

Realtek
Bluetooth Radio Rfrequency Tool
RTLBTAPP
User Manual

Draft v0.9

2020/05/25

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Revision History

Date	Version	
2014/9/11	Draft v0.1	First release
2014/10/27	Draft v0.2	Add read/write efuse
2015/08/10	Draft v0.3	Add LE Test
2016/05/24	Draft v0.4	Certification TX
2016/06/07	Draft v0.5	Modify RF Test
2016/07/25	Draft v0.6	Modify UI
2019/04/02	Draft v0.7	Modify all page for new GUI
2019/07/30	Draft v0.8	Add Efuse Map read/write for RTL8761B
2020/05/25	Draft v0.9	Modify all Picture

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1. Overview

This document is used to introduce RF test tool “RTLBTAPP” for Realtek Bluetooth chip series. Customers should comply with the steps and requirements under this document. Contact Realtek Bluetooth FAE if any problem arises in the use of test.

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2.Files

RF tool package is provided to customers in binary format:

RTLBTAPP.exe	MP executable file
RtlBluetoothMP.dll	MP dll library

If Chip are Combo chips(WLAN) or BT Controller s, then need to have the FW patch directory: **BTPatchCode**

The directory include firmware patch:

BTPatchCode\ Patch_rtl8723a.bin	RTL8723A firmware patch
BTPatchCode\ Patch_rtl8723b.bin	RTL8723B firmware patch
BTPatchCode\ Patch_rtl8821a.bin	RTL8821A firmware patch
BTPatchCode\ Patch_rtl8761a.bin	RTL8761A firmware patch
BTPatchCode\ Patch_rtl8703b.bin	RTL8703B firmware patch
BTPatchCode\ Patch_rtl8723d.bin	RTL8723D firmware patch
BTPatchCode\ Patch_rtl8822b.bin	RTL8822B firmware patch
BTPatchCode\ Patch_rtl8821c.bin	RTL8821C firmware patch
BTPatchCode\ Patch_rtl8822c.bin	RTL8822C firmware patch
BTPatchCode\ Patch_rtl8761b.bin	RTL8761B firmware patch
.....	
BTPatchCode\ Patch_rtl8852a.bin	RTL8852A firmware patch



Figure 1File List

Double click “RTLBTAPP.exe” to open this tool. However, please use “**Run Administrator**” to open it in Vista/Windows7 or higher.

3. Hardware environment

Before use this tool, PC/NB should direct connected UART/USB port. The connection **between Bluetooth and HOST chip must be cut off.**

4. RTLBTAPP Main Page

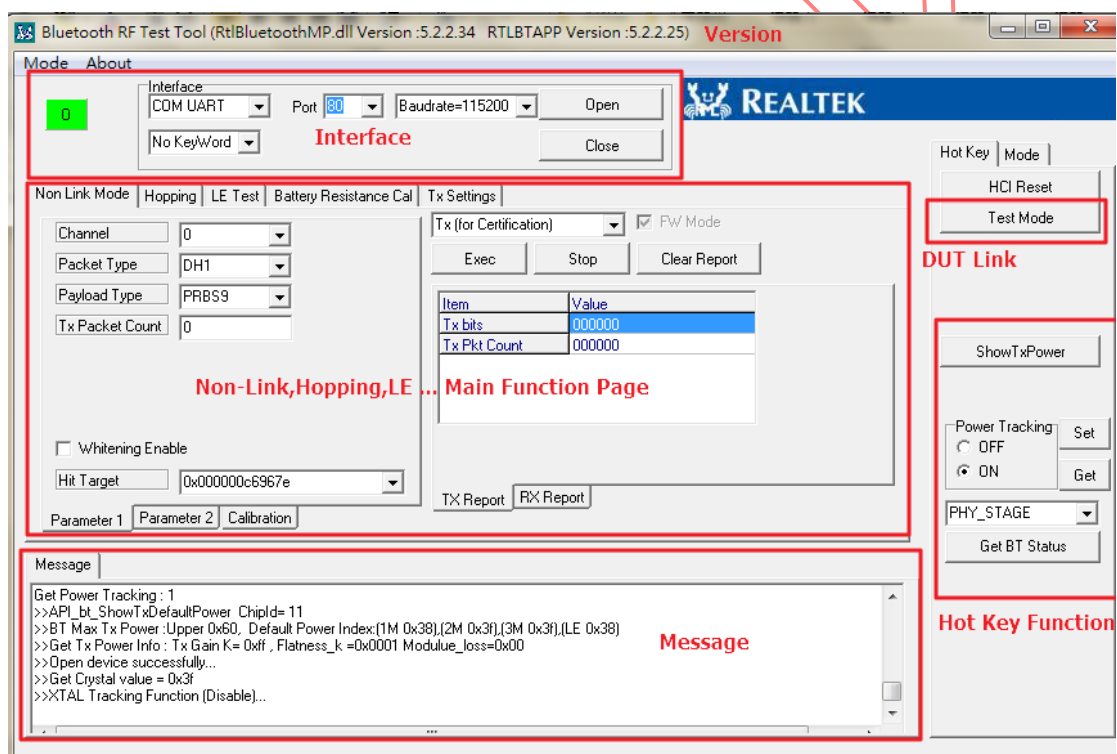


Figure 2 RTLBTAPP main page

This RF Tool is mainly divided into several blocks.

1. Interface block: Interface setting.
2. Message: Show execute message.
3. Main test page block: include all test page.
4. Hot key: Include DUT Link mode and common button.
5. Version information: Show Version number.

4.1 Interface block

Below is a description of opening the device:

Step 1: Select correct interface.

- **USB :**

If the module interface is “USB”, please select “USB” and “Port =1” to Open.

The device is mp usb driver of Realtek.

