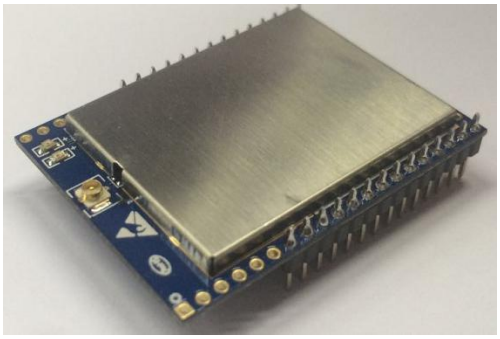
# Shenzhen HI-Link Electronic Co.,Ltd

# HLK-B32 User Manual



# Content

# 1. Product Profile

## 1.1 Overview

HLK-B32 is a new low-cost embedded UART-WIFI module (serial-Wireless network) developed by Shenzhen Hi-Link co., Ltd.

This product is an embedded module based on the serial interface in line with the network standard , built-in TCP/IP protocol stack, can realize the user serial port-wireless network (WIFI) conversion.

Through the HLK-B32 module, the traditional serial device can transmit its own data through the Internet network without changing any configuration, which provides a complete and fast solution for the user's serial port device to transmit the data through the network.

## 1.2 Product Characteristics

- Compatible 2.4G 802.11 b/g/n; 5G 802.11 a
- Dedicated high-performance 32-bit RISC CPU
- Support for 20 MHz and 40MHz bandwidth in the 2.4 GHz band
- Single frequency 1T1R mode, data rate up to 150Mbps
- Support for 2.4g/ 5 GHz band, dual frequency 1T1R
- Support two working modes of STA/AP
- Built-in TCP/IP protocol stack
- Support various AT instructions
- Support one-click configuration of intelligent networking features
- Support wireless upgrade (OTA)
- 5V single power supply, low power consumption
- More GPIO pins
- Fast transmission speed of serial port

## 1.3 Product Packaging

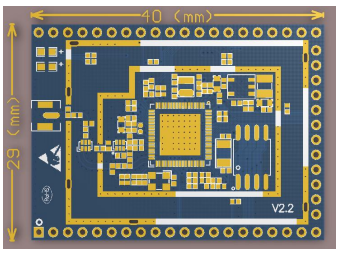



Figure 1. HLK-B32encapsulation size

## 1.4 Technical Specifications

Table 1 Product Technical specifications

| | | |
|---|---|---|
| **Module** | **Model** | HLK-B32 |
| | **Package** | Plug-in |
| **Wireless parameter** | **Wireless standard** | 2.4G 802.11 b/g/n; 5G 802.11 a |
| | **Frequency range** | 2.4G wifi: 2412MHz-2462MHz;<br>5G Wi-Fi: 5150-5250MHz; 5250-5350MHz; 5470-5725MHz; 5725-5850MHz |
| | **Transmitting power** | 802.11b: 15.85dBm (@1Mbps) |
| | | 802.11g: 16.85dBm (@6Mbps) |
| | | 802.11n20: 13.69dBm; 802.11n40: 12.16dBm |
| | | 802.11a: 5150-5250MHz: 11.78dBm;5250-5350MHz: 14.28dBm;<br>5470-5725MHz: 15.35dBm;5725-5850MHz: 11.74dBm; |
| | **Receiving sensitivity** | 802.11b: -88.4 dBm (@11Mbps ,CCK) |
| | | 802.11g: -75.7dBm (@54Mbps, OFDM) |
| | | 802.11n: -73.6dBm (@HT20, MCS7) |
| | | 802.11a: -75.0 dBm (@MCS7) |
| | **Antenna form** | External: Dipole Antenna |
| | | Built-in: no built-in antenna |
| **Hardware parameters** | **Hardware interface** | UART, IIC, PWM, GPIO, SPI |
| | **Working voltage** | 5V |
| | **GPIO drive capability** | Max:16ma |
| | **Working current** | Continuous send=><br>Average value: ~100mA, peak value:120mA<br>In normal mode =><br>Average: ~100mA, Peak: 110mA |
| | **Working temperature** | -40℃~80℃ |
| | **Storage environment** | Temperature: <40℃, The relative humidity: <90% R.H. |
| **Serial transmission** | **Transmission speed** | 110-921600bps |
| | **TCP Client** | 2 |
| **Software parameters** | **Wireless network type** | STA |
| | **Security mechanism** | WEP/WPA-PSK/WPA2-PSK |
| | **Encryption type** | WEP64/WEP128/TKIP/AES |
| | **Firmware upgrade** | Wireless, uart |
| | **networking protocol** | IPv4, TCP/UDP |
| | **User configuration** | AT+instruction, smart config |

