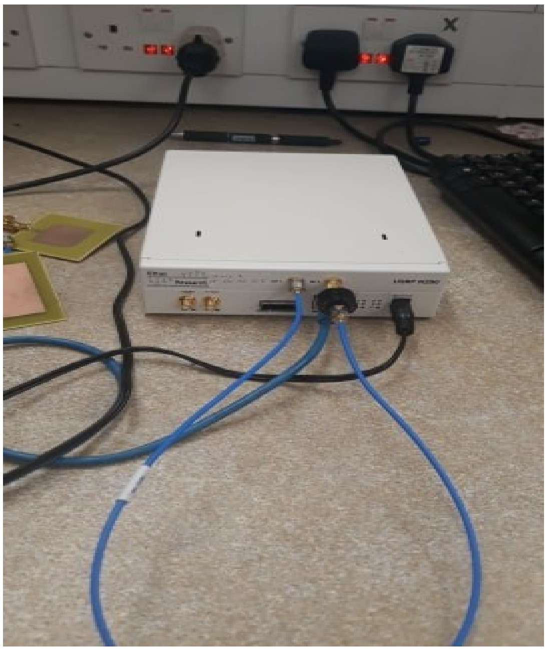
# Problem report on GNU RADIO wifi tranceiver made by Bastian Bloessl

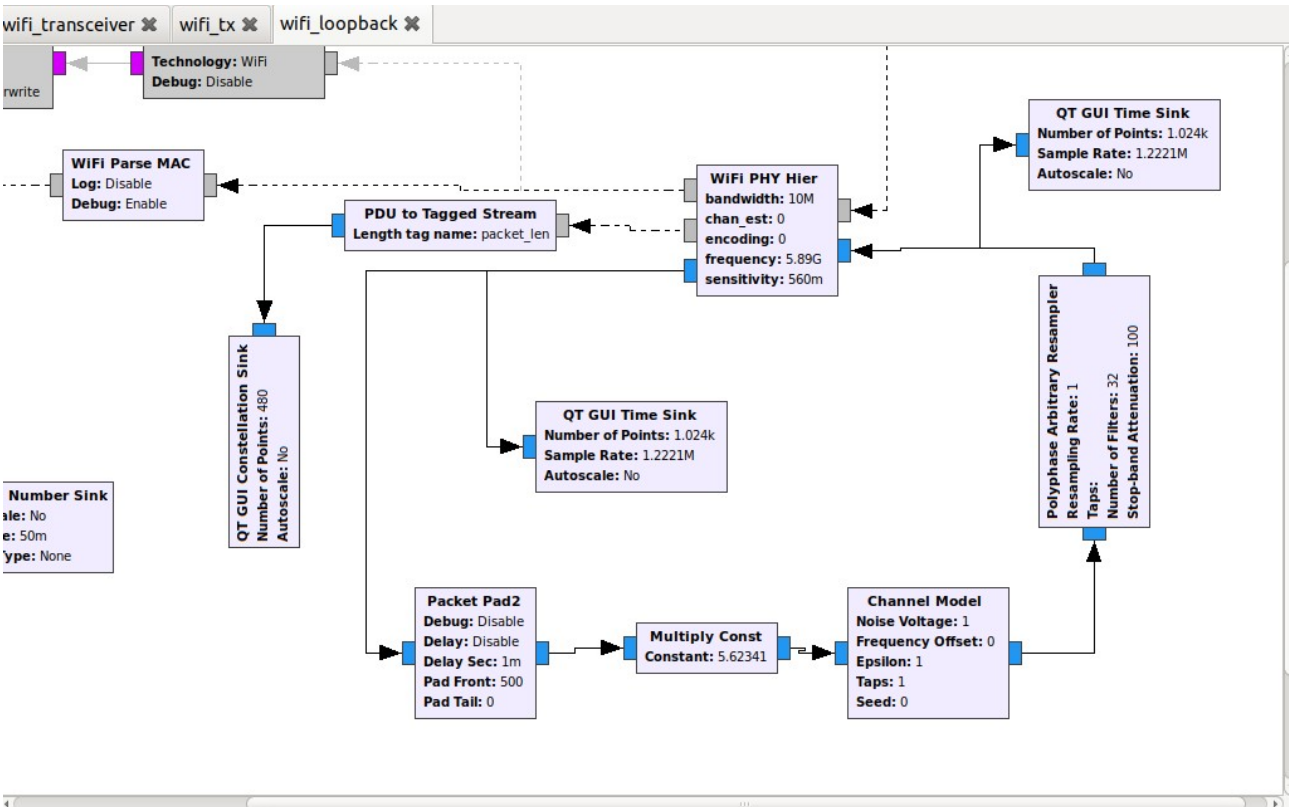
Hi everyone,
I'm working on a wifi IEEE 802.11 a/g/p tranceiver made by Bastian Bloessl and shared on github.
This IEEE 802.11 a/g/p transceiver for GNU Radio is fitted for operation with Ettus N210s and B210s. Interoperability was tested with many off-the-shelf WiFi cards and IEEE 802.11p prototypes. The code can also be used in simulations.

