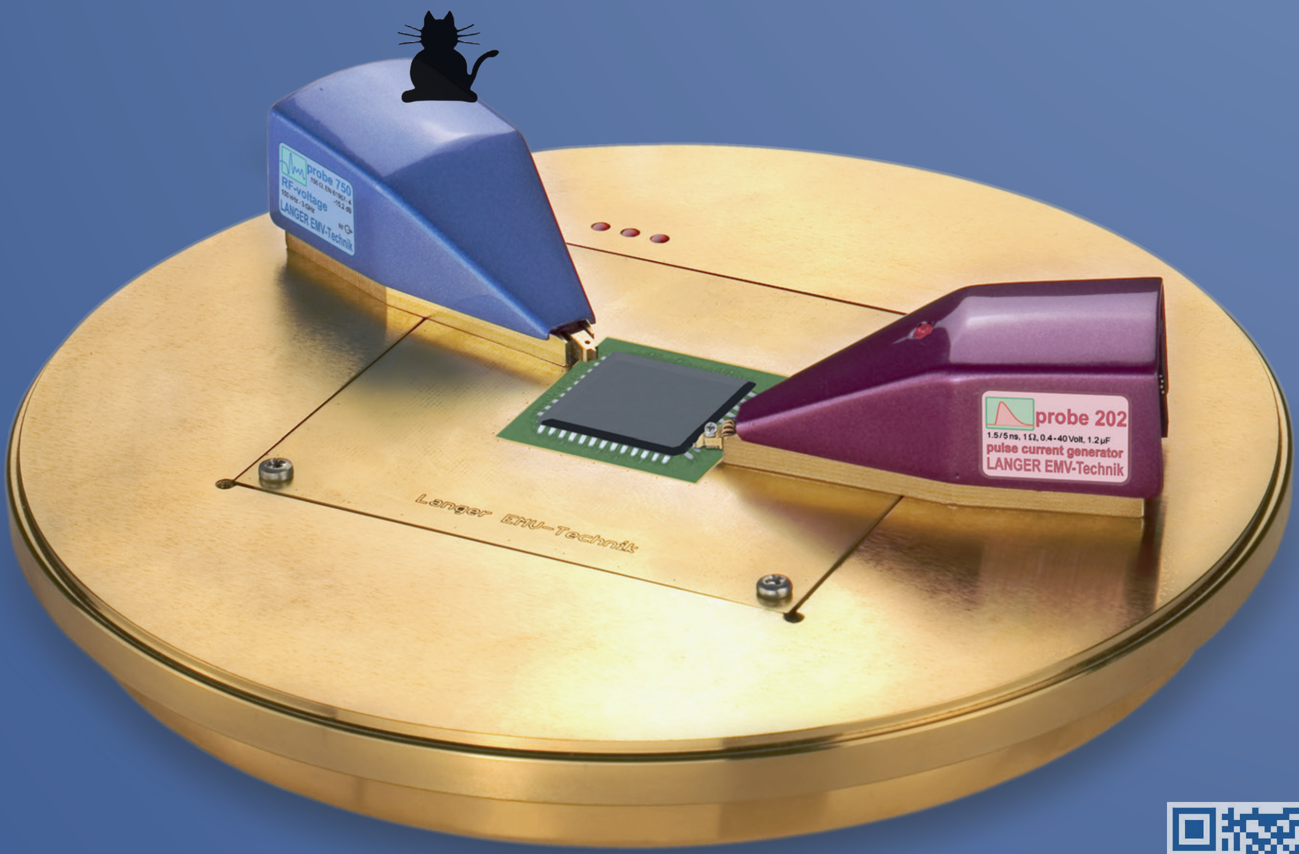
LANGER
EMV-Technik

IC EMC
Measurement Technology



IC Test System - Measurement Methods and Strategies

Features of the IC Test System:

- Numerous IC tests with IC in operation
- Small scale test set-up – with high frequency range up to 6 GHz
- Probe contains the coupling network - no need to integrate coupling network on the test board
- All pins can be easily accessed
- One system for all pre-compliance IC tests and measurements
- Pulse generator included, probes are completely shielded

→ Extremely precise and reproducible IC test results

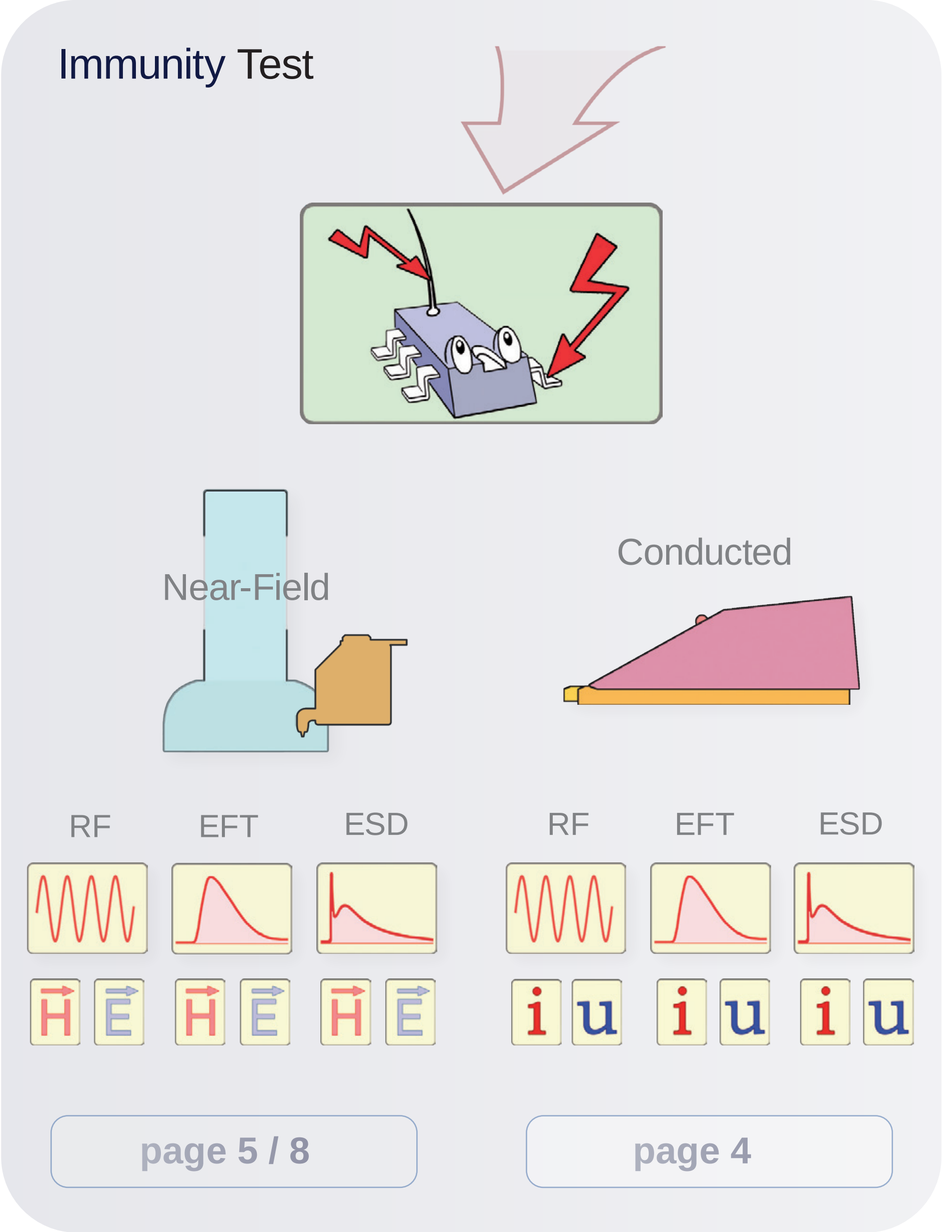
The IC Test System has been developed to measure the EMC behaviour of integrated circuits (ICs) under the selective influence of conducted or near-field coupled (E-or H-field) disturbances. In addition, it can also be used to measure the RF emissions from ICs.
The results of these measurements enable semiconductor manufacturers to optimize their ICs and allow users to integrate ICs to ideally suit their electronic design.