## 1.5 Pins Introduction

Table 2 Module pin interface

| Pin | Network Name | Type | Description |
|---|---|---|---|
| 1 | NC | | NC |
| 2 | NC | | NC |
| 3 | NC | | NC |
| 4 | NC | | NC |
| 5 | NC | | NC |
| 6 | NC | | NC |
| 7 | NC | | NC |
| 8 | GND | Ground | GND |
| 9 | NC | | NC |
| 10 | 3V3 | P | External power supply pin: 3.3V@ 200mA |
| 11 | NC | | NC |
| 12 | NC | | NC |
| 13 | NC | | NC |
| 14 | NC | | NC |
| 15 | NC | | NC |
| 16 | GPIO0 | I/O | ES0 pin, pull down 1 second, serial 0 into AT command mode; Pull down ≥ 8 seconds, restore factory default parameter settings |
| 17 | NC | | NC |
| 18 | NC | | NC |
| 19 | NC | | NC |
| 20 | NC | | NC |
| 21 | NC | | NC |
| 22 | NC | | NC |
| 23 | NC | | NC |
| 24 | NC | | NC |
| 25 | NC | | NC |
| 26 | NC | | NC |
| 27 | NC | | NC |
| 28 | NC | | NC |
| 29 | NC | | NC |
| 30 | NC | | NC |
| 31 | NC | | NC |

| | | | |
|---|---|---|---|
| 32 | NC | | NC |
| 33 | NC | | NC |
| 34 | NC | | NC |
| 35 | GPIO59 | | SOCKET connection status indication |
| 36 | GPIO58 | | WIFI connection status indication |
| 37 | NC | | NC |
| 38 | UART_RXD0 | | Serial port 0 input for transparent transmission and at command setting |
| 39 | UART_TXD0 | | Serial port 0 output, used for transparent transmission and at command setting, need to be pulled low or left hanging |
| 40 | UART_RXD1 | | Serial port 1 input |
| 41 | NC | | NC |
| 42 | SYS_RST_N | I | RST pin, module reset, active low, reset time ≥ 500ms |
| 43 | NC | | NC |
| 44 | UART_TXD1 | | Serial port 1 output |
| 45 | NC | | NC |
| 46 | VDD_5V | P | 5V input |
| 47 | NC | | NC |
| 48 | NC | | NC |
| 49 | GPIO33 | | Wifi indicator |
| 50 | GND | Ground | Ground |
| 51 | NC | | NC |
| 52 | NC | | NC |

# 2. Functional Description

## 2.1 WiFi Indicator Flashing Description

The module is flashed by the LED indicator in different modes, so that the module running status can be quickly and easily known. The WiFi indicator of the module mainly has the following status:

(1) The wifi indicator flashes twice periodically: indicates that the module is in the one-click distribution mode.

(2) The wifi indicator flashes thirdly periodically: indicates that the module is in the sta

mode and the target ap hotspot is not connected.

(3) The wifi indicator flashes fourthly periodically: indicates that the module is in 2.4g ap mode, but it does not indicate whether there is a sta client device connected.

(4) The wifi indicator flashes periodically: indicates that the module is in the 5.8g ap mode, but it does not indicate whether there is a sta client device connected.

(5) The wifi indicator flashes quickly: indicates that the module is in the sta mode and is connected to the wifi hotspot. When there is data transmission, the module LED will flash quickly.

## 2.2 Wifi Connection Status Indicator Pin

GPIO58 pin is used as the indicator pin of the module's wifi connection status in sta mode. When the module's wifi is connected to the router, GPIO58 will output a high level, otherwise will output low level, and other modes will output low level.

## 2.3 Socket Connection Status Indicator Pin

The GPIO59 pin is used as the indicator pin of the module socket's connection status. When the socket connection is successful, the GPIO outputs a high level, otherwise outputs low level.

## 2.4 One-click Distribution Mode

For the IOT wifi module, based on cost and performance considerations, there is no touch screen interactive interface like a mobile phone. Users can see the ap list on the mobile phone and click the password to connect to the network. What should I do? One-click configuration is the wifi module in promiscuous mode (can capture all 802.11 frames in the air), APP sends the SSID and password to the wifi module through UDP broadcast or multicast through certain encoding rules, the module parses out, and then connects to the router.

Install the Android app HLK-TCPdemo, then select Configure Networking, select the elian mode, then select V5, input the password, click to open the configuration and start the configuration. When the distribution network is successful, the module will change from double flash to quick flash, indicating network successful connected.

