AB1602 User Manual
(OEM/Integrators Installation Manual)

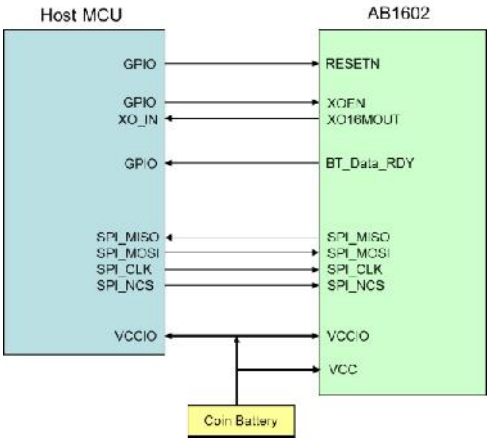
Product Overview

AB1602 is a low-power, single-chip Bluetooth Low Energy Single mode controller. It integrates a low-power physical layer, a link controller with a security engine. It supports the standard HCI interface which is able to connect to different MCUs for varies applications. The SPI and UART interface are used for connecting to external host MCU and the Bluetooth profiles are implemented on the host MCU as well.

Applications

- Sports and Fitness Devices
- Smart Watch
- Home Automation Devices
- Health Care Devices

Application Block Diagram



Key Features

- Integrated 1.4V~3.6V LDO regulator
- Support standard HCI interface
- Wide-spread 16MHz crystal support
- AES128 encryption and decryption
- RoHS Compliant
- Package QFN 4x4 28 pin

Specifications

Standard	Bluetooth v4.2 Single Mode Controller
Frequency Band	2.4GHz ISM
Bluetooth Profile	ANP v1.0 FMP v1.0

Airoha Technology Corp.

	PXP v1.0 HOGP v1.0 CSCP v1.0 HRP v1.0 RSCP v1.0
Output Power	Typical 4 dBm
Sensitivity	-93 dBm
RAM	8KB
IC Package	QFN 4x4 28 pin
Physical Intefaces	UART, SPI
Temperature Range	-40 - 85℃
Power Consumption	Peak Tx/Rx : 16mA (1.5V) Sleep : 4 uA Deep Sleep : 1uA

1 Introduction

The Airoha AB1602 Family Lab Test Tool provides a quick-and-easy test suite for Airoha AB1602 devices. Three basic functions including TX, RX and Crystal Trim are included in this utility. User may use this tool to perform continuous TX, Burst TX, RX BER and Crystal Clock Trimming to test Airoha AB1602 Family products.

1.1 Supported Chips

The Airoha AB1602 Family Lab Test Tool supports AB1602.

2 Environment Setup

2.1 Hardware Setup

An UART interface is used for PC-to-DUT connection. User may also use an USB-to-UART adaptor at PC side and then connect to DUT side. A reference connection diagram is shown in figure 2-1.

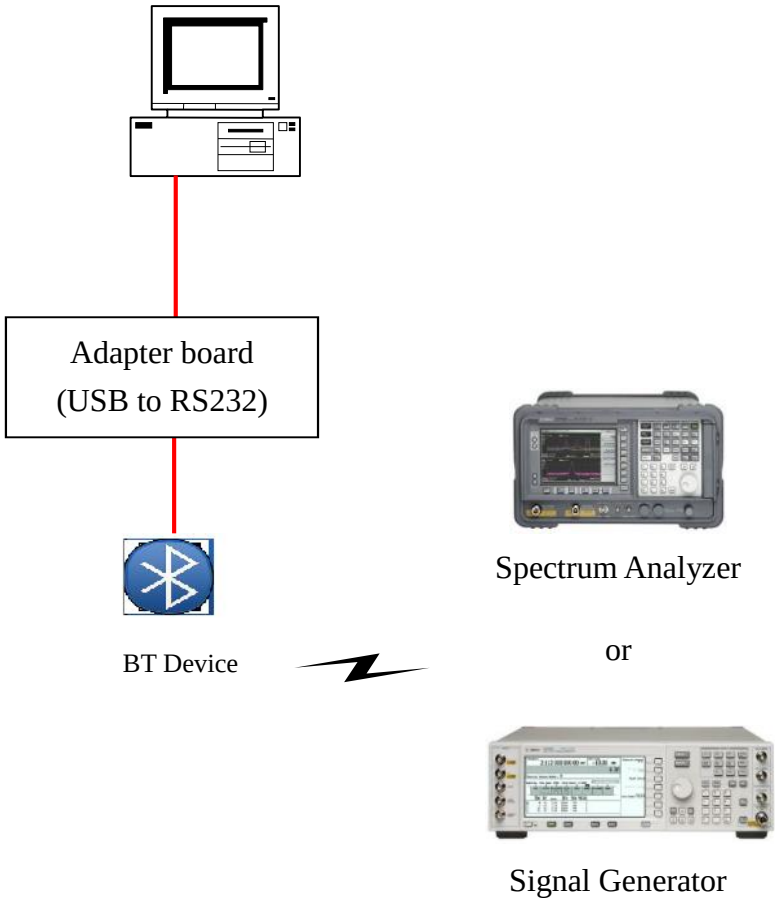


Figure 2-1

If an USB-to-UART adaptor made by Airoha is used (as in Figure 2-2), the J1 connector (to DUT) pin definition is shown in Figure 2-3. The VCC selection on JP12 should be set to +3.3V (with a jumper).

