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ICI-DP sets

Double Pulse Magnetic Field Source sets

available as:

- ICI-DP HH150-15 set, size of probetip 150 µm
- ICI-DP HH250-15 set, size of probetip 250 µm
- ICI-DP HH500-15 Set, size of probetip 500 µm
- ICI-DP HH1000-15 set, size of probetip 1000 µm

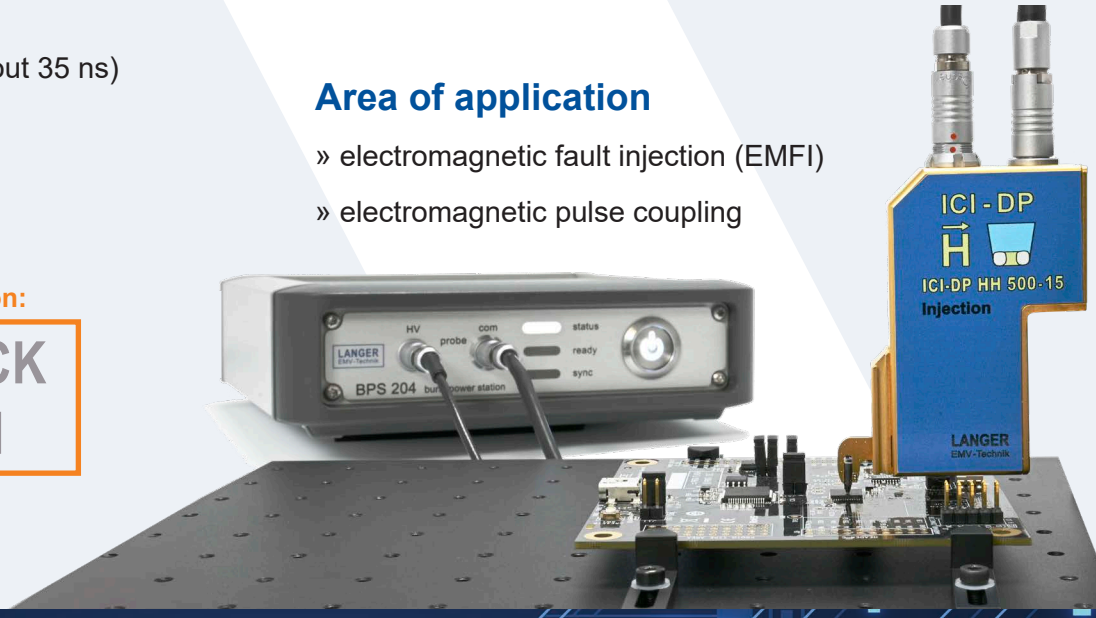
Unique Selling Point:

- high voltage up to 1000 V
- magnetic field probe tips down to 150 µm coil diameter (150 µm, 250 µm, 500 µm, 1000 µm)
- all probe tips spring loaded
- double pulse sequence with variable delay down to 25 ns
- high similarity of both pulses
- all parameters controlable via software/ API including pulse polarity
- pulse rise time about 2 ns
- low trigger to pulse delay (about 35 ns)

Area of application

» electromagnetic fault injection (EMFI)

» electromagnetic pulse coupling



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More variety of ICI-DP probe tips for electromagnetic fault injection (EMFI)

Langer EMV-Technik GmbH has been offering the ICI series for fault injection into cryptographic circuits and protocols for several years. This has now been extended with the ICI-DP series. In addition to a stronger disturbance effect, the new system now also offers the possibility to generate two disturbance pulses in quick succession.

In addition to the improved disturbance parameters, Langer EMV-Technik now also offers different probe tips. Tip diameters of 1000 µm, 500 µm, 250 µm, and even 150 µm are available.

While the two larger probe tips (500 µm & 1000 µm) are mainly designed for attacks on encapsulated circuits, the two small probe tips (250 µm & 150 µm) allow for very precise localized fault injection into decapped circuits. The following figure shows an example of a chip with an edge length of 4 mm and a possible positioning of the different ICI-DP probe tips. The significantly increased spatial resolution of the small probe tips is clearly visible.

