

HAC-LH480 Series
Low Power Data Radio Module
Version 2.2C



SHENZHEN HAC TELECOM TECHNOLOGY CO., LTD

Address : F1.6, Building 2, Jiuxiangling New Industry Park, No.4227, Xilihu Road, Nanshan, Shenzhen, China.

Tel : +86-755-23981078

Fax : +86-755-23981007

E-mail : webmaster@rf-module-china.com

Website : <http://www.rf-module-china.com>



Catalogue

I. Features of HAC-LH480 Series	3
II. Applications of HAC-LH480 Series	4
III. How to use HAC-LH480 Series	4
1. Power Supply	4
2. Connector Definition.....	5
3. Function Setting of HAC-LH480.....	5
4. Setting method:	6
5. Channel Frequency for HAC-LH480.....	9
6. The attentions for data transmission	9
7. Supported Protocol and Transmission Capacity	10
8. Low Power Consumption (Sleep Function) Instruction	10
9. Dimension sketch map (Unit: mm):.....	12
IV. Networking Application of HAC-LH480 Series	13
V. Technical specification of HAC-LH480 Series.....	13

I. Features of HAC-LH480 Series

1. Low power transmission with 500mW (27dbm) as maximal transmission power, users can customize for other smaller powers.

2. The carrier frequency covers from 470MHz to 490MHz.

3. High anti-interference and Low BER (Bit error Rate)

Based on the GFSK or RC2FSK modulation, the high-efficiency forward error correction channel encoding technology is used to enhance data's resistance to both transient interference and random interference, and the actual bit error rate of $10^{-5} \sim 10^{-6}$ can be achieved when channel bit error rate is 10^{-3} .

4. Long Transmission Distance

Within the visible range, when the height of antenna is higher than 2m, and the baud rate is 1200bps, the longest reliable transmission distance is 5000m. But if the baud rate is 9600bps, the reliable transmission distance is 2500m.

5. Transparent data transmission

Transparent data interface used in transceivers is for meeting many standard or nonstandard user protocols. It can filter the false data in the air automatically, i.e. the received data is the data that had been sent.

6. Multi-channels

It can be customized for multi-channels according to users' requirements to meet variable requirements. The channel setting is done by serial port command, please refer to Page 5 for more information.

7. Two serial ports with three connection methods

HAC-LH480 transceivers provide 2 ports with three connections, COM1: a UART interface of TTL level, COM2: a non-standard RS-232 port or a non-standard RS-485 port, which both are defined by user software (define it just by plugging out and in one short circuit device and then power on).

8. Big data buffer area

With optional interface baud rate: 1200/2400/4800/9600bps and 8N1/8E1/8O1 data format (set by user). The transceiver can transmit big data frame, and the users can program more neatly.

9. Intelligent data control and no any complicated transmission programs required

Even for half duplex communication, no any excessive programs about RF is required. All

RF system data sending/receiving, including other On-the-Fly conversion and control are performed by HAC-LH480 transceivers automatically.

10. Low power consumption and sleep function

+5V power supply, the receiving current is less than 50mA, the transmitting current is less than 400mA, and the sleep current is less than 5 μ A.

11. High reliability, small and light

By using monolithic radio-frequency integrated circuit and single-chip MCU, the transceivers have little peripheral circuits, high reliability, and low failure rate.

II. Applications of HAC-LH480 Series

- * Auto Meter Reading system.
- * Remote control and telemetry.
- * Automatic data collection system.
- * Building automation, security, wireless monitoring and control for room equipment, access control systems.
- * POS system

III. How to use HAC-LH480 Series

HAC-LH480 offers COM1 and COM2. The COM1 (Pin3 and Pin4 of JP1) is fixed for the TTL level/UART port. And the COM2 (Pin6 and Pin7 of JP1) is decided by the D Jumper of JP2. The using method is shown as follow:

D=1 (without short-circuit) COM2 = non-standard RS485

D=0 (with short-circuit) COM2 = non-standard RS232

HAC-LH480 module can connect with MCU or other intelligent devices directly. The using method is shown as follow:

1. Power Supply

The voltage range of power supply is +4.75~5.25 V DC. Please use better ripple factor. If HAC-LH480 needs to share power supply and ground with other equipment, please use single point access method. If possible, the signal is insulated by optocoupler, the power supply is insulated by transformer, so that it can get the best communication results, and it is steady and reliable.

2. Connector Definition

HAC-LH480 offers one 9-pin connector (JP1). Their definitions and connection methods with terminals are shown in Table 1.

