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Custom-made electronics

Webinar

Importance of EMC in an electronics design

The
power to
control

FACTORY OF THE FUTURE

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WINNER OF THE 2022 AWARD

3rd
time



back by
popular
demand

webinar EMC
Wednesday 14.12.2022

Speaker: René Janssen
Sales Engineer

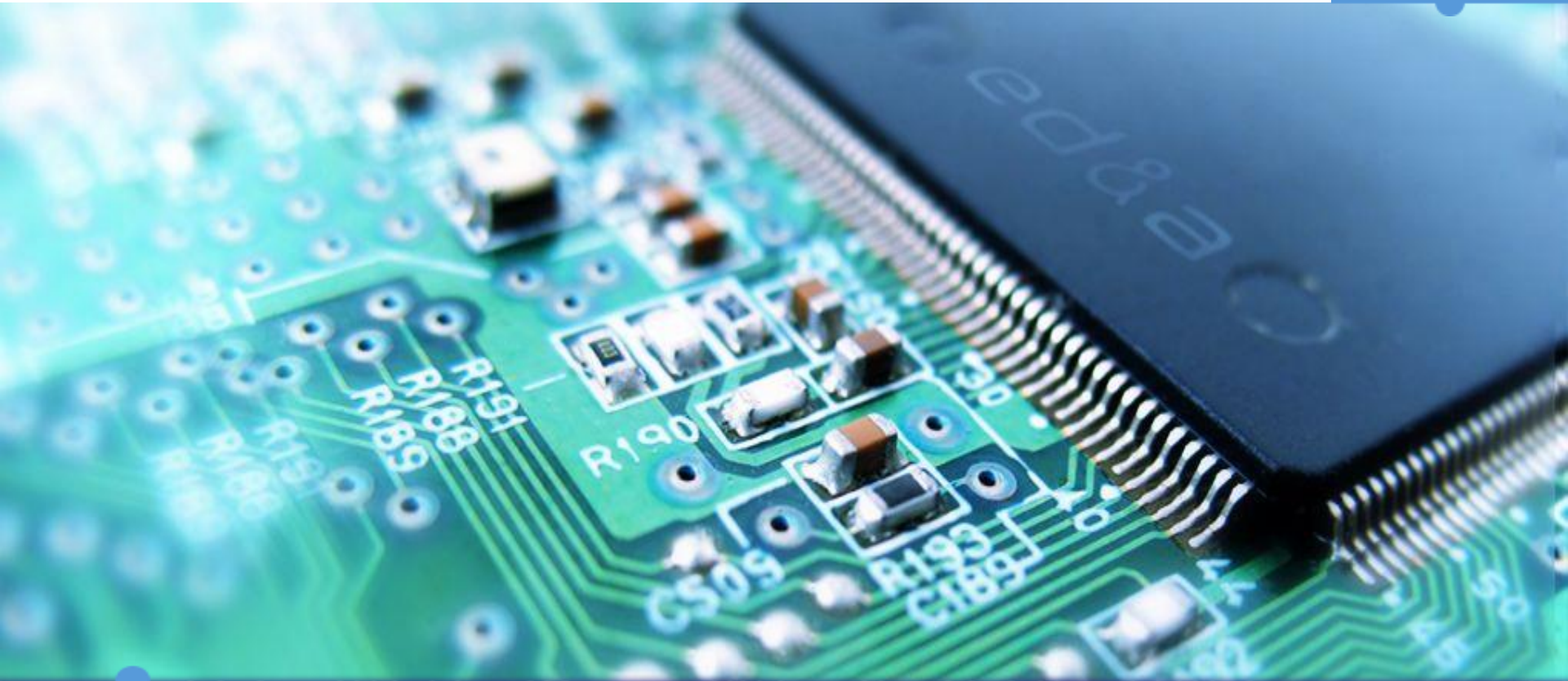
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Agenda

- **Presentation**
 - Intro E.D.&A.
 - What does EMC mean?
 - Typical use cases
 - Measurements
 - Internal vs external testing
 - Design improvements
- **Questions**

In general

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E.D.&A.

Electronics, Development & Assembly

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- Founded in 1981
- HQ Located in Belgium, Kalmthout (Antwerp)
- Sales office in Bonn, Germany
- 100+ employees (70% highly educated)
- Turnover +/- 30 million euro, export 75%
- E.D.&A. develops and produces custom-made electronic controllers for machines and appliances.
 - Industrial market
 - Consumer market



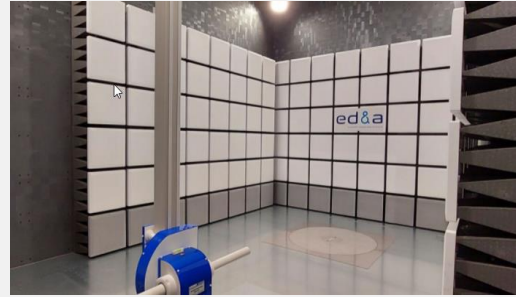
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Development/Design



Pre-compliance tests



Production/assembly



Five key values of E.D.&A.