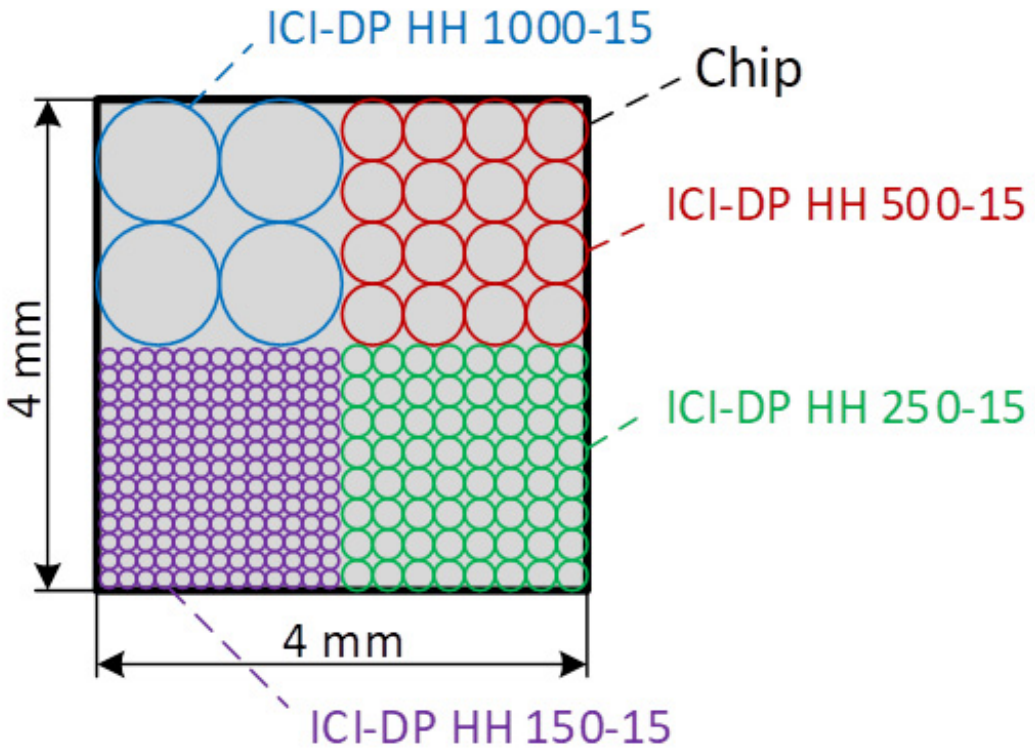

Figure 1: Comparison of the different ICI-DP probe tips

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The product range of Langer EMV-Technik GmbH is completed by different tip types, i.e. the dimensions of the probe tip in relation to the housing. While the standard tip type 01 is close to the housing, tip type 02 offers more space both laterally and downwards. Tip type 03 is designed for users who require extra space at the bottom. Other customized tip types are available upon request. All tip types can also be ordered for the ICI series.

