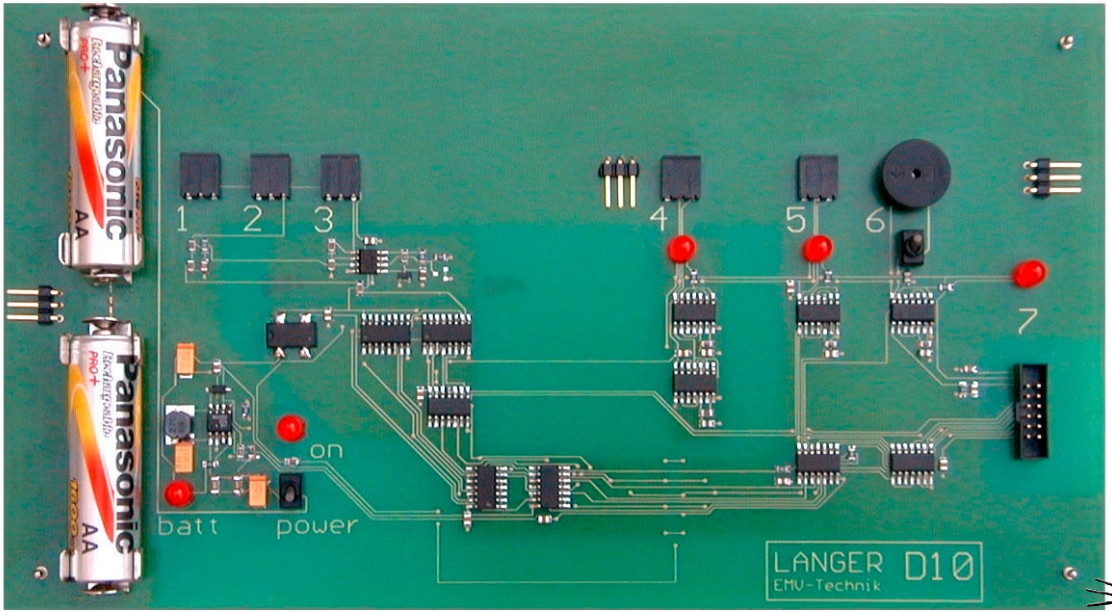
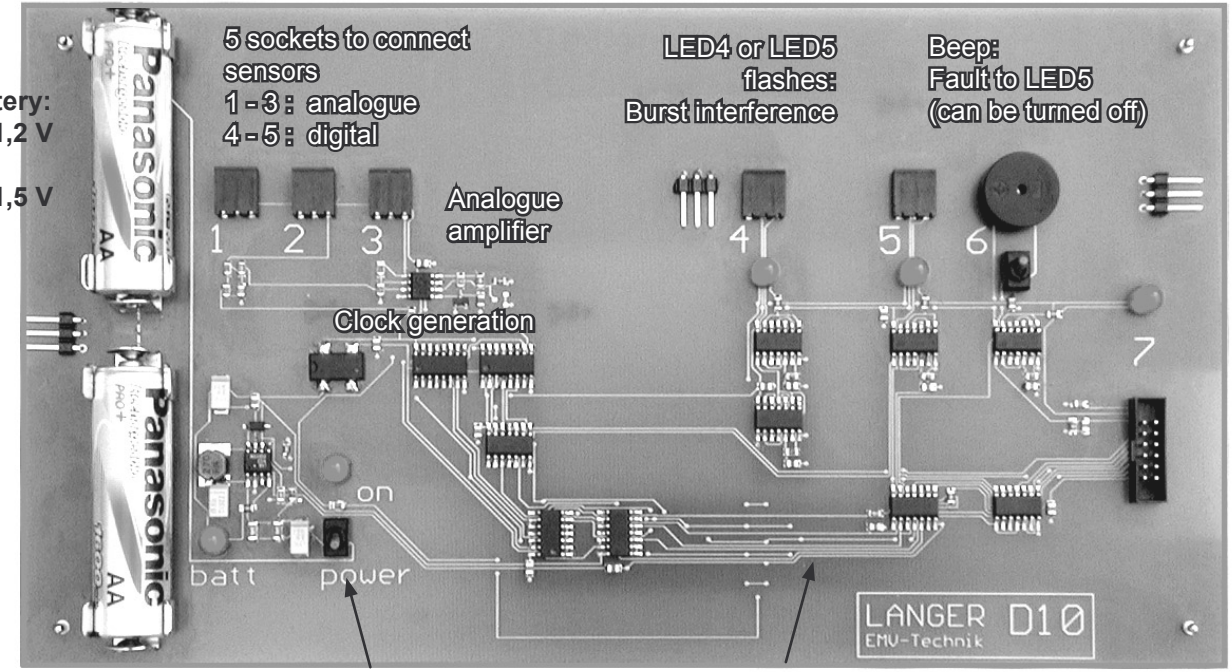
D10 Demonstration Board



Contents

Demonstration board description



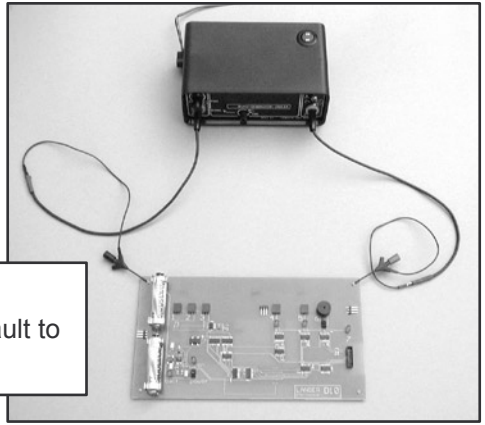
Measurement technology - Disturbance immunity

