NEW RADIO COMMUNICATION FOR NEW ERA

NRC7292 Evaluation Kit User Guide

(Raspberry Pi setup)

Ultra-low power & Long-range Wi-Fi

Ver 1.5
Aug. 16, 2023

NEWRACOM, Inc.

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NRC7292 Evaluation Kit User Guide (Raspberry Pi setup)
Ultra-low power & Long-range Wi-Fi

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1 Overview

The NRC7292 Evaluation Kit uses a Raspberry Pi board as a Linux host for NRC7292, an IEEE 802.11ah Wi-Fi chip. The supported Raspberry Pi boards are currently:

- Raspberry Pi 3 Model B : https://www.raspberrypi.org/products/raspberry-pi-3-model-b/

Figure 1.1 Raspberry Pi 3 Model B Board

- Raspberry Pi 3 Model B+ : https://www.raspberrypi.org/products/raspberry-pi-3-model-b-plus/

Figure 1.2 Raspberry Pi 3 Model B+ Board

- Raspberry Pi 4 Model B : https://www.raspberrypi.org/products/raspberry-pi-4-model-b/

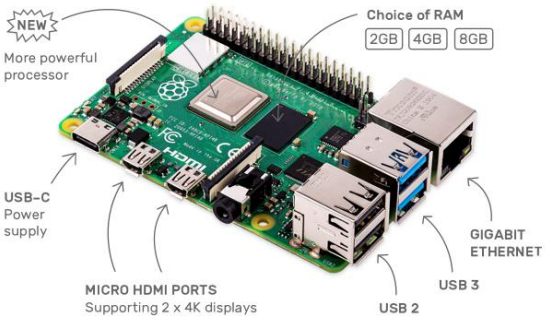

Figure 1.3 Raspberry Pi 4 Model B Board

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Figure 1.4, Figure 1.5, and Figure 1.6 show the connection between the NRC7292 adapter board and the Raspberry Pi board.

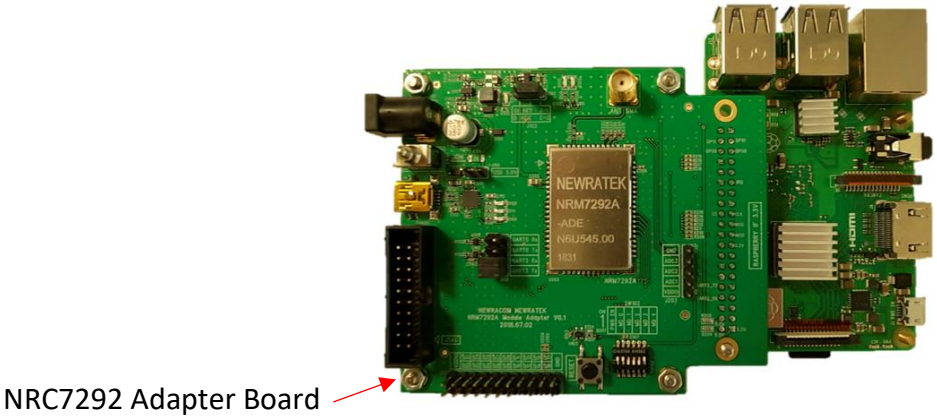

Figure 1.4 NRC7292 Evaluation Kit v1.0

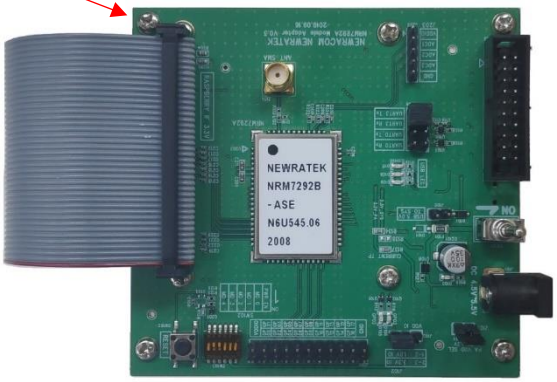

Figure 1.5 NRC7292 Evaluation Kit v2.0 (top view)

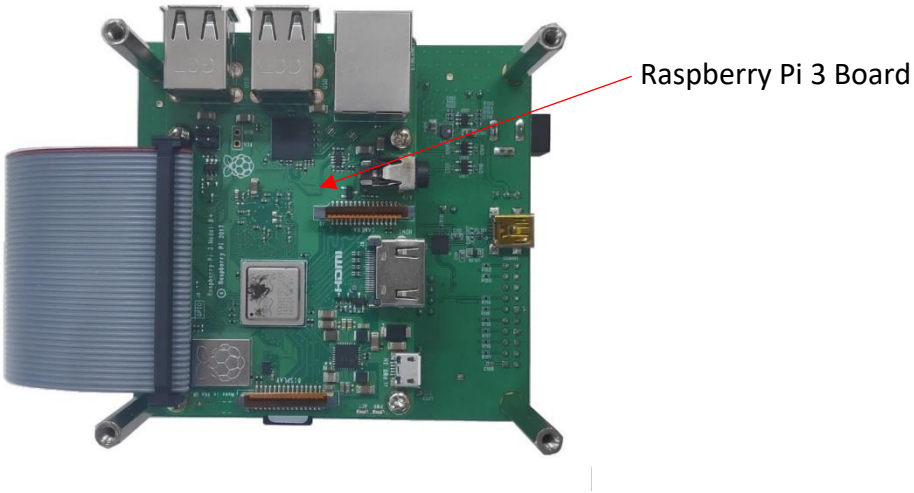

Figure 1.6 NRC7292 Evaluation Kit v2.0 (bottom view)

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Raspberry Pi OS is the recommended operating system for normal use on Raspberry Pi boards. And for the NRC7292 Evaluation Kit, it requires some additional configuration.

- Enable SSH or VNC (optional)
- Enable SPI and Serial Port
- Disable Broadcom Wi-Fi and Bluetooth
- Disable User mode SPI device driver
- Upgrade the Linux kernel (optional)
- Install the Linux kernel headers
- Install the required packages, etc.

This document describes how to configure a Raspberry Pi for the NRC7292 Evaluation Kit, which includes the NRC7292 Software Package (https://github.com/newracom/nrc7292_sw_pkg).

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2 Installing Raspberry Pi OS

Raspberry Pi recommends the use of Raspberry Pi Imager to install an operating system on the SD card. The Raspberry Pi OS can be quickly and easily installed on a microSD card using Raspberry Pi Imager.

Prepare the following:

- A computer with a microSD card reader
- A microSD card of at least 8 GB in size

2.1 Download and install Raspberry Pi Imager

Download the Raspberry Pi Imager for Windows at https://www.raspberrypi.org/software/.

Figure 2.1 Raspberry Pi Imager Download Page

Raspberry Pi Imager for Windows : https://downloads.raspberrypi.org/imager/imager_latest.exe

