

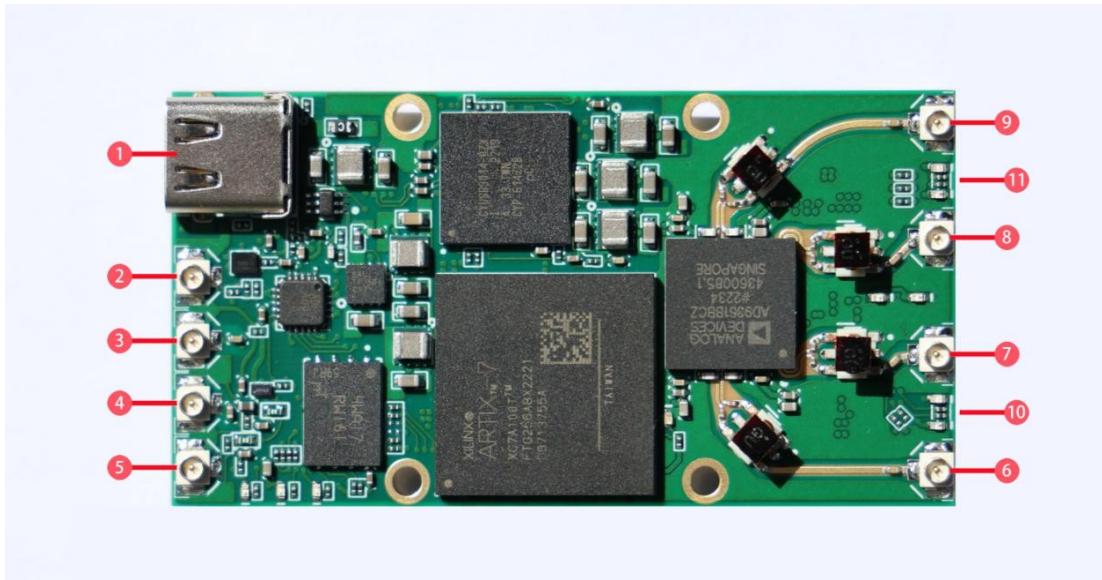
# Tiny B210 User Manual

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## 1、 Interface Introduction

There are a total of 11 external interfaces, with 10 and 11 located on the back. As shown in the following figure:

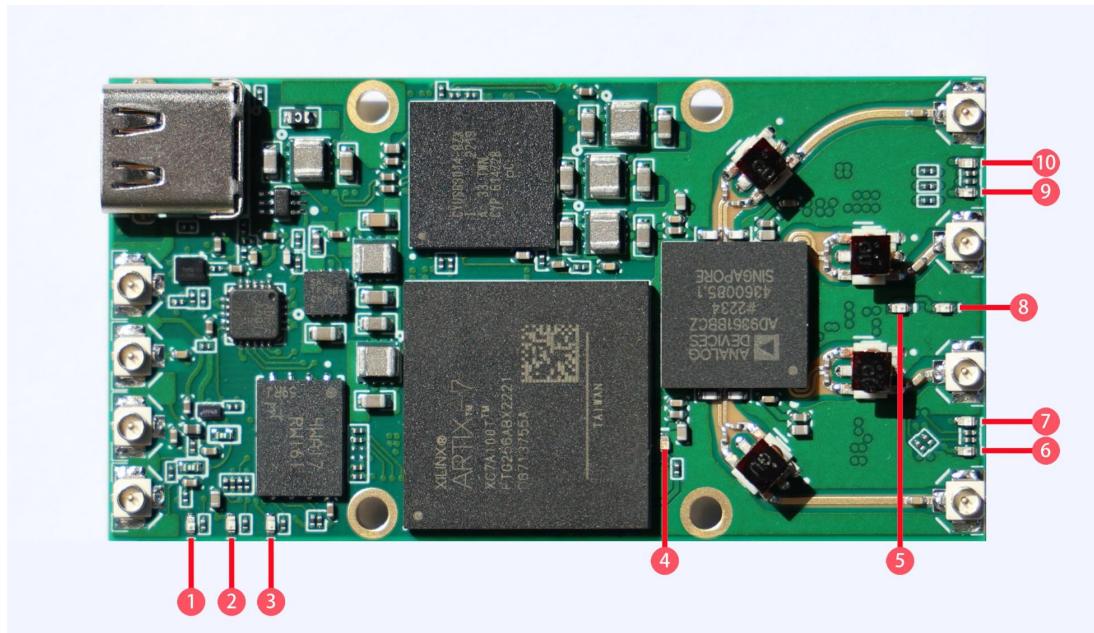


Interface label diagram

1. Type-C USB 3.0 interface, supports forward and reverse insertion, uses a high-speed cable that supports USB 3.0, and plugs it into the USB 3.0 interface of the computer. Otherwise, it may be classified as USB 2.0 mode and the transfer rate will be greatly reduced.
2. 40M crystal oscillator output, with peak to peak voltage of approximately 300mV.
3. Connect GPS active antenna. Regardless of whether the software is connected or not, as long as the GPS antenna is connected and receives a signal, it will tame the 40M clock. GPS taming has the highest priority, as long as the GPS antenna is connected and a GPS signal is received (PPS of the GPS module has output), even if the software has set an external reference clock input, it will be ignored.
4. Connect to an external active clock, and UHD defaults to a frequency of 10MHz.
5. PPS synchronization signal input.
6. TXA, The transmission port of channel A.
7. RXA, The input power of the receiving port of channel A should not exceed 0dBm.
8. RXB, The receiving port of channel B.
9. TXB, The input power of the transmitting port of channel B should not exceed 0dBm.
10. There are IO expansion ports on the reverse side, which can be customized and developed by customers.
11. There are IO expansion ports on the reverse side, which can be customized and developed by customers.

Note: There are a total of 16 3.3V level IO ports on ports 10 and 11.

## 2、Introduction to the meaning of LED



LED label diagram

1. Constant illumination indicates that the external 10M clock is locked.
2. Constant illumination indicates GPS clock lock.
3. A one second flash indicates receiving a GPS signal, usually received first before locking.
4. DONE indicator light
5. Keep LDE.
6. TXA indicator light.
7. RXA indicator light.
8. Keep LDE.
9. RXB indicator light.
10. TXB indicator light.

### 3、 Double engine test

In this test, we will use tinyb210 as a model generator to send a 2GHz signal to the outside,. View the results using a spectrum analyzer.

Open the project we provided in gnuradio on the Linux system, copy project 2tx-2g to the Linux system, then open gnuradio and select the folder where the file will be stored. As shown in Figure 1-1 below.

