LANGER
EMV-Technik

IC TEST SYSTEM

Manual

P512 Set

RF power injection and RF measurement

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1 Declaration of Conformity

Manufacturer:
Langer EMV-Technik GmbH

Nöthnitzer Hang 31
01728 Bannewitz
Germany

Langer EMV-Technik GmbH herewith declares that the

P512 Set, RF Power Injection / RF Probe head
with Probe **P512**

conforms with the following relevant regulations:

- EMC Directive 2014/30/EU
- Low-Voltage Directive 2014/35/EU
- Restriction of certain Hazardous Substances 2011/65/EU

The following applicable standards were used to implement the requirements specified by the aforementioned directives:

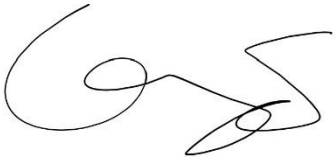
- DIN EN IEC 61000-6-1:2019-11 (EMC immunity)
- DIN EN IEC 61000-6-3:2022-06 (EMC emission)
- DIN EN 61010-1:2020-03 (Safety)
- DIN EN IEC 63000:2019-05 (Restriction of hazardous substances)

Name of the person authorized to compile the technical documentation:

Katja Langer

Bannewitz, 2025-09-08

Signature:



K. Langer, Managing Director

2 General Information

2.1 Storage of the User Manual

This user manual enables the safe and efficient use of the P512 Set. It must be kept close at hand and accessible to the use.

2.2 Reading and Understanding the User Manual

Read the user manual carefully, observe the safety information (Chapter 3) and follow the instructions given in this manual before putting the device into service.

2.3 Local Safety and Accident Prevention Regulations

The local accident prevention and general safety regulations also apply to ensure that the P512 Set is used for its intended purpose.

2.4 Images

Figures and images have been included in this user manual to assist the reader's understanding but may differ from the device's actual version.

2.5 Limitation of Liability

In the following cases, Langer EMV-Technik GmbH can assume no liability for damage to property and personal injury if:

- The information given in this user manual has not been observed.
- P512 Set was operated by staff not qualified in the field of EMC.
- P512 Set was subjected to unauthorized modifications or technical changes.
- P512 Set was not used according to its intended purpose.
- Spare parts or accessories were used that had not been approved by Langer EMV-Technik GmbH.

The actual scope of delivery may deviate from the illustrations and texts in this user manual due to the customization of orders or due to technical changes and innovations.

2.6 Errors and Omissions

The information in this manual has been carefully checked and is believed to be accurate; however, the Langer EMV-Technik GmbH assumes no responsibility for any clerical, typographical, or proofreading errors, or omissions.

2.7 Copyright

3 Safety

3.1 Labels and Signs

		
General warning sign	Warning; Electricity	Prohibition sign; No access for people with active implanted cardiac devices.

Table 1: Safety signs

Safety instructions in this user manual are marked by symbols (**Table** 1). Observe the safety precautions and act cautiously to avoid accidents as well as personal and material damages.

3.2 Intended Use

The probe set P512 Set is used for testing the conducted immunity of integrated circuits. In accordance with the IEC 62132-4 standard, radio frequency power can be introduced into the circuits via the probe P512. The built-in DPI coupling network can couple RF power of up to 2 W at a frequency of up to 12 GHz.
When adapted to 50 Ω, RF signals up to the specified maximum frequency can also be measured via the measuring tip.
The P512 probe is built according to its specified use and should therefore only be used for the following purposes:

- Conducted injection of RF power into IC pins or balls with the P512 within the stated specifications.
- RF measurements of the emitted signals considering the coupling network of the P512.

3.3 Reasonably foreseeable Misuse

	**Danger resulting from misuse!** **Misuse of the P512 Set can lead to dangerous situations!**
Warning!	

Incorrect applications of the sets include:

- Use of the product outside of the given specifications.
- Modification or changes to the product without the consent of Langer EMV Technik GmbH.
- Operation of the product with a technical defect.

3.4 Staff Requisition

Only qualified staff with training, knowledge, and experience in the field of EMC is allowed to operate the P512 Set.

Persons whose ability to perform is influenced or impaired by alcohol, drugs, or pharmaceuticals, are not allowed to operate the P512 Set.

3.5 Safety Instructions

 Warning; Electricity!	**Danger resulting from electricity!** **Risk of injury by electrocution!** **Risk of burns due to heat!**

RF currents can cause irreversible damage to the body, therefore the following safety instructions have to be observed.

- All cable connections must be closed before operating the P512 probe.
- Do not touch the probe tip of the P512 probe when it is in operation.
- If any insulation is damaged, the power supply must be disconnected immediately.
- Damaged parts must be replaced with undamaged parts before operation. Contact Langer EMV-Technik GmbH to obtain a replacement.
- Protect live parts from moisture to avoid short circuits.
- Never leave a Langer EMV-Technik GmbH product unattended while it is in operation.

 Prohibition; No access for people with active implanted cardiac devices	**Danger resulting from electro-magnetic fields!** **Risk of affecting a cardiac device!**

Electromagnetic near fields are generated at the probe due to its function. Therefore, persons with a cardiac device, such as a pacemaker, must not work on or approach the P512 Set during operation.

4 Scope of delivery

4.1 Scope of delivery P512 Set

Item.	Designation	Type	Parameter	Quantity
1.	RF probe up to 12 GHz	**P512**	12 GHz	1
2.	Power supply unit		12 V	1
3.	Shielded measurement cable	**SF104/11SMA/11SMA/1000mm**		1
4.	System case	**P512 case**		1
5.	Quick guide			1
6.	User manual			1

Important: The scope of delivery may deviate depending on the respective order.

