

All-In-One A DATV linear Transponder

using an Analog Devices ADALM-PLUTO

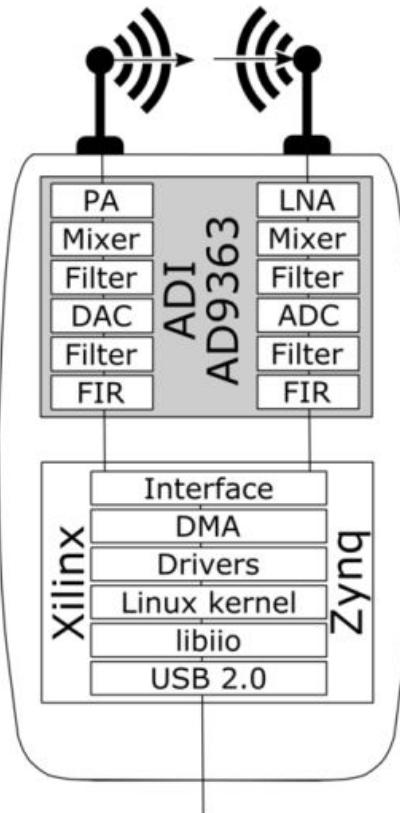
HAMRADIO 2022

HB9DUG Michel

June 24, 2022

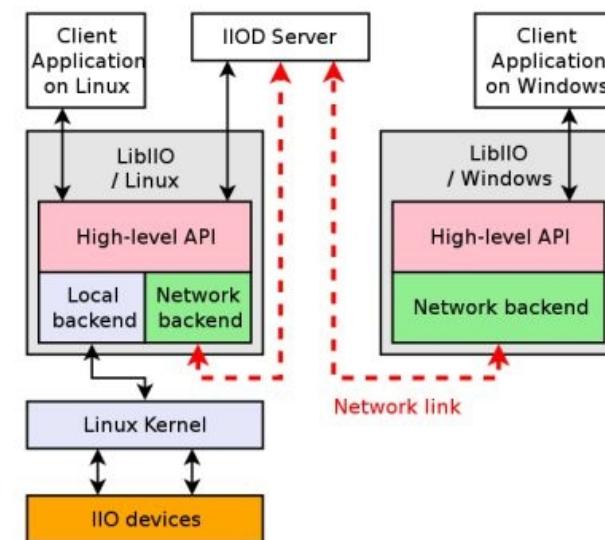


Project hardware



- ▶ 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

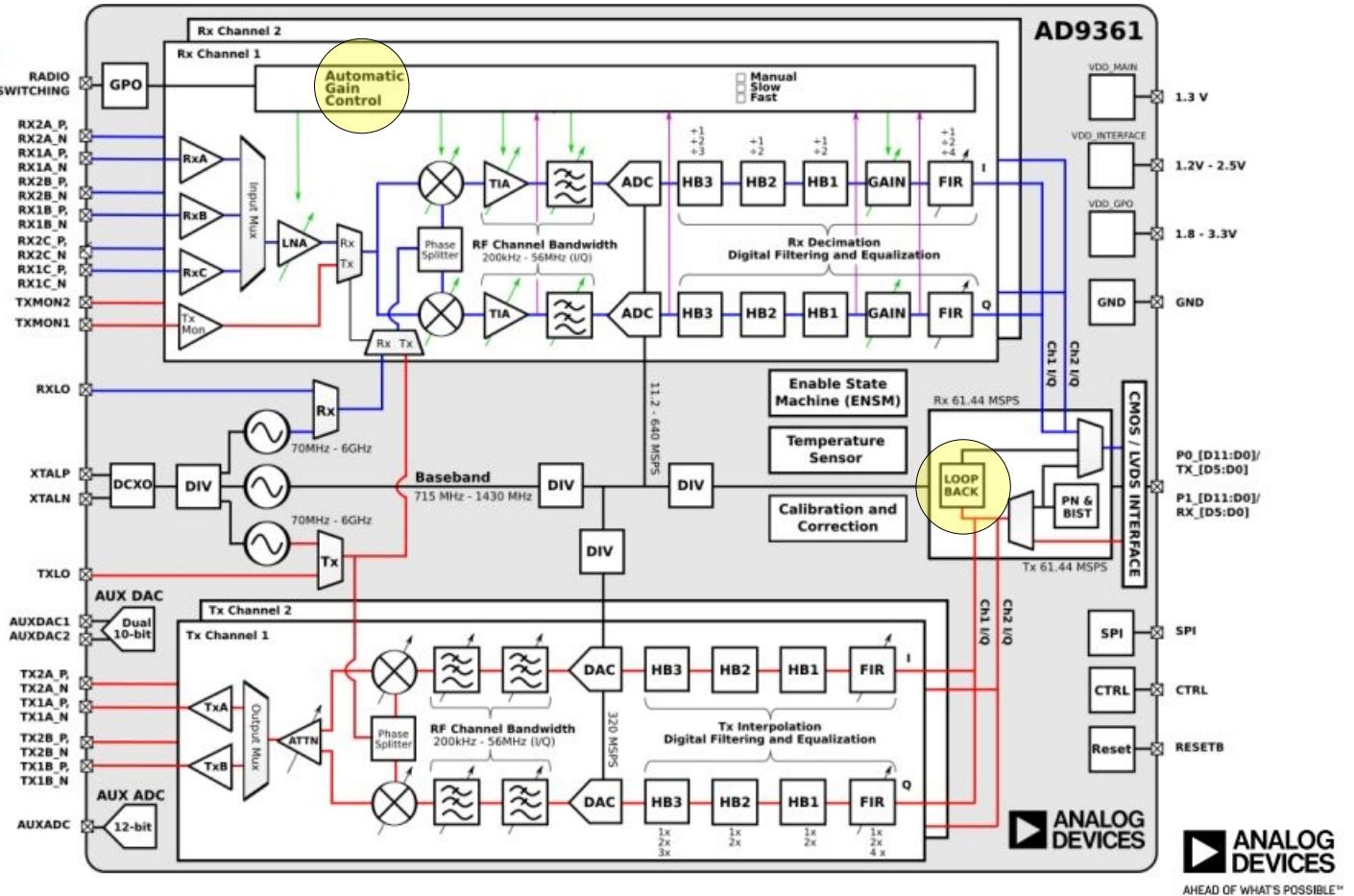
- ▶ Cross Platform
 - Windows
 - Linux
 - MAC
- ▶ Cross framework
 - Stacked libraries based on libiio



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>



PySDR: A Guide to SDR and DSP using Python
<https://pysdr.org/>

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 sample 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 128000000  
  
while :  
do  
    echo "Press <CTRL+C> to exit."  
    sleep 1  
done
```

References

The screenshot shows the homepage of the **swissATV.ch** website. The header includes the logo "swissATV.ch" and the tagline "groupe technique ATV de l'IAPC". The navigation bar features links for Home, News, Activités, Hardware, Académie, and Labs, along with a search bar and font size controls.

The main content area displays several project cards:

- A-Tech 2014 Automne** (2014-10-22 09:50:46): A photograph of a group of people gathered around a table with electronic equipment.
- DATV-Express DVB-T 1 MHz** (2014-10-13 11:10:14): An image of a green printed circuit board (PCB) labeled "DATV-Express DVB-T 1 MHz". Below it is a smaller image of the "L'équipe du projet DATV-Express".
- H264 DigiThin** (2014-10-01 17:23:43): An image of a yellow PCB labeled "H264 DigiThin". Below it is a caption: "Brian G4EWJ a publié les détails de son projet".
- DVB-T2, le standard pour...** (2014-08-15 12:30:06): An image of a tablet displaying a video feed. Below it is a caption: "nos futurs relais DATV ?".

Below these cards, there is a section titled "Hardware" featuring five more project cards:

- SR-Systems**: An image of a complex multi-board assembly.
- MK808 DigiLite**: An image of a small single-board computer.
- BATC DTX1**: An image of a PCB labeled "BATC DTX1".
- AGAF**: An image of a PCB labeled "AGAF".
- Hides USB DVBT**: An image of a PCB labeled "Hides USB DVBT".

At the bottom left, there is a sidebar for "SWISS ATV.ch" with the text "The Home of amateur television" and "IAPC - ATV Technical Group".

Good hack !