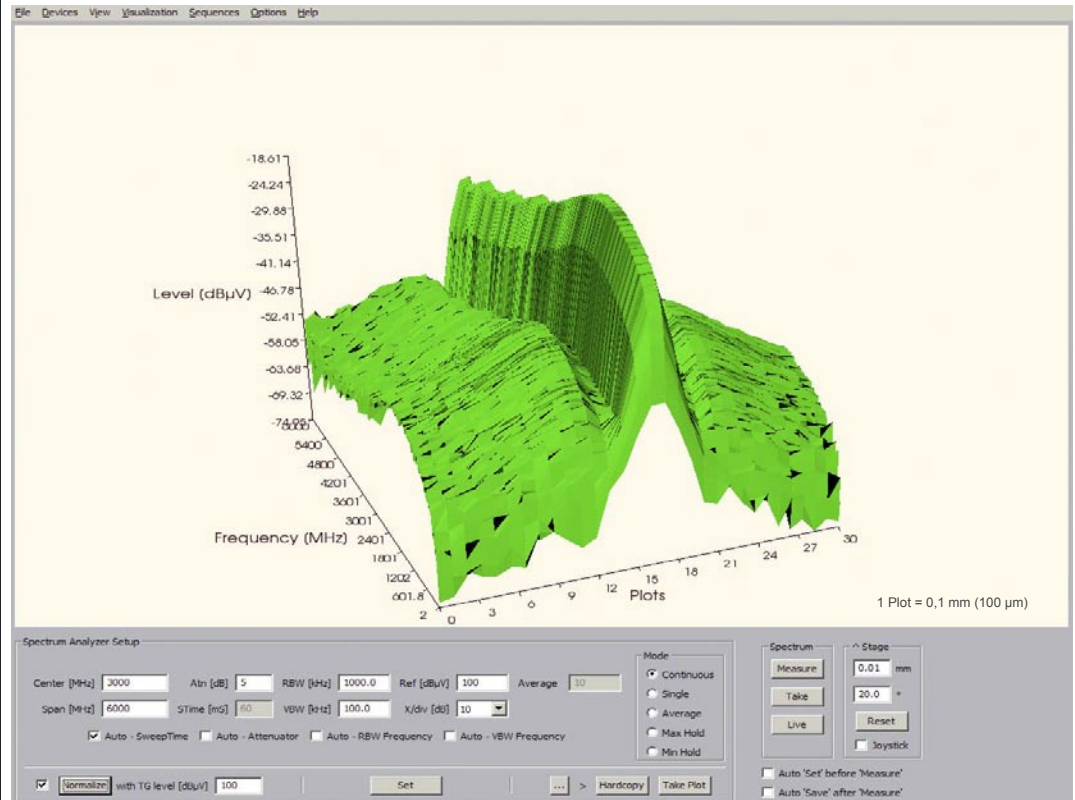
Probes

Characteristic

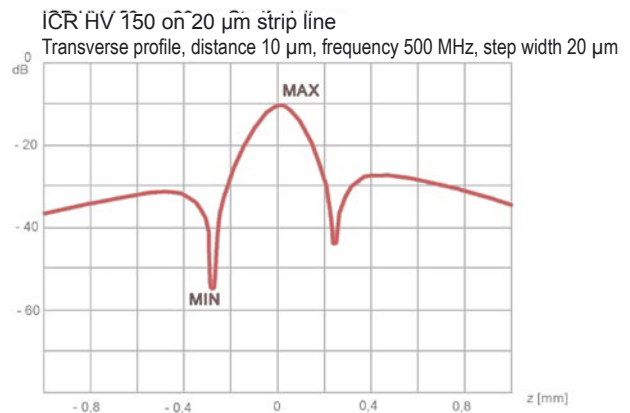
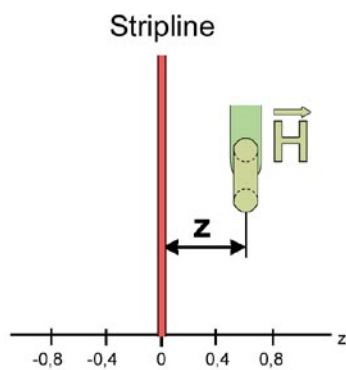


**H field probes**  
ICR HV 150-27  
1.5 MHz - 6 GHz  
ICR HV 150-6  
2.5 MHz - 6 GHz

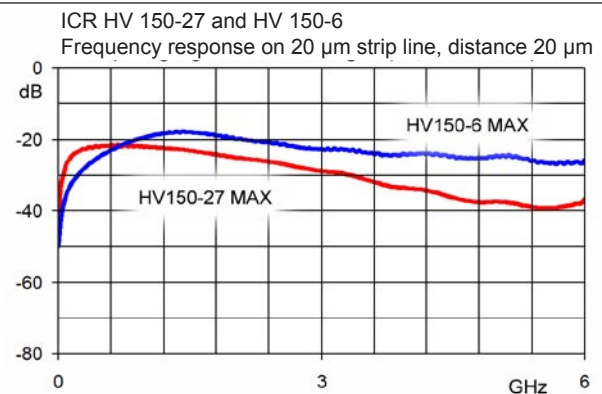
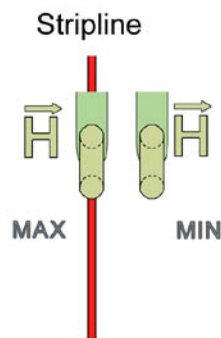
- Resolution 80 µm
- Vertical measuring coil
- Inside diameter 150 µm
- Screened measuring coil



**Transverse profile**  
Position z of the HV probe variable relative to the strip line SL



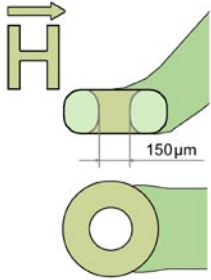
**Frequency response**  
of the HV probe measured at minimum and maximum





