



Test Plan

Louder-ESP32

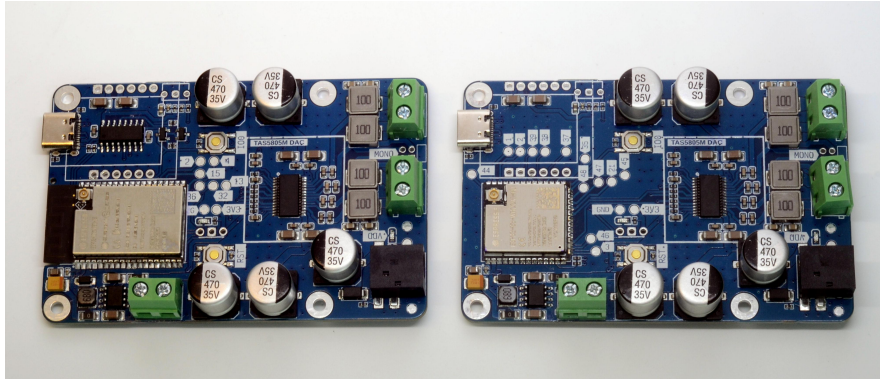
(TD-ESP-AUDIO-LOUDER)

Louder-ESP32S3

(TD-ESP-AUDIO-LOUDER-S3)



Louder-ESP32 and Louder-ESP32S3



<https://sonocotta.com/>

<https://github.com/sonocotta/esp32-audio-dock>

Introduction

Louder-ESP32 and Louder-ESP32S3 are audio development boards based on Espressif ESP32 MCU and Texas Instruments TAS5805M I2S DAC. Core of the board is a combination of powerful MCU and capable DAC and all the power and auxiliary circuitry to make it work. But on top of that boards have few external interfaces that extend usage scenarios of the boards.

