



TELECOM  
Paris



# ADALM Pluto : Transmission and Reception

4TE05 (Ex: TELECOM205)

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# Project deliverables: complete overview

## Mandatory

### ■ Hardware focused part:

- Plot the measured AM/AM and efficiency characteristics of the PA allocated to your group
- ADALM-Pluto back-to-back experiments:
  - Plot the SER+BER vs DAC scale for Tx Gain fixed to  $-10$  dB<sup>1</sup>.
  - Plot the SER+BER vs Tx Gain for DAC scale fixed to  $-10$  dBFS<sup>1</sup>.

### ■ Simulation focused part:

- For each functional block (UST) of both the transmitter and receiver, provide the detail performance analysis. Example:
  - filters: passband and stopband frequency and attenuations analysis,
  - converters: quantization noise analysis,
  - ...
- Provide a hardware configuration that minimises the RX and TX power consumption that meets the desired specifications
- For the global simulation chain, provide the SNR at the receiver output (ADC) against the distance between transmitter and receiver.

<sup>1</sup>The choice of the RX AGC mode is left to the student but should be properly discussed.

### ■ Hardware focused part:

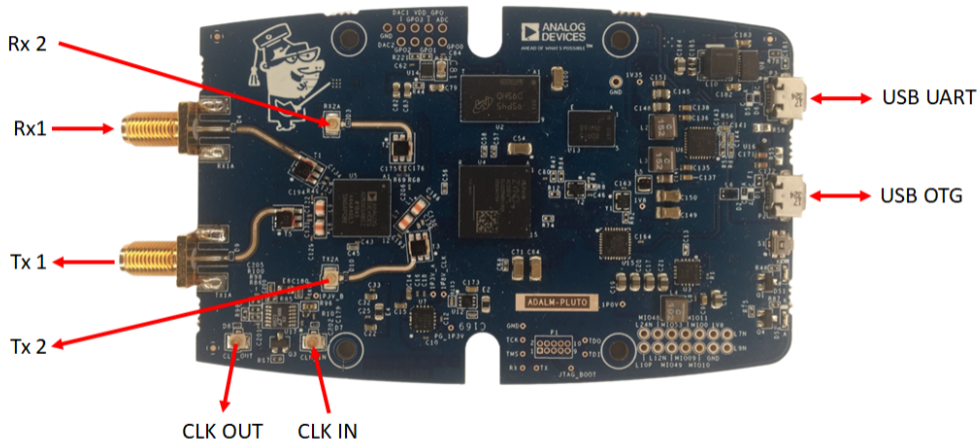
- Provide a description of each blocks of the SDR board with the support of slides and explain the hardware main specifications of the blocks
- Demonstrate the transmission over a wireless channel with two ADALM-Pluto boards and provide the instantaneous BER.
- Demonstrate the BER variation with an exogenous perturbation. The perturbation is left to the student choice but it should be properly justified.

### ■ Simulation focused part:

- Plot the BER against the distance between transmitter and receiver.
- Use one of the en/decoder of D1 to encode and decode the bitstream,

# ADALM-Pluto in one minute

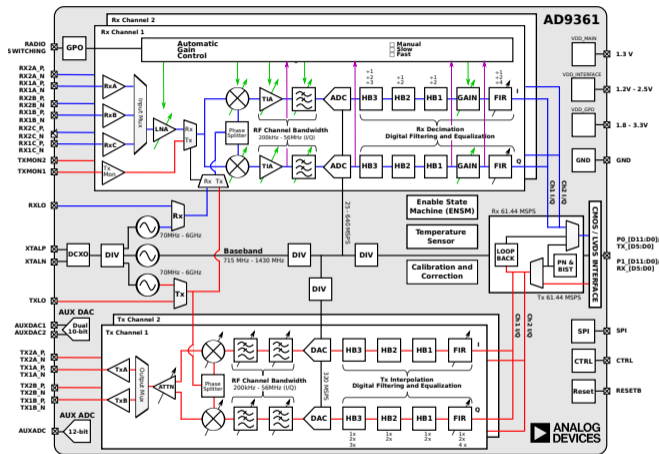
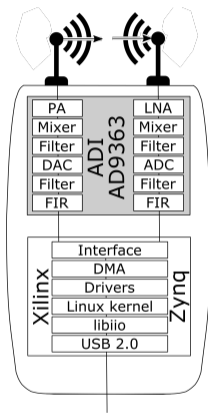
Under the hood, the AD9363



