WP4
Upgrade of Irradiation and Characterization Facilities

Task 4.5: Design & Development of a New Electronics Characterization System for EMC Control (*ITAINNOVA, CNRS-IPHC*)

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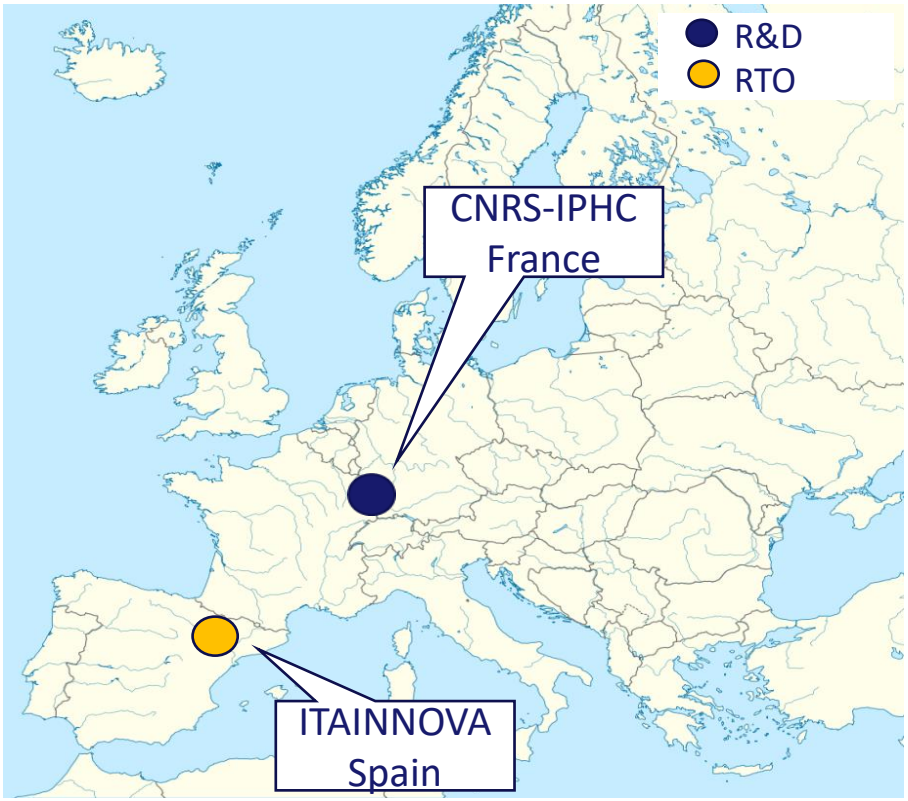
Outline

1. Introduction
2. Automatic TF measurement system
3. Portable noise measurement system for IRRAD Facilities
4. Summary

1. Introduction

- **Goal:** The main goal of this activity is to upgrade Electromagnetic Compatibility (EMC) tests in order to improve the support for detector electronics designers.
  - Noise studies were greatly demanded on previous AIDA 2020 project
- **Activities:** Two activities are planned
  - Design and develop an automatic EMC test bench to measure the noise transfer functions (TF) of physics detectors.
  - Design and develop a portable test bench to perform in-situ EMC conducted emission measurements of power units in irradiation facilities.
- **Innovative Approach:**
  - Introducing unique systems for measuring detector Transfer Functions (TF) against electromagnetic noise and a novel portable test bench for on-site noise emission assessments of DC-DC converters and small power supply units

1. Introduction



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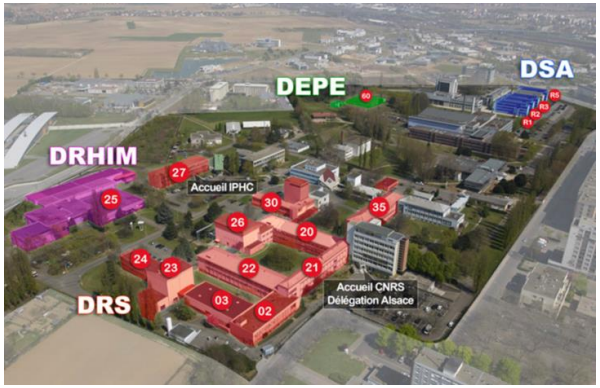