Hardware highlights

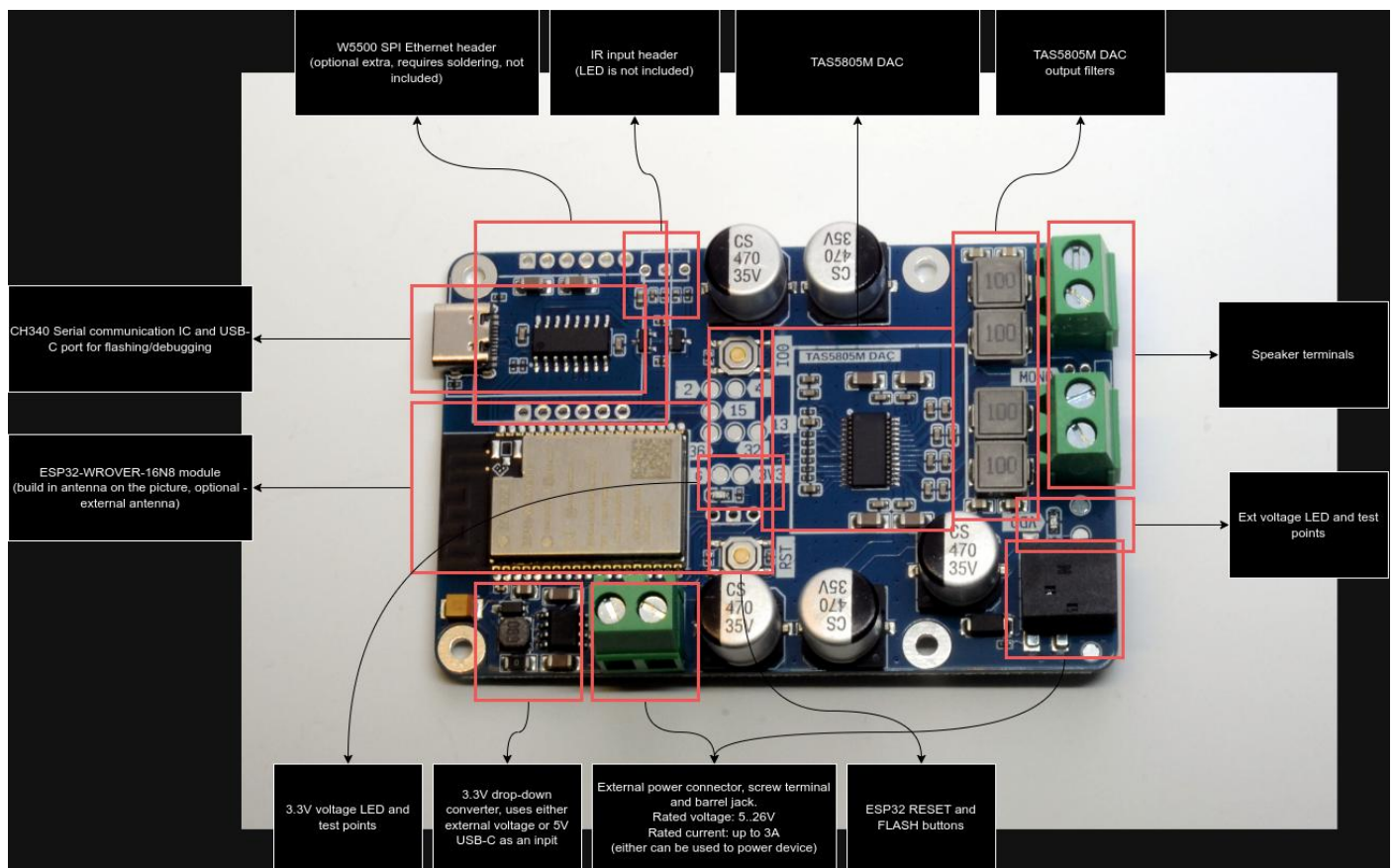
MCU Core and audio

- ESP32 Dual Core 32-bit LX6/LX7 microprocessor running at 240 MHz
- 16MB (Louder) of flash storage
- 8MB of PSRAM
- Stereo I2S DAC TAS5805M with built in D-Class amp