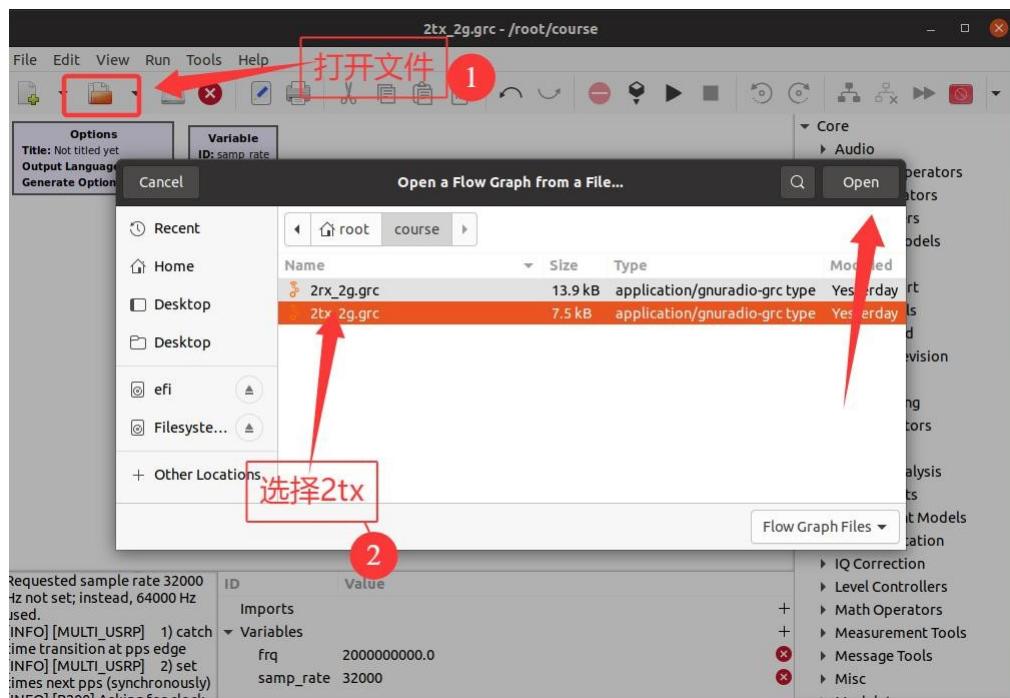


Figure 1-1

At this point, connect tinyb210. After inserting Type-C, insert the other end into the USB port of the computer, as shown in Figure 1-2

As shown.

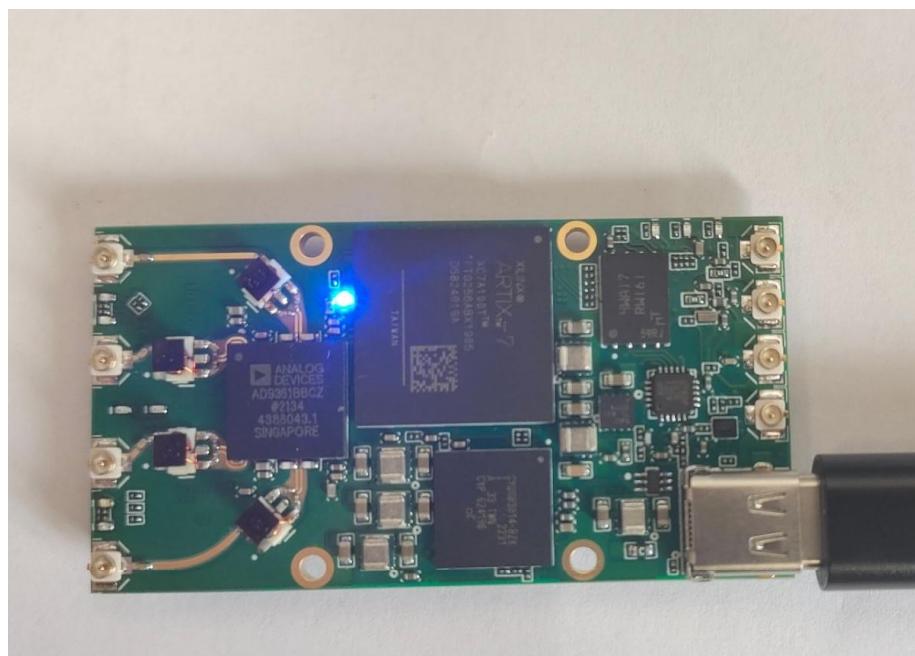


Figure 1-2

After opening the project, click on 'Run' and wait for a while. When a box appears, it means that the program has successfully run, as shown in Figure 1-3.

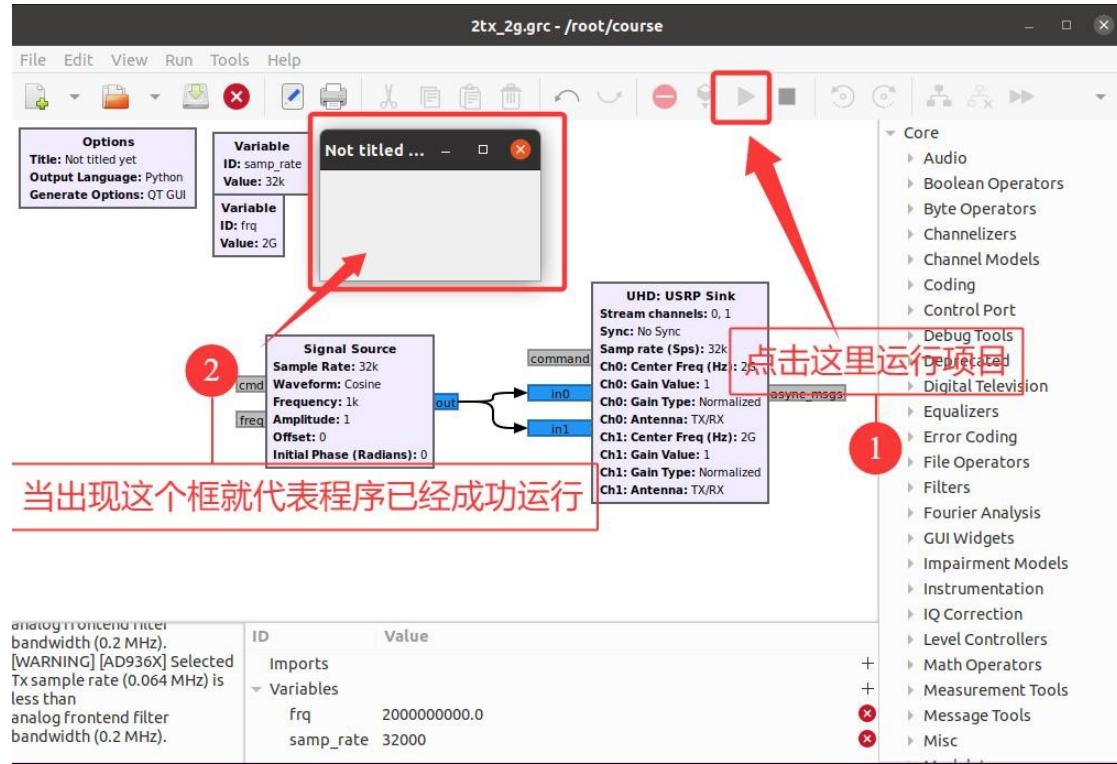


Figure 1-3

After successful operation, a red LED light will light up at the output port, and then connect to the spectrometer at the output interface, as shown in Figure 1-4.



Figure 1-4

At this time, the spectrometer will display the output waveform, as shown in Figures 1-5 and 1-6.