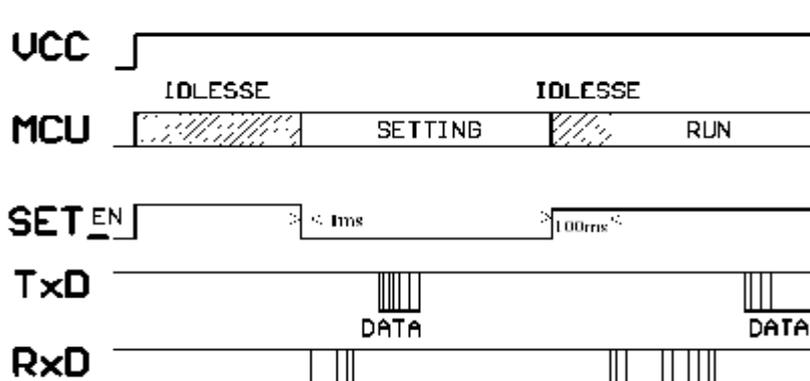
Table 1: Pin Definitions and connection methods

Pin	Definition	Instruction	Level	Input / Output	Remarks
1	GND	Power ground		Power ground	
2	VCC	Power supply DC	+4.75~ 5.25V	Input	
3	Rx	Receiving end of UART	TTL	Input	COM1
4	Tx	Transmitting end of UART	TTL	output	
5	SET_EN	Setting enable		Input	
6	A(TxD)	A/TxD		Input / output	COM2
7	B(RxD)	B/RxD		Input / output	
8	SLP/SET	Sleep	TTL	Input	
9	RESET	Reset signal	TTL	Input	

3. Function Setting of HAC-LH480

Before using the module, you need to make some simple configurations to confirm the channel, interface baud rate, data format, sleep function and so on according to your needs. Users can use LH_studio upper machine software to set the LH480 module through setting cables. Users also can do the software for setting by themselves. When setting, please pay attention to the control of setting enable (SET_EN). When HAC-LH480 is in the idle state, let the SET_EN be low level for 1ms, after that, HAC-LH480 will enter setting state. If let the SET_EN be high level for 100ms, after that, HAC-LH480 will enter working state.

SET_EN Timing sequence diagram:





Note: Default setting of HAC-LH480 before ex-factory: 0 channel, 9600bps, 8N1, sleep function close. Meanwhile, if the users have detailed requirements, we could do the setting before ex-factory.

4. Setting method:

A. Interface and Data Format

Users can set the parameters of HAC-LH480 module through UART port by using ASCII code or hex data. The baud rate is 9600bps, 8N1. (Note: After enter setting state, the baud rate and data format of HAC-LH480 is in fixed status.).

B. Command Format

	Identifier	Read-write sign	Command word	Parameter	End code
ASCII	\$	R / W	1byte	n byte	↵ (Enter)
Hex	0x24	0x52/0x57	1byte	n byte	0x0D

- Identifier: \$- Command starts
- Read-write sign: R-read parameter, W-write parameter
- Command word: C-channel Number, V-verifying code, B-baud rate, S-sleep function
- Parameter: Refer to command paraphrase
- End code: Enter –Ending sign command (0x0D)

There is no distinction between capital and small letters in entire commands. If wrong input occurs, by pressing ‘Backspace’ (0x08) the last byte can be deleted and the command can be input again.

C. Command paraphrase

● Read the current parameter. For example, the initial parameters are 0 channel, even parity, 1200bps, no sleep function. And the display is shown as follow:

Input the command:

ASCII	\$R↵
Hex	24 52 0D

Return:

ASCII	Channel: 0x00 (Channel No.: 0~31) Verifying: 8E1 (Parity bit: 8E1/8O1/8N1) Baud rate: 1200 (Baud rate: 1200~9600) Sleep: Close (Sleeping function: Close/Open)
Hex	20 20 43 68 61 6E 6E 65 6C 3A 20 30 0D 0A 20 20 20 56 65 72 69 66 79 3A 20 38 65 31 0D 0A 42 61 75 64 20 72 61 74 65 3A 20 31 32 30 30 20 0D 0A 20 20 20 20 53 6C 65 65 70 3A 20 43 6C 6F 73 65 0D 0A

● To write the Channel parameter:

Input the command:

ASCII	\$WC 08 ✓
Hex	24 57 43 30 38 0D

Return:

ASCII	Channel: 0x08 (Channel No.: 0~31)
Hex	20 20 43 68 61 6E 6E 65 6C 3A 20 38 (32 33) 0D 0A

Note: The new channel No. is 8. '\$WC' is the command for writing channels, the related parameter range is **00~31**. When the channel number is less than 10, the anterior '0' cannot be omitted.

