



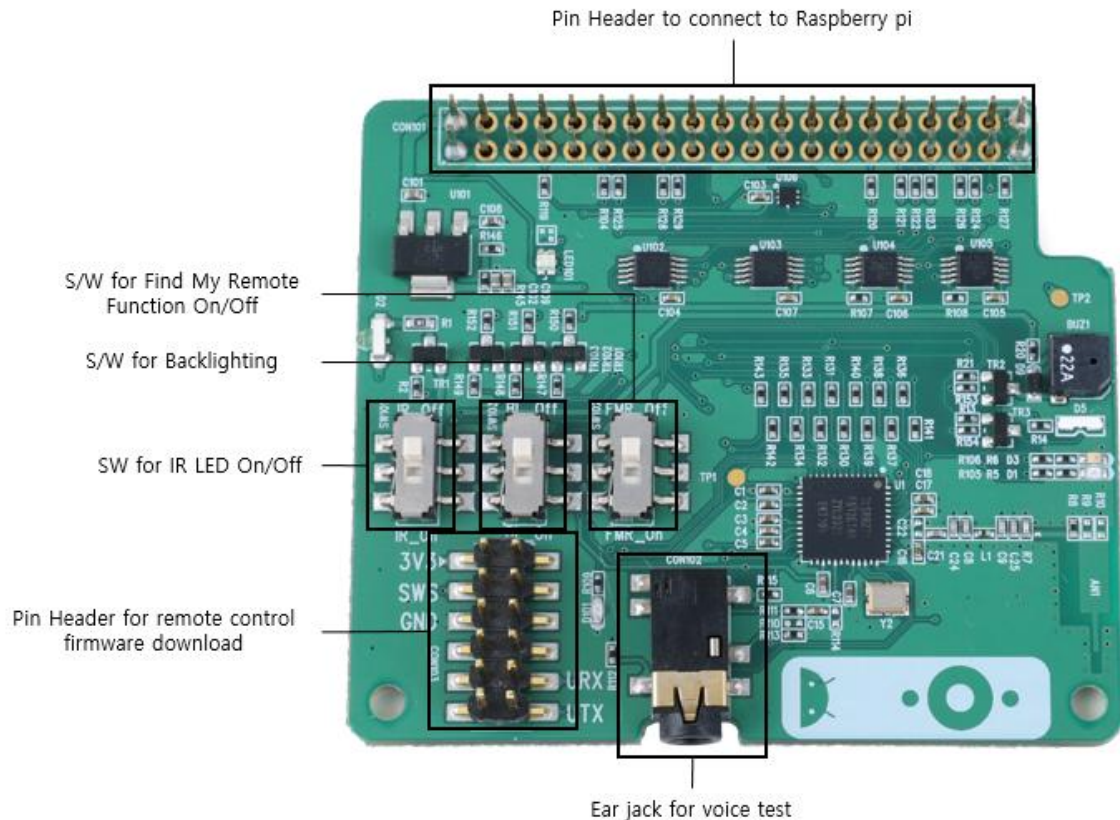
APPENDIX H

: USER'S MANUAL

G91(Bender) Manual



G91(Bender) Configuration



Compatible Raspberry Pi versions

Any Raspberry Pi with a 40-pin connector can be used

Assembly

G91(Bender) is designed to be used as a Raspberry Pi “Hat”

Any Raspberry Pi with a 40-pin connector can be used

With the power removed from the Raspberry Pi:

Align the female 40-pin connector of G91(Bender) with the male 40-pin connector of the Raspberry Pi, and then fully mate the two devices.

Note: Improper alignment can permanently damage both G91(Bender) and the Raspberry Pi

Apply power to the Raspberry Pi.

The red power LED on G91(Bender) should light, and the status LED may be dim red.

Battery Management

Device is powered by a constant voltage supply (from the Raspberry Pi)

Device still sends the information for battery level using Bluetooth battery service, but the indicated value is always 100%.

Bluetooth 5.0 LE identification

1. Device Name: G91
2. Vendor ID: 0x0957
3. Product ID: 0x0001
4. Vendor ID Source : Bluetooth SIG
5. Hardware Version : 'V', '1', '.', '0'

Pairing mode & Re-pairing mode

1. From the Raspberry Pi SSH console:
 - a. Run `./benderDriver.py`
 - b. From the prompt:
 - i. Enter “reset” to reset the device
 - ii. Enter “power” to exit the factory test mode (first time only)
 - iii. Enter “pair” to enter pairing mode
2. After that, the green led starts blinking to indicate that the G91(Bender) has entered pairing mode.
3. If pairing is successfully made, the green led stops blinking and the G91(Bender) starts working in Bluetooth.
4. If pairing is not successfully made for 2mins (re-pairing) or 10mins (pairing), the green led stops blinking and the red led blinks 4 times. The G91(Bender) stops pairing and goes back to the previous state.

Un-pairing mode (Clear Bond Cache)

1. From the Raspberry Pi SSH console:
 - a. Run `./benderDriver.py`
 - b. From the prompt:
 - i. Enter “reset” to reset the device
 - ii. Enter “clear” to clear the bond cache
2. Led will flash briefly to indicate cleared bond cache.