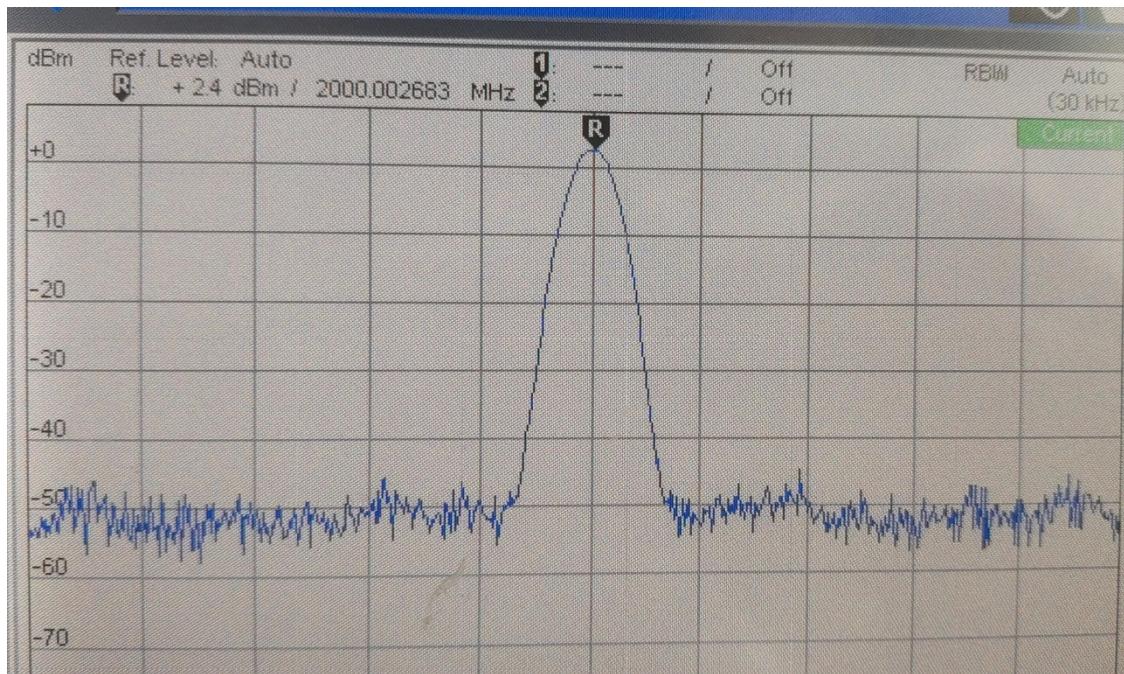


Figure 1-5

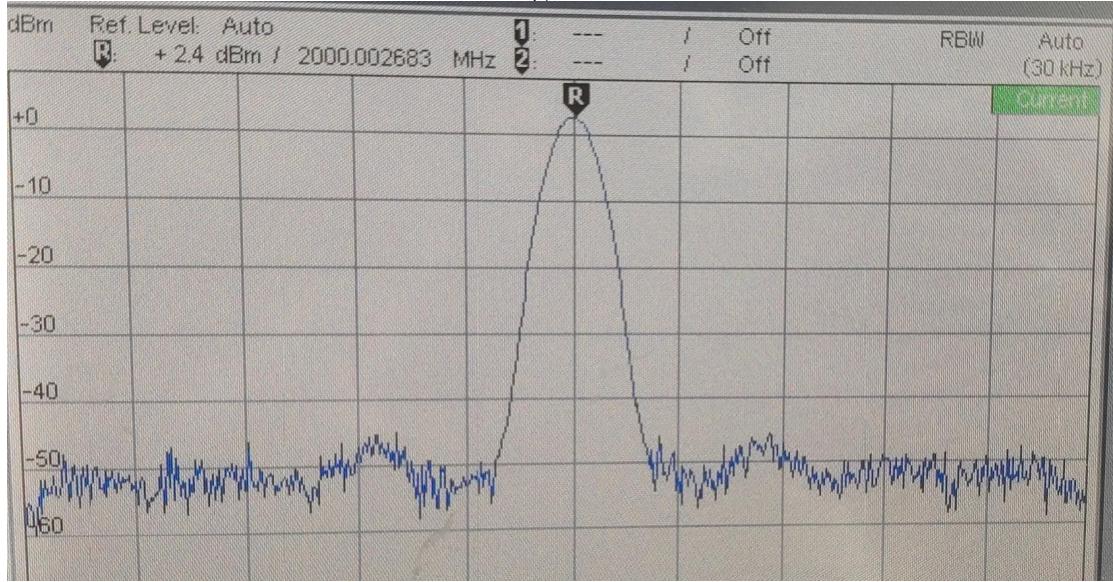


Figure 1-6

From the figure, it can be seen that his 2G output power is 2.4dBm, and there may be some errors due to different factors.

#### 4、Double Income Test

This test uses tinyb210 as a carrier to receive two signals, receiving a 2GHz, -25dBm signal generated by a signal generator.

First, copy the project to the Linux system and open it, as shown in Figure 1-7.

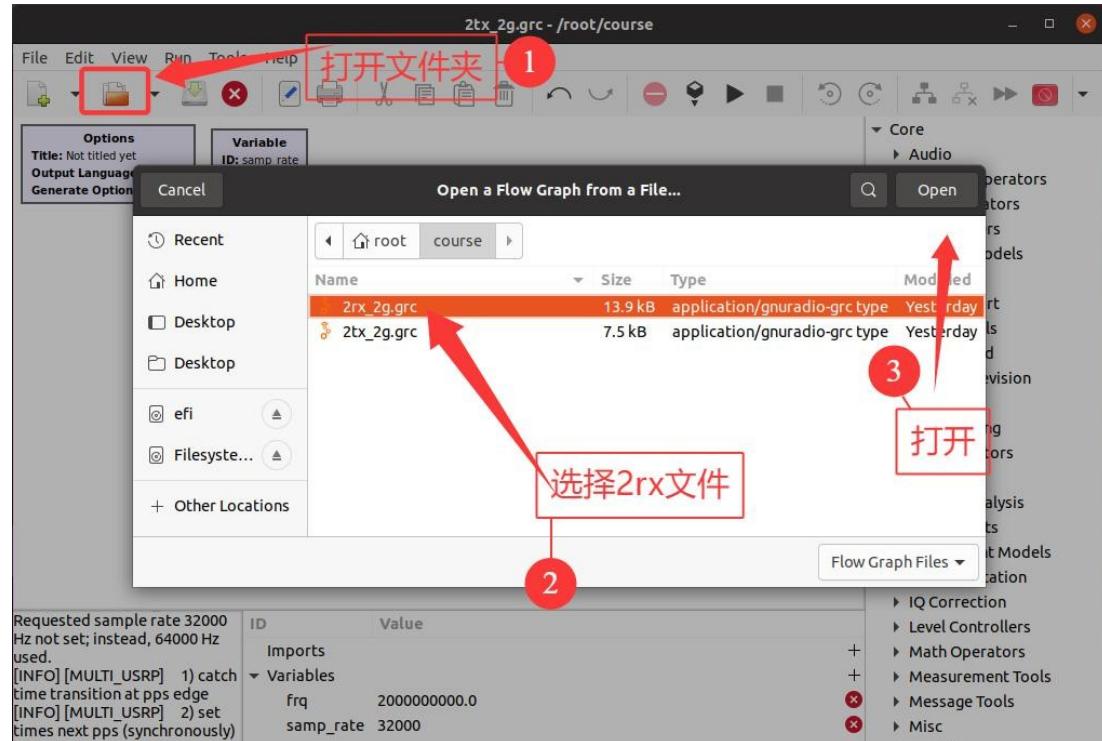


Figure 1-7

Connect tinyb210, just like a dual transmitter connection. After running the program, when it appears as shown in Figure 1-8, it indicates that the program has run successfully.