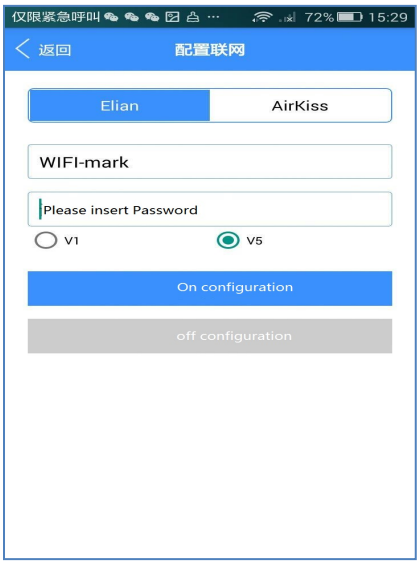



Figure 2. One-click distribution network

## 2.5 Web Distribution Function

When the module is in ap mode, input 192.168.16.254 in the browser, and then input the account and password admin, later enter the web page setting interface. (Default factory firmware is not supported)


Figure 3. Module web page setting interface

When the module is in the sta mode, input the module's ip in the browser to access to the

module's web page setup function.

## 2.6 Serial to WIFI STA

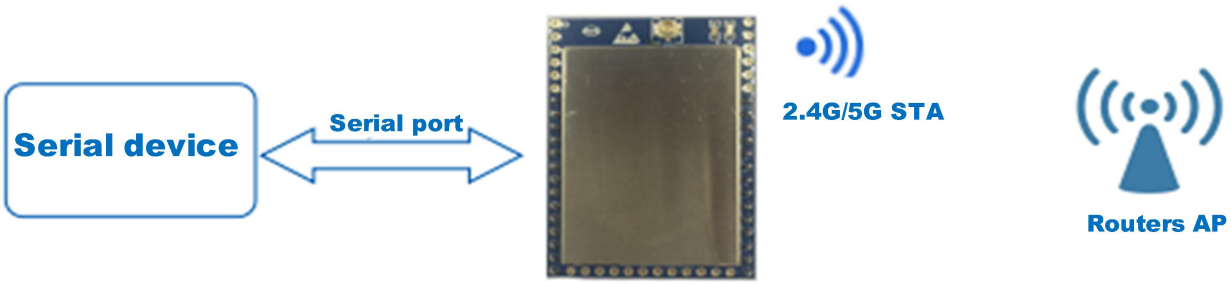



Figure 4. Module as STA

The module converts the serial port data into wifi data to achieve the purpose of networking.

## 2.7 Serial Port Working State Conversion

After the HLK-B32 is powered on, the default mode is transmission mode. By pulling down the pin ES0 (GPIO0) to enter at instruction mode longer than 50ms, the module will process the received data as at instructions, send at instructions to let the module into transparent mode, After the network connection, the data received by the serial port will be transmitted as transparent data.

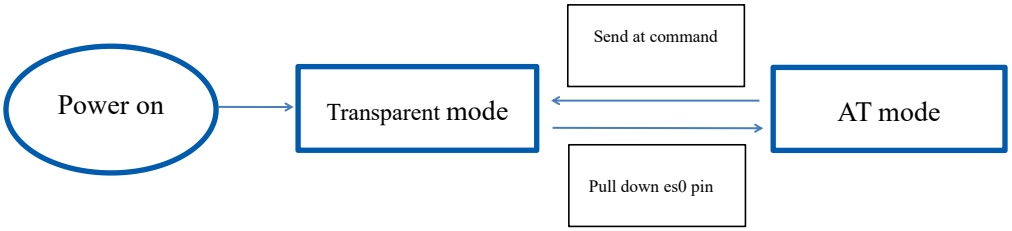



Figure 6. Serial port mode conversion

## 2.8 Serial Port-network Data Conversion

### 2.8.1 Module as TCP Server

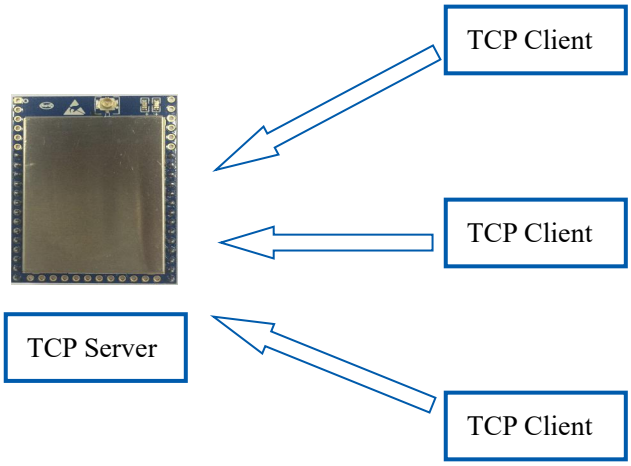



Figure 7. TCP Server

In this mode, the module listens to the specified port, waits for TCP Client connection, and after the connection, all TCP data is directly sent to the serial port end, and the data of the serial port end is sent to all TCP Client ends. When the module is used as the TCP server, the most supporting two TCP clients are connected to the TCP server.