Advertising

1. The G91(Bender) shall choose a very aggressive advertising interval, aimed at the best possible reconnection experience.
2. Advertising interval is 20~25ms.
3. If the connection is not established for 30 seconds, the advertisement interval will change to 30-35ms.

Connection Parameter

1. Connection Interval Time: 10ms
2. Connection Slave Latency: 99 (1s)
3. Connection Supervision Time Out: 4s

Reconnection

Device will reconnect automatically if paired.

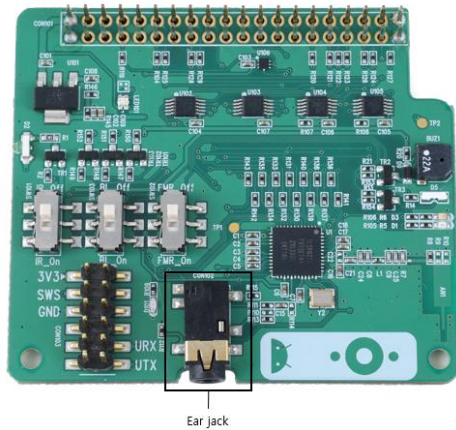
ATV Voice Service

Type	Short-form	UUID	Properties
ATV Voice Service	ATVV_SERVICE_UUID	AB5E0001-5A21-4F05-BC7D-AF01F617B664	
Write Characteristic	ATVV_CHAR_TX	AB5E0002-5A21-4F05-BC7D-AF01F617B664	Write
Read Characteristic	ATVV_CHAR_RX	AB5E0003-5A21-4F05-BC7D-AF01F617B664	Notify
Control Characteristic	ATVV_CHAR_CTL	AB5E0004-5A21-4F05-BC7D-AF01F617B664	Notify

)

Voice Search initiated by the Remote Control (PTT, Press-to-Talk)

1. Attach a 3.5mm male-to-male cable from the A/V port of the Raspberry Pi to the line in jack of G91(Bender)
2. From the Raspberry Pi SSH console:
 - a. Run `./benderDriver.py`
 - b. From the prompt:
 - i. Enter “reset” to reset the device
 - ii. Enter “assist” followed by an assistant query, e.g. “assist tell me a joke”
3. The green status LED will light while the assistant query is being generated.



Pin Header to connect to Raspberry pi

	3.3 VDC Power	1	2	5 VDC Power	
	GPIO 2 I2C SDA (Fixed Pull-UP)	3	4	5 VDC Power	
	GPIO 3 I2C SCL (Fixed Pull-UP)	5	6	Ground	
U106 IN2	GPIO 4 GPCLK0	7	8	GPIO 14 TXD	
	Ground	9	10	GPIO 15 RXD	
RESET	GPIO 17	11	12	GPIO 18 PCM_CLK	U103 A1
	GPIO 27	13	14	Ground	
U105 A0	GPIO 22	15	16	GPIO 23	U105 A1
	3.3 VDC Power	17	18	GPIO 24	JACK_DETECT
GREEN_LED_OUT	GPIO 10 SPI0 MOSI	19	20	Ground	
RED_LED_OUT	GPIO 9 SPI0 MISO	21	22	GPIO 25	BACKLIGHT
BLUE_LED_OUT	GPIO 11 SPI0 SCLK	23	24	GPIO 8 SPI0_CE0	RED_LED (DETECT OR DRIVE)
	Ground	25	26	GPIO 7 SPI0_CE1	GREEN_LED (DETECT OR DRIVE)
	GPIO 0 I2C0_SDA	27	28	GPIO 1 I2C0_SCL	
U102 EN	GPIO 5 GPCLK1	29	30	Ground	
U102 A0	GPIO 6 GPCLK2	31	32	GPIO 12 PWM0	U102 A1
U103 EN	GPIO 13 PWM1	33	34	Ground	
U104 A0	GPIO 19 PCM_FS	35	36	GPIO 16	U103 A0
BUZZER	GPIO 26	37	38	GPIO 20 PCM_DIN	U104 A1
	Ground	39	40	GPIO 21 PCM DOUT	

benderDriver.py script commands

1. PAIR: Enter pairing mode. (Press BACK + HOME button for 5 seconds)
2. CLEAR: Perform factory reset. (Press HOME + VOL_MUTE button for 5 seconds)
3. RESET: Perform reset.
4. BUG: Perform bugreport. (Press CENTER + BACK button for 1.5 seconds)
5. TALKBACK: Perform accessibility shortcut. (Press DOWN + BACK button for 1.5 seconds)
6. FINDMY: Tests the buzzer functionality.
7. BACKLIGHT: Tests the backlight functionality.
8. LED: Flash the operator status RGB LED.
9. EXIT: End script execution.
10. Button commands

