

# All-In-One

## Un transpondeur linéaire DATV

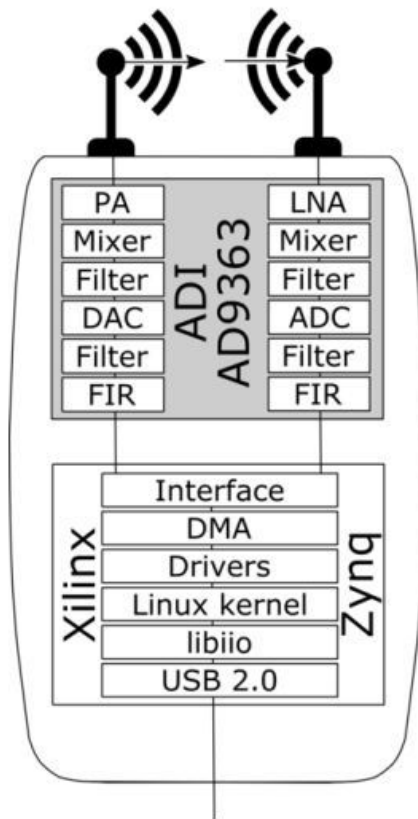
### utilisant un Analog Devices ADALM-PLUTO

**NÎMES 2024**

**HB9DUG Michel**

**June 28, 2024**

# Project hardware



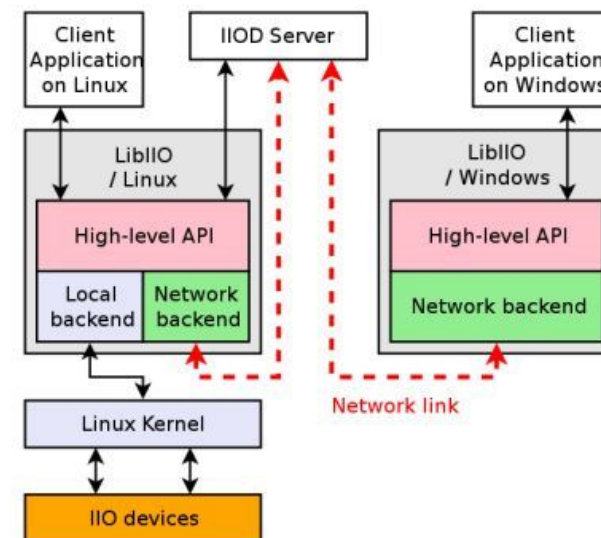
- ▶ Runs Linux inside the device
- ▶ Uses Linux's IIO framework to expose I/Q data and control
- ▶ Multi-Function USB Device
  - Native IIO over USB
  - Serial over USB
    - Kernel console
    - COMx, ttyACMx
  - Ethernet over USB (RNDIS)
  - Mass Storage
  - Device Firmware Update (DFU)
- ▶ USB Host
  - USB dongles

