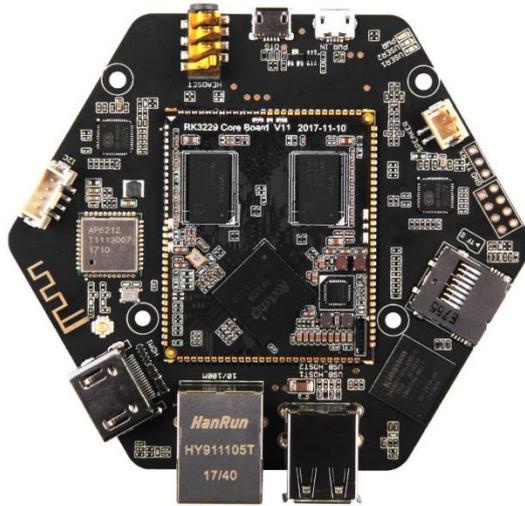


ReSpeaker Core v2.0 User Manual



Seed's ReSpeaker Core v2.0 is designed for voice interface applications. It is based on the Rockchip RK3229, a quad-core ARM Cortex A7, running up to 1.5GHz, with 1GB RAM. The board features a six microphone array with speech algorithms including DoA (Direction of Arrival), BF (Beam-Forming), AEC (Acoustic Echo Cancellation), etc.

ReSpeaker Core v2.0 runs a GNU/Linux operating system. It benefits from a powerful and active community allowing for the use of existing software and tools for development, testing, and deployment, enabling rapid product development.

ReSpeaker Core v2.0 is designed as a feature rich development board for businesses to evaluate. To this end the board consists of two main sections, the first being the center core module containing the CPU, Memory (RAM), and PMU. The second section is the outer carrier board which contains the peripherals such as the eMMC, connectors, and wireless connectivity components. Either section or both can be customized through Seed's customization services.

Features

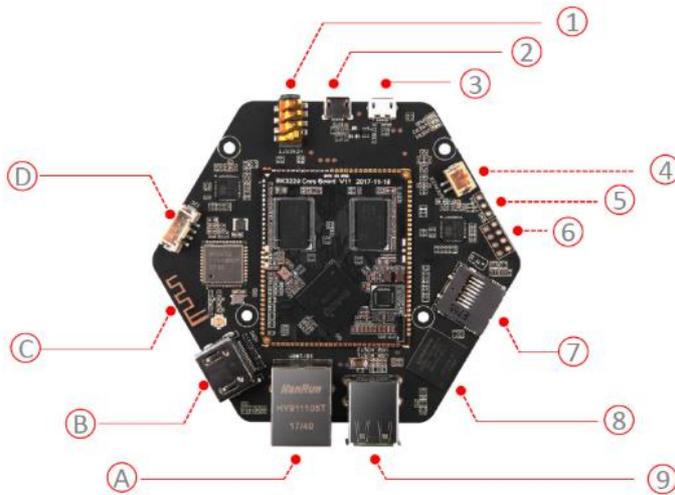
- All-in-One Solution with High Performance SoC
- 1GB RAM & 4GB eMMC
- 6 Microphone Array
- USB OTG, USB device
- WiFi b/g/n and Bluetooth V4.1 dual mode
- Detect range: ~5 meters
- Grove socket for other sensor
- 3.5mm audio jack & JST2.0 connector
- 8 channel ADCs for 6 microphone array and 2 loopback (hardware loopback)
- Debian-based Linux system
- C++ SDK and Python wrapper
- SDK for speech algorithm with Full documents
- Speech algorithms and features:

Specification

| | | |
|----------------------|--------------------------|---|
| Soc(Rockchip RK3229) | CPU | Quad-Core Cortex-A7, up to 1.5GHz |
| | GPU | Mali400MP, Support OpenGL ES1.1/2.0 |
| | Memory | 1GB RAM(Core Module includes RAM and PMU) |
| | System | Operating Voltage:3.6-5V 80 pins on-module PMU on-module |
| Peripheral | Networks | WiFi b/g/n; Bluetooth V4.1 dual mode; Ethernet |
| | USB | 2 x USB Host; 1 x USB OTG; 1 x USB power |
| | Grove | 1 x Grove socket (I2C and Digital) |
| | Vedio | HDMI 2.0 with HDCP 1.4/2.2, up to 4K/60Hz |
| | Audio | 6 Microphone Array; 3.5mm Audio Jack; JST2.0 Audio output connector |
| | Storage | 4GB eMMC on-board; SD slot |
| | Others | 12 x RGB LEDs; 8 GPIO pins |
| Power Consumption | Standby Mode | 200mA /5V |
| | Work with Algorithm Mode | 330mA /5V |