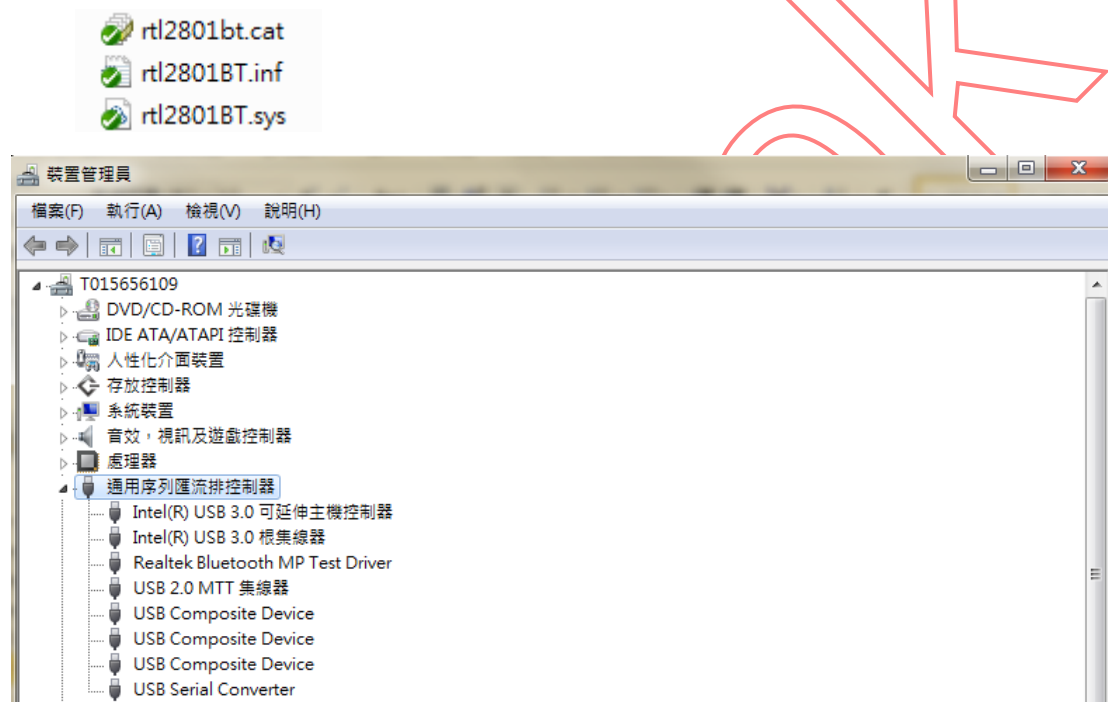


Figure 3BT MP Driver

- **UART:**

If the module interface is UART, please select “UART” and check COM port number in Device Manager. “RTLBTAPP” only supports COM port number is smaller than “99”. If COM port number is larger than “99”, open operation will fail.



Figure 4 Check COM port number

- SDIO:

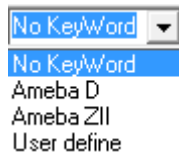
If the module interface is SDIO, please select “SDIO”

- WINUSB:

If interface of device is USB and use WINUSB driver of Microsoft, then select this interface.

- KeyWord:

If you need to transfer a special string first to open bt test mode (ex. Ameba D/ZII...) you need to select a special string.



Step 2: Click “Open”

After clicking “Open” button, the up left corner changes to green means it is successful to open BT Device and download firmware patch. You could double check it by the two lines in the “Message”. The firmware patch is downloaded one time only, after the device module is powered on. Therefore if you want to re-download firmware patch, first you should power off device and re-start.

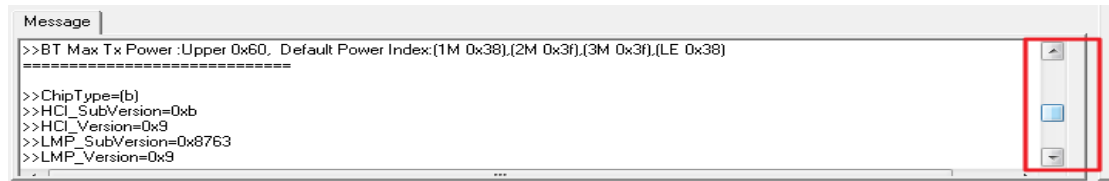


Figure 5 How to check if device was opened and patch was downloaded successfully

Note: This message will difference depending on the chip.

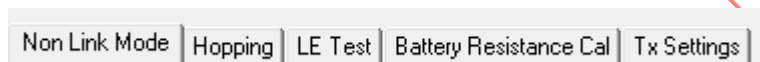
4.2 Message

You can use the up and down keys to see the current message.

**Figure 6 Message Box**

4.3 Main Test Tab Page

This supports hotkey will difference depending on the chip.



- NonLink Mode: Non-singling test
- Hopping : Hopping test for certification.
- LE Test : BLE Tx/Rx
- Tx Setting : Set Tx power level.
BT SOC Only:
- Battery Resistance Cal: BT Soc only for Battery Resistance Calibration.

4.4 Hot Key

This supports hotkey will difference depending on the chip. In general, the HCI RESET will definitely support it.

Hot Key
Mode

HCI Reset

Test Mode

GetChipInfo

ShowTxPower

Read BD Address

Read Thermal

Power Tracking

☐ OFF
 ☒ ON

Set

Get

PHY_STAGE ▼

Dynamic Log

- HCI Reset: Device excute “HCI Reset “
- Test Mode :Enter to test mode for BDR/EDR singling mode test.
- GetChipInfo:Get information of chip.ex: LMP Version.
- ShowTxPower: Show tx power level .
- Read BD Address: Show BD Address from device.
- Read Thermal : Read thermal raw data from device.
- Power Tracking(Set and Get): Disable or enable thermal power tracking.
- Dynamic Log: Log for Realtek debug.

Figure 7 Hot Key function

4.5 Mode(BT Soc Only)

The page only use BT Soc chip.

Hot Key

Mode

Erase FlashConfig Page

☐ TPM
 ☒ IQM

Set Mode

Get Mode

Adaptivity(LBT)

Disable

☐ No Tx Mode
 ☐ Reduce Tx Mode

LbtAntGain(0.5dB) :

4

Get

Set

extPALNA

☒ Disable
 ☐ Enable

Get

Set

- Erase FlashConfig Page: Erase config area of flash.
- TPM/IQM: Set or Get RF Mode
- Adaptivity: Set or Get LBT parameters.
- extPALNA: disable or enable extern PA/LNA function.

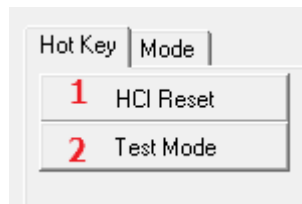
Figure 8 Mode page(BT SOC)

5.DUT singling (Link) Test Mode:

➤ **BR/EDR:**

Enter link(singling) test mode by , please follow the below operations.

- **Step 1:** Click “HCI Reset” button in HOT Key page to reset.
- **Step 2:** Click “Test Mode” button in HOT Keypage to enter DUT Test Mode (link test mode).
- **Step 3:** After testing, click “HCI Reset” button to exit DUT Test Mode



