E103-W10 User Manual

ESP8285 Serial transfer WiFi module



Chengdu Ebyte Electronic Technology Co.,Ltd.

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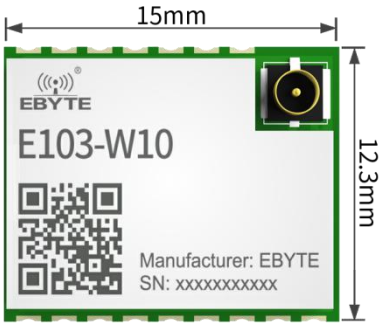
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1 Introduction

1.1 Brief Introduction



E103-W10 is an ultra-cost-effective 100mW serial-to-Wi-Fi module with a small package of patches that work in the 2.4 to 2.4835GHz band. The module can use serial port for data sending and receiving, reducing the threshold for wireless applications.

E103-W10 is a chip development based on Esppressif's ESP8285N08 chip developed by Chengdu Yiyot Electronics Technology Co., Ltd. The module integrates the transmission function, that is, take-it-and-use, supports basic AT instructions, WiFi function instructions, TCP/IP instructions, MQTT instructions, HTTP instructions AT instruction set, users can use the network access function through serial port, widely used in wearable devices, home automation, home security, personal health care, smart appliances, accessories and remote control, automotive, lighting, industrial Internet and other fields.

E103-W10 supports the standard IEEE 802.11b/g/n protocol, which is easily configured to enable network access and minimize developer work and project development time.

1.2 Features

- In ideal conditions, the communication distance is 250m;
- Maximum transmit power : 100mW;
- Supports ISM 2.4GHz band;
- Support Wi-Fi instructions, TCP/IP instructions and other instruction sets;
- The AT instruction allows the module to enter WeChat AirKiss configuration mode;
- Supports 2.7 to 3.6V power supply, ＞3.3V power supply can guarantee the best performance;
- Industrial-grade standard design, supports long-term use at -40 to -85 degrees C;
- Supports the IPEX interface.

1.3 Application

- Smart home and industrial sensors, etc.;
- Security system, positioning system;
- Wireless remote control, drones;
- Wireless game remote control;
- Health care products;
- Wireless voice, wireless headphones;
- Automotive applications.

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2 Specification and parameter

2.1 Limit parameter

Main parameter	Performance		Remark
	Min	Max	
Power supply（V）	0	3.6	Voltage over 3.6V will cause permanent damage to module
Blocking power（dBm）	-	10	Chances of burn is slim when modules are used in short distance
Operating temperature（℃）	-40	+85	Industrial grade

2.2 Operating parameter

Main parameter	Performance			Remark
	Min	Type	Max	
Operating voltage（V）	2.7	3.3	3.6	≥3.6 V ensures output power
Communication level（V）	-	3.3	-	-
Operating temperature（℃）	-40	-	+85	Industrial grade
Operating frequency（MHz）	2400	2430	2483.5	Support ISM band
Max TX power（dBm）	19	19.5	20	-
Wifi version		802.11		
Tx802.11 b,CCK 11Mbps,POUT=+19 dBm（mA）		197		Power consumption tested conditions: 1.Supply voltage: 3.3 V, 2.Ambient temperature: 25℃ 3.TX power consumption： Measured based on a 50% send-to-air ratio.
Tx802.11 g,OFDM 54Mbps,POUT=+15 dBm（mA）		147		
Tx802.11 n,MCS7,POUT=+13 dBm（mA）		142		
Rx802.11 b, 1024 bytes，-80 dBm（mA）		73		
Rx 802.11 g, 1024 bytes，-70 dBm（mA）		72		
Rx 802.11 n，1024 bytes，–65dBm（mA）		72		
Modem-sleep ①（mA）		15		
Light-sleep ②（mA）		0.9		
Deep-sleep ③（uA）		20		
Off（uA）		0.5		

Description:

A: Modem-sleep mode is used in scenarios that require the CPU to work all the time, such as PWM or I2S. When Wi-Fi connecting, if there is no data transmission, according to the 802.11 standard (such as U-APSD), turn off the Wi-Fi Modem circuit to save power. For example, in DTIM3, keep the sleep interval of 300 ms, and wake up 3 ms each time to

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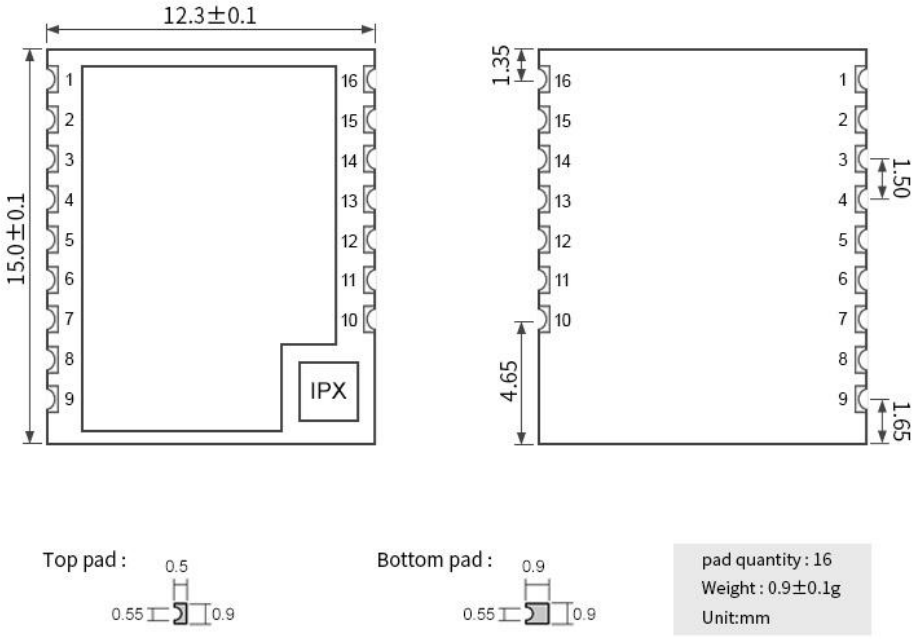
receive the Beacon packet of the AP, the current is about 15 mA.