Probes

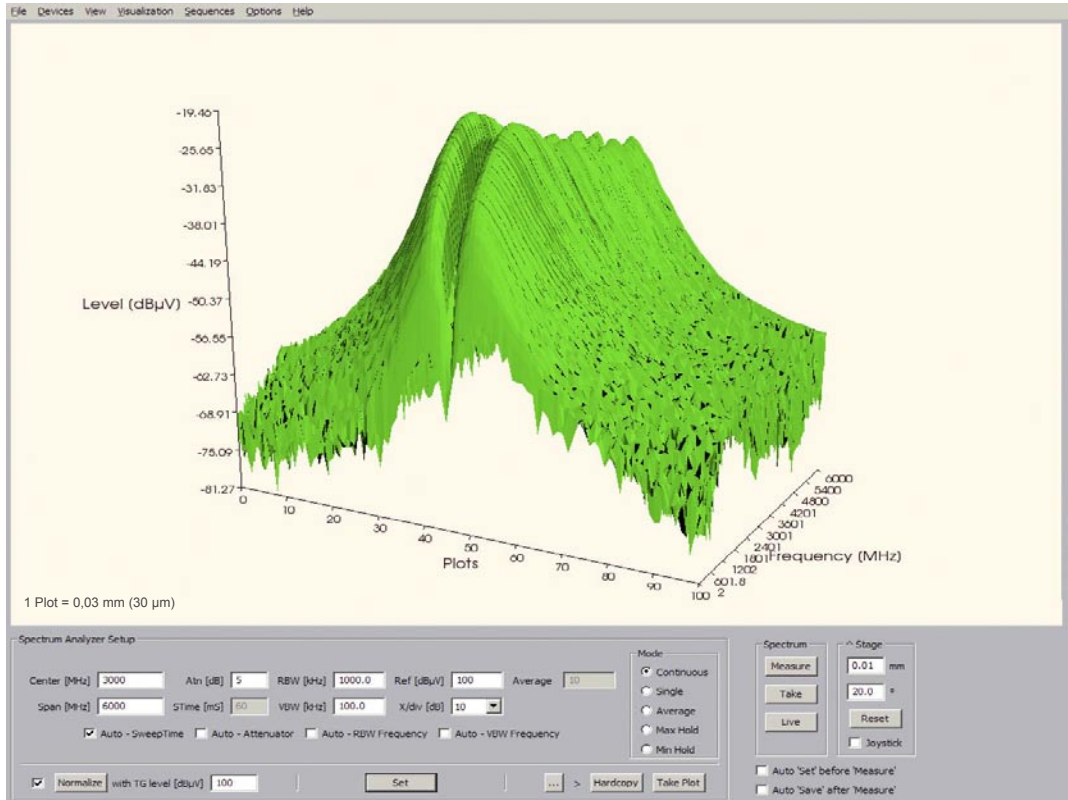
Characteristic



**H field probes**  
ICR HH 150-27  
1.5 MHz - 6 GHz

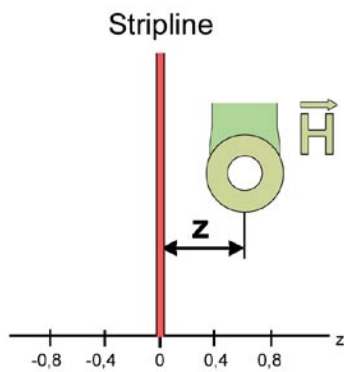
ICR HH 150-6  
2.5 MHz - 6 GHz

- Resolution 100 µm
- Horizontal measuring coil
- Inside diameter 150 µm
- Screened measuring coil

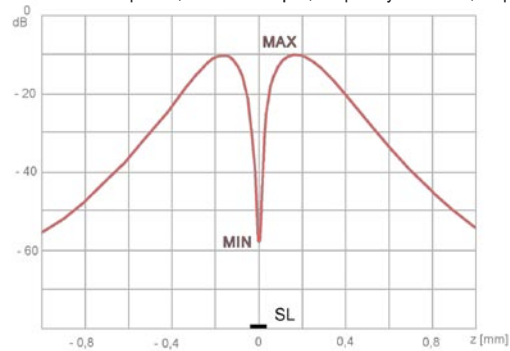


**Transverse profile**

Position z of the HH probe variable relative to the strip line SL

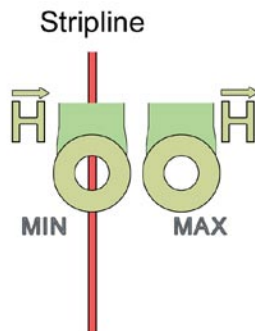


ICR HH 150 on 20 µm strip line  
Transverse profile, distance 10 µm, frequency 500 MHz, step width 20 µm

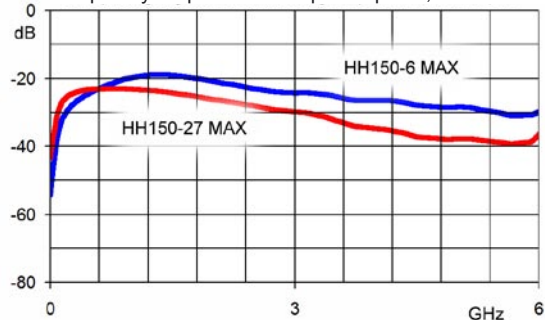


**Frequency response**

of the HH probe measured at minimum and maximum



ICR HH 150-27 and HH 150-6  
Frequency response on 20 µm strip line, distance 20 µm

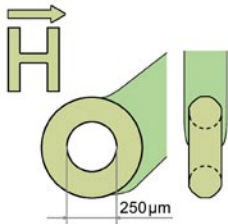


# 1.4 ICR probes

# Probe characteristics ICR HV 250



## Probes



### H-field probes

ICR HV 250-75

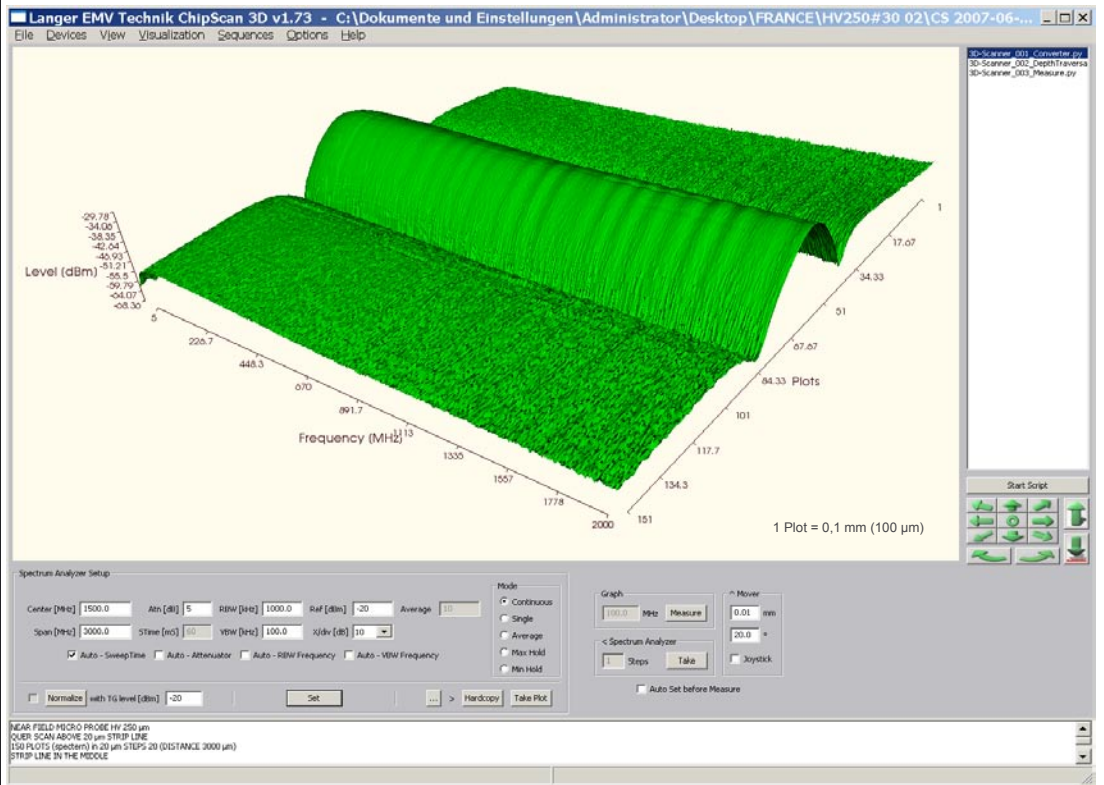
500 kHz - 2 GHz

ICR HV 250-6

2.5 MHz - 6 GHz

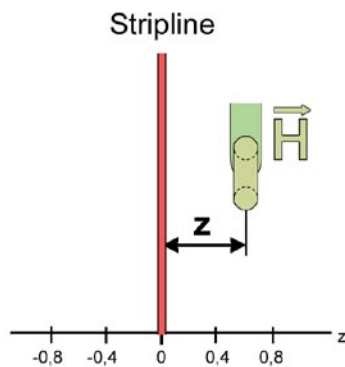
- Resolution 110 μm
- Vertical measuring coil
- Inside diameter 250 μm
- Screened measuring coil