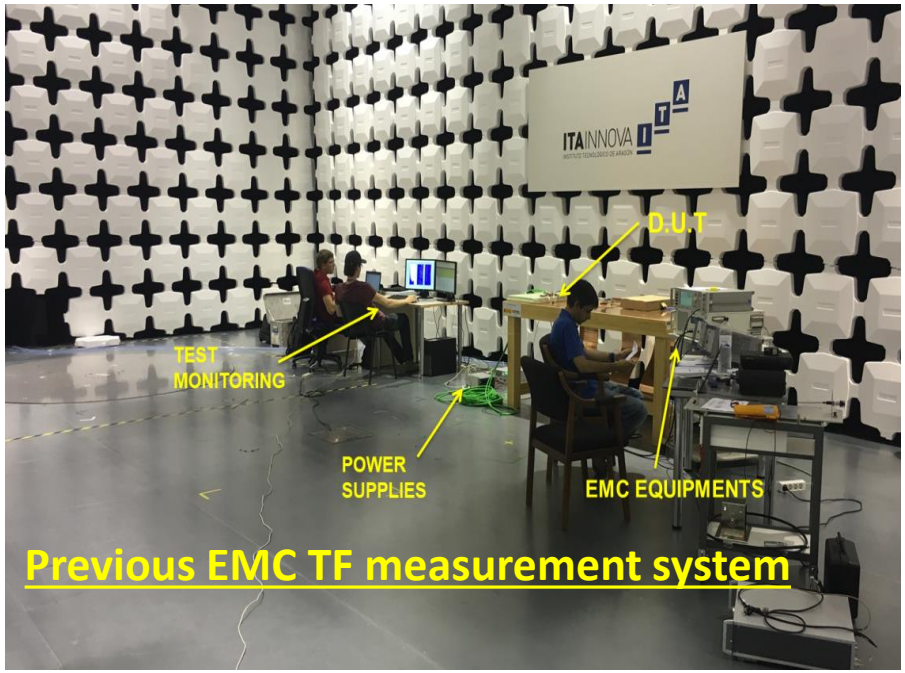
- Two institutes participates in this tasks:
  - Instituto Tecnológico de Aragón (ITAINNOVA) (Zaragoza, Spain)
  - Institut Pluridisciplinaire Hubert CURIEN (IPHC)/CNRS (Strasbourg, France)

1. Introduction

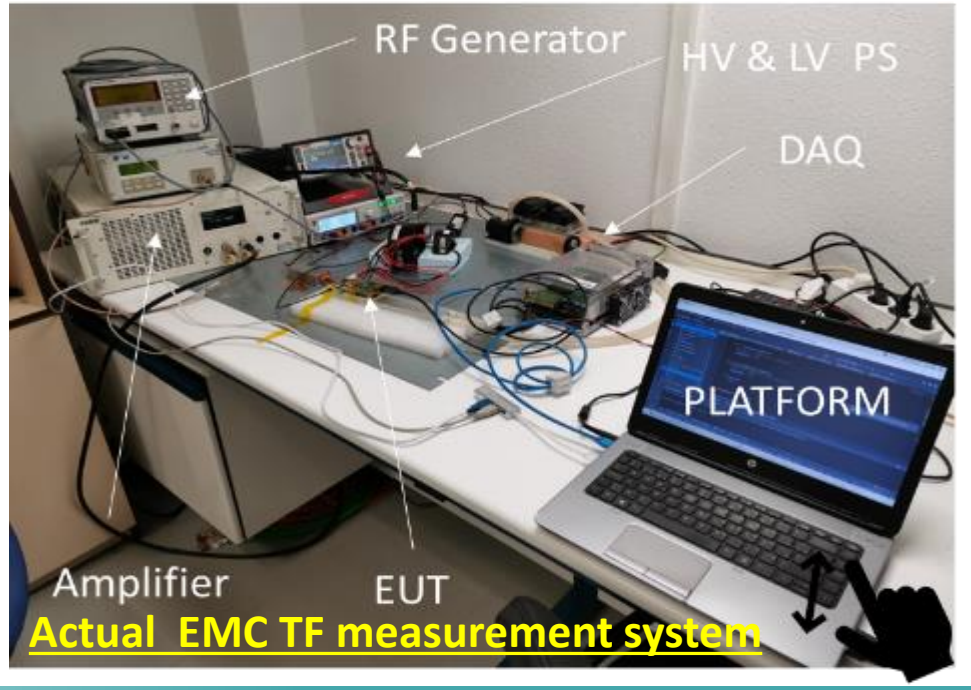
- ITAINNOVA and IPHC will participate in both activities
  - ITAINNOVA will provide the design /control of the EMC equipment (both test benches)
  - IPHC-CNRS will be in charge of the *interface between the EMC system and the DAQ* of the detector for the TF test bench and the *technical background about radiation aspects and regular access* to its radiation facility.
- One Milestone and deliverable are planned:
  - **MS17: Apply TF test bench to FEE prototypes [M23]**
  - D4.5 : Develop a conductive noise test bench for irradiation facilities [M44]