NO	Button Command	Button Name	G10	G11	G20
1	POWER	Power	O	O	O
2	INPUT	Input/Magic	O	O	O
3	1	1			O
4	2	2			O
5	3	3			O
6	4	4			O
7	5	5			O
8	6	6			O
9	7	7			O
10	8	8			O
11	9	9			O
12	SUBTITLE	Subtitles/Text			O
13	0	0			O
14	INFO	Info			O
15	RED	Red			O
16	GREEN	Green			O
17	YELLOW	Yellow			O
18	BLUE	Blue			O
19	BOOKMARK	Bookmark/All Apps/User Profile	O	O	O
20	ASSIST	Assistant	O	O	O
21	DASHBOARD	Settings/Notification	O	O	O
22	UP	D-pad Up	O	O	O
23	LEFT	D-pad Left	O	O	O
24	CENTER	D-pad Center	O	O	O
25	RIGHT	D-pad Right	O	O	O
26	DOWN	D-pad Down	O	O	O
27	BACK	Back	O	O	O
28	HOME	Home	O	O	O
29	GUIDE	Guide/Live	O	O	O
30	FREETV	FreeTV/LiveTV		O	
31	VOL_UP	Volume Up	O	O	O
32	CH_UP	Channel Up	O	O	O
33	VOL_MUTE	Mute	O	O	O
34	VOL_DN	Volume Down	O	O	O
35	CH_DN	Channel Down	O	O	O
36	YOUTUBE	APP01	O	O	O
37	NETFLIX	APP02	O	O	O
38	APP03	APP03	O	O	O
39	APP04	APP04	O	O	O

Google Test Automation
User Information

Product name : Remote Control Module

Model name : G91

(1) Overview

The G91 the remote bot under the format of a raspberry pi hat.

The G91 is effectively a reference remote & the raspberry pi is used to simulate the key presses and can even be used to simulate voice commands.

(2) Specification

Categories	Details
Product name	Remote control module
Model name	G91
Frequency	2.400GHz ~ 2.4835 GHz
Output Power(Max.)	7.4 dBm
Channel	40 channels
Rated Power	DC 5 V / 1 A
Operating temperature range	0 °C ~ 40 °C

(3) Precautions

This product has been evaluated for suitability for use in business environments.

There is a risk of radio interference when used in a home environment.

This product must be powered via the Raspberry Pi.

Do not expose this product to water or moisture, and do not place it on a conductive surface while in operation.

Do not allow this product to come into contact with conductive materials.

Do not expose this product to heat from any source. It is designed to operate stably at normal room temperature.

Do not expose this product to high-intensity light sources.

Use this product in a well-ventilated environment, and do not cover it with objects.

To prevent mechanical damage to the connectors of this product, be careful when handling.

Hold only the edges of the product while power is supplied to this product. Touching any parts may cause damage due to static electricity.

Do not connect other peripherals to this product.

Do not arbitrarily change the conditions of use of this product, expand the operating frequency range, or increase the transmission power (including installing additional amplifiers).



FCC ID : OZ5G91

CMIIT ID : XXXXYZNNNN

Manufacturer

OHSUNG ELECTRONCIS Co., Ltd.

335-4, SANHO-DAERO, GUMI-SI, GYEONGSANGBUK-DO, KOREA

Ohsung Electronics (Suzhou) Co.,Ltd.

No. 188, Tunpu South Road, Tonglitun Village, Wujiang, Jiangsu Province

PT. Ohsung Electronics Indonesia

Jalan Selayar Blok D7, Kawasan Industri MM2100, Mekarwangi Cikarang Barat, Bekasi, Jawa Barat, 17520
INDONESIA

Oh Sung Mexico S.A. De C.V.

Cerrada Centinela 1719, Parque Industrial Cachanilla, B.C., Mexicali 21394, Mexico

Importer :

Address :

(1) Federal Communication Commission Interference Statement

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 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.

Warning!

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Note: The manufacturer is not responsible for any Radio or TV interference caused by unauthorized modifications to operate the equipment.

(2) FCC Caution

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- ☐ This device may not cause harmful interference
- ☐ This device must accept any interference received, including interference that may cause undesired operation. Any changes or modifications not expressly approved by the party responsible for compliance could void the authority to operate equipment. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

(3) Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. The device has been evaluated to meet general RF exposure requirements. The device can be used in portable exposure conditions without restriction.

INTEGRATION INSTRUCTIONS

1. List of applicable FCC rules

- FCC §15.205
- FCC §15.207
- FCC §15.209
- FCC §15.247

2. Summarize the specific operational use conditions

- This product has been evaluated for suitability for use in business environments.
- There is a risk of radio interference when used in a home environment.
- This product must be powered via the Raspberry Pi 4 Model B.
- Do not expose this product to water or moisture, and do not place it on a conductive surface while in operation.
- Do not allow this product to come into contact with conductive materials.
- Do not expose this product to heat from any source. It is designed to operate stably at normal room temperature.
- Do not expose this product to high-intensity light sources.
- Use this product in a well-ventilated environment, and do not cover it with objects.
- To prevent mechanical damage to the connectors of this product, be careful when handling.
- Hold only the edges of the product while power is supplied to this product. Touching any parts may cause damage due to static electricity.
- Do not connect other peripherals to this product.
- Do not arbitrarily change the conditions of use of this product, expand the operating frequency range, or increase the transmission power (including installing additional amplifiers).

3. Limited module procedures

- This device is not for sale to general consumers and is for limited sale to verified consumers¹⁾ only.

