

DSLWP 卫星 Live CD 用户指南

DSLWP Live CD User Manual

Verson 0.1



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1 概述 Overview

1.1 关于 DSLWP About DSLWP

DSLWP is a lunar formation flying mission led by Harbin Institute of Technology for low frequency radio astronomy, amateur radio and education. It consists of a pair of 47 kg microsatellites, to be launched into a lunar transfer orbit, and finally enter a 300 x 9000km lunar elliptical orbit. Onboard each satellite, there are two VHF/UHF SDR transceivers to provide beacon, telemetry, telecommand, digital image downlink and a GMSK-JT4 repeater. Onboard transmitting power is about 2 W.

项目网站: <http://lilacsat.hit.edu.cn/>

Website: <http://lilacsat.hit.edu.cn/>

联系邮箱: lilacsat@163.com

E-mail: lilacsat@163.com

Link budgets: http://lilacsat.hit.edu.cn/wp/?page_id=676

Decoder (GNU Radio OOT module): <https://github.com/bg2bhc/gr-dslwp>

Decoder (Linux Live CD): https://1drv.ms/u/s!Av6J6WjI3UbMhHm8gwMr4Z_keqWH

Decoder (Linux Live CD):

TLE: <http://lilacsat.hit.edu.cn/tle/dslwp.txt>

DSLWP-A Telemetry Display: http://lilacsat.hit.edu.cn/dashboard/pages_en/telemetry-a.html

DSLWP-B Telemetry Display: http://lilacsat.hit.edu.cn/dashboard/pages_en/telemetry-b.html

1.2 关于此 Live CD About This Live CD

本 Live CD 是一个可启动的 Ubuntu 软件无线电环境, 使用 respin-gtk 制作, 用于 DSLWP 卫星遥测的简易接收与 SDR 实验, 且不必对计算机进行永久性更改。

This Live CD is a bootable Ubuntu SDR environment created with respin-gtk for quick and easy reception of DSLWP telemetry and SDR experiment without having to make any permanent modifications to a PC or laptop.

本 Live CD 以 ISO 镜像的形式发布, 可烧录在 DVD 光盘或 U 盘中启动电脑, 也可在虚拟机中运行。

It is supplied as an ISO image to be downloaded and burned onto a recordable DVD disc or copied to a USB flash drive using a utility such as the Ubuntu Startup Disk Creator (Ubuntu Linux OS) or Unetbootin (Windows, MacOS, Linux). Creating a USB drive from the image will provide much faster booting and operation, and allow making changes and storing files. Finally, the ISO image may be

booted within a virtual environment such as VirtualBox, QEMU/kvm, VMware, or Parallels.

此 Live CD 基于如下软件制作：

- Ubuntu Linux 14.04.2 LTS;
- GNU Radio and GRC 3.7.8;
- gpredict （卫星跟踪）;
- gqrx （通用 SDR 接收机软件）;
- gr-fcdproplus;
- hamlib;
- gr-lilacsat
- gr-dslwp 等。

This Live CD is based on the following software:

- Ubuntu Linux 14.04.2 LTS,
- GNU Radio and GRC 3.7.8,
- gpredict,
- gqrx,
- gr-fcdproplus,
- hamlib,
- gr-lilacsat
- gr-dslwp, etc.

2 使用示例 Guided Tutorial

在本章中，我们将以使用 RTL-SDR 接收机和卫星的默认遥测模式为例，介绍 Live CD 的使用。您可根据实际的硬件情况与卫星的工作模式选择合适的 GRC 流程图。

In this chapter we will take RTL-SDR and default telemetry mode as example to show how to use this Live CD. Select the correct GRC flow graph depending on your hardware and operating mode of the satellite.

2.1 准备 Preparation

使用 Live CD ISO 文件制作 USB 启动盘，并启动电脑。

Make a bootable USB disk from the Live CD ISO file, then boot your computer with it.