## ▶ Cross Platform

- Windows
- Linux
- MAC

## ▶ Cross framework

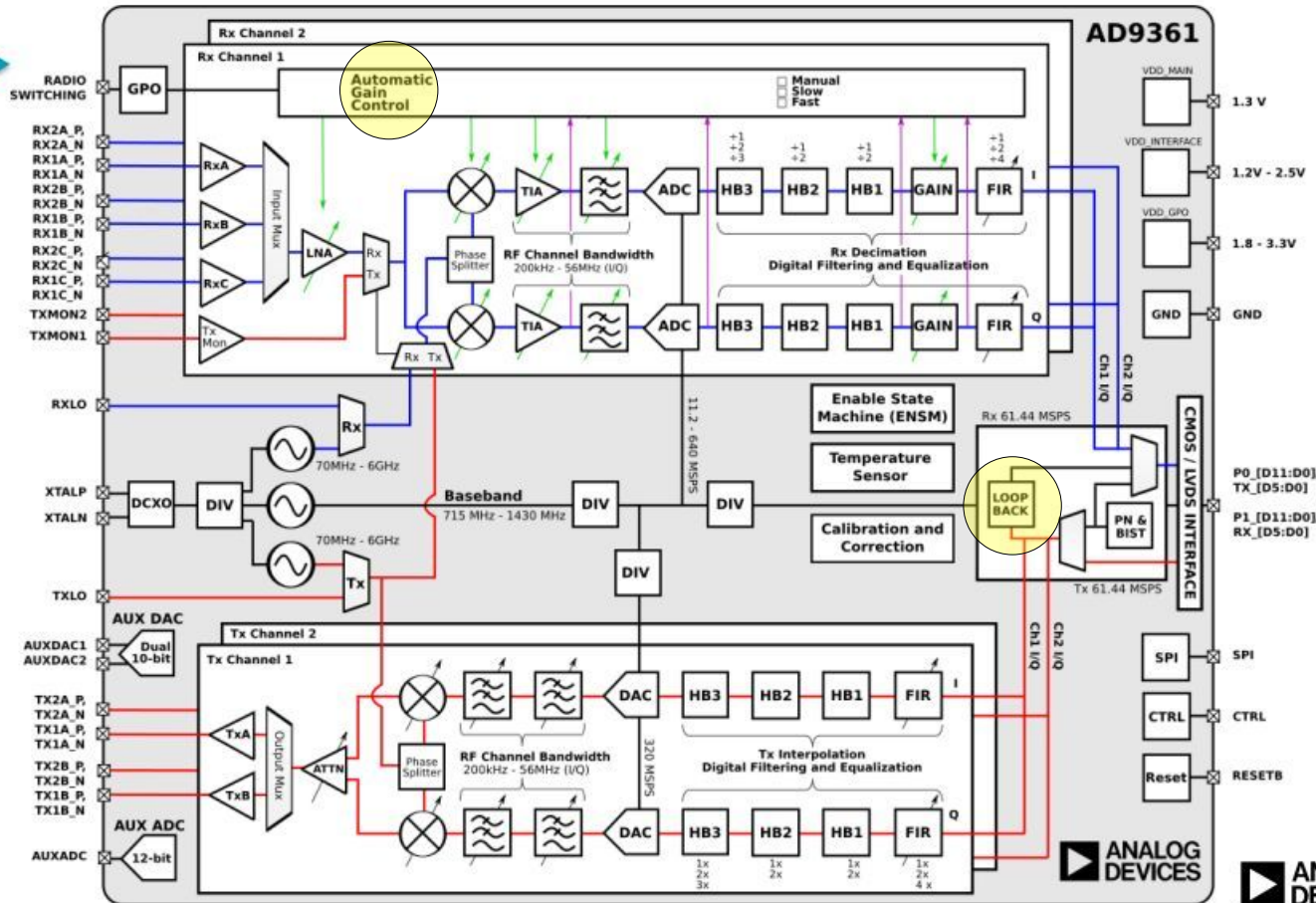
- Stacked libraries based on libiio



# Project hardware



- ▶ AD9361: 2 Rx + 2 Tx
- ▶ AD9364: 1 Rx + 1 Tx
- ▶ AD9363: 2 Rx + 2 Tx
- ▶ Major sections:
  - RF input/output paths
  - RF PLL/LO
  - Clock generation
  - ADC/DAC
  - Digital filters
  - Digital interface
  - Enable state machine
  - RX Gain (AGC)
  - TX Attenuation
  - Aux DAC/ADC and GPOs
  - Analog and Digital Correction/Calibration



# Project software

## IIO

Linux kernel Industrial Input / Output frame framework

## IIO - libiio

System library

Provides high-level C, C++, C# or Python programming interface to IIO  
Cross Platform (Linux, Windows, MacOS X, BSD)

<https://github.com/analogdevicesinc/libiio>

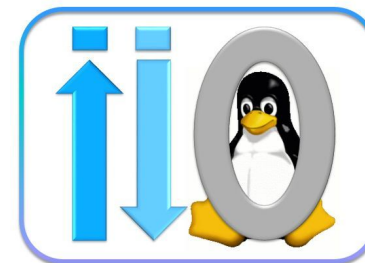
## IIO – libiio – Command line tools

iio\_info, iio\_attr, iio\_readdev, iio\_writedev et iio\_reg  
included with the libiio