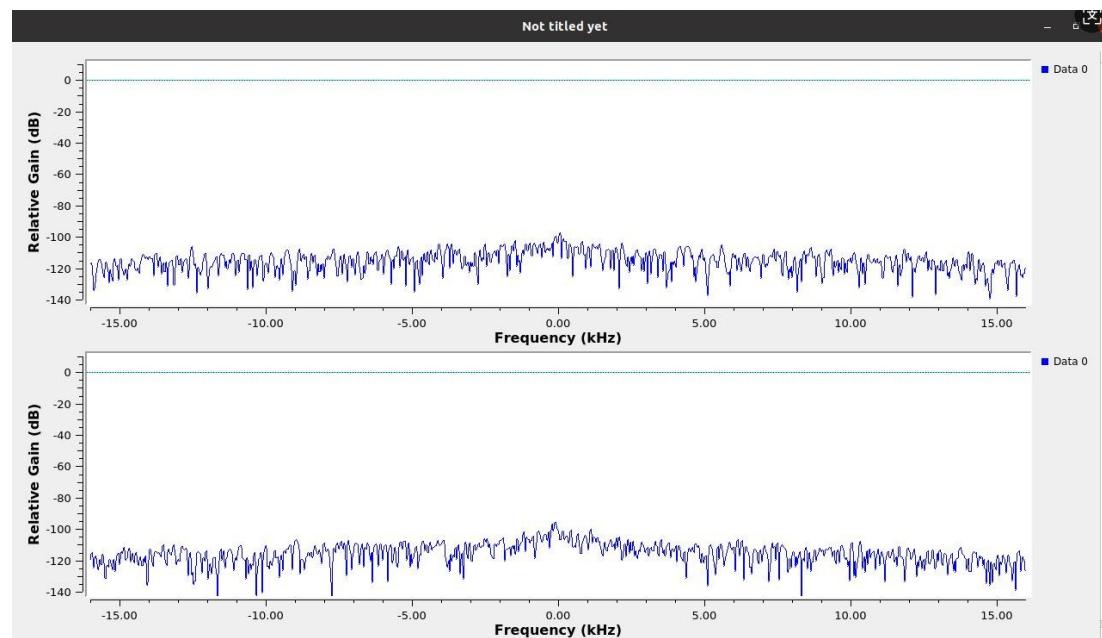


Figure 1-8

At this point, two green LED lights will light up on the board, and the input port next to the LED will be connected to the signal generator as shown in Figure 1-9. Connect the signal generator to these two interfaces separately.

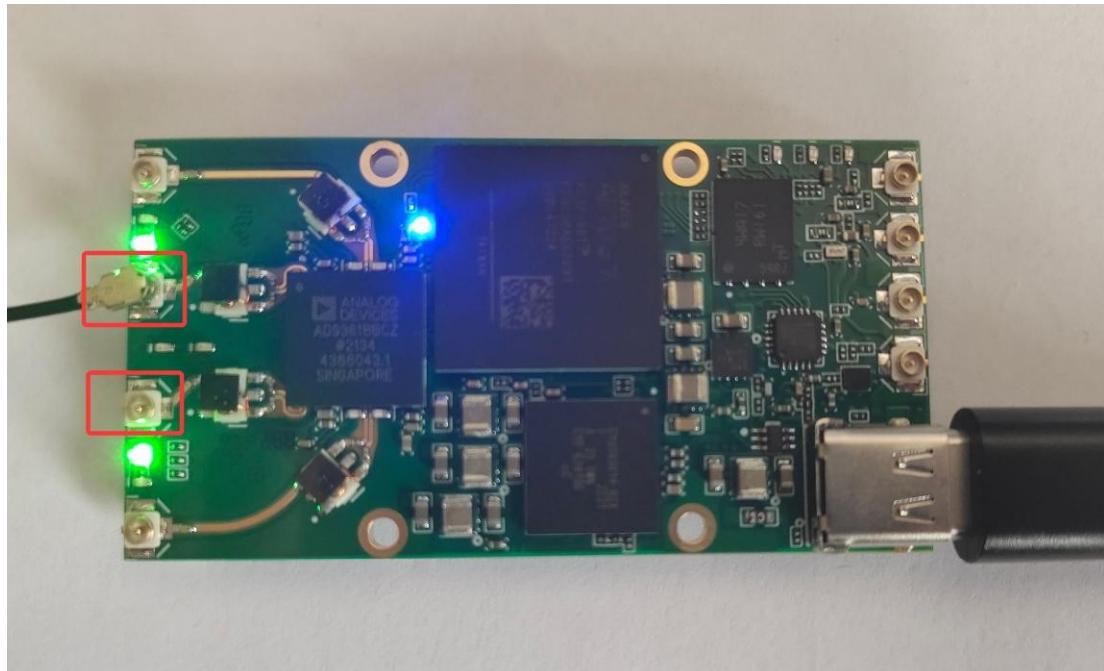
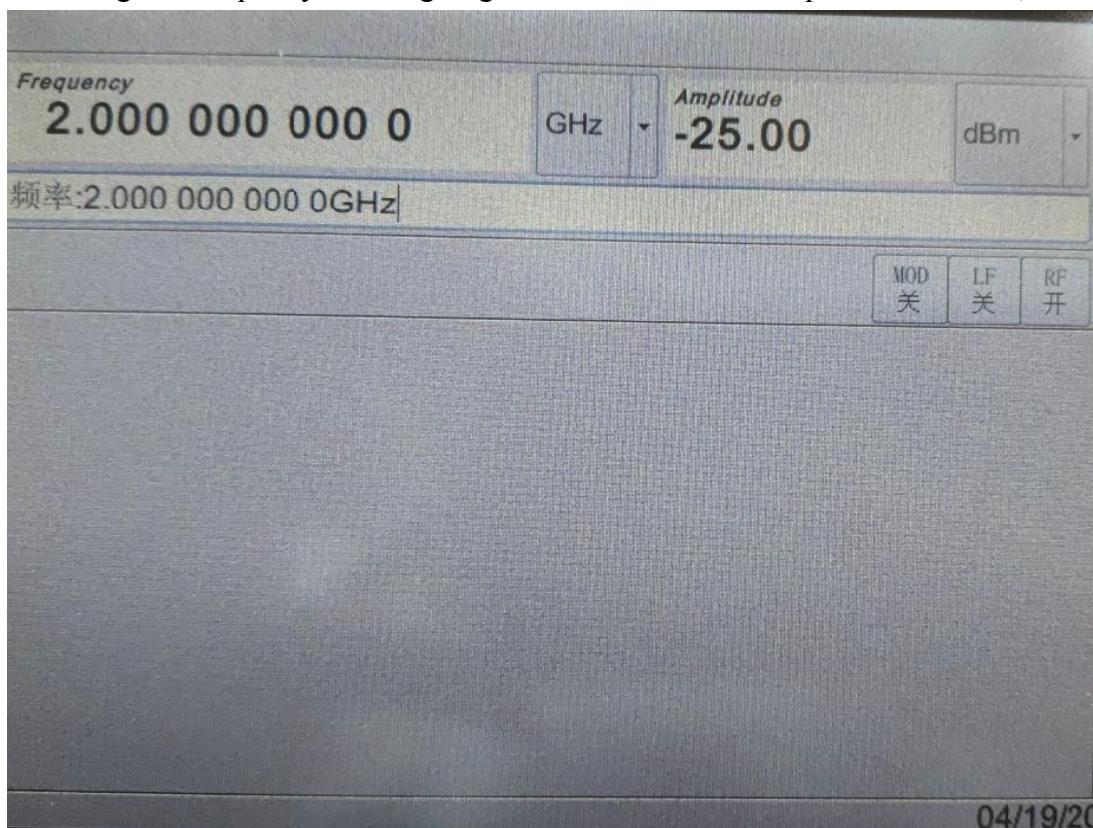