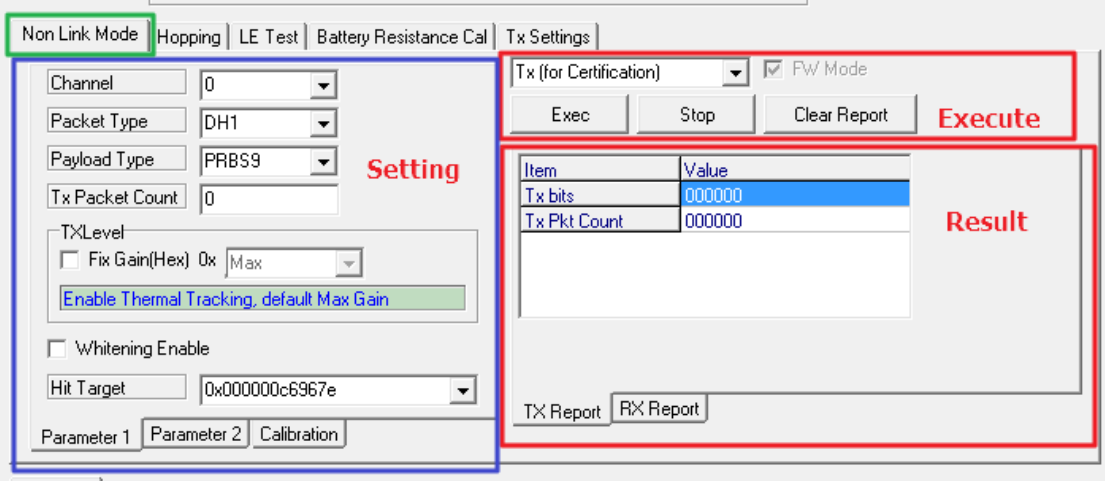
➤ **BLE:**

BLE must be **connected directly to the instrument.**

6.Non Link (Singling) Mode Test

Page

The main page :



Non Link Mode | Hopping | LE Test | Battery Resistance Cal | Tx Settings

Setting

Channel: 0
 Packet Type: DH1
 Payload Type: PRBS9
 Tx Packet Count: 0
 TXLevel:
☐ Fix Gain(Hex) 0x Max
 Enable Thermal Tracking, default Max Gain
☐ Whitening Enable
 Hit Target: 0x000000c6967e
 Parameter 1 | Parameter 2 | Calibration

Result

Tx (for Certification): ☐ FW Mode
 Exec | Stop | Clear Report | **Execute**

Item	Value
Tx bits	000000
Tx Pkt Count	000000

Tx Report | Rx Report

Figure 9 How to set Non-Link(Singling) mode parameter

6.1 Non Link (Singling) Execute

Parameter No.	Name	Value Range
Parameter 1	Channel	Channel 0 BDR/EDR :0~78 BLE:0~39
Parameter 1	Packet Type	Packet Type DH1 DH1, DH3, DH5 2DH1, 2DH3, 2DH5 3DH1, 3DH3, 3DH5
Parameter 1	Payload Type	Payload Type PRBS9 ALL0,ALL1,0101,1010, 0x0_0xF,0000_1111,1111_0000, PRBS9
Parameter 1	Tx Packet Count (for packet tx)	Tx Packet Count 0 0~0x FFF or 0~0x3FFFFFF 0 : Infinite Tx packet count
Parameter 1	Whitening Coeff Value	☐ Whitening Enable 0x00~0x7F:Enable Whitening 0x80~0xFF:Disable Whitening
Parameter 1	HitTarget(Target BD_ADDR)	Hit Target 0x000000c6967e 6 bytes
Parameter 2	PacketHeader	0x0~0x3FFFFFF(Realtek define)
Parameter 1	Tx Gain Index	1~7
	If is Tx level Page :	
	Fix Gain	Enable/Disable

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Debug

	Tx Gain Index	1~Max Tx power	
Parameter 1	Tx Gain Value	Realtek define	
Parameter 1	Tx DAC	Realtek define	

Table 1 non-link test mode parameters

Use non-link test mode, please follow below step and select correct parameter

- **Step 1:** Select “Non Link Mode”.
- **Step 2:** Choose parameters in ”Parameter 1”, ”Parameter 2” and .
- **Step 3:** Select “Con-Tx”, “Pkt-Tx” 、 “Pkt-Rx” 、 ”LE Tx(Continues Tx)” or “Single Tone”.
- **Step 4:** Click “Exec” button.
- **Step 5:** After testing, click “Stop” button.

The green rectangle shows current information about TX/RX packet counts.

6.2 Calibration(Non-Singling) Setting

Page

Page explanation below:

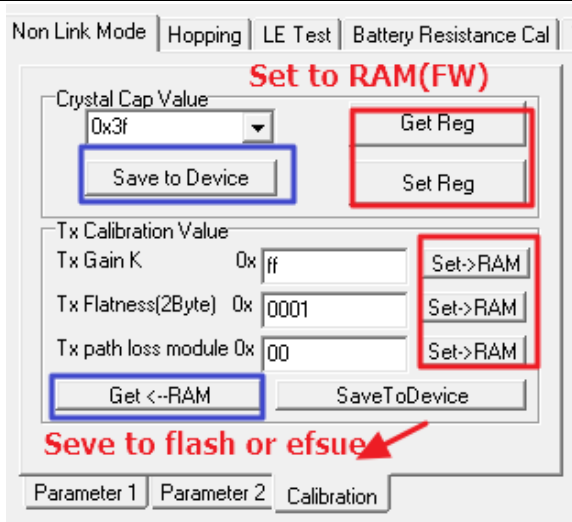
Non Link Mode Hopping LE Test Battery Resistance Cal		Item	Explanation
		Crystal Cap	Crystal cap value 0x00~0x3F or 0x00~0x7F Note: depend on Cjip
		Tx gain k	2' complement -12~+12(Dec)
		TxFlatness K	2' complement -7~+7(Dec)
		Tx path loos module	2' complement -12~12(Dec)
		Note: The set is 2' complement	

Table 2 Calibration(Non-Singling) Setting Page

- Save to device Button: Save to flash or efuse
- Set->RAM: Set to RAM or FW. Get <-RAM : Get data from RAM (FW)

6.2.1 Calibration Tx power

The Tx power k setting show in “Tx calibration Value”. The simple illustration is below:

- Tx Gain K: Trim Tx power value
- Tx flatness :Trim Tx power of channel.
- Tx path loss module: Default is 0 , Set the loss between rf pin of chip and antenna.

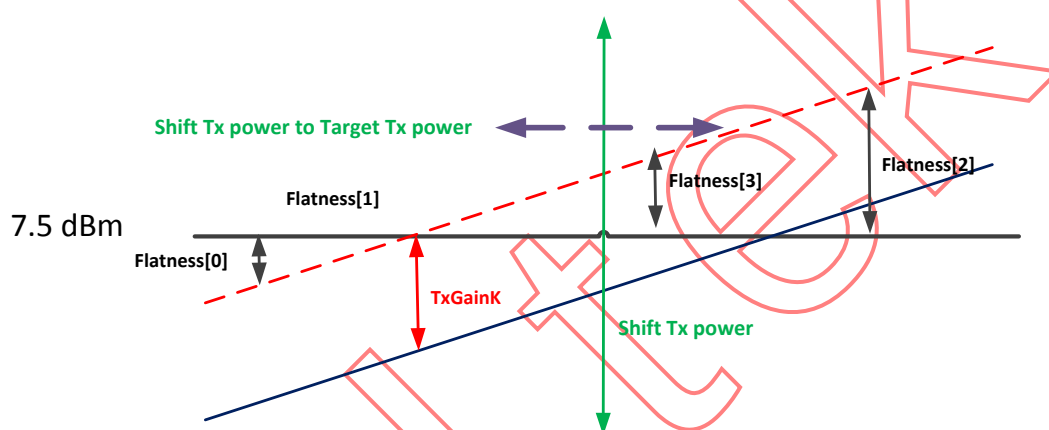


Figure 10 Calibration Tx power simple illustration

The setting page show as:

Figure 11 Calibration Tx power setting page

6.2.2 Calibration frequency offset

Before writing the proper crystal value to efuse, users should tune it. The following steps show how to change the crystal value directly.

