

RTL8762X RF Test Tool User Guide

V0.5

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Revision History

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Glossary

Abbreviation	Implication
BLE	Bluetooth Low Energy 4.0
BT Enhance	Bluetooth 5.0
Single Tone	Single Tone

1 Overview

This document introduces how to setup the testing environment for RTL8762X RF, including the test mode specified in BT spec and the single tone test mode. It can be used for a whole series of RTL8762X chip. FCC/BQB/CE/SRRC/KC and other certifications can use this tool to assist in testing. Contact Realtek Bluetooth FAE if any problem arises in the use of test.

2 Download Image

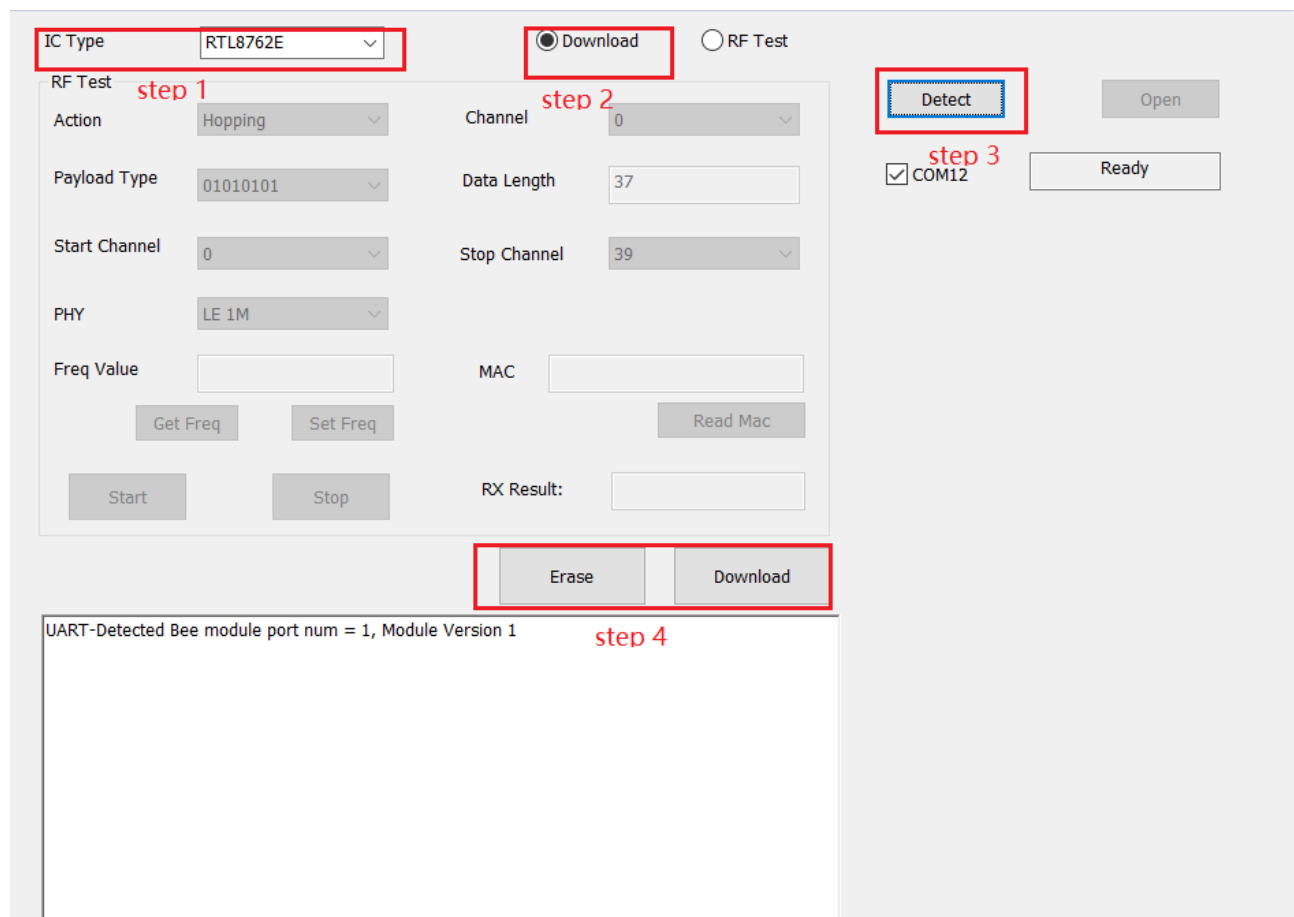
2.1 Download/Erase Flow

RF Test Tool download process is shown in Figure 2-1.

1. Choose 'IC Type', support RTL8762C/52C, RTL8762D, RTL8762E.
2. Choose 'Download' radio button.
3. Detect the port(UART mode)and select com port.
4. Click 'Download or Erase' button to download or Erase images.

Note:

- 1) Before downloading, users need to pull P0_3 to low level.
- 2) RF Test Tool only can download one port at one time.



The screenshot displays the RF Test Tool interface with four steps highlighted for the download process:

- Step 1:** Selecting the IC Type as RTL8762E from the dropdown menu.
- Step 2:** Selecting the Download radio button.
- Step 3:** Clicking the Detect button to identify the COM port (COM12 is shown as detected).
- Step 4:** Clicking the Download button to initiate the image download.

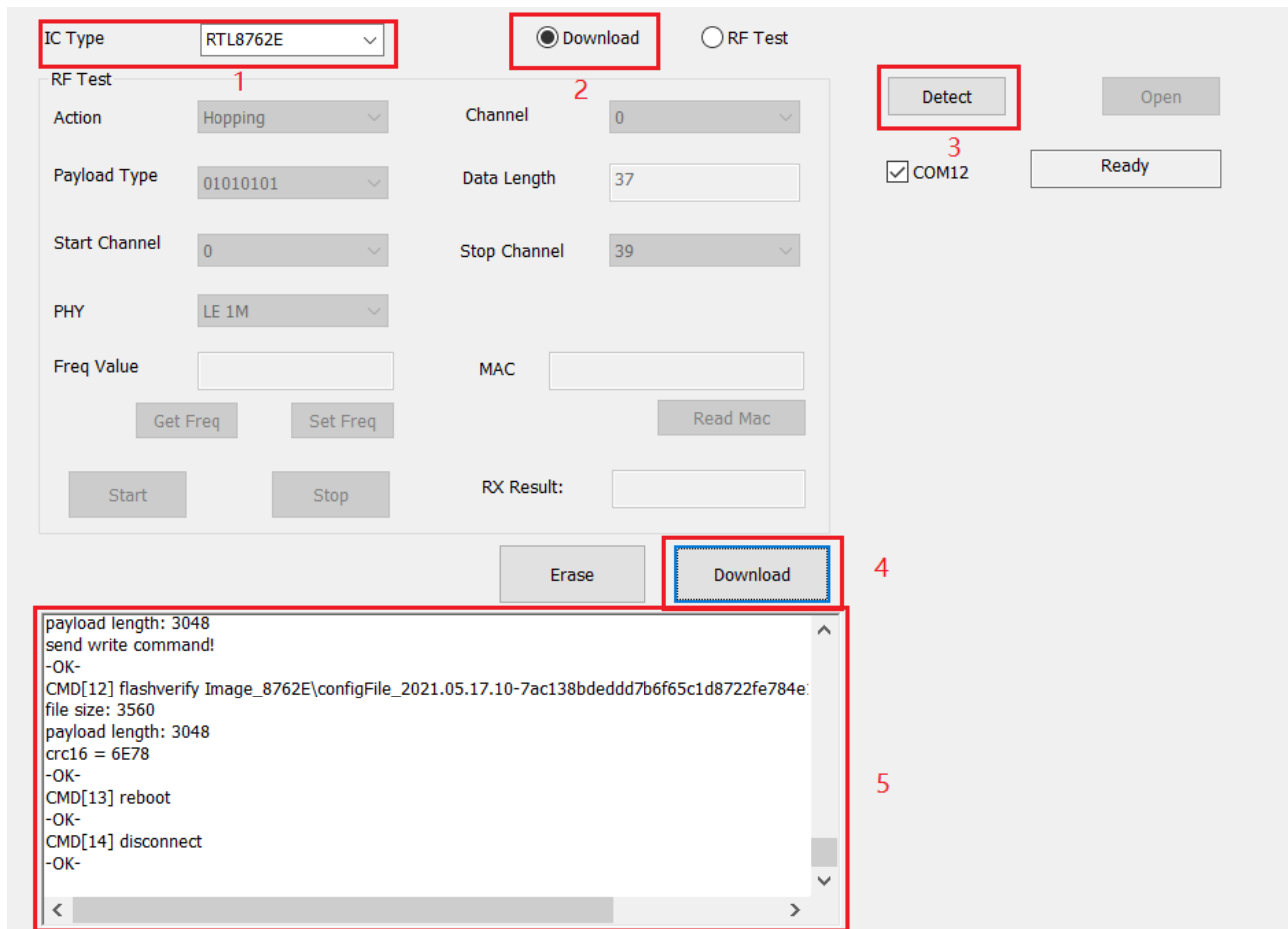
Additional interface elements include:

- RF Test mode selection (Download selected, RF Test unselected).
- Action: Hopping.
- Channel: 0.
- Payload Type: 01010101.
- Data Length: 37.
- Start Channel: 0.
- Stop Channel: 39.
- PHY: LE 1M.
- Freq Value and MAC input fields with Set Freq and Read Mac buttons.
- Start and Stop buttons.
- RX Result: input field.
- Erase and Download buttons at the bottom.
- Status bar: UART-Detected Bee module port num = 1, Module Version 1.

Figure 2-1 Download Flow

2.2 Download Status

The downloading status is shown in Figure 2-2.



IC Type: RTL8762E

☒ Download ☐ RF Test

RF Test

Action: Hopping

Channel: 0

Payload Type: 01010101

Data Length: 37

Start Channel: 0

Stop Channel: 39

PHY: LE 1M

Freq Value:

MAC:

Get Freq Set Freq Read Mac

Start Stop RX Result:

Erase Download

Detect Open

☒ COM12 Ready

payload length: 3048
send write command!
-OK-
CMD[12] flashverify Image_8762E\configFile_2021.05.17.10-7ac138bdeddd7b6f65c1d8722fe784e:
file size: 3560
payload length: 3048
crc16 = 6E78
-OK-
CMD[13] reboot
-OK-
CMD[14] disconnect
-OK-

Figure 2-2 Download Status

3 BLE Direct Test Mode(BQB Test)

3.1 UART Port

RTL8762X supports two types of RF Test interfaces (HCI and 2-wire UART for DTM)specified by BT spec. This document mainly introduces HCI Test Interface. HCI Test interface uses P3_0 (TX_OUTPUT) and P3_1 (RX_INPUT) of the chip as the pin of UART port.

UART interface parameters used by RTL8762X HCI Interface are as below:

- Baud rate:115200
- Data bit:8
- Stop bit:1
- Parity bit:No
- Flow control:No

Note:The instrument should use the same UART interface settings as chip for communication.

3.2 Instrument Connection

Please refer to Figure 3-1 for connection between the instrument and RTL8762X, the RF port of instrument is connected with RTL8762X RFIO by cable. The UART of instrument is connected with the UART interface of RTL8762X.

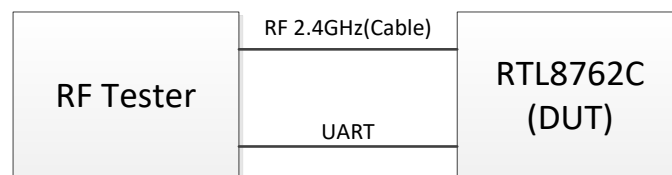


Figure 3-1 Wiring diagram of RF Tester and RTL8762X

3.3 Enter Test Mode

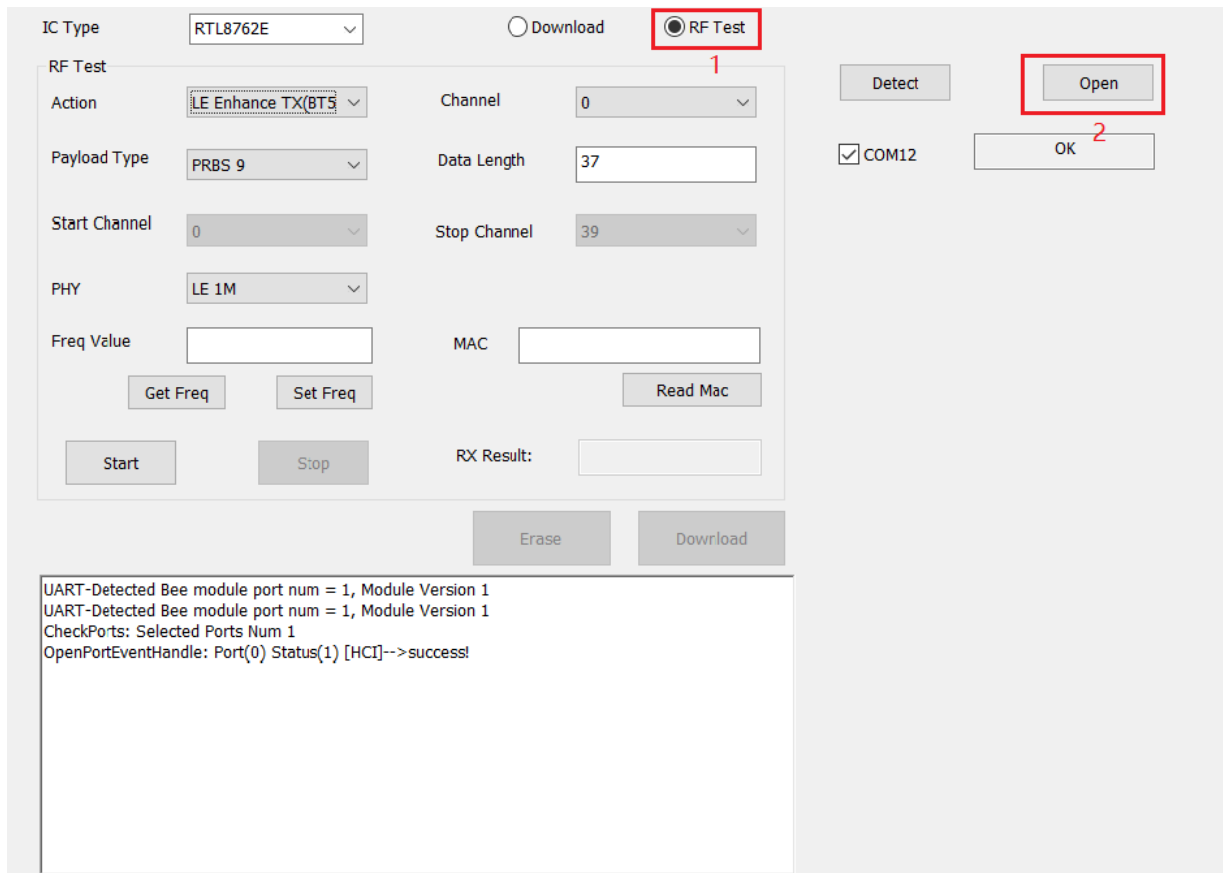
After downloading corresponding Image, reset RTL8762X and enters the appointed test mode. HCI Test Interface needs to download HCI patch image and OTA Header bin and Config file.