Figure 1-9 Physical Connection Diagram

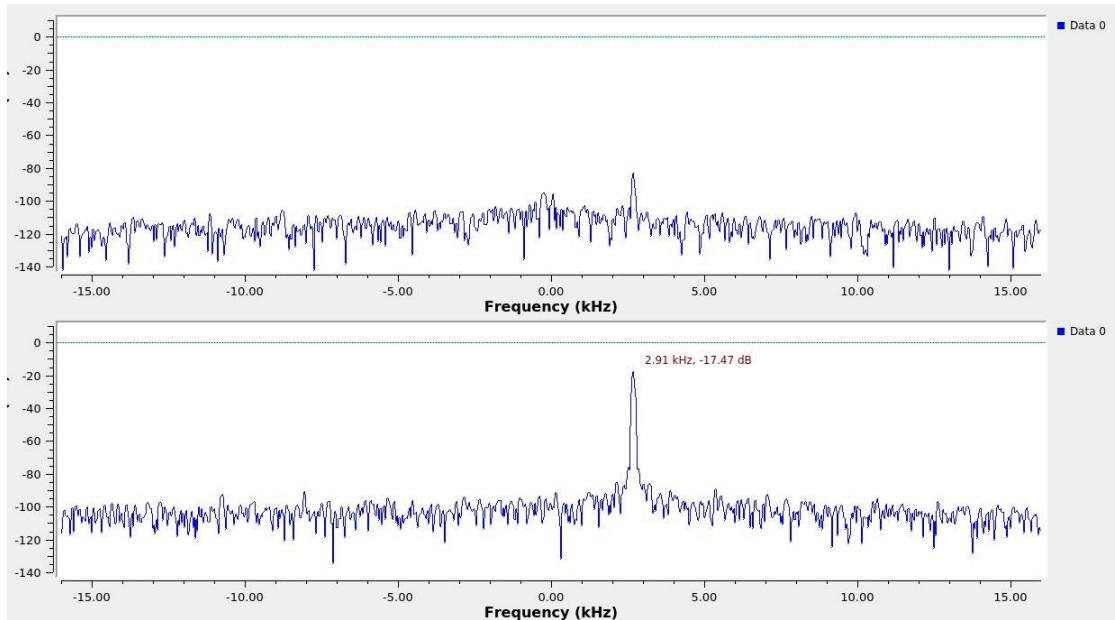
Change the frequency of the signal generator to 2GHz and the power to -25dBm, as



shown in Figure 1-10.

Figure 1-10

After connecting the signal generator to the two inputs separately, the computer will display as



shown in Figures 1-11 and 1-12.

Figure 1-11

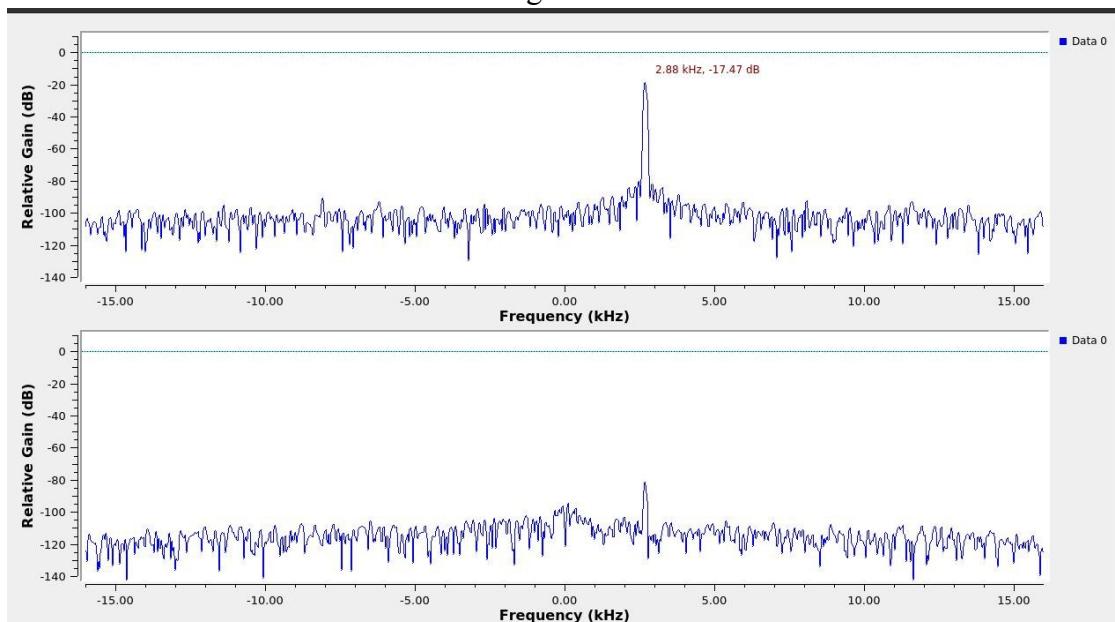
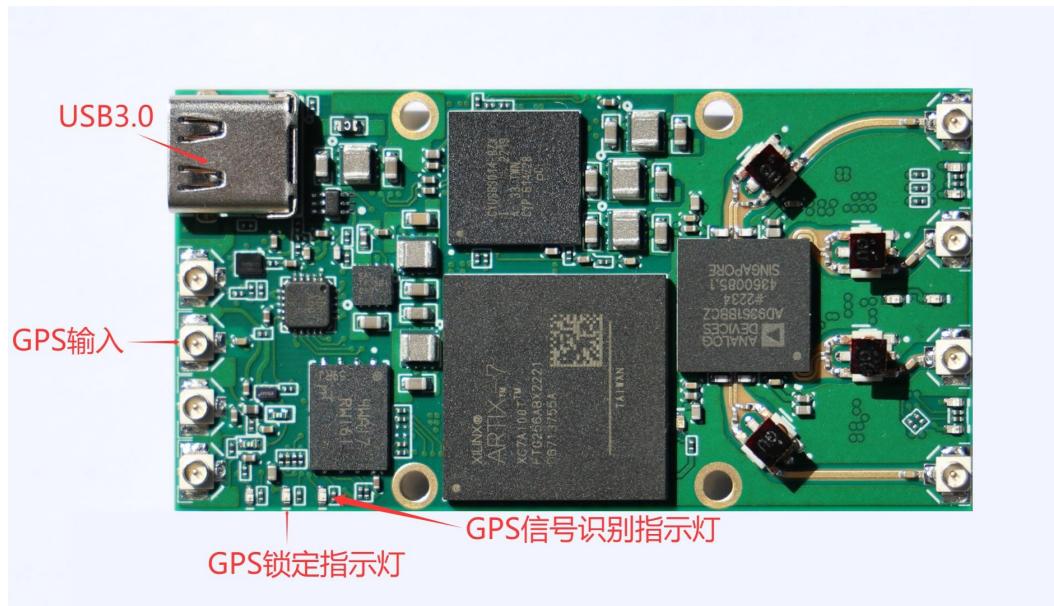


Figure 1-12

From the graph, it can be seen that the power of the signal received by tinyb210 is approximately -17.5dB.