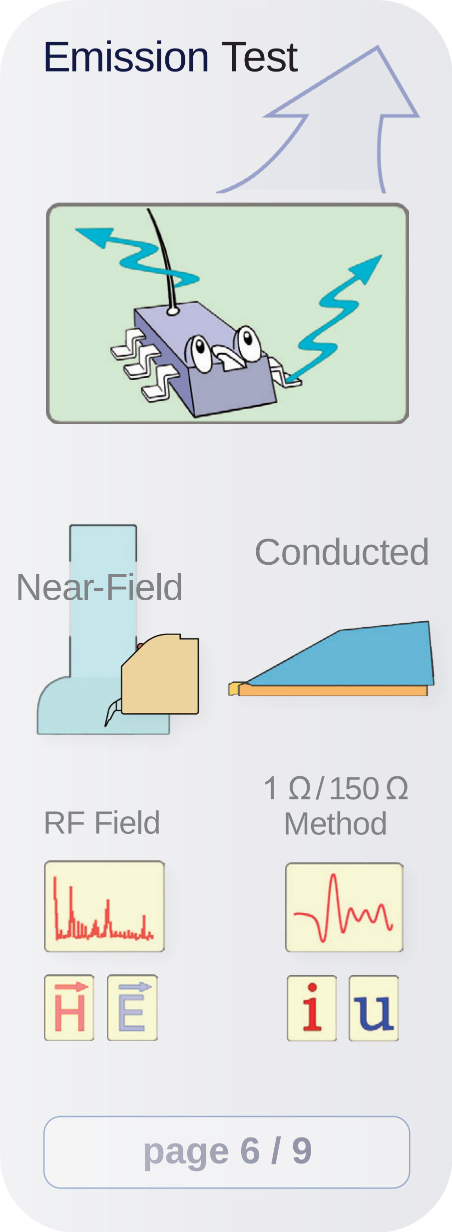
Advantages for IC manufacturer

- Check EMC characteristics of ICs
- Identify causes of disturbance
- Optimize ICs

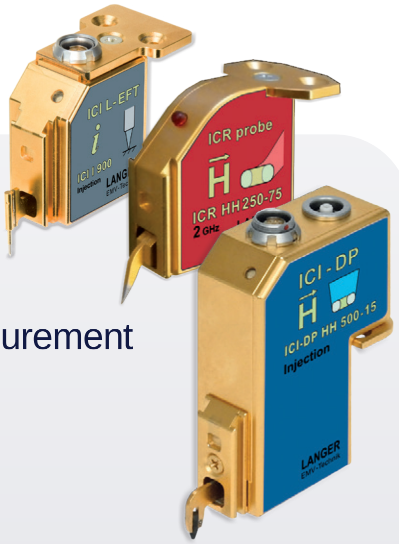
Advantages for IC users

- Controlled component selection and layout
- Identify sensitive pins
- Keep track of changes in the EMC characteristics
- Time and cost savings in development and assembly



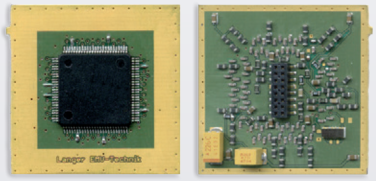


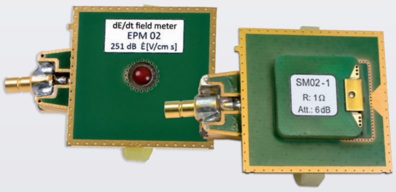
IC Test System - Probes and Components



Probes for Emission and Immunity Measurement

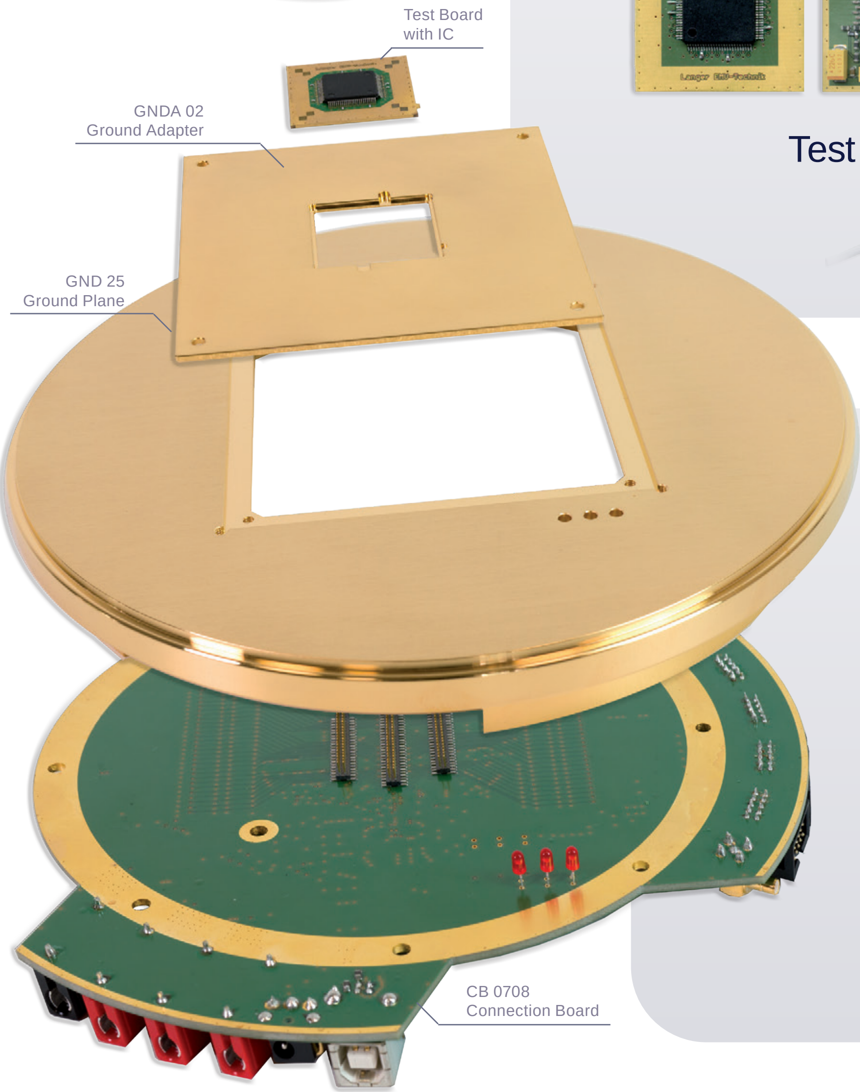
- Conducted emission 1 Ω / 150 Ω
- Conducted immunity EFT / ESD / DPI
- Near-field emission measurement
- Near-field immunity testing
- Side channel analysis
- Near-field scan / volume scan
- Pulse and double pulse injection