### 2.8.2 Module as TCP Client

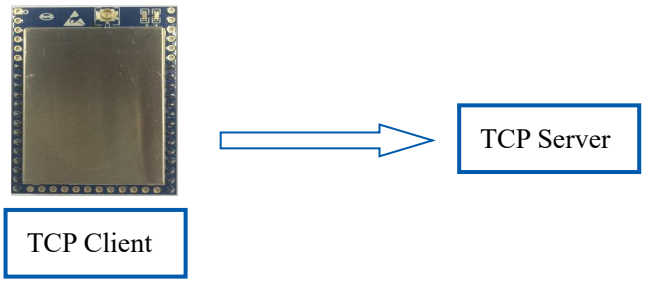



Figure 10. TCP Client

In this mode, the module will actively connect to the specified IP, port, all the data sent from the TCP Server end is sent directly to the serial port, and the data from the serial port to the TCP Server side. Abnormal network disconnection can result in active re-connection of the module.

### 2.8.3 Module as UDP Server

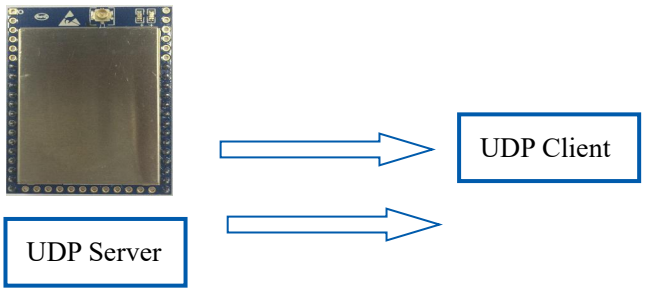



Figure 11. UDP Server

In this mode, the module opens the local designated port, once it receives the data sent to the port, the module sends the data to the serial port and records the remote ip, port. The module only records the remote information on the last connection, and the data sent by the serial port is sent directly to the recorded remote ip, port.

### 2.8.4 Module as UDP Client

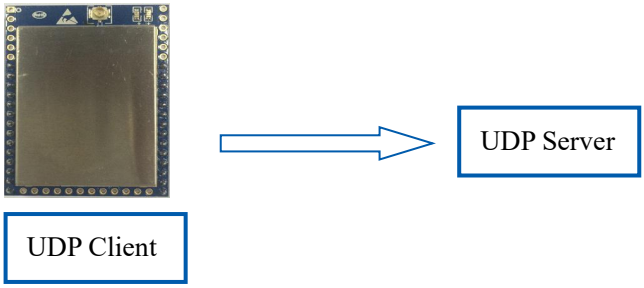



Figure 12. UDP Client

In this mode, the module sends the serial port data directly to the specified ip, port, and the data returned from the server will be sent to the serial port.

## 2.9 Application Areas

- Smart home;
- Instruments and instruments;
- Wi-Fi remote monitoring / control;
- Toy field;
- Color LED control;
- Fire protection, security intelligent integrated management;
- Smart card terminals, wireless POS machines, handheld devices and so on.

# 3. AT Instructions

**The AT command mode is displayed**

**ES/RST pin:**

In any state, keeping GPIO0 pin (pin 16) low for a time greater than Tes(50ms) and less than Trst(3s) will immediately enter the AT command mode.

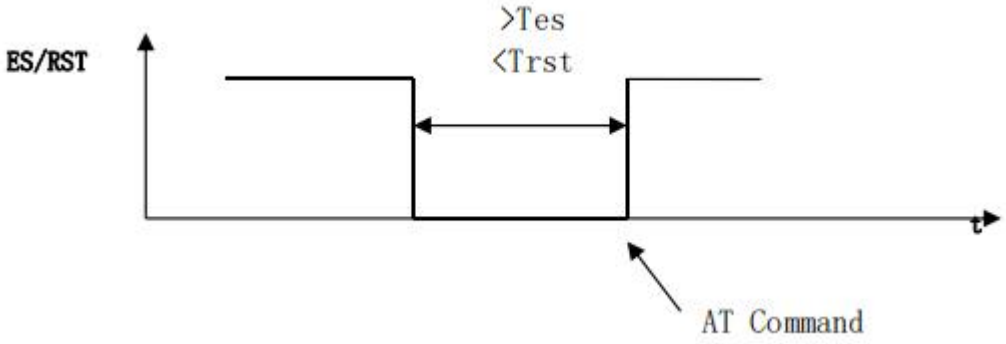



Figure 13. ES/RST Exits transparent transmission mode

Instruction format: in AT instruction mode, the system can be configured through the AT instructions of the serial port. The command format is as follows:

at+[command]=[value],[value],[value].....

All commands begin with "at" and "\ r" end. If the command is not encapsulated in this format, it will not be processed and will return a different return value depending on the command module.

For example:“at+ver=?”