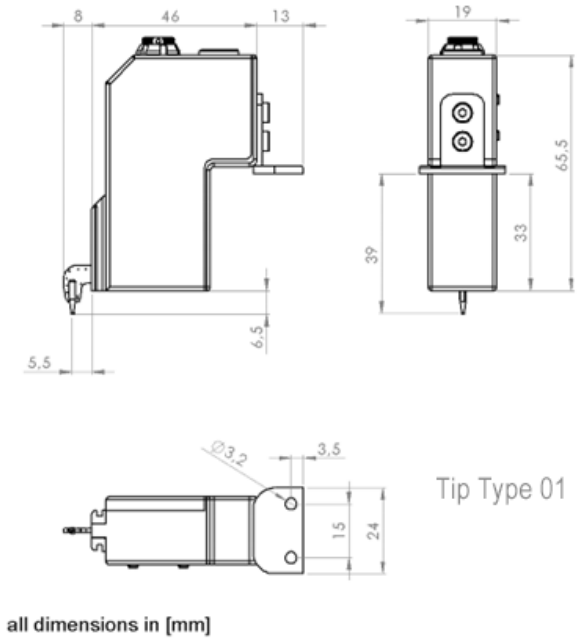

Figure 2: Tip Type 01

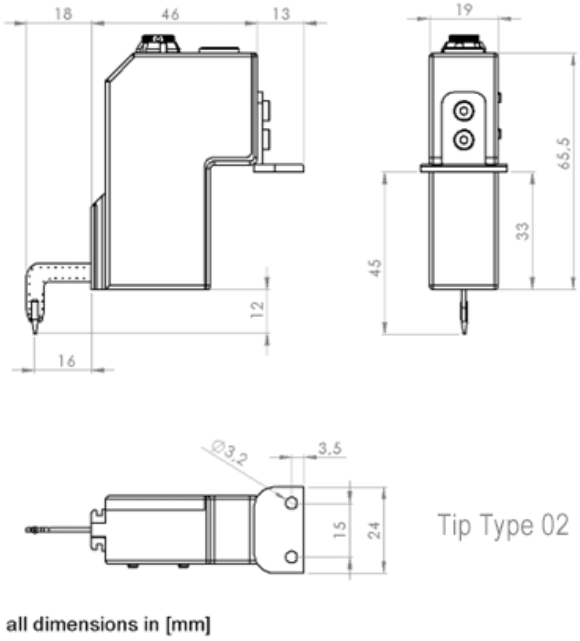

Figure 3: Tip Type 02

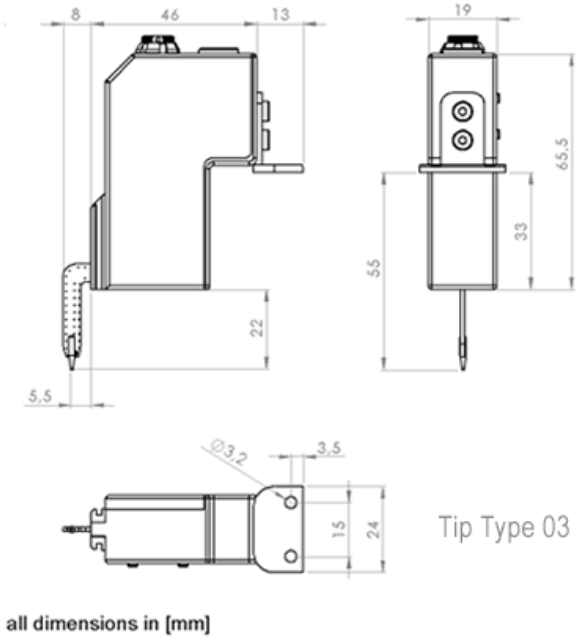

Figure 4: Tip Type 3

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ESA1 set

Emission Development System

The ESA1 is a system of EMC tools for measuring the interference of assemblies and devices. The CS-ESA software allows the developer to quickly and comprehensively suppress interference affecting the DUT. Interference measurements taken during the development stage with ESA1 are proportional to the results from far-field measurements or from measurements with artificial networks. With the ESA1 tools disturbance sources can be localized, effects can be detected, and EMC measures individually determined. The effects of improvements implemented by ESA1 are proportional to the results from far-field measurements. ESA1 is designed for use at the developer's working place.

Scope of delivery

1x CS-ESA set, ChipScan-ESA Software / USB
1x Dongle, Licence Dongle
1x HFW 21, RF Current Transformer
1x HFA 21, RF Bypass
1x Z23-1 set, Shielding Tent (900 x 500x 400) mm
1x PA 203 BNC, Preamplifier 100 kHz up to 3 GHz
11x RF near-field 30 MHz up to 3 GHz

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ESA1 set

ESA1 set – Application example: Troubleshooting emission problems on electronics

The PCB to be troubleshooted (DUT) is a microcontroller board with two cables connected. The first cable is used for the voltage supply, the second one is used for the connection to a communication partner via a serial interface.

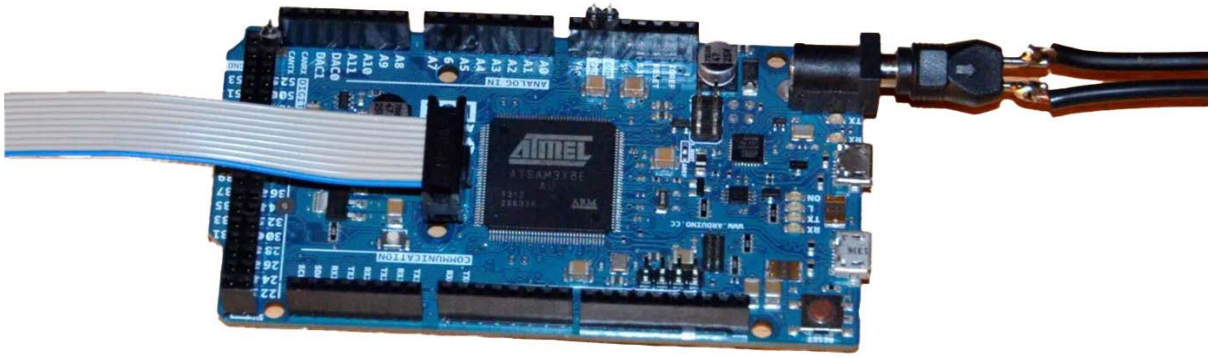

Figure 1: DUT - Electronics with interference emission problems

The radiated emission of this board and its cables was measured with an antenna in the far field and has the following spectrum:

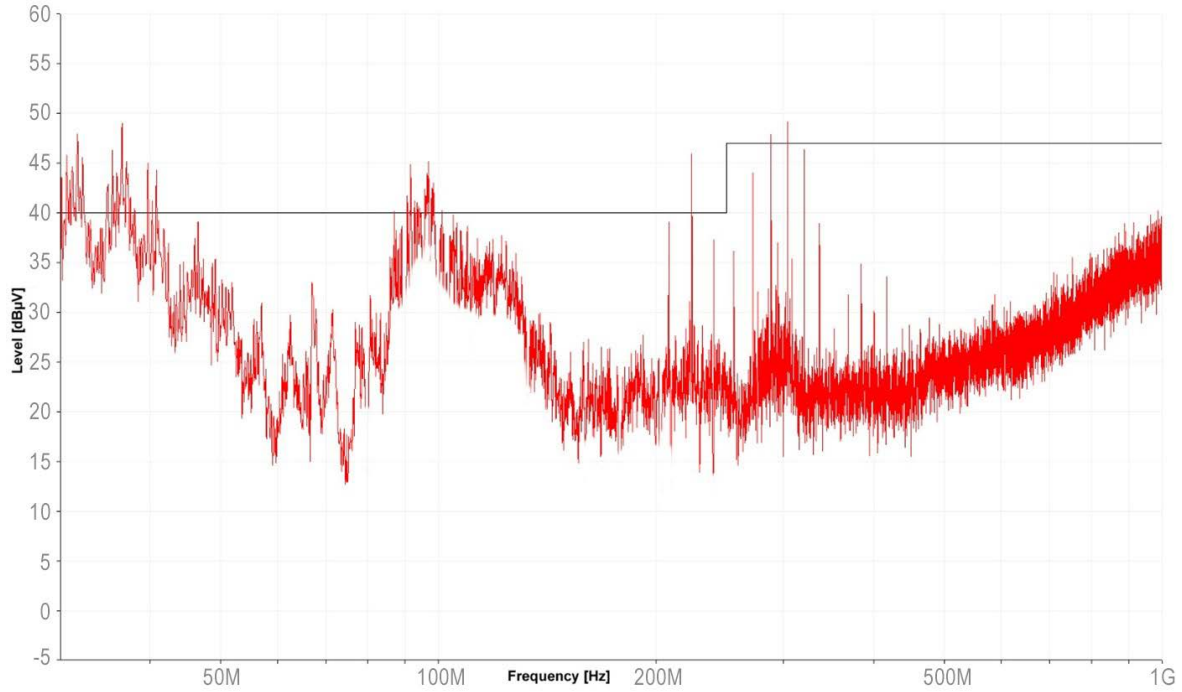

Figure 2: Radiated interference in the far field - spectrum of the antenna measurement

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The spectrum shows several limit violations. The emission problem can now be solved directly in the hardware designer's workplace, without having to go back to a laboratory for far-field measurements.

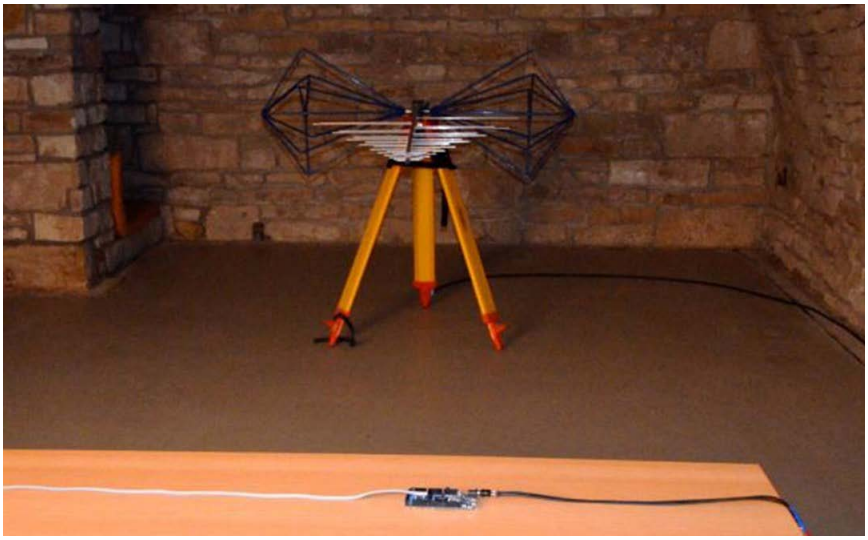

Figure 3: Setup of the far-field measurement - antenna at a distance of 3 m from the circuit board

