Phased Array Project using 2 ADAR1000's

Software setup: -

For Windows:

1. Clone cn0566 branch of pyadi from darshiltrivedi/pyadi-iio (this is temporary) by writing:-
    - Git clone --branch cn0566 https://github.com/darshiltrivedi/pyadi-iio.git
2. Install libiio from https://github.com/analogdevicesinc/libiio
3. Build from source
    - Cd pyadi-iio
    - Write python3 setup.py install
4. Open cloned pyadi/examples/cn0566/Phased_Array.py
    - This file performs all the phased array beamforming demos
    - The file is well commented has detail guide on what method/function does what

Note:- Even If you are using Windows PC step 1 to 5 are needed to be done on the Pi for this project

For Raspberry Pi:

1. Install Latest version of Kuiper Linux on SD card
2. Build from source pyadi and pylibiio
    - Git clone --branch cn0566 https://github.com/darshiltrivedi/pyadi-iio.git
    - Cd pyadi-iio
    - sudo python3 setup.py install
    - cd ../
    - git clone https://www.github.com/analogdevicesinc/libiio
    - cd libiio
    - cmake .
    - make
    - sudo make install
3. Update pylibiio, sudo pip3 install pylibiio==0.23.1
    - sudo mv /lib/python3.7/site-packages/iio.py /lib/python3.7/site-packages/iio_save.py (After updating pylibiio previous version was present for me so do this hack to avoid dependencies)
4. Download overlay file from: -
    - https://github.com/darshiltrivedi/Phased-Array/blob/main/Phased-Array-Python/PhasedArray-python-Master/Source-code/Overlays/rpi-cn0566-overlay.dtbo
    - Move this to /boot/overlays of your RPI i.e. cd "directory where you downloaded overlay file"
    - Sudo mv rpi-cn0566-overlay.dtbo /boot/overlays/rpi-cn0566-overlay.dtbo

5. Enable that overlay in /boot/config.txt file
    - Sudo mousepad /boot/config.txt
    - Add this to config file at the end and save it, dtoverlay= rpi-cn0566-overlay
    - Reboot the Pi
6. Open cloned pyadi/examples/cn0566/Phased_Array.py
    - This file performs all the phased array beamforming demos
    - The file is well commented has detail guide on what method/function does what

Note: - cn0566 branch of pyadi from darshiltrivedi/pyadi-iio is temporary and finally will merge into analogdevicesinc/pyadi-iio

Pluto Rev.C: -

This hack needs to be done in order to enable 2nd channel of pluto

Detailed guide on how to do so is at: -
https://github.com/darshiltrivedi/Phased-Array/blob/main/Pluto%20Hacks/RevC_2r2t.txt

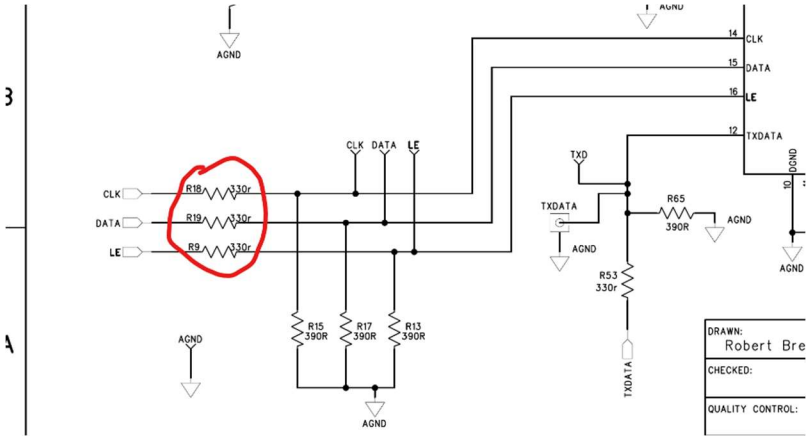
Hardware setup: -

Pluto: -

1. Pop open blue box of pluto rev C. you would see 2nd Rx and Tx channel.
2. Connect UFL to SMA connector. Drill sma size holes on blue box next to current channels and fit those 2nd pair in their.

