

Načrtovanje elektronike za

EMC²

študentska delavnica
in tekmovanje



UNIVERZA V LJUBLJANI
Fakulteta za elektrotehniko



Laboratorij za fotovoltaike
in optoelektroniko



MIDEM 2024
Rimske Terme
3.10.2024



iskraemeco

BY ELSEWEDY ELECTRIC

KOLEKTOR



INSTRUMENTATION
TECHNOLOGIES

MAHLE



svet
ELEKTRONIKE



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EMC²

študentska delavnica
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FE

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svet
ELEKTRONIKE



WURTH
ELEKTRONIK
MORE THAN
YOU EXPECT



MIDEM 2024 - EMC workshop competition - Rimske Terme

3.10.2024

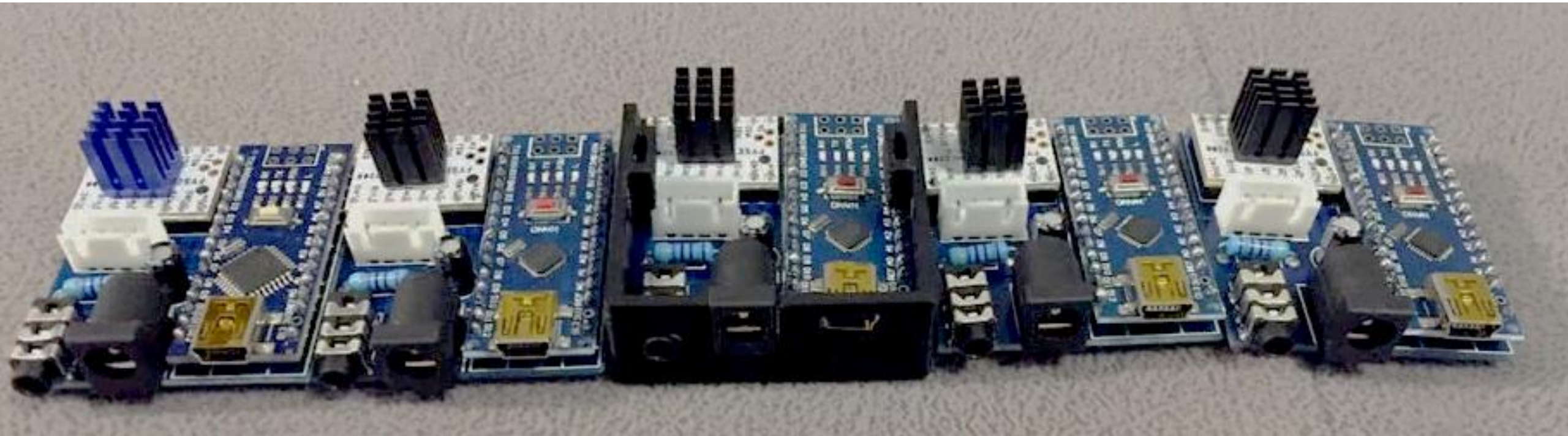
Introduction to student EMC competition

Marko Jankovec

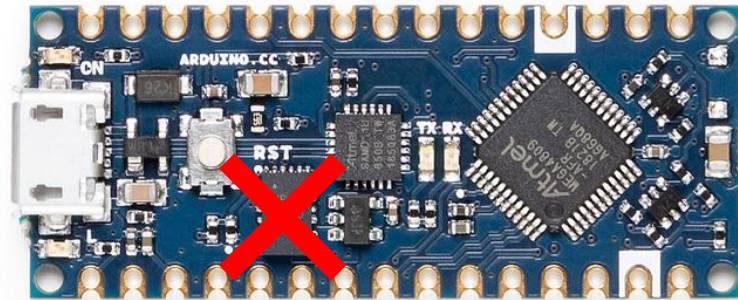
Why?



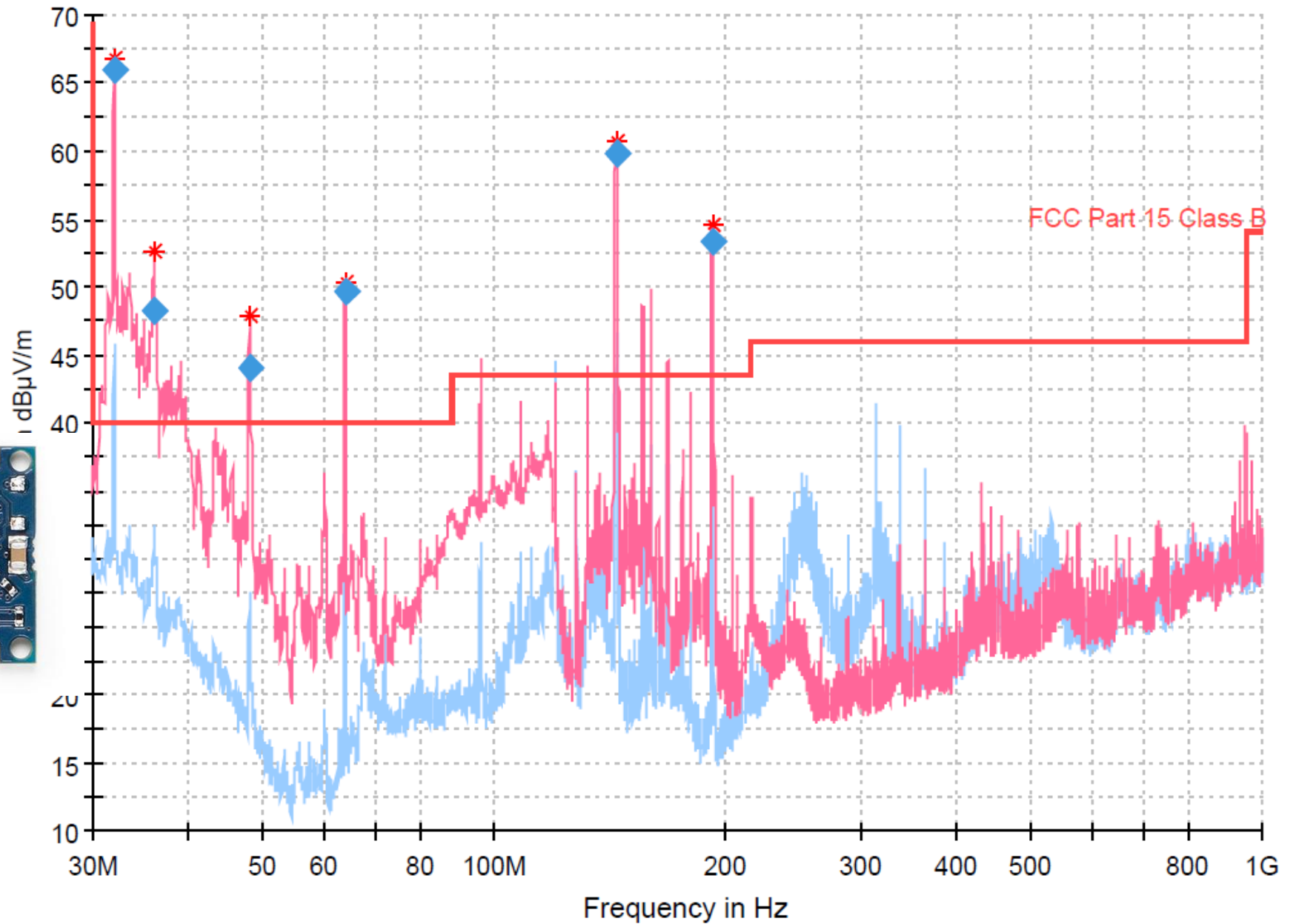
Entusiastic project



Problem!



Solution?



Why?



Because!



1. EMC competition 2016: HELLA SATURNUS



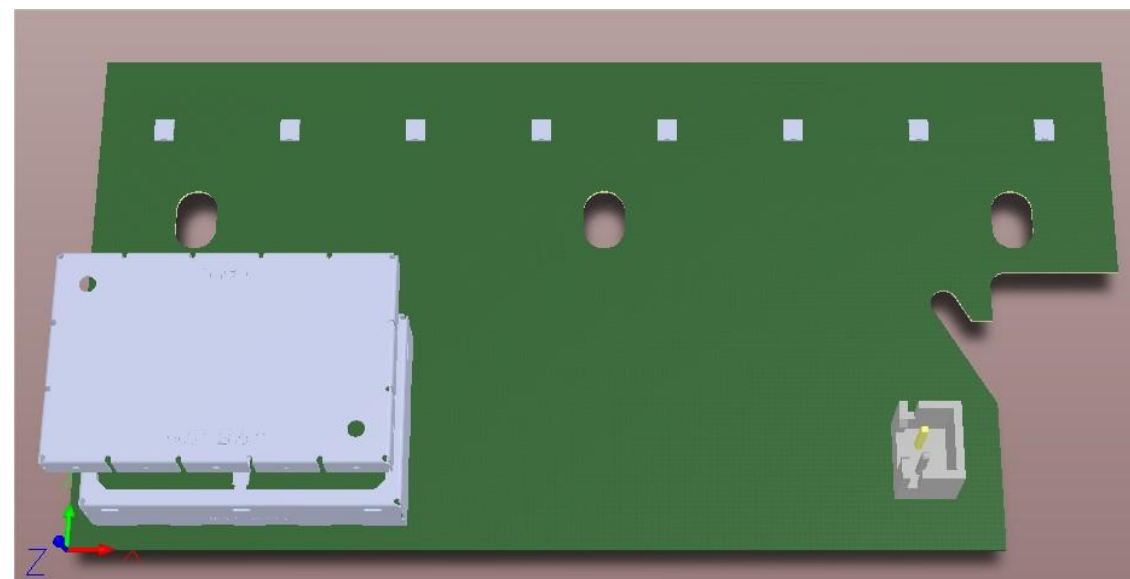
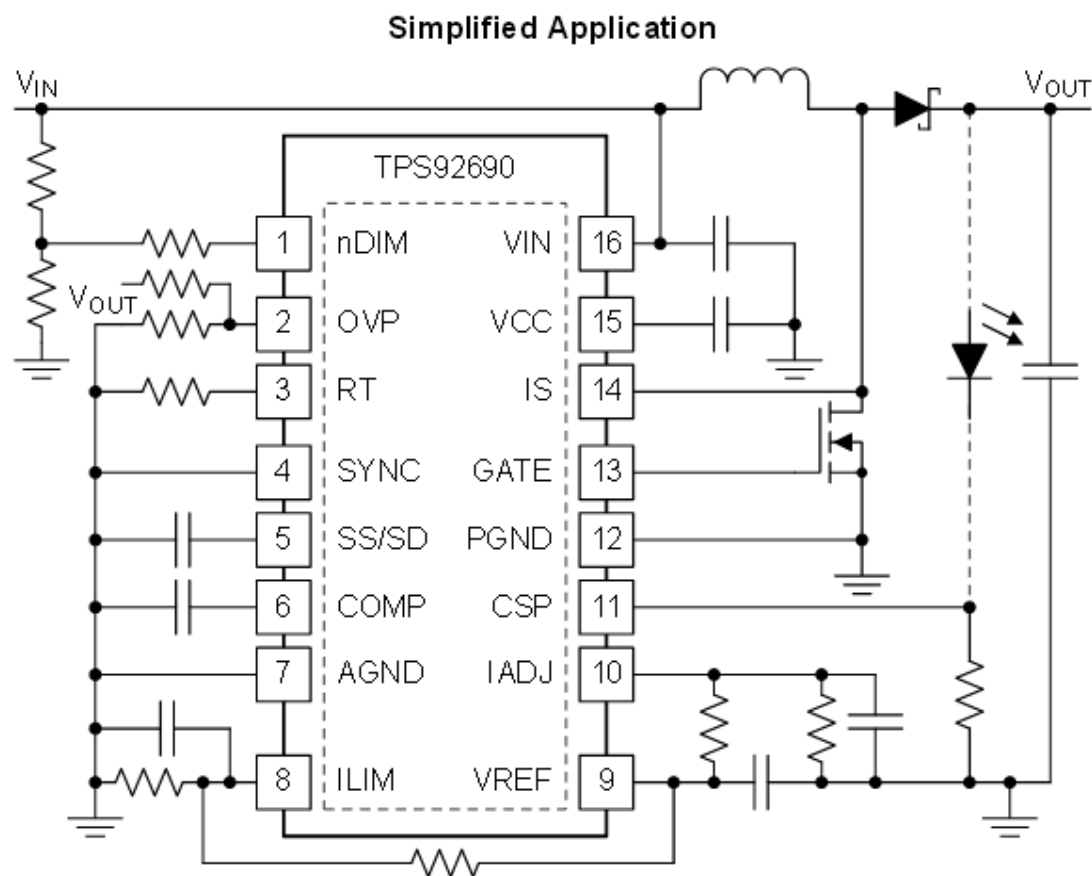
MAHLE



TEXAS INSTRUMENTS



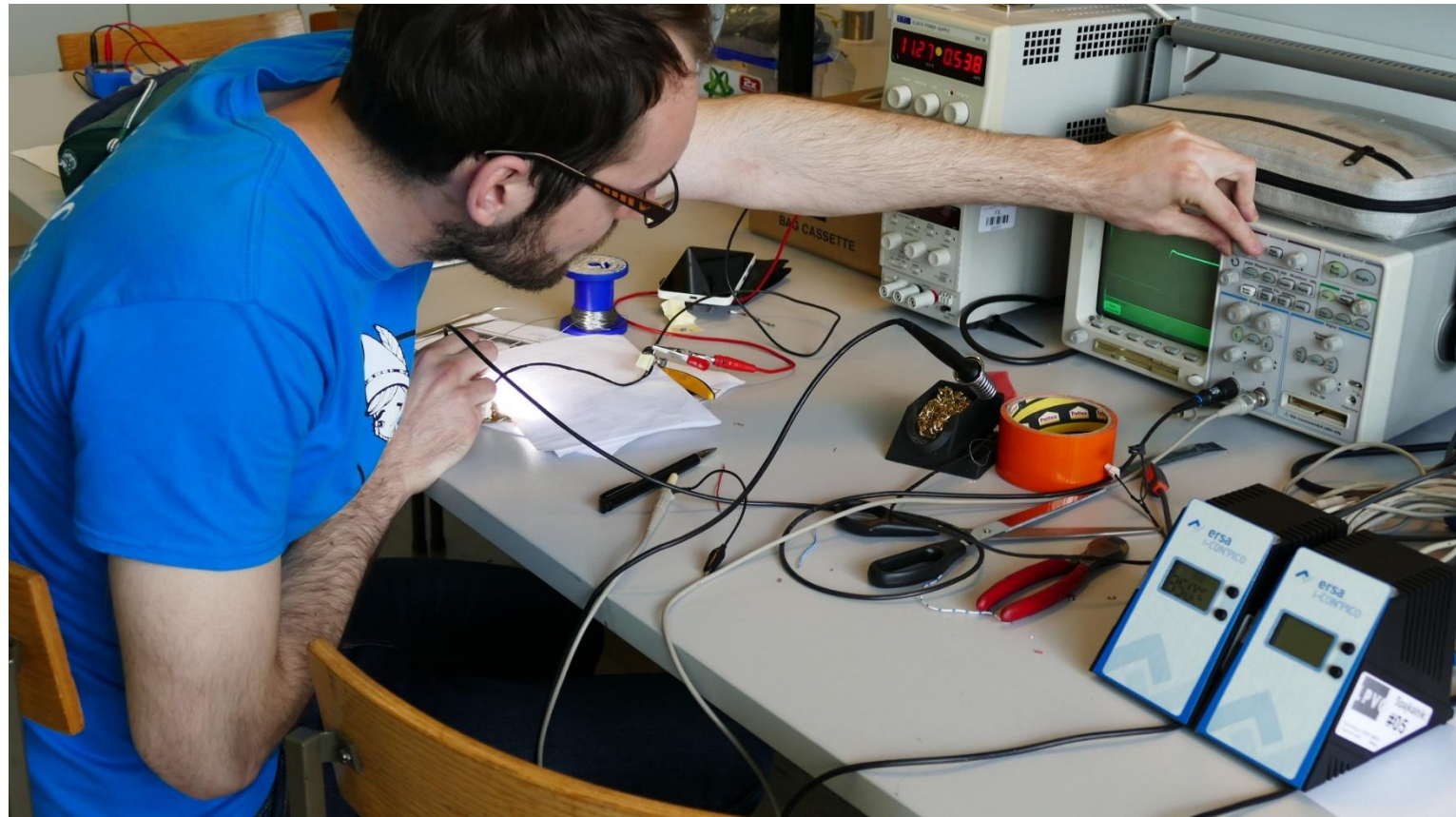
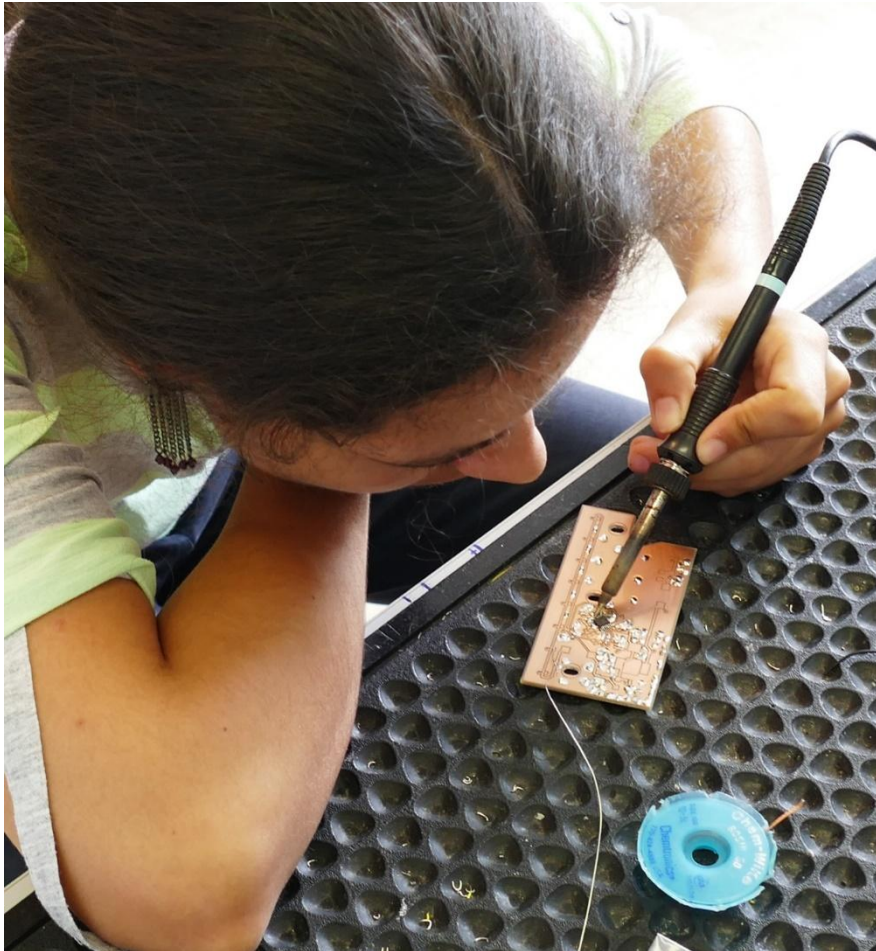
Challenge