Step 1: Reproduction

The ESA1 set from Langer EMV-Technik GmbH is used for troubleshooting and can be set up directly at the hardware designer's desk. The circuit board is placed on the base plate of the shielding tent and the DUT is supplied with power via the HFW 21.

The HFW 21 is an RF current transformer. It measures the high-frequency excitation currents from the DUT that cause the antenna, consisting of cables and PCB, to radiate.

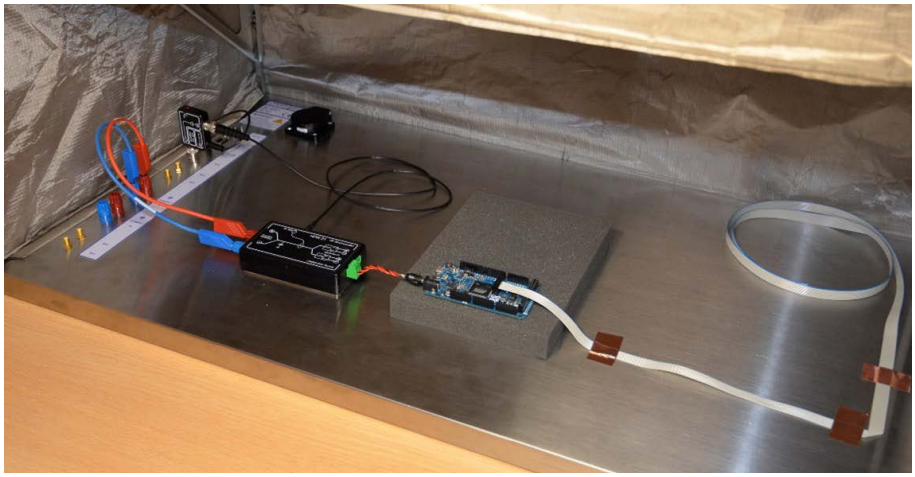

Figure 4: ESA1 measurement - measurement setup with HFW 21

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The measured spectrum is recorded with the tent closed and differs slightly from the emission spectrum of the antenna measurement due to the set-up. Nevertheless, the measurement results are proportional to each other.