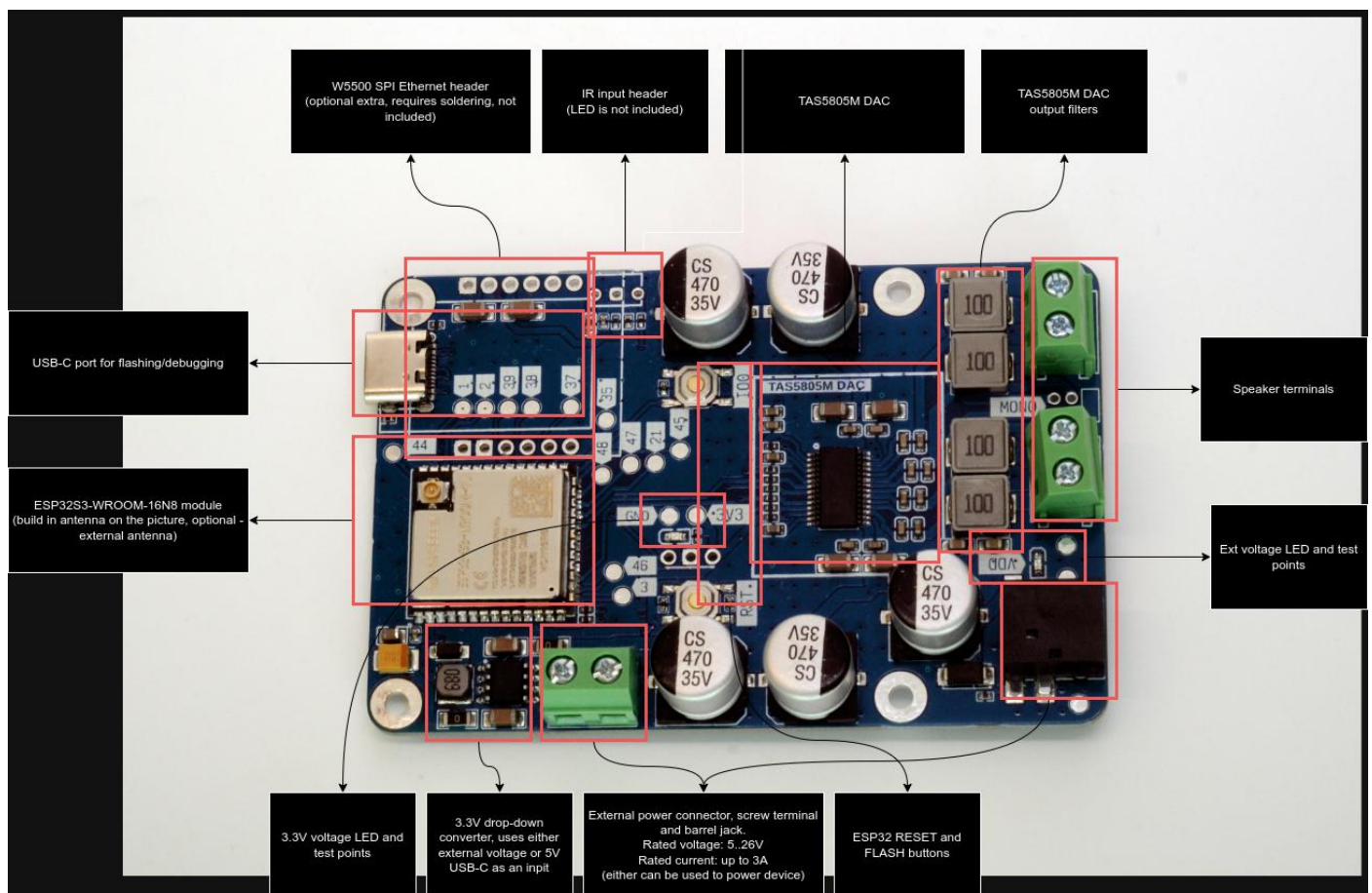
Peripheral

- Wi-Fi: 802.11 b/g/n
- Bluetooth: v4.2 (ESP32) and Bluetooth 5 (LE) (ESP32-S3)
- External 2.4G Antenna for better perception
- IR reader header (optional via header)
- RGB led header (optional via header)
- Wiznet W5500 SPI Ethernet (optional via header)
- SSD1306 128x64 OLED screen connector (soldering required, screen is not included)

Louder- ESP32



Louder-ESP32S3



Test tools

- Louder-ESP32 / Louder-ESP32S3 board
- DC Power Supply 12..20V/3A with barrel jack output (5.5mm/2.5mm pin positive)
- USB cable type C
- Pair of 4-8 Ohm speakers, 3W or above
- Ubuntu Laptop with esp-idf tools installed (refer to Espressif [getting started documentation](#))

To test the boards connectivity you need an WiFi access point with PSA/PSA2 security and appropriate credentials

Test Plan

0. Visual inspection

- Inspect boards for fabrication defects, specifically to monitor solder bridges, bad soldering, misplaced or missing components.

Boards with any of the above defects can be considered for repair (whenever possible) and re-testing.

