

2018/02/06 Ver.0.01

2018/02/18 Ver.0.02

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CAUTION!!!

This document explains how to install gnuradio, Blockstream, bitcoinfiore, and all Raspbian Linux into **empty USB-HDD**. I confirmed it works with only this clean-install method. If you want to install them into your existing Raspbian environment, please study and understand what to do inside patches well and try it on your own risk.

Anyway, **ABSOLUTELY NO WARRANTY**

Preperations:

- Raspberry Pi 3 model B
- 8GB reasonable price & speed microSD card
- USB-HDD (500GB~2GB)
- Reliable 5V USB Power Source
- RTL-SDR

Download and write boot image into microSD

Make Raspbian stretch image into microSD with Win32DiskImager

RASPBIAN STRETCH WITH DESKTOP

Image with desktop based on Debian Stretch

Version: November 2017

Release date: 2017-11-29

Kernel version: 4.9

Release notes: [Link](#)

SHA-256: 64c4103316efe2a85fd2814f2af16313abac7d4ad68e3d95ae6709e2e894cc1b

This is very common procedure, so, please refer to the other technical sources.

Install Raspbian stretch into Raspberry Pi 3 model B

Power off Raspberry Pi.

Connect USB-HDD to Raspberry Pi.

Installation Guide for gnuradio, Blockstream & bitcoinfiore into Raspberry Pi3 model B

Insert microSD into Raspberry Pi.

Turn on Power.

Setup Preferences (Mouse / Keyboard / Region / Time-zone / Resolution / Bluetooth, etc...)

Enable VNC server (optional)

DON'T set super user password until finish the installation.

We checked out this installation using user 'pi' account only.

NOTE(for Japanese): Don't set Menu Language 'Japanese' for now.

reboot

Setup bootable USB HDD

Firmware upgrade (It has done once already, no need to do it again.)

```
pi@raspberrypi$~$ sudo apt update
pi@raspberrypi$~$ sudo apt -y install rpi-update
pi@raspberrypi$~$ sudo rpi-update
```

Modify config.txt

```
pi@raspberrypi$~$ echo "program_usb_boot_mode=1" | sudo tee -a /boot/config.txt
pi@raspberrypi$~$ echo "program_usb_boot_timeout=1" | sudo tee -a /boot/config.txt
pi@raspberrypi$~$ reboot
```

Check firmware version

```
pi@raspberrypi$~$ vcgencmd otp_dump | grep 17:
```

Check if it's 17:3020000a

Initialize connected USB-HDD

```
pi@raspberrypi$~$ sudo umount /dev/sda2 (if necessary)
pi@raspberrypi$~$ sudo umount /dev/sda1 (if necessary)
pi@raspberrypi$~$ sudo parted /dev/sda
(parted) mktable msdos [Yes]
(parted) mkpart primary fat32 0% 100M
(parted) mkpart primary ext4 100M 100%
(parted) quit
```

Format USB-HDD

```
pi@raspberrypi$~$ sudo mkfs -t vfat -n BOOT -F 32 /dev/sda1
pi@raspberrypi$~$ sudo mkfs -t ext4 /dev/sda2 [Yes]
```

Mount USB-HDD on microSD file-system

```
pi@raspberrypi$~ $ sudo mount /dev/sda2 /mnt
pi@raspberrypi$~ $ sudo mkdir /mnt/boot
pi@raspberrypi$~ $ sudo mount /dev/sda1 /mnt/boot
```

Copy boot image from microSD to USB-HDD

```
pi@raspberrypi$~ $ sudo rsync -ax --progress / /boot /mnt
```

Modify USB-HDD /boot/cmdline.txt

```
pi@raspberrypi$~ $ ls -al /dev/disk/by-partuuid
pi@raspberrypi$~ $ sudo vi /mnt/boot/cmdline.txt (leafpad is much easier)
Modify PARTUUID from that of microSD to USB-HDD.
Insert rootdelay=10 (after 'rootwait')
```

Modify USB-HDD /etc/fstab

```
pi@raspberrypi$~ $ sudo vi /mnt/etc/fstab (leafpad is much easier)
```