2. Automatic TF measurement system

- Developing an automated EMC test bench to accurately measure the noise transfer functions (TF) of physics detectors, addressing a gap in current capabilities.



Previous EMC TF measurement system

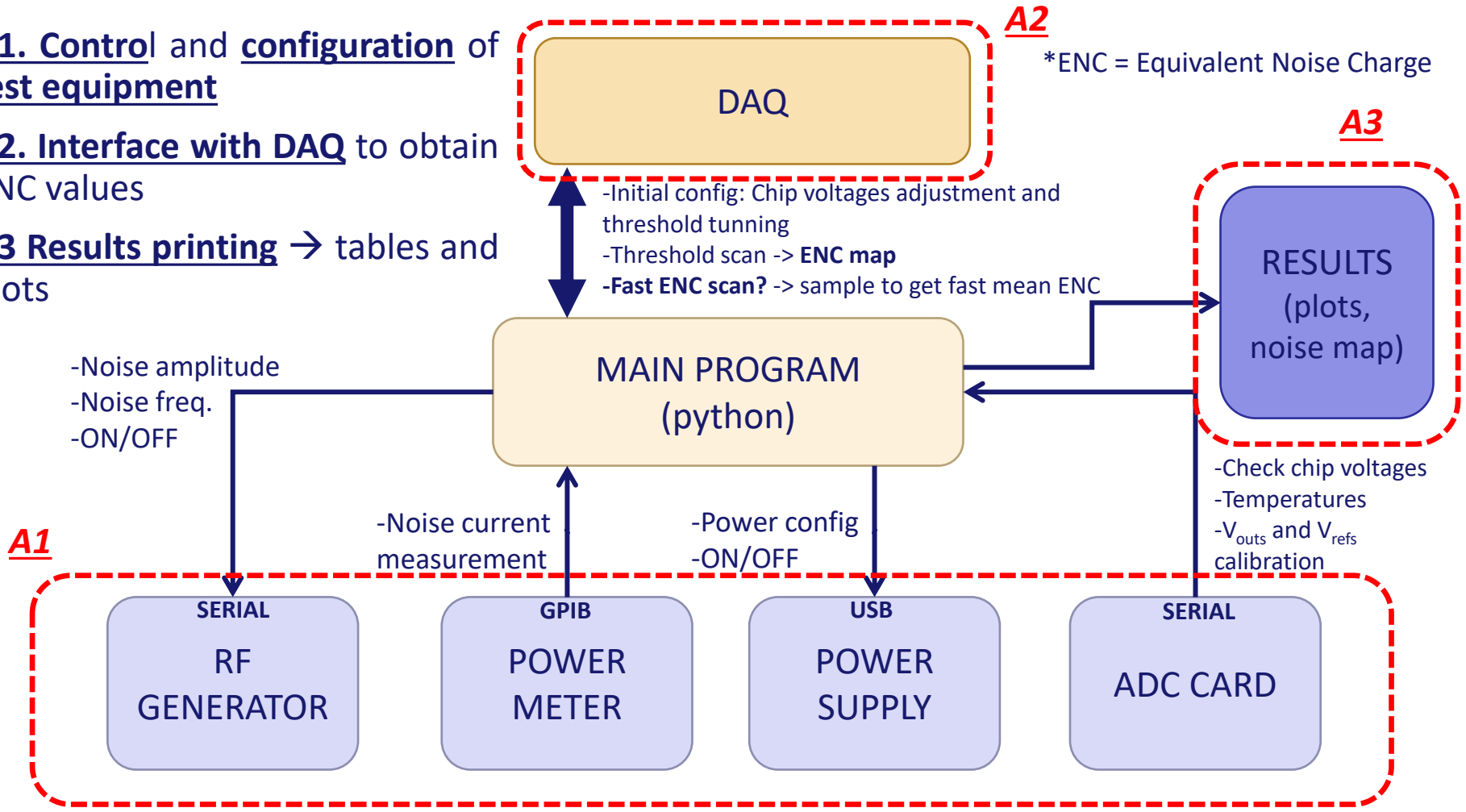


Actual EMC TF measurement system

2. Automatic TF measurement system

- This the simplified scheme of the system.

