



RT58X MPTCB and MP Tool

User Guide

Introduction

This document describes the RT58X Mass Production Pack created by Rafael Microelectronics. The goal of Mass Production Pack is to provide a utility to test an “RT58x-inside” product’s functionality while on production lines and without the need for additional equipment.

The Mass Production Pack contains the following hardware and software items:

- 1-to-4 Mass Production Test Control Board (MPTCB) – hardware providing Bluetooth®, Zigbee 3.0 & Sub-GHz TX/RX capabilities controlled by the MP Tool program
- Mass Production Tool (MP Tool) – software application running on the Microsoft Windows operating system

The following functionality is provided by this pack:

- Over Current Protection (OCP) Check
- Write/Verify Flash
- GPIO test
- Crystal Trim
- Tx Power Calibration
- RF Tx Test
- RF Rx Test

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1. Environment Setup of Mass Production Test Control Board (MPTCB)

The complete testing suite includes:

- One PC (running Windows XP operating system or later version)
- 1-to-4 MPTCB hardware (from Rafael Micro)
- One Type-B USB cable
- One 5V/3A Adapter (from Rafael Micro)
- MP Tool application software (from Rafael Micro)

Figure 1 and Figure 2 shows a 1-to-4 MPTCB hardware. The user must connect the DC 5V/3A adapter to supply power to the MPTCB. To avoid any instability caused by supply-related issues, we suggest using the 5V/3A adapter from Rafael Micro.

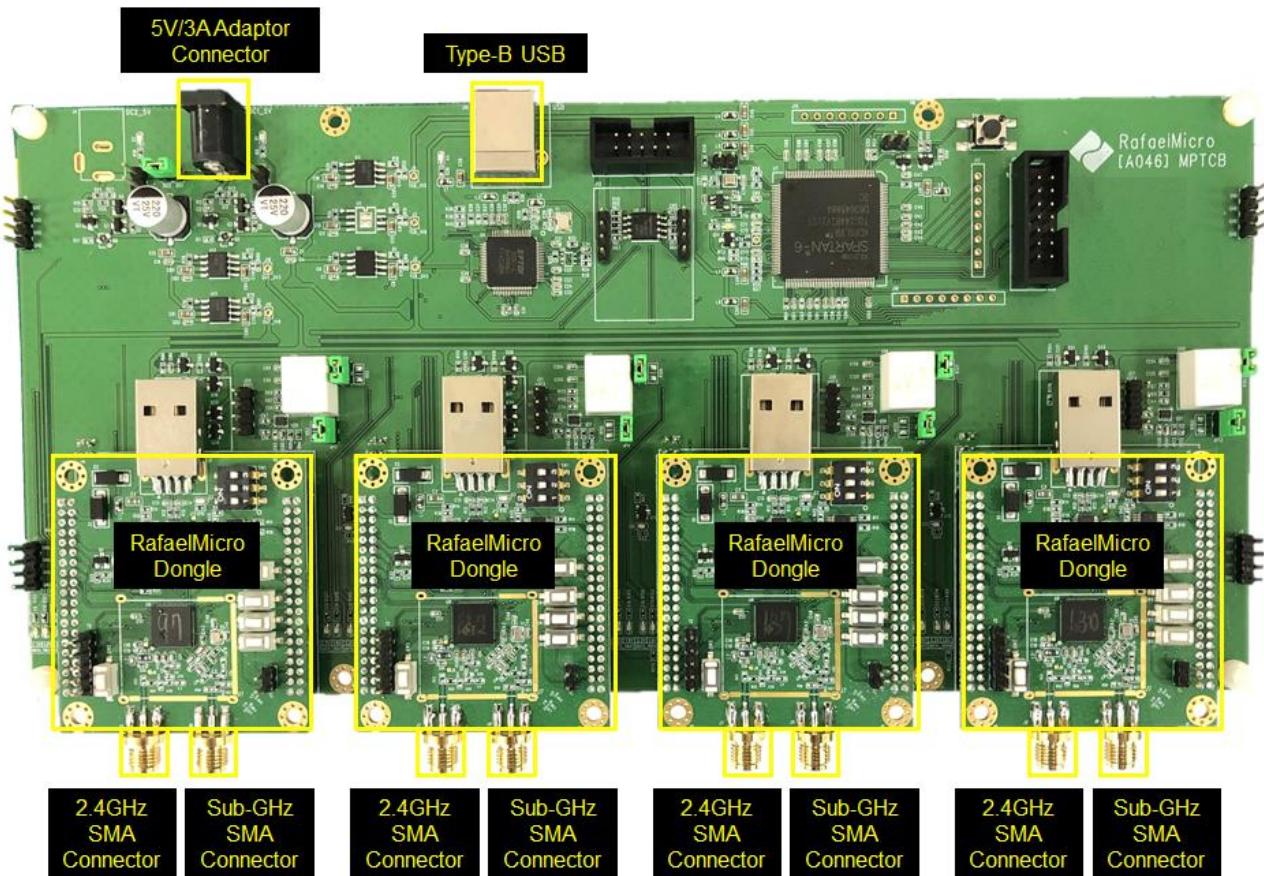


Figure 1. Connectors on 1-to-4 MPTCB (Top View)



Figure 2. Connectors on 1-to-4 MPTCB (Bottom View)

Figure 3 shows a reference connection setup between a PC, the 1-to-4 MPTCB, and the DUT.

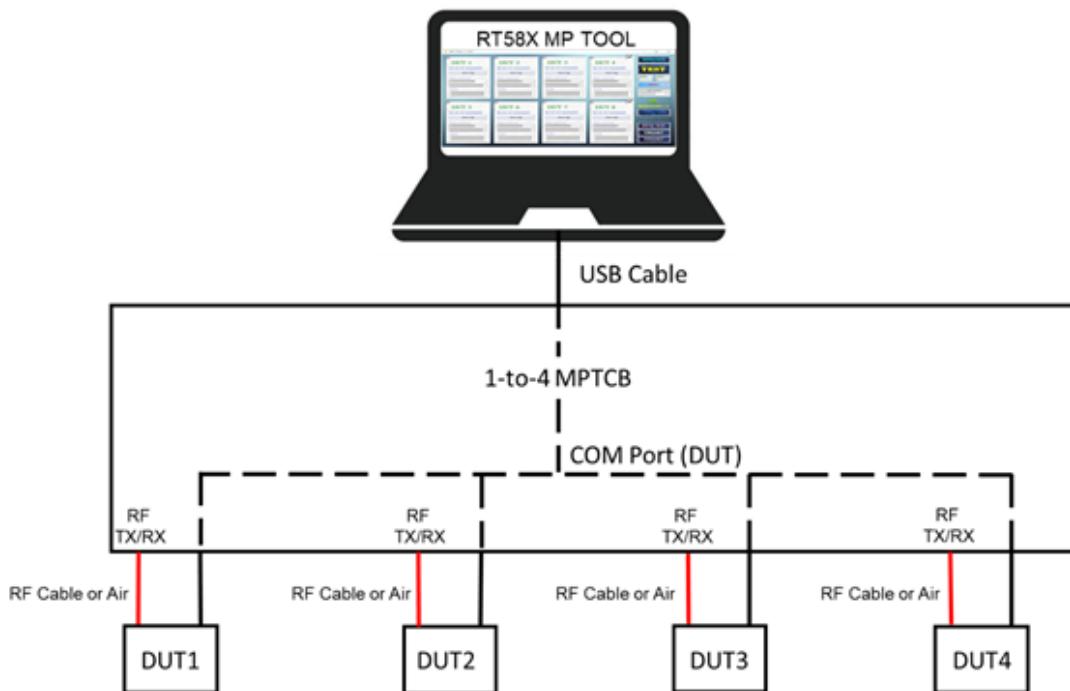


Figure 3. 1-to-4 MPTCB Connection block diagram

1.1 Hardware setup of Mass Production Test Control Board (MPTCB)

There is one Type-B USB port on the 1-to-4 MPTCB for the connection to the PC. The DC 5V/3A adaptor must supply power to the 1-to-4 MPTCB before connecting the Type-B USB port to the PC. There is a USB-to-UART bridge IC attached to the Type-B USB port on the 1-to-4 MPTCB. Four virtual UART ports appear as USB-to-Serial bridges in Windows Device Manager when the USB port is connected to the PC. Software settings use the COM port number of each device.

The MPTCB Connector shown in Figure 4 is essentially an UART interface for the DUT to connect with a PC. Moreover, it provides VCC for the DUT such that no additional power supply is required to the DUT. The reference clock of the DUT will also be sent to the MPTCB via this interface for crystal trimming.

Power Supply to DUT	3.3V	1	2	3.3V	Power Supply to DUT
	-	3	4	-	
Connect to DUT's UART TX	UART-TX	5	6	UART-RX	Connect to DUT's UART RX
Ground	GND	7	8	GND	Ground
	-	9	10	-	
	-	11	12	-	
	-	13	14	-	
	-	15	16	Reset	Connect to DUT's Reset
	-	17	18	GND	Ground
Connect to DUT's GPIO2,6,10 or 14	CLK Trim	19	20	GND	Ground

Figure 4. MPTCB Connector Hardware Description

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1.2 Power supply of 1-to-4 Mass Production Test Control Board (MPTCB)

Power is supplied to the 1-to-4 MPTCB by a 5V/3A DC power supply. The DC 5V/3A adaptor must supply power to the 1-to-4 MPTCB before the Type-B USB port is connected to the PC. The 5V/3A power adaptor provided by Rafael Micro is strongly recommended for use with the 1-to-4 MPTCB to prevent any instability problem that can be caused by power supply-related issues.

- DC 5V/3A – Use a DC 5V/3A adapter to supply power to the 1-to-4 MPTCB.
- VCCIO – The 1-to-4 MPTCB MP Tool can automatically select 1.8V or 3.3V for VCCIO on the 1-to-4 MPTCB. However, VCCIO must be manually set to 1.8V or 3.3V on the evaluation kit (RT58X EVK).

Figure 5 shows the connection between the 1-to-4 MPTCB and RT58X EVK.



Figure 5. Connect RT58X EVK to 1-to-4 MPTCB

Figure 6 and Table 1 shows jumper settings for the EVK connected to the 1-to-4 MPTCB. The RT58X EVK provides a connector for attaching to a Rafael Micro MPTCB via 20-pin IDE cable. The Rafael Micro MPTCB is a calibration kit for adjusting the crystal and downloading Rafael Micro chipset firmware. When the RT58X EVK is connected to an MPTCB, SW8 and SW9 must be set to OFF.

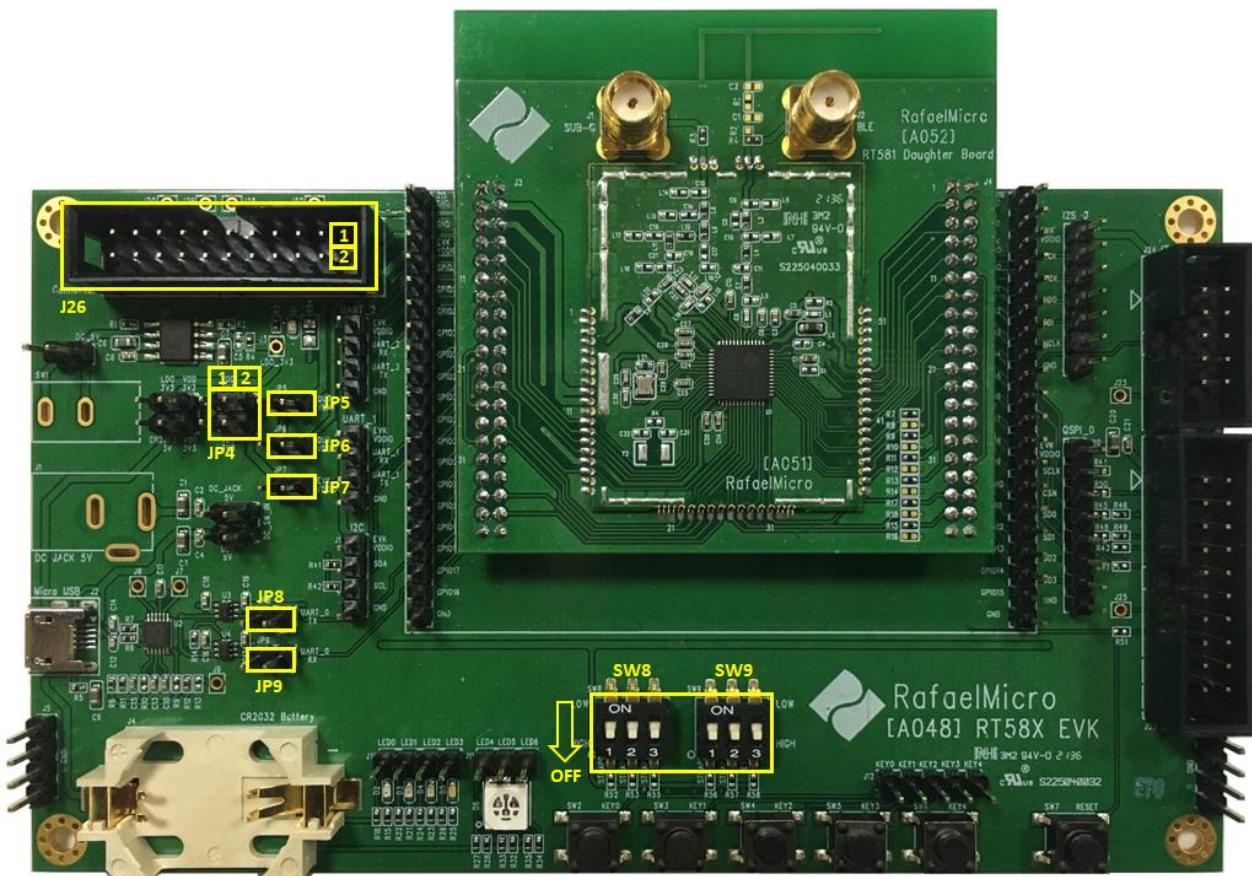


Figure 6. Top view of the RT58X Series Evaluation Board

Table 1. MPTCB connection jumper settings

Mode	JP4	JP5	JP6	JP7	JP8	JP9	SW8	SW9
MPTCB connection	X	O	O	X	X	X	OFF	OFF

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Figure 7 shows the jumpers, jacks, and power supply circuit of the 1-to-4 MPTCB. Please refer to Table 2, for a detailed description of each jumper, jack.