3.4 Precautions

1. The chip will automatically perform parameter calibration when it is powered on. Connect with the cable, turn on the instrument, and then power on RTL8762X, so that the chip can detect the correct resistance value. Avoid abnormal RF test results caused by external impedance change.
2. Component values of RF matching circuits need readjustment to adapt to the impedance of cable.
3. Cable of RF cable needs compensation.
4. When using MT8852B for testing, it is required to set the Power range of instrument. On MT8852B Front panel, select config→MT8852B→RX/TX setting→range, set range as 2 or 3.
5. The test needs to be done in a shield room to avoid signal interference from other 2.4GH frequency bands such as Wi-Fi.

4 RF Certification Test

Before doing RF test, selecting 'RF Test' radio button is necessary. It is shown in Figure 4-1.



IC Type:

☐ Download ☒ RF Test

RF Test

Action: Channel:

Payload Type: Data Length:

Start Channel: Stop Channel:

PHY:

Freq Value: MAC:

RX Result:

☒ COM12

```

UART-Detected Bee module port num = 1, Module Version 1
UART-Detected Bee module port num = 1, Module Version 1
CheckPorts: Selected Ports Num 1
OpenPortEventHandle: Port(0) Status(1) [HCI]-->success!
  
```

Figure 4-1 Open Success

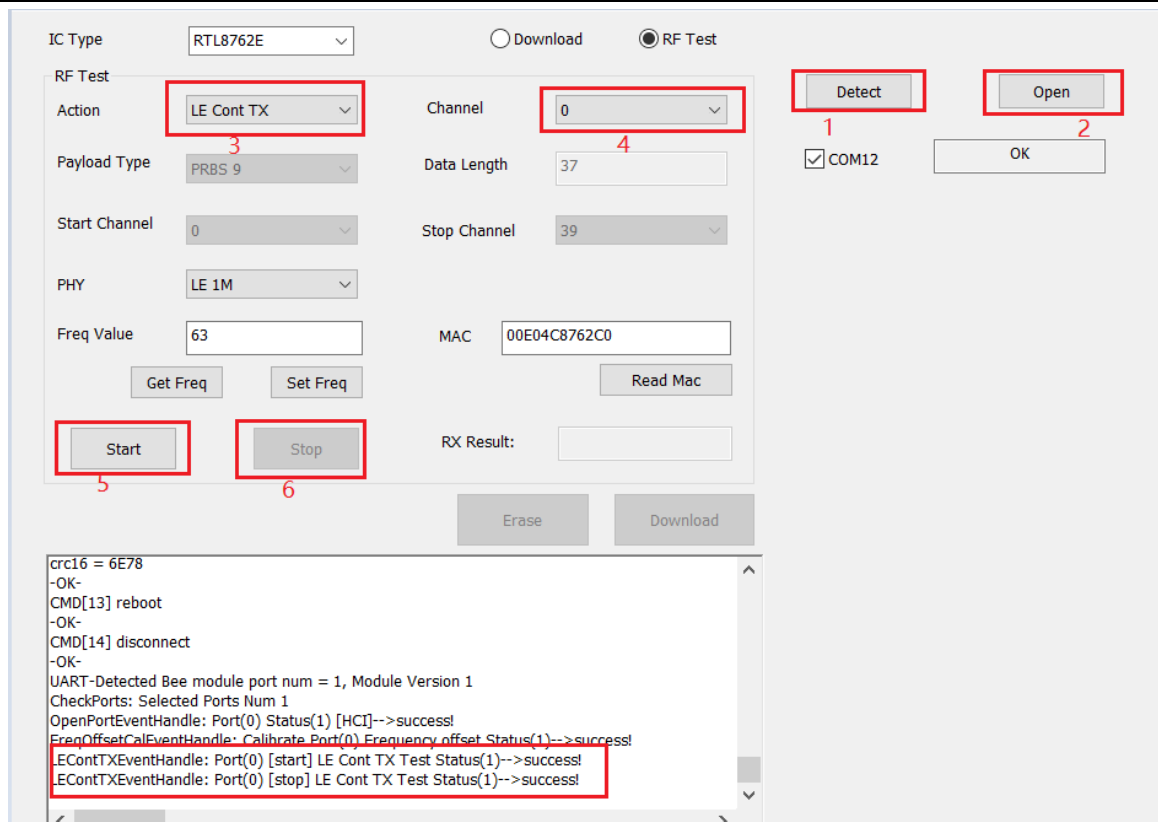
4.1 LE Cont TX Test(duty cycle 100%)

It is required to directly make TX measurement for RF test, such as Band Edge verification.

TX test setting is shown in Figure 4-2, TX Channel and TX Enable need to be configured for TX test, properly select Channel and set TX Enable to enable state before starting TX test.

Operation steps:

1. Detect UART com port.
2. Open UART com port.
3. You can see the message below to check open com port successes.
4. Select TX test item.
5. Choose TX channel.
6. Click 'Start' button and DUT will transmit TX signal.
7. Click 'Stop' to end test.



IC Type: RTL8762E

RF Test: ☐ Download ☒ RF Test

Action: LE Cont TX

Channel: 0

Payload Type: PRBS 9

Data Length: 37

Start Channel: 0

Stop Channel: 39

PHY: LE 1M

Freq Value: 63

MAC: 00E04C8762C0

Get Freq Set Freq Read Mac

Start Stop

RX Result:

Erase Download

Detect Open

COM12 OK

```

crc16 = 6E78
-OK-
CMD[13] reboot
-OK-
CMD[14] disconnect
-OK-
UART-Detected Bee module port num = 1, Module Version 1
CheckPorts: Selected Ports Num 1
OpenPortEventHandle: Port(0) Status(1) [HCI]-->success!
FreqOffsetCalEventHandle: Calibrate Port(0) Frequency offset Status(1)-->success!
LEContTXEventHandle: Port(0) [start] LE Cont TX Test Status(1)-->success!
LEContTXEventHandle: Port(0) [stop] LE Cont TX Test Status(1)-->success!
  
```

Figure 4-2 LE Cont TX Test Setting

Users can check the test state diagram of LE Cont_TX by the spectrum analyzer. The waveforms are shown in Figure 4-3 display on the spectrum analyzer.