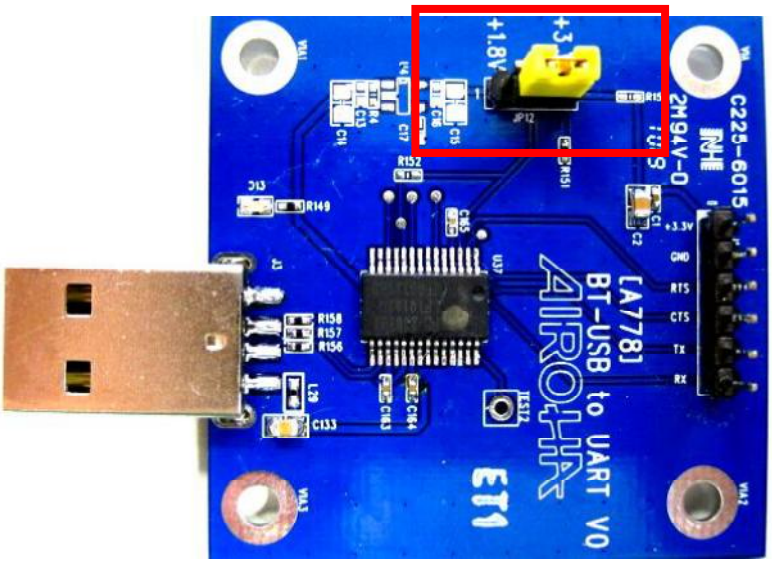


Figure 2-2

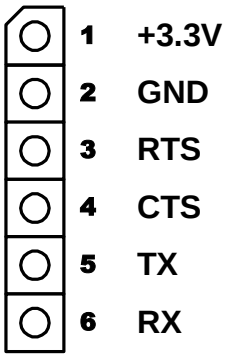


Figure 2-3

2.2 Software Setup

If the AIROHA USB-to-UART adaptor board is used, the driver should be installed at first (PL2303_Prolific_DriverInstaller_v110.exe). When the driver is installed and the board is connected to PC, an USB-to-Serial COM port would be presented in the device manager as in figure 2-4.

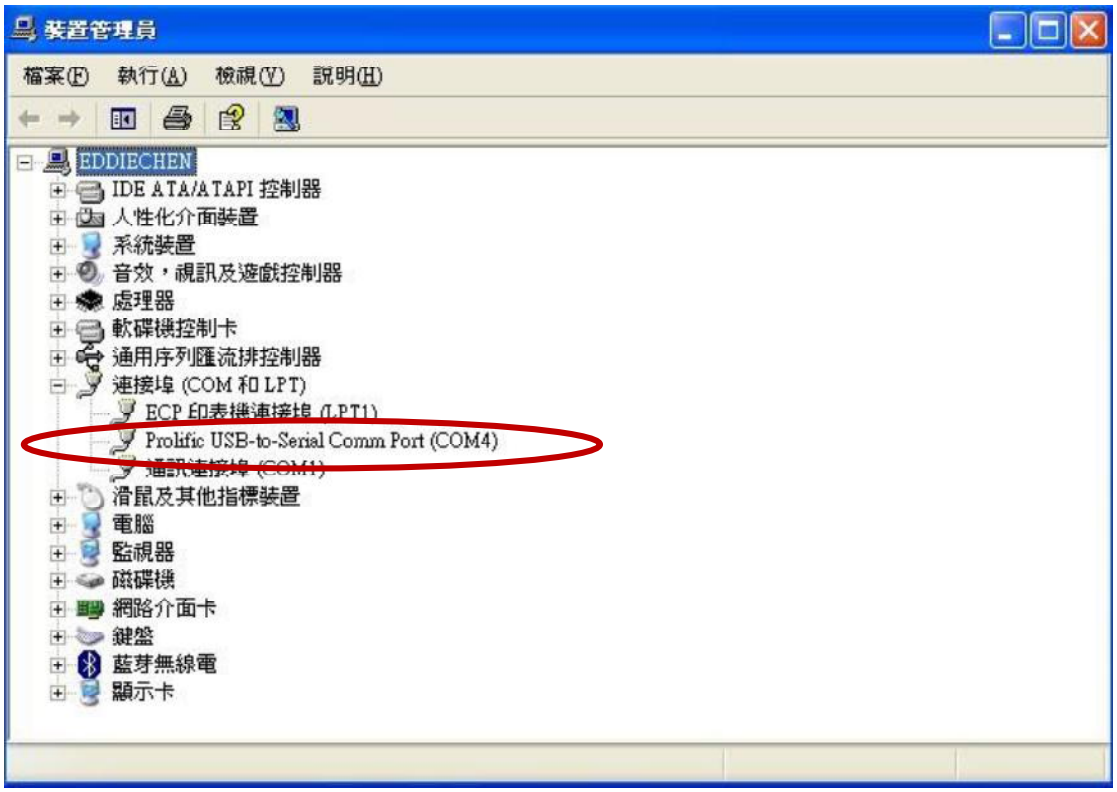


Figure 2-4

When installing the Airoha AB1602 Family Lab Test tool, execute the file “setup.exe” in the “Airoha.AB1602FamilyLabTestTool” pack. Several message boxes will be shown during the installation. Click “Next” step by step and the “Close” to complete the whole process as in figure 2-5.