Test Boards and Measuring Equipment

- IC Test Boards
- Field Measurement Systems
- Shunts



ICE1 - IC Test Environment

- GND 25 Ground Plane
- CB 0708 Connection Board with CB-Control Software
- GNDA 1-4 Ground Adapter
- SGA 30 / 45 Probe Adapter
- TH 22 Probe Head Holder
- OA 4005 Oscilloscope Adapter
- DM-CAM Digital Microscope Camera

Conducted Immunity Test

L-EFT

P202 / P302 Probe set - Langer pulses

- EFT - immunity test against pulsed interference
- Pulse rise time 1.5 / 5 ns and 1.5 / 20 ns
- P202 pulse current generator
  - → mechanisms of coupling via H-field
  - → 40 A; high pulse current
  - → 1 Ω; low internal impedance
- P302 pulse voltage generator
  - → mechanisms of coupling via E-field
  - → 500 V; high pulse voltage
  - → 150 Ω; high internal impedance

EFT

P250 Probe set

- EFT pulse injection according to IEC 62215-3 / IEC 61000-4-4
- Exchangeable probe tips allow different coupling capacitors
- Max. input voltage 6 kV
- Operation with standard EFT / burst generator
- Different coupling capacitances (2.2 pF - 100 nF) available

ESD

P331 / P331-2 Probe sets

- ESD pulse injection according to IEC 61000-4-2
- P331: 0.2 ns pulse rise time
- P331-2: 0.7 ns pulse rise time
- Voltage range 100 V - 6 kV
- Measuring on high-speed interfaces such as USB, LVDS, Ethernet, etc.

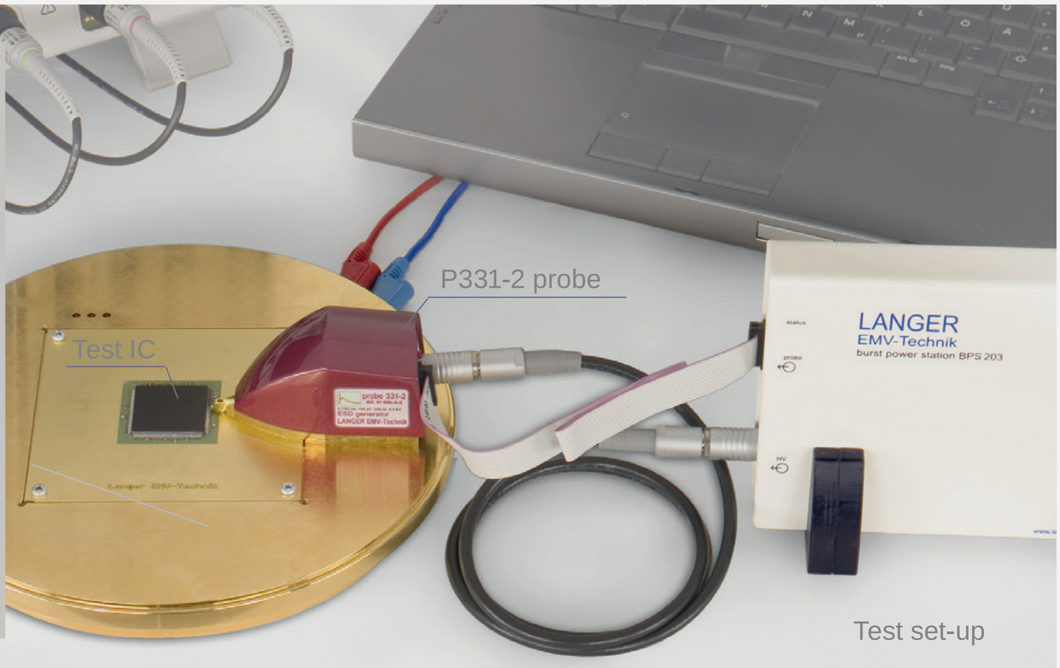
DPI

P501 / P503 / P512 Probe sets

- DPI - RF direct power injection according to IEC 62132-4
- Voltage and current measurement at the IC pin
- Frequency range up to 12 GHz
- Max. forward power 30 W
- Coupling capacitance selectable (e. g. 3 µF, 6.8 nF)

Conducted Immunity Test

- Immunity test against different disturbances (EFT, ESD, RF)
- Reliable pin detection
- Reproducible test of all pins
- Voltage and current monitoring possible
- Shielded probes without side-effects
- Allows precise fault analysis of error patterns



Test set-up

L-ESD

P1202 / P1301 Probe set - Langer pulses

- ESD immunity test against magnetic and electric fields
- 0.2 ns pulse rise time
- H-field strength up to 5 mT
- E-field strength up to 3000 kV/m

ESD

P1202-2 Probe set

- ESD immunity test according to IEC 61000-4-2 / HMM
- H-field pulses
- 0.7 - 1 ns pulse rise time
- H-field strength up to 5 mT