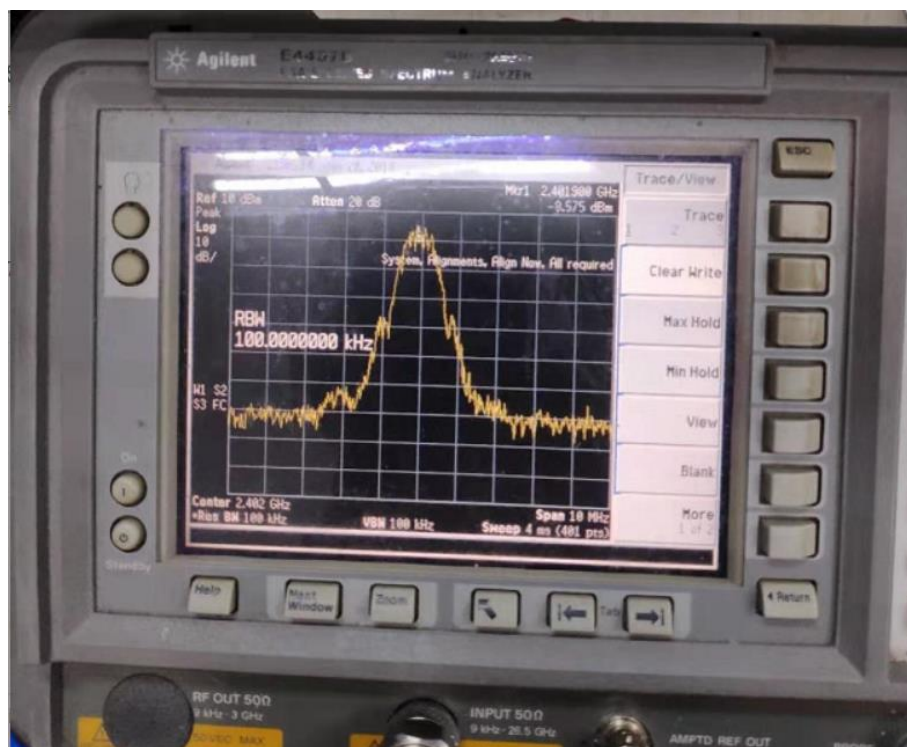


Figure 4-3 LE Cont_TX Test Waveforms

4.2 LE RX(BT4) Test

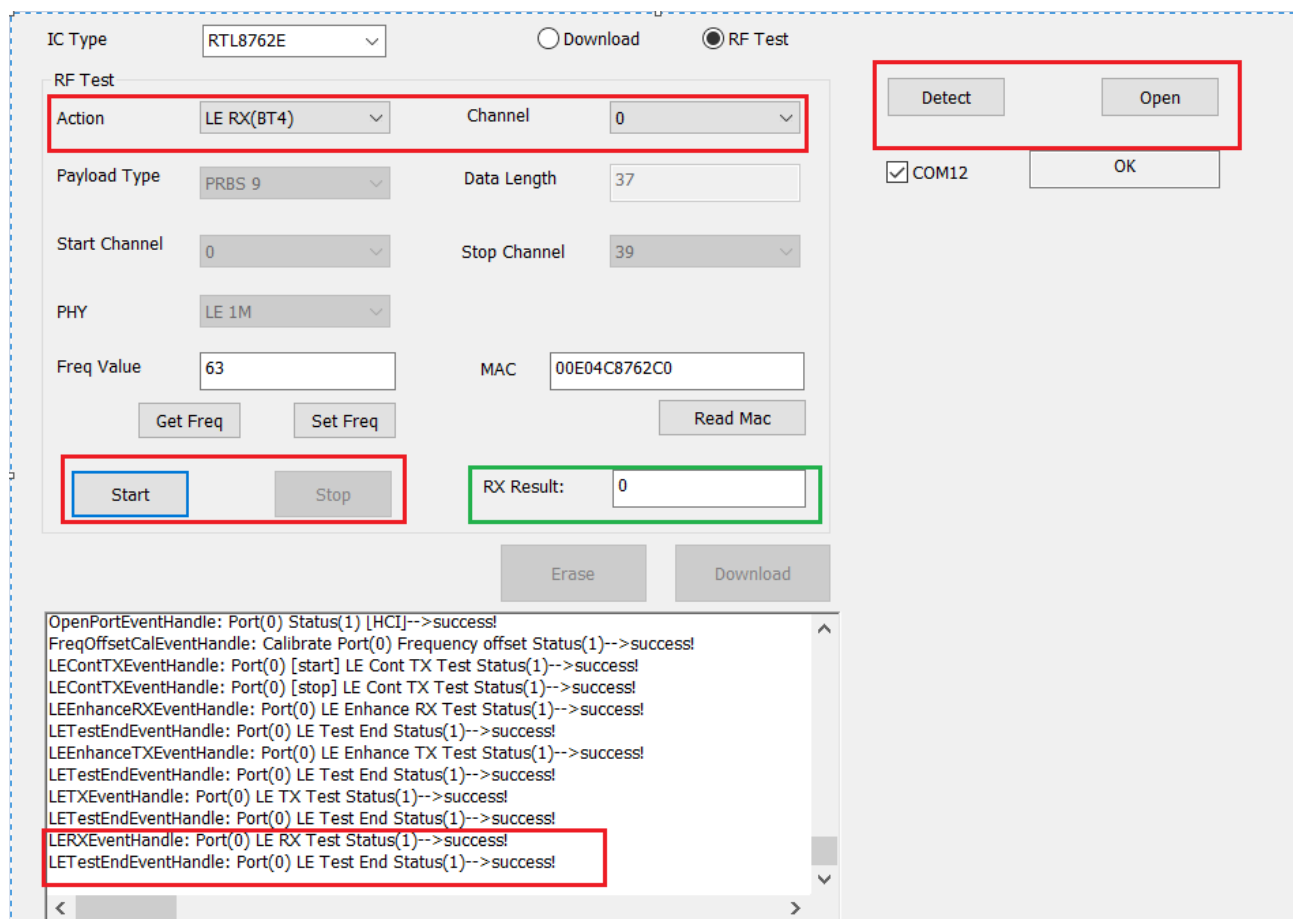
LE RX (BT4) is for BT4.2 spec. To test whether RX can generate interference, prepare testing environment first, and click ‘Detect’, and then click ‘Open’ to open the port after UART is detected.

Channel is the only parameter to be set. As is shown in Figure 4-4, select LE RX, click ‘Start’ to start testing, and click ‘Stop’ to stop testing.

Operation steps:

1. Detect UART com port.
2. Open UART com port.
3. Select RX test item.
4. Choose RX channel .
5. Click ‘Start’ to start test.
6. Click ‘Stop’ to end test.

Note:The ‘RX Result’ is the total number of Rx received.



IC Type: Download ☐ RF Test ☒

RF Test

Action: Channel:

Payload Type: Data Length:

Start Channel: Stop Channel:

PHY:

Freq Value: MAC:

Get Freq Set Freq Read Mac

Start Stop

RX Result:

Erase Download

OpenPortEventHandle: Port(0) Status(1) [HCI]-->success!
FreqOffsetCalEventHandle: Calibrate Port(0) Frequency offset Status(1)-->success!
LEContTXEventHandle: Port(0) [start] LE Cont TX Test Status(1)-->success!
LEContTXEventHandle: Port(0) [stop] LE Cont TX Test Status(1)-->success!
LEEnhanceRXEventHandle: Port(0) LE Enhance RX Test Status(1)-->success!
LETTestEndEventHandle: Port(0) LE Test End Status(1)-->success!
LEEnhanceTXEventHandle: Port(0) LE Enhance TX Test Status(1)-->success!
LETTestEndEventHandle: Port(0) LE Test End Status(1)-->success!
LETXEventHandle: Port(0) LE TX Test Status(1)-->success!
LETTestEndEventHandle: Port(0) LE Test End Status(1)-->success!
LERXEventHandle: Port(0) LE RX Test Status(1)-->success!
LETTestEndEventHandle: Port(0) LE Test End Status(1)-->success!