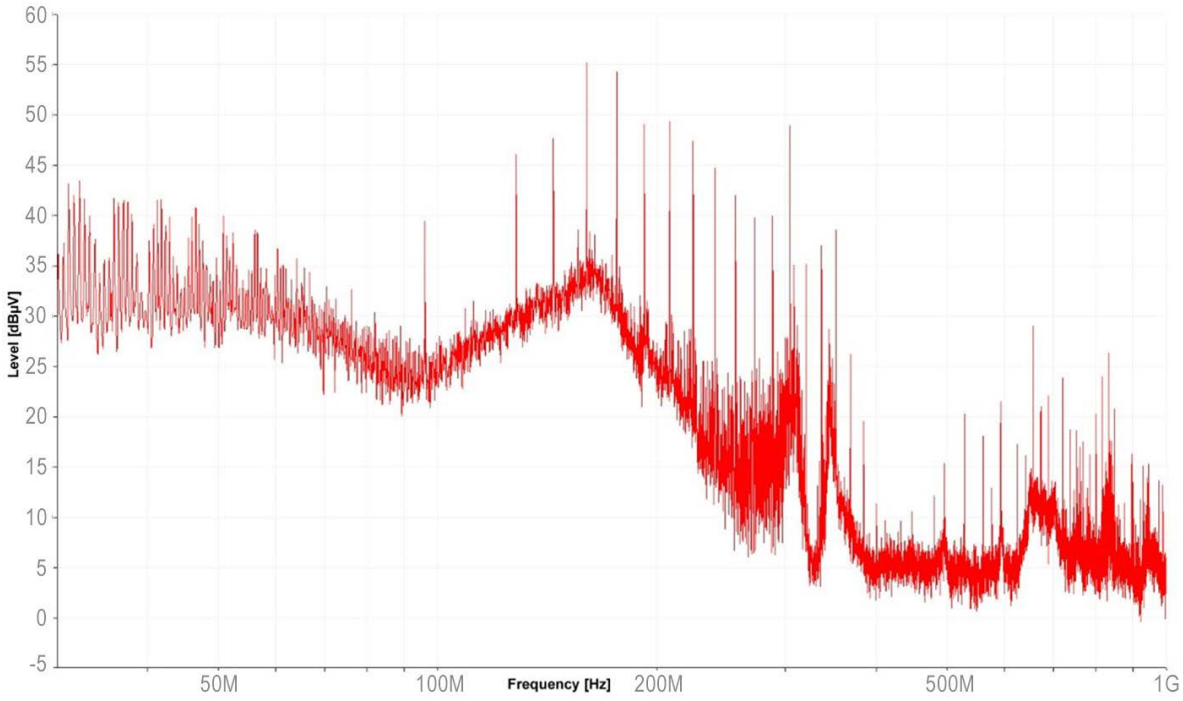

Figure 5: ESA1 measurement - spectrum recorded with the HFW 21

Step 2: Investigation and modification

To locate the RF sources on the DUT, near-field probes are used in the open tent.

Using an E-field probe, a strong electric RF field can be measured around the coil of the DC-DC converter. The communication cable is placed directly above the coil (Figure 1). Disturbances are coupled into the communication cable via the electric field. The harmonics of the 500 kHz clocked DC/DC converter exceed the limit by 5 dB in the 100 MHz range in the antenna measurement (Figure 2). The ESA1 set measurement should therefore reduce the interference by more than 5 dB (preferably 10 dB).

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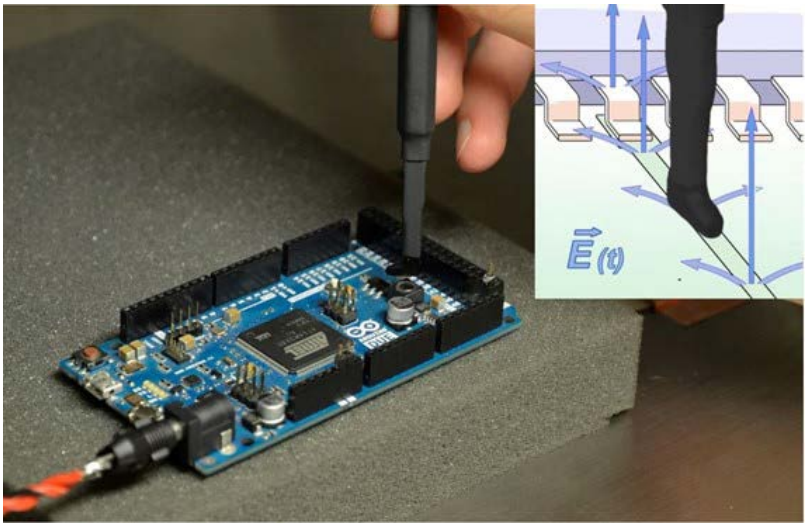

Figure 6: Use of an E-field probe to localise RF sources

To confirm this assumption and to reduce the electrical field coupling, a shield is placed over the coil of the DC/DC converter and connected to the GND of the electronics.

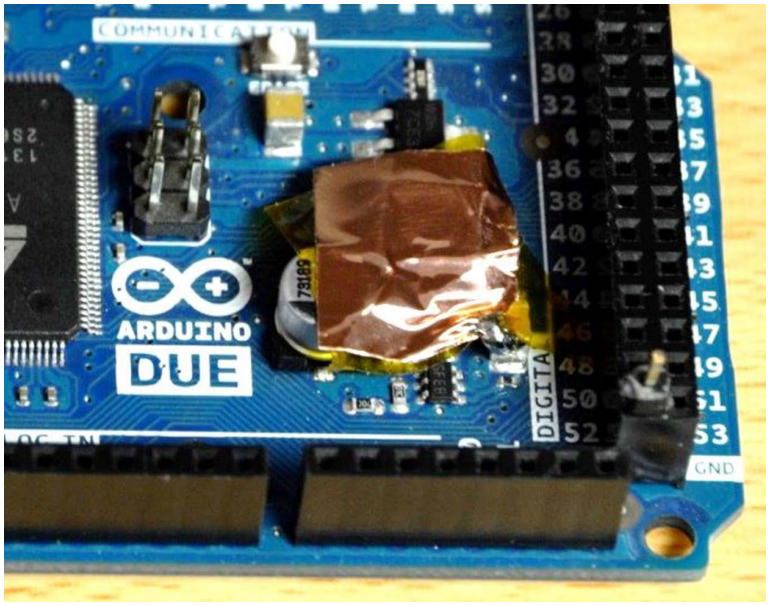

Figure 7: Shielding the choke with copper tape

A magnetic field probe is used to identify the clock line of the serial interface in the ribbon cable as a source of interference (Figure 8). The spikes are in the frequency range between 200 MHz and 400 MHz and correspond to the frequencies in the antenna measurement (Figure 2).