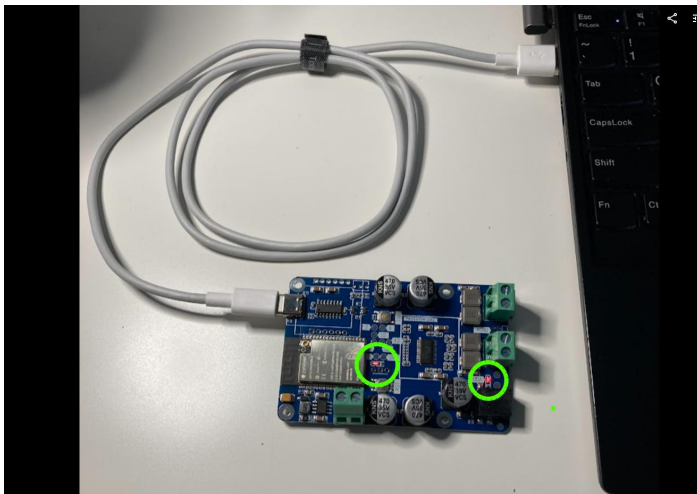
1. Basic voltage tests

Setup

Connect the board to the laptop using the USB-C cable

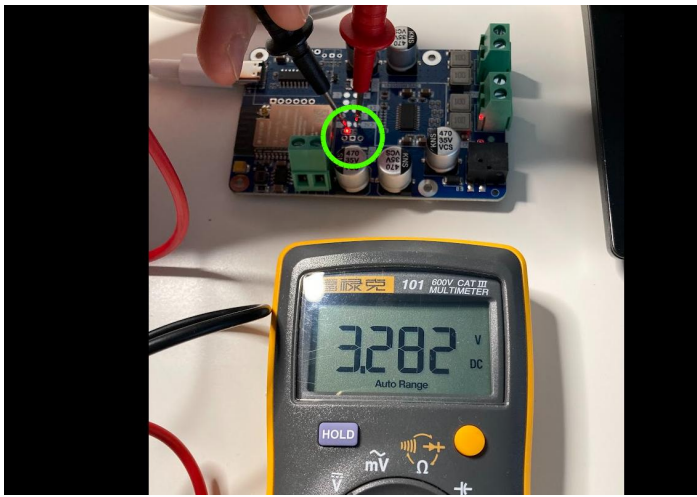
Assert

3.3V LED should light up red
VDD voltage Led should light up red



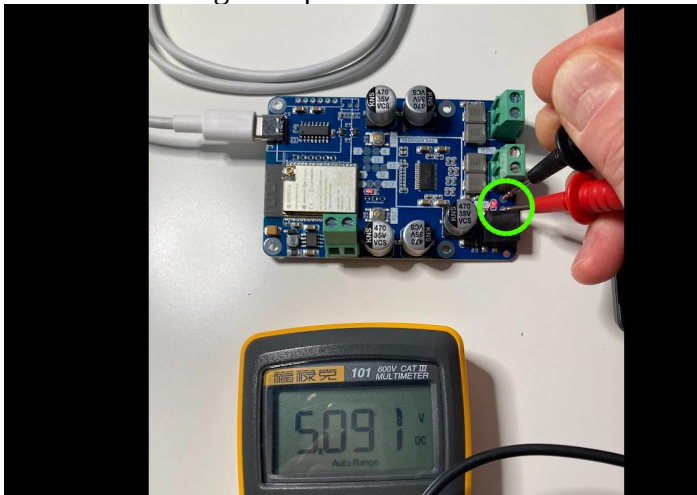
Test 3.3V line

It should measure 3.3V with 5% tolerance



Test VDD voltage test point

It should measure 3.3V with 5% tolerance



Verify Serial connection over USB by running command in the console
`ls -al /dev/ttyUSB*`

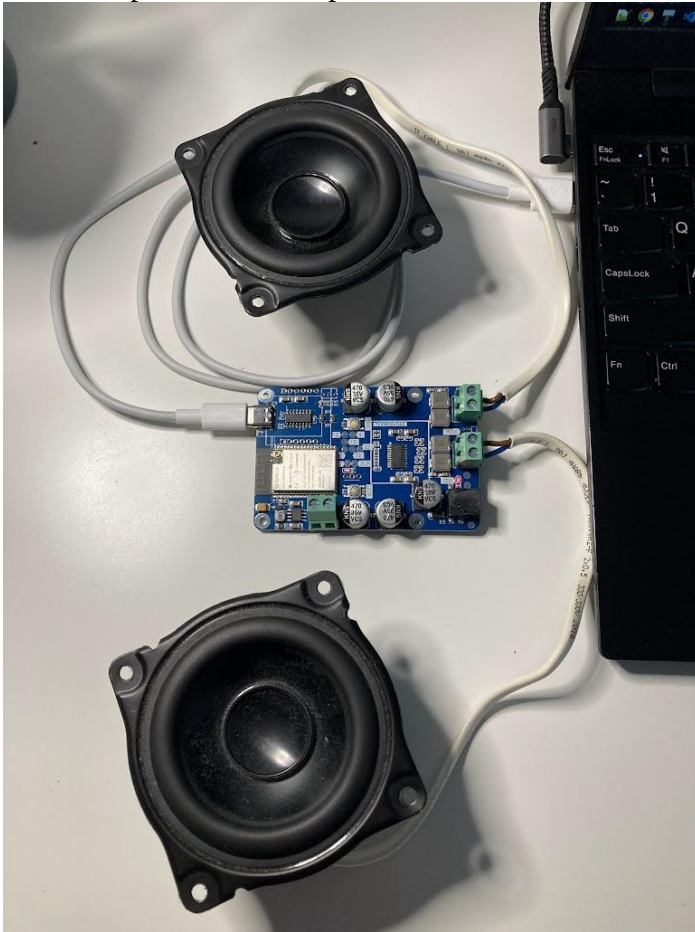
Device should be detected by laptop as serial device

```
amalyshenko@LPT00432: ~  
amalyshenko@LPT00432: ~$ ls -al /dev/ttyUSB*  
crw-rw-rw-+ 1 root dialout 188, 0 sty  9 12:03 /dev/ttyUSB0  
amalyshenko@LPT00432: ~$
```