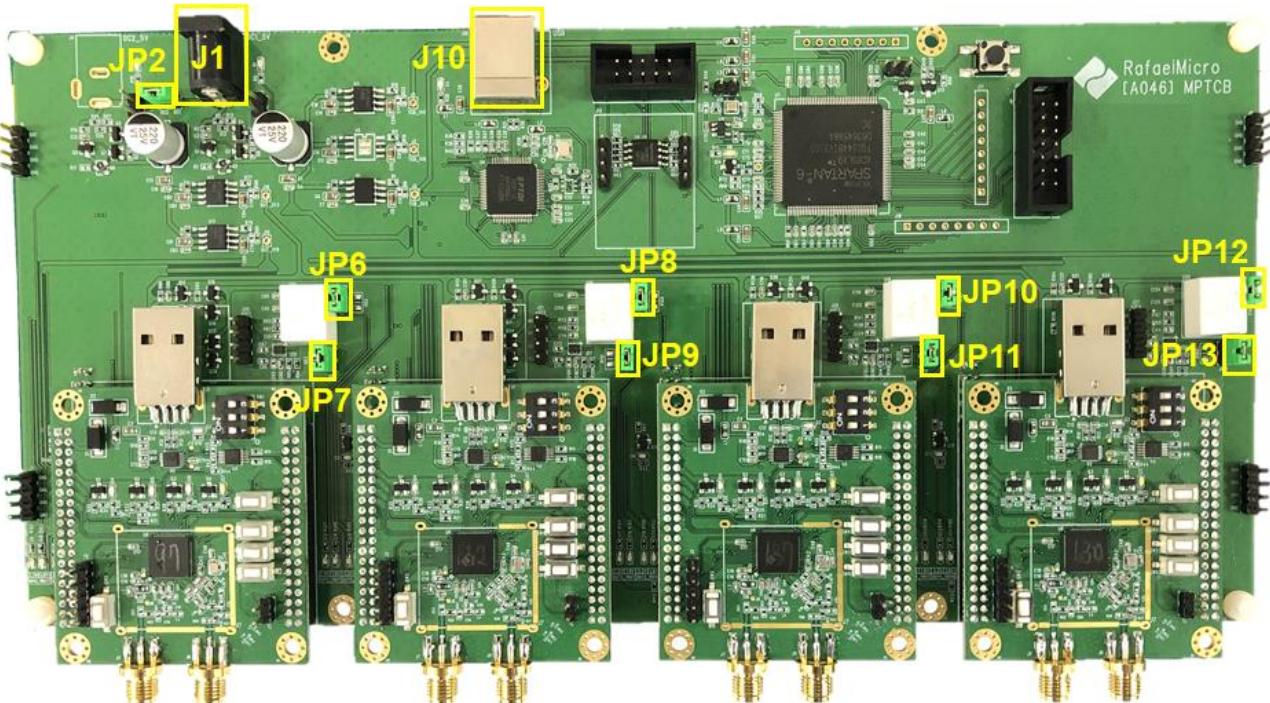


Figure 7. 1-to-4 MPTCB jumper settings

Table 2. 1-to-4 MPTCB jumper functions and Jacks

Block	Description
JP2	Short – Use one 5V/3A adaptor to supply power to the 1-to-4 MPTCB. Connect the 5V/3A adaptor to J1.
JP6/JP7/JP8/JP9	Short
JP10/JP11/JP12/JP13	Short
J1	5V/3A adapter jack
J10	Type-B USB port

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1.3 Software setup of Mass Production Test Control Board (MPTCB)

The RT58X 1-to-4 Mass Production Test Control Board (MPTCB) has a USB-to-serial interface. Connect the RT58X MPTCB with the PC through a Type-B USB cable and then four COM ports will be detected automatically.

UART0 is for console command. A reference connection diagram is shown in Figure 8.

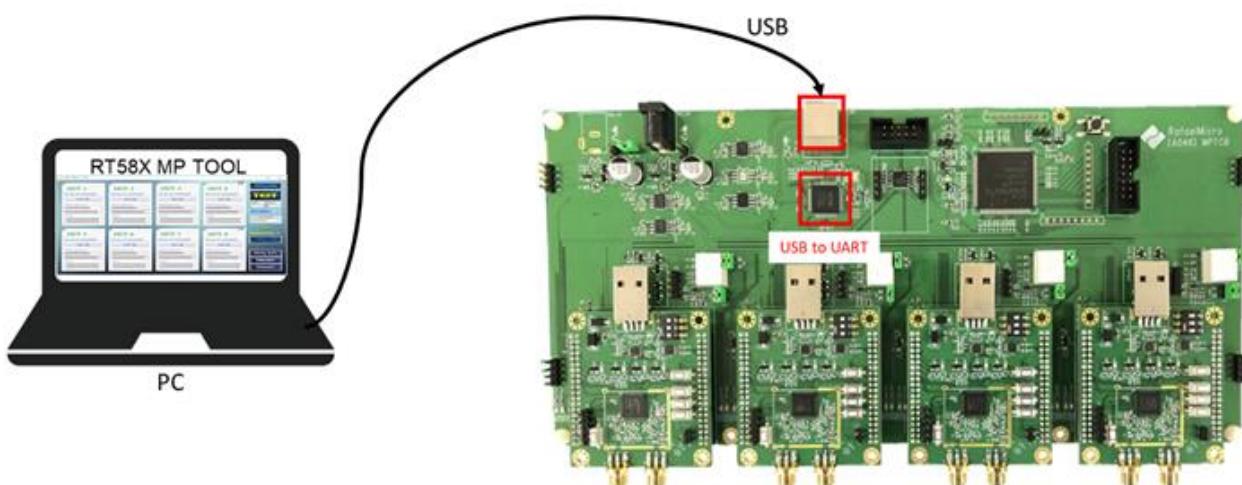


Figure 8. RT58X MPTCB Connections

FT4232HL Driver installation for Windows. The FTDI driver for the FT4232HL chip used on the RT58X MPTCB is available for download at the following link:

https://ftdichip.com/wp-content/uploads/2021/08/CDM212364_Setup.zip

When the driver is installed and the board is connected to the PC, four COM ports will appear when the 1-to-4 MPTCB is connected (as shown in Figure 9).

For faster response from Loadstar Devices using virtual COM (serial) ports, you should change the COM port settings as shown in Figure 10 (Change the latency timer setting to 1 msec). Once the settings have been changed, they should persist between plugins and restarts. However, if you move the hardware to a different computer, you will need to change the settings again in the new computer.

Mass Production Tool is created with c sharp, the following third-party packages are required:

<https://www.microsoft.com/en-us/download/confirmation.aspx?id=30679>

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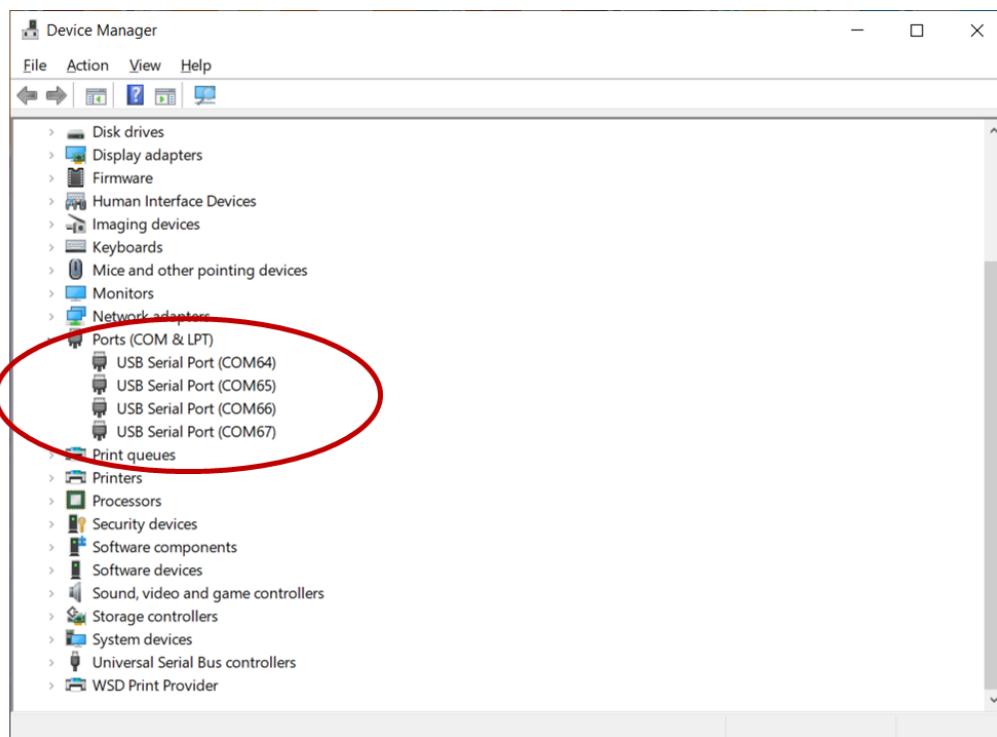


Figure 9. Windows device manager with driver installed & powered MPTCB attached

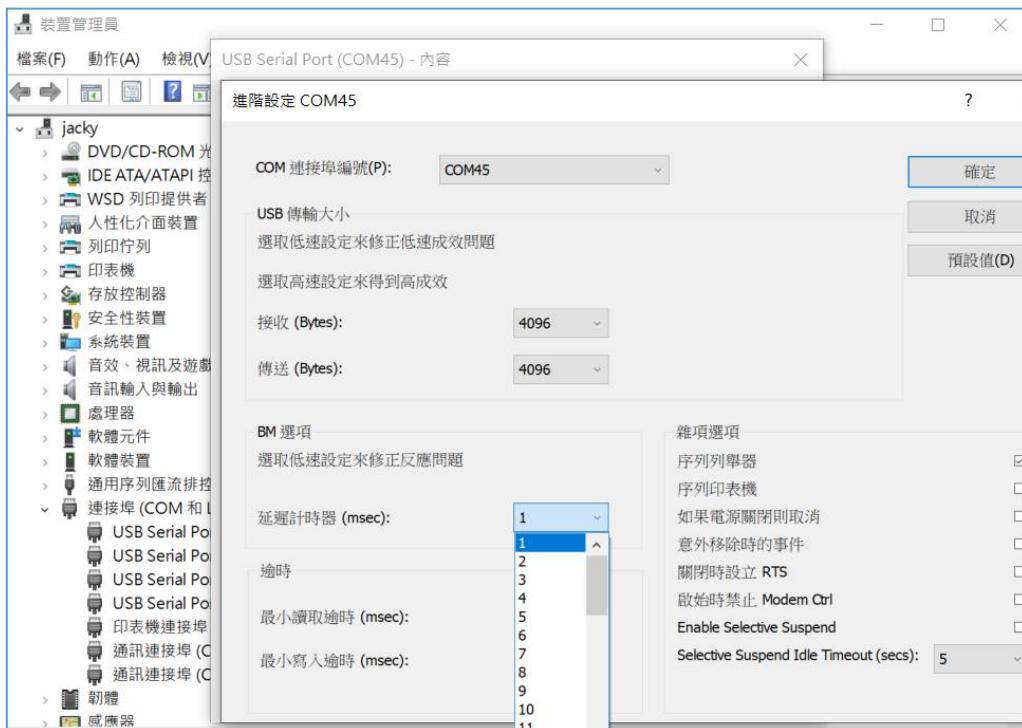


Figure 10. Latency Timer settings for virtual COM ports

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2. Mass Production Tool User Interface

The Mass Production Tool (MP Tool) is used for mass production tests on devices utilizing a Rafael Micro RT58X chip. Mass production processes include flash write/verify, crystal trim and RF TX/RX Test. When the installation is complete, you can double-click “MP_TOOL.exe” in the file directory to start the application, as shown in Figure 10.