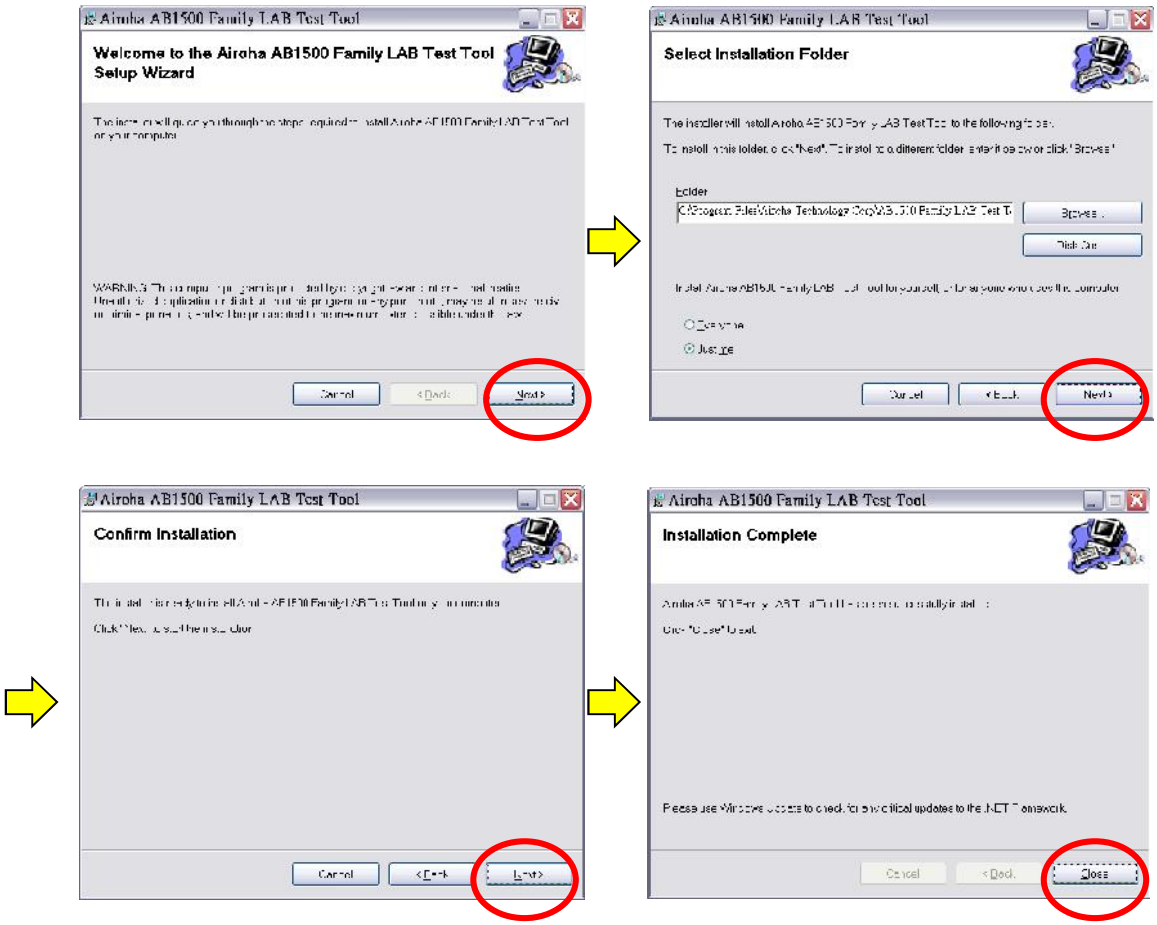

Airoha AB1500 Family LAB Test Tool
Welcome to the Airoha AB1500 Family LAB Test Tool Setup Wizard
Cancel
< Back
Next >
Airoha AB1500 Family LAB Test Tool
Select Installation Folder
Folder
Browse...
Disk Cost...
Everyone
Just me
Cancel
< Back
Next >
Airoha AB1500 Family LAB Test Tool
Confirm Installation
Cancel
< Back
Next >
Airoha AB1500 Family LAB Test Tool
Installation Complete
Cancel
< Back
Close

Figure 2-5

3 The User Interface

Figure 3-1 shows the user interface when Airoha Lab Test Tool is launched. Three regions: COM port selection & .airoha save/write, Function Tab, and Output Window are included in the user interface.

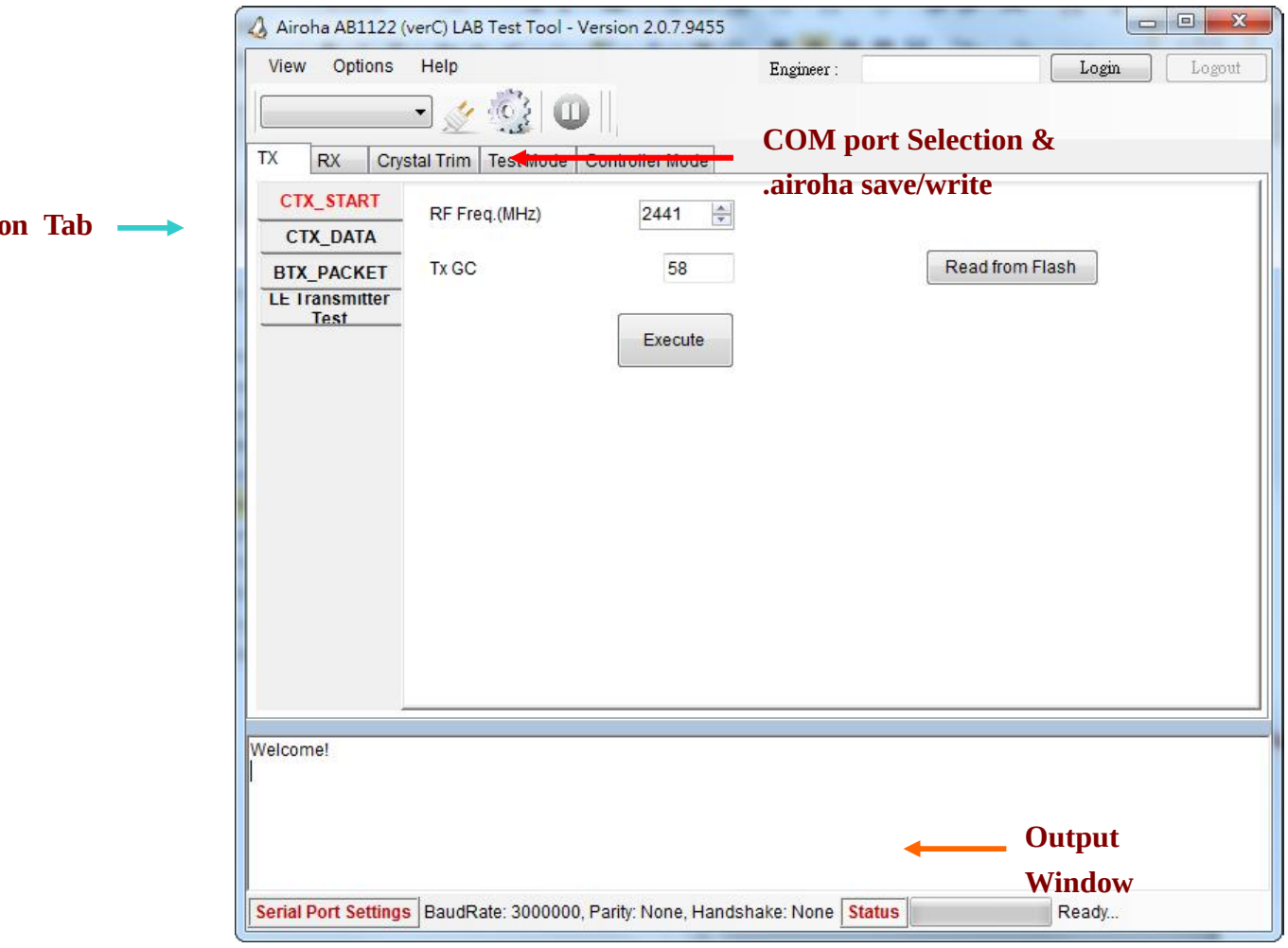


Figure 3-1

Connection Process

- Power-on the DUT, and press the connection button of the device to enter discoverable mode.
- Select corresponding COM port number of DUT in the COM Select region of the Lab Test Tool, and then press “Enable COM port” button.