Figure 1: P512 Set system case

5 P512 Probe Set

5.1 General Description

The P512 probe set is used to inject high-frequency currents and voltages into IC pins or to measure RF signals in a 50 Ohm matched circuit. For "Direct Power Injection" (DPI), the P512 is used in conjunction with an RF signal generator and an RF power amplifier. The probe acts as an RF coupling network to inject RF power into the circuits up to the maximum useful frequency of 12 GHz.

Figure 2: Probe P512 side view

The RF power is coupled into the device under test (DUT) via the P512 probe. The DPI coupling network is built into the P512 probe and is therefore the same for all measurements. The probe tip in GSG (Ground-Signal-Ground) configuration enables reproducible injection of RF power up to 12 GHz.

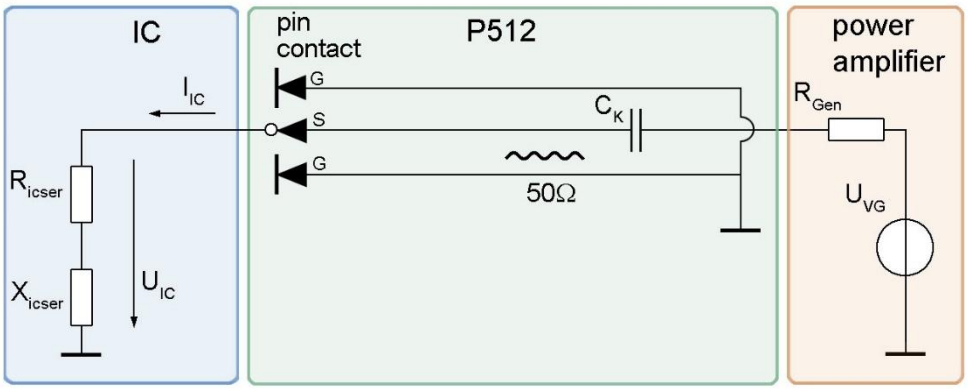


Figure 3: Equivalent circuit of the test setup with P512 and power amplifier

When using the P512 probe as a probe, the GSG format of the probe tip enables reproducible measurement of RF power up to 12 GHz in the 50 Ohm system.

5.2 Design and Function

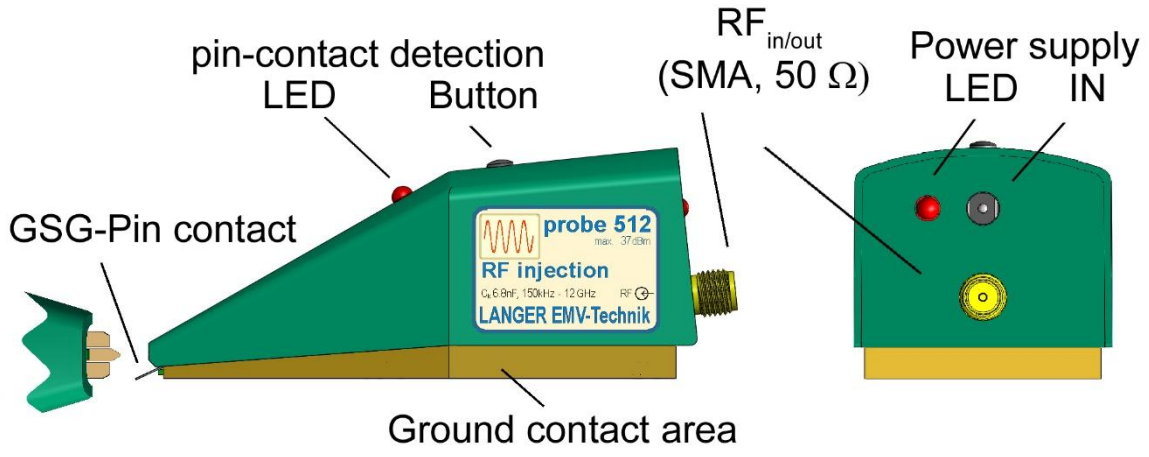


Figure 4: Connections and indicators of the P512

The P512 contains a 50 Ohm RF connection from the RF connector $RF_{in/out}$ (SMA) to the probe tip.
The ground connection to the DUT is routed via the ground contacts on the side of the pin contact (ground-signal-ground) and the contact surface of the base.
The coupling capacitor integrated in the P512 (standard value 6.8 nF) is part of the coupling network for DPI measurements. It can also be customized when ordering the P512 (see Figure 5; C_K).
The LED on the back of the P512 indicates the connection of the power supply.

The button on the top of the probe activates the pin contact detection. This detects a galvanic connection between the probe tip and the IC pin/ball. The connection is indicated by the pin contact detection LED on the top of the probe.

