EMC EUROPE 2023
International Symposium and Exhibition on Electromagnetic Compatibility
Kraków, Poland, September 4 - 8, 2023

The biggest impressions from the conference

From the minds of

Lennart Hasselgren, Björn Bergqvist, Henrik Holst, Helin Zhou and Georgios Mademlis

2023-09-06

In short

Very nice town, well organized conference

Many attendants (15 swedes, 5 from Volvo), and large vehicle focus,

>650 attendants, 210 papers presented (mixed quality observed), (14+4) rejected

2 presentations by Volvo, 4 Swedish oral contributions in total, 3 posters

Specific goodies found for more reading

Complete conference stored in “external info” folder. The number for the paper = same as in sub-folders

Workshops interesting for “espionage”

what is said – and what is not being said, get ideas for AE projects, evaluate VCC competence level

Getting to Krakow

After several delays and midnight taxi, we finally arrived

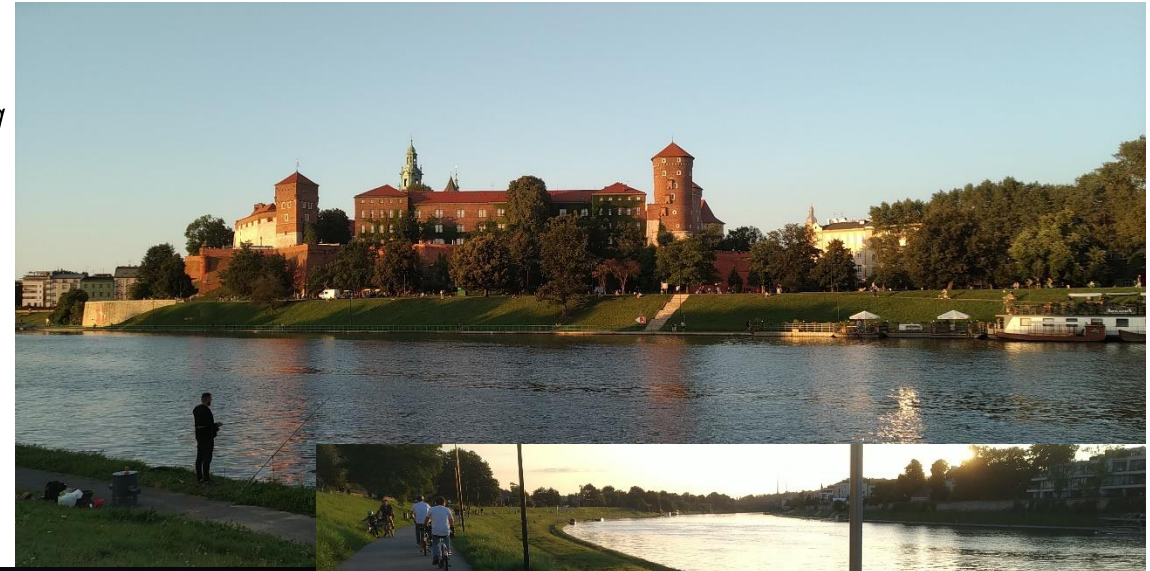
Krakow at a glance

World cultural heritage, along Wisla river

Bike friendly old town

Trams ☺!

Giant squares and > 100 churches

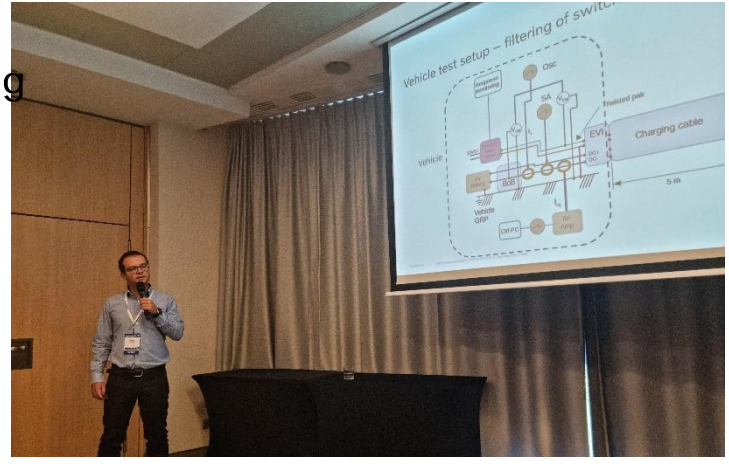


Volvo related papers/presentations

Time domain filter tuning for PLC protection

- Georgios M, Lennart H, Henrik H

OS-4B: Filtering



Emission from Wireless Power Transfer of electrical vehicles

- FOI (+ VCC)

S-parameter modelling of el. machines

- Helin Zhou

WS-16B: Automotive EMC workshop

What did we see?

