

USRP X Series Quick Start (Daughterboard Installation)

Contents

- 1 Application Note Number
- 2 Revision History
- 3 Abstract
- 4 Overview
- 5 Tools Required
- 6 Pre-installed Software
- 7 Box Contents
 - ◆ 7.1 USRP Box
 - ◆ 7.2 Daughterboard Boxes
 - ◆ 7.3 Antenna Boxes
- 8 Proper Care and Handling
- 9 Installation Process
 - ◆ 9.1 Step 1
 - ◆ 9.2 Step 2
 - ◆ 9.3 Step 3
 - ◆ 9.4 Step 4
 - ◆ 9.5 Step 5
 - ◆ 9.6 Step 6
 - ◆ 9.7 Step 7
 - ◆ 9.8 Step 8
 - ◆ 9.9 Step 9
 - ◆ 9.10 Step 10
 - ◆ 9.11 Step 11
 - ◆ 9.12 Step 12
 - ◆ 9.13 Step 13
 - ◆ 9.14 Step 14
 - ◆ 9.15 Step 15
- 10 UBX daughterboard Installation Video
- 11 UHD FFT
- 12 Success

AN-904

Date	Author	Details
2016-05-01	Neel Pandeya Nate Temple	Initial creation
2020-Apr-27	Jose Loera	Added section "UBX Daughterboard Installation Video" and link. Link also provided here as well

This application note is a detailed step-by-step guide to install a daughterboard into the USRP X300/X310.

This Quick Start is meant to show you how to put together your new X300/310. We will start at the point when you have yet to unpack the boxes and go all the way to being able to ping the device, performing a quick software probe to verify hardware components and finally running a simple FFT demo. This Quick Start does not cover the installation of software on the host computer. If you have not installed UHD/Gnuradio on your system, please reference the Building and Installing the USRP Open-Source Toolchain (UHD and GNU Radio) on [Linux](#), [OS X](#) and [Windows](#) Application Notes. You may also use the [Live SDR Environment](#) to perform the verification steps for your USRP. Detailed information on the [Live SDR Environment](#) is available at the [Live SDR Environment Getting Started Guides](#) page.

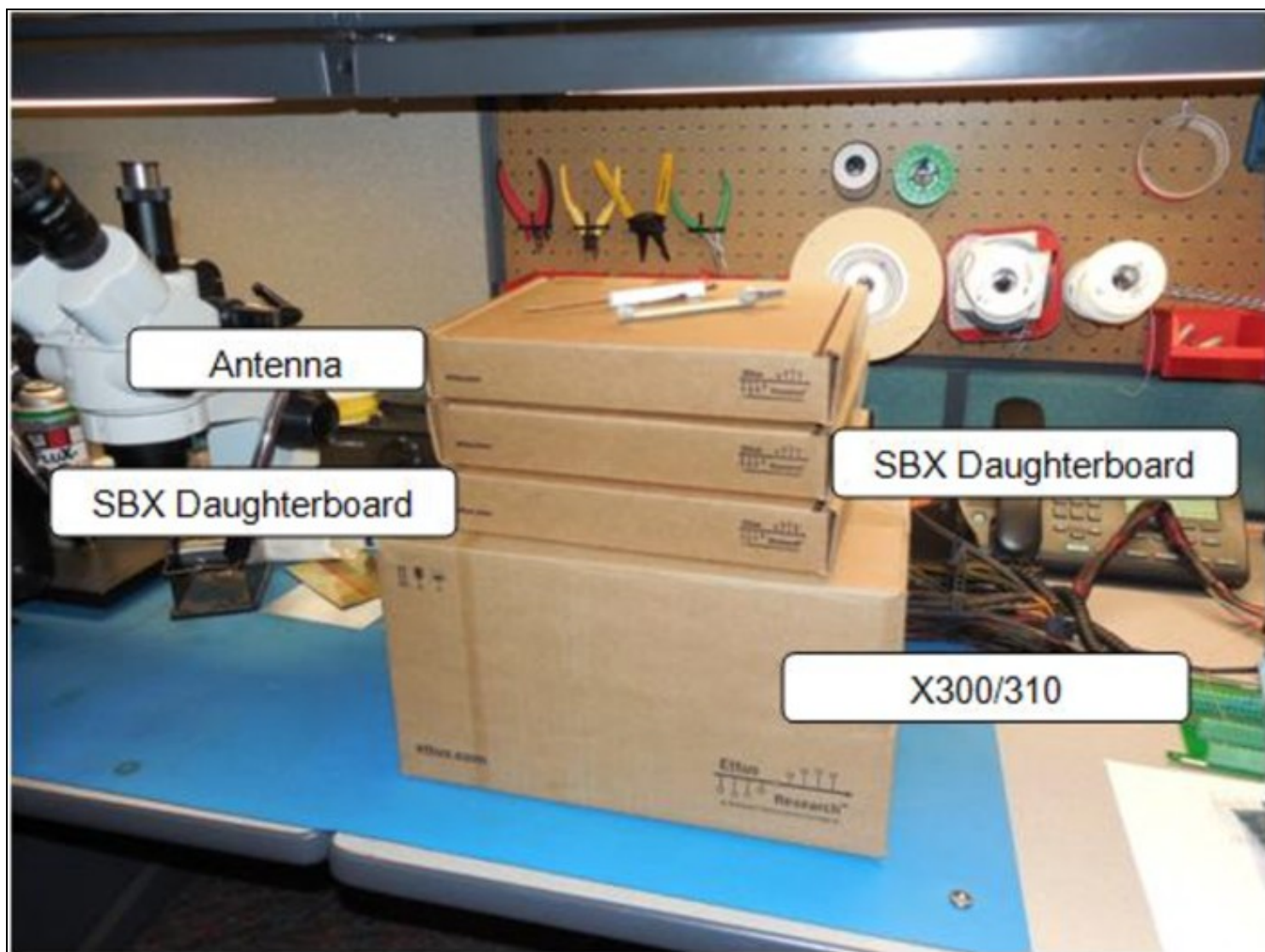
- Philips Screwdriver
- 5/16" wrench

- UHD Latest
- GNU Radio

- 1 x USRP X300/X310
- 1 x SFP Adapter for 1 GigE
- 1 x Power Supply and US Cord
- 1 x USB 2.0 JTAG Debug Cable
- 1 x Gigabit Ethernet Cable
- 4 x SMA-Bulkhead Cables
- 16 x Daughterboard Screws