- Step 1: Select new “XTAL CAP Value”.
- Step 2: Click “Set Reg”.
- Step 3: Click “Get Reg” from device.

By changing the crystal value and transmitting **signal tone** over and over again, users could find the most accurate one and write it to config file.

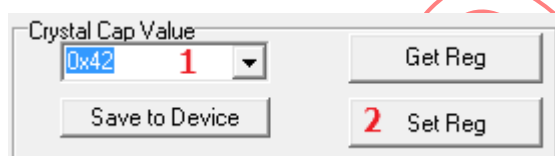


Figure 13 Calibration frequency offset

6.2.3 Set/Get Thermal RAW Value to/from RAM (BT Controller Only)

This function is only for supporting BT controller.

- **Step 1:** Please Click “Read Thermal” to get current thermal value.
- **Step 2:** Select “Non Link Mode page”.
- **Step 3:** Please Click “Set” and type value(decimal) first from **Step 1**.
- **Step 4:** Please Click “Get” to get value.

Note: If you click “Get” before “Set” at the first time, you will get default value “255”

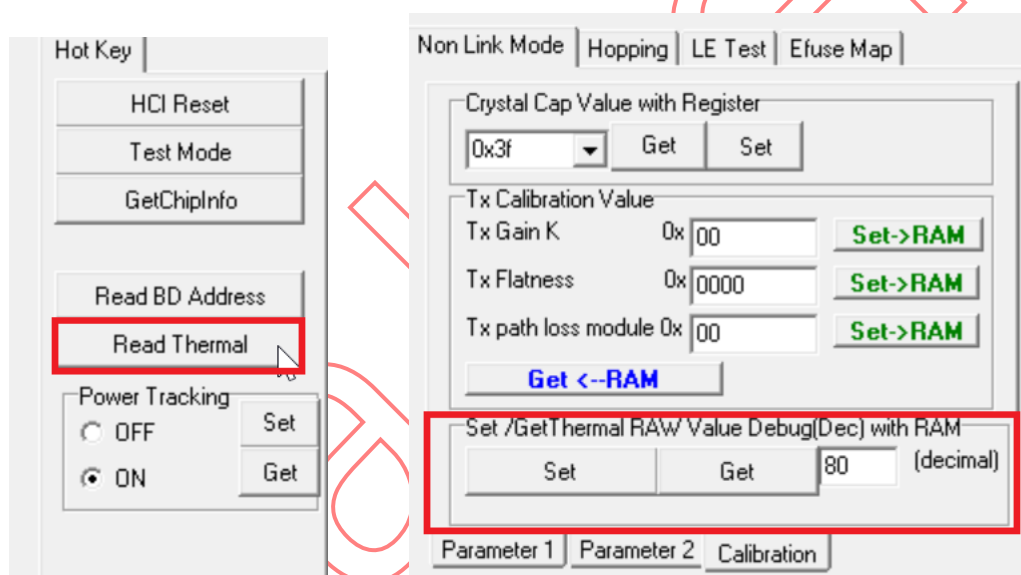


Figure 14 Set/Get Thermal RAW Value to/from RAM

6.3 DUT Tx (Non-Singling) Setting step by step

Follow below steps to enter non-link mode, DUT will enter TX mode, send packet to tester.

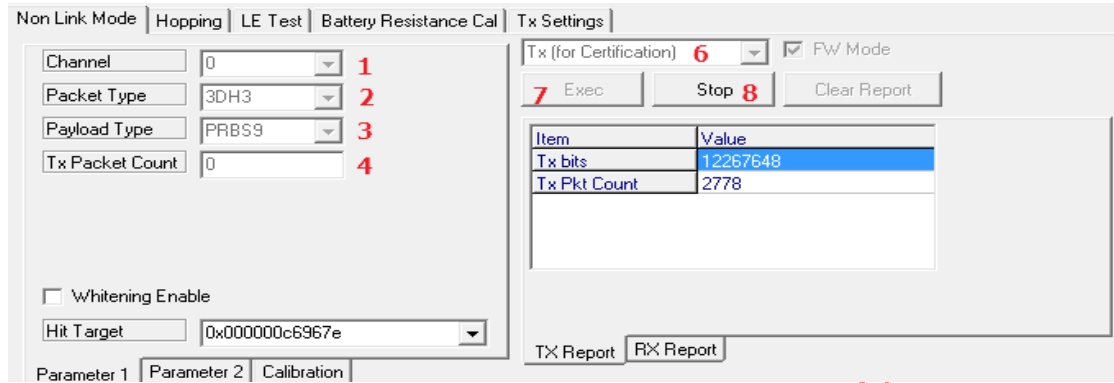


Figure 15 DUT Tx (Non-Singling) Setting page

- **Step 1:** Choose “Channel”.
- **Step 2:** Choose “Packet Type”. Ex :3DH3
- **Step 3:** Set “Payload Type” = “PRBS9”;
- **Step 4:** Set “Tx Packet Count” = “0”;
- **Step 5:** Use default settings in “Parameter 2”.
- **Step 6:** Select “Pkt-Tx”.
- **Step 7:** Click “Exec” button and start to test.
- **Step 8:** After testing, click “Stop” button.

The green rectangle shows current TX packet counts and TX bits which are evaluated by TX times and are not completely correct.