Participating OEMS

- Volvo Car, Volvo Bus, Stellantis, Daimler, Toyota, etc

Suppliers:

- Siemens, Thyssen-Krupp, etc

Interesting research

- Active noise cancellation (use of notch filters, comb with ML)
- Machine learning
- New measurement techniques
  - In-situ measurements
  - MSC and emission

Missing items (that we did not find)

- Other OEMs work on drive shaft emission
- Ideas from other OEMS on how to handle AD and functional safety (e.g test 2 fail)

Total summary: *we are lacking* – in Sweden – a research structure for EMC (forskarskola) with a critical mass of PhD students as can be seen in other European countries

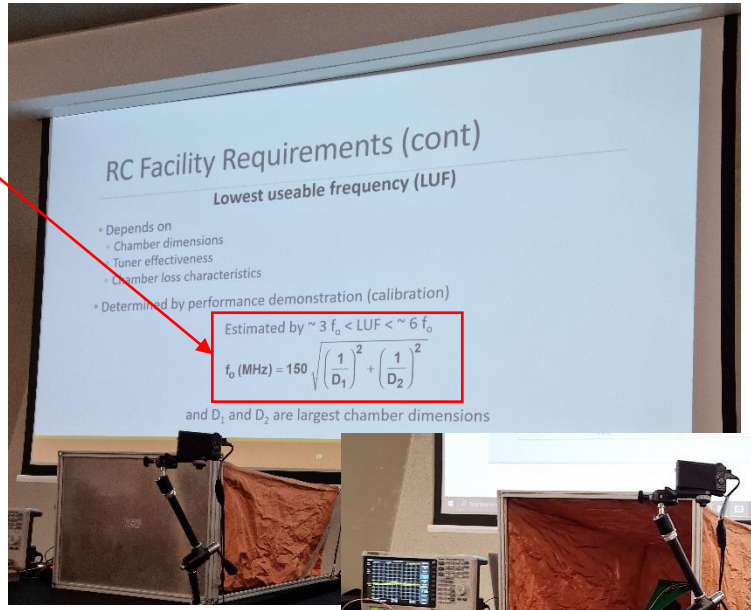
- Frank Leferink's group in University of Twente is a master example
- Other examples: KU Leuven, TU Graz (Austria), Ancona (Italy)
- Missing group (what has happened?): Univ. York

What did we see?

- Larger focus on modelling, testing and analysis of **power electronic components**
  - Workshops on SiC/GaN and standard Si inverters
  - Workshop on design rules for PCB:s
  - Multiple papers on modelling of PE components (modelling parasitic elements, power modules, etc.)
- **Automotive EMC** is one of the largest focus areas
- Wide-spread use of **machine learning** for
  - ✓ Designing individual components
  - ✓ Predicting emissions
  - ✓ Evaluating system design rules
  - ✗ Still problematic areas to be solved
  - ✗ Computational expensive
  - ✗ Needs lots of data

Workshop stirred chambers, MSC (WS-01A-D)

- Size of chamber affects the frequency that can be tested: the larger the chamber, the lower frequencies can be used
- It is easy to reproduce results in multiple test facilities, not sensitive to antenna positioning
- Injection antennas must not face each other and need to have a minimum distance from the walls to allow enough space for reflections
- Suitable for radiated immunity measurements, but also emission



Workshop Technology update on vehicle EMC (WS-06-A-B)

Abishek (Analog Devices): modern communication networks and PSDs

A lot of devices in cars – new functions

Example of interfaces:

- A2B Automotive Audio Bus
- E2B Ethernet to Edge Bus
- Acoustic noise cancellation systems
  - Audio sensors in bumpers

- Error sources - elevating noise
  - UTP mixed cables upto 20 dB difference between cables
  - CM choke leakage into termination resistors = unbalance current
  - CM choke variation upto 10 dB between items (due to manufacturing
  - Powerline injection series inductors – routing optimization

Spread spectrum technique is very complex to achieve

- **Would rather be without it**

Workshop Technology update on vehicle EMC (WS-06-A-B)

Garth dÀbreau (ETS Lindgren) what happens in testing business?