- 2 x SBX Daughterboards

- One or more Antennas





All Ettus Research products are individually tested before shipment. The USRP? is guaranteed to be functional at the time it is received by the customer. Improper use or handling of the USRP? can easily cause the device to become non-functional. Ettus Research recommends you perform the installation with no power to the USRP and using ESD equipment. Listed below are some examples of actions which can prevent damage to the unit:

- Never allow metal objects to touch the circuit board while powered.
- Always properly terminate the transmit port with an antenna or 50? load.
- Always handle the board with proper anti-static methods.
- Never allow the board to directly or indirectly come into contact with any voltage spikes.
- Never allow any water, or condensing moisture, to come into contact with the boards.
- Always use caution with FPGA, firmware, or software modifications.

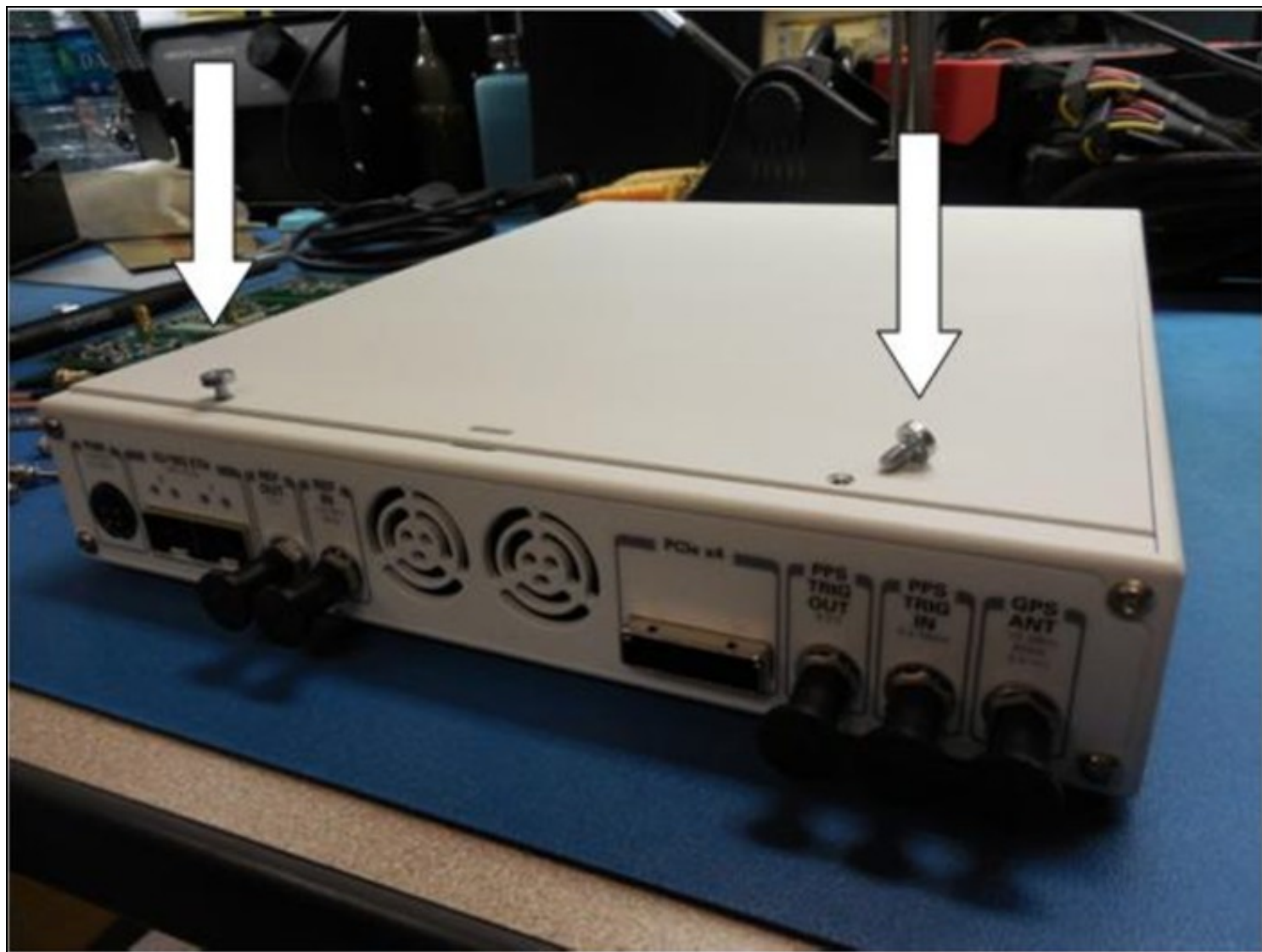


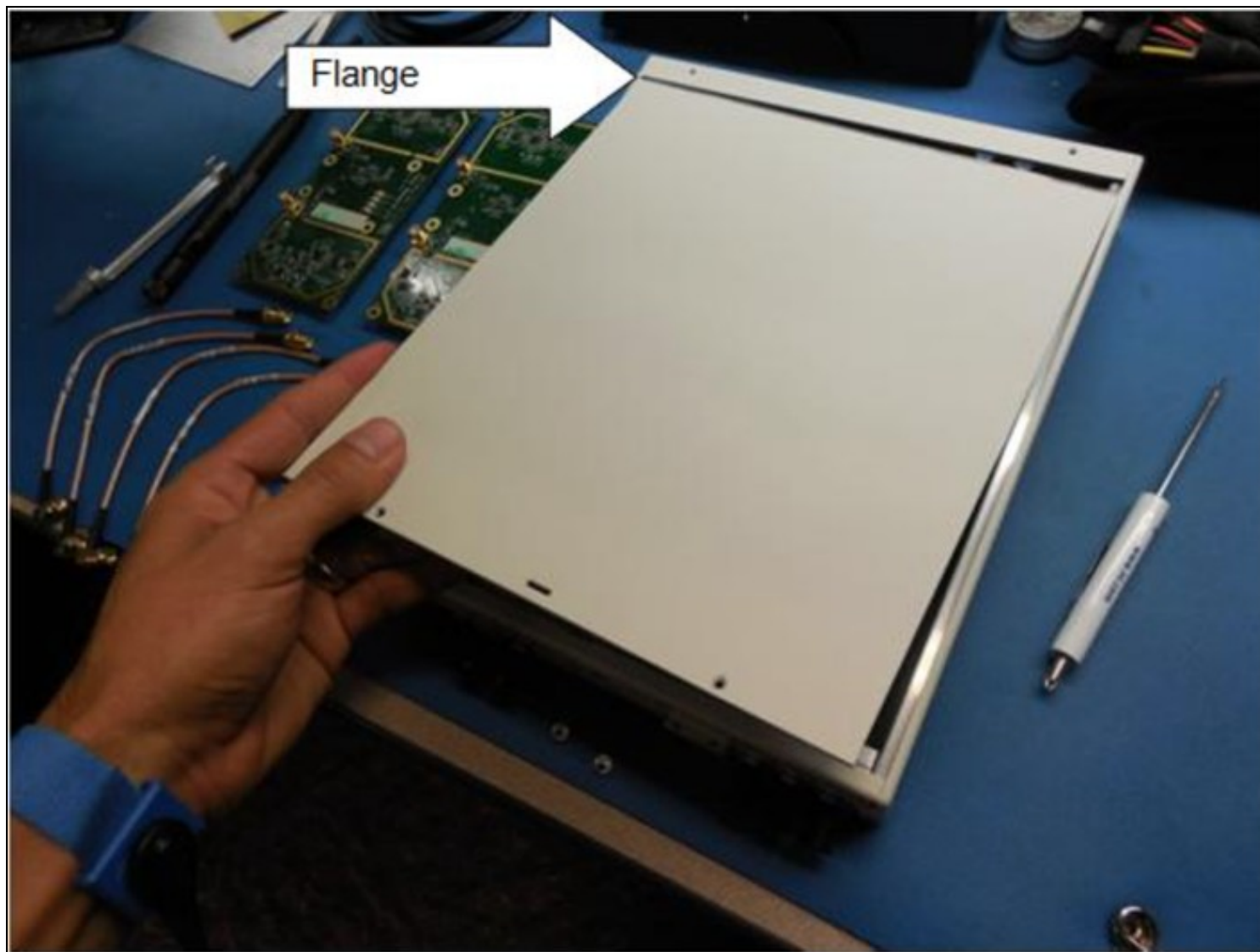
Never apply more than -15 dBm of power into any RF input.



Always use at least 30dB attenuation if operating in loopback configuration

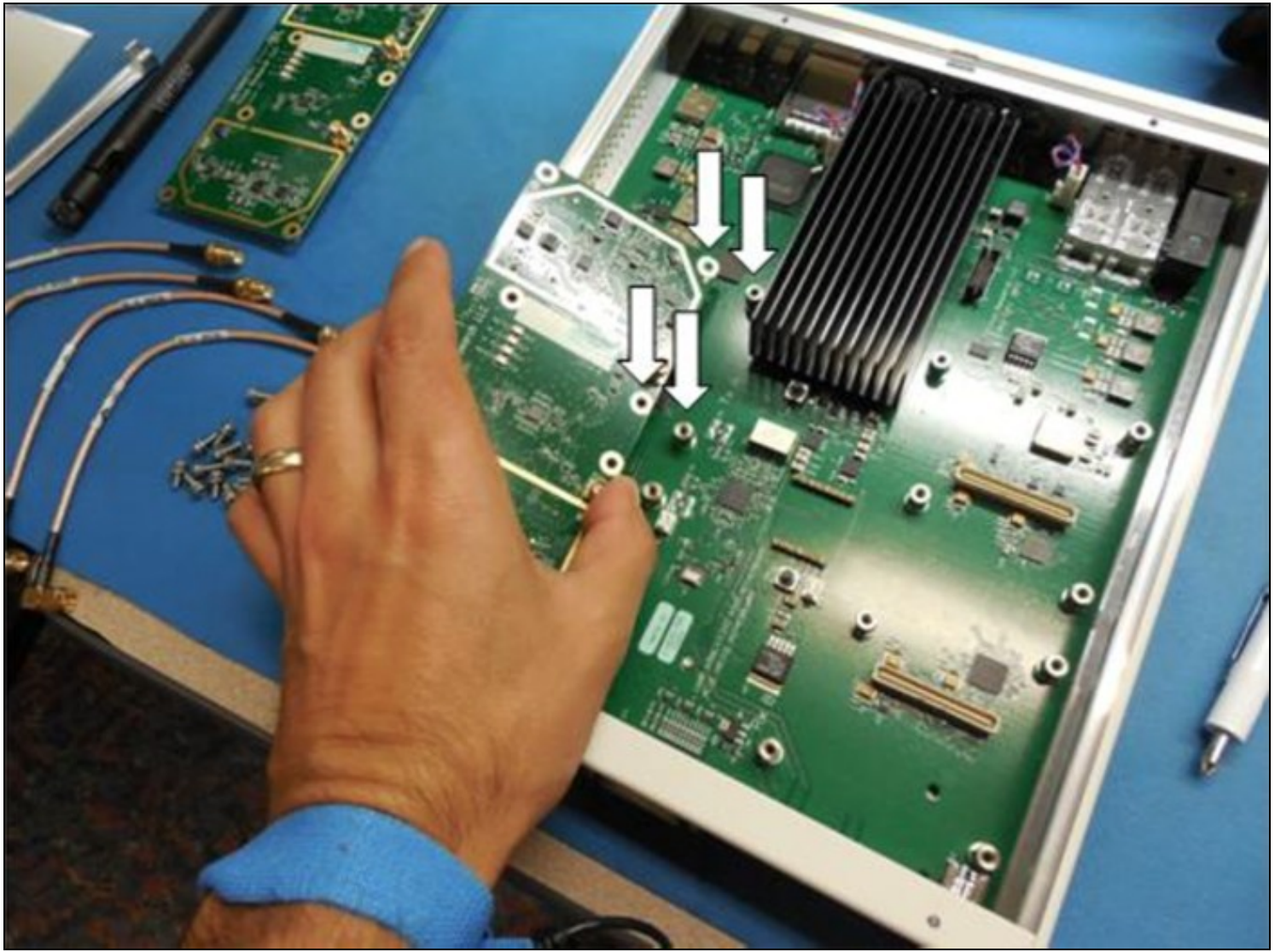
Unscrew the 2 screws on the top of the USRP and remove cover. (Lift up about 15 degrees and wiggle back as there is a flange on the front part of the cover)