## Characteristic

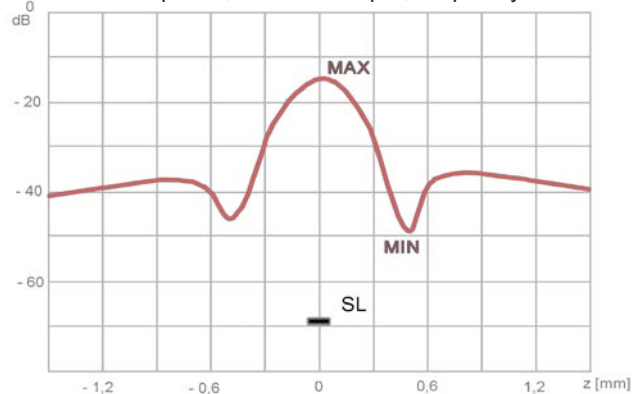


### Transverse profile

Position  $z$  of the HV probe variable relative to the strip line SL

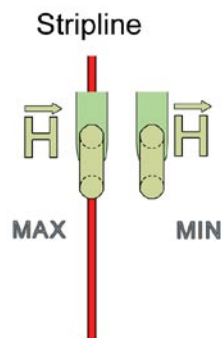


ICR HV 250 on 20 μm strip line  
Transverse profile, distance 20 μm, frequency 500 MHz

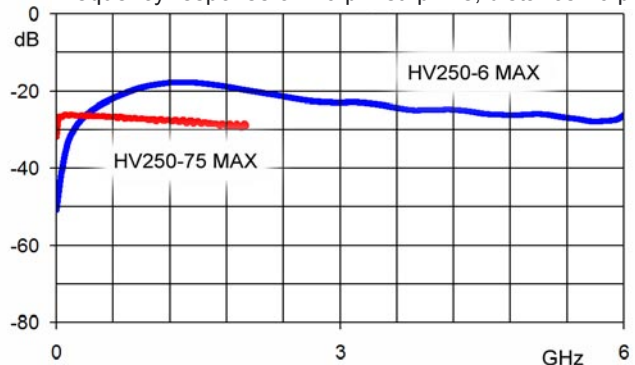


### Frequency response

of the HV probe measured at minimum and maximum



ICR HV 250-75 and HV 250-6  
Frequency response on 20 μm strip line, distance 20 μm

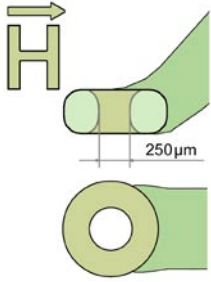


# 1.4 ICR probes

# Probe characteristics ICR HH 250



## Probes



### H-field probes

ICR HH 250-75

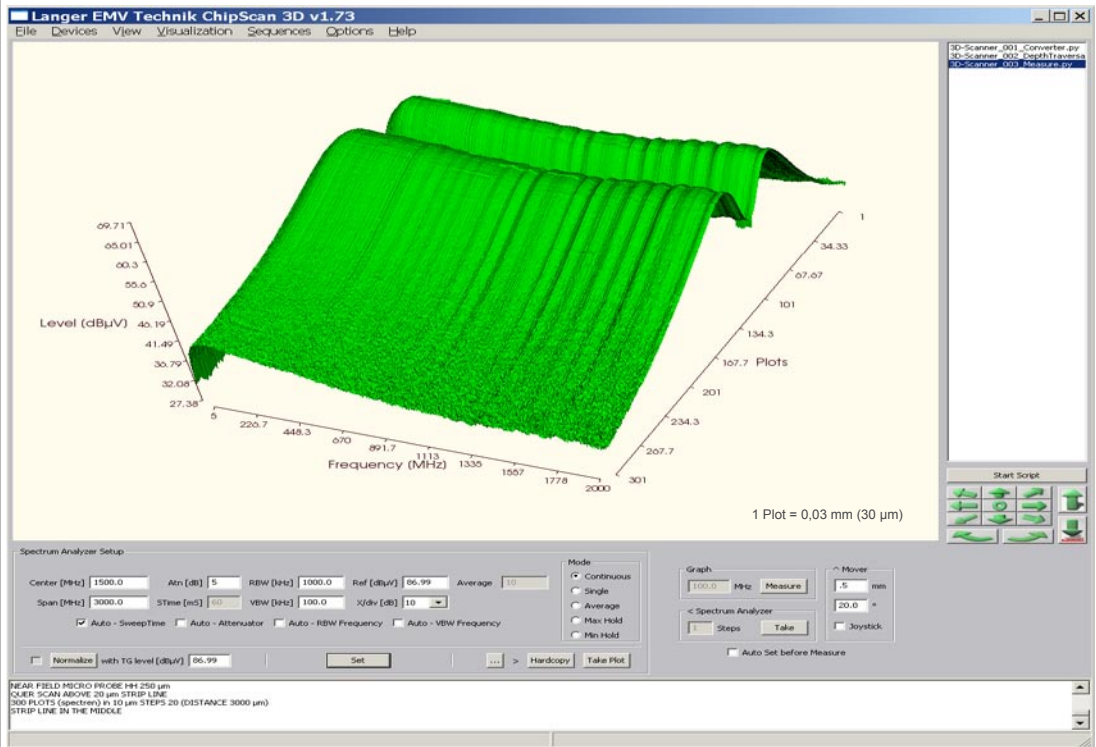
500 kHz - 2 GHz

ICR HH 250-6

2.5 MHz - 6 GHz

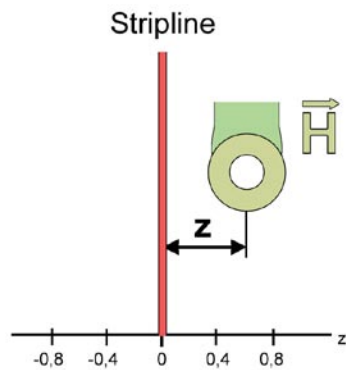
- Resolution 150 µm
- Horizontal measuring coil
- Inside diameter 250 µm
- Screened measuring coil