You can find his project here : https://github.com/bastibl/gr-ieee802-11
I'm using Gnu Radio 3.7.11 and a USRP ETUS N200.
I'm working on Unbuntu 18.04, dual booted with Windows.
Here is the assembly i use :



I have connected the port RF1 to RF2 with a wire and a 30dB atenuator.
After I connect the USRP to my computer (Acer) with an ethernet wire.
I set manually the wire connection settings, with an IPV4 adress of 192.168.10.1 and a subnet mask of 255.255.255.0 .

I have first run the simulation program called Wifi Loopback.



Technology: WiFi
Debug: Disable

WiFi Parse MAC
Log: Disable
Debug: Enable

PDU to Tagged Stream
Length tag name: packet_len

WiFi PHY Hier
bandwidth: 10M
chan_est: 0
encoding: 0
frequency: 5.89G
sensitivity: 560m

QT GUI Time Sink
Number of Points: 1.024k
Sample Rate: 1.2221M
Autoscale: No

QT GUI Constellation Sink
Number of Points: 480
Autoscale: No

QT GUI Time Sink
Number of Points: 1.024k
Sample Rate: 1.2221M
Autoscale: No

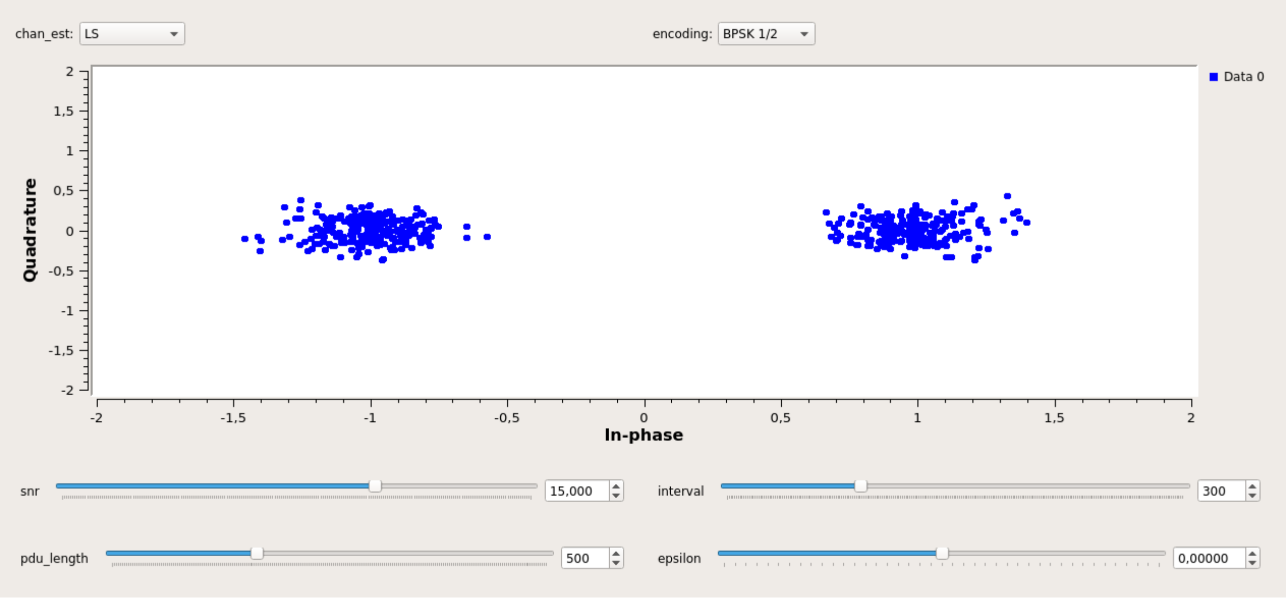
Polyphase Arbitrary Resampler
Resampling Rate: 1
Taps:
Number of Filters: 32
Stop-band Attenuation: 100

Number Sink
ale: No
e: 50m
ype: None

Packet Pad2
Debug: Disable
Delay: Disable
Delay Sec: 1m
Pad Front: 500
Pad Tail: 0