Hardware Overview

Interface and storage



- ① **3.5mm Headphone jack:** Output audio. You can plug active speakers or Headphones into this port.
- ② **USB OTG:** This USB Port is used to connect to your computer via serial mode of putty (or other serial tools).
- ③ **USB Power Input:** This port is used to provide power for Respeaker Core v2.0.
- ④ **Speaker Jack:** Output audio for passive speakers. 1st 2.0 Socket.
- ⑤ **UART:** You also can connect the ReSpeaker Core v2.0 with your computer via this UART port.
- ⑥ **8 Pins GPIO:** General Purpose Input Output interface for extended applications.
- ⑦ **SD Card Slot:** To plug in micro-SD card.
- ⑧ **eMMC:** You can burn the image into eMMC, so that the ReSpeaker Core v2.0 can boot from the eMMC.
- ⑨ **USB Host:** You can plug USB device, such as USB mouse, USB keyboard and USB flash disk.
- Ⓐ **Ethernet:** Access to the Internet.
- Ⓑ **HDMI:** Output video.
- Ⓒ **Bluetooth and WIFI Antenna:** The onboard Antenna is for WIFI and Bluetooth.
- Ⓓ **Grove Socket:** Grove Socket for digital or I2C

Attention

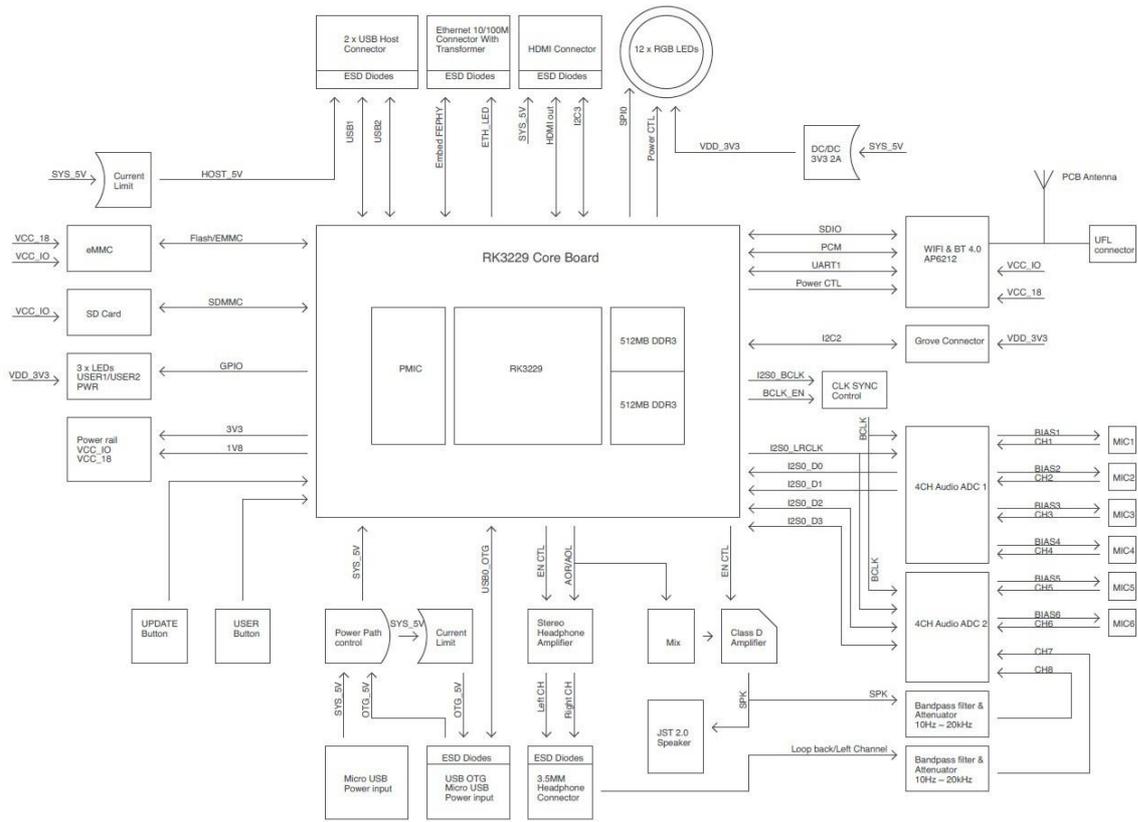
USB terminal output: loaded with 5 Vd.c. / 0.5 A x 2;