## Characteristic



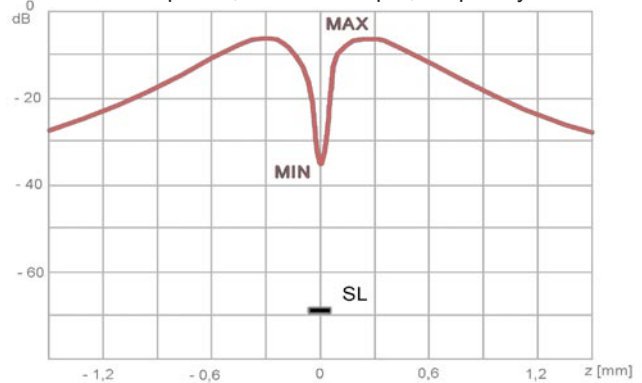
### Transverse profile

Position  $z$  of the HH probe variable relative to the strip line SL



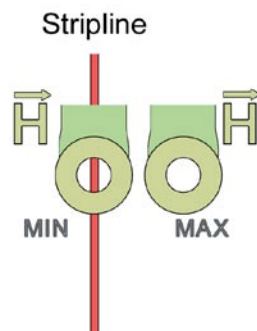
### ICR HH 250 on 20 µm strip line

Transverse profile, distance 20 µm, frequency 500 MHz



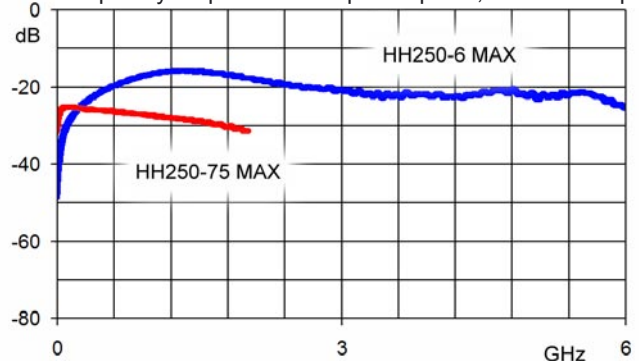
### Frequency response

of the HH probe measured at minimum and maximum



### ICR HH 250-75 and HH 250-6

Frequency response on 20 µm strip line, distance 20 µm

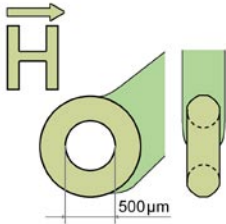


# 1.4 ICR probes

# Probe characteristics ICR HV 500



## Probes



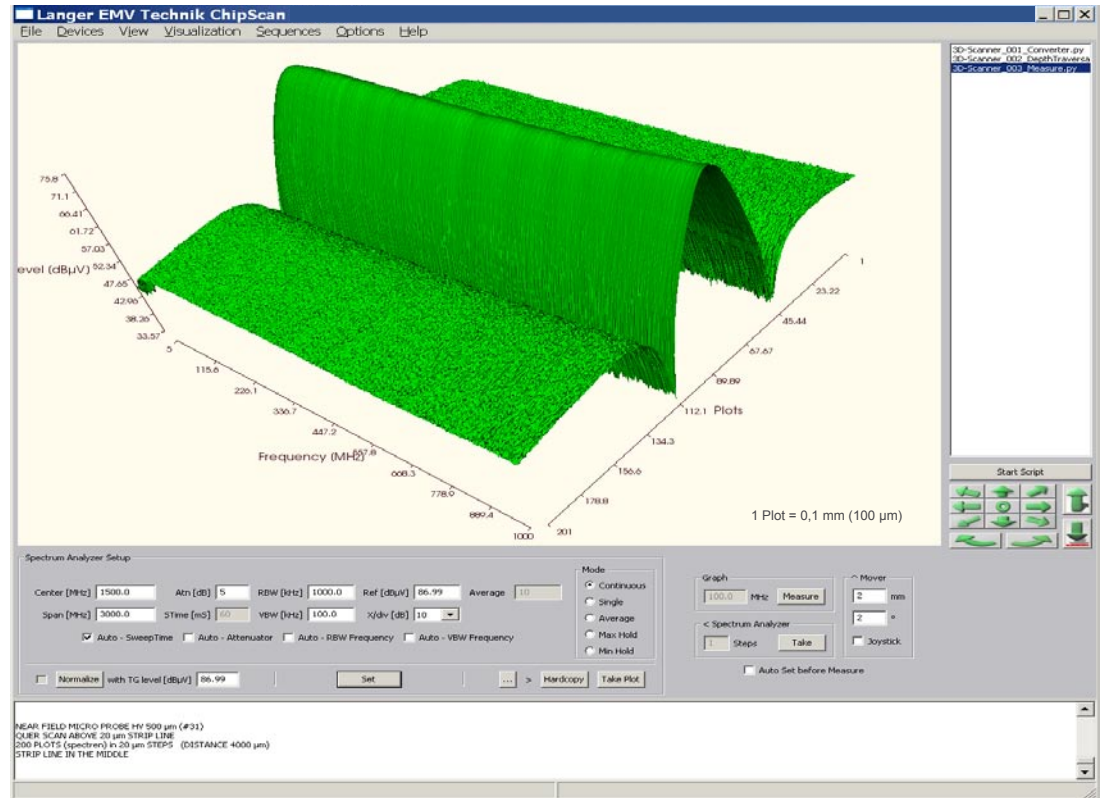
### H-field probes

ICR HV 500-75  
200 kHz - 1 GHz

ICR HV 500-6  
2 MHz - 6 GHz

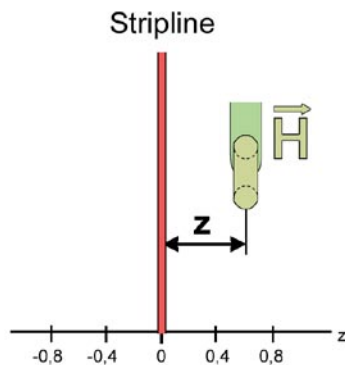
- Resolution 300 μm
- Vertical measuring coil
- Inside diameter 500 μm
- Screened measuring coil

## Characteristic

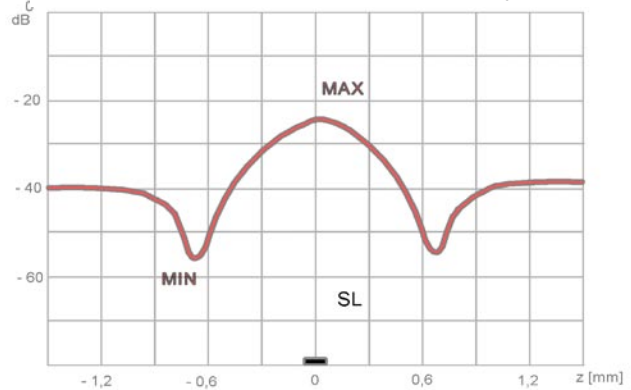


### Transverse profile

Position  $z$  of the HV probe variable relative to the strip line SL

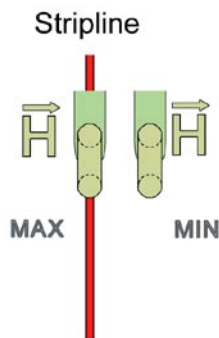


ICR HV 500 on 20 μm strip line  
Transverse profile, distance 20 μm, frequency 500 MHz