Figure 4-4 LE RX Parameter Setting

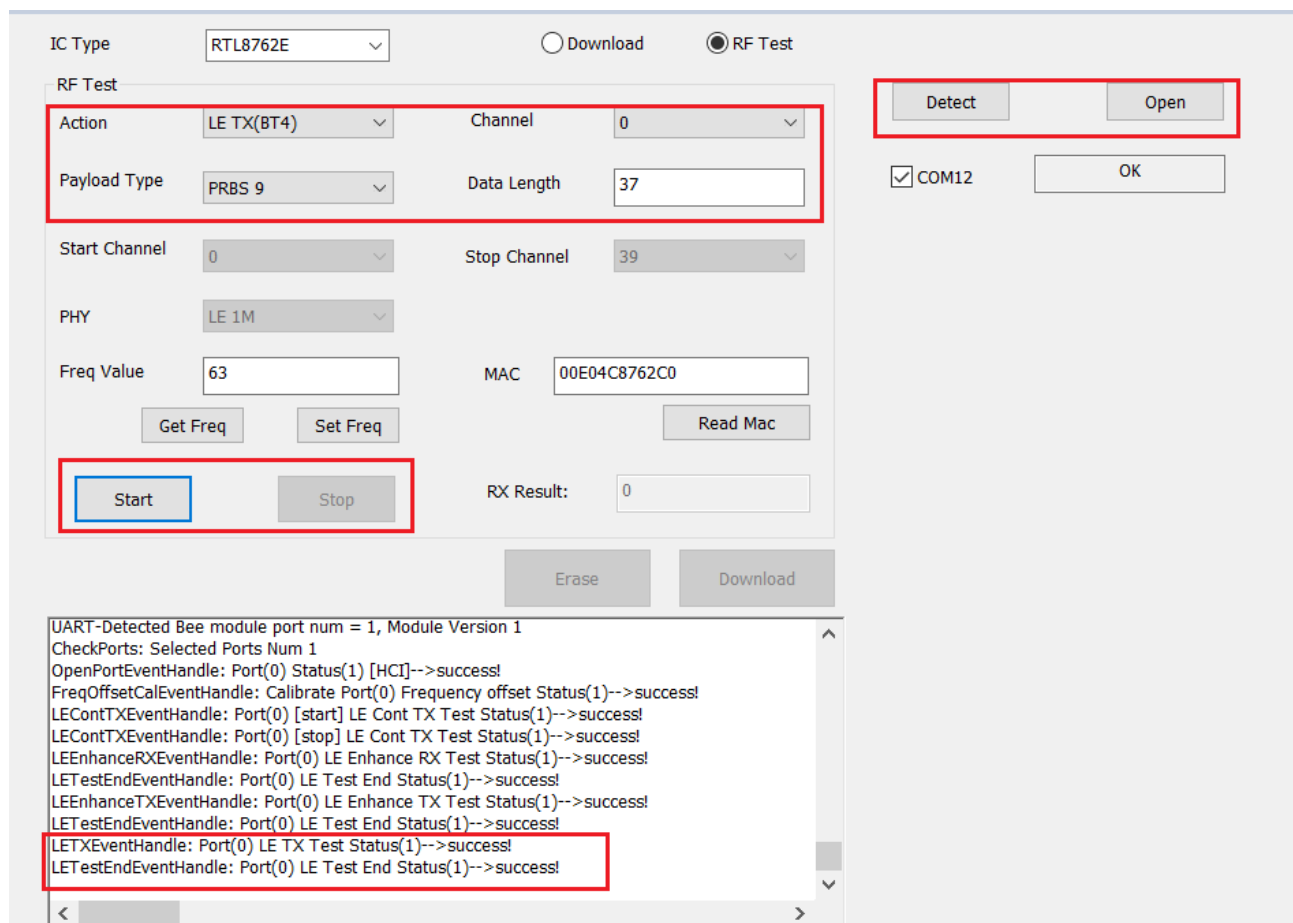
4.3 LE TX(BT4) Test

LE TX (BT4) is for BT4.2 spec. Prepare testing environment first, and click ‘Detect’, and then click ‘Open’ to open the port after UART is detected.

LE TX test setting is as shown in Figure 4-5, select LE TX, click ‘Start’ to start testing, and click ‘Stop’ to stop testing.

Operation steps:

1. Detect UART com port.
2. Open UART com port.
3. Select LE TX test item.
4. Choose channel and set payload and data length.
5. Click ‘Start’ to start test.
6. Click ‘Stop’ to end test.



IC Type: Download ☒ RF Test

RF Test

Action: Channel:

Payload Type: Data Length:

Start Channel: Stop Channel:

PHY:

Freq Value: MAC:

Get Freq Set Freq Read Mac

Start Stop RX Result:

Erase Download

UART-Detected Bee module port num = 1, Module Version 1
 CheckPorts: Selected Ports Num 1
 OpenPortEventHandle: Port(0) Status(1) [HCI]-->success!
 FreqOffsetCalEventHandle: Calibrate Port(0) Frequency offset Status(1)-->success!
 LEContTXEventHandle: Port(0) [start] LE Cont TX Test Status(1)-->success!
 LEContTXEventHandle: Port(0) [stop] LE Cont TX Test Status(1)-->success!
 LEEEnhanceRXEventHandle: Port(0) LE Enhance RX Test Status(1)-->success!
 LETestEndEventHandle: Port(0) LE Test End Status(1)-->success!
 LEEEnhanceTXEventHandle: Port(0) LE Enhance TX Test Status(1)-->success!
 LETestEndEventHandle: Port(0) LE Test End Status(1)-->success!
 LETXEventHandle: Port(0) LE TX Test Status(1)-->success!
 LETestEndEventHandle: Port(0) LE Test End Status(1)-->success!