Speaker port: 4 Ω;

OTG port: 5 Vd.c. / 0.3 A;

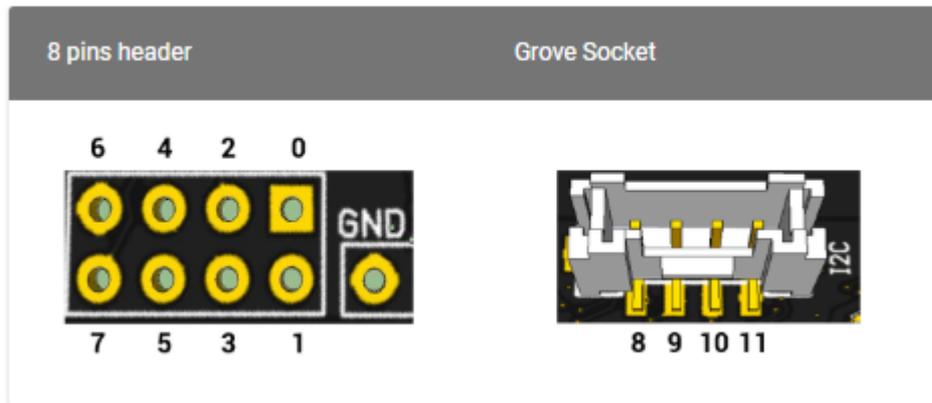
I2C port: 3.3 Vd.c., 0.2 A;

System Diagram



Pin Out

Pin index definition for headers



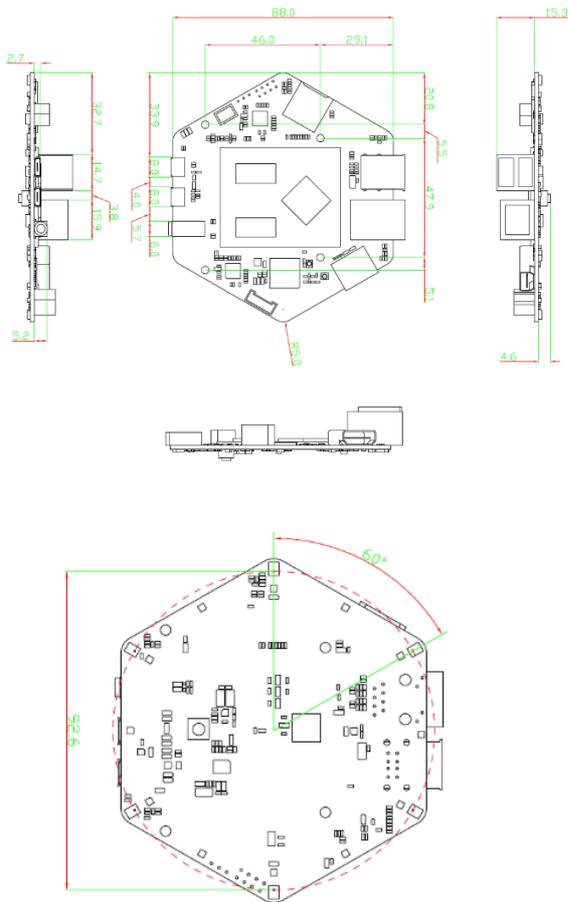
GPIO Pins

| MRAA | HEADER PIN INDEX | SYSFS PIN | RK3229 PIN |
|------|------------------|-----------|------------|
| 0 | 0 | 1091 | GPIO2_D3 |
| 1 | 1 | -- | VCC |
| 2 | 2 | 1043 | GPIO1_B3 |
| 3 | 3 | 1127 | GPIO3_D7 |
| 4 | 4 | 1017 | GPIO0_C1 |
| 5 | 5 | 1067 | GPIO2_A3 |
| 6 | 6 | -- | GND |
| 7 | 7 | 1013 | GPIO0_B5 |
| 8 | 8 | 1085 | GPIO2_C5 |
| 9 | 9 | 1084 | GPIO2_C4 |
| 10 | 10 | -- | VCC |
| 11 | 11 | -- | GND |