The basis of our quality management system

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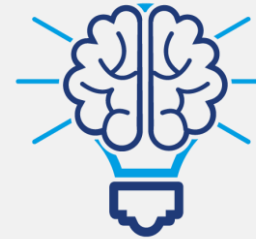
Teamwork



Customer-oriented



Quality



Innovation

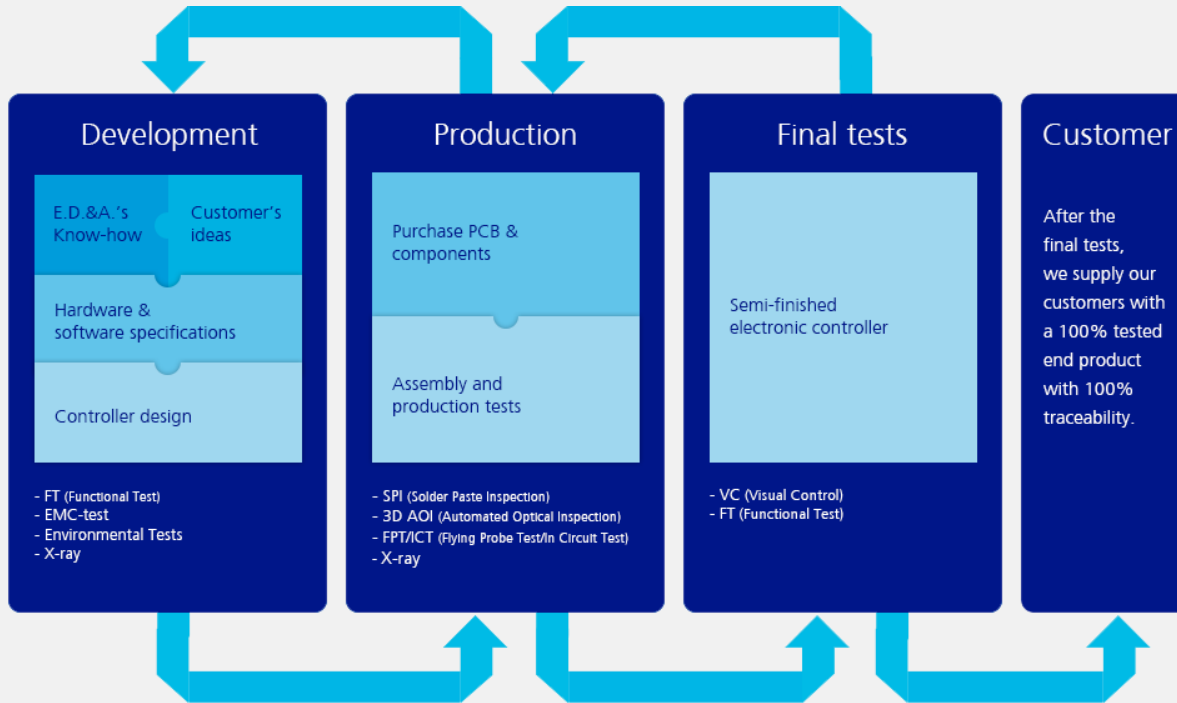


Respect



Working method: only 1 point of contact

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Custom-made electronics

Possible methods of cooperation

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Custom-made electronics for machines and appliances that are produced in series.

- “One-stop-shopping”: E.D.&A. takes care of the complete hardware & software, including housing, cabling, etc.
- “Co-development”: E.D.&A. develops hardware and software low level drivers. Customer takes care of the application software.

EMC

ElectroMagnetic Compatibility

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EMC

A practical take on black magic

EMC

Typical example



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EMC: What is it?

ElectroMagnetic Compatibility

- How much does your product radiate?
- Performance under external stimuli
- Related, yet different: radio-testing (RED)
 - WiFi, Bluetooth, LTE, etc.



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Why?

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- International regulations
 - EU: Directive 2014/30/EU
 - US: FCC part 15
- Prevent “weird stuff” from ever happening
- Validate product performance, i.e. murphy’s law



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How do we do it?

First time right for a new design

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- Define which standards are applicable for your product in the specification phase
- Design rules according these standards
- Design review with our EMC-experts
- First prototype
- Pre-compliance test session
- Design modifications
- Second prototype
- Pre-compliance verification
- External tests for certification (very small chance of failures)



Practical examples

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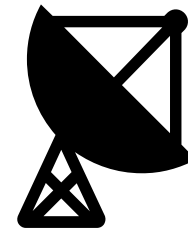


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Two facets

1. Emission

- Purpose:
 - Check whether EM radiation falls within limits
 - prevent unintended side effects to others
- What is not included?
 - Ionizing, optical and infrared radiation
 - Intentional radiation (RF transmitter)



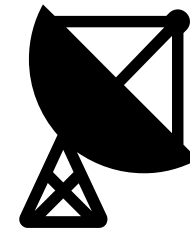
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Two facets

1. Emission: types



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- Radiated emission
 - measured with an antenna
- Conducted emission
 - On a cable



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Two facets

2: Immunity



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- Purpose:
 - determine vulnerability of a product
 - prevent unintended side effects **from** others
- What is not included?
 - DC phenomena
 - Effects of intentional jammers, military stuff, etc.
 - Etc.