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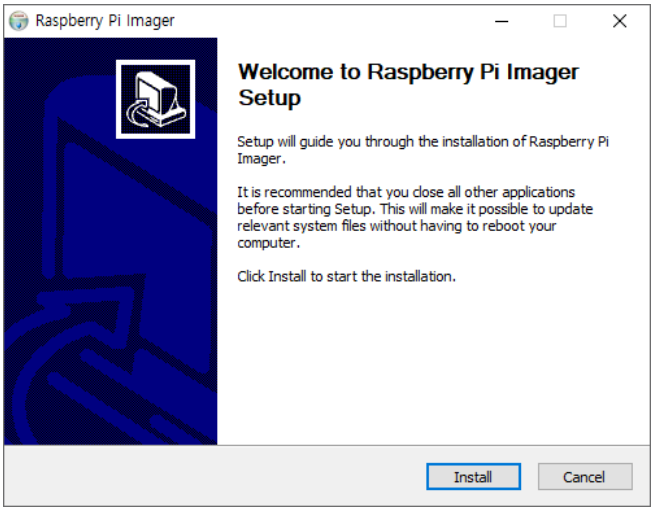
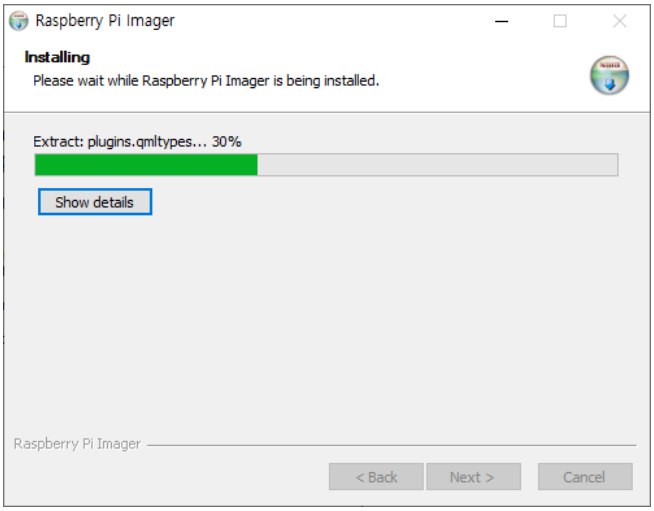
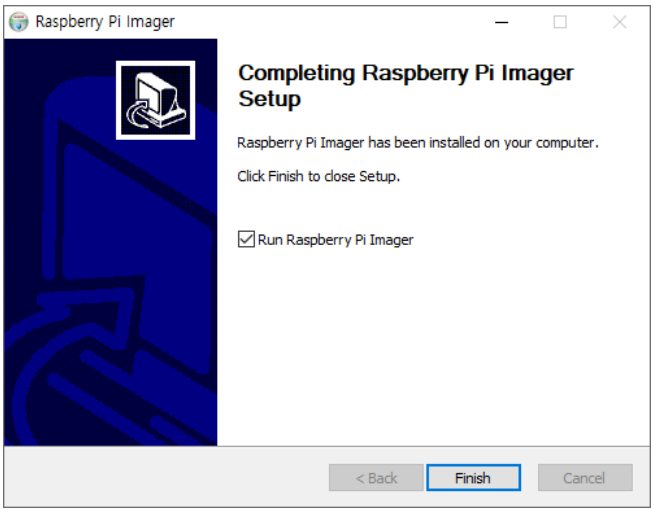
When the download finishes, click it to launch the installer and follow as below.







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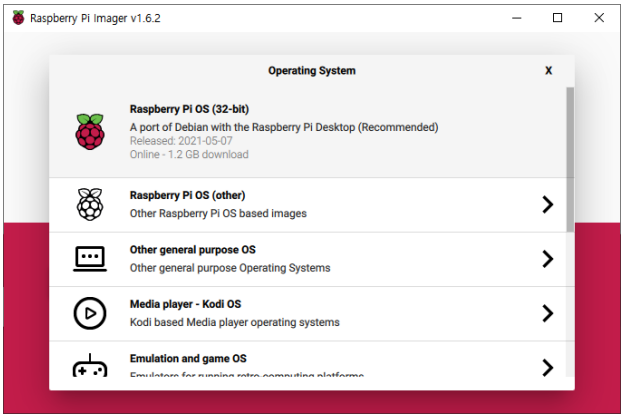
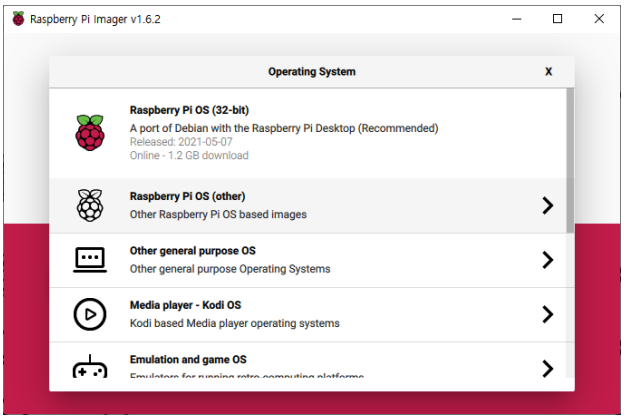
2.2 Write Raspberry Pi OS image on microSD card

After inserting the microSD card into a computer with a microSD card reader, launch the Raspberry Pi Imager. And click the "CHOOSE OS" button to choose the operating system.

Select the “Raspberry Pi OS (32-bit)” menu to install the latest Raspberry Pi OS. The release date is May 7, 2021 when this document is written.



Or select the "Raspberry Pi OS (other)" menu to install the Raspberry Pi OS of other size.



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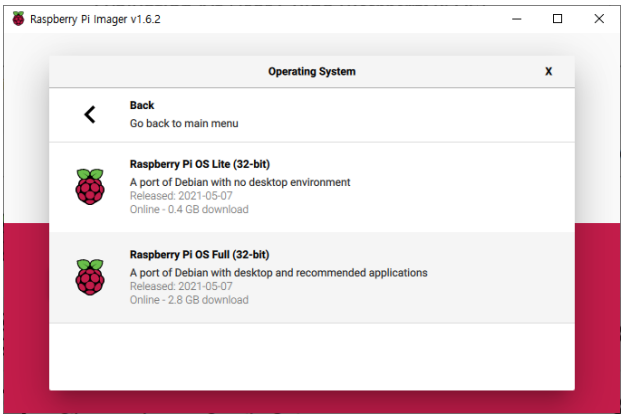
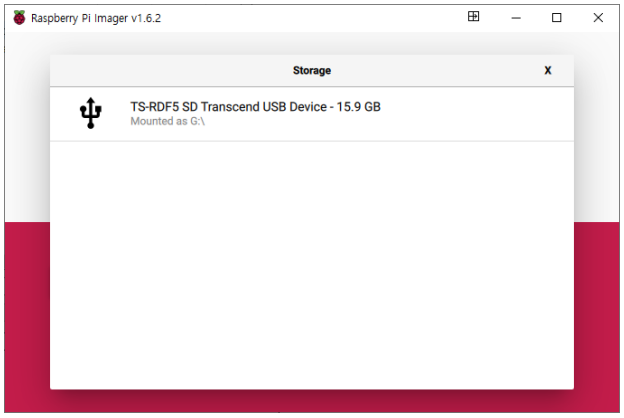


Click the “CHOOSE STORAGE” button to choose the SD card.

Select the microSD card to write the Raspberry Pi OS image.



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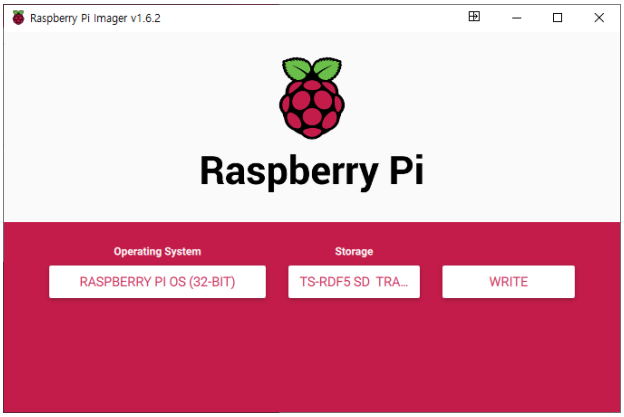
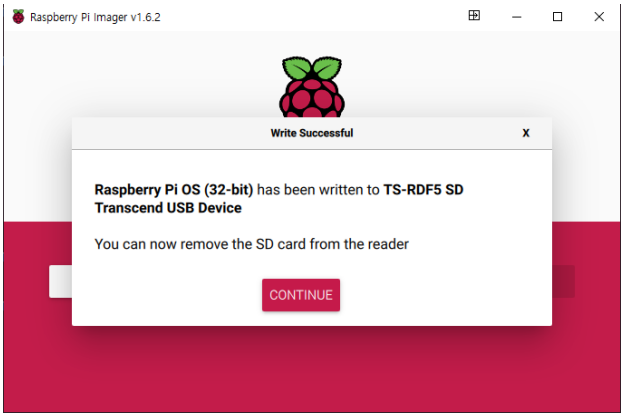
Click the “WRITE” button and wait for the Raspberry Pi Imager to finish writing.