Multiply Const
Constant: 5.62341

Channel Model
Noise Voltage: 1
Frequency Offset: 0
Epsilon: 1
Taps: 1
Seed: 0



chan_est: LS

encoding: BPSK 1/2

snr 15,000

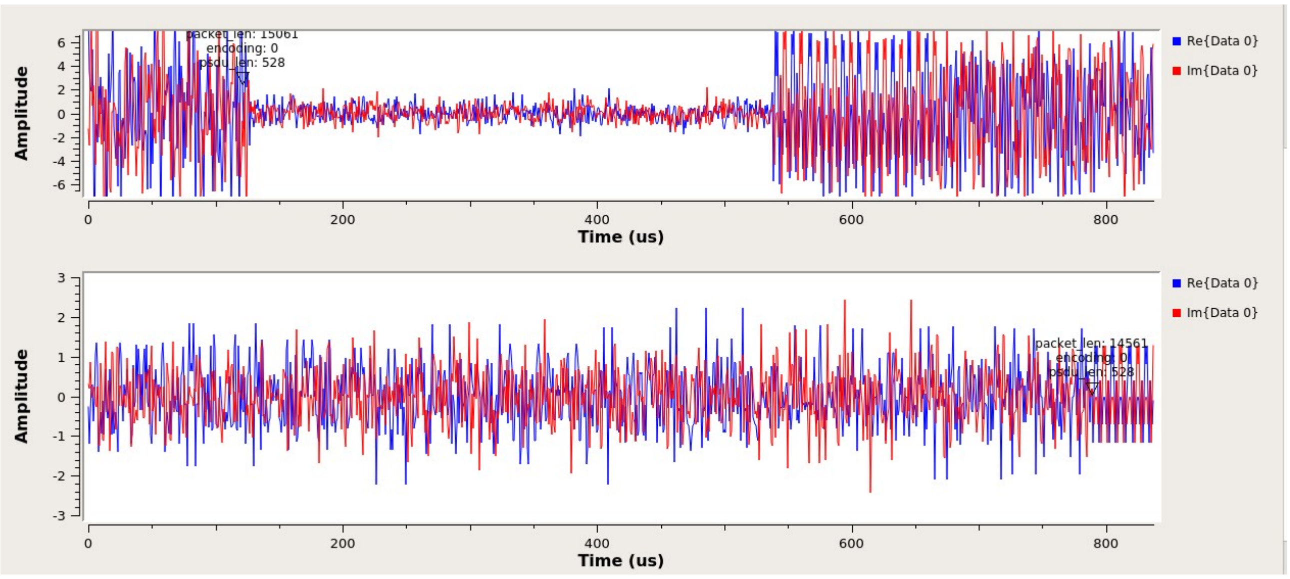
interval 300

pdu_length 500

epsilon 0,00000

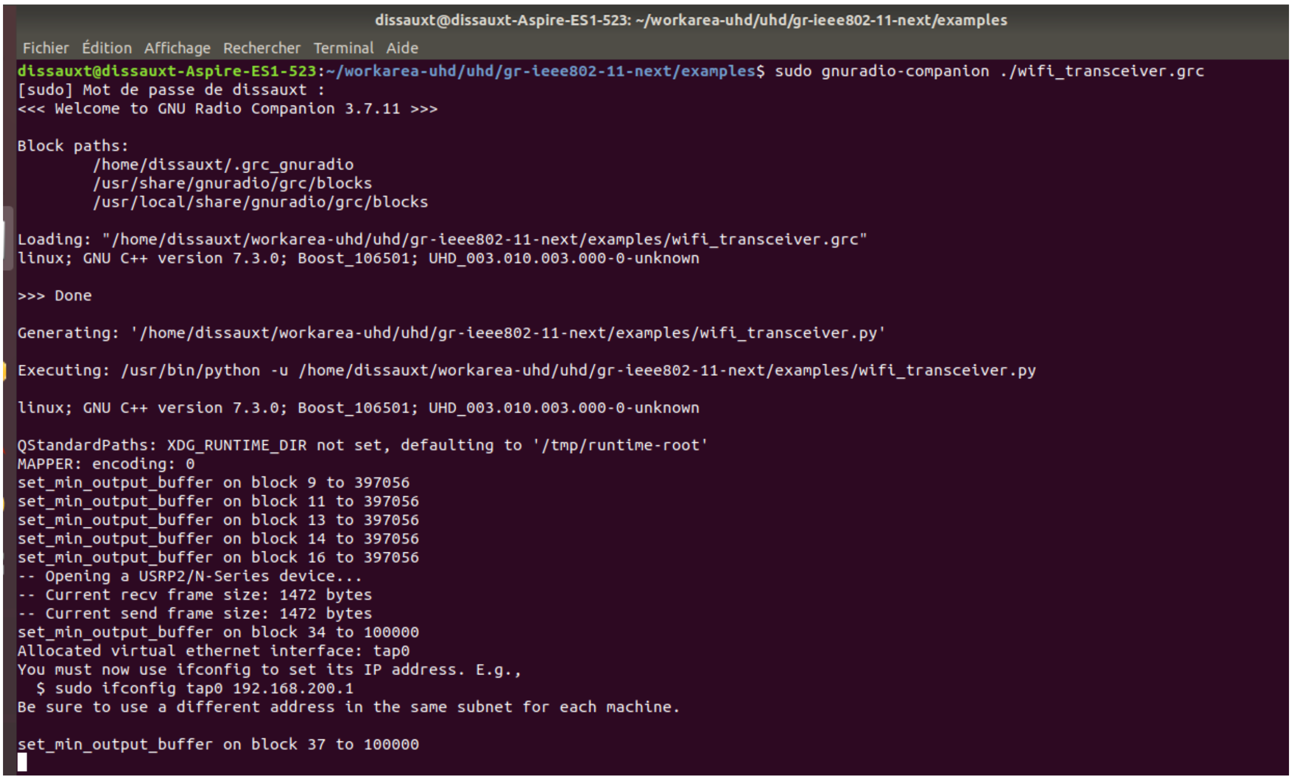
Here is the constellation diagram on the reception part of th tranceiver. We see that it matches correctly with BPSK that i put in the instructions.