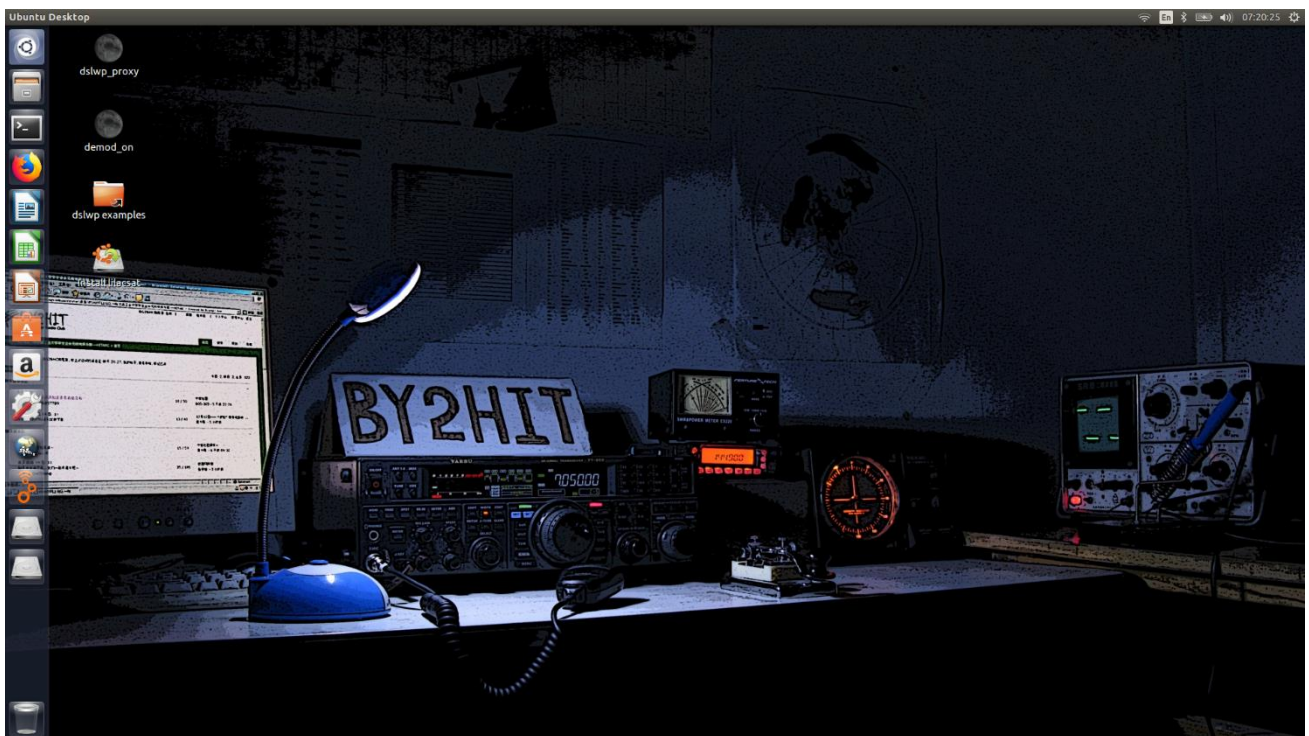


Figure 1

2.2 连接至 Internet Connect to the Internet

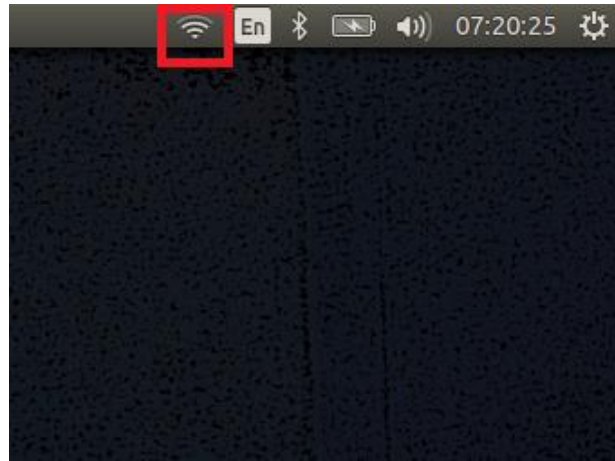


Figure 2

2.3 启动下行代理服务器 Start the Downlink Proxy

检查 tornado 包版本，运行下面命令：

Check tornado version by command:

```
python -m pip list |grep tornado
```

确保版本在 4.5.3 之前,如果不匹配,请运行以下命令:

Make sure it not newer than 4.5.3,if not,use these coommonds:

```
sudo python -m pip uninstall tornado  
sudo python -m pip install tornado==4.5.3
```

双击桌面上的图标启动下行代理服务器。

Double click DSLWP_PROXY icon on desktop to start downlink proxy

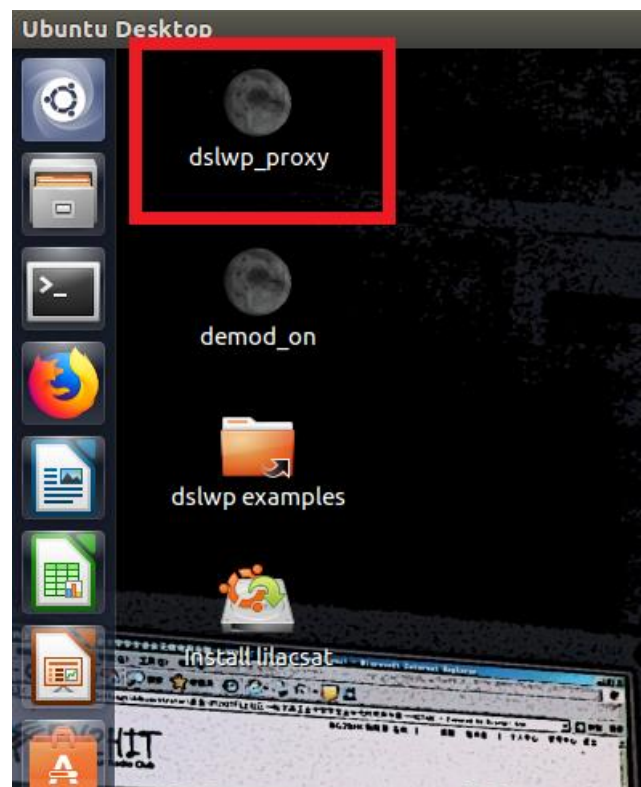


Figure 3

在代理窗口中：编辑个人信息(1)；保存设置；(2)更新轨道信息(3)，在消息窗口(5)中可见成功

信息；启动代理服务器(4)。

In the proxy window, edit your user information (1); click SAVE CONFIGURE button (2); update orbit information by clicking UPDATE button (3) and start the proxy (4). If SAVE CONFIGURE (2) and UPDATE (3) succeed, success message will show in message form (5)