If the device is correctly plugged in and the “Enable COM port” is clicked, a message “COMxx is Open.” will be shown in the output window, as in figure 3-2 and figure 3-3.

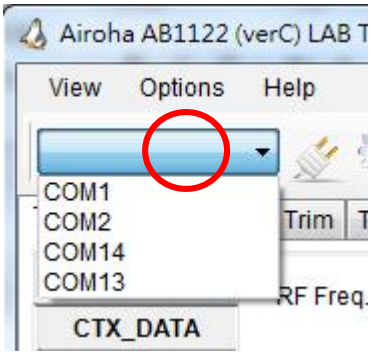


Figure 3-2

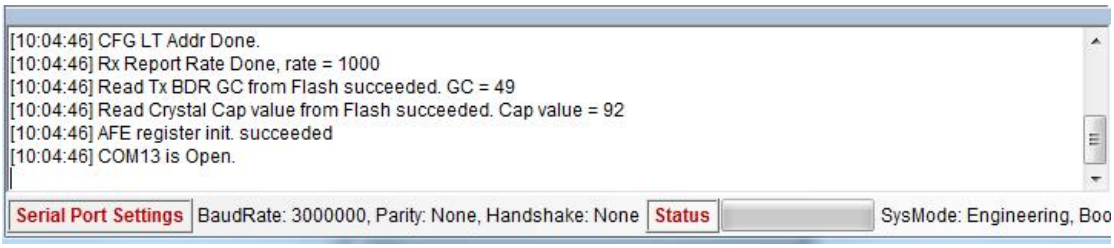


Figure 3-3

If the success message is not shown, please check if the DUT is correctly powered up, the link between DUT and PC is correctly connected, and the DUT is in discoverable mode, then click “Enable COM port” again.

4 Test Functions

4.1 TX Test

There are three modes supported in the TX Test functions, i.e. Single-tone TX, Continuous TX and Burst TX.

Single Tone Transmission

When CTX_START is selected, a continuous single-tone signal without any modulation (i.e. Carrier Only) will be sent out at RF port. User may first set different RF frequency and TX power setting on the Parameter block, and then click “Execute” to start single tone transmission. The RF frequency ranges from 2402 to 2480, and Tx GC ranges from 16 to 63.

To save the current Tx GC setting, click the Write to EEPROM button.

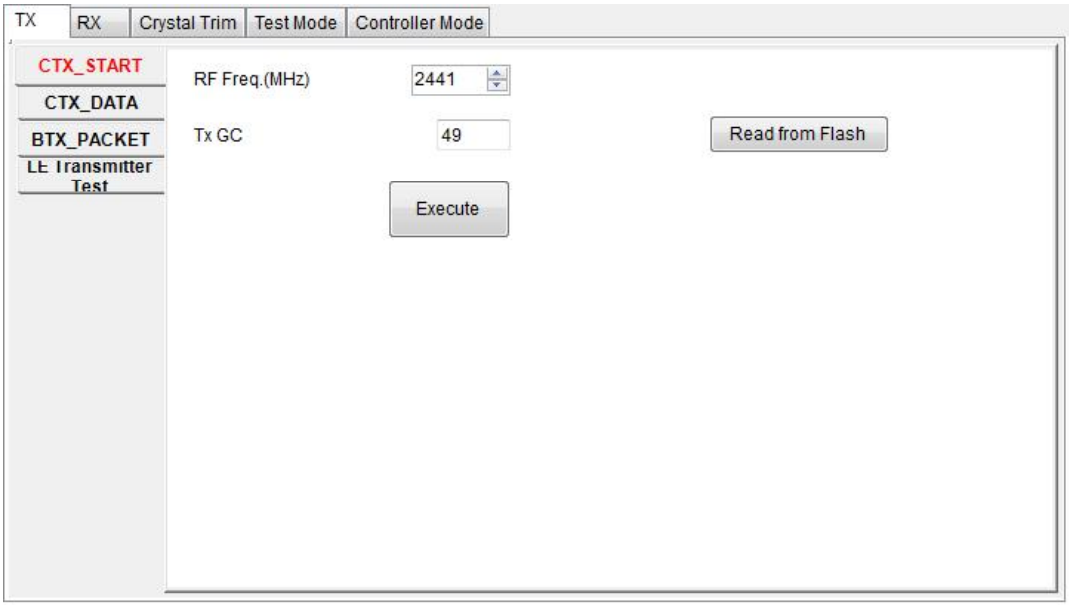


Figure 4-1 Single tone transmission setting of Tx Tab

Continuous Data Transmission

When CTX_DATA is selected, a continuous modulated signal will be sent out at RF port. User may first set different RF frequency, TX power setting, and choose modulation type with data format on the Parameter block, and then click “Execute” to start single tone transmission. The RF frequency ranges from 2402 to 2480, and Tx GC ranges from 16 to 63. The data format supports all 0, all 1, 1010, and PN. GFSK, 1/4pi-DQPSK, and D8PSK are supported for the modulation type.

To save the current Tx GC setting, click the Write to EEPROM button.