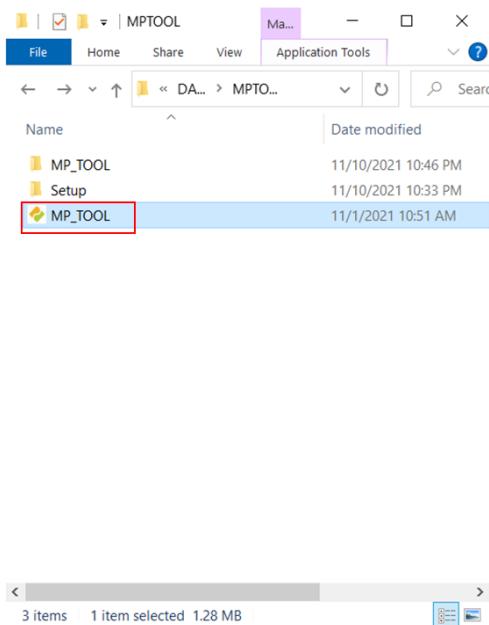


Figure 10. RT58X MP Tool Software Path

MP Tool creates a log file for each DUT. The log files are saved in the working folder (see Figure 11).

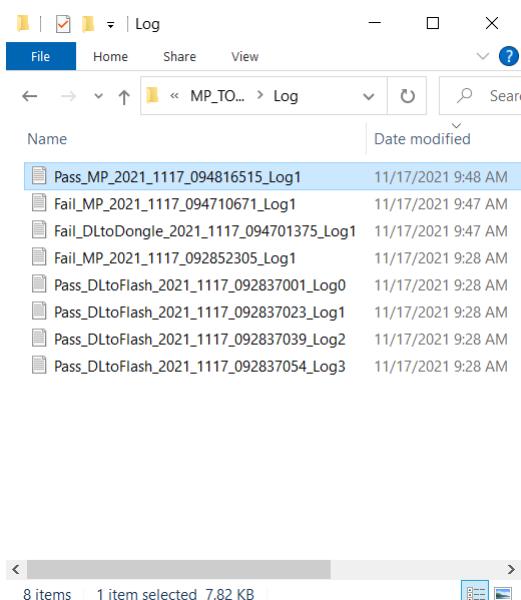


Figure 11. Log list in file manager

Figure 12 shows the MP Tool graphic interface.



Figure 12. Tool setup progress

Quick start procedure:

1. Set the test parameters on the Setting for the selected test item(s).
2. Click the checkbox to select the DUT for testing. The DUTs are shown in the same sequence as the COM ports.
3. Click the “TEST” button to start testing the DUTs.
4. MP TOOL will update pass/fail times after testing.
5. MP Tool supports 1 to 16 parallel test; user can click the button to toggle between the two windows.

If the DUT passes all tests, the corresponding DUT box is PASS using green as shown in Figure 13.

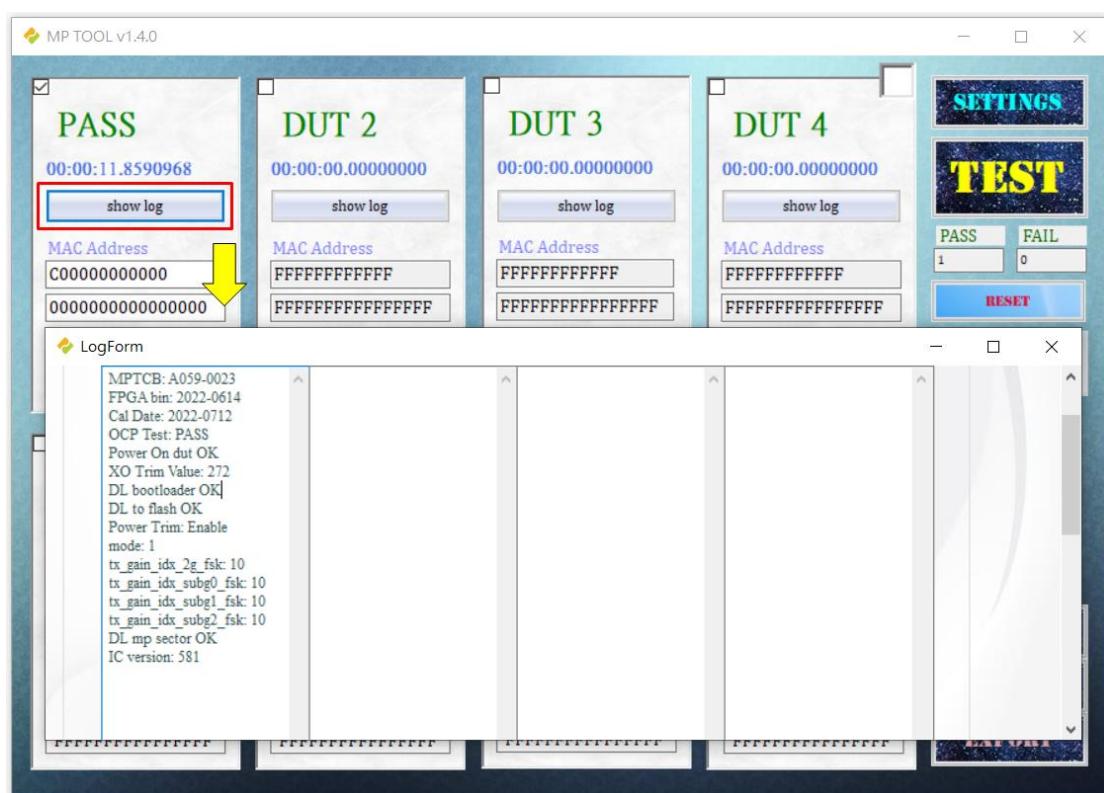


Figure 13. Test pass result

If a DUT fails a test, the corresponding DUT box shows FAIL using red as shown in Figure 14.

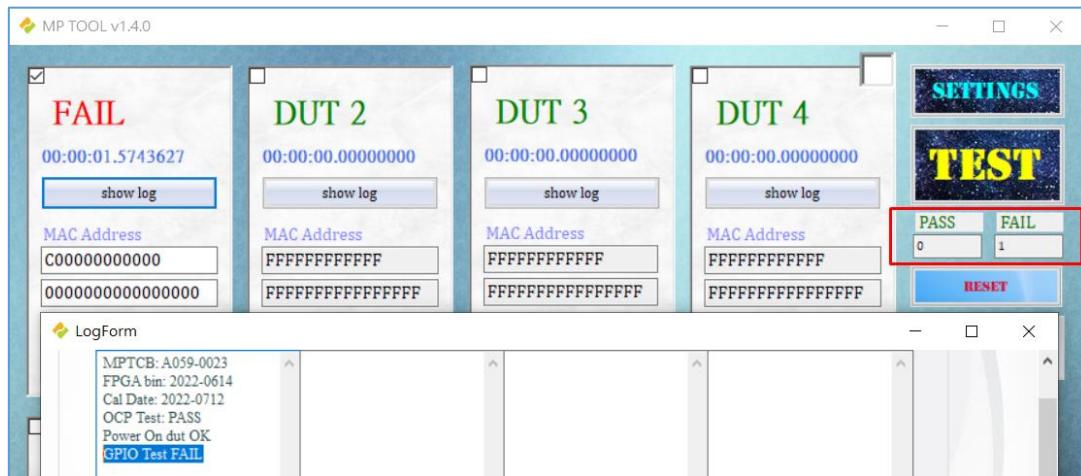


Figure 14. Test fail result

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3. Parameter Setting

3.1 Test Items

The MP Tool operation procedure is explained as below. Please refer to Figure 15.

1. Click the “Sync” button to confirm the DUT COM port settings are correct.
2. Click the “Select DUT Image” button to select Test binary file.
3. Click the “Select Bootloader Image” button to select the Test binary file. If user has not selected any bootloader image, MP Tool will show warning message such as “bootloader FW does not exist”.
4. Click the “Select MP Sector” button to select the Test binary file.
5. Click the “Download” button to download FW to the MPTCB.
6. Click the “Test Config” button to set detail items for each test.
7. Select the checkboxes for each test item. User is not allowed to cancel any item in to do list.
8. Click the “Select Public Key” button to select the public key file which is in .der or .pem format.
9. Select the checkboxes for security boot.

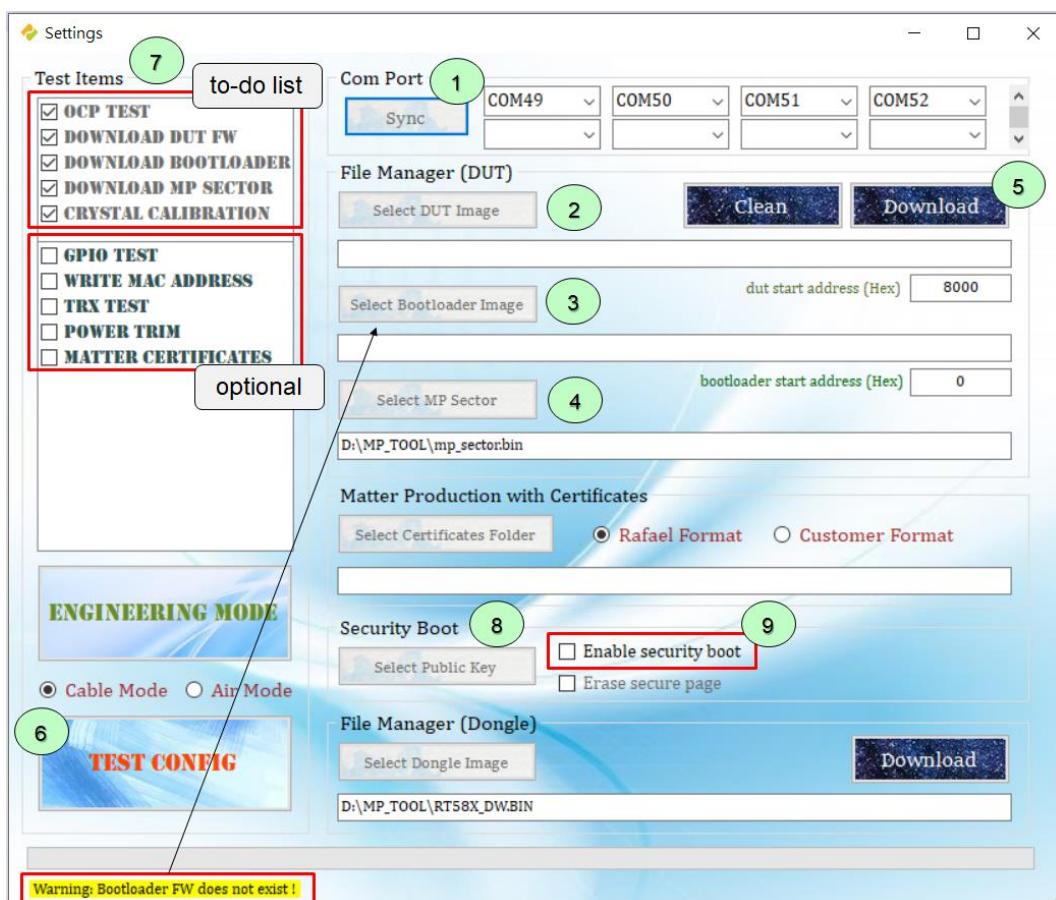


Figure 15. Setting dialog

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3.2 Test Config Setting

3.2.1 Over Current Protection (OCP) Test

To confirm whether the DUT has a short circuit causing a large current, the MPTOOL can set the current-limiting circuitry to screen-out defective DUT products as shown in Figure 16.