Standard overview

- CISPR 36 is coming (=chinese req on LF field emission)
- CISPR 12 v7 is cancelled and shall be restarted

Reverb (MSC):

- *Simultanouos testing* of multiple vehicles possible
- Fast stirring a challenge: DUT response time critical

Test chamber challenges

- Dynos need to handle EV modes, e.g. regen mode, maybe also dynamic mode profile
- EV charging inside chamber

Component test on propulsion system
many companies struggle with this:

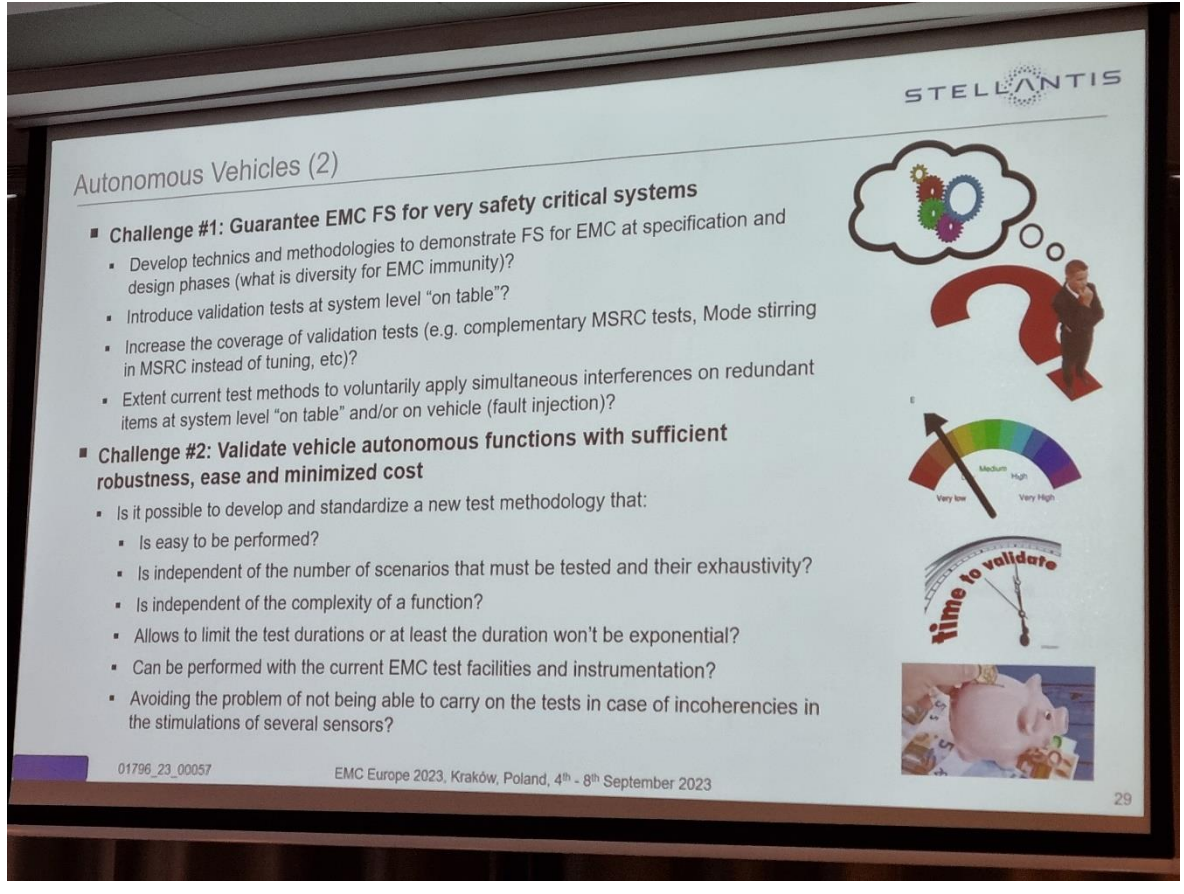
- Test setups do not reflect the drive shaft emission effect
- Drive shaft mechanical load outside chamber – no alternatives are available

Keynote speaker: M Klingler, Stellantis vehicle EMC (page 3)

EMI challenges:

AD mode + functional safety

- Demonstrate Functional Safety
- new types of tests?