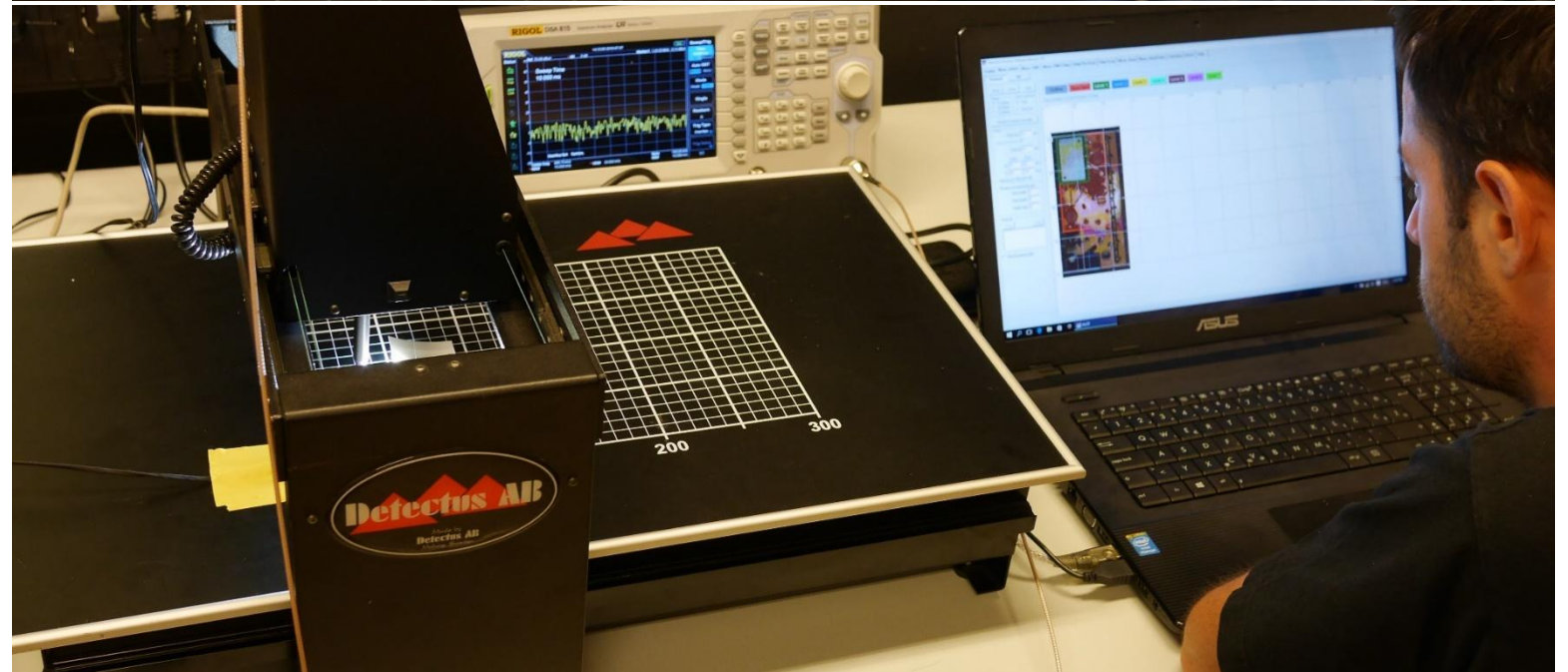
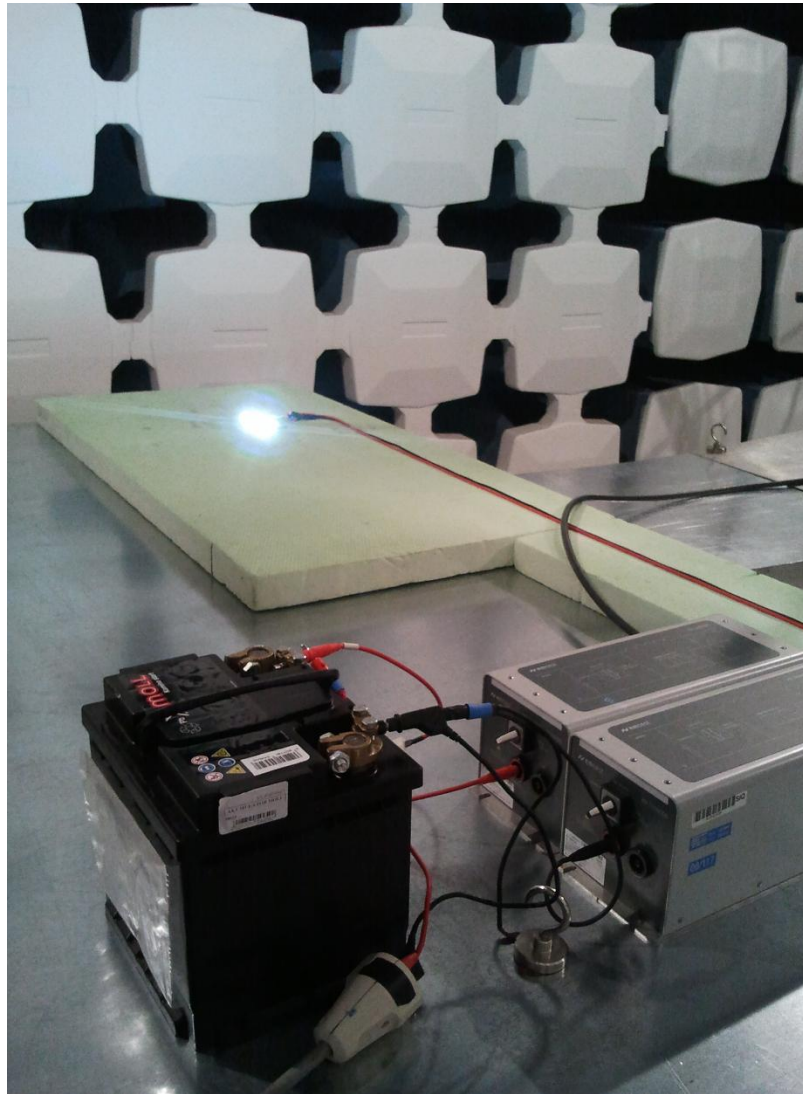
Lectures and excursions



Projects

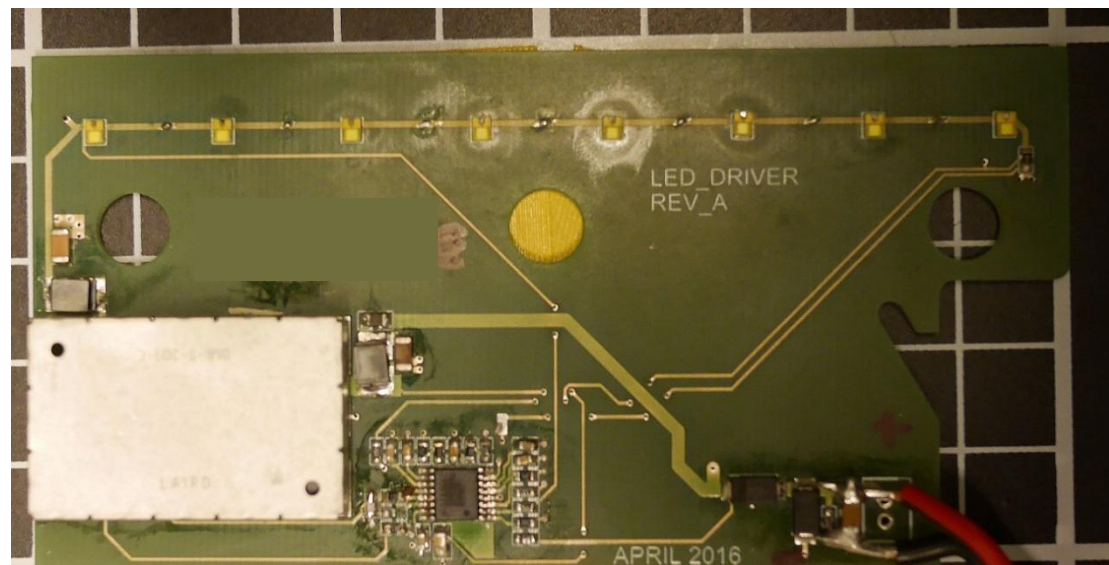
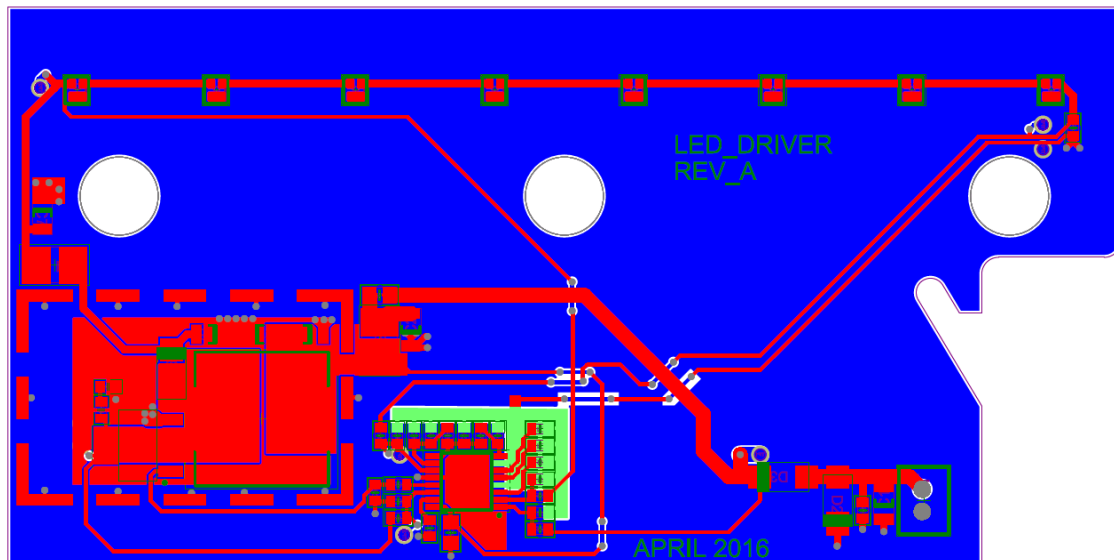


Measurements

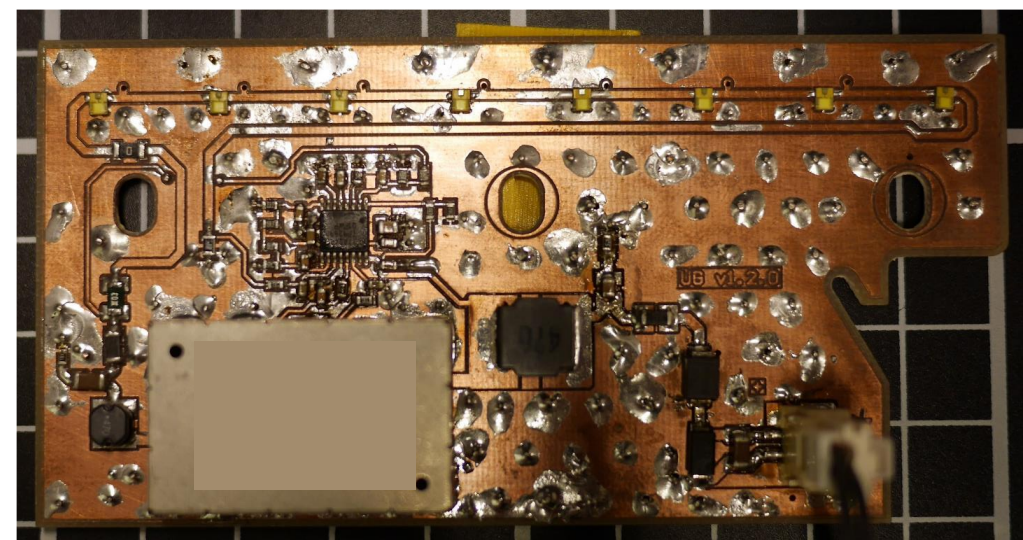
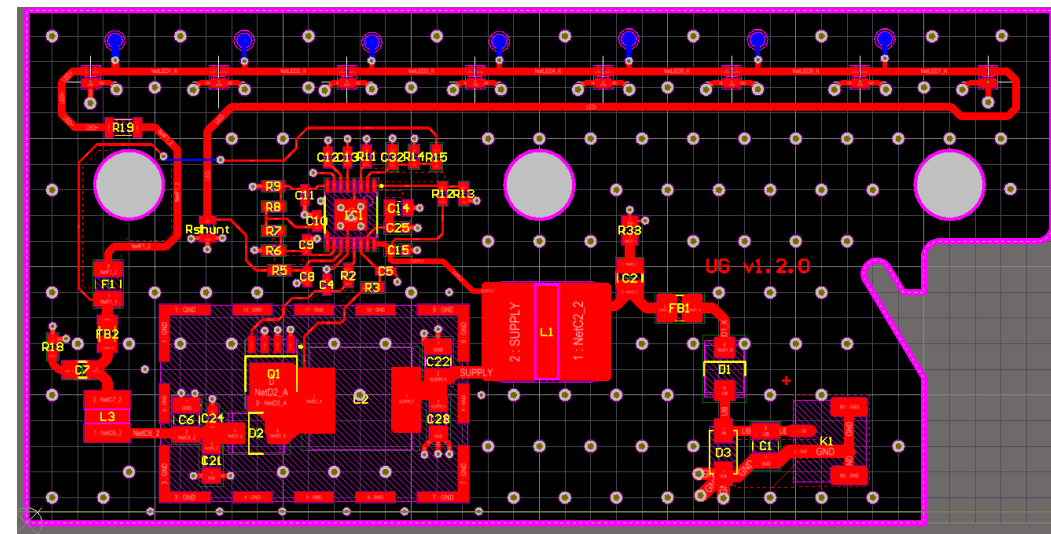