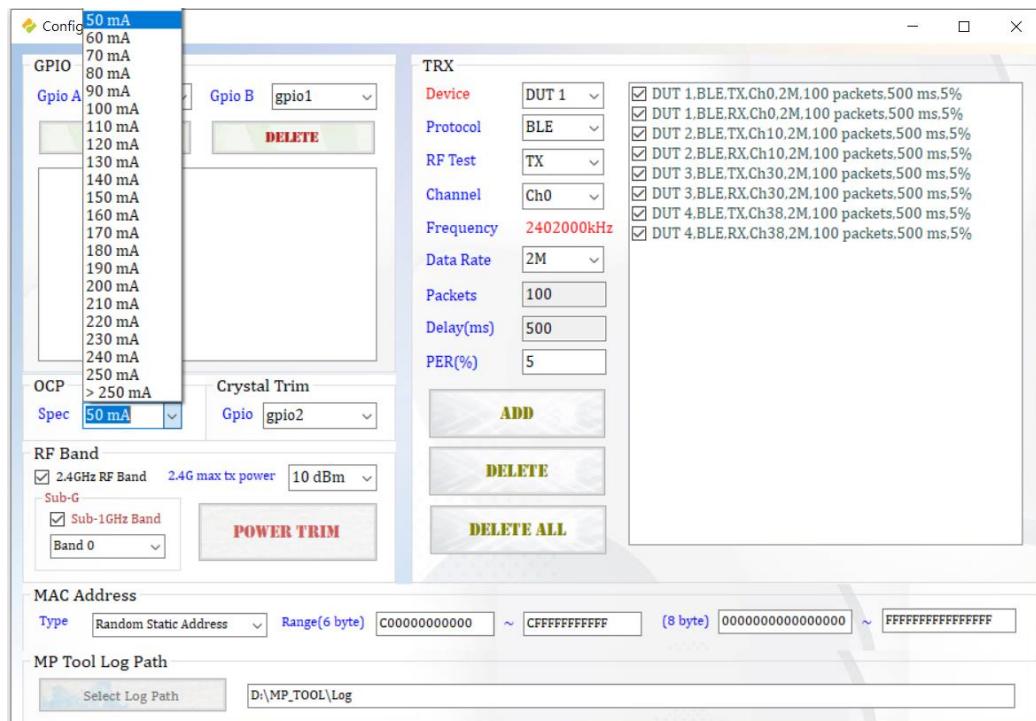


Figure 16. Over Current Protection (OCP) current limit Setting

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3.2.2 GPIO Test

GPIO test is done by checking the connection between two GPIO pins. In the control panel, configure two GPIO pins to be a pair before the test as shown in Figure 17.

1. Select the GPIO Test function.
2. Click the Add button in the GPIO Test section. The MP Tool shows the GPIO Test Pair Dialog window.
3. Select the GPIOs you want to pair, and then select the Pair button.

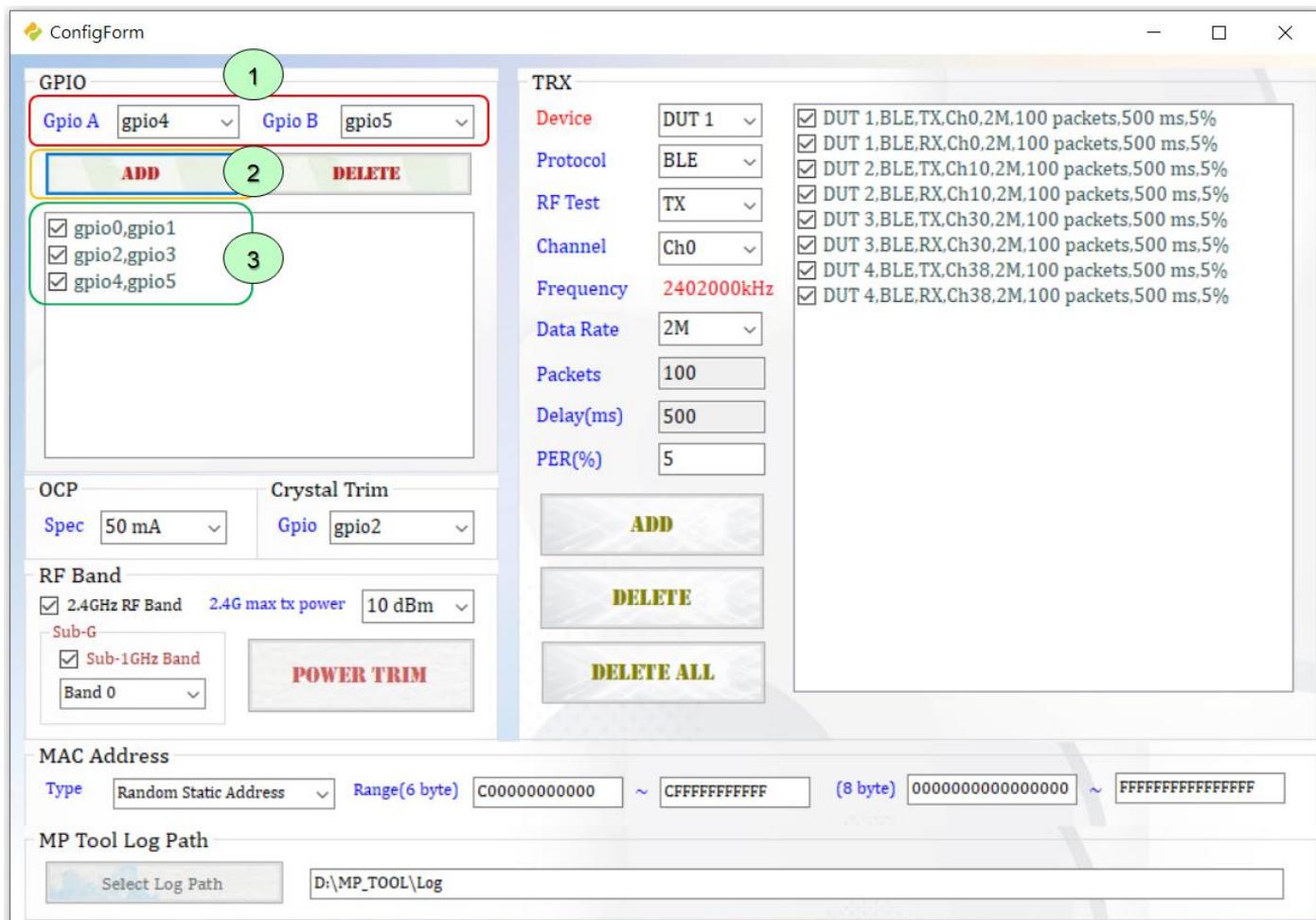


Figure 17. GPIO Test Setting

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3.2.3 Crystal trim

The Crystal Trim test adjusts crystal offset by measuring the frequency offset of the crystal signal using the 1-to-4 MPTCB. The operating environment is described as follows, please refer to Figure 18.

- When performing the 'Crystal Trim' test, the 1-to-4 MPTCB tunes the capacitance of each crystal circuit and measures the frequency offset.
- GPIOs that can be used for crystal trim are GPIO2, 6, 14. You can select one of the GPIO do the crystal trim.

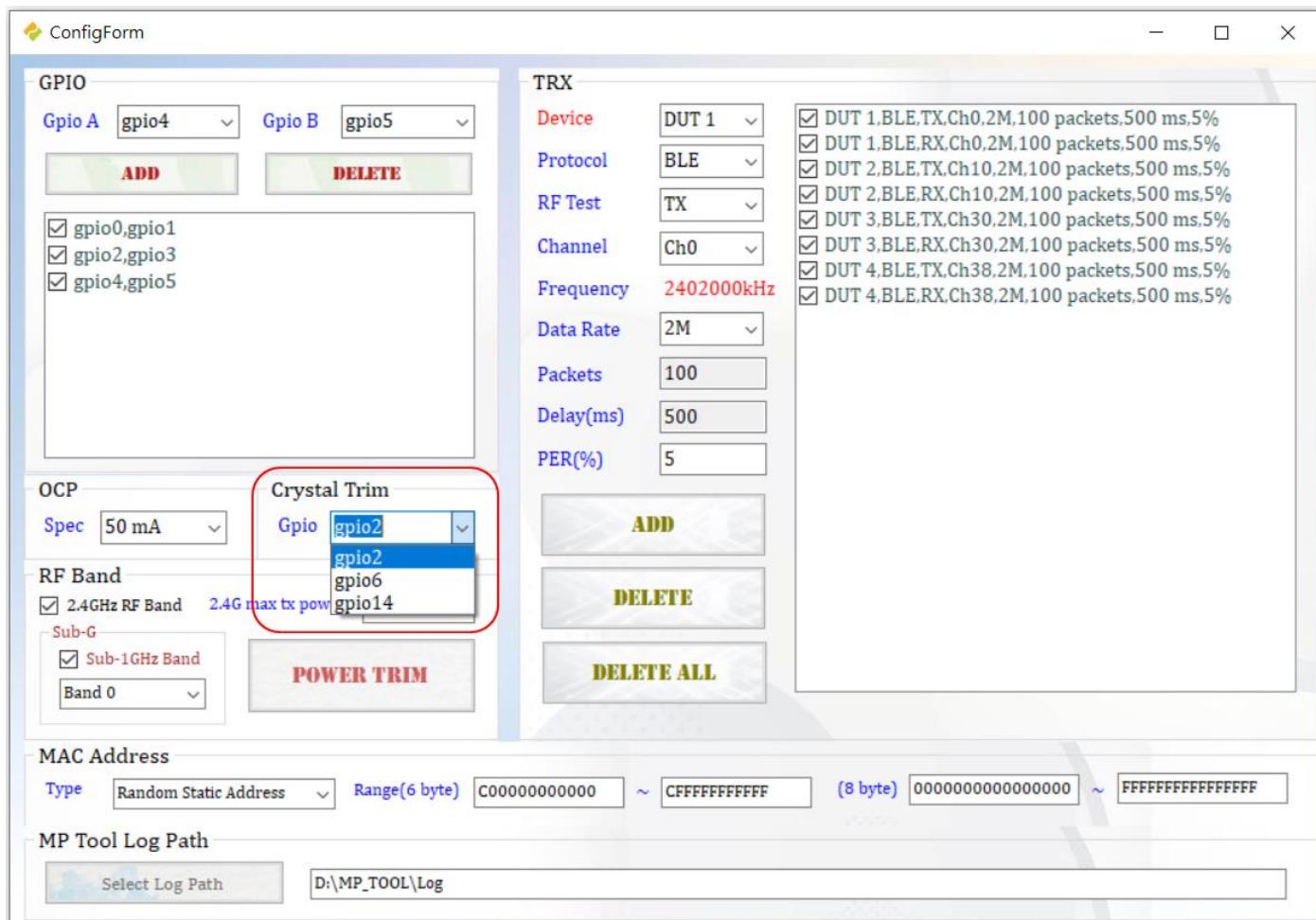


Figure 18. crystal trim settings

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3.2.4 RF TX/RX test

To test Bluetooth®, Zigbee 3.0 & Sub-GHz TX/RX settings, please refer to Figure 19 below.

The DUT transmits TX burst signals on the specified channel and the MPTCB RX measures the DUT TX Packet to check if the Packet Error Rate (PER) is abnormal. If it is not, the DUT RX measures the PER of TX burst packets from the MPTCB.