2. Audio tests

Setup

Connect speakers to the speaker terminals



Assert

Flash test firmware package using the following command

```
esptool.py --chip esp32 --port "/dev/ttyUSB0" --baud 460800 --before default_reset --after hard_reset write_flash -z --flash_mode dio --flash_freq 40m --flash_size 4MB 0x1000 bootloader.bin 0x8000 partitions.bin 0xe000 boot_app0.bin 0x10000 firmware.bin
```

Flashing should run without error

```
Auto-detected: /dev/ttyUSB0
"/home/amalysenko/.platformio/penv/bin/python" "/home/amalysenko/.platformio/packages/tool-esptoolpy/esptool.py" --chip esp32 --port /dev/ttyUSB0 --baud 460800 --before default_reset --after hard_reset write_flash -z --flash_mode dio --flash_freq 40m --flash_size 4MB 0x1000 /home/amalysenko/prj/esp32-audio-dock/firmware/esp32-125-b-audio-dock/esp32-audio-dock/firmware/esp32-125-b-audio-dock/esp32-125-bare-pio/build/loader-lolin_d1_mini_32/partitions.bin 0xe000 /home/amalysenko/.platformio/penv/bin/python "/home/amalysenko/.platformio/packages/tool-esptoolpy/esptool.py" --chip esp32 --port /dev/ttyUSB0 --baud 460800 --before default_reset --after hard_reset write_flash -z --flash_mode dio --flash_freq 40m --flash_size 4MB 0x1000 bootloader.bin 0x8000 partitions.bin 0xe000 boot_app0.bin 0x10000 firmware.bin
esptool.py v4.5.1
Serial port /dev/ttyUSB0
Connecting.....
Chip is ESP32-D0W0-V2 (revision v3.1)
Features: WiFi, BT, Dual Core, 240MHz, VRef calibration in efuse, Coding Scheme None
Crystal is 40MHz
MAC: d8:ef:76:79:98:b4
Uploading stub...
Running stub...
Stub running...
Changing baud rate to 460800
Changed.
Configuring flash size...
Flash will be erased from 0x00001000 to 0x00005fff...
Flash will be erased from 0x00008000 to 0x0000ffff...
Flash will be erased from 0x0000e000 to 0x0000ffff...
Flash will be erased from 0x00010000 to 0x0005cfff...
Compressed 17488 bytes to 12168...
Writing at 0x00001000... (100 %)
Wrote 17488 bytes (12168 compressed) at 0x00001000 in 0.5 seconds (effective 256.3 kbit/s)...
Hash of data verified.
Compressed 3072 bytes to 146...
Writing at 0x00008000... (100 %)
Wrote 3072 bytes (146 compressed) at 0x00008000 in 0.1 seconds (effective 441.0 kbit/s)...
Hash of data verified.
Compressed 8192 bytes to 47...
Writing at 0x0000e000... (100 %)
Wrote 8192 bytes (47 compressed) at 0x0000e000 in 0.1 seconds (effective 610.2 kbit/s)...
Hash of data verified.
Compressed 31360 bytes to 174265...
Writing at 0x00010000... (9 %)
Writing at 0x00010330... (18 %)
Writing at 0x00024204... (27 %)
Writing at 0x00029448... (36 %)
Writing at 0x0002e68c... (45 %)
Writing at 0x00034885... (54 %)
Writing at 0x00039f84... (63 %)
Writing at 0x0004242a... (72 %)
Writing at 0x0004e294... (81 %)
Writing at 0x000537c0... (90 %)
Writing at 0x000556d0... (100 %)
Wrote 31360 bytes (174265 compressed) at 0x00010000 in 4.0 seconds (effective 631.6 kbit/s)...
Hash of data verified.
Leaving...
Hard resetting via RTS pin...
[SUCCESS] Took 9.27 seconds
```