Note 1): Android OS-based OTT set-top box manufacturer

- The OZ5G91 radio module cannot be tested stand alone.
- The OZ5G91 radio module does not include its own RF shield and power supply regulation. To demonstrate compliance, the OZ5G91 was tested in a configuration with a Raspberry Pi 4 Model B according to the test plan described below:

- DTS Bandwidth (6 dB): FCC 15.247(a)(2)
- Output Power: FCC 15.247(b)(3)
- Power Spectral Density: FCC 15.247(e)
- Band Edge Compliance: FCC 15.247(d)
- Spurious Conducted Emissions: FCC 15.247(d)
- AC Power line Conducted emission: FCC 15.207(a)
- Spurious Radiated Emissions: FCC 15.247(d)
- RF Exposure Assessment: FCC 1.1310, 2.1093

Test results demonstrate compliance with FCC Part 15.247 for the OZ5G91 wireless module to support integration within the host model: Raspberry Pi 4 Model B. Testing for spurious radiated emissions of the OZ5G91 integrated into Raspberry Pi 4 Model B has been completed.

The OZ5G91 wireless module can only be used with the Raspberry Pi series with a 40-pin GPIO (general purpose input/output) header as a new host. This is because a stable power supply is possible through the 40-pin GPIO (general-purpose input/output) header of the Raspberry Pi series.

The OZ5G91 module does not have its own power supply regulation, so to overcome this limitation it must be powered via the 40-pin GPIO (general purpose input/output) header on the Raspberry Pi series.

Grantee must submit a Class II Permitted Change for each additional host configuration.

Integration of the OZ5G91 radio within a new host product requires testing according to the plan outlined below:

Conducted Testing:

Output Power: FCC 15.247(b)(3)

- a. Applicable Channel: 0, 19, 39
- b. Applicable Frequency: 2402 MHz, 2440 MHz, 2480 MHz
- c. Applicable Modulation: GFSK
- d. Operation status: Continuous RF transmitting mode

Band Edge Compliance: FCC 15.247(d)

- a. Applicable Channel: 0, 39
- b. Applicable Frequency: 2402 MHz, 2480 MHz
- c. Applicable Modulation: GFSK
- d. Operation status: Continuous RF transmitting mode

Radiated Testing:

Spurious Radiated Emissions: FCC 15.247(d)

- a. Applicable Channel: 0, 19, 39
- b. Applicable Frequency: 2402 MHz, 2440 MHz, 2480 MHz
- c. Applicable Modulation: GFSK
- d. Operation status: Continuous RF transmitting mode

When compliance is demonstrated, a C2PC is required to authorize the integration of the OZ5G91 within the new host product.

4. Trace antenna designs

- Not applicable.

5. RF exposure considerations

- Mobile: 20 cm from a person's body

6. Antennas

- PCB pattern antenna (Integrated antenna)

7. Label and compliance information

- The "FCC ID" is printed on the back of the product.

8. Information on test modes and additional testing requirements

- This product has been tested in conjunction with a host and complies with FCC §15.205, FCC §15.207, FCC §15.209, and FCC §15.247.
- Each host integration must be evaluated against Rule Parts §15.205, §15.207, and §15.209.
- Details on how to put the device into transmitter test modes. (See Appendix 1.)

9. Additional testing, Part 15 Subpart B disclaimer

- This product has been tested in conjunction with a host and complies with FCC §15.107 and FCC §15.109.
- The host device must be evaluated for compliance.

10. Note EMI Considerations

- This product has been tested in conjunction with a host and complies with FCC §15.205, FCC §15.207, FCC §15.209, and FCC §15.247.
- If the host (Raspberry Pi 4 Model B) version changes, emission testing must be performed to ensure compliance with §15.209.

11. How to make changes

- This device is not for sale to general consumers and is for limited sale to verified consumers¹⁾ only.

Note 1): Android OS-based OTT set-top box manufacturer

- If changes are required, you must contact the beneficiary for processing.

12. The test plan to show continued compliance

- Testing should be repeated according to the test plan set out in Section 3 of the INTEGRATION INSTRUCTIONS. Once continued compliance is demonstrated, a Permissive Change application will be submitted to approve the change.

Appendix 1

Details on how to put the device into transmitter test modes

1 Overview

This document presents the usage guide for Telink “EMI_Test_Tool” which is a software on PC side used to implement EMI test.

Before EMI test, the DUT (Device Under Test) must be pre-calibrated (generally calibrated on jig system) with calibration values written into corresponding flash addresses.

2 Test Guide

1) Hardware connection

Connect miniUSB interface of Telink burning EVK with PC USB via an USB cable; the indicating light on the EVK will blink once to indicate normal connection between the EVK and PC.

Then connect the USB interface of the burning EVK with DUT via USB or Swire.

- ✧ USB connection method: Connect the DUT with the burning EVK via USB interface directly. This method only applies to DUT with USB interface, e.g. a dongle board.



Figure 1 USB connection method

- ✧ Swire connection method: Connect VCC, GND and SWM of the burning EVK with VCC, GND and SWS of the DUT, respectively.