E1 disturbance immunity development system

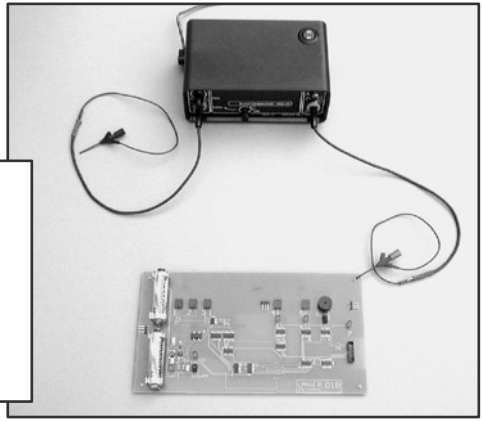
Injection of disturbance current with SGZ21:

Stimulation of the critical faults by:
Injecting disturbance current into the natural disturbance current paths and thus
- simulating compliance test conditions
- distinguishing between faults caused by disturbance current and electric fields

Disturbance current can be injected at any corner (GND)



Two-pole injection:
High disturbance current (fault to **LED5) Small electric fields**

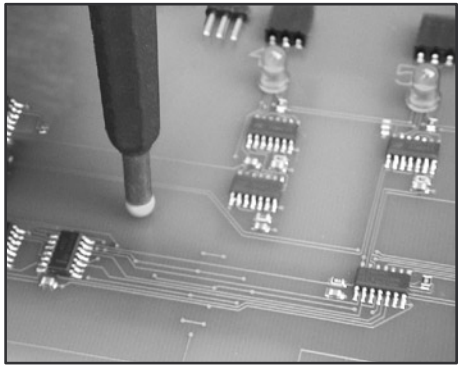


Single-pole injection:
Large electric fields
(fault to **LED4)**
Low disturbance currents: depending on connecting point (fault to LED5)

Attention!
Do not connect SGZ21 directly to IC pins and signal lines!

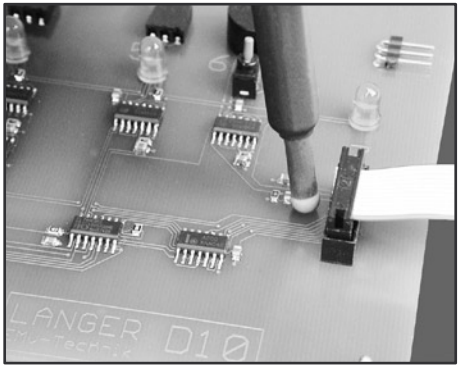
Search for fault locations with field sources

BS 04 DB magnetic field probe:



Interference:
LED5

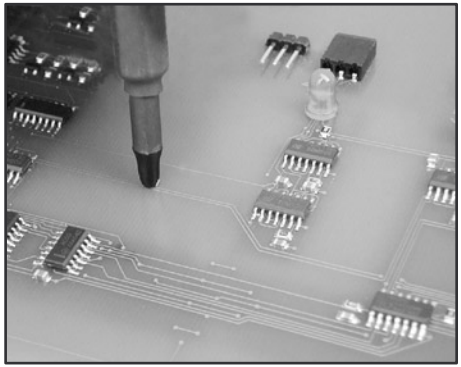
BS 04 DB magnetic field probe:



Interference:
LED7

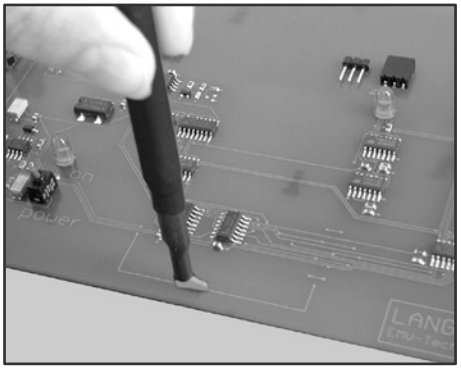
BS 05 DU magnetic field probe:

Determining the lines' susceptibility



Interference:
LED5

ES 05 D electric field probe



Interference:
LED4

Signal transfer with S31 sensor

Objective:

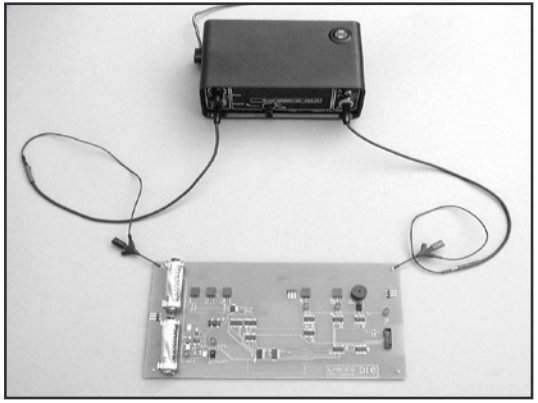
Evaluation of modifications on the module and/or in the field of shielding/ filtering

Procedure:

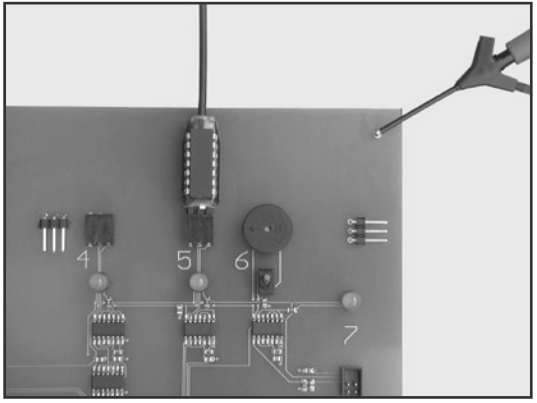
- Connect a sensor to the line likely to be disturbed and link this to SGZ21 via an optical fibre.
- The SGZ21 counter displays the number of pulses on the connected line.
- The module is disturbed (as described on page 6). Evaluate any additional pulses on the line:
- The smaller the number of (disturbance) pulses the better the module.
- The efficiency of modifications becomes visible after a measuring time of 1 sec.