Module will return: HLK-B32 (V1.00 (Nov 30 2017)

Query instruction format: at+[command]=?

## 3.1 Query Current Module Version: at+ver

Grammatical rules:

| Command type | Grammar | Return and description |
|---|---|---|
| EO | at+ver=? | at+ver=HLK-B32(V1.00(Nov 30 2017)): current version |

## 3.2 Local Port Operation: at+CLport

| Command type | Grammar | Return and description |
|---|---|---|
| EO | at+CLport=8080 | at+CLport=8080<br>Ok<br>Description: set the local port to port 8080 |
| | at+CLport=? | at+CLport=?<br>8080<br>Description: Query local port |

## 3.3 Set up Serial Port: at+uart

| Command Type | Grammar | Return and description |
|---|---|---|
| EO | at+uart=115200,8,n,1 | at+uart=115200,8,n,1<br>Ok<br>Description: Set up serial Port parameters |
| Query Command | at+uart=? | at+uart=?<br>115200,8,n,1<br>Description：query serial port parameters |

## 3.4 Set up DHCP: at+dhcpc

| Command Type | Grammar | Return and description |
|---|---|---|
| EO | at+dhcpc=1 | at+dhcpc=1<br>ok |
| Query Command | at+dhcpc=? | at+dhcpc=?<br>1<br>Description: 1: dhcp mode, 0: static ip |

## 3.5 Set up Wifi Connection Mode: at+netmode

| Command Type | Grammar | Return and description |
|---|---|---|
| EO | at+netmode=3 | at+netmode=3<br>Ok<br>Description: set the module to ap mode |
| Query Command | at+netmode=? | at+netmode=?<br>3<br>Description: 1: One-click distribution network 2: sta mode, 3: 2.4G ap mode, 4: 5.8G ap mode |

## 3.6 Set up TCP Connection Mode: at+mode

| Command Type | Grammar | Return and description |
|---|---|---|
| EO | at+mode=client | at+mode=client<br>Ok<br>Description: set the module to client mode |
| Query Command | at+mode=? | at+mode=?<br>client<br>Description: client: server: |

## 3.7 Set up Remote IP When Modules Work as Client: at+remoteip

| Command Type | Grammar | Return and description |
|---|---|---|
| EO | at+remoteip=192.168.11.102 | at+remoteip=192.168.11.102<br>ok<br>Description: set the remote ip of the mode |
| Query Command | at+remoteip=? | at+remoteip=?<br>192.168.11.102<br>Description: query remote ip |

## 3.8 Set up Remote Port When Module Act as Client: at+remoteport

| Command Type | Grammar | Return and description |
|---|---|---|
| EO | at+remoteport=1234 | at+remoteport=1234<br>ok<br>Description: set the remote port of the mode |
| Query Command | at+remoteport=? | at+remoteport=?<br>1234<br>Description：query remote port |

## 3.9 Set Parameter Submission: at+net_commit

| Command Type | Grammar | Return and description |
|---|---|---|
| EO | at+net_commit=1 | at+net_commit=1<br>Ok<br>Description: submit setup parameters |

## 3.10 System Restart: at+reconn

| Command Type | Grammar | Return and description |
|---|---|---|
| EO | at+reconn=1 | at+reconn=1<br>Description: Quit at command mode |
| EO | at+net_commit=1<br>at+reconn=1 | at+net_commit=1<br>ok<br>at+reconn=1<br>ok<br>Description: System restart |

## 3.11 Set the Module's ssid and Password: at+wifi_conf

| Command Type | Grammar | Return and description |
|---|---|---|
| EO | at+wifi_conf=HI-LINK_5FE8,none,12345678 | at+wifi_conf=HI-LINK_5FE8,none,12345678<br>ok<br>Description: set the ssid and password of the module |
| Query Command | at+wifi_conf=? | at+wifi_conf=?<br>HI-LINK_5FE8,none,12345678<br>Description: Query the ssid and password of the module |

## 3.12 Set up Socket Connection Protocol: at+remotepro

| Command Type | Grammar | Return and description |
|---|---|---|
| EO | at+remotepro=tcp | at+remotepro=tcp<br>ok<br>Description: set the module socket protocol to tcp |
| Query Command | at+remotepro=? | at+remotepro=?<br>tcp<br>Description: query module socket connection protocol |

## 3.13 Set Network Connection Parameters: at+net_ip

| Command Type | Grammar | Return and description |
|---|---|---|
| EO | at+net_ip=192.168.16.254,255.255.255.0,192.168.16.254 | at+net_ip=192.168.16.254,255.255.255.0,192.168.16.254<br>ok<br>Description: set the ip, gateway, dns of the module |
| Query Command | at+net_ip=? | at+net_ip=?<br>192.168.16.254,255.255.255.0,192.168.16.254<br>Description: query module ip, gateway, dns |

