



Shenzhen HI-Link Electronic Co.,Ltd

HLK-B32 User Manual



Content

1. Product Profile	1
1.1 Overview	1
1.2 Product Characteristics	1
1.3 Product Packaging	1
1.4 Technical Specifications	2
1.5 Pins Introduction	3
2. Functional Description	4
2.1 WiFi Indicator Flashing Description	4
2.2 Wifi Connection Status Indicator Pin	5
2.3 Socket Connection Status Indicator Pin	5
2.4 One-click Distribution Mode	5
2.5 Web Distribution Function	6
2.6 Serial to WIFI STA	7
2.7 Serial Port Working State Conversion	8
2.8 Serial Port-network Data Conversion.....	8
2.8.1 Module as TCP Server	8
2.8.2 Module as TCP Client.....	9
2.8.3 Module as UDP Server	9
2.8.4 Module as UDP Client	10
2.9 Application Areas	10
3. AT Instructions	10
3.1 Query Current Module Version: at+ver	11
3.2 Local Port Operation: at+CLport	11
3.3 Set up Serial Port: at+uart	12
3.4 Set up DHCP: at+dhcpc	12
3.5 Set up Wifi Connection Mode: at+netmode	12
3.6 Set up TCP Connection Mode: at+mode	12
3.7 Set up Remote IP When Modules Work as Client: at+remoteip	13
3.8 Set up Remote Port When Module Act as Client: at+remoteport	13
3.9 Set Parameter Submission: at+net_commit	13
3.10 System Restart: at+reconn	13
3.11 Set the Module's ssid and Password: at+wifi_conf	14
3.12 Set up Socket Connection Protocol: at+remotepro	14
3.13 Set Network Connection Parameters: at+net_ip	14
3.14 Query Network Connection Status in STA Mode: at+wifi_ConState	14
3.15 Query Module MAC Address: at+Get_MAC	15
3.16 Set the Frame Length: at + uartpacklen	15
3.17 Set the Frame Time:at+uartpacktimeout	
4. Upgrade Introduction	17

4.1	Introduction of Serial Port Upgrade Method	17
4.1.1	Open Serial Port Upgrade Software	17
4.1.2	Start to Upgrade	18
4.2	Introduction of Network Upgrade Methods	18
4.2.1	Router Connection	18
4.2.2	Lookup Module IP	18
5.	Electrical Specification	21
5.1	Electric Parameter	21
5.2	Current Waveform	21
5.2.1	STA Mode	24
5.2.1	Smart C Mode	25
6.	Appendix A Document Revision	25

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

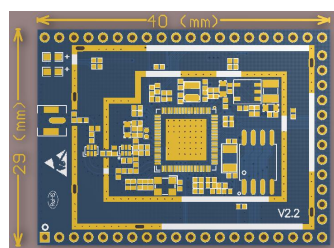


Figure 1. HLK-B32encapsulation size

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; 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; 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=> Average value: ~100mA, peak value:120mA In normal mode => Average: ~100mA, Peak: 110mA
	Working temperature	-40°C~80°C
	Storage environment	Temperature: <40°C, 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 $\geq 500\text{ms}$
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.

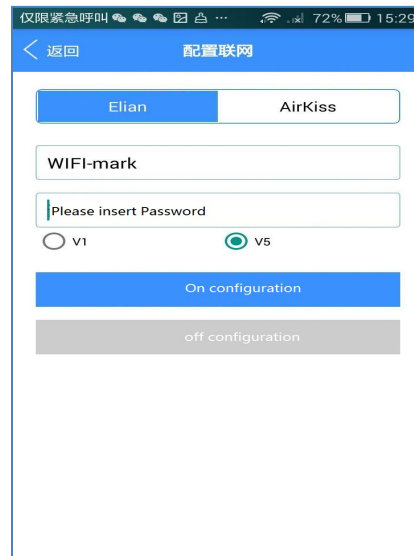


Figure 2. One-click distribution network

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)