Results

A

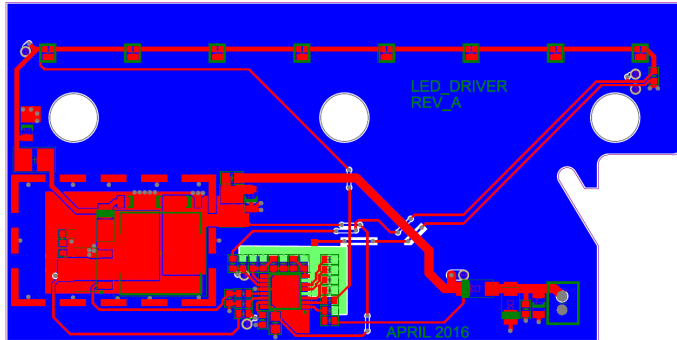


B

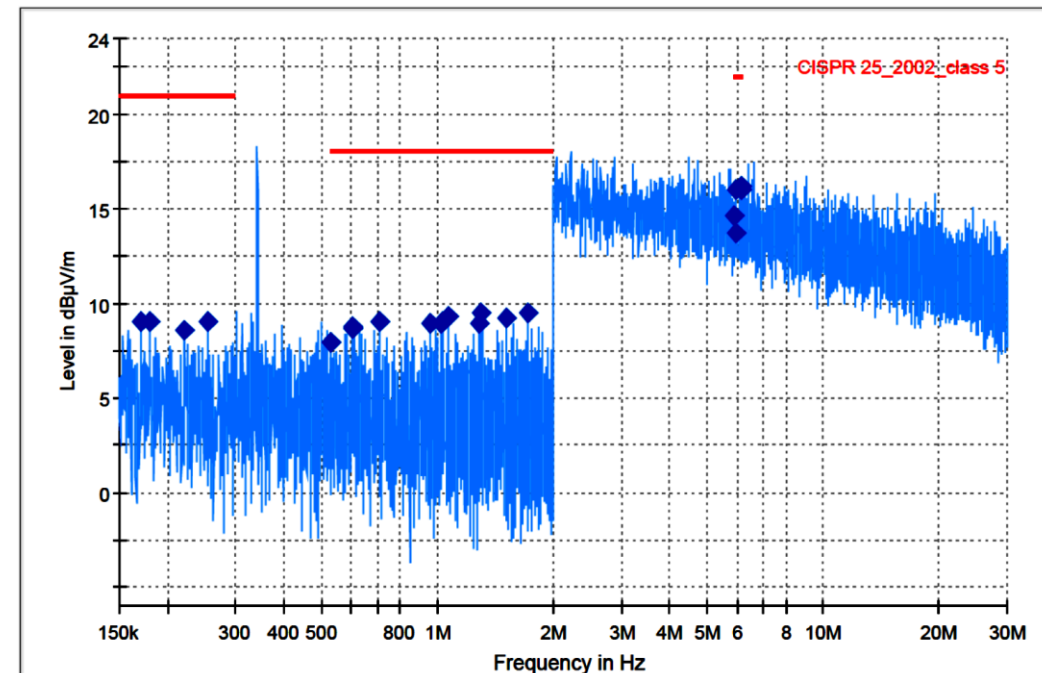
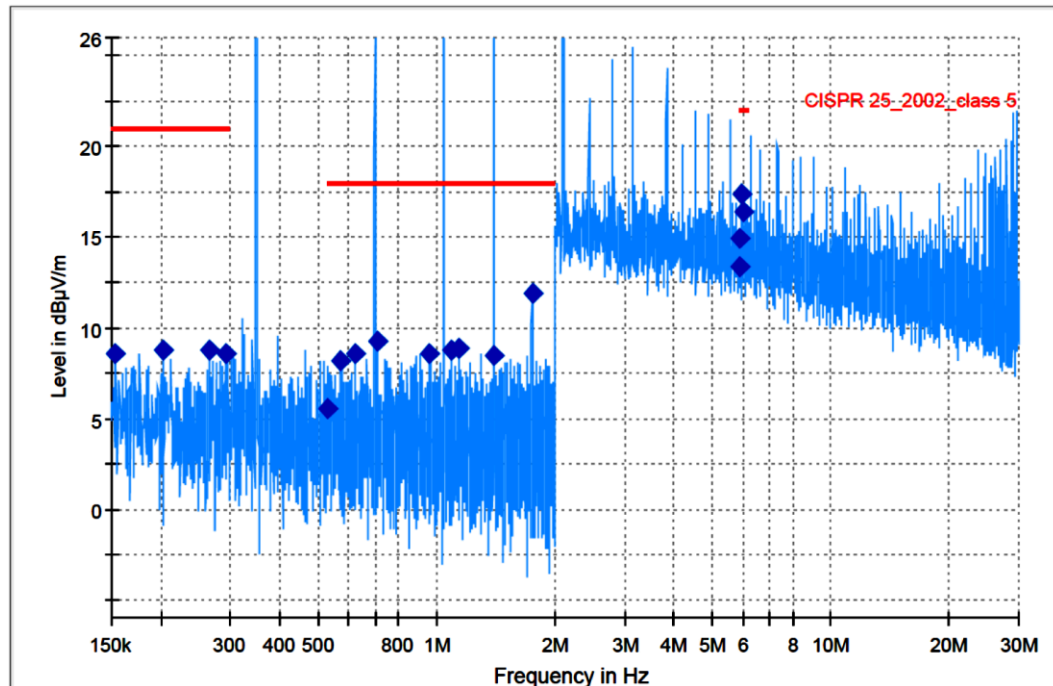
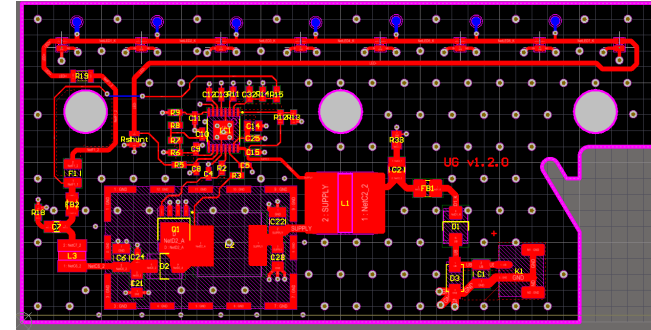


Results

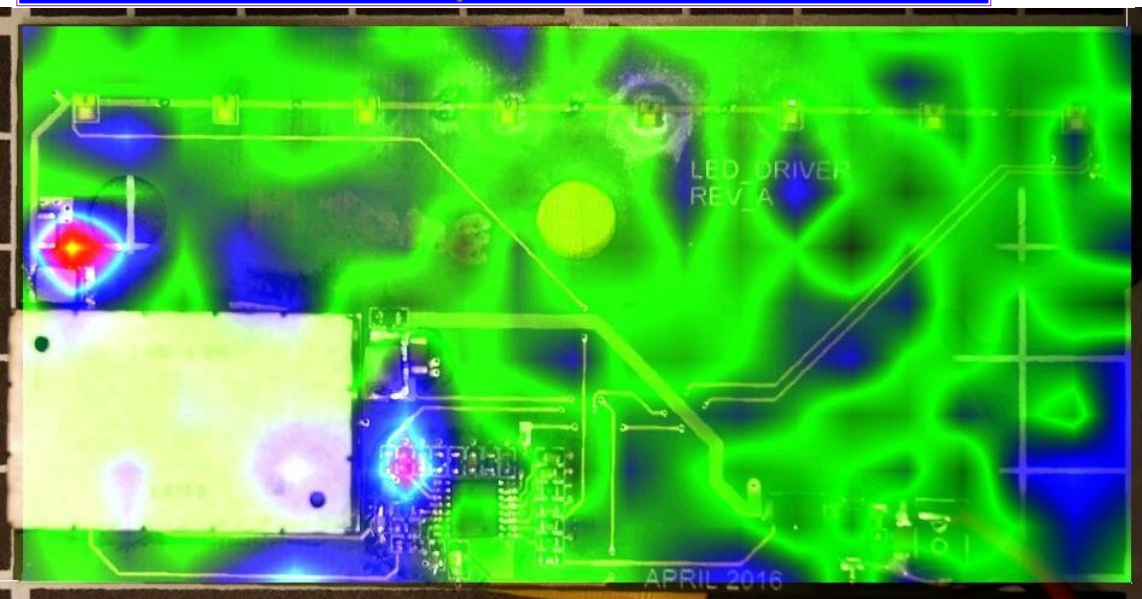
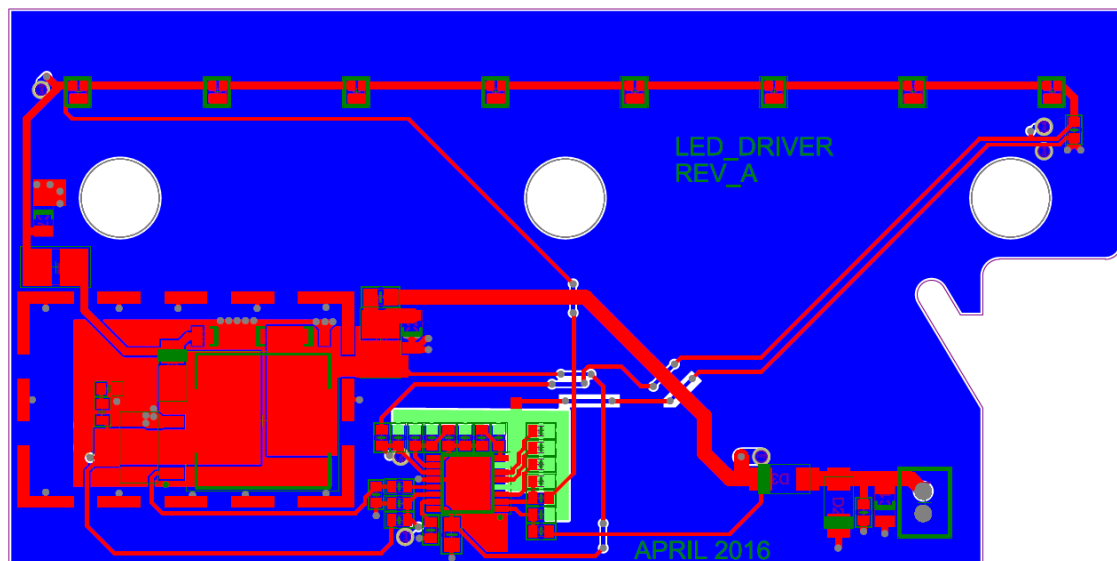
A



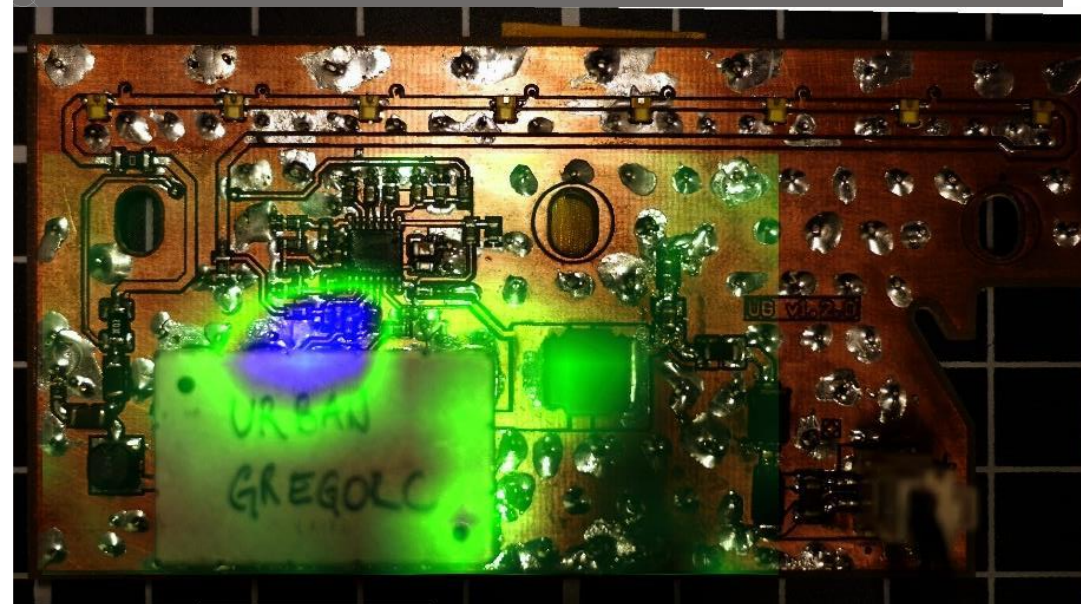
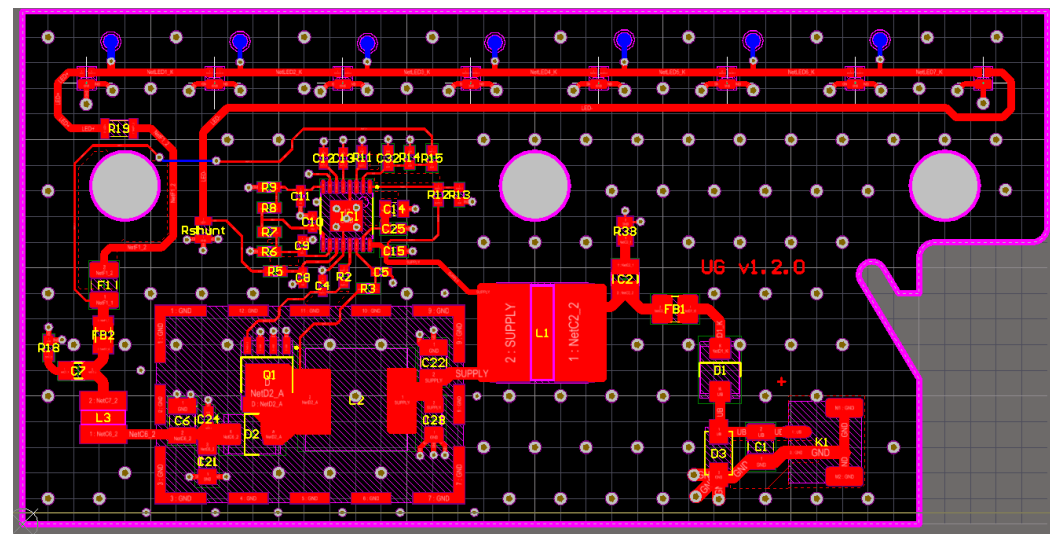
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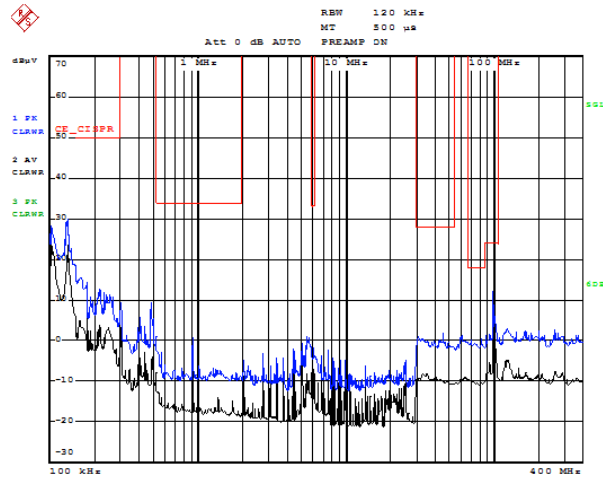
Results A



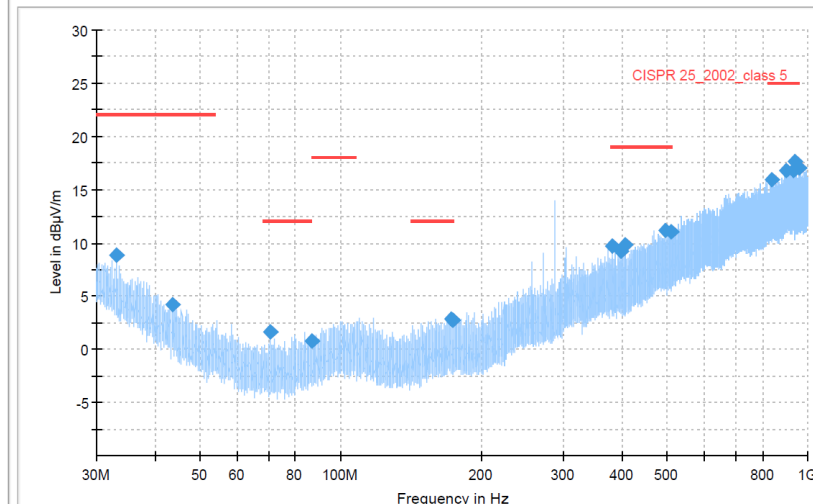
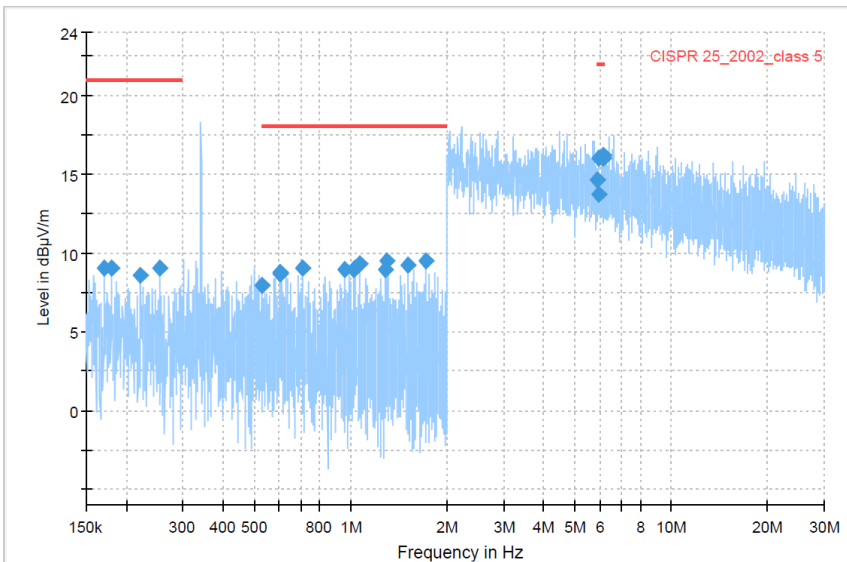
B



1. EMC competition 2016: HELLA SATURNUS



Urban Gregorc



Načrtovanje elektronike za EMC²

7. 5. 202



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Fakulteta *za elektrotehniko*
Katedra *za elektroniko*