## 3.14 Query Network Connection Status in STA Mode: at+wifi_ConState

| Command Type | Grammar | Return and description |
|---|---|---|
| Query Command | at+wifi_ConState=? | at+wifi_ConState=?<br>Disconnected<br>Description: in sta mode, the module wifi is not connected, and the<br>Connected indicates that the network is connected |

## 3.15 Query Module MAC Address: at+Get_MAC

| Command Type | Grammar | Return and description |
|---|---|---|
| Query Command | at+Get_MAC=?<br>40:D6:3C:15:5F:E8 | at+Get_MAC=?<br>40:D6:3C:15:5F:E8<br>Description: query module mac address |

## 3.16 Set the Frame Length: at + uartpacklen

| Command Type | Grammar | Return and description |
|---|---|---|
| EO | at+uartpacklen=64 | at+uartpacklen=64<br>Ok<br>Description:Set the frame length of the module to 64 bytes |
| Query Command | at+uartpacklen=? | at+uartpacklen=?<br>64<br>Description:The frame length of the query module is 64 bytes |

## 3.17 Set the Frame Time:at+uartpacktimeout

| Command Type | Grammar | Return and description |
|---|---|---|
| EO | at+uartpacktimeout=200 | at+uartpacktimeout=200<br>Ok<br>Description:Set the frame time of the module to 200ms |
| Query Command | at+uartpacktimeout=? | at+uartpacktimeout=?<br>200<br>Description:The frame grouping time of the query module is 200ms |

# 4. Upgrade Introduction

The upgrade of HLK-B32 module can be carried out through serial port or network, and the appropriate upgrade method can be selected according to the field environment.

## 4.1 Introduction of Serial Port Upgrade Method

In the upgrade folder there is a img file, upgrade software mainly read the files inside to upgrade; There are three files in the img folder, where HLK-B32.img and HLK-B32 (b.1.00.1 20180611182552). Img file contents are the same, only file names are different, HLK-B32 (b.1.00.120180611182552). Txt records the default parameter for this firmware; HLK-B32 (b.1.00.120180611182) 552) "is the firmware version number, when the module runs this firmware query version number and this version number the same, each firmware has a unique version number, automatically generated by the compilation system; When there is a new firmware to upgrade, the three files can be overwritten.

### 4.1.1 Open Serial Port Upgrade Software

Open serial port upgrade software HLK-B32_uart.exe, input lowercase string c, select serial port number, select the corresponding baud rate through digital key 1 / 2 / 3 / 4

## 4.2 Introduction of Network Upgrade Methods

In order to realize the network upgrade of the module, it is necessary to connect the line module through wifi, and then to upgrade the data transmission according to the ip of the module.

### 4.2.1 Router Connection

Modules that need to be upgraded can be configured and connected to routers through serial port configuration tools, or ap mode can be used.

### 4.2.2 Lookup Module IP

Because you need to input the ip, of the module when upgrading, you can go to the router to find the corresponding ip, of the module or use HLK-_Discover to search the corresponding ip. for the module in the local area network.


Figure 18. Lookup module ip

# 5. Electrical Specification

## 5.1 Electric Parameter

| Electric parameter(for information only) | |
|---|---|
| Power input voltage | DC:5±0.2V |
| No-load running current | 60±20mA @5V |
| Module average power consumption | about 300mW |
| Module current peak | 450mA |
| Requirements for power supply current | ≥800mA |