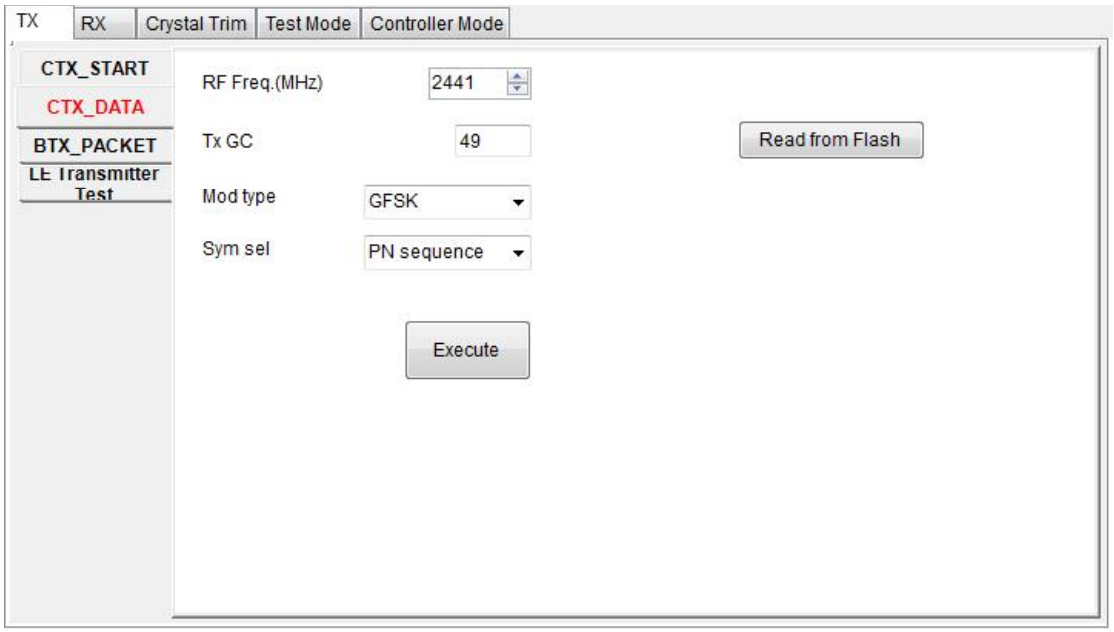


Figure 4-2 Continuous data transmission setting of Tx Tab

Burst Data Transmission

When BTX_PACKET is selected, a burst-type modulated signal will be sent out at RF port. User may select a RF frequency for transmit. Then set TX GC value, packet type (DH1, DH3, DH5, 2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3 and 3-DH5 are supported) and Data type (all 0, all 1, 1010, 11110000 and PN) and then click “Execute” to start packet transmission.

To save the current Tx GC setting, click the Write to EEPROM button.

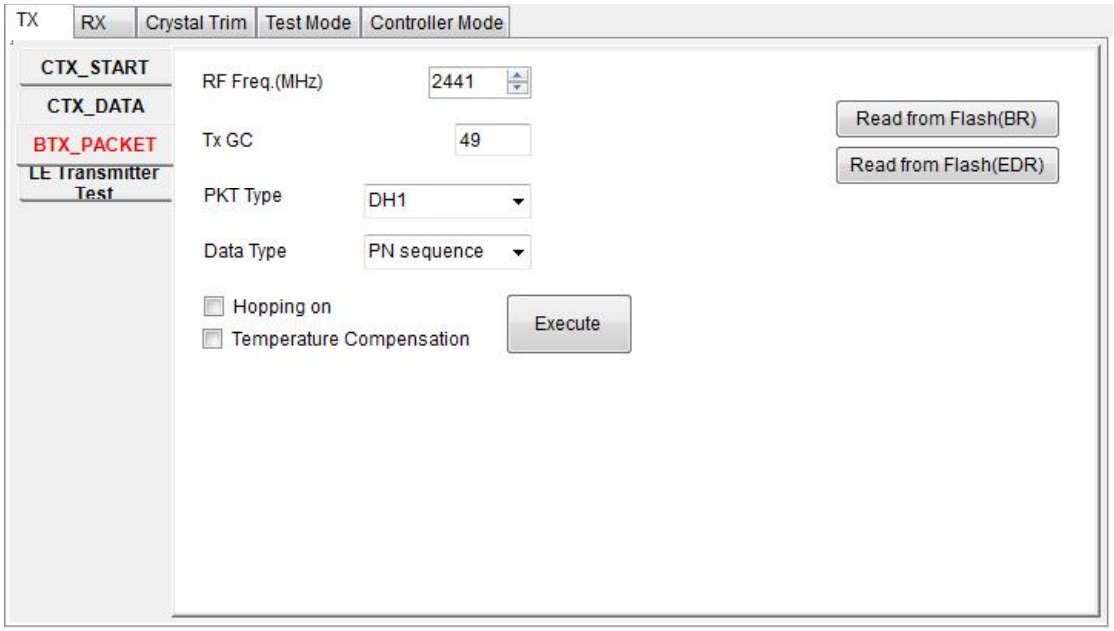


Figure 4-3 Burst data transmission setting of Tx Tab

If you want to do hopping in specific channels, set channel information in ‘Specific Channels Hopping by continuous fixed channel switching’. 1 is for enabled and 0 is for disabled.

This function is enabled by sending continuous fixed channel BTx command. You could set the sending interval by ‘Hopping Interval (ms)’ setting.

After setting channels and interval, click ‘Start specific channels BTx’ to start specific channel hopping.

If this function is executed, click ‘Stop’ to stop it.

LE Transmitter Test

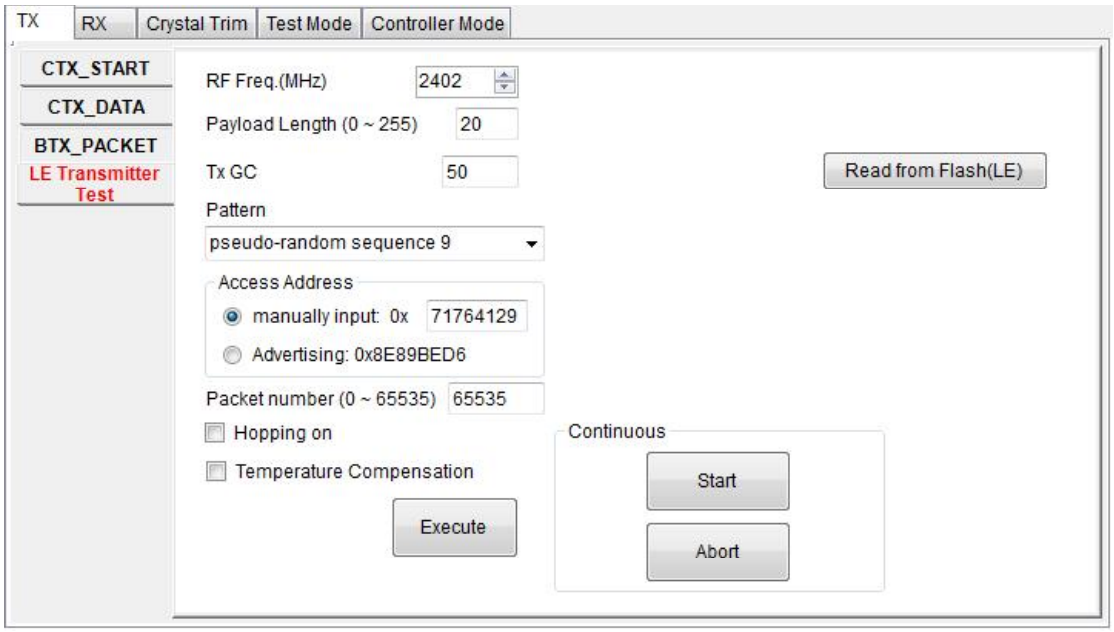


Figure 4-4 LE Transmitter Test setting of Tx Tab

4.2 RX Test

Two RX modes, continuous receiving and burst receiving, are supported in the RX Test function. The former is used for CE/FCC tests, and the later is used for bit error rate (BER) calculation.