I2C Pins

| MRAA | HEADER PIN INDEX | SYSFS PIN | RK3229 PIN |
|------|------------------|-----------|------------|
| 0 | 8 | -- | I2C2_SCL |
| 0 | 9 | -- | I2C2_SDA |

Dim ensions



Applications

- Smart speaker
- Intelligent voice assistant systems
- Voice recorders
- Voice conferencing system
- Meeting communicating equipment
- Voice interacting robot
- Car voice assistant
- Other scenarios need voice command

Getting Started

Preparation

- How to install image
- How to access the serial console
- How to set up WiFi
- How to connect to SSH & VNC
- How to set up Bluetooth
- Audio record and play test

Prerequisites

- ReSpeaker Core V2.0
- Wi-Fi Network
- 4GB (or more) SD card and SD card reader
- PC or Mac
- [USB To Uart Adapter](#) (Optional)
- 5V 1A Micro USB adapter for power (Optional)
- two Micro-USB cables
- Grove Cable with ferrite

Note: the ferrite shall be placed within 10cm to ReSpeaker Core V2.

Caution

Please plug the USB cable gently, otherwise you may damage the interface. Please use the USB cable with 4 wires inside, the 2 wires cable can't transfer data. If you are not sure about the wire you have, you can click [here](#) to buy

Image Installation

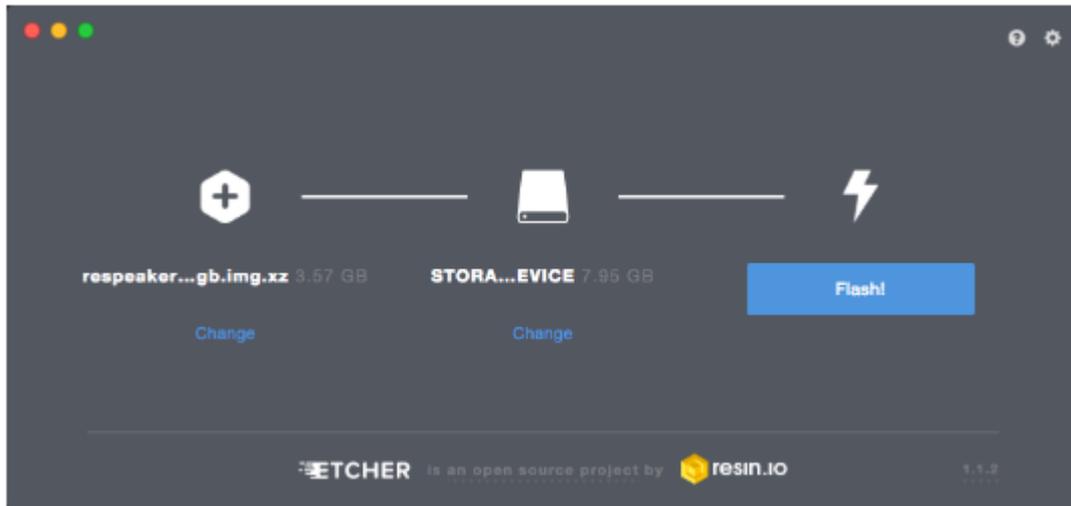
Similar to the Raspberry Pi, you need to install the ReSpeaker Core v2.0 image from an SD card to get up and running. We offer two ways to boot the Respeaker core v2.0. You can either boot from the SD card or boot from the eMMC

A. Boot from the SD card



- **Step 1.** Click the OneDrive icon above to download our latest image zip files: respeaker-debian-9-lxqt-sd-*****-4gb.img.xz or respeaker-debian-9-iot-sd-*****-4gb.img.xz.
- **Step 2.** Plug the SD card into your PC or MAC with an SD card reader. You need an SD card with a capacity of more than 4G.
- **Step 3.** Click to download Etcher here, and burn the *.img.xz file directly to your SD card with Etcher. Or unzip the *.img.xz file to a *.img file, then burn it to SD card with other image writing tools.

Click the Plus icon to add the image you just download, the software will automatically select the SD card you plug. Then click Flash! to start burning. It will take about 10 minutes to finish.



- **Step 4.** After writing the image to the SD card, insert the SD card in your ReSpeaker Core v2.0. Power the board using the PWR_IN micro usb port and DO NOT remove the SD card after powering on. ReSpeaker Core v2.0 will boot from the SD card, and you can see USER1 and USER2 LEDs light up. USER1 is typically configured at boot to blink in a heartbeat pattern and USER2 is typically configured at boot to light during SD card accesses. Now, you should go to the next part: Serial Console.