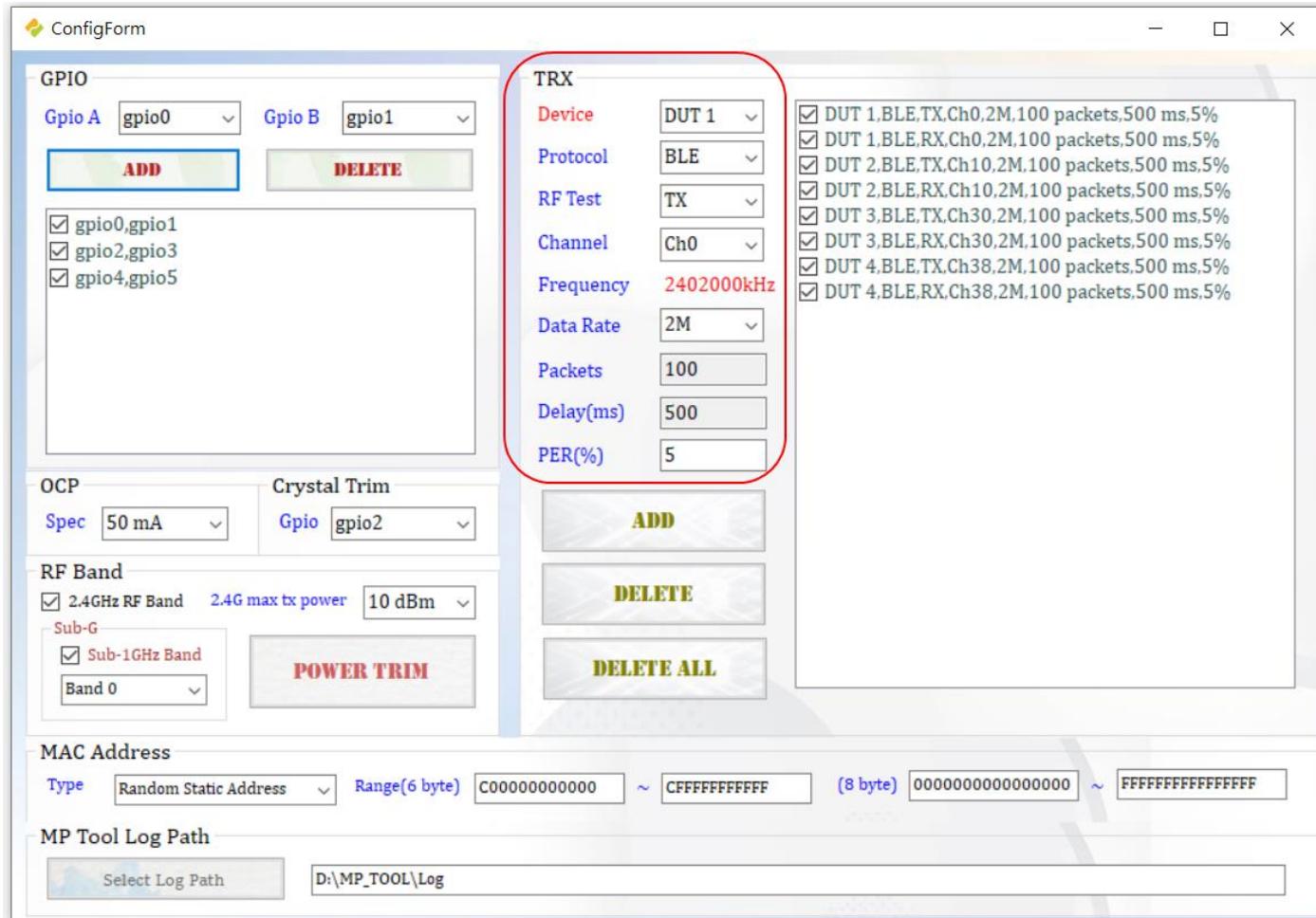


Figure 19. RF TX/RX Test Setting-1

The MP Tool RF TX/RX Test operation procedure is explained below. Please refer to Figure 20.

1. Select the DUT.
2. Select the RF Mode Protocol (Bluetooth® 5 Low Energy, Zigbee 3.0 or Sub-GHz).
3. Select the RF Test: TX or RX.
4. Select the RF Channel.
5. Select the RF Data Rate.
6. Set the quantity of RF Packets.

7. Setup the Test Delay(ms).
8. Setup RF Packet Error Rate (PER) Limit.
9. Click the Add button in the RF Test section. The MP Tool shows the RF Test Pair Dialog window.
10. Select the RF Test Type you want to pair, and then select the Pair button.
11. Close the Window.

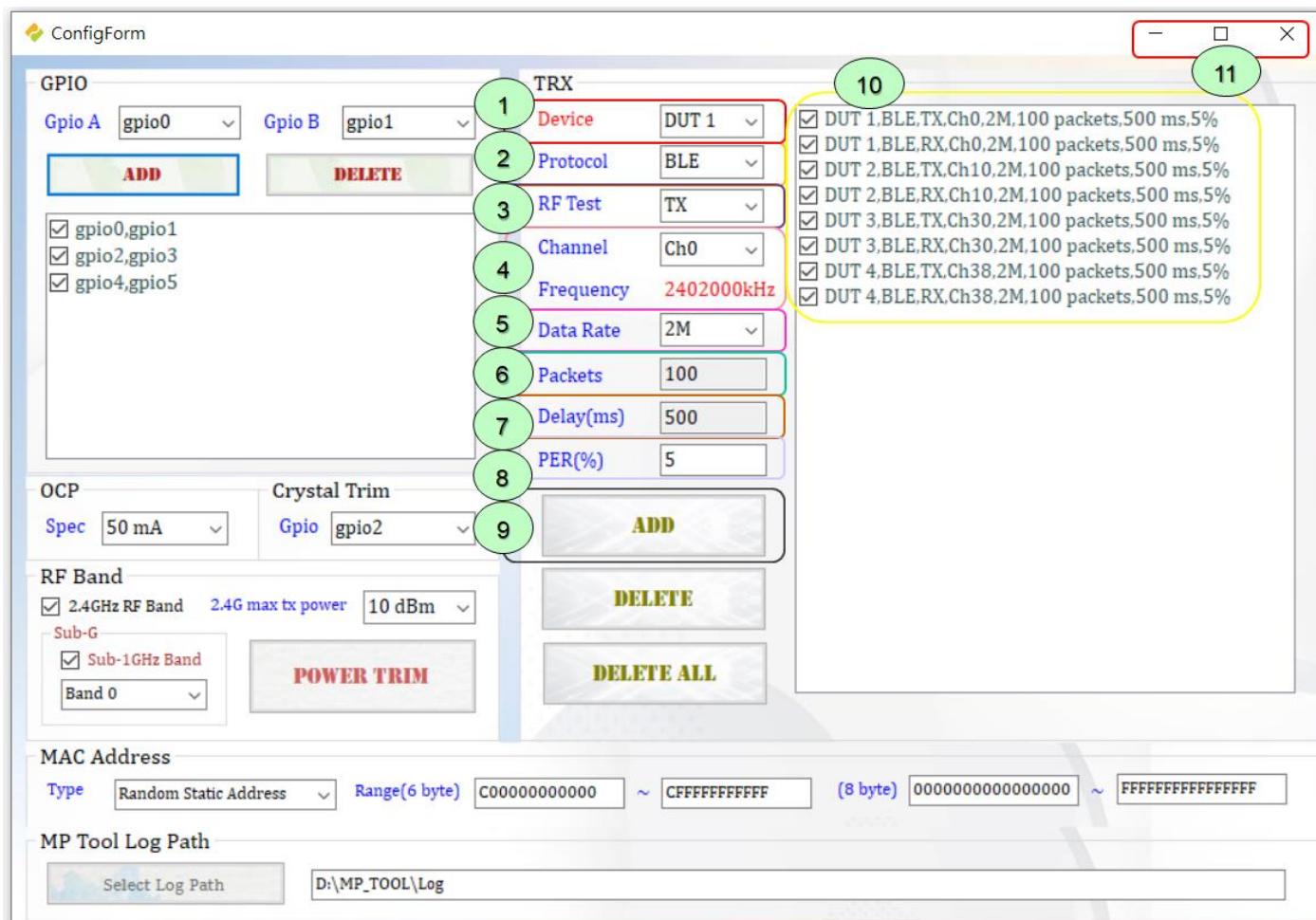


Figure 20. RF TX/RX Test Setting-2

3.2.5 MAC Address Setting

The MP Tool about MAC address settings are shown below. Please refer to Figure 21.

1. Select the MAC address type.
2. Setup 6 bytes MAC address Limit for BLE.
3. Setup 8 bytes MAC address Limit for ZigBee.

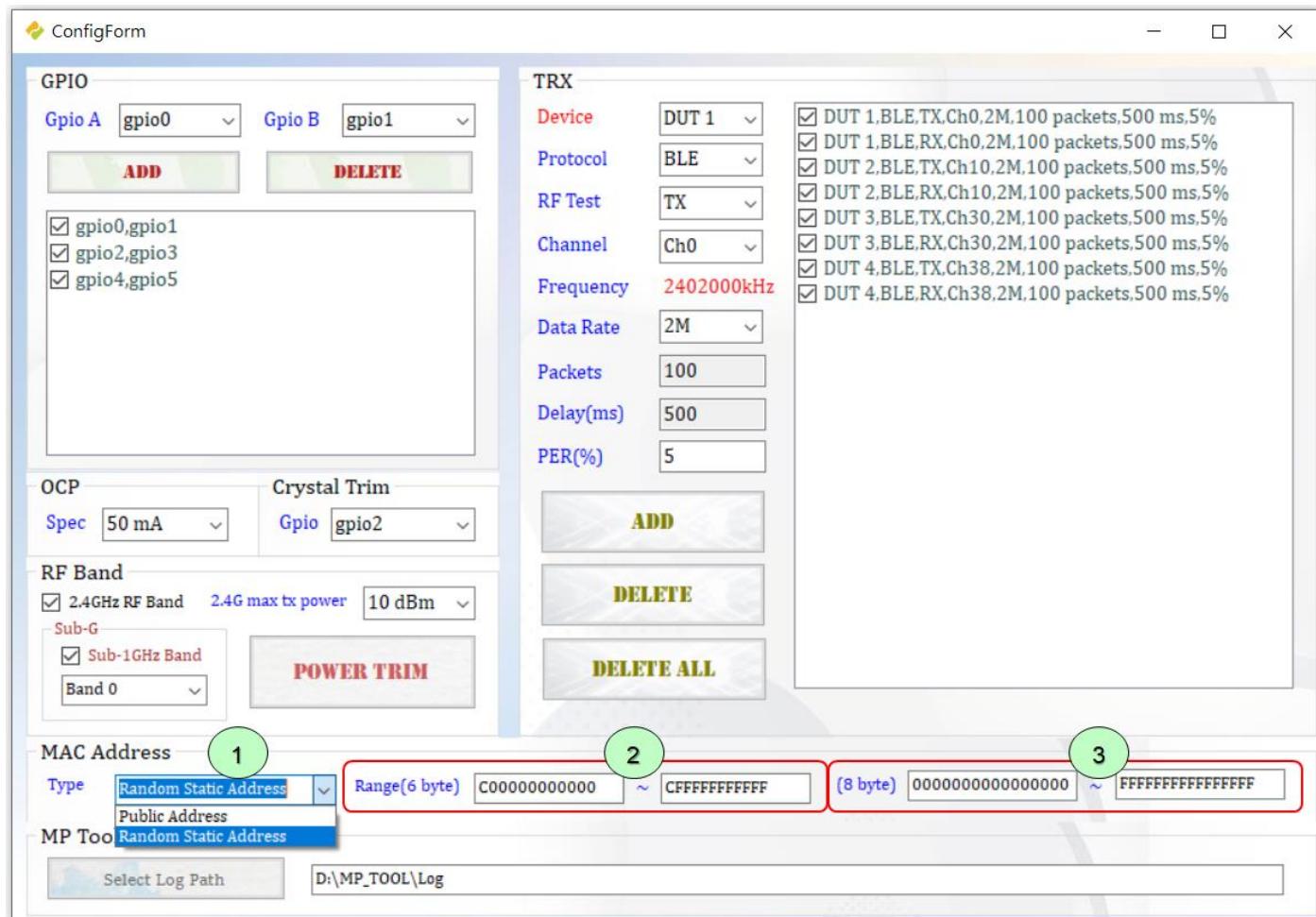


Figure 21. MAC Address Setting

3.2.6 Power Trim

Following step-by-step instructions for 2.4GHz and Sub-G power trim.

1. Click the “POWER TRIM” button in the RF band section as shown in Figure 2
2. Select 2.4G max tx power for 0.4, or 10 dBm.
3. Select tx calibration type for golden DUT or signal generator as shown in Figure 23.
4. For using golden DUT to start calibration, DUT will transmit single tone, and user can select stage value to change output power.
5. If use signal generator to start calibration, the output power from signal generator must be in -10 to 10 dBm.
6. Click the “Start Cal” button to get RSSI value.
7. Select “POWER TRIM” checkbox as shown in Figure 24.
8. Click “TEST” button to start power trim as shown in Figure 25.
9. In some cases, user may want to setup tx power without calibration. Select “apply fixed stage” and fill in stage value as shown in Figure 23.