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Two facets

2. Immunity: types

- Continuous signals
 - phenomena that are always present
- Transients
 - short pulses, effects of switching ops (ESD, power dips, lightning, etc.)



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The labs

EMC-room for conducted testing

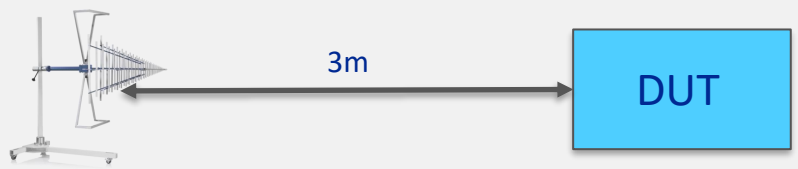
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The labs

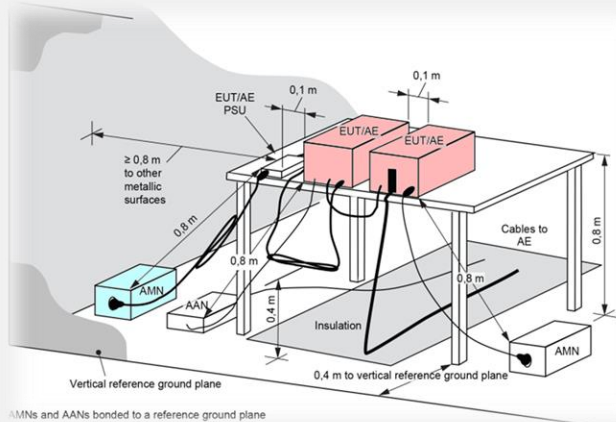
3M SAR (Semi Anechoic Room)

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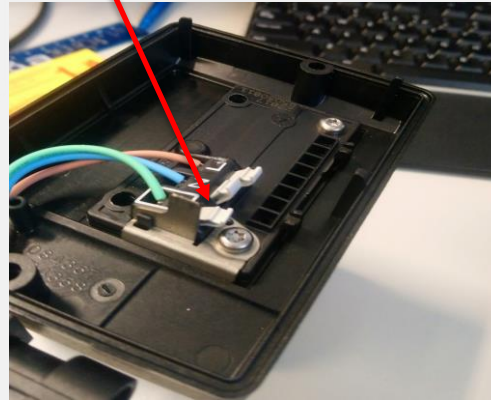


Conducted emission

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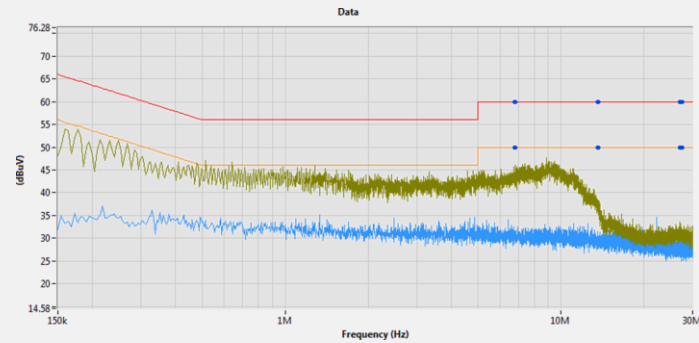
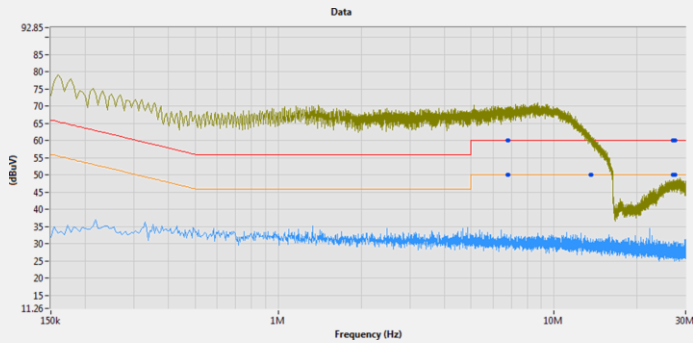
- Earthing connections
- Cable flows
- Shielding