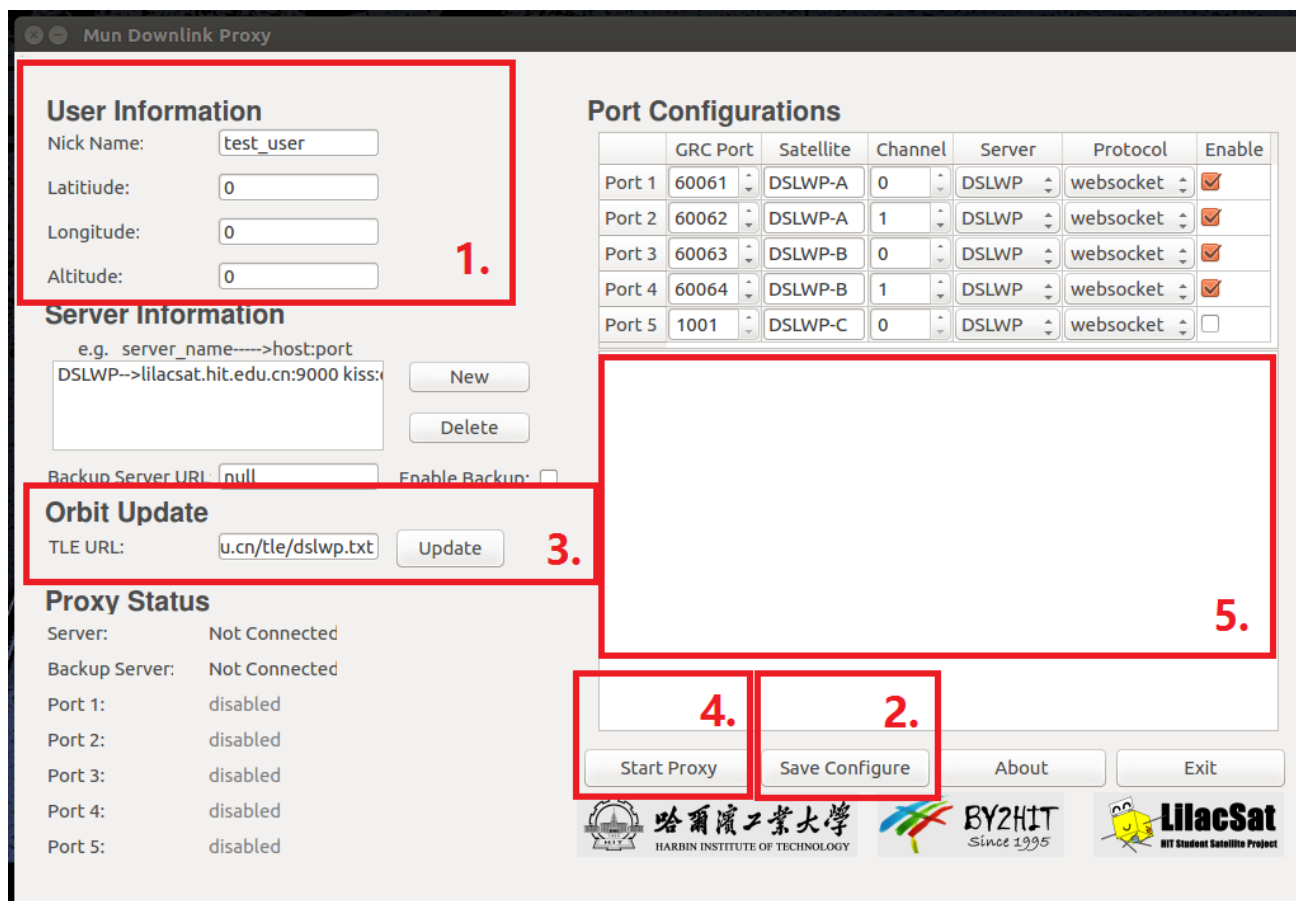


Figure 4

说明：Proxy Status 中的 Server 会始终保持 “Not Connected” 的状态，如数据发送成功，在上图 5 中会有 “[websocket] Received data successfully” 表明数据发送成功。

Notice: The Server Status will show “Not Connected” all time. After data upload to server successful. There will be “[websocket] Received data successfully” at Figure 4’s Area5.