## 5、Using GPSDO for synchronous testing

Insert the GPS active antenna into the GPS interface of Tiny B210 and plug in USB 3.0 as shown in the

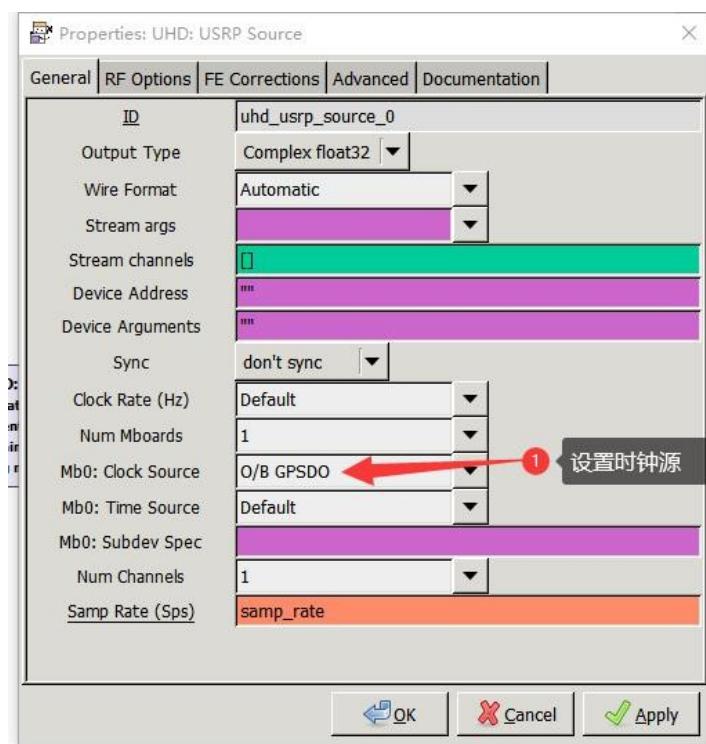


following figure:

Schematic diagram of GPSDO synchronization interface

When the GPS signal recognition indicator light flashes for one second, it indicates that the GPS signal has been recognized. After enabling GPSDO clock synchronization in the software, wait for a few minutes. When the GPS lock indicator light is on, it indicates that the GPS lock is successful. The waiting time for GPS lock is related to the location of the weather GPS active antenna.

In the following figure, to setup the GPSDO module in GNU Radio, it is necessary to use the USRP SINK. Set the clock source CLOCK SOURCE to O/B GPSDO with the USRP SOURCE module.



Set the clock source to GPSDO module in GNU Radio

After the GPS lock indicator light is on, verification can be performed. In the Ubuntu computer with UHD installed, enter the installation directory:/usr/local/lib/uhd/examples directory (this directory is the default location for

```
a@aa:~$ cd /usr/local/lib/uhd/examples/
a@aa:/usr/local/lib/uhd/examples$ sudo ./sync_to_gps
[sudo] password for a:
Creating the USRP device with: ...
[INFO] [UHD] linux; GNU C++ version 9.4.0; Boost_107100; UHD_4.3.0.0-79-g56f3aab2
[INFO] [B200] Detected Device: B210
[INFO] [B200] Operating over USB 3.
[INFO] [B200] Detecting internal GPSDO...
[INFO] [GPS] Found an internal GPSDO: 8GPSTCXO v3.2 for TinyB210
[WARNING] [GPS] update_cache(): Malformed GPSDO string: 2.8785,N,11610.2294,E,0.31,294.45,190425,,*05
[INFO] [B200] Initialize CODEC control...
[INFO] [B200] Initialize Radio control...
[INFO] [B200] Performing register loopback test...
[INFO] [B200] Register loopback test passed
[INFO] [B200] Performing register loopback test...
[INFO] [B200] Register loopback test passed
[INFO] [B200] Setting master clock rate selection to 'automatic'.
[INFO] [B200] Asking for clock rate 16.000000 MHz...
[INFO] [B200] Actually got clock rate 16.000000 MHz.

Using Device: Single USRP:
Device: B-Series Device
Mboard 0: B210
RX Channel: 0
RX DSP: 0
RX Dboard: A
RX Subdev: FE-RX2
RX Channel: 1
RX DSP: 1
RX Dboard: A
RX Subdev: FE-RX1
TX Channel: 0
TX DSP: 0
TX Dboard: A
TX Subdev: FE-TX2
TX Channel: 1
TX DSP: 1
TX Dboard: A
TX Subdev: FE-TX1
```

compilation and installation). Run command: sudo./sync\_to-ugps. As shown in the following figure:

Screenshot of GPSDO synchronous operation

The GPS lock successfully prints the following information:

```
a@aa:~$ cd /usr/local/lib/uhd/examples/
a@aa:/usr/local/lib/uhd/examples$ sudo ./sync_to_gps
RX Subdev: FE-RX2
RX Channel: 1
RX DSP: 1
RX Dboard: A
RX Subdev: FE-RX1
TX Channel: 0
TX DSP: 0
TX Dboard: A
TX Subdev: FE-TX2
TX Channel: 1
TX DSP: 1
TX Dboard: A
TX Subdev: FE-TX1

Synchronizing mboard 0: B210
*****
*****Helpful Notes on Clock/PPS Selection*****
***
As you can see, the default 10 MHz Reference and 1 PPS signals are now from the GPSDO.
If you would like to use the internal reference(TCXO) in other applications, you must configure that explicitly.
You can no longer select the external SMAs for 10 MHz or 1 PPS signaling.
*****
***

Waiting for reference lock...LOCKED
GPS Locked
USRP time: 1745050608.000000000
GPSDO time: 1745050608.000000000

SUCCESS: USRP time synchronized to GPS time
```

Screenshot of successful GPSDO locking

This command can also enable the GPSDO clock lock function, but because it requires waiting for the clock lock to be enabled, the result of this run will show that GPSDO failed to lock, and verification will need to wait for the GPS lock indicator light to turn on.

Note that since GPSDO synchronizes with the external 10M clock by adjusting the clock, both cannot be used simultaneously. The specific usage depends on the final program run by the software.

## 6、10M synchronous test

This test is to connect an external clock of 10MHz with a power of -10dB to tinyb210, and then use a spectrum analyzer to test whether it is synchronized with 10MHz.

Firstly, copy the project to the Linux system and open it using Gnuradio, as shown in

