

HAC-LEN Series Low power Data Radio module



SHENZHEN HAC TELECOM TECHNOLOGY CO., LTD



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SHENZHEN HAC TELECOM TECHNOLOGY CO.,LTD

Tel: 86-755-23981079, 23981077 Fax: 86-755-23981007

Address: 1903, Tower A of Haisong Bldg, 9th Tairan Road, Chegongmiao, Futian, Shenzhen , China

E-mail:webmaster@haccomm.com, www.haccomm.com



I. Features of HAC-LEN series

1. The transmission power is 500mw or 800mw.
2. Frequency range 868/915MHz.
3. The highest receiving sensitivity is $-118\text{dBm}@1200\text{bps}$.
4. High anti-interference and low BER (Bit Error Rate).

Based on the GFSK modulation mode, the high-efficiency forward error correction channel encoding technology is used to enhance data's resistance to both burst interference and random interference, meanwhile the actual bit error rate can be achieved $10^{-5} \sim 10^{-6}$ when channel bit error rate is 10^{-2} .

5. Long transmission distance

Within the range of visibility, the max reliable transmission distance is 2Km (BER= $10^{-3}/1200\text{bps}$) when the antenna height is greater than 2m, the reliable transmission distance is more than 1Km (BER= $10^{-3}/9600\text{bps}$).

5. Use for industry/army

Because of adopting the high quality component and high reliable TCXO crystal, the temperature can achieve -35 to $+80$ (industry grade).

- 6 Transparent data transmission

Transparent data interface is offered to suit any standard user protocol. Any false data generated in the air can be filtrated automatically (What has been received is exactly what has been transmitted).

- 7 Multi-channel

The standard HAC-LEN series configuration provides 8 channels. If the user needs, it can be extended to 16/32 channels, meeting the multiple communication combination mode of the user.

- 8 Three kinds of interface modes(TTL、RS-232、RS-485)

RS232, RS485 interface diversion chip, DB9 standard interface connector and special power connector are used.

- 9 Large data buffer zone

Interface baud rate is 1200/2400/4800/9600bps with format of 8N1/8E1 and user can define it by itself. It can transmit unlimited data when Interface baud rate is not bigger than air effective baud rate band.

- 10 Intelligent data control and the user don't need to prepare excessive programs.

Even for semi duplex communication, the user doesn't need to prepare excessive



programs, only receiving/transmitting the data from the interface. HAC-LEN series will automatically complete the other operations, such as transmission/receiving conversion in the air, controlling, etc.

11 HAC-LEN has two lights, which can indicate the power source and the data's transmission and receiving.

II. Application of HAC-LEN series

Series HAC-LEN data RF module is suitable for:

Matching for the exports;

Communication of army and police;

Data transmission system for railway, electricity and oil field;

Industrial remote controlling and remote testing, automatic data collecting system

III. How to use HAC-LEN series

HAC-LEN Series Radio provides three interface modes including standard RS-232, RS-485 and UART/TTL levels allowing direct connection with computer, user's RS-485 device, SMC or the other and other UART components for application. The using method is showing as follows

1. Power supply

HAC-LEN uses DC power supply with voltage of +5V. We suggest not to use the switch power or boosted circuit. But if you have to use, please pay more attention to the interference of power switch pulse on RF module. You had better choose the switch power of higher frequency. Of cause the linearity power is better. If you can separate module from other equipment by optocoupler, meanwhile separate module power from other equipment power by linearity power, the communication quality will be better.

2. Definition of HAC-LEN series connecting terminal

HAC-LEN series can supply one 2P power connector and one (DB9) data pin connector, and its definitions as well as connection method for terminals are shown in Table 1. Table 1 and table 2.



Table 1: Definition of 2P power supply interface pins and connection method

Pin No.	Pin Name	Description	Level	Connected to the terminal	Remarks
1	GND	Black wire	-	Earth	
2	VCC	Red wire	+	DC5V@450mA	

Table 2: Definition of DB9 (positive) interface pins and connection method

Pin No	Definition	Instruction	Level	Connected to the terminal	Connecting with the computer
1	sleep	Sleep controlling (input)	TTL	Sleep signal	
2	RxD	The RxD of RS-232	RS-232	TxD	Connect to 3 rd pin of computer
3	TxD	The TxD of RS-232	RS-232	RxD	Connect to 2 nd pin of computer
4	Reset	Reset signal (input)	TTL		Reset by minus pulse
5	SGND	Grounding of the signal			Connect to 5 th pin of computer
6	TxD	TxD of TTL	TTL	RxD	
7	RxD	RxD of TTL	TTL	TxD	
8	A	The A of RS-485	RS-485	A	
9	B	The B of RS-485	RS-485	B	

The sleep function can't be used. If you want to use it, Please inform us when you order.