Click the “CONTINUE” button to eject the microSD card after the following message.



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NOTE:

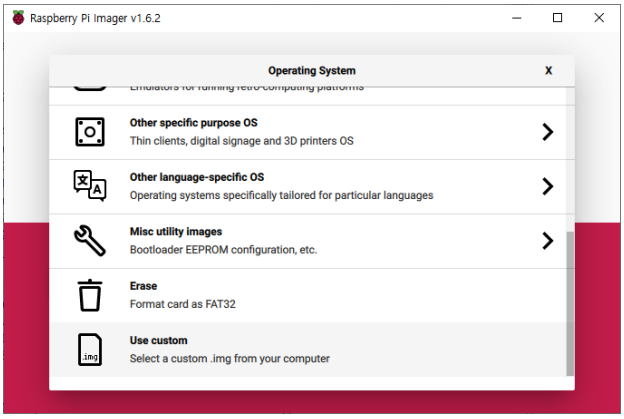
Previous versions of the Raspberry Pi OS can be downloaded from http://downloads.raspberrypi.org/.

Index of /

Name	Last modified	Size	Description
AstroPi/	2017-09-04 15:41	-	
AstroPi_NOOBS/	2020-01-08 10:11	-	
AstroPi_flight/	2020-11-16 16:23	-	
AstroPi_lite/	2018-12-03 16:23	-	
NOOBS/	2021-03-25 14:47	-	
NOOBS_lite/	2013-12-24 10:54	-	
Raspberry_Pi_Education_Manual.pdf	2013-09-16 13:51	2.8M	
arch/	2016-03-08 21:27	-	
data_partition/	2014-06-22 15:35	-	
eeprom_recovery.json	2021-04-30 13:34	1.7K	
favicon.ico	2011-10-12 05:36	1.1K	
html/	2021-07-09 09:12	-	
imager/	2021-05-26 16:01	-	
nightlies/	2021-08-12 11:54	-	
openelec/	2015-02-12 14:22	-	
openelec_pi1/	2016-03-14 14:52	-	
openelec_pi2/	2016-03-14 14:52	-	
operating-systems-categories.json	2021-05-28 16:19	3.0K	
os_list.json	2021-03-25 15:46	9.3K	
os_list_imagingutility.json	2021-05-28 16:18	5.0K	
os_list_imagingutility_v2.json	2021-08-09 15:04	9.0K	
os_list_v2.json	2021-03-25 15:46	9.6K	
os_list_v3.json	2021-05-27 12:49	21K	
osmc_pi1/	2016-05-13 09:26	-	
osmc_pi2/	2016-05-13 09:26	-	
pidora/	2014-07-08 16:25	-	
piserver.json	2021-05-28 16:09	730	
pixel_x86/	2016-12-12 18:50	-	
raspbian/	2020-02-25 16:50	-	
raspbian_full/	2020-02-14 13:52	-	
raspbian_lite/	2020-02-14 13:49	-	
raspbmc/	2015-05-02 18:17	-	
raspios_arm64/	2020-05-28 04:38	-	
raspios_armhf/	2021-05-28 16:04	-	
raspios_full_armhf/	2021-05-28 16:04	-	
raspios_lite_arm64/	2020-08-24 18:50	-	
raspios_lite_armhf/	2021-05-28 16:04	-	
riscos/	2014-04-28 18:50	-	
riscos_1760/	2015-02-23 18:45	-	
robots.txt	2013-08-21 12:58	26	
rpd_x86/	2018-12-03 16:25	-	
rss.xml	2021-05-28 15:52	49K	
rsz_img_0661.jpg	2015-11-26 07:11	111K	
rsz_img_4054-500x349.jpg	2015-11-26 07:11	59K	
ubuntu/	2015-02-03 17:29	-	
weather_station/	2016-03-24 05:11	-	
wp-slice-noobs	2021-06-01 10:08	657	
wp-slice-noobs-lite	2021-05-28 15:52	672	
wp-slice-other	2021-05-28 15:52	10K	
wp-slice-raspbian	2021-05-28 15:52	1.0K	

Figure 2.2 Raspberry Pi Download Page

The downloaded Raspberry Pi OS image can also be selected in Raspberry Pi Imager and written to the SD card. Click the “Use custom” menu in the “Operating System” window.



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The release date of Raspberry Pi OS that supports Raspberry Pi 3 Model B/B+ and Raspberry Pi 4 Model B can be found at https://en.wikipedia.org/wiki/Raspberry_Pi_OS.

Raspberry Pi Model	Raspberry Pi OS Release Date
Raspberry Pi 3 Model B	2016-02-09 ~ latest
Raspberry Pi 3 Model B+	2018-04-18 ~ latest
Raspberry Pi 4 Model B	2019-06-24 ~ latest

Table 2.1 Supported Raspberry Pi OS Release Dates

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Release date	Debian version	Linux Kernel	GCC	APT	X Server	Pi 1/1+	Pi 2	Pi 3	Pi Zero W	Pi 3+	Pi 4	Pi Zero 2 W
2013-09-27	7 (Wheezy)	3.6	4.7.2	0.9.7	7.7	✓	✘	✘	✘	✘	✘	✘
2013-10-07						✓	✘	✘	✘	✘	✘	✘
2013-12-24		3.10				✓	✘	✘	✘	✘	✘	✘
2014-01-09						✓	✘	✘	✘	✘	✘	✘
2014-06-22		3.12				✓	✘	✘	✘	✘	✘	✘
2014-07-08						✓	✘	✘	✘	✘	✘	✘
2014-09-12						✓	✘	✘	✘	✘	✘	✘
2014-10-08						✓	✘	✘	✘	✘	✘	✘
2014-12-25						✓	✘	✘	✘	✘	✘	✘
2015-02-02		3.18				✓	✓	✘	✘	✘	✘	✘
2015-02-17						✓	✓	✘	✘	✘	✘	✘
2015-02-18						✓	✓	✘	✘	✘	✘	✘
2015-05-07						✓	✓	✘	✘	✘	✘	✘
2015-05-12						✓	✓	✘	✘	✘	✘	✘
2015-09-28	8 (Jessie)	4.1	4.9	1.0.9.8.1		✓	✓	✘	✘	✘	✘	✘
2015-11-24						✓	✓	✘	✘	✘	✘	✘
2016-02-08						✓	✓	✘	✘	✘	✘	✘
2016-02-09						✓	✓	✘	✘	✘	✘	✘
2016-02-29						✓	✓	✓	✘	✘	✘	✘
2016-03-18						✓	✓	✓	✘	✘	✘	✘
2016-05-13		4.4				✓	✓	✓	✘	✘	✘	✘
2016-05-31						✓	✓	✓	✘	✘	✘	✘
2016-09-28						✓	✓	✓	✘	✘	✘	✘
2016-11-29						✓	✓	✓	✘	✘	✘	✘
2017-02-27		4.9				✓	✓	✓	✘	✘	✘	✘
2017-03-03						✓	✓	✓	✓	✘	✘	✘
2017-04-10						✓	✓	✓	✓	✘	✘	✘
2017-06-23						✓	✓	✓	✓	✘	✘	✘
2017-07-05						✓	✓	✓	✓	✘	✘	✘
2017-08-17	9 (Stretch)		6.3	1.4.6		✓	✓	✓	✓	✘	✘	✘
2017-09-08						✓	✓	✓	✓	✘	✘	✘
2017-11-29						✓	✓	✓	✓	✘	✘	✘
2018-03-13						✓	✓	✓	✓	✘	✘	✘
2018-04-18		4.14		1.4.8		✓	✓	✓	✓	✓	✘	✘
2018-06-29						✓	✓	✓	✓	✓	✘	✘
2018-10-09						✓	✓	✓	✓	✓	✘	✘
2018-11-13						✓	✓	✓	✓	✓	✘	✘
2019-04-08				1.4.9		✓	✓	✓	✓	✓	✘	✘
2019-06-24	10 (Buster)	4.19	8.3	1.8.2		✓	✓	✓	✓	✓	✓	✘
2019-07-10						✓	✓	✓	✓	✓	✓	✘
2019-09-30						✓	✓	✓	✓	✓	✓	✘
2020-02-07						✓	✓	✓	✓	✓	✓	✘
2020-02-14						✓	✓	✓	✓	✓	✓	✘
2020-05-27						✓	✓	✓	✓	✓	✓	✘
2020-08-20		5.4.51				✓	✓	✓	✓	✓	✓	✘
2020-12-02		5.4.79		1.8.2.1		✓	✓	✓	✓	✓	✓	✘
2021-01-11		5.4.83		1.8.2.2		✓	✓	✓	✓	✓	✓	✘
2021-03-04		5.10.17				✓	✓	✓	✓	✓	✓	✘
2021-05-07				1.8.2.3		✓	✓	✓	✓	✓	✓	✓
2021-10-30		5.10.63				✓	✓	✓	✓	✓	✓	✓
2021-12-03	11 (Bullseye)		10.2.1	2.2.4	1.20.11	✓	✓	✓	✓	✓	✓	✓
2022-01-28		5.10.92				✓	✓	✓	✓	✓	✓	✓
2022-03-08		5.10.103				✓	✓	✓	✓	✓	✓	✓
2022-04-04		5.15.30				✓	✓	✓	✓	✓	✓	✓
2022-09-06		5.15.61				✓	✓	✓	✓	✓	✓	✓
2022-09-22						✓	✓	✓	✓	✓	✓	✓
2023-02-21		5.15.84				✓	✓	✓	✓	✓	✓	✓
2023-05-03		6.1.21				✓	✓	✓	✓	✓	✓	✓