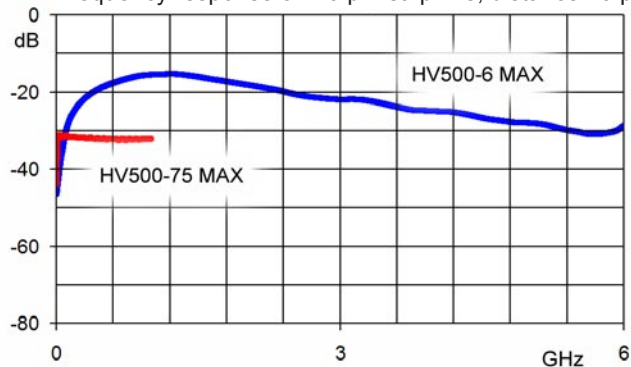


### Frequency response

of the HV probe measured at minimum and maximum



ICR HV 500-75 and HV 500-6  
Frequency response on 20 μm strip line, distance 20 μm



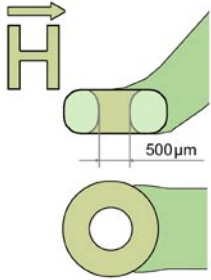
# 1.4 ICR probes

# Probe characteristics ICR HH 500



## Probes

## Characteristic

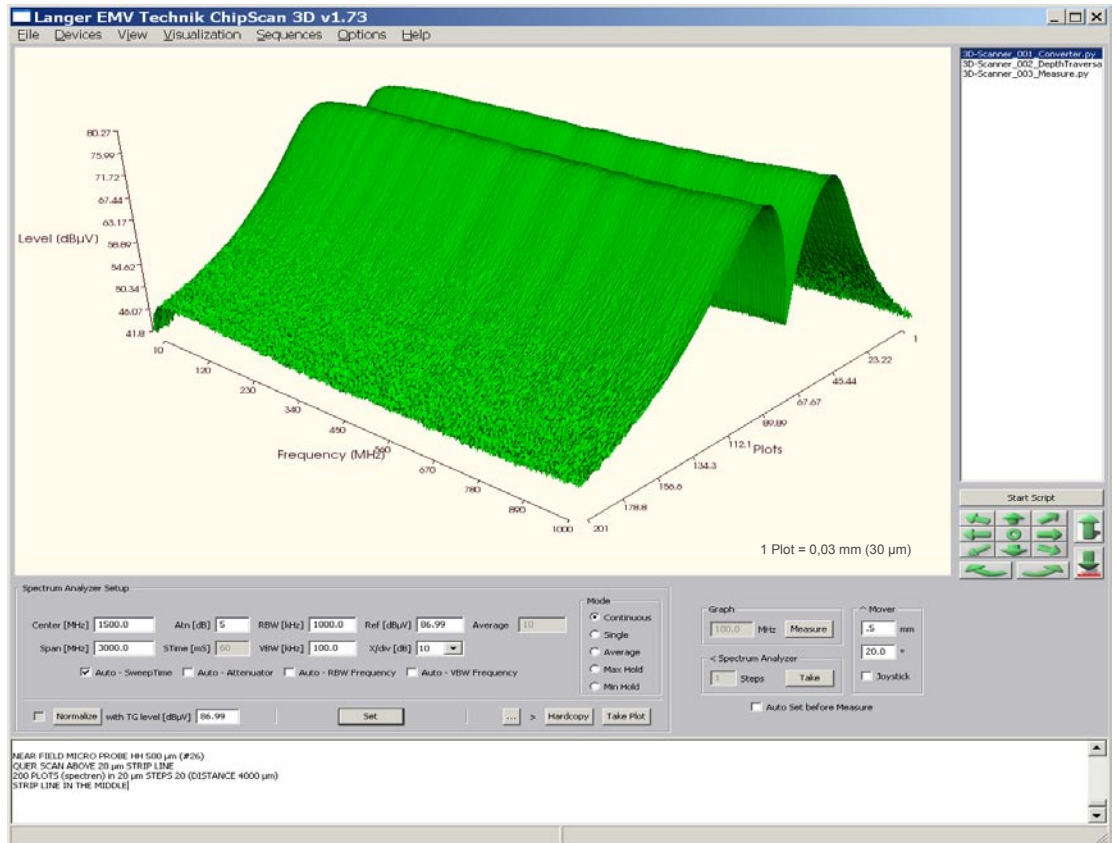


### H-field probes

ICR HH 500-75  
200 kHz - 1 GHz

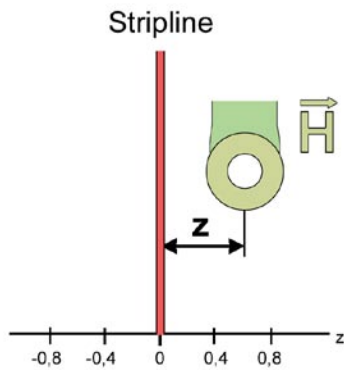
ICR HH 500-6  
2 MHz - 6 GHz

- Resolution 300 µm
- Horizontal measuring coil
- Inside diameter 500 µm
- Screened measuring coil

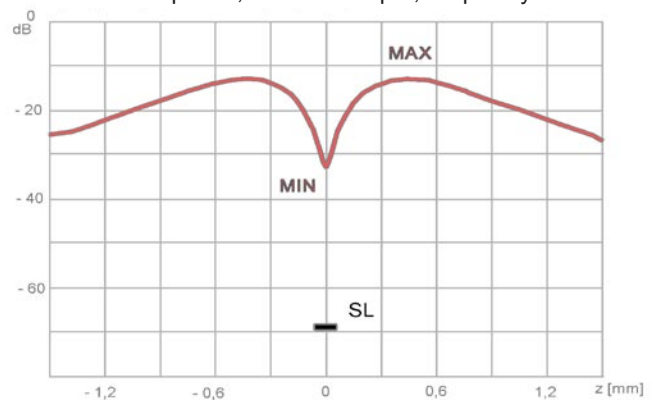


### Transverse profile

Position  $z$  of the HH probe variable relative to the strip line SL

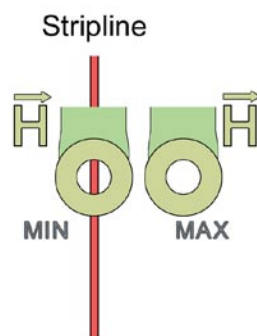


ICR HH 500 on 20 µm strip line  
Transverse profile, distance 20 µm, frequency 500 MHz