3. Setting of channel, data format and the interface baud rate:

Before using HAC-LEN, the user needs to make simple configuration based on his own needs to determine the channel, data format and the additional function.

There is a switch of 8 bits on the HAC-LEN. When turn it to "ON", it means 0 and the opposite means 1.

Note: When choosing the code switch every time, the choice will be effective after the power supply start again.



a. Channel configuration:

The 1,2,3 bit on the switch provide 8 channel options, and the user can choose to use 0-7 channels through them. Within one communication network, as long as the operation mode of switch is the same, it can communicate with each other.

The standard set in factory is 7 channels, SW321=111(7). Frequency: 869.926MHz

The corresponding frequency of the other channel is as follows (table 3)

Table 3: 868MHz Corresponding frequency points of 0 ~ 7 channels

Channel No.	Frequency	Channel No.	Frequency
CBA=000(0)	868.050 MHz	CBA=100(4)	869.350 MHz
CBA=001(1)	868.350 MHz	CBA=101(5)	869.675 MHz
CBA=010(2)	868.575 MHz	CBA=110(6)	869.500 MHz
CBA=011(3)	869.225 MHz	CBA=111(7)	869.926MHz

Table4: 915MHz Corresponding frequency points of 0~7 channels

Channel No.	Frequency	Channel No.	Frequency
CBA=000(0)	912.2000 MHz	CBA=100(4)	916.6940 MHz
CBA=001(1)	913.4288 MHz	CBA=101(5)	916.2332 MHz
CBA=010(2)	913.7360 MHz	CBA=110(6)	915.1580 MHz
CBA=011(3)	912.5072 MHz	CBA=111(7)	915.9260MHz

b. Checkout mode selection:

HAC-LEN can support no checkout and parity checkout modes, that is 8N1/8E1. You can choose checkout mode through the fifth bit of the switch:

The standard set in factory: 5th bit =1, 8E1 (even parity)

5th bit=1 8E1 (even checkout)

5th bit=0 8N1 (no checkout)

c. Selection of interface data's baud rate:

We can set the interface baud rate in order to satisfy different demands of customers. It can be set through the 7,8 bit on the switch.

In order to achieve the best communication quality, the air communication baud rate of HAC-LEN series is relation to the hardware of HAC-LEN, so it can't be changed after



selling. The data following the LEN is air effective baud rate, for example:

HAC-LEN12 means the efficiency baud rate in air is 1200bps

HAC-LEN192 means the efficiency baud rate in air is 19200bps

The model of the LEN serial in our company is as follows:

HAC-LEN12, HAC-LEN48, HAC-LEN96, HAC-LEN192, HAC-LEN384.

Interface baud rate is different from the air baud rate. Each kind of LEN provides 4 kinds of interface baud rate for the selection of customer, as table 4

Table 4: The selection of interface baud rate

Type	Switch SW8,SW7	Interface baud rate
HAC-LEN12 HAC-LEN48 HAC-LEN96	00	1200bps
	01	2400bps
	10	4800bps
	11	9600bps
HAC-LEN192	00	2400bps
	01	4800bps
	10	9600bps
	11	19200bps
HAC-LEN384	00	4800bps
	01	9600bps
	10	19200bps
	11	38400bps

Because the buffer zone is limited in RAM of LEN, when the interface baud rate is bigger than air efficiency baud rate for HAC-LEN12 and HAC-LEN48, if the user want to send the long data at one time, the data may be lose because of the overflow of the buffer zone. So it is better for user to send the smaller data packet. the longest data you can send each time is as table 5.

Table5: the longest data time as different the interface baud rate

Type	Interface baud rate	Allowed longest data
HAC-LEN12	2400bps	500Bytes
	4800bps	400Bytes
	9600bps	300Bytes
HAC-LEN48	9600bps	500Bytes



When the interface baud rate is smaller than the air efficiency baud rate, theoretically, you can send infinitude long data packet but we advise you not to send the long data packet. We suggest the data length for each packet is between 60 Bytes and 100 Bytes. It should not longer than 120 Bytes, meanwhile, it is better for user to use the ARQ mode to resend the mistake data packet.

The analysis is as follows:

Assume the real error rate is 10^{-4} , the user need to transmit the 1KB data, if you want to send the 1KB date as one packet, theoretically, there will be 1 error bit at least when receiving, while the 1KB data can not be received correctly for ever.