## pyadi-iio

Analog Devices python interfaces for hardware with IIO drivers

<https://analogdevicesinc.github.io/pyadi-iio/guides/quick.html>



# Project software (Python)

Python program:

```
#
# version 1.0 2021-12-20, HB9DUG Michel
#
# proto transponder DATV
# input = 437 MHz
# output = 1280 MHz
# rf bandwidth = 2 MHz

import adi

# setup interface
sdr = adi.Pluto('ip:172.22.22.150')
sdr.sample_rate = 8.192e6

# Configure RX channel
sdr.rx_enabled_channels = [0]
sdr.rx_lo = 437000000
sdr.rx_rf_bandwidth = 2000000

# configure TX channel
sdr.tx_enabled_channels = [0]
sdr.tx_lo = 1280000000
sdr.tx_rf_bandwidth = 2000000
sdr.tx_cyclic_buffer = True
```

```
# Mute TX on power up
sdr.tx_hardwaregain_chan0 = -60

# Use RF loop back mode
sdr.loopback = 2

# AGC
sdr.gain_control_mode = 'slow_attack'

# TX on (-60 to 0 dB)
sdr.tx_hardwaregain_chan0 = -10

while True:
    print(' ')
    stop = input('Return to Exit')
    sdr.tx_hardwaregain_chan0 = -60
    break
```

# Project software (IIO Command tools)

The goal : standalone Pluto using the mass storage drive support (USB Flash Drive)

**Auto Run Support**  
runme[XX].sh

```
#
# version 1.0 2022-05-01
#
# HB9TV / HB9DUG
#
# proto transponder DATV
# input = 437 MHz
# output = 1280 MHz
# rf bandwidth = 2 MHz
# sample rate = 4096 MHz

# Configure sampla rate
iio_attr --uri "ip:192.168.2.1" -c ad9361-phy voltage0 sampling_frequency 4096000

# Configure RX channel
iio_attr --input-channel --uri "ip:192.168.2.1" -c ad9361-phy voltage0 rf_port_select A_BALANCED
iio_attr --input-channel --uri "ip:192.168.2.1" -c ad9361-phy voltage0 gain_control_mode slow_attack
iio_attr --input-channel --uri "ip:192.168.2.1" -c ad9361-phy voltage0 rf_bandwidth 2000000
iio_attr --uri "ip:192.168.2.1" -c ad9361-phy altvoltage0 frequency 437000000

# configure TX channel
iio_attr --output-channel --uri "ip:192.168.2.1" -c ad9361-phy voltage0 rf_port_select A
iio_attr --output-channel --uri "ip:192.168.2.1" -c ad9361-phy voltage0 hardwaregain -10.000000
iio_attr --output-channel --uri "ip:192.168.2.1" -c ad9361-phy voltage0 rf_bandwidth 2000000
iio_attr --uri "ip:192.168.2.1" -c ad9361-phy altvoltage1 frequency 1280000000

while :
do
  echo "Press <CTRL+C> to exit."
  sleep 1
done
```

# References

The screenshot shows the homepage of swissATV.ch. The header includes the logo 'swissATV.ch' with the tagline 'groupe technique ATV de l'IAPC'. Navigation tabs are provided for Home, News, Activités, Hardware, Académie, and Labs. A search bar and a font size control are also present. Below the header, a secondary navigation bar offers categories like All, News, Labs, Tests, Hardware, Software, and Académie, along with sorting options: Default, Title, Date, and Random. The main content area features a grid of four article cards:

- A-Tech 2014 Automne**: 2014-10-22 09:50:46. Includes a photo of a workshop.
- DATV-Express DVB-T 1 MHz**: 2014-10-13 11:10:14. Includes a photo of a green PCB.
- H264 DigiThin**: 2014-10-01 17:23:43. Includes a photo of a yellow PCB.
- DVB-T2, le standard pour...**: 2014-08-15 12:30:06. Includes a photo of an i-TAB DTV tablet.

Below the grid is a 'Hardware' section with five featured items, each with a 'Read More' button:

- SR-Systems
- MK808 DigiThin
- BATC DTX1
- AGAF
- Hides USB DVB-T

Good hack !