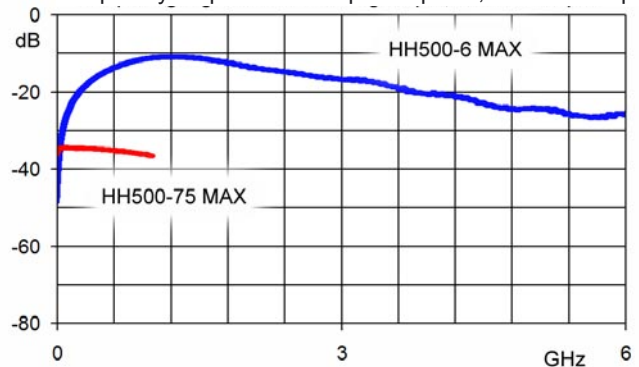


### Frequency response

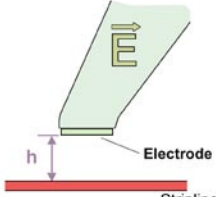
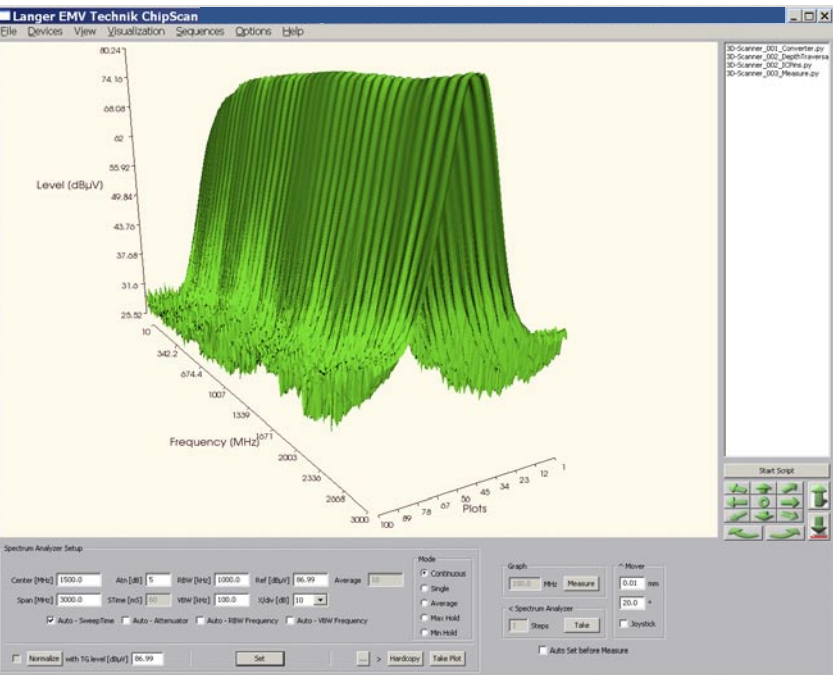
of the HH probe measured at minimum and maximum

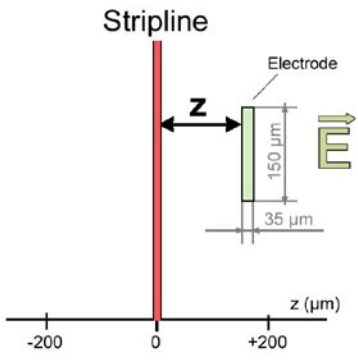
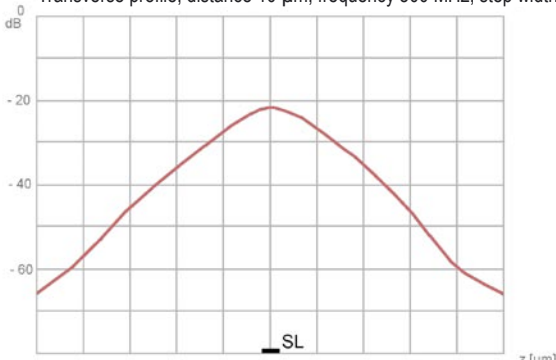


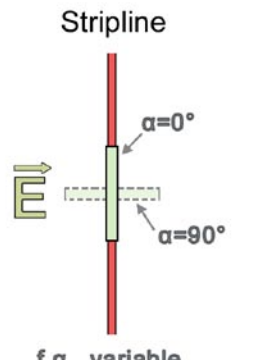
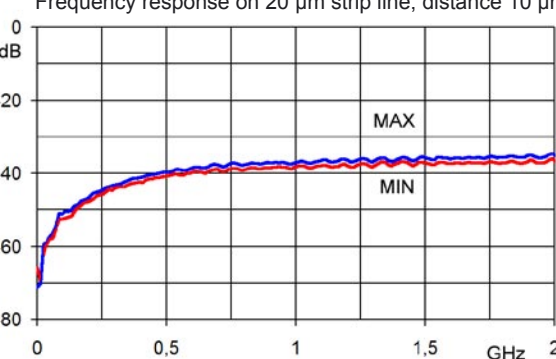
ICR HH 500-75 and HH 500-6  
Frequency response on 20 µm strip line, distance 20 µm





Probe	Characteristic
 <p><b>E-field probe</b> ICR E 150 7 MHz - 3 GHz</p> <ul style="list-style-type: none"> <li>- Resolution 65 <math>\mu\text{m}</math></li> <li>- Horizontal Electrode</li> <li>- Diameter Electrode 150 <math>\mu\text{m}</math> x 35 <math>\mu\text{m}</math></li> </ul>	

<p><b>Transverse profile</b></p> <p>Position <math>z</math> of the E probe variable relative to the strip line SL</p>		<p>ICR E 150 on 20 <math>\mu\text{m}</math> strip line Transverse profile, distance 10 <math>\mu\text{m}</math>, frequency 500 MHz, step width 5 <math>\mu\text{m}</math></p> 
---	--	--

<p><b>Angel <math>\alpha</math></b></p> <p>of the E probe variable relative to the strip line SL</p>	 <p><math>f, \alpha \dots</math> variable</p>	<p>ICR E 150 Frequency response on 20 <math>\mu\text{m}</math> strip line, distance 10 <math>\mu\text{m}</math></p> 
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The characteristics show the dependence of the probe position  $s$  ( $x, y, z$ ) relative to the space, probe angle  $\alpha$  and signal frequency  $f$  of the ICR E 150 E-field microprobe.



**2.  
IC scanner**

**Scanner ICS 103**



**Application:**

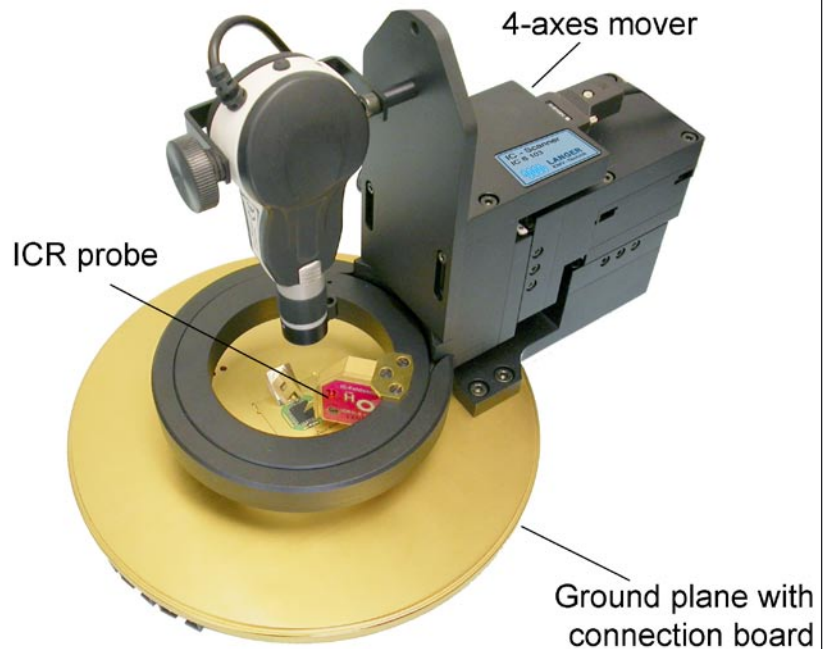
- Scan the DUT surface
- Move the E and H field probes with high solution of micrometers