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Conducted emission

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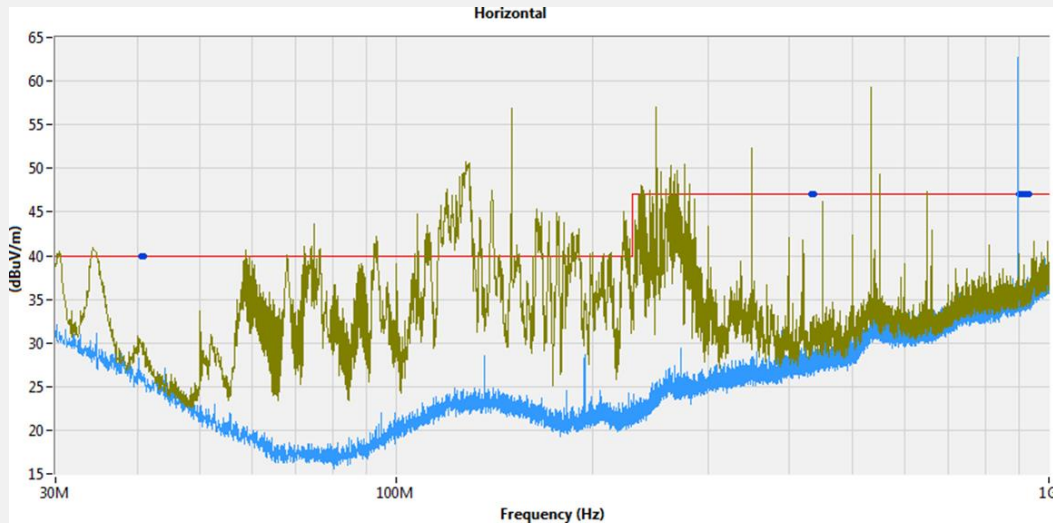


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Radiated emission

Test, debug and solving

Issue: High emission during pre-compliance testing



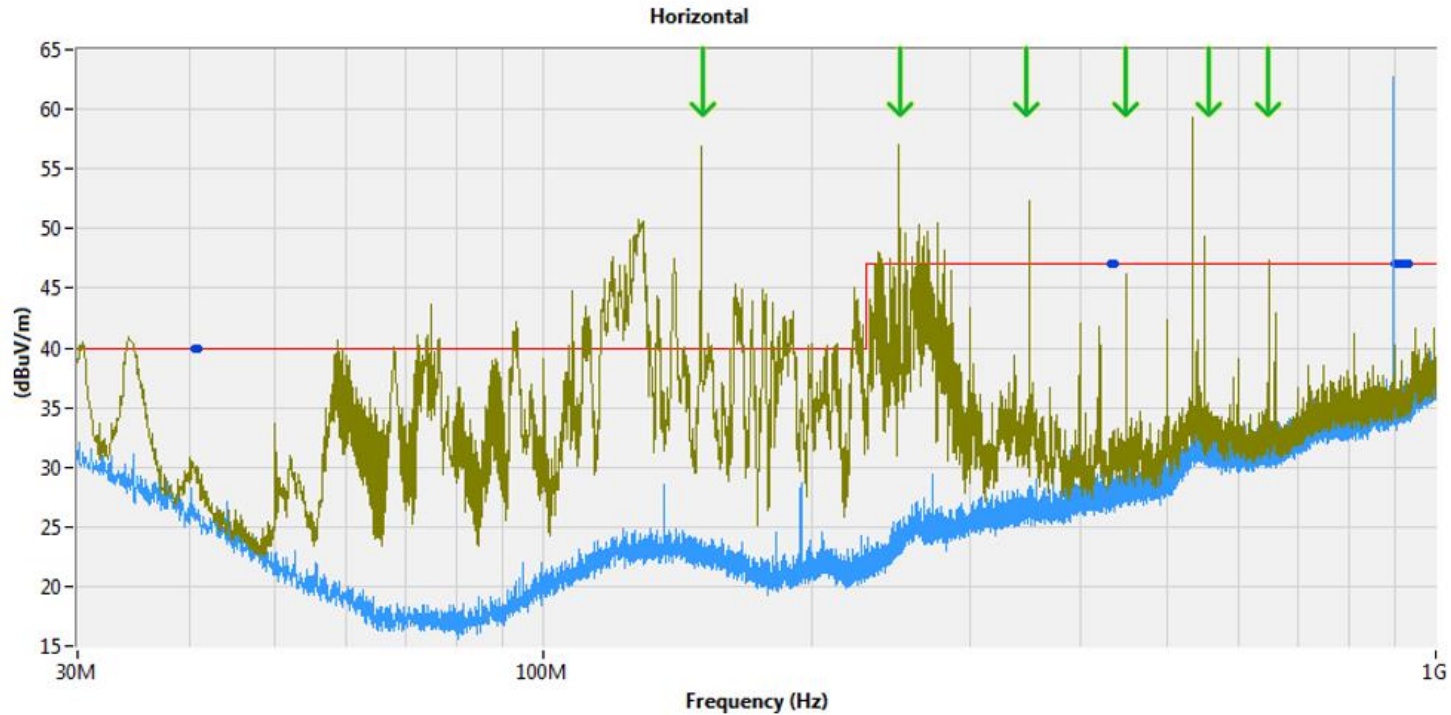
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Case study: radiated emission (1/3)