B. Boot from the eMMC

There is no firmware in the EMMC when leaving the factory, you can flash the ReSpeaker image files to the ReSpeaker's eMMC (onboard flash memory) by using your PC or Mac. Then the ReSpeaker will boot from it's eMMC (onboard flash memory) and not from the SD card.

- **Step 1.** Download our latest image zip file `respeaker-debian-9-iot-flasher-*****-4gb.img.xz` or `respeaker-debian-9-lxqt-flasher-*****-4gb.img.xz` at OneDrive. The lxqt version comes with Debian desktop and the iot version does not. And the flasher version is for flashing eMMC, and the sd version is for booting from SD card.
- **Step 2.** Burn the *.img.xz file directly to SD card with Etcher, or unzip the *.img.xz file to a *.img file, then burn it to SD card with other image writing tools.
- **Step 3.** After burning SD card, insert the SD card in the ReSpeaker Core v2.0. Power the board using the PWR_IN micro USB and do not remove the SD card while it's flashing.

During the flashing process, you'll see the USER1 and USER2 LEDs blink alternately. It will take about 10 minutes to complete. When the LEDs turn off, you can power off the board, pull out the SD card and power again. If the LEDs light up, that means the image was flashed to the eMMC correctly.

You can also check the image version with this command: `cat /etc/issue.net`.

Serial Console

Now your ReSpeaker Core v2.0 can boot, you might want to get access to the Linux system via a console, to setup the WiFi, etc. You have two ways to get the console:

- A. The OTG USB port - This requires a running Linux system on the board
- B. The UART port - This is the hard way to access the console, it can be used for debugging low level issues

Connection via OTG

- **Step 1.** Find a micro USB cable, and please make sure it's a data cable (not just a power cable), plug the micro USB end to the ReSpeaker's **OTG** micro USB port (There're two micro USB ports on the ReSpeaker board, which are labeled with different silk-screen, one is **PWR_IN** and another is **OTG**), then plug another end of this cable into your computer.



- **Step 2.** Check at your computer if the serial port has risen:
 - Windows: check the device manager, there should be new serial device named COMx which x is an increasing number. If you use windows XP/7%, maybe you need install [windows CDC drivers](#).
 - Linux: `ls /dev/ttyACM*`, you should get `/dev/ttyACMx` where x will vary depending on which USB port you used.
 - Mac: `ls /dev/cu.usb*`, you should get `/dev/cu.usbmodem14xx` where xx will vary depending on which USB port you used.
- **Step 3.** Use your favorite serial debugging tool to connect the serial port, the serial has: 115200 baud rate, 8Bits, Parity None, Stop Bits 1, Flow Control None. For examples:
 - Windows: use [PUTTY](#), select Serial protocol, fill in the correct COM port of ReSpeaker Core v2.0, 115200 baud, 8Bits, Parity None, Stop Bits 1, Flow Control None.
 - Linux: Depend on your USB To TTL Adapter, it could be `screen /dev/ttyACM0(,1, and so on) 115200` or `screen /dev/ttyUSB0(,1, and so on) 115200`
 - Mac: Depend on your USB To TTL Adapter, it could be `screen /dev/cu.usbserial1412(,1422, and so on) 115200` or `screen /dev/cu.usbmodem1412(,1422, and so on) 115200`
- **Step 4.** The default user name is `respeaker`, and password is `respeaker` too.

Connection via The UART port

In this section we will guide you how to establish a connection from your computer to your ReSpeaker using your USB to TTL adapter which will be connected to the ReSpeaker's Uart port (Uart port located just to the left of the ReSpeaker speaker plug).