**System component parts:**

- 4-axes mover (x, y, z,  $\alpha$ )
- Test board with  
Ground plane GND 22 and  
Connection board
- optional universal holder UH-DUT
- Software ChipScan

**Properties:**

The IC scanner can be adapted with different ICR probes to measure E- and H-near fields. The probes can be moved above the chip surface in all three axes and around the z-axis. The scanner allows the user to check the position of the probe tip visually through a microscope. The scanner is controlled via PC with the Software ChipScan.



Axes	x	y	z	$\alpha$ -rotation
Max. measuring range	25 mm	25 mm	25 mm	+/- 180°
Accuracy	10 $\mu$ m	10 $\mu$ m	100 $\mu$ m	1°
Repeatability	+/- 1 $\mu$ m	+/- 1 $\mu$ m	+/- 1 $\mu$ m	+/- 1°
Max. speed	5 mm/s	5 mm/s	5 mm/s	90°/s

Control	USB
Supply voltage	110 / 230 V
Dimension / total weight	(320 x 220 x 270) mm / 4.35 kg

Software:	<p><b>ChipScan</b></p> <ul style="list-style-type: none"> <li>- zero position, manual or script-based probe movement</li> <li>- visualisation of the measuring results in 2 D or 3 D</li> <li>- output as excel data</li> </ul>
optional Accessories:	<ul style="list-style-type: none"> <li>- Near-field microprobes for E and H fields</li> <li>- Video inspection microscope with holder</li> </ul>
Scope of delivery:	<ul style="list-style-type: none"> <li>- IC scanner ICS 103</li> <li>- Control and supply unit with link cable</li> <li>- Ground plane or UH-DUT</li> <li>- Software ChipScan</li> </ul>



The IC scanner from Langer EMV-Technik is operated and controlled with the modular „ChipScan“ program system. The device manager initialises the connected measuring and control devices when the program is started. After this the measurement data ranges can be set for the spectrum analyser and the positioning system via the program's user interface. The command control set (script) is now started to execute the measuring algorithms. All measurements are carried out automatically. The measured data can be displayed in the visualisation area in real time.

### User interface when the program is started:

**Graphical User Interface (GUI) of the modular „ChipScan“ program system**

### Areas of the user interface:

- 1 Menu bar
- 2 Spectrum analyser setup to set up the device via the user interface
- 3 Graphic joystick to manually guide the positioning device (x, y, z,  $\alpha$ ) (Options: setting the step width in  $\mu\text{m}$  and degrees)
- 4 Spectrum analyser measure for individual measurements
- 5 Script window and start button for scripts (Command scripts for mover control and measuring algorithms)
- 6 Output window for program messages and alphanumeric script output
- 7 Visualisation range for 2D and 3D graphics of the measuring results (Options in the View and Visualisation menu)

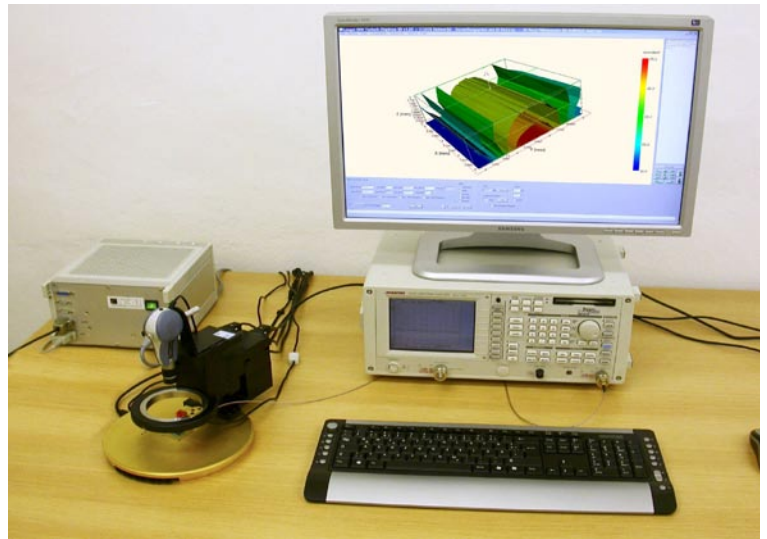
### 3. ChipScan

## Calibration of ICR-Probes above Stripline analogue to IEC 61967-6

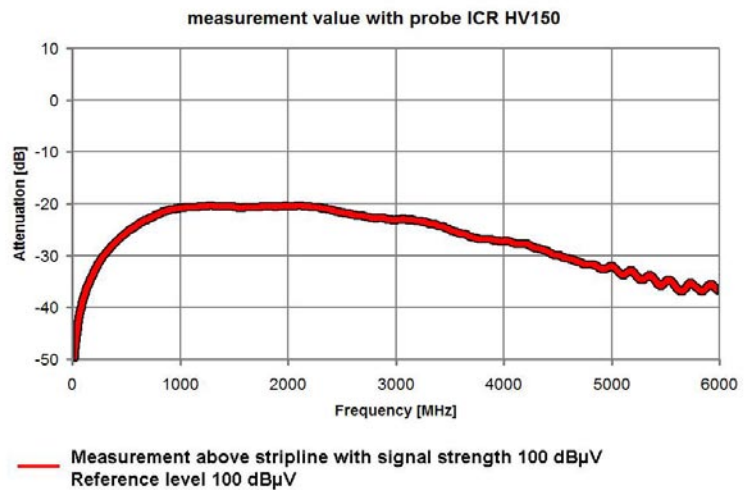


#### IC Scanner System ICS 103

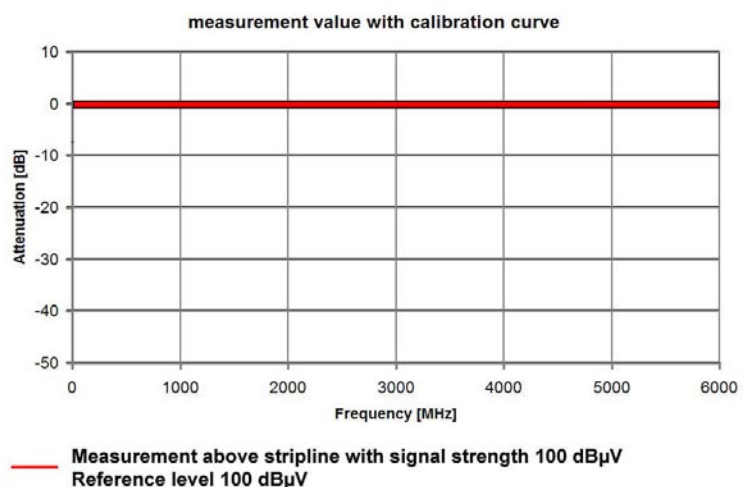
In this application the scanner is used as the probe test setup to calibrate the near field microprobes.  
The near-field microprobes are calibrated above a stripline.