Laboratorij za fotovoltaike
in optoelektroniko

ISKRAEMECO



KEYSIGHT
TECHNOLOGIES

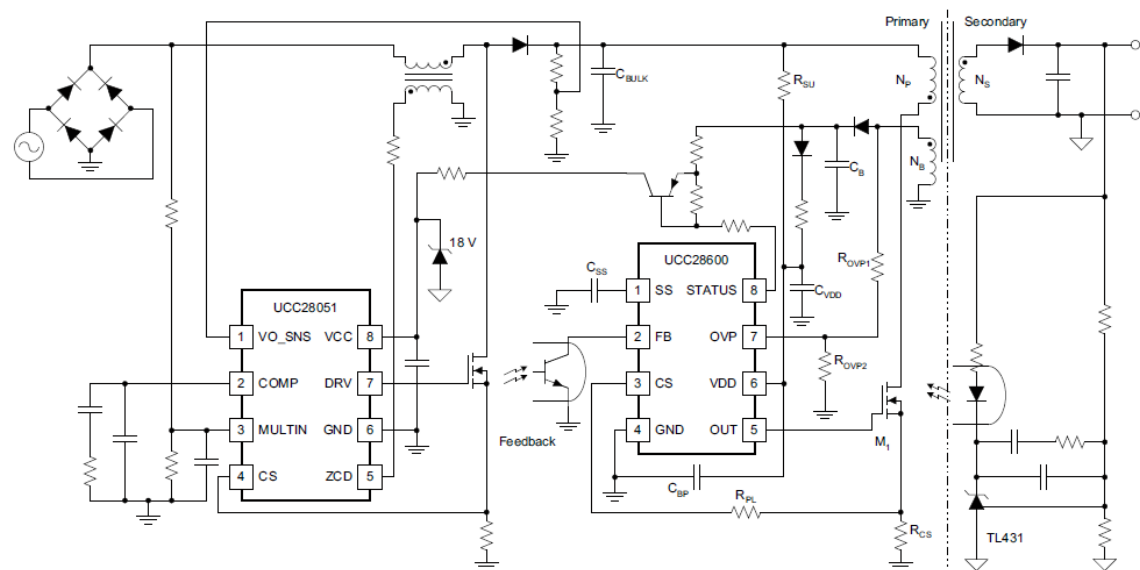


TEXAS INSTRUMENTS



sreda, 8. 3. 2017 ob 17h v P3-C0

2. EMC competition 2017



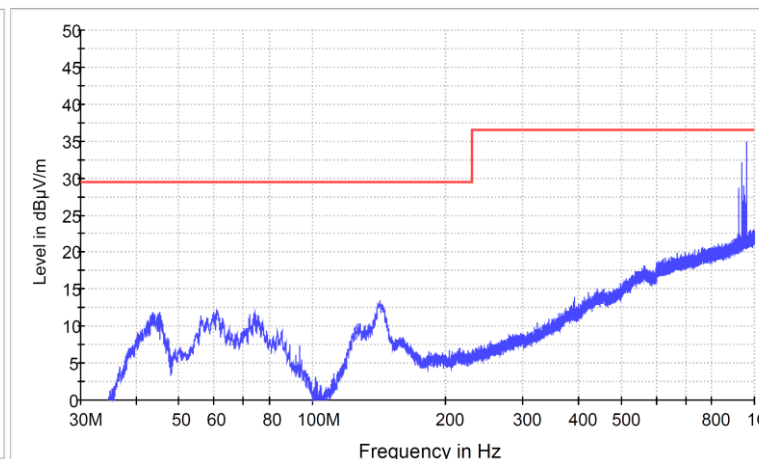
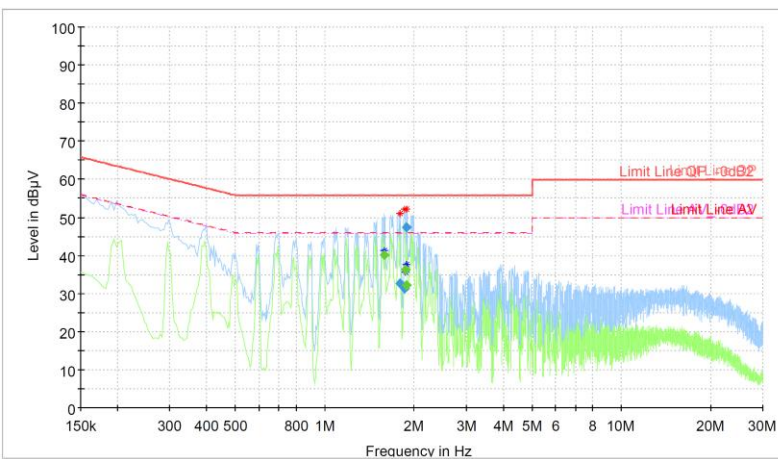
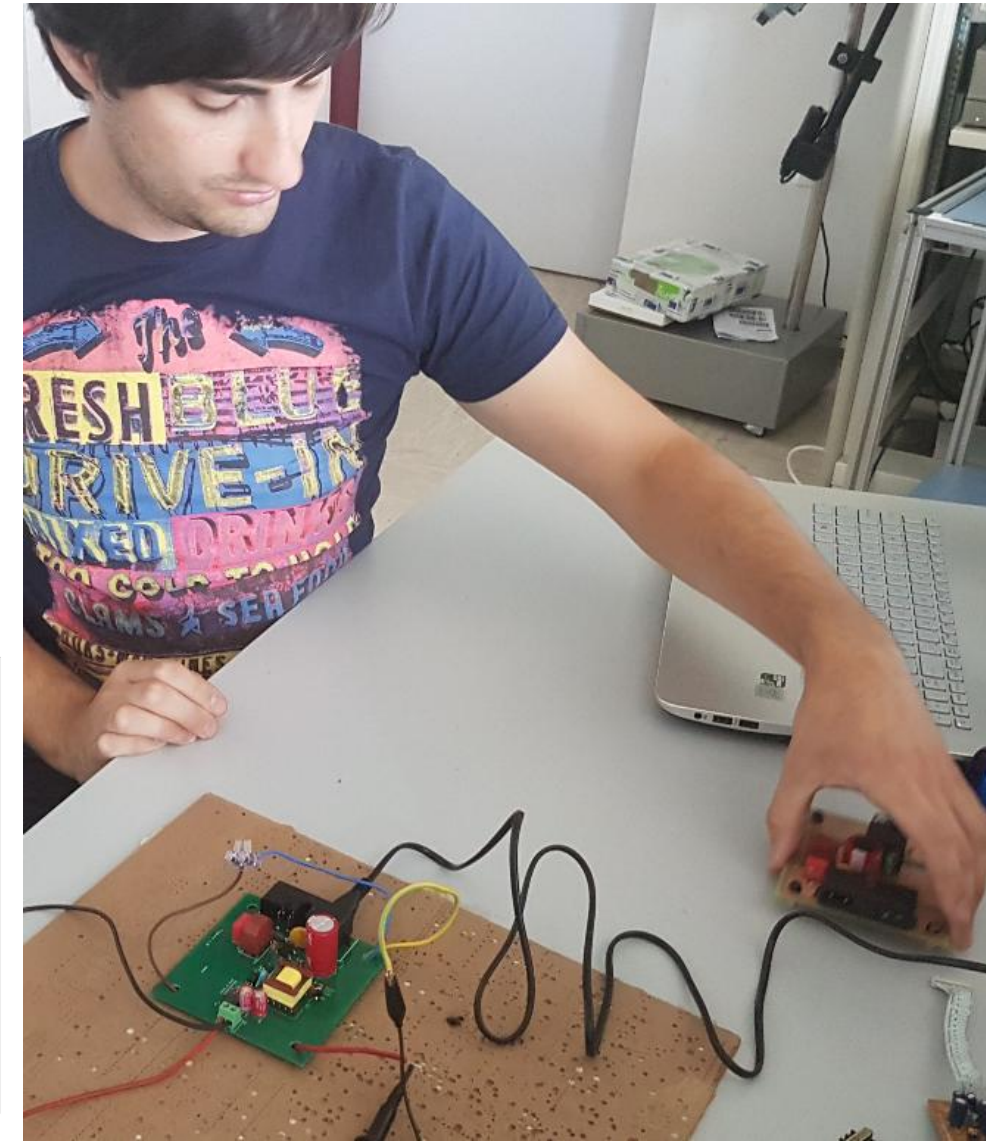
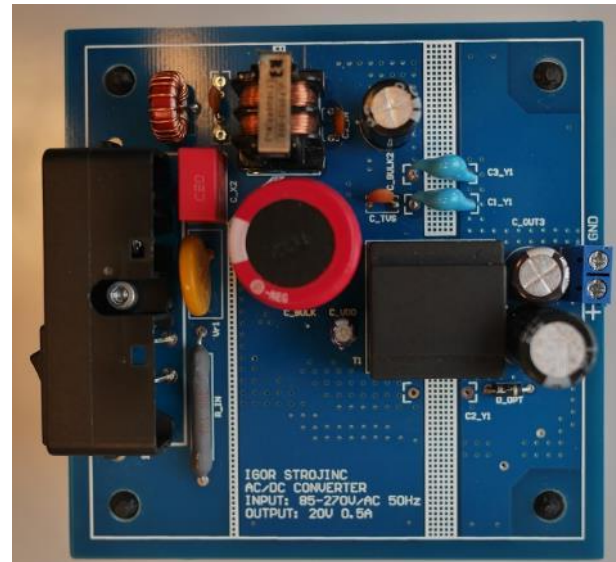
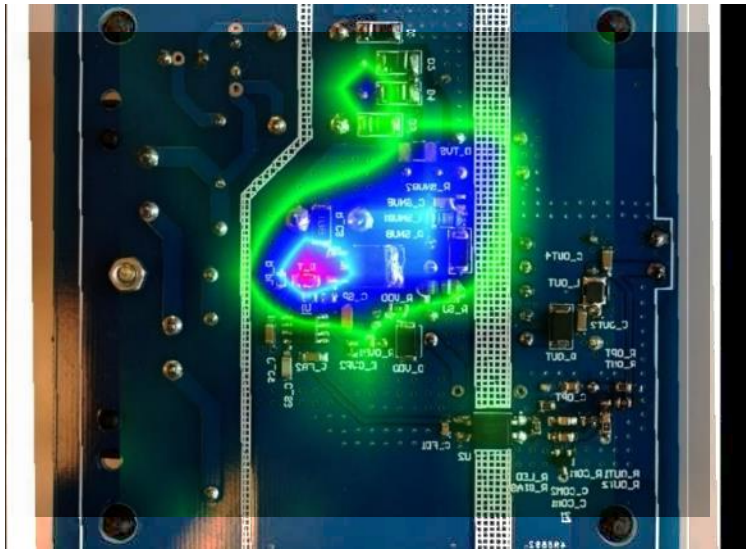
ISKRAEMECO 

UCC28600
(MOS)

UCC28720
(BJT)

2. EMC competition 2017: ISKRAEMECO

Igor Strojinc





Načrtovanje elektronike za

M. J.

5. 2024

EMC



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Katedra za elektroniko



Laboratorij za fotoniko
in optoelektroniko

RAHLE



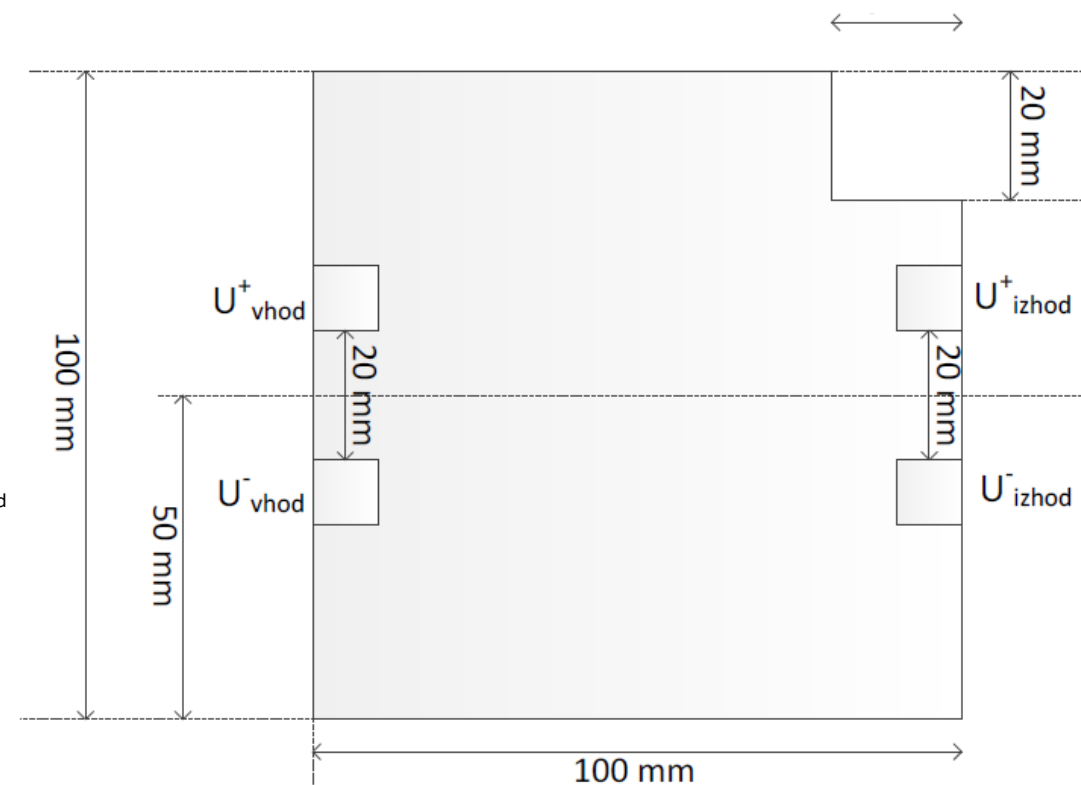
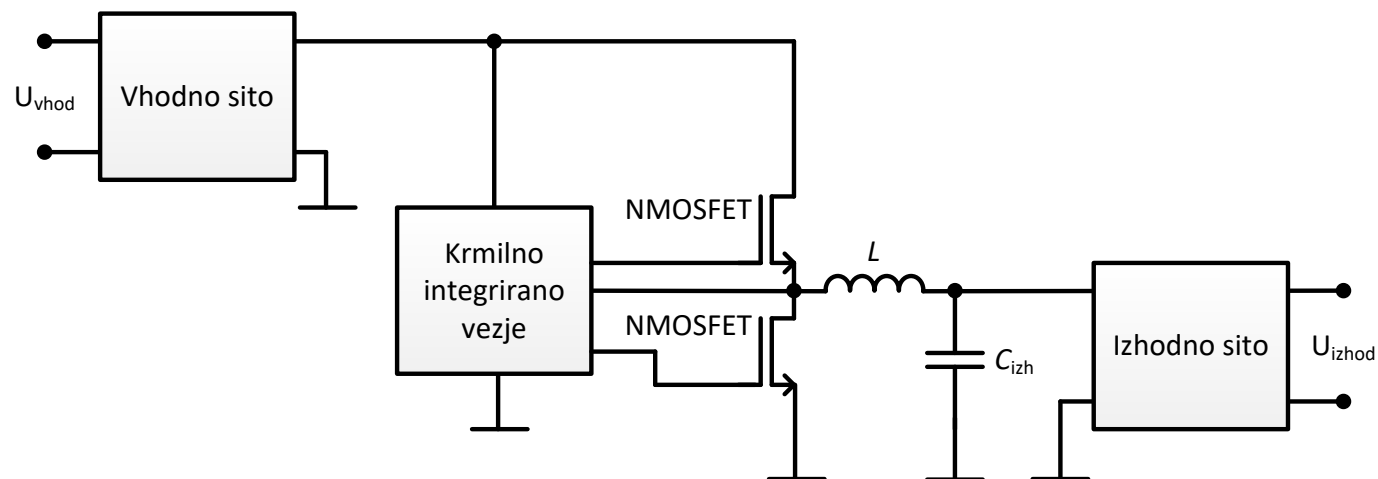
TEXAS INSTRUMENTS

svet
ELEKTRONIKE

torek, 6. 3. 2018 ob 16h v P03-C0

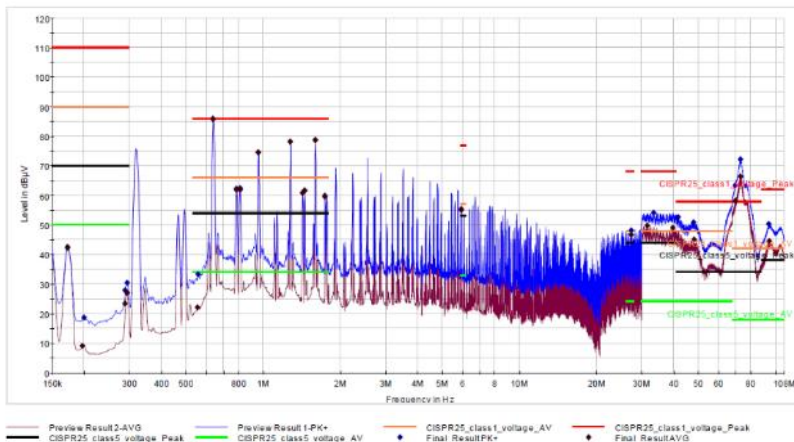
3. EMC competition 2018

MAHLE

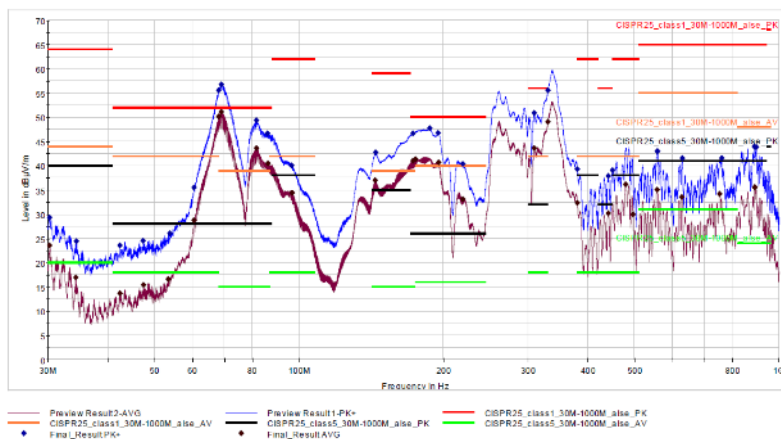
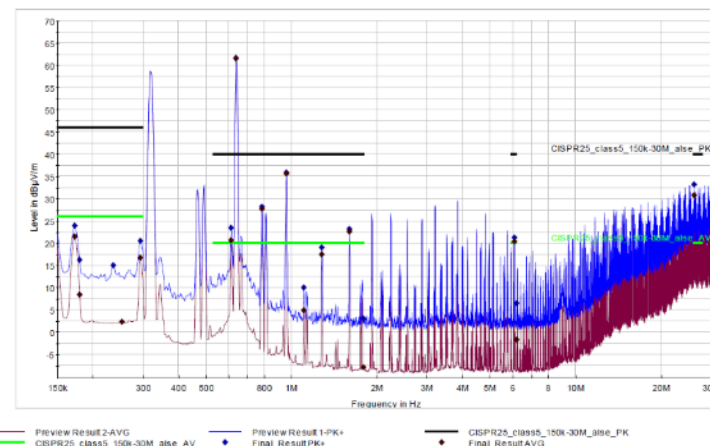


3. EMC competition 2018: MAHLE EDS

Matic Novak



Slika 25: Rezultat na 48V+ priključku s PKAV detektorji in razredom 5 mejnimi vrednostmi

Slika 52: Rezultat s PKAV detektorji in razredom 5 mejnimi vrednostmi v frekvenčnem področju
30 MHz – 1000 MHzSlika 50: Rezultat s PKAV detektorji in razredom 5 mejnimi vrednostmi v frekvenčnem področju
150 kHz – 30 MHz