2.4 启动接收框图 Start the Receiver Flow graph

单击图标启动 GRC。

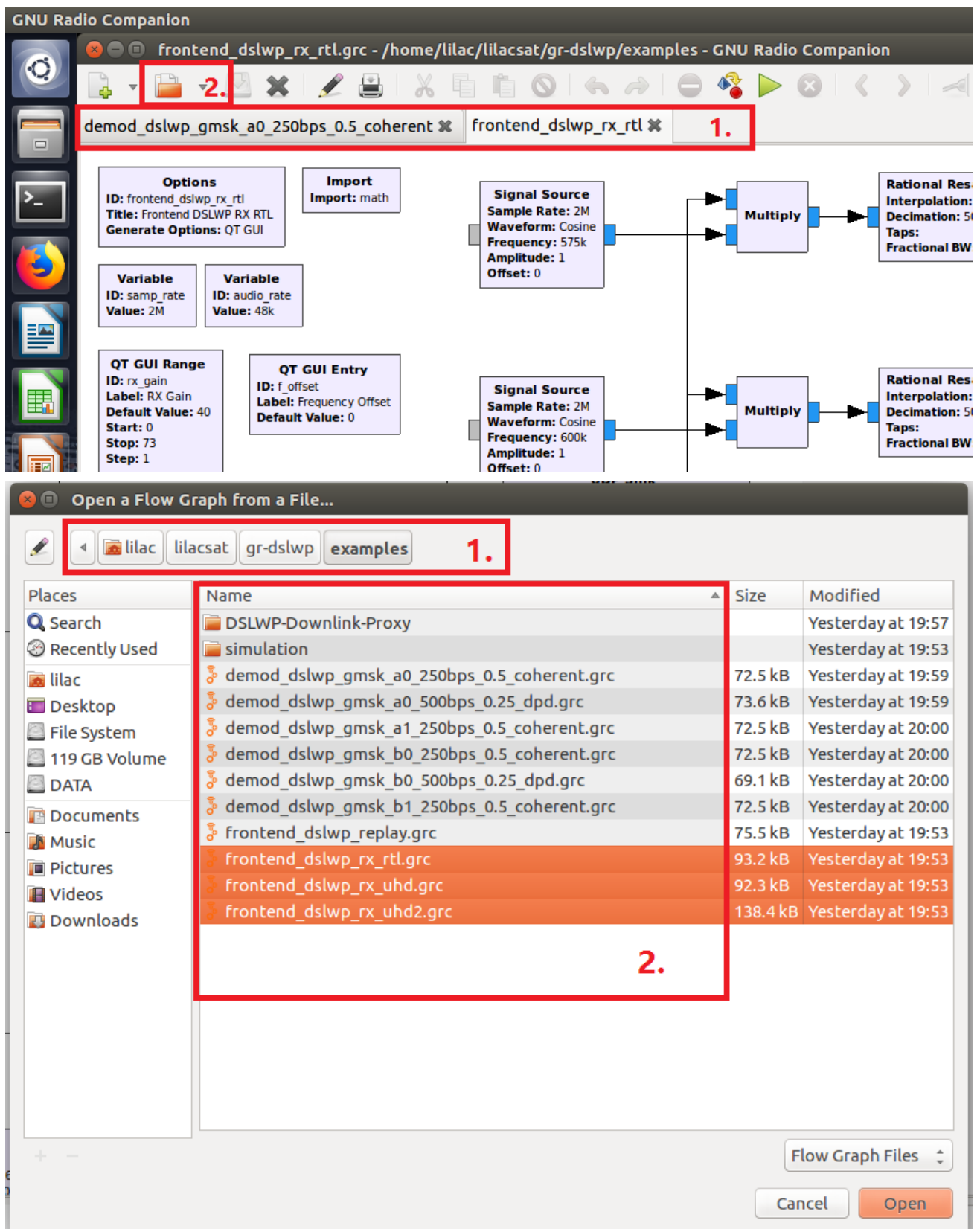
Single click the GRC icon on launch bar to start it.



Figure 5

进入 Live CD 后首次运行 GRC 时，软件不会打开任何接收框图。如果没有打开的框图，点击 **OPEN AN EXISTING FLOW GRAPH** 按钮，进入对应目录，选择适合你硬件的框图。以“frontend_dslwp”开头的三个框图是不同硬件的接收框图。对于电视棒等 rtl-sdr，使用以“rtl”结尾的框图。对于 usrp，以“uhd”结尾的框图为单通道天线框图，以“uhd2”结尾的框图是双天线正交安装的框图。