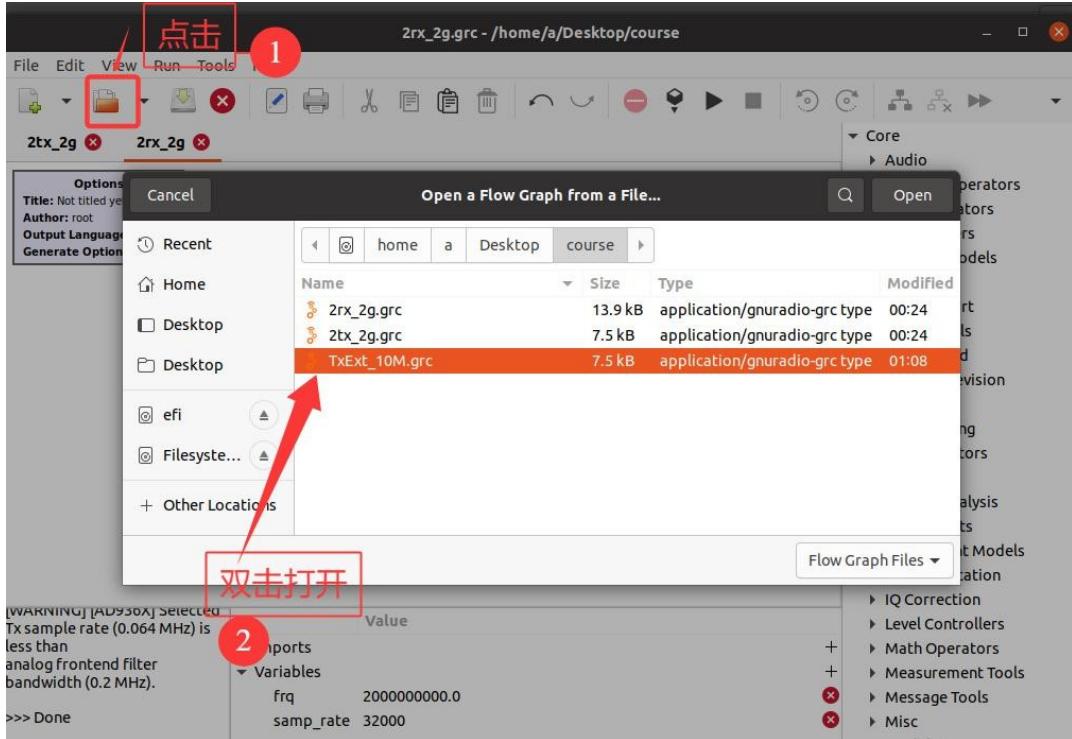


Figure 1-13.

Figure 1-13

Connecting tinyb210 is the same as double sending connection. After running the program, when it appears as shown in Figure 1-14, it indicates that the program has run successfully.

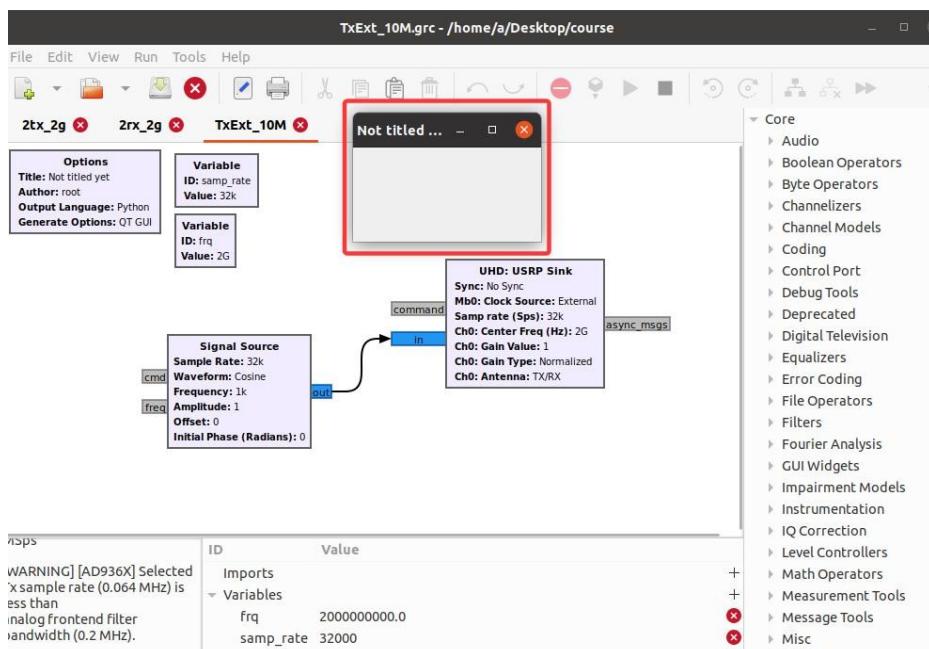


Figure 1-14

Use a signal generator to output a 10MHz signal with a power of -10dB, as shown in Figure 1-15.

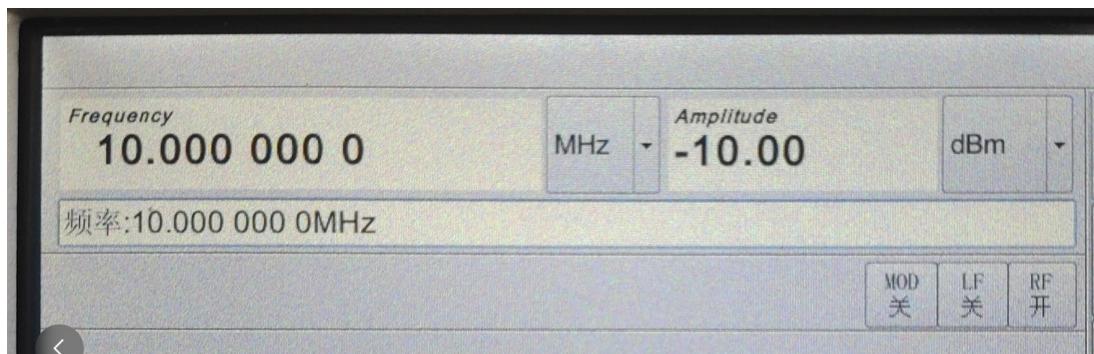


Figure 1-15

Then connect tinyb210, as shown in Figure 1-16.

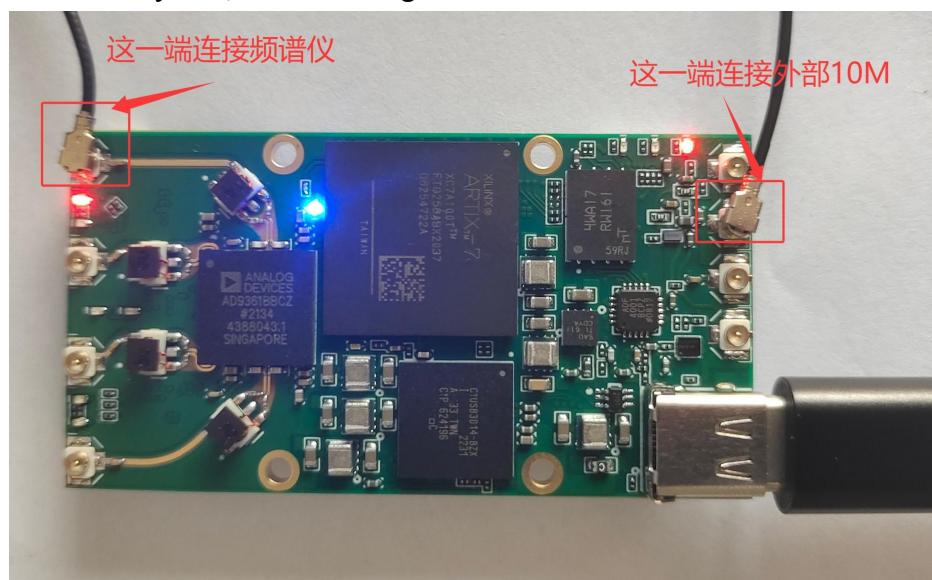


Figure 1-16

At this time, the waveform of the spectrometer is shown in Figure 1-17.