Načrtovanje elektronike za

EMC²



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Katedra za elektroniko



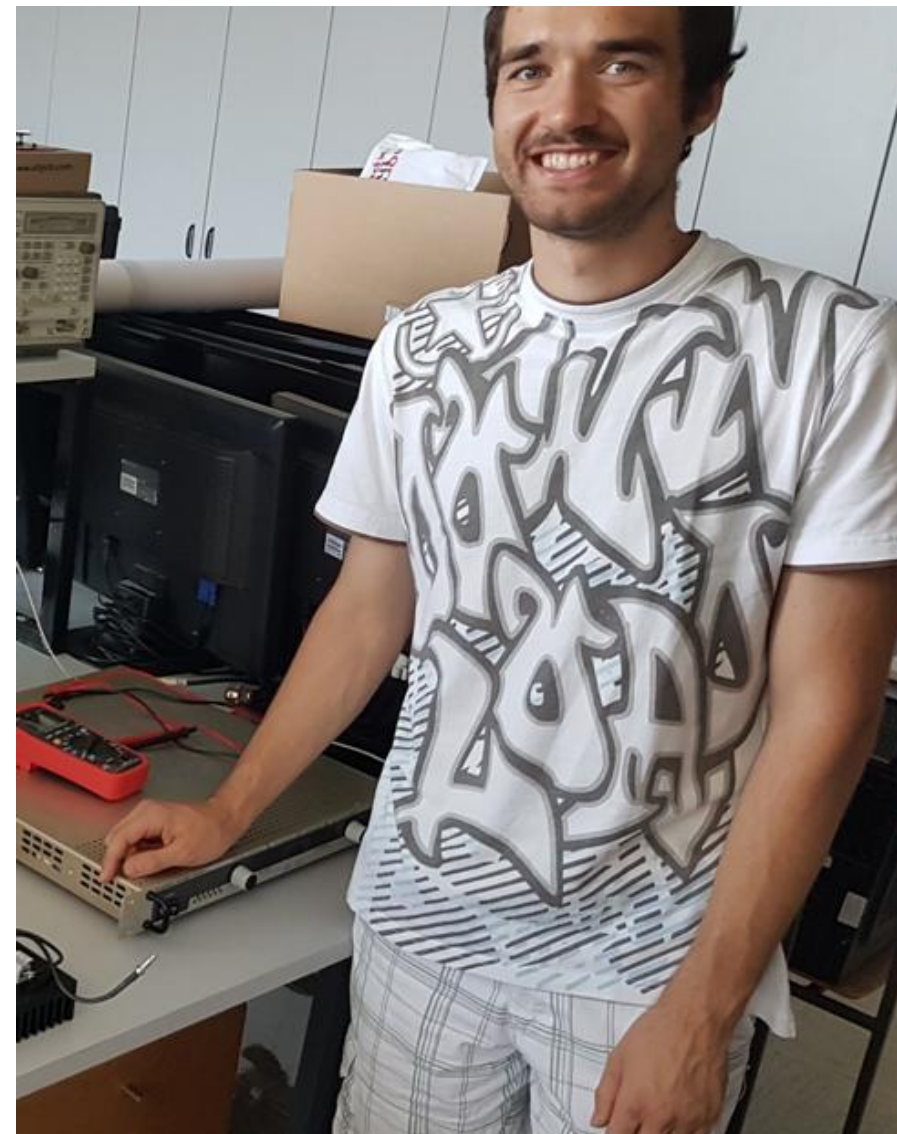
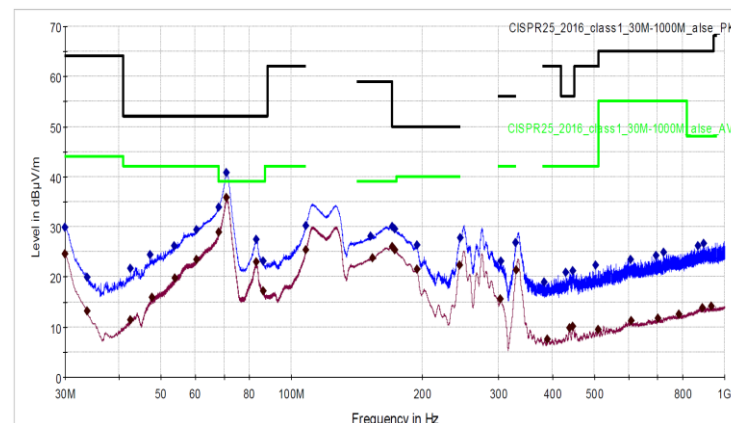
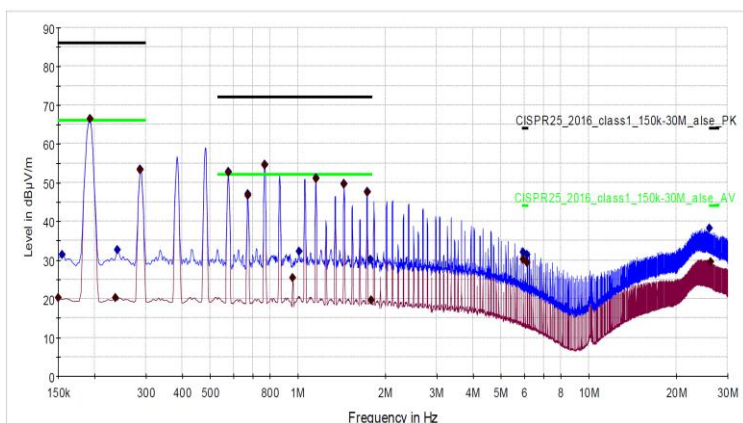
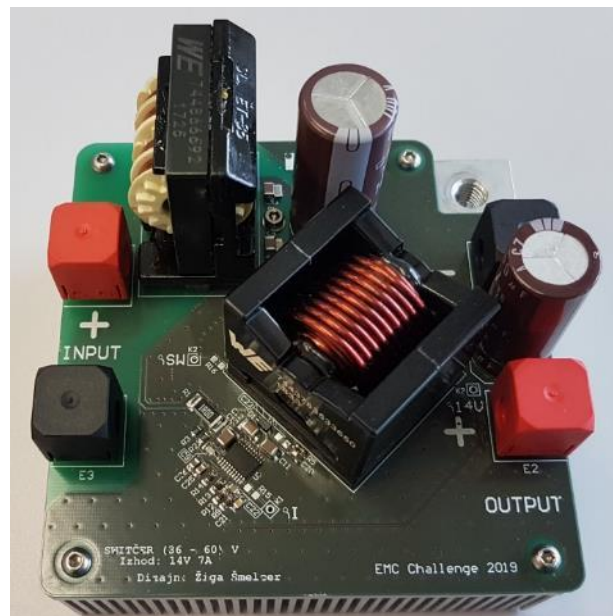
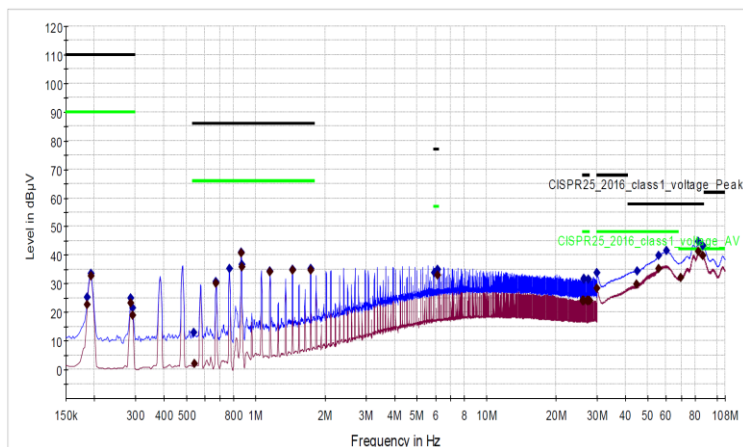
Laboratorij za fotoniko
in optoelektroniko



Vsako sredo ob 17h v P02-C0

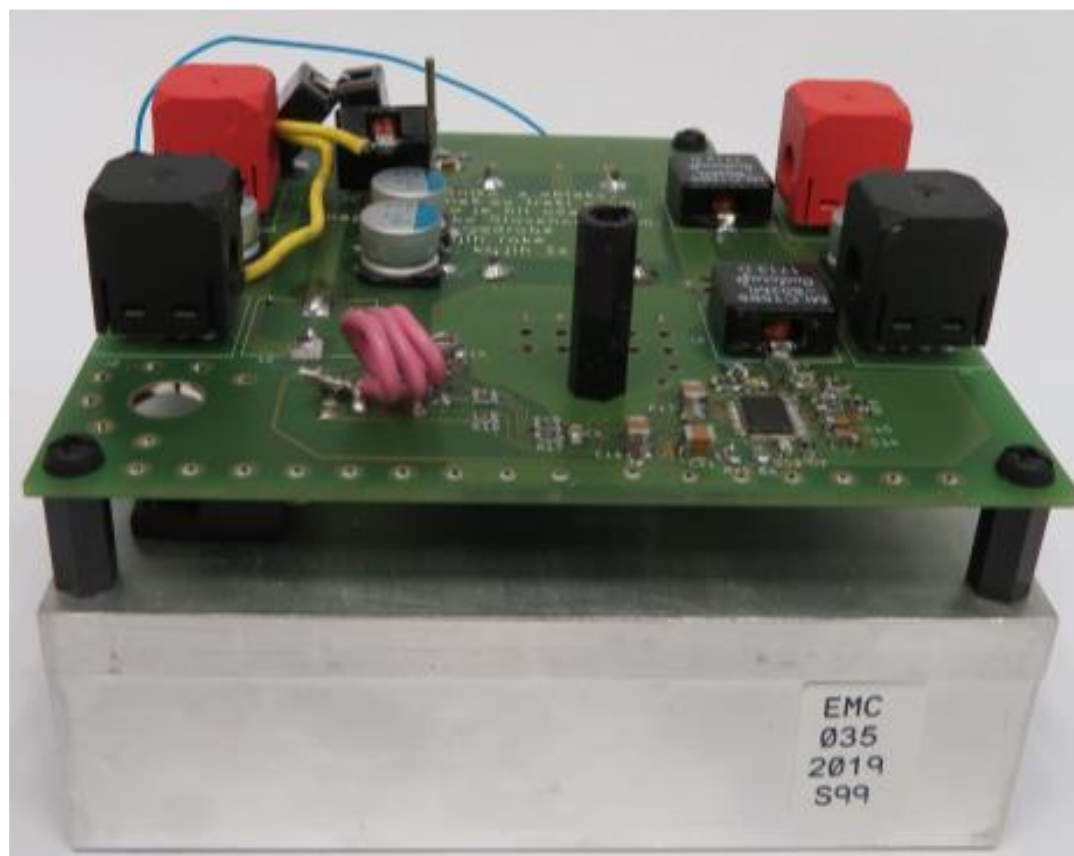
4. EMC competition 2019: MAHLE EDS

Žiga Šmelcer

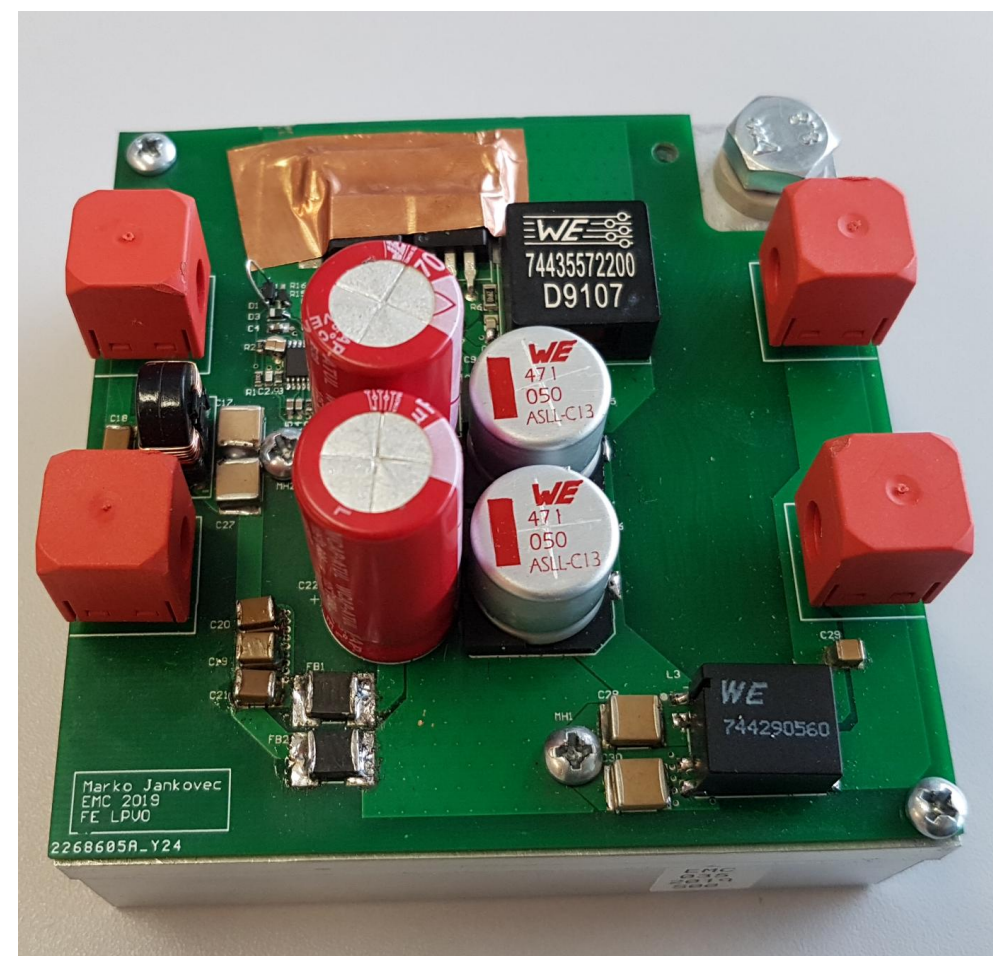


MAHLE & FE battle!

Industry

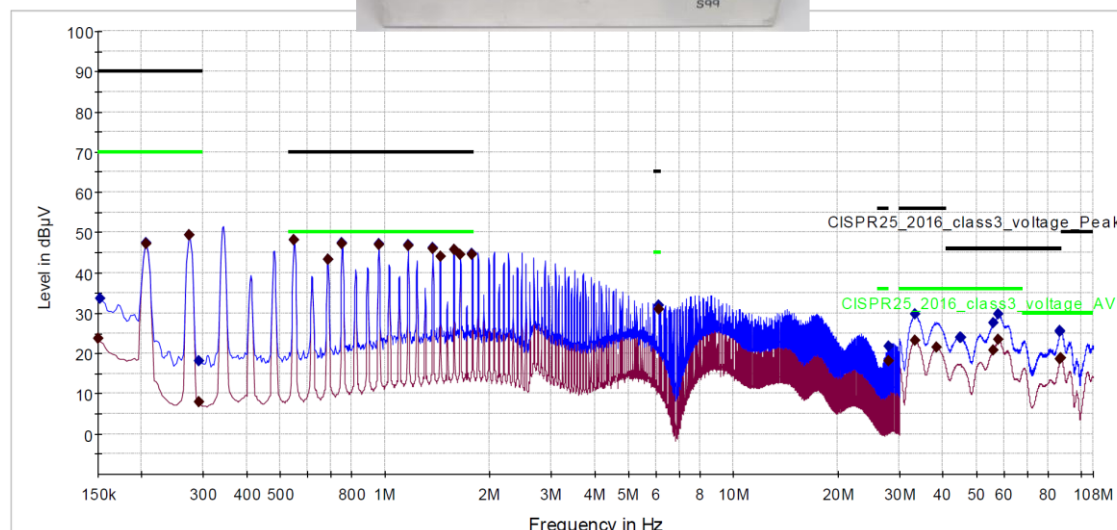


Academia

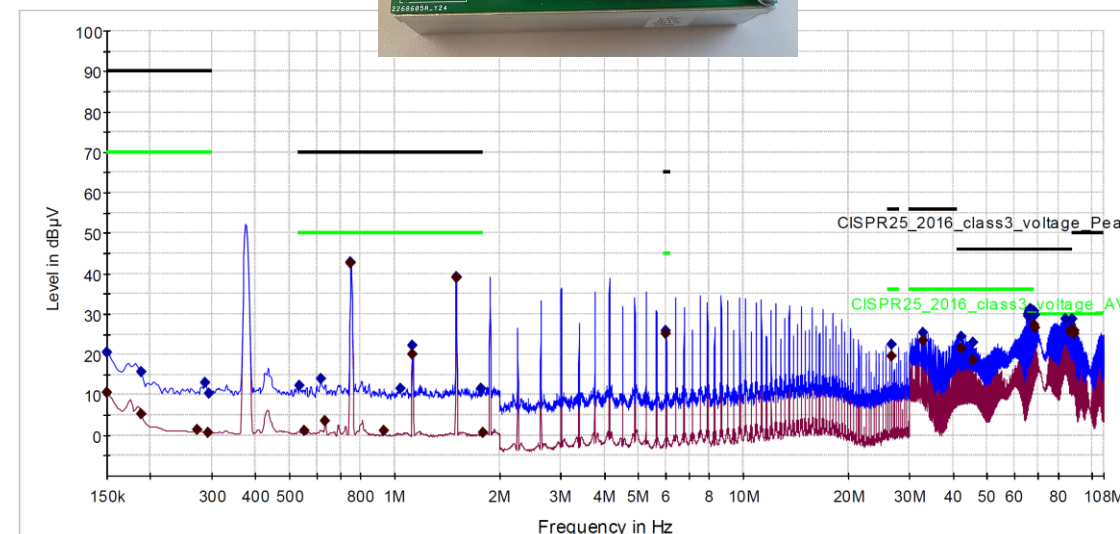
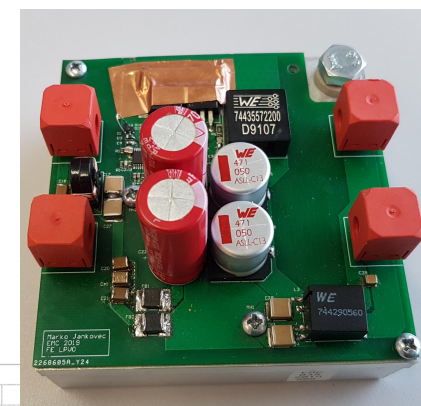


MAHLE & FE battle!