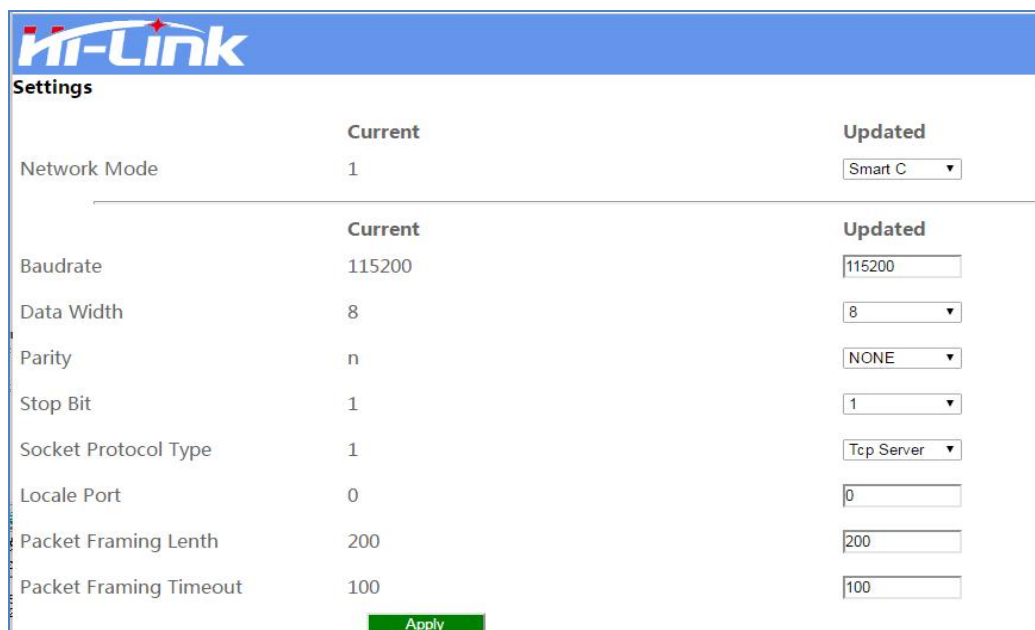


Figure 3. Module web page setting interface

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

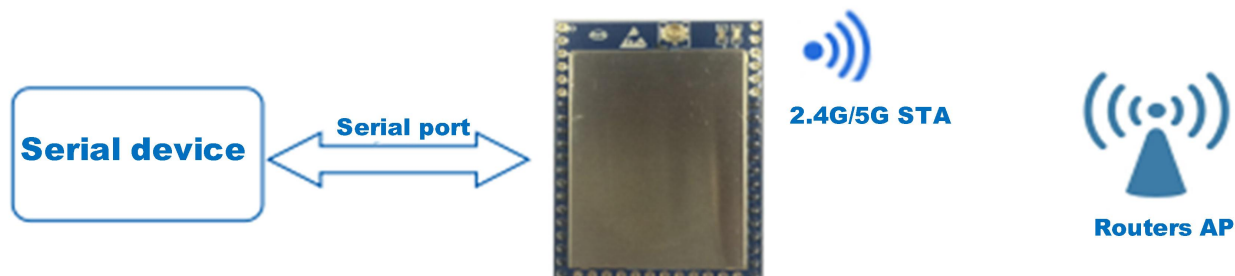


Figure 4. Module as STA

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.