If we divide the 1KB data to 10 packets, that is mean every packet including 100B data, after transmit 10 packets, it will be only one error packet, then resend the error one. Though you transmit the one more packet and the efficiency decreased 10%, you can transmit all of the data correctly.

4. The indicator of the power supply and the data transmission and receiving:

Indicator of power: red light is on after supplying the electricity

Indicator of data transmission & receiving: when receiving the air signal, the green light is on; when receiving the serial data, the red light is on.

5. Antenna Configuration

HAC-LEN series wireless data module uses the SMA type of antenna connector to satisfy customer's different requirements about antenna.

When choosing the antenna, the customer must notice the compatibility of the 50 impedance matching and the work frequency of antenna must be in accordance with the order frequency. If you use the high gain and the directional YAGI antenna, the transmit distance will be further improved.

In addition, the 0.5w transmission power must be supported by antenna.

IV. Networking application of HAC-LEN series

The communication channel of HAC-LEN is semi duplex, which is most 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. A unique address is given to every station. The coordination of communication is controlled by master station that uses data frames containing address code to transmit data or command. Slave station will receive all of the data and command and compare the received address code with local address code. If they are different, the data will be deserted without any response. If those address codes are the 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 back the data of response. All these jobs must be performed by upper protocol, and it is assured that there is only one transmitter-receiver in the state of transmission in the communication network at any instant moment so as to avoid the cross-interference.

HAC-LEN 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 semi duplex while always observing the time sequence of come-and-go for receiving and transmitting.

. Technical specification of HAC-LEN series

Frequency range: 868.050-869.926MHz

912.200~916.690MHz

Frequency reliable : $\pm 3\text{ppm}$

Modulation mode: GFSK

Transmission power: 27dBm (500mw)

Receiving sensitivity: -113 ~ -120dBm

([-115dBm@9600bps](#)/SINAD 12dB, -120dBm@1200bps/SINAD12dB)

Interface velocity : 1200 ~ 38400bps (different according to the type)

Format of the interface data: 8E1/8N1

Working temperature: -35 ~ 80 (industry grade)

Power: +4.75V~+5.5V (500mw)

+7.2V~+9V (800mw)



Transmitting current: 450mA (500mw)
500mA (800mw)

Receiving current: 50mA

Working humidity: 10%~90% relative humidity without condensation

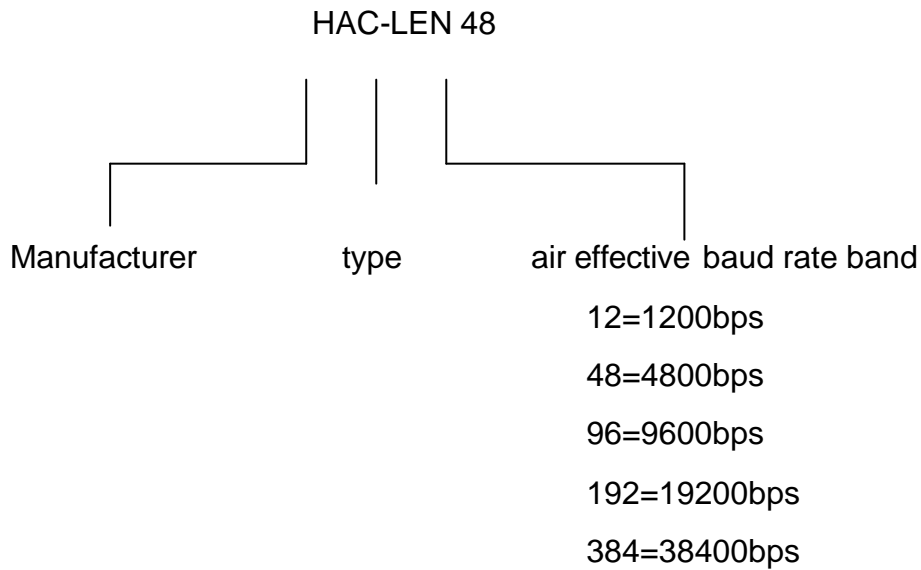
Dimension : 78 mm x 56 mm x 15mm

(The size exclude antenna and DB9 connector)

. Type Description of HAC-LEN series

For product type HAC LEN, HAC- indicates the name of manufacturer Shenzhen HAC Technology Co., Ltd; L indicates low frequency 20dB ~ 29dB, E indicates that the products are used for industry/army. N indicates 868/915MHz frequency band.

The other definition is as follows:



2. We can make the module which can satisfy CE ,FCC and RoHS under given specifically transmitting power , frequency and hopping frequency soft.