B. Light-sleep mode is used for applications where the CPU can be suspended, such as a Wi-Fi switch. While maintaining the Wi-Fi connection, if there is no data transmission, according to the 802.11 standard (U-APSD), turn off the Wi-Fi Modem and suspend the CPU to save power. For example, in DTIM3, keep the sleep interval for 300 ms, and wake up 3 ms each time to receive the Beacon packet of the AP, the current is about 0.9 mA.

C. Deep-sleep mode is used in scenarios that require Wi-Fi connection. For applications that a data packet is sent for a long time (e.g. measure the temperature every 100 s). It takes 0.3 ~ 1 s to connect to the AP after waking up every 300 s, and the overall average current is less than 1 mA. The flow of 20 μA is obtained at 2.5 V.

Main parameter	Description	Remark
Reference distance	250m	Test condition：clear and open area, antenna gain: 5dBi，antenna height: 2.5m
Crystal frequency	26MHz	-
Encapsulate	S	-
Interface	1.5mm	-
Communication Interface	UART	-
Outter size	15*12.3mm	-
RF interface	IPEX	Equivalent impedance : 50Ω
Weight	0.9g	-

3 Size and pin definition

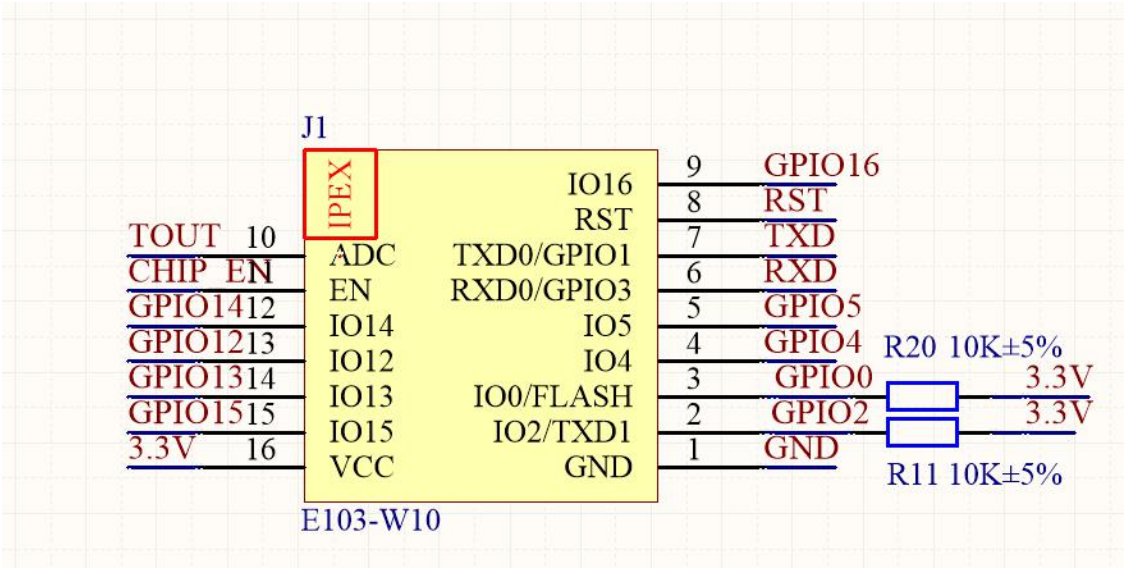


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Pin No.	Item	Direction	Description
1	GND	-	GND
2	IO2	Input/Output	GPIO2; Can be used as UART1_TX when flashing
3	IO0	Input/Output	GPIO0;SPI_CS2;
4	IO4	Input/Output	GPIO4
5	IO5	Input/Output	GPIO5
6	RXD0	Input/Output	GPIO3;Can be used as UART1_TX when flashing
7	TXD0	Input/Output	GPIO1; SPI_CS1;Can be used as UART1_TX when flashing
8	RST	Input	External reset signal (low level valid), reset module; The pull-up resistor is connected to the inside of the module
9	IO16	Input/Output	GPIO16; Deep sleep wake-up
10	ADC	Input	TOUT;ADC port (Note: ADC port port inside the chip) can be used to detect the input in voltage of the VDD3P3 (Pin3, Pin4) supply voltage and the TOUT (Pin6) (both of which cannot be used at the same time)
11	EN	Input	Chip enables end, high level: effective, chip works properly; Low level: Chip closed , small current., and the pull-up resistor is connected inside the module
12	IO14	Input/Output	GPIO14; HSPI_CLK
13	IO12	Input/Output	GPIO12;HSPI_MISO
14	IO13	Input/Output	GPIO13; HSPI_MOSI; UART0_CTS
15	IO15	Input/Output	GPIO15; HSPI_CS；UART0_RTS； Resistance is connected to ground in the inside of the module
16	VCC	-	Module power：2.7~3.3V

4 Recommended wire diagram



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Note:

(1)Module supply DC voltage : 3.3V;

(2) Wi-Fi module maximum output current : 12mA;

(3) Wi-Fi module NRST pin low level is effective; EN enable pin high level is effective;

(4) Wi-Fi startup mode:

GPIO15，GPIO0,GPIO2 Level	Boot mode
[0,1,1]	Normal working mode
[0,0,1]	Flashing mode

(5) The RXD0 of the Wi-Fi module is connected to the TXD of the external MCU, and the TXD0 of the Wi-Fi module is connected to the RXD of the external MCU.

