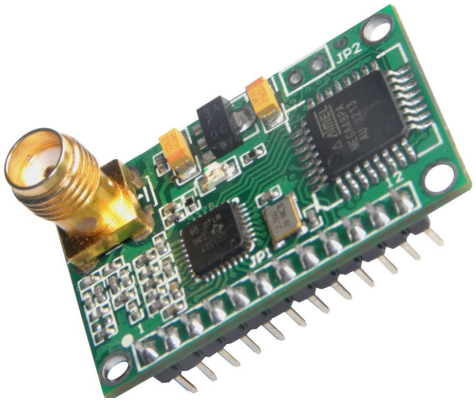
HAC-UH480P Series

Low Power Data Radio Module

Version 2.0



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Catalogue

I. Features of HAC-UH480P Series

1. Low power transmission with 30mW (15dbm) 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 2-GFSK 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} ~ 10^{-6} can be achieved when channel bit error rate is 10^{-2}.
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 1500m. But if the baud rate is 9600bps, the reliable transmission distance is 1000m.
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. TTL level/UART port.
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-UH480P transceivers automatically.
10. Low power consumption and sleep function

    The receiving current is less than 35mA, the transmitting current is less than 70mA, and the

sleep current is less than 5μA.

11. High reliability, small and light

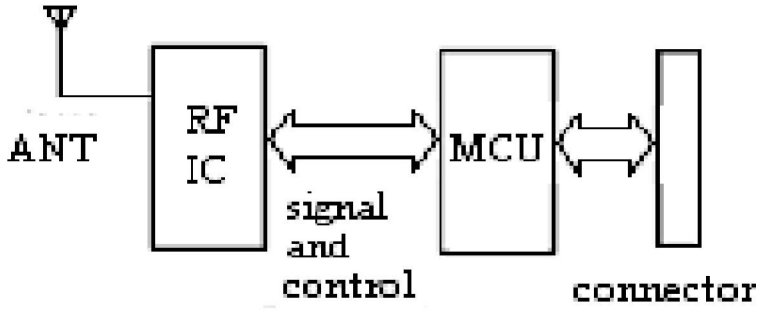
By using monolithic radio-frequency integrated circuit and single-chip MCU, the transceivers have little peripheral circuits, high reliability, and low failure rate.

II. Applications of HAC-UH480P 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-UH480P Series

HAC-UH480P offers UART/TTL level. It can connect with MCU or other UART devices directly. The using method is shown as follow:



HAC-UH480 series principle map

1. Power Supply

The voltage range of power supply is +3.3~5.5 V DC. Please use better ripple factor. If HAC-UH480P 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.

If users need the low-voltage and low power-consumption production, the power supply range (+2.5~+3.6V) can be customized.

2. Connector Definition

HAC-UH480P offers a 12-pin connector (JP1) and a 2-pin connector (JP2). The 2-pin of JP2 can connect with ground. The JP1 definitions and connection methods with terminals are shown in Table 1.

Table 1: Pin Definitions and connection methods

pin	name	function	level	Connection with terminal	remark
1	GND	Ground		Ground	
2	VCC	Power supply DC	+3.3～5.5V		
3	SET_EN	Setting enable	TTL		
4	RxD/RS-232	Serial data receiving end	RS232	TxD	COM2
5	TxD/RS-232	Serial data transmitting end	RS232	RxD	COM2
6	RESET	Reset signal (Input)	TTL	Negative pulse reset	Note: Page 13
7	SLEEP	Sleep control (input)	TTL	Sleep signal	High level sleep
8	TxD/TTL	Serial data transmitting end	TTL	RxD	COM1
9	RxD/TTL	Serial data receiving end	TTL	TxD	COM1
10	SGND	Signal ground			Connected with power supply ground
11	A /RS-485	A of RS485	RS485	A /RS-485	COM3
12	B /RS-485	B of RS485	RS485	B /RS-485	COM3

3. LED Indicator of HAC-UH480P

a. When the module is powered on, the LED indicator will flash one time, the lighted time is about 2s.

b. When the module receives the valid data, the LED indicator will flash continuously.

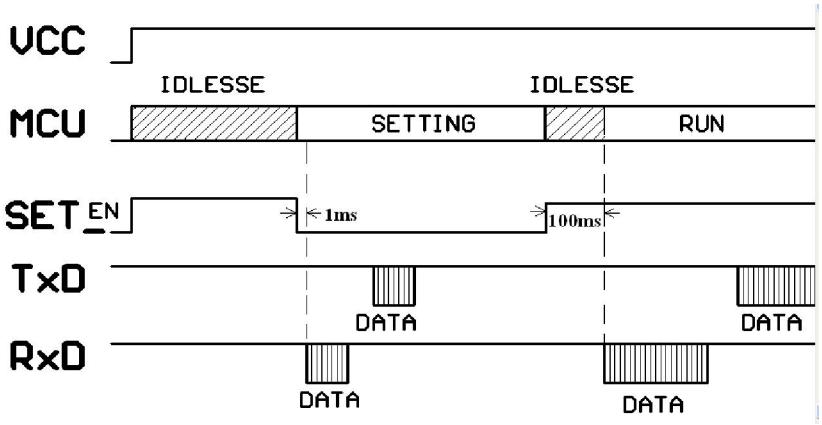
c. When the module receive data from serial port then send the data,the LED will light continuously.

d. When the module enters parameter setting state, the LED indicator light continuously, but the brightness is weak.