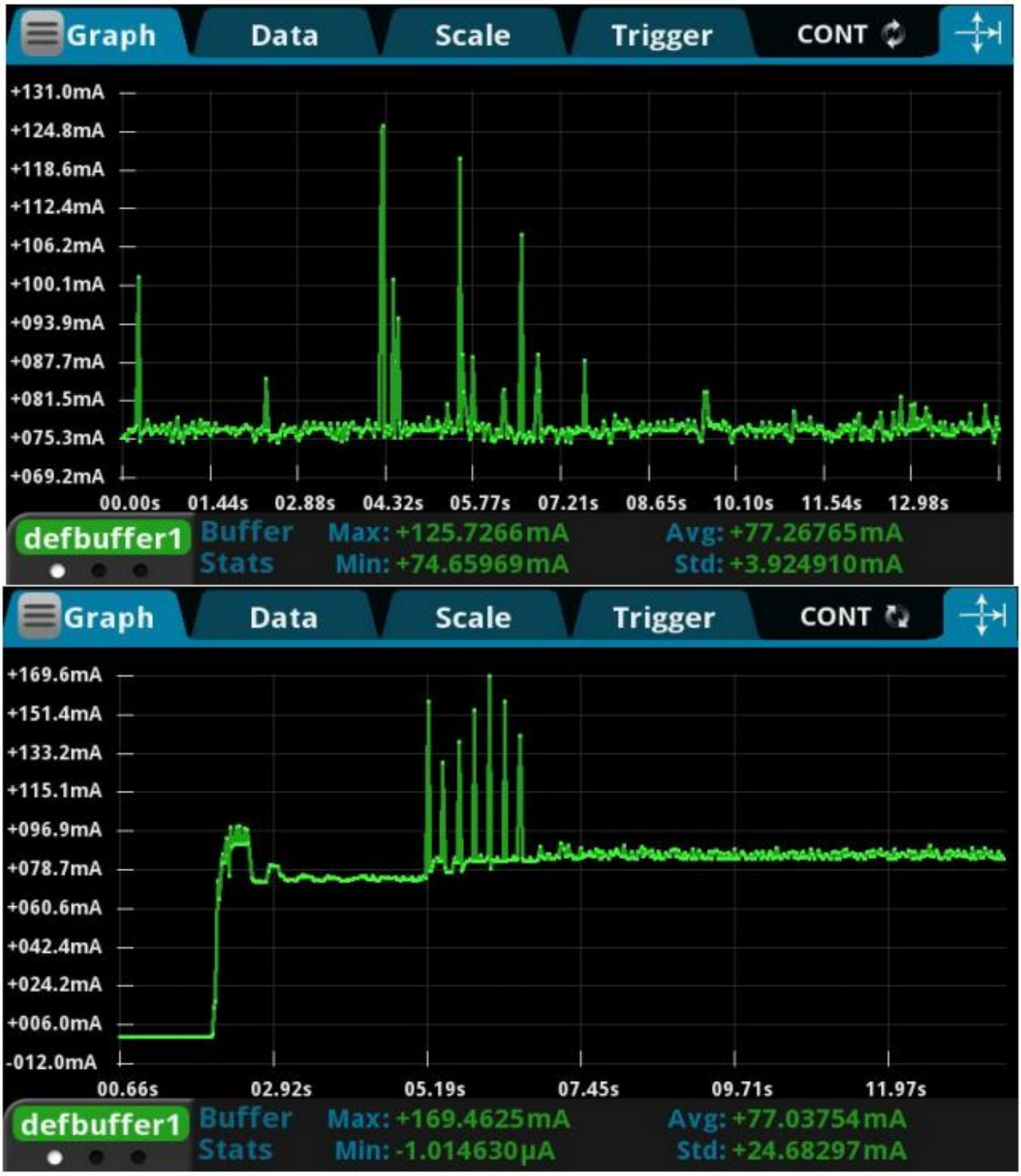
## 5.2 Current Waveform

Module test environment:single module without baseboard test, single and dual frequency antenna. The module current peak shall refer to the table above.

### 5.2.1 STA Mode

5V power supply， the module is configured in STA mode to test the current. Average value:77mA, maximum value:169mA

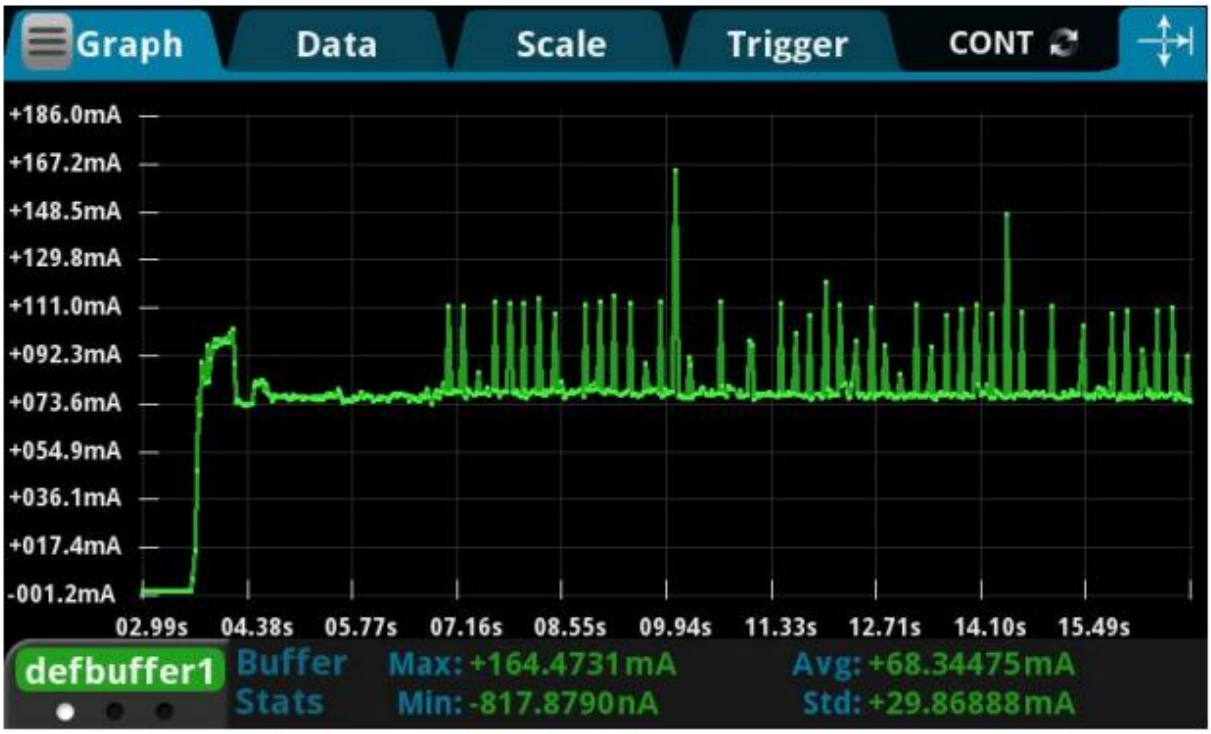
The detailed current waveform is shown below.