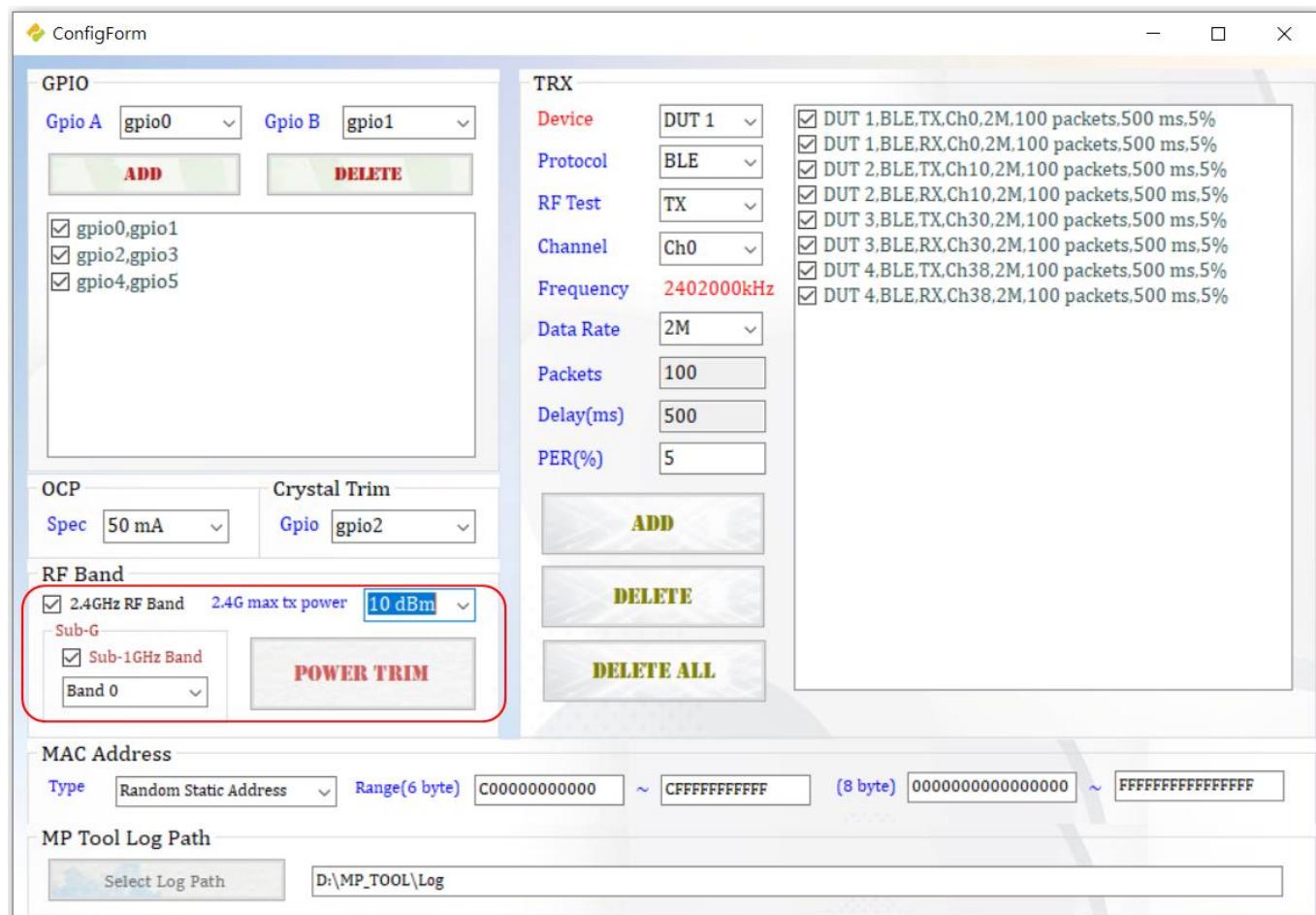


Figure 22. Power Trim Setting

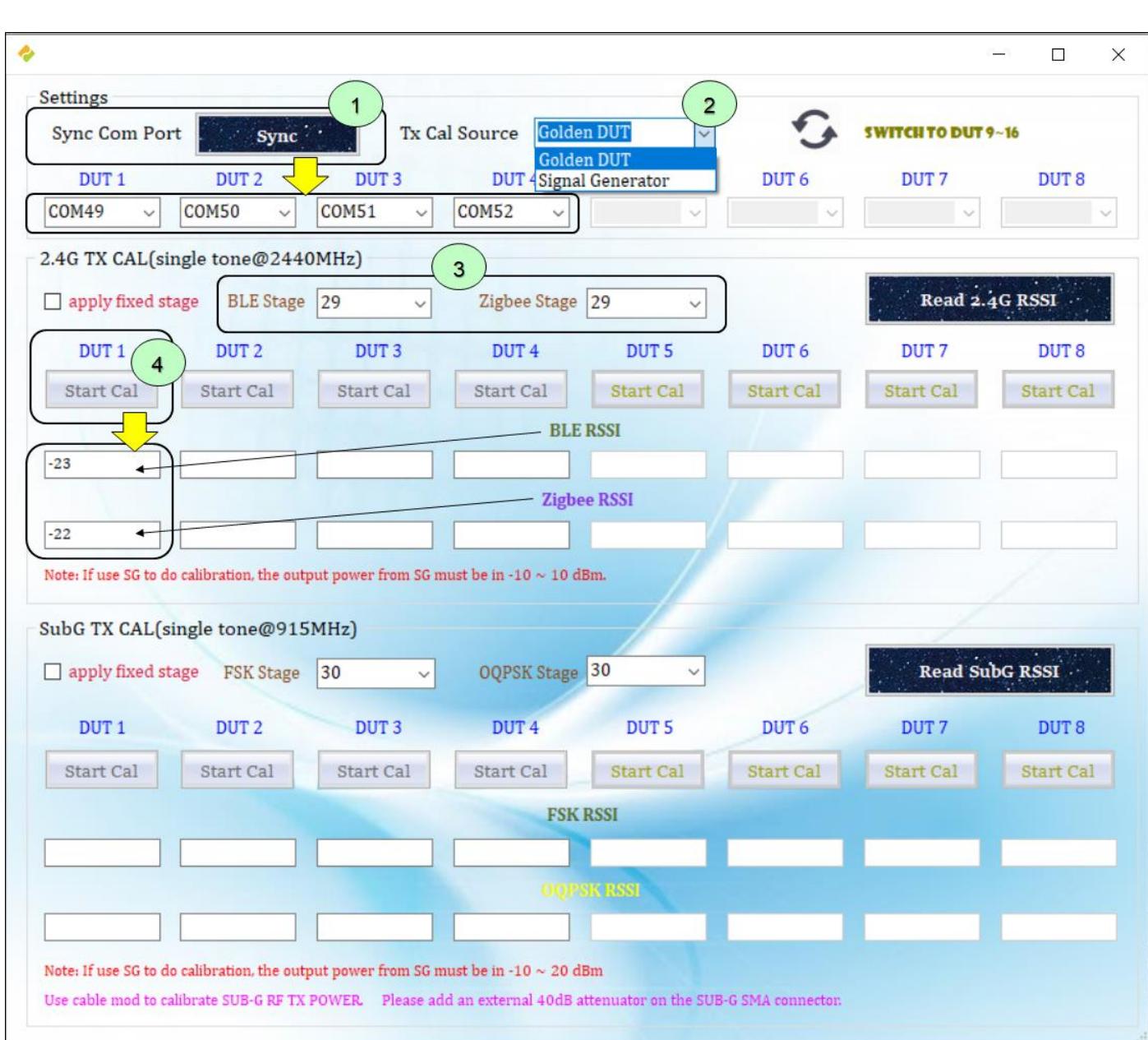


Figure 23. Power Trim Setting-2

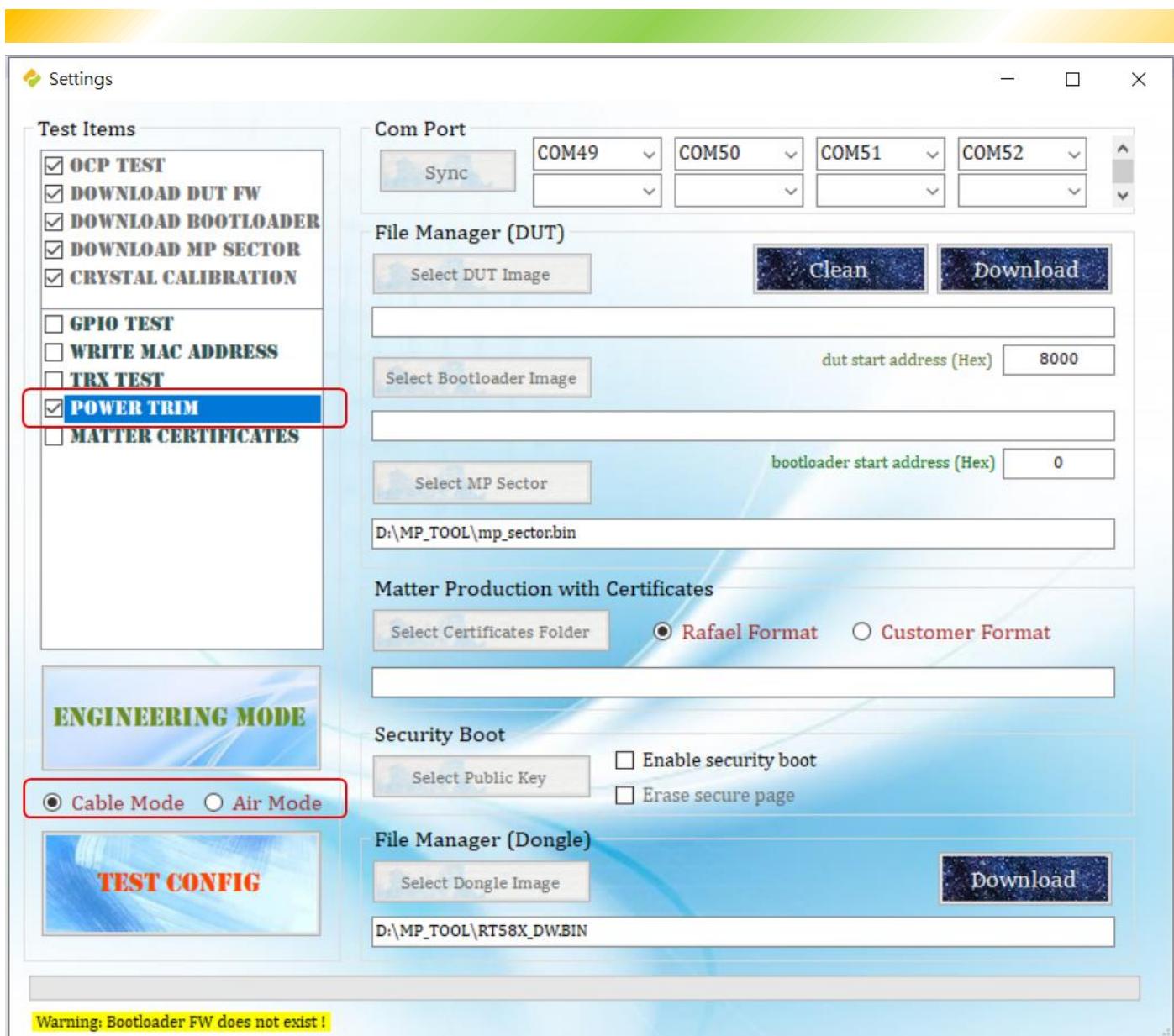


Figure 24. Power Trim Setting-3

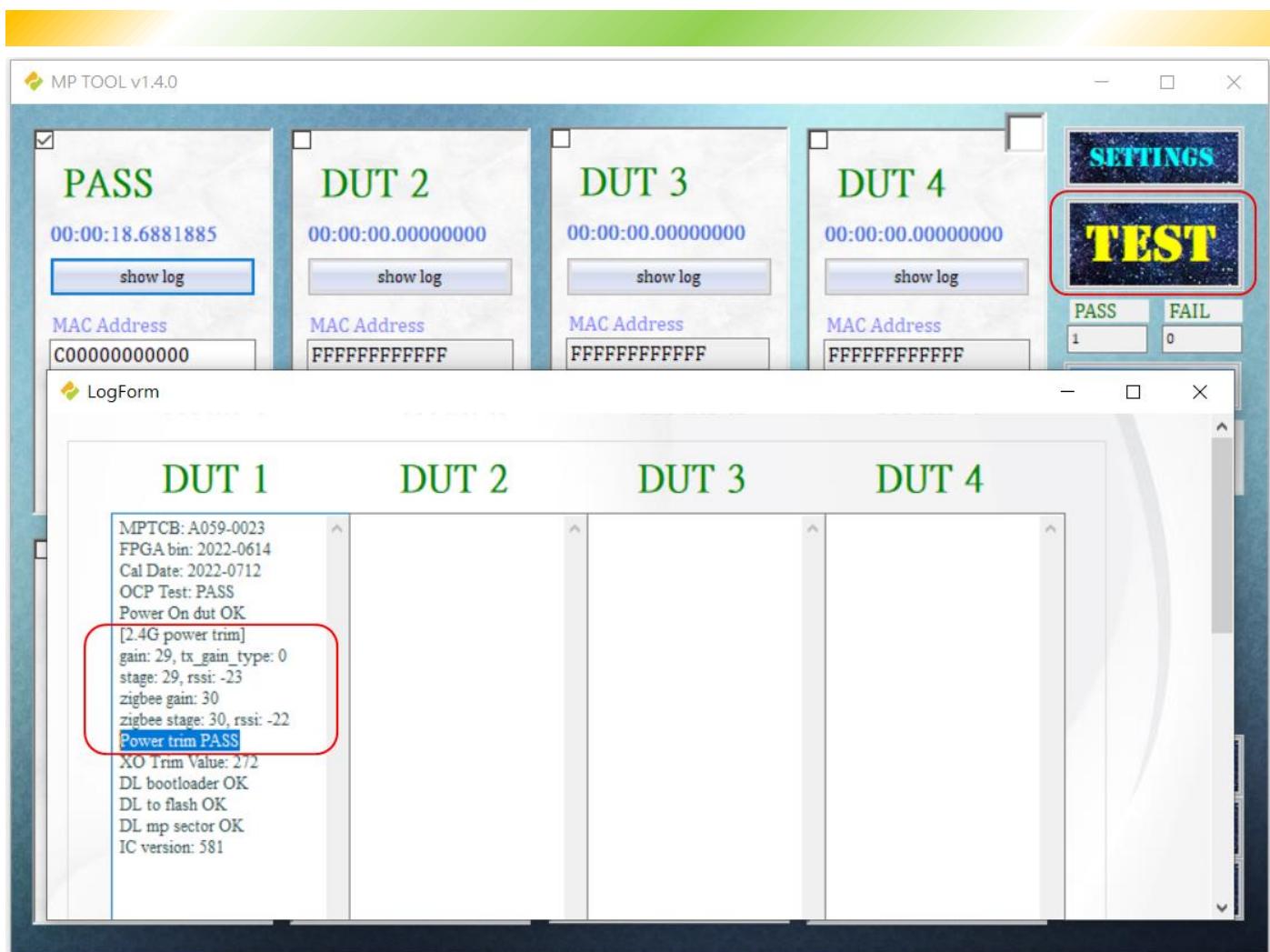


Figure 25. Power Trim Setting-4

3.2.7 Security boot

The operation procedure of security boot is explained below. Please refer to Figure 26 and Figure 27. If user wants to erase the secure page in flash, click the “Erase secure page” checkbox.