Update SSH Host Key

```
pi@raspberrypi$~ $ cd /mnt
pi@raspberrypi$:/mnt $ sudo mount --bind /dev dev
pi@raspberrypi$:/mnt $ sudo mount --bind /sys sys
pi@raspberrypi$:/mnt $ sudo mount --bind /proc proc
pi@raspberrypi$:/mnt $ sudo chroot /mnt
root@raspberrypi:/# rm /etc/ssh/ssh_host*
root@raspberrypi:/# dpkg-reconfigure openssh-server
root@raspberrypi:/# exit
pi@raspberrypi$:/mnt $ sudo umount dev
pi@raspberrypi$:/mnt $ sudo umount sys
pi@raspberrypi$:/mnt $ sudo umount proc
pi@raspberrypi$:/mnt $ cd
pi@raspberrypi$~ $ sudo umount /mnt/boot
pi@raspberrypi$~ $ sudo umount /mnt
```

Power off

```
pi@raspberrypi$~ $ poweroff
```

Disconnect Power Source (physically!)

Remove microSD,

Connect Power Source again.

Make swap partition on microSD to expand I/O bandwidth (STRONGLY RECOMMENDED)

Insert microSD

Click [Cancel] on GUI

```
pi@raspberrypi$~$ sudo umount /dev/mmcblk0p1
```

```
pi@raspberrypi$~$ sudo umount /dev/mmcblk0p2
```

```
pi@raspberrypi$~$ sudo parted /dev/mmcblk0
```

```
(parted) mktable msdos [Yes]
```

```
(parted) quit
```

```
pi@raspberrypi$~$ reboot
```

```
pi@raspberrypi$~$ sudo mkswap -f /dev/mmcblk0
```

```
pi@raspberrypi$~$ sudo swapon --fixpgsz --discard=once /dev/mmcblk0
```

```
pi@raspberrypi$~$ sudo swapoff /var/swap #down HDD swap priority
```

```
pi@raspberrypi$~$ sudo swapon /var/swap #resume HDD swap area
```

Check swap environment

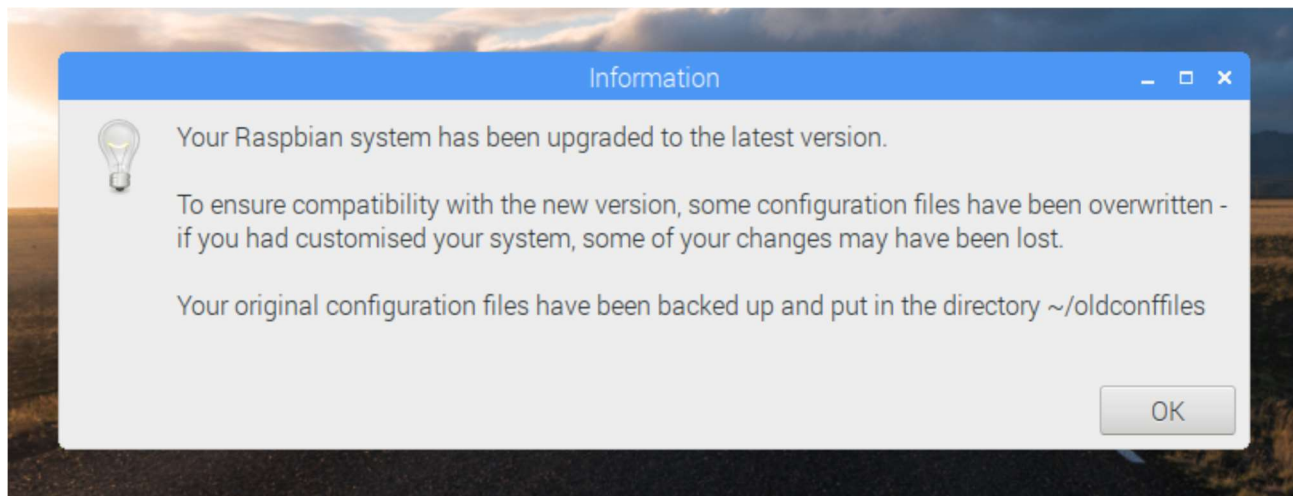
```
pi@raspberrypi$~$ swapon
```

NAME	TYPE	SIZE	USED	PRI
/var/swap	file	100M	0B	-2
/dev/mmcblk0	partition	7.3G	0B	-1