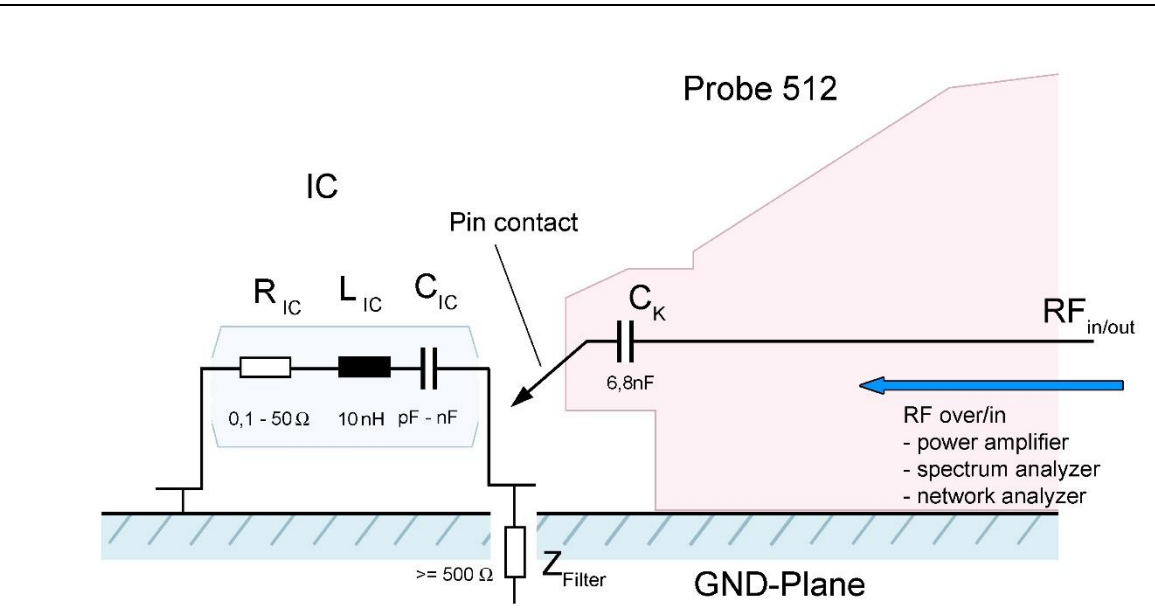


Figure 5: Equivalent circuit of the P512 probe on an IC mounted on a test board

5.3 Contact Detection

The pin contact detection indicates whether there is a galvanic connection between the probe tip and an IC pin/ball.

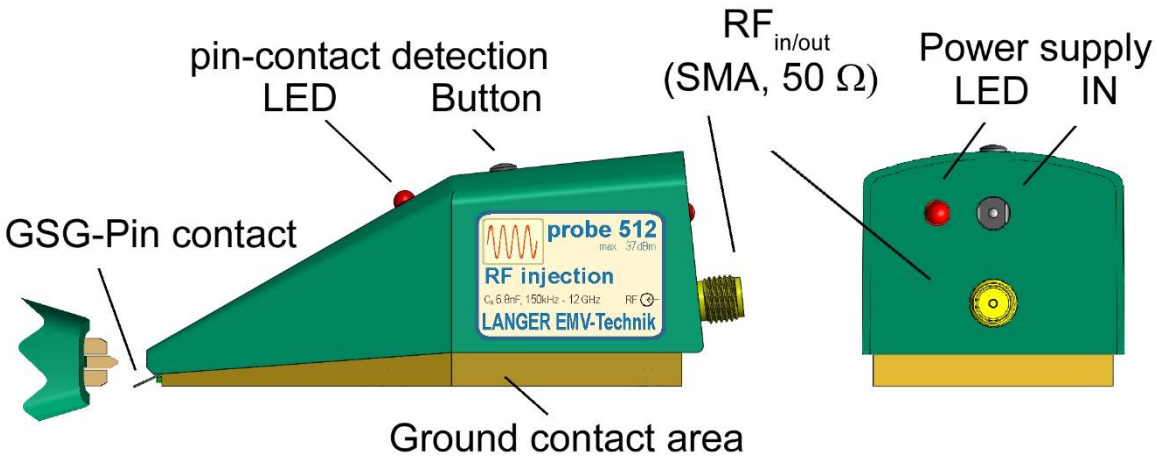


Figure 6: Illustration of the P512 probe with pin contact detection

When the pin contact detection button is pressed, a voltage of -5 V is supplied to the probe tip.

If there is a galvanic connection between the probe tip and the IC pin/ball, the voltage level at the probe tip drops due to the hardware structure of the internal IC/circuit.

The voltage drop is detected, and the contact is indicated by the LED in the upper part of the probe housing.

NOTE: Internally non-connected pins (NC) cannot be detected.

6 Operational Notes

The measurement set-up should always be operated via a filtered power supply.
Attention! Functional near fields and interference emissions can occur when operating EMC test setups. It is the responsibility of the user to take measures to prevent interference with the proper functioning of products outside the EMC environment of the test setup (in particular due to interference emissions).
This can be achieved by:

- observing an appropriate safety distance,
- use of shielded or shielding rooms.

The interference coupled into the ICs can destroy the device under test if the intensity is too high. Protect the device under test by:

- increasing the disturbance gradually and stopping when a functional fault occurs,
- interrupting the power supply to the device under test in the event of a latch-up.

Attention! Make sure that internal malfunctions are visible from the outside. If the faults are not visible from the outside, the DUT may be destroyed by an increase in the power supplied. If necessary, the following measures must be taken:

- Monitoring of representative signals in the DUT
- special test firmware?
- visible reaction of the DUT to inputs (reaction test of the DUT)

Langer EMV-Technik GmbH accepts no liability for the destruction of the DUT!