Figure 2.3 Raspberry Pi OS Release History

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3 Setting up Raspberry Pi

To set up the Raspberry Pi, prepare the following and connect it to the Raspberry Pi board as shown in Figure 3.1.

- A 5V power adapter (optional)
- Keyboard and mouse
- TV or PC monitor with HDMI port
- HDMI cable
  - Raspberry Pi 3 : standard HDMI
  - Raspberry Pi 4 : Micro HDMI
- Ethernet cable with internet access

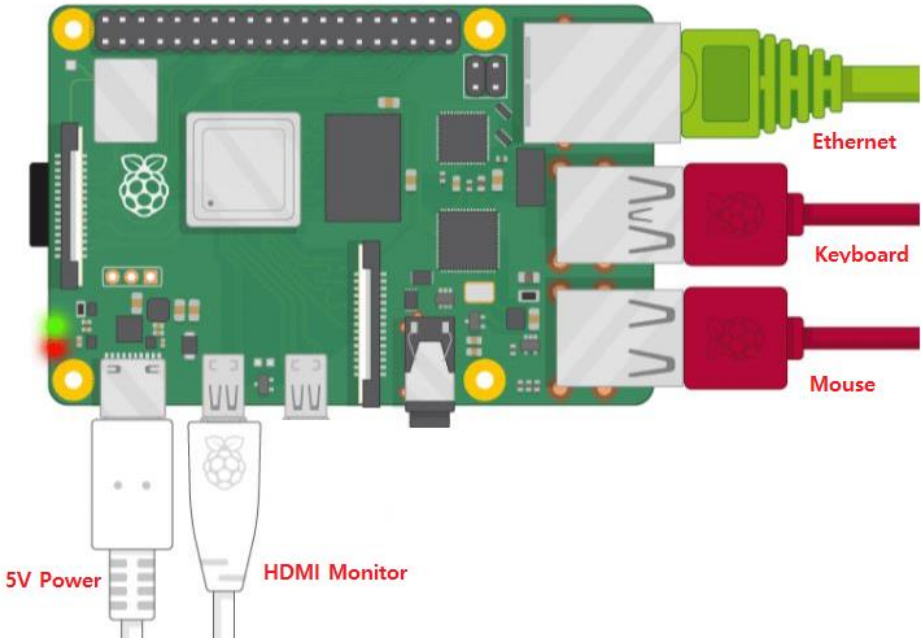

Figure 3.1 Raspberry Pi Model 4 B Cable Connection

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3.1 Enable the required interfaces

Launch the Raspberry Pi configuration tool.

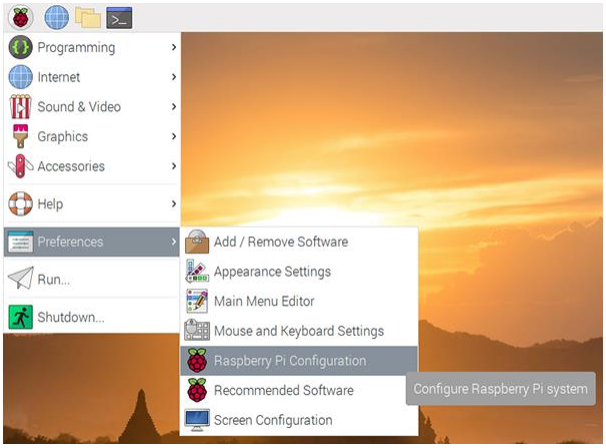
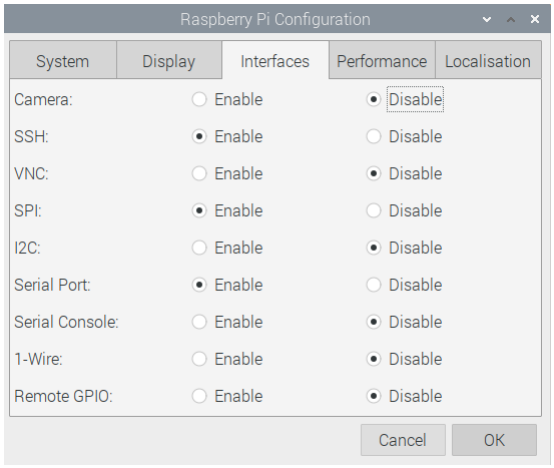


Figure 3.2 Raspberry Pi Configuration Tool Menu

Enable the required interfaces in the “Interfaces” tap.

- Enable SSH or VNC for remote access (optional)
- Enable SPI and Serial Port to communicate with the NRC7292
  - The SPI is used in Linux host mode and standalone mode that supports AT Command
  - The Serial Port is used only in standalone mode that supports AT Command
- Disable serial console so that the console log is not output via the Serial Port



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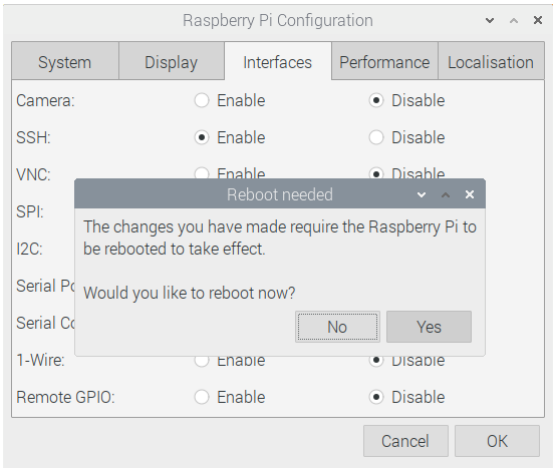
After completing all configuration, reboot the system.



NOTE:

The Raspberry Pi configuration tool can also be run from the command line.