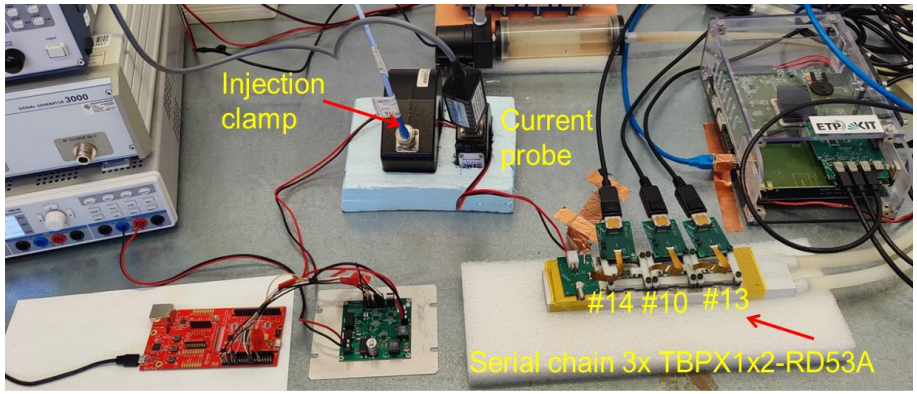
- **A1. Control** and **configuration** of **test equipment**
- **A2. Interface with DAQ** to obtain ENC values
- **A3 Results printing** → tables and plots

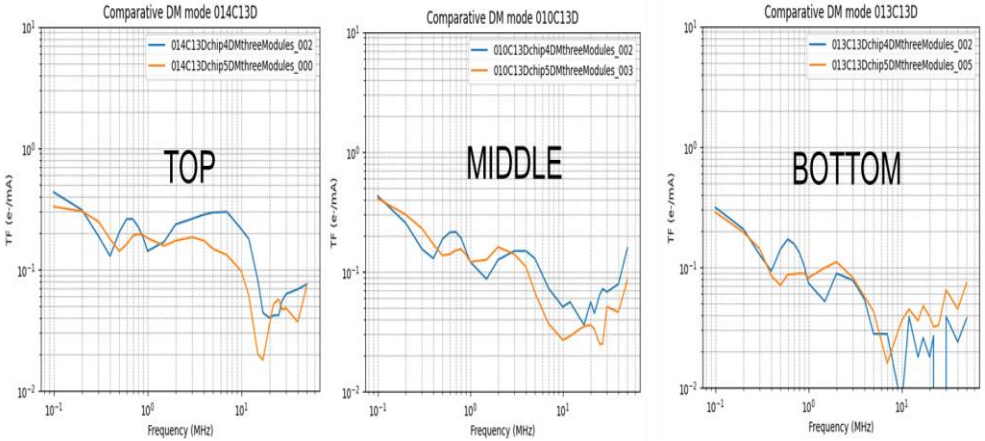


2. Automatic TF measurement system

- This activity is completed
  - **MS17 completed & submitted**
- The system is being used regularly today