7 Measurement setup

7.1 Direct power injection DPI

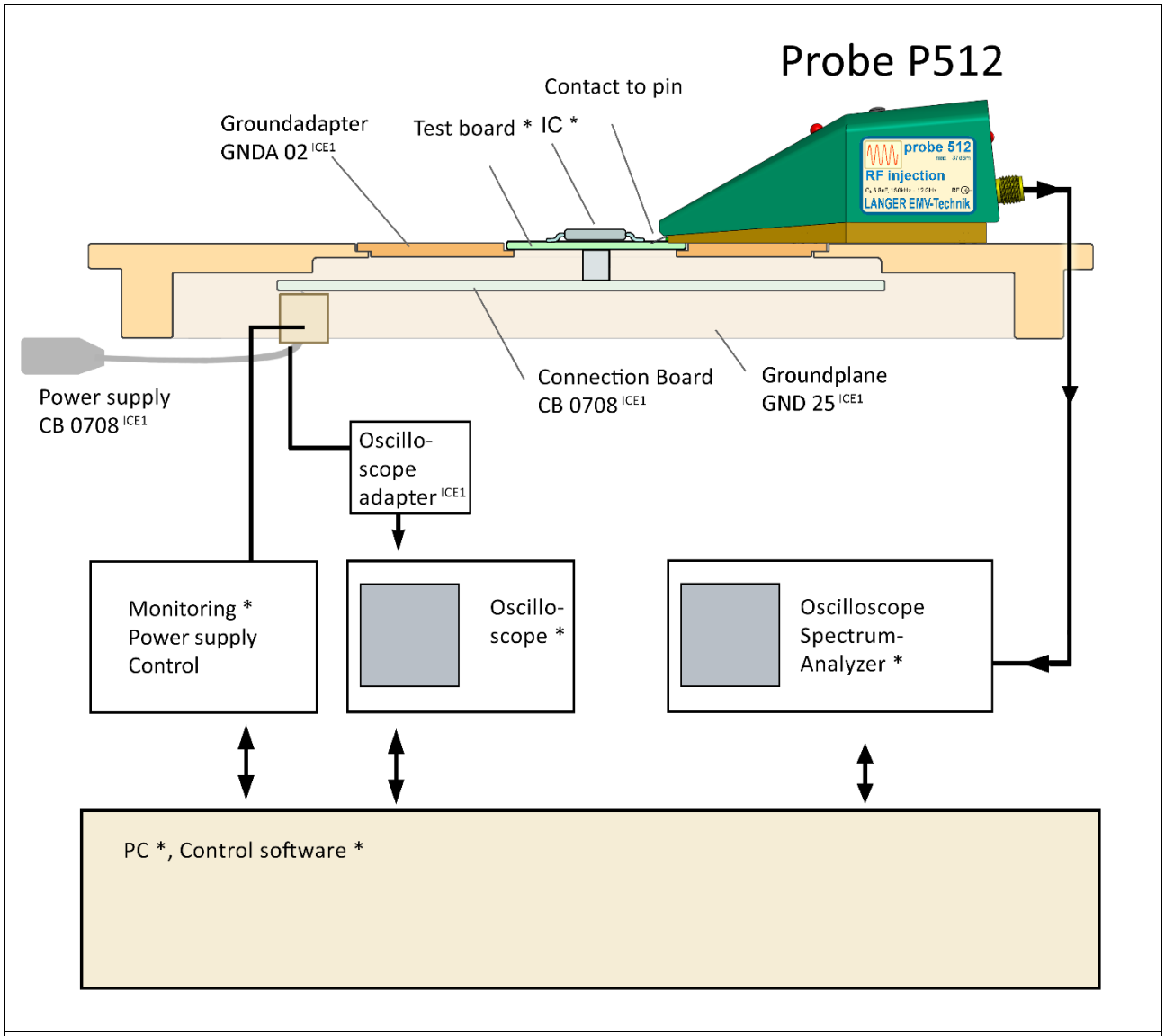


Figure 7: Measuring set-up with ICE1 set (* not included in the scope of delivery of the P512 set and ICE1 included in the ICE1 set)

Figure 7 shows the measurement setup for DPI measurement with the P512 set. Components from the ICE1 set (IC test environment) from Langer EMV-Technik GmbH are also required for the measurement setup.

The circuit to be tested (IC/DUT) is mounted on the test board. This test board is connected to the CB 0708 Connection Board. The test board is inserted in the GNDA 02 ground adapter, which is located in the GND 25 ground plane.

The GND 25 and the GNDA 02 are the ground reference of the measurement setup.

The P512 is placed on the GND 25 for measurement. The base of the P512 housing has magnets to fix the probe to GND 25.

During the measurement, all pins of the IC can be individually contacted with the P512. The RF power is fed into the IC pin via the coupling network of the P512 and via its pin contact.
The forward and reverse power is measured using a power meter between the power amplifier and the P512 probe.

This allows measurements to be carried out in accordance with the IEC 62132-4 standard (Figure 8 and Figure 9).