5 Operating guidance

5.1 As TCP Client, single connection

1. Setting Wi-Fi mode

Command

AT+CWMODE=3 // SoftAP+Station mode

Response: OK

For example:



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2. Connecting the router

Command

AT+CWJAP="SSID","password" //SSID: Router name

// password：Key of the router

Response: OK

Example: (router name E880-IR01, password JSZXE880)



3. Checking local IP address

AT+CIFSR

Example：

+CIFSR:APIP,"192.168.4.1" //Router IP address

+CIFSR:APMAC,"c6:4f:33:d6:4a:fc"

+CIFSR:STAIP,"192.168.1.124" //E103-W10 IP address from the router

+CIFSR:STAMAC,"c4:4f:33:d6:4a:fc"

Example:



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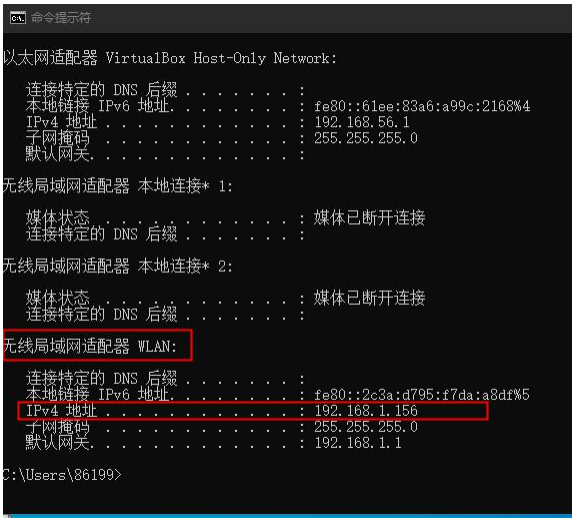
4. The PC uses a wireless connection to the router .



5. The PC views the IP address of the "WLAN adapter Wi-Fi". Using it later when creating the server.
   Open “command prompt ”， and writing ipconfig.



   Checking IP address:



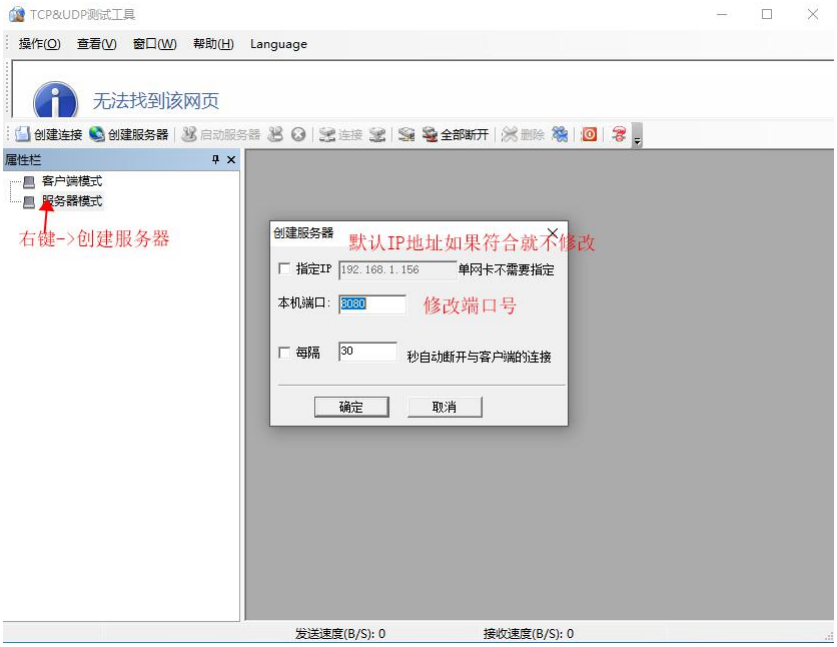
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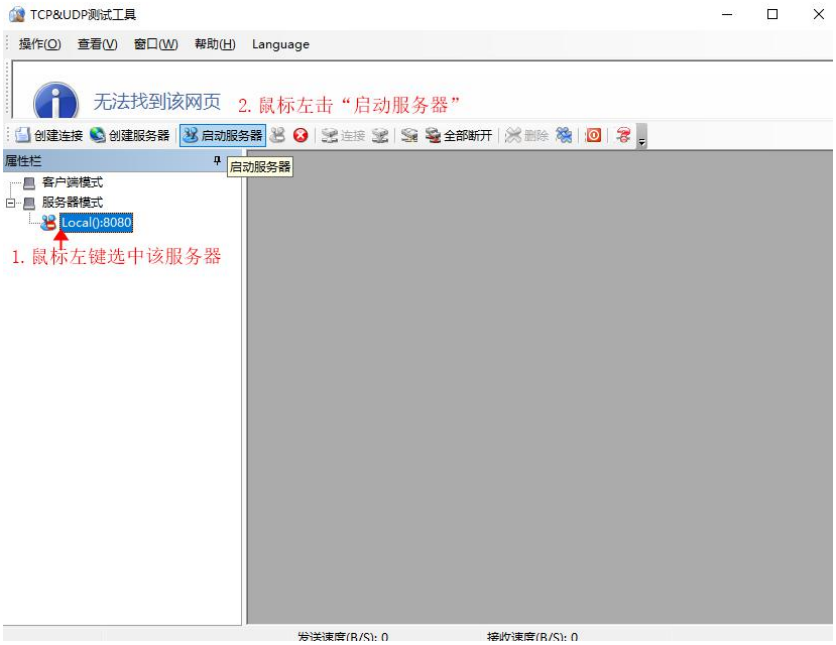
6. Open the network debug assistant on the PC and create the server.