The calibration data is measured above the stripline. The measurement takes place analogue to norm IEC 61967-6.



For practical measurement the calibration data for the individual probe is used. The measured curve is corrected by the calibration curve.  
The measurement above the stripline with calibration results in a horizontal line. So the measurements with different microprobes are comparable.





-This product complies with the requirements of the following European Community Directives: 89/336/EC (Electromagnetic Compatibility) and 73/23/EC (Low Voltage) as amended by 93/68/EC (CE-Marking).

### Safety precautions

- When using the near-field microprobes please observe the following basic safety instructions to protect the near-field microprobes against the risk of injury:
- Read and comply with the operating manual.
- Keep the operating manual in a safe place for subsequent use.
- Follow the safety instructions and warnings on the unit.
- Always perform a visual check of the near-field microprobes before use.
- Keep hands away from probe tips.
- Do not leave the IC scanner with near-field microprobes unsupervised.
- Read the explanation of the symbols on the probe case and in the operating manual.
- The near-field micro probe has been designed for IC measurements of magnetic or electric field. Any other use is not permitted.
- Do not switch the IC scanner with ICR probes on until it has been completely assembled.
- Damaged connection cables are extremely dangerous!

### Safety symbol

This CAUTION symbol indicates a potentially hazardous situation which could result in minor or moderate injury or damage to the near-field micro probes if ignored. This symbol indicates that the operator must refer to an explanation in the operating instructions.

### The warranty is only valid under the following conditions:

- the near-field microprobes have been treated properly,
- the operating instructions have been followed,
- for maintenance only original parts have to be used,
- external components like video microscope, spectrum analyzer, motor control unit separate warranty terms of the relevant manufacturer apply.

### The warranty is forfeited if:

- attempts have been made to repair the near-field microprobe,
- the near-field microprobe has been altered,
- the near-field micro probe has been used incorrectly.



- The near-field microprobes' (ICR probes') original packaging is a special case that is also used for delivery.

One probe case contains 1 to 3 ICR probes according to the options ordered.

Each ICR probe is provided with a protective cap.

- There is a Caution symbol on the probe's protective cap.

- The protective cap is labelled:

**„Never, under any circumstances, touch the probe tip!“** 

- Always insert the ICR probe into a probe holder or IC scanner with the probe's cap locked in place.

- Move the probe holder or IC scanner manually to its maximum height position on the z-axis before inserting the ICR probe.

- Only remove the protective cap just before you start to prepare an automatic measurement. This is particularly true when approaching the DUT starting position.

- Return the probe holder or IC scanner manually to its maximum height position on the z-axis at the end of each automatic measurement or if it is in the idle state.

Then fit and lock the ICR probe's protective cap.

- Only transport a probe mover or probe holder with the ICR probe removed.

Proceed according to the following sequence when removing the probe:

> Bring the probe mover into its maximum height position by hand.

> Fit and lock the protective cap before removing the ICR probe from the probe holder or an IC scanner.

> Place the removed ICR probe into the probe case.



IC TEST SYSTEM

Nöthnitzer Hang 31  
 Germany 01728 Bannewitz  
 Phone: +49 (351) 43 00 93 - 0  
 Fax: +49 (351) 43 00 93 - 22  
 email: mail@langer-emv.de

CERTIFICATE OF CALIBRATION

Cert. No. 090210QSHH150

Muster

This Probe has been individually calibrated using the following procedure for monitoring the RF function:

**Publication:**  
 Magnetic Near Field Probe

**Calibration Procedure:** LACPHH150  
**Uncertainty:** +/- 1.5 dB

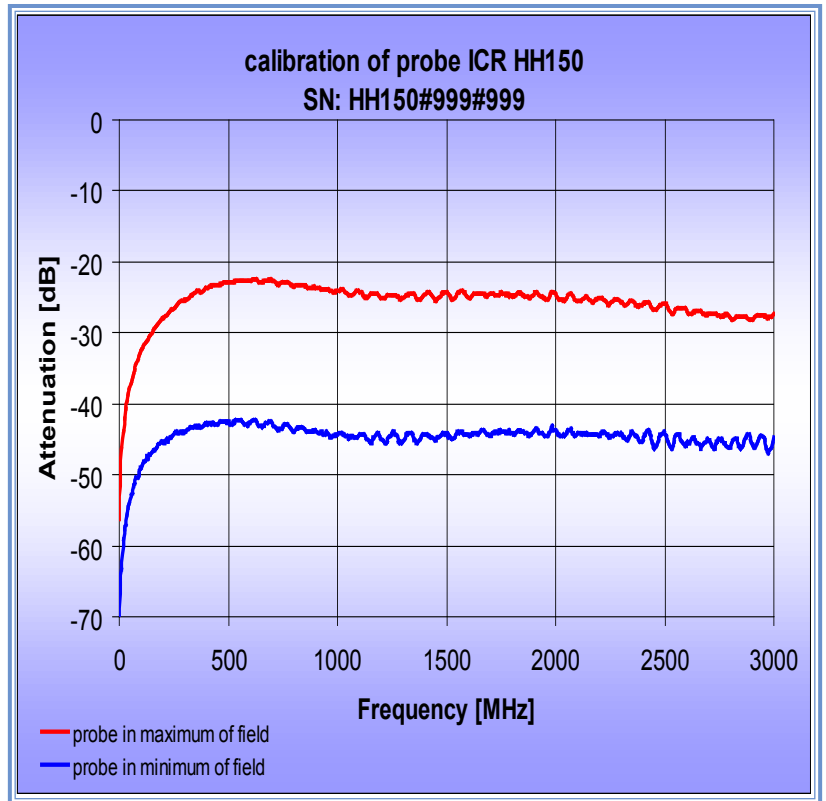
**Date of Cal.:** Jan 10, 2009  
**Date Due:** Jan 09, 2010

**Cal. Interval:** 12 months

**Model:** ICR HH150  
**Serial:** #999#999

**Manufacturer:**  
 Langer EMV-Technik

**Temperature:** 21°C  
**Humidity:** 50 %



**Test and Measurement Equipment**

Manufacturer	Model	Serial	Due Date
Rohde & Schwarz	FLS-6	100407	2010/03/30

TG = 100dBµV, Att = 5dB, RBW = 1MHz, VBW = 100kHz, SWT = 120ms, normalized

*C. Stange*  
 .....  
 Dipl.-Ing. C. Stange  
 Development

**LANGER**  
 EMV-Technik GmbH  
 Nöthnitzer Hang 31  
 DE-01728 Bannewitz

This calibration is in compliance with the International EMC Standard of ICs IEC 61967. Supporting Documentation relative to traceability is on file and available for examination upon request.

This certificate shall not be reproduced except in full without the written approval of Langer EMV-Technik.