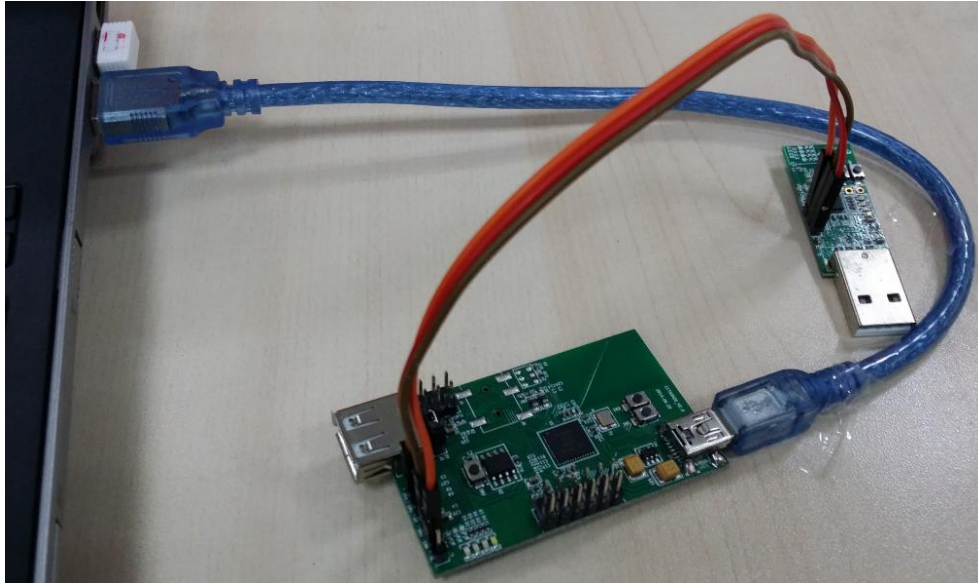


Figure 2 Swire connection method

2) Download EMI test file

Use Telink WtcdB tool to download test binary file into DUT flash.

Step 1: Start the WtcdB on PC side, click the “**RstMCU**” button to reset MCU and check hardware connection.

Step 2: Click the “**BIN**” button and select the directory containing the test bin file to be downloaded. The test bin file should be selected according to chip part number, crystal (12MHz/16MHz) as well as crystal capacitor (internal/external). Then select this bin file in the left “Bin file list window”.

Step 3: Click the “**SWB**” button to download the selected bin file into DUT flash starting from address 0x0.

Step 4: Power cycle the DUT, i.e. reconnect the DUT with the burning EVK.

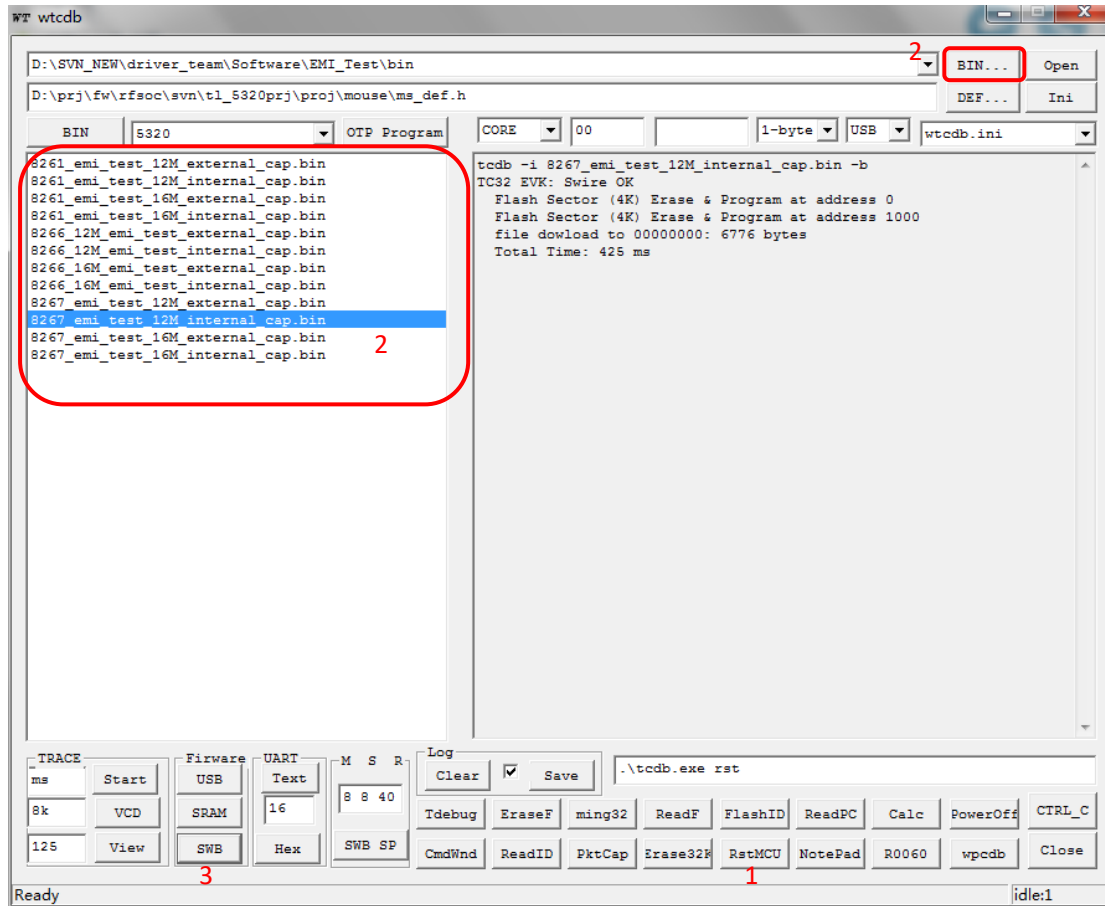
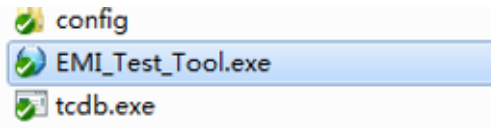


Figure 3 Firmware burning steps

3) EMI test

Step 1: Double click “EMI_Test_Tool.exe” to start this tool.