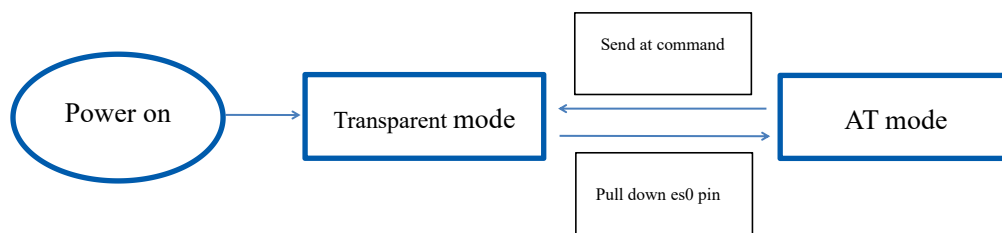


Figure 6. Serial port mode conversion

2.8 Serial Port-network Data Conversion

2.8.1 Module as TCP Server

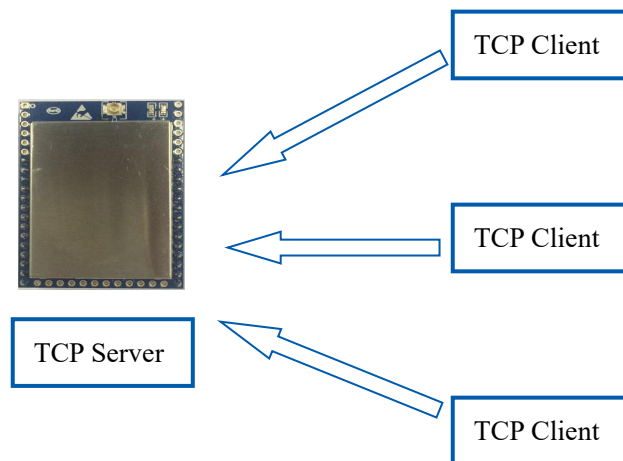


Figure 7. TCP Server

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

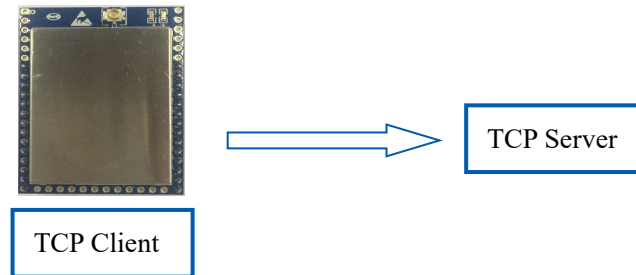


Figure 10. TCP Client

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

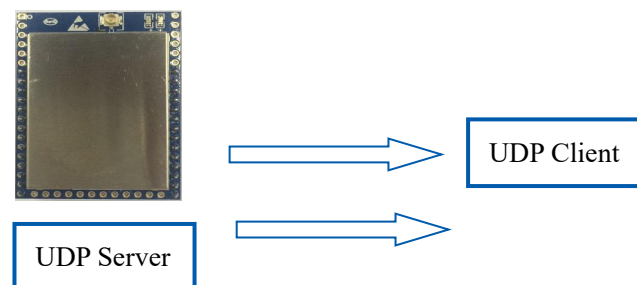


Figure 11. UDP Server

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

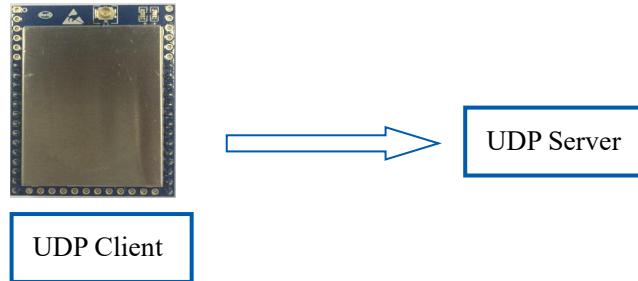


Figure 12. UDP Client

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 $T_{es}(50ms)$ and less than $Trst(3s)$ will immediately enter the AT command mode.

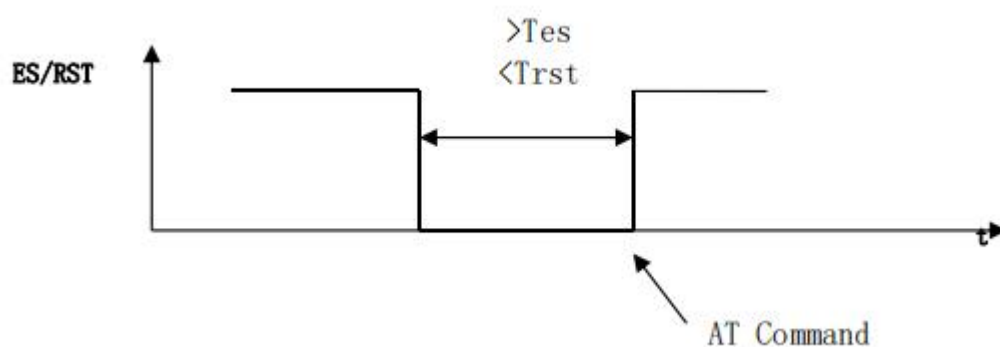


Figure 13. ES/RST Exits transparent transmission mode

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 Ok Description: set the local port to port 8080
	at+CLport=?	at+CLport=? 8080 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 Ok Description: Set up serial Port parameters
Query Command	at+uart=?	at+uart=? 115200,8,n,1 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 ok
Query Command	at+dhcpc=?	at+dhcpc=? 1 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 Ok Description: set the module to ap mode
Query Command	at+netmode=?	at+netmode=? 3 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 Ok Description: set the module to client mode
Query Command	at+mode=?	at+mode=? client 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 ok Description: set the remote ip of the mode
Query Command	at+remoteip=?	at+remoteip=? 192.168.11.102 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 ok Description: set the remote port of the mode
Query Command	at+remoteport=?	at+remoteport=? 1234 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 Ok Description: submit setup parameters