Figure 4-5 LE TX Parameter Setting

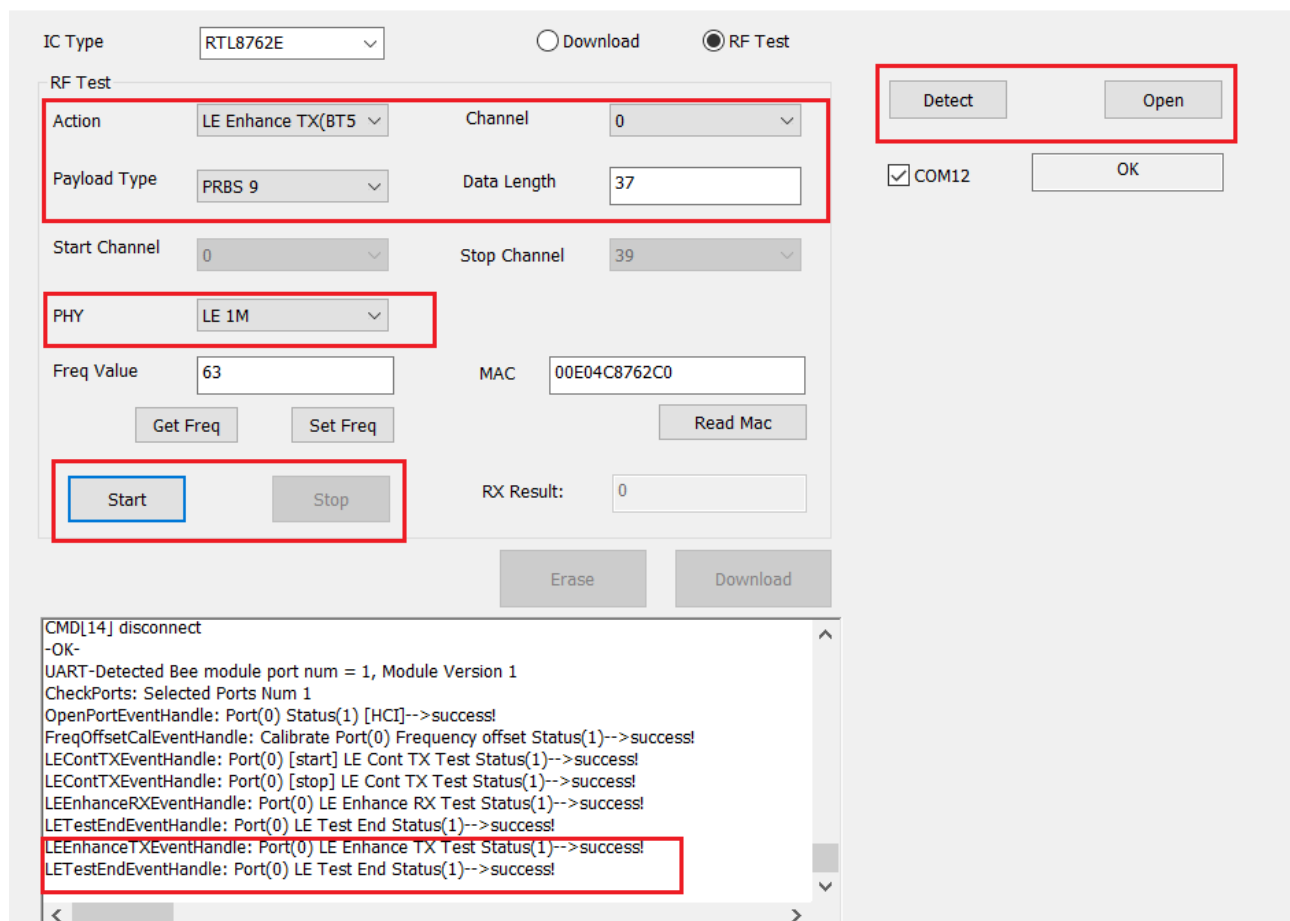
4.4 LE Enhance(BT5) TX Test

LE Enhance TX (BT5) is for BT5.0 spec. To test LE Enhance TX, prepare testing environment first, and click ‘Detect’, and then click ‘Open’ to open the port after UART is detected.

LE Enhance TX test setting is as shown in Figure 4-6, select LE Enhance TX, click ‘Start’ to start testing, and click ‘Stop’ to stop testing.

Operation steps:

1. Detect UART com port.
2. Open UART com port.
3. Select LE Enhance TX test item.
4. Choose channel and PHY first, then set payload and data length.
5. Click ‘Start’ to start test.
6. Click ‘Stop’ to end test.



IC Type: ☐ Download ☒ RF Test

RF Test

Action: Channel:

Payload Type: Data Length:

Start Channel: Stop Channel:

PHY:

Freq Value: MAC:

RX Result:

☒ COM12

```

CMD[14] disconnect
-OK-
UART-Detected Bee module port num = 1, Module Version 1
CheckPorts: Selected Ports Num 1
OpenPortEventHandle: Port(0) Status(1) [HCI]-->success!
FreqOffsetCalEventHandle: Calibrate Port(0) Frequency offset Status(1)-->success!
LEContTXEventHandle: Port(0) [start] LE Cont TX Test Status(1)-->success!
LEContTXEventHandle: Port(0) [stop] LE Cont TX Test Status(1)-->success!
LEEnhanceRXEventHandle: Port(0) LE Enhance RX Test Status(1)-->success!
LETTestEndEventHandle: Port(0) LE Test End Status(1)-->success!
LEEnhanceTXEventHandle: Port(0) LE Enhance TX Test Status(1)-->success!
LETTestEndEventHandle: Port(0) LE Test End Status(1)-->success!
  
```

Figure 4-6 LE Enhance TX Parameter Setting

4.5 LE Enhance RX(BT5) Test

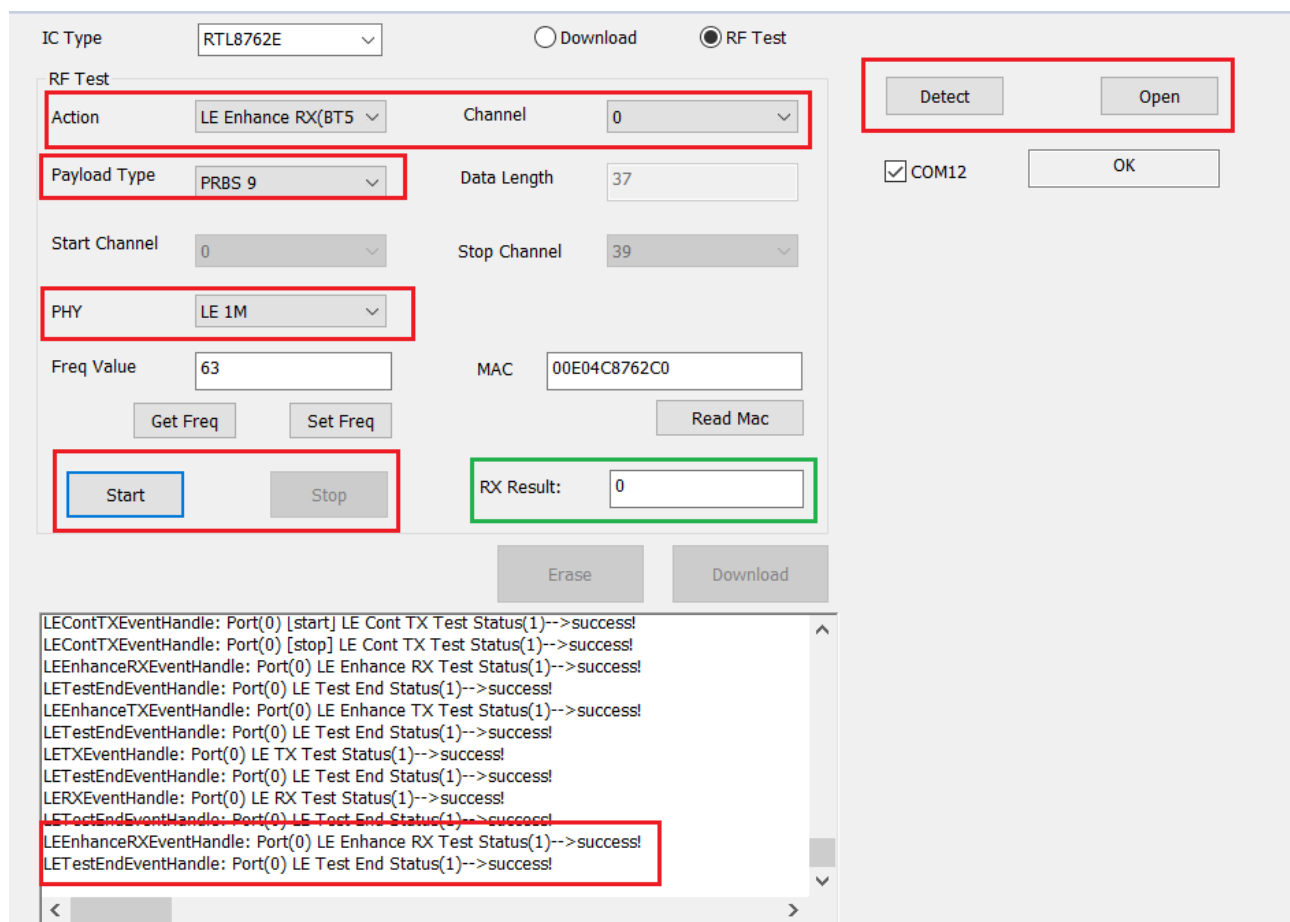
LE Enhance Rx(BT5) is for BT5.0 spec. To test LE Enhance RX, prepare testing environment first, and click ‘Detect’, and then click ‘Open’ to open the port after UART is detected.