Here are the 2 GUI TimeSink, placed before the emission and after the reception signals :



So for moment it works correctly.

Afterwards, I tried the tranceiver.grc program .
I launch the program with a sudo command on the terminal, otherwise it doesn’t work.


dissauxt@dissauxt-Aspire-ES1-523: ~/workarea-uhd/uhd/gr-ieee802-11-next/examples
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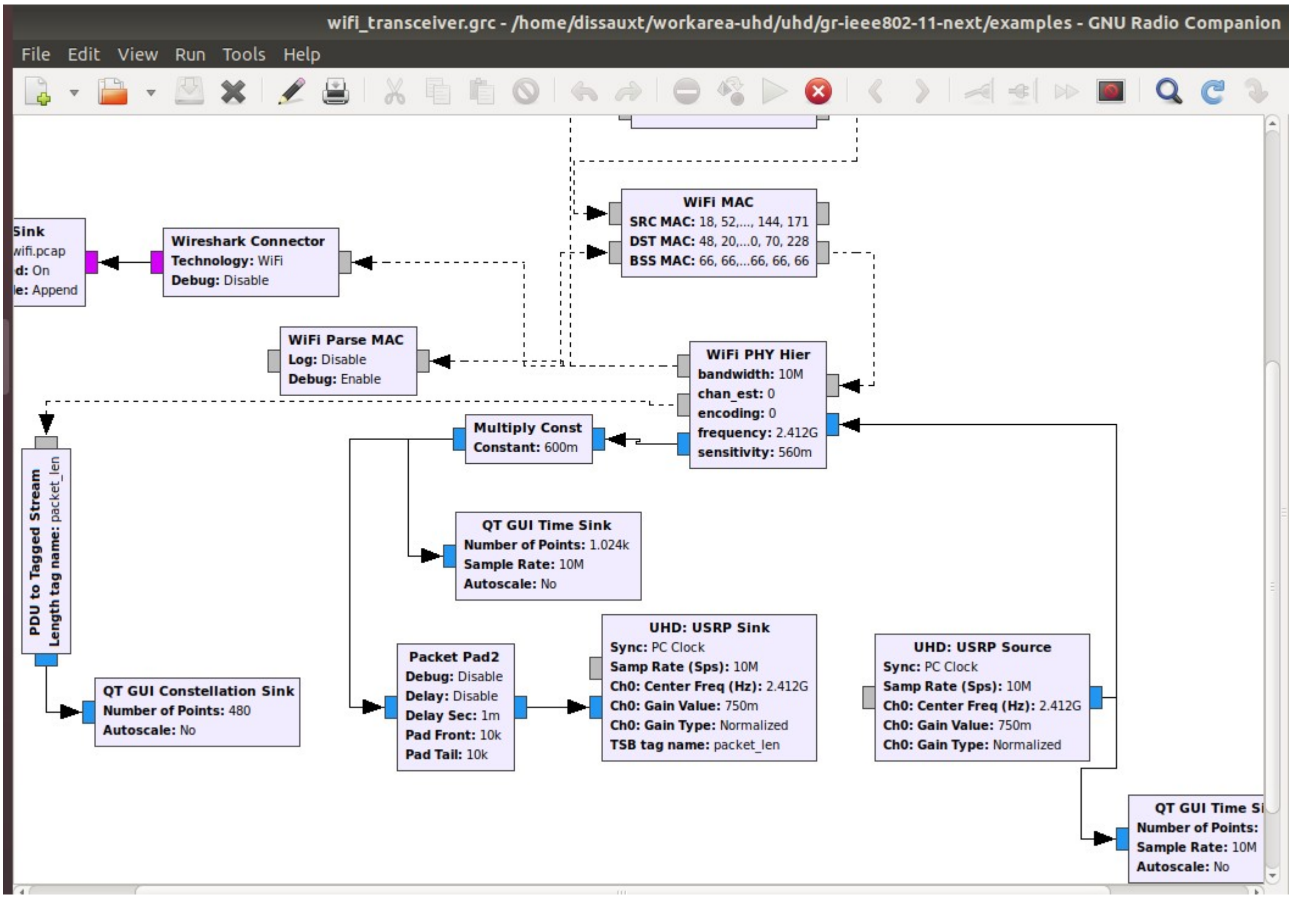
Rechercher
Terminal
Aide

```
dissauxt@dissauxt-Aspire-ES1-523:~/workarea-uhd/uhd/gr-ieee802-11-next/examples$ sudo gnuradio-companion ./wifi_transceiver.grc
[sudo] Mot de passe de dissauxt :
<<< Welcome to GNU Radio Companion 3.7.11 >>>

Block paths:
        /home/dissauxt/.grc_gnuradio
        /usr/share/gnuradio/grc/blocks
        /usr/local/share/gnuradio/grc/blocks

Loading: "/home/dissauxt/workarea-uhd/uhd/gr-ieee802-11-next/examples/wifi_transceiver.grc"
linux; GNU C++ version 7.3.0; Boost_106501; UHD_003.010.003.000-0-unknown

>>> Done

Generating: '/home/dissauxt/workarea-uhd/uhd/gr-ieee802-11-next/examples/wifi_transceiver.py'

Executing: /usr/bin/python -u /home/dissauxt/workarea-uhd/uhd/gr-ieee802-11-next/examples/wifi_transceiver.py

linux; GNU C++ version 7.3.0; Boost_106501; UHD_003.010.003.000-0-unknown

QStandardPaths: XDG_RUNTIME_DIR not set, defaulting to '/tmp/runtime-root'
MAPPER: encoding: 0
set_min_output_buffer on block 9 to 397056
set_min_output_buffer on block 11 to 397056
set_min_output_buffer on block 13 to 397056
set_min_output_buffer on block 14 to 397056
set_min_output_buffer on block 16 to 397056
-- Opening a USRP2/N-Series device...
-- Current recv frame size: 1472 bytes
-- Current send frame size: 1472 bytes
set_min_output_buffer on block 34 to 100000
Allocated virtual ethernet interface: tap0
You must now use ifconfig to set its IP address. E.g.,
  $ sudo ifconfig tap0 192.168.200.1
Be sure to use a different address in the same subnet for each machine.

set_min_output_buffer on block 37 to 100000
```