3.10 System Restart: at+reconn

Command Type	Grammar	Return and description
EO	at+reconn=1	at+reconn=1 Description: Quit at command mode
EO	at+net_commit=1 at+reconn=1	at+net_commit=1 ok at+reconn=1 ok 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 ok Description: set the ssid and password of the module
Query Command	at+wifi_conf=?	at+wifi_conf=? HI-LINK_5FE8,none,12345678 Description: Query the ssid and password of the module

3.12 Set up Socket Connection Protocol: at+remoteopro

Command Type	Grammar	Return and description
EO	at+remoteopro=tcp	at+remoteopro=tcp ok Description: set the module socket protocol to tcp
Query Command	at+remoteopro=?	at+remoteopro=? tcp 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 ok Description: set the ip, gateway, dns of the module
Query Command	at+net_ip=?	at+net_ip=? 192.168.16.254,255.255.255.0,192.168.16.254 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=? Disconnected Description: in sta mode, the module wifi is not connected, and the 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=? 40:D6:3C:15:5F:E8	at+Get_MAC=? 40:D6:3C:15:5F:E8 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 Ok Description:Set the frame length of the module to 64 bytes
Query Command	at+uartpacklen=?	at+uartpacklen=? 64 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 Ok Description:Set the frame time of the module to 200ms
Query Command	at+uartpacktimeout=?	at+uartpacktimeout=? 200 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