EFT

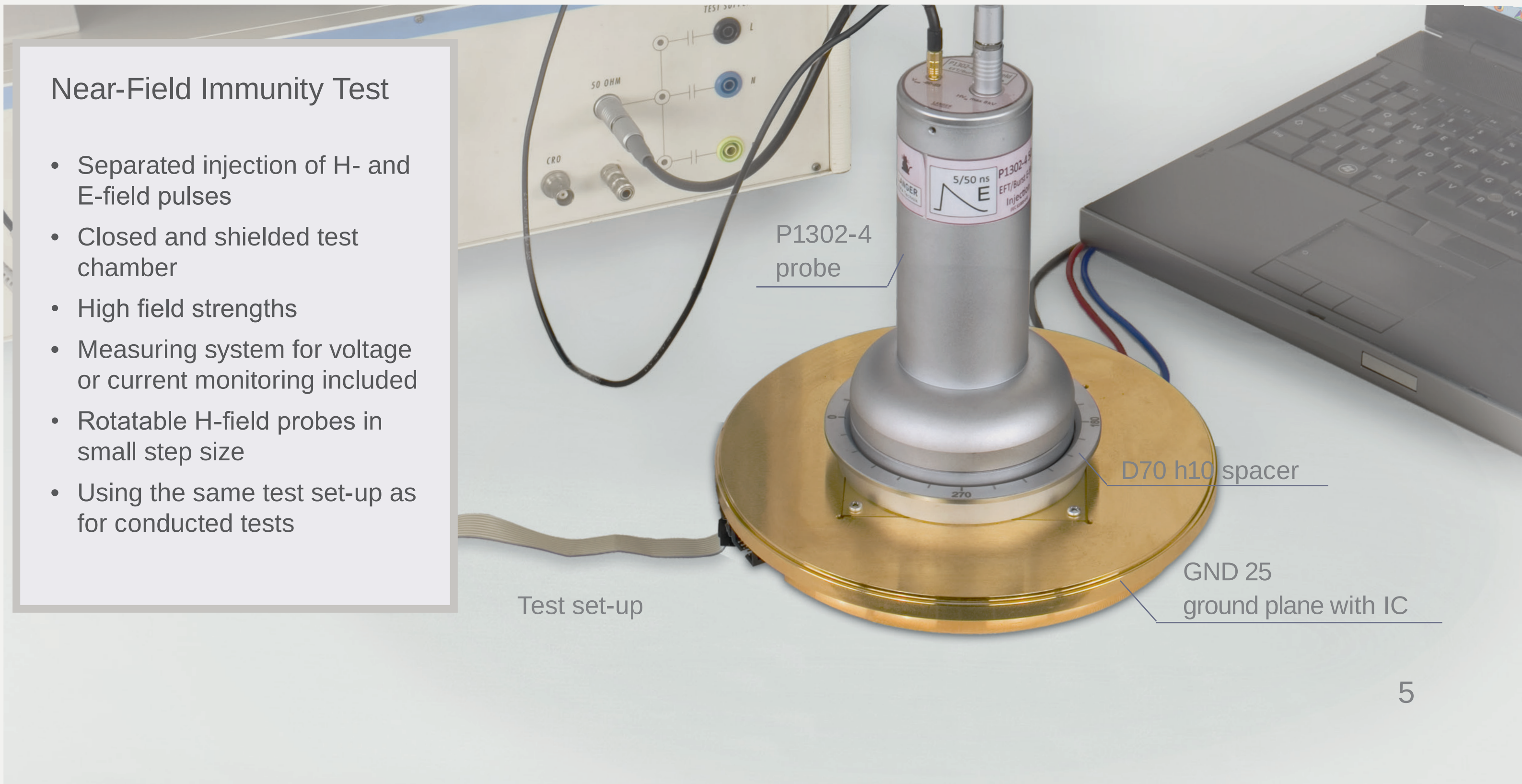
P1202-4 / P1302-4 Probe sets

- EFT/ Burst immunity test according to IEC 61000-4-4
- H- and E-field pulses
- Generator according to IEC 61000-4-4 required
- Voltage level up to 8 kV
- 50 Ω termination available

RF

P1400 / P1500 Probe sets

- Alternative test method to IEC 62132-2
- Immunity test against RF
- H- and E-field pulses
- Frequency range up to 3 GHz
- Up to 100 W forward power

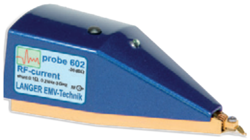


Test set-up

Near-Field Immunity Test

- Separated injection of H- and E-field pulses
- Closed and shielded test chamber
- High field strengths
- Measuring system for voltage or current monitoring included
- Rotatable H-field probes in small step size
- Using the same test set-up as for conducted tests

1 Ω / 150 Ω Method



P603 / P750 Probe sets

- Conducted emissions - 1 Ω / 150 Ω method
- RF voltage and current measurement according to IEC 61967-4
- Frequency range up to 3 GHz
- Optional with integrated preamplifier
- 0.1 Ω shunt resistor option available

1 Ω / 150 Ω Method

S603 / S750 Probe set

- Conducted emissions - 1 Ω / 150 Ω method
- RF voltage and current measurement according to IEC 61967-4
- Frequency range up to 3 GHz
- SMA connector

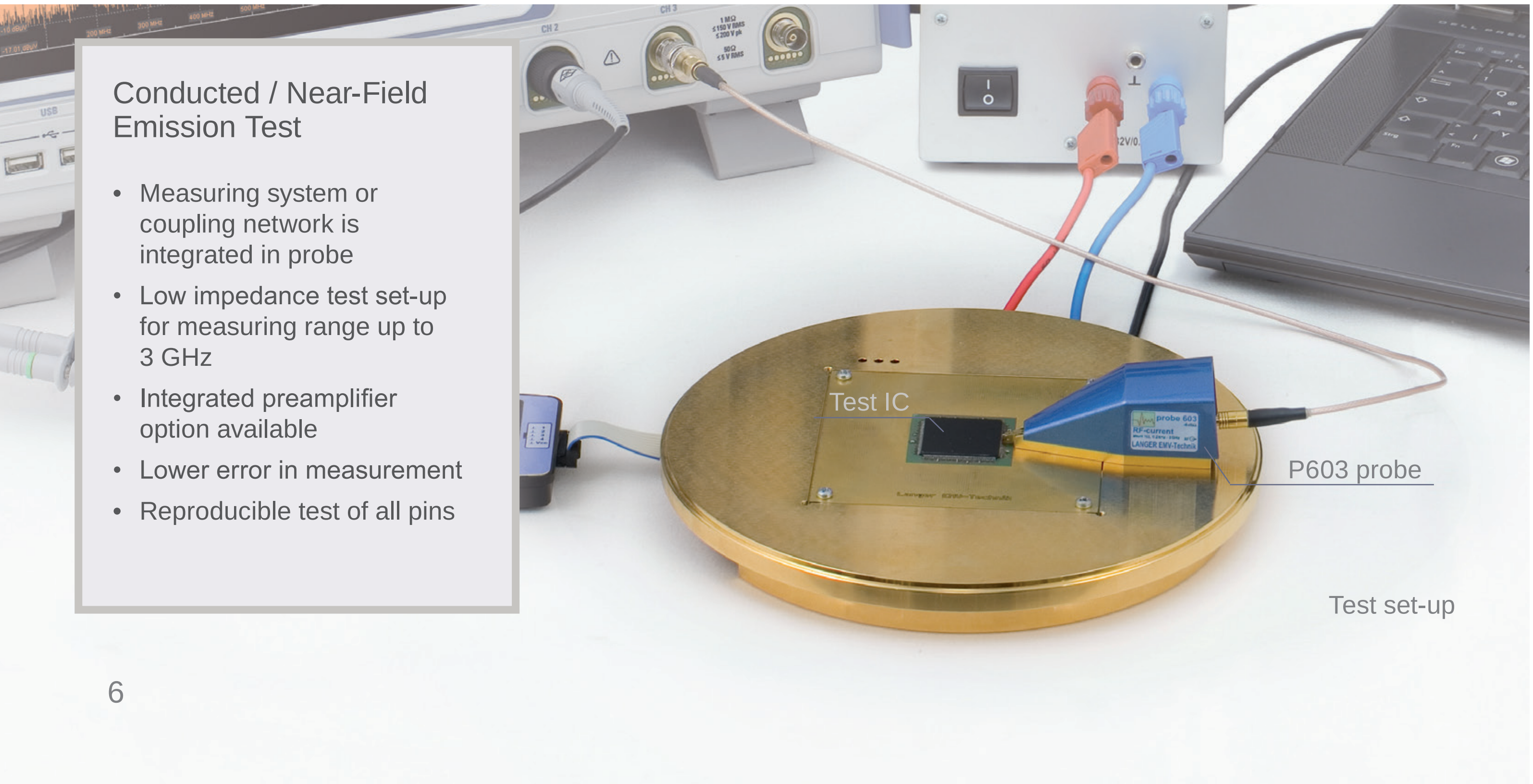
RF

P1600 / P1700 Probe sets

- Alternative test method to IEC 61967-2 / -3
- Near-field emissions
- Separated measurements for H- and E-fields
- Frequency range up to 3 GHz