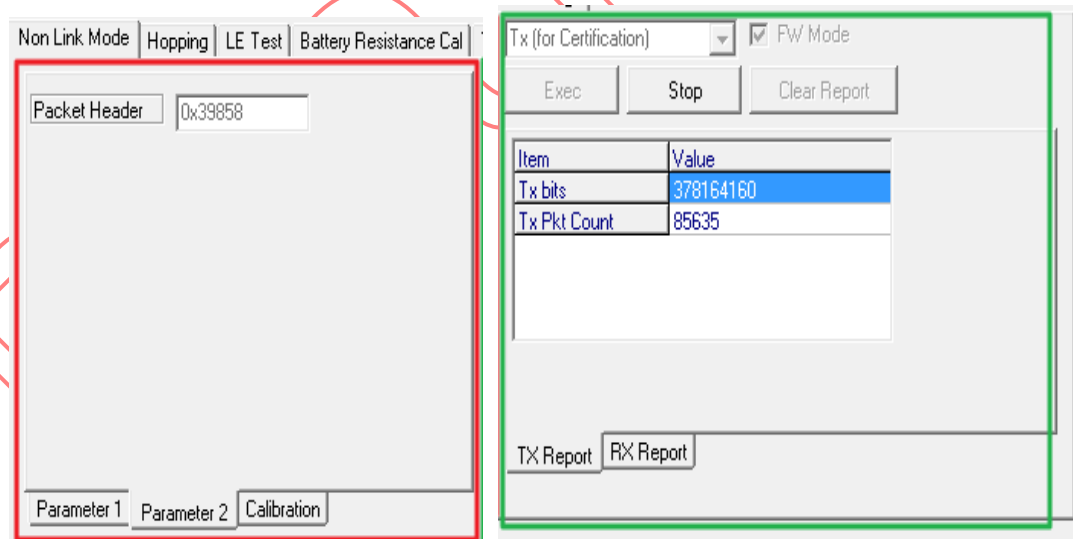


Figure 16 DUT Tx (Non-Singling) Setting page & result

6.4 DUT Rx (Non-Singling) Setting

step by step

The step by step show as:

Step 1: Choose “Channel”.

Step 2: Choose “Packet Type”.

Step 3: Set “Payload Type” = “PRBS9”;

Step 4: Set “Hit Target” = “0xc6967e”;

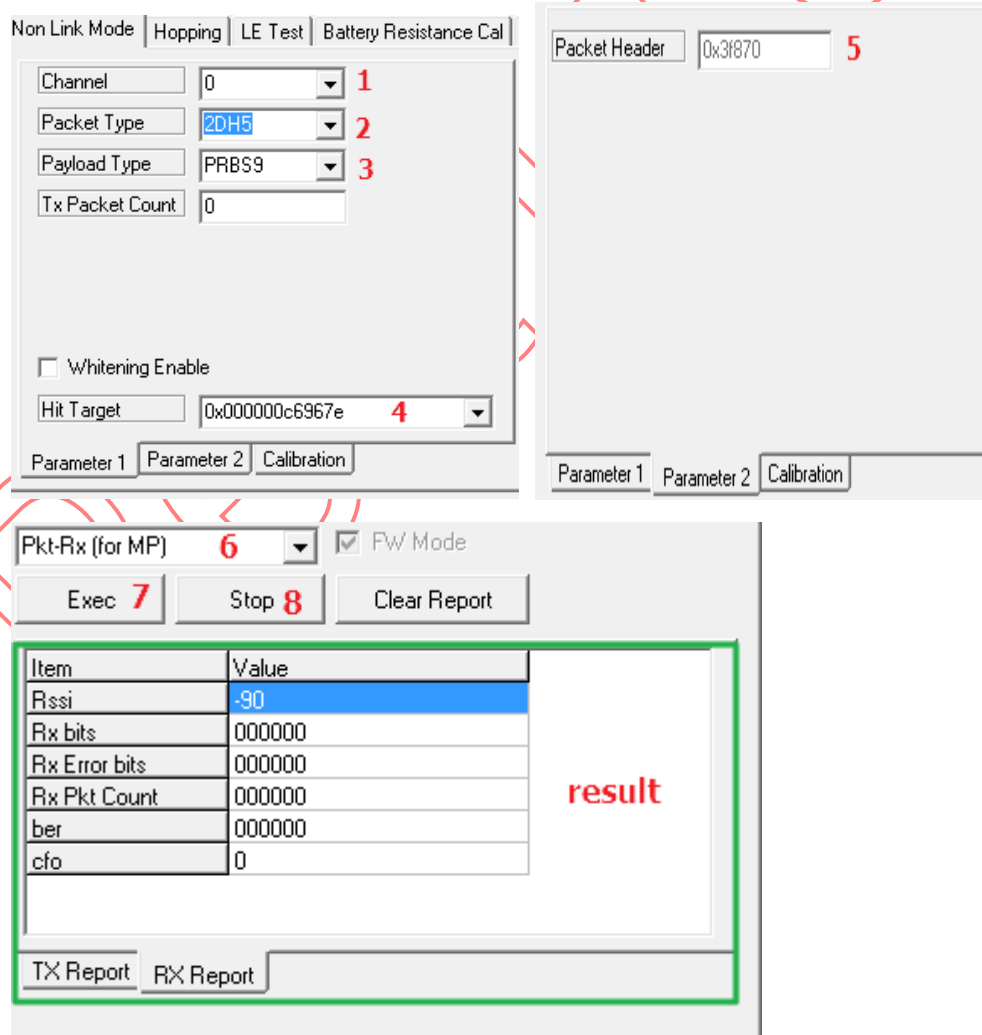
Step 5: Use default settings in “Parameter 2”.

Step 6: Select “Pkt-Rx”.

Step 7: Click “Exec” button and start to test.

Step 8: After testing, click “Stop” button.

The green rectangle shows correct RSSI, RX bits, RX error bits, RX packet counts, ber and CFO.



The screenshot displays the Realtek Bluetooth RF Tool interface. The top section shows configuration options: Channel (0), Packet Type (2DHS), Payload Type (PRBS9), Tx Packet Count (0), Whitening Enable (unchecked), and Hit Target (0x000000c6967e). The bottom section shows the results of the test, including RSSI (-90), Rx bits (000000), Rx Error bits (000000), Rx Pkt Count (000000), ber (000000), and cfo (0). The results are highlighted with a green rectangle and labeled "result".

Non Link Mode | Hopping | LE Test | Battery Resistance Cal

Channel: 0
Packet Type: 2DHS
Payload Type: PRBS9
Tx Packet Count: 0

☐ Whitening Enable
Hit Target: 0x000000c6967e

Parameter 1 | Parameter 2 | Calibration

Packet Header: 0x3f870

Pkt-Rx (for MP)
Exec | Stop | Clear Report

Item	Value
Rssi	-90
Rx bits	000000
Rx Error bits	000000
Rx Pkt Count	000000
ber	000000
cfo	0

TX Report | RX Report

Figure 17 DUT Rx (Non-Singling) Setting page & Result

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6.5 Single Carrier (Tone) Test step by step

This mode only could transmit single carrier (tone).

- **Step 1:** Choose “Channel” and “Tx Gain Index” = “6”.
- **Step 2:** Select “Single Tone”.
- **Step 3:** Click “Exec” button and start to test.
- **Step 4:** After testing, click “Stop” button.