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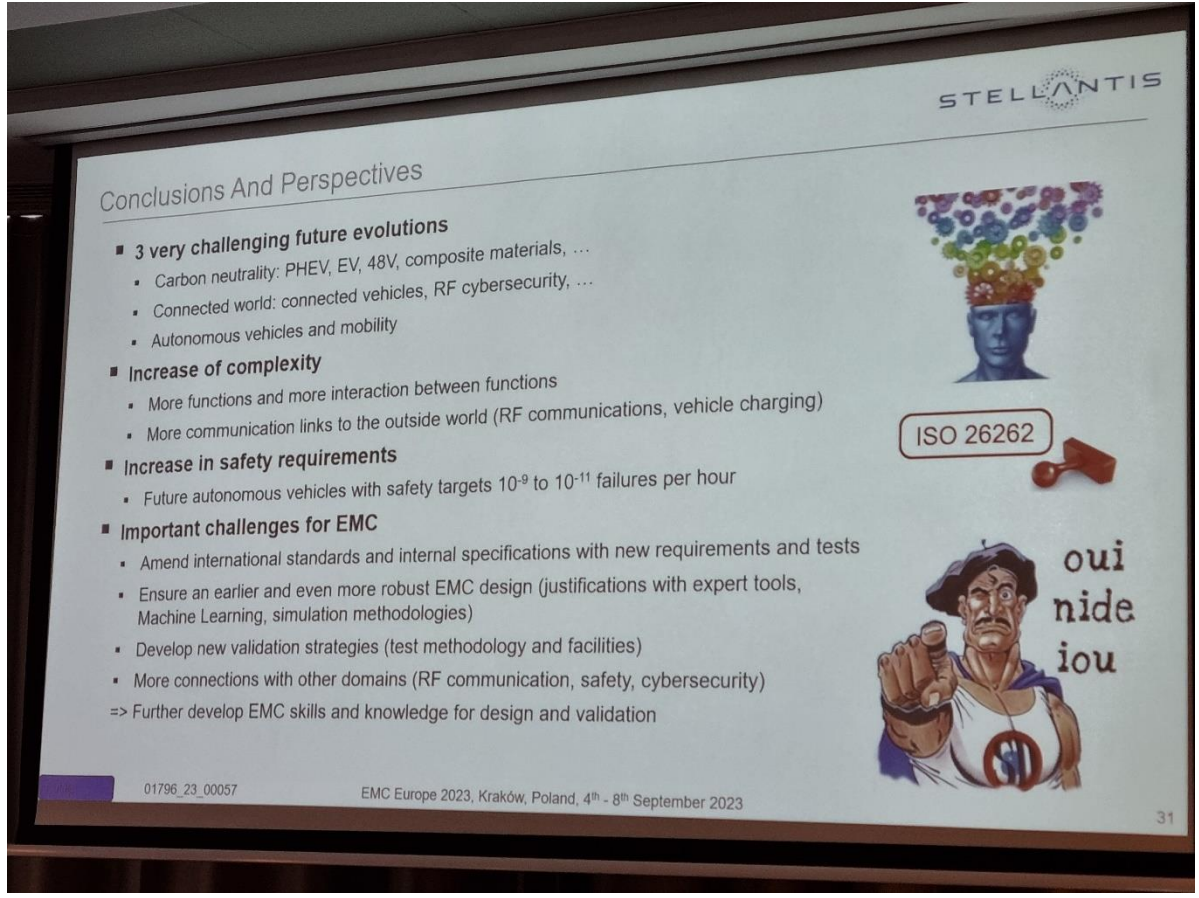
Conclusions



Active noise cancellation on inverter (OS-04A)

Stefan Haensel (Siemens)

Active noise cancellation by injection of counteracting signals

- Voltage sense current cancellation
- Capacitive injection in HV DC
- Gives smaller filters

Stability challenge

- High frequency – phase stability + computation speed
- Low frequency – phase stability + having enough energy storage