Conducted / Near-Field Emission Test

- Measuring system or coupling network is integrated in probe
- Low impedance test set-up for measuring range up to 3 GHz
- Integrated preamplifier option available
- Lower error in measurement
- Reproducible test of all pins



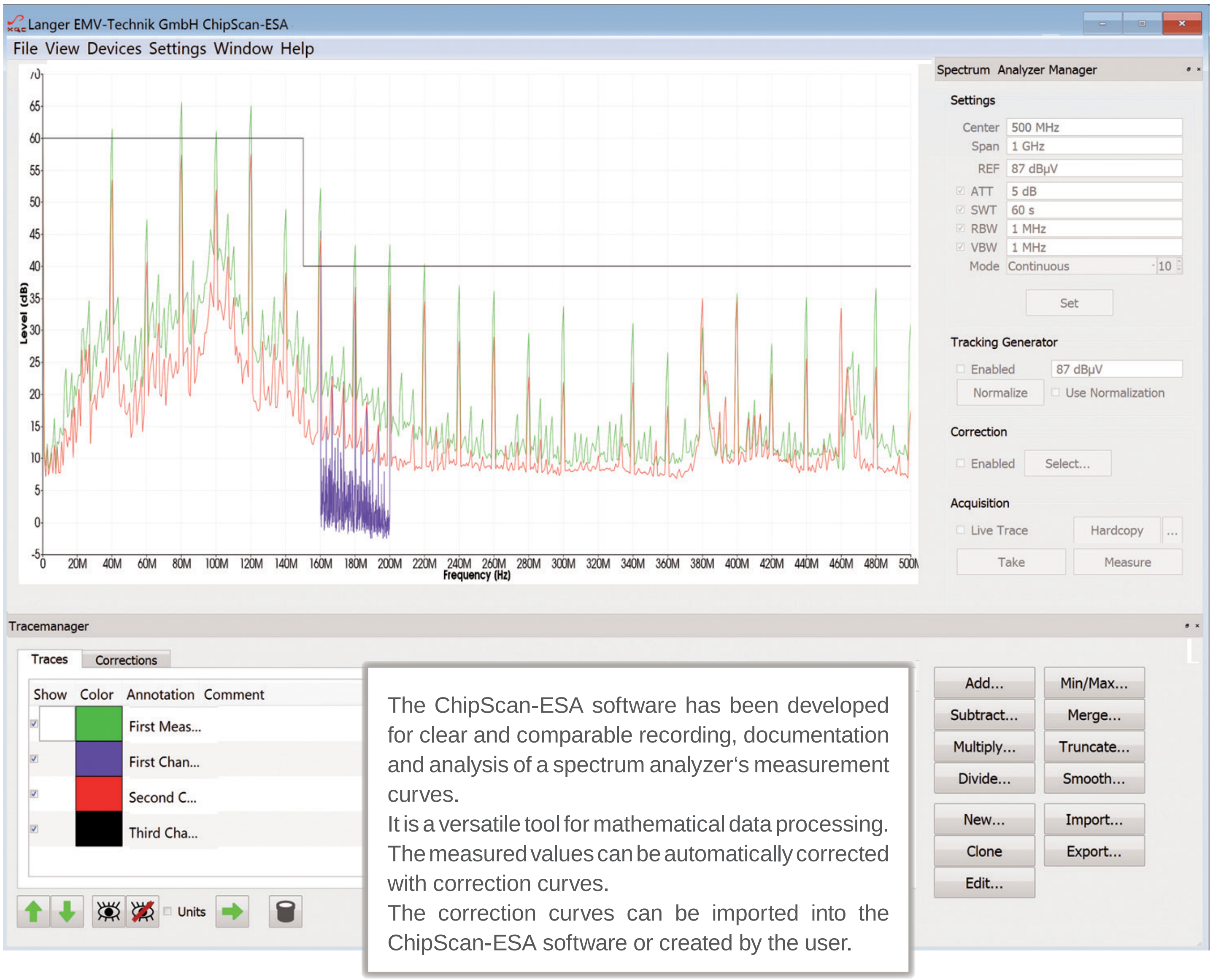
Test set-up

Features of the ChipScan-ESA Software:

- Data acquisition for spectrum analyzers
- Quick visualization of results
- Data processing and analysis
- Configuration of the spectrum analyzer
- Documentation and data export

ChipScan-ESA is particularly suitable for measurements with:

- TEM-cell
- Antenna
- Coupling clamp
- Probe tips
- Strip line
- Network simulation
- Near-field probes
- RF transformer
- IC measurements according to the 1 Ω / 150 Ω method



Settings

Center 500 MHz
Span 1 GHz
REF 87 dBµV
☑ ATT 5 dB
☑ SWT 60 s
☑ RBW 1 MHz
☑ VBW 1 MHz
Mode Continuous 10

Tracking Generator

☐ Enabled 87 dBµV
☐ Use Normalization

Correction

☐ Enabled

Acquisition

☐ Live Trace

Show	Color	Annotation	Comment
☑	🟩	First Meas...	
☑	🟪	First Chan...	
☑	🟥	Second C...	
☑	⬛	Third Cha...	

The ChipScan-ESA software has been developed for clear and comparable recording, documentation and analysis of a spectrum analyzer‘s measurement curves.
It is a versatile tool for mathematical data processing.
The measured values can be automatically corrected with correction curves.
The correction curves can be imported into the ChipScan-ESA software or created by the user.

EM Fault Injection

ICI Probe series
IC EM Pulse Injection
Langer Pulse

- Pulse injection into IC
  → for EMFI & pulse immunity analysis
- Pulse rise time: 2 ns
- Spatial resolution: 500 µm

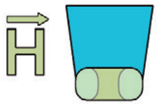
ICI-DP Probe series
IC EM Douple Pulse Injection
Langer Pulse

- Double pulse injection into IC
  → for EMFI & pulse immunity analysis
- Pulse rise time: 2 ns
- Spatial resolution: 250 - 1000 µm
  due to different probe tips

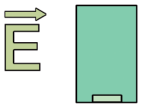
The ICI and ICI-DP probes enable the injection of fast transient magnetic or electric fields as well as current pulses into integrated circuits. They are intended to use for high-precision and high-resolution electromagnetic fault injection (EMFI) or body biasing injection (BBI). With the ICI-DP probes, single disturbance pulses as well as a double pulse sequence with a pulse following time down to 25 ns can be injected into ICs with precise timing and location.