<https://wiki.analog.com/university/tools/pluto/hacking/hardware>

# ADALM-Pluto in one more minute

Under the hood, the AD9363 (continued)



<https://pysdr.org/content/pluto.html>

<https://wiki.analog.com/university/tools/pluto/users/transmit>

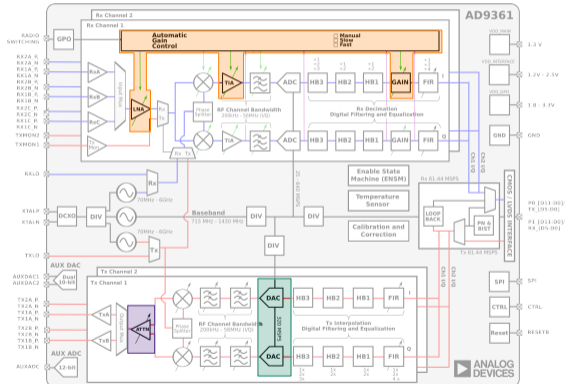
# Hardware and Python parameters I

## Example values

```
sdr.gain_control_mode_chan0 = 'manual'
```

```
sdr.rx_hardwaregain_chan0 = 70.0 # dB
```

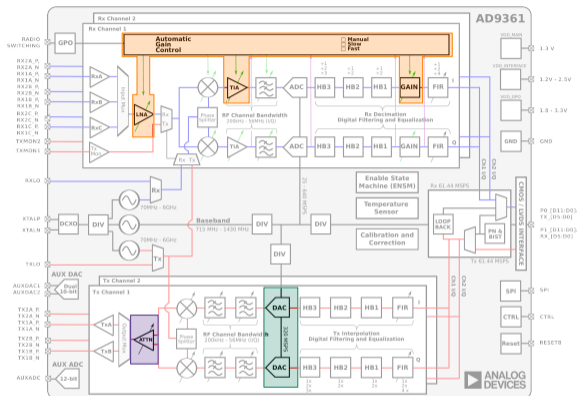
```
sdr.gain_control_mode_chan0 = 'fast_attack'
```



```
sdr.tx_hardwaregain_chan0 = -50
```

# Hardware and Python parameters II

## Example values



```
samples = np.exp(2.0j*np.pi*100e3*t) # Simulate a sinusoid of 100 kHz, so it should
show up at 915.1 MHz at the receiver
samples *= 2**14 # The PlutoSDR expects samples to be between -2^14 and +2^14, not -1
and +1 like some SDRs
```

```
DAC_scale_factor = 0.75; % Adjust this factor to ensure the signal does not saturate
the DAC.
```

```
tx.transmitRepeat(DAC_scale_factor*samples)
```

# Where to start? I

The moodle page :

<https://moodle.ip-paris.fr/course/section.php?id=83299>

The screenshot shows a web browser window displaying a Moodle course page. The browser's address bar shows the URL <https://moodle.ip-paris.fr/course/section.php?id=83299>. The page header includes the Institut Polytechnique de Paris logo and navigation links: Accueil, Tableau de bord, Mes cours, Aide et assistance. The main content area is titled "D2 - Hardware AMS" and includes a breadcrumb trail: Télécom Paris / 2025-2026 / F1 / Diplôme d'ingénieur / 2A / 2025/2026 - PRJ\_4TE05\_TP - Projet de synthèse : système de communications / D2 - Hardware AMS. Below the title, there are two navigation arrows: "◀ D1 - Digital Comm" and "▶ D3 - Optical fibre transmission". The main text reads: "Bienvenue dans la section AMS/RF du projet (aussi appelée partie D2).". It contains a list of resources:

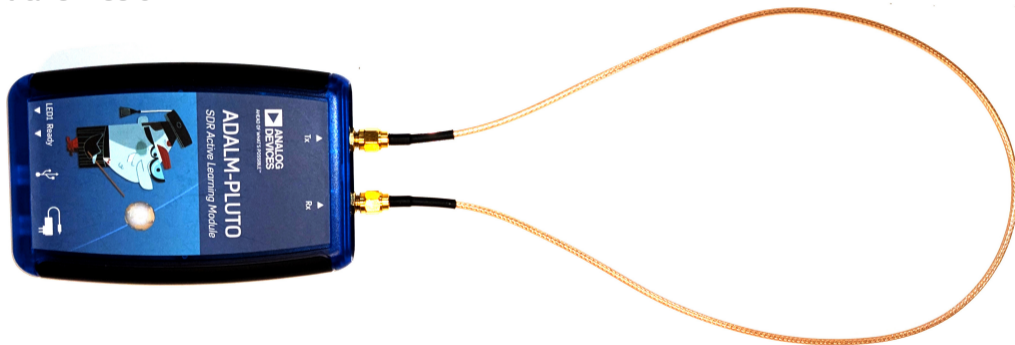
- Lors de la première séance nous vous présentons les spécificités de cette partie du projet. Les diapos de cette présentation sont disponibles à ce lien suivant : [Présentation D2](#)
- Nous ferons également une étude de cas sur le débogage de la modélisation des systèmes matériels : [Présentation Debug](#)
- Nous vous rappelons que les présentations sur les traitements numériques pour les systèmes AMS sous Matlab sont disponibles sur le lien suivant : [Présentation Matlab](#)
- Pour débiter cette partie du projet, nous vous fournissons un ensemble de code qui constitue une base quasi-complète de la chaîne de transmission/réception. Votre objectif principal est d'optimiser chaque composant de cette chaîne afin de respecter les différentes contraintes (radio, circuit, BER). Cet ensemble de code Matlab est disponible au lien suivant : [Code de base D2 - TELECOM205](#).

A red rectangular box highlights the link "Code de base D2 - TELECOM205". The left sidebar contains a navigation menu with "D2 - Hardware AMS" selected. The footer of the page shows "Première Séance 'Hardware measurements' (09/03/26)".

In the ADALM-Pluto-SDR/ directory:

```
Terminal - germain
File Edit View Terminal Tabs Help
~/tmp/TELECOM205_CRAN_scripts$ tree
├── ADALM-Pluto-SDR
│   ├── ADALM_Pluto_Rx.m
│   ├── ADALM_Pluto_Tx.m
│   ├── README.md
│   └── subblocks
│       ├── ADC.m
│       ├── basebandAnalogFiltFake.m
│       ├── basebandAnalogFilt.m
│       ├── basebandAnalogFiltTF.m
│       ├── BBamp.m
│       ├── complx2cart.m
│       ├── DAC.m
│       ├── downMixer.m
│       ├── instanciateChannelModel.m
│       ├── .octaverc
│       ├── rcosdesign.m
│       ├── rflNA.m
│       ├── rfPA.m
│       ├── RX.m
│       ├── RX_proj.m
│       └── signal_analysis_and_performance_function
│           ├── perf_estim.m
│           ├── plot_spectrum.m
│           ├── simple_plot_spectrum.m
│           └── simple_raw_spectrum.m
├── startup.m
├── TX.m
├── TX_proj.m
└── upMixer.m
```

Begin with the back-to-back experiments, and then move to the wireless transmission.





<https://youtu.be/UohP6mSBFhs?si=KxfWgT9EpJm0ITsR&t=38>

**Turn The Radio On** by *The Cadillac Three*