- **Step 1.** Connect Uart port and your PC/Mac with an USB To TTL Adapter. Note that the voltage of RX/TX are 3.3V. If you don't have an USB To TTL Adapter, you can click [here](#) to get one.
- **Step 2.** Use the following Serial debugging tools with 115200 baud:
 - Windows: use [PUTTY](#), select Serial protocol, fill in the correct COM port of ReSpeaker Core v2.0, 115200 baud, 8Bits, Parity None, Stop Bits 1, Flow Control None.
 - Linux: Depend on your USB To TTL Adapter, it could be `screen /dev/ttyACM0(,1, and so on) 115200` or `screen /dev/ttyUSB0(,1, and so on) 115200`.
 - Mac: Depend on your USB To TTL Adapter, it could be `screen /dev/cu.usbserial1412(,1422, and so on) 115200` or `screen /dev/cu.usbmodem1412(,1422, and so on) 115200`.
- **Step 3.** The login user name is `respeaker`, and password is `respeaker` too.
- **Step 4.** If you do not have a USB to TTL Adapter, you may also use an Arduino. If using an Arduino, connect one end of a jumper wire to the RESET pin on the Arduino and the other end to the GND pin on the Arduino. This will bypass your Arduino's ATMEGA MCU and turn your Arduino into a USB to TTL adapter, see video tutorial [here](#). Now connect the GND pin on the Arduino to the GND pin on the Uart port of the Respeaker. Connect the Rx pin on the Arduino to the Rx pin on the Uart port of the Respeaker. Connect the Tx pin on the Arduino to the Tx pin on the Uart port of the Respeaker. And lastly, connect the Arduino to your PC/Mac via the Arduino's USB cable. Now check that your Mac or Linux PC finds your Arduino by typing this command.

`ls /dev/cu.usb* (Mac)`

`ls /dev/ttyACM* (Linux)`

You should get back something like:

`/dev/cu.usbmodem14XX` where XX will vary depending on which USB port you used (on Mac)

`/dev/ttyACMX` where X will vary depending on which USB port you used (on Linux)

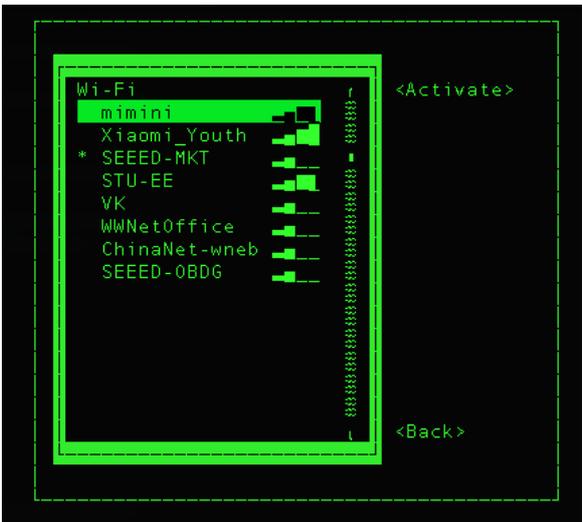
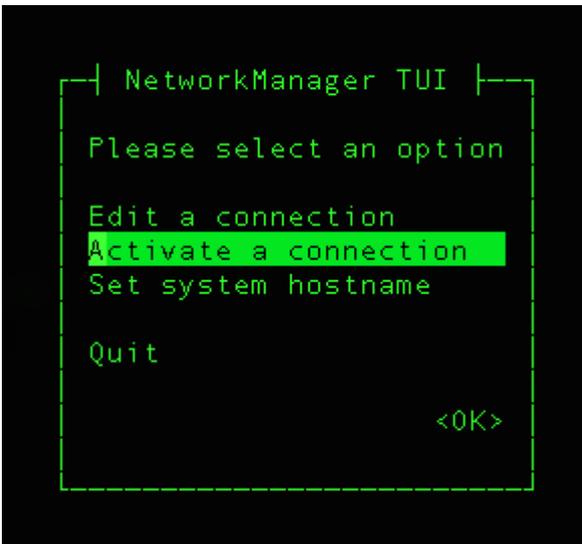
Now follow step 2 above to connect to your Respeaker over this serial connection. And note this is a one time procedure as you'll next setup your Respeaker for Wi-Fi connectivity and then connect via ssh or VNC going forward.

Network Setting Up

A.Wi-Fi Setting Up

Configure your ReSpeaker's network with the Network Manager tool, nmtui. nmtui will already be installed on the ReSpeaker image.

```
respeaker@v2:~$ sudo nmtui # respeaker user needs sudo
```



Select your Wi-Fi for ReSpeaker v2.0, and type your Wi-Fi password and press Enter Key again.

When you see a “*” mark, it means that your ReSpeaker has successfully connected to your Wi-Fi network.