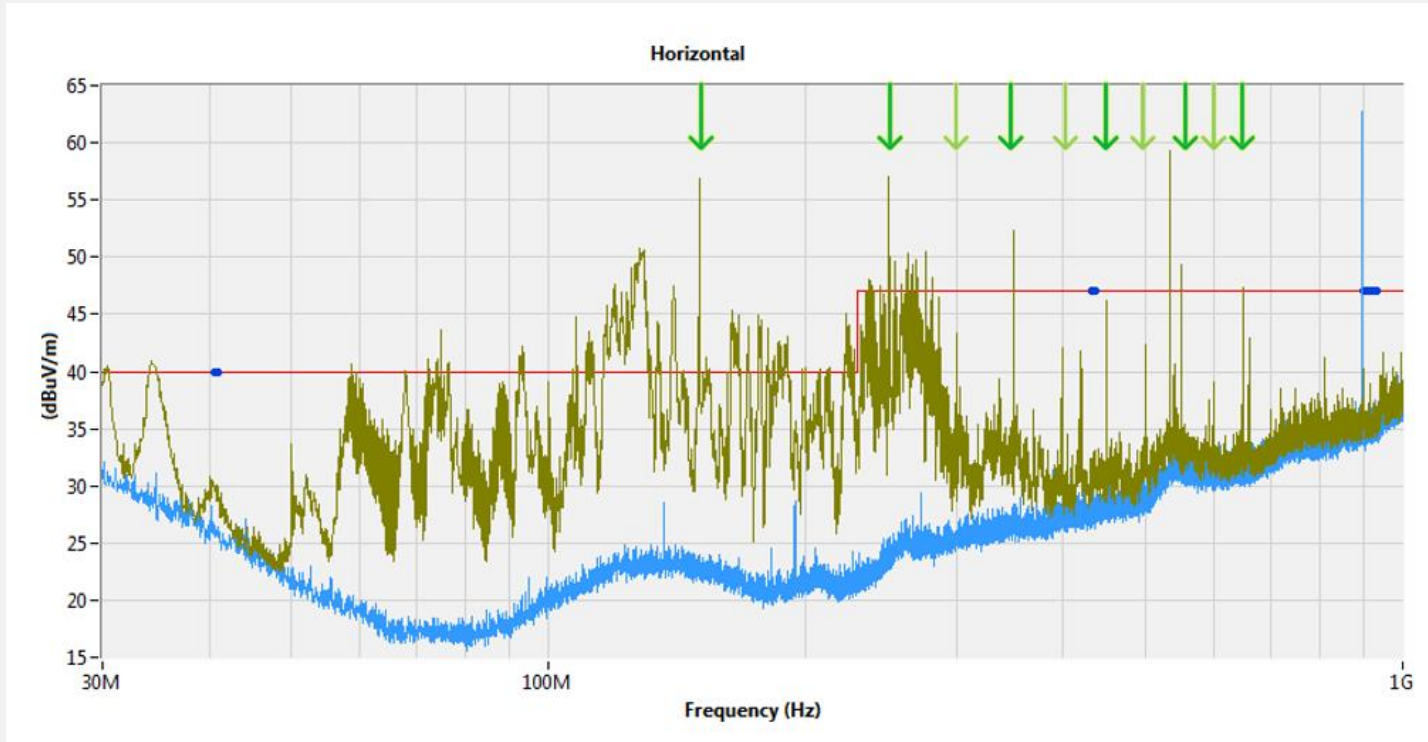
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Case study: radiated emission (2/3)

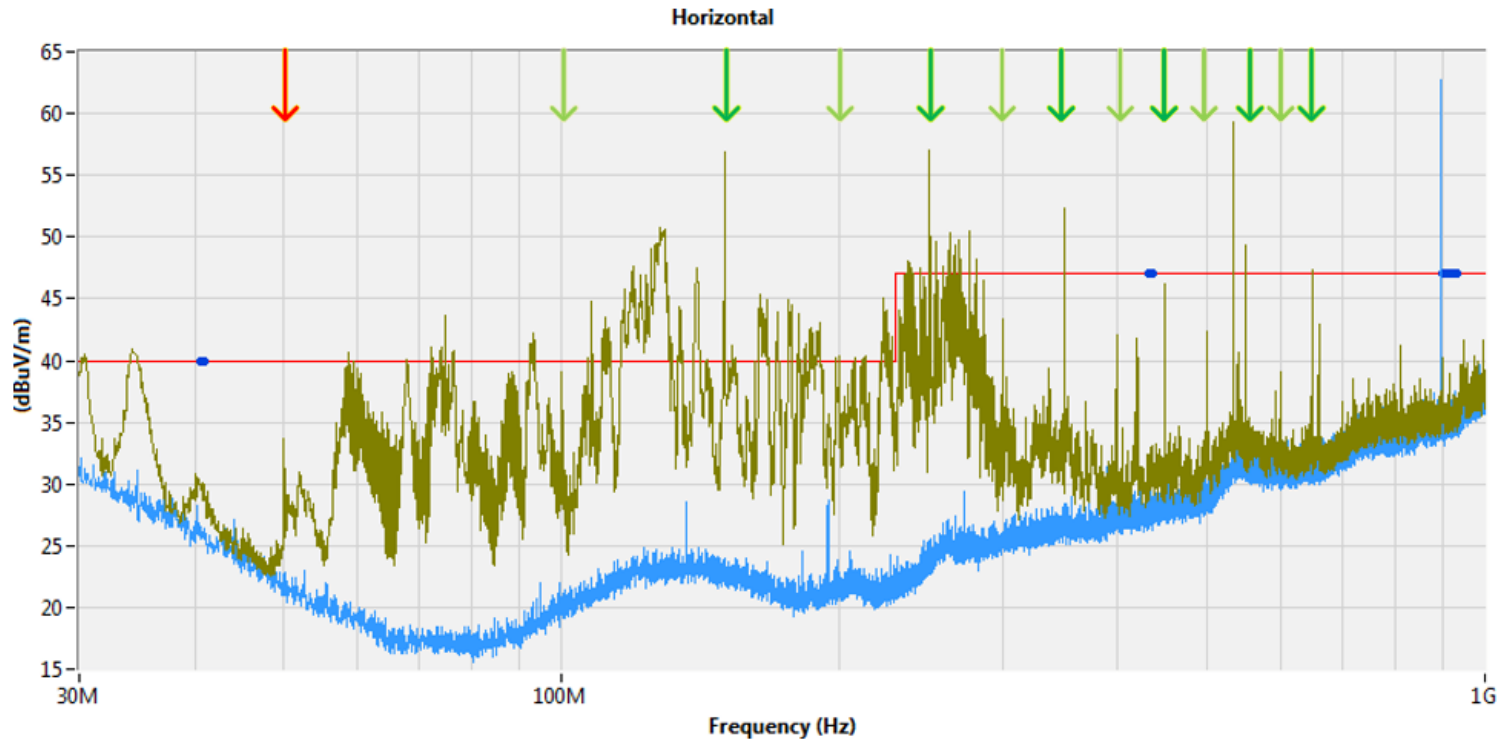
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Case study: radiated emission (3/3)