● To write the parity bit parameter:

Input the command:

ASCII	\$WV E ✓
Hex	24 57 56 45 0D

Return:

ASCII	Verify: 8E1
Hex	20 20 20 56 65 72 69 66 79 3A 20 38 65 31 0D 0A

Note: The parity bit set as 8E1. '\$WV' is the command for writing channels, the related parameter selection is **N, O, E**, which respectively represent 8N1, 8O1, 8E1. 8 and 1 means that there are 8 efficient data bits, one start bit and one stop bit.

● To write the baud rate parameter:

Input the command:

ASCII	\$WBD✓
Hex	24 57 42 44 0D

Return:

ASCII	Baud rate: 9600
Hex	42 61 75 64 20 72 61 74 65 3A 20 39 36 30 30 20 0D 0A

Note: The baud rate set as 9600bps. ‘\$WB’ is the command for writing channels, the related parameter selection is **A, B, C, D**, which respectively mean: 1200bps, 2400bps, 4800bps, 9600bps.

- To write the sleep parameter:

Input the command:

ASCII	\$WSO✓
Hex	24 57 53 4F 0D

Return:

ASCII	Sleep: Open
Hex	20 20 20 20 53 6C 65 65 70 3A 20 4F 70 65 6E 20 0D 0A

Note: Open the sleep function. ‘\$WS’ is the command for writing channels, the related parameter selection is **O, C and other characters**, which respectively represent opening the sleep function (O) and closing the sleep function(C).

- To write the command of error:

When any error occur in identifier、read-write sign、command word, return:

ASCII	Error!
Hex	45 72 72 6F 72 21 20 0D 0A

When identifier, read-write sign and command word are correct, but parameter is wrong,

return:

ASCII	Error!
Hex	(command sign:) 45 72 72 6F 72 21 20 0D 0A

Note: Red words are setting parameters, different setting leads to different return character.

5. Channel Frequency for HAC-LH480

Channel No.	Frequency (MHz)						
0	470.150	8	474.950	16	479.750	24	484.550
1	470.750	9	475.550	17	480.350	25	485.150
2	471.350	10	476.150	18	480.950	26	485.750
3	471.950	11	476.750	19	481.550	27	486.350
4	472.550	12	477.350	20	482.150	28	486.950
5	473.150	13	477.950	21	482.750	29	487.550
6	473.750	14	478.550	22	483.350	30	488.150
7	474.350	15	479.150	23	483.950	31	488.750

Note: The channel frequency can be customized according to the users' requirements.

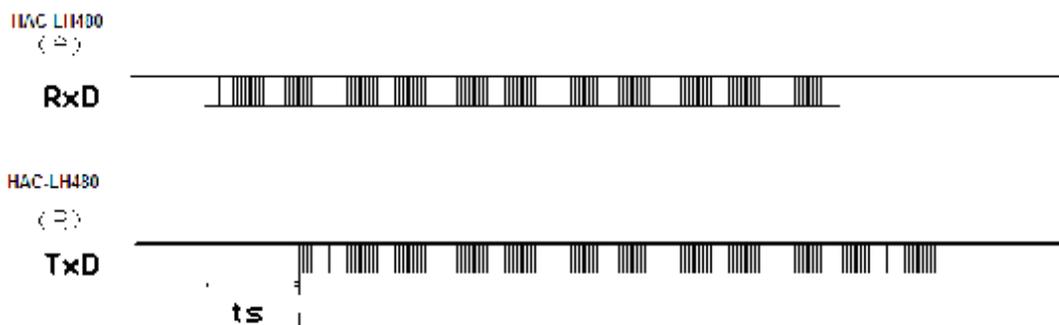
6. The attentions for data transmission

A. The delay time of transceivers between the first byte sent by TxD and the first byte received by RxD.

Due to the data processing will be made on user's data by HAC-LH480 transceiver using FEC (Forward Error Correction) or other correction algorithm, when RxD of HAC-LH480 transceiver 'A' receives the data, then transmits it, the other one transceiver 'B' will have a delay (t_s) to receive and transmit by TxD. Different RF data rate causes different delay time. Please see the specific delay time below:

RF baud rate (bps)	Delay t_s (ms)	RF baud rate (bps)	Delay t_s (ms)
1200	80	4800	20
2400	40	9600	10

Timing diagram:



B. Error dealing procedure

To enhance the reliability and stability of user's systems, a verify bit or a Cyclic Redundancy Check (CRC) mode is highly recommended to resent the wrong information while using HAC-LH480 series modules.