Validate tone sound from both speakers

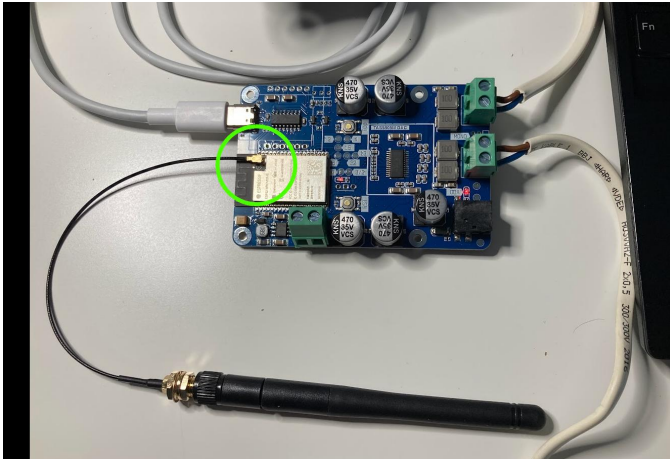
Speakers should emit clean tone sound at 500 Hz (square wave).

3. Firmware flashing and connectivity validation

Setup

[ONLY EXTERNAL ANTENNA VERSION]

Connect external antenna to the board



Assert

Flash squeezelite-esp32 firmware with hardware configuration and WiFi credentials baked into firmware using following command

```
esptool.py 460800 /dev/ttyUSB0 --chip esp32 --before=default_reset --after=hard_reset write_flash --flash_mode qio --flash_freq 80m --flash_size 4MB \
0x1000 firmware/master-v4.3-I2S-4MFlash-2.1670-16-bootloader.bin \
0x8000 firmware/master-v4.3-I2S-4MFlash-2.1670-16-partition-table.bin \
0x9000 firmware/common-esp-nvs.bin \
0xd000 firmware/master-v4.3-I2S-4MFlash-2.1670-16-ota_data_initial.bin \
0x10000 firmware/master-v4.3-I2S-4MFlash-2.1670-16-recovery.bin \
0x150000 firmware/master-v4.3-I2S-4MFlash-2.1670-16-squeezelite.bin \
0x3f0000 firmware/louder-esp32-settings.bin
```

Connect serial console to the board check the output logs. Reboot the board by pressing the RESET button

Flashing should run without error

```
Flashing firmware...
esptool.py v4.7.0
Serial port /dev/ttyUSB0
Connecting...
Chip is ESP32-D0W0-V3 (revision v3.1)
Features: WiFi, BT, Dual Core, 240MHz, VREF calibration in efuse, Coding Scheme None
Crystal is 40MHz
MAC: db-ef-76-79-98-b4
Uploading stub...
Running stub...
Stub running...
Changing baud rate to 921600
Changed.
Configuring flash size...
Flash will be erased from 0x00001000 to 0x00007fff...
Flash will be erased from 0x00008000 to 0x0000ffff...
Flash will be erased from 0x00009000 to 0x0000ffff...
Flash will be erased from 0x00009000 to 0x0000ffff...
Flash will be erased from 0x00100000 to 0x0012efff...
Flash will be erased from 0x00150000 to 0x0035ffff...
Flash will be erased from 0x00310000 to 0x0037ffff...
Warning: Image file at 0x3900 is protected with a hash checksum, so not changing the flash mode setting. Use the --flash_mode=keep option instead of --flash to generate an image file without a hash checksum
Wrote 26496 bytes (16645 compressed) at 0x00001000 in 0.6 seconds (effective 358.8 kbit/s)...
Hash of data verified.
Compressed 3072 bytes to 158...
Wrote 3072 bytes (159 compressed) at 0x00008000 in 0.1 seconds (effective 472.7 kbit/s)...
Hash of data verified.
Compressed 16384 bytes to 1908...
Wrote 16384 bytes (1908 compressed) at 0x00009000 in 0.2 seconds (effective 617.3 kbit/s)...
Hash of data verified.
Compressed 8192 bytes to 31...
Wrote 8192 bytes (31 compressed) at 0x00009000 in 0.1 seconds (effective 786.4 kbit/s)...
Hash of data verified.
Compressed 130272 bytes to 867997...
Wrote 130272 bytes (867997 compressed) at 0x00100000 in 12.9 seconds (effective 810.9 kbit/s)...
Hash of data verified.
Compressed 2643840 bytes to 1743792...
Wrote 2643840 bytes (1743792 compressed) at 0x00150000 in 25.7 seconds (effective 821.2 kbit/s)...
Hash of data verified.
Compressed 65536 bytes to 1660...
Wrote 65536 bytes (1660 compressed) at 0x003f0000 in 0.4 seconds (effective 1469.4 kbit/s)...
Hash of data verified.
Leaving...
Hard resetting via RTS pin...
```