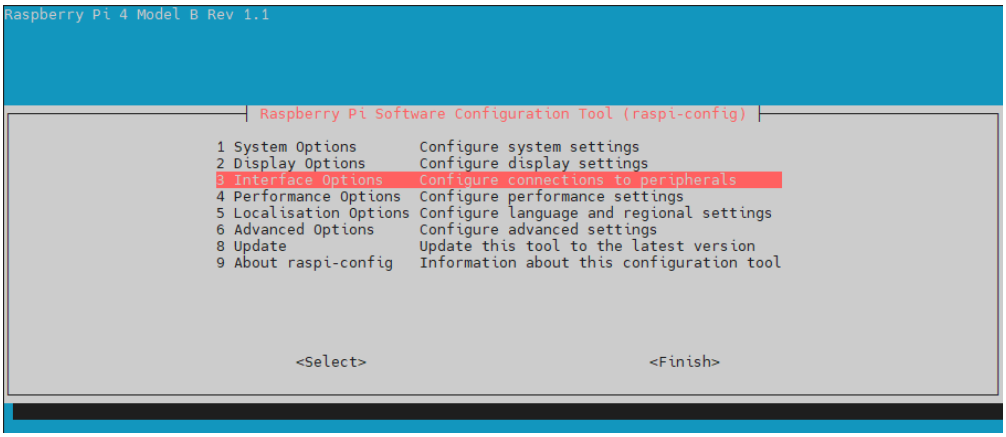
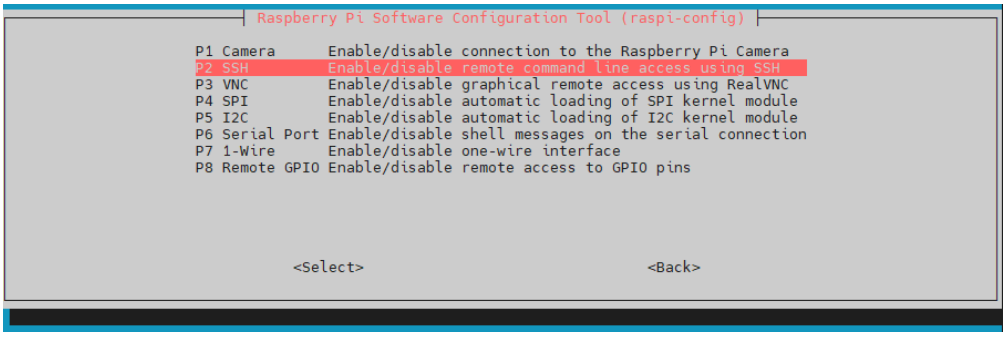


Figure 3.3 Raspberry Pi Configuration Tool (command line)

- Enable SSH



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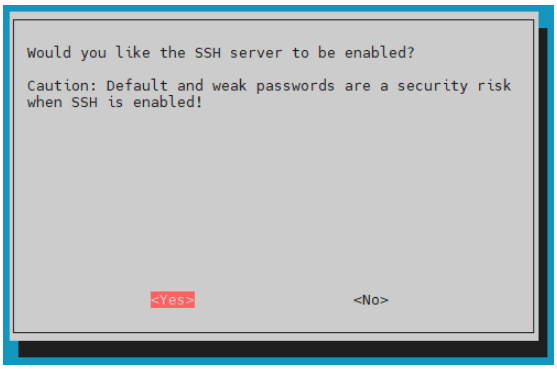
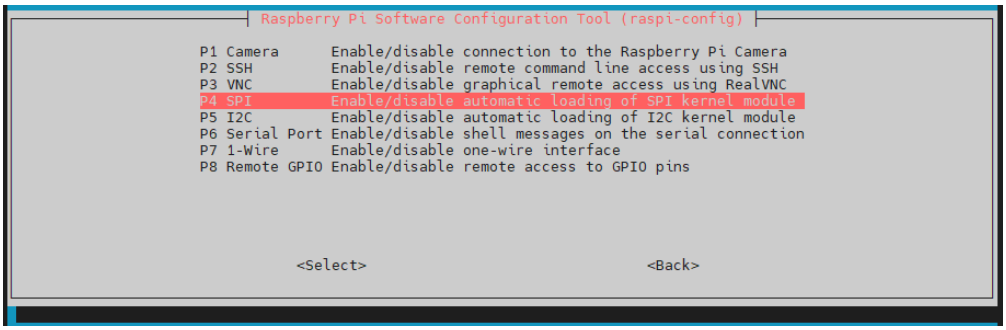
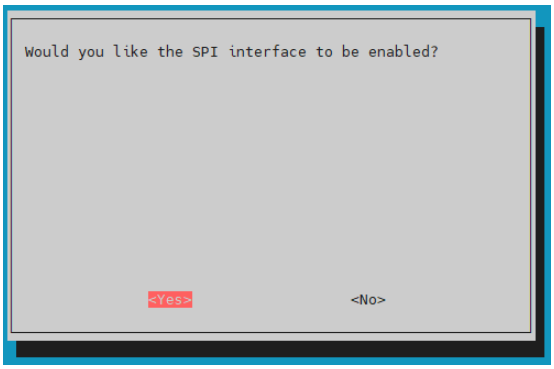
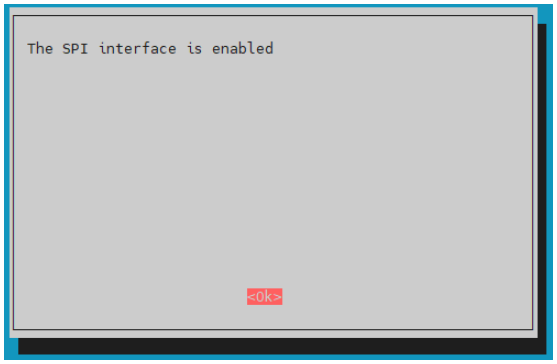