Now find the IP address of your ReSpeaker by using the command below.

```

root@v2:/home/respeaker# ip address
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: sit0@NONE: <NOARP> mtu 1480 qdisc noop state DOWN group default qlen 1
    link/sit 0.0.0.0 brd 0.0.0.0
3: wlan0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default
    link/ether e0:76:d0:37:38:6d brd ff:ff:ff:ff:ff:ff
    inet **192.168.7.108**/24 brd 192.168.7.255 scope global dynamic wlan0
        valid_lft 604332sec preferred_lft 604332sec
    inet6 2601:647:4680:ebf0:ec0a:5965:e710:f329/64 scope global noprefixroute dynamic
        valid_lft 345598sec preferred_lft 345598sec
    inet6 fe80::64de:cac8:65ef:aac8/64 scope link
        valid_lft forever preferred_lft forever

```

In addition to the Network Manager GUI interface, Network Manager also has a command line tool. If you are connecting to a hidden Wi-Fi network, you'll need to use this command line tool:

```

nmcli c add type wifi con-name mywifi ifname wlan0 ssid your_wifi_ssid
nmcli con modify mywifi wifi-sec.key-mgmt wpa-psk
nmcli con modify mywifi wifi-sec.psk your_wifi_password
nmcli con up mywifi

```

B. Ethernet Connectivity

You can connect to a network using an Ethernet cable. Just plug the Ethernet cable which has connected to the Internet will be OK.

B. Connect to Speaker or Headset

The board uses the built-in codec of the SOC to render playback. Both the JST speaker port and the headset port are driven by their own amplifier, and both amplifiers are connected to the same codec of the SOC. The sound card driver that SEEED implemented drives both the capture device and the playback device. So there's no discrete capture or playback sound card in ALSA device list. They're all named `seed-8mic-voicecard`.

The simplest way to heard sound from the board is to plug in a headset. If you prefer loud speaker, the board can output up to 8W of drive capability.

C. Bluetooth Setting Up

Activate the Bluetooth

Please tap the commands below to update and activate the Bluetooth of ReSpeaker Core v2.0:

```

sudo apt update
sudo apt upgrade

```

Then activate the bluetooth by the command:

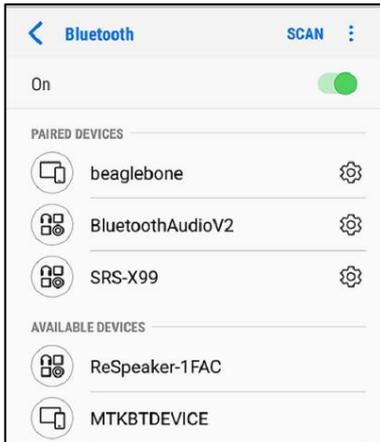
```

sudo systemctl enable bt-auto-connect.service
sudo reboot -f

```

Using the ReSpeaker Core v2.0 as a Bluetooth Speaker-Slave Device

When the ReSpeaker Core v2.0 restart, open the bluetooth of your phone or computer, you will find a bluetooth device called **ReSpeaker-xxxx**. Choose and connect to it. Plug a speaker or headset into the ReSpeaker Core v2.0 then play music and enjoy your bluetooth speaker.



Using the ReSpeaker Core v2.0 as a Bluetooth Player-Master Device

In addition to just working as a bluetooth speaker, it can also serve as a bluetooth player to hack your bluetooth headset or bluetooth speaker. OK, let's hacking.

- **Step 1.** Tap `bluetoothctl` to open the bluetooth shell.
- **Step 2.** Tap scan on to scan your bluetooth device.
- **Step 3.** When the ReSpeaker Core v2.0 find your target device, tap scan off. For this wiki, say, MDR-1000X headset is our target, mark the device ID Device 04:5D:4B:81:35:84.

```
respeaker@v2:~$ bluetoothctl
[NEW] Controller 43:43:A0:12:1F:AC ReSpeaker-1FAC [default]
Agent registered
[bluetooth]# scan on
Discovery started
[CHG] Controller 43:43:A0:12:1F:AC Discovering: yes
[NEW] Device C8:69:CD:BB:9B:B3 C8-69-CD-BB-9B-B3
[NEW] Device E1:D9:68:0E:51:C0 MTKBTDEVICE
[NEW] Device 62:15:9C:3F:40:AA 62-15-9C-3F-40-AA
[NEW] Device 56:AF:DE:C0:34:25 56-AF-DE-C0-34-25
[NEW] Device B8:86:87:99:FB:10 SOLARRAIN
[CHG] Device B8:86:87:99:FB:10 Trusted: yes
[NEW] Device 04:5D:4B:81:35:84 MDR-1000X
[CHG] Device 04:5D:4B:81:35:84 Trusted: yes
[CHG] Device 4C:04:59:38:D3:25 ManufacturerData Key: 0x004c
[CHG] Device 4C:04:59:38:D3:25 ManufacturerData Value:
    10 05 0b 10 99 18 0a          .....
[bluetooth]# scan off
[CHG] Device 04:5D:4B:81:35:84 RSSI is nil
[CHG] Device B8:86:87:99:FB:10 TxPower is nil
[CHG] Device B8:86:87:99:FB:10 RSSI is nil
[CHG] Device 4C:04:59:38:D3:25 RSSI is nil
[CHG] Device 58:44:98:93:35:24 RSSI is nil
Discovery stopped
[bluetooth]#
```