Using the "TCP-UDP Test Tool" to do the test.

Create a server with an IP address of 192.168.1.156 and a port of 8080.



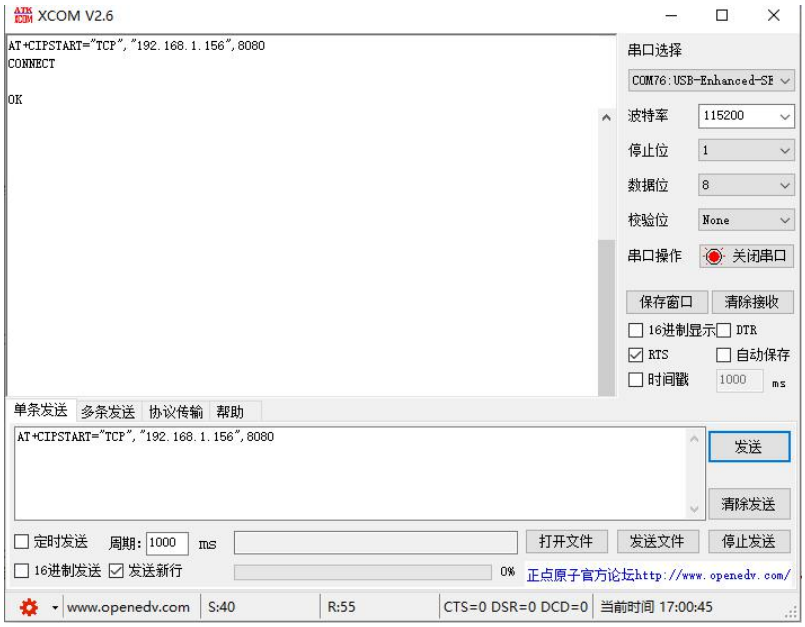
Starting the server



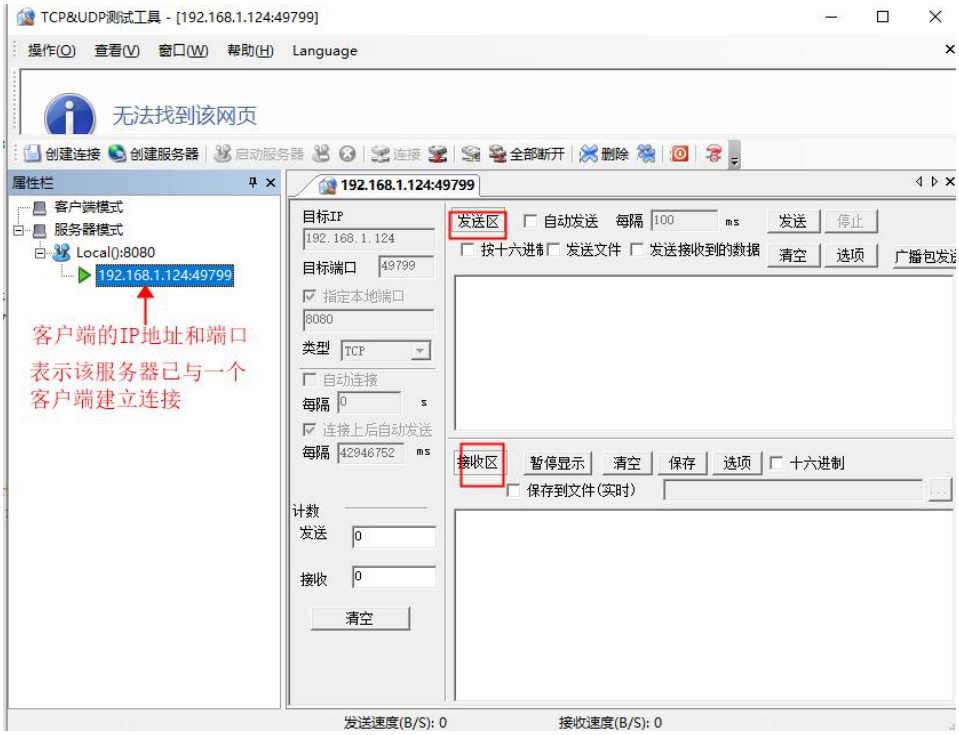
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7. E103-W10 connects to PC server as TCP client.