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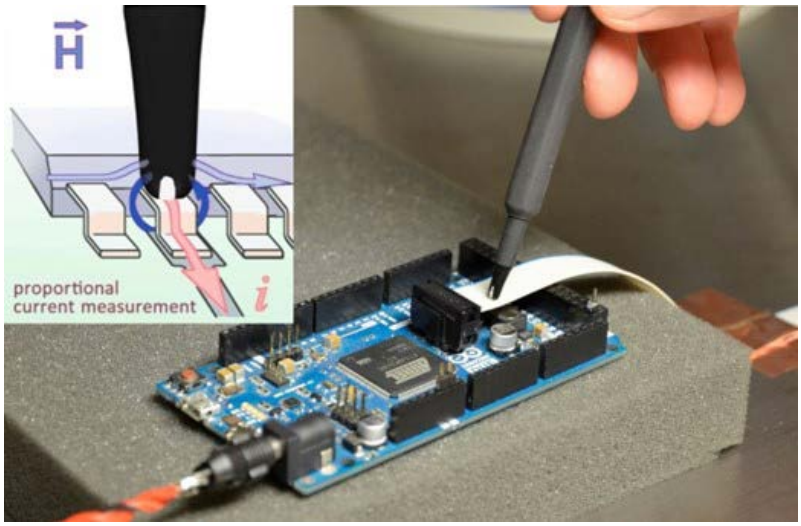

Figure 8: Use of a magnetic field probe to localise RF sources

To reduce the spikes, a 47-pF filter capacitor is added to the clock line.

