Anechoic chamber training

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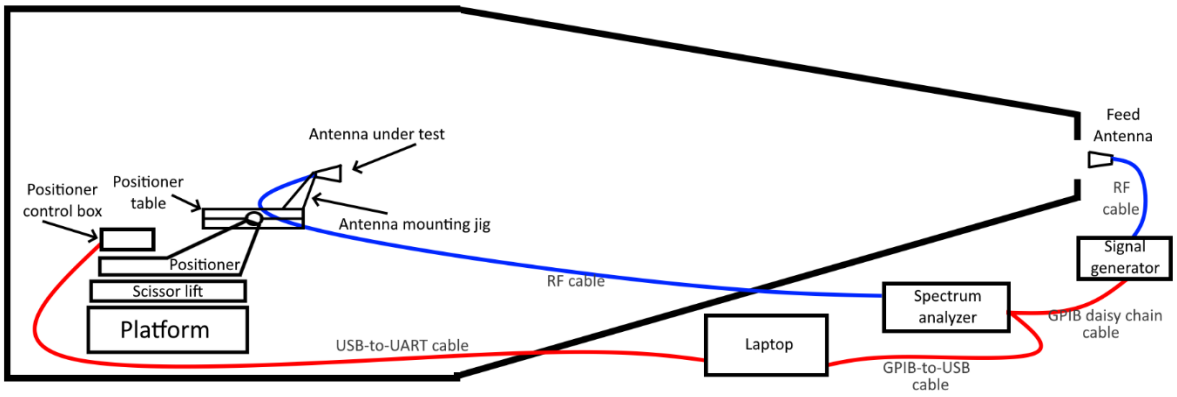
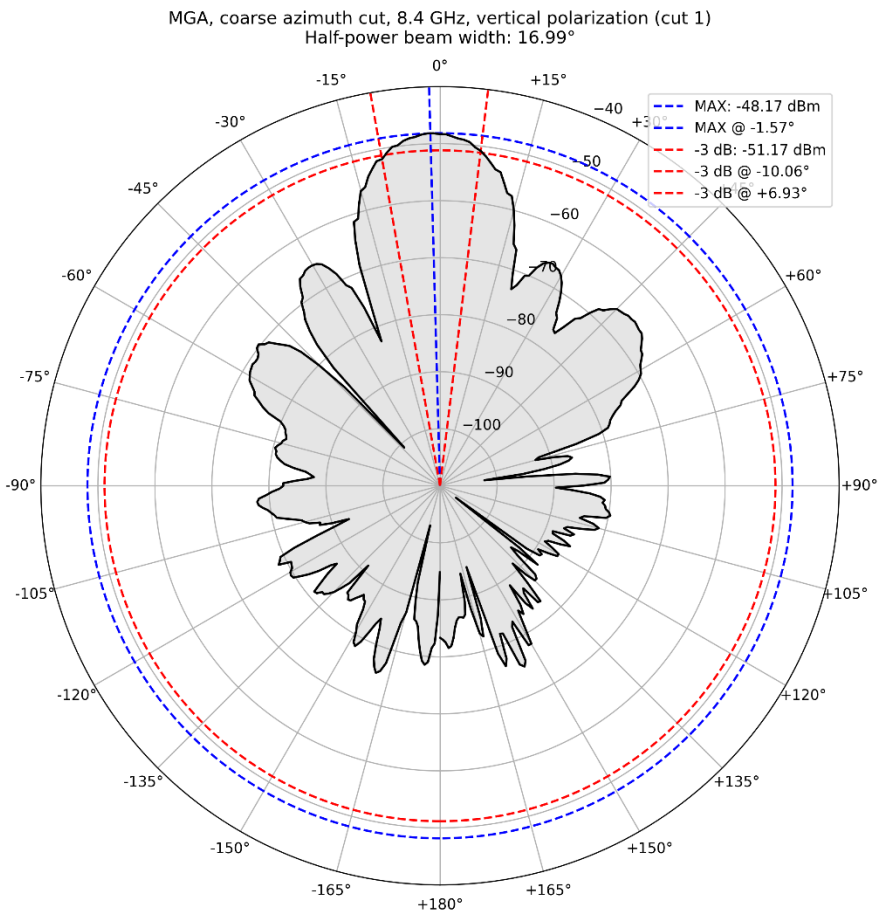
1. Purpose

The chamber has RF-dampening foam, which isolates it from any outside interference. It also has a turntable that we can remotely control. We put an RF source in the window of the chamber (the “throat”) and attach an antenna to the turntable. We then change parameters (antenna position, source polarization, source frequency, etc.) and measure the power received by the antenna. In this way, we can characterize the performance of an antenna.