Here you can see the flowgraph of the tranceiver (not in its entirely) :


wifi_transceiver.grc - /home/dissauxt/workarea-uhd/uhd/gr-ieee802-11-next/examples - GNU Radio Companion
File Edit View Run Tools Help

Sink
wifi.pcap
d: On
le: Append

Wireshark Connector
Technology: WiFi
Debug: Disable

WiFi MAC
SRC MAC: 18, 52,..., 144, 171
DST MAC: 48, 20,...0, 70, 228
BSS MAC: 66, 66,...66, 66, 66

WiFi Parse MAC
Log: Disable
Debug: Enable

WiFi PHY Hier
bandwidth: 10M
chan_est: 0
encoding: 0
frequency: 2.412G
sensitivity: 560m

Multiply Const
Constant: 600m

PDU to Tagged Stream
Length tag name: packet_len

QT GUI Time Sink
Number of Points: 1.024k
Sample Rate: 10M
Autoscale: No

QT GUI Constellation Sink
Number of Points: 480
Autoscale: No

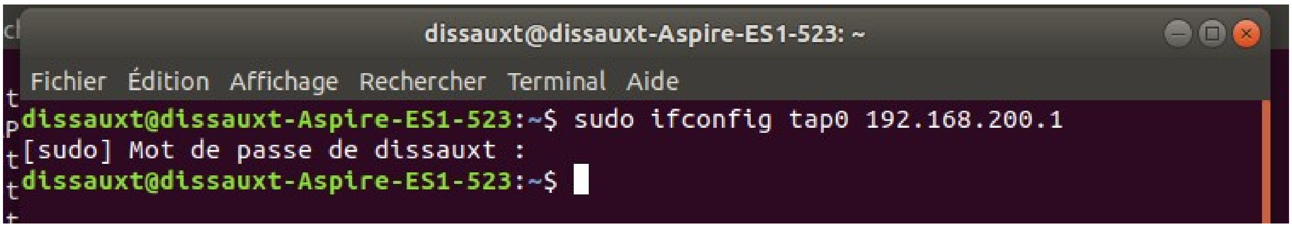
Packet Pad2
Debug: Disable
Delay: Disable
Delay Sec: 1m
Pad Front: 10k
Pad Tail: 10k

UHD: USRP Sink
Sync: PC Clock
Samp Rate (Sps): 10M
Ch0: Center Freq (Hz): 2.412G
Ch0: Gain Value: 750m
Ch0: Gain Type: Normalized
TSB tag name: packet_len