Example:
Interference through disturbance current

Feed the disturbance current through the equipment under test (EUT) via a two-pole connection.



Plug the S31 sensor into socket 5 and connect it to the SGZ21 generator via an optical fibre; switch on the generator and read the numerical value displyed by the counter



Note:

In practice the sensor is attached to the module with super glue via a three-pole socket (several are included in the scope of delivery) and connected with CuL wire.

Magnetic field measurement with MSA 02

Objective:

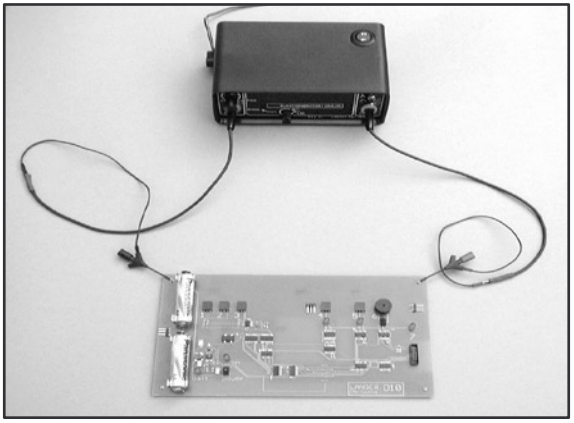
Detection of magnetic fields during burst interference

Where is the EUT exposed to particularly high stress through magnetic fields?

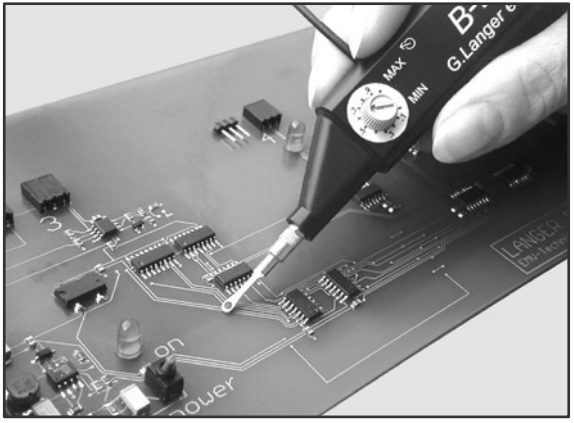
Lead the burst current through the EUT to take measurements, connect MSA02 to SGZ21 via an optical fibre, adjust a medium amplification, switch on MSA02 and take measurements.
The higher the numerical value the greater the average magnetic field intensity.

Example:

Interference through disturbance current



Feed the disturbance current through the EUT via a two-pole connection and measure the magnetic fields of the disturbance current at the same time.

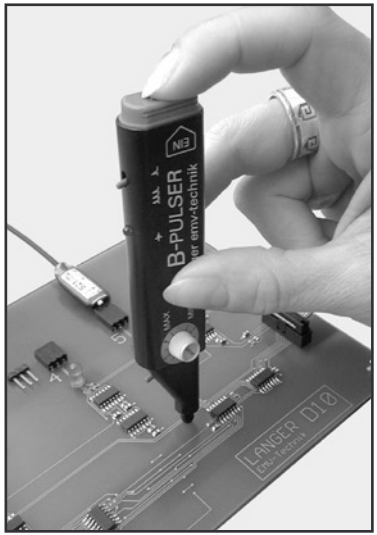


MSA02 magnetic field probe with 05R probe head (white)

Attention:
Try to hold the probe head flatly over the EUT as shown in the picture.

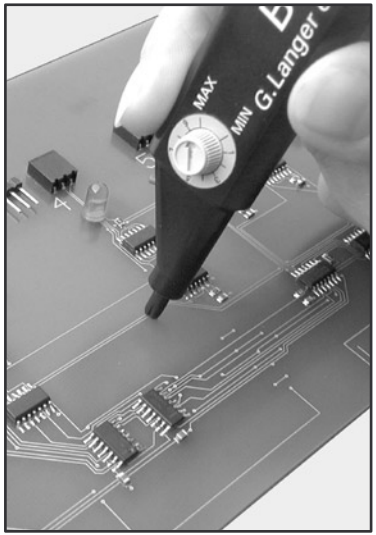
P1 mini burst generators

Coupling of magnetic fields in signal line loops with P11 (red)



Fault to **LED5**, beep, measurement via sensor

Evaluating the susceptibility of IC inputs with P12 (yellow)



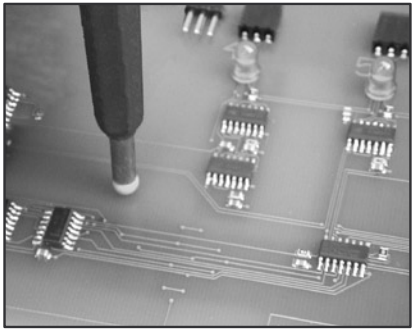
Fault to **LED5**, beep, measurement via sensor