Here's how everything is connected when characterizing an antenna:



Here’s an example of a data product we can produce. This is showing how the power received by an antenna changed as we rotated the pan axis from -180 degrees to +180 degrees. “MGA” is the name of the antenna we were testing:



2. Turntable

Use Mayo code

3. Spectrum Analyzer

Use Mayo code

4. Signal Generator

We usually do this manually

5. Polarization

Flip the thing manually

6. Scissor Lift

TBD

7. Setting up your laptop

7.1. Prerequisites:

Laptop

- Windows 10 or 11
- Admin rights
    - MSU-issued laptops usually DO NOT have admin rights.
- At least 2 USB-A ports (can use a hub/dongle/whatever)
- A recent version of Python installed
    - Let's say at least Python 3.10 (TODO: Figure out the actual minimum version)
        - You can check your version with **`python --version`**
    - If you're feeling frisky, you can use UV to manage your Python install(s). I recommend this.
- WiFi
- Install Microsoft VSCode
    - Optional, but highly recommended.

Membership in MSU-SSC GitHub organization.

- Optional, but highly recommended
- If you ain't a member, ask David Mayo for access.

7.2. Installing GPIB crap

We control and read from the spec-an using PyVISA, which is a wrapper around VISA, which uses GPIB, which is similar to but not identical to HPIB, which is what the sig-gen

uses. I don't know what all that means either, but the long and short of it is that you have to install a bunch of crap to make it work.

7.2.1. Install NI-Visa

Download and run NI-Visa install from this link:
https://www.ni.com/en/support/downloads/drivers/download.ni-visa.html#484351

Reboot your computer.

7.2.2 Install Keysight Instrument Control Bundle

VERY IMPORTANT! Make sure you installed NI-Visa FIRST. The order matters a lot (although I don't know why.)

- Go here: https://www.keysight.com/us/en/lib/software-detail/computer-software/keysight-instrument-control-bundle-download-1184883.html
- Click the download button.
- Make an account (I know, it's super annoying).
- Download the software installer.
- Run the software installer.
- Reboot your computer.

At this point, your computer should be able to "speak" VISA/GPIB.

7.2.3 Verify GPIB functionality

- Plug the GPIB cable into your computer and into a GPIB device (like the spec-an).
- Open the program "Keysight Connection Expert" on your computer.
- In the left column, under "My Instruments," make sure you see something with a green checkbox
    - It should have an address that looks something like "GPIB0::18::INSTR".
    - Its name might show up, like "E4418B, HEWLETT-PACKARD", or it might show as something like "<Unknown Model>, <Unknown Manufacturer>". As long as SOMETHING shows up, and it has a green checkmark, you have successfully installed everything. Congrats! I'm proud of you.

7.3 Installing everything else

Everything else will be installed by installing the Python package I've made. So, if you know what you're doing, the pip command is:

```
pip install "git+https://github.com/msu-ssc/lems-anechoic@0.2.1"
```

Read on for more detailed steps

7.3.1. Make a folder somewhere

I have a folder called dev at **C:\users\mayo\dev** that I will use. Inside that, I am going to make a folder called “anechoic”

```
PS C:\Users\mayo> cd c:\users\mayo\dev
PS C:\users\mayo\dev> mkdir anechoic


    Directory: C:\users\mayo\dev


Mode                 LastWriteTime         Length Name
----                 -------------         ------ ----
d-----         3/27/2025  10:40 AM                anechoic


PS C:\users\mayo\dev> cd anechoic
PS C:\users\mayo\dev\anechoic>
```

7.3.2 Install all the stuff

If you’re using UV (recommended)

```
PS C:\users\mayo\dev\anechoic> uv init
Initialized project `anechoic`
PS C:\users\mayo\dev\anechoic> uv add "git+https://github.com/msu-ssc/lems-anechoic@0.2.1"
Using CPython 3.13.1
Creating virtual environment at: .venv
  <BUNCH OF OUTPUT REMOVED>
PS C:\users\mayo\dev\anechoic>
```

If you’re using regular Python:

```
PS C:\users\mayo\dev\anechoic> python -m venv .venv
PS C:\users\mayo\dev\anechoic> .\.venv\Scripts\activate
(.venv) PS C:\users\mayo\dev\anechoic> python -m pip install "git+https://github.com/msu-ssc/lems-anechoic@0.2.1"
Collecting git+https://github.com/msu-ssc/lems-anechoic@0.2.1
  <BUNCH OF OUTPUT REMOVED>
(.venv) PS C:\users\mayo\dev\anechoic>
```

You’re done! It’s installed!

8. Controlling the turntable

Refer to “turntable.md” document

9. Controlling the spec-an

Refer to “spec_an.py” example script