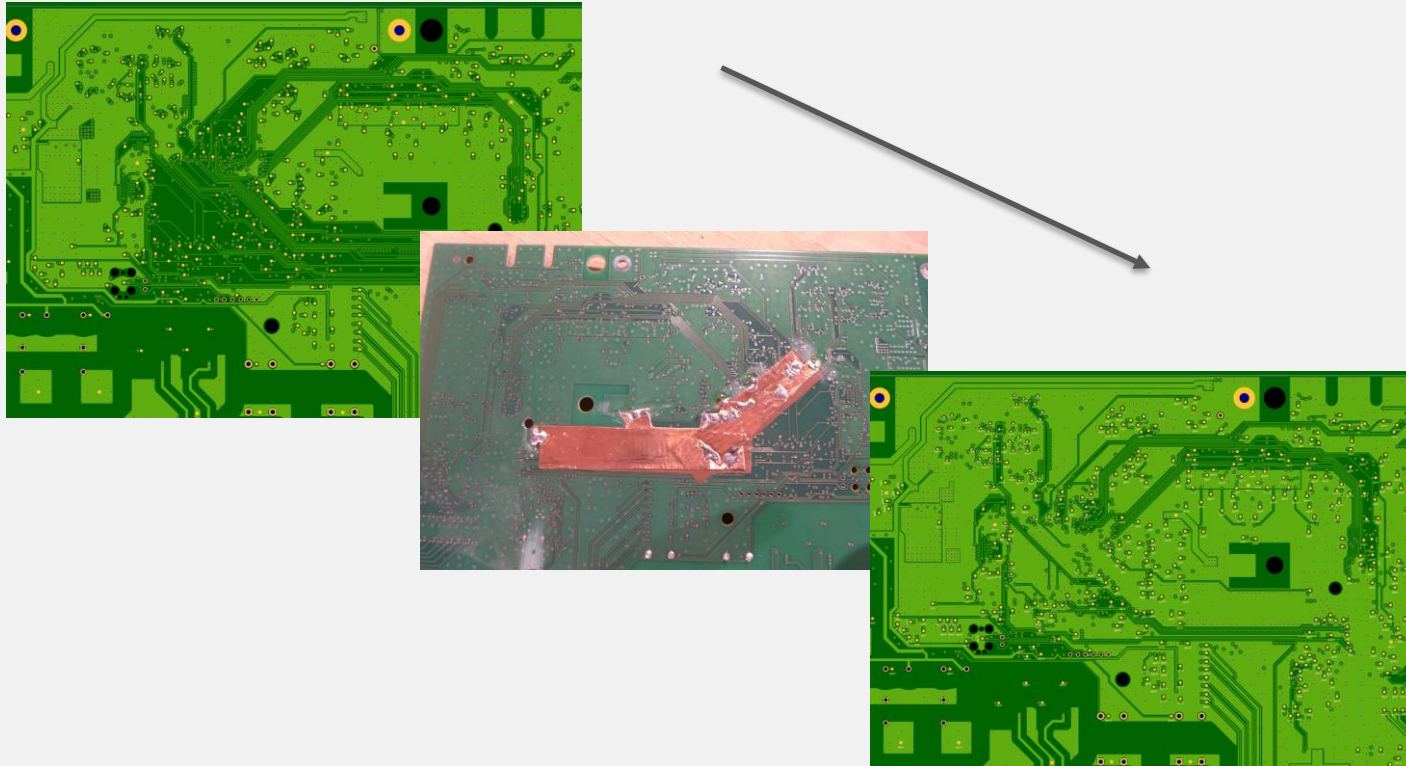
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Radiated emission