Continuous Data Receiving

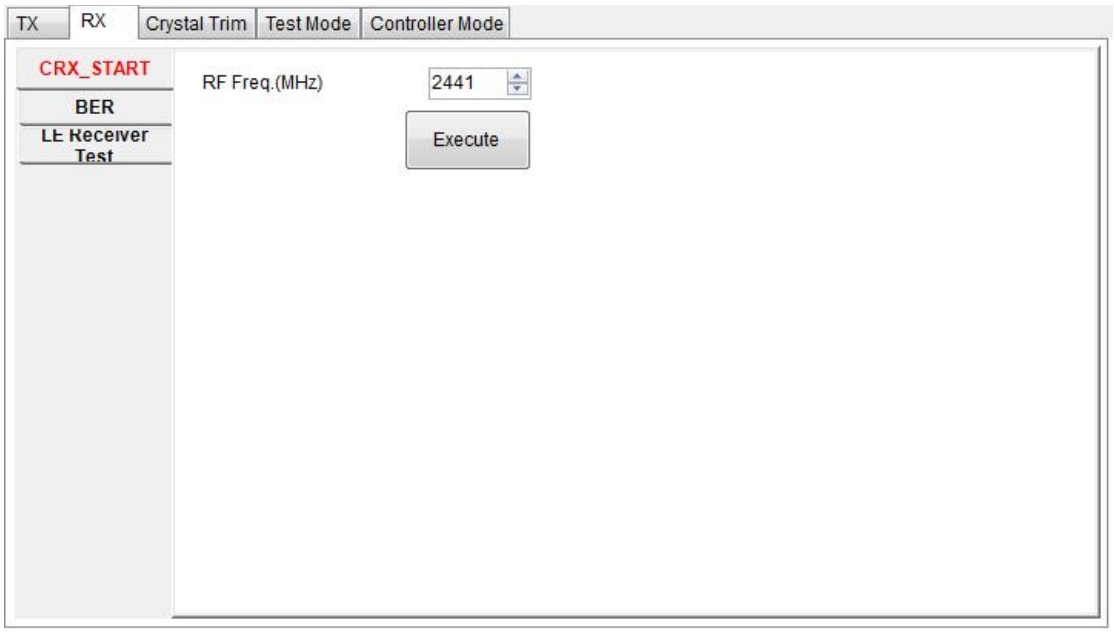


Figure 4-5 Continuous Data Receiving setting of Rx Tab

When CRX_START is selected, user may set different RF frequency at first, and then click “Execute” to start continuous receiving. The RF frequency ranges from 2402 to 2480.

Burst Data Receiving

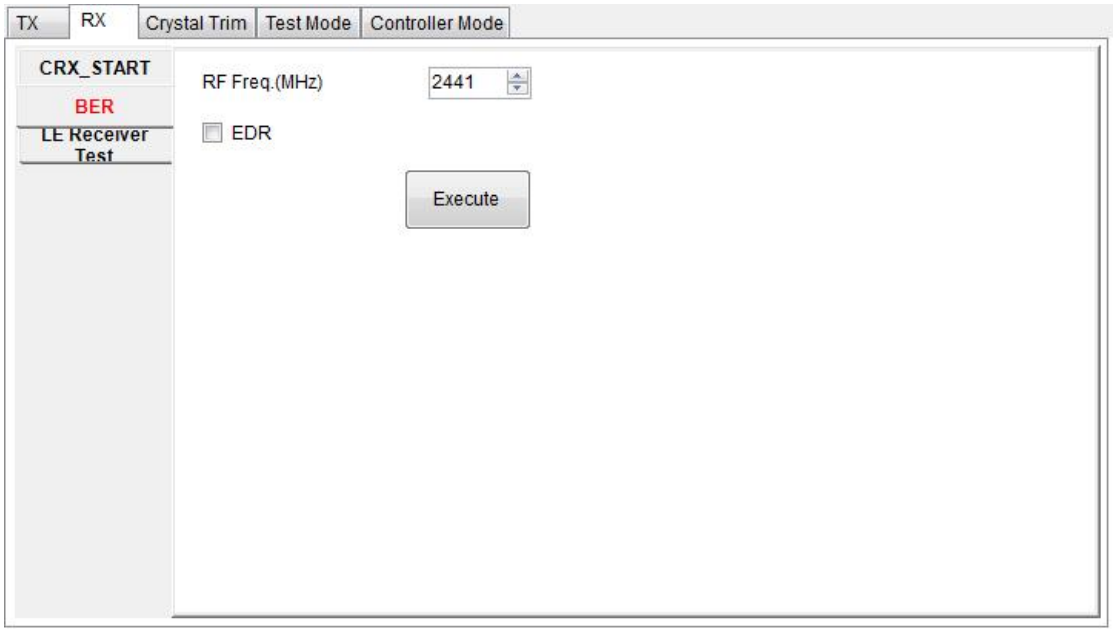


Figure 4-6 Burst Data Receiving setting of Rx Tab

When BER is selected, user should set a RF frequency at first, and then click “Execute” to start burst receiving. In order to measure BER, a signal generator is required to generate Bluetooth standard packets and transmitted to the DUT. The associated settings of the signal generator must be set as follows,

- BD address = 0x006BC6967E
- LT_ADDR = 7
- Payload data = PN9 with initial seed = 0x01FF

If the transmitted data of signal generator is successfully received and decoded by DUT, a group of BER test results will be shown in the output window including: (as in figure 4-6)

- BER(%): Bit error rate
- Bits: Number of received data bits
- #RPkt: Number of received packets
- #EPkt: Number of expected packets
- #ACloss: Number of packets with AC_Loss
- #Hdr: Number of packets with header error
- #CRC: Number of packets with CRC error
- RSSI: Received Signal Strength Indication