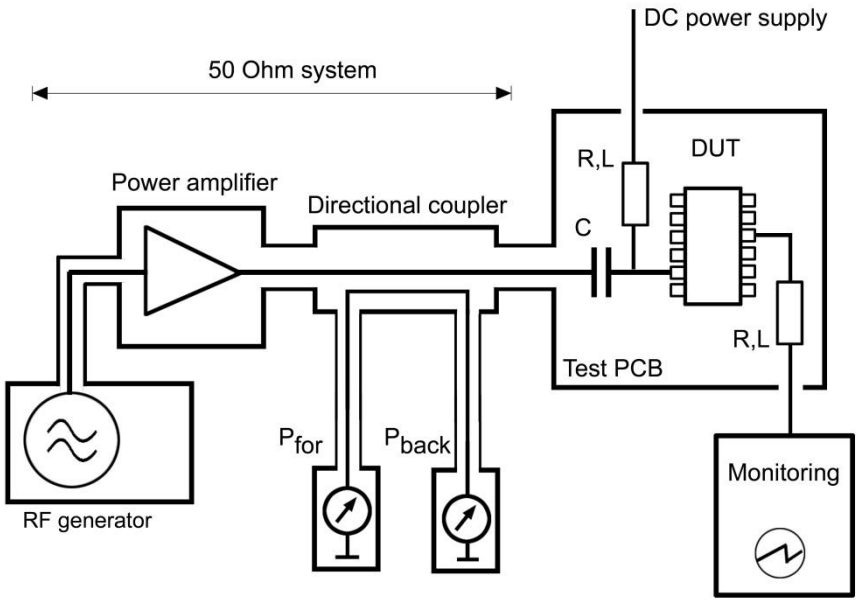


Figure 8: DPI measurement setup according to standard IEC 62132-4

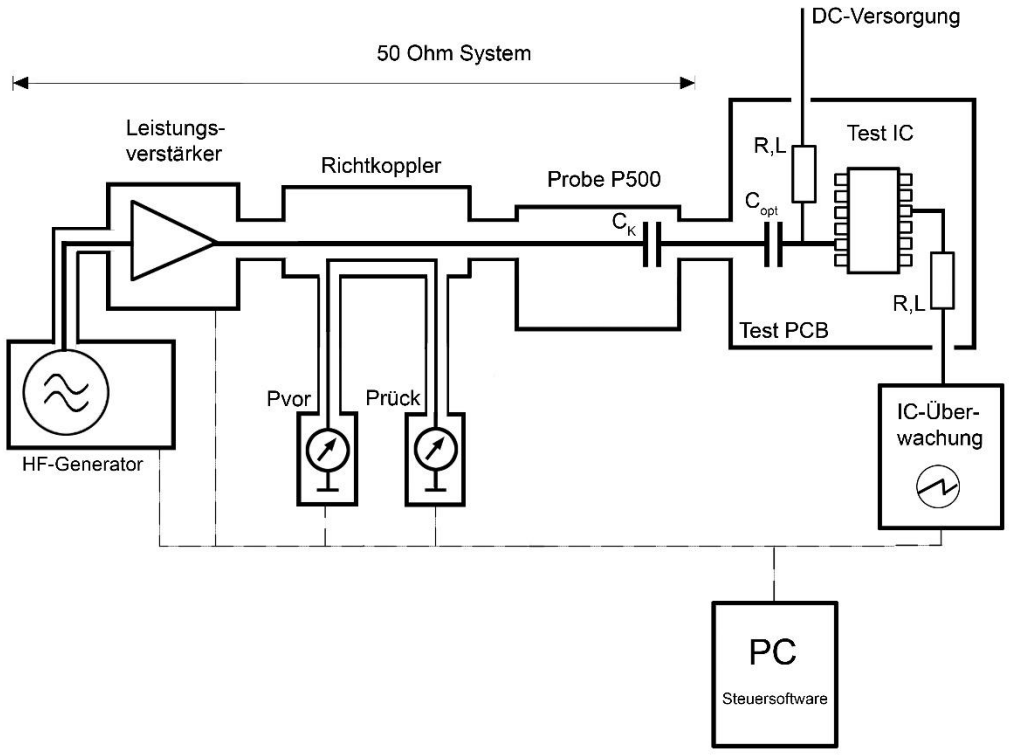


Figure 9: DPI measurement set-up with probe P512

7.2 Measurements of RF signals (P512 HF-T set)

Figure 10 shows the P512 probe in use as an RF probe head. Components from the ICE1 set (IC test environment) from Langer EMV-Technik GmbH are also required for the measurement setup.

The test board is assembled with the circuit to be tested (IC/DUT). The test board is connected, for example, to the CB 0708 Connection Board (optional) or a customer-specific solution. The test board is inserted in the GNDA 02 ground adapter, which is located in GND 25.

The GND 25 and the GNDA 02 are the ground reference of the measurement setup.

The P512 is placed on the GND 25 for measurement. The base of the P512 housing has magnets to fix the probe to the GND 25.

The P512 probe is connected to a corresponding RF measuring device.