At the same time, the PC-side "TCP-UDP Test Tool" displays the connection window:



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8. Transmit data

AT+CIPSEND=4 // Setting to the data which is about to be sent, such as 4 bytes

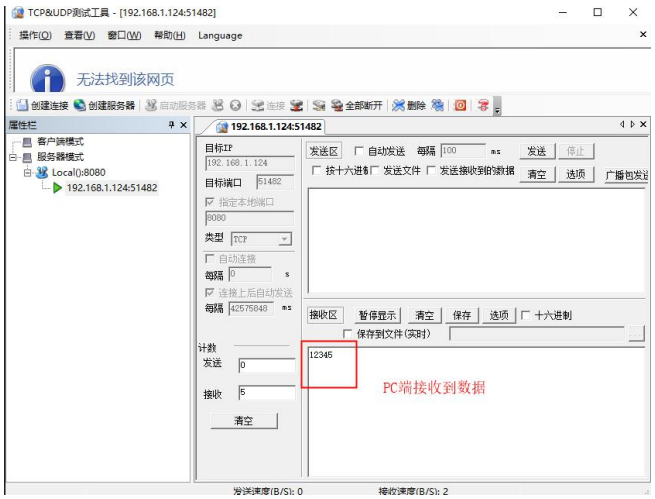
> // Wait for serial data, no return line change, no need to check "Send new line"

Response:

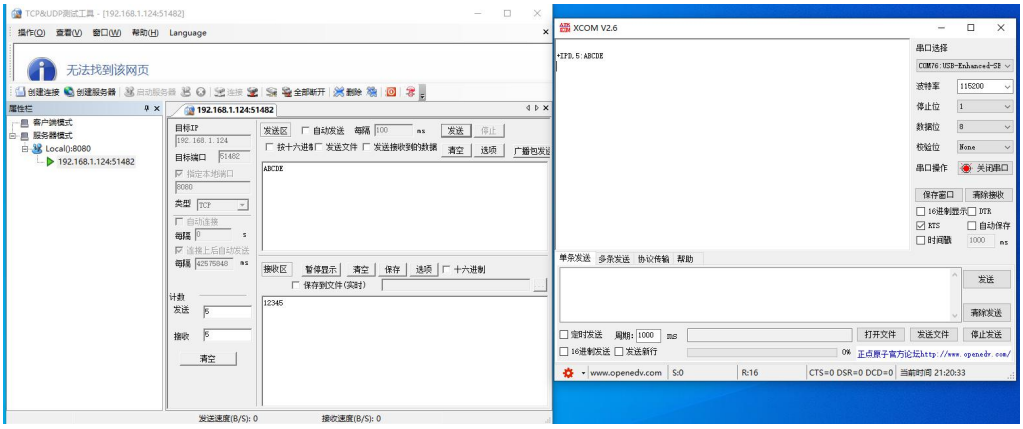
Recv 5 bytes //Length of the data received by the serial

SEND OK //Successfully





9. Data received



5.2 As TCP server, single connection

1. Setting Wi-Fi mode

Command

AT+CWMODE=3 // Soft AP+Station mode

Response: OK

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2. Multiple connections:

AT+CIPMUX=1

Response: OK

3. Configuration ESP Soft AP

AT+CWSAP=”E103-W10 _SOFTAP”,”12345678”,5,3

Response: OK

4. Checking local softAP addres, example in the following picture is 192.168.4.1



5. Creating TCP server

AT+CIPSERVER=1 // Default port：333

Response: OK

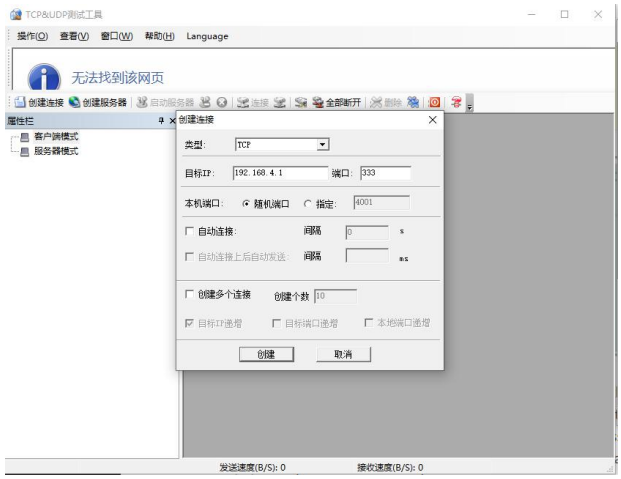
6. PC connected to E103-W10 SoftAP



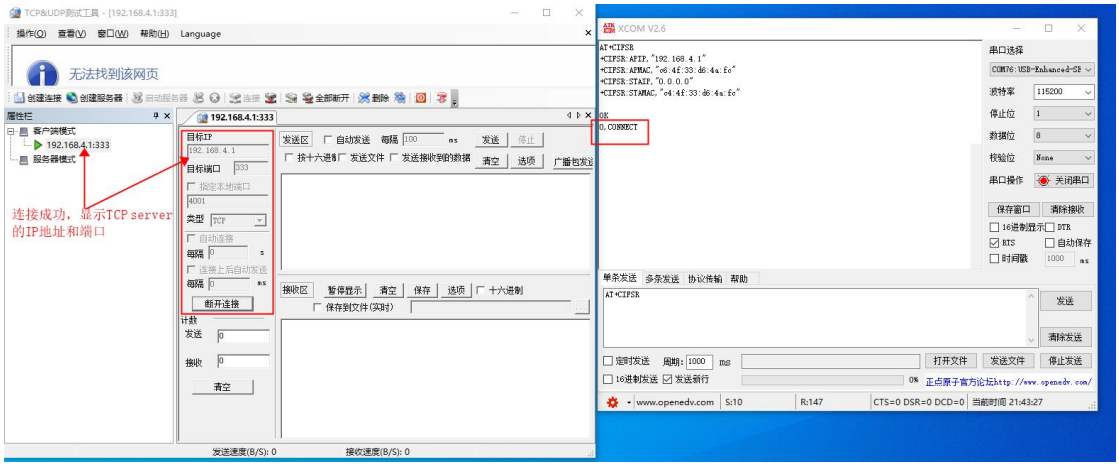
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7. Open the "TCP-UDP Test Tool" to create TCP Client and connect to the TCP server created by E103-W10