ADF4159: -

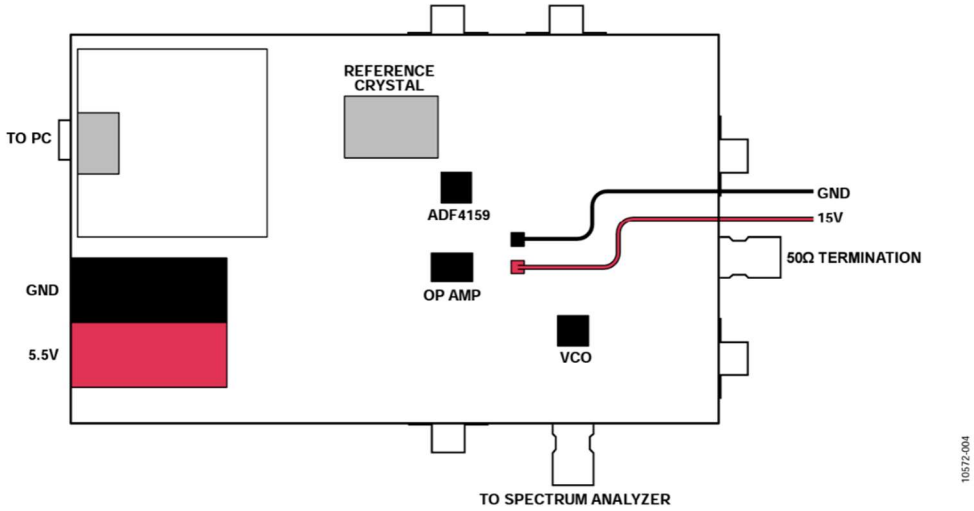
1. Pop out R18, R19 and R9 resistor on adf4159 Eval board.



2. Connect CLK to spi-clock of rpi via external 330 Ohm resistor(you must connect external 330Ohm resistor for level shifting)
3. Connect data to MOSI of rpi via external 330 Ohm resistor. Leave MISO disconnected
4. Connect LE to gpio 27 of rpi via external 330 Ohm resistor. (It is chip select)

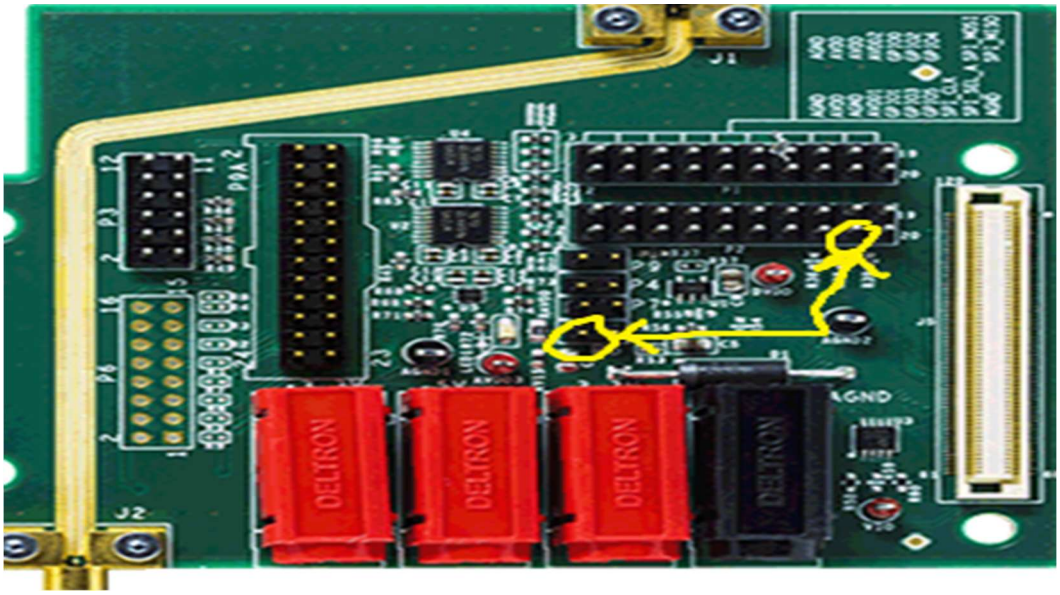
5. Adf4159 needs 3 power supply
    a. 5V from usb connected to Pi
    b. 5/5.5 V given to banana jacks below usb
    c. +15V to Gnd as shown in figure

EVALUATION SETUP



ADAR1000

1. Connect CLK, MOSI, MISO of both the ADAR1000 to respective pin of RPI.
2. Connect CS of 1st adar1000(Beam0) to gpio 8 of Pi and CS of 2nd adar1000(Beam1) to gpio 27.
3. Set address of both adar1000 to 00 on eval-board i.e. Do not connect any pins.
4. (Connector P1 and P2 are identical) Short Chip_select pin of P2/P1 to OE pin of level-shifter i.e. Pin 1 of P5 using jumper cable. This needs to be done in order to avoid cross-talk between 2 adar. Do this for both adar1000



5. Connect +5, +3.3 and Gnd to both adar1000.
6. Connect all Rx channel of both adar1000 to antenna array in order i.e. 1st adar/beam0's channel 1 to 1st antenna array and so on.
7. Connect o/p of both adar1000 to 2 mixers.
8. Connect o/p of adf4159(which is labeled to spectrum analyzer in figure 2) to a 4-20GHz frequency splitter and those divided output to LO of both the mixers.
9. Connect IF of both the mixers to 2 Rx channels of Pluto.
10. Connect Pluto to device on which you are running source code i.e. if using windows to run connect pluto to windows machine.
11. Place Signal Frequency/ frequency Source to mechanical boresight of antenna array.
12. Run the Phased_Array.py from examples folder