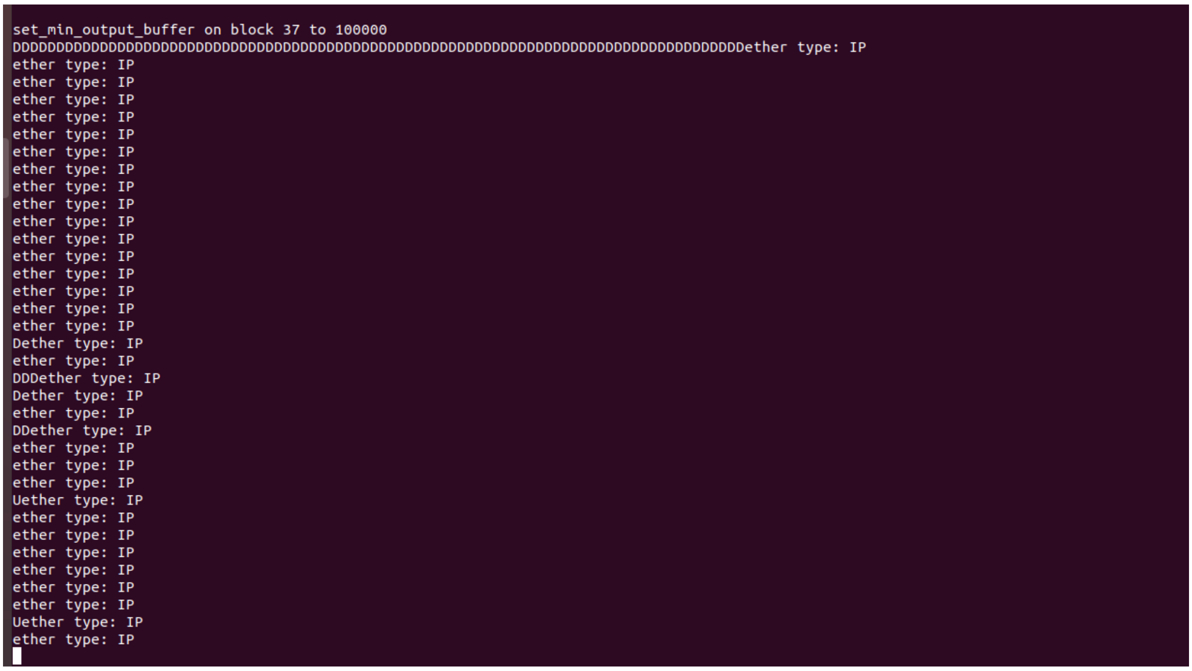
UHD: USRP Source
Sync: PC Clock
Samp Rate (Sps): 10M
Ch0: Center Freq (Hz): 2.412G
Ch0: Gain Value: 750m
Ch0: Gain Type: Normalized

QT GUI Time Si
Number of Points:
Sample Rate: 10M
Autoscale: No

As the program in the terminal shows, we allocate a virtual internet interface called tap0.
We make that in a new terminal. The following screen comes from the principal terminal after the command :

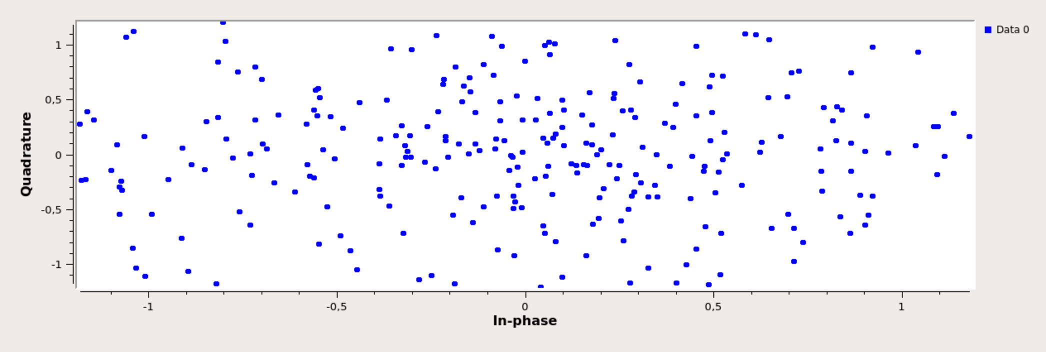

dissauxt@dissauxt-Aspire-ES1-523: ~
Fichier Édition Affichage Rechercher Terminal Aide

```
dissauxt@dissauxt-Aspire-ES1-523:~$ sudo ifconfig tap0 192.168.200.1
[sudo] Mot de passe de dissauxt :
dissauxt@dissauxt-Aspire-ES1-523:~$ 
```