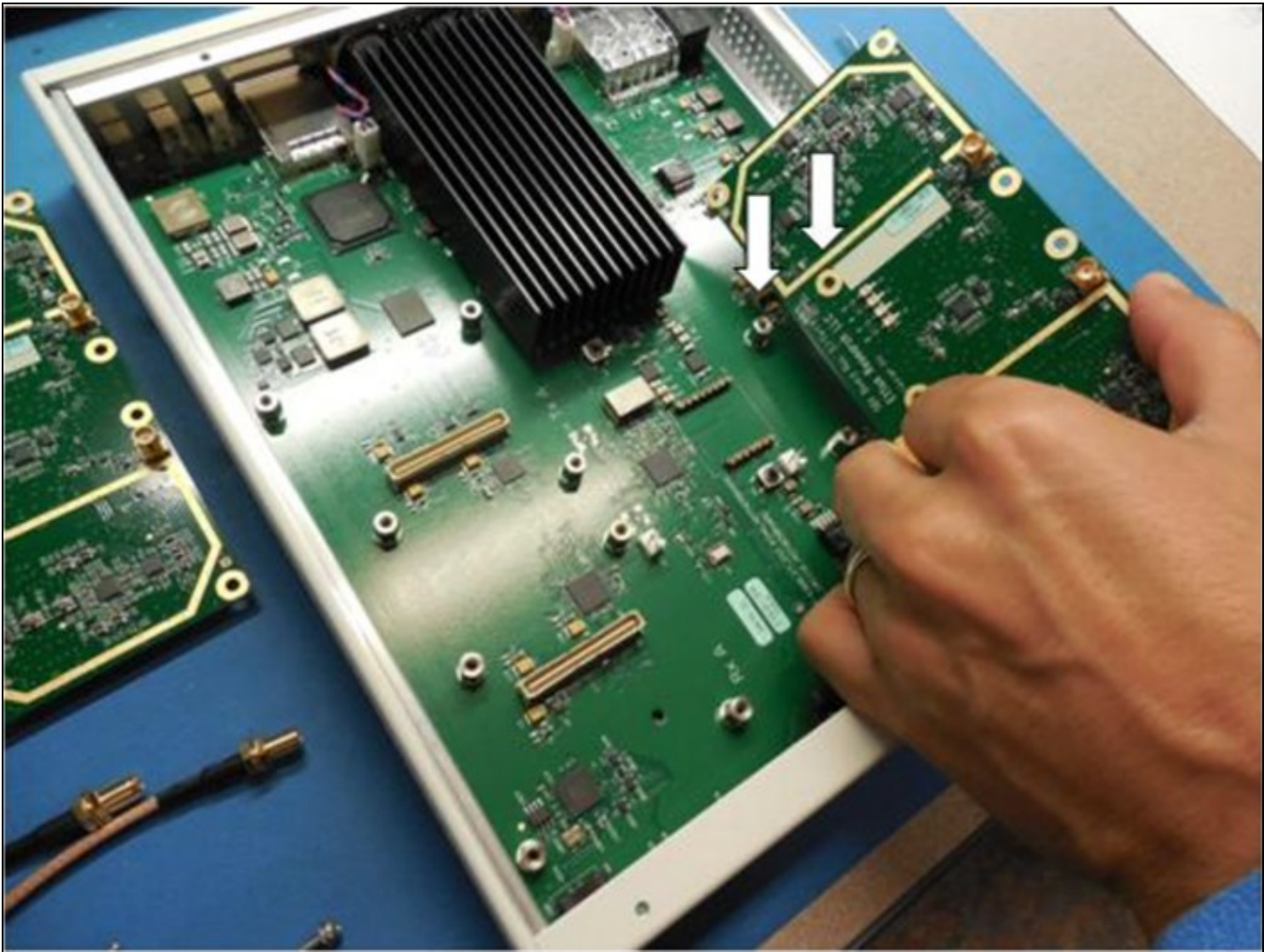






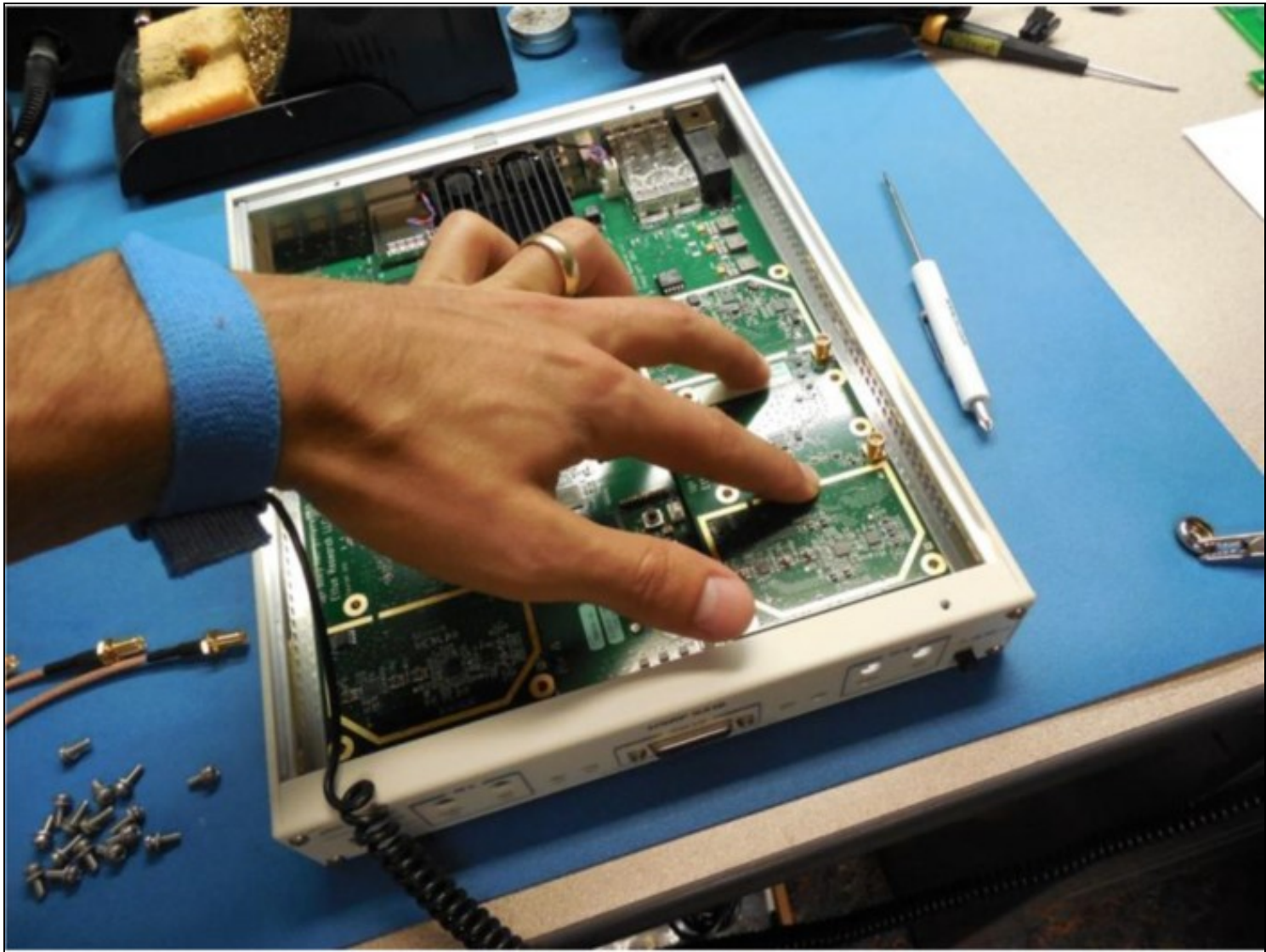
Line up the 8 screw holes on the Daughterboard with the USRP Motherboard standoffs (they only go one way).