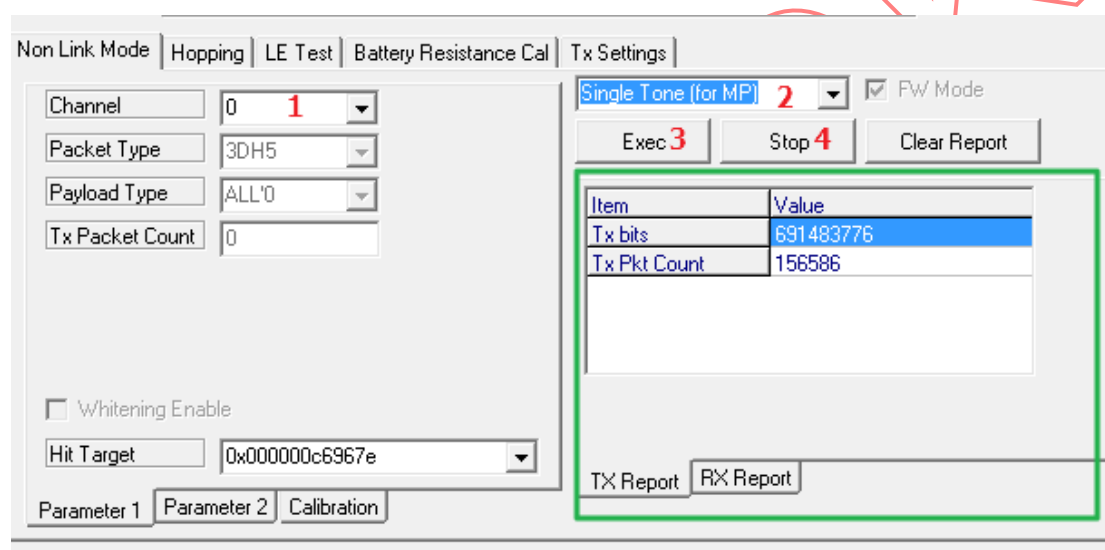


Figure 18 Single Carrier (Tone) Test setting

The green rectangle shows current TX packet counts and TX bits which are evaluated by TX times and are not completely correct.

7.Hopping Mode Test

Hopping Test supports three kinds of parameters that are “Packet Type”, “Channel”, and “Ckb_Whitening”.

1. Packet Type: The “Packet Type” is from “DH1” to “3DH5”, “LE” for BT4.0, and “NULL” for null packet.
2. Channel: The number from “0” to “39” is to transmit fixed frequency. Only the option of “Hopping” will transmit hopping frequency.
3. Ckb_Whitening : To select “Ckb_Whitening” causes whitening enable.

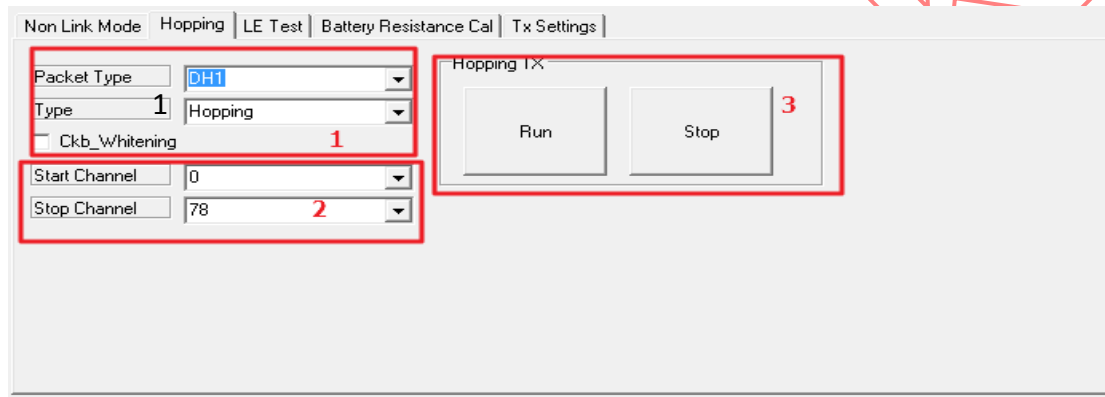


Figure 19 Set Hopping mode parameters

- **Step 1:** Select “Hopping”.
- **Step 2:** Choose “Packet Type”, “Channel” and “Ckb_Whitening”
- **Step 3:** Click “Run” button.
- **Step 4:** After testing, click “Stop” button.

Name	Value Range
Packet Type	DH1, DH3, DH5, 2DH1, 2DH3, 2DH5, 3DH1, 3DH3, 3DH5, LE : For BT 4.0 NULL :For NULL packet
Start Channel End Channel	0~39 : Fix Channel Mode(Only) Hopping : Hopping Mode
Ckb_Whitening	Enable/Disable Whitening

Table 3 Hopping mode parameters

8.LE DUT Tx/Rx Test

This page uses the hci command of the standard BT spec. Users can use this page to test the performance of BLE.

- **Step 1:** Select “LE PKT TX” or “LE PKT RX”

- **Step 2:** Select parameters:

Channel: 0~39

Data Len:0~ 255 .If the BLE is BT4.0, then len rang is 0~39.

Payload type:PRBS9,11110000,101010,ALL’0,ALL1,PRBS15.....

PHY: LE1M,LE2M,LRS8,LRS2.The parameter depend on chip.

Modulation Index: stable Modulation please refer BT Spec.

- **Step 3:** Click “Run” button.
- **Step 4:** After testing, click “Stop” button.

If test is LE Tx, then go to end.

- **Step 5:** If is “LE PKT RX” then result. After executing the stop, the result will show here.Use this information to calculate PER.