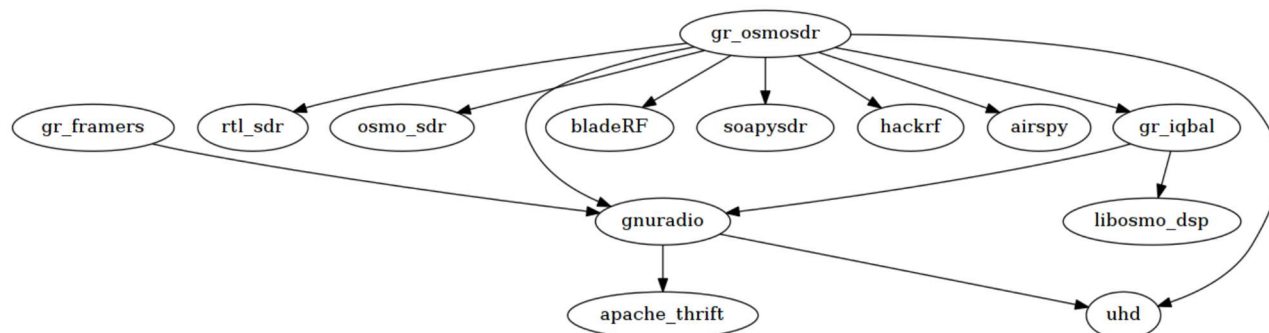
Upgrade overall Raspberry Pi modules

```
pi@raspberrypi$~$ sudo apt update && sudo apt -y upgrade && reboot
```

NOTE: Raspberry Pi may have been restored to the default environment by upgrading automatically.
Please check the Preferences and swap file settings...



NOTE: gnuradio dependency chart



Build overall modules

copy build_Blockstream_RaspPi3B-2018-02-18_1.tar.gz into your home directory.

```
pi@raspberrypi$~$ tar -zxvf build_Blockstream_RaspPi3B-2018-02-18_1.tar.gz
```

```
pi@raspberrypi$~$ script buildall.log
```

Script started, file is buildall.log

```
pi@raspberrypi$~$ ./build_BlockStream_RasPi3B.sh
```

Approximately, it will take around **15 hours** building pilgrimage.

Wait for finish by Sleep, Gaming, Trading, Read any Books, and clean up the other tasks. That's up to you!

Test after build finish

```
pi@raspberrypi$~$ exit
```

exit

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Script done, file is buildall.log

```
pi@raspberrypi$~ $ source ~/.profile # Just in case
```

```
pi@raspberrypi$~ $ sudo ldconfig # Just in case
```

```
pi@raspberrypi$~ $ cd ~/satellite/grc
```

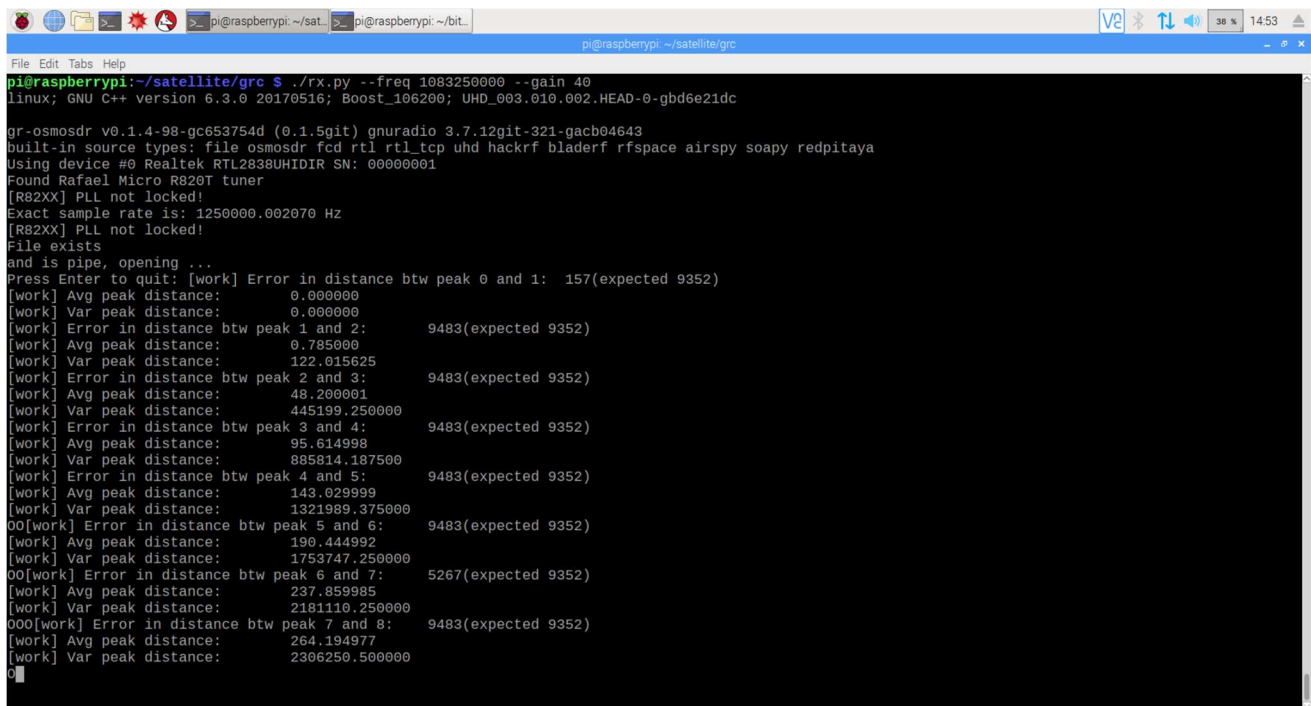
Insert RTL-SDR into USB port.

```
pi@raspberrypi$~/satellite/grc $ ./rx.py --freq <your frequency> --gain 40
```