Solving the issue



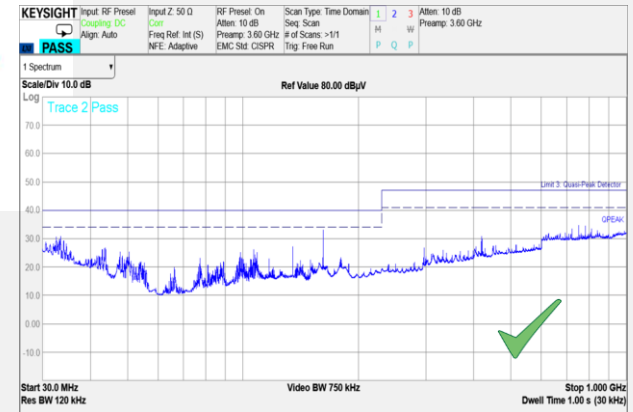
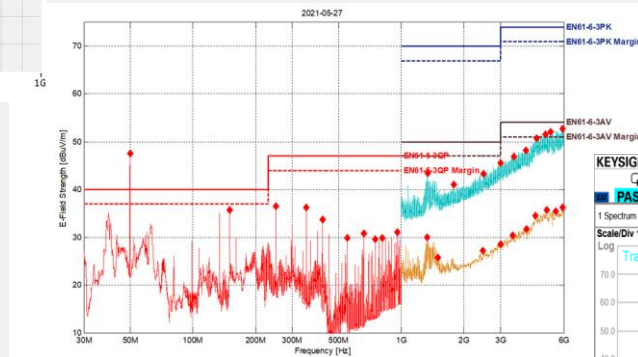
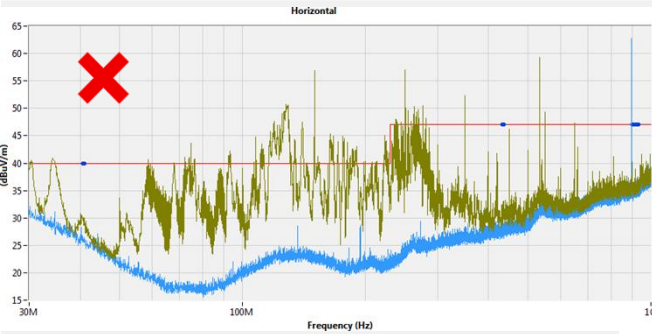
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Measurements during process

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Why does this work?

1. Shielding of traces
2. Return current is routed better through GND vias

Conducted RF immunity

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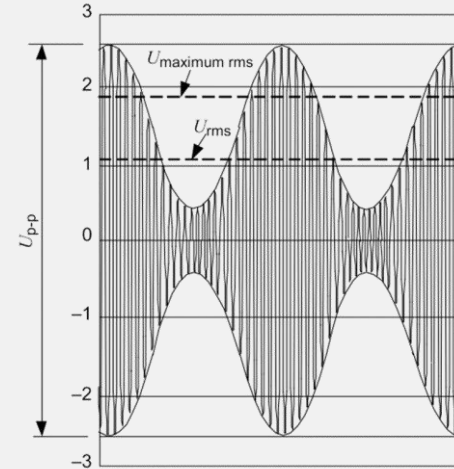
IEC61000-4-6

AM modulated sine wave

Depth: 80%

Mod freq.: 1 kHz

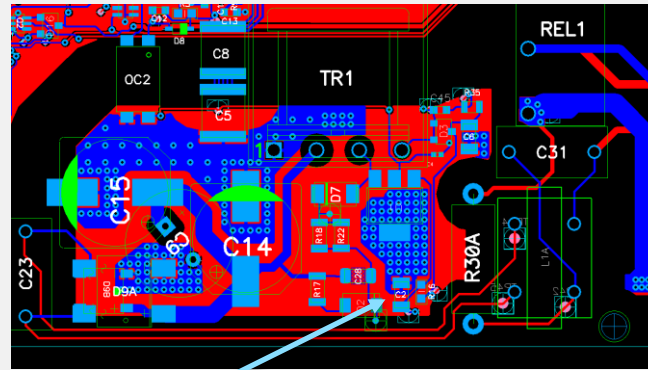
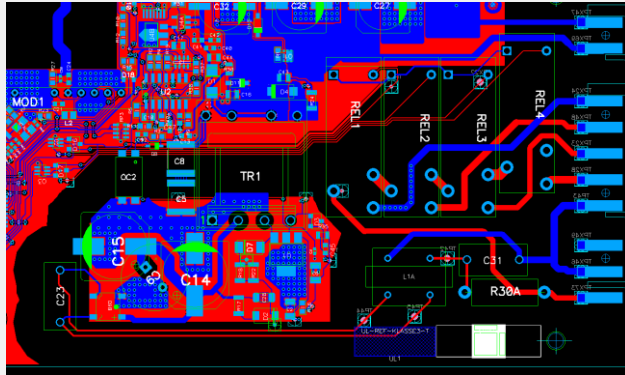
Carrier frequency: swept 150kHz – 80MHz (300 MHz)