Coupling of electric fields in signal lines with P21 (blue)

Fault to **LED4**, measurement via sensor

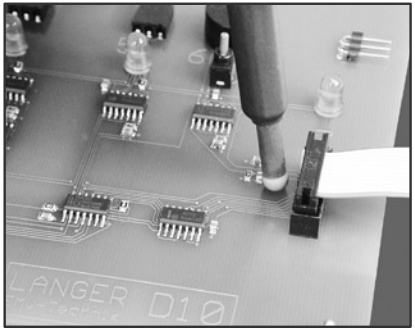
H1 - H3 field source sets for burst generators

BS 04 DB magnetic field probe :



Interference:
LED5

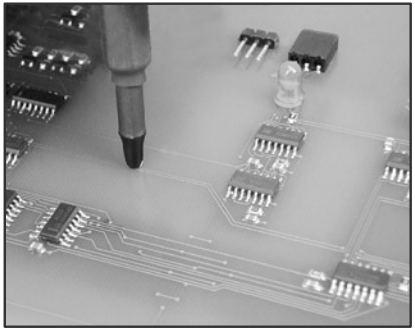
BS 04 DB magnetic field probe:



Interference:
LED7

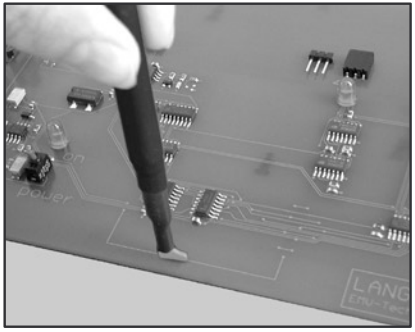
BS 05 DU magnetic field probe:

Determining the lines‘ susceptibility



Interference:
LED5

ES 05 D electric field probe:

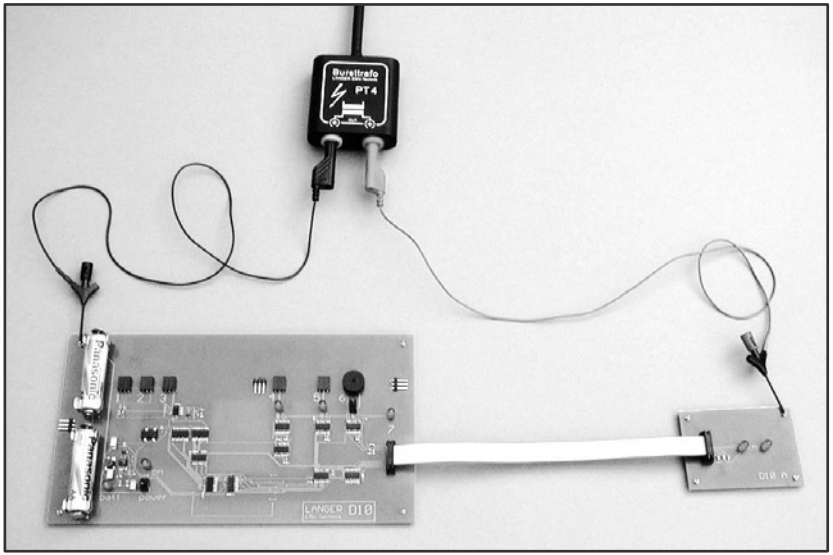


Interference:
LED4

Attention: **The set polarity of the disturbance quantity influences the measurement result. Please always use the supplied connecting cable (dielectric strength).**

PT4 burst transformer

Connect PT4 to GND via both cables.
A disturbance current flows through both modules.
Fault to **LED5** and **LED7**



Other variants:

- Only inject disturbance current into individual sections and/or in different directions. To do so, connect PT4 to different corner points; remove the plug-in module with cable if necessary.

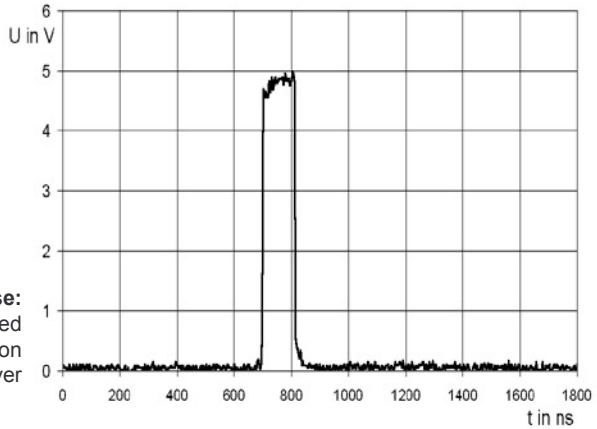
- Establish a single-pole connection betwwen PT4 and GND.
  Faults to **LED4** (electric fields) and to **LED5** depending on the injection point (disturbance current)

Note:
Depending on the level of the line which is interfered with, the disturbance quantity must have a certain polarity:
Low level: The disturbance pulses must be positive (line to LED4)
High level: The disturbance pulses must be negative (line to LED5 changes its level at approx. 0.5 Hz and thus causes a different susceptibility).