### 5.2.2 Smart C Mode

5V power supply, no mode is configured for the module, and the tested current is in the default STA state to be distributed. Average value:68mA, maximum value:167mA

The detailed current waveform is shown below




# 6. Appendix A Document Revision

| Version No. | Revised scope | Date |
|---|---|---|
| V1.21 | Power supply changed from 3.3v to 5v | |
| V1.22 | Add upgrade function description | |
| V1.23 | Add the instruction of the at command netmode, update the picture of the serial port configuration tool<br>Add wifi, socket indicated pin description<br>Add one-click distribution description, web set description | |
| | | |
| V1.25 | Increased electrical characteristics | 2020-02-10 |
| V1.26 | Modify instruction description, add instruction description | 2022-04-24 |

**FCC Caution:**
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.

IMPORTANT NOTE:

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 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.

## OEM/Integrators Installation Manual

**List of applicable FCC rules** This module has been tested and found to comply with part 15.247 and part 15.407 requirements for Modular Approval.

The input voltage to the module should be nominally 5 VDC, typical value 5VDC and the ambient temperature of the module should not exceed 80℃.
**Limited module procedures** N/A
**Trace antenna designs** N/A
**Antennas**
The module of HLK-B32 has one antenna port and the antenna gain as below:
2.4G Wi-Fi: 3.76dBi; 5G Wi-Fi: 4.69dBi.
The external antennas is Dipole Antenna.

**Label and compliance information** When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: Contains Transmitter Module FCC ID: 2AD56HLK-B32, the FCC ID can be used only when all FCC ID compliance requirements are met.

**Information on test modes and additional testing requirements**

a) The modular transmitter has been fully tested by the module grantee on the required number of channels, modulation types, and modes, it should not be necessary for the host installer to re-test all the available transmitter modes or settings. It is recommended that the host product manufacturer, installing the modular transmitter, perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions limits or band edge limits (e.g., where a different antenna may be causing additional emissions).

b) The testing should check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure). This investigation is especially important when integrating multiple modular transmitters where the certification is based on testing each of them in a stand-alone configuration. It is important to note that host product manufacturers should not assume that because the modular transmitter is certified that they do not have any responsibility for final product compliance.

c) If the investigation indicates a compliance concern the host product manufacturer is obligated to mitigate the issue. Host products using a modular transmitter are subject to all the applicable individual technical rules as well as to the general conditions of operation in Sections 15.5, 15.15, and 15.29 to not cause interference. The operator of the host product will be obligated to stop operating the device until the interference has been corrected.

Additional testing, Part 15 Subpart B disclaimer

The final host / module combination need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part15 digital device. The host integrator installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation and should refer to guidance in KDB 996369. For host products with certified modular transmitter, the frequency range of investigation of the composite system is specified by rule in Sections 15.33(a)(1) through (a)(3), or the range applicable to the digital device, as shown in Section 15.33(b)(1), whichever is the higher frequency range of investigation. When testing the host product, all the transmitters must be operating. The transmitters can be enabled by using publicly available drivers and turned on, so the transmitters are active. In certain conditions it might be appropriate to use a technology-specific call box (test set) where accessory devices or drivers are not available. When testing for emissions from the unintentional radiator, the transmitter

shall be placed in the receive mode or idle mode, if possible. If receive mode only is not possible then, the radio shall be passive (preferred) and/or active scanning. In these cases, this would need to enable activity on the communication BUS (i.e., PCIe, SDIO, USB) to ensure the unintentional radiator circuitry is enabled. Testing laboratories may need to add attenuation or filters depending on the signal strength of any active beacons (if applicable) from the enabled radio(s). See ANSI C63.4, ANSI C63.10 and ANSI C63.26 for further general testing details.