4. Function Setting of HAC-UH480P

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 UH_studio upper machine software to set the UH480P 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-UH480P is in the idle state, let the SET_EN be low level for 1ms, after that, HAC-UH480P will enter setting state. If let the SET_EN be high level for 100ms, after that, HAC-UH480P will enter working state.

SET_EN Timing sequence diagram：



Note: Default setting of HAC-UH480P 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.

5. Setting method：

A. Interface and Data Format

Users can set the parameters of HAC-UH480P 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-UH480P 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	$WC08↙
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	$WVE↙
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.

6. Channel Frequency for HAC-UH480P

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	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.

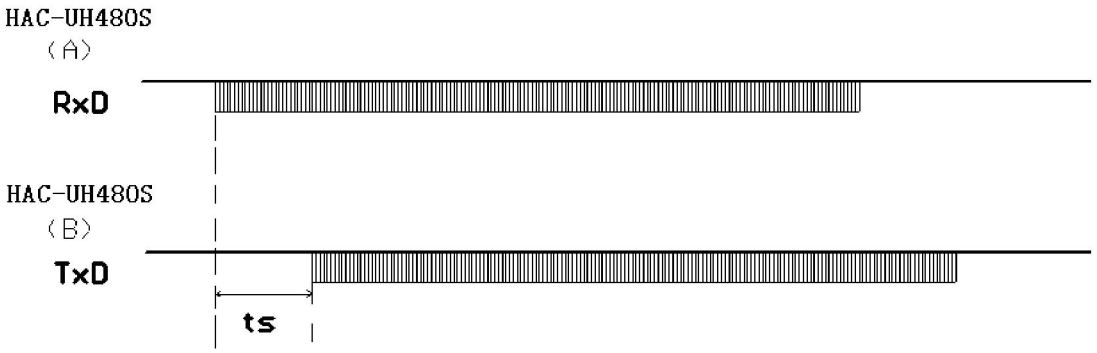
7. The attentions for data transmission

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-UH480P transceiver using FEC (Forward Error Correction) or other correction algorithm, when RxD of HAC-UH480P transceiver 'A' receives the data, then transmits it, the other one transceiver 'B' will have a delay (ts) 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 ts（ms）	RF baud rate（bps）	Delay ts（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-UH480P series modules.

C. Large-number data transmission

In theory, when the interface data rate is faster than the RF data rate, HAC-UH480P 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.

8. Supported Protocol and Transmission Capacity

The standard HAC-UH480P 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.

9. Low Power Consumption (Sleep Function) Instruction

Due to reducing more consumption, HAC-UH480P transceivers support Sleep function. In sleep mode, the current consumption is less than 5μA.

A. How to use the Sleep Function

The Pin7 '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.

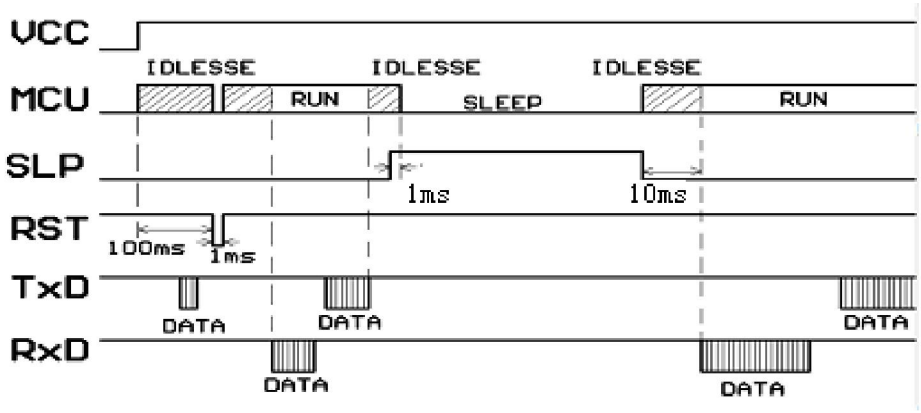
If the sleep signal keeps in low level, the module is in working state. From sleep mode to working mode, it takes the transceiver 12ms after falling edge.

To disable the sleep function of HAC-UH480P, the SLP (SLEEP) pin should be definitely connected with 0 or ground.