C. Large-number data transmission

In theory, when the interface data rate is faster than the RF data rate, HAC-LH480 transceivers can send unlimited-long data package, but any long packages more than 120 Bytes are not recommended. The length of each package should be between 60~100bytes. We also recommend user to resent the wrong information using Automatic Error Request Equipment (ARQ).

The analyzing as below:

What if the actual transmission BER (Bit Error Rate) is 10^{-4} , 1 packet with 1KB data, which is about 10-thousand bits, is sent, theoretically, at least 1 bit will be received wrongly, then the 1KB information will never be received correctly.

But if we package the data into 10 packets with 100B for each, when all 10 packets are sent, there will be only 1 packet wrong according to this probability. After that, resend this wrong packet using ARQ mode. So by resending one more packet and the efficiency rate is reduced 10%, but all data will be absolutely received correctly.

7. Supported Protocol and Transmission Capacity

The standard HAC-LH480 module offers transparent protocol, it can support variable applications and protocols. If users want to lower cost or reduce the CPU workload of terminal device, we can add some special functions like addressing, data collection and command paraphrase based on transparent protocol according to the requirements.

8. Low Power Consumption (Sleep Function) Instruction

Due to reducing more consumption, HAC-LH480 transceivers support Sleep function. In sleep mode, the current consumption is less than 5 μ A.

A. How to use the Sleep Function

The Pin8 'SLP' of JP1 is the sleep control signal. When this signal keeps in high level, the transceiver will stay in sleep mode. The conversion from idle mode to sleep mode will be finished in 1ms after the rising edge. If the Sleep signal arrives when the transceiver is transmitting data, the

module will enter sleep mode after finishing transmission.

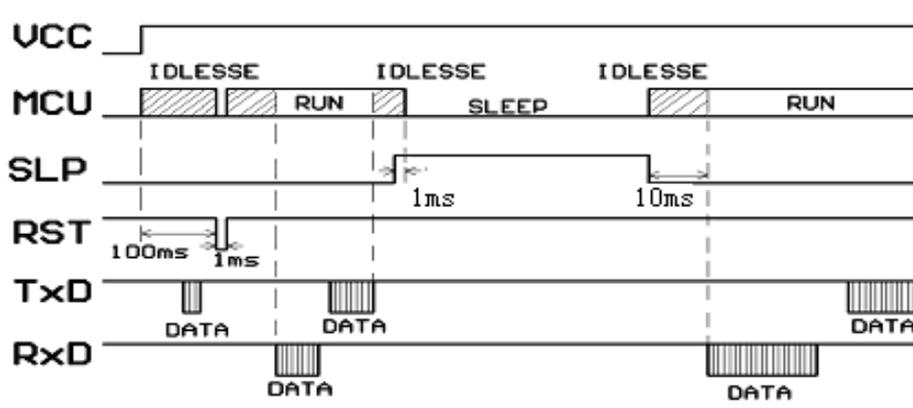
If the sleep signal keeps in low level, the module is in working state. From sleep mode to working mode, it takes the transceiver 12ms after falling edge.

To disable the sleep function of HAC-LH480, the SLP (SLEEP) pin should be definitely connected with 0 or ground.