Industry



Academia





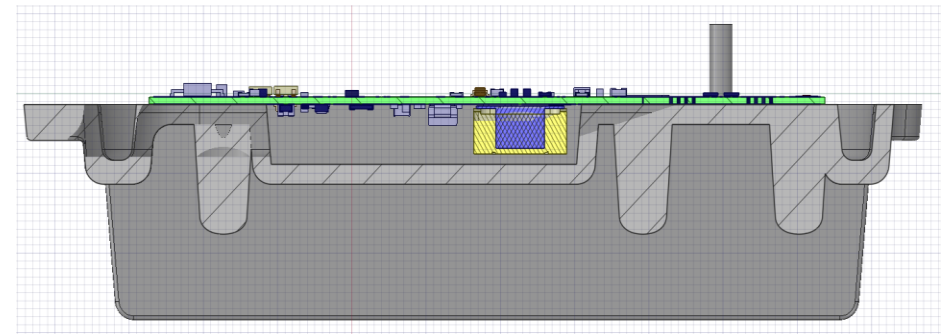
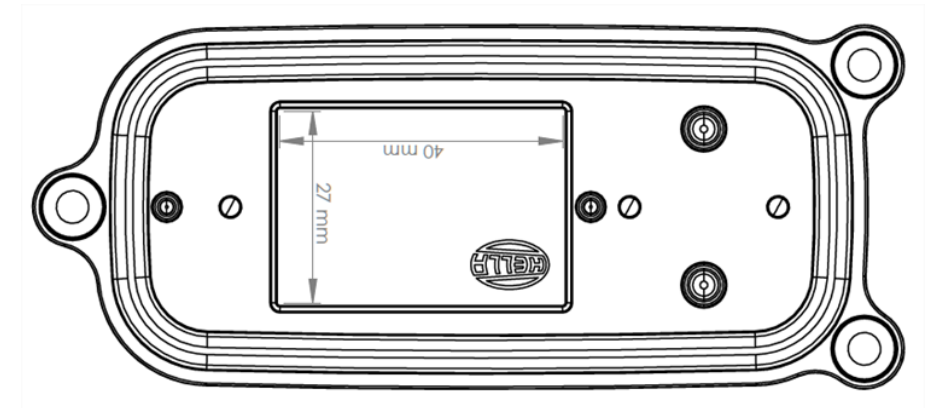
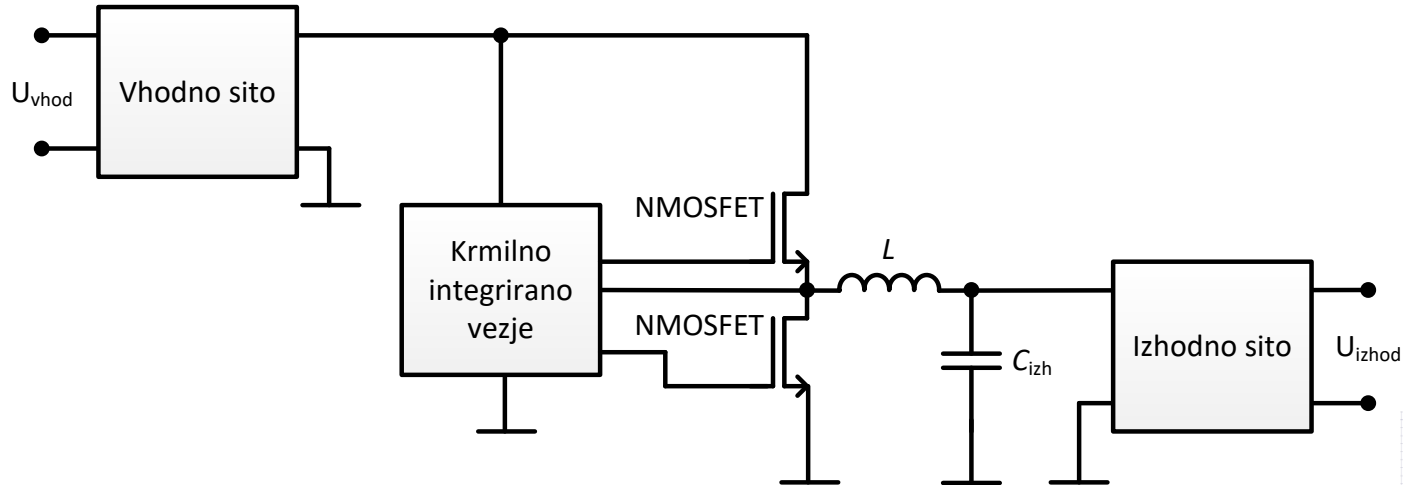
ŠTUDENTSKA DELAVNICA IN TEKMOVANJE
Načrtovanje elektronike za
EMC²



Univerza v Ljubljani
Fakulteta *za elektrotehniko*

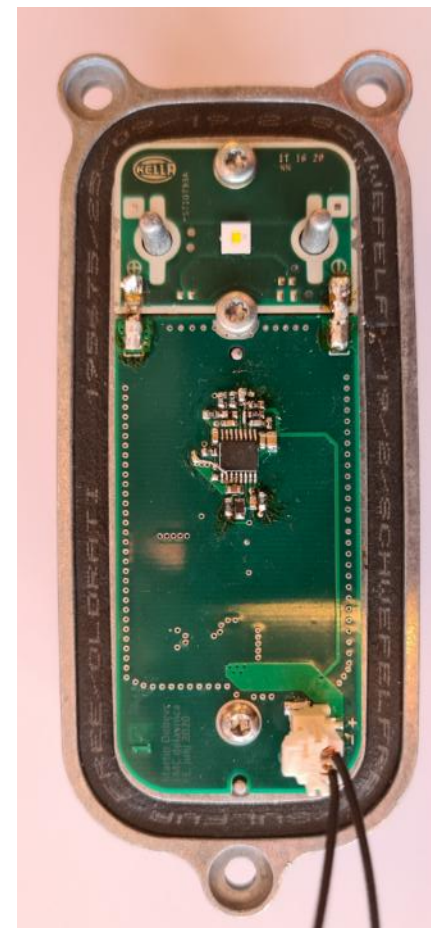
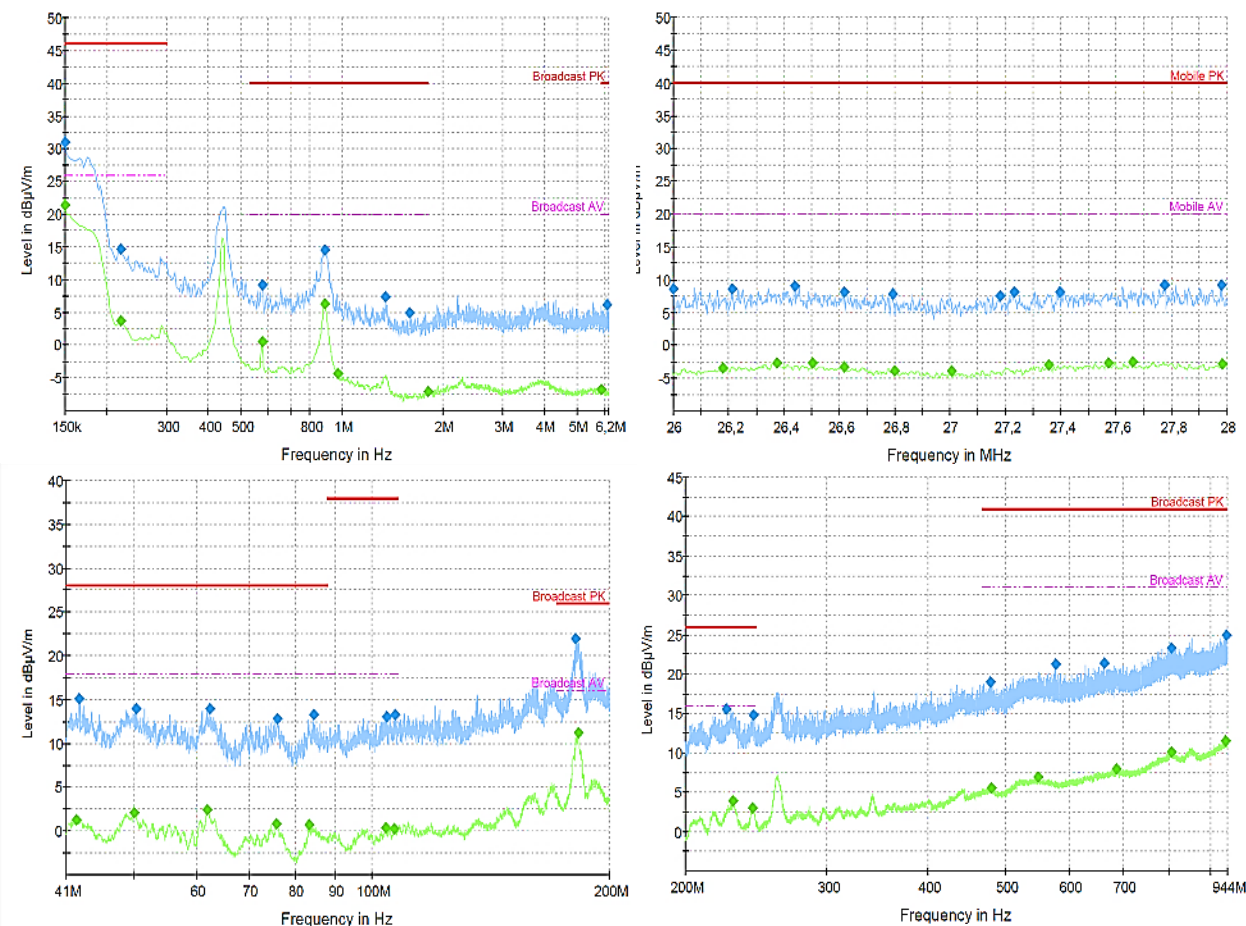


5. EMC competition 2020



5. EMC competition 2020: HELLA SATURNUS

Martin Debevc



Načrtovanje elektronike za EMC

študentska delavnica in tekmovanje

NAGRADNI SKLAD >6000 EUR



**vsak torek ob
16.15 v P3-C0**



Laboratorij za fotovoltaiiko
in optoelektroniko



Laboratorij za
električne stroje



Laboratorij za regulacijsko tehniko in
močnostno elektroniko

KOLEKTOR



MAHLE



FORVIA



ISKRAEMECO

goap

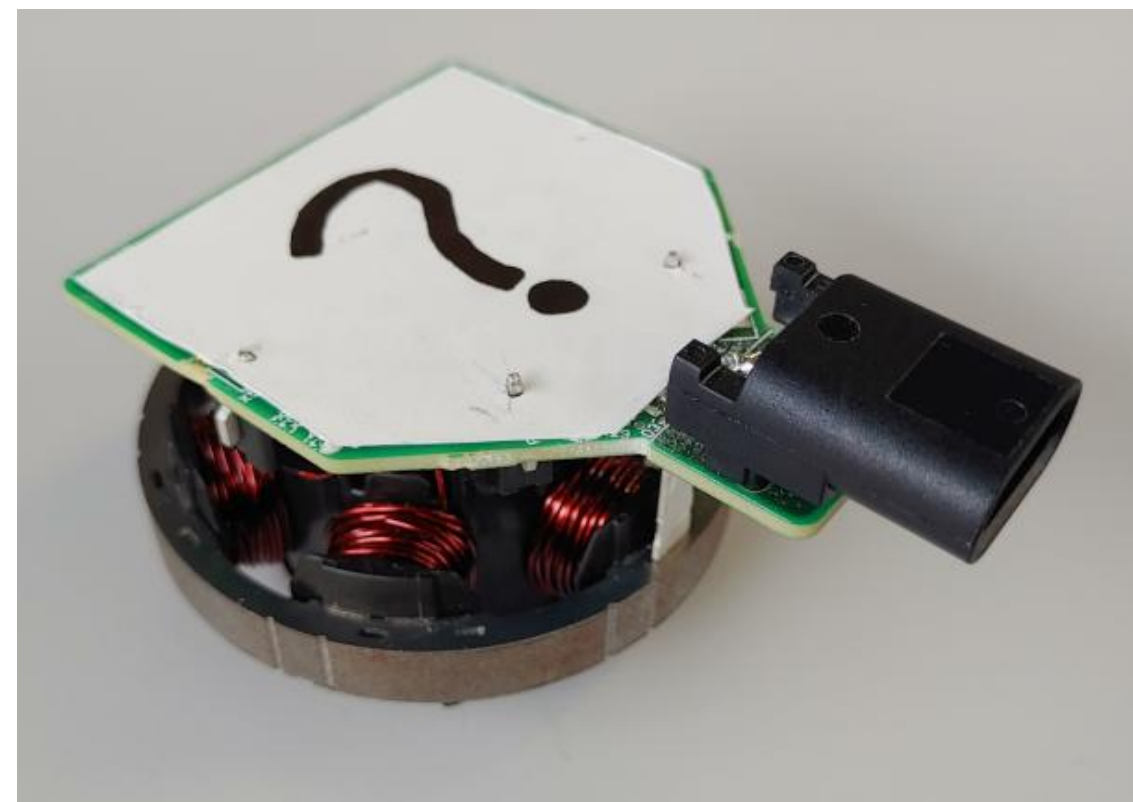
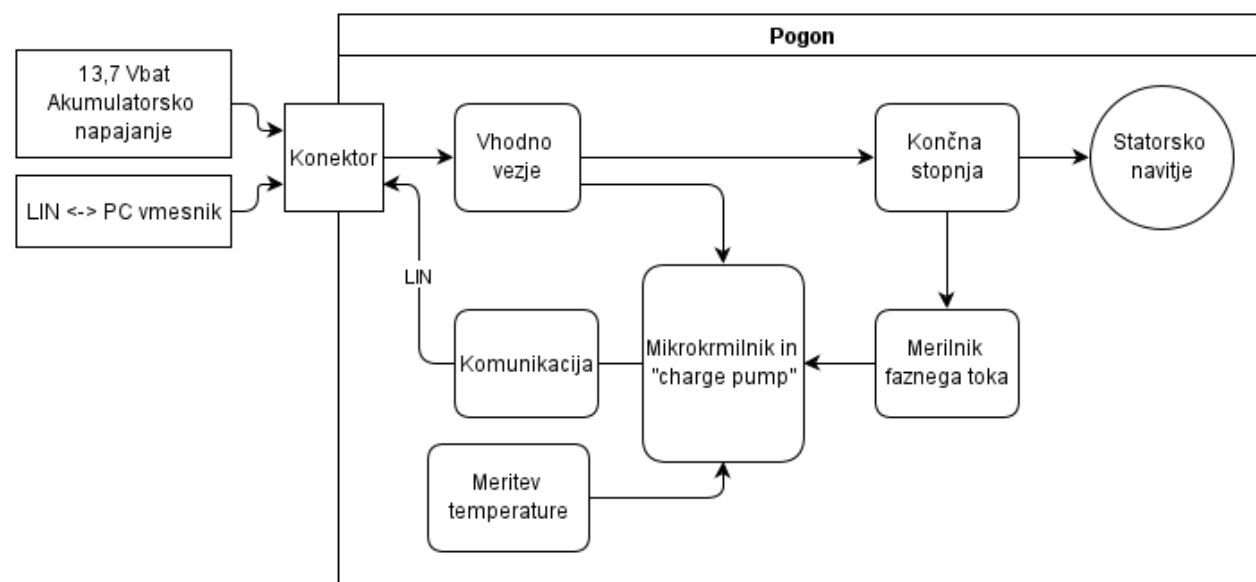
COMPUTER CONTROLS



svet
ELEKTRONIKE

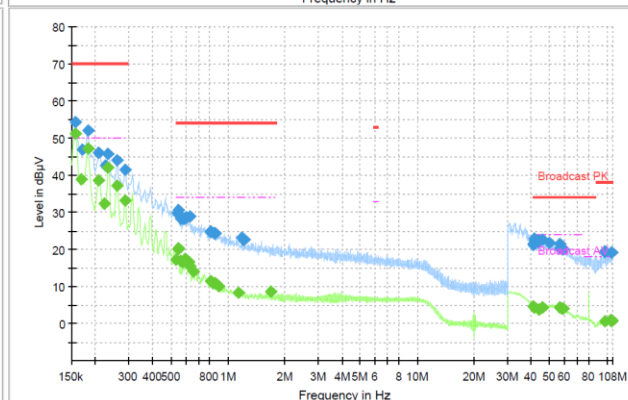
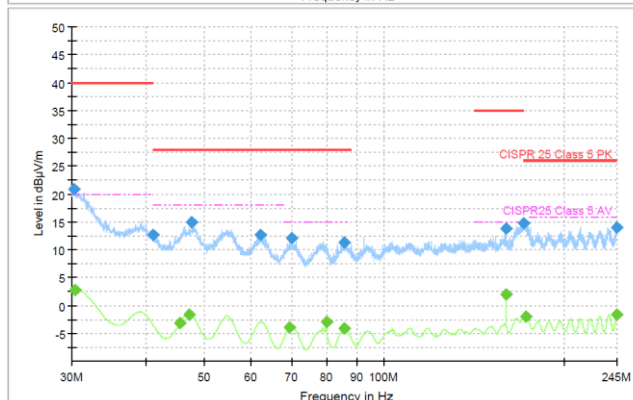
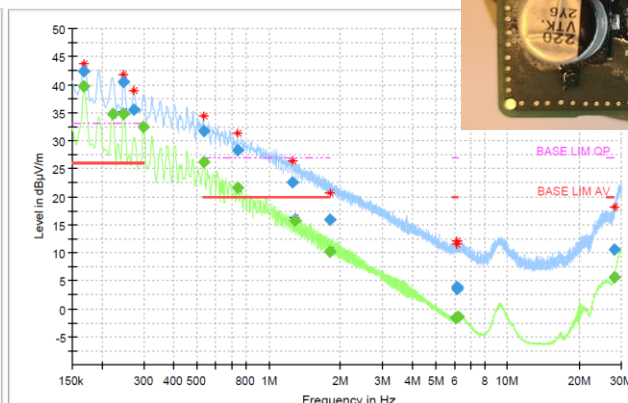
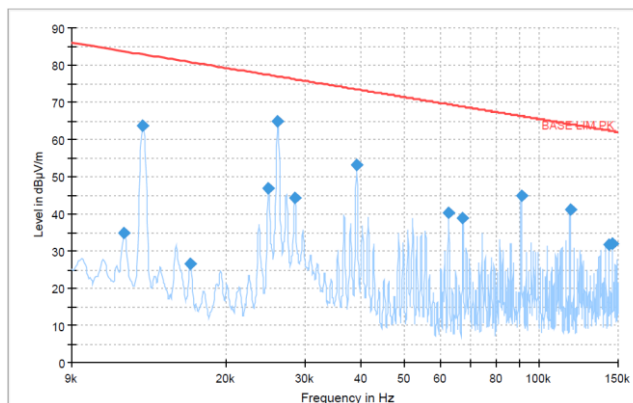
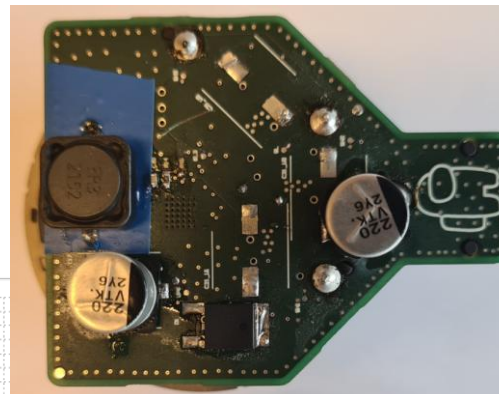
6. EMC competition 2023