Board should boot up within around 3 seconds.

It should not go into boot loop.

In few seconds it should connect to the WiFi network and receive IP address automatically from DHCP server


```

I (2414) display: No display driver
I (2420) esp_app_main: Initialization led was not configured
I (2424) led_w: led_w: configuration invalid
I (2425) esp_app_main: Checking for update OK
W (2430) config: value not found for key boot
I (2434) uart: queue free space: 3
W (2454) config: value not found for key update
I (2454) network_handlers: Network manager configuration: polling max 10176, polling min 15000, ap_delay 20000, dhcp_timeout 8000, eth_timeout 8000
I (2470) http_server: Initializing HTTP Server
I (2480) network_handlers: Running recovery, skipping ethernet, starting WiFi
I (2484) wifi:wifi driver task: 3ffc98bc, prio:23, stack:6656, core=0
I (2494) wifi:wifi firmware version: 8cc6d1
I (2494) wifi:wifi certification version: V7.0
I (2504) wifi:config NVS flash: enabled
I (2504) wifi:config name formatting: disabled
I (2508) wifi:init data frame dynamic rx buffer num: 40
I (2518) wifi:init management frame dynamic rx buffer num: 40
I (2514) wifi:link management short buffer num: 32
I (2524) wifi:init static tx buffer num: 12
I (2524) wifi:init tx cache buffer num: 32
I (2534) wifi:init static rx buffer size: 1600
I (2534) wifi:init static rx buffer num: 12
I (2544) wifi:init dynamic rx buffer num: 40
I (2544) wifi:init: tcpip mbox: 32
I (2554) wifi:init: udp mbox: 32
I (2554) wifi:init: tcp mbox: 32
I (2554) wifi:init: tcp rx win: 8192
I (2554) wifi:init: tcp rx win: 32768
I (2564) wifi:init: tcp mss: 1440
I (2564) wifi:init: wifi firmware data: SP310M
I (2574) network_wifi: Starting wifi
I (2574) esp_app_main: esp_app_main: init: task ID 2021, 17:07:07
I (2664) wifi:mode = sta (0befe7679:9b:84)
I (2664) wifi:enable wdt

I (2864) network_handlers: Existing wifi config found. Attempting to connect.
I (2674) network: Starting DHCP client
I (2674) network_wifi: WiFi Connecting to wifi-12-private
*****
This mode is used to flash Squeezelite into the OTA partition
*****
Type 'help' to get the list of commands.
Use UP/DOWN arrows to navigate through command history.
Press TAB when typing command name to auto-complete.

*****
Your terminal application does not support escape sequences.
Line editing and history features are disabled.
On Windows, try using PTTY instead.
*****
recovery-squeezelite-esp32-1 (5884) wifi:new=0,0,0, old=<1,0>, ap=<255,255>, sta=<0,0>, prof:1
I (5814) wifi:state: init -> auth (0b)
I (5814) wifi:state: auth -> assoc (0)
I (5824) wifi:state: assoc -> run (1b)
I (5834) wifi:connected with wifi-12-private, bssid = 08:f3:c1:88:5e:40
I (5834) wifi:security: WPA2-PSK, phy: bgn, rssi: -54
I (5844) wifi:pm_start_type: 1

I (5854) network: Got an IP address from Interface WiFi, IP=192.168.1.154, Gateway=192.168.1.3, NetMask=255.255.255.0, Address was changed
I (5864) esp_netif_handlers: sta ip: 192.168.1.154, mask: 255.255.255.0, gw: 192.168.1.3
I (5874) esp_app_main: Network connected and mode initialized with loader-esp32
I (5884) squeezelite-ota: sending LMS discovery for OTA update
I (5794) wifi:AP's beacon interval = 102400 us, DTIM period = 2
I (5864) squeezelite-ota: sending LMS discovery for OTA update
I (5868) squeezelite-ota: sending LMS discovery for OTA update
I (5884) squeezelite-ota: sending LMS discovery for OTA update