Noise studies at system level
CMS-ITK –pase II

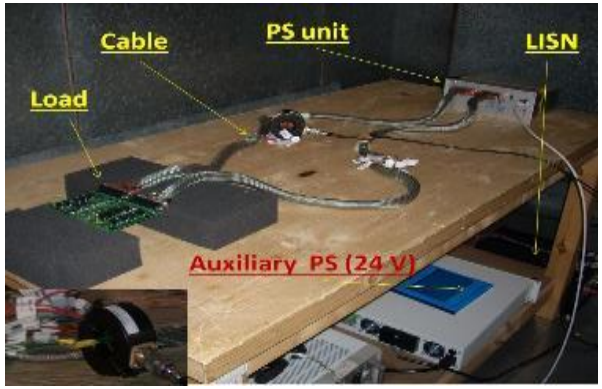




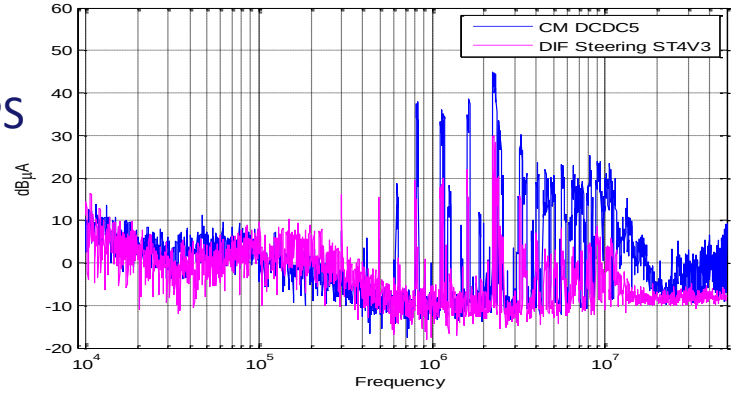
- The new updates will be implemented soon through the EUROLABS project.
  - New cooling system and new function for the graphical user interface.

3. Portable noise measurement system for IRRAD Facilities

- During the third year, the development of a customized portable test bench, designed to perform in-situ conducted EMC emission measurements of power supplies in IRRAD configurations, has been initiated.



Standard test bench for PS conducted emissions



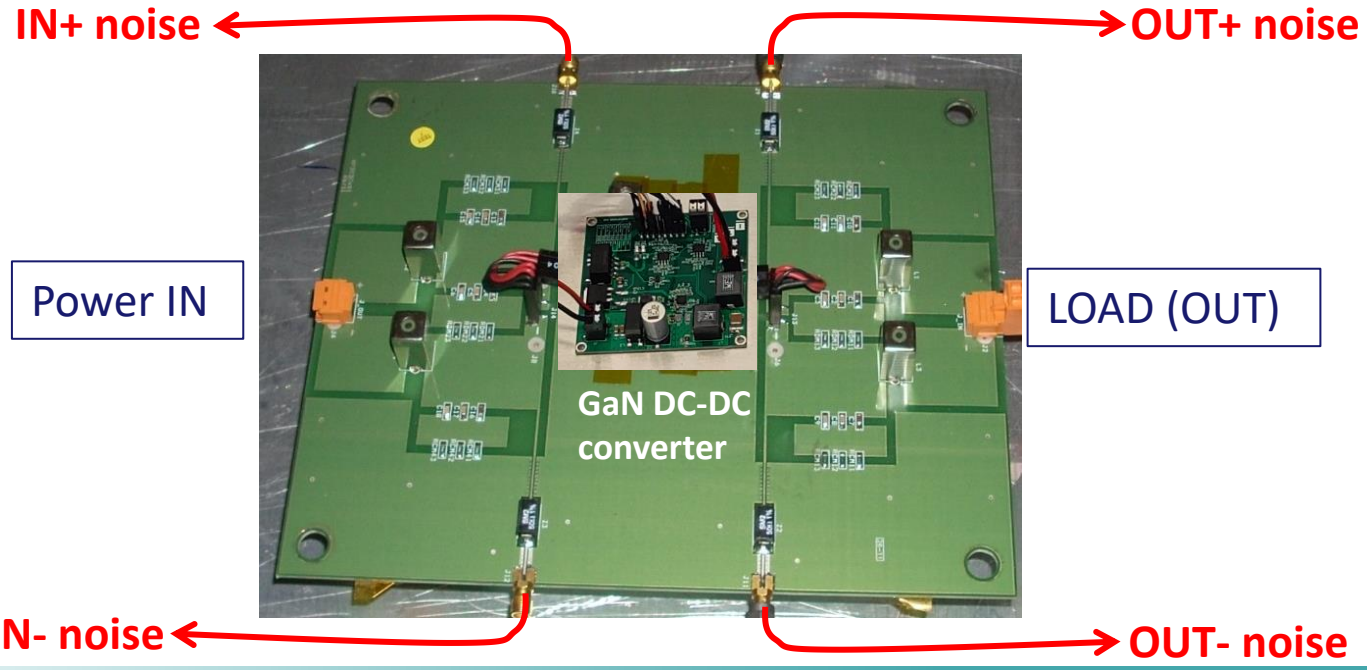
- A GaN transistor-based DC-DC converter will be used as a reference power unit to design the system (current source).
  - The unit has already been designed
- Validation test will be performed at IPHC -Strasburg