After you have aligned the Daughterboard correctly you can press the Daughterboard on to the connectors below them (you will feel them snap into place).





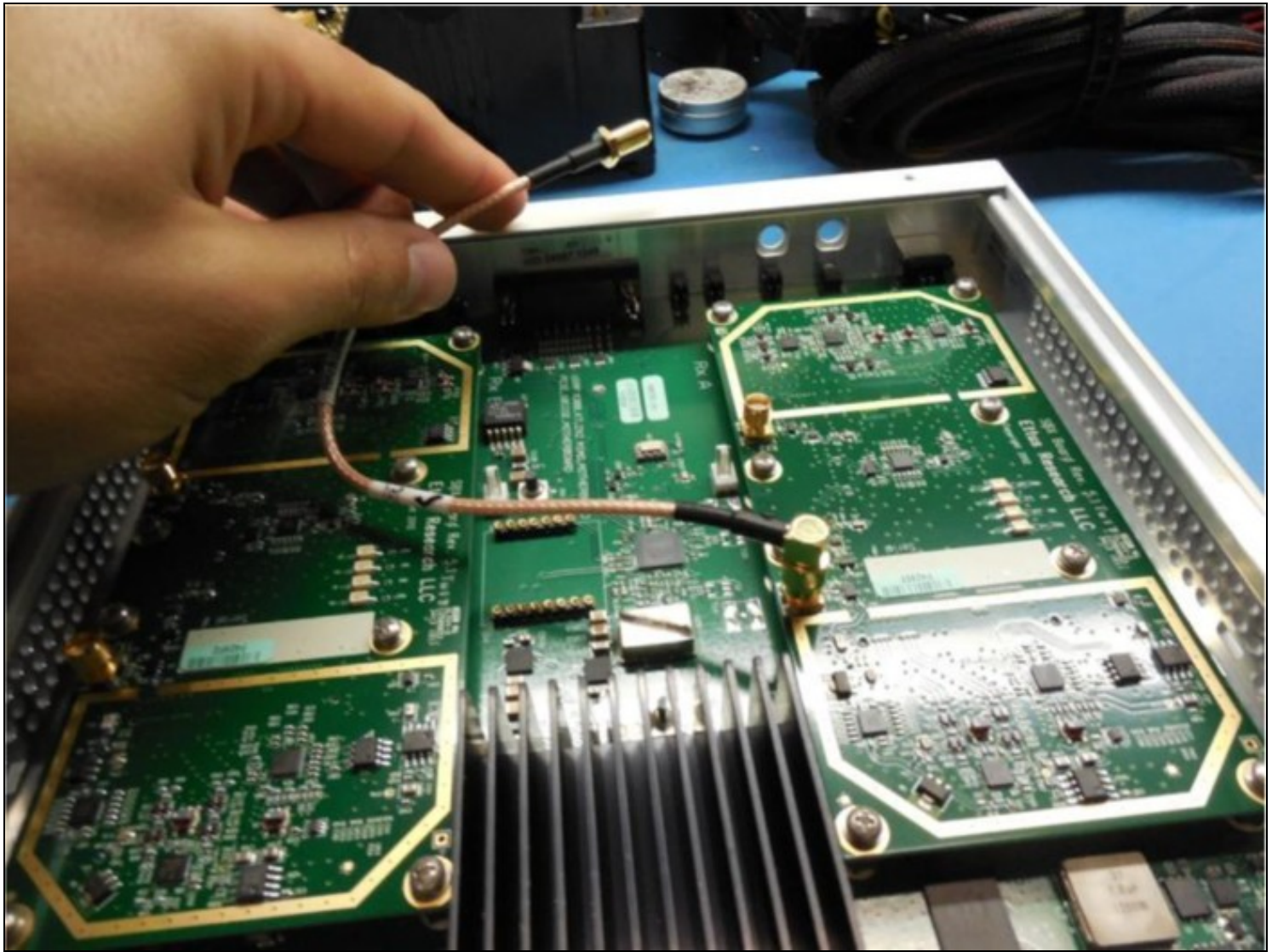
Put 8 of the screws provided in the daughterboard