ICI and ICI-DP Probe types

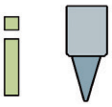
ICI HH500-15
Pulse Magnetic
Field Source



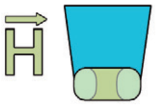
ICI E450
Pulse Electric
Field Source

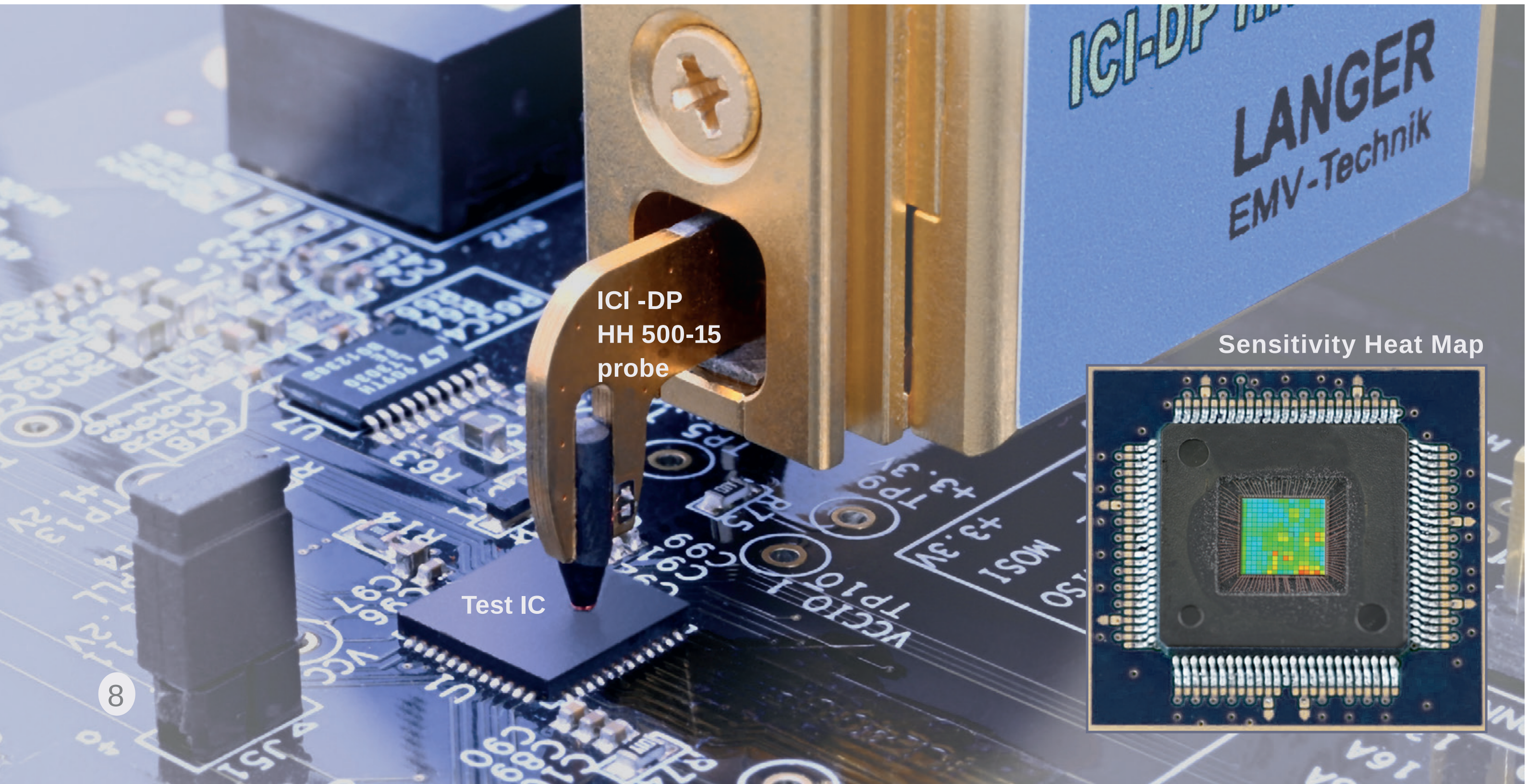


ICI I900
Pulse Current
Source (FBBI)



ICI-DP HH500-15
Double Pulse Magnetic
Field Source





ICR Probe series

Near-Field Microprobes for Radiated Emission Surface Scan according to IEC 61967-3 and Side-Channel Analysis

- Spatial resolution down to 60 µm
- 200 kHz - 6 GHz frequency range
- Side-channel analysis
- Integrated preamplifier

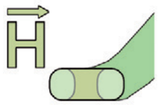
With an ICR microprobe high-frequency magnetic or electric fields in the range between 200 kHz and 6 GHz can be measured above an integrated circuit or a small module with a very high spatial measuring resolution - down to 60 µm. Mounted onto an IC scanner the near-field microprobes can be moved along all three axes over the chip surface and also rotated around the z-axis.