LE Enhance RX test setting is as shown in Figure 4-7, select LE Enhance RX, click ‘Start’ to start testing, and click ‘Stop’ to stop testing.

Operation steps:

1. Detect UART com port.
2. Open UART com port.
3. Select LE Enhance RX test item.
4. Choose channel and PHY.
5. Click ‘Start’ to start test.
6. Click ‘Stop’ to end test.

Note: The ‘RX Result’ is the total number of Rx received.



IC Type: Download ☐ RF Test ☒

RF Test

Action: Channel:

Payload Type: Data Length:

Start Channel: Stop Channel:

PHY:

Freq Value: MAC:

Get Freq Set Freq Read Mac

Start Stop

RX Result:

Erase Download

Log Window:

```

LEContTXEventHandle: Port(0) [start] LE Cont TX Test Status(1)-->success!
LEContTXEventHandle: Port(0) [stop] LE Cont TX Test Status(1)-->success!
LEEnhanceRXEventHandle: Port(0) LE Enhance RX Test Status(1)-->success!
LETTestEndEventHandle: Port(0) LE Test End Status(1)-->success!
LEEnhanceTXEventHandle: Port(0) LE Enhance TX Test Status(1)-->success!
LETTestEndEventHandle: Port(0) LE Test End Status(1)-->success!
LETXEventHandle: Port(0) LE TX Test Status(1)-->success!
LETTestEndEventHandle: Port(0) LE Test End Status(1)-->success!
LERXEventHandle: Port(0) LE RX Test Status(1)-->success!
LETTestEndEventHandle: Port(0) LE Test End Status(1)-->success!
LEEnhanceRXEventHandle: Port(0) LE Enhance RX Test Status(1)-->success!
LETTestEndEventHandle: Port(0) LE Test End Status(1)-->success!
  
```

Figure 4-7 LE Enhance RX Parameter Setting

4.6 Single Tone TX

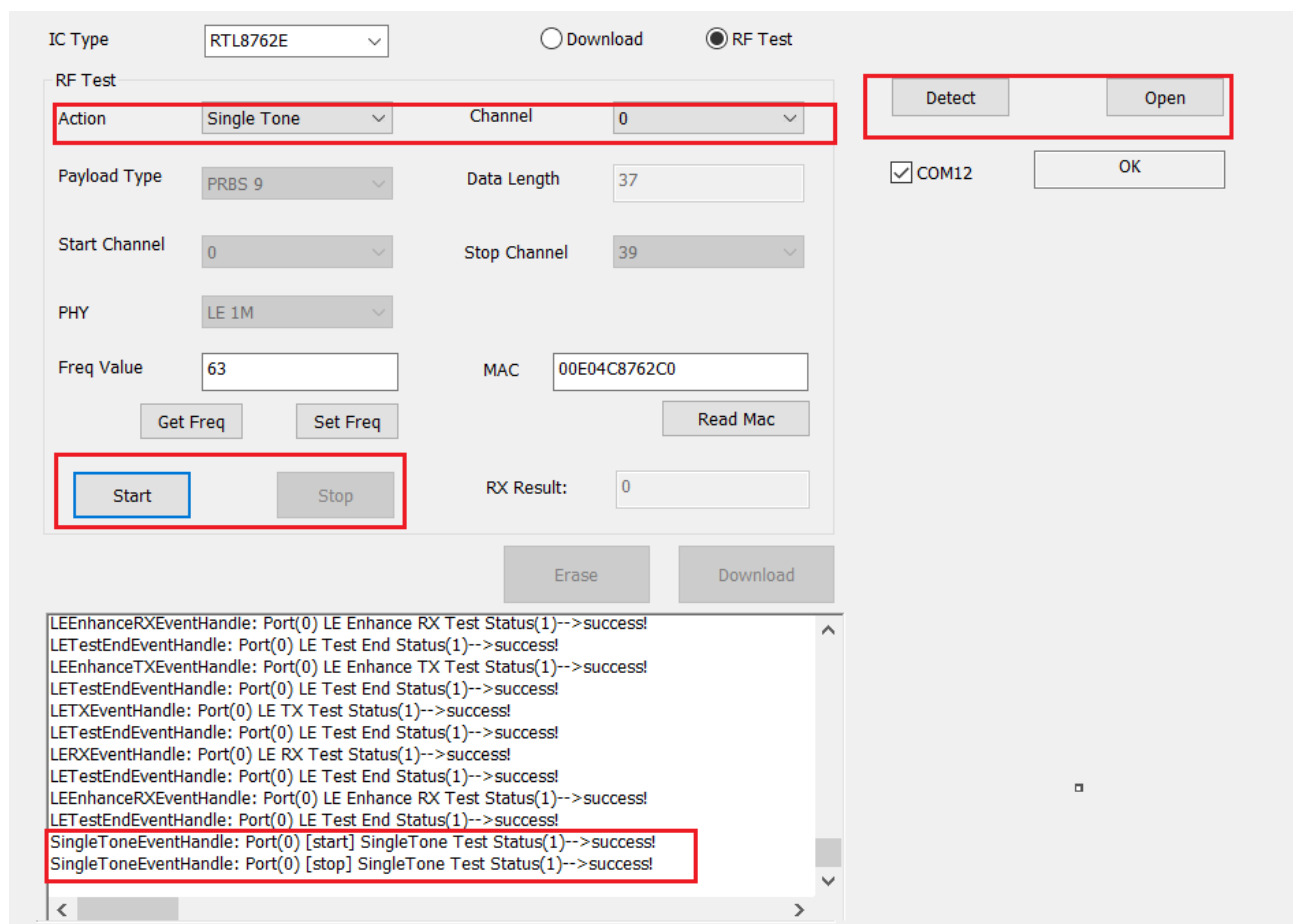
To test Single Tone, prepare testing environment first, and click ‘Detect’, and then click ‘Open’ to open the port after UART is detected.

Channel is the only parameter to be set. As is shown in Figure 4-8, select Single Tone, click ‘Start’ to start testing, and click ‘Stop’ to stop testing.

Operation steps:

1. Detect UART com port.
2. Open UART com port.
3. Select Single Tone test item.
4. Choose channel.
5. Click ‘Start’ to start test.
6. Click ‘Stop’ to end test.

Note: On Single Tone test, users can get/set frequency offset through ‘GetFreqValue’ and ‘SetFreqValue’ buttons.