1. Select bootloader and application image files which have been signed digitally by Security Boot Tool (refer to step 1 and step 2 in Figure 19, MP Sector is no need to be signed)
2. Click “Download” button in step 3, and then click the “Select Public Key” button in step 4 to select the public key file which is in .der format or .pem format.
3. Click the “Enable security boot” checkbox to enable security boot mechanism in step 5.
4. After completing the above steps, click “TEST” button to start MP test as shown in Figure 27. MP Tool will verify that the signature is valid.
5. Lastly, we can open Tera Term to check if security boot is successful as shown in Figure 28.

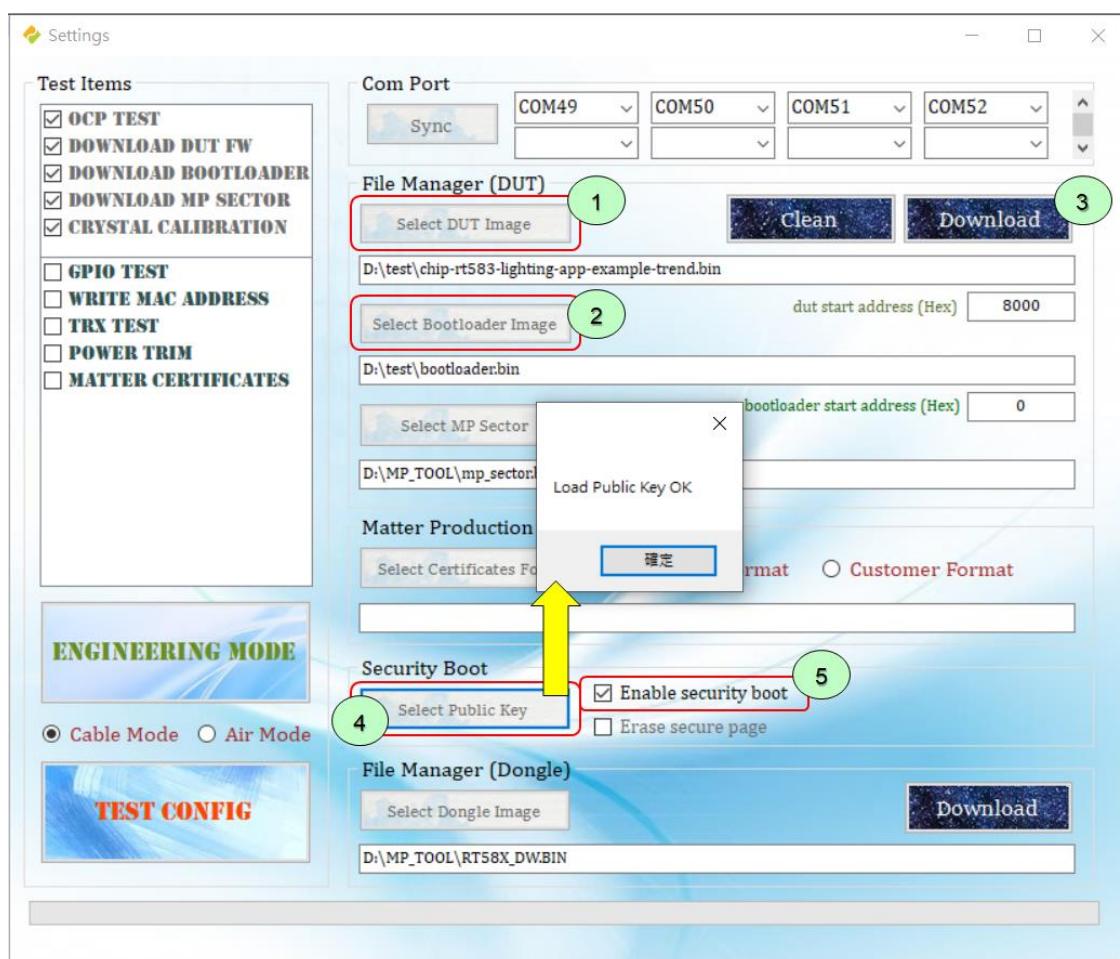


Figure 26. Security Boot Setting

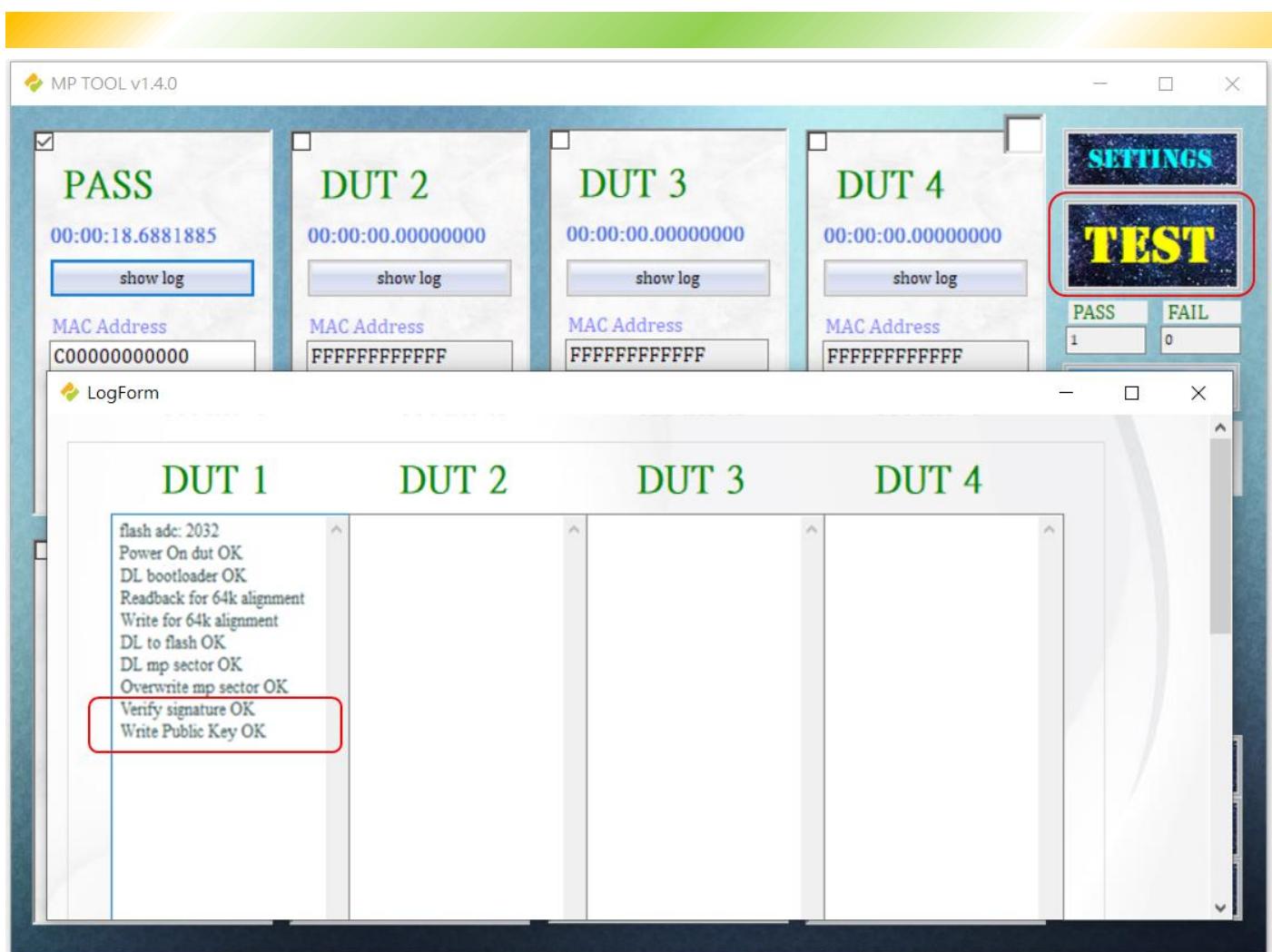


Figure 27. Security Boot Test Result

```
COM74:115200baud - Tera Term VT
File Edit Setup Control Window KanjiCode Help
[BOOT] Bootloader Running...
[SECURE_BOOT] APP image correct.
[BOOT] Bootloader check completed. Boot into application.
-----
BLE data rate (P) demo: start...
-----
BLE stack initial...
[COMMON] SET CONTLR INFO status = 0
[COMMON] SET EVENT MASK status = 0
[COMMON] READ VER status = 0, hci_revision = 6110
[COMMON] READ BUFFER status = 0 size = 7
Sento status 0...Wait cfm
Recv cfm status 0
Se[GAP] SET ADDR status = 0
AP] SET ADDR stWait cfm
Recv cfm status 0
Se[GATT] WRITE DEFAULT DATA LENGTH status = 0
ATT] WRITE DEFAWait cfm
Recv cfm status 0
Sento status 0...Wait cfm
Recv cfm status 0
Write default data length, status: 0
Sento status 0...Wait cfm
Recv cfm status 0
Se[GATT] GET ATT HANDLES COMPLETED.
[GATT] GET ATT HANDLES COMPLETED.
[GATT] GET ATT HANDLES COMPLETED.
[GATT] GET ATT HANDLES COMPLETED.
[ADV] SET PARAM status = 0
DV] SET PARAM sWait cfm
Recv cfm status 0
Se[ADV] SET DATA status = 0
DV] SET DATA stWait cfm
Recv cfm status 0
Se[ADV] SET SCAN RSP status = 0
DV] SET SCAN RSWait cfm
Recv cfm status 0
Se[ADV] SET ENABLE status = 0
DV] SET ENABLE Wait cfm
Recv cfm status 0
Advertising...
```

Figure 28. Data Rate Demo for Security Boot

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3.2.8 Matter production with Certificates

The operation procedure of matter production with certificates is explained below. If user's product is only for Bluetooth or Zigbee application, this chapter can be ignored.

1. Select certificates folder, which contains certificates bin files as shown in Figure 29.
2. Select certificates format.
3. Click on the "MATTER CERTIFICATES" checkbox.
4. Click "TEST" button to write certificates into flash.
5. If all test items are pass, tool will delete certificates bin file as shown in Figure 30.