The figure below shows the tool interface.

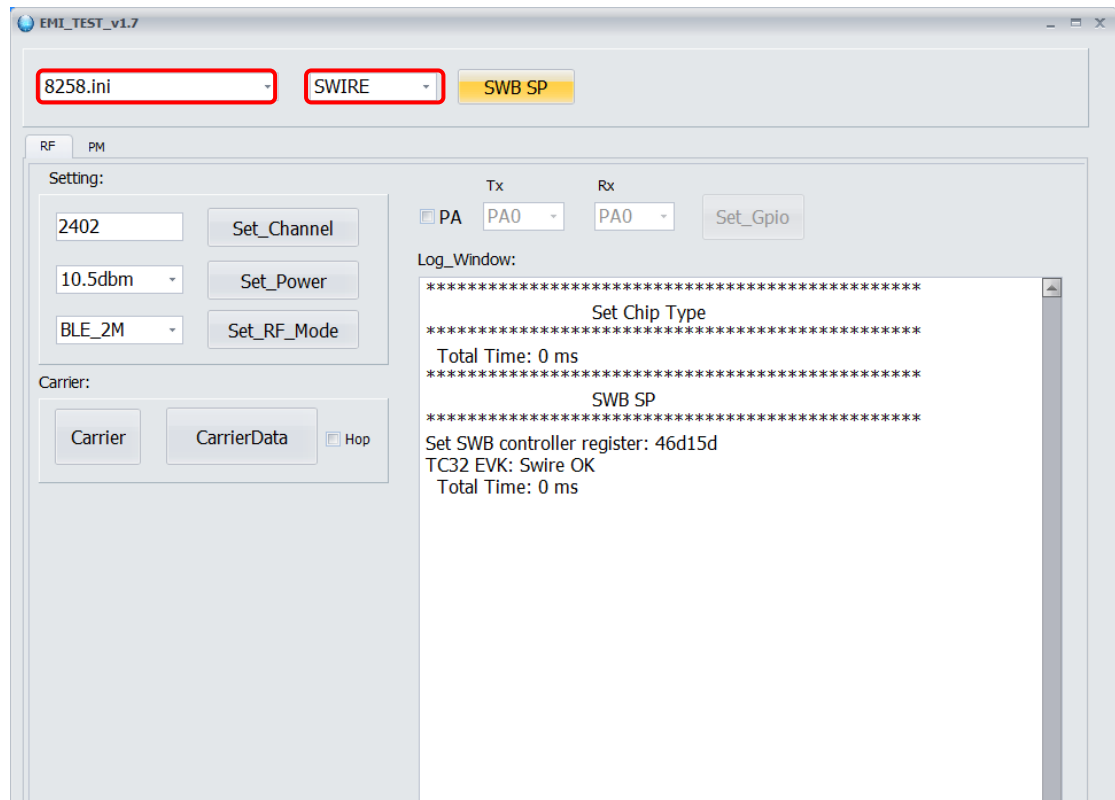


Figure 4 EMI_Test_Tool interface

Step 2: Select chip type, and then choose communication method according to the connection method between DUT and PC.

- ✧ SWIRE method: If DUT is connected to PC via a burning EVK, the “SWIRE” method should be selected.
- ✧ USB method: If DUT is directly connected to PC without using a burning EVK as adapter, the “USB” method should be selected. This USB option is not supported currently.

Step 3: Click the “SWB SP” button to ensure normal Swire connection and communication, as shown below.