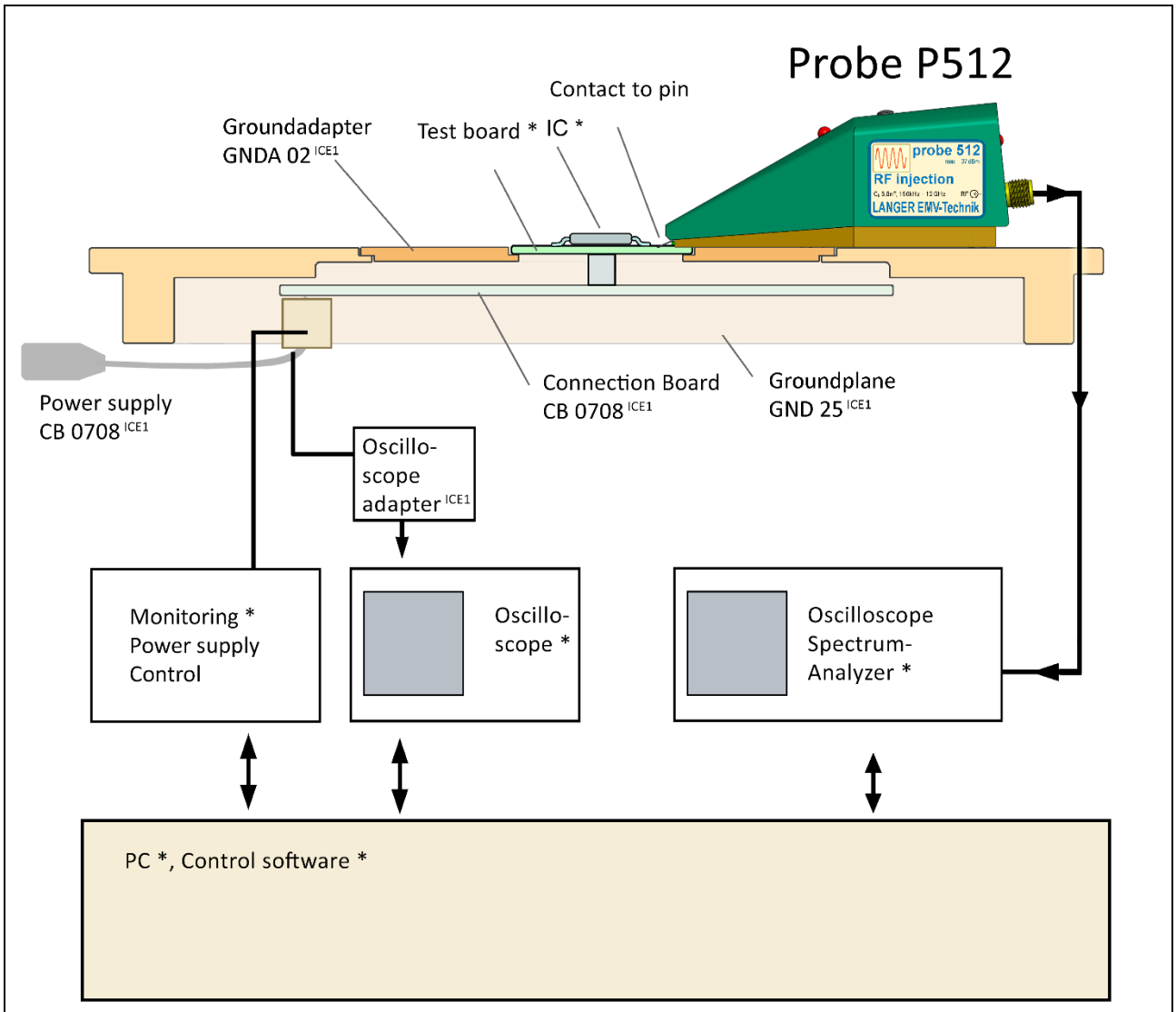


Figure 10: Using the P512 set as a 50 Ohm RF probe (* not included in the scope of delivery of the P512 set and ICE1 included in the ICE1 set)

Other standard oscilloscope probes (not included in the scope of delivery) can be used in the measurement setup with the TH22 (probe holder) supplied in the ICE1 set

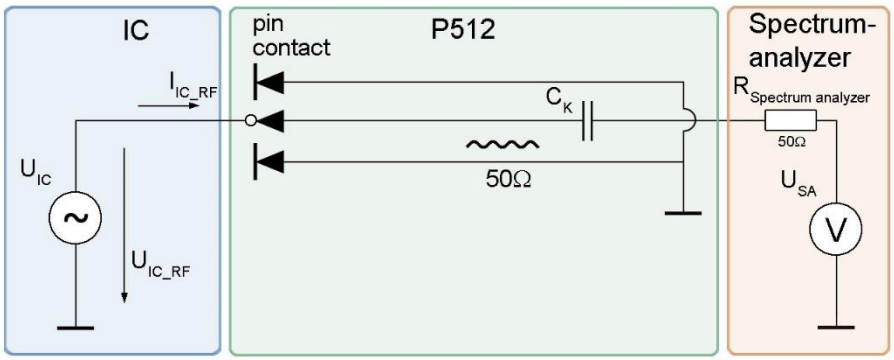


Figure 11: Equivalent circuit for RF measurements with the P512 probe as a probe in combination with a spectrum analyzer

8 Technical Parameters

8.1 P512 Probe

Frequency range	Bis 12 GHz
Input matching	< -10 dB @ 12 GHz see (Figure 12)
Insertion loss	> -3 dB @ 12 GHz see (Figure 12)
Coupling capacity (C_K)	6.8 nF *
Max. forward power	9 W≡39,5dBm (Figure 13)
Power supply voltage	12 V / DC
Weight	39 g
Connector	50 Ω / SMA
Dimensions (L x B x H)	(82x35x32) mm