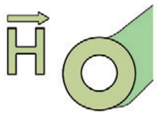
Near-Field Microprobe types

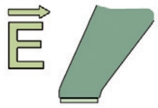
ICR HH
horizontal
200 kHz - 6 GHz

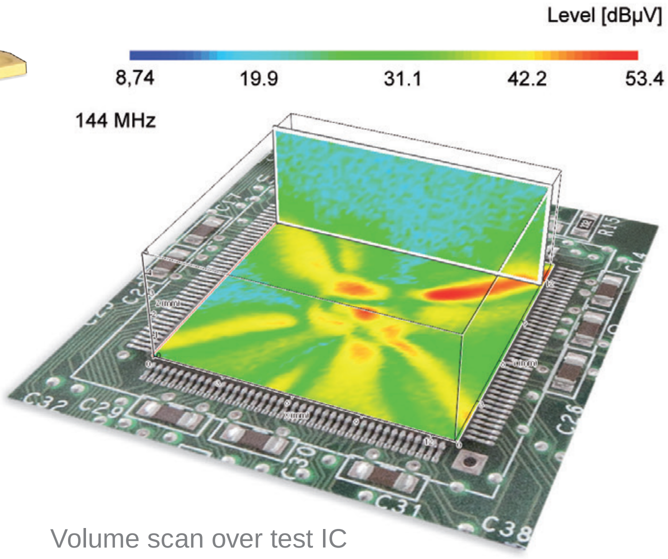
ICR HV
vertical
200 kHz - 6 GHz

ICR E
horizontal
7 MHz - 3 GHz









Volume scan over test IC

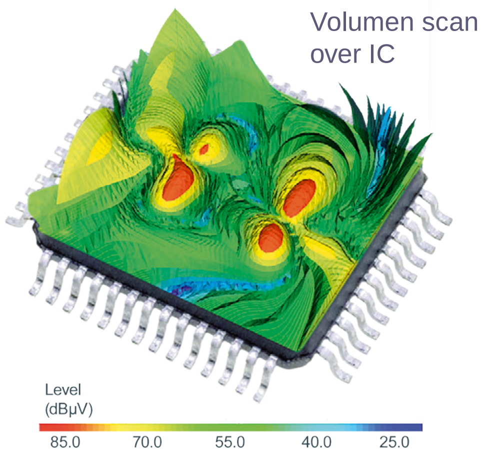
ICR HV 100-6 microprobe

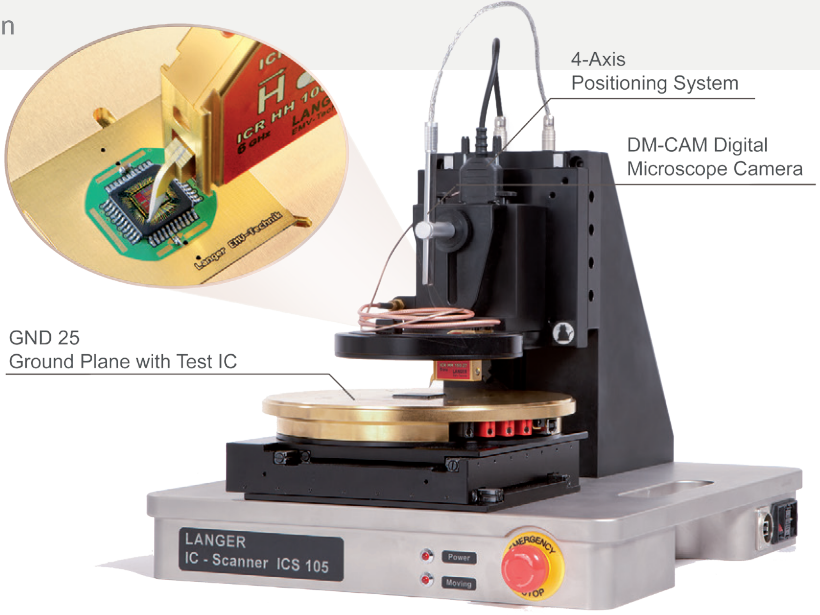
Test IC

Surface Scan above ICs or PCBs

ICS 105 set
IC Scanner 4-Axis Positioning System
for Surface Scans over ICs in accordance to IEC 61967-3

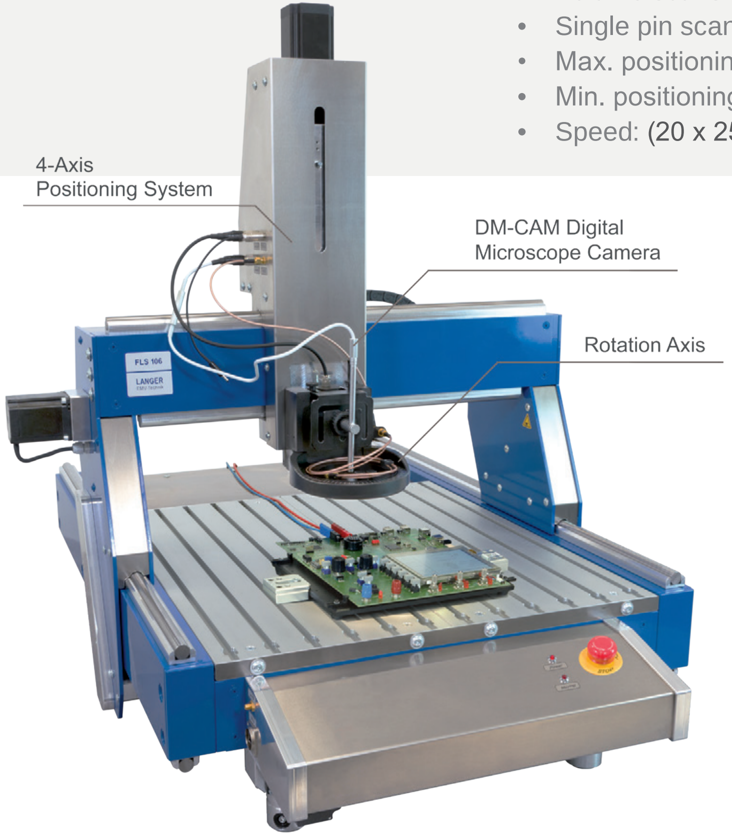
- Volume scans over ICs
- Single pin scans
- Max. positioning distance: (50 x 50 x 50) mm and +/- 180° α-rotation
- Min. positioning distance: (10 x 10 x 10) µm and 1° α-rotation
- Speed: (10 x 10 x 5) mm/s and 90°/s α-rotation

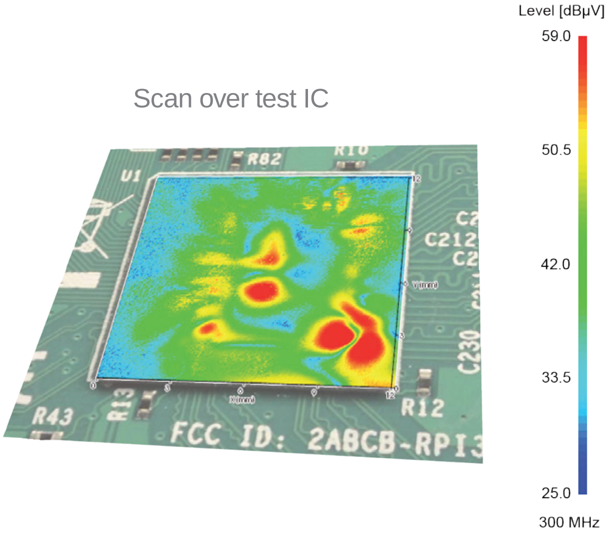




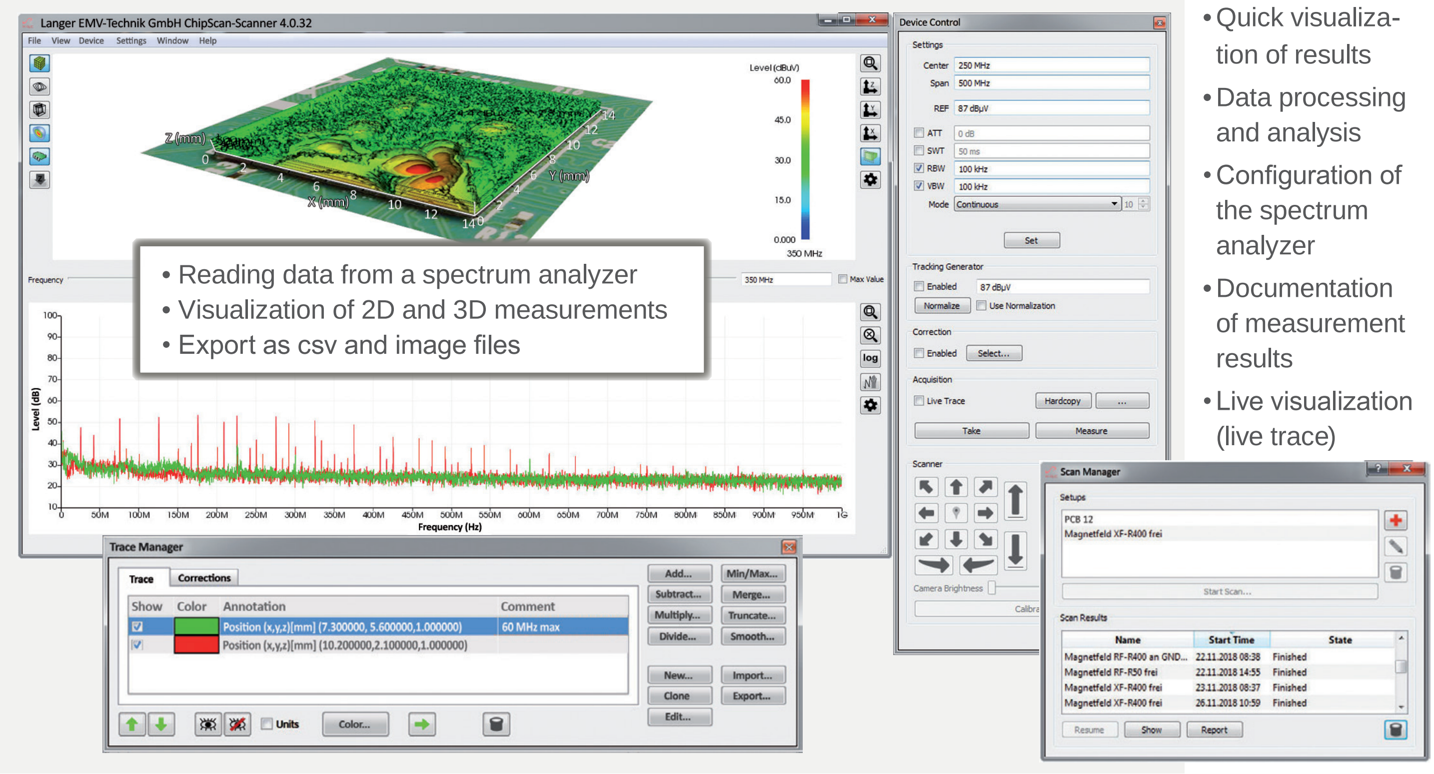
FLS 106 IC set
IC Scanner 4-Axis Positioning System
for Surface Scans over ICs in accordance with IEC61967-3