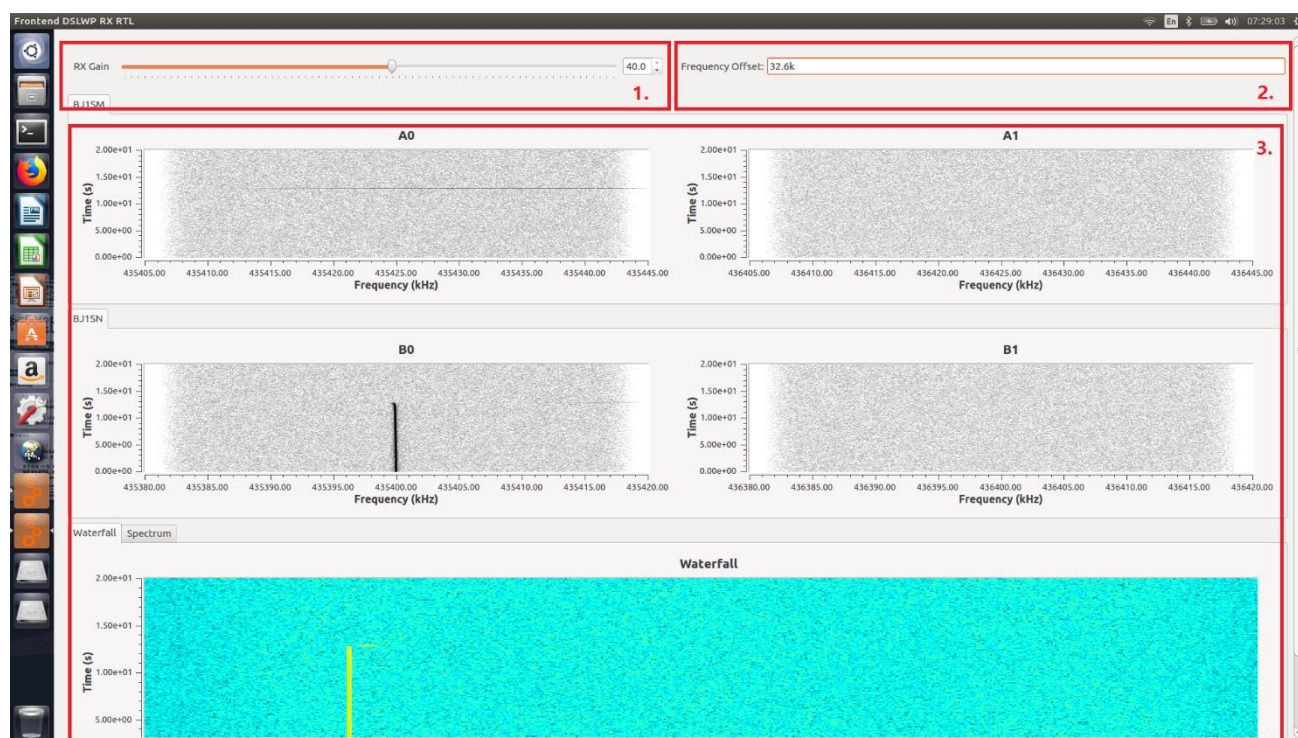
By default, there may be no opened flow graphs for receive frontend. If there is no opened flow graph, click on the **OPEN AN EXISTING FLOW GRAPH** button, locate to the folder as follows, and then select flow graph which matches your hardware. The three flow graphs starting with “frontend_dslwp” are for different hardware. If you’re using rtl-sdr, i.e., USB DVB TV stick (TV stick for short), use the flow graph ending with “rtl”. If you’re using USRP please use flow graph ending with “uhd”. The flow graph ending with “uhd2” are for dual polarization configuration, and the other one is for single polarization configuration.



运行框图后你会看到如下图的窗口。在图中1区域根据你的硬件调整RX GAIN到合适的范围。由于下行频率较低，接收频率设置误差必须低于 500Hz。首先，打开 frontend 开头的 grc，等

待预热十五分钟以上，然后利用已知频率的发射机，发射 435.425MHz, 436.425MHz, 435.4MHz 或 436.4MHz 其中任一频率，在瀑布图窗口中读出发射频率，根据发射频率与在瀑布图中读出的频率计算频率差，并填入 FREQUENCY OFFSET 框中。记下 RX GAIN 和 FREQUENCY OFFSET 数值。