Repeat steps 2- 4 for the second Daughterboard

It is recommended to connect the bulkhead cables one at a time to avoid confusion. The Daughterboards and front panel of the X300/310 are clearly labeled as to which cable goes where.

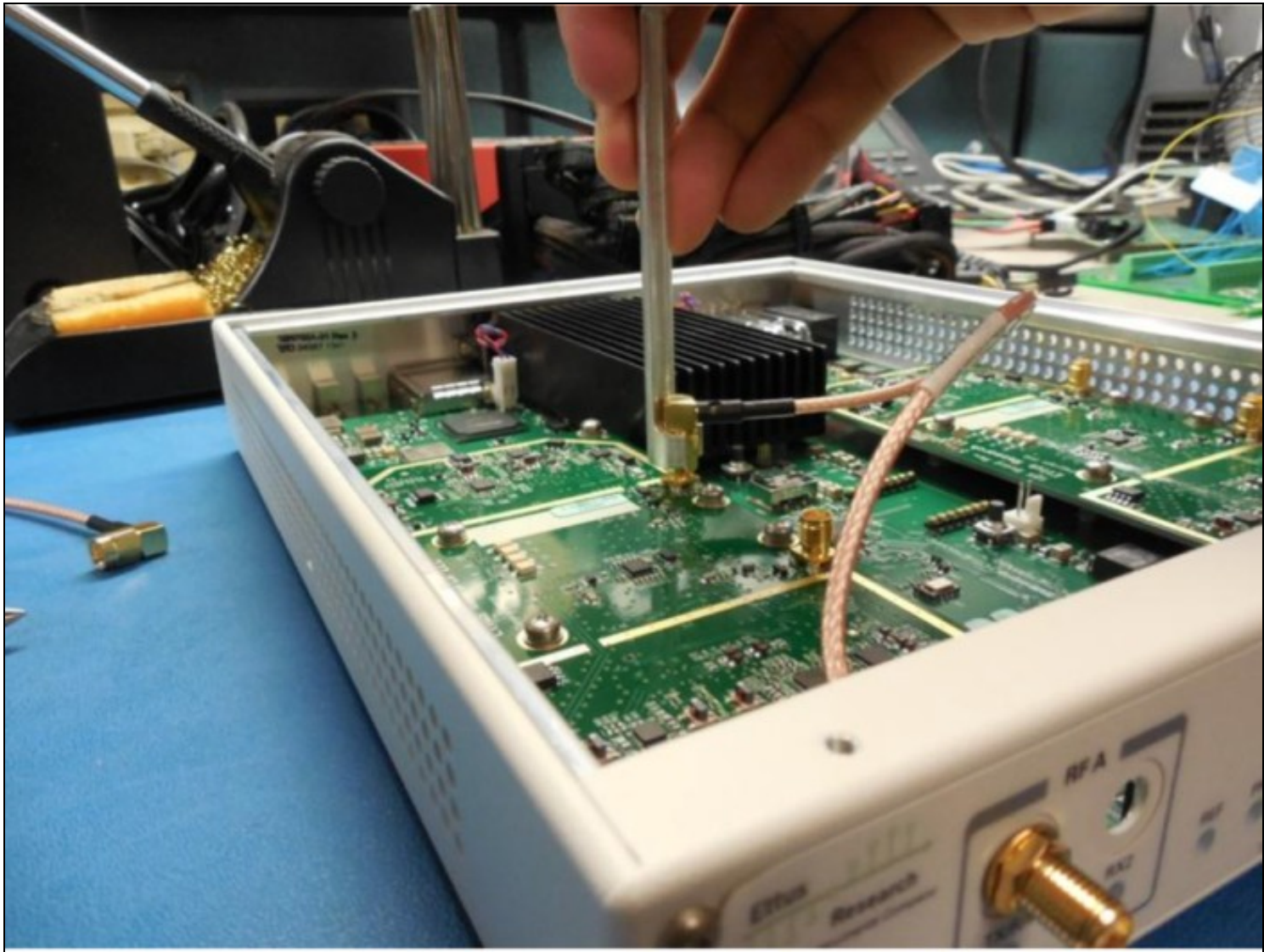












Repeat step 6 for the other bulkhead cables





Install USRP cover with screws



Connect the SFP 1 GigE adapter into USRP SFP port 0





Connect the Gigabit Ethernet cable and power cord provided



On the computer(host) you plan to use to connect to the USRP set the Ethernet adapter to have an IP address of 192.168.10.1 with a subnet mask of 255.255.255.0. Connect the other end of the Gigabit Ethernet cable to your computer.