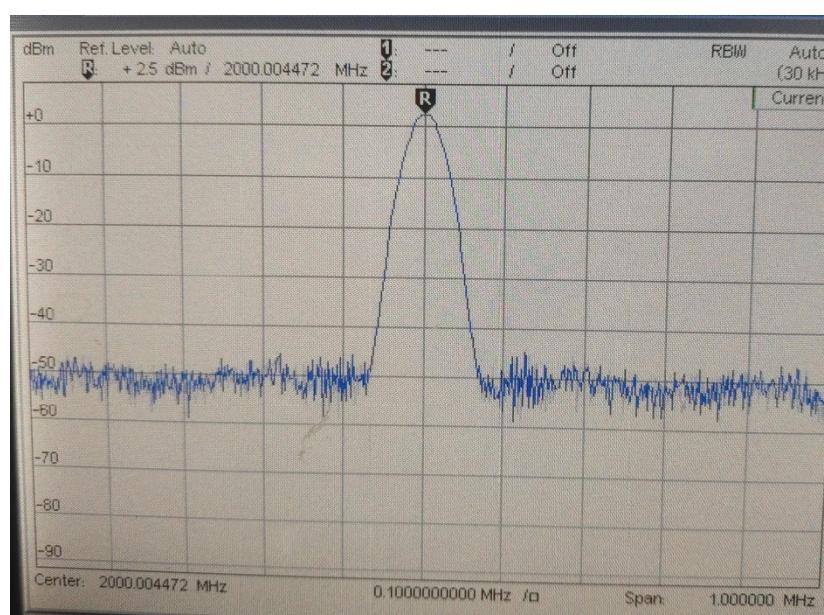


Figure 1-17

When the frequency of the signal generator is reduced or increased, the waveform on the spectrometer will also change accordingly, as shown in Figure 1-18.

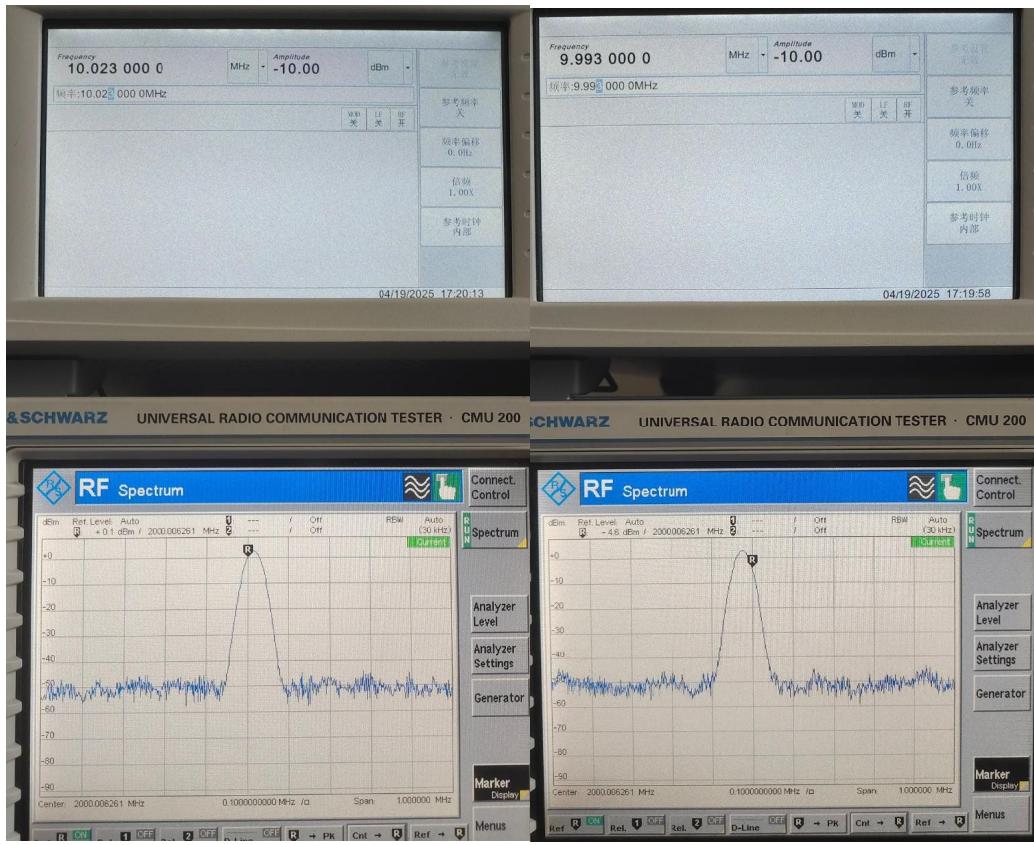
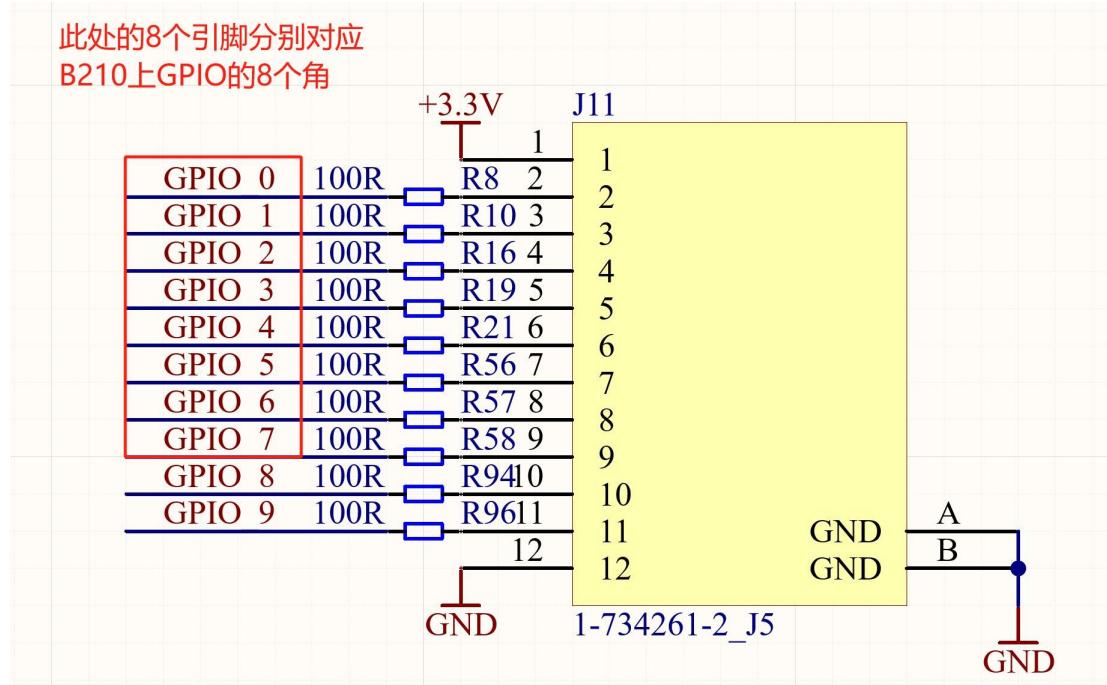


Figure 1-18

At this point, it means that the 10M clock has been synchronized and calibrated according to 10M.

## 7、 GPIO interface definition

On the official version of B210, there are 8 GPIO ports available for everyone to use. On TinyB210, 8 GPIO are also introduced, corresponding to each one. The interface definitions introduced by GPIO in the schematic diagram are shown in the following figure. The usage of GPO0 to 7 is the same as the official version of B210. GPO8 and 9 are undefined functions. If there is a need for customized functions, please contact us.



The position of the J11 interface in the above figure is within the red box shown in the following figure. Install in the order of 1 corner on top and 12 corners on the bottom.