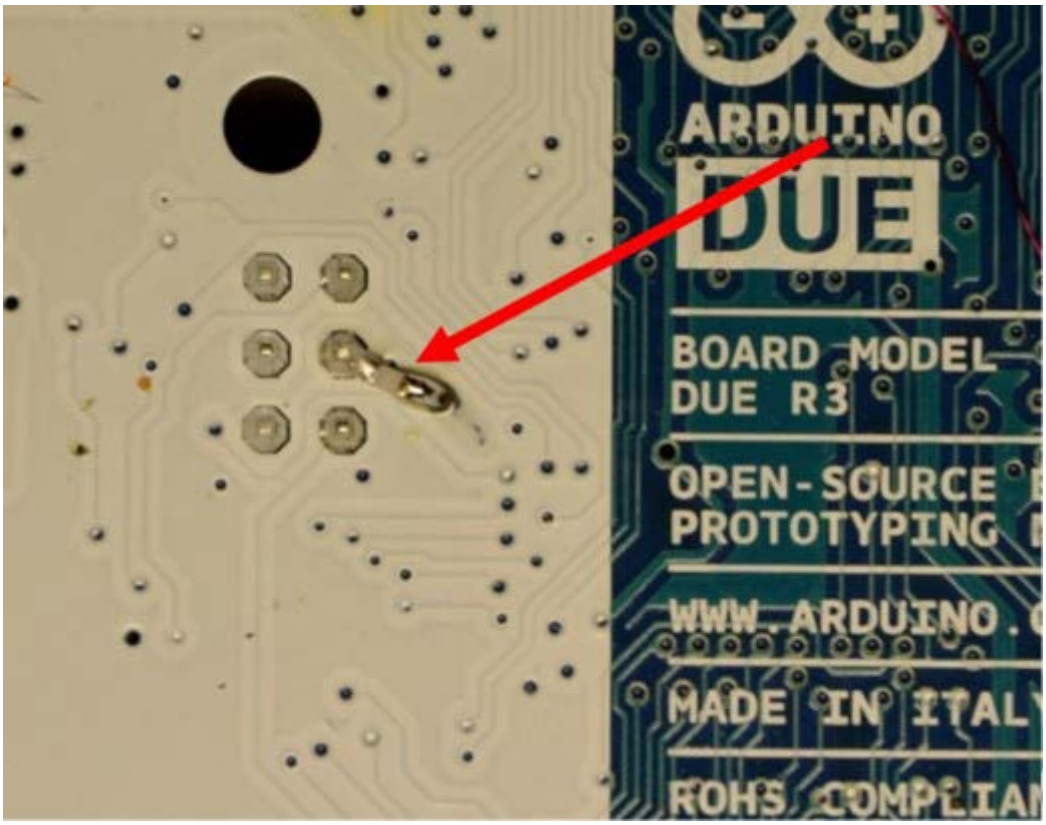

Figure 9: Additional capacitor on the clock line of the ribbon cable

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Step 3: Verifying the effectiveness

The effectiveness of the modifications is checked with an HFW 21 measurement in a closed tent. The intensity of the high-frequency excitation currents in the supply cable has been successfully reduced (Figure 10). The shielding of the coil mainly reduces the broadband interference in the lower frequency range, while the capacitor on the clock line reduces the spikes. With this knowledge, another antenna measurement can now be carried out.

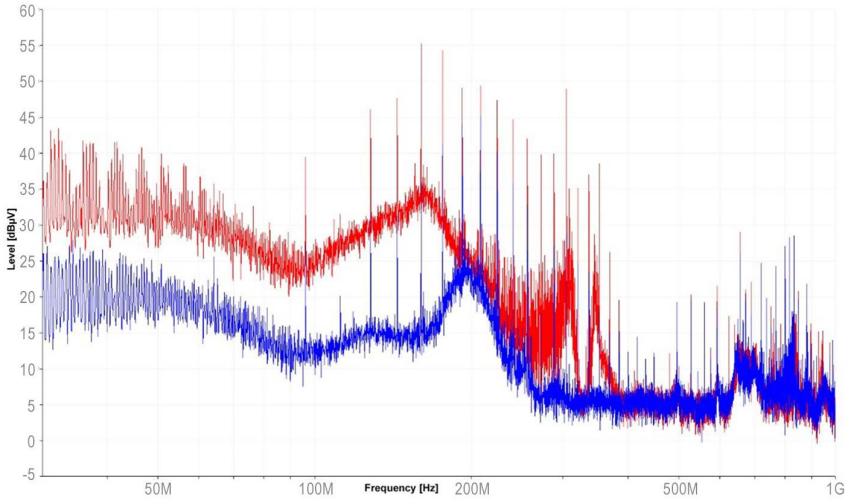

Figure 10: Comparison of the spectra of the antenna measurement (red - unmodified, blue - with modifications)

The limit is no longer exceeded (Figure 11). The EMC problem is finally solved once a feasible implementation of the modifications has been found. In the case of the coil for instance, this can be done by changing the mounting position.

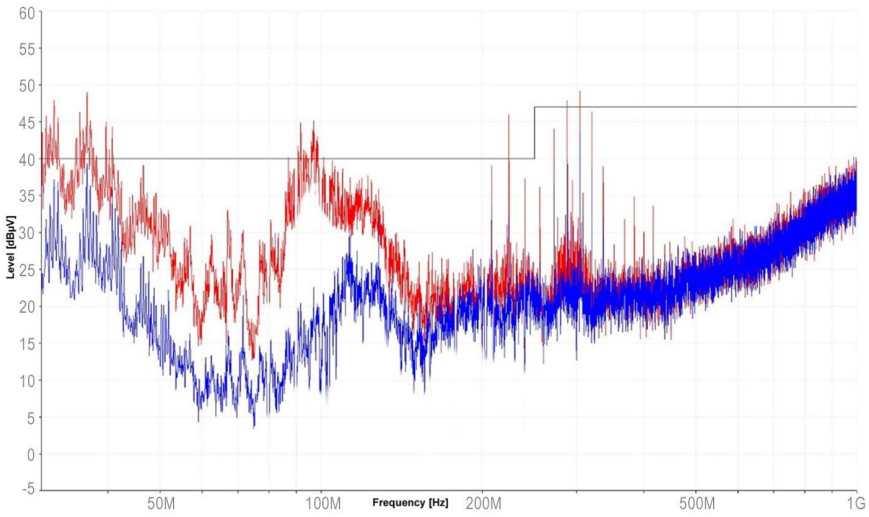

Figure 11: Comparison of the spectra of the antenna measurement (red - unmodified, blue - with modifications)

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