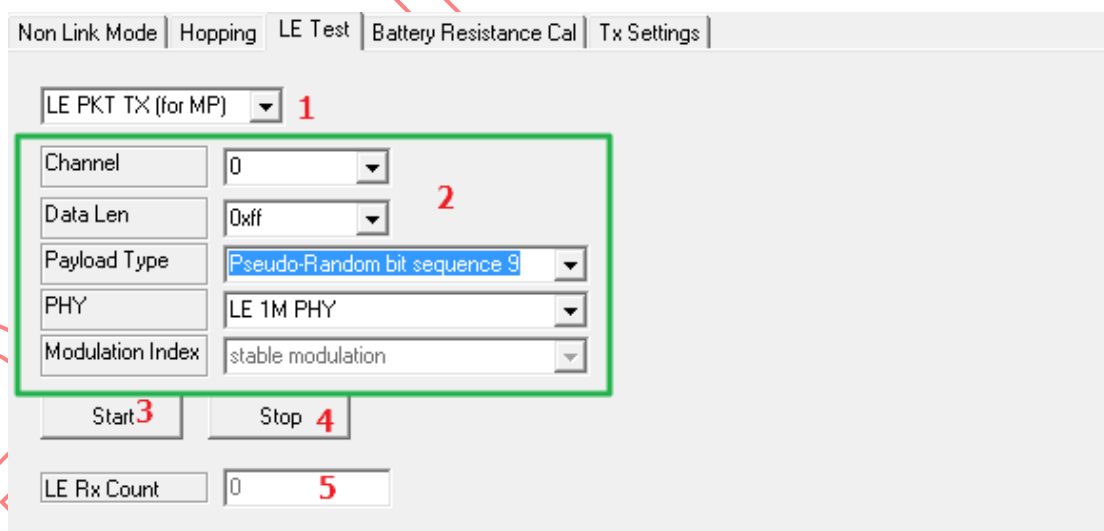
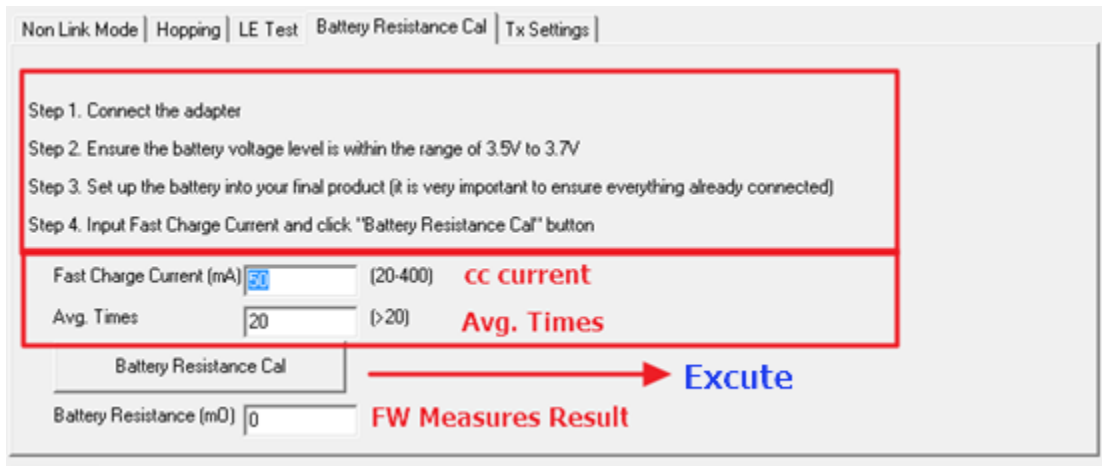


Figure 20 LE DUT Tx/Rx Test step

9. Battery Resistance Cal Page

The Page Only support BT Soc BBPro series(RTL8763B...).



Non Link Mode | Hopping | LE Test | **Battery Resistance Cal** | Tx Settings

Step 1. Connect the adapter
 Step 2. Ensure the battery voltage level is within the range of 3.5V to 3.7V
 Step 3. Set up the battery into your final product (it is very important to ensure everything already connected)
 Step 4. Input Fast Charge Current and click "Battery Resistance Cal" button

Fast Charge Current (mA) (20-400) **cc current**
 Avg. Times (>20) **Avg. Times**

Battery Resistance Cal → **Excute**

Battery Resistance (mO) **FW Measures Result**

Figure 21 Battery Resistance Calibration

- Fast Charge Current: It is cc current, please to set. The ranges depend on chip.
- Avg. Time: Set average times.
- Battery Resistance Cal Button: Execute.
- Battery Resistance(mO) :FW measure result. This unit is m Ohm.

10. Tx Power Setting Page

The page or part of the functions support depends on chip. All “save to device” “function Does not support combo chip(ex. RTL8822C, AmebaD/ZII).