- Volume scans over ICs
- Single pin scans
- Max. positioning distance: (600 x 400 x125) mm and +/- 180° α-rotation
- Min. positioning distance: (20 x 20 x 20) µm and 1° α-rotation
- Speed: (20 x 25 x 10) mm/s and 90°/s α-rotation





ChipScan- Scanner Software



- Reading data from a spectrum analyzer
- Visualization of 2D and 3D measurements
- Export as csv and image files

Settings
Center 250 MHz
Span 500 MHz
REF 87 dBµV
☐ ATT 0 dB
☐ SWT 50 ms
☑ RBW 100 kHz
☑ VBW 100 kHz
Mode Continuous

Tracking Generator
☐ Enabled 87 dBµV
Normalize ☐ Use Normalization

Correction
☐ Enabled Select...

Acquisition
☐ Live Trace Hardcopy ...
Take Measure

Show	Color	Annotation	Comment
☑	🟩	Position (x,y,z)[mm] (7.300000, 5.600000,1.000000)	60 MHz max
☑	🟥	Position (x,y,z)[mm] (10.200000,2.100000,1.000000)	

Setups: PCB 12, Magnetfeld XF-R400 frei

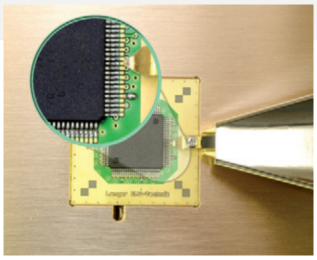
Scan Results

Name	Start Time	State
Magnetfeld RF-R400 an GND...	22.11.2018 08:38	Finished
Magnetfeld RF-R50 frei	22.11.2018 14:55	Finished
Magnetfeld XF-R400 frei	23.11.2018 08:37	Finished
Magnetfeld XF-R400 frei	26.11.2018 10:59	Finished

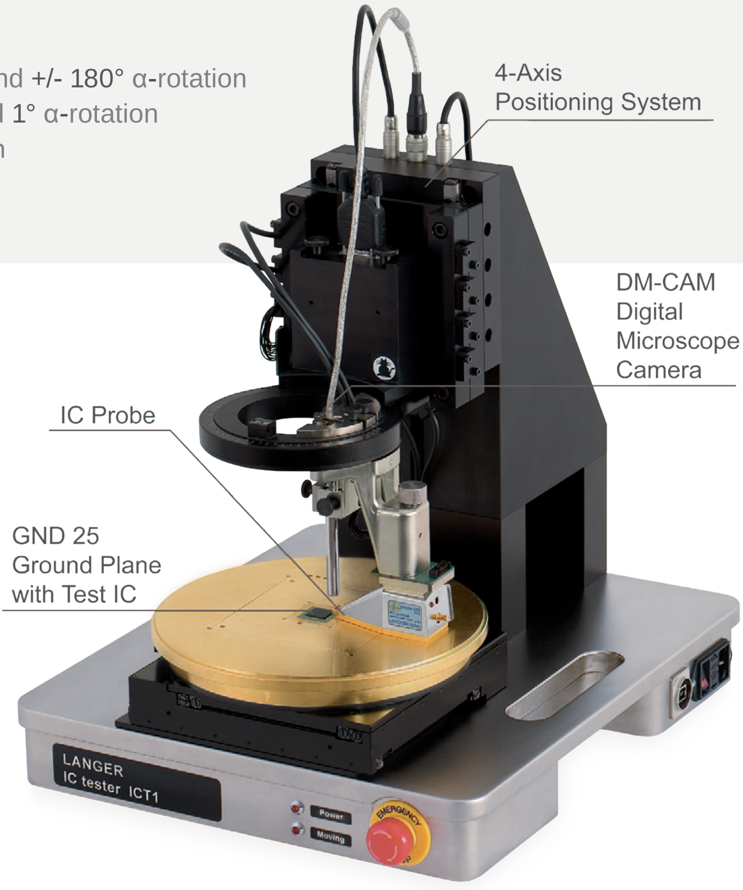
- Quick visualization of results
- Data processing and analysis
- Configuration of the spectrum analyzer
- Documentation of measurement results
- Live visualization (live trace)

ICT 1
IC Tester for Automated Measurement

- Max. positioning distance: (50 x 50 x 50) mm and +/- 180° α-rotation
- Min. positioning distance: (10 x 10 x 10) µm and 1° α-rotation
- Speed: (10 x 10 x 10) mm/s and 90°/s α-rotation



Automated Test:
- 1 Ω / 150 Ω
- DPI
- ESD
- EFT
- Near-field scans
- Side channel analysis



The ICT1 automatic IC tester is a positioning system which can be used with the IC Test System to run automated EMC tests on ICs. Both, conducted and capacitive / inductive coupled immunity and emission tests are possible. The ICT1's automatic pin recognition and high-precision positioning (10 µm) features ensure that each pin of the test IC is recognized and can be tested separately. The ICs can also be subjected to interference field tests.

Langer EMV-Technik is in the forefront of research, development, and production in the field of EMC. Through EMC experimental seminars and EMC workshops we offer our comprehensive knowledge to our customers.

Our interference emission and interference immunity EMC measurement technology as well as the IC test system are used mainly in the development stage and are in worldwide demand.

Developers and designers gain new perspectives and more efficient working strategies for module- and IC developments with the EMC know how and measurement technology of Langer EMV-Technik GmbH.

The individual pre-compliance consulting services provided by Langer EMV-Technik GmbH help developers and designers quickly find solutions to complex EMC problems in IC, device, and module development.

We make both our comprehensive EMC expertise and research results available to our customers via practical experimental EMC seminars and in-house events.

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