B. Attentions about use of sleep function:

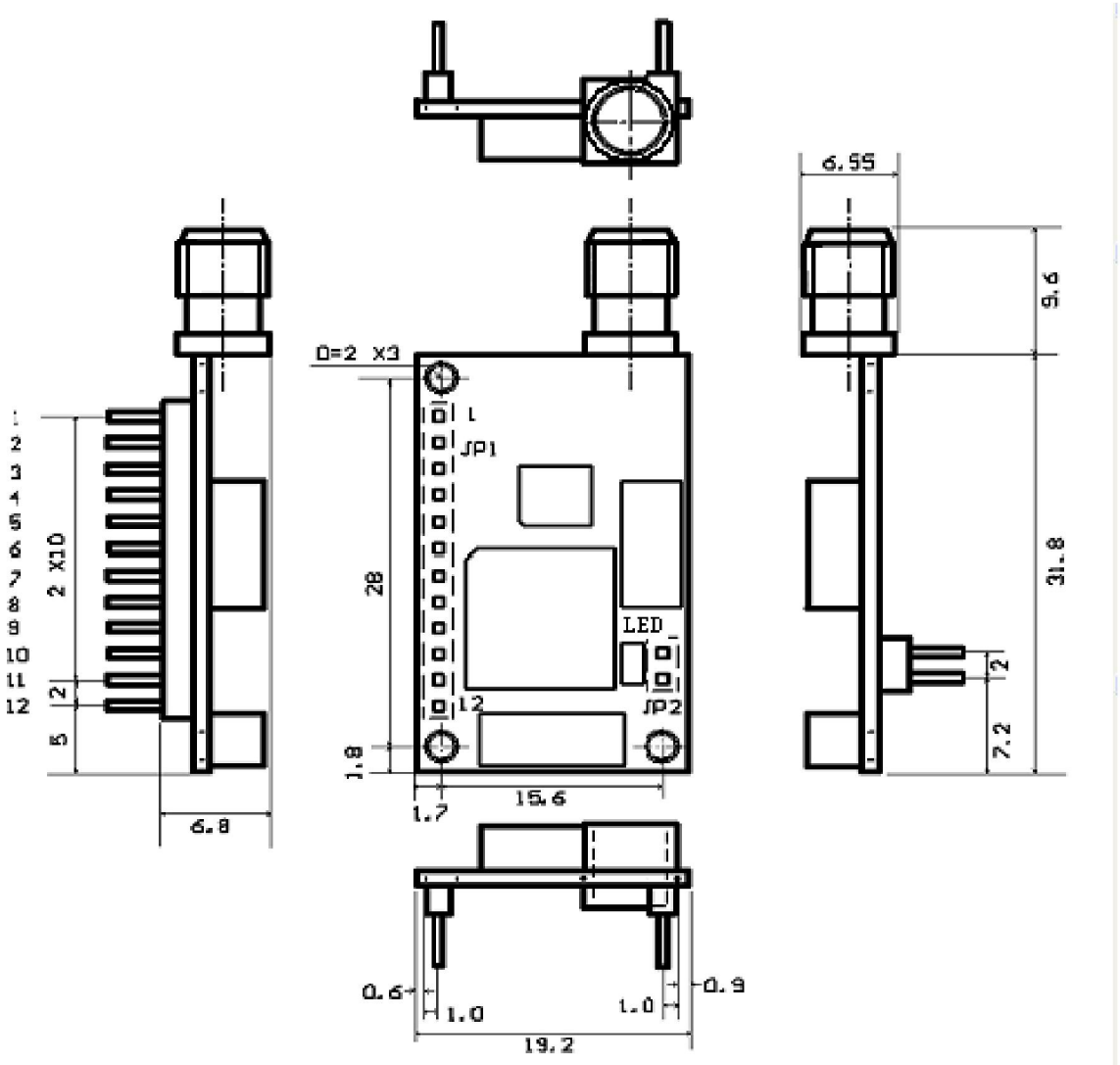
When the sleep function is enabled, any supply glitches, such as switch dithering, fire striking or quick switching on and off, could cause the transceiver to be switched to the wrong sleep mode. So After power on, users can avoid this error by making a compulsive restoration once after the CPU delays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

C. Sleep Time Diagram:



10. 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.



11. Using Method for RESET Signal

The RESET signal is valid by low level. When input more than 5ms low-pulse signal, HAC-UH480P will reset. When using RESET signal, the low-pulse signal is needed, the controller should output low level. When high level is needed, the controller output could not output high level, it should be high-resistor status.

IV. Networking Application of HAC-UH480P Series

The communication channel of HAC-UH480P 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-UH480P 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-UH480P Series

Modulation mode : 2-GFSK

Working frequency : 470~490MHz

Transmission power : 15dBm

Receiving sensitivity : -120dBm @ 1200bps (1%BER), -112dBm @ 9600bps (1%BER)

Channel Bandwidth : 50KHZ（1200BPS）
50KHZ（2400BPS）
50KHZ（4800BPS）
67KHz（9600BPS）

Channel Interval : 600KHz

Channel : 32 channels

RF data rate : 1200/2400/4800/9600 (optional)

Interface data format : 8E1/8N1/8O1 (optional)

Temperature : -30℃~70℃

Power supply : +3.3 ~ 5.5VDC

Dimension : 31.8mm×19.2mm×6.8mm

Transmitting current : ≤70mA

Receiving current : ≤35mA

Sleeping current : ≤5μA

Humidity : 10%~90% relative humidity without condensation