Table 2: P512 technical parameters

* Customer specific - CK refer to label on the respective probe

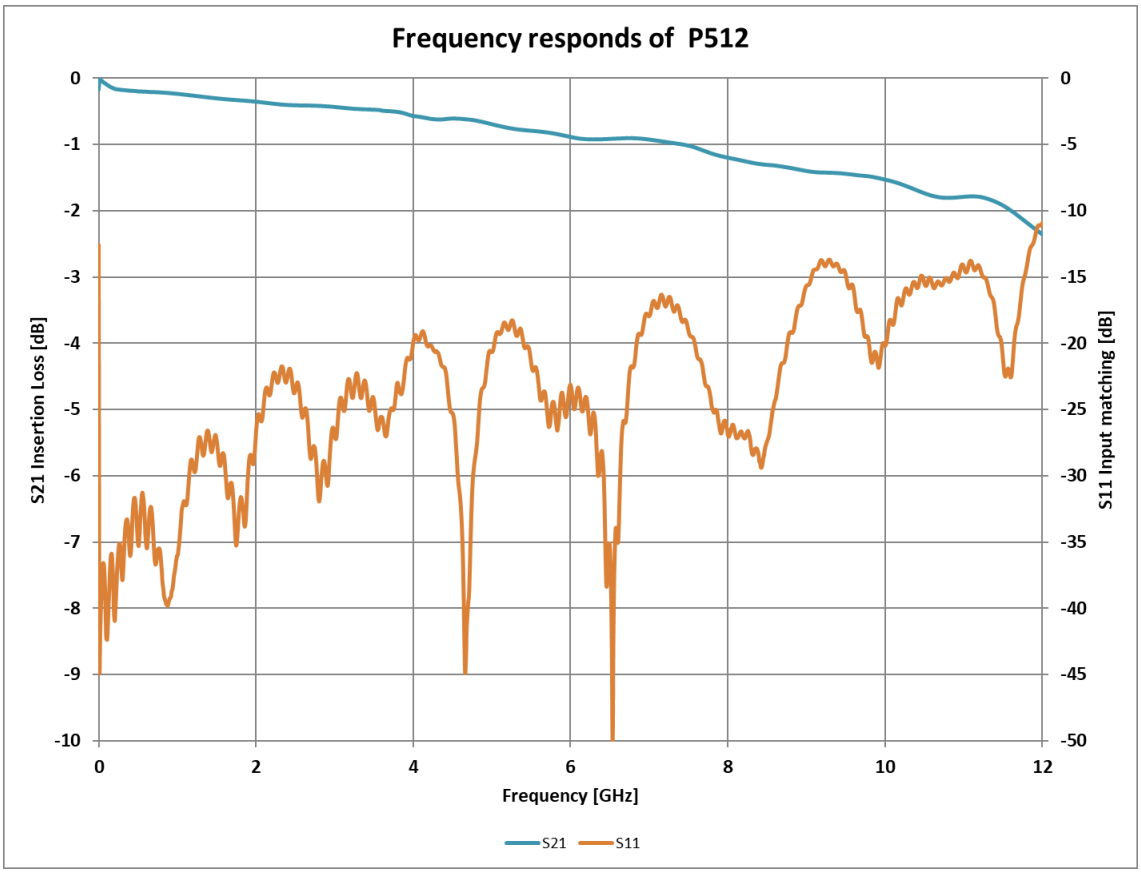


Figure 12: Frequency responds of probe P512

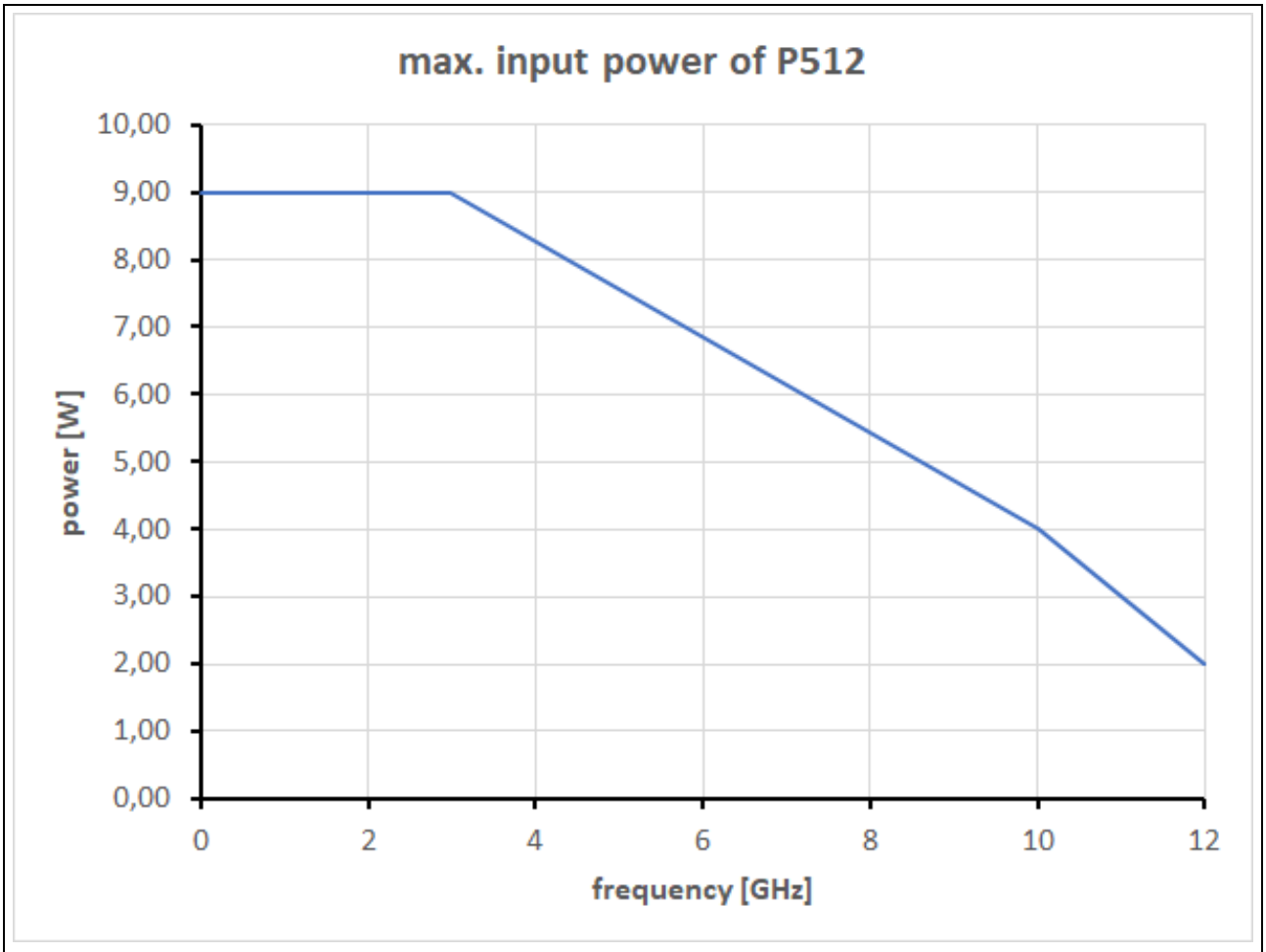


Figure 13: Diagram of maximum input power (determined with mismatch at probe tip)