Editing Wired connection 1

Connection name:

General Ethernet 802.1x Security IPv4 Settings IPv6 Settings

Method:

Addresses

Address	Netmask	Gateway
192.168.10.1	255.255.255.0	0.0.0.0

DNS servers:

Search domains:

DHCP client ID:

☐ Require IPv4 addressing for this connection to complete

Power on the USRP (button on the front right of the USRP)

Ping the device from host computer:

```
$ ping 192.168.10.2
```

```
jose@betty ~ $ ping 192.168.10.2
PING 192.168.10.2 (192.168.10.2) 56(84) bytes of data.
64 bytes from 192.168.10.2: icmp_seq=1 ttl=32 time=1.58 ms
64 bytes from 192.168.10.2: icmp_seq=2 ttl=32 time=2.60 ms
64 bytes from 192.168.10.2: icmp_seq=3 ttl=32 time=0.665 ms
64 bytes from 192.168.10.2: icmp_seq=4 ttl=32 time=0.409 ms
64 bytes from 192.168.10.2: icmp_seq=5 ttl=32 time=0.652 ms
^C
--- 192.168.10.2 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4001ms
rtt min/avg/max/mdev = 0.409/1.183/2.609/0.817 ms
jose@betty ~ $
```

Assuming you have properly installed the UHD driver you can now run this command in a terminal/command window:

```
$ uhd_usrp_probe
```

This will tell you about the hardware inside of your USRP. The output will look like the following:

```
$ uhd_usrp_probe
linux; GNU C++ version 4.8.4; Boost_105400; UHD_003.010.git-202-g9e0861e1
```

```
-- X300 initialization sequence...
-- Determining maximum frame size... 1472 bytes.
-- Setup basic communication...
-- Loading values from EEPROM...
-- Setup RF frontend clocking...
-- Radio 1x clock:200
-- Detecting internal GPSDO.... No GPSDO found
-- Initialize Radio0 control...
-- Performing register loopback test... pass
-- Initialize Radio1 control...
-- Performing register loopback test... pass
```

```
Device: X-Series Device
```

```
  Mboard: X300
  revision: 7
  revision_compat: 7
  product: 30518
  mac-addr0: ff:ff:ff:ff:ff:ff
  mac-addr1: ff:ff:ff:ff:ff:ff
  gateway: 255.255.255.255
  ip-addr0: 255.255.255.255
  subnet0: 255.255.255.255
  ip-addr1: 255.255.255.255
  subnet1: 255.255.255.255
  ip-addr2: 255.255.255.255
  subnet2: 255.255.255.255
  ip-addr3: 255.255.255.255
  subnet3: 255.255.255.255
  serial: FFFFFFFF
  FW Version: 4.0
  FPGA Version: 20.0
```

```
Time sources: internal, external, gpsdo
Clock sources: internal, external, gpsdo
Sensors: ref_locked
```

```
  RX DSP: 0
  Freq range: -100.000 to 100.000 MHz
```

```
  RX DSP: 1
  Freq range: -100.000 to 100.000 MHz
```

```
  RX Dboard: A
  ID: SBX (0x0054)
  Serial: FFFFFFFF
```

```
  RX Frontend: 0
  Name: SBXv3 RX
  Antennas: TX/RX, RX2, CAL
  Sensors: lo_locked
  Freq range: 400.000 to 4400.000 MHz
  Gain range PGA0: 0.0 to 31.5 step 0.5 dB
```



```

| | | | Bandwidth range: 40000000.0 to 40000000.0 step 0.0 Hz
| | | | Connection Type: IQ
| | | | Uses LO offset: No
| | | |
| | | | /
| | | | RX Codec: A
| | | | Name: ads62p48
| | | | Gain range digital: 0.0 to 6.0 step 0.5 dB
| | | |
| | | | /
| | | | RX Dboard: B
| | | | ID: SBX (0x0054)
| | | | Serial: FFFFFFFF
| | | |
| | | | /
| | | | RX Frontend: 0
| | | | Name: SBXv3 RX
| | | | Antennas: TX/RX, RX2, CAL
| | | | Sensors: lo_locked
| | | | Freq range: 400.000 to 4400.000 MHz
| | | | Gain range PGA0: 0.0 to 31.5 step 0.5 dB
| | | | Bandwidth range: 40000000.0 to 40000000.0 step 0.0 Hz
| | | | Connection Type: IQ
| | | | Uses LO offset: No
| | | |
| | | | /
| | | | RX Codec: B
| | | | Name: ads62p48
| | | | Gain range digital: 0.0 to 6.0 step 0.5 dB
| | | |
| | | | /
| | | | TX DSP: 0
| | | | Freq range: -100.000 to 100.000 MHz
| | | |
| | | | /
| | | | TX DSP: 1
| | | | Freq range: -100.000 to 100.000 MHz
| | | |
| | | | /
| | | | TX Dboard: A
| | | | ID: SBX (0x0055)
| | | | Serial: FFFFFFFF
| | | |
| | | | /
| | | | TX Frontend: 0
| | | | Name: SBXv3 TX
| | | | Antennas: TX/RX, CAL
| | | | Sensors: lo_locked
| | | | Freq range: 400.000 to 4400.000 MHz
| | | | Gain range PGA0: 0.0 to 31.5 step 0.5 dB
| | | | Bandwidth range: 40000000.0 to 40000000.0 step 0.0 Hz
| | | | Connection Type: QI
| | | | Uses LO offset: No
| | | |
| | | | /
| | | | TX Codec: A
| | | | Name: ad9146
| | | | Gain Elements: None
| | | |
| | | | /
| | | | TX Dboard: B
| | | | ID: SBX (0x0055)
| | | | Serial: FFFFFFFF
| | | |
| | | | /
| | | | TX Frontend: 0
| | | | Name: SBXv3 TX
| | | | Antennas: TX/RX, CAL
| | | | Sensors: lo_locked
| | | | Freq range: 400.000 to 4400.000 MHz
| | | | Gain range PGA0: 0.0 to 31.5 step 0.5 dB
| | | | Bandwidth range: 40000000.0 to 40000000.0 step 0.0 Hz
| | | | Connection Type: QI
| | | | Uses LO offset: No
| | | |
| | | | /
| | | | TX Codec: B
| | | | Name: ad9146
| | | | Gain Elements: None

```

The following link is a video of the steps to install the UBX daughterboard. The procedure is similar to what is outlined above.