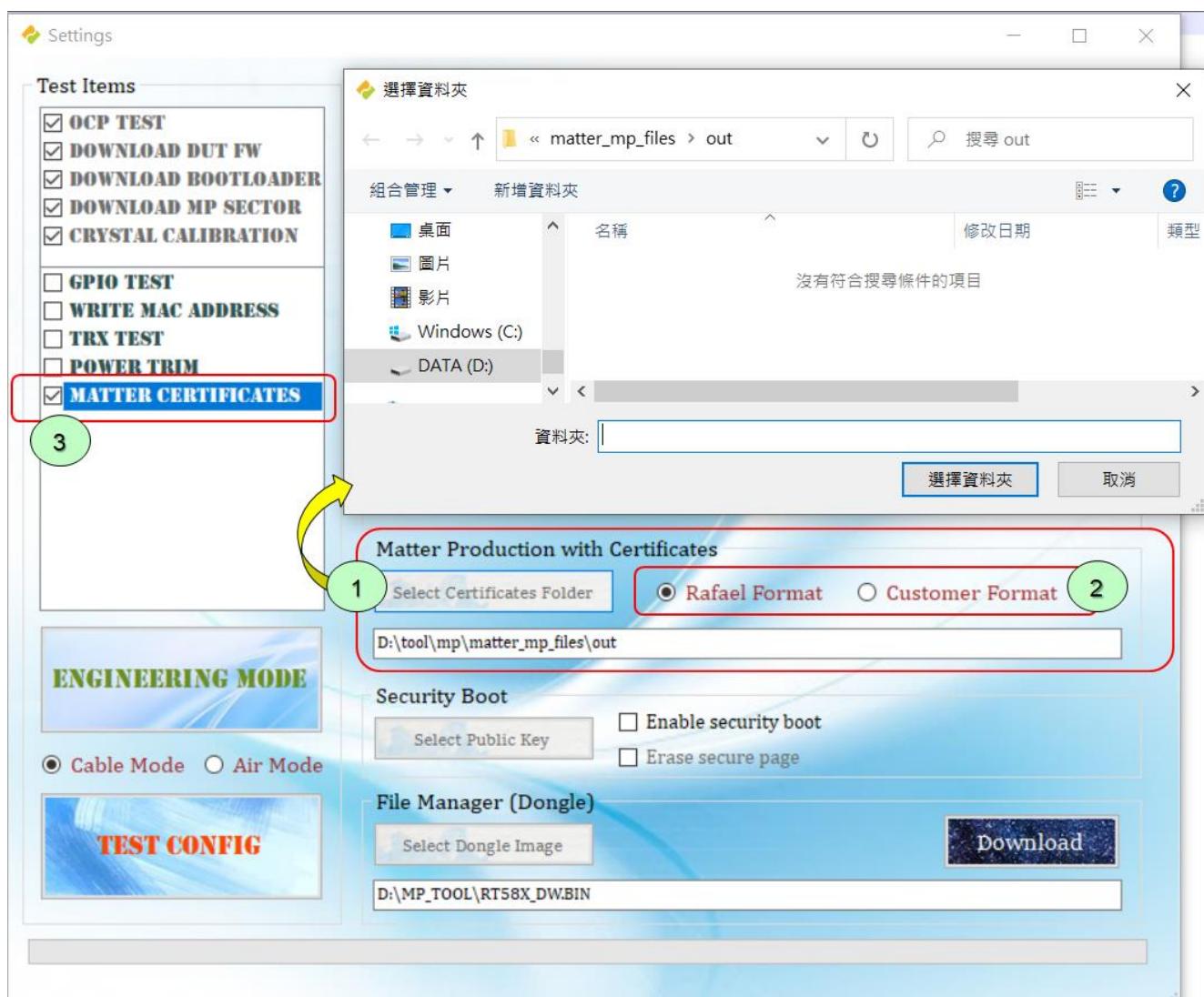


Figure 29. Select certificates folder

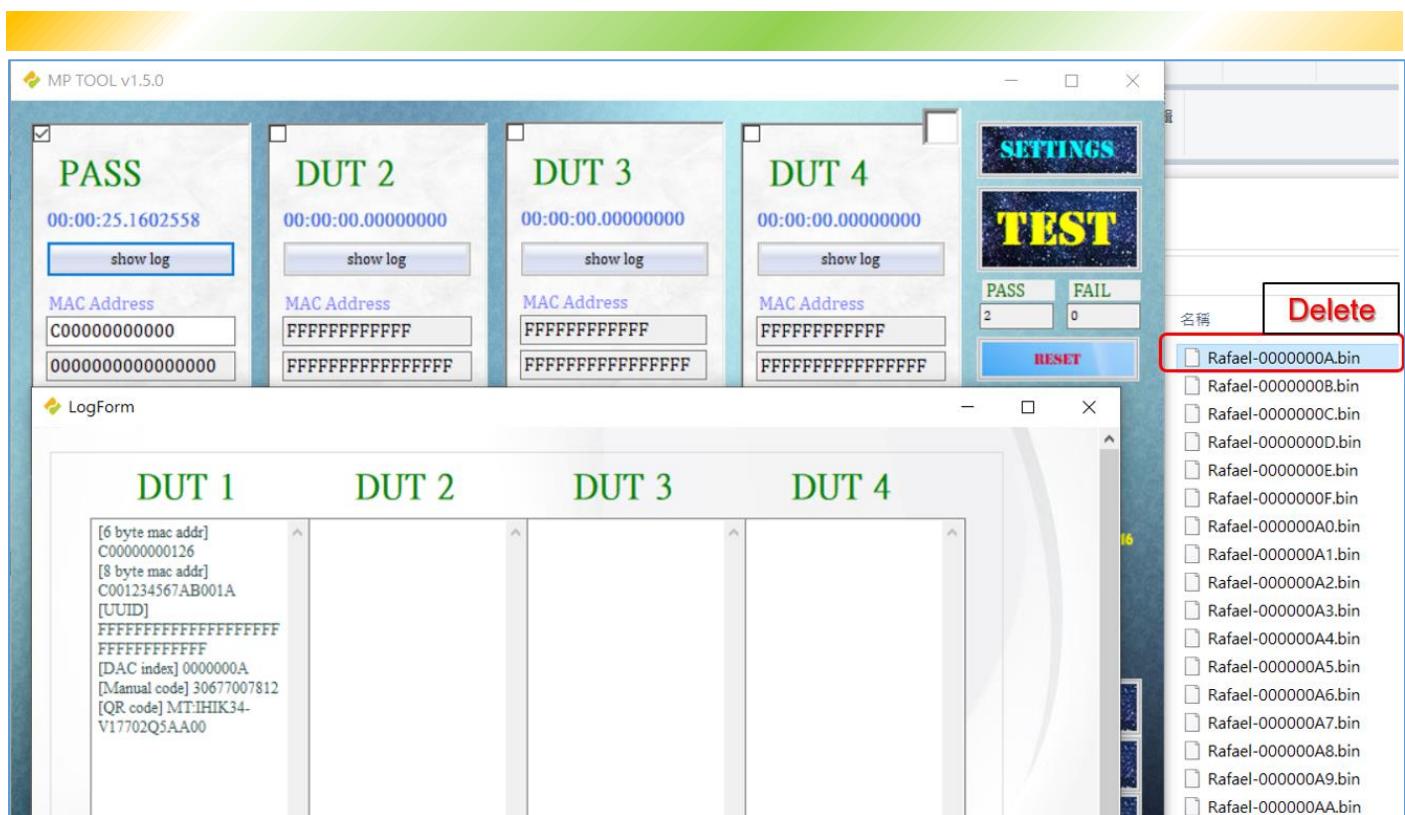


Figure 30. Enter index for Certificates

4. Contact Information

Address	8F., No.28, Chenggong 12th St., Zhubei City, Hsinchu County 30264 Taiwan R.O.C.		
Contact	Tel: 886-3-5506258	Fax: 886-3-5506228	www.rafaelmicro.com
Sales	World-wide	886-3-5506258 ext. 206	michael.gauer@rafaelmicro.com
	China	86-1360-2679953	evan.tu@rafaelmicro.com
	Korea	82-10-5580-0657	hyunsu.lee@rafaelmicro.com
Technical Support	886-3-5506258 ext. 302	yenchih.shen@rafaelmicro.com	

5. Revision History

Revision	Description	Owner	Date
1.0	First official release	Gary Hou	2021/11/25
1.1	Update MP Tool window	Gary Hou	2022/02/08
1.2	Add power trim and security boot guide	Jacky	2022/03/24
1.3	Support 1M/2M flash download	Jacky	2022/11/15
1.4	Support Sub-G 915 MHz power trim, matter production with certificates, and 1 to 16 parallel test	Jacky	2023/06/06
1.4.1	Support Sub-G 433 MHz	Jacky	2023/07/21
1.5	Revise matter production with certificates	Jacky	2023/08/25

6. Q & A

If user update the latest version MP Tool, it may show the message “test image is not valid” or “dongle image is not valid” in the process of testing. This message is to remind user to update test image or dongle image for new feature as shown in Figure 31. Please refer to Figure 32 for image upgrade.

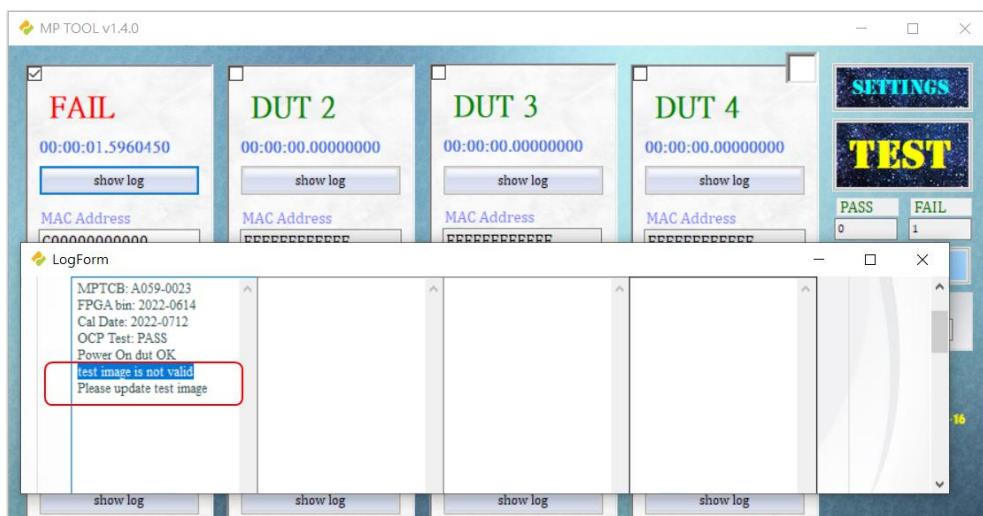


Figure 31. Warning message in the process of testing

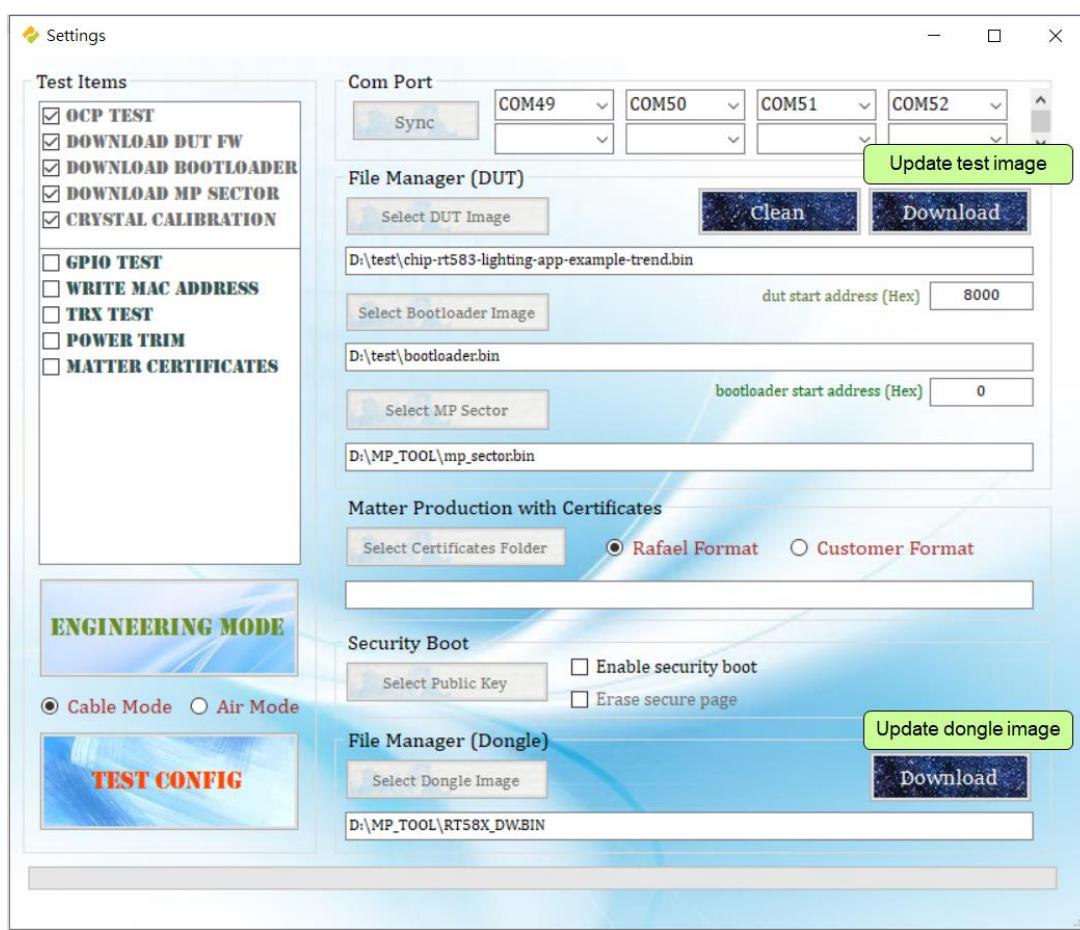


Figure 32. test image/dongle image upgrade

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