e.g.: `./rx.py --freq 1083250000 --gain 40`

Put temporary value into frequency parameter just for checking software is enough for now. Ku-Band LNB output frequency is over 1GHz = $1000^3 = 1000000000$. You have to calculate exact frequency from your home region satellite frequency and your LNB L.O. frequency when you connect RTL-SDR with satellite antenna and try receiving Blockstream satellite radio wave.

If everything is OK, you can see the following result.



```
pi@raspberrypi:~/satellite/grc $ ./rx.py --freq 1083250000 --gain 40
linux, GNU C++ version 6.3.0 20170516; Boost_106200; UHD_003.010.002.HEAD-0-gbd6e21dc

gr-osmosdr v0.1.4-98-gc653754d (0.1.5git) gnuradio 3.7.12git-321-gacb04643
built-in source types: file osmosdr fcd rtl rtl_tcp uhd hackrf bladerf rfspice airspy soapy redpitaya
Using device #0 Realtek RTL2838UHDIR SN: 00000001
Found Rafael Micro R820T tuner
[R82XX] PLL not locked!
Exact sample rate is: 1250000.002070 Hz
[R82XX] PLL not locked!
File exists
and is pipe, opening ...
Press Enter to quit: [work] Error in distance btw peak 0 and 1: 157(expected 9352)
[work] Avg peak distance: 0.000000
[work] Var peak distance: 0.000000
[work] Error in distance btw peak 1 and 2: 9483(expected 9352)
[work] Avg peak distance: 0.785000
[work] Var peak distance: 122.015625
[work] Error in distance btw peak 2 and 3: 9483(expected 9352)
[work] Avg peak distance: 48.200001
[work] Var peak distance: 445199.250000
[work] Error in distance btw peak 3 and 4: 9483(expected 9352)
[work] Avg peak distance: 95.614998
[work] Var peak distance: 885814.187500
[work] Error in distance btw peak 4 and 5: 9483(expected 9352)
[work] Avg peak distance: 143.029999
[work] Var peak distance: 1321989.375000
00[work] Error in distance btw peak 5 and 6: 9483(expected 9352)
[work] Avg peak distance: 190.444992
[work] Var peak distance: 1753747.250000
00[work] Error in distance btw peak 6 and 7: 5267(expected 9352)
[work] Avg peak distance: 237.859985
[work] Var peak distance: 2181110.250000
000[work] Error in distance btw peak 7 and 8: 9483(expected 9352)
[work] Avg peak distance: 264.194977
[work] Var peak distance: 2306250.500000
```

CONGRATULATIONS!!!

If this document helps you, you can tip a pinch of BTC to the following address.

We can progress to the next step by your donations!

BTC Legacy

BTC Segwit



153w1iUUzMdFu8ckWrXsJiDSk81rk8r7K1



38jcX8eZQkX7npyZuMEV8wqbj76Wq2oouX

Special Thanks:

I'm inspired and received a lot of information from [grubles](#) and the following links.

If you want to construct normal Blockstream station (not using Raspberry Pi, but also with enough powerful PC), you should refer to the following links.

[\[Building Your Own Bitcoin Satellite Node: Part 1—Hardware Assembly\]](#)

[\[Building Your Own Bitcoin Satellite Node: Part 2—Software Installation\]](#)

[\[Building Your Own Bitcoin Satellite Node: Part 3—Dish Alignment\]](#)

End of Document.