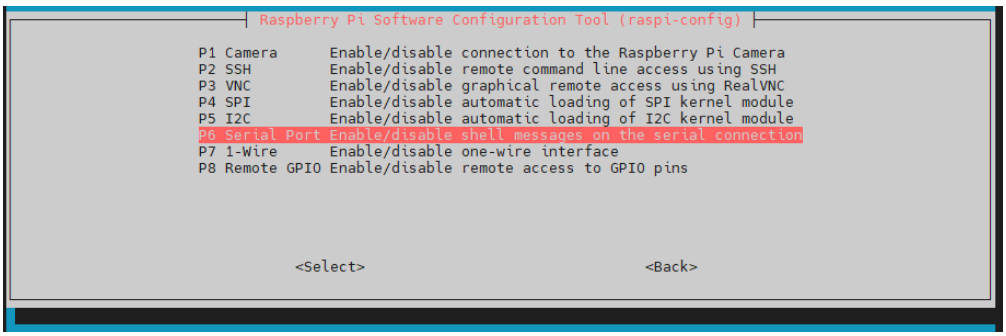
- Enable SPI







- Enable Serial Port



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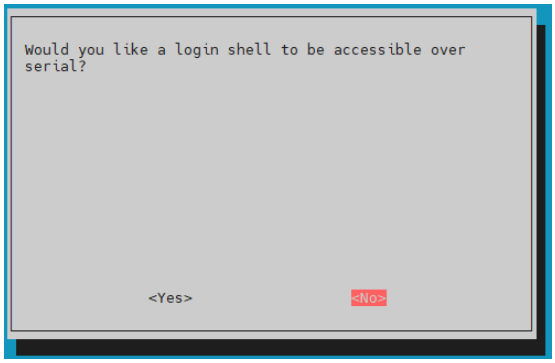
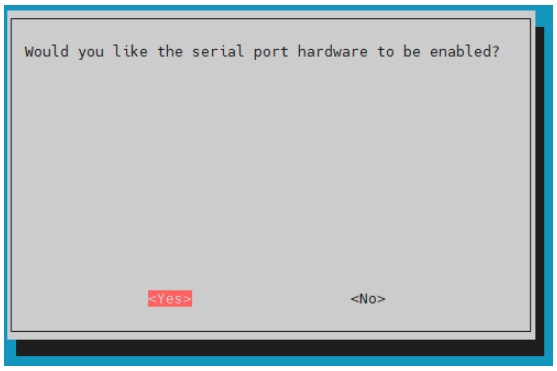
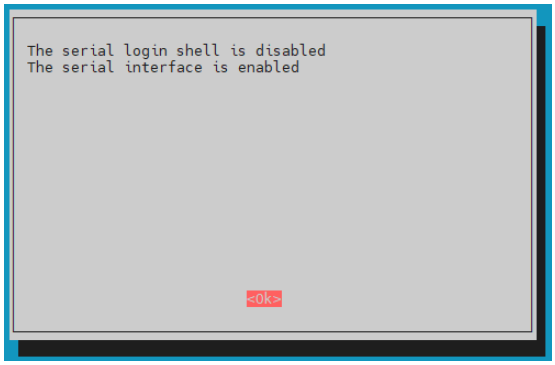
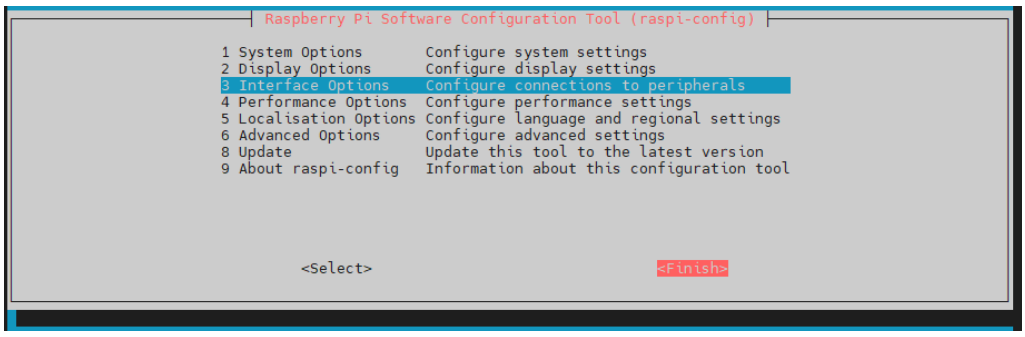
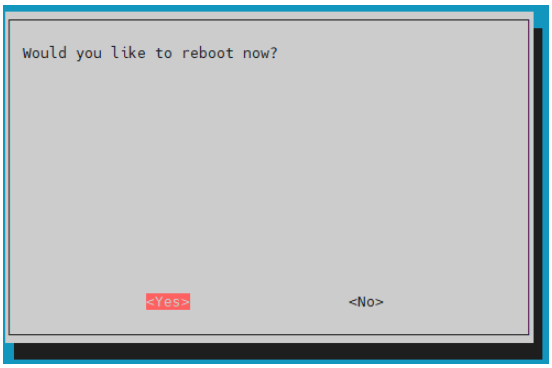






- Fininsh and reboot





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3.2 Install the required packages

Update the list of available packages.

```
$ sudo apt update
```

Upgrade installed packages, including the Linux kernel. If there is a newer version than the current kernel, it will be upgraded. Upgrading the package is optional.

```
$ sudo apt upgrade
```

Alternatively, only the kernel can be upgraded to the latest version by installing the raspberrypi-bootloader and raspberrypi-kernel packages.

```
$ uname -a
```

```
Linux raspberrypi 5.10.17-v7l+ #1414 SMP Fri Apr 30 13:20:47 BST 2021 armv7l GNU/Linux
```

```
$ ls -l /lib/modules
```

```
drwxr-xr-x 3 root root 4096 May  7 15:41 5.10.17+
drwxr-xr-x 3 root root 4096 May  7 15:41 5.10.17-v7+
drwxr-xr-x 3 root root 4096 May  7 15:41 5.10.17-v7l+
drwxr-xr-x 3 root root 4096 May  7 15:41 5.10.17-v8+
```

```
$ sudo apt install raspberrypi-bootloader raspberrypi-kernel
```

```
$ sudo reboot
```

```
$ uname -a
```

```
Linux raspberrypi 5.10.52-v7l+ #1441 SMP Tue Aug 3 18:11:56 BST 2021 armv7l GNU/Linux
```

```
$ ls -l /lib/modules
```

```
drwxr-xr-x 3 root root 4096 Aug 27 02:13 5.10.52+
drwxr-xr-x 3 root root 4096 Aug 27 02:13 5.10.52-v7+
drwxr-xr-x 3 root root 4096 Aug 27 02:13 5.10.52-v7l+
drwxr-xr-x 3 root root 4096 Aug 27 02:13 5.10.52-v8+
```

The headers for the upgraded kernel needed to build the kernel module can be installed from the raspberrypi-kernel-headers package.

```
$ sudo apt install raspberrypi-kernel-headers
```

```
$ ls -l /usr/src
```

```
drwxr-xr-x 23 root root 4096 Aug 24 22:48 linux-headers-5.10.52+
drwxr-xr-x 23 root root 4096 Aug 24 22:48 linux-headers-5.10.52-v7+
drwxr-xr-x 23 root root 4096 Aug 24 22:48 linux-headers-5.10.52-v7l+
```

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Finally, install the remaining required packages.

```
$ sudo apt install vim iperf iperf3
```

NOTE: Kernel Build (Optional)

If the kernel is not up to date, the kernel headers can only be installed manually using the kernel source. The kernel source for Raspberry Pi OS can be found and downloaded at https://github.com/raspberrypi/linux/releases.

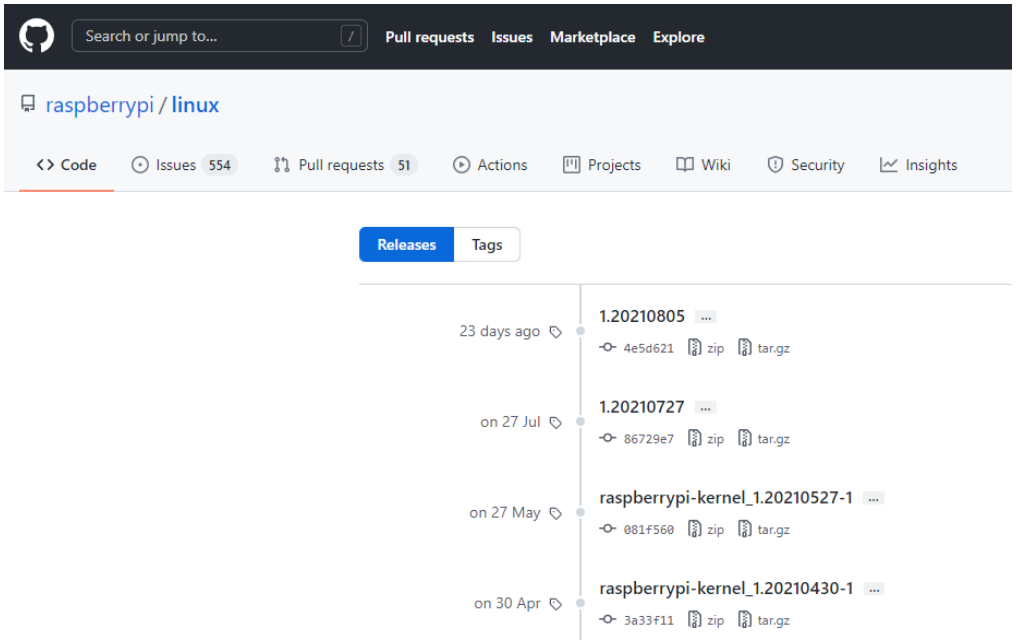

Figure 3.4 Raspberry Pi OS Kernel Source download page

Find and download the kernel source that matches the kernel version of Raspberry Pi OS.

```
$ uname -a
```

```
Linux raspberrypi 5.10.17-v7l+ #1414 SMP Fri Apr 30 13:20:47 BST 2021 armv7l GNU/Linux
```

```
$ cd ~/Download
$ wget https://github.com/raspberrypi/linux/archive/refs/tags/raspberrypi-kernel_1.20210527-1.tar.gz
$ tar xzvf raspberrypi-kernel_1.20210527-1.tar.gz
$ cd linux-raspberrypi-kernel_1.20210527-1/
$ vim Makefile
```

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```
1 # SPDX-License-Identifier: GPL-2.0
2 VERSION = 5
3 PATCHLEVEL = 10
4 SUBLEVEL = 17
5 EXTRAVERSION =
6 NAME = Kleptomaniac Octopus
```

The downloaded kernel source needs to set up for building external modules. We don't need to change this value.

First, install the required packages.