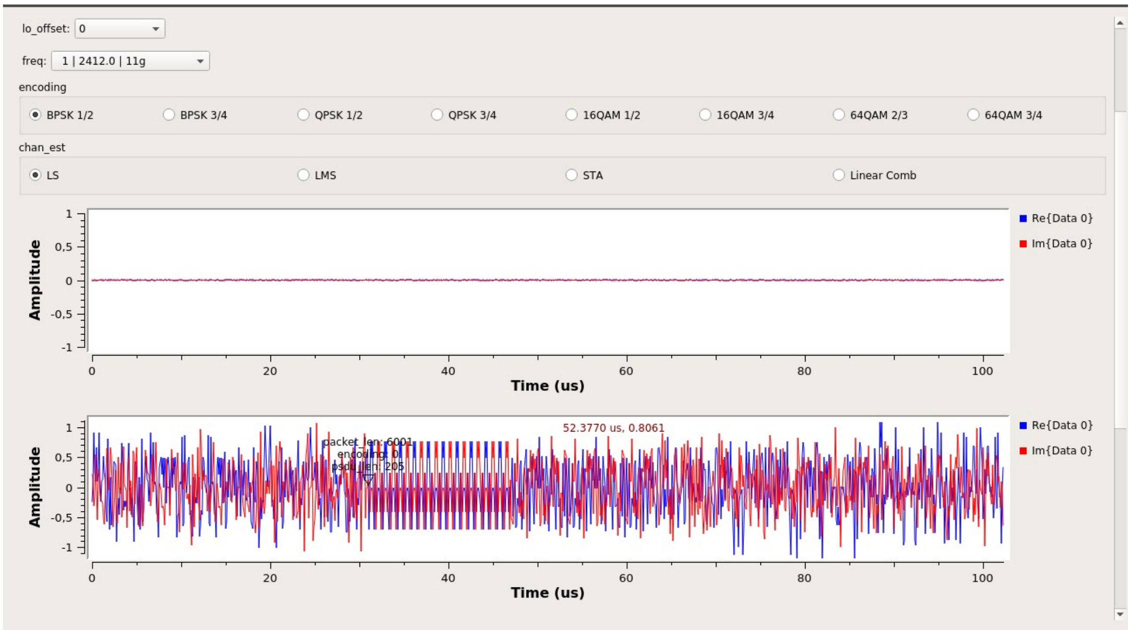


```
set_min_output_buffer on block 37 to 100000
DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDether type: IP
ether type: IP
ether type: IP
ether type: IP
ether type: IP
ether type: IP
ether type: IP
ether type: IP
ether type: IP
ether type: IP
ether type: IP
ether type: IP
ether type: IP
ether type: IP
ether type: IP
ether type: IP
ether type: IP
Dether type: IP
ether type: IP
DDDether type: IP
Dether type: IP
ether type: IP
DDether type: IP
ether type: IP
ether type: IP
ether type: IP
Uether type: IP
ether type: IP
ether type: IP
ether type: IP
ether type: IP
ether type: IP
ether type: IP
Uether type: IP
ether type: IP
```

It seems to work, because we receive « D » on the terminal, it’s probably to say « data packet received ».  Unfortunately, it doesn’t match with the constellation diagram :



This one seems to be totally random, like if we were receiving noise. So that i added in the flowgraph two GUI Time sink (as you can see in the screenshot above). Here are the results :



lo_offset: 0

freq: 1 | 2412.0 | 11g

encoding

● BPSK 1/2 ○ BPSK 3/4 ○ QPSK 1/2 ○ QPSK 3/4 ○ 16QAM 1/2 ○ 16QAM 3/4 ○ 64QAM 2/3 ○ 64QAM 3/4

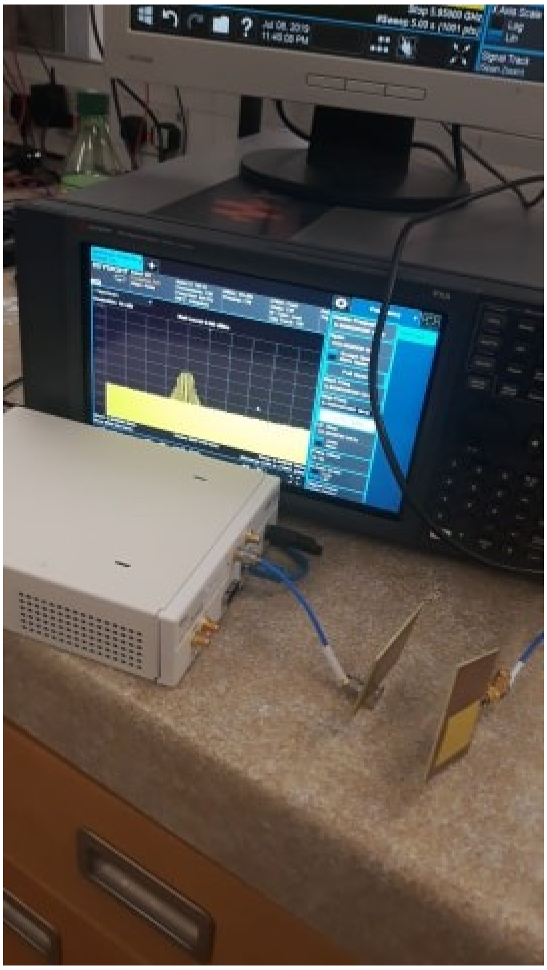
chan_est

● LS ○ LMS ○ STA ○ Linear Comb

The first graph is the GUI time sink after the receiver USRP and the second one is the GUI time sink before the emitter USRP.
So we have the correct curve in emission (compared to the simulation above) but we don't receive anything in reception (only noise, as suggested by the constellation diagram).