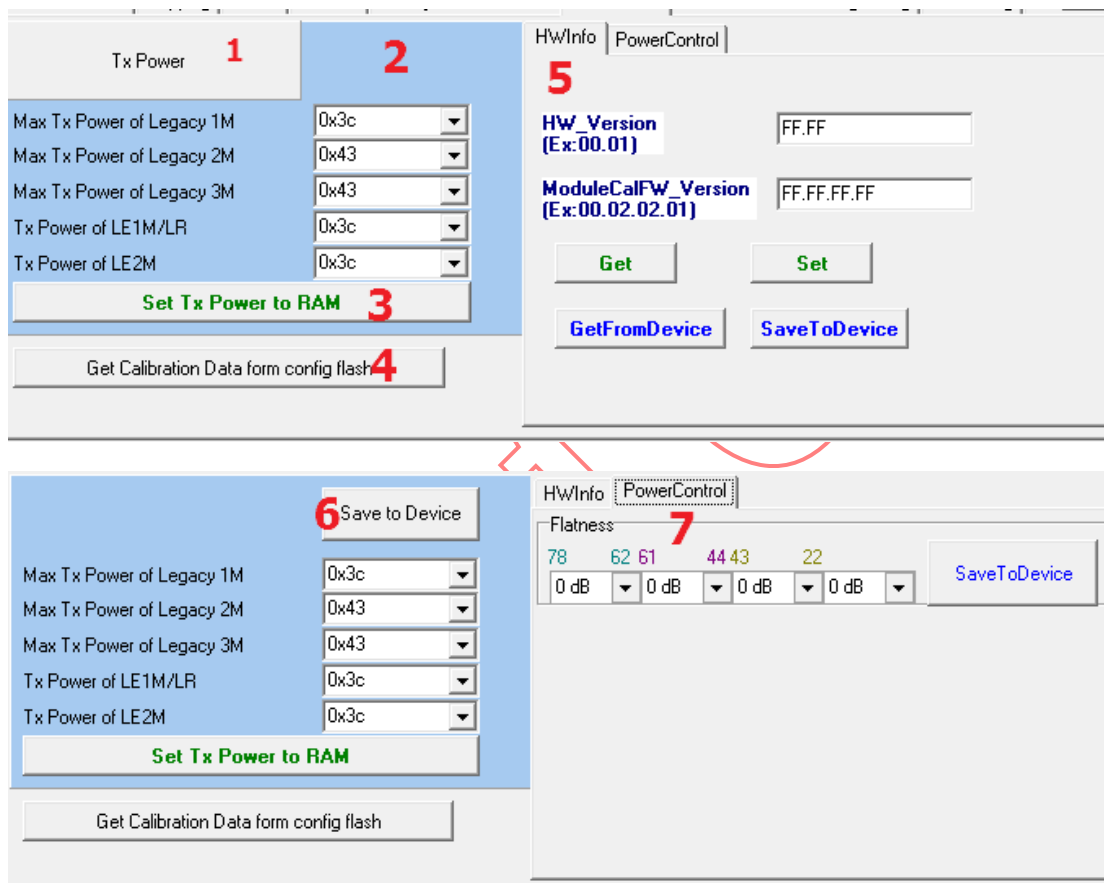


Figure 22 Tx power setting page

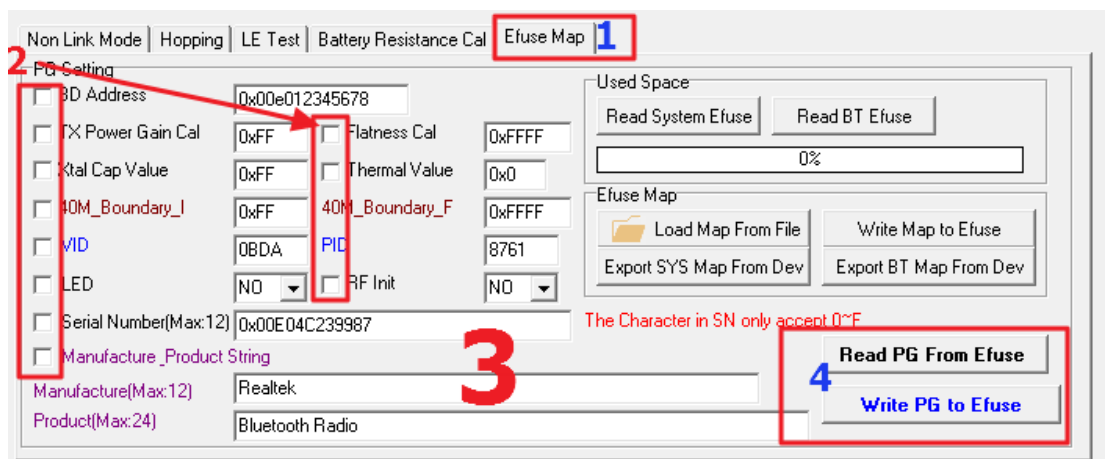
- 1. Get tx power from FW : Depended by Chip. tx power from FW.
- 2. Set tx power level : Depended by Chip .
- 3. Set Tx power to RAM: Set to RAM(FW). This is temp setting.
- 4. Get Calibration Data from config flash: BT SOC only. The function depended by chip.
- 5. Save to device: Save to flash or efuse(**Does not support combo chip**)
- 6. HW Info: BT SOC only. Write HW information to flash.
- 7. PowerControl: Adjustment channel tx power . This function depended by chip.

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11.Efuse Map read/write(BT Controller Only)

The page support depends on chip. This function for only BT controllers.(RTL8761A,RTL8761B...).

- **Step 1:** Select “Efuse Map page”.
- **Step 2:** Select checkbox you want to read/write:
 - BD Address: 0xFFFFFFFFFFFF (6 bytes)
 - Thermal Value: 0~0x7F.
 - Tx Power Gain Cal: 0xF4(-12) ~ 0x0C(12).
 - Flatness Cal: 2 bytes.
 - Xtal Cap Value: 1 byte.
 - 40M_Boundary_F: 2 bytes.
 - 40M_Boundary_I: 1 byte.
 - VID/PID: USB PID/VID
 - LED:LED function setting.
 - Serial Number(Max12 byte):USB serial number, max:12 byte.
 - Manufacture: Manufacture string ,Max 12 byte.
 - Product: Product name string ,max 24 byte.
 - RF Init: Power need to do RF initial.
- **Step 3:** Fill the value in the blank.
- **Step 4:** Click Read PG From Efuse/Write PG From Efuse.
- **Step5 :**Click Read System Efuse / BT Efuse can show Remaining Space.



Non Link Mode | Hopping | LE Test | Battery Resistance Cal | **Efuse Map** **1**

2 PG Setting

☐ BD Address: 0x00e012345678

☐ TX Power Gain Cal: 0xFF

☐ Xtal Cap Value: 0xFF

☐ 40M_Boundary_I: 0xFF

☐ VID: 0BDA

☐ LED: NO

☐ Serial Number(Max:12): 0x00E04C239987

☐ Manufacture_Product String

Manufacture(Max:12): Realtek

Product(Max:24): Bluetooth Radio

☐ Flatness Cal: 0xFFFF

☐ Thermal Value: 0x0

☐ 40M_Boundary_F: 0xFFFF

☐ PID: 8761

☐ RF Init: NO

3

4 Read PG From Efuse
Write PG to Efuse

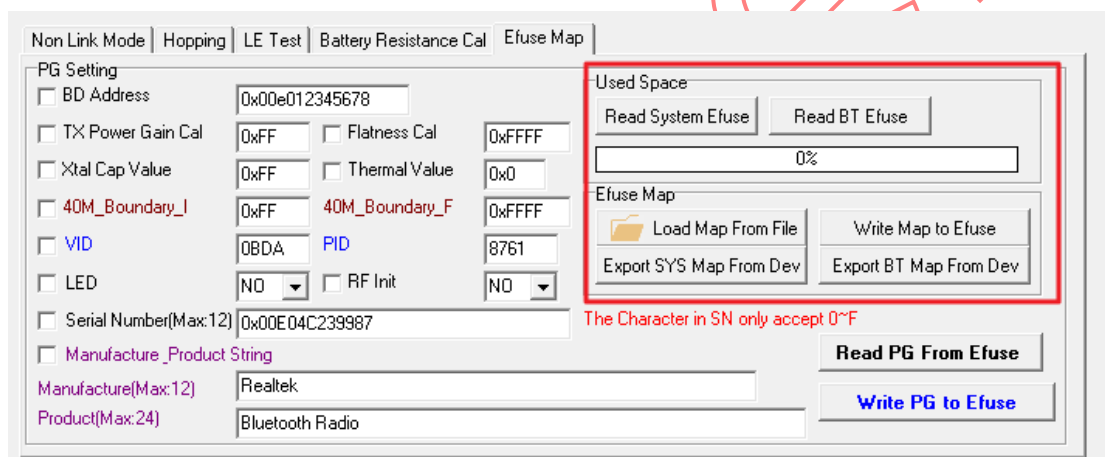
Used Space: Read System Efuse | Read BT Efuse | 0%

Efuse Map: Load Map From File | Write Map to Efuse | Export SYS Map From Dev | Export BT Map From Dev

The Character in SN only accept 0~F

Figure 23 Efuse Read/Write(BT controller Only)

If need use map , then use “Used Space” page.



Non Link Mode | Hopping | LE Test | Battery Resistance Cal | **Efuse Map**

PG Setting

☐ BD Address: 0x00e012345678

☐ TX Power Gain Cal: 0xFF

☐ Xtal Cap Value: 0xFF

☐ 40M_Boundary_I: 0xFF

☐ VID: 0BDA

☐ LED: NO

☐ Serial Number(Max:12): 0x00E04C239987

☐ Manufacture_Product String

Manufacture(Max:12): Realtek

Product(Max:24): Bluetooth Radio

☐ Flatness Cal: 0xFFFF

☐ Thermal Value: 0x0

☐ 40M_Boundary_F: 0xFFFF

☐ PID: 8761

☐ RF Init: NO

Used Space

Read System Efuse | Read BT Efuse | 0%

Efuse Map: Load Map From File | Write Map to Efuse | Export SYS Map From Dev | Export BT Map From Dev

The Character in SN only accept 0~F

Read PG From Efuse
Write PG to Efuse

Figure 24 Efuse Read/Write for file mode(BT controller Only)