```
$ sudo apt install git bc bison flex libssl-dev make libcurl4-openssl-dev
```

Prepare the default configuration by running the following commands, depending on Raspberry Pi version.

Raspberry Pi Model 3 B/B+ :

```
$ KERNEL=kernel7
$ make bcm2709_defconfig
```

Raspberry Pi Model 4 B (32-bit) :

```
$ KERNEL=kernel7l
$ make bcm2711_defconfig
```

Use the make target "modules" or "modules_prepare" to prepare the kernel for building external modules.

```
$ make <modules | modules_prepare>
```

"make module_prepare" completes faster than "make modules" but does not generate the Module.symvers file. If the module is built without the Module.symvers file, a warning message is output.

```
WARNING: Symbol version dump "Module.symvers" is missing.
         Modules may not have dependencies or modversions.
  MODPOST /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/Module.symvers
WARNING: modpost: Symbol info of vmlinux is missing. Unresolved symbol check will be entirely skipped.
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc.mod.o
  LD [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc.ko
make[1]: Leaving directory '/home/pi/Downloads/linux-raspberrypi-kernel_1.20210527-1'
```

Add a build link to refer to this kernel when building external modules.

```
$ cd /lib/modules/$(uname -r)
```

```
$ sudo ln -s ~/Downloads/linux-raspberrypi-kernel_1.20210527-1/build
```

* If a symbolic link is already existed, please delete that in advance and re-create this.

```
$ sudo rm -f build
```

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3.3 Disable Broadcom Wi-Fi and Bluetooth

Broadcom Wi-Fi and Bluetooth can be disabled to use only Newracom Wi-Fi. This is possible with the Device Tree Overlay.

Device Tree Blob Overlay files for disabling Broadcom Wi-Fi and Bluetooth can be found in the /boot/overlays directory.

$ ls -l /boot/overlays/disable-*

```
-rwxr-xr-x 1 root root 1073 Jan  5  2021 /boot/overlays/disable-bt.dtbo
-rwxr-xr-x 1 root root  387 Jan  5  2021 /boot/overlays/disable-wifi.dtbo
```

Device Tree Overlay on the Raspberry Pi is possible by adding the dtoverlay parameter in the /boot/config.txt file.

$ sudo vim /boot/config.txt (Raspberry Pi 4 case)

```
dtoverlay=disable-bt
dtoverlay=disable-wifi
dtoverlay= disable-spidev
```

$ sudo vim /boot/config.txt (Raspberry Pi 3 case)

```
dtoverlay=pi3-disable-bt
dtoverlay=pi3-disable-wifi
dtoverlay= pi3-disable-spidev
```

After reboot, the wlan0 interface be removed.

$ sudo reboot

$ ifconfig -a

```
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.123.25  netmask 255.255.255.0  broadcast 192.168.123.255
        inet6 fe80::cf3d:c28b:eb76:f77  prefixlen 64  scopeid 0x20<link>
        ether dc:a6:32:1f:75:a1  txqueuelen 1000  (Ethernet)
        RX packets 75  bytes 8984 (8.7 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 101  bytes 13911 (13.5 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 4  bytes 444 (444.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 4  bytes 444 (444.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

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3.4 Disable User mode SPI device driver

In the NRC7292 Evaluation Kit, the NRC7292 module is connected to SPI Master 0 of Raspberry Pi and is selected by number 0 of the two chip-select pins.

When the User mode SPI device driver is loaded into the kernel, the chip-select pins are in the busy state.

$ ls -l /dev/spidev*

```
crw-rw---- 1 root spi 153, 0 Aug 24 22:23 /dev/spidev0.0
crw-rw---- 1 root spi 153, 1 Aug 24 22:23 /dev/spidev0.1
```

The NRC7292 host driver cannot be loaded into the kernel using the insmod command unless the User mode SPI device driver is removed from the kernel. However, the Device Tree Blob Overlay file for disabling the User mode SPI device driver is not in the /boot/overlays directory. It is necessary to manually create and add the dtbo file.

$ vim newracom.dts

(1) Earlier Linux Kernel Version 5.16:

```
/*
 * Device Tree overlay for Newracom
 *
 */
/dts-v1/;
/plugin/;
/ {
        compatible = "brcm,bcm2835", "brcm,bcm2708", "brcm,bcm2709", "brcm,bcm2711";
        fragment@0 {
                target = <&spi>;
                __overlay__ {
                        pinctrl-names="default";
                        pinctrl-0=<&nrc_pins>;
                        status = "okay";

                        spidev@0{
                                status = "disabled";
                        };
                        spidev@1{
                                status = "disabled";
                        };

                };
        };

        fragment@1 {
                target = <&gpio>;
```

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```
                __overlay__ {
                        nrc_pins: nrc_pins {
                                brcm,pins = <5 7 8 9 10 11>;
                                brcm,function = <0 1 1 4 4 4>;
                                brcm,pull = <1 2 2 2 2 1>;
                        };
                };
        };
};
```

(2) Linux Kernel Version 5.16 and Later

In the nrc driver, the spi_busnum_to_master function is used to obtain the bus number to create the spi device. However, since the spi_busnum_to_master function has been removed from Linux Kernel Version 5.16 and later, the following modifications must be additionally applied to the DT overlay.

```
/*
 * Device Tree overlay for Newracom
 *
 */
/dts-v1/;
/plugin/;
/ {
        compatible = "brcm,bcm2835", "brcm,bcm2708", "brcm,bcm2709", "brcm,bcm2711";
        fragment@0 {
                target = <&spi>;
                __overlay__ {
                        pinctrl-names="default";
                        pinctrl-0=<&nrc_pins>;
                        status = "okay";

                        spidev@0{
                                status = "disabled";
                        };
                        spidev@1{
                                status = "disabled";
                        };

                };
        };

        fragment@1 {
                target = <&gpio>;
                __overlay__ {
                        nrc_pins: nrc_pins {
                                brcm,pins = <5 7 8 9 10 11>;
                                brcm,function = <0 1 1 4 4 4>;
                                brcm,pull = <1 2 2 2 2 1>;
                        };
```

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```
                };
        };

    fragment@2 {
        target = <&spi0>;
        __overlay__ {
            pinctrl-names="default";
            pinctrl-0=<&nrc_pins>;
            status = "okay";
            #address-cells = <1>;
            #size-cells = <0>;

            nrc: nrc-cspi@0 {                    /* Bus Number */
                compatible ="nrc80211";
                reg = <0>;                        /* CS Number */
                interrupt-parent = <&gpio>;
                interrupts = <5 4>;                /* GPIO Number */ /* IRQ_TYPE_LEVEL_HIGH */
                spi-max-frequency = <20000000>;    /* Max Freq */
            };
        };
    };

    __overrides__ {
        max_speed_hz = <&nrc>,"spi-max-frequency:0";
    };
};
```

$ dtc -I dts -O dtb -o newracom.dtbo newracom.dts

$ sudo cp newracom.dtbo /boot/overlays/

After adding the dtoverlay parameter to the /boot/config.txt file.

$ sudo vim /boot/config.txt (Raspberry Pi 4 case)

```
dtoverlay=disable-bt
dtoverlay=disable-wifi
dtoverlay=newracom
```

$ sudo vim /boot/config.txt (Raspberry Pi 3 case)

```
dtoverlay=pi3-disable-bt
dtoverlay=pi3-disable-wifi
dtoverlay=newracom
```

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Reboot the system and check the spi devices.

$ ls -l /dev/spidev*

```
pi@raspberrypi:~ $ ls -l /dev/spidev*
ls: cannot access '/dev/spidev*': No such file or directory
```

NOTE:

When Newracom Wi-Fi operates in host mode, the User mode SPI device driver must be removed from the kernel. However, it does not need to be removed when Newracom Wi-Fi operates in Standalone mode that supports AT Command.