60 YEARS

KOLEKTOR

6. EMC competition 2023 - KOLEKTOR

Luka Kavčič – aka Grega



Načrtovanje elektronike za

EMC²

študentska delavnica
in tekmovanje



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Laboratorij za fotovoltaike
in optoelektroniko



MIDEM 2024
Rimske Terme
3.10.2024



60000



Mikroemeco
HYPERLEVED ELECTRIC

KOLEKTOR



INSTRUMENTATION
TECHNOLOGIES

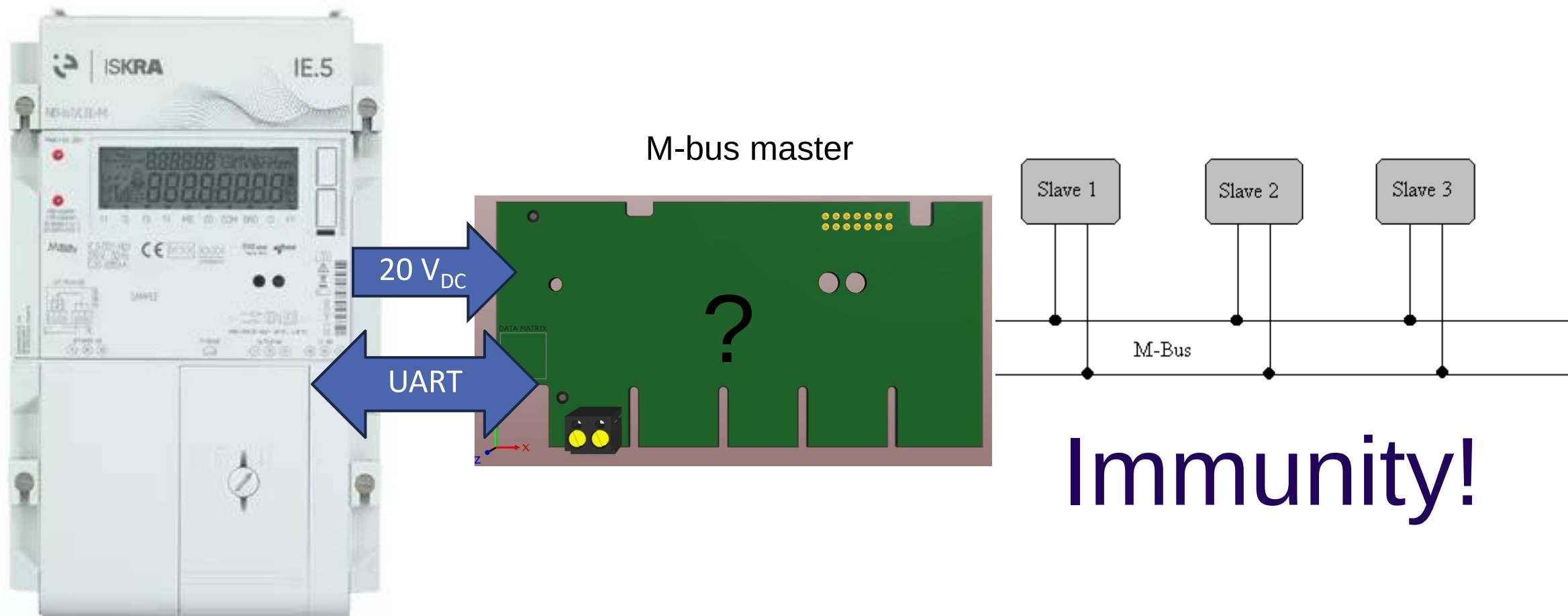
MAHLE



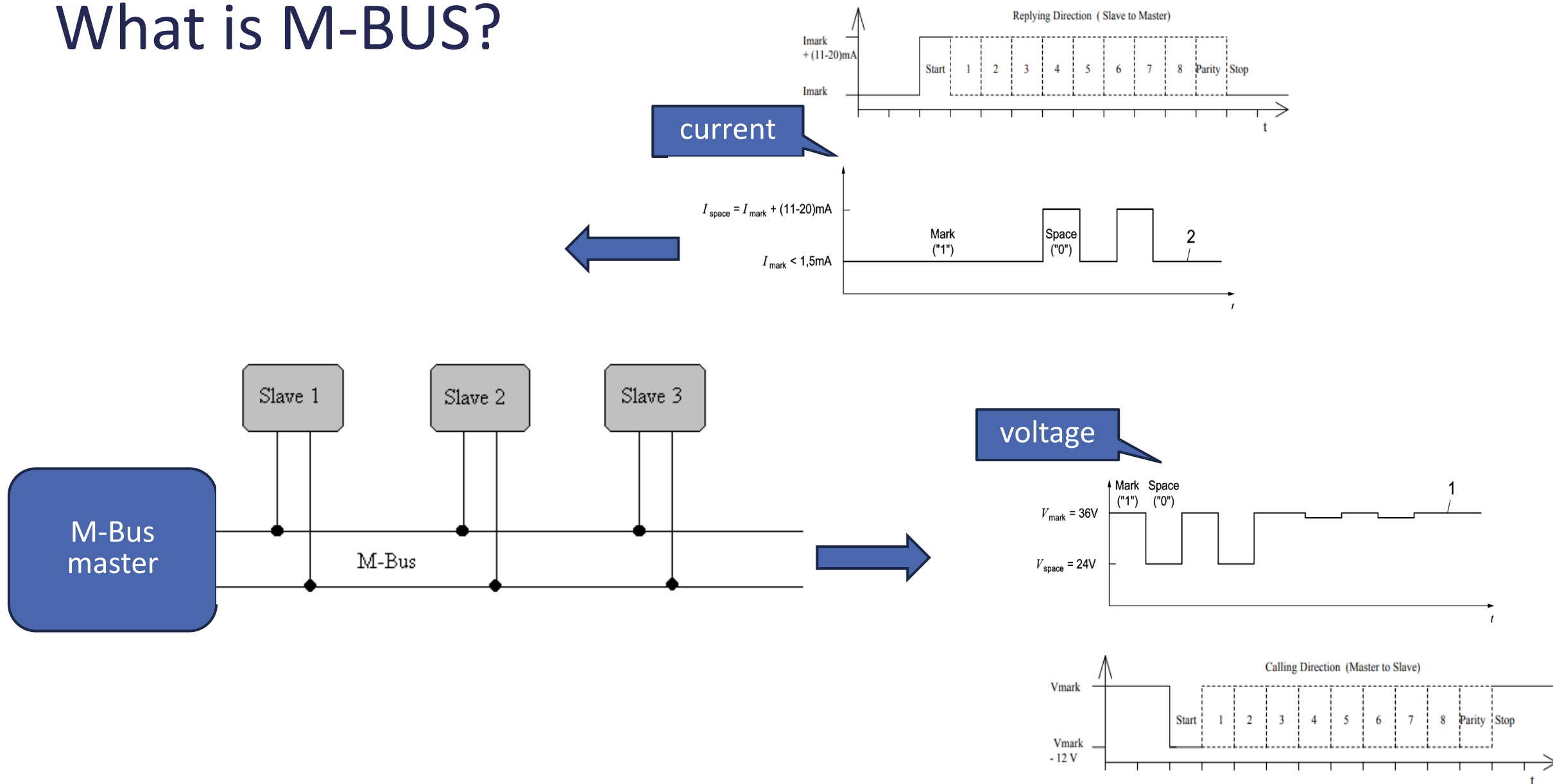
svet
ELEKTRONIKE



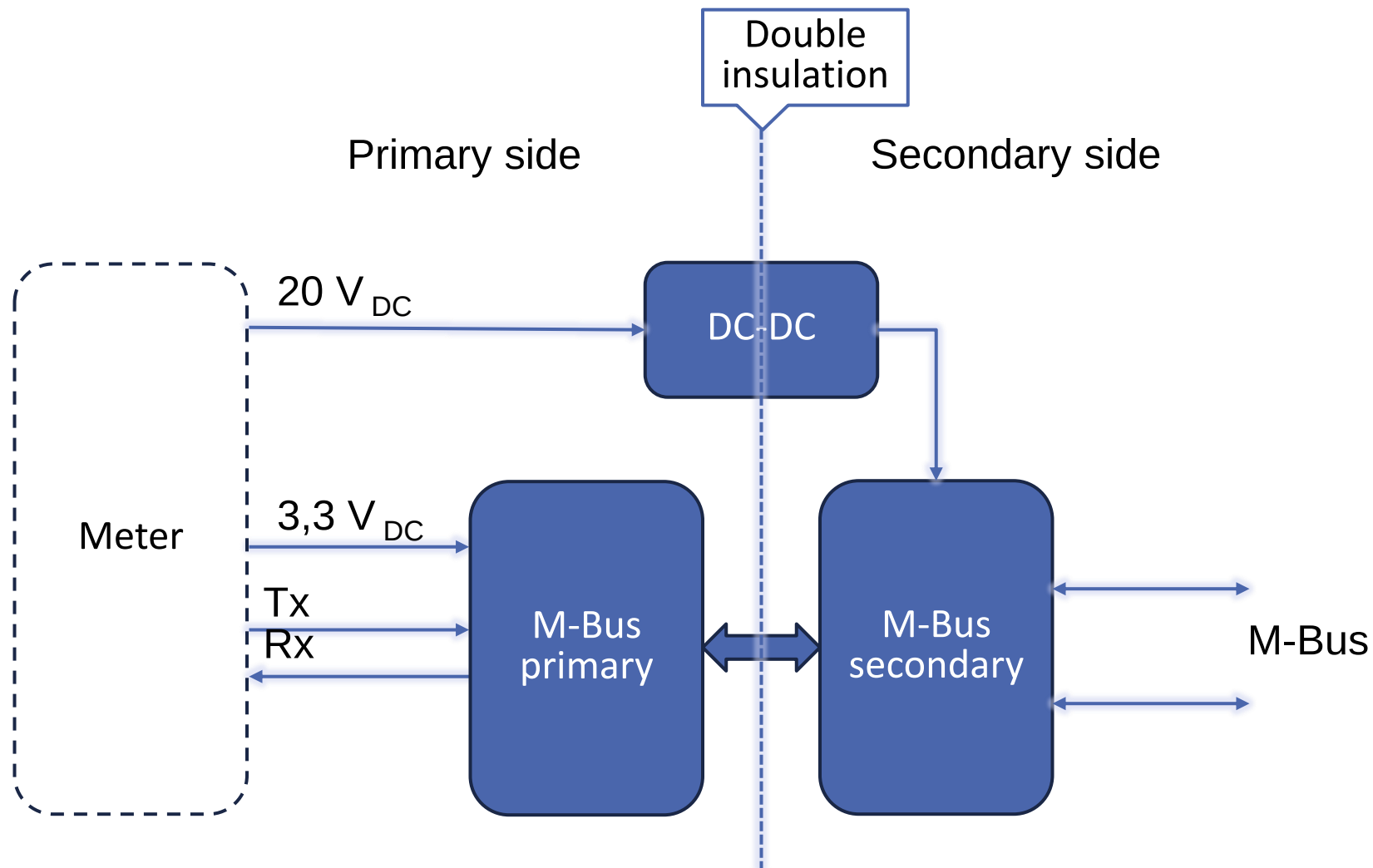
7. EMC competition 2024 - ISKRAEMECO



What is M-BUS?



Challenge



Specifications

Full M-bus compliance with up to 4 slave devices

Baudrates from 300 – 9600 baud

Temperature range from -40 to +70 °C

EMC emmissions compliant to CISPR 32: 2015

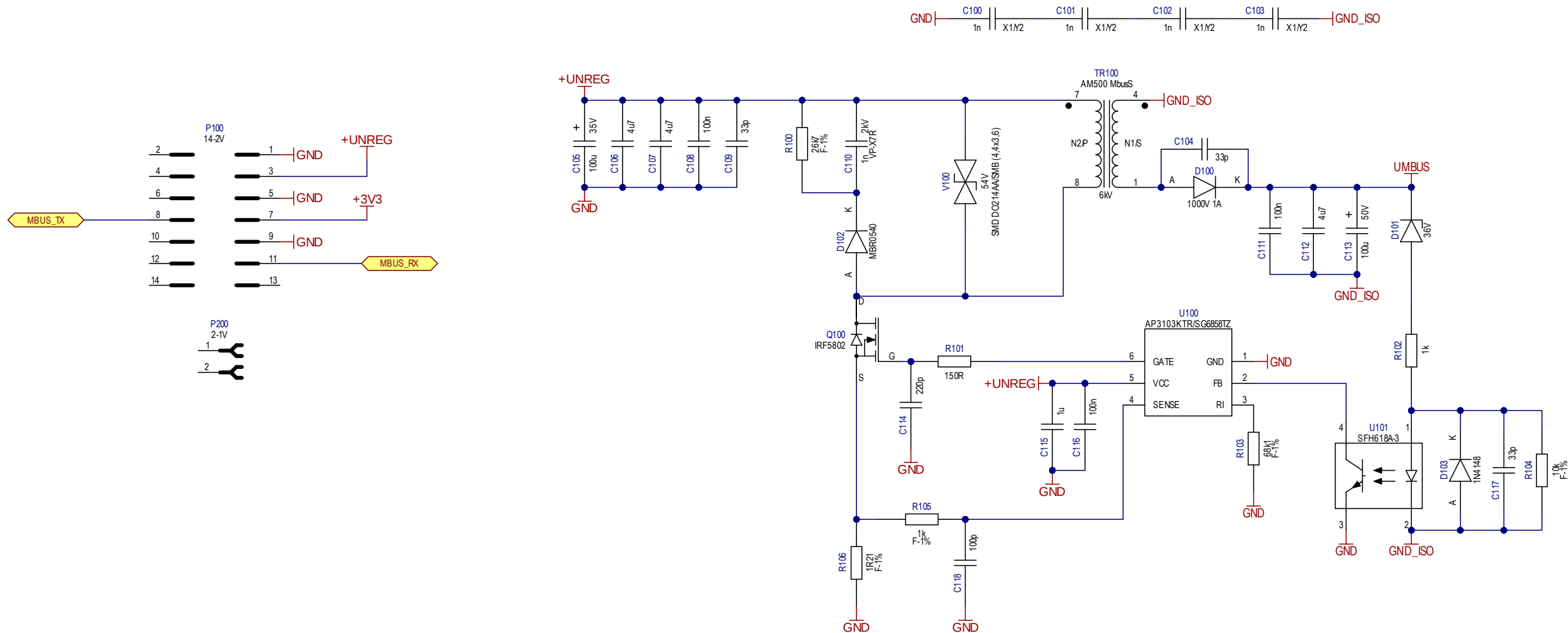
EMC immunity compliant to IEC 61000-4-4: 2012

Safety compliant to IEC 61000-4-6: 2013

Power consumption

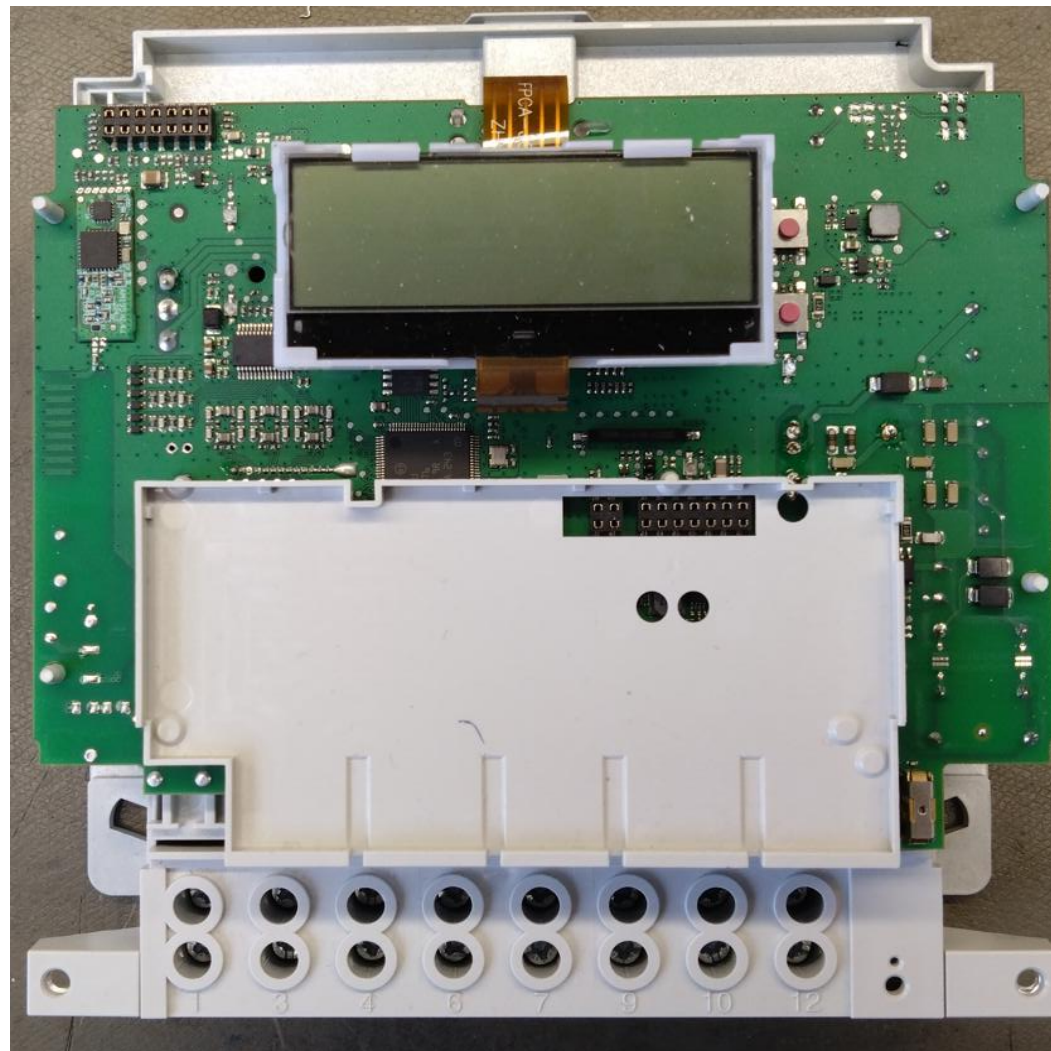
Cost of components

Basic schematics

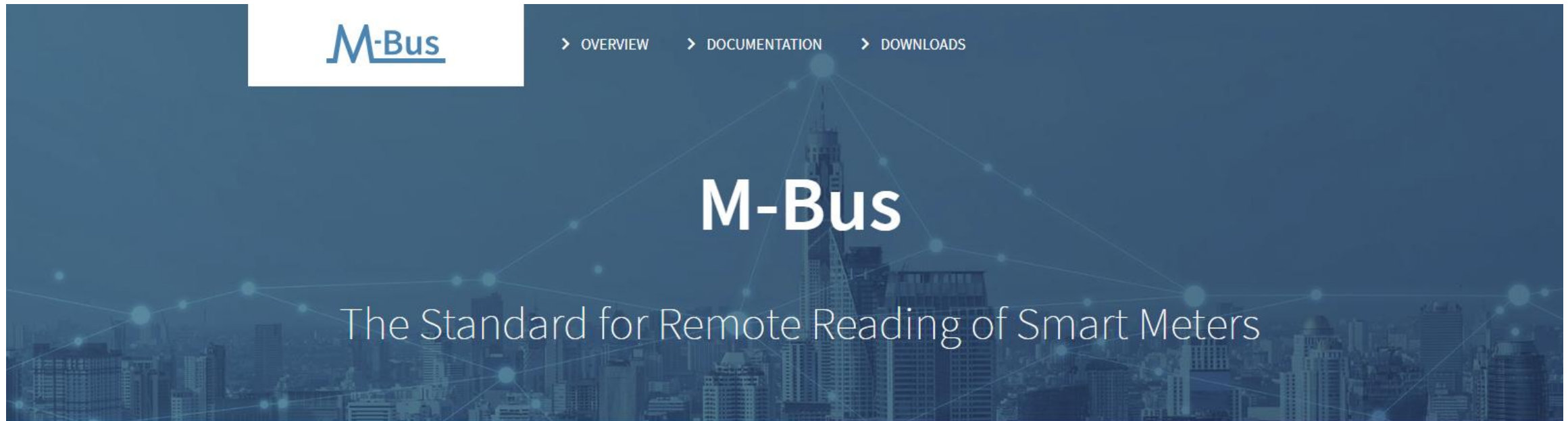


The floor plan shows a building with a central hall and several rooms. The rooms are color-coded: yellow for walls, green for floors, and red for furniture. The rooms include a large central hall, a kitchen area with a sink and stove, a bathroom with a toilet and shower, and several bedrooms with beds. A legend in the bottom left corner identifies symbols for doors, windows, and furniture. A scale bar in the bottom right corner indicates distances in meters.