New approach

- RF mixed feedback
- LF sensor network loop

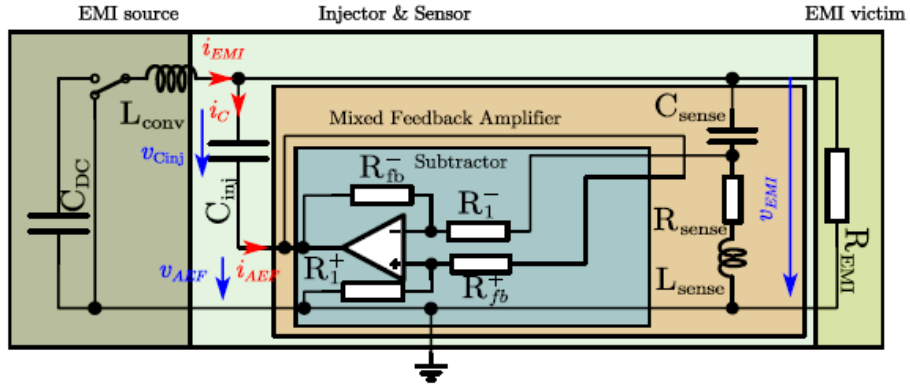


Fig. 5. Feedback voltage sense current injecting topology built up with an op-amp as a subtractor

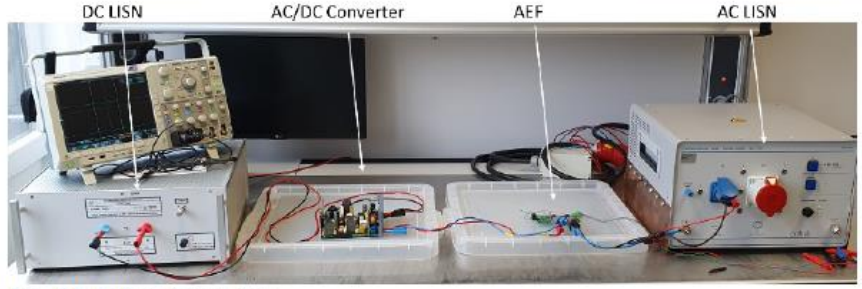


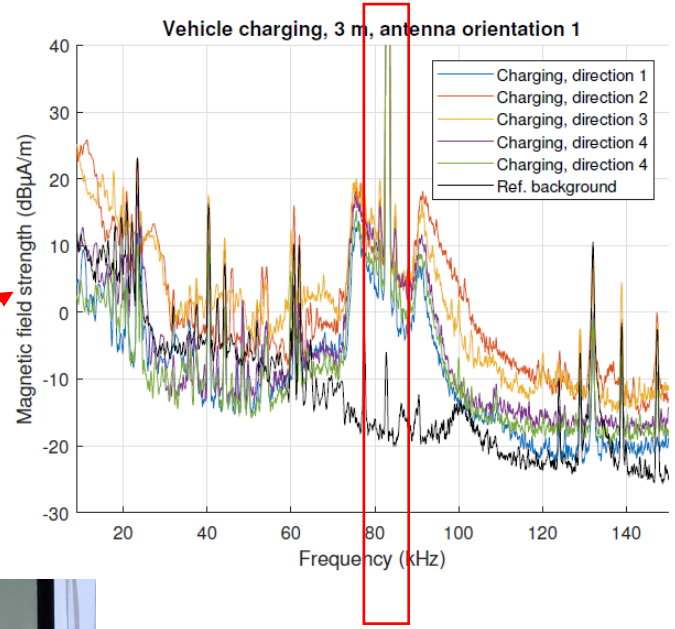
Fig. 11. Laboratory setup

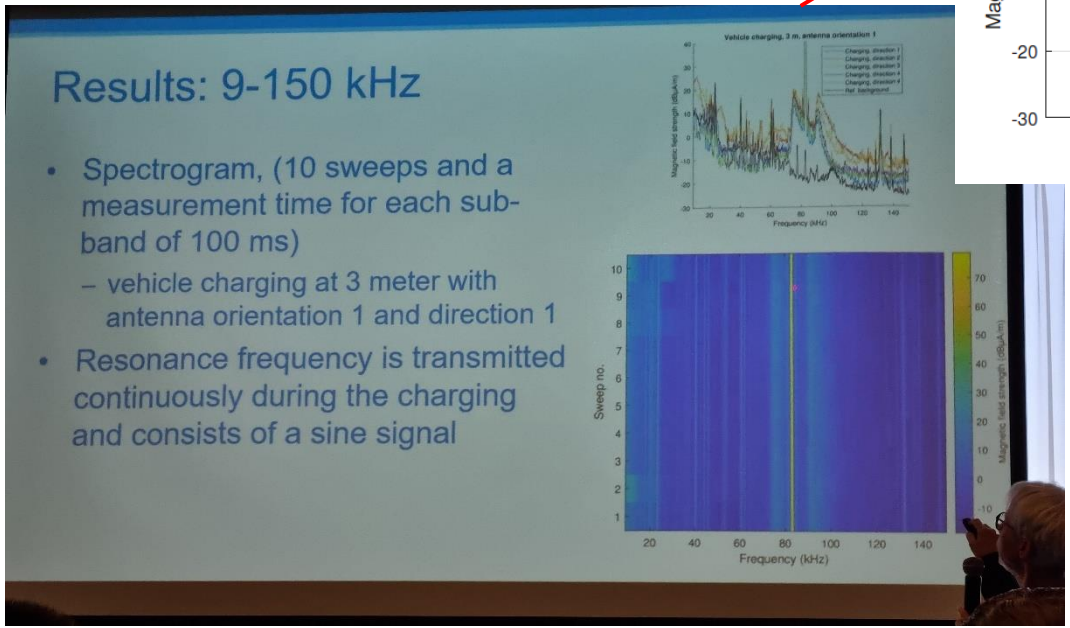
RE from WPT of vehicles (OS-08B)