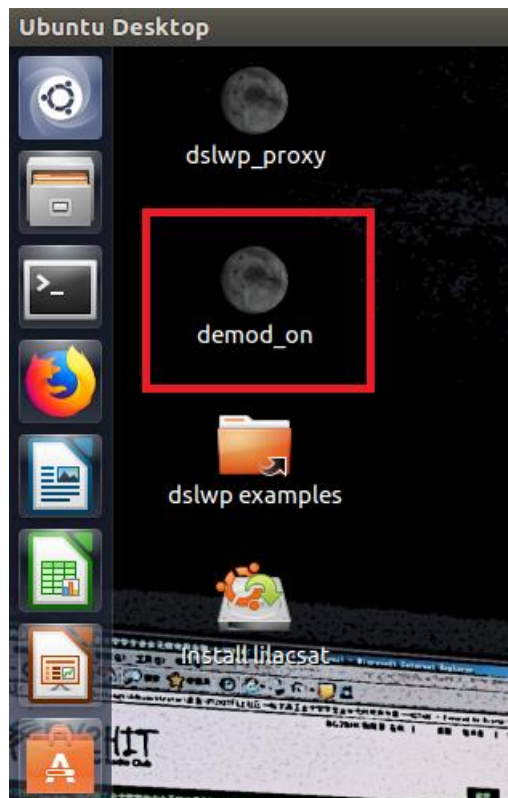
After opening correct flow graph, you'll see window show up as following shown. Adjust RX GAIN to proper level, according to your hardware configuration (1). As the bandwidth of the downlink signal is quite low, the frequency of the receiver must be calibrated within 500 Hz. First, start frontend grc, and wait at least 15 minutes for the warming up the crystal, then use a precious frequency source, to transmit at either 435.425MHz, 436.425MHz, 435.4MHz or 436.4MHz, and read frequency of received signal on waterfall display (3). Then calculate frequency offset between actual signal frequency and shown signal frequency, and fill in FREQUENCY OFFSET form (2). Copy the gain and frequency offset values for future use.

