Alinket Electronic Technology (Shanghai) Co,.Ltd

ALX41X Bluetooth IoT Controller User Manual

Version:1.2

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Revision History

Date	Revision Content	Revision By	Version
2015/5/20	Initial Version	Xiaohui Lou	1.0
2015/10/28	Remove the content about ALX412,chang errors according to datasheet	YuLin Liu Huanli Wang	1.1
2015/12/11	Change to new template, add typical application parts	Huanli Wang	1.2

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1 Product Overview

1.1 General Specification

The ALX41X Bluetooth Controller is an advanced Bluetooth Low Energy SoC that supports wireless charging. The ALX41X is designed to support the entire spectrum of Bluetooth Smart use cases for the medical, home automation, accessory, sensor, Internet Of Things(IOT), and wearable market segments.

The ALX41X radio has been designed to provide low power, low cost, and robust communications for applications operating in the globally available 2.4 GHz unlicensed Industrial, Scientific, and Medical (ISM) band.

1.2 Hardware Introduction

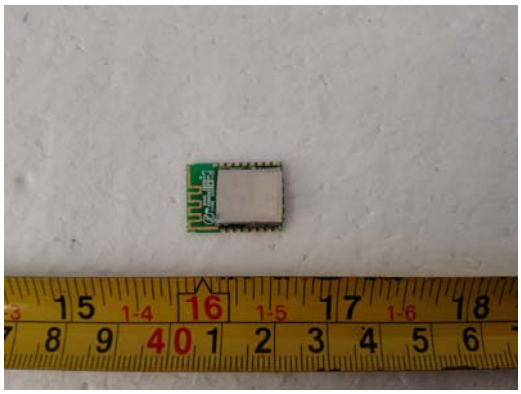

Figure 1 ALX41X Demo

1.2.1 Block Diagram

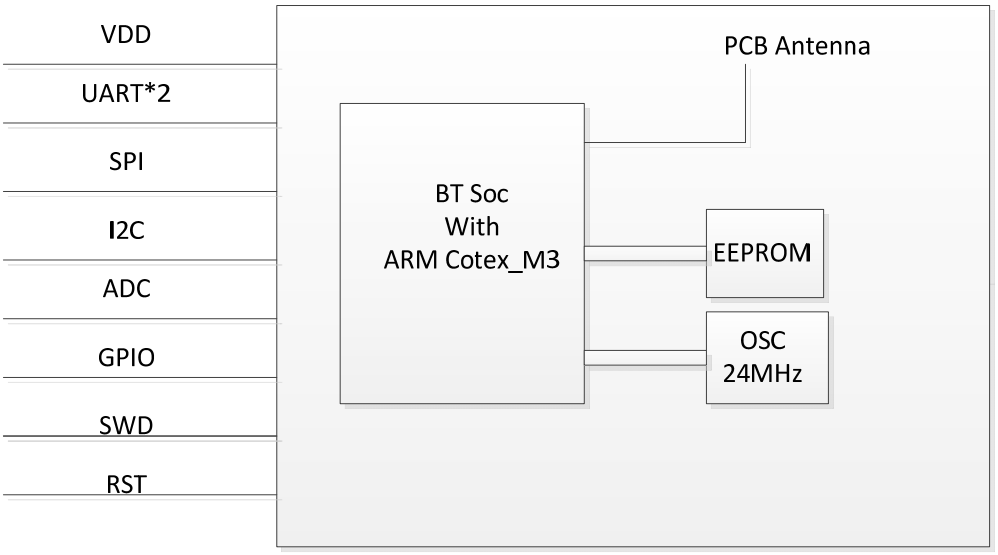

Figure 2 Block Diagram

Alinket offers Serial-to-BLE SPI-to-BLE and AiDK software for ALX41X. The modules are also compatible with AiDK with Alinket Patch file.

1.2.2 Pins Assignments

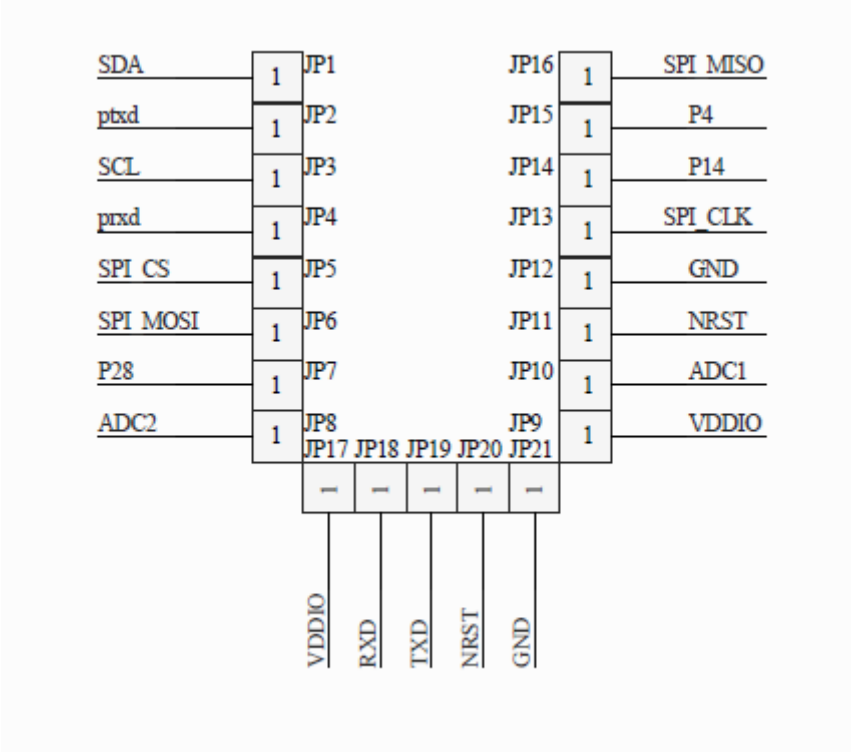

Figure 3 Ball Maps

Notes: the ball maps between IC and schematic are identical.

Table 1 Pins Description

Pin#	Type	Name （Main function）	Alternate functions	PIN connection (when not using)
JP1	I/O	SDA	GPIO0,CTS,SPI_1:MOSI (master)	floating
JP2	I/O	ptxd	P0,A/DSPI_2: MOSI (master & slave)	floating
JP3	I/O	SCL	GPIO1,RTS,SPI_1:CLK (master)	floating
JP4	I/O	prxd	P2,SPI_2:CS (slave)	floating
JP5	I/O	SPI_CS	P26,XTALO32K,SPI_2:CS (slave)	floating
JP6	I/O	SPI_MOSI	P27,XTALI32K,SPI_2:MOSI(master & slave)	floating
JP7	I/O	P28	P13,A/D,PWM3	floating
JP8	I/O	ADC2	P1,IR_TX,SPI_2: MISO (master & slave)	floating
JP9	S	VDDIO	3.3V	
JP10	I/O	ADC1	P8,A/D	floating
JP11	I	NRST	Active-low system reset	I/O
JP12	S	GND		
JP13	I/O	SPI_CLK	P24,SPI_2: CLK (master & slave), SPI_1: MISO (master)	floating
JP14	I/O	P14	P38,A/D,PWM2	floating
JP15	I/O	P4	IR_TX,SPI_2: MOSI (master)	floating
JP16	I/O	SPI_MISO	P25,SPI_2:MISO (master & slave)	floating
JP17	S	VDDIO	3.3V	
JP18	I	RXD	GPIO3	floating
JP19	O	TXD	GPIO2	floating
JP20	I	NRST	Active-low system reset	I/O
JP21	S	GND		

Notes: For each pin function, please refer to ALX41X user manual.

1.2.3 Mechanical Size

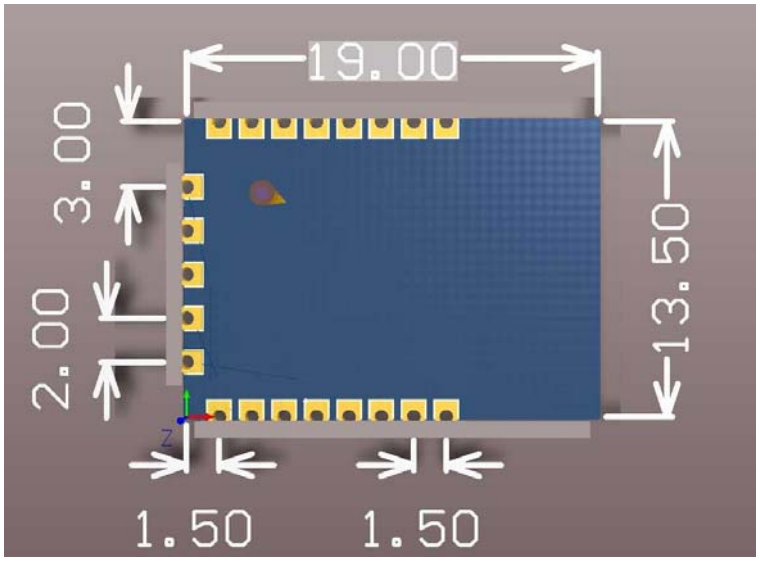

Figure 4 Pad Dimensions

1.2.4 Antenna Specification

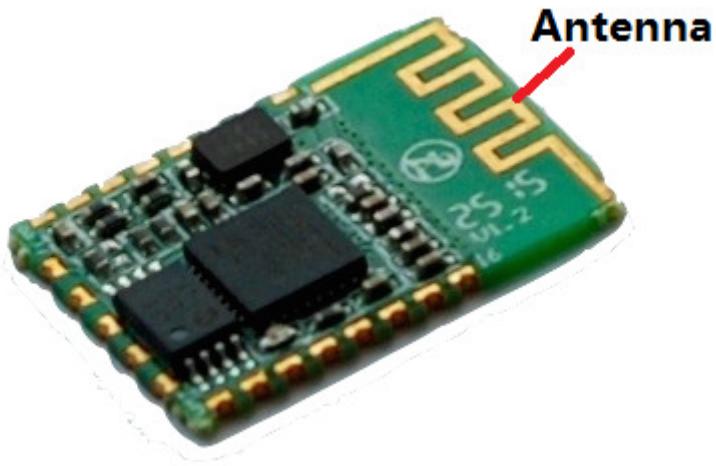

Figure 5 Printed On-board Antenna

1.2.5 Evaluation Kit

Alinket provides the evaluation kit to promote user to familiar the product and develop the detailed application. The evaluation kit shown as below .User can connect to ALX41X module with the RS-232 UART port or Wireless port to configure the parameters, manage the module or do some functional tests.

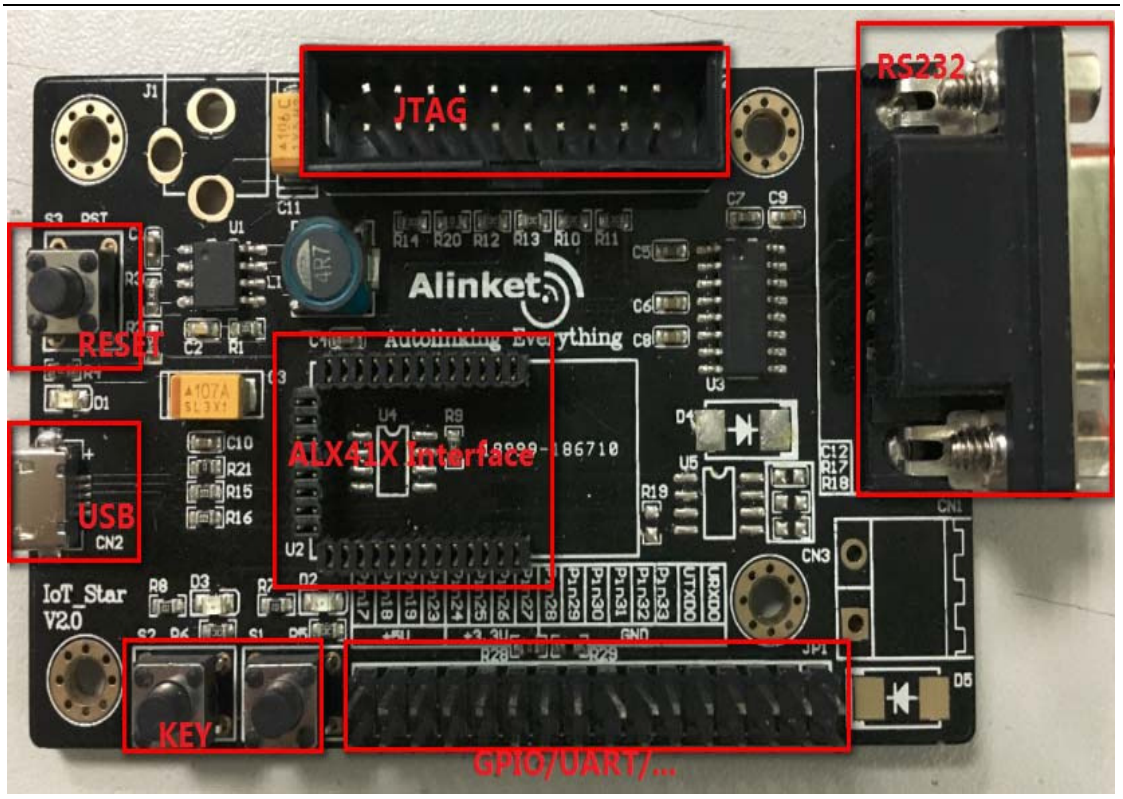

Figure 6 ALX41X Evaluation Kit

The external interface description for evaluation kit as follows:

- Auto-Select power supply sources between Vusb and Vext.
- Power indicator LED for availability of onboard 3.6V regulated output
- Two LEDs to indicate two GPO status
- A RST button to reset EVB
- Two Key buttons to test GPIO function
- A RS232 interface connector
- Two custom UART ports
- A JTAG debug interface connector
- Pads for headers to access the I/O Pins of ALX41X

1.2.6 Order Information

Base on customer detailed requirement, ALX41X series modules provide different variants and physical type for detailed application.

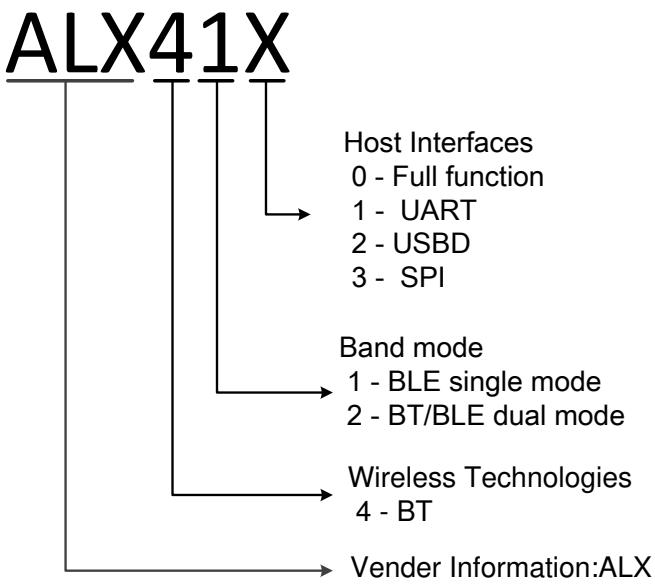

Figure 7 ALX41X Order Information

1.3 Range of operation

Table 2 Range of operation

Symbol	Description	Min	Max	Unit
Topr	Operating ambient temperature range	-40	85	°C
Tstg	Storage temperature	-40	125	°C
VDDIO	IO Power supply		3.6	V
VDDFE	RF input power		1.4	V
MSL	Moisture Sensitivity Level	3		
RoHS	Restriction of Hazardous Substances	Compliant		

1.3.1 Recommend operation condition

Table 3 Recommend temperature and humidity

Operating Temperature	-20°C to 70°C
Humidity range	Max 95%, No condensing, relative humidity

The maximum operating ambient temperature range can up to 85°C, but exposure to absolute-maximum-rated conditions may cause performance degradation and affect device reliability.

1.3.2 Consumption

Table 4 Current Consumption

Operational Mode	Conditions	Typ	Max	Unit
Receive	Receiver and baseband are both operating,100% ON	9.8	10.0	mA
Transmit	Transmitter and baseband are both operating,100% ON	9.1	9.3	mA
Sleep	Internal LPO is in use	12.0	13.0	µA
	-	0.65	-	

Currents measured between power terminals (Vdd) using 90% efficient DC-DC converter at 3.0V.

1.4 Hardware Reference Design

1.5 Software Reference Design

1.5.1 Transparent Transmission Mode

ALX41X modules support serial interface transparent transmission mode. The benefit of this mode is achieves a plug and play serial data port, and reduces user complexity furthest. In this mode, user should only configure the necessary parameters. After power on, module can automatically connect to the default master.

1.5.2 Configuration Mode

In configuration mode, user can finish ALX41X module configuration management and parameters setting work. Please refer to the data format of the document provided by Alinket, also you can define your own data format.

1.5.3 GPIO Port

The ALX41X has 10 general-purpose I/Os (GPIOs) in the 21-pin package. All GPIOs support programmable pull-up and pull-down resistors, and all support a 2 mA drive strength except P26, P27, and P28, which provide a 16 mA drive strength at 3.3V supply.
The following GPIOs are available:

- SPI_2: MOSI(P0,A/D)
- ADC2(P1,IR_TX,SPI_2: MISO(master & slave))
- PRXD (P2,SPI_2:CS (slave))
- ADC1(P8,A/D)

- SPI_MOSI(P27,XTALI32K,SPI_2:MOSI(master & slave))
- SPI_CS (P26,XTALO32K,SPI_2:CS (slave))
- P28 (P13,A/D,PWM3)
- P14 (P38,A/D,PWM2)
- SPI_CLK(P24,SPI_2: CLK (master & slave), SPI_1: MISO (master))
- SPI_MISO(P25,SPI_2:MISO (master & slave))

1.6 BLE Protocol

ALX41X module supports Bluetooth Core Specification version 4.0 (called Bluetooth Smart). It includes Classic Bluetooth and Bluetooth low energy protocols. Bluetooth low energy is a subset of Bluetooth v4.0 with an entirely new protocol stack for rapid build-up of simple links. As an alternative to the Bluetooth standard protocols that were introduced in Bluetooth v1.0 to v3.0, it is aimed at very low power applications running off a coin cell.

2 Operation Guideline

2.1 Usage Preparation

The application is based on the evaluation kit with ALX41X module of Alinket.

2.1.1 Debug Tools

Hardware: ALX41X BT communication module, PC, USB-to-Serial converter (TTL interface)
Software: PC OS: Windows8.1, Serial Debugger Tool (ascs UartAssist), Alinket Control Message Tool (ASCS1.0.4), Alinket BT console on PC(Alinket DTU)

2.1.2 Connect the Module to Serial Port

Serial cable (USB-to-Serial converter), ALX41X BT communication module is connected to the PC via a 4-pins connector (Tx, Rx, Vcc, Gnd):

Serial Port	BT Communication Module
Tx	URXTD0
Rx	UTXTD0
VCC (5V)	VCC (5V)
GND	GND

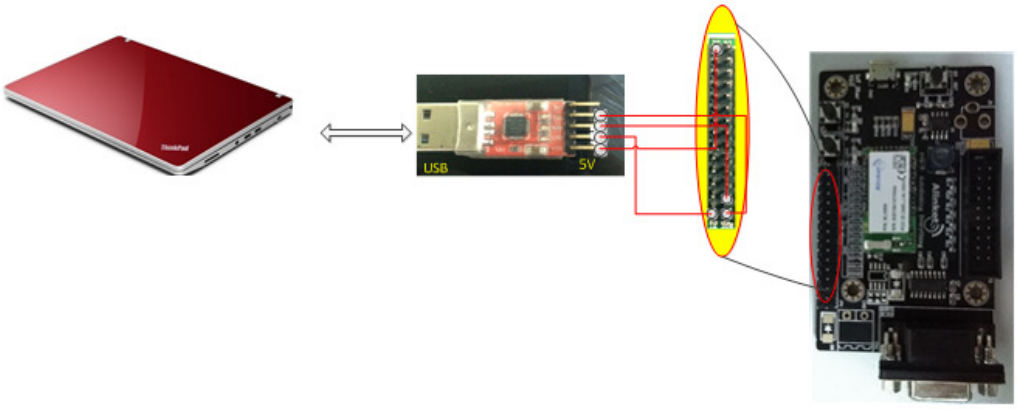

Figure 8 Debug Connection

2.2 Usage Introduction

2.2.1 Configuration With UART Transparent

Firstly, you should power on the ALX410. Turn on the Bluetooth icon in the lower right corner of the computer， shown as Figure 9. Here PC will discover ALX41X BT module.

Figure 9 Bluetooth icon

Step 1: Select ALX410 Bluetooth name, shown as Figure 10.

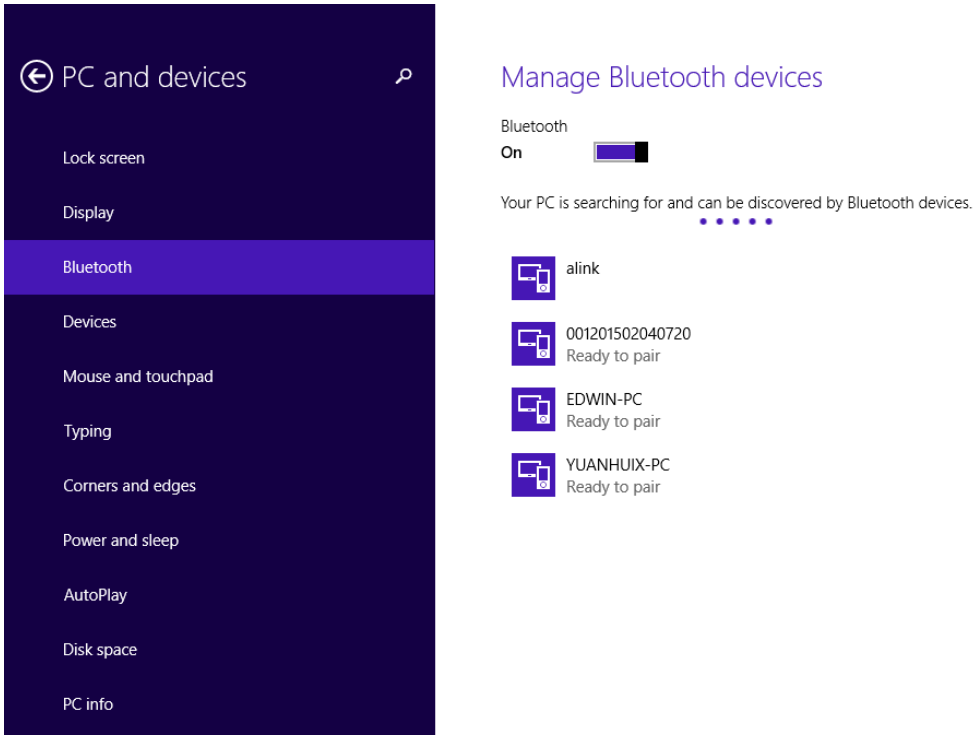

Figure 10 Find ALX410 Bluetooth name

Step 2: Click pairing, shown as Figure 11.

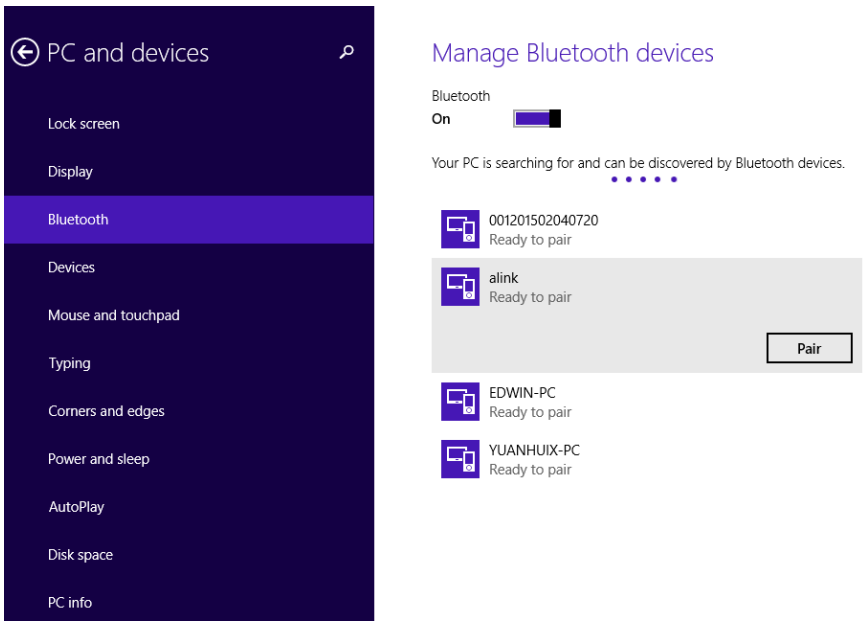

Figure 11 Pair

Step 3: If the following error message appears, shown as Figure 12, click Close.

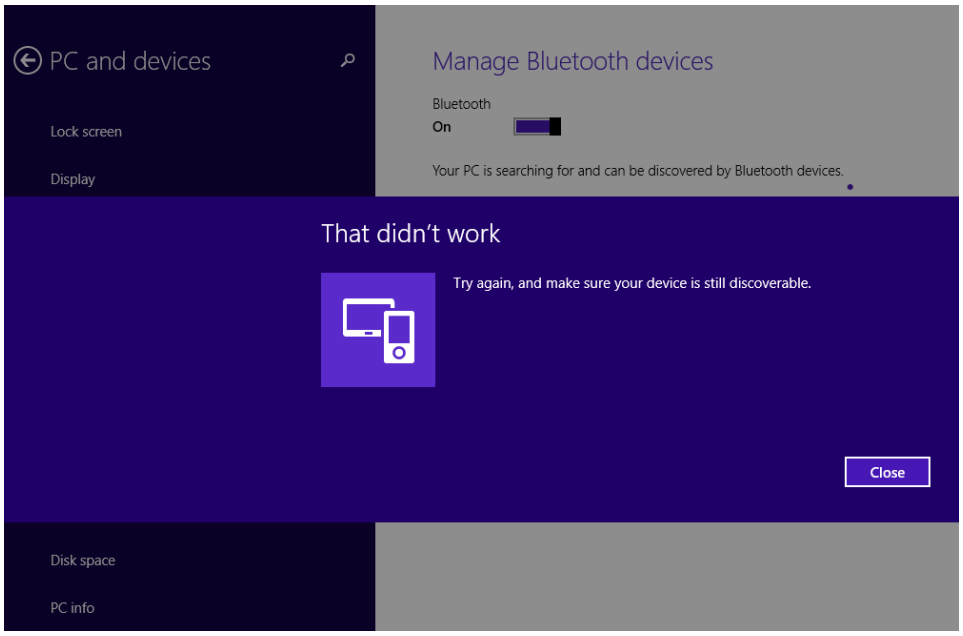

Figure 12 Error message

Then pair again, as step 2.

Step 4: A progress bar will appear as connecting, shown as Figure 13.

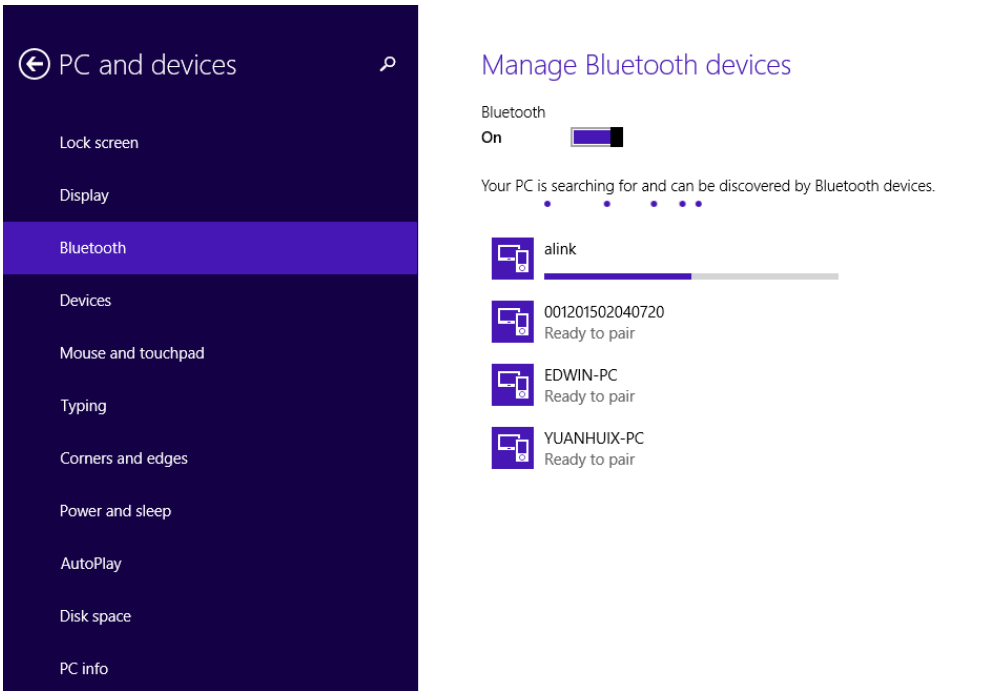

Figure 13 Connecting

Step 5: If connect successfully, it is shown as Figure 14. At the same time, the LED on the ALX41X module will light on.

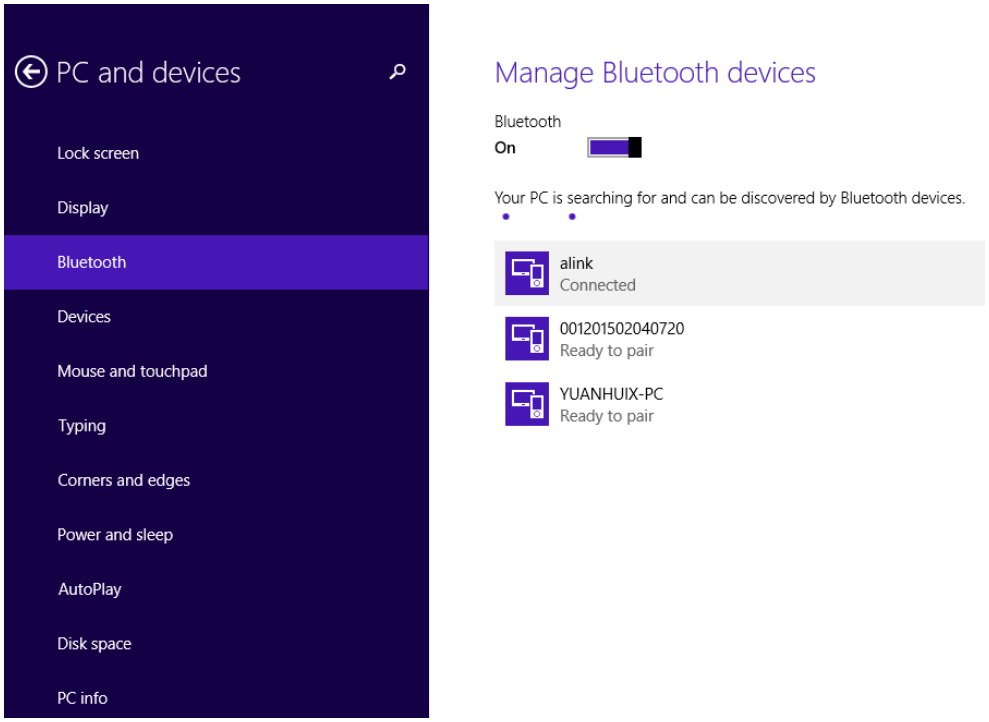

Figure 14 Connect successfully

2.2.2 Configuration With ACM

We can change some configurations by sending commands to the module. Open Alinket Control Message Tool (ASCS1.0.4) on PC and set the serial port properties shown as Figure 15.

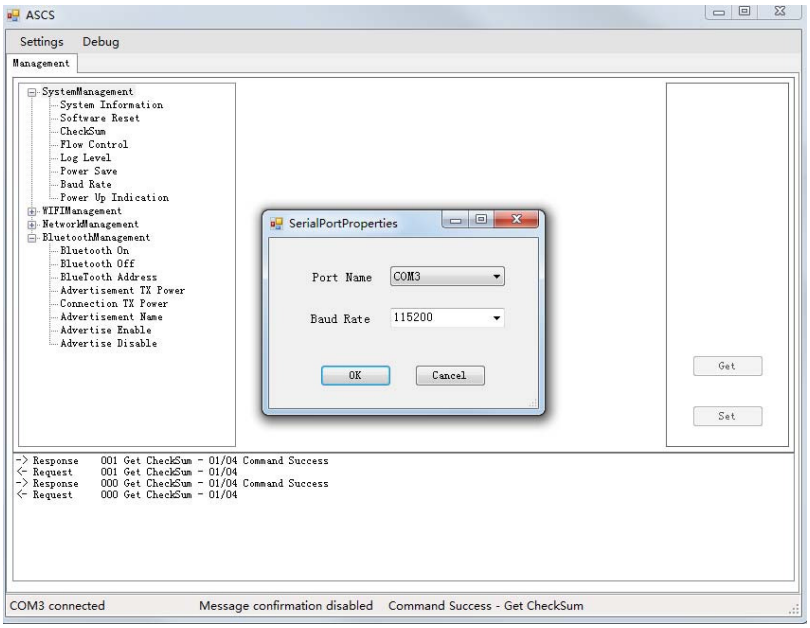

Figure 15 Alinket Control Message Tool on PC

The information you can get or set shown as Table 5.

Table 5 ACM Item

ID	Name	Description
1	Power Up Indication	Reports the power up reason
2	Software Reset	Let the module reset itself
3	Get System Information	Includes manufacture, product name, SN, hardware version, bootloader version, firmware version, Bluetooth firmware version and produce date
4	Get UART Baud Rate	Show the UART baud rate
5	Set UART Baud Rate	After receiving the response restart the ASCS
6	BT On	Initialize its stack
7	Get BT Address	Return the MAC address
8	Get BT Advertisement TX Power	Unit: db
9	Set BT Advertisement TX Power	Unit: db
10	Get BT Connection TX Power	Unit: db
11	Set BT Connection TX Power	Unit: db
12	Get Advertisement Name	Length < = 16
13	Set Advertisement Name	Length < = 16
14	Disable Advertise	Should not scan the ALX41X.
15	Enable Advertise	Should scan the ALX41X

After changing the configurations, the master will find the module. You can follow the 2.2.1 part

to establish communication.

3 Recommended Reflow Profile

Referred to IPC/JEDEC Standard
Peak Temperature < 250 °C
Number of Times <= 2Times

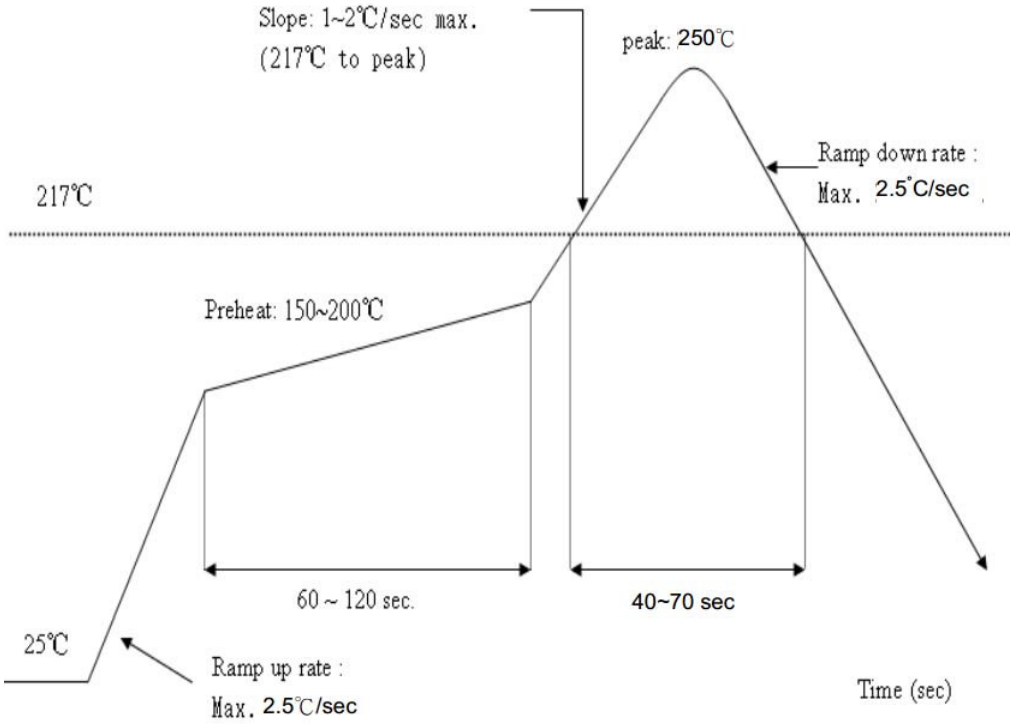

Figure 16 Recommended Reflow Profile

4 Appendix C: Acronyms and Abbreviations

The following list of acronyms and abbreviations may appear in this document.

-ACM	Alinket Controller Message
-ADC	Analog-to-Digital Converter
-ARM	Advanced RISC Machines
-ART	Adaptive Real-Time Memory

-DTU	Data Transfer Unit
-EVK	Evaluation Kit
-GFSK	Gauss frequency Shift Keying
-GPIO	General-Purpose Input-Output
-IP	Internet Protocol
-IC	Integrated Circuit
-IoT	Internet Of Things
-JTAG	Joint Test Action Group
-LC	Link Control
-LDO	Low Dropout Regulator
-LO	Local Oscillator
-LQFP	Low-profile Quad Flat Package
-MAC	Medium Access Control
-MSL	Moisture Sensitivity Level
-PWM	Pulse Width Modulation
-PER	Packet Error Rate
-RC	Real Clock
-RF	Radio Frequency
-RoHS	Restriction of Hazardous Substances
-RSSI	Receiver Signal Strength Indicator
-SoC	System-on-Chip
-SPI	Serial Peripheral Interface
-SSID	Service Set Identifier
-UART	universal asynchronous receiver/transmitter

5 Appendix D: Reference

[1] ALX41X IoT Wi-Fi Network Controller Family Data Sheet, Alinket

[2] AN_ALX41X_DS, Alinket

[3] AN_ALX41X_Firmware Download, Alinket

[4] AN_ACM _User Manual, Alinket

6 Technical Support Contact

For technical support, please contact:

Alinket Electronic Technology (Shanghai) Co., Ltd.

E-Mail: support@alinket.com

Tel: +86 21 61048128;

Address: Floor 4, No.10, Lane 198, Zhangheng Road, Shanghai, 201204 P. R. China

FCC Warning
Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. 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.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator& your body.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Note: 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 or 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.

FCC Label Instructions

The outside of final products that contains this module device must display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID: 2AELJ-ALX41X” or “Contains FCC ID: 2AELJ-ALX41X” Any similar wording that expresses the same meaning may be used.

To satisfy FCC RF Exposure requirements for mobile and base station transmission devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.