```

4. External power test

Setup

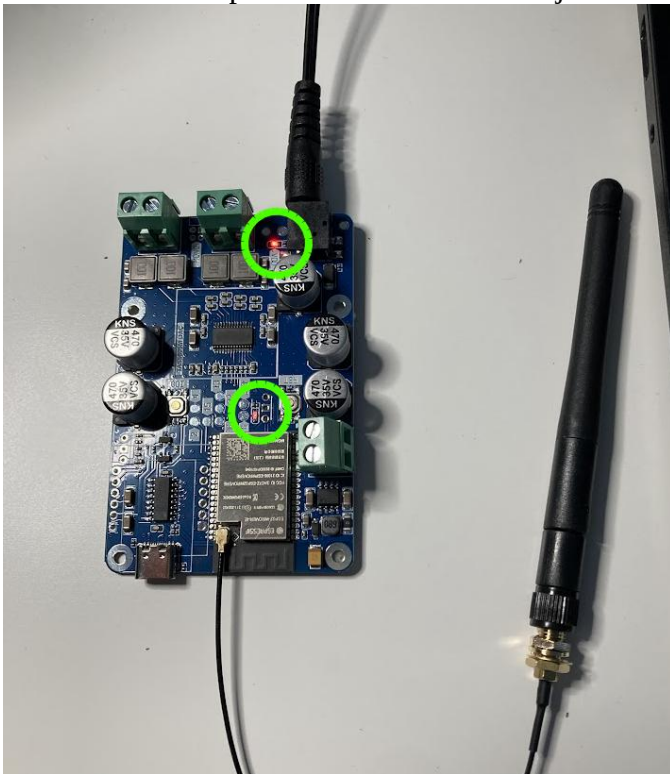
Disconnect speakers and USB cable.

Connect external power source with barrel jack

Assert

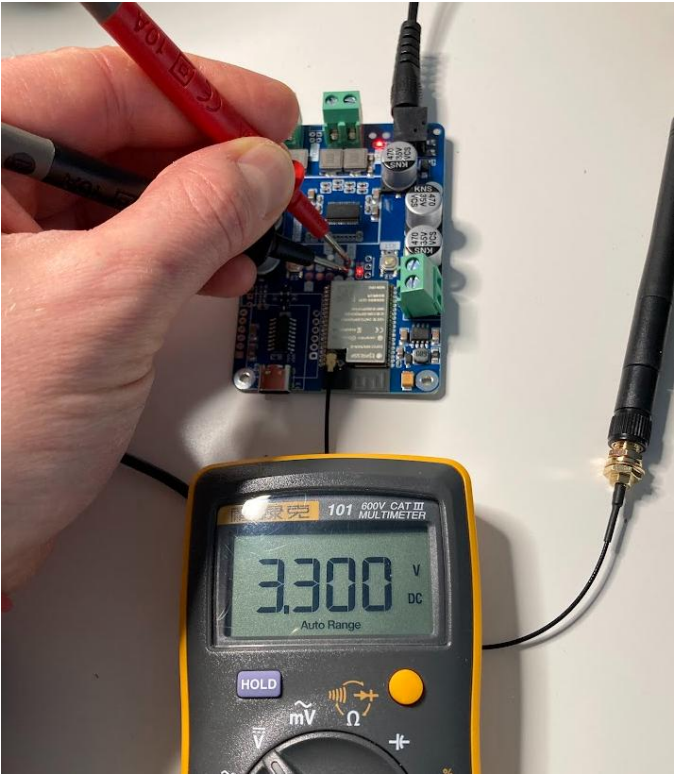
3.3V LED should light up red

VDD voltage LED should light up bright red



Check 3.3V voltage level

It should measure 3.3V with 5% tolerance



Check VDD voltage line

It should show external voltage (12V..20V)