Click connection, the following picture shows connect successfully



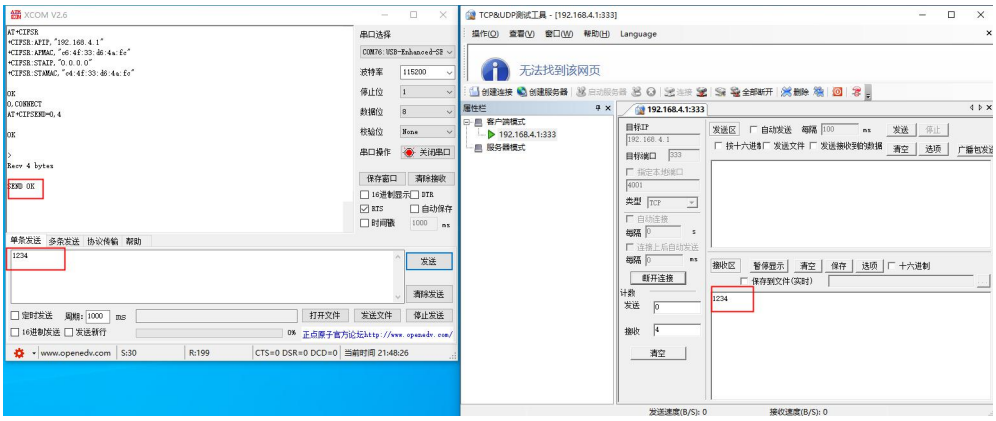
8. Data transmission

//The first connection ID defaults to 0

AT-CIPSEND-0,4 // Sends 4 bytes of data to a connection with an ID of 0

> // Wait for input data without entering a new line

Response: Send OK

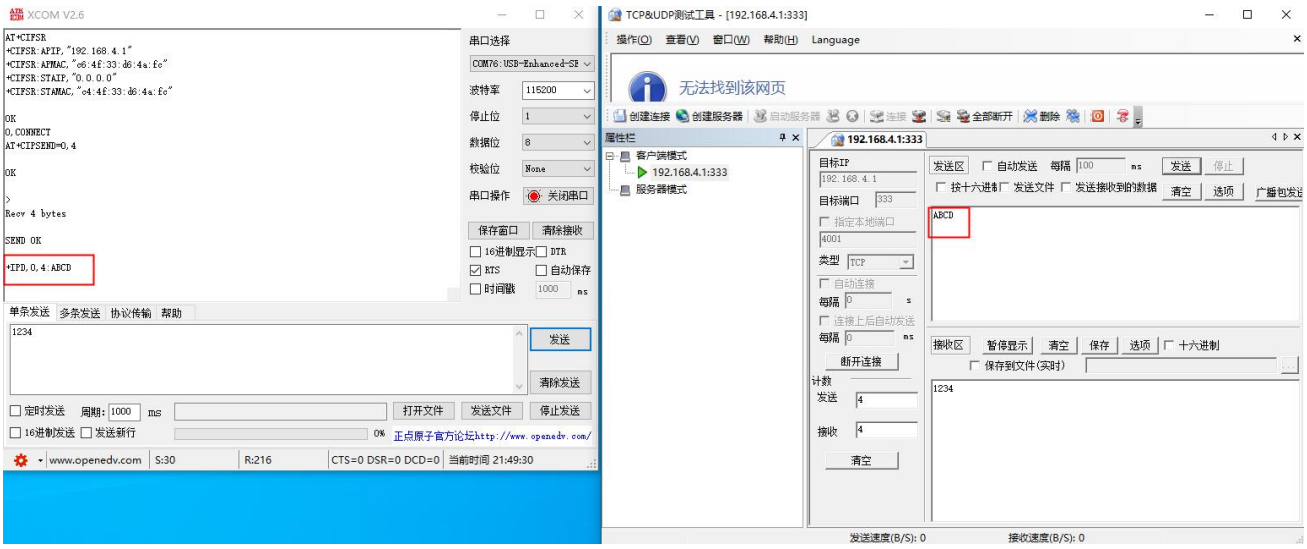


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Data receiving

+IPD,0,n:xxxxxxxxxx //receiving n bytes, contents：xxxxxxxxxx



9. Close TCP connection

AT+CIPCLOSE=0

Response:

0, Close

OK

```
AT+CIPCLOSE=0
0,CLOSED

OK
```

6 Network description

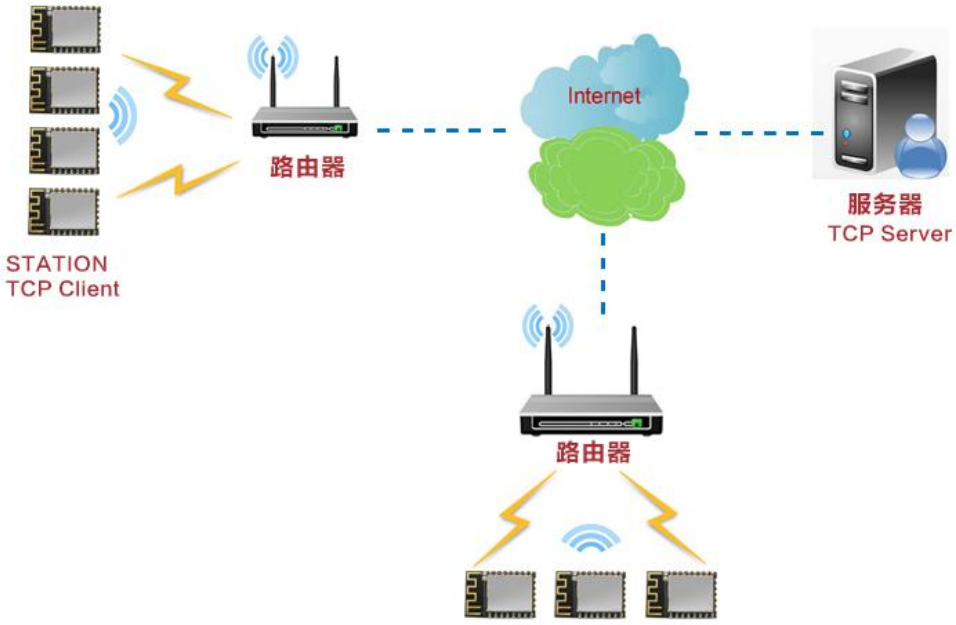
6.1 Network roles

No.	Note
1	E103-W10 module supports AP mode (equivalent to router), STATION mode (equivalent to Wi-Fi device), STATION-AP mode, and up to 10 Wi-Fi devices at the same time in AP mode.
2	E103-W10 supports three Socket roles: TCP Server, TCP Client, and UDP. Up to 5 Socket connections are supported simultaneously in TCP Server mode. TCP-based connectivity mechanisms, if you need to be connected for a long time, be aware that you should use the TCP heartbeat pack.

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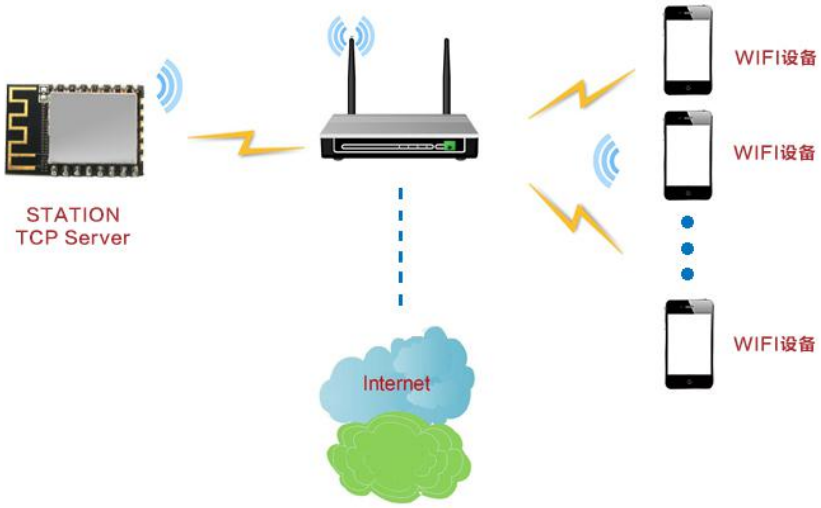
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6.2 Network modes

Module establishes TCP Client connection communication with remote server in STATION mode (typical application)
The network model can meet the home Internet of Things, smart meter reading, real-time monitoring and other applications, modules can be real-time data exchange with the network server. The user interacts with the network server to perform various operations on the module side in real time.

The module establishes TCP Server connection communication with Wi-Fi devices in STATE mode
The networking model is similar to the first one, with the difference that the module is built in STATE mode with TCP Server instead of TCP Client. This mode can support up to 5 remote device connections under networked conditions.

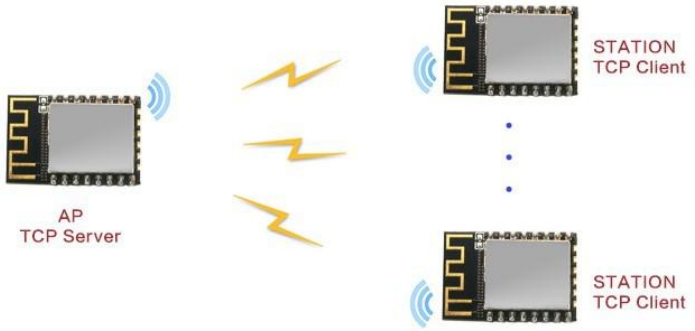
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Module establishes TCP Server in AP mode, and the other modules establish TCP Client in STATION mode to communicate with each other

The network model can be referred to simply as an intra-module network, an AP mode module can connect up to 10 RATIONAL, that is, in the network has a maximum of 9 module devices. TCP Server can be built on any module under complete intranet completion, and the remaining 10 modules can communicate with TCP Client (but no more than 5 clients can access TCP Server at the same time).