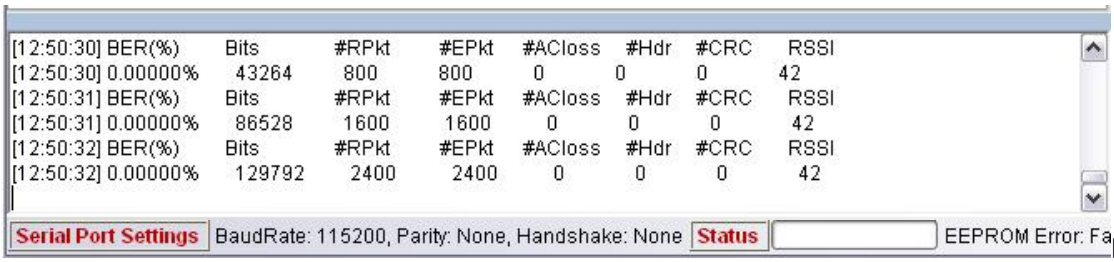


Figure 4-7 BER results

LE Receiver Test

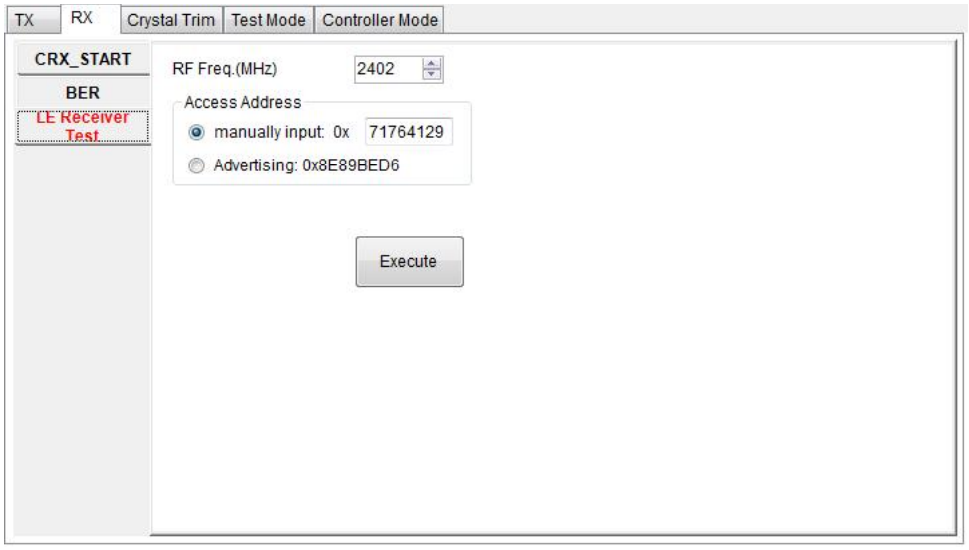


Figure 4-8 LE Receiver test setting of Rx Tab

4.3 Crystal Trim

When a 16MHz crystal is used on the DUT, user may adjust cap value to fine tune the output reference 16MHz clock frequency ("crystal trim") to meet the clock accuracy spec., and write the tuned cap value into EEPROM. Whenever DUT is powered on, the parameters in EEPROM will be read out and write into DUT, thus the output 16MHz reference clock frequency could be set to the trimmed value.

The crystal trimming can be performed either by a spectrum analyzer or a frequency counter. The method is described below,

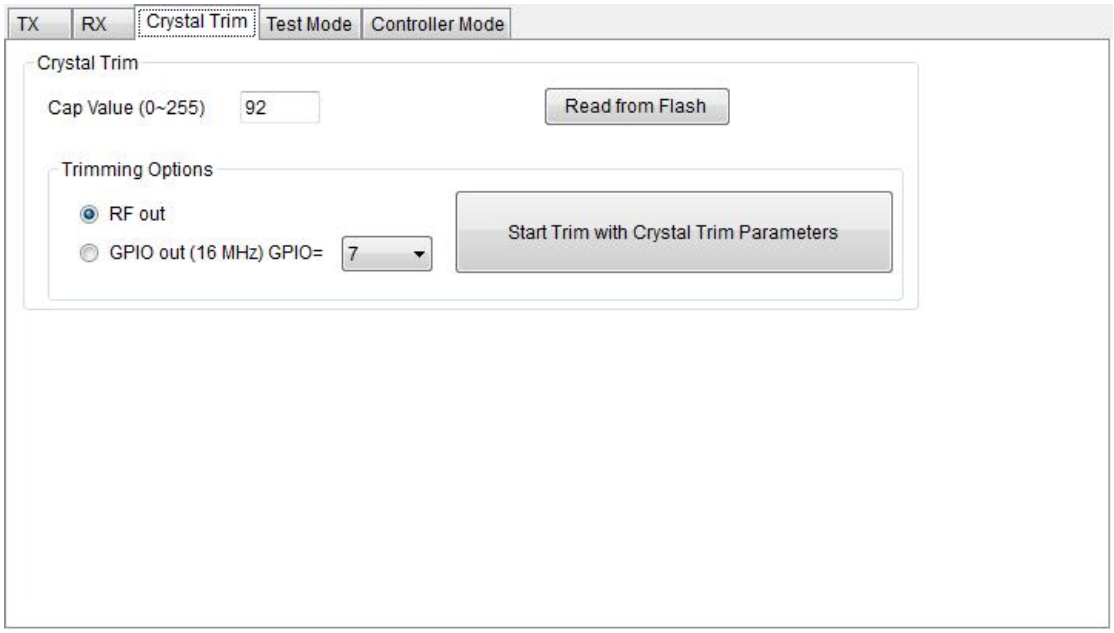


Figure 4-9

Crystal Trim function

- **When a spectrum analyzer is used:** Choose the "RF out" item in figure 4-7 and click "Start Trim with Crystal Trim Parameters" to transmit a single-tone RF signal at 2441MHz. Using spectrum analyzer to measure the frequency of the tone at RF output port, and then fine-tune the cap value until the carrier frequency offset is less than (2.4 G * n ppm) Hz. (n ppm is the reference clock accuracy spec of the Bluetooth specifications)
- **When a frequency counter is used:** Choose the "PIO7 out" item in figure 4-7 and click "Start Trim with Crystal Trim Parameters" to send out the reference 16 MHz clock at pin PIO7. Measure the clock with a frequency counter, and then fine-tune the cap value until the reference clock frequency offset is less than (16 M * n PPM) Hz. (n ppm is the reference clock accuracy spec of the Bluetooth specifications)

- After the trimming finished, click the “Write to EEPROM” button to write the tuned cap value to EEPROM.