I have tested the wifi emitter and receiver programs alone too. It was the same problem.

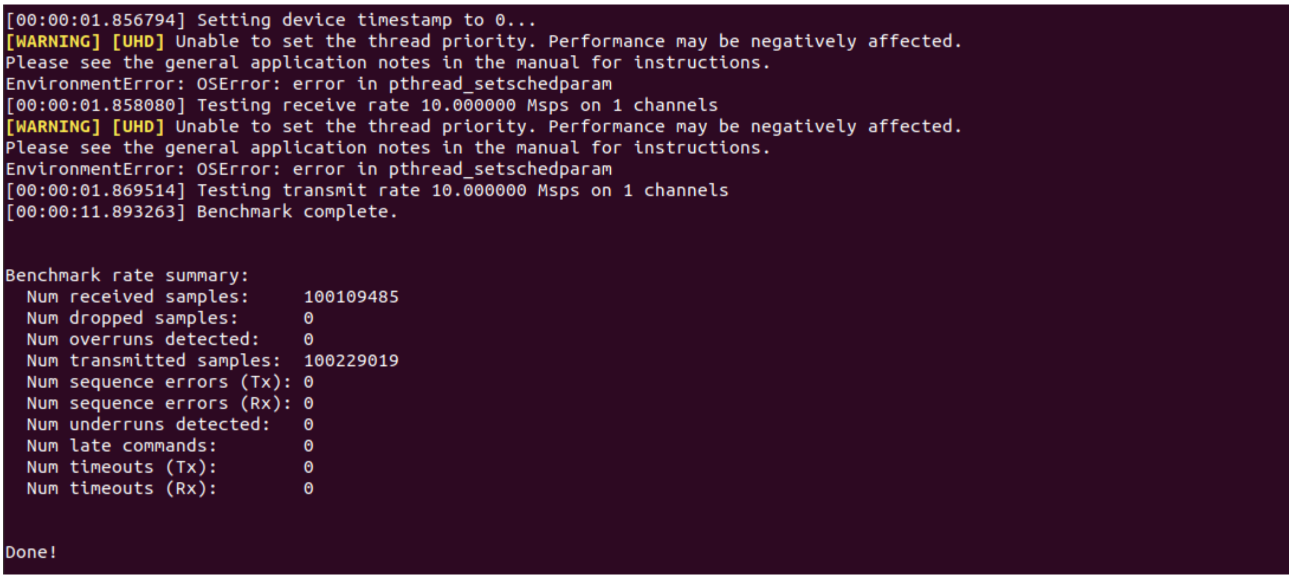
Then i wanted to see if the data was really emitted from the USRP. So i plugged one antenna on the URSP and one antenna on the spectrum analizer (could be done with a wire too).



I suceeded to see all the subcarriers, the spectrum was centered at 2,4 GHz et had  20 MHz bandwidth as predicted by theory.

As conclusion, I have deduced that the USRP emmits data (probably the correct one) but we are not able to catch this data in the RF2 output of the USRP (used as input here).

I have another problem that i can't fix when executing the benchmark of the USRP , and perhaps it comes from that :



```
[00:00:01.856794] Setting device timestamp to 0...
[WARNING] [UHD] Unable to set the thread priority. Performance may be negatively affected.
Please see the general application notes in the manual for instructions.
EnvironmentError: OSError: error in pthread_setschedparam
[00:00:01.858080] Testing receive rate 10.000000 Msps on 1 channels
[WARNING] [UHD] Unable to set the thread priority. Performance may be negatively affected.
Please see the general application notes in the manual for instructions.
EnvironmentError: OSError: error in pthread_setschedparam
[00:00:01.869514] Testing transmit rate 10.000000 Msps on 1 channels
[00:00:11.893263] Benchmark complete.


Benchmark rate summary:
  Num received samples:     100109485
  Num dropped samples:      0
  Num overruns detected:    0
  Num transmitted samples:  100229019
  Num sequence errors (Tx): 0
  Num sequence errors (Rx): 0
  Num underruns detected:   0
  Num late commands:        0
  Num timeouts (Tx):        0
  Num timeouts (Rx):        0


Done!
```

I thank everyone for the reading and I hope you will have ideas on how to solve this problem.

Timothé, a french intern engineer in electronics in Heriot-Watt university (Scotland).