- [Video: UBX Installation into a USRP X-series device.](#)

Try the UHD_FFT demo that comes with GNU Radio

1. Connect one antenna to RX2 on the left Daughterboard (Daughterboard A)



2.From the terminal/command window:

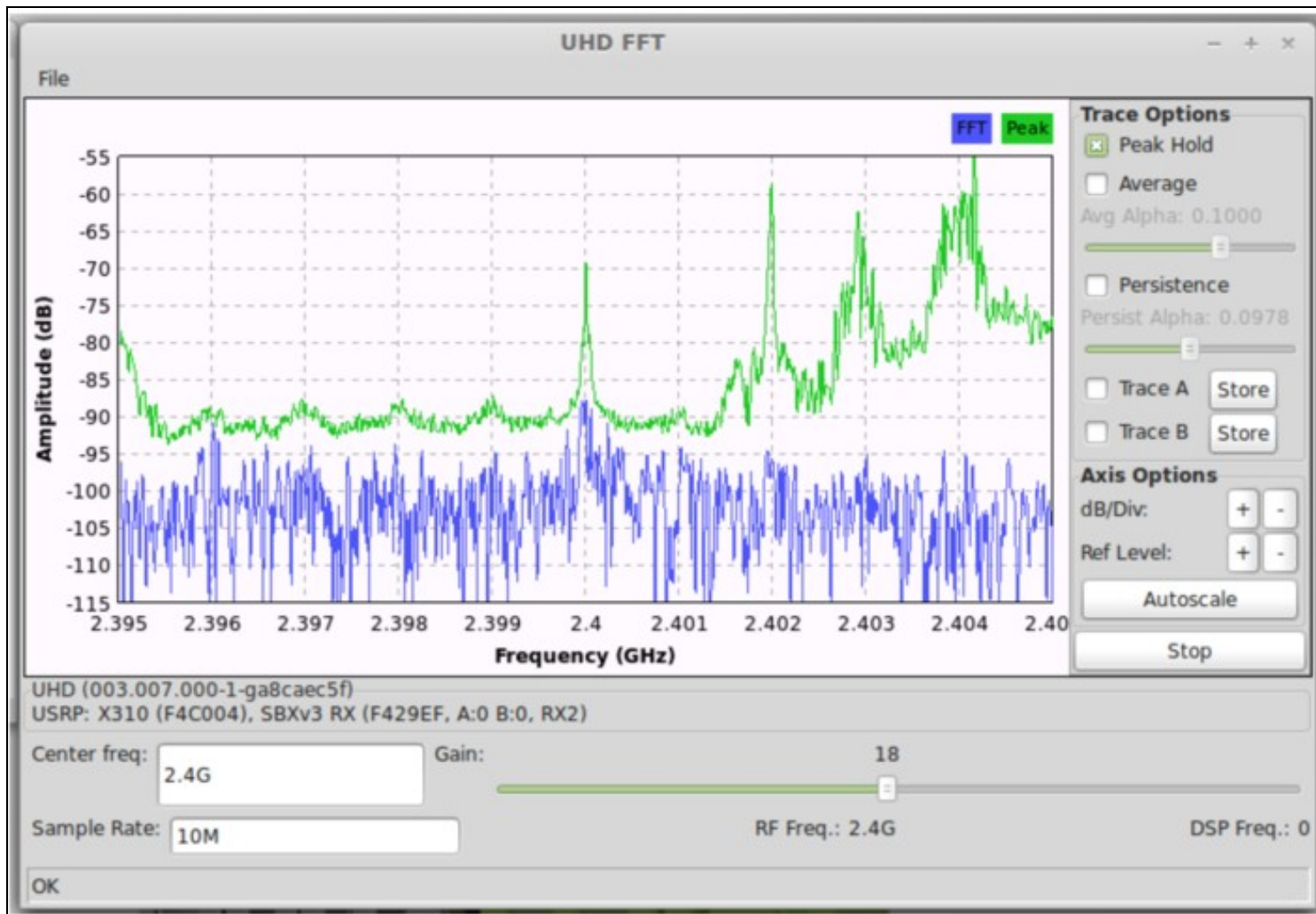
```
$ uhd_fft --ant RX2
```

Terminal

```
jose@betty ~ $ uhd_fft
linux; GNU C++ version 4.8.1; Boost_105300; UHD_003.007.000-1-ga8caec5f

-- X300 initialization sequence...
-- Determining maximum frame size... 1472 bytes.
-- Setup basic communication...
-- Loading values from EEPROM...
-- Setup RF frontend clocking...
-- Radio 1x clock:200
-- Initialize Radio control...
-- Performing register loopback test... pass
-- Sync DAC's.
-- Performing register loopback test... pass
-- Sync DAC's.
-- Setting references to internal sources
Using Volk machine: avx_64_mmx_orc

UHD Warning:
  The recv buffer could not be resized sufficiently.
  Target sock buff size: 33554432 bytes.
  Actual sock buff size: 1000000 bytes.
  See the transport application notes on buffer resizing.
  Please run: sudo sysctl -w net.core.rmem_max=33554432
```

Congratulations! You have successfully setup and verified your new USRP X300/X310. A more detailed verification guide is at the [Verifying the Operation of the USRP Using UHD and GNU Radio application note](#). For additional step-by-step guides to using your USRP X300/X310, see the [Application Notes](#) section of the Ettus Research Knowledge Base.