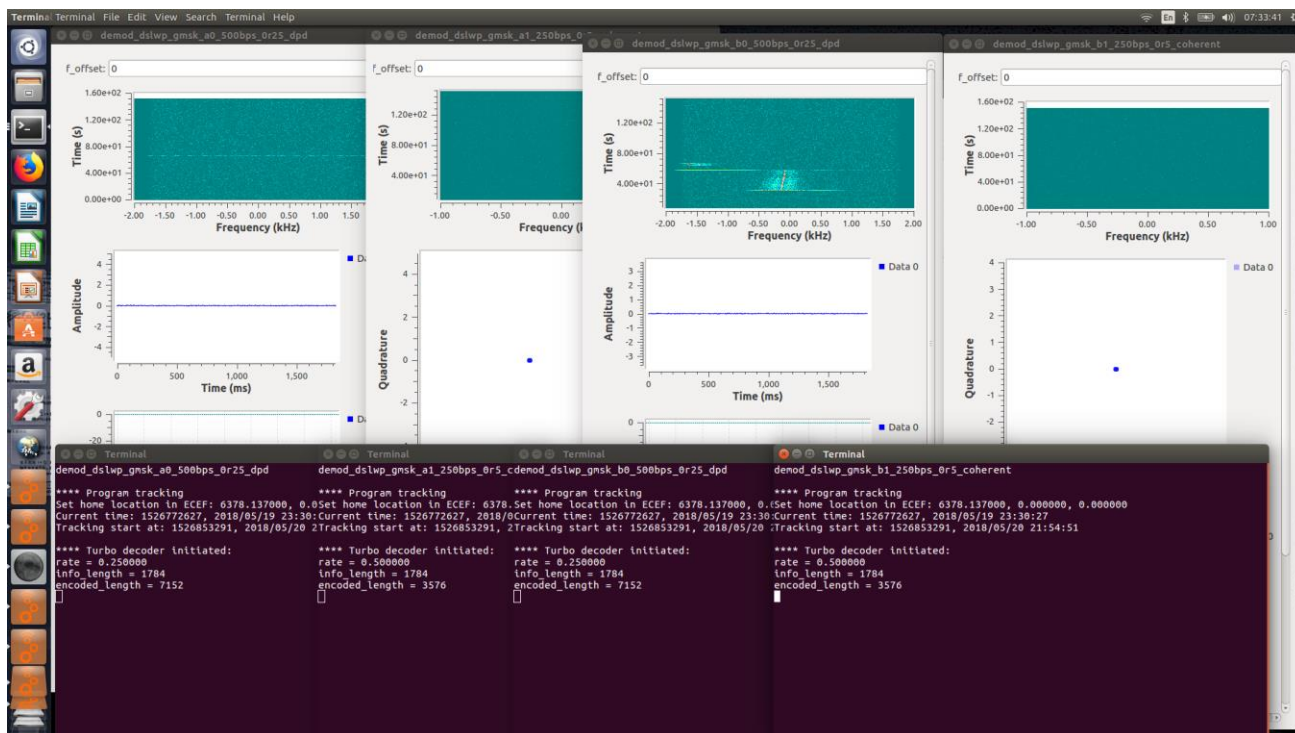


最小化 GRC 窗口，双击桌面上的 DEMOD_ON 图标。程序运行后会显示八个窗口，每个窗口为一种解调模式。TLE 表示卫星轨道的方法只对近地卫星有效，对于 DSLWP 卫星，采用查表的方法确定卫星轨道。当前查找表文件为根据第一个发射窗口计算的卫星轨道，如果系统时间正确，即在 2018-5-20 21:54:30 到 2018-5-22 21:54:30 之间，四个终端窗口会输出卫星轨道信息，如果系统时间在上述时间之外，四个终端窗口会显示错误信息，并且程序会自动退出。如果发射时间窗口发生变化，我们会在网站上更新查找表文件。

Then minimize GRC window, double click DEMOD_ON icon on desktop. Eight window will show up, each representing one demodulator. Since TLE is only for near-earth orbit satellite tracking,

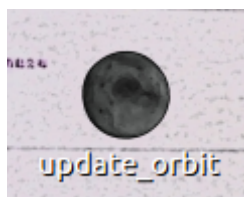
DSLWP satellites uses look-up table for orbit determination. If system time is later than table time, an error message will show in terminal window, and the program will exit. If system time is earlier than table time, the program will wait. The current file provides the data for the first launch window, and valid between 2018-5-20 21:54:30 and 2018-5-22 21:54:30. We will update the file everyday and if the launch time changes.





双击 updateorbit 可以从服务器下载卫星轨道数据

Double click updateorbit icon on desktop will update orbit look-up table



3 注意事项 Notes

3.1 用户名与密码 User Name and Password

User Name: lilac

Password: lilac

3.2 本地安装 Install Locally

为方便使用，您可能希望将解调软件安装在本地。可按照如下步骤进行。

You may want to install the software locally for a better use. Follow the instructions below.

安装 Ubuntu 系统。

Install the Ubuntu operating system.

安装 GNU Radio，推荐使用脚本安装。

```
$ wget http://www.sbrac.org/files/build-gnuradio && chmod a+x ./build-gnuradio && ./build-gnuradio
```

Install GNU Radio. It is recommended to use the build-gnuradio script.

```
$ wget http://www.sbrac.org/files/build-gnuradio && chmod a+x ./build-gnuradio && ./build-gnuradio
```

安装 gr-dslwp。

```
$ git clone https://github.com/bg2bhc/gr-dslwp
```

```
$ cd gr-dslwp
```

```
$ mkdir build
```

```
$ cd build
```

```
$ cmake ../
```

```
$ make
```

```
$ sudo make install
```

```
$ sudo ldconfig
```

Install gr-dslwp.

```
$ git clone https://github.com/bg2bhc/gr-dslwp
```

```
$ cd gr-dslwp
```

```
$ mkdir build
```

```
$ cd build
```

```
$ cmake ../
```

```
$ make
```

```
$ sudo make install
```

```
$ sudo ldconfig
```

安装代理服务器。根据 `gr-dslwp/examples/DSLWP-Downlink-Proxy/readme.md` 中的步骤进行。

Setup proxy. Follow the instructions in `gr-dslwp/examples/DSLWP-Downlink-Proxy/readme.md`.

根据硬件情况，可能需要安装其它软件。

Other software may be required depending on your hardware.

3.3 其他问题 **Other Problems**

若出现其他异常，如网络中断，关闭所有程序，按步骤重新启动。

If something else goes wrong, for example a network disconnection, close everything and restart.