- **Step 4.** Now using the command `pair + device ID` to match bluetooth device with the ReSpeaker Core v2.0.
- **Step 5.** When you see the message Pairing successful, tap `connect + device ID`.

```
[bluetooth]# pair 04:5D:4B:81:35:84
Attempting to pair with 04:5D:4B:81:35:84
[CHG] Device 04:5D:4B:81:35:84 Connected: yes
[CHG] Device 04:5D:4B:81:35:84 UUIDs: 00001108-0000-1000-8000-00805f9b34fb
[CHG] Device 04:5D:4B:81:35:84 UUIDs: 0000110b-0000-1000-8000-00805f9b34fb
[CHG] Device 04:5D:4B:81:35:84 UUIDs: 0000110c-0000-1000-8000-00805f9b34fb
[CHG] Device 04:5D:4B:81:35:84 UUIDs: 0000110e-0000-1000-8000-00805f9b34fb
[CHG] Device 04:5D:4B:81:35:84 UUIDs: 0000111e-0000-1000-8000-00805f9b34fb
[CHG] Device 04:5D:4B:81:35:84 ServicesResolved: yes
[CHG] Device 04:5D:4B:81:35:84 Paired: yes
Pairing successful
[CHG] Controller 43:43:A0:12:1F:AC Discoverable: no
[CHG] Device 04:5D:4B:81:35:84 ServicesResolved: no
[CHG] Device 04:5D:4B:81:35:84 Connected: no
[CHG] Controller 43:43:A0:12:1F:AC Discoverable: yes
[bluetooth]# connect 04:5D:4B:81:35:84
Attempting to connect to 04:5D:4B:81:35:84
[CHG] Device 04:5D:4B:81:35:84 Connected: yes
Connection successful
[CHG] Device 04:5D:4B:81:35:84 ServicesResolved: yes
[CHG] Controller 43:43:A0:12:1F:AC Discoverable: no
[MDR-100X]#
```

If Connection successful pops up, configuration!

Notice to Host Manufacturer

Host Manufacturer who integrate this transmitter into a non-accessible enclosure, it's acceptable to label the device with the FCC identifier such as "This product contains transmitter FCC ID Z4T-RESPEAKERV2." to avoid duplicated FCC Equipment Authorization Procedure when following conditions are satisfied:

- The transmitter is limited to installation in mobile application, a separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093.
- No any modifications done to the transmitter when the end-user device integrate this transmitter into it.
- Only antennas already approved with this device are used, and shall be in accordance with all grant conditions and installation requirements.
- Host manufacturer shall apply SDoC testing to ensure that the device still complies corresponding FCC Rules. SDoC compliance statement set out in Section 2.1077 shall be implemented properly.
- Host manufacturer provides appropriate Part 15 user and labeling information including any appropriate RF exposure warnings:

Labeling Instruction for End User Device Integrator

Section 15.19 Labelling requirements shall be complied on end user device. Integrator shall bear the following statement in a conspicuous location on the device:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Labelling rules for special device(too small or limitation of nature, please refer to §2.925, § 15.19 (a)(5). For E-label, please refer to §2.935.

Instruction for indicating compliance info in End-user Device manual

Information to user required in Section 15.105 and Section 15.21 shall be included in user's manual or instruction manual of Final product properly.

FCC regulatory compliance information

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Warning: changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Manufacturer Information

Company Name: Seeed Technology Co., Ltd.

Company Address: 1F, Tower B, Building 2, Shanshui Building, NanshanYungu Innovation
Industry Park, Liuxian Ave, Nanshan District, Shenzhen, Guangdong, PRC.

Zip: 518055

Tel: 0086 755 86524359

Fax: 0086 755 26978025