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Conducted RF immunity

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- Root cause: misplaced decoupling capacitor
- Exacerbated by closer routing of mains to power supply



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Radiated RF immunity

Available from Q1-2023

- Most issues are tackled by conducted RF immunity to 300 Mhz
- Equipment is ordered → Long lead times



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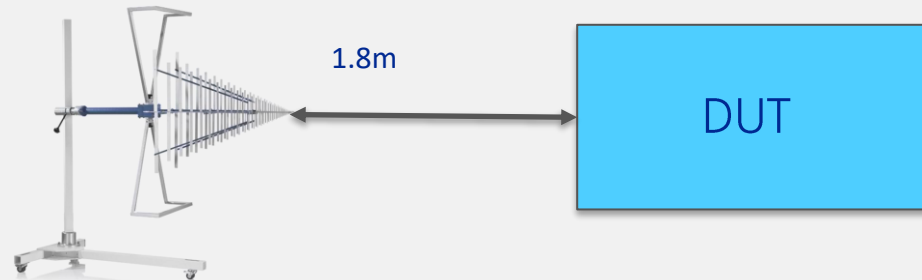
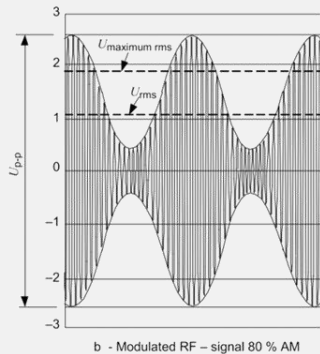


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Radiated RF immunity

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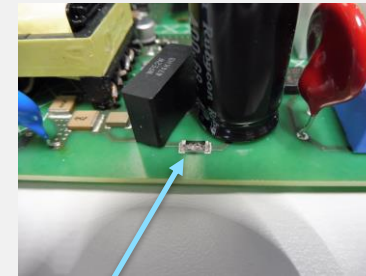
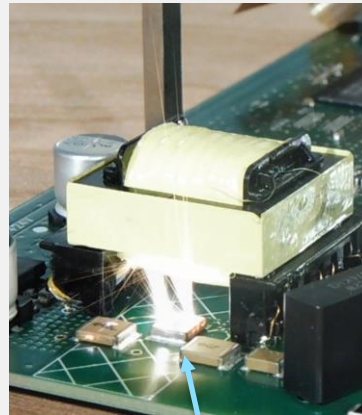
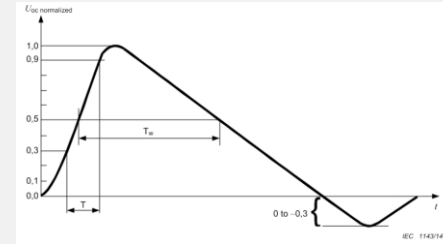
- Observe behaviour with a camera
- Check behaviour with communication interface (modbus, serial, etc.)



Other related tests

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- Surge
 - ‘low-frequency’ transients
 - Current: 8/20 μ s
 - Voltage: 1.5/50 μ s
 - Simulates lightning
 - 1 – 2 kV is a common test level

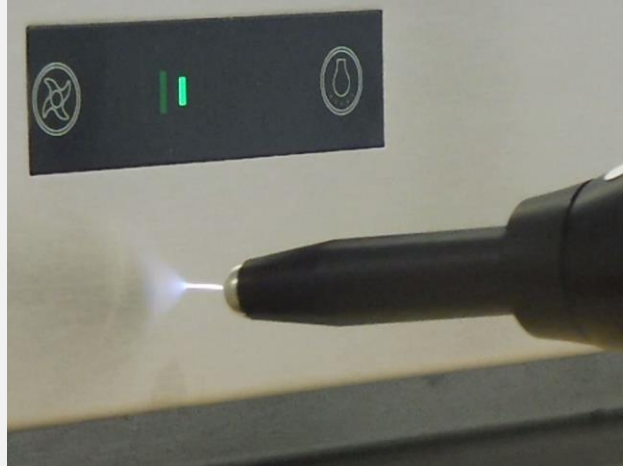


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Other related tests

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- ESD
 - Check for damages
 - Check functionality



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Typical EMC-considerations/ improvements

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- Groundplanes
- Filters
- Trace placements & lengths
- Cable placements
- Shielding
- Earthing connections



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Internal vs external testing

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Pros

- Costs
- Efficiency
- Lead time
- Quality

Cons

- External accreditation



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Recap

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- EMC issues are mostly generated by NOT considering a possible impact of design & changes
- From early start until end of design
- Cable from another supplier might result in bad results
- Continuous considerations saves a lot of time and money



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Let's make products better together

Audit of existing products

- Are you -like many other companies- considering reshoring your electronic controllers? Contact us for a no-obligation audit of your existing electronics in terms of:
 - electronics design
 - manufacturability
 - (EMC) regulations

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Thank you for your attention

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