3.5 Packages and configurations required for Newracom Wi-Fi

Install hostapd and dnsmasq packages for AP mode.

$ sudo apt install hostapd dnsmasq

Remove the default configuration file to set the configuration file using the -c option when running wpa_supplicant.

$ cd /etc/wpa_supplicant/

$ sudo mv wpa_supplicant.conf wpa_supplicant.conf.unused

Before loading the NRC7292 host driver into the Kernel using the insmod command, the mac80211 module must be loaded into the Kernel. Add the mac80211 module to always be loaded into the kernel during boot.

$ sudo vim /etc/modules

```
i2c-dev
mac80211
```

```
1 # /etc/modules: kernel modules to load at boot time.
2 #
3 # This file contains the names of kernel modules that should be loaded
4 # at boot time, one per line. Lines beginning with "#" are ignored.
5
6 i2c-dev
7 mac80211
```

We don’t use existing Broadcom’s WiFi, so please add it into the raspi-blacklist.conf.

$ sudo vim /etc/modprobe.d/raspi-blacklist.conf

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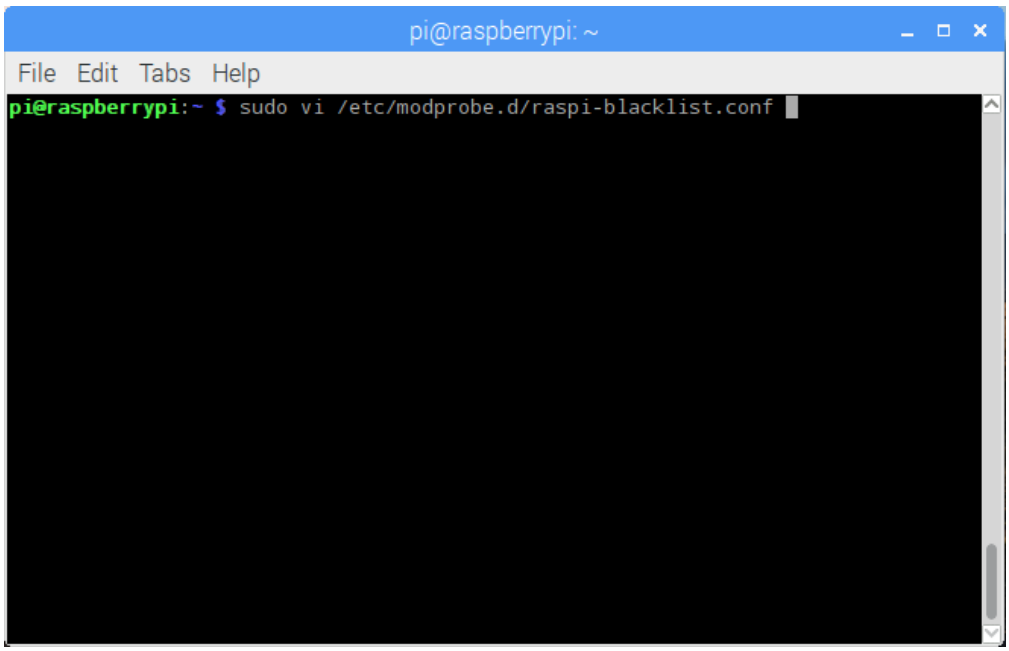
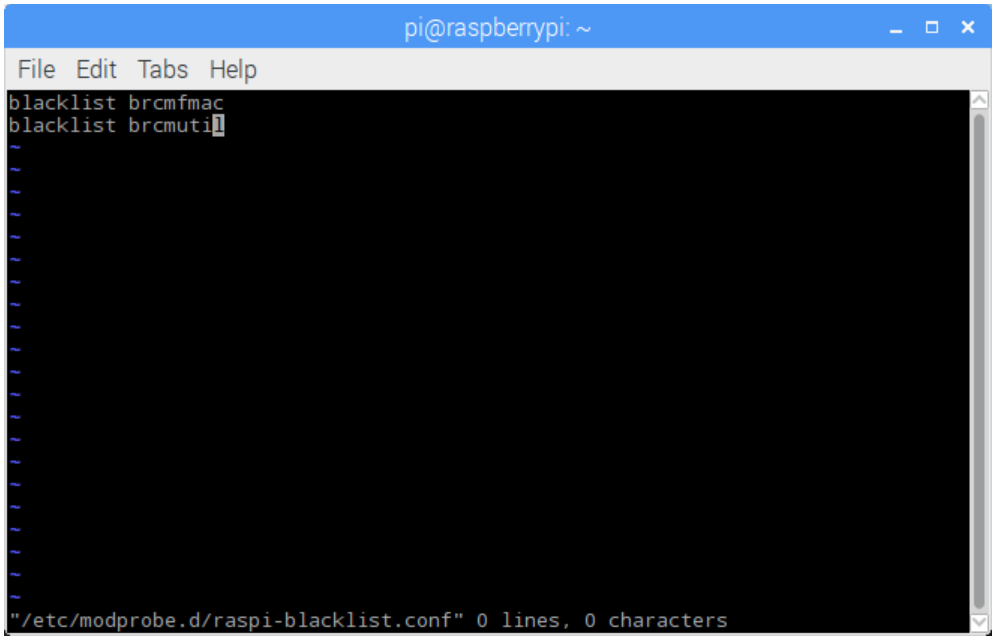


Add blacklist

```
blacklist brcmfmac
blacklist brcmutil
```



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4 Installing NRC7292 Software Package

NRC7292 Software Package contains files for evaluating Newracom Wi-Fi in host mode. After installing it, make sure there are no issues with the configured Raspberry Pi.

4.1 Download and install the package from GitHub repository

$ cd ~

$ git clone https://github.com/newracom/nrc7292_sw_pkg.git

$ cd nrc7292_sw_pkg/package/evk/sw_pkg

$ chmod +x update.sh

$ ./update.sh

```
Copy new package
apply nrc_pkg
Change mode
Done
```

4.2 Compile and replace the nrc7292 host driver

$ cd ~/ nrc7292_sw_pkg/package/src/nrc

$ make

```
make[1]: Entering directory '/usr/src/linux-headers-5.10.52-v7l+'
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-mac80211.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-trx.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-init.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-debug.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/hif.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/wim.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-hif-debug.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-hif-uart.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-hif-ssp.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-fw.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-netlink.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-ssp.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-hif-cspi.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/mac80211-ext.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-stats.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-pm.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-dump.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-hif-sdio.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-bd.o
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc-recovery.o
  LD [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc.o
  MODPOST /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/Module.symvers
  CC [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc.mod.o
  LD [M]  /home/pi/nrc7292_sw_pkg/package/host/nrc_driver/source/nrc_driver/nrc/nrc.ko
make[1]: Leaving directory '/usr/src/linux-headers-5.10.52-v7l+'
```

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$ cp -b nrc.ko ~/nrc_pkg/sw/driver

$ ls -l ~/nrc_pkg/sw/driver

```
-rw-r--r-- 1 pi pi 204792 Aug 27 08:39 nrc.ko
-rwxr-xr-x 1 pi pi 213744 Aug 27 08:30 nrc.ko~
```

4.3 Start Newracom Wi-Fi in AP or STA mode

Please refer to the Host Mode User Guide on how to get started.

- Directory : nrc7292_sw_pkg/package/doc
- File Name : UG-7292-001-EVK User Guide (Host Mode).pdf

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5 Revision History

Revision No	Date	Comments
Ver 1.0	8/30/2021	Initial version
Ver 1.1	9/10/2021	Added blacklist and explanation about build symbolic link
Ver 1.2	2/03/2022	Added console command for Raspberry Pi configuration
Ver 1.3	5/20/2022	Document overhaul
Ver 1.4	6/12/2023	Update for v1.4 SW package
Ver 1.5	8/16/2023	Added additional fixes to dtbo file for supporting kernel version 5.16 and higher.

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