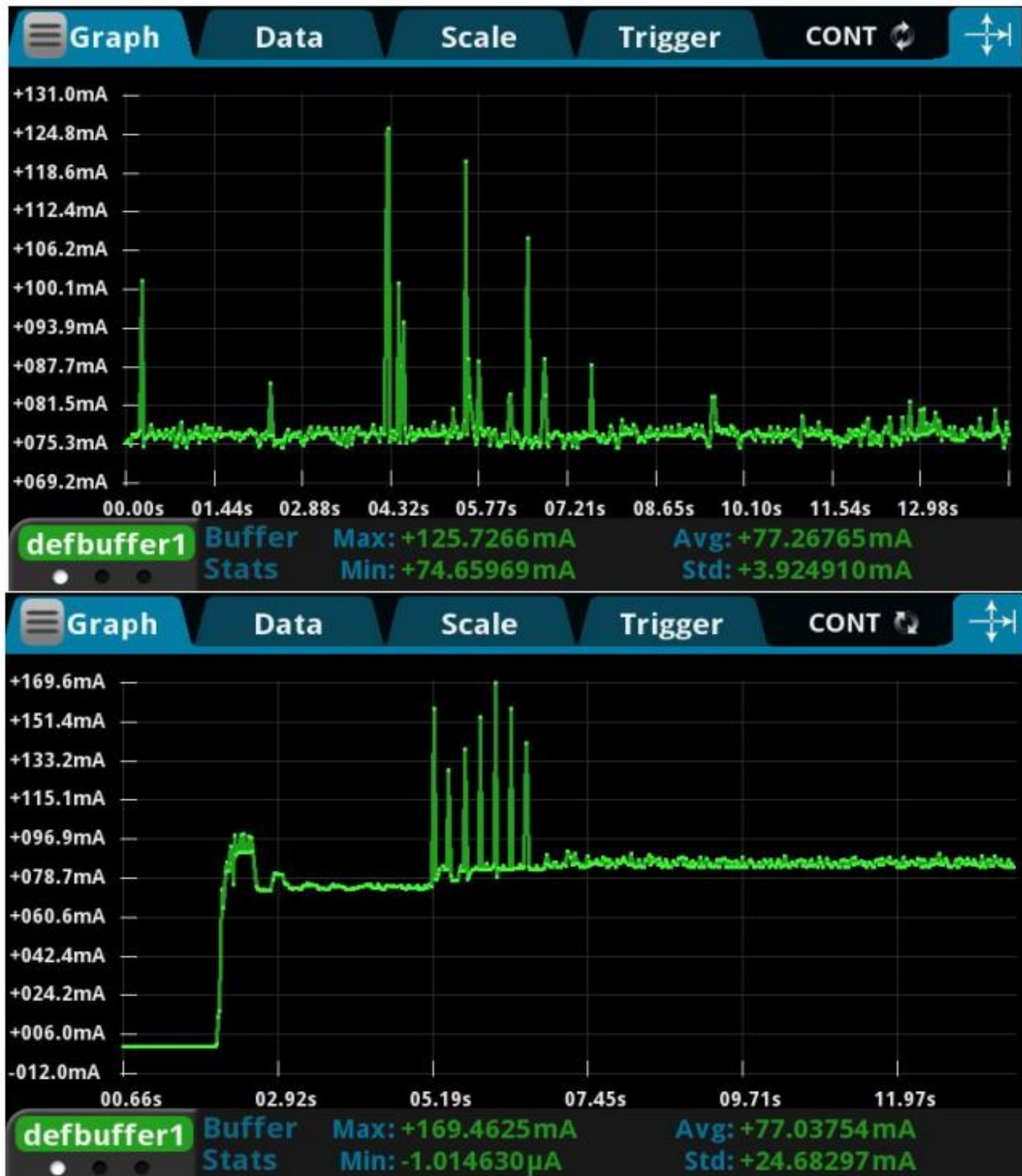
5.2 Current Waveform

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

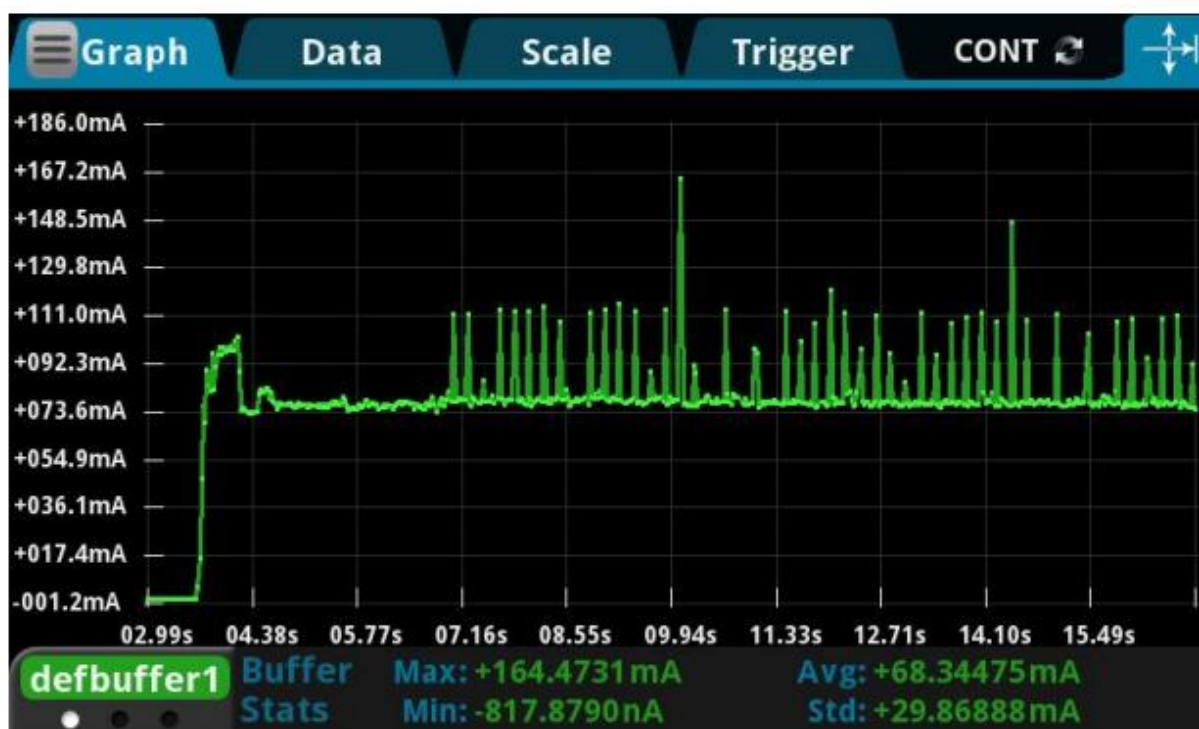
The detailed current waveform is shown below.



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 Add wifi, socket indicated pin description 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°C.

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.