Mechanical limitations



M-BUS specifications



M-Bus

The Standard for Remote Reading of Smart Meters

[> OVERVIEW](#) [> DOCUMENTATION](#) [> DOWNLOADS](#)

M-Bus

M-Bus (Meter-Bus) is a European standard (EN 13757-2 physical and link layer, EN 13757-3 application layer) for the remote reading of water meter, gas or electricity meters. M-Bus is also usable for other types of consumption meters. The M-Bus interface is made for communication on two wires, making it cost-effective. A radio variant of M-Bus (Wireless M-Bus) (circle-link) is also specified in EN 13757-4.

[Get to know the standard](#) [Read the documentation](#)

OMS-Group

The Open Metering System (OMS)[®] is based on M-Bus. It is the only system definition across Europe which integrates all media (electricity, gas, heat and water incl. submetering) into one system. The OMS-Group e. V. is a nonprofit organization and interest group of meter manufacturers, utilities, meter operators, electronics manufacturers, communication firms, and IT companies.

[Visit the OMS-Group website](#)

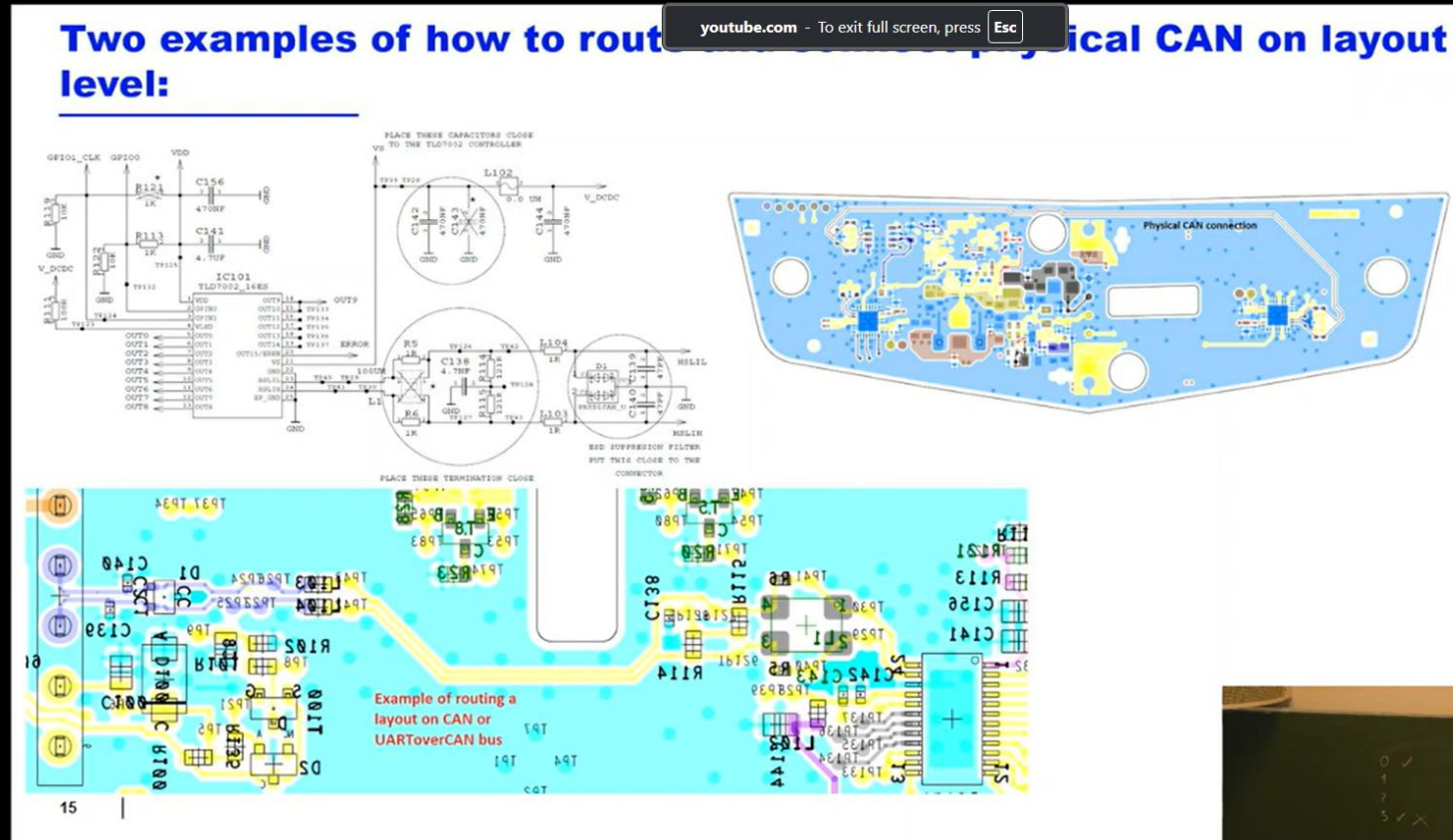
Lecture on M-BUS



EMC and overvoltage protection



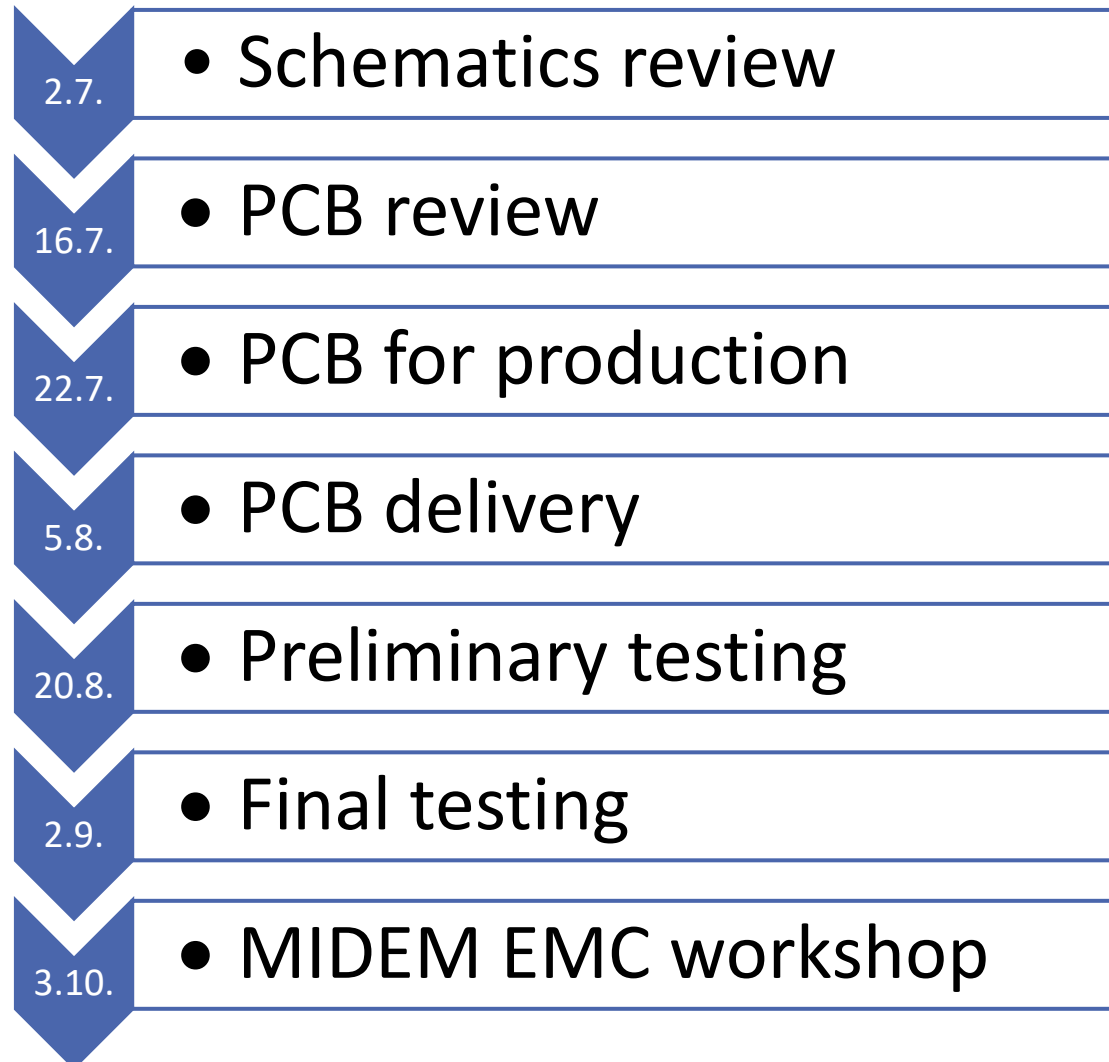
Designing for automotive industry



Company tour



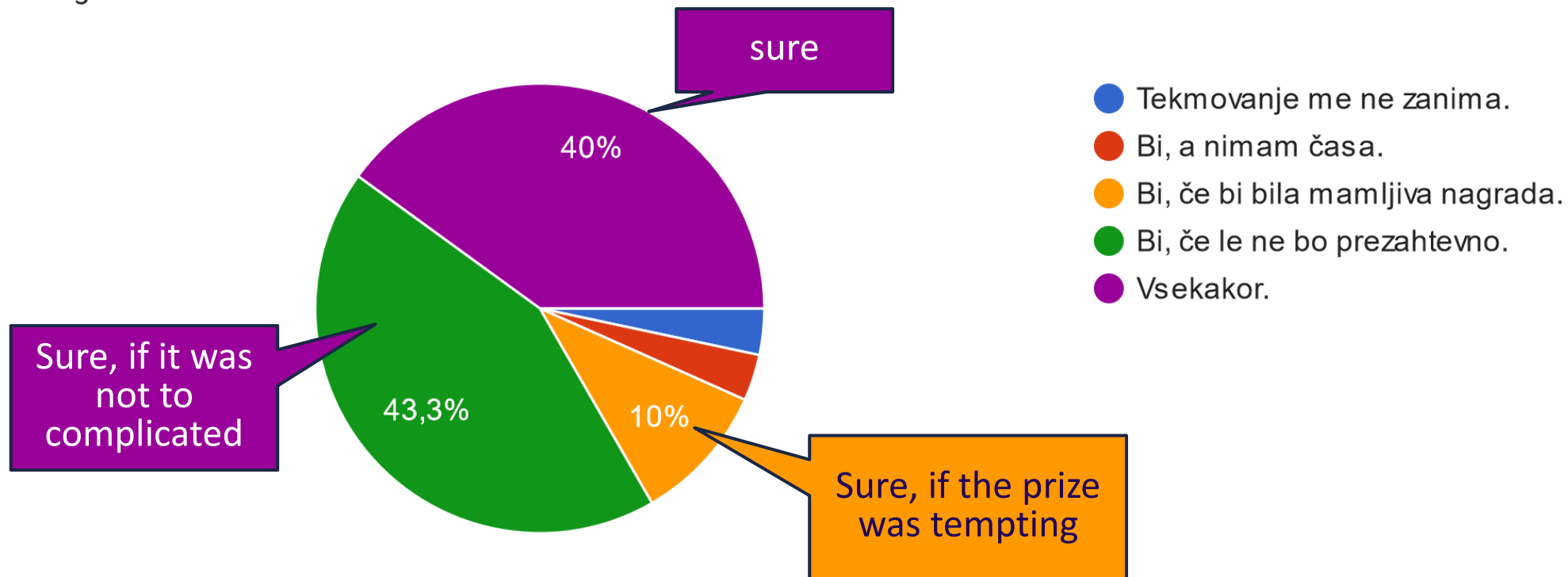
EMC competition milestones



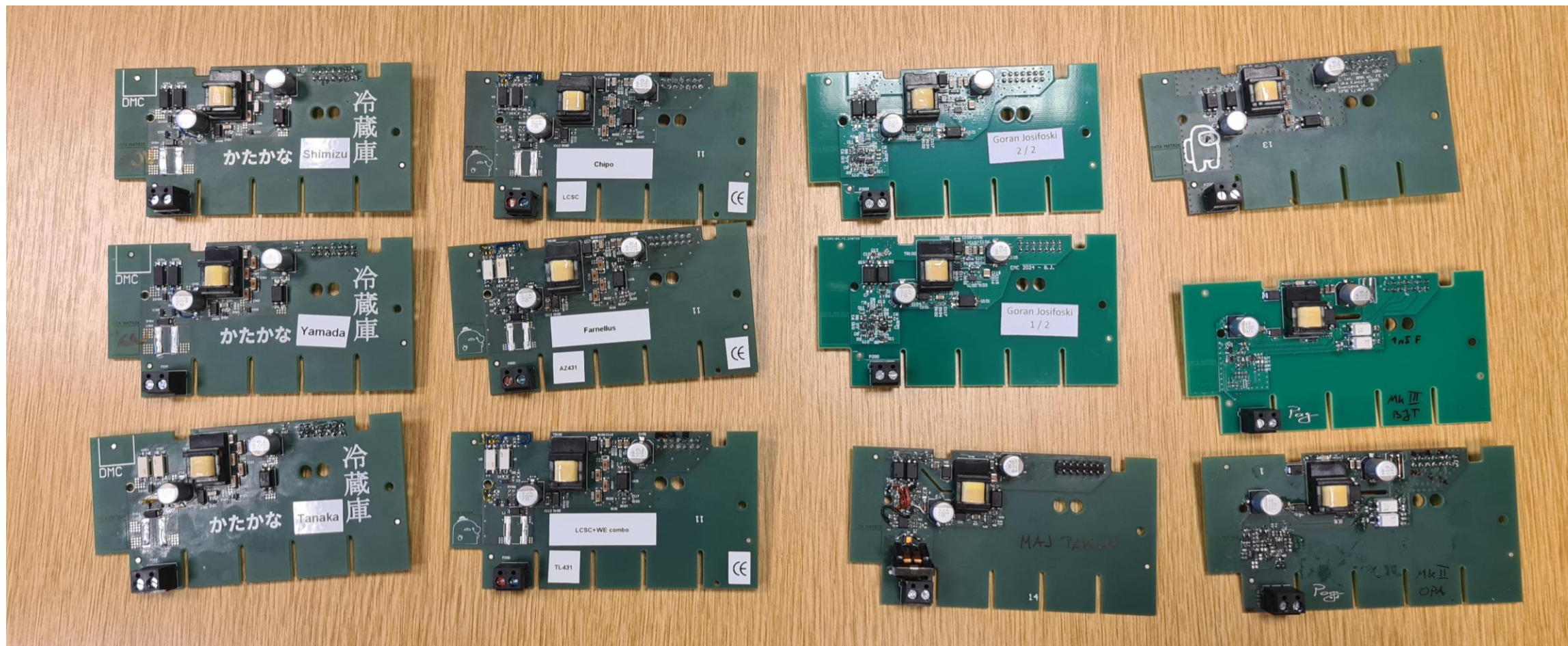
Enthusiasm

Ali bi sodelovali pri tekmovanju?

30 odgovorov



6 students submitted 12 designs



Načrtovanje elektronike za

MIDEM 2024 - EMC workshop competition -
Rimske Terme 3.10.2024



UNIVERZA V LJUBLJANI
Fakulteta za elektrotehniko

EMC²

študentska delavnica
in tekmovanje



Laboratorij za fotovoltaike
in optoelektroniko



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Rimske Terme
3.10.2024



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BY ELSEWEDY ELECTRIC

KOLEKTOR



INSTRUMENTATION
TECHNOLOGIES

MAHLE



svet
ELEKTRONIKE



WÜRTH
ELEKTRONIK
MORE THAN
YOU EXPECT



INTECTIV