IC Type: Download ☒ RF Test

RF Test

Action: Channel: Detect Open

Payload Type: Data Length: ☒ COM12 OK

Start Channel: Stop Channel:

PHY:

Freq Value: MAC: Get Freq Set Freq Read Mac

Start Stop RX Result:

Erase Download

Log Window:

```

LEEnhanceRXEventHandle: Port(0) LE Enhance RX Test Status(1)-->success!
LETestEndEventHandle: Port(0) LE Test End Status(1)-->success!
LEEnhanceTXEventHandle: Port(0) LE Enhance TX Test Status(1)-->success!
LETestEndEventHandle: Port(0) LE Test End Status(1)-->success!
LETXEventHandle: Port(0) LE TX Test Status(1)-->success!
LETestEndEventHandle: Port(0) LE Test End Status(1)-->success!
LERXEventHandle: Port(0) LE RX Test Status(1)-->success!
LETestEndEventHandle: Port(0) LE Test End Status(1)-->success!
LEEnhanceRXEventHandle: Port(0) LE Enhance RX Test Status(1)-->success!
LETestEndEventHandle: Port(0) LE Test End Status(1)-->success!
SingleToneEventHandle: Port(0) [start] SingleTone Test Status(1)-->success!
SingleToneEventHandle: Port(0) [stop] SingleTone Test Status(1)-->success!

```

Figure 4-8 Single Tone Test

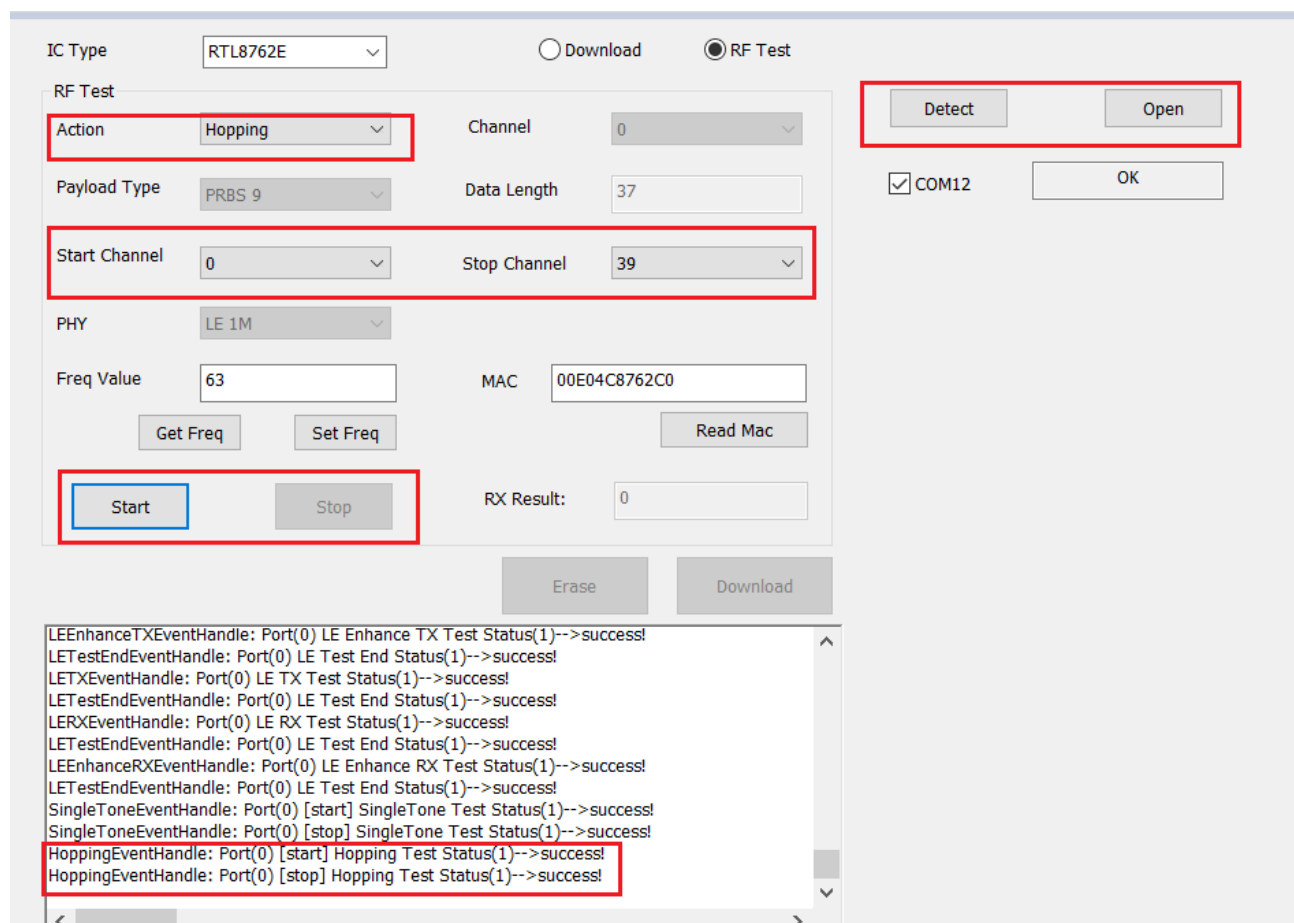
4.7 Hopping Test

To test Hopping, prepare testing environment first, and click ‘Detect’, and then click ‘Open’ to open the port after UART is detected.

Channel is the only parameter to be set. As shown in Figure 4-9, select Hopping, click ‘Start’ to start testing, and click ‘Stop’ to stop testing.

Operation steps:

1. Detect UART com port.
2. Open UART com port.
3. Select Hopping test item.
4. Choose start channel and stop channel.
5. Click ‘Start’ to start test.
6. Click ‘Stop’ to end test.



IC Type: Download ☒ RF Test

RF Test

Action: Channel:

Payload Type: Data Length:

Start Channel: Stop Channel:

PHY:

Freq Value: MAC:

Get Freq Set Freq Read Mac

Start Stop RX Result:

Erase Download

Log Window:

```

LEEnhanceTXEventHandle: Port(0) LE Enhance TX Test Status(1)-->success!
LETTestEndEventHandle: Port(0) LE Test End Status(1)-->success!
LETXEventHandle: Port(0) LE TX Test Status(1)-->success!
LETTestEndEventHandle: Port(0) LE Test End Status(1)-->success!
LERXEventHandle: Port(0) LE RX Test Status(1)-->success!
LETTestEndEventHandle: Port(0) LE Test End Status(1)-->success!
LEEnhanceRXEventHandle: Port(0) LE Enhance RX Test Status(1)-->success!
LETTestEndEventHandle: Port(0) LE Test End Status(1)-->success!
SingleToneEventHandle: Port(0) [start] SingleTone Test Status(1)-->success!
SingleToneEventHandle: Port(0) [stop] SingleTone Test Status(1)-->success!
HoppingEventHandle: Port(0) [start] Hopping Test Status(1)-->success!
HoppingEventHandle: Port(0) [stop] Hopping Test Status(1)-->success!

```

Figure 4-9 Hopping Test

Keysight Spectrum Analyzer - Swept SA

RF 50 Ω AC SENSE:INT ALIGN AUTO 06:06:10 PM Jan 26, 2016

Ref Level 5.00 dBm

PNO: Fast IF Gain: Low Trig: Free Run Atten: 16 dB

Avg Type: Log-Pwr Avg/Hold: >100/100

TRACE 1 2 3 4 5 6
TYPE M W W W W W W
DET P N N N N N N

10 dB/div Log Ref 5.00 dBm

Center 2.44100 GHz Res BW 910 kHz Span 100.0 MHz

VBW 50 MHz Sweep 1.000 ms (1001 pts)

MSG STATUS

Trace/Detector

Select Trace 1

Clear Write

Trace Average

Max Hold

Min Hold

View Blank Trace On

More 1 of 3

Figure 4-10 Hopping Test Waveforms