Kia Wiklundh (FOI)

WPT at 85 kHz

RE measurements outdoors, not in a chamber



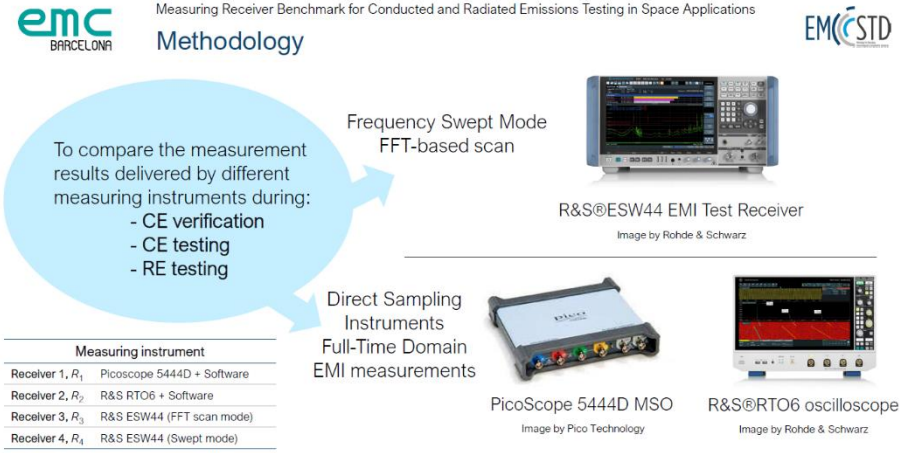


1) Instrument benchmark on conducted and radiated emission (SS-03A no 120)
2) Efficient in situ assessment of radiated emissions no 102

1) M Astarua (Catalunya, Spain)
2) Jordi Sole-Lloveras (EMC Barcelona)

There may be big advantages in using time domain technique combined with multi-port system for in-situ measurements

- Possible to identify and remove background noise in realtime
- Improvement of OATS (tent) measurement – *replacing ALSE*



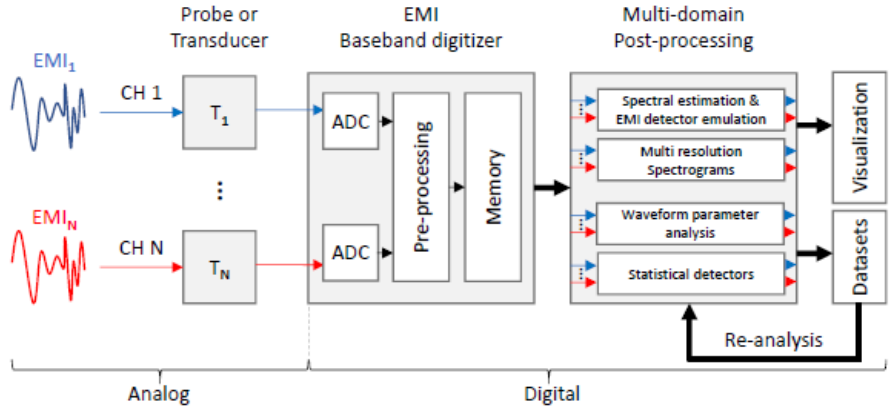


Fig. 2. Block diagram of the multi-channel time-domain EMI measurement system used during the experiments.