3. Portable noise measurement system for IRRAD Facilities

- A collaborative meeting between IPHC and ITAINNOVA was held in Strasbourg, focusing on a comprehensive tour of the irradiation facility and synchronization of ongoing activities.
- During the discussions, there was a detailed exploration of the design for the test set-up and corresponding test procedures.
- Work is currently underway to develop a new portable test plate design that can be placed in the target area.

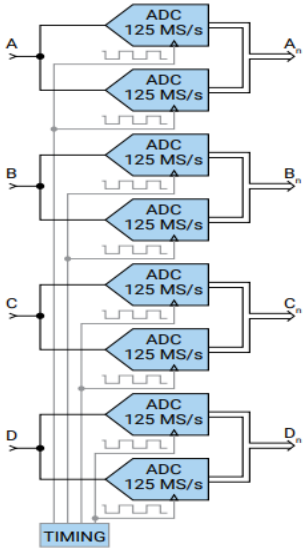
3. Portable noise measurement system for IRRAD Facilities

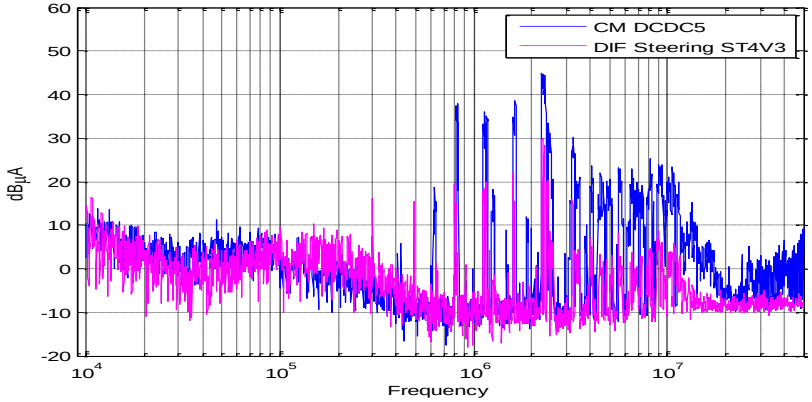
- A dedicated PCB for these tests is going to be submitted during this month.
- The GaN DC-DC converter is located in the middle of the PCB using the big ground plane as a heatsink.
- "LISN" like circuits are implemented at input and output of the PCB allowing measuring all lines noise through SMA connectors.



3. Portable noise measurement system for IRRAD Facilities

- **Technological Integration**: Incorporating a 4-channel oscilloscope with high resolution and sampling rate for simultaneous noise output capture, facilitating post-processing identification of Common and Differential Mode noise.
  - ➢14-bit resolution and a sampling rate of 125MS/s.
- **Software Development:** Initiating the creation of Python-based software to automate measurement and signal processing tasks, elevating the efficiency and precision of noise analysis





3. Portable noise measurement system for IRRAD Facilities

- Being a single PCB test-bench will make it very portable and assures repetitive and automatized noise measurements.
- The fact of using an oscilloscope enables the possibility of measuring other signals of interest synchronized with noise measurements.
  - **Transients presented during the test will be measured**
- Python software provides high flexibility to implement upgrades:
  - Control of other equipment, further configuration, real-time processing, post-processing, etc.

4. Summary

- WP4.T5 activities are going well
- The Automatic TF measurement system has been completed (**MS17 completed**)
- The activity during the third year of the project has been focused on the development of a portable noise measurement system
  - The measurement method and components have been selected and designed.
  - A meeting was held last summer with the IPHC in Strasbourg to define the test set-up.
- Final test phase scheduled for the upcoming summer or autumn.