4.4 Test Mode

AB1500 supports entering test mode by UART.

The feature ‘Enable CC UART’ should be turned on for this function.

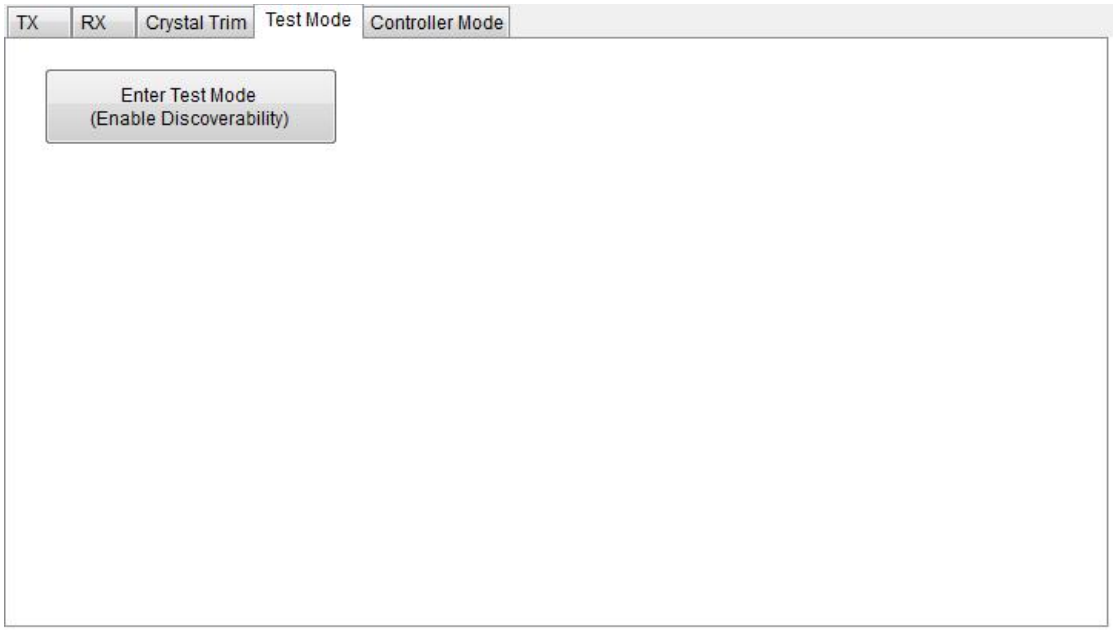


Figure 4-10 Enter Test Mode function

- Do not click Enable COM port because test mode conflicts with LAB test mode
- Click ‘Enter Test Mode’ button to force DUT into test mode directly.
- If DUT is already in LAB test mode, reset it before entering test mode function.

4.5 Controller Mode

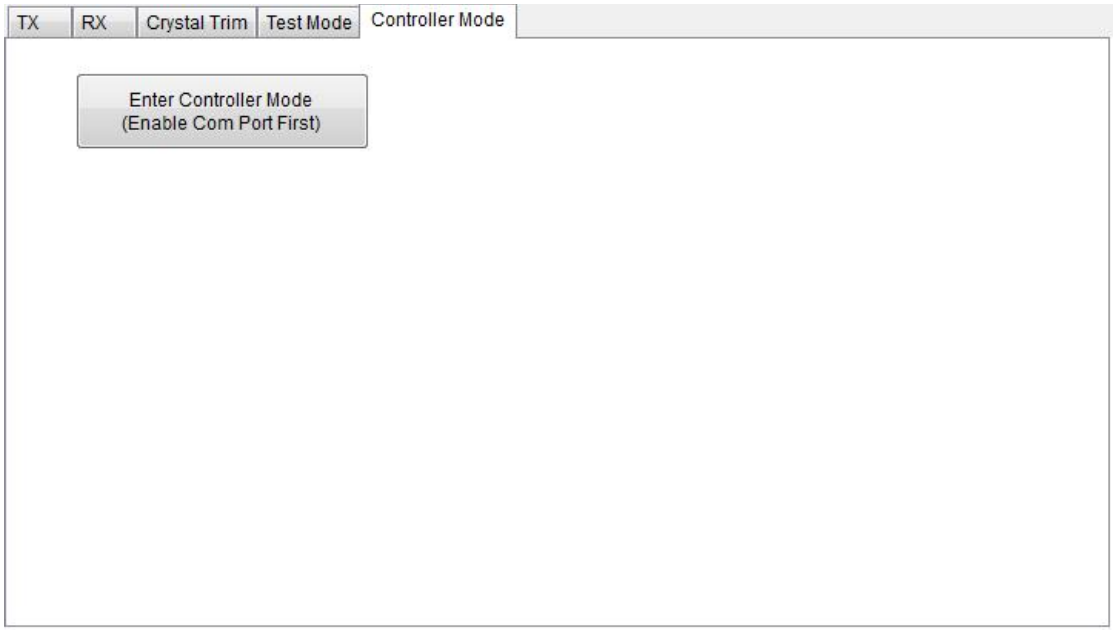


Figure 4-11 Controller Mode function

Warning

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

(1) This device may not cause harmful interference, and

(2) This device must accept any interference received, including interference that may cause undesired operation.

This module is intended for OEM integrator. The OEM integrator is responsible for the compliance to all the rules that apply to the product into which this certified RF module is integrated. Additional testing and certification may be necessary when multiple modules are used.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user authority to operate the equipment.

Referring to the multi-transmitter policy, multiple-transmitter(s) and module(s) can be operated

simultaneously without C2P.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following “Contains FCC ID: UOW-AB1602

Manual Information To the End User

This module is intended for OEM integrator. The OEM integrator is responsible for the compliance to all the rules that apply to the product into which this certified RF module is integrated
Additional testing and certification may be necessary when multiple modules are used

Manual Information to the End User:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user s manual of the end product which integrate this module. The end user manual shall include all required regulatory information/warning as show in this manual

The module is limited to installation in mobile or fixed application per part 2.1091 (b)