B. Attentions about use of sleep function:

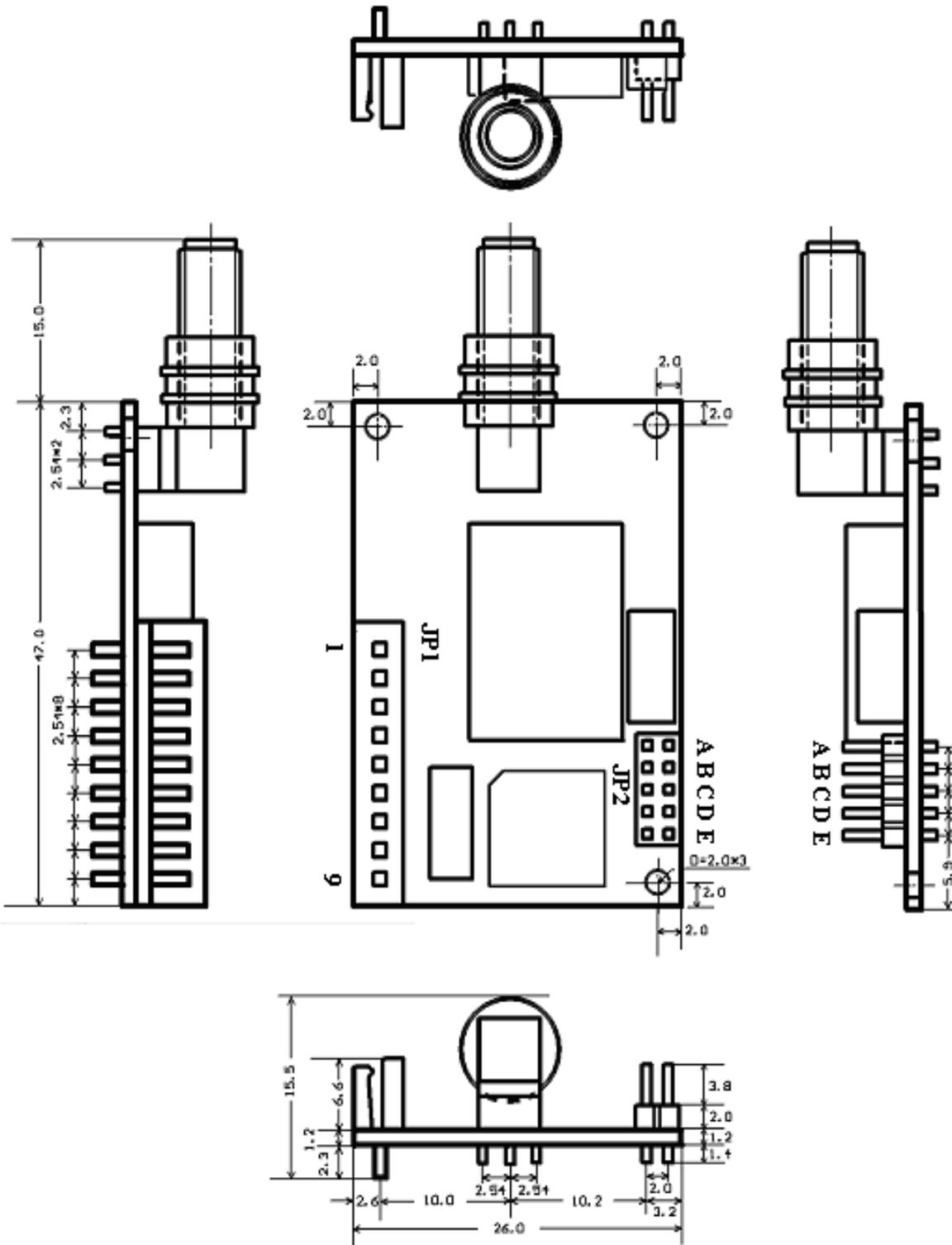
When the sleep function is enabled, any supply glitches, such as switch dithering, fire striking or quick switching on and off, could cause the transceiver to be switched to the wrong sleep mode. So After power on, users can avoid this error by making a compulsive restoration once after the CPU delays 500ms. But such a condition occurs seldom.

C. Sleep Time Diagram:



9. Dimension sketch map (Unit: mm):

The dimension of our standard product is shown as follow. To meeting different needs of users, smaller sizes and different shapes can also be provided.





IV. Networking Application of HAC-LH480 Series

The communication channel of HAC-LH480 is half duplex, which is mostly suitable for the communication mode of point to multi-point. Under this mode, one master station must be set, and all of the rest are slave stations with a unique address. The coordination of communication is controlled by master station that uses data frames containing address code to transmit data or command. All of slave stations will receive the data and command and compare the received address code with local address code. If they are different, the data will be dismissed with no response. If they are same, it means the data is sent to the local. Slave station will make different responses according to the transmitted data or command and send the data back as response. All these jobs must be performed by upper level protocol, which will assure that there is only one transmitter-receiver in transmission mode in the communication network at any transient moment so as to avoid the cross-interference.

HAC-LH480 transceivers can also be used for point-to-point communication with easier operation. For the programming of serial port, all you have to do is to remember that its communication mode is half duplex and always to observe the time sequence of come-and-go for receiving and transmitting.

V. Technical specification of HAC-LH480 Series

Modulation mode	: GFSK
Working frequency	: 470~490MHz
Transmission power	: 500mW
Receiving sensitivity	: -123dBm~-116dBm (-118dBm @ 9600bps)
Channel	: 32 channels
RF data rate	: 1200/2400/4800/9600 (optional)
Interface data format	: 8E1/8N1/8O1 (optional)
Temperature	: -20°C~70°C (Commercial grade, default) / -40°C~80°C (Industrial grade)
Power supply	: +4.75 ~ 5.25VDC
Dimension	: 47mm×26mm×10mm
Transmitting current	: ≤400mA (The transmitting power is 27dBm.)
Receiving current	: ≤50mA
Sleeping current	: ≤5μA
Humidity	: 10%~90% relative humidity without condensation