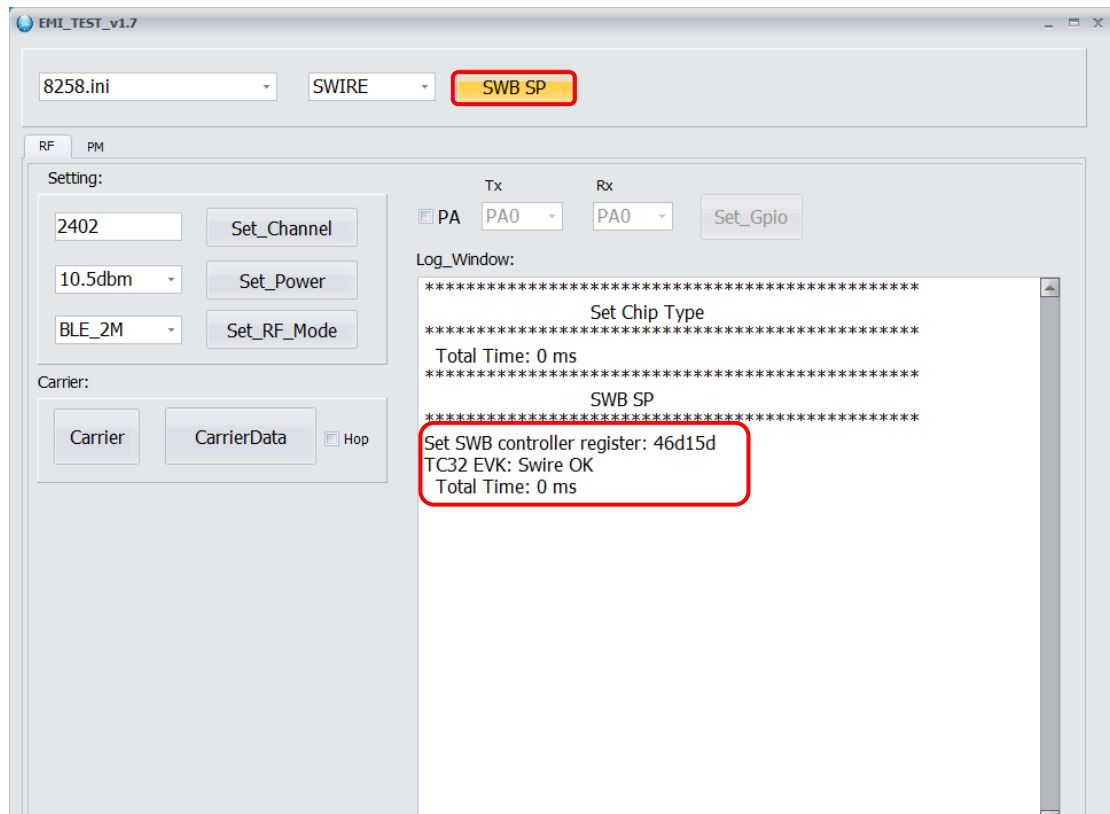


Figure 5 Test Swire connection and communication

Step 4: Configure PA option.

If the DUT has PA (Power Amplifier) module, it's needed to follow the steps below to configure the PA option: Tick the "PA" box, select the TXEN GPIO and RXEN GPIO to control the PA via the Tx and Rx drop-down box, then click the "Set_Gpio" button to enable high-level output of the TX_gpio and low-level output of the RX_gpio. This operation will take a relatively long duration. After the PA option is configured, the normal test items can be started.

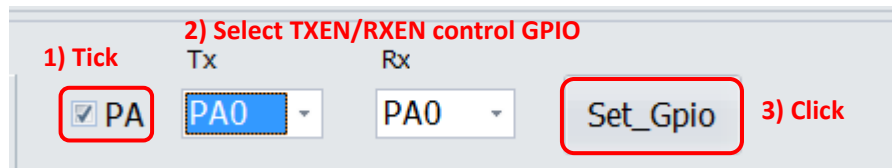


Figure 6 Configure PA option

If the DUT has no PA (Power Amplifier) module, this step can be skipped.

Step 5: Depending on specific test items, set frequency point, Tx power and RF mode, and click corresponding setting button ("Set_Channel" , "Set_Power" , "Set_RF_Mode") to confirm the configuration.

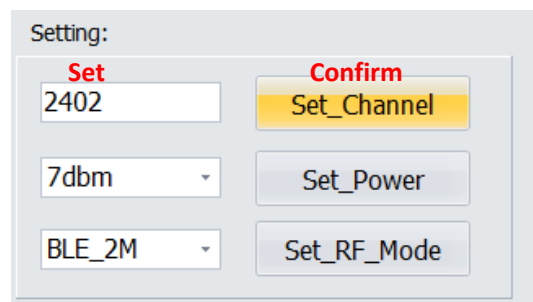


Figure 7 Set frequency point, Tx power and RF mode

Step 6: Set test mode.

- ✧ Set test mode as carrier mode. As shown below, the DUT will enter “single carrier mode” by clicking the “Carrier” button, or enter “Carrier+Data mode” by clicking the “CarrierData” button.

***Note:** “CarrierData” (CD, Carrier+Data mode) is continuous transmission mode, and it should be adopted for certification test including FCC/CE/KCC/SRRC.

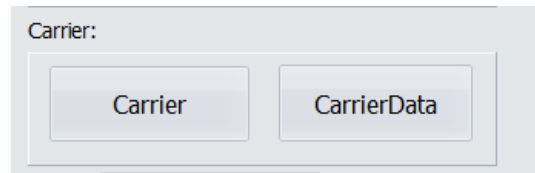
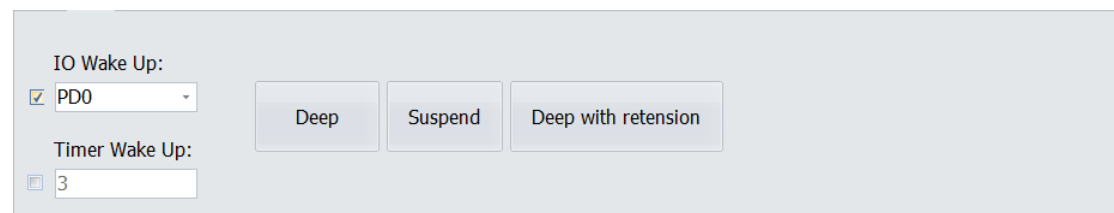


Figure 8 Carrier test mode

For chip types which support current test in Suspend and Deep Sleep low-power (PM) mode, the tool will also show related PM test items, as shown below:



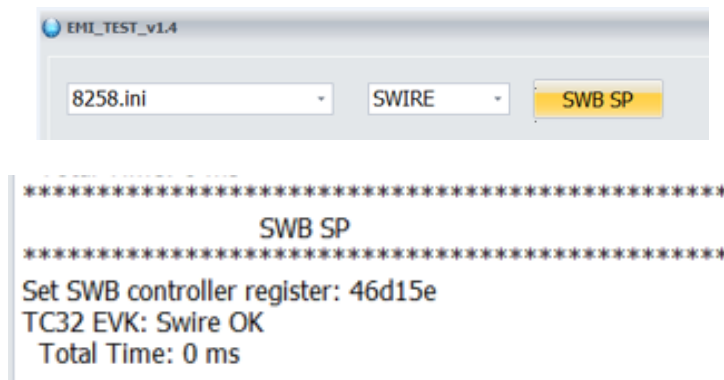
- 1) Connect the DUT with specific current test device, and then select either IO wakeup or Timer wakeup as needed.
 - ✧ To select IO wakeup, please tick the box for “IO Wake Up”, and select wakeup GPIO pin.
 - ✧ To select Timer wakeup, please tick the box for “Timer Wake Up”, and fill in wakeup time (unit: second).
- 2) Then click certain button to select working mode as needed. After clicking the working mode button, user can observe current in corresponding mode.

3 Test Example

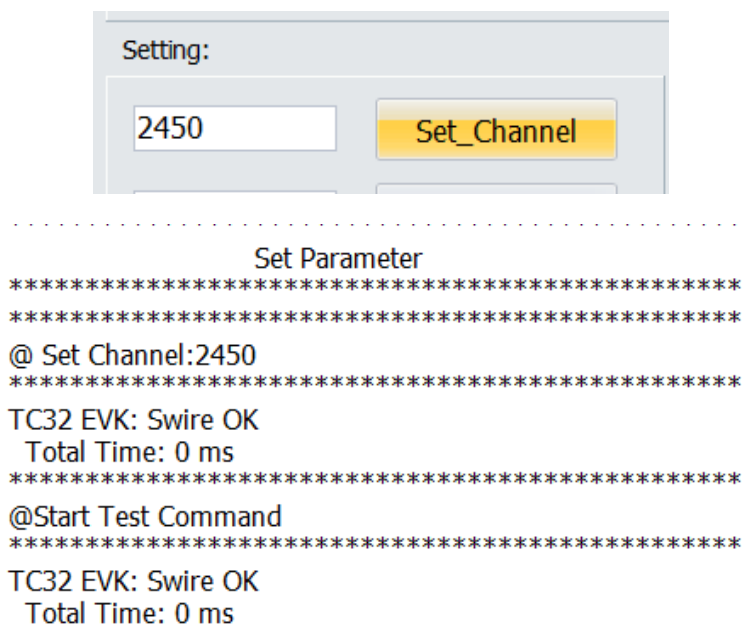
Suppose it's needed to continuously send packets with payload of "0x55" in the Channel "2450MHz" with the "5dBm" Power and "BLE_1M" RF Mode, the steps below should be followed.

- 1) First ensure hardware connection is correct. Select "SWIRE" and click the "SWB SP" button.

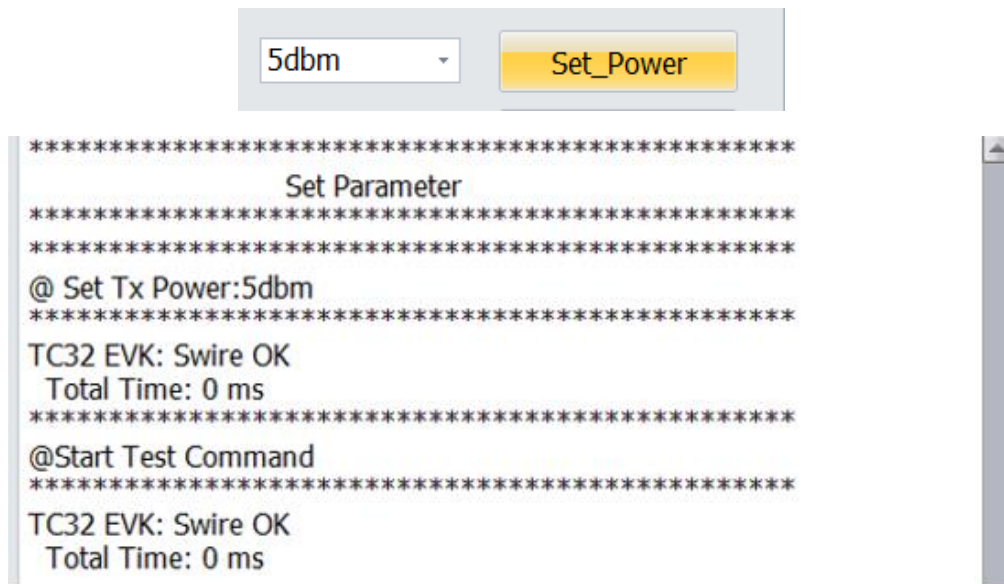
If the right log window shows "Swire OK", it indicates hardware connection is normal and user can continue the test; otherwise user should check the hardware connection.



- 2) Input the frequency point "2450" and click the "Set_Channel" button. If the right log window shows setting success information, continue the test.



- 3) Select Tx power as “5dbm” and click the “Set_Power” button. If the right log window shows setting success information, continue the test.



- 4) Select RF mode as “BLE_1M” and click the “Set_RF_Mode” button. If the right log window shows setting success information, continue the test.