8.2 Housing and probe tip dimensions

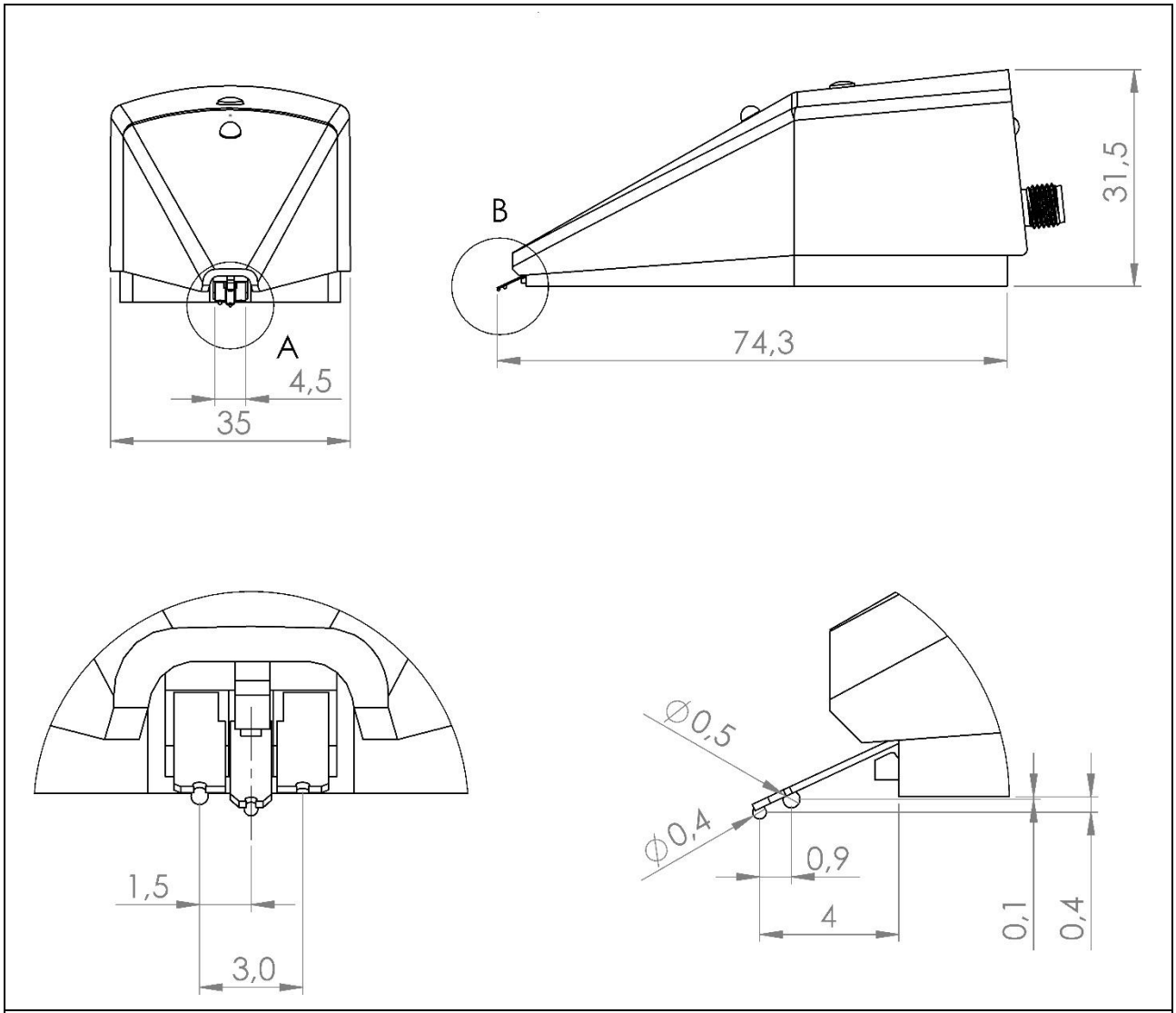


Figure 14: Specification of housing and tip dimensions

9 Information on Recycling and Disposal

In accordance with the WEEE Directive 2012/19/EU (Waste of Electrical and Electronic Equipment), the following must be observed:

At the end of its service life, this product should be taken to a suitable disposal facility for recycling and disposal. Do not dispose of with household waste.

10 Customer service

Please contact us if you have any questions, comments or suggestions.

You can contact us:

Monday – Friday
8:00 Uhr bis 15 Uhr (CET)

Contact us at:

Address: Langer EMV-Technik GmbH
Nöthnitzer Hang 31
01728 Bannewitz
Germany
Internet: https://www.langer-emv.com/

E-mail: mail@langer-emv.de

Phone: +49 (0) 351-430093-0

Fax: +49 (0) 351-430093-22

Calibration

We recommend having the product calibrated every two years by the manufacturer Langer EMV-Technik GmbH or by a certified distributor.

11 Warranty

Langer EMV-Technik GmbH shall remedy all defects attributable to material or manufacturing faults within the statutory warranty period by repairing the product or supplying replacement parts.

This guarantee is only granted on condition that:

- the information and instructions in the operating instructions are observed.

The guarantee expires if:

- an unauthorized repair is carried out on the product
- the product is modified
- the product is not used as intended