Optical Fibre Probe (digital OSE)

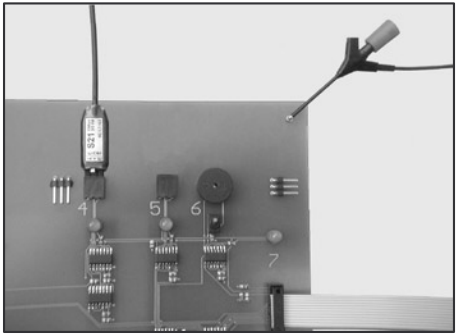
Isolated measurement of digital signals during burst/ESD tests

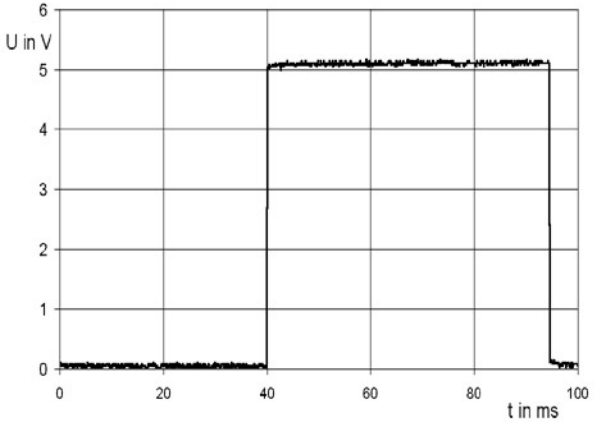
Main usage:
Monitoring of modules such as watchdog, reset, chip-select lines



Oscillographed disturbance pulse:
A 5 V pulse of differing width is displayed depending on the pulse expansion set on the optical receiver

Plug the S21, S25 or S31 sensor into socket 4 and connect to the oscilloscope via an optical fibre and optical receiver.
Generate electric fields by establishing a single-pole connection between SGZ21 or PT4 and GND or using the ES 05 E field source or P21 E pulser.
Oscilliograph the signal.

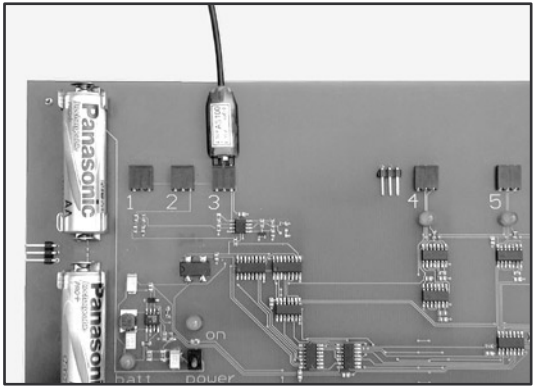


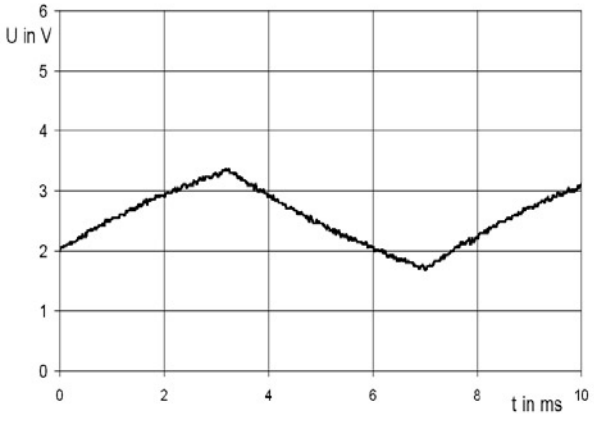


Attention: **Observe the switch position on the sensor: The output signal is negated or not negated.**

Optical Fibre Probe (analog A)

- Plug the A100 or A110 sensor into socket 3.
- Connect it to the oscilloscope via an optical fibre and optical receiver.
- Oscillograph the signal.

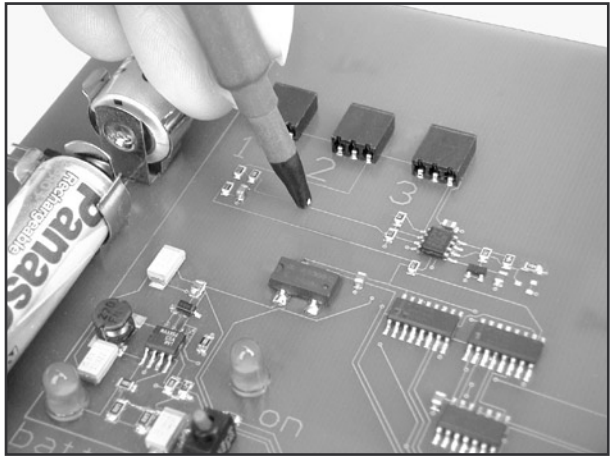




Attention:
The AE100 optical receiver always has an output voltage range of 0 to 10 V.
Observe the switch position on the sensor and take the divider factor into consideration if necessary.

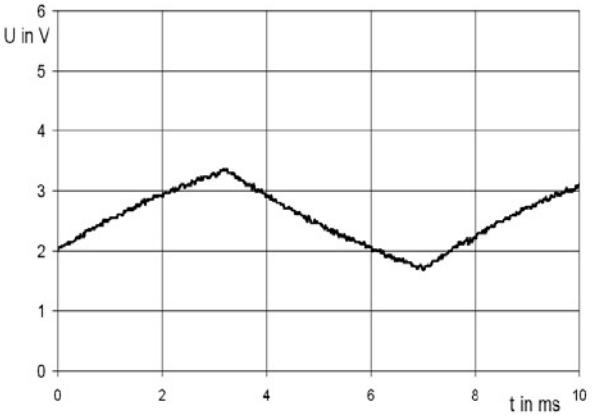
Interference to useful signal during radiated RF emission

Fault localisation with RF generator, power amplifier and RF near-field probe (as a field source)



Variation:
- Coupling with RF R400
- Lower susceptibility when coupled in via RF E05

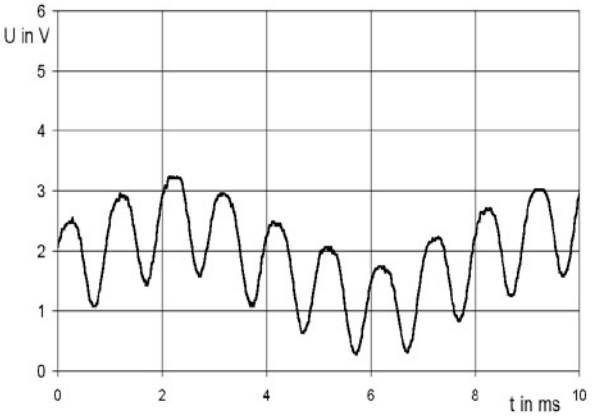
Initial state:
Voltage measurement with AS100 sensor on socket 3



Interference through RF
Coupling with RF U 2,5 probe

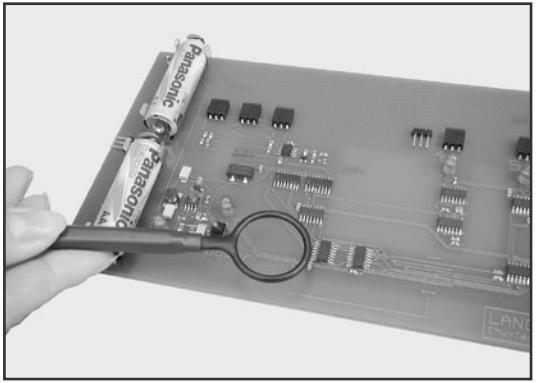
at 200 - 250 MHz with 1 W and 1 kHz AM

The useful signal is superimposed by a 1 kHz disturbance.



Interference to supply voltage during RF coupling

Fault localisation with RF generator, power amplifier and RF near-field probe (as field source)



Interference through RF

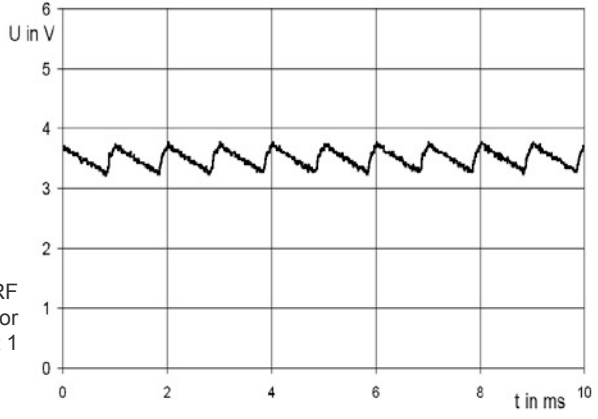
Coupling with RF R400 probe at 200 - 250 MHz with 1 W and 1 kHz AM

Attention!

Cyclically check the temperature of the probe heads and interrupt the measurement if necessary to cool them.

Function-related disturbances can be emitted during these measurements. (The EUT is excited to oscillate and acts as a sending aerial.)

Cables which are connected to the EUT modify the transient currents flowing through the EUT and thus influence the measurement result.



+5 V supply voltage during RF coupling measured with AS100 or AS110 sensor on socket 1

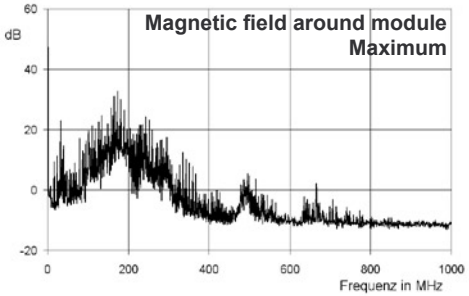
Measurement technology - Disturbance emission
RF near-field probes

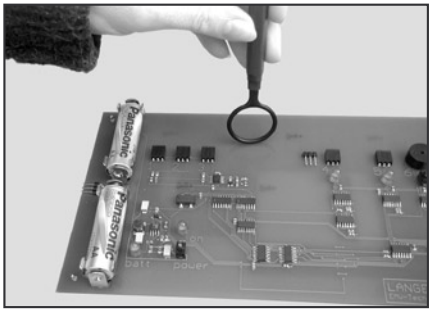
Measurement of the magnetic and electric RF fields on the module

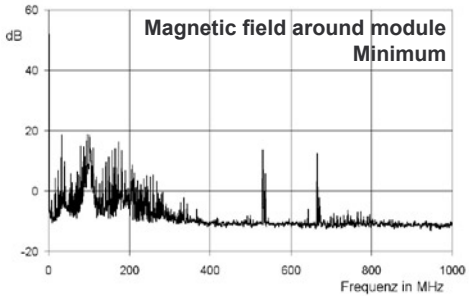
Two tasks:
- Measuring the field intensity, evaluation in the frequency range
- Measuring the field line orientation

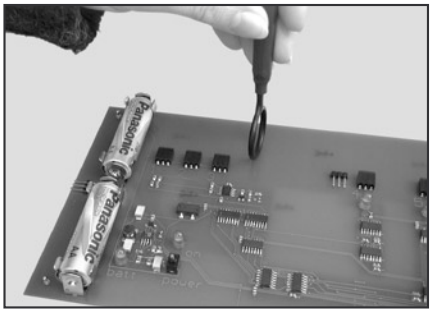
Fault localisation procedure:

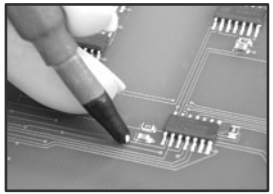
1. Measuring the fields on GND, cables and structural metal parts
2. Tracking these fields with smaller and smaller probes down to the field source on the module









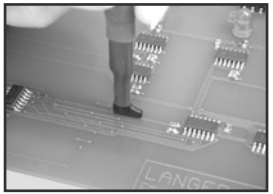


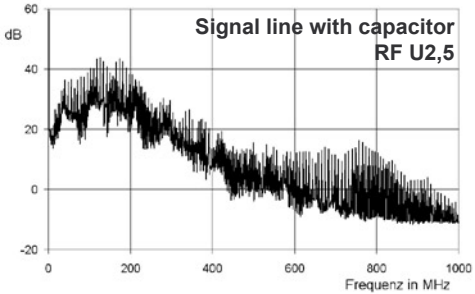
Currents flowing on signal lines

Measurement with RF U2,5 probe

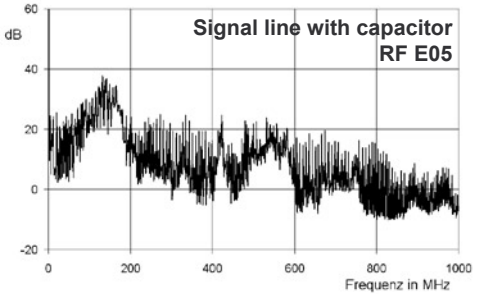
Electric fields on signal lines

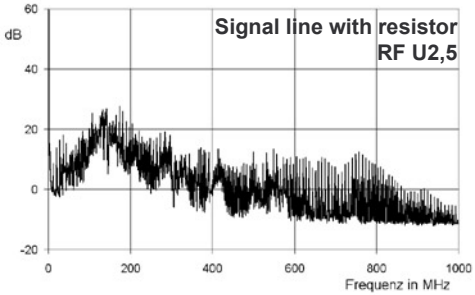
Measurement with RF E05 probe



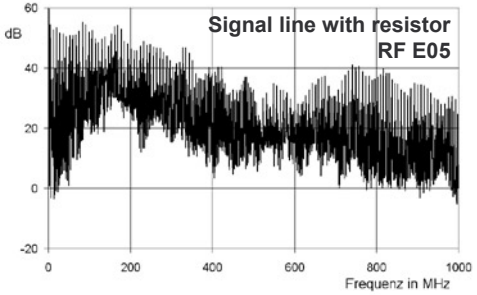


RF current flows to GND (intense magnetic field) through the capacitor at the end of the signal line, the elctric field is dampened.



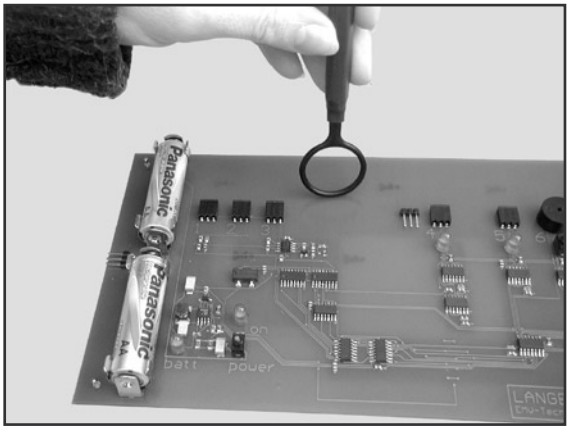


RF current is dampened through the resistor at the end of the signal line, coupling out of an electric field is intensified.



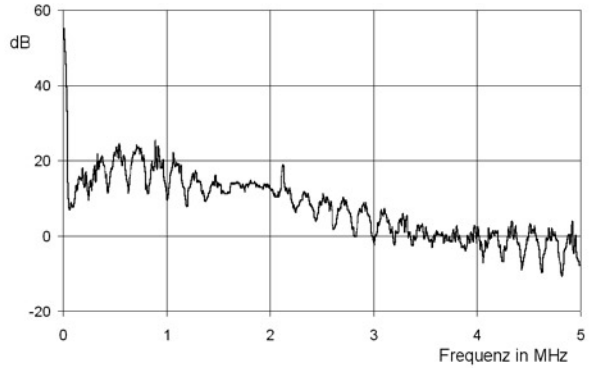
LF near-field probes

- LF probes are only magnetic field probes
- Applicable in the frequency range between 100 kHz and 50 MHz
- Main field of application:
  Power electronics
  Switching transformers

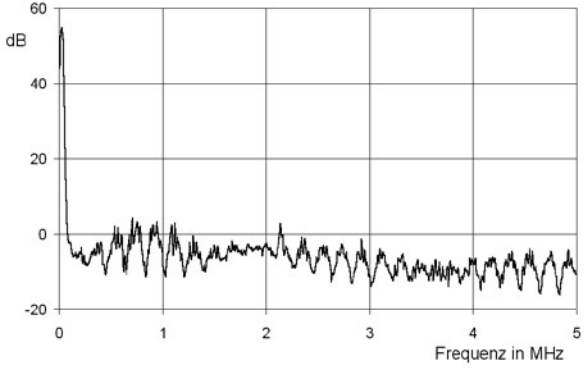


Comparison of RF and LF probes in the frequency range up to 5 MHz:

LF R400 to GND



RF R400 to GND



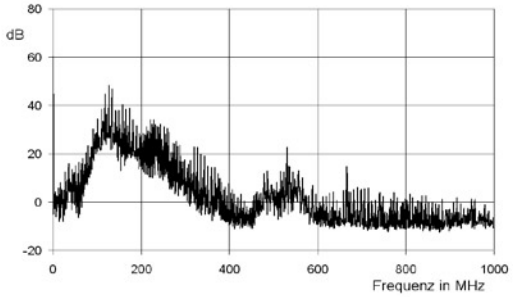
ESA1 disturbance emission development system

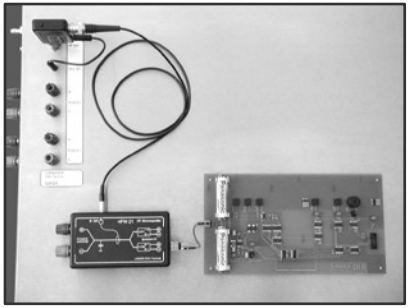
Measurement with HFW21

- Transient currents in D10 generate voltage differences in the GND system.
- The voltage differences couple in neighbouring metal parts (e.g. metal enclosures, shielding) and thus cause disturbance emissions

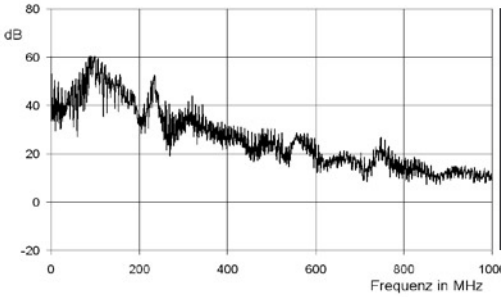
Measurement set-up:

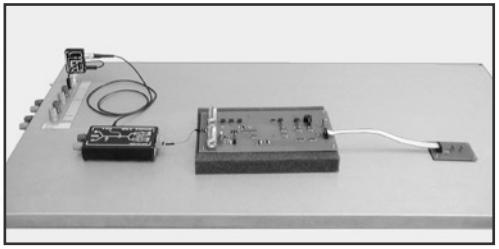
- Connect HFW 21 to a spectrum analyser via a BNC-SMB cable and the PA201 pre-amplifier.
- Connect the GND of D10 to the HFW21 COM port via a a short cable and an adapter socket (green with plug pin).
- HFW21 must make contect with the base plate.
- If D10 is switched off, the shielding effect of the tent can be demonstrated - D10 acts as a receiving aerial for disturbances from the surroundings.





Measurement without plug-in board: Only HFW21 is connected to GND and measures transient currents between D10 and the base plate
Parameter: Distance between D10 (EUT) and the base plate (e.g. shielding enclosure)



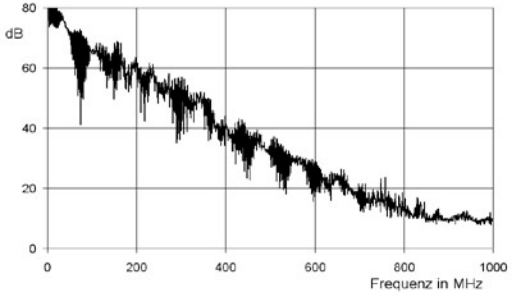


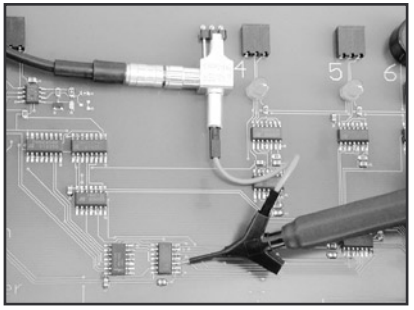
Measurement with plug-in board: Only HFW21 is connected to GND and measures transient currents between D10 and the base plate
Parameter: Distance and position of the plug-in board relative to the base plate

HFU 02 RF transformer

- Measurement of the RF voltage on IC outputs, IC inputs and of the IC supply voltage
- Evaluation of filters
- Particularly suitable for extremely small structures
- High susceptibility

Examples:

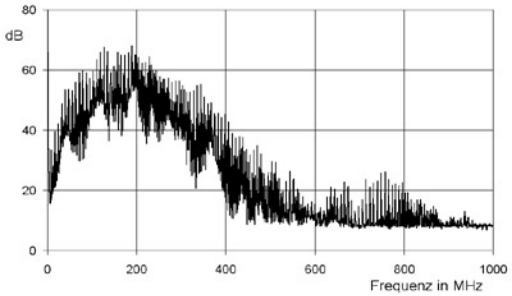


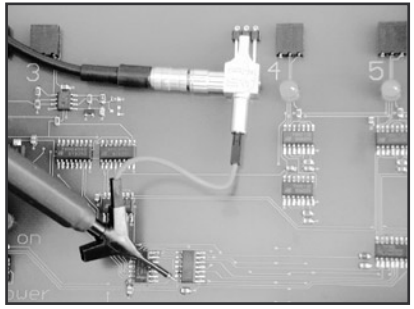


Voltage to PIN3: IC output

Measurement:

- Establish the GND connection of the converter via the plug pins beside LED4.
- Connect to spectrum analyser via SMB-BNC cable.
- Connect the prod via the red cable.
- Take measurements on any IC pin.





Voltage to PIN14: Supply voltage