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7 AT command

Please refer to E103-W10 user manual: https://www.ebyte.com/en/downpdf.aspx?id=1375

8 FQA

8.1 The transmission distance is not ideal

- When there is a straight-line communication barrier, the communication distance will be attenuated accordingly;
- Temperature, humidity, same frequency interference, will lead to increased loss rate of communication;
- Ground absorption, reflection of radio waves, close to the ground test results are poor;
- The sea water has a strong ability to absorb radio waves, so the seaside test effect is poor;
- There is a metal object near the antenna, or placed in a metal shell, the signal attenuation will be very serious;
- The power register is set incorrectly and the air rate is set too high (the higher the air rate, the closer the distance);
- The low voltage of the power supply at room temperature is lower than the recommended value, and the lower the voltage, the lower the power;
- Use the antenna to match the module poorly or the quality of the antenna itself is a problem.

8.2 Module is easy to be damaged

- Please check the power supply to ensure that between the recommended supply voltage, if the maximum value is exceeded, the module will be permanently damaged;
- Please check the stability of the power supply, the voltage can not fluctuate significantly and frequently;
- Make sure that the installation process anti-static operation, high-frequency device static sensitivity;
- Make sure that the humidity of the installation process should not be too high, some components are humidity sensitive devices;
- If there are no special needs, it is not recommended to use at high or low temperatures.

8.3 BER(Bit Error Rate) is high

- There is the same frequency signal interference nearby, away from the source of interference or modify the frequency, channel to avoid interference;
- The clock waveform on the SPI is not standard, check whether there is interference on the SPI line, the SPI bus line should not be too long;
- The power supply is not ideal may also cause garbled code, it is necessary to ensure the reliability of the power supply;
- Extension cords, feeders of poor quality or too long, will also result in a high error rate.

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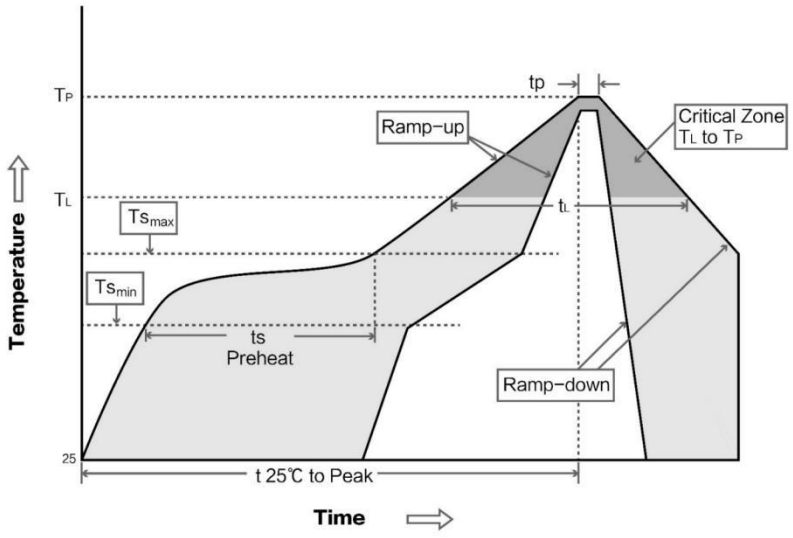
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9 Production guidance

9.1 Reflow soldering temperature

Profile Feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	100℃	150℃
Preheat temperature max (Tsmax)	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	3℃/second max	3℃/second max
Liquidous Temperature (TL)	183℃	217℃
Time（tL）Maintained Above（TL）	60-90 sec	30-90 sec
Peak temperature（Tp）	220-235℃	230-250℃
Aveage ramp-down rate（Tp to Tsmax）	6℃/second max	6℃/second max
Time 25℃ to peak temperature	6 minutes max	8 minutes max

9.2 Reflow soldering curve



10 Related module

Model No.	Core IC	Frequency (Hz)	Tx power(dBm)	Distance(km)	Size(mm)	Package	Interface
E103-W01	ESP8266EX	2.4G	20	0.1	16*24	SMA	TTL

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11 Antenna recommendation

The antenna is an important role in the communication process. A good antenna can largely improve the communication system. Therefore, we recommend some antennas for wireless modules with excellent performance and reasonable price.

Model No.	Type	Frequency Hz	Interface	Gain dBi	Height mm	Cable cm	Function feature
TX2400-NP-5010	Flexible antenna	2.4G	2.0	10x50	-	IPEX	Flexible FPC soft antenna
TX2400-JZ-3	Rubber antenna	2.4G	2.0	30	-	SMA-J	Short straight &omnidirectional
TX2400-JZ-5	Rubber antenna	2.4G	2.0	50	-	SMA-J	Short straight &omnidirectional
TX2400-JW-5	Rubber antenna	2.4G	2.0	50	-	SMA-J	Fixed bend &omnidirectional
TX2400-JK-11	Rubber antenna	2.4G	2.5	110	-	SMA-J	Flexible &omnidirectional
TX2400-JK-20	Rubber antenna	2.4G	3.0	200	-	SMA-J	Flexible &omnidirectional
TX2400-XPL-150	Sucker antenna	2.4G	3.5	150	150	SMA-J	Small Sucker antenna&cost-effective

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Version	Date	Description	Issued by
1.0	2020-12-22	Initial version